The RealTime challenges for the EISCAT_3D Phased Array Radar system

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AARI, Russia

IRA, Ukraine

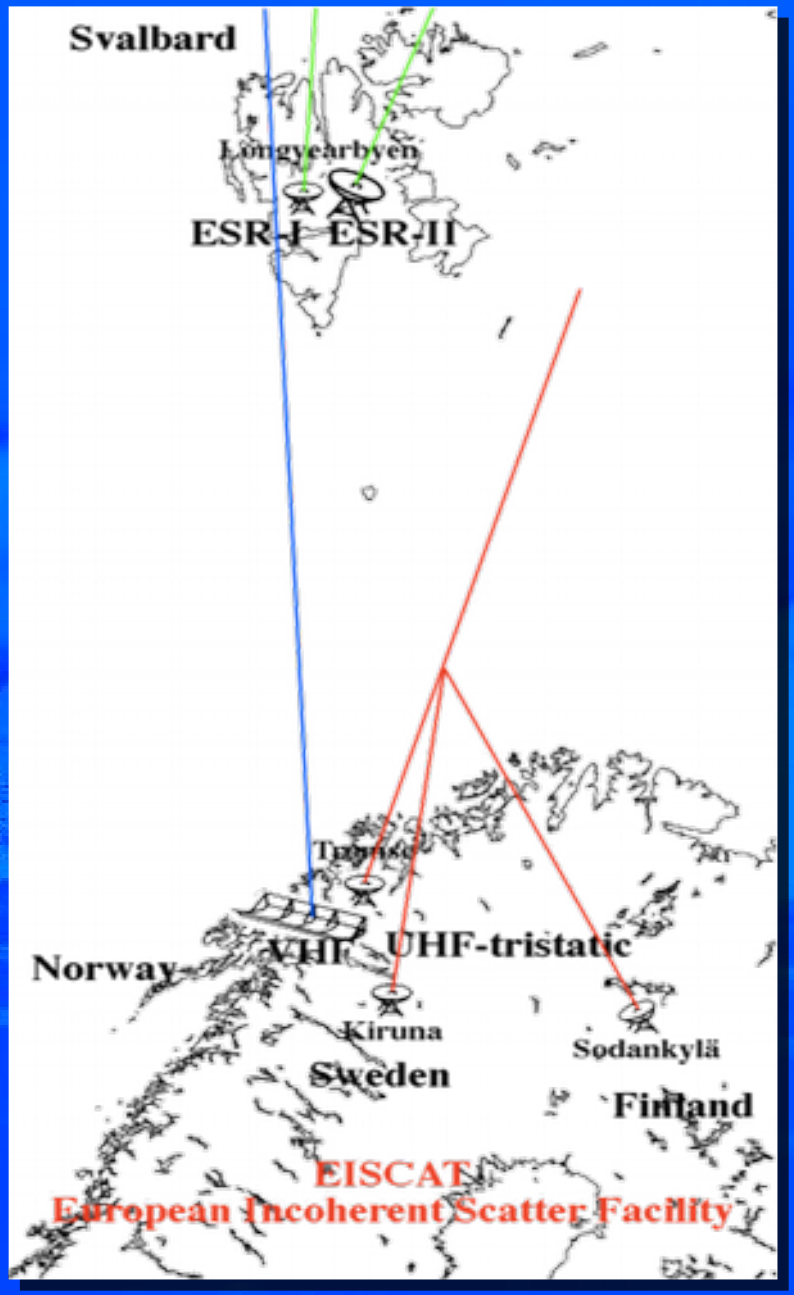
IRAP, France

KOPRI & KASI, S. Korea

* EISCAT host countries

Current EISCAT installations in Northern Scandinavia and Finland

Unique: tristatic IS radar!

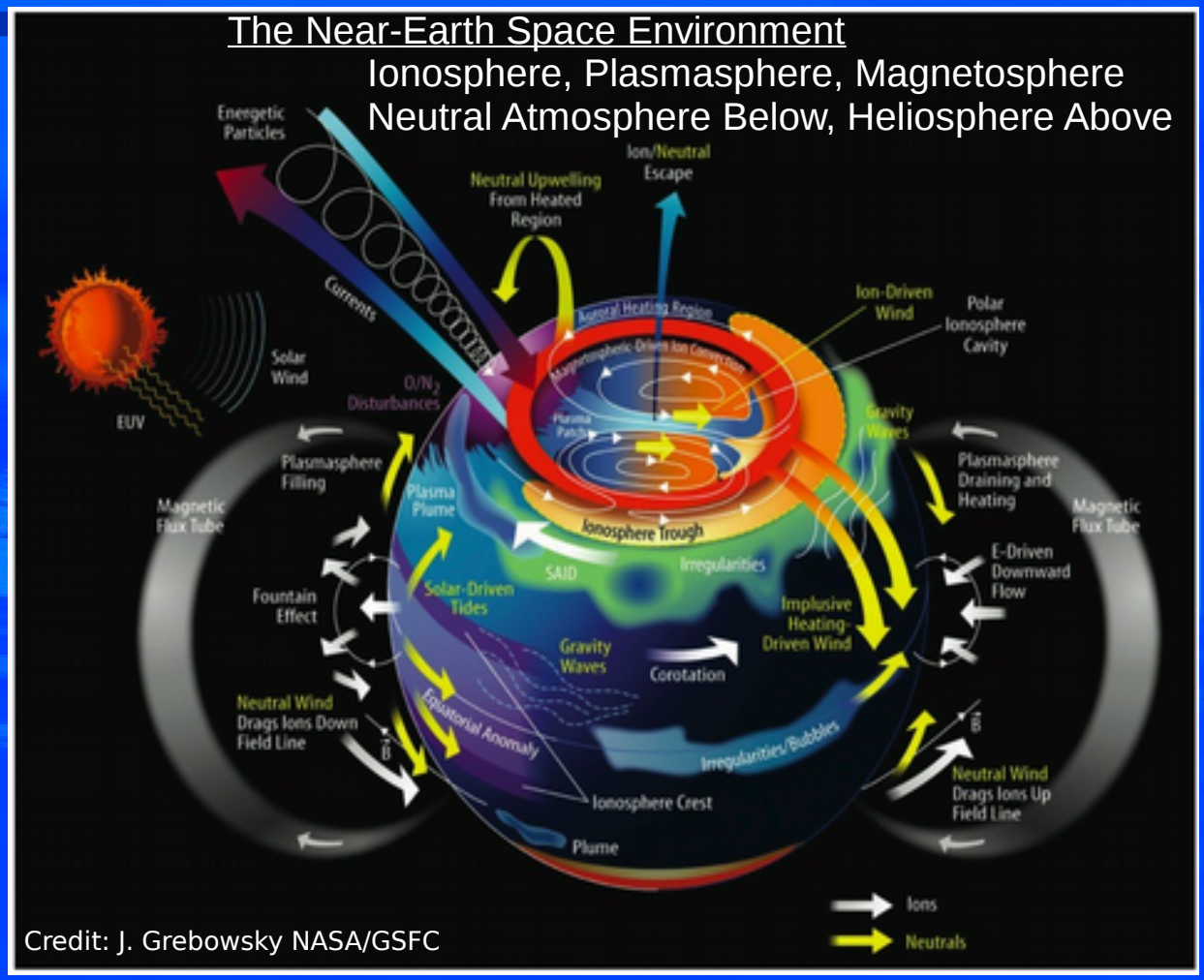


EISCAT Radars

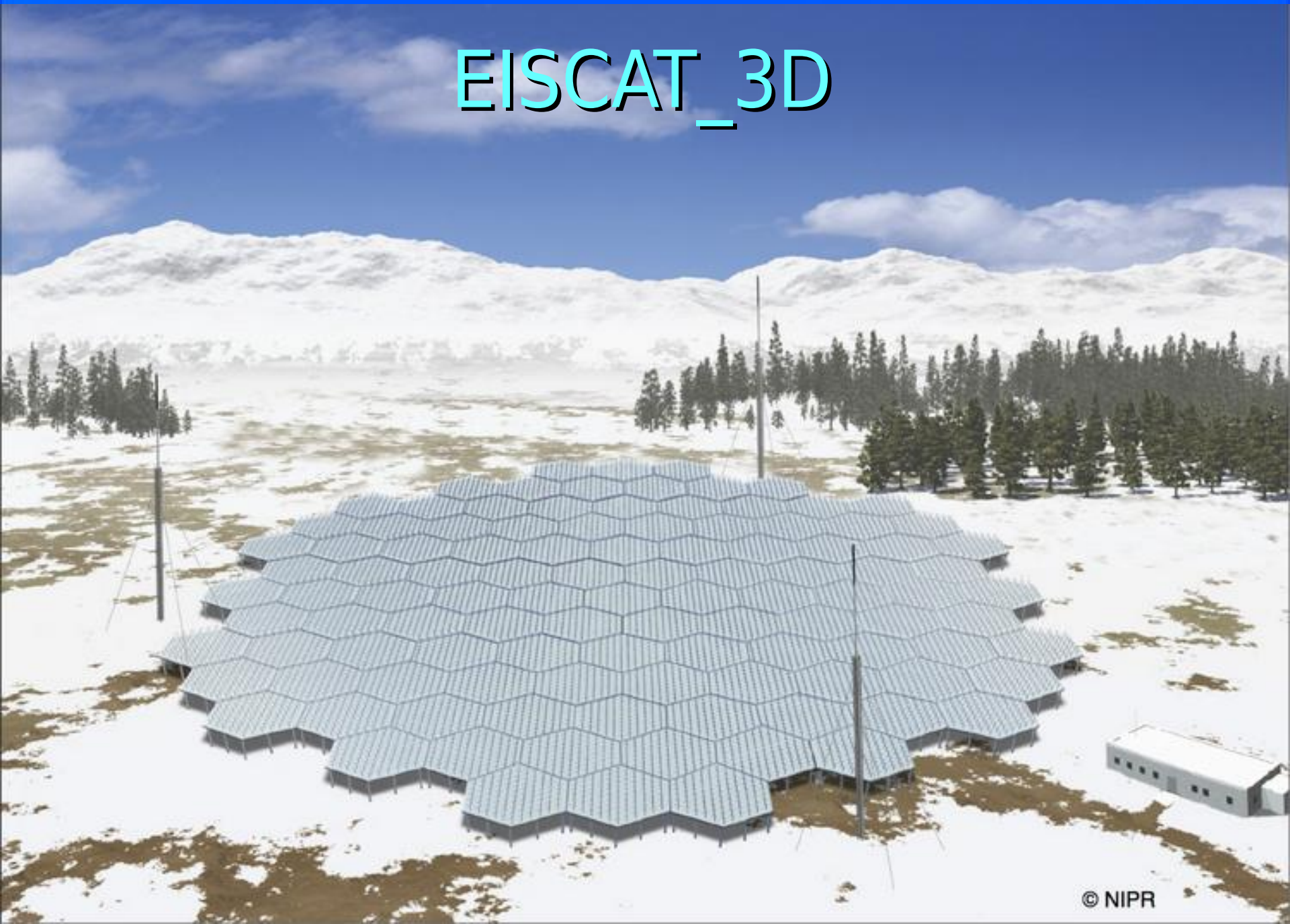
EISCAT Science

How is Earth's atmosphere coupled to space?

- Space weather effects
- Climate change
- Space debris
- Near-Earth object studies
- Radio astronomy
- Micrometeors
- Basic plasma physics via active experiments
- e-Science



EISCAT_3D



EISCAT_3D

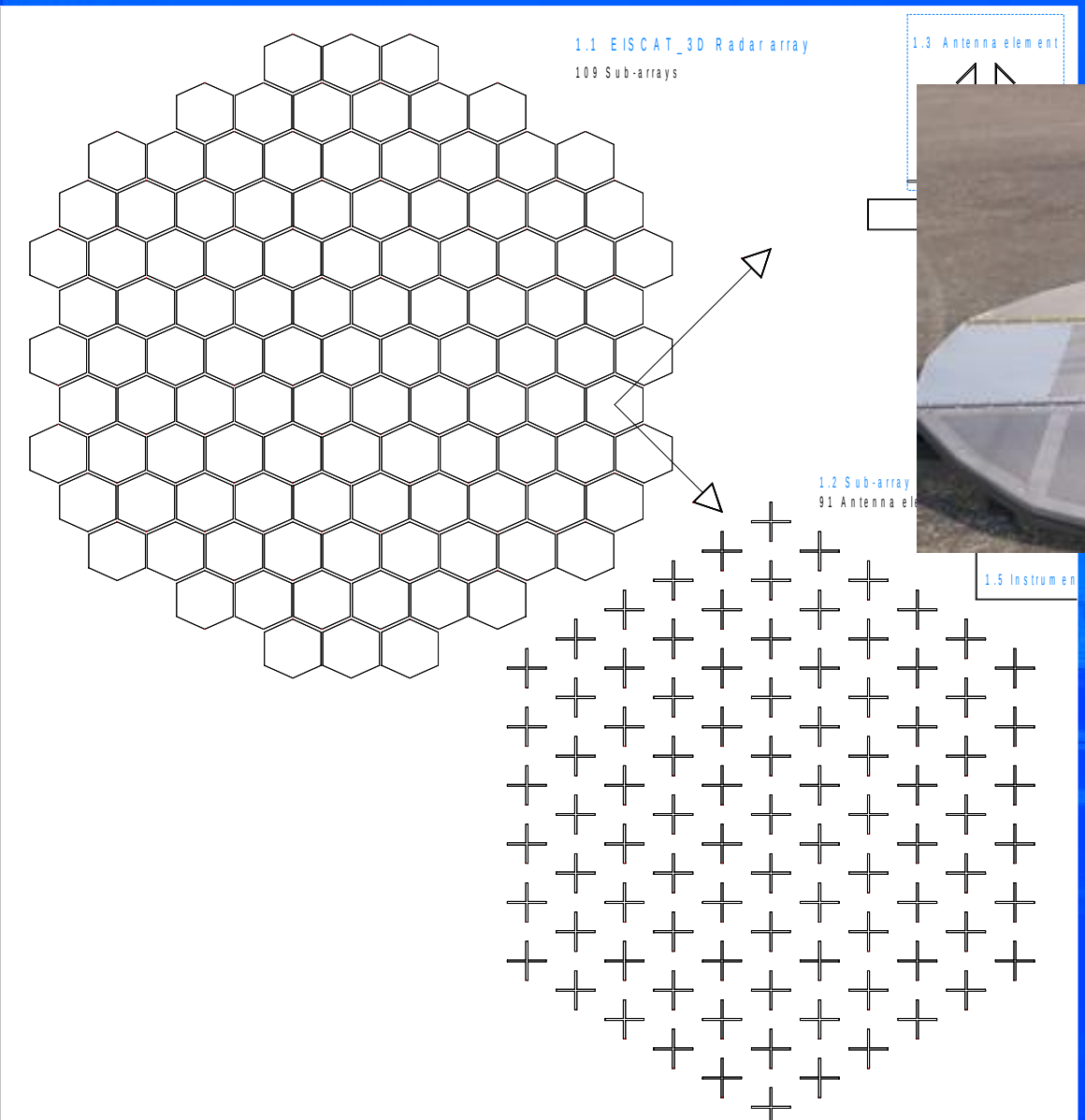
EISCAT_3D will be a volumetric **vector**-imaging radar for studying the geospace environment

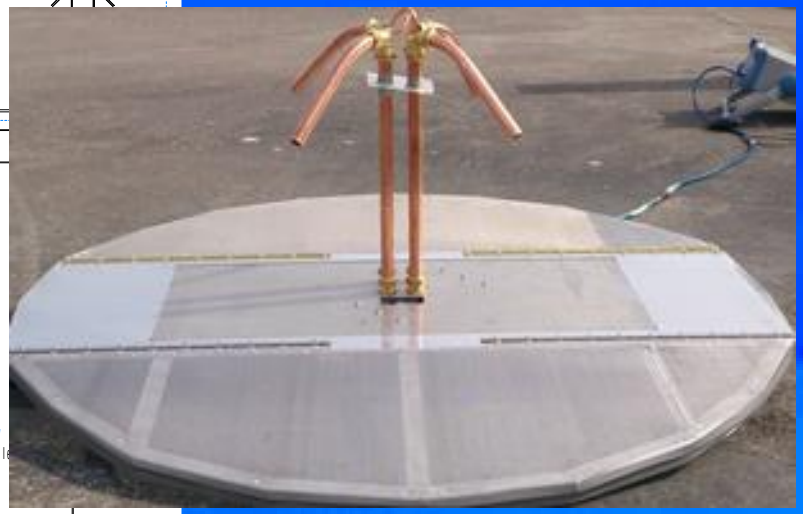
It represents a revolutionary upgrade to the existing EISCAT mainland facilities, utilizing multi-static, phased-array technologies

It will support continuous measurements of the space environment via unattended operations

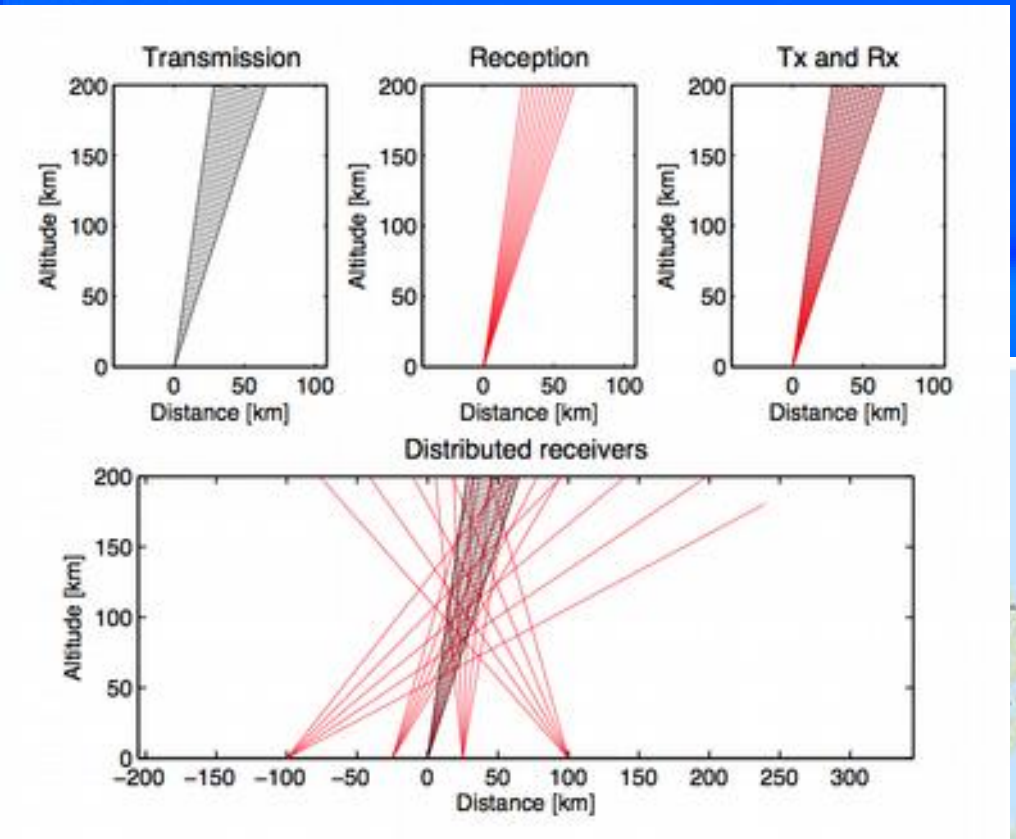
EISCAT_3D will have the sensitivity needed for ionospheric measurements at better than 100 msec time scales and 50-100 meter spatial scales (order of magnitude improvements over current systems)

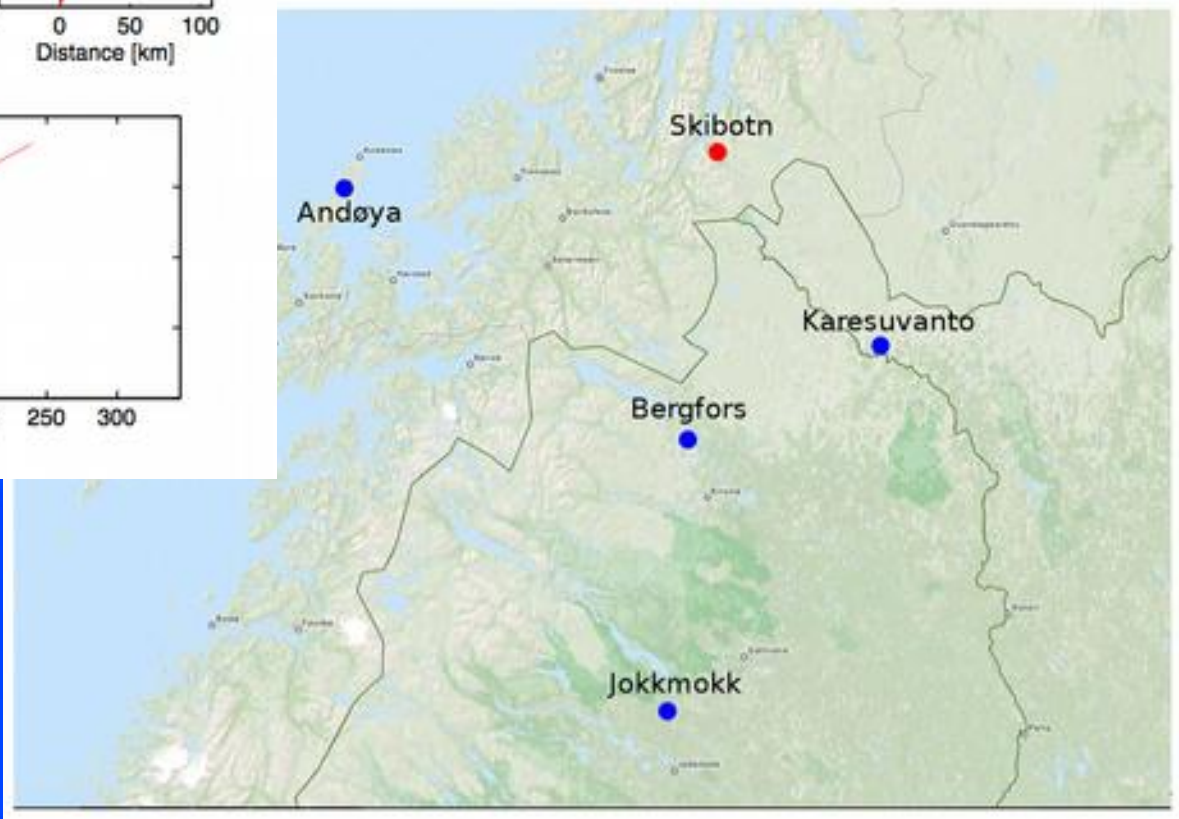
9919+ Antennas Per Site



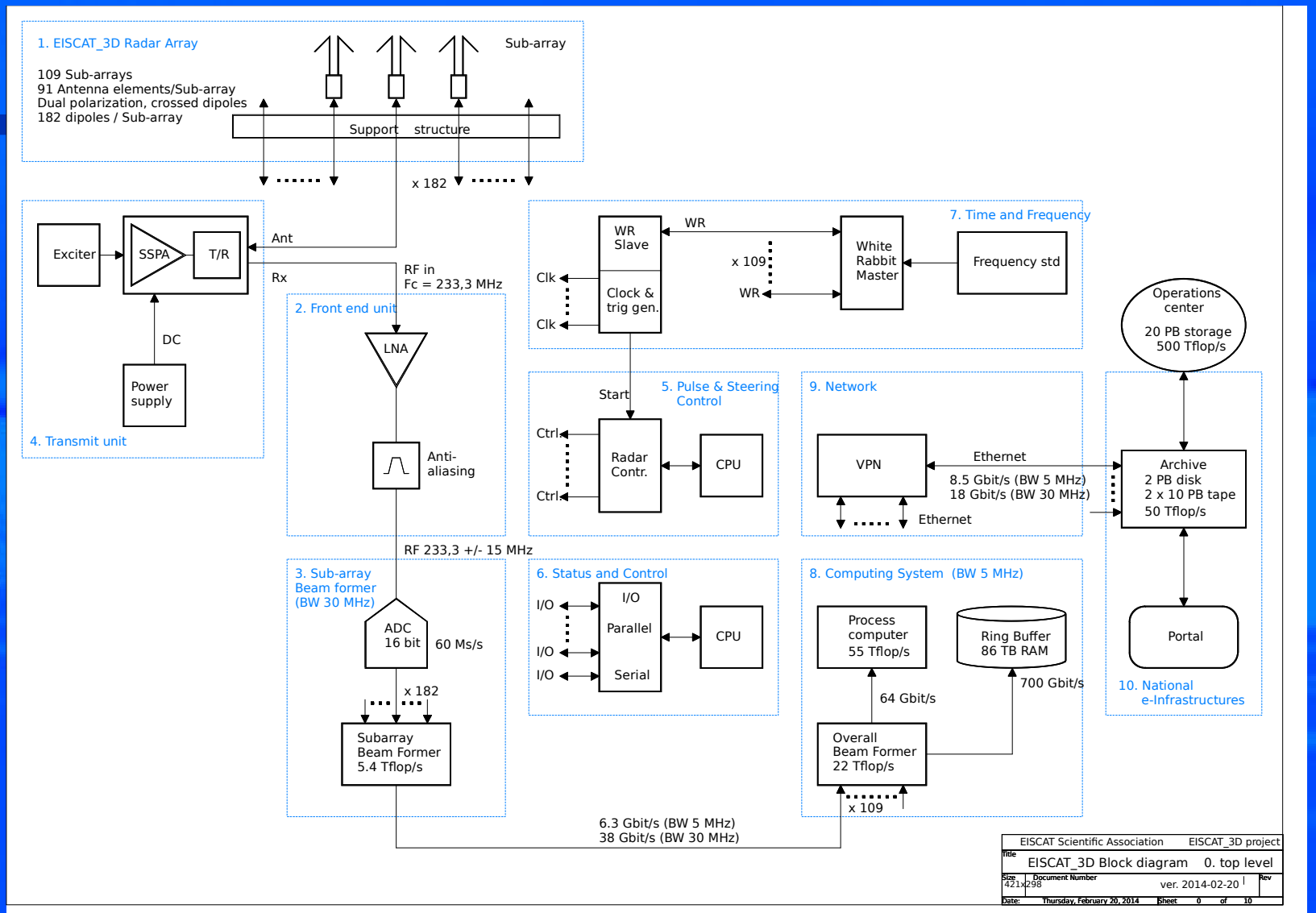


Multistatic Phased Array





Component Modules



Beamforming

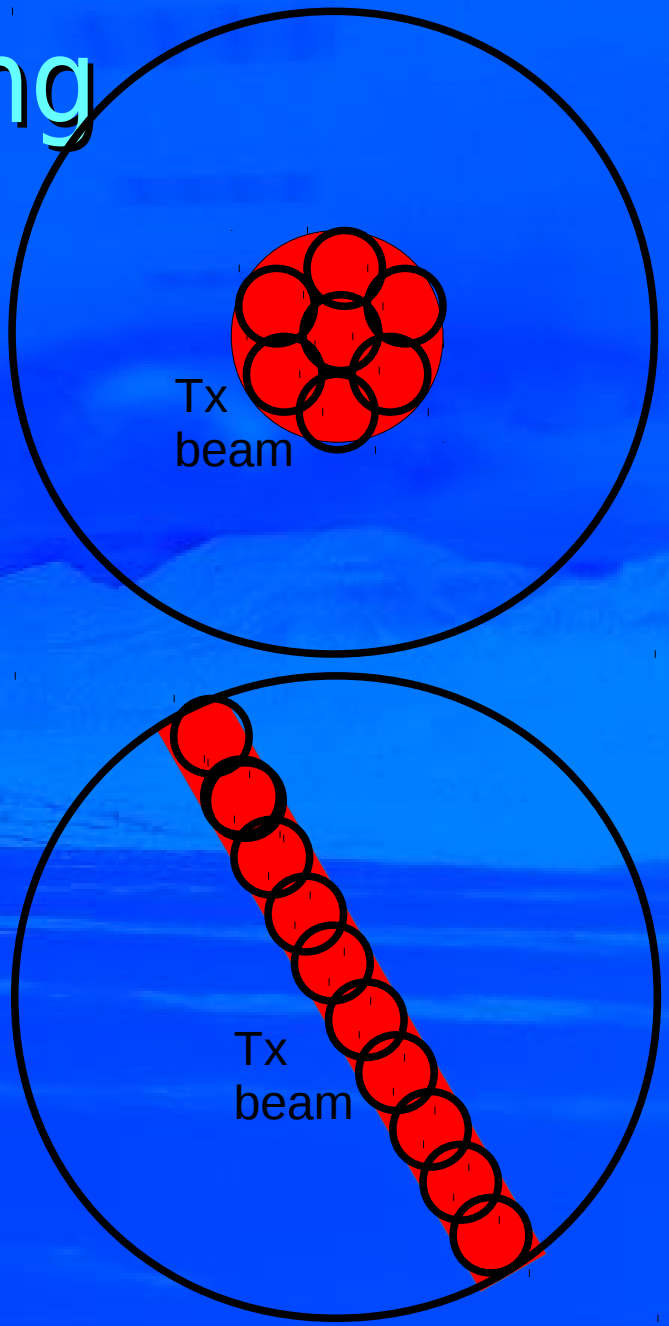
- Direction controlled by individual delays
  - 60 cm separation between antennas
  - Beam width 1° (beam resolution)
  - → delay 30 ps
- Resolution ~6 ps

Tx beamforming

- Signal generated by exciter
- Amplified to 500W → total 10MW
- Transmission freq ~1kHz
- Modulation BW <5MHz
  - Baud length 200ns
  - Nominal resolution 30m

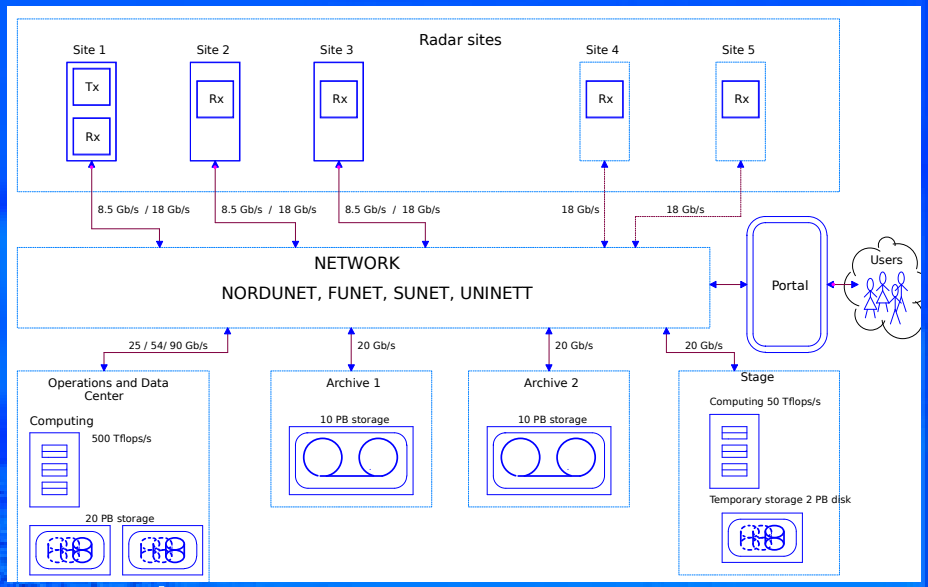
Rx beamforming

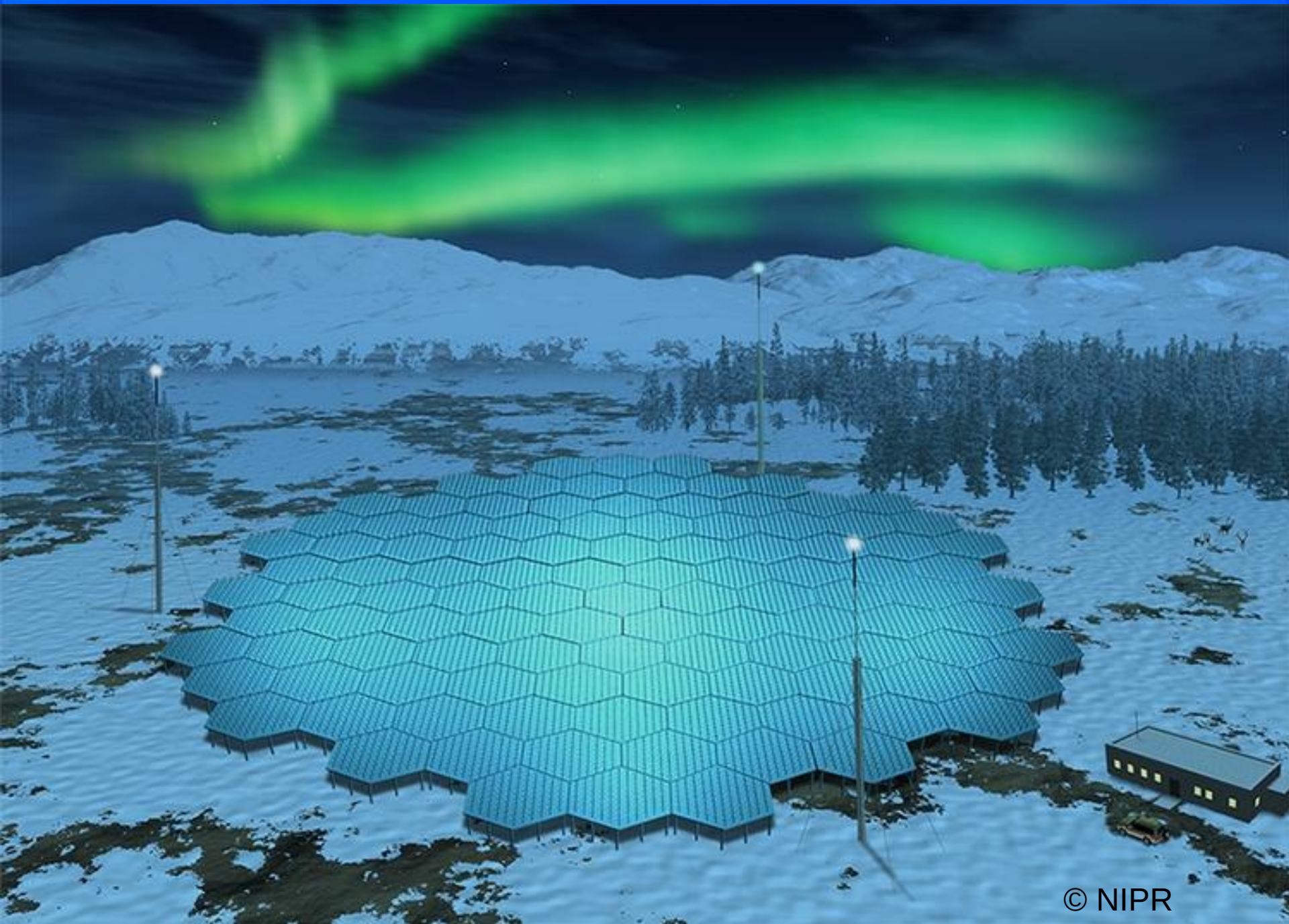
- Two stages
- Subarray (91*2)
  - ADC
  - FIR filter (FPGA)
    - Delay
    - Shift
    - LP filter
  - Total no taps 36-240
- Fullarray (109*2)
  - CPU/GPU cluster



Operation Centre

- Control operation
- Collect data from sites
  - 20 PB buffer
- Process 500 Tflop/s
  - 3D profiling
  - Reduce to physical parameters
- Send to archive
  - 2-4 PB/year
- Serve users
  - Portal for access & control

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