MTCA.4 based BPMs at DESY

BUTTON AND STRIP-LINE BPM ELECTRONICS

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Thanks for Material, Discussions and Inspiration

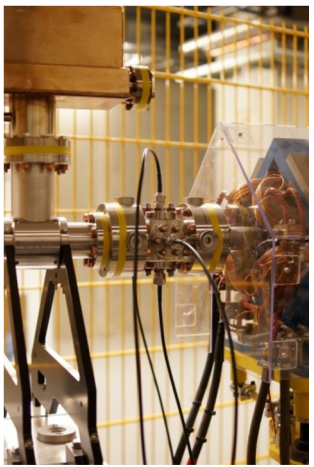
Bastian Lorbeer, Dirk Lipka, Nicoleta Baboi, Frank Schmidt-Foehre,
Gero Kube, Mathias Werner, DESY

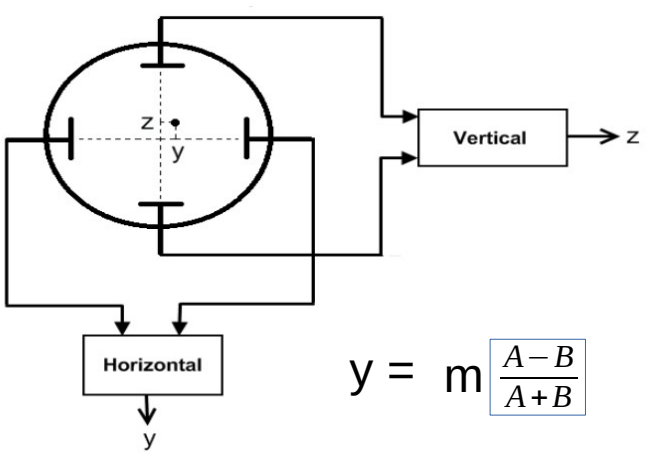
M. Bruno, O. Tavares, LNLS

MTCA.4 based BPMs at DESY

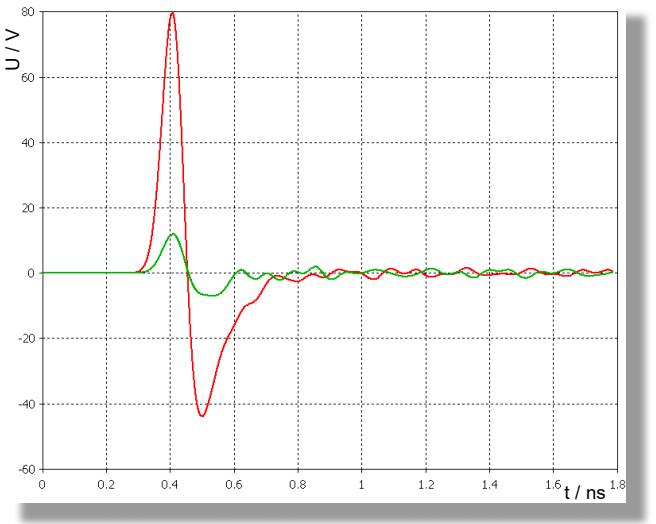
What is a BPM ? = Beam Position Monitor

18FL2EXTR



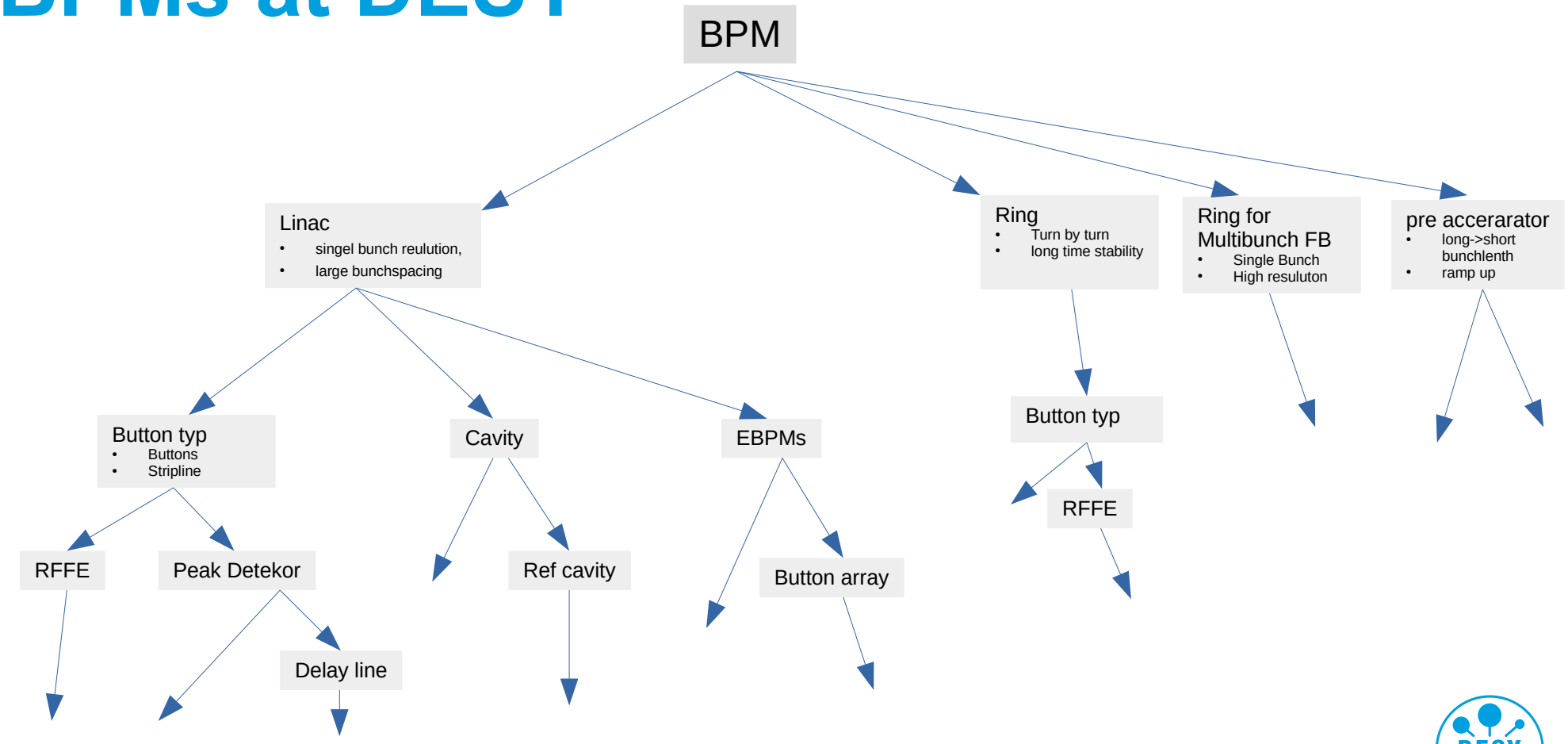


$$y = m\frac{A-B}{A+B}$$



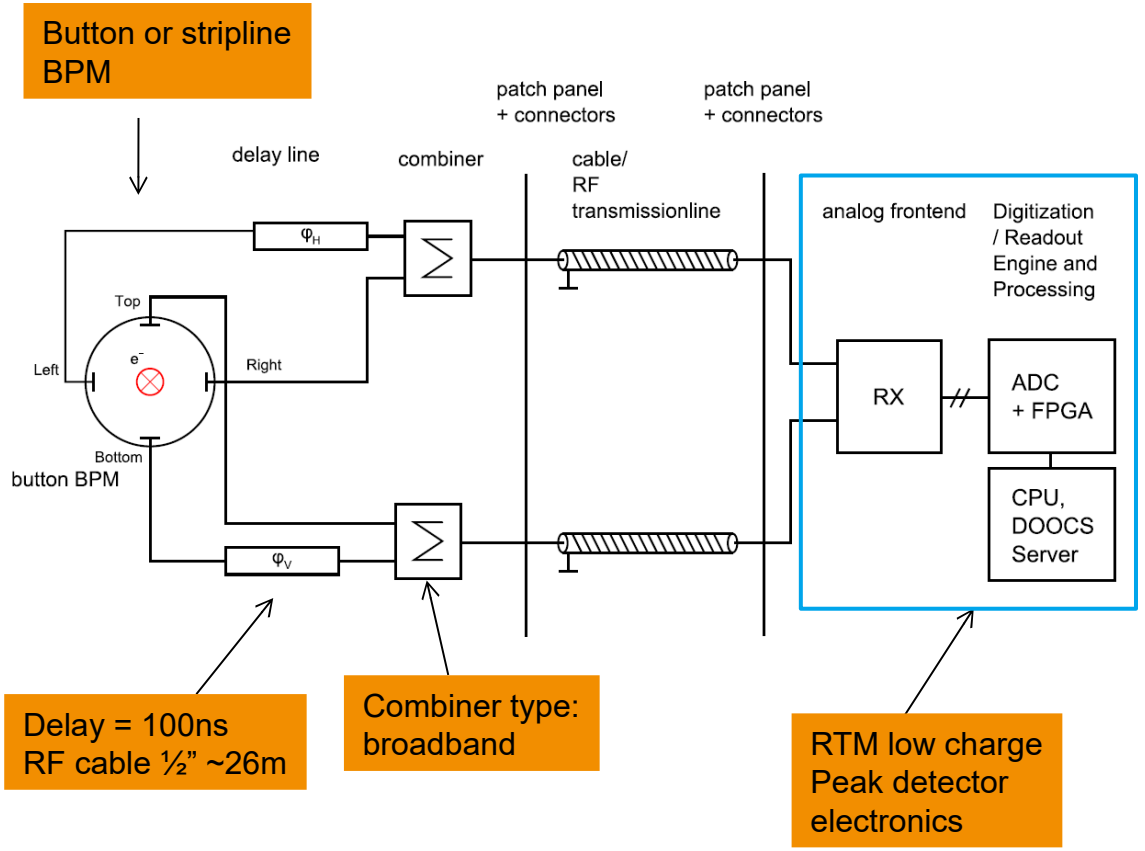
(Quelle :Dirk Lipka MDI, internel talk 2019)

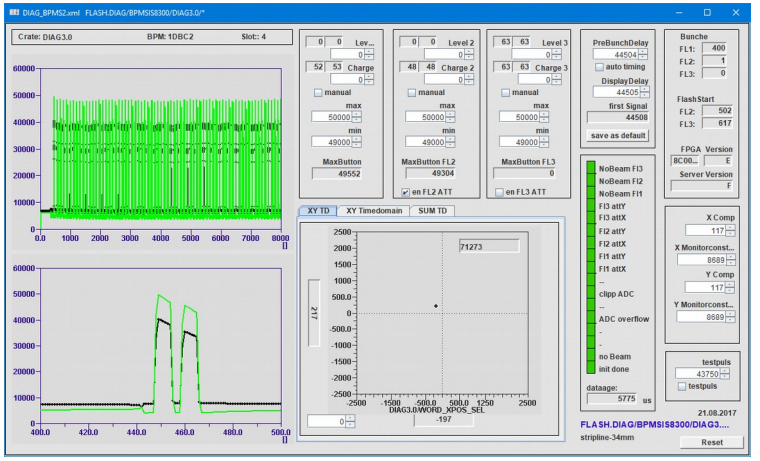
BPMs at DESY


BPM
Linac
• singel bunch reulution,
• large bunchspacing
Ring
• Turn by turn
• long time stability
Ring for Multibunch FB
• Single Bunch
• High resuluton
pre accerarator
• long->short bunchlenth
• ramp up
Button typ
• Buttons
• Stripline
Cavity
EBPMs
Button typ
RFFE
RFFE
Peak Detekor
Ref cavity
Button array
Delay line

Peakdetektor with delayline

for linacs with large bunchspacing





Peakdetektor

4 Channel Input RTM

Struck SIS8300L2

Crate with electronic 6 Struck ADCs for 12 BPMs
possible 12 AMC for 24 BPMs

Delayline = 100ns
RF cable ½” ~26m

(Quelle: B Lorbeer, Desy Operatortrainig 2019)

EBPMS for Energie measurement

Beam position measurment with 500mm range

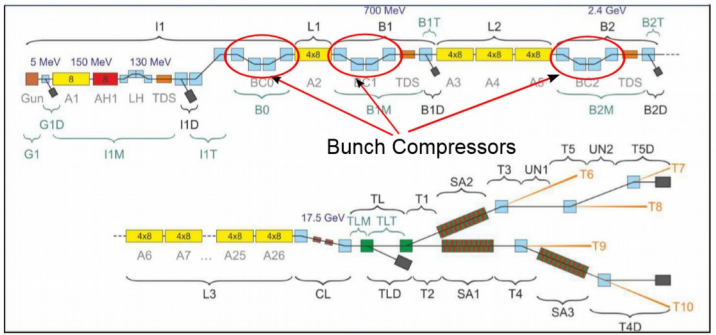


Figure 1: European XFEL Section Overview with bunch compressors.

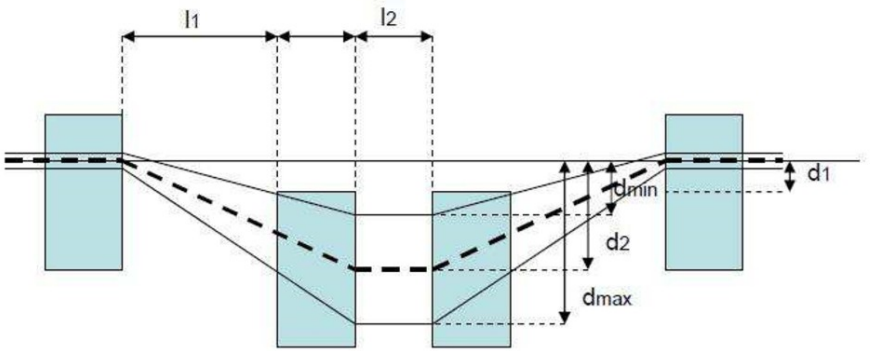


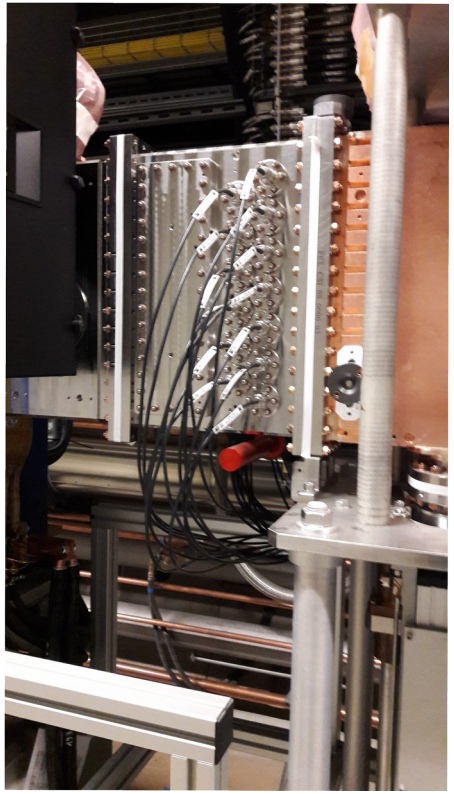
Figure 2: Sketch of XFEL BC chicane layout.

- Mtca crate installed in tunnel near to Bunchcompressor
- Radiation Problems at BC2
- SSD and FPGA lachtup problems
- need SSD replace (typ. 2 time/year)
- reboot FPGA (typ. 2 time/year)

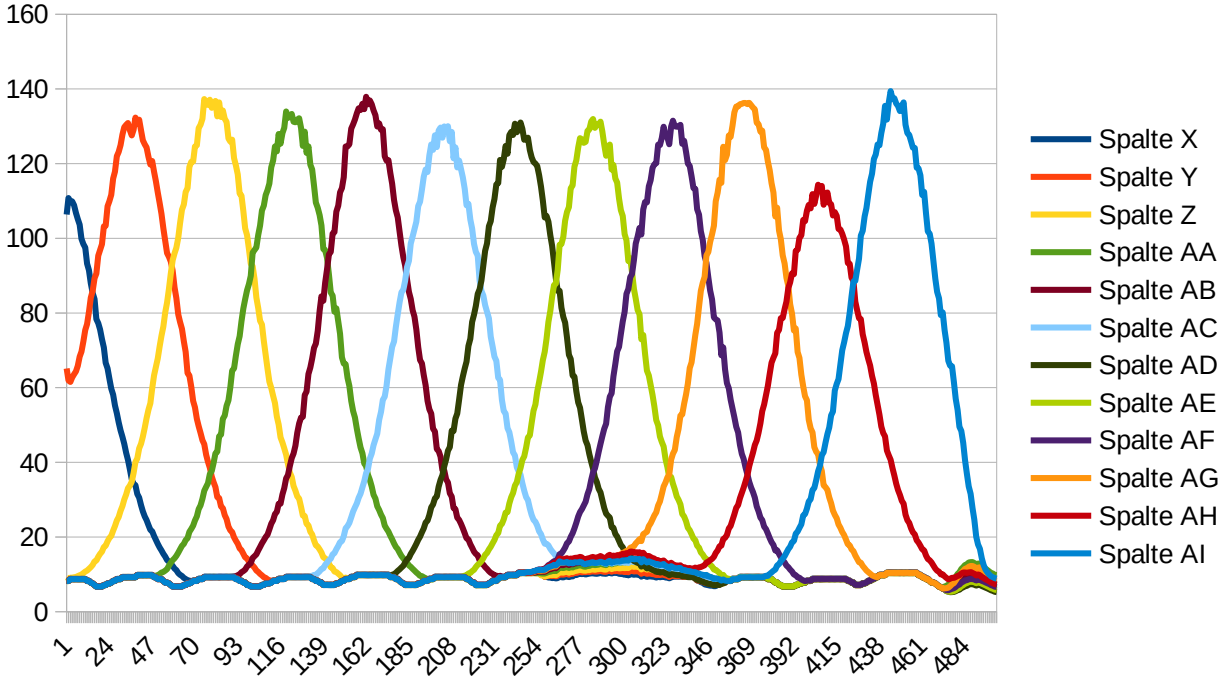
(Quelle: B. Lorbeer et al., IPAC2018)

Button Overlap

button array



13 x Button array



Position scan 550mm

Ideas for new Petra BPM

Motivation:

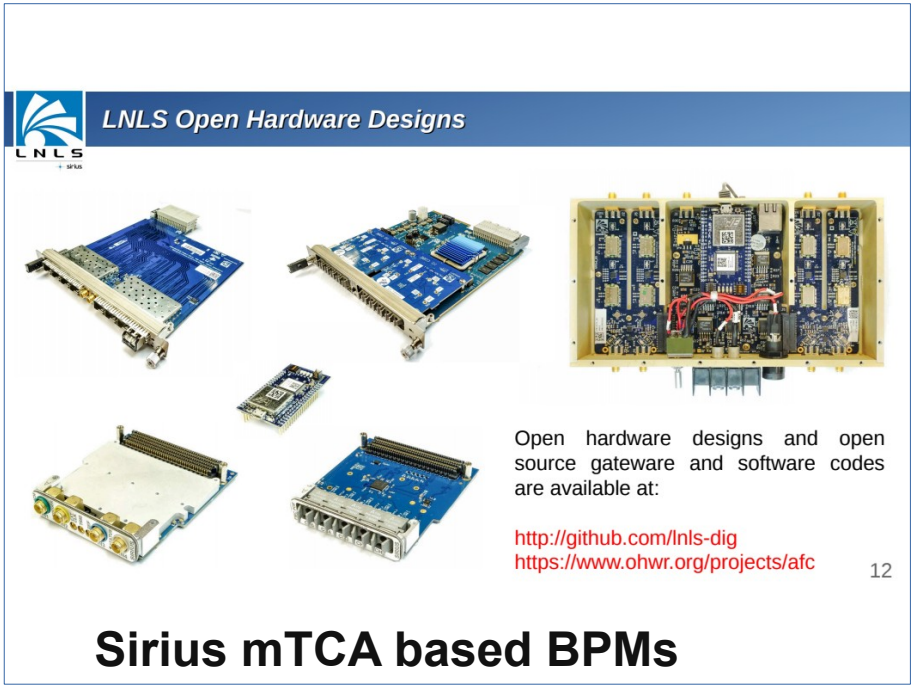
- **Looking for replacement for outdated libera BPM**
- **new requirement for Petra 4**
- **mtca.4 at PETRA**

Libera Spark

Compact beam position monitor electronics
for electron & hadron linear machines

Libera Brilliance+

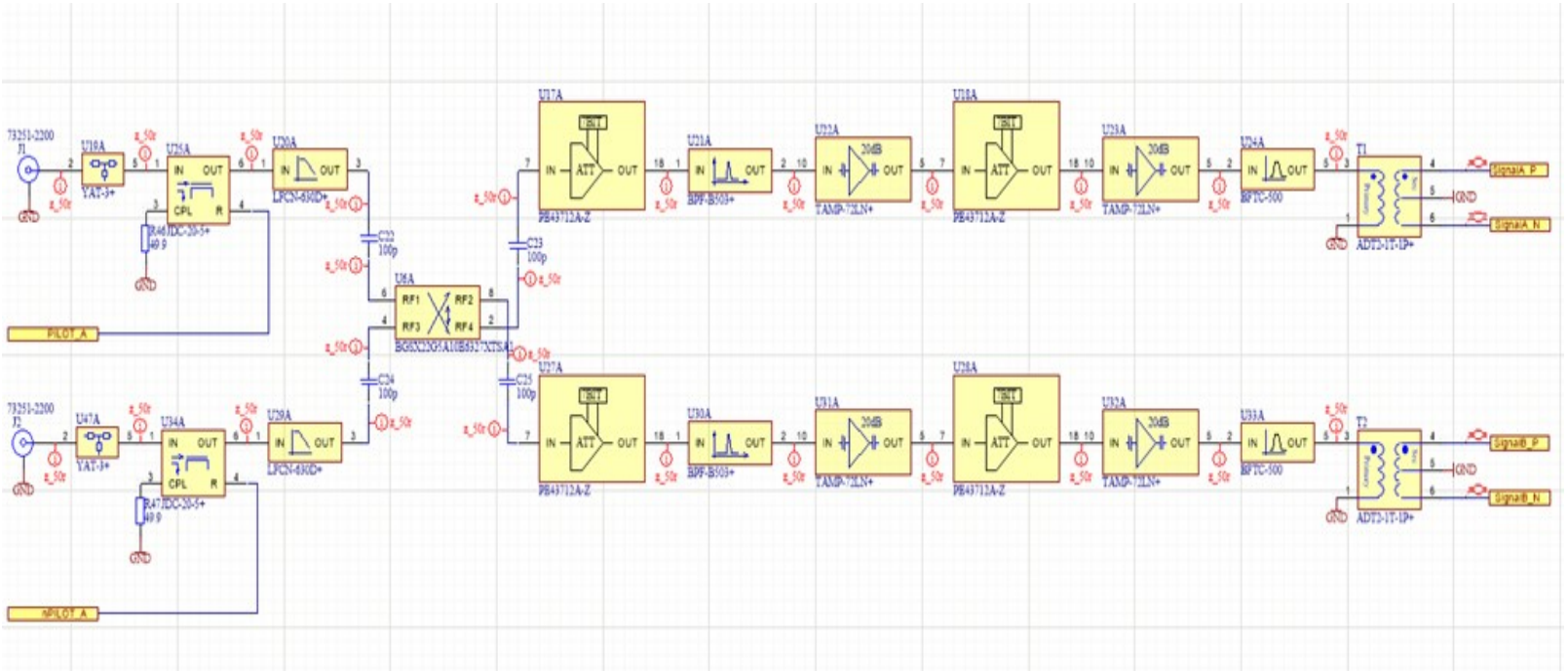
High performance beam position monitor
electronics for electron circular machines



(Quelle: RF BPM ELECTRONICS M. Bruno, O. Tavares, LNLS, Campinas, SP, Brazi)

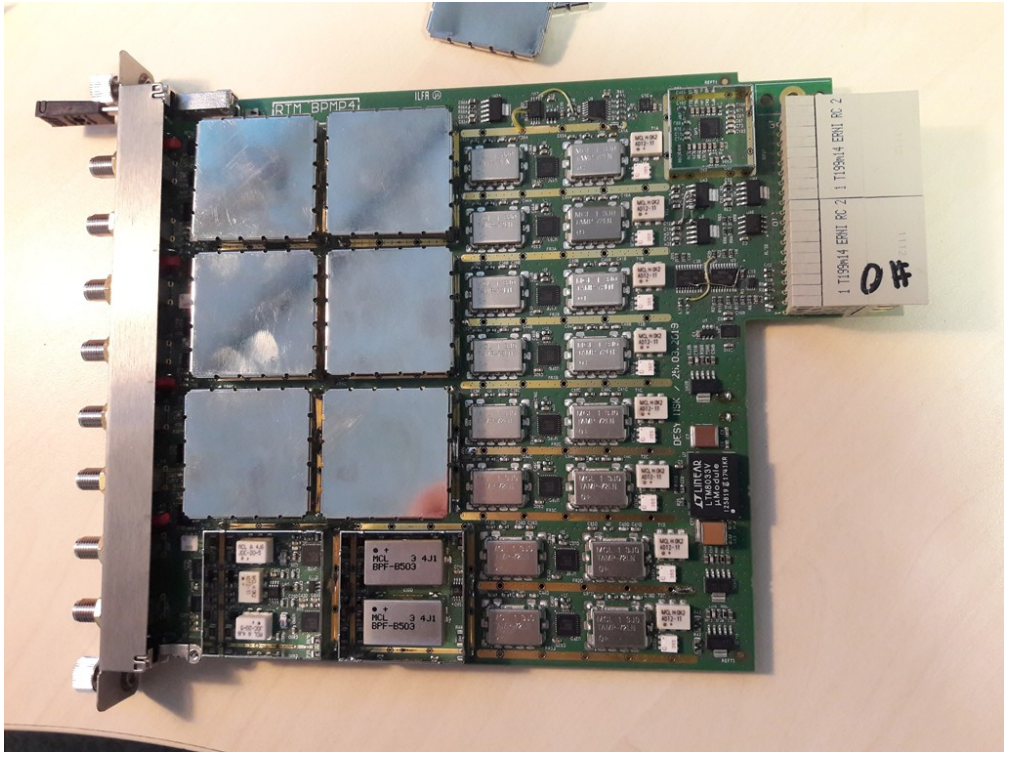
Detector with Pilot and Switching

RTM Testsetup



RTM BPM Developement

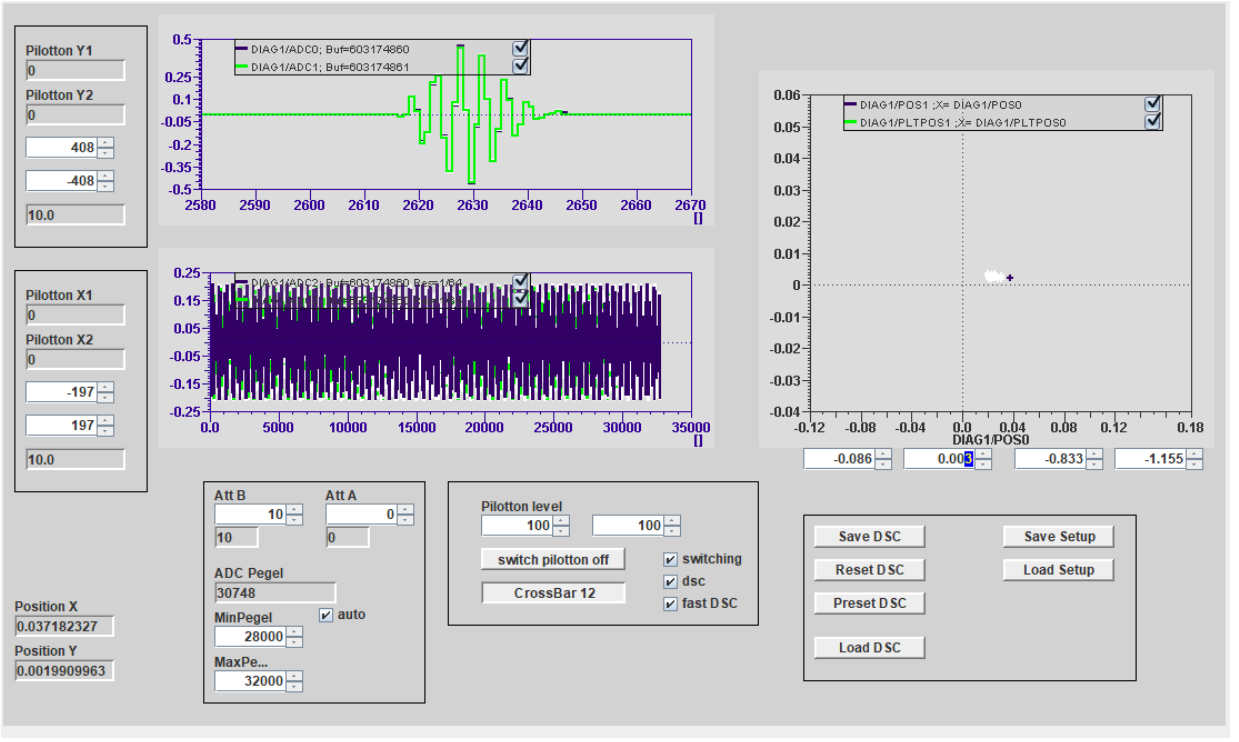
Prototype



- 8 Channel for 2 BPMs
- SIS8325 250MSPS ADC
- Pilot ton
- 2 Channel Switching
- PLL
- temperature stabilized
- Mtca.4 RTM
- Based on SIRIUS open Hardware design

RTM BPM Development

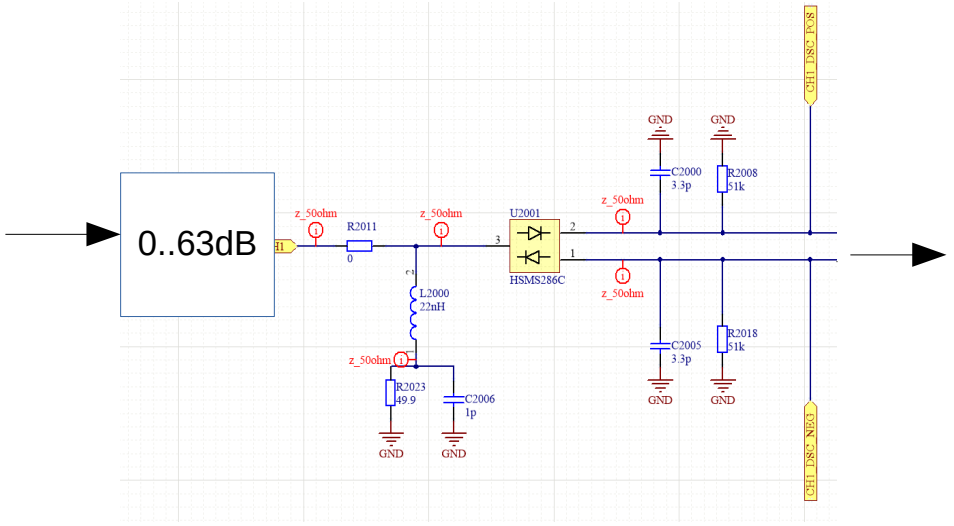
Promising first results



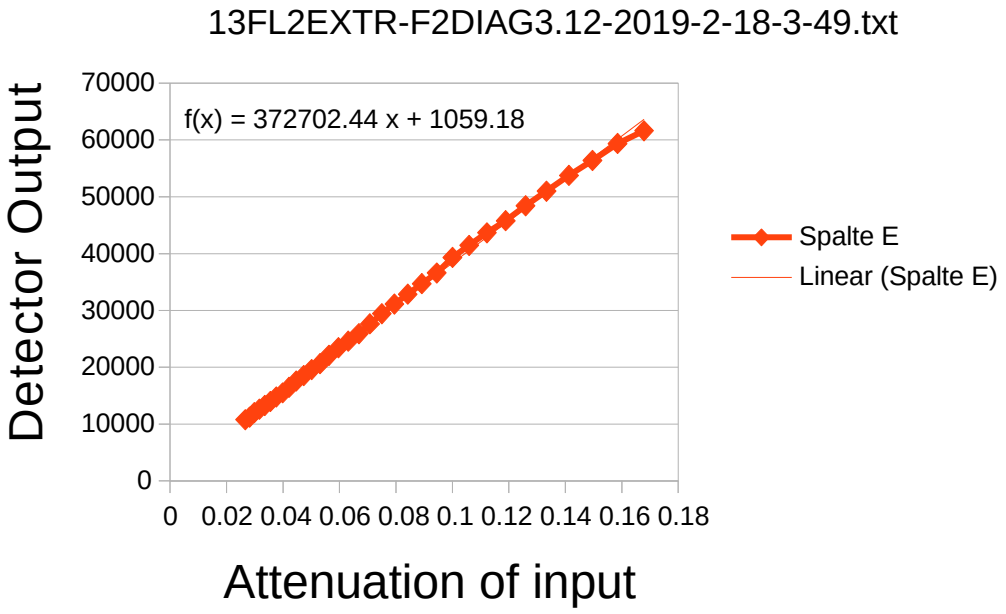
Thank you for your attention!

Peakdetektor Calibrating

appendix



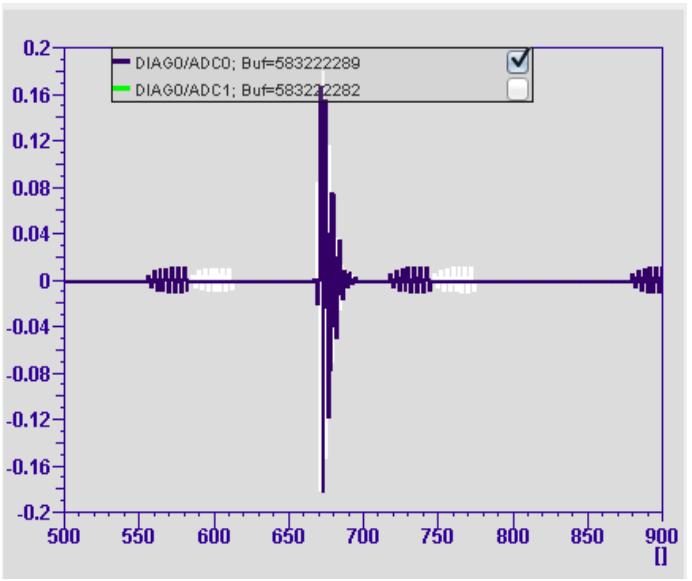
(Quelle: B. Lorbeer, 2017)



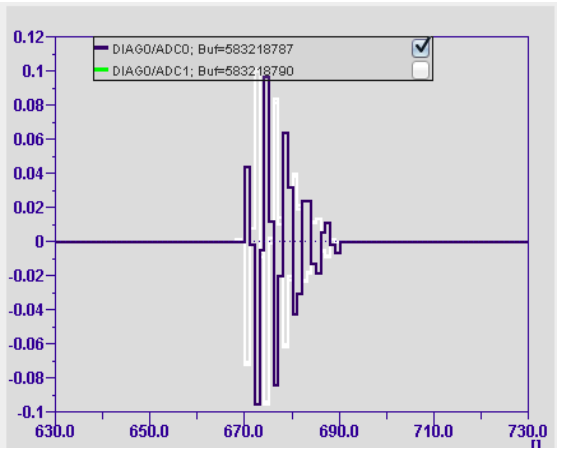
Lock-in-filter for pilot-tone separation

appendix

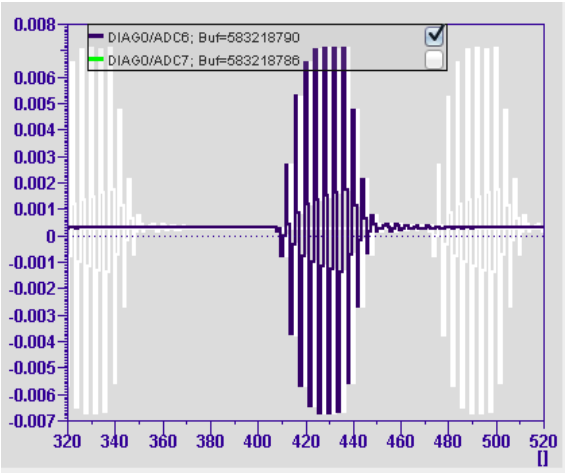
preliminary, under labor conditions



Signal and Pilot-ton



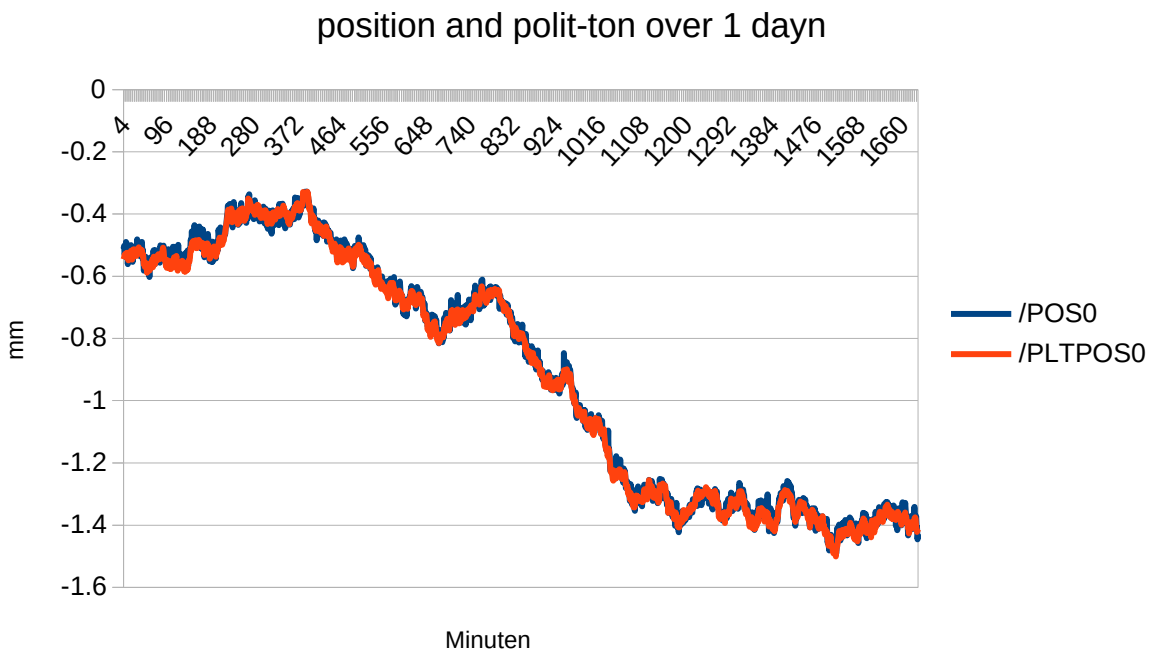
signal



Drifts : signal and pilot-tone

appendix

preliminary, under labor conditions



generic server for mtca.4 BPMs

appendix

generic server

MSK Firmware
Internal Interface
(VHDL code)

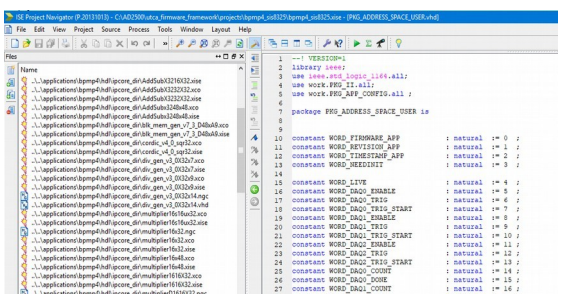
.map file

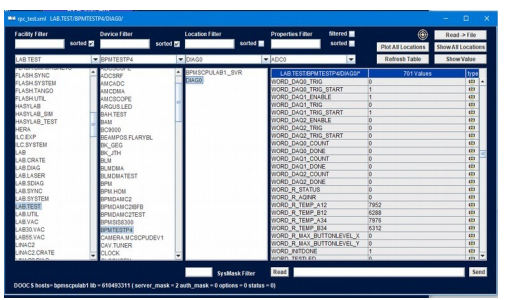
Doocs server
generated
property's
from .map file

automatic generated
Doocs calls for all
Internal Interface
registers

PCIe Bus

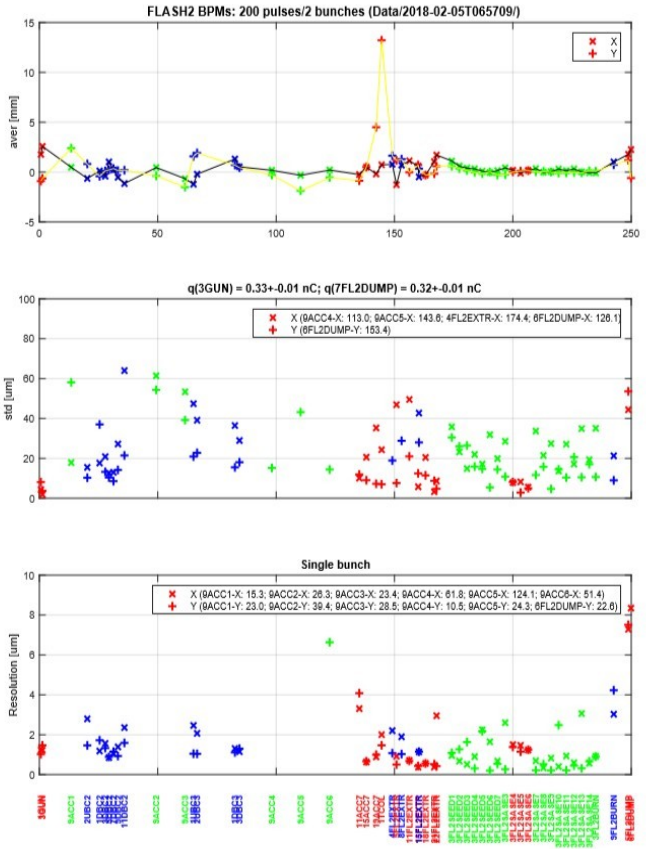
Default settings on demand
for Internal Interface Registers

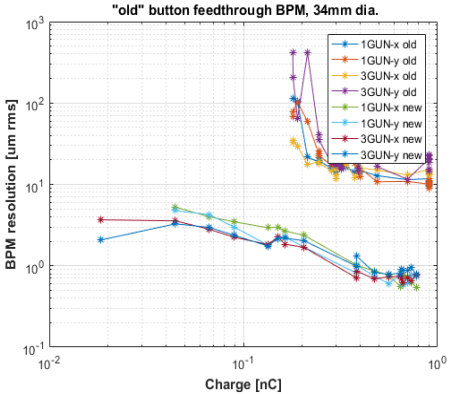


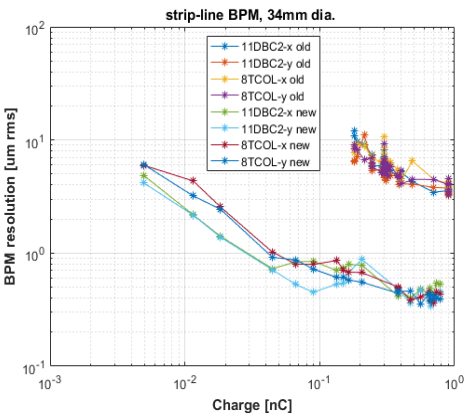


Resolution of BPMs at Flash

appendix







(Quelle: N.Baboi,B.Lorbeer Flash Messchicht 2017-19)

PSI type BPMs at XFEL and FLASH

appendix