

New results from GridPix detectors: summary

With the GridPix detector [1], consisting of an integrated Micromegas or InGrid [2] and a TimePix pixel CMOS chip [3], equipped with a SiProt [4] protection layer, single primary electrons from ionizing particles can be detected: see fig.1. A track image from two β 's from a ^{90}Sr source traversing the drift space of $14 \times 14 \times 30 \text{ mm}^3$ is shown in fig.2.

GridPix can be applied in a large TPC (drift length $\sim 2 \text{ m}$), but the same concept can be applied with a drift length of only 1 mm . This detector consists of a protected CMOS pixel chip, InGrid, and a 1 mm thick gas layer. It could be applied as high rate, low-mass, low power and radiation hard vertex detector [5]. A prototype (fig.3) has been constructed using the CMS pixel FE chip (PSI-46). A β -track from ^{90}Sr is shown in fig.4.

In a testbeam with $5 \text{ GeV}/c$ electrons and pions, a transition radiator was placed in front of GridPix. The TR X-rays, emitted along the track, can clearly be seen in fig5.

InGrid is a Micromegas made in 'wafer post processing' technology. By repeating the procedure, a 2nd grid can be placed onto the first one. With this TwinGrid (fig.6) one can distribute the gain over two avalanche regions, allowing the reduction of the risky avalanche field above the anode chip. It could operate like a GEM, and ion feedback ($< 1\%$ for InGrid) may be further reduced.

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- [1] Detection of single electrons by means of a Micromegas-covered MediPix2 pixel CMOS readout circuit. M. Campbell et al., Nucl. Instr. & Methods A 540 (2005) 295 – 304
- [2] An electron multiplying 'Micromegas' grid made in silicon wafer post-processing technology. M. Chefdeville et al., Nucl. Instr. and Methods A 556 (2006) 490-494
- [3] TimePix: a 65 k programmable pixel readout chip for arrival time, energy and/or photon counting measurements. X. Llopert et al.: Nucl. Instr. & Methods A581(2007) 485-494
- [4] Results from MPGDs with Protected Pixel Sensors as Active Anode. H.v.d.Graaf et al.: Conference Records IEEE NSS-Mic, Honolulu, Hawaii, 2007.
- [5] Gossip: A vertex detector combining a thin gas layer as signal generator with a CMOS readout pixel array. M. Campbell et al., Nucl. Instr & Methods A 560 (2006) 131-134

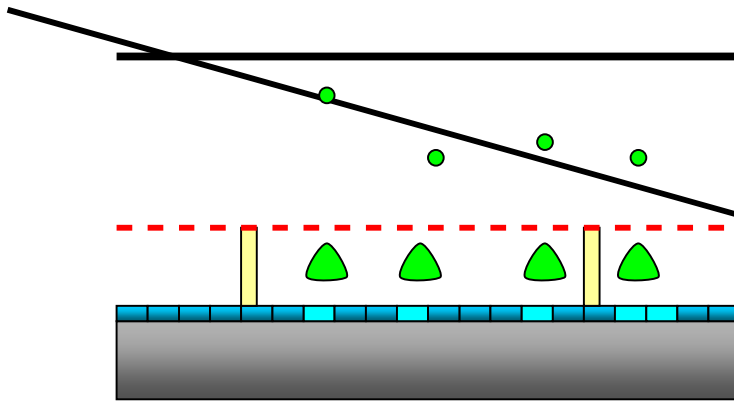


Fig. 1 Layout of a GridPix chamber.

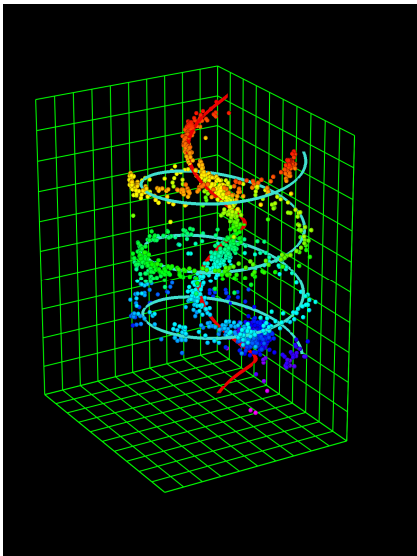


Fig. 2 Image of two electron tracks. The GridPix detector is placed in a B-field of 0.2 T with vertical field lines.

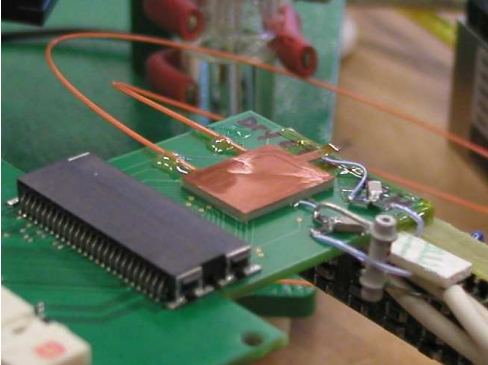


Fig. 3. Small drift gap prototype with SiProt protected PSI-46 chip, Micromegas and a gas cap. The gas foil/cathode is placed at 1.2 mm distance from the chip. The orange lines are the gas tubes

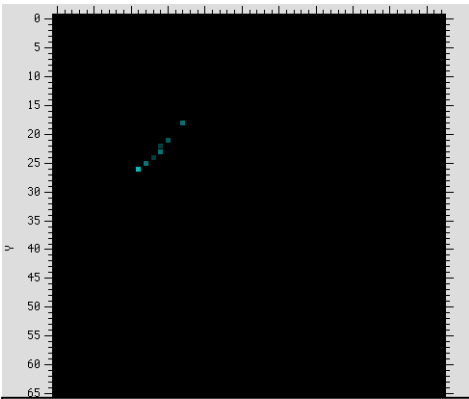


Fig. 4 A β -track from ^{90}Sr . The PSI-46 chip has 52 x 80 pixels of 100 x 150 μm .

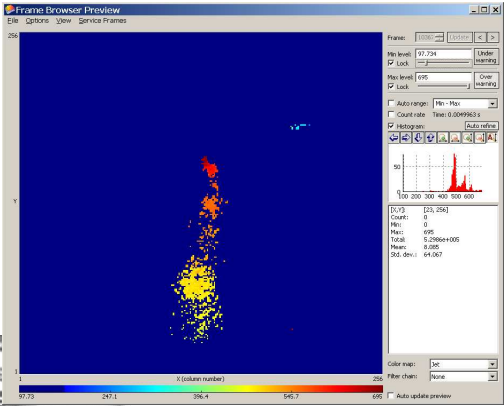


Fig. 5 Track from a 5 GeV/c electron after passing a Transition Radiator

