

Industrial pilot projects for the utilisation of large scale infrastructures for neutron and photon based techniques – Autumn 2019

A call for proposals within Vinnovas program “**Research infrastructure - utilisation and collaboration**” for collaboration around skills development and industrial utilisation of advanced experimental environments such as MAX IV and ESS.

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If there are any uncertainties, please refer to the Swedish text.

Revision history

Date	Change

1 Summary

Through co-funding of industrial needs-driven pilot projects, Vinnova wants to strengthen Swedish skills regarding how industry can use and benefit from large-scale research infrastructures for advanced neutron and photon-based techniques¹.

Each project proposal should be based on the development needs of at least one Swedish company which is also a project participant.

The work in the project shall aim to verify whether neutron or photon-based technologies are suitable options to meet the challenge or development need of the company. It should also create an additional value for the company's challenges compared to what can be obtained with more established analytical techniques. The project activities should be carried out in collaboration between the company and expert competence within neutron or photon-based technologies. The project consortium shall therefore also include at least one additional Swedish participant organization that assists with appropriate and sufficient expertise in this.

The funding offer is not aimed at companies where these method/techniques are already confirmed as relevant tools within the intended application area. The offer also does not apply to challenges/applications where the company has already received funding from Vinnova to verify how the technologies can be used.

Up to SEK 10 million is available for the call, which consists of three different sub-calls (see section 4.1).

A) Preparatory projects for survey and planning

Each project proposal can apply for a maximum grant of SEK 100.000. The maximum project period length is 3 months. The proposal shall be based on a hypothesis regarding how photon or neutron-based technologies can meet the company's needs. The project activities can include identification of available technologies, methods and relevant experimental stations at specific research infrastructures, as well as method selection and planning of experiments.

B) Pilot experiments at large scale research infrastructures for neutron and photon-based techniques

Each project proposal can apply for a maximum grant of SEK 500.000. The maximum project period length is 18 months. The call for proposals funds experiments at MAX IV as well as at international large-scale research infrastructures for neutron and photon-based techniques. All types of access for experimental/beam time are allowed and beam time is an eligible cost.

¹ Photon-based experiments can be performed at both synchrotron radiation facilities and facilities for XFEL.

C) Development projects for improved industrially relevant post-experimental analysis and management of data from neutron or photon-based techniques

Each project proposal can apply for a maximum grant of SEK 300.000.

The maximum project period length is 8 months. The proposal shall be based on already obtained data/results from a previously performed experiment using photon or neutron-based techniques that involves the material/challenge of the company. The proposal should include development activities related to how data processing methods for measurement data from photon or neutron-based technology can better suit an industrial application.

Important dates:

- Proposals should be submitted to Vinnova by: **20 November 2019 at 14:00**
- Decision date: 30 January 2020
- Project start date between: 1 February – 1 March 2020

Contact Details:

Questions on the contents:

Maria Öhman, Call responsible project manager
maria.ohman@vinnova.se

Rebecca Hollertz, project manager
08-473 3076
rebecca.hollertz@vinnova.se

Administrative questions:

Marie Wikström
08-473 3179
marie.wikstrom@vinnova.se

Contact regarding the eServices portal (Intressentportalen)

Vinnova's IT-support
08-473 32 99
helpdesk@vinnova.se

Link to call for proposals website:

<https://www.vinnova.se/en/calls-for-proposals/research-infrastructure-utilisation-and-collaboration/industrial-pilot-projects-autumn-2019/>

2 What we want to accomplish?

World-leading research increasingly requires access to advanced large-scale research infrastructures. In addition to contributing to excellent basic research, these infrastructures also enable cutting-edge applied research and innovative development work in industrial and public sectors.

MAX IV in Lund is Sweden's largest research infrastructure and one of the world's brightest source for synchrotron radiation. In close proximity, the European Spallation Source (ESS) is being built to become the world's strongest neutron source. This will give unique development opportunities within a wide range of research areas, such as life sciences and materials science.

Through the "Research infrastructure – utilisation and collaboration" programme, Vinnova wants to strengthen the Swedish innovation system by contributing to capacity building and increased understanding of how the use of advanced research infrastructures can respond to industrial and societal needs.

With this call for proposals we especially want to support industrial innovation work and encourage Swedish companies to better see the possibilities of advanced neutron or photon-based experiments within their respective areas of application. This can be anything from the development or improvement of new materials, drugs or processes to the need to investigate why a construction has failed. The call for proposals funds experiments at MAX IV as well as at international large-scale research infrastructures for neutron and photon- based techniques.

In all, the techniques allow for an extensive portfolio of analytical possibilities based on e.g. scattering, diffraction, crystallography, spectroscopy and various forms of imaging in 2D and 3D. Neutrons and photons interact in different ways with a material. Therefore, both comparable and complementary analyses are made possible. For example, you can study how different materials and biological structures are constructed, map the chemical states of materials, or follow different types of processes in real time and in realistic experimental environments. Provided that an intended experimental environment is in place, the techniques can be used for experiments in relevant environments for different applications - for example at extreme temperatures and high pressures, in gases and liquids, or under mechanical load.

The possibility of in-situ analyses under manufacturing and operating conditions (in operando) opens for ground-breaking development opportunities for many industrial applications. The capacity of MAX IV already offers opportunities to design experiments in completely new ways – and the same will apply to ESS. In addition to industry relevant experiments, even more user applications could

benefit from the technologies. Compared to other synchrotron facilities, the potential of MAX IV is particularly competitive for experiments that depend on high brilliance and coherence during analysis. This opens for new opportunities regarding e.g. imaging of unstructured materials within materials research and life sciences.

The research infrastructures in Lund are still under construction, and even after full completion, MAX IV and ESS will not be able to offer all types of experiments. International facilities will thus be needed as an important complement also in the future. This call for proposals can therefore also fund experiments at large-scale research infrastructures for neutron and photon-based techniques² outside Sweden. The Appendix of this document provides a number of suggestions on where more information can be obtained concerning the capacity and availability of MAX IV and various international facilities.

Additional funding opportunities are planned by Vinnova, but the content will be developed gradually based on experience and outcomes from this call, as well as from other initiatives.

Vinnova is tasked with promoting sustainable growth by increasing the innovation capacity. Through our efforts, we strengthen the capacity to achieve the goals for sustainable development in Agenda 2030³ and contribute to the global commitment. Since gender equality is a prerequisite for sustainable growth, this must permeate the work with all sustainability goals⁴.

3 To whom is this call for proposals directed?

This call for proposals is aimed at project consortia consisting of companies, research institutes, academia or other legal entities.

The project consortium shall consist of at least two project participants. Of these, at least one participant must be a Swedish-registered company (or the Swedish establishment or branch of a company) who owns the problem or development need that the project addresses. Please note that solely enhancing the skills within a company does not constitute a sufficient need in this context.

² ESS is a spallation source, but experiments with other types of neutron sources are also permitted. MAX IV mainly uses synchrotron light, but also experiments at XFEL facilities are permitted.

³ Read more (in Swedish only): <https://www.vinnova.se/m/agenda-2030/>

⁴ Read more about what our work for equality innovation means for you who apply for grants from us (in Swedish only): <https://www.vinnova.se/m/jamstalld-innovation/>

At least one additional Swedish organization must be a formal project participant and assist with the expertise linked to the neutron or photon-based technology addressed. This expert competence can come from all types of organizations, from research organizations as well as from companies with relevant expertise, or from the research infrastructure where the experiments will be performed.

The funding offer is not aimed at companies where these method/techniques are already confirmed as relevant tools within the intended application area. The offer also does not apply to a challenge/application where the company has already received funding from Vinnova to verify how the technologies can be used.

In this call for proposals, only Swedish organizations can receive funding from Vinnova. Swedish organizations also mean foreign organizations that have a branch or establishment in Sweden. However, the costs in the project must be attributable to the activities of that branch or establishment. A non-Swedish organization can be a project partner if it finances its own costs in the project.

4 What do we fund?

4.1 Activities which you can seek funding for

The concept on which the project proposal is based must be motivated by the development need of the company/companies (see chapter 3).

One project goal shall be to confirm yet unknown added value with neutron and/or photon-based techniques for the company in comparison with more established analysis techniques (i.e. which is allowed in a laboratory environment and does not require large-scale research infrastructure).

The project activities must be carried out in collaboration and with a mutual exchange of knowledge between the company and at least one additional Swedish participant who contributes with necessary skills with respect to relevant neutron or photon-based technology/ies. Participation to mainly coordinate and administer project management is not allowed.

The project can consist of complementary activities to work that is already carried out within the company⁵ using more established analysis techniques.

⁵ If the project activities are complementary to an existing innovation project, the corresponding activities cannot already have been granted other funding. An existing project can thus not be supplemented in order to reallocate already existing projects resources.

It is important that the pilot projects granted funding can be displayed and inspire others. In connection with final reporting to Vinnova, a description of the purpose, participating actors and overall project results must therefore be enclosed for free publication and dissemination (see section 8.2.).

The call for proposals consists of three different sub-offers, A-C.

In addition to the above, the following applies to the respective sub-offer:

A) Preparatory projects for survey and planning

- Each project proposal can apply for a maximum grant of SEK 100.000 for a project period of maximum three (3) months.
- The project proposal shall be based on an already identified challenge for the company and, when applicable, also describe the limitations of more established analytical techniques. The focus may be a broader mapping of relevant opportunities for different applications for the company and/or a narrower study for handling feasibility issues linked to a more complex industry-relevant experiment.
- The expertise shall be able to guide the company in the photon or neutron-based techniques of relevance for the application area.
- The following types of project activities constitutes eligible costs:
 - o Identification and mapping of available photon or neutron-based techniques and methods, as well as relevant experimental stations in specific research infrastructures.
 - o Method selection, planning of experiments, dialogue with expertise (e.g. staff at an identified experimental station), or planning for adaptation of relevant experimental environments. A technical feasibility study at a chosen experimental station can be included, provided that this is necessary to verify e.g. a new industry-relevant experimental environment for further planning. For this, the applicants shall however also refer to a dialogue that confirms the experimental station's availability.
 - o Planning for how the results can be developed after the project (however, not writing of an additional project proposal).

Supplementary experiments with more established analysis techniques or modeling are only approved project activities for an A-project if they can be clearly justified as necessary for designing future experiments.

B) Pilot experiments at large scale research infrastructures for neutron and photon techniques

- Each project proposal can apply for a maximum grant of SEK 500.000 for a project period of maximum 18 months.
- To justify the need for neutron or photon experiments, the proposal shall clearly describe relevant preparatory work and, where applicable, any identified limitations when using more established analytical techniques.
- The expertise within the relevant neutron or photon-based technology shall include the necessary and sufficient skills for planning of and conducting the experiments as well as managing the data collected and the interpretation of measured results.
- In addition to the experiment's implementation at the research infrastructure, which is mandatory, the following types of project activities constitutes eligible costs:
 - o Design of experiments, including necessary method development or adaptation of relevant experimental environment
 - o Sample preparation/manufacturing directly linked to the neutron / synchrotron experiment to be performed
 - o Travel and living in connection with the experiment's implementation
 - o Analysis, treatment and interpretation of measurement results/data, including comparisons with already existing results from more established analytical techniques or modeling
 - o Planning for how the results can be developed after the project

To meet the purpose of the call for proposals, we expect that representatives from the company/companies also intend to participate in the implementation of the experiments at the research infrastructure.

Please note that any complementary experiments with more established analytical equipment or modelling are only approved project activities if they can be justified as necessary for sample characterisation, interpretation of results or experimental design. In this context, sample preparation/manufacturing refers only to adaptation to the current experiment. Work packages that include advanced material development or manufacturing per se are not allowed.

The call for proposals funds experiments at MAX IV as well as at international large-scale research infrastructures for neutron and photon-based techniques.

In order to perform neutron or photon experiments at a large-scale research infrastructure, access needs to be actively approved by the infrastructure itself.

Experimental time (also called beam time) is to the largest extent granted based on scientific excellence through a peer review process. However, many large-scale research facilities also provide access for experiments that the stakeholders themselves pay for, so-called proprietary access (or non-peer reviewed access)⁶. In this call for proposals, all types of availability (access models) are allowed.

Access (experimental time) does not need to be formally approved or fixed in time when the proposal is submitted to Vinnova. However, the project consortium should motivate in the proposal that the experiment is expected to be technically feasible and possible to carry at the experimental station with respect to the project time. This means that:

- Project consortia intending paid experimental access (proprietary access) is expected to refer to a dialogue with a named research infrastructure which confirms that the experimental station is possible to schedule during the project period.
- Project consortia intending to seek experimental access through open calls (not yet granted) is expected to describe what measures can be taken to enable the project to be implemented if no free access is granted.
- If experimental access has been granted before the proposal is submitted to Vinnova, a short confirmation can be attached to the proposal. Note, however, that no project activities may be started before the project's start date.
- Project consortia who intend to carry out experiments in direct collaboration with staff at the research infrastructure, which is not a project participant, should enclose a letter of support confirming this.

We recommend an early dialogue with the user office of the identified facility⁷.

Regardless of the path to experimental time/access and financing of individual project activities, the applicants shall describe which human and financial resources are available to implement the project plan in full. If resources that are not intended to report costs to Vinnova intend to contribute to the project, such resource allocation should still be verified by the organization that host the resource⁸.

⁶ Please note that Vinnova's funding conditions that certain information be made available for free publication after the end of the project, regardless of whether the "access model" used allows confidentiality by the research infrastructure itself.

⁷ For a research infrastructure to take on a task and approve access, they may first require that a technical feasibility study of a desired experiment has been performed. They may also want to ensure that sample handling will be safe.

⁸ This may involve collaboration with a research infrastructure (friendly beam time, analysis support, etc.), synergies with organizations that are not project participants, or already ongoing projects.

C) Development projects for improved industrially relevant post-experimental analysis and data management

- Each project proposal can apply for a maximum grant of SEK 300.000 for a project period of maximum eight (8) months.
- The projects shall be based on already obtained measurement data from a previously performed experiment at a research infrastructure for photon or neutron-based techniques that involves the material/challenge of the company, but where suitable methods have been lacking in order to fully utilize the value of experimental data of industrial relevance.
- The proposal shall address development activities, with a clearly described hypothesis, where data processing methods for data from photon or neutron-based experiments are created, modified, adapted or validated in order to give a more qualified answer (for example, ensuring statistical reliability, repeatability or visualization).
- The project activities can also include comparisons with already existing results from more established analysis techniques / modeling. Note, however, that implementation of complementary experiments with more established analysis techniques or modeling is not approved project activities for C-projects.

This offer can follow on a Vinnova-funded pilot experiment (sub-call B) provided this already has been provide implemented in accordance with that granted project plan. Additional funding to complete data analysis that has already received funding is not the goal of this call and will therefore not be funded.

4.2 Eligible costs

Vinnova's funding is through grants and is subject to certain regulations. These regulations control, among other things, the types of costs of the project partners that may be covered by grants. The types of project activities approved in this call shall be covered by **Industrial research** (sub-calls B and C) or **Feasibility study** (sub-call A) in the rules on state aid for research, development and innovation. A description can be found in the "Vinnova's Table of aid levels for state aid"⁹. Eligible costs are shown in the "Vinnova's general terms and conditions for grants" and are described in more detail in the "Vinnova Guide to Terms and conditions for eligible costs"¹⁰.

⁹ See s.8 in [vinnova.se/globalassets/huvudsajt/sok-finansiering/dokument/stodnivaer-statligt-stod.pdf](https://www.vinnova.se/globalassets/huvudsajt/sok-finansiering/dokument/stodnivaer-statligt-stod.pdf) (in Swedish only)

¹⁰ See Sections 4.1 – 4.5 of the <https://www.vinnova.se/globalassets/dokument/guide-till-vinnovas-villkor-om-stodberattigande-kostnader-2017-04-21-master.pdf> (in Swedish only)

All eligible costs that occur at an international research infrastructure can be accounted for as consultancy costs for any of the project partners¹¹. Please note that subcontractors/consultants may only be used to the extent specified in the project description. Travel expenses shall be reasonable and appropriate.

5 What size grant do we fund?

Up to SEK 10 million is available for the call.

There is no overall requirement for own funding from any project partner, except from what is required by the state aid rules (see below).

Grants to organisations carrying out economic activities (hereinafter "companies") are subject to state aid rules. Therefore, the amount that a company seeks in grants from Vinnova can only represent a certain proportion of its total eligible cost. For this call, companies can apply for the following share in support from Vinnova, depending on the size of the company¹²:

- Large: 50 percent
- Medium: 60 percent
- Small: 70 percent

The remaining costs must be financed by the company itself.

This call also permits, by means of eligible certificate, aid to undertakings under the De Minimis regulation (also known as 'negligible aid')¹³.

Each project participant is responsible for ensuring that the grant received does not exceed the level of aid permitted under state aid rules.

¹¹ The same applies to the use of the Swedish synchrotron MAX IV in cases where Lund University is not a project partner. When so is the case, the costs should instead be included as instrument cost for Lund University.

¹² For the current definition of small and medium sized companies see:

<http://ec.europa.eu/DocsRoom/documents/15582/attachments/1/translations>

¹³ For more information on De Minimis aid, as well as the download of the mandatory certificate, see:

<https://www.vinnova.se/sok-finansiering/regler-for-finansiering/statligt-stod/>

6 Conditions for us to assess the proposal

Vinnova will only assess proposals that meet the following formal requirements:

- ✓ The project consortium consists of at least two participants, of which at least one is a Swedish company¹⁴ which owns the need, and at least one is a different Swedish organization that contributes expertise in the photon/neutron-based technologies addressed.
- ✓ All project participants are legal entities.
- ✓ All project participants that seek grants from Vinnova are Swedish¹⁵ organizations.
- ✓ The proposal follows the instructions in section 9 and contains all the mandatory attachments requested there.

7 Assessment of proposals received

7.1 What do we assess?

Only the written content of the submitted proposal will be assessed, and what is assessed is the degree to which the project proposals meet the three main criteria of Potential, Feasibility and Participants. The bulleted list below indicates what contributes positively to the assessment.

Potential

- It is clear how the project activities are in line with the purpose of the call for proposals – according to paragraph 4.1.
- Background work of relevance is described, and it is clear which added value of the neutron or photon-based experiment at a large-scale research infrastructure is expected beyond what can be achieved with more established analytical techniques.
- The project proposal clarifies the collaboration and knowledge/technology transfer within the project consortium. Where applicable, it is also clear how the results of generic value linked to the analytical method and/or data processing can benefit players outside the participant group.

¹⁴ In this context, the term "company" does not apply to incorporated research institutes, or companies that do not themselves own the development needs that the project intends to meet. However, these can fulfill the role of expertise. Swedish organizations also mean foreign organizations that have a branch or an office in Sweden.

¹⁵ Swedish organizations also mean foreign organizations that have a branch or an office in Sweden. However, the costs in the project must be attributable to the activities of the branch or the establishment.

- The project results have the potential to contribute to economic, environmental and socially sustainable societal development.

Feasibility

- The project activities and time schedule are reasonable with respect to the available resources. Relevant risks associated with the project implementation are managed in an appropriate and credible manner.
- For sub-call B:
The project consortium describes the dialog that has been conducted with the intended research infrastructure and motivates in a credible way that the desired experiments are technically feasible and possible to carry out at an intended experimental station with respect to the project time.
- For sub-call C:
The project activities include relevant development initiatives with clearly described hypothesis and goals, and there is sufficient background information regarding previously performed experiment and measurement data in order to enable an assess of this.

Participants

- The project consortium is appropriately composed with respect to project goals and implementation, e.g. skills and allocated time.
- For sub-calls A and B:
It is clear how the added value of neutron or photon-based techniques at large-scale research infrastructures cannot already be considered as confirmed for the company for the intended application/challenge.
- The gender distribution in the implementation is well balanced, including commitment and influence. A possible imbalance is explained in a credible and specific way for the project proposal.

7.2 How do we assess the proposals?

The proposals that meet the formal requirements (see section 6) will be assessed according to the assessment criteria by specially chosen persons appointed by Vinnova. This results in a recommendation for funding to Vinnova. Also staff at Vinnova participate in the assessment process.

Vinnova decides which projects are to be financed, taking into account the assessors' recommendation as well as using a portfolio perspective. In the event of a competitive situation, account is taken to the present project portfolio's breadth of scope and needs-owned companies, and to an even distribution of projects for each sub-call.

Proposals that do not meet formal requirements will be rejected without further justification.

8 Decisions and conditions

8.1 About our decisions

The granted amount to each participant in the project is stated in the grant decision. Vinnova's grants is awarded with support from the rules on state aid for research, development and innovation, stated in SFS 2015:208, or with support from the De Minimis regulation, EU no 1407/201 (also known as negligible aid). The aid foundation is set out in the grant decision and also governs the eligibility of costs.

Vinnova's decision to grant or refuse a proposal cannot be appealed.

8.2 Terms and conditions for awarded grants

Vinnova's general conditions for grants apply to the awarded grants¹⁶. These conditions include rules on project agreements, prerequisites for payment, follow-up, reporting and utilisation of results. Note that a project agreement must be prepared before the first status report is submitted to Vinnova.

The following special conditions apply to the grants awarded in this call:

1. In connection with final reporting to Vinnova, an easily accessible description ("one -pager") of the purpose, participating actors and overall description of sample/materials selection and project results must be enclosed for open publication and dissemination. This includes mentioning of the research infrastructure, experimental stations and method choices that the project has addressed. A representative from the company must also be mentioned as a contact person. A template for this is distributed by Vinnova.

Additional special conditions may be decided for individual projects.

If you do not comply with Vinnova's terms, you may be liable to repay the grant. This is also true if you have been granted an incorrect or excessive amount of funds.

¹⁶ Current terms and conditions can be found on our website, along with help to understand and meet the terms: <https://www.vinnova.se/contentassets/e8744691aa1e46e89c4cc67c7c00a50d/multi-participants.pdf>

9 How to apply

To apply for a grant, you fill in a special Web-based form in Vinnova's eServices portal (Intresseportalen). You will also upload the following mandatory attachments, according to templates downloaded from the Web page of the call for proposals¹⁷. The documents must be written with twelve (12) point normal black text.

Please note that the proposal will be assessed by both Swedish and non-Swedish speaking evaluators. **Therefore, our strong recommendation is that the proposal is written in English.** If the proposal is written in Swedish it will be translated without your co-operation.

Mandatory attachments:

- **Project description:** May consist of maximum:
For sub-call B: Five (5) A4 pages. For sub-calls A and C: Three (3) A4 pages.
- **CV – Appendix:** Shall include relevant information for project managers and all key personnel in the consortium, including participants in consultant roles.
- **Letter of Intent:** Shall be attached from at least one company amongst the project partners and shall be able to justify an interest and need in accordance with the purpose of the call. It shall be signed by a person qualified to sign contracts for research- and innovation projects on behalf of the organisations concerned.

If an organisation seeks support according to the “de Minimis regulation”, the mandatory certificate for this shall be attached as ”Other attachments”.

As ”Other attachments” the following is attached when applicable:

- Project consortia who have already received/been granted experimental time at a research infrastructure shall attach documentation that supports this. However, this documentation must not contain any further description of the project itself.
- Project consortia who intend to carry out experiments in direct collaboration with staff at the research infrastructure, which is not a project participant, should enclose a letter of support confirming this.

No additional material may be attached to the proposal.

¹⁷ You find templates for the required documents to attach on:
<https://www.vinnova.se/en/e/research-infrastructure-utilisation-and-collaboration/pilot-projects-neutron-photon-2019/>

Proposals should be submitted to Vinnova by: **20 November 2019 at 14:00.**
When the proposal period has expired, any complementary of the proposal can only be made at the request of Vinnova.

10 Who can read the proposal?

Proposals submitted to Vinnova become public documents, but Vinnova does not disclose information about the individual's business or operational conditions, inventions and research results if it can be assumed that any individual suffers damage if the information is divulged.

Appendix. Short guide to research infrastructures for neutron- and photon-based techniques

Short guide for using MAX IV and international research infrastructures

All together, a comprehensive portfolio of advanced experiments is permitted at MAX IV and international large-scale research infrastructures for photon- and neutron-based technologies. Detailed information on the capacity and availability of individual international facilities can be provided through their respective websites. Most also have user offices that offer special support for industry and can answer if any of their experimental stations and instruments is suitable for what is desired.

The Swedish synchrotron facility MAX IV has now opened up for experimental possibilities at several beamlines: BioMAX (macromolecular crystallography), HIPPIE (ambient pressure x-ray photoemission spectroscopy), NanoMAX (hard x-ray nano-diffraction and imaging), FinEstBeAMS (photoemission in gas-phase and photoluminescence spectroscopy), Balder (hard x-ray absorption), Bloch (angle-resolved photoemission spectroscopy), MAXPEEM (photoelectron microscopy) and Veritas (open port branch). Between 22nd August and 17th September 2019 it is possible to apply for beamtime for the period March-August 2020. See the following link for information and specifications:

<https://www.maxiv.lu.se/users/>

Through the Swedish Research Council, Sweden also finances the experimental station "Swedish materials science beamline (SMS P21.2 Diffraction & Imaging) at the German synchrotron Petra III¹⁸ in Hamburg (administered by Linköping University and KTH), and also has an overall user agreement with Petra III. Petra III complements MAX IV particularly well when needed for higher energy levels. Sweden also co-finances the reflectometer "Super ADAM" at the neutron source ILL¹⁹ in Grenoble (administered by Uppsala University). The Swedish Research Council also finances Swedish membership in the ILL neutron source, as well as in the synchrotron ESRF²⁰ in France and the free-electron laser XFEL²¹ in Germany, and they also contributes to operating costs of the neutron source ISIS²² in England.

There are a number of collaborative initiatives between European research infrastructures, whose websites convey both basic knowledge and links to useful individual sites. See for example the collaborative platform "The European Analytical

¹⁸ Petra III at Deutsches Elektronen-Synchrotron (DESY) Hamburg, Tyskland

¹⁹ Institut Laue-Langevin (ILL), Grenoble, Frankrike

²⁰ European Synchrotron Radiation Facility (ESRF), Grenoble, Frankrike.

²¹ European X-Ray Free-Electron Laser (XFEL), Hamburg och Schenefeld, Tyskland

²² ISIS Neutron and Muon Source (ISIS) Oxford, England.

Research Infrastructures Village” (www.eariv.eu).

Regarding **neutron sources**, the website for EU projects SINE2020 gives additional information on the possibilities, performance and availability for industry of several European facilities, see <https://sine2020.eu/>.

Regarding **photon-based sources**, additional information is provided on both European synchrotron facilities and free electron laser (FEL) facilities via the websites of the EU Project CALIPSOplus (<http://www.calipsoplus.eu>), as well as the collaboration platform LEAPS (<https://www.leaps-initiative.eu/consortium/>). The initiative Lightsources.org also collects several overseas facilities (<https://lightsources.org/lightsources-of-the-world/>).

The above links are only examples and guidance, and that the offer of the call is not limited to the research infrastructures involved in these collaboration initiatives. Several overseas research infrastructures also offer relevant and unique opportunities for industrial proposals.

Analysis options with neutron or photon-based techniques

Neutrons and photons interact in different ways with a material. Therefore, both comparable and complementary analyses are made possible. For example, you can study how different materials and biological structures are constructed, map the chemical states of materials, or follow different types of processes in real time and in realistic experimental environments. The techniques allow for an extensive portfolio of analytical possibilities based on, for example, scattering, diffraction, crystallography, spectroscopy and various forms of imaging in 2D and 3D.

Neutrons stand out by being able to distinguish light elements, such as hydrogen and lithium, which are of great relevance for, among other things, battery and energy storage applications. Since neutrons are susceptible to isotopes, deuterium can be used as a marker for the study of, for example, biological materials. You can also study issues related to magnetic properties and superconductivity. Because neutrons penetrate deep into the materials, the technology is also suitable for non-destructive analysis to find hidden defects and internal stresses, even inside large, compact materials or components.

Photons have a shallower penetration depth and are therefore well suited for surface analyses and for experiments using thinner samples. The strong light from a synchrotron facility allows measurements with high spatial and/or time resolution which may, for example, be used to follow rapid chemical and biological processes in real time. Considering certain variations between different synchrotron facilities, experiments can be conducted using a broad wavelength spectrum, for instance hard and soft X-ray radiation, ultraviolet light and infrared light.