FSD v_drift & electric field analysis

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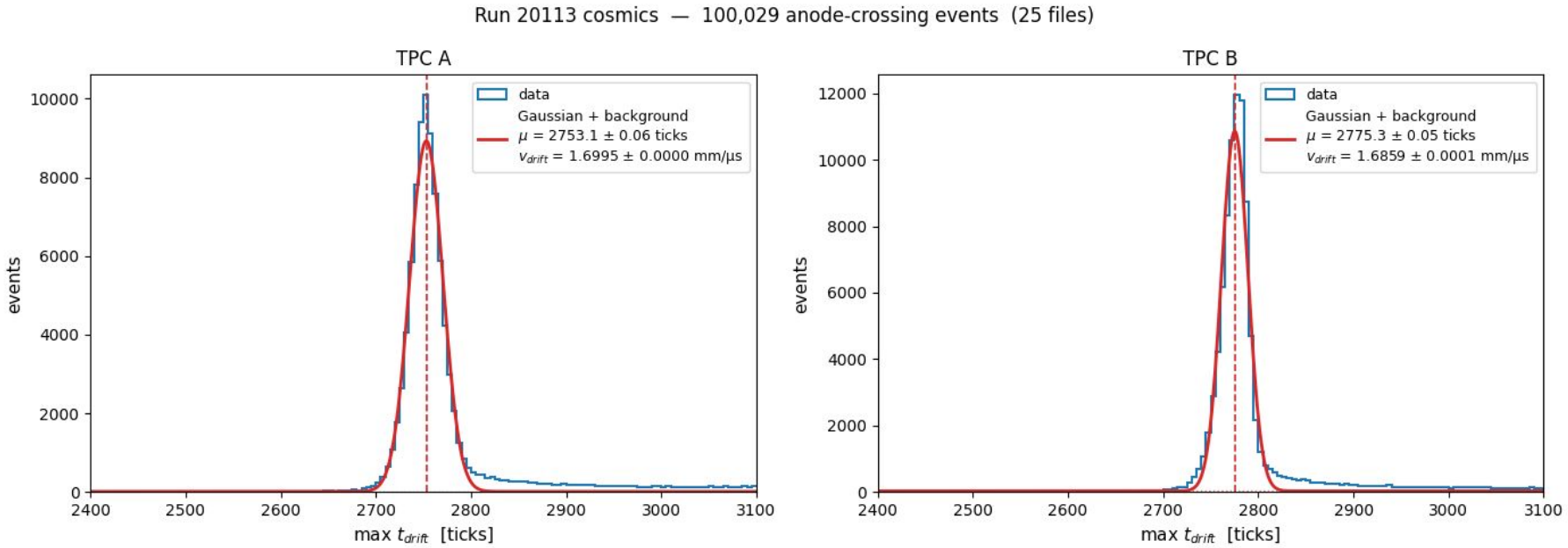
Recap

Analysing anode to anode crossing events and fitting for the max. Drift time led to higher v_drift values than the standard setting used in ndlar_flow: [1.699, 1.686] vs [1.60, 1.63] mm/us



Y-dependance of the drift velocity

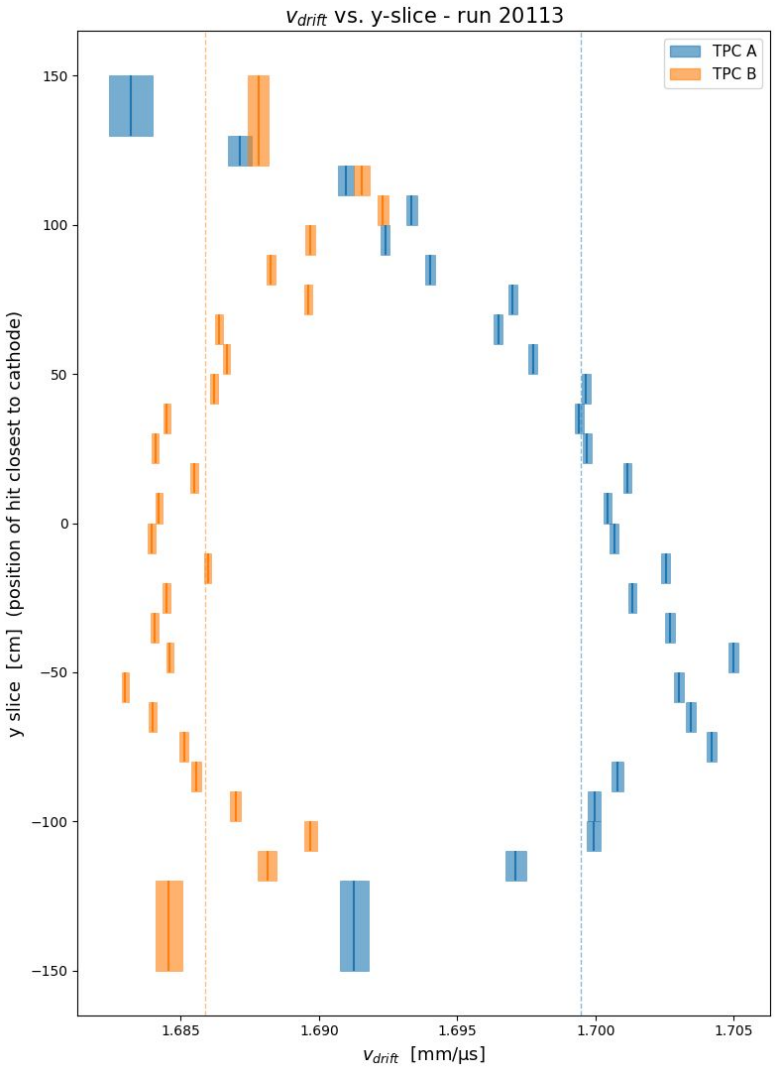
Procedure:

- Find per anode crossing event the max drift time (charge closest to the cathode)
- Find its y coordinate and allocate it to the bin of 10cm
- Fit the gaussian to each bin
- Due to statistics, bins had to be combined towards the top and bottom

Y-dependance of the drift velocity

- Besides having different v_drift per TPC, there seems to be major fluctuations within one TPC (especially TPC A)
- The top ~50 cm still have approx. same vdrift

⇒ Electric field is likely not entirely homogenous



Electric field

Relationship between drift velocity and electric field:

$$v = \mu E$$

With the electron mobility μ:

$$\mu = \frac{a_0 + a_1 E + a_2 E^{3/2} + a_3 E^{5/2}}{1 + (a_1/a_0)E + a_4 E^2 + a_5 E^3} \left(\frac{T}{T_0}\right)^{-3/2}$$

$a_0 = 551.6, \quad a_1 = 7158.3, \quad a_2 = 4440.43, \quad a_3 = 4.29, \quad a_4 = 43.63, \quad a_5 = 0.2053$

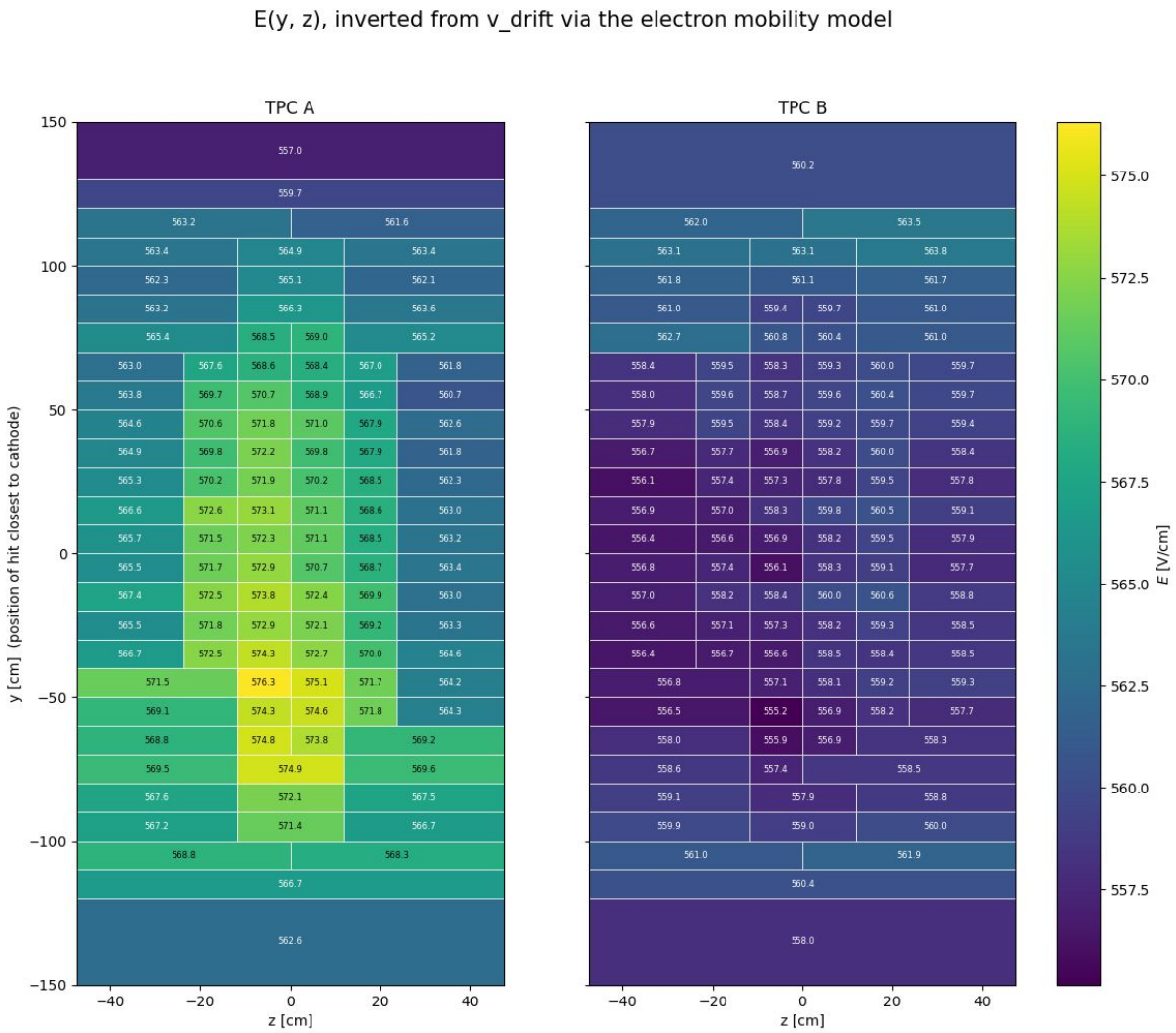
Finding the correct E:

- Variate E to calculate different v_drift_theoretical so that:

  v_drift_measured - v_drift_theoretical = 0

YZ-dependence of the electric field

- +100’000 anode to anode crossing events.
- Adding more data will increase how small we can make the bins
- Antisymmetric behaviour between TPC A and TPC B



Relative E field deviations

- 1 cosmics run + 6 hv_scan runs (at different voltages)
- About a 2.5% variation in the electric field strength