

## 3DST Software

# Preliminary Full Spill Studies w/ ECal

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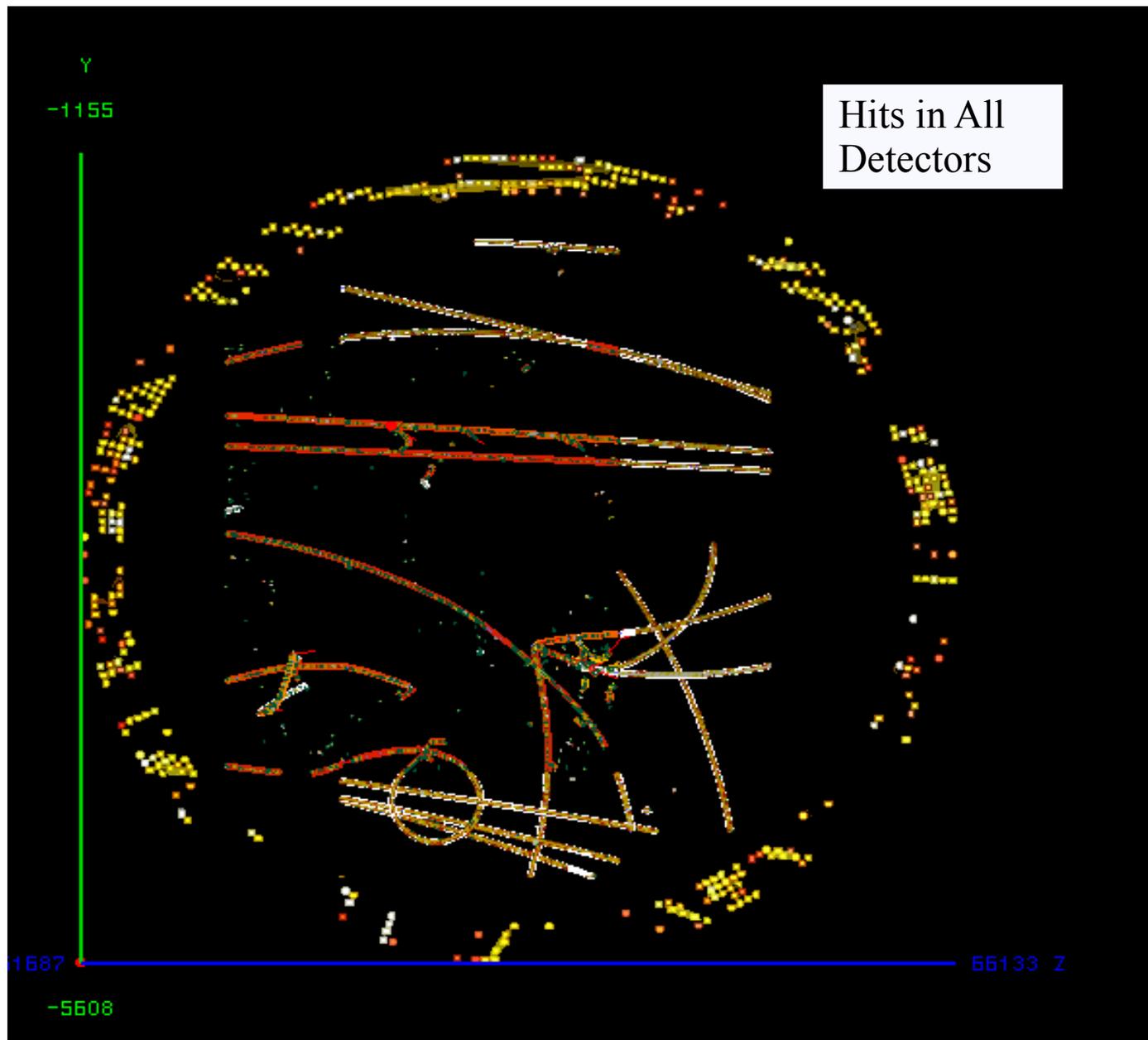
- The full spill simulation
  - ➔ ECal simulation is approximate
  - ➔ These are ECal, 3DST & TPC centered
    - result probably applies to ECal & STT as well.
  - ➔ Both RHC and FHC studied
    - Updated to use consistent simulations
- Basic performance with different ECal integration times
  - ➔ Looked at 400 ns windows
  - ➔ Overlap seen and needs to be evaluated for effect
    - Selection efficiency
    - External backgrounds



# The Full Spill Simulation

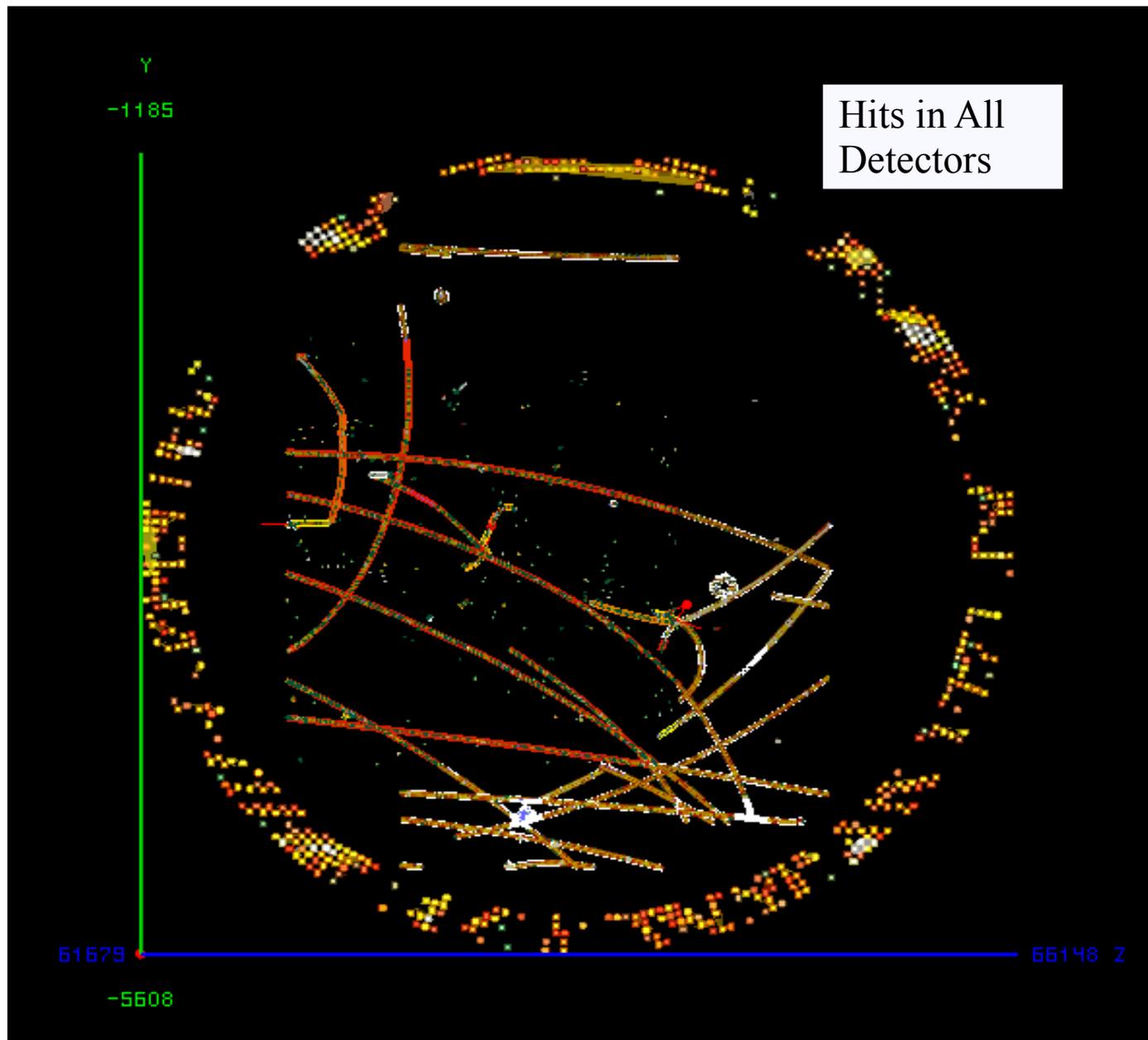
- Use the full chain
  - ➔ GENIE:
    - FHC and RHC beam with  $7.5 \times 10^{13}$  POT per spill
    - Includes 250 m of rock upstream of hall
  - ➔ EDepSim:
    - Track all particles, but only save trajectories hitting sensitive detectors
  - ➔ sand-stt:
    - Simulate ecal response for each individual interaction
  - ➔ ERepSim:
    - Overlay interactions (~3500 per RHC spill).
    - Simulate 3DST and TPC
      - Overlay edep-sim results and simulate electronics response
    - Use sand-stt for ECal
      - Uses 400 ns integration, and does not include dead time and event overlap.
      - For each channel, sort hits by time, and combine hits within the targeted integration window (either 400ns or 30 ns).
      - Now including significant fixes in how errep-sim uses the output
  - ➔ CubeRecon
    - Already built to handle full spill, so just run it.
- Updated with consistent simulations for both FHC and RHC (21/03/04)

# Typical FHC Spill w/ 3DST neutrino



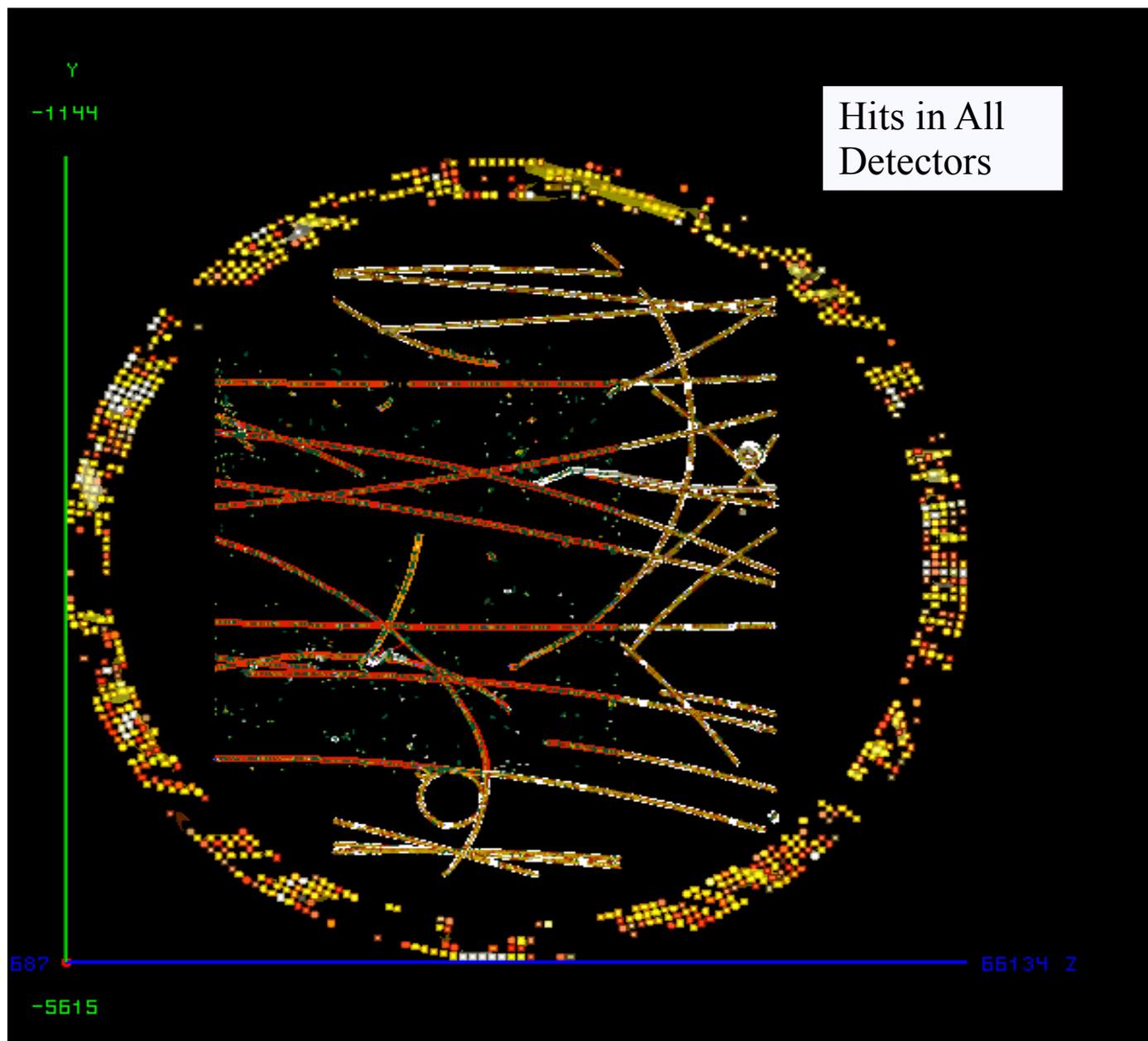
First event with a 3DST neutrino interaction

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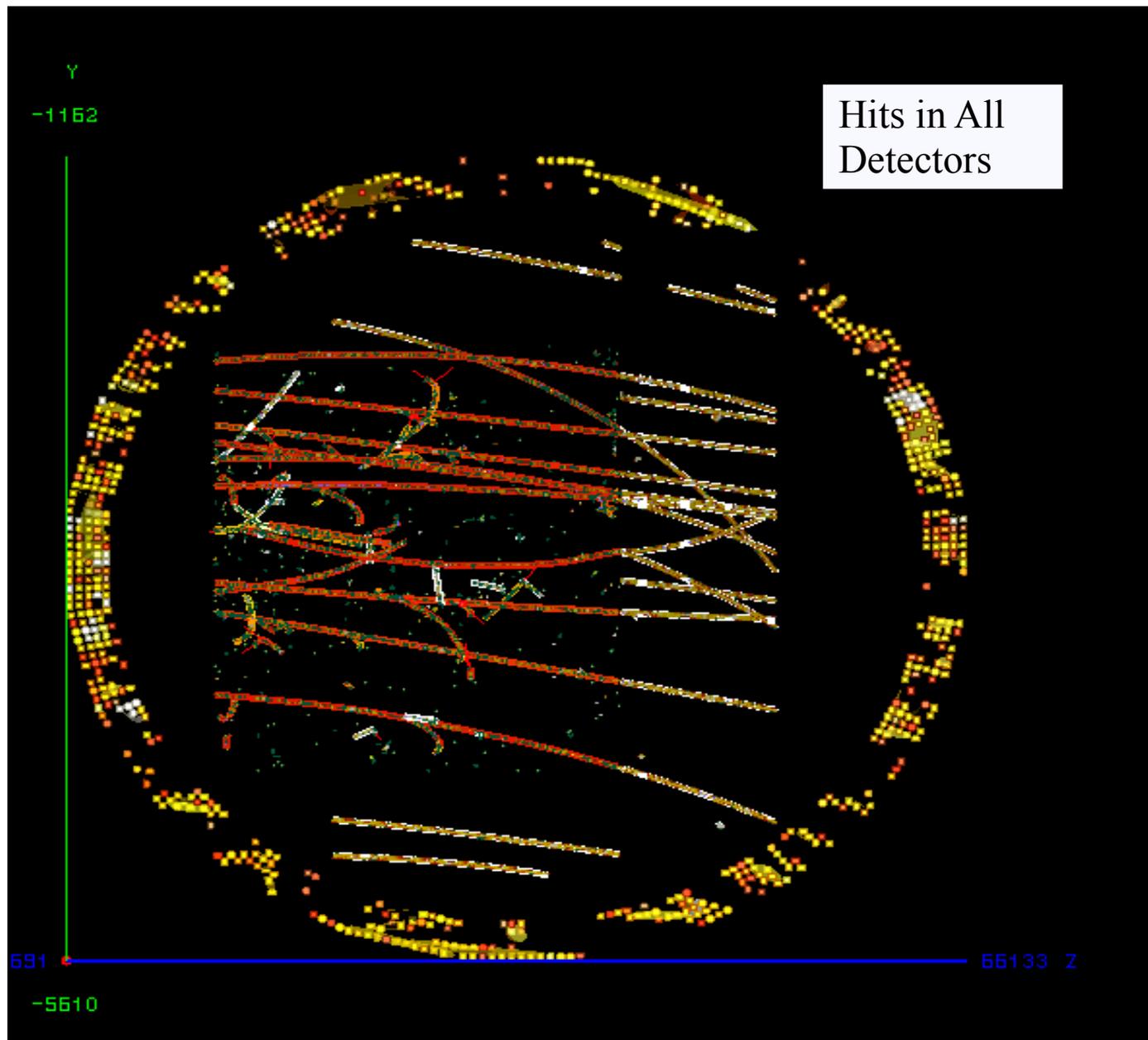
Second event with a 3DST neutrino interaction

# Typical FHC Spill w/ 3DST neutrino



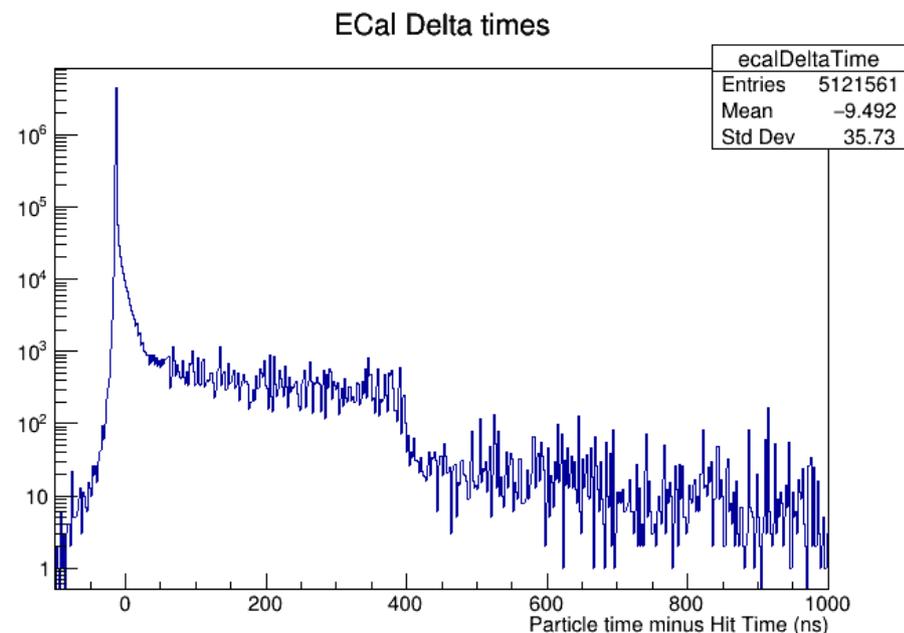
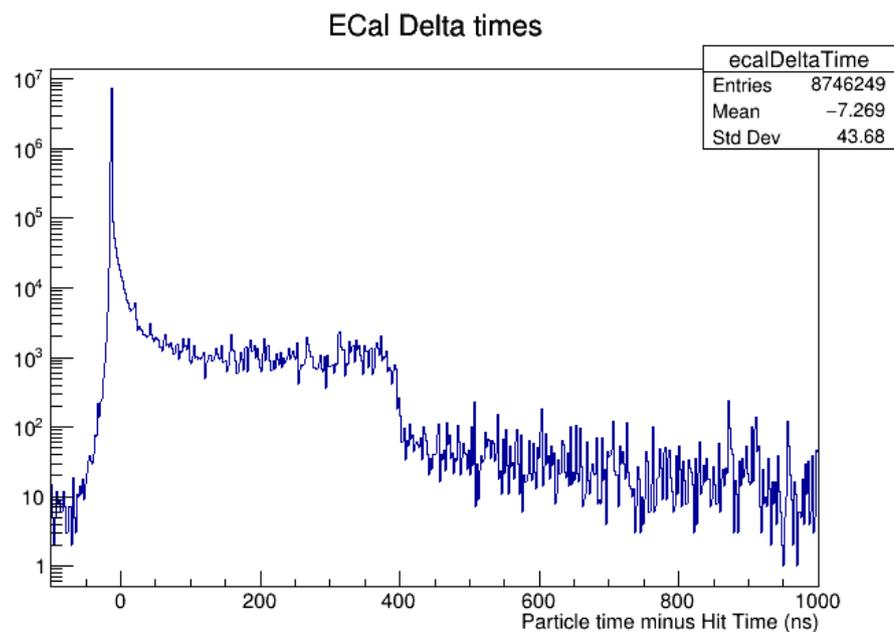
Third event with a 3DST neutrino interaction

# Typical FHC Spill w/ 3DST neutrino



Fourth event with a 3DST neutrino interaction

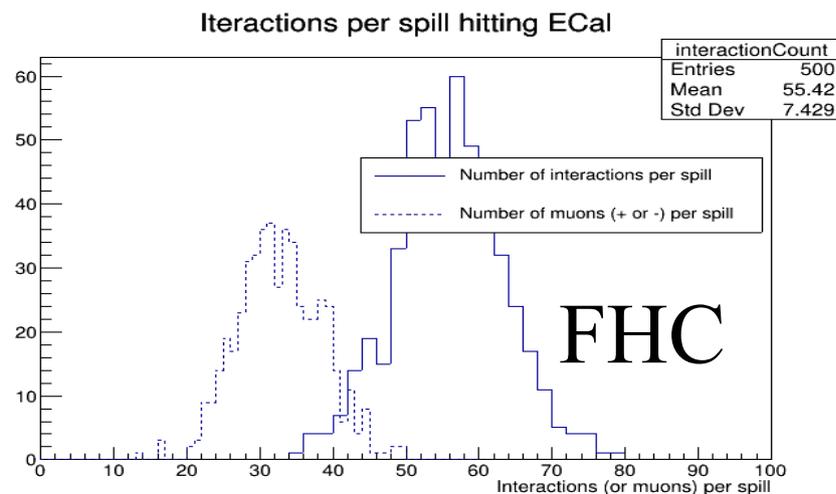
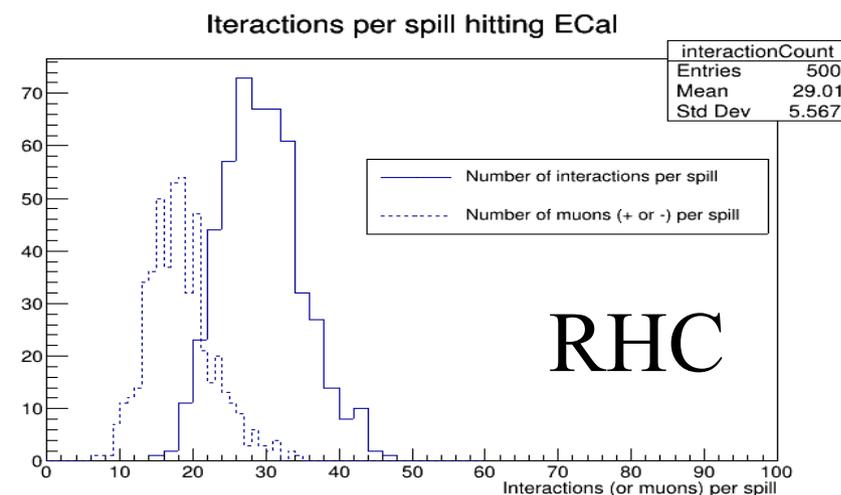
# Simulation Surprises



- The new SAND-STT simulation has trajectories contributing to hits for a full micro-second
  - ➔ 800 ns can make since because hits are being combined
- This can lead to an overestimation of the overlap

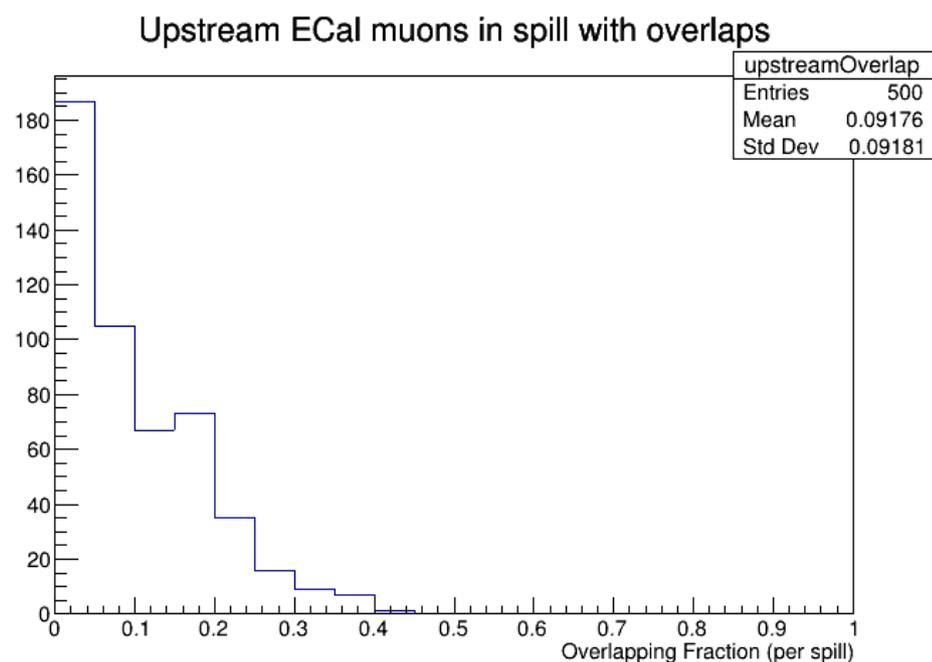
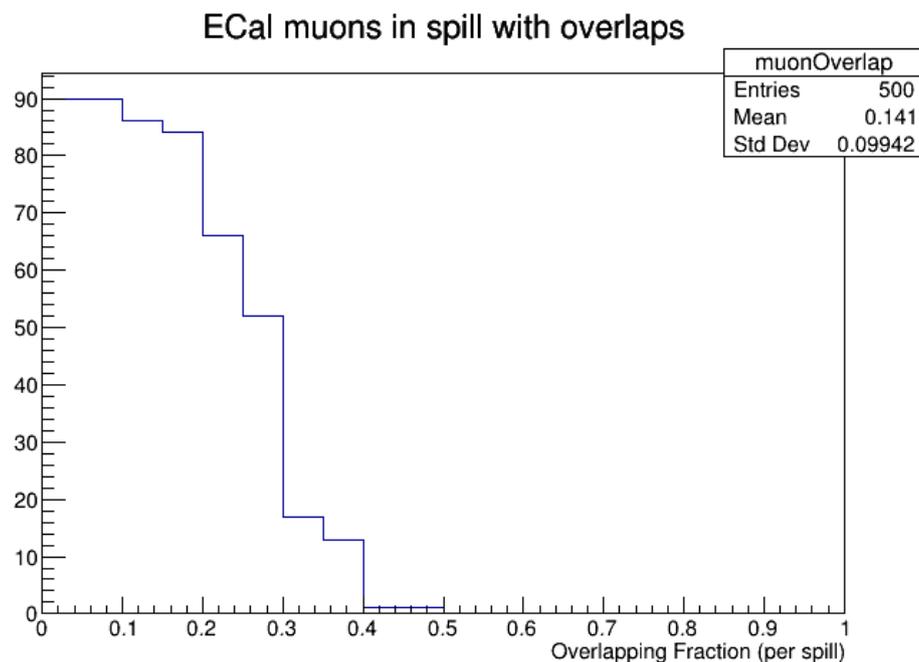
# Interactions hitting the ECal

- An interaction hits the ECal if:
  - ➔ A charged particle deposits energy
  - ➔ Deposited energy generates enough light
- Interactions per RHC spill: 29
  - ➔ Most of the interactions are from the upstream side of the yoke
- Interactions per FHC spill: 55



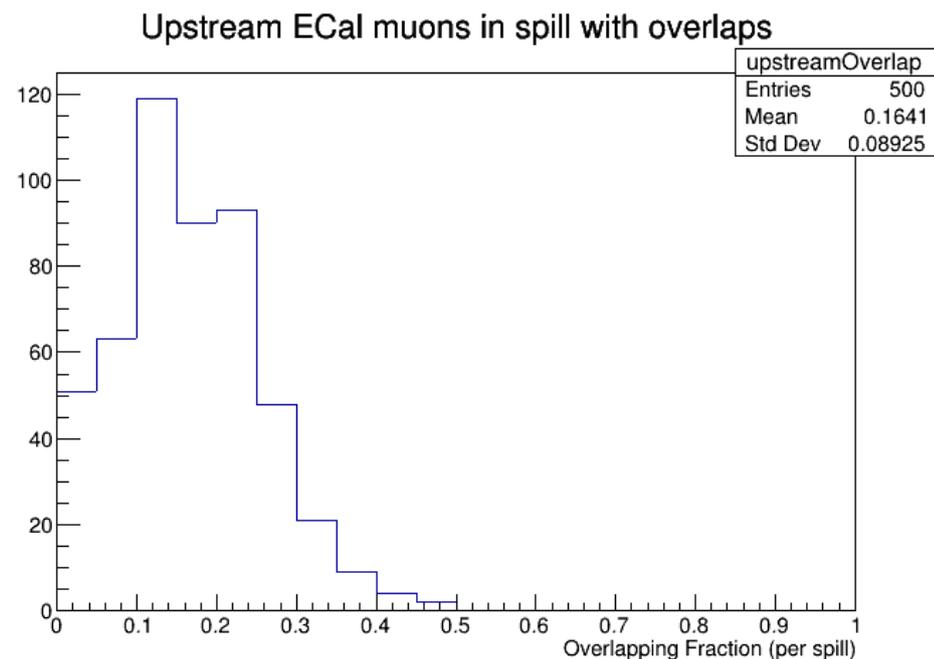
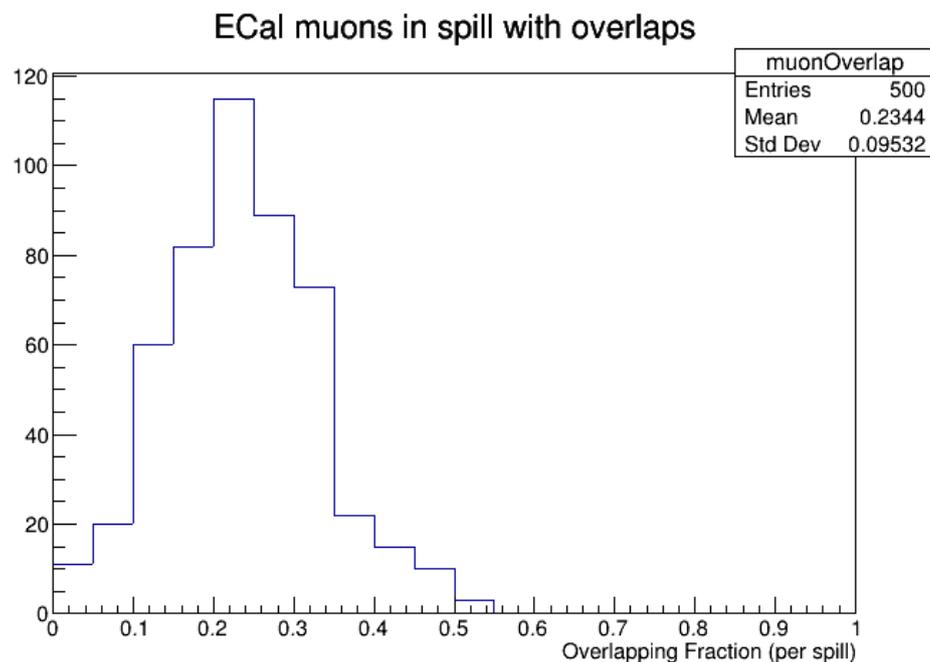
# RHC Overlapping Interactions

- Fraction of all muons with an overlap in the ECal
  - ➔ Could be on upstream or downstream side
- Fraction of all muons with an overlap on the upstream side of the ECal
  - ➔ Ignore overlaps on downstream side



# FHC Overlapping Interactions

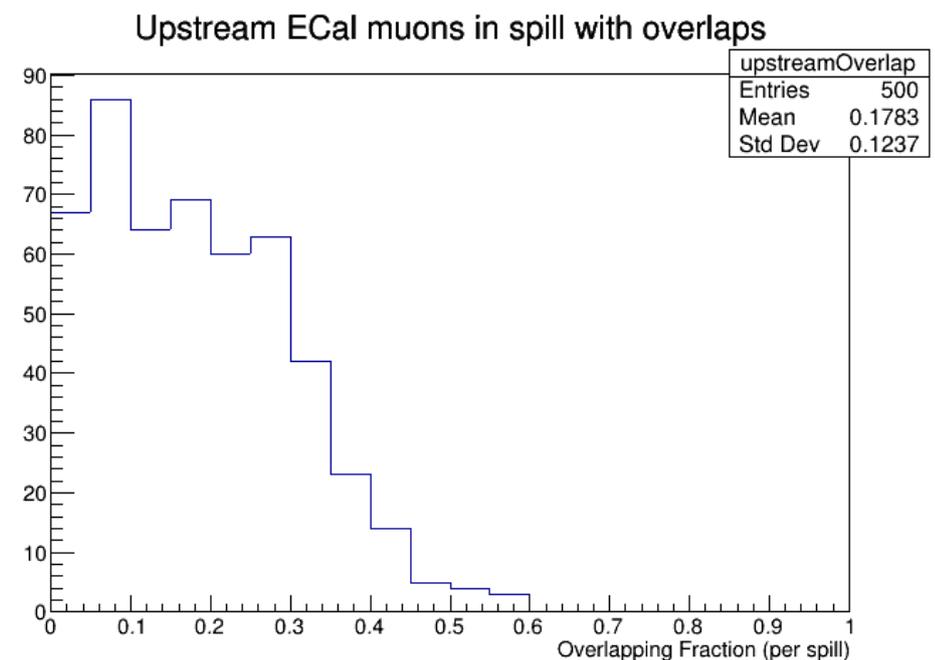
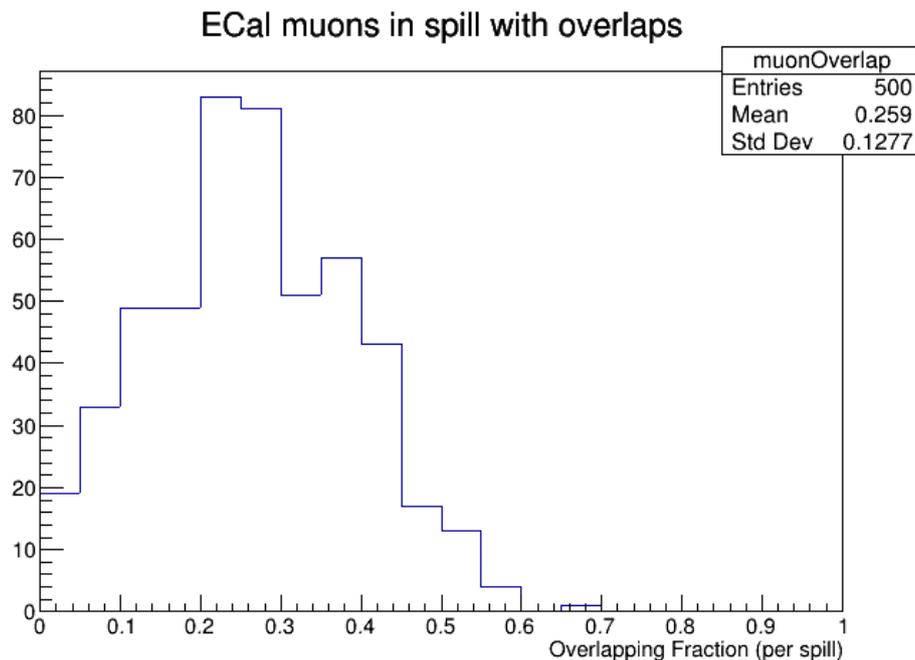
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# RHC Overlapping Particles

(separated by 1 m, different primaries)

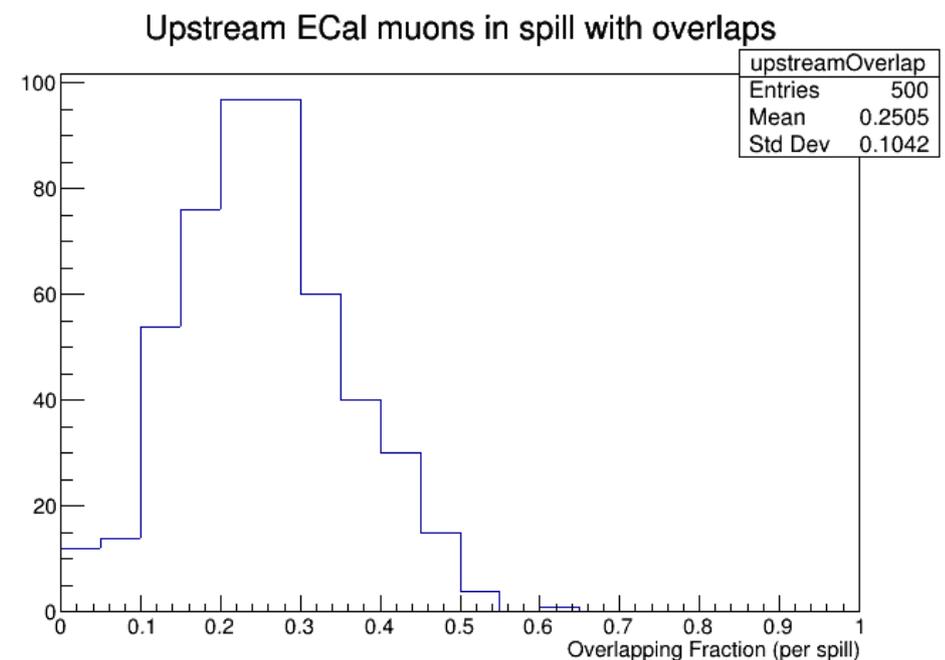
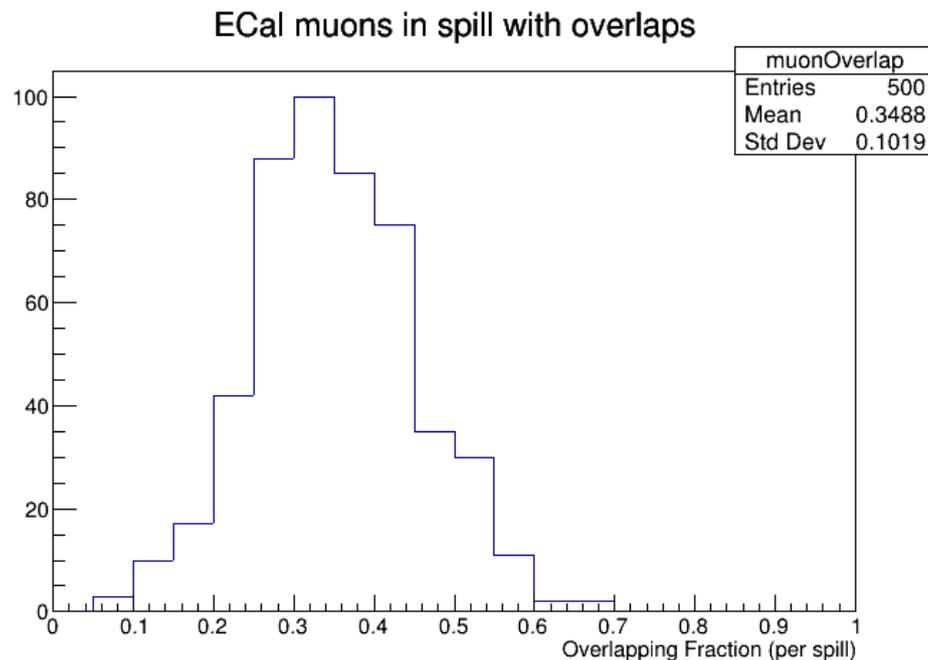
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# Backup Slides