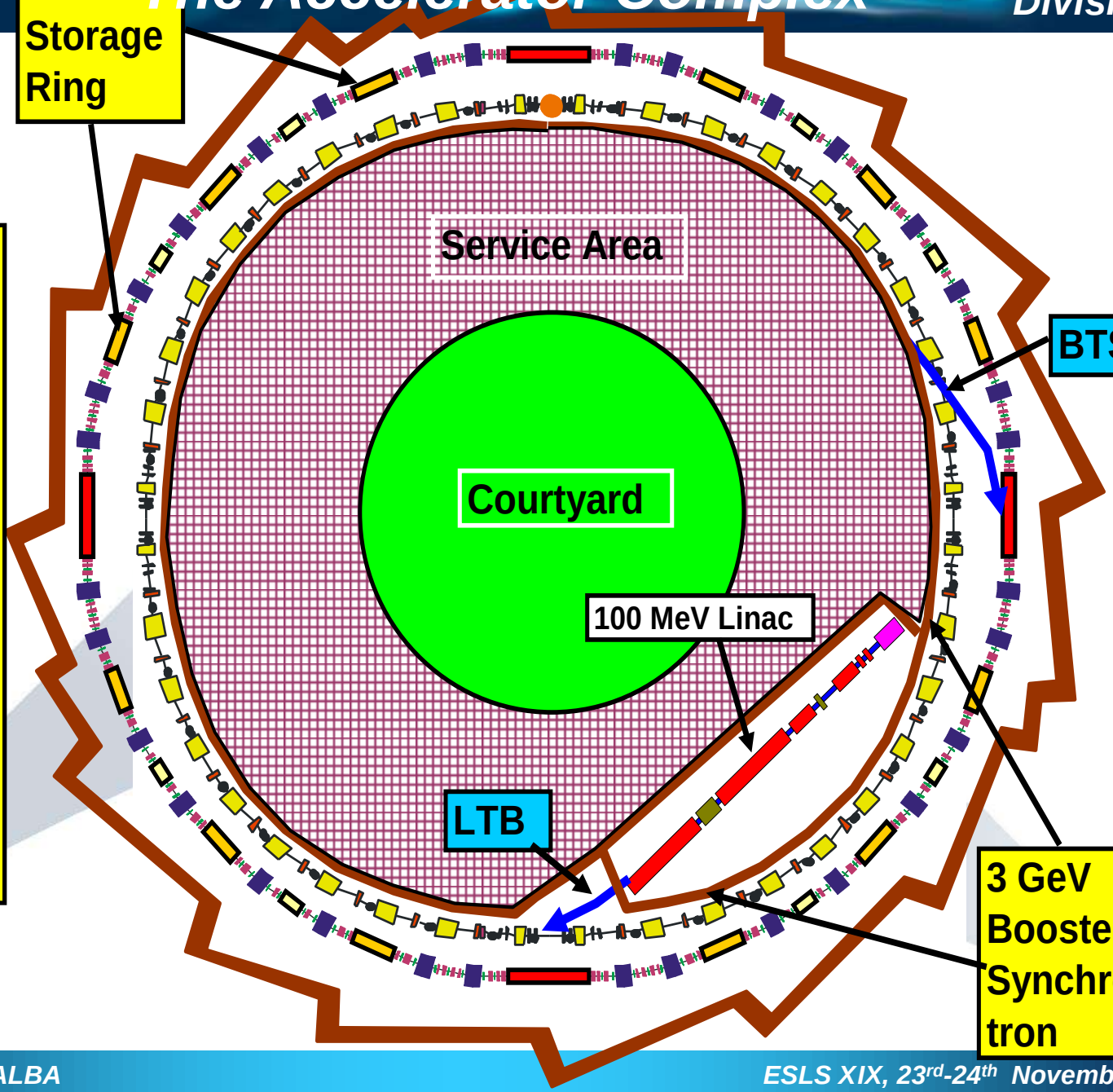
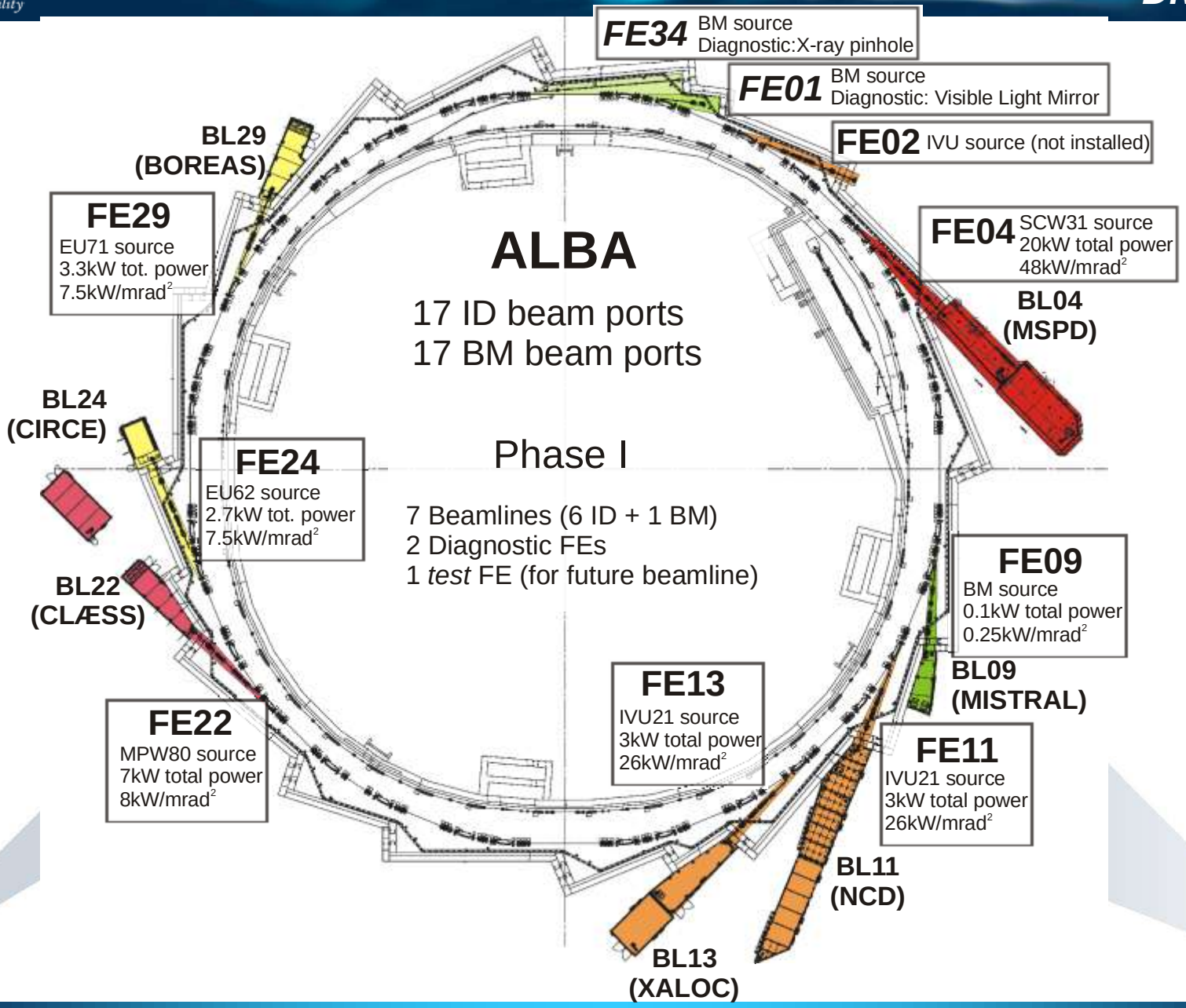
Contents

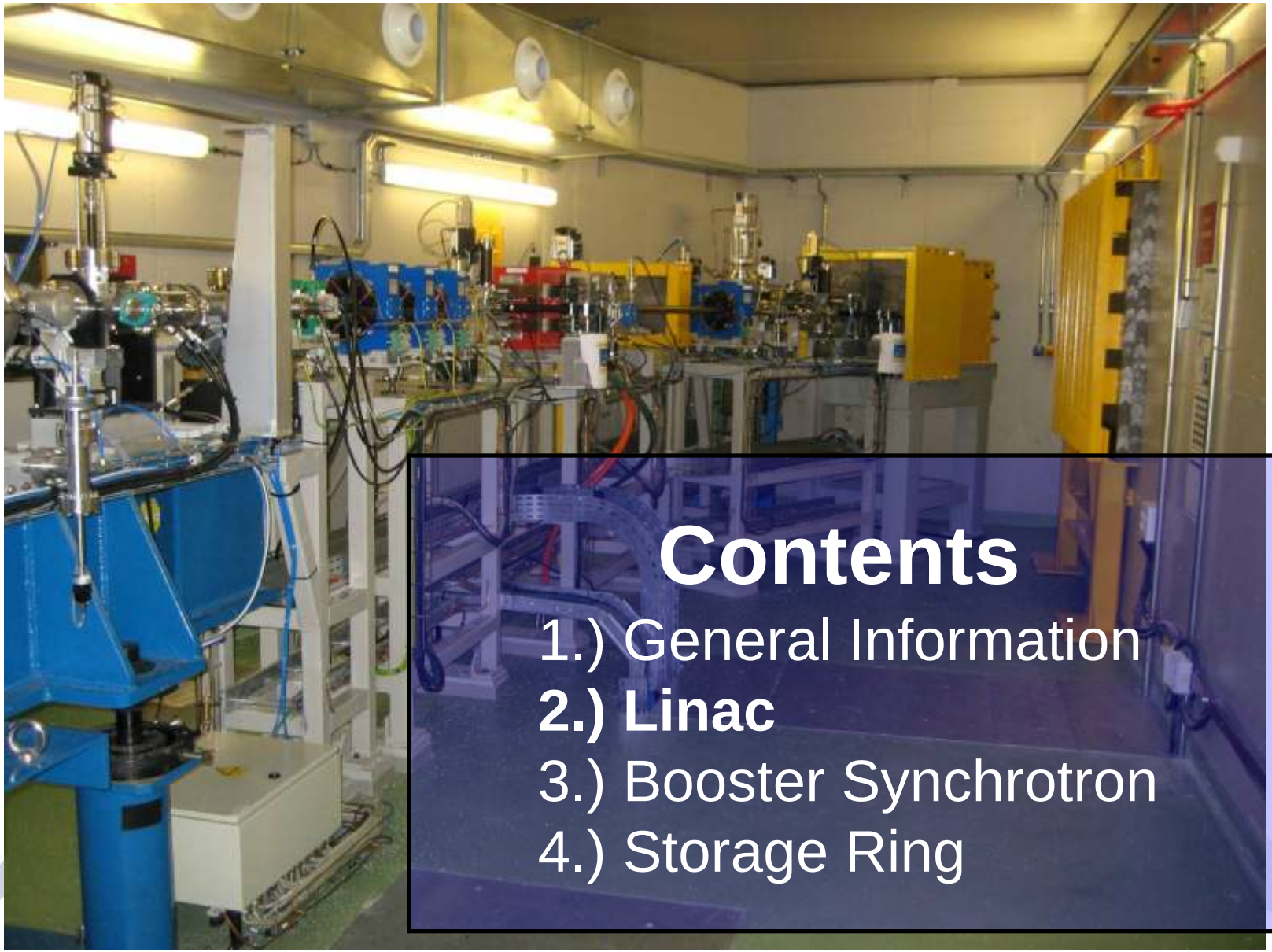
The Accelerator Complex

Accelerator complex of ALBA:
We followed the concept of the SLS to have the booster and the storage ring in the same tunnel.
The preinjector is a 100 MeV Linac

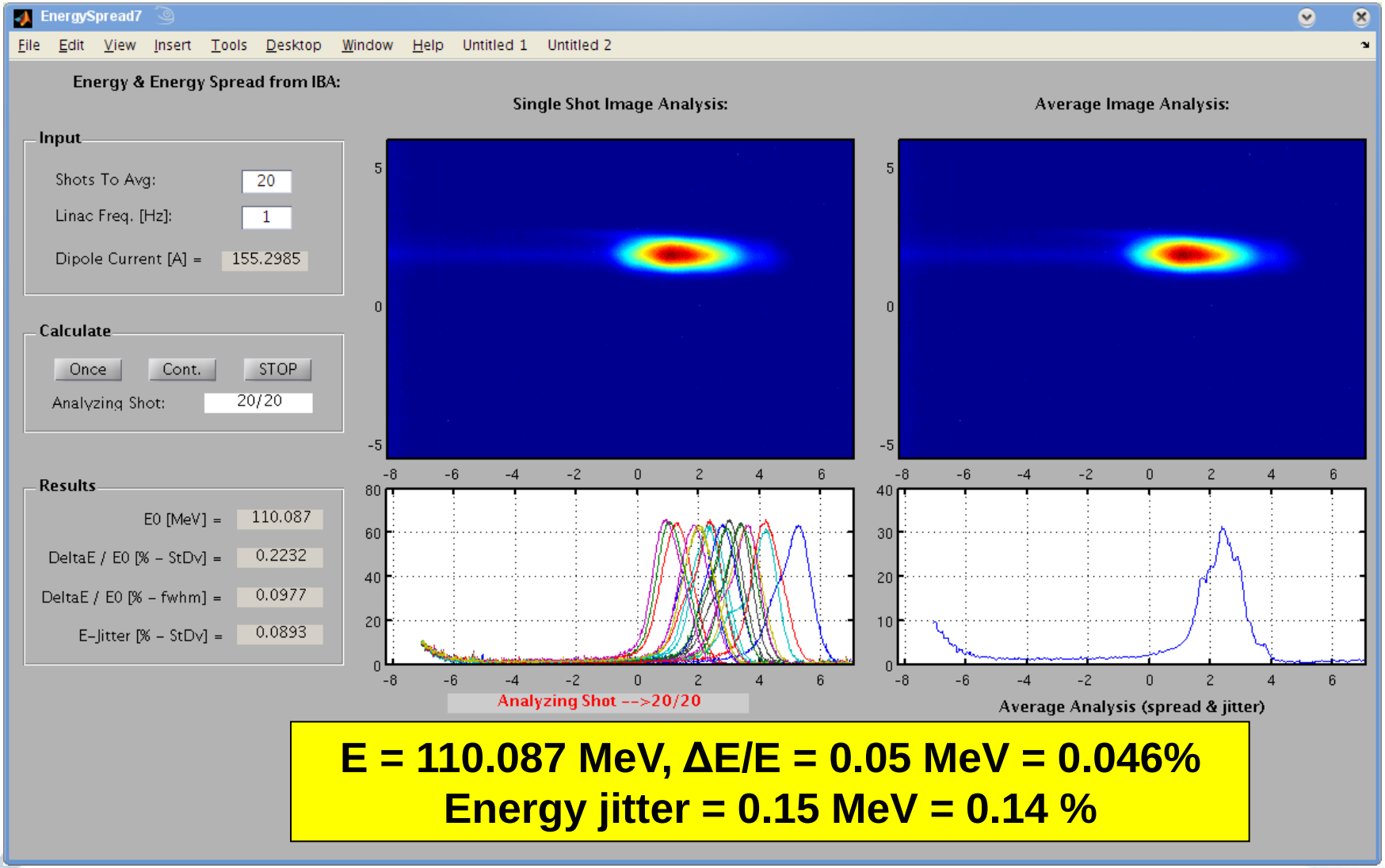


ID's, Front Ends and Beam Lines

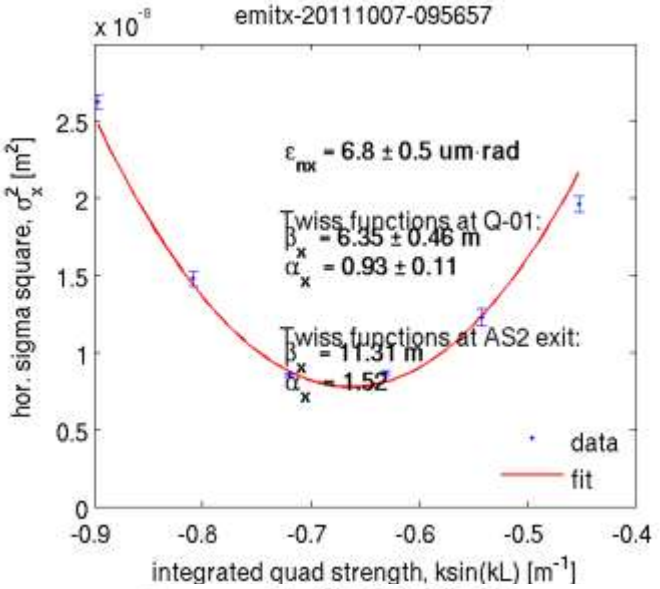


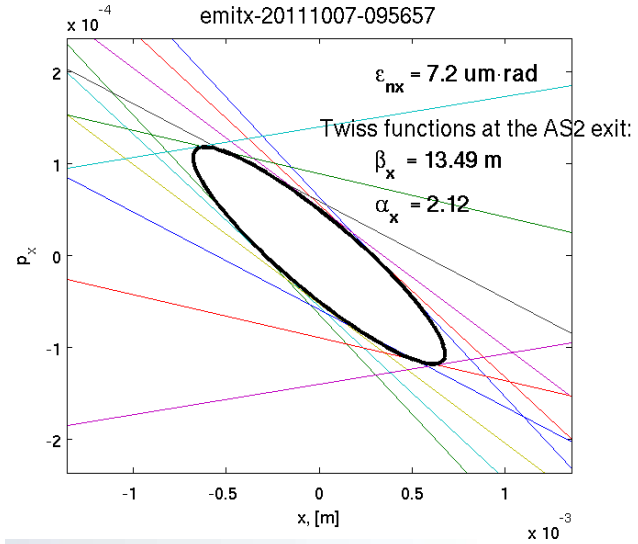


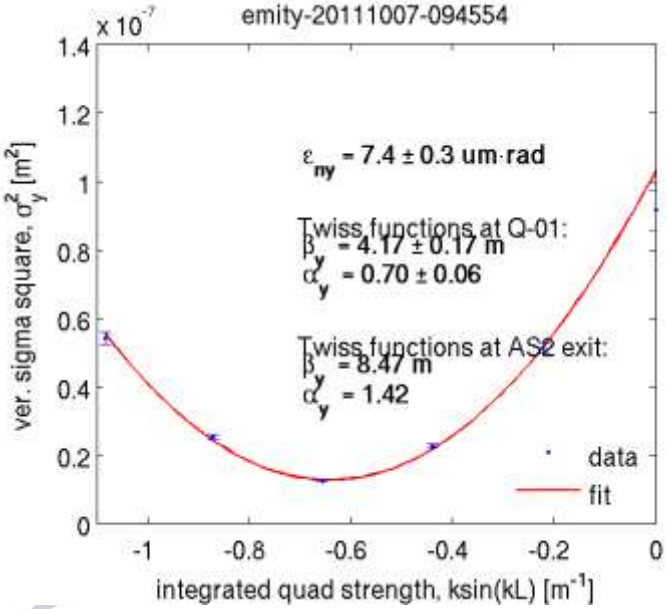
Contents

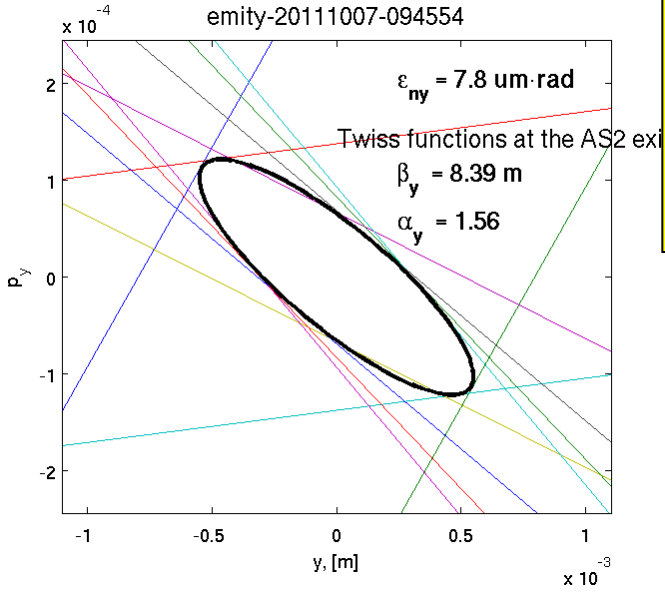


E = 110.087 MeV, ΔE/E = 0.05 MeV = 0.046%
Energy jitter = 0.15 MeV = 0.14 %





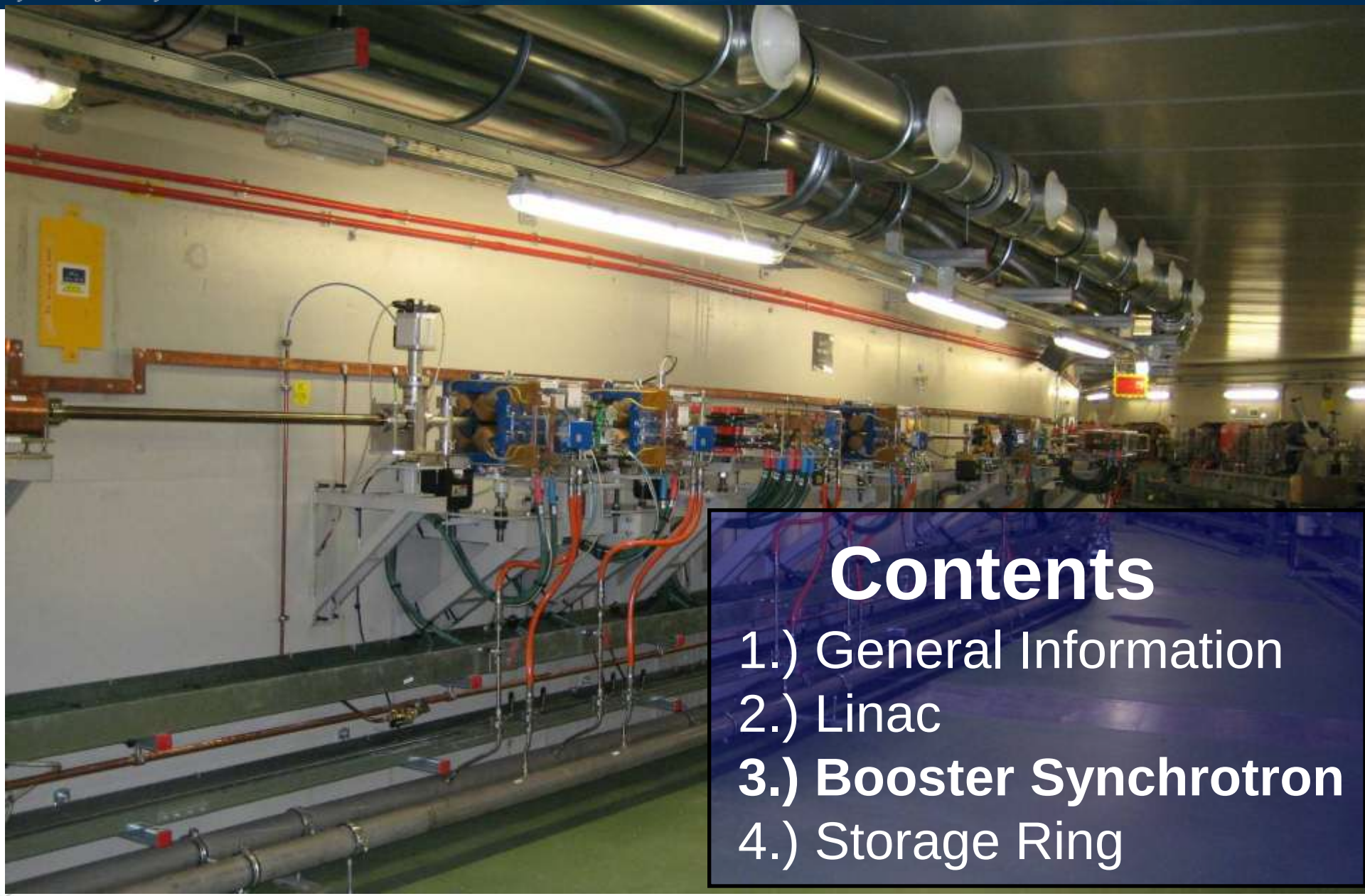




Conditions at the exit of the Linac:

ε(x) = 65.1 nmard
β(x) = 10.4 m/rad
α(x) = 1.98
ε(y) = 46.6 nmard
β(y) = 8.46 m/rad
α(y) = 1.87

Project ALBA: Booster Synchrotron



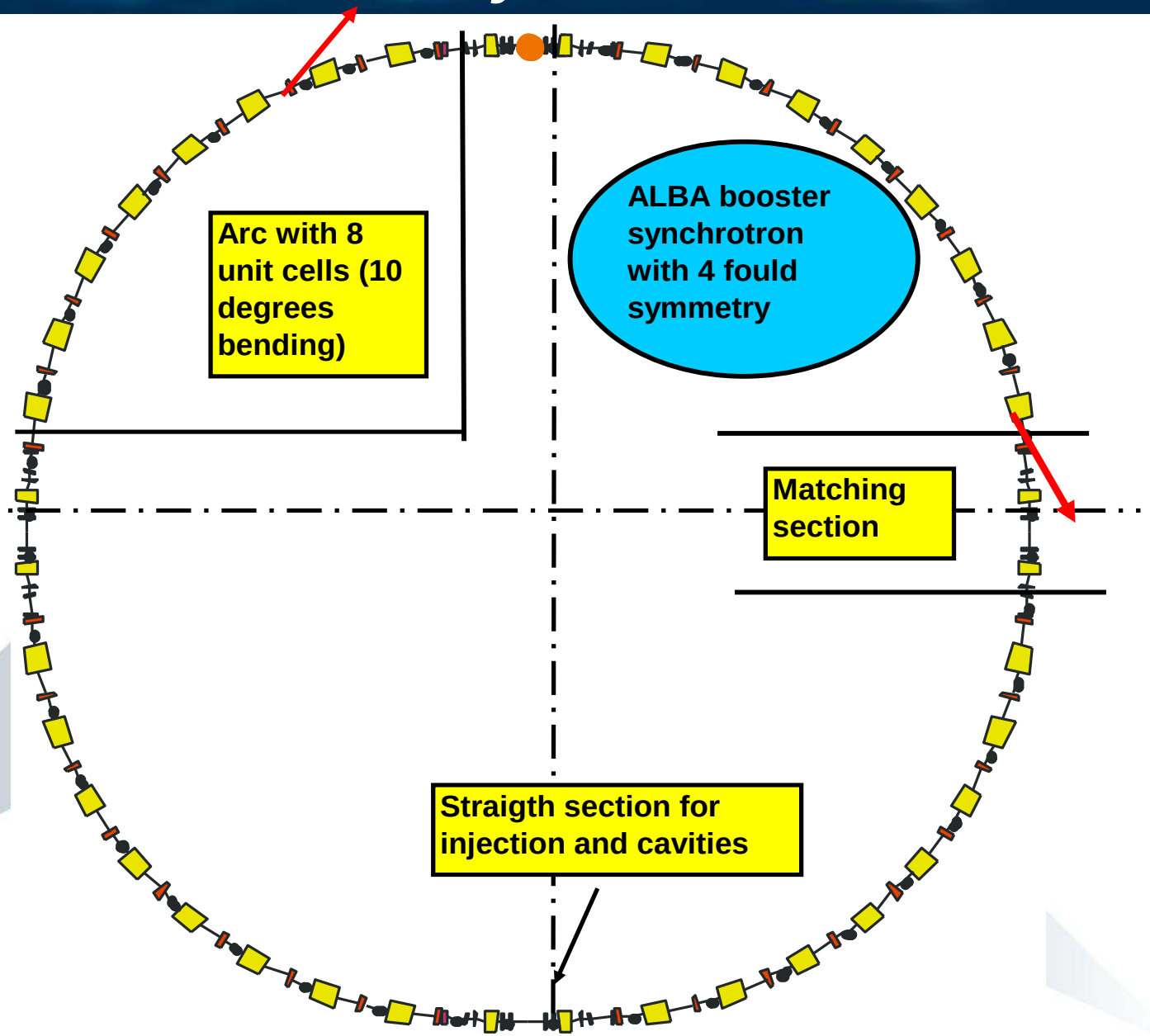
Contents

Layout of Booster Synchrotron

3 GeV Booster
gradient dip., with built-in sextupole.
Circumference: 249.6 m

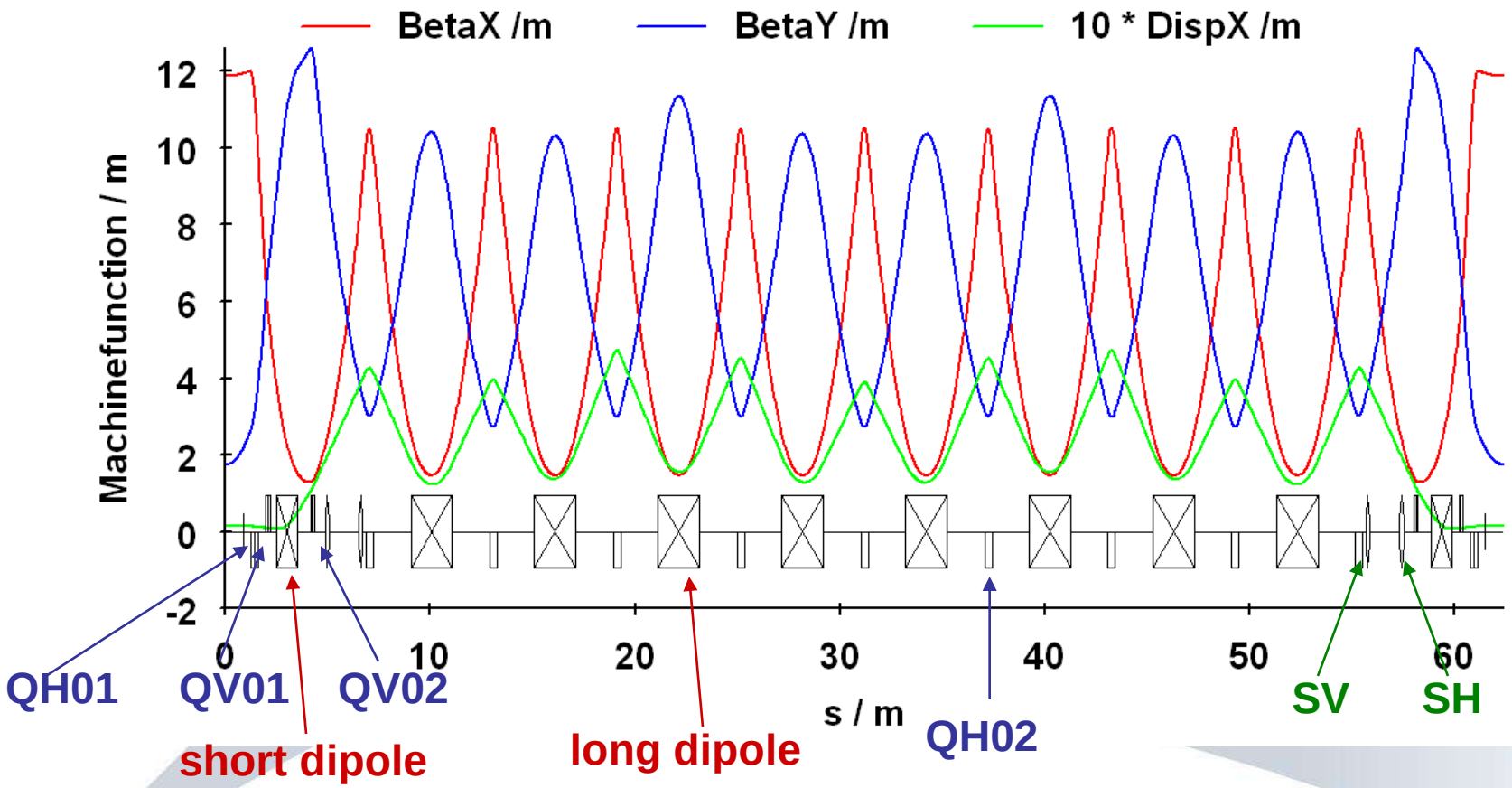
4 superperiods:
32 long dip. 2 m
8 short dip. 1 m
60 quads in 4 families

Emittance
10 nm·rad



Lattice of Booster Synchrotron

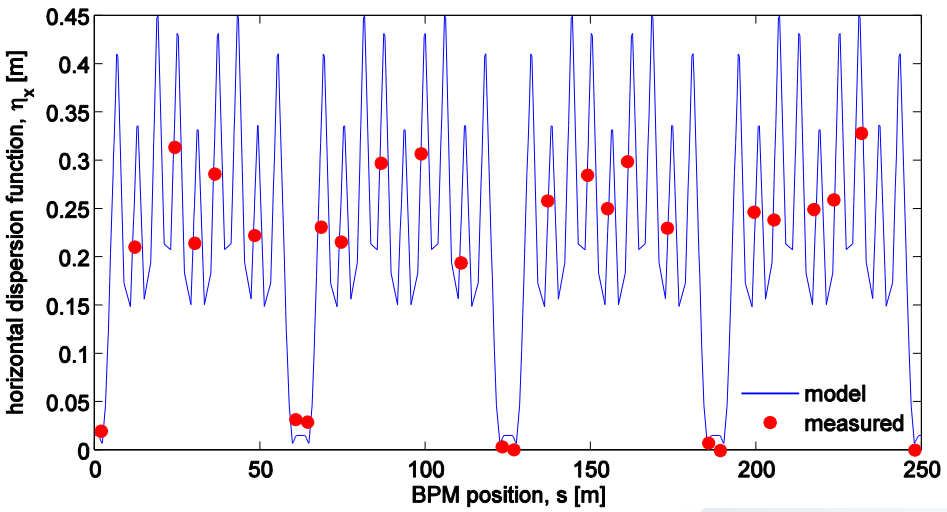
The lattice is a TME-structure
The ALBA synchrotron should have the smallest emittance in the world



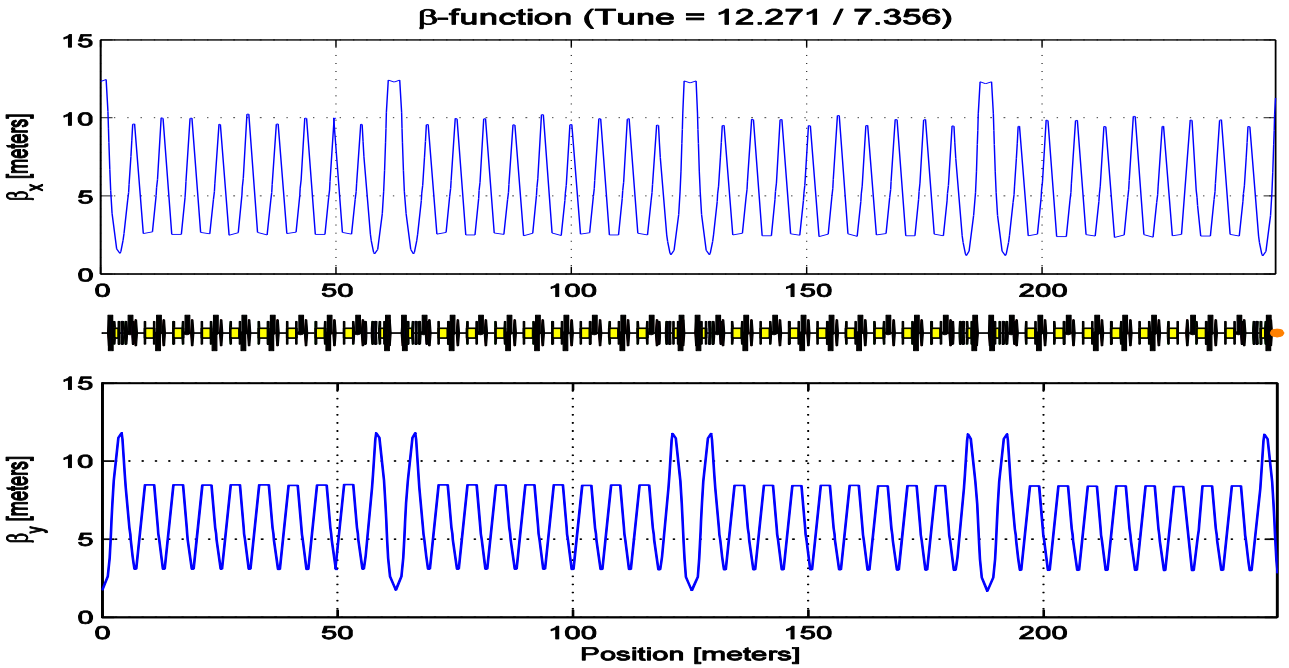
Q(x) is given by QH02 and Q(y) is given by the bends. All the other quads for fine tuning

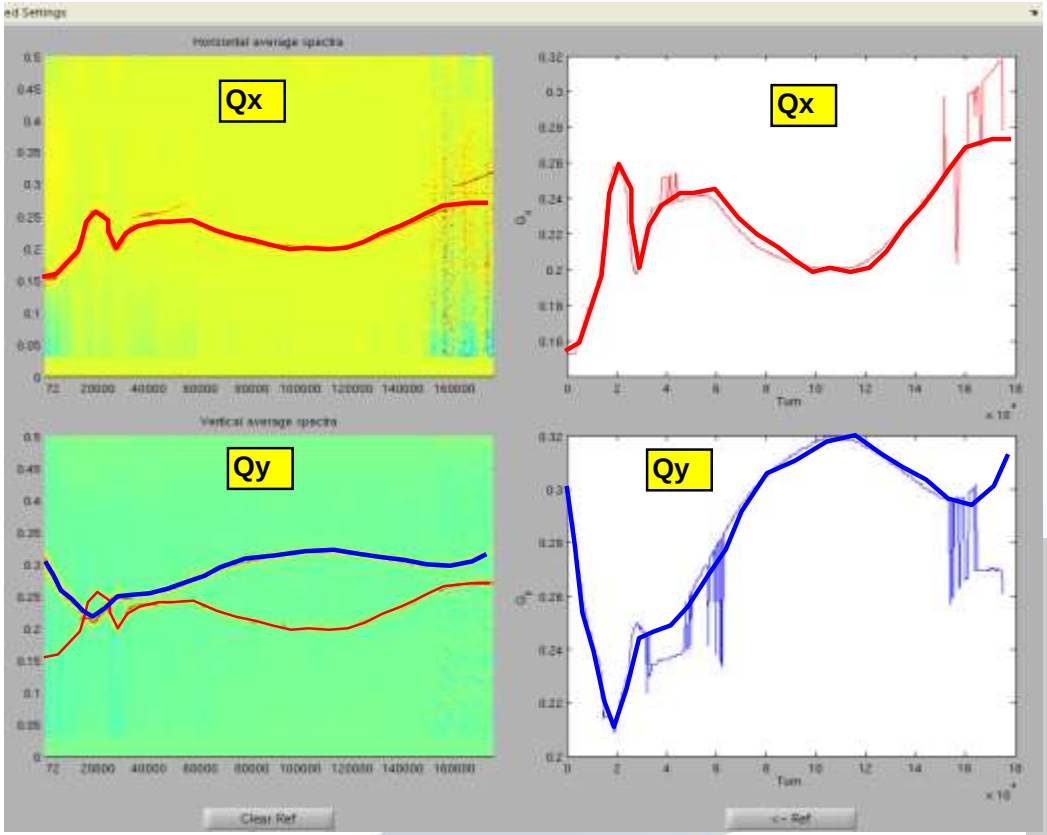
Design working point: $Q_x = 12.42$, $Q_y = 7.38$

LOCO: Dispersion Functions (DC)

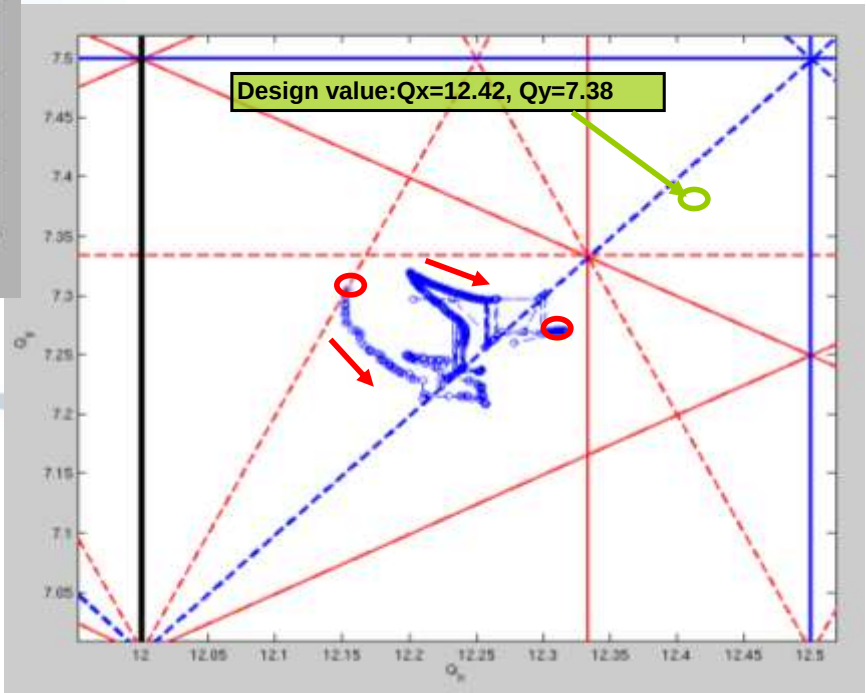


Good agreement with the model



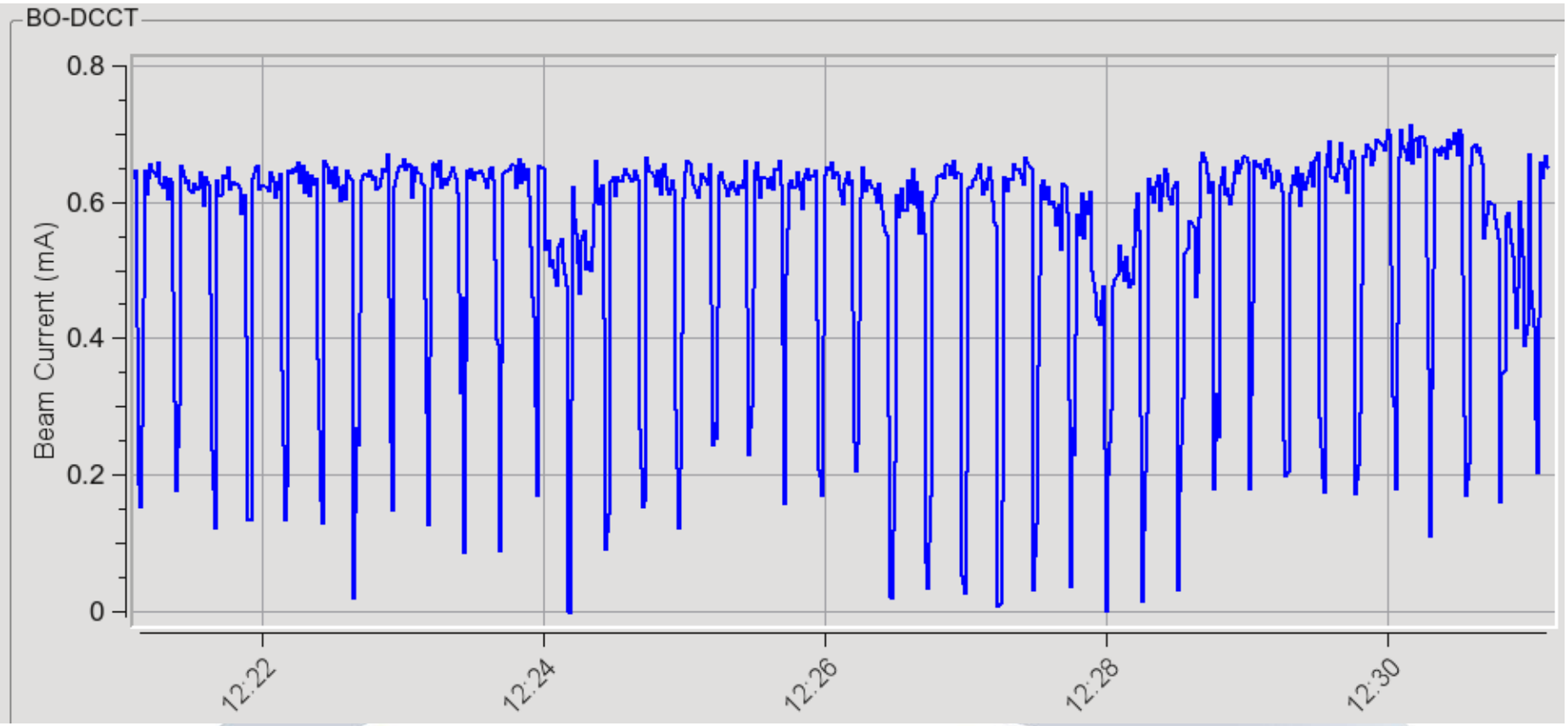


We don't understand the movement of the working point. It has to be investigated



Booster Injection Efficiency

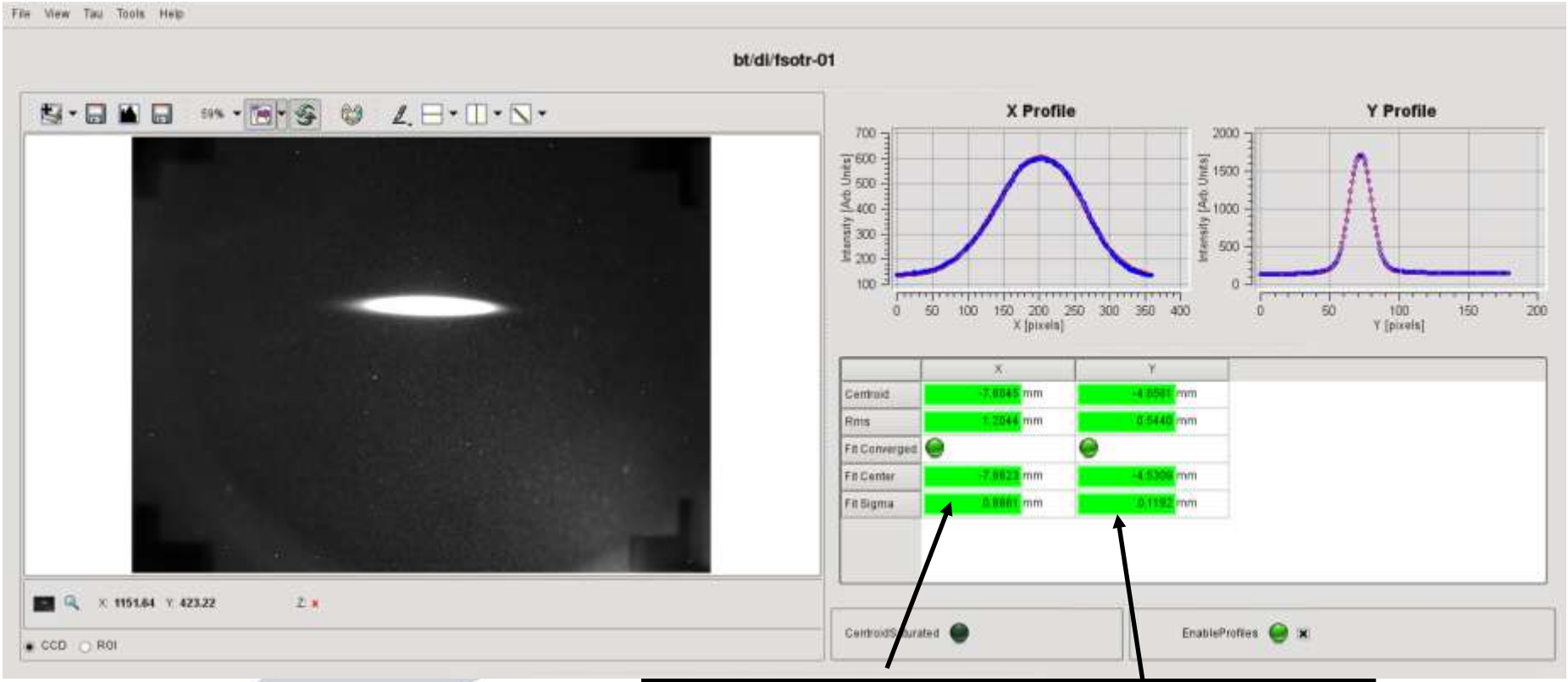
9th October 2011



Each 14th shot is a "Bad Shot"

Booster Emittance

1st extracted Beam from the Booster Synchrotron, 28th of October 2010

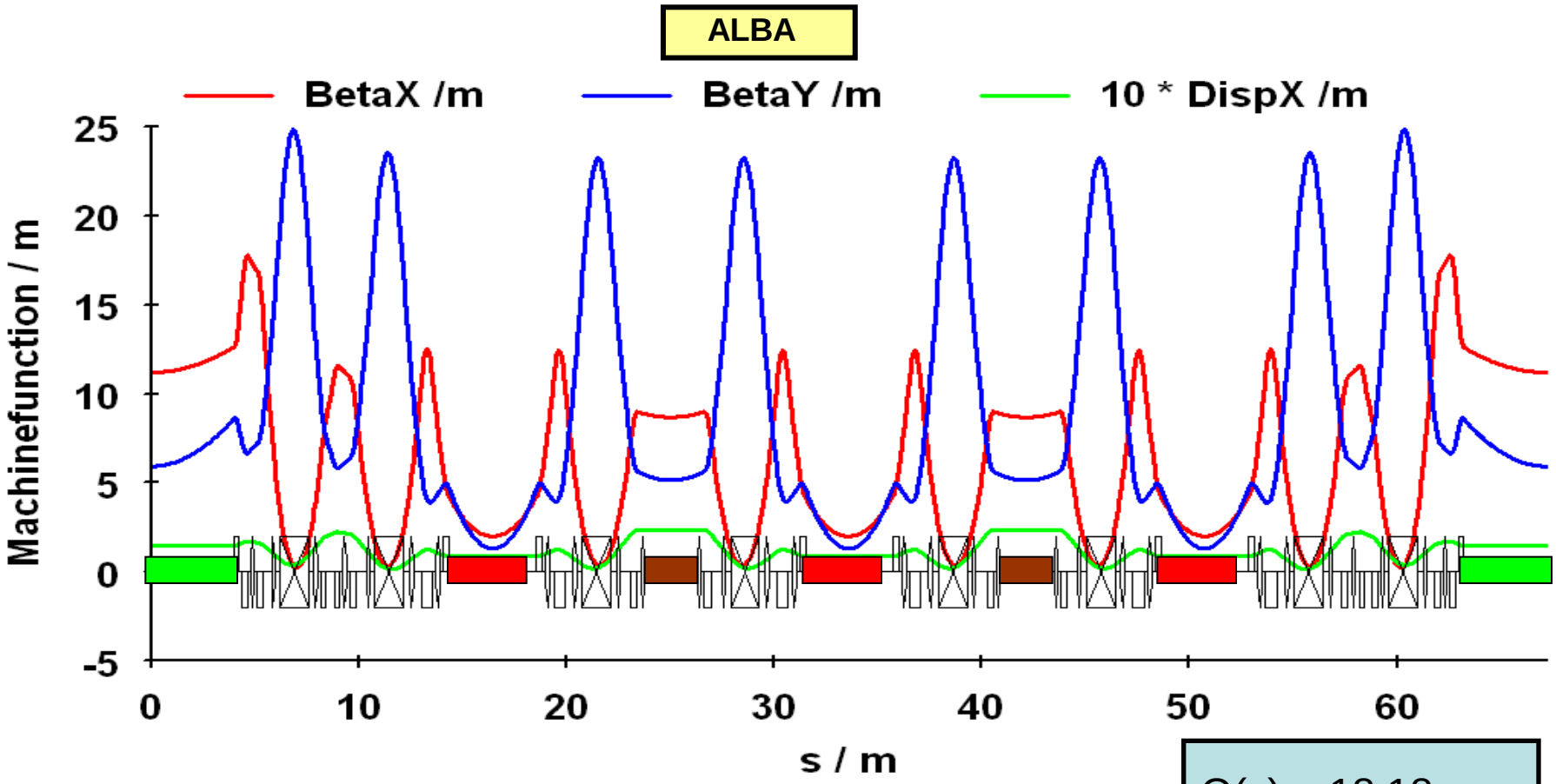


σ(x) = 0.86 mm, σ(y) = 0.19 mm
ε(x) = 13 nmrad, ε(y) = 2,6 nmrad

We are 30 % off to the theoretical emittance and have a coupling factor of roughly 20%.

Contents

Storage Ring Lattice



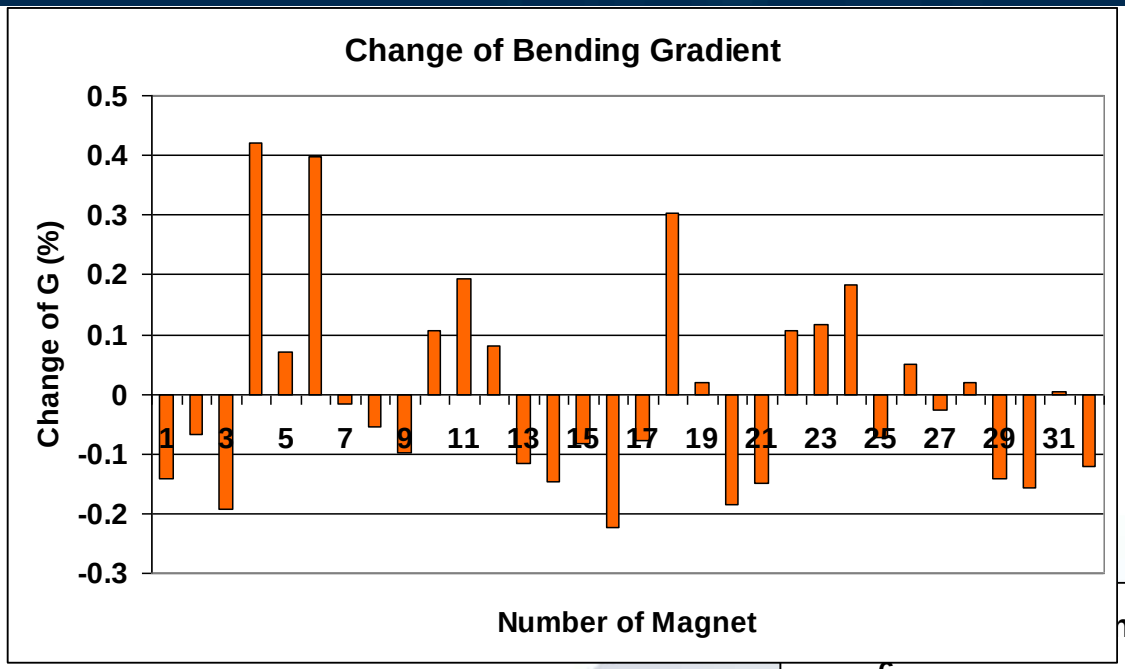
4 long: σ(x) = 300μm, σ(y) = 16.2 μm

12 medium: σ(x) = 147μm, σ(y) = 7.6 μm

8 short: σ(x) = 362μm, σ(y) = 15.1 μm

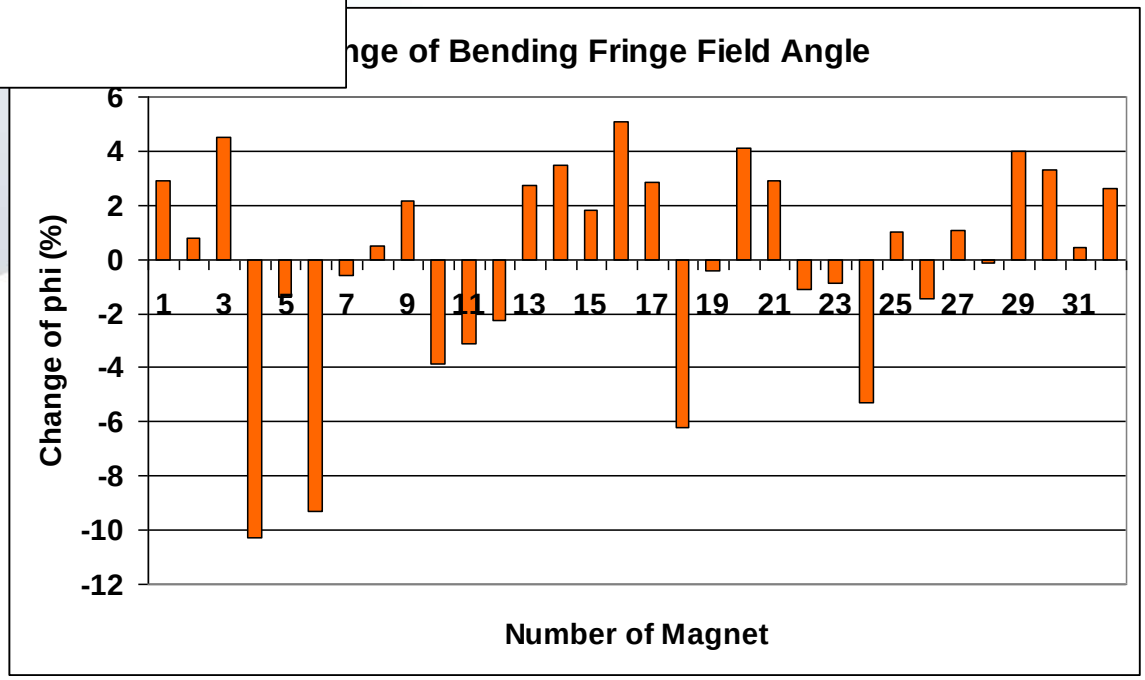
Q(x) = 18.18
Q(y) = 8.37
ε(x) = 4.5 nmrad
$\alpha = 8.83 \times 10^{-4}$
$\delta E/E = 1.05 \times 10^{-3}$

Bending Magnets: Individual Settings

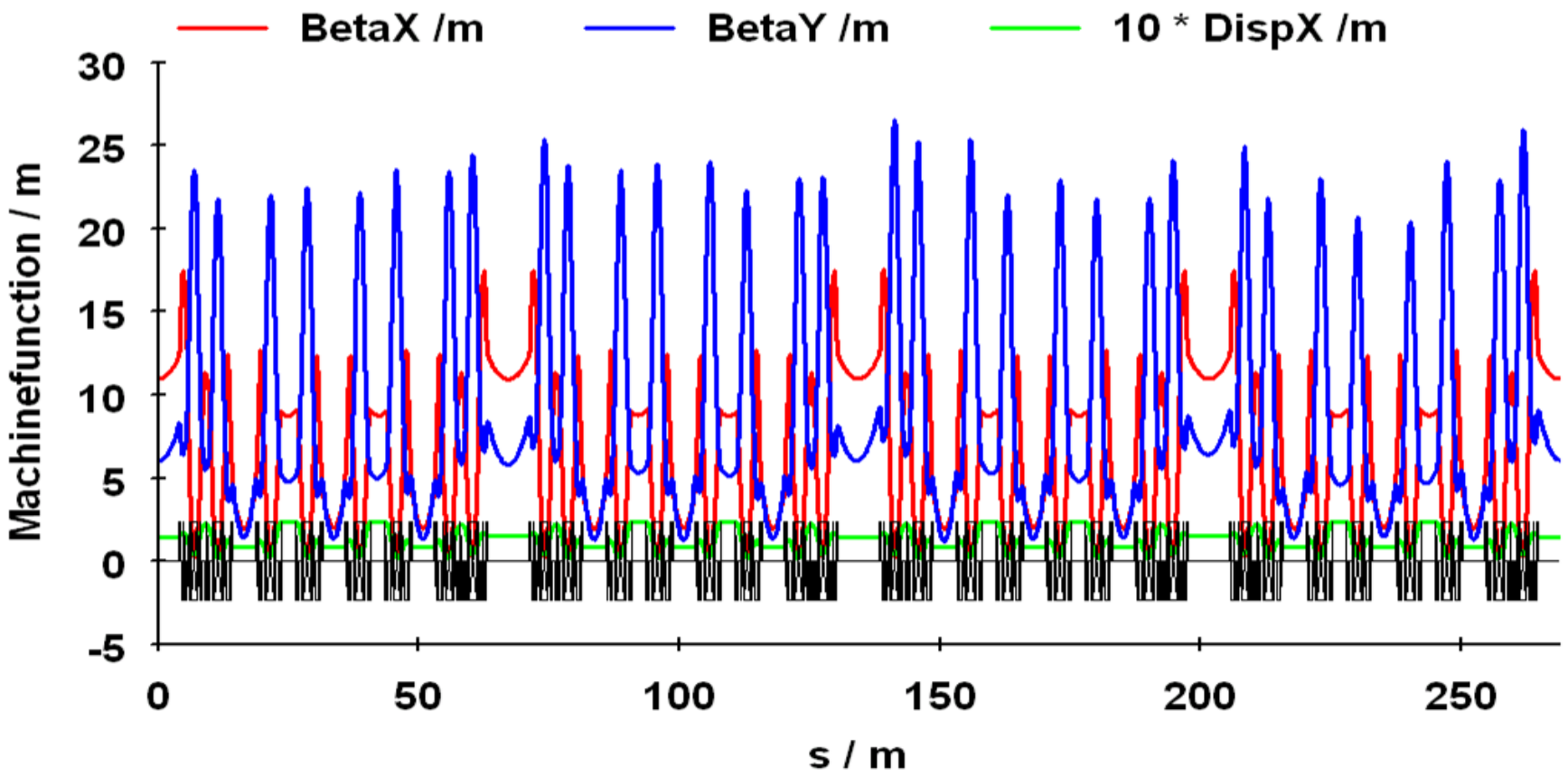


Change of k-Values of the individual magnets.

Change of fringe field angle of the individual Magnets.



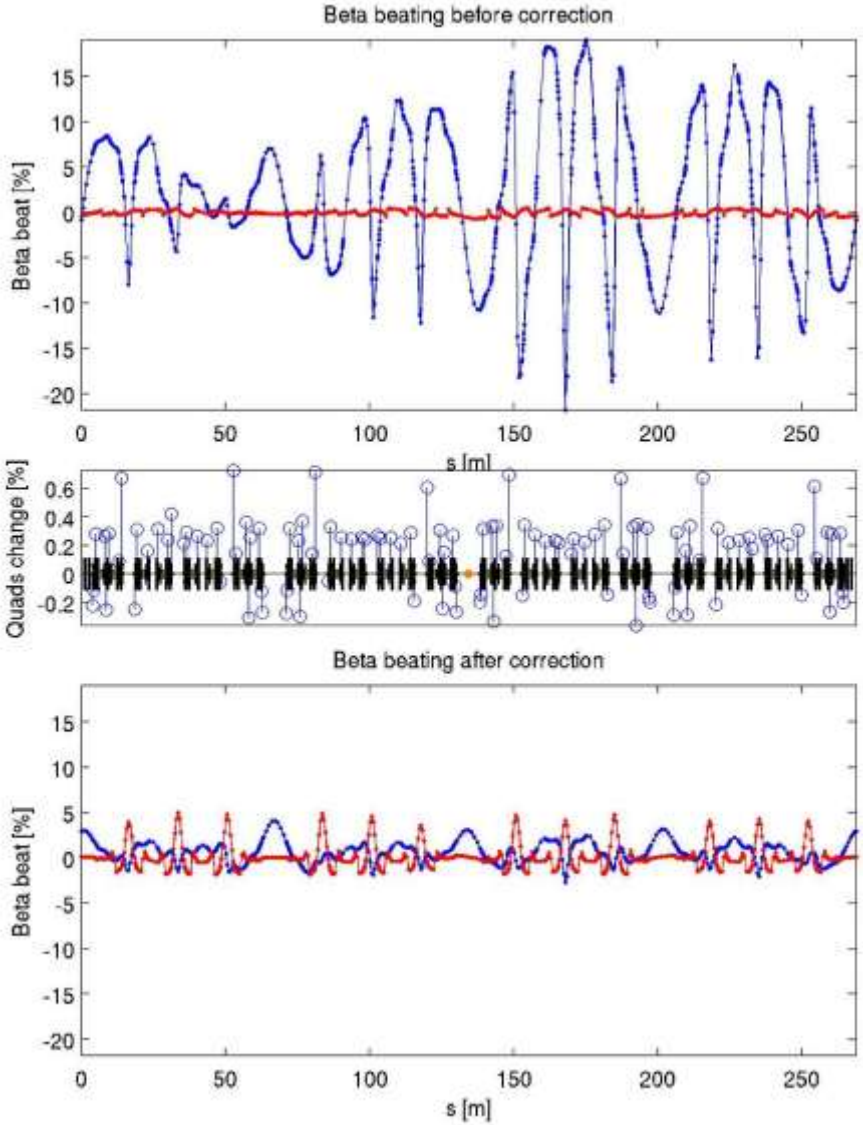
ALBA-Lattice with individual Settings



C = 268.8 m, Qx = 18.183, Qy = 8.395, ε = 4.44 nmrad

Rho = 6.99718, l = 1.373893 m, k = individual, phi = individual

Reduction of Beta Beating



According to the individual characteristics of the bending magnet, the beta beating (deviation from the model) will be around +/- 3% and the settings of the power supplies will vary about +/- 0.6 % from the nominal ones. These are the guide lines for the real machine

Storage Ring Commissioning

22th of November 2010:

The storage ring was assembled (without ID's) and ready for commissioning, but the CNS certificate was missing. It was decided to install the out of vacuum undulators. This means the commissioning has to be made with 3 small vacuum chambers (+/- 4 mm)

1.) Phase: Weekend 12th/13th February 2011

For this weekend we got from CNS the allowance for the storage ring injection and one turn. We realized the miss-positioning of on BTS quadrupole and had a problem with the kicker power supplies. In general no success, we broad the beam into the first bending magnet of the storage ring.

2.) Phase: March - June 2011

We got the allowance from the CNS for the commissioning of the machine at the 8th of March 2011. We commissioned the storage ring very successful until 10th of June.

Storage Ring Commissioning

June to September 2022:
Installation of the in vacuum undulators and the SCW wiggler.
Restart of the machine in the middle of September 2011

3.) Phase: September to October 2011:
Commissioning of the in vacuum undulators and the SCW.
22nd October 2011:
Start of beam line commissioning. In the morning shift machine optimisation and in the afternoon shift beam line commissioning.

Apple II EU62 , EU71 and MPW are installed

SR Commissioning: 9th March 2011

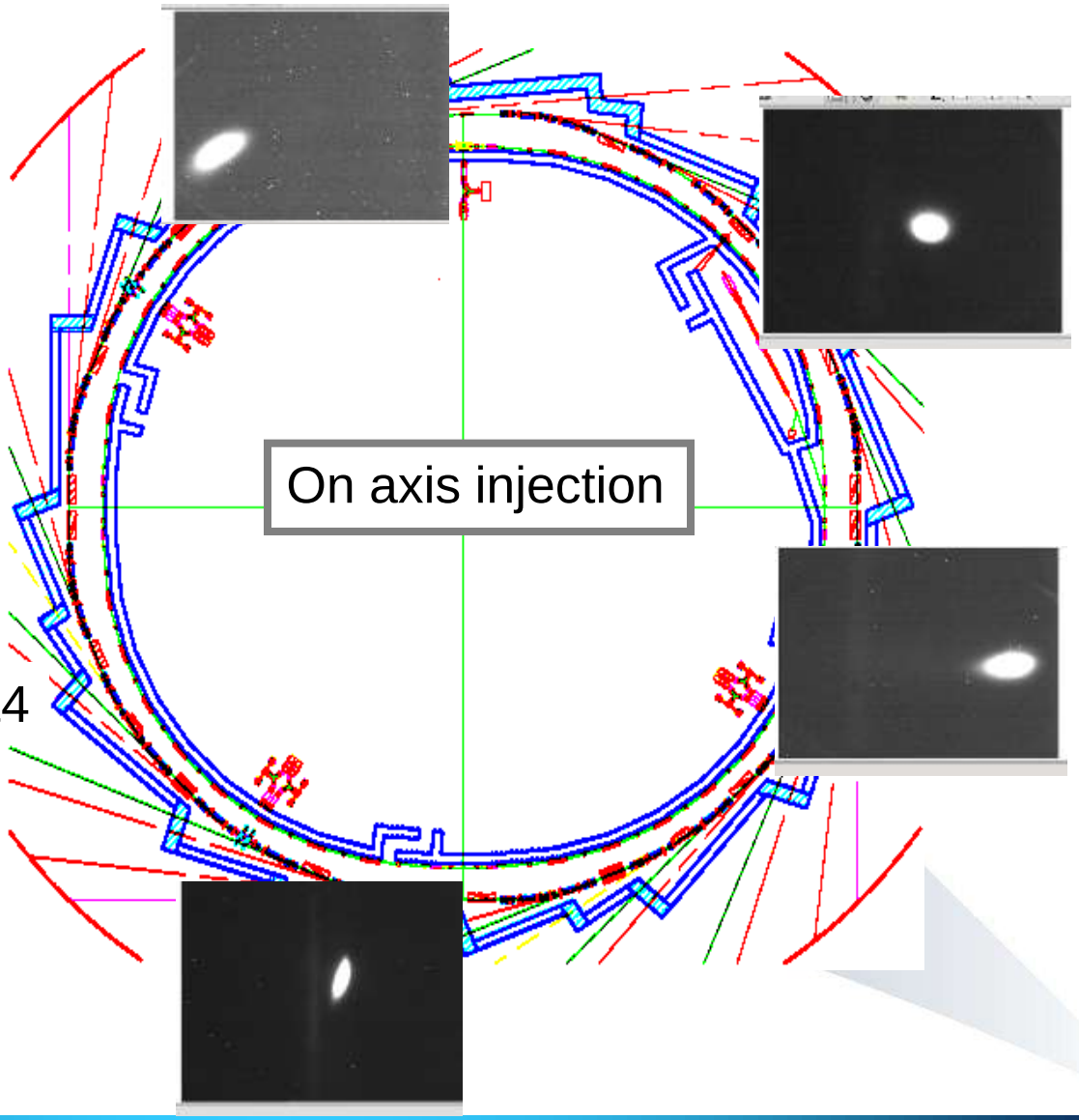
- Recabling Quads:

✓ Sectors 1&2

✓ Quadrant 1

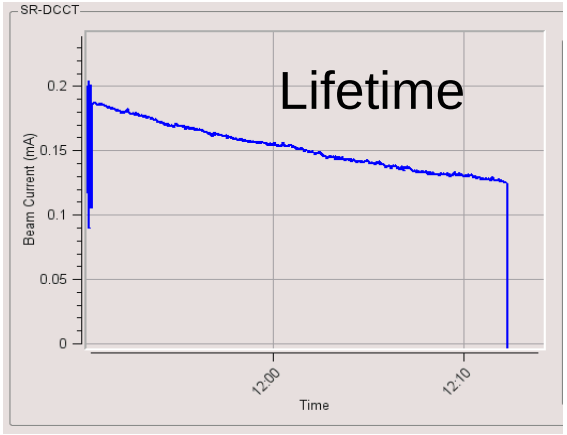
✓ Quadrant 2

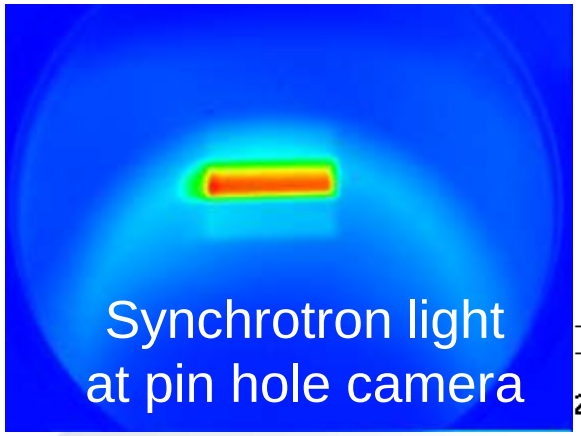
✓ Quadrants 3&4

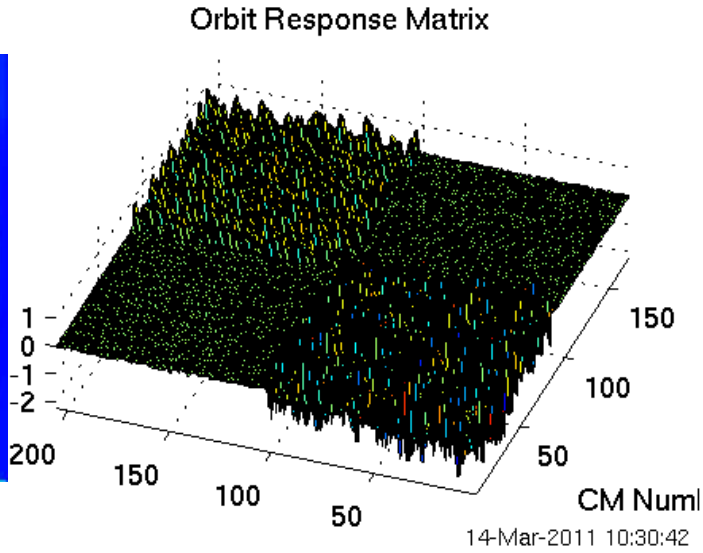


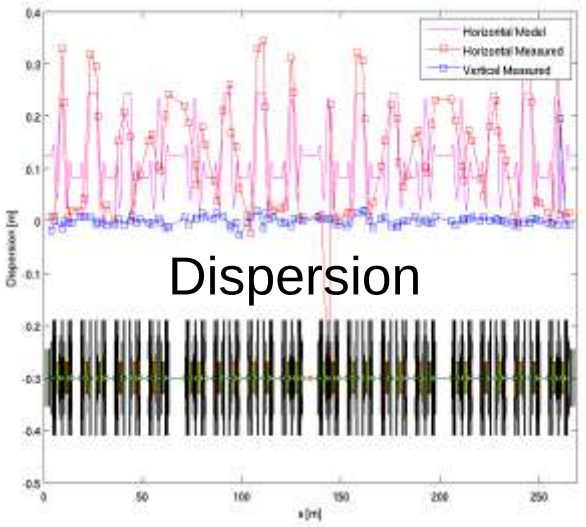
19h35: 1st turn !

13 -14 March: Firsts measurements

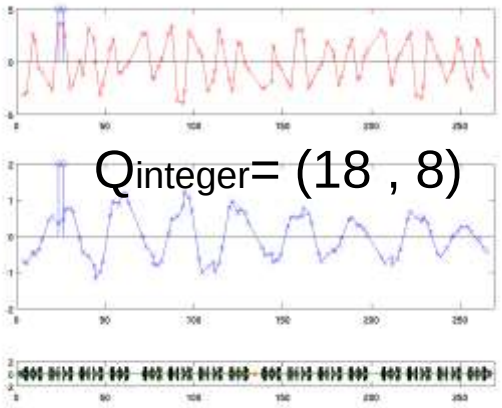








Energy = 2.985 GeV



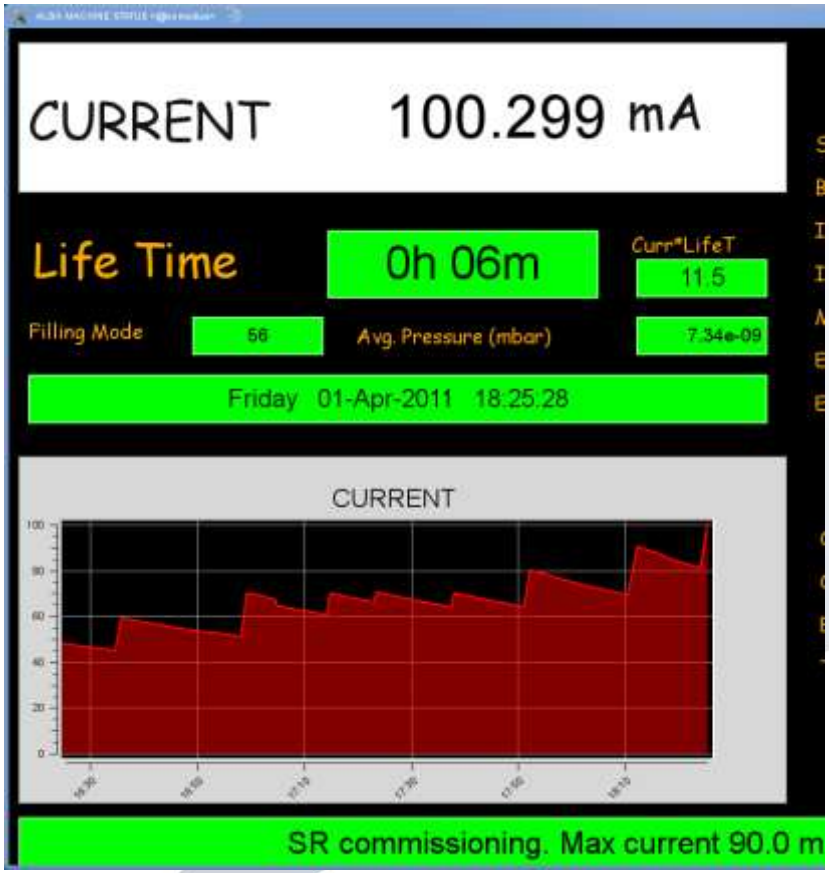
1st Accumulated Beam at ALBA

16th of March 2011:
a historical day of the ALBA – project:
the first accumulated beam at ALBA.

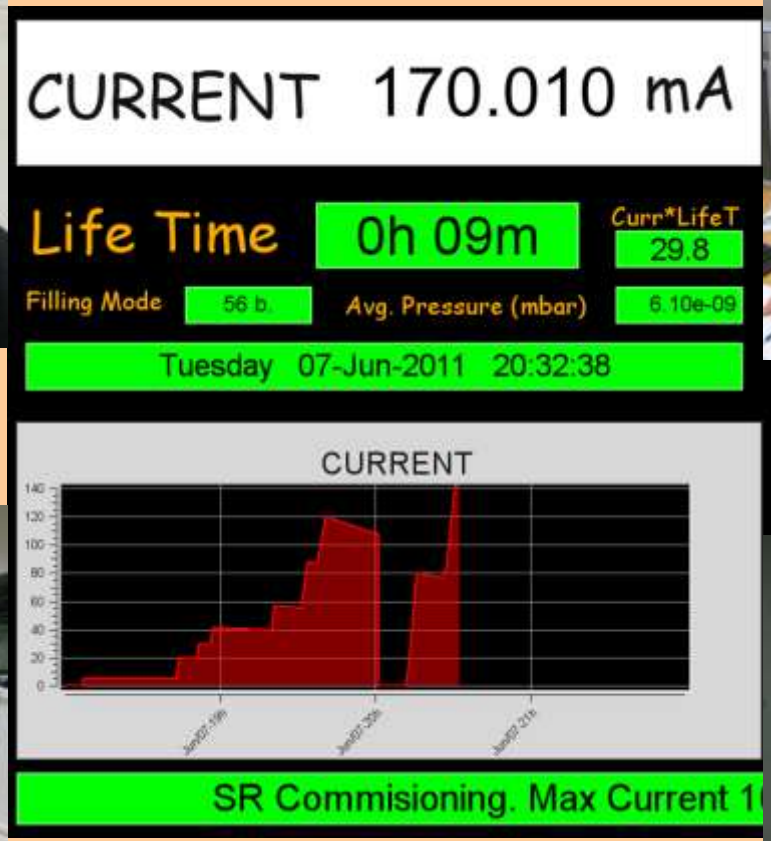
1st Accumulated Beam at ALBA

16th of March 2011:
A historical day of the ALBA – project,
The Accelerator Division is celebrating this success.

Once the MPS was operational…



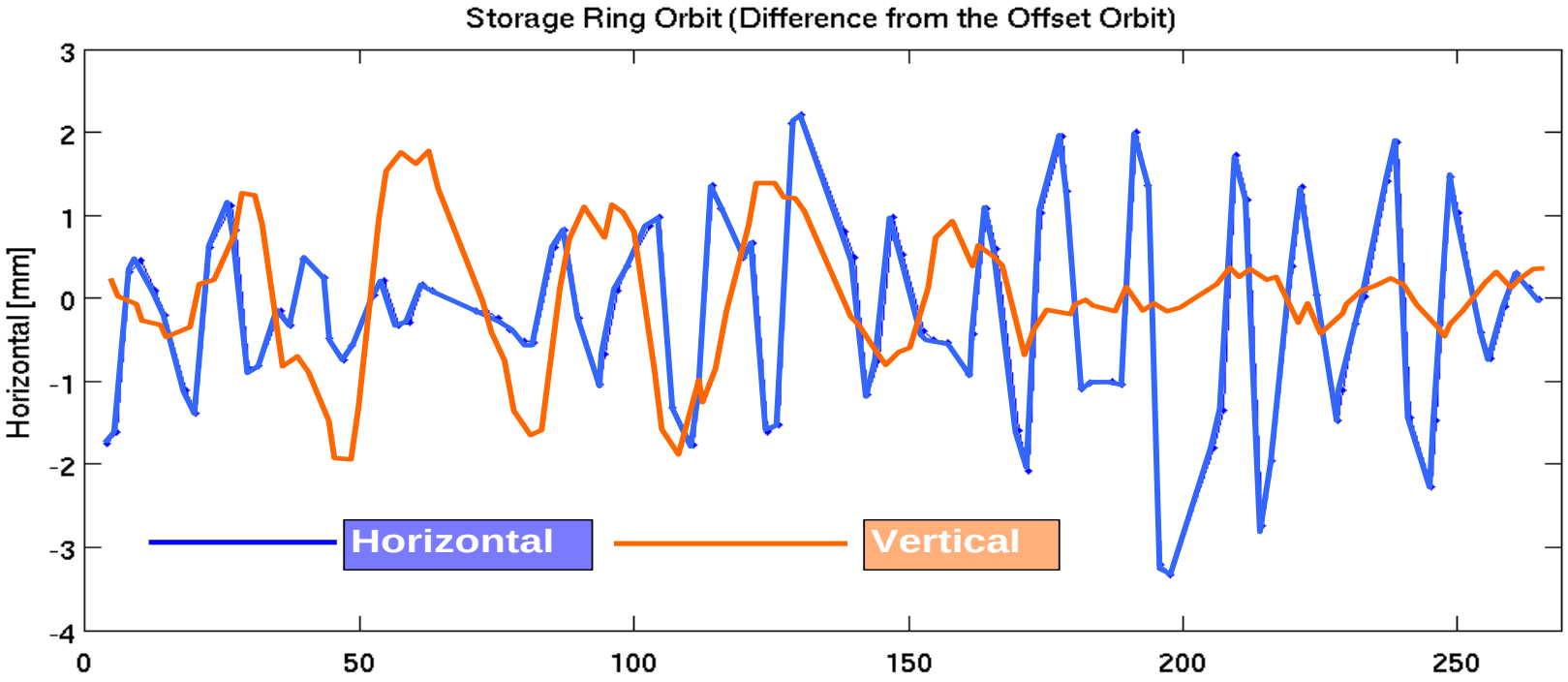
7th of June: 170 mA at ALBA



Orbit Correction

Raw orbit without correctors

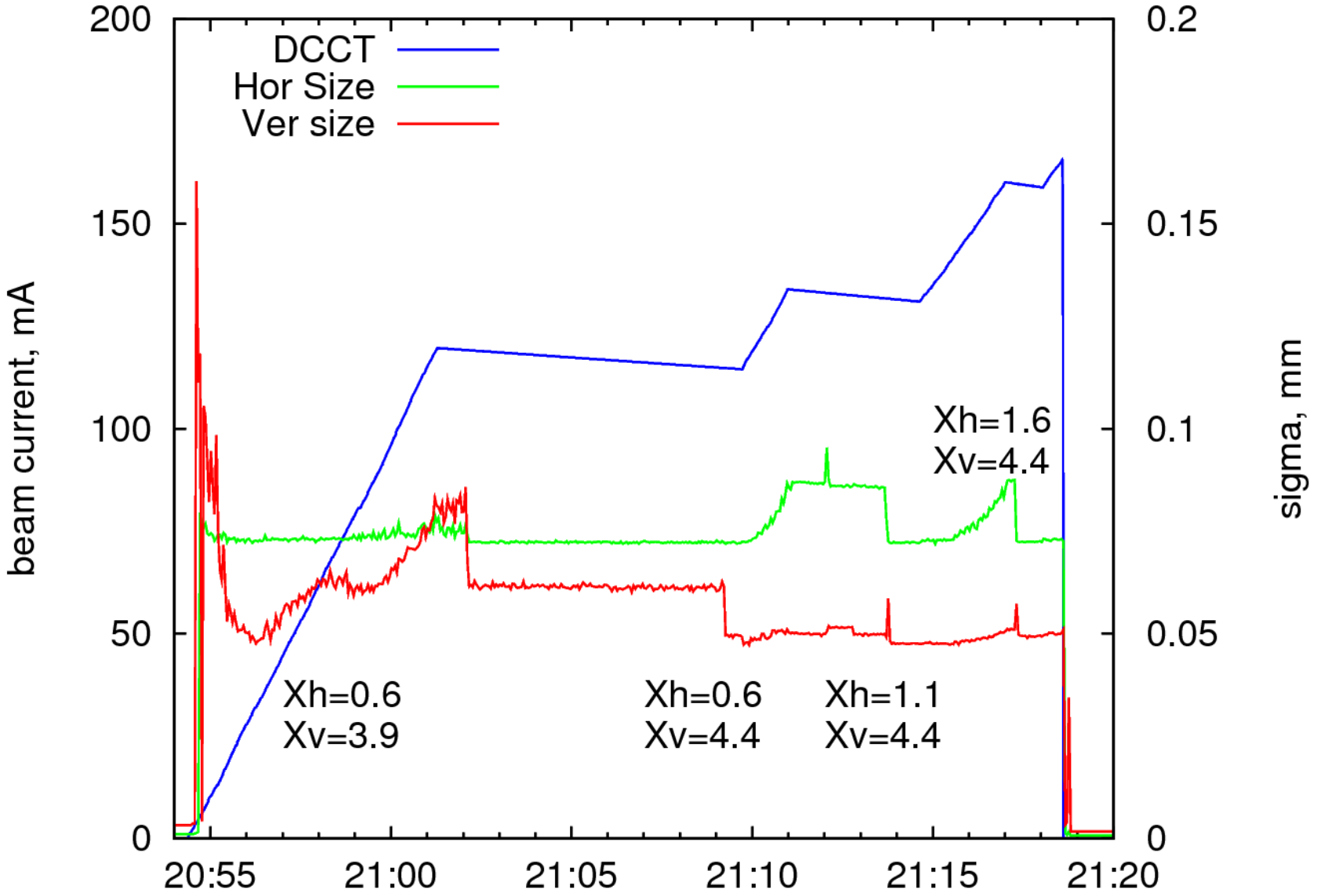
Offsets of BBA included and RF frecuency adjusted



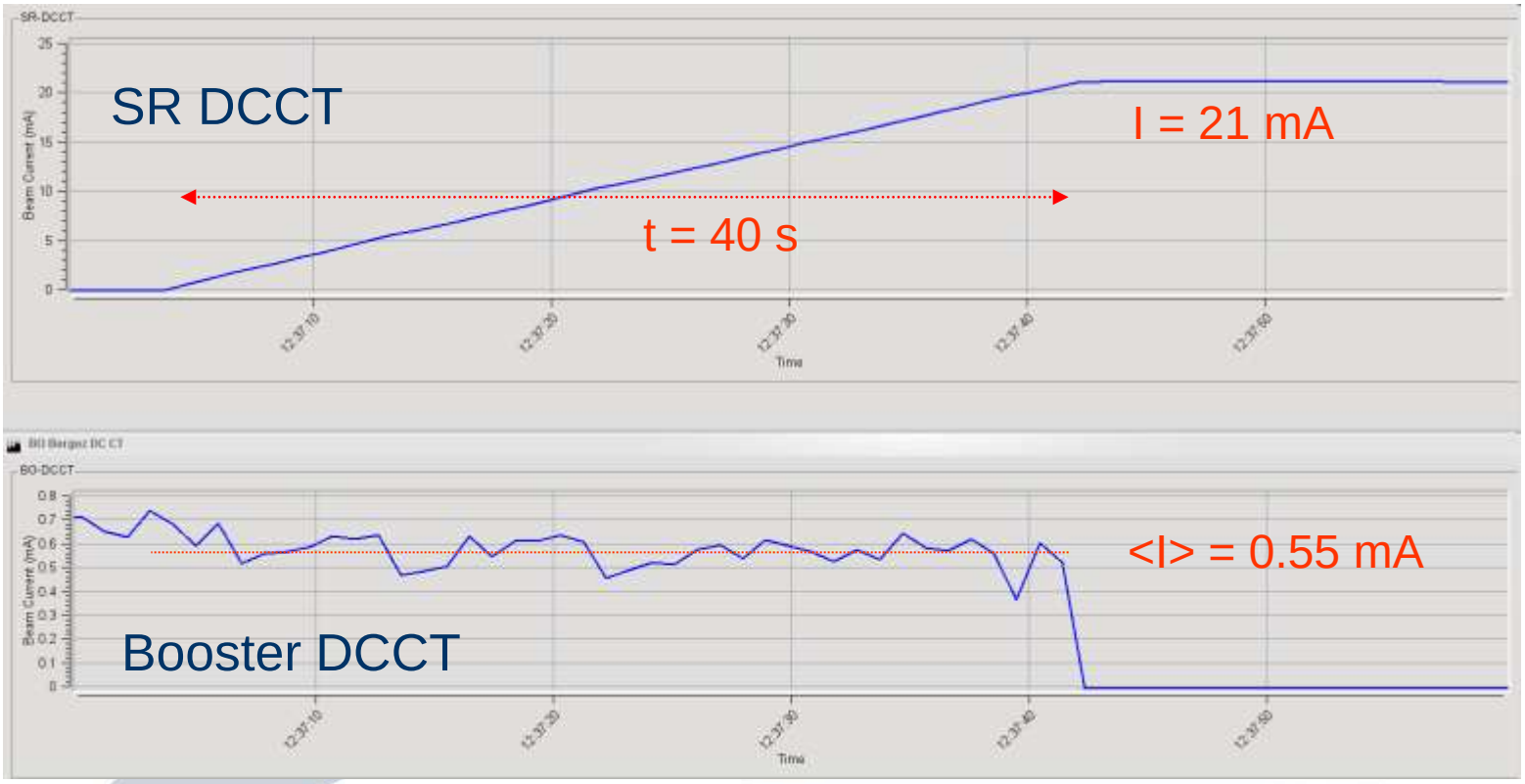
Horizontal orbit < 3mm
Vertical orbit < 2 mm

Good alignment

7th of June: 170 mA at ALBA



Injection Efficiency



Injection efficiency ~ 95%

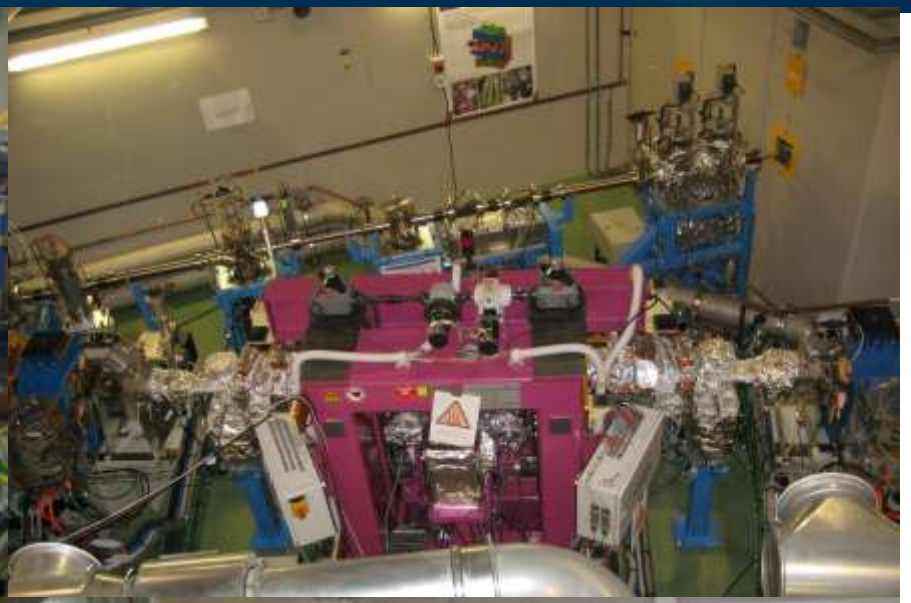
Summary of Measurements

- Tune
- Chromaticity
- Beam Based Alignment
- Orbit correction, including frequency adjustment
- LOCO measurements:

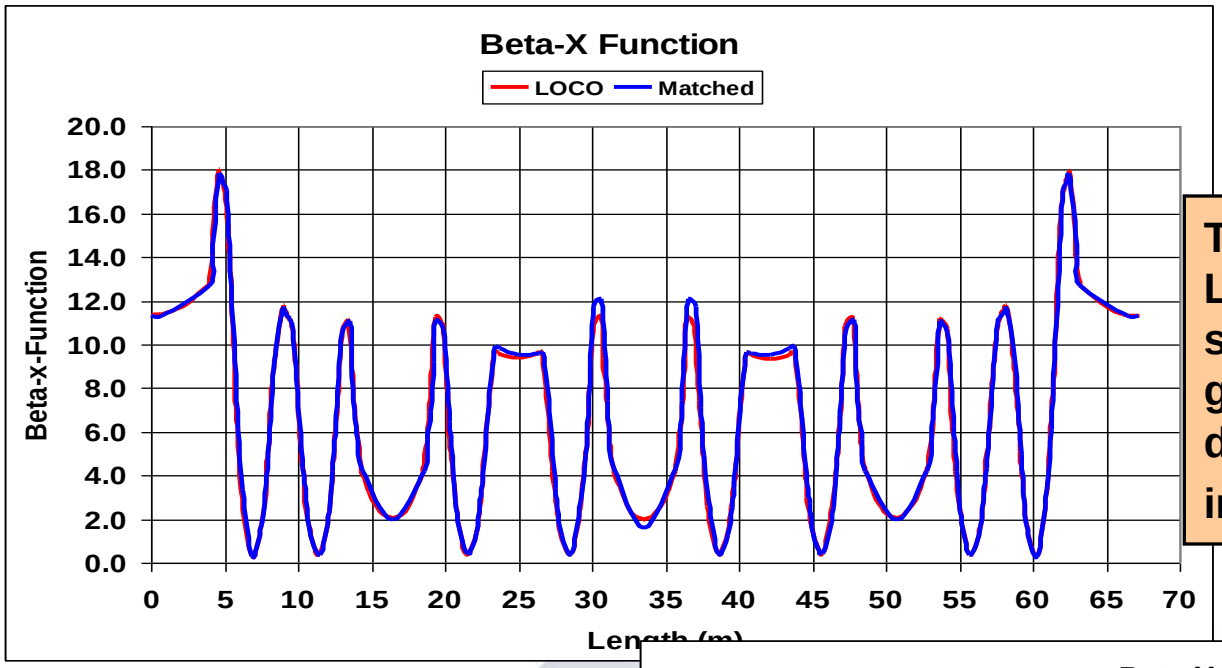
  Beta functions, dispersion and beating correction
- Beam size, emittance
- Bunch length
- Vacuum performance
- Closing IDs
- Slow orbit correction system

(Most of these measurements were done with 10~20 mA)

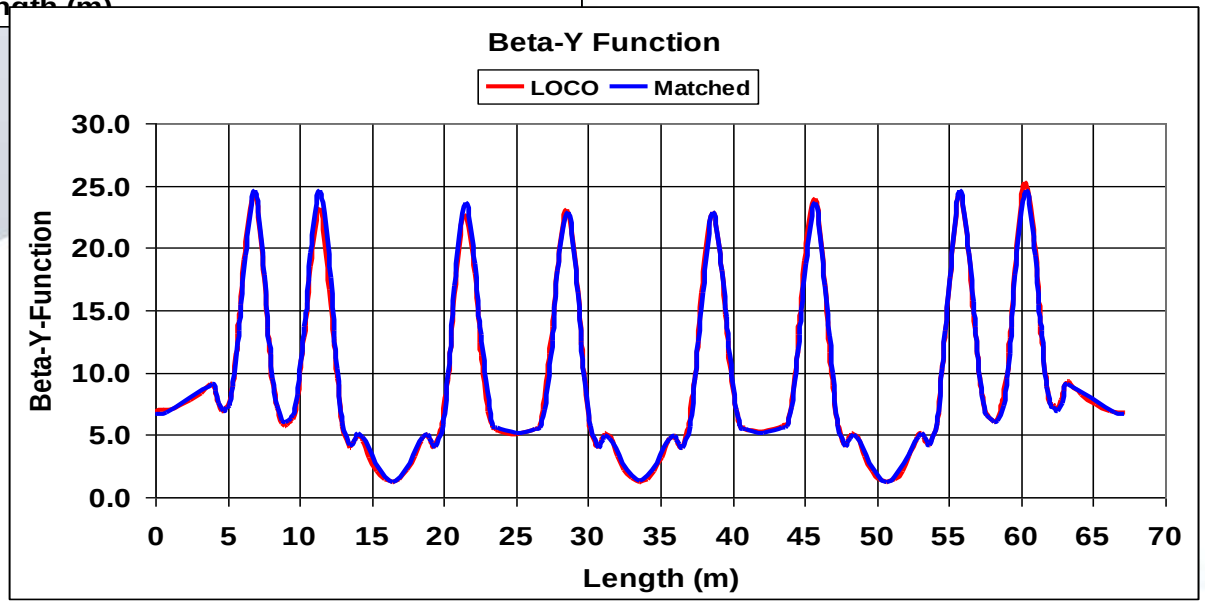
Storage Ring Commissioning



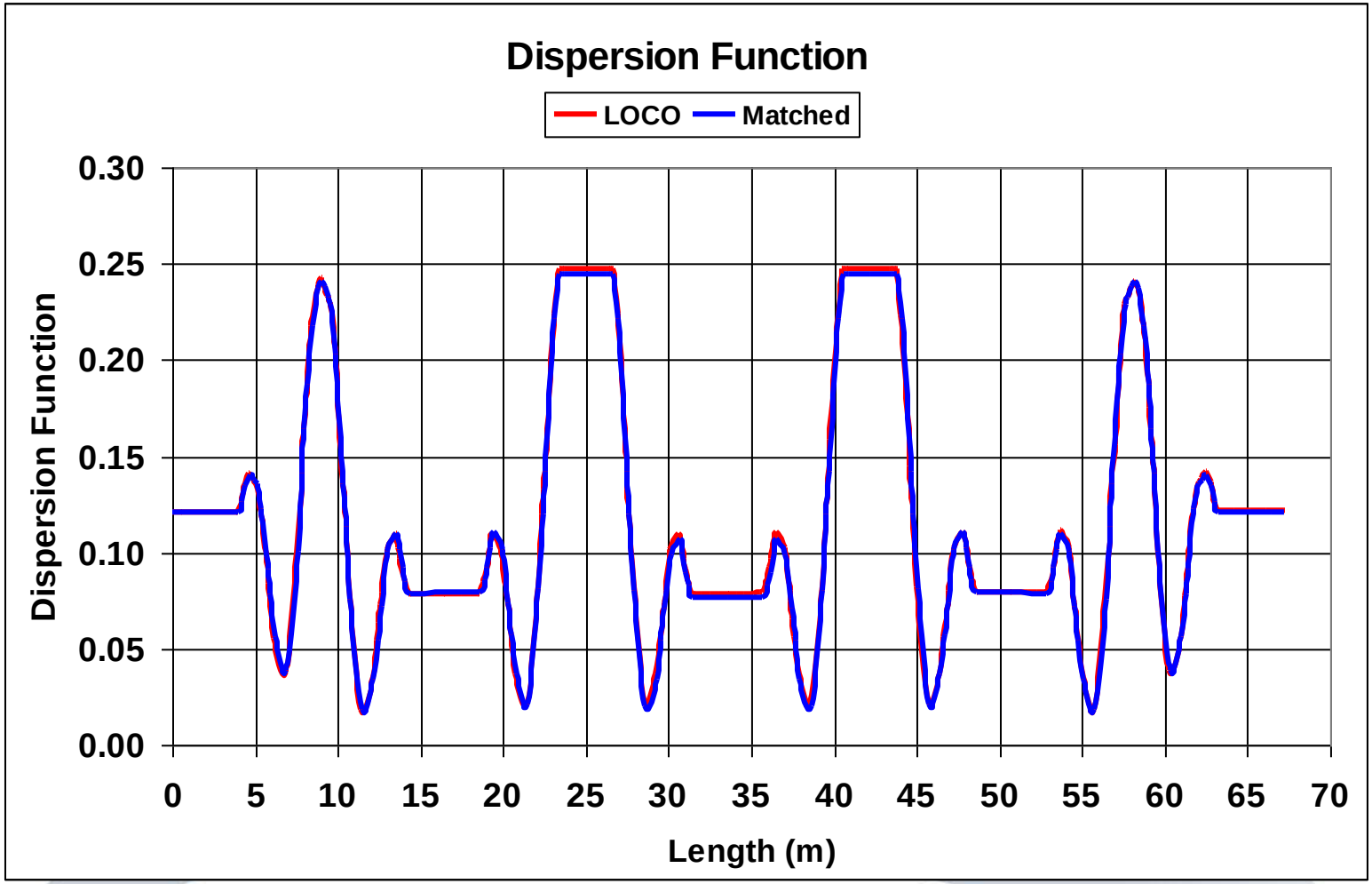
Beta-x Function from LOCO and matched BAD



The agreement between the LOCO results and the matched solution with model are pretty good. There are small differences in the short and in the middle medium straight.

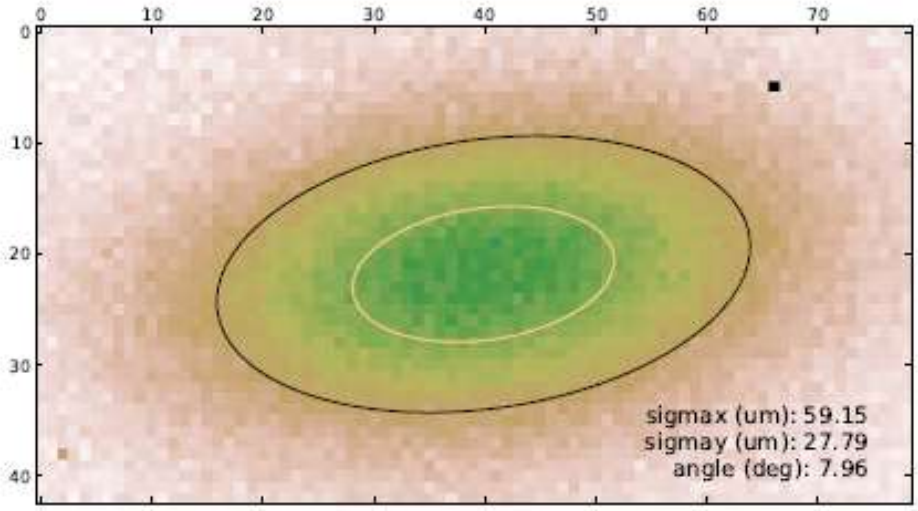


Dispers. Funct. from LOCO and matched BAD



The agreement between the LOCO results and the matched lattice with the model are pretty good.

Ubaldo's Results

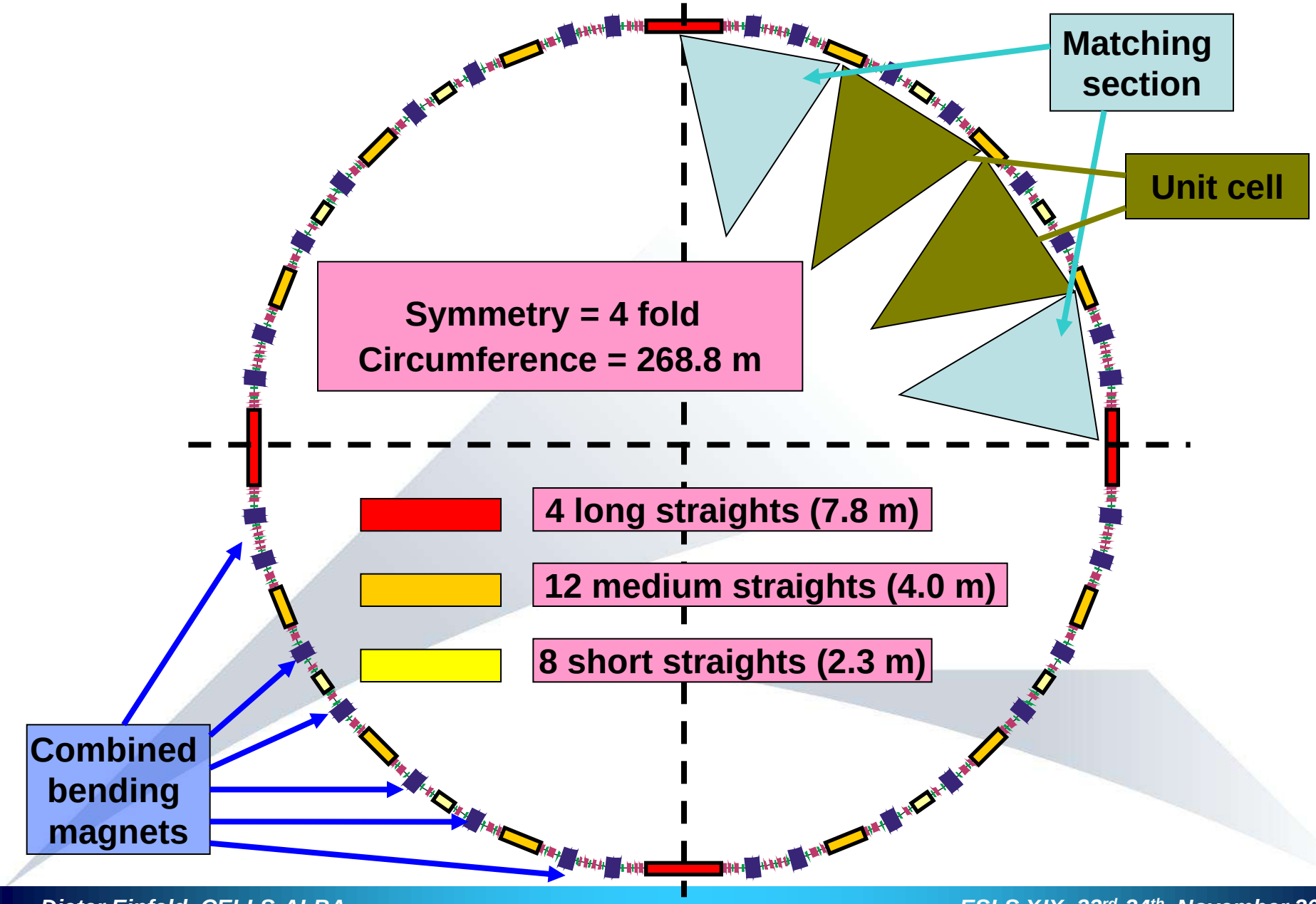


Summary:
All the evaluations from: LOCOand pinhole agree very well. The emittance of the storage ring is 4.6 nmrad

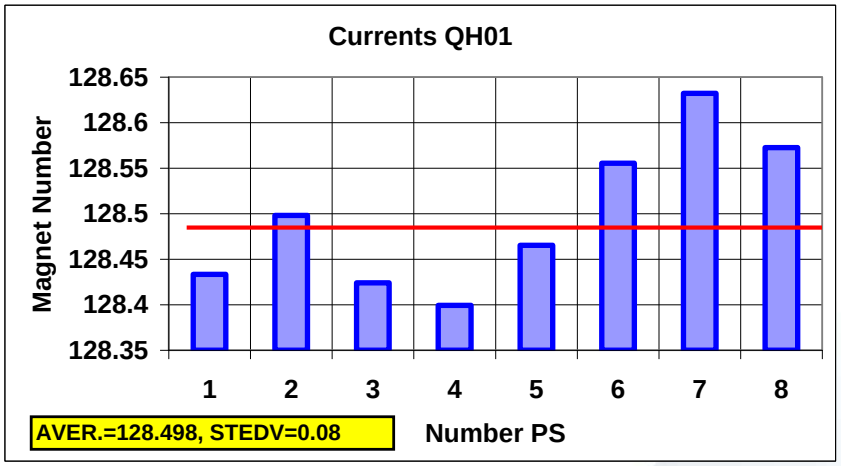
Table 1: Horizontal and Vertical parameters used for the emittance calculation, and associated error bars.

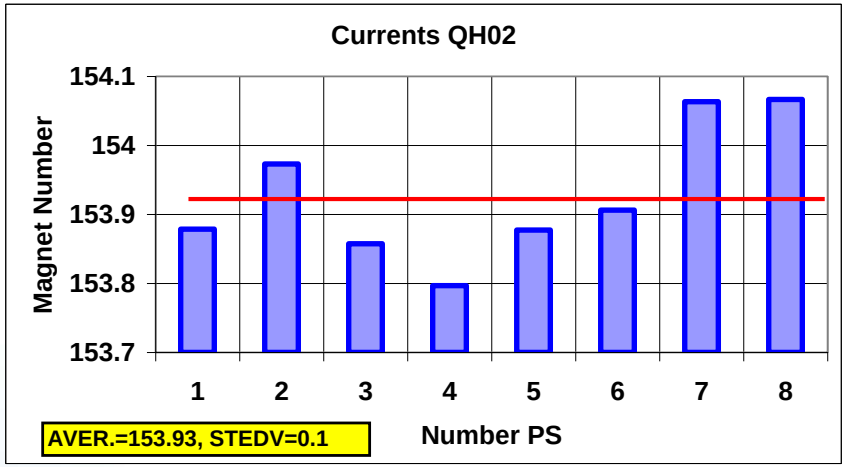
	σ, µm	β, m	D, m	ϵ, **nmrad**
Hor Value	59.15	0.489	0.0355	**4.58**
Hor Error	3%	1%	1%	**10**
Ver Value	27.79	24.465	0.0	**0.031**
Ver Error	3%	1%	0.0	**7**

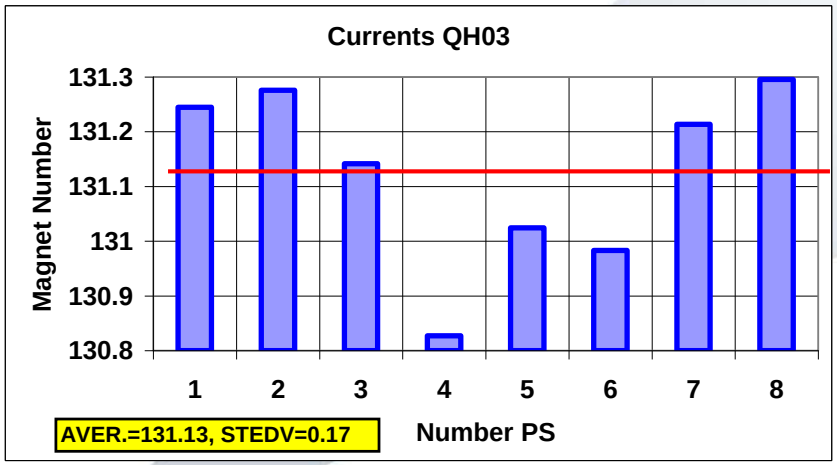
Layout of ALBA Storage Ring

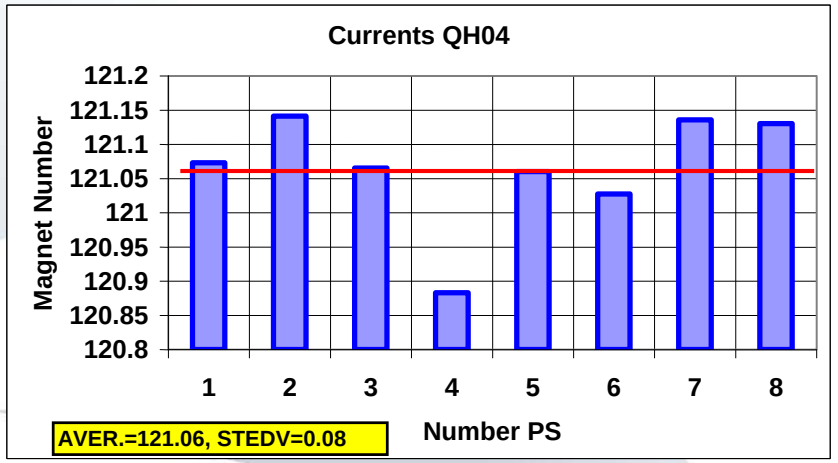


Settings of QH01 and QH04









Longitudinal Symmetry

QH01: AVER.=128.498, STEDV=0.08

QH02: AVER.=153.93, STEDV=0.1

QH03: AVER.=131.13, STEDV=0.17

QH04: AVER.=121.06, STEDV=0.08

QH05: AVER.=143.24, STEDV=0.08

QH06: AVER.=173.33, STEDV=0.13

QH08/09: AVER.=166.01, STEDV=0.42

QH07/10: AVER.=170.23, STEDV=0.24

QV01: AVER.=147.85, STEDV=0.28

QV03: AVER.=161.58, STEDV=0.97

QV03/04: AVER.=161.78, STEDV=0.81

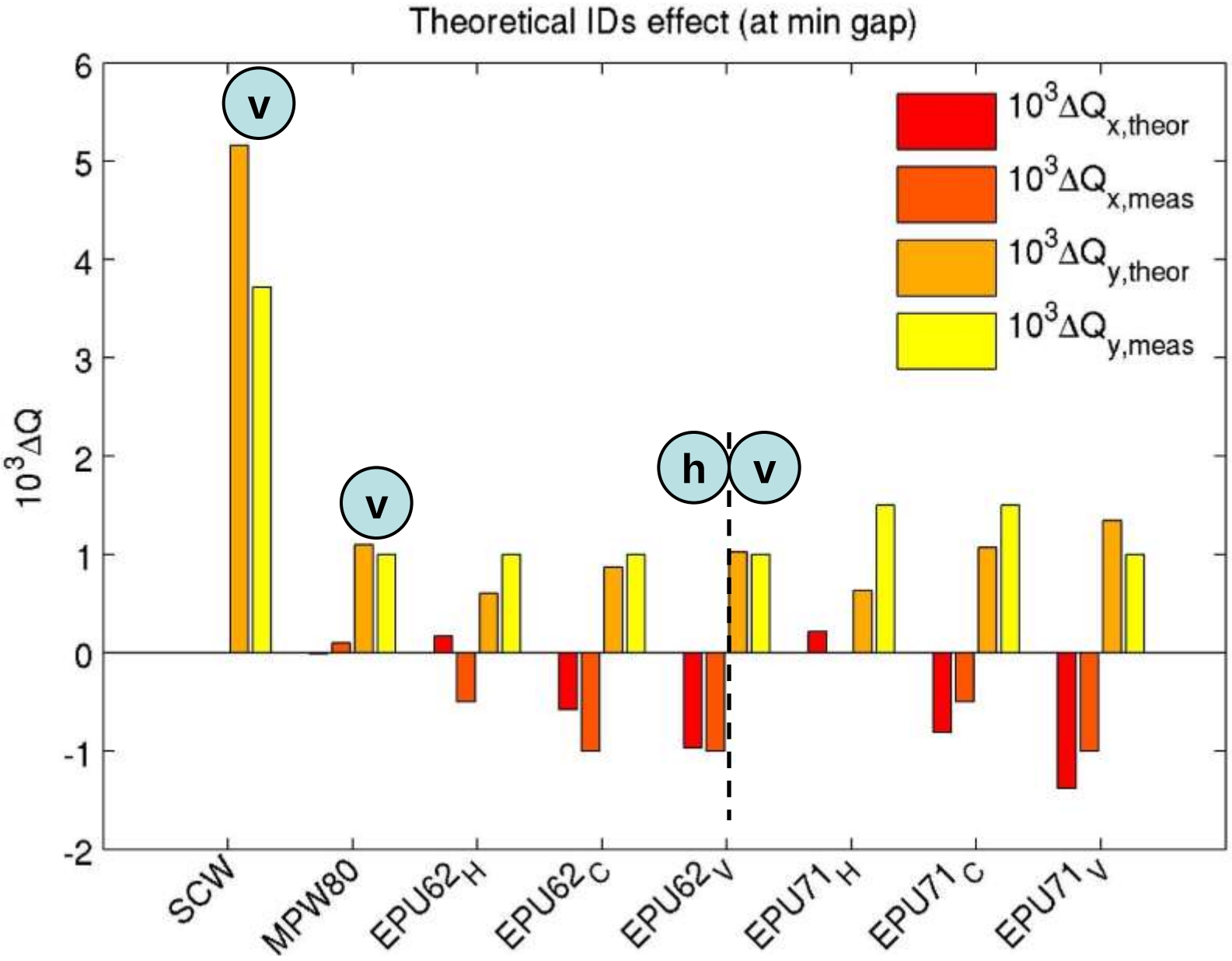
QV02: AVER.=161.47, STEDV=0.64

QV04: AVER.=161.97, STEDV=0.62

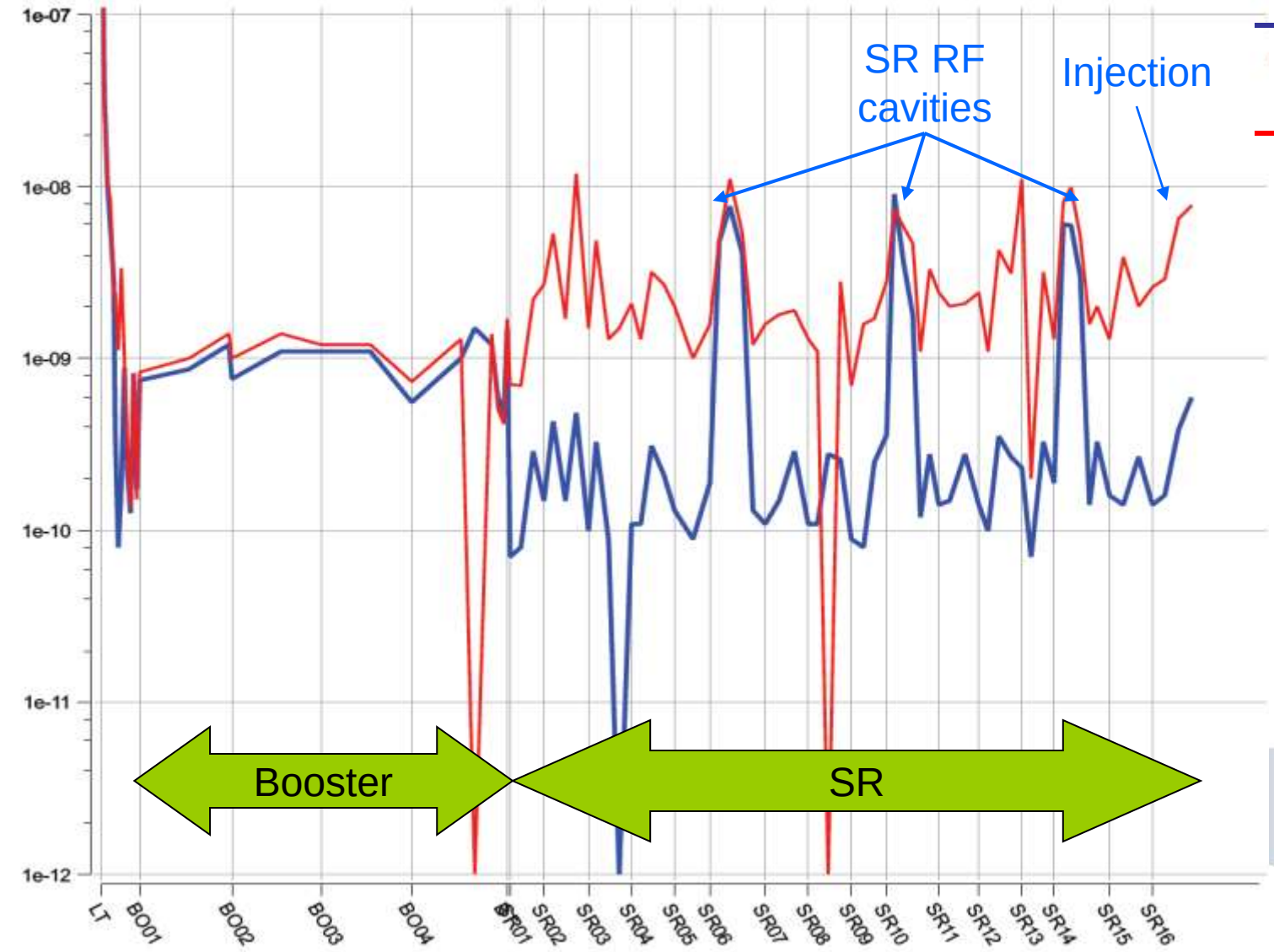
For the horizontal focussing quadrupoles there are standard deviations up to 0.42 %,this is in a good agreement with the expected values. For the vertical focussing quadrupoles the values are going up to roughly 1 %. This is okay, but it could be a bit better. The difference between the horizontal and vertical direction is given by the variation of the gradient from magnet to magnet.

The BINP- and the ALBA team after a successful injection with a field of 2.1 T at the SCW and all the other ID's are closed.

ID's: Change of Tune



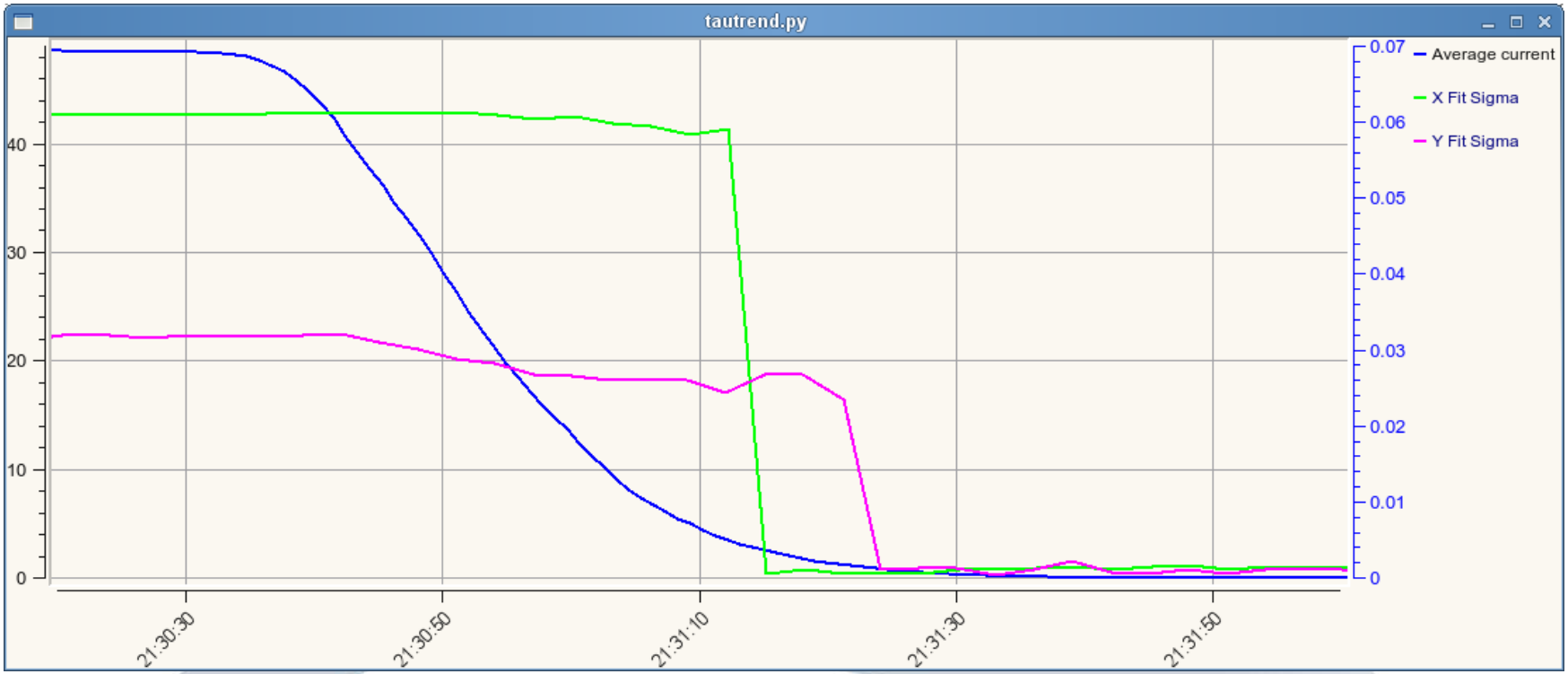
Pressure Profile (mbar) for ALBA machine

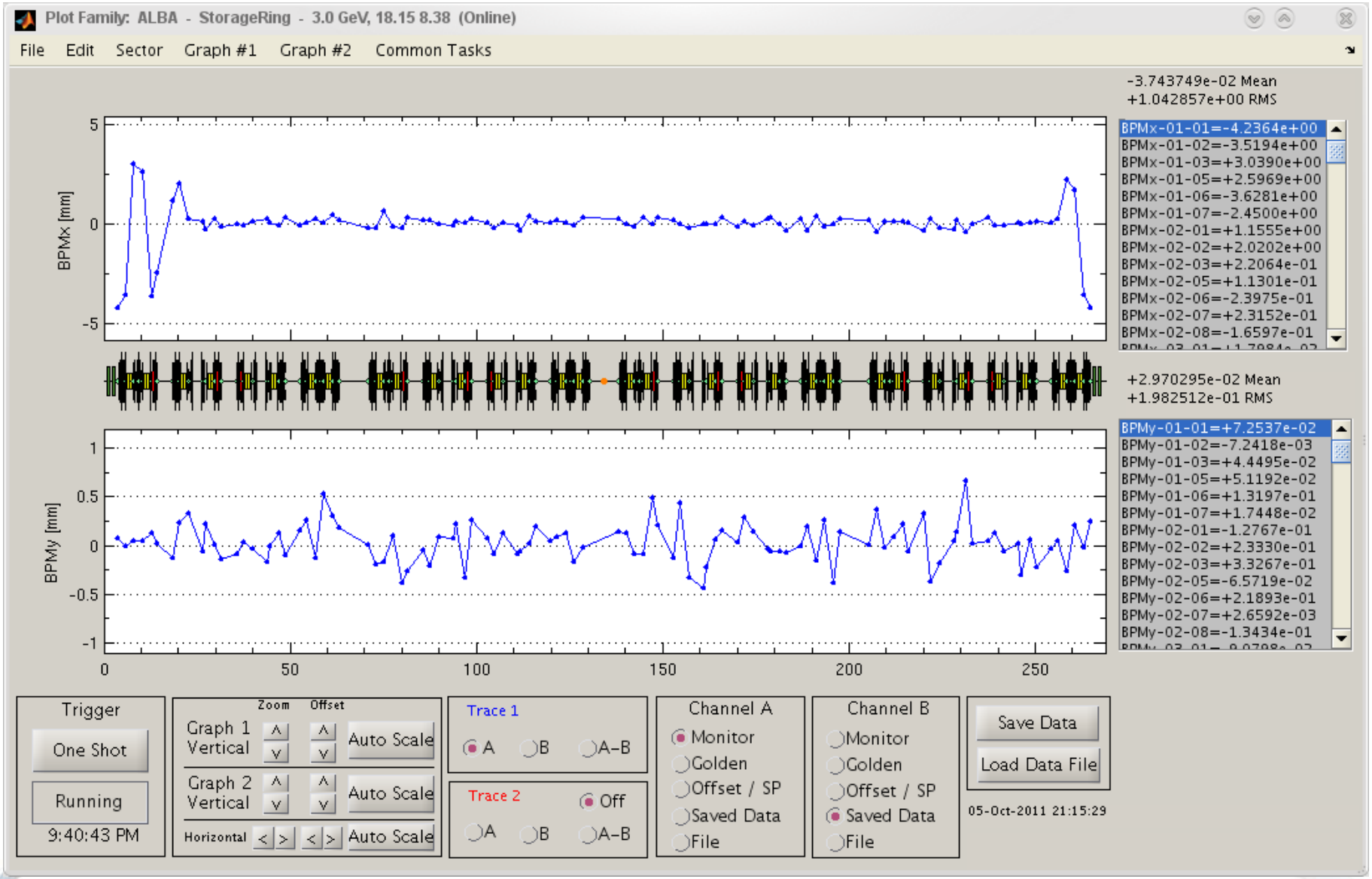


Base pressure (no beam), P_{avg}=5e-10 mbar

Pressure at 125mA, P_{avg}=3e-9 mbar

Accident at ALBA




Plot Family: ALBA - StorageRing - 3.0 GeV, 18.15 8.38 (Online)
File Edit Sector Graph #1 Graph #2 Common Tasks
-3.743749e-02 Mean
+1.042857e+00 RMS
BPMx-01-01=-4.2364e+00
BPMx-01-02=-3.5194e+00
BPMx-01-03=+3.0390e+00
BPMx-01-05=+2.5969e+00
BPMx-01-06=-3.6281e+00
BPMx-01-07=-2.4500e+00
BPMx-02-01=+1.1555e+00
BPMx-02-02=+2.0202e+00
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BPMx-02-05=+1.1301e-01
BPMx-02-06=-2.3975e-01
BPMx-02-07=+2.3152e-01
BPMx-02-08=-1.6597e-01
BPMx [mm]
+2.970295e-02 Mean
+1.982512e-01 RMS
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BPMy-01-03=+4.4495e-02
BPMy-01-05=+5.1192e-02
BPMy-01-06=+1.3197e-01
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BPMy-02-03=+3.3267e-01
BPMy-02-05=-6.5719e-02
BPMy-02-06=+2.1893e-01
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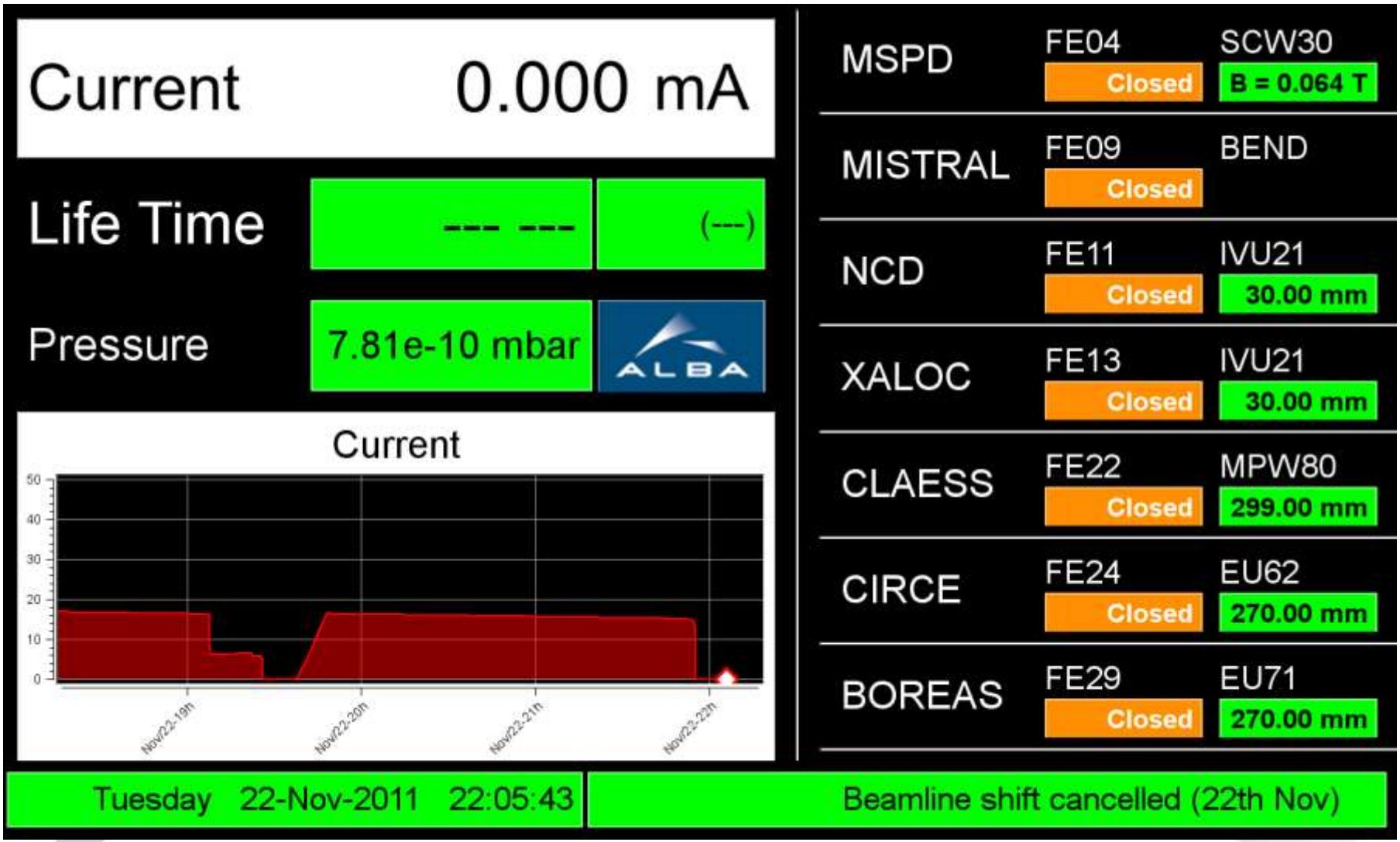
BPMy-02-08=-1.3434e-01
BPMy [mm]
Trigger
One Shot
Running
9:40:43 PM
Zoom Offset
Graph 1 Vertical
Auto Scale
Graph 2 Vertical
Auto Scale
Horizontal
Auto Scale
Trace 1
A B A-B
Trace 2
Off
A B A-B
Channel A
Monitor
Golden
Offset / SP
Saved Data
File
Channel B
Monitor
Golden
Offset / SP
Saved Data
File
Save Data
Load Data File
05-Oct-2011 21:15:29

Accident at ALBA

Beam delivered to the beam Lines



Storage Ring Commissioning

Summary:

1.)The accelerator complex of ALBA has been successful commissioned.

2.)The deviation from the models are in the range of percentages.

3.) We have to understand the transfer lines.

4.) The beam lines are in the commissioning phase

5.) We have to go to higher currents to look for instabilities and cleaning the vacuum system.

6.) Next year we have to install the fast orbit feedback system and

7.) We have to prepare for the top up injection.

More details tomorrow in the presentation of Marc Munoz