

IAA Correlator Center

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Abstract

The MicroPARSEC correlator was tested, and its hardware and software were improved. Now MicroPARSEC became the main correlator at IAA RAS. A set of experiments was processed by it. Also the old TISS-1M correlator was used.

1. Introduction

The MicroPARSEC and TISS-1M correlators are located and staffed by the Institute of Applied Astronomy in Saint-Petersburg, Russia. The correlators are sponsored and funded by the Russian Academy of Sciences, by the Russian Foundations of Basic Research and by the Russian Ministry of Science and Education. Dedicated to processing geodetic, astrometric and astrophysical observations, the general role of correlators is as an operational processor for VLBI observations in Russia.

2. General Information

The MicroPARSEC correlator and the TISS-1M correlator are used in IAA Correlation Center.

The old correlator TISS-1M was developed in 1985-1995. It consists of the 3-station correlator and tape devices S2-PT. The Mark III data stream format is processed.

The TISS-1M has two disadvantages. The bandwidth of the frequency channel is limited to 2 MHz, and only 1-bit sampling condition can be processed.

The new correlator MicroPARSEC was developed in recent years. It is based on the Altera program logical integral scheme (PLIS) technology. MicroPARSEC was developed using a standard PCI plate, which is inserted to the usual IBM PC computer. MicroPARSEC is directly connected to the S2-PT tape drive. One MicroPARSEC board can process 2 frequency channels with maximum bandwidth of 16 MHz and 1-bit or 2-bit sampling condition. VSI data stream format is used. The correlator with single MicroPARSEC board and single S2-PT unit was developed in 2003–2004.

3. Summary of Activities

The main focus of our activities was to test MicroPARSEC and improve its characteristics. Many experiments have been performed. Many changes of the MicroPARSEC software and some changes of hardware (PLIS reprogramming) have been done.

A bug in the hardware algorithm of the PC correlation was found. PLIS were reprogrammed.

Early for the first experiments the low precision ephemerides model was used in MicroPARSEC hardware. Now the high precision ephemerides are used.

The automatic processing of the experiments was reached. Now the full 8-hour tape can be processed automatically.

The post processing software was expanded by the observation quality control and multiband synthesis algorithm.

As result correlator with single MicroPARSEC board became fully operational.

The next goal in the MicroPARSEC correlator development is to expand number of the simultaneously processed channels and bases. It can be achieved by using a set of MicroPARSEC boards. The first multi board correlator was developed at the end of 2005. It consists of 4 MicroPARSEC boards, one S2-PT unit, special commutation unit and one IBM PC computer (Figure 1). This correlator can process up to 8 frequency channels on 1 base. The development is in its final stage. We hope to begin testing this correlator by the end of February 2006.

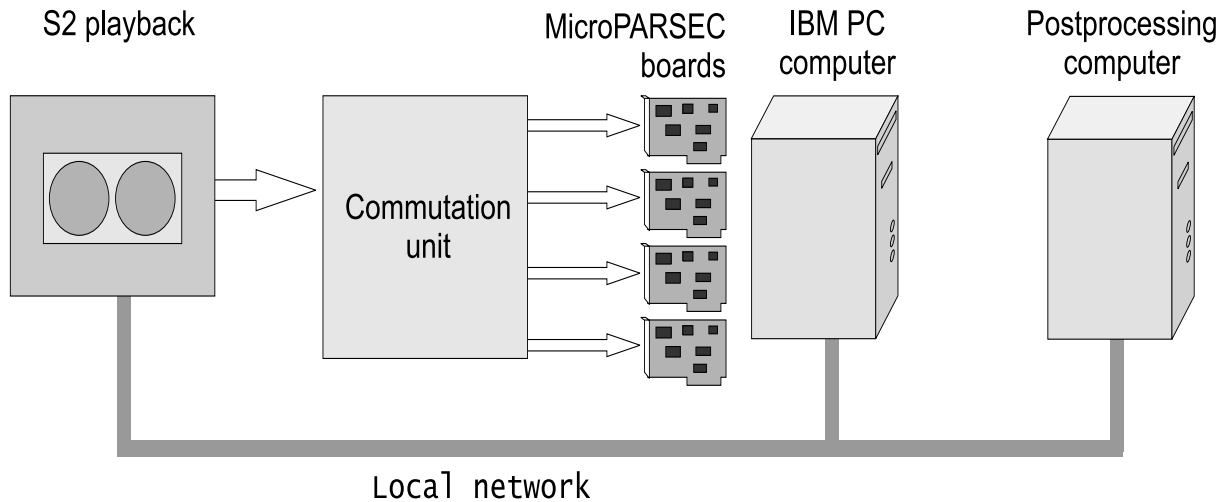


Figure 1. The 4 MicroPARSEC board correlator.

The next multibase multichannel MicroPARSEC correlator will consist of 12 MicroPARSEC boards and 2 S2-PT devices. We plan to begin testing in the middle of 2006.

Also we hope to use modern RadioAstronDigital (RDR) compatible playback units with the MicroPARSEC correlator.

4. Experiments Done

Since January 2005, 14 experiments have been observed at the Russian VLBI network QUASAR at the stations Svetloe, Zelechukskaya, and Badary. They have been processed at the IAA Correlator Center with the MicroPARSEC correlator.

The new VLBI station Badary did its first observation in August 2005. The correlation response was achieved at both X-band and S-band.

The MicroPARSEC correlator software was tested and improved in these experiments.

The post processing software of multiband synthesis also was tested.

The MicroPARSEC correlator was the main device to process these experiments. Also TISS-1M correlator was used.

Also one of the MicroPARSEC boards was used as mobile correlator for testing hardware of the stations. The board was connected to the sampling unit, before formatting and recording systems. The autocorrelation functions and spectra were obtained in real time. Some defects of the station apparatus were found and eliminated.

5. Staff

- Alexey Melnikov — software development, correlator operator
- Yuriy Rusinov — software development, correlator operator
- Violet Shantir — software development, post processing
- Igor Surkis — principle investigator, system integration, software development
- Vladimir Zimovsky — hardware development, system integration, correlator operator

6. Conclusion

The new correlator MicroPARSEC was successfully used to process geodetic VLBI observations in 2005. The main efforts in 2006 will focus on expanding the number of simultaneously processed frequency channels and bases.