1. Wide angle corrections SAMPLE/PATH

Looking at "Computing guide for Small Angle Scattering Experiments", ILL98GH14T by Ghosh, Egelhaaf & Rennie, we see that for scattering at larger angles the transmission should be modified due to the longer path length after the scattering event. (They ignored this!)

The longer path length after scattering will also slightly increase the probability of a second scattering event, but that does not concern us here.

If our on-axis transmission is T_0 through a sample of thickness d, then the transmission at some other thickness x is $\exp(-\mu x)$ where attenuation coefficient $\mu = -\log_e(T_0)/d$.

If a neutron scatters at angle 2θ at distance x into the sample, its total transmission is then:

$$T'' = \exp(-\mu x).\exp\{ -\mu(d-x)/\cos(2\theta) \}$$

T" should be integrated and averaged between $x = 0$ and $x = d$.

Hammouda, gives an approximate result for the integral, see page 208 of http://www.ncnr.nist.gov/staff/hammouda/the_SANS_toolbox.pdf,

$$T' = T_0(1 - T_0^A) / (\log_e(T_0)A) \quad \text{where} \quad A = \{ (1/\cos(2\theta)) - 1 \}$$

For example if $T_0 = 0.2$ and $2\theta = 40^o$ then $T' = 0.158$, a shift of ~20% of the SANS curve. Note that the result is independent of sample thickness, as may be verified by the numerical calculations in the attached spreadsheet. Note T_0 is a function of neutron wavelength, whilst A is a function of detector pixel location.

There will be a similar term also for the improved detection efficiency of the LOQ HAB scintillator at larger angles of incidence. It is not clear yet what we should do for the SANS2d or LOQ Ordela detector, where other factors such as bowing of the detector window in the centre may compensate. It may be that not yet having this sample path term in Mantid is confusing my attempts to detect "parallax" and other issues at higher angles onto the SANS2d detector.

Thus I would like to be able in the mask file to turn this on/off.

SAMPLE/PATH/ON or /OFF

For unusual sample geometries, such as a thin cylinder, we would need a more sophisticated function.

Hammouda also puts in a $\cos(2\theta)^3$ term to "correct for solid angles with a flat detector", but I think that Mantid does this anyway as the solid angle of each detector pixel seen from the sample is explicitly calculated, and the exact distance is used in the time of flight.

RKH 10/10/12