# SAI-VNIIFTRI VLBI Analysis Center in 2017–2018

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

## 1 General Information

The SAI-VNIIFTRI VLBI Analysis Center is located at Sternberg State Astronomical Institute (SAI) of Lomonosov Moscow State University in Moscow and at the National research institute of physicotechnical and radio engineering measurements (VNIIFTRI), Mendeleevo, 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 ASC correlator during the Radioastron mission [1].

## 2 Activities during the Past Two Years

The AC SAI-VNIIFTRI performs data processing of all kinds of VLBI observing sessions. For VLBI data analysis we use the ARIADNA software package developed by V. Zharov [4]. Version 4.11 of this software was finished and tested at the end of 2018. All reductions are performed in agreement with the IERS Conventions (2010). Now the package uses files in VGOS(NetCDF) [2] and NGS format as input data and creates SINEX output files for every IVS session. The package was automated for the purposes of the Russian EOP operative service, and now it is used at VNIIFTRI for operational VLBI session processing [3].

The staff of the joint AC is

- Vladimir Zharov, Prof.: development of the ARIADNA software, development of the methods of parameter estimation (SAI);
- Sergey Pasynok, scientific researcher: development of control scripts, global solution (VNIIFTRI);
- Natalya Shmeleva, engineer: VLBI data processing (SAI).

## 3 Current Status

- **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. The main features of version 4.11 are: input data in vgosDB and NGS formats, performing all reductions in agreement with the IERS Conventions (2010), automatic generation of SINEX files, combination of some of the SINEX files to stabilize solutions, and non-interactive mode. Starting from version 4, the software has allowed the use of the CIO-based transformation matrix. The method that uses calculation of the equinox-based transformation matrix for precession-nutation was

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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.

The EOP series was obtained from observations that were made in 2017–2018.

- **Routine Analysis**

  During 2017–2018 the routine data processing was performed with the ARIADNA software using the least-squares method with rigid constraints.

  The AC SAI-VNIIFTRI operationally processed the 24-hour and Intensive VLBI sessions. Forming the data bases of the VLBI sessions and processing of all sessions is fully automated. The EOP series vnf_2017.eoxy, vnf_2018.eoxy, vnf_2017.eopi, and vnf_2018.eopi were calculated. These series were computed with the VTRF2015 catalog of station positions and velocities.

  SINEX files were generated for all sessions.

  Weighted mean (WM) and weighted root mean square (WRMS) UT1 differences between AC SAI-VNIIFTRI and AC BKG, IAA, and USNO estimates from all Intensive sessions are shown in Figure 1, and those from 24-hour solutions are shown in Figure 2.

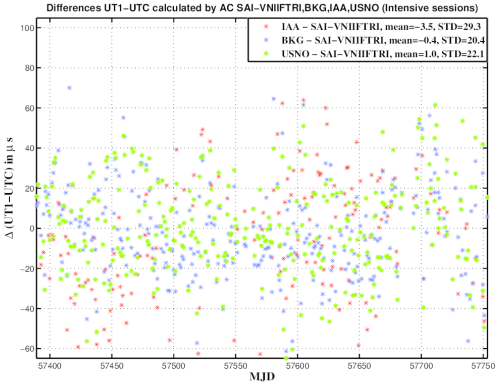


**Fig. 1** AC BKG, IAA, and USNO to AC SAI-VNIIFTRI UT1 differences from the solutions of Intensive sessions.

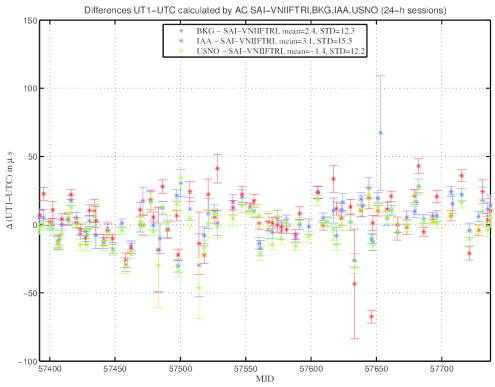


**Fig. 2** AC BKG, IAA, and USNO to AC SAI-VNIIFTRI UT1 differences from the solutions of 24-hour sessions.

## 4 Future Plans

- Continuing investigations of VLBI estimation of EOP, station coordinates, source coordinates and their variability.
- Improvement of the ARIADNA software for processing of the GNSS troposphere zenith delays.

## References

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