# ON THE SHOULDERS OF GIANTS: FROM YuMO'S BRILLIANT PAST TO ITS BRIGHT FUTURE

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YuMO, the time-of-flight small-angle neutron scattering spectrometer at the IBR-2 pulsed reactor, is a rare example of a scientific instrument whose competitiveness has been preserved through continuous conceptual, technical, and software modernization. Emerging from the pioneering Dubna SANS work of Yu.M. Ostanevich, L. Cser, A.B. Kunchenko and their colleagues, YuMO was built around a principle that remains decisive today: to deliver a high useful neutron flux to the sample and convert it into reliable structural information with maximum efficiency. Its "direct-view" geometry, the time-of-flight technique, and the high peak intensity of IBR-2 made the instrument especially powerful for time-dependent soft-matter and biological systems.

One of YuMO's key breakthroughs was the implementation of a two-detector system with central holes in the detectors. This concept allowed the transmitted beam to pass through the first detector while two detector positions simultaneously covered a broad momentum-transfer range. Combined with the in-beam vanadium calibration scheme, this approach enabled absolute-scale SANS measurements, reduced auxiliary measurements, and helped ensure stable and reproducible results. As a result, YuMO became not only a high-flux instrument, but also a high-throughput instrument, capable of producing interpretable data rapidly during an experiment.

The same philosophy has guided subsequent upgrades. Over the years, YuMO has acquired advanced sample environments, including precise temperature control, high-pressure systems for liquid samples, magnetic-field capabilities, illumination options, and an flexible automated sample-changing area. The standard sample holder evolved from single-sample operation to computer-controlled measurements of up to 25 samples, while the geometry of the sample environment remained compatible with specialized devices. Automation has become an essential part of the instrument: SONIX+ controls experimental parameters and sample-environment devices, while SAS -based data treatment and on-line processing provide rapid feedback to users and allow beam-time strategies to be adjusted during the experiment.

The scientific impact of this development is illustrated by experiments on lipid phase transitions, DNA–lipid complexes, and amyloid-beta peptide interactions with lipid membranes, where YuMO's flux, dynamic range, absolute calibration, and temperature stability were essential for observing structural transformations and kinetic processes. These examples show that the instrument's technical architecture directly translates into scientific capability.

The future of YuMO is now being shaped by cold-neutron capabilities and detectors modernization. The cold moderator has expanded opportunities at longer wavelengths and so the lower scattering momentum transfer, while the upgraded boron-based direct-beam detector provides stable, efficient transmission monitoring and rapid neutron-absorption measurements. The ongoing commissioning of a position-sensitive detector with a central hole opens the way toward improved studies of anisotropic scattering, kinetic processes, and complex sample environments.

The talk will present selected experiments performed at YuMO and discuss how the ideas laid down by its founders continue to define the instrument's bright future as a modern, automated, high-flux SANS platform for soft matter, materials science, and structural biology.