

ESRF | The European Synchrotron

Results with the completely commissioned new ESRF Beam Loss Detectors system

Laura Torino Libera Workshop 2018, 17/05/2018

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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BLDs Position





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BLDs Position







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Standard operation





ADC-Offset

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



ADC-Offset

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





ADC-Offset

No beam





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$\mathsf{SA}_{\mathsf{C}}=\mathsf{SA}\times\mathsf{G}\times\mathsf{C}\times\mathsf{A}$

- 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







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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

$$\mathsf{SA}_{C,M} = \mathsf{SA}_M \times G \times C \times A$$

Look-up tables according to gain and attenuation



Protection from Ambient Light

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





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Injection Mode





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Injection Settings

- Triggered Mode on
- Termination = 50 Ω
- 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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Losses acquired at 4 Hz For each BLD, 1 value per shot is saved



Archiving – Injection





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Archiving – Injection





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Archiving – Standard Operation, Pressure Burst





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Archiving – Standard Operation, Pressure Burst





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Archiving – Standard Operation, IDs Scan





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Archiving – Standard Operation, IDs Scan





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Archiving – Standard Operation, IDs Scan





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ADC Losses – Machine Studies

- Triggered Mode ON
- Termination = 50Ω
- 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
 - $\hfill\square$ To return calibrated data
- An All-Application has been developed
 - $\hfill\square$ 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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