TrackPerf Package and Tracks at Calorimeter

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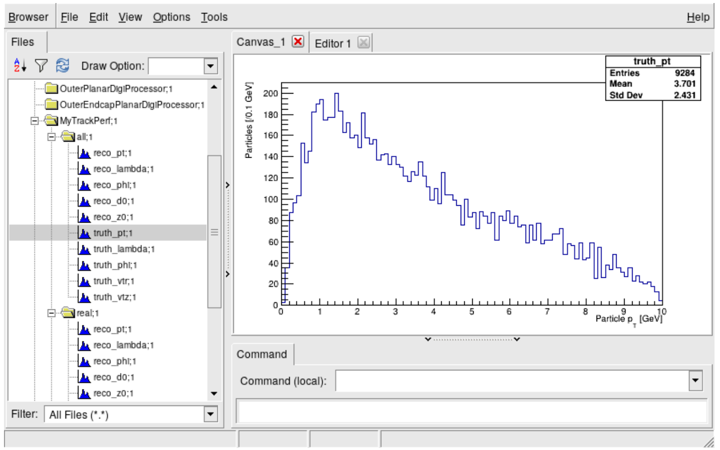
Muon Collider

TrackPerf: Package for Common Tracking Plots

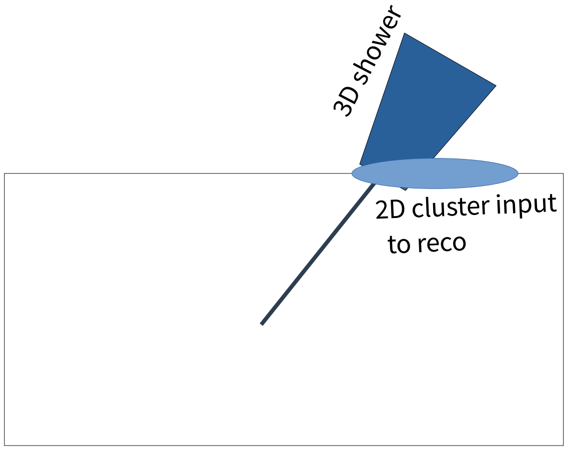
- **Common way to compare the different tracking approaches**
  - Anyone already working on this? Started: TrackPerf
- **Proposed functionality**
  - Input: EVENT::Track collection
  - Output: all the histogram you would want
    - Parameters of truth particles matched/not-matched/all
    - Parameters of tracks matched/not-matched/all
    - Resolution plots of all parameters
  - Configurable selection on truth particles
    - Default: charged, decay in tracker, left tracker
    - Option to filter for particles from b-meson decay
  - Apache Parquet file for custom studies (already there)

```
registerProcessorParameter("MatchProb",
                           "Minimum matching probabilty to be considered a good track-mc match.",
                           _matchProb,
                           _matchProb);

registerInputCollection( LCIO::MCPARTICLE,
                         "MCParticleCollection" ,
                         "Name of the MCParticle collection"  ,
                         _mcpColName,
                         _mcpColName
                         );

registerInputCollection( LCIO::TRACK,
                         "TrackCollection" ,
                         "Name of the Track collection" ,
                         _trkColName,
                         _trkColName
                         );

registerInputCollection( LCIO::LCRELATION,
                         "MCTrackRelationCollection" ,
                         "Name of LCRelation collection with track to MC matching",
                         _trkMatchColName,
                         _trkMatchColName
                         );
```



Track State at Calorimeter

- **Tracks at calorimeter needed for Pflow and electron/photon ID**
- **Marlin implementation (createTrackStateAtCaloFace)**
  - Propagate to layer 0 of DD4hep calorimeter
- ***Proposed* ACTS implementation**
  - Don't have access to calorimeter geometry in ACTS
  - Will propagate to a cylinder approximating calorimeter entrance
- **Notes of track states at calorimeters**
  - Calo clusters are 3D objects projected on a 2D surface
  - Center is *not* the *entrance* to the calorimeter
  - Even more complicated in presence of B-field



Calorimeter and B-field

Why is the *HCal* inside the solenoid?? → jet energy smeared over a large area.. easy to blend with BIB

hadronic calorimeter

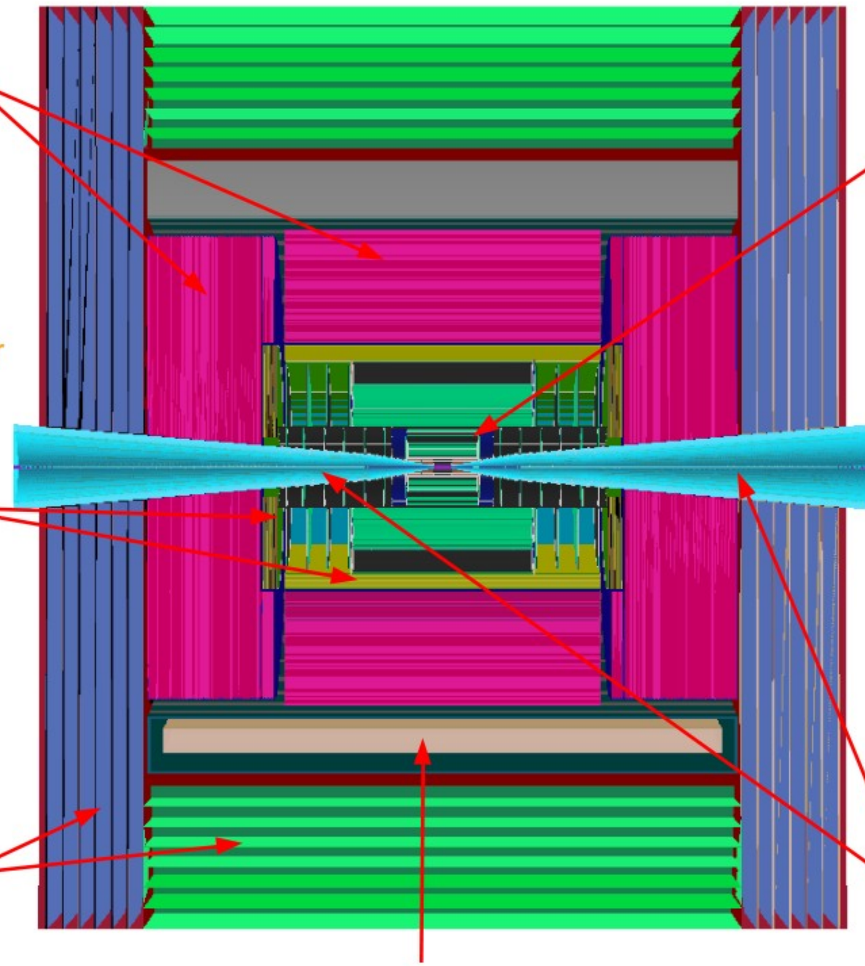
- 60 layers of 19-mm steel absorber + plastic scintillating tiles;
- 30x30 mm^2 cell size;
- 7.5 λ_I.

electromagnetic calorimeter

- 40 layers of 1.9-mm W absorber + silicon pad sensors;
- 5x5 mm^2 cell granularity;
- 22 X_0 + 1 λ_I.

muon detectors

- 7-barrel, 6-endcap RPC layers interleaved in the magnet's iron yoke;
- 30x30 mm^2 cell size.



superconducting solenoid (3.57T)

tracking system

- Vertex Detector:
  - double-sensor layers (4 barrel cylinders and 4+4 endcap disks);
  - 25x25 μm^2 pixel Si sensors.
- Inner Tracker:
  - 3 barrel layers and 7+7 endcap disks;
  - 50 μm x 1 mm macro-pixel Si sensors.
- Outer Tracker:
  - 3 barrel layers and 4+4 endcap disks;
  - 50 μm x 10 mm micro-strip Si sensors.

shielding nozzles

- Tungsten cones + borated polyethylene cladding.

BACKUP

Tracker Acceptance

- **Charged particle**
- **Generator status == 1**
- **Not decayed in tracker**
- **Vertex radius < 25 mm (first layer)**
- **$\lambda < 75°$**
- **Optional: particle from b-meson**
  - Define second processor to understand secondary vertex tracking