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GridPix - Production and Applications of Integrated Pixel Readouts

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Many experiments in particle physics employ Micropattern Gas Detectors (MPGDs) in combination with pads or stripes with a typical size of several square mm. With a pixelized readout structure the performance can be improved, as the size of the gas amplification stage is matched by the granularity of the readout.

GridPix detectors are pixel chips with an integrated Micromegas structure, which has been added to the chip by techniques of industrial post processing. The holes of the grid are perfectly aligned to the pixels, i.e. there is only one hole above each pixel. Due to the alignment, amplification takes place directly above a single pixel and is mostly collected by this pixel. This way even single electrons of the primary ionization can be separated.

Among the possible applications for GridPix detectors are particle tracking and X-ray detection. To study the tracking performance they have been tested in a time projection chamber (TPC) of 26 cm drift length. The results show that a spatial resolution near the diffusion limit of the drift gas can be achieved. Another TPC has been used to study the performance of X-ray detection. First studies show an energy resolution of about 5% for $^{5}5$Fe sources. For the application in large experiments a large scale production process has to been developed, in which GridPix detectors are manufactured on a whole wafer instead per chip. This production process is presented additionally to the performance studies.

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