Harri Hellgren

System Integration Engineer

EISCAT Association

Current Associates

Forskningsrådet, Norway

Suomen Akatemia, Finland

Vetenskapsrådet, Sweden

CRIRP, PRC

NIPR, Japan

NERC
UKRI, U.K.

Affiliates

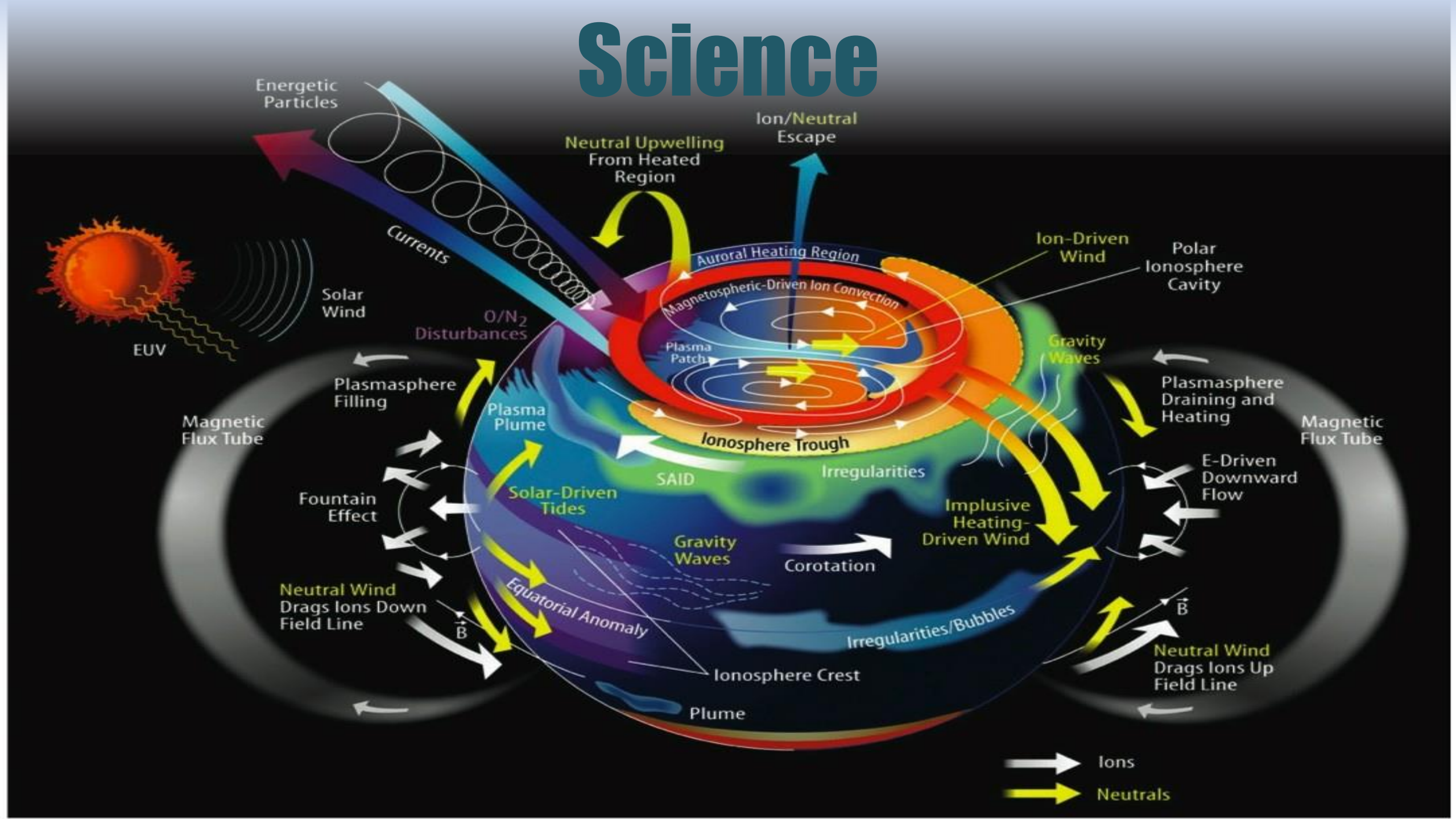
KOPRI & KASI, S. Korea

DLR-SO, Germany

IRA, Ukraine

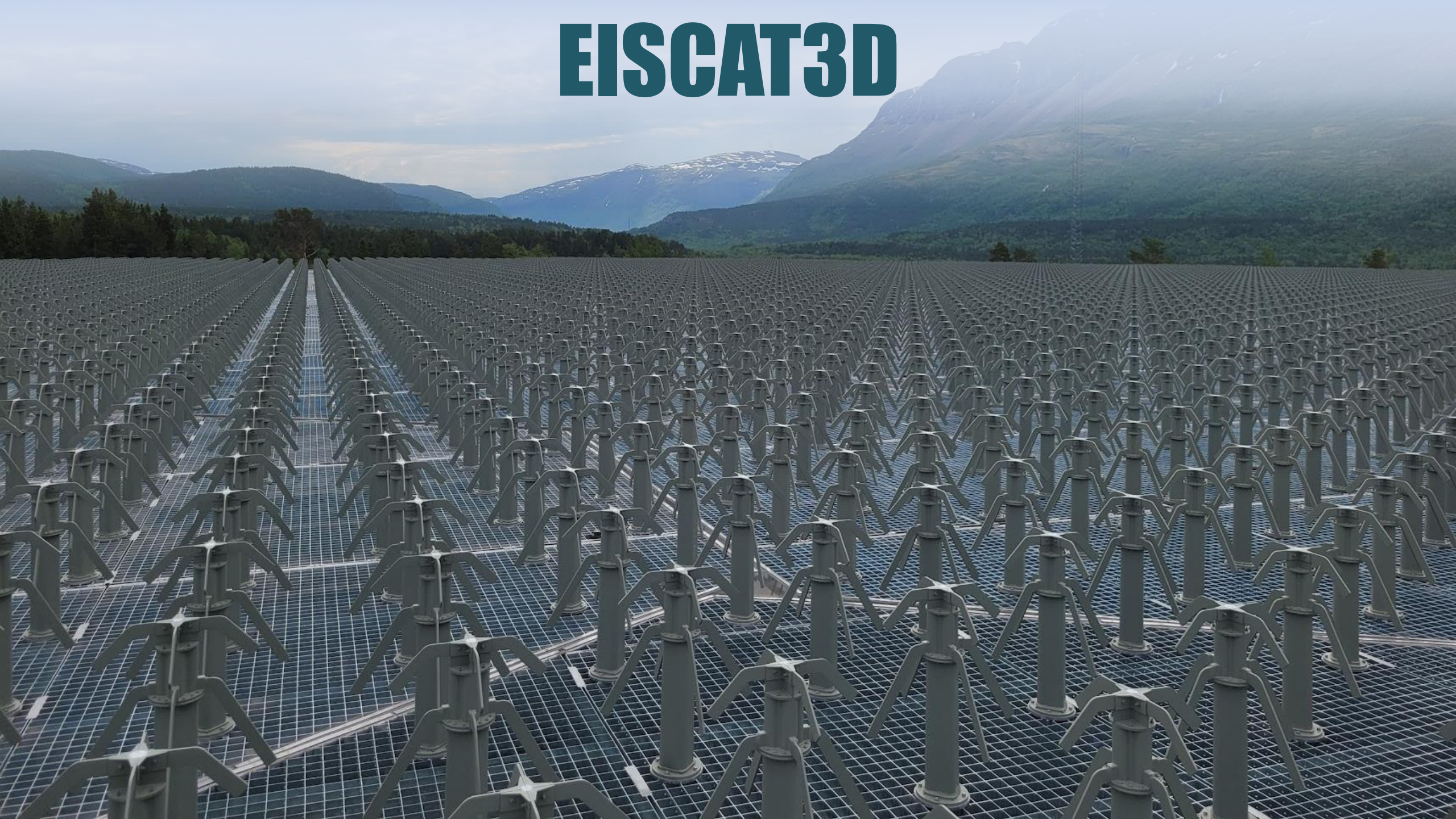
METI Int, U.S.

Science


Energetic Particles
Ion/Neutral Escape
Neutral Upwelling From Heated Region
Currents
Auroral Heating Region
Magnetospheric-Driven Ion Convection
Ion-Driven Wind
Polar Ionosphere Cavity
Solar Wind
EUV
O/N2 Disturbances
Plasma Patch
Gravity Waves
Plasmasphere Filling
Plasmasphere Draining and Heating
Magnetic Flux Tube
Plasma Plume
Ionosphere Trough
Magnetic Flux Tube
SAID
Irregularities
E-Driven Downward Flow
Fountain Effect
Solar-Driven Tides
Implusive Heating-Driven Wind
Gravity Waves
Corotation
Neutral Wind Drags Ions Down Field Line
B
Equatorial Anomaly
Irregularities/Bubbles
B
Neutral Wind Drags Ions Up Field Line
Ionosphere Crest
Plume
Ions
Neutrals

Old

EISCAT3D



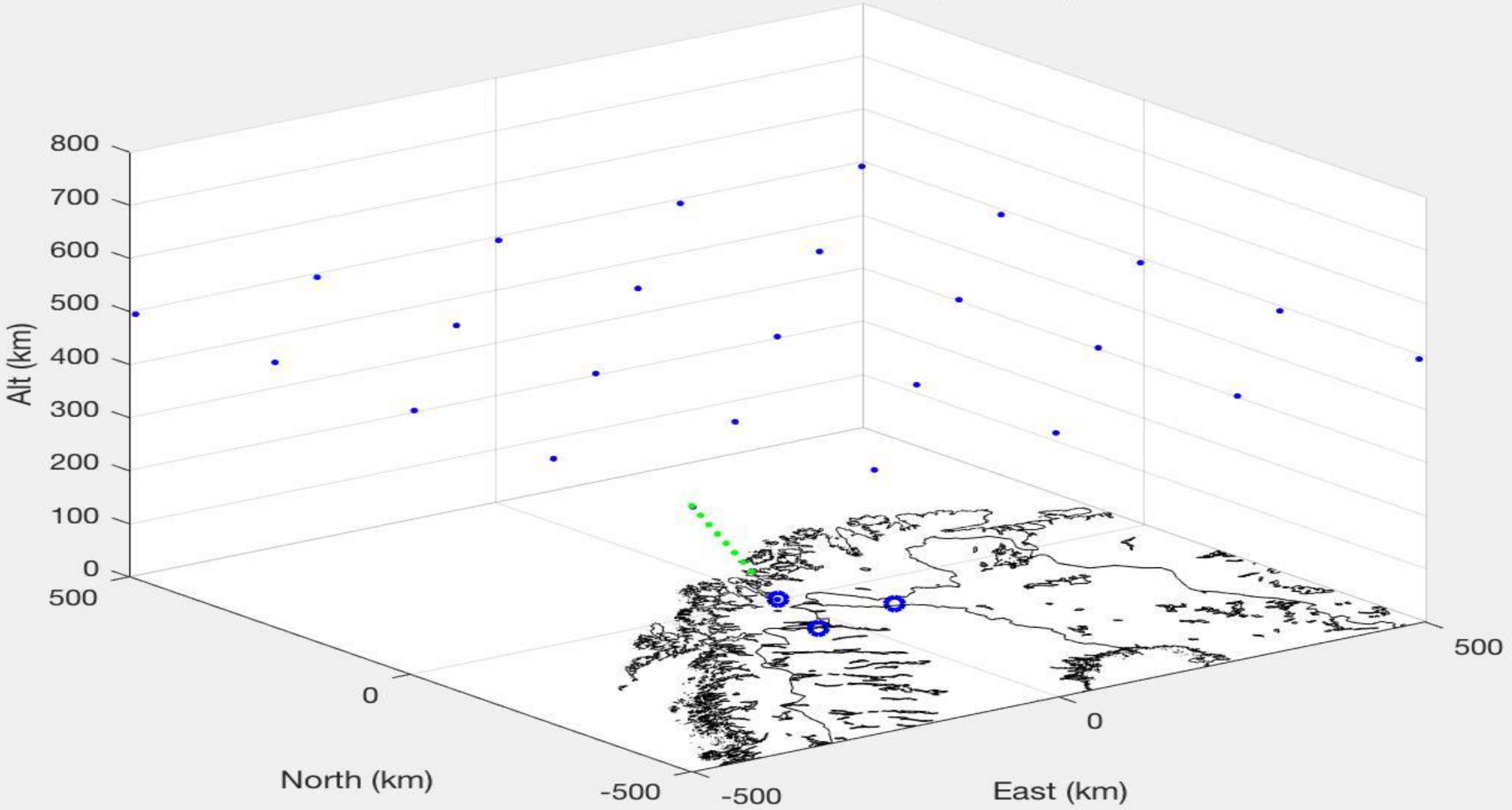
EISCAT3D

3 sites option for 5
10 000 antennas each
5 MW transmit power
2000 TB / year data
Operation starting 2024
Ready, probably never

Skibotn, Norway

Karesuvanto, Finland


EISCAT_3D, Stage 1
EISCAT_3D Skibotn
EISCAT_3D Karesuvanto
EISCAT_3D Kaiseniemi
E8
E45
Site Skibotn
Site Kaiseniemi
Site Karesuvanto

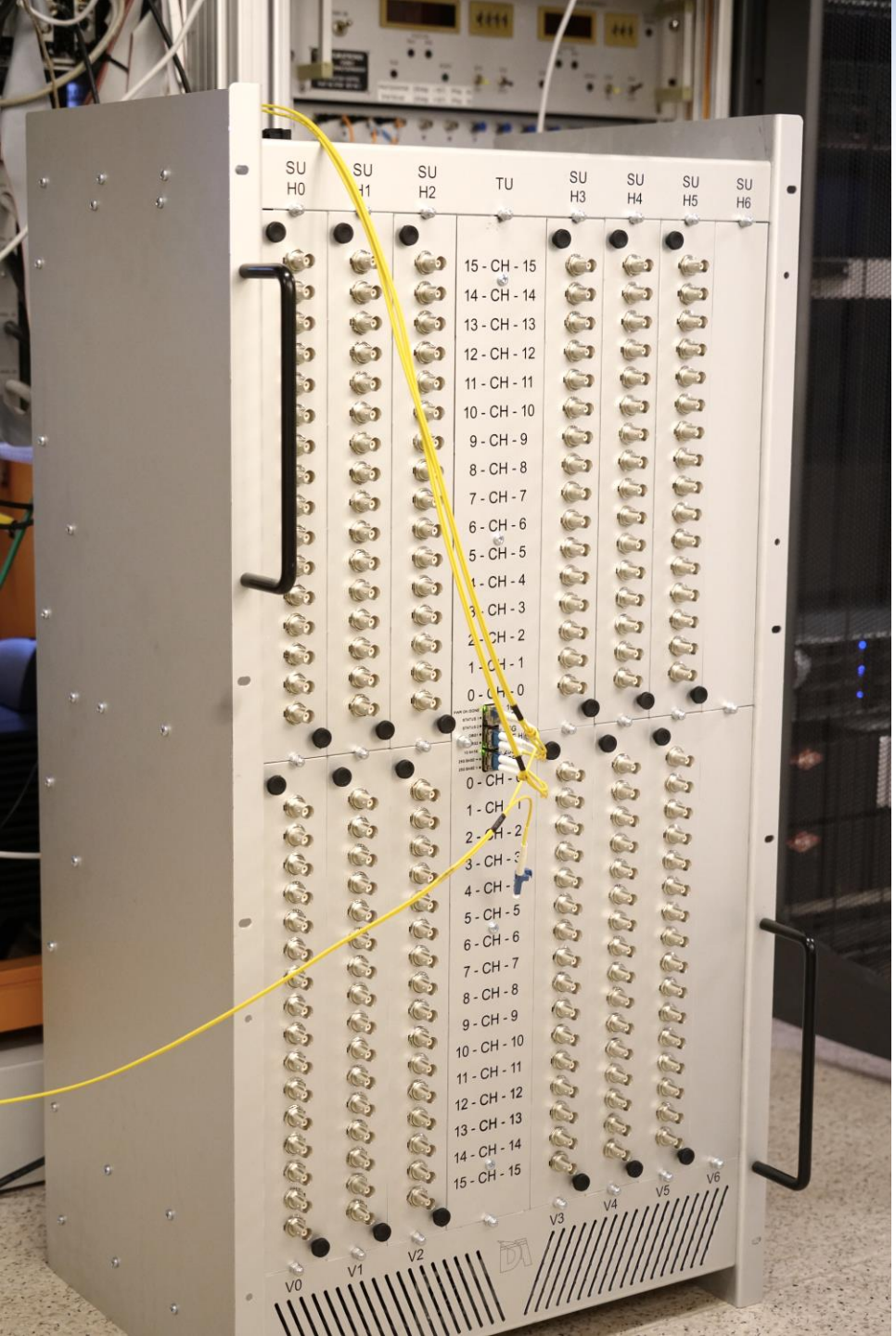

User 1 PulSeq 1, TX: Az -135 El 35, Time 0 μsec
800
700
600
500
400
300
200
100
0
Alt (km)
500
0
North (km)
-500
-500
0
500
East (km)

Transmitters

- Solid State Power Amplifier
- One channel 500W peak 25% duty cycle
- First stage 3.5 MW design up to 10 MW peak

Modulator

- 16 channel arbitrary waveform generator
- 52 MSPS independently to each polarizations
- Digital upconverter with phase shift



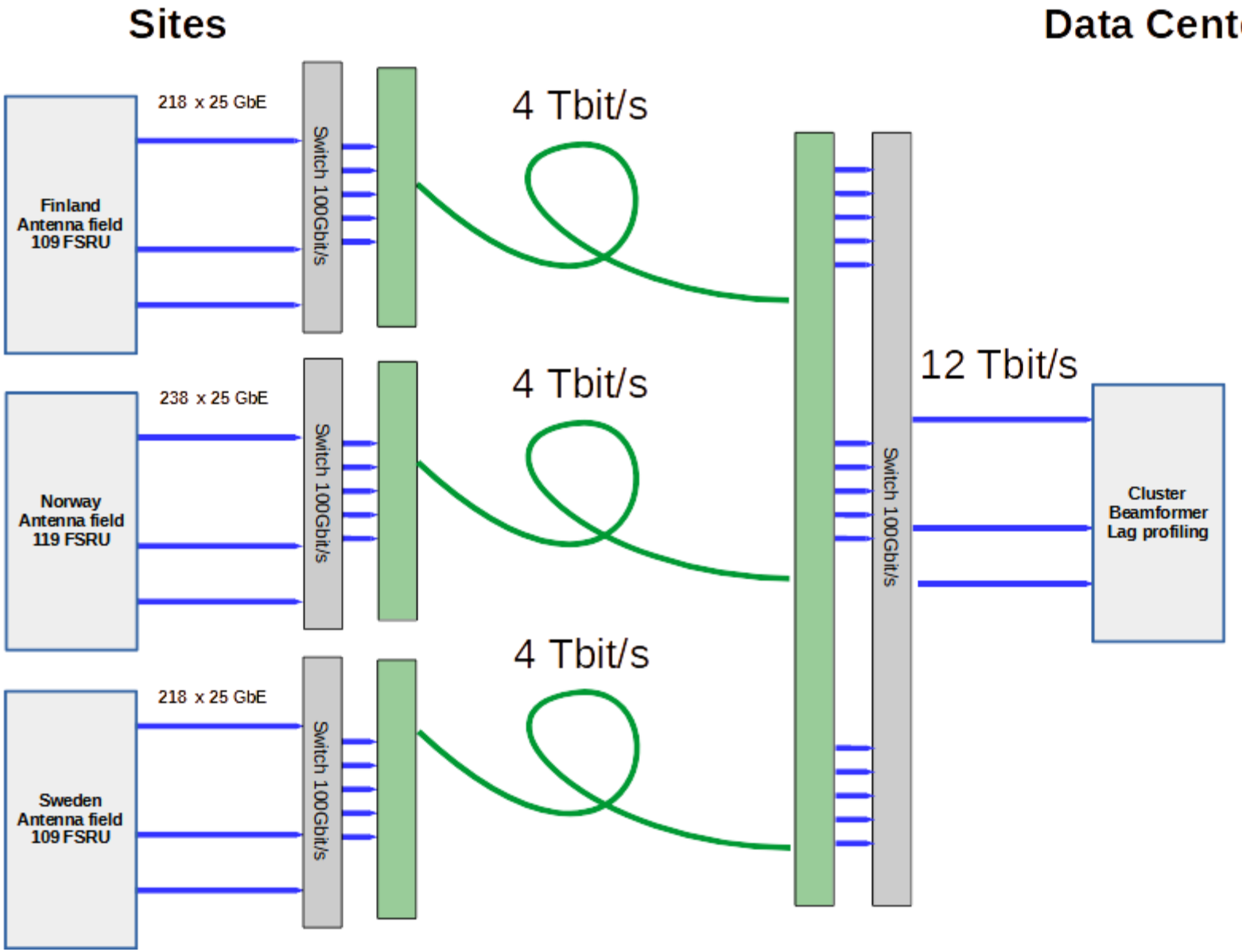
Receiver

- 182 channels
- 104 MSPS ADC Nyquist sampling
- 233 MHz +/- 15 MHz analog bandwidth
- First level of beamforming in FPGA
- 10 independent beams
- One 25 GbE link for both polarizations
- True Time Delay filters

Timing & synchronization

- CERN White rabbit network synchronization
- 9.6 ns resolution <100 ps uncertainty to the master clock
- All times are UTC

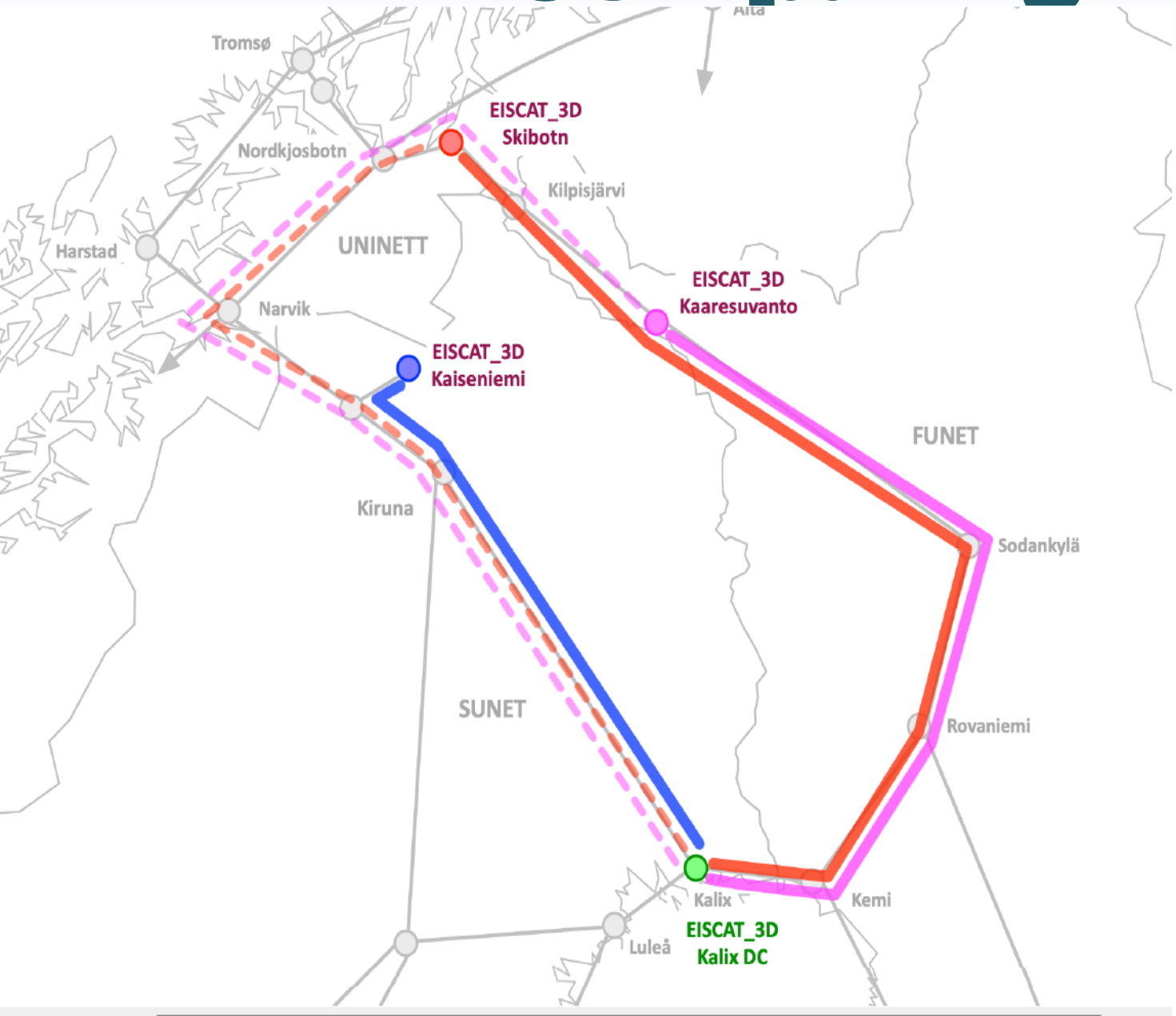
Computing network



An optical ring of 3 sites and a data center will be constructed.

From each site there is a logical point-to-point connection to the data center.

Computing network



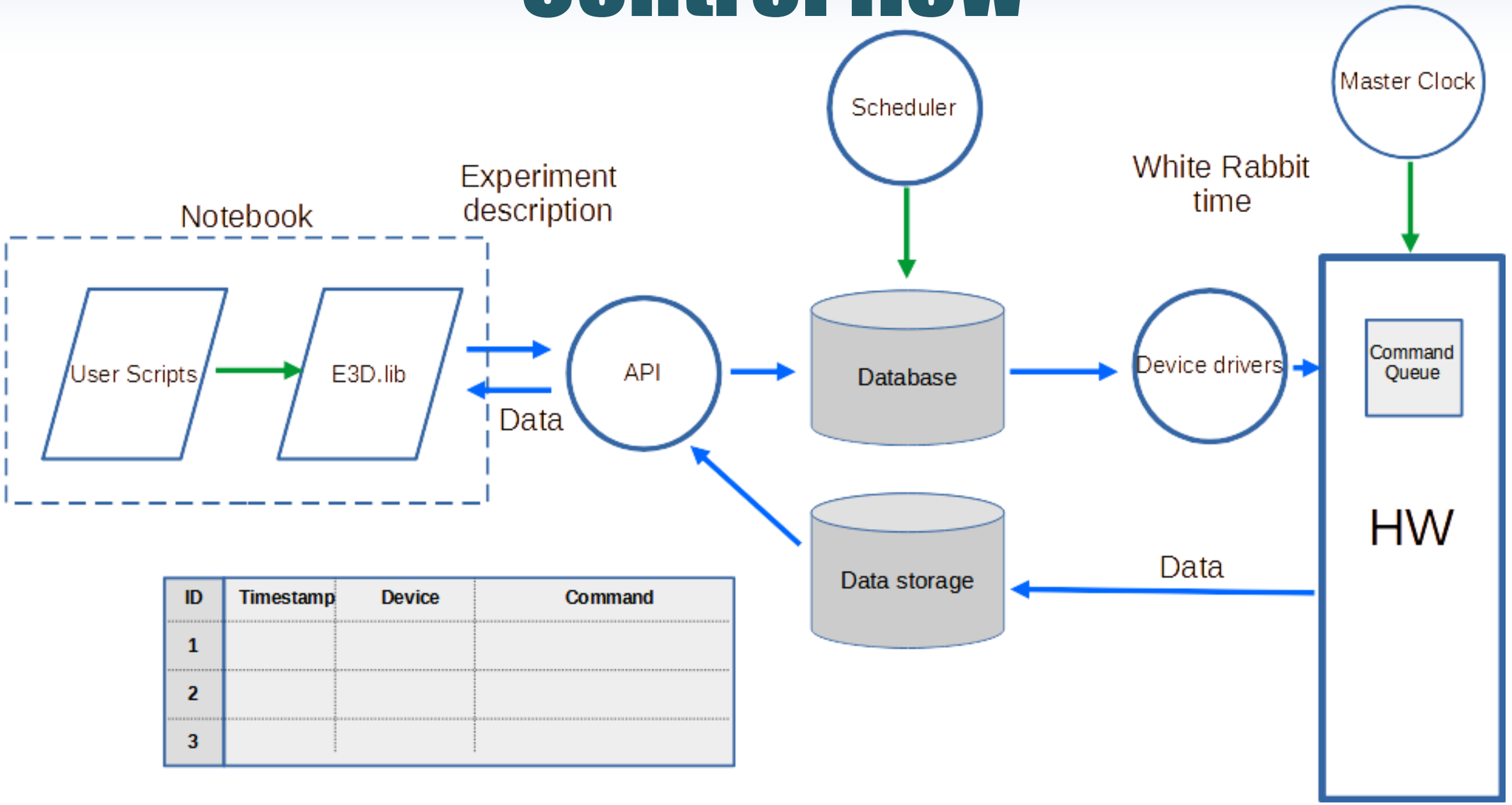
All equipment already received and are installations work. NO and FI installations May - June. SWE later this summer.

Control and data center will be in Kalix. Fibers are connected and line systems installed.

Operations room will be in Kiruna.

Network will be White Rabbit enabled.

Control flow



ID	Timestamp	Device	Command
1			
2			
3			

Tango Controls

- Jupyter Notebooks are used in internal development as well as user interface
- Database used for asynchronous fast control, 1000s of events/ second
  - Postgres with TimescaleDB extension is evaluated
- Grafana as a monitoring tool
- Limited number of different devices
- Rewrite Device drivers for Tango compatibility
- Lot of equipment use SNMP protocol
- Tango and White Rabbit, any connection?
- Operator GUI in Taranta
- Web based Alarms and logs interface