

## **Cryogenic moderator system for a 5MW spallation neutron source**

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### **Abstract**

As part of the work for the design-update-phase for the planned European Spallation Source (ESS) existing cryogenic moderator concepts are studied and reviewed with respect to their usability for up to 5 MW of beam power on the target:

A concept for a forced convection, supercritical hydrogen moderator at 15bar allowing accepting high heat load at low H<sub>2</sub> temperature without the risk of nucleate boiling. However the high operating pressure requires large wall thickness leading to unacceptable high wall temperature. One possible alternative is a two-phase hydrogen moderator, which operates on the principle of natural convection at slightly above 20K and low operating pressure. In addition a concept for a 77K beryllium filter reflector as well as a water premoderator will be investigated.

Overall geometry, estimation of the heat load in the structural material as well as in the H<sub>2</sub> were obtained from detailed Monte-Carlo-simulations. Also, lifetime due to radiation damage is considered. In addition material investigations under cryogenic temperatures as well as the influence of welding seams on the material properties are investigated. The first cryogenic cycle concepts including all necessary components, pressure drop and inventory estimations are shown.