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Thermal moderator-reflector assembly for HBS

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The thermal moderator is the key component in a research neutron source to convert the primary neutrons which typically have energies in the MeV regime into useful neutrons for investigations that shall have energies well below 1 eV. In the case of a HiCANS as HBS, the thermal moderator has to be optimized according to the compact target size and to the proton pulse lengths at the different target stations. Extraction channels in the thermal moderator are used to either place cold sources feeding instruments that need a cold neutron spectrum or to extract thermal neutron beams from the volume of highest thermal neutron flux density. Requirements of restricted space, neutron transparency of the main structural materials, the technically demanding flowing liquid thermal moderator material, the complex nature of intense thermal and induced mechanical loading, industry-standard requirements for operational safety, etc. impose important boundary conditions on the design of the thermal moderator.

Here, we present the details of a thermal moderator design serving up to 12 instruments at a target station operated at 96 Hz. The thermal moderator consists of a combined welded complex-profiled Al vessel containing 12 thin-walled cast extraction channels arranged in 2 levels. The vessel is filled with H₂O as moderator material which is pumped for cooling purposes. The entire system is surrounded by a lead reflector and arranged on top of the compact Ta target. We show the results of simulations concerning the neutronics and the thermal behaviour of this thermal moderator-reflector assembly.

This work is part of the collaboration within ELENA and LENS on the development of HiCANS.

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