Machine-mode aware beam loss monitoring

cosylab CONTROL SYSTEM LABORATORY

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ELSA

TUP007

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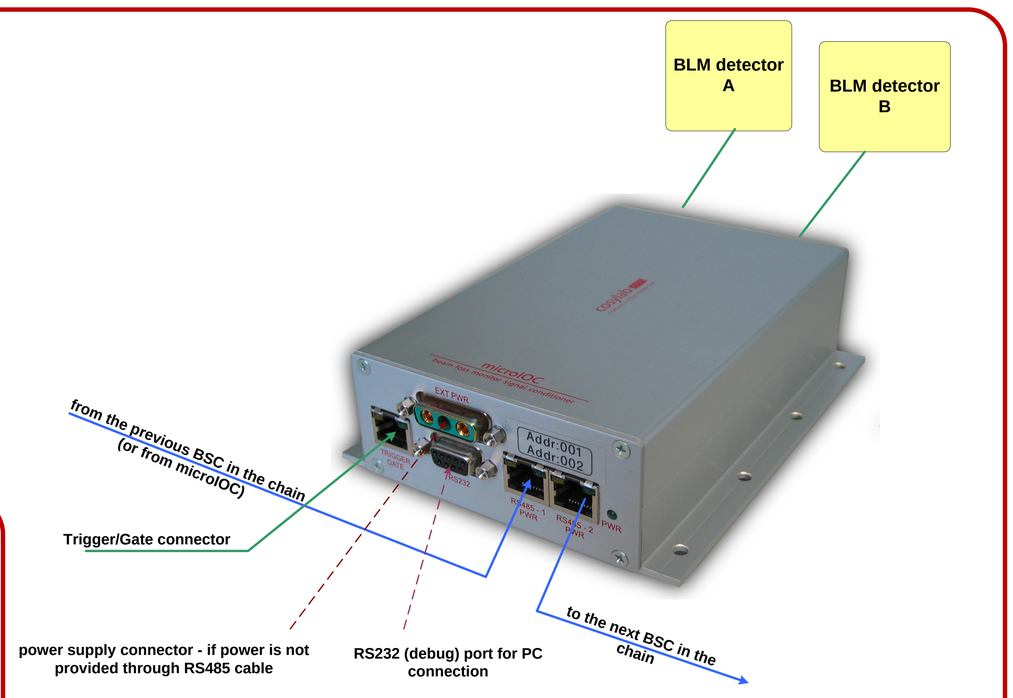
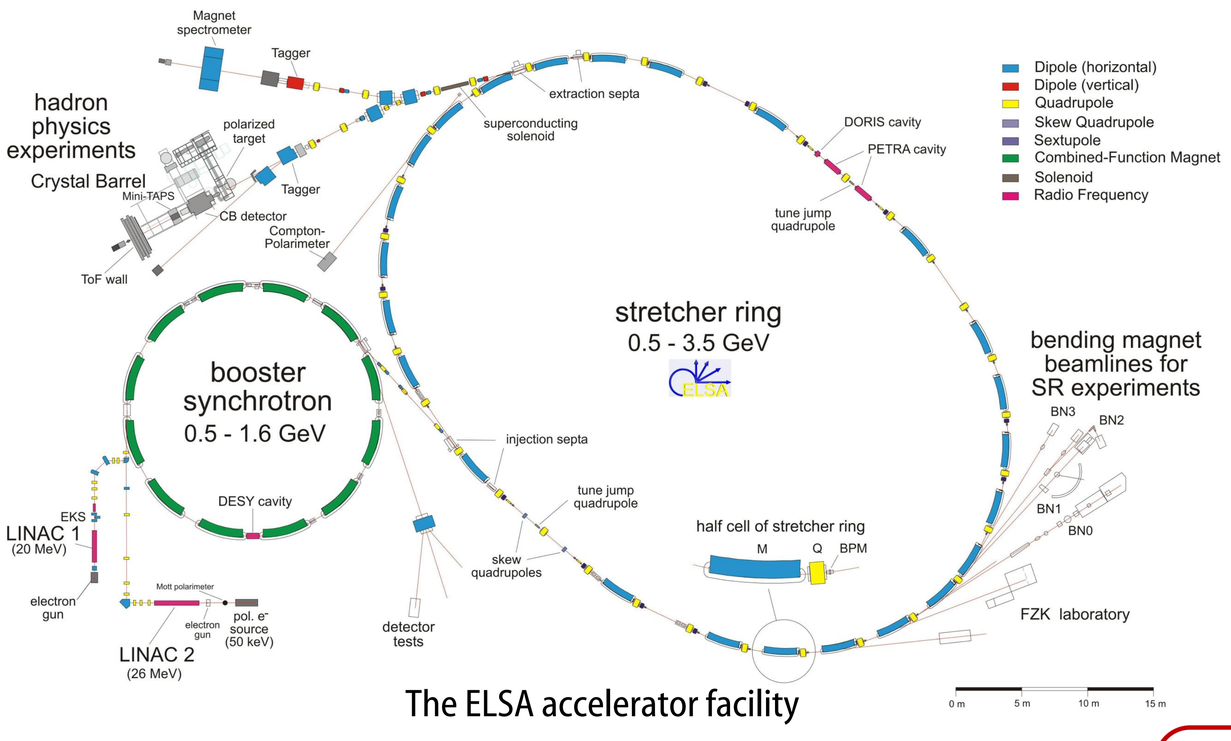
Introduction

- ☑ Beam-loss level monitoring is a powerful diagnostic tool concerning accelerator health.
- ☑ For identification of high radiation areas, average beam loss values are required. Averaging is typically done on a 1 second scale.
- ☑ To reveal correlations of beam loss events with the different phases of the acceleration cycle, time resolved beam loss information on the scale of msec is required.
- ☑ In this poster time resolved beam loss monitoring on a less than 20 msec scale is presented. The measurements were performed at ELSA with data acquisition system developed at COSYLAB.



ELSA machine

Electron Stretcher Accelerator (ELSA)



The ELSA accelerator facility

ELSA delivers a continuous electron beam to hadron experiments.

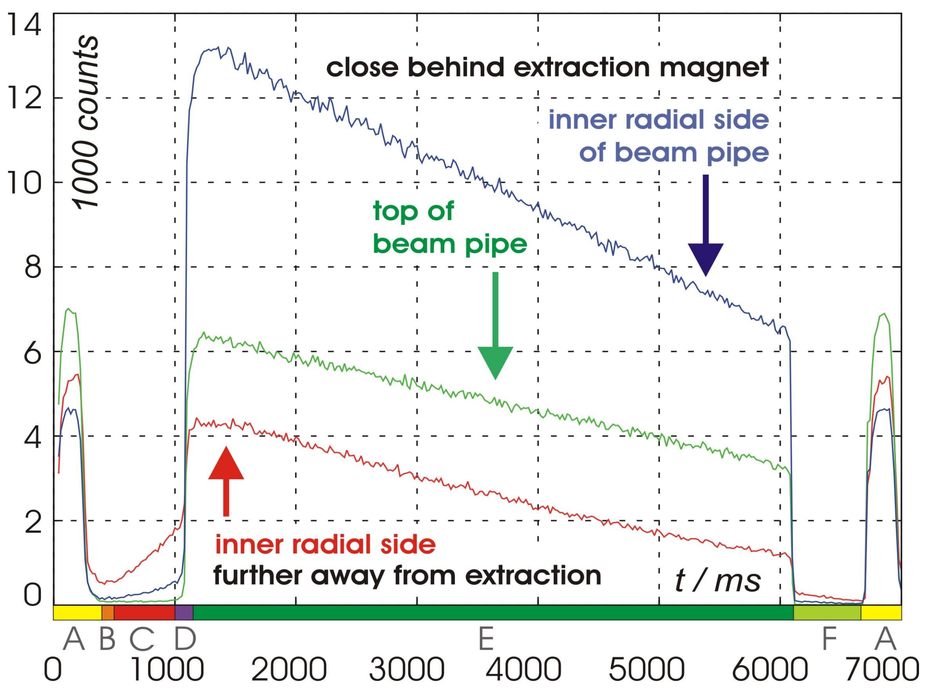
The ELSA accelerator facility at the University of Bonn consists of:

- ☑ 50 keV source of polarized electrons
- ☑ two thermionic electron guns
- ☑ two injector LINACs
- ☑ booster synchrotron
- ☑ 3.5 GeV stretcher ring

During the fast energy ramp, a sophisticated scheme for the correction of depolarizing resonances is mandatory. Depending on ramping speed, these resonances occur every 20 ms to 50 ms during acceleration. The correction scheme can be optimized if time resolved beam loss on the same time scale is known.

Test measurements at ELSA

- ☑ 3 BLMs were used to measure beam loss of electron beam with energy 3.2 GeV and 7 mA current.
- ☑ 7 second time interval with 20 ms time slots was used to cover the whole ELSA cycle. Beam loss was summed over 100 cycles.
- ☑ All machine cycles are clearly visible.



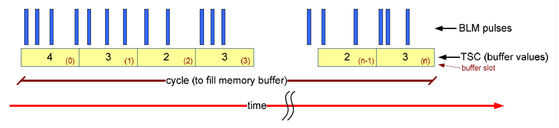
First measurements with the BLM system test setup at ELSA.

Cycle phases are: injection (A), damping (B), fast energy ramp (C), extraction preparation (D), slow resonance extraction (E), ramp down (F).

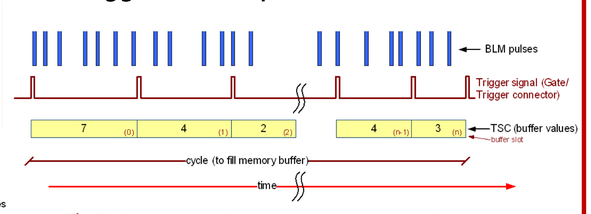
Operating modes

To accommodate all possible applications allowed by the sensor, a flexible data acquisition system is required.

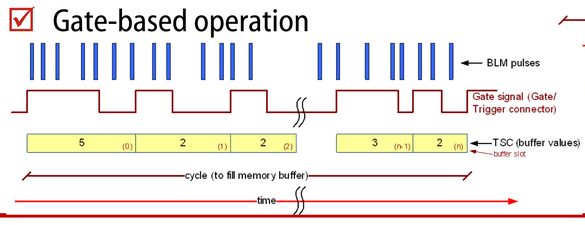
☑ Time-based operation



☑ Trigger-based operation



☑ Gate-based operation



☑ Triggered time-based operation

CONCLUSIONS

☑ The newly developed beam loss detection system with improved read-out scheme is a powerful tool for quality assurance.

☑ It provides in-situ detection and enables investigation of problems related to aperture limitations, steering errors and component malfunctions by a precise measurement of beam loss rates - both, spatially and time resolved.

☑ First measurements confirm the functional efficiency of software triggered readout scheme, tests of the hardware gated modes will follow soon.