



**FSUE «Science-Research Institute for
Precision Instrument Engineering»**

STATE OF THE SLR IN RUSSIA

State of the SLR in Russia

During a long period, the Russian SLR stations were unable to deliver measurement data to the ILRS. Currently, in accordance with a recent decision of the State Administration, it is permitted to deliver measurement data from two Russian stations (Altay and Baikonur) to the ILRS, as well as to resume data delivery from the Komsomolsk station.

Altay SLR station

The Altay SLR station has been recently upgraded: a new laser has been installed with a pulse repetition rate of 300 Hz (instead of 5 Hz), and a higher average output power (0.75 W instead of 0.25 W).

The measurement data delivery to the ILRS has started Oct. 10, 2008.



Interaction of the Russian SLR Station Network, Data Collection Center, and ILRS

Basic functions of the Data Collection and Analysis Center:

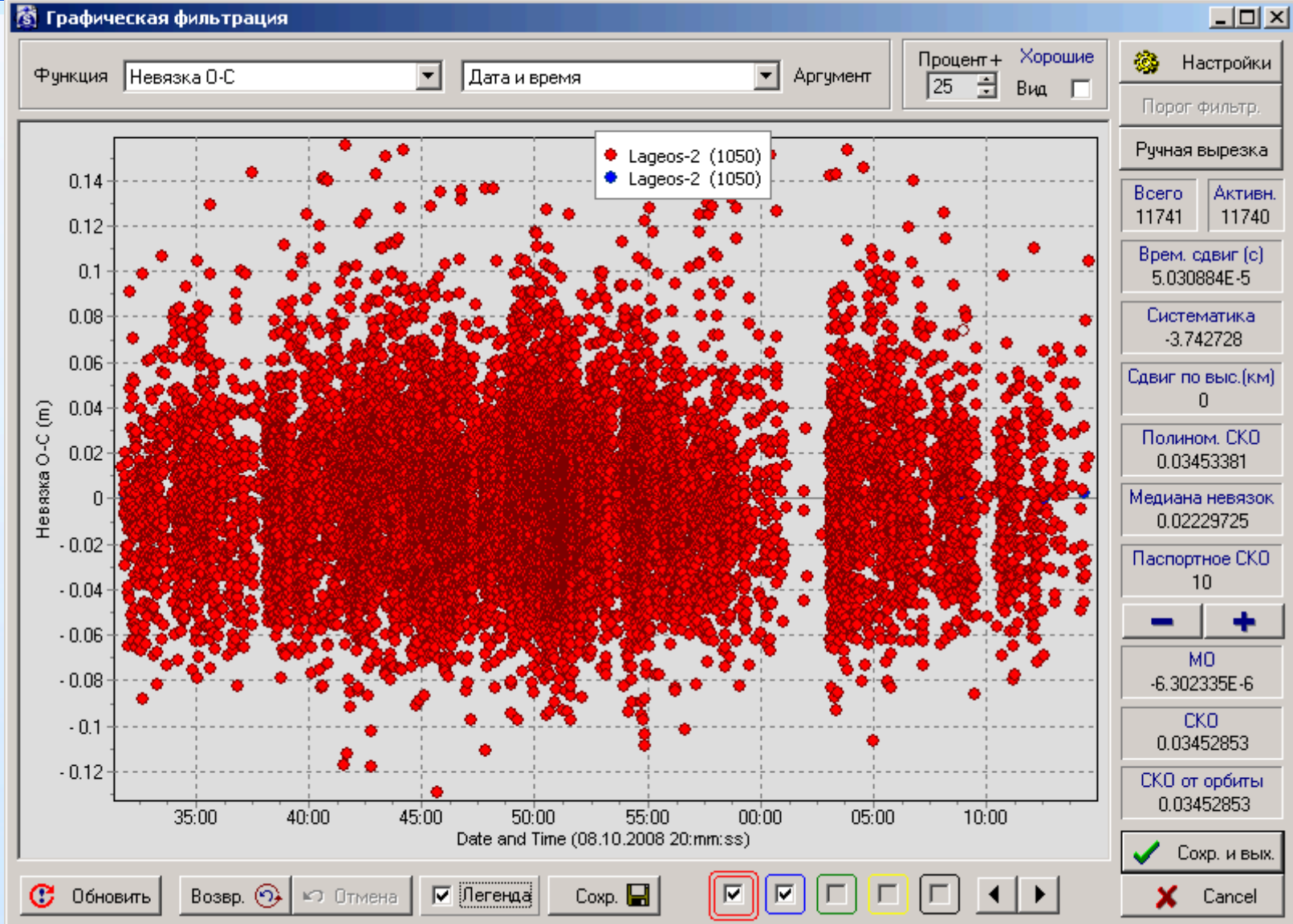
- Provision of ephemeris data for the SLR stations
- Collection and storage of measurement data from all stations
- Monitoring of measurement data accuracy, completeness, and correctness of data delivery
- Calculation of normal point data and their delivery to the ILRS Data Centers (during the first phase of operation)
- «Feedback» to SLR stations and ILRS concerning measurement data quality and completeness

Correction of Altay Station Coordinates

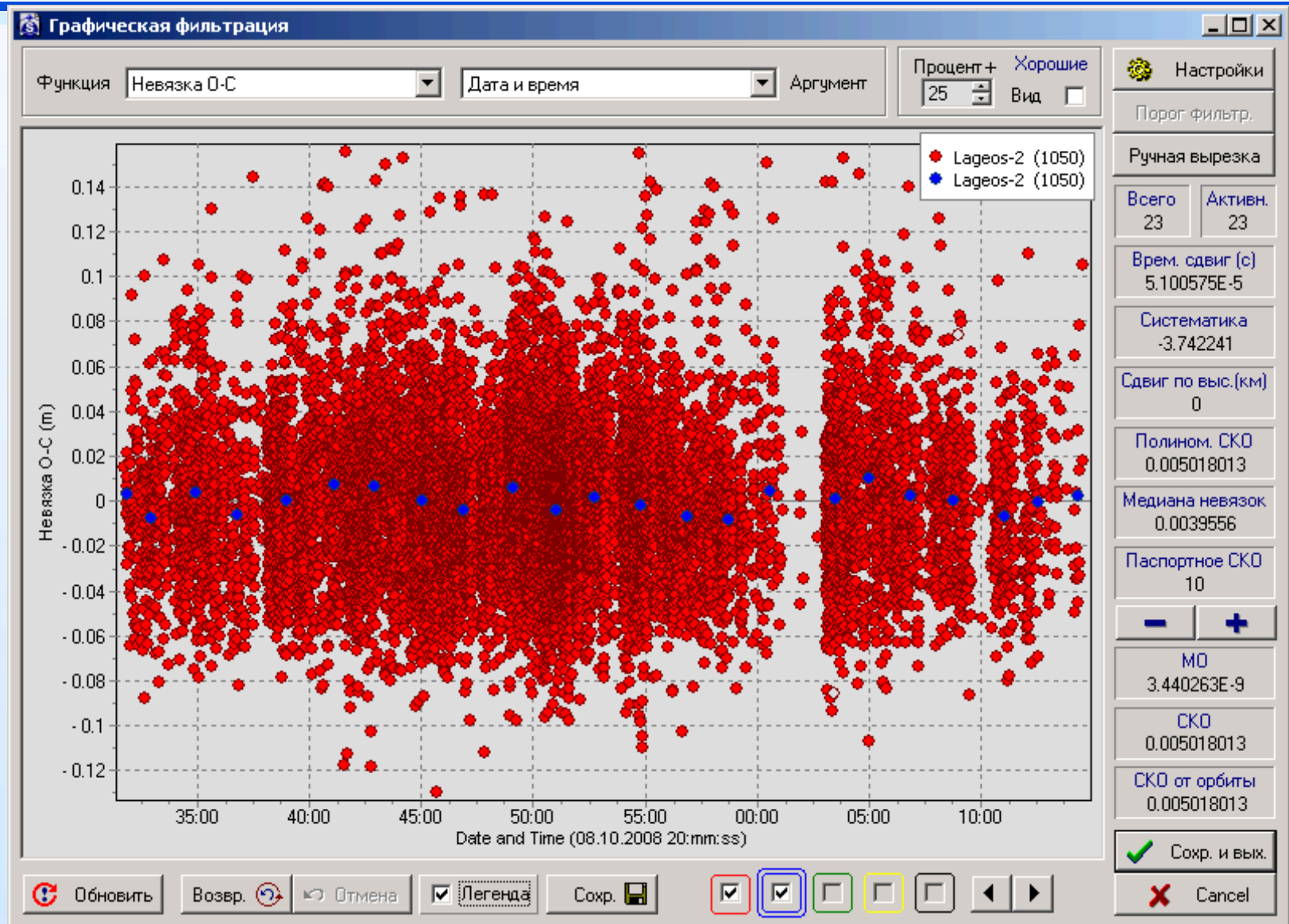
Date	UTC	Dur	Inc	%	Ele	ME	RMS	ORMS	SCNAME
02:01:08	14:51	11	7	100	32:39	0.069	0.009	0.070	Lageos-1
05:01:08	14:17	7	5	100	39:45	0.045	0.011	0.046	Lageos-1
05:03:08	22:21	7	5	100	33:43	0.018	0.010	0.021	Lageos-1
13:03:08	22:01	9	6	100	31:43	0.015	0.004	0.015	Lageos-1
26:03:08	21:47	13	8	100	44:54	0.009	0.011	0.014	Lageos-1
19:04:08	20:46	8	5	100	52:54	0.019	0.015	0.024	Lageos-1
14:07:08	19:51	18	10	100	47:75	0.013	0.005	0.014	Lageos-1
24:07:08	16:49	9	6	100	50:56	-0.035	0.008	0.036	Lageos-1
13:08:08	21:21	13	7	88	30:51	0.012	0.008	0.014	Lageos-1
18:08:08	17:59	23	11	100	31:78	-0.007	0.012	0.014	Lageos-1
28:08:08	22:03	11	7	100	29:49	-0.022	0.006	0.023	Lageos-1
13:09:08	21:15	17	10	100	32:53	-0.023	0.008	0.025	Lageos-1
09:10:08	13:47	37	7	100	30:39	0.020	0.015	0.025	Lageos-1
28:01:08	00:07	5	4	100	51:55	-0.023	0.008	0.024	Lageos-2
16:02:08	22:13	9	6	100	40:57	0.031	0.010	0.033	Lageos-2
01:03:08	20:01	3	3	100	48:48	0.013	0.012	0.017	Lageos-2
08:03:08	18:45	14	8	100	38:42	0.005	0.012	0.013	Lageos-2
13:03:08	17:23	7	5	100	30:31	-0.016	0.006	0.017	Lageos-2
13:03:08	21:15	9	6	100	68:80	0.006	0.005	0.008	Lageos-2
13:04:08	18:54	8	5	100	55:78	0.013	0.008	0.015	Lageos-2
21:04:08	15:43	15	9	100	42:64	0.009	0.010	0.013	Lageos-2
24:04:08	17:45	17	10	100	36:80	0.017	0.009	0.020	Lageos-2
09:10:08	22:35	45	6	100	30:38	0.002	0.032	0.032	Lageos-2

Coordinates: X=543.406156; Y=3955.302241; Z=4957.821063

Raw measurement data deviations from the smoothed orbit (Altay SLR stations, LAGEOS-2, 08.10.2008)



Normal point data deviations from smoothed orbit (Altay SLR station, LAGEOS-2, 08.10.2008)



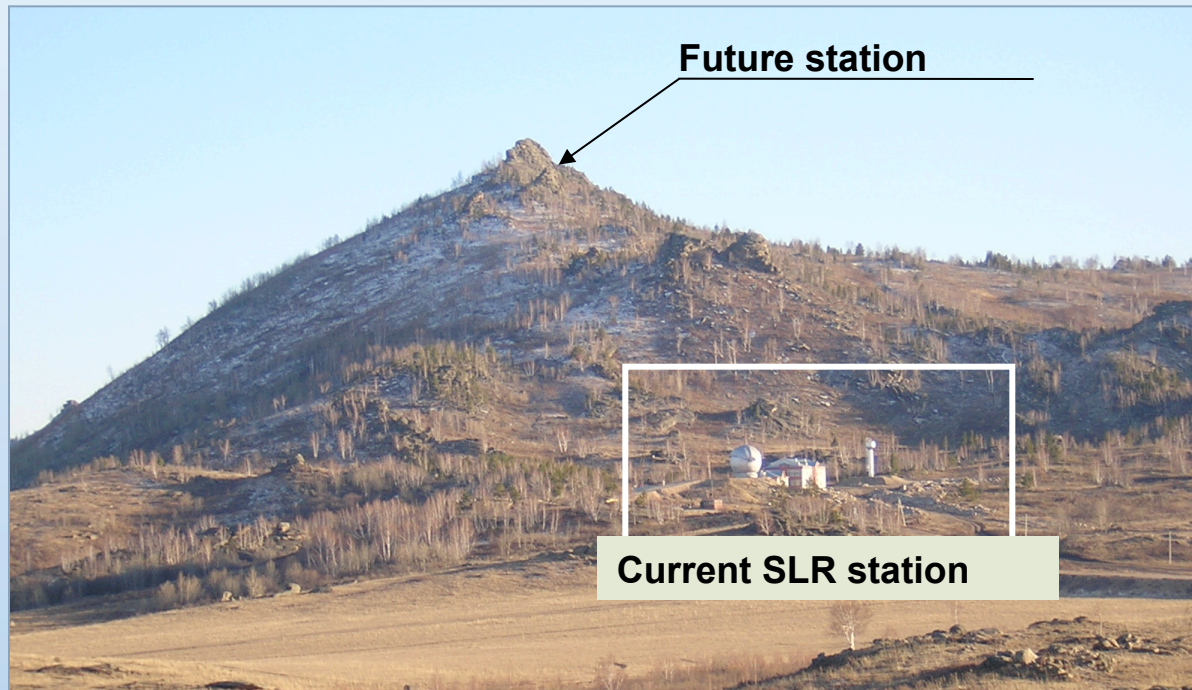
Correction of Komsomolsk SLR station coordinates

Date	UTC	Dur	Inc	%	Ele	ME	RMS	ORMS	SCNAME
02:01:08	11:03	16	9	90	31:40	-0.002	0.016	0.016	Lageos-1
11:01:08	09:23	6	5	100	55:63	0.009	0.012	0.015	Lageos-1
14:01:08	09:13	3	3	100	28:34	-0.035	0.024	0.043	Lageos-1
18:02:08	19:17	7	5	100	31:40	-0.002	0.008	0.008	Lageos-1
22:08:08	15:47	20	10	91	41:62	-0.001	0.017	0.017	Lageos-1
01:10:08	17:45	5	3	75	41:47	0.042	0.024	0.049	Lageos-1
03:02:08	19:11	11	4	67	44:49	0.024	0.014	0.028	Lageos-2
05:02:08	19:16	3	3	100	37:43	-0.015	0.039	0.042	Lageos-2
17:02:08	20:33	10	7	100	39:66	-0.014	0.011	0.018	Lageos-2
20:02:08	18:53	22	12	100	37:71	-0.015	0.011	0.019	Lageos-2
22:02:08	19:14	20	7	64	56:76	-0.016	0.016	0.023	Lageos-2
23:02:08	17:35	9	5	83	40:53	0.005	0.005	0.007	Lageos-2
25:02:08	17:39	14	9	100	50:60	-0.008	0.011	0.014	Lageos-2
27:02:08	17:59	11	7	100	47:65	-0.027	0.013	0.030	Lageos-2
06:03:08	18:41	9	6	100	56:81	0.010	0.006	0.012	Lageos-2
10:03:08	18:59	11	7	100	33:59	0.012	0.012	0.017	Lageos-2
05:04:08	14:03	17	9	90	58:70	-0.006	0.014	0.016	Lageos-2
15:04:08	11:19	11	7	100	41:46	-0.045	0.056	0.072	Lageos-2
01:10:08	18:03	26	11	85	38:63	0.050	0.016	0.052	Lageos-2

Coordinates: X=-2948.545480; Y=2774.313007; Z=4912.302412

Altay Optic Laser Center (AOLC)

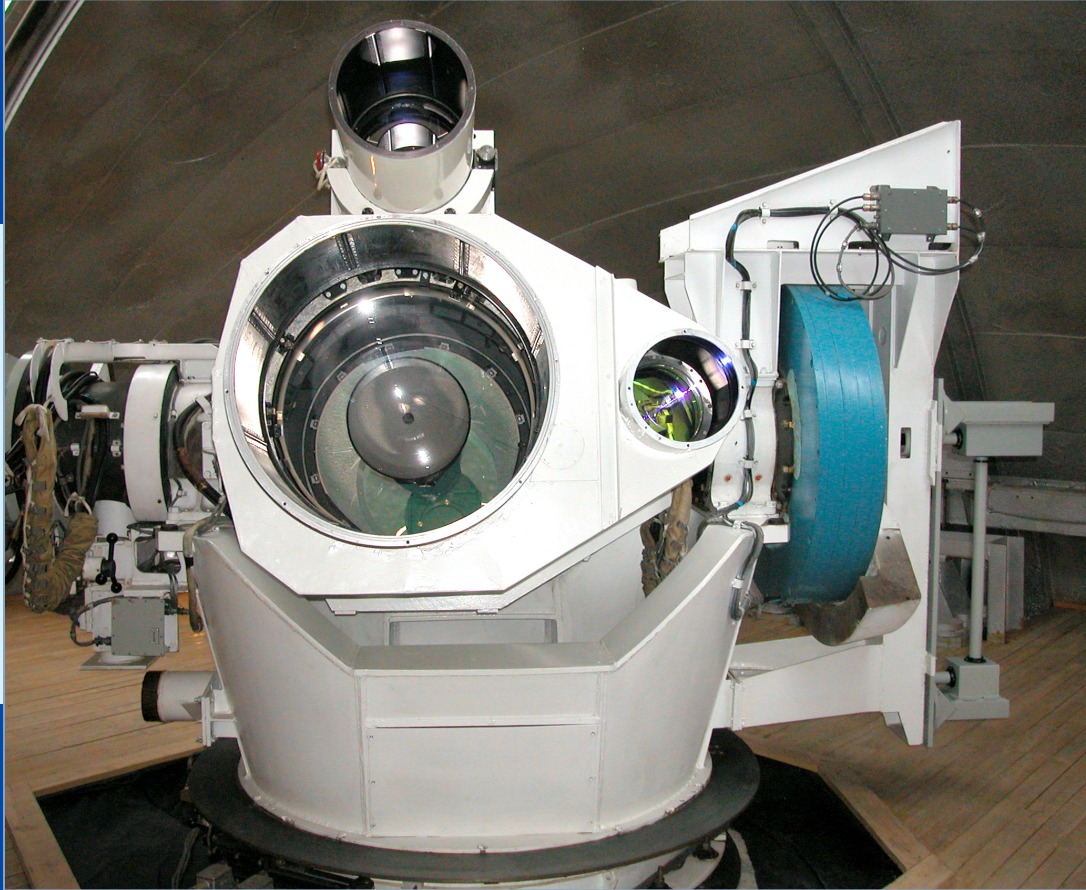
The SLR station Altay is housed in the Altay Optical-Laser Center (AOLC), 300 km to South-West from city Barnaul, 20 km to North from town Zmeinogorsk.



Current SLR station Altay



Altay station telescope



- Receive aperture 60 cm
- Transmit aperture 20cm
- Tracking camera: ICCD, FOV 10'x12'
- Laser 2,5 mJ 150 ps 300 Hz
- Photometry: up to 15^m
- Angle measurements $\pm 2''$

Wide Field Telescope

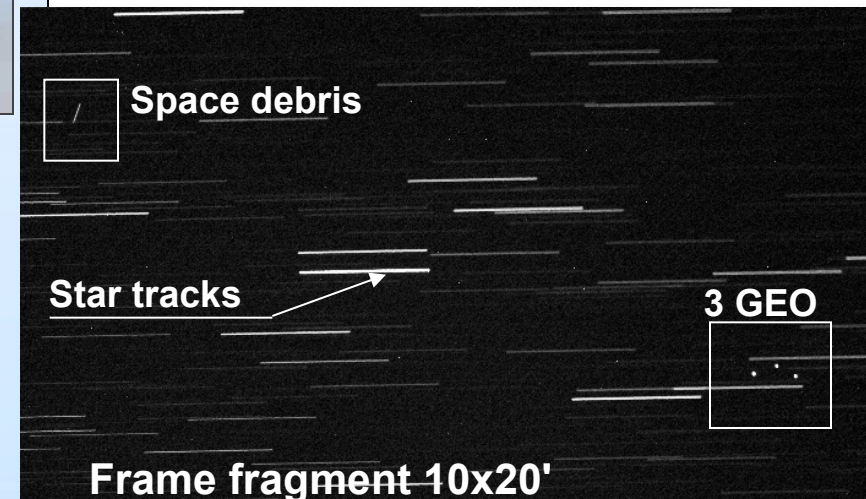


BASIC PARAMETERS:

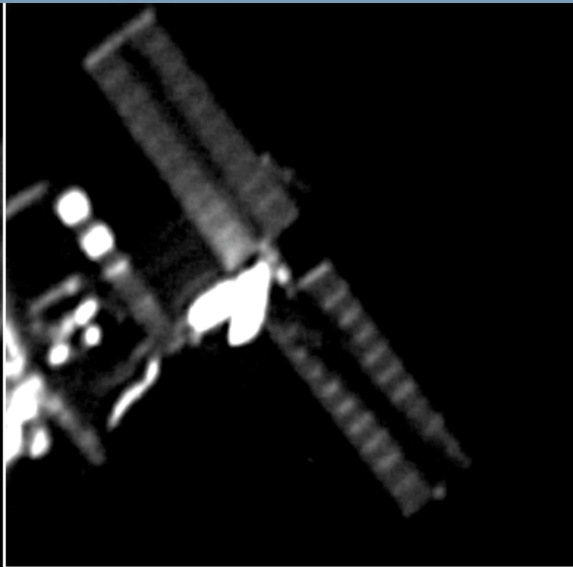
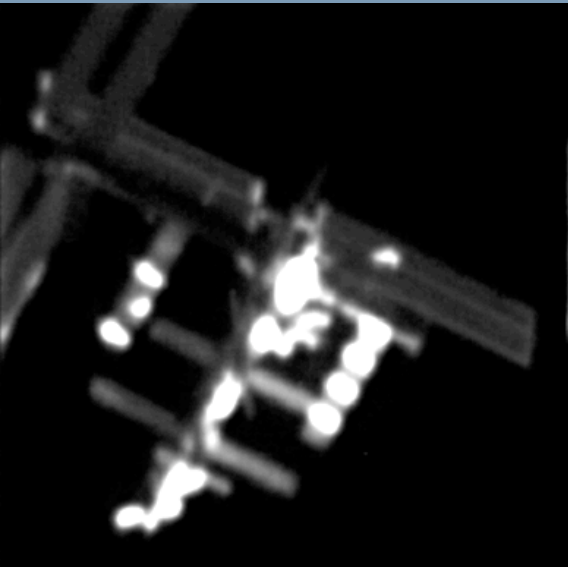
- aperture – 0,35 m;
- CCD format – 4096x4096;
- angular FOW 6.25 sq. deg
- exposition time up to 2.5 sec.
- minimum brightness for HEO spacecraft 16^m
- SC position measurement accuracy $\leq 0,4''$;
- GEO area scanning rate 600 sq. deg/h

Purpose:

GEO SC search and angle measurement



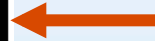
ISS images (with use of adaptive optic system)



26. 10. 2006

Culmination range
450 km

Elevation 45°

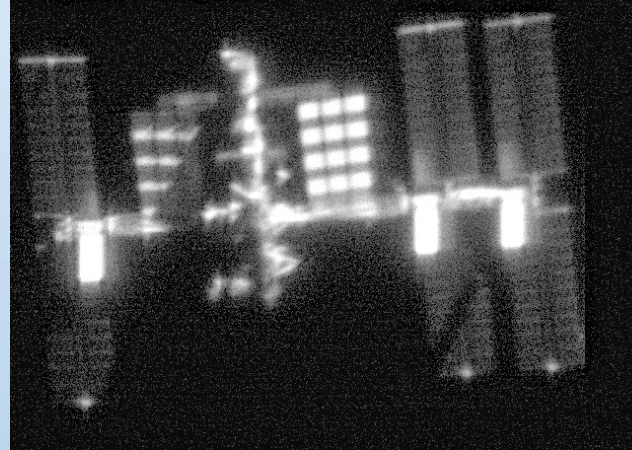


03. 04. 2008.

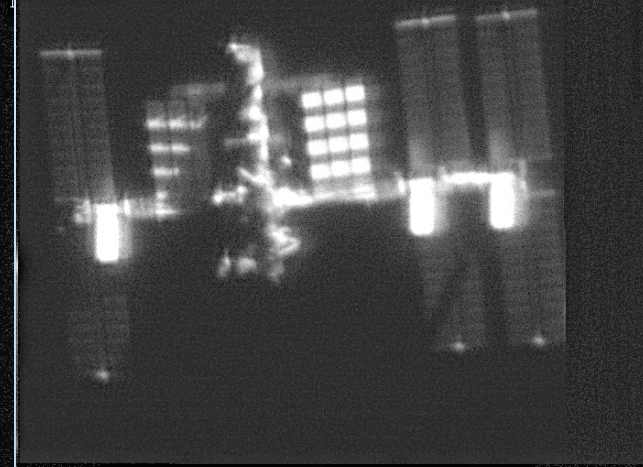
Culmination range
416 km
Elevation
 55°



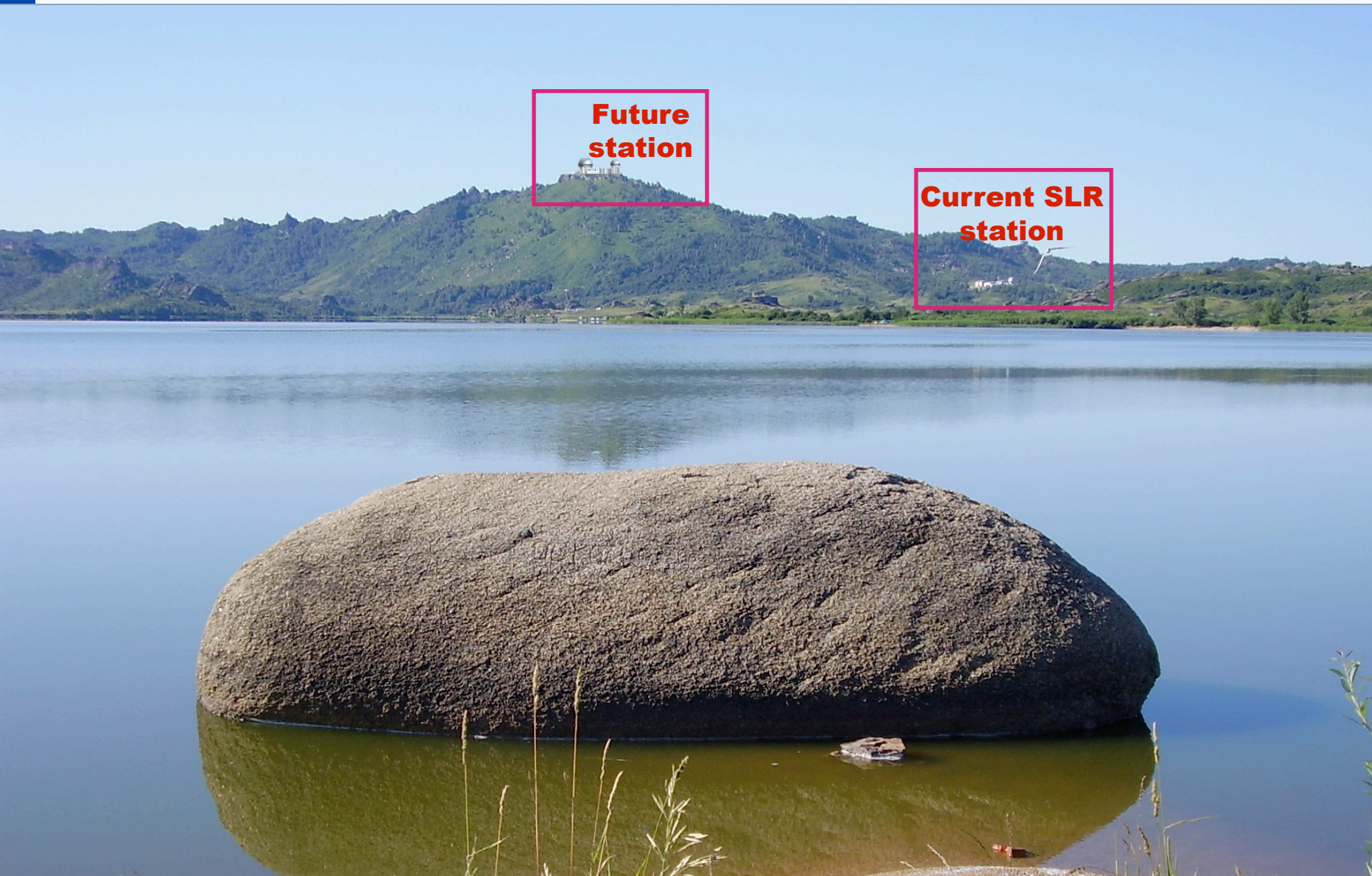
T=2008-04-03 16:37:18,791
L(km) =416,344
A(grad)=265,7620
H(grad)=55,3506



T=2008-04-03 16:37:18,066
L(km) =413,483
A(grad)=265,8931
H(grad)=55,9728



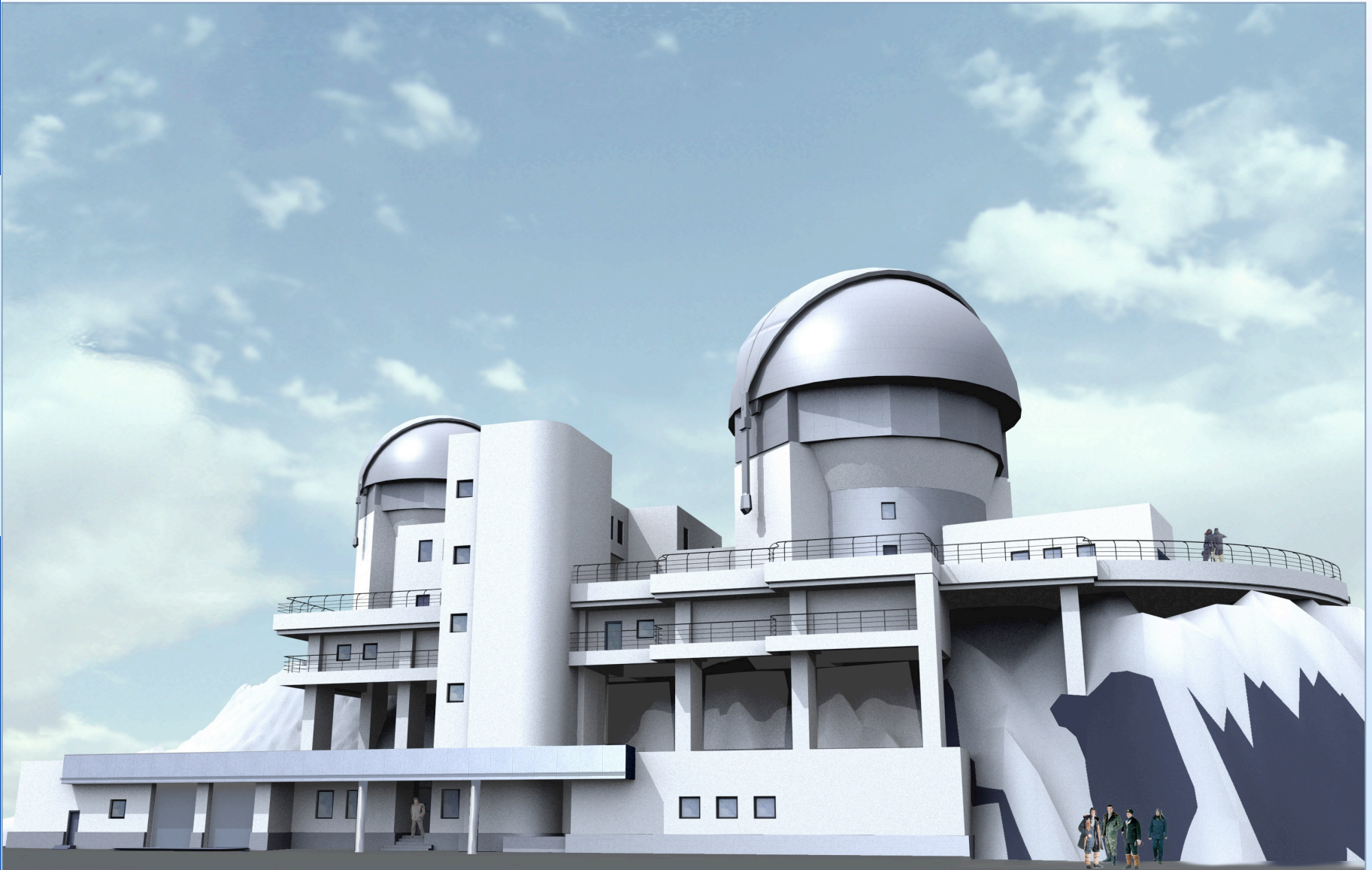
AOLC view across the Kolyvan Lake



**Future
station**

**Current SLR
station**

Future Station Concept



Baikonur SLR Station



RUSSIAN SLR NETWORK

- SLR stations currently in operation
- SLR stations to be provided by IPIE for RAS
- SLR stations to be provided by IPIE for other State services

