

Investigation of Pancake-like Moderator-Reflector Structure for the High Brilliance Neutron Source (HBS)

The High Brilliance Neutron Source (HBS) project is developing a high-current accelerator-driven neutron source (HiCANS) to maintain a healthy neutron landscape in Europe. Despite the lower primary neutron yield of the nuclear reactions compared to reactor or spallation neutron sources, HiCANS achieve a competitive neutron brightness by a compact moderator and reflector design, which makes a large fraction of the primary neutron spectrum available for applications. The spectral and temporal, i.e. frequency and pulse length, characteristics of the neutron pulse are tailored to the instruments hosted at a target station.

Based on the ‘pancake’ and ‘butterfly’ moderator geometries developed for the European Spallation Source (ESS), we investigate a pancake-like structure by means of Monte Carlo simulations involving multi-parameter optimization routines. By increasing the interface area, we try to improve the coupling between thermal and cryogenic moderator. The extraction surfaces of the applied pancake-like geometry achieve a cold neutron flux of 85%-87% of a cylindrical para H₂ moderator (length= 10 cm, diameter = 2.4 cm) with ideal coupling. The flux through the thermal extraction surfaces reaches 70%-79% in comparison to an ideal case with just a single extraction channel looking at the thermal flux maximum in the center of the thermal moderator. The optimized structure with up to twelve extraction channels looks therefore very promising for target stations that serve a large number of thermal and cold instruments. At this workshop, we will present the results of our study of this moderator-reflector assembly.

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