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Construction of the DREAM Diffractometer at ESS

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Neutron diffraction instrument DREAM is among the first instruments to be constructed at the European Spallation Source (ESS) in Lund, Sweden. The Diffraction Resolved by Energy and Angle Measurements (DREAM) instrument is being built as an in-kind contribution from the Jülich Centre of Neutron Science (Germany) and Laboratoire Leon Brillouin (France)¹. The instrument views both cold and thermal neutron moderators. A solid Si bender will be reflecting the cold neutrons into the incident beam while transmitting the thermal neutrons. As a result, the neutron bandwidth will include both thermal and cold neutrons at their peak intensities, providing the Q -range of $0.01 - 25 \text{ \AA}^{-1}$ in a single frame, which is ideally suited for conventional powder diffraction, pair-distribution function and low-angle diffraction measurements.

The long ESS pulse is shaped to the experimental needs by pulse-shaping choppers. The combination of pulse shaping and an unprecedented peak brightness of the ESS source provides a user with a particularly flexible choice between high resolution and high intensity. We note that the estimated highest resolution in the backscattering detector is $\Delta d \sim 0.0003 \text{ \AA}$, which will set a new world record in neutron diffraction. The highest-resolution diffraction will be available from the first days of ESS operation, using a dedicated detector. Another feature of the instrument is the neutron polarizer, which will enable half-polarization studies of magnetic nanoparticles at low scattering angles.

The construction of the instrument at the ESS site has begun in December 2021. Two experimental caves, detector support frame, sample vessel, and control hutch have been completed. In this talk, I will remind the broad science case of DREAM, which still remains very relevant. The progress on manufacturing all instrument components will be discussed, including the most recent installation activities. We will outline our plans for the instrument commissioning with and without neutrons at the ESS site.

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