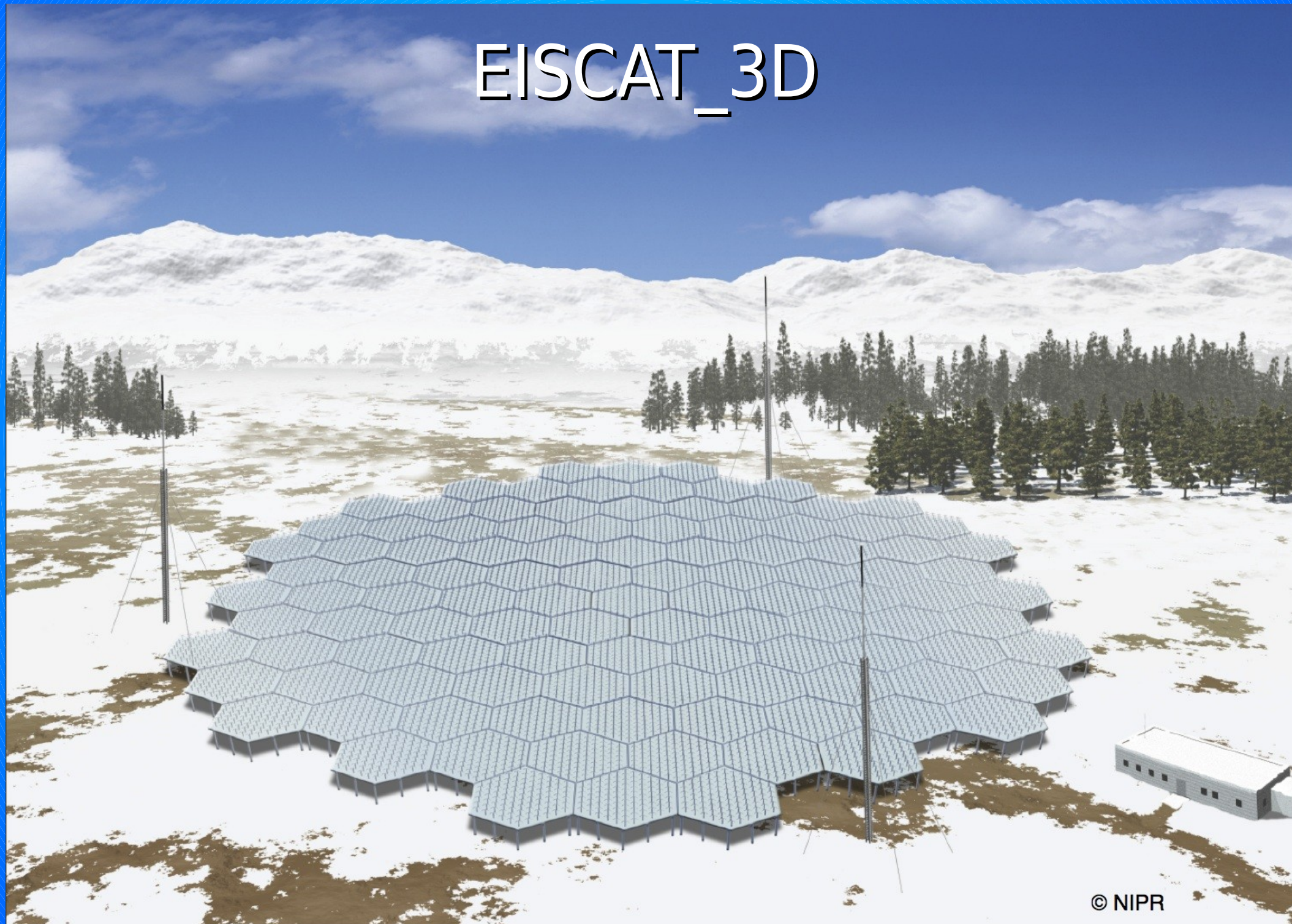
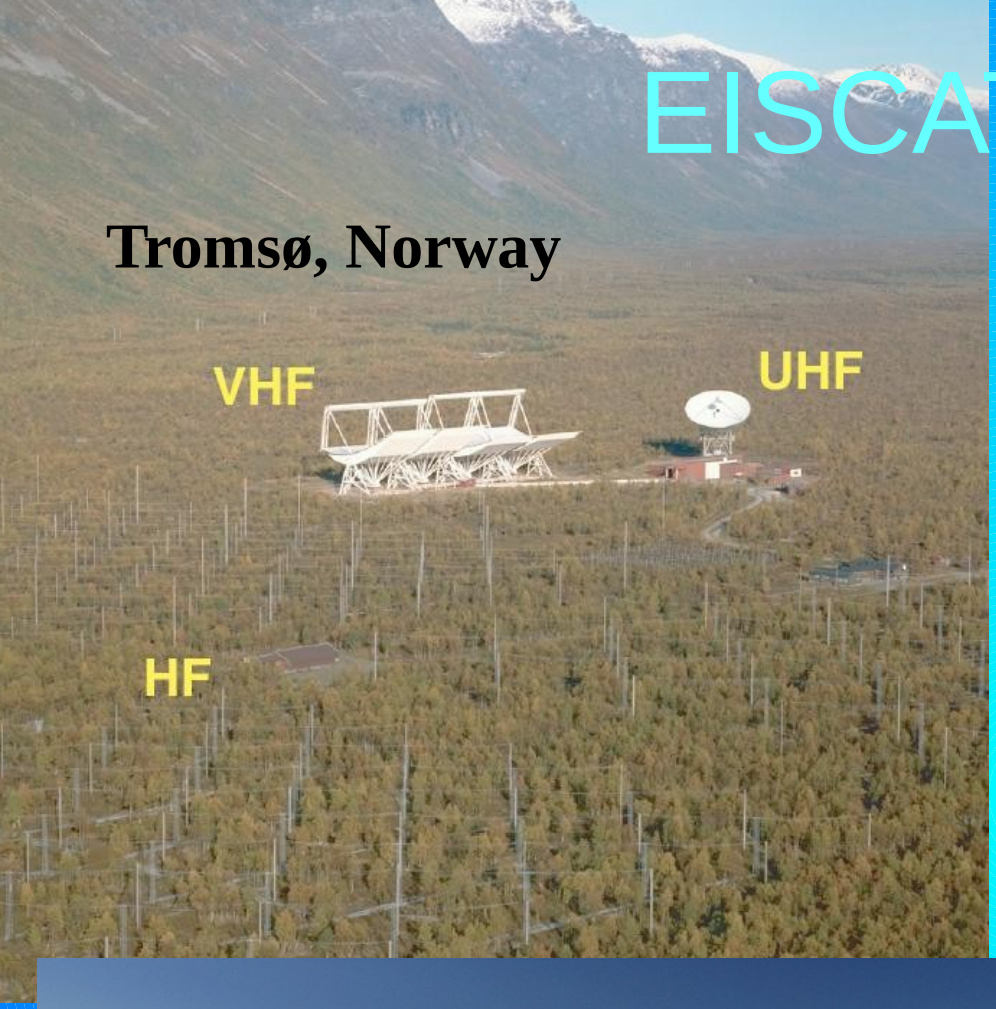
EISCAT_3D



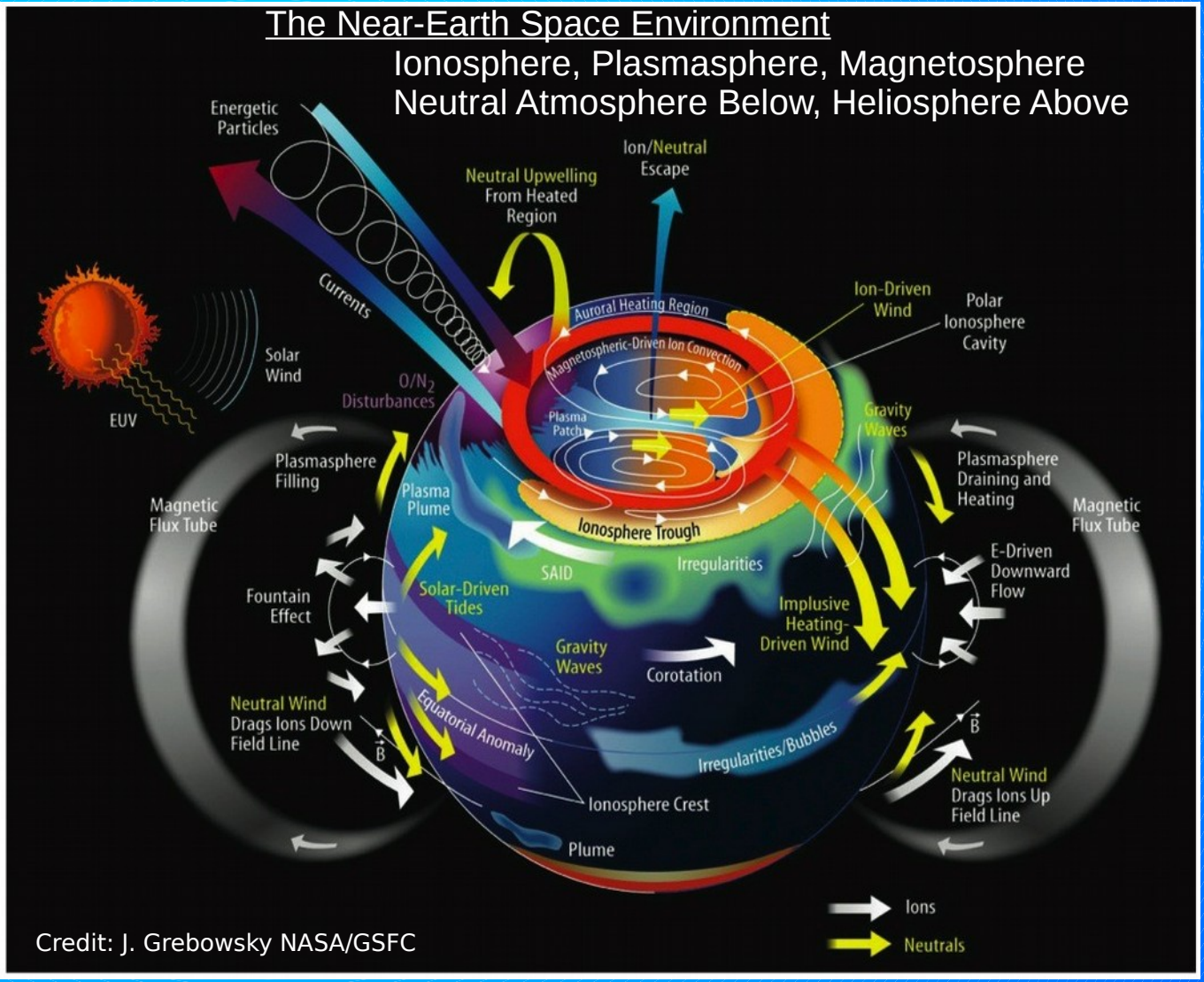
EISCAT Radars



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 Scientific Association

CRIRP, PRC

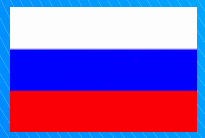
Suomen Akatemia, Finland*

NIPR/ISEE, Japan

Forskningsrådet, Norway*

Vetenskapsrådet, Sweden*

NERC, U.K.



AARI, Russia

IRA, Ukraine

IRAP, France

KOPRI & KASI, S. Korea

* EISCAT host countries

Funding status for EISCAT_3D

European Commission (Horizon2020, InfraDev-3): **3.1 M€** to prepare the EISCAT_3D design for a large-scale production environment.

Finland: A total of **12.8 M€** have been allocated by the Finnish Academy and the University of Oulu for participation in the EISCAT_3D project. This includes both in-kind contributions and a stipulation that sufficient funds are raised from other sources.

Norway: The Research Council of Norway allocated **228 MNOK** for participation in the EISCAT_3D production phase project under the condition that the project start by the end of 2016.

Sweden: The Swedish Research Council (VR) have allocated **120 Million SEK** for the construction of EISCAT_3D under the conditions that sufficient funds are raised from other funding sources and a percentage of the funds be used in Sweden.

Japan: E3D is included in programme ‘Study of Coupling Processes in the Solar Terrestrial System.’, which in turn is **one of the 10 selected projects** in the Roadmap 2014.

China: China’s Research Institute for Radio Wave Propagation (CRIRP) are proposing EISCAT_3D for the **next five year plan**.

United Kingdom: EISCAT_3D has been identified on the Research Councils **UK capital roadmap**.

EISCAT_3D Competence Centre

- EISCAT 14M (Ingemar Häggström, Carl-Fredrik Enell, Anders Tjulin)
  - Provide requirements details for use cases, data model, searching, visualisation
  - Prepare and provide testing/sample data
- SNIC 7M (Åke Sandgren)
  - Portal development (liferay)
  - Testing with sample data
- CSC 7M (Ari Lukkarinen, Ville Savolainen)
  - Visualisation
    - SciGraph, R, OpenLayer, Mayavi…
- NeIC - (John White)
  - Connect the Portal with NeIC Grid/Cloud distributed storage
- EGI (Yin Chen)
  - Provide technical supports, introduce best practices
  - Provide logistical support, e.g, booking Webex, training
  - Monitoring the progress

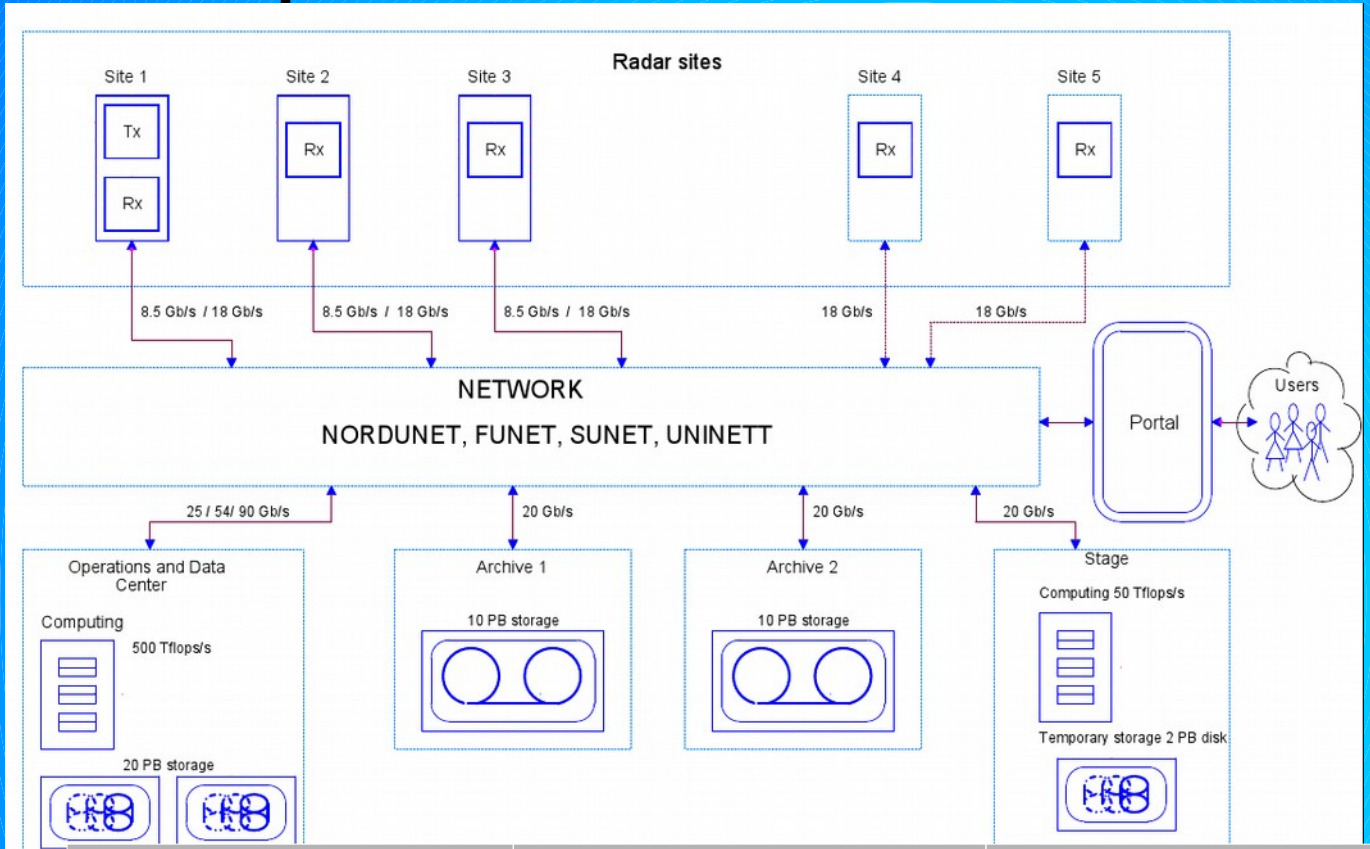
Actions

- Weekly telecons (vidyo)
- f2f on opportunity (4 sofar)
- MidTerm working plan
  - first portal prototype based on the first version of design specification to be delivered by the end of the year
  - find some EISCAT users to test the portal and provide feedback
  - final portal delivery by the end of Feb 2016

EISCAT-3D Data Portal Specification

- EISCAT 3D users will access EISCAT 3D data via a web portal. The portal will provide facilities allowing users to authenticate, search, visualize, stage and (re)analyse and download desired datasets.
- The basic portal services
  - MUST include an online graphical web interface
  - MUST implement user authentication
  - SHOULD include access APIs for the most commonly used languages
    - Matlab
    - Python
    - GNU R
- Additional portal services
  - SHOULD include data citation by PID in order to track the usage and publication of EISCAT 3D data
  - SHOULD include a scientific gateway integrating community applications/tools/services allowing users to run workflows for experiments, data mining and analysis
  - MAY include collaboration areas, which allows registered users to share their experimental data, workflows and experiences.

Top level infrastructure view



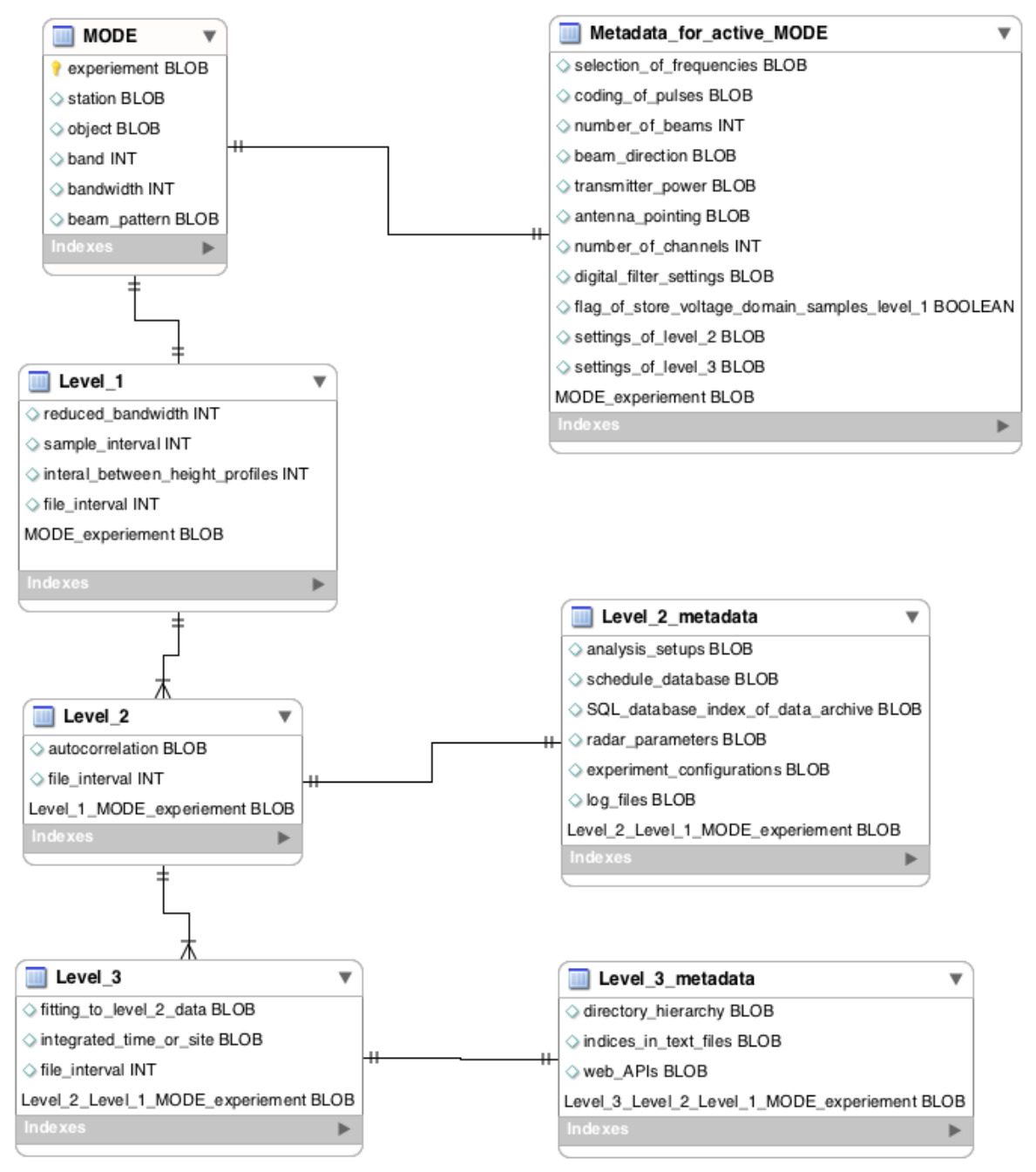
Part	Function	Comments
Network	Data transfer, system control, possibly distributed timing	File format and transfer TBD. Evaluating FTS, GridFTP etc
Operations and data centre	Control and configuration of experiments. Realtime processing of multi-site data.	Location to be evaluated: central cluster vs distributed computing
Archive	Long-term archival	Tape archives at two separate redundant sites
Stage	Temporary storage to retrieve and reprocess archived data	Computation resources for reprocessing
Portal	User interface for search, retrieval and reprocessing	EISCAT user authentication

EISCAT 3D metadata and data model

- Metadata and data objects, following lessons learned from ESPAS and ENVRI
  - should make sure names of fields etc follow standards from DC, SKOS, ISO-xyz...
  - Should probably define one or more separate experiment detail and scheduling object(s)
  - transmitter and receiver status logging
- Method in principle: different files from the station (data, log (status), environment log)
  - pack the different files into data and metadata objects for archival?
  - Pack into hdf5 files upon retrieval

Data Model

- Data levels
- Metadata



Data Model

- Mode
  - Identifier syntax
    - /eiscat/(passive|active)/(station)/(object)/(200|500|930|1400)/....

Element Name	Semantics	Syntex	Type
experiment	passive (radio astronomy: reception only) active(radar:transmit and receive)	passive active	text
station	receiver location e.g., proposed EISCAT-3D sites in Skibotn, Karesuvanto, Bergfors		text
object	e.g., star or other celestial object (passive experiment) or transmitter location (e.g., Tx station in Skibotn, for active experiment))		text
band	frequency, e.g., 235MHz, 500MHz, 930MHz		number
bandwidth			
beam_pattern			

Data Model

- MetaData for active mode

Element Name	Semantics	Syntax	Type
selection_of_frequencies	selection of transmitter frequency/frequencies		
coding_of_pulses	the coding of the transmitted pulses (different pulse code programs are used optimised for certain altitude ranges, range and time resolutions)		text
number_of_beams	number of beams in EISCAT-3D		number
beam_direction	beam direction in EISCAT-3D		text
transmitter_power	transmitter power in EISCAT-3D		
antenna_pointing	antenna pointing or scan patterns in EISCAT		text
number_of_channels	configuration of receiver: number of channels, digital filter settings, etc.		number
digital_filter_settings	configuration of receiver: digital filter settings		text
flag_of_store_voltage_domain_samples_level_1	whether to store voltage domain samples (level 1 data)		boolean
settings_of_level_2	integration time and storage of level 2 data		text
settings_of_level_3	integration, calibration and other analysis settings for level 3 data		text

Metadata objects

Radar site	
Name	string
Type	active/passive
Location	(latitude, longitude, height over mean sea level)

Source	
Passive: Celestial object	RA, dec, catalogue name
Active Transmitter site	-> **Station**
Active Transmitter mode	-> **Tx mode**

Tx mode	
Frequency1	Center frequency MHz
Power1	per amplifier and total
...	

Rx mode	
Experiment type	active/passive
band	eg 230 MHz
analog settings gain, anti aliasing filter	ever changed?
bandwidth (need to specify separately?)	MHz
sample rate	MHz
other ADC settings	
filter 1	digital channel settings eg filter parameters, window (ion line, plasma line)
(repeat channels as needed)	
downsampling	part of digital filter parameters, decide on how to specify

Working Progress

- Data flow
- Data volumes
- Specification of Functional Components
- Data Access
- Data Visualisation
- Data storage
- Data Transferring Service