

# EISCAT\_3D

## Network and instrument integration

**FUNET**

by CSC

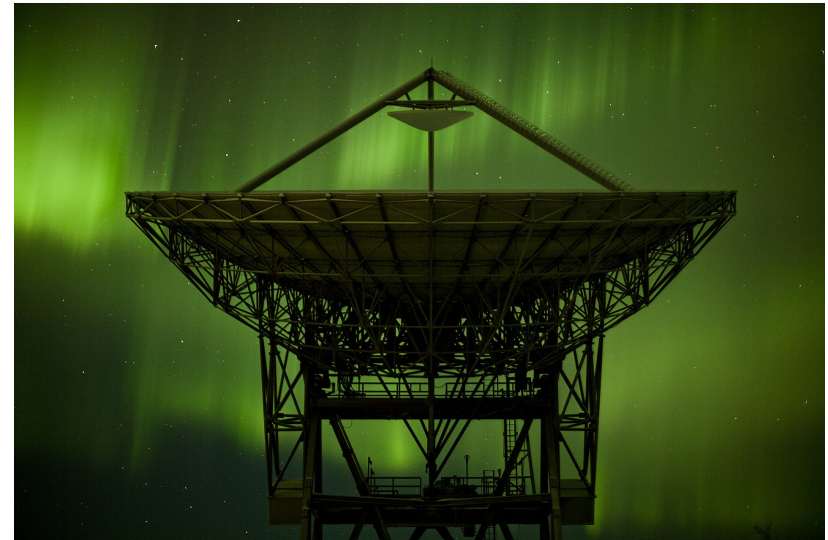
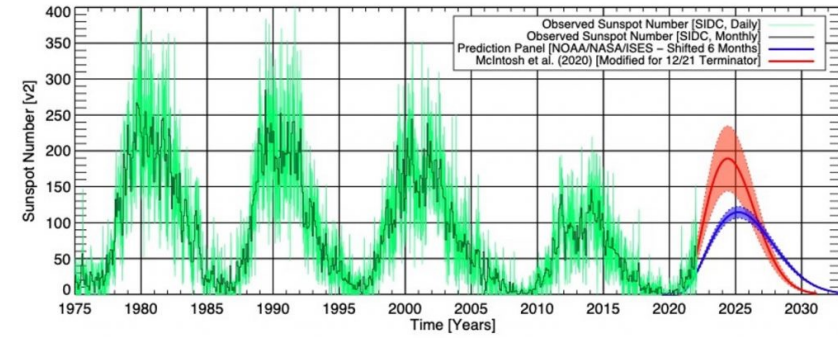
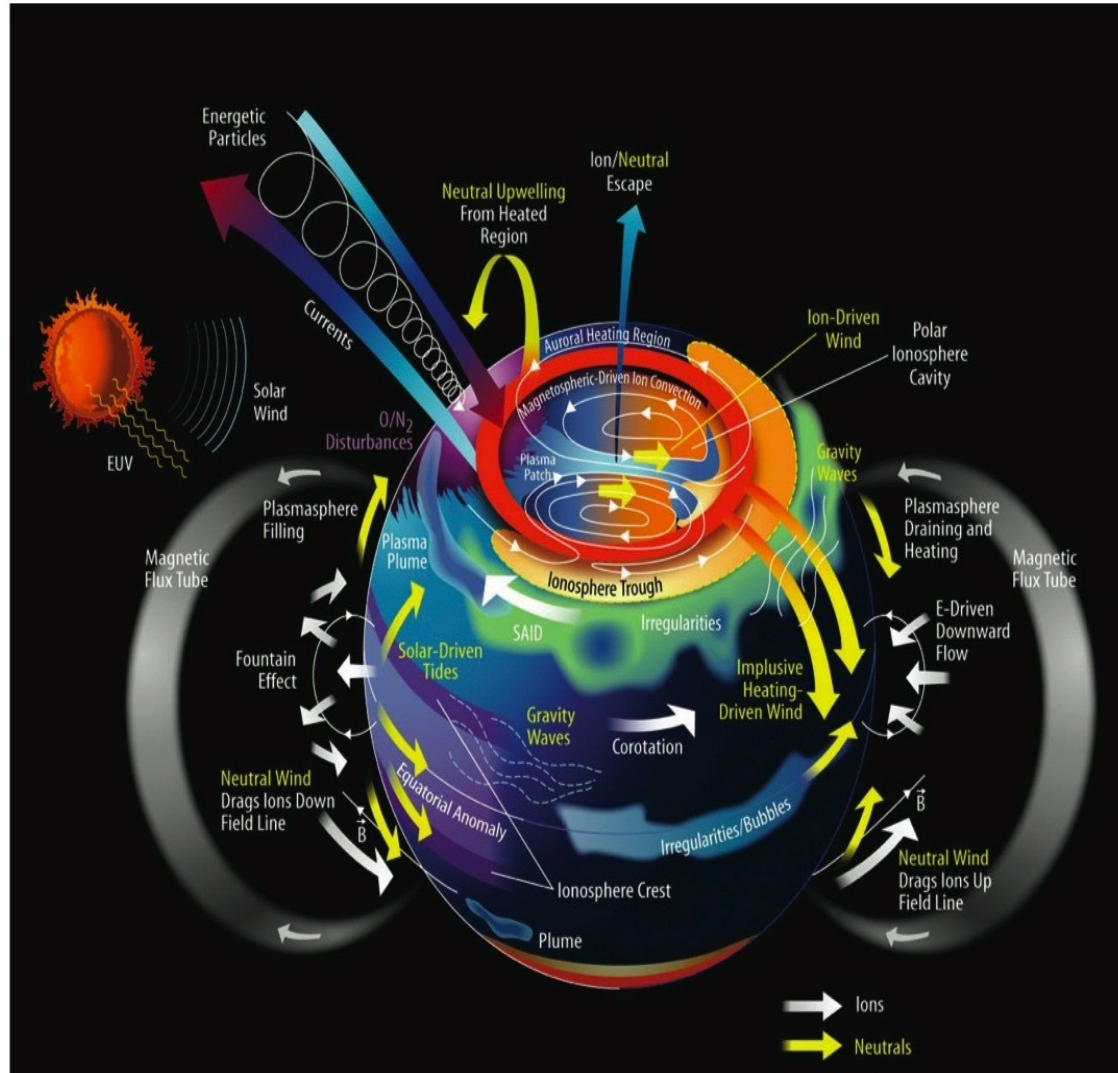


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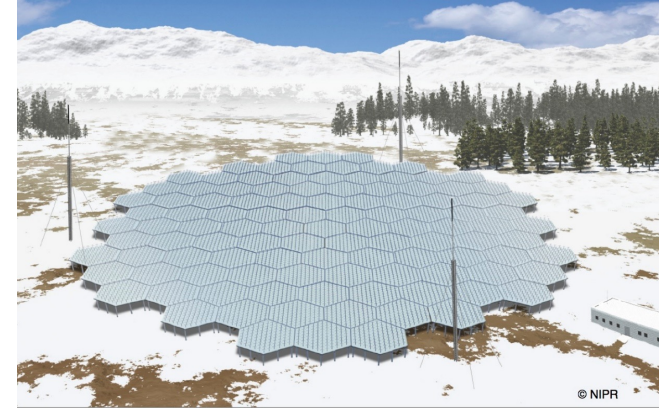
Jani Myyry (CSC/Funet)

13th SIG-NGN meeting, online

# THE SCIENCE CASE



# EISCAT 3D - INFORMATION



An extremely versatile and largely **software-defined** instrument

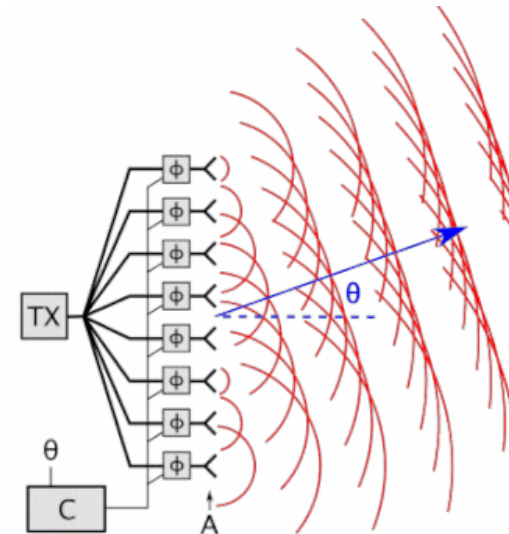
Multi-user capability

Easy expansion to new fields

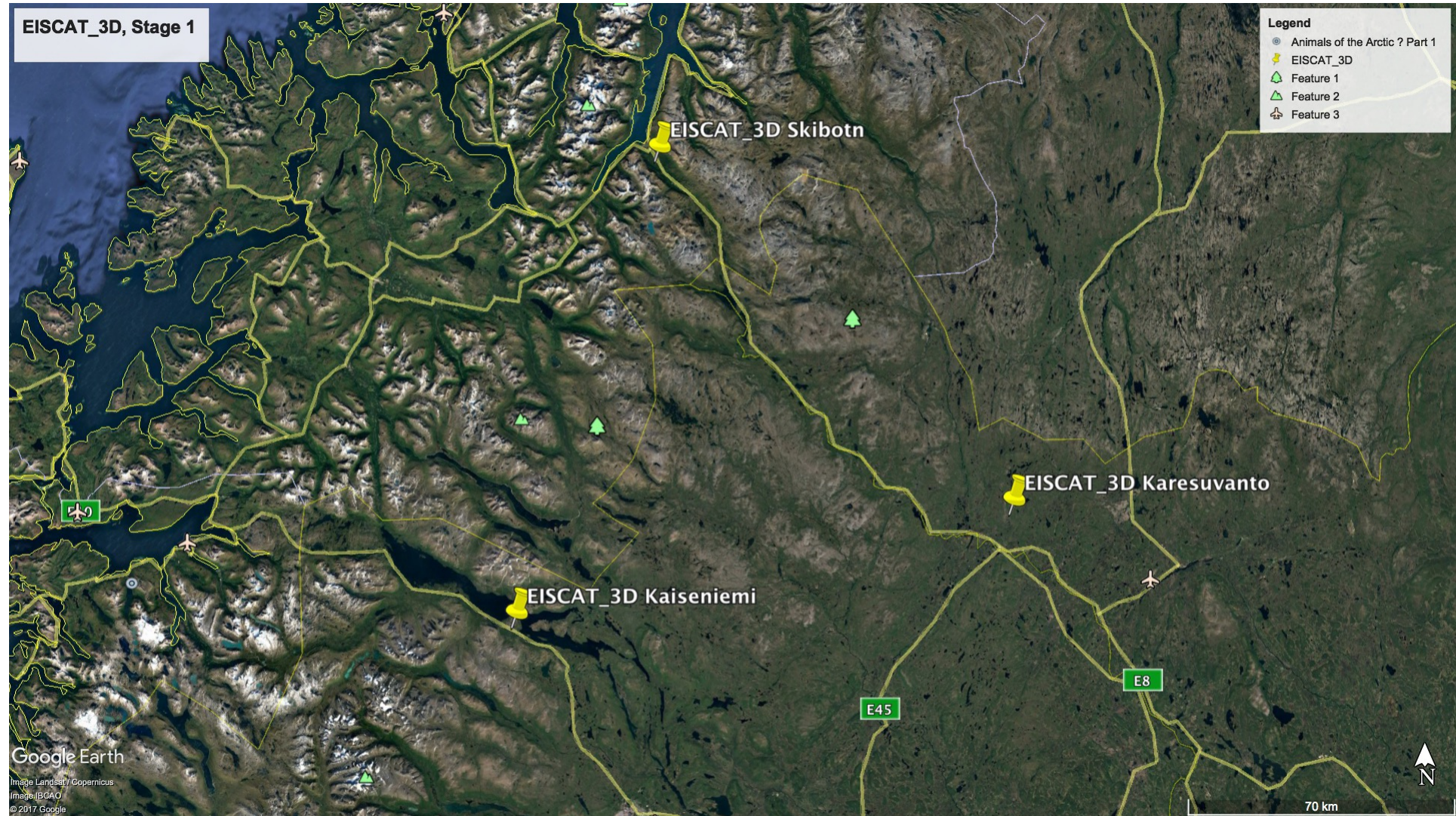
Tri-static, 1.25 MW, 233 MHz

10k (Tx/Rx) + 5k (Rx) +5k (Rx) antennas

ESFRI Landmark Facility



# EISCAT 3D LOCATIONS



# EISCAT\_3D antenna sites (2/2023)



**Skibotn, Norway**



**Kaaresuvanto, Finland**

# EISCAT\_3D antenna sites (6/2023)



Skibotn, Norway



Kaaresuvanto, Finland



NREN engineers



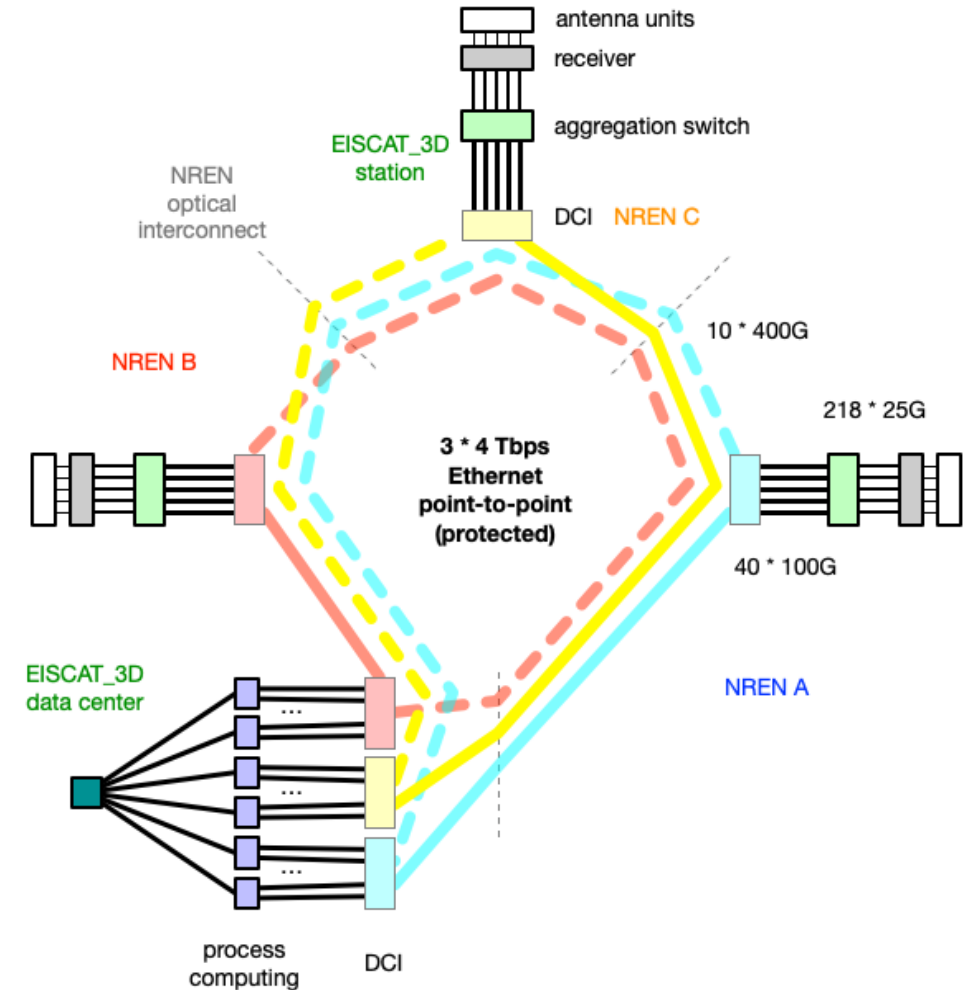
# EISCAT\_3D instrument and network architecture

- Centralised computing at the DC
  - SUNET Orion in Kalix, Sweden
- Three antenna sites in Finland, Norway and Sweden
  - All data feed to the DC
  - Max. 3,6 Tbps per site
- 1750+ km optical ring to connect antenna sites to the DC
  - 3 interconnected NREN open line systems
  - High OSNR (67 % spans Raman amplified)
  - Licensing-free spectrum



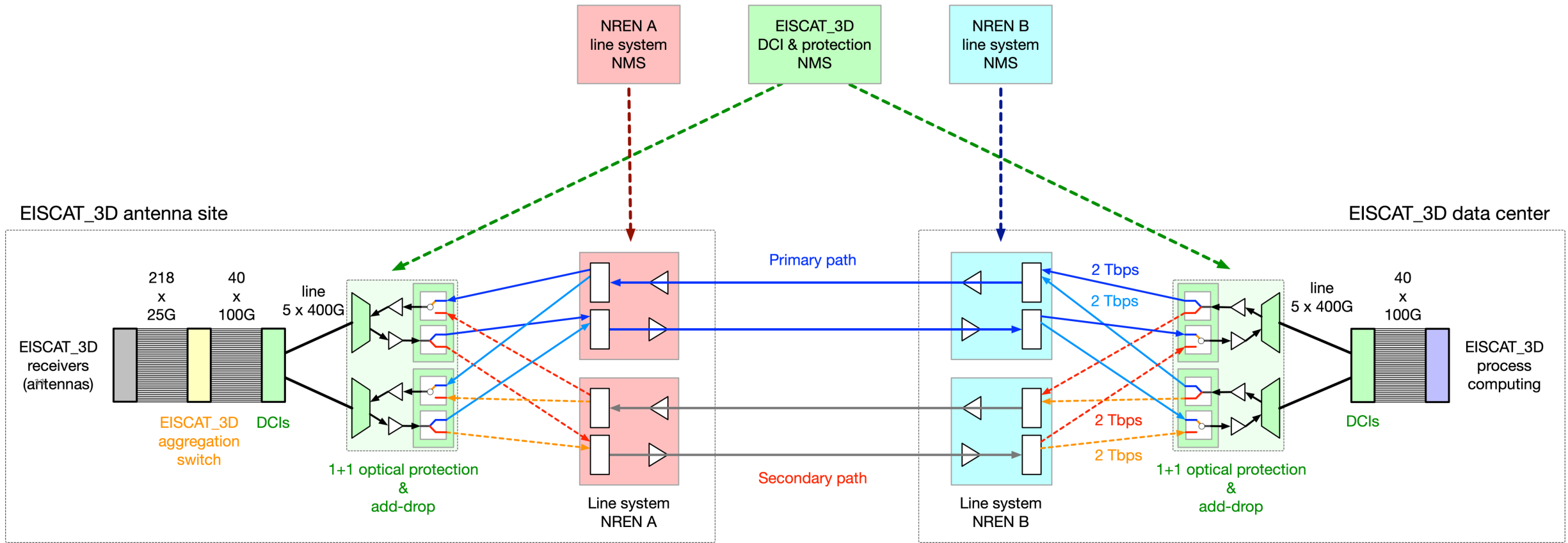
# EISCAT\_3D instrument and network architecture

- 10 x 400G transport per site (SE: 8 x)
  - Optically protected in group of channels
  - Spectrum use optimised (100 -> 75 GHz)
- Operational challenges
  - Almost 40 alienwaves in each NREN domain (including protection)
  - ADVA/Adtran & Nokia OLS behaviour
  - No big margins -> issues need to be fixed
- Partial service ramp up on-going
  - Currently 17 out of 28 channels (400G) online
  - Currently 36 out of 112 OLS alienwaves online
- First production use next week



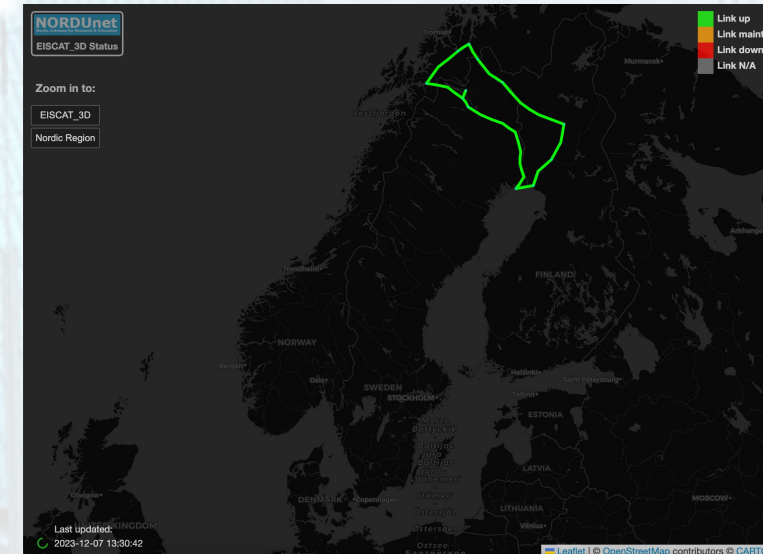


# EISCAT\_3D site-to-site protected transport



# Monitoring tools for performance troubleshooting

- Common metrics database (InfluxDB)
  - Relevant NREN OLS metrics (partial coverage)
  - All EISCAT\_3D DCI transport metrics
  - Relevant packet layer metrics (in the future)
  - Read-only access for providing NRENs
- Grafana dashboards (DCI)
- Proof-of-concept weathermap soon for OLS layer



# OLS performance considerations

- Optical line system power equalisation differ
  - ADVA/Adtran uses power delta (dB) to the baseline
    - > need to calculate from the baudrate, easy to fine-tune
  - Nokia has some pre-defined baudrates
    - > flex-baudrate fine-tuning?
- Amplifier parameters after fiber changes
  - Nokia (apparently) more automatic
  - ADVA/Adtran requires manual interventation
- How much we can really tune our line systems?
  - Maximum amplifier output power
    - 120 mW -> 1,88 mW per 75 GHz; or +2,74 dBm per 75GHz
  - Maximum channel launch power
    - +2,7 dBm (@ 65 Gbaud) typical
    - How much more could it be before nonlinear effects kick in?

# Performance tuning (amplifiers & channels)

SE site: OSNR ~ 27 dB (550 km)



# Performance tuning (amplifiers & channels)

**NO site: OSNR ~ 22,5 dB (850 km)?**



# Performance tuning (amplifiers & channels)



SUNET amplifier tuning  
+0,5 dB gain

SIKT baudrate change  
+0,5 dB gain

# Thank you!

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