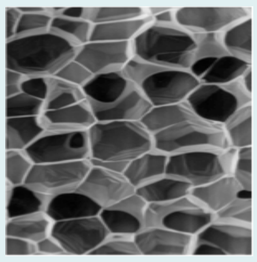
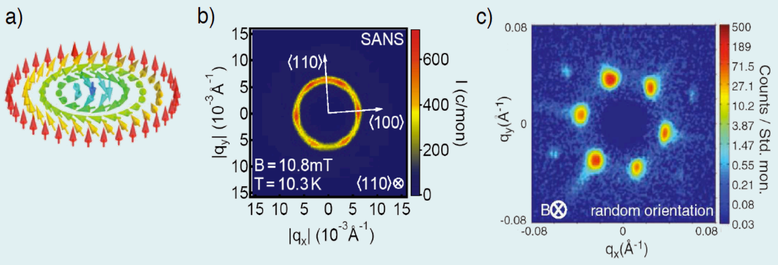
SKADI
Small K Advanced DIffractometer

S. Jaksch[1], **H. Frielinghaus**[1], J. Jestin[2], W.G. Bouwman[3]
[1] Jülich Centre for Neutron Science, Outstation at Maier-Leibnitz Zentrum, Garching, Germany
[2] Laboratoire Léon Brillouin, CEA Saclay, Gif/Yvette Cedex, France
[3] Delft University of Technology, JB Delft, The Netherlands

Science Case

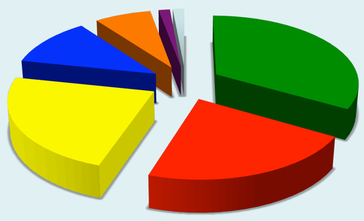


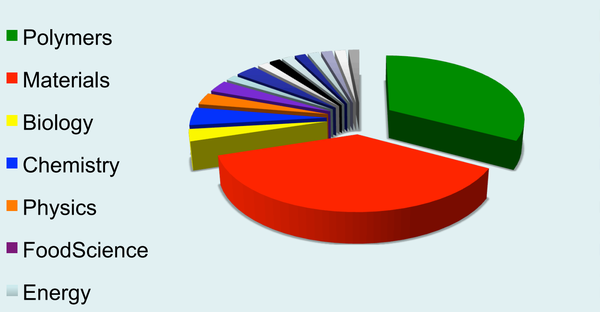


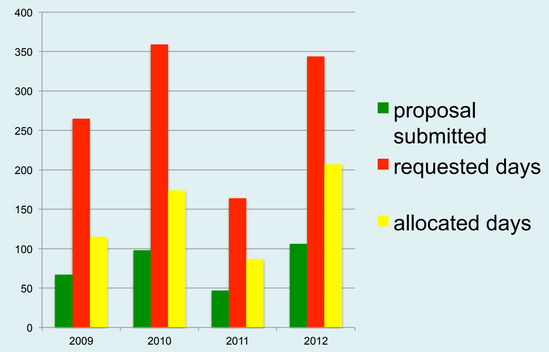
SKADI aims to cater a wide range of fields and different investigations. Of specific interest nowadays are systems with a wide range of length scales, such as nano-foams [1], which have to be captured in a single measurement as they polymerize during synthesis. Another interesting field are skyrmions [2], which promise high density data storage in future computers. In-situ measurements, also

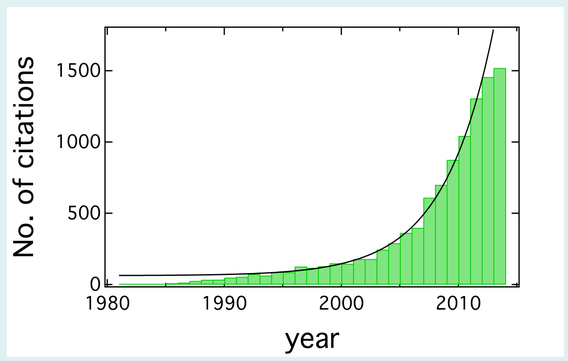
with large machinery [3] plays a major role in material science, while soft-matter systems in application need to be investigated in a wide range of length scales to understand and improve upon their inner mechanisms, which will allow, among other things, for improved drugs and every day products.

User Base



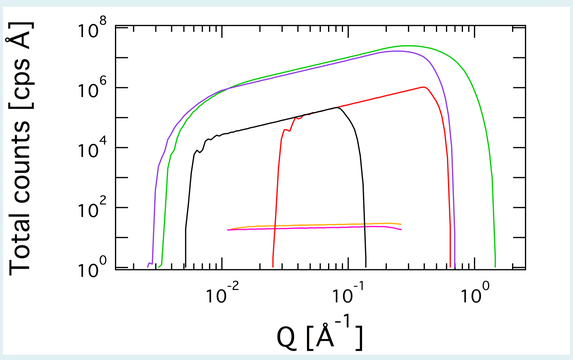






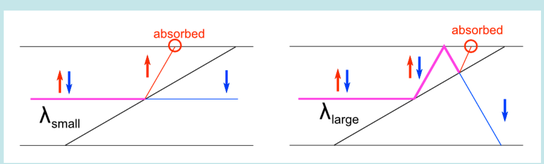
In preparation for the proposal of SKADI we were asking the European science community to express their support by letters of interest. We collected 70 of these letters in various fields and across a wide range of nations as shown above. This shows that there is indeed a wide user base waiting for additional high quality SANS instruments such as SKADI. To emphasize the need for additional SANS instruments we provided the requested and allocated beamtime days for SANS instruments in the MLZ where overbooking factors of two are common. Newly emerging fields, such as food science may request even more beamtime. As a comparison we show the development of biology related SANS publications since 1980. This shows the excellent track record of SANS instruments for fast publications, also in new fields, which makes SANS instruments excellent day one instruments, considering the early success strategy at ESS.

Instrumental Overview

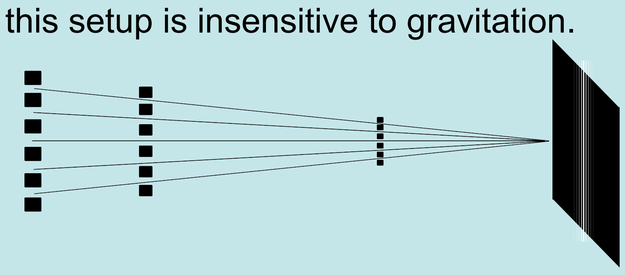


Intensity comparison with D22 (red and black) with SKADI (Lilac and green) for similar collimations. Gain factors (orange and pink) are around 25.

Polarizer
Polarizers and polarization analysis will allow for the investigation of four channel polarization. With this detailed analysis of magnetic materials and magnetic composites are possible.

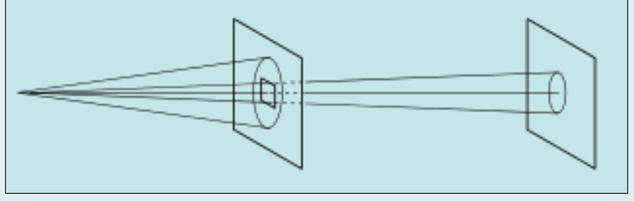


High Resolution Add-Ons
VSANS will provide for a Q range down to at least 10^{-4} Å^{-1} which allows for investigation of samples with structures on the micrometer scale. Using vertical slits this setup is insensitive to gravitation.



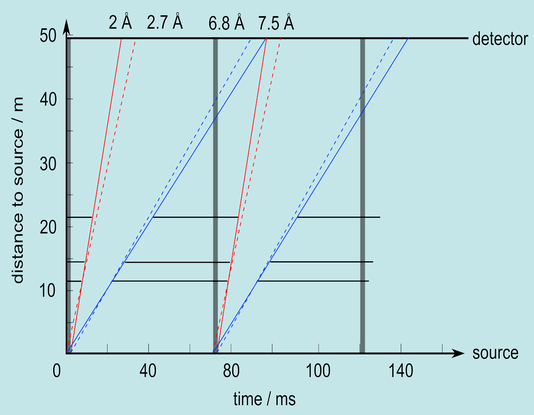
Forward Detector
This detector features a 20x20 cm^2 aperture at low Q. It is positioned at 0.2xCollimation Length.

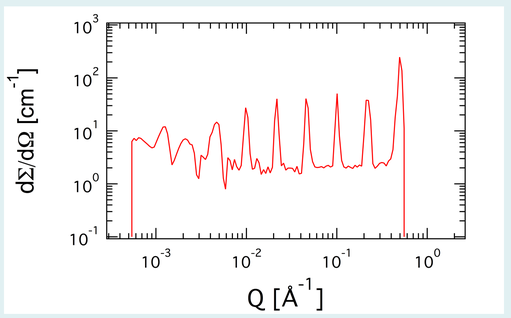
Rear Detector
This detector at collimation length resolves lower Q values. The overlap between front an rear detector is compensated by the time-of-flight capability of SKADI.



Sample Position
This large 3x3m^2 sample position will accommodate large custom sample environments e.g. stress/ heating rigs [4].

Chopper System
The chopper system with three choppers at 11.5, 14.5 and 21.5 m allows for the selection of a suitable wavelength band which can either be modified to use maximum intensity or maximum resolution. Standard mode is Δλ = 5.5 Å @ 14 Hz.





Plot of δ-peaks over SKADI's complete Q range. FOM gains compared to D22 are 36. This gain includes the improved Q resolution.

References
[1] Courtesy of Klemmer, H.; Strey, R., In University Cologne.
[2] Mühlbauer, S.; Binz, B.; Jonietz, F.; Pfleiderer, C.; Rosch, A.; Neubauer, A.; Georgii, R.; Böni, P., *Science* **323**, 915-919.(2009)
[3] Lippmann, T.; Beckmann, F. Harwi Ii., website HZG
[4] The Engineering Materials Diffractometer at SNS, Vulcan @ SNS website