IAA Correlator Center Biennial Report 2015+2016

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Abstract The IAA Correlator Center activities in 2015 and 2016 are described. All regular observations of Russian national geodetic VLBI programs were transferred to the IAA in e-VLBI mode and correlated using the ARC, RASFX, and DiFX correlators.

1 General Information

The IAA Correlator Center is located at St. Petersburg, Russia and maintained by the Institute of Applied Astronomy. The main goal of the IAA Correlator Center is processing geodetic, astrometric, and astrophysical observations made with the Russian national VLBI network Quasar. At present, three correlators are involved in this processing: ARC, RASFX, and DiFX.

The ARC (Astrometric Radiointerferometric Correlator) is the main data processing instrument in the IAA Correlator Center for UT and EOP determination. The ARC is a six-station 15-baseline correlator. It is able to process up to 16 frequency channels on each baseline for a total of 240 channels. The correlator is able to handle two-bit VLBI signals with 32 MHz maximum clock frequency. The maximum data rate from each station is 1 Gbit per second. The correlator is using VSI-H input signals, and it is equipped with Mark 5B playback systems. The ARC was designed and built by the IAA RAS in 2007–2009. The correlator is the XF type and based on FPGA technology.

The Institute of Applied Astronomy of the Russian Academy of Sciences (IAA RAS)

IAA Correlator Center

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In 2014, the Russian Academy of Sciences' FX (RASFX) six-station near-real time GPU-based VGOS correlator was developed [1]. The correlator software is installed on an HPC cluster, which contains 40 servers, each equipped with two Intel CPUs and two Nvidia GPUs.

Since 2015, the DiFX software correlator has been installed on the HPC cluster.

2 Activities during the Past Years

ARC commonly operates with data obtained from 32-m antennas, which are located in "Svetloe", "Badary" and "Zelenchukskaya". ARC processes daily Intensive one-hour sessions for UT determination and weekly 24-hour sessions for EOP determination in standard legacy IVS geodetic setup (1-bit, 14 freq. channels of 8 MHz bandwidth). More than 800 sessions were processed in 2015–2016.

In March 2015, RASFX and DiFX correlators were used for comissioning of the new 13-m antennas "Zelenchukskaya" and "Badary" as two element radiointerferometers. Since Novemeber 2015, IAA carried out multiple (up to seven) sessions per day.

In 2015–2016 the following types of sessions were perfomed:

- 0.5-1 hour geodetic program in S/X band for UT determination ("R", two 13-m stations)
- 23-hour geodetic program in S/X band to improve positions for 13-m antennas ("Ru-TEST", two 13-m and three 32-m radio telescopes)
- Test geodetic programs in X/Ka and S/X/Ka bands ("Ru-TEST").

- Miscellaneous test sessions, including international cooperation ("Ru-TEST").

More than 1,700 sessions were carried out during 2015–2016 [2]. The broadband acquisition system (BRAS) and data transfering and recording system (DTRS), developed in the IAA, were used in e-VLBI mode in all sessions at 13-m antennas [3, 4]. During the sessions 2-8 frequency channels of 512 MHz bandwidth and 2-bit sampling (4-16 Gbps per station) were recorded in VDIF data format.

The RASFX correlator was used for processing for all sessions observed by 13-m antennas; the DiFX correlator was used for correlating all of these sessions.

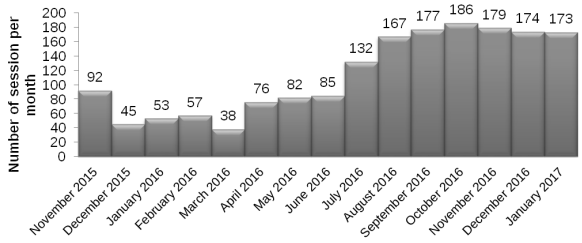

Fig. 1 Monthly distribution of number of sessions.

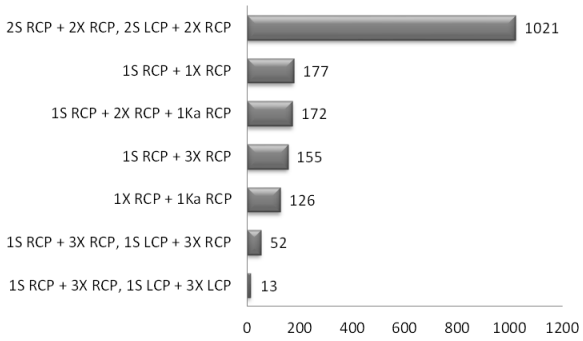

Fig. 2 Distribution of sessions by observational setup.

3 Staff

The list of the staff members of the IAA Correlator Center in 2015–2016 is given below.

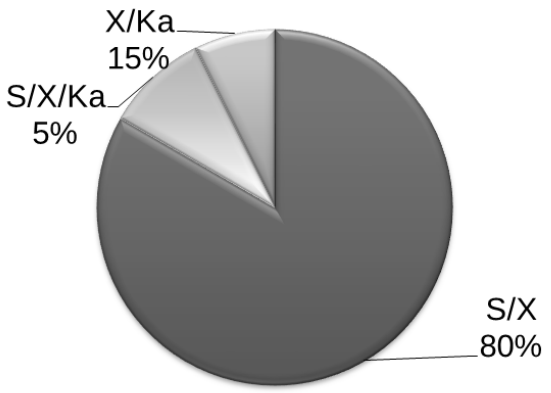

Fig. 3 Distribution of sessions by frequency bands.

- Igor Surkis — leading investigator, software developer;
- Voytsekh Ken — GPU software developer;
- Alexey Melnikov — DiFX processing, scheduler of the Ru-sessions;
- Vladimir Mishin — software developer, data processing;
- Nadezhda Mishina — software developer;
- Yana Kurdubova — software developer, data processing;
- Violet Shantyr — software developer, post processing;
- Vladimir Zimovsky — lead for data processing;
- Ekaterina Medvedeva — data processing;
- Alexander Salnikov — lead for e-VLBI data transfer;
- Ilya Bezrukov — e-VLBI data transfer; and
- Vladislav Yakovlev — e-VLBI data transfer.

4 Future Plans

In 2017 and 2018, the IAA Correlator Center activities will be focused on the following aspects:

- Routine processing of the geodetic observations,
- Processing for improving antenna positions, and
- Developing new features for the RASFX correlator.

References

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2. Dmitry Zhuravov et al. RASFX Correlator Processing Result. *13th European VLBI Network Symposium and Users Meeting. Program and Abstracts Book* IAA RAS, 2016, p. 82.
3. Alexander Ipatov et al. New generation VLBI: Intraday UT1 estimations. *IVS 2016 General Meeting Book of abstracts.* 2016. p 59.
4. Evgeny Nosov et al. Operating Experience of Broadband Acquisition System on RT-13 Radio Telescopes. *IVS 2016 General Meeting Book of abstracts.* 2016. p 29.