ESS & MAX IV: Cross Border Science and Society

MAX4ESSFUN



Strengthening the regional scientific user base for ESS and MAX IV through cross border cooperation

ESS & MAX IV:
Cross Border
Science and Society

Interreg
Öresund-Kattegat-Skagerrak
European Regional Development Fund

EUROPEAN UNION

ESS & MAX IV: Cross Border Science and Society—MAX4ESSFUN

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Photos: Johan Persson (cover page), Roger Eriksson (page 3), Kenneth Ruona (pages 4 and 8-9), ESS (page 6), Johanne Horsbøll (page 11), European X-FEL (Page 12). Portrait photos from institutions or individuals.

Malmö, August 2018.

MAX4ESSFUN

Cross border network and graduate program

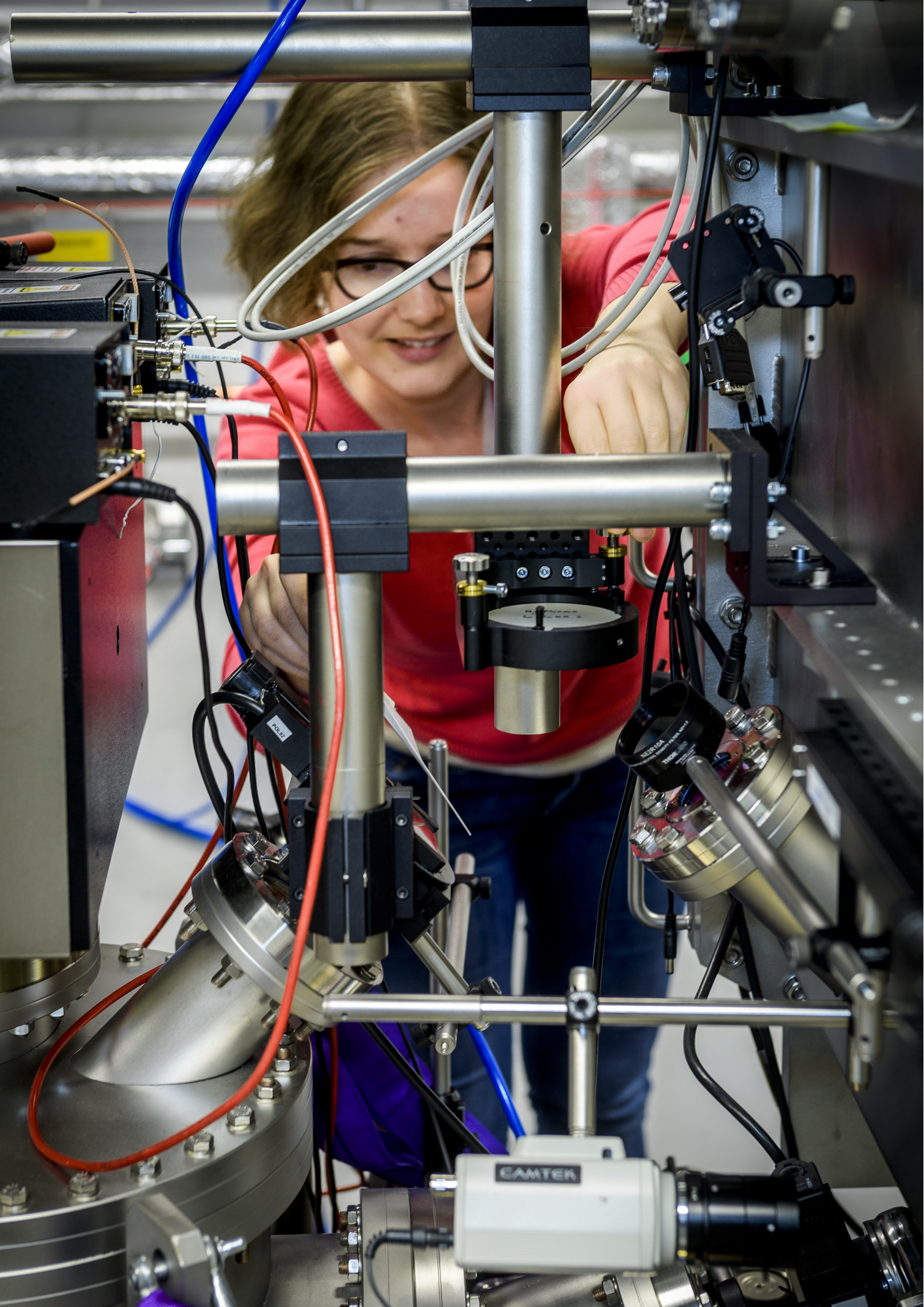
194 six-months experiments, corresponding to 1200 months worth of training for young scientists and almost 600 months worth of supervising from senior researchers. With a cross border perspective the work package MAX4ESSFUN has developed a unique model for establishing a comprehensive expertise around MAX IV and ESS, taking advantage of the different strengths from the participating universities. An important cross border network of scientists in Sweden, Denmark and Norway has been established through summer schools and workshops. Everything thanks to the EU Interreg project ESS & MAX IV: Cross Border Science and Society, with a total budget of 19 million euros.

Increased competence

Eight universities in Sweden, Denmark and Norway have collaborated together with ESS and MAX IV within the project work package MAX4ESSFUN. In order to create a cross border network between researchers and to get young scientists used to the scientific methods of synchrothron light and neutrons, a unique model has been developed. Young scientists with a supervisor have made six-months experiments together with a co-supervisor from another country or from the research facilties. The project set the ambitious goal of conducting 176 experiments during a three-year period. In total 242 applications for grants were filed and 194 experiments were approved and conducted within the budget of the project.

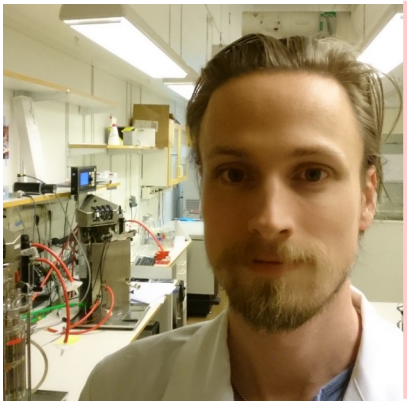
This is one of several initiatives aiming to strengthen the expertise on the methods and technologies used by MAX IV and ESS and the MAX4ESSFUN-model has both caught attention and reached significant success.




CAMTEK

Broad spectrum of experiments

The cross border and cross scientific collaboration within the 194 experiments has increased both the width and depth on using technologies at ESS and MAX IV. The experiments have been conducted within the fields of applied material sciences, chemistry, life science and medicine, but also environmental sciences, geosciences, structural biology and cultural heritage.



A whole new field of experimental opportunities have opened up for me through the experience I've gathered during the project and the threshold for me using these methods have been lowered conciderably. The facilities are truly top of the line technology, so it'd be super cool using them!

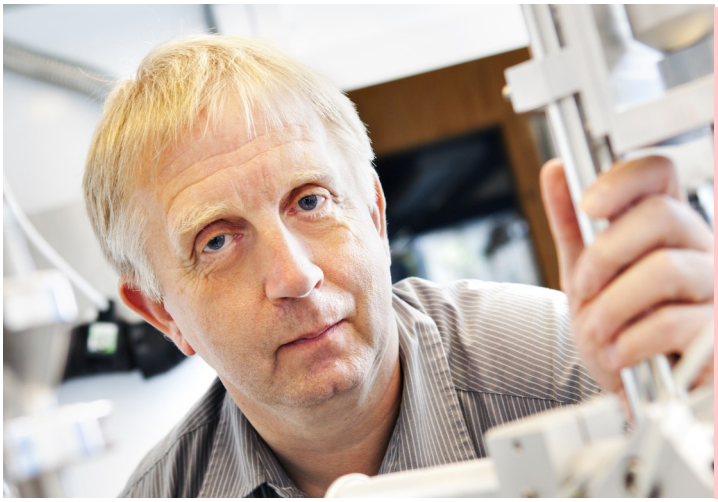
Mikael Andersson, PhD student at University of Gothenburg

The experiments have initiated research on a higher level, giving new opportunities for exchange of experiences as the researchers have different fields of expertise. This has led to many new cooperations within new science areas, for example the imaging projects within life sciences. 20 scientific articles have already been published from the experiments, and more will come within the next months.

One of the six months projects where I was main supervisor allowed my PhD student to work in Gothenburg for more than three months and learn a new cutting edge technology method that allows data collection from very small crystals and to follow very fast biochemical reactions with crystallography. Without MAX4ESSFUN this would not have happened.

Gregers Rom Andersen, supervisor, Aarhus University





I have been surprised by the great interest from new research areas to participate in the project. For example, we have a number of new researchers from the life science-area.

Jesper Andersen, former physical sciences director at MAX IV

ESS and MAX IV

In the new district Brunnshög, in the northern parts of the city of Lund in Sweden, two world class research facilities are situated. The synchrotron X-ray source MAX IV was operational already in 2016, whereas the neutron spallation source ESS will start operations from 2020 and will be fully operational around 2023. In short both facilities situated next to each other in Lund can be used to examine materials in various ways. The research facilities can be used for basic research, but scientists and companies may also use the facilties for applied research.

MAX IV is a national laboratory hosted by Lund university, while financed within the framework of Swedish research grants, whereas ESS is a European Research Infrastructure Consortium (ERIC). Apart from the spallation source in Lund, ESS also operates a Data Management Center in Copenhagen in Denmark.

ESS and MAX IV offer unique opportunities in studying samples and materials on a nano-level using the most advanced world-class techniques available. Synchrotron X-ray and neutron techniques complement each other and present a unique scientific scope for both life sciences and material sciences. The strategic locations in Lund and Copenhagen presents many opportunities for growth and development for both researchers and industry in the area.



Studies on next-generation antibiotics using neutrons



Through the MAX4ESSFUN Interreg program, a PhD student from the University of Oslo has teamed up with researchers at Malmö University to carry out studies on next-generation antibiotics using neutrons at France's ILL.

Josefine Eilsø Nielsen is a first-year PhD student at the Department of Chemistry at the University of Oslo (UiO). She works in the group of Associate Professor Reidar Lund, focusing on research in antimicrobial peptides' interaction with lipid model membranes (using lipid vesicles and supported bilayers).

Bacterial resistance to conventional antibiotics represents a major setback of modern medicine and desperately calls for innovation of new compounds and strategies. Antimicrobial peptides are a group of molecules that are a natural part of the human immune system shown to have effect against a broad spectrum of pathogens, including both gram-positive and gram-negative bacteria.

"When combining the results from scattering methods, together with other complimentary techniques, we gain biochemical and biophysical understanding of these systems," Eilsø Nielsen says. "This knowledge can be used in the development of new antibiotics for the future based on antimicrobial peptides designed specifically for the task."

Eilsø Nielsen felt that the collaboration with Marité Cárdenas group at Malmö University was extremely valuable for the project.

She travelled to Malmö for two weeks in August 2017 to learn the QCM-D method from Cárdenas and her post-doc Tania Lind. During this stay they produced results demonstrating clear interaction between the peptide under investigation and a supported lipid bilayer dependent on temperature, concentration of peptide, and salt concentration.

"They are really experts in lipids and neutron reflectometry, while our group in Oslo mainly have specialized in small-angle scattering techniques. When combining these two methods we can hopefully both get an understanding of how the peptides interact with the surface on the membrane and the cell (lipid vesicle) in bulk."

You can read more interviews with young scientists at
www.scienceandsociety.eu



- ☑ 194 CROSS BORDER PROJECTS
- ☑ ALMOST 200 YOUNG SCIENTISTS WITH USER COMPETENCE
- ☑ SUMMER SCHOOLS AND WORKSHOPS
- ☑ DATABASES OF COURSES AND EXPERIMENTS

The MAX4ESSFUN model

In order to get young scientists to become aquainted with the methods of either synchrotron light and/or neutrons in their research, and to build up a user competence within the region, a special model was developed for the project.

The building blocks of the model are:

- Young (or new) scientists, PhDs or postdocs, get an opportunity to conduct a financed six month experiment within their current fields of research using either synchrotron radiation or neutrons.
- Each experiment involved a research collaboration, either across the national borders or together with ESS och MAX IV. This facilitated the establishment of a cross border researchers' network.
- As MAX IV wasn't operational until June 2016 and still has limited beam time slots and ESS still is under construction, the scientists have been conducting most of their experiments on other synchrotron and neutron facilities around Europe and elsewhere.



Good achievments

A halftime evaluation (Ramböll, October 2017) showed that among those who hade participated in the experiments

- 90 % had obtained new results
- 90 % had made new contacts for use in future research
- 80 % had gained insight in new research areas
- 76 % had increased the probablity that they'd use ESS or MAX IV in future research
- 70 % had gained insight in how to use ESS or MAX IV in their research

As the project terminates the remaining experiments will be evaluated.



Thanks to MAX4ESSFUN the network between researchers in the region has been greatly strengthened and expanded.

Sine Larsen, professor, University of Copenhagen

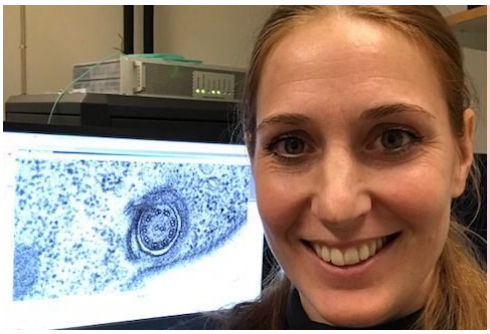
Through MAX4ESSFUN we have established cooperation with many research groups at other universities whom with we had no prior contact. Before MAX4ESSFUN there wasn't much research cooperation with other Scandinavian countries. This has definitely been strengthened through the project.

Helmer Fjellvåg, professor, University of Oslo



We're very happy to be a part of this project, and to get the opportunity to expand the knowledge within our area and meeting so many other researchers with same focus and interest and that we can cooperate with.

Aleksandar Matic, professor, Chalmers University of Technology



We're very pleased with the cross border network set up by the project. I believe the relationships started will continue long after the end of the project, which is very positive.

Johanna Höög, supervisor, University of Gothenburg

The new Scandinavian network of researchers will lead to commitment and knowledge of each others fields of expertice, which in its turn will lead to scientific returns and lay the foundation to many new and exciting future research initiatives. The workshops and e-learning activities within the project will also continue after the end of the project. At the DTU we are very positive and happy to be a project partner.

Luise Theil Kuhn, head of section, Technical University of Denmark

MAX4ESSFUN has held six summer schools, six workshops and four other events, where some 950 researchers have participated. The events have raised issues such as how the industry can increase usage of the research facilities, and how food science and technology as well as biomedicines can use technologies at ESS and MAX IV. The work package has also developed a database providing an overview on which courses within the various methods that are being offered by a number of universities in the region.





Future cooperation

There are good opportunities for the cross border research networks to carry on and to further develop in the future. The networks have laid the foundations for new cooperation, as the universities have gained new knowledge on each others strengths. Participants have in many cases participated in new projects as a direct result of the cooperation within the experiments conducted through MAX4ESSFUN.

A long term effect of the project is that there now are about 200 young scientists and 230 senior researchers in the region with increased competence in using the available technologies at MAX IV and ESS. This knowledge may also be transferred to new areas at the universities and to new cooperation with industry.

The MAX4ESSFUN project model has awoken interesent in Germany and throughout the project, there has been a dialogue on the complentary research facilties in Hamburg: DESY and European XFEL. There was for example a seminar at the Swedish-Danish-German conference Fehmarnbelt Days in Malmö in May 2018, where representatives from the German research facilities and the City of Hamburg discussed future possibilities of cooperation with ESS, MAX IV, universities and regions in Sweden and in Danmark.

Therefore it is in all our interest to further develop the research networks and competences in a larger geography, at the same time as the dialogue between national governments, universities, research facilities and regions is important from a cross border perspective.



It's been very useful for the young scientists to expand their competences in other research environments. It has created strong bonds to other universities and this will prove valuable for the future.

Stacey Sörensen, pro vice-chancellor, Lund University

Cooperation within the project has been very cordial and it has been shown that there are fantastic synergies to gain with a project in this area. I'm eagerly awaiting the results from the experiments and I hope these can lay the foundations to many more joint projects in the future.

Kell Mortensen, professor, University of Copenhagen

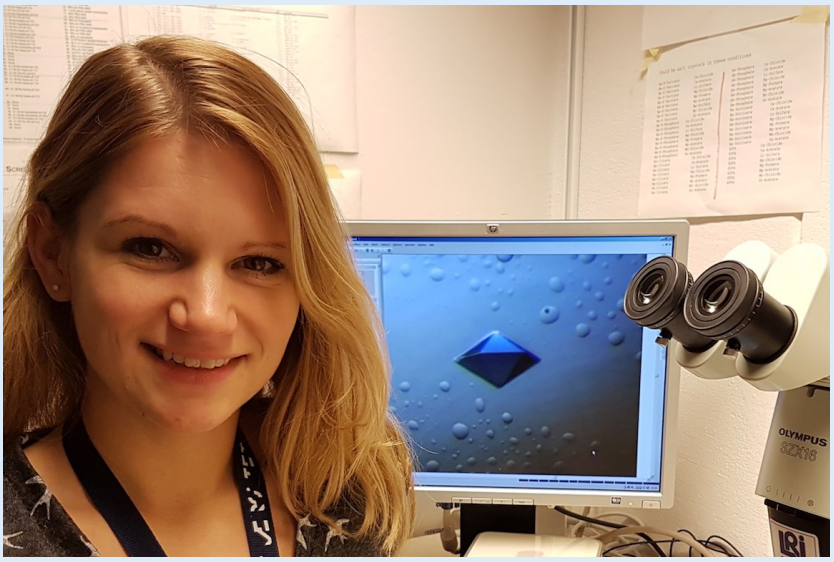




When the project has finished, we'll have a far greater network of researchers to cooperate with and that is a really good starting point for much more research with the technologies available at ESS and MAX IV.

Marité Cardénas, Malmö University's representative in the Steering Committee of the project

Probing protein structures using X-rays



Janina Sprenger, originally from Germany, received her PhD at the Medical Faculty of Lund University, where she focused on how to develop medication against diseases like malaria. After completing her PhD, Janina joined Sara Linse's research group at the Division of Biochemistry and Structural Biology at Lund University, where she is now involved in several research projects. One of these has been funded within MAX4ESSFUN.

"I guess I was always interested in science and trying to understand how things really work, but also to create new functions of whatever I find in my surroundings—which wasn't always a pleasure for my parents."

Janina is already quite experienced in using X-rays and has conducted several experiments at different synchrotron facilities, including ESRF in Grenoble, DESY in Hamburg, Diamond Light Source in the UK, and MAX-lab in Lund. In the future she believes that a neutron source like the European Spallation Source (ESS) could be very useful for her research.

Janina's research projects include experts from Lund University, MAX IV and the US. She explains that the international team is important because the partners have complementary skills that they put into the project.

"Due to the cross-border setup between Lund University and MAX IV, I was able to get input on the crystallography part of our project and advice on how to conduct and evaluate the experiments. I also get insights into the status of the BioMAX beamline at MAX IV and can follow the process."

Janina participated in the annual MAX4ESSFUN meeting and the "Synchrotron and Neutron Scattering" Interreg workshop in October 2016. She thinks these kinds of activities are very valuable.

"The scattering workshop and the annual meeting gave me the possibility to gain expert input from different fields. Since my project is interdisciplinary, it is otherwise difficult to get that kind of feedback and discussions. Also I managed to get in contact with a group in Copenhagen with similar interests, which opens new possibilities of funding in the future."

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www.scienceandsociety.eu

Three countries — one world class science region

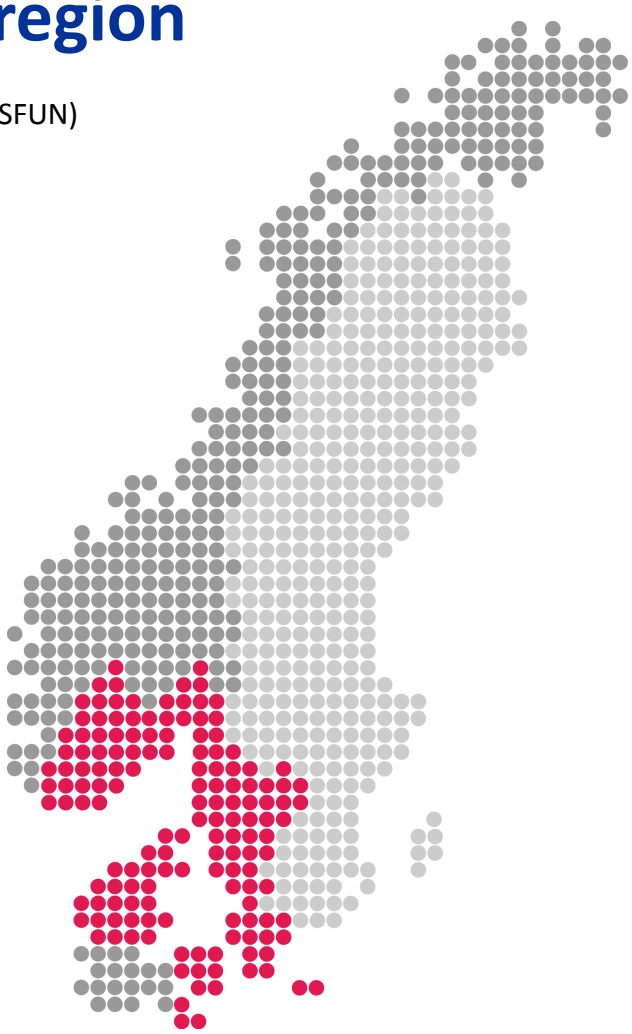
The Cross Border Network & Graduate Program (MAX4ESSFUN) was one out of six work packages in the ESS & MAX IV: Cross Border Science and Society project, and was led by the University of Copenhagen. In total, there were 10 partners participating in the work package, with a total budget of 13.5 million euros

Partners of MAX4ESSFUN were:

Research facilities:
European Spallation Source

MAX IV Laboratory—Lund University (SE)

Universities:
University of Copenhagen (DK)
Lund University (SE)
Aarhus University (DK)
Chalmers University of Technology (SE)
Malmö University (SE)
Technical University of Denmark—DTU (DK)
University of Gothenburg (SE)
University of Oslo (NO)



The ESS & MAX IV: Cross Border Science and Society project

ESS & MAX IV: Cross Border Science and Society was a Danish-Swedish-Norwegian project that aimed to seize opportunities brought by the region through the construction of two world class research facilities in Lund, Sweden: The European Spallation Source (ESS) and the MAX IV-laboratory, part of Lund university.

The project was led by Region Skåne and the Capital Region of Denmark, and the project period was from September 2015 to August 2018. The project, which was co-funded by the European Regional Development Fund with 9.5 million euros, was the largest project in the history of the Interreg Öresund-Kattegat-Skagerrak programme. The project included 27 partners in Denmark, Norway and Sweden and was divided into six different work packages:

- MAX4ESSFUN
- Cross Border Barriers
- International Attractiveness
- Welcoming International Talents
- Regional Supply Base
- Strategic Platform











UiO : University of Oslo









Technical University of Denmark

