JAGIELLONIAN UNIVERSITY
IN KRAKOW

SOLARIS
NATIONAL SYNCHROTRON
RADIATION CENTRE

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Status of the Solaris 1.5 GeV Storage Ring

Diagnostics Experts of European Light Sources
DEELS 2016

DESY 28.06.2016

Arkadiusz Kisiel

Programme

1. Design parameters

2. Current status of the machine

3. Beam Based Alignment

4. Summary in discussion

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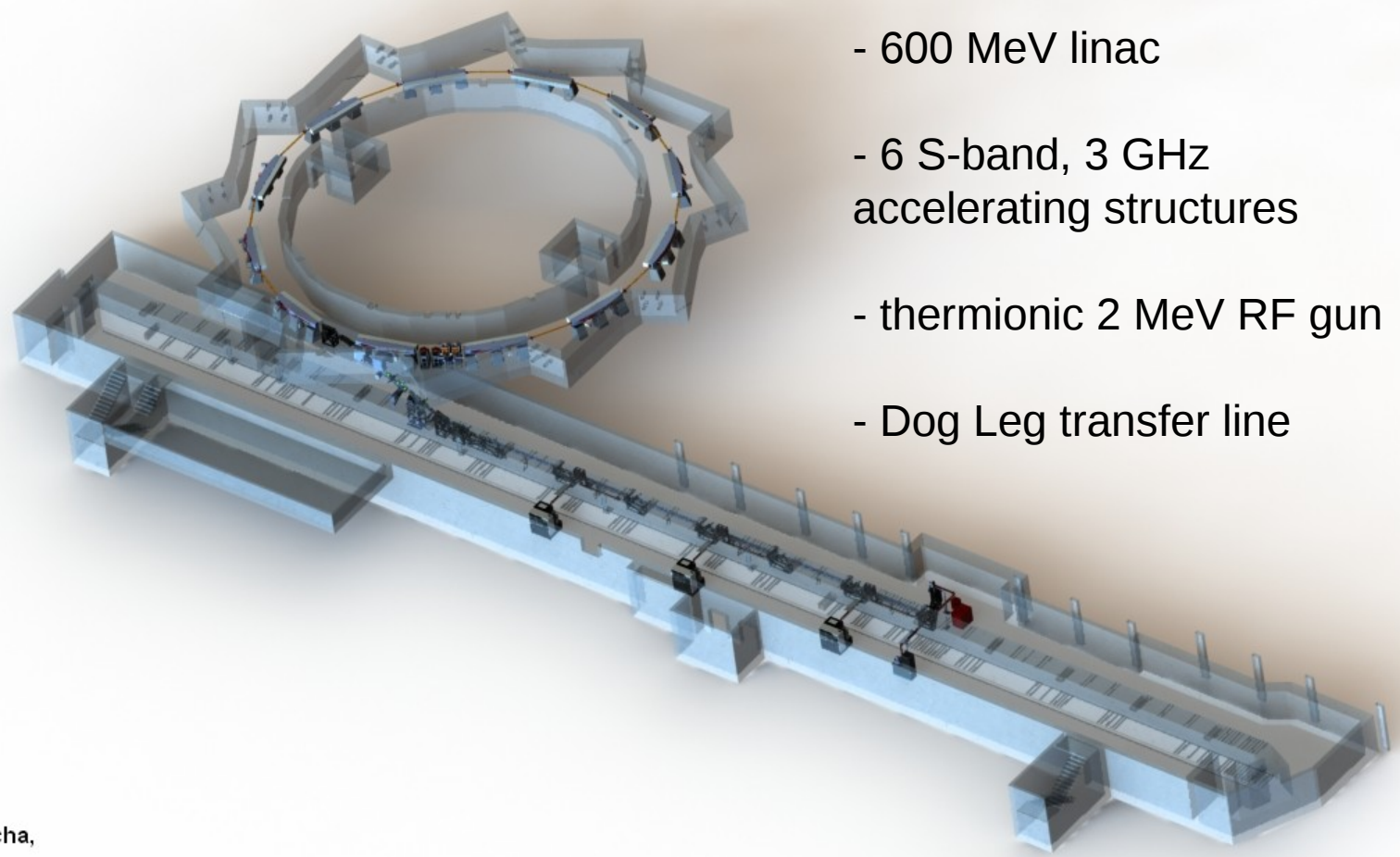
MACHINE DESCRIPTION

Designed parameters



- 600 MeV linac

- 6 S-band, 3 GHz accelerating structures

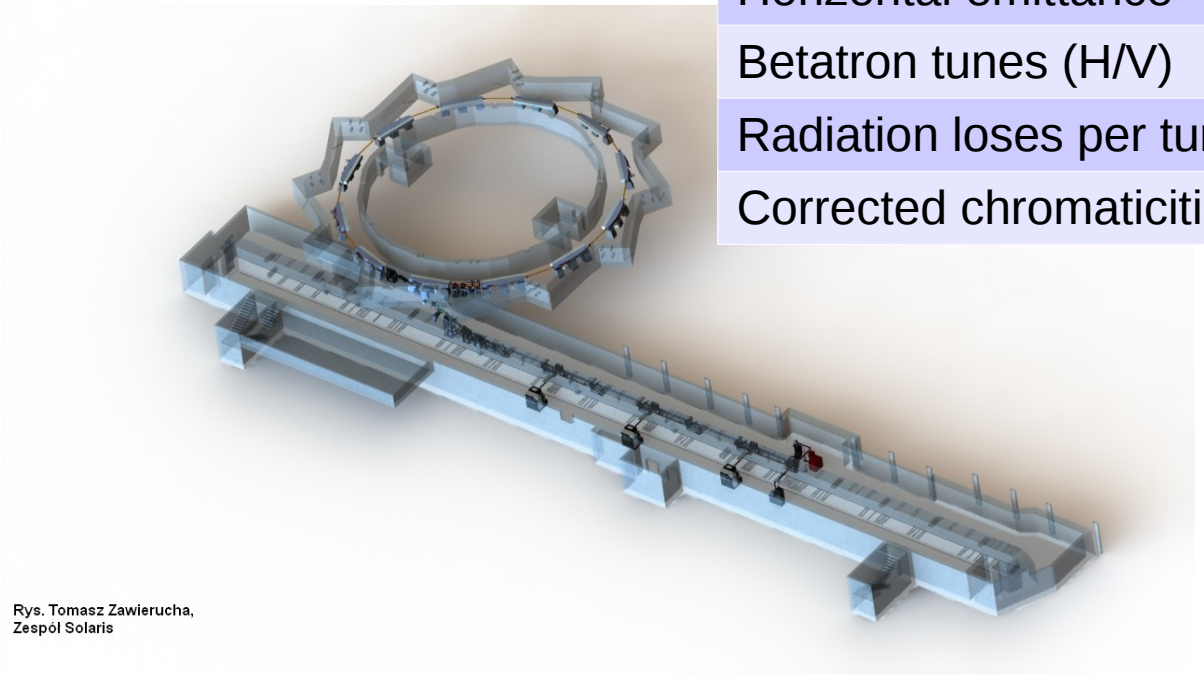
- thermionic 2 MeV RF gun

- Dog Leg transfer line

Rys. Tomasz Zawierucha,
Zespół Solaris

Designed parameters

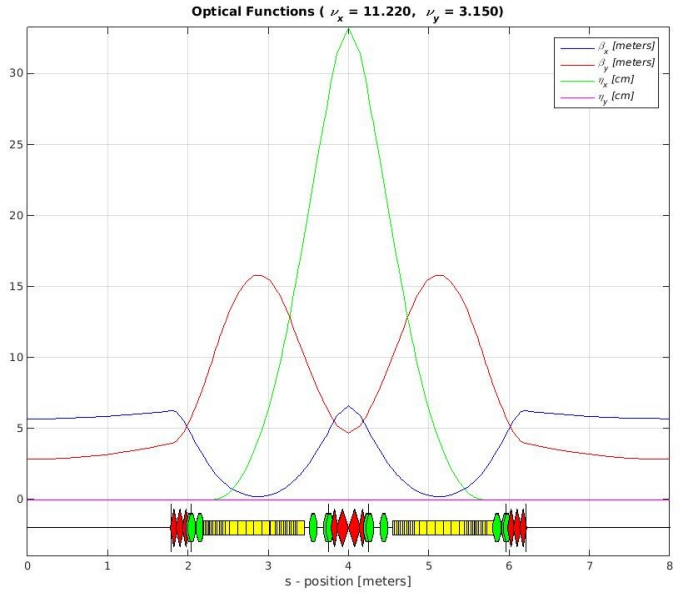
Energy	1.5 GeV
Beam current	500 mA
Circumference	96 m
Periodicity	12
Beam lifetime	13 hrs
RF frequency	99.93 MHz
Bunch charge	5 nC
Horizontal emittance	5.598 nm rad
Betatron tunes (H/V)	11.22/3.15
Radiation loses per turn	114.1 keV
Corrected chromaticities	+1, +1

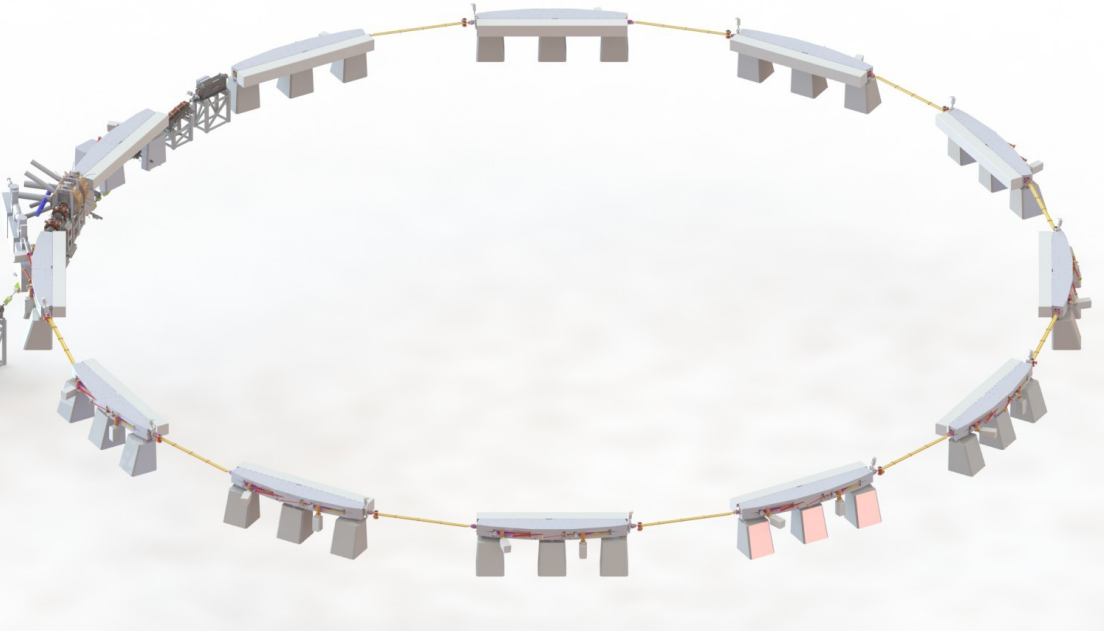


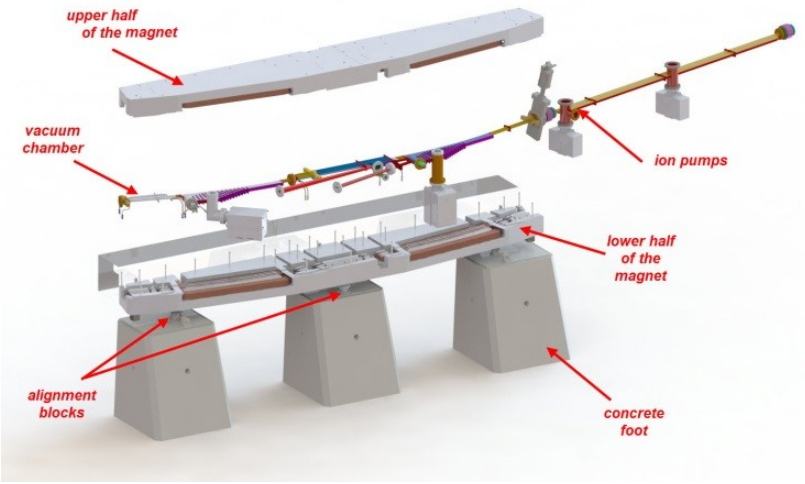
Rys. Tomasz Zawierucha,
Zespół Solaris

Storage ring

- 12 DBA integrated blocks
- 2 Main RF Cavities (100 MHz)
- 2 Landau Cavities (300 MHz)







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COMMISSIONING STATUS

Current status

Commissioning of the machine has started in May 2015 and was divided into 3 phases:

1. First turn and accumulation - approx. 2 weeks

2. From September after the shutdown, optics optimization, energy ramping, orbit correction, increasing injected current (100 mA achived before winter shutdown)

3. After Landau Cavities installation (from February 2016) further machine improvements (details on the next slides)

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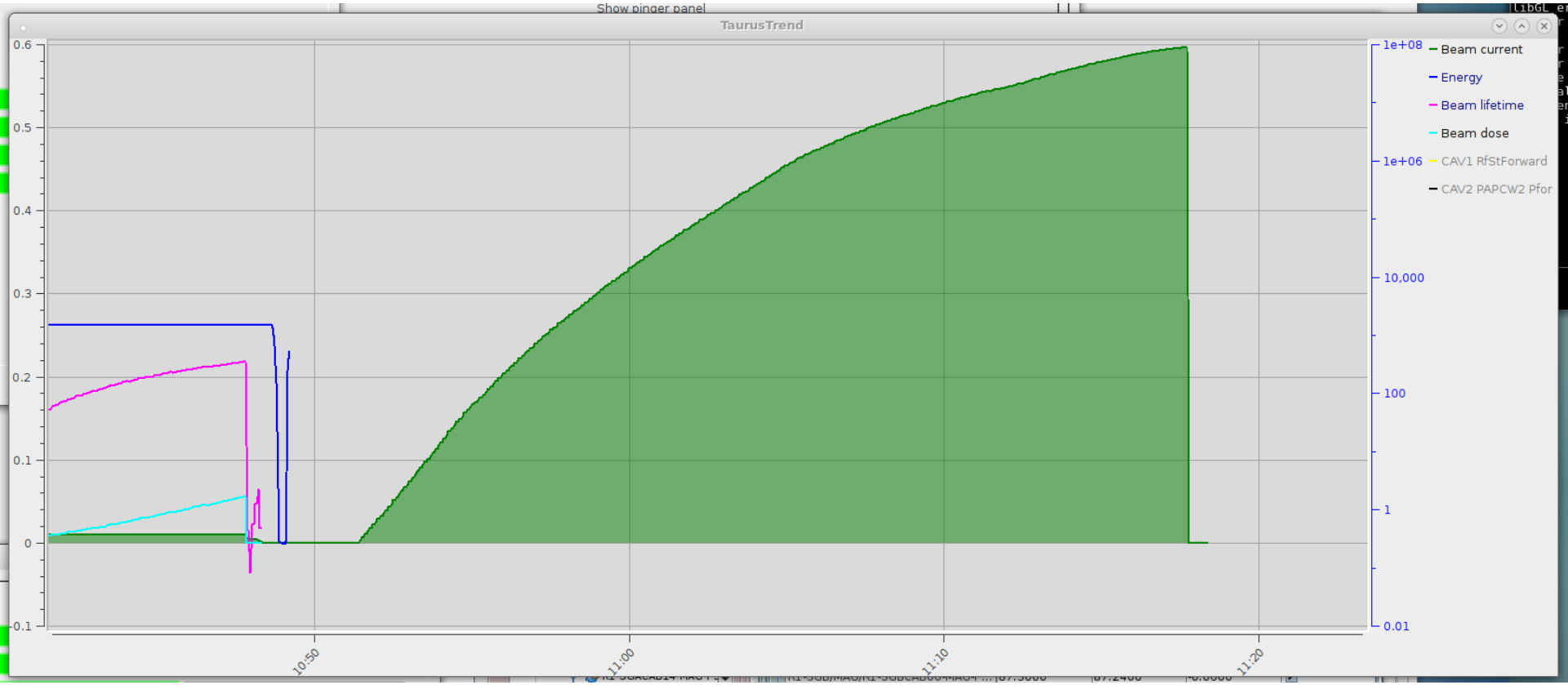
4. Start of the first beamline commissioning (UARPES)

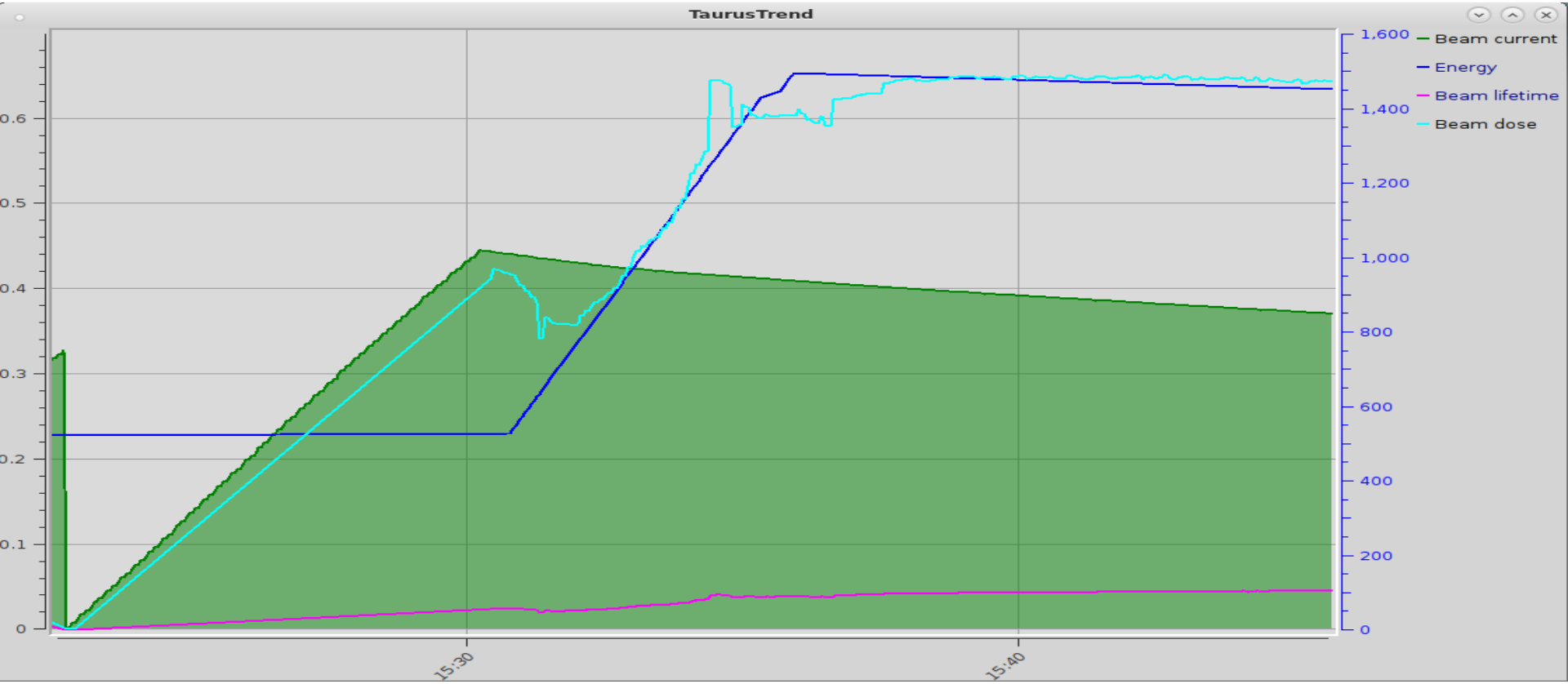
Beam current

25th May 2016 596 mA injected at 524 MeV energy

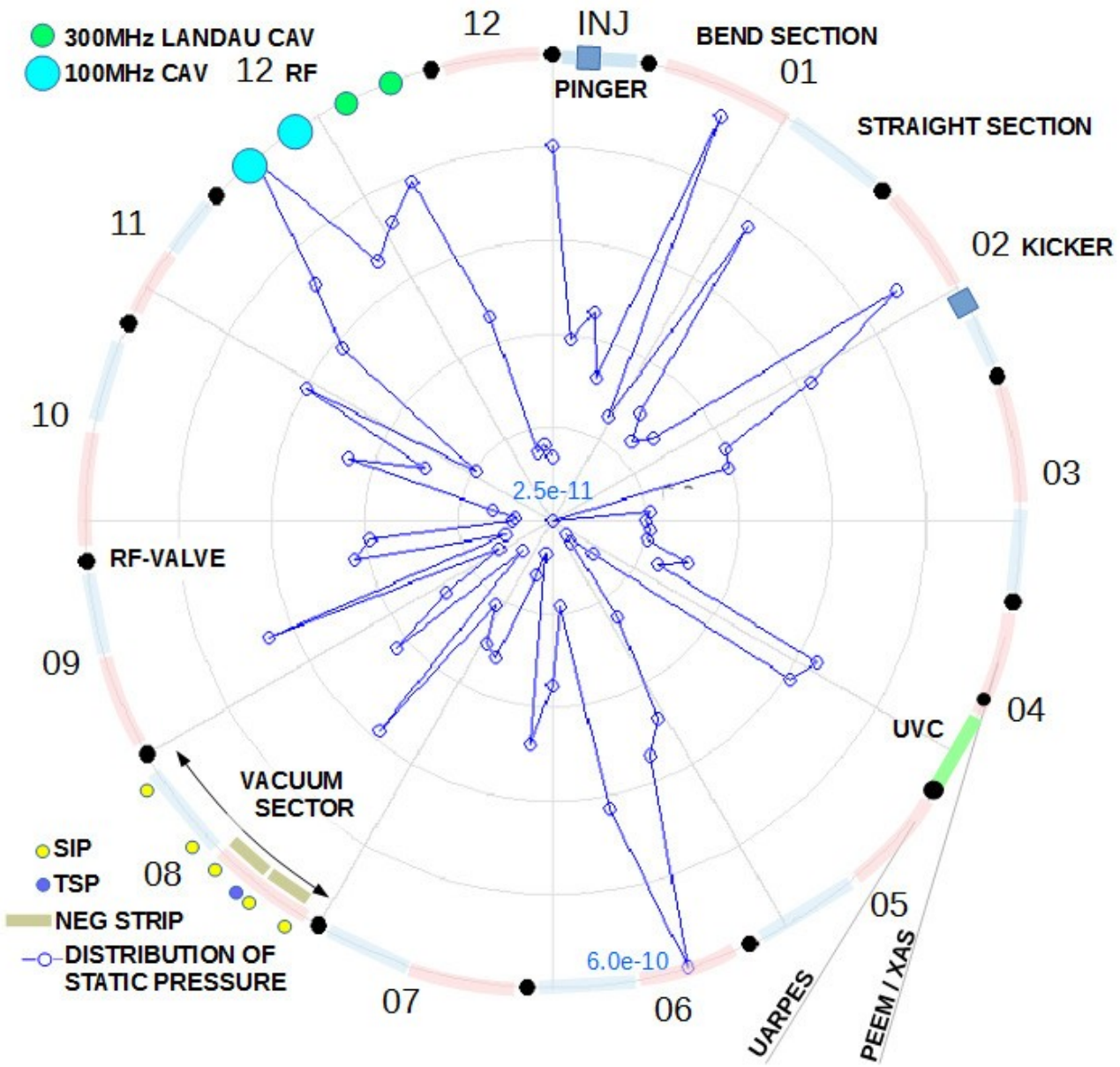


Beam current

9th June 2016 408 mA ramped to the final 1.5 GeV energy

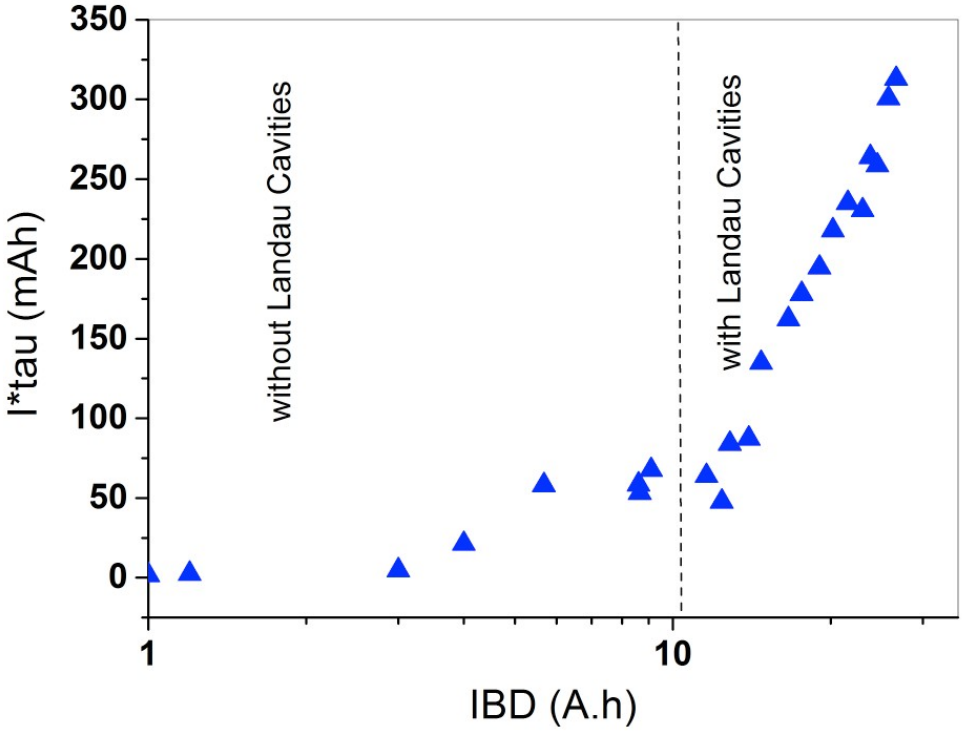


Vacuum

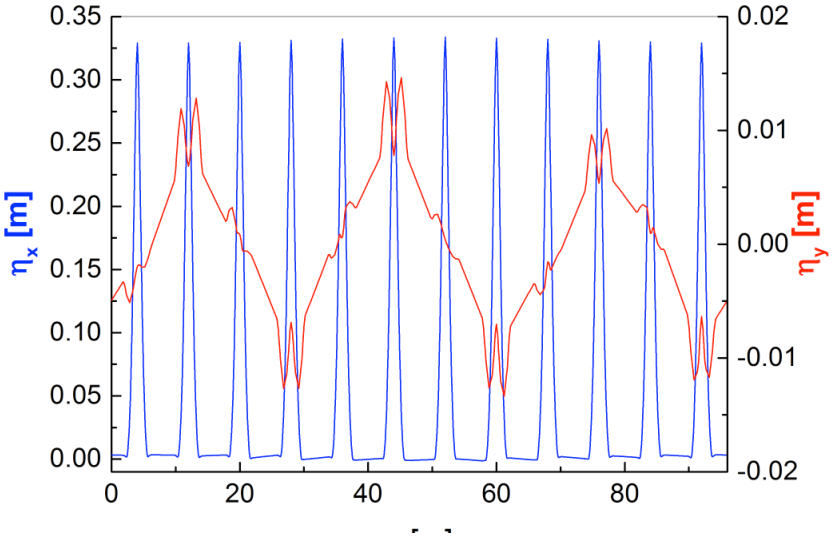

300MHz LANDAU CAV
100MHz CAV
12 RF
12
INJ
PINGER
BEND SECTION
01
STRAIGHT SECTION
02 KICKER
03
04
UVC
05
PEEM / XAS
UARPES
06
07
VACUUM SECTOR
08
09
RF-VALVE
10
11
2.5e-11
6.0e-10
SIP
TSP
NEG STRIP
DISTRIBUTION OF STATIC PRESSURE

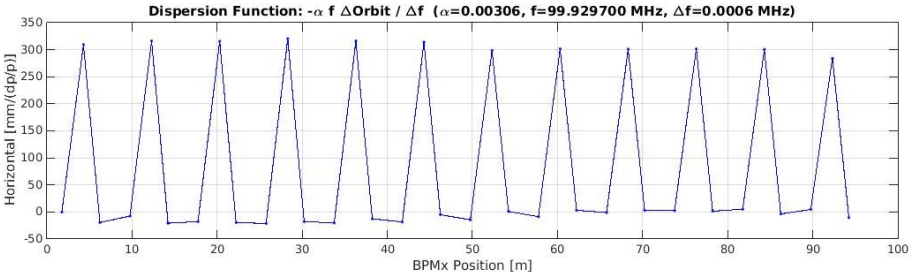
Beam lifetime

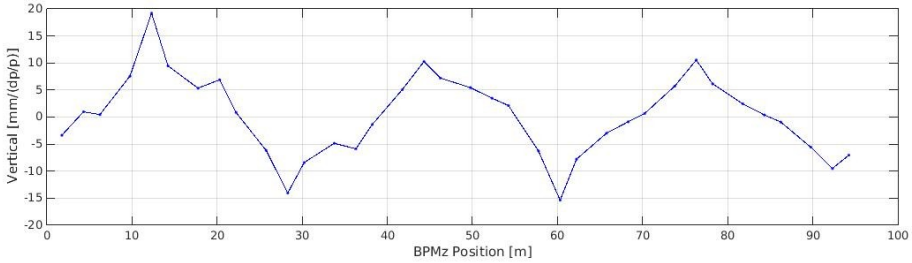
After the installation of Landau cavities the beam lifetime increased by a factor of ~6 and still rises.
Harmonic cavities still needs a fine tuning.

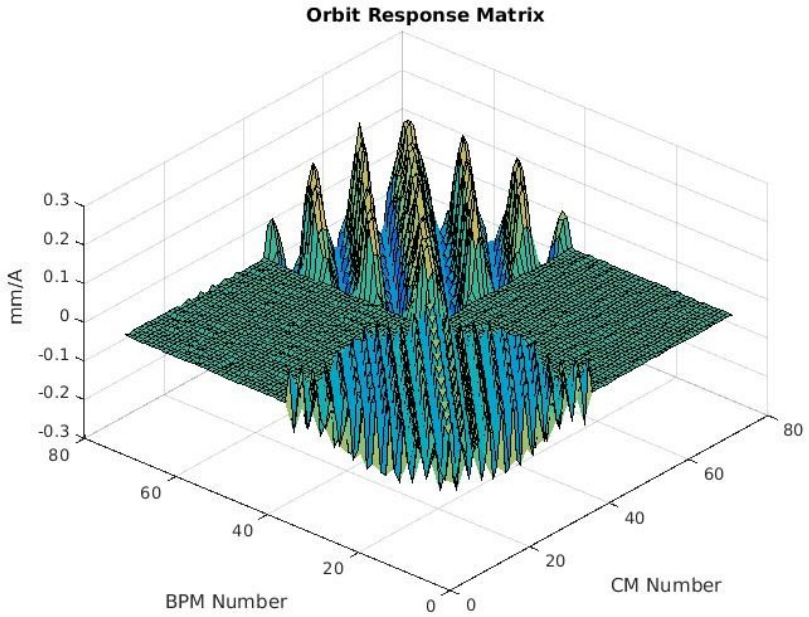


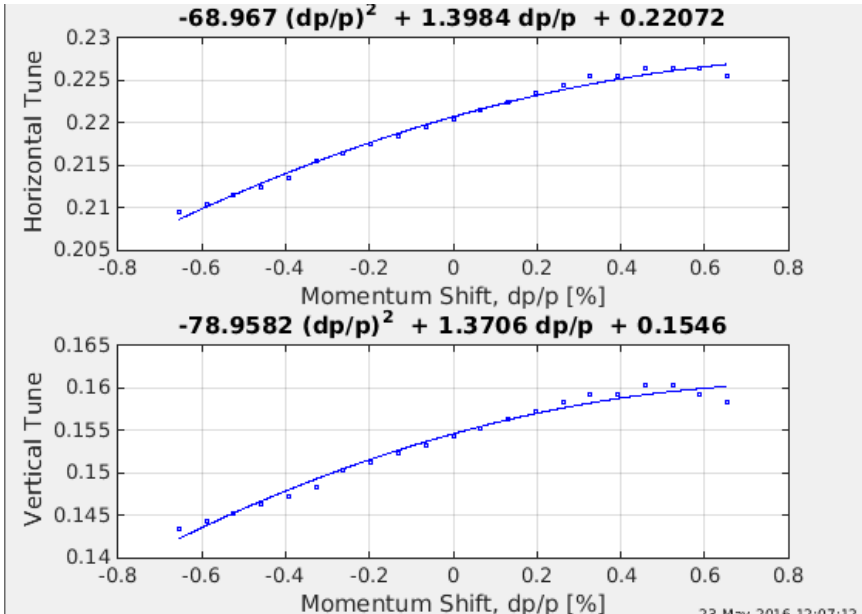
Optics correction





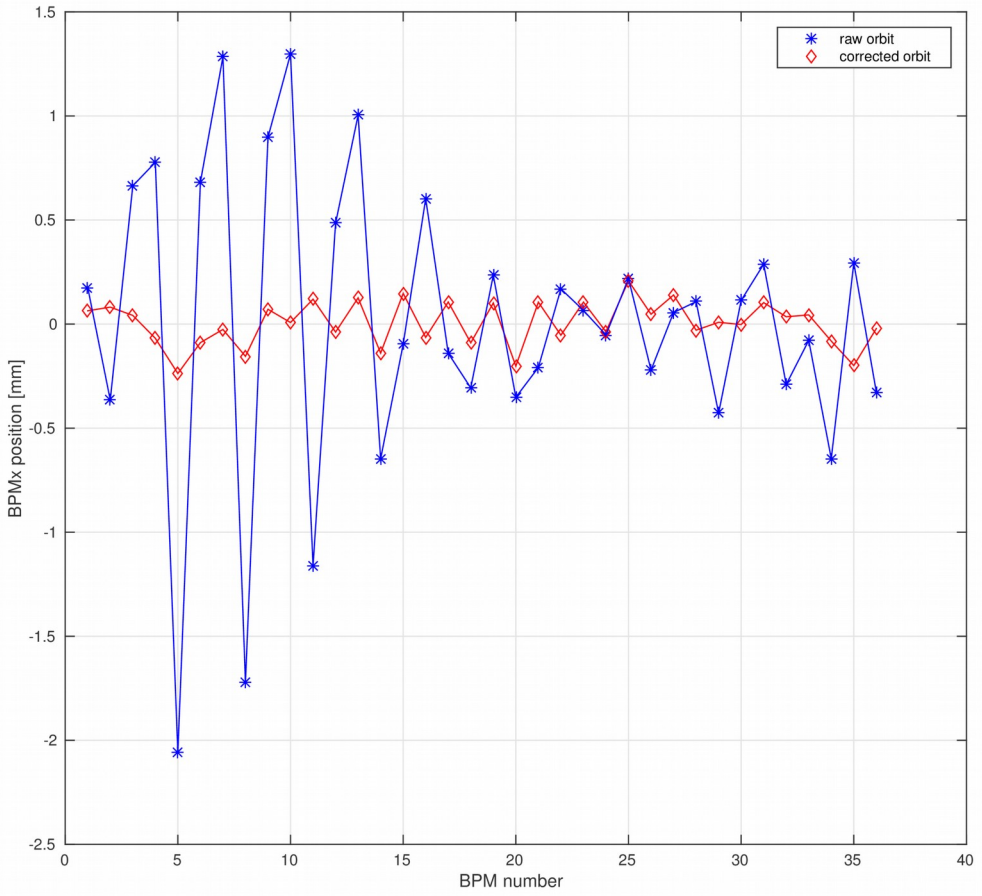






Orbit correction

RMS values without any correction: **700 um** horizontal and **1000 um** vertical. With correction: **180 um** horizontal and **170 um** in vertical plane



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BEAM BASED ALIGNMENT

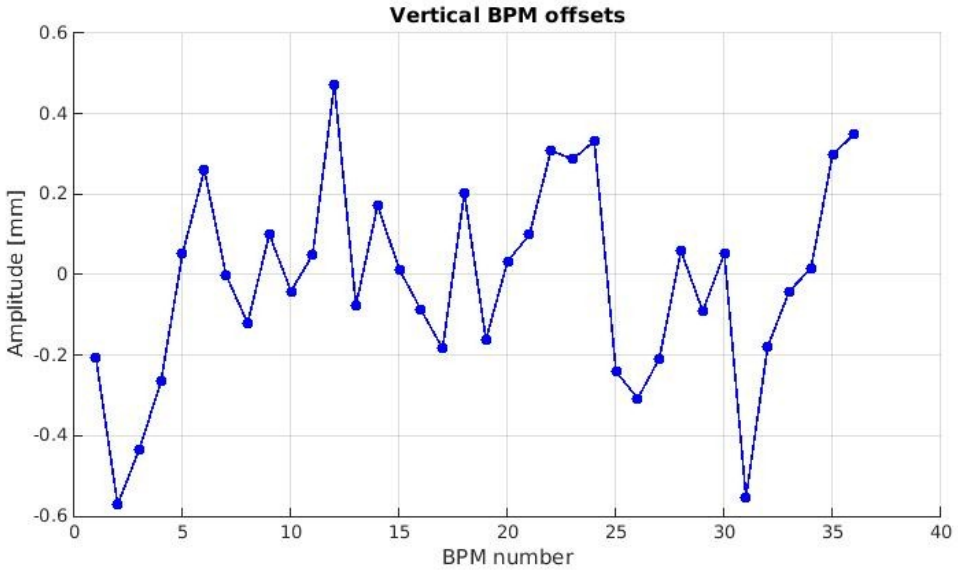
Description

- Beam Based Alignment is handled by Matlab Middle Layer routines.
- All quads are connected in series to the same PS, therefore shunt reistors are used to bypass 1% of supplying current and generate the kick.
- Everything works fine, orbit RMS is getting better
- ... almost

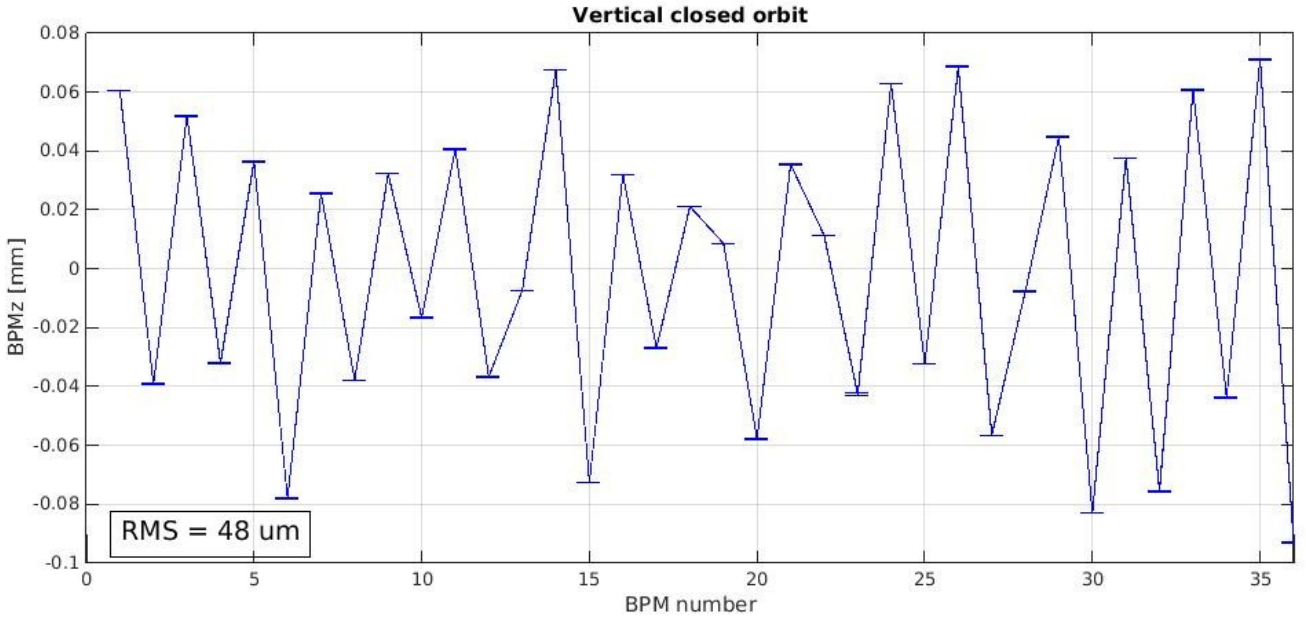
Vertical plane

All offsets are < 0.6 mm, what seems to be reasonable

RMS of closed orbit in vertical plane decreased from 170 um (before BBA) down to 48 um

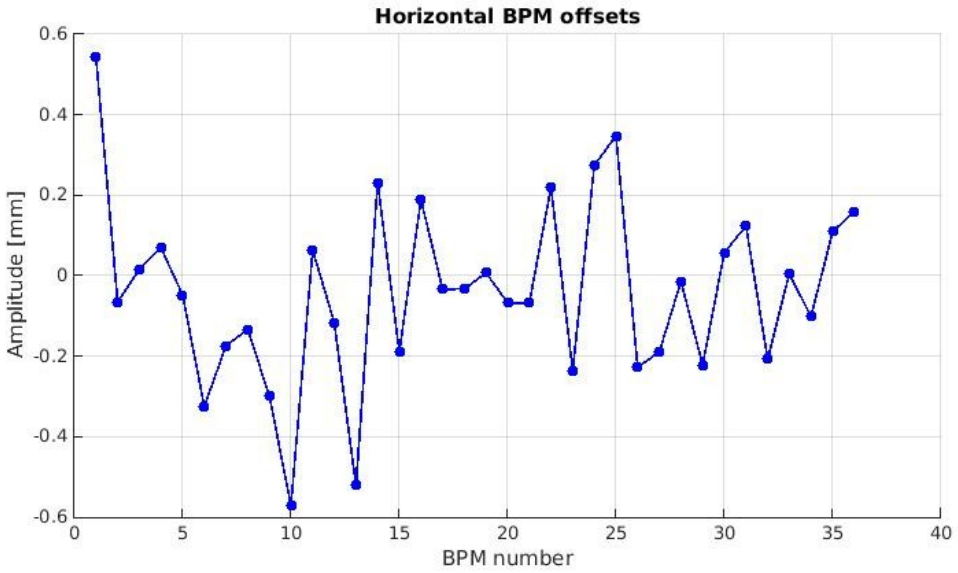


The orbit is stable and repetitive from injection to injection



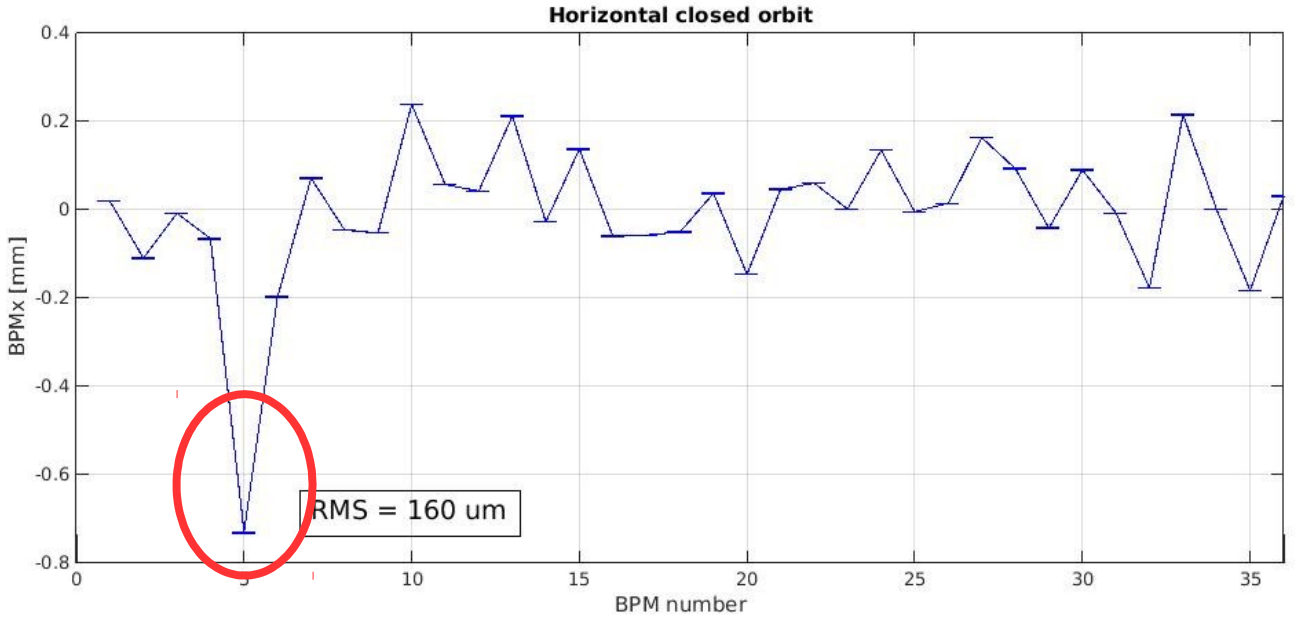
Horizontal plane

All offsets are also < 0.6 mm
Unfortunately RMS is not decreasing due to huge misalignment in the center BPM in DBA2



Orbit correction stops – corrector PS limits reached

The orbit is stable and repetitive from injection to injection



What can be wrong?

Before blaming the mechanical alignment it's better to check what else could caused this problem:

- **is it buttons or cabling? -** *Probably not, cabling attenuation ok, no signs of different performance on f.ex. disperssion, response matrix*

- **is it Libera?** - *no, modules were changed and problem still exists on the same BPM*

- **is it Control System bug?** - *no, direct data stream from LB+ is the same*

Summary

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- **is it Control System bug?** - *no, direct data stream from LB+ is the same*

- WHAT ELSE COULD POSSIBLY CAUSED THIS?

Thanks for your attention