PROCEEDINGS OF SCIENCE

VLBI data recording/playback system and correlators for “Radioastron” project

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A new hard disks based digital recorder, “Radioastron” data recorder (“RDR-1”), for VLBI and SVLBI data has been developed in data processing department of Astro Space Center. Five efficient specimens of “RDR-1” have already been made. These units were successfully used for tests of the “Radioastron” antenna. VLBI observations at 6 cm using Kalyazin 64-m antenna and Puschino 22-m antenna were also successfully carried out. The hybrid correlator has been developed in the data processing department of Astro Space Center. This correlator is compatible with the data exchange specification of “Radioastron” space radio telescope (SRT). The operating model of the system was developed to study the properties of the hardware and the software. The correlator was used during tests of the “Radioastron” antenna carried out in Astro Space Center. Moreover, all this equipment has already been used for primary data processing of VLBI experiments with participation of RT-64 in Kalyazin (KRAO ASC) and of RT-22 in Puschino (PRAO ASC). Some results of this data processing are presented.

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1. Introduction

The main feature of the ASC cross-correlator developed and produced for the "Radioastron" mission is a possibility of application of computer hard disk arrays for storage and playback of radio astronomical data. During VLBI experiments, the data are recorded with "Radioastron" data recorder ("RDR-1") onto hard disk arrays. The disks are mounted in demountable cartridges (racks). For correlation, a cartridge (rack) can easily be removed from the "RDR-1" system and placed in the cross-correlator rack.

2. The basic characteristics of the "RDR-1" system

- Clock frequency for data reception is up to 32 MHz.
- The established frequencies are 2, 4, 8, 16, 32 MHz.
- Speed of data recording is 128 Mbit/s (up to 448 Mbit/s).
- Time of continuous data recording is more than 14 hours.
- Volume of the information to be written is up to 900 Gbit.
- Number of input channels for data recording is up to 16.

The system uses an external synchronization. The standard clock signal frequency is 32 MHz. Time sampling includes 1 Hz labels as well as the 32 MHz clock signal.

3. The basic parameters of the hybrid correlator

The two-station hybrid correlator has been manufactured and successfully tested. We intend to upgrade this device up to five-station correlator next year. The basic parameters of the current version of hybrid correlator are:

- Number of input channels: 2.
- Channel bandwidth: 2, 4, 8, 16 MHz.
- Integration time: 0.1, 1, 2, 3, ..., 5000 s.
- Delay to be inserted: 0, ..., 0.5 s.

The hybrid correlator uses the XF-scheme. The main advantage of this device is fast data processing. For example, correlation function for 1-second time interval could be estimated in 2 – 3 seconds.

4. The software correlator

The software correlator has been developed using C++ 7.0. The FX scheme was adopted. The C++ software is very flexible and allows to process data more accurately than in the hybrid correlator. The disadvantage of this software is slow data processing. We intend to solve this problem via application of Multi-Processor System in our correlation computer.

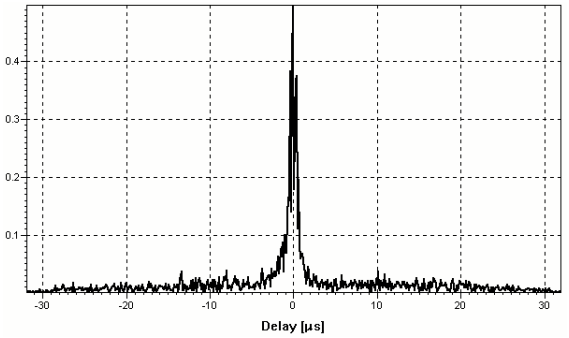

Figure 1: Correlation function amplitude vs delay. Test experiment: "Puschino – Kalyazin", 6-cm band, source: 3C273. Software correlator was used.

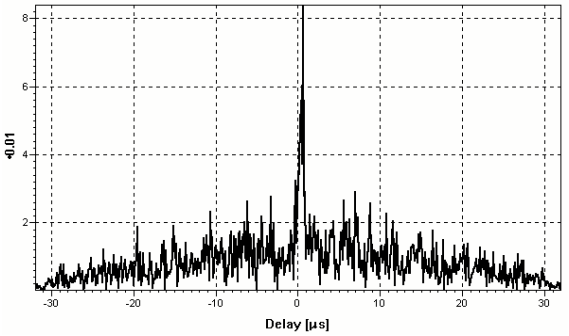

Figure 2: Correlation function amplitude vs delay. Test experiment: "Puschino – Radioastron", 6-cm band, source: Cyg A. Software correlator was used.

5. Conclusion

The "Radioastron" data recorder "RDR-1" for VLBI and SVLBI data has been developed in Astro Space Center. Preliminary tests of this recorder as well as of hybrid and software correlators demonstrate that all hardware and software is compatible with the "Radioastron" data exchange specification and can be useful for this SVLBI project.

Acknowledgments

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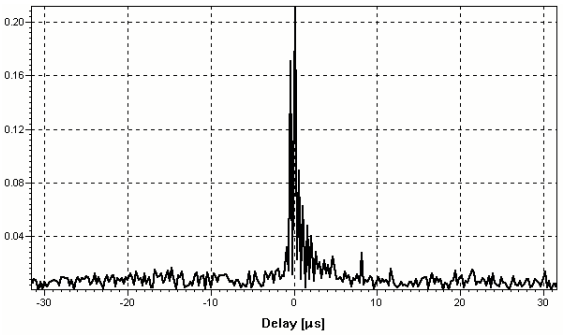

Figure 3: Correlation function amplitude vs delay. Test experiment: "Puschino – Radioastron", 6-cm band, source: Cyg A. Hybrid correlator was used.

References

[1] Carlson B.R. et al. 1999, PASP, 111, 1025