

# SAI VLBI Analysis Center Report 2012

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## Abstract

This report presents an overview of the SAI VLBI Analysis Center activities during 2012 and the plans for 2013. The SAI AC 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

SAI AC 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).

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

The ARIADNA package (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, Professor: development of the ARIADNA software, development of the methods of parameter estimation;
- Dmitry Duev, post-graduate student: VLBI data processing, troposphere 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 the performance of all reductions in agreement with the IERS Conventions (2010), the generation of the SINEX files, and the combination of some of the SINEX files to stabilize solutions.

A new model for delay was developed for the ground-space interferometer. It was realized as software ORBITA, which is used for correlation and routine analysis of the Radioastron observations.

- **Routine Analysis**

During 2012 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.

SAI AC operationally processed the 24-hour and Intensive VLBI sessions. Creation of databases of the VLBI sessions and processing of all sessions is fully automated. The EOP series sai2012a.eops and sai2012a.eopi were calculated. These series were computed with the catalog VTRF2008 of station positions and velocities. Experimental series sai2012b.eops was calculated with the experimental catalog of radio sources with non-zero velocities. New EOP series will be used in 2013 for generation of new nutation series.

- **Global Solution**

An experimental catalog of the radio source positions and velocities was obtained by N.Voronkov.

- **Troposphere Modeling**

At the stations with the meteorological data missing, we used surface data files (temporal coverage: four times daily, spatial coverage: 2.5 degrees latitude x 2.5 degrees longitude global grid) from NCEP/NCAR Reanalyzes (<http://www.cdc.noaa.gov/data/gridded/data.ncep.reanalysis.surface.html>) for calculating air temperature, pressure, and relative humidity. For that purpose a program was written to interpolate these data to the given coordinates of the station at the time of observations.

This method was used for generation of air temperature, pressure and relative humidity for the ground stations that participate in observations with the space radio telescope.