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Evolution and applications of the RD51 VMM3a/SRS gaseous beam telescope

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The RD51 collaboration at CERN focuses on the R&D of Micro-Pattern Gaseous Detectors (MPGDs). Included in this work are joint test beam campaigns at a semi-permanent facility at the H4 beam line of CERN's Super Proton Synchrotron (SPS). As part of the test beam infrastructure, two beam telescopes with 10 x 10 cm² active area are provided. Both of them are read out with the RD51 Scalable Readout System (SRS), covering up to 5k readout channels (typically around 500 per detector).

In one of the telescopes, making use of Gas Electron Multiplier (GEM) detectors, the SRS is used with the ATLAS/BNL VMM3a front-end ASIC, which was successfully integrated into the SRS over the past years. The interaction points of the interacting particles are obtained with 50 μm resolution and the interaction time with nanosecond resolution. The front-end electronics provides also the charge information, allowing a detector characterisation in energy, space and time. Due to the front-end's self-triggered continuous readout, particle interactions up to the MHz regime can be recorded.

Having commissioned the electronics in various test beam campaigns, this presentation gives a deeper insight into the telescope's performance. In particular, the many different detectors that have been successfully characterised are presented, showing the suitability of the electronics for R&D purposes. One detector type, the μRWELL, is especially highlighted as it is intended to be used as a technology for a third beam telescope in the future. In addition, a pattern injection technology is reviewed that allowed the operation of the self-triggered beam telescope as added beam detectors of the NA61/SHINE experiment, which was operated in event-matching mode.

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