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CSPEC : Development of the cold chopper spectrometer of the ESS.

Monday, 20 March 2023 16:00 (2 hours)

The European Spallation Source (ESS), expected to be the world's most powerful neutron source, is currently under construction in Lund. Among the endorsed instruments foreseen for day one instrumentation at ESS, is the cold time-of-flight spectrometer CSPEC [1]. CSPEC is a joint proposal from the Technische Universität München (TUM), Germany, and the Laboratoire Léon Brillouin (LLB), Saclay, France. Experiments in an electric field, or laser excited light harvesting proteins, are still in an exploration stage, mainly due to the lack of flux at the instruments available today. CSPEC will benefit from the high brilliance of the ESS spallation in addition to the cumulative flux provided by repetition rate multiplication (RRM) that results in large flux gains making it possible to probe time-dependent phenomena with millisecond to second time resolution.

The unique pulse structure of the ESS with its long pulse duration (2.86 ms) and a repetition rate of 14 Hz requires new concepts for the instrumentation to make optimum use of the available source time frame. With an instrument length of ~160 m, moderator to sample, a wavelength range of $\Delta \leq 1.7 \text{ \AA}$ can be probed within each ESS time period via RRM. The energy resolution can be tuned in the range of $\Delta E/E = 6 - 1\%$, and CSPEC will use cold neutrons in the range 2 - 20 \AA . The guide is optimised to enhance signal to noise and will be able to focus on samples ranging from several mm^2 to several cm^2 in area. The large detector area, with a radius of 3.5 m, $-30^\circ < 2\theta < 140^\circ$ and 3.5 m in height. In addition the sample chamber will, via the use of a gate valve, enable experiments under real and transient conditions. CSPEC is in the manufacturing phase and we will present the current design layout, expected performance and progress towards final construction.

[1] P.P. Deen *et al.*, *CSPEC: The cold chopper spectrometer of the ESS, a detailed overview prior to commissioning*, Review of Scientific Instruments 92, 105104 (2021).

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