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A novel concept of staircase neutron moderator

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Cold neutron moderator design evolution has led to two main solutions. Flux-hungry instruments using large samples and limited angular resolution require a large bright surface and are better served by the LD2 moderators. Brilliance-hungry instruments using small samples and requiring a fine angular resolution are best served by L-pH2 moderators with sizes exactly matching the required.

However, flux-hungry instruments do not enjoy high brilliance of L-pH2 flat moderators. Moreover, even brilliance-hungry instruments do not fully exploit potential of increased brilliance because for smaller moderator sizes beam intensity is significantly reduced.

In the case of compact or spallation neutron source several cold moderators can be installed, each geometrically adapted to specific instrument needs. More issues arise when the neutron source has only one cold moderator, as it is typical for research reactors. Compromises required in such situation potentially reduce the overall performance of the whole instrument suite.

In the present report we discuss in details a novel concept of a staircase pH2 moderator, which is made of a narrow elongated moderators having a high brightness (1), thus combining both high brilliance and high flux. This eliminates the need to compromise and paves the way to increased brightness (by factor 2-3) for the majority of cold neutron instruments. This approach can be potentially exploited for thermal moderators as well.

[1] A.Ioffe, P.Konik, K.Batkov. "High-brilliance and high-flux neutron cold source based on elongated rectangular moderators", submitted to this conference.

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