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Systematic Performance Study of Common Neutron Guide Geometries

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Abstract

We will here present the results for a systematic benchmarking for various settings of wavelength, divergence restrictions, and guide length, of 4 different long guide geometries: elliptic, parabolic, ballistic, and straight.

With this work we have mapped out parts of the neutron phase space, to show where advanced guide geometries have significant transport advantages over simple guide geometries.

The main results are that elliptic and parabolic geometries perform almost equal, and are the other geometries strongly superior, except for low-divergence, cold neutrons. In addition, it was found possible to transport thermal neutrons over more than 100 m by means of elliptical guides with only a 50 percent loss in phase space density.

This will allow instrument designers to use tabulated values to choose a starting point for the guide optimization, based on the neutronic requirements for the instrument.