Russian Radio Interferometer of New Generation

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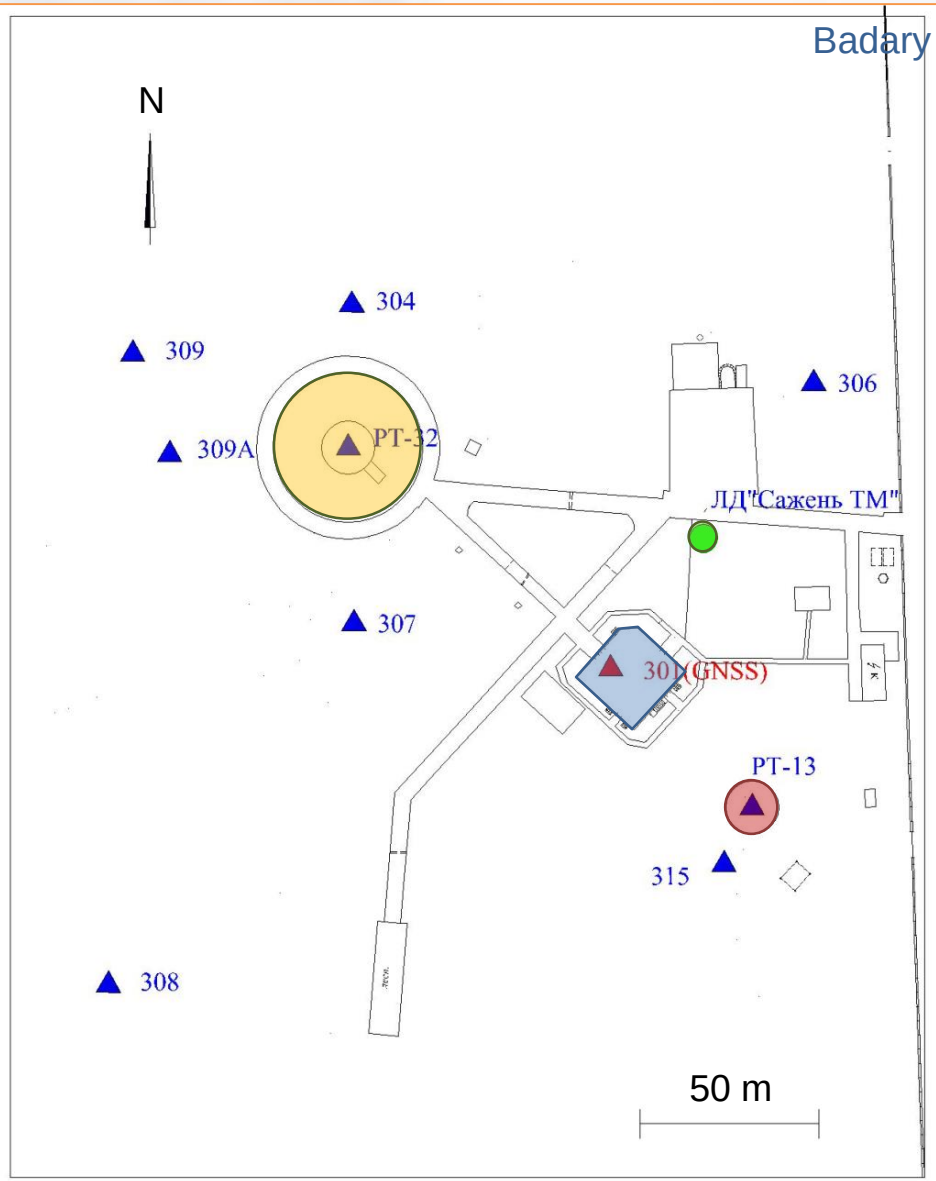
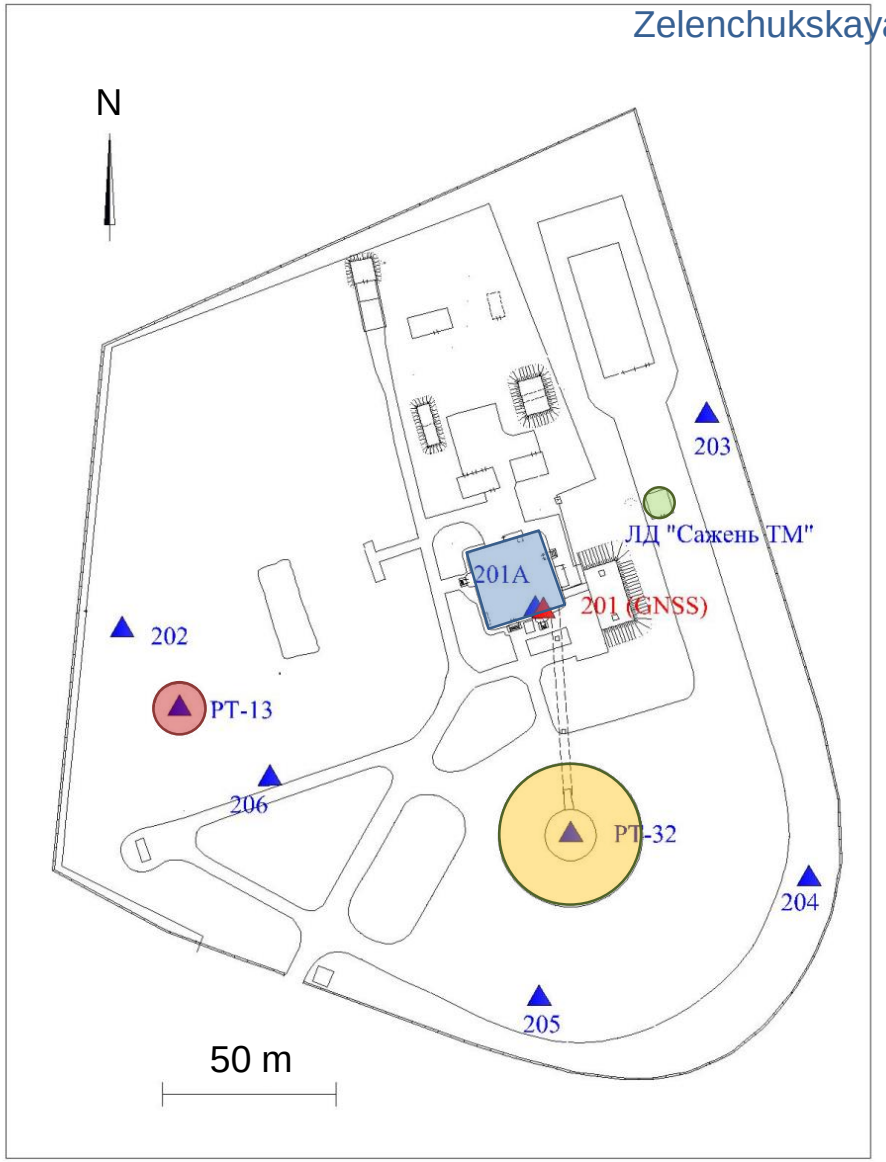
"Quasar" VLBI Network

Antenna Systems of RT-13 radio telescopes

Technical requirements	
Main mirror diameter	13.2 m
Mount	alt-azimuth
Sub-reflector scheme	Ringfocus
Sub-reflector Mount	Hexapod
Azimuth speed	12 °/sec
Elevation speed	6 °/sec
Limits by Az; El	±270°; 0° – 110°
Operation	24h/7d
Tracking accuracy	±15 arcsec
Surface accuracy (RMS)	0.3 – 0.1 mm
Frequency range	2-40 GHz
The surface efficiency	> 0.7
Polarization	LCP and RCP
Ambient temperature	–35°C to +50°C
Humidity	up to 100%
Snow load	100 kg/m2
Wind velocity	50 m/sec

Location of RT-13





Tower (foundation) construction

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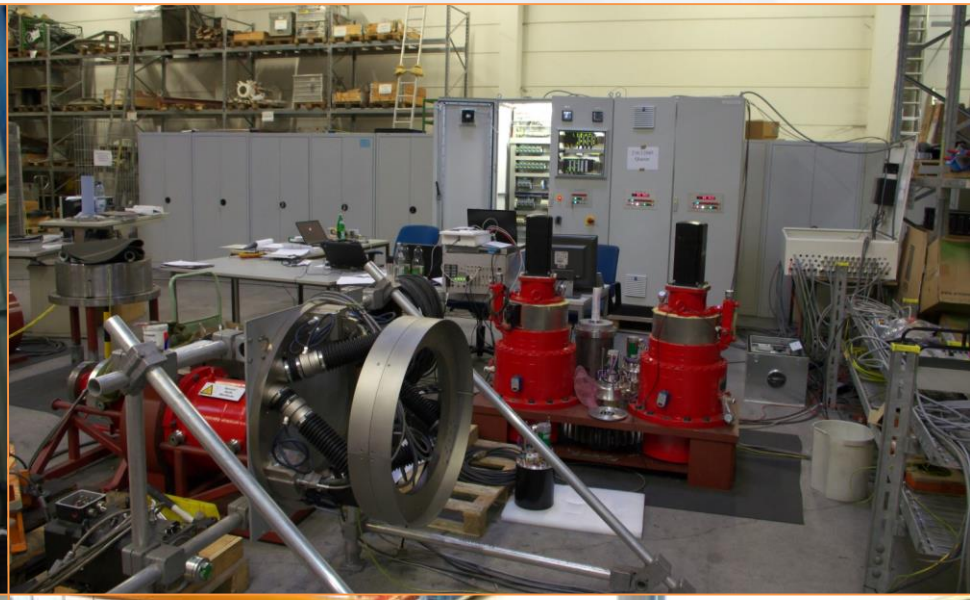
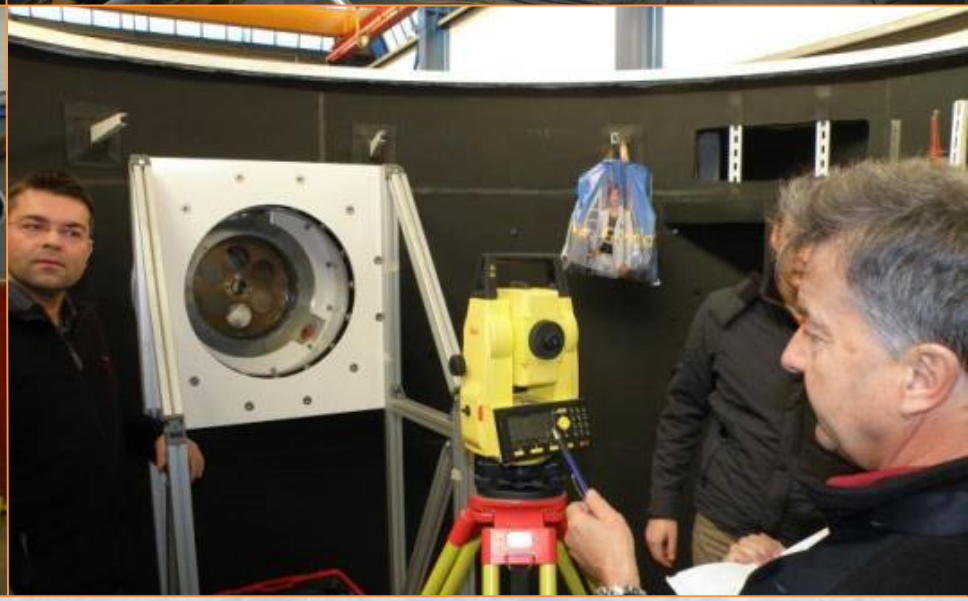
Fabrication and in-plant tests

Fabrication and in-plant tests



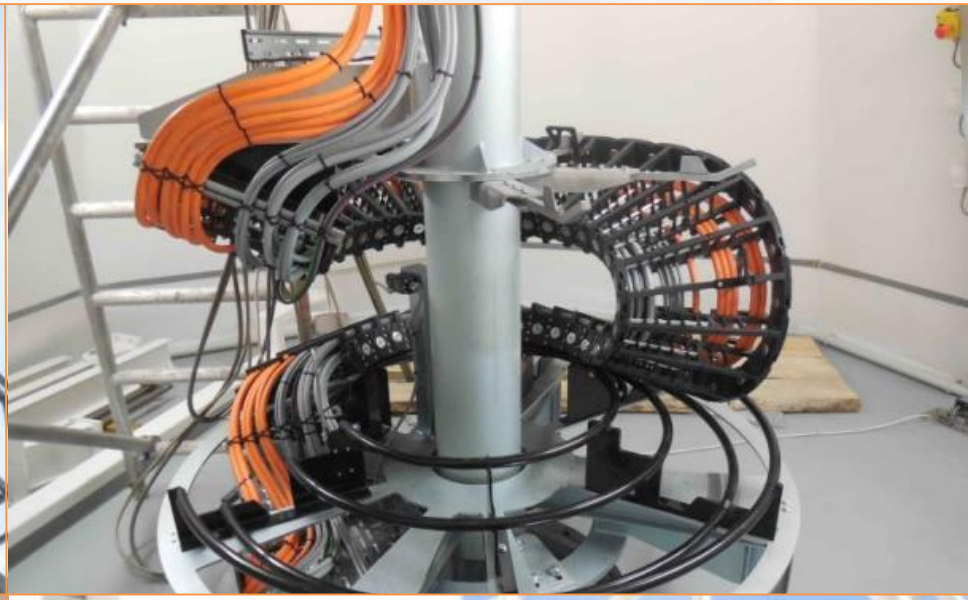


Delivery

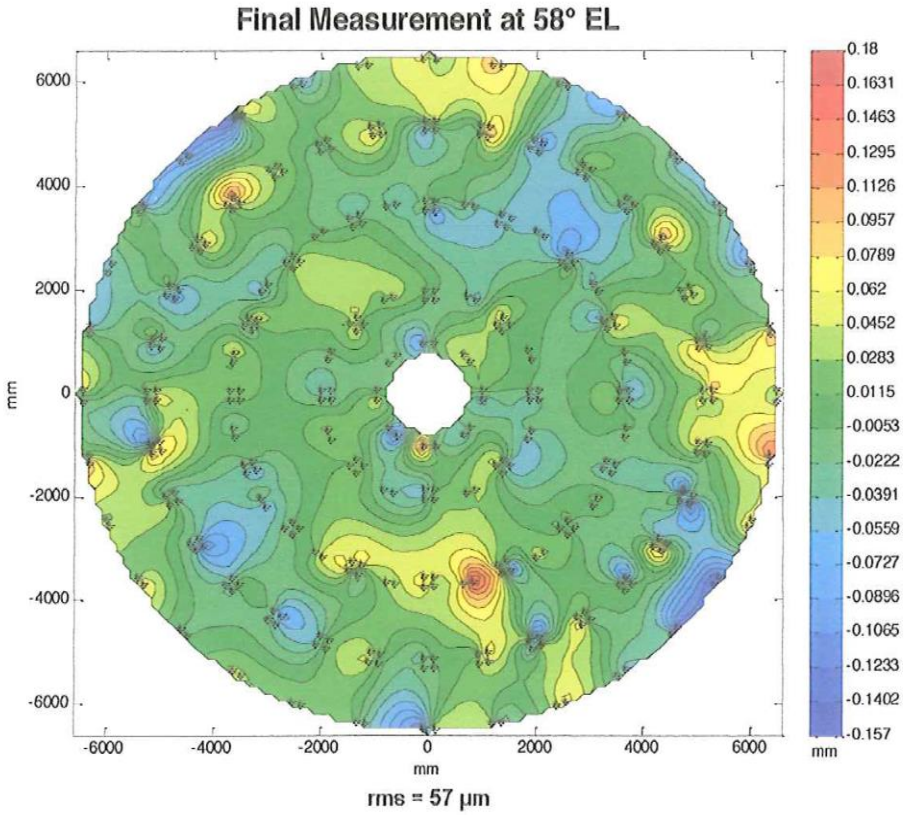
On-site installation works

On-site installation works in Zelenchukskaya

On-site installation works



Photogrammetric measurement of reflective surface



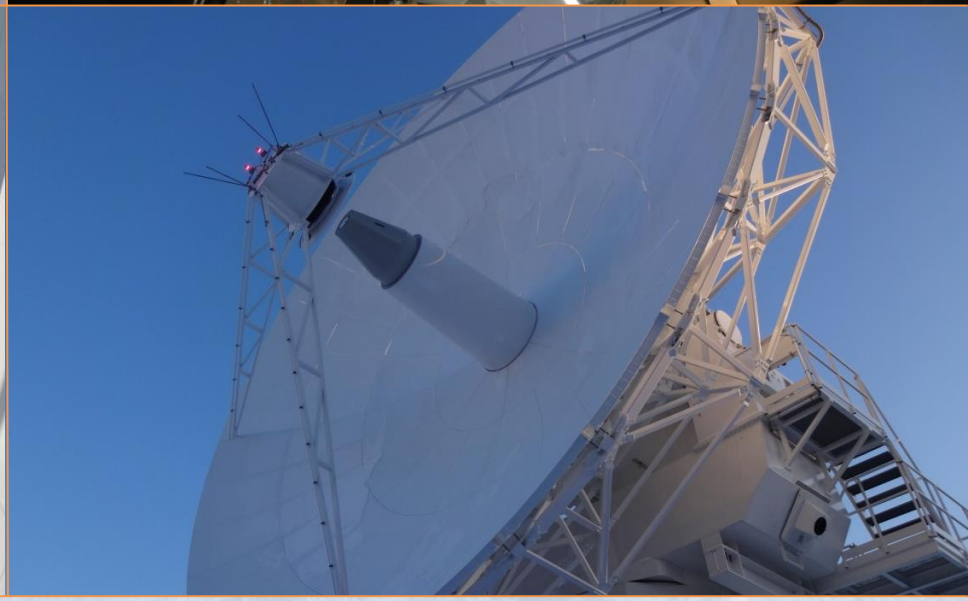
Elevation (°)	RMS (µm)	
	Badary	Zelenchukskaya
58	57	53
0	151	142
90	132	130

Front end system

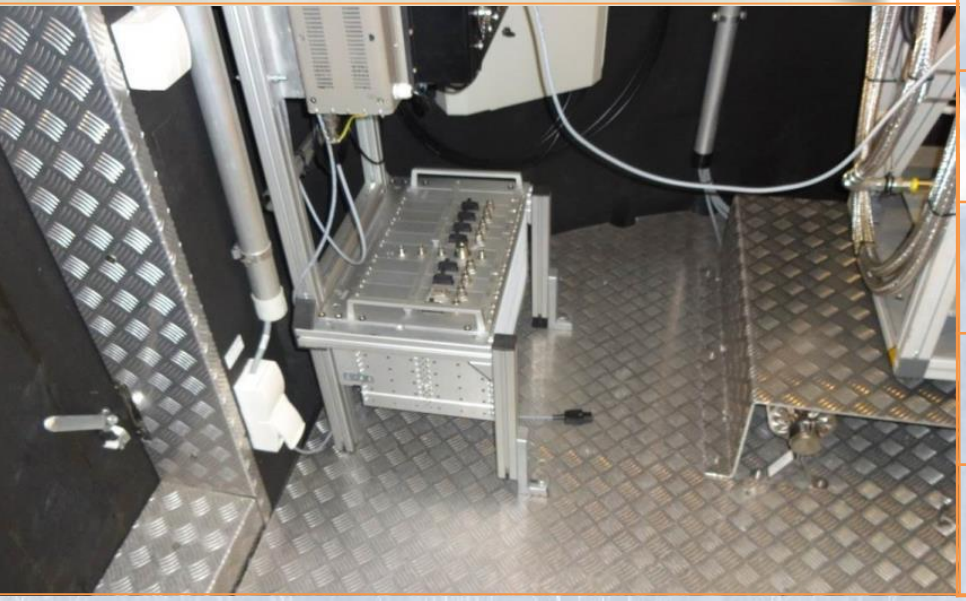
Triband S/X/Ka feed			
Band	S (13 cm)	X (3.5 cm)	Ka (1 cm)
Frequency (GHz)	2.2-2.6	7.0-9.5	28.0-34.0
Polarization	RCP+LCP		
Results of on-site measurements, 14.04.2014, Badary, 60°			
Tsys (K),	35	25	70
SEFD (Ja)	1000	670	2100
Surface efficiency	0.7	0.8	0.7

Installation and calibration of receiving system

09.12.2014

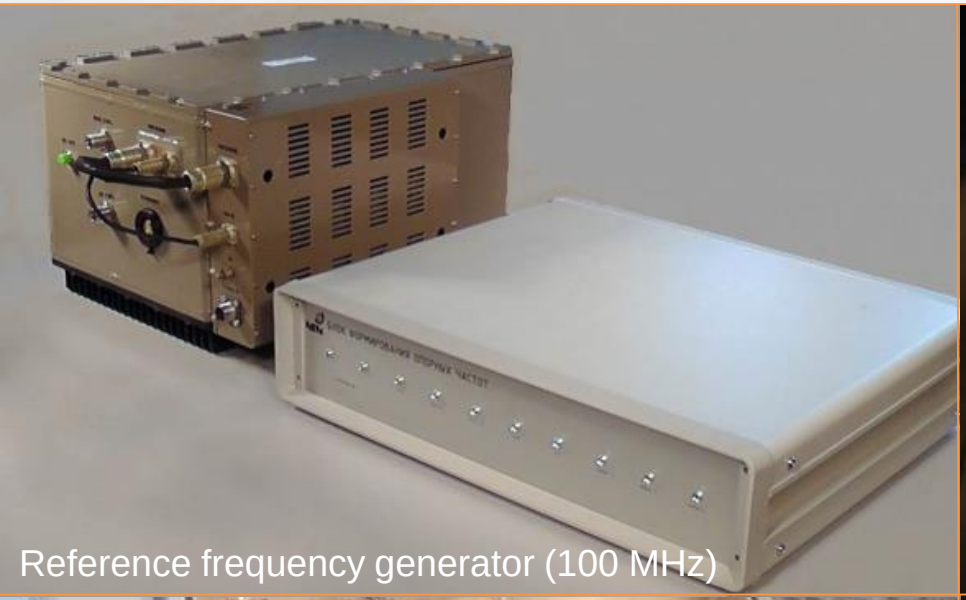


Digital back end system

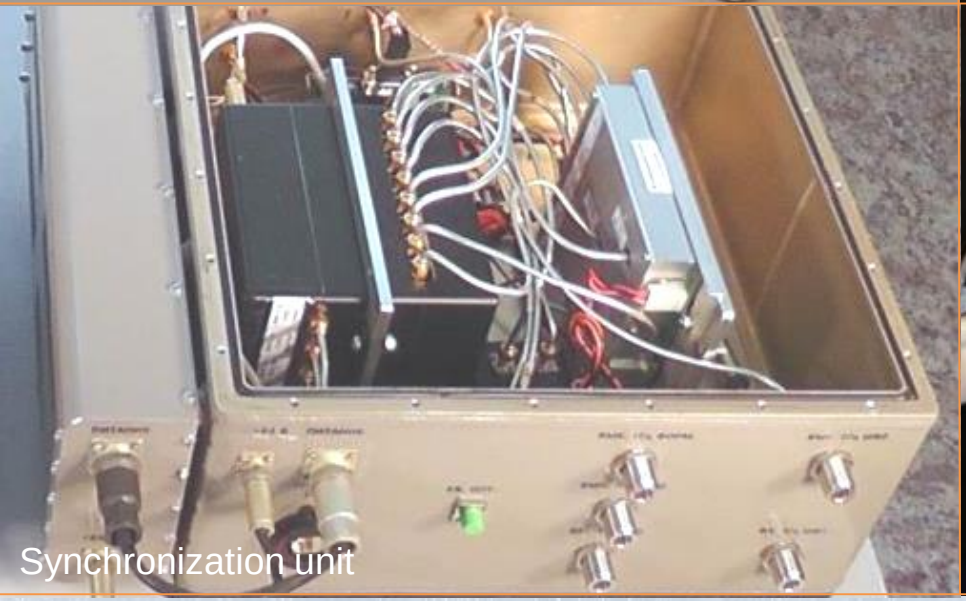


BRoadband Acquisition System (BRAS)	
Number of channel	8
Intermediate frequency	1024 - 1536 MHz
Channel bandwidth	512 MHz
ADC	8 bits, Fs=1024 MHz
Output samples width	2/8 bits
Data frames format	VDIF
Total output data rate	16 Gbps
Location	Focal cabin

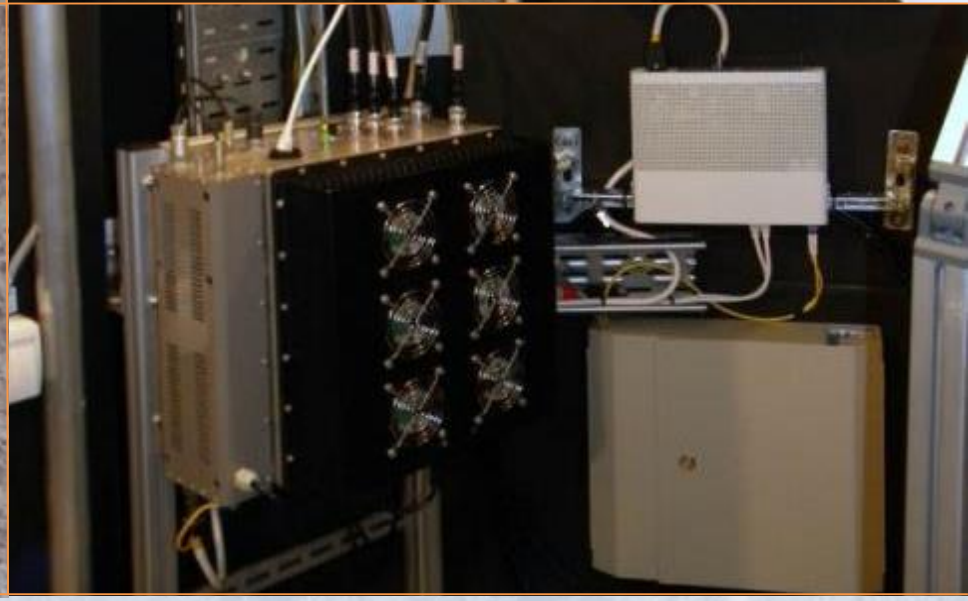
Time and frequency synchronization system



Reference frequency generator (100 MHz)



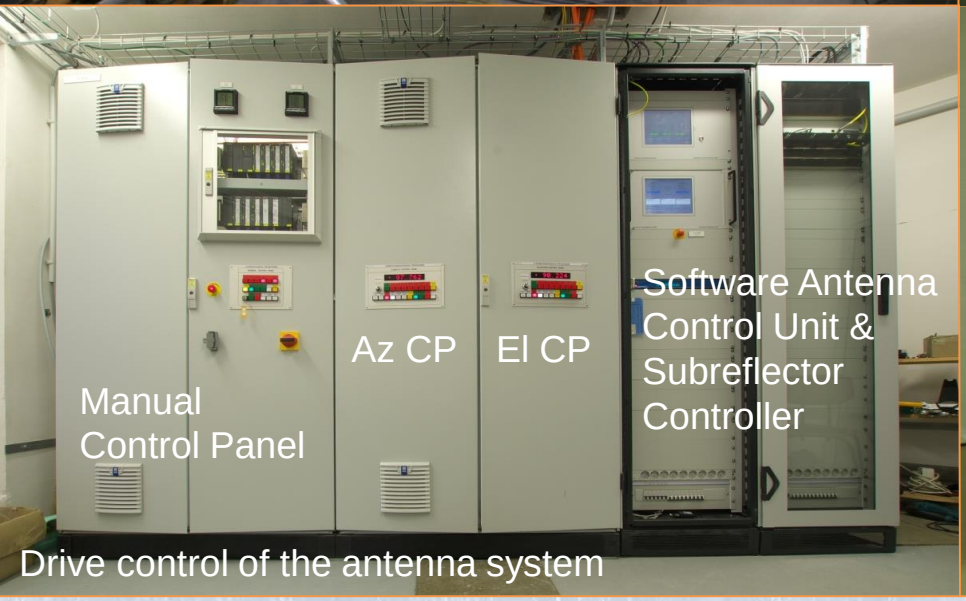
Synchronization unit



Antenna control system


In-plant tests of control system

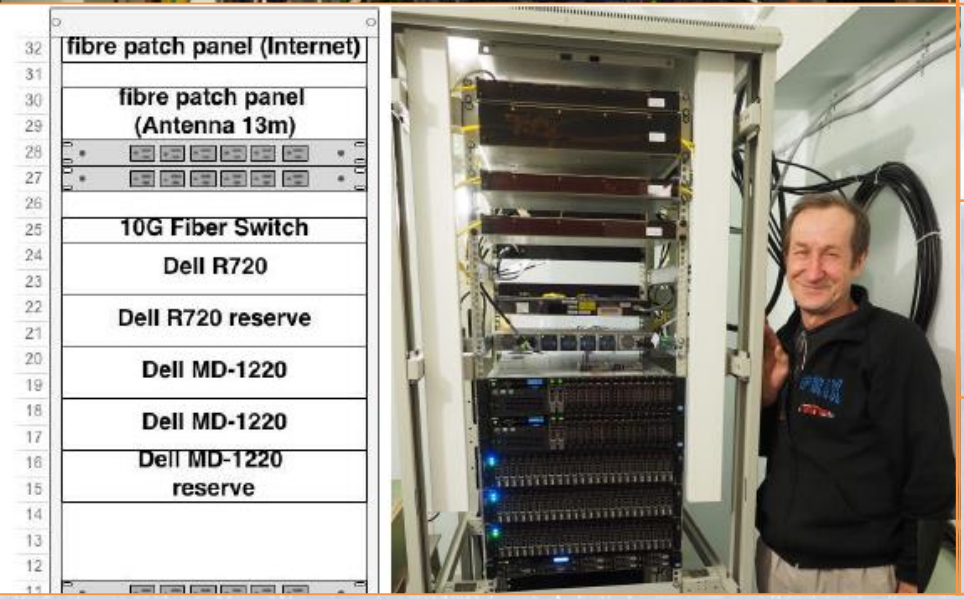

Mechanical control



Drive control of the antenna system


Control room

Data Recording and Transmitting system

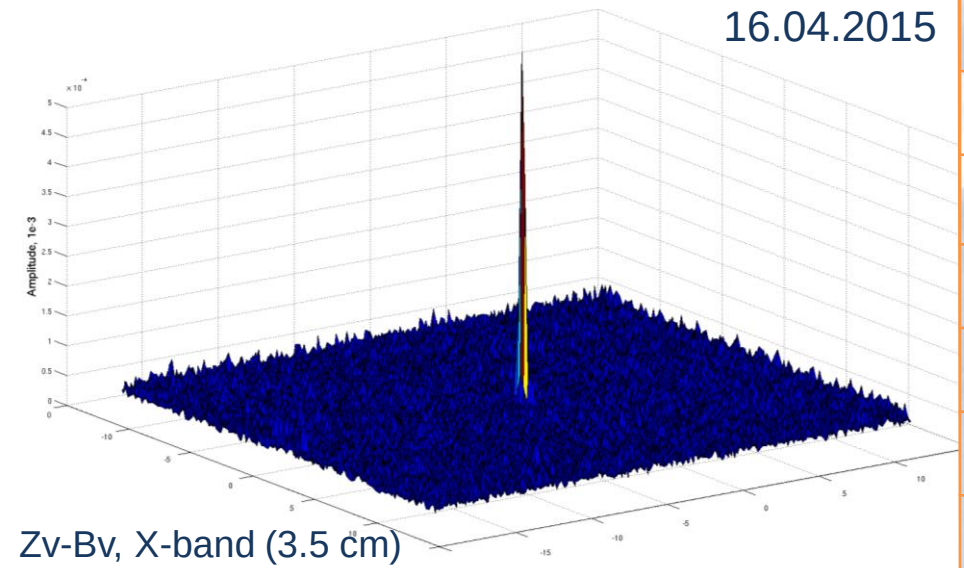


Data Recording System (DRS)	
Number of data streams	8
Total data recording rate	16 Gbps (8×2Gbps)
Data transfer rate to DPC (with recording and buffering)	0,4 - 2Gbps
Data storage	20 TB (4-5 1h sessions)
Data format	VDIF

Software Correlator

High-Performance Computing Cluster	
Hybrid-blade server	40
CPU	2×(Intel E5-2670, 8-core, 2.6 GHz)
GPU	2×(NVIDIA Tesla K20)
RAM	64 – 256 GB
Data storage	75 TB
Ethernet	16×10 Gbps

16.04.2015



Zv-Bv, X-band (3.5 cm)

Software Correlator	
Number of stations	up to 6
Input data stream	up to 16 Gbps (from each station) in near-real time
Number of bands	4
Bandwidth	up to 1024 MHz
Input data format	VDIF
Delay (RMS)	10 ps

Zelenchukskaya and Badary

Thank you very much for your attention!