

Science and design overview of the EISCAT_3D radar

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For thirty years, the EISCAT Scientific Association (www.eiscat.se) has operated a network of leading facilities for ground-based research in solar-terrestrial physics. The UHF and VHF radars at Tromso in northern Norway, together with the receiver sites at Kiruna, Sweden and Sodankyla, Finland and the EISCAT Svalbard Radar near Longyearbyen, represent a uniquely capable group of instruments serving a worldwide user community. The EISCAT mainland radars in particular, however, are based on ageing transmitters and antennas which are slow-moving and increasingly hard to maintain. For several years now, EISCAT (with support from international partners including the European Union) has been planning to replace the current set of mainland radars with a new state-of-the-art radar system, better suited to the current needs of the research community. EISCAT_3D (www.eiscat3d.se) will be the next-generation radar for the high-latitude atmosphere and geospace, with capabilities going beyond anything currently available. The facility will consist of large phased arrays in three countries. EISCAT_3D will comprise tens of thousands, up to more than 100 000, antenna elements. The new facility combines volumetric imaging and tracking, aperture synthesis imaging, multistatic configuration, improved sensitivity and transmitter flexibility. EISCAT_3D will be the first multistatic phased array ISR. A network of five sites is planned, with receivers located around 120 km and 250 km from the active site, providing optimal geometries for vectors in the middle and upper atmosphere. At the passive sites, the design allows the transmitted beam to be imaged using multi-beam techniques. EISCAT_3D will be a modular system, allowing an array to be split into sections for imaging. The result will be a new data product, range-dependent images of small structures, with sizes down to a few tens of metres. The antenna gain and array size will deliver large increases in the figure-of-merit relative to the existing EISCAT radars. An active site comprising 16,000 elements will exceed the sensitivity of the present VHF radar by an order of magnitude. In this talk the technical specifications and science case for EISCAT_3D will be discussed and the current progress reviewed. Studies of the atmospheric energy budget, exploration of small-scale and large-scale processes, as well as geospace environment monitoring and potential space weather service applications will be presented.

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