# In-situ light scattering at neutron beam lines - experiences made and challenges ahead

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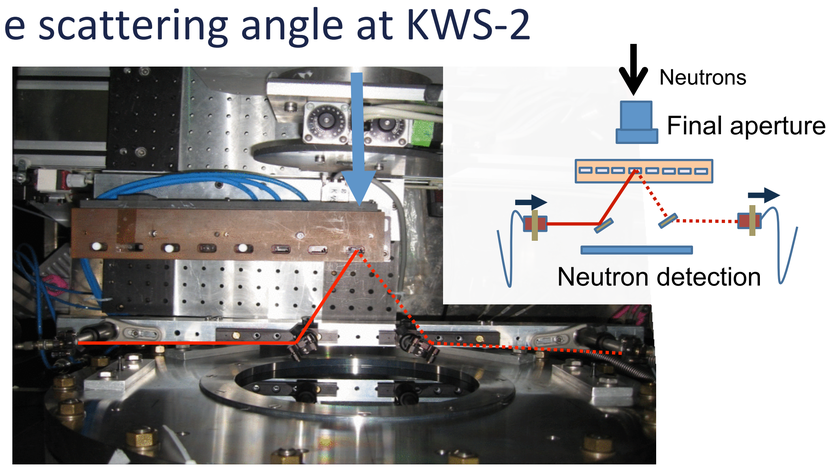
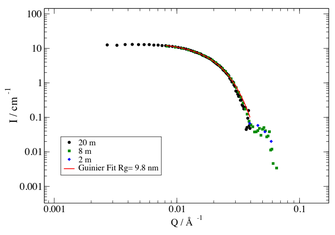
## In-situ light scattering at Small-Angle Scattering Instruments

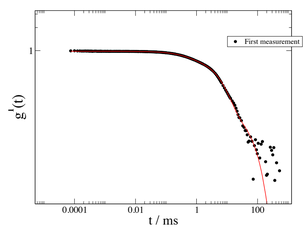
### One scattering angle at KWS-2




### Calibration sample: 20 nm $SiO_2$ in $H_2O$

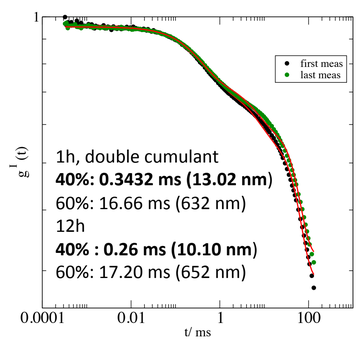


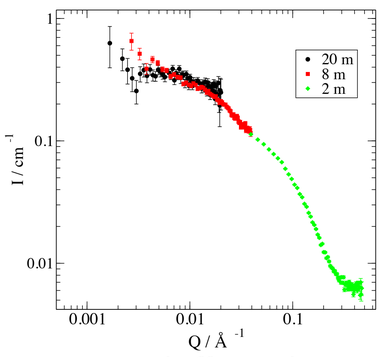

Particle size is confirmed in a Guinier fit of the SANS data.




The light-scattering angle is determined from the auto-correlation function: θ=60°

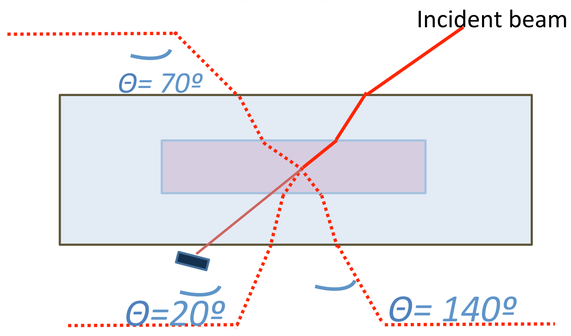
### A biological sample in time: Apo-myoglobin (MG)

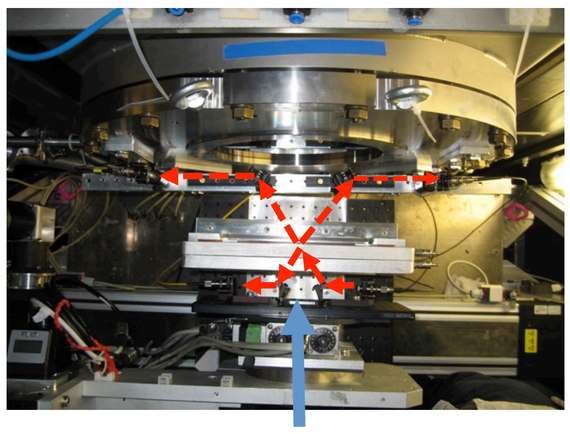


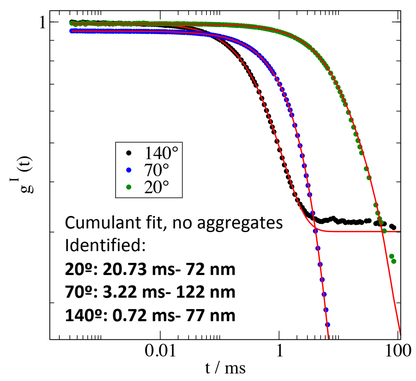

The SANS curve is a time-average and offers only a hint about the presence of the aggregates, while DLS even allows their size determination.

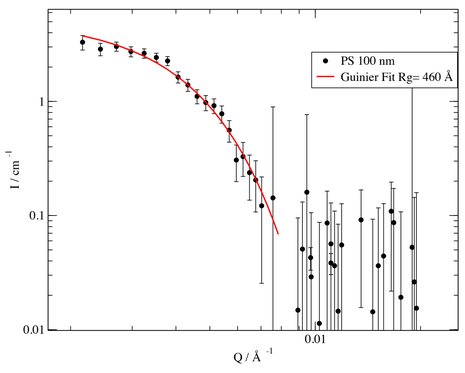
### Three scattering angles at KWS-2



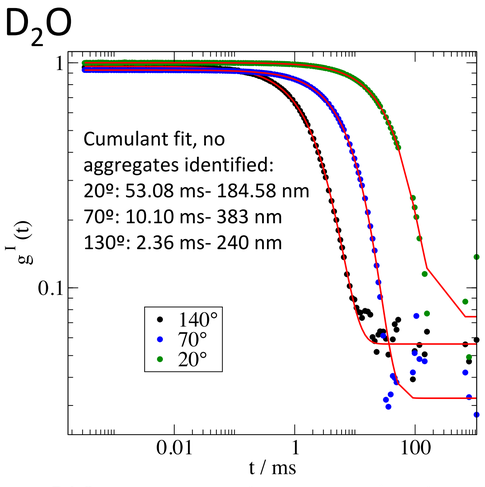



### Calibration sample: 100 nm Polystyrene particles in $D_2O$



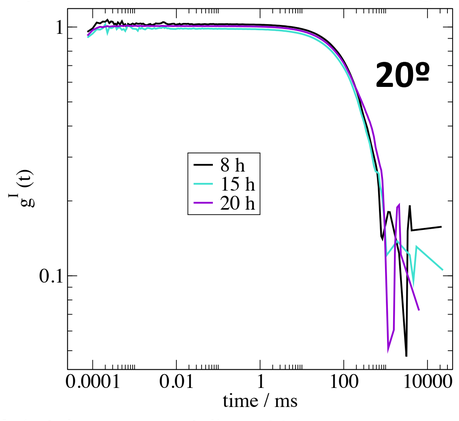




### 300 nm Polystyrene particles in $D_2O$



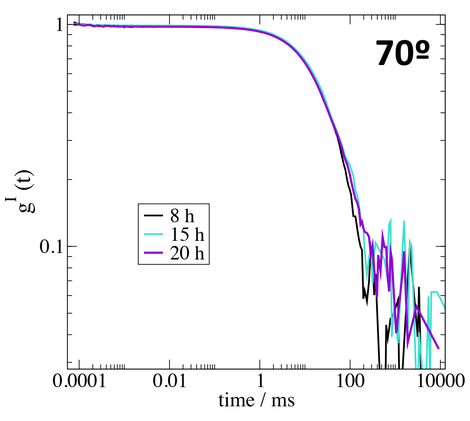

DLS accesses a size-range that is not accessible for standard SANS instruments.

### Apomyoglobin (N) 38 mg/mL: Time evolution at different scattering angles




**8h** (triple exponential)
82%: 32.81 ms (114 nm)
18%: 359 ms (too large)
Last term: background

**20 h**
78%: 31.37 ms (110 nm)
22%: 352 ms (too large)




**8h** (double cumulant):
82%: 0.089 ms (3.4 nm)
18%: 16.75 ms (635 nm)

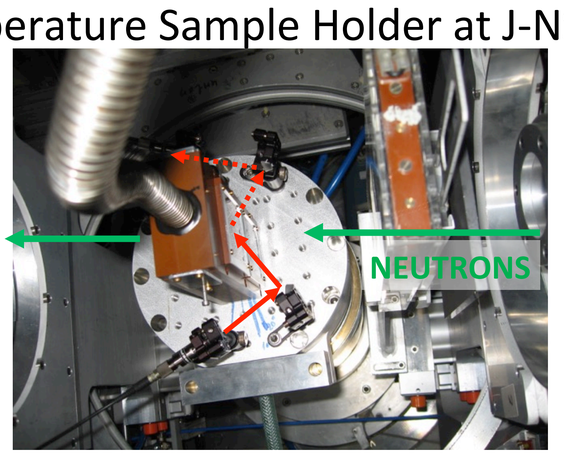
**20 h**
78%: 0.76 ms (9.4 nm)
22%: 12.7 ms (619 nm)

**Remarks:**

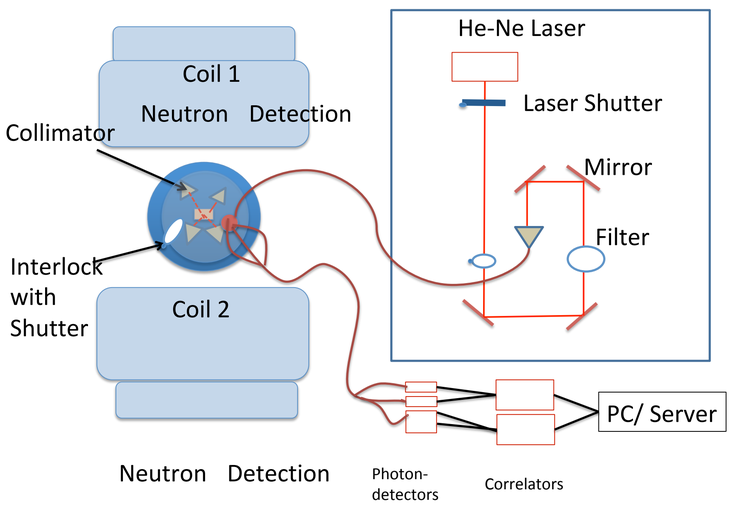
- Cross-validation within the results delivered by the three scattering angles is possible
- Three-angle set-up is difficult to align
- Probably not suitable for routine user service.

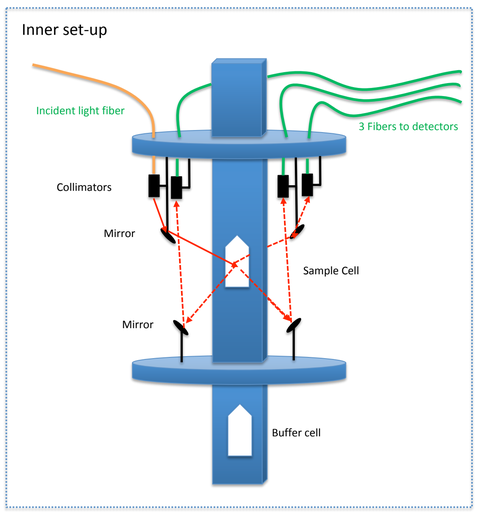
## In-situ light scattering at Spin Echo Instrument J-NSE

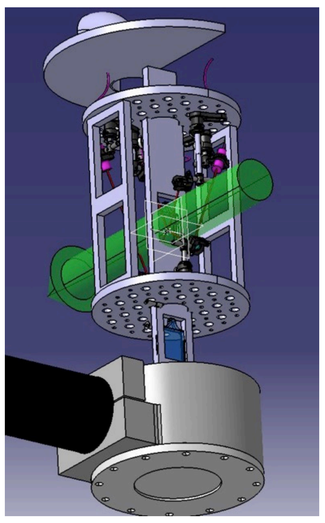
### High-Temperature Sample Holder at J-NSE




### New 3-scattering angle DLS at J-NSE



## Summary: Lessons learned

- Each instrument requires its own set-up.
- Strong link to instrument control software required (sample and file name of neutron data is used for DLS data).
- Online data treatment of light scattering data can enable a quick response to sample degradation.

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