



# EISCAT\_3D

Craig Heinselman  
EISCAT Scientific Association

# Solar Eclipse



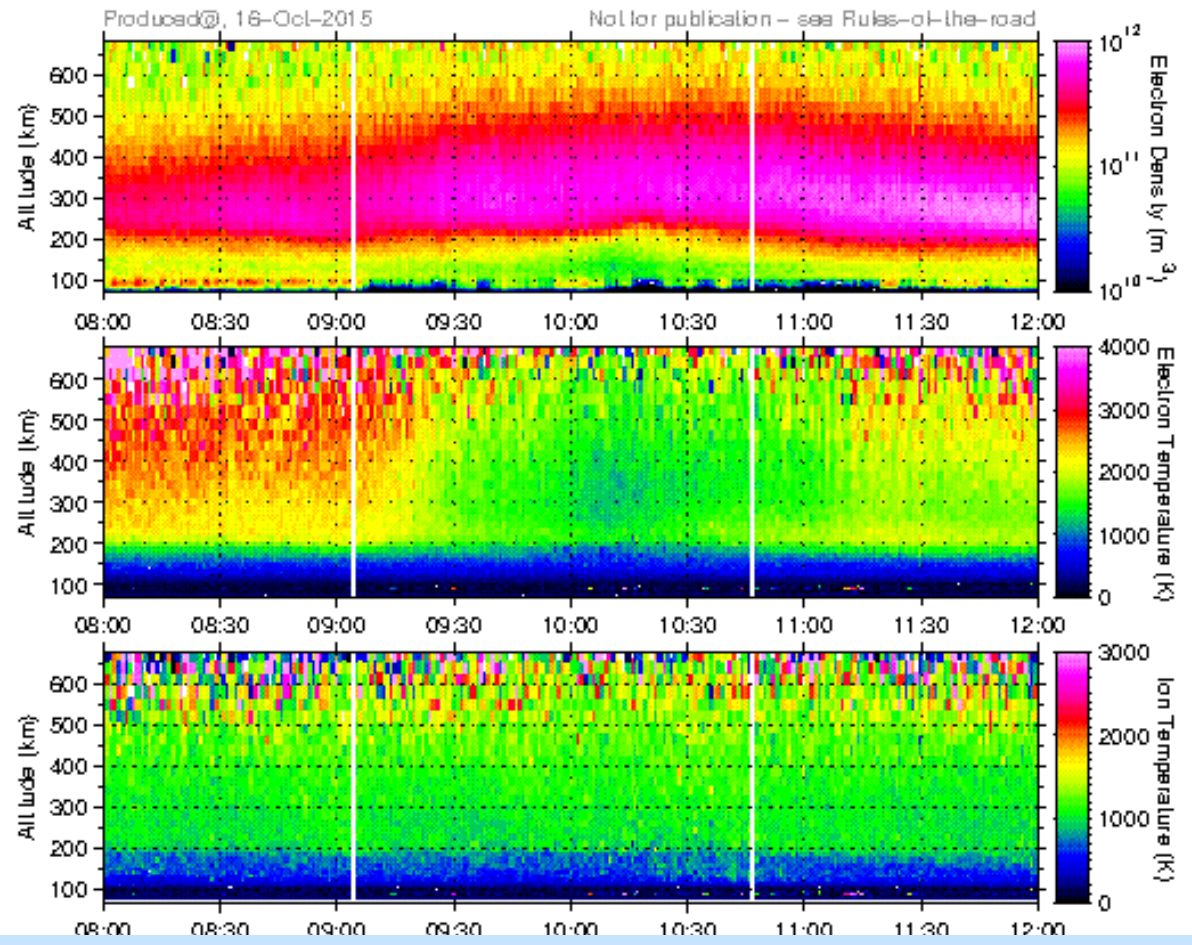
95%

9:04-10:08-11:13



## EISCAT Scientific Association

**EISCAT UHF RADAR**  
 CP, uhfa, beata, 20 March 2015



Local Measurements



# Solar Eclipse



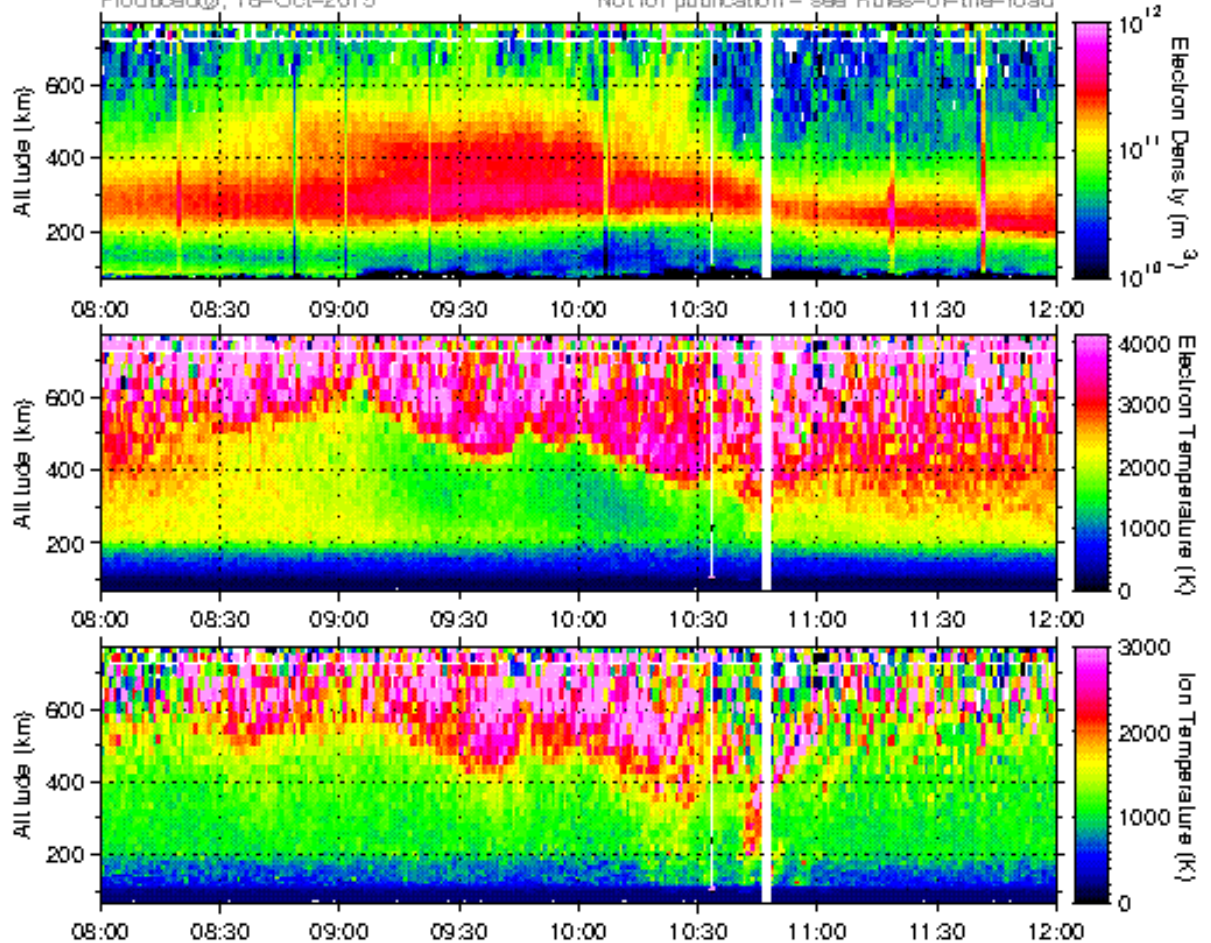
## EISCAT Scientific Association

### EISCAT VHF RADAR

CP, vhf, bella, 20 March 2015

Produced @ 16-Oct-2015

Not for publication - see Rules-of-the-road



9:04-10:08-11:13

Looking Northward

# Solar Eclipse



Photo by  
Assar Westman

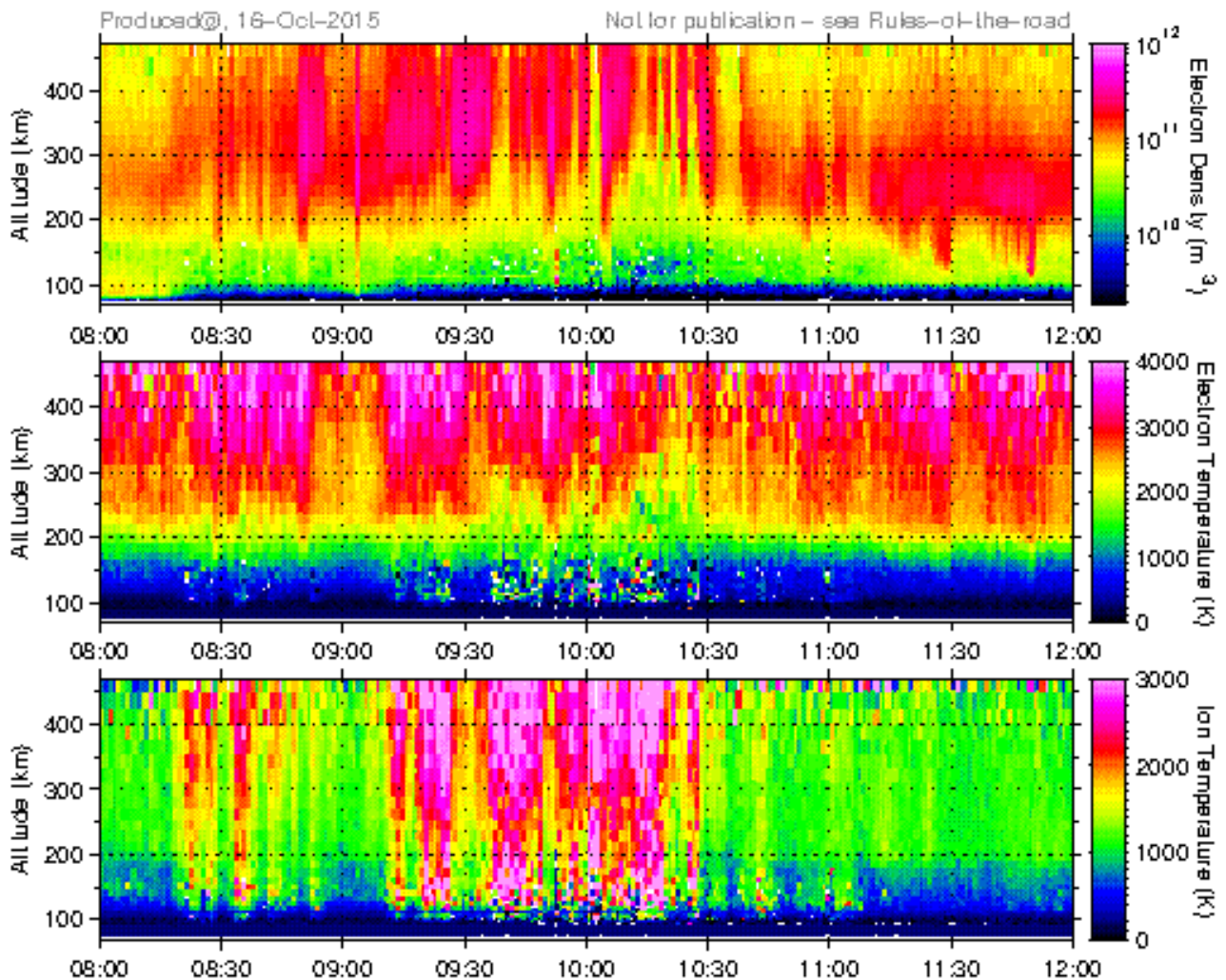
9:12-10:12-11:12



## EISCAT Scientific Association

### EISCAT SVALBARD RADAR

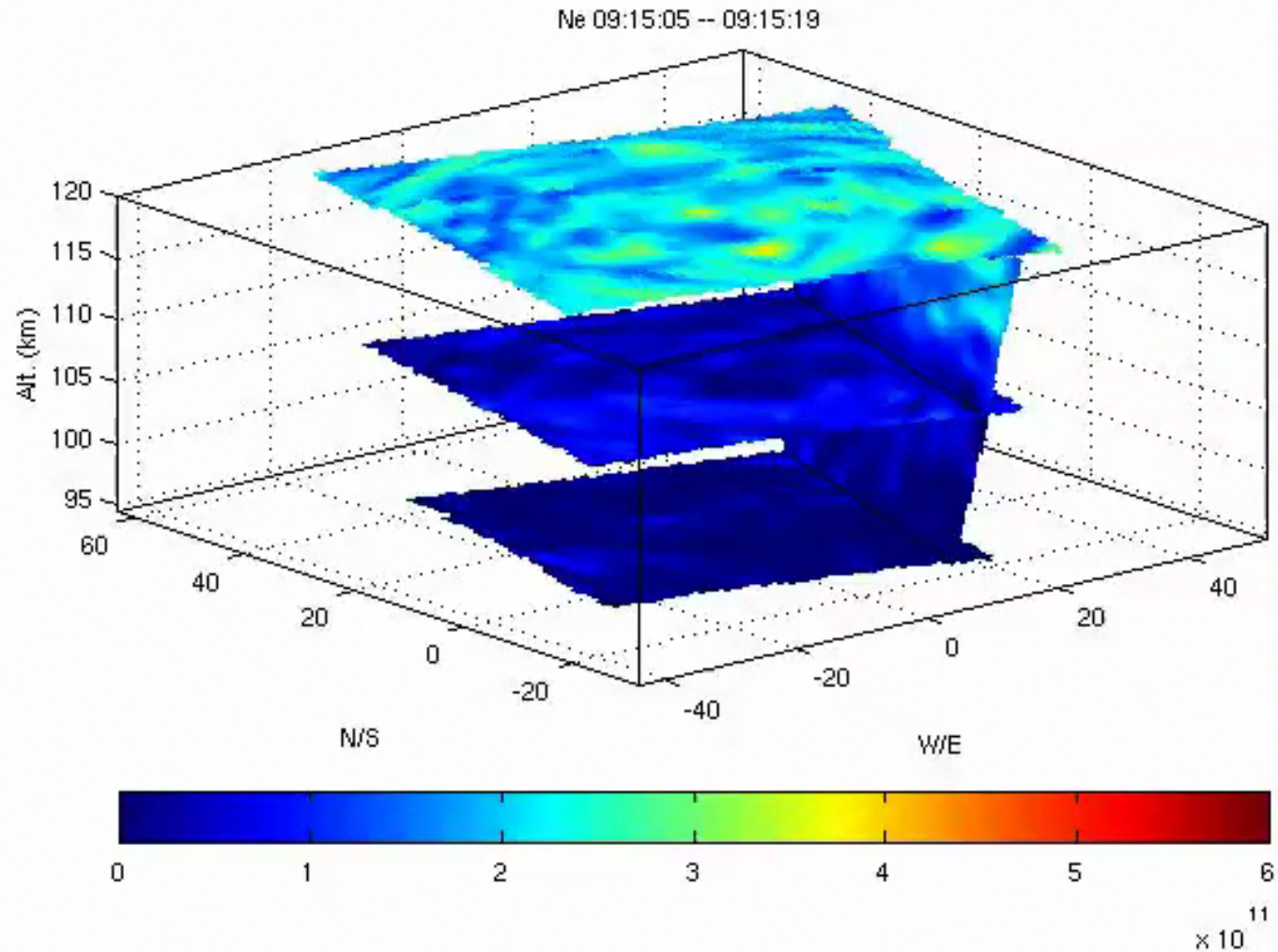
CP, 42m, ipy, 20 March 2015





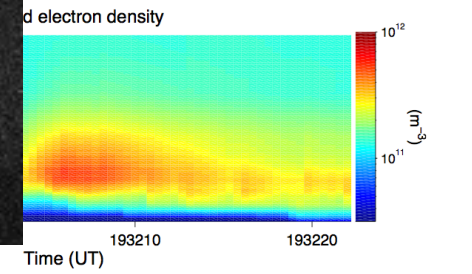
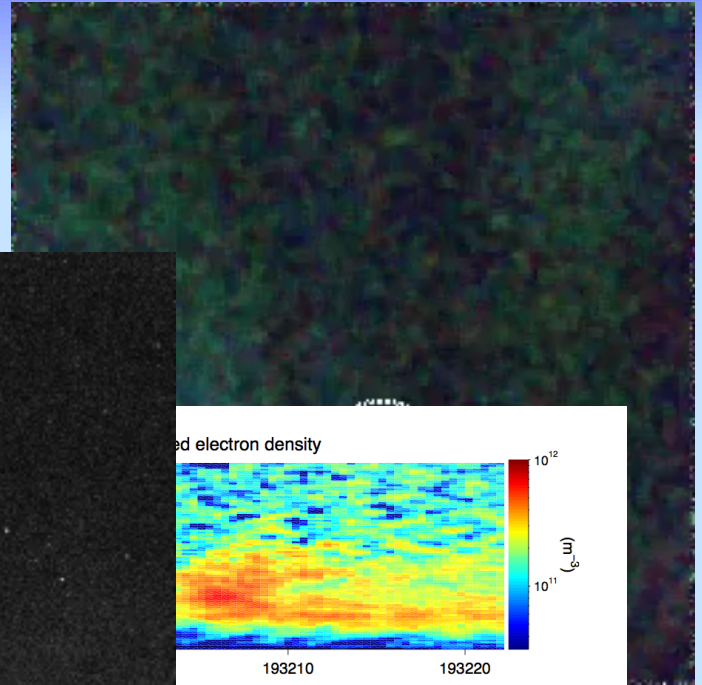
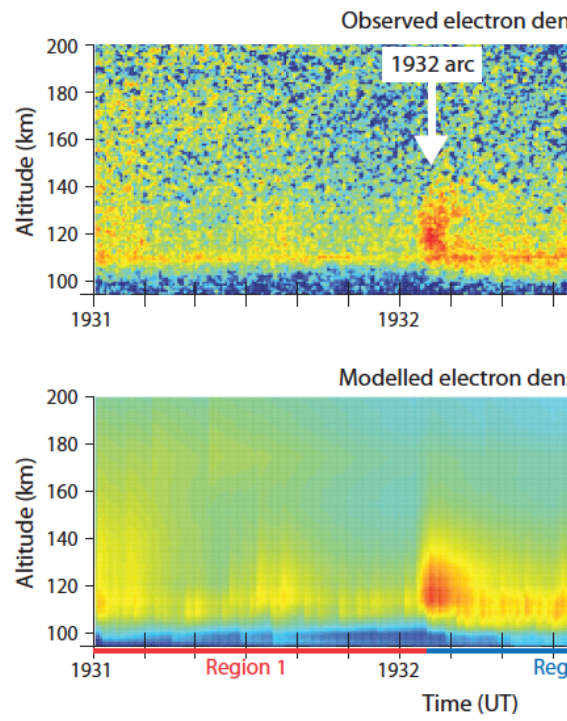


# AMISR view of an aurora



# Auroral Structure

Power profile: 0.44 sec, 0.9 km range



**Fig. 7.** Top: E-region enhancements in electron density corresponding to auroral arcs drifting over EISCAT. Bottom: modelled electron density.

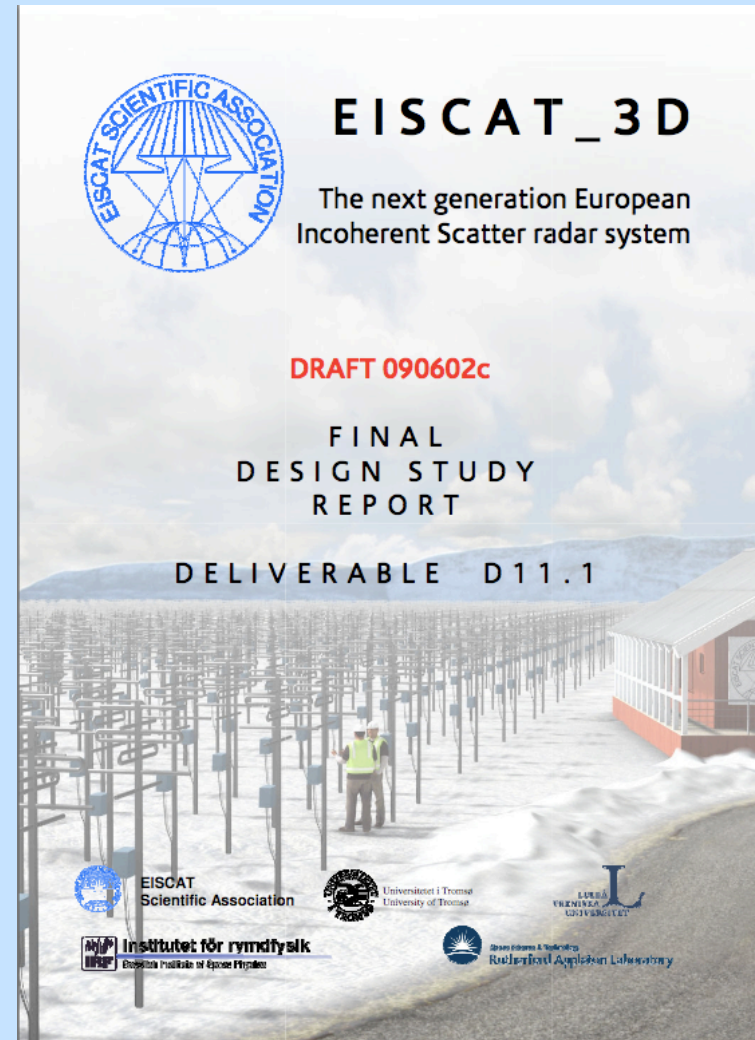
**Fig. 12.** Top: electron density profiles from EISCAT measurements, for the 1932 arc. Bottom: corresponding modelled electron density. The bite-out in the data at 19:32:10 UT is not reproduced by the model, and is believed to be caused by horizontal convection of plasma near the arc.





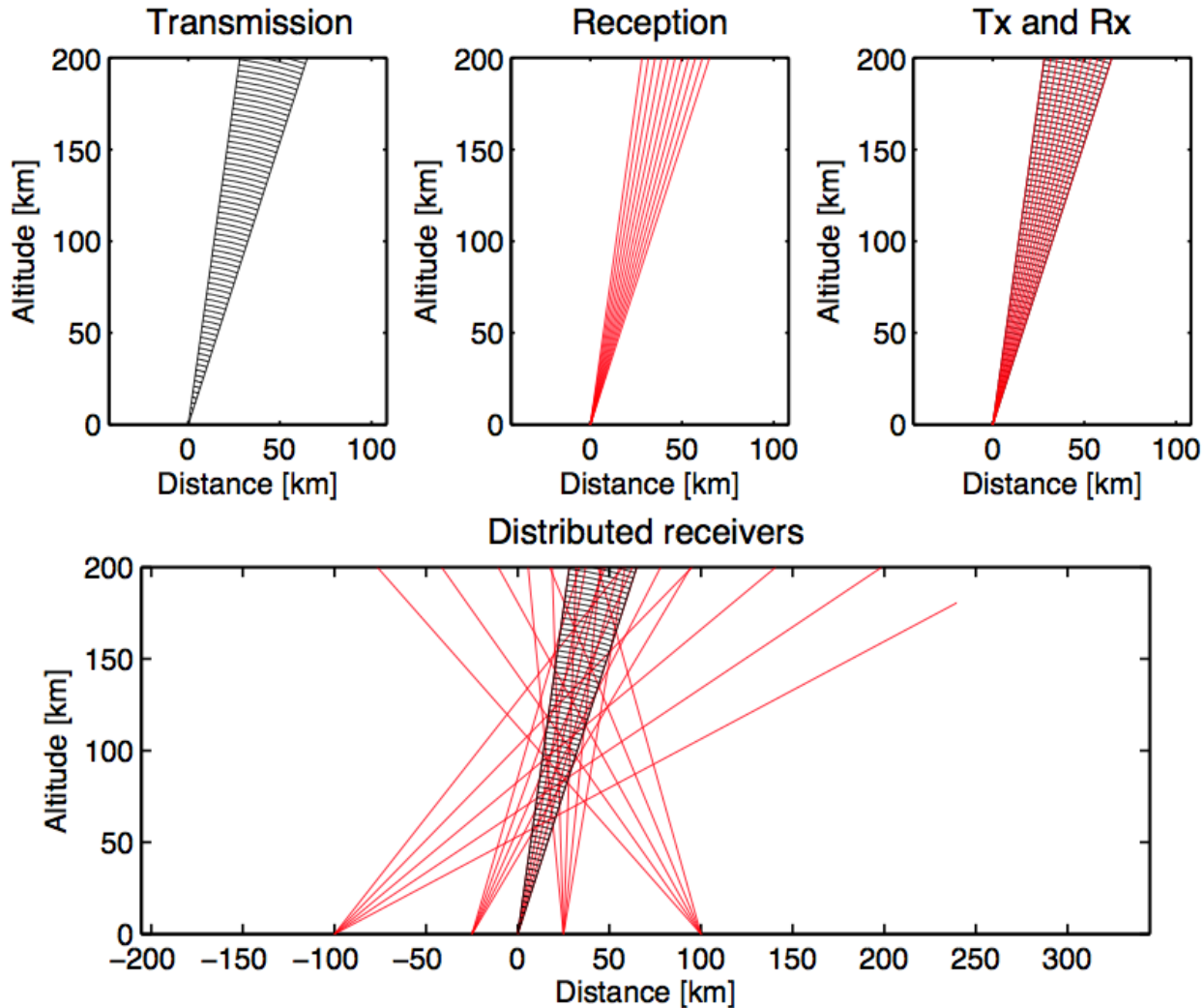
# EISCAT\_3D

- Phased array technologies for rapid beam steering (volumetric imaging)
- Multiple sites for vector measurements of the ionospheric plasma
- Sufficient sensitivity for sub-second measurements of auroral phenomena
- Interferometric capabilities for 100-m spatial scale measurements
- Design Study 2005-2009
  - 5 partners, 30 man years
  - EISCAT, University of Tromsø, Luleå University of Technology, Rutherford Appleton Laboratory, Swedish Institute of Space Physics
  - Total budgeted volume 2.8 MEUR
  - EU FP6 support 2 MEUR
- Preparatory Phase 2010-2014
- Implementation ~5 years to complete first stage



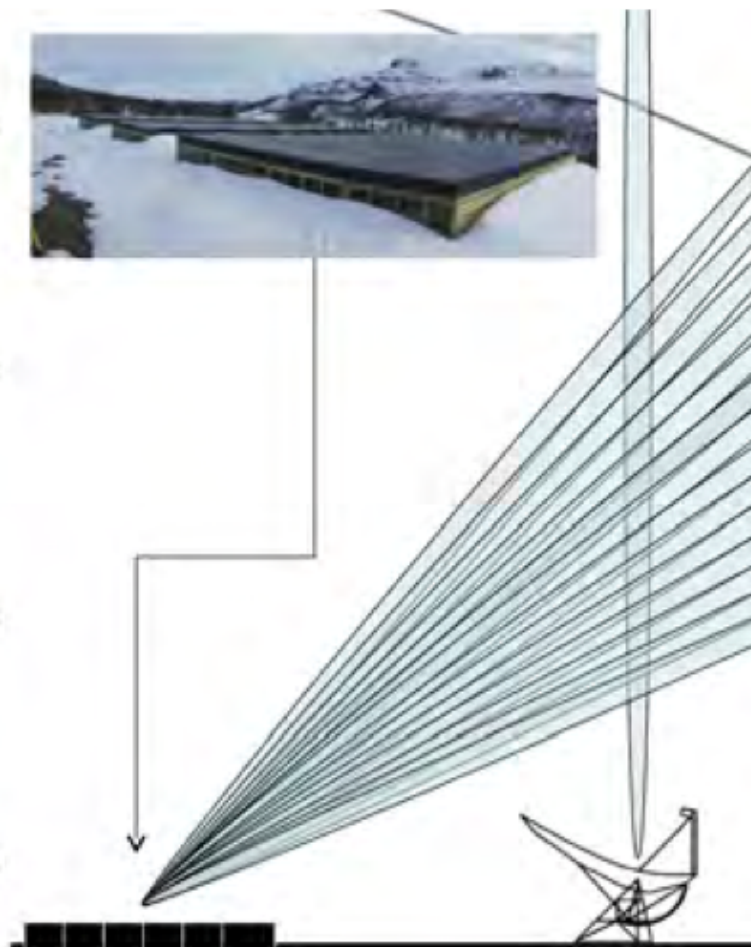
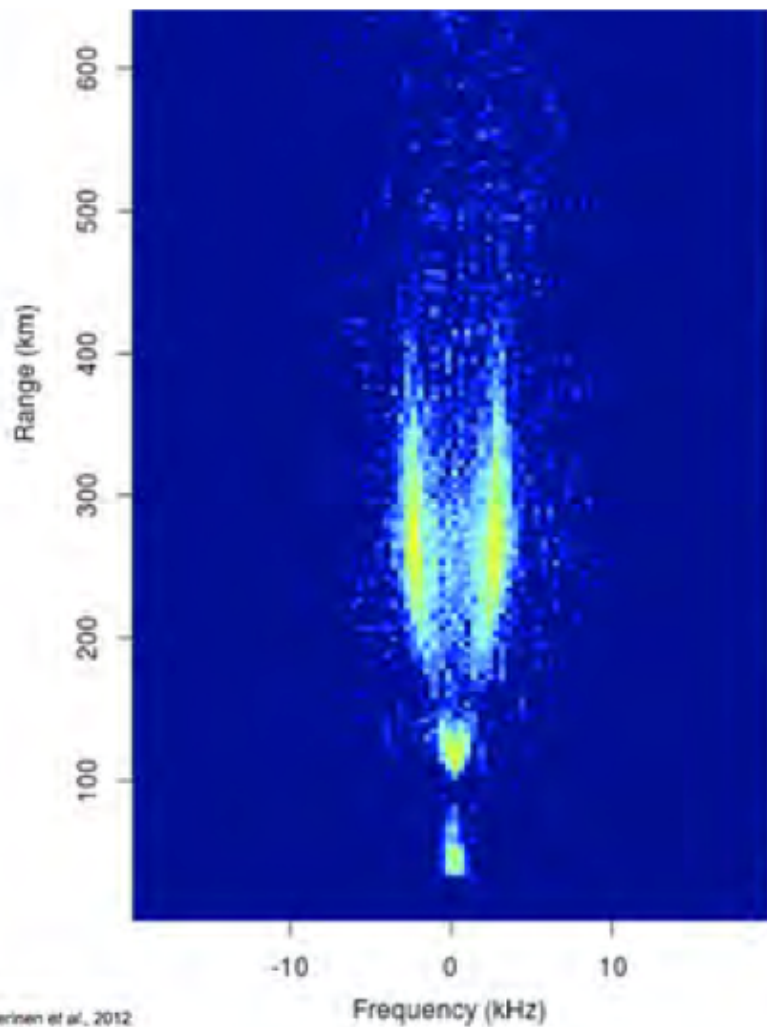


# Multistatic Phased Array





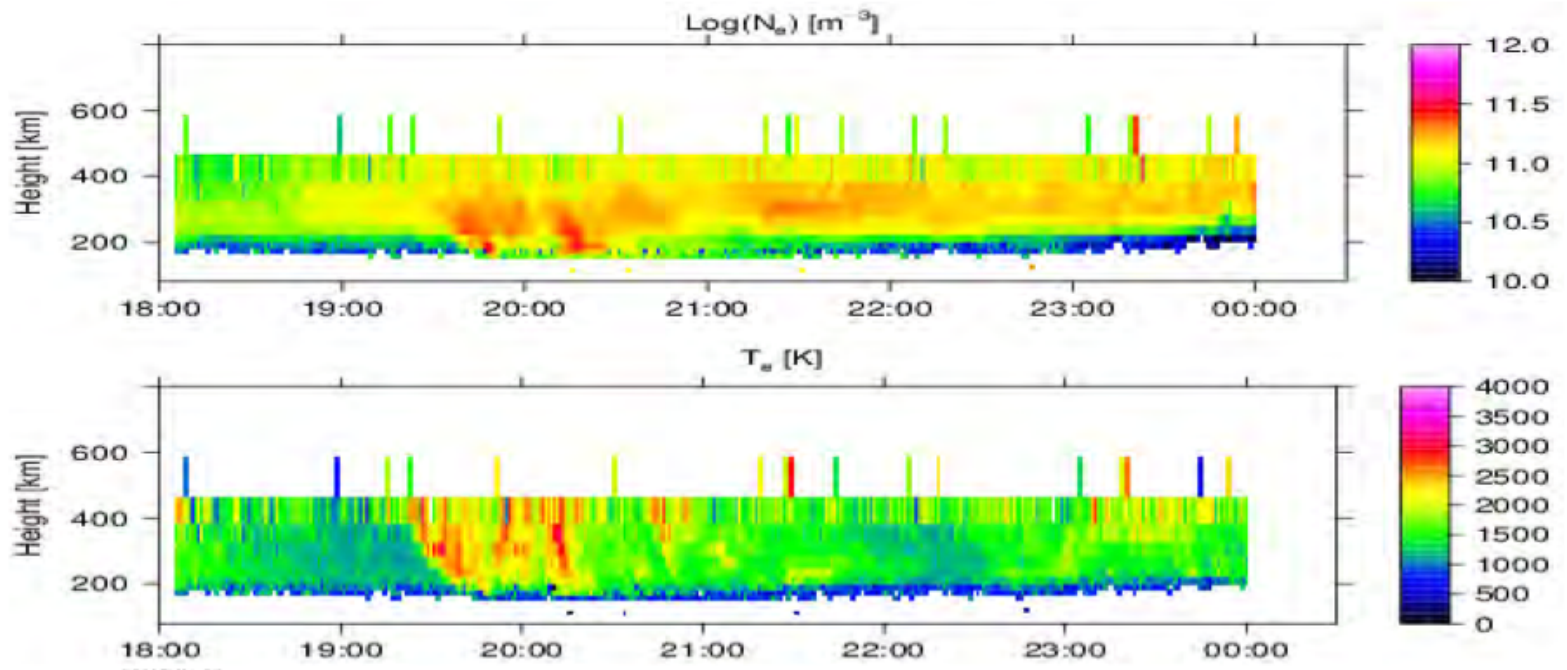
# First multibeam receiver data analysis, KAIRA receiving EISCAT VHF



Verinen et al., 2012



# Bistatic KAIRA compared to monostatic EISCAT VHF



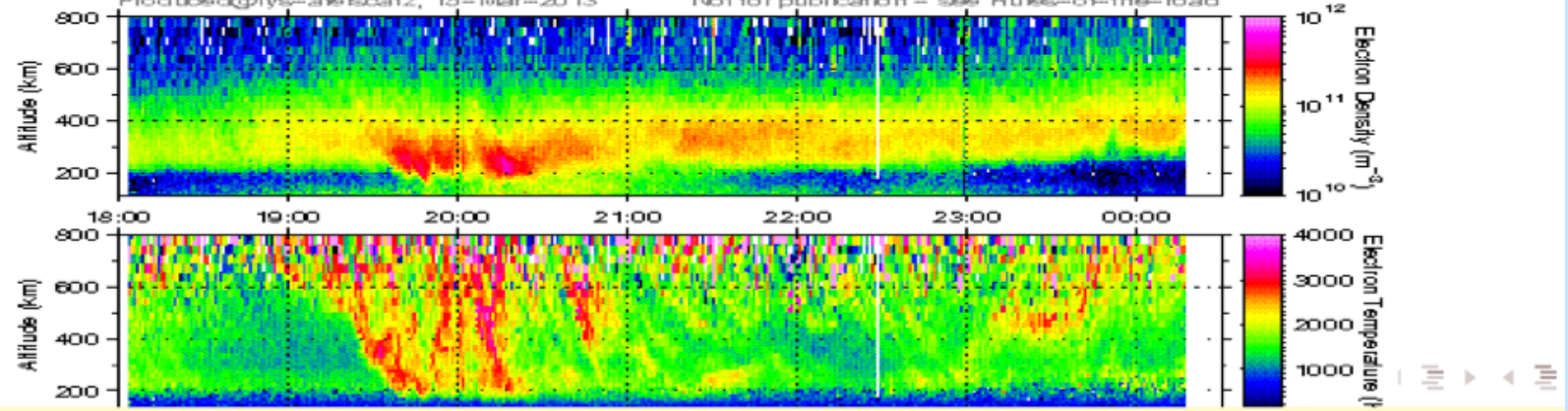
## EISCAT Scientific Association

### EISCAT VHF RADAR

RT, vhf, bella, 14–15 March 2013

Produced @ phys-ateisecat2, 15-Mar-2013

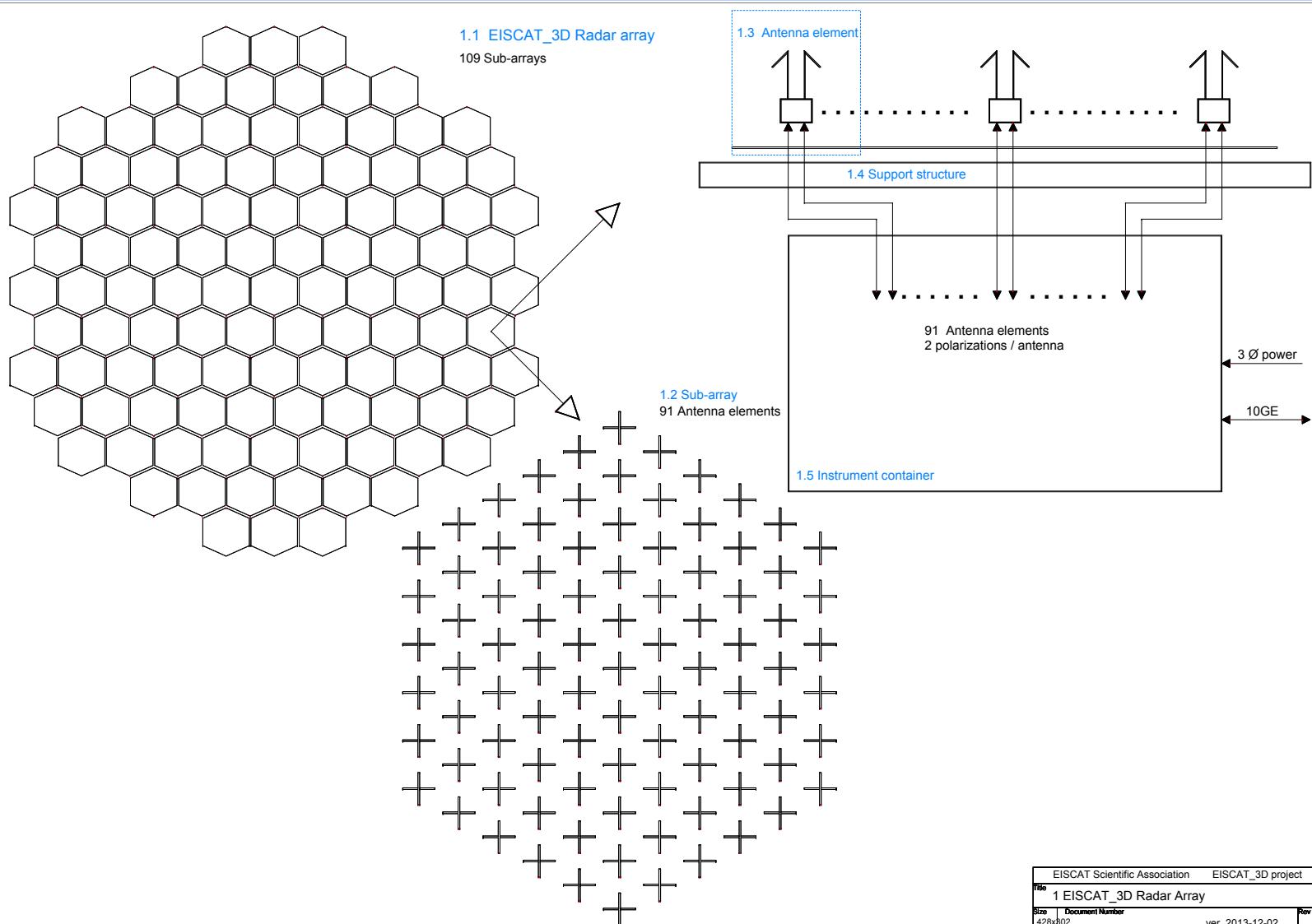
Not for publication - see Rules-of-the-road

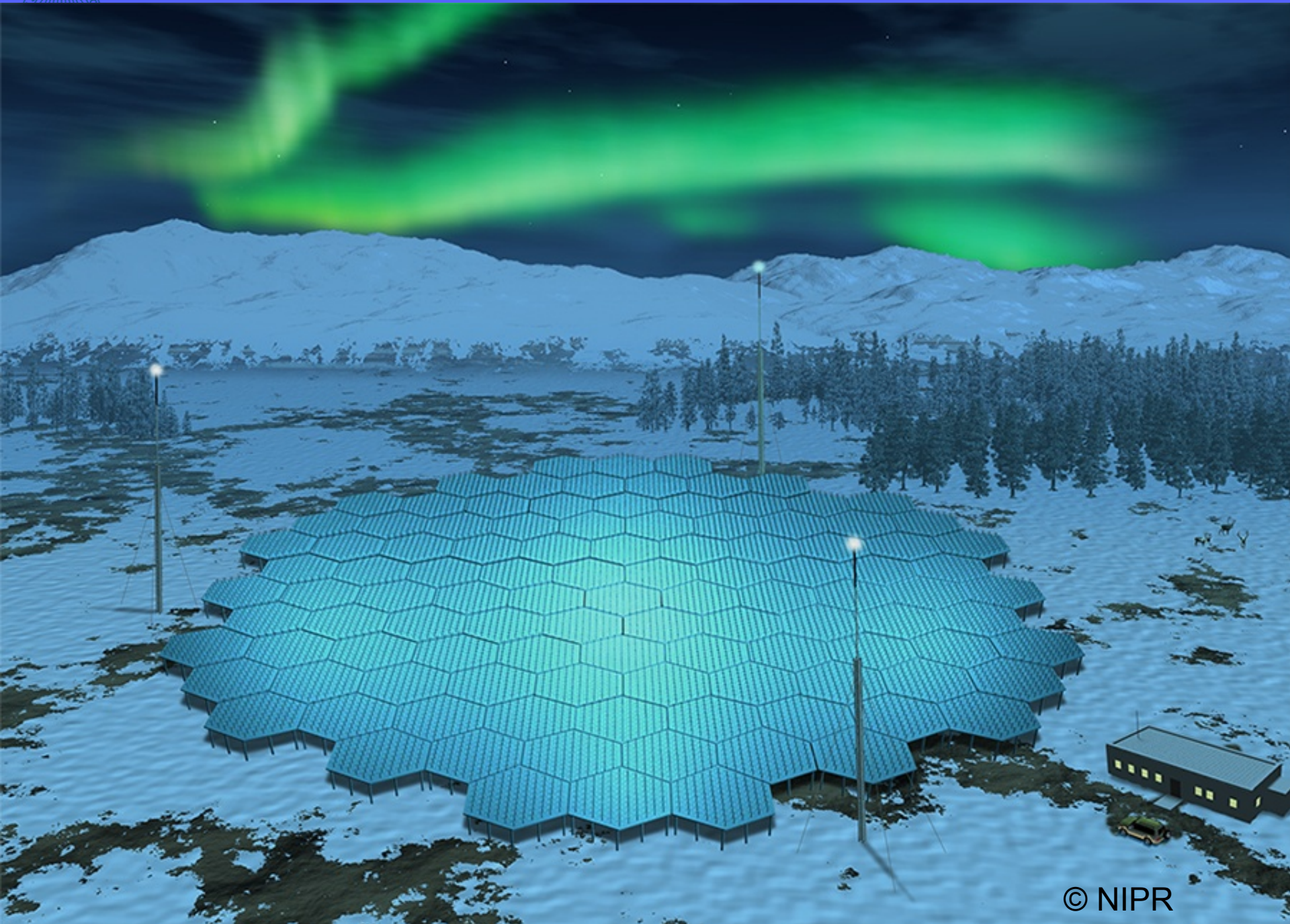






# 9919+ Antennas Per Site









# EISCAT



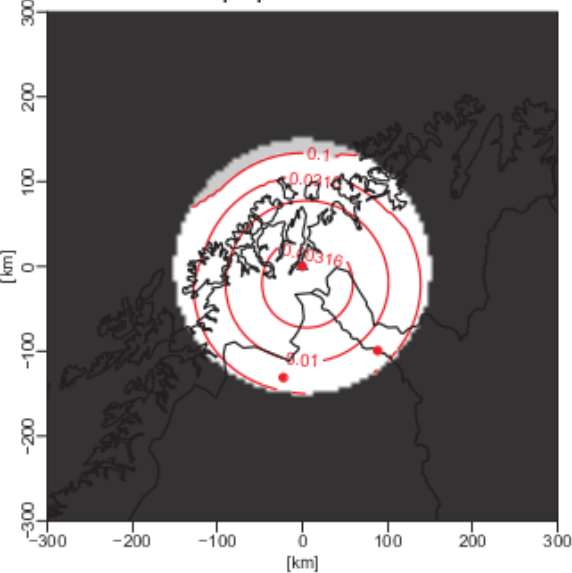




# EISCAT\_3D Stage 1

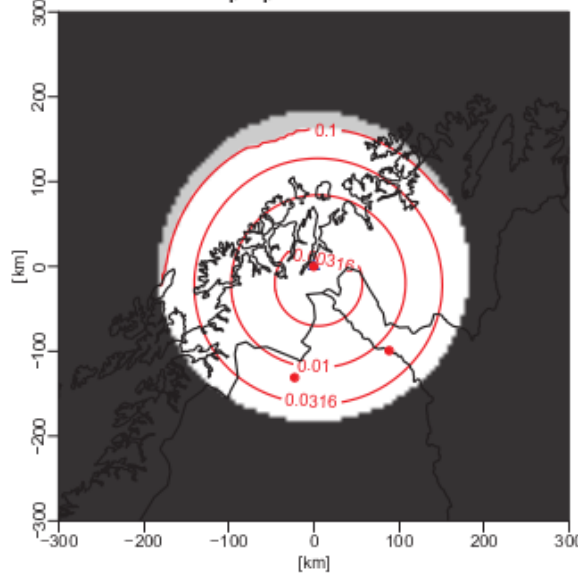


Isotropic parameters 90 km



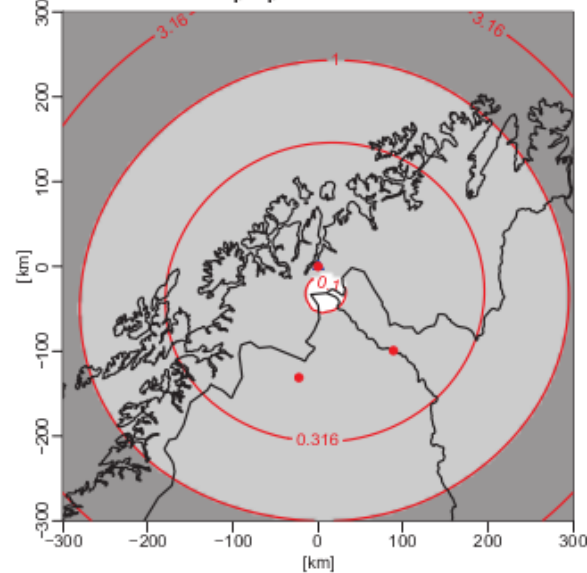
$\log_{10}(\text{integration time [s]})$

Isotropic parameters 110 km



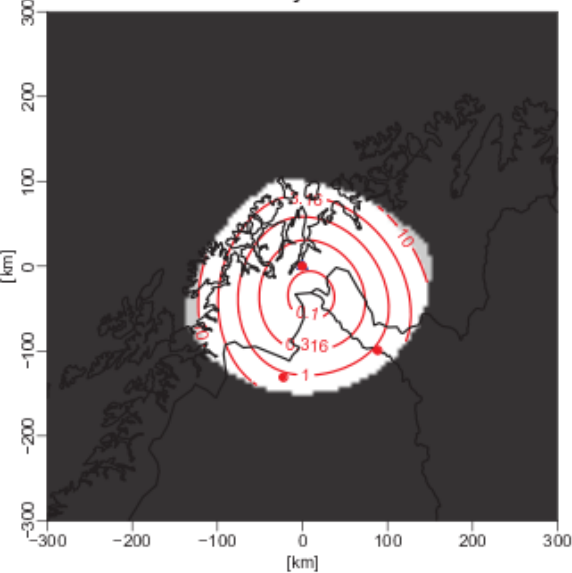
$\log_{10}(\text{integration time [s]})$

Isotropic parameters 300 km



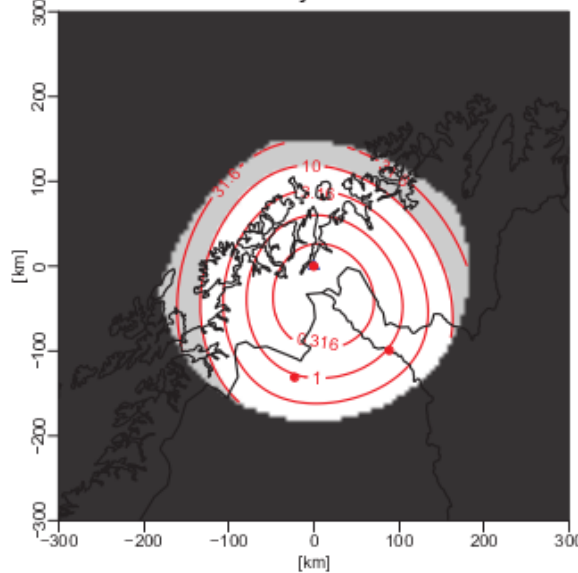
$\log_{10}(\text{integration time [s]})$

Velocity 90 km



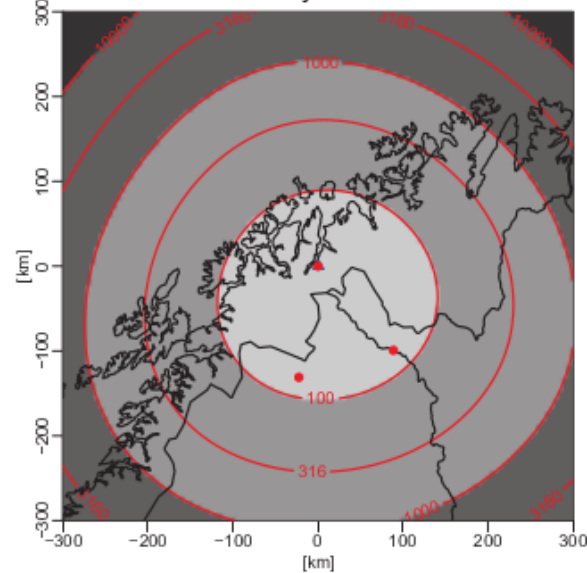
$\log_{10}(\text{integration time [s]})$

Velocity 110 km



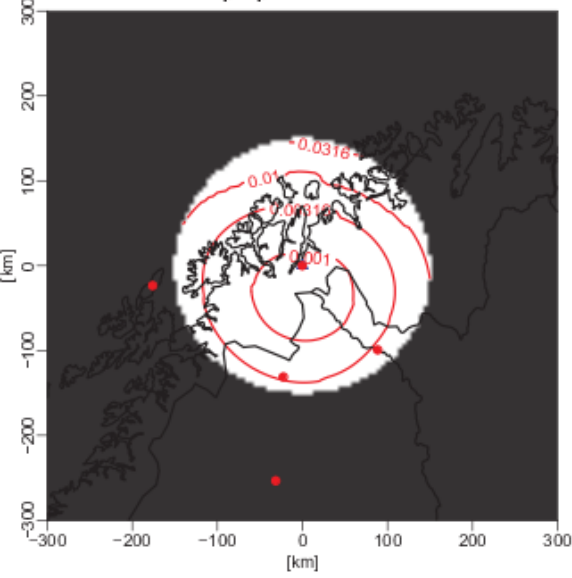
$\log_{10}(\text{integration time [s]})$

Velocity 300 km

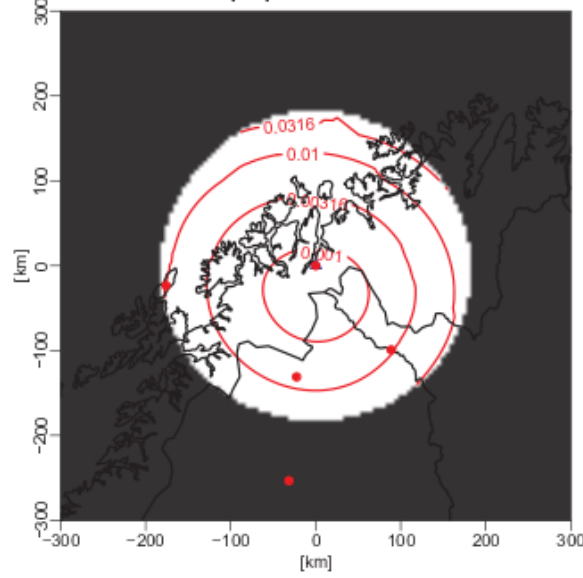


$\log_{10}(\text{integration time [s]})$

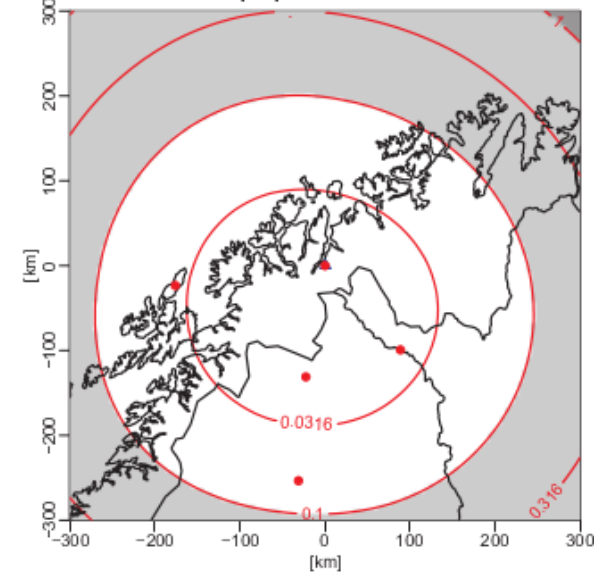
Isotropic parameters 90 km



Isotropic parameters 110 km



Isotropic parameters 300 km

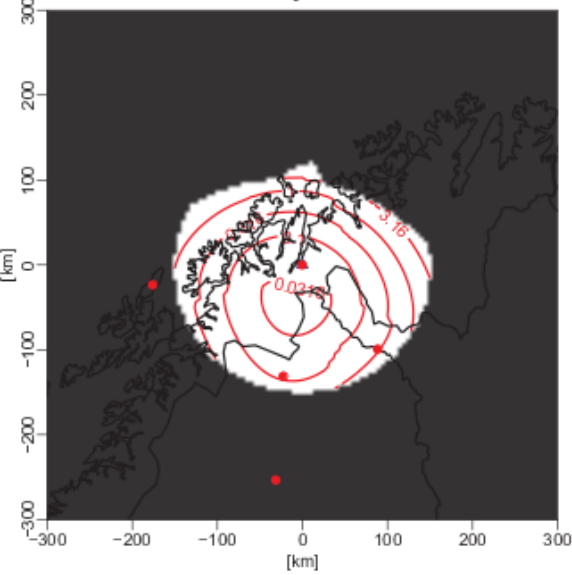


$\log_{10}(\text{integration time [s]})$

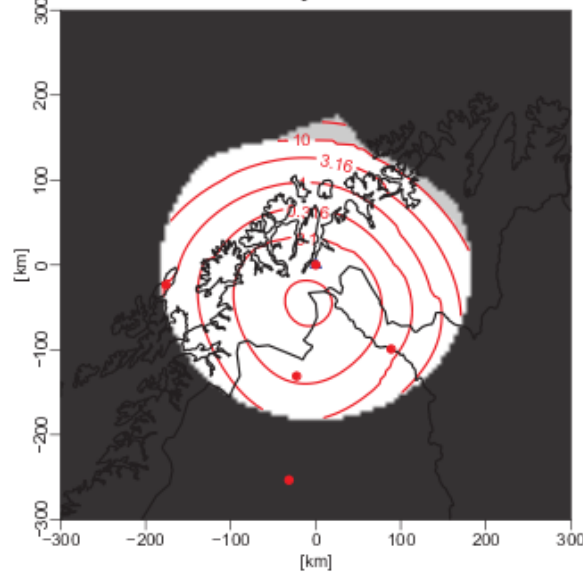
$\log_{10}(\text{integration time [s]})$

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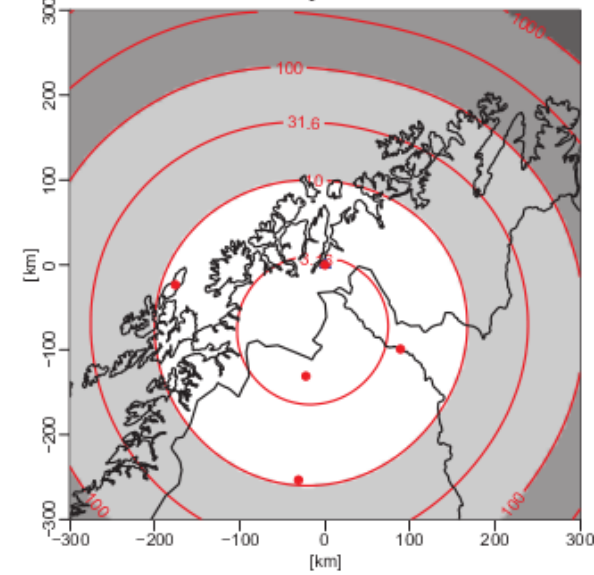
Velocity 90 km



Velocity 110 km



Velocity 300 km



$\log_{10}(\text{integration time [s]})$

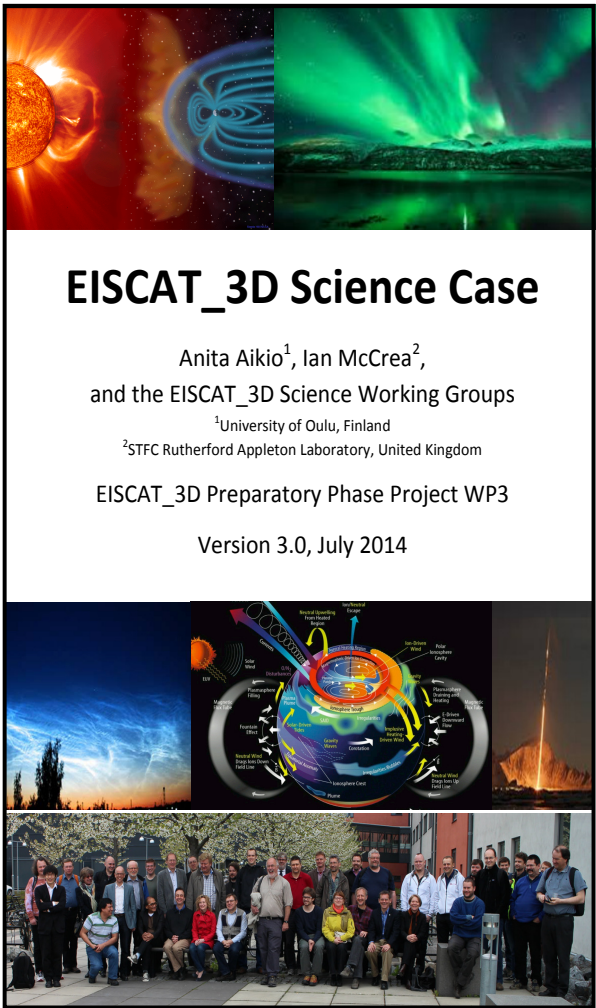
$\log_{10}(\text{integration time [s]})$

$\log_{10}(\text{integration time [s]})$



# EISCAT\_3D Science

- An extremely versatile and largely software-defined instrument
- Specific science plans are developed within national user communities
- Easy expansion to new fields
- Easy inclusion of new nations



**EISCAT\_3D Science Case**

Anita Aikio<sup>1</sup>, Ian McCrea<sup>2</sup>,  
and the EISCAT\_3D Science Working Groups

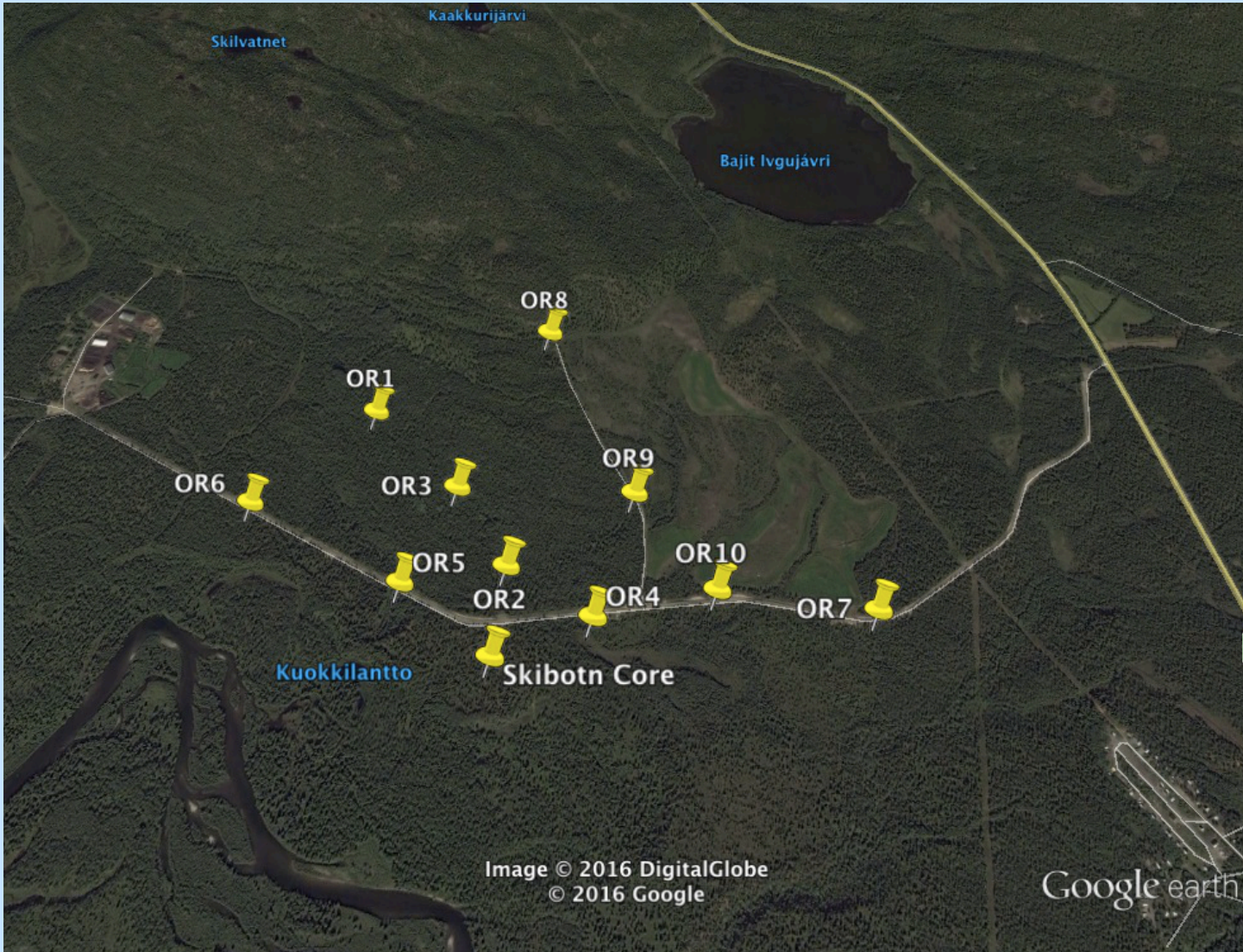
<sup>1</sup>University of Oulu, Finland  
<sup>2</sup>STFC Rutherford Appleton Laboratory, United Kingdom

EISCAT\_3D Preparatory Phase Project WP3

Version 3.0, July 2014



# Potential Skibotn Site







# Potential Karesuvanto Site

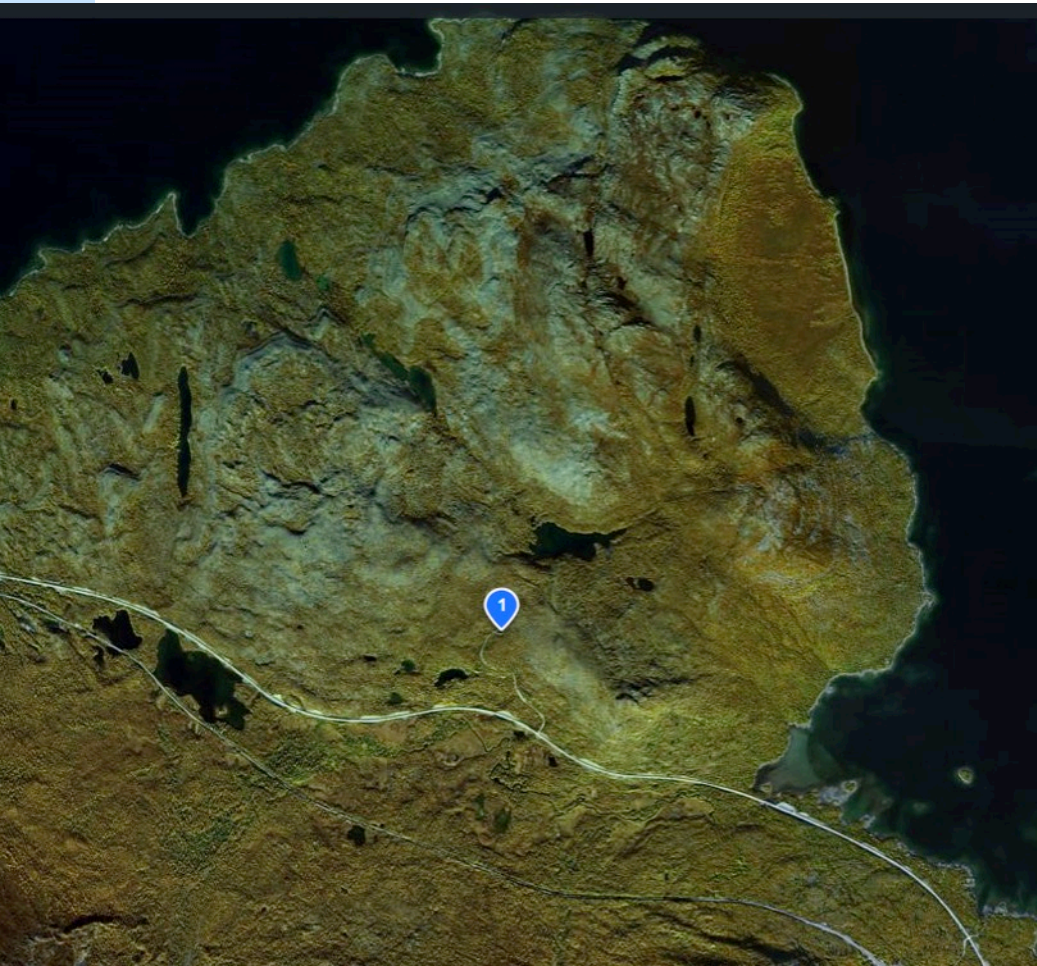






# Potential Kaiseniemi Site

Hired Tyréns to investigate the costs of various options at the new location.





# Status Overview

## Funded

European Commission EISCAT3D\_PfP

NelC Study

Funding commitments (conditional) from

Finland

Norway

Sweden

Some funding from

Japan



# EISCAT3D\_PfP Objective

The overall objective of this project, “EISCAT\_3D: Preparation for Production” (EISCAT3D\_PfP), is to facilitate a smooth and swift transition of the EISCAT\_3D project from the FP7 Preparatory Phase to its implementation (Figure 1). The eventual system will be owned by EISCAT Scientific Association, the Coordinator of the previous EISCAT\_3D Preparatory Phase project which was completed in September 2014 and achieved the major requirements for implementing EISCAT\_3D.

EISCAT3D\_PfP will collaborate with engineering companies, electronic manufacturers and other industrial partners and SMEs to bridge from the FP7 Preparatory Phase toward the efficient implementation of this new research infrastructure. An important first step in the technical integration and system testing is setting up a test-bed made up of an array consisting of 91 antenna elements. This Test Subarray will be used to test manufacture-ready sub-assemblies, low-level software, and the integration/interoperability of the system components prior to launching full scale ...



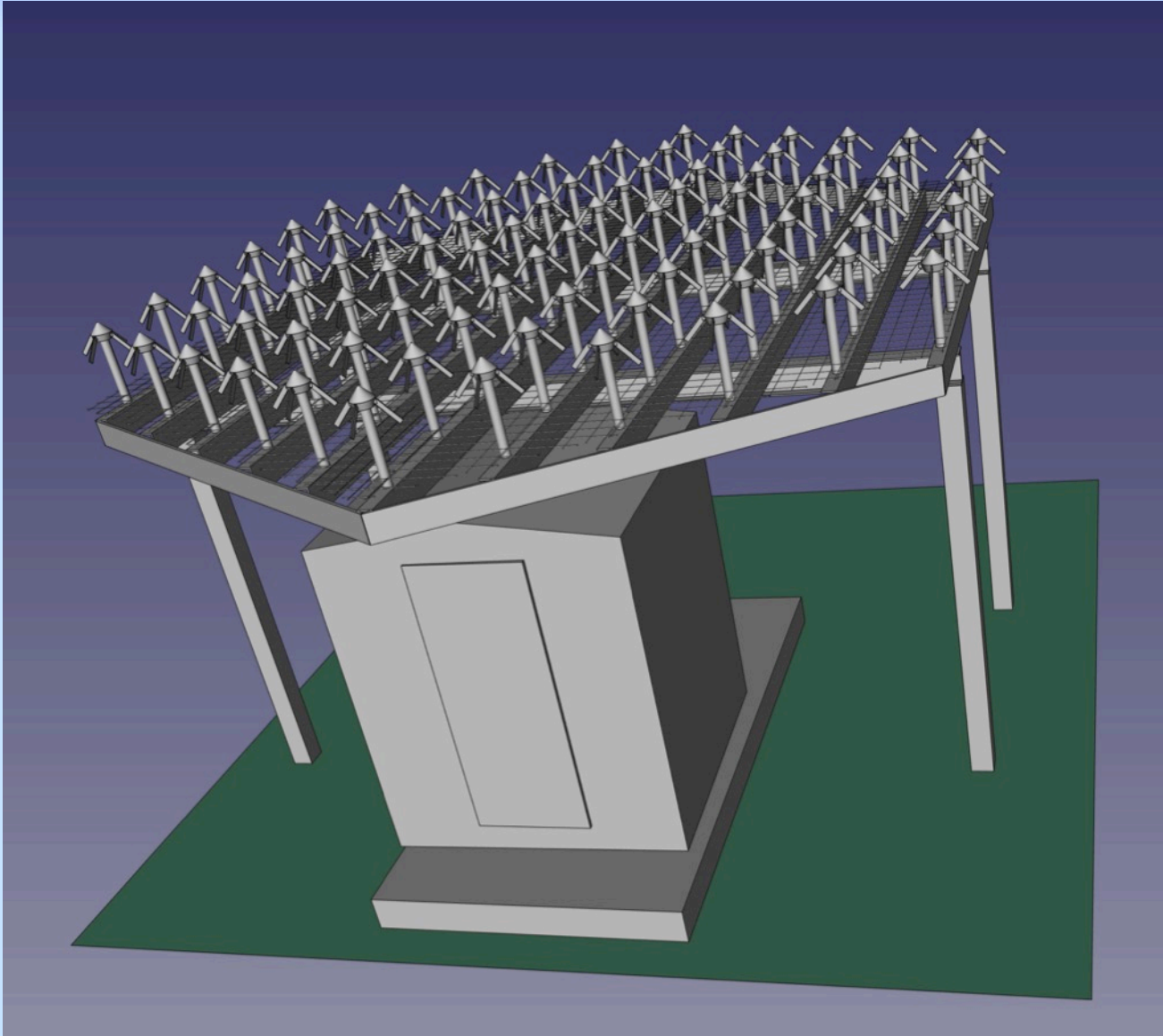
# Test Subarray Location







# Test Subarray





Questions?