

## Design Stage Divergent Neutron Beams

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Higher background on detectors compared to anticipated design levels? Persistent hot spots on detectors? Increased radiation levels? These are common aspects of a new instrument, and even an old instrument. The divergent beam exiting from a guide, or reflecting from a chopper, can create unwanted background, or damage neighbouring equipment.

For instance, persistent hot spots and higher background counts on the detector of the backscattering spectrometer, EMU, had been present since hot commissioning. While the scientists and technical support team worked on step-wise tests to localise some of the causes, the extreme worst-case beam divergence was also investigated within the CAD model. This additional CAD analysis showed that a neutron beam exiting a guide with the highest possible beam divergence could actually bypass the in-operation beam stop and reflect off an analyser array back onto the detectors. This was just one of a few issues creating a higher background for the instrument.

From our experience, during the instrument commissioning stage and subsequent years after, instrument and technical support teams spend a lot of time adding and improving shielding, to reduce background neutrons and gammas. This tedious and time consuming process may be reduced if future design projects allow for specific, divergent neutron beams, milestone design review steps. Divergent beams and their shielding are very easily overlooked in the design phase of instrument projects. We will outline a mechanism allowing to avoid such problems, through consideration throughout the design process.

### Formal Invitation Letter Required

Yes

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