

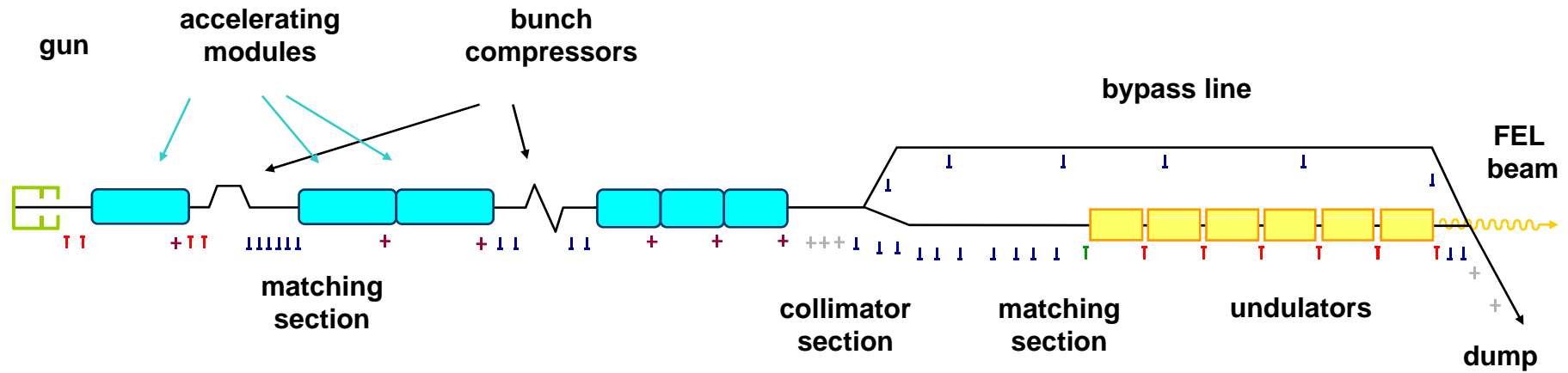
Update on the FLASH BPMs and HOM-BPMs

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for the BPM and the HOM teams

(DESY, CEA-Saclay, SLAC, FNAL,
Cockroft/Daresbury, KEK, PSI)

- 1. FLASH BPMs
 - button, stripline, cavity
 - 2. HOM-BPMs
 - 3. BPM prototypes for the XFEL
 - re-entrant cavity, button and resonant stripline (PSI)
- (last report in June)

1. FLASH BPMs



- ┐ button BPM (Ø34mm & 9mm) with TTF2-electronics
- ⊥ stripline BPM (Ø34mm & 44mm) with TTF2-electronics
- ┐ button with Neumann-type electronics
- + cavity or re-entrant cavity BPM
- + other type of BPM or electronics

Button-BPMs

Shutdown work

replaced GUN BPMs

- same type as UBC2

81MHz used for re-synchronization of 9MHz trigger

- installed at all UND BPMs

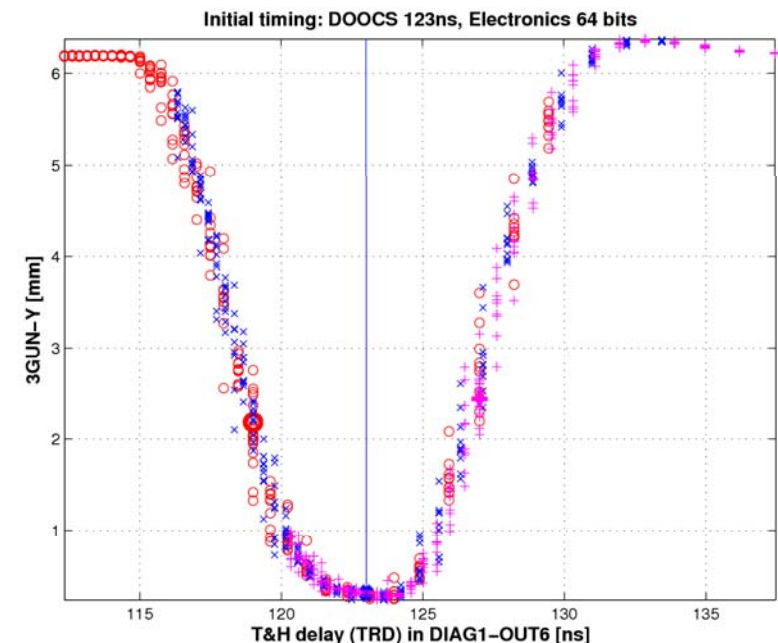
Status at end of shutdown

GUN, UBC2, UND

- LP filter and extra amplifier
- one with Neumann electronics (21SEED)

Trigger delay

- very critical for button-BPMs
- set/checked for all button BPMs



Button BPMs (2)

Calibration

5UNDx

- checked against wire scanners (slope and zero)

GUN

- zero calibrated
- slope calibrated for 1GUN and 3GUN-y (yesterday)
- 3GUN-x: strange behaviour (or large beam offset)
→ need checking

UBC2

- zero calibrated
- large discrepancy to cal. factors for GUN (same BPM-type after shutdown) → need checking

Remaining work

calibrate BPMs in undulators (2 and 4UNDx)

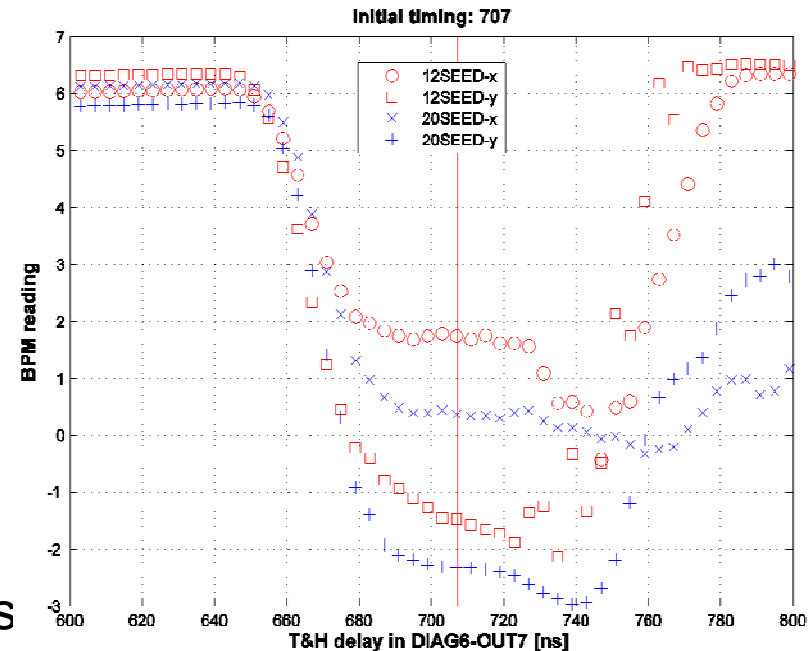
Stripline-BPMs

Shutdown work

- 6MATCH: short repaired
- 3EXP: new BPM
- 2DBC2: moved to 1DBC2 (for energy feedback)

Trigger delay

- checked/adjusted
- not as critical as for button BPMs



Prototypes for stripline-electronics with improved linearity tested

- next slide

Frascati electronics

BPMs 2, 9 and 16ACC7 (used for position feedback)

Stripline-BPMs: Electronics-Prototypes with Improved Linearity

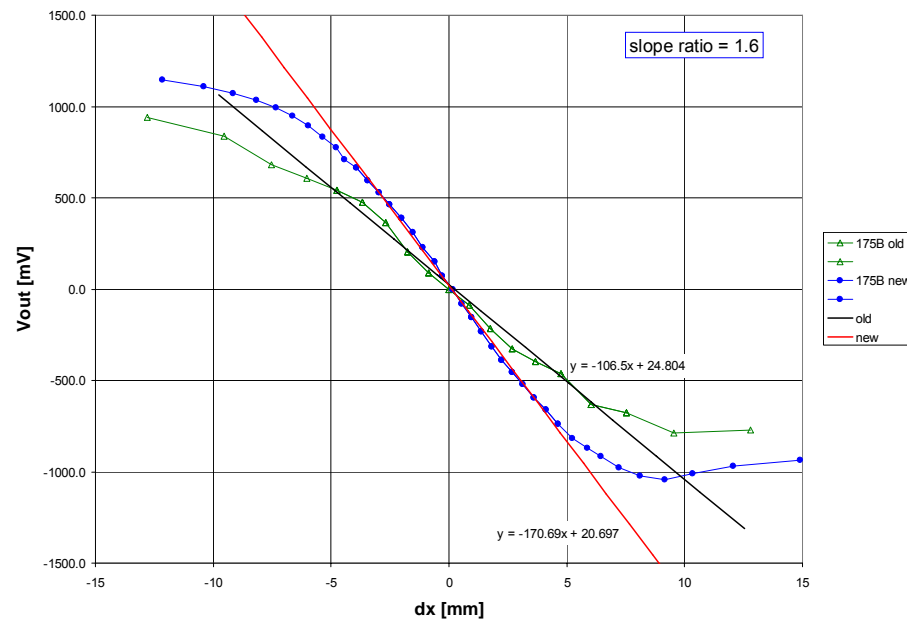
Design in Zeuthen (Riesch)

2 prototypes installed at BPM 5DBC2

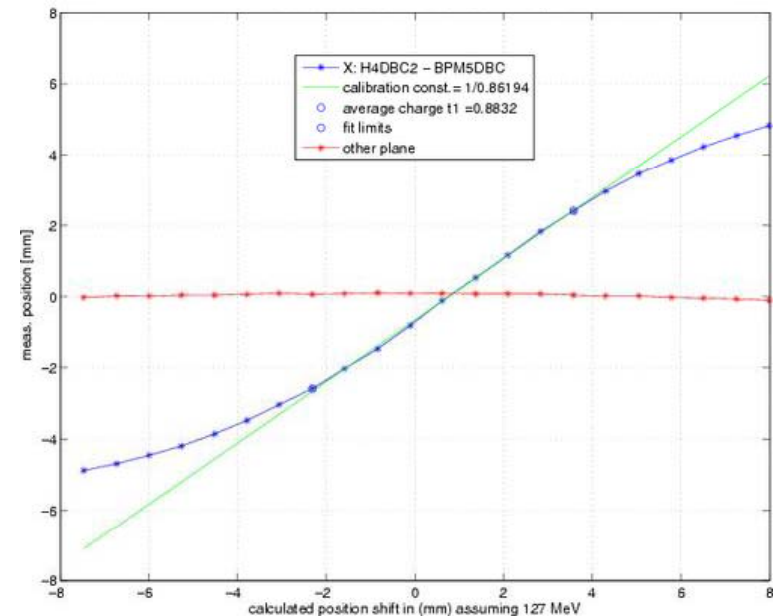
More electronics

to be installed in Dec-Jan and later

Measurements in Lab



Measurements at FLASH



Cavity-BPMs

ACC2-6

Shutdown:

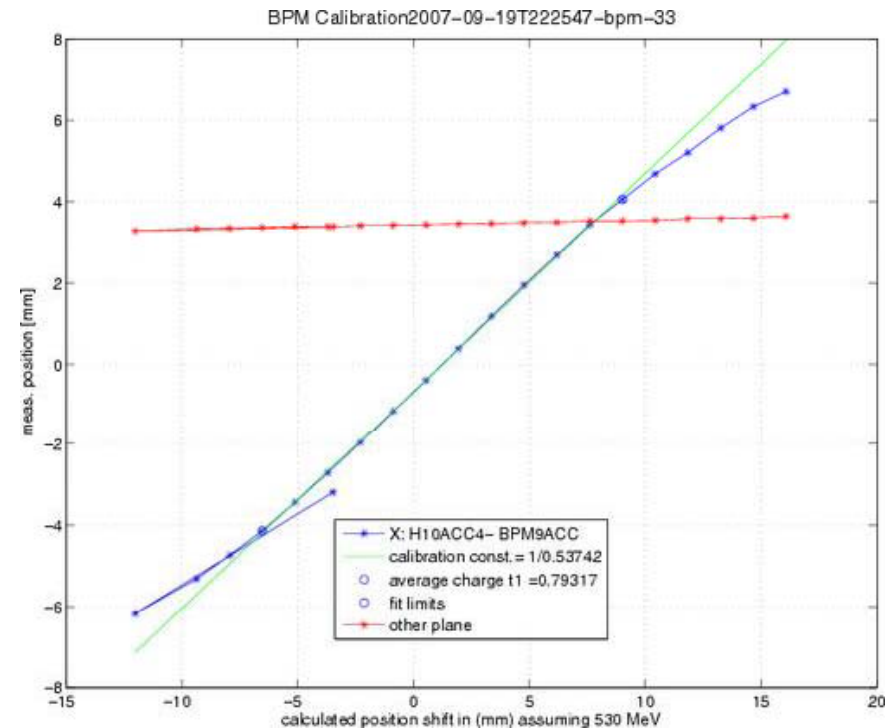
- new BPMs in new cryo-modules (ACC3 and ACC6)
- in most of them needed readjustment of electronics

Calibrated

- then readjusted electronics for best dynamical range
- \Rightarrow some uncertainties about calibration and sign (need checking)

Re-entrant cavity

- also checked calibration (possibly wrong sign in y corrected yesterday night)



Test Intra-Pulse Feedback

Goal

test hardware
proof of principle

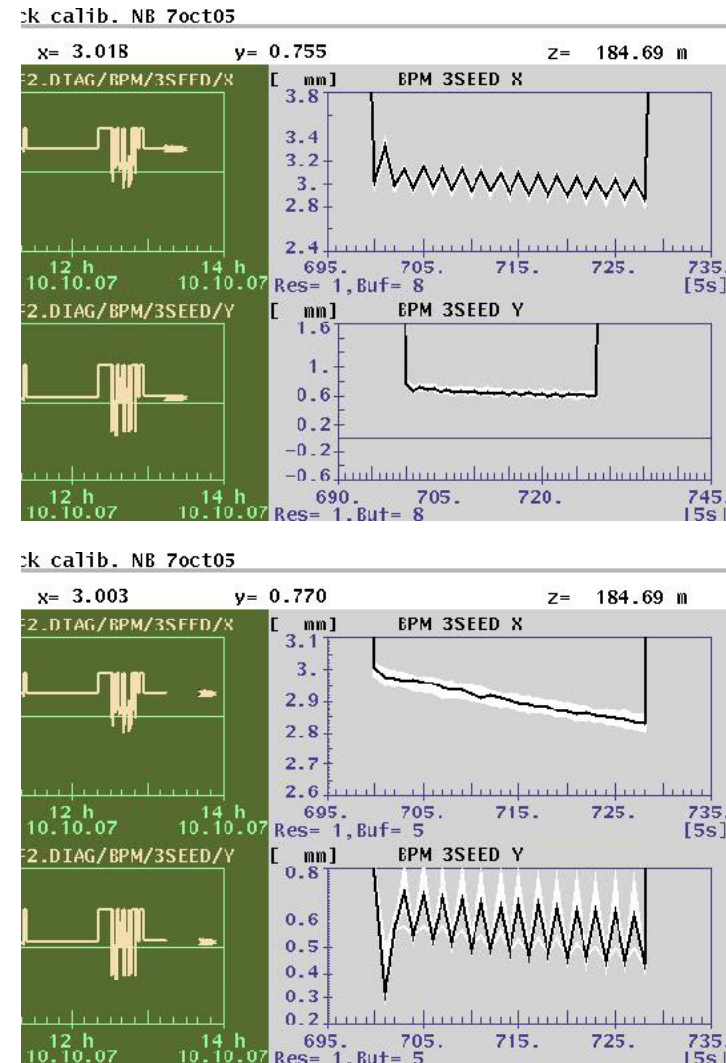
One shift so far

first hardware tests

- all kickers tested → ok
- two modified BPMs:
6MATCH and 3SEED (extra
output for feedback) → ok
- 500 kHz modulation on
pulse pattern

3 more shifts to follow

long bunch trains
close feedback loop
influence on SASE?



Some More Problems

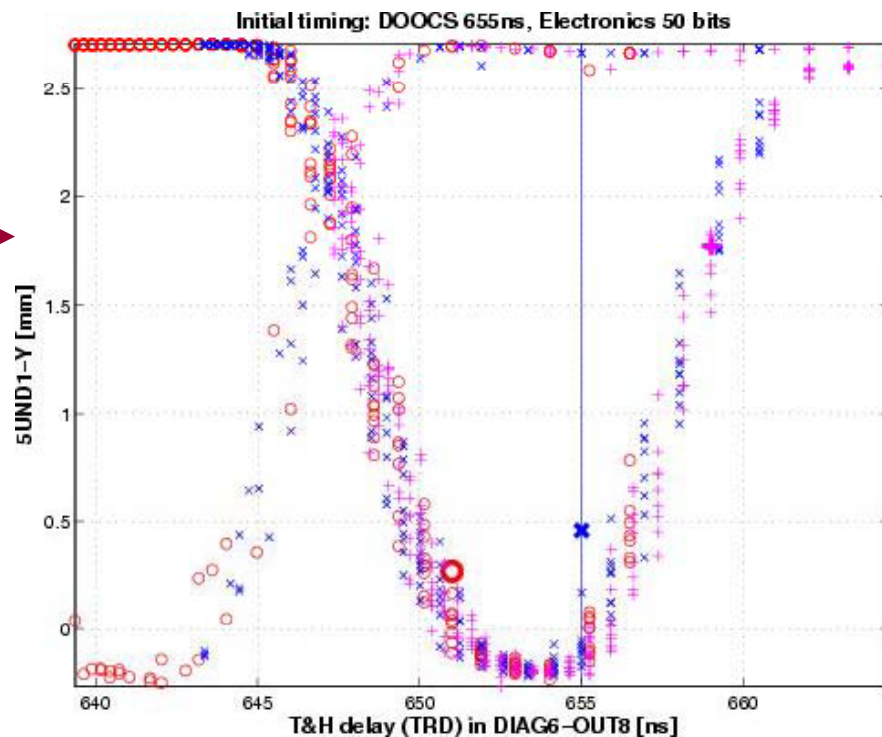
Trigger

jumps

- observed at BPMs in VMEDIAG6 (CON-23)

drifts/jumps

- not clear why



Delay modules

some cannot be set easily

FLASH BPMs: Future Work

Following shifts this studies

- cold BPMs: check calibration

- GUN and UBC2 BPMs: check calibration

- calibrated BPMs in undulators (2 and 4UNDx)

- other BPMs to check

- intra-train feedback

- energy feedback: with BPMs 2UBC2, 1DBC2 and EBPM

Longer term:

- build and install improved stripline electronics

- planned to replace 2UBC2 with stripline (May 2008)

 - better resolution

2. HOM-BPMs at FLASH

HOM electronics

installed at all HOM couplers of
cryo-modules ACC1-ACC5

Used in the past for

measuring cavity alignment
inside modules

feedback tests

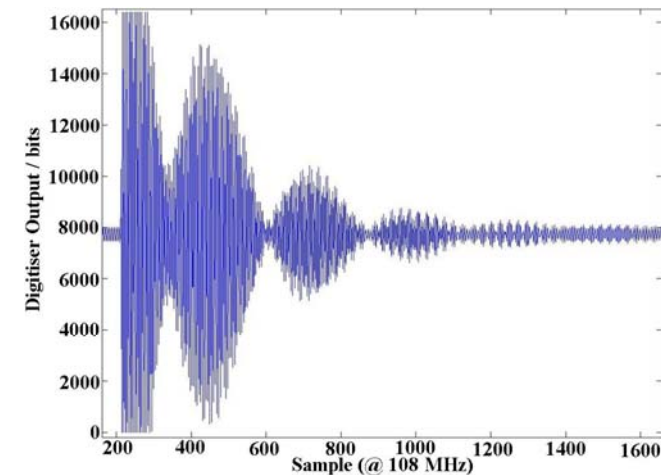
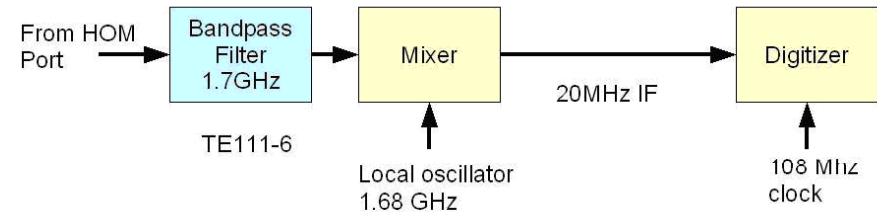
align beam to roughly minimize
wakes

Last run (Jan 2007)

optimized time of calibration
(30min for ACC2-5)

calibrated single bunch

tests with multi-bunch



HOM-BPMs at FLASH: Status

KW38-40

shutdown: improved LO oscillator (A. Bertolini)

repeated calibration for single bunch, checked procedure

- ok, but unstable in time!
- looking for suspects:
 - hardware ok, also new LO box ok
 - 9MHz trigger drifts in time by $\sim 100\text{ps}$ \rightarrow is this the problem?

first broadband data from ACC6

- info about mode axes, cavity geometry etc.

HOM-based phase measurement with LLRF colleagues

2008

recheck calibration stability

multi-bunch etc.

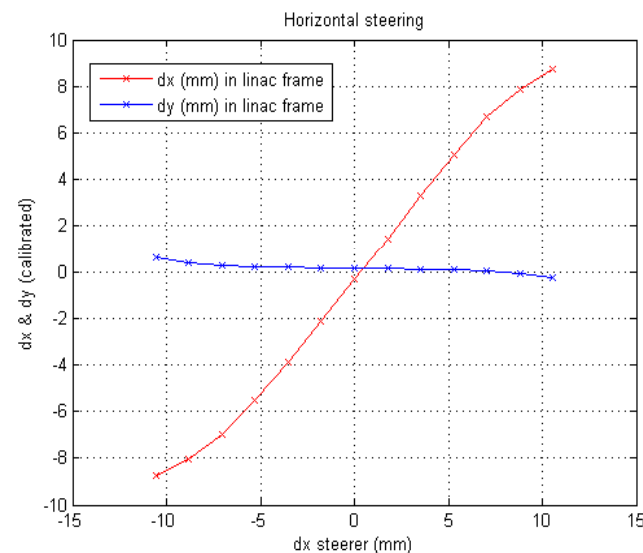
3. Work on BPM-Prototypes for the XFEL

Re-entrant cavity prototype for cold BPM 12ACC7

- good linearity in range ± 5 mm
- single bunch resolution
4-8 μm rms @ 1nC

with 6dB attenuator:
good linearity:

- ± 10 mm @ 0.8 nC
- ± 15 mm @ 0.45 nC

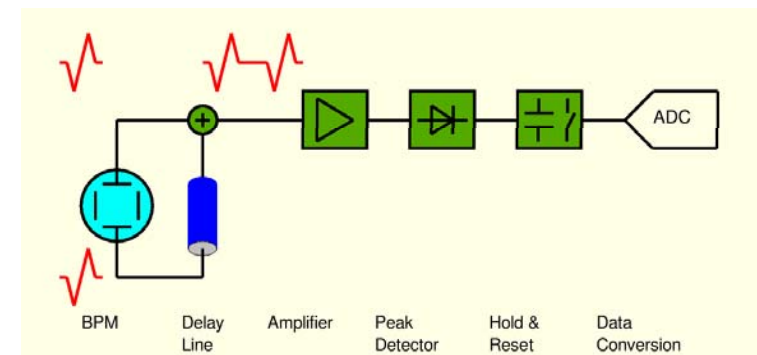
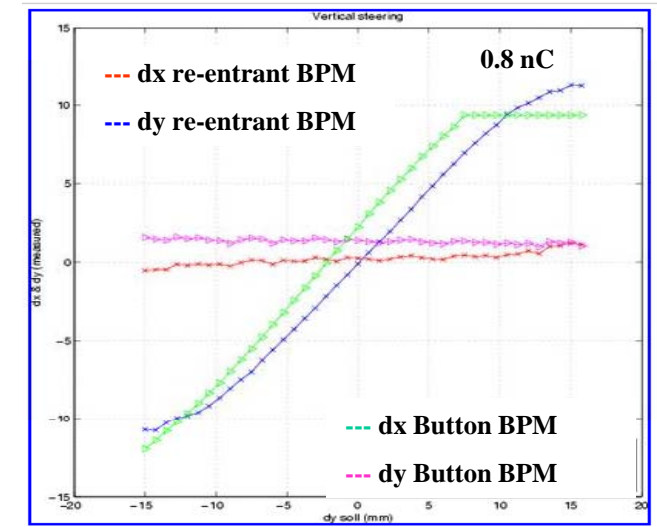
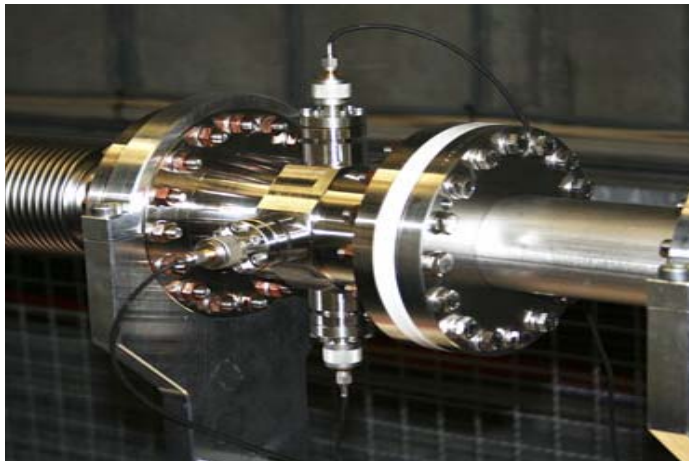


Charge	Resolution Re-entrant	Resolution Re-entrant+ 6 dB attenuator
1.0 nC	~ 4 μm	
0.8 nC		~ 12 μm
0.5 nC	~ 11.8 μm	~ 21 μm
0.2 nC	~ 30.1 μm	~ 55 μm

Work on BPM-Prototypes for the XFEL (2)

Button prototype for cold BPM 13ACC7

- electronics based on HERA-e type (Delay Line and Peak Detection)
- very good linearity
- single bunch resolution $\leq 30 \mu\text{m}$ rms for 0.2 – 1.1 nC

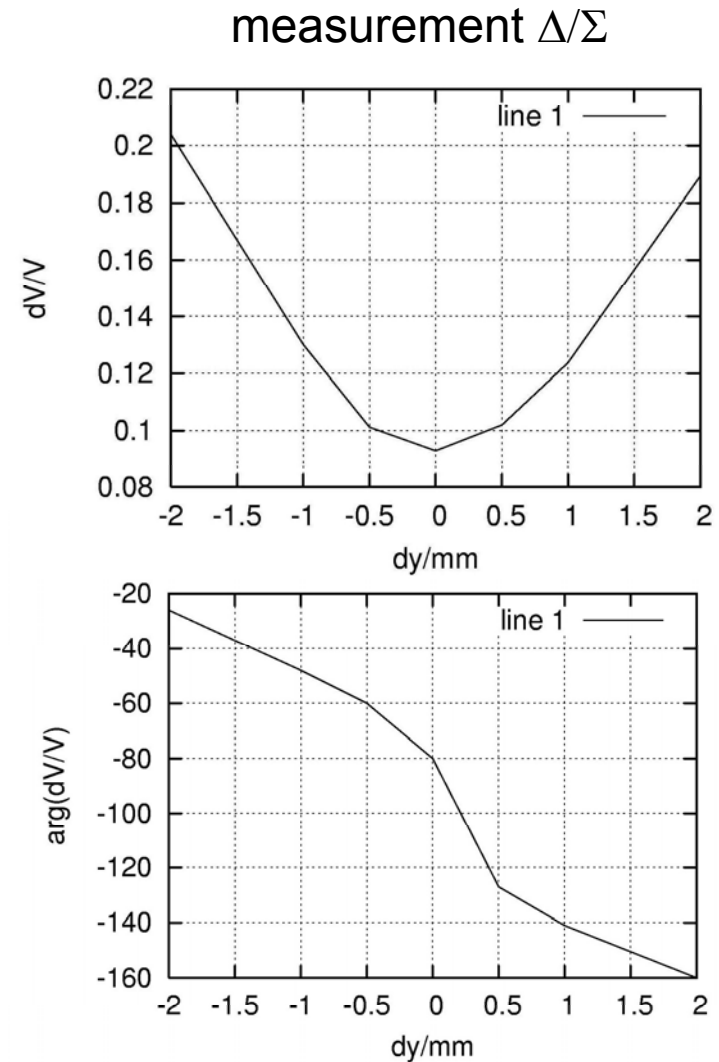


Work on BPM-Prototypes for the XFEL (3)

Resonant Striplines (PSI)

4 prototypes installed for feedback
first beam tests → ok

beam measurements with RF Front-End to follow



Summary

FLASH BPMs

most BPMs

- slope calibrated; zero calibrated for GUN and UBC2 BPMs

5DBC2

- electronics-prototypes with improved linearity

GUN and UBC2

- need check of calibration

UND

- 81 MHz signal used for re-synchronization of 9MHz trigger
- BPMs in UND to be calibrated

cold BPMs

- need calibration/sign check

trigger delay – jumps/drifts?

intra-pulse feedback under test

Summary

HOM-BPMs

calibration unstable

→ to be checked in next run

raw-signals can be used to center beam in modules

XFEL Prototypes

re-entrant cavity BPM for cryo-modules

- good linearity and resolution

button BPMs for cryo-modules

- good linearity and dynamic range

resonant striplines (PSI)

- first tests with vacuum part
- electronics tests to follow