

# The 8th International Conference on Micro Pattern Gaseous Detectors (MPGD2024)



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## Towards MPGDs with embedded pixel ASICs

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To reconstruct the interaction position of particles, most MPGDs employ anode structures with strip pitches or pad sizes of hundreds of micrometres up to several millimetres. By using hybrid pixel ASICs with pixel pitches of typically  $50\ \mu\text{m}$  as readout anode, the granularity is increased significantly. This offers the possibility for various experimental applications (e.g. X-ray polarimetry, rare-event searches, micro-dosimetry or neutron detection) to perform the event selection, based purely on geometrical parameters, i.e. the event topology.

In this presentation, a new research line within the CERN EP R&D programme is presented. The goal is to combine MPGDs with the Timepix4 ASIC. The Timepix4 has an active area of around  $7\ \text{cm}^2$  with  $512 \times 448$  square pixels ( $55\ \mu\text{m}$  pitch). It can record particle interactions with up to  $3.6\ \text{MHz}/\text{mm}^2$ , each of its pixels provides the charge information with around 700 electrons resolution and the signal arrival time with around 200 ps resolution. Most importantly, however, the Timepix4 contains Through Silicon Vias (TSVs), which enable a full connection of the ASIC from the back side. Thus, it can be tiled on four sides, allowing it to cover large areas without loss of active area.

As part of the research line, triple-GEM and  $\mu\text{RWELL}$  detectors are read out with the Timepix4. The goal of the  $\mu\text{RWELL}$  studies is to investigate a possible next step, the embedding of the Timepix4 ASIC into a  $\mu\text{RWELL}$  foil, using standard PCB technologies. An additional target of the research line is the investigation of producing and embedding hybrid ASICs with larger pixel pitch, as most MPGD applications do not require anode structures with  $55\ \mu\text{m}$  pixel pitch. Nonetheless, they would profit from the ambiguity-free results of a pixelated anode.

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