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Measuring and simulating the scattering from materials for moderator/reflector design. New geometries for moderators using nanodiamond particles

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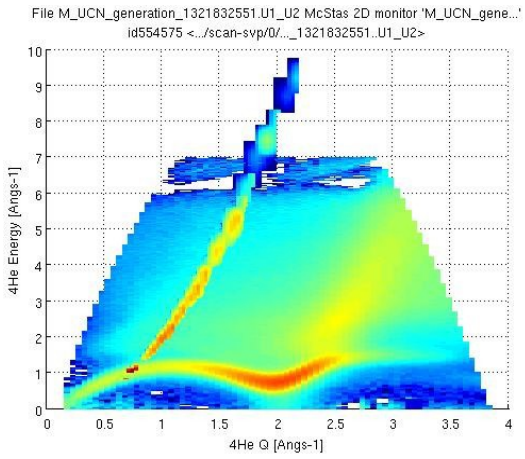
Abstract

In this contribution, we shall present measurements performed in some materials commonly used in moderators or postmoderators: water, water ice, hydrogen, deuterium, helium, methane. This data can be obtained from e.g. data mining at the ILL, and new experiments. Such data can also be computed from molecular dynamics simulations, which then fully describe the elastic and inelastic channels, for coherent and incoherent processes. Such data can then be used for virtual experiments using McStas, and reactorspallation studies with MCNP/X.
The use of new moderator geometries, using either nanodiamond particles as reflector or spacers/crystal wafers in the moderation volume will be demonstrated, with computation of their expected gain.
The special case of ultra cold neutron production will be discussed, using solid deuterium and liquid helium moderators. The principle of neutron cooling will be presented, as well as measurements and corresponding virtual experiments. The additional knowledge from simulation will be highlighted, to help understand the measurements and possibly improve the ultra cold neutron production.



Drawing 1: Ultra cold neutrons produced by cooling down on the 4He elementary excitation

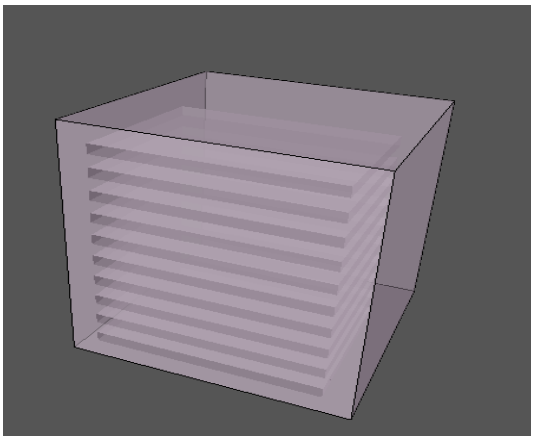
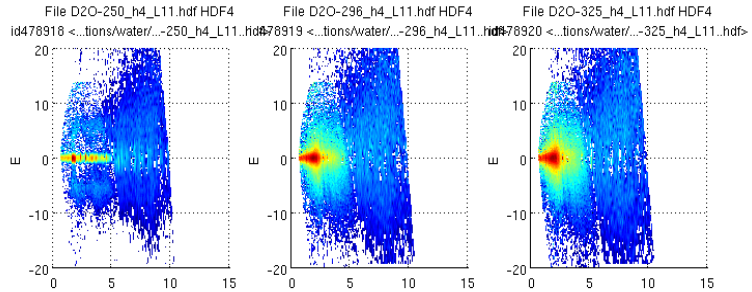


Illustration 1: A cold moderator box with spacers inserts,simulated with McStas



Drawing 2: Heavy water measurements (IN4@ILL) at T=250, 296 and 325 K