New Diagnostics in the FLASH Dump Line

Nicoleta Baboi
for the Dump-Diagnostics team

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- Motivation of Dump Line upgrade
  - Problems with the old dump line
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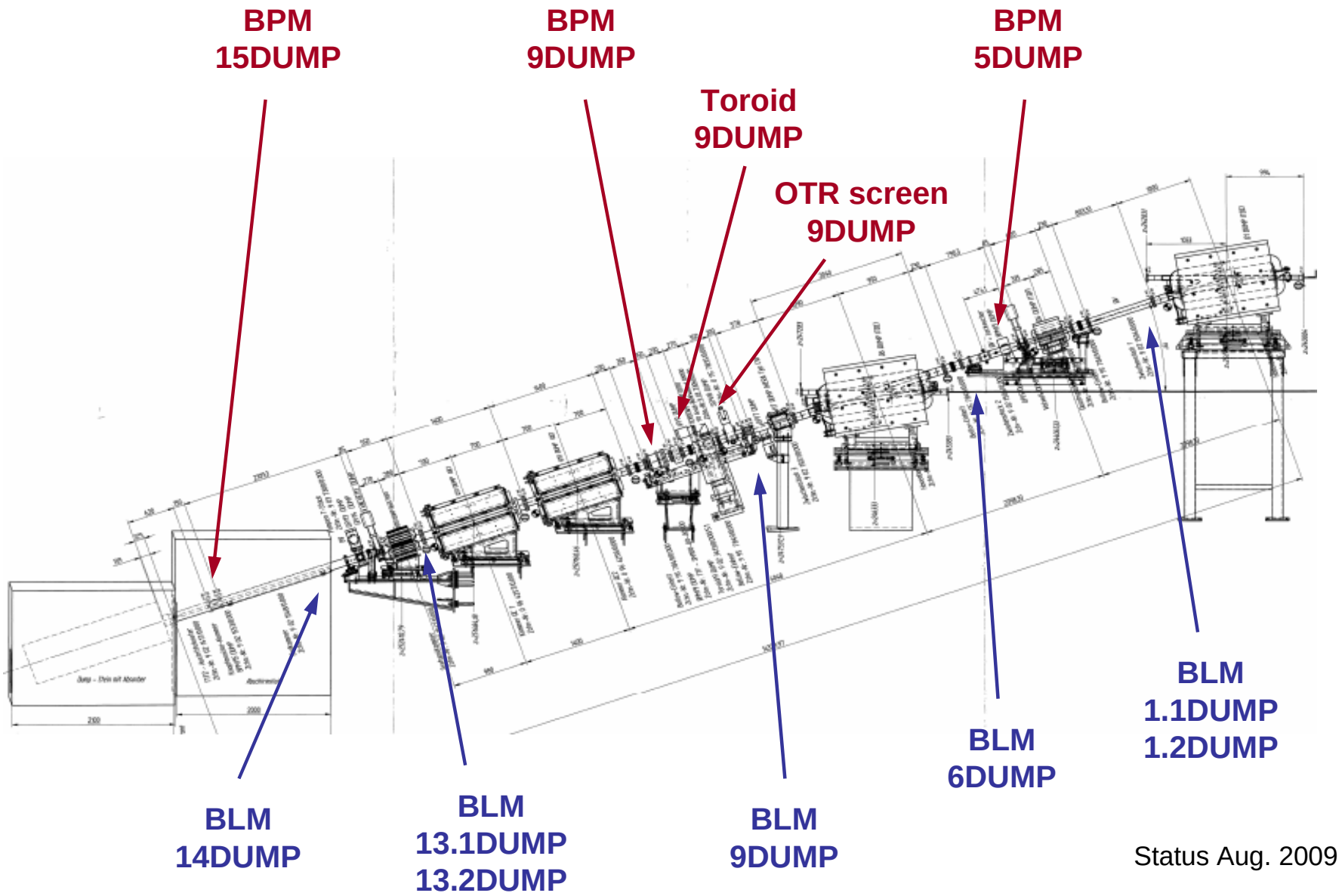
  - Beam Position Monitors (BPMs)
  - Glass fibers
  - Ionization Chamber
  - Beam Halo Monitors (BHMs)
- Some data analysis and questions
- Summary

Old Dump Line



Status Aug. 2009

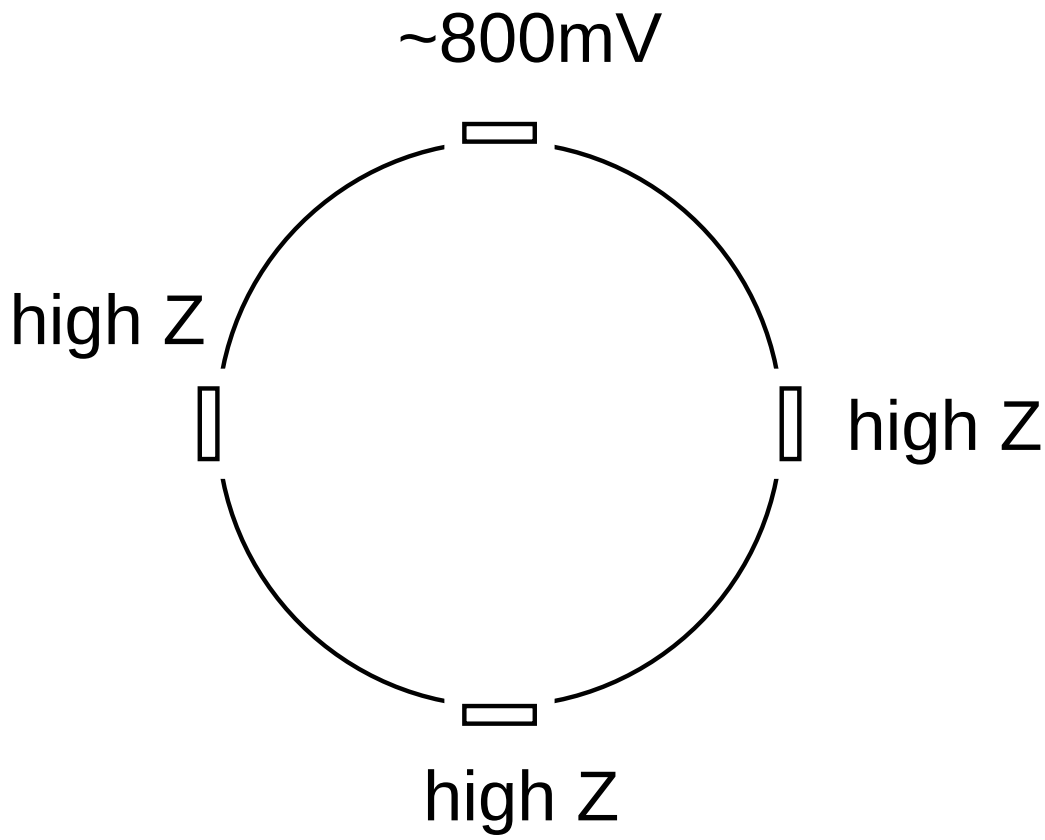
September 2008

- 9 mA studies
  - achieved 550 bunches/pulse, 2.5 nC, 1 MHz, 890 MeV
  - terminated by vacuum problem in the dump line

    $\Rightarrow$ not sufficient diagnostics at the dump

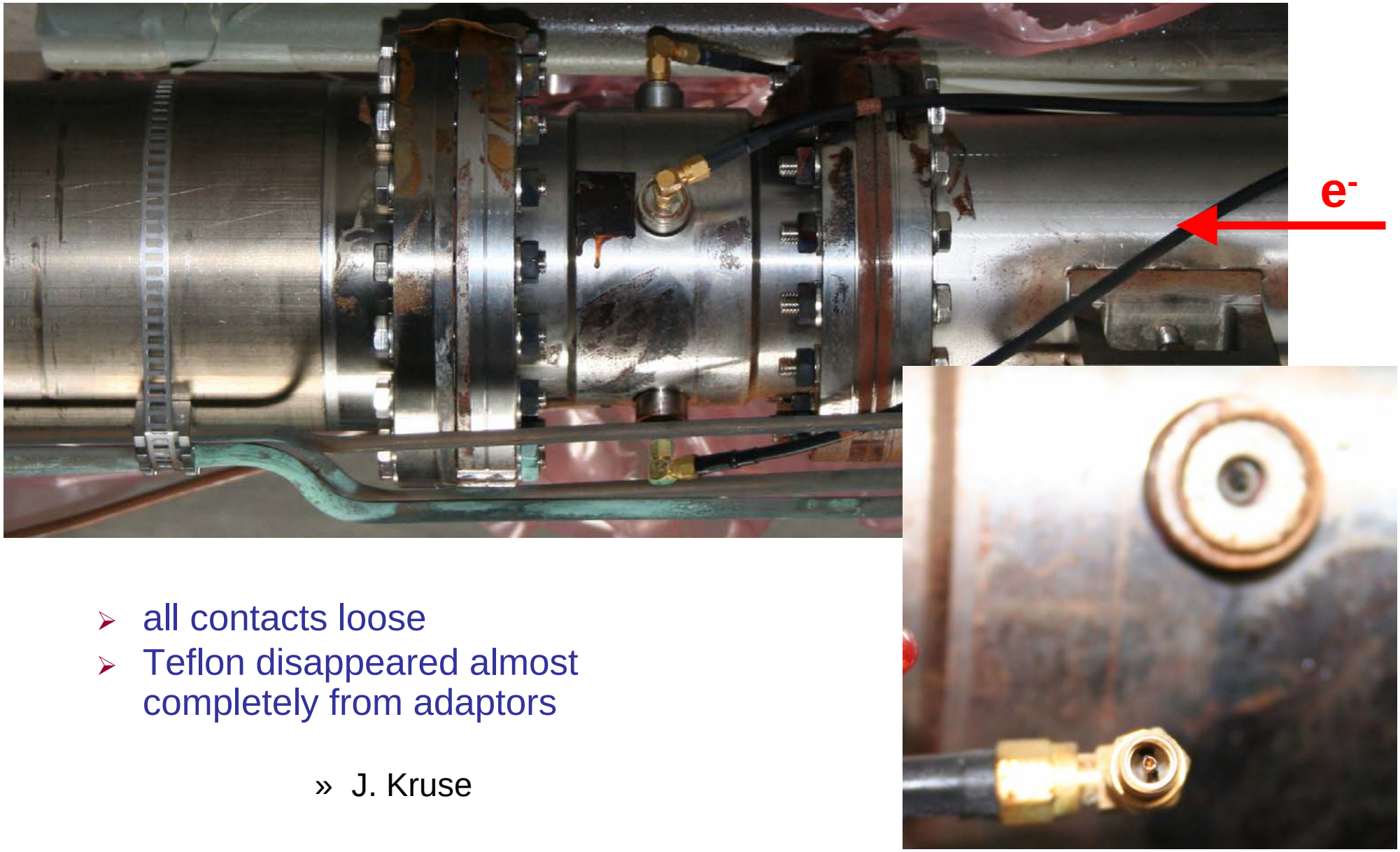
Old BPM 15DUMP

- Strange behavior of BPM signals
  - measured impedance from end of cable (in bld. 49):
  - L, R, D: high Z
  - U: voltage measured (~800mV)
  - ⇒ buttons or connectors damaged by radiation



J. Kruse

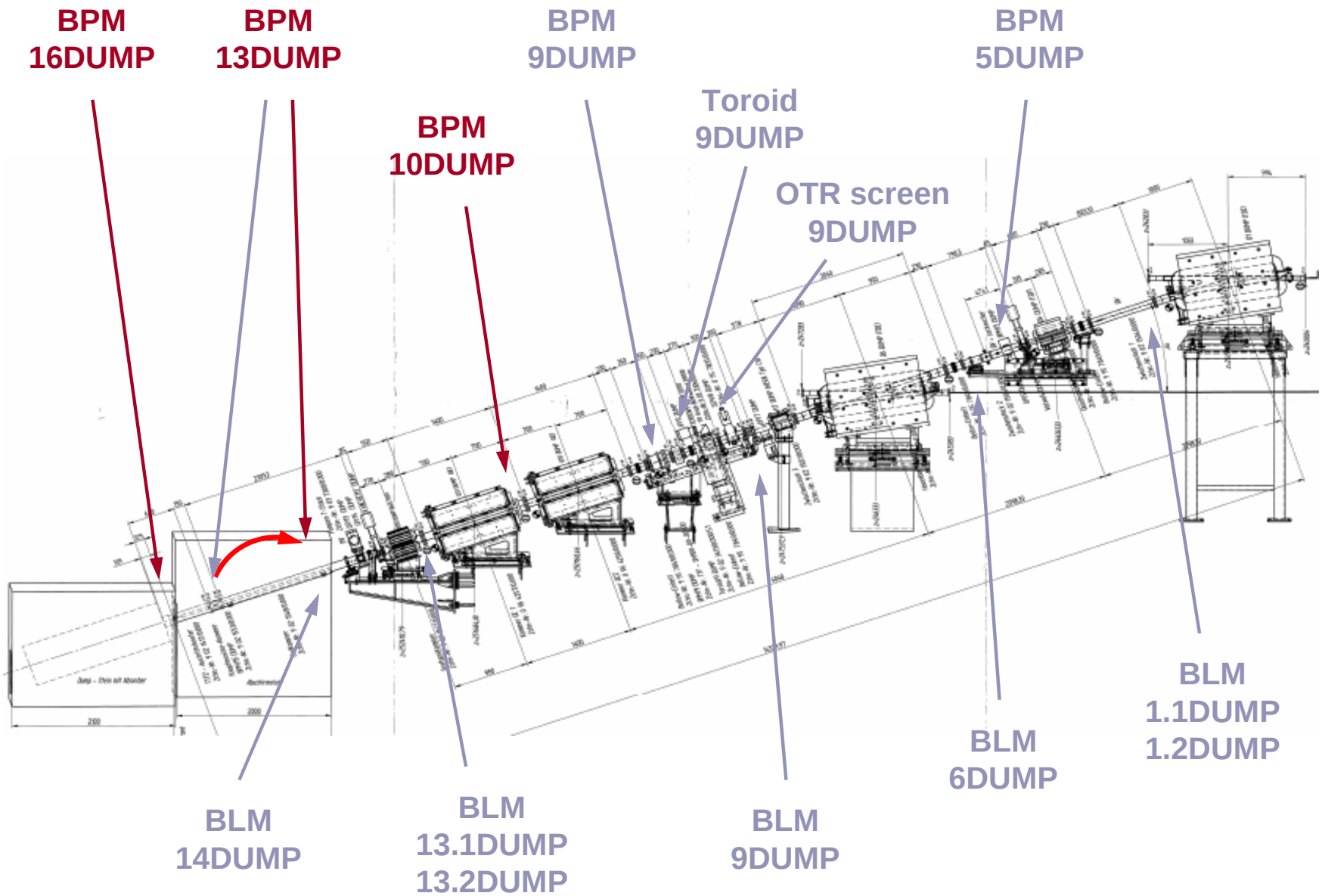
Old Dump Line



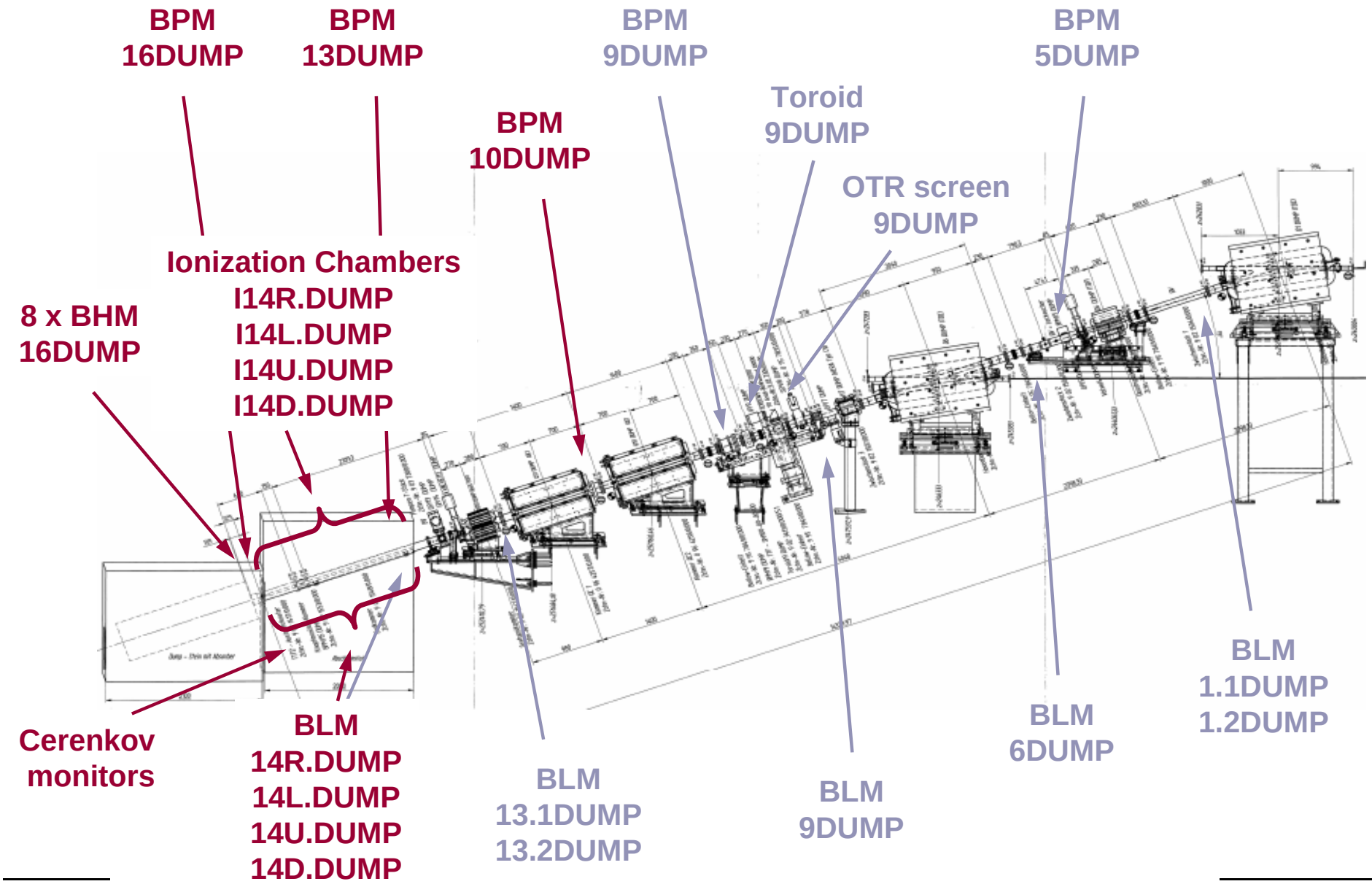
- all contacts loose
- Teflon disappeared almost completely from adaptors

» J. Kruse

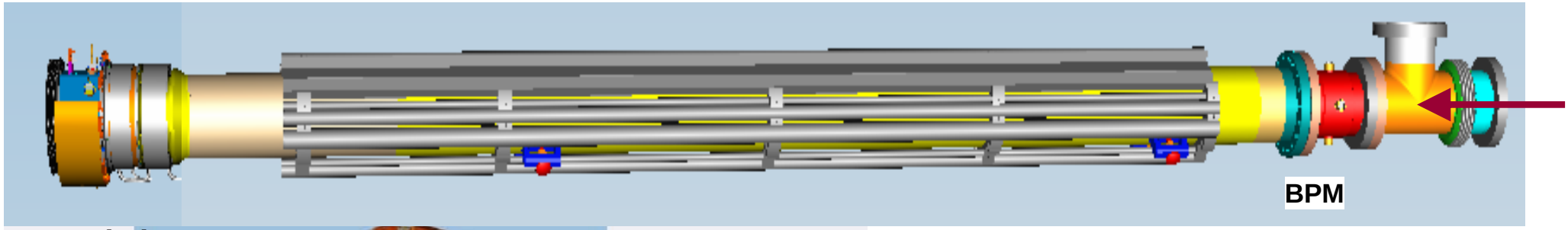
Dump Line Upgrade 2009
New BPMs

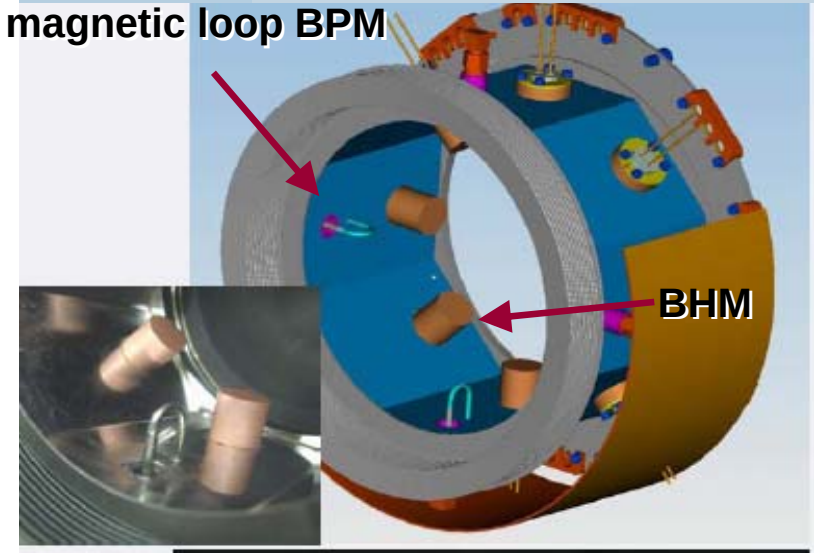


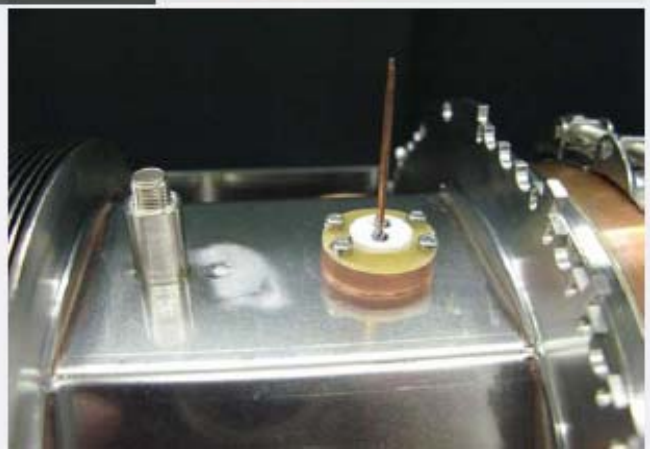
Dump Line Upgrade 2009
New Loss Monitors



Dump Chamber



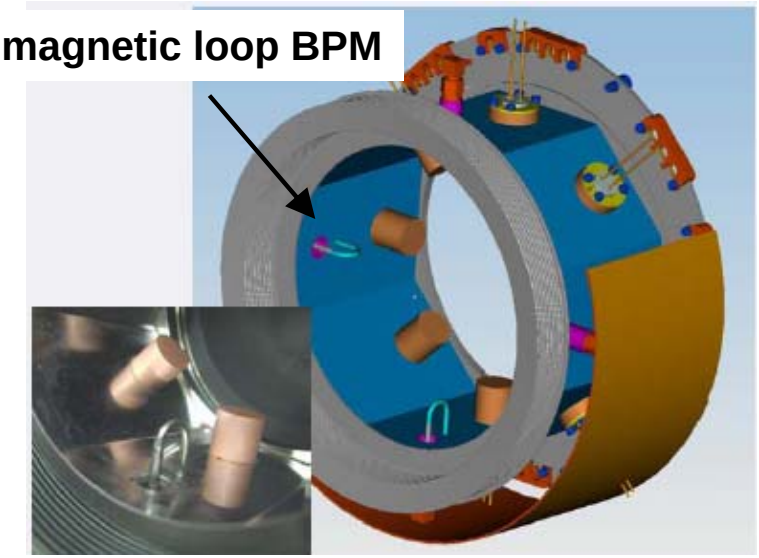


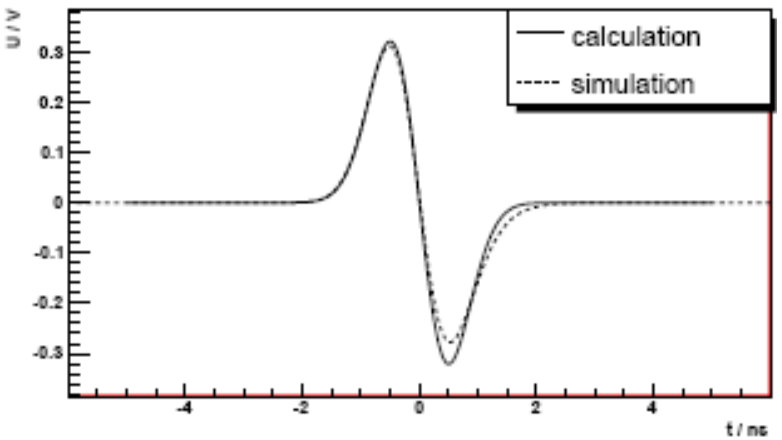


» T. Wohlenberg, M. Schmitz, MDI3

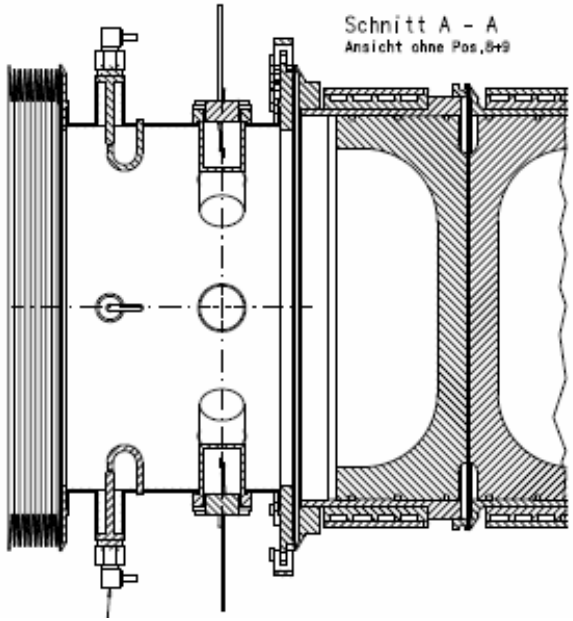
Magnetic loop (in-air) BPM 16DUMP

- Idea
  - Not possible to use (button) BPMs in air (or Nitrogen),
  - ⇒ magnetic loops
  - signal not (significantly) influenced by ions
- Simulations and analytical calculations
  - in agreement with each other



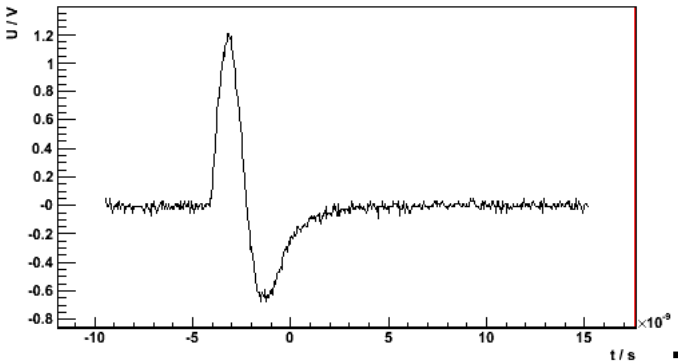


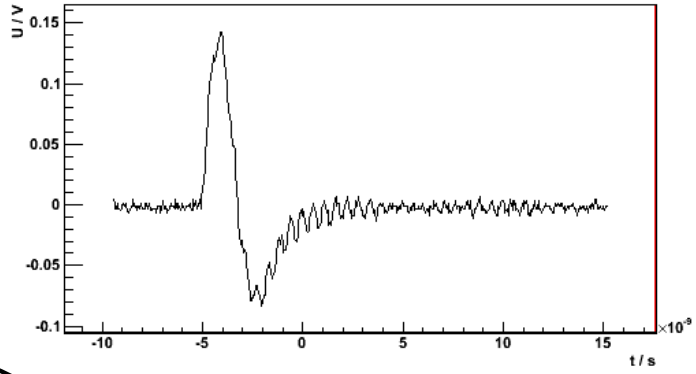
» D. Lipka

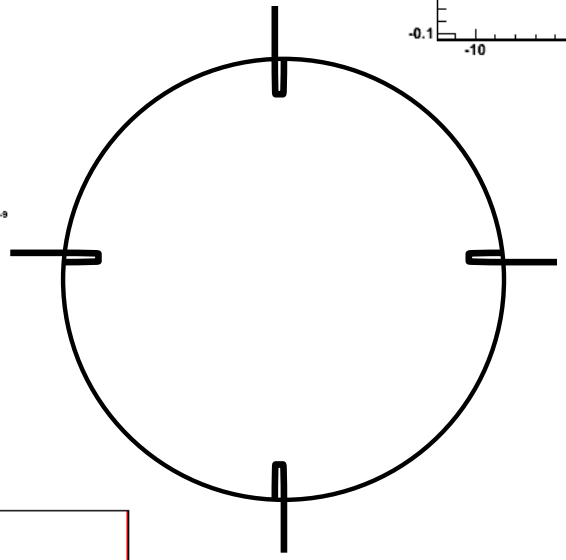


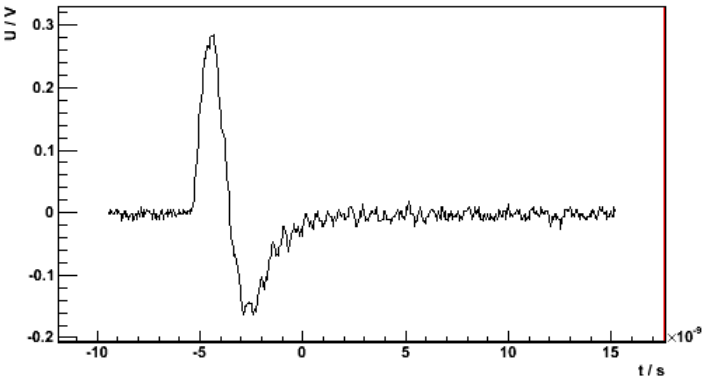
Magnetic loop (in-air) BPM 16DUMP (2)

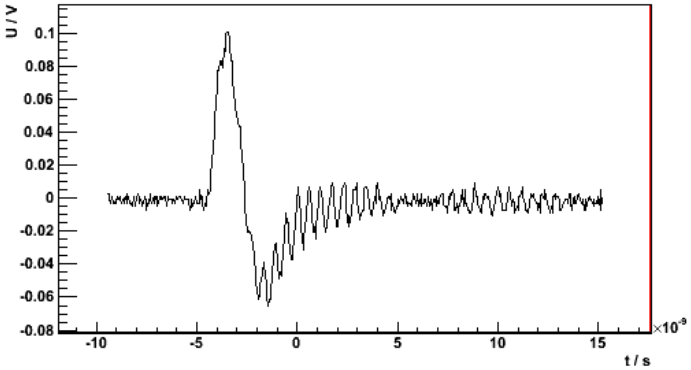
- Measurement





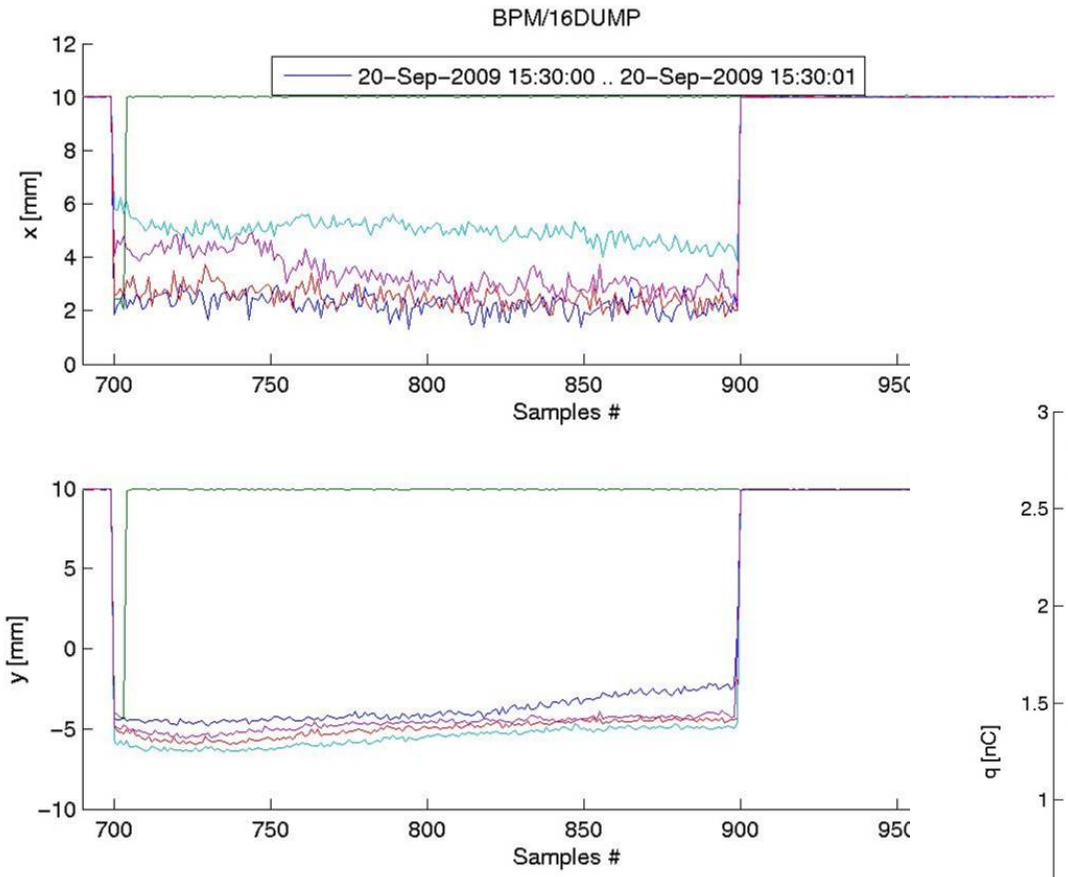


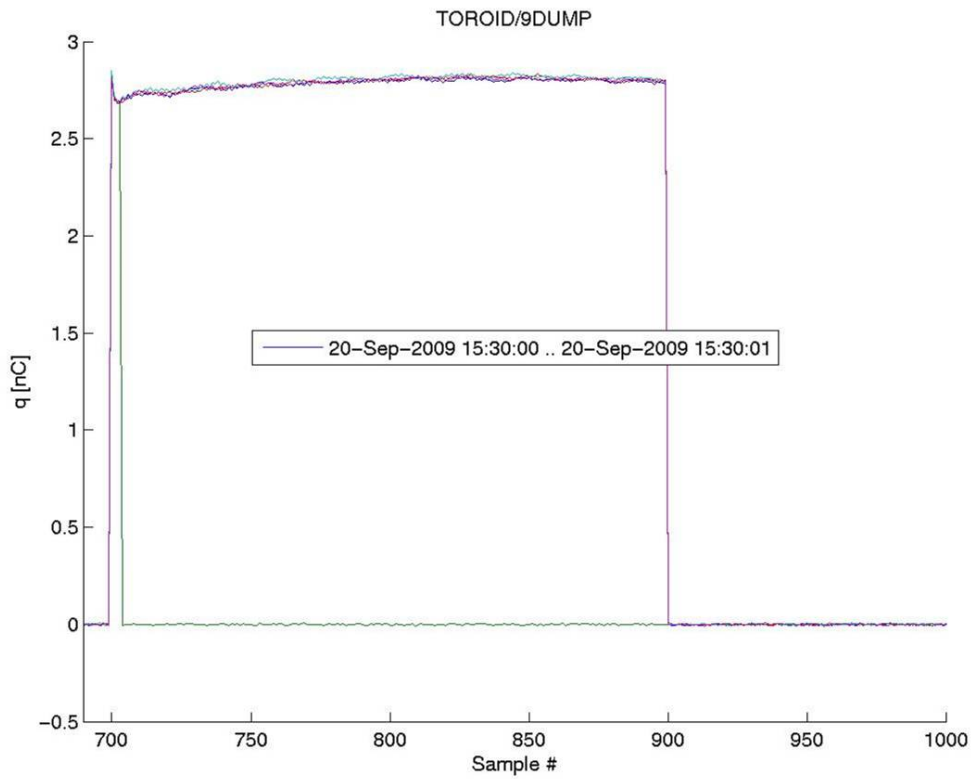




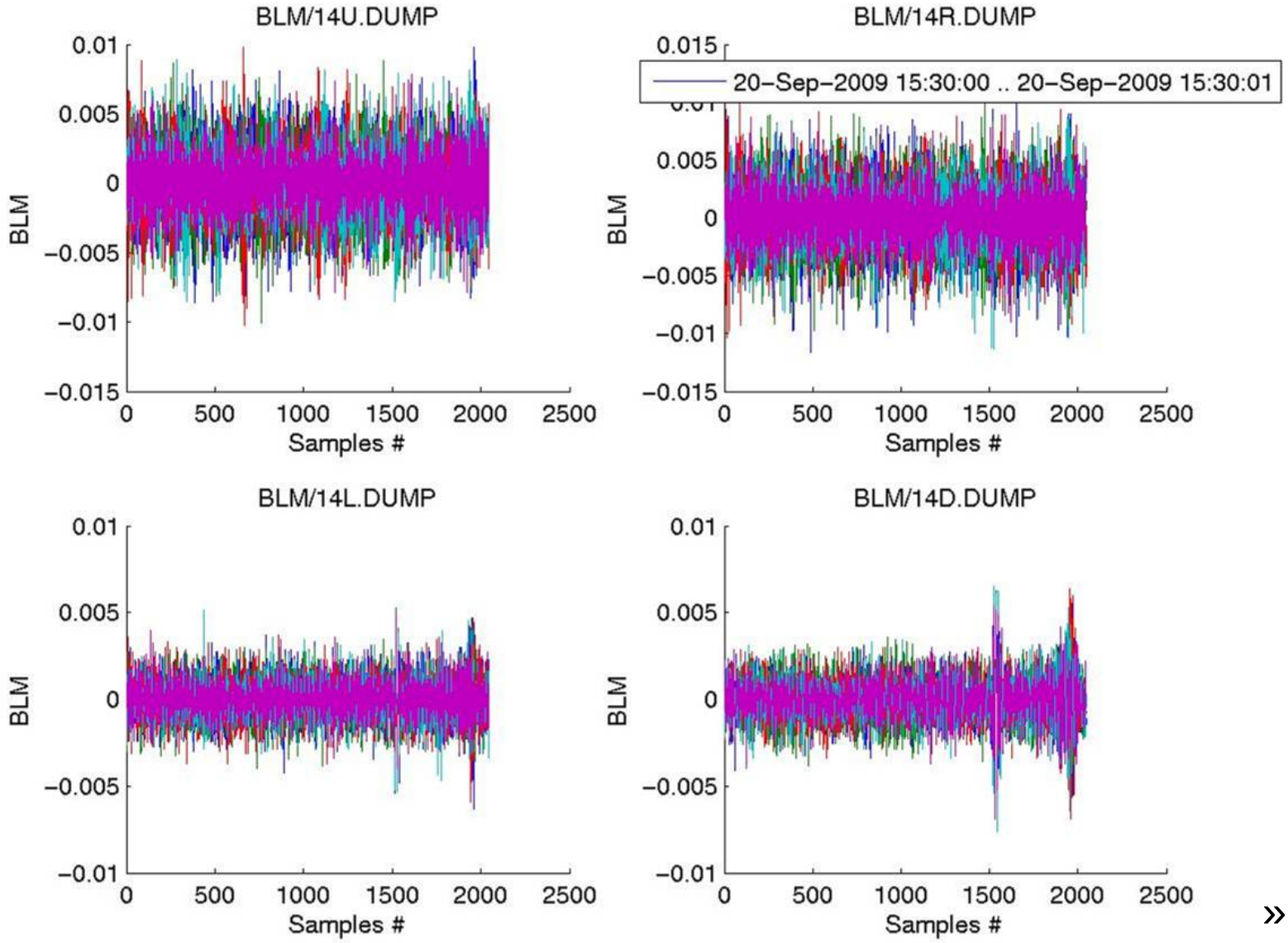
» D. Lipka

Magnetic loop (in-air) BPM 16DUMP (3)





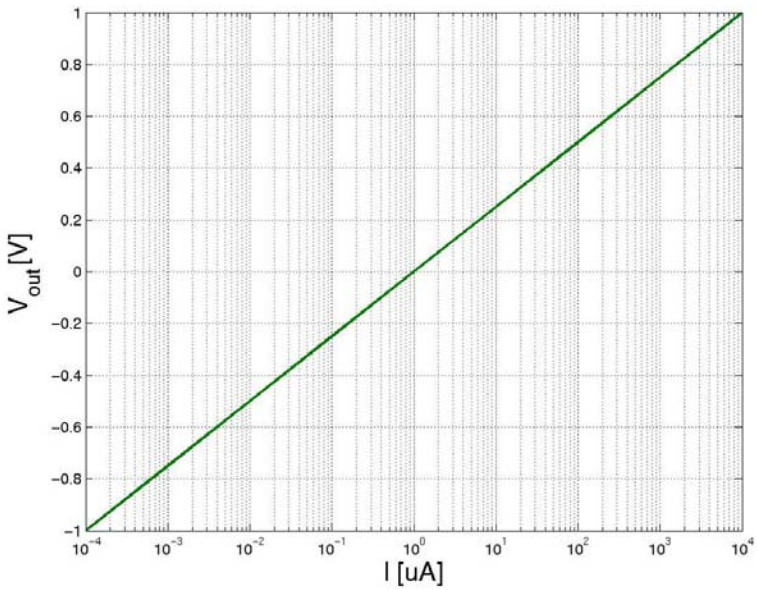
Glass fiber BLMs



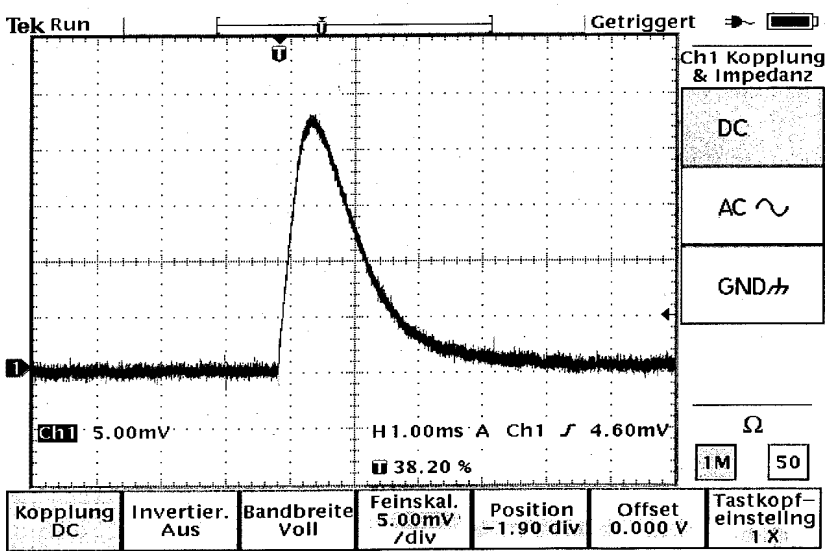
» H. Tiessen

Ionization Chambers

- air filled HF cables
- measures $O2^-$
- electronics -> large dynamic range
  - $V_{out} = 0.25V \cdot \log(I/1\mu A)$
  - voltage (not current) displayed in DOOCS

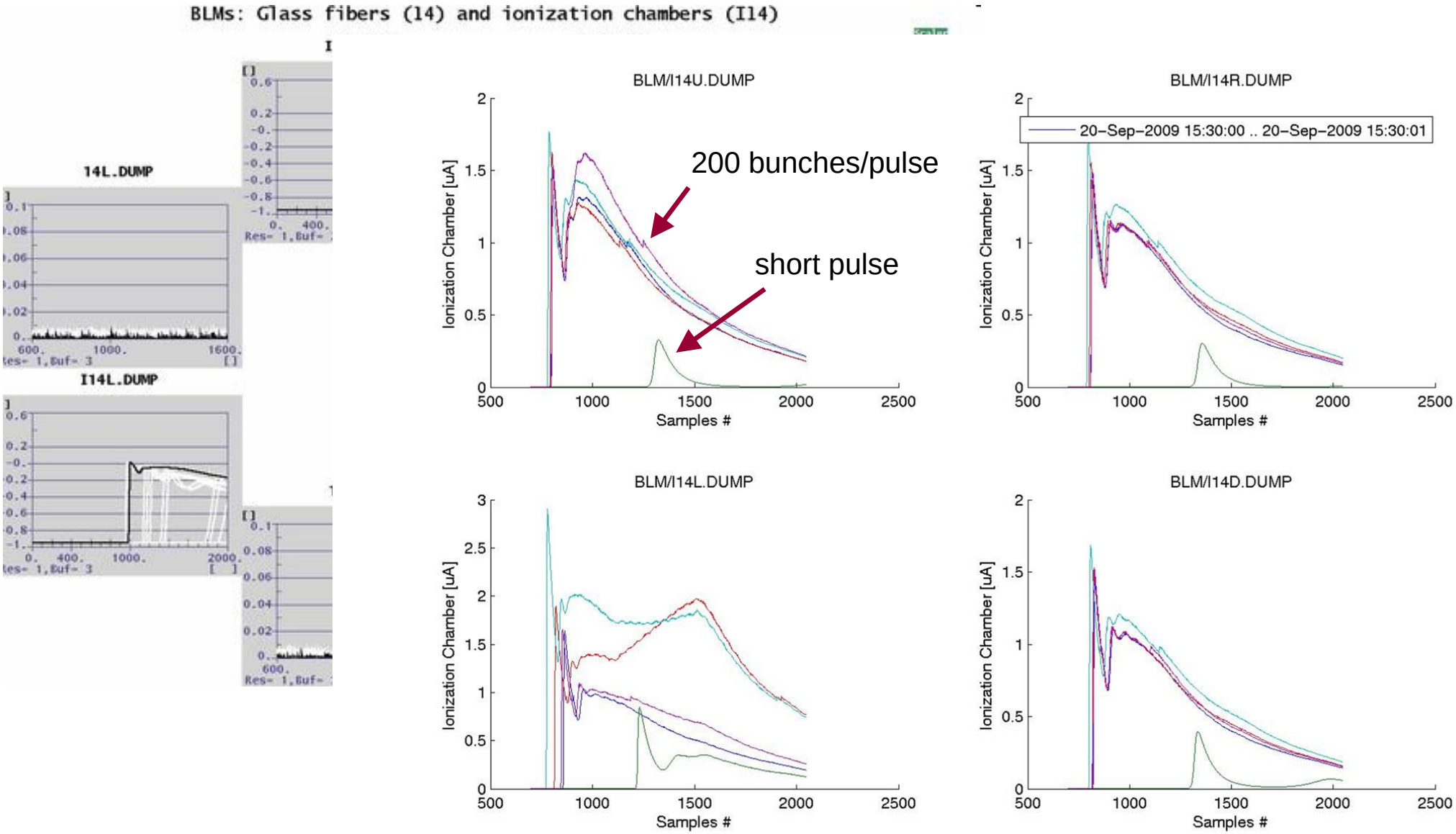


- test measurement in FLASH



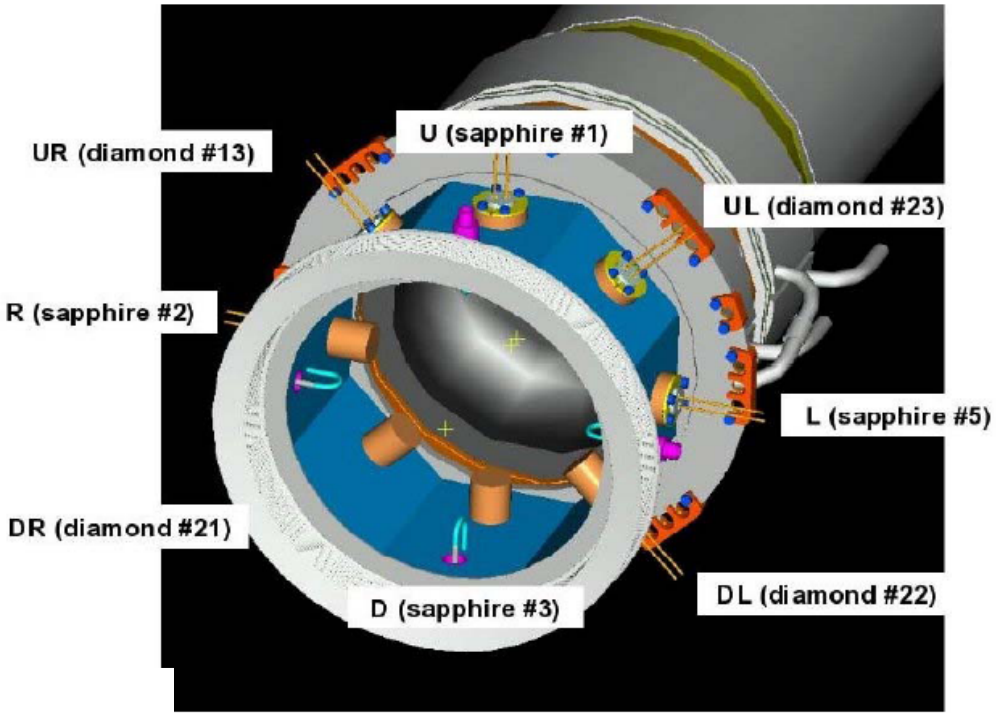
» P. Smirnov

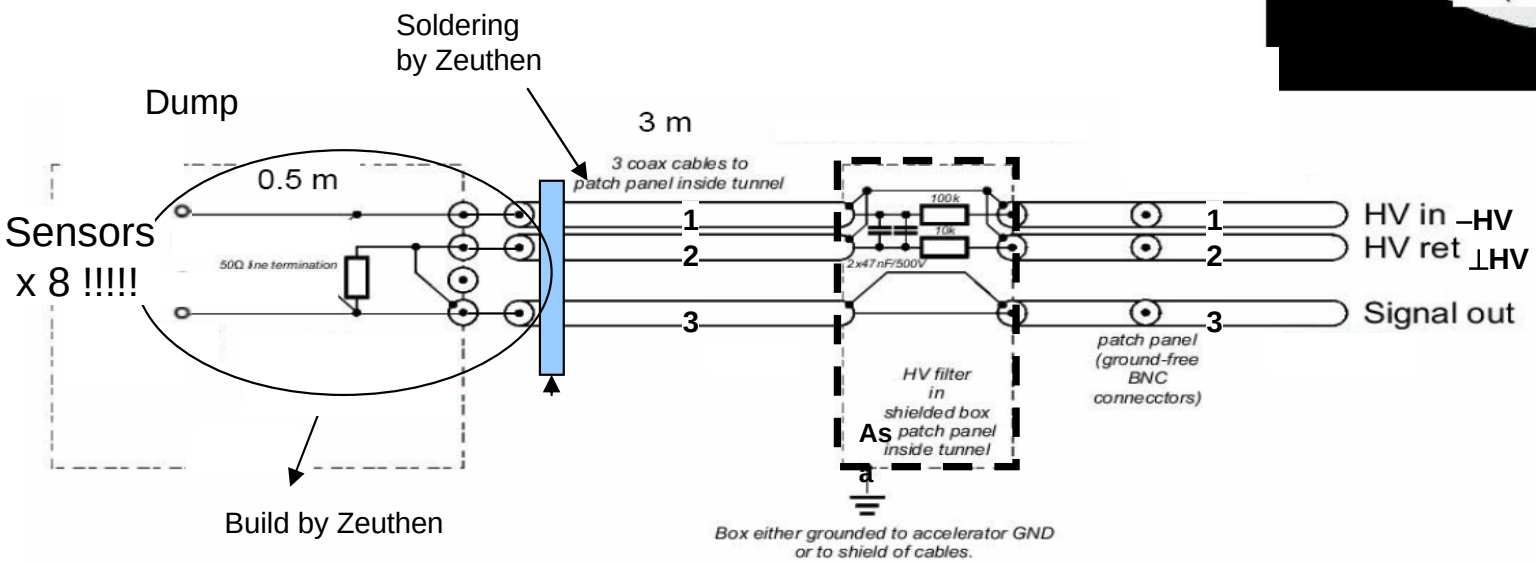
Ionization Chambers (2)



Beam Halo Monitors (BHM)

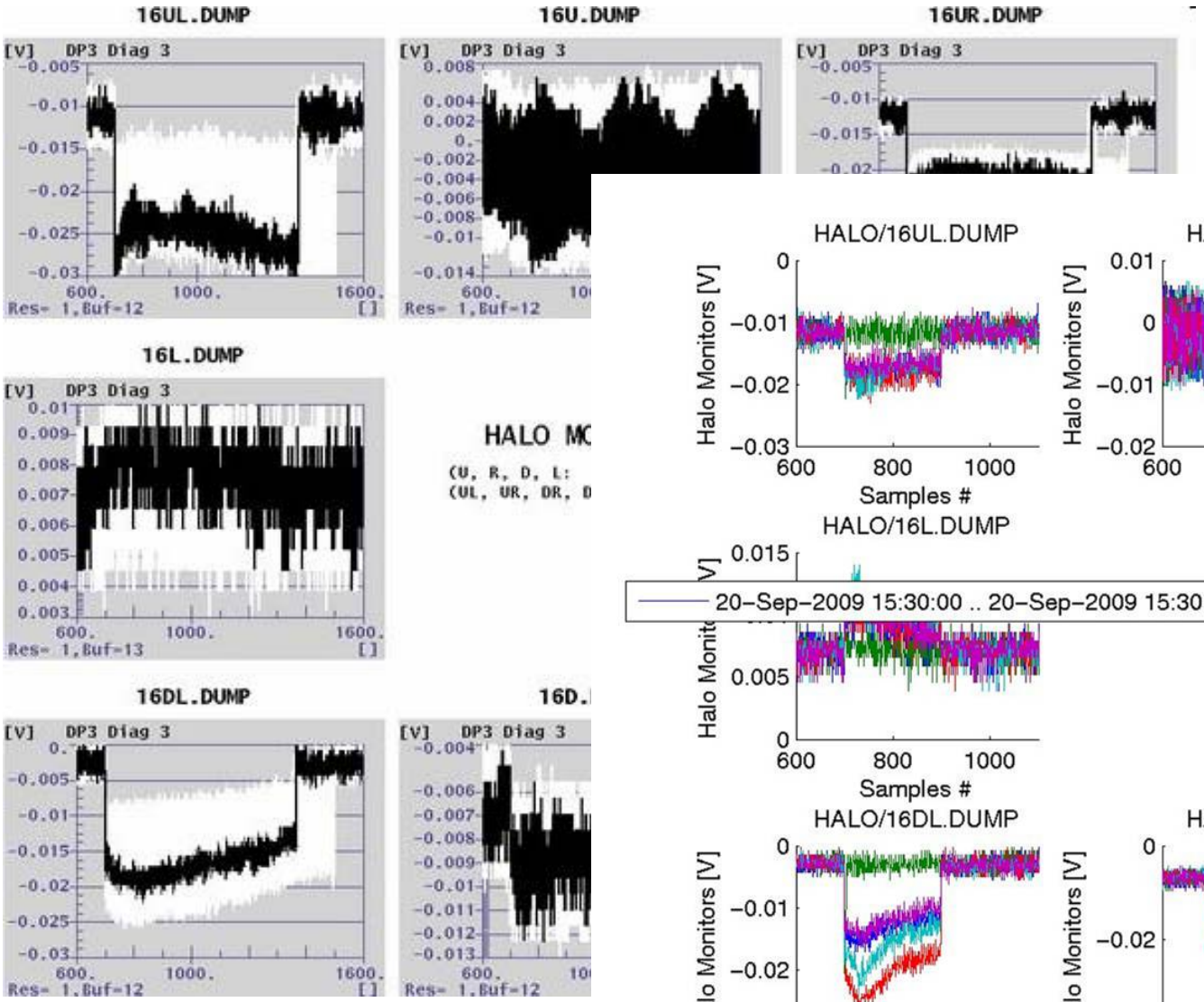
- Solid state ionization chambers
  - sensitive to very small losses

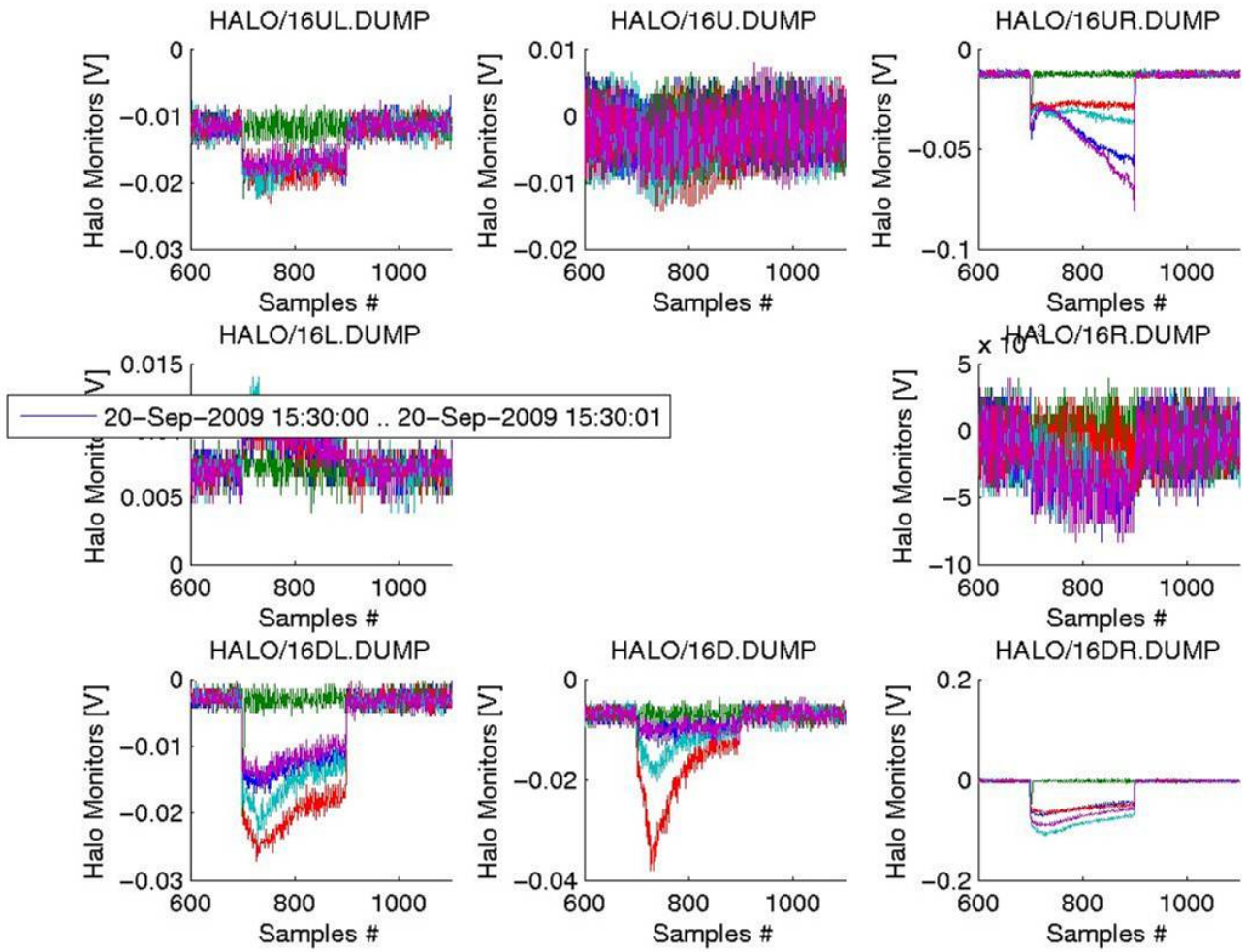




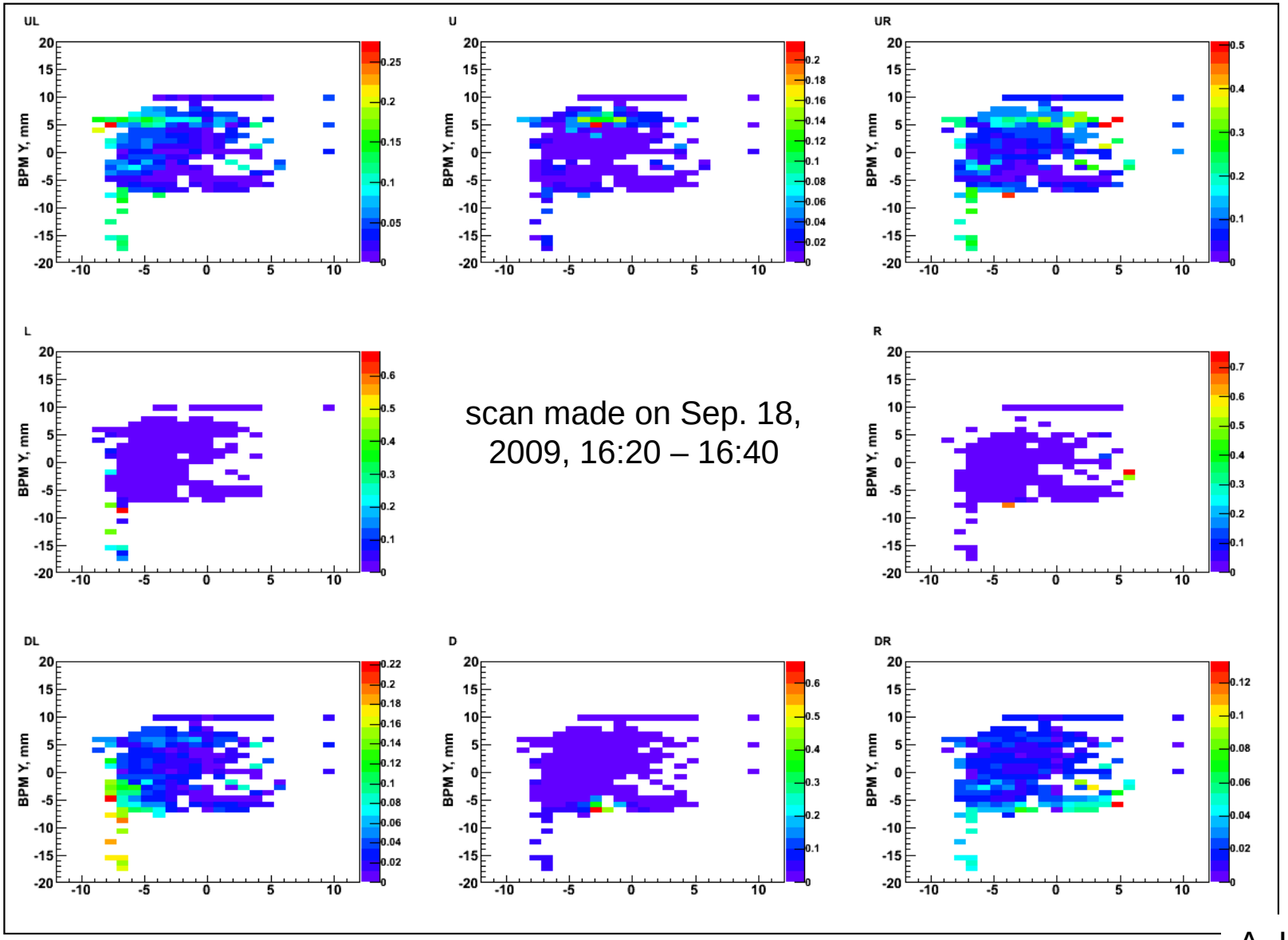
» A. Ignatenko

Beam Halo Monitors (BHM) (2)





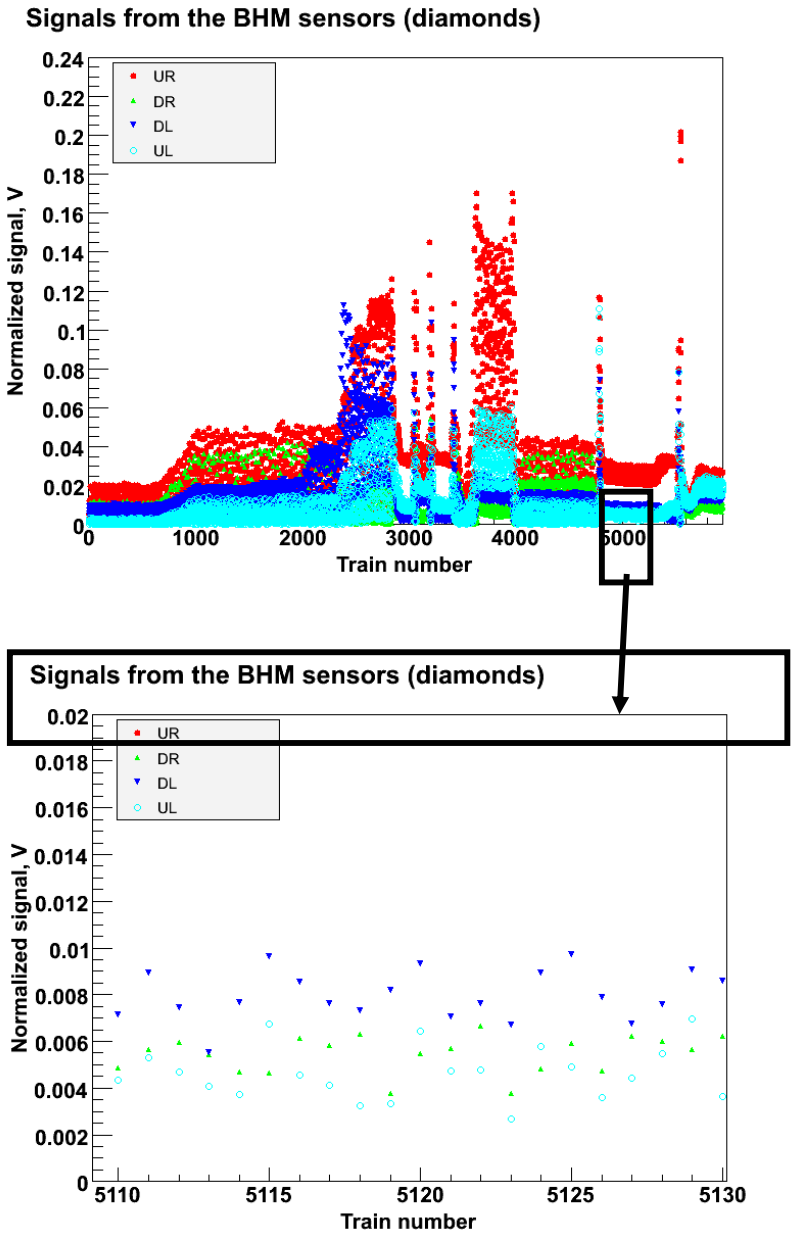
Beam Scan: BHM vs. BPM

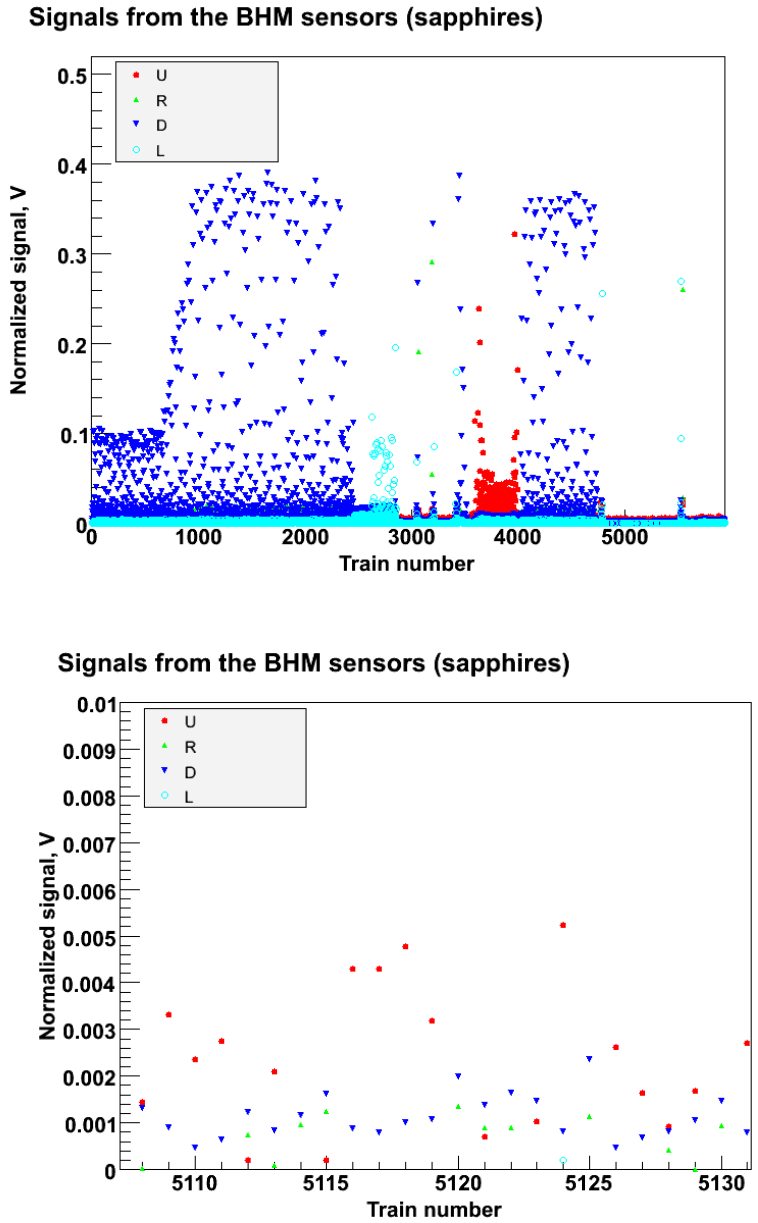


scan made on Sep. 18, 2009, 16:20 – 16:40

A. Ignatenko

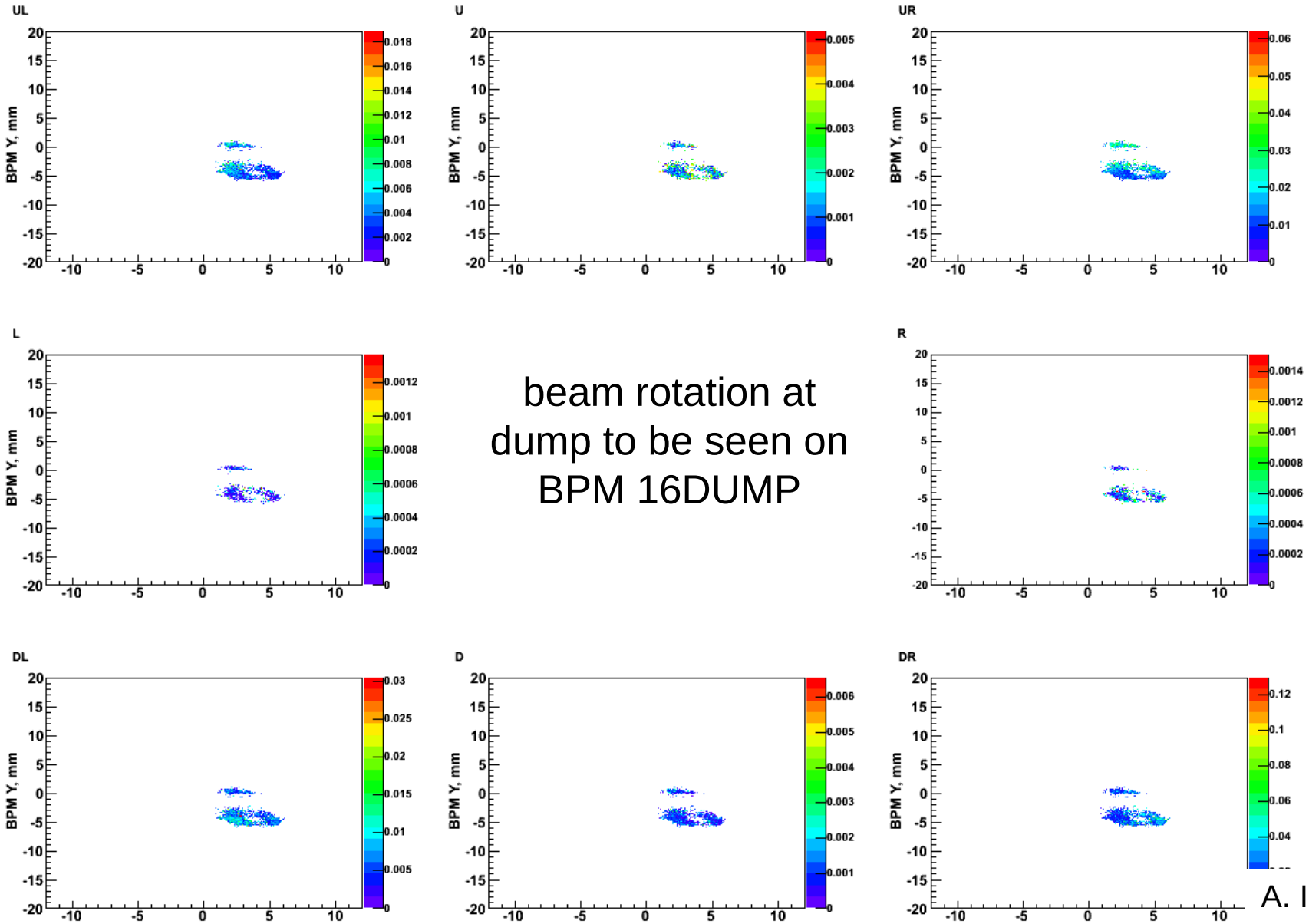
Beam Scan: BHM signals





A. Ignatenko

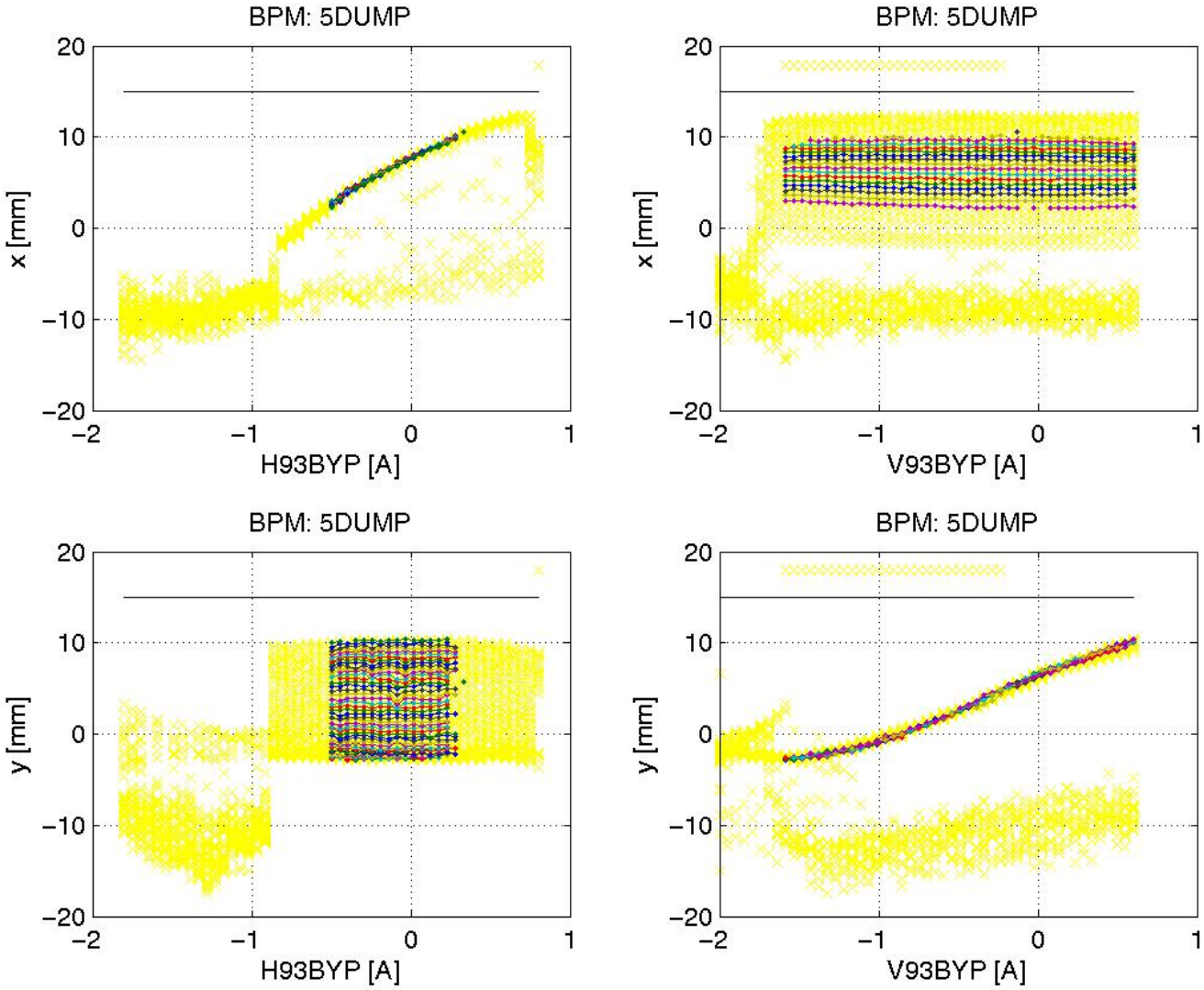
Beam Rotation on BHM



beam rotation at dump to be seen on BPM 16DUMP

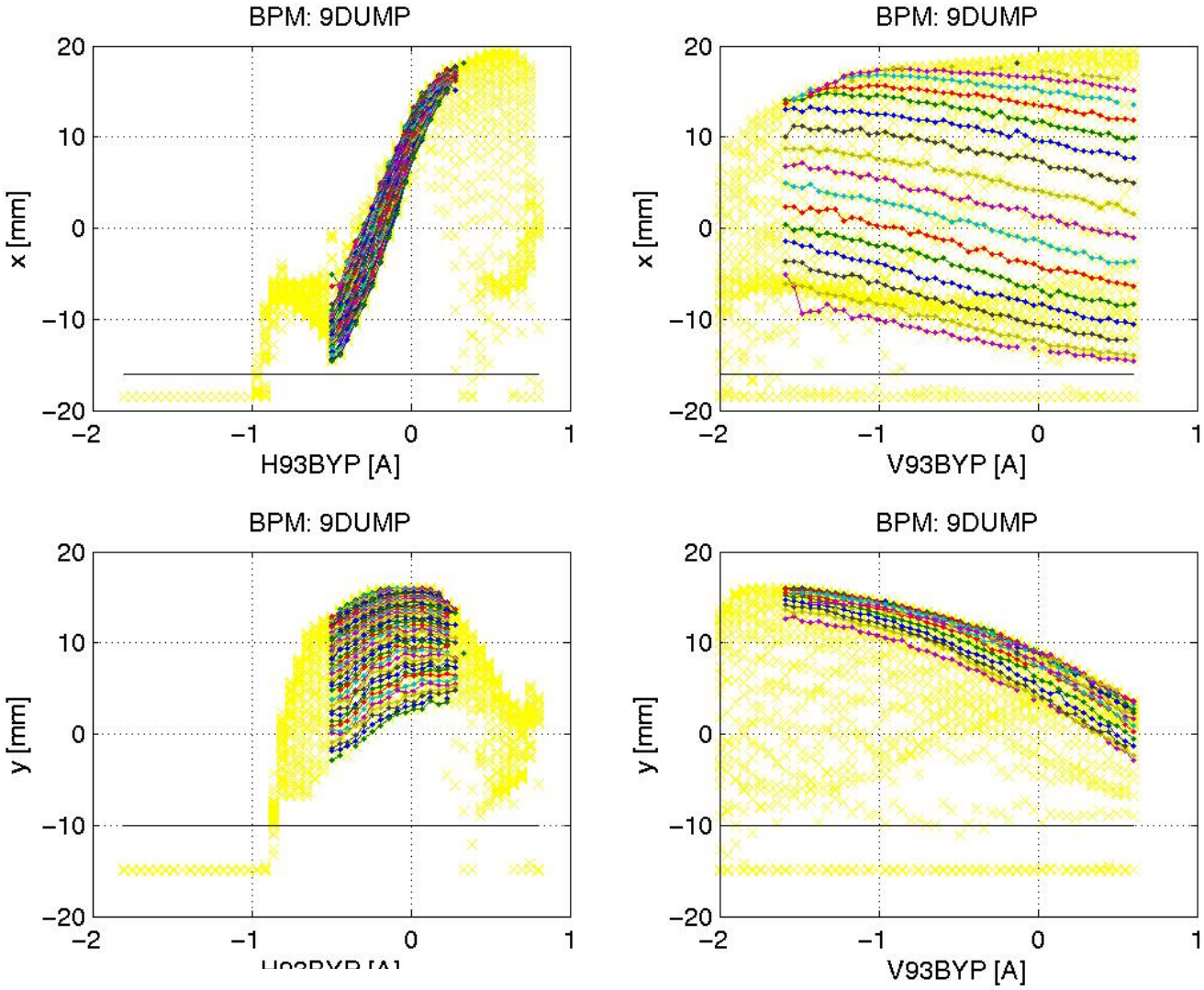
A. Ignatenko

Beam Scan with Steerers 93BYP



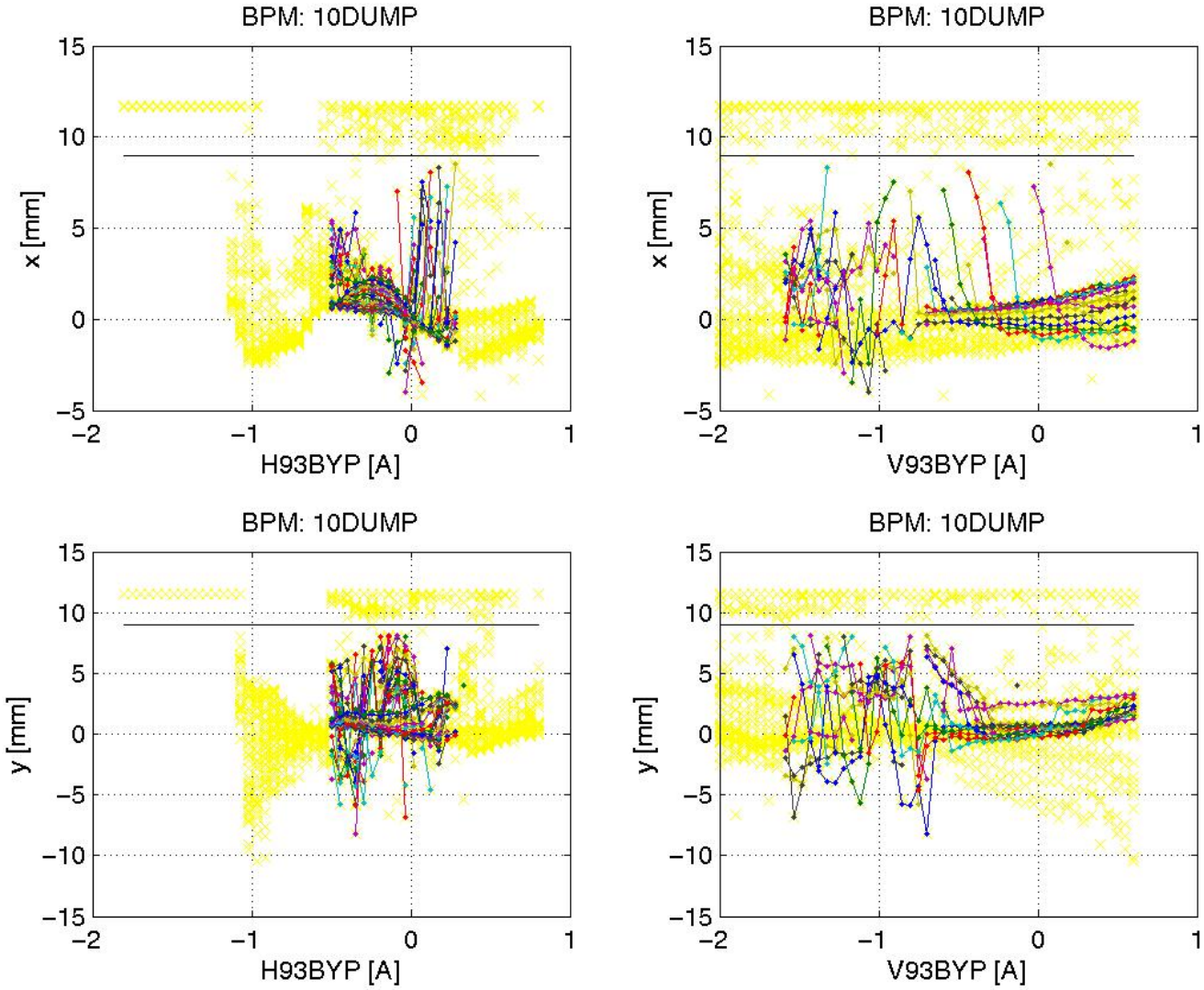
Scan made on Sep 8, ~14:30

Beam Scan with Steerers 93BYP

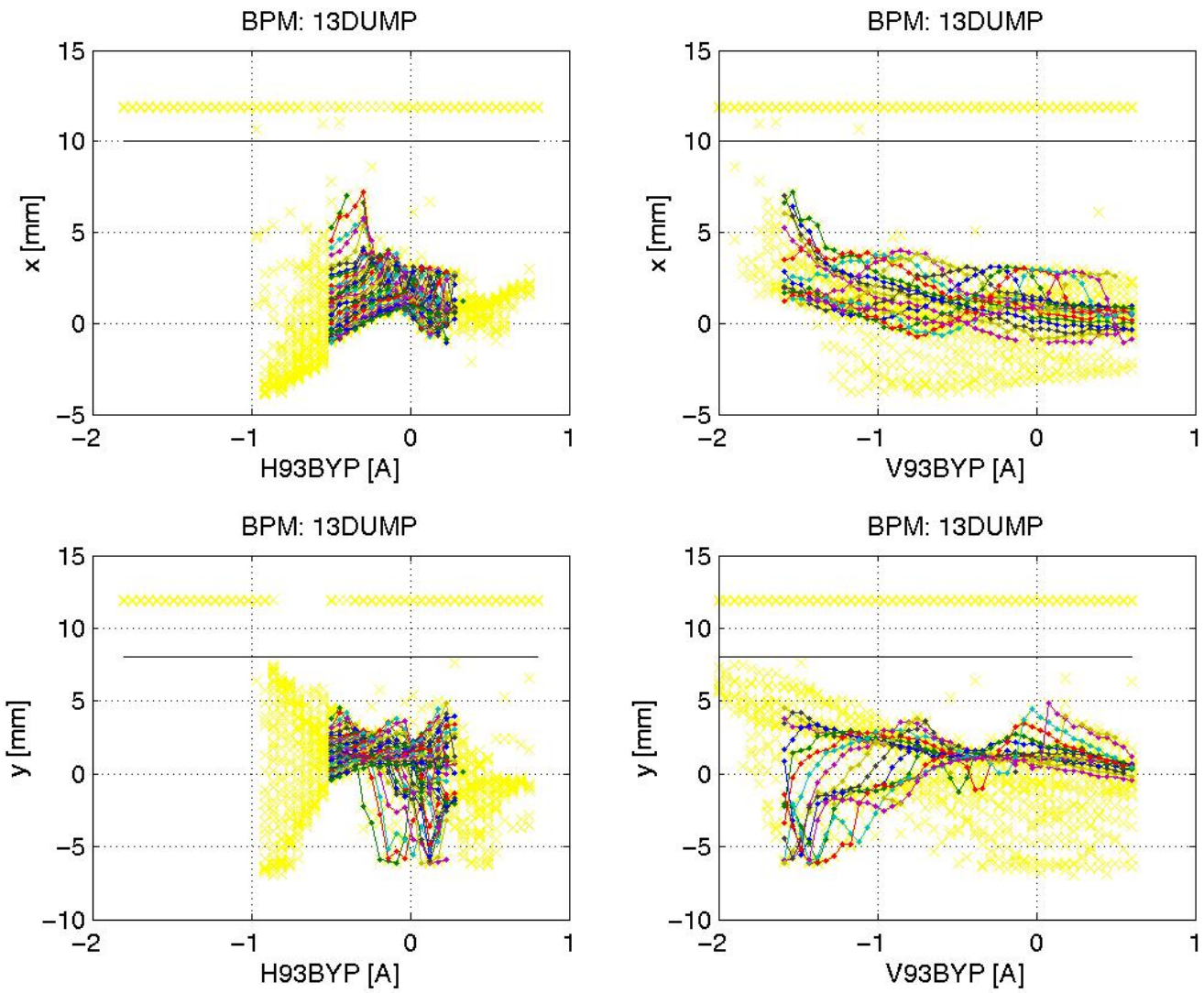


coupling between X and Y planes?

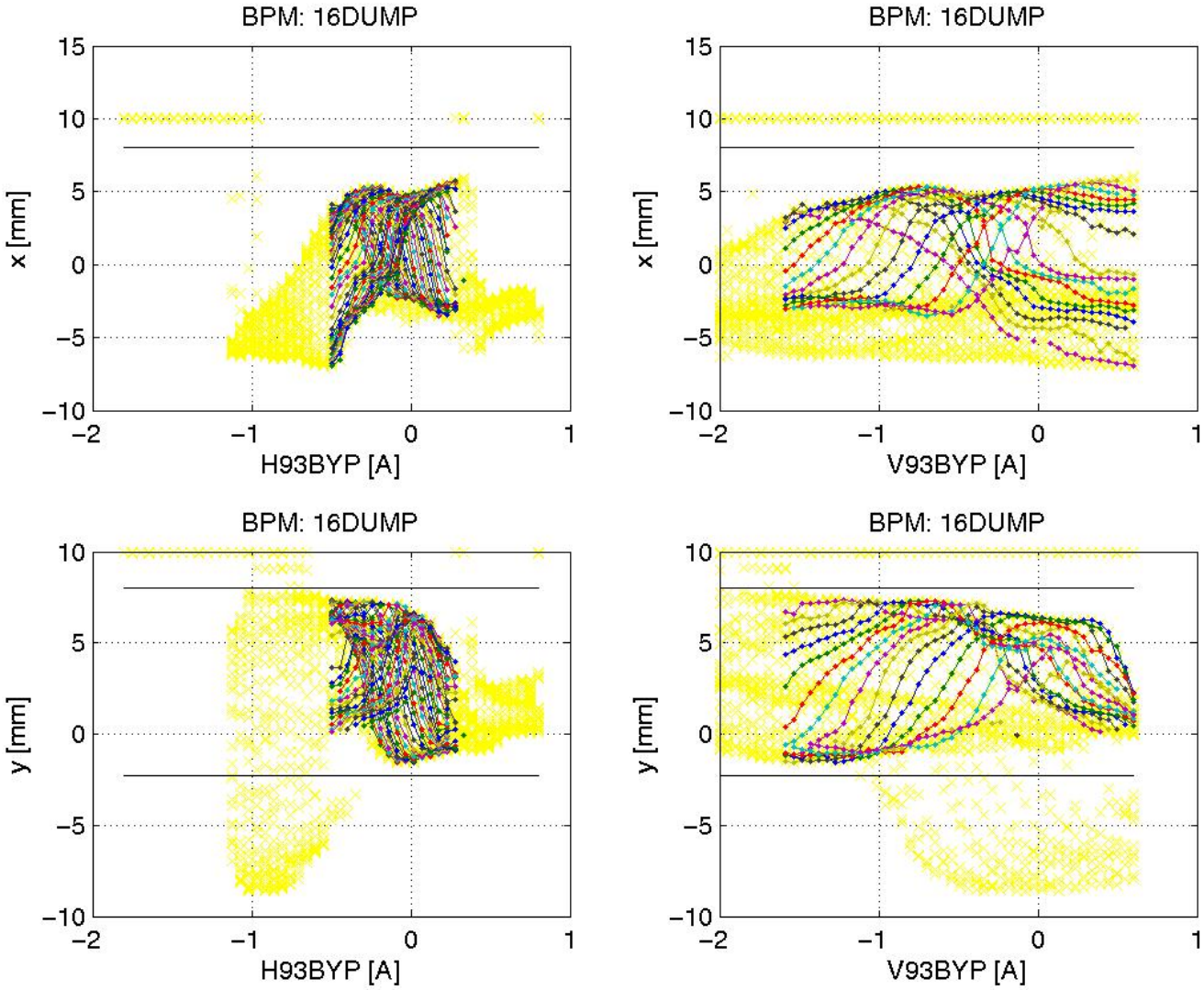
Beam Scan with Steerers 93BYP



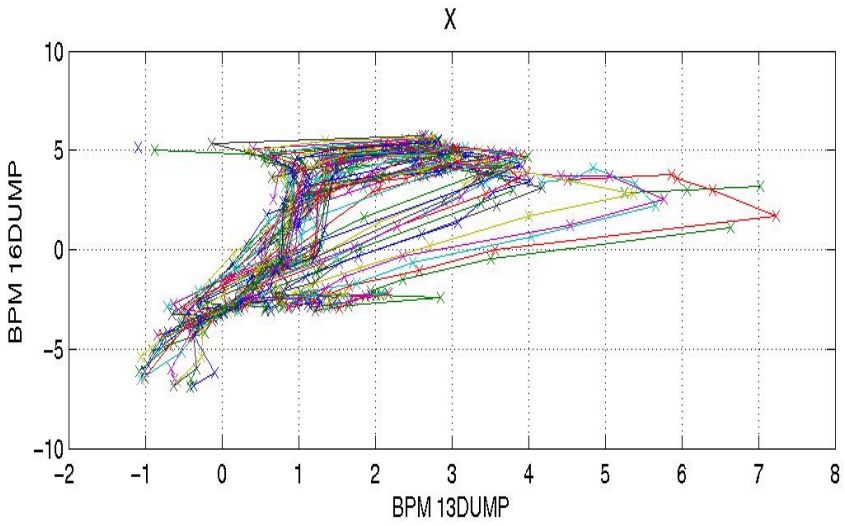
Beam Scan with Steerers 93BYP



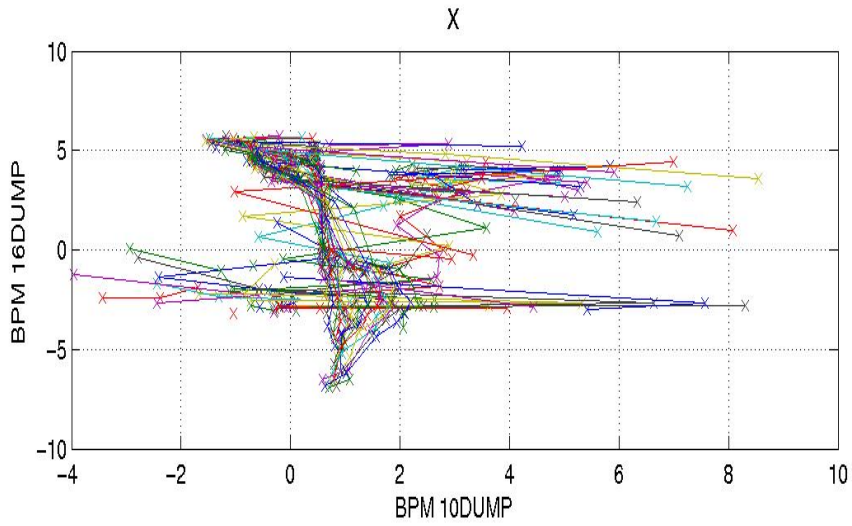
Beam Scan with Steerers 93BYP

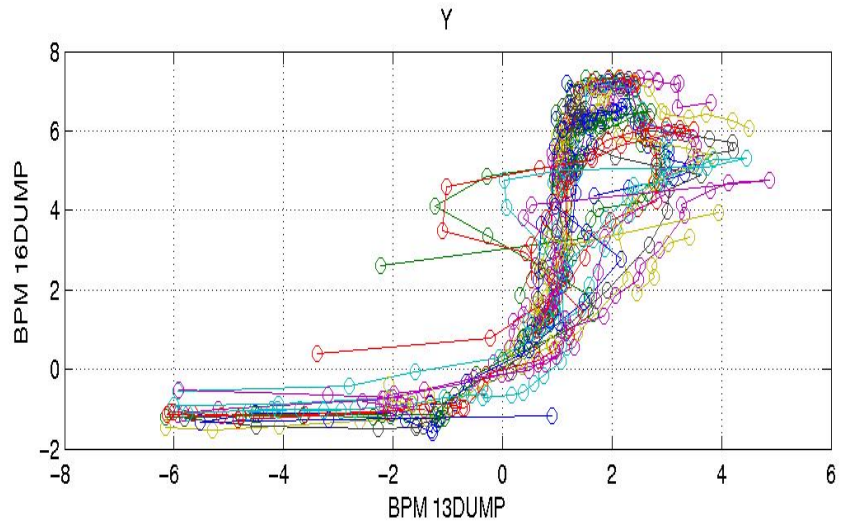


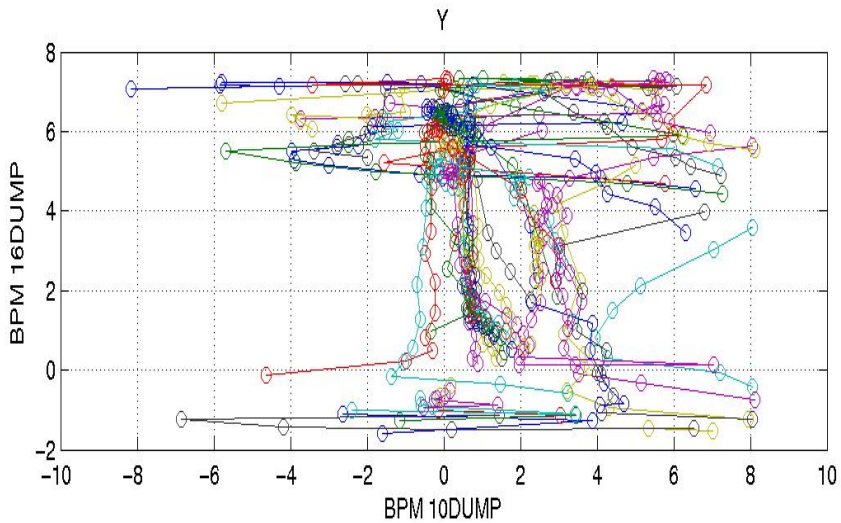
Beam Scan: BPM Correlations



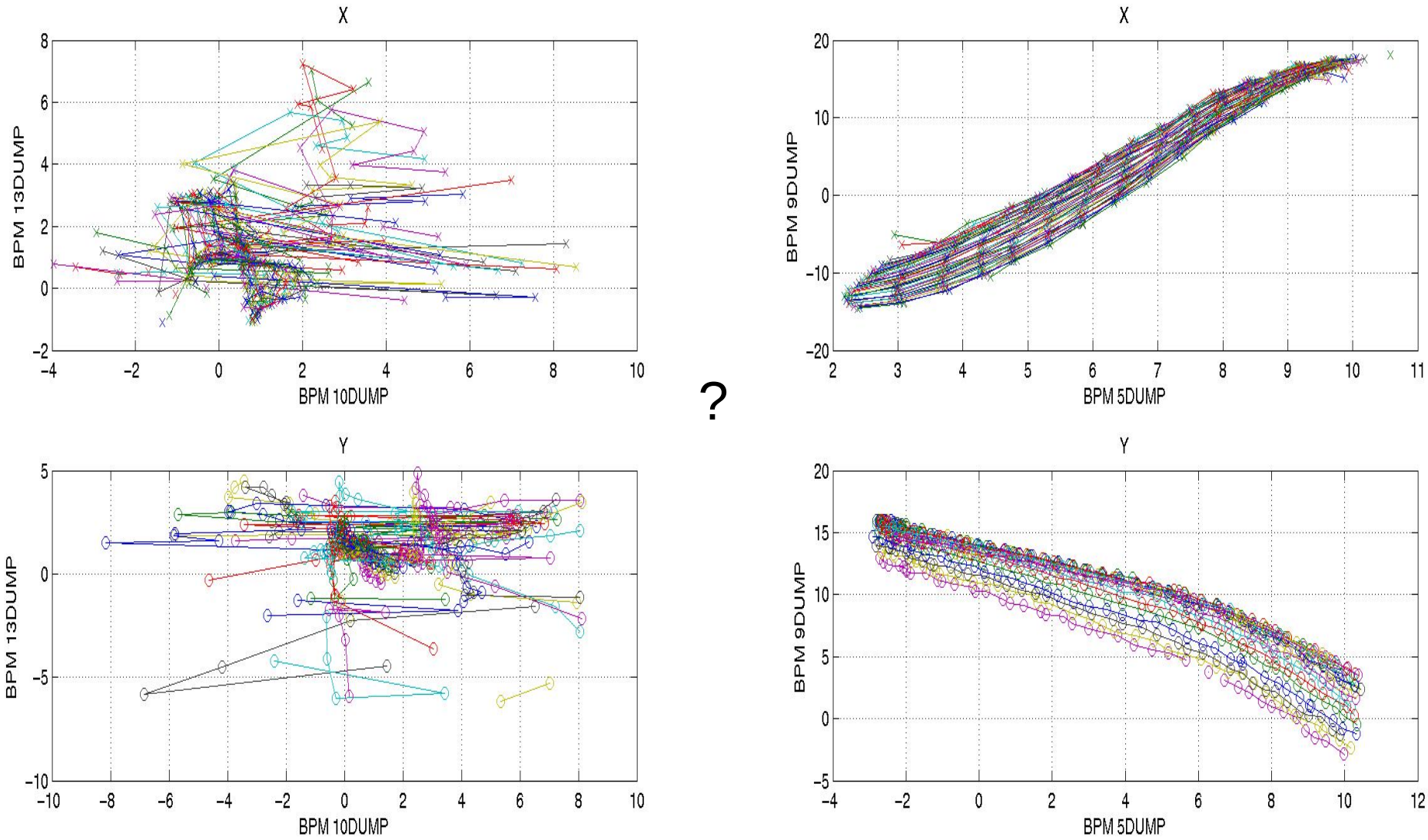
?







Beam Scan: BPM Correlations (2)



Summary

- Motivation of dump line upgrade
  - damage of dump line with long pulses in Sep 2008
- Lots of new useful diagnostics
  - BPMs
  - BLM: glass fibers, ionization chambers, beam halo monitors (diamond and sapphire), Cerenkov fibers
  - still some things not understood (BPM calibration, BLM signals and correlations)
  - however, good diagnostics for beam alignment
- Still to do
  - understand beam movement
  - calibrate dump BPMs