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Conceptual design of a reflective focusing system for a SANS instrument

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The focusing devices used in small angle scattering have a completely different purpose comparing with other neutron techniques. In other methods, like diffraction or spectroscopy, focusing devices are used in order to increase the amount of neutrons going through the sample, at the cost of increasing the divergence of the beam and therefore, causing a decrease in the angular resolution of the measurement. On the other hand, in small angle scattering, focusing optics cannot be used with the same purpose due to the need of collimated beams. The focusing devices in SANS are designed to focus at the detector, not at the sample, in order to increase the momentum transfer (Q) range of the measurement and its resolution.

This work proposes a design of a reflective focusing system that would avoid the chromatic aberrations found in MgF₂ lenses and could be used in integrated in existing TOF-SANS instruments. Its performance is found to be good and it is possible to focus at the required distances. The limitations of this device are analyzed and engineering requirements as alignment and surface quality are also discussed in detail.

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