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Port-GISANS: A portable GISANS booster for revealing the structure of complex soft matter interfaces and biomembranes

Port-GISANS will be a module to enable grazing incidence small angle neutron scattering (GISANS) experiments for existing and future small-angle neutron scattering (SANS) instruments by improving flux, resolution and signal to noise ratio. This will allow GISANS experiments at ESS from day one on its SANS instruments. By focusing the incident flux vertically on the sample and improving the signal-to-noise ratio, Port-GISANS will enable high quality surface scattering experiments with neutrons addressing scientific questions which currently remain unsolved. To showcase the capabilities of the method we will present neutron ray tracing simulation results for the device as well as some simulations of the expected gain in signal to noise ratio for some selected sample systems, such as colloidal nanoparticles at an interface.

The potential of the device for extension of the applicability of GISANS to areas unfeasible today will be discussed. Examples of such systems include single lipid membranes, curvature induced phase separation of biomembranes [1], responsiveness of lipid membranes to external stimuli in situ such as exposure to light for photolipids [2], hydration and in-plane structure of DNA composites during encapsulation by protective shells [3], micellar nanoreactors [4] and high background systems, for example, experiments at the liquid/air interface.

[1] Paracini et al, ACS. Appl. Mater. Interfaces , 15, 3772-3780 (2023),

[2] Urban et al, Langmuir, 36, 10, 2629-2634 (2020)

[3] Nguyen et al, Angewandte Chemie, 58, 912-916 (2019)

[4] Hintermayr et al, Nano letter, 19, 8, 4928-4933 (2019)

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