Progress on the FLASH BPMs and HOM-BPMs
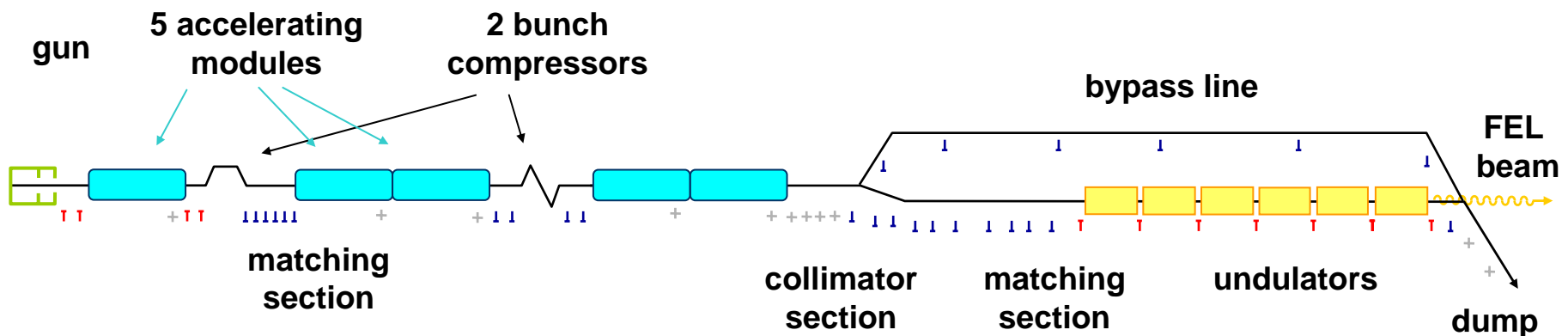
N. Baboi
for the BPM and the HOM teams
(DESY, CEA-Saclay, SLAC, FNAL, Cockroft/Daresbury, KEK, PSI)

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

- Mostly button and stripline BPMs
  - ➢ in modules: cavity and re-entrant cavity BPMs

gun

5 accelerating modules

2 bunch compressors

bypass line

FEL beam

matching section

collimator section
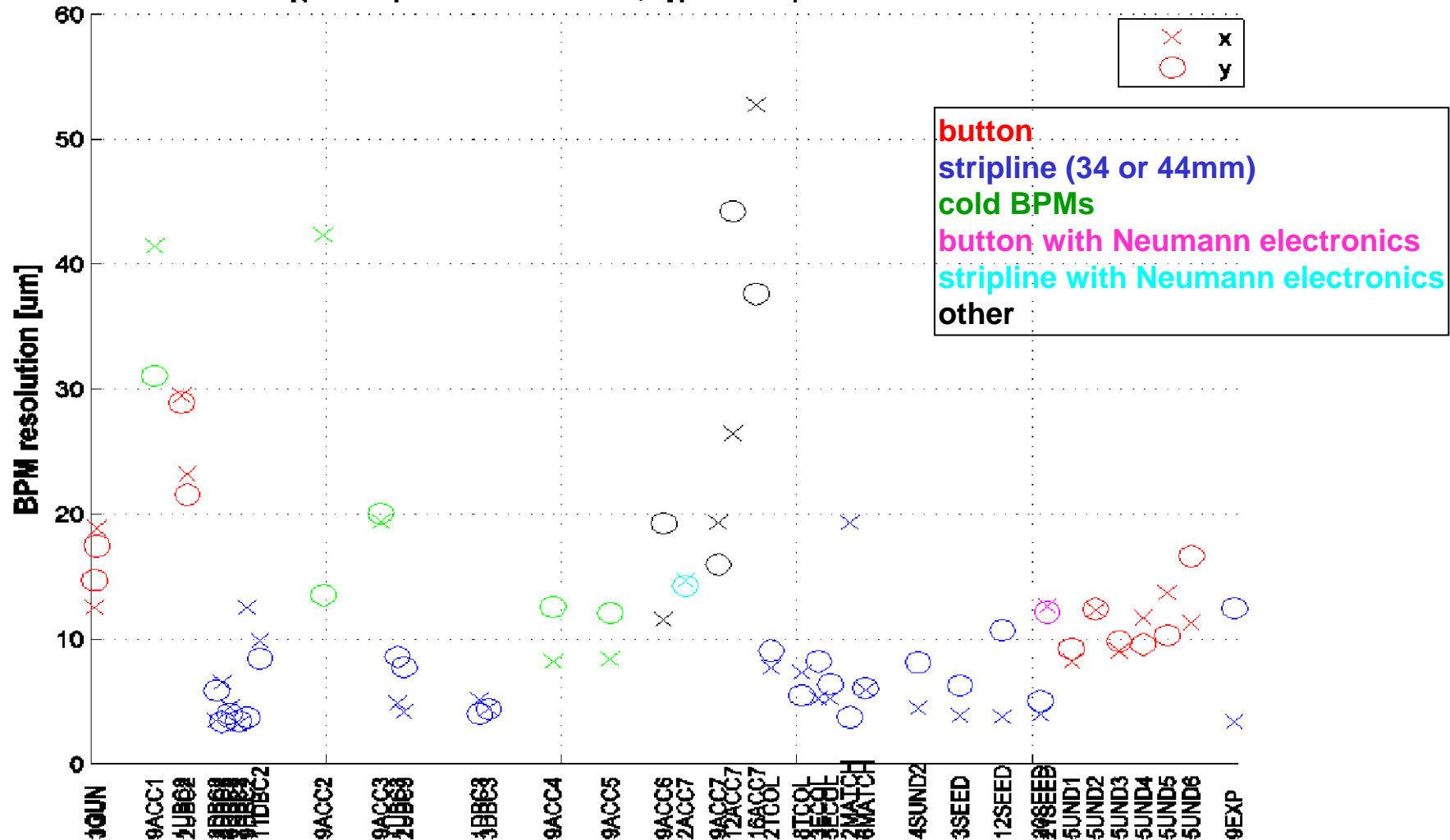
matching section

undulators

dump

↥ → button BPM (Ø34mm & 10mm)
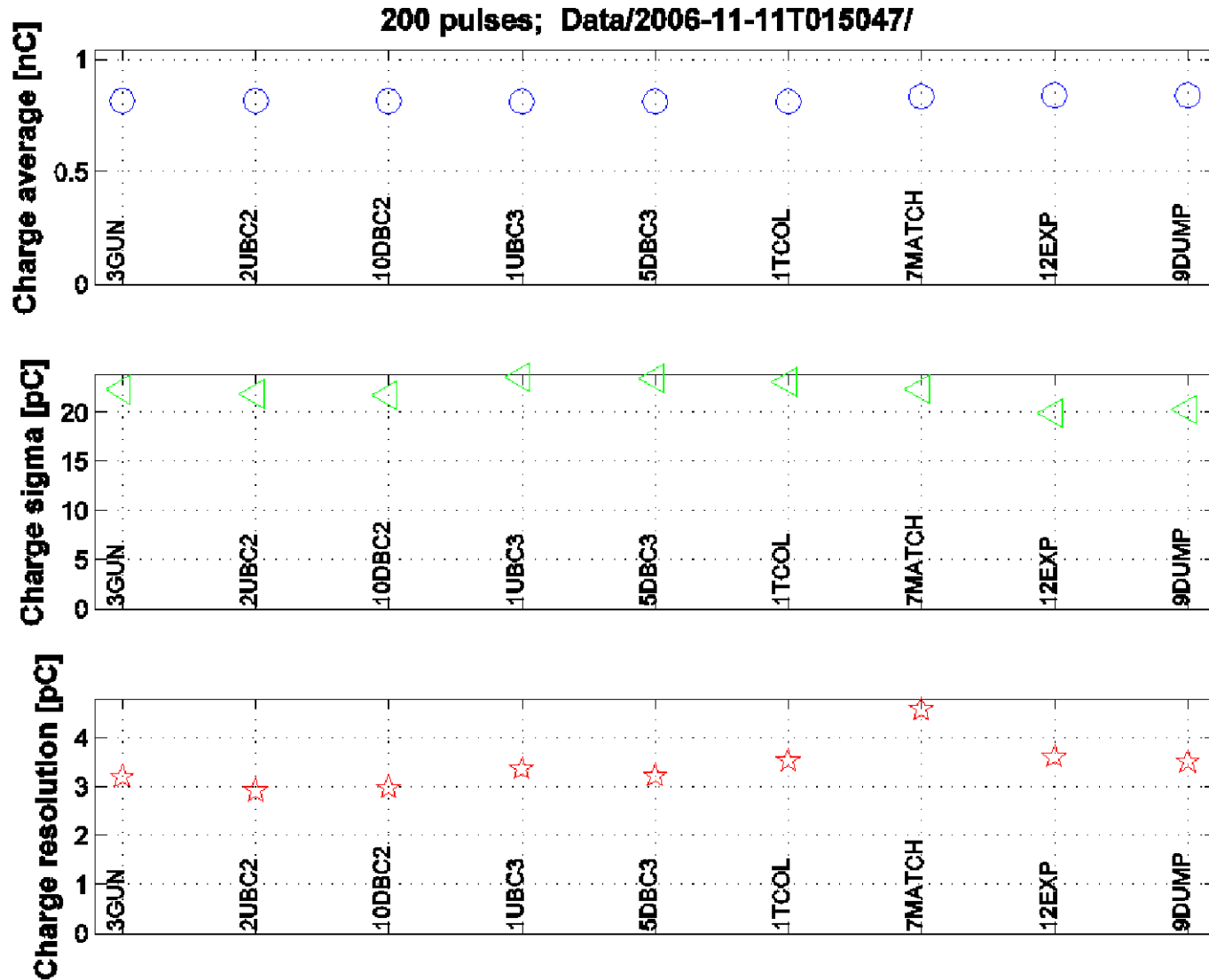↧ → stripline BPM (Ø34mm & 44mm)
+ → other type of BPM

FLASH BPMs: Resolution
Typical Measurement for 0.85 nC

200 pulses; Data/2007-02-02T141243/
q(3GUN) = 0.85+-0.03 nC; q(9DUMP) = 0.85+-0.03 nC

button
stripline (34 or 44mm)
cold BPMs
button with Neumann electronics
stripline with Neumann electronics
other

Toroid resolution

200 pulses; Data/2006-11-11T015047/

FLASH BPMs: Older work

- **Button BPMs**
  - additional amplifier and low pass-filter
  - $\Rightarrow$ improved resolution and removed non-linearities

- **Method to measure resolution**
  - based on correlations among BPMs
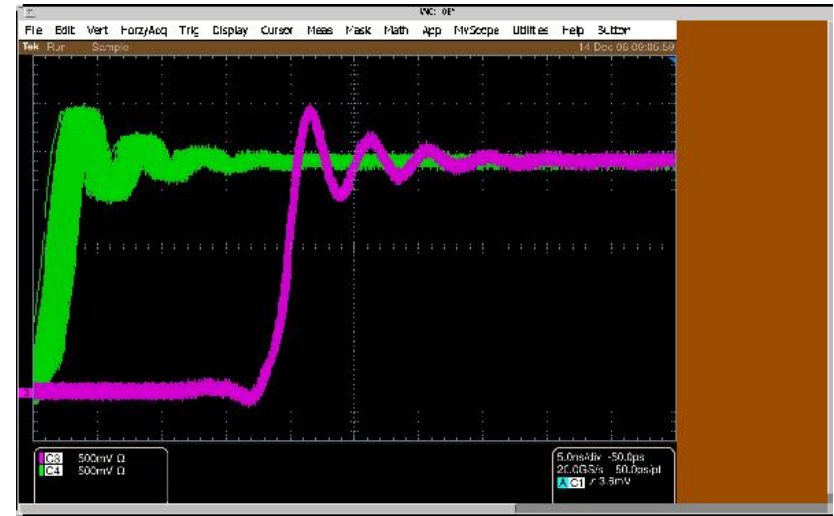 - also for toroids and other current monitors

- **FLASH BPMs with Neumann electronics**
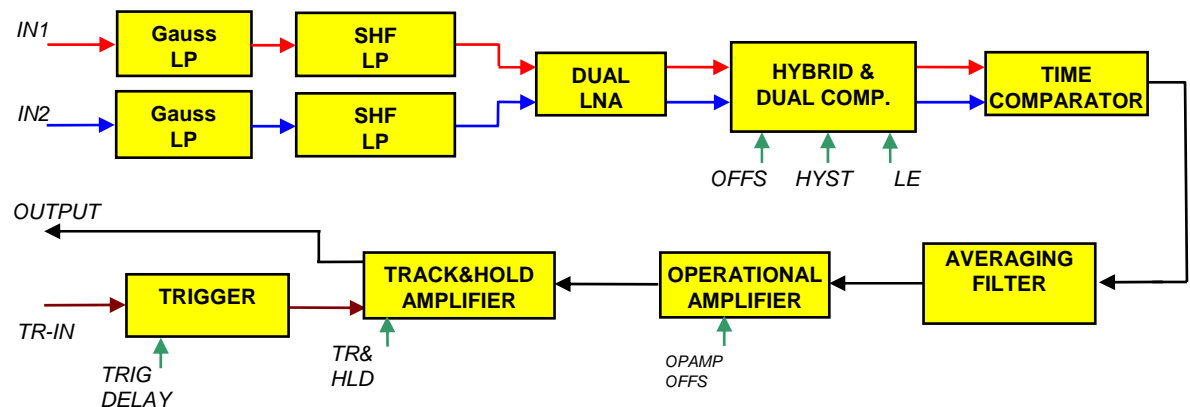 - 2ACC7 and 21SEED

Button BPMs: Trigger

- **Trigger**
  - contributes to apparent signal noise from BPM (sometimes correlated among BPMs)
  - solution: 9 MHz trigger has been synchronized to a 81 MHz sine signal (Winter)
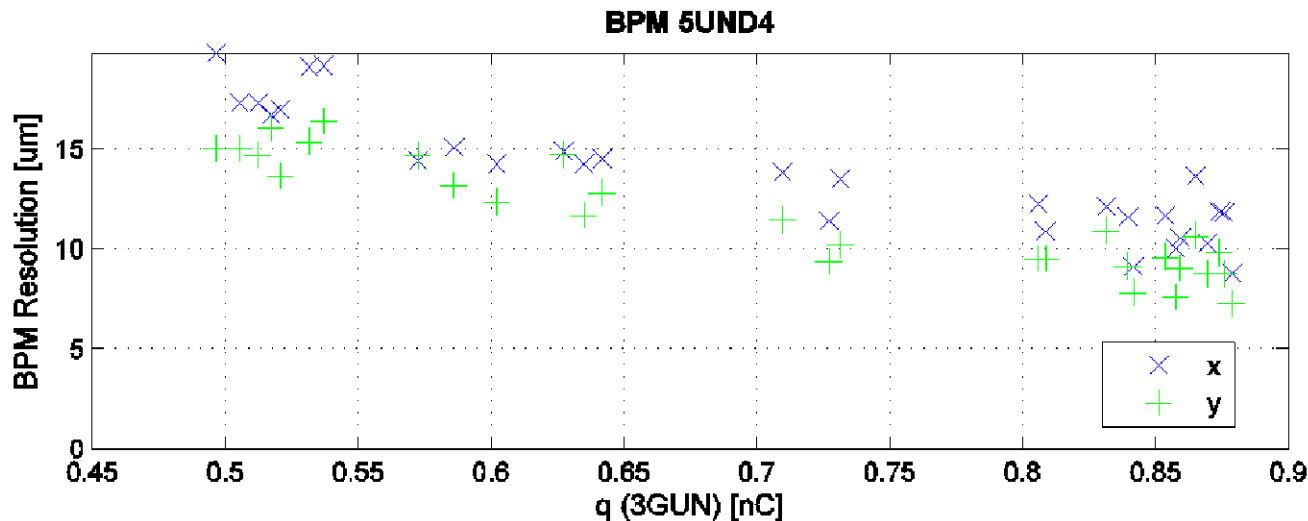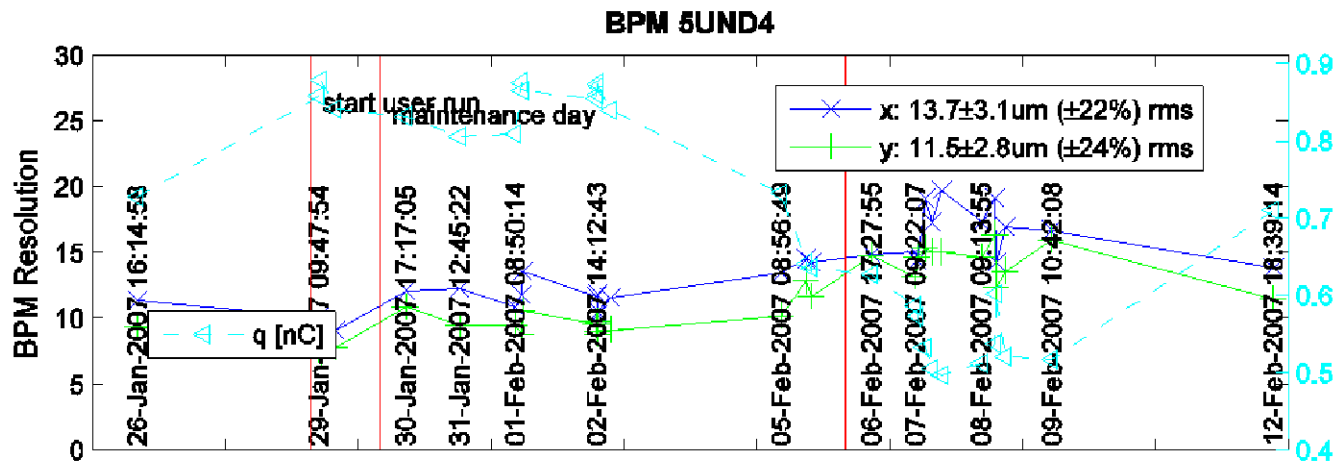

- **Modified electronics**
  - for new trigger
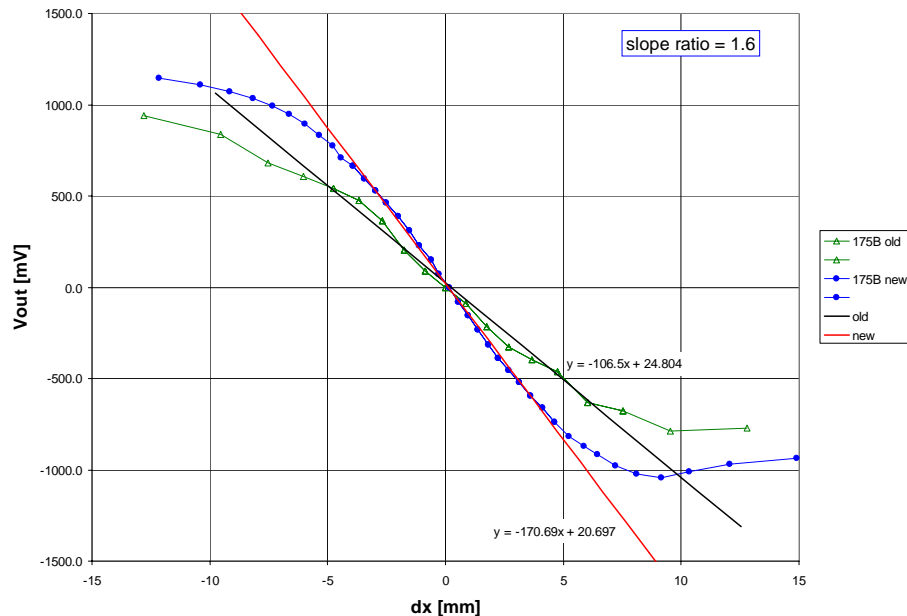 - installed at 5UND5 and 5UND6
  - under study

Button BPMs:
Resolution versus time and charge
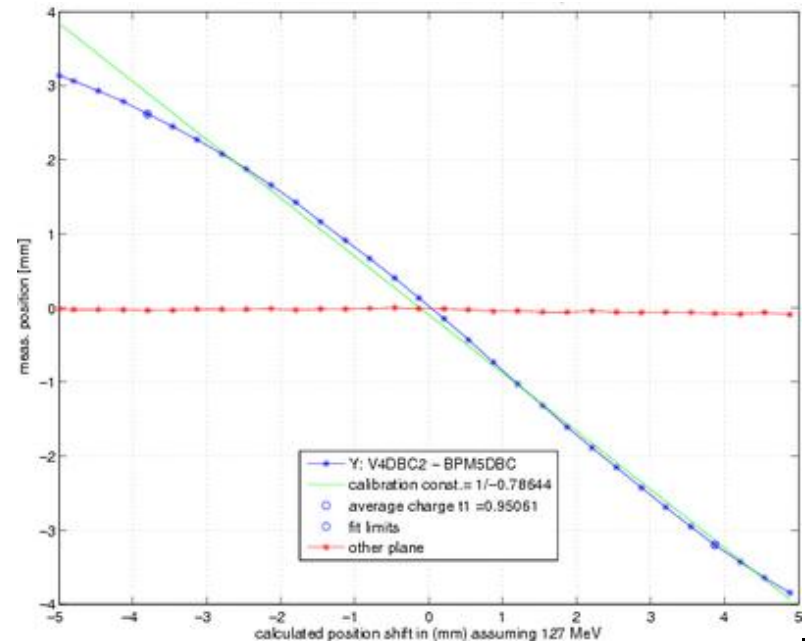
Stripline BPMs

- ## Improved electronics
  - ➤ work in Zeuthen (Riesch)
  - ➤ removed non-linearities
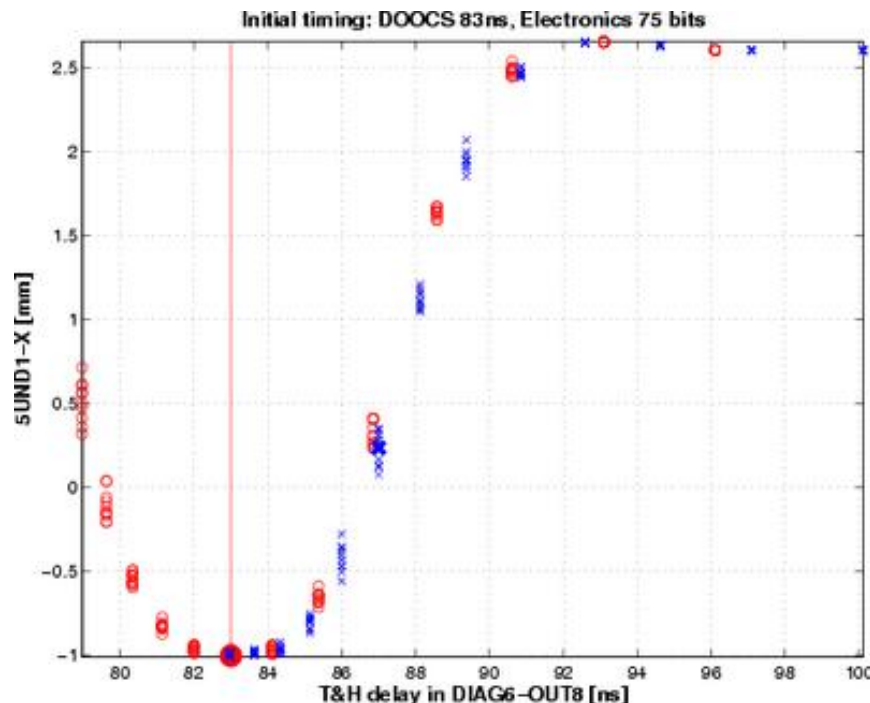
Measurements in Lab

Measurements at FLASH (BPM 5DBC2)

Other BPM work

- ## DOOCS electronics server (Petrosyan)
  - ➢ enables remote reading and setting of electronics parameters (previously separate Windows server made automatization difficult)
  - ➢ programs to set parameters and trigger timing

Initial timing: DOOCS 83ns, Electronics 75 bits

Other BPM work (2)
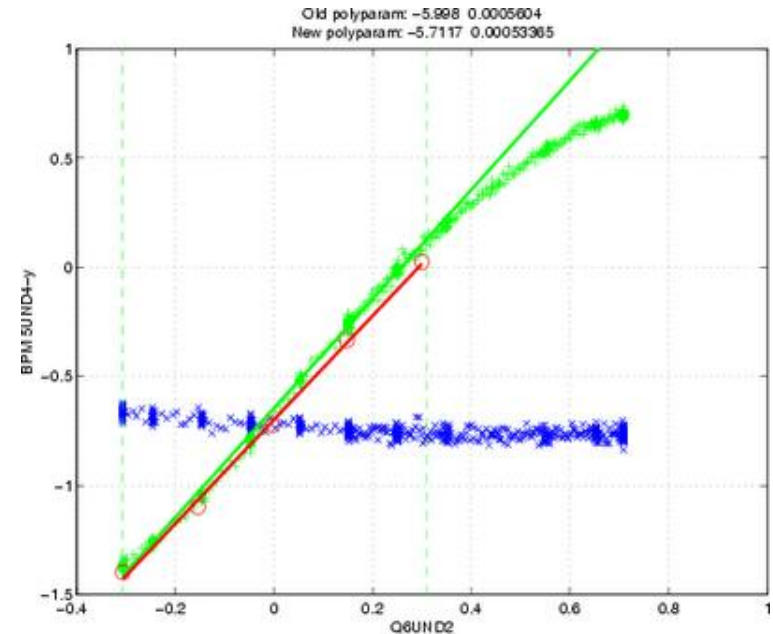
- **UND-BPMs**
  - ➢ re-calibrated after changes
  - ➢ re-calibrated to check stability (Castro) → mostly ok

- **6MATCH (stripline)**
  - ➢ found short
  - ➢ repaired during current shutdown

- **Calibration**
  - ➢ data taken with the ORM program (Prat)
  - ➢ not trivial to interpret data

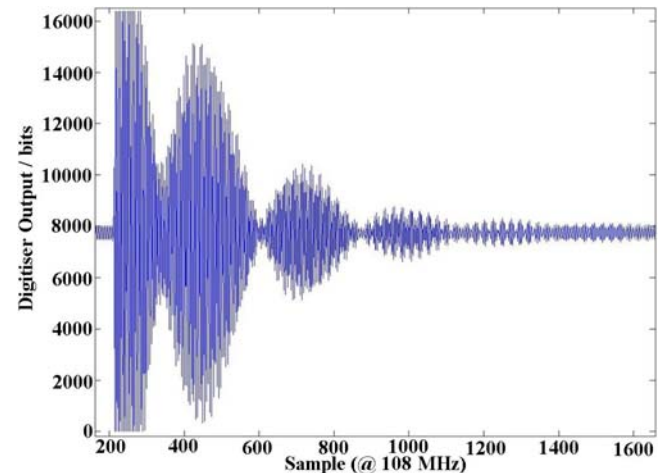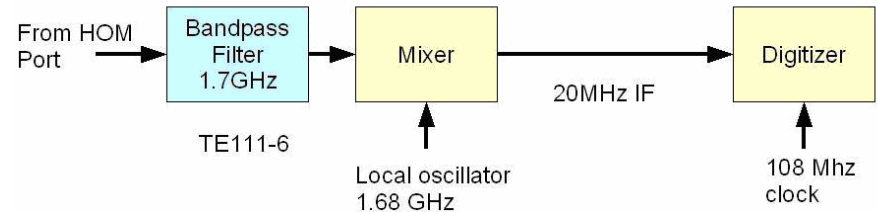Old polyparam: −5.998 0.0005604
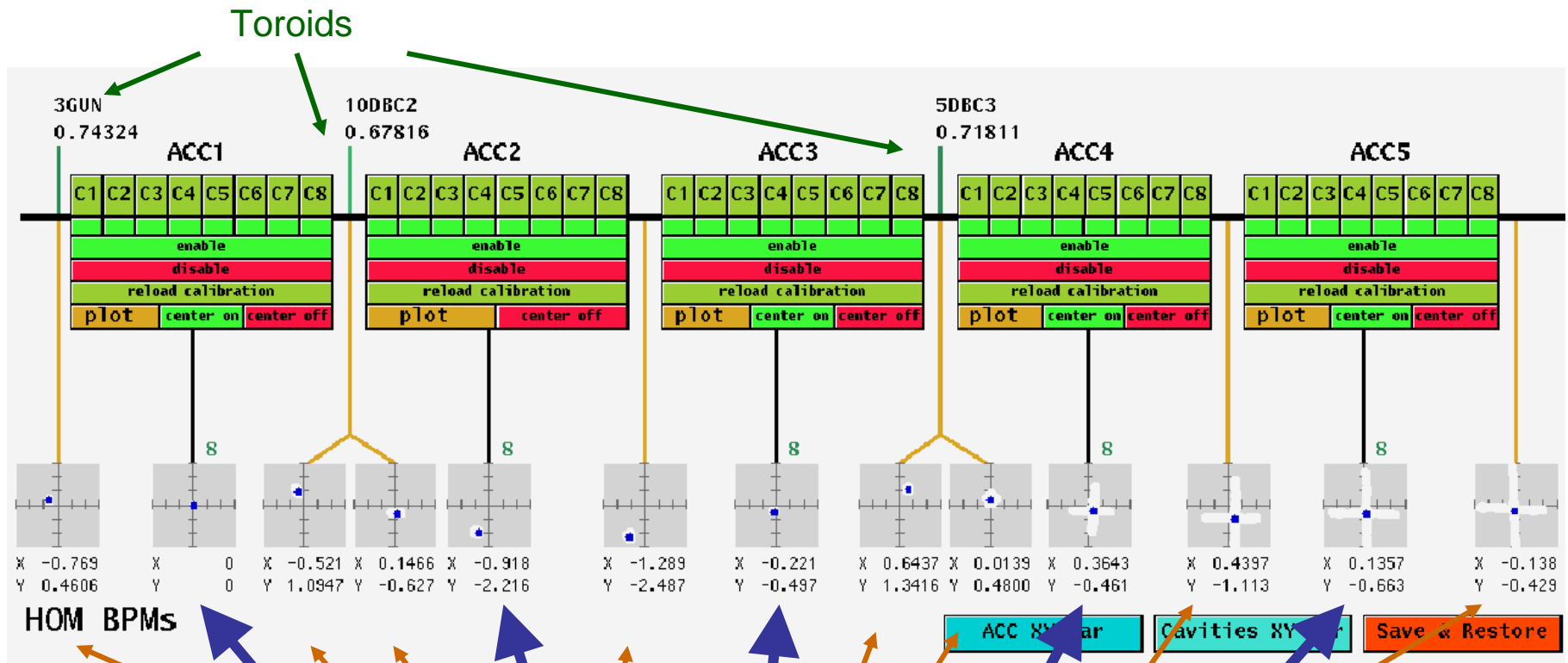New polyparam: −5.7117 0.00053365

Future work on FLASH BPMs

- check all BPMs, timing, calibration etc.
- several modified stripline electronics installed
- "standard" 81 MHz signal will be used
  - ➢ check button BPMs
- Install TTF2-electronics at feedback BPMs
  - ➢ so far Frascati electronics
- Test intra-pulse feedback system
  - ➢ test modified BPMs, test kicker etc.

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)
    - • ACC1 not calibrated
  - ➤ calibrated single bunch
  - ➤ tests with multi-bunch

From HOM Port → Bandpass Filter 1.7GHz → Mixer → 20MHz IF → Digitizer

TE111-6

Local oscillator 1.68 GHz

108 Mhz clock

HOM-BPMs at FLASH: Status

HOM-BPMs at FLASH: Status (2)

- ## Resolution
  - single bunch: 2-10 μm rms measured so far
  - potential to improve by changes in the LO oscillator

- ## Multi-bunch
  - capability demonstrated, with worse resolution (as expected)

HOM-BPMs at FLASH: Planned Work

- **HOM-BPMs:**
  - single-bunch calibration: check codes, stability etc.
  - multi-bunch calibration: resolution, code
- **test HOM digitizer**
  - alternative digital electronics for the HOM-BPMs
- **test improved LO oscillator**
- **Cavity alignment**
  - measure for new modules
- **DOOCS:**
  - improve interface, particularly for multi-bunch
- **Broad-band setup:**
  - phase measurement with LLRF colleagues
  - repeat some previous measurements to have more data

3. Work on BPMs for XFEL

- **Button BPM**
  - ➢ 13ACC7
  - ➢ good linearity
  - ➢ resolution 30 μm
- **Re-entrant cavity BPM**
  - ➢ 12ACC7
  - ➢ v. good resolution

16ACC7/X vs. H10ACC6/PS.RBV

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- **PSI resonant stripline BPM**
  - ➢ for feedback
  - ➢ studied spectra, signals
  - ➢ 3 more are installed this shutdown => test next accel. studies period