

Gossip: a Gaseous Vertex and Tracking detector: 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. The InGrid, made in 'wafer post processing' technology, is shown in fig. 2. A track image from two β 's from ^{90}Sr through the drift space of $14 \times 14 \times 30 \text{ mm}^3$ is shown in fig.3.

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 Gas On Slimmed Silicon Pixel (Gossip) detector consists of a protected CMOS pixel chip, InGrid, and a 1 mm thick gas layer. Gossip could be applied as high rate, low-mass, low power and radiation hard vertex detector [5]. With Gossip, a track section is obtained from the individual positions, in three dimensions, of some 4 – 10 primary electrons along the track.

A prototype (fig.4) has been constructed using the CMS pixel FE chip (PSI-46). A β -track from ^{90}Sr is shown in fig.5.

The 20 μm thick layer of amorphous silicon, covering the pixel chip has proved to be an adequate protection against hard-to-exclude discharges between InGrid and the chip.

By placing 4 or 8 Gossip detectors in a row, a 'beam telescope' is constructed, which can be used to measure the performance of Gossip in terms of spatial resolution and efficiency. The well-known chamber ageing is under study using a ^{90}Sr source of 5 GBq.

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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

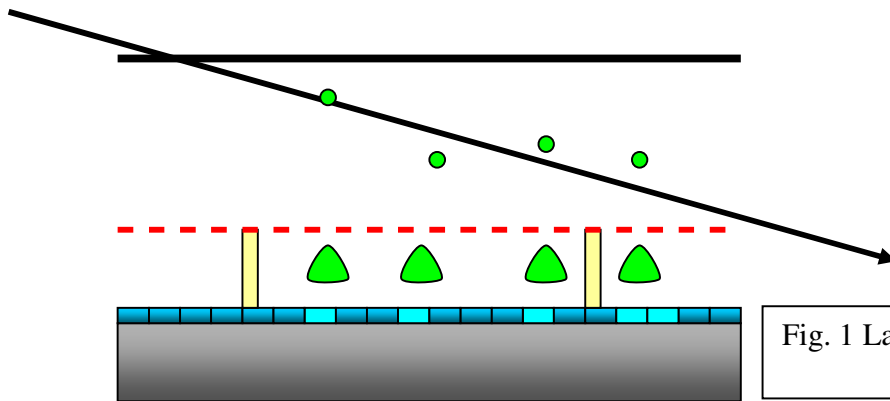


Fig. 1 Layout of a GridPix chamber.

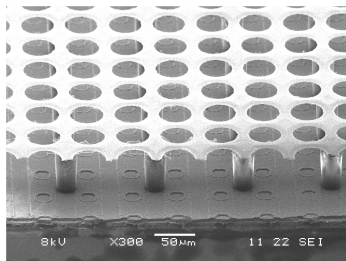


Fig. 2. The Ingrid is constructed on top of the TimePix chip. Prior to this, the chip has been covered with a high-resistive layer of amorphous silicon as protection against discharges between the grid and the (grounded) pixel chip.

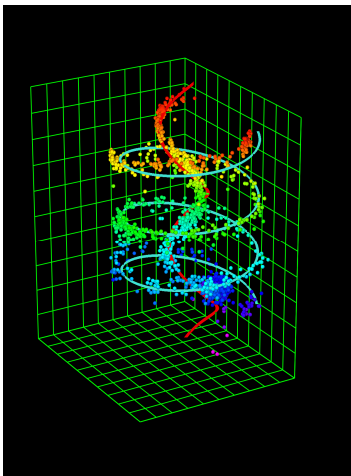


Fig. 3 Image of two electron tracks. The GridPix detector is placed in a B-field of 0.2 T with vertical field lines. The chip pixelated surface measures 14 mm x 14 mm, and the distance between the cathode (at the bottom) and the chip is 30 mm.

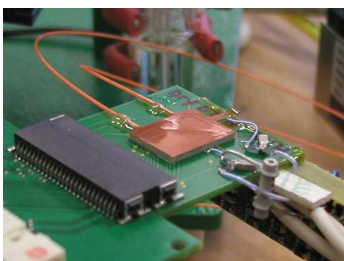


Fig. 4. Gossip prototype with SiProt protected PSI-46 chip, Micromegas and a gas cap. The gas foil/cathode is placed at 1.2 mm distance from the chip. The orange lines are gas tubes.

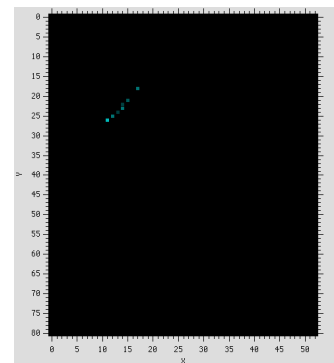


Fig. 5 A β -track from ^{90}Sr , measured with the Gossip prototype. The PSI-46 chip has 52 x 80 pixels of 100 x 150 μm .