

The Multi-Beam Meter Wavelengths Array

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Background

- Recently there has been an increasing interest in astronomy to studying the bursts-like events and rapid changes of radiation intensity in different ranges of the electromagnetic spectrum. These phenomena are usually determined by extremely powerful ejection and transformation of energy in some kind of extreme physical conditions.
- Among these phenomena one can name the following ones:

- Radio emission accompanying gamma bursts;
- Giant pulses of radio pulsars; pulsars with long-time switch off radio emission;
- Transient sources;
- Rapid changes in the flux density of extragalactic radio sources;
- Supernova explosions;
- Microlensing phenomena;
- Unusual interstellar scattering of radio emission;
- Some active processes on the Sun (coronal mass ejection) and in the interplanetary plasma, etc.

- The above-mentioned burst-like events have not almost been investigated before in radio band mainly due to the lack of the appropriate radio telescopes. To fill this lack a new, relatively low cost meter wavelength radio telescope is suggested for construction at Pushchino Radio Astronomy Observatory (PRAO FIAN).

Requirements to the New Instrument

- frequency range (*72.8-73.5; 150.6-151.3MHz;*
LPA: 109-113 MHz)
- the antenna elements – polarizations
- the effective area $> 3 \times 10^4$ sq.m.
- the large sky area
- the beam is $\sim 1'$ (small confusion)
- $\sim 2-3$ independent beams (outer stations)
- total bandwidth up to 30 MHz

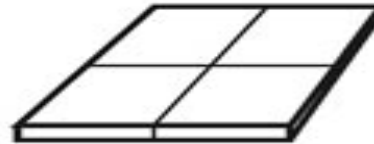
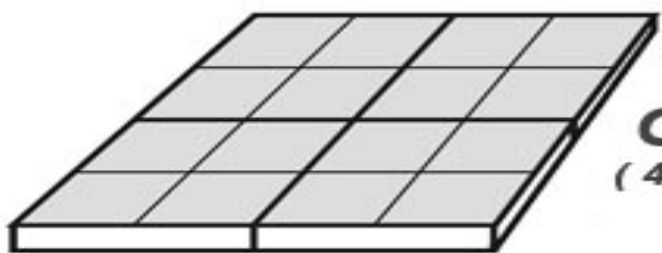
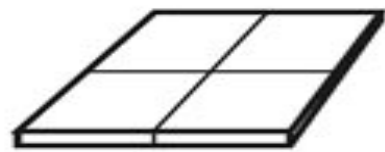


The main parameters

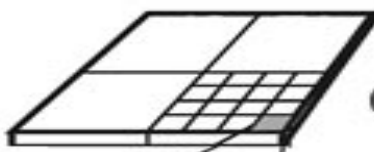
- Frequency range
 - Effective area
 - Polarization
 - FoV
 - Number of simultaneous beams
- 60(40) – 152 MHz
 - $>10^5$ sq.m. at 60MHz
 $>5 \times 10^4$ sq.m at 150MHz
 - two polarization modes
 - ~ 2 steradians
 - >100 (for the central core)
2-3 (for outer stations)

The configuration and structure

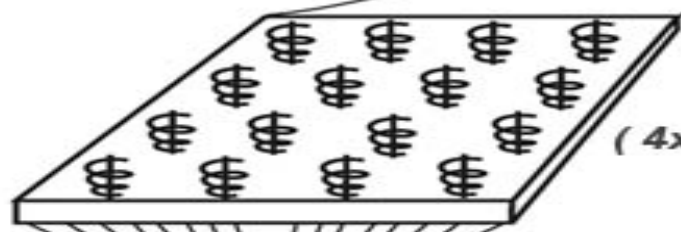
- The core (~25% of the total effective area).
- ~ 15 outer stations (~75% of the area) placed inside the 5 km radius.
- The module consist of 16 wideband antenna elements.
- The station consist of 64 modules.
- The core consist of 4 station.
- An output signal will transformed into the digital form.



Core
(4096 active elements)



Station
(1024 active elements)



Module
(4x4=16 active elements)

Beam-forming matrix

Commutator

A D C

Control room
* Beam-forming system
* Registration

Conclusion

- The PRAO site could be considered as an appropriate place for the location of the future radio telescope. In this case the existing infrastructure of the observatory and the experience of the PRAO staff in the meter wavelengths radio astronomy could be used during the construction of the instrument as well as for its future operation.
- New radio telescope can work together with LOFAR: first of all as large guide in the case of the burst-like events detection and second one as the possible interferometer with long baseline.