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High tracking performance in 3D with gaseous pixel detectors based on the Timepix3 chip.

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Our group is developing gaseous pixel detectors by using micromegas-based amplification structures on top of CMOS pixel readout chips of the Medipix family. By means of wafer post-processing techniques we add a spark-protection layer and a grid to create the amplification region above the chip. An inserted gas layer and cathode plane above the grid create a complete gaseous detector able to reconstruct 3D track segments due to the TDC per pixel topology which enables the recording of the drift time. By fitting the track segments, we obtain the resolutions for the position and angle.

Using a small scale prototype of the Timepix3 chip, we have demonstrated high tracking performance in [1]. However, the resolution along the drift direction is dominated by timewalk. The existing Timepix3 chip, thanks to the simultaneous measurement of the time-of-arrival (ToA) and charge via time-over-threshold (ToT) allows corrections to remaining timewalk effects, improving further the resolution.

We have developed a gaseous pixel detector based on the Timepix3 chip. The detector was used SPS/Cern in order to measure the tracking performance. I will report on the timewalk correction obtained with real data from a particle beam. The results obtained make this detector the most precise gaseous detector to date for measuring the creation position of individual ionisation electrons.

References

[1] S. Tsigaridas, et al., Precision tracking with a single gaseous pixel detector, Nucl. Instr. and Meth. A 795 (2015) 309-317.

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