

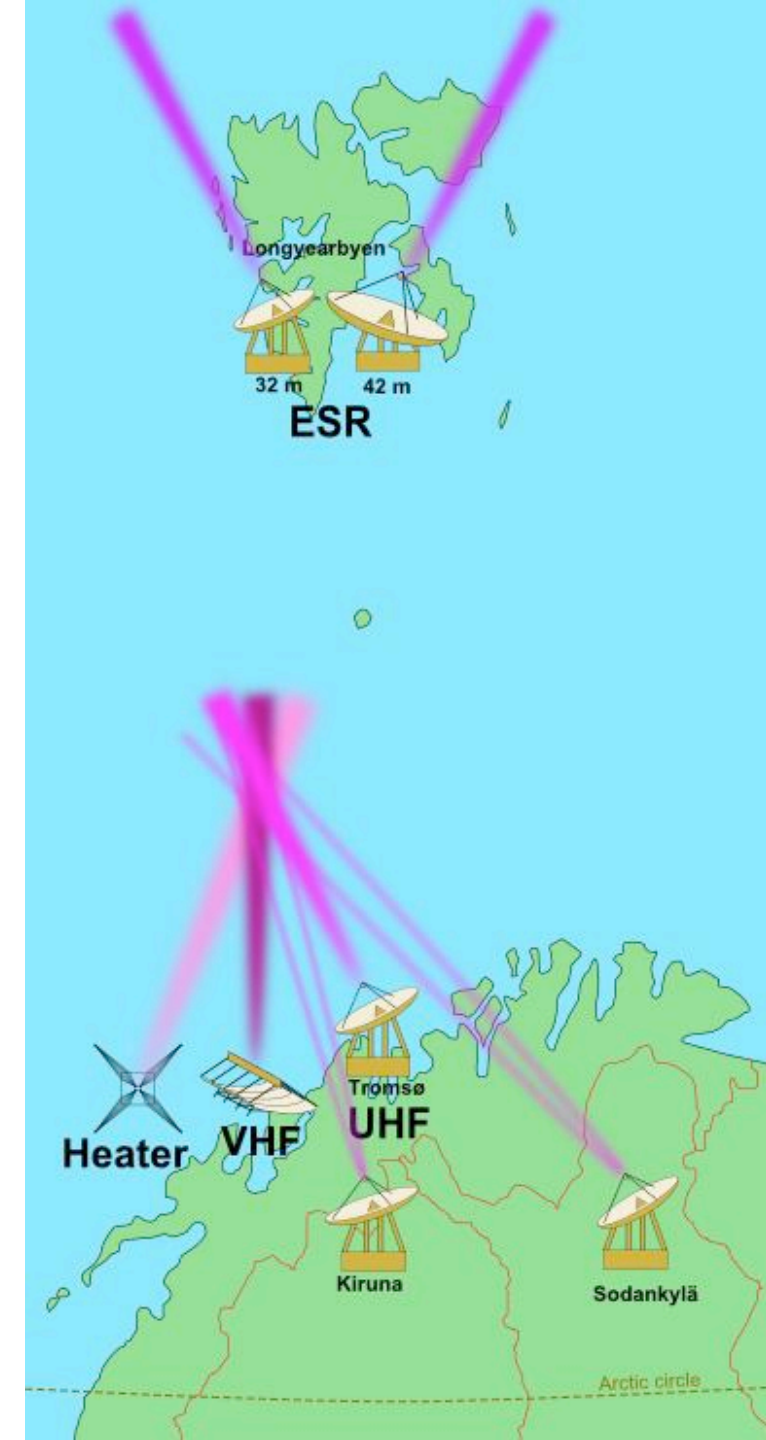
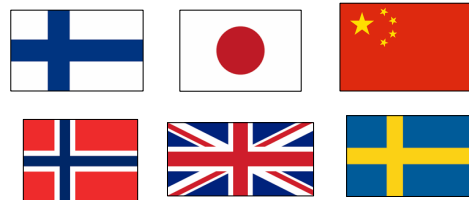
EISCAT Scientific Association

Dr Axel Steuwer

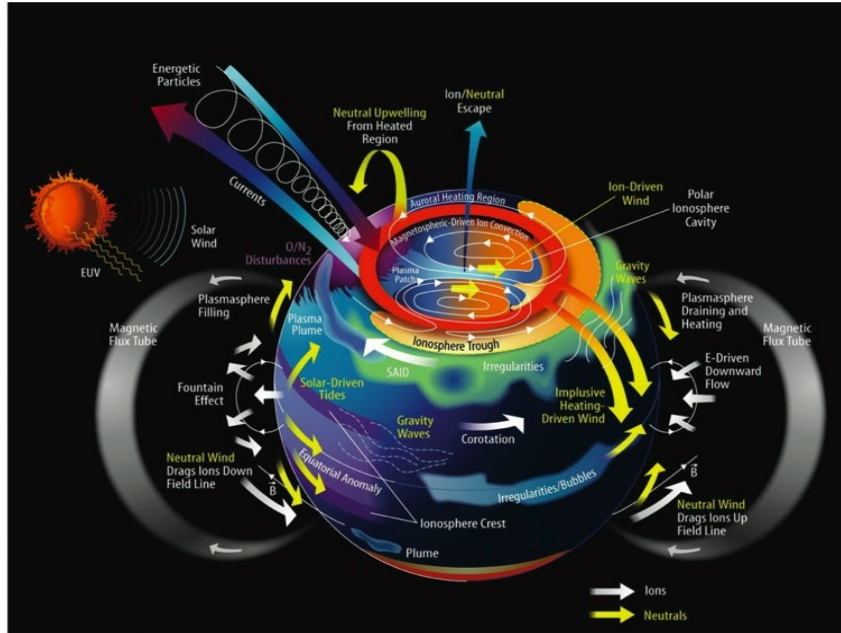
Director Designate

EISCAT Scientific Association

- **EISCAT** is an **international organisation** performing **fundamental research** in solar-terrestrial and atmospheric physics using **radar systems**.
- EISCAT was founded as an organisation in 1976. The first EISCAT radars started operations in 1981.
- The **EISCAT Associates** are **research organisations and councils** in Finland, Japan, China, Norway, UK and Sweden. They finance EISCAT through annual fees.



VARIOUS SCIENCE TOPICS



- Atmospheric physics and global change
- Space and plasma physics
- In- and outflow of matter in Earth's atmosphere
- Space debris, near-earth objects and space weather
- Radio astronomy

We don't always know where the science will lead and are open to modifying the software to accommodate changes in paths

Status quo

- EISCAT has over time grown from a set of research instruments to a research infrastructure
- Over time it has participated in projects addressing new needs
- ENVRIplus
 - Providing common solutions for shared problems in ENVRI community
 - Data standards, guidelines for RI and data access
- EOSC-hub
 - Competence Centre to develop an EISCAT_3D data portal
 - EISCAT_3D data model
- AARC and AARC2
 - Development of an integrated cross-discipline authentication and authorisation framework, also for EISCAT



Ongoing collaborative projects

- ENVRI-FAIR

- Connecting ENVRI (environmental research infrastructure) community to EOSC
- Ensure that the present EISCAT data services are FAIR
- Include FAIRness in the planning of the future EISCAT_3D data handling



- PITHIA-NRF

- Integrating observing facilities, data processing tools and prediction models dedicated to ionosphere, thermosphere and plasmasphere research
- EGI notebooks to be used in trans national activities
 - See PITHIA-NRF virtual booth

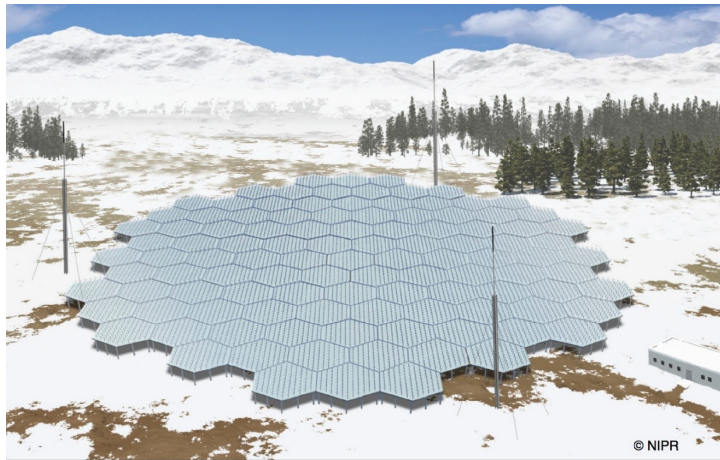


- EGI-ACE

- Prepare EISCAT for possible integration into EOSC compute platform



EISCAT 3D



An extremely versatile and largely software-defined instrument

Multi-user capability

Easy expansion to new fields

ESFRI Landmark Facility

EISCAT 3D ESFRI LANDMARK

European Strategy Forum on Research Infrastructures **ESFRI**

**ROADMAP 2018
STRATEGY
REPORT
ON RESEARCH
INFRASTRUCTURES**

ESFRI LANDMARKS ENVIRONMENT 111
183

EISCAT_3D

Next generation European Incoherent Scatter radar system

AN UPGRADE OF THE EISCAT SYSTEMS TO INVESTIGATE THE ATMOSPHERE AND NEAR-EARTH SPACE ENVIRONMENT

TYPE single-sited

LEGAL STATUS EISCAT Scientific Association, 1975

POLITICAL SUPPORT
Lead country: SE
member countries: CN, FI, JP, NO, UK
The full list of research institutions involved must be found in the website of the RI

ROADMAP ENTRY 2008

TIMELINE

2005-2009 Design Phase

2010-2014 Preparation Phase

2015-2017 Interim/Transition Phase

2017-2021 Implementation/Construction Phase

2022 Operation Start

ESTIMATED COSTS
capital value: 123 M€
design: 2.6 M€
preparation: 8.5 M€
construction: 72.2 M€
operation: 5.1 M€/year

HEADQUARTERS
EISCAT Scientific Association
Kiruna, Sweden

WEBSITE
www.eiscat3d.se

SWEDEN

in the ionosphere. The measured spectra reveal high-resolution information on the ionospheric plasma parameters, but can also be used for obtaining atmospheric data and observations of meteors and space debris orbits. In both active and passive mode, the receivers will provide high-quality scientific and monitoring data from the ionosphere as well as from space within its designed frequency spectrum. The research will both be organized through common observation modes and through requests from individual groups.

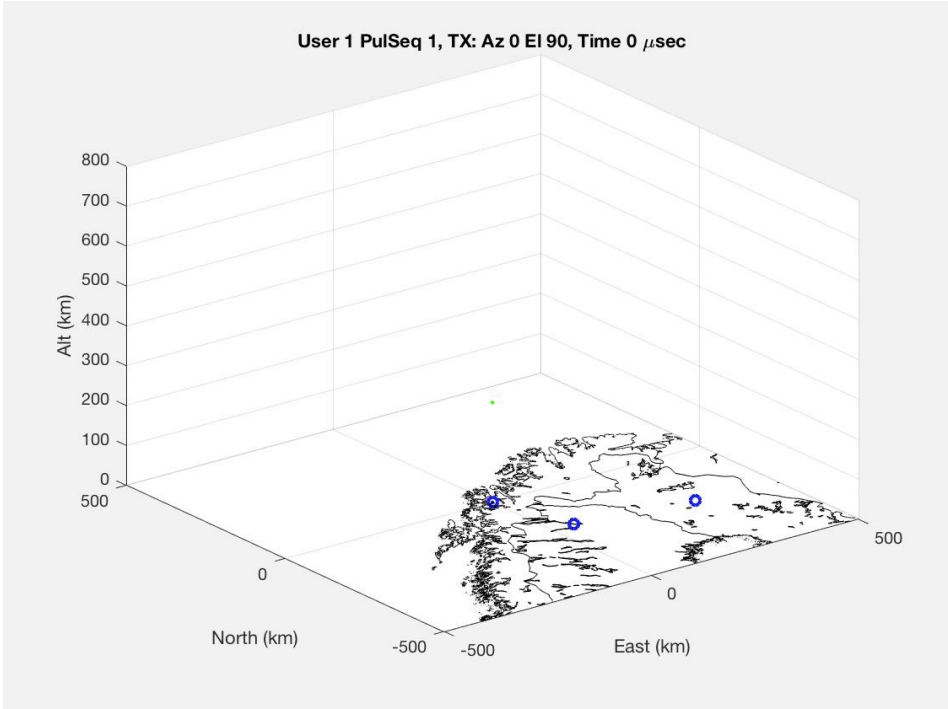
DESCRIPTION
The next generation European Incoherent Scatter radar system upgrade (EISCAT_3D) will be a three-dimensional imaging radar to study the atmosphere and the near-Earth space environment above the Fennoscandinavian Arctic as well as to support the solar system and radio astronomy sciences. The EISCAT_3D system will consist of a phased-array radar system located in Northern Fennoscandinavia near space research centres in Kiruna (Sweden), Sodankylä (Finland) and Tromsø (Norway), two rocket launch facilities at Andøya (Norway) and Esrange (Sweden), and several other distributed instrument networks for geospace observation such as magnetometers and auroral cameras. The radar system is designed to investigate how the Earth's atmosphere is coupled to space but it will also be suitable for a wide range of other scientific targets including climate change, space weather, plasma physics, space debris and near-Earth object studies.

ACTIVITY
EISCAT_3D will be an integral part of EISCAT Scientific Association which has successfully managed incoherent scatter radars on the mainland and on Svalbard for more than thirty-five years. The present EISCAT systems are fully integrated in the global network of incoherent scatter radars. The EISCAT_3D system will consist of five phased-array antenna fields located in the northernmost areas of Finland, Norway and Sweden. Each field will consist of around 10,000 crossed dipole antenna elements arranged in 10g hexagons in a honeycomb-structure. One of these sites – the core site – will transmit radio-waves at 233 MHz, and all five sites will have sensitive receivers to measure the returned radio signals. The central array of each site will be of a size of about 70 m from side to side, and the sites will be located from 90 km to 250 km from the core site in order to be able to maximise the coverage by the system. EISCAT_3D is designed to use several different measurement techniques which, although they have individually been used elsewhere, have never been combined together in a single radar system. The design of EISCAT_3D allows large numbers of antennas to be combined together to make either a single radar beam, or a number of simultaneous beams, via beam-forming. EISCAT_3D will measure the spectra of radio-waves that are back-scattered from free electrons, whose motions are controlled by inherent ion-acoustic and electron plasma waves

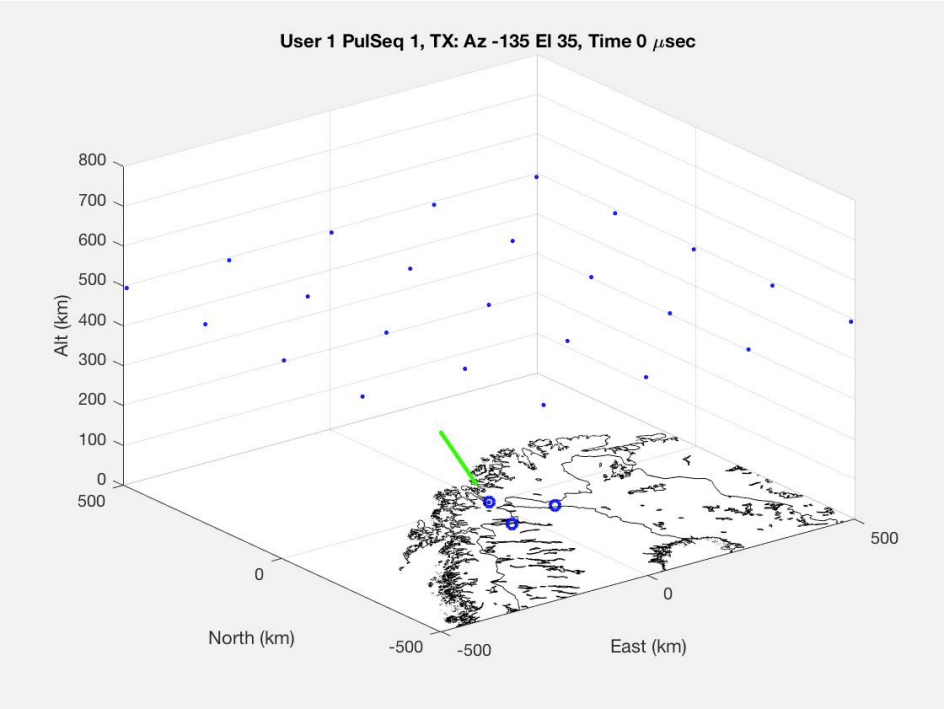
IMPACT
The original scientific vision for EISCAT_3D was that it would become a RI almost fully dedicated to the research area of solar-terrestrial physics. This is an area of physics where the interaction between the Sun and the Earth is studied, which is significant for most aspects of human life. Understanding, and being able to predict, the effects of solar-terrestrial processes has profound consequences for a range of practical applications including long-term global climate change, human space-flight, satellite operations, communications, position finding, terrestrial monitoring, long-distance energy transport and human health. EISCAT_3D, while functioning mainly as a radar for scientific research, was also envisioned to have a substantial user community from the applied sciences sector, requiring data products relevant to the above mentioned applications. Additionally, it was also designed to be used as a vehicle to advance all aspects of the incoherent scatter technique, including the development of new methods of radar coding, signal processing and data analysis.

ROADMAP 2018 STRATEGY REPORT - ENVIRONMENTAL ANALYSIS - ESFRI LANDMARKS

EISCAT 3D

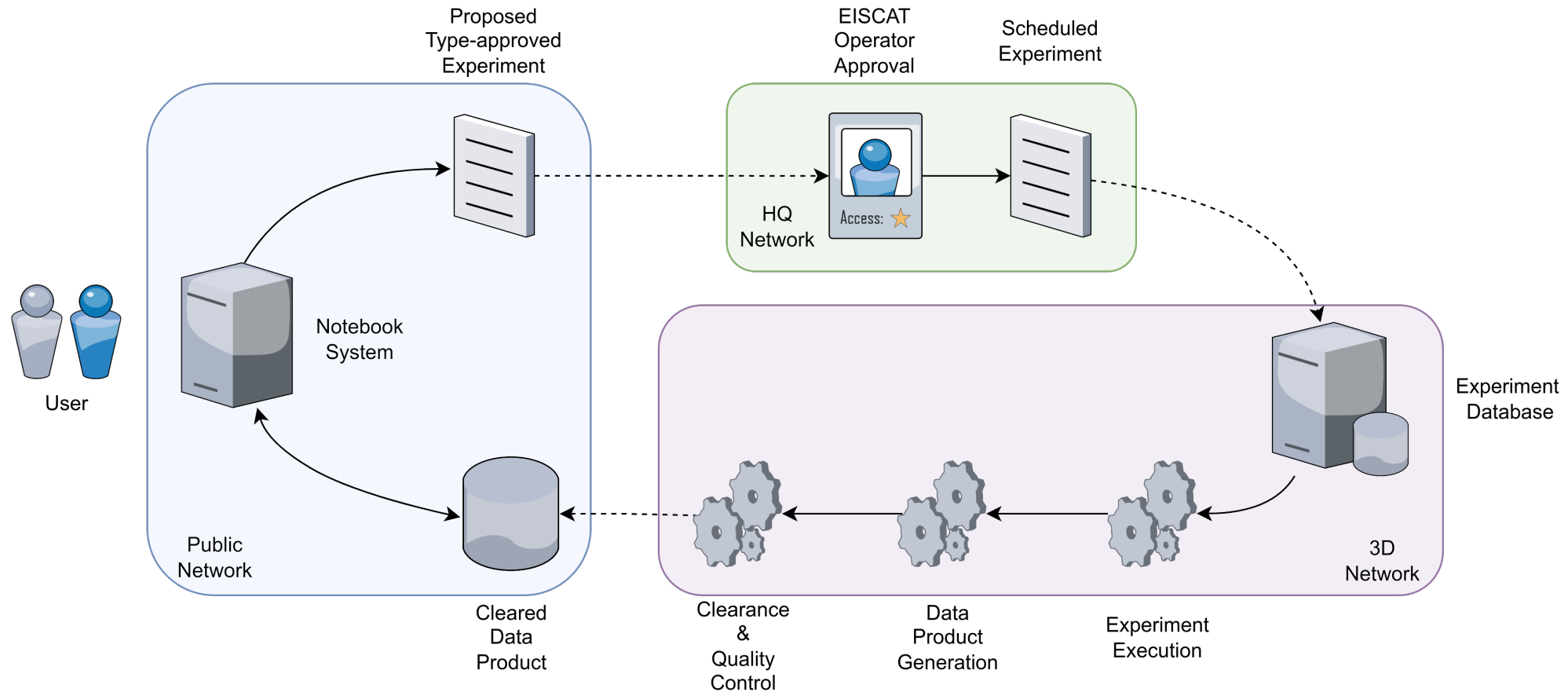


Old system (disc antenna)



Eiscat 3D (phased array antenna)

EXPERIMENT FLOW



EISCAT 3D: ENABLING GLOBAL RESEARCH WITH INTEROPERABLE DIGITAL INFRASTRUCTURES

- Shared resources required (EOSC, EGI, ETC)
- Serving a global scientific community
- Eiscat 3D - Important instrument in combination with other ground-based systems, Satellites, sounding rockets, balloons for understanding global problems
- IT Challenges
 - Data Volumes Throughput
 - Data Reduction
 - Authentication
 - Security
 - FAIR
 - Searching
 - Etc..