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Reconstruction of Micropattern Detector Signals using Convolutional Neural Networks

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Micropattern gaseous detector (MPGD) technologies, such as GEMs or MicroMegas, are particularly suitable for precision tracking and triggering in high rate environments. Given their relatively low production costs, MPGDs are an exemplary candidate for the next generation of particle detectors. Having acknowledged these advantages, both the ATLAS and CMS collaborations at the LHC are exploiting these new technologies for their detector upgrade programs in the coming years. When MPGDs are utilized for triggering purposes, the measured signals need to be precisely reconstructed within less than 200 ns, which can be achieved by the usage of FPGAs.

In this work, we present for a novel approach to identify reconstructed signals, their timing and the corresponding spatial position on the detector. In particular, we study the effect of noise and dead readout strips on the reconstruction performance. Our approach leverages the potential of convolutional neural networks (CNNs), which have been recently manifesting an outstanding performance in a range of modeling tasks. The proposed neural network architecture of our CNN is designed simply enough, so that it can be modeled directly by an FPGA and thus provide precise information on reconstructed signals already in trigger level.

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Reconstruction

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