EISCAT-3D

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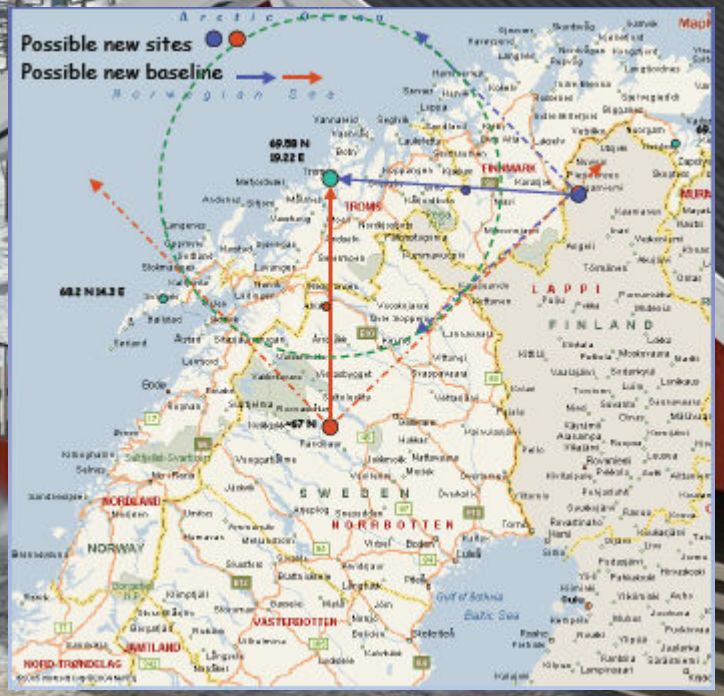
What is EISCAT-3D?

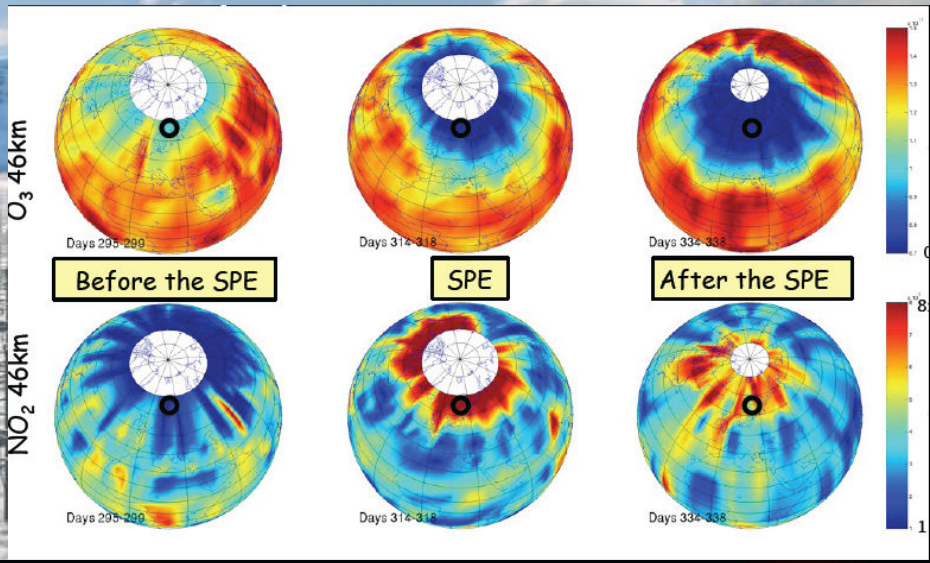
- Europe's next-generation radar for upper atmosphere and geospace studies
- Project of the EISCAT Scientific Association – an international research organisation of seven countries
- Replaces current dish-based radar systems
- Multiple large phased arrays (active sites 16000 elements, passive sites 8000 elements)
- Much better resolution and higher sensitivity.
- New capabilities for volumetric imaging and interferometry
- ESFRI project since December 2008

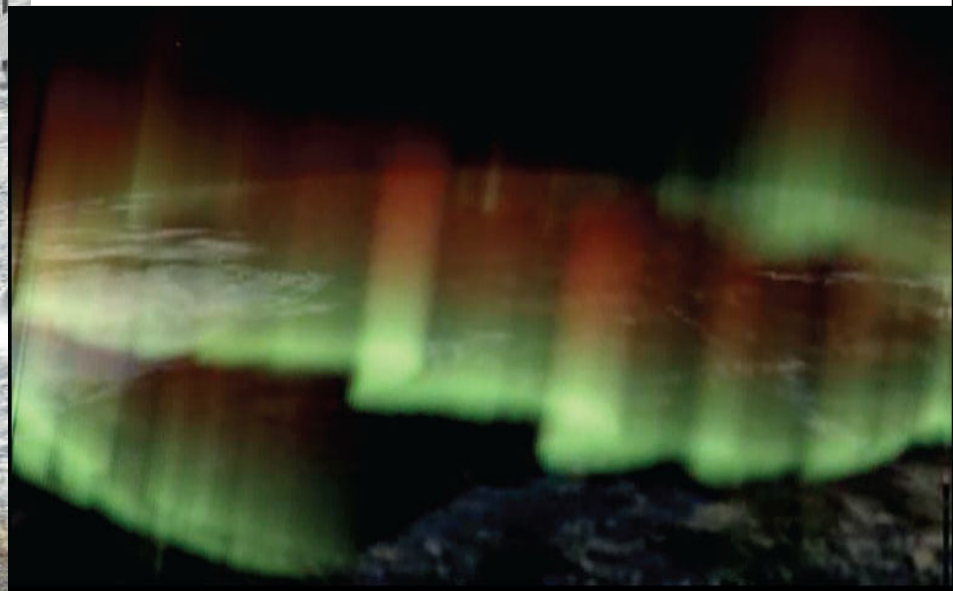


Why is EISCAT-3D important?

Major science questions:

- Coupling of the different atmospheric regions
- Effects of solar variability on climate
- Turbulence in the ionised and neutral atmosphere
- Atmospheric dust and aerosols
- Effects of meteoric material
- Importance of plasma outflow
- Space debris and satellite drag





Status and Timeline

Original discussions in 2002

Application for FP6 Design Study funding 2004

FP6 Design Study 2005-2009 (2.8 ME)

Added to ESFRI Roadmap December 2008

Preparing Preparatory Phase Application

National Funding Decisions Autumn 2009

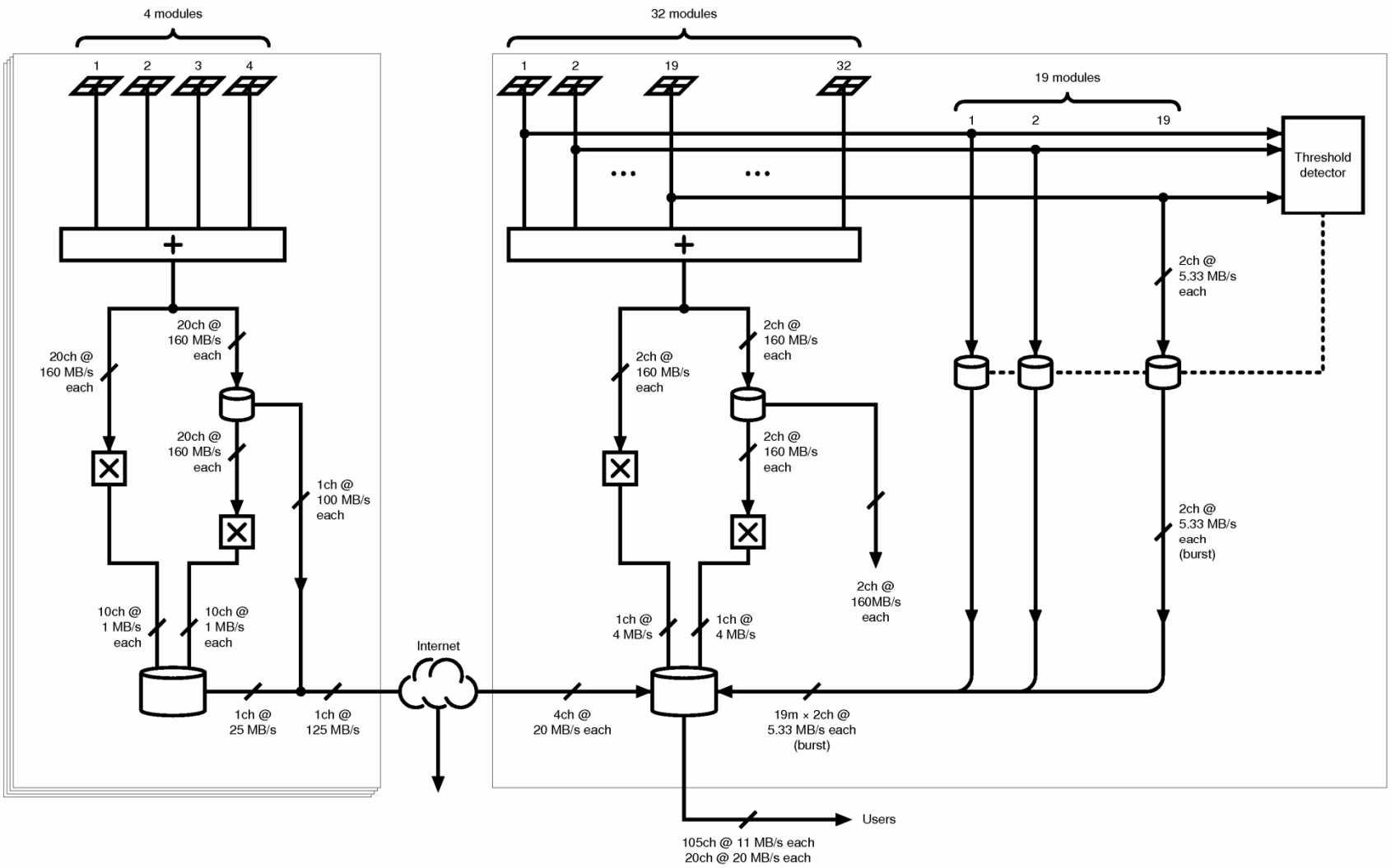
Submission of FP7 Application December 2009

Preparatory Phase 2010-2013

Construction 2014-2015

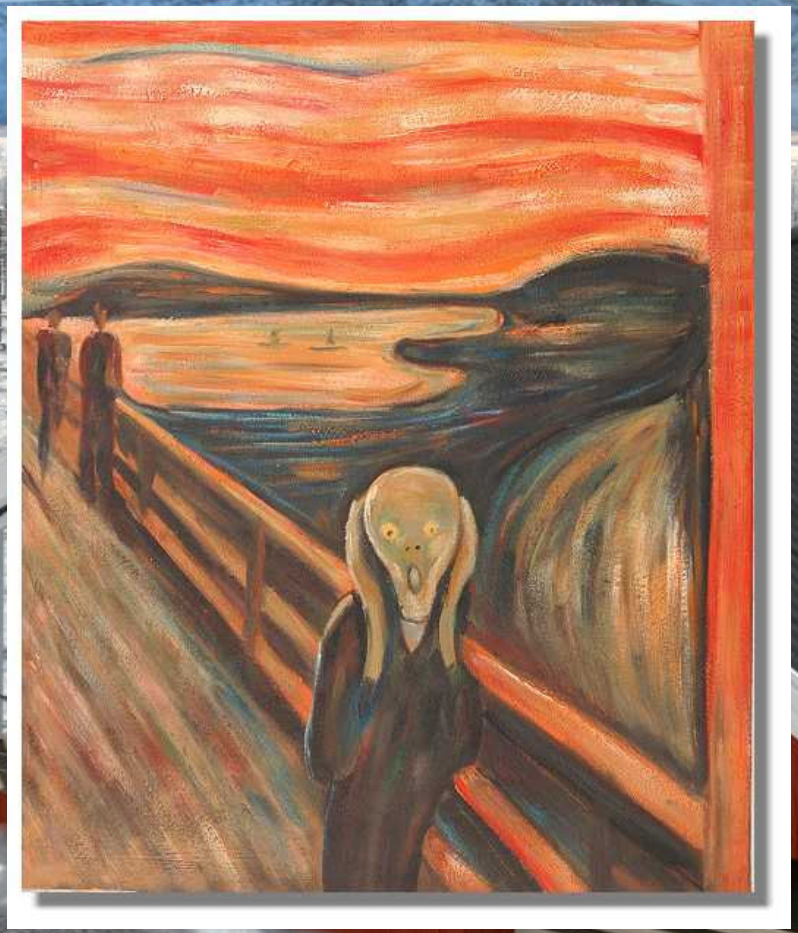
Operations 2015-2045

EISCAT-3D Data System



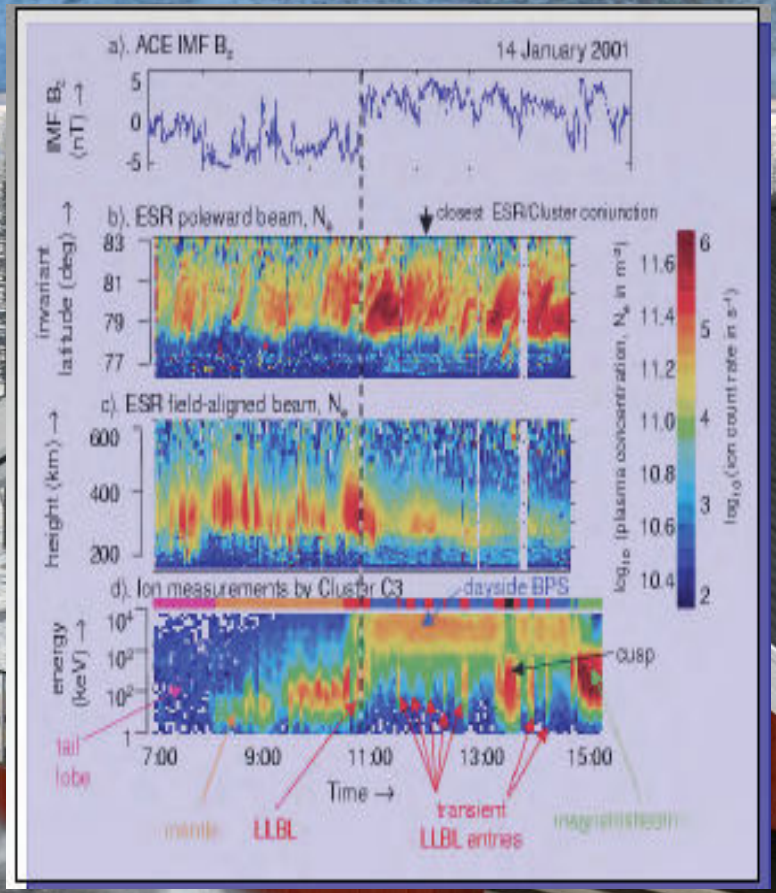
Low-Level Data

- Voltage data (lowest level)
  - 80 MHz sampling, 16 bits
  - 2.56 Gb/s/element means 4×10^{13} b/s (!)
  - Combine by group (49 antennas)
  - Then into <10 beams
  - Each beam ~ 25 TB/day
- Beam-formed data: Central site
  - Only one (fast scanning) signal beam
  - Small volume calibration beam(s)
  - Approx 1 TB/hour (320 MB/s)
- Beam-formed data: Remote sites
  - 5-10 beams, but intersection limited
  - Same order as central site
  - Identical short-term storage at all sites



Higher-Level Data

- **Interferometry Data**
  - 19 modules in use (202 MB/s, 17 TB/day)
  - But keep only 5% of samples above threshold
  - Lead-in and follow-on data (tens of GB)
- **Supporting Instruments**
  - Common data network for other diagnostics
  - Optical instruments, other radars
  - Estimated at 150 GB/day at central site
  - 30 GB/day for each remote station
- **Highest-Level Data**
  - Analysed data products (small)
  - Correlation functions ~200 TB/year
  - Maybe not needed...



Archiving Requirements

Ring Buffer

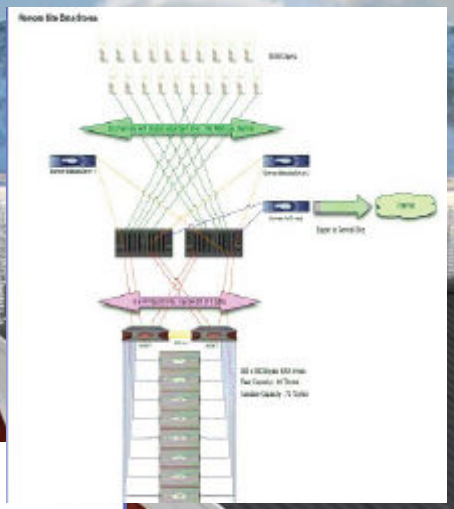
- High volume (~100 TB) short duration (hours/days)
- Data accumulate constantly , oldest over-written
- Records interferometry when events detected
- Latent archive data in event of network outage

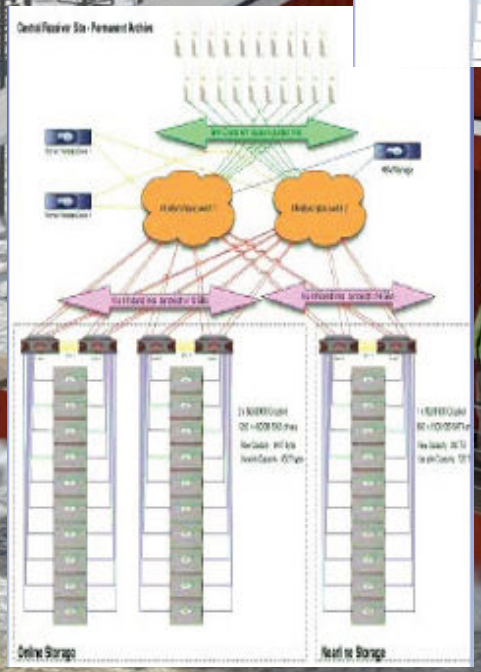
Interferometry System

- Small area (~100 GB), few minutes of data
- Data accumulate constantly, threshold tested
- If event detected, divert data flow, otherwise delete

Permanent Archive

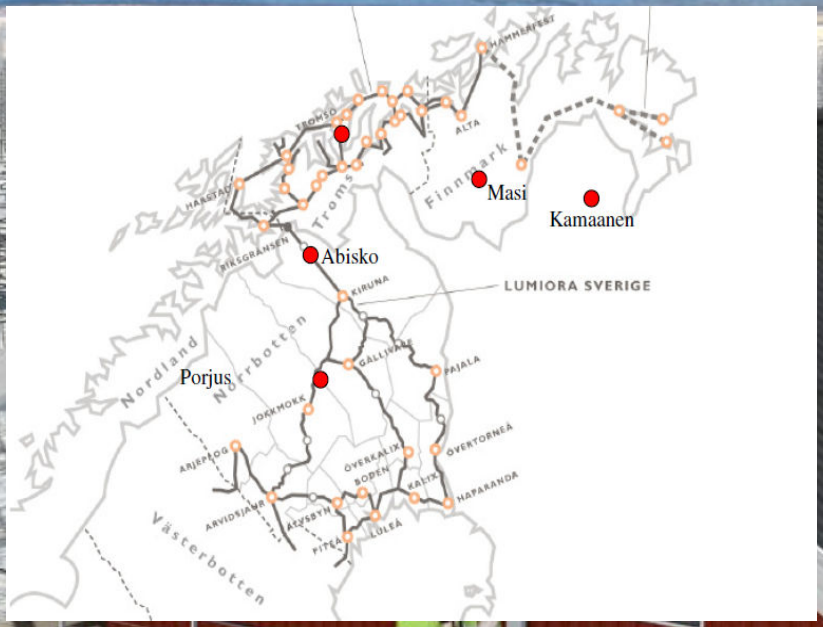
- Large capacity (~1PB) permanent archive
- Mid and high-level data @ 200 TB/year
- Tiered storage, connected to multi-user computing





Network Requirements

- Data transfer from the remotes
  - 1 beam is 320 MB/s, remotes have multiple beams
  - Supporting instruments add ~30% overhead
- Recover from interrupts quickly
  - Otherwise we may never catch up
  - Interrupts might last days/weeks
- Fast links already practical
  - Protocols for 10 GB/s links exist already
  - How should we factor network costs into our plan?
- Back-up if the network fails
  - Something to tell us if the site is alive
  - …and how cold it is……
  - Mobile phone, satellite, microwave link



Lumiora Fibre Network

Get involved !

- FP7 proposal to be submitted at beginning of December
- Plan includes a work package to look at data handling, including the possible role of data centres.
- There is still (just) time to get involved with our consortium.
- Contacts

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