Contribution ID: **895** Type: **Poster Presentation**

C1Po2A-02 [23]: Current status of a cryostat for the provision of hydrogen with adjustable ortho-para-ratios for neutron moderation

Monday, July 22, 2019 2:00 PM (2 hours)

Compact Accelerator-driven Neutron Sources (CANS), such as the future High Brilliance Neutron Source (HBS), represent an efficient and cost-effective means to provide neutrons for scattering experiments. CANS have a lower neutron production compared to current reactor- or spallation-based neutron sources. However, CANS enable a holistic optimization of the neutron production chain and thus can be competitive in terms of the relevant usable neutron flux at the sample position. A main subject of such optimization are the cold moderators. When using liquid para-H2 as cold neutron moderating medium, so-called low-dimensional moderators can be implemented (as foreseen at European Spallation Source ESS), leading to a significantly increased neutron brightness. In the context of the HBS project, there are endeavors to further optimize such low-dimensional LH2 moderators by „poisoning“para-H2 by admixing well-defined amounts ortho-H2, resulting in an increased neutron scattering cross section. This enables the user to tailor the neutron spectrum provided by the cold moderator towards the needs of the used instrument. At TU Dresden and Forschungszentrum Jülich, an experiment has been set up to prove the feasibility of this concept. Its core component is a LHe-cooled flow cryostat that mixes a normal-H2 and a para-H2 flow to obtain the desired para-H2 concentration. The resulting LH2 mixture at 17 - 20 K is fed into a small cold moderator vessel (approx. 200 ml). In this work, the current status of the experimental setup is presented. The construction of the cryostat and its periphery and the commissioning of the entire setup (cold leak tests, production of several different ortho-para-H2 mixtures and its metrological monitoring) have been completed. It is shown that the concept of the mixing cryostat works as intended and the setup is ready for measurements at neutron sources.

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Session Classification: C1Po2A - Structures and Contaminants