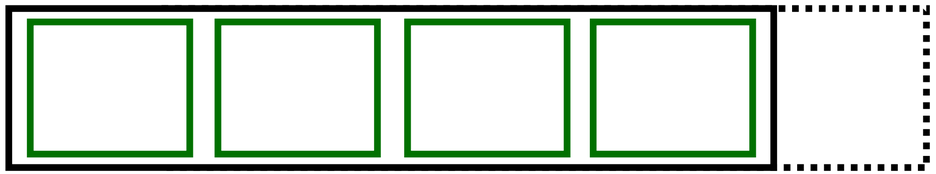
V2 vs V3 summary info

For Nils

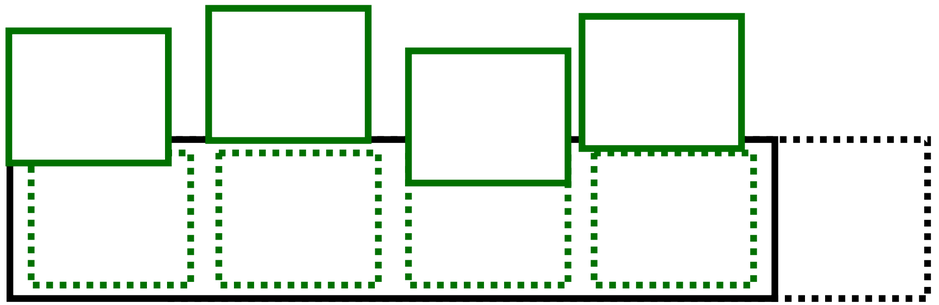
Overview of alignment v3 module

- Starts from 2022 SciFi survey positions unless otherwise marked
- DD4HEP + PrKalman tracking
- Run on 600k events (up from 200k)
  - All modules sufficient statistics to align
- Aligns Tz degree of freedom (new since v2)
- Uses loose tracking mode (see setup here) and PatPV3D
- Uses D0 particle information (see selections here)
- Constrained average Tx, Tz in SciFi back layer:
  - Ideally allows us to compare alignments with a shared momentum scale reference/prevent changes in curvature bias
  - But this scale is not necessarily correct
- These alignments shown consider modules only: mats alignment performed as a separate step

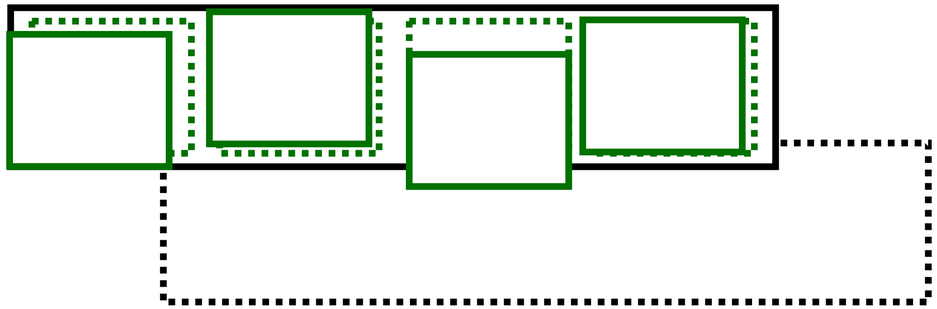
How do module/mat alignments work together?



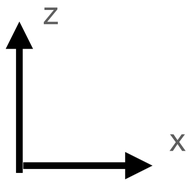
AlignV9:
Module x only
No z correction to survey



AlignV9 + mats:
Module x only
Mats x and z adjustment
all z correction handled by mats (unphysical)



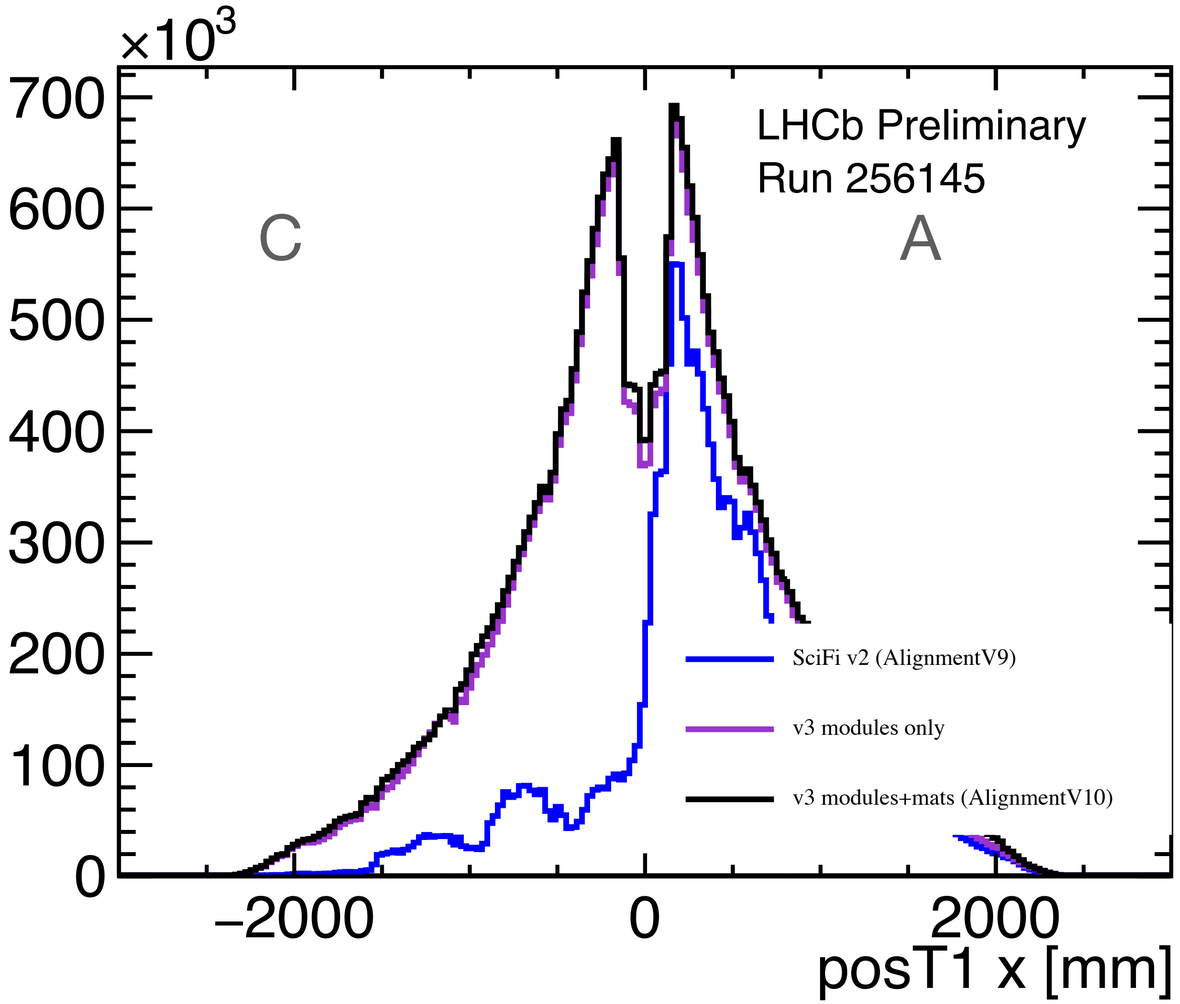
SciFi v3
Module motion in x and z
Mats in x and z
Largest efficiency improvement is from module component!

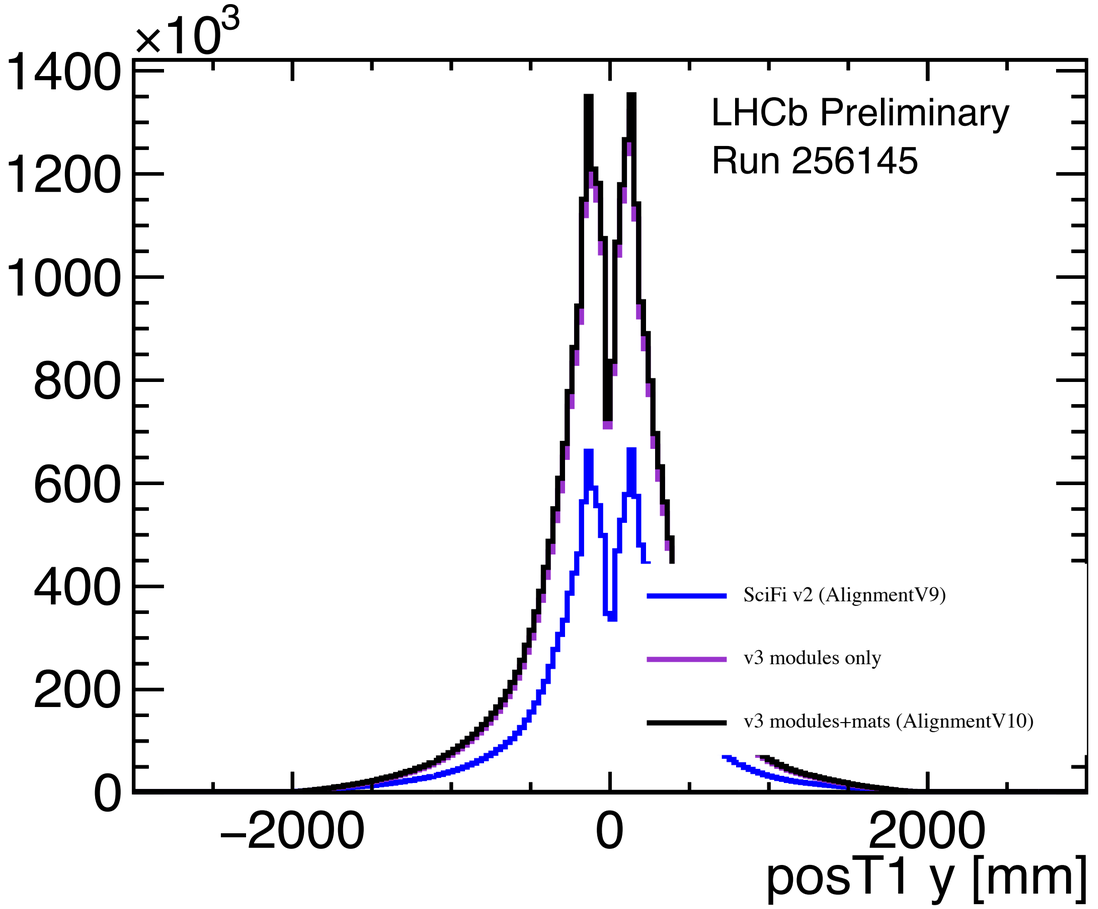


Mat alignment and the real SciFi

- Real mats are glued together with very fine tolerance/quality control (~50um), but prelim mat alignment sees movements up to 1.5mm
  - “mat alignment” moves the mats in software to match best hit position in tracking
    - Depends on module alignment quality
    - Depends on relative position of glued SiPM readouts relative to mats
  - Long term goal SciFi team: correct for hit positions in readout without moving mat material in simulation
    - Understand rotations in survey positions that may produce z movements in reconstruction
    - Understand true variations in SiPM positions
  - In the short term: offline mat alignment to improve reconstruction

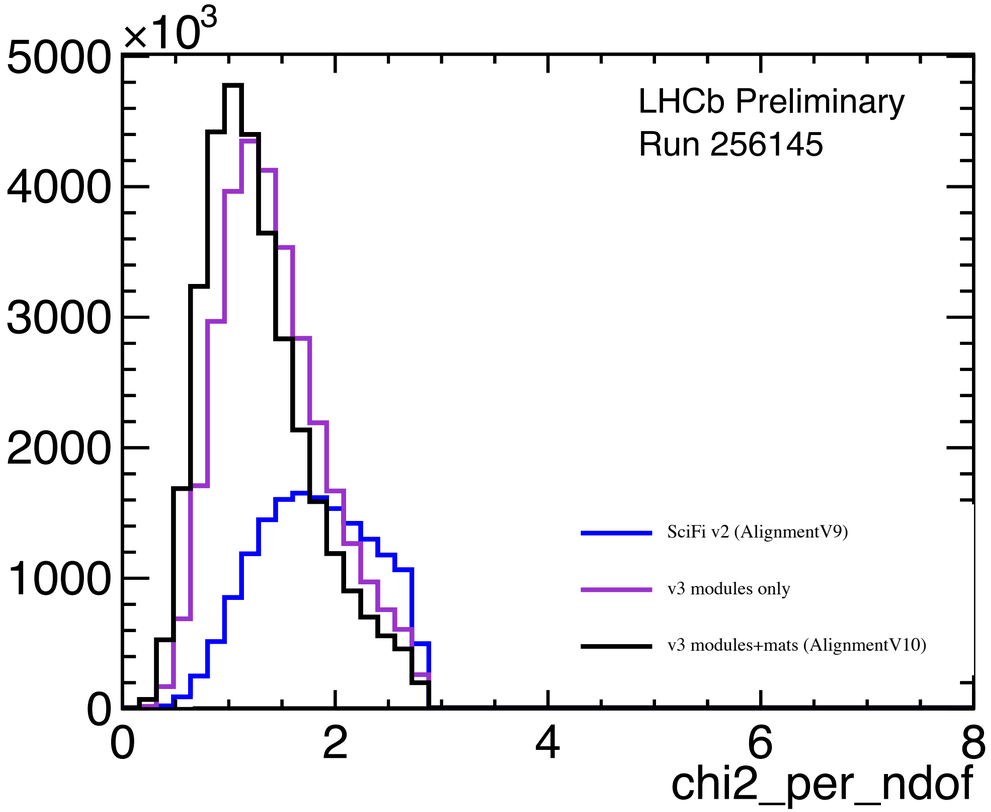
Plots: performance on Moore long tracks

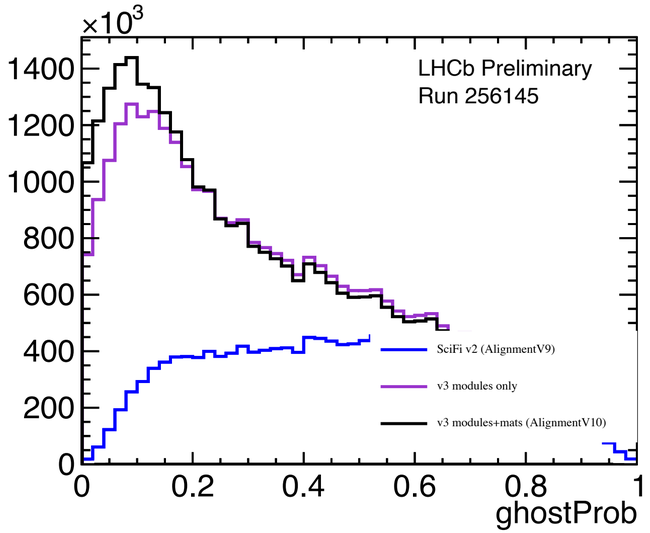


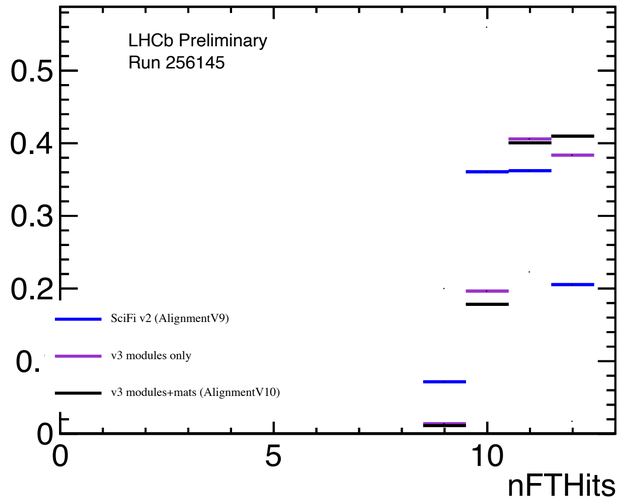


Improvement v3: more symmetric A and C side

Plots: performance on Moore long tracks



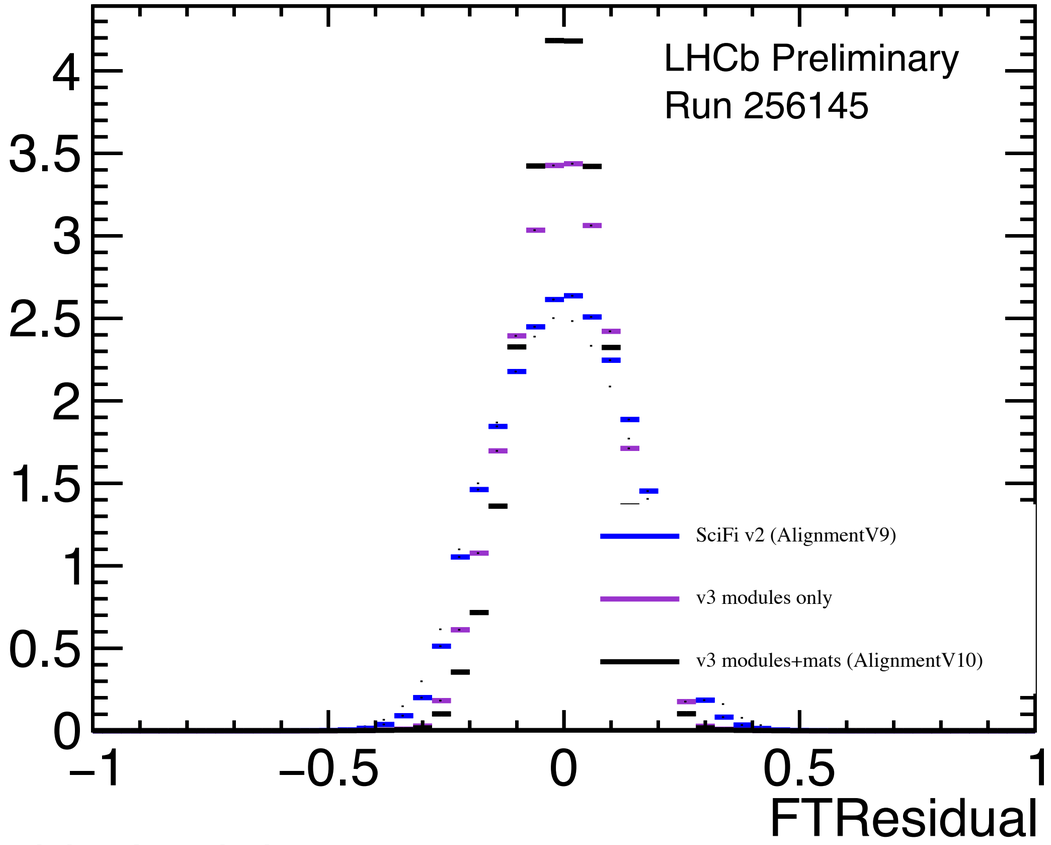




This one: normalised distribution

Much better track chi2
Much improved ghost probability
Greater proportion of 12 hit tracks

Plots: performance on Moore long tracks



Residual std dev:
AlignmentV9: 0.137
v3 modules: 0.110
AlignmentV10: 0.096