RPC test with heavy-ion beams*

C. Simon[1], *N. Herrmann*[1], *I. Deppner*[1], *P.-A. Loizeau*[1], *J. Frühauf*[2], *C. Xiang*[1,3], *M. Kiš*[2], *M. Petriş*[4], *M. Petrovici*[4], *and the CBM-TOF working group*

[1]Ruprecht-Karls-Universität, Heidelberg, Germany; [2]GSI, Darmstadt, Germany; [3]Central China Normal University, Wuhan, China; [4]NIPNE, Bucharest, Romania

The Time-of-Flight (ToF) wall of CBM, conceptualized on the basis of high-resolution timing Multi-gap Resistive Plate Chambers (MRPC), is intended to account for concise hadron identification at an unprecedented event rate of 10 MHz. For the layout of the outer wall, strip-MRPCs are foreseen [1]. To explore the performance and limitations of the current design, high-rate tests with GSI/SIS-18 heavy-ion beams irradiating the full surface of a $30 \times 30\,\mathrm{cm}^2$, fully differential multi-strip MRPC demonstrator [2] have been performed in the fall of 2012. In order to test the equipment under realistic conditions, data were taken from several heavy-ion reactions (Kr+Pb, Ni+Pb, D+Pb) at beam energies of 1-2 AGeV with particle fluxes on the detector surface between $50\,\mathrm{Hz/cm}^2$ and $20\,\mathrm{kHz/cm}^2$. In this report, we present preliminary results from the Ni+Pb beamtime in early November 2012, where the incident particle flux amounted to $\sim 50\,\mathrm{Hz/cm}^2$.

The testbeam setup (cf. Fig. 1) consisted - looking downstream - of a diamond start counter, the target, two plastic counters of size $2 \times 2\,\mathrm{cm}^2$ for cross checks, the MRPC demonstrator and a reference MRPC constructed by the Bucharest group [3], enabling us to determine the efficiency and timing resolution of the demonstrator against a substantial area ($85\,\mathrm{cm}^2$) of the reference counter. A

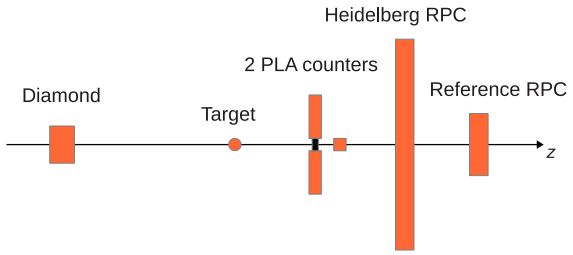

Figure 1: Testbeam setup in November 2012.

calibration scheme, based on ROOT and Go4, adjusted to the layout of the prototype is currently under development [4]. First, hits are built and clustered in both the demonstrator and the reference counter. Then a matching algorithm assigns the geometrically most suitable pendant in the demonstrator to clusters originating from one-cluster events in the reference counter. We find that our demonstrator is capable of dealing well with multi-hit exposure (cf. Fig. 2 left), facilitating the study of inter-hit dependencies. Furthermore, we studied the counter response in terms

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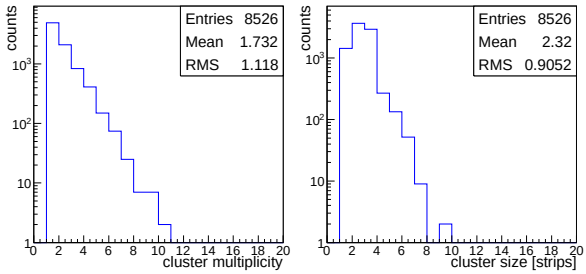

Figure 2: Cluster multiplicity (left) and cluster size (right) of the demonstrator.

of the cluster size (cf. Fig. 2 right), which averages at about 2.3 strips. On the strip level, we found the resolution of the cluster mean time difference to be 80 ps (cf. Fig. 3), which approximately translates into a single-counter timing resolution of 57 ps for our demonstrator. This promising result was achieved so far only for the small area ($4\,\mathrm{cm}^2$) covered by the plastic counters, that were requested to have clean conditions. The analysis of the efficiency as function of the hit rate on the counter surface, a task of utmost importance, is in progress.

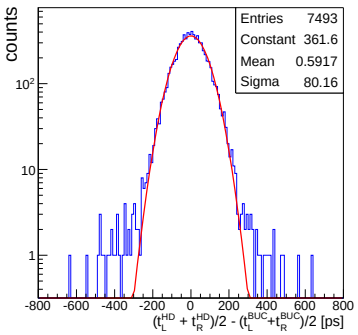

Figure 3: First hint at timing resolution on the strip level.

References

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