Beams Department

BLM test results at PS and PSB

Jaime Gil Flores [*BE/ABP*]

In collaboration: S. Gilardoni, S. Aumon [*BE/ABP*]
R. Steerenberg, B. Mikulec, G. Metral, K. Hanke [*BE/OP*]
E. Effinger [*BE/BI*]

Motivations

- *Renew* old BLM system on PS and PSB:
  - *NO* spare available for ACEM detectors
  - ACEM has to be recalibrated every year:
    Dose taken during the intervention should be minimized

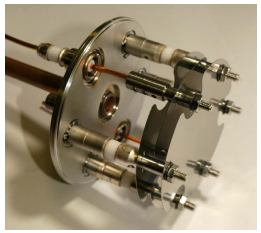
- *Test for future BLM system of LINAC 4*

Tests with different BLM types

ACEM
(current)

LIC

LHC BLM



SEM

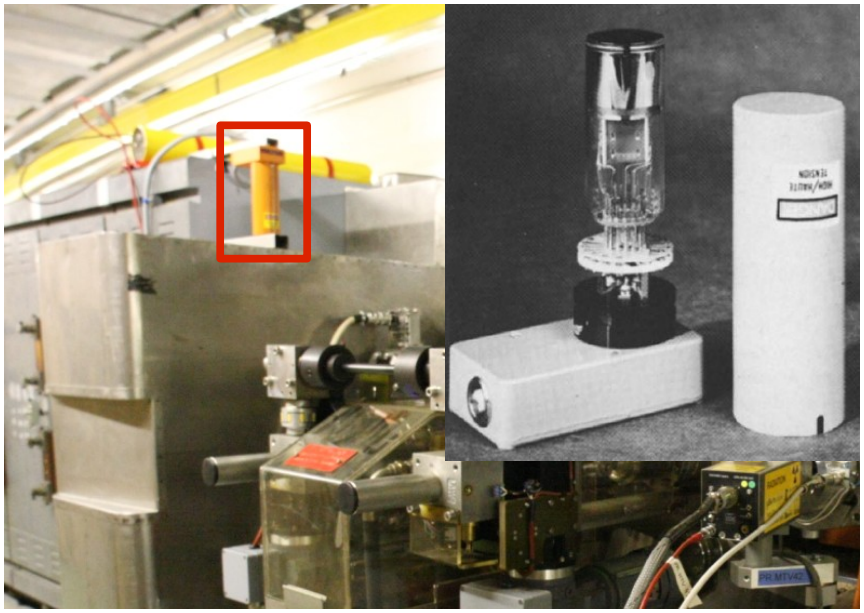
PEP-II BLM

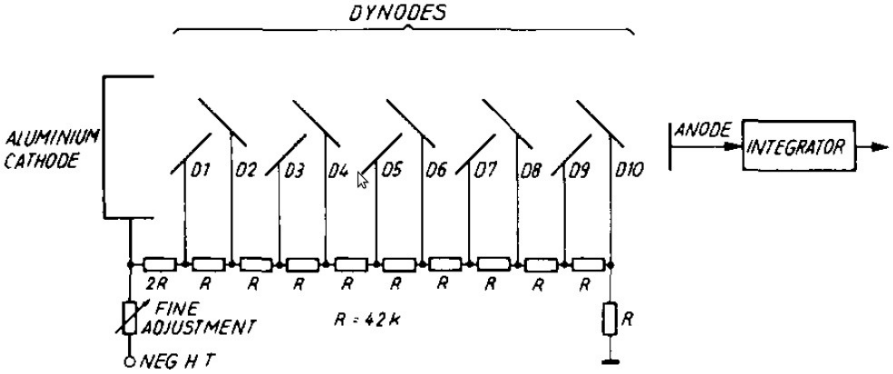
Courtesy of U. Wienands (SLAC)

BLM types

ACEM:

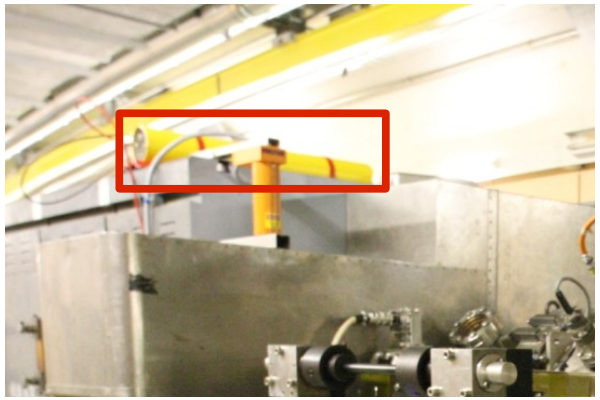
- Glass vacuum tube
  (40 mm diam. & 90 mm long)
- 10 Stage Electron-Multiplier
- Multiplication factor up to 10^6
- *Pros*:
  - Fast response
  - High sensitivity
- *Cons*:
  - Calibration
  - Aging due to the radiation
  - Reduced size (small solid angle)
  - Saturation for large losses





BLM types

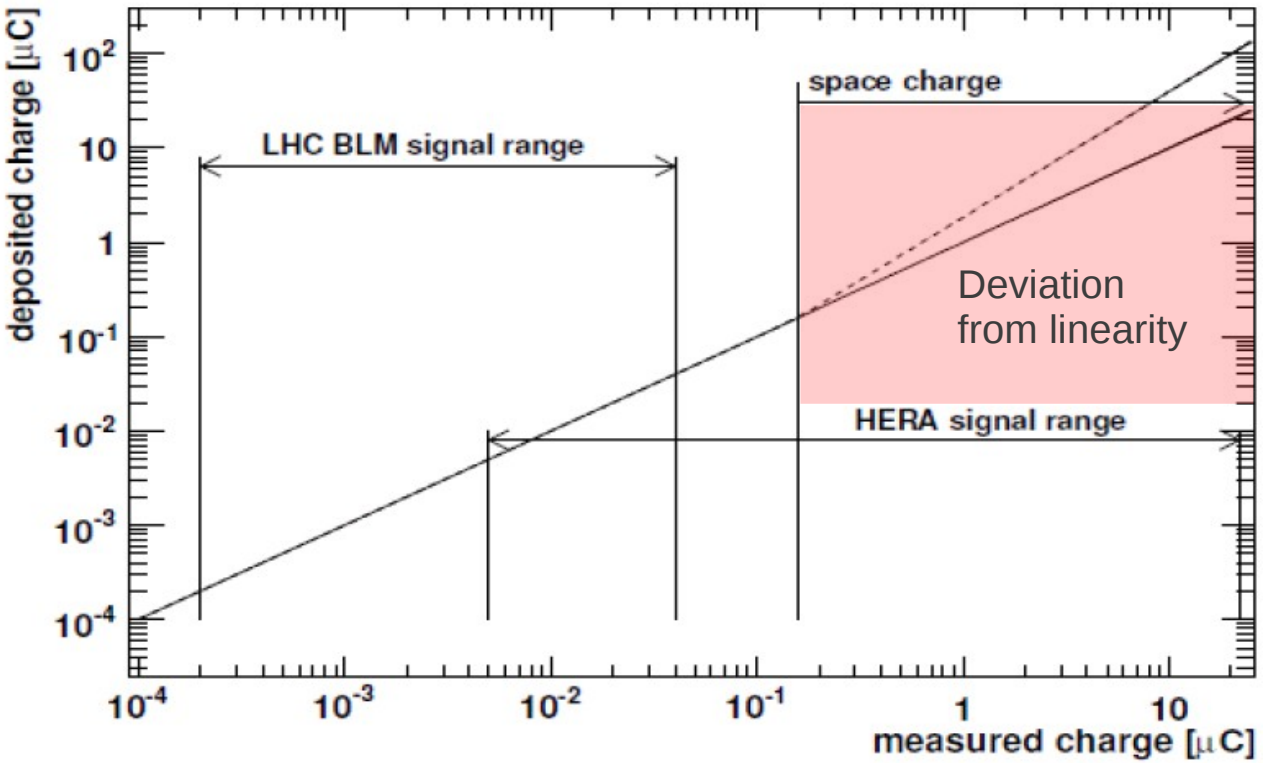
LHC BLM:



- Ionization chamber (N_2)
- Parallel *Al* electrode plates
- 9 cm diam. & 50 cm long

- *Pros*:
  - Large volume (1.5 l)
  - Fully tested in LHC
- *Cons*:
  - Slow time response
  - Sensitivity to small instantaneous (~ few μs) losses
  - Large volume (PSB)
  - Saturated with very large losses

LHC BLM calibration curve



Lit: M. Stockner thesis

"http://cern.ch/blm/Talks_and_papers/stockner/thesis_mstockner_cern_11_2007.pdf"

BLM types

LIC:

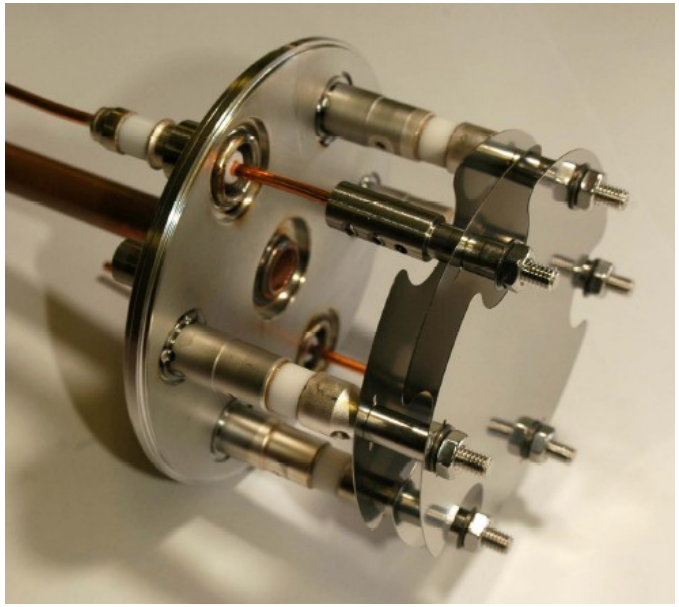
- Same operation as LHC BLM
- Different chamber pressure (0.01 bar.)
- 9 cm diam. & 18 cm long
- *Pros*:
  - Time response faster than LHC BLM (not fully tested)
- *Cons*:
  - Sensitivity to small instantaneous losses
  - Reduced size

BLM types

SEM:

- Based on *secondary electron* emission

- *Pros*:
  - Very high loss rate
  - High linearity
  - Fast response
- *Cons*:
  - Low sensitivity
  (10.000 times *less* than LHC BLMs)
  - Reduced size



BLM types

PEP-II detector:

- 1 cm^3 *Fuse-silica Cherenkov* counter
- Small (fast) Hamamatsu PMT
- 5 mm lead Shielding (1 kg)
- 40 mm diam. & 150 mm long
- Tested in UA9 (SPS experiment)
- *Pros*:
  - Fast response
- *Cons*:
  - No data available about aging due to radiation from protons
  - linearity of response (*to be tested*)

PS

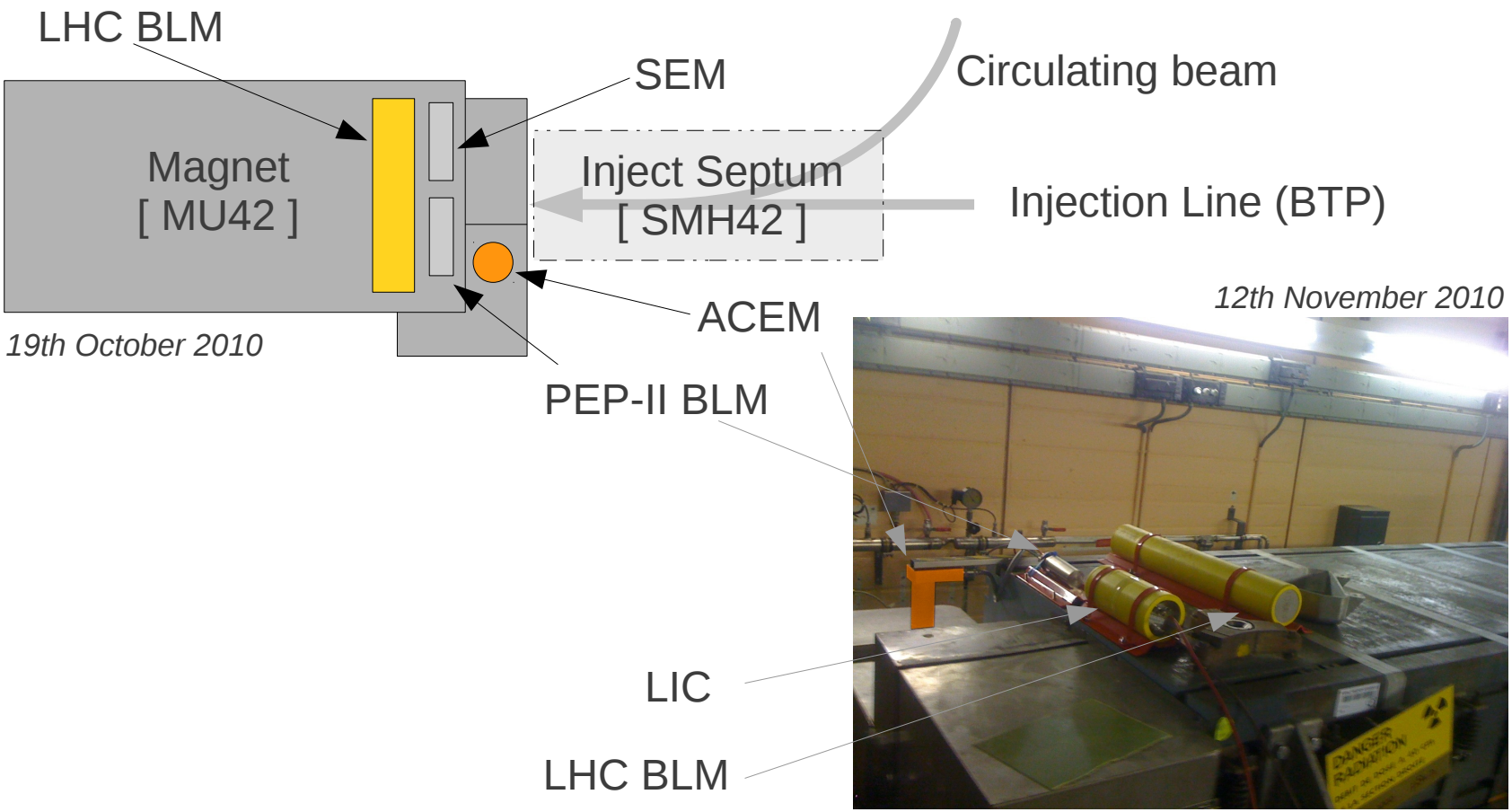
Measurement conditions

- Oscilloscope (1 GHz):
  - Terminated 50Ω

- Direct signal from detectors via spare OASIS cable.

- Two sets of data:
  - 19/10/2010 – compare SEM, PEP-II BLM & ACEM
  - 12/11/2010 – compare LIC, PEP-II BLM & ACEM

Detector installation



Beam Types

TOF:

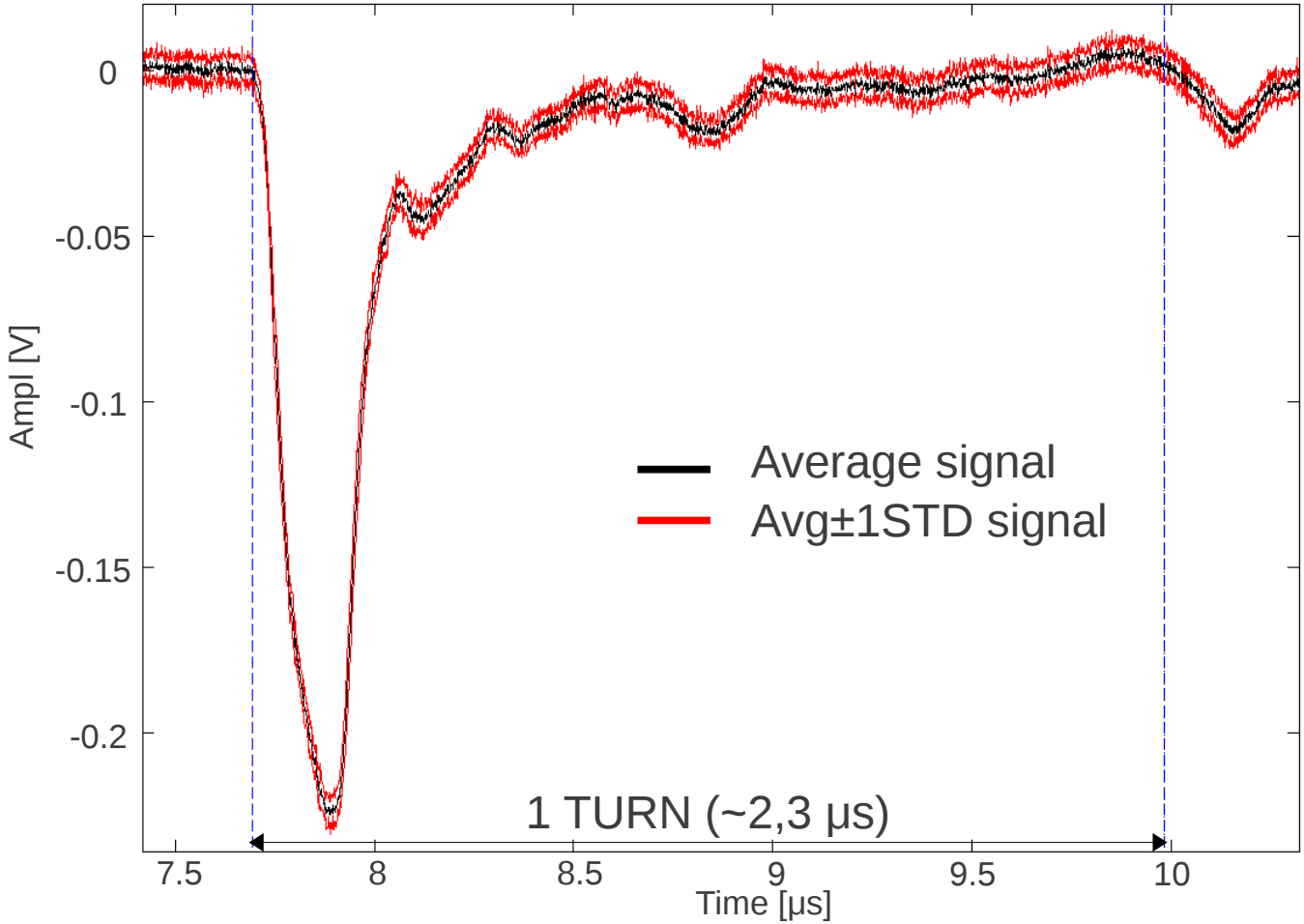
- 1 Bunch
- 234 ns length
- 850 10^{10} p/bunch
- Toward the *nTOF* facility

CNGS:

- 8 Bunches
- 173 ns length
- 350 10^{10} p/bunch
- To *Gran Sasso*

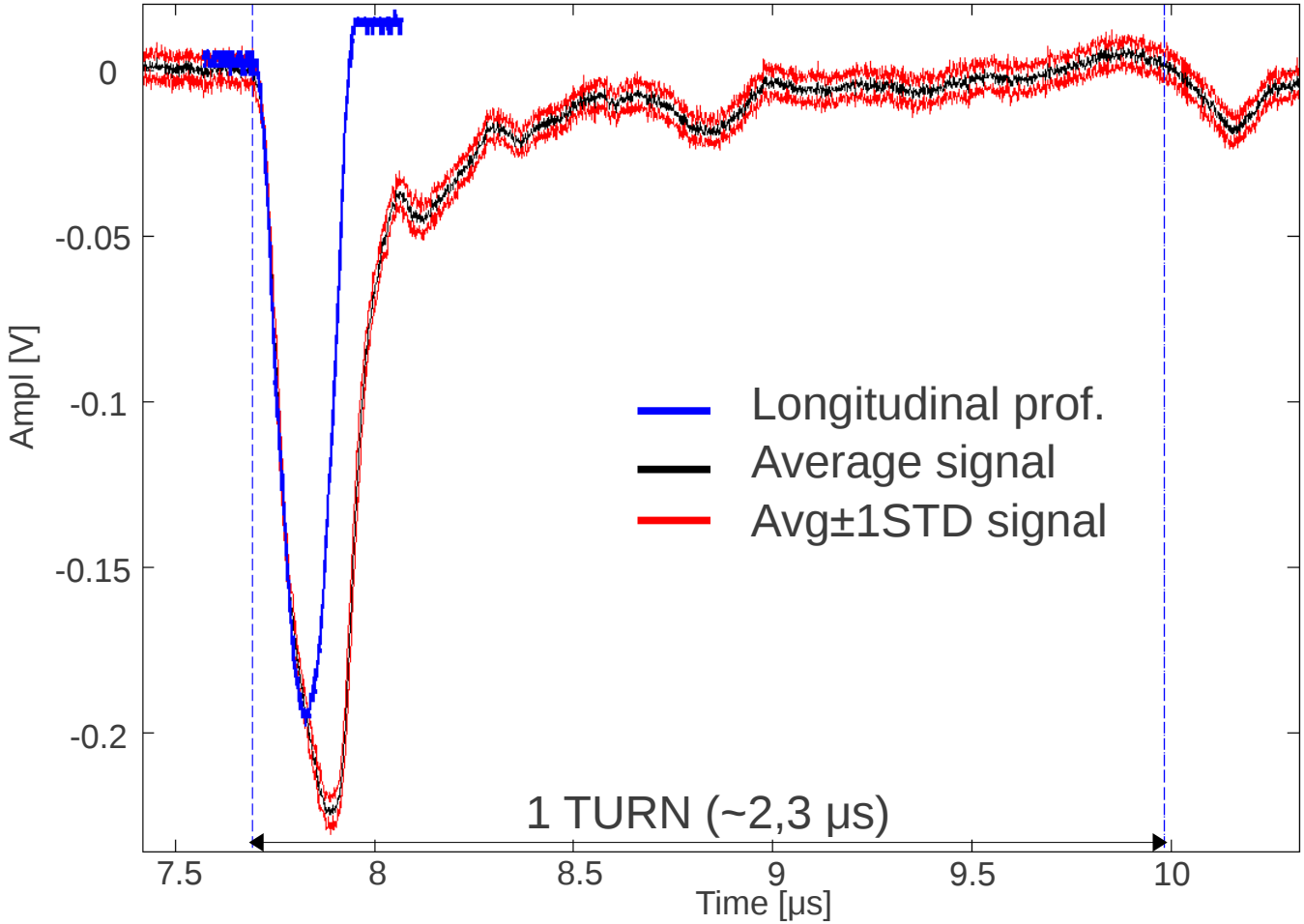
BLM Results

19th October 2010 [ACEM TOF]



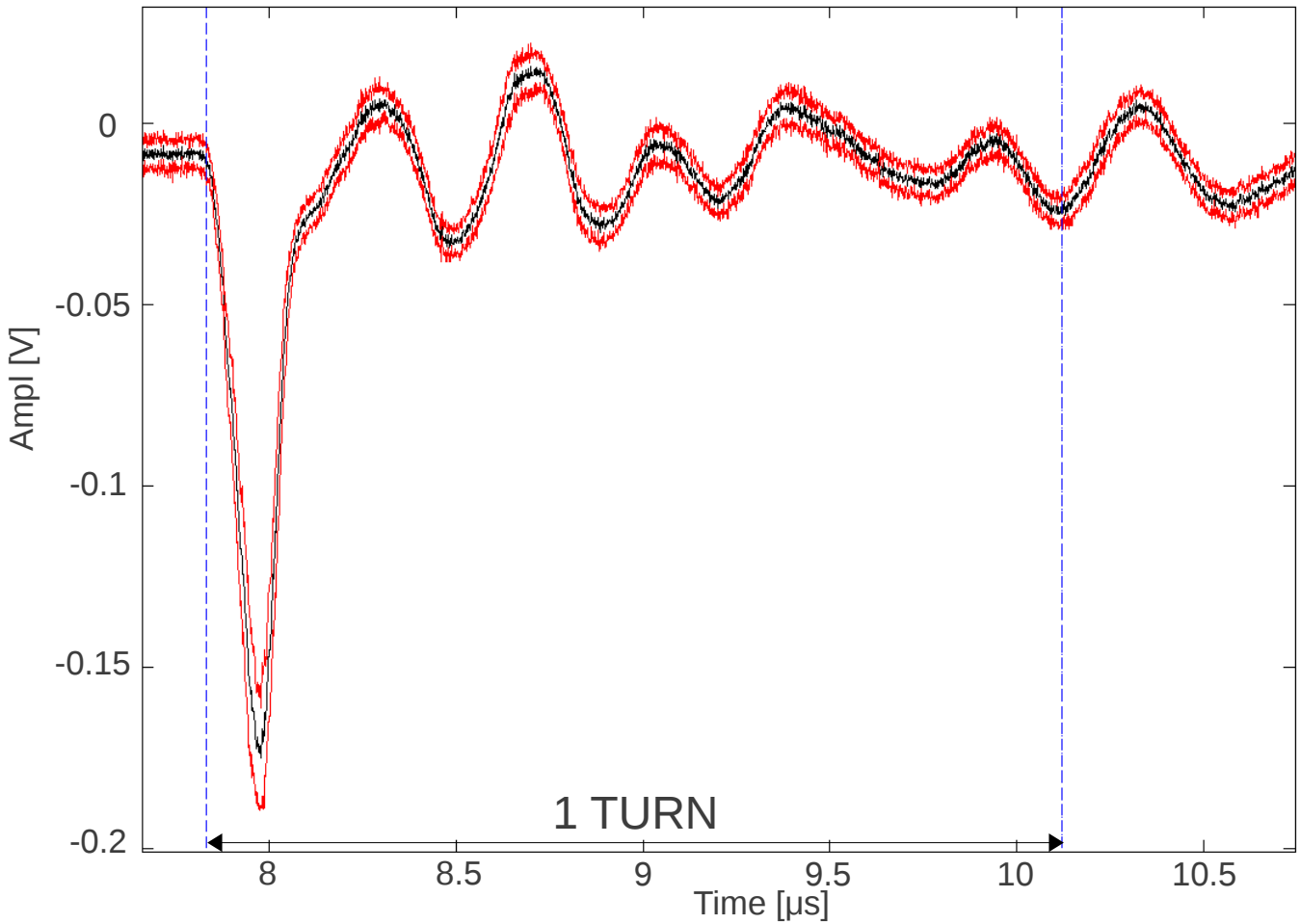
BLM Results

19th October 2010 [ACEM TOF]



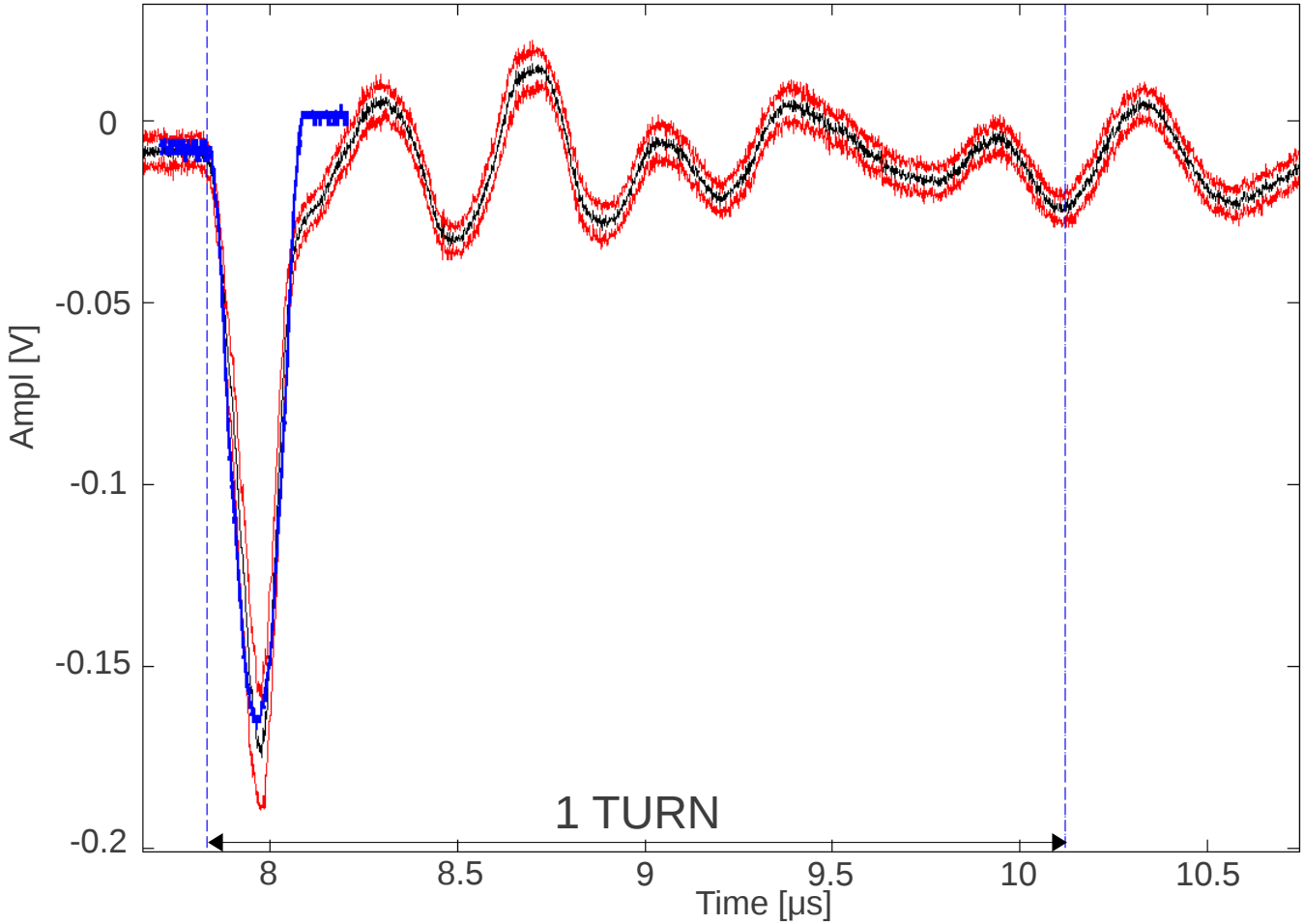
BLM Results

19th October 2010 [PEP-II TOF]



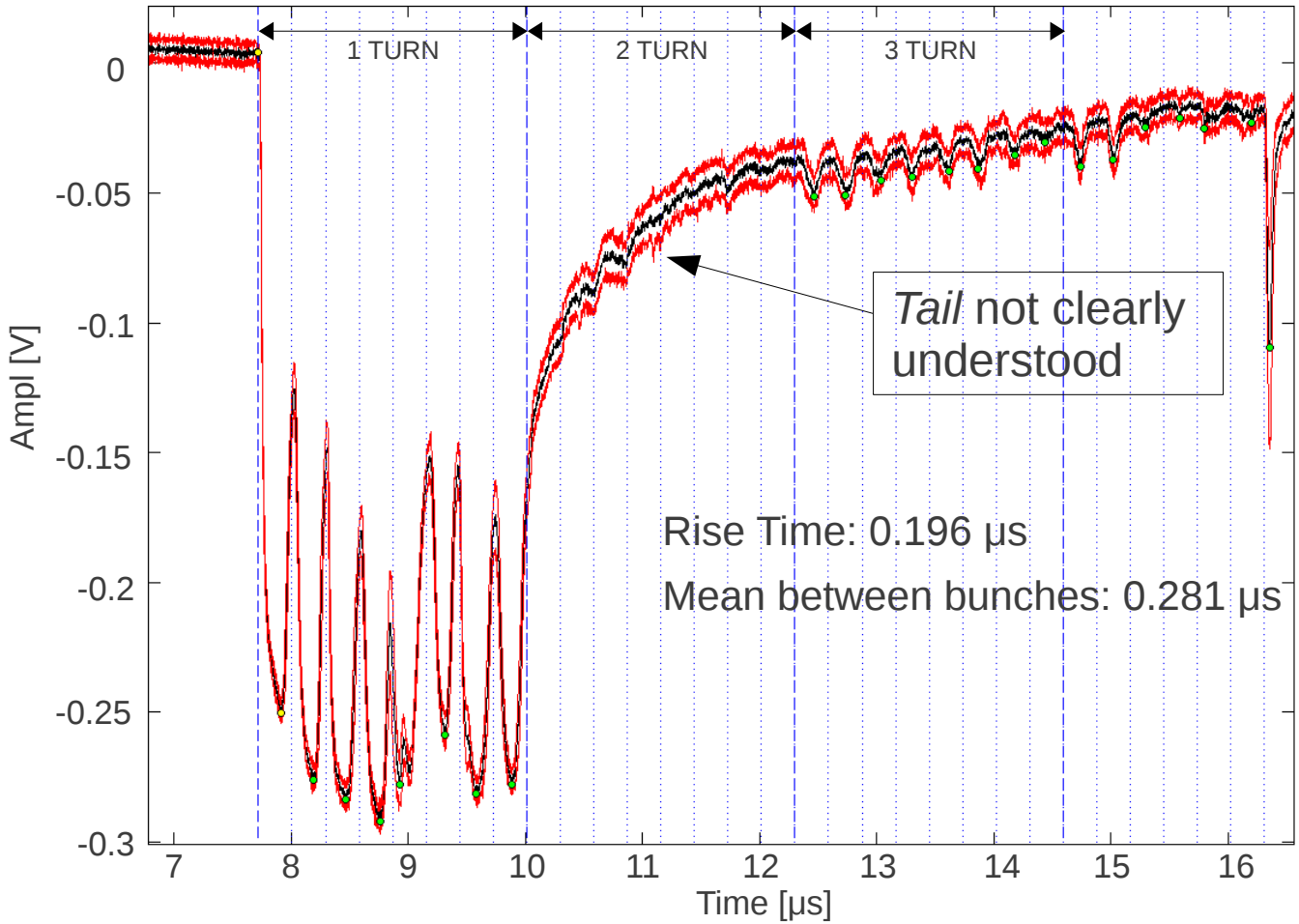
BLM Results

19th October 2010 [PEP-II TOF]



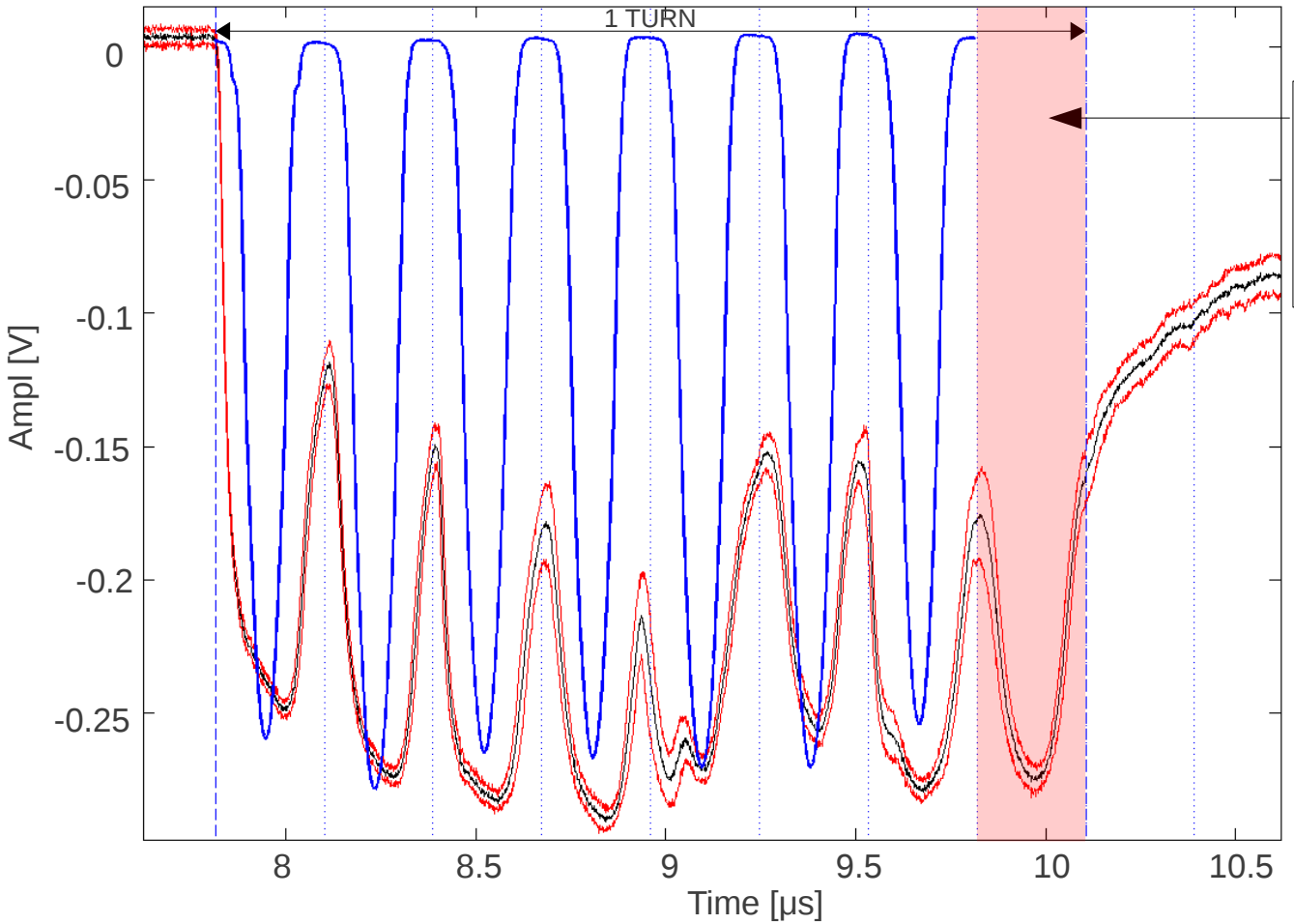
BLM Results

19th October 2010 [ACEM CNGS]



BLM Results

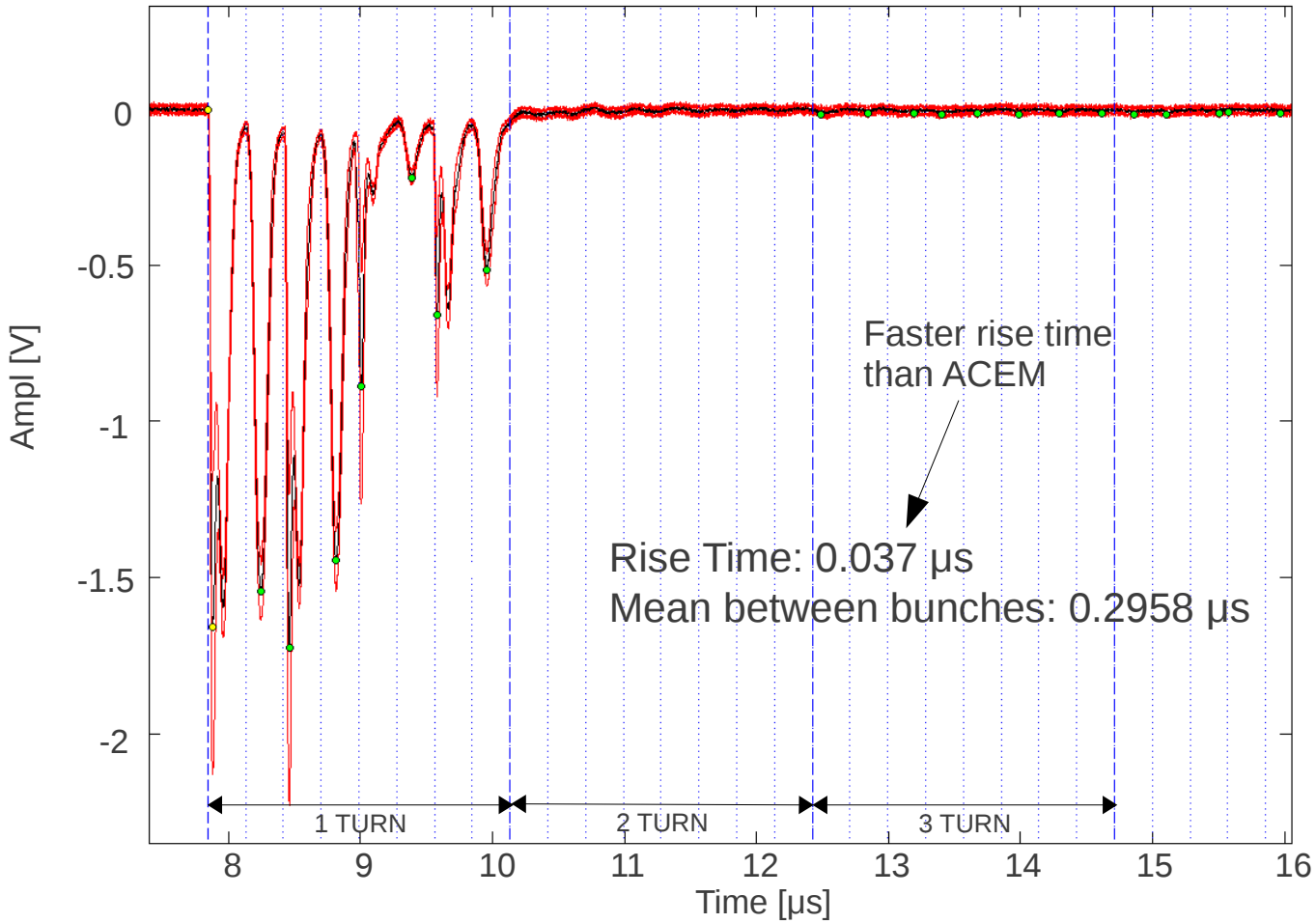
19th October 2010 [ACEM CNGS]



1 Bunch missing in the reference from the *tomoscope*

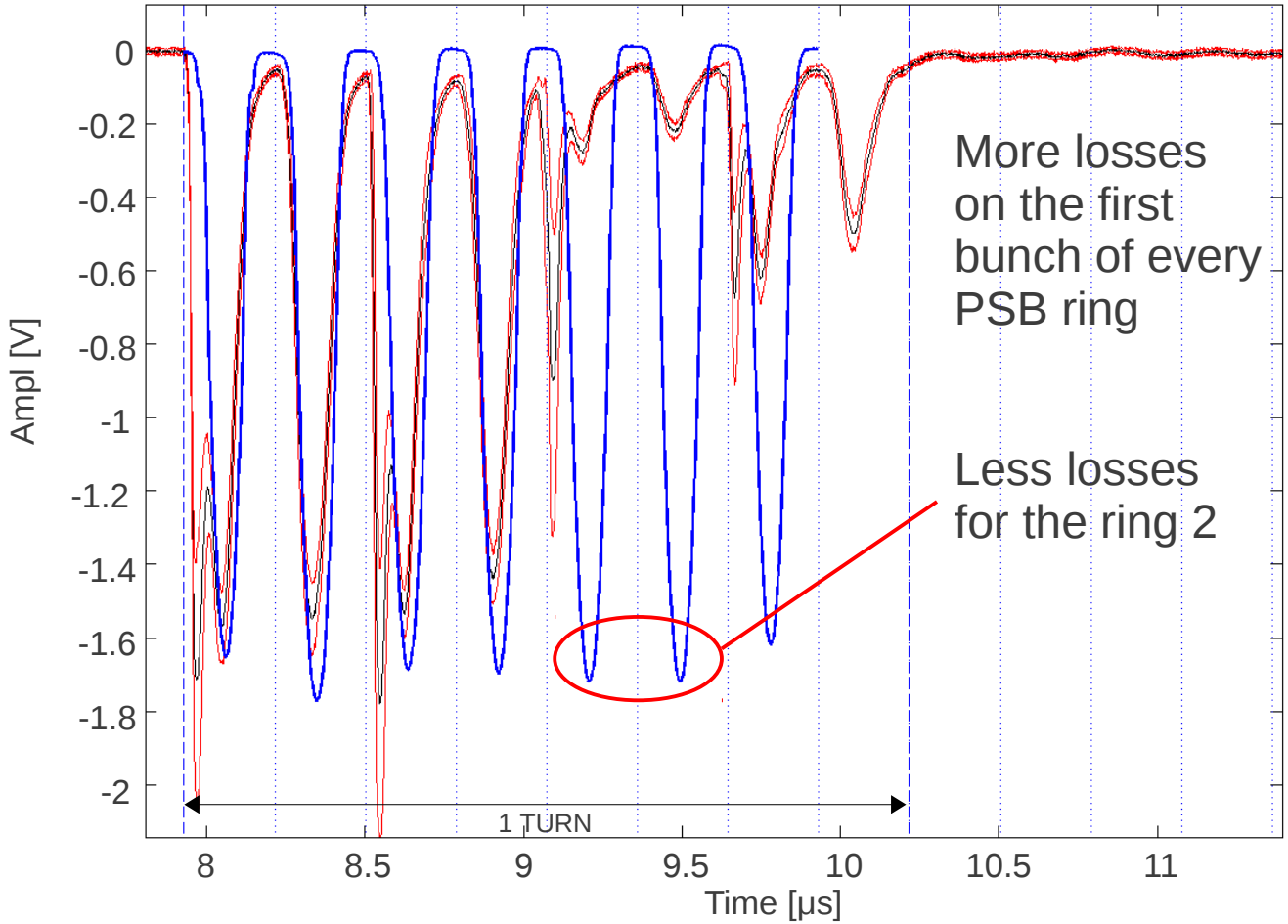
BLM Results

19th October 2010 [PEP-II CNGS]



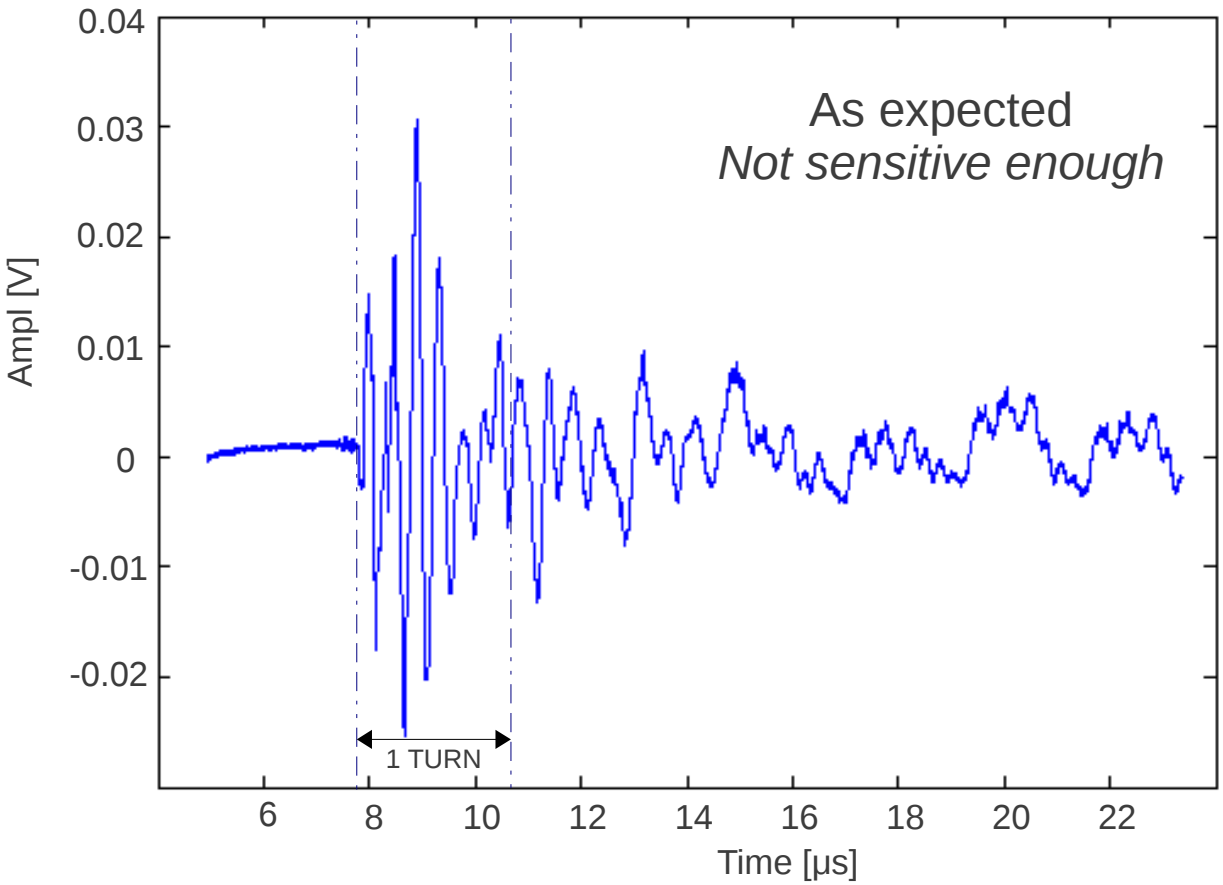
BLM Results

19th October 2010 [PEP-II CNGS]



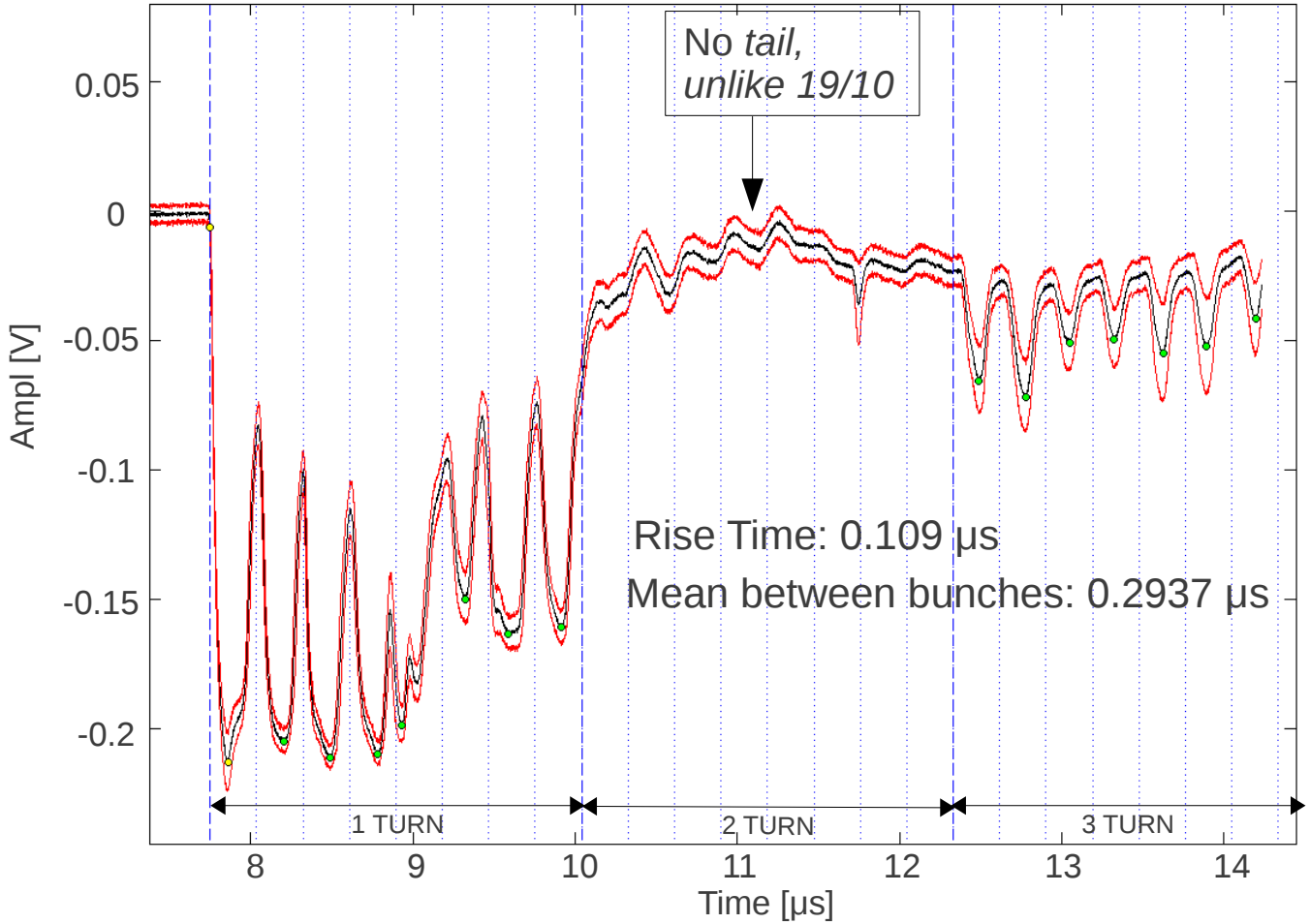
BLM Results

19th October 2010 [SEM]



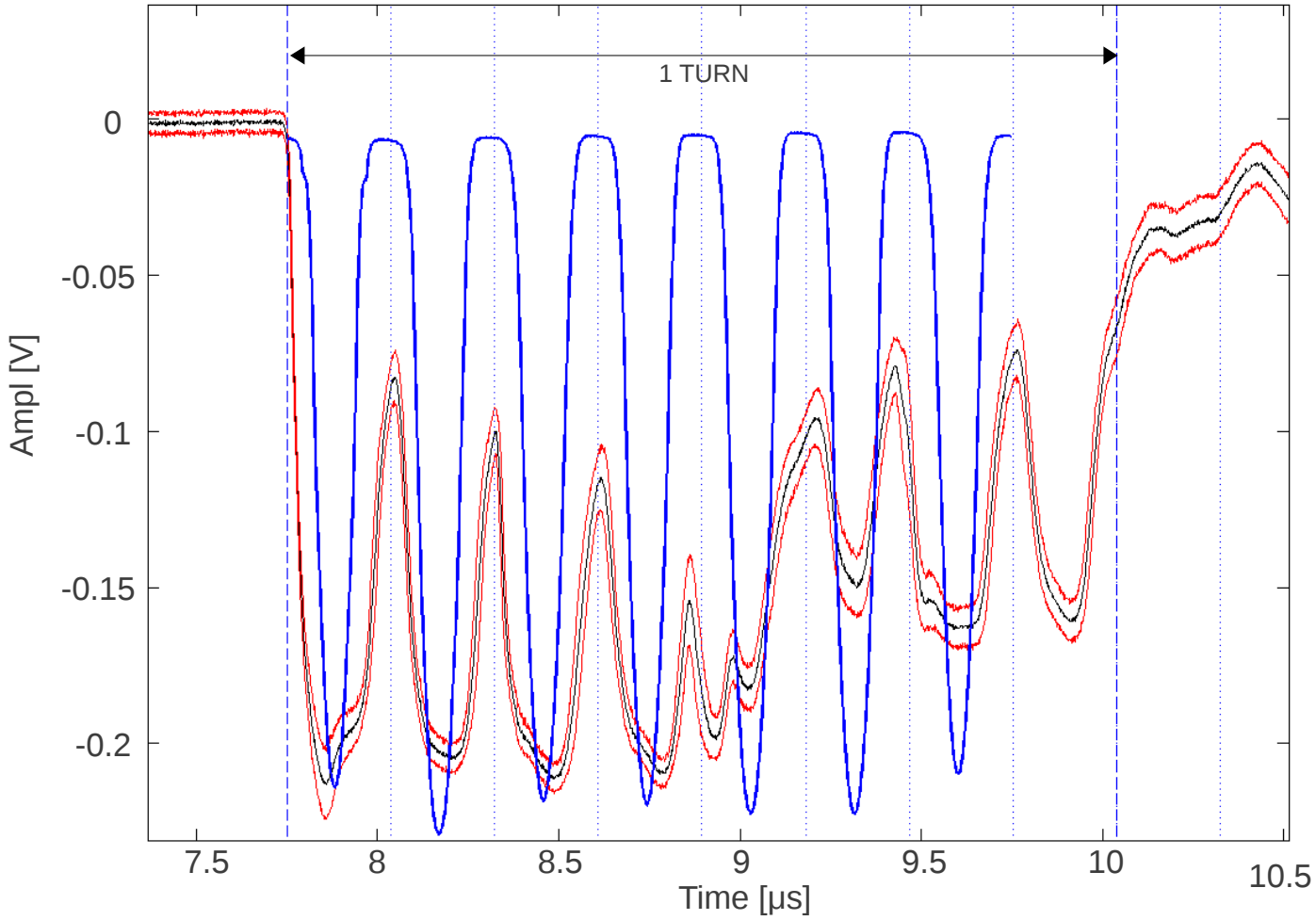
BLM Results

12th November 2010 [ACEM CNGS]



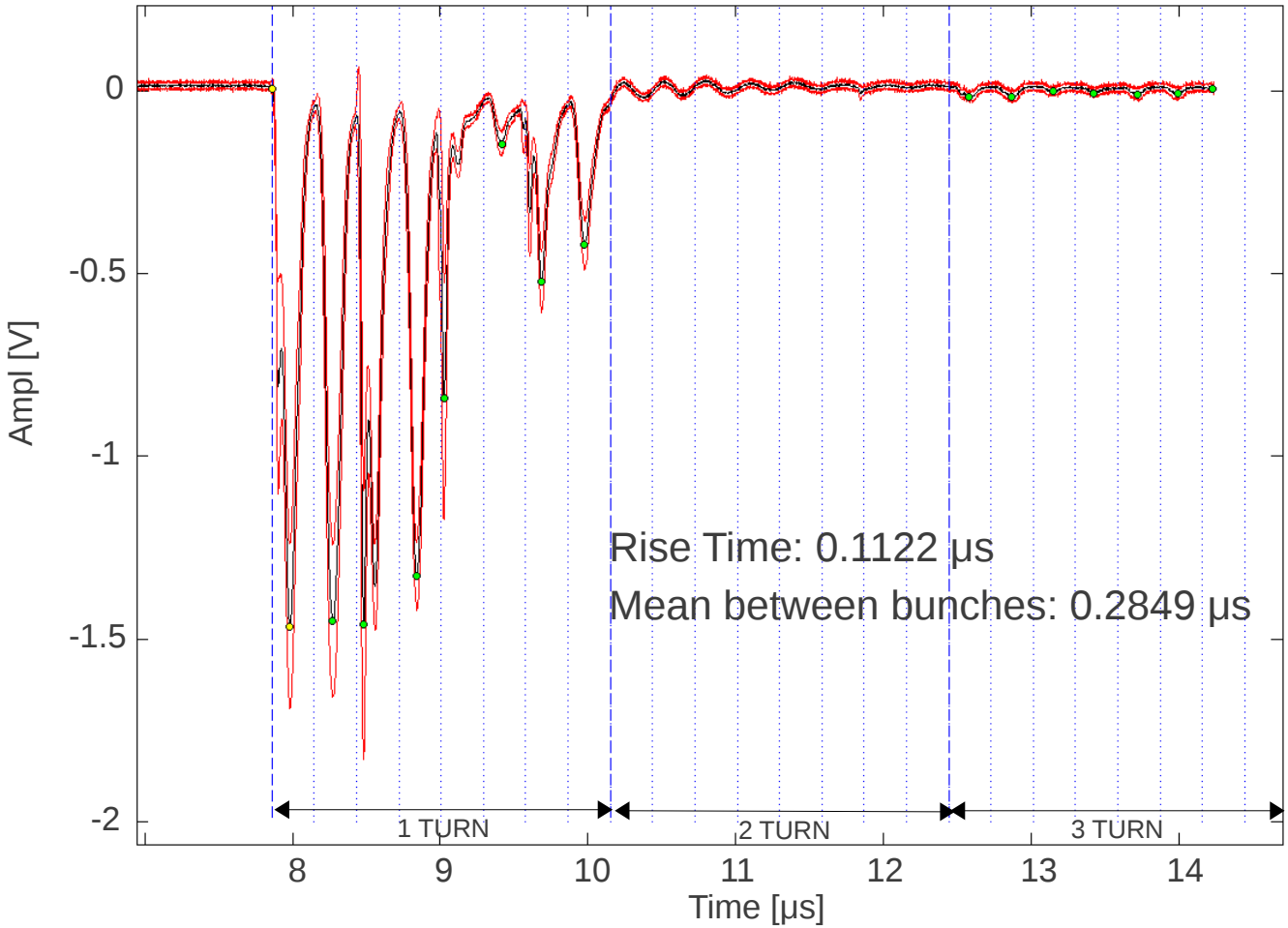
BLM Results

12th November 2010 [ACEM CNGS]



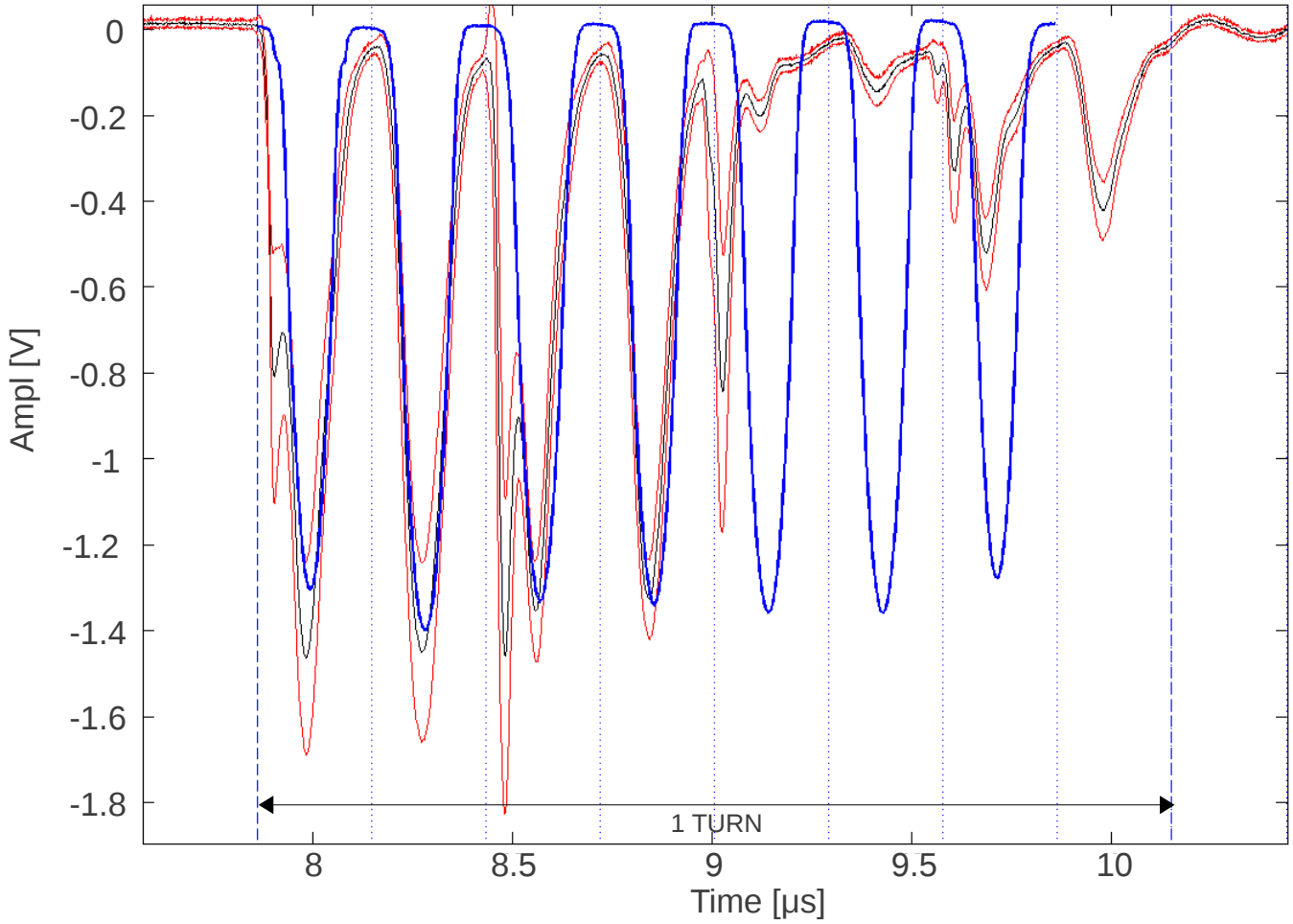
BLM Results

12th November 2010 [PEP-II CNGS]



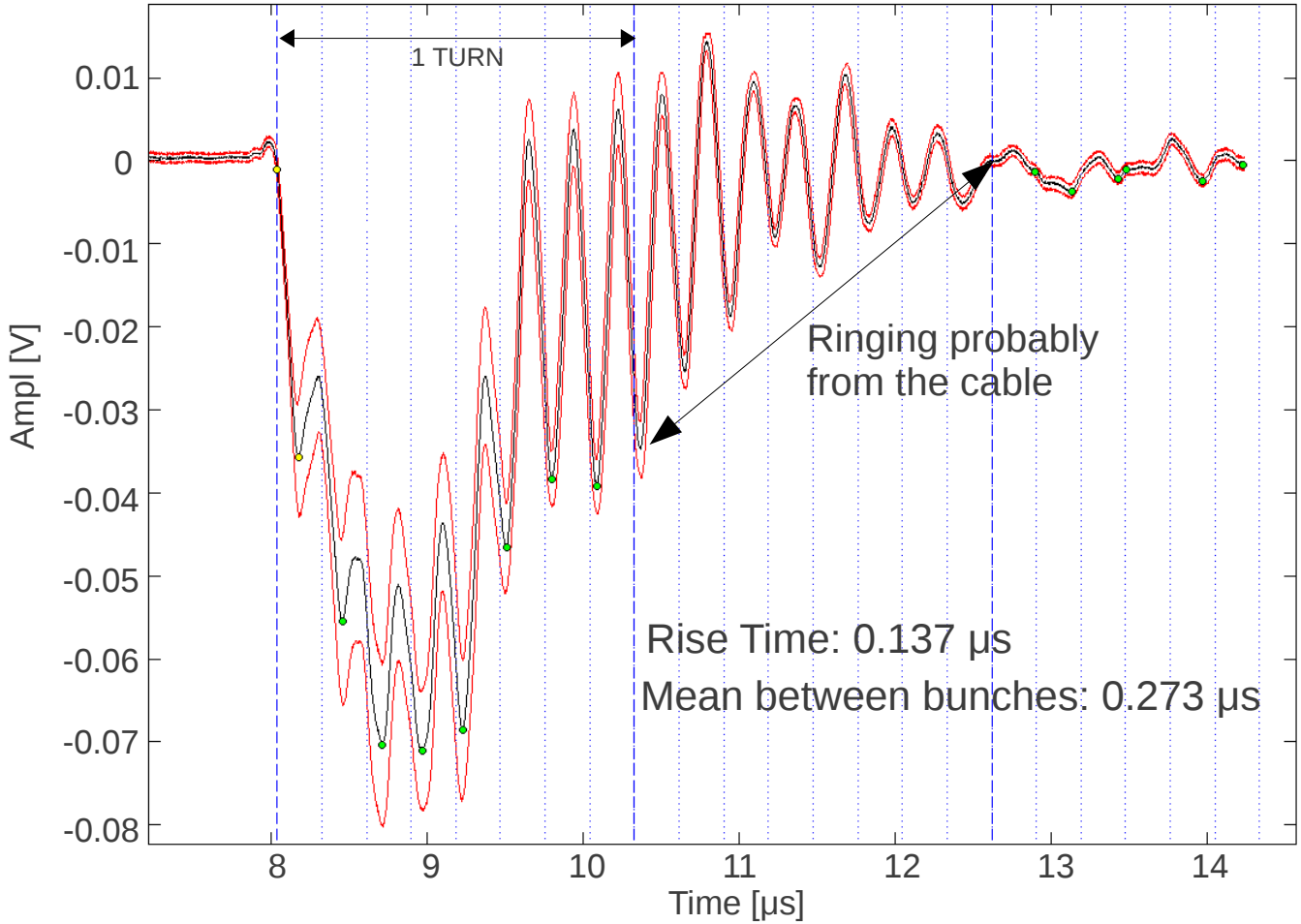
BLM Results

12th November 2010 [PEP-II CNGS]



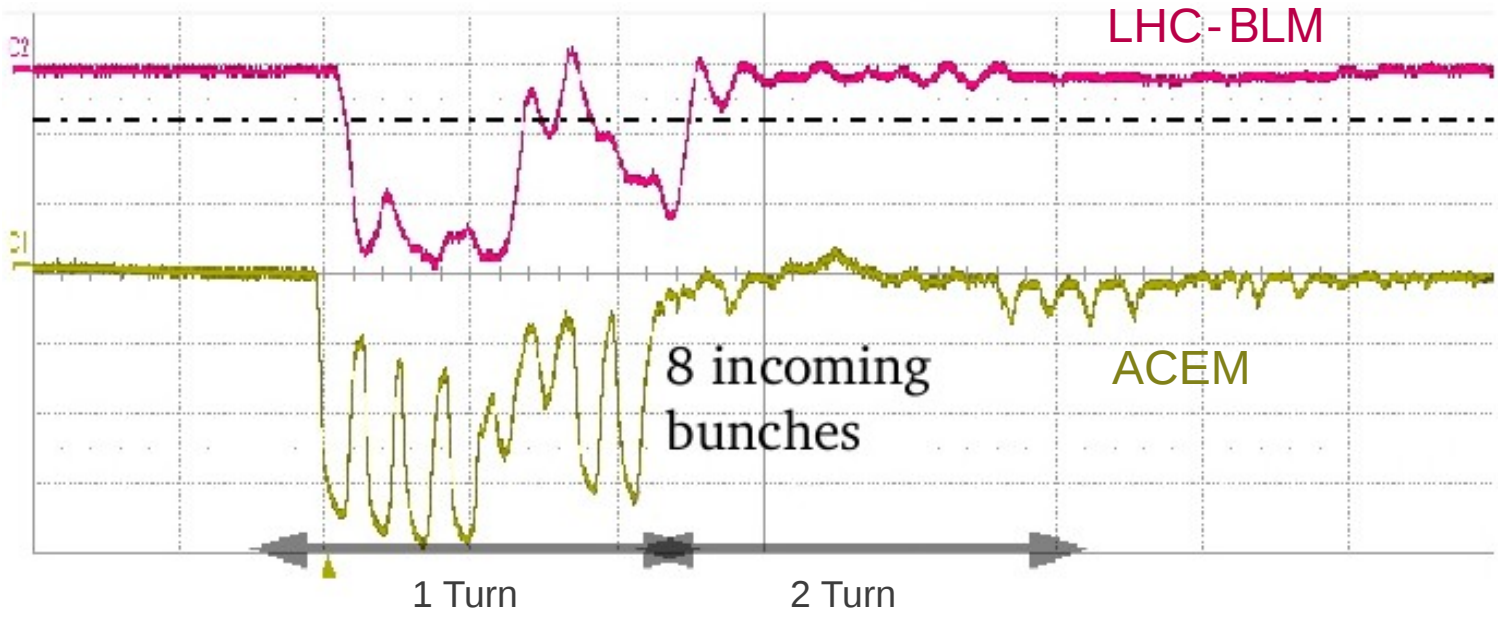
BLM Results

12th November 2010 [LIC CNGS]



BLM Results

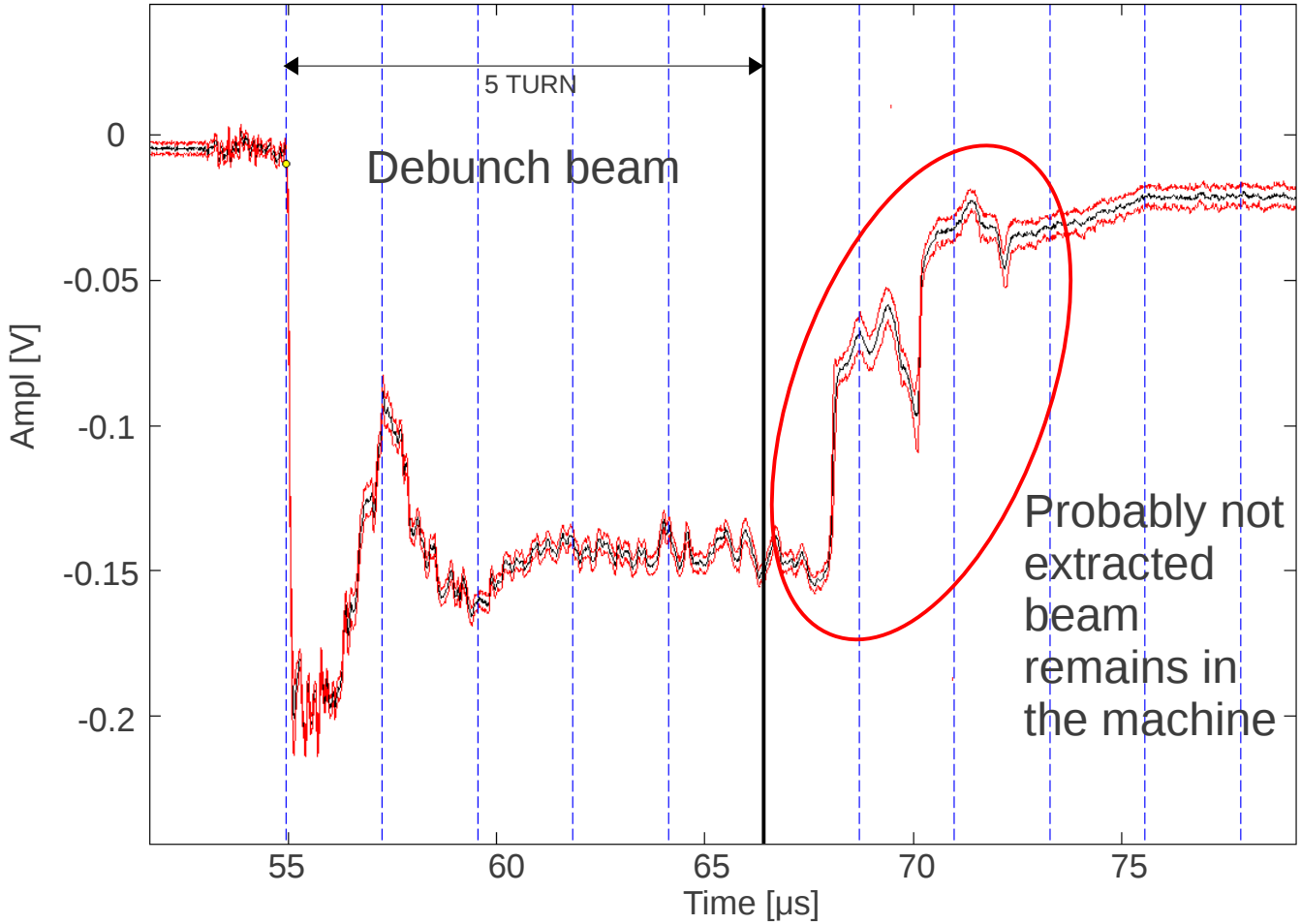
LHC / ACEM CNGS



S. Aumon
MSWG Meeting 13/08/2010

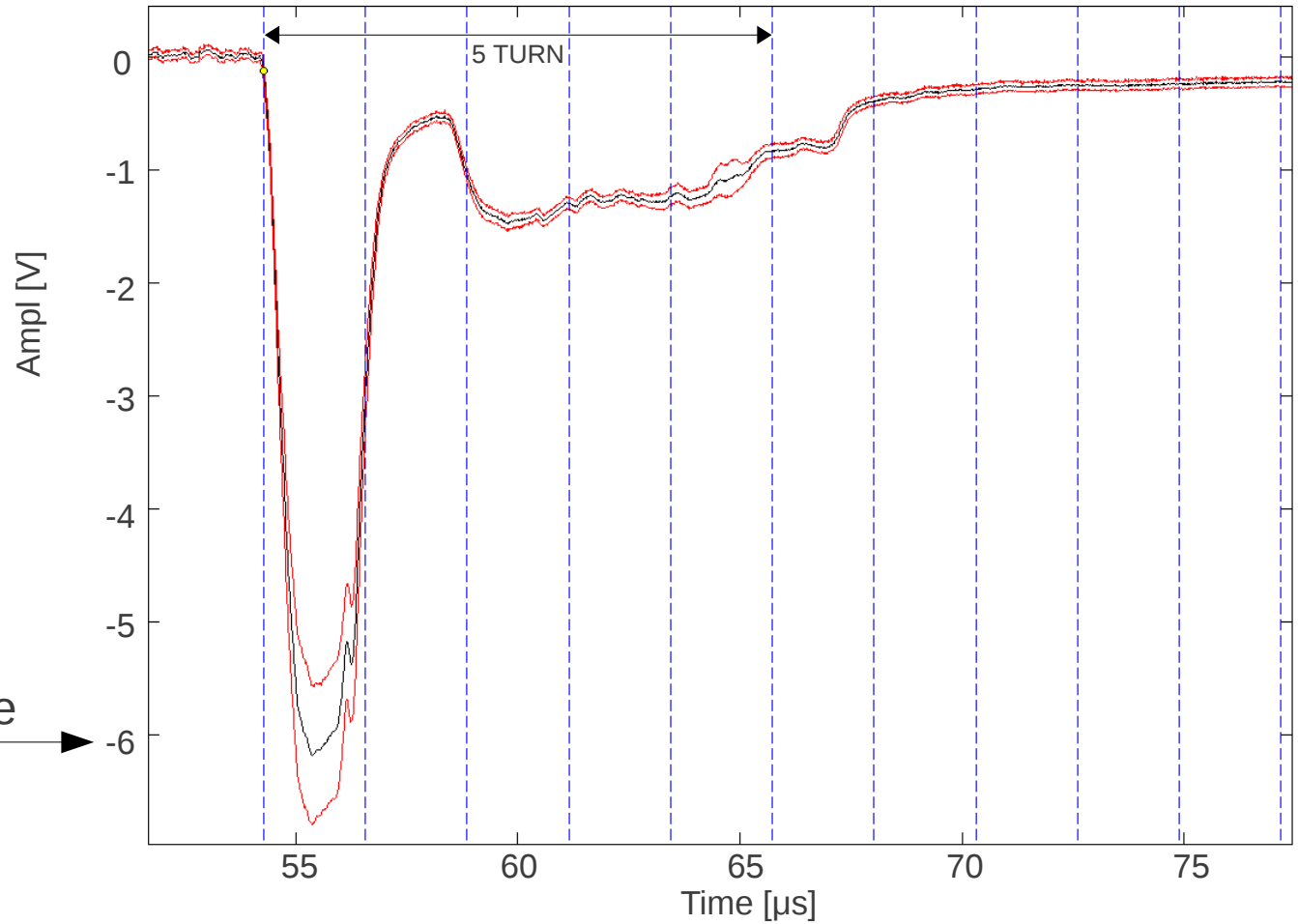
BLM Results

12th November 2010 [ACEM CNGS extraction]



BLM Results

12th November 2010 [LHC BLM CNGS extraction]

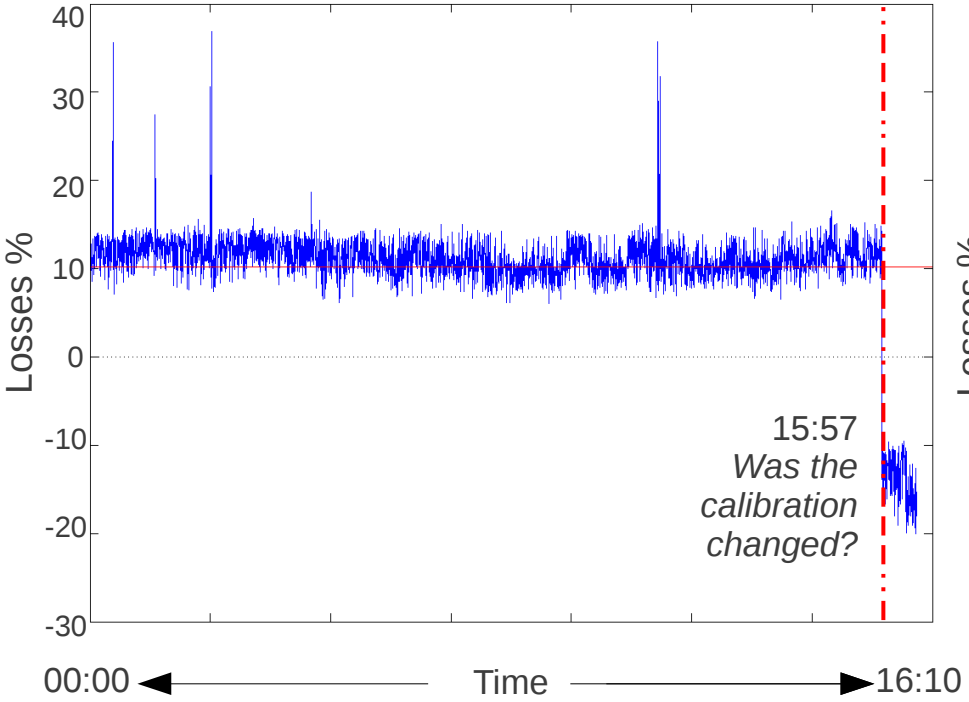


Very large signal

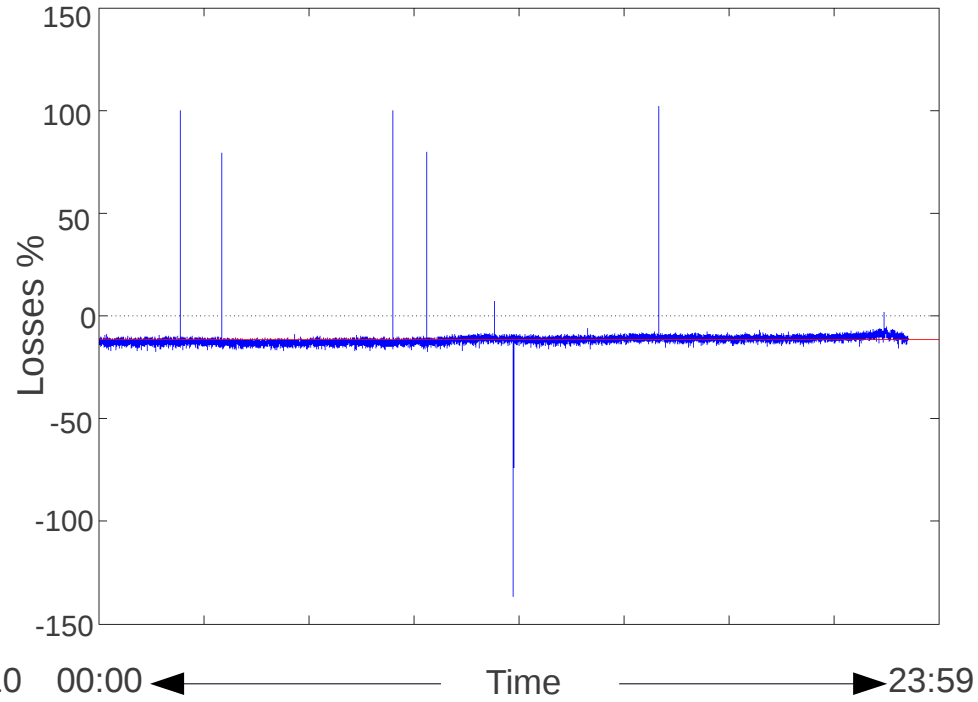
Transformers

Losses between BT transformer & PS ring transformer

19/10/10
Relative losses [mean]: 10.17%
Relative losses [sd]: 5.45%



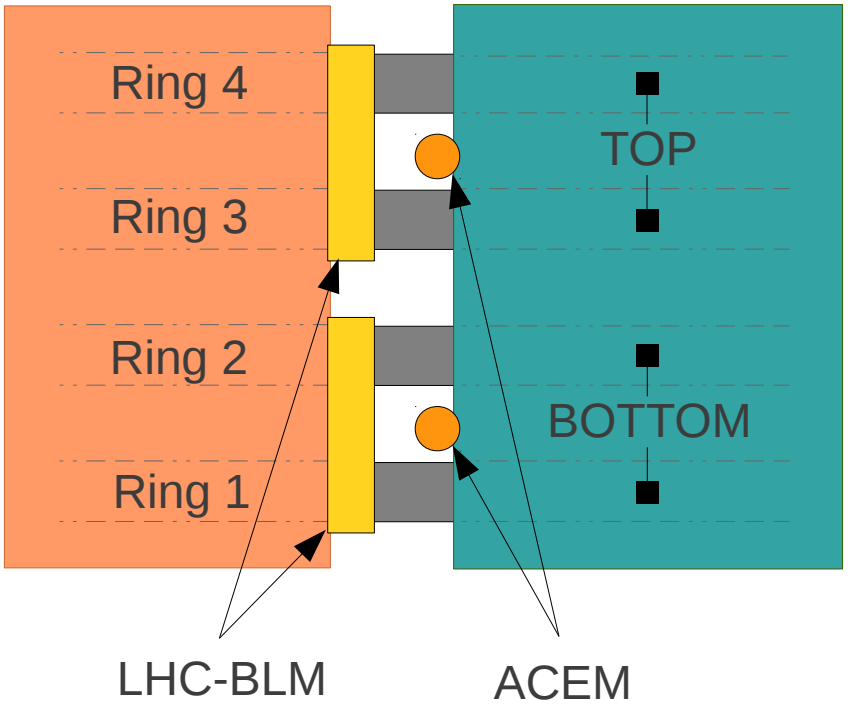
12/11/10
Relative losses [mean]: -11.67%
Relative losses [sd]: 3.06%



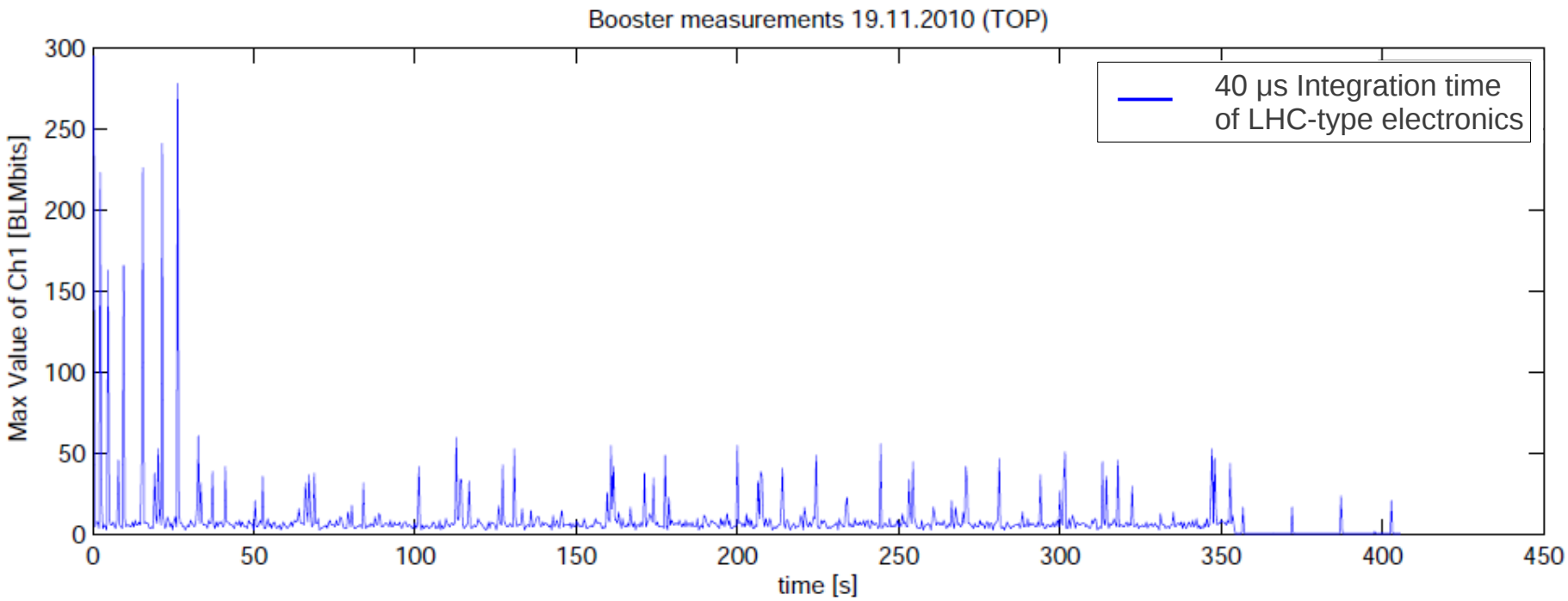
PSB

Detector Installation

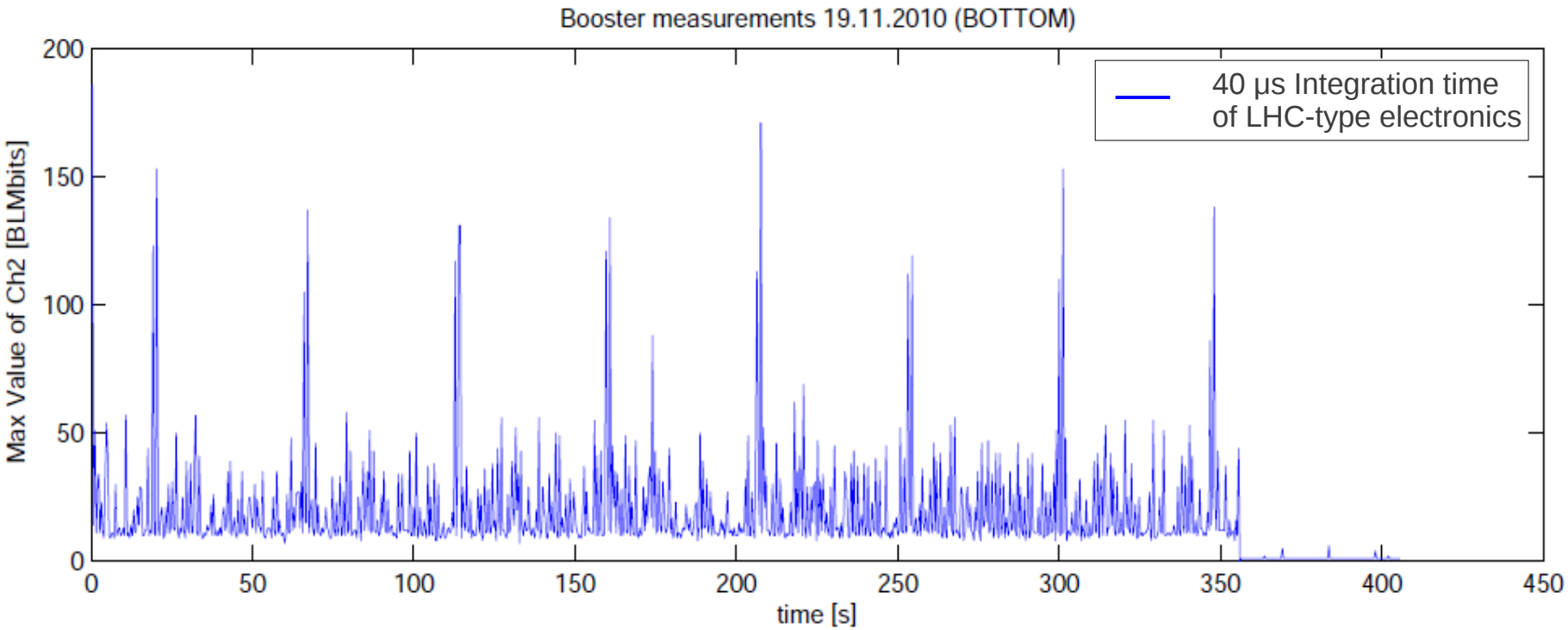
Section 7



BLM Results


Booster measurements 19.11.2010 (TOP)
40 µs Integration time
of LHC-type electronics
Max Value of Ch1 [BLMbits]
time [s]
0
50
100
150
200
250
300
350
400
450

BLM Results


Booster measurements 19.11.2010 (BOTTOM)
40 µs Integration time
of LHC-type electronics
Max Value of Ch2 [BLMbits]
time [s]
0
50
100
150
200
250
300
350
400
450

Conclusions

See Simone's slides