

BPM Development at the VUV-FEL

Work during KW40-41 - Oct. 3-16, 2005

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TTF meeting, Nov. 3, 2005

Beam Position Monitors in the VUV-FEL

- More than 60 BPMs built in TTF

- button - normal: GUN (2), IDUMP (1), UBC2 (2), UND – DIAG (7), DUMP (2)
- button - coupled: inside the undulators (12)
- stripline (34mm): most BPMs (21)
- stripline (44mm): BYP (7), ECOL (2)
- Zeuthen striplines: ACC6+7 (2), DUMP (1)
- Cavity (Zeuthen): ACC2-5 (4)
- Reentrant Cavity (CEA, Saclay): ACC1 (1)

- Prototype of button BPM for XFEL: ACC7 (1)

Overview

- **TTF2-type electronics**

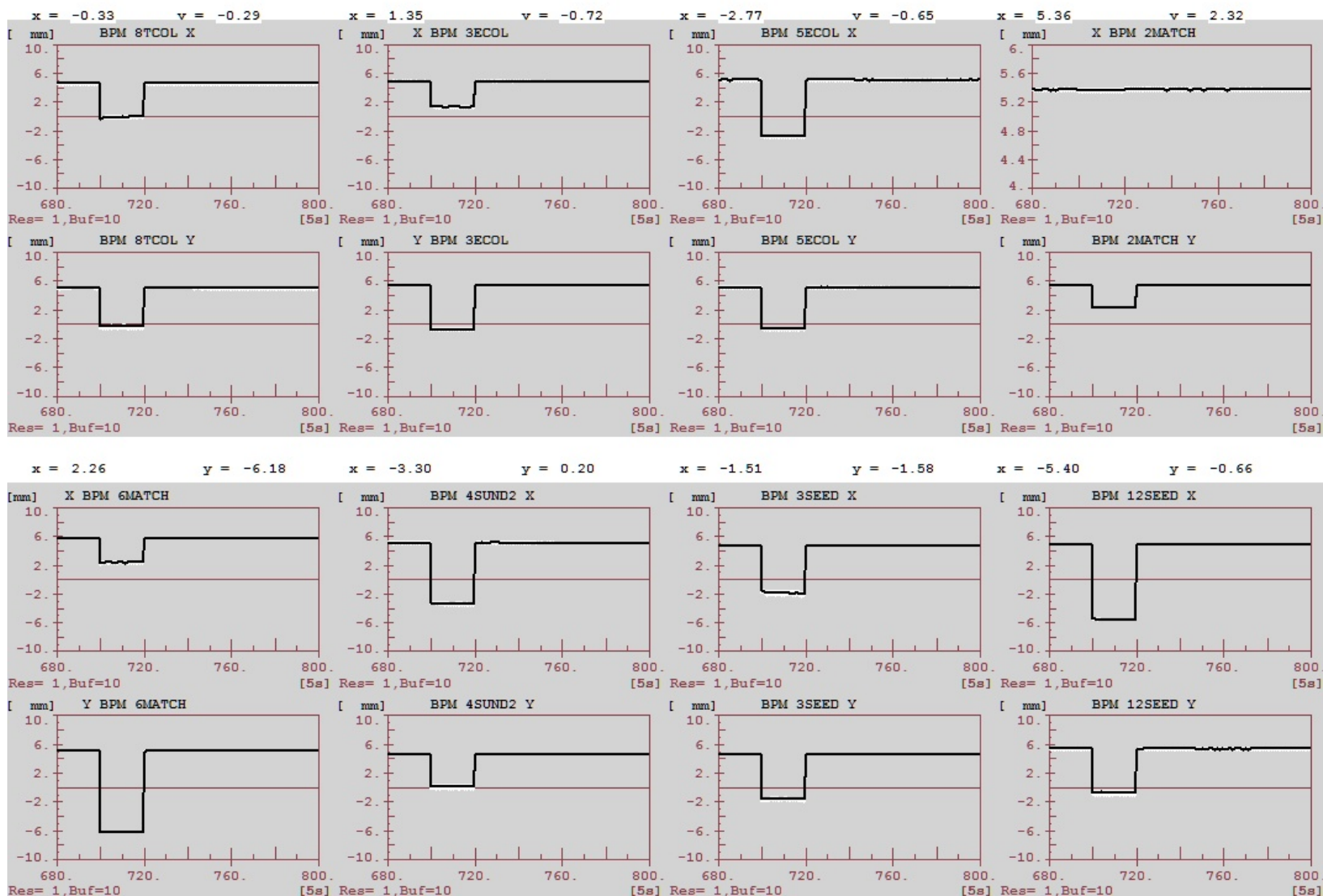
- started to mount it since March 2005
 - button and stripline
- had to set each electronics separately, particularly the trigger delay for the Track and Hold unit
- almost all BPMs have this type now
 - except: GUN and 2UBC2 (due to lack of amplifiers); ACC7, used for position feedback with Frascati electronics

- **Difficulties before KW40**

- bad resolution at buttons, critical mostly in undulator
- no reliable signal at 12SEED and 20SEED
- bad or no signal at other individual BPMs
- instable trigger delay – critical for button BPMs

BPM signals

BPMs: Undulator Seed



Button BPMs

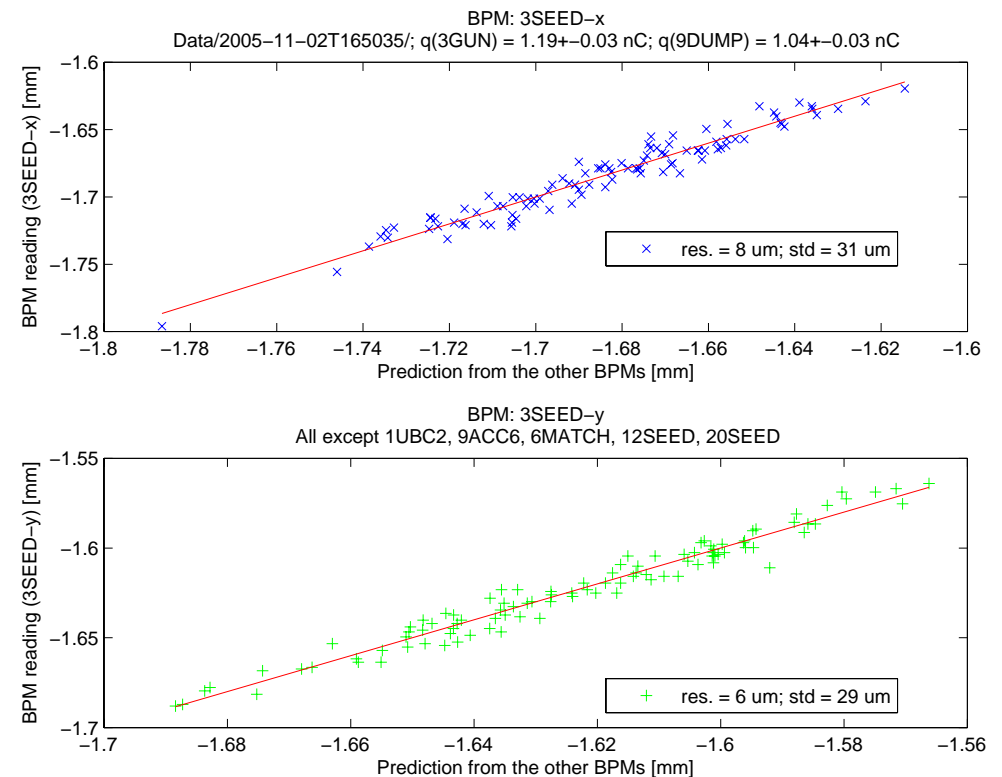
- Amplifier

- extra amplifiers have been mounted at the button BPMs in
 - UND (diagnostics stations only 5UND1 ... 5UND6)
 - 1UBC2
- this improved the resolution to about 50 um;
Note: more precise numbers will be available after calibration of this BPMs!
- when available, will mount amplifiers also at GUN, and at BPMs inside the undulator

BPM resolution

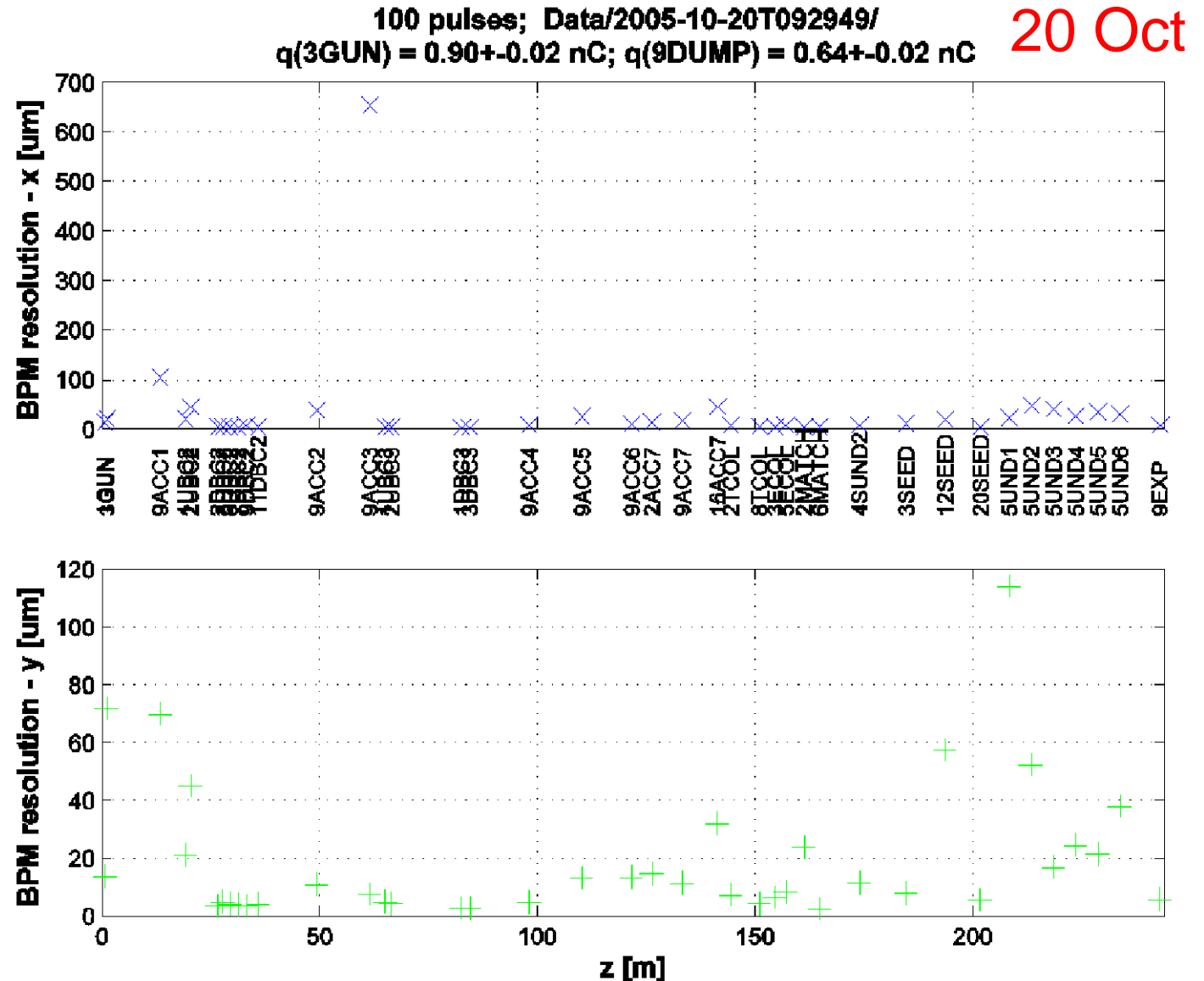
- Measured by correlation of BPM signals
 - this represents only the electronics noise
 - the dependence on position, charge etc. is removed

stripline (34mm)



BPM resolution (2)

- Oct. 20
 - just after machine study weeks
- Note: UND BPMs **not calibrated!** – precise numbers will be available after calibration

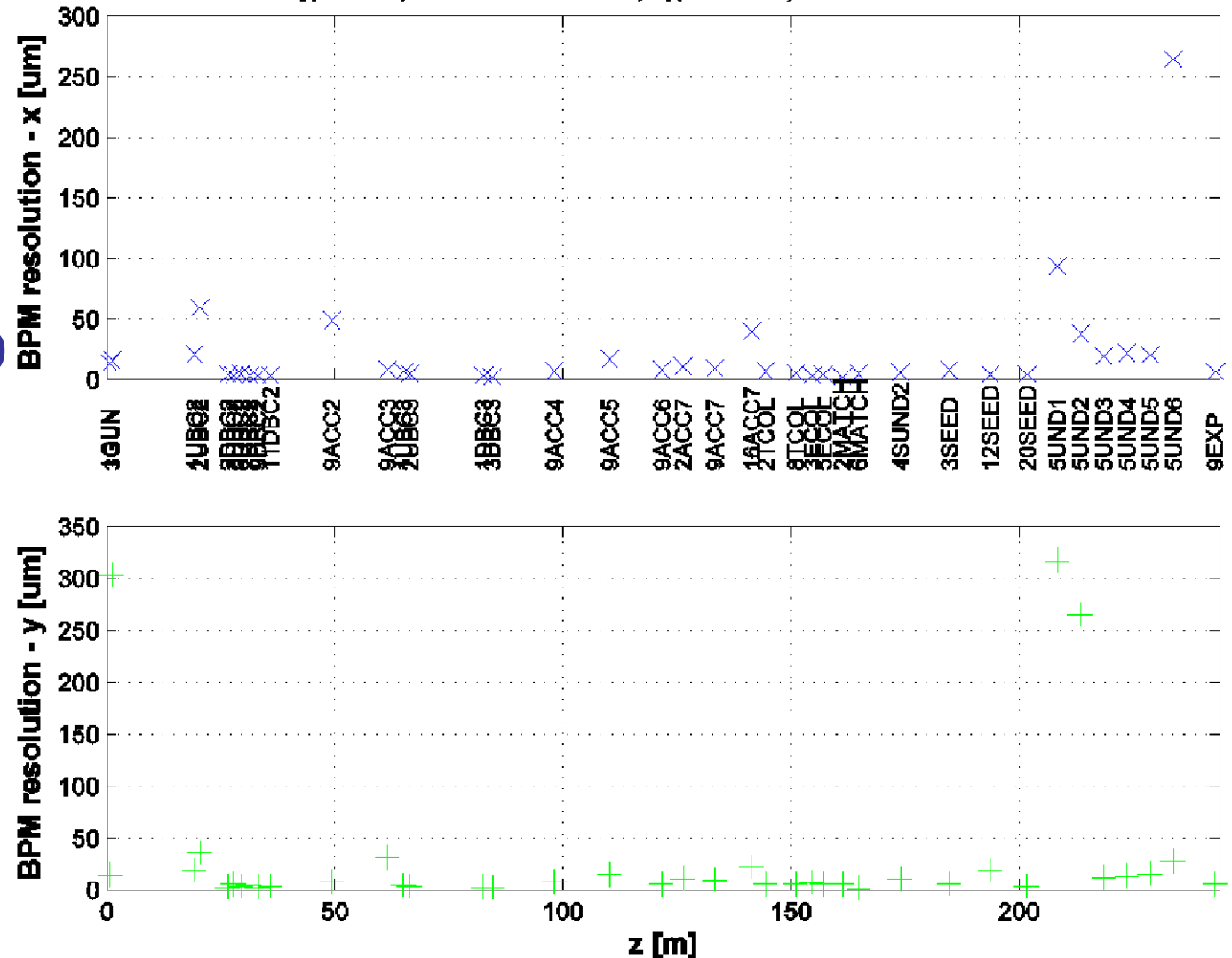


BPM resolution (3)

- Nov. 2 (now)
- Note: UND BPMs **not calibrated!**
- a few UND BPMs now show bad resolution, as compared to Oct. 20
 - need checkup (suspect trigger)

100 pulses; Data/2005-11-02T165035/
 $q(3GUN) = 1.19 \pm 0.03 \text{ nC}$; $q(9DUMP) = 1.04 \pm 0.03 \text{ nC}$

2 Nov



Studies on 12 and 20SEED

- Signals from up and down pickups from 12SEED

- 0.9 nC
- scope mounted in tunnel
- similar to signals from 2MATCH! \Rightarrow no problem with pickup itself

- Cables

- ok

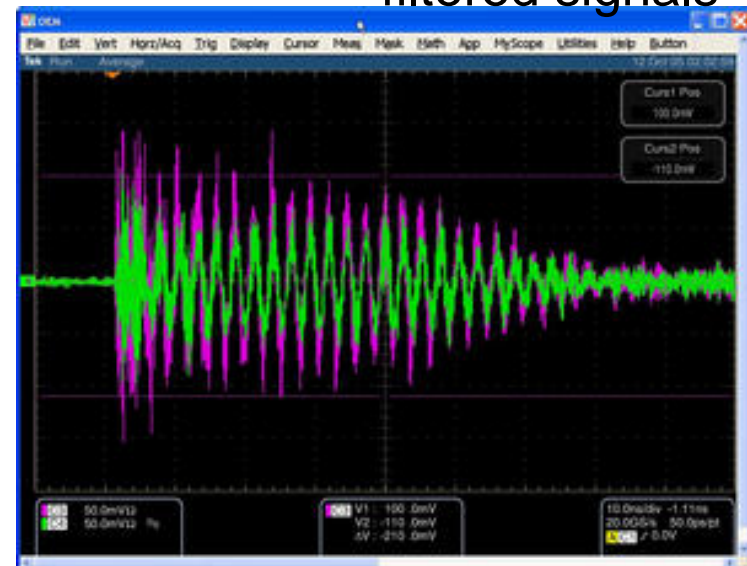
- Electronics

- changed electronics \Rightarrow electronics ok

raw signals



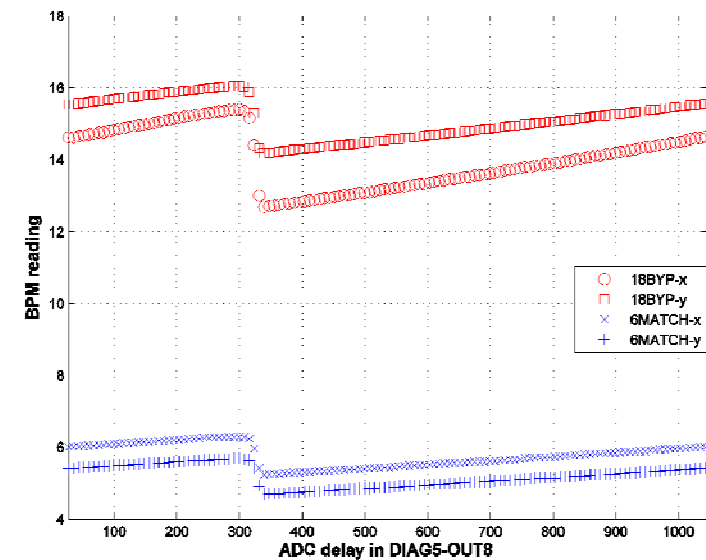
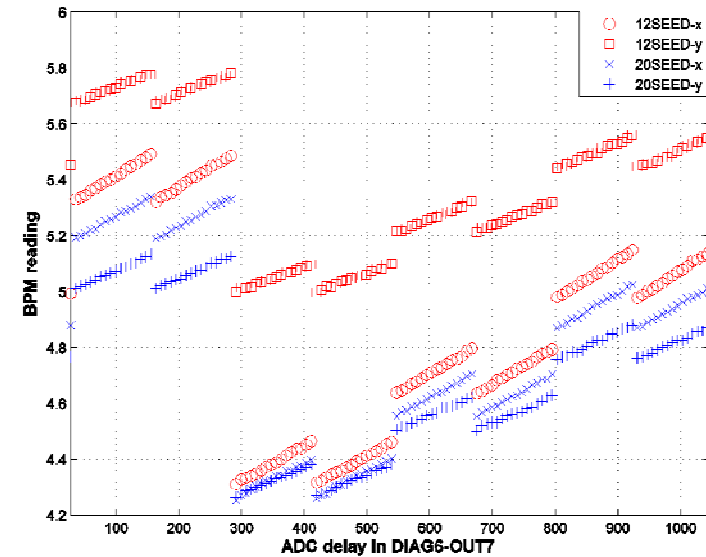
filtered signals



Studies on 12 and 20SEED (2)

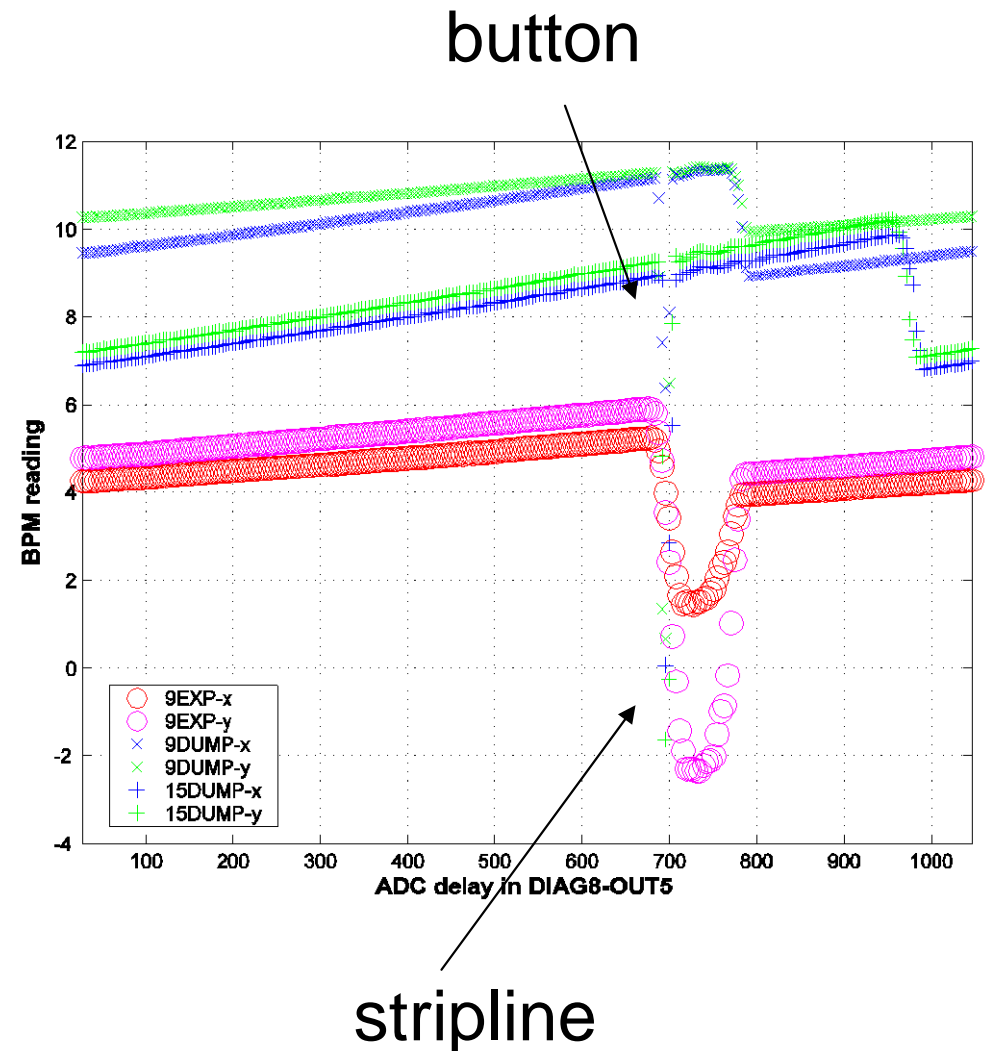
• Timing

- looked different from other BPMs
- MVP changed delay unit =>
=> solved problem!



General works during KW40 and 41

- Re-checked electronics settings, particularly delay
 - rough timing in DOOCS, finer in the electronics
 - very critical for button BPMs
 - checked for
 - all button BPMs in diagnostics stations and UBC2
 - after installation of additional amplifier
 - at other problematic BPMs
 - we systematically had to change the trigger delay by 4-8ns! (in DOOCS) – similar to toroids



General works during KW40 and 41 (2)

- Checked cables

- checked for several problematic BPMs
- found only two cables interchanged (left-right - 4SUND2)

- Measured calibration curves

- within the transfer function measurements (who generated own lookup tables)
- calibration coefficients not changed for all measured BPMs (still to be done)
- will use these measurements to generate lookup tables
- found wrong gradient for cold steerers
(for more see next talk)

Other work

- IDUMP

- BPM and TTF2-electronics installed
- used for energy measurement

- 9ACC1

- electronics mounted by CEA, Saclay
- also charge signal (already calibrated)
- to be calibrated

- Prototype of BPM for XFEL

- built in ACC7 area
- to be connected to electronics

- Test of Neumann electronics at 21SEED

- ongoing till next machine studies

- I²C server

- Luydvig Petrosyan
- ready, tested on one BPM crate
- interface to be written

Work to be done

- (Re)Check timing for button BPMs (and other)
 - it seems to have changed outside the BPM window for several BPMs
- Calibrate BPMs in
 - UND – with the wire scanners
 - check resolution after recalibration
 - ACC1
 - 12 and 20SEED
 - BYP
 - other individual BPMs
- Measure dependence of BPM signal with charge at several BPMs

Work to be done (2)

- Calibrate 0-point
 - with splitter method or
 - based on BBA results
- Make lookup tables
- Mount TTF2-type electronics in GUN
 - when amplifiers arrive
- 9EXP...15DUMP
 - these BPMs hang on same timing
 - have to delay timing for stripline (9EXP), so that the button window be within the stripline window
- Work on electronics
 - study further the performance of individual components

Summary

- All BPMs are operational, except:
 - BPMs in the undulators (2UNDx and 4UNDx): due to lack of amplifiers
 - 21SEED: used for tests (understand signals, test Neumann-type electronics)
 - DUMP: timing is wrong; cables have to be installed
 - Note: BYP BPMs have to be checked and calibrated
 - individual BPMs elsewhere

Summary (2)

• Calibration

- almost all BPMs are calibrated
- for many the constant has to be adjusted based on the transfer function measurements
- many have a slight offset, due to ADC and electronics offsets
- still to fully calibrate
 - UND – diagnostics stations; (amplifiers have been installed)
 - BYP
 - individual BPMs elsewhere
- make lookup tables