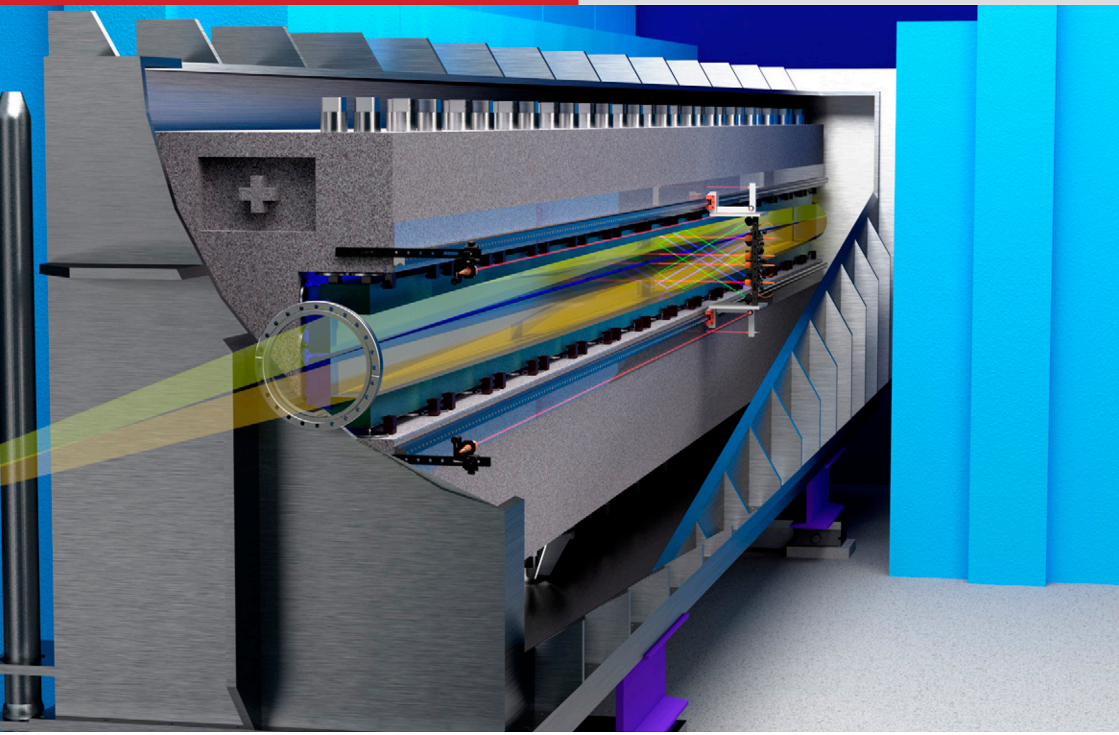
Number 48 | September 2016

SWISS NEUTRON NEWS



Schweizerische Gesellschaft für Neutronenstreuung
Société Suisse pour la Diffusion des Neutrons
Swiss Neutron Scattering Society

On the cover

Concept of the Estia Selene guide. See the related article "Estia: Design of the polarized, small sample reflectometer at ESS" by A. Glavic et al.

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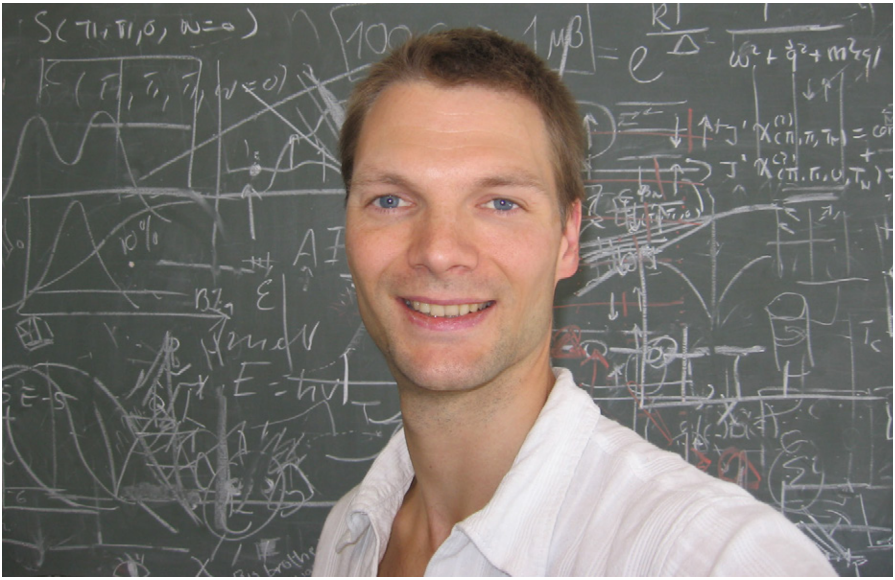

Dear Colleagues,

Welcome to a new issue of Swiss Neutron News. In it you will find an article about the neutron reflectometer Estia, which will be built at ESS. It is a perfect example of how the advent of a new neutron source should be approached – not only will ESS give unprecedented pulsed flux. Estia will bring orders of magnitude gains due to the invention of a new guide system – the Selene concept. This concept was developed is Switzerland, and will be built as Swiss in-kind contribution to ESS. I congratulate and thank everyone involved. There is nothing more motivating than to work on an innovative project pushing the boundaries of result oriented performance.

I take this occasion as representative of the neutron user community to express my concern that ESS instrument teams are under pressure to reduce instrument budgets below levels where both performance (e.g. flux and detector coverage) and capabilities (measurement options, experiment types) suffer. Of course each component of ESS should be built cost effectively. But squeezing each instrument 2 million below the meaningful minimum only saves 2% of the total budget, while severely reducing the value of the entire ESS for the scientific community. Limiting the capabilities of the instruments should be the last resort after all other stones have been turned. I write this not to point fingers, not at all – building ESS on time, on budget and to scope is a formidable challenge, but to remind all stakeholders that we are building ESS to advance science through enabling hitherto impossible experiments.

Another challenge that requires careful optimization of science output per investment is the need to provide the scientific community with sufficient capacity for neutron access. ESS will push the boundaries of capability, but the capacity for neutron science comes from the joint European landscape of neutron sources. Some sources have closed (e.g. Risø), some will close (HZB, LLB) and others operate at reduced number of days (ISIS) or flux (ILL). Eventually a new "capacity per cost optimized" source will be needed somewhere in Europe, and it is important efforts are devoted now to pave the way. I am grateful to see this happening both in France and in Germany, and hope the end-goal - neutron measurement capacity for scientific user – comes before short term regional and institutional priorities in the process. But, it is absolutely clear that in the next decade by far the most cost effective path to a sustainable neutron science capacity is to maximise flux, operation days and number of instruments at existing sources. To this end, our Swiss Neutron Source SINQ at PSI has developed a very exciting plan for a complete upgrade of guides etc. in the near future, which we can look forward to in proud anticipation.

Hoping an enjoyable summer has recharged the batteries, I wish you all an exciting and productive autumn semester.

Cordially
Henrik M. Ronnow

Estia: Design of the polarized, small sample reflectometer at ESS

Artur Glavic[1], Jochen Stahn[1] and Sven Schütz[2]
[1]Laboratory for Neutron Scattering and Imaging, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland*
[2]Laboratory for Scientific Developments and Novel Materials, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland
(Dated: July 13, 2016)

The European Spallation Source (ESS) [1] will be the worlds leading neutron source with user operation starting in 2023. To achieve this, the project is not only aiming to use the most powerful spallation of 5 MW to produce the neutron pulses but in addition supports many novel instrument and moderation concepts to make the most efficient use of the produced particles. One of the most ambitious and revolutionary instrument concepts is the Estia reflectometer that is designed at PSI as Swiss in-kind contribution. As one of the first tier experiments at ESS, Estia will enable polarized reflectometry on tiny samples by employing a novel focusing concept. This novel concept relies on recent advances in neutron optics, including the development of the Selene neutron guide concept, which corrects the largest aberration effects which conventional neutron transportation optics suffer from.

SELENE GUIDE FOR ABERRATION CORRECTED FOCUSING REFLECTOMETRY

The center piece of Estia is its truly focusing neutron guide, based on the Selene concept[2]. A Selene guide transports only the useful neutrons and enables beam manipulation (size and divergence) similar to a photo-

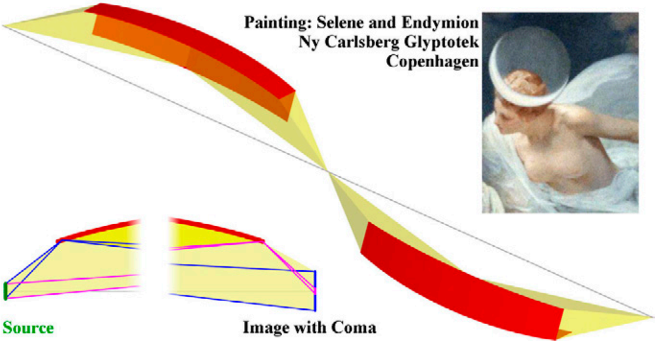

Figure 1
Concept of the Selene neutron guide: Two planar elliptical mirrors, one for horizontal and the other for vertical focusing, make up each of the two sections. The focus in the middle of the two ellipses exhibits coma aberration, which is corrected in the second ellipsis. The insert depicts Selene, the titan-goddess of the moon in Greek mythology. The relation to the neutron guide is the silhouette on the moon, forming half an ellipse.

graphic lens. In conventional light optics, point-to-point focusing allows to define the image size with an illumination field diaphragm located at the initial focal point (here called virtual source). The divergence of the beam is controlled by an aperture behind the optical lens, far from the image.

For neutrons the lens has to be replaced by a reflecting device, here a pair of planar-elliptic mirrors for vertical and horizontal focusing. Like all focusing optical devices this suffers from aberrations, which are largest in this case for reflections close to the focal points. Avoidance of these regions and compensation of the coma aberration by a second, identical reflector results in the optical path as illustrated in the 3D graphics in Figure 1 (red: reflectors, yellow: beam). In this device all neutrons are reflected exactly 4 times, once on each of the horizontal and vertical ellipses.

The Selene guide is truly focusing in the sense that the phase space density is zero outside a volume defined by the virtual source and the aperture. Thus the beam footprint on the sample can be tuned and over-illumination can be avoided. This is in contrast to all other elliptic guides discussed nowadays, which suffer from strong coma aberration effects and multiple reflected beams leading to poor focusing. In addition, compared to these conventional neutron optics, the intensity of neutrons within the Selene guide that do not reach the sample is drastically reduced, which results in a lower background.

The special guide geometry allows for efficient optics to polarize and filter the beam or to implement constant resolution without using pulse shaping choppers. The convergent beam can be used efficiently on sample surfaces from 1x1 mm^2 to 50x10 mm^2. To allow for high detector angles and to reduce the influence of gravity, the scattering plane of Estia is horizontal.

A prototype of the Selene guide with a total length of 4 m was built and tested successfully at PSI [3]. It is now used to reduce the measuring time on tiny samples (width below 2 mm) by up to two orders of magnitude.

It outperforms the predicted focusing capability and confirms that it is possible to build and align such a high-precision guide.

For Estia the Selene concept was expanded by adding a second beam path in the vertical direction, which shares its focal points with the first. This allows the efficient use of twice as many neutrons and, in addition, the possibility to incident both neutron spin polarizations on the sample at the same time. The total usable divergence at the sample is 1.5° horizontally and 2x1.5° vertically, which are separated by 1° allowing separate detection and analysis.

ESTIA DESIGN OVERVIEW

ESS will use 14 Hz pulses of protons coming directly from a linear accelerator that produces 2 GeV particles. The beam is directed on one section of a large tungsten disk that rotates locked to the source frequency so that each pulse hits a different section, allowing efficient dissipation of the deposited thermal energy. In comparison to similar sources as the SNS or ISIS it uses long proton pulses, which limits the initial time resolution. For reflectivity and other large structure methods, however, the wavelength resolution has only to be moderate and therefore this limited time resolution matches the requirements for such instruments. Additionally the moderators for cold neutrons, normally used for these techniques, can be optimized for these longer pulses, increasing the relative flux of lower energy neutrons.

Estia is one of the shorter instruments at ESS with a moderator to sample distance of 35 m. It will be placed in the east hall within the target building, close to the backwards direction with respect to the proton beam (Figure 2).

Starting at 2m from the source, the produced neutrons are extracted by an elliptical feeder guide, that refocuses on the virtual source position at 11 m. The lack of aberration correction in this feeder is compensated by the cold source being much larger than the virtual source slit, so that the brightness of the beam after the virtual source is not impaired.

The natural wavelength resolution for 4 Å/12 Å neutrons at this distance is 7%/2%, matching the typical experimental requirements. Therefore Estia does not need sophisticated pulse shaping or frame multiplication choppers as most other ESS instruments but only one 14 Hz bandwidth determination chopper at 10.7 m from the moderator is used.

A set of neutron absorbers cutting down the beam to the desired shape (virtual source) is located directly after the chopper. The virtual source opening, which is projected onto the sample by the Selene guide, can be adjusted for heights up to 20 mm and width between 60 μm and 5 mm.

Neutrons from the virtual source are transported to the experimental cave by the Selene guide mirrors, which are mounted in two large granite blocks. The space between the two blocks is used for the instrument shutter and optical components for beam characterization and neutron polarization.

The second ellipsis of the Selene guide ends within the experimental cave (purple in Figure 2), where additional optical components as a slit assembly to restrict divergence are placed within the beam path before the neutrons reach the sample at the final focus

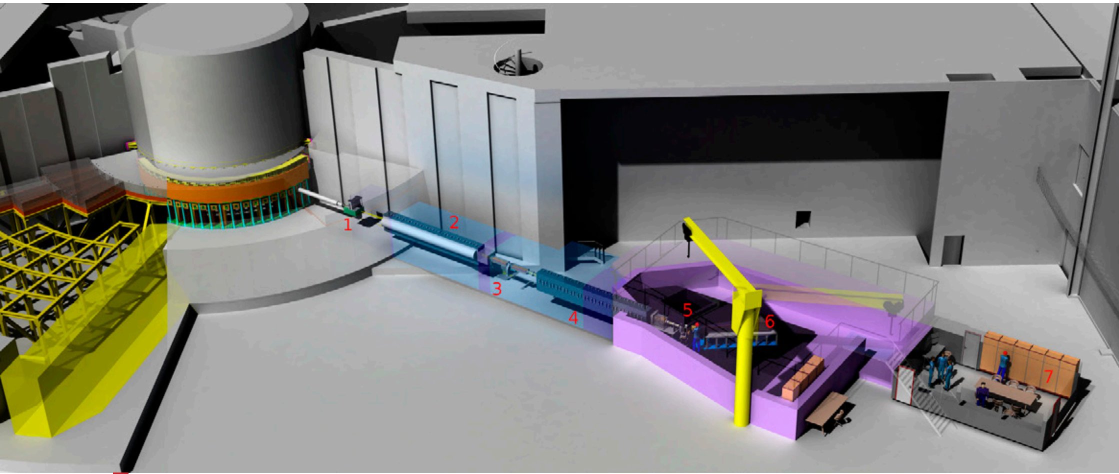

Figure 2
Overview of the Estia instrument within the ESS target hall. The cold moderator is at the beginning of the beamline starting from the top left. Within the bunker shielding one can find the bandwidth definition chopper (1) in a common housing with the virtual source. The first (2) and second (4) ellipses of the Selene guide are interrupted by components close to the middle focus (3), including the neutron polarizers. In the purple experimental cave the sample stage (5) and detector (6) are accessed by users during their experiments. Measurements are planned and controlled from within the hutch (7).

of the optical system. The table for these components as well as the sample positioning stage and detector table sit on air pads on a polished granite "dance floor" to allow flexible positioning.

Sample and detector can be rotated horizontally to reach large scattering angles of up to 145° or reflect from the back side up to -10°. The sample position is adjusted with respect to the neutron beam using a mechanical hexapod, accessing all degrees of freedom. A magnetic field and low temperatures can be applied to the sample using instrument specific equipment.

The reflection angle at the sample is measured on two 2D position sensitive detectors with 4m distance from the sample. A surface area of $500 \times 250\,mm^2$ each with $0.5 \times 2\,mm^2$ resolution will be sufficient for high angular resolution in these specular experiments and sufficient coverage for off-specular and potential grazing incidence neutron scattering (GISANS) measurements.

While the whole beam path in front of the sample is passing through a single vacuum vessel to minimize intensity losses, the area between sample and detector will be covered with a flight tube filled with Ar gas, reducing air scattering.

IMPLEMENTATION OF THE SELENE CONCEPT

Neutron optical elements are coated with supermirrors, a procedure that limits the maximal size of individual components. For this reason the elliptical guides for the Selene system need to be build out of several individual segments of ≈500 mm length. In the case of Estia with a mirror lengths of 7.2 m, this means that 15 segments of vertical and horizontal guides are needed for each beam path and Selene mirror, a total of 120 segments.

All segments need to be mounted separately and adjusted with respect to each other. Missalignments, especially small rotations, change the beam paths of all neutrons hitting this segment. So to keep the focusing capability of the Selene guide the precision must match the focus size.

As reflectometry is performed under small incident angles, the projected size of the sample within the beam in horizontal direction is in the order of 100 µm. Due to the long distance from the mirror segments to the sample any mirror motion is amplified and the sample size translates to a precision for each segment alignment screw of a few µm. This is where Swiss precision meets neutron scattering, as µm precision on several meters

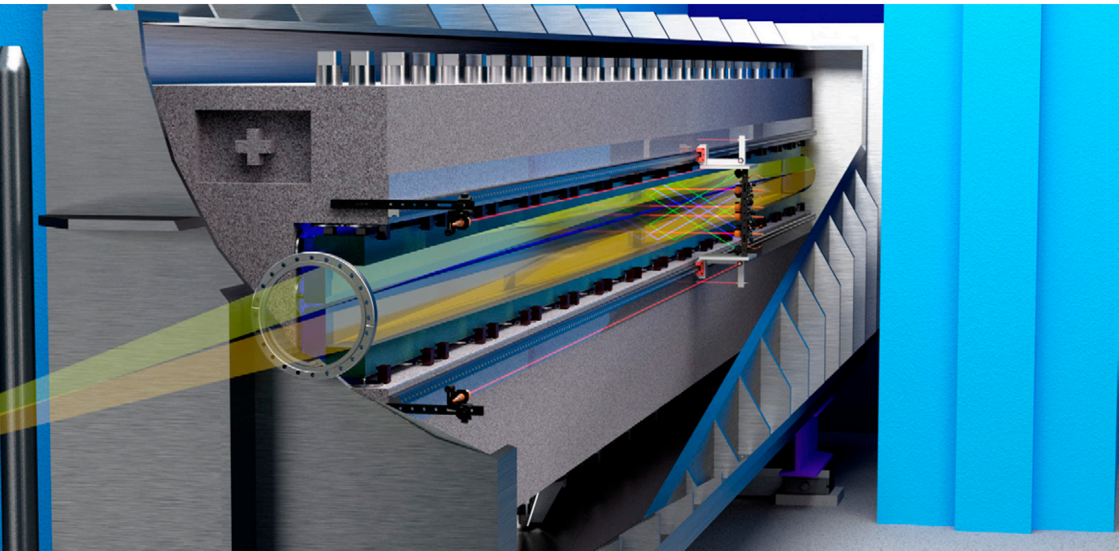

Figure 3
Concept for the Estia Selene guide including a large granite carrier, motorized mirror mounts, vacuum vessel and laser-optical metrology system. Two separate beams are transported, that intersect at each focal point. The guide will be thermalized and reach µm precision for the mirror segments over 7 m distance.

of guide require high mechanical and thermal stability, motorized precise adjusters and a suitable method to measure the deviation from the desired position.

Figure 3 shows the Estia solution for one of the two elliptical Selene guide mirrors. The mirror segments are mounted on motorized actuators with kinematic mounts within a rectangular cut-out in a single beam of granite. A large vacuum vessel houses the granite beam, mechanically decoupled with vacuum bellows on the mounting posts. Thermostats keep the temperature of the granite stable to avoid any negative impact from thermal expansion.

The alignment position of the adjuster screws is measured with a metrology cart, that can be translated over the length of the assembly. A collection of fiber coupled laser collimators are mounted on the cart and used to reflect the beams of an absolute distance interferrometer from the mirror surface. This way, the distance of the neutron mirror to the long elliptical axis can be measured at several points of one segment with 0.5µm precision, allowing the calculation of possible actuator movements needed.

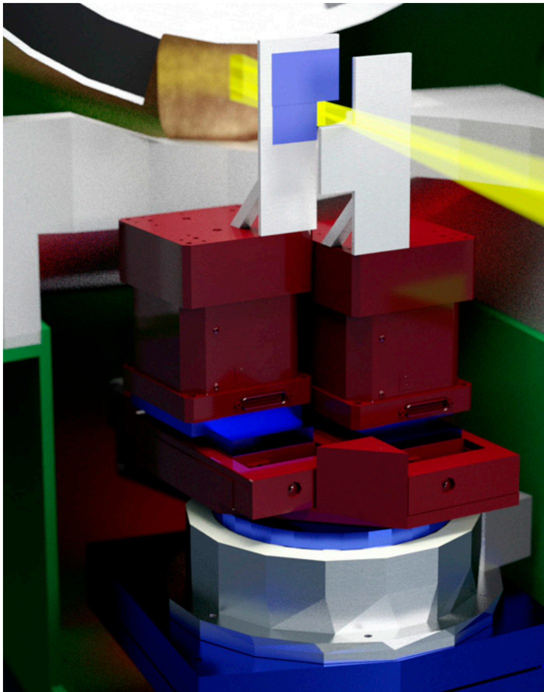

Figure 4
Virtual source definition within the vacuum housing of the bandwidth chopper. Two L-shaped absorber plates restrict the neutron beam in vertical and horizontal direction, defining a rectangular area that is projected onto the sample by the Selene guide. For well aligned optics this concept allows to remove almost all neutrons that would not hit the sample without reducing the usable intensity.

THE VIRTUAL SOURCE

The imaging properties of the Selene guide opens a unique opportunity for Estia as it allows to define the beam size at the sample position by the restriction of transmitted neutrons at the first focal point, the virtual source. For a perfect imaging system one could use absorbers with an opening of the exact size and orientation of the measured sample surface (rectangular in most cases) that would produce a beam of solely used neutrons, thus allowing the reduction of background without any negative impact on the measured intensity. In addition one could use a reduced size to measure a selective area on the sample.

Practically it is sufficiently accurate to approximate the sample shape with a pair of L-shaped absorbers that can be moved vertically as well as parallel to the beam direction and rotated around the focal point to achieve similar results. In the solution shown in Figure 4 each absorber is attached to a vertical translation stage on top of a horizontal axis. Both of these are attached to a larger rotation axis that is fixed to a kinematic mounting plate. The virtual source assembly is within the same vacuum box as the chopper but mechanically decoupled using a separate foundation post through a vacuum bellow at the base of the box.

EXPERIMENTAL CAVE AND SAMPLE ENVIRONMENT

The area accessed by users to perform their measurements is called experimental cave. An overview of the components within the cave is shown in Figure 5.

After leaving the second Selene guide section, the beam is focused on the sample position ≈2m from the end of the granite beam. The divergence of the beam hitting the sample can be reduced vertically as well as horizontally by a slit assembly directly after the end of the Selene mount. Reducing the horizontal divergence Estia can measure reflectivities in almost conventional configuration as well as off-specular scattering while

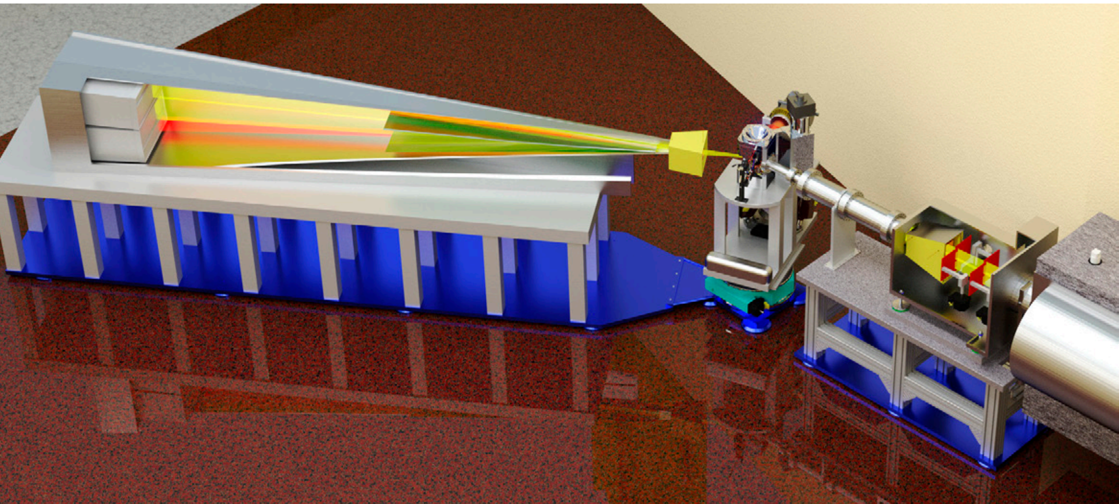

Figure 5
Overview of the interior of the experimental cave of Estia. The detector arm (left), sample stage (center-right) and optics table (right) can all be moved with air pads on a "dance floor" that covers most of the cave area.

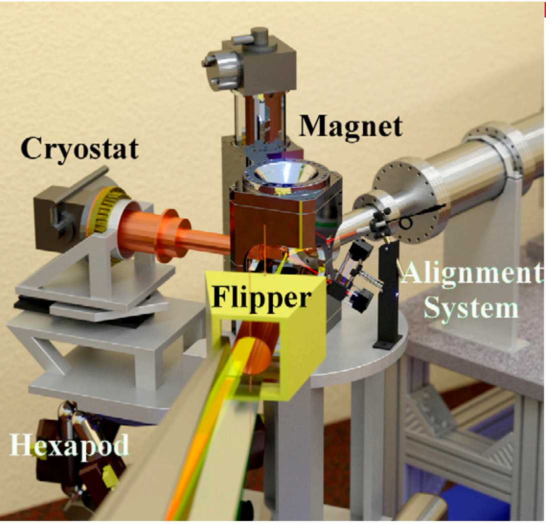

Figure 6
Close up of the area around the sample with a view on the cryostat on top of the hexapod, magnet, spin-flipper and laser alignment system.

maintaining the capability to define the beam size at the sample position with the virtual source.

The incident beam angle will be defined with a heavy duty rotation stage, while the sample adjustment will be done with a mechanical hexapod system. Detector rotation will use a contact wheel at the end of the detector arm together with air pads and a central axis attached to the sample stage, allowing precise motion.

As a polarized reflectometer Estia will perform many investigations on magnetic thin films, which require the application of magnetic field of ≈1 T as well as, in many cases, low temperatures down to a few K. The instrument will have a dedicated room temperature bore cryomagnet with >2 T field over 8 cm pole distance, allowing high flexibility without any material in the beam to cause scattering background. Low temperatures will be reached with a small, liquid He flow cryostat, that reaches into the magnet as showin in Figure 6. Such a system allows very fast cool down times of ≈15 min with a base temperature of 2 K.

Simulated intensity of Estia for regular experiments is very large so that short measurements are expected, reaching down to only seconds. For this reason fast cool down is essential as well as minimization of down time due to sample alignment. Therefore a laser alignment system will be attached to the sample rotation, that will reflect the beam from the sample surface and measure it at two distances from the sample with a camera sensor to deduce angular and positional offsets. This way the sample surface can be automatically aligned in seconds after a change as well as during fast temperature sweeps.

POLARIZATION CONCEPT

The limited sample size and therefore small neutron beam focus area have the implication that, sufficiently far away from each focus, the local variation of direction of the neutron beam is small. For this reason, a correctly shaped polarizing transmission supermirror can be used for efficient polarization of the beam.

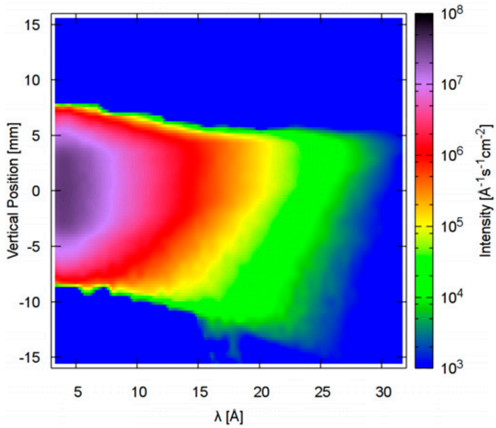

Figure 7
Neutron beam intensity on the sample for different wavelengths and vertical positions. The change of shape at longer wavelengths, diverging from the 10mm virtual source, is a result of the influence from gravity.

A logarithmic spiral with the pole in one focus leads to a constant intersection angle for the whole neutron beam. Two of these transmission polarizers will be used, before and after the middle focus, to polarize the beam. Expected polarization exceeds 99% with ≈80% transmission of the used polarization state.

The polarized neutrons are transported to the sample through a guide field produced by permanent magnets and can be switched with radio frequency spin-flippers, one of which will be positioned to only flip the neutrons in one beam path for simultaneous separate spin-up and spin-down beams incident on the sample.

Polarization analysis will be done similarly with mirrors mounted on the detector arm. The analyzers will, in addition to allowing the spin-down state to be transmitted, also reflect the spin-up state onto the detector to be measured on different areas of the detector. This possibility together with the separate flipping of the two incident beams adds the possibility to measure all four relevant spin-states, up-up;down-down;up-down;down-up, at once.

EXPECTED PERFORMANCE

Monte-Carlo based neutron ray-tracing simulations have been performed for the Estia design geometry using the McStas program[4]. The resulting intensity at the sample position for a virtual source size of 10x10 mm^2 is shown in Figure 7. As can be seen, the virtual source size is nicely projected onto the sample for neutrons with up to ≈15 Å wavelength. Above that the beam smears out a few mm to the bottom, which will not reduce the measured intensity if the virtual source is slightly larger than the sample.

The integrated intensity on a 10x10 mm^2 sample is shown in Figure 8 in comparison to a point directly after the virtual source as well as a simulation ignoring the effects of gravity. Intensity reduction at short wavelength (4 Å) from the simulation is as expected analytically

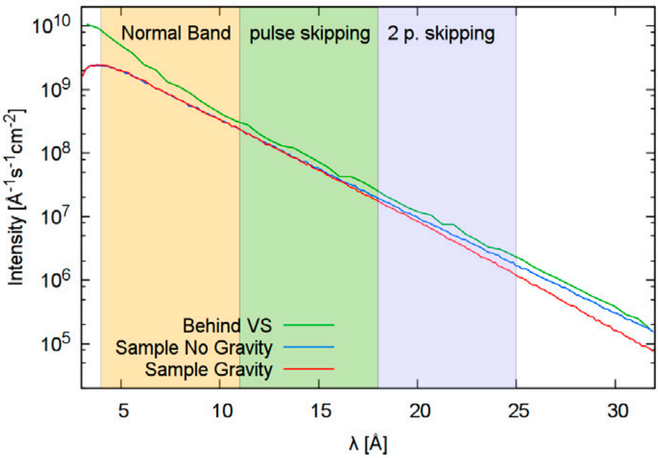

Figure 8
Intensity transfer through the Selene guide system. Each neutron undergoes exactly 4 reflections between virtual source and sample position, leading to a significant reduction of intensity for short wavelengths. Above 16Å loss due to gravity additionally reduces the transmission efficiency for the guide.

from four reflections from the m=4 neutron guide. Transmission efficiency reaches about 80% at 10 Å, when the supermirrors become total reflecting, and declines again above 16 Å due to gravity.

As typical reactivities quickly drop for higher wave vector transfer q (or smaller wavelength), it is optimal to start at the peak of the incidence spectrum. The optimal wavelength band for typical reflectivity experiments is therefore the range from 4 Å to 11 Å[5] (7 Å width is given by moderator-detector distance).

With the given chopper position of Estia it is possible to reduce the rotation speed to 7 Hz or even $4.\bar{6}$ Hz, so called pulse-skipping mode, to increase the measurement band- width for the cost of intensity. Although the intensity at 25 Å is drastically lower than at 4 Å, the reflectivity drop of q^{-4} will compensate this difference and it might still be advantageous to use this option to be able to measure the whole q-range without moving the sample or for time dependent studies.

As an example, a 2 pulse skipping measurement on a 10x10 mm^2 sample performed with an incident angle of 1.75° (1.0-2.5°) would cover a q-range from 0.01 Å^{-1} to 0.13 Å^{-1} to measure reflectivities down to 10^{-5} within a single pulse or 10^{-6} in a few seconds.

With this incident intensity it is possible to not only reduce experimental time for typical square cm samples but to measure tiny samples smaller than 1 mm^2 with reflectivities down to 10^{-7} in reasonable time. This will allow Estia to investigate novel systems in a broad range of scientific fields.

CONCLUSION

The focusing reflectometry concept implemented using the Selene neutron guide in conjunction with the large ESS brilliance will allow Estia to achieve outstanding performance for the measurement of polarized reflectometry from small to tiny samples. Technical challenges resulting from the required alignment accuracy will likely be manageable by using in-vacuum single segment adjustment with optical feedback within a stable mechanics. Instrument specific sample environment and automatic adjustment will prepare the instrument to optimize throughput and make full use of the available beam intensity.

These unique features will enable users to perform completely new types of experiments using sub-second time resolution, mm^2 area selection, fine grained physical parameter mapping (e.g. magnetic field scans) or large sample numbers.

* artur.glavic@psi.ch

[1] S. Peggs, R. Kreier, C. Carlile, R. Miyamoto, A. Paahlsson, M. Trojer and J. G. W. II, Tech. Rep., European Spal- lation Source ESS (2013), URL http://eval.esss.lu. se/cgi- bin/public/DocDB/ShowDocument?docid=274.

[2] J. Stahn, U. Filges and T. Panzner, Eur. Phys. J. Appl. Phys. 58, 11001 (2012).

[3] J. Stahn and A. Glavic, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrome- ters, Detectors and Associated Equipment 821, 44 (2016).

[4] K. Lefmann and K. Nielsen, Neutron News 10 (1999). [5] Note1, yellow area in Fig. 8.

Announcements

SGN/SSDN Members

Presently the SGN has 200 members. New members can register online on the SGN website: http://sgn.web.psi.ch

SGN/SSDN Annual Member Fee

The SGN/SSDN members are kindly asked to pay their annual member fees. At the general assembly 2013 of the society, the fee has been increased from CHF 10 to **CHF 20**. It can be paid either by bank transfer or in cash during your next visit at PSI. The bank account of the society is accessible for both Swiss national and international bank transfers. The coordinates are as follows:
Postfinance: 50-70723-6 (BIC: POFICHBEXXX),
IBAN: CH39 0900 0000 5007 0723 6.

The SGN is an organization with tax charitable status. All fees and donations payed to the SGN are **tax deductible**.

SGN/SSDN General Assembly 2016

The SGN/SSDN General Assembly 2016 will be held at Paul Scherrer Institut, November 10th, 2016.

PSI Facility News

Recent news and scientific highlights of the three major PSI user facilities SLS, SINQ and SμS can be found in the **quarterly electronic newsletter** available online under: https://www.psi.ch/science/facility-newsletter

SINQ Call for Proposals

The next **deadline** for the submission of beam time requests for the Swiss spallation neutron source 'SINQ' (http://sinq.web.psi.ch) is:
Feb 20, 2017

Registration of publications

Please remember to **register all publications either based on data taken at SINQ, SLS, SμS or having a PSI co-author** to the Digital User Office: https://duo.psi.ch. Please follow the link 'Publications' from your DUO main menu.

Open Positions at SINQ and ILL

To look for open positions at SINQ or ILL, have a look at the following webpages: https://www.psi.ch/lbr/open-positions | http://www.ill.eu/careers

PhD positions at ILL

The PhD program of the Institut Laue-Langevin, ILL, is open to researchers in Switzerland. Consult the page https://www.ill.eu/science-technology/phd-students/home/ for information on the PhD program of ILL or get in contact with the managers of the program using the email address phd@ill.eu. The Swiss agreement with the ILL includes that ILL funds and hosts one PhD student from Switzerland.

Winner of the Young Scientist Prize 2016 of the Swiss Neutron Scattering Society, sponsored by SwissNeutronics

The Young Scientist Prize 2016 of the society is awarded to a young researcher for his outstanding achievements using neutron scattering in the framework of his PhD thesis. The prize was awarded at the meeting of the Swiss Physical Society, 23.8.2016, in Lugano.

The prize is awarded to

Dr. Andrea Scotti

in recognition of his outstanding work on the behavior of highly concentrated colloidal suspensions of soft microgel particles using neutron scattering.
The photograph shows Dr. Andrea Scotti (right) together with the president of the Swiss Society for Neutron Scattering, Prof. Henrik Ronnow (left).

Young Scientist Prize 2017 of the Swiss Neutron Scattering Society, sponsored by SwissNeutronics

Call for Nominations

The Swiss Neutron Scattering Society hereby announces the call for nominations for the 4th Young Scientist Prize of the Swiss Neutron Scattering Society.

The prize will be awarded to a young scientist in recognition of a notable scientific achievement in the form of a PhD thesis. The science should include the use of neutron scattering, and eligible nominees should have a clear affiliation with Swiss Neutron Scattering (be member of the Swiss Neutron Scattering Society, be based in Switzerland, or have conducted experiments at Swiss neutron facilities). The PhD must have been awarded within two years of the announcement of this Call. The prize amounts to 1'000 CHF and is sponsored by SwissNeutronics.

Nominations for the prize should be submitted to the Swiss Neutron Scattering Society, Dr. Urs Gasser: (Urs.Gasser@psi.ch). The deadline for nominations is January 31st, 2017.

Nominations should include:

- A nomination letter including the motivation for the award
- A CV and publication list of the nominee
- Digital copy of the nominated work (PhD thesis)
- Letter documenting the acceptance of the nomination by the nominee
- Letters of support from authorities in the relevant field are accepted

Nominations for the prize will be treated confidentially. Nominations for the prize will be evaluated by a Selection Committee appointed by the board of the Swiss Neutron Scattering Society. The nominations will be acknowledged, but there will be no further communication.

Conferences and Workshops 2016 and beyond

An updated list with online links can be found here:
http://www.psi.ch/useroffice/conference-calendar

October 2016

MEDSI2016: Mechanical Engineering Design of Synchrotron Radiation Equipment and Instrumentation
October 2, 2016, Barcelona, Spain

Retinal proteins - EMBO Conference
October 2-7, 2016, Potsdam, Germany

Workshop on an accelerator based source for nonlinear THz science at SwissFEL
October 3, 2016, Windisch, Switzerland

Modern Trends in Neutron Scattering for Magnetic Systems and Single Crystal Diffraction with Polarized Neutrons
October 3-7, 2016, Tutzing, Germany

IWAA2016: International Workshops on Accelerator Alignment
October 3-7, 2016, Grenoble, France

4th International Conference on Competitive Materials and Technology Processes
October 3-7, 2016, Miskolc, Hungary

FIB & EM Prep User Group Meeting
October 5, 2016, Manchester, UK

NCS2016: VI-th National Crystallographic Symposium
October 5-7, 2016, Sofia, Bulgaria

Methods and Techniques in structural biology: beyond black boxes. Season 2
October 5-8, 2016, Strasbourg, France

Autumn School on Microstructural Characterization and Modelling of Thin-Film Solar Cells
October 9-14, 2016, Akademie Schmoeckwitz, Berlin, Germany

BESSY II Foresight Workshop on Energy Materials Research
October 10-11, 2016, Berlin, Germany

2nd International Workshop on X-ray Crystallography in Structural Biology
October 15-19, 2016, Lahore, Pakistan

NOBUGS 2016 and McStas-School
October 16-19, 2016, Copenhagen, Denmark

PSI2016: Physics of fundamental Symmetries and Interactions
October 16-20, 2016, PSI Villigen, Switzerland

Workshop on SoNDe applications: Neutron detection in research and industry
October 17-19, 2016, Freising, Germany

Solution scattering from biological macromolecules
October 17-24, 2016, Hamburg, Germany

International Research Conference on Structure and Thermodynamics of Oxides at High Temperature
October 21-22, 2016, Davis, CA, USA

7th International Conference on Bioinformatics
October 24-25, 2016, Rome, Italy

NSS: IEEE Nuclear Science Symposium 2016
October 29 - November 6, 2016, Strasbourg, France

International School on Fundamental Crystallography (Fifth MaThCryst school in Latin America)/Workshop on nanocrystallography
October 30 - November 5, 2016, Havana, Cuba

November 2016

4th International Technical Meeting on Small Reactors
November 2-4, 2016, Ottawa, Canada

25th Buffalo-Hamilton-Toronto (BHT) meeting
November 4, 2016, Hamilton, Canada

Biomolecular interaction analysis 2016: From molecules to cells. EMBO Practical Course
November 7-11, 2016, Porto, Portugal

Storyboarding Science - Interdisciplinary Workshop for Scientists and Filmmakers
November 13-16, 2016, Weggis, Switzerland

De-Mystifying X-ray Data Processing in Macromolecular Crystallography
November 14-15, 2016, London, UK

GISAXS 2016
November 16-18, 2016, Hamburg, Germany

Annual Meeting 2016 and General Assembly of CrSJ
November 17-18, 2016, Mito, Japan

First BornAgain School and User Meeting
November 21-22, 2016, Garching, Germany

December 2016

AsCA
December 4-7, 2016, Hanoi, Vietnam

New Trends in Magnetic Structure Determination
December 12-16, 2016, Grenoble, France

January 2017

LiXS 2017: Liquid-Xray-Spectroscopy
January 17-18, 2017, Gif-sur-Yvette, France

12th Soleil Users' Meeting
January 19-20, 2017, Gif-sur-Yvette, France

February 2017

HERCULES European School 2017: Neutrons and synchrotron radiation for science
February 27 - March 30, 2017, Grenoble, France

March 2017

16th BCA/CCG Intensive Teaching School in X-Ray Structure Analysis
March 25 - April 2, 2017, Trevelyan College, Durham, UK

July 2017

mmc2017: Microscience Microscopy Congress
July 3-6, 2017, Manchester, UK

ICNS 2017: 9th International Conference on Neutron Scattering
July 9-13, 2017, Daejeon Convention Center, Korea

9th International Conference on Borate Glasses, Crystals and Melts and 2nd International Conference on Phosphate Glasses
July 24-28, 2017, Oxford, UK

August 2017

Crystallographic Computing School
August 15-20, 2017, Bangalore, India

XXIV Congress & General Assembly of the International Union of Crystallography
August 21-28, 2017, Hyderabad, India

August 2018

XRM2018: 14th International Conference on X-ray Microscopy
August 19-24, 2018, Saskatoon, Saskatchewan, Canada

October 2018

SAS2018: XVII International Conference on Small-Angle Scattering
October 7-12, 2018, Traverse City, MI, USA

Editorial

Editor
Swiss Neutron Scattering Society

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henrik.ronnow@epfl.ch

Board Members
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livia.bove@epfl.ch

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Address
Sekretariat SGN/SSDN
c/o Paul Scherrer Institut
WLGA/018
5232 Villigen PSI, Switzerland
phone: +41 56 310 46 66
fax: +41 56 310 32 94
http://sgn.web.psi.ch

Bank Account
Postfinance: 50-70723-6 (BIC: POFICHBEXXX)
IBAN: CH39 0900 0000 5007 0723 6

Printing
Paul Scherrer Institut
Circulation: 1600
2 numbers per year

Swiss Neutron Scattering Society
Sekretariat SGN/SSDN
WLGA/018
Paul Scherrer Institut
5232 Villigen PSI, Switzerland