Stony Brook University

DEEP UNDERGROUND NEUTRINO EXPERIMENT

SAND Software Meeting

# Full Spill Simulation Status ECal, 3DST & TPC

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- Beginnings of a Tool Chain
- Current simulation progress and limitations
- Full Spill Events
- Initial observations

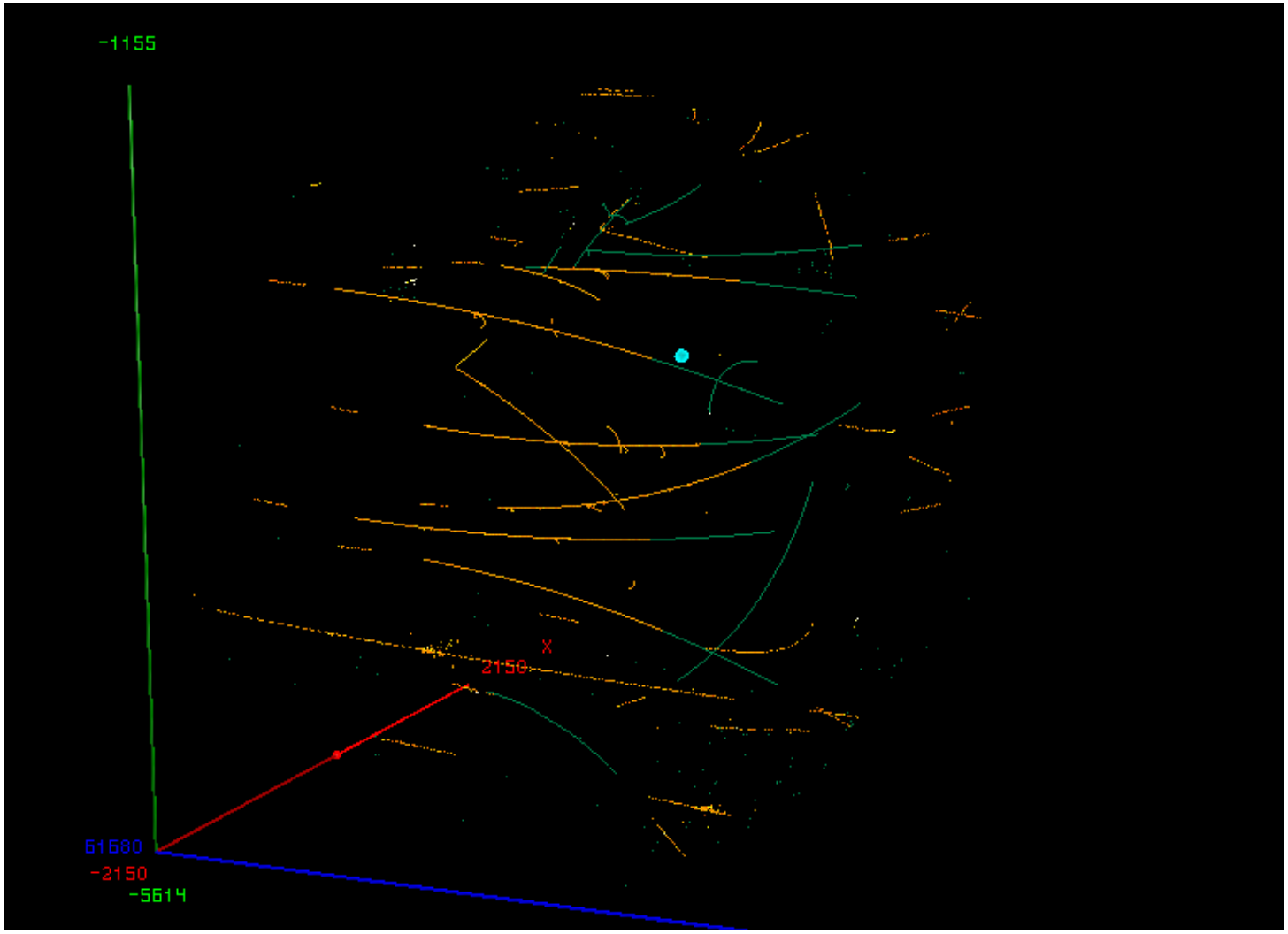
# Tool Chain

- Current spills sizes are limited by technical issues
  - Possible event size limitations in edep-sim
- Geometries generated using DUNE ND GGD
- Interactions from GENIE
  - $7.5 \times 10^{13}$ POT in 10 μs spill
  - gSimple flux in limited volume
    - Flux to 4m x 4m "square" centered on the beam
    - Interactions include 40 m of rock
    - This means that the "track" rate hitting detector will be underestimated
- EDepSim: interactions bunched according to the DUNE beam timing
- sand-stt: Simulate the ECal electronics
- ERepSim: Simulate the 3DST and TPC electronics
- CubeRecon (translate, build hits, and reconstruct tracks)

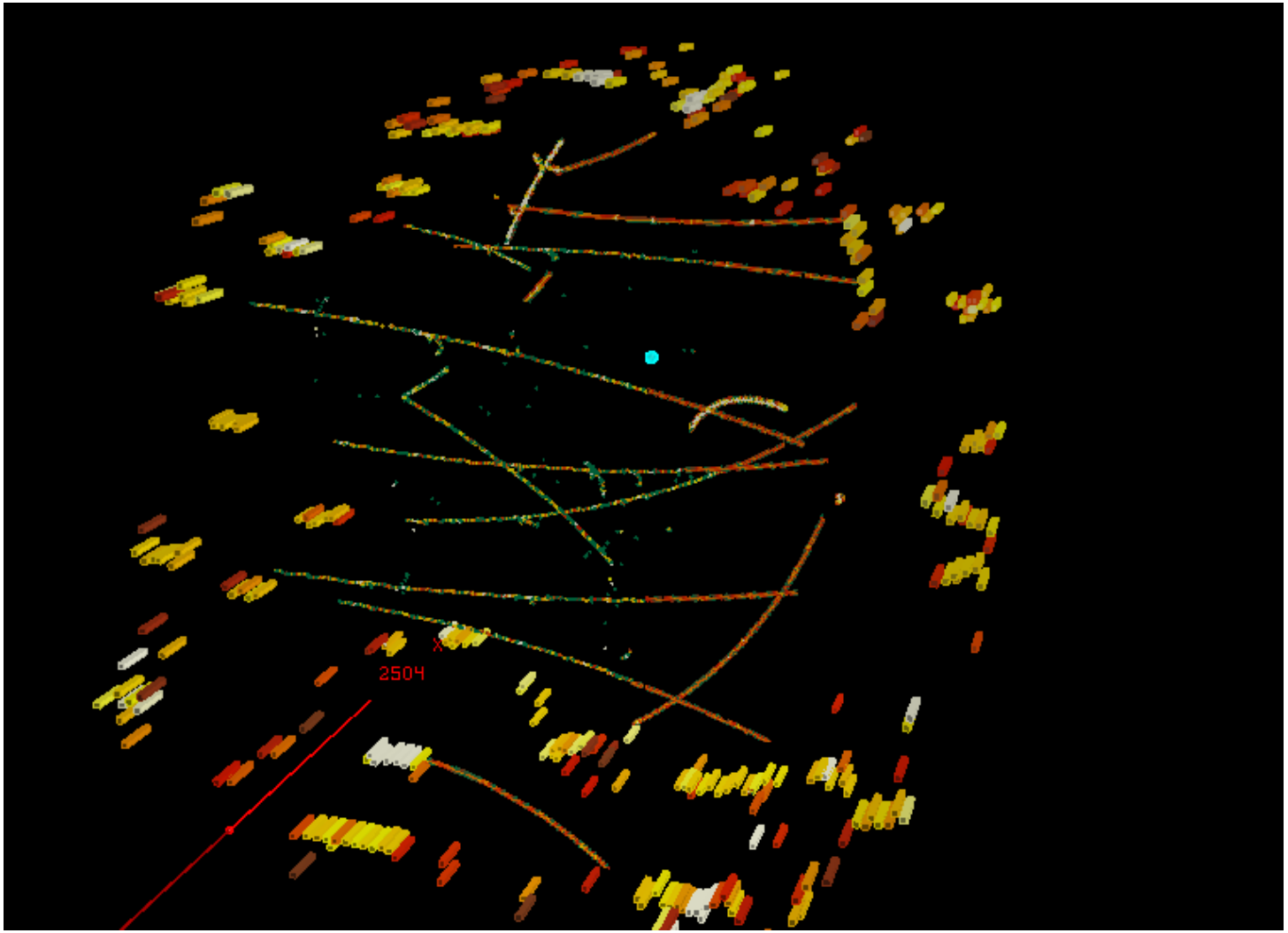
# Current Progress and Limitations

- Have a working stack (beam simulation through reconstruction) for 3DST and TPC. ECal is clustering is close.
- We are having problems running full beam spill events
  - Goal: $7.5 \times 10^{13}$ POT in 10 μs spill with the ntuple flux (not limited to 4x4 cross section) of 250 m of upstream rock
    - Currently doing 4x4 plane with 40 m of upstream rock
- Provenance of ECal hits has been lost
  - Need to reconstruct which hit segments contribute to which hits based on knowledge of sand-stt digitization simulation
  - Makes hit efficiency calculations in ECal "tricky"
- Cannot optimize the current integration window in the ECal
  - Integration window is fixed at 400 ns.

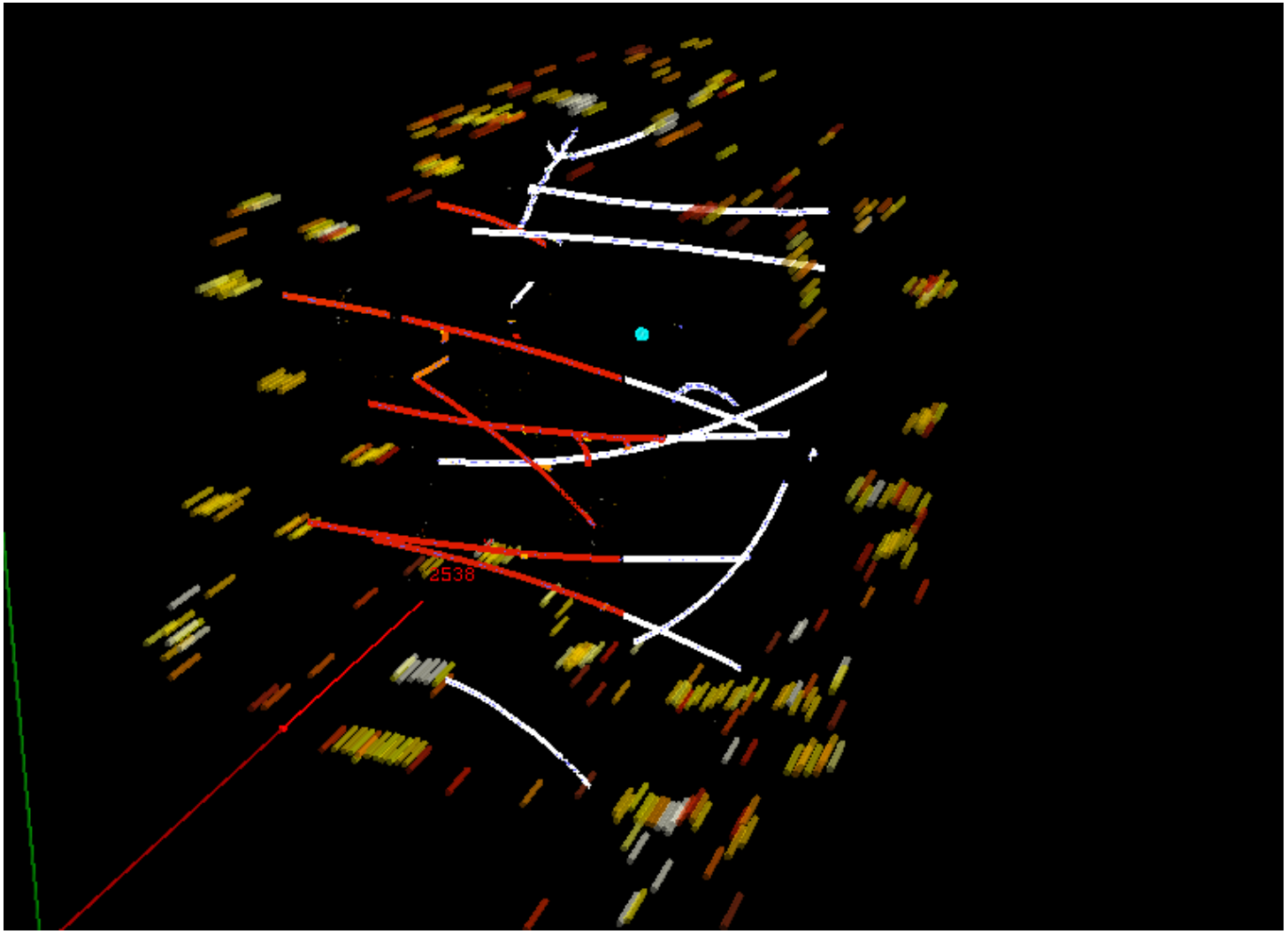
# Full Spill Events: Hit Segments



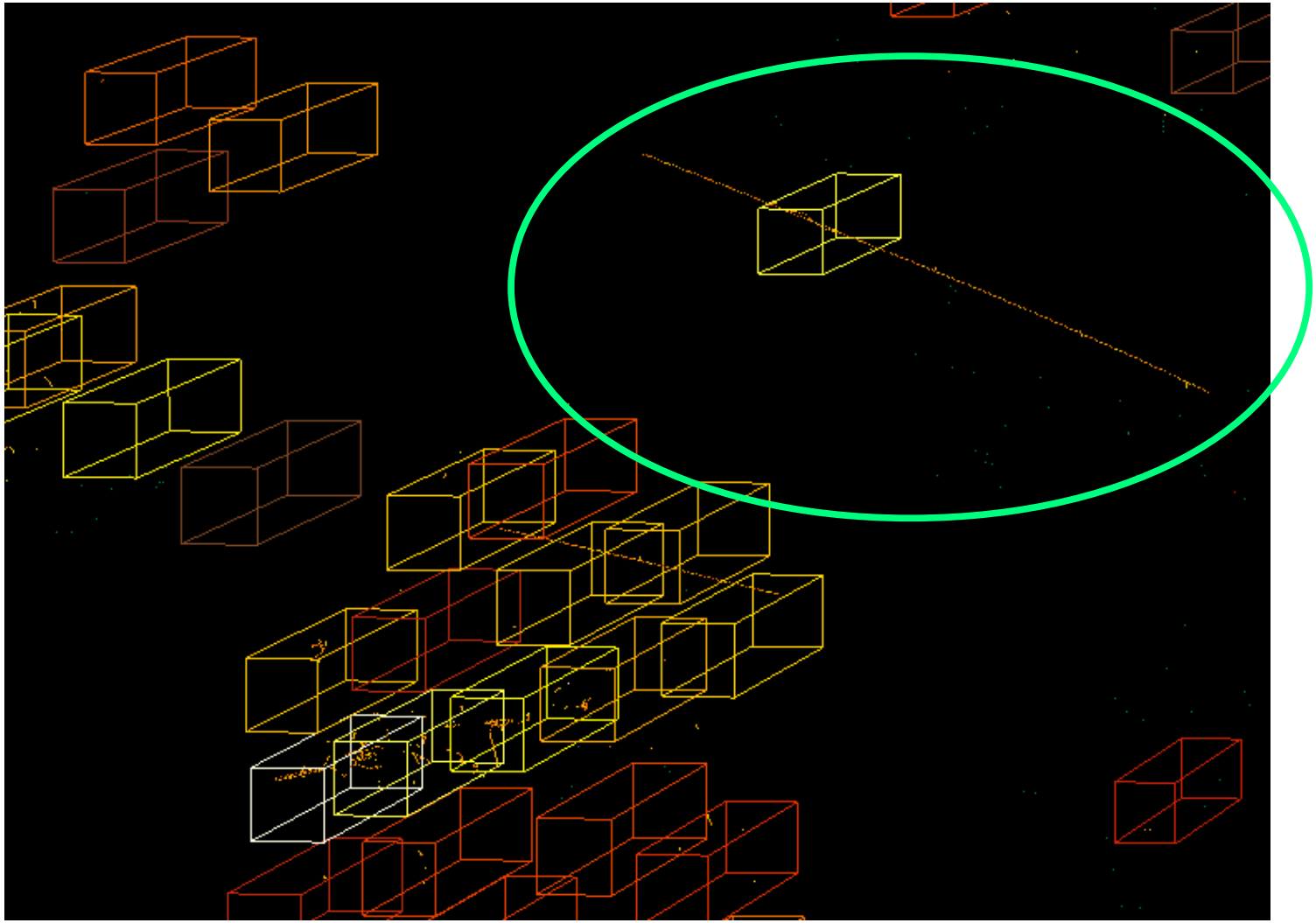
# Full Spill Events: Hits



# Full Spill Events: Reconstruction

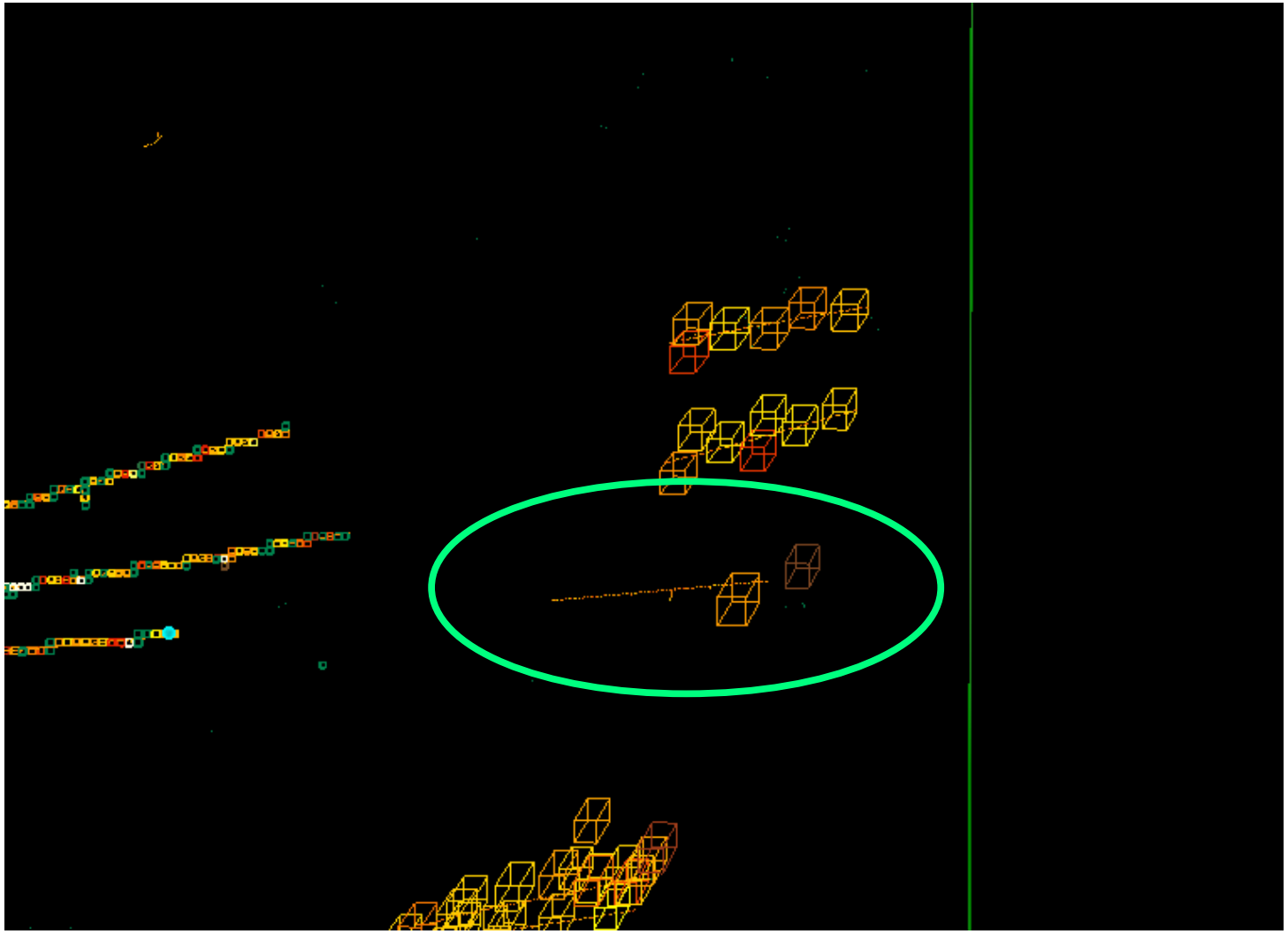


# Some Concerns



MIP track is shadowed by other tracks in the same bar

# Another example



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# Backup Slides