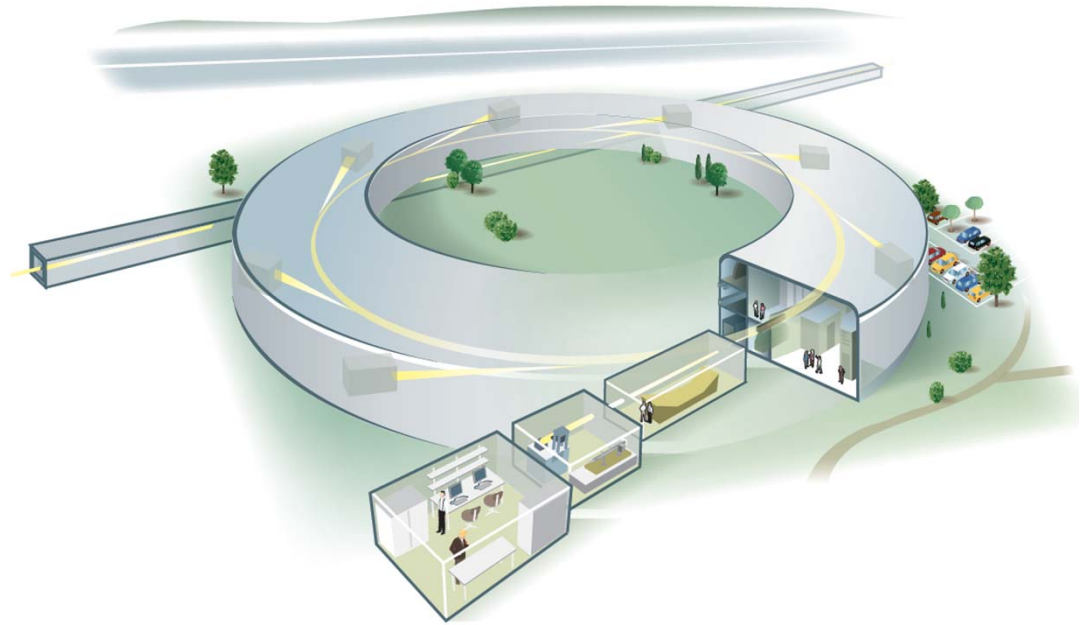




The MAX IV project

Sverker Werin
Lund University, MAX-lab





MAX-lab



The image is an aerial architectural rendering of the MAX IV facility. The central feature is a large, circular, blue-tinted structure, likely the storage ring, surrounded by green landscaping and several rectangular buildings. A road runs along the top and right sides of the facility, and a small pond is visible on the right. The overall scene is set in a green, rural-like environment.

The MAX IV facility

Approval and starting date 27 April 2009

3.5 GeV linac with Short Pulse Facility

3 GeV storage ring

1.5 GeV storage ring

MAX-lab



MAX-lab → “The MAX IV laboratory”



Chair of the board Prof.
Lars Börjesson,
Gothenburg University



Director Prof. Sine Larsen,
Copenhagen University



Science Director Prof.
Jesper Andersen, Lund
University



Machine Director Prof.
Mikael Eriksson, Lund
University/MAX-lab



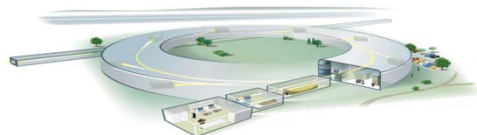
Administrative Director
Bamse

MAX IV facility overview

3.4 GeV linac
(SPF, **FEL**)
~ 300m

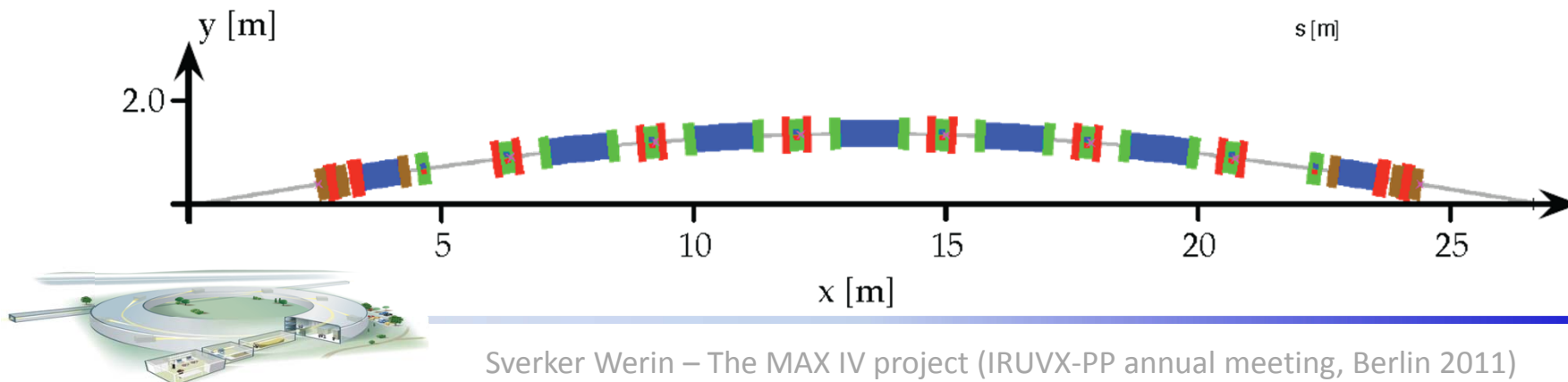
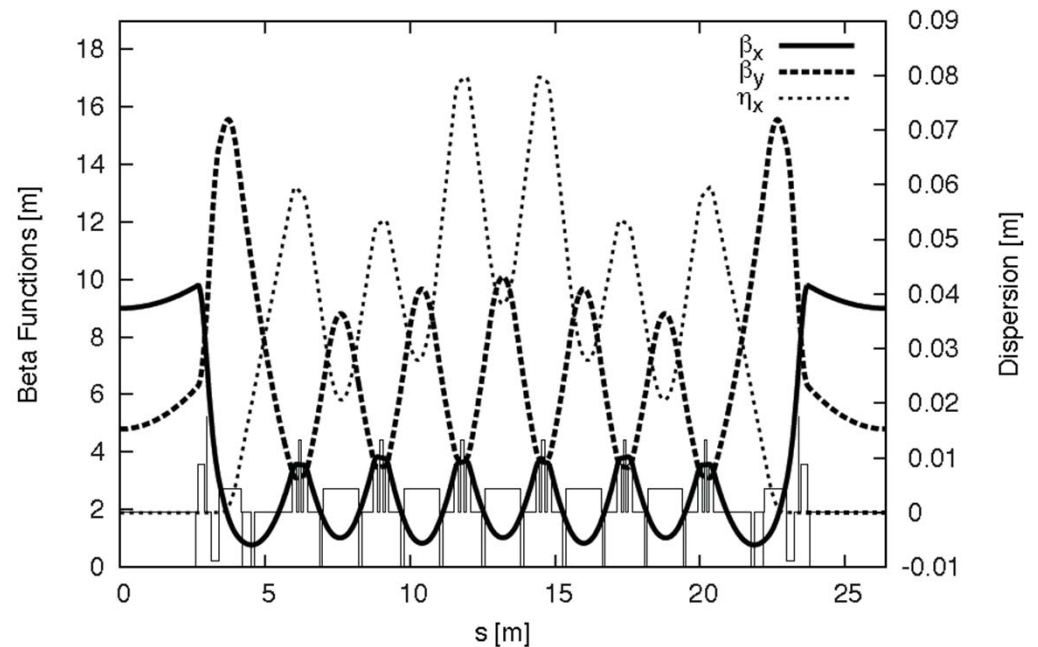
1.5 GeV SR
(IR/UV)
96 m, 12 DBAs
 $\epsilon_x = 6 \text{ nm rad}$

3 GeV SR
(X-ray)
528 m, 20 MBAs
 $\epsilon_x < 0.3 \text{ nm rad}$

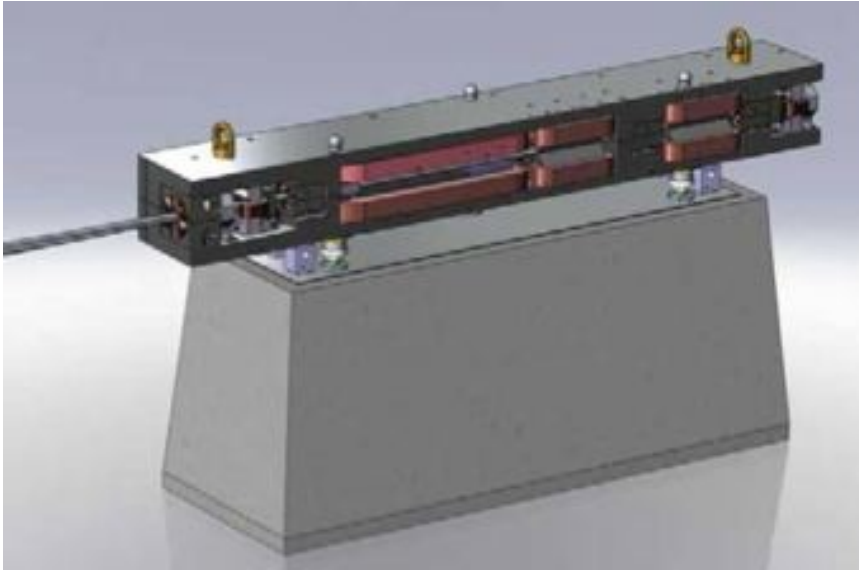


MAX IV - 3 GeV ring

Energy [GeV]	3.0
Main radio frequency [MHz]	99.931
Circulating current [mA]	500
Circumference [m]	528
Number of achromats	20
# of straights available for IDs	19
ε_x (bare lattice) [nmrad]	0.326
ε_x (with 4 PMDWs) [nmrad]	0.263

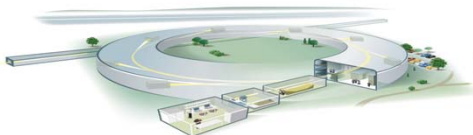
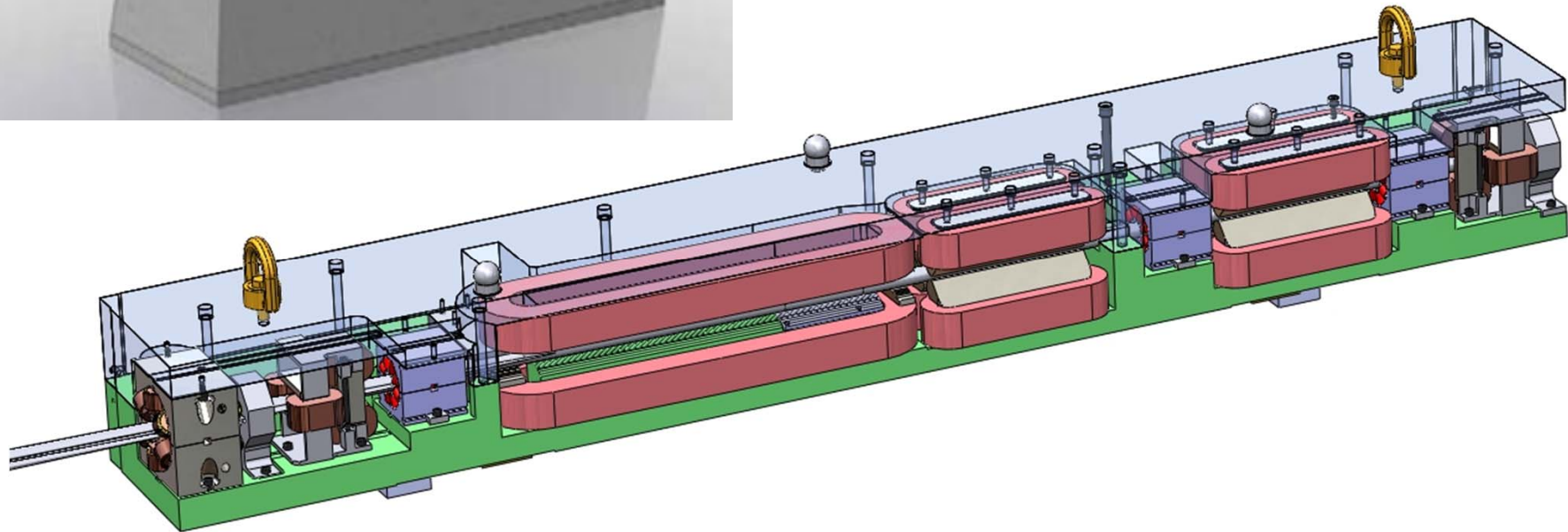


MAX IV - 3 GeV ring

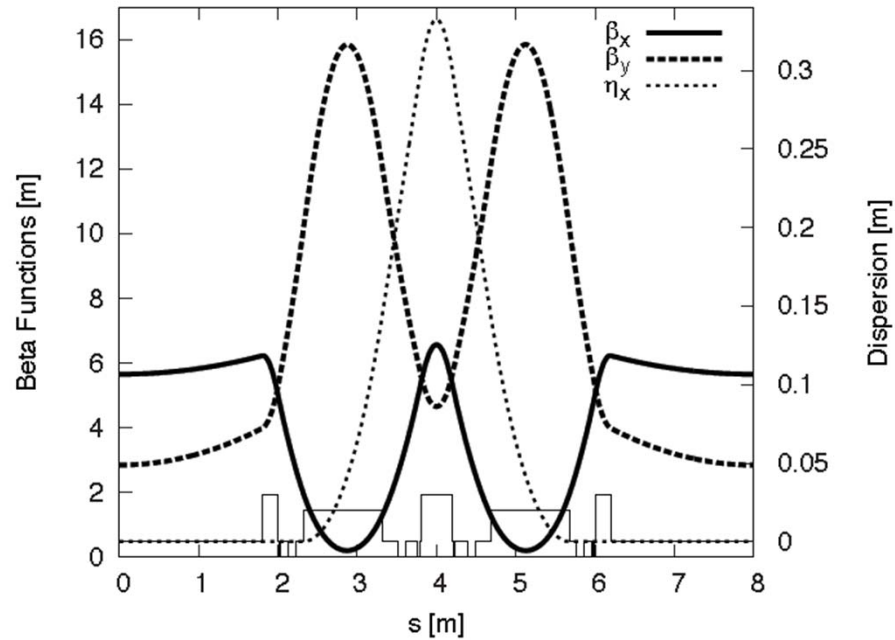


Sample of features

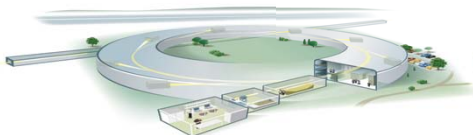
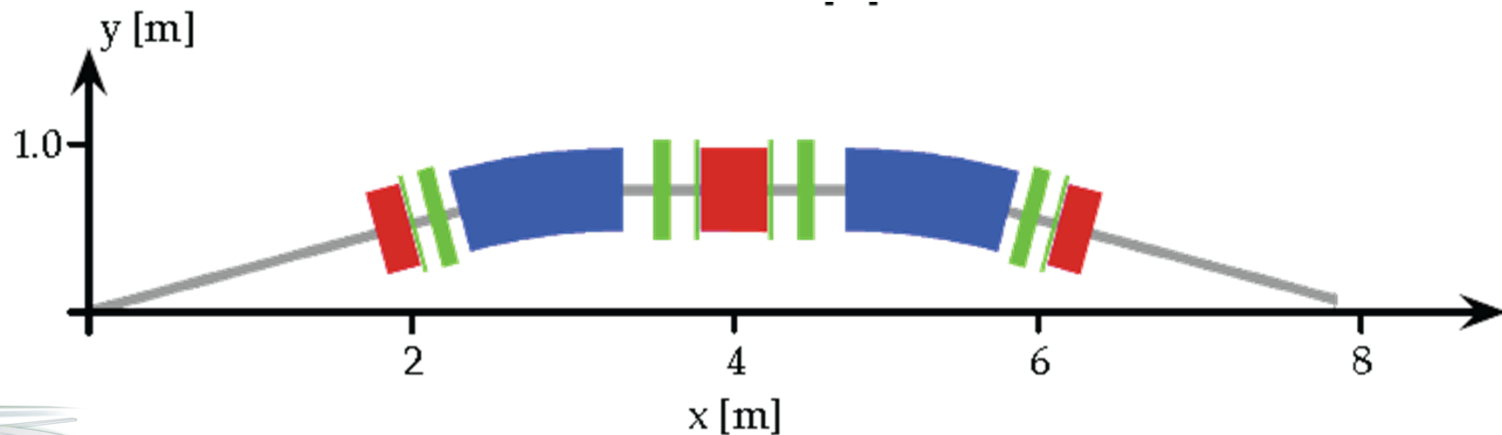
Fully-integrated magnet design in all cells
NEG-coated Cu vacuum chamber



MAX IV – 1.5 GeV ring



Energy [GeV]	1.5
Main radio frequency [MHz]	99.931
Circulating current [mA]	500
Circumference [m]	96
Number of achromats	12
Length of straight section [m]	3.5
ϵ_x (bare lattice) [nmrad]	6.00



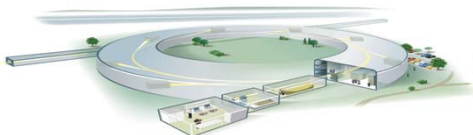
Preparation of the *two* sites



Swedish occupation
of Krakow 1655



Swedish occupation
of Lund 1658
(keeping the Danes out 1676)



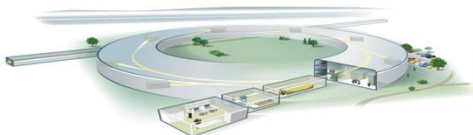
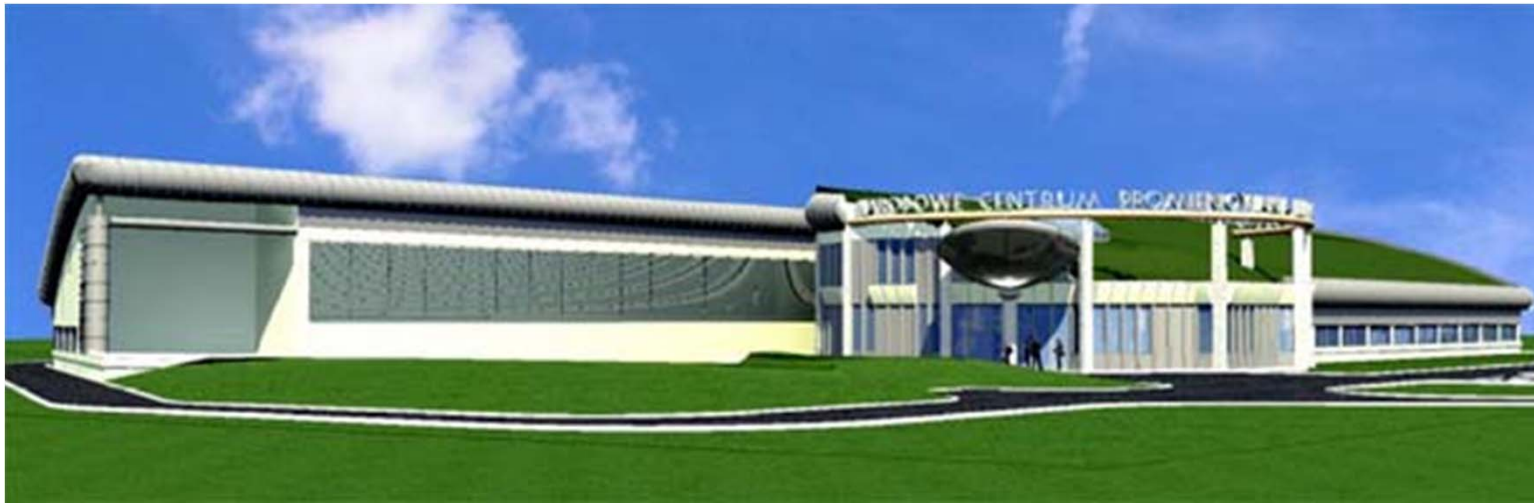


JAGIELLONIAN
UNIVERSITY
IN KRAKÓW



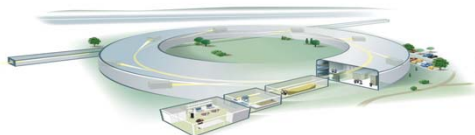
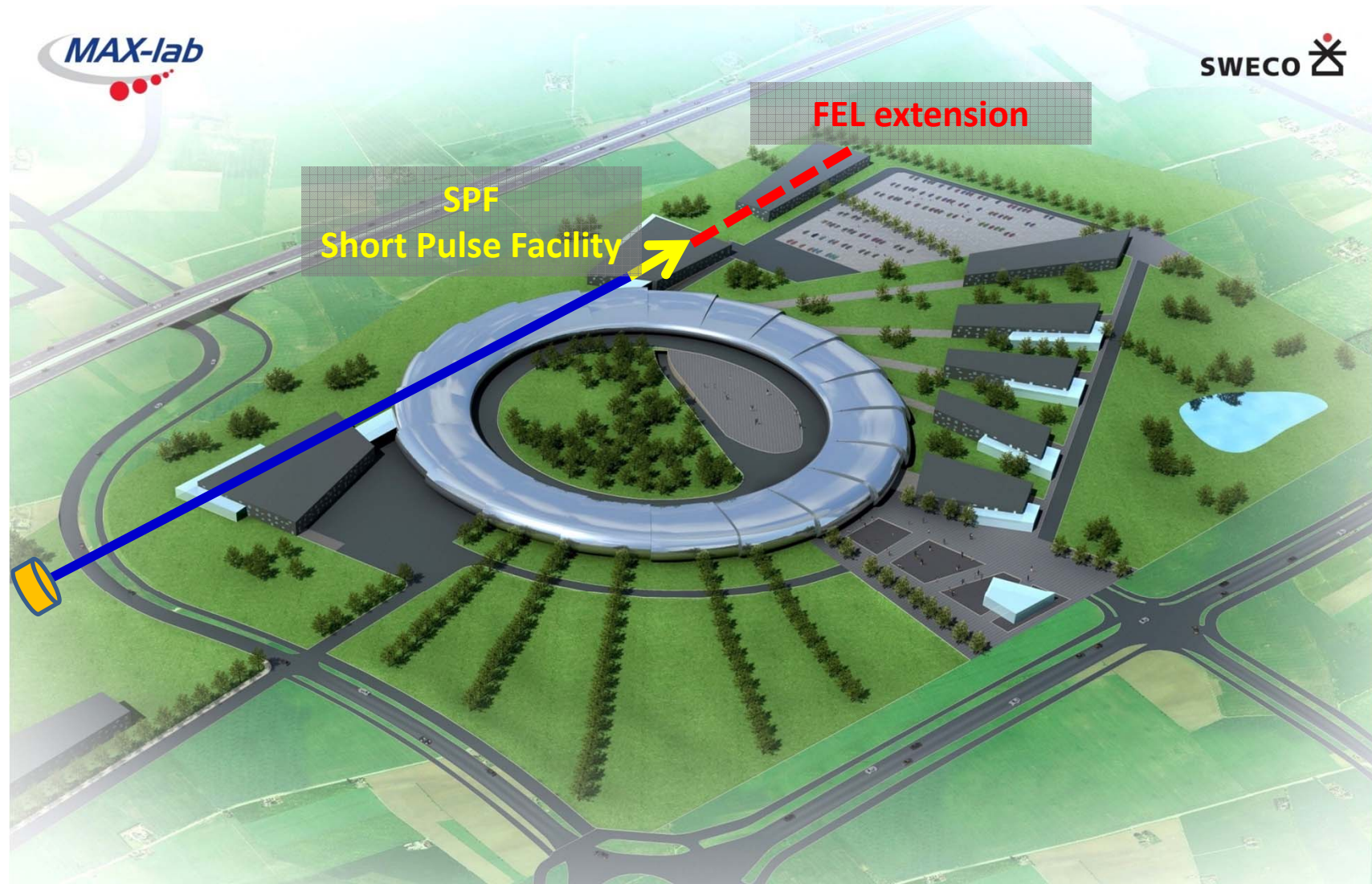
Centrum Promieniowania Synchrotronowego

Solaris, Kraków

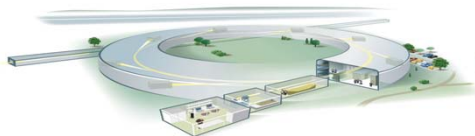
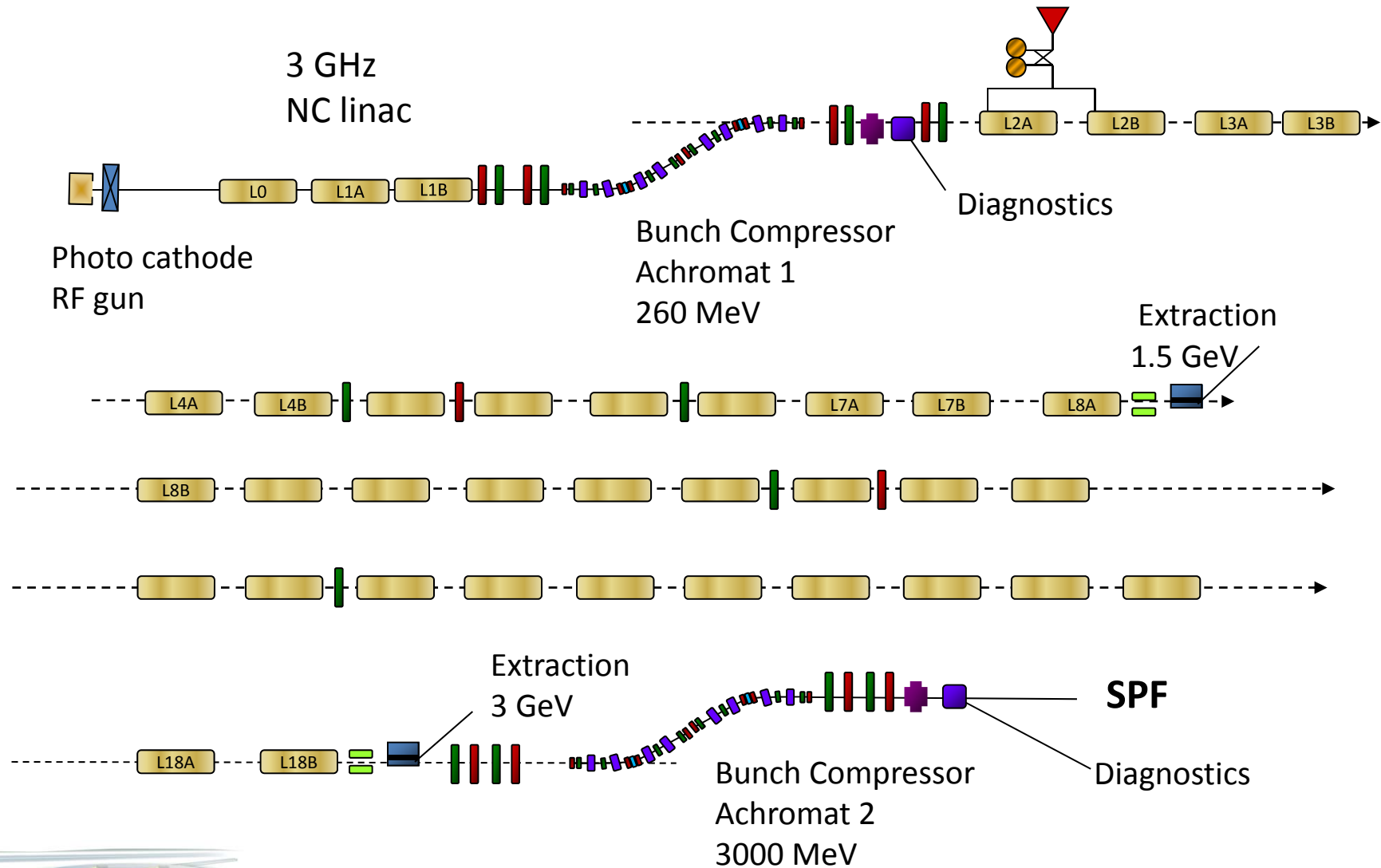


Sverker Werin – The MAX IV project (IRUVX-PP annual meeting, Berlin 2011)

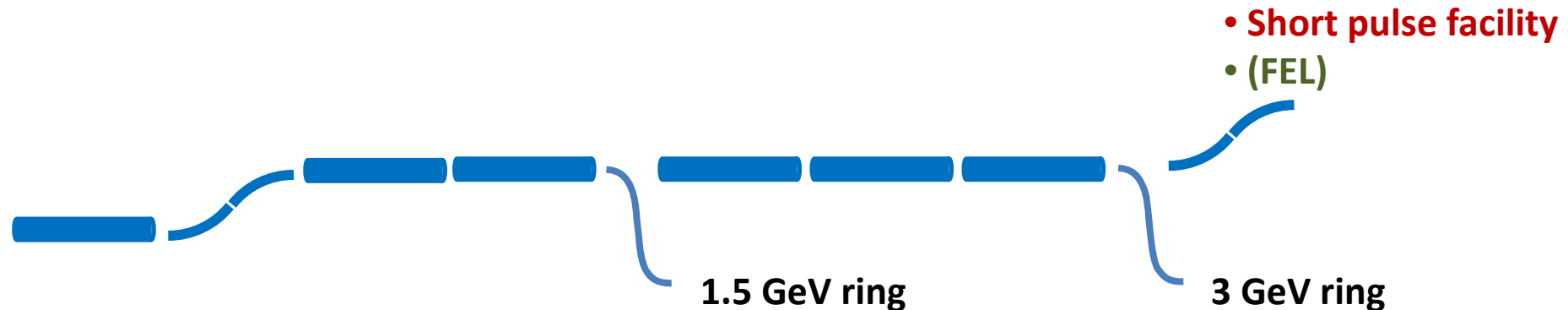
The MAX IV Injector



Schematic layout - MAX IV Injector



Different modes for the injector



Injection and top up for the two rings

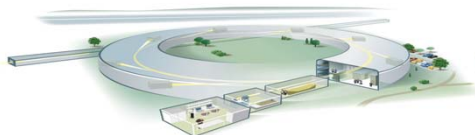
- 1.5 GeV and 3 GeV
- 300 pC charge (3x100 pC)
- ~ 660 ps pulse length
- (~ 0.4 mm mrad emittance)

High brightness injector for SPF

- 3 GeV
- 100 pC
- <100 fs clean pulses
- < 10 mm mrad

FEL (phase two)

- lower emittance
- lower peak current



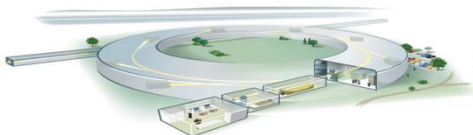
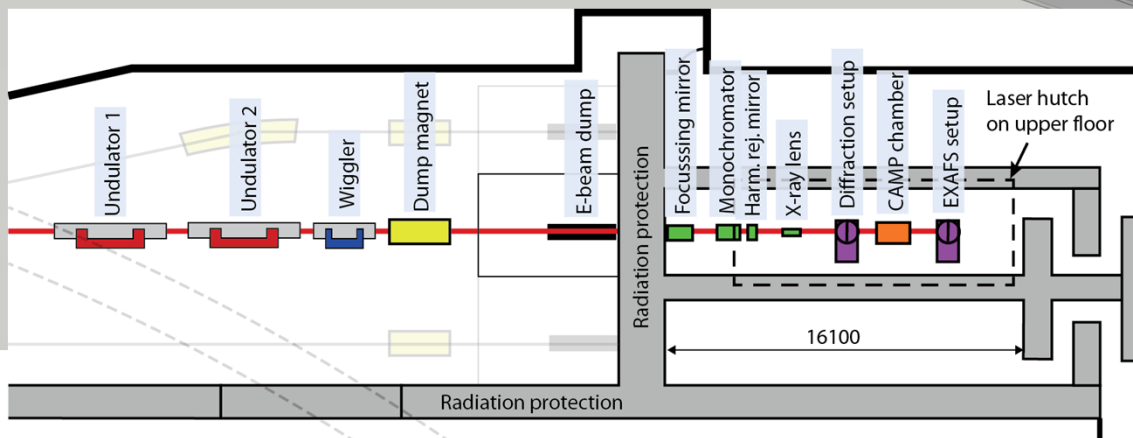
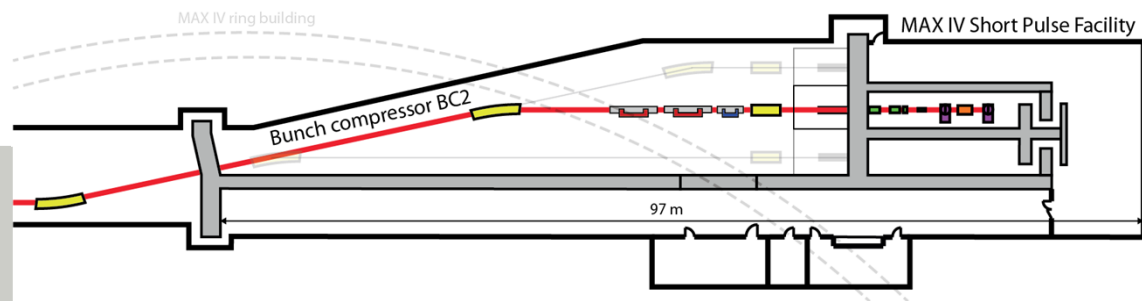
The SPF facility

X-rays

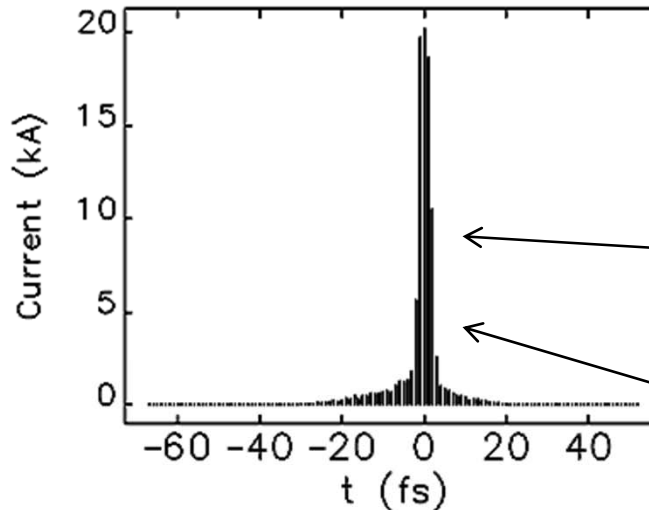
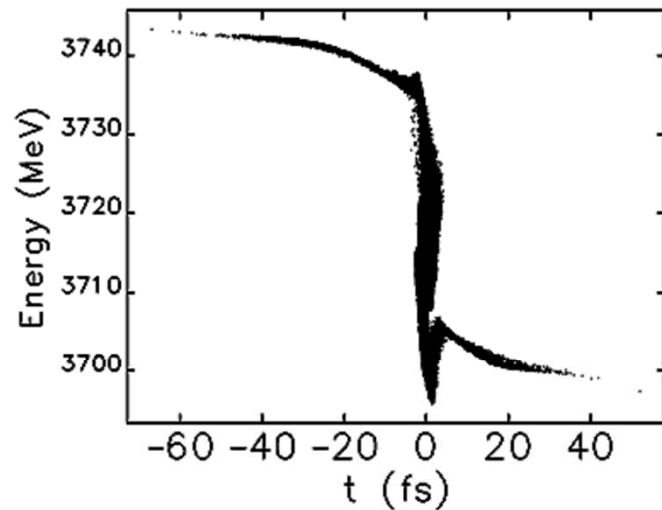
100 fs

Spontaneous U radiation

Priority as beamline 2-5

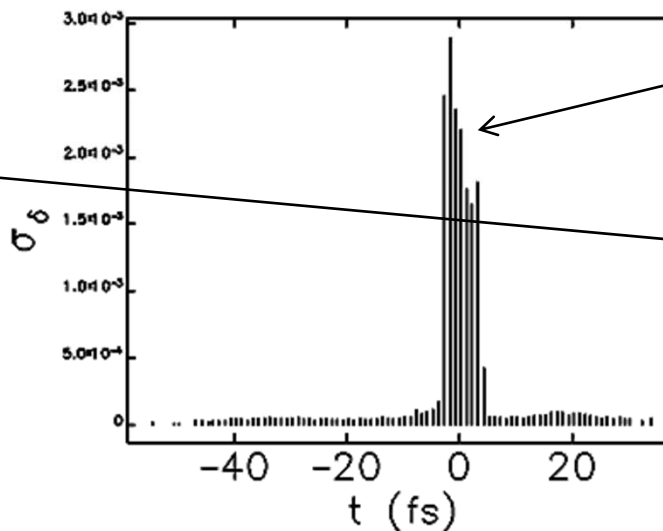
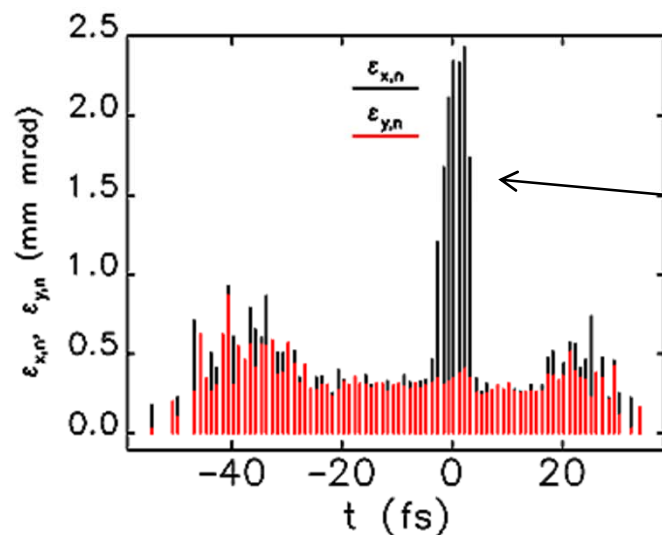


SPF optimised pulse



$I \sim 18$ kA

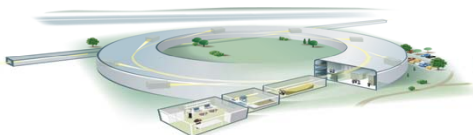
$\Delta t \sim 10$ fs FWHM



$dE/E \sim 0.25$ %

$\epsilon \sim 2.5$ mm mrad

Results by Sara Thorin

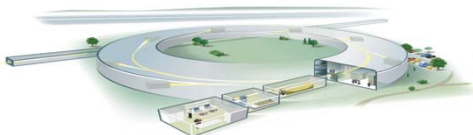


Time schedule

	2010	2011	2012	2013	2014	
Linac building		→				
Linac installation			→			
Linac commissioning				→		
Linac operation					→	

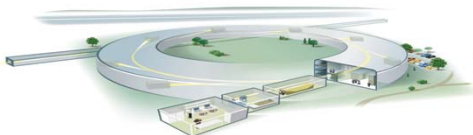
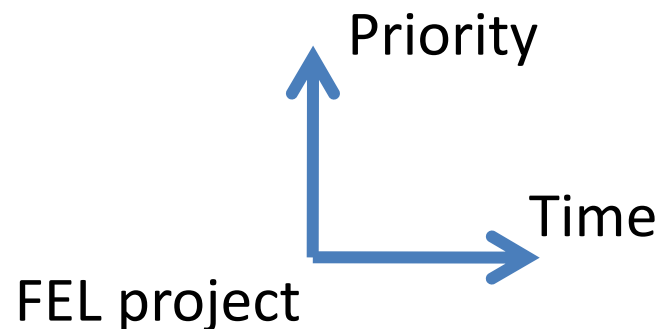
Procurement, contract and order

- ✓ Accelerating structures – Research Instruments
- ✓ RF-units - Skandinova
- ✓ Gun laser– KM labs
 - Electron gun + diagnostics line test stand in progress.
 - Cooling system test stand in progress.

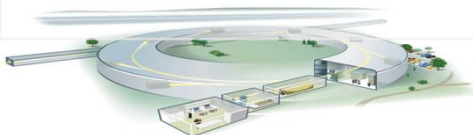
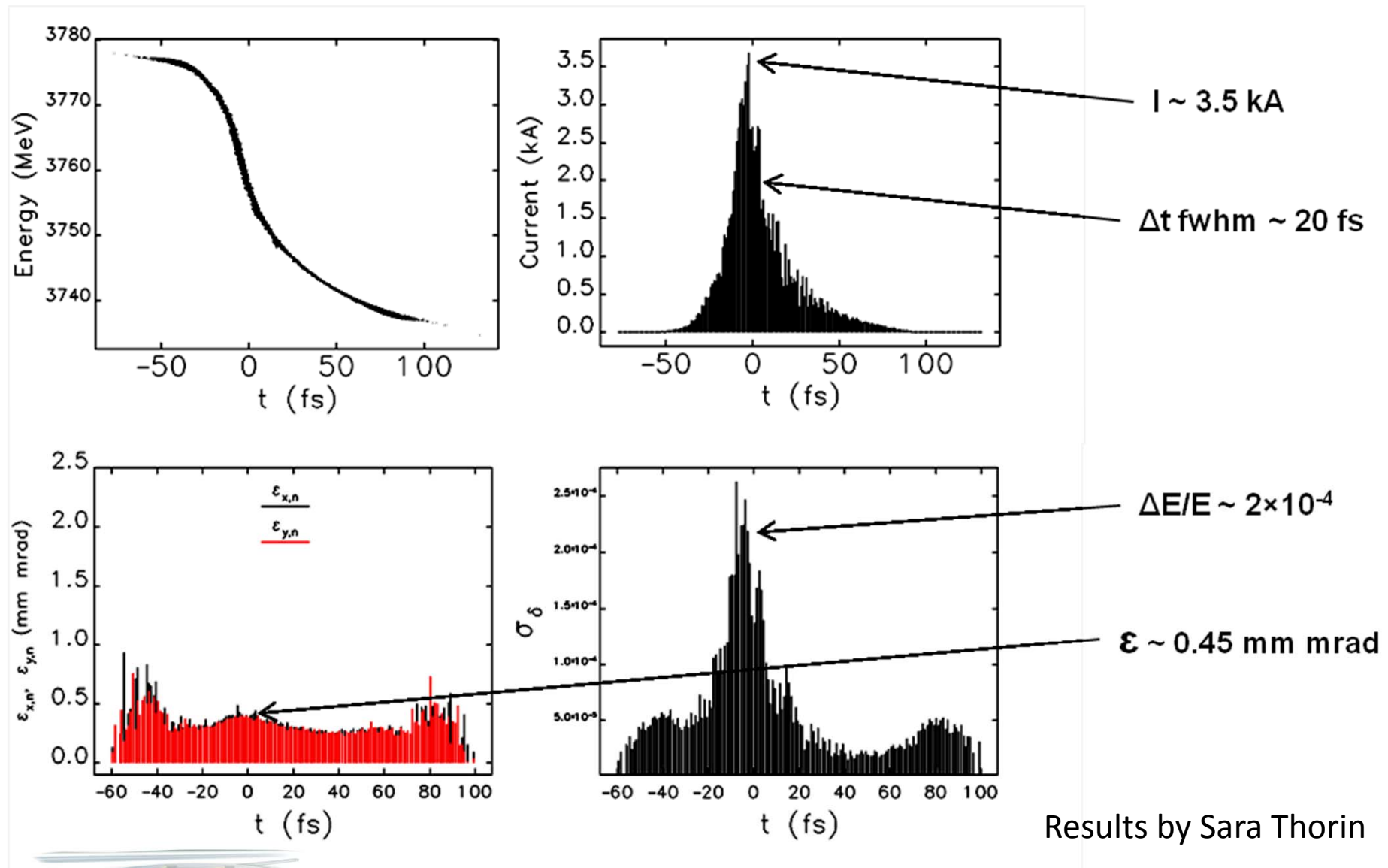


MAX IV FEL PROJECT

- Phase II of the MAX IV project
- The linac is built to be able to drive an FEL
- Wavelength range to be defined
- Primary target X-rays by extending the linac.
- Scientific vision “MAX IV 2020 and beyond” (2011)

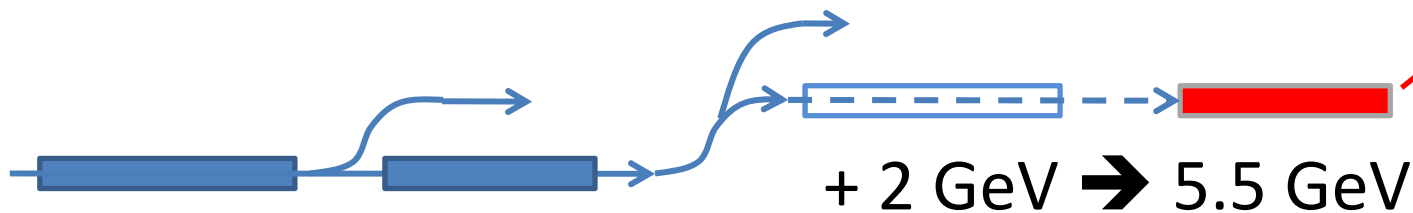
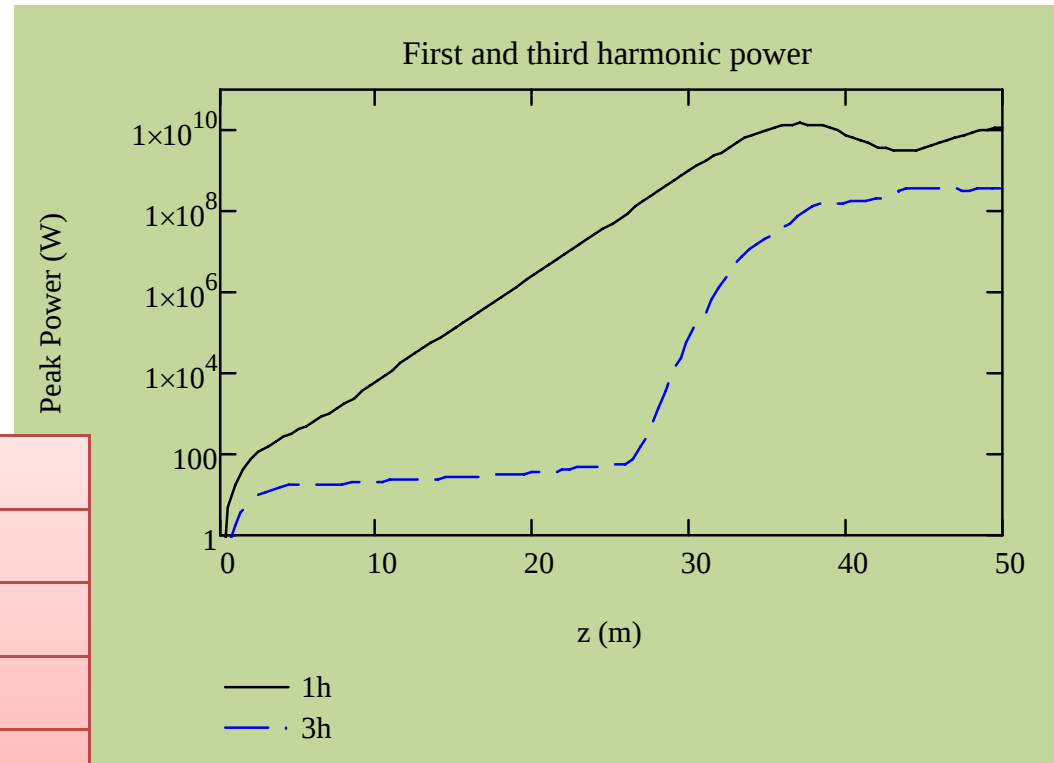


FEL optimised pulse

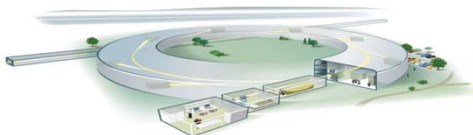


FEL-4 (X-ray)

First harmonic	0.176	nm
Electron energy	5500	MeV
Undulator period	2	cm
K	1.5	
I peak	3400	A
Energy spread	0.02	%
Emittance (norm)	0.4	mm mRad



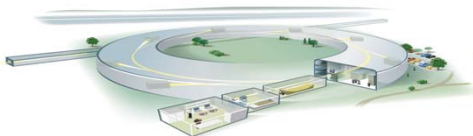
FEL-4
SASE
1-0.15 nm



2010 Nov 22
Ceremonial casting



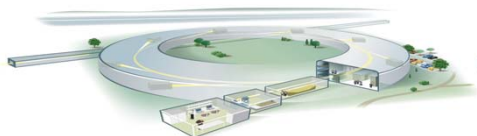
Photo Annika Nyberg



Sverker Werin – The MAX IV project (IRUVX-PP annual meeting, Berlin 2011)



Thank you!



Sverker Werin – The MAX IV project (IRUVX-PP annual meeting, Berlin 2011)