

Institute of Applied Astronomy Technology Development Center

*Leonid Fedotov, Dmitry Ivanov, Alexander Ipatov, Irina Ipatova, Alexey Lavrov,
Mikhail Kosobokov, Andrey Mikhailov*

Abstract

The domain of IAA TDC includes the development of software and hardware for Russian VLBI network QUASAR. This report describes IAA activities in this direction. The main result of this year is the beginning of regular VLBI observations on the three station QUASAR network.

1. General

Technology Development Center is responsible for all parts of the Russian VLBI network and consists of separate laboratories developing hardware and software for this project. Now the 32 m radio telescopes in Svetloe and Zelenchukskaya are participating in international VLBI network observations and in domestic radioastronomical and VLBI observations.

The Badary station was equipped with improved VLBI registration terminal produced at IAA. The main result of this year is the beginning of regular VLBI observations on the three station QUASAR network. The first EOP series was obtained.

2. Technical/Scientific

2.1. VLBI Data Acquisition and Recorder Equipment

New VLBI Data Acquisition System was installed at Badary observatory. The system consists of two-channel IF Distributor, new DAS R1000 with 13 VC's (currently available) and 16-channel Samplers Unit (Figure 1). This equipment was developed at IAA RAS. S2-RT terminal was used as a recorder. This VLBI equipment configuration is used in regular QUASAR network observations.

We plan to add soon the 14th VC to the DAS and to install a Mark 5B recorder with Converter from S2 interface to VSI-H which is under construction at IAA.

2.2. The Cable Length Calibration System

The Cable Length Calibration System used in VLBI observations is a standard part of Mark III/IV terminal. It consists of two separate parts: Ground Unit and Antenna Unit combined with Phase Calibration Generator. The Antenna Unit built at IAA was already installed at "Svetloe" observatory and is currently used together with standard Mark IV Ground Unit. We are developing the new Ground Unit to equip the other two antennas of the QUASAR network. The new device is compatible with the Mark IV and based on the same principle of modulation of 5 MHz reference frequency with 5 kHz signal. The prototype of this device (Figure 2) was installed at the end of the year at "Zelenchukskaya" observatory.

2.3. New Receivers Digital Control System "G3"

The new Receivers Digital Control System was developed and installed at all observatories of the QUASAR VLBI network. This is the third generation of receivers control systems at IAA and

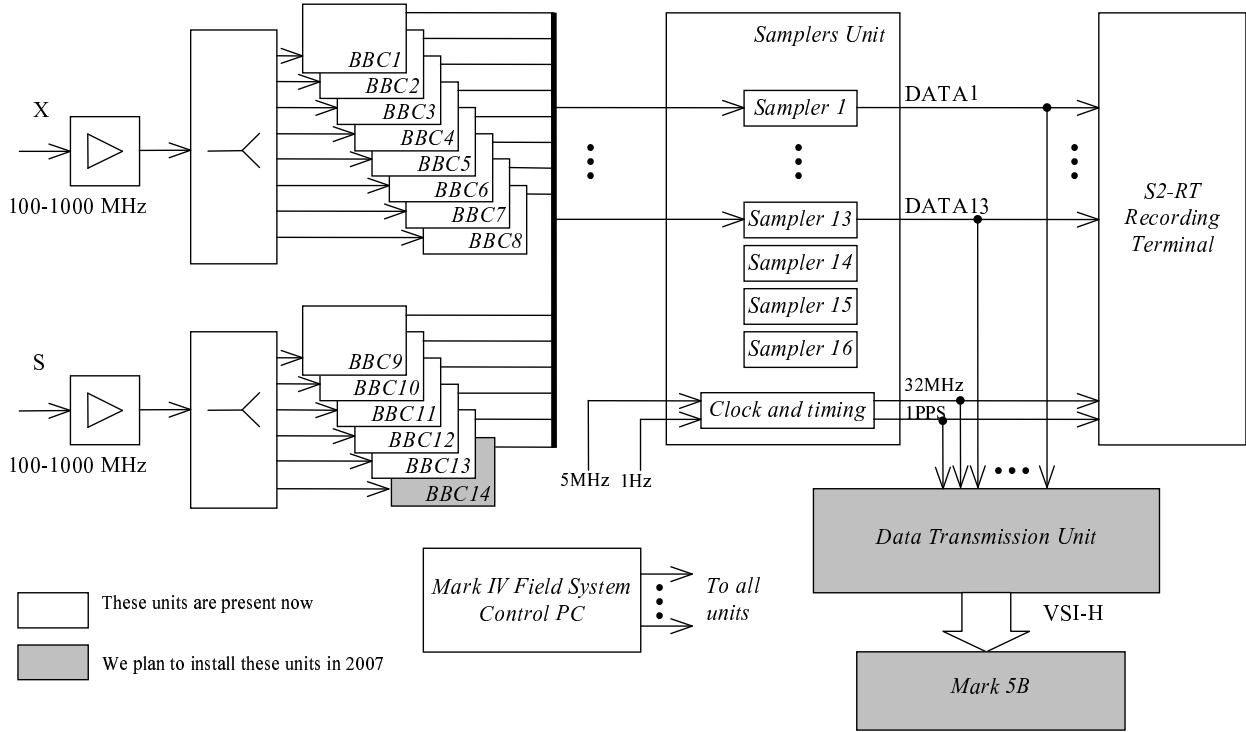


Figure 1. VLBI Data Acquisition Equipment Configuration at Badary observatory

therefore it was named “G3”.

The G3 is a distributed control system based on a common data bus. Figure 3 shows location of system parts on the radio telescope. The G3 system consists of: RS232 to RS485 Transceiver, Power Control Unit (PCU), up to 16 Receiver Control Units (RCU), Distributor and up to 8 Cryogenic System Control Units (CSCU). Each control unit contains Atmel Atmega8535 Single-chip Microprocessor with integrated serial port, digital I/O ports and 10-bit analog-digital converter.

The Power Control Unit distributes the common data bus to the Receiver Control Units and to other devices in secondary focus cabin of radio telescope. It also controls the power-on commands of the Receiver Control Units.

The Transceiver, PCU and Distributor provide optical isolation up to 1000 V from long cables. The G3 system uses its own protocol for data communication. It allows to connect up to 127

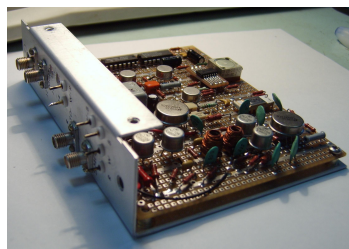


Figure 2. Prototype of the Cable Length Calibration System Ground Unit (without phase comparator)

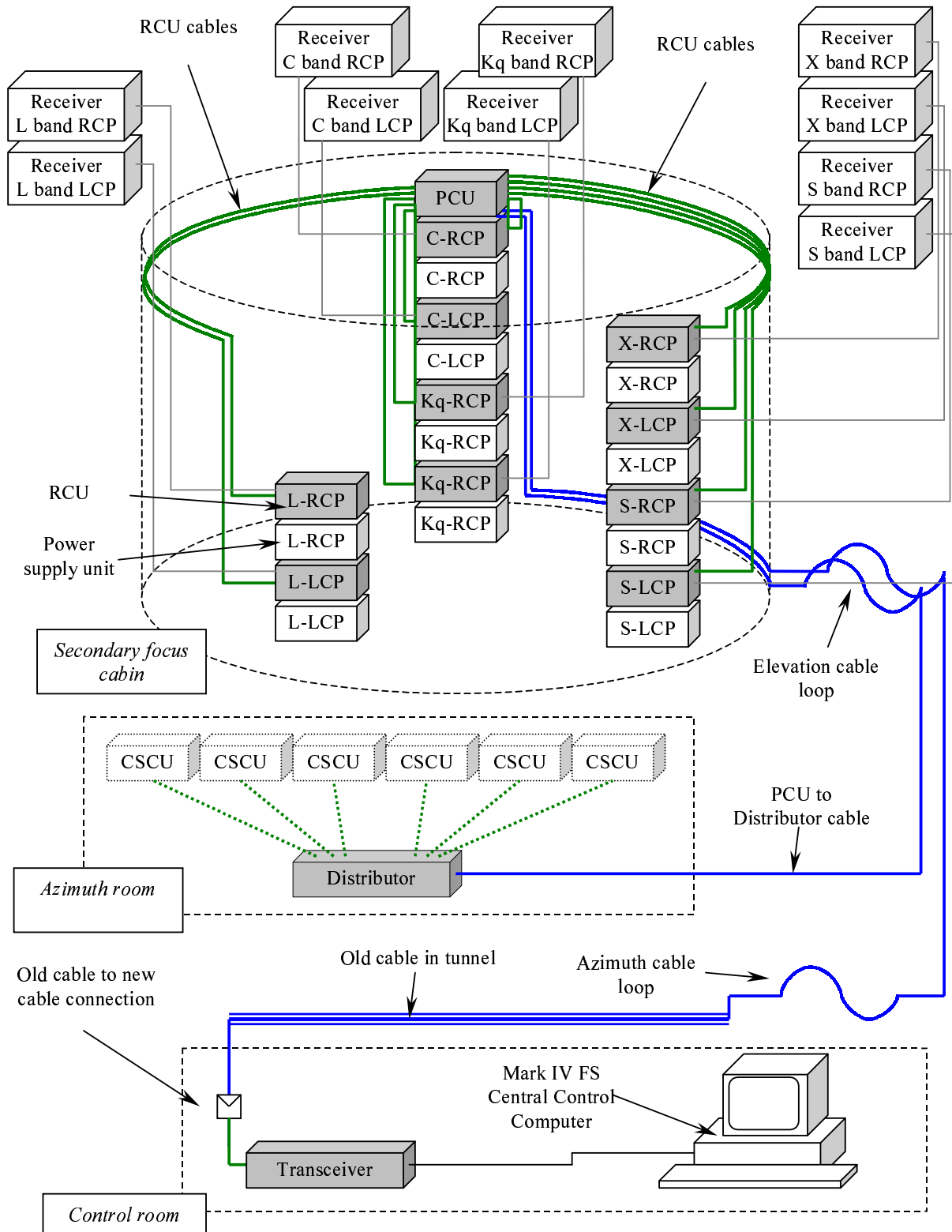


Figure 3. New Receivers Digital Control System "G3"

devices to one serial interface. The protocol is optimized for low transfer rate devices with relative simple control logic. The G3 control software is integrated into the station software on Mark IV Field System Central Control Computer.

We plan to use common bus and protocol designed for G3 as standard facility for development of control interfaces for different devices on radio telescope. Some examples of ongoing projects to be mentioned here are LO and Phase Calibration Control Unit and R1000 DAS.

2.4. New Receiver for 7 mm Band

New receiver and feed for the 7 mm band were installed on antenna at “Svetloe” observatory at the end of year. Switching to this frequency band in geodetic VLBI is now a topic for discussion within international VLBI community. The new receiver should be used for the evaluation of antenna performance on this band. We plan to use it for Solar observations as well.

Input frequency range of the receiver is 42.1–42.6 GHz, synchronized LO frequency is 42 GHz. The front-end amplifier is not cooled. Achieved system noise temperature is about 540 K.

3. Technical Staff

For all, the IAA address (8, Zhdanovskaya st., St. Petersburg, 197110, Institute of Applied Astronomy (IAA) RAS, Russia, Director Andrey Finkelstein, FAX +7-812-230-7413) is valid.

Table 1. Technical Staff

Prof. Alexander Ipatov	Vice Director	Radio telescope performance	+7-812-275-1004	ipatov@ipa.nw.ru
Prof. Nikolay Koltsov	Main Scientific Researcher	VLBI and radiometric registration system	+7-812-235-3316	nec@ipa.rssi.ru
Dr. Sergey Smolentsev	Vice Director	Time keeping Frequency standard	+7-812-275-4415	smolen@ipa.rssi.ru
Dr. Alexander Salnikov	Chief of Laboratory Communication and Computer Systems	Network Communication Computers	+7-812-230-8361	ais@ipa.nw.ru
Dr. Edward Korkin	Main Scientific Researcher	Dish metal constructions	+7-812-230-7415	korkin@ipa.rssi.ru
Dr. Irina Ipatova	Senior Scientific Researcher	Receivers Antenna performance	+7-812-230-6496	ipatova@ipa.rssi.ru
Dr. Vyacheslav Mardyshkin	Chief of Receivers Laboratory	Receivers Refrigerators Antenna performance	+7-812-230-6496	vvm2@iaa.nw.ru
Dr. Andrey Mikhailov	Scientific Researcher	FS software Radio telescope control system	+7-812-230-6496	agm@ipa.nw.ru
Dr. Dmitry Ivanov	Chief of Laboratory Time and Frequency	Time keeping Frequency standard	+7-812-230-7416	labtf@ipa.rssi.ru
Dr. Leonid Fedotov	Chief of Laboratory Signals Conversion and Registration	VLBI DAS and registration system	+7-812-235-3316	flv@ipa.rssi.ru