# Laboratory tests of beam loss monitor detectors for SIS 100*

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A main source of primary beams at FAIR will be the SIS 100 synchrotron. SIS 100 will deliver ion beams with more than two orders of magnitude higher intensity than SIS 18 and will be operated in a range of 18-100 Tm rigidity. During the machine operation beam losses are unavoidable. In order to achieve quantitative determination of beam losses LHC-type beam loss monitor (BLMI) are foreseen[1]. This detector is robust, easy to maintain and has a well understood response. This contribution describes the bench test and characterization of BLMI.

The CERN LHC beam loss monitor consists of parallel plate ionization chambers, packed in a cylindrical stainless steel vessel with a wall thickness of 2 mm. The volume of a detector is filled by nitrogen gas under overpressure of 100 mbar. The standard operation point for the detectors is 1.5 kV.

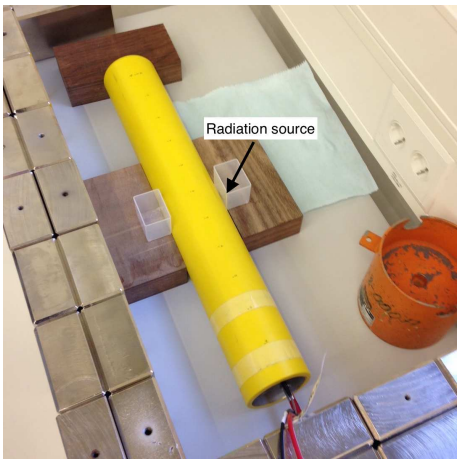


Figure 1: Testing bench of a BLMI characterization

Characterization of BLMI was performed in the detector laboratory of GSI. The test bench is shown in Figure 1. BLMI (yellow tube) was placed in a location which was surrounded by iron bricks in order to prevent unnecessary irradiation to the personnel. $^{60}$Co $\gamma$ source with activity of 2.3 MBq was placed on the detector surface as indicated in Figure 1. The ionization current was measured by a Keithley 6485 picoampermeter.

Two series of measurements were done: without a radiation source and with a radiation source. The results are shown in Figure 2. The black squares represent an ionization current with a subtracted leakage current for the corresponding detector. According to the experimental data all

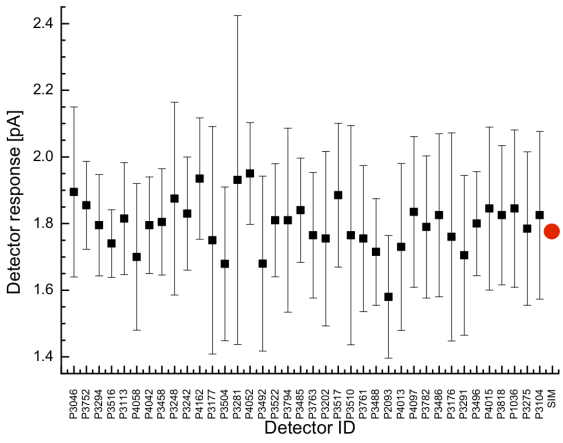


Figure 2: Black squares: ionization current in a $^{60}$Co radiation field (leakage current is subtracted); red circle: FLUKA simulation

detectors have the same efficiency within the error bars.

The model of BLMI was implemented in FLUKA Monte-Carlo code[2]. The response function of a detector was calculated in an isotropic $^{60}$Co radiation field and compared with a measured ionization current (Figure 2 red circle). Simulated response matches with measured ionization current within the error bar.

A testing bench for BLMI acceptance test was established and 38 BLMIs were characterized in the detector laboratory of GSI. The acceptance test shows that all the detectors have uniform response and can be integrated into the SIS 100 beam loss monitoring system. Also FLUKA simulations were done and match measured response within the error bars.

## References

[1] Measurements and Simulations of Ionization Chamber Signals in Mixed Radiation Fields for the LHC BLM System M.Stockner et. all, CERN-AB-2006-086 BI

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