The European Synchrotron

Results with the completely commissioned new ESRF Beam Loss Detectors system

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Beam Loss Detection

Monitor and localize the particle losses around the machine to protect the accelerator from damages, see "hidden" obstacles, and improve the machine parameters

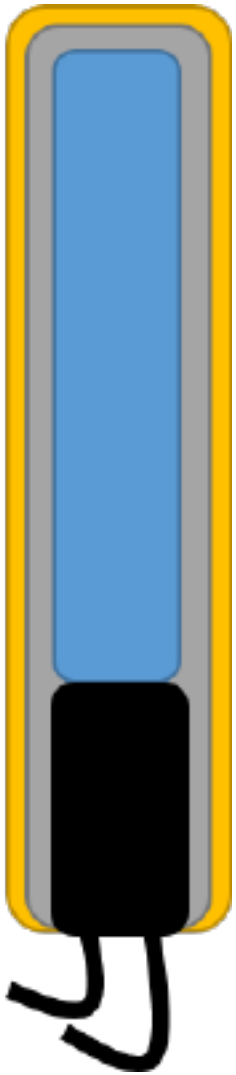
- **Fast Losses:** Beam losses over (almost) bunch by bunch or turn by turn base
- **Slow Losses:** Beam losses integrated over time

Beam Loss Detection

Monitor and localize the particle losses around the machine to protect the accelerator from damages, see "hidden" obstacles, and improve the machine parameters

- Current ESRF system is getting obsolete
- Design a new system for EBS
- Commissioning of the new system on ESRF current machine to have it ready for EBS

ESRF/EBS BLDs – Resume



- 128 BLDs PMT+Scintillator+Lead shielding
- Power/Readout electronics Libera-BLM
- 4 BLDs per BLM (32)
- Independent gain and attenuation settings
- Relative calibrated losses
- "Slow" /"fast" losses
- Standard/Injection operation

BLDs Position

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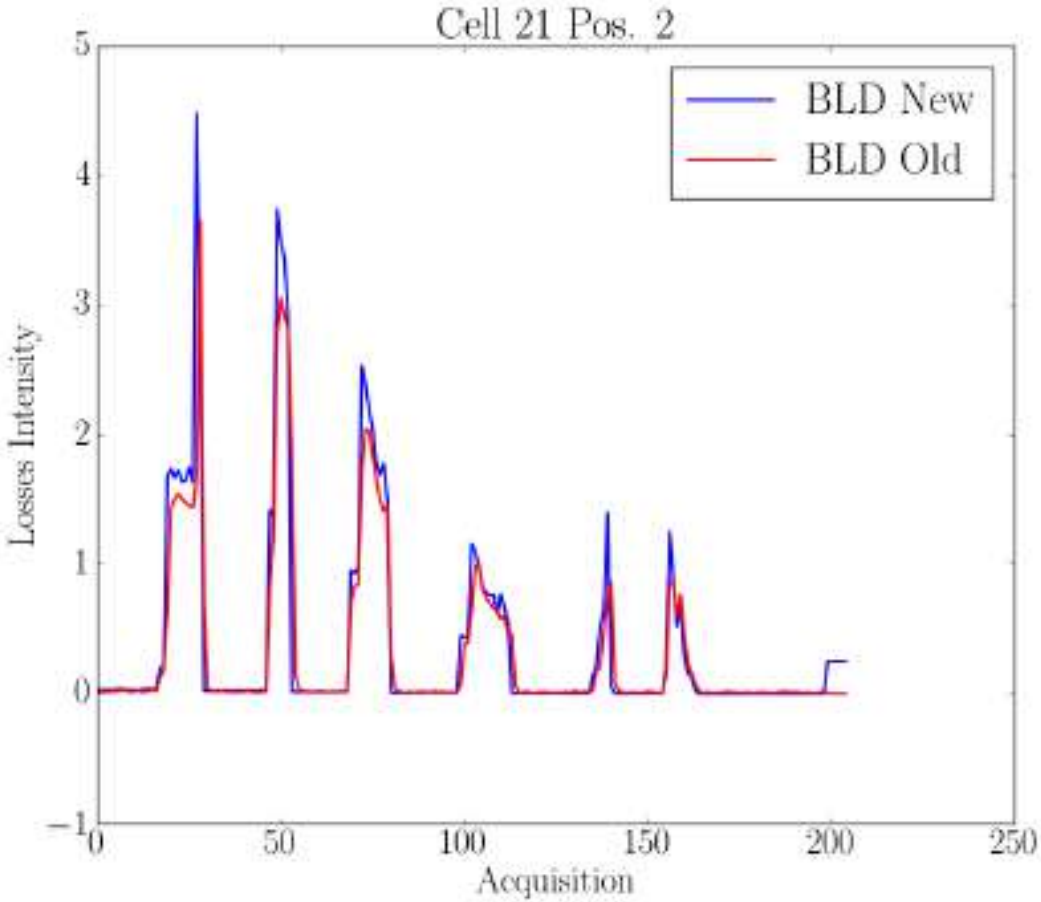

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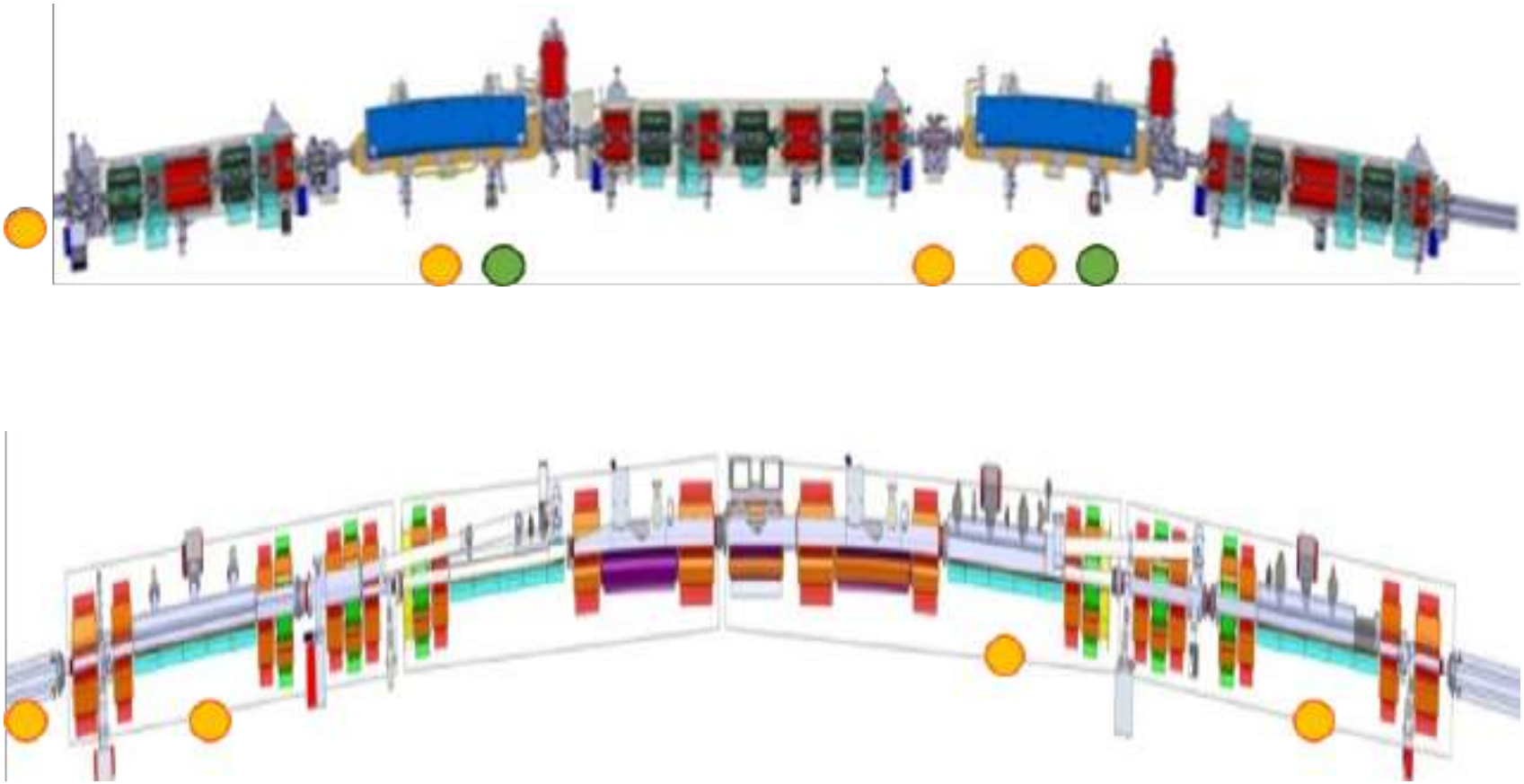
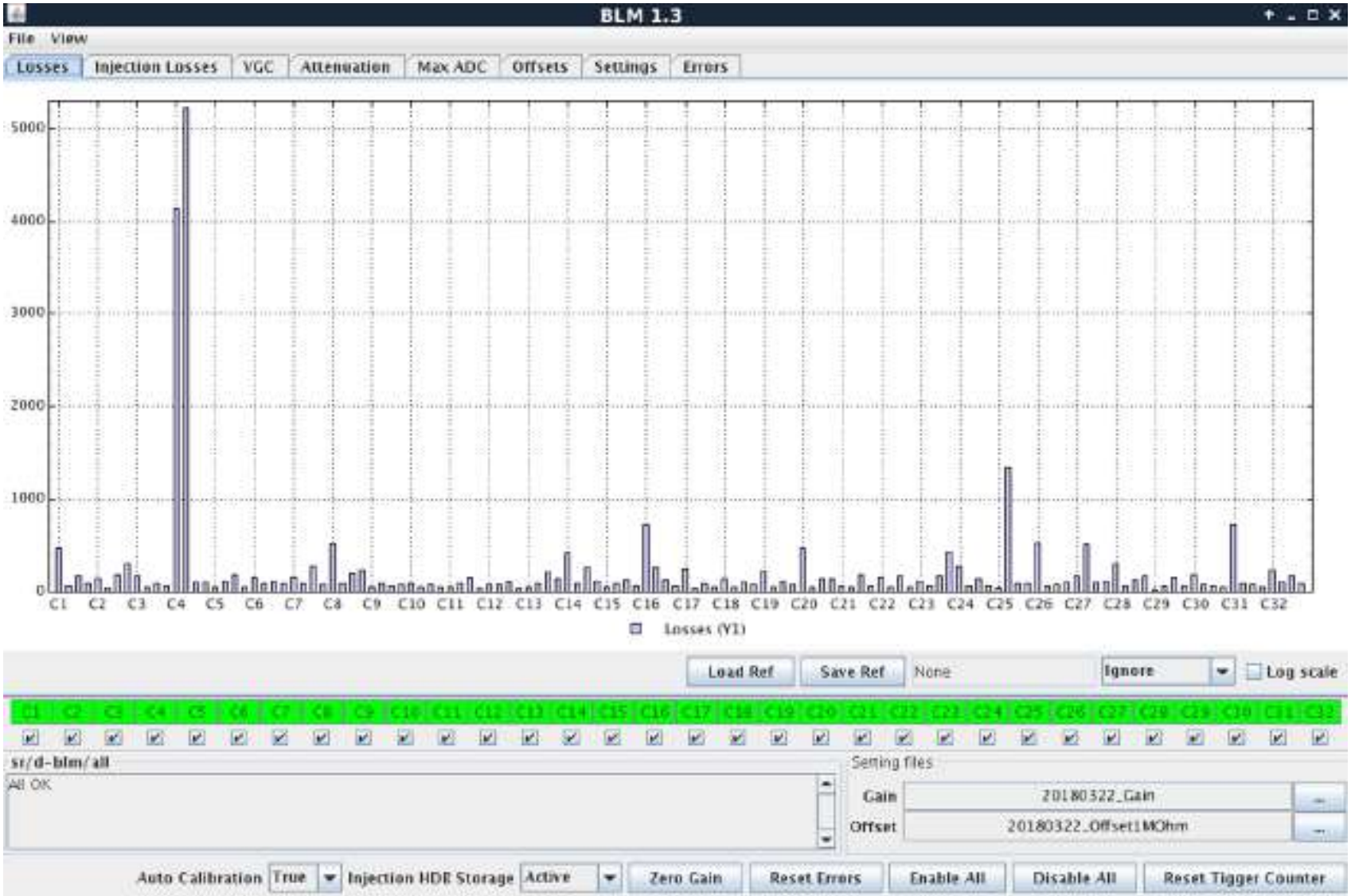
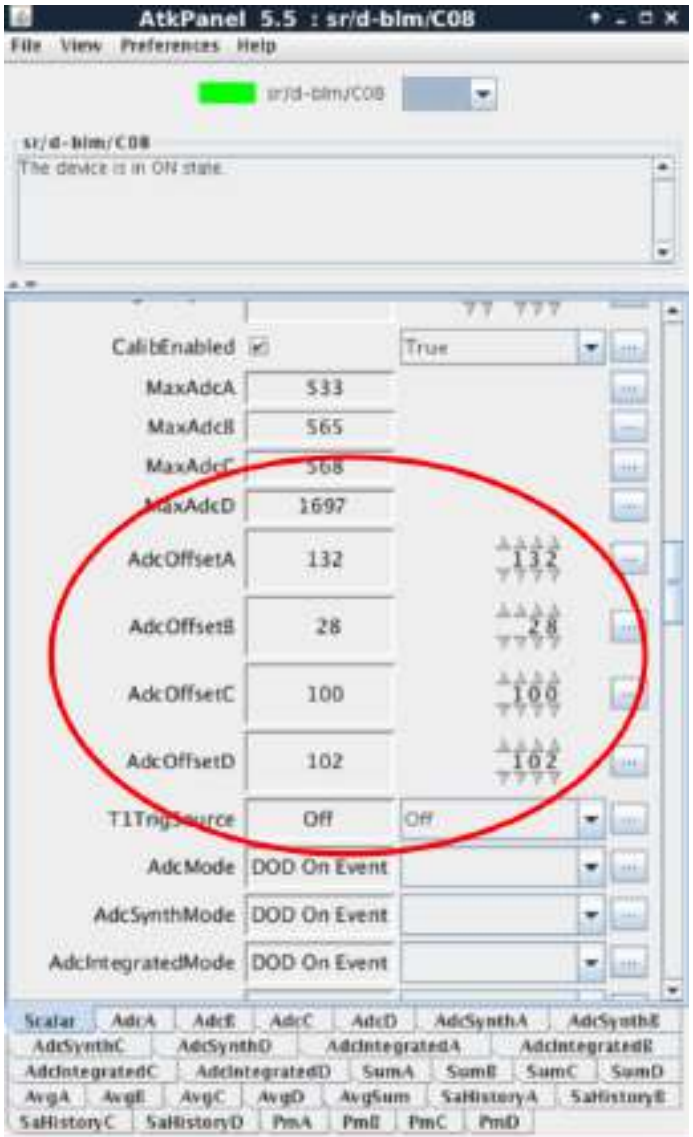


Standard operation

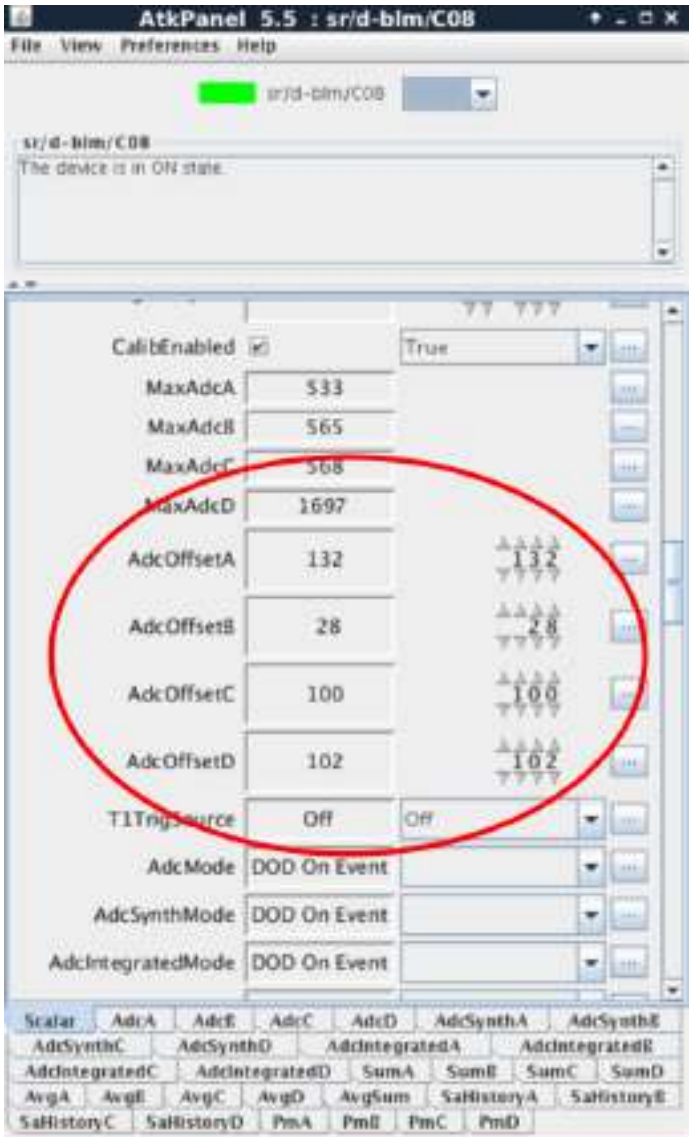


ADC-Offset



Measure ADC-signal for all the gain, attenuation and termination condition without beam

ADC-Offset



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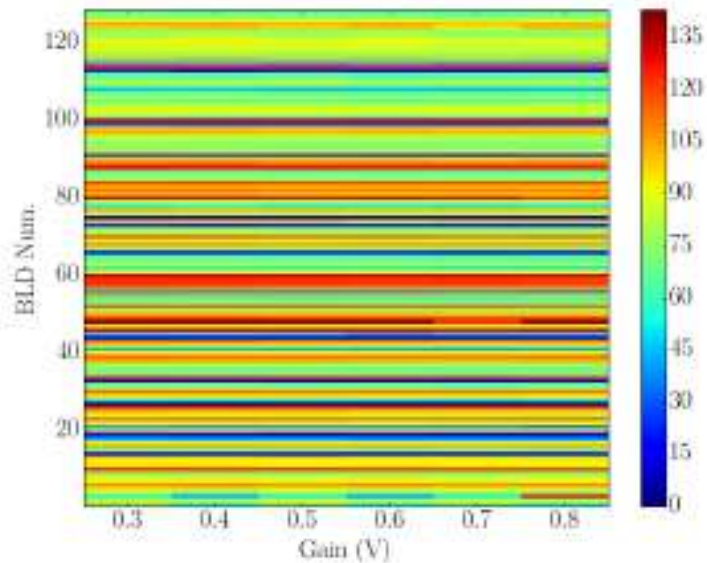
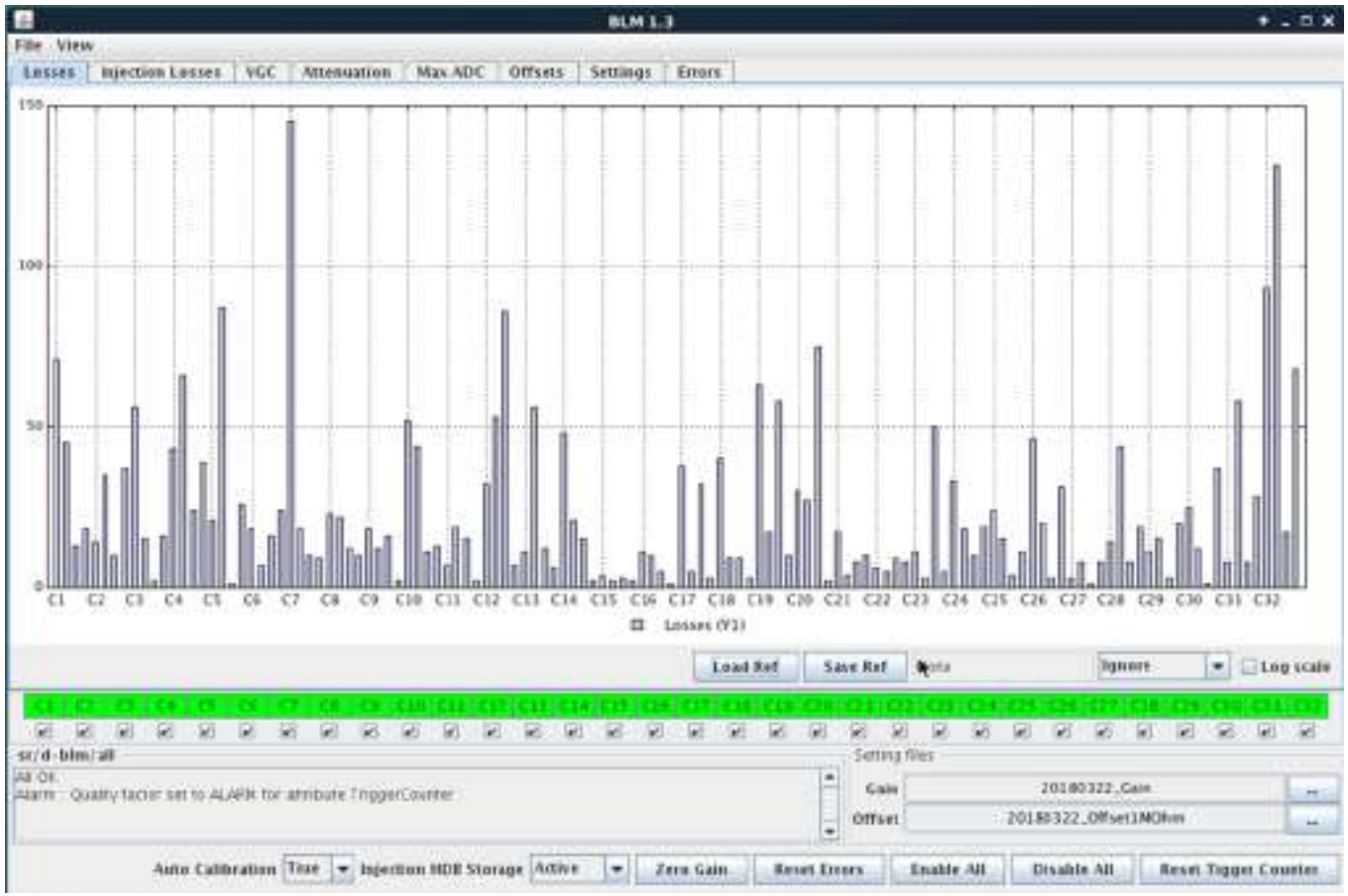
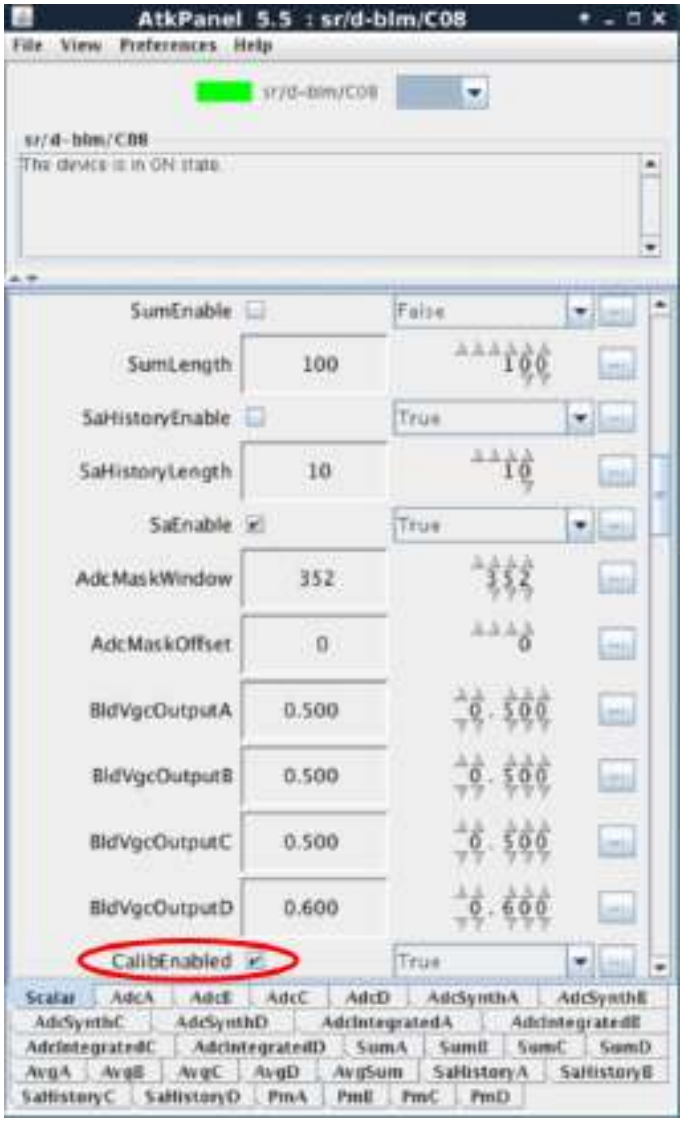


ADC-Offset

No beam



Calibration



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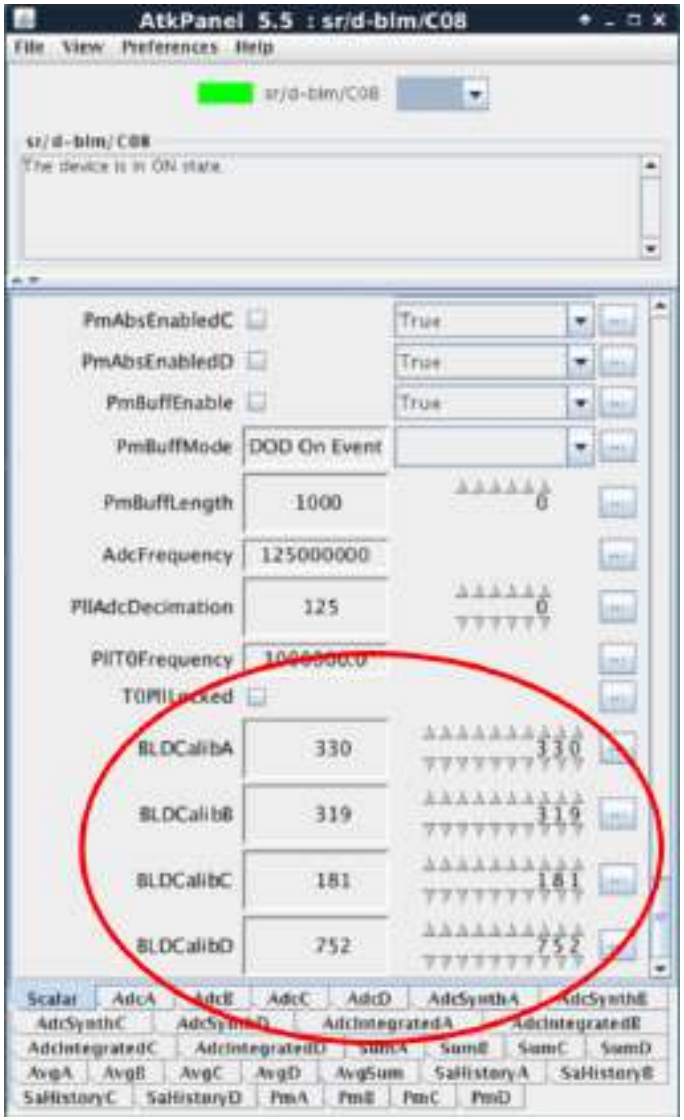
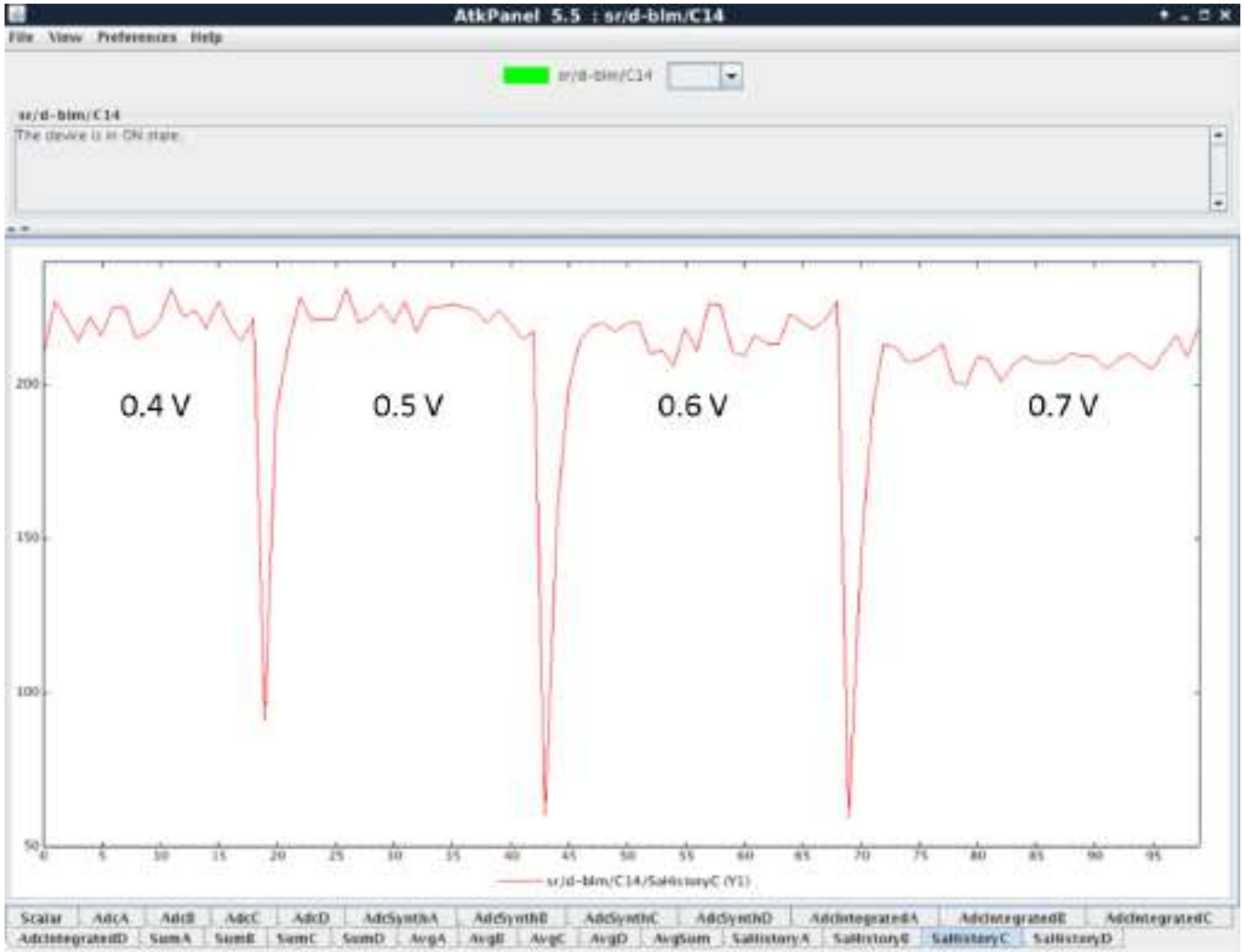


$$SA_C = SA \times G \times C \times A$$

- SA_C: Calibrated Losses
- SA: Losses (Could be SA, TbT, Avg, ADC Synt.)
- G: Coefficient depending on the applied gain
- C: Calibration value (inverse of the sensitivity of the PMT)
- A: Value depending on the BLD Attenuation

Calibration

Calibration



Auto-Gain

In order to avoid saturation gain and saturation are automatically decreased

Problems:

- When calibration is on, no raw SA data are available
- Calibrated SA maximum different for all BLDs

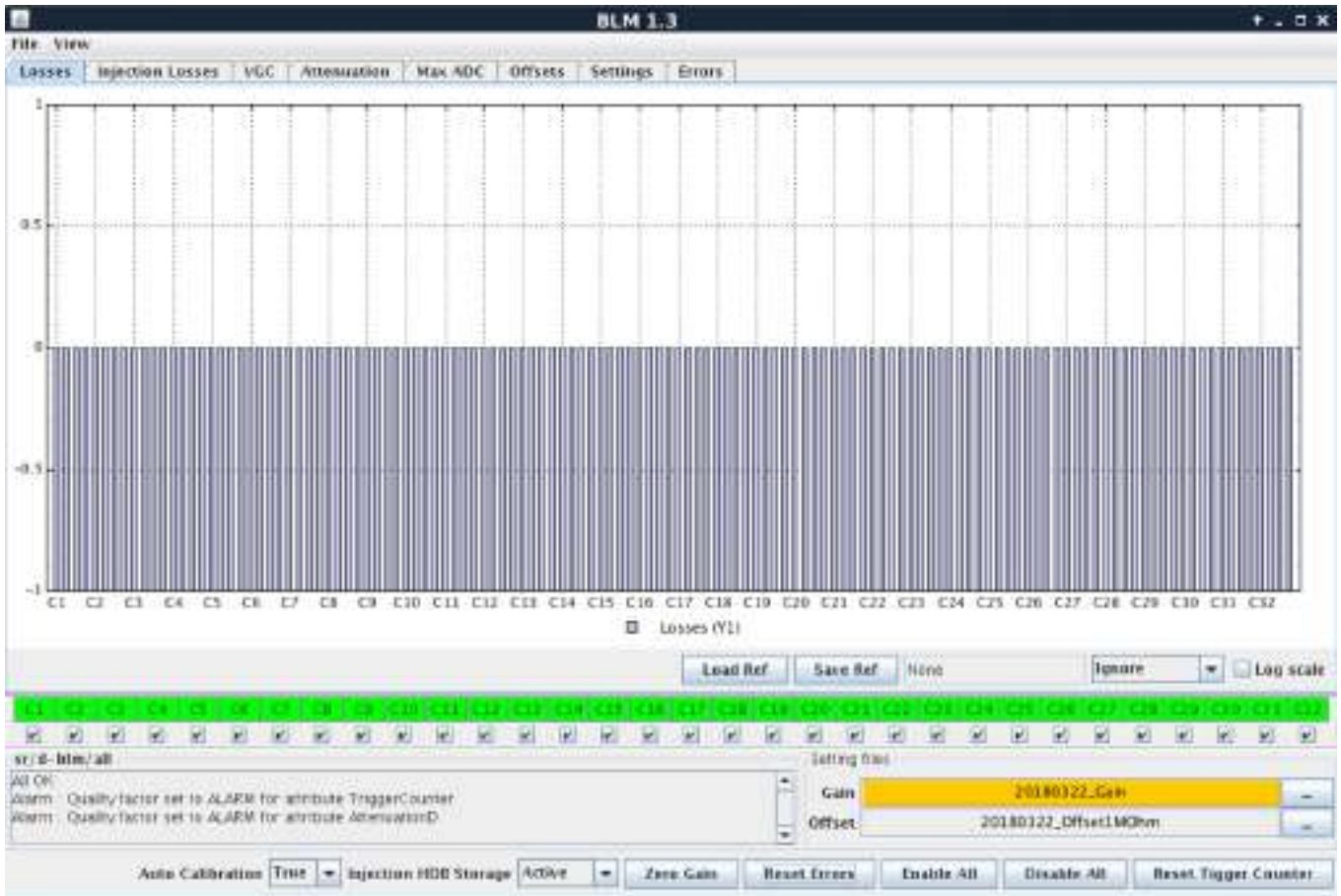
$$SA_{C,M} = SA_M \times G \times C \times A$$

$\Downarrow$

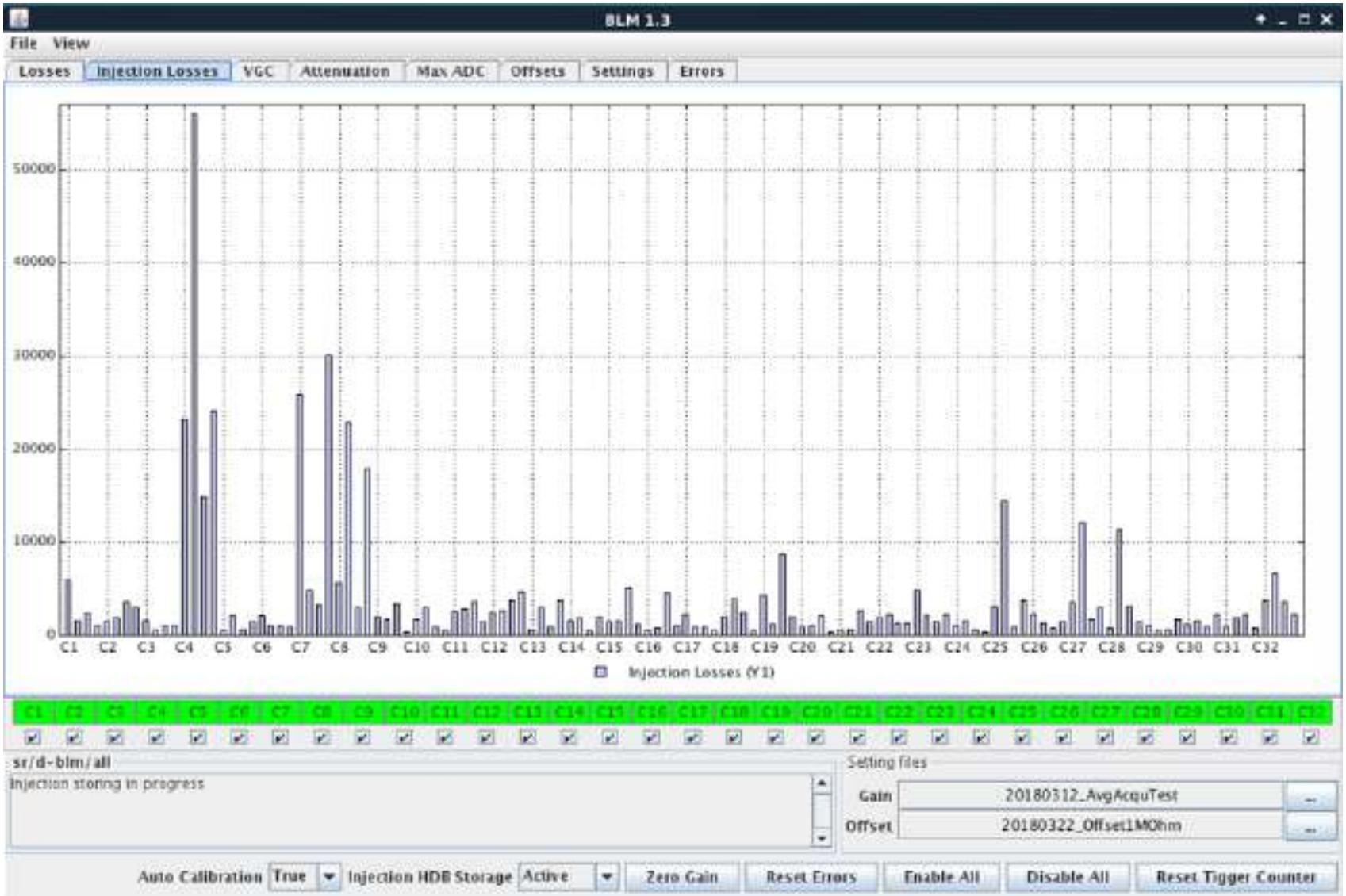
Look-up tables according to gain and attenuation

Protection from Ambient Light

To avoid problem due with ambient light during shutdown ⇒ Zero gain automatically set when current in the storage ring is zero



Injection Mode



Injection Settings

- Triggered Mode on
- Termination $= 50\,\Omega$
- Gain and Attenuation chosen not to saturate ADC data
- AVGmode: enabled
- DecimationAvgN $= 2$
- AVGLength $= 10$

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Switch to injection mode when Linac and septum are in ON state

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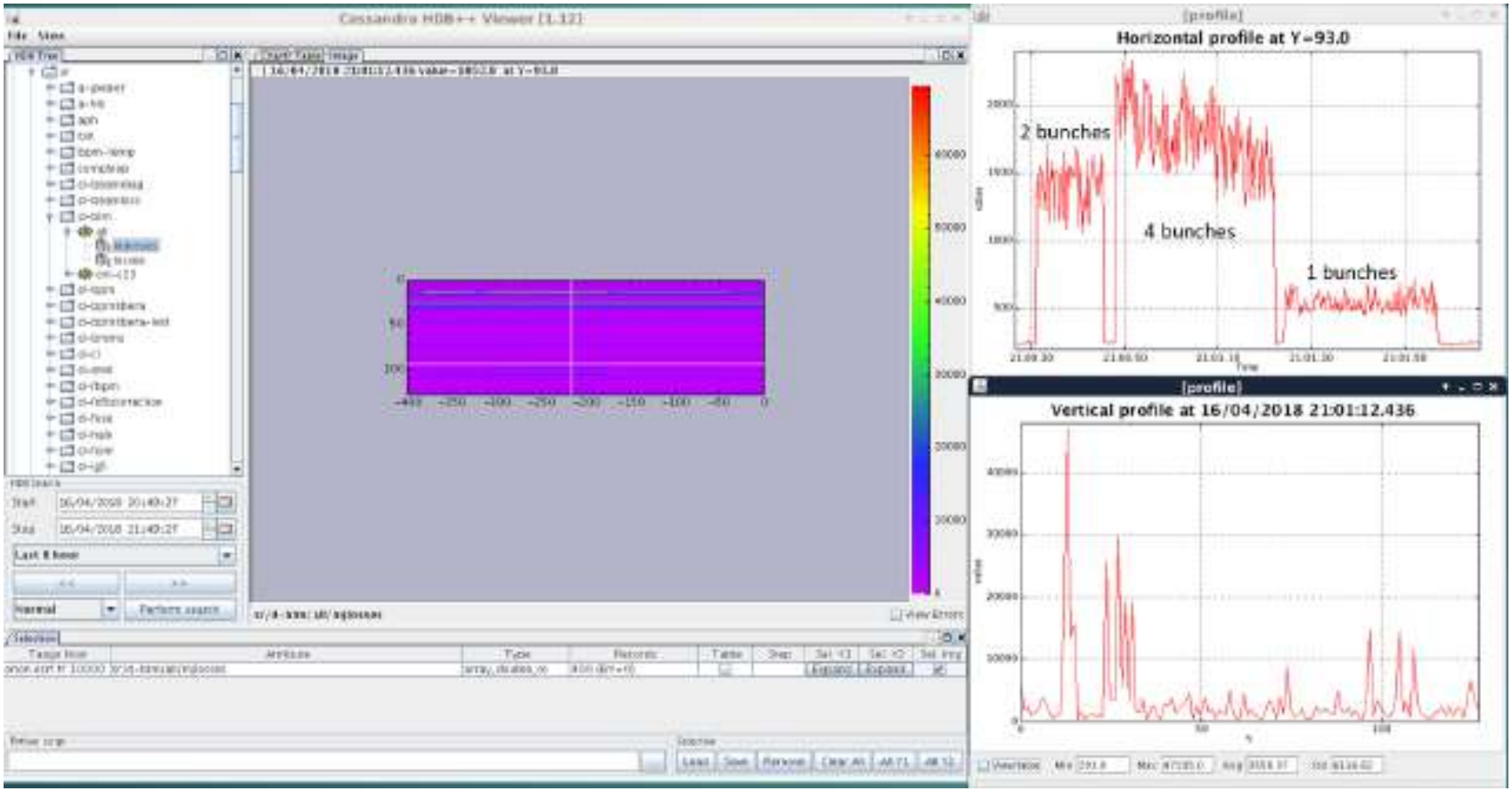
Switch to injection mode when Linac and septum are in ON state

Losses acquired at 4 Hz
For each BLD, 1 value per shot is saved

Archiving – Injection



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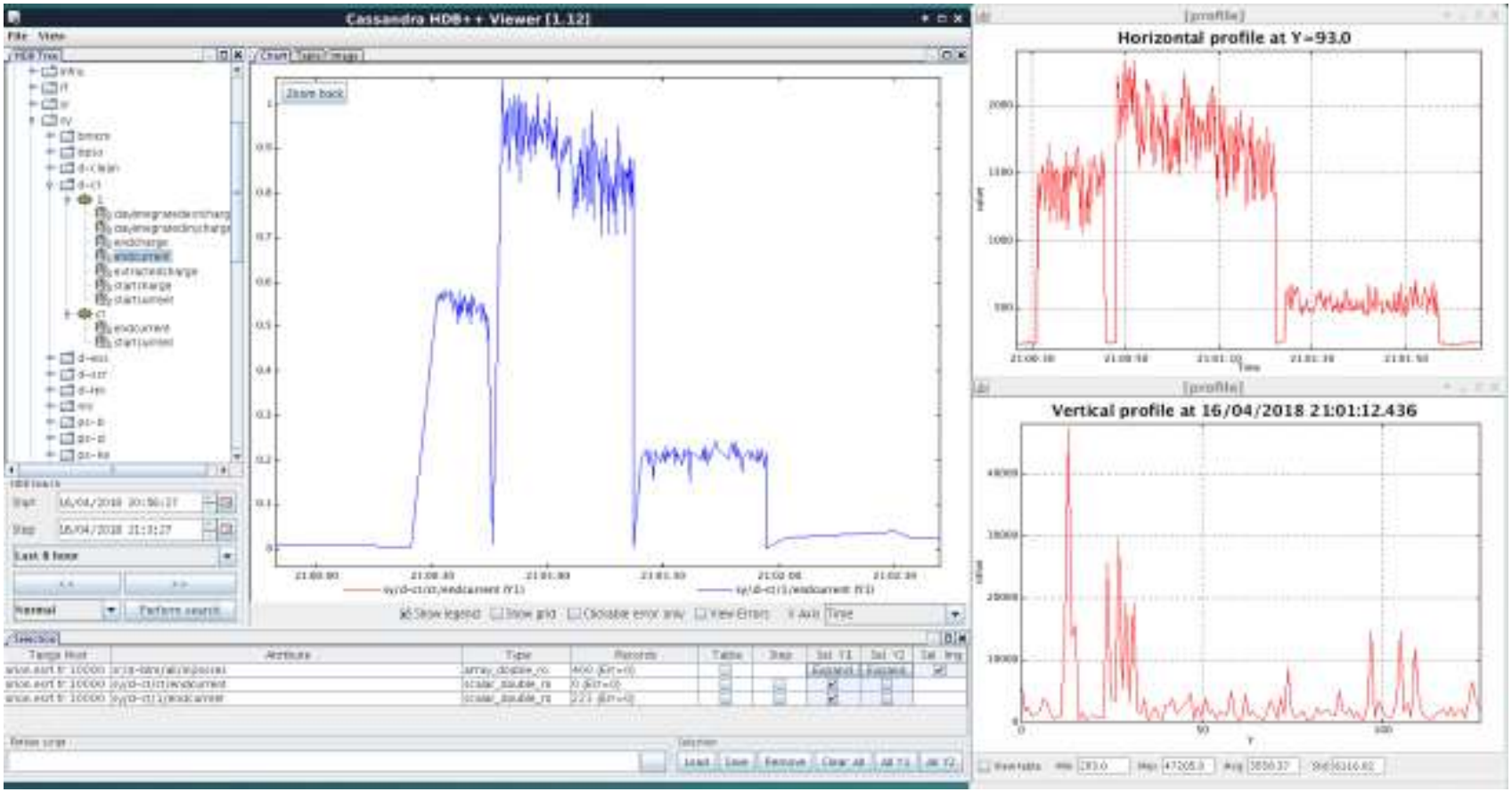
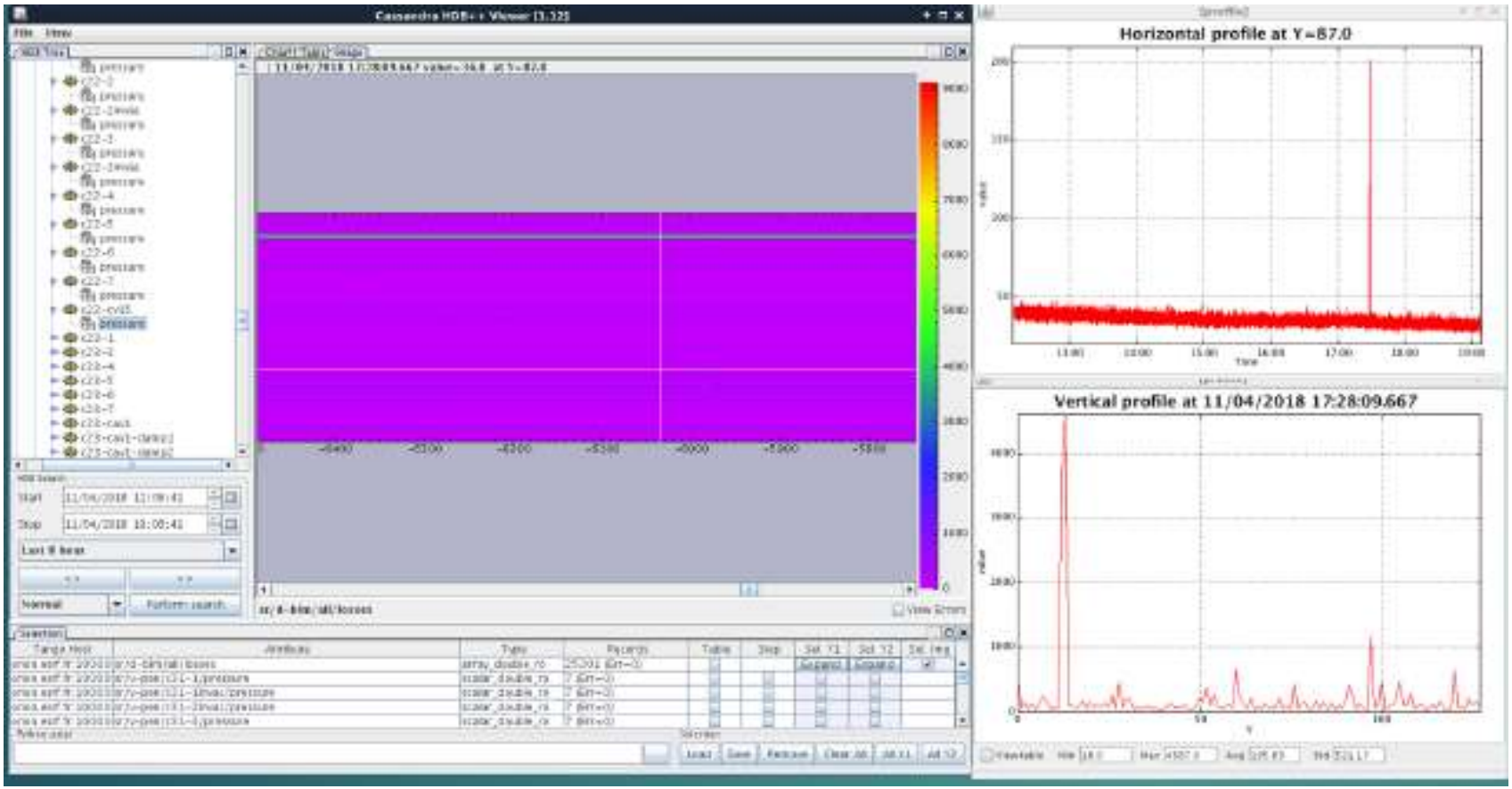


Archiving – Standard Operation, Pressure Burst



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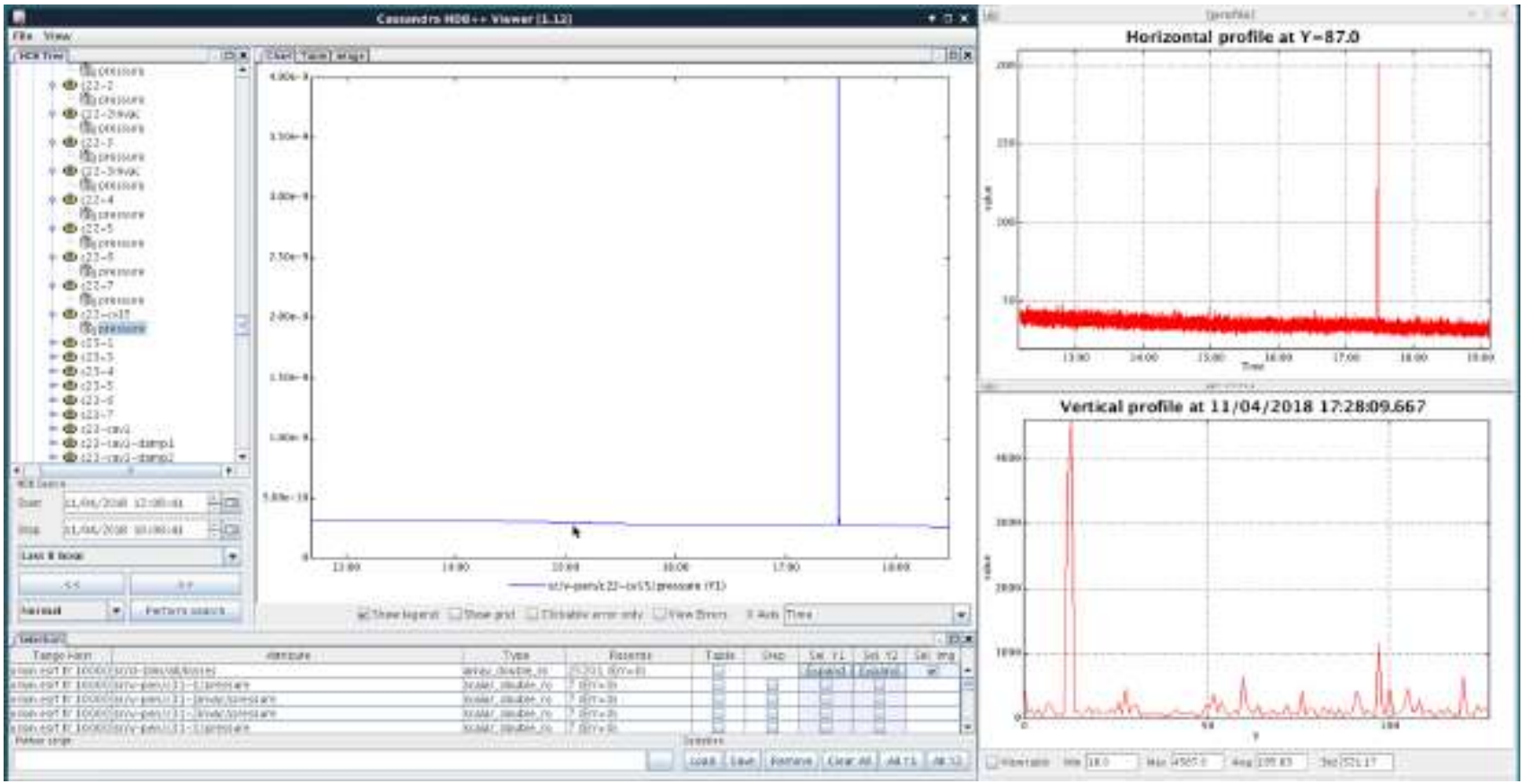
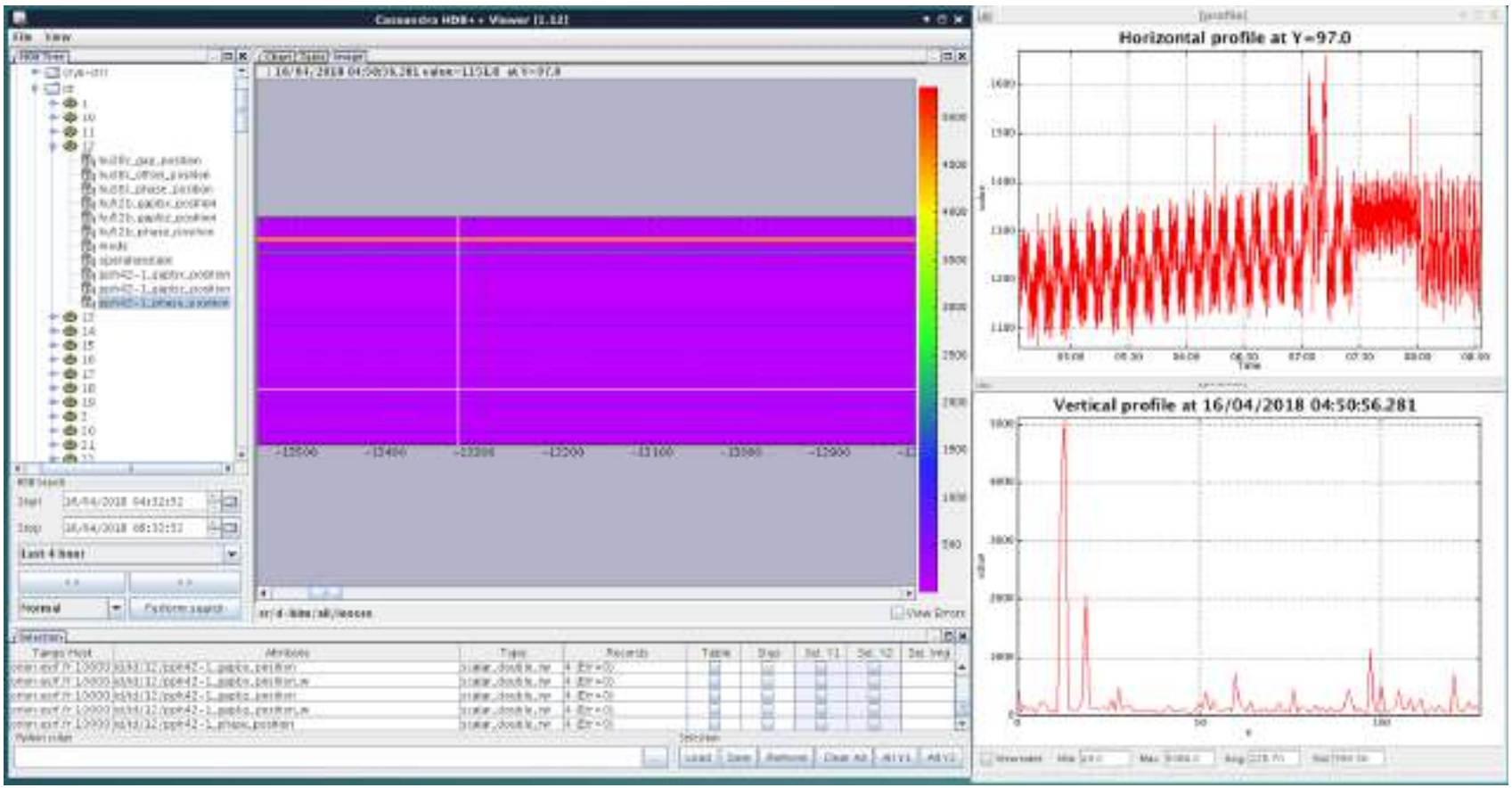


Archiving – Standard Operation, IDs Scan



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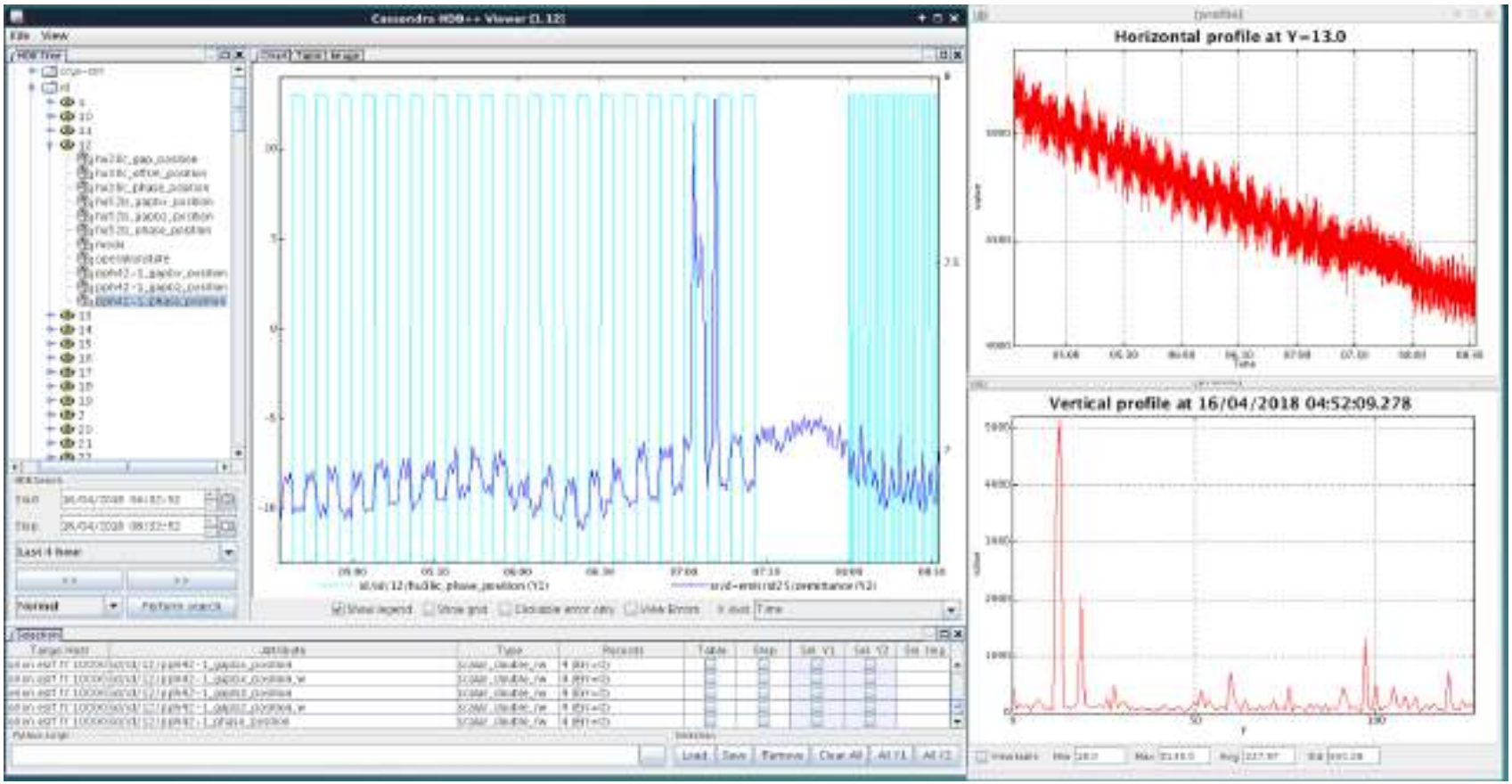

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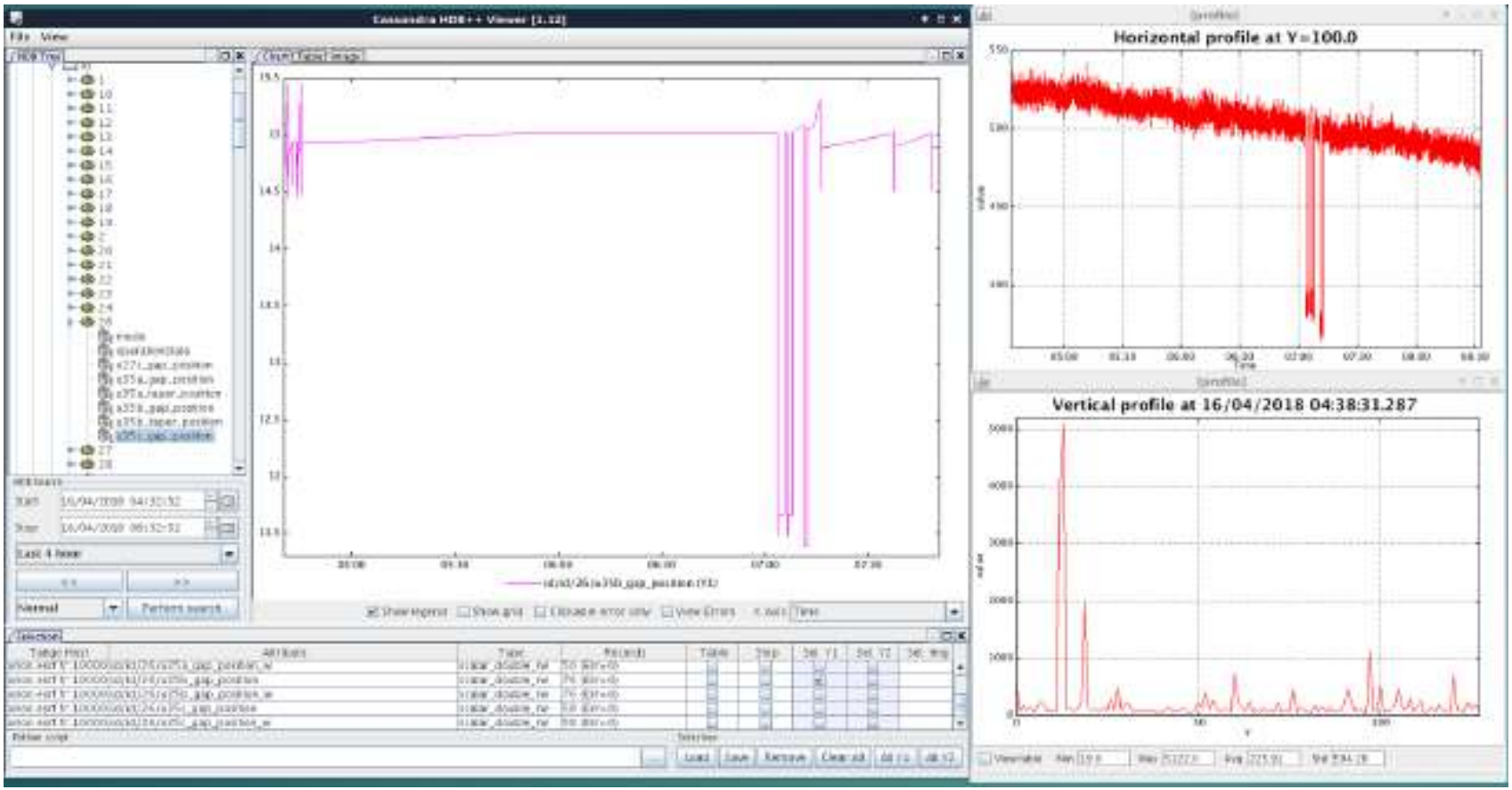
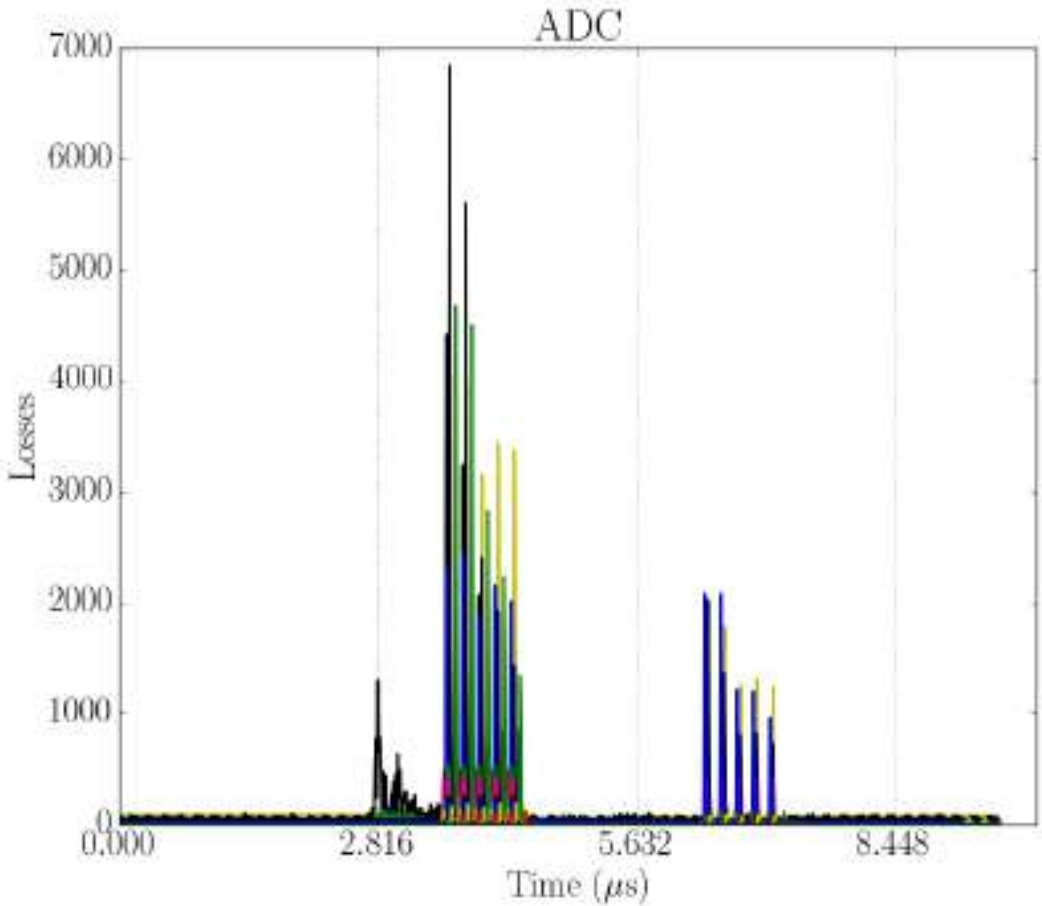


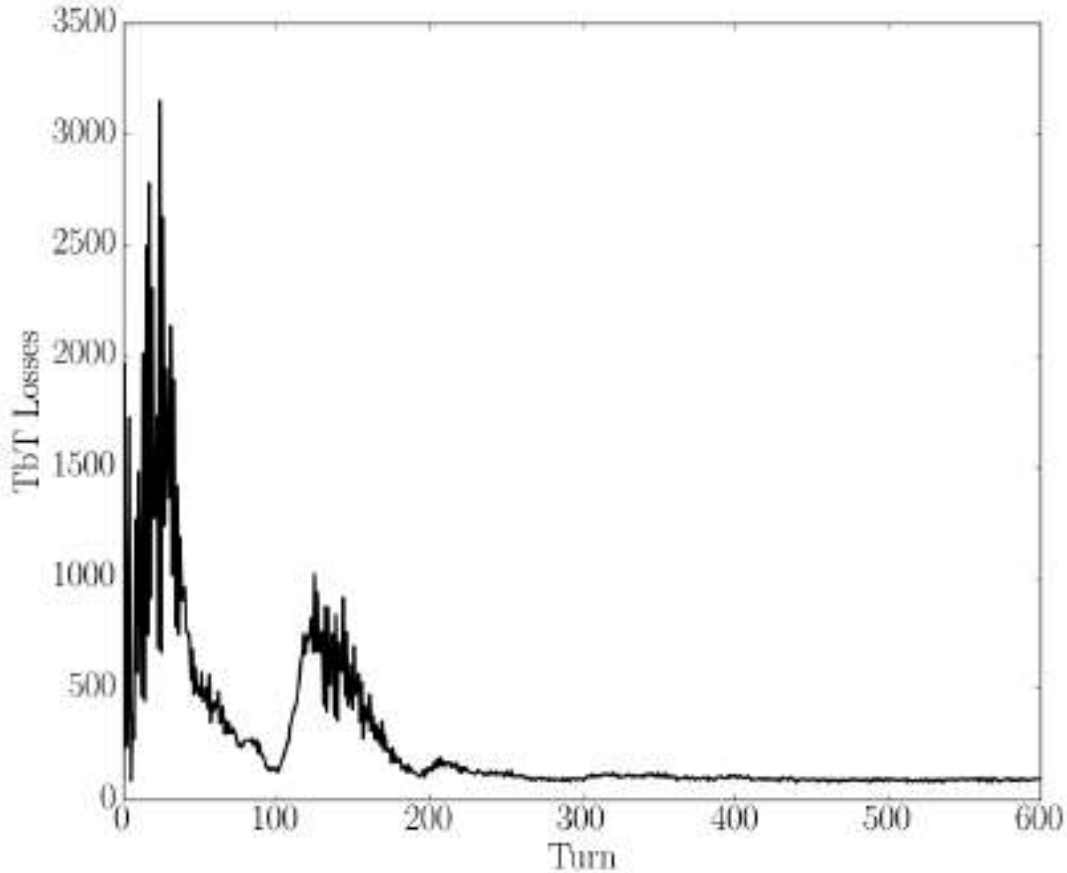
ADC Losses – Machine Studies

- Triggered Mode ON
- Termination = 50 Ω
- AdcEnabled: ✓
- AdcSynthEnable: ✓
- AdcLength = 1800
- AdcSynthLength = 1800



TbT Losses – Machine Studies

- Triggered Mode ON
- Termination = 50 Ω
- TbtEnabled: ✓
- AdcLength = 600



Summary

- 128 BLDs have been commissioned
- Modifications on Libera BLM server have been performed:
  - To set ADC-Offset
  - To return calibrated data
- An All-Application has been developed
  - Standard operation
  - Injection mode
- Auto-gain routine to avoid saturation
- Data are stored for comparison with EBS
- ADC and TbT losses for machine studies

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