

The EISCAT_3D Project in Norway: E3DN

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EISCAT_3D (E3D) is a project to build the next generation of incoherent scatter radars endowed with 3-dimensional scalar and vector capabilities that will replace the current EISCAT radars in Northern Scandinavia. One active (transmitting) site in Norway and four passive (receiving) sites in the Nordic countries will provide 3-D vector imaging capabilities by rapid scanning and multi-beam forming. The unprecedented flexibility of the solid-state transmitter with high duty-cycle, arbitrary wave-forming and polarisation and its pulsed power of 10 MW will provide unrivalled experimental capabilities to investigate the highly non-stationary and non-homogeneous state of the polar upper atmosphere. Aperture Synthesis Imaging Radar (ASIR) will endow E3D with imaging capabilities in 3-dimensions that includes sub-beam resolution. Complemented by pulse compression, it will provide 3-dimensional images of certain types of incoherent scatter radar targets resolved to about 100 metres at 100 km range, depending on the signal-to-noise ratio. The Norwegian scientific programme is inspired by the pioneer polar scientist Kristian Birkeland (picture) and includes pressing questions on polar upper atmospheric research, among others: (Q1) How to proceed beyond the present simplistic, static, stationary and homogeneous analysis of upper atmospheric and ionospheric processes? (Q2) How does space weather affect ionospheric processes and how to support modelling and space weather services? (Q3) How to advance fundamental plasma physics by employing the ionosphere as a natural plasma physics laboratory? (Q4) How does the influx of extraterrestrial material interact with the upper atmosphere and where does the material originate from? (Q5) How does solar activity couple from geospace into the lower atmosphere and climate system, and does this energy change the wave forcing of geospace from below?

At present the EISCAT_3D project is in its preparatory phase funded by the European Union's FP7 ESFRI Programme and is expected to end this year. The principle output of the preparatory phase is a detailed set of specifications that can be employed for the industrial production of all the parts of the infrastructure and their deployment and testing. The estimated cost of the full research infrastructures localised in the three Nordic Countries (Finland, Norway and Sweden) is estimated to be about 130 million euros. Efforts are ongoing to raise funds for the construction phase. The start of the construction phase is contingent upon the approval of funds from the Research Councils (or equivalent) of the Consortium members (China, Finland, Japan, Norway, Sweden and the United Kingdom).

Kristian Birkeland's astonishing curiosity-driven creativity to unravel nature's riddles presented before his eyes

