Zelenchukskaya Radio Astronomical Observatory

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Abstract

This report provides information about Zelenchukskaya network station: general information, facilities, staff, present status and outlook.

1. General Information

Zelenchukskaya Radio Astronomical Observatory was founded by Institute of Applied Astronomy (IAA) as one of the three stations of Russian VLBI network QUASAR [1]. Sponsoring organization of the project is Russian Academy of Sciences (RAS). The Zelenchukskaya Radio Astronomical Observatory is situated in Republic Karachaevo-Cherkessiya (Northern Caucasia) about 70 km south of Cherkessk, close by the Zelenchukskaya site (not far from Radiotelescope RATAN-600). The geographic location of the observatory is shown on the web site of IAA RAS (http://www.ipa.nw.ru/PAGE/koi8-r/DEPOBSERV/rus_zel.htm). The basic instruments of the observatory are 32-m radio telescope and technical systems provided realization of VLBI observations.

Figure 1. Zelenchukskaya Observatory.

Table 1. Zelenchukskaya Observatory location and address.

Longitude	$41^\circ 34'$
Latitude	$43^\circ 47'$
Zelenchukskaya Observatory	
Republic Karachaevo-Cherkessia	
357140, Russia	
ipazel@mail.svkchr.ru	

2. Technical and Scientific Information

The Zelenchukskaya station equipment includes the following main components: 32 m radio telescope, equipped with low noise receivers, frequency and time keeping system with H-masers, local geodetic network, GPS Rogue SNR-8000 receiver (geodetic) and GPS/GLONASS K161 receiver (synchronization of time keeping system), data acquisition system VLBA, recording terminals Mark 5A and S2, control computers, local computer network and technical service systems. DAS VLBA was installed and completed by BBC-modules in 2005. Automatic meteo station has been installed at Zelenchukskaya in 2001. Local geodetic network (Fig. 2) is adjusted with accuracy of 2–3 mm. Characteristics of the radio telescope and other main components of the station are presented in Tables 2–4.

The time and frequency system is composed of four hydrogen standard CH1-80 and GPS/GLONASS receivers for the preliminary time synchronization with an accuracy of not more than 100 ns. Frequency stability of H-masers is presented in Table 4. Local VHF oscillators are locked by reference 5 MHz signal and provide 10–20 mW power output signals at frequencies 1.26, 2.02, 8.08, 4.5, 22.12 GHz. A pulse calibration system includes pulse generator with duration of pulses about 50 ps.

Table 2. Technical parameters of the radio telescope.

Year of construction	2000
Mount	AZEL
Azimuth range	±270 (from south)
Elevation range	from $-5°$ to $95°$
Maximum azimuth - velocity - tracking velocity - acceleration	 1.5 °/s, 1.5 ′/s, 0.2 °/s^2
Maximum elevation - velocity - tracking velocity - acceleration	 0.8 °/s, 1.0 ′/s, 0.2 °/s^2
Pointing accuracy	better than $10''$
Configuration	Cassegrain (with asymmetrical subreflector)
Main reflector diameter	32 m
Subreflector diameter	4 m
Focal length	11.4 m
Main reflector shape	quasi-paraboloid
Subreflector shape	quasi-hyperboloid
Surface tolerance of main reflector	± 0.5 mm
Frequency capability	1.4–22 GHz
Axis offset	−11.5 mm

Table 3. Parameters of receivers.

Wave band	Frequency range	Input noise temperature
18–21 cm	1.38–1.72 GHz	12 K
13 cm	2.15–2.5 GHz	12 K
6 cm	4.6–5.1 GHz	10 K
3.5 cm	8.2–8.9 GHz	15 K
1.35 cm	22.2–22.7 GHz	20 K

Table 4. Frequency stability of the CH1-80 H-maser.

Sample time interval	(Allan variance)$^{1/2}$
1 second	$3 \cdot 10^{-13}$
10 seconds	$3 \cdot 10^{-14}$
100 seconds	$1 \cdot 10^{-14}$
1000 seconds	$3 - 5 \cdot 10^{-15}$

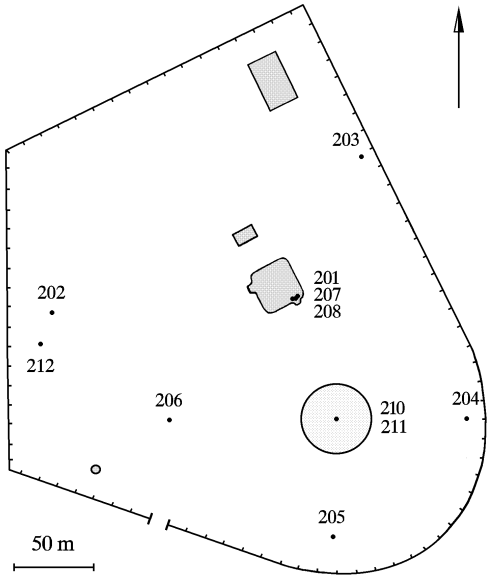

Figure 2. Local geodetic network at Zelenchukskaya Observatory.

Local geodetic network includes 11 reference points (Figure 2): 202–206, 212 are ground marks, 201, 207, 208 are located at the roof of laboratory building and intended for installation of GPS/GLONASS receivers, 210 is the intersection of radiotelescope axes and 211 is intermediate mark on azimutal platform of radiotelescope.

3. Technical Staff

Andrey Dyakov — Observatory chief,
Dmitry Dzuba — FS, pointing system controls,
Anatoly Mishurinsky — front end and receivers support,
Alexey Bosov — electrical power system support,
Viktor Sherstukov — mechanical facilities support.

4. Outlook

Our plans for the coming year are the following:

- Final adjustment of all radio telescope systems from point of view of VLBI requirements.
- Connection of observatory with optical fiber lines.
- Participation in IVS R4, R1, EURO, T2 and RDV observing sessions during 2006 year.

References

[1] Finkelstein A., Ipatov A., Smolentsev S. Radio Astronomy Observatories Svetloe, Zelenchukskaya and Badary of VLBI Network QUASAR. In: IVS 2004 General Meeting Proc., eds. N. R. Vandenberg, K. D. Baver, NASA/CP-2004-212255, 2004. P. 161–165.