HD and VD pre-phase 2 validation

Andy Chappell, Dom Brailsford

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DEEP UNDERGROUND NEUTRINO EXPERIMENT

WARWICK

Phase 1 HD

- Phase 1 ran dunesw v09_78_01d01 gen through reco1 for long baseline HD 1x2x6
- Resultant production datasets (currently unofficial) used as baseline for validation checks

higuera_fardet-hd__fd_mc_2023a__mc__hit-reconstructed__*__v09_78_01d01__preliminary
prodgenie_nu_dune10kt_1x2x6.fcl
prodgenie_anu_dune10kt_1x2x6.fcl
prodgenie_nue_dune10kt_1x2x6.fcl
prodgenie_anue_dune10kt_1x2x6.fcl
prodgenie_nutau_dune10kt_1x2x6.fcl
prodgenie_anutau_dune10kt_1x2x6.fcl

Phase 1 VD

- Phase 1 ran dunesw v09_75_03d00 gen through reco1 for long baseline VD 1x8x6
- Resultant production datasets (currently unofficial) used as baseline for validation checks

higuera_fardet-vd__fd_mc_2023a__mc__hit-reconstructed__*__v09_75_03d00__preliminary
prodgenie_nu_dunevd10kt_1x8x6_3view_30deg.fcl
prodgenie_anu_dunevd10kt_1x8x6_3view_30deg.fcl
prodgenie_nu_numu2nue_nue2nutau_dunevd10kt_1x8x6_3view_30deg.fcl
prodgenie_anu_numu2nue_nue2nutau_dunevd10kt_1x8x6_3view_30deg.fcl
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prodgenie_anu_numu2nutau_nue2numu_dunevd10kt_1x8x6_3view_30deg.fcl

Updates for Phase 2

- Pandora
  - New PFO characterization BDTs
  - New primary vertex finding networks
  - Updates to various clustering algorithms to accommodate the large difference in strip pitch between induction and collection planes in the vertical drift far detector
- dunesw
  - Numerous new releases (and corresponding LArSoft updates) since the end of phase 1

v09_75_03d01
v09_76_00d00
v09_77_00d00
v09_78_01d00-01 — Since VD reco1

v09_78_03d00-01
v09_78_06d00
v09_79_00d00-02
v09_81_00d01 — Since HD reco1

Includes bug fix when not accounting for interplane timing

Includes Pandora updates (and other upstream updates)

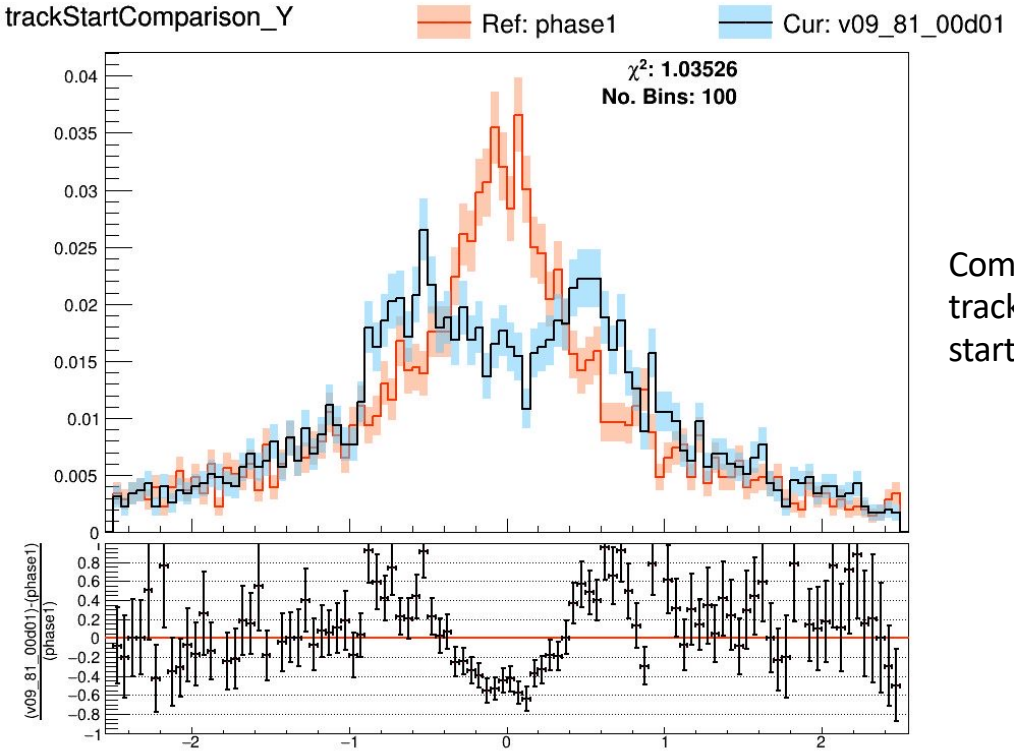
- Need to ensure that integration of phase 2 updates and dunesw/LArSoft changes have no unintended consequences

Validation process

- For the comparison, we take a subset of the events from the phase 1 SAM datasets
  - 3000 events per sample (this isn't a performance assessment, just checking distributions look similar)
  - Run reco2 and the Pandora analyser using v09_78_01d01 to generate a phase 1 reference
    - v09_78_01d01 is equivalent to v09_75_03d00 for VD
  - Run reco2 and the Pandora analyser using v09_81_00d01 to generate the phase 2 comparison

HD validation

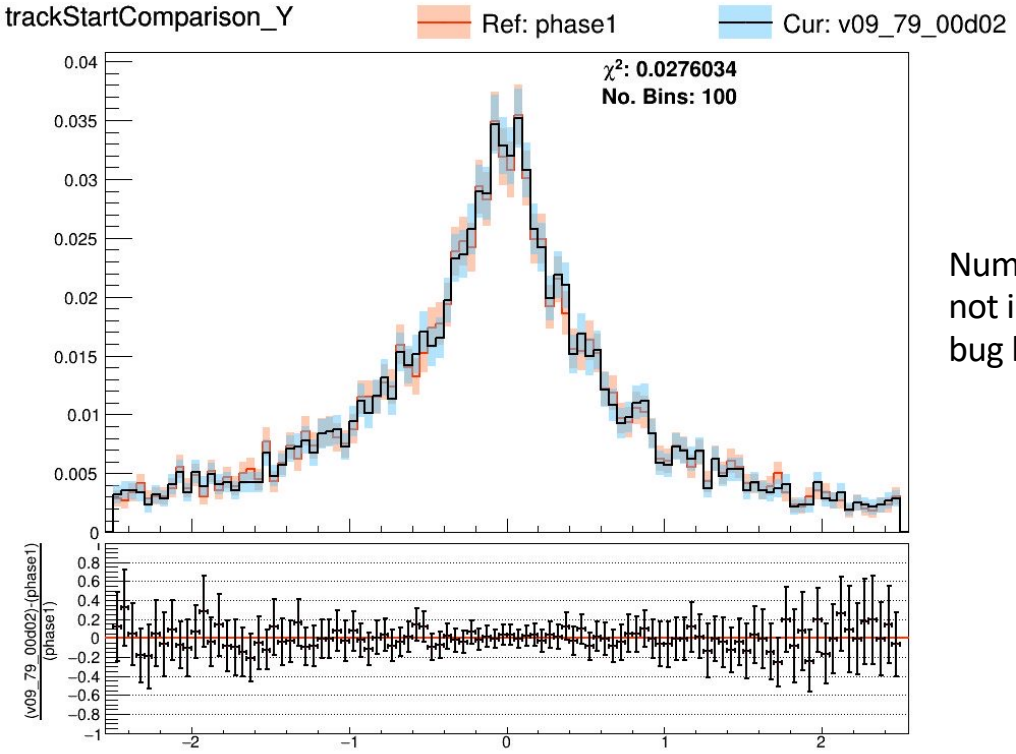
- The first comparison identified a clear bug between v09_78_01d01 and v09_81_00d01



Comparing the reconstructed track start position to the true start position

HD validation

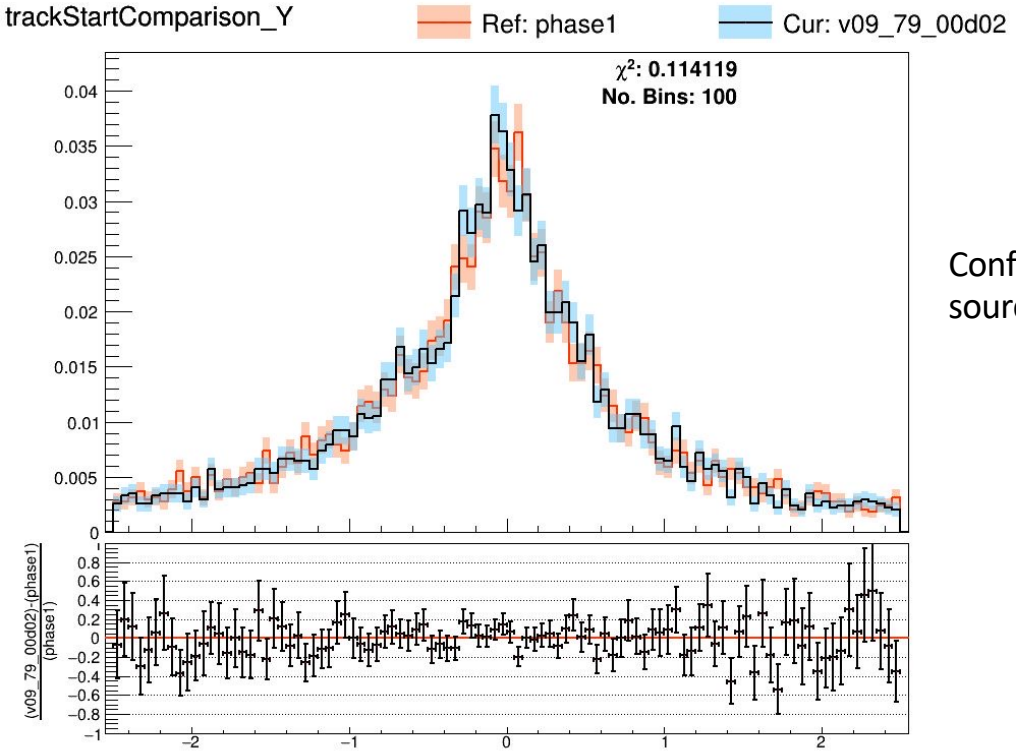
- Previous release validation confirms bug was introduced specifically in v09_81_00d01



Numerous changes meant it was not immediately clear where the bug had been introduced

HD validation

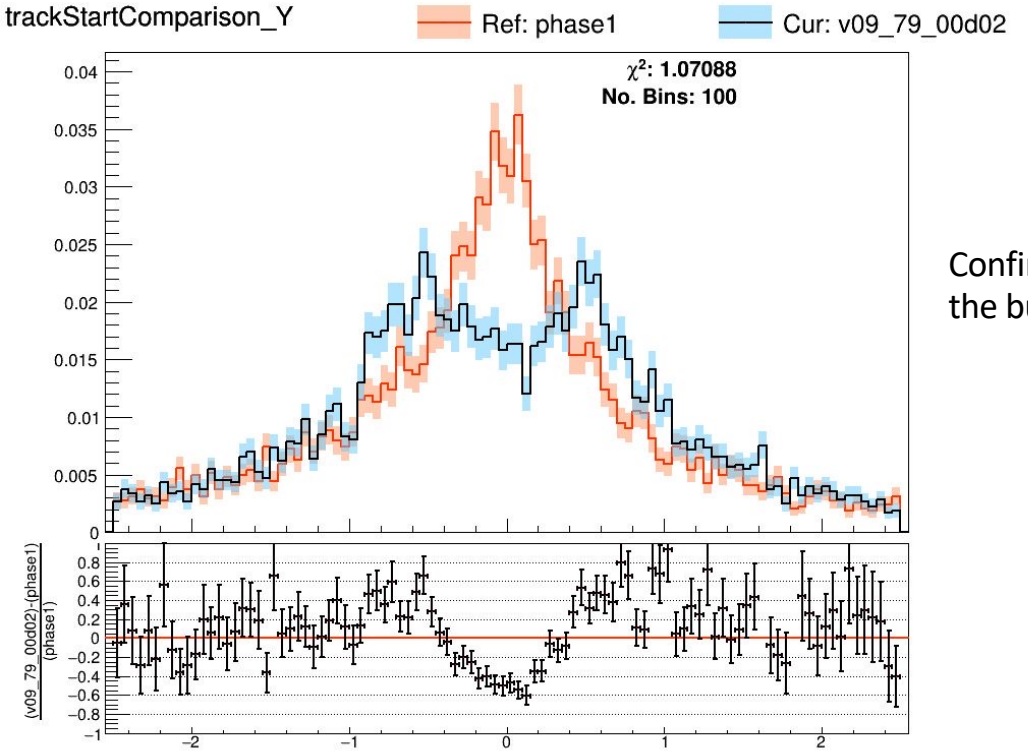
- Rolled back to v09_79_00d02 and then incorporated only the Pandora changes



Confirmed these were not the source of the bug

HD validation

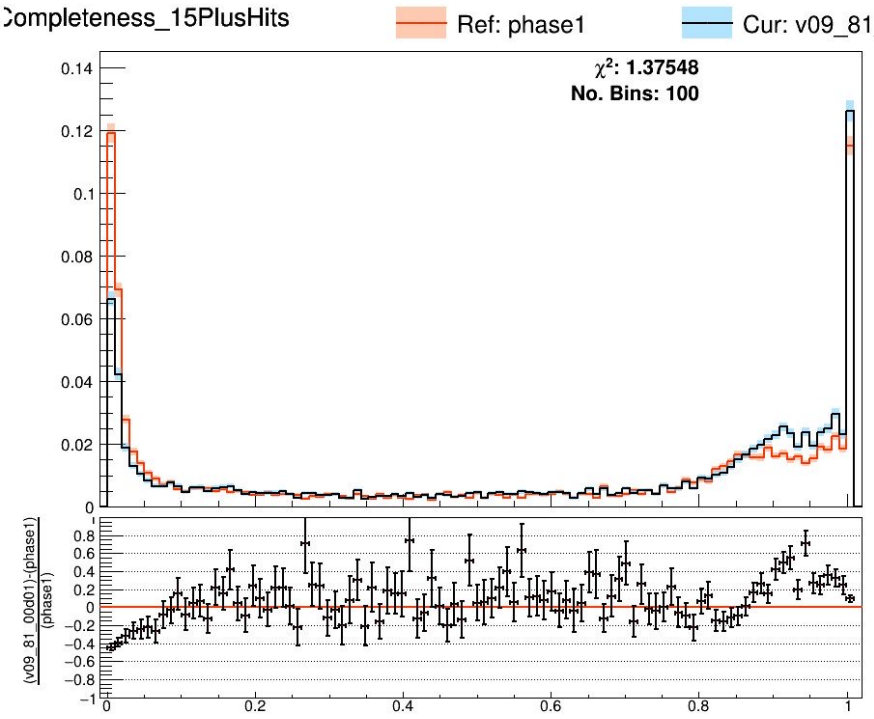
- A dunecore change updated the HD v5 GDML

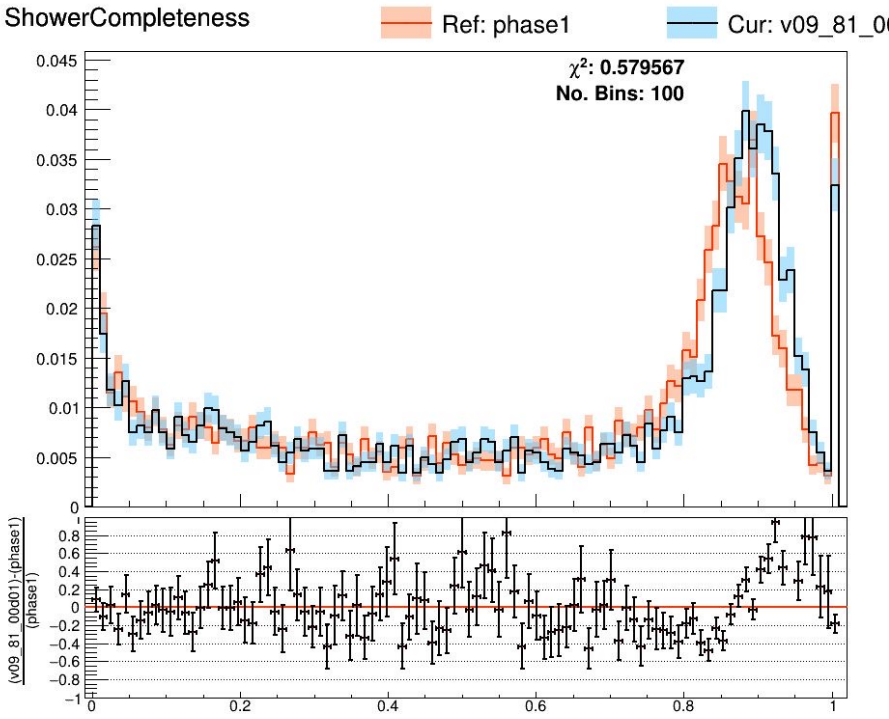


Confirmed this is the source of the bug

VD validation

- VD comparison looks good, with useful improvements in particle completeness





Summary

- Phase 2 validations look good following HD GDML bug fix
- Provisionally, without geometry issue, HD runs look unchanged, as hoped given updates targeted VD improvements
  - Reverting geometry change for a new phase 2 production release (v09_81_00d02)
  - Will revalidate when tagged release is available
  - From Pandora perspective, we are ready to complete the FD production
- VD runs show gains in particle completeness, in line with targeted updates