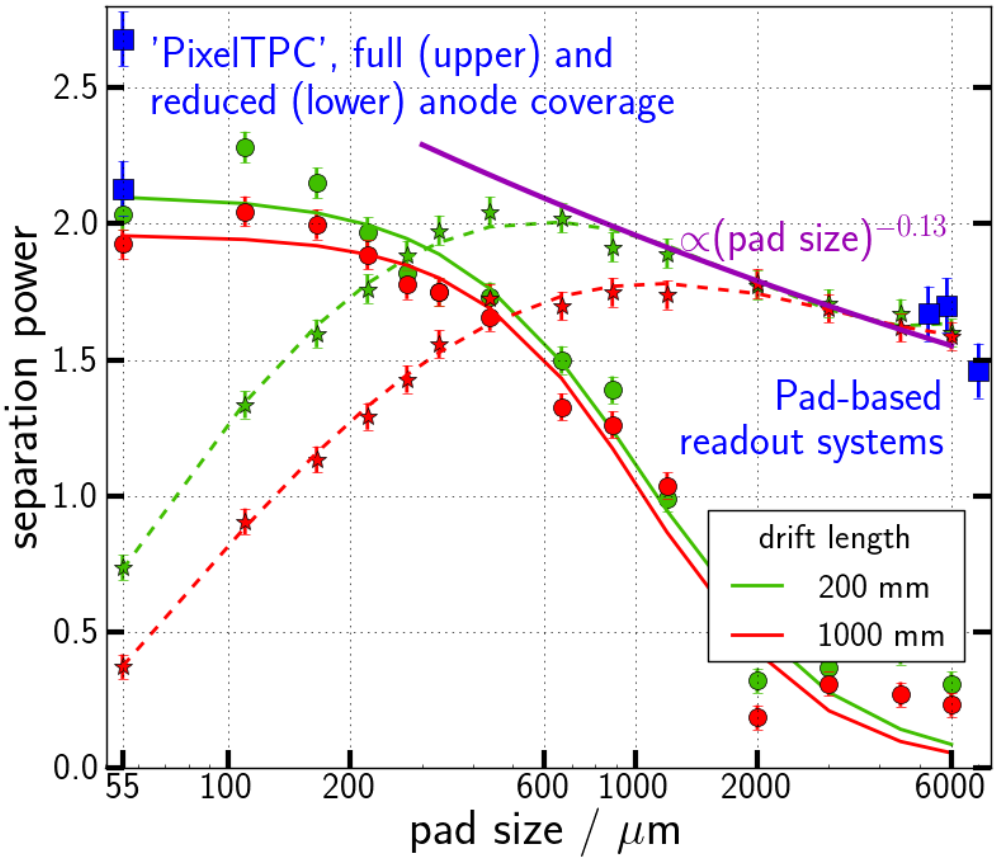
High anode granularity dE/dx-performance simulation plot



- The plot is for the upcoming GridGem paper.
- The plot shows separation power based on dE/dx versus anode granularity.
- The green and red curve are my simulation.
- The blue points are references to performance results from existing readout systems.
- The purple line is a text book cross reference for expected behavior.

- Conditions: I am looking at pion/kaon-separation of 300 mm long tracks, at a momentum of their largest ionisation difference of about 15%. This is where the absolute value of my y-axis comes from (~ overall normalisation).
- My simulation was run at these conditions, the reference points were extrapolated to them.

- My simulation points are still work in progress.
- My questions are: Are you generally ok with the blue points and with the comparison done here? Have I missed some results of a system? And what could be a published reference for the Micromegas point?

Details - simulation

- The dashed curve (and stars along it) are separation power based on dE/dx by charge summation, so the conventional method.
- The solid curve (and circles) are based on my implementation of cluster counting, using the source extractor software.
- Each red and green point is the respective maximum of a scan of GEM-voltages and therefore the gain. The gain needs to be adapted to the pad size to prohibit the signal from falling below the channel threshold, as well as the signal from going into overrange.
- Charge summation: For decreasing pad size, the gain needs to increase in order for the signal to stay above threshold. This is capped at a GEM voltage of 280 V, which is high; then the curve falls off. This threshold effect is compensated to a degree by smaller drift length, because the charge is more concentrated.
- The cluster counting points at 55 µm are currently under investigation, looking why they are so low.

Details – references

- The blue points on the left are extrapolations from GridPix (ref.: arxiv.org/abs/1902.01987), the ones on the right are (f.l.t.r.) AsianGem (ref.: arxiv.org/abs/1801.04499), GridGem (same paper of the plot) and Micromegas (ref. missing).
- The extrapolation is done by dividing the available ionisation difference by the dE/dx resolution to get a separation power (for pad-based), and extrapolating the separation power to 300 mm track length using the published or expected scaling exponent.
- The GridPix has two points, the upper one for an extrapolation considering a full anode coverage (as the other systems as well as my simulation do), the lower one taking the current estimated anode coverage of 60% into account.
- For the Micromegas, the latest value I found was that 5% resolution is achieved for the ILD TPC, so I extrapolated that.
- The error bars given on the blue points are at the moment flat 0.1 which does not reflect the quite small (statistical?) errors from the publications, but rather the potential systematic errors of the extrapolation and comparison of the systems.