Diamond-II: Beam Loss Monitoring

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Diagnostics Group

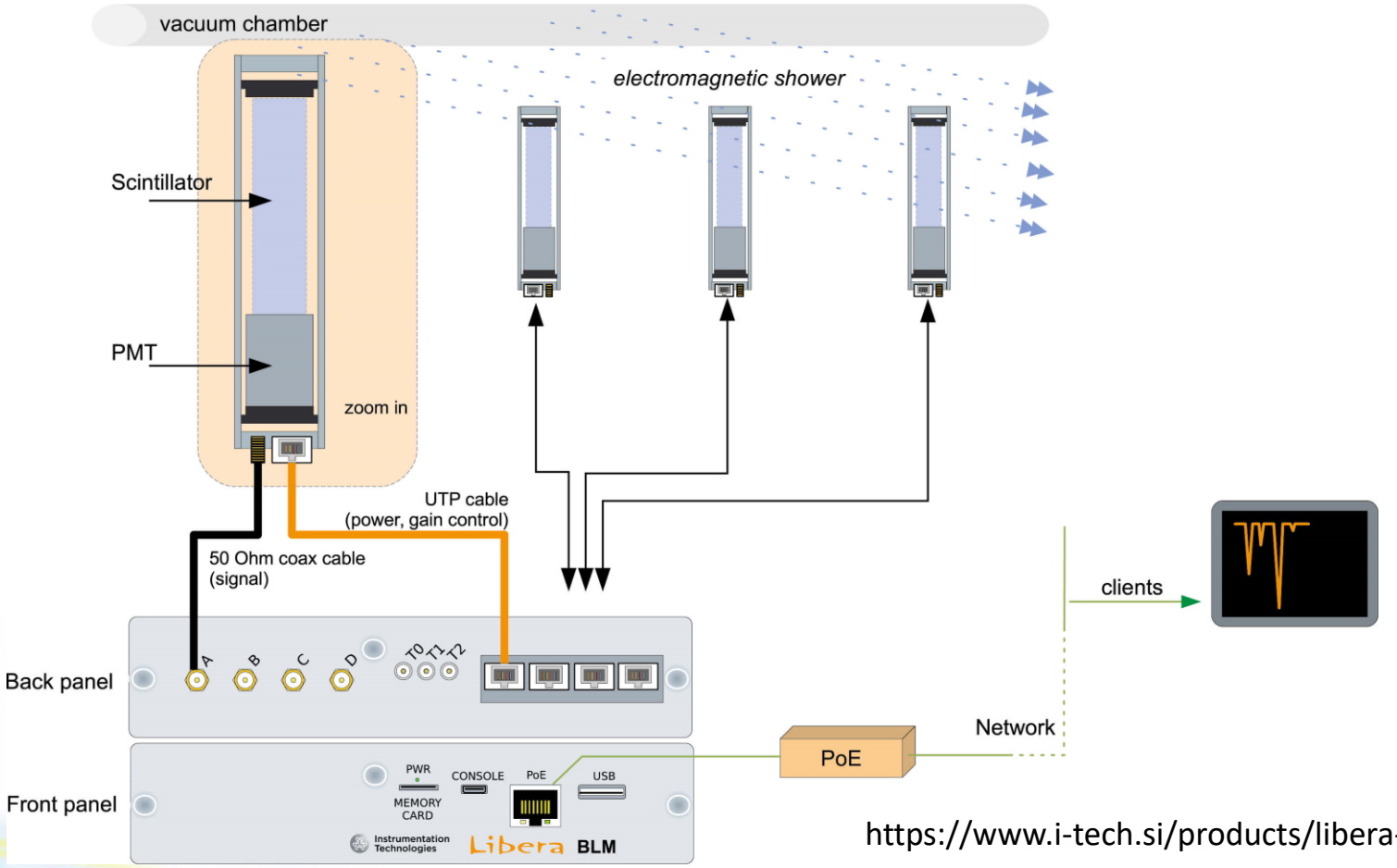
Requirements

- Measurement of both “slow” and “fast” losses:
  - “slow” = losses that determine the beam lifetime (1s timescale)
  - “fast” = losses from faults or beam perturbation from injection (single turn to almost bunch-by-bunch)
- Compatible with spatial constraints of the lattice
- Distributed around the storage ring
- Ability to deploy extra detectors as necessary (at injection, collimators)

L. Torino and K. B. Scheidt, “New Beam Loss Detector System for EBS-ESRF”, in Proc. 7th Int. Beam Instrumentation Conf. (IBIC’18), Shanghai, China, Sep. 2018, pp. 346–352. doi:10.18429/JACoW-IBIC2018-WEOB01

Beam Loss Monitoring

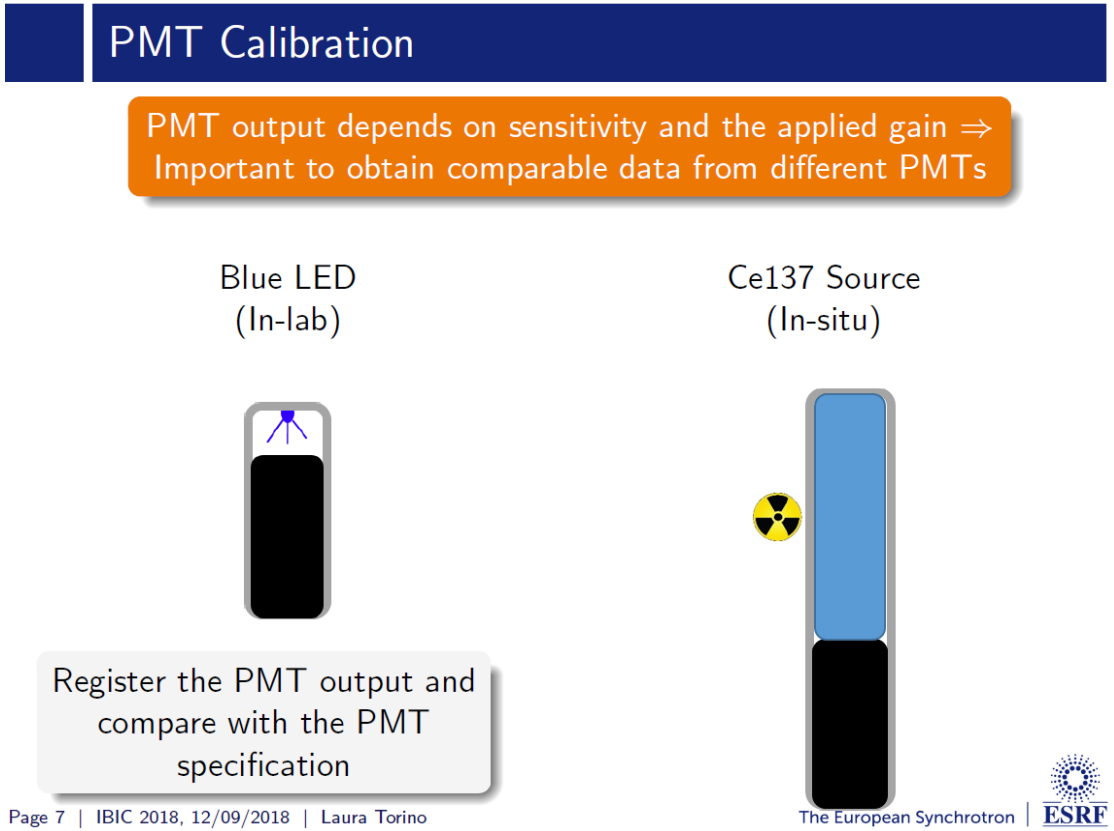
Use the same approach as the ESRF-EBS and Soleil
→ Scintillator + PMT, with Libera BLM Electronics



https://www.i-tech.si/products/libera-blm/

Instrumentation + Calibration

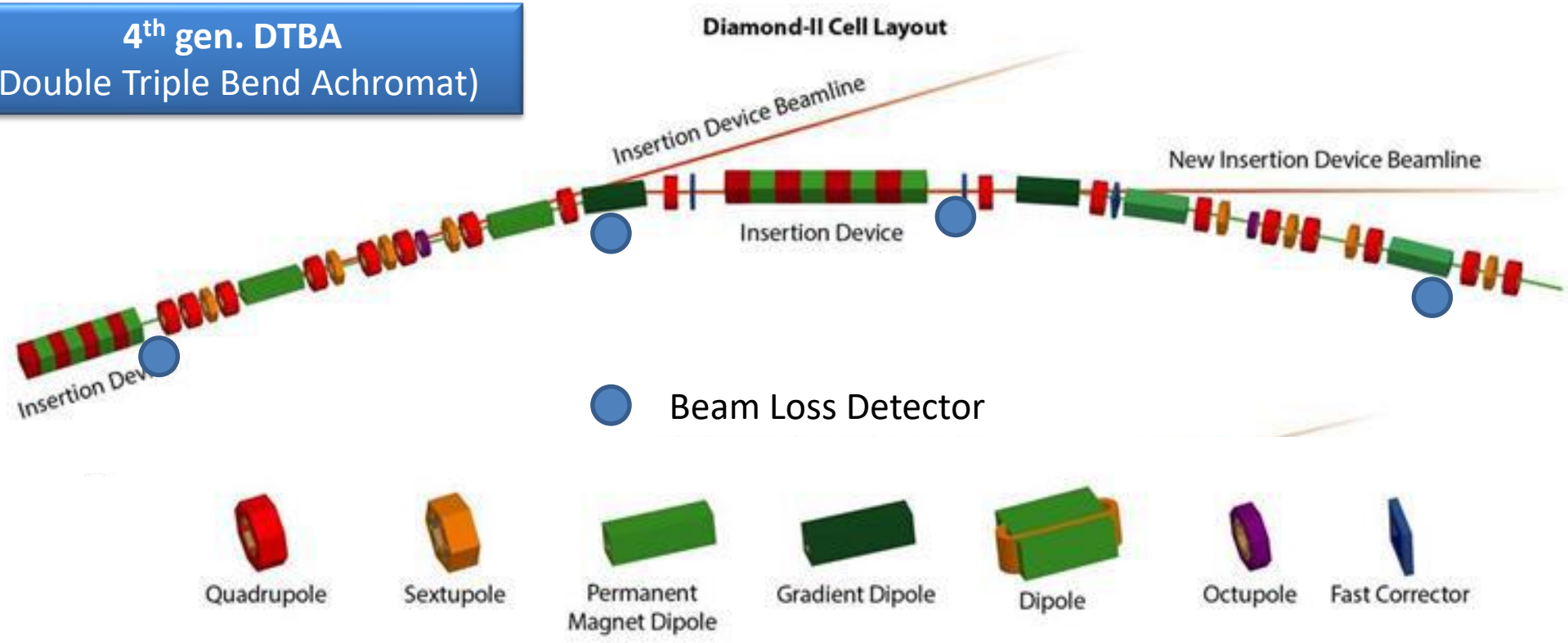
Beam Loss Detector (BLD)	Readout Electronics
Scintillator + PMT	Libera Beam Loss Monitor (BLM)
Commercially available or built in-house	Commercially available
4 per cell: 2 per girder • Scintillator at the same height as beam pipe • Exact locations to be decided, but must ensure consistency on all girders.	1 per cell (supporting 4x BLDs): • In-tunnel
96 x BLDs + extras	• 24 x BLMs + extras



L. Torino and K. B. Scheidt, "New Beam Loss Detector System for EBS-ESRF", IBIC 2018, Shanghai, China.

Systematic Location (TBC)

4th gen. DTBA
(Double Triple Bend Achromat)



General guidance to select appropriate locations:

- Downstream of each straight section
- Downstream of bending magnets
- In the middle of the arcs
- On radial inside

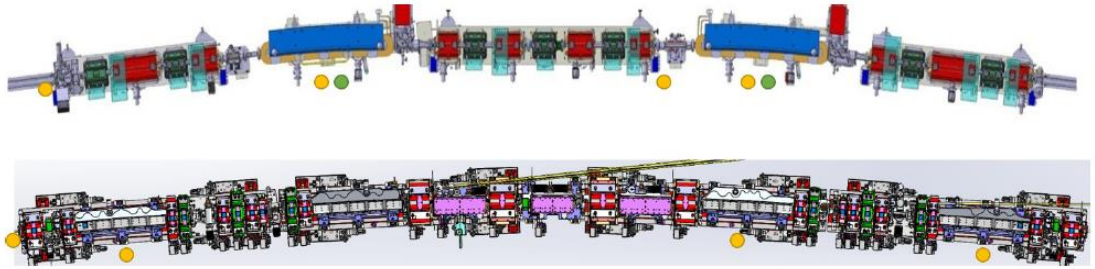
L. Torino and K. B. Scheidt, "New Beam Loss Detector System for EBS-ESRF", IBIC 2018, Shanghai, China.
N. Hubert et al., "New Beam Loss Monitors for Soleil", IBIC 2020, LNLS, Brazil.

Diamond-II Conceptual Design Report, L.C. Chapon, A.J. Dent, A. Harrison, M. Launchbury, D.I. Stuart, R.P. Walker et al., 2019

Studies on Diamond-I

- We already have 5x BLMs and 20x BLDs deployed on Diamond-I
- Planning studies to:
  - Develop new BLM system incl. controls, data analysis etc and assess performance.
  - Compare BLMs in Diamond vs Diamond-II (same as the ESRF-EBS approach shown below)

Location ESRF-EBS

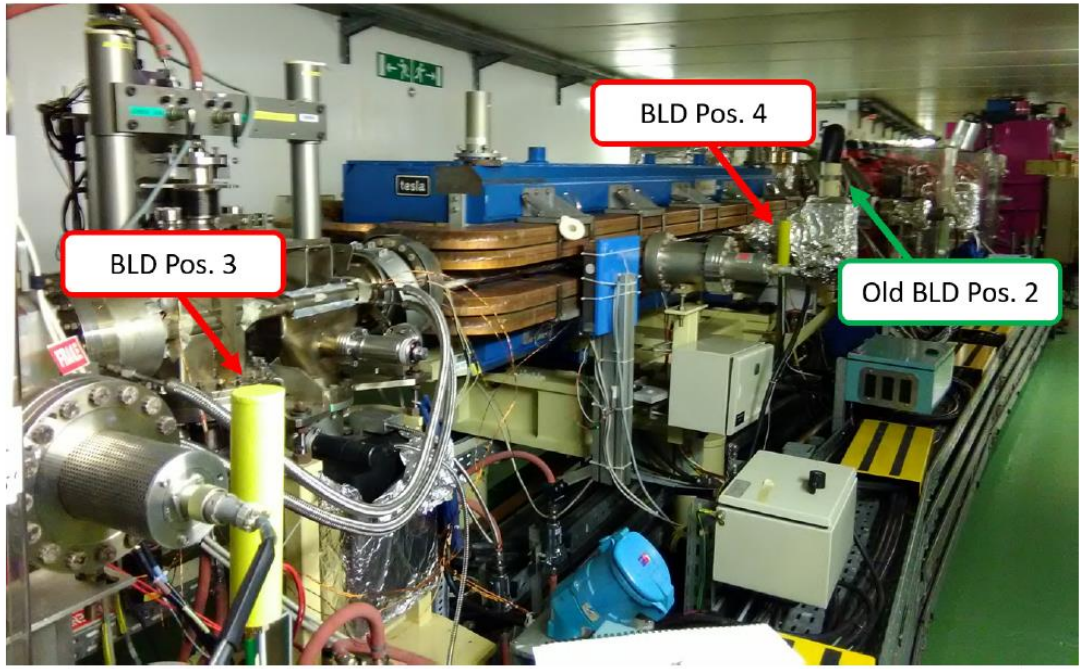


- Inner side of bending magnets
- Comparison old BLD system
- Losses @ IDs monitoring

"Old" BLD system:
64 detectors

"New" BLD system:
128 detectors

ESRF Location Example



Summary

- New beam loss monitoring system using well-established scintillator + PMT with Libera BLM electronics.
- Enabling monitoring of both “slow” and “fast” losses.
- Periodic calibration (annual) using methods established at ESRF-EBS and Soleil.
- Studies are planned on Diamond.
- Locations on Diamond-II girders to be decided.

Thanks to G. Rehm, L. Torino and N. Hubert
for many useful discussions.