Shanghai Astronomical Observatory
Chinese Academy of Sciences

SHESHAN CO-LOCATION SURVEY

Report and results

Surveyed on November 2003
Reported on December 2005

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Introduction

The ITRF is the result of a combination of the different terrestrial reference frames provided by the four space geodetic techniques GPS, VLBI, SLR and DORIS. To perform this combination between independant reference frames, it is necessary to get some co-location sites where the various techniques are observing and whose ties have been surveyed in three dimensions. Many co-location sites have been identified and some of them have missing or inconsistent ties. Furthermore, new instruments are installed or replaced on these sites. Then, the ties with the existent techniques on the site have to be determined.

In this frame, it has been decided as one of the top priorities to survey the Sheshan co-location site (China). Some of the ties at Sheshan were missing (VLBI and SLR with GPS), and the one between the VLBI and SLR points was inconsistent.

This document presents the results of the Sheshan local ties survey with as many details as necessary about the observations and the computations to fully understand the content of the resulting SINEX file.

Acknowledgements

We would like to express our special thanks to Professor YANG Fumin and Dr. LI Jingling and all their colleagues and students from the Shanghai Astronomic Observatory (SHAO), not only for their very cooperative work in a technical and adminsitrative point of view, but also for the “extras” which made us really enjoy our stay in Shanghai and made this work a success.

We would also like to express our thanks to all the people working at the Sheshan VLBI station and at the Laser station for their very warmful welcome and useful help which also contributed to the success of this work.

1. Co-location site description

The Sheshan ITRF site is located in Sheshan area, about 30 km southwest of Shanghai. Sheshan station is the observational base of Shanghai Astronomical Observatory (SHAO), Chinese Academy of Sciences (CAS), where there are the main following equipments :

- Very Long Baseline Interferometry (VLBI) station, with a 25 m radio telescope with a set of hydrogen masers.
- Third-generation Satellite Laser Ranging (SLR) station, with a 60 cm telescope.
- Global Positioning System (GPS) station.

Sheshan co-location site can be divided into two main sub-sites :
On one site, one can find the 25 m VLBI radiotelescope and the IGS GPS station (SHAO).
The second one is the running SLR station site. It should be moved to another site within the next months or year, about 500 m further on the other site of the small hill.

A local control network was set up from which the instruments were observed and tied together with terrestrial and GPS observations, including the future SLR station site.

1.1. ITRF space geodetic techniques

1.1.1. SHAO IGS GPS station

Global view of the antenna with the dome (JPLA model)

The GPS receiver and the PC

DOMES number : 21605M002

SHAO mark and antenna without its dome

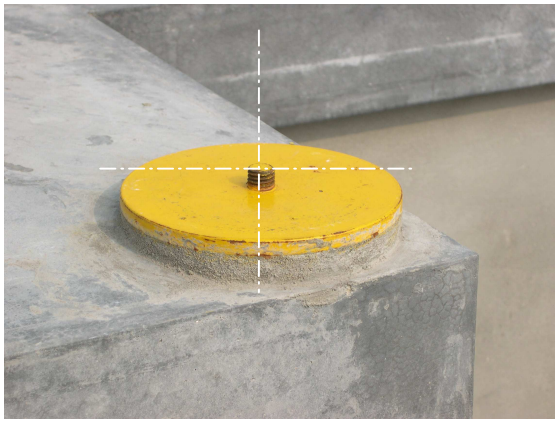
The station reference point is a mark distinct from the antenna one.
(cf annexes 5.1 and 5.2).

1.1.2. SLR station

DOMES number : 21605S001	
	
Current location : building hosting the SLR telescope	*Global view of the telescope*

The SLR System Reference Point (SRP) is the point in the telescope optics where the two rotation axes intersect(cf annexe 5.3.). This reference point can not be materialized.

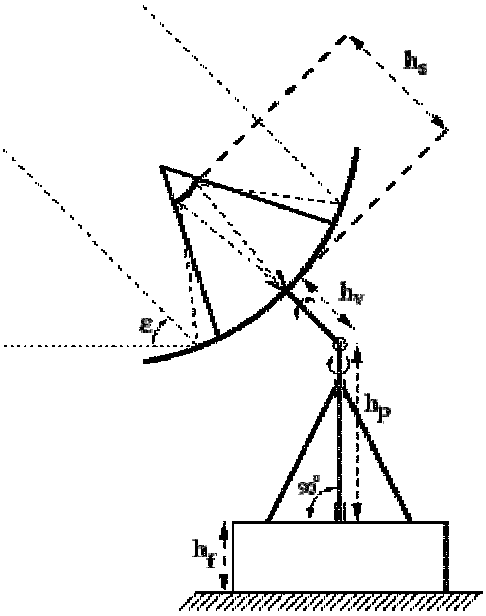
On the new SLR site, a survey point has been tied by GPS observations and included in the survey network. It is located on the terrace roof of the building which will host the new SLR station. The point is materialized by a screw used as forced centring. The reference height is the top of this screw.

DOMES number : 21605M101	
	 
Future location : global view of the site	*Reference point*

1.1.3. VLBI station

The Sheshan 25-m radio telescope is an alt-az antenna run by SHAO. It has been in operation since 1987, and it is one of the five main facilities of the Chinese National Astronomical Observatory. The station is a member of the European VLBI Network (EVN), the International VLBI Service for Geodesy and Astrometry (IVS), and the Asia Pacific Telescope.

DOMES number : 21605S009



Global view of the VLBI antenna

The measurement data is received at the phase centre of the receiver feed horn. The VLBI reference point is generally described as the point where the two rotation axes intersect.

Levelling benchmarks fixed on the VLBI platform base have been tied to the survey control network to realize a stability control system.

1.2. Other points of interest

1.2.1. EGNOS GPS station

The antenna is set up on a metallic support on top of a concrete pier. The EGNOS reference point is located at the top and centre of the metallic support.

Choke Ring antenna of EGNOS GPS station

Reference point

1.2.2. Survey control points and temporary stations

A survey network was set up, from which the instruments were observed and tied together with GPS and conventional observations. Some points with well identified markers should be used and included in future surveys.

- VLBI station : 4 points (1, 2, 4 and 5) equiped with self-centring devices and one domed brass mark (7) surrounding the space geodetic instruments.
  (cf Annexe 5.7.)

- current SLR site : 1 domed brass mark in a corner of the roof terrace.

- new SLR site : 1 concrete pillar with self-centring device on the edge of the SLR terrace roof. This point should be used as a reference and included in a local network to intersect the future new telescope position.

Some temporary points have also been set up and included in the survey network :

- 3 heavy tripods on the VLBI building roof, on the cable car building and on the current SLR station roof terrace
- a metallic pillar on a building roof near the VLBI building

They were all equiped with forced-centring devices. The heights (tacheometres, trefoils, prisms, even GPS antenna) refer to the top and the centre of these centring devices.

2. Survey description

2.1. Organization

The local ties survey of the Sheshan co-location site is a cooperative project in which the four following agencies participated :

- Shanghai Astronomical Observatory (SHAO)
- Tongji University of Shanghai
- NASA Goddard Space Flight Center (GSFC)
- Institut Géographique National (IGN)

The survey team gathered 4 members ; Jim Long, coming from NASA/GSFC, who has experience in numerous local ties surveys ; Valérie Michel and Stéphane Kaloustian from the Special Works unit of IGN, which mainly deals with micro-geodesy and metrology ; Bruno Garayt from the IGN geodetic research laboratory.
Dr. Jinling Li, Head of the Shanghai Observatory VLBI group from the Shanghai Astronomic Observatory (SHAO) and two students from the Tongji University of Shanghai and the Shanghai astronomic Observatory gave us their support during the survey.
Also, this project took many benefits of support from the VLBI and SLR stations staff and facilities.

VLBI antenna operator

The survey took place from November the 22nd to December, the 3rd 2003. The meteorological conditions were stable during the survey (clouds with some rain). Furthermore, in planning the survey work, it was necessary to coordinate with the astronomic observations planning for the VLBI and SLR.

2.2. Equipments

All the conventional topometric survey instruments and equipments belong to IGN or NASA and had been temporarily imported for the needs of the survey. Some GPS equipments have been lent by the Tongji University.

2.2.1. Instruments

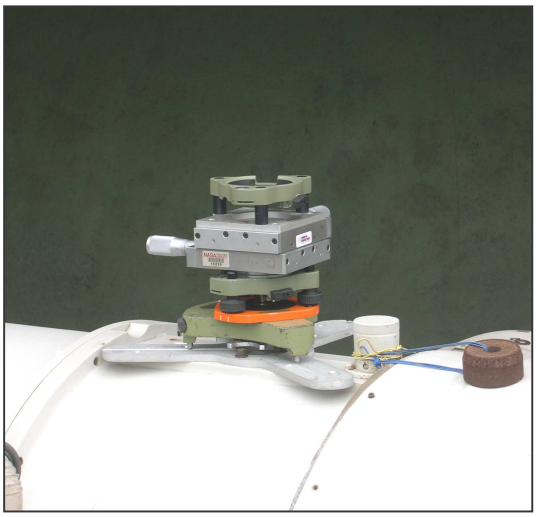
Leica total stations (TC2002, TDA5005 and T3000) were used. Those total stations, which are regularly calibrated at IGN's calibration unit, have a standard-deviation of 0.15 mgon about angles and 1 mm + 1 ppm about distances. Leica accurate corner cube reflectors (GPHP1P), which are calibrated with the total stations, were used to determine distances.
For the altimetric observations, an electronic level (Leica NA3003) and invar bar code levelling rods were used. This equipment, regularly calibrated at IGN's calibration unit, has a resolution of 0.01mm.
For the GPS observations, Leica SR530 receivers with Leica AT504 choke ring antennas and Ashetch UZ-12 receiver with Ashtech ASH701945-02 rev C choke ring antenna were used.

All these instruments allowed the observations to be recorded electronically on PCMCIA cards or REC modules and then downloaded to laptop PC for processing.

2.2.2. Equipment and accessories

Several very useful accessories have been also brought for this type of fieldworks. These accessories included such items as :

- § heavy tripods in order to ensure the stability of temporary stations;
- § platform with translation stage in order to centre a target on a vertical rotation axis;



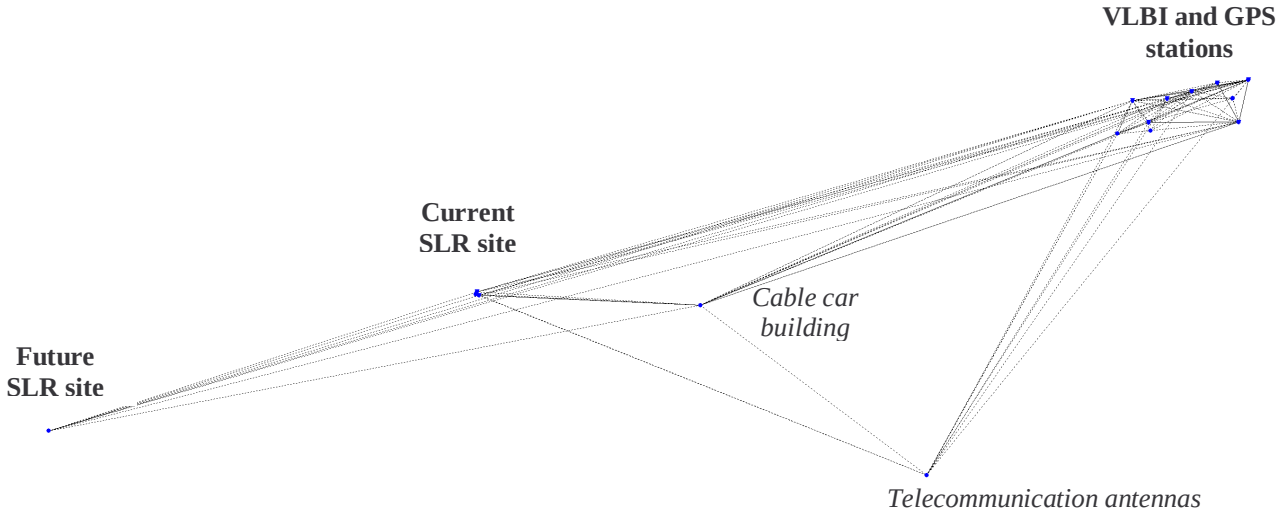
Patform with translation stage on vertical axis

- § 0.5m, 1.8m and 3.0m long Invar levelling rods that are all calibrated and associated to each other;
- § calibrated trefoils targets, prisms;
- § trivet plates and tribachs regularly calibrated.

2.3. Survey network and geodetic instruments observations

2.3.1. Strategy

All the survey was conducted in order to provide the highest accuracy in the determination of the 3D vectors between the observing instruments. This survey encountered many difficulties so that the strategy has been to mix GPS and topometric observations.



The survey network

The main difficulties were :

- the 2 subsites and the future SLR site are not directly visible from each other :
  - the VLBI site and running SLR one are separated by a hill
  - the 2 SLR sites (the running one and the new one) are on 2 different sides of another hill
- the SLR and VLBI reference points are not materialized and can not be observed directly.
- the SLR is installed at the top of a 2 stage building, in a narrow place with some surrounding trees.

Therefore, it has been decided to :

- set up one temporary station on a cable car building roof at the top of the hill between the VLBI and current SLR sites. From this point, the 2 subsites could have been tied with GPS and conventional observations.
- tie the future SLR site to the 2 other subsites with GPS observations with long sessions (many days).

- establish a ground network polygon on the VLBI sites. It has been observed by high precision topometry in order to ensure the best accuracy in the link between the IGS permanent station and the VLBI one, including the 4 reference points, the 2 temporary ones and the brass mark.

- set up 2 points observed by GPS and conventional observations on the SLR terrace to intersect and level the telescope.

- use the telecommunication antennas as orientation.

2.3.2. Observations

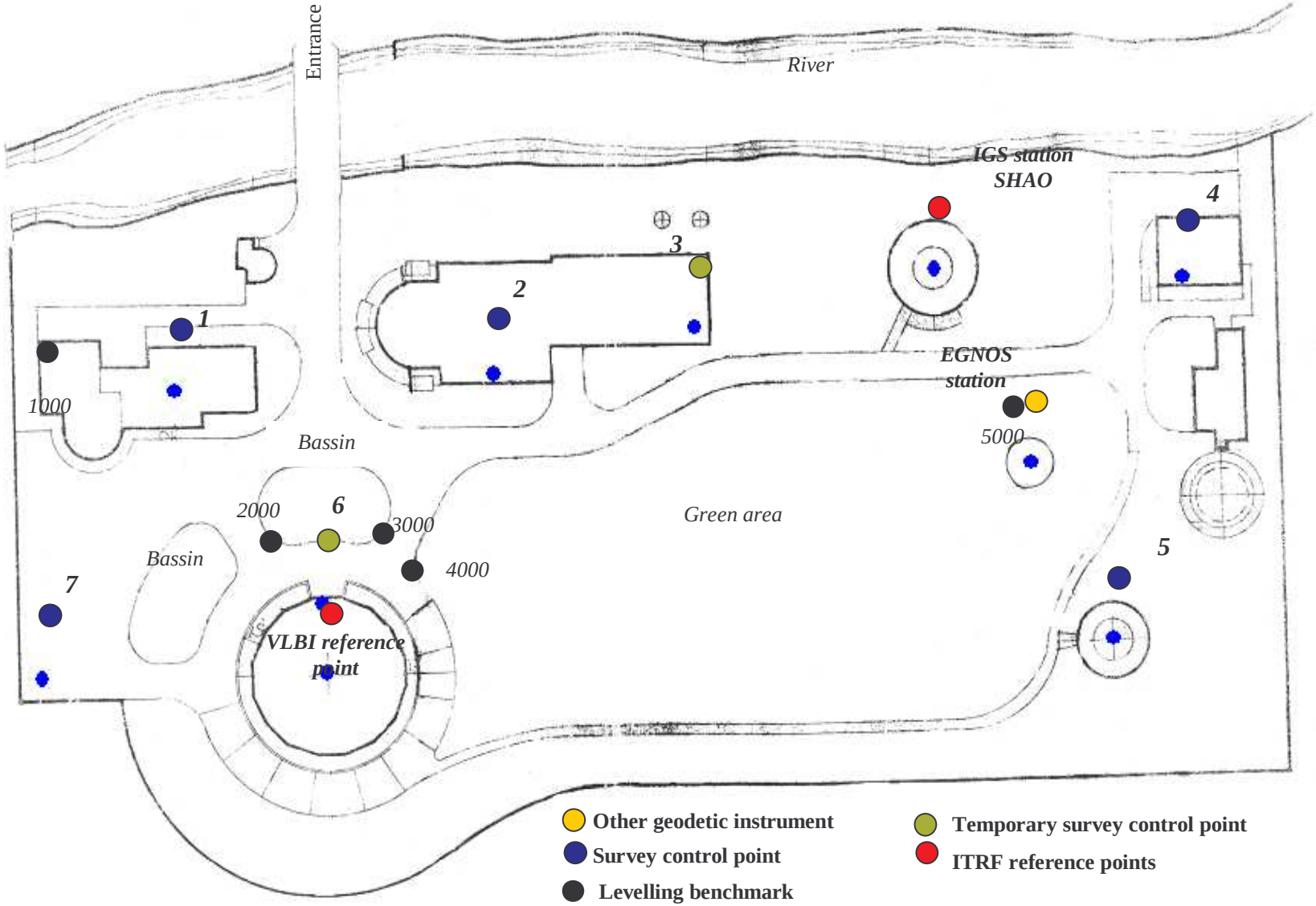
2.3.2.1.Survey network principles

All the visible lines of sights have been observed with the tacheometres described in 2.2.1 (the survey network is presented in 2.3.1).
Horizontal directions and zenith distances were observed in sets, with each set consisting of one reading in both direct and reverse telescope positions. Any observed angle was rejected if the difference between the two circles was greater than 1mgon. Distance measurements were observed over each line one time in both direct and reverse positions. Meteorological data (atmospheric pressure and temperature) were recorded at the beginning of each station.
On each point, two different total stations were set up and two different operators observed, in order to avoid any systematic effect. Heights and levelling were controlled before and after each set up.

So as to tie the current SLR site and the VLBI one with conventional observations, some communications antennas outside the VLBI station and also visible from the cable car station have been intersected.

As far as direct levelling is concerned, a forward run and a backward run were observed between each benchmark. Before each workday, the instrument collimation was checked. The electronic level instrument was set to perform two readings on bar code rod, and that measurement was rejected if the difference between the two readings was greater than 0.04 mm. In the same way, if the difference between the two runs was greater than 0.1 mm$\sqrt{n}$, where n is the number of traverse legs, a third run was completed.
The survey points 1, 2, 4, 5 and 7 were included in the direct levelling network as well as a levelling benchmark at the bottom of the EGNOS concrete pier (5000), 3 ones on the VLBI buiding (2000, 3000, 4000) and one on the southwest corner of the residence building (1000).

The VLBI station survey points



2.3.2.2.SLR System Reference Point (SRP)

The reference point has been determined in two successive steps : the first one to materialize its horizontal position, the second one to measure the vertical eccentricity between the reference point and a horizontal plane defined on top of the tribrach placed on the translation stage.

In a first step, the SLR vertical rotation axis was determined. It has been materialized by setting up a plaform on its top. The centre of the platform should be invariant by any telescope horizontal rotation.
The platform is actually a translation stage. Once the telescope points at a zenith angle of 90°, a target on the translation stage was sighted from one total station set up on a tripod and the direction recorded. The SLR has been rotated 180° around the vertical axis, and the same target sighted again. Then the translation stage was adjusted of half the difference of the two directions. The same thing was done with the SLR telescope oriented at a direction of 90° from the original position. This operation was repeated until the target doesn't move anymore when sighted with the total station, regardless the direction the SLR is pointing. The platform is therefore on the vertical rotation axis.

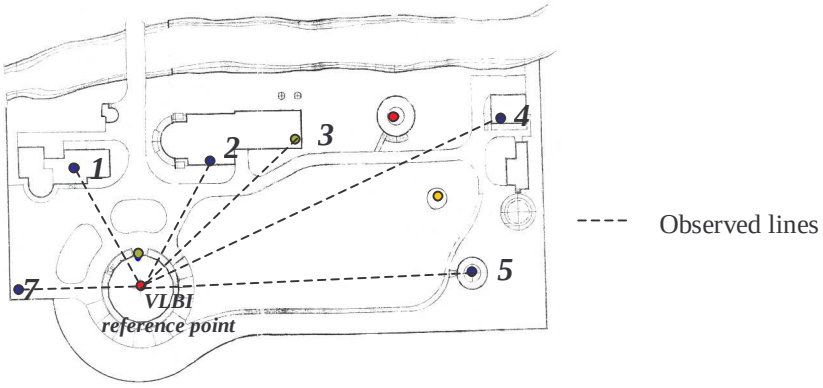
A virtual horizontal rotation axis piercing point was graphically marked on a paper sticked onto the tube. Then, the offset from the platform on the top of the SLR to the intersection point has to be determined.
It is the result of the two following values :

- Height difference between the top of the trybrach on the translation stage on the vertical axis, and the top of the horizontal axis by direct levelling.
- Distance from the top of the horizontal axis to the centre with a calliper gauge.

Annexe 5.3. shows some pictures.

2.3.2.3.VLBI reference point

VLBI reference point is defined by the intersection of the two rotation axes if they do intersect (Sheshan case) ; if not, by the orthogonal projection of the secondary axis on the primary axis.
Therefore, the determination of the VLBI reference point leads to the determination of the two axes.
The general method to determine an axis is to observe a target installed on the antenna from the different points of the topometric network while the antenna is rotating around this axis.

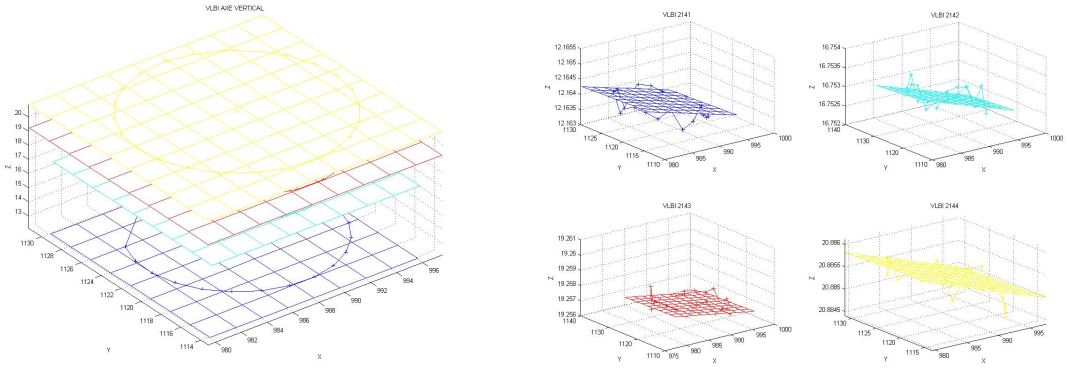


The survey network for the VLBI reference point determination

Target placed on the VLBI antenna structure

The vertical Axis

The vertical axis has been determined by observing 4 targets installed on the part of the antenna linked to this axis at different heights. Each target describes a circle, inscribed in a plane orthogonal to the vertical axis.
The antenna described the whole horizontal circle by 15° step. In this way, 24 positions have been determined for each horizontal circle.
The measurements took place on November 2003, the 26th between 8:30 am and 2:00 pm. At least three instruments could sight the target in an optimized geometry to perform each intersection. Consequently, the tacheometers had to be moved from one of the seven points of the polygon to another.



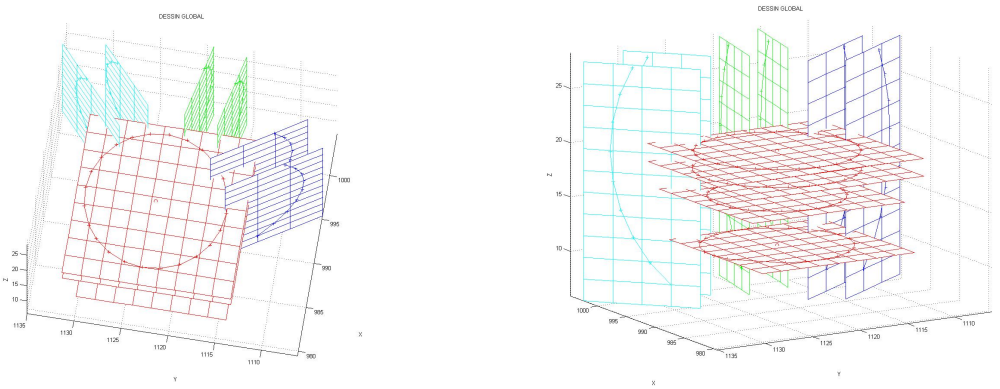
The 4 observed plans and circles and their residuals.

The horizontal axis

The horizontal axis has been observed through two targets set up on the antenna part linked to the secondary axis. The target could only describe an arc of the vertical circle and nine positions have been recorded with 10° steps. In order to fulfill the lack of redundancy and the shortness of the arcs of circle, it has been decided to operate three times the same observation in three different orientations around the vertical axis.
The measurement took place on November 2003, the 27th between 01:00 pm and 05:00 pm. The same strategy of observation has been used.

The precision of the 3x2x9 points goes from 0.2 mm to 0.3 mm thanks to a good geometry of the observation figure.

Each target describes an arc of a circle, inscribed in a plane orthogonal to the horizontal axis oriented toward one specific direction. Independent adjustments let check the parallelism of the 2 planes described by the both targets in a given orientation so that the horizontality of this secondary axis. These results led to the adjustment with constraint and the horizontal axis has then be determined. The 3 different orientations give 3 different horizontal axis what let the horizontality be controlled.



Views of the circles or arcs of circles described by the different targets when rotating the antenna

2.3.2.4.GPS antenna intersections

For the SHAO and EGNOS GPS antennas, the same procedure has been followed since the antennas could not be removed : the reference point had to be determined indirectly.

As far as the planimetric position is concerned, from each station pointing at the antennas, both right side and left side of an element theoretically centered on the phase center of the antenna have been observed. This element has been chosen so that it is well defined for the operator : the choke ring antennas elements. In the adjustment, the mean direction of two observations from a same station, was used to process the planimetric position.

Then, as far as the altimetric position is concerned, the zenithal angles have been measured on a well defined element of the antenna. Then, the resulting position have been reduced to the reference point using the manufacture values.

The SHAO antenna height was measured on three different points on the choke ring antenna. It differs by less than 1mm from the value provided by the sitelog and used for the GPS observations.

2.3.2.5.GPS observations

In order to tie the 3 sub-sites and the IGS SHAO station, GPS observations have been conducted during many sessions.

The SHAO IGS station dome has been removed during all the conventional survey so as to facilitate the observations. But to tie the station to the survey network and the other instruments, only the GPS observations with the dome have been used to be consistent with the IGS solution.

The GPS observations for the piers and the temporary stations were carried out during the survey with the following specifications :

- § Cut-off angle 10°
- § Data recording rate 30 s

A table suming up the GPS observations is presented in annexe 5.6.

3. Computations

3.1. On-site validation

3.1.1. Survey control networks

It has been pre-processed on site in order to point out any problems consequently to the observations. The observations have been checked in a local coordinate system by a 3D Least Squares Adjustment with the software COMP3D developed at IGN by Y. EGELS.
The outliers have been detected and the precision has been estimated in order to check if the requirements of such a survey were achieved.

The a priori standard deviations for the different observations from tacheometers are :

- § 0.5 mgon for horizontal angles,
- § 0.8 mgon for vertical angles,
- § 1 mm + 1 ppm for distances,

The levelling network has been also validated on site by adjustments between 2 successive benchmarks, and finally by a global adjustment.

3.1.2. GPS

The GPS baselines have been processed on site to check the ambiguities resolution.

3.2. GPS network

The GPS baselines have been processed with the BERNESE software version 4.2.
The antenna excentricity from the SHAO sitelog was used to get the station reference point position.

The main features of the adopted processing strategy are presented in the followig table :

Measurement models	• DE200 planetary ephemeris model • Earth potential model : JGM3 • Ground antenna : IGS/NGS elevation-dependent phase center models (cf annexe 5.15) • Solid Earth tides applied (IERS Conventions 96) • Orbits and ERPs : IGS final products
Processing parameters	• Elevation dependant weighting • Elevation cutoff angle : 10 degrees • Troposphere model : Saastamoinen

Estimated parameters :	• Adjustment : Weighted least-squares algorithms • Ambiguity resolution : SIGMA strategy • Solved ambiguities introduced to daily solutions • Daily final solutions : L1 only • Constrained solutions (no stations fixed) • No troposphere zenith delays estimation

Daily solutions were produced and correlations correctly modelled. The corresponding NEQs were combined using ADDNEQ program providing a full covariance matrix given in annexe 5.10.

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--------------------------------------------------------------------------------------------
COMPARISON OF STATION COORDINATES WITH RESPECT TO THE COMBINED SOLUTION IN MM
- UNWEIGHTED RMS OF INDIVIDUAL COORDINATE RESIDUALS
 ------------------------------------------------------------------------------------------
 TOTAL NUMBER OF STATIONS:     8
 ------------------------------------------------------------------------------------------

 NUM  STATION         #FIL C   RMS     1     2     3     4     5     6     7     8
 ------------------------------------------------------------------------------------------

   5  30               7  N    1.0    -.6    .1    .3   -.4  -2.3   -.6    .4
   Current SLR station    E    1.0    -.3  -1.0   -.5   2.0   -.1    .7   -.2
   Survey point 30        U    1.7     .0    .4    .6    .7  -2.3   2.6  -2.2

   4  40               8  N    1.3    -.3    .3    .2   -.6  -2.6   -.6    .9   1.8
   New Laser site         E    1.0    -.5  -1.2   -.5   2.0    .0    .7   -.2   1.0
   Survey point 40        U    2.5    -.4  -1.1   -.3   1.7  -2.3   3.1    .3   4.7

   2  5                8  N     .1    -.1   -.1   -.1   -.1   -.1   -.1   -.1   -.1
   VLBI site              E     .0     .0    .0    .0    .0    .0    .0    .0   -.1
   Survey point 5         U     .0     .0    .0    .0    .0    .0    .0    .0    .0

   6  1                4  N     .7    -.7          .5   -.6   -.4
   VLBI site              E     .5     .3          .2    .9   -.1
   Survey point 1         U    1.5    -.9         -.6   1.7   1.6

   7  2                2  N    1.4                     -1.3   -.4
   VLBI site              E    1.5                      1.5   -.1
   Survey point 2         U     .9                      -.2    .8

   3  20               1  N     .0                                 -.4
   Cable car building     E     .0                                  .5
   Temporary station      U     .0                                1.8

   8  35               1  N     .0                                       .9
   Current SLR station    E     .0                                      -.2
   Vertical Axis          U     .0                                       .3

  10  4                2  N     .4                                       .2    .4
   VLBI site              E     .4                                      -.3    .2
   Survey point 4         U     .7                                      -.6    .3
 ------------------------------------------------------------------------------------------
```

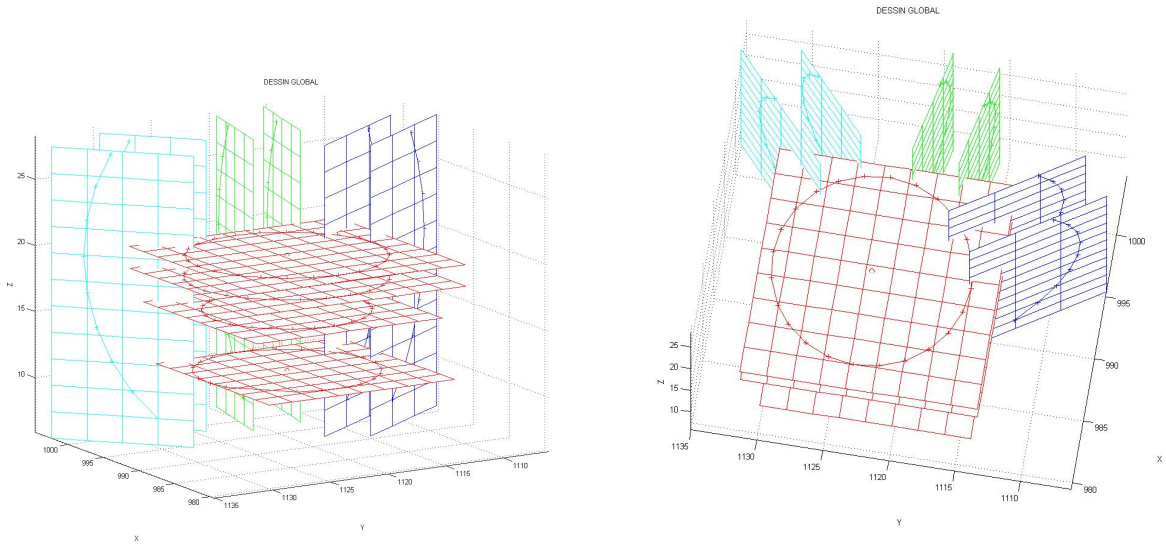
For this solution, the survey point 5 has been constrained (1 mm) to first results coming from a preliminary constrained adjustment on ITRF2000 IGS station coordinates at observations epoch.

3.3. VLBI Reference point

The first computations have been done in the local topocentric network that was defined by the polygon observations.

The 10 plane and circle fittings have been computed by programs developed on the Matlab 6.1 software. A first on-site program has been developed in order to check the quality of the target positions determinations and the precision to fit a circle. Then a more elaborate program taking into account the variances-covariances matrix of the polygon and the target positions has been used to compute the circle fittings.

Each target describes a circle, inscribed in a plane orthogonal to the vertical axis. Independent adjustments let check the parallelism of the four planes so that the alignment of the 4 centers, and the verticality of the primary axis. These results led to the adjustment with constraints and the vertical axis was then determined.
The processing of the coordinates of all the observation points is a least squares adjustment with constraints on the points of the polygon coming from the polygon observations. It has been led with the software COMP3D in a local topocentric reference system.
The precision of the 4x25 points goes from 0.2 mm to 2.2 mm.



2 views of the circle and plane fittings in the local topocentric network

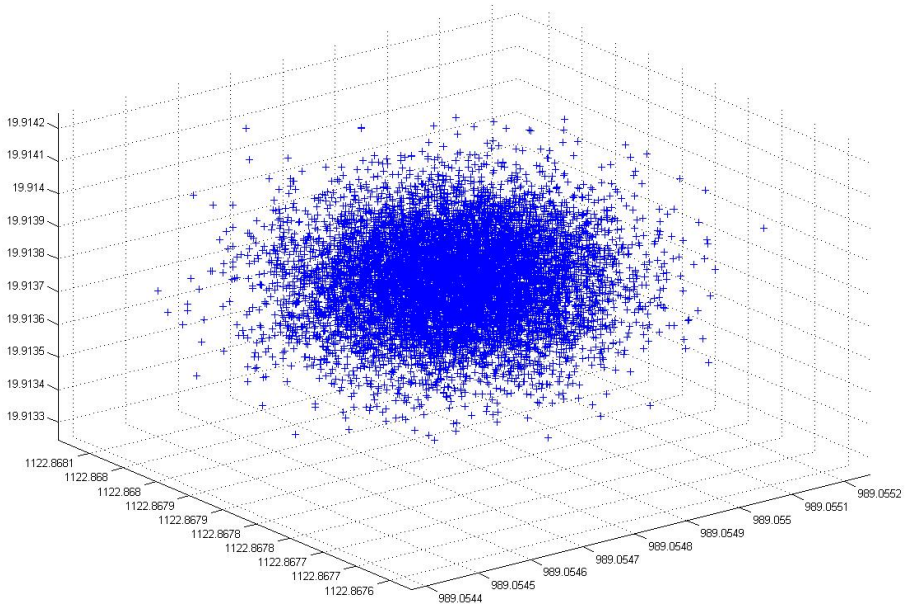
Therefore, we have to determine if the axes intersect. The distance between the vertical axis and the horizontal axis in the 3 orientations have been processed. The mean of these distances is 0.17 mm. The axes are then assumed to intersect and the VLBI reference point is in the local system:

VLBI Reference point		
x (m)	y (m)	z (m)
989.0548	1122.8679	19.9138

One can find more information such as residuals on data analysis in annex 5.5.

3.3.1. Precision

The precision has been determined by using a Monte-Carlo method. Random sets of coordinates of the observed points have been performed depending on the precision of their determinations. Then the same processing as presented previously has been done to get a new set of coordinates for the VLBI reference point.
We obtain this points distribution :



Monte-Carlo distribution of the estimated point position expressed in a local reference frame (m)

The cloud is centered on the VLBI reference point and the size of the cloud is described by the following elements :

VLBI Reference point		
σx (m)	σy (m)	σz (m)
0.0002	0.0002	0.0002

3.3.2. Fictitious observations

Given the position of the reference point and its precision, a set of fictitious observations have been computed with their associated precision. These fictitious observations correspond to fictitious horizontal and vertical angles that would be measured from the points of the polygon to the VLBI reference point.
Therefore, this set of fictitious observation is equivalent to an intersection of the VLBI reference point from points 1, 2, 3, 4, 5 and 7.
They were introduced in the final computation of the co-location site.

3.4. Survey control network

The analysis of the survey network observations has been carried out with the "Microsearch Geolab" software. The input files were developped from all the topometric observations (distances, horizontal and zenithal angles, direct levelling, planimetric and altimetric centerings). The coordinates of one point have been constrained and an azimuth computed from the GPS observations analysis has been introduced.

During the survey the antenna height has been checked by direct measurements using a calliper gauge. The difference with the value published in the sitelog and used to tie the station to the network with GPS is below 1 mm.

4. Results

The final results have been processed with the "Microsearch GeoLab" software. The input files were developped from :

- § all the topometric observations : distances, horizontal and zenithal angles, direct levelling, planimetric and altimetric centerings.
- § an extracted covariance matrix of the GPS baselines not including the IGS station
- § the GPS baseline between point 5 and the IGS station with its covariance matrix

The ITRF2000 coordinates of SHAO IGS GPS station at epoch 2003:332 have been constrained at 1mm (see ITRF2000 solution extracted coordinates in annex 5.9).

The following station name translation table has been used for the computation :

Point description	Used name or code	Computation name
SHAO IGS reference point	21605M002	21605M002 (GPS observations) 8 (topometry) *Rem : shao for GPS observations*
EGNOS station reference point :	9	9
SLR station : • System Reference Point (SRP) • Top and axis of the domed brass mark	21605S001 30	21605S001 30 (GPS and topometry observations)
Future SLR site	21605M101	40 (GPS observations)
VLBI reference point	21605S009	21605S009 (fictitious observations)

Point description	Used name or code	Computation name
Survey points : • 1 • 2 • 4 • 5 • 7	 1 2 4 5 7	 1 2 4 5 7
Telecommunication antenna (for conventional observations orientation)	50	50
Levelling benchmarks • residence building (SW corner) • VLBI building : east side of the entrance door, between the 2nd and the 3rd window • VLBI building : east side of the entrance door, before the first window • VLBI building : east side of the entrance door, before the first window • EGNOS concrete pier	 1000 2000 3000 4000 5000	 1000 2000 3000 4000 5000

The results of the adjustment are the coordinates of all the points of interest as well as their confidence ellipsoids in the ITRF2000 at the mean epoch of the observations (2003:332). Here is a table with the 3D coordinates and confidence region at 95% of the points of interest :

Adjusted XYZ Coordinates:

CODE	FFF	STATION	X-COORDINATE STD DEV	Y-COORDINATE STD DEV	Z-COORDINATE STD DEV		
XYZ		1	-2831656.7602 0.0065	4675722.7944 0.0065	3275351.5380 0.0065	m	0
XYZ		2	-2831688.2105 0.0065	4675699.9057 0.0065	3275352.0292 0.0065	m	0
XYZ		21605M002	-2831733.4794 0.0065	4675665.9616 0.0065	3275369.4295 0.0065	m	0
XYZ		21605M101	-2830750.7235 0.0065	4676573.2264 0.0065	3275076.8381 0.0065	m	0
XYZ		21605S001	-2831088.2992 0.0065	4676203.2595 0.0066	3275172.7324 0.0066	m	0
XYZ		21605S009	-2831687.1234 0.0065	4675733.5870 0.0065	3275327.6040 0.0065	m	0
XYZ		30	-2831090.9971 0.0065	4676203.2944 0.0065	3275169.0342 0.0065	m	0
XYZ		4	-2831761.2654 0.0065	4675644.5260 0.0065	3275371.0285 0.0065	m	0
XYZ		5	-2831764.2148 0.0065	4675670.1144 0.0065	3275329.9418 0.0065	m	0
XYZ		50	-2831606.1642 0.0025	4676084.7377 0.0027	3275034.3758 0.0026	m	0
XYZ		7	-2831648.7154 0.0065	4675742.5076 0.0065	3275316.1102 0.0065	m	0
XYZ		9	-2831750.8156 0.0065	4675661.3587 0.0065	3275352.1592 0.0065	m	0

```
3D Station Confidence Regions (95.000 percent):
STATION         MAJ-SEMI (AZ,VANG)    MED-SEMI (AZ,VANG)    MIN-SEMI (AZ,VANG)
------------ -------------------- -------------------- --------------------

1                0.0183 (210, 88)      0.0182 ( 73,  1)      0.0182 (343,  1)
2                0.0183 (213, 88)      0.0182 ( 73,  1)      0.0182 (343,  1)
21605M002        0.0182 (203, 88)      0.0182 ( 81,  1)      0.0182 (351,  2)
21605M101        0.0184 (200, 88)      0.0182 ( 76,  1)      0.0182 (346,  2)
21605S001        0.0184 (170, 86)      0.0183 (328,  3)      0.0182 ( 58,  1)
21605S009        0.0184 (212, 88)      0.0182 (313,  0)      0.0182 ( 43,  1)
30               0.0184 (199, 88)      0.0182 ( 77,  1)      0.0182 (347,  2)
4                0.0183 (214, 89)      0.0182 ( 75,  1)      0.0182 (345,  1)
5                0.0183 (203, 88)      0.0182 ( 81,  1)      0.0182 (351,  2)
50               0.0085 (170, 89)      0.0069 (329,  1)      0.0063 ( 59,  0)
7                0.0183 (211, 88)      0.0182 ( 62,  1)      0.0182 (332,  1)
8                0.0184 ( 49, 90)      0.0182 (259,  0)      0.0182 (169,  0)
9                0.0184 (215, 89)      0.0182 ( 46,  1)      0.0182 (316,  0)

Adjusted Ellipsoid height coordinates:

 CODE FFF STATION                          Ellipsoid height     STD DEV
 ---- --- ------------------------------- ---------------------- -------------

 EHGT     1                                        20.4107        0.0008 m
 EHGT     1000                                     13.5202        0.0008 m
 EHGT     2                                        17.8503        0.0008 m
 EHGT     2000                                     13.8777        0.0008 m
 EHGT     3000                                     13.8830        0.0008 m
 EHGT     4                                        19.5079        0.0008 m
 EHGT     4000                                     13.8604        0.0008 m
 EHGT     5                                        18.3353        0.0008 m
 EHGT     5000                                     13.1702        0.0008 m
 EHGT     7                                        12.9814        0.0008 m
```

Furthermore the whole covariance matrix is computed and it is possible to extract a covariance submatrix of reference points for :

- SHAO IGS GPS station 21605M002
- SLR station 21605S001
- VLBI station 21605S009

The results and the full covariance matrix are presented in annexes 5.11. and 5.12. The covariance matrix has finally been converted into the SINEX format using a special program from CATREF package. The resulted file is given in annexe 5.15.

5. ANNEXES

5.1. SHAO IGS station site log

```
     SHAO Site Information Form
     International GPS Service
     See Instructions at:
       ftp://igscb.jpl.nasa.gov/pub/station/general/sitelog_instr.txt

0.   Form

     Prepared by (full name)  : Oivind Ruud
     Date Prepared            : 2005-02-09
     Report Type              : UPDATE
     If Update:
      Previous Site Log       : shao_20041018.log
      Modified/Added Sections : 3.2-3.6

1.  Site Identification of the GNSS Monument

     Site Name                : Shanghai Observatory, Sheshan station
     Four Character ID        : SHAO
     Monument Inscription     : 4027-S
     IERS DOMES Number        : 21605M002
     CDP Number               : (A4)
     Monument Description     : CONCRETE PILLAR
       Height of the Monument : 6 m
       Monument Foundation    : CONCRETE BLOCK
       Foundation Depth       : 8 m
     Marker Description       : BRASS NAIL
     Date Installed           : 1994-05-01
     Geologic Characteristic  : BEDROCK
       Bedrock Type           : SEDIMENTARY
       Bedrock Condition      : (FRESH/JOINTED/WEATHERED)
       Fracture Spacing       : (1-10 cm/10-50 cm/50-200 cm/over 200 cm)
       Fault zones nearby     : NO
         Distance/activity    : (multiple lines)
     Additional Information   : (multiple lines)
                              : A 6 meter concrete pillar inside observatory
                              : dome serves as the monument. Pillar is tapered
                              : and almost 2 meters wide at the bottom.
                              : Geological Province:  alluvial plain of the
                              : Yangtse Delta.
                              : Local Geology: So-Se is a small hill in the
                              : alluvium plains of the Yangtse Delta,
                              : interbedded with volcanic series of the Mesozoic
                              : era.
                              : Geological information from "NASA Space Geodesy
                              : Program: Catalogue of Site Information",
                              : Technical Memorandum 4482, March 1993, p537.

2.   Site Location Information

     City or Town             : Sheshan
     State or Province        :
     Country                  : China
     Tectonic Plate           : Eurasian
     Approximate Position (ITRF)
       X coordinate (m)       : -2831733.5651
       Y coordinate (m)       : 4675666.0700
       Z coordinate (m)       : 3275369.4958
       Latitude (N is +)      : +310558.7128
       Longitude (E is +)     : +1211201.5990
       Elevation (m,ellips.)  : 22.2085
     Additional Information   : ITRF2000
                              : The station is located at the Shanghai
                              : Observatory in the Zi-Ka-Wei Section.
                              : Site information from "NASA Space Geodesy
                              : Program: Catalogue of Site Information",
                              : Technical Memorandum 4482, March 1993, p537.

3.  GNSS Receiver Information


3.1  Receiver Type            : ROGUE SNR-8100
```

```
     Satellite System         : GPS
     Serial Number            : 140
     Firmware Version         : 3.0 -1994/10/10   17:01:54
     Elevation Cutoff Setting : 4 deg
     Date Installed           : 1995-01-20T00:00Z
     Date Removed             : 1999-05-28T09:24Z
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)

3.2  Receiver Type            : ROGUE SNR-8100
     Satellite System         : GPS
     Serial Number            : 140
     Firmware Version         : 3.2.32.8
     Elevation Cutoff Setting : 4 deg
     Date Installed           : 1999-05-28T09:24Z
     Date Removed             : 2002-07-01T23:59Z
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)

3.3  Receiver Type            : ROGUE SNR-8100
     Satellite System         : GPS
     Serial Number            : 140
     Firmware Version         : 3.2.32.10
     Elevation Cutoff Setting : 4 deg
     Date Installed           : 2002-07-02T00:00Z
     Date Removed             : 2003-11-25T23:59Z
     Temperature Stabiliz.    : none
     Additional Information   : (multiple lines)

3.4  Receiver Type            : ROGUE SNR-8100
     Satellite System         : GPS
     Serial Number            : 140
     Firmware Version         : 3.2.32.11
     Elevation Cutoff Setting : 4 deg
     Date Installed           : 2004-10-01T01:00Z
     Date Removed             : 2004-10-04T23:59Z
     Temperature Stabiliz.    : none
     Additional Information   : Firmware upgrade.

3.5  Receiver Type            : ROGUE SNR-8100
     Satellite System         : GPS
     Serial Number            : 140
     Firmware Version         : 3.2.32.10
     Elevation Cutoff Setting : 4 deg
     Date Installed           : 2004-10-07T00:00Z
     Date Removed             : 2004-12-28T23:59Z
     Temperature Stabiliz.    : none
     Additional Information   : Firmware reverted to old version.

3.6  Receiver Type            : ROGUE SNR-8100
     Satellite System         : GPS
     Serial Number            : 140
     Firmware Version         : 3.2.32.11
     Elevation Cutoff Setting : 4 deg
     Date Installed           : 2004-12-29T02:00Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : none
     Additional Information   : Firmware upgrade.

3.x  Receiver Type            : (A20, from rcvr_ant.tab; see instructions)
     Satellite System         : (GPS/GLONASS/GPS+GLONASS)
     Serial Number            : (A5)
     Firmware Version         : (A11)
     Elevation Cutoff Setting : (deg)
     Date Installed           : (CCYY-MM-DDThh:mmZ)
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Temperature Stabiliz.    : (none or tolerance in degrees C)
     Additional Information   : (multiple lines)

4.  GNSS Antenna Information


4.1  Antenna Type             : AOAD/M_T        JPLA
     Serial Number            : 429
     Antenna Reference Point  : BPA
     Marker->ARP Up Ecc. (m)  : 0.0814
```

```
     Marker->ARP North Ecc(m) : 0.0000
     Marker->ARP East Ecc(m)  : 0.0000
     Alignment from True N    :
     Antenna Radome Type      : JPLA
     Radome Serial Number     :
     Antenna Cable Type       : (vendor & type number)
     Antenna Cable Length     : 20 m
     Date Installed           : 1995-01-20T00:00Z
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Additional Information   : (multiple lines)

4.x  Antenna Type             : (A20, from rcvr_ant.tab; see instructions)
     Serial Number            : (A*, but note the first A5 is used in SINEX)
     Antenna Reference Point  : (BPA/BCR/XXX from "antenna.gra"; see instr.)
     Marker->ARP Up Ecc. (m)  : (F8.4)
     Marker->ARP North Ecc(m) : (F8.4)
     Marker->ARP East Ecc(m)  : (F8.4)
     Alignment from True N    : (deg; + is clockwise/east)
     Antenna Radome Type      : (A4 from rcvr_ant.tab; see instructions)
     Radome Serial Number     :
     Antenna Cable Type       : (vendor & type number)
     Antenna Cable Length     : (m)
     Date Installed           : (CCYY-MM-DDThh:mmZ)
     Date Removed             : (CCYY-MM-DDThh:mmZ)
     Additional Information   : (multiple lines)

5.  Surveyed Local Ties


5.1  Tied Marker Name         : 7226
     Tied Marker Usage        : (SLR/VLBI/LOCAL CONTROL/FOOTPRINT/etc)
     Tied Marker CDP Number   : 7226
     Tied Marker DOMES Number : 21605S008
     Differential Components from GNSS Marker to the tied monument (ITRS)
       dx (m)                 :
       dy (m)                 :
       dz (m)                 :
     Accuracy (mm)            : (mm)
     Survey method            : (GPS CAMPAIGN/TRILATERATION/TRIANGULATION/etc)
     Date Measured            : (CCYY-MM-DDThh:mmZ)
     Additional Information   : VLBI 6m radiotelescope ref. pt.

5.2  Tied Marker Name         : 7233
     Tied Marker Usage        : (SLR/VLBI/LOCAL CONTROL/FOOTPRINT/etc)
     Tied Marker CDP Number   :
     Tied Marker DOMES Number :
     Differential Components from GNSS Marker to the tied monument (ITRS)
       dx (m)                 :
       dy (m)                 :
       dz (m)                 :
     Accuracy (mm)            : (mm)
     Survey method            : (GPS CAMPAIGN/TRILATERATION/TRIANGULATION/etc)
     Date Measured            : (CCYY-MM-DDThh:mmZ)
     Additional Information   : Antenna reference point

5.x  Tied Marker Name         :
     Tied Marker Usage        : (SLR/VLBI/LOCAL CONTROL/FOOTPRINT/etc)
     Tied Marker CDP Number   : (A4)
     Tied Marker DOMES Number : (A9)
     Differential Components from GNSS Marker to the tied monument (ITRS)
       dx (m)                 :
       dy (m)                 :
       dz (m)                 :
     Accuracy (mm)            : (mm)
     Survey method            : (GPS CAMPAIGN/TRILATERATION/TRIANGULATION/etc)
     Date Measured            : (CCYY-MM-DDThh:mmZ)
     Additional Information   : (multiple lines)

6.   Frequency Standard


6.1  Standard Type            : INTERNAL
       Input Frequency        : (if external)
       Effective Dates        : 1995-01-20/CCYY-MM-DD
       Notes                  : (multiple lines)
```

```
6.x  Standard Type            : (INTERNAL or EXTERNAL H-MASER/CESIUM/etc)
       Input Frequency        : (if external)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Notes                  : (multiple lines)

7.   Collocation Information


7.1  Instrumentation Type     : VLBI
       Status                 : (PERMANENT/MOBILE)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Notes                  : SLR station nearby (5 Km)

7.x  Instrumentation Type     : (GPS/GLONASS/DORIS/PRARE/SLR/VLBI/TIME/etc)
       Status                 : (PERMANENT/MOBILE)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Notes                  : (multiple lines)

8.   Meteorological Instrumentation


8.1.1  Humidity Sensor Model  :
       Manufacturer           :
       Serial Number          :
       Data Sampling Interval :
       Accuracy (% rel h)     : (% rel h)
       Aspiration             : (UNASPIRATED/NATURAL/FAN/etc)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : CCYY-MM-DD/CCYY-MM-DD
       Notes                  : (multiple lines)

8.1.x  Humidity Sensor Model  :
       Manufacturer           :
       Serial Number          :
       Data Sampling Interval : (sec)
       Accuracy (% rel h)     : (% rel h)
       Aspiration             : (UNASPIRATED/NATURAL/FAN/etc)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Notes                  : (multiple lines)

8.2.1  Pressure Sensor Model  :
       Manufacturer           :
       Serial Number          :
       Data Sampling Interval :
       Accuracy               : (mbar)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : CCYY-MM-DD/CCYY-MM-DD
       Notes                  : (multiple lines)

8.2.x  Pressure Sensor Model  :
       Manufacturer           :
       Serial Number          :
       Data Sampling Interval : (sec)
       Accuracy               : (hPa)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Notes                  : (multiple lines)

8.3.1  Temp. Sensor Model     :
       Manufacturer           :
       Serial Number          :
       Data Sampling Interval :
       Accuracy               : (deg C)
       Aspiration             : (UNASPIRATED/NATURAL/FAN/etc)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : CCYY-MM-DD/CCYY-MM-DD
       Notes                  : (multiple lines)

8.3.x  Temp. Sensor Model     :
       Manufacturer           :
```

```
       Serial Number          :
       Data Sampling Interval : (sec)
       Accuracy               : (hPa)
       Aspiration             : (UNASPIRATED/NATURAL/FAN/etc)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Notes                  : (multiple lines)

8.4.1  Water Vapor Radiometer :
       Manufacturer           :
       Serial Number          :
       Distance to Antenna    : (m)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : CCYY-MM-DD/CCYY-MM-DD
       Notes                  : (multiple lines)

8.4.x  Water Vapor Radiometer :
       Manufacturer           :
       Serial Number          :
       Distance to Antenna    : (m)
       Height Diff to Ant     : (m)
       Calibration date       : (CCYY-MM-DD)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Notes                  : (multiple lines)

8.5.1  Other Instrumentation  : (multiple lines)

8.5.x  Other Instrumentation  :

9.  Local Ongoing Conditions Possibly Affecting Computed Position


9.1.x  Radio Interferences    : (TV/CELL PHONE ANTENNA/RADAR/etc)
       Observed Degredations  : (SN RATIO/DATA GAPS/etc)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Additional Information : (multiple lines)

9.2.x  Multipath Sources      : (METAL ROOF/DOME/VLBI ANTENNA/etc)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Additional Information : (multiple lines)

9.3.x  Signal Obstructions    : (TREES/BUILDLINGS/etc)
       Effective Dates        : (CCYY-MM-DD/CCYY-MM-DD)
       Additional Information : (multiple lines)

10.   Local Episodic Effects Possibly Affecting Data Quality


10.x Date                     : (CCYY-MM-DD/CCYY-MM-DD)
     Event                    : (TREE CLEARING/CONSTRUCTION/etc)

11.   On-Site, Point of Contact Agency Information

     Agency                   : Shanghai Astronomical Observatory
     Preferred Abbreviation   : SHAO
     Mailing Address          : Shanghai Astronomical Observatory
                              : Chinese Academy Of Science
                              : Nandan Road 80
                              : Shanghai, 200030, China
     Primary Contact
       Contact Name           : Li Yan
       Telephone (primary)    : 86-21-64386191-668
       Telephone (secondary)  :
       Fax                    : 86-21-64384618
       E-mail                 : liyan@shao.ac.cn
     Secondary Contact
       Contact Name           : Shuanggen Jin
       Telephone (primary)    : 86-21-64386191-668
       Telephone (secondary)  :
       Fax                    : 86-21-4384618
       E-mail                 : sgjin@shao.ac.cn
     Additional Information   : (multiple lines)

12.  Responsible Agency (if different from 11.)
```

```
     Agency                    : Jet Propulsion Laboratory
     Preferred Abbreviation    : JPL
     Mailing Address           : 4800 Oak Grove Drive
                               : Pasadena, CA
                               : USA    91109
     Primary Contact
       Contact Name            : David A. Stowers
       Telephone (primary)     : 818-354-7055
       Telephone (secondary)   :
       Fax                     : 818-393-4965
       E-mail                  : dstowers@jpl.nasa.gov
     Secondary Contact
       Contact Name            : Network Engineer/UNAVCO
       Telephone (primary)     : 303-381-7476
       Telephone (secondary)   : 303-381-7500
       Fax                     : 303-381-7451
       E-mail                  : ruud@unavco.org
     Additional Information    : Oivind Ruud (303-381-7476)

13.  More Information

     Primary Data Center       : JPL (ODC-Operational Data Center)
     Secondary Data Center     : CDDIS (GDC-Global Data Center)
     URL for More Information  : http://www.unavco.net/public/logs/
                               : sitedetails.aspx
       Hardcopy on File
       Site Map                : (Y or URL)
       Site Diagram            : (Y)
       Horizon Mask            : (Y)
       Monument Description    : (Y)
       Site Pictures           : Y
     Additional Information    : (multiple lines)
     Antenna Graphics with Dimensions

AOAD/M_T

                        -----
                      /     +     \                        <--  0.128  L2
                     |      +      |                       <--  0.110  L1
   +-------------------------------------------------+     <--  0.102  TCR
   |                                                 |
   |                                                 |
   |                                                 |
   |                                                 |
+-+-------------------------------------------------+-+   <--  0.038
+-------------------+-------------+-------------------+   <--  0.035  BCR
                    |             |
                   =|             |
                    +------x------+                   <--  0.000  BPA=ARP

<--                      0.381                        -->

  ARP: Antenna Reference Point
   L1 : L1 Phase Center                  L2 : L2 Phase Center
   TCR: Top of Chokering                 BCR: Bottom of Chokering
   TGP: Top of Ground Plane              BGP: Bottom of Ground Plane
   TPA: Top of Preamplifier              BPA: Bottom of Preamplifier
   TOP: Top of Pole

All dimensions are in meters.
```

5.2. SLR site log

```
     ILRS Site and System Information Form
     International Laser Ranging Service

0.   Form

     Prepared by (Full Name)    : Yang Fumin
     Preparer E-mail            : yangfm@center.shao.ac.cn
     Date Prepared              : 2002-05-09
     Report Type                : UPDATE
     Format Version             : 1.0


1.   Identification of the Ranging System Reference Point (SRP)

     Site Name                  : Shanghai
     IERS DOMES Number          : 21605S001
     CDP Pad ID                 : 7837
     Subnetwork                 : WPLTN
     Description                : AZ EL INTERSECT
     Monument Description       : N.A.
     Monument Inscription       : N.A.
     Mark Description           : N.A.
     Date Installed             : 1983-03-19
     Date Removed               : (yyyy-mm-dd)
     Geologic Characteristic    : SANDSTONES
     Additional Information     : The site is located in southwest
                                  Shanghai, 30 km away from town.
                                  SRP is center of 45 deg bending
                                  mirror.

2.   Site Location Information

     City or Town               : Shanghai
     State or Province          : Shanghai
     Country                    : P.R. Chinese
     Tectonic Plate             : Eurasian
     Approximate Position
       X coordinate          [m]: -2831088.101
       Y coordinate          [m]:  4676203.354
       Z coordinate          [m]:  3275172.810
       Latitude            [deg]:     31.0975 N
       Longitude           [deg]:    121.1917 E
       Elevation             [m]:     29.023
     Additional Information     : The site is located by the
                                  Sheshan hill


3.   General System Information

3.01 System Name                : Shanghai
     4-Character Code           : SHAL
     CDP System Number          : 28
     CDP Occupation Number      : 05
     Eccentricity to SRP (if Not Identical With SRP)
       North                 [m]: 0
       East                  [m]: 0
       Up                    [m]: 0
       Date Measured            : N.A.
     Date Installed             : 1983-03-19
     Date Removed               : (yyyy-mm-dd)
     Additional Information     : (multiple lines)


4.   Telescope Information

4.01 Receiving Telescope Type   : CASSEGRAIN
       Aperture              [m]: 0.6
       Mount                    : AZ-EL
     Xmitting Telescope Type    : REFRACTOR
       Aperture              [m]: 0.15
     Tracking Camera Type       : ICCD
```

```
        Model                    :
        Manufacturer             : China
        Field of View       [deg]: 0.3
        Minimum Magnitude   [mag]: 13
      Transmit/Receive Path      : SEPARATE
      Transmit/Receive Switch    : NONE
      Max Slew Rate Az    [deg/s]:  5
      Max Slew Rate El    [deg/s]:  1
      Max Used Tracking Rate Az  :  5
      Max Used Tracking Rate El  :  1
      Telescope Shelter          : DOME
      Daylight Filter Type       : Oven controlled spectral filter
      Dayl. Filt. Bandwidth  [nm]: 0.3
      Adjustable Attenuation     : NO
      Transmit Efficiency        : 0.60
      Receive Efficiency         : 0.51,0.1(3nm filter included)
      Date Installed             : 1983-3-19
      Date Removed               : (yyyy-mm-dd)
      Additional Information     : The filter is used in daylight tracking only


5.    Laser System Information

 5.01 Laser Type                 : ND:YAG
      Number of Amplifiers       : 1
      Primary Wavelength     [nm]: 1064
      Primary Maximum Energy [mJ]: Not used for laser ranging
      Secondary Wavelength   [nm]: 532
      Secondary Max. Energy  [mJ]: 40
      Xmit Energy Adjustable     : NO
      Pulse Width (FWHM)     [ps]: 50~100
      Max. Repetition Rate   [Hz]: 8
      Fullw. Beam Divergence  ["]: 20
      Final Beam Diameter     [m]: 0.12
      Eyesafe                    : NO
      Eyesafe Standard           : N.A.
      Date Installed             : 1995-10-01
      Date Removed               : (yyyy-mm-dd)
      Additional Information     : SFUR Passively Mode-locked laser


 6.   Receiver System

 6.01.01 Primary Chain
         Wavelength          [nm]: 532
         Detector Type             : CSPAD
           Manufacturer            : PESO Consulting
           Model                   : 0402
           Quantum Efficiency [%]: ~20
           Nominal Gain            :
           Rise Time          [ps]:
           Jitter (Single PE)[ps]: 30
           Field of View       ["]: 80
           Date Installed          : 1998-03-19
           Date Removed            : (yyyy-mm-dd)
         Signal Processing         : Time Walk Compensated
           Manufacturer            : Graz
           Model                   : 1998-03-19
           Date Installed          : (yyyy-mm-dd)
           Date Removed            : (yyyy-mm-dd)
           Amplitude Measurement : NO
           Return-rate Controlled: NO
           Mode of Operation       : Single to Multi Photon
         Time of Flight Observ.    : INTERVAL

           Manufacturer            : Hewlett-Packard
           Model                   : 5370B
           Resolution         [ps]: 20
           Precision          [ps]: 35
           Date Installed          : 1990-04-01
           Date Removed            : (yyyy-mm-dd)
         Additional Information    : (multiple lines)


 7.   Tracking Capabilities
```

```
7.01 Satellites
       Very Low Alt (<400 km)   : NIGHT
       Low Altitude (400-2000)  : YES
       Lageos                   : YES
       GLONASS                  : YES
       Etalon                   : NIGHT
       GPS                      : NIGHT
       Moon                     : NO
     Avge Pass Switch Time   [s]: ~20
     Average values for Lageos
       Single Shot RMS      [mm]: 16
       # of Obs per NP           : 40
       Use of Semi-trains        : YES
       # of Semi-train Tracks    : 3-4
     Range Gate Width       [ns]: 100-30000
     Beam Pointing Accuracy  ["]: 5
     Angle Encoder Resolution["]: 1
     Min. Tracking Elev.   [deg]: 15
     Operation
       Months per Year           : 12
       Days per Week             : 7
       Hours per Day             : 12~24
       Staff per Shift           : 1
       System Shared With        : NO
       Time Allocated to SLR [%]: 100
       Remotely Controllable     : NO
     Date First Applicable       : 1983-11-07
     Date Last Applicable        : (yyyy-mm-dd)
     Additional Information      : Minimum Tracking Elevation
                                   In north and west is 25 deg.


8.   Calibration

8.01 Calibration Type            : PRE+POST
     Target Location             : EXTERNAL(short target within the dome)
     Target Type                 : see additional information
     Target Structure            : Short CALIBR TARGET, see additional
                                   information
     Target Distance         [m]: 2.0
       Date Measured             : 2000-06-20
       Accuracy (mm)        [mm]: 1
       Verification              :
     Return-rate Controlled      : (YES/NO)
     Mode of Operation           : (MULTI/SINGLE/FEW PHOTON/DON'T KNOW)
     Average Cal Interval  [min]: 120 or more
     Single Shot RMS        [mm]: 8
     Edit Criterion 1st Chain    : ITERATIVE 2.5 SIGMA
     Edit Criterion 2nd Chain    : N.A.
     Application of Cal Data     :
     Date Installed              : 2000-06-20
     Date Removed                : (yyyy-mm-dd)
     Additional Information      : Target is made of a prism and a diffusor
                                   to direct the beam into receiver.


9.   Time and Frequency Standards

9.01.01 Frequency Standard Type : Oven Controlled Crystal Oscillator
        Model                   : 58503A
        Manufacturer            : HP
        Short Term Stab.  [e-12]: 5
        Long Term Stab.   [e-12]: 1
        Time Reference          : GPS
        Synchronization         : GPS
        Epoch Accuracy      [ns]: 110
        Date Installed          : 1997-10-01
        Date Removed            : (yyyy-mm-dd)
        Additional Information  :

9.02.01 GPS Timing Rcvr Model   : 58503A
        Manufacturer            : HP
        Date Installed          : 1997-10-01
        Date Removed            : (yyyy-mm-dd)
        Additional Information  : (multiple lines)
```

10. Preprocessing Information

```
10.01 On-site NP Generation      : YES
      Data Screening             : Polyfit fit + orbit solve
      Edit Criterion 1st Chain   : 2.5 SIGMA
      Edit Criterion 2nd Chain   : N.A.
      Upload interval            : No
      Date First Applicable      : 1983-11-07
      Date Last Applicable       : (yyyy-mm-dd)
      Additional Information     : (multiple lines)
```

11. Aircraft Detection

```
11.01 Detection Type             : NONE
      Date Installed             : (yyyy-mm-dd)
      Date Removed               : (yyyy-mm-dd)
      Additional Information     : No limit to laser transmit in the area of
                                   the station, because there are few aircraft
                                   and the transmitted laser energy is low.
```

12. Meteorological Instrumentation

```
12.01.01 Pressure Sensor Model   :
         Manufacturer            : China
         Recording Interval      : PER PASS
         Accuracy          [mbar]: 0.3
         Height Diff to SRP   [m]: 2
         Date Installed          : 1999-09-01
         Calibration Interval    : EVERY FEW YEARS
         Date Removed            : (yyyy-mm-dd hh:mm UT)
         Additional Information  : Pressures compared with
                                   local Met Office barometers

12.02.01 Temp Sensor Model       :
         Manufacturer            : China
         Recording Interval      : PER PASS
         Accuracy         [deg C]: 0.3
         Date Installed          : 1990-04-01
         Calibration Interval    : EVERY FEW YEARS
         Date Removed            : (yyyy-mm-dd hh:mm UT)
         Additional Information  : Temperatures compared with local Met
                                   office readings


12.03.01 Humidity Sensor Model   :
         Manufacturer            : China
         Recording Interval      : PER PASS
         Accuracy       [% rel h]: 3
         Date Installed          : 1990-04-01
         Calibration Interval    : EVERY FEW YEARS
         Date Removed            : (yyyy-mm-dd hh:mm UT)
         Additional Information  : Humidity compared with local Met
                                   office readings
```

13. Local Ties, Eccentricities, and Collocation Information

13.01 Collocated Permanent Geodetic Systems

```
      GPS                        : IGS
        Date Installed           : 1995-01-25
        Date Removed             : (yyyy-mm-dd)
        Additional Information   : (multiple lines)
      GLONASS                    : NO
        Date Installed           : (yyyy-mm-dd)
        Date Removed             : (yyyy-mm-dd)
        Additional Information   : (multiple lines)
      DORIS                      : NO
        Date Installed           : (yyyy-mm-dd)
        Date Removed             : (yyyy-mm-dd)
        Additional Information   : (multiple lines)
      PRARE                      : YES
```

```
        Date Installed           : 1996-05-03
        Date Removed             : 1998-12-01
        Additional Information   : (multiple lines)
      VLBI                       : YES
        Date Installed           : 1987-11-01
        Date Removed             : (yyyy-mm-dd)
        Additional Information   : (multiple lines)
      Gravimeter                 : NO
        Date Installed           : (yyyy-mm-dd)
        Date Removed             : (yyyy-mm-dd)
        Additional Information   : (multiple lines)

13.02.01 Local Ties from the SRP to Other Monuments or Systems on Site

         Monument Name           : None
         Instrumentation Type    : VLBI
         Instrumentation Status  : PERMANENT
         DOMES Number            : 21605S009
         CDP Number              : 7227
         Differential Components (ITRS)
           dx                [m]: -598.854 +- 0
           dy                [m]: -469.637 +- 0
           dz                [m]: 154.972 +- 0
           Date Measured          : 1992
           Determined by          : Shanghai Obs.
         Date Installed          : (yyyy-mm-dd)
         Date Removed            : (yyyy-mm-dd)
         Additional Information  : (multiple lines)

13.02.02 Local Ties from the SRP to Other Monuments or Systems on Site

         Monument Name           : JPL 4027-S
         Instrumentation Type    : GPS
         Instrumentation Status  : PERMANENT
         DOMES Number            : 21605M002
         CDP Number              : N.A.
         Differential Components (ITRS)
           dx                [m]: -645.121 +- 0
           dy                [m]: -537.348 +- 0
           dz                [m]: 196.639 +- 0
           Date Measured          : 1997-01-01
           Determined by          : Shanghai Obs.
         Date Installed          : 1994-10-01
         Date Removed            : (yyyy-mm-dd)
         Additional Information  : The previous site log had the wrong
                                   signs for Dx, Dy, Dz.


14.   Local Events Possibly Affecting Computed Position

14.01 Date                       : (yyyy-mm-dd hh:mm UT)
      Event                      : (EARTHQUAKE/CONSTRUCTION/etc)
      Additional Information     : (multiple lines)


15.   On-Site, Point of Contact Agency Information

      Agency                     : Shanghai Astronomical Observatory,
                                   The Chinese Academy of Sciences
      Mailing Address            : Shanghai Observatory
                                   80 Nandan Rd,Shanghai 200030
                                   China
      Primary Contact
        Contact Name             : Yang Fumin
        Telephone (primary)      : +86-021-64696290
        Telephone (secondary)    :
        Fax                      : +86-021-64384618
        E-mail                   : yangfm@center.shao.ac.cn
      Secondary Contact
        Contact Name             : Zhang Zhongping
        Telephone (primary)      : +86 -021-64386191
        Telephone (secondary)    :
        Fax                      : +86-021-64384618
        E-mail                   : zzp@center.shao.ac.cn
      Additional Information     : (multiple lines)
```

16. Responsible Agency (if different from 15.)

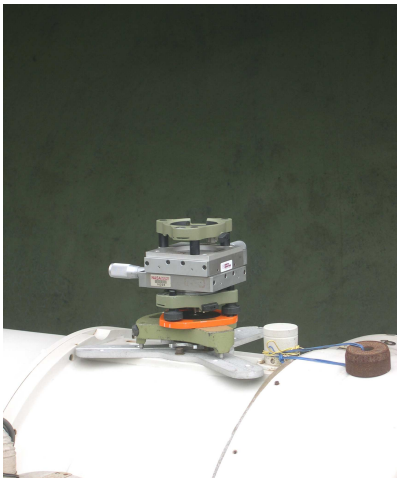
```
Agency                    : (multiple lines)
Mailing Address           : (multiple lines)
Primary Contact
  Contact Name            :
  Telephone (primary)     :
  Telephone (secondary)   :
  Fax                     :
  E-mail                  :
Secondary Contact
  Contact Name            :
  Telephone (primary)     :
  Telephone (secondary)   :
  Fax                     :
  E-mail                  :
Additional Information    : (multiple lines)
```

17. More Information

```
URL for More Information  : http:/center.shao.ac.cn/
Hardcopy on File
  Site Map                : NO
  Site Diagram            : NO
  Horizon Mask            : NO
  Monument Description    : NO
  Site Pictures           : NO
Additional Information    : (multiple lines)
```

5.3. SLR observations description

The platform …



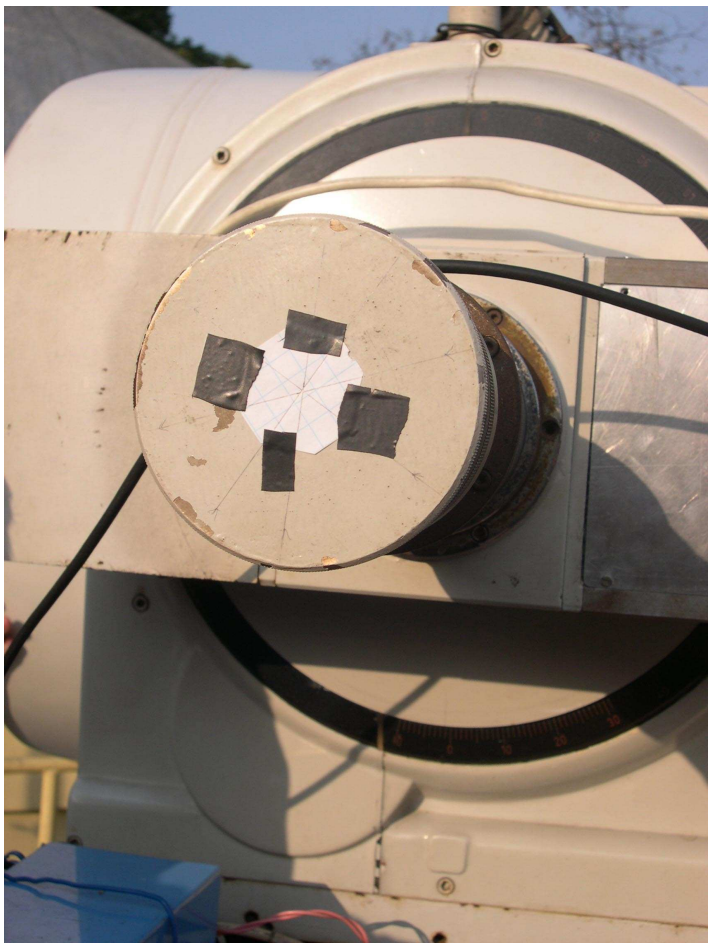
and the translation stage

The tanslation stage fixed on the platform has been put on top of the SLR and has been centered on the SLR vertical rotation axis. It could be used with target, prism or GPS antenna. This point has been included into the levelling observations.

Choke ring antenna set up on the translation stage

Translation stage with target

Translation stage with prism



Percing point of the horizontal axis of the telescope

5.4. VLBI site log

```
Network Station Configuration File
International VLBI Service

Refer to the instructions in the file
ftp://ivscc.gsfc.nasa.gov/config/instructions.txt
for how to fill out and submit this form.
990624 nrv Form version 0.5
990702 nrv Form version 0.6
990713 nrv Form version 0.7
991020 nrv Form version 0.8

0. Form

   Prepared by (full name) :
   Date prepared           : yyyy-mmm-dd
   Report type             : new/update

1. Site identification

   Site name               : Seshan VLBI station
   Site 8-letter code      : Shanghai
   Site 2-letter code(s)   : Sh

   IERS DOMES number       :
   CDP occupation code     : 21605
   CDP monument number     : 7227
   Surveyed into national network? : (yes/no)
   IGS station code        : (4 letters, all upper case, blank if not an
                              IGS station)
   ILRS station name       : (blank if not an ILRS station)
   Additional information  : (multiple lines allowed)

2. Site information

2.1 Site location information

   City or Town            :   Seshan
   State or Province       :   Shanghai
   Country                 :   China
   Tectonic plate          :   Eurasia
   Approximate position
     X coordinate (m)      :   -2831684.706
     Y coordinate (m)      :    4675732.890
     Z coordinate (m)      :    3275328.254
     Latitude (deg)        :    31.0992N
     Longitude (deg)       :   +121.1996E
     Elevation (m)         :    5
     Source of position    :    GPS
   Additional information  : (multiple lines allowed)

2.2 Site local survey network information

   Number of reference markers  :
   Type of marker          : (pillar, ground marker, etc.)
   Frequency of surveying  : (annual, biannual, etc.)
   Surveying method        : (directions, distances, levelling, GPS, etc.)
   Survey instruments used : (theodolite, etc.)
   Accuracy                : ( xx mm)
   Survey performed by     :
   Survey documentation    : (URL, publication, report, etc.)
   Most recent survey date : (yyyy-mmm-dd)
   Results provided to IERS: (yes/no)
   Results provided to CDDIS: (yes/no)
   Person responsible      : (name and contact information)
   Additional information  : (multiple lines allowed)

2.3 Site descriptive information

   Electronic file available at IVSCC:
   (Please upload these files to ftp://ivscc.gsfc.nasa.gov/incoming
    and send e-mail to ivscc+AEA-ivscc.gsfc.nasa.gov telling the names.)
```

```
      ns is for Network Stations (don't change)
      Xy is station 2-letter code
      sm, sd, hm, md, sp indicate the type of file (don't change)
      NN are numbers, 01 is the first such file, 02 the second, etc.
      .type is the file type, .ps for PostScript, .jpg for JPEG, etc.
    Site map              : nsXysmNN.type
    Site diagram          : nsXysmNN.type
    Horizon mask diagram  : nsXysmNN.type
    Monument description  : nsXysmNN.type
    Site photographs      : nsXysmNN.type
  URLs for reference
    Site map              :
    Site diagram          :
    Horizon mask          :
    Monument description  :
    Site photographs      :
  Additional information  : (multiple lines allowed)

3. Antenna information

  Diameter (m)            :   25
  Axis type               :   AZEL
  Axis offset (m)         :
  Slew rate first axis    :   30/min
  Slew rate second axis   :   20/min
  Limit stops first axis  :   438, -81
  Limit stops second axis :   87.6, 5
  Horizon mask data       : (Pairs of values separated with /.
                             Either line segment end points:
                             Az1 El1/Az2 El2/..../Azlast Ellast
                             or step function:
                             Az1 El1/Az2 El2/..../Azlast )
  Occupation dates        : (yyyy-mmm-dd to yyyy-mmm-dd)
  Additional information  : (multiple lines allowed)

4. Receiver information

  Feed location           :  cassegrain focus
  Feed type               : (NASA/CDP prime-focus, dichroic, etc.)
  X 1st-stage amplifier   :  cooled HEMT
  X bandwidth (MHz)       :  800
  X Tsys at zenith (K)    :  45
  X SEFD (Jy)             :  700
  X aperture efficiency   : (optional)
  X LO frequencies (MHz)  :  7600, 8000
  S 1st-stage amplifier   :  cooled HEMT
  S bandwidth (MHz)       :  300
  S Tsys at zenith (K)    :  100
  S SEFD (Jy)             :  1700
  S aperture efficiency   : (optional)
  S LO frequencies (MHz)  :  1600
  Phase calibrator type   :  NASA/CDP with 5 MHz
  Additional information  : (multiple lines allowed)

5. Cables between receiver and back end

  Length of cable run     : (between front end and back end, meters)
  X band cable type       : flexible cable
  X band freq. bandpass   : 8200 - 9000 (MHz)
  S band cable type       : flexible cable
  S band freq. bandpass   : 2150 - 2450 (MHz)
  LO ref signal cable type: flexible cable
  LO ref signal freq.     : 100 (MHz)
  Phase cal ref signal cable type: flexible cable
  Phase cal ref signal freq. : 5 (MHz)
  Cable meas. system type :  MarkIII cable

  Additional information  : (multiple lines allowed, e.g. multiple
                            signals multiplexed on a single cable)

6. Data acquisition system information

6.1 Video/baseband converter set (group each set of up to 16
      mixers with similar characteristics)
  Type of converters      :  VLBA
  Number of mixers        :  VLBA type has 1 mixer per converter,
```

```
   Sidebands available     :  U, L
   Number of mixers with
   the following filters in
   all sideband outputs:
     2 MHz                 :   yes
     4 MHz                 :   yes
     8 MHz                 :   yes
    16 MHz                 :   yes
    32 MHz                 :   yes
   Additional information  : (multiple lines allowed)

6.1.x (add sections for each additional video/baseband converter set)

6.2 Formatter
   Formatter type          :   MarkIV, VLBA S2
   Serial number or rack ID: (e.g. formatter ID)
   Additional information  : (multiple lines allowed)

6.2.x (add sections for each additional formatter)

6.3 Decoder
   Decode type             :  VLBA(DQA), S2
   Additional information  : (multiple lines allowed)

6.3.x (add sections for each additional decoder)

6.4 IF distribution
   IF distributor type     :  VLBA
   Additional information  : (multiple lines allowed)

6.4.x (add sections for each additional IF distribution)

6.5 Up/down converters
   X up/down converter freq.: 479.9 (MHz)
   S up/down converter freq.: (MHz) (up/down)
   Additional information  : (multiple lines allowed)

6.5.x (add sections for each additional converter)

6.6 Other rack equipment   : (e.g. CresTech VIA interface box,
                              K4 DMS tape changer, etc.)
   Additional information  : (multiple lines allowed)

6.6.x (add lines or sections for other types of rack equipment)

6.7 Recorders

   Recorder type           :  VLBA4, S2
   Number of recorders     :
   Tape type               :  thick, thin, S2 type
   Additional information  : (multiple lines allowed)

6.7.x (add sections for each recorder type)

6.8 Data Acquisition System Configuration Types Supported
    (list only those that are actually usable)

   6.8.1 Configuration 1   : (list elements from section 6 that
                           :  make a usable configuration)
                           : Example:
                           : 6.1.1 VLBA BBCs
                           : 6.2   VLBA, MK4, S2 formatter
                           : 6.3   VLBA DQA
                           : 6.4   VLBA IF distribution
                           : 6.5   UP converter
                           : 6.7   VLBA recorder S2 recorder

   6.8.x (list additional configurations)

7 Meteorological instrumentation

7.1 Humidity sensor
   Manufacturer            :    China
   Model                   :    HC
   Accuracy                :    3% RH
```

```
   Effective dates         : (yyyy-mmm-dd to yyyy-mmm-dd)
   Additional information  : (multiple lines allowed)

7.2 Pressure sensor
   Manufacturer            :    China
   Model                   :    GDJ-5
   Accuracy                :    0.3 mbar
   Effective dates         : (yyyy-mmm-dd to yyyy-mmm-dd)
   Height relative to VLBI : (m)
   Additional information  : (multiple lines allowed)

7.3 Temperature sensor
   Manufacturer            :   USA
   Model                   :   AD590
   Accuracy                :   0.2 degree
   Effective dates         : (yyyy-mmm-dd to yyyy-mmm-dd)
   Additional information  : (multiple lines allowed)

8. Time and frequency standards

8.1
   Standard type           :   H-maser/GPS
   Installed dates         : (yyyy-mmm-dd to yyyy-mmm-dd)
   Manufacturer            :   H-maser Shanghai, GPS USA
   Model number or ID      :                       TAC
   Additional information  : (multiple lines allowed)

8.x (add more sections for each standard)

9. Auxilliary equipment information

   Type of equipment       : (WVR, etc.)
   Installed dates         : (yyyy-mmm-dd to yyyy-mmm-dd)
   Manufacturer            :
   Model number or ID      :
   Additional information  : (multiple lines allowed)

9.x (add sections for additional auxilliary equipment)

10. Co-location information

10.1
   Instrument type         : (Doris/Glonass/Prare/SLR/GPS)
   Instrument name         :
   Status                  : (Permanent/Mobile)
   Effective dates         : (yyyy-mmm-dd to yyyy-mmm-dd)
   Included in local survey: (yes/no)
   Additional information  : (multiple lines allowed)

10.x (add sections for each type)

11. Field System computer information

   System vendor           :   SWT
   CPU                     :   PII
   CPU speed               :   333 (MHz)
   Memory                  :   64 (Mbytes)
   Disk                    :   4.3 (Gbytes)
   Linux release           :   Debian GNU/Linux 2.0
   Internet connection     :   none
   Antenna interface type  :   serial
   Spare FS computer?      :   yes

12. Known RFI sources          none

12.1
   Center frequency        : (MHz)
   Approximate bandwidth   :
   Approximate az/el range : (give range affected by RFI)
   Additional informaiton  : (multiple lines allowed, give estimate
                              of strength of interference)

12.x (add sections for multiple RFI sources and frequencies)

13. On-site contact information
```

```
   Agency                  : Shanghai Astronomical Observatory
                             Chinese Academy of sciences
   Shipping address        : Shanghai Observatory
                             80 Nandan Road
                             Shanghai 200030
                             China
   Postal address          : Shanghai Observatory
                             80 Nandan Road
                             Shanghai 200030
                             China

   URL of site web page    :
   On-site Friend of VLBI
     Name                  :  Huang Xinyong
     Telephone (primary)   :  86 21 34250656
     Telephone (alternate) :  86 21 64386191-505
     Fax                   :  86 21 64384618
     E-mail                :  xhuang@center.shao.ac.cn
   On-site VLBI operations room
     Telephone (primary)   :  86 21 57651763
     Telephone (alternate) :
     Fax                   :
     E-mail                :
   Other on-site contact
     Name                  :
     Telephone (primary)   :
     Telephone (alternate) :
     Fax                   :
     E-mail                :
   Additional information  : (multiple lines allowed)

14. Responsible agency (if different from on-site information)

   Agency                  : (multiple lines)
   Shipping address        : (multiple lines)
   Postal address          : (if different, multiple lines)
   URL of agency web page  :
   Primary administrative agency contact
     Contact person        :
     Telephone (primary)   :
     Telephone (alternate) :
     Fax                   :
     E-mail                :
   Alternate agency contact
     Contact person        :
     Telephone (primary)   :
     Telephone (alternate) :
     Fax                   :
     E-mail                :
   Additional information  : (multiple lines allowed)

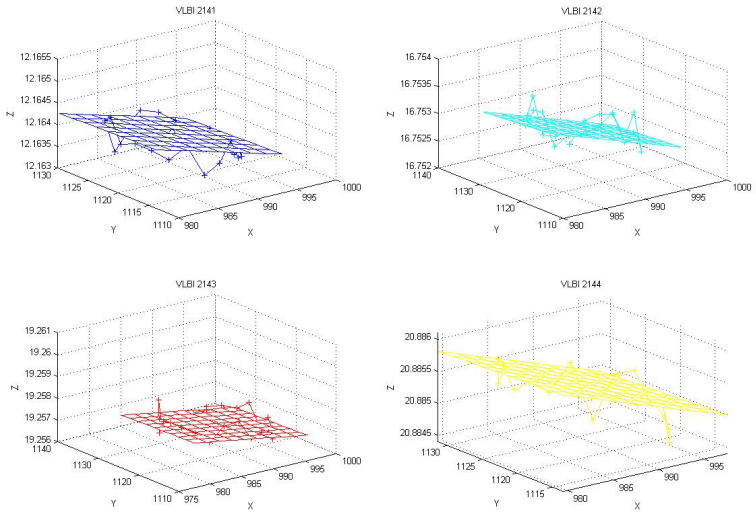
15. More information

   Additional information  : (multiple lines allowed)
```

5.5. VLBI reference point : data analysis

5.5.1. Vertical Axis

By a least squares adjustment, each of the 4 circles is determined independantly ; the radius, the centre and the plane elements are processed.



The four observed and computed planes and circles

The residuals (m) are presented here :

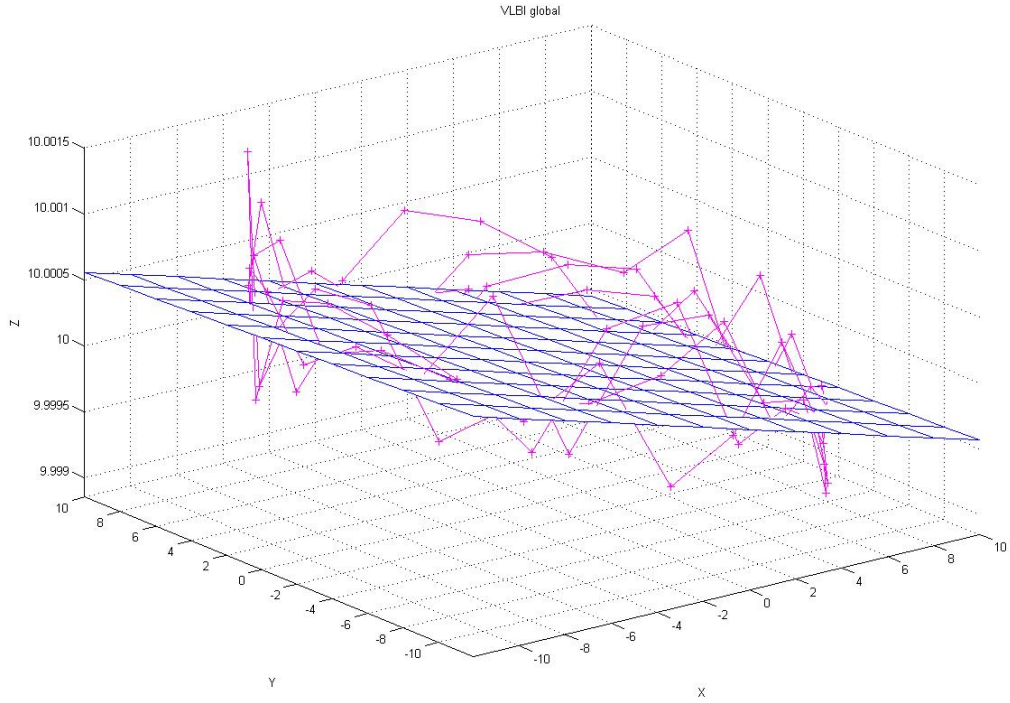
	Residuals wrt the plane	Residuals wrt the circle		Residuals wrt the plane	Residuals wrt the circle
1st circle (23 points)	-4.155E-05	-4.117E-04	2nd circle (25 points)	-3.644E-04	-2.577E-04
	3.372E-04	-1.177E-03		9.879E-05	-7.861E-04
	3.191E-04	-4.926E-04		2.497E-04	-2.189E-04
	1.841E-04	-4.744E-04		2.771E-04	-1.911E-04
	-2.577E-04	-1.164E-05		-1.132E-04	1.143E-04
	1.848E-04	1.836E-04		3.756E-04	-3.333E-04
	-1.914E-04	1.475E-04		-1.558E-04	-8.331E-05
	-1.879E-04	1.725E-04		-3.052E-04	3.173E-04
	-4.814E-06	2.603E-05		-6.934E-05	-6.330E-05
	-4.112E-05	-1.388E-04		5.620E-05	-4.078E-04
	5.731E-06	1.358E-04		-1.234E-04	1.436E-04
	4.393E-04	-2.731E-05		3.971E-04	-4.649E-05
	-3.585E-05	2.287E-04		1.232E-04	-3.574E-04
	-3.145E-04	7.698E-04		-3.999E-05	6.911E-04
	3.085E-04	1.209E-04		-8.829E-05	-4.464E-04
	-6.153E-05	2.765E-05		-3.184E-04	2.714E-04
	8.031E-05	-2.055E-04		2.719E-04	-3.709E-05
	1.378E-04	4.227E-04		2.831E-04	1.092E-03
	1.401E-05	-5.562E-05		1.453E-05	-1.061E-03
	5.104E-04	-2.042E-04		-3.597E-05	-2.762E-04
	3.274E-04	1.222E-03		1.281E-04	2.937E-04
	-6.119E-04	3.059E-05		4.922E-04	3.925E-04
	-2.416E-04	-2.869E-04		-2.178E-04	2.642E-04
				-2.331E-04	7.778E-04
				-6.441E-05	2.090E-04

	Residuals wrt the plane	Residuals wrt the circle		Residuals wrt the plane	Residuals wrt the circle
3rd circle (25 points)	-3.644E-04	-2.577E-04	4th circle (25 points)	1.828E-04	-2.909E-04
	9.879E-05	-7.861E-04		2.520E-04	-7.313E-04
	2.497E-04	-2.189E-04		2.101E-04	-3.841E-04
	2.771E-04	-1.911E-04		5.440E-04	-5.830E-04
	-1.132E-04	1.143E-04		-4.395E-04	8.257E-06
	3.756E-04	-3.333E-04		1.553E-04	-4.420E-04
	-1.558E-04	-8.331E-05		-1.712E-04	-1.691E-04
	-3.052E-04	3.173E-04		-5.172E-04	8.878E-04
	-6.934E-05	-6.330E-05		-7.961E-05	-9.754E-05
	5.620E-05	-4.078E-04		4.586E-05	-1.893E-04
	-1.234E-04	1.436E-04		-1.356E-04	2.389E-04
	3.971E-04	-4.649E-05		6.813E-04	-1.581E-04
	1.232E-04	-3.574E-04		5.025E-04	-1.698E-04
	-3.999E-05	6.911E-04		-2.667E-04	2.154E-04
	-8.829E-05	-4.464E-04		7.823E-05	-4.568E-04
	-3.184E-04	2.714E-04		2.412E-04	3.324E-04
	2.719E-04	-3.709E-05		3.247E-04	-1.532E-04
	2.831E-04	1.092E-03		2.299E-04	1.003E-03
	1.453E-05	-1.061E-03		-4.435E-04	-6.648E-04
	-3.597E-05	-2.762E-04		9.025E-04	-5.280E-04
	1.281E-04	2.937E-04		-5.351E-04	3.459E-04
	4.922E-04	3.925E-04		-2.711E-04	6.374E-04
	-2.178E-04	2.642E-04		-4.791E-04	4.016E-04
	-2.331E-04	7.778E-04		-9.063E-05	7.799E-04
	-6.441E-05	2.090E-04		-1.724E-05	1.668E-04

The residuals represent the distance in meter from the point to the plane or the circle.
These 4 circles should have their planes parallel and their centres aligned. A first check is made at this level in order to validate that a global adjustment is possible.

	1st circle		2nd circle		3rd circle		4th circle	
Normal vector (m)	x	4.3012E-05	x	4.626E-05	x	4.1683E-05	x	7.1383E-05
	y	-3.9706E-06	y	1.5112E-05	y	1.7145E-06	y	9.0771E-06
	z	1	z	1	z	1	z	1
Centre (m)	x	989.0544	x	989.0549	x	989.0549	x	989.0551
	y	1122.8680	y	1122.8679	y	1122.8679	y	1122.8679
	z	12.1636	z	16.7529	z	19.2572	z	20.8853

By applying a translation (vector of the coordinates of the centre) and a scale factor (10 m / radius), it is possible to compute the final direction of the vertical axis.



The combined vertical axis orthogonal plane

The results are presented here :

Residuals wrt the plane (m)	Residuals wrt the circle (m)
2.693E-05	-5.973E-04
5.869E-04	-1.686E-03
5.726E-04	-6.995E-04
3.821E-04	-6.677E-04
-2.551E-04	-2.208E-07
3.650E-04	2.834E-04
-1.931E-04	2.347E-04
-2.135E-04	2.716E-04
1.908E-05	6.170E-05
-6.405E-05	-1.763E-04
-2.794E-05	2.129E-04
5.638E-04	-2.546E-05
-1.402E-04	3.347E-04
-5.571E-04	1.102E-03
3.231E-04	1.675E-04
-2.092E-04	2.781E-05
-1.235E-06	-3.112E-04
9.394E-05	5.832E-04
-6.327E-05	-1.040E-04
6.724E-04	-3.178E-04
4.399E-04	1.722E-03
-8.114E-04	2.974E-05
-2.592E-04	-4.188E-04
-6.649E-04	-4.089E-04

Residuals wrt the plane (m)	Residuals wrt the circle (m)
4.155E-04	-9.471E-04
3.698E-04	-4.866E-04
8.091E-04	-7.429E-04
-4.826E-04	3.427E-05
2.859E-04	-5.539E-04
-1.574E-04	-1.968E-04
-6.306E-04	1.185E-03
-8.091E-05	-1.087E-04
5.860E-05	-2.337E-04
-2.036E-04	3.211E-04
8.434E-04	-2.052E-04
5.900E-04	-2.271E-04
-4.316E-04	2.708E-04
1.121E-05	-6.149E-04
2.221E-04	4.140E-04
3.355E-04	-2.248E-04
2.216E-04	1.288E-03
-6.444E-04	-8.958E-04
1.138E-03	-7.147E-04
-7.208E-04	4.331E-04
-3.537E-04	8.189E-04
-5.981E-04	5.168E-04
-6.546E-05	1.019E-03
4.847E-05	2.224E-04

8.714E-05	-1.239E-03	-2.961E-04	-8.451E-05
3.510E-04	-3.342E-04	-4.888E-05	-1.416E-03
4.191E-04	-2.854E-04	1.827E-04	-5.817E-04
-1.711E-04	2.023E-04	2.437E-04	-3.143E-04
6.293E-04	-5.036E-04	-2.518E-04	5.500E-05
-1.876E-04	-1.069E-04	-1.192E-04	-5.955E-04
-4.041E-04	5.265E-04	-2.859E-04	-2.013E-04
-1.640E-05	-7.834E-05	-7.493E-04	1.039E-03
1.902E-04	-6.275E-04	-4.455E-04	1.619E-04
-9.338E-05	2.401E-04	1.021E-04	6.525E-04
7.241E-04	-6.689E-05	1.067E-04	3.372E-04
2.775E-04	-5.655E-04	7.690E-04	-8.268E-04
4.094E-07	1.087E-03	6.410E-04	-6.087E-04
-9.948E-05	-7.191E-04	-4.009E-04	7.738E-04
-4.900E-04	4.116E-04	6.974E-04	-2.786E-04
4.168E-04	-8.080E-05	-3.125E-05	7.253E-05
4.077E-04	1.703E-03	6.683E-05	-6.100E-04
-4.149E-05	-1.706E-03	-1.983E-04	4.615E-04
-1.414E-04	-4.621E-04	2.333E-04	-5.446E-04
1.039E-04	4.423E-04	2.994E-04	-2.037E-04
6.729E-04	6.020E-04	-2.693E-04	3.614E-04
-4.522E-04	4.047E-04	-3.842E-05	8.617E-04
-4.695E-04	1.224E-03	1.058E-04	2.781E-04
-1.901E-04	3.298E-04	-1.504E-04	9.961E-04
3.103E-04	-3.769E-04	-1.636E-04	2.069E-04

Normal vector (m)	x	4.3012E-05
	y	-3.9706E-06
	z	1

The radius is estimated to be equal to 10.0000 m. The estimated centre is 0.017 mm from the theoretical value.

Final results on the vertical axis

Then the determination of the centres and the radius are computed by least squares with some added constraints on the plane that contains the circle.

The residuals are presented here:

1st circle (23 points)	2nd circle (25 points)	3rd circle (25 points)	4th circle (25 points)
-4.117E-04	-2.577E-04	-2.909E-04	-6.438E-05
-1.177E-03	-7.861E-04	-7.313E-04	-1.074E-03
-4.926E-04	-2.189E-04	-3.841E-04	-4.495E-04
-4.744E-04	-1.911E-04	-5.830E-04	-2.511E-04
-1.165E-05	1.143E-04	8.260E-06	2.480E-05
1.836E-04	-3.333E-04	-4.420E-04	-4.680E-04
1.475E-04	-8.331E-05	-1.691E-04	-1.708E-04
1.725E-04	3.173E-04	8.878E-04	7.661E-04
2.602E-05	-6.330E-05	-9.754E-05	1.064E-04
-1.388E-04	-4.078E-04	-1.893E-04	4.800E-04
1.358E-04	1.436E-04	2.389E-04	2.460E-04
-2.732E-05	-4.649E-05	-1.581E-04	-6.280E-04
2.287E-04	-3.574E-04	-1.698E-04	-4.584E-04
7.698E-04	6.911E-04	2.154E-04	5.903E-04
1.209E-04	-4.464E-04	-4.568E-04	-1.997E-04
2.765E-05	2.714E-04	3.324E-04	6.922E-05
-2.055E-04	-3.709E-05	-1.532E-04	-4.432E-04
4.227E-04	1.092E-03	1.003E-03	3.674E-04
-5.563E-05	-1.061E-03	-6.648E-04	-3.917E-04
-2.042E-04	-2.762E-04	-5.280E-04	-1.352E-04
1.222E-03	2.937E-04	3.459E-04	2.893E-04
3.059E-05	3.925E-04	6.374E-04	6.643E-04
-2.869E-04	2.642E-04	4.016E-04	2.190E-04
	7.778E-04	7.799E-04	7.561E-04
	2.090E-04	1.668E-04	1.556E-04

The residuals represent the distance in metre from the point to the circle.

	1st circle		2nd circle		3rd circle		4th circle	
Centre (m)	x	989.0544	x	989.0549	x	989.0549	x	989.0551
	y	1122.8680	y	1122.8679	y	1122.8679	y	1122.8679
	z	12.1638	z	16.7529	z	19.2571	z	20.8854

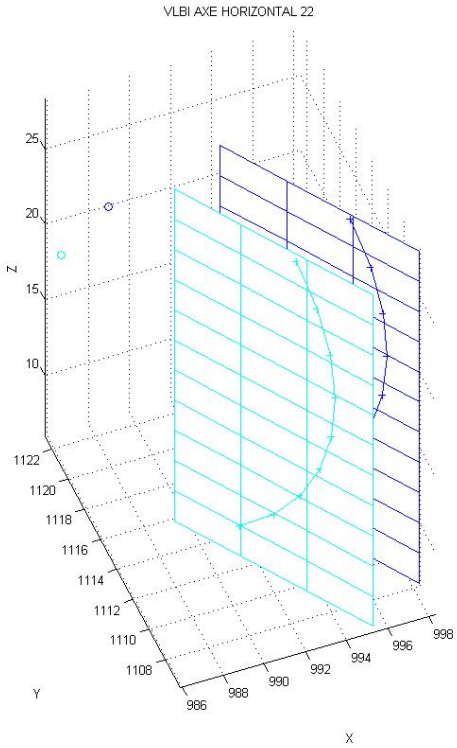
5.5.2. Horizontal Axis

Strategy

The horizontal axis has been observed through two targets set up on the antenna part linked to the secondary axis. The target could only describe an arc of the vertical circle and positions have been recorded with 10° step. In order to fulfill the lack of redundancy and the shortness of the arcs of circle, it has been decided to operate three times the same observation in three different orientations around the vertical axis. In this way, 9 positions have been determined for each vertical of the 2x3 circles by intersections from the points of the topometric network.
The processing of the coordinates of all the observation points is a least squares adjustment with constraints on the points of the polygon coming from the polygon observations. It has been led with the software COMP3D. The precision of the 3x2x9 points goes from 0.3 mm to 0.9 mm.
Each of the 3 couples of circle arcs have been processed like for the vertical axis and give the horizontal axis in its orientation.

Position 1

After having processed the 2 arcs independently and then determined the direction of the normal vector, we have the following results :



The 2 computed circle arcs and planes described by the 2 targets from position 1

Normal vector to the axis

Normal vector (m)	x	8.428E-01
	y	5.382E-01
	z	-2.797E-05

Centers of each arc of circle

		1st circle		2nd circle
Centre (m)	x	988.9939	x	985.8774
	y	1122.8292	y	1120.8390
	z	19.9139	z	19.9138

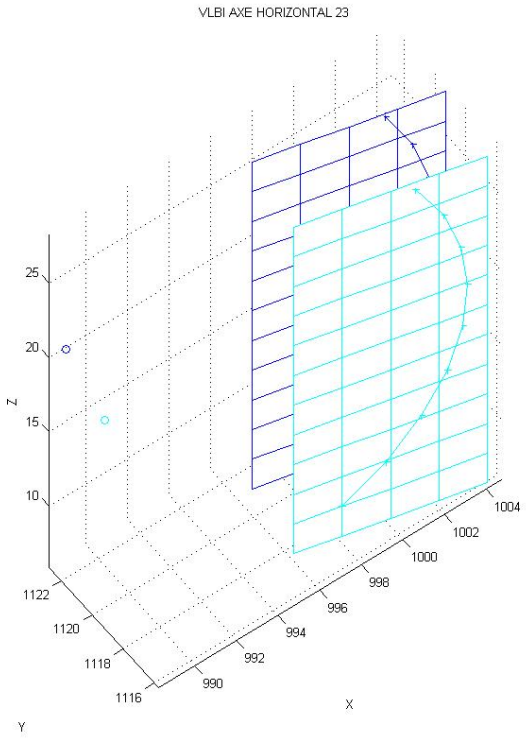
The residuals are presented here:

1st circle (9 points)	2nd circle (9 points)
-1.547E-05	3.634E-05
3.679E-05	-2.128E-05
1.647E-04	-3.654E-04
4.425E-05	-1.370E-04
-3.733E-05	-6.418E-05
-1.962E-04	1.775E-04
1.363E-04	3.707E-04
-1.485E-04	4.121E-05
1.539E-05	-3.789E-05

The residuals represent the distance in metre from the point to the circle.

Position 2

After having processed the 2 arcs independently and then determined the direction of the normal vector, we have the following results :



The 2 computed circle arcs and planes described by the 2 targets from position 2

Normal vector to the axis

Normal vector (m)	x	2.152E-01
	y	9.766E-01
	z	1.837E-05

Centers of each arc of circle

		1st circle		2nd circle
Centre (m)	x	989.0386	x	988.2414
	y	1122.7954	y	1119.1848
	z	19.9137	z	19.9139

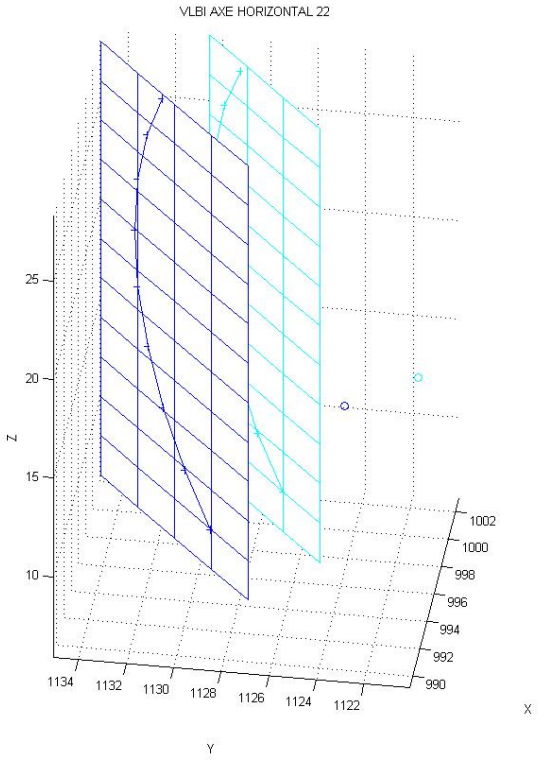
The residuals are presented here:

1st circle (9 points)	2nd circle (9 points)
1.588E-05	6.484E-06
-1.719E-04	-2.901E-04
-5.876E-06	1.765E-04
1.341E-04	1.146E-04
-1.713E-04	7.343E-05
9.655E-05	-1.056E-05
2.952E-05	3.481E-05
8.682E-05	-1.079E-04
-1.388E-05	2.681E-06

The residuals represent the distance in metre from the point to the circle.

Position 3

After having processed the 2 arcs independently and then determined the direction of the normal vector, we have the following results :



The 2 computed circle arcs and planes described by the 2 targets from position 3

Normal vector to the axis

Normal vector (m)	x	-6.765E-01
	y	7.365E-01
	z	9.354E-06

Centers of each arc of circle

		1st circle		2nd circle
Centre (m)	x	989.1049	x	991.6056
	y	1122.8131	y	1120.0893
	z	19.9135	z	19.9138

The residuals are presented here:

1st circle (9 points)	2nd circle (9 points)
-8.883E-06	4.394E-06
1.563E-04	4.882E-05
-1.306E-04	-2.962E-04
1.205E-04	8.533E-05
-2.994E-05	1.882E-04
-1.411E-04	1.153E-04
-8.080E-06	8.078E-06
3.671E-05	-1.565E-04
5.143E-06	2.554E-06

The residuals represent the distance in metre from the point to the circle.

5.6. GPS observations schedule

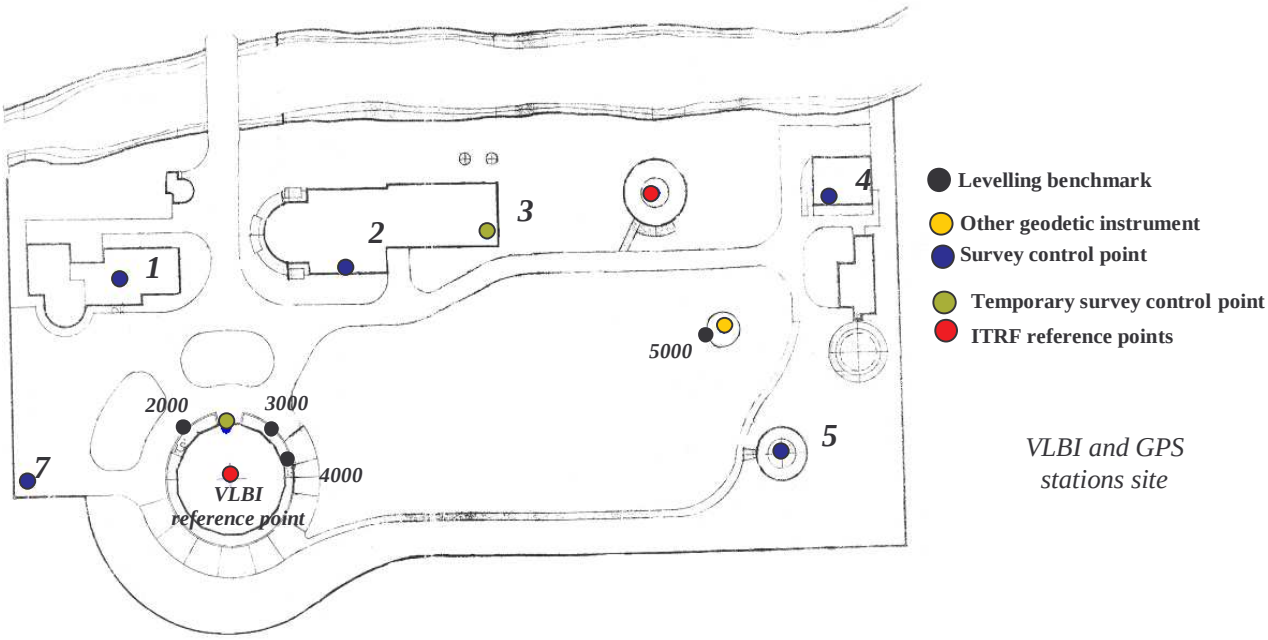
Point	Start (UT)	End (TU)	Ant. Height (m)	Ant. Type
Survey point 1 (Top and centre of the screw)	DOY 329 07:20	DOY 329 23:10	N,E 0.0000 UP 0.1743	LEIAT504
	DOY 331 09:43	DOY 332 02:25	N,E 0.0000 UP 0.1758	
	DOY 332 04:53	DOY 333 04:57	N,E 0.0000 UP 0.0651	ASH701945C_M
Survey point 2 (Top and centre of the screw)	DOY 332 09:15	DOY 333 13:32	N,E 0.0000 UP 0.0625	ASH701945C_M
Temporary station 3 (Top and centre of heavy tripod)	DOY 335 05:04	DOY 336 16:16	N,E 0.0000 UP -0.1622	LEIAT504
Survey point 4 (Top and centre of the screw)	DOY 335 08:25	DOY 336 14:27	N,E 0.0000 Up 0.0654	ASH701945C_M
Survey point 5 (Top and centre of the screw)	DOY 327 00:04	DOY 327 08:45	N,E 0.0000 Up 0.1675	LEIAT504
	DOY 329 07:02	DOY 329 22:57	N,E 0.0000 Up 0.1675	
	DOY 330 07:22	DOY 331 02:34	N,E 0.0000 Up 0.1676	
	DOY 331 09:10	DOY 332 13:05	N,E 0.0000 Up 0.1676	
	DOY 333 04:57	DOY 333 15:36	N,E 0.0000 Up 0.1676	
	DOY 334 00:08	DOY 334 06:42	N,E 0.0000 Up 0.1676	
	DOY 335 08:45	DOY 336 18:21	N,E 0.0000 Up 0.0567	ASH701945C_M
Cable car building roof (Top and centre of heavy tripod)	DOY 327 01:08	DOY 327 07:15	N,E 0.0000 Up 0.1883	LEIAT504
	DOY 334 00:42	DOY 334 06:03	N,E 0.0000 Up 0.1878	
Current SLR site (Top and centre of the domed brass mark)	DOY 327 01:25	DOY 327 07:34	N,E 0.0000 Up 1.5998	LEIAT504
	DOY 327 09:18	DOY 330 08:39	N,E 0.0000 Up 1.5998	
	DOY 330 08:42	DOY 335 01:18	N,E 0.0000 Up 1.5998	
	DOY 335 07:32	DOY 335 23:59	N,E 0.0000 Up 1.6005	
SLR telescope (Top and centre of heavy tripod) on the vertical axis)	DOY 335 03:51	DOY 335 05:22	N,E 0.0000 Up 0.1455	LEIAT504

Point	Start (UT)	End (TU)	Ant. Height (m)	Ant. Type
Future SLR site (Top and centre of screw)	DOY 327 02:14	DOY 327 06:17	N,E 0.0000 Up 0.1765	LEIAT504
	DOY 329 06:07	DOY 330 08:16	N,E 0.0000 Up 0.1750	
	DOY 330 08:24	DOY 332 01:23	N,E 0.0000 Up 0.1750	
	DOY 332 07:19	DOY 334 01:06	N,E 0.0000 Up 0.1750	
	DOY 334 01:16	DOY 336 02:11	N,E 0.0000 Up 0.1743	

All the antenna heights are related to the GPS antenna reference point. They were measured to 0.001m.

5.7. Survey control points

5.7.1. The VLBI site



VLBI and GPS stations site

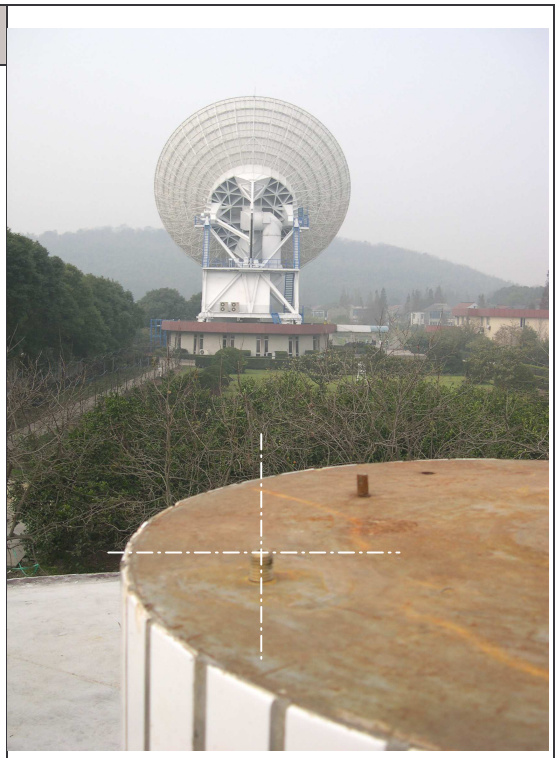
Point 1	
• Residence building roof terrace • Concrete block • Top and centre of the 5/9 inch screw embedded on top • Horizontal self-centering • Direct levelling is possible	

Point 2	
• Workshop building roof terrace • Concrete block • Top and axis of the 5/9 inch screw embedded on top • Horizontal self-centering • • Direct levelling is possible	

Point 4	
• Power station building roof terrace • Top and centre of the 5/9 inch screw embedded on a concrete wall • Horizontal self centering • Direct levelling is possible	

Point 5

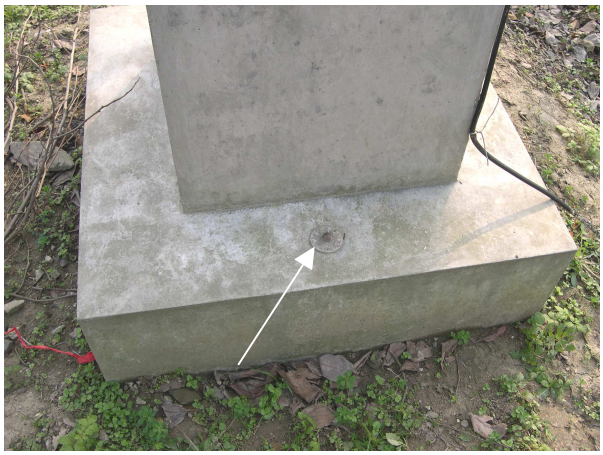
- Circular building roof terrace
- Concrete pillar
- Top and axis of the 5/9 inch screw embedded on top of a metallic plate



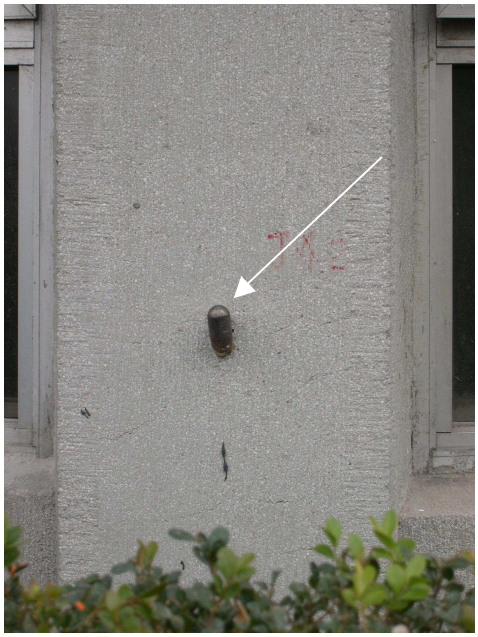
Point 7

- Southwest corner of the Sheshan VLBI and GPS site
- Brass mark
- Top and centre

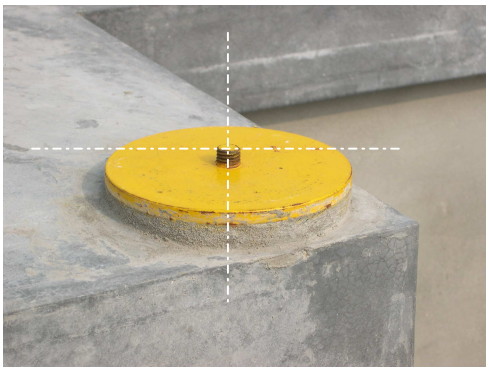
- Direct levelling is possible

Levelling benchmark 5000 EGNOS concrete pier base	
Levelling benchmark 4000 VLBI building : east side of the entrance door, between the 2nd and the 3rd window **Levelling benchmark 3000** VLBI building : east side of the entrance door, before the first window	

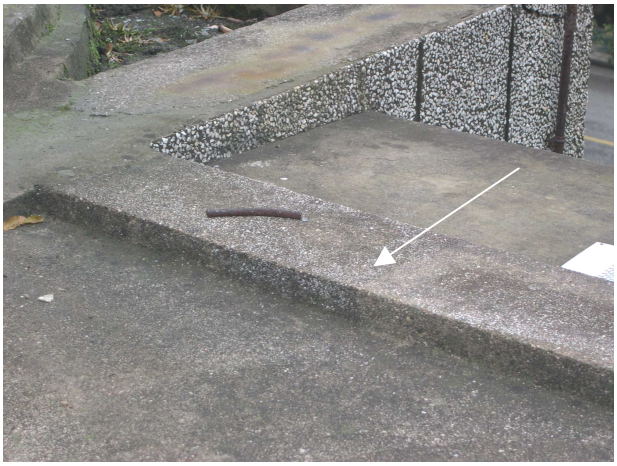
Levelling benchmark 1000	
Residence building Southwest corner	

Levelling benchmark 2000	
VLBI building : west side of the entrance door, between the 1st and the 2nd window	

5.7.2. Future Laser site

Point 40	
• Roof terrace • Top and centre of the 5/9 inch screw embedded on a concrete wall • Horizontal self centring device 	

5.7.3. Current Laser site

Point 30	
• Roof terrace • Top and centre of the domed brass mark 	

5.8. GPS stations antenna intersections

SHAO antenna intersections

References for horizontal and vertical determinations

EGNOS station antenna intersections

References for horizontal and vertical determinations

5.9. SHAO ITRF00 solution extracted SINEX file (2003:332)

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+FILE/REFERENCE
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 OUTPUT            ITRF2000 station positions and velocities
 CONTACT           Zuheir Altamimi (altamimi@ensg.ign.fr)
 SOFTWARE          CATREF
 INPUT             ITRF2000 solution

-FILE/REFERENCE
*-------------------------------------------------------------------------------
+FILE/COMMENT
*
*
*
-FILE/COMMENT
*-------------------------------------------------------------------------------
+SITE/ID
*CODE PT __DOMES__ T _STATION DESCRIPTION__ APPROX_LON_ APPROX_LAT_ _APP_H_
 SHAO  A 21605M002 C SHAO 21605M002         121 12  1.5  31  5 58.7    22.1
-SITE/ID
*-------------------------------------------------------------------------------
+SOLUTION/ESTIMATE
*INDEX TYPE__ CODE PT SOLN _REF_EPOCH__ UNIT S __ESTIMATED VALUE____ _STD_DEV___
     1 STAX   SHAO  A    1 03:332:00000 m    2 -.283173347973873E+07  .28099E-02
     2 STAY   SHAO  A    1 03:332:00000 m    2  .467566596147055E+07  .37934E-02
     3 STAZ   SHAO  A    1 03:332:00000 m    2  .327536942805999E+07  .41691E-02
     4 VELX   SHAO  A    1 03:332:00000 m/y  2 -.306849379564895E-01  .36973E-03
     5 VELY   SHAO  A    1 03:332:00000 m/y  2 -.112298145785553E-01  .47404E-03
     6 VELZ   SHAO  A    1 03:332:00000 m/y  2 -.134405028949834E-01  .50139E-03
-SOLUTION/ESTIMATE
*-------------------------------------------------------------------------------
+SOLUTION/MATRIX_ESTIMATE L COVA
*PARA1 PARA2 ____PARA2+0__________ ____PARA2+1__________ ____PARA2+2__________
     1     1  .789586586910286E-05
     2     1 -.675355859736665E-05  .143901087749258E-04
     3     1 -.366676857322245E-05  .710583822654907E-05  .173816038805136E-04
     4     1  .909518310360241E-06 -.697783727328794E-06 -.407114576292363E-06
     4     4  .136704294273500E-06
     5     1 -.700266444278191E-06  .153999620572736E-05  .768759497656955E-06
     5     4 -.100358887177672E-06  .224716413573800E-06
     6     1 -.405050988634622E-06  .763564394034003E-06  .187424035250533E-05
     6     4 -.634127591622395E-07  .114111700029834E-06  .251400982655323E-06
-SOLUTION/MATRIX_ESTIMATE L COVA
%ENDSNX
```

5.10. GPS network covariance matrix

```
3DC
XYZ  000 30                -2831090.9957       4676203.2927       3275169.0349 m
XYZ  000 21605M101         -2830750.7222       4676573.2249       3275076.8389 m
XYZ  000 5                 -2831764.2137       4675670.1135       3275329.9428 m
XYZ  000 1                 -2831656.7582       4675722.7915       3275351.5377 m
XYZ  000 2                 -2831688.2092       4675699.9038       3275352.0305 m
XYZ  000 20                -2831329.3639       4676117.4997       3275186.2389 m
XYZ  000 35                -2831088.5498       4676203.6733       3275173.0261 m
XYZ  000 4                 -2831761.2663       4675644.5288       3275371.0320 m
COV  CT UPPR                 16
ELEM   2.891744470469999e-06  -1.626026259449000e-09  -9.099042949519999e-10
ELEM   2.891167744960000e-06  -1.061760804113000e-09  -5.993748729220000e-10
ELEM   2.889973609098000e-06  -7.359131078819999e-11  -3.091820283120000e-11
ELEM   2.890975921210000e-06  -9.759094503009999e-10  -5.264261509750000e-10
ELEM   2.891089015580000e-06  -1.087418361388000e-09  -5.822672112929999e-10
ELEM   2.890946801570000e-06  -9.090698247919998e-10  -5.042909670270000e-10
ELEM   2.891198387630000e-06  -1.130632186900000e-09  -6.310814377549999e-10
ELEM   2.890596556690000e-06  -6.554968629149999e-10  -3.200880065730000e-10
ELEM   2.893530051190000e-06   1.534121823757000e-09  -1.156430017550000e-09
ELEM   2.892473282230000e-06   1.096443434302000e-09   9.326423042889998e-11
ELEM   2.890027816249999e-06  -3.482852444059999e-11  -8.320794352439999e-10
ELEM   2.891993368830000e-06   8.189126654709999e-10  -9.336661419879999e-10
ELEM   2.892196373990000e-06   9.006193382100000e-10  -8.530903950309999e-10
ELEM   2.891903186380000e-06   8.283584556259999e-10  -1.114642979547000e-09
ELEM   2.892470655220000e-06   1.061117880263000e-09  -4.889573729359999e-10
ELEM   2.891177313750000e-06   4.575439549640000e-10
ELEM   2.891852068060000e-06  -6.344591527100000e-10   1.043093016733000e-09
ELEM   2.891275984130000e-06   3.618963164210000e-11   5.074540841649999e-11
ELEM   2.889991012967000e-06  -4.752004703650000e-10   9.069036767340000e-10
ELEM   2.891073617659999e-06  -5.234227970829999e-10   9.920190140159999e-10
ELEM   2.891173672350000e-06  -4.758584733679999e-10   8.379290585229999e-10
ELEM   2.890997255189999e-06  -6.219625311649999e-10   1.059360535710000e-09
ELEM   2.891275599759999e-06  -2.584976737465000e-10   5.524970944279999e-10
ELEM   2.890616728890000e-06
ELEM   2.891856056260000e-06  -1.762414034651000e-09  -9.908773247179998e-10
ELEM   2.889954498973000e-06  -1.124942020527000e-10  -4.567350624600000e-11
ELEM   2.890921840640000e-06  -9.889171241289997e-10  -5.253090122269999e-10
ELEM   2.891096867710000e-06  -1.154190802489000e-09  -6.119828348959999e-10
ELEM   2.890926149630000e-06  -9.242163540959999e-10  -4.963574445120000e-10
ELEM   2.891886693149999e-06  -1.831303370118000e-09  -1.022582829788000e-09
ELEM   2.890628939140000e-06  -7.376333639089999e-10  -3.593196716069999e-10
ELEM   2.893901572250000e-06   1.692272513337000e-09   1.487687494088000e-10
ELEM   2.890035324470000e-06  -6.022710748619999e-11  -7.499904452720000e-10
ELEM   2.891959558720000e-06   7.741952163089999e-10  -9.055680253749998e-10
ELEM   2.892276091749999e-06   9.043528537809999e-10  -7.552191566749999e-10
ELEM   2.891737889940000e-06   7.554507424900000e-10  -1.720610211239000e-09
ELEM   2.893898962580000e-06   1.656936079604000e-09  -4.780466360009999e-10
ELEM   2.891270345740000e-06   4.692014242600000e-10
ELEM   2.892003986690000e-06   5.626365186849999e-11   7.890291054129999e-11
ELEM   2.889982609714000e-06  -4.389019585219999e-10   9.156631927500000e-10
ELEM   2.891036290420000e-06  -5.182222108710000e-10   1.049725243053000e-09
ELEM   2.891198390519999e-06  -4.355336912659999e-10   8.253143455089999e-10
ELEM   2.890944356629999e-06  -9.783719586110000e-10   1.708552018011000e-09
ELEM   2.892003596540000e-06  -2.633528933696000e-10   6.175689323689999e-10
ELEM   2.890659116520000e-06
ELEM   2.889996555409000e-06  -7.543861341159999e-13  -7.792194466289999e-13
ELEM   2.889992274163000e-06   1.099073985997000e-11   5.282254444560000e-12
ELEM   2.889995158671999e-06   5.273405484199999e-12   7.367734163759999e-13
ELEM   2.889977140100000e-06   6.595608840879999e-11   2.319360168479000e-11
ELEM   2.889985147712000e-06   7.992883961769999e-11   2.455552246753000e-11
ELEM   2.889996381431000e-06  -9.352117209239999e-13   2.757980122824000e-12
ELEM   2.889996143873000e-06   1.844958002236000e-12  -1.098838779012000e-11
ELEM   2.889998530435000e-06   2.875458128345000e-12  -7.666665362649999e-12
```

```
ELEM   2.889997253633000e-06   5.899249344609999e-13  -5.093172171679999e-11
ELEM   2.890012739120000e-06   4.108605474659999e-11  -7.073571571799999e-11
ELEM   2.890032668560000e-06   4.359582189720000e-11  -5.551451728169999e-13
ELEM   2.889996125377000e-06  -7.907364029689999e-13
ELEM   2.889994714190000e-06  -7.119148455519999e-12   1.528794672885000e-12
ELEM   2.889994702341000e-06  -4.902288241010000e-12   3.435509726989999e-12
ELEM   2.889993934179000e-06  -1.563226886597000e-11  -3.655558792040000e-11
ELEM   2.889982893223000e-06  -3.319217002659999e-11  -4.397987000899999e-11
ELEM   2.889982231702000e-06  -2.433355960691000e-12   7.455072570540000e-12
ELEM   2.889995944174000e-06
ELEM   2.892950941430000e-06  -2.682553170678000e-09  -1.578611233423000e-09
ELEM   2.891432492080000e-06  -1.326625093383000e-09  -7.440310271359999e-10
ELEM   2.890608197610000e-06  -5.105102051219999e-10  -2.911747663270000e-10
ELEM   2.890952483310000e-06  -8.188553550370000e-10  -4.706096553679999e-10
ELEM   2.890404267650000e-06  -3.913647525439999e-10  -1.941921289870000e-10
ELEM   2.895901044760000e-06   2.705445735481000e-09  -1.316563089625000e-09
ELEM   2.892775775639999e-06   1.243751784288000e-09  -5.952205982050000e-10
ELEM   2.891168611960000e-06   5.575897073499999e-10  -9.471365134859999e-10
ELEM   2.891956928820000e-06   8.803421008709999e-10  -3.691458213089999e-10
ELEM   2.890761751980000e-06   3.263944637119999e-10
ELEM   2.893463468480000e-06  -7.364420353930000e-10   1.246641807408000e-09
ELEM   2.891594170240000e-06  -3.153263914200000e-10   4.819733084789999e-10
ELEM   2.890644556699999e-06  -5.128161540400000e-10   7.904590349299999e-10
ELEM   2.891035908939999e-06  -1.848100159649000e-10   3.341815880750000e-10
ELEM   2.890422864800000e-06
ELEM   2.895040966310000e-06  -4.666223504010000e-09  -2.666383556520000e-09
ELEM   2.890699249949999e-06  -5.865434552809999e-10  -3.273926740470000e-10
ELEM   2.891127513270000e-06  -9.744374071259999e-10  -5.499299169649999e-10
ELEM   2.890467255199999e-06  -4.441709669290000e-10  -2.175506707719000e-10
ELEM   2.899674439729999e-06   4.402206646549999e-09  -6.790703877249999e-10
ELEM   2.891309600610000e-06   6.207175674279999e-10  -1.112406791761000e-09
ELEM   2.892273464739999e-06   1.014402079622000e-09  -4.316047631430000e-10
ELEM   2.890864456800000e-06   3.700712258970000e-10
ELEM   2.895724835680000e-06  -3.591165950640000e-10   5.423245637759999e-10
ELEM   2.890720641730000e-06  -5.994883152479999e-10   9.206195285889999e-10
ELEM   2.891198006149999e-06  -2.155064212377000e-10   3.742686509149999e-10
ELEM   2.890475615970000e-06
ELEM   2.914211928700000e-06  -2.375101612520000e-08  -1.038421490683000e-08
ELEM   2.890956792300000e-06  -8.240841453369999e-10  -4.672413719279999e-10
ELEM   2.890390930299999e-06  -4.216018110440000e-10  -1.989435761374000e-10
ELEM   2.935746119230000e-06   1.894331718537000e-08  -8.824386505039999e-10
ELEM   2.891735257149999e-06   7.899952639139998e-10  -3.090853748630000e-10
ELEM   2.890711379280000e-06   2.728766419971000e-10
ELEM   2.911915716769999e-06  -4.838649472859999e-10   7.717133718759999e-10
ELEM   2.890943975149999e-06  -1.651113618568000e-10   3.568022576320000e-10
ELEM   2.890381748770000e-06
ELEM   3.028944070370000e-06  -1.301289858097000e-07  -5.361701969329999e-08
ELEM   2.890659584700000e-06  -6.958613348319999e-10  -3.468310894640000e-10
ELEM   3.099842694809999e-06   8.583650057029999e-08  -5.469038314890000e-10
ELEM   2.891267707170000e-06   4.854594490089999e-10
ELEM   2.992339208990000e-06  -2.950607221730000e-10   5.822535430380000e-10
ELEM   2.890658735039999e-06
ELEM   2.895214337410000e-06  -4.675576275180000e-09  -2.622666697030000e-09
ELEM   2.900435012590000e-06   4.517919801610000e-09
ELEM   2.895490670539999e-06
```

5.11. Global results listing

```
================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0001
================================================================================
Fri Jan 13 08:40:49 2006

Input file:  D:\itrf\surveys\shanghai\calculs\global2-1mm\shao_juillet.iob
Output file: D:\itrf\surveys\shanghai\calculs\global2-1mm\shao_juillet.lst
Options file: C:\Program Files\Microsearch\GeoLab\default.gpj
```

PARAMETERS		OBSERVATIONS	
Description	Number	Description	Number
No. of Stations	151	Directions	326
Coord Parameters	415	Distances	134
Free Latitudes	132	Azimuths	0
Free Longitudes	132	Vertical Angles	0
Free Heights	151	Zenithal Angles	249
Fixed Coordinates	38	Angles	0
Astro. Latitudes	0	Heights	0
Astro. Longitudes	0	Height Differences	170
Geoid Records	0	Auxiliary Params.	0
All Aux. Pars.	126	2-D Coords.	0
Direction Pars.	126	2-D Coord. Diffs.	174
Scale Parameters	0	3-D Coords.	33
Constant Pars.	0	3-D Coord. Diffs.	0
Rotation Pars.	0		
Translation Pars.	0		
	---		---
Total Parameters	541	Total Observations	1086
Degrees of Freedom =	545		

SUMMARY OF SELECTED OPTIONS

OPTION	SELECTION
Computation Mode	Adjustment
Maximum Iterations	30
Convergence Criterion	0.00010
Residual Rejection Criterion	Tau Max
Confidence Region Types	1D 2D 3D Station Relative
Relative Confidence Regions	All
Variance Factor (VF) Known	Yes
Scale Covariance Matrix With VF	Yes
Scale Residual Variances With VF	No
Force Convergence in Max Iters	No
Distances Contribute To Heights	No
Compute Full Inverse	Yes
Optimize Band Width	Yes
Generate Initial Coordinates	Yes
Re-Transform Obs After 1st Pass	Yes
Geoid Interpolation Method	Bi-Quadratic

```
================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0003
================================================================================
Adjusted PLH Coordinates:
                                LATITUDE         LONGITUDE  ELIP-HEIGHT
 CODE FFF STATION                STD DEV           STD DEV      STD DEV
 ---- --- ------------ ----------------- ----------------- ------------
 PLH  000 1            N 31  5 58.067032 E121 11 58.011190      20.4107 m       0
                                  0.0012            0.0012       0.0012
 PLH  110 1000         N 31  5 58.066967 E121 11 58.011239      13.5202 m       0
                                  0.0000            0.0000       0.0012
 PLH  000 2            N 31  5 58.135801 E121 11 59.473688      17.8503 m       0
                                  0.0012            0.0012       0.0012
 PLH  000 20           N 31  5 50.652884 E121 11 39.729417      78.9294 m       0
                                  0.0013            0.0013       0.0017
 PLH  110 2000         N 31  5 58.135755 E121 11 59.473740      13.8777 m       0
                                  0.0000            0.0000       0.0012
 PLH  000 21605M002    N 31  5 58.713196 E121 12  1.598328      22.0572 m       0
                                  0.0012            0.0012       0.0012
 PLH  000 21605M101    N 31  5 46.098824 E121 11 12.146630      99.6422 m       0
                                  0.0012            0.0012       0.0013
 PLH  000 21605S001    N 31  5 51.140938 E121 11 30.272414      27.8560 m       0
                                  0.0014            0.0013       0.0014
 PLH  000 21605S009    N 31  5 56.982969 E121 11 58.780239      29.4210 m       0
                                  0.0012            0.0012       0.0013
 PLH  000 3            N 31  5 58.402656 E121 12  0.523506      19.0166 m       0
                                  0.0012            0.0012       0.0013
 PLH  000 30           N 31  5 51.014181 E121 11 30.358816      27.1679 m       0
                                  0.0012            0.0012       0.0013
 PLH  110 3000         N 31  5 58.402616 E121 12  0.523569      13.8830 m       0
                                  0.0000            0.0000       0.0012
 PLH  000 35           N 31  5 51.140938 E121 11 30.272414      28.4224 m       0
                                  0.0014            0.0013       0.0013
 PLH  000 4            N 31  5 58.823789 E121 12  2.914136      19.5079 m       0
                                  0.0012            0.0012       0.0012
 PLH  110 4000         N 31  5 58.823726 E121 12  2.914171      13.8604 m       0
                                  0.0000            0.0000       0.0012
 PLH  000 5            N 31  5 57.288755 E121 12  2.509137      18.3353 m       0
                                  0.0012            0.0012       0.0012
 PLH  000 50           N 31  5 44.496162 E121 11 49.303772      99.2615 m       0
                                  0.0024            0.0023       0.0030
 PLH  110 5000         N 31  5 57.288763 E121 12  2.509111      13.1702 m       0
                                  0.0000            0.0000       0.0012
 PLH  000 7            N 31  5 56.869114 E121 11 57.366202      12.9814 m       0
                                  0.0012            0.0012       0.0012
 PLH  000 8            N 31  5 58.713209 E121 12  1.598324      22.1370 m       0
                                  0.0012            0.0012       0.0013
 PLH  000 9            N 31  5 58.148476 E121 12  2.247827      17.4547 m       0
                                  0.0012            0.0012       0.0013


Adjusted XYZ Coordinates:
                              X-COORDINATE       Y-COORDINATE       Z-COORDINATE
 CODE FFF STATION                 STD DEV            STD DEV            STD DEV
 ---- --- ------------ ----------------- ----------------- -----------------
 XYZ      1                -2831656.7597       4675722.7942       3275351.5384 m       0
                                  0.0012             0.0012             0.0012
 XYZ      1000             -2831653.7050       4675717.7476       3275347.9776 m       0
                                  0.0006             0.0009             0.0006
 XYZ      2                -2831688.2100       4675699.9055       3275352.0295 m       0
                                  0.0012             0.0012             0.0012
 XYZ      20               -2831329.3668       4676117.5036       3275186.2413 m       0
                                  0.0014             0.0016             0.0014
 XYZ      2000             -2831686.4494       4675696.9958       3275349.9763 m       0
                                  0.0005             0.0009             0.0006
 XYZ      21605M002        -2831733.4800       4675665.9620       3275369.4290 m       0
                                  0.0012             0.0012             0.0012
 XYZ      21605M101        -2830750.7229       4676573.2261       3275076.8386 m       0
                                  0.0012             0.0013             0.0012
 XYZ      21605S001        -2831088.2986       4676203.2592       3275172.7329 m       0
                                  0.0014             0.0013             0.0014
 XYZ      21605S009        -2831687.1229       4675733.5867       3275327.6044 m       0
                                  0.0012             0.0012             0.0012
```

```
================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0            GRS80       UNITS: m,GRAD Page 0014
================================================================================
Adjusted XYZ Coordinates:
                           X-COORDINATE       Y-COORDINATE       Z-COORDINATE
 CODE FFF STATION               STD DEV            STD DEV            STD DEV
 ---- --- ------------ ----------------- ----------------- -----------------
 XYZ      3              -2831710.3259       4675682.7163       3275359.6692 m       0
                                 0.0012             0.0012             0.0012
 XYZ      30             -2831090.9966       4676203.2941       3275169.0348 m       0
                                 0.0012             0.0013             0.0012
 XYZ      3000           -2831708.0506       4675678.9560       3275357.0165 m       0
                                 0.0005             0.0009             0.0006
 XYZ      35             -2831088.5498       4676203.6741       3275173.0255 m       0
                                 0.0013             0.0013             0.0014
 XYZ      4              -2831761.2648       4675644.5256       3275371.0286 m       0
                                 0.0012             0.0012             0.0012
 XYZ      4000           -2831758.7610       4675640.3897       3275368.1099 m       0
                                 0.0005             0.0009             0.0006
 XYZ      5              -2831764.2140       4675670.1139       3275329.9424 m       0
                                 0.0012             0.0012             0.0012
 XYZ      50             -2831606.1642       4676084.7377       3275034.3758 m       0
                                 0.0025             0.0027             0.0026
 XYZ      5000           -2831761.9222       4675666.3311       3275327.2747 m       0
                                 0.0005             0.0009             0.0006
 XYZ      7              -2831648.7148       4675742.5073       3275316.1106 m       0
                                 0.0012             0.0012             0.0012
 XYZ      8              -2831733.5152       4675666.0203       3275369.4705 m       0
                                 0.0012             0.0012             0.0012
 XYZ      9              -2831750.8152       4675661.3584       3275352.1594 m       0
                                 0.0012             0.0012             0.0012


Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                 OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                    STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
XCT  21605M002                                -2831733.48000   0.0000   0.0091
                                                      0.0008   0.0005
YCT  21605M002                                 4675665.96200  -0.0000  -0.0020
                                                      0.0012   0.0008
ZCT  21605M002                                 3275369.42900  -0.0000  -0.0036
                                                      0.0009   0.0006
XCT  21605M002                                -2831733.48000   0.0000   0.0063
                                                      0.0010   0.0008
YCT  21605M002                                 4675665.96200  -0.0000  -0.0014
                                                      0.0014   0.0011
ZCT  21605M002                                 3275369.42900  -0.0000  -0.0025
                                                      0.0011   0.0008
XCT  5                                        -2831764.21380  -0.0003  -0.4378
                                                      0.0010   0.0008
YCT  5                                         4675670.11370   0.0001   0.0807
                                                      0.0014   0.0011
ZCT  5                                         3275329.94260   0.0002   0.1888
                                                      0.0011   0.0008
XCT  30                                       -2831090.99570  -0.0010  -0.1373
                                                      0.0070   0.0070
YCT  30                                        4676203.29270   0.0000   0.0026
                                                      0.0100   0.0099
ZCT  30                                        3275169.03490   0.0013   0.1735
                                                      0.0076   0.0076
XCT  21605M101                                -2830750.72220  -0.0010  -0.1361
                                                      0.0070   0.0070
YCT  21605M101                                 4676573.22490   0.0000   0.0018
                                                      0.0100   0.0099
ZCT  21605M101                                 3275076.83890   0.0010   0.1350
                                                      0.0076   0.0076
XCT  5                                        -2831764.21370  -0.0006  -0.0888
                                                      0.0070   0.0070
YCT  5                                         4675670.11350   0.0001   0.0070
                                                      0.0100   0.0099
ZCT  5                                         3275329.94280   0.0002   0.0322
                                                      0.0076   0.0076
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0017
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
XCT  1                                        -2831656.75820  -0.0010  -0.1386
                                                      0.0070   0.0070
YCT  1                                         4675722.79150  -0.0001  -0.0069
                                                      0.0100   0.0099
ZCT  1                                         3275351.53770   0.0030   0.3986
                                                      0.0076   0.0076
XCT  2                                        -2831688.20920  -0.0019  -0.2645
                                                      0.0070   0.0070
YCT  2                                         4675699.90380  -0.0002  -0.0207
                                                      0.0100   0.0099
ZCT  2                                         3275352.03050   0.0011   0.1409
                                                      0.0076   0.0076
XCT  20                                       -2831329.36390  -0.0004  -0.0633
                                                      0.0070   0.0070
YCT  20                                        4676117.49970   0.0004   0.0448
                                                      0.0100   0.0100
ZCT  20                                        3275186.23890   0.0053   0.6969
                                                      0.0077   0.0076
XCT  35                                       -2831088.54980  -0.0009  -0.1262
                                                      0.0071   0.0070
YCT  35                                        4676203.67330  -0.0004  -0.0383
                                                      0.0102   0.0102
ZCT  35                                        3275173.02610   0.0003   0.0371
                                                      0.0079   0.0078
XCT  4                                        -2831761.26630  -0.0011  -0.1530
                                                      0.0070   0.0070
YCT  4                                         4675644.52880   0.0004   0.0365
                                                      0.0100   0.0099
ZCT  4                                         3275371.03200  -0.0047  -0.6211
                                                      0.0076   0.0076
DIR               111504       112020           0  0      0.0      1.9      0.5
                                                        4.0      3.6
DIR               111504       112001          13 44     61.0      1.5      0.4
                                                        4.0      3.7
DIR               111504       112002          10 20     86.0      0.7      0.2
                                                        4.0      3.6
DIR               111504       112003          11 89      9.0     -3.9     -1.1
                                                        4.0      3.5
DIR               111504       112050         368 37     25.0      0.0      0.0
                                                        4.0      3.5
DIR               111504       112006         399 14     10.0      1.9      0.5
                                                        4.0      3.7
DIR               111504       112007           0  0     51.0     -2.1     -0.6
                                                        4.0      3.7
DIR               111504       112020           0  0      0.0      1.7      0.7
                                                        4.0      2.6
DIR               111504       112005         338 95     74.0     -1.7     -0.7
                                                        4.0      2.6
DIR               111502       112020           0  0      0.0     -2.1     -0.6
                                                        4.0      3.6
DIR               111502       112001          22 93     43.0     -2.3     -0.7
                                                        4.0      3.2
DIR               111502       112003         208 12     11.0      6.5      2.2
                                                        4.0      2.9
DIR               111502       112005         246 37     31.0     -5.7     -1.7
                                                        4.0      3.5
DIR               111502       112050         362 72     69.0     -2.3     -0.7
                                                        4.0      3.4
DIR               111502       112006         368 77      0.0      4.4      1.4
                                                        4.0      3.2
DIR               111502       112007         387 59     42.0      1.7      0.5
                                                        4.0      3.5
DIR               111502       112020           0  0      0.0     -1.7     -0.6
                                                        4.0      2.8
DIR               111502       112004         211 87     24.0      1.7      0.6
                                                        4.0      2.8
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0017
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               111502       112020           0  0      0.0     -1.8     -0.7
                                                           4.0      2.5
DIR               111502       112003         208 12     16.0      1.8      0.7
                                                           4.0      2.5
DIR               111502       112020           0  0      0.0     -0.9     -0.3
                                                           4.0      2.7
DIR               111502       112007         387 59     44.0      0.9      0.3
                                                           4.0      2.7
DIR               111502       112020           0  0      0.0      0.0      0.0
                                                           4.0      0.0        *
DIR               111502       112020           0  0      0.0     -1.9     -0.5
                                                           4.0      3.5
DIR               111502       112001          22 93     41.0     -0.0     -0.0
                                                           4.0      3.1
DIR               111502       112004         211 87     23.0      2.6      0.8
                                                           4.0      3.4
DIR               111502       112005         246 37     30.0     -4.5     -1.3
                                                           4.0      3.4
DIR               111502       112006         368 77      1.0      3.7      1.2
                                                           4.0      3.1
DIR               111502       112020           0  0      0.0     -1.7     -0.6
                                                           4.0      2.8
DIR               111502       112004         211 87     24.0      1.7      0.6
                                                           4.0      2.8
DIR               111502       112020           0  0      0.0      2.1      0.8
                                                           4.0      2.7
DIR               111502       112050         362 72     73.0     -2.1     -0.8
                                                           4.0      2.7
DIR               111505       112020           0  0      0.0     -2.7     -0.8
                                                           4.0      3.4
DIR               111505       112001          33 41     11.0      0.5      0.1
                                                           4.0      3.5
DIR               111505       112004         134 99      1.0      2.9      0.9
                                                           4.0      3.1
DIR               111505       112003          57 55     85.0     -4.8     -1.5
                                                           4.0      3.2
DIR               111505       112002          40 74     16.0      4.2      1.2
                                                           4.0      3.4
DIR               111505       112020           0  0      0.0     -1.2     -0.4
                                                           4.0      3.2
DIR               111505       112006          20 57     39.0     -4.9     -1.5
                                                           4.0      3.2
DIR               111505       112001          33 41      7.0      6.0      1.9
                                                           4.0      3.2
DIR               111506       112020           0  0      0.0     -4.5     -1.8
                                                           4.0      2.5
DIR               111506       112007           2 62     68.0      4.5      1.8
                                                           4.0      2.5
DIR               111506       112020           0  0      0.0     -0.2     -0.0
                                                           4.0      3.5
DIR               111506       112001          83 90     90.0      6.1      2.1
                                                           4.0      2.9
DIR               111506       112002         166 91     43.0     -2.8     -0.9
                                                           4.0      3.1
DIR               111506       112003         185 10     72.0     -2.6     -0.8
                                                           4.0      3.4
DIR               111506       112004         198 94     82.0      2.1      0.6
                                                           4.0      3.5
DIR               111506       112005         224 34     74.0     -2.6     -0.8
                                                           4.0      3.5
ZANG              111504       112020          94 31     93.0     -5.0     -0.4
                                                          12.0     12.0
ZANG              111504       112001          99 56     56.0     -6.0     -0.8
                                                           8.0      7.9
ZANG              111504       112002         101 12     81.0     -8.9     -1.1
                                                           8.0      7.8
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0017
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ZANG              111504       112003         100 70     40.0     -6.0     -1.1
                                                           6.0      5.5
ZANG              111504       112050          91 17     45.0    -20.6     -2.1
                                                          10.0      9.8
ZANG              111504       112006         100 88     24.0     -4.6     -0.8
                                                           6.0      5.8
ZANG              111504       112007         102 10      3.0     -2.4     -0.4
                                                           6.0      5.9
ZANG              111504       112020          94 31     95.0     -3.0     -0.3
                                                          12.0     12.0
ZANG              111504       112020          94 31     96.0     -2.0     -0.2
                                                          12.0     12.0
ZANG              111504       112005         101 55     13.0     -3.8     -0.8
                                                           6.0      4.7
ZANG              111502       112001          95 80     71.0     -2.6     -0.5
                                                           6.0      5.2
ZANG              111502       112003          97 92     97.0      0.1      0.0
                                                           6.0      4.9
ZANG              111502       112005          99 64     12.0      3.2      0.6
                                                           6.0      5.6
ZANG              111502       112050          89 73     62.0     -7.0     -0.7
                                                          10.0      9.7
ZANG              111502       112006         100  4     98.0      0.4      0.1
                                                           6.0      4.8
ZANG              111502       112007         103 34     52.0     -0.4     -0.1
                                                           6.0      5.6
ZANG              111502       112020          93 22     54.0     -7.1     -0.6
                                                          12.0     11.9
ZANG              111502       112020          93 22     52.0     -9.1     -0.8
                                                          12.0     11.9
ZANG              111502       112020          93 22     53.0     -8.1     -0.7
                                                          12.0     11.9
ZANG              111502       112004          98 87     31.0      5.1      0.9
                                                           6.0      5.8
ZANG              111502       112020          93 22     56.0     -5.1     -0.4
                                                          12.0     11.9
ZANG              111502       112003          97 92     96.0     -0.9     -0.2
                                                           6.0      4.9
ZANG              111502       112020          93 22     58.0     -3.1     -0.3
                                                          12.0     11.9
ZANG              111502       112007         103 34     51.0     -1.4     -0.3
                                                           6.0      5.6
ZANG              111502       112020          93 22     54.0     -7.1     -0.6
                                                          12.0     11.9
ZANG              111502       112020          93 22     53.0     -8.1     -0.7
                                                          12.0     11.9
ZANG              111502       112001          95 80     73.0     -0.6     -0.1
                                                           6.0      5.2
ZANG              111502       112004          98 87     24.0     -1.9     -0.3
                                                           6.0      5.8
ZANG              111502       112005          99 64     17.0      8.2      1.5
                                                           6.0      5.6
ZANG              111502       112006         100  4     97.0     -0.6     -0.1
                                                           6.0      4.8
ZANG              111502       112020          93 22     53.0     -8.1     -0.7
                                                          12.0     11.9
ZANG              111502       112020          93 22     52.0     -9.1     -0.8
                                                          12.0     11.9
ZANG              111502       112004          98 87     28.0      2.1      0.4
                                                           6.0      5.8
ZANG              111502       112020          93 22     55.0     -6.1     -0.5
                                                          12.0     11.9
ZANG              111505       112020          93 96     58.0     -8.4     -0.7
                                                          12.0     12.0
ZANG              111505       112004          98 44     89.0      1.0      0.2
                                                           6.0      4.9
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0            GRS80       UNITS: m,GRAD Page 0021
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ZANG              111505       112003          99 52     67.0     -4.2     -0.8
                                                           6.0      5.4
ZANG              111505       112002         100 35     99.0      2.9      0.5
                                                           6.0      5.6
ZANG              111505       112020          93 96     60.0     -6.4     -0.5
                                                          12.0     12.0
ZANG              111505       112020          93 96     62.0     -4.4     -0.4
                                                          12.0     12.0
ZANG              111505       112020          93 96     57.0     -9.4     -0.8
                                                          12.0     12.0
ZANG              111505       112006         100 31     65.0     -5.4     -0.9
                                                           6.0      5.7
ZANG              111505       112001          98 91      7.0      7.6      1.3
                                                           6.0      5.8
ZANG              111506       112020          92 85     82.0     -5.8     -0.5
                                                          12.0     11.9
ZANG              111506       112007         106  5      9.0      5.1      1.1
                                                           6.0      4.5
ZANG              111506       112020          92 85     78.0     -9.8     -0.8
                                                          12.0     11.9
ZANG              111506       112001          94 57     16.0      0.8      0.2
                                                           6.0      4.4
ZANG              111506       112002          99 95     14.0     -0.4     -0.1
                                                           6.0      4.3
ZANG              111506       112003          98 96     50.0     -1.7     -0.3
                                                           6.0      5.5
ZANG              111506       112004          99 11     86.0     -2.3     -0.4
                                                           6.0      5.8
ZANG              111506       112005          99 68     39.0      2.5      0.4
                                                           6.0      5.7
ZANG              111506       112020          92 85     79.0     -8.8     -0.7
                                                          12.0     11.9
ZANG              111506       112020          92 85     78.0     -9.8     -0.8
                                                          12.0     11.9
ZANG              111506       112020          92 85     77.0    -10.8     -0.9
                                                          12.0     11.9
DIST              111504       113207               158.96160   0.0000   0.0512
                                                        0.0010   0.0010     0.31
DIST              111504       113206               121.62180  -0.0005  -0.4728
                                                        0.0010   0.0010     3.80
DIST              111504       113101               132.01280  -0.0009  -0.8883
                                                        0.0010   0.0010     6.59
DIST              111504       113102                93.62180  -0.0006  -0.6547
                                                        0.0010   0.0010     6.83
DIST              111504       113205                48.49390  -0.0010  -1.0573
                                                        0.0010   0.0010    21.38
DIST              111504       113103                64.67400  -0.0010  -0.9883
                                                        0.0010   0.0010    14.70
DIST              111502       113103                29.02600  -0.0004  -0.4239
                                                        0.0010   0.0010    14.11
DIST              111502       113201                38.90110  -0.0006  -0.6492
                                                        0.0010   0.0010    16.42
DIST              111502       113207                68.22080  -0.0000  -0.0386
                                                        0.0010   0.0010     0.55
DIST              111502       113105                84.57040  -0.0010  -0.9808
                                                        0.0010   0.0010    11.40
DIST              111502       113206                33.57650  -0.0004  -0.4210
                                                        0.0010   0.0010    12.34
DIST              111502       113104                93.62190  -0.0007  -0.7197
                                                        0.0010   0.0010     7.52
DIST              111502       113103                29.02630  -0.0007  -0.7344
                                                        0.0010   0.0010    24.44
DIST              111502       113207                68.22110  -0.0003  -0.3469
                                                        0.0010   0.0010     4.95
DIST              111502       113206                33.57630  -0.0002  -0.2177
                                                        0.0010   0.0010     6.38
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIST              111502       113201               38.90100  -0.0005  -0.5476
                                                        0.0010   0.0010    13.85
DIST              111502       113205               84.57050  -0.0011  -1.0926
                                                        0.0010   0.0010    12.70
DIST              111502       113104               93.62240  -0.0012  -1.2309
                                                        0.0010   0.0010    12.86
DIST              111505       113102               84.57040  -0.0009  -0.9418
                                                        0.0010   0.0010    10.93
DIST              111505       113103               62.81970  -0.0010  -0.9830
                                                        0.0010   0.0010    15.13
DIST              111505       113201              121.60710  -0.0009  -0.9022
                                                        0.0010   0.0010     7.29
DIST              111505       113204               48.49450  -0.0016  -1.5840
                                                        0.0010   0.0010    32.01
DIST              111505       113206              101.17580  -0.0006  -0.6611
                                                        0.0010   0.0010     6.42
DIST              111506       113207               37.48340  -0.0010  -0.9916
                                                        0.0010   0.0010    25.85
DIST              111506       113102               33.57590   0.0002   0.1731
                                                        0.0010   0.0010     5.06
DIST              111506       113103               59.64610  -0.0014  -1.4410
                                                        0.0010   0.0010    23.35
DIST              111506       113201               30.36470  -0.0004  -0.4305
                                                        0.0010   0.0010    13.95
DIST              111506       113104              121.62230  -0.0010  -1.0172
                                                        0.0010   0.0010     8.18
DIST              111506       113105              101.17600  -0.0009  -0.8904
                                                        0.0010   0.0010     8.64
DIR               111205       112020          0  0      0.0     -9.1     -3.5
                                                        4.0      2.6
DIR               111205       112004        134 98      88.0      9.1      3.5
                                                        4.0      2.6
DIR               111205       112020          0  0      0.0      0.6      0.2
                                                        4.0      3.5
DIR               111205       112006         20 57      33.0      2.9      0.8
                                                        4.0      3.5
DIR               111205       112001         33 41      15.0     -0.2     -0.1
                                                        4.0      3.5
DIR               111205       112002         40 74      25.0     -1.6     -0.5
                                                        4.0      3.5
DIR               111205       112003         57 55      85.0     -1.7     -0.5
                                                        4.0      3.2
DIR               111204       112020          0  0      0.0     -0.0     -0.0
                                                        4.0      2.8
DIR               111204       112002         10 20      85.0      0.0      0.0
                                                        4.0      2.8
DIR               111204       112020          0  0      0.0      1.9      0.6
                                                        4.0      3.4
DIR               111204       112001         13 44      63.0     -0.3     -0.1
                                                        4.0      3.4
DIR               111204       112003         11 89      11.0     -5.6     -1.7
                                                        4.0      3.3
DIR               111204       112006        399 14       8.0      4.0      1.2
                                                        4.0      3.4
DIR               111204       112020          0  0      0.0      0.9      0.3
                                                        4.0      3.2
DIR               111204       112007          0  0     48.0     -0.0     -0.0
                                                        4.0      3.2
DIR               111204       112005        338 95      72.0     -0.9     -0.3
                                                        4.0      2.9
DIR               111204       112020          0  0      0.0      3.4      1.3
                                                        4.0      2.7
DIR               111204       112050        368 37      30.0     -3.4     -1.3
                                                        4.0      2.7
DIR               101207       112004          0  0      0.0      1.7      0.7
                                                        4.0      2.5
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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               101207       112001         352 36     21.0     -1.7     -0.7
                                                           4.0      2.5
ZANG              111205       112020          93 96     57.0     -9.9     -0.8
                                                          12.0     12.0
ZANG              111205       112004          98 44     96.0      1.4      0.3
                                                           6.0      4.9
ZANG              111205       112020          93 96     58.0     -8.9     -0.4
                                                          20.0     20.0
ZANG              111205       112006         100 31     75.0      1.3      0.2
                                                           6.0      5.7
ZANG              111205       112001          98 91      7.0      4.9      0.8
                                                           6.0      5.8
ZANG              111205       112002         100 36      1.0      1.1      0.2
                                                           6.0      5.6
ZANG              111205       112003          99 52     85.0      8.6      1.6
                                                           6.0      5.4
ZANG              111205       112020          93 96     53.0    -13.9     -1.2
                                                          12.0     12.0
ZANG              111205       112020          93 96     58.0     -8.9     -0.7
                                                          12.0     12.0
ZANG              111205       112020          93 96     53.0    -13.9     -1.2
                                                          12.0     12.0
ZANG              111205       112020          93 96     55.0    -11.9     -1.0
                                                          12.0     12.0
ZANG              111204       112020          94 31     90.0     -8.5     -0.7
                                                          12.0     12.0
ZANG              111204       112002         101 12     91.0     -2.4     -0.4
                                                           6.0      5.7
ZANG              111204       112020          94 31     91.0     -7.5     -0.6
                                                          12.0     12.0
ZANG              111204       112020          94 31     95.0     -3.5     -0.3
                                                          12.0     12.0
ZANG              111204       112001          99 56     66.0      1.5      0.3
                                                           6.0      5.9
ZANG              111204       112003         100 70     52.0      1.0      0.2
                                                           6.0      5.5
ZANG              111204       112006         100 88     33.0      1.7      0.3
                                                           6.0      5.8
ZANG              111204       112020          94 31     88.0    -10.5     -0.9
                                                          12.0     12.0
ZANG              111204       112007         102 10      6.0     -1.5     -0.3
                                                           6.0      5.9
ZANG              111204       112005         101 55     17.0     -6.6     -1.4
                                                           6.0      4.8
ZANG              111204       112020          94 31     90.0     -8.5     -0.7
                                                          12.0     12.0
ZANG              111204       112020          94 31     92.0     -6.5     -0.5
                                                          12.0     12.0
ZANG              111204       112020          94 31     89.0     -9.5     -0.8
                                                          12.0     12.0
ZANG              111204       112020          94 31     89.0     -9.5     -0.8
                                                          12.0     12.0
ZANG              111204       112050          91 17     62.0     -4.2     -0.4
                                                          10.0      9.8
ZANG              101207       112004          97 93     59.0      5.2      0.9
                                                           6.0      5.8
ZANG              101207       112001          90 58     44.0     -2.4     -0.7
                                                           6.0      3.7
ZANG              101207       112004          97 93     52.0     -1.8     -0.3
                                                           6.0      5.8
DIST              111205       113204                 48.49300  -0.0001  -0.0671
                                                        0.0010   0.0010     1.36
DIST              111205       113103                 62.82030  -0.0015  -1.5787
                                                        0.0010   0.0010    24.30
DIST              111205       113102                 84.56980  -0.0003  -0.2971
                                                        0.0010   0.0010     3.45
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIST              111205       113101               121.60620   0.0000   0.0258
                                                       0.0010   0.0010     0.21
DIST              111205       113206               101.17430   0.0009   0.8996
                                                       0.0010   0.0010     8.73
DIST              111204       113202                93.62110   0.0000   0.0159
                                                       0.0010   0.0010     0.17
DIST              111204       113201               132.01160   0.0003   0.3098
                                                       0.0010   0.0010     2.30
DIST              111204       113203                64.67300   0.0000   0.0358
                                                       0.0010   0.0010     0.53
DIST              111204       113207               158.96080   0.0008   0.8534
                                                       0.0010   0.0010     5.21
DIST              111204       113206               121.62090   0.0004   0.4154
                                                       0.0010   0.0010     3.34
DIST              111204       113105                48.49370  -0.0009  -0.8875
                                                       0.0010   0.0010    17.95
DIST              101207       113101                41.10920  -0.0000  -0.0483
                                                       0.0010   0.0010     1.14
DIR               111207       112004           0  0      0.0     -2.5     -0.7
                                                        4.0      3.5
DIR               111207       112006           2 81     51.0      6.6      2.1
                                                        4.0      3.1
DIR               111207       112050         157 27     58.0     -4.8     -1.5
                                                        4.0      3.2
DIR               111207       112020         199 99     31.0      4.3      1.3
                                                        4.0      3.4
DIR               111207       112002         385 92     58.0     -3.7     -1.1
                                                        4.0      3.4
DIR               111206       112004           0  0      0.0      1.4      0.5
                                                        4.0      2.8
DIR               111206       112005          25 39     90.0     -1.4     -0.5
                                                        4.0      2.8
DIR               111206       112004           0  0      0.0     -6.8     -2.0
                                                        4.0      3.5
DIR               111206       112020         201  5      8.0      0.5      0.1
                                                        4.0      3.5
DIR               111206       112007         203 67     72.0     12.3      4.2
                                                        4.0      2.9
DIR               111206       112001         284 96      9.0     -2.8     -1.0
                                                        4.0      2.9
DIR               111206       112002         367 96     52.0     -1.1     -0.4
                                                        4.0      3.0
DIR               111206       112003         386 15     81.0     -2.0     -0.6
                                                        4.0      3.3
ZANG              111207       112004          97 90     15.0      1.0      0.2
                                                        6.0      5.8
ZANG              111207       112006          93 95     10.0      3.3      0.9
                                                        6.0      3.7
ZANG              111207       112050          87 79     91.0    -22.0     -2.3
                                                       10.0      9.6
ZANG              111207       112020          91 89     41.0     -7.1     -0.6
                                                       12.0     11.9
ZANG              111207       112002          96 65     55.0     -3.5     -0.7
                                                        6.0      5.2
ZANG              111207       112020          91 89     39.0     -9.1     -0.8
                                                       12.0     11.9
ZANG              111207       112020          91 89     39.0     -9.1     -0.8
                                                       12.0     11.9
ZANG              111206       112004          99 11     91.0      1.8      0.3
                                                        6.0      5.9
ZANG              111206       112005          99 68     44.0      6.4      1.1
                                                        6.0      5.7
ZANG              111206       112004          99 11     93.0      3.8      0.6
                                                        6.0      5.9
ZANG              111206       112004          99 11     93.0      3.8      0.6
                                                        6.0      5.9
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ZANG              111206       112020          92 85     74.0    -14.0     -1.2
                                                         12.0     11.9
ZANG              111206       112007         106  5      5.0     -2.0     -0.4
                                                          6.0      4.5
ZANG              111206       112001          94 57     16.0     -2.6     -0.6
                                                          6.0      4.4
ZANG              111206       112002          99 95     20.0      2.3      0.5
                                                          6.0      4.4
ZANG              111206       112003          98 96     53.0     -0.5     -0.1
                                                          6.0      5.5
ZANG              111206       112020          92 85     81.0     -7.0     -0.6
                                                         12.0     11.9
ZANG              111206       112004          99 11     86.0     -3.2     -0.6
                                                          6.0      5.9
ZANG              111206       112004          99 11     90.0      0.8      0.1
                                                          6.0      5.9
ZANG              111206       112004          99 11     88.0     -1.2     -0.2
                                                          6.0      5.9
DIST              111207       113104               158.96260  -0.0009  -0.9485
                                                       0.0010   0.0010     5.78
DIST              111207       113206                37.48250  -0.0001  -0.1230
                                                       0.0010   0.0010     3.20
DIST              111207       113102                68.22120  -0.0004  -0.3872
                                                       0.0010   0.0010     5.51
DIST              111206       113105               101.17550  -0.0003  -0.2732
                                                       0.0010   0.0010     2.65
DIST              111206       113204               121.62120   0.0002   0.1604
                                                       0.0010   0.0010     1.29
DIST              111206       113103                59.64550  -0.0007  -0.7547
                                                       0.0010   0.0010    12.22
DIST              111206       113201                30.36370   0.0005   0.4766
                                                       0.0010   0.0010    15.46
DIST              111206       113102                33.57540   0.0007   0.7205
                                                       0.0010   0.0010    21.08
DIST              111206       113207                37.48240  -0.0000  -0.0416
                                                       0.0010   0.0010     1.08
ELAT              112001       1               0 00  0.000000   0.0000   0.8669
                                                       0.0001   0.0000   142.21
ELON              112001       1               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000   108.76
EHDF              112001       1                    -0.22520  -0.0005  -1.0797
                                                       0.0005   0.0005  2156.11
ELAT              113101       1               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     5.16
ELON              113101       1               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    36.03
EHDF              113101       1                    -0.22520   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
ELAT              113201       1               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     5.67
ELON              113201       1               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    76.23
EHDF              113201       1                    -0.22520   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
ELAT              112002       2               0 00  0.000000   0.0001   4.0859
                                                       0.0001   0.0000   268.50
ELON              112002       2               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000   201.53
EHDF              112002       2                    -0.22550  -0.0001  -0.2637
                                                       0.0005   0.0004   519.26
ELAT              113102       2               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    10.88
ELON              113102       2               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    89.33
EHDF              113102       2                    -0.22550   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ELAT              113202       2               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     0.16
ELON              113202       2               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     0.67
EHDF              113202       2                    -0.22550  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              111502       2               0 00  0.000000   0.0001   1.0607
                                                       0.0001   0.0001   396.52
ELON              111502       2               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000   146.87
EHDF              111502       2                    -0.22550  -0.0004  -0.7819
                                                       0.0005   0.0005  1604.10
ELAT              112003       3               0 00  0.000000  -0.0007  -0.0007
                                                       0.0002  -0.0000 201560.6
ELON              112003       3               0 00  0.000000   0.0000   0.0000
                                                       0.0002  -0.0000  4261.08
EHDF              112003       3                    -0.00310  -0.0003  -0.7034
                                                       0.0005   0.0004 88956.26
ELAT              113103       3               0 00  0.000000  -0.0001  -0.0001
                                                       0.0002  -0.0000 34951.25
ELON              113103       3               0 00  0.000000   0.0000   0.0000
                                                       0.0002  -0.0000  2667.00
EHDF              113103       3                    -0.00310  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              113203       3               0 00  0.000000  -0.0000  -0.0000
                                                       0.0002  -0.0000    88.48
ELON              113203       3               0 00  0.000000  -0.0000  -0.0000
                                                       0.0002  -0.0000   432.20
EHDF              113203       3                    -0.00310  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              111204       4               0 00  0.000000   0.0001   0.0001
                                                       0.0001  -0.0000   363.51
ELON              111204       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    60.70
EHDF              111204       4                    -0.22760  -0.0005  -0.1699
                                                       0.0005   0.0004  2244.83
ELAT              112004       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    77.09
ELON              112004       4               0 00  0.000000   0.0001   0.0001
                                                       0.0001  -0.0000   392.22
EHDF              112004       4                    -0.22760   0.0007   1.6407
                                                       0.0005   0.0004  3127.00
ELAT              113104       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    51.38
ELON              113104       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000   159.22
EHDF              113104       4                    -0.22760  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              113204       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    66.61
ELON              113204       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     9.40
EHDF              113204       4                    -0.22760   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
ELAT              111504       4               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000   202.32
ELON              111504       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000   174.64
EHDF              111504       4                    -0.22760   0.0000   0.0021
                                                       0.0005   0.0004     4.05
ELAT              111505       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000   165.09
ELON              111505       5               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000   182.06
EHDF              111505       5                    -0.21850   0.0008   1.7258
                                                       0.0005   0.0004  3451.83
```

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                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0031
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ELAT              111205       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000   191.02
ELON              111205       5               0 00  0.000000  -0.0001  -0.0001
                                                       0.0001  -0.0000   317.83
EHDF              111205       5                     -0.21850   0.0002   0.5538
                                                       0.0005   0.0004  1105.07
ELAT              112005       5               0 00  0.000000   0.0001   0.0001
                                                       0.0001  -0.0000   260.36
ELON              112005       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000   162.04
EHDF              112005       5                     -0.21850   0.0000   0.0883
                                                       0.0005   0.0004   170.35
ELAT              113105       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    52.29
ELON              113105       5               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    85.46
EHDF              113105       5                     -0.21850  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              113205       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    61.43
ELON              113205       5               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    36.25
EHDF              113205       5                     -0.21850  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              111506       6               0 00  0.000000  -0.0001  -3.1223
                                                       0.0001   0.0000 585022.0
ELON              111506       6               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000 33483.25
EHDF              111506       6                      0.00000  -0.0001  -0.3288
                                                       0.0005   0.0004 810316.4
ELAT              111206       6               0 00  0.000000  -0.0001  -4.0136
                                                       0.0001   0.0000 391484.2
ELON              111206       6               0 00  0.000000   0.0001   0.0001
                                                       0.0001  -0.0000 277167.4
EHDF              111206       6                      0.00000  -0.0003  -0.7074
                                                       0.0005   0.0005 877447.6
ELAT              112006       6               0 00  0.000000   0.0000   0.1993
                                                       0.0001   0.0000 40041.72
ELON              112006       6               0 00  0.000000  -0.0001  -0.0001
                                                       0.0001  -0.0000 672079.5
EHDF              112006       6                      0.00000   0.0001   0.1491
                                                       0.0005   0.0004 739382.5
ELAT              113206       6               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 981564.7
ELON              113206       6               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 192291.3
EHDF              113206       6                      0.00000  -0.0000  -0.0000
                                                       0.0005   0.0000     0.01*
ELAT              111207       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    31.75
ELON              111207       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     0.66
EHDF              111207       7                     -1.51210  -0.0001  -0.1457
                                                       0.0005   0.0004    38.47
ELAT              112007       7               0 00  0.000000   0.0002   0.0002
                                                       0.0001  -0.0000   116.00
ELON              112007       7               0 00  0.000000  -0.0001  -0.0001
                                                       0.0001  -0.0000    44.19
EHDF              112007       7                     -1.51210   0.0001   0.3090
                                                       0.0005   0.0004    88.35
ELAT              113207       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     1.46
ELON              113207       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     2.91
EHDF              113207       7                     -1.51210   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
```

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                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ELAT              101207       7               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     1.60
ELON              101207       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     8.37
EHDF              101207       7                    -1.59720   0.0002   0.4263
                                                       0.0005   0.0004   101.44
ELAT              112020       20              0 00  0.000000  -0.0006  -1.2959
                                                       0.0010   0.0005  2500.00
ELON              112020       20              0 00  0.000000   0.0002   0.0002
                                                       0.0010  -0.0000   938.44
EHDF              112020       20                   -0.23870  -0.0024  -5.3547
                                                       0.0010   0.0004  9959.97
                                                  ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
ELAT              112050       50              0 00  0.000000  -0.0006  -0.0006
                                                       0.0010  -0.0000 453455.5
ELON              112050       50              0 00  0.000000   0.0009   0.0009
                                                       0.0010  -0.0000 705054.9
EHDF              112050       50                    0.00000  -0.0007  -3.1327
                                                       0.0010   0.0002 545230.2
DIR               121503       122020           0  0      0.0      0.1      0.0
                                                         4.0      3.2
DIR               121503       122001          16 21     32.0     -1.1     -0.4
                                                         4.0      3.0
DIR               121503       122005         262 79     67.0      1.0      0.3
                                                         4.0      2.9
DIR               121503       122020           0  0      0.0     -1.9     -0.6
                                                         4.0      3.3
DIR               121503       122002           7 73     24.0     -1.1     -0.4
                                                         4.0      2.9
DIR               121503       122004         213 16     25.0     -1.2     -0.4
                                                         4.0      2.9
DIR               121503       122006         386 57     24.0      4.1      1.3
                                                         4.0      3.2
DIR               121503       122020           0  0      0.0      2.3      0.8
                                                         4.0      2.8
DIR               121503       122007         393 30     47.0     -2.3     -0.8
                                                         4.0      2.8
DIR               121507       122020           0  0      0.0      1.1      0.3
                                                         4.0      3.5
DIR               121507       122002         185 93     22.0     -0.9     -0.3
                                                         4.0      3.5
DIR               121507       122003         192  3     28.0      0.7      0.2
                                                         4.0      3.6
DIR               121507       122004         200  0     69.0     -4.2     -1.2
                                                         4.0      3.6
DIR               121507       122050         357 28      8.0      8.4      2.5
                                                         4.0      3.3
DIR               121507       122006         202 82     33.0     -4.9     -1.5
                                                         4.0      3.2
DIR               121507       122020           0  0      0.0      0.5      0.2
                                                         4.0      2.5
DIR               121507       122001         152 36     83.0     -0.5     -0.2
                                                         4.0      2.5
DIR               121501       122020           0  0      0.0      3.0      0.8
                                                         4.0      3.6
DIR               121501       122002         224 56      8.0      1.9      0.6
                                                         4.0      3.2
DIR               121501       122003         218 23     16.0     -4.6     -1.3
                                                         4.0      3.5
DIR               121501       122004         216 73     74.0     -1.3     -0.4
                                                         4.0      3.6
DIR               121501       122005         240 66     87.0      0.6      0.2
                                                         4.0      3.6
DIR               121501       122050         360 15     28.0      3.3      1.0
                                                         4.0      3.4
```

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================================================================================
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               121501       122007         355 65     81.0     -2.9     -1.0
                                                           4.0      3.0
DIR               121501       122020           0  0      0.0      0.3      0.1
                                                           4.0      2.7
DIR               121501       122050         360 15     29.0     -0.3     -0.1
                                                           4.0      2.7
DIR               121501       122020           0  0      0.0     -1.2     -0.5
                                                           4.0      2.4
DIR               121501       122006         287 39     31.0      1.2      0.5
                                                           4.0      2.4
DIR               121506       122020           0  0      0.0     -0.5     -0.1
                                                           4.0      3.5
DIR               121506       122007           2 62     87.0     -2.8     -0.9
                                                           4.0      3.0
DIR               121506       122002         166 91     36.0      0.6      0.2
                                                           4.0      3.1
DIR               121506       122004         198 94     80.0      3.5      1.0
                                                           4.0      3.5
DIR               121506       122005         224 34     67.0      2.8      0.8
                                                           4.0      3.4
DIR               121506       122001          83 91      5.0     -3.5     -1.2
                                                           4.0      2.9
DIR               121506       122020           0  0      0.0      0.5      0.2
                                                           4.0      2.7
DIR               121506       122050         360 43     47.0     -0.5     -0.2
                                                           4.0      2.7
DIR               121506       122020           0  0      0.0      1.3      0.5
                                                           4.0      2.7
DIR               121506       122003         185 10     77.0     -1.3     -0.5
                                                           4.0      2.7
ZANG              121503       122020          93 64     61.0    -14.2     -1.2
                                                          12.0     11.9
ZANG              121503       122001          98 47      6.0      2.0      0.4
                                                           6.0      5.6
ZANG              121503       122005         100 47      1.0      3.2      0.6
                                                           6.0      5.1
ZANG              121503       122020          93 64     64.0    -11.2     -0.9
                                                          12.0     11.9
ZANG              121503       122002         102  6     46.0      9.6      2.2
                                                           6.0      4.4
ZANG              121503       122004          99 29     34.0     -0.6     -0.1
                                                           6.0      5.2
ZANG              121503       122006         101  3     14.0     -5.3     -1.0
                                                           6.0      5.5
ZANG              121503       122020          93 64     69.0     -6.2     -0.5
                                                          12.0     11.9
ZANG              121503       122007         102 93     87.0     -9.8     -1.7
                                                           6.0      5.8
ZANG              121507       122020          91 90     43.0     -9.8     -0.8
                                                          12.0     11.9
ZANG              121507       122002          96 73     46.0      3.6      0.7
                                                           6.0      5.5
ZANG              121507       122003          97  6     15.0     -1.3     -0.2
                                                           6.0      5.6
ZANG              121507       122004          97 93     52.0      0.9      0.2
                                                           6.0      5.8
ZANG              121507       122050          87 81     15.0    -16.4     -1.7
                                                          10.0      9.6
ZANG              121507       122006          94  9     23.0     -5.0     -1.1
                                                           6.0      4.4
ZANG              121507       122020          91 90     44.0     -8.8     -0.7
                                                          12.0     11.9
ZANG              121507       122020          91 90     43.0     -9.8     -0.8
                                                          12.0     11.9
ZANG              121507       122001          90 58     40.0      1.6      0.3
                                                           6.0      4.7
```

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================================================================================
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ZANG              121501       122020          93  7     15.0    -14.1     -1.2
                                                          12.0     11.9
ZANG              121501       122002         104 19     25.0     -5.1     -1.0
                                                           6.0      5.0
ZANG              121501       122003         101 53      3.0     -1.7     -0.3
                                                           6.0      5.3
ZANG              121501       122004         100 43     53.0     -0.8     -0.1
                                                           6.0      5.8
ZANG              121501       122005         101  9     13.0      3.0      0.5
                                                           6.0      5.7
ZANG              121501       122050          89 61     12.0     -2.1     -0.2
                                                          10.0      9.7
ZANG              121501       122007         109 41     69.0     -1.0     -0.2
                                                           6.0      4.9
ZANG              121501       122020          93  7     19.0    -10.1     -0.8
                                                          12.0     11.9
ZANG              121501       122020          93  7     18.0    -11.1     -0.9
                                                          12.0     11.9
ZANG              121501       122050          89 61      0.0    -14.1     -1.5
                                                          10.0      9.7
ZANG              121501       122020          93  7     20.0     -9.1     -0.8
                                                          12.0     11.9
ZANG              121501       122006         105 42     92.0      6.7      1.6
                                                           6.0      4.3
ZANG              121506       122020          92 85     80.0     -7.9     -0.7
                                                          12.0     11.9
ZANG              121506       122007         105 90     75.0     -3.3     -0.7
                                                           6.0      4.7
ZANG              121506       122002          99 95      5.0     -4.0     -0.8
                                                           6.0      4.8
ZANG              121506       122004          99 11     90.0      2.7      0.5
                                                           6.0      5.8
ZANG              121506       122005          99 68     40.0      2.4      0.4
                                                           6.0      5.6
ZANG              121506       122001          94 57     22.0      7.7      1.8
                                                           6.0      4.3
ZANG              121506       122020          92 85     76.0    -11.9     -1.0
                                                          12.0     11.9
ZANG              121506       122050          89  0     98.0     -9.6     -1.0
                                                          10.0      9.7
ZANG              121506       122020          92 85     76.0    -11.9     -1.0
                                                          12.0     11.9
ZANG              121506       122003          98 96     82.0     -5.6     -1.1
                                                           6.0      5.2
DIST              121503       123205                 62.81950  -0.0009  -0.9291
                                                        0.0010   0.0010    14.47
DIST              121503       123204                 64.67400  -0.0009  -0.9328
                                                        0.0010   0.0010    13.98
DIST              121503       123101                 67.39690   0.0001   0.1530
                                                        0.0010   0.0010     2.21
DIST              121503       123202                 29.02570  -0.0003  -0.2942
                                                        0.0010   0.0010     9.86
DIST              121503       123107                 96.18400   0.0008   0.8608
                                                        0.0010   0.0010     8.63
DIST              121507       123202                 68.21570   0.0007   0.7203
                                                        0.0010   0.0010    10.25
DIST              121507       123203                 96.18440   0.0005   0.4928
                                                        0.0010   0.0010     4.94
DIST              121507       123206                 37.47410   0.0003   0.3542
                                                        0.0010   0.0010     9.22
DIST              121507       123104                158.95930  -0.0004  -0.4188
                                                        0.0010   0.0010     2.56
DIST              121507       123201                 41.10920   0.0000   0.0120
                                                        0.0010   0.0010     0.28
DIST              121501       123202                 38.90060  -0.0001  -0.0860
                                                        0.0010   0.0010     2.17
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIST              121501       123203               67.39740  -0.0003  -0.3345
                                                     0.0010   0.0010     4.83
DIST              121501       123107               41.10890   0.0003   0.3112
                                                     0.0010   0.0010     7.40
DIST              121501       123104              132.01260  -0.0007  -0.6759
                                                     0.0010   0.0010     5.02
DIST              121501       123205              121.60680  -0.0006  -0.6544
                                                     0.0010   0.0010     5.29
DIST              121501       123106               30.36460  -0.0002  -0.2193
                                                     0.0010   0.0010     7.11
DIST              121506       123105              101.17560  -0.0005  -0.4638
                                                     0.0010   0.0010     4.50
DIST              121506       123104              121.62210  -0.0007  -0.7133
                                                     0.0010   0.0010     5.74
DIST              121506       123202               33.57610   0.0001   0.1414
                                                     0.0010   0.0010     4.14
DIST              121506       123207               37.47470  -0.0003  -0.3269
                                                     0.0010   0.0010     8.51
DIST              121506       123101               30.36490  -0.0005  -0.4594
                                                     0.0010   0.0010    14.91
DIST              121506       123103               59.64490  -0.0002  -0.1591
                                                     0.0010   0.0010     2.60
DIR               121207       122020          0  0     0.0      3.6      1.0
                                                     4.0      3.4
DIR               121207       122001        152 36     84.0      1.2      0.4
                                                     4.0      3.1
DIR               121207       122002        185 93     25.0     -1.5     -0.4
                                                     4.0      3.5
DIR               121207       122004        200  0     67.0      0.3      0.1
                                                     4.0      3.6
DIR               121207       122006        202 82     37.0     -6.5     -2.0
                                                     4.0      3.2
DIR               121207       122050        357 28     16.0      2.9      0.9
                                                     4.0      3.3
DIR               121201       122004          0  0      0.0     -1.4     -0.6
                                                     4.0      2.5
DIR               121201       122007        138 92      2.0      1.4      0.6
                                                     4.0      2.5
DIR               121201       122004          0  0      0.0     -1.3     -0.4
                                                     4.0      3.6
DIR               121201       122005         23 93     12.0      1.6      0.4
                                                     4.0      3.6
DIR               121201       122006         70 65     63.0     -0.1     -0.0
                                                     4.0      2.9
DIR               121201       122050        143 41     59.0     -2.0     -0.6
                                                     4.0      3.4
DIR               121201       122020        183 26     25.0      3.6      1.0
                                                     4.0      3.5
DIR               121201       122003          1 49     36.0      1.6      0.5
                                                     4.0      3.5
DIR               121201       122002          7 82     40.0     -3.4     -1.0
                                                     4.0      3.3
ZANG              121207       122020         91 90     38.0    -14.7     -1.2
                                                    12.0     11.9
ZANG              121207       122001         90 58     33.0     -4.0     -0.9
                                                     6.0      4.6
ZANG              121207       122002         96 73     42.0      0.5      0.1
                                                     6.0      5.5
ZANG              121207       122004         97 93     55.0      4.3      0.7
                                                     6.0      5.8
ZANG              121207       122006         94  9     25.0     -1.4     -0.3
                                                     6.0      4.4
ZANG              121207       122050         87 81     33.0      1.7      0.2
                                                    10.0      9.6
ZANG              121207       122004         97 93     53.0      2.3      0.4
                                                     6.0      5.8
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ZANG              121207       122020          91 90     40.0    -12.7     -1.1
                                                         12.0     11.9
ZANG              121201       122004         100 43     53.0      0.8      0.1
                                                          6.0      5.8
ZANG              121201       122007         109 41     72.0      7.2      1.5
                                                          6.0      4.9
ZANG              121201       122004         100 43     52.0     -0.2     -0.0
                                                          6.0      5.8
ZANG              121201       122005         101  9      4.0     -4.3     -0.8
                                                          6.0      5.7
ZANG              121201       122006         105 42     70.0     -8.3     -2.0
                                                          6.0      4.2
ZANG              121201       122050          89 61     10.0     -3.6     -0.4
                                                         10.0      9.7
ZANG              121201       122020          93  7     15.0    -13.7     -1.1
                                                         12.0     11.9
ZANG              121201       122003         101 53      9.0      7.5      1.4
                                                          6.0      5.3
ZANG              121201       122002         104 19     25.0      0.3      0.1
                                                          6.0      5.0
ZANG              121201       122020          93  7     12.0    -16.7     -1.4
                                                         12.0     11.9
DIST              121207       123102                68.21560   0.0008   0.8224
                                                        0.0010   0.0010    11.70
DIST              121207       123106                37.47410   0.0003   0.3406
                                                        0.0010   0.0010     8.87
DIST              121207       123101                41.10890   0.0003   0.3184
                                                        0.0010   0.0010     7.57
DIST              121207       123204               158.95820   0.0006   0.6651
                                                        0.0010   0.0010     4.06
DIST              121201       123107                41.10860   0.0006   0.6214
                                                        0.0010   0.0010    14.77
DIST              121201       123206                30.36390   0.0005   0.4991
                                                        0.0010   0.0010    16.18
DIST              121201       123104               132.01240  -0.0005  -0.4879
                                                        0.0010   0.0010     3.62
DIST              121201       123202                38.89970   0.0008   0.8005
                                                        0.0010   0.0010    20.23
DIST              121201       123203                67.39630   0.0008   0.7744
                                                        0.0010   0.0010    11.19
DIST              121201       123105               121.60630  -0.0001  -0.1446
                                                        0.0010   0.0010     1.17
DIR               121206       122020           0  0      0.0      1.6      0.7
                                                          4.0      2.4
DIR               121206       122001          83 91      4.0     -1.6     -0.7
                                                          4.0      2.4
DIR               121206       122020           0  0      0.0      1.5      0.4
                                                          4.0      3.4
DIR               121206       122002         166 91     40.0     -1.0     -0.3
                                                          4.0      3.1
DIR               121206       122003         185 10     73.0      3.4      1.0
                                                          4.0      3.4
DIR               121206       122004         198 94     87.0     -1.2     -0.3
                                                          4.0      3.5
DIR               121206       122005         224 34     75.0     -2.7     -0.8
                                                          4.0      3.4
DIR               121206       122020           0  0      0.0      0.6      0.2
                                                          4.0      2.5
DIR               121206       122007           2 62     85.0     -0.6     -0.2
                                                          4.0      2.5
DIR               121206       122020           0  0      0.0     -2.0     -0.7
                                                          4.0      2.7
DIR               121206       122050         360 43     42.0      2.0      0.7
                                                          4.0      2.7
DIR               121203       122020           0  0      0.0      2.1      0.8
                                                          4.0      2.7
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Microsearch GeoLab, V2001.9.20.0            GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               121203       122006         386 57     35.0     -2.1     -0.8
                                                           4.0      2.7
DIR               121203       122020           0  0      0.0      1.1      0.4
                                                           4.0      2.8
DIR               121203       122007         393 30     45.0     -1.1     -0.4
                                                           4.0      2.8
DIR               121203       122020           0  0      0.0      3.2      0.9
                                                           4.0      3.5
DIR               121203       122002           7 73     32.0     -2.5     -0.9
                                                           4.0      2.8
DIR               121203       122005         262 79     74.0     -3.2     -1.0
                                                           4.0      3.2
DIR               121203       122004         213 16     25.0      3.1      1.0
                                                           4.0      3.2
DIR               121203       122050         364 65     34.0     -0.6     -0.2
                                                           4.0      3.4
DIR               121203       122020           0  0      0.0      1.3      0.5
                                                           4.0      2.7
DIR               121203       122001          16 21     34.0     -1.3     -0.5
                                                           4.0      2.7
ZANG              121206       122020          92 85     84.0     -3.4     -0.3
                                                          12.0     11.9
ZANG              121206       122001          94 56     96.0    -10.3     -2.4
                                                           6.0      4.3
ZANG              121206       122020          92 85     80.0     -7.4     -0.6
                                                          12.0     11.9
ZANG              121206       122020          92 85     81.0     -6.4     -0.5
                                                          12.0     11.9
ZANG              121206       122002          99 95      4.0      2.2      0.5
                                                           6.0      4.8
ZANG              121206       122003          98 96     87.0      3.4      0.7
                                                           6.0      5.2
ZANG              121206       122004          99 11     81.0     -4.3     -0.7
                                                           6.0      5.8
ZANG              121206       122005          99 68     33.0     -2.2     -0.4
                                                           6.0      5.6
ZANG              121206       122020          92 85     79.0     -8.4     -0.7
                                                          12.0     11.9
ZANG              121206       122007         105 90     79.0      7.2      1.5
                                                           6.0      4.7
ZANG              121206       122020          92 85     80.0     -7.4     -0.6
                                                          12.0     11.9
ZANG              121206       122020          92 85     75.0    -12.4     -1.0
                                                          12.0     11.9
ZANG              121203       122020          93 64     75.0     -0.2     -0.0
                                                          12.0     11.9
ZANG              121203       122006         101  3     34.0     14.6      2.7
                                                           6.0      5.5
ZANG              121203       122020          93 64     72.0     -3.2     -0.3
                                                          12.0     11.9
ZANG              121203       122020          93 64     75.0     -0.2     -0.0
                                                          12.0     11.9
ZANG              121203       122007         102 93     96.0     -0.8     -0.1
                                                           6.0      5.8
ZANG              121203       122020          93 64     68.0     -7.2     -0.6
                                                          12.0     11.9
ZANG              121203       122002         102  6     29.0     -7.6     -1.7
                                                           6.0      4.4
ZANG              121203       122005         100 47      1.0      3.1      0.6
                                                           6.0      5.1
ZANG              121203       122004          99 29     42.0      7.3      1.4
                                                           6.0      5.2
ZANG              121203       122020          93 64     65.0    -10.2     -0.9
                                                          12.0     11.9
ZANG              121203       122020          93 64     65.0    -10.2     -0.9
                                                          12.0     11.9
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
ZANG              121203       122001          98 47      8.0      3.9      0.7
                                                           6.0      5.6
DIST              121206       123101               30.36480  -0.0004  -0.3640
                                                      0.0010   0.0010    11.80
DIST              121206       123203               59.64410   0.0006   0.5897
                                                      0.0010   0.0010     9.63
DIST              121206       123202               33.57530   0.0009   0.8858
                                                      0.0010   0.0010    25.91
DIST              121206       123104              121.62180  -0.0004  -0.4536
                                                      0.0010   0.0010     3.65
DIST              121206       123205              101.17490   0.0002   0.2235
                                                      0.0010   0.0010     2.17
DIST              121206       123107               37.47440  -0.0000  -0.0188
                                                      0.0010   0.0010     0.49
DIST              121203       123106               59.64470  -0.0001  -0.0641
                                                      0.0010   0.0010     1.05
DIST              121203       123105               62.81920  -0.0007  -0.7020
                                                      0.0010   0.0010    10.93
DIST              121203       123202               29.02530   0.0001   0.1535
                                                      0.0010   0.0010     5.14
DIST              121203       123104               64.67350  -0.0004  -0.4300
                                                      0.0010   0.0010     6.45
DIST              121203       123207               96.18430   0.0006   0.5827
                                                      0.0010   0.0010     5.84
DIST              121203       123101               67.39720  -0.0001  -0.1100
                                                      0.0010   0.0010     1.59
ELAT              121201       1               0 00  0.000000  -0.0000  -0.9944
                                                      0.0001   0.0000   106.76
ELON              121201       1               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    16.69
EHDF              121201       1                    -0.22530   0.0001   0.2384
                                                      0.0005   0.0004   471.97
ELAT              122001       1               0 00  0.000000  -0.0001  -2.1791
                                                      0.0001   0.0000   256.53
ELON              122001       1               0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000   205.34
EHDF              122001       1                    -0.22530  -0.0002  -0.5424
                                                      0.0005   0.0005  1083.68
ELAT              123101       1               0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000    16.69
ELON              123101       1               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    25.28
EHDF              123101       1                    -0.22530   0.0000   0.0000
                                                      0.0005   0.0000     0.00*
ELAT              123201       1               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000     0.47
ELON              123201       1               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000     0.22
EHDF              123201       1                    -0.22530  -0.0000  -0.0000
                                                      0.0005   0.0000     0.00*
ELAT              121501       1               0 00  0.000000   0.0000   1.0821
                                                      0.0001   0.0000   140.81
ELON              121501       1               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    33.65
EHDF              121501       1                    -0.22530  -0.0002  -0.5008
                                                      0.0005   0.0004   991.67
ELAT              122002       2               0 00  0.000000  -0.0000  -0.2156
                                                      0.0001   0.0001    78.34
ELON              122002       2               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000     4.63
EHDF              122002       2                    -0.22550  -0.0002  -0.4436
                                                      0.0005   0.0005   912.89
ELAT              123102       2               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    20.23
ELON              123102       2               0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    28.97
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
EHDF              123102       2                     -0.22550  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              123202       2               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    56.34
ELON              123202       2               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    89.86
EHDF              123202       2                     -0.22550  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              121203       3               0 00  0.000000   0.0001   3.8965
                                                       0.0001   0.0000 821423.3
ELON              121203       3               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000 256184.7
EHDF              121203       3                      0.00000  -0.0001  -0.1762
                                                       0.0005   0.0004 509551.0
ELAT              122003       3               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 24455.23
ELON              122003       3               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 42349.67
EHDF              122003       3                      0.00000   0.0002   0.3927
                                                       0.0005   0.0004 998801.4
ELAT              123103       3               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000 580245.5
ELON              123103       3               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000 813462.2
EHDF              123103       3                      0.00000   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
ELAT              123203       3               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 436461.2
ELON              123203       3               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 899789.6
EHDF              123203       3                      0.00000  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              121503       3               0 00  0.000000   0.0001   2.1085
                                                       0.0001   0.0000 694699.7
ELON              121503       3               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 149238.4
EHDF              121503       3                      0.00000  -0.0001  -0.1550
                                                       0.0005   0.0004 703647.1
ELAT              122004       4               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    66.40
ELON              122004       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    12.06
EHDF              122004       4                     -0.22750   0.0006   1.5151
                                                       0.0005   0.0004  2680.68
ELAT              123104       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    38.94
ELON              123104       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000   130.01
EHDF              123104       4                     -0.22750  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              123204       4               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     2.77
ELON              123204       4               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    12.71
EHDF              123204       4                     -0.22750  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              122005       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    21.88
ELON              122005       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    28.99
EHDF              122005       5                     -0.21850   0.0004   1.0255
                                                       0.0005   0.0004  1868.84
ELAT              123105       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    18.38
ELON              123105       5               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    53.55
```

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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
EHDF              123105       5                     -0.21850  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              123205       5               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    28.55
ELON              123205       5               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    53.67
EHDF              123205       5                     -0.21850  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              121206       6               0 00  0.000000   0.0000   1.2745
                                                       0.0001   0.0000 74654.44
ELON              121206       6               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000 20316.73
EHDF              121206       6                      0.00020   0.0002   0.5107
                                                       0.0005   0.0005 533653.3
ELAT              121506       6               0 00  0.000000   0.0001   2.7648
                                                       0.0001   0.0000 877348.0
ELON              121506       6               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 159092.8
EHDF              121506       6                      0.00020  -0.0001  -0.3297
                                                       0.0005   0.0005  1312580
ELAT              122006       6               0 00  0.000000   0.0001   3.0903
                                                       0.0001   0.0000 727013.6
ELON              122006       6               0 00  0.000000  -0.0001  -0.0001
                                                       0.0001  -0.0000 382971.6
EHDF              122006       6                      0.00020  -0.0003  -0.6422
                                                       0.0005   0.0005  1817557
ELAT              123106       6               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 16035.00
ELON              123106       6               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 11695.32
EHDF              123106       6                      0.00020  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              123206       6               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000 13837.12
ELON              123206       6               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000 30756.16
EHDF              123206       6                      0.00020   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
ELAT              121207       7               0 00  0.000000  -0.0001  -0.0001
                                                       0.0001  -0.0000    50.87
ELON              121207       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     2.23
EHDF              121207       7                     -1.59670   0.0004   1.0015
                                                       0.0005   0.0004   267.63
ELAT              121507       7               0 00  0.000000  -0.0001  -0.0001
                                                       0.0001  -0.0000    46.74
ELON              121507       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    16.29
EHDF              121507       7                     -1.59670   0.0003   0.7838
                                                       0.0005   0.0004   210.30
ELAT              122007       7               0 00  0.000000  -0.0001  -4.2860
                                                       0.0001   0.0000    32.85
                                                  ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
ELON              122007       7               0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    20.07
EHDF              122007       7                     -1.59670   0.0006   1.4128
                                                       0.0005   0.0004   392.49
ELAT              123107       7               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     7.64
ELON              123107       7               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     6.79
EHDF              123107       7                     -1.59670   0.0000   0.0000
                                                       0.0005   0.0000     0.00*
ELAT              123207       7               0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     1.06
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ELON              123207       7              0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000     1.19
EHDF              123207       7                    -1.59670   0.0000   0.0000
                                                      0.0005   0.0000     0.00*
ELAT              122020       20             0 00  0.000000  -0.0001  -0.2940
                                                      0.0010   0.0004   535.77
ELON              122020       20             0 00  0.000000   0.0000   0.0000
                                                      0.0010  -0.0000   201.35
EHDF              122020       20                   -0.23870  -0.0022  -5.1193
                                                      0.0010   0.0004  9007.39
                                                   ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
ELAT              122050       50             0 00  0.000000   0.0006   0.0006
                                                      0.0010  -0.0000 438981.4
ELON              122050       50             0 00  0.000000  -0.0010  -0.0010
                                                      0.0010  -0.0000 780337.3
EHDF              122050       50                    0.00000  -0.0006  -2.3030
                                                      0.0010   0.0003 445386.8
DIR               311231       312050          0  0      0.0     -0.2     -0.1
                                                        4.0      2.7
DIR               311231       312020        378 92     60.0      0.7      0.2
                                                        4.0      2.7
DIR               311231       312035        304 38     84.0     -0.0     -0.0
                                                        4.0      0.1
DIR               311231       312030        396 43     49.0     -0.5     -1.0
                                                        4.0      0.5
ZANG              311231       312050         91 80     13.0     35.7      3.0
                                                       12.0     11.8
ZANG              311231       312020         87 43     30.0     48.3      4.1
                                                       12.0     11.6
ZANG              311231       312035        101 54     62.0      0.1      0.2
                                                        6.0      0.4
ZANG              311231       312030         97 86     73.0     -0.2     -0.5
                                                        6.0      0.4
ZANG              311231       312050         91 80     12.0     34.7      2.9
                                                       12.0     11.8
DIST              311231       313230                3.78840   0.0003   0.3048
                                                      0.0010   0.0009    72.06
DIST              311231       313235                2.99610   0.0001   0.1204
                                                      0.0010   0.0009    37.52
DIST              311231       313235                2.99620   0.0000   0.0133
                                                      0.0010   0.0009     4.14
DIR               311530       312050          0  0      0.0      4.7      1.7
                                                        4.0      2.7
DIR               311530       312020        378 63     88.0     -5.2     -1.9
                                                        4.0      2.7
DIR               311530       312031        196 40     70.0      0.5      1.0
                                                        4.0      0.5
DIR               311530       312035        242  1     61.0      0.0      0.2
                                                        4.0      0.2
DIR               311530       312050          0  0      0.0      3.5      1.3
                                                        4.0      2.7
DIR               311530       312020        378 63     85.0     -3.5     -1.3
                                                        4.0      2.7
ZANG              311530       312050         91 75     74.0     17.2      2.2
                                                        8.0      7.7
ZANG              311530       312020         87 28     38.0     37.8      3.3
                                                       12.0     11.6
ZANG              311530       312031        102 13     59.0     -0.0     -0.1
                                                        6.0      0.4
ZANG              311530       312035        102 80     69.0     -0.3     -0.5
                                                        6.0      0.6
ZANG              311530       312050         91 75     86.0     29.2      3.8
                                                        8.0      7.7
ZANG              311530       312020         87 28     41.0     40.8      3.5
                                                       12.0     11.6
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0023
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
DIST              311530       313235                 4.53040  -0.0002  -0.2359
                                                       0.0010   0.0009    44.60
DIST              311530       313231                 3.78900  -0.0003  -0.3360
                                                       0.0010   0.0009    79.32
EHDF              30N          35                    -0.15613   0.0005   0.9400
                                                       0.0005   0.0005   101.97
EHDF              35           31                     0.03137  -0.0004  -0.8032
                                                       0.0005   0.0005   130.70
EHDF              31           30N                    0.12469  -0.0000  -0.0000
                                                       0.0001   0.0000     0.13*
EHDF              30N          31                    -0.12472   0.0000   0.0000
                                                       0.0001   0.0000     8.05*
EHDF              31           35                    -0.03107   0.0001   0.1877
                                                       0.0005   0.0005    30.55
EHDF              35           30N                    0.15584  -0.0002  -0.3500
                                                       0.0005   0.0005    37.97
EHDF              30N          36                    -0.67711   0.0000   0.0000
                                                       0.0001   0.0000     5.10*
EHDF              36           37                    -0.00428   0.0000   0.0000
                                                       0.0001   0.0000  5481.53*
EHDF              37           30N                    0.68132   0.0000   0.0000
                                                       0.0001   0.0000     5.10*
EHDF              30N          360                   -0.68100  -0.0000  -0.0000
                                                       0.0001   0.0000     5.24*
EHDF              360          35                     0.52538  -0.0000  -0.0000
                                                       0.0001   0.0000    45.66*
EHDF              35           370                   -0.52566   0.0000   0.0000
                                                       0.0001   0.0000    26.61*
EHDF              370          30N                    0.68130   0.0000   0.0000
                                                       0.0001   0.0000     3.06*
EHDF              30N          361                   -0.68099   0.0000   0.0000
                                                       0.0001   0.0000     0.73*
EHDF              361          371                    0.00028   0.0000   0.0000
                                                       0.0001   0.0000 11517.88*
EHDF              371          30N                    0.68070   0.0000   0.0000
                                                       0.0001   0.0000     0.73*
EHDF              21605S001    36                     0.04500   0.0000   0.0000
                                                       0.0002   0.0000     0.00*
ELAT              30           312030          0 00   0.000000  -0.0000  -2.1053
                                                       0.0001   0.0000    27.20
ELON              30           312030          0 00   0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     9.13
EHDF              30           312030                 1.65060   0.0002   0.5023
                                                       0.0005   0.0004   131.37
ELAT              30           311530          0 00   0.000000   0.0001   2.3486
                                                       0.0001   0.0000    31.67
ELON              30           311530          0 00   0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    12.00
EHDF              30           311530                 1.65060   0.0002   0.5329
                                                       0.0005   0.0004   139.56
ELAT              30           313230          0 00   0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     0.53
ELON              30           313230          0 00   0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     1.57
EHDF              30           313230                 1.65060  -0.0000  -0.0000
                                                       0.0005   0.0000     0.00*
ELAT              31           312031          0 00   0.000000  -0.0000  -1.9407
                                                       0.0001   0.0000   190.05
ELON              31           312031          0 00   0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    63.80
EHDF              31           312031                 0.23820   0.0001   0.1323
                                                       0.0005   0.0004   242.96
ELAT              31           311231          0 00   0.000000   0.0000   1.8527
                                                       0.0001   0.0000   185.90
ELON              31           311231          0 00   0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    75.70
```

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                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0048
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
EHDF              31           311231                 0.23820   0.0002   0.5340
                                                        0.0005   0.0004   982.40
ELAT              31           313231           0 00  0.000000   0.0000   0.0000
                                                        0.0001  -0.0000     4.01
ELON              31           313231           0 00  0.000000  -0.0000  -0.0000
                                                        0.0001  -0.0000    11.95
EHDF              31           313231                 0.23820  -0.0000  -0.0000
                                                        0.0005   0.0000     0.00*
ELAT              35           312035           0 00  0.000000  -0.0000  -0.0000
                                                        0.0001  -0.0000     7.44
ELON              35           312035           0 00  0.000000  -0.0000  -0.0000
                                                        0.0001  -0.0000    11.15
EHDF              35           312035                 0.19650   0.0002   0.3455
                                                        0.0005   0.0004   763.27
ELAT              35           313235           0 00  0.000000   0.0000   0.0000
                                                        0.0001  -0.0000     3.14
ELON              35           313235           0 00  0.000000  -0.0000  -0.0000
                                                        0.0001  -0.0000     7.95
EHDF              35           313235                 0.19650  -0.0000  -0.0000
                                                        0.0005   0.0000     0.00*
ELAT              35           21605S001        0 00  0.000000   0.0000   0.0000
                                                        0.0001  -0.0000     0.00
ELON              35           21605S001        0 00  0.000000  -0.0000  -0.0000
                                                        0.0001  -0.0000     0.00
ELAT              50           312050           0 00  0.000000   0.0000   0.0000
                                                        0.0001   0.0000 359687.3*
ELON              50           312050           0 00  0.000000   0.0000   0.0000
                                                        0.0001   0.0000 143822.0*
EHDF              50           312050                 0.00000  -0.0000  -0.0000
                                                        0.0001   0.0000 921926.9*
ELAT              20           312020           0 00  0.000000  -0.0000  -0.0000
                                                        0.0001  -0.0000    54.57
ELON              20           312020           0 00  0.000000  -0.0000  -0.0000
                                                        0.0001  -0.0000     2.43
EHDF              20           312020                 0.23780  -0.0022  -6.7557
                                                        0.0010   0.0003  9153.03
                                                    ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
EHDF              30           30N                    1.41010   0.0001   0.0001
                                                        0.0002   0.0000    52.16*
DIR               411220       412030             0  0     0.0     -1.8     -0.5
                                                          4.0      3.3
DIR               411220       412001         169 10     91.0      3.2      1.0
                                                          4.0      3.4
DIR               411220       412003         171 12     76.0     -2.8     -0.8
                                                          4.0      3.4
DIR               411220       412050         238  0     26.0      1.3      0.5
                                                          4.0      2.9
DIR               411220       412030             0  0     0.0      2.8      1.0
                                                          4.0      2.7
DIR               411220       413202         170 73     67.0     -2.8     -1.0
                                                          4.0      2.7
DIR               421220       422030             0  0     0.0     -3.7     -1.3
                                                          4.0      2.7
DIR               421220       423202         170 73     54.0      3.7      1.3
                                                          4.0      2.7
DIR               421220       422030             0  0     0.0     -1.5     -0.5
                                                          4.0      3.3
DIR               421220       422001         169 10     91.0      3.5      1.0
                                                          4.0      3.4
DIR               421220       422003         171 12     73.0      0.4      0.1
                                                          4.0      3.4
DIR               421220       422050         238  0     30.0     -2.4     -0.8
                                                          4.0      2.9
DIR               421220       422030             0  0     0.0     -2.3     -0.7
                                                          4.0      3.3
DIR               421220       422001         169 10     91.0      2.7      0.8
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0050
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
                                                          4.0      3.4
DIR               421220       422003         171 12     69.0      3.7      1.1
                                                          4.0      3.4
DIR               421220       422050         238  0     31.0     -4.1     -1.4
                                                          4.0      2.9
ZANG              411220       412030         112 71     76.0     -5.7     -1.3
                                                          6.0      4.5
ZANG              411220       412001         106 93     26.0      9.9      1.7
                                                          6.0      5.8
ZANG              411220       412003         106 35     92.0     12.4      2.1
                                                          6.0      5.8
ZANG              411220       412050          95 96     78.0     -2.6     -0.6
                                                          6.0      4.5
ZANG              411220       412030         112 71     77.0     -4.7     -1.0
                                                          6.0      4.5
ZANG              411220       413202         106 78      0.0      8.7      1.5
                                                          6.0      5.8
ZANG              421220       422030         112 71     78.0     -6.8     -1.4
                                                          6.0      5.0
ZANG              421220       423202         106 78      6.0     14.8      2.5
                                                          6.0      5.9
ZANG              421220       422030         112 71     84.0     -0.8     -0.2
                                                          6.0      5.0
ZANG              421220       422001         106 93     23.0      7.0      1.2
                                                          6.0      5.8
ZANG              421220       422003         106 35     87.0      7.4      1.3
                                                          6.0      5.8
ZANG              421220       422030         112 71     83.0     -1.8     -0.4
                                                          6.0      5.0
ZANG              421220       422001         106 93     31.0     15.0      2.6
                                                          6.0      5.8
ZANG              421220       422003         106 35     91.0     11.4      2.0
                                                          6.0      5.8
DIST              411220       413202               575.01460   0.0016   1.7776
                                                       0.0010   0.0009     2.83
DIST              421220       423202               575.01570   0.0005   0.5728
                                                       0.0010   0.0009     0.91
ELAT              1            412001          0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     9.59
ELON              1            412001          0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     4.52
EHDF              1            412001                0.22730  -0.0001  -0.0001
                                                       0.0005   0.0000   353.92*
ELAT              1            422001          0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000    18.42
ELON              1            422001          0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000     8.68
EHDF              1            422001                0.22730  -0.0002  -0.0002
                                                       0.0005   0.0000   786.55*
ELAT              2            413202          0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    37.08
ELON              2            413202          0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    62.29
EHDF              2            413202                0.22460  -0.0001  -0.0001
                                                       0.0005   0.0000   295.52*
ELAT              2            423202          0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000     1.01
ELON              2            423202          0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000    25.79
EHDF              2            423202                0.22460  -0.0001  -0.0001
                                                       0.0005   0.0000   504.80*
ELAT              3            412003          0 00  0.000000  -0.0000  -0.0000
                                                       0.0001  -0.0000  4744.27
ELON              3            412003          0 00  0.000000   0.0000   0.0000
                                                       0.0001  -0.0000  2054.61
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0            GRS80       UNITS: m,GRAD Page 0048
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
EHDF              3            412003                0.00000  -0.0004  -2.1390
                                                      0.0010   0.0002 999987.8
ELAT              3            422003          0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000  4549.90
ELON              3            422003          0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000  1970.44
EHDF              3            422003                0.00000  -0.0005  -2.3648
                                                      0.0010   0.0002 999988.4
ELAT              20           411220          0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    79.69
ELON              20           411220          0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    53.98
EHDF              20           411220                0.23570  -0.0001  -0.3730
                                                      0.0010   0.0004   632.18
ELAT              20           421220          0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    79.68
ELON              20           421220          0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    46.89
EHDF              20           421220                0.23470   0.0007   1.5912
                                                      0.0010   0.0004  2867.90
ELAT              30           412030          0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000     5.65
ELON              30           412030          0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000     0.25
EHDF              30           412030                1.65060   0.0176   3.8129
                                                      0.0050   0.0046 10549.46
ELAT              30           422030          0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000     6.50
ELON              30           422030          0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000     0.29
EHDF              30           422030                1.65060   0.0161   3.4331
                                                      0.0050   0.0047  9681.51
ELAT              50           412050          0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000  9468.56
ELON              50           412050          0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000  7075.69
EHDF              50           412050                0.00000   0.0001   0.5742
                                                      0.0010   0.0002 999928.1
ELAT              50           422050          0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000 801155.5
ELON              50           422050          0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000 598689.9
EHDF              50           422050                0.00000  -0.0000  -0.0000
                                                      0.0010   0.0000     0.01*
ELAT              4            4ANT            0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000    19.63
ELON              4            4ANT            0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000     8.04
EHDF              4            4ANT                  0.06540   0.0001   0.7409
                                                      0.0010   0.0001  1324.65
ELAT              5            5ANT            0 00  0.000000  -0.0000  -0.0000
                                                      0.0001  -0.0000   112.90
ELON              5            5ANT            0 00  0.000000   0.0000   0.0000
                                                      0.0001  -0.0000    38.21
EHDF              5            5ANT                  0.05670   0.0005   2.1953
                                                      0.0010   0.0002  7894.58
DIR               411220       412030            0  0      0.0      7.5      2.2
                                                              5.0      3.5
DIR               411220       5ANT            176 36     81.0     -7.5     -2.2
                                                              5.0      3.5
DIR               421220       422030            0  0      0.0      3.6      1.0
                                                              5.0      3.5
DIR               421220       4ANT            172 40     12.0     -3.6     -1.0
                                                              5.0      3.5
DIR               421220       422030            0  0      0.0      3.5      1.0
                                                              5.0      3.5
```

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================================================================================
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0048
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               421220       5ANT           176 36     73.0     -3.5     -1.0
                                                           5.0      3.5
DIR               421220       422030           0  0      0.0      9.1      2.6
                                                           5.0      3.5
DIR               421220       8              171 38     61.0     -9.1     -2.6
                                                           5.0      3.5
DIR               421220       422030           0  0      0.0      6.0      1.7
                                                           5.0      3.5
DIR               421220       5ANT           176 36     78.0     -6.0     -1.7
                                                           5.0      3.5
DIST              4112205      5ANT                   0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              5ANT         4112205                0.10200   0.0000   0.0000
                                                        0.0001   0.0000    12.38*
DIR               5ANT         411220           0  0      0.0      0.0      0.0
                                                           1.0      0.0        *
DIR               5ANT         4112205          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              411220       4112205        106  4     50.0    -16.2     -2.1
                                                           8.0      7.9
DIST              4212204      4ANT                   0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              4ANT         4212204                0.10200   0.0000   0.0000
                                                        0.0001   0.0000     4.29*
DIR               4ANT         421220           0  0      0.0      0.0      0.0
                                                           1.0      0.0        *
DIR               4ANT         4212204          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              421220       4212204        105 69     29.0     -5.8     -0.7
                                                           8.0      7.9
DIST              4212205      5ANT                   0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              5ANT         4212205                0.10200   0.0000   0.0000
                                                        0.0001   0.0000     4.97*
DIR               5ANT         421220           0  0      0.0      0.0      0.0
                                                           1.0      0.1
DIR               5ANT         4212205          0  0      0.0     -0.0     -0.0
                                                           8.0      5.6
ZANG              421220       4212205        106  4     51.0    -15.0     -1.9
                                                           8.0      7.9
DIST              4212208      8                      0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              8            4212208                0.10200   0.0000   0.0000
                                                        0.0001   0.0000     5.29*
DIR               8            421220           0  0      0.0      0.0      0.0
                                                           1.0      0.0        *
DIR               8            4212208          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              421220       4212208        105 73     64.0     -6.8     -0.9
                                                           8.0      7.9
DIST              4212205      5ANT                   0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              5ANT         4212205                0.10200   0.0000   0.0000
                                                        0.0001   0.0000     4.97*
DIR               5ANT         421220           0  0      0.0      0.0      0.0
                                                           1.0      0.1
DIR               5ANT         4212205          0  0      0.0     -0.0     -0.0
                                                           8.0      5.6
ZANG              421220       4212205        106  4     68.0      2.0      0.3
                                                           8.0      7.9
DIR               111205       112020           0  0      0.0      4.1      1.2
                                                           5.0      3.4
DIR               111205       8               88 75     67.0     -4.1     -1.2
                                                           5.0      3.4
DIR               111205       112020           0  0      0.0     -1.7     -0.6
                                                           5.0      2.6
```

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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM          TO                      STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               111205        9              104 49     21.0      1.7      0.6
                                                           5.0      2.6
DIR               111204        112020           0  0      0.0      1.9      0.7
                                                           5.0      2.8
DIR               111204        9              369 55     87.0     -1.9     -0.7
                                                           5.0      2.8
DIR               111204        112020           0  0      0.0      7.7      2.4
                                                           5.0      3.2
DIR               111204        8               18 54     85.0     -7.7     -2.4
                                                           5.0      3.2
DIST              1112058       8                      0.20210   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              8             1112058                0.10200   0.0000   0.0000
                                                         0.0001   0.0000    15.24*
DIR               8             111205           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               8             1112058          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              111205        1112058         95 30     66.0     -1.6     -0.2
                                                           8.0      7.2
DIST              1112059       9                      0.20150   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              9             1112059                0.10080   0.0000   0.0000
                                                         0.0001   0.0000   214.62*
DIR               9             111205           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               9             1112059          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              111205        1112059        102 33     43.0    -11.8     -2.1
                                                           8.0      5.8
DIST              1112049       9                      0.20150   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              9             1112049                0.10080  -0.0001  -0.0001
                                                         0.0001   0.0000   340.93*
DIR               9             111204           0  0      0.0      0.0      0.0
                                                           1.0      0.0         *
DIR               9             1112049          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              111204        1112049        105 11     17.0     18.8      3.2
                                                           8.0      5.9
DIST              1112048       8                      0.20210   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              8             1112048                0.10200   0.0000   0.0000
                                                         0.0001   0.0000   101.67*
DIR               8             111204           0  0      0.0      0.0      0.0
                                                           1.0      0.0         *
DIR               8             1112048          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              111204        1112048         95 43     65.0     -7.2     -1.1
                                                           8.0      6.5
DIR               111206        112004           0  0      0.0     -3.0     -0.9
                                                           5.0      3.5
DIR               111206        9                7 96     40.0      3.0      0.9
                                                           5.0      3.5
DIR               111206        112004           0  0      0.0     -6.1     -1.7
                                                           5.0      3.5
DIR               111206        8              392 44     35.0      6.1      1.7
                                                           5.0      3.5
DIST              1112069       9                      0.20150   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              9             1112069                0.10080   0.0000   0.0000
                                                         0.0001   0.0000     8.86*
DIR               9             111206           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               9             1112069          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
```

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================================================================================
                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM          TO                      STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
ZANG              111206       1112069        100 32     24.0     -1.8     -0.2
                                                           8.0      7.8
DIST              1112068      8                      0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              8            1112068                0.10200  -0.0000  -0.0000
                                                        0.0001   0.0000    51.82*
DIR               8            111206           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0        *
DIR               8            1112068          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              111206       1112068         96 99     53.0      9.4      1.2
                                                           8.0      7.8
DIR               121201       122004           0  0      0.0     -6.8     -2.0
                                                           5.0      3.5
DIR               121201       8              398 16      3.0      6.8      2.0
                                                           5.0      3.5
DIST              1212018      8                      0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              8            1212018                0.10200  -0.0000  -0.0000
                                                        0.0001   0.0000     5.13*
DIR               8            121201           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0        *
DIR               8            1212018          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              121201       1212018         98 94     80.0      1.0      0.1
                                                           8.0      7.8
DIR               121206       122020           0  0      0.0     -7.9     -2.3
                                                           5.0      3.5
DIR               121206       8              191 39     15.0      7.9      2.3
                                                           5.0      3.5
DIR               121206       122020           0  0      0.0     -0.4     -0.1
                                                           5.0      3.4
DIR               121206       9              206 91     29.0      0.4      0.1
                                                           5.0      3.4
DIR               121203       122020           0  0      0.0    -28.6     -3.4
                                                          10.0      8.5
DIR               121203       8              205 39      9.0      7.1      3.4
                                                           5.0      2.1
DIR               121203       122020           0  0      0.0     -2.0     -0.6
                                                           5.0      3.1
DIR               121203       9              236 81     80.0      2.0      0.6
                                                           5.0      3.1
DIST              1212068      8                      0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              8            1212068                0.10200  -0.0000  -0.0000
                                                        0.0001   0.0000    42.88*
DIR               8            121206           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0        *
DIR               8            1212068          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              121206       1212068         96 99     46.0      7.7      1.0
                                                           8.0      7.8
DIST              1212069      9                      0.20150   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              9            1212069                0.10080  -0.0000  -0.0000
                                                        0.0001   0.0000     0.55*
DIR               9            121206           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0        *
DIR               9            1212069          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121206       1212069        100 32     21.0      0.1      0.0
                                                           8.0      7.8
DIST              1212038      8                      0.20210   0.0000   0.0000
                                                        0.0001   0.0000     0.00*
EHDF              8            1212038                0.10200   0.0000   0.0000
                                                        0.0001   0.0000    76.59*
```

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                              shao_juillet.iob
Microsearch GeoLab, V2001.9.20.0            GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               8            121203           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               8            1212038          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121203       1212038         93 15     90.0     -4.7     -0.7
                                                           8.0      6.3
DIST              1212039      9                       0.20150   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              9            1212039                 0.10080   0.0000   0.0000
                                                         0.0001   0.0000    69.18*
DIR               9            121203           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               9            1212039          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121203       1212039        102  1     28.0     -6.5     -0.9
                                                           8.0      7.2
DIR               111504       112020           0  0      0.0      8.0      2.5
                                                           5.0      3.2
DIR               111504       8               18 54     85.0     -8.0     -2.5
                                                           5.0      3.2
DIR               111504       112020           0  0      0.0     -1.6     -0.6
                                                           5.0      2.8
DIR               111504       9              369 55     80.0      1.6      0.6
                                                           5.0      2.8
DIR               111502       112020           0  0      0.0     -7.2     -2.1
                                                           5.0      3.4
DIR               111502       8              206 93     28.0      7.2      2.1
                                                           5.0      3.4
DIR               111502       112020           0  0      0.0     -1.8     -0.5
                                                           5.0      3.4
DIR               111502       9              226  7      7.0      1.8      0.5
                                                           5.0      3.4
DIR               111502       112020           0  0      0.0     -8.7     -2.5
                                                           5.0      3.4
DIR               111502       8              206 93     25.0      8.7      2.5
                                                           5.0      3.4
DIR               111502       112020           0  0      0.0      7.7      2.3
                                                           5.0      3.4
DIR               111502       9              226  7     26.0     -7.7     -2.3
                                                           5.0      3.4
DIR               111505       112020           0  0      0.0     -2.5     -0.8
                                                           5.0      3.4
DIR               111505       8               88 75     54.0      2.5      0.8
                                                           5.0      3.4
DIR               111505       112020           0  0      0.0      2.0      0.7
                                                           5.0      2.6
DIR               111505       9              104 49     29.0     -2.0     -0.7
                                                           5.0      2.6
DIR               111506       112020           0  0      0.0     -4.6     -1.3
                                                           5.0      3.4
DIR               111506       8              191 39     22.0      4.6      1.3
                                                           5.0      3.4
DIR               111506       112020           0  0      0.0      0.8      0.2
                                                           5.0      3.4
DIR               111506       9              206 91     32.0     -0.8     -0.2
                                                           5.0      3.4
DIST              1115048      8                       0.20210   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              8            1115048                 0.10200   0.0000   0.0000
                                                         0.0001   0.0000    44.37*
DIR               8            111504           0  0      0.0      0.0      0.0
                                                           1.0      0.0         *
DIR               8            1115048          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              111504       1115048         95 43     60.0     -3.2     -0.5
                                                           8.0      6.5
```

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================================================================================
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIST              1115049      9                       0.20150  -0.0000  -0.0000
                                                       0.0001   0.0000     0.00*
EHDF              9            1115049                 0.10080  -0.0001  -0.0001
                                                       0.0001   0.0000   325.21*
DIR               9            111504           0  0      0.0      0.0      0.0
                                                         1.0      0.0         *
DIR               9            1115049          0  0      0.0     -0.0     -0.0
                                                         8.0      0.0
ZANG              111504       1115049        105 11       4.0     18.0      3.1
                                                         8.0      5.8
DIST              1115028      8                       0.20210   0.0000   0.0000
                                                       0.0001   0.0000     0.00*
EHDF              8            1115028                 0.10200  -0.0000  -0.0000
                                                       0.0001   0.0000    45.21*
DIR               8            111502           0  0      0.0     -0.0     -0.0
                                                         1.0      0.1
DIR               8            1115028          0  0      0.0     -0.0     -0.0
                                                         8.0      5.6
ZANG              111502       1115028         95 50      67.0      3.4      0.5
                                                         8.0      7.6
DIST              1115029      9                       0.20150   0.0000   0.0000
                                                       0.0001   0.0000     0.00*
EHDF              9            1115029                 0.10080   0.0000   0.0000
                                                       0.0001   0.0000    13.88*
DIR               9            111502           0  0      0.0      0.0      0.0
                                                         1.0      0.1
DIR               9            1115029          0  0      0.0      0.0      0.0
                                                         8.0      5.6
ZANG              111502       1115029        100 45      20.0     -2.6     -0.3
                                                         8.0      7.8
DIST              1115028      8                       0.20210   0.0000   0.0000
                                                       0.0001   0.0000     0.00*
EHDF              8            1115028                 0.10200  -0.0000  -0.0000
                                                       0.0001   0.0000    45.21*
DIR               8            111502           0  0      0.0     -0.0     -0.0
                                                         1.0      0.1
DIR               8            1115028          0  0      0.0     -0.0     -0.0
                                                         8.0      5.6
ZANG              111502       1115028         95 50      71.0      7.4      1.0
                                                         8.0      7.6
DIST              1115029      9                       0.20150   0.0000   0.0000
                                                       0.0001   0.0000     0.00*
EHDF              9            1115029                 0.10080   0.0000   0.0000
                                                       0.0001   0.0000    13.88*
DIR               9            111502           0  0      0.0      0.0      0.0
                                                         1.0      0.1
DIR               9            1115029          0  0      0.0      0.0      0.0
                                                         8.0      5.6
ZANG              111502       1115029        100 45      21.0     -1.6     -0.2
                                                         8.0      7.8
DIST              1115058      8                       0.20210   0.0000   0.0000
                                                       0.0001   0.0000     0.00*
EHDF              8            1115058                 0.10200  -0.0000  -0.0000
                                                       0.0001   0.0000    94.88*
DIR               8            111505           0  0      0.0     -0.0     -0.0
                                                         1.0      0.0         *
DIR               8            1115058          0  0      0.0     -0.0     -0.0
                                                         8.0      0.0
ZANG              111505       1115058         95 30      71.0      9.7      1.3
                                                         8.0      7.2
DIST              1115059      9                       0.20150   0.0000   0.0000
                                                       0.0001   0.0000     0.00*
EHDF              9            1115059                 0.10080   0.0000   0.0000
                                                       0.0001   0.0000   232.59*
DIR               9            111505           0  0      0.0     -0.0     -0.0
                                                         1.0      0.0         *
```

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================================================================================
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               9            1115059          0  0      0.0     -0.0     -0.0
                                                           8.0      0.0
ZANG              111505       1115059        102 33      30.0    -12.8     -2.2
                                                           8.0      5.8
DIST              1115068      8                       0.20210   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              8            1115068                 0.10200  -0.0000  -0.0000
                                                         0.0001   0.0000     9.24*
DIR               8            111506           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               8            1115068          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              111506       1115068         96 99      44.0      1.7      0.2
                                                           8.0      7.8
DIST              1115069      9                       0.20150   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              9            1115069                 0.10080   0.0000   0.0000
                                                         0.0001   0.0000    73.46*
DIR               9            111506           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               9            1115069          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              111506       1115069        100 32      10.0    -14.6     -1.9
                                                           8.0      7.8
DIR               121503       122020           0  0      0.0    -27.4     -3.2
                                                          10.0      8.5
DIR               121503       8              205 39      12.0      6.9      3.2
                                                           5.0      2.1
DIR               121503       122020           0  0      0.0     -0.9     -0.3
                                                           5.0      3.1
DIR               121503       9              236 81      83.0      0.9      0.3
                                                           5.0      3.1
DIR               121501       122020           0  0      0.0     -3.6     -1.0
                                                           5.0      3.5
DIR               121501       8              214 89      79.0      3.6      1.0
                                                           5.0      3.5
DIR               121501       122020           0  0      0.0      3.2      0.9
                                                           5.0      3.5
DIR               121501       9              226 61      45.0     -3.2     -0.9
                                                           5.0      3.5
DIR               121501       122020           0  0      0.0     -6.1     -1.8
                                                           5.0      3.5
DIR               121501       8              214 89      74.0      6.1      1.8
                                                           5.0      3.5
DIR               121506       122020           0  0      0.0     -5.7     -1.6
                                                           5.0      3.5
DIR               121506       8              191 39      19.0      5.7      1.6
                                                           5.0      3.5
DIR               121506       122020           0  0      0.0     -1.2     -0.4
                                                           5.0      3.4
DIR               121506       9              206 91      27.0      1.2      0.4
                                                           5.0      3.4
DIST              1215038      8                       0.20210   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              8            1215038                 0.10200   0.0000   0.0000
                                                         0.0001   0.0000   166.45*
DIR               8            121503           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0         *
DIR               8            1215038          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121503       1215038         93 15      84.0    -10.2     -1.6
                                                           8.0      6.3
DIST              1215039      9                       0.20150   0.0000   0.0000
                                                         0.0001   0.0000     0.00*
EHDF              9            1215039                 0.10080  -0.0000  -0.0000
                                                         0.0001   0.0000     5.00*
```

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================================================================================
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               9            121503           0  0      0.0      0.0      0.0
                                                           1.0      0.0        *
DIR               9            1215039          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121503       1215039        102  1     35.0      0.5      0.1
                                                           8.0      7.2
DIST              1215018      8                        0.20210   0.0000   0.0000
                                                          0.0001   0.0000     0.00*
EHDF              8            1215018                  0.10200  -0.0000  -0.0000
                                                          0.0001   0.0000    24.45*
DIR               8            121501           0  0      0.0     -0.0     -0.0
                                                           1.0      0.1
DIR               8            1215018          0  0      0.0     -0.0     -0.0
                                                           8.0      5.6
ZANG              121501       1215018         98 94     89.0      7.8      1.0
                                                           8.0      7.8
DIST              1215019      9                        0.20150   0.0000   0.0000
                                                          0.0001   0.0000     0.00*
EHDF              9            1215019                  0.10080   0.0000   0.0000
                                                          0.0001   0.0000    28.40*
DIR               9            121501           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0        *
DIR               9            1215019          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121501       1215019        101 74     85.0     -6.5     -0.8
                                                           8.0      7.8
DIST              1215018      8                        0.20210   0.0000   0.0000
                                                          0.0001   0.0000     0.00*
EHDF              8            1215018                  0.10200  -0.0000  -0.0000
                                                          0.0001   0.0000    24.45*
DIR               8            121501           0  0      0.0     -0.0     -0.0
                                                           1.0      0.1
DIR               8            1215018          0  0      0.0     -0.0     -0.0
                                                           8.0      5.6
ZANG              121501       1215018         98 94     83.0      1.8      0.2
                                                           8.0      7.8
DIST              1215068      8                        0.20210   0.0000   0.0000
                                                          0.0001   0.0000     0.00*
EHDF              8            1215068                  0.10200  -0.0000  -0.0000
                                                          0.0001   0.0000    66.33*
DIR               8            121506           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0        *
DIR               8            1215068          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121506       1215068         96 99     53.0     12.0      1.5
                                                           8.0      7.8
DIST              1215069      9                        0.20150   0.0000   0.0000
                                                          0.0001   0.0000     0.00*
EHDF              9            1215069                  0.10080   0.0000   0.0000
                                                          0.0001   0.0000    16.82*
DIR               9            121506           0  0      0.0     -0.0     -0.0
                                                           1.0      0.0        *
DIR               9            1215069          0  0      0.0      0.0      0.0
                                                           8.0      0.0
ZANG              121506       1215069        100 32     20.0     -3.3     -0.4
                                                           8.0      7.8
ELAT              8            21605M002        0 00  0.000000  -0.0004  -0.0004
                                                          0.0001  -0.0000  4948.79
ELON              8            21605M002        0 00  0.000000   0.0001   0.0001
                                                          0.0001  -0.0000  1311.44
DIR               1            5                0  0      0.0      0.0      0.2
                                                           1.0      0.2
DIR               1            21605S009       52 47     64.0     -0.0     -0.2
                                                           1.0      0.2
DIR               2            6                0  0      0.0     -0.0     -0.2
                                                           1.0      0.2
```

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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                  OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                     STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ---------------- -------- --------
DIR               2            21605S009      388  4     59.0      0.3      0.2
                                                           3.0      2.0
DIR               3            6                0  0      0.0     -0.0     -0.2
                                                           1.0      0.3
DIR               3            21605S009      391 19     75.0      0.4      0.2
                                                           3.0      2.5
DIR               4            7                0  0      0.0      0.1      0.2
                                                           1.0      0.2
DIR               4            21605S009      394 33     91.0     -0.9     -0.2
                                                           4.0      3.8
DIR               5            20               0  0      0.0      0.2      0.7
                                                           1.0      0.2
DIR               5            21605S009       14 73      5.0     -2.7     -0.7
                                                           4.0      3.7
DIR               7            4                0  0      0.0      0.0      0.1
                                                           1.0      0.2
DIR               7            21605S009       18 80     10.0     -0.4     -0.1
                                                           4.0      2.9
ZANG              1            21605S009       85 58     74.0      3.7      0.9
                                                           5.0      4.0
ZANG              2            21605S009       82  6     52.0      0.8      0.2
                                                           5.0      4.1
ZANG              3            21605S009       89 67     86.0      0.2      0.0
                                                           5.0      4.5
ZANG              4            21605S009       94 89     51.0     -3.9     -0.8
                                                           5.0      4.9
ZANG              5            21605S009       92 92      2.0     -3.1     -0.6
                                                           5.0      4.8
ZANG              7            21605S009       73 78     34.0     -2.3     -0.6
                                                           5.0      4.0
EHDF              1000         7                      -0.53867  -0.0001  -0.4396
                                                         0.0002   0.0002     1.67
EHDF              7            2000                    0.89629   0.0000   0.0000
                                                         0.0001   0.0000     0.16*
EHDF              2000         3000                    0.00526   0.0000   0.0000
                                                         0.0001   0.0000     0.60*
EHDF              3000         4000                   -0.02269   0.0000   0.0000
                                                         0.0001   0.0000     0.48*
EHDF              4000         5000                   -0.69030   0.0002   1.1965
                                                         0.0002   0.0002     3.78
EHDF              5000         4000                    0.69026  -0.0001  -0.9355
                                                         0.0002   0.0002     2.96
EHDF              4000         3000                    0.02271  -0.0001  -0.0001
                                                         0.0001   0.0000     0.79*
EHDF              3000         2000                   -0.00502  -0.0003  -1.4262
                                                         0.0002   0.0002     8.87
EHDF              2000         7                      -0.89623  -0.0001  -0.0001
                                                         0.0001   0.0000     1.04*
EHDF              7            1000                    0.53882  -0.0001  -0.5326
                                                         0.0002   0.0002     2.02
EHDF              8005         8001                   -0.50393  -0.0000  -0.0000
                                                         0.0001   0.0000    19.84*
EHDF              8001         8002                    0.50271   0.0000   0.0000
                                                         0.0001   0.0000    19.89*
EHDF              8002         8001                   -0.50273   0.0000   0.0000
                                                         0.0001   0.0000    19.89*
EHDF              8001         8005                    0.50395  -0.0000  -0.0000
                                                         0.0001   0.0000    19.84*
EHDF              8005         5000                   -3.54012   0.0001   0.4243
                                                         0.0002   0.0001     1.20
EHDF              5000         8005                    3.54000   0.0001   0.4243
                                                         0.0002   0.0001     1.20
EHDF              5000         4001                    4.09617  -0.0000  -0.0000
                                                         0.0001   0.0000     0.09*
EHDF              4001         5000                   -4.09608  -0.0001  -0.0001
                                                         0.0001   0.0000     1.76*
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================================================================================
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0054
================================================================================
Residuals (critical value = 4.205, N,E,Up for 3D):
NOTE: Observation values shown are reduced to mark-to-mark.
                                                    OBSERVATION RESIDUAL  STD RES
TYPE AT           FROM         TO                       STD DEV  STD DEV      PPM
---- ------------ ------------ ------------ ----------------- -------- --------
EHDF              4002         4                      2.22324   0.0000   0.0000
                                                       0.0001   0.0000    13.07*
EHDF              4            4002                  -2.22319  -0.0001  -0.0001
                                                       0.0001   0.0000    35.56*
EHDF              1000         6N                     4.31180  -0.0001  -0.4187
                                                       0.0003   0.0003     3.47
EHDF              6N           1000                  -4.31162  -0.0001  -0.2914
                                                       0.0003   0.0003     2.42
EHDF              6N           1                      2.57897  -0.0002  -1.0763
                                                       0.0002   0.0002     5.68
EHDF              1            6N                    -2.57894   0.0001   0.8890
                                                       0.0002   0.0002     4.69
EHDF              2            6N                    -0.01846   0.0000   0.0000
                                                       0.0001   0.0000     0.19*
EHDF              6N           2                      0.01850  -0.0000  -0.0000
                                                       0.0001   0.0000     1.38*
EHDF              2            6N                    -0.01835  -0.0001  -0.0001
                                                       0.0001   0.0000     3.08*
EHDF              3N           2                     -0.98991   0.0000   0.0000
                                                       0.0001   0.0000     1.49*
EHDF              2            3N                     0.98982   0.0000   0.0000
                                                       0.0001   0.0000     1.61*
EHDF              5            4002                  -1.05083   0.0001   0.0001
                                                       0.0001   0.0000     1.61*
EHDF              4002         5                      1.05070   0.0001   0.0001
                                                       0.0001   0.0000     1.07*
EHDF              4001         4002                   0.01810   0.0001   0.0001
                                                       0.0001   0.0000  4492.95*
EHDF              6N           6                      0.21820   0.0000   0.0000
                                                       0.0001   0.0000   111.94*
EHDF              3N           3                      0.17640   0.0000   0.1201
                                                       0.0002   0.0001    79.15
```

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================================================================================

 ------------------------------------------------------------------------------
|                                                                              |
|                   S T A T I S T I C S     S U M M A R Y                      |
|                                                                              |
 ------------------------------------------------------------------------------
|                                    |                                         |
|     Residual Critical Value Type   |               Tau Max                   |
|     Residual Critical Value        |                4.2045                   |
|     Number of Flagged Residuals    |                     4                   |
|     Convergence Criterion          |                0.0001                   |
|     Final Iteration Counter Value  |                     3                   |
|     Confidence Level Used          |               95.0000                   |
|     Estimated Variance Factor      |                2.3337                   |
|     Number of Degrees of Freedom   |                   545                   |
|                                    |                                         |
 ------------------------------------------------------------------------------
|                                                                              |
|                 Chi-Square Test on the Variance Factor:                      |
|                                                                              |
|                  2.0796e+00  <  1.0000  <  2.6376e+00  ?                     |
|                                                                              |
|                   ********   THE TEST FAILS   ********                      |
|                                                                              |
 ------------------------------------------------------------------------------

 ------------------------------------------------------------------------------
|                                                                              |
| NOTE:  All confidence regions were computed using the following factors:     |
|        ---------------------------------------------------------------      |
|        Variance factor used      =          2.3337                          |
|        1-D expansion factor      =          1.9600                          |
|        2-D expansion factor      =          2.4477                          |
|        3-D expansion factor      =          2.7955                          |
|                                                                              |
|        Note that, for relative confidence regions, precisions are            |
|        computed from the ratio of the major semi-axis and the spatial        |
|        distance between the two stations.                                    |
|                                                                              |
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Microsearch GeoLab, V2001.9.20.0             GRS80       UNITS: m,GRAD Page 0067
================================================================================
2-D and 1-D Station Confidence Regions (95.000 and 95.000 percent):
STATION            MAJOR SEMI-AXIS  AZ     MINOR SEMI-AXIS             VERTICAL
------------ -------------------- --- ------------------ --------------------
1                           0.0029   9             0.0029               0.0024
1000                        0.0000   0             0.0000               0.0024
2                           0.0029  60             0.0029               0.0024
20                          0.0033 123             0.0032               0.0034
2000                        0.0000   0             0.0000               0.0024
21605M002                   0.0029 180             0.0029               0.0023
21605M101                   0.0029 179             0.0029               0.0026
21605S001                   0.0035 149             0.0030               0.0027
21605S009                   0.0030 150             0.0029               0.0025
3                           0.0030  79             0.0029               0.0025
30                          0.0029 178             0.0029               0.0026
3000                        0.0000   0             0.0000               0.0024
35                          0.0035 149             0.0030               0.0026
4                           0.0029  44             0.0029               0.0024
4000                        0.0000   0             0.0000               0.0024
5                           0.0029 164             0.0029               0.0024
50                          0.0060 149             0.0055               0.0060
5000                        0.0000   0             0.0000               0.0024
7                           0.0030  28             0.0030               0.0024
8                           0.0029  82             0.0029               0.0025
9                           0.0030  13             0.0030               0.0025


3D Station Confidence Regions (95.000 percent):
STATION         MAJ-SEMI (AZ,VANG)    MED-SEMI (AZ,VANG)    MIN-SEMI (AZ,VANG)
------------ -------------------- -------------------- --------------------
1                0.0035 (189, 86)      0.0033 (  9,  4)      0.0033 ( 99,  0)
1000             0.0035 (  0, 90)      0.0000 ( 90,  0)      0.0000 (  0,  0)
2                0.0035 (192, 86)      0.0033 ( 61,  3)      0.0033 (331,  3)
20               0.0049 (174, 86)      0.0037 (302,  2)      0.0036 ( 32,  3)
2000             0.0035 (  0, 90)      0.0000 ( 90,  0)      0.0000 (  0,  0)
21605M002        0.0033 (184, 84)      0.0033 (340,  5)      0.0033 ( 71,  2)
21605M101        0.0037 (183, 86)      0.0033 (359,  4)      0.0033 ( 89,  0)
21605S001        0.0040 (150,  7)      0.0038 (316, 83)      0.0034 ( 59,  2)
21605S009        0.0035 (177, 86)      0.0034 (330,  3)      0.0033 ( 60,  2)
3                0.0035 (201, 87)      0.0034 ( 79,  1)      0.0033 (349,  2)
30               0.0036 (180, 86)      0.0033 (358,  4)      0.0033 ( 88,  0)
3000             0.0035 (  0, 90)      0.0000 ( 90,  0)      0.0000 (  0,  0)
35               0.0040 (149,  5)      0.0037 (309, 85)      0.0034 ( 59,  2)
4                0.0034 (190, 84)      0.0033 ( 48,  5)      0.0033 (317,  4)
4000             0.0035 (  0, 90)      0.0000 ( 90,  0)      0.0000 (  0,  0)
5                0.0034 (183, 84)      0.0033 (341,  5)      0.0033 ( 71,  2)
50               0.0085 (170, 89)      0.0069 (329,  1)      0.0063 ( 59,  0)
5000             0.0034 (  0, 90)      0.0000 ( 90,  0)      0.0000 (  0,  0)
7                0.0035 (194, 82)      0.0034 ( 29,  8)      0.0034 (299,  2)
8                0.0035 (175, 90)      0.0033 ( 82,  0)      0.0033 (352,  0)
9                0.0035 (191, 85)      0.0034 ( 13,  5)      0.0034 (283,  0)
```

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2-D and 1-D Relative Station Confidence Regions (95.000 and 95.000 percent):
```

FROM	TO	MAJ-SEMI	AZ	MIN-SEMI	VERTICAL	DISTANCE	PPM
1	1000	0.0029	9	0.0029	0.0006	6.8905	425.35
1	2	0.0005	73	0.0005	0.0004	38.9005	13.62
1	20	0.0016	106	0.0014	0.0024	538.7994	2.88
1	2000	0.0029	9	0.0029	0.0006	39.3634	74.46
1	21605M002	0.0006	9	0.0006	0.0008	97.1389	6.56
1	21605M101	0.0007	2	0.0006	0.0011	1272.6339	0.51
1	21605S001	0.0020	149	0.0009	0.0013	765.4842	2.68
1	21605S009	0.0008	152	0.0004	0.0006	40.1402	18.79
1	3	0.0007	80	0.0005	0.0006	67.3920	10.96
1	30	0.0006	1	0.0006	0.0010	764.3793	0.81
1	3000	0.0029	9	0.0029	0.0006	67.6945	43.30
1	35	0.0020	149	0.0008	0.0012	765.4900	2.63
1	4	0.0007	176	0.0006	0.0006	132.0119	5.61
1	4000	0.0029	9	0.0029	0.0006	132.1717	22.17
1	5	0.0006	8	0.0005	0.0006	121.6060	4.80
1	50	0.0051	146	0.0048	0.0055	483.8957	10.64
1	5000	0.0029	9	0.0029	0.0006	121.8029	24.06
1	7	0.0007	40	0.0005	0.0005	41.3336	16.38
1	8	0.0007	46	0.0006	0.0007	97.1403	7.08
1	9	0.0010	17	0.0008	0.0007	112.3440	8.62
1000	2	0.0029	60	0.0029	0.0005	39.0557	75.04
1000	20	0.0033	123	0.0032	0.0025	539.5913	6.06
1000	2000	0.0000	0	0.0000	0.0004	38.8179	0.00
1000	21605M002	0.0029	180	0.0029	0.0009	97.4985	29.34
1000	21605M101	0.0029	179	0.0029	0.0011	1273.0815	2.30
1000	21605S001	0.0035	149	0.0030	0.0014	765.5825	4.60
1000	21605S009	0.0030	150	0.0029	0.0007	42.2220	70.66
1000	3	0.0030	79	0.0029	0.0007	67.6004	43.90
1000	30	0.0029	178	0.0029	0.0011	764.4716	3.83
1000	3000	0.0000	0	0.0000	0.0005	67.3790	0.00
1000	35	0.0035	149	0.0030	0.0012	765.5934	4.57
1000	4	0.0029	44	0.0029	0.0006	132.1435	22.14
1000	4000	0.0000	0	0.0000	0.0005	132.0087	0.00
1000	5	0.0029	164	0.0029	0.0006	121.6819	23.66
1000	50	0.0060	149	0.0055	0.0055	485.0649	12.37
1000	5000	0.0000	0	0.0000	0.0006	121.5863	0.00
1000	7	0.0030	28	0.0030	0.0004	40.6627	73.32
1000	8	0.0029	82	0.0029	0.0007	97.5055	29.58
1000	9	0.0030	13	0.0030	0.0007	112.3727	26.73
2	20	0.0016	111	0.0014	0.0024	575.0151	2.70
2	2000	0.0029	60	0.0029	0.0005	3.9726	737.73
2	21605M002	0.0006	60	0.0006	0.0008	59.1969	10.76
2	21605M101	0.0006	32	0.0006	0.0011	1310.4582	0.49
2	21605S001	0.0020	149	0.0009	0.0013	803.3715	2.55
2	21605S009	0.0007	161	0.0006	0.0006	41.6195	17.54
2	3	0.0008	75	0.0005	0.0005	29.0336	26.47
2	30	0.0006	38	0.0006	0.0010	802.2163	0.78
2	3000	0.0029	60	0.0029	0.0005	29.2814	100.09
2	35	0.0020	149	0.0008	0.0012	803.3788	2.51
2	4	0.0007	37	0.0006	0.0006	93.6211	7.33
2	4000	0.0029	60	0.0029	0.0006	93.6918	31.28
2	5	0.0006	58	0.0005	0.0006	84.5694	6.84
2	50	0.0052	147	0.0048	0.0055	505.6986	10.28
2	5000	0.0029	60	0.0029	0.0006	84.6967	34.60
2	7	0.0008	54	0.0006	0.0005	68.3005	11.51
2	8	0.0007	68	0.0006	0.0007	59.2027	12.17
2	9	0.0009	36	0.0008	0.0007	73.5208	12.90
20	2000	0.0033	123	0.0032	0.0025	575.4511	5.68
20	21605M002	0.0016	123	0.0014	0.0025	633.0522	2.49
20	21605M101	0.0016	116	0.0014	0.0025	744.6346	2.08
20	21605S001	0.0024	145	0.0016	0.0026	256.2232	9.56
20	21605S009	0.0016	119	0.0014	0.0025	543.4751	2.94
20	3	0.0017	106	0.0014	0.0025	603.5289	2.77
20	30	0.0015	113	0.0013	0.0025	253.9221	6.05
20	3000	0.0033	123	0.0032	0.0025	604.0609	5.41
20	35	0.0024	145	0.0015	0.0026	256.1109	9.45
20	4	0.0017	130	0.0015	0.0024	666.6261	2.50
20	4000	0.0033	123	0.0032	0.0025	667.1531	4.90

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2-D and 1-D Relative Station Confidence Regions (95.000 and 95.000 percent):
```

FROM	TO	MAJ-SEMI	AZ	MIN-SEMI	VERTICAL	DISTANCE	PPM
20	5	0.0016	123	0.0014	0.0024	640.2341	2.42
20	50	0.0052	133	0.0045	0.0057	317.4170	16.24
20	5000	0.0033	123	0.0032	0.0025	640.7427	5.10
20	7	0.0016	86	0.0014	0.0025	509.3833	3.14
20	8	0.0016	120	0.0014	0.0025	633.0451	2.55
20	9	0.0017	135	0.0016	0.0025	642.8188	2.70
2000	21605M002	0.0029	180	0.0029	0.0008	59.6102	47.99
2000	21605M101	0.0029	179	0.0029	0.0011	1310.7127	2.24
2000	21605S001	0.0035	149	0.0030	0.0013	803.4315	4.38
2000	21605S009	0.0030	150	0.0029	0.0006	42.8934	69.55
2000	3	0.0030	79	0.0029	0.0007	29.4609	100.74
2000	30	0.0029	178	0.0029	0.0010	802.2730	3.65
2000	3000	0.0000	0	0.0000	0.0003	29.0105	0.00
2000	35	0.0035	149	0.0030	0.0012	803.4416	4.36
2000	4	0.0029	44	0.0029	0.0005	93.7745	31.19
2000	4000	0.0000	0	0.0000	0.0003	93.6058	0.00
2000	5	0.0029	164	0.0029	0.0005	84.6837	34.00
2000	50	0.0060	149	0.0055	0.0055	506.3528	11.85
2000	5000	0.0000	0	0.0000	0.0005	84.5685	0.00
2000	7	0.0030	28	0.0030	0.0002	68.1329	43.76
2000	8	0.0029	82	0.0029	0.0007	59.6212	48.37
2000	9	0.0030	13	0.0030	0.0007	73.6053	40.81
21605M002	21605M101	0.0006	179	0.0006	0.0012	1369.1416	0.47
21605M002	21605S001	0.0020	149	0.0009	0.0014	862.3437	2.38
21605M002	21605S009	0.0008	150	0.0006	0.0009	92.0400	9.20
21605M002	3	0.0008	79	0.0006	0.0009	30.2005	26.18
21605M002	30	0.0006	178	0.0006	0.0011	861.2018	0.72
21605M002	3000	0.0029	180	0.0029	0.0008	31.1379	91.88
21605M002	35	0.0020	149	0.0008	0.0013	862.3477	2.34
21605M002	4	0.0006	44	0.0006	0.0007	35.1294	17.39
21605M002	4000	0.0029	180	0.0029	0.0008	35.9835	79.51
21605M002	4001	0.0029	180	0.0029	0.0007	35.3635	80.90
21605M002	4002	0.0029	180	0.0029	0.0006	35.3610	80.91
21605M002	411220	0.0016	123	0.0014	0.0034	633.0734	2.55
21605M002	5	0.0003	164	0.0003	0.0006	50.2097	6.44
21605M002	50	0.0053	149	0.0047	0.0055	551.2195	9.57
21605M002	5000	0.0029	180	0.0029	0.0007	50.8535	56.26
21605M002	7	0.0008	28	0.0007	0.0008	126.0444	6.66
21605M002	8	0.0004	82	0.0003	0.0009	0.0798	4555.54
21605M002	9	0.0009	13	0.0008	0.0009	24.8986	36.76
21605M101	21605S001	0.0020	149	0.0008	0.0012	509.9300	3.93
21605M101	21605S009	0.0009	154	0.0006	0.0012	1282.4675	0.69
21605M101	3	0.0008	78	0.0007	0.0011	1339.3427	0.62
21605M101	30	0.0005	1	0.0004	0.0009	511.0146	0.95
21605M101	3000	0.0029	179	0.0029	0.0011	1339.6622	2.19
21605M101	35	0.0020	149	0.0007	0.0011	509.8505	3.86
21605M101	4	0.0007	2	0.0007	0.0010	1403.6478	0.53
21605M101	4000	0.0029	179	0.0029	0.0011	1403.9813	2.09
21605M101	5	0.0006	2	0.0005	0.0010	1380.8828	0.42
21605M101	50	0.0052	148	0.0048	0.0055	986.0040	5.32
21605M101	5000	0.0029	179	0.0029	0.0011	1381.1954	2.12
21605M101	7	0.0009	29	0.0008	0.0011	1246.4887	0.69
21605M101	8	0.0007	28	0.0007	0.0012	1369.1371	0.51
21605M101	9	0.0010	14	0.0009	0.0012	1381.1187	0.73
21605S001	21605S009	0.0021	149	0.0009	0.0014	776.6389	2.76
21605S001	3	0.0021	148	0.0010	0.0014	832.3629	2.49
21605S001	30	0.0020	149	0.0006	0.0008	4.5778	429.23
21605S001	3000	0.0035	149	0.0030	0.0013	832.4342	4.23
21605S001	35	0.0004	0	0.0004	0.0007	0.5664	660.16
21605S001	4	0.0021	150	0.0009	0.0013	896.8767	2.32
21605S001	4000	0.0035	149	0.0030	0.0013	896.9470	3.92
21605S001	5	0.0020	149	0.0008	0.0013	875.1116	2.32
21605S001	50	0.0056	150	0.0048	0.0056	548.9762	10.21
21605S001	5000	0.0035	149	0.0030	0.0013	875.1821	4.02
21605S001	7	0.0021	150	0.0010	0.0013	739.5375	2.84
21605S001	8	0.0021	149	0.0009	0.0014	862.3432	2.40
21605S001	9	0.0022	151	0.0011	0.0014	874.5162	2.48
21605S009	3	0.0008	120	0.0007	0.0007	64.4540	12.85

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2-D and 1-D Relative Station Confidence Regions (95.000 and 95.000 percent):

FROM	TO	MAJ-SEMI	AZ	MIN-SEMI	VERTICAL	DISTANCE	PPM
21605S009	30	0.0009	153	0.0006	0.0011	775.3296	1.12
21605S009	3000	0.0030	150	0.0029	0.0007	65.4794	45.56
21605S009	35	0.0021	149	0.0008	0.0012	776.6380	2.71
21605S009	4	0.0009	153	0.0007	0.0007	123.7520	7.40
21605S009	4000	0.0030	150	0.0029	0.0007	124.3317	24.00
21605S009	5	0.0008	150	0.0005	0.0007	99.8864	8.10
21605S009	50	0.0052	150	0.0048	0.0055	464.5905	11.12
21605S009	5000	0.0030	150	0.0029	0.0007	100.5900	29.66
21605S009	7	0.0007	91	0.0006	0.0006	41.0715	17.76
21605S009	8	0.0009	146	0.0007	0.0008	92.0338	9.46
21605S009	9	0.0011	168	0.0009	0.0008	99.3810	10.87
3	30	0.0008	79	0.0007	0.0011	831.2109	0.99
3	3000	0.0030	79	0.0029	0.0007	5.1336	578.15
3	35	0.0020	148	0.0010	0.0012	832.3692	2.45
3	4	0.0008	72	0.0006	0.0007	64.6709	12.58
3	4000	0.0030	79	0.0029	0.0007	64.8748	45.75
3	5	0.0007	80	0.0005	0.0007	62.8206	11.86
3	50	0.0053	144	0.0048	0.0055	527.5288	9.98
3	5000	0.0030	79	0.0029	0.0007	63.0876	47.05
3	7	0.0009	70	0.0007	0.0006	96.2718	9.41
3	8	0.0009	77	0.0006	0.0007	30.2087	28.49
3	9	0.0010	66	0.0008	0.0008	46.3890	21.51
30	3000	0.0029	178	0.0029	0.0010	831.2781	3.52
30	35	0.0019	149	0.0005	0.0006	4.6965	410.74
30	4	0.0007	180	0.0006	0.0010	895.7026	0.81
30	4000	0.0029	178	0.0029	0.0010	895.7687	3.27
30	5	0.0006	1	0.0005	0.0010	873.7243	0.63
30	50	0.0052	148	0.0048	0.0055	545.5148	9.60
30	5000	0.0029	178	0.0029	0.0010	873.7908	3.35
30	7	0.0008	31	0.0007	0.0010	738.2448	1.14
30	8	0.0007	26	0.0007	0.0011	861.2014	0.78
30	9	0.0010	14	0.0008	0.0011	873.2637	1.14
3000	35	0.0035	149	0.0030	0.0012	832.4440	4.20
3000	4	0.0029	44	0.0029	0.0005	64.9118	45.06
3000	4000	0.0000	0	0.0000	0.0002	64.6681	0.00
3000	5	0.0029	164	0.0029	0.0005	62.9724	45.72
3000	50	0.0060	149	0.0055	0.0055	528.3338	11.36
3000	5000	0.0000	0	0.0000	0.0004	62.8181	0.00
3000	7	0.0030	28	0.0030	0.0003	96.0875	31.03
3000	8	0.0029	82	0.0029	0.0007	31.1590	92.55
3000	9	0.0030	13	0.0030	0.0007	46.4982	64.59
35	4	0.0020	150	0.0008	0.0011	896.8822	2.28
35	4000	0.0035	149	0.0030	0.0012	896.9561	3.90
35	5	0.0020	149	0.0007	0.0011	875.1180	2.28
35	50	0.0056	150	0.0048	0.0055	548.9028	10.19
35	5000	0.0035	149	0.0030	0.0012	875.1918	4.00
35	7	0.0021	150	0.0010	0.0012	739.5492	2.79
35	8	0.0020	149	0.0008	0.0013	862.3471	2.36
35	9	0.0021	151	0.0011	0.0013	874.5231	2.44
4	4000	0.0029	44	0.0029	0.0005	5.6475	517.97
4	5	0.0006	24	0.0005	0.0003	48.4927	11.67
4	50	0.0054	148	0.0048	0.0055	575.4806	9.32
4	5000	0.0029	44	0.0029	0.0004	48.8909	59.83
4	7	0.0009	175	0.0008	0.0005	159.0091	5.74
4	8	0.0007	73	0.0006	0.0007	35.1353	19.73
4	9	0.0010	33	0.0007	0.0007	27.3603	35.28
4000	5	0.0029	164	0.0029	0.0005	48.6829	59.13
4000	50	0.0060	149	0.0055	0.0055	576.2892	10.41
4000	5000	0.0000	0	0.0000	0.0004	48.4816	0.00
4000	7	0.0030	28	0.0030	0.0004	158.8776	18.76
4000	8	0.0029	82	0.0029	0.0007	36.0018	80.10
4000	9	0.0030	13	0.0030	0.0007	27.5180	109.15
5	50	0.0053	149	0.0047	0.0055	533.1530	9.88
5	5000	0.0029	164	0.0029	0.0004	5.1651	557.37
5	7	0.0008	27	0.0007	0.0005	137.0117	5.84
5	8	0.0004	96	0.0004	0.0007	50.2160	8.89
5	9	0.0009	11	0.0007	0.0007	27.3822	32.35
50	5000	0.0060	149	0.0055	0.0055	533.9610	11.24
50	7	0.0051	155	0.0048	0.0055	445.3163	11.36

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2-D and 1-D Relative Station Confidence Regions (95.000 and 95.000 percent):
FROM         TO           MAJ-SEMI  AZ MIN-SEMI  VERTICAL     DISTANCE      PPM
------------ ------------ -------- --- -------- --------- ------------ --------
50           8              0.0053 149   0.0048    0.0055     551.2086     9.59
50           9              0.0054 148   0.0048    0.0055     548.7807     9.75
5000         7              0.0030  28   0.0030    0.0005     136.9064    21.78
5000         8              0.0029  82   0.0029    0.0007      50.8679    56.69
5000         9              0.0030  13   0.0030    0.0007      27.7009   108.43
7            8              0.0009  44   0.0008    0.0007     126.0502     7.02
7            9              0.0011  23   0.0010    0.0007     135.3113     8.17
8            9              0.0009  23   0.0008    0.0007      24.9138    37.67

Fri Jan 13 08:40:59 2006
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5.12. Global results covariance matrix of selected points (extracted from Microsearch Geolab)

```
* Extracted coordinates follow: (extracted on Thu Feb 16 13:59:01 2006)
* Source (GeoLab adjustment): shao_juillet
* Variance factor of adjustment = 2.333654
* Variance factor used in computing covariance matrix = 1.000000
* Number of degrees of freedom of adjustment = 545
* Number of stations in adjusted network = 151
* Number of stations extracted = 8
*
 3DC
 XYZ      21605M002          -2831733.4800       4675665.9620       3275369.4290 m       0
 XYZ      1                  -2831656.7597       4675722.7942       3275351.5384 m       0
 XYZ      2                  -2831688.2100       4675699.9055       3275352.0295 m       0
 XYZ      4                  -2831761.2648       4675644.5256       3275371.0286 m       0
 XYZ      5                  -2831764.2140       4675670.1139       3275329.9424 m       0
 XYZ      50                 -2831606.1642       4676084.7377       3275034.3758 m       0
 XYZ      7                  -2831648.7148       4675742.5073       3275316.1106 m       0
 XYZ      9                  -2831750.8152       4675661.3584       3275352.1594 m       0
 COV  CT UPPR
 ELEM    5.85384317448479e-07    1.41104792193693e-13    1.05803601061658e-12
 ELEM    5.85134321271144e-07   -1.96362008898018e-11   -1.32208246061886e-10
 ELEM    5.85134536906489e-07   -1.92266070121915e-11   -1.32468634204932e-10
 ELEM    5.85135361250819e-07   -1.74219301822409e-11   -1.30520909236125e-10
 ELEM    5.85136464316289e-07    -1.4448636598879e-11   -1.24996520421604e-10
 ELEM    5.85148493201455e-07   -4.34993080546534e-11    -1.1963837224795e-10
 ELEM    5.85134040825255e-07   -2.07341680502413e-11   -1.31050583548807e-10
 ELEM    5.85135967406851e-07   -1.81986543055728e-11    -1.3246638289865e-10
 ELEM    5.85382723726469e-07    1.67731235843002e-13   -1.84643132969886e-11
 ELEM    5.85337246010179e-07    -2.1628100672361e-11   -1.93979104017078e-11
 ELEM    5.85337615267927e-07   -1.90194632366219e-11   -1.84514754786999e-11
 ELEM    5.85342081076638e-07   -7.39619193975391e-12   -2.03068689825962e-11
 ELEM    5.85331432120253e-07   -2.07526245359652e-11   -4.71507582849652e-12
 ELEM     5.8533698236904e-07    9.09695119649777e-12   -1.78469604027174e-11
 ELEM    5.85337986200496e-07   -2.11868212917439e-11   -1.76801576230203e-11
 ELEM    5.85339936412229e-07   -1.33370388171546e-11
 ELEM    5.85383435188236e-07   -1.28170236262463e-10   -8.96938705203152e-12
 ELEM    5.85252710694737e-07   -1.29162165441213e-10   -1.00925504392593e-11
 ELEM    5.85253860473777e-07   -1.32457476052657e-10   -1.52387739129534e-11
 ELEM    5.85253313091813e-07   -1.34568711020659e-10   -2.04264001626336e-11
 ELEM    5.85244388045889e-07   -1.36529632242663e-10   -5.44288468455015e-11
 ELEM    5.85233353840885e-07   -1.29371287724947e-10   -8.36243195658092e-12
 ELEM    5.85252317220179e-07      -1.31733621924e-10   -1.10771119498156e-11
 ELEM    5.85253528496446e-07
 ELEM    6.49020703995023e-07    1.93364308548669e-09    2.52213844485653e-08
 ELEM     6.3917319656345e-07    1.78291501233989e-09    2.43269326324261e-08
 ELEM    6.19301613593168e-07    4.19016214436548e-09    1.63908453563671e-08
 ELEM    6.15488439696276e-07    2.05371495156135e-09       1.59064797282e-08
 ELEM    6.38042826632626e-07   -8.51774289805314e-10    1.00822160710431e-08
 ELEM    6.33396803928547e-07    -4.4817476205805e-10    1.71927902027528e-08
 ELEM     6.2891648925854e-07    6.67449428096777e-10    2.22073606862614e-08
 ELEM    6.13540722619126e-07    3.47576994001324e-09    2.70050023496114e-09
 ELEM     6.0435088218048e-07    1.87100610461688e-09     2.5726794714163e-09
 ELEM    5.95180696660459e-07    5.12818888172711e-10    2.46978192227634e-09
 ELEM    5.90876942795902e-07     1.8966468489455e-09   -2.17882640760512e-08
 ELEM    6.08811124273516e-07    4.37599542685696e-08    3.50923741745832e-09
 ELEM    6.08351721286282e-07    4.42002981069808e-10    2.57627675529039e-09
 ELEM    5.95444012557709e-07    1.62458231982156e-09
 ELEM     6.2556739678023e-07    2.44294249291441e-08     3.1687528817271e-09
 ELEM    6.16454509212748e-07    1.62287821395148e-08   -1.59844451477726e-09
 ELEM    6.04556421155176e-07    1.63325041861449e-08    1.78089029007614e-09
 ELEM    6.01542776002354e-07    8.09575244052651e-09    8.59427112619569e-09
 ELEM    6.34745023100527e-07    1.74583347444174e-08    6.68558650312673e-09
 ELEM    6.18328026750633e-07    2.24291440533576e-08     4.1298190064461e-09
```

```
 ELEM     6.08014651841436e-07
 ELEM     6.45951104693414e-07     3.99259407499211e-09     2.32307754998916e-08
 ELEM     6.19693596873907e-07     3.62581230262212e-09     1.58978670196663e-08
 ELEM       6.154796156658e-07     2.06094640878367e-09     1.59214271490984e-08
 ELEM     6.34051190537074e-07     1.59176051077572e-09     1.60668517918713e-08
 ELEM     6.33239859953062e-07     7.85976595708914e-10     1.89112541555904e-08
 ELEM     6.29684581025772e-07     4.55332582477698e-10     2.21406256243678e-08
 ELEM     6.12902976624903e-07    -5.80067081561846e-10     2.15791725457327e-09
 ELEM     5.95575556567128e-07     1.17798952550661e-09     2.52983389688372e-09
 ELEM     5.90828143914433e-07     1.80104667970422e-09    -1.16448453166728e-08
 ELEM     6.07504165441883e-07     2.63752777870829e-08      1.5463232527555e-09
 ELEM     6.03731938627295e-07     3.48493727467063e-09     2.10022601604831e-09
 ELEM     5.96045807426769e-07     2.17424373683788e-09
 ELEM     6.24374891353293e-07     1.58398235944431e-08    -7.54108469104739e-10
 ELEM     6.05363019464553e-07      1.6431918942966e-08     1.69960973578185e-09
 ELEM     6.01381853532443e-07      1.4142226316061e-08     4.37776255600671e-09
 ELEM     6.23617911501983e-07     1.92248930890504e-08     4.38838547837262e-09
 ELEM     6.16190233848276e-07     2.22636903959286e-08     4.44484921007222e-09
 ELEM     6.08815729696143e-07
 ELEM     6.27312548841621e-07     2.40099363141121e-09     1.17492063245476e-08
 ELEM     6.15469475727913e-07     2.52711181706635e-09     1.64564515958106e-08
 ELEM     6.11956443908458e-07     5.68718038846856e-09     2.81687166562759e-08
 ELEM     6.19065890405332e-07     4.75310695580904e-09     1.73576112870453e-08
 ELEM     6.21661835721502e-07      3.4345934017405e-10     1.30677255313412e-08
 ELEM     6.11882207863816e-07     8.19096730607393e-10     2.05335803310477e-09
 ELEM     5.90316949236663e-07     1.07279879082828e-09      9.6070247442249e-09
 ELEM     5.91717056688307e-07    -1.12966935708948e-08     3.41418002945047e-09
 ELEM     5.96695092102751e-07    -9.52607586770036e-10     8.62813330537591e-10
 ELEM     5.94347500949296e-07     3.26811410460187e-09
 ELEM     6.17420699597625e-07     1.59400915072552e-08     1.84392258206496e-09
 ELEM     6.01386106831021e-07     2.72917846277118e-08    -3.97839839014023e-09
 ELEM     5.85429911486664e-07     1.72478362443205e-08    -2.68063346643376e-09
 ELEM     6.03317112129047e-07     1.30680401621673e-08     4.34234726666206e-09
 ELEM       6.102533530831e-07
 ELEM     6.15487238900811e-07      2.1340772079333e-09     1.59119658709851e-08
 ELEM     6.15679976467109e-07     1.93495934028051e-09      1.5605403298828e-08
 ELEM     6.15501313208753e-07     2.04833761603934e-09     1.58861025151361e-08
 ELEM     6.15470089618604e-07      2.0569132409024e-09     1.59380224042705e-08
 ELEM     5.91614357188403e-07     2.52449651813984e-09     2.23719867410786e-09
 ELEM     5.90935165177675e-07     2.29999727215714e-09      2.4929234454107e-09
 ELEM     5.90755397142936e-07     1.88438452739912e-09     2.57417279491573e-09
 ELEM     5.90574086484684e-07     1.75252722776996e-09
 ELEM     6.02322393232884e-07     1.55582056571102e-08     2.05617929981406e-09
 ELEM     6.02810156184485e-07     1.63311340362156e-08     1.63994404960074e-09
 ELEM      6.0157476198572e-07     1.65159044798534e-08     1.39298179059603e-09
 ELEM      6.0127192843381e-07
 ELEM      3.5696303753473e-06    -7.09543730136773e-08     6.58174384631091e-07
 ELEM     6.46805476931584e-07    -4.84089556085582e-09    -1.32611180673354e-08
 ELEM     6.23156570936152e-07     4.13820066511544e-09     2.98833385639956e-08
 ELEM     2.27839520818696e-06      1.4050394802661e-07    -2.38086295543755e-08
 ELEM     6.09548157247565e-07     4.69877298970995e-08     1.31778952257861e-09
 ELEM     5.94602639971172e-07     3.15175820457071e-09
 ELEM       2.894843393599e-06    -1.36759843193301e-08     1.44803632895251e-08
 ELEM     6.66703275200048e-07     2.80963956145459e-08    -2.92278730424936e-10
 ELEM     5.96643082446665e-07
 ELEM     6.46754099304683e-07     2.23612714105338e-09     1.48286639405051e-08
 ELEM     6.26152499617807e-07     4.92180716709065e-10     2.10890351255973e-08
 ELEM     6.35619384316264e-07     1.98354286137052e-09     2.60287410171011e-09
 ELEM     5.96022889233826e-07     1.34063586197524e-09
 ELEM      6.3420170100325e-07      2.1399052209316e-08     4.24233333457196e-09
 ELEM     6.06460460775774e-07
 ELEM     6.61967789098423e-07    -5.96658993887831e-10     2.11986648209788e-08
 ELEM     6.43404744752679e-07      6.0295049871393e-09
 ELEM     6.41963660538069e-07
*
* End of extracted coordinates
```

5.13. Ellipsoid height of the levelling benchmarks and levelled survey points (extracted from Microsearch Geolab)

```
*
* Extracted coordinates follow: (extracted on Thu Feb 16 13:55:53 2006)
* Source (GeoLab adjustment): shao_juillet
* Variance factor of adjustment = 2.333654
* Variance factor used in computing covariance matrix = 1.000000
* Number of degrees of freedom of adjustment = 545
* Number of stations in adjusted network = 151
* Number of stations extracted = 10
*
 EHGT     1                                                  20.4107     0.0008 m
 EHGT     1000                                               13.5202     0.0008 m
 EHGT     2                                                  17.8503     0.0008 m
 EHGT     2000                                               13.8777     0.0008 m
 EHGT     3000                                               13.8830     0.0008 m
 EHGT     4                                                  19.5079     0.0008 m
 EHGT     4000                                               13.8604     0.0008 m
 EHGT     5                                                  18.3353     0.0008 m
 EHGT     5000                                               13.1702     0.0008 m
 EHGT     7                                                  12.9814     0.0008 m
*
* End of extracted coordinates
*
```

5.14. IGS/NGS elevation-dependent phase center relative models

```
ROGUE           AOAD/M_T                                            (  0) 96/06/30
       0.0       0.0     110.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
       0.0       0.0     128.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0

LEICA           LEIAT504                                            (  2) 99/02/05
        .3        -.3     109.3
    .0    .0   -.1   -.1    .0    .0    .0    .1    .1    .1
    .1    .2    .2    .3    .4    .5    .6    .0    .0
       1.1       1.1     128.2
    .0   -.1   -.1   -.1    .0    .0    .0    .0    .0   -.1
   -.2   -.2   -.3   -.3   -.2   -.1    .3    .0    .0

ASHTECH         ASH701945C_M          (no radom)                    (  0) 96/06/30
       0.0       0.0     110.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
       0.0       0.0     128.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
```

5.15. SINEX file : 21605_IGN_2003-332.SNX

```
%=SNX 1.00 IGN 06:013:00000 IGN 03:332:00000 03:332:00000 C 00009
*-------------------------------------------------------------------------------
+FILE/COMMENT
* File created by geotosnx software (Z.Altamimi)
* Original input file: shao_juillet2.cov
* Matrix Scalling Factor used:         1.0000000000
-FILE/COMMENT
*-------------------------------------------------------------------------------
+SITE/ID
*CODE PT __DOMES__ T _STATION DESCRIPTION__ APPROX_LON_ APPROX_LAT_ _APP_H_
 SHAO  A 21605M002   21605M002              121 12 01.5  31 05 58.7    22.1
 7837  A 21605S001   21605S001              121 11 30.2  31 05 51.1    27.9
 7227  A 21605S009   21605S009              121 11 58.7  31 05 56.9    29.4
-SITE/ID
*-------------------------------------------------------------------------------
+SOLUTION/EPOCHS
*Code PT SOLN T Data_start__ Data_end____ Mean_epoch__
-SOLUTION/EPOCHS
*-------------------------------------------------------------------------------
+SOLUTION/ESTIMATE
*INDEX TYPE__ CODE PT SOLN _REF_EPOCH__ UNIT S __ESTIMATED VALUE____ _STD_DEV___
     1 STAX   SHAO  A    1 03:332:00000 m    2 -.283173348000000E+07 0.11688E-02
     2 STAY   SHAO  A    1 03:332:00000 m    2 0.467566596200000E+07 0.11688E-02
     3 STAZ   SHAO  A    1 03:332:00000 m    2 0.327536942900000E+07 0.11688E-02
     4 STAX   7837  A    1 03:332:00000 m    2 -.283108829860000E+07 0.13739E-02
     5 STAY   7837  A    1 03:332:00000 m    2 0.467620325920000E+07 0.12720E-02
     6 STAZ   7837  A    1 03:332:00000 m    2 0.327517273290000E+07 0.13915E-02
     7 STAX   7227  A    1 03:332:00000 m    2 -.283168712290000E+07 0.12460E-02
     8 STAY   7227  A    1 03:332:00000 m    2 0.467573358670000E+07 0.11992E-02
     9 STAZ   7227  A    1 03:332:00000 m    2 0.327532760440000E+07 0.12265E-02
-SOLUTION/ESTIMATE
*-------------------------------------------------------------------------------
+SOLUTION/MATRIX_ESTIMATE L COVA
*PARA1 PARA2 ____PARA2+0__________ ____PARA2+1__________ ____PARA2+2__________
     1     1 0.136608451550408E-05
     2     1 0.329299509227381E-12 0.136608079629085E-05
     3     1 0.246907957154911E-11 0.391431918175545E-12 0.136608245653616E-05
     4     1 0.136551283355459E-05 0.488889432660378E-10 -.455191422138606E-09
     4     4 0.188759926177756E-05
     5     1 -.117906983707973E-09 0.136597124534316E-05 -.215699798509621E-09
     5     4 -.107397450989922E-06 0.161793926655169E-05
     6     1 -.152434778085041E-09 0.134528079837136E-09 0.136575892427090E-05
     6     4 -.165381400509625E-07 0.216342710643521E-06 0.193632749376858E-05
     7     1 0.136550327785402E-05 -.461884316601965E-10 -.300567753305019E-09
     7     4 0.145817695926904E-05 0.718833690486268E-08 0.430456220944338E-07
     7     7 0.155251759916955E-05
     8     1 -.472937574136496E-10 0.136597069288473E-05 -.201157005240766E-10
     8     4 0.484015451463556E-08 0.139236258155494E-05 0.637671155013970E-08
     8     7 -.709278168352204E-08 0.143814883836310E-05
     9     1 -.308397613328774E-09 -.528694378786543E-10 0.136578193892274E-05
     9     4 0.432230022487151E-07 0.358688594276535E-08 0.142097894933250E-05
     9     7 0.518361608160984E-07 0.259924913729066E-07 0.150436138466331E-05
-SOLUTION/MATRIX_ESTIMATE L COVA
%ENDSNX
```