Comparison of anode piercing track selection on old and new data and MC

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Previous MC and data

 In MCC11 and the previous production, a clear difference was observed between the distribution of time difference between the track and matched



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Drift velocity update

- A recent update to dunetpc has changed the drift velocity in protodune_detproperties.
- Running the old production with this value causes the 'readout position' of tracks without a t₀ to desynchronise from the collection time.
- This can be resolved by manually using the old drift velocity, but this then needs to be changed if the data set uses a different velocity.
- This can be resolved by not calculating the time based on the drift velocity, but by using the TPC hits of the track, and taking the earliest one in time which fulfil the requirements.



Old data with time from hit

• To ensure that the new method of calculating track time does not change things substantially, I have looked at some old production again.



• The change does narrow the peak slightly, but there is still a substantial difference between the MC and data.



New data

• Moving to the new production, the matching is greatly improved.



 Before cuts (I), purity in the peak looks to approach 90% by extrapolating background, and looks to exceed it after the other cuts (r).







Data comparison

- The slight offset visible in the previous production has disappeared in the very latest data set.
- The peak is asymmetric, with a 'hump' of flashes later than tracks – this looks to be due to late scintillation light.
- Background is lower, but still limits the purity.



Difference between reconstructed track time and matched flash time of 2000 events in run 5430

Difference between reconstructed track time and matched flash time after cuts in run 5387







MC comparison

- Very little has changed between MCC11 and 12, in terms of the peak width. The height, though, suggests there are fewer tracks in MCC12 (~1 per event, ~2 previously)
- There looks to be more background in MCC12, also.







Difference between reconstructed time and matched flash time in 900 events of MCC11 FLF 1 GeV

Conclusions

- Flash to track matching is substantially improved in the new data production. This seems to be due to the updates to flash reconstruction.
- MCC12 more closely resembles the data in this respect.
- Selection purity is better in the new production, but due to the higher background it is still significantly short of the MC. New cuts and further tuning of the current ones could improve this further.

