

# MAX IV - status and brief inside view

Bernhard Meirose (MAX IV)



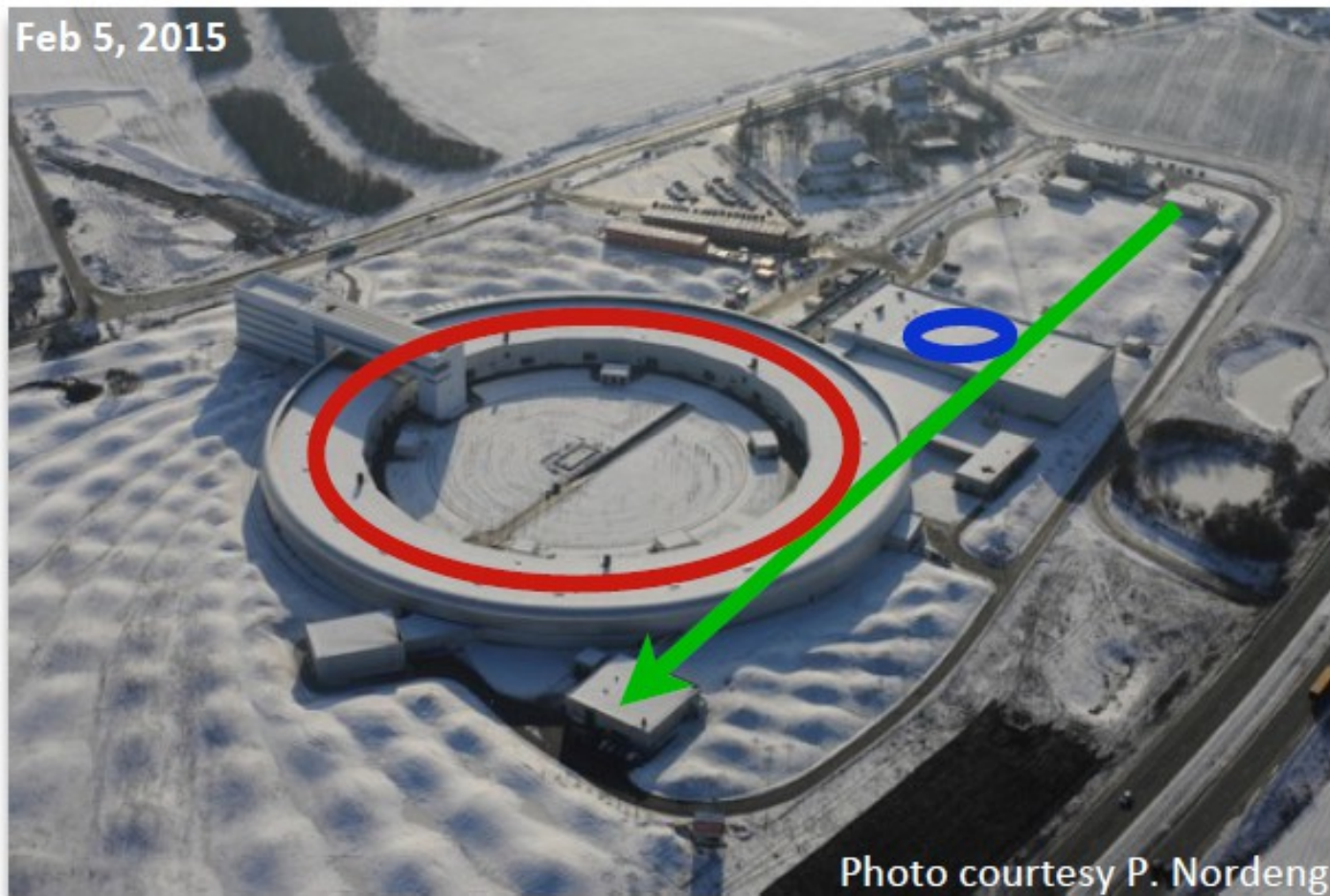
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# The MAX IV Facility



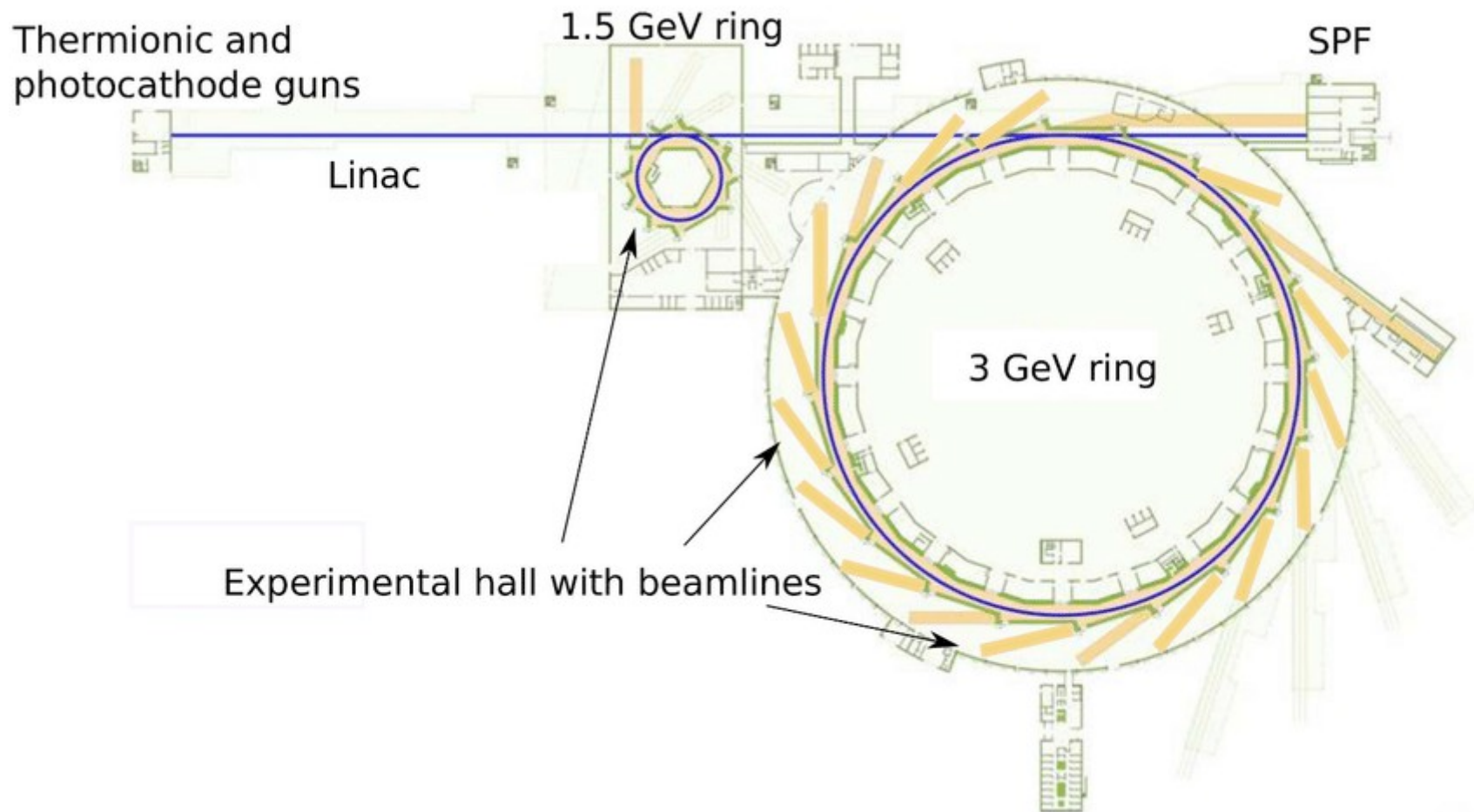
# The MAX IV Facility

- One linac
- Two separate storage rings at 1.5 GeV (UV) and 3 GeV (x-rays)



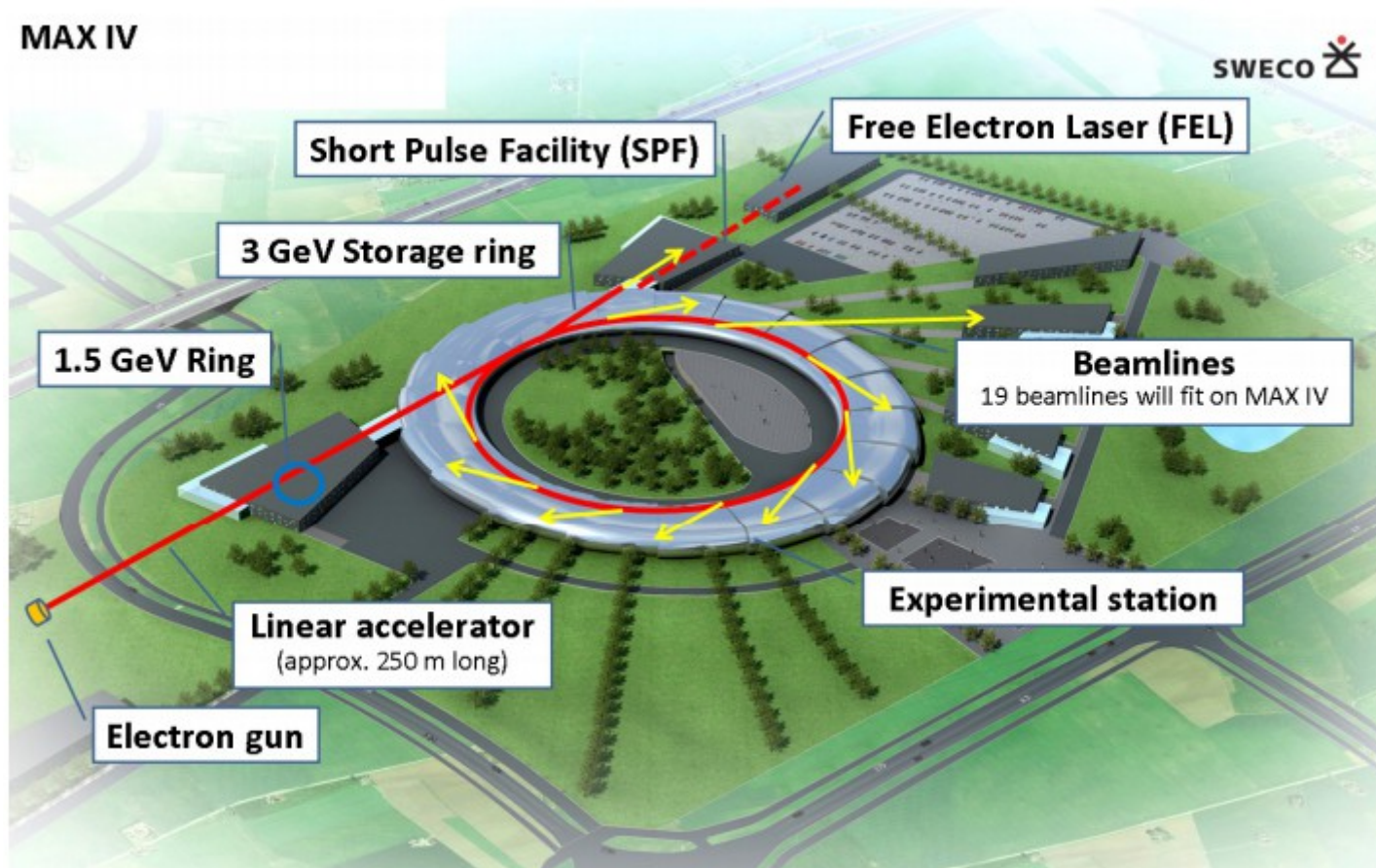
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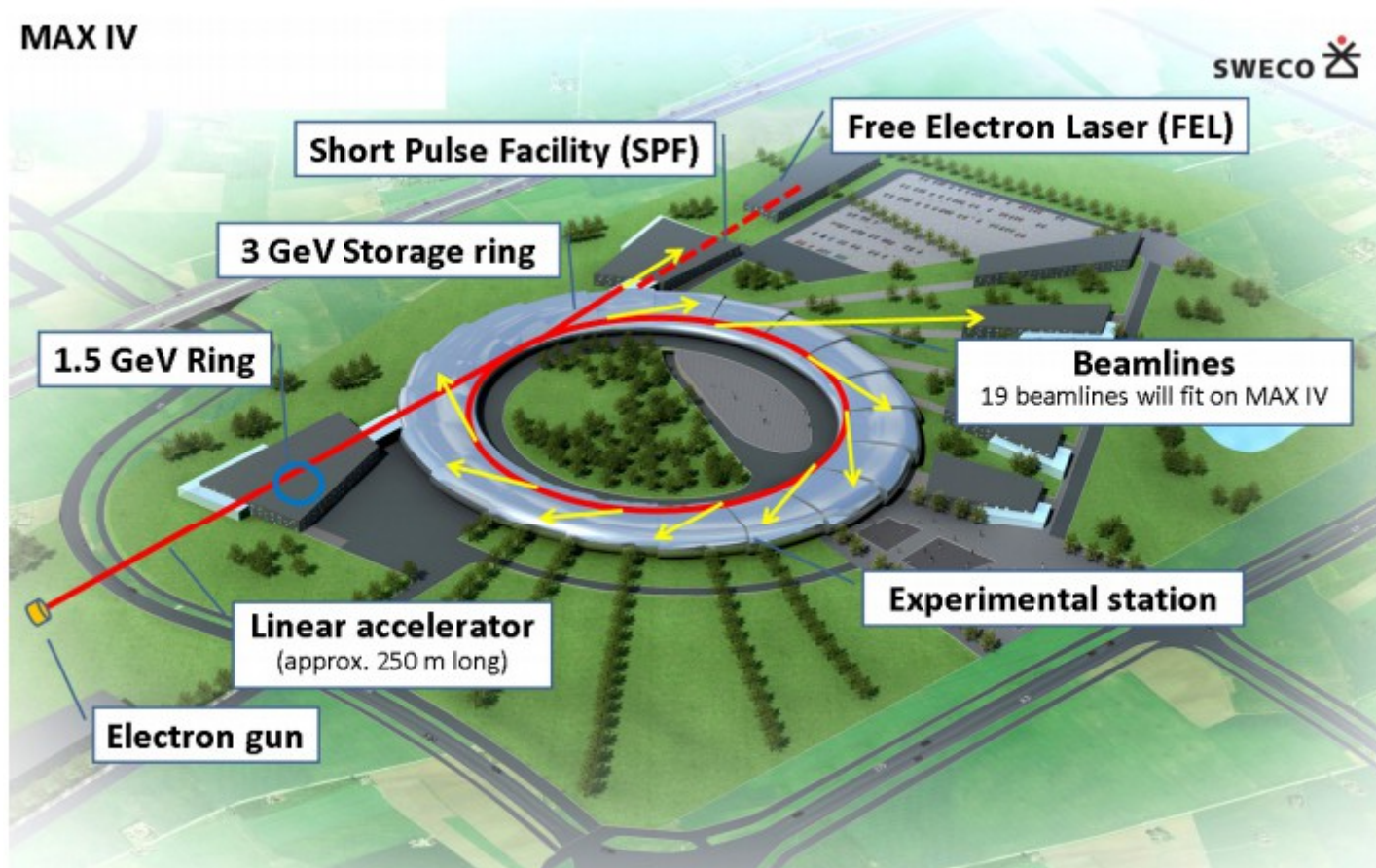
# Status

- Total of 16 beamlines funded to date
- BioMAX, Hippie, NanoMAX: operational and receive regular users
- Bloch and FinEstBeAMS: receiving first friendly users for commissioning

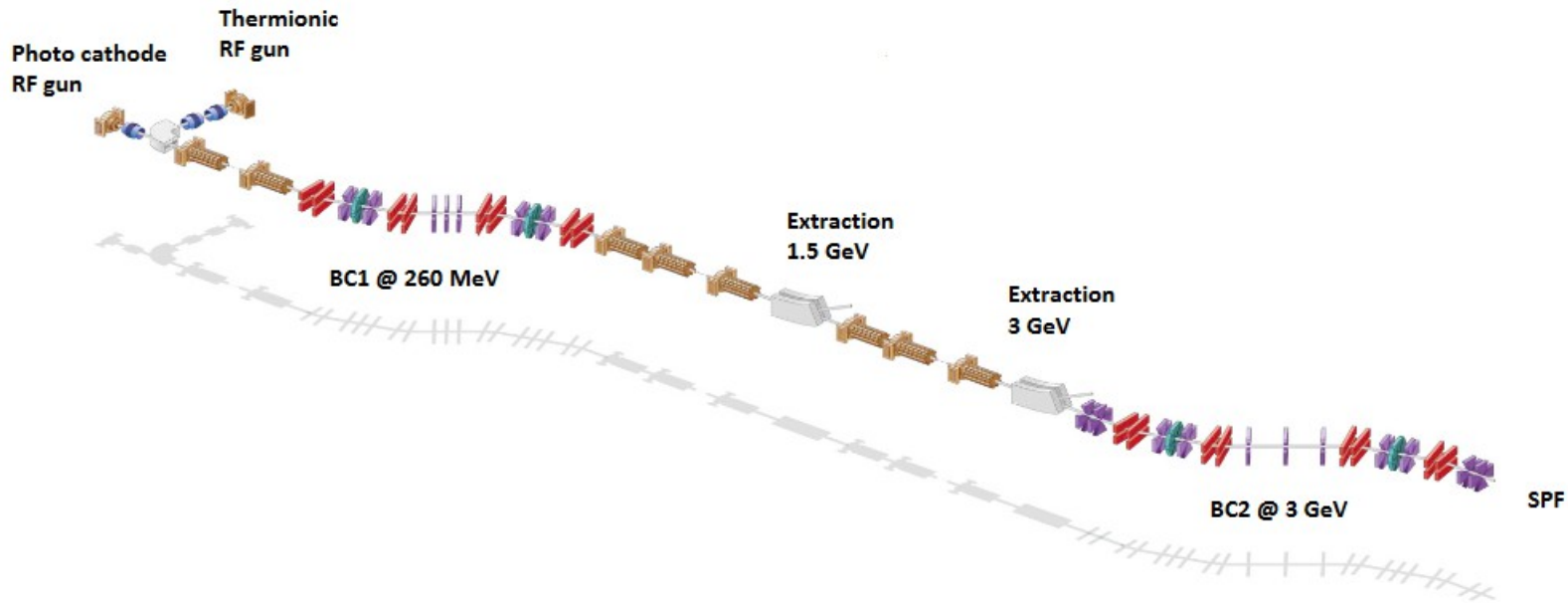


# Status

- Balder and Veritas: will receive first friendly users (commissioning) in 2019
- From January 2017 to August 2018: more than 300 users did 450 visits



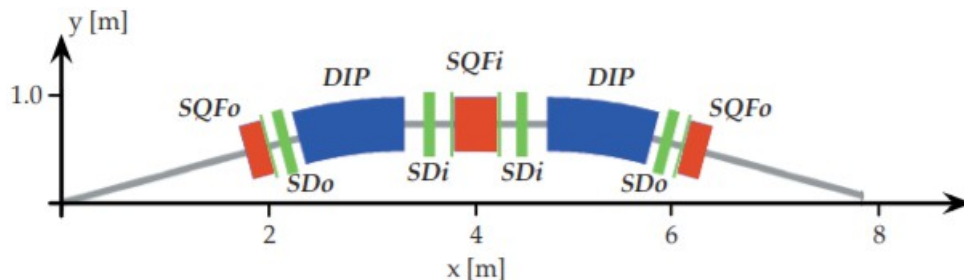
# Linac (~ 300m)



- Continuous top-up injector to both storage rings
- Also accelerates and compresses electron bunches for the SPF
- Photo-RF gun for SPF pulses
- Thermionic RF gun for storage ring injection
- Design repetition rate as ring injector: 10 Hz (current: 2 Hz)
- Design repetition rate for SPF: 100 Hz (current: 2 Hz)
- Energy spread  $< 0.4\%$

# 1.5 GeV Storage Ring (R1)

- Circumference 96 m
- 500 mA design store current (currently at 200-300 mA)
- Double bend achromat lattice
- 12 achromats 8 m long (10 ID)
- Compact magnet block
- low radio-frequency (100 MHz  $\rightarrow$  max. 32 bunches spaced by 10 ns)



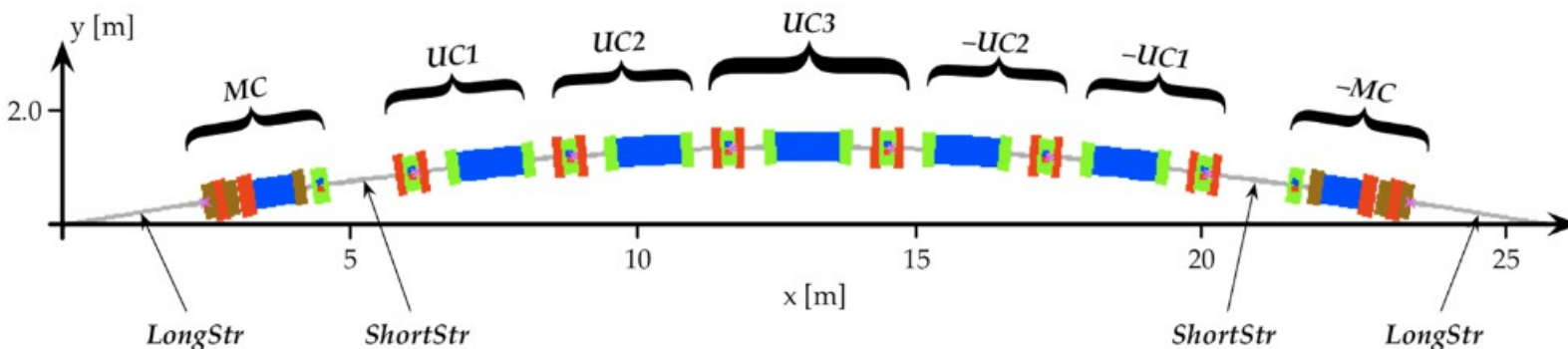
2 dipoles,  
Bending angle:  $30^\circ$   
Bending radius: 3.8 m



# 3 GeV Storage Ring (R3)



- Circumference 528 m
- 500 mA design store current (currently at 150-200 mA)
- 7-bend achromat lattice
- 20 achromats 26.4m long (19 ID)
- Compact magnet block
- low radio-frequency (100 MHz  $\rightarrow$  max. 176 bunches spaced by 10 ns)
- Current \* Lifetime  $>$  3 A·h



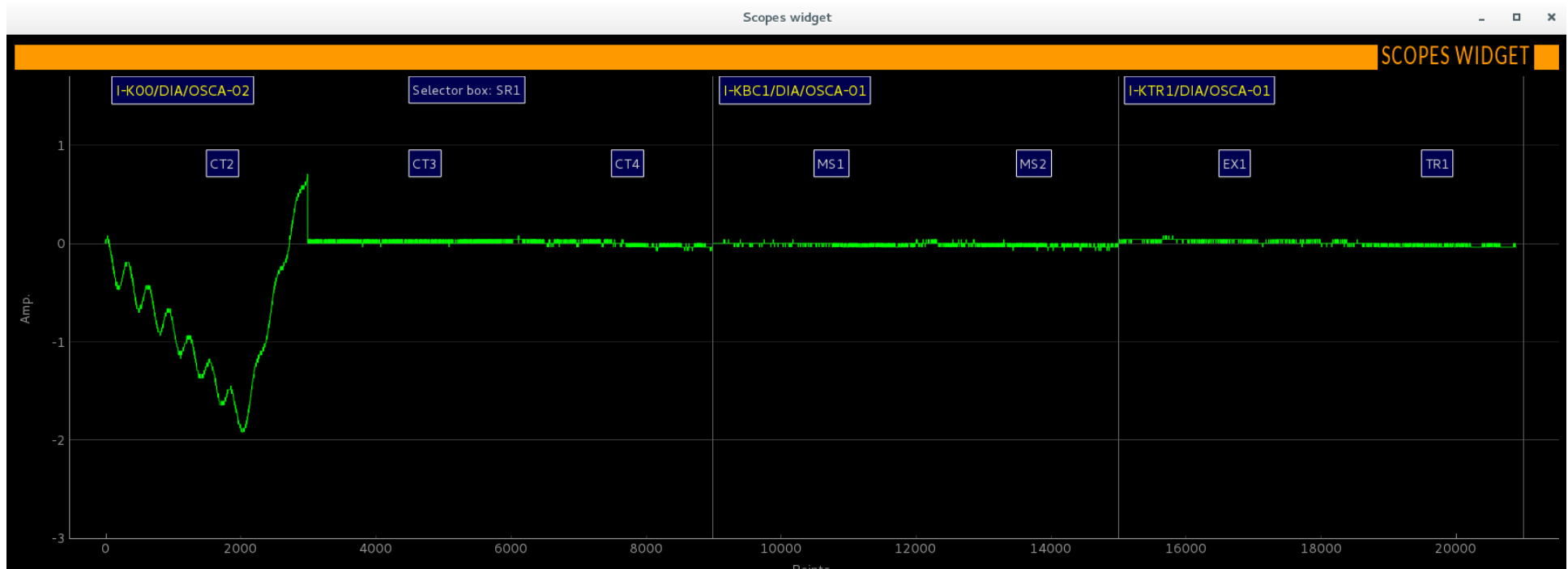
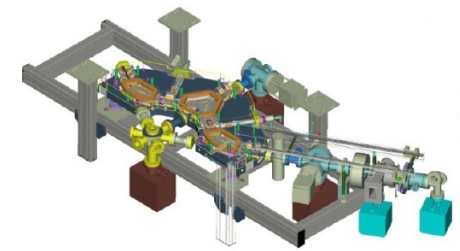
7 dipoles,  
Bending angle:  $18^\circ$   
Bending radius: 19 m

# 3GeV Ring State Grid

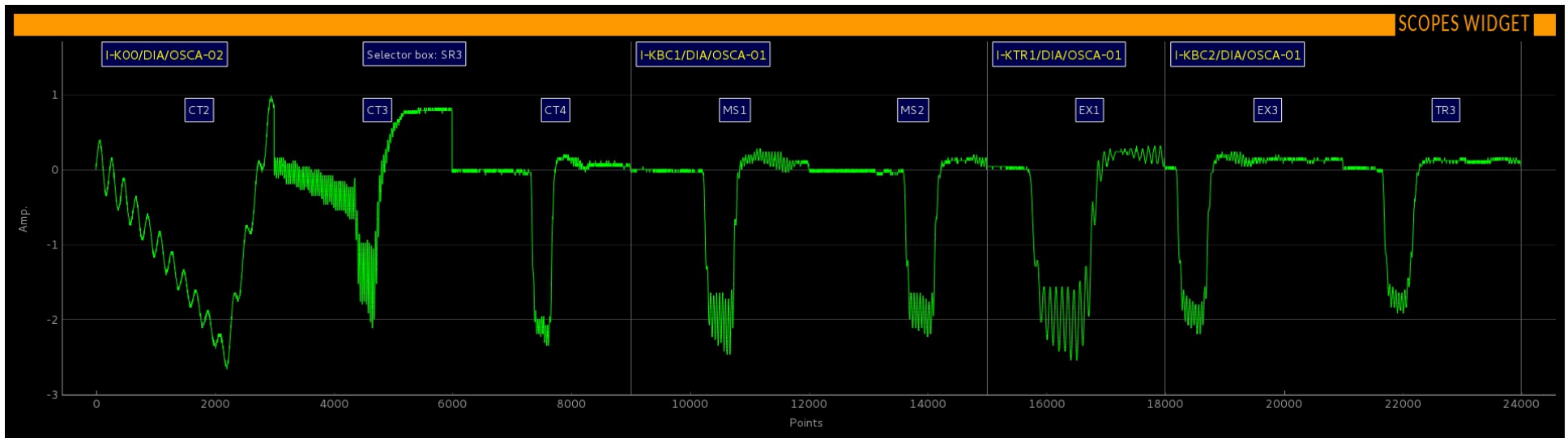
StateGrid 1.0.8 3 GeV ring

3 GeV ring		VAC R Pumps	VAC R Valves	VAC FE Pumps	VAC FE Inserts	VAC FE	MAG	RF	TIM	DIA	DIA TCO	DIA BPM	DIA Inserts	WAT	PSS	MPS	CTL	
301	6/6 ON	4/4 CLOSE					2/145 STANDBY	2/3 RUNNING	5/5 ON	1/3 UNKNOWN	26/26 ON	11/11 ON	4/4 ON	21/21 ON		3/3 ON	301	
302	4/4 ON	2/2 CLOSE	ON	4/4 CLOSE			143/143 ON		3/3 ON		35/35 ON	10/10 ON		21/21 ON		3/3 ON	302	
303	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE	CLOSE		143/143 ON		3/3 ON		48/48 ON	10/10 ON		21/21 ON		3/3 ON	303	
304	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		21/21 ON		2/2 ON	304	
305	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		21/21 ON		2/2 ON	305	
306	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE			147/147 ON		3/3 ON		30/30 ON	10/10 ON		21/21 ON		2/2 ON	306	
307	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		21/21 ON		2/2 ON	307	
308	5/5 ON	2/2 CLOSE	ON	2/2 CLOSE	CLOSE		147/147 ON		4/4 ON		2/51 UNKNOWN	10/10 ON		21/21 ON		1/4 ALARM	308	
309	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		21/21 ON		2/2 ON	309	
310	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE			2/145 ALARM		1/4 NA		32/32 ON	10/10 ON		21/21 ON		2/2 ON	310	
311	4/4 ON	4/4 CLOSE	ON	2/2 CLOSE	CLOSE		143/143 ON		3/3 ON		48/48 ON	10/10 ON	ON	21/21 ON		3/3 ON	311	
312	4/4 ON	2/2 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		21/21 ON		2/2 ON	312	
313	5/5 ON	3/4 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		22/22 ON		3/3 ON	313	
314	4/4 ON	3/4 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		22/22 ON		3/3 ON	314	
315	5/5 ON	3/4 CLOSE	ON	2/2 CLOSE			143/143 ON		3/3 ON		30/30 ON	10/10 ON		22/22 ON		4/4 ON	315	
316	5/5 ON	2/4 CLOSE	ON	2/2 CLOSE	CLOSE		143/143 ON	ON	3/3 ON		33/33 ON	10/10 ON		26/26 ON		1/5 ALARM	316	
317	5/5 ON	2/4 CLOSE	ON	2/2 CLOSE	CLOSE		143/143 ON	2/3 RUNNING	3/3 ON		33/33 ON	10/10 ON		26/26 ON		1/5 ALARM	317	
318	4/4 ON	3/4 CLOSE	ON	2/2 CLOSE			143/143 ON	ON	3/3 ON		30/30 ON	10/10 ON		1/22 ALARM		1/3 ALARM	318	
319	4/4 ON	3/4 CLOSE	ON	2/2 CLOSE			143/143 ON	1/3 ALARM	4/4 ON	1/2 ALARM	30/30 ON	10/10 ON		1/22 OFF		3/3 ON	319	
320	6/6 ON	3/4 CLOSE	ON	3/5 CLOSE			149/149 ON	ON	3/3 ON	RUNNING	34/34 ON	10/10 ON		22/22 ON		4/4 ON	320	
PLC		20/20 RUNNING					40/40 RUNNING							RUNNING			PLC	
Alarm							ON								ON	2/5 ALARM	Alarm	
Global								1/4 RUNNING				ON					1/3 ALARM	Global

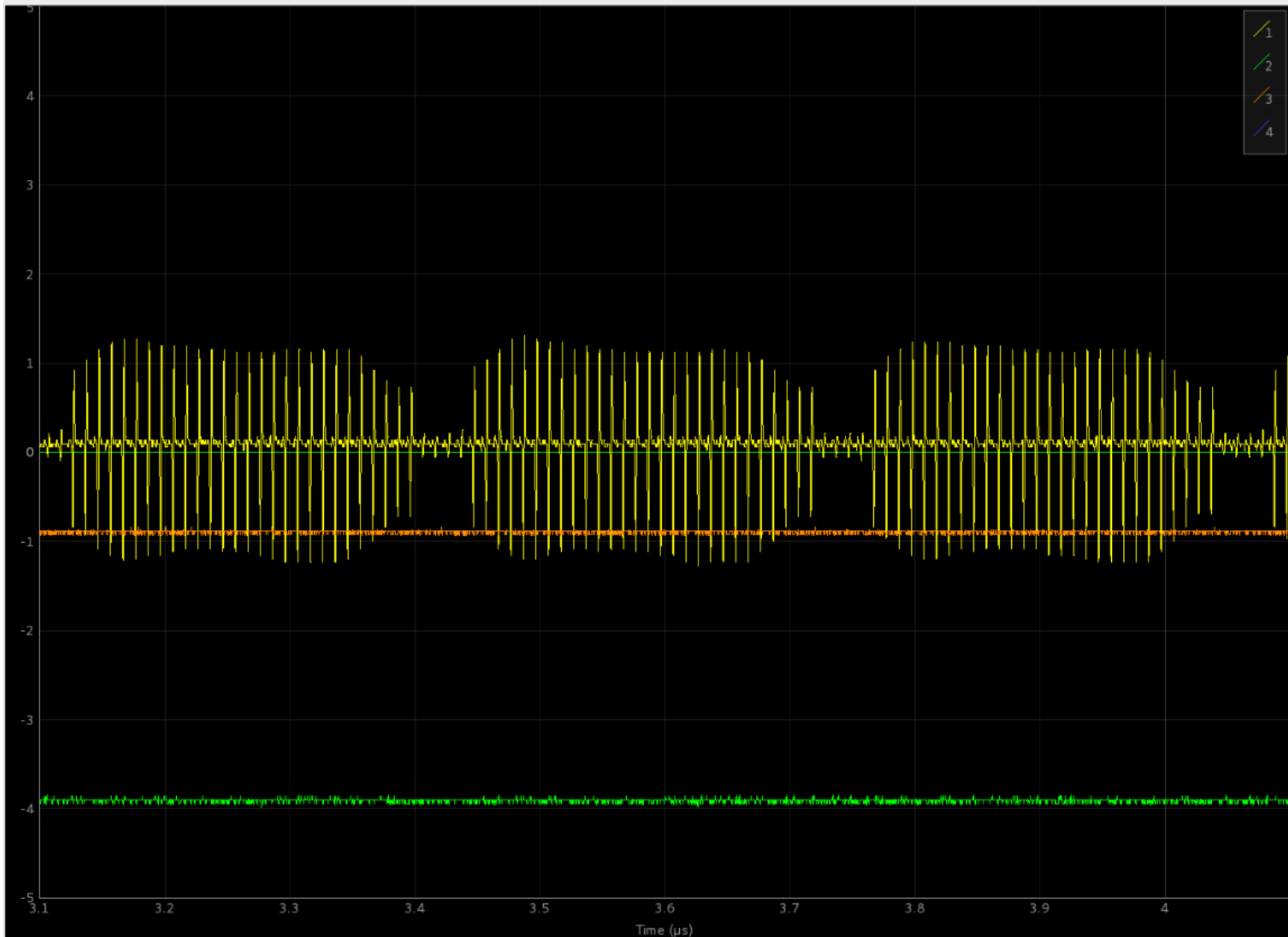
# Thermionic Gun



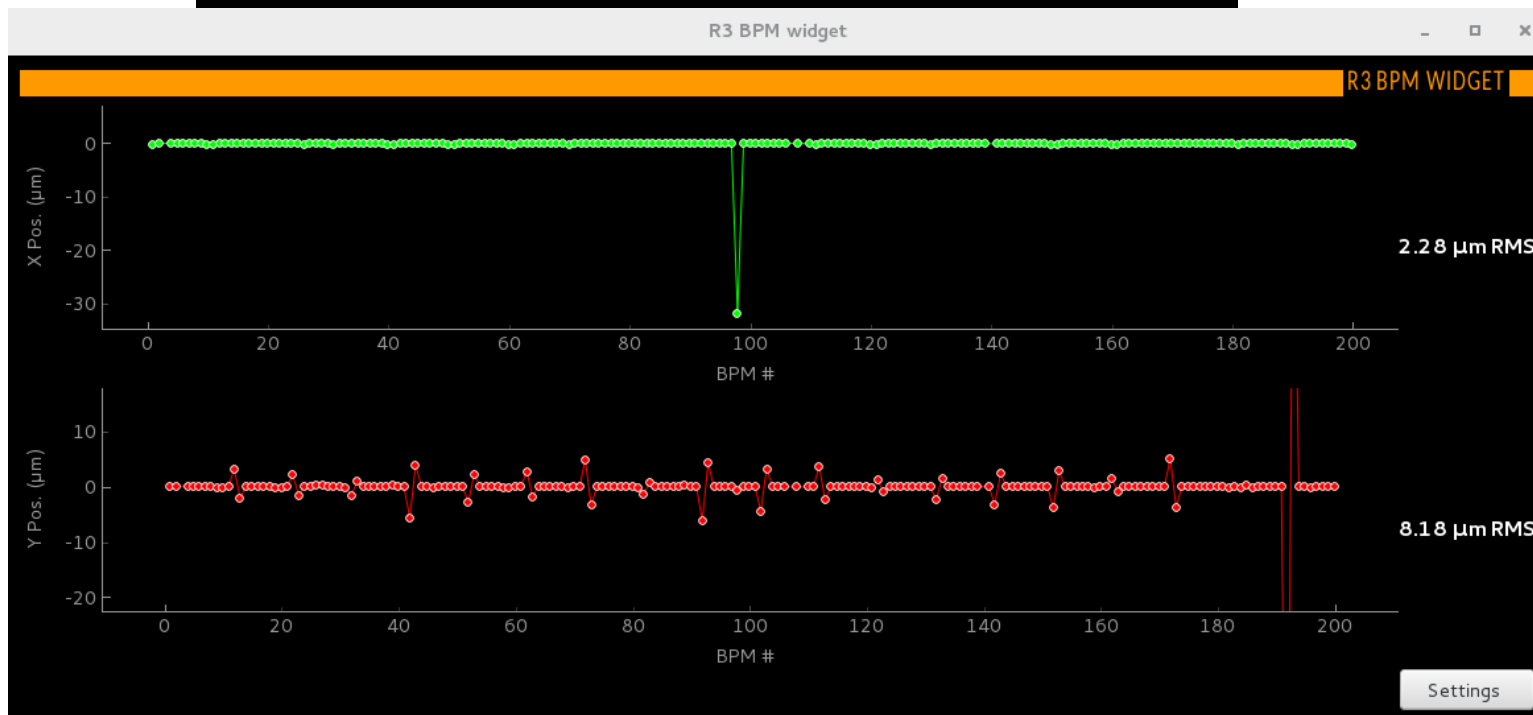
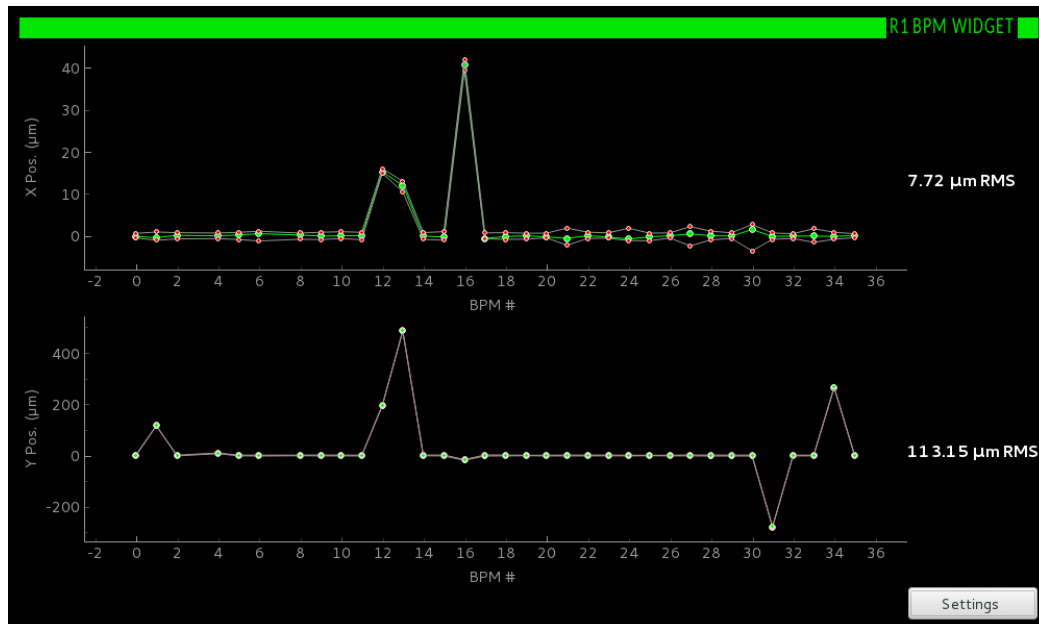
# Linac - injection



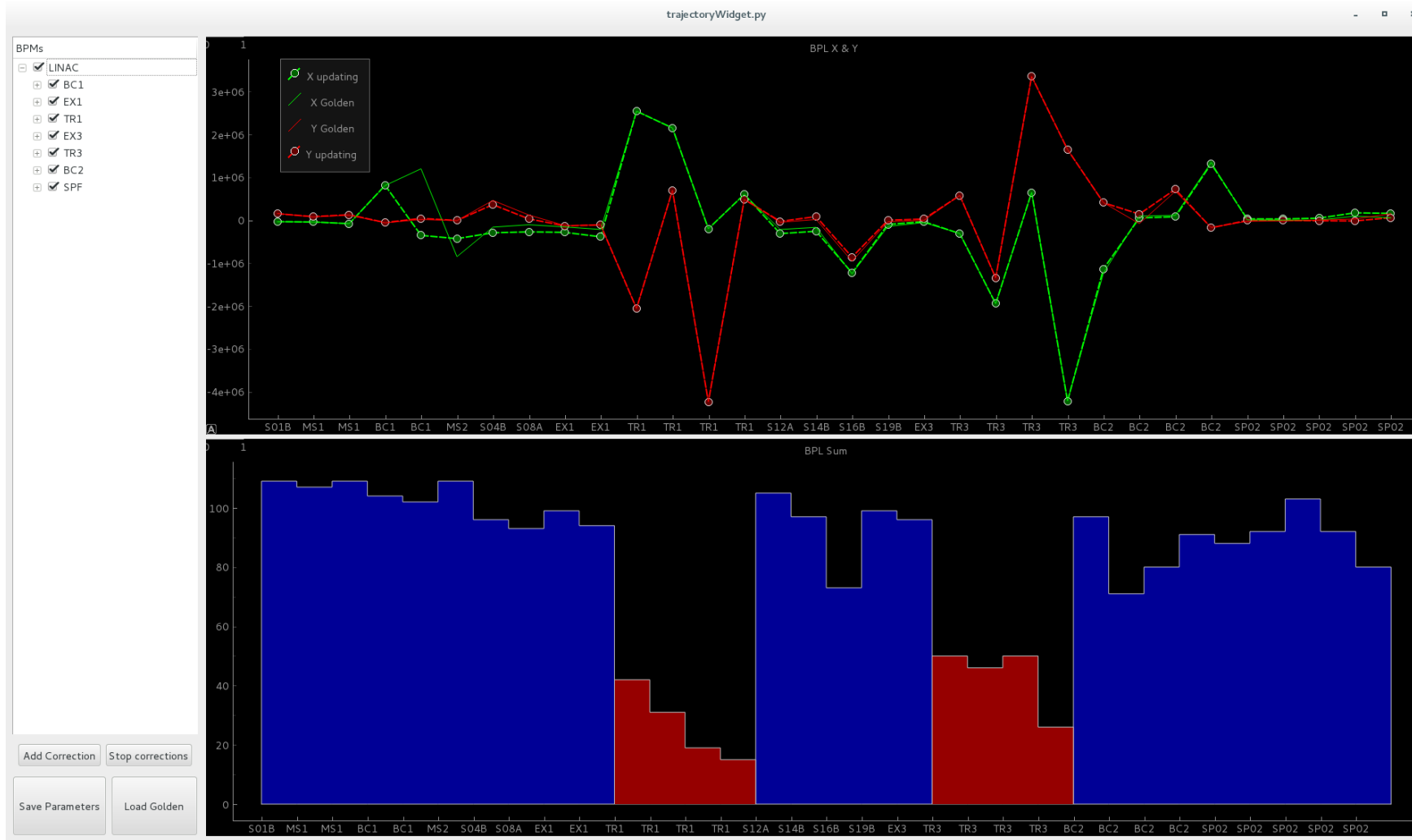
# R1 Bunches



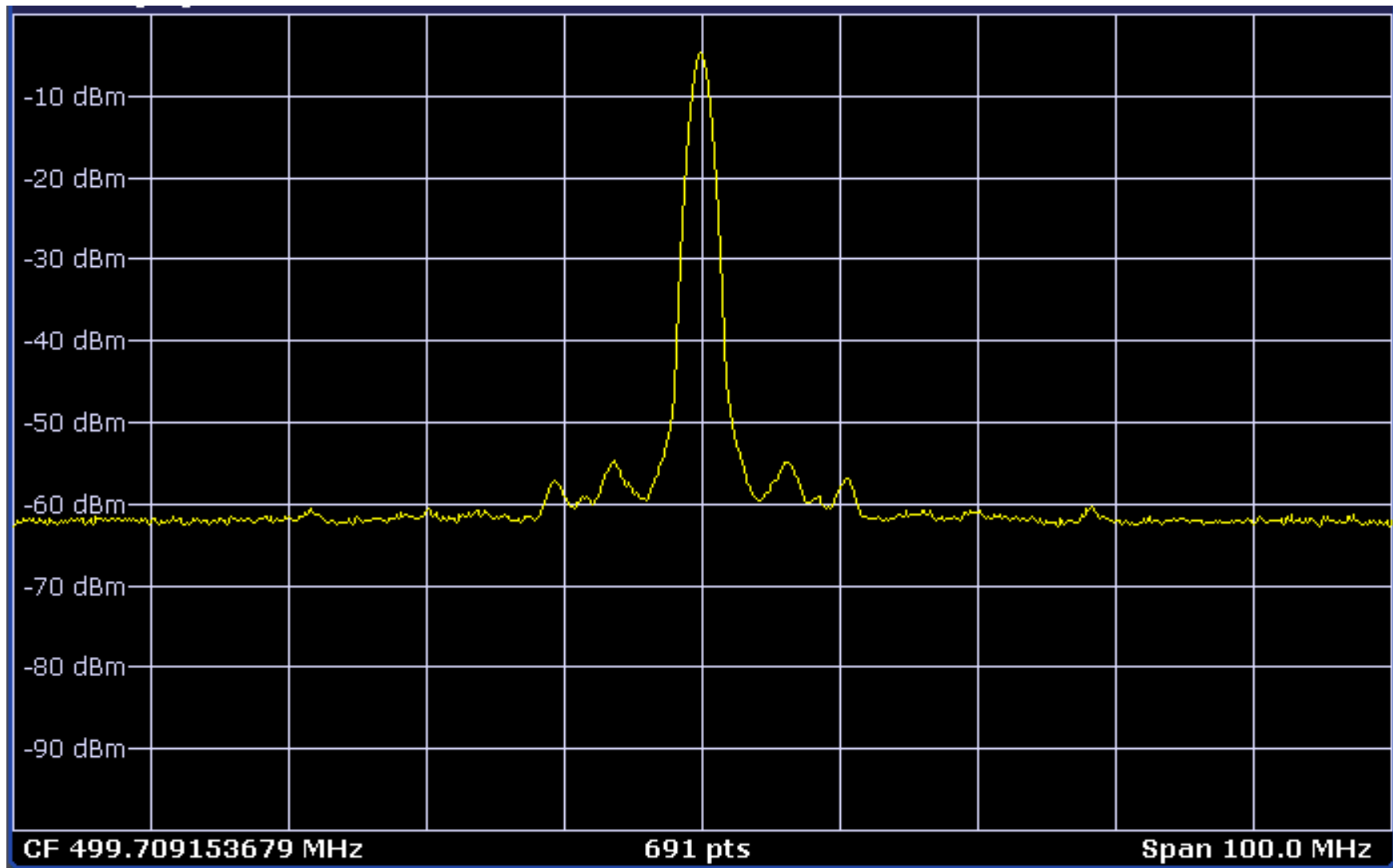
# Beam Position Monitors



# Linac trajectory



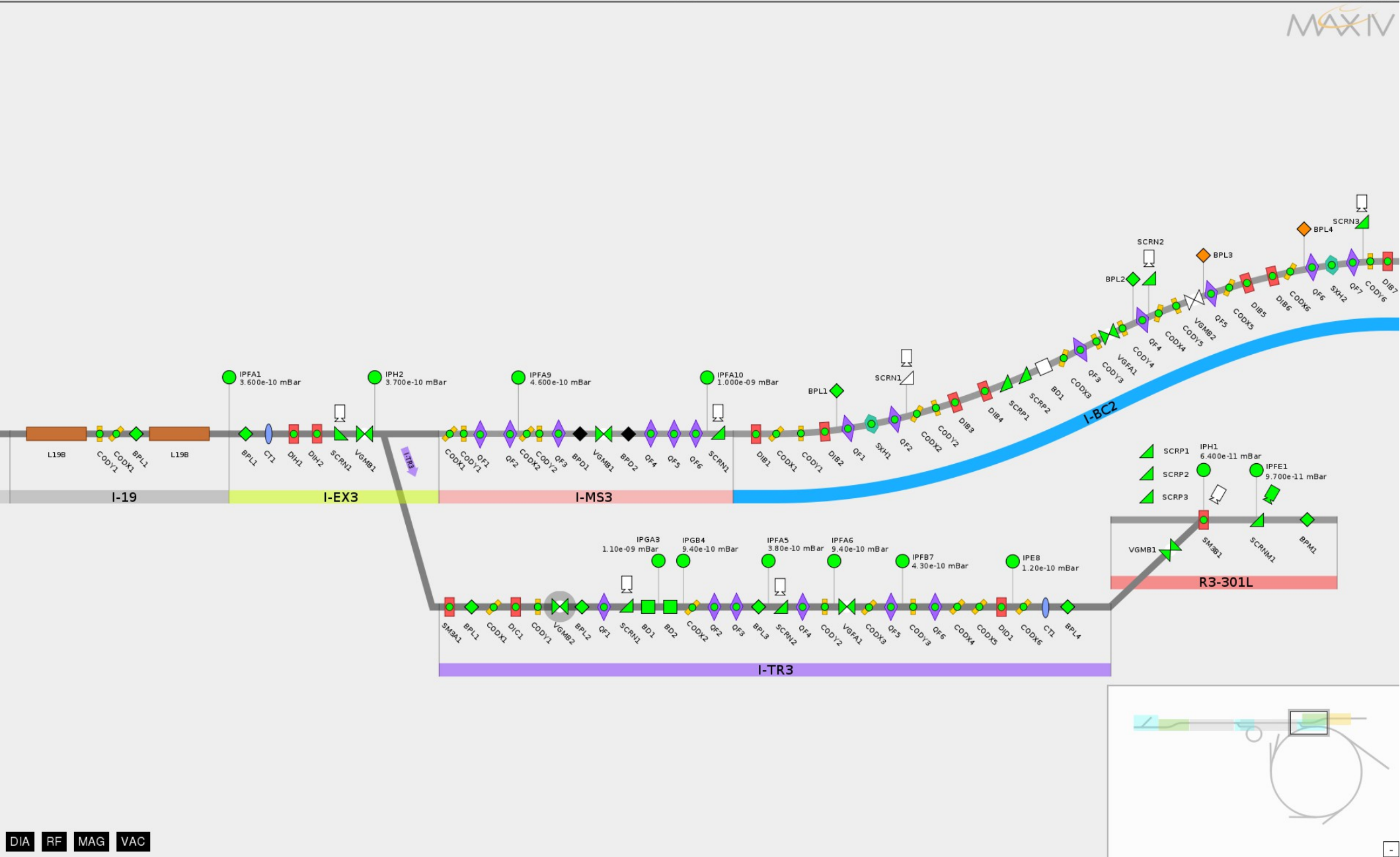
# Beam Spectrum





# We monitor, control, tune and develop every inch of our accelerators

ctlinacsynoptic



# Beam delivery

- Beam-delivery 24/7
- Day, evening and night shifts
- Beamlines (users) already taking data

## Linac

Repetition rate 2 Hz

FemtoMAX

OPEN

## 1.5 GeV Ring

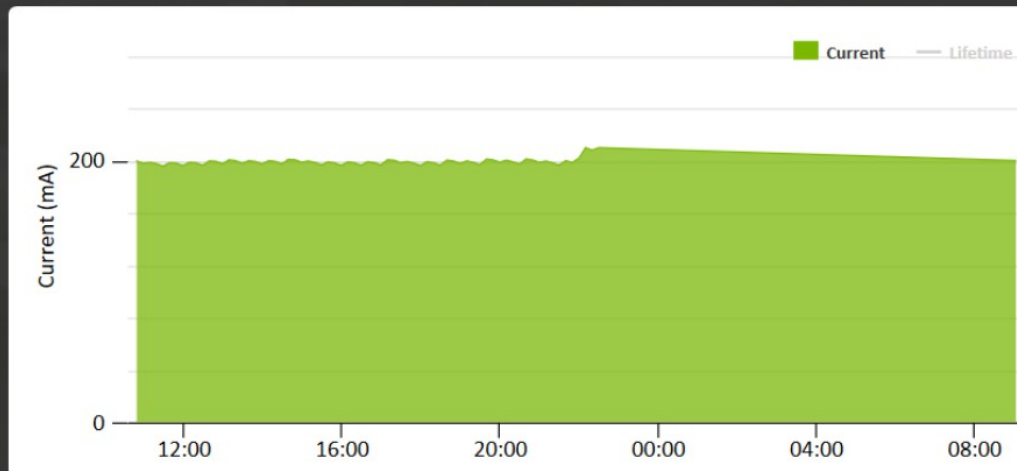
200.08 mA

Delivery: Top-Up

19.39 h

NEXT INJECTION:

2018-10-04 09:30:00



BLOCH	30.00	OPEN
FLEXPES		
FinEstBeaMS	46.80	OPEN
SPECIES	150.00	CLOSED
MAXPEEM		CLOSED

# Opportunities at MAX IV



## Vacancies

[Our recruitment process](#)

[Relocation process](#)

[Compensation & benefits](#)

[Meet our employees](#)

## Vacancies

Current vacancies are listed here. We also advertise vacant positions on the [Lund University web site](#). We hope you will find a position that matches your qualifications and interests, and welcome your application.

# Opportunities at MAX IV

- Most positions require experience
- Machine division most natural fit for particle physicists:
- Accelerator development
- Accelerator operations, beam diagnostics (e.g. beam conditions monitoring experience in ATLAS, control room shifts, etc)
- Radiation shielding: skills with MC particle transport codes (Geant4, FLUKA)
- Programming skills (development of GUIs, python: we develop our own tools)
- End of October more clarity on numbers, but new vacancies will appear
- We're part of Lund University



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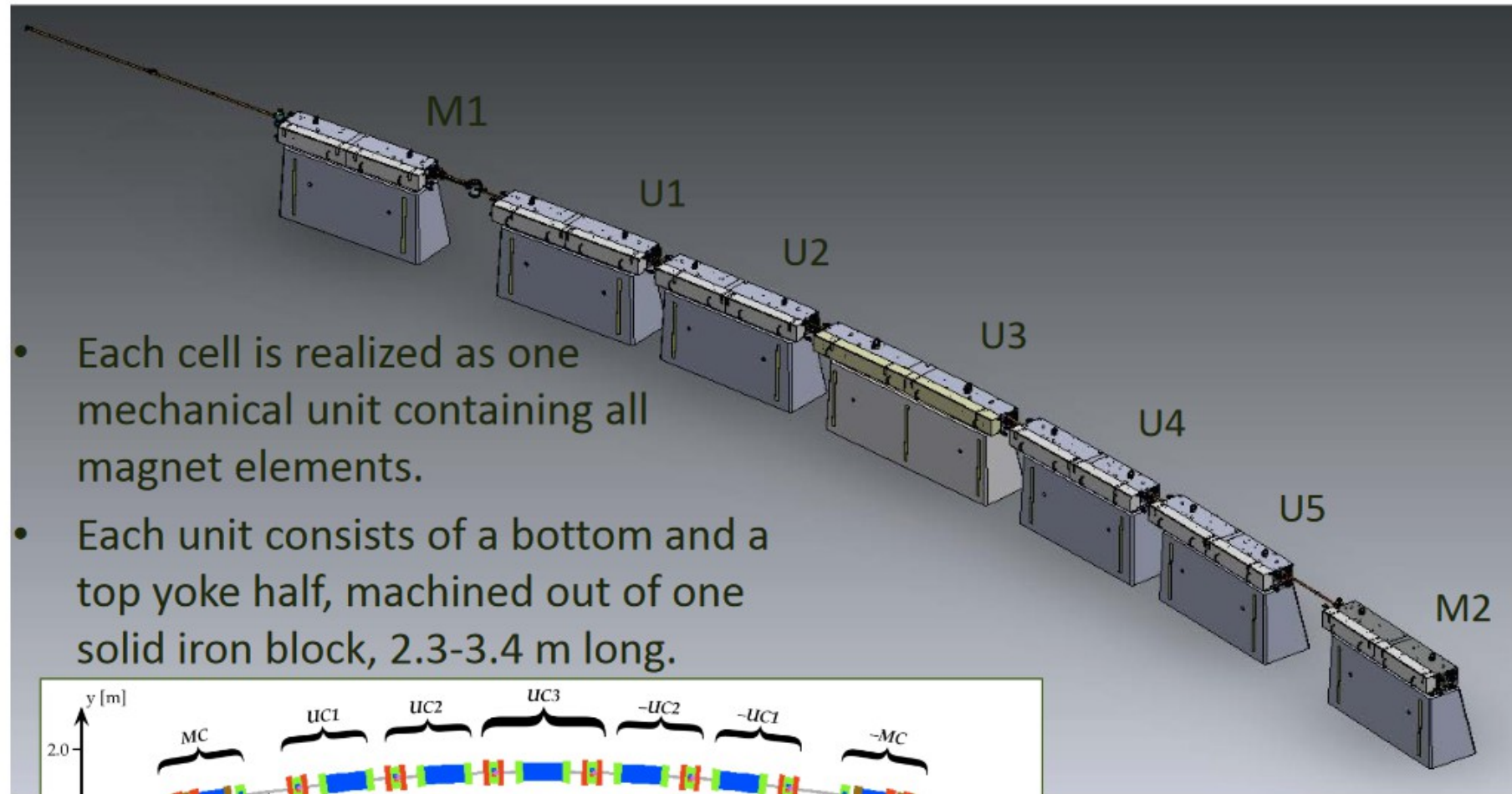
**Thanks**



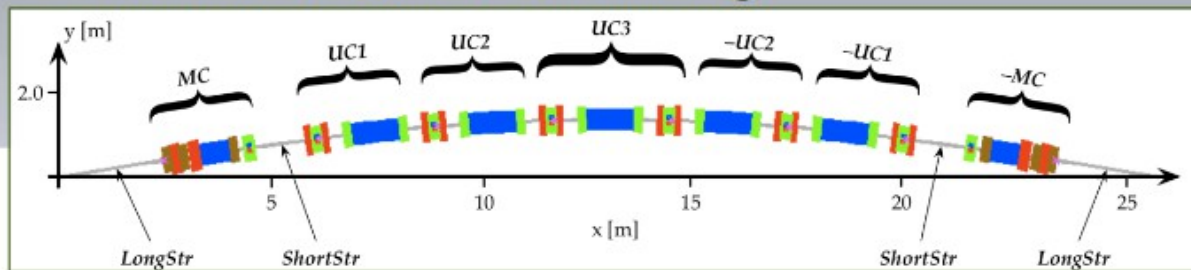
# Backup



# achromat 3D cad assembly:

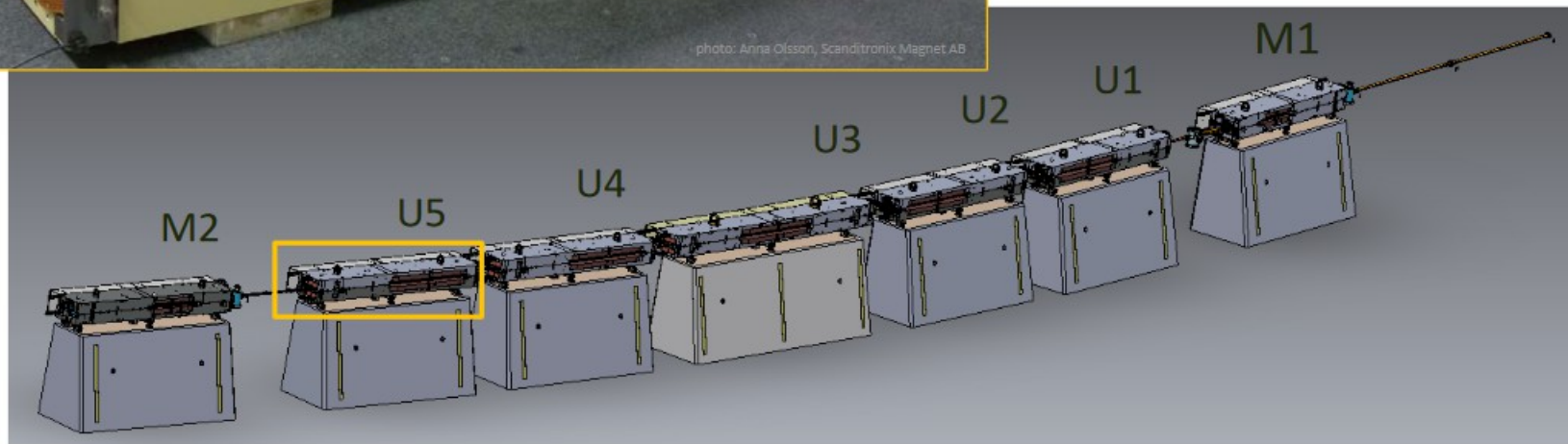
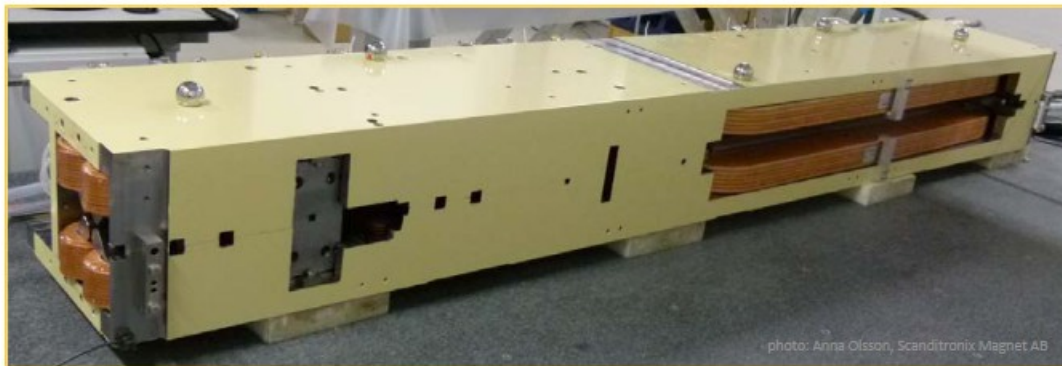


- Each cell is realized as one mechanical unit containing all magnet elements.
- Each unit consists of a bottom and a top yoke half, machined out of one solid iron block, 2.3-3.4 m long.



# a MAX IV magnet block:

- a U5 bottom half →
- ↓ an assembled U5



Martin Johansson,  
Workshop on Accelerator R&D for Ultimate Storage Rings, Huairou, Beijing, China, Oct 30-Nov 1, 2012





# Linac time structure

