# Tau benchmark in the Insert

Sebouh Paul
UC Riverside
10/22/2024

τ benchmark as proxy for jets

- Simulate τ with 3.0<η<4.0
- Allow them to decay in dd4hep
  - ~65% of τ decays are hadronic
  - In analysis, only select events with no muons nor electrons
- Truth "hadronic final state" four momentum, $p_{hfs}=p_\tau-p_{\nu\tau}$
  - Further require $m_{hfs}>m_{\pi\pm}$ to ensure that there is more than one hadron in the jet

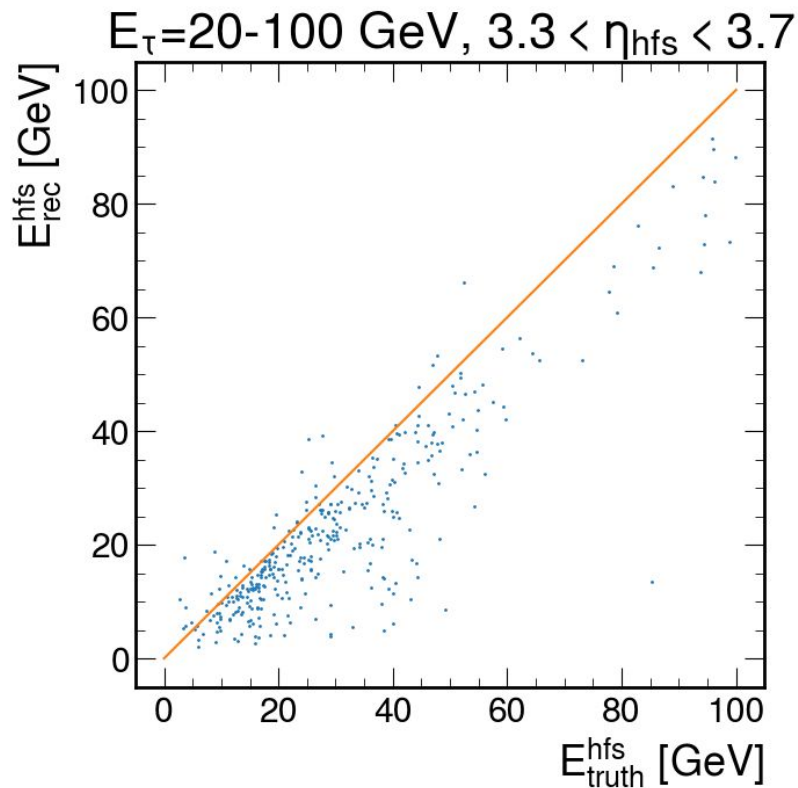https://github.com/eic/detector_benchmarks/tree/insert_tau
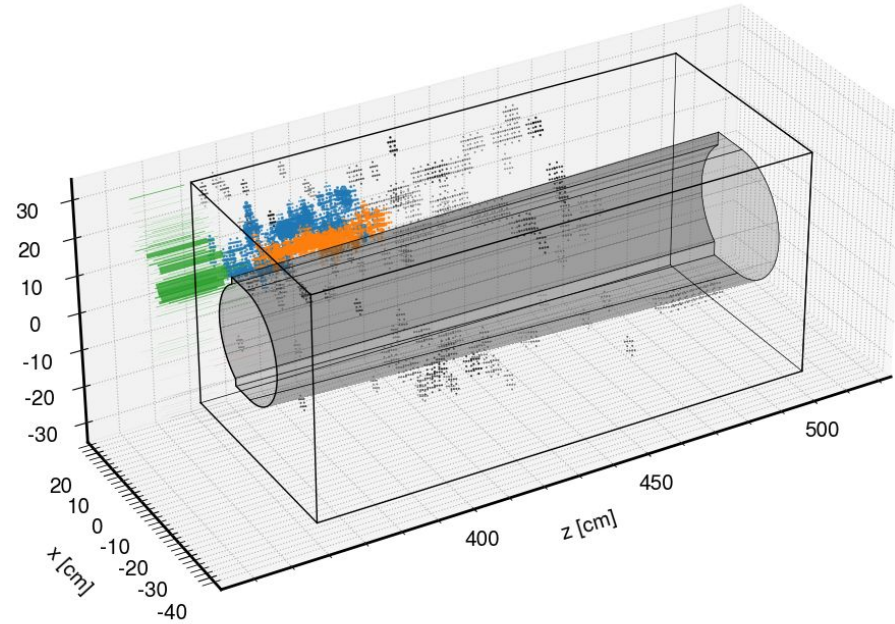
More events
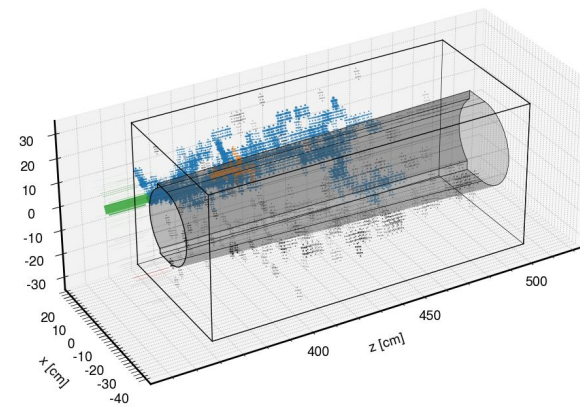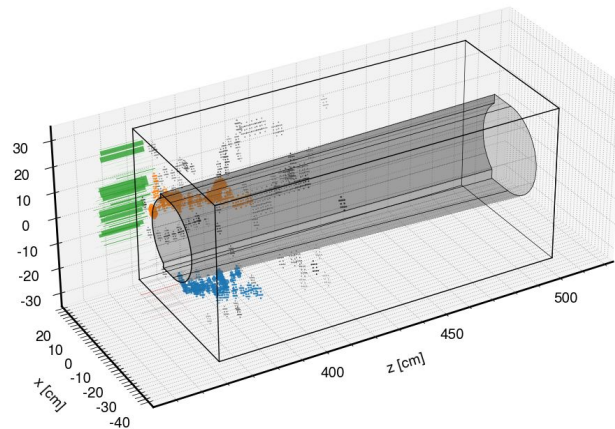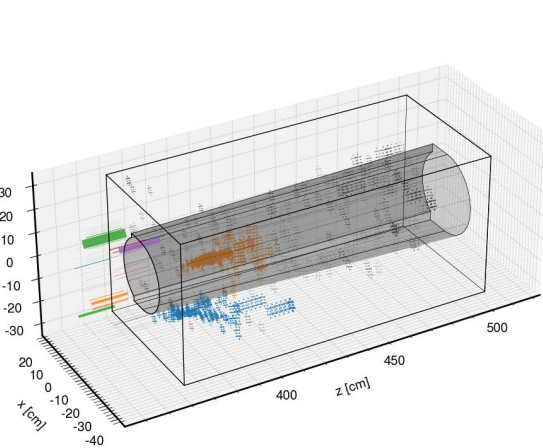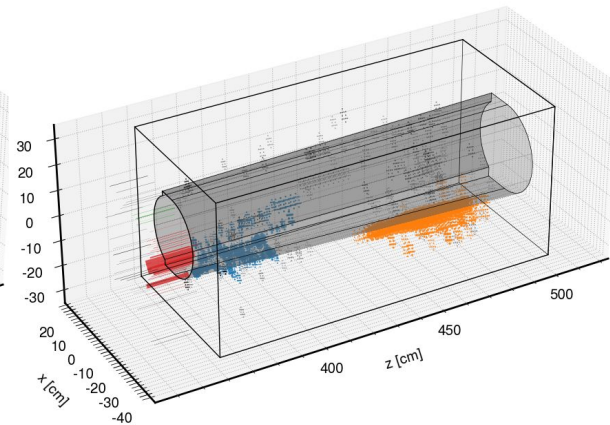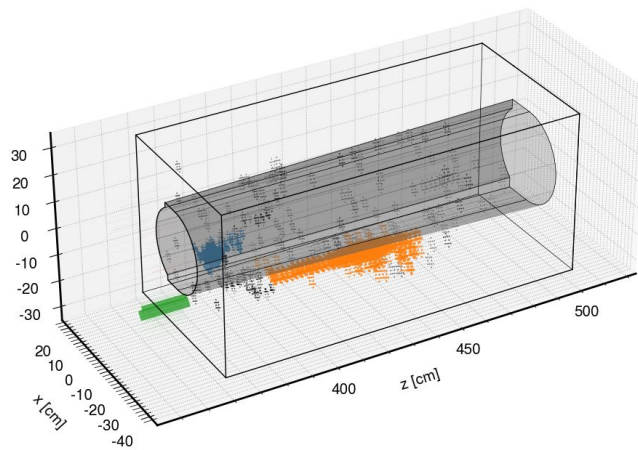
Energy reconstruction

- Sum of energies of all clusters in FEMC, insert and LFHCAL.
  - TODO include corrections for non-compensation of the insert
- Compared to the energy of the hadronic final state of the tau decay

Theta reconstruction

- Direction determined by sum of momenta, assuming all particles are massless

$$\vec{p}_{\text{tot}} = \sum_{i \in \text{clusters}} E_i \frac{\vec{x}_i}{|\vec{x}_i|}$$

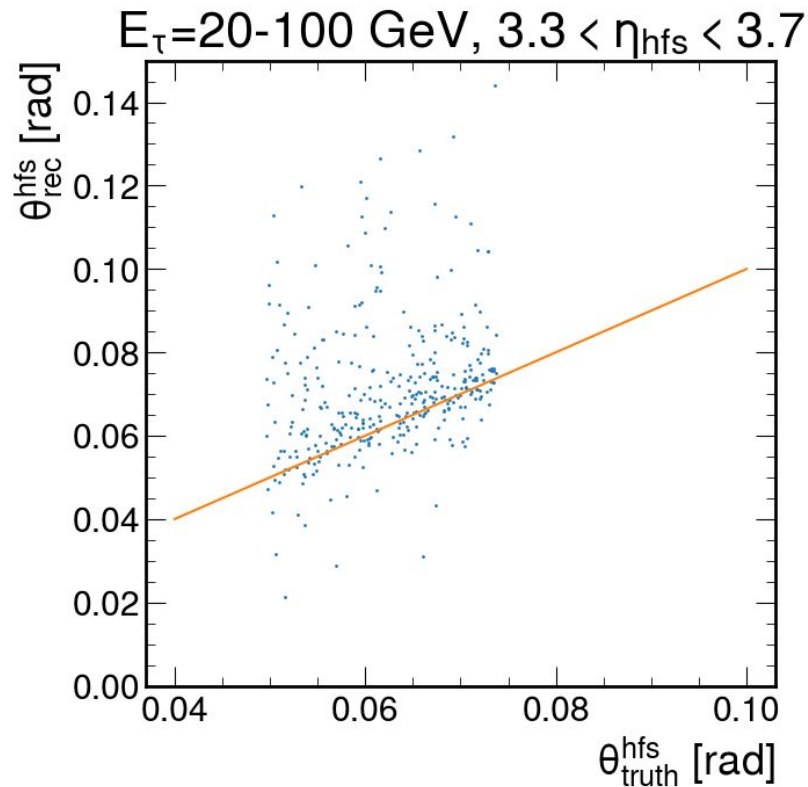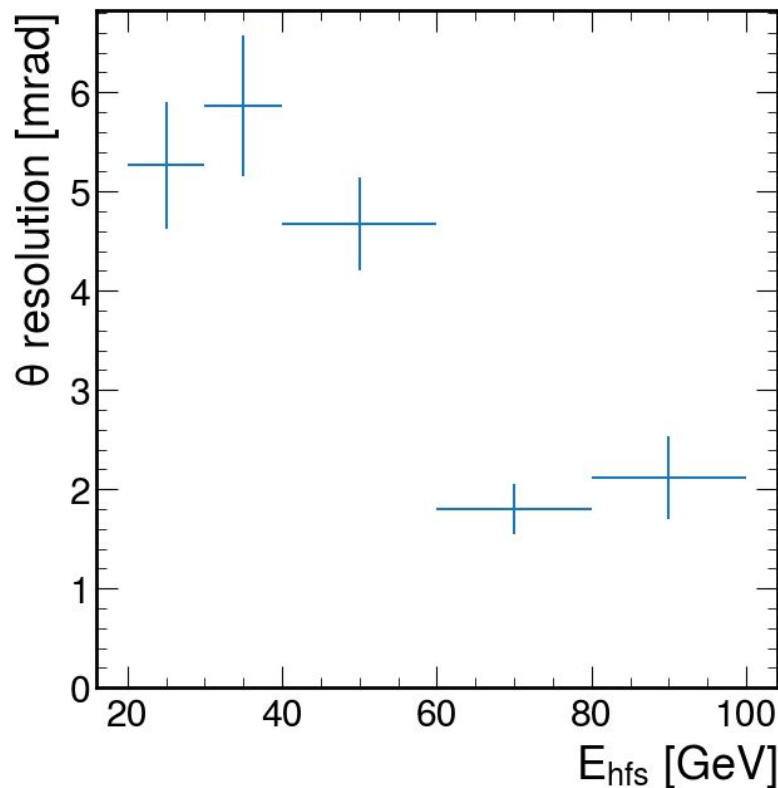- This should improve when corrections are included

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- This should improve once energy corrections are included

Summary

- A benchmark is being developed which uses tau decay as a source of jets in the insert
- Plans:
  - Distinguish between hadrons and photons (which come from π0 decay) in jets
  - Improve energy and theta reconstruction with corrections for the non-compensating nature of the detector
  - Increase statistics in order to determine η dependence of performance