On dE/dx in multitrack environments

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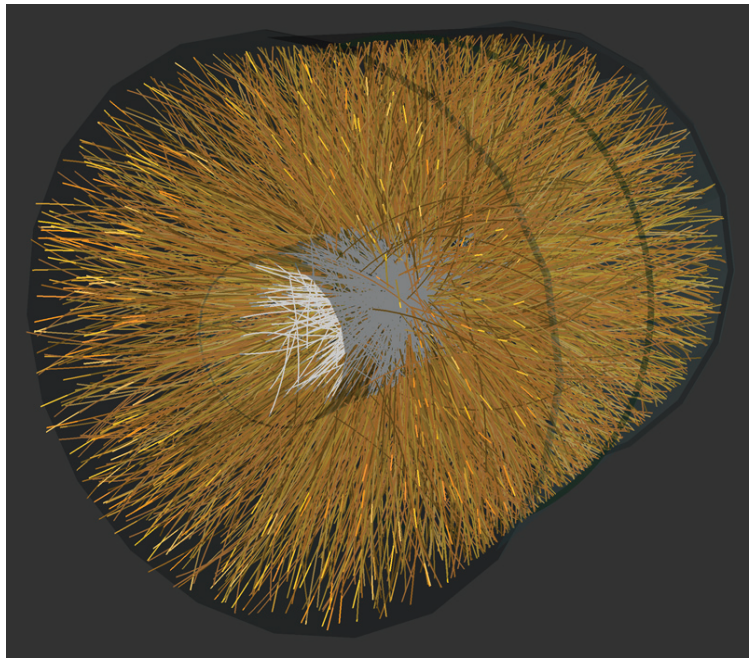
Heavy Flavour working meeting

25.02.2021

The issue with multiple tracks

- If tracks are too close to each other, the TPC may not be able to resolve their individual hits and instead merge them to *double hits*.
- This depends on the available separation in r/phi and z, which in turn depends on granularity (in phi) and readout electronics timing (drift in z).



ALICE TPC reconstructed tracks
from Pb-Pb collisions

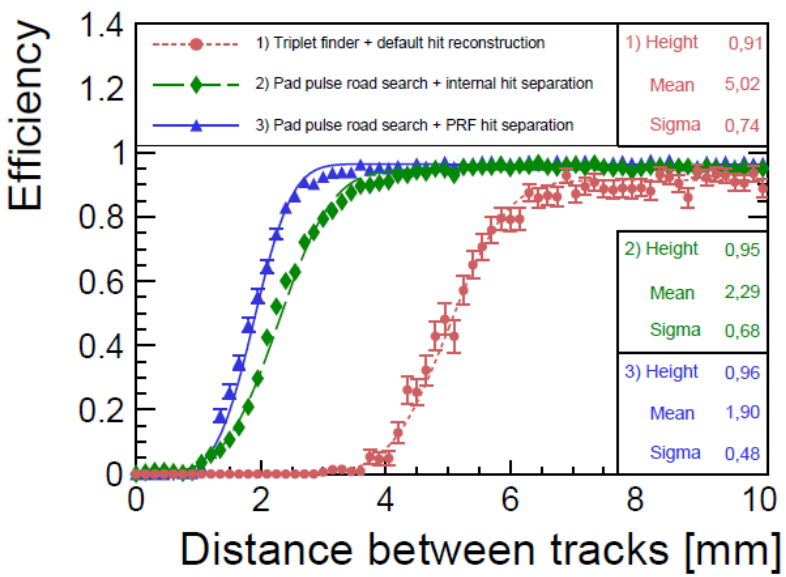
https://doi.org/10.1016/j.phpro.2012.02.390

Granularity examples

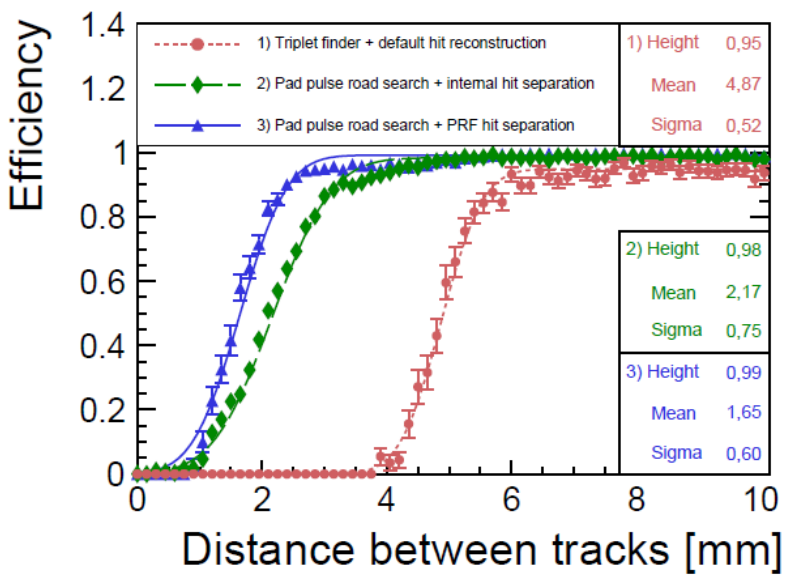
- ALICE, pad readout, with both wire chamber and GEM amplification
  - IROC: 4 x 7.5 mm²
  - OROC, inner: 6 x 10 mm²
  - OROC, outer: 6 x 15 mm²
- LCTPC
  - GEMs + pads: ~ 1.3 x 6 mm² → Double track studies by Oleksiy Fedorchuk improved
  - Micromegas + pads: 2 x 7 mm² double hit separation from 4 mm to 2 mm in r/phi
  - GridPix: 55 x 55 µm²
- ILD Sim
  - 1 x 6 mm² → Double hit separation: 2 mm in r/phi; 5 mm in z

Double hit resolution

- Double track studies by Oleksiy Fedorchuk improved double hit separation from 4 mm to 2 mm in r/phi with a new charge sharing algorithm.
- Thesis: https://ediss.sub.uni-hamburg.de/handle/ediss/8760 paper in preparation



(a) Measurement.



(b) Simulation.

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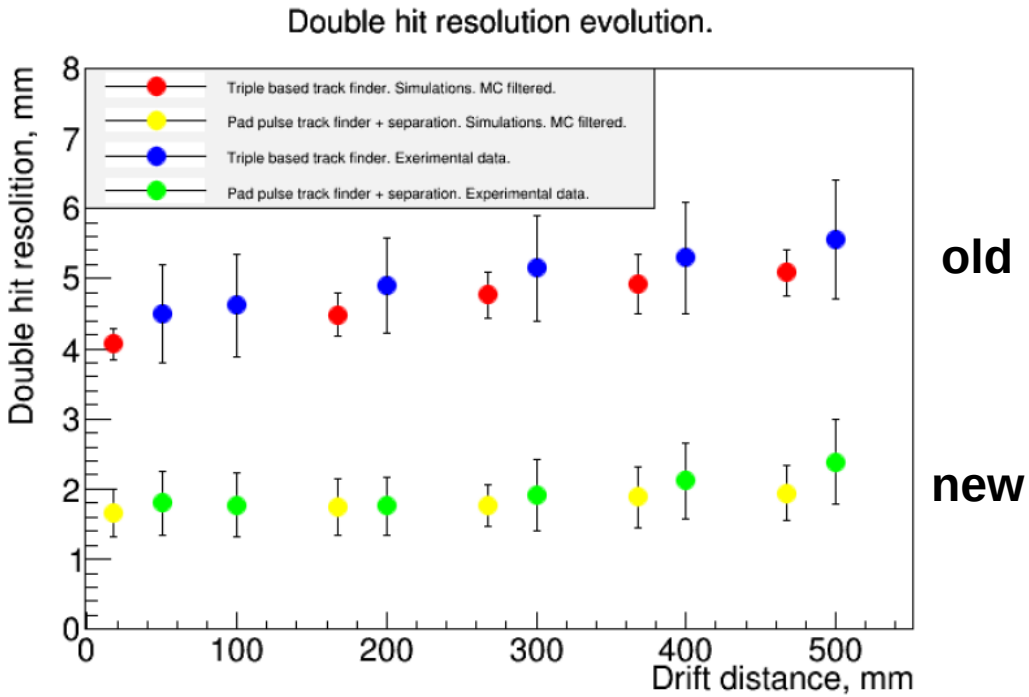
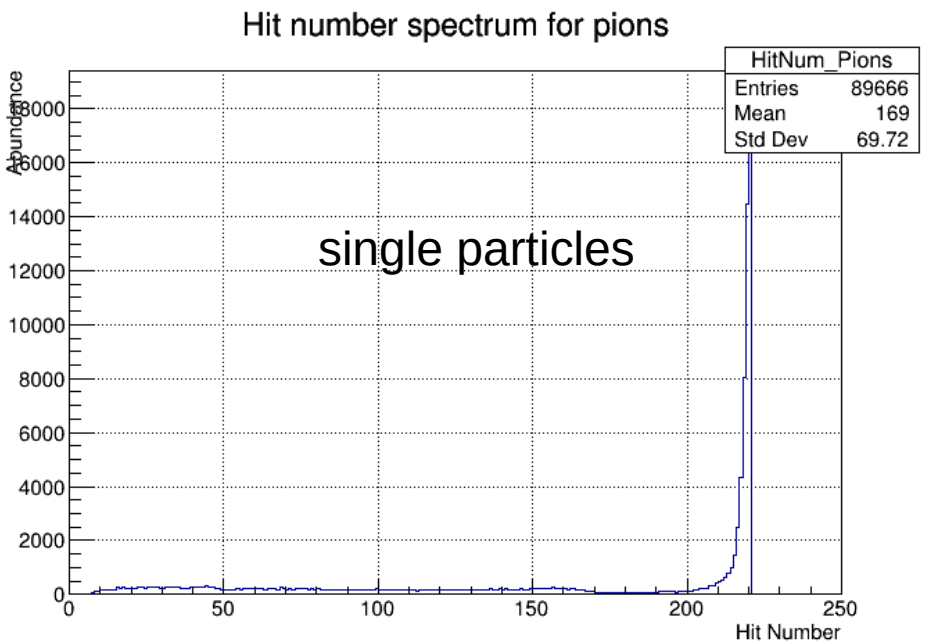
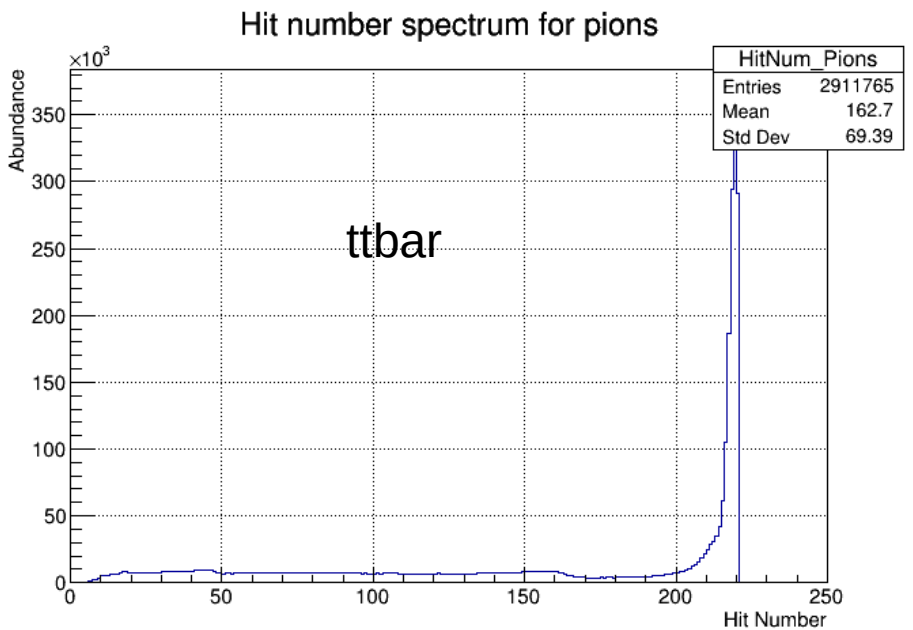


Single particles vs. ttbar hit number

- TPC (IDR-L) has 220 rows = max. number of hits per track
- ttbar has more track with low number of hits and the peak is a bit broader
- Low number of hits can come from very forward tracks, curlers, in-TPC decays, backscatter





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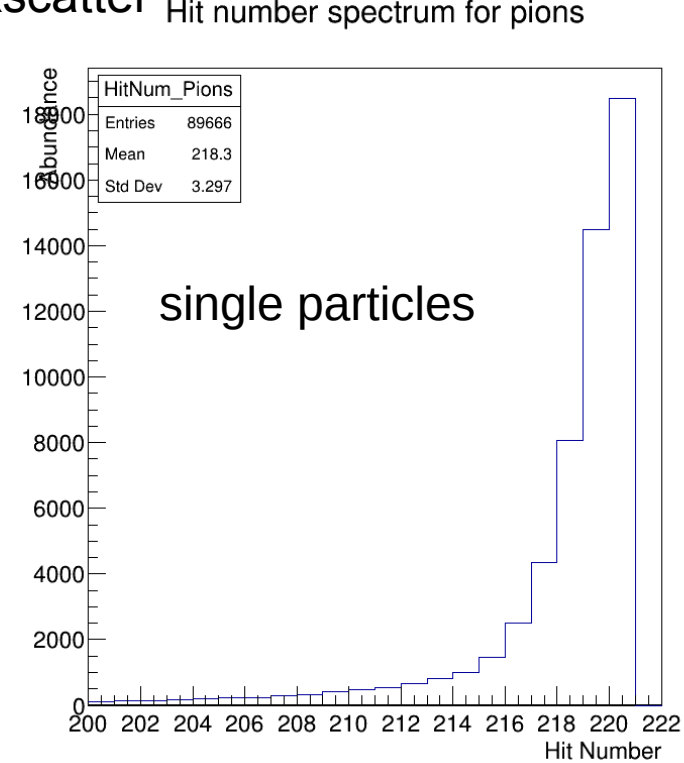

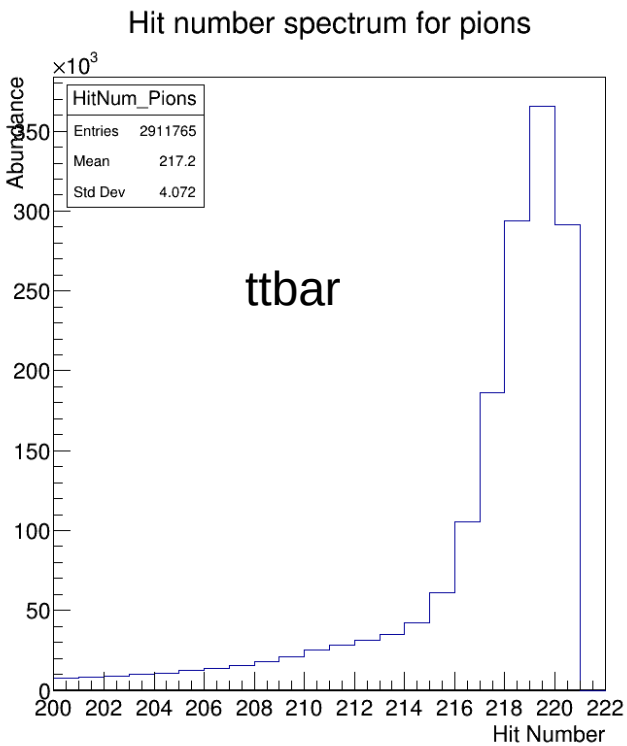

Overall resolution & separation power

- The dE/dx resolution and consequently the separation power is slightly worse in ttbar
- The statistics are much larger