DNR: STYR 2018/777-3

Status of beamlines at MAX IV

December 2018

Beamlines at MAX IV

The first seven beamlines[1] at MAX IV were funded by the Knut and Alice Wallenberg Foundation (KAW) together with twelve Swedish Universities[2] in 2011. In 2012 Estonia and Finland funded the construction of the eighth beamline, FinEstBeAMS. These eight beamlines constitute the Phase I beamlines. In 2013, KAW and the Swedish Research Council (VR) funded the Transfer Package, three beamlines (SPECIES, FlexPES and MAXPEEM) consisting of moved and upgraded instruments from MAX-lab. In addition, VR also financed two new beamlines, CoSAXS and SoftiMAX. These five beamlines represent the Phase II beamlines. The Danish Agency for Science and Higher Education, the Capital Region of Denmark and the Central Denmark Region fund together with the Technical University of Denmark, Aarhus University and the University of Copenhagen, the DanMAX beamline. In 2017, two beamlines received funding: KAW granted funding for the construction of the ForMAX beamline, and the Novo Nordisk Foundation (NNF) granted funding for the MicroMAX beamline. Currently MAX IV has sixteen funded beamlines.

Status of MAX IV

The last report on the status of beamlines at MAX IV was submitted to VR in September[3] 2018. MAX IV accelerators are performing well, all three deliver light to beamlines. From the time beamlines were up and running after summer shutdown of the accelerators (linac and 1.5 GeV-ring in mid-September and 3.0 GeV-ring in October) and 27 November a total of 101 users (regular as well as experts) made 107 user visits to MAX IV. Users came from 10 different countries and 26 different institutions. The largest fraction of users, almost 45 %, during this period were from Sweden. Swedish users came from 10 different universities and research facilities. The number of users from Finland and Estonia during this period stand out, explained by the fact that the FinEstBeAMS beamline has had expert users from these two countries to help commissioning the beamline and make it ready for regular user operation. Seen over the whole of 2018 Swedish users dominate beamtime at MAX IV.

In the beginning of September, Christoph Quitmann resigned as Director for MAX IV Laboratory. At the following MAX IV Board meeting, Ian McNulty, Physical Science Director, was appointed interim Director. The MAX IV Board has since started the search for a new Director in dialogue with Lund University Vice-Chancellor.

In response to the reports on MAX IV project management published this summer, Lund University Vice-Chancellor asked the MAX IV Board for a plan of action concerning the issues raised in these reports. The action plan from the MAX IV Board identified three main problem areas: i) lack of professional project management; ii) uncertainties in the command chain and delegation of responsibility within the organisation, including the MAX IV Board; and iii) insufficient communication. During the months that have followed since, MAX IV Board and Management have worked to implement the changes requested in order to restore confidence in and strengthen project management at MAX IV. 6 November, the MAX IV Board submitted a report containing an update on the issues raised in the action plan to Lund University Vice-Chancellor and the Swedish Research Council.

MAX IV Management has defined a list of priorities with estimation of dates to deliver baseline beamline capabilities to users based on knowledge currently at hand. The key next step is to resource-load this list of priorities to give more precise dates for delivering beamlines with baseline

[1] Balder, BioMAX, Bloch, FemtoMAX, HIPPIE, NanoMAX and Veritas

[2] Chalmers University of Technology, Gothenburg University, Karlstad University, Karolinska Institutet, KTH Royal Institute of Technology in Stockholm, Linköping University, Luleå University of Technology, Lund University, Stockholm University, Swedish University of Agricultural Sciences (SLU), Umeå University and Uppsala University

[3] Status of beamlines at MAX IV, September 2018, DNR: 2018/777-2, submitted to VR via e-mail to J. Holmberg and N. Ottosson 31 August 2018

capabilities to users. This working document will guide allocation of resources and eventually the development of a fully resource-loaded time plan for managing projects.

New projects and sub-projects that require internal and/or critical pooled resources go through the Pooled Resource Coordination Committee (PRCC). After prioritisation by MAX IV Management, PRCC discusses project specifications, resource needs and availability with the appointed project managers and resource owners. The status of each project is followed-up by PRCC and reported to MAX IV Management. The aim is to set up a system to follow up on resource usage in the projects.

Work to relieve resource bottlenecks is ongoing. MAX IV Management has analysed the current situation and has presented a scheme to mitigate and address these bottlenecks. Some of the measures proposed are currently being implemented.

In the end of September, the MAX IV annual user meeting was held in Lund. More than 250 participants attended the three-day meeting and many expressed the importance to meet, not only to discuss science with colleagues and collaborators, but also to learn and understand the time plan and overview of the status of the beamlines, as well as to meet with the new Directors at MAX IV.

Appendix 1 lists the current status of individual beamlines and current beamline development priorities with estimated dates to deliver baseline beamline capabilities. This list is based on updated information from each beamline on each's progress, the anticipated availability of resources for installation and commissioning of the beamlines, and prioritisation by MAX IV Management based on the above and expected user need. The listed dates are based on estimations made under the current circumstances and may change as MAX IV establishes a more complete resource-loaded time plan.

Appendix 1
Current status of individual beamlines

Status of beamlines at MAX IV

December 2018

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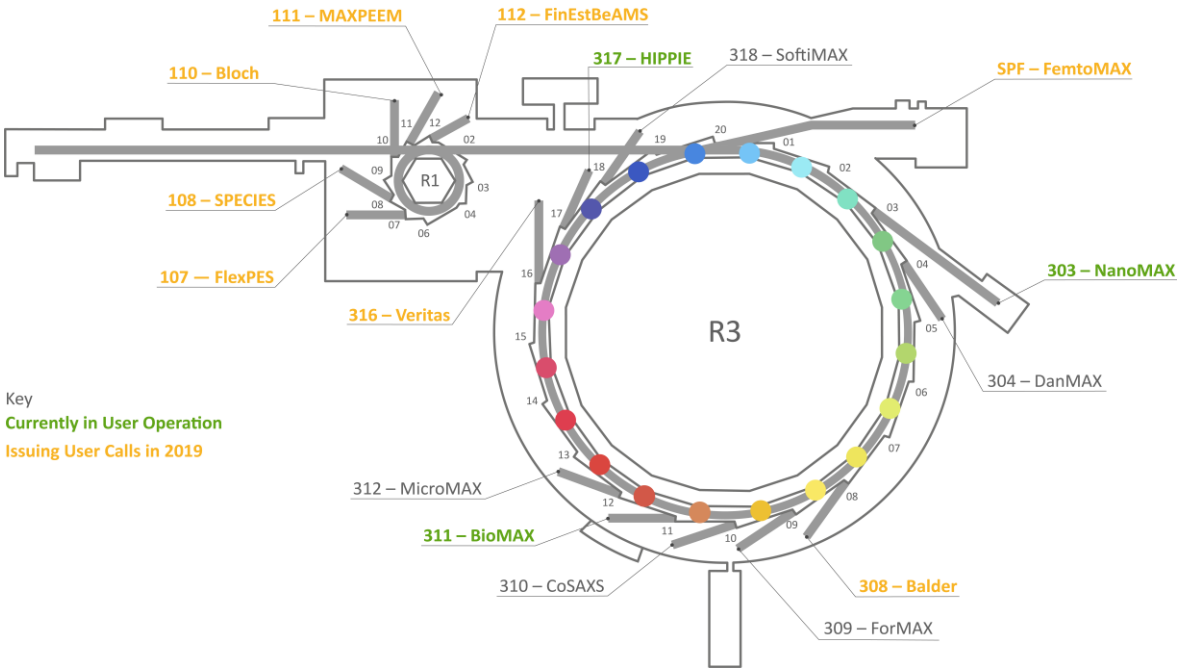
Location of beamlines at MAX IV



Funding of MAX IV beamlines

Beamline	Funding agency* (installation)	Phase
Balder	KAW & Swe universities	Phase I
BioMAX	KAW & Swe universities	Phase I
Bloch	KAW & Swe universities	Phase I
CoSAXS	VR	Phase II
DanMAX	Denmark & MAX IV	Phase III
FemtoMAX	KAW & Swe universities	Phase I
FinEstBeAMS	Estonia & Finland	Phase I
FlexPES	VR	Phase II
ForMAX	KAW	Phase III
HIPPIE	KAW & Swe universities	Phase I
MAXPEEM	VR	Phase II
MicroMAX	NNF	Phase III
NanoMAX	KAW & Swe universities	Phase I
SoftiMAX	VR	Phase II
SPECIES	VR & KAW	Phase II
Veritas	KAW & Swe universities	Phase I

**KAW: Knut and Alice Wallenberg Foundation; NNF: the Novo Nordisk Foundation; Swe Universities: Chalmers University of Technology, Gothenburg University, Karlstad University, Karolinska Institutet, KTH Royal Institute of Technology in Stockholm, Linköping University, Luleå University of Technology, Lund University, Stockholm University, Swedish University of Agricultural Sciences (SLU), Umeå University and Uppsala University; VR. Swedish Research Council;*

Current status of individual beamlines

Development priorities for individual beamlines

Priority	Beamline	Status	First Expert Users	First Regular Users
1	**MAXPEEM**	SSM permit submitted	Q1 2019	Q3 2019
2	**SPECIES**	Installing	Q2 2019	Q1 2020
3	**FlexPES**	Installing	Q2 2019	Q1 2020
4	**FemtoMAX (10 Hz)**	Commissioning	Q2 2019	Q4 2019
5	**CoSAXS**	Installing	Q4 2019	Q3 2020
6	**SoftiMAX**	Installing	Q1 2020	Q4 2020
7	**DanMAX**	Installing	Q2 2020	2021
8	**ForMAX**	Designing	autumn 2021	autumn 2022
9	**MicroMAX**	Designing	autumn 2021	autumn 2022
10	**FinEstBeAMS**	Commissioning	open	Q2 2019
11	**Bloch**	Commissioning	Q4 2018	Q2 2019
12	**FemtoMAX (2 Hz)**	Commissioning	Q2 2018	N.A.
13	**Veritas**	Commissioning	Q1 2019	Q3 2019
14	**Balder**	Commissioning	Q4 2018	Q3 2019
15	**BioMAX**	User operation		
16	**NanoMAX**	User operation		
17	**Hippie**	User operation		

Balder

The SSM permit for Balder was approved in September and commissioning of the beamline is ongoing. We anticipate the beamline will be ready for first expert users at the end of this year.

- SSM permit: in place
- Commissioning: ongoing
- First expert user: Q4 2018
- First regular users: Q3 2019

BioMAX

BioMAX is in regular user operation, while some commissioning activities are remaining and ongoing in parallel. Commissioning activities include adding remote access to the portfolio. The sample changer is now in continuous use for regular user operation.

Since the last report in September* BioMAX has delivered 27 shifts+ to 34 users. The next regular user call will open in Q1 2019 for users requesting beamtime at BioMAX autumn and winter 2019.

* Status of beamlines at MAX IV, September 2018, DNR: 2018/777-2, submitted to VR via e-mail to J. Holmberg and N. Ottosson 31 August 2018

+ 1 shift = 4 hours

Bloch

Bloch beamline staff are currently doing last commissioning activities of the ARPES-endstation before it is ready for the first expert users. The goal is to have regular users Q2 2019.

- Commissioning: ongoing
- First expert users: Q4 2018
- First regular users: Q2 2019

CoSAXS

Beamline installation activities continue, as does development of the sample environment instrumentation. In an effort to deliver the most beamlines to the most users sooner, planned submission of the CoSAXS SSM permit application has been postponed compared to the previous schedule. We currently do not expect this will delay when CoSAXS can take first regular users; however, there is some risk of further delay to the CoSAXS schedule.

- SSM permit submission: planned for Q3 2019
- Start of commissioning: Q3 2019
- First expert users: Q4 2019
- First regular users: Q3 2020

DanMAX

The construction of infrastructure for DanMAX is underway. Radiation hutches are complete. The construction of control and preparation rooms have started and is expected to be finished in March 2019. The detailed design of the endstation equipment is nearing completion; the review is tentatively scheduled for Q1 2019. The final design review of the X-ray optics is ongoing.

- SSM permit submission: planned for Q1 2020
- Start of commissioning: Q1 2020
- First expert users: Q2 2020
- First regular users: 2021

FemtoMAX

FemtoMAX needs 100 Hz for full scope of user experiments, however many experiments can be performed at lower repetition rates. For user calls to be published, at least 10 Hz operation needs to be established. The SSM permit application for 10 Hz operation of the linac, and thus FemtoMAX, has been up-prioritised and commissioning at 10 Hz is expected to start Q2 2019. Meanwhile, technical commissioning activities and feasibility tests with expert users at 2 Hz are ongoing.

- SSM permit 2 Hz: in place
- SSM permit 10 Hz submission: planned for Q2 2019
- Start of commissioning, 10 Hz: Q2 2019
- First expert users, 10 Hz: Q2 2019
- First regular users: Q4 2019

FinEstBeAMS

FinEstBeAMS is currently taking expert users who help with the commissioning of the beamline making it ready to take regular user, which will be possible sooner than expected. The first call for regular users at FinEstBeAMS is open. Beamtime from this call will be allocated from April 2019.

- Commissioning: ongoing
- First expert users: Q2 2018
- First regular users: Q2 2019

FlexPES

FlexPES front ends and optics are in place and minor installations are remaining, work on this is ongoing. There has been an adjustment in the schedule for SSM permit application submission. We do not believe this change will affect the dates for first regular user at FlexPES.

- SSM permit submission: planned for Q1 2019
- Start of commissioning: Q2 2019
- First expert users: Q2 2019
- First regular users: Q1 2020

ForMAX

The detailed design report (DDR) for the optics for ForMAX was reviewed mid-November by a panel of external expert. The agreement with the research platform *Treesearch* settling the operation costs of ForMAX, has been finalised. Design of the experimental station and infrastructure is ongoing and the process for first procurements has started.

- Start installation: Q3 2019
- Start of commissioning: Q2 2021
- First expert users: autumn 2021
- First regular users: autumn 2022

HIPPIE

HIPPIE has regular user operation at the standard catalysis cell and has had expert users commissioning the PM-IRRAS cell. Since September, two groups from regular user call have completed beamtime and so have two groups from expert commissioning call. The electrochemical cell will be commissioned by expert users in Q1 2019.

The next regular user call will open in Q1 2019 for users requesting beamtime at HIPPIE autumn and winter 2019.

MAXPEEM

The MAXPEEM SSM permit application has been submitted. This application took longer to finalise than anticipated; we realised that extra radiation shielding was required and have installed that in the MAXPEEM optical hutch.

MAXPEEM front ends and optics are in place and the control system is nearly complete. The beamline will be ready to take light when the SSM permit application is approved.

- SSM permit submission: submitted
- Start of commissioning: Q1 2019
- First expert users: Q1 2019
- First regular users: Q3 2019

MicroMAX

The MicroMAX Scientific and Technical Advisory Panel (STAP) has had their first meeting and as a result of discussions and input there, the optical design has been modified as compared to the initial proposed design. The detailed design report (DDR) will be reviewed by external evaluators in March 2019.

- Start installation: Q3 2019
- Start of commissioning: Q2 2021
- First expert users: autumn 2021
- First regular users: autumn 2022

NanoMAX

NanoMAX is in regular user operation. In order for the NanoMAX team to focus on operations and user community growth at the KB-station, MAX IV Management has decided to delay development of the second experimental station (the FZP-station). This has been approved by KAW and KTH.

Since September, beamtime has been used to improve the focused beam intensity and stability and detector read-out reliability. Two user proposals will be executed in December. Ten proposals are scheduled for experiments during the first half of 2019.

The next regular user call will open in Q1 2019 for users requesting beamtime at NanoMAX autumn and winter 2019.

SoftiMAX

The undulator for SoftiMAX is fully built and preparation for its installation and alignment in the 3 GeV-ring at the end of the year is ongoing. The SoftiMAX STXM-station design is finished and the design of the second experimental station, the CXI-station, is starting.

In an effort to deliver the most beamlines to the most users sooner, planned submission of the SoftiMAX SSM permit application has been postponed compared to the previous schedule. We currently expect arrival of first regular user will be delayed by one calendar quarter, however there is some risk of further delay to the SoftiMAX schedule.

- SSM permit submission: planned for Q4 2019
- Start of commissioning: Q4 2019
- First expert users: Q1 2020
- First regular users: Q4 2020

SPECIES

The Radiation Safety team is preparing the SPECIES SSM permit application. Submission of the application is planned in the beginning of 2019.

The SPECIES team has continued installation of the beamline as far as they can without synchrotron radiation light. The beamline will be ready to take light as soon as it has permission from SSM.

Since 1 September, the SPECIES beamline has had eight user visits doing preliminary experiments using experimental setup at an external X-ray source.

- SSM permit submission: planned for Q1 2019
- Start of commissioning: Q2 2019
- First expert users: Q2 2019
- First regular users: Q1 2020

VERITAS

The Veritas beamline has two branch lines, Veritas A and Veritas B. Currently, Veritas A is being commissioned while the spectrometer at Veritas B is being built up. The final parts of the spectrometer optics will be delivered from Uppsala in the beginning of next year. Beamline staff will start doing initial experiments at the end of the year at both branch lines. Veritas B will be ready to have expert users early in 2019 and Veritas A will take expert users shortly thereafter, although limited without the spectrometer.

- Commissioning: ongoing
- First expert users: Q1 2019
- First regular users: Q3 2019