ESRF	**Experiment title:** **Beyond hard spheres: Self-organization of colloidal dumbbells**	**Experiment number**: SC-3940
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Shifts: 9	**Local contact(s)**: Sylvain Prevost, Narayan	

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Report:

The aim of this experiment was to study the self-organization of highly anisotropic dumbbell-like polystyrene colloids as a result of gravity-induced osmotic compression under different solvent condition.

Colloidal crystals of anisotropic dumbbells of different anisotropy were measured. These crystals were formed from an aqueous suspension of colloids at different salt concentrations due to osmotic pressure. Height scans of the sample sediments were performed (fig.1). At the top of the sediment the data showed only the form factor (not shown) followed by a broad structure factor ring at lower positions in the capillary (fig. 1, left). As one goes down into the sediment, shrap reflections (fig. 1, middle) appear that indicate the appearance of structures with long-range order. Single crystal diffraction patterns were also observed (fig. 1, right).

We would like to stress that measuring such data is very challenging. The wavevector of the lowest-order diffraction features in Fig. 1 is of the order $q \sim 0.01$ nm^{-1}, corresponding to d-values in the direct space of about 600 nm. The upgraded ID02 is now able to resolve these tiny-angle Bragg peaks with excellent resolution: the measured peak width is about 2% of its q value! Moreover, this extremely high angular resolution is combined with very low background. The polystyrene particles have very low scattering contrast in water so that in our previous experiement at BM-26B we were not able to detect the diffraction peaks for these aqueous samples. Therefore, our present experiment took profit of the unique properties of the beamline after its upgrade.

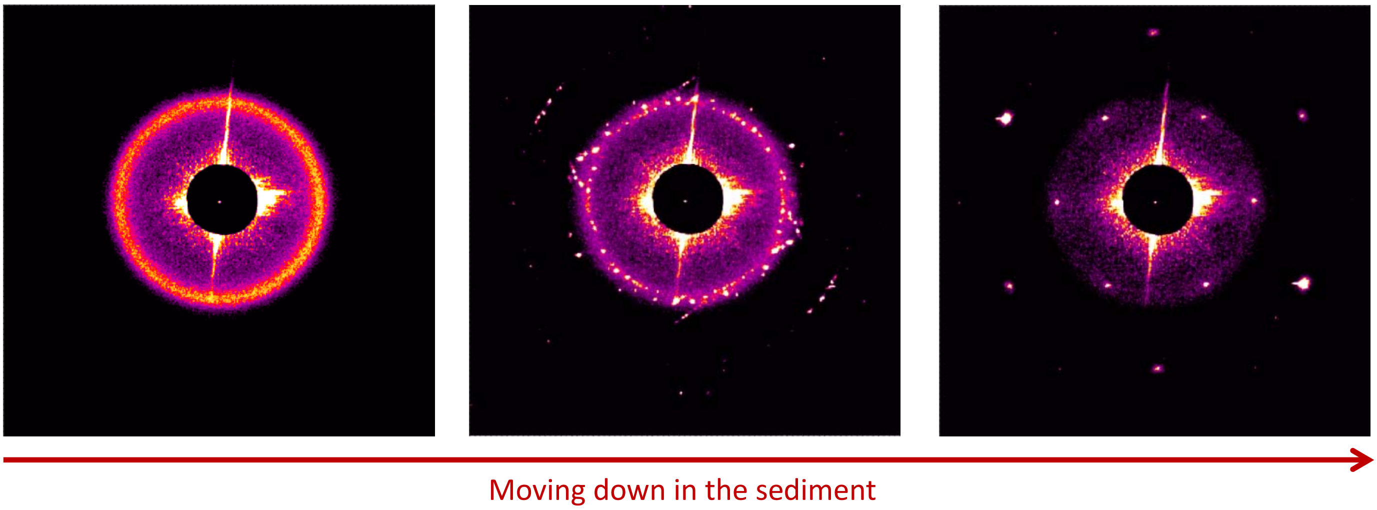

Figure 1. 2-D SAXS patterns of height scan through the sedimented sample of anisotropic colloidal dumbbells at different heights from the bottom of the sediment. Sample 6S_9_5_1.

Rotation scans (with a total range of 100 degrees) were performed at a particular height that showed single crystal pattern. In figure 2 we present the characteristic SAXS patterns for selected angles. With extensive and detailed analysis of the obtained structure we might be able to determine the exact ordering in the self-assembled phase.

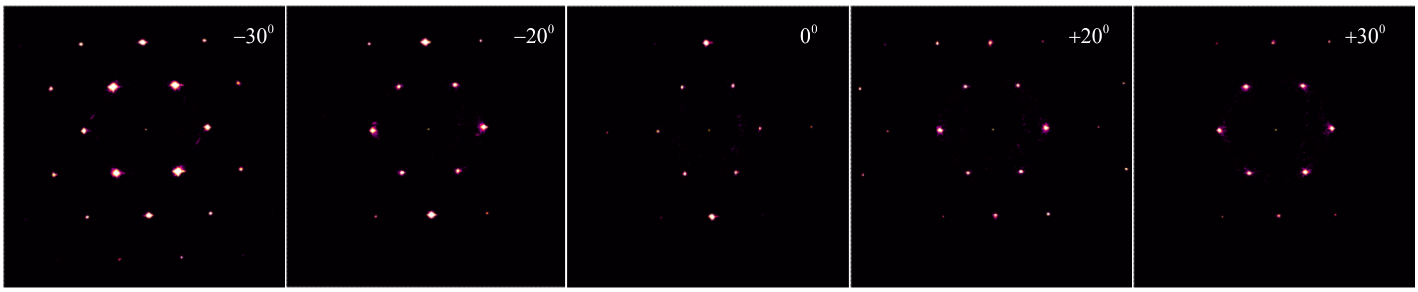

Figure 2. 2-D SAXS patterns of crystal of colloidal dumbbells at different rotation angles. Sample 6S_9_5.

To summarize, we are convinced that the data collected in our experiment will be able to reveal the 3D structure of highly ordered phases in the dispersion of anisotropic dumbbells. We are currently performing detailed quantitative analysis of the data to comment on the exact crystal symmetry. From the width of the diffraction peak we also hope to access the spatial extent of positional order and the crystal quality.

Finally, we would like to thank Dr. S. Prevost and Dr T. Narayanan for their excellent support not only during the week but also in the weekend.