Comparison of guide systems for instruments at the high brilliance source (HBS)

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Introduction

“High Brilliance Source” (HBS) is a new compact accelerator-driven neutron source is developed at Jülich Centre for Neutron Science. A 60 m long medium-resolution Disordered Materials Diffractometer was envisioned to be built at HBS. In this work, the performance of the neutron guide systems for this instrument is studied by using neutron ray-tracing simulations.

Results & Discussions

Flux:

![Flux](image)

Fig.3. Neutron flux at the sample position for different types of neutron guides. 0.5 Å < λ < 1.2 Å.

Spatial and divergence distribution:

![Spatial and divergence distribution](image)

Fig.4. Neutron spatial distribution at the sample for 1/4 ballistic guide with 2×2 cm² guide entry and different d. The wavelength used is 0.5 Å < λ < 1.2 Å.

Number of reflections and Brilliance transfer:

![Number of reflections and Brilliance transfer](image)

Fig.7. The total number of reflections for neutrons arriving at a 1×1 cm² sample (a) and out of the 1×1 cm² sample (b), 0.5 Å < λ < 1.2 Å.

Fig.8. Brilliance transfers of the guides with different shapes studied for two different divergence ranges.

Simulation

Three different types of geometries considered in our simulations, all with a square cross-section. The entrance and exit cross-sections of the guide system are always identical and are chosen to be of 2×2 cm² and 3×3 cm². guide shapes are change with the guide type, moderator-guide entry distance and the guide entry/exit cross-section. All guides have a m = 5 coating. In simulation, the moderator is a 2 cm diameter thermal moderator, the pulse repetition rate is 96 Hz, the total neutron flux at the moderator is set to 4×10¹² n·s⁻¹·cm⁻²; the divergence of the initial neutron beam is ±1 deg yielding a bandwidth Δλ= 0.7 Å; the sample size is 1×1 cm²;