Compact SANS Construction proposal

Instrument Back-end

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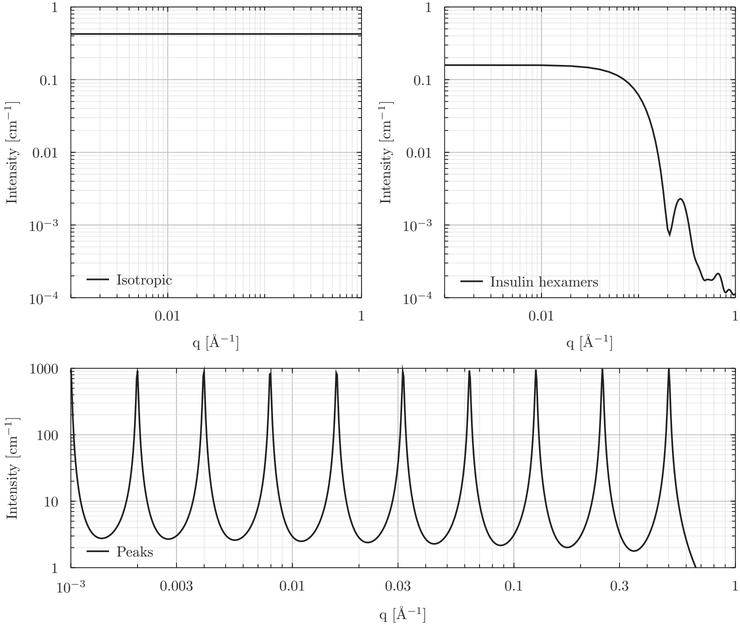
Sample models



$I(q)$-monitor

$$R_{ij} = \sqrt{X_i^2 + Y_j^2}, \qquad 2\theta_{ij} = \mathrm{atan}(R_{ij}/dist),$$

$$\Omega_{ij} = \frac{dA \cdot \cos(2\theta_{ij})}{dist^2 + X_i^2 + Y_j^2},$$

$$v_s = \frac{\mathrm{length}}{\mathrm{time}_s}, \qquad \lambda_s = \frac{2\pi}{\mathtt{V2K} v_s},$$

$$q_{ijs} = \frac{4\pi \sin(\theta_{ij})}{\lambda_s}, \qquad k = \mathtt{floor}\left(\frac{q_{ijs} - q_{\min}}{\Delta q}\right).$$

$$\mathrm{Counts}_k = \sum_{ijs \in k} Counts_{ijs}$$

$$\mathrm{Weight}_k = \sum_{ijs \in k} \phi_s \Omega_{ij}$$

$$I(q_k) = \mathrm{Counts}_k / \mathrm{Weight}_k, \qquad \frac{\partial^2 S(q_k)}{\partial q \partial t} = \mathrm{Counts}_k / \Delta q$$

Signal to noise estimation

Signal:

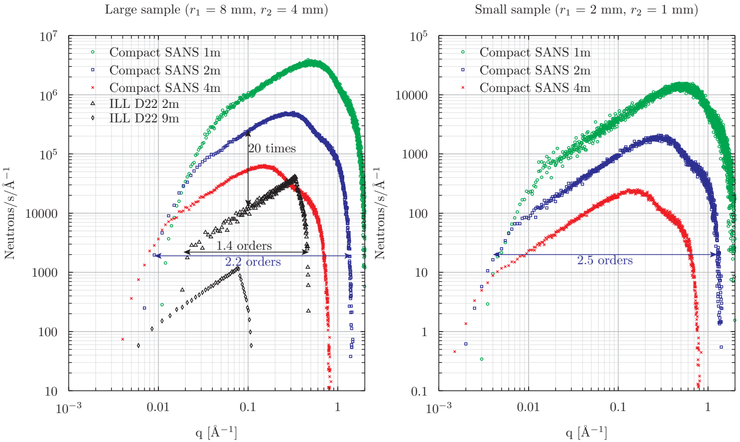
$$S(q) = \frac{\partial^2 S(q)}{\partial q \partial t} \Delta q \Delta t. \tag{1}$$

Assuming Poisson statistics, the level of statistical noise can be estimated as:

$$N(q) = \sqrt{\left(\frac{\partial^2 S(q)}{\partial q \partial t} + \frac{\partial^2 B(q)}{\partial q \partial t}\right) \Delta q \Delta t}, \tag{2}$$

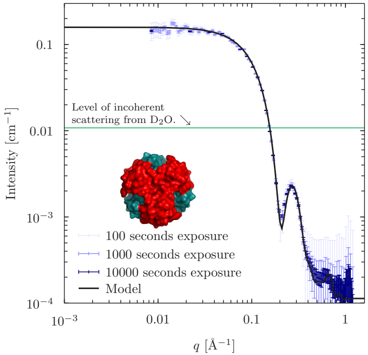
where $\frac{\partial^2 B(q)}{\partial q \partial t}$ is the differential count rate of the background.

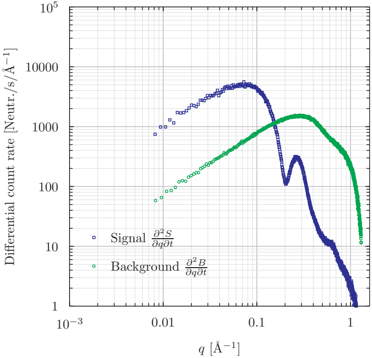
Isotropic spectrum



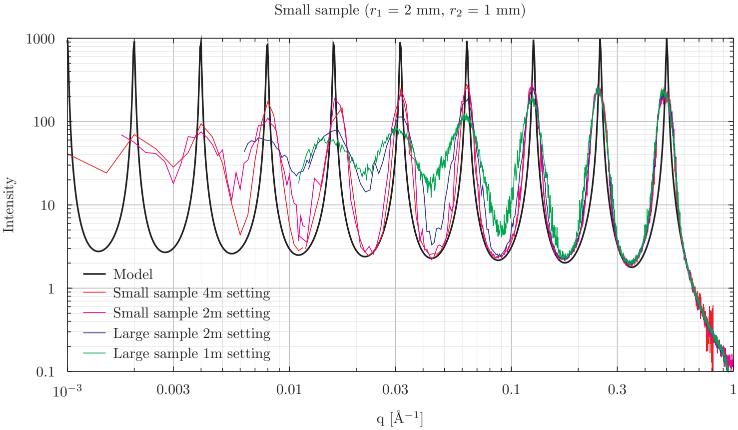
1mm water

Insulin hexamers





Logarithmic peaks



Conclusion

- Measure 100 μl of sample very fast (10 to 100 sec) allowing for new types of time resolved studies
- Measure down to 10 μl of weakly scattering sample within reasonable time (1000 sec)
- Relatively poor λ-resolution does not seem to be an issue for the types of sample considered
- To broaden the use of the instrument resolution may be improved with a system of choppers