SAI VLBI Analysis Center 2013 Annual Report

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Abstract This report presents an overview of the SAI VLBI Analysis Center activities during 2013 and the plans for 2014. The AC SAI analyzes all IVS sessions for computations of the Earth orientation parameters (EOP) and time series of the ICRF source positions and performs research and software development aimed at improving the VLBI technique.

1 General Information

The SAI VLBI Analysis Center is located at Sternberg State Astronomical Institute of Lomonosov Moscow State University in Moscow, Russia. The Analysis Center participates in geodetic and astrometric VLBI analysis, software development, and research aimed at improving the VLBI technique, especially for support of the Radioastron mission.

2 Component Description

AC SAI performs data processing of all kinds of VLBI observation sessions. For VLBI data analysis we use the ARIADNA software package developed at SAI. Version 4 was finished and tested in 2012. All reductions are performed in agreement with the IERS Conventions (2010).

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SAI Analysis Center

IVS 2013 Annual Report

The package uses files in the NGS format as input data.

Package ARIADNA (v. 4) is the basis of software named ORBITA installed on the correlator of the AstroSpace Center of Lebedev Physical Institute. It is used for correlation of the ground-space interferometer data during the Radioastron mission.

3 Staff

- Vladimir Zharov, Prof.: development of the ARIADNA software, development of the methods of parameter estimation;
- Leila Kuznetsova, post-graduate student: VLBI data processing, nutation modeling;
- Nikolay Voronkov, scientific researcher: global solution;
- Svetlana Nosova, engineer: VLBI data processing;
- Natalya Shmeleva, engineer: VLBI data processing.

4 Current Status and Activities

- **Software development for VLBI processing**
  The ARIADNA software is being developed to provide contributions to IVS products. The software is used for calculating all types of IVS products. Version 4 was developed in 2012. The main features of this version are performing all reductions in agreement with the IERS Conventions (2010), generation of the SINEX files, and combination of some of the SINEX files to stabilize solution.

This version of the software was corrected in 2013: now it is possible to use the CIO based transformation matrix. A new series of the EOP was obtained from observations that were made in 2013.

The method that uses calculation of the equinox-based transformation matrix for precession-nutation was kept to compare new series with old ones. The equinox-based matrix $Q(t)$ that transforms from the true equinox and equator of date system to the GCRS is composed of the classical nutation matrix, the precession matrix including four rotations, and a separate rotation matrix for the frame biases. A new series of the nutation angles will be used for the preparation of our suggestion for improving the nutation theory.

Some corrections of the model of delay for the ground-space interferometer were made and realized in software ORBITA, which is used for the correlation and routine analysis of the Radioastron observations.

- **Routine analysis**

  During 2013 the routine data processing was performed with the ARIADNA software using the least-squares method with rigid constraints, and non-rigid constraints were used for generation of SINEX files.

  AC SAI operationally processed the 24-hour and Intensive VLBI sessions. The formation of the databases of the VLBI sessions and processing of all sessions is fully automated. The EOP series sai2013a.eops and sai2013a.eopi were calculated. These series were computed with the VTRF2008 catalog of station positions and velocities. Experimental series sai2013c.eops was calculated with the CIO based transformation matrix. New EOP series will be used for the development of new nutation theory.