The European Synchrotron

Status of the newly installed BeamLoss Detectors

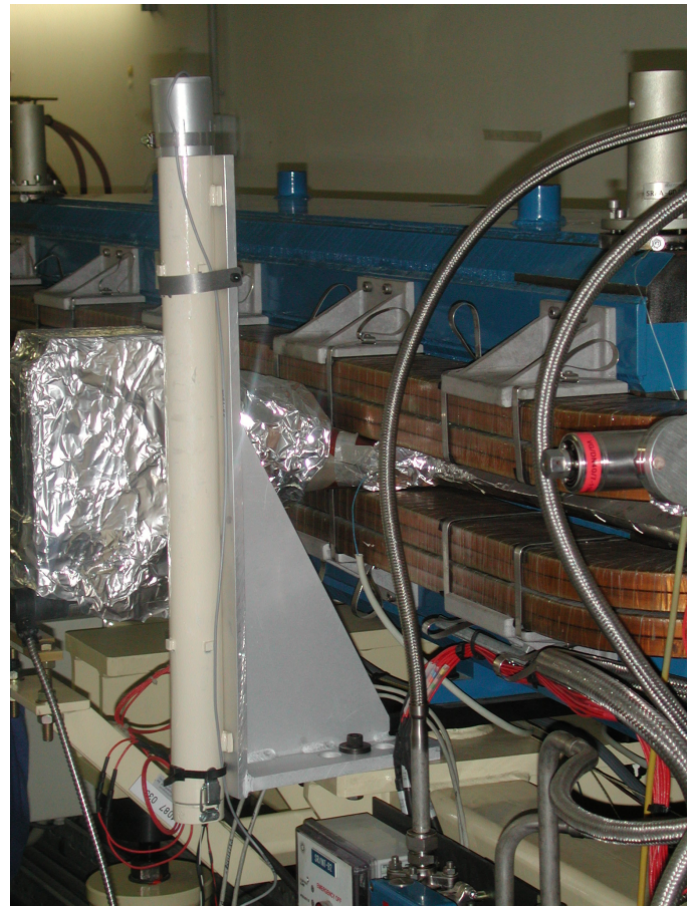
Laura Torino

DEELS 2017, 12/06/2017

On the previous episodes...

What we had

- 64 "Slow" Beam Loss Detectors
  - PMT + scintillator
  - Read out $<$ 1Hz
- 64 Ionization Chambers
  - Extremely heavy



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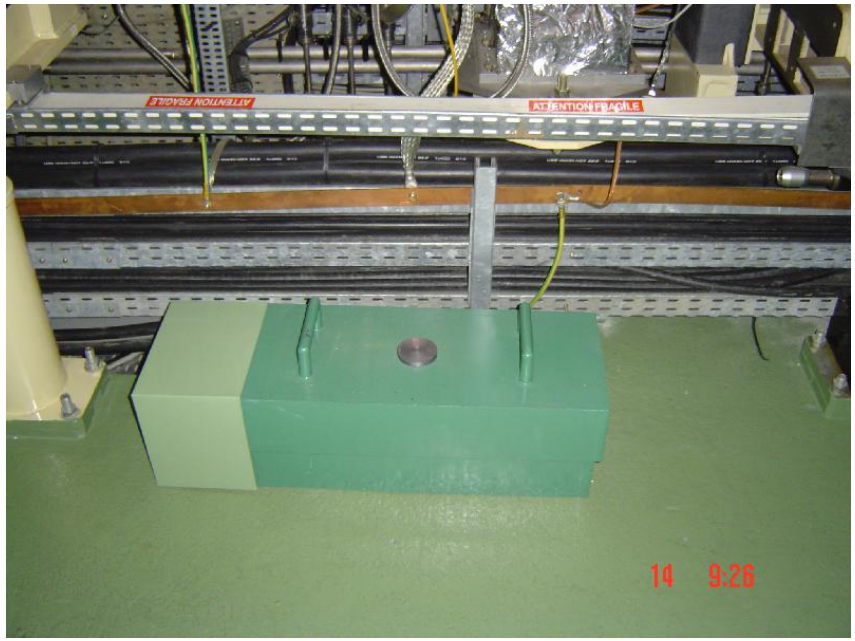

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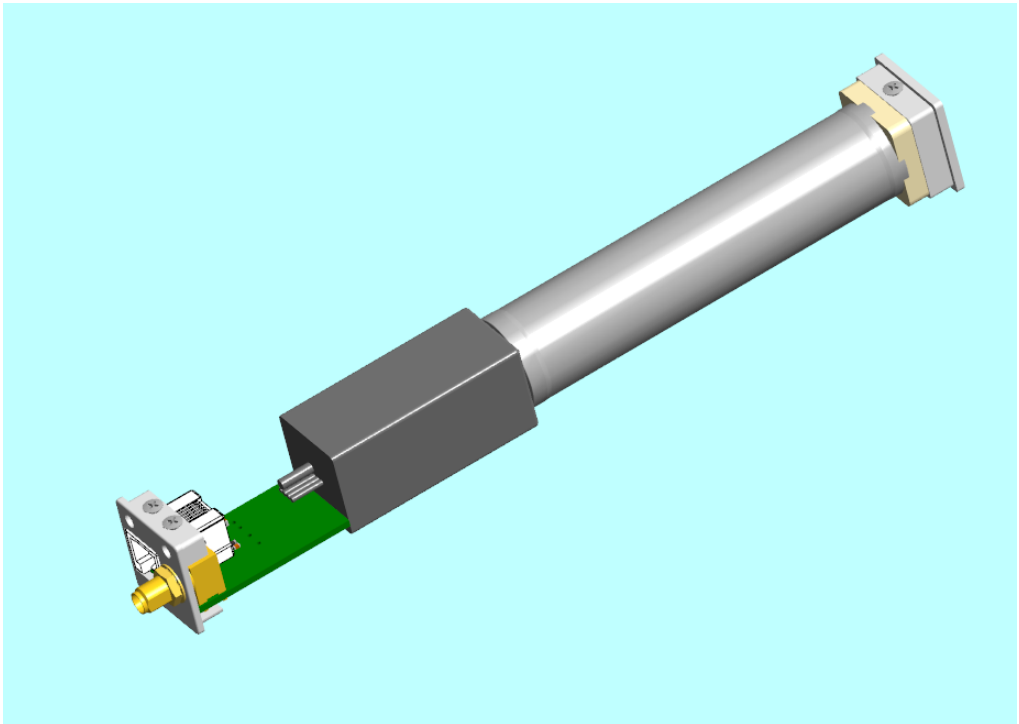
What we decided to have

Off-shelf PMT coupled with a scintillator and Commercial electronic to control and read the results

New ESRF BLM System – BLD



- PMT Hamamatsu H10721-110
  - 8 mm active area
  - Powered 5 V
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- EJ-200 scintillator rod (100x22mm)
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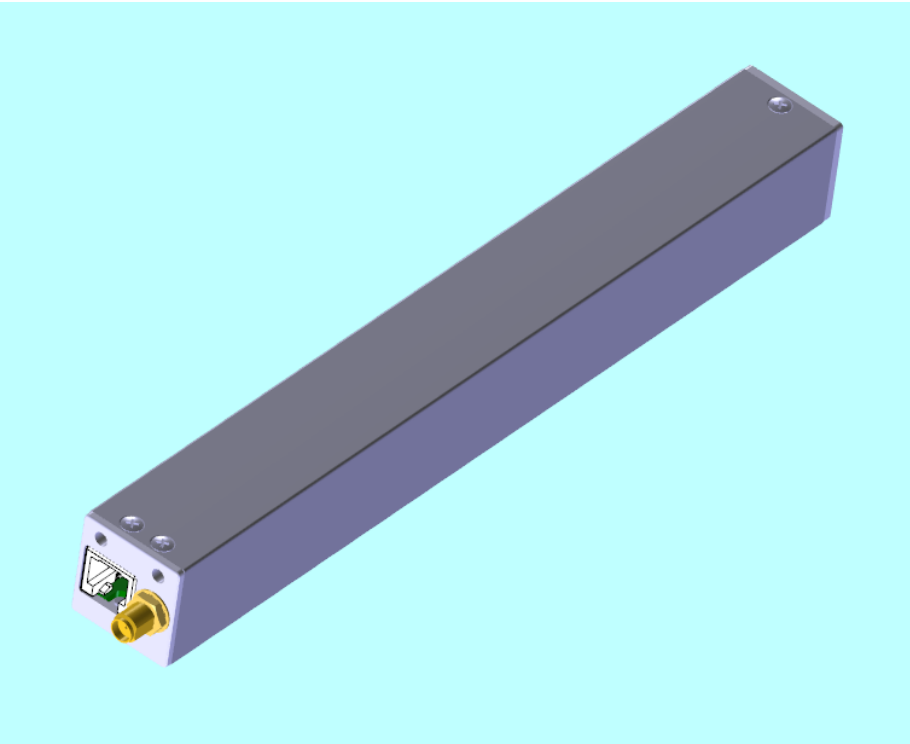

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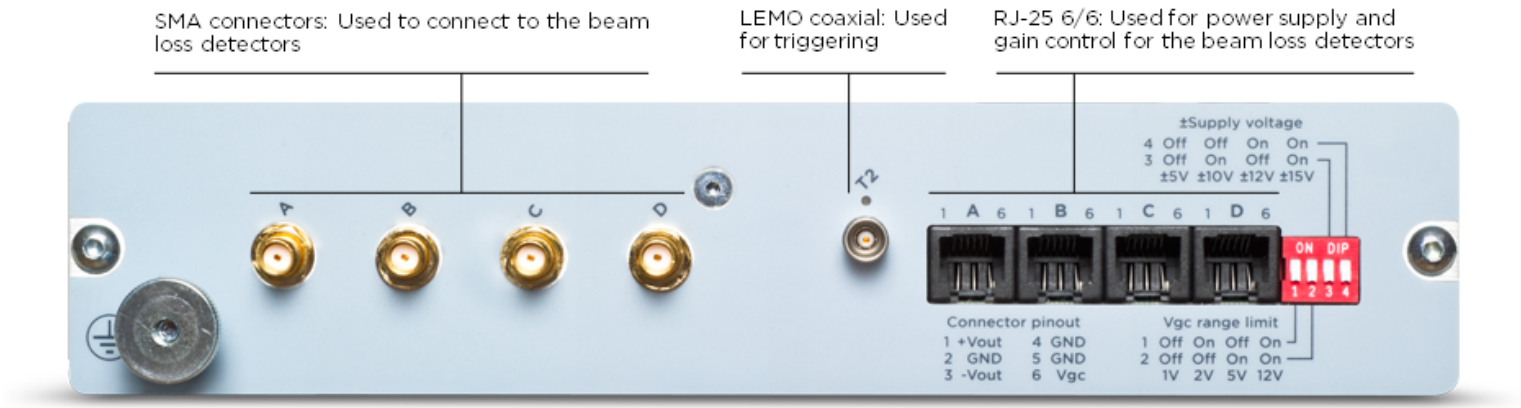
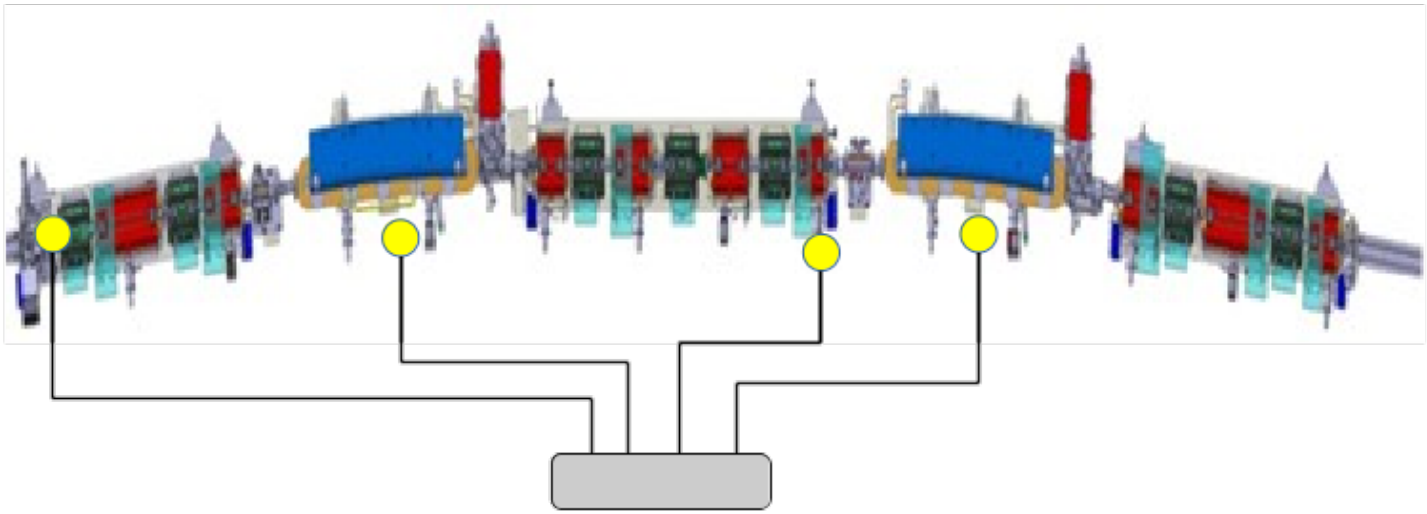


- General power supply
- Trigger input
- 4 independent gain control channels
- 4 independent impedance settings (50 Ω/1 MΩ)
- 4 independent read out channels
- 8 ns ADC sample

BLDs Location



32 ESRF cells ⇒ 32 Libera BLM units
4 BLDs per cell ⇒ 128 BLDs

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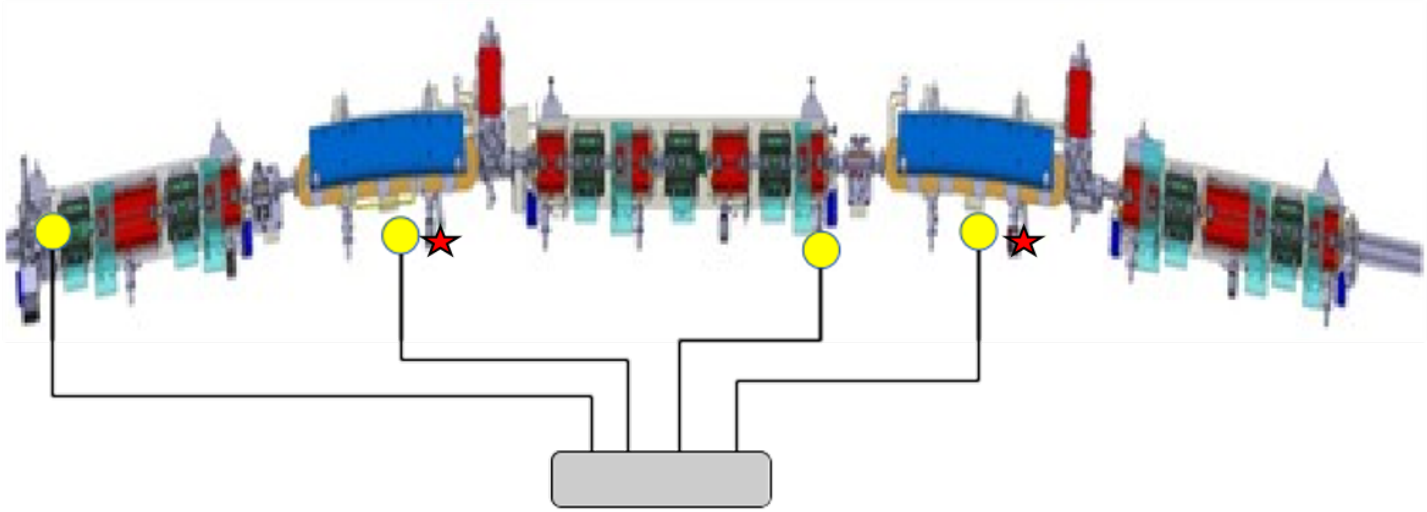

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Direct comparison with the current BLD system

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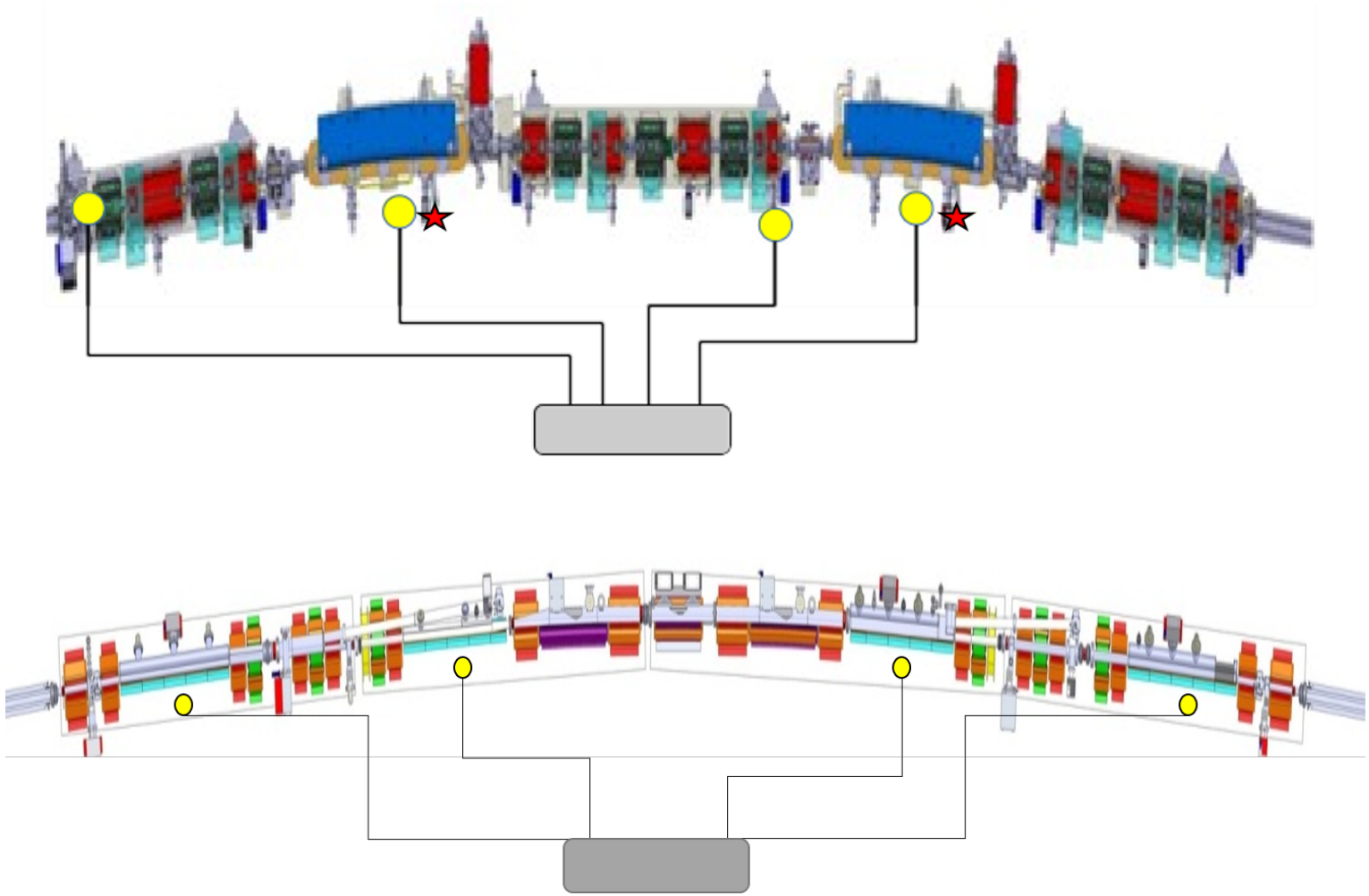
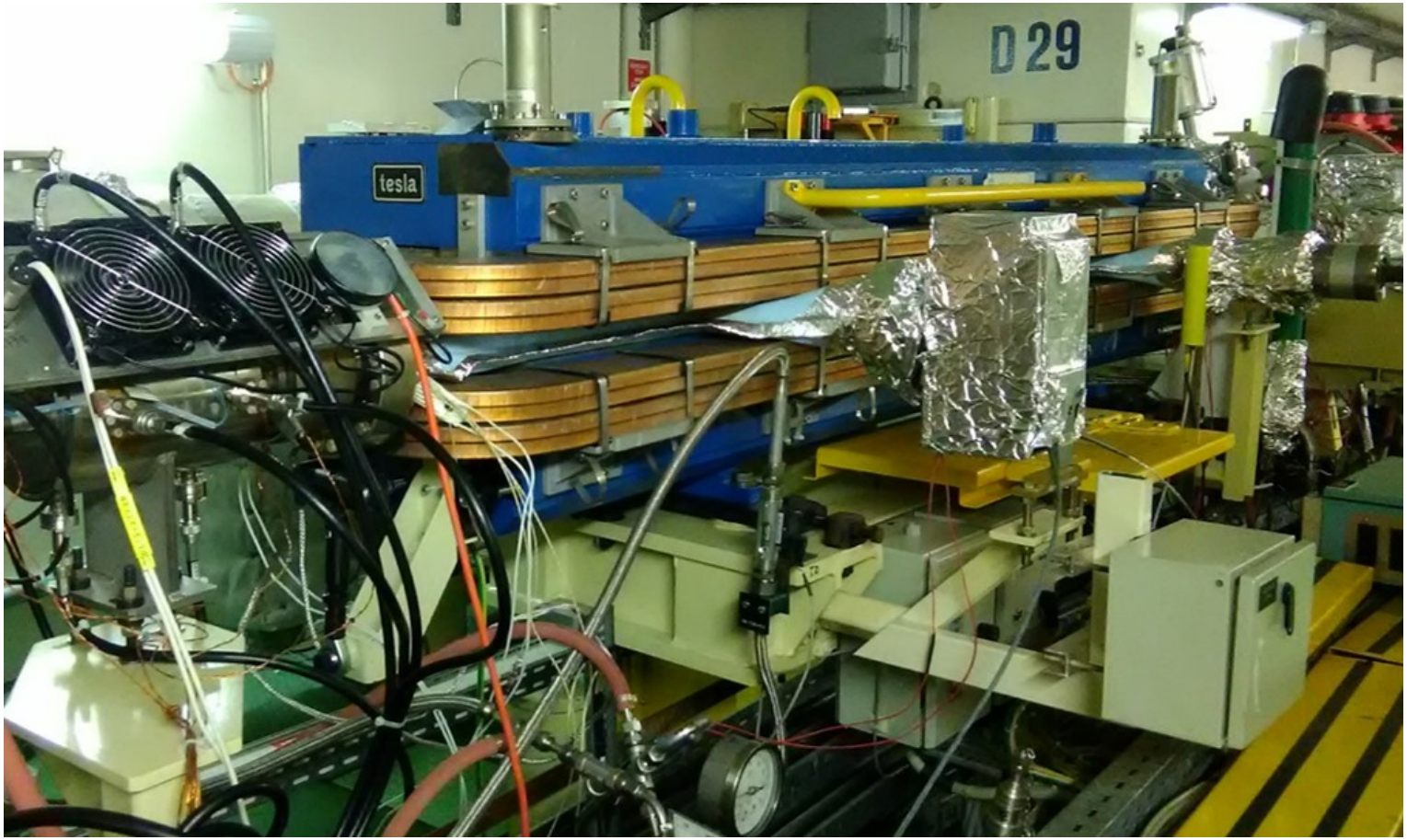


Example



Status

- 128 BLDs relatively calibrated
- 128 BLDs installed
- Cell 4 to Cell 26 (92 BLDs) commissioned
- Cell 1 to Cell 3 and Cell 27 to Cell 32 installed (preliminary results)

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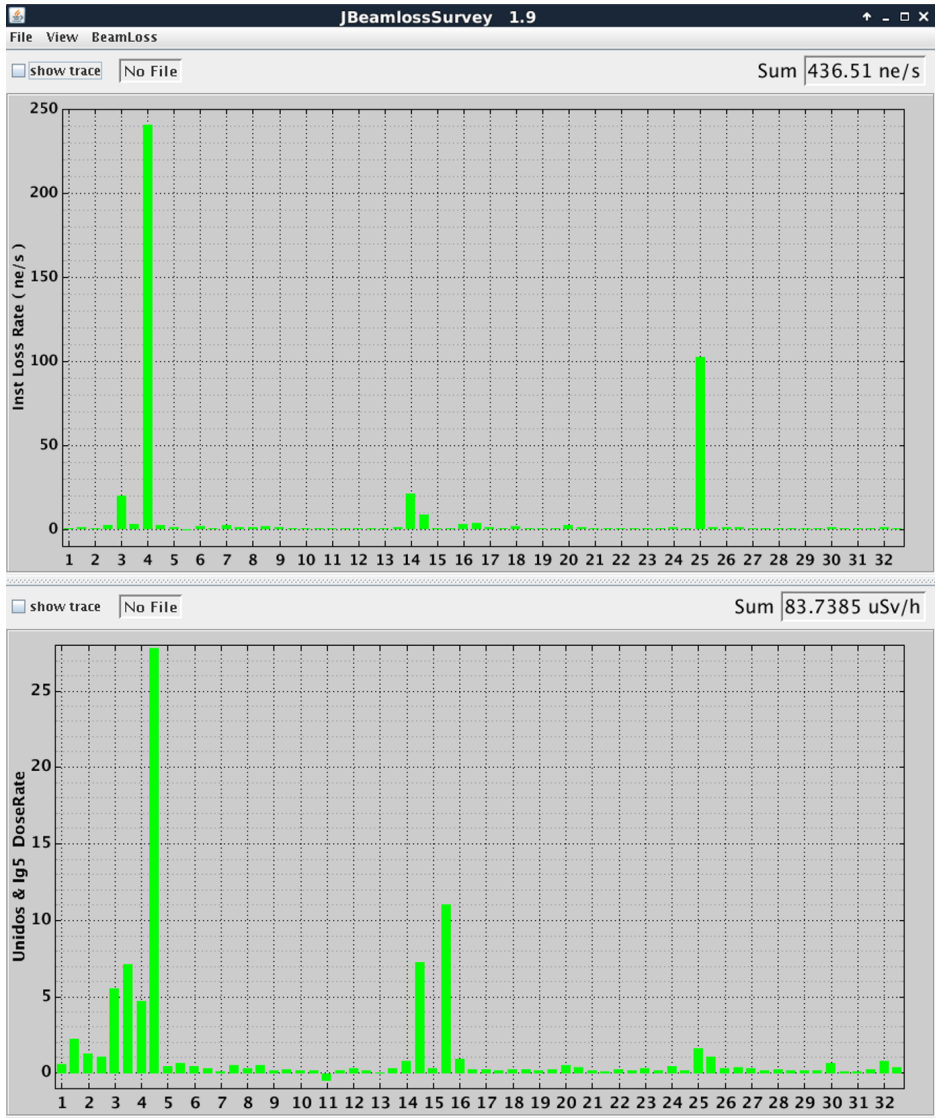
$\Rightarrow$ Slow Losses

$\Rightarrow$ Fast Losses

$\Rightarrow$ Turn by Turn Losses

Slow Losses – Current System

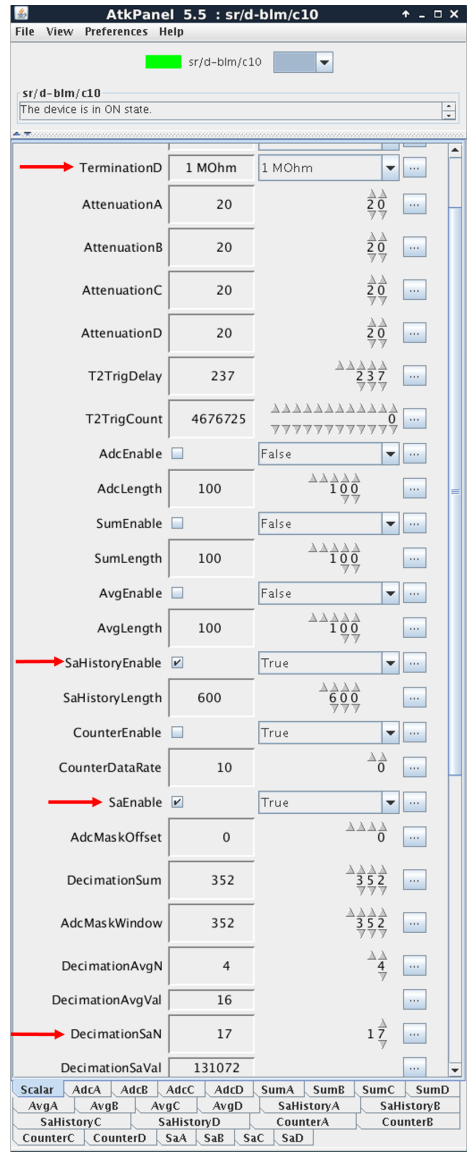


Usefull tool during machine operation

Slow Losses – New System

Settings

- High Impedance
- Decimation Level
- Integration Time



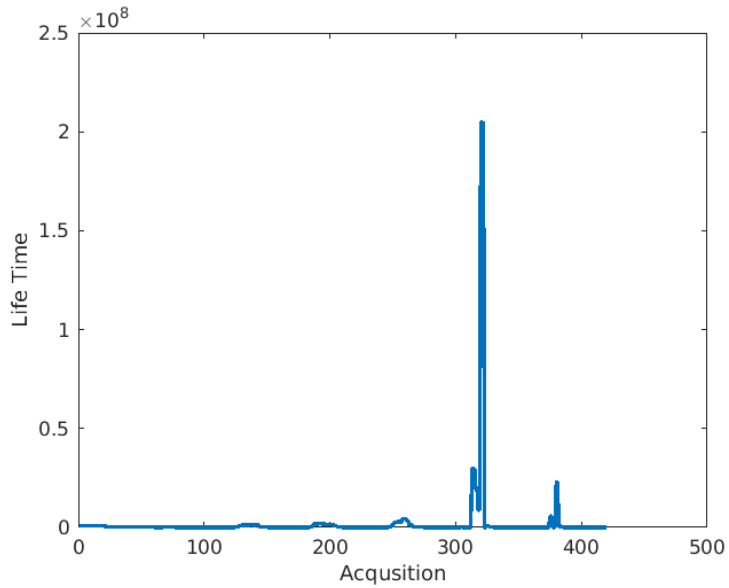
Synchrotron Radiation Influence – Test

X-rays produced by synchrotron radiation interact with the BLD scintillator and produce unwanted background

Low losses condition (Low current/High Lifetime)

⇓

Only synchrotron radiation is detected



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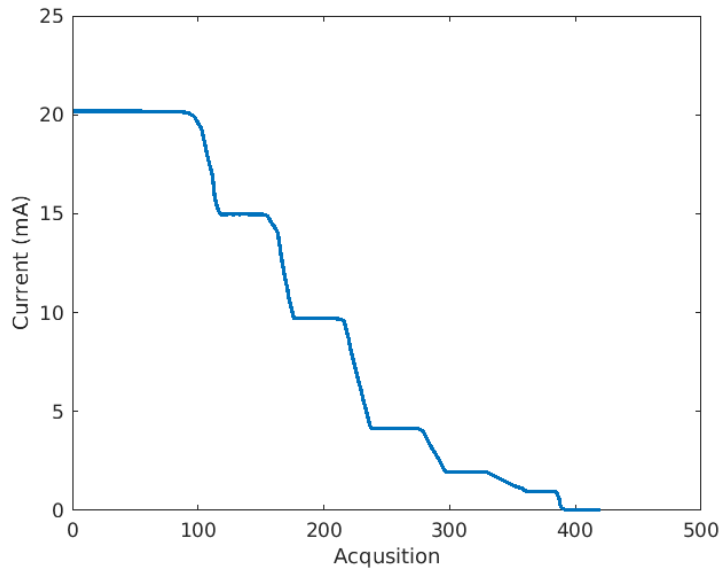
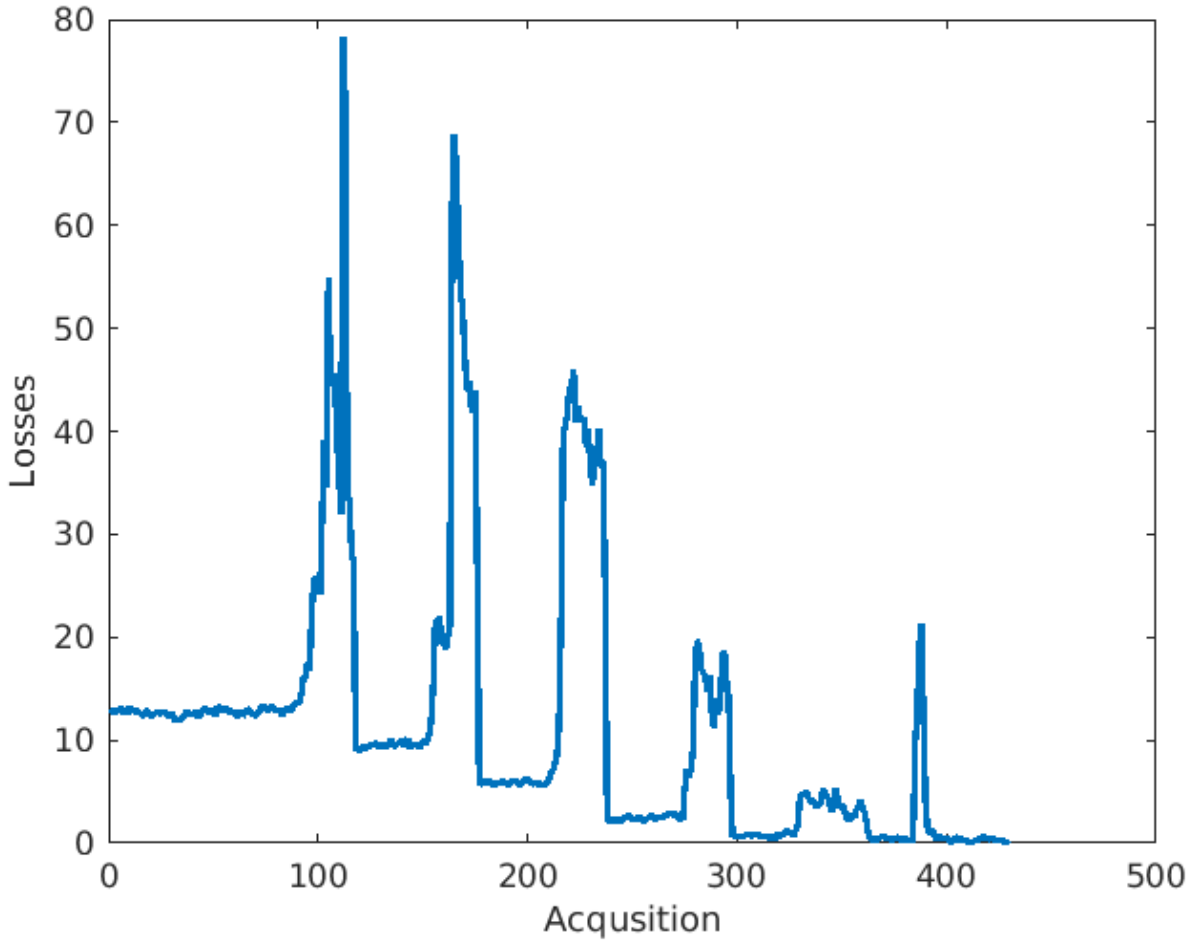


Synchrotron Radiation Influence – Evidence



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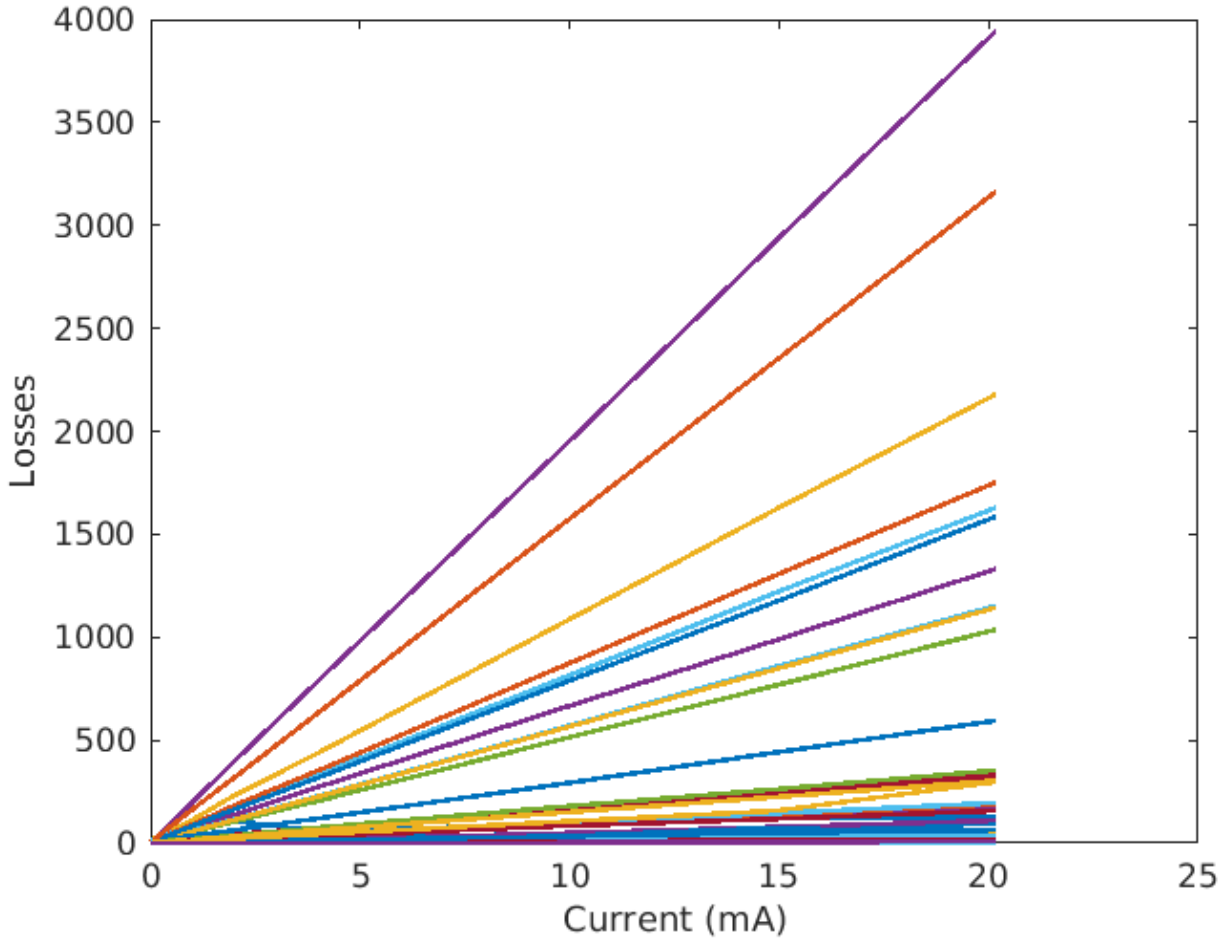

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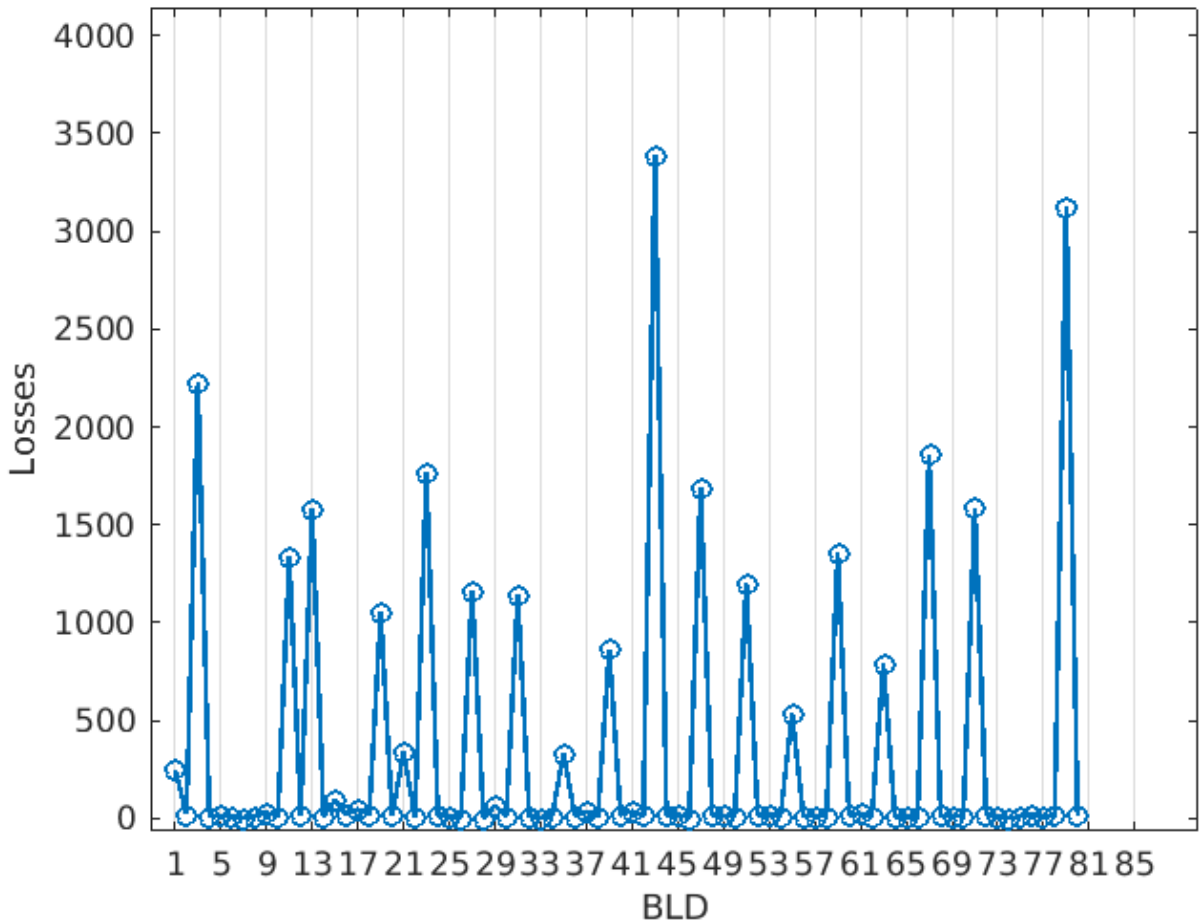
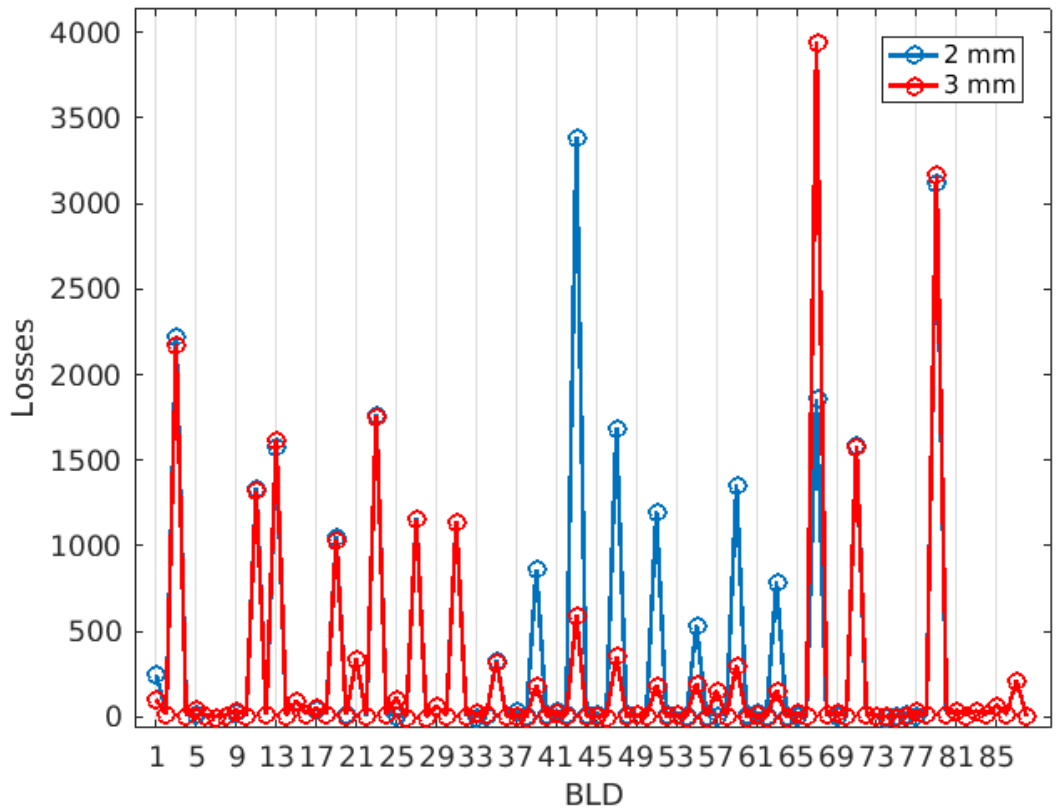


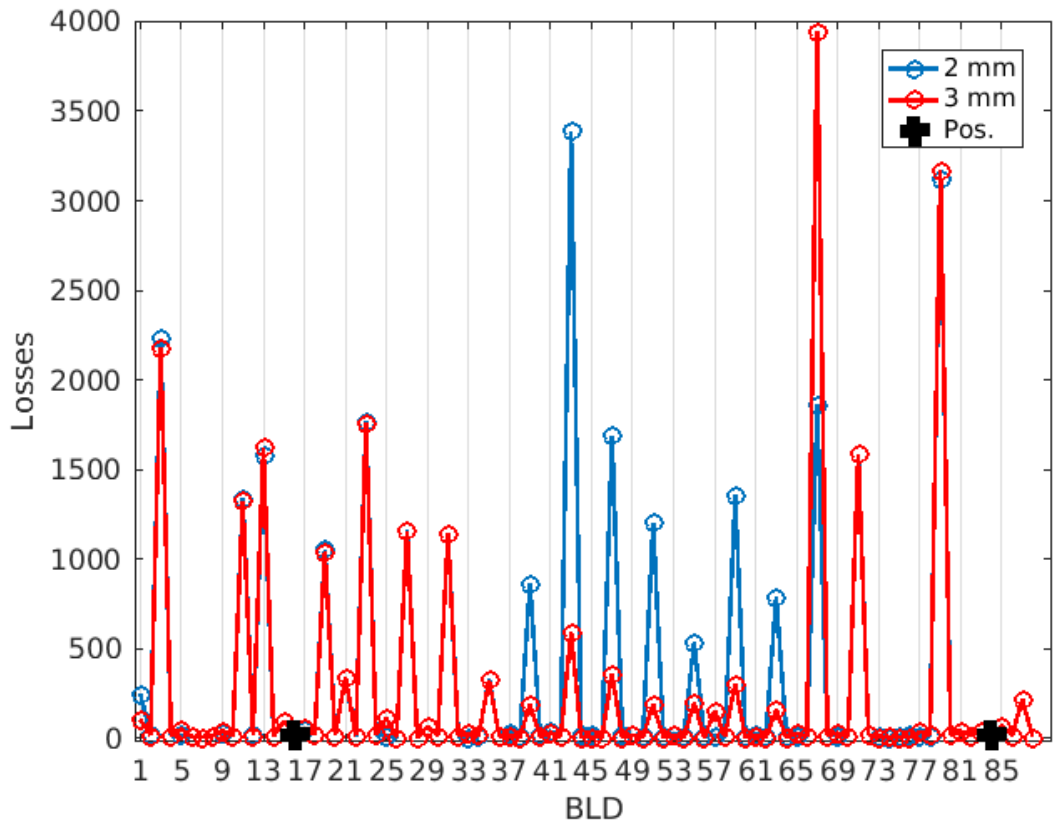
Synchrotron Radiation Influence – Shielding

Increase the lead shielding from 2 to 3 mm (Cell 13 to Cell 19, preliminary)

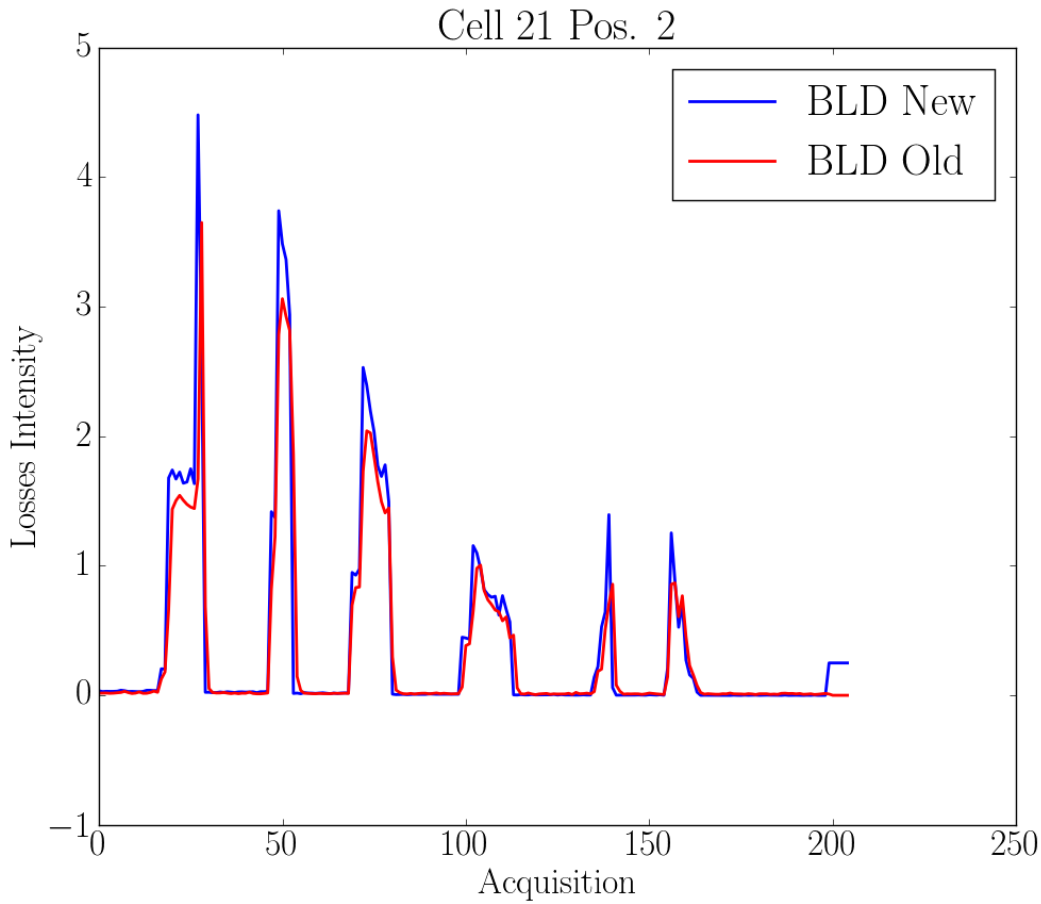


Synchrotron Radiation Influence – Position

Design a specific suport of BLDs in position 3



Comparison Current/New BLDs

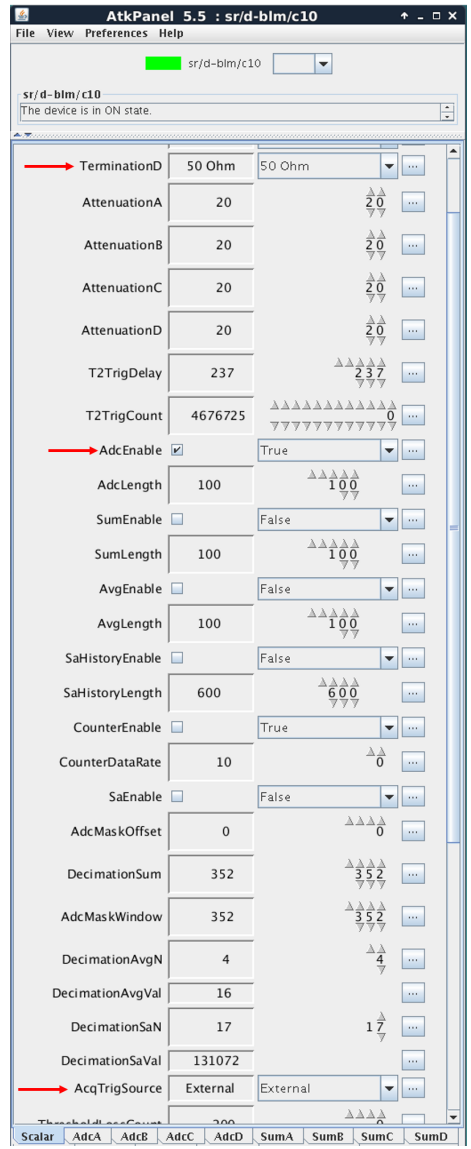


Data acquired during top-up injection

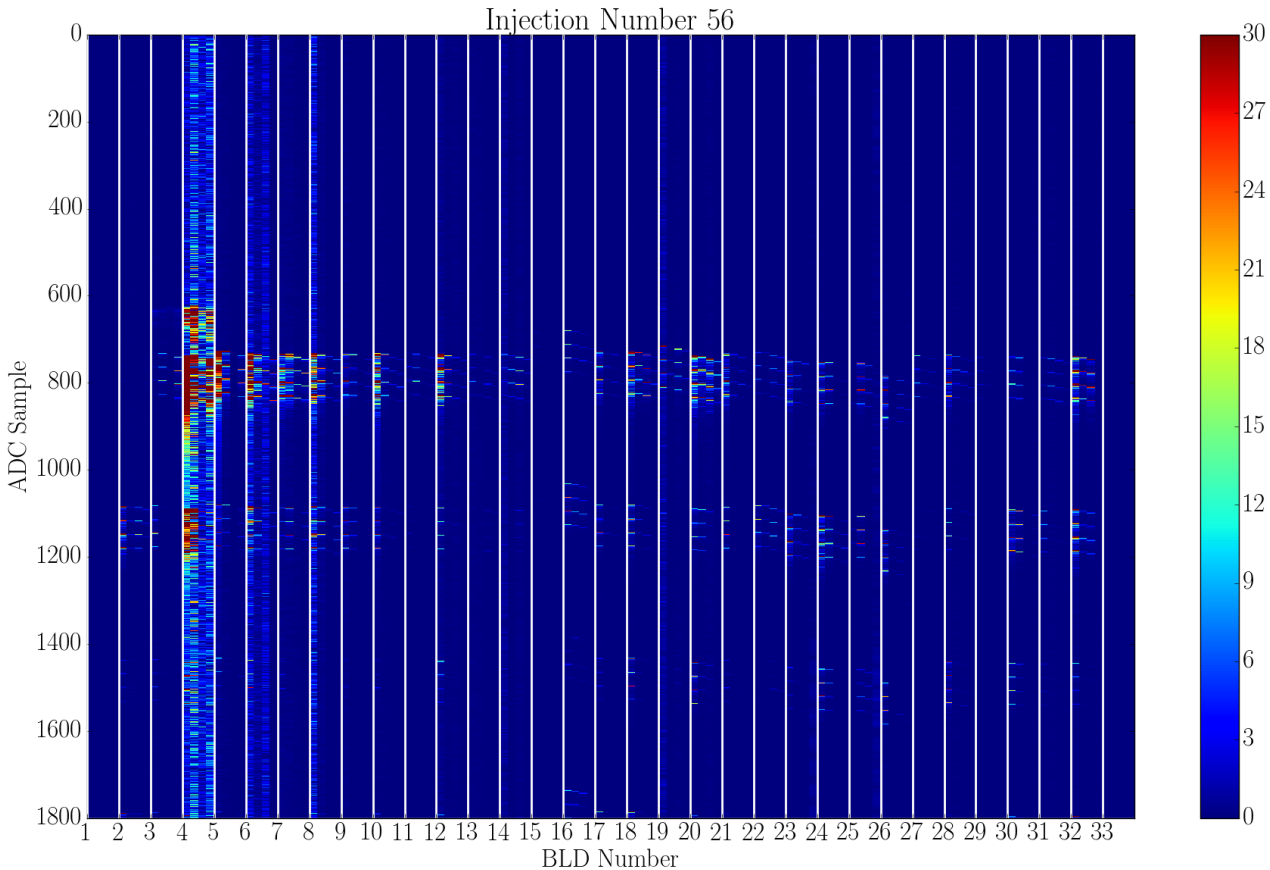
Fast Acquisition

Settings

- 50 Ω Impedance
- ADC Sample (8 ns)
- External Trigger



Fast Acquisition – Injection Monitoring



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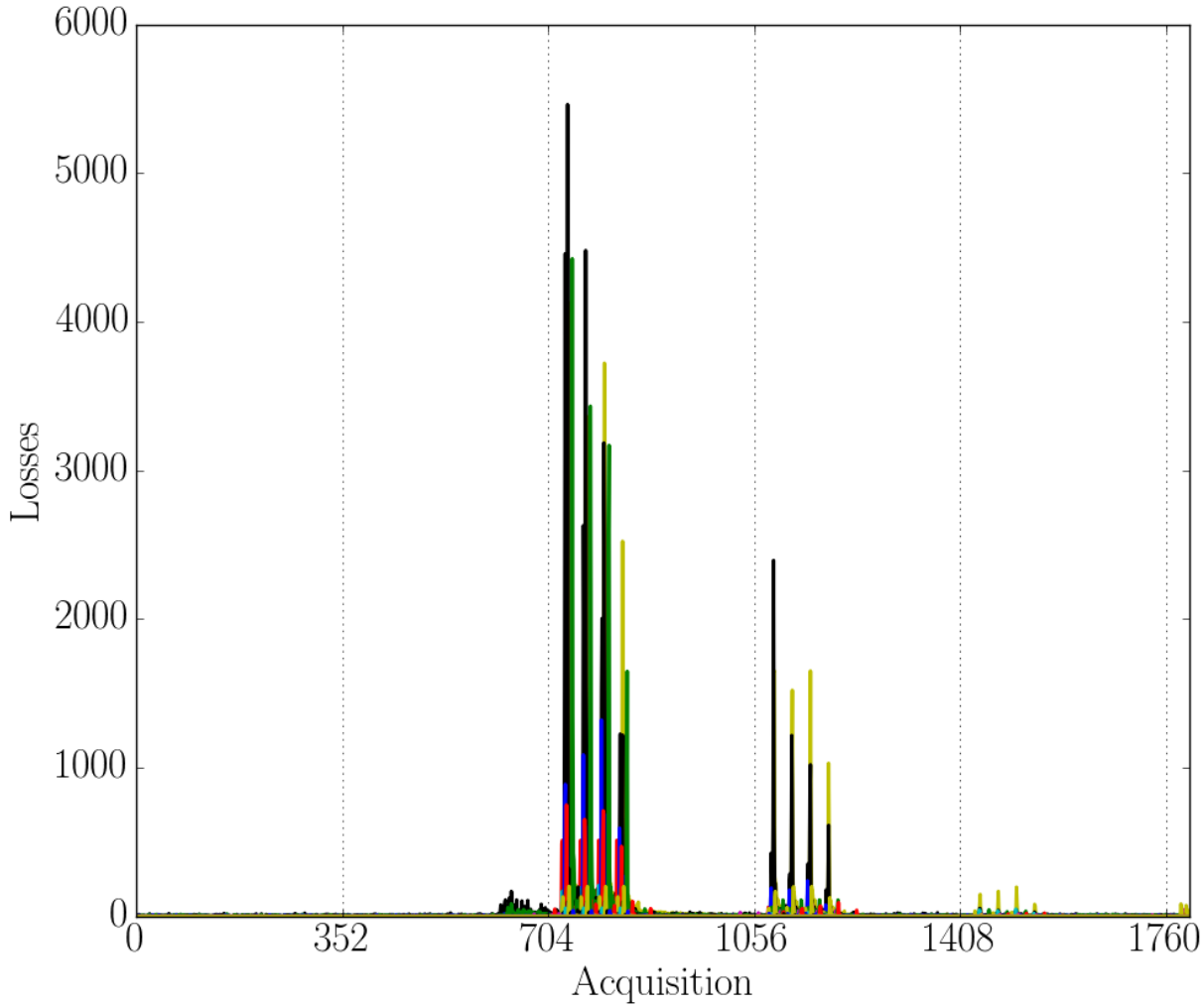
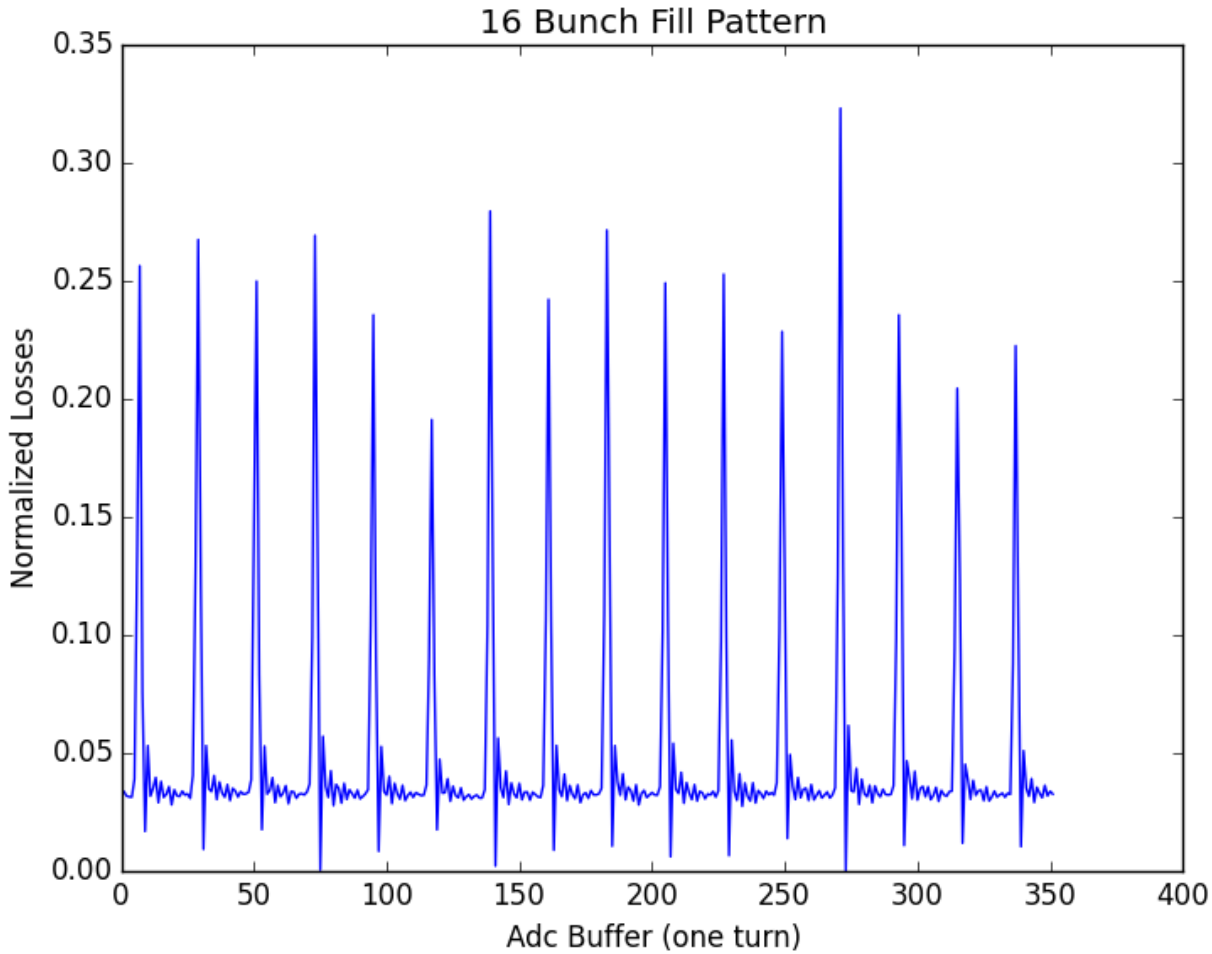


Fast Acquisition – Bunch by Bunch Losses

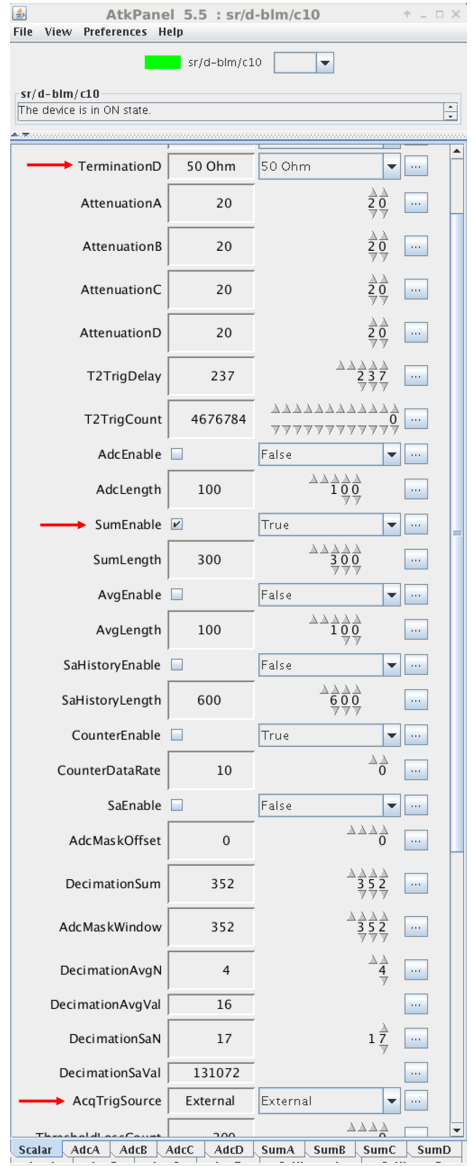
BLD after a vertical scraper (7.2 mm) aperture ⇒ Counting mode



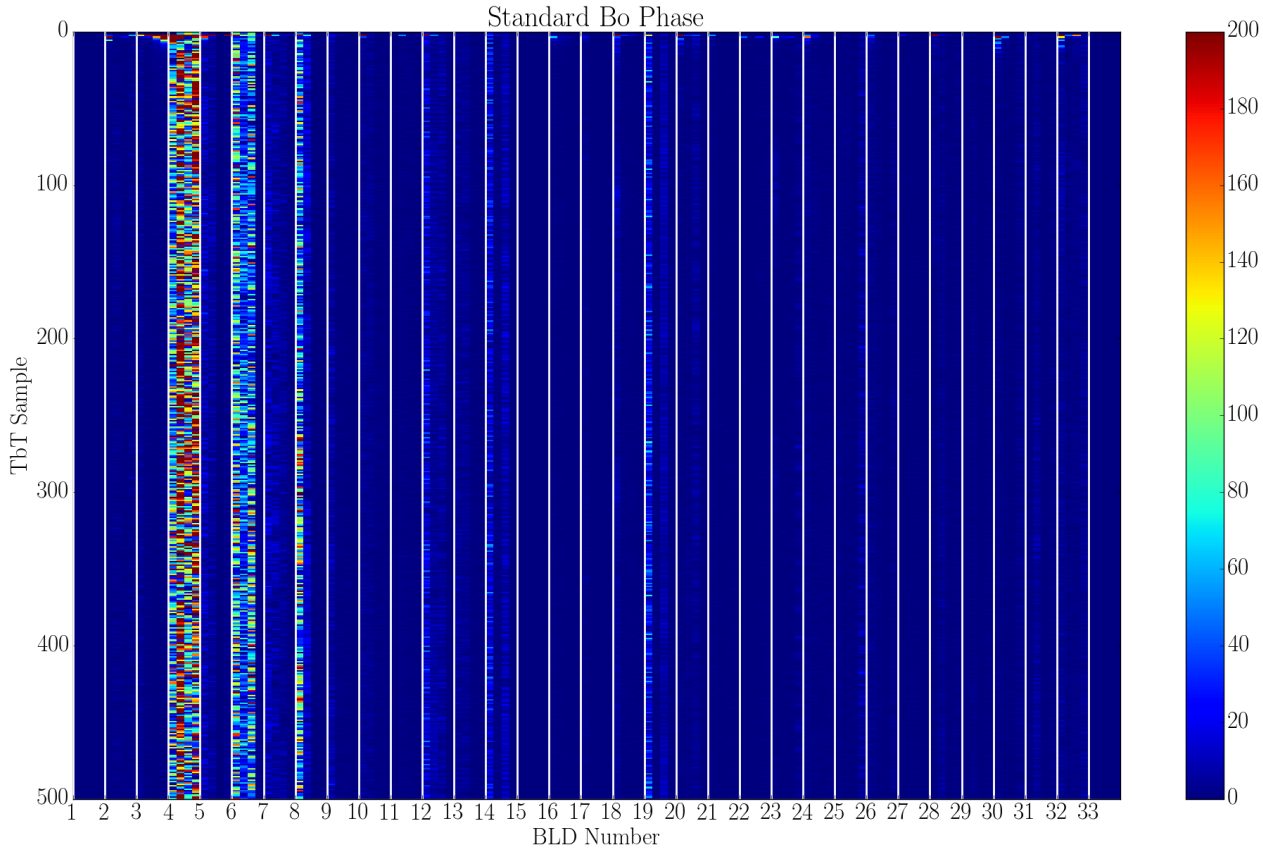
Turn by Turn Acquisition

Settings

- 50 Ω Impedance
- DecimationSum = 1 turn (352)
- External Trigger



Turn by Turn – Booster Phase Shift



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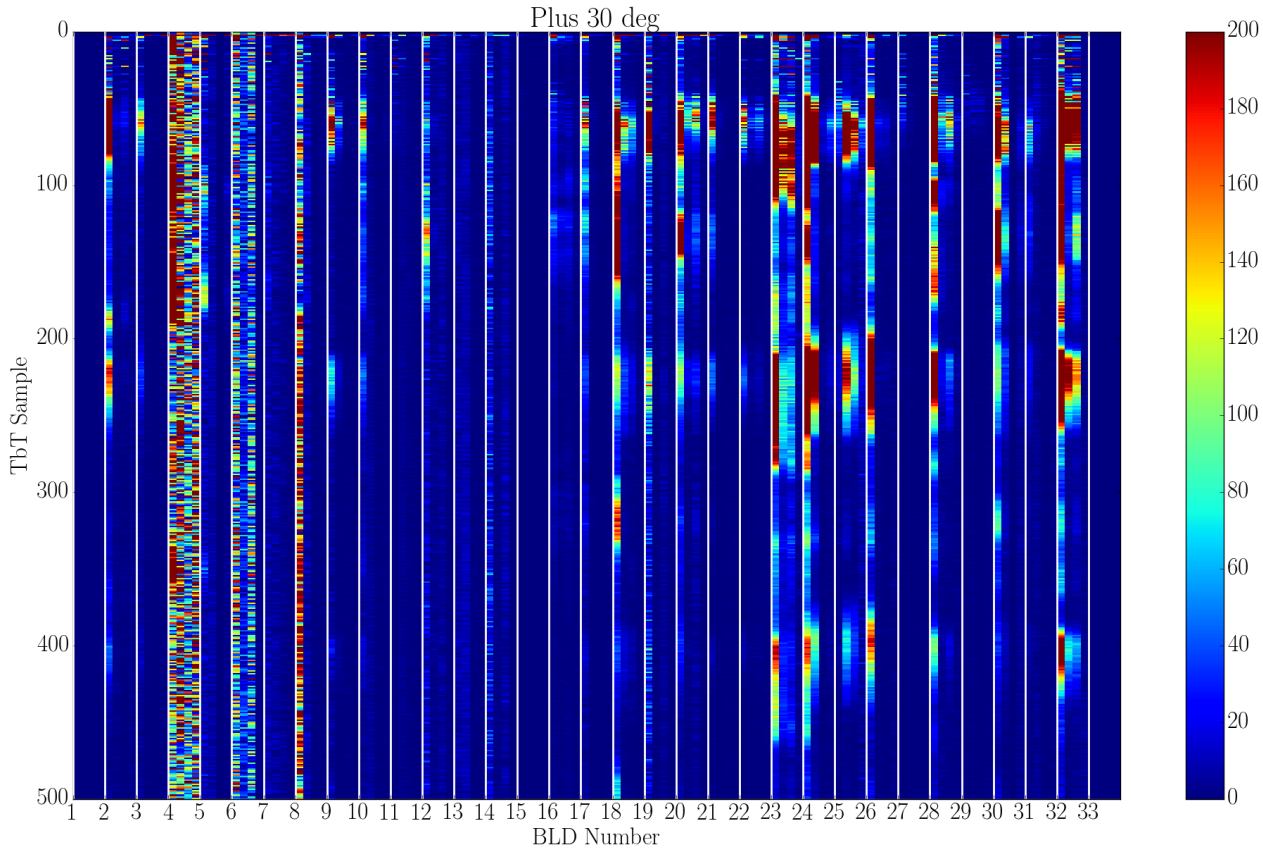

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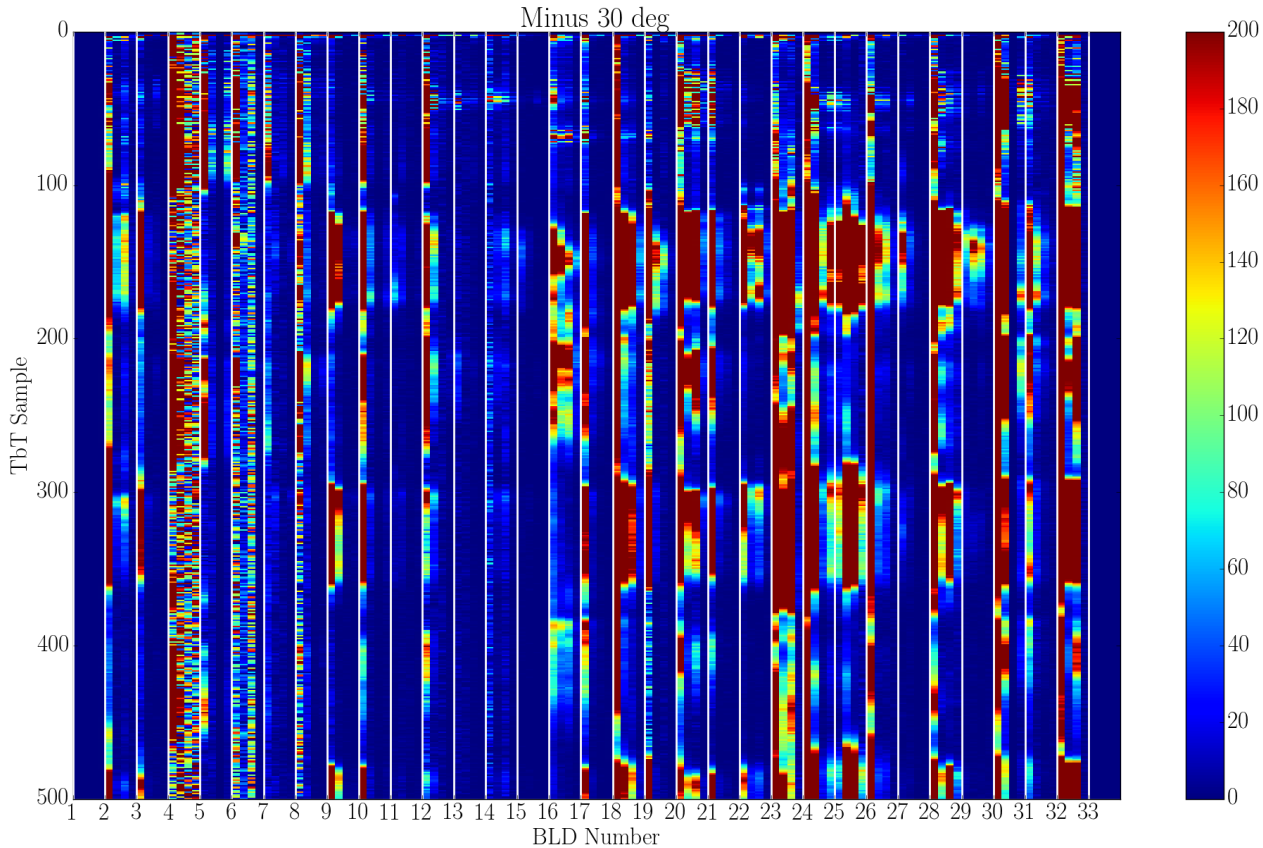

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Many thanks to K. Scheidt, F. TaouTaou, N. Benoist, JL. Pons