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A Proposal for the ICONE Cold Neutron Moderator

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Compact Accelerator-driven Neutron Sources (CANS) and their high current variants (HiCANS) with a notably larger neutron yield, have the potential to become an important part in the currently ongoing transformation of the neutron research landscape. One particular effort is the ICONE project, an initiative to build a French HiCANS to serve the needs of the French neutron scattering community (1).
Since in a CANS, neutrons are produced in a smaller and more confined region than e.g. in spallation sources performance gains are expected, when moderators are placed in close proximity to the neutron production region.
Of particular interest is to utilize the concept of a low-dimensional (i.e. disc-like 2D or pencil-like 1D geometries) para-hydrogen neutron moderator (2), that predicts significant gains in emission brightness. The objective of the CONEMO (Cold Neutron Moderator) project is to develop tools and methods for modeling these low dimensional moderators to integrate them into ICONE.

For engineering issues, we are currently focusing our efforts on a 2D flat moderator which enables both a rather simple construction, since there is only one cold cell, while still providing good performances (see Fig.1).

We will describe the constrains which led to this design and the performances which can be achieved in terms of brilliance. The optimal positioning of different scattering instruments around such a moderator is also proposed.

The flux of cold and thermal neutrons has been studied with the open source Monte Carlo particle transport code OpenMC (3). The brightness of the emission surface was used as the figure of merit (FOM) for the comparison of different layouts. As OpenMC is target not capable to simulate accelerated charged particles a strategy to implement a realistic target has been developed for the materials Beryllium and Tantalum for protons with energies 25 MeV respectively 40 MeV.

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References

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