[time-of-flight SANS]
(Chapter 5.4 of *Elements*)

Time-of-Flight SANS

Figure 5-TOFS.1 shows the overall weighting function and the resolution width for a representative time-of-flight instrument with converging multiaperture collimation and averaged over a broad wavelength distribution (Carpenter and Faber 1978). The weighting function accounts for the detector efficiency and incident flux for all the pixels included in the sum of data at each Q. The averaged resolution is the Q-width of the weighted sum of contributions from different wavelengths and different detector angles to the total count at each Q.

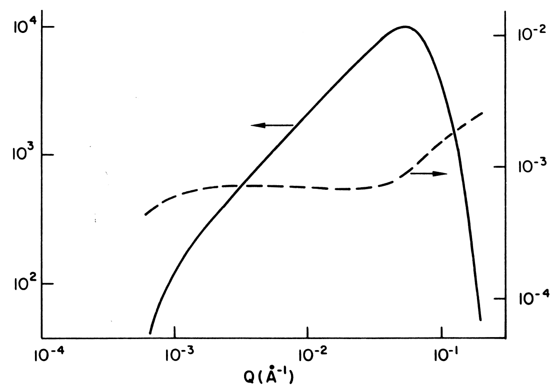

Figure 5-STO1 The instrument weighting function and resolution broadening width (dashed line) for a t-o-f SANS instrument simulated in 1978. Left scale, counting rate, arbitrary units. Right scale, averaged resolution, $\Delta Q, \mathring{A}^{-1}$.

The figure is from an early design study of a "medium resolution" instrument that was never built, but led to the t-o-f SANS instruments at IPNS. Refer to the original paper (Carpenter and Faber 1978) for assumed parameters. Performance corresponds to use of a conceptual 20-K solid methane moderator at a pulsed spallation source with a 0.5 MW proton beam. Constructing the collimator is very demanding, and the operability of solid methane moderators at such a high power is questionable. Liquid hydrogen is the moderator of choice for current instruments on high-power sources.

In an intensity-resolution plot similar to Figure 5-STO.1 for a monochromatic-beam instrument, the weighting function would appear as in Figure 5.19 in *Elements* for a single wavelength, and the resolution broadening width is constant because there is no wavelength averaging in that case and because all the pixels are of the same size.

Reference

Carpenter, J. M., and J. Faber Jr. (1978). Design study of a time-of-flight small-angle diffractometer for a pulsed neutron source. *J. Appl. Crystallogr.* **11**, 464-5.