



Contribution ID: 82

Type: Poster

## FREIA - A neutron reflectometer optimised for soft matter and life sciences at ESS

The instrument suite at ESS includes two reflectometers which will work together to support the full range of reflectometry science. Both instruments have high beam flux and unique designs that enable fast measurements, but FREIA is optimized for soft matter and life sciences. An overview of the instrument is shown below. The instrument has a downward-oriented elliptical guide focusing a neutron beam with a broad vertical divergence and wavelength range ( $2 \leq \lambda \leq 10 \text{ \AA}$ ) onto a horizontal sample surface. From this high-divergence beam, a range of incident angles can be selected to cover the Q-range of interest without moving the sample. The collimation system will have three possible modes. The first option is a standard pair of slits that will allow complete freedom to select an angular resolution or incident angle within a range of approximately  $0.2$ – $3.7^\circ$ . Typical sample sizes are expected to be 30 mm (across the beam) by 40 mm (along the beam direction), although this can be reduced to 20 mm or extended to circa 80 mm. The second option allows fast measurements over the full Q-range to be carried out because the collimation system will be able to rapidly switch between up to three well-collimated incident angles. Since this means angle changes are achieved without moving the sample, this arrangement avoids the measurement dead time related to angle changes and settling times for free liquid surfaces. Finally, the collimation system will also allow for an  $m=6$  supermirror to be inserted to deflect the beam upwards and thereby allow reflections from underneath the interface to be measured (appropriate for liquid-liquid samples or where complex sample environments are required above the sample). FREIA will use the “multi-blade” detector design [1, 2] with a sample-detector distance of 3 m and area coverage of  $4.75^\circ$  (V) and  $3.8^\circ$  (H) to allow for off-specular measurements.

### References

- [1] F. Piscitelli et al., J. Instrumentation 13, P05009 (2018)  
 [2] F. Piscitelli et al., J. Instrumentation 12, P03013 (2017)

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Instrumentation and methods

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**Session Classification:** Poster session