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Neutron experimental performance testing of low-dimensional cold moderators

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A major milestone in cold neutron moderator developments has been the invention of low-dimensional geometries [1], such as the butterfly moderator of ESS. Monte-Carlo simulations have shown that if para-hydrogen is used as moderator material, these novel moderators can increase significantly the brightness, desired by most types of neutron instruments. Various designs were extensively studied by simulations, however, few experiments are available to validate them. Difficulties in experimental investigation of moderator properties can be overcome by the dedicated Test Facility installed at a radial channel of the 10 MW Budapest reactor [2]. This beamline is looking directly on the reactor core; thus an unusually hard neutron spectrum is available. The beam hits a Be plate installed in a Pb reflector placed close to the channel exit. Neutrons scattered by this Be are slowed-down in the cryogenic moderator cell tested, which is also installed in the Pb block. Cold neutrons leaving the moderator assembly (e.g. a tube-type vessel filled with liquid p-hydrogen) through a collimator are measured by a camera obscura system with time-of-flight option [3] using a chopper. This system enables to measure the spatial and spectral distribution of neutrons emerging from the moderator, thus its various features are characterized.
[1] Mezei F et al, J.Neutron Research, 17, 101-105 (2014). [2] Rosta L, Applied Physics A 74, 52-54 (2002); [3] Füzi J et al, Physica B; 385-386, 1315-1317 (2006)

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