

Center for
X-Rays in Swedish Material Science

Academic hosting of the
Swedish Material Science beamline
at PETRA III

PETRA III Swedish Node
Center for X-Rays in Swedish Material Science

2020 Organisational Report
Grant 2018-6942

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Preface

Synchrotrons are considered to be a key research tool, which can enhance our understanding of material properties - both in basic and applied research.

Sweden has therefore invested significantly in such research infrastructures. Such investments include the MAX IV facility in southern Sweden as well as at PETRA III, Hamburg, Germany.

The investments at PETRA III have been undertaken as part of contract between DESY and the Swedish Research Council (VR). This contract includes the building of a Swedish Material Science Beamline; and, from autumn 2019, provides Swedish organisations with 5300 hours per year of privileged access to beamlines at PETRA III.

The monitoring of Swedish access rights, and general safeguarding of Swedish interests at PETRA III, has been tasked to the host universities KTH and Linköping University - who have established the Center for X-Rays in Swedish Material Science (CeXS) for this purpose. CeXS ought to also undertake outreach and educational activities.

The inauguration of CeXS was held in August 2019. The Swedish Material Science beamline was commissioned and become fully operational during 2019.

Together CeXS and the Swedish Material Science Beamline comprise the PETRA III Swedish node.

This report provides information about Swedish interests and use of PETRA III as well as key CeXS activities during 2020.



Summary

Proposal submission data shows sustained Swedish research interest for using PETRA III and its Swedish Material Science beamline. The Swedish beamline attracts 20% of proposals at PETRA III. Similar proposal rates are seen at the P22 and P03 beamlines. The other beamlines attract 10% or less proposal submissions. Nonetheless, there is a consistent general research interest in all beamlines at the PETRA III synchrotron.

Proposals for Swedish privileged beam time access were:

- University led in 95% of proposals.
- Research institutes led in 5% of proposals

And,

- Swedish industry undertook 5 paid projects, 1 of which was at the Swedish Material Science beamline

Despite the Covid-19 restriction, during 2020, 102 Swedish users visited PETRA III to undertake measurements, with additional users also gaining access via 1 remote access project and 9 mail in projects.

The total number of Swedish research projects was 42, of which 37 were privileged access projects. 7 of the 37 privileged access projects conducted measurements at the Swedish beamline.

Total Swedish beam time was 3719 hours, which 70% of that stipulated in the contract. This report assesses DESY's closedown and restricted access as well as quarantine periods and organisations/people's own travel restrictions. These meant that Swedish researchers had access for two weeks in March and in the period August-December. Thus, the actual beam time hours may be considered to be acceptable. However judgement is deferred to the Steering Committee for the Swedish beamline and VR.

Significant research results have emerged during 2020 from the use of PETRA III and the Swedish Material Science beamline, with 88 papers being published in 2020 – compared to 53 in 2018.

The Swedish Material Science SMS beamline also attracted many non-Swedish users. People affiliated to organisations outside of Sweden led 48 open access projects, which had 1496 hours of beam time access.

There were also 4 paid international industry projects at the Swedish Material Science beamline.

Concerning development of the P21.2 beamline's experimental capabilities, CeXS engaged experts from various university groups with the SMS beamline manager in order to capture user needs and specifications for two experimental environments. Furthermore, an RÅC funded project will develop an AM experimental environment.

To sustain Sweden's PETRA III Swedish node investments into the future PETRA IV era, CeXS orchestrated 3 Scientific Instrument Proposals (SIPs) for the future PETRA IV and supported a fourth. These were highly judged in DESY's SIP review. A concern is that it is impractical to implement all four SIPs on the same beamline and so alternative scenarios will be investigated during 2021.

CeXS will therefore continue to work to inform DESY and other stakeholders about the future instrumentation needs of the Swedish materials research community for leading research.

CeXS organised and held community briefings, events and educational initiatives as well as contributed to educational activities organised by industry and research institutes.

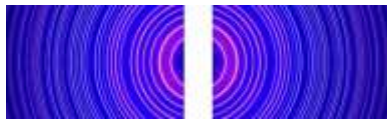
Proactive dissemination of PETRA III Swedish Node information via direct mails, briefings, the [CeXS homepage](#) and the [CeXS LinkedIn](#) site occurred throughout 2020.



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1. Background

Sweden has invested in the construction of a Swedish Material Science beamline (SMS), with two branches (P21.1 and P21.2), at the PETRA III synchrotron in Hamburg, Germany. This became operational during 2019.

From 2019, researchers affiliated to Swedish organisations have also had 5300 hours of privileged access to all DESY operated beamlines at PETRA III.

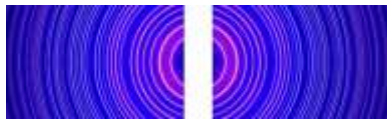
In connection with these investments, the Center for X-Rays in Swedish Material Science (CeXS) was established to act as the academic host of the Swedish Material Science beamline.

Furthermore, the Swedish Research Council (VR) has tasked CeXS with securing Swedish interests at PETRA III and collecting data about a) Swedish use of PETRA III and b) international's use of the P21 beamline at PETRA III.

CeXS should also arrange workshops and disseminate information about PETRA III opportunities to the Swedish material science community.

Together CeXS and the SMS constitute the PETRA III Swedish Node.

For 2020, a year characterised by the emergence of the Covid-19 pandemic, this report provides information relating to these tasks.



2. The PETRA III Swedish Node's organisational entities

CeXS was inaugurated in August 2019 and established an organisational structure. This organisation continued to function during 2020 and is described below.

2.1 CeXS

CeXS Management Team

CeXS activities continue to be planned and implemented by the following people:

Director. Peter Hedström. KTH. 0.3 FTE

Vice Director. Fredrik Eriksson. LiU. 0.3 FTE

Manager. Denise McCluskey. KTH. 0.5 FTE

CeXS Board

The management team reports to a board, which sets the direction for CeXS. Board members are:

Jens Birch (LiU), Chair

Mikael Östling (KTH), vice Chair

Per Dannetun (LiU)

Annika Borgenstam (KTH)

Ulrich Lienert (DESY)

Conny Sâthe (MaxIV)

The board met on 4 March and 21 August 2020.

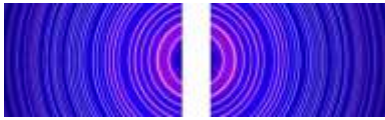
Figure 1 illustrates the above CeXS organisation as well as the governance stipulated by the VR-DESY contract.

Representation on governance fora

The VR-DESY contract stipulates two governance fora.

- The Steering Committee, which has one CeXS nominated representative, who is Prof. Ulf Karlsson (2020-2021).
- The Steering Group comprises only CeXS nominated representatives. As reported for 2019, two of these representatives are the director and vice director of CeXS. During 2020, Assoc Prof Lina Rogström (LiU) was also nominated by CeXS.

CeXS reminded DESY about the need to organise and hold regular meetings of these governance fora.



2.2 DESY's organisation and processes

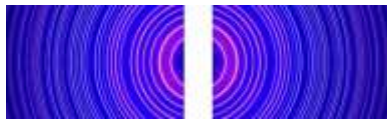
To establish the basis for meeting future obligations to VR, CeXS has learned more about DESY's organisation with respect to governance of the VR-DESY contract, operations of the SMS and its two branches as well as DESY's process for allocating beamtime.

The P21.1 beamline branch is managed by Dr. Martin von Zimmermann and run by him and a staff of 2 FTE beamline scientists. The P21.2 beamline branch is managed by Dr. Ulrich Lienert and run by him and a staff of 4 beamline scientists. For their respective beamline branches, Drs. Lienert and von Zimmermann have overall responsibility for planning beamline use, supporting users at the beamline as well as planning beamline maintenance and instrument upgrades.

Beam time allocation, including privileged beam time access, is decided as part of DESY's call process. The person responsible for that process is DESY's Dr Oliver Seek. DESY makes a call and researchers submit proposals for beam time access. Proposals are assessed on the basis of scientific excellence and project feasibility by independent scientists. Scientists then meet together in a so called Project Review Panel (PRP), which ranks proposals, with the ranking being the basis for beam time prioritisation. (see [this CeXS homepage](#) for a fuller description of that process).

There are various PRPs for differing beamlines (see [this DESY site](#) for more information about the PRP beamline groupings and members). CeXS has taken an active role in identifying and providing lists of suggested candidates for the PRPs to DESY, which DESY then select from. Currently there are 9 Swedish representatives on 8 of 13 PRPs.

Note. In order to be proactive in safeguarding Swedish interests, CeXS requested that we observe the PRP that involves the SMS beamline. It was agreed that from 2020 CeXS would be invited to observe such PRPs. However, there was an oversight at DESY and this did not happen during 2020. DESY have assured CeXS that they will take measures to avoid the reoccurrence of such an oversight.



Key organisational units in the PETRA III Swedish Node, including the governance fora, are illustrated in Figure 1.

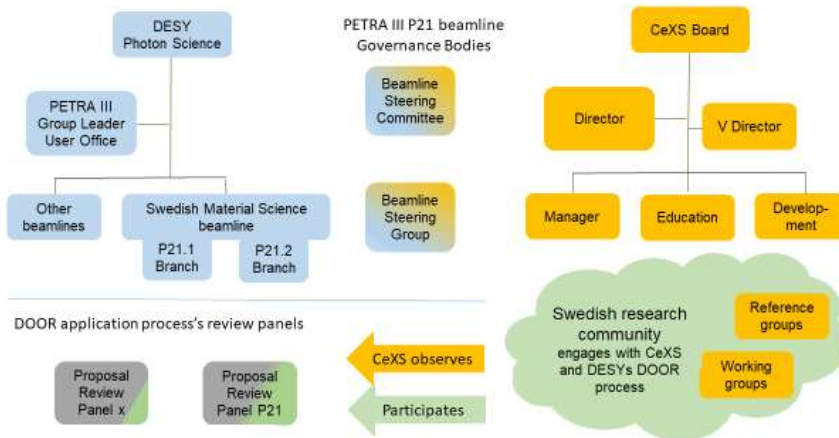
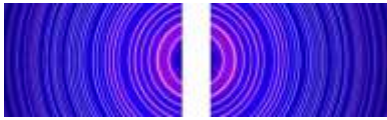


Figure 1. Academic hosting of the Swedish Material Science beamline and governance of the VR-DESY contract.

During our interactions with DESY we became aware of the need for a greater understanding of DESY's implementation of the VR-DESY agreement. We have raised this with the Steering Committee for the SMS.



3. Data sources concerning Swedish use of PETRA III

3.1 Available sources

1. Dates of PETRA III Operational Planning Schedules. This included the scheduled down times, scheduled maintenance periods, and periods where Covid-19 restrictions were in place.
2. The list of proposals from Swedish organisations. This list includes proposals that were submitted for DESY's 1 Sept 2019, 1 March 2020 and 1 Sept 2020 deadlines. Note. Proposals submitted in Sept 2019 were allocated beam time in either 2019 or 2020.

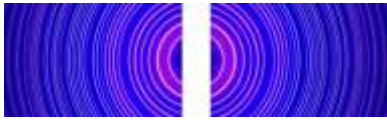
For accepted proposals, the actual beam time access dates and number of shifts at the beamline were also provided.

3. Extract of proposals that had selected the “applying for privileged Swedish access” in the DOOR system. This option became available during 2019. Extracts contained the name and organisation of the project leader, principal investigator and co-proposers as well as the proposal's abstract, requested beamline and the method/experimental setup.
4. Number of instances where Swedish industry paid for access to PETRA III and were industry from any country paid for access to the SMS.
5. A list of non-Swedish proposals that were allocated beam time at the SMS, during 2020.

This data comprised the surnames of the project leader and principal investigator, the title of the proposal and the number of shifts allocated at P21.

The list of organisations that obtained access was provided separately.

6. List of articles, based on measurement data from PETRA III, with Swedish authors that were published during 2020.
7. The number of Swedish users with particular qualifications/titles



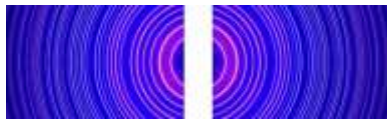
From the profile information that users provide to DESY, the number of users in 2019 with the title/qualification of Mr, Ms, BSc, DiplIng, MSc, PhD and Professor was provided.

3.2 Delimitations

The above data sources mean that there is limited or incomplete data concerning:

- Gender distribution at the proposal stage
- Academic discipline of the proposers

How the limitations in the data affect the analysis in the report is explained below.



4. PETRA III: Submissions and approved projects

The DESY beam time calls that enabled open research access to PETRA III during 2020 had deadlines in September 2019, March 2020 and September 2020. However, due to Covid-19 disruptions, the September 2020 call was only open to proposals for 6 of the 18 beamlines¹.

Proposals to various calls

The September 2019 call received 75 Swedish proposals, the March 2020 call received 55 proposals and the September 2020 call received 6 proposals.

In comparison, 84 Swedish proposals were submitted to the September 2018 deadline, 59 to the March 2019 call deadline. Excluding the September 2020 call data due to the special circumstances, this data indicates that Swedish researchers prefer to apply to the autumn deadlines.

Beamline proposers specify the beamline that they wish to undertake measurements at.

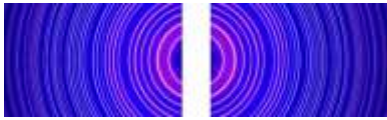
For the proposals submitted by the Sept 2018 deadline, the most requested beamlines were P22, P07, P03 and P64. The Swedish Material Science beamlines (P21.2 and P21.1) became available during 2019 - and, immediately, this beamline became one of the most requested beamlines at PETRA III. P22, P07 and P03 are the next most popular beamlines, with varying interest in other beamlines. The less frequently requested beamlines tend to receive just a couple of proposals at each call. Accordingly, there is a sustained demand for privileged access as well as a sustained high demand for the SMS in this period.

Actual Swedish open research access

During 2020, Covid-19 disruptions limited the number of Swedish open access proposals that gained beam time at PETRA III to 37 projects (there were 62 Swedish open access projects in 2019).

Of the 37 open access projects, 27 projects had researchers at the beamline conducting measurements

¹ P01, P09 (for a few setups), P11, P24, P61 (HZG hutch only), P65



themselves, 1 project had remote access and in 9 projects the researchers mailed in the samples and the beamline scientists conducted the measurements.

Figure 2 and Table 1 shows the beamlines that open access projects gained access to during 2020. The highest number of projects, 13, were carried out at the P22 beamline, which represents a 60% proposal success rate. The SMS granted access to 7 projects, with a 29% proposal success rate. P03 and P10 granted access to 4 and 3 projects each. Thereafter, other beamlines granted access to 0 or 1 Swedish proposal.

Table 1 also contains the total number of beam time hours is also provided.

The total beam time that Swedish research open access projects had during 2020 was 3719 hours. This is 70% of the beam time stipulated in the contract (see Covid-19 disruptions below).

Covid-19 disruptions meant that Swedish researchers in practice only gained physical access to PETRA III facilities during part of March and in the period August-December 2020 (see the discussion below and Table 3).

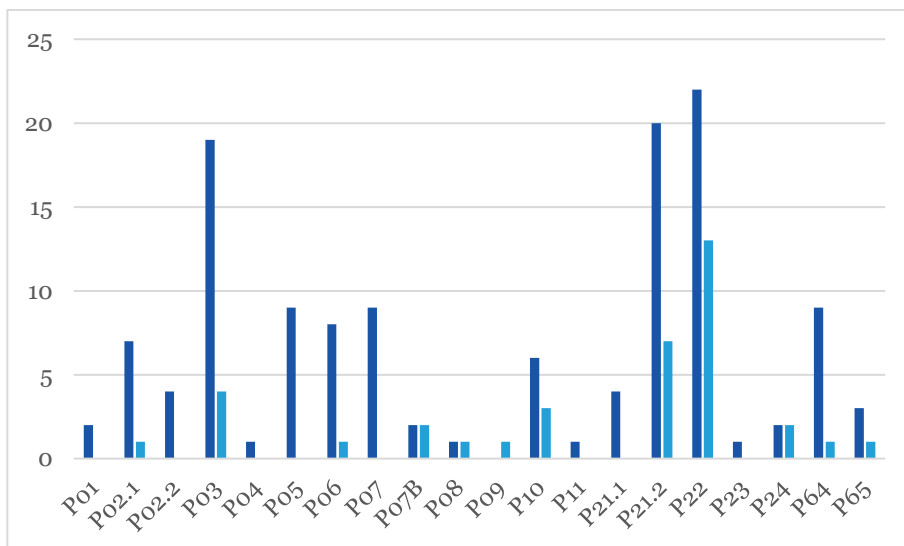


Figure 2. Distribution per beamline of open access projects proposals (dark blue) and granted open access projects (light blue).

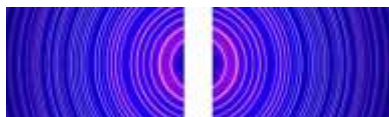
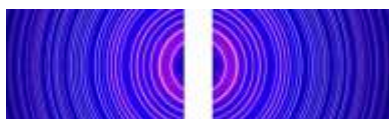


Table 1. Proposals and granted access hours per beamline.

| Beamline | No proposals | No of projects granted access | Access as a percentage of applications | Total Swedish Open Access (Hours) |
|----------|--------------|-------------------------------|--|-----------------------------------|
| P01 | 2 | 0 | 0% | 0 |
| P02.1 | 7 | 1 | 14% | 142 |
| P02.2 | 4 | 0 | 0% | 0 |
| P03 | 19 | 4 | 21% | 382 |
| P04 | 1 | 0 | 0% | 0 |
| P05 | 9 | 0 | 0% | 0 |
| P06 | 8 | 1 | 13% | 96 |
| P07 | 9 | 0 | 0% | 0 |
| P07B | 2 | 2 | 100% | 96 |
| P08 | 1 | 1 | 100% | 142 |
| P09 | 0 | 1 | NA | 144 |
| P10 | 6 | 3 | 50% | 380 |
| P11 | 1 | 0 | 0% | 0 |
| P21.1 | 4 | 0 | 0% | 0 |
| P21.2 | 20 | 7 | 35% | 860 |
| P22 | 22 | 13 | 59% | 1191 |
| P23 | 1 | 0 | 0% | 0 |
| P24 | 2 | 2 | 100% | 166 |
| P64 | 9 | 1 | 11% | 96 |
| P65 | 3 | 1 | 33% | 96 |

Swedish industry's paid use

Swedish companies paid to undertake 5 beam time projects at PETRA III during 2020. The beamlines used were P03, P07, P22 and SMS.



5. The Swedish Material Science Beamline

5.1 Swedish open access interest and use

Of the 130 proposals submitted to PETRA III in September 2019 and March 2020, 24 proposals (18.5%) requested use of the Swedish Material Science beamline. 4 proposals requested use of the P21.1 beamline branch and 20 requested the P21.2 beamline branch.

Beam time was granted to 7 of these 24 proposals during 2020. All 7 of which accessed the P21.2 beamline branch.

These 7 projects were allocated 860 hours of beam time.

Some Swedish researchers postponed beam time from 2020 to 2021.

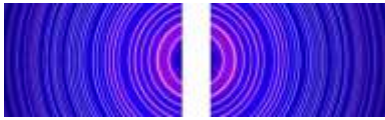
5.2 Paid industry use

In addition to the one Swedish company paying to undertake measurements at the Swedish Material Science beamline, three other non-Swedish companies also undertook paid research and free feasibility studies for a total of 71 hours. This accounted for 45 hours at P21.1 and 26 hours at P21.2. All 45 hours at P21.1 was paid use. Of the 26 industry hours at P21.2, 18 hours was paid used and 8 hours were free feasibility use. There was a reduction in industry paid use compared to 2019², which may be attributed to the impact of the Covid-19 pandemic.

5.3 International use

The Swedish Material Science beamlines also attracted proposals from principal scientists that were not affiliated to Swedish organisations.

² In our report last year, we did not receive information about industry use of the P21.1 beamline. Therefore, for as a complement to our report about 2019, the following 2019 information is now available. Industry undertook paid research and free feasibility studies for a total of 164 hours at the SMS during 2019. This accounted for 96 hours at P21.1 and 68 hours at P21.2. Of the 96 hours at P21.1, 92 hours was paid used and 4 hours were free feasibility use. Of the 68 industry hours at P21.2, 64 hours was paid used and 4 hours were free feasibility use.

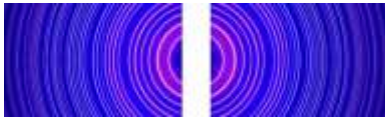


The P21.1 beamline was used by researchers from Denmark, Germany, the United Kingdom, Slovakia and Switzerland. These researchers conducted 31 beam time projects, gaining 2728 hours of beam time access.

The P21.2 branch was used by researchers from Austria, Denmark, Germany, Norway, the United Kingdom, Slovakia and Switzerland in 17 projects that had beam time access for a total of 1496 hours.

In total, 48 international projects gained access for 4224 hours.

30% of Swedish proposals actually gained access to SMS. Some Swedish researchers deferred measurements into 2021. Further analysis will be made.



6. Industry, Research Institute and Academic use

Due to GDPR concerns, there is limited data about the distribution of academic, research institute and industry use of PETRA III.

6.1 Industry

There were 5 Swedish industry co applicants to university projects.

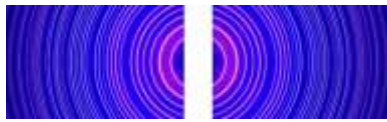
Swedish industry paid for 5 beam time projects.

6.2 Research Institutes

Swedish research institutes led 5% of the open access projects.

6.3 Universities

Universities led 95% of the open access projects.



7. PETRA III Users' qualifications

In 2020, there were a total of 102 users who gained physical access to PETRA III, compared to 200 in 2019.

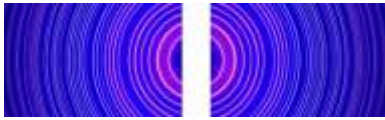
Given the sustained high proposal submission rate, the reduction in users in 2020 is attributed to Covid-19 disruptions: i) this limited the number of Swedish projects that were carried out PETRA III during 2020 and ii) limited access to 3 people per project.

Swedish users registered their own data about qualifications or use the title Mr/Ms, which are shown in Table 2.

In addition to the on-site users, there were also 'virtual' users of PETRA III: 1 project was run via remote access and 9 projects mailed in their samples. Such users are not included in the figures below.

Table 2. Qualifications and gender of Swedish users who gained access to PETRA III during 2020.

| Qualifications | distinct | |
|----------------|----------|-------|
| | females | Males |
| B. Eng. | 1 | 0 |
| Dipl. Ing. | 1 | 0 |
| Dr. | 8 | 42 |
| M. Eng. | 1 | 1 |
| M. Sc. | 5 | 8 |
| Mr. | 0 | 13 |
| Ms. | 8 | 0 |
| PD Dr. | 1 | 0 |
| Prof. Dr. | 1 | 12 |
| | 26 | 76 |

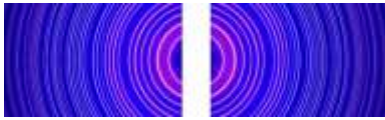


8. PETRA III Users' publications

The number of peer review publications involving measurement data at PETRA III, where one of the authors was affiliated to a Swedish organisation, was 88 in 2020, 60 in 2019 and 53 papers in 2018. i.e. there was a 66% increase in the publication rate compared to the 2018 baseline.

In 2019, DESY has flagged two concerns regarding publications:

- Users fail to register publications in their database
- It is taking a longer time to get from the beam time measurements to a publication. This is due to the time and expertise required to analyse the large volumes of data produced during the beam time experiments.



9. CeXS Strategy Area 4. Gender

The user qualifications section above illustrates that CeXS and PETRA III operations are primarily undertaken by professionals with level 2 and above degrees. At this level, in the Science and Engineering sector, there is a recognised gender imbalance with female representation being at most 20-30% and declining to 20% at professor level.

9.1 PETRA III Users

From their names, the gender of users was attributed. This indicates that 25% of users were female, which is representative of the gender distribution in the science and engineering disciplines within the Swedish university and overall research community.

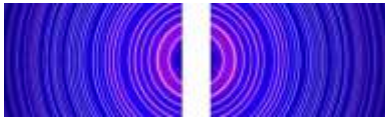
The March 2020 proposals indicated that 10% of the proposal leaders were female, and 19% of the PI.

9.2 CeXS Board

In this context, with a board membership at professor level, one in six (16.7%) of the Board are female. This representation reflects the level of gender inequality in Science & Engineering disciplines within the Swedish University sector.

9.3 CeXS Management team

One in three (33.3%) of the CeXS Management team is female. This representation reflects the level of gender inequality in Science & Engineering disciplines within the Swedish University sector.



10. CeXS Strategy Area 1. Competences

During 2020, CeXS organised two competence development events for the Swedish Material Science research community.

29 January SMS Satellite Meeting at PETRA III

On 29 January, CeXS and the P21.2 beamline manager jointly organised and held a SMS satellite meeting at PETRA III. This was attended by 30 researchers from the Swedish community. The agenda was beamline updates, emerging research results from the Swedish community, and a discussion of topics of interest to the community, especially education and training. There was also a visit to the beamline.

One outcome of the meeting was a request for CeXS to organise education on the topic of data analysis, which is becoming a major bottleneck in the research process. The meeting requested CeXS schedule this in the autumn of 2020 in order to enable senior researchers, post docs and PhD students to all attend. However, due to Covid-19 restriction and given the need for physical participation for hands-on activities, such an event will be scheduled when it is feasible.

14 September DESY Workshop

Professor Peter Hedström made a presentation of scientific research.

1 October DESY Workshop

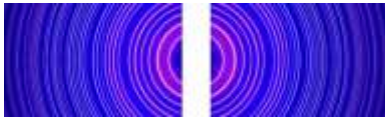
Professor Peter Hedström made a presentation of the scientific instrumentation proposal

11 November Online Workshop

This online workshop was co-organised by the MetaLSF project that is sponsored by EIT RawMaterials.

The workshop topic was “Synchrotron instruments and material science & engineering research - current developments and future perspectives”

International speakers, who develop and use synchrotrons for material science and engineering research, addressed:



- Synchrotrons' upgrade plans and future instrument capabilities
- Current and future research opportunities

And, the workshop participants were able to discuss:

- How to influence and make use of synchrotron upgrades in order to further advance material science and engineering research.

60 researchers and 10 presenters/organisers participated in this online event.

11. CeXS Strategy Area 2. Capacity

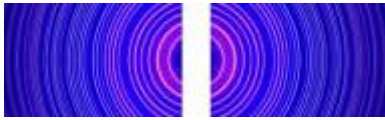
CeXS participated in the training for industry researchers and new institutes at two educational events.

On 4 June, Dr Denise McCluskey was invited to speak about the PETRA III Swedish Node at a RISE internal competence development event on Large Scale Research Facilities.

There were 30 participants.

On 25 November, an online event was organised by the MetalBeams initiative which is run by Jernkontoret, Swerim and RISE. Dr Ulrich Lienert and Professor Jens Birch each gave a presentation. One presentation focused on the SMS beamline and the other on in-situ measurements.

There were 25 participants.



12. CeXS Strategy Area 7. Communications

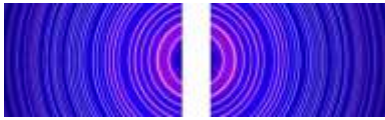
12.1 Workshops/conferences

On 11 March, Professor Peter Hedström was invited to a pre-event at the Annual Conference of the Metalliska Material Strategic Innovation Programme, which is organised by the Swedish iron and steel producers' association. He spoke about the PETRA III Swedish Node and the MetaLSF project. 35 researchers from industry, research institutes and universities were there in person to hear the talk.

12.2 Social media platforms

The web portal cexs.kth.se was launched in 2019. During 2020, this was continually updated.

During 2020, CeXS established a linkedin profile, which has more than 100 followers.



13. CeXS Strategy Area 3. Infrastructure

13.1 Infrastructure enhancements at PETRA III

During 2020, CeXS experts from various university groups engaged with the SMS beamline manager in order to capture user needs and specifications for two experimental environments. DESY will procure these during 2021.

RÅC funded a Swedish-German project lead by KTH's Ass Prof Greta Lindval. One work package will develop an experimental environment for in-operando measurements of electron beam additive manufacturing processes. CeXS's Director is leading that work package.

13.2 Upgrade to PETRA IV

CeXS academic hosting duties during 2020 had significant emphasis on addressing DESY's sudden call for Scientific Instrument Proposals for PETRA IV and the corresponding need to set strategic directions for Swedish materials research as well as instrumentation.

CeXS mobilised the Swedish community, secured support of international experts and orchestrated the submission of 3 SIPs and collaborated on a fourth. All 4 SIPs were positively reviewed by an international panel established by DESY.

The Swedish community were engaged in the SIP creation process via 3 events.

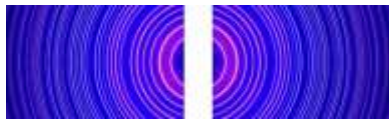
1. Briefing on 26 June

An online briefing informed the Swedish research community about DESY's sudden call for Scientific Instrument Proposals (SIPs) for a future PETRA IV.

Prior to the briefing, an invitation and written briefing was emailed to all 200 Swedish users of PETRA III plus other interested parties.

30 researchers participated in this online event.

2. Proposal workshop on 14 September



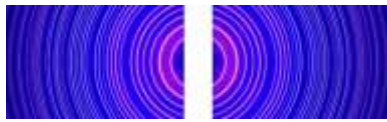
At an online workshop, for each of the 4 Swedish SIPs, the principal investigator presented an outline of the research case and the instrument design.

The community was able to pose questions as well as participate in breakout sessions to discuss the science case further.

30 researchers participated in this online event.

3. Workshop session on 11 November

At the 11 November workshop reported above, breakout sessions were held that enabled participants to have detailed discussion of the almost completed SIPs.



14. Discussion

14.1 Issue with revenues from purchased beam time

In our report about 2019 use of PETRA III, we flagged the issue about revenues from paid use of the Swedish Material Science beamline. During 2020, there was a tentative plan to use such revenues to employ a beamline scientists that could provide additional support to industry. The discussion is being pursued.

14.2 Beam time access hours and Covid-19 disruptions

The total beam time access time of 3719 hours for Swedish researchers is less than the 5300 hours stipulated in the VR-DESY operational contract. The VR-DESY contract does not include a Force Majeure clause for eventualities such as the Covid-19 pandemic and its disruptions. Accordingly, this section therefore assesses whether or not the 3719 hours could be considered to be a reasonable effort by DESY to fulfil their contractual obligations to VR.

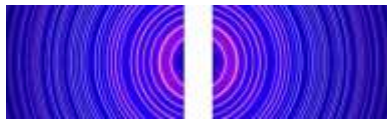
DESY planned a total of 248 days of beam time access, with regular shutdowns and scheduled maintenance periods, distributed over the calendar year as shown in the first row of Table 3. We calculate this 248 days of beam time capacity corresponds to 5300 hours per beamline when running 3 shifts each of 8 hours duration.

In December 19 and early January 2020, the Covid-19 virus emerged, spread and developed into a pandemic. Covid-19 pandemic containment measurements disrupted operations of the PETRA III beamline in a number of ways:

- Beamline operations were essentially shut down during March until May 2020, for all measurements except Covid-19 related research.
- From May 2020, a maximum of 3 researchers were allowed to participate in each beamline project.

Moreover,

- German national and local governmental restrictions meant that in the period March-June, Swedish researchers would need to go into quarantine.
- Swedish organisations, especially companies, had travel restrictions.



The impact of these effects on beam time access possibilities throughout 2020 is shown on Table 3 for various scenarios.

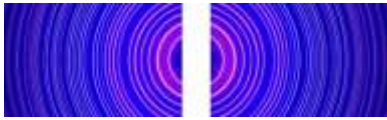
Table 3. Covid-19 disruptions to beam time operations during 2020 for 3 scenarios. RS Regular Shutdown, M scheduled maintenance, HS Holiday shut down, CS Covid-19 Shutdown, CR Covid-19 Restrictions.

| | Jan- Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total Beam Days |
|--------------------------|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------------------|
| Planned beamtime days | 0 | 31 | 30 | 25 | 30 | 6 | 28 | 23 | 31 | 23 | 21 | 248 |
| Scenario 1 | 0 | 18 | 0 | 25 | 30 | 6 | 28 | 23 | 31 | 23 | 21 | 205 |
| Scenario 2 | 0 | 0 | 0 | 25 | 30 | 6 | 28 | 23 | 31 | 23 | 21 | 187 |
| Scenario 3 | 0 | 18 | 0 | 0 | 0 | 0 | 28 | 23 | 31 | 23 | 21 | 144 |
| | RS | | | M | | HS | | M | | M | HS | |
| | | CS | CS | CR | CR | CR | CR | CR | CR | CR | CR | |

Table 3's second row assesses the disruption assuming there were projects running on 13th March: if researchers had already started their scheduled beam time, they could continue to take measurements until the 20th March. In this scenario, assuming people go into quarantine prior from 20 March to the scheduled summer holiday shut down, then DESY could provide 205 beam time days, which corresponds to a potential capacity of 4920 beam time hours per beamline.

The third row in Table 3 illustrates the effects of the disruption assuming there were no projects running on 13th March (if researchers had already not started a scheduled beam time before 13th March, then no beam time would be possible that month). This scenario, which also assumes people would travel and go into quarantine prior to the summer, estimates the beamline access to 187 days, which corresponds to a capacity of 4488 hours per beamline.

The fourth row illustrates the effects of the disruption assuming there were some projects running in March and that there was no one would travel from 20 March to the scheduled summer shut down. In this scenario,



beamline access was possible for 144 days, which corresponds to 3456 hours per beamline.

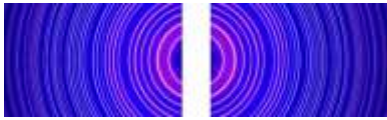
The actual access hours that Swedish research projects gained for open access proposals was 3719 hours for the total facility.

This falls between scenarios 2 and 3 - with the mail in access and remote access projects providing additional access capacity. The shortfall could be seen to be reasonable from this respect.

14.2 Governance issues

The above Covid-19 beam time access concern arose after other discussions about support for education and beamline upgrade planning. Together they show the need for enhanced insight into DESY's implementation of the operational agreement with VR.

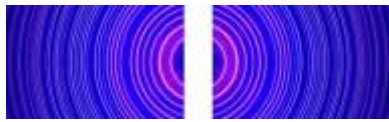
We will raise these concerns with the Steering Committee.



15. Budget

CeXS is ramping up its activities and so our current under spend will be resolved.





16. Conclusions

Based on our emerging experiences when undertaking the CeXS role in governing the VR-DESY contract, CeXS have flagged the need for more information about the DESY implementation of the VR-DESY agreement with the Beamline Steering Committee.

There is sustained Swedish research interest for use of PETRA III and its Swedish Material Science beamline.

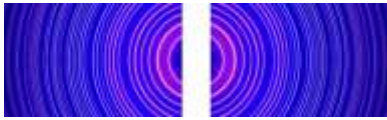
Despite the Covid-19 pandemic restrictions, Swedish research projects were conducted measurements at the Swedish Material Science beamline and other beamlines at PETRA III.

Total Swedish beam time was 3719 hours, which is less than stipulated in the contract. However, given DESY's shutdown, restricted access, quarantine periods and organisations/people's own travel restrictions, this may be judged to be acceptable. This judgement is deferred to the Beamline Steering Committee and VR.

Significant research results have emerged during 2020 from the use of PETRA III and the Swedish Material Science beamline, with 50% more papers published in 2020 than in 2018 and 2019.

To shape future research opportunities at the Swedish beamline in the short term, CeXS has engaged the Swedish research community in defining together with the beamline manager new experimental environments, 2 of which will be procured by DESY and 1 which is being developed as part of an R&C project.

To sustain Sweden's PETRA III Swedish node investments into the future PETRA IV era, CeXS orchestrated 3 Scientific Instrument Proposals (SIPs) for the future PETRA IV and will continue to work to inform DESY and other stakeholders about the instrumentation needs of the Swedish materials research community.



CeXS organised and held community briefings, events and educational initiatives as well as contributed to educational activities organised by industry actors.

Dissemination was a continual practice of CeXS during 2020, via direct mails, the cexs.kth.se homepage and the [cexs](#) linked in site.

