MAX IV
The New Swedish Synchrotron Radiation Facility

MAX IV is planned to be the next generation Swedish synchrotron radiation facility. It will replace the existing laboratory consisting of the MAX I, II and III storage rings. The main source at MAX IV will be a 3-GeV ring with state-of-the-art low emittance for the production of soft and hard x-rays. The linac injector will provide short pulses to a short pulse facility. In addition the MAX III ring and an upgraded MAX II ring will be reinstalled at the new locations. This solution allows the production of synchrotron radiation with optimal characteristics in a wide energy region, fulfilling the needs of most diverse research areas. The MAX IV design also includes an option for a Free Electron Laser as a second development stage of the facility.

Green Light for MAX IV - April 27th 2009

On April 27th at the Old Bishops House in Lund a Memorandum of Understanding was signed between the Swedish Research Council (VR), the Swedish Governmental Agency for Innovation Systems (VINNOVA), Lund University and Region Skåne, defining the start of the MAX IV project. These stakeholders represent a large fraction of the first phase investment costs. A consortium will be set up with the goal to break ground in 2010 for the first beamlines to be ready in 2015.

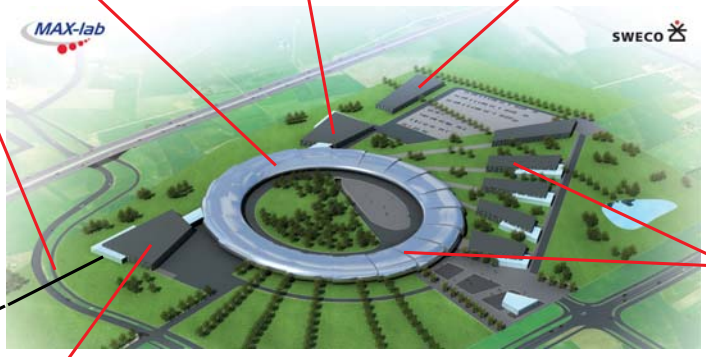
The MAX IV Facility

3 GeV storage ring (approx. 500 m in circumference)
The main storage ring will operate at 3 GeVwith full energy injection and top-up. The emittance is well below 1 nm rad. The ring will have 20 (long) straight sections.

Short Pulse Facility (SPF)
Compressed electron bunches (100 fs) directly from the linac will produce incoherent X-ray pulses. The SPF will use the linac most of the time as the top-up of the storage rings only uses a fraction of the time.

Free Electron Laser (FEL)
MAX IV is prepared to be expanded with a laser like light source in the future. This stage of the MAX IV is not included in phase I. The FEL will most likely be based on seeding.

Linear accelerator (approx. 250 m long)
A normal conducting 3 GHz linac with 2 bunch compressors and ejection at three energies will be used. 34 linac sections driven two-by-two from one klystron and a SLED cavity station will allow for a maximum energy of 3.4 GeV, providing a safety margin in operation.



Electron gun
A photo cathode RF gun will supply the Short Pulse Facility while the storage rings will be injected from either a thermionic or photo cathode RF gun.

Beamlines at the 3 GeV ring
19 long straight sections are available for beamlines including 2 damping wiggler sources. With the compact ring design it is not possible to install canted undulators but in addition a smaller number of short straight sections are available for insertion devices. The standard beamlines can be up to 50 m (ID centre to end of experiment hall floor) while a limited number of beamlines with significantly longer length is foreseen.

The MAX II and MAX III rings
The lower energy beamlines will be housed on the relocated MAX II and MAX III storage rings (electron energy 1.5 GeV and 0.7 GeV respectively but the energies of the upgraded and relocated rings might be different).

The MAX IV Storage Rings

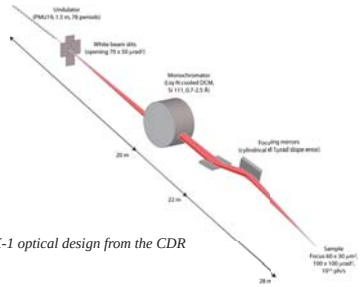
The MAX IV facility will consist of the new 3 GeV storage ring and the two translocated MAX II and MAX III rings covering the lower energy range. The MAX II ring will be upgraded though the details around the lower energy range facility is yet to be determined.

	Energy / GeV	Circumference m	Straight sections	Current A	Horizontal emittance nmrad	Vertical emittance nmrad
MAX IV 3-GeV	3.0	ca 500	20	0.5	0.24	0.009
MAX II (today)	1.5	90	10	0.3	8.8	0.9
MAX II (upgraded)	1.0	90	10	0.5	4.5	0.05
MAX III	0.7	36	8	0.28	13	-

Macromolecular Crystallography at MAX IV

The Conceptual Design Report for MAX IV published in 2006 suggested two macromolecular crystallography beamlines:
MX-1 High-throughput
MX-2 Microfocus.

The detailed design of the two suggested beamlines is being prepared. One of the important questions is at what beam size the micro-focus beamline should aim.



The MX-1 optical design from the CDR

MX-1 High-throughput (from CDR)

Insertion device	In-vacuum, 19 mm period
Flux at 1st optical element*	5 x 10^{14} photons/s/0.1%bw
Heat load at 1st optical el.*	8 W/mm^2
Wavelength range	0.7 - 2.5 Å
Flux at sample*	1 x 10^{13} ph/s
Beam size at sample	60 x 30 µm^2
Beam divergence at sample	0.1 x 0.1 mrad^2
*At 1 Å	

MX-2 Micro-focus (from CDR)

Insertion device	In-vacuum, 19 mm period
Flux at 1st optical element*	1 x 10^{15} photons/s/0.1%bw
Heat load at 1st optical el.*	15 W/mm^2
Wavelength range	0.7 - 2.0 Å
Flux at sample*	2 x 10^{13} ph/s
Beam size at sample	10 x 7 µm^2
Beam divergence at sample	0.8 x 0.4 mrad^2
*At 1 Å	

The coming MAX-lab User's Meeting will take place November 2nd - 4th 2009 and will focus on MAX IV. It will be an excellent opportunity for users to discuss and express their views on the future facilities at MAX IV, but will also cover the science and operation of the present facilities.

For more information:
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