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# Tracking Data Structure Update

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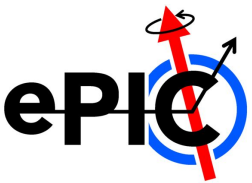

# Proposed change 1:
# look up table for volume ID to detector name

Save this relation to podio metadata?

```
Volume ID        Name       Approaches
2 acts_beampipe_central::Barrel 1
12 EndcapMPGDSubAssembly::NegativeEndcap 1,2
15 OuterSiTrackerSubAssembly::NegativeEndcap 1,2
20 MiddleSiTrackerSubAssembly::NegativeEndcap 1,2
25 InnerSiTrackerSubAssembly::NegativeEndcap 1,2
27 VertexBarrelSubAssembly::Barrel 1
29 InnerSiTrackerSubAssembly::PositiveEndcap 1,2
31 MiddleSiTrackerSubAssembly::Barrel 1
32 MiddleSiTrackerSubAssembly::PositiveEndcap 1,2
34 OuterSiTrackerSubAssembly::Barrel 1
35 OuterSiTrackerSubAssembly::PositiveEndcap 1,2
37 EndcapMPGDSubAssembly::PositiveEndcap 1,2
38 InnerMPGDBarrelSubAssembly::Barrel 1
39 EndcapTOFSubAssembly::PositiveEndcap 1,2
41 BarrelTOFSubAssembly::Barrel 1
42 OuterBarrelMPGDSubAssembly::Barrel 1
```

Reason: study detector specific behaviors (i.e. chi2 distribution per surface) with user friendly detector names

Verdic: will provide a script under https://github.com/eic/snippets

# Proposed change 2: get 3D position of measurement

```
edm4eic::Measurement2D:
  Description: "2D measurement (on an arbitrary surface)"
  Author: "W. Deconinck"
  Members:
    - uint64_t          surface          // Surface for bound coordinates (geometryID)
    - edm4hep::Vector2f loc              // 2D location on surface
    - float             time             // Measurement time
    - edm4eic::Cov3f    covariance       // Covariance on location and time
  VectorMembers:
    - float             weights          // Weight for each of the hits, mirrors hits array
  OneToManyRelations:
    - edm4eic::TrackerHit hits           // Hits in this measurement (single or clustered)
```

~~Add: -edm4hep::Vector3f pos // 3D position~~

Write a downstream algorithm/plugin to convert 2D position to 3D and write into rootfiles

Verdic: will provide a script under https://github.com/eic/snippets

- One needs to run the script in eic-container to calculate 3d position on he flight.
- Until clustering and alignment/calibration implemented, the measurement 3d position right now is effectively the same as trackerhit position

# Proposed change 3: link MCParticle to TrackerHit

**DD4hep**

```
#---------- SimTrackerHit
edm4hep::SimTrackerHit:
  Description: "Simulated tracker hit"
  Author: "F.Gaede, DESY"
  Members:
    - uint64_t cellID      //ID of the sen
    - float EDep                    //ene
    - float time                    //pro
    - float pathLength              //pat
    - int32_t   quality                 /
    - edm4hep::Vector3d position    //the hit position in [mm].
    - edm4hep::Vector3f momentum    //the 3-momentum of the particle at
  OneToOneRelations:
    - edm4hep::MCParticle MCParticle //MCParticle that caused the hit.
```

**EICrecon**

```
edm4eic::TrackerHit:
  Description: "Tracker hit (reconstructed from Raw)"
  Author: "W. Armstrong, S. Joosten"
  Members:
    - uint64_t          cellID            // The detector specifi
    - edm4hep::Vector3f position          // Hit (cell) position
    - edm4eic::CovDiag3f positionError    // Covariance Matrix
    - float             time              // Hit time
    - float             timeError         // Error on the time
    - float             edep              // Energy deposit in th
    - float             edepError         // Error on the energy
```

~~Add MCParticle to TrackerHit~~

Suggested change: Link TrackerHit to SimHit which has access to MCParticle

Verdic: Track recon algorithm should not rely on simulation only info. So instead of modifying the trackerhit collection, we will create a new association to link SimHit to TrackerHit.

# Proposed change 4: New TrackSeed structure

```
edm4eic::TrackSeed:
Description: save seed parameters and associated hits
Author:
Members:
        OneToManyRelations:
          -    edm4eic::TrackerHit triplets // three tracker hits used to form the seed
        OneToOneRelations:
          -    edm4eic::TrackParameters seedParams  // parameters from triplet
```

The TrackSeeding algorithm will produce TrackSeed instead of TrackParameters

Verdic: will have a draft to finalze during ePIC meeting workfest.

- In addition to the proposed members, also add line surface and perigee. Those info are useful for truth seeding as well.
- Seeding uses tracker hits for now. Will need to update to measurement2D in the future

# Proposed change 5: link seed to trajectory

```
edm4eic::Trajectory:
  Description: "Raw trajectory from the tracking algorithm. What is called hit here is 2d measurement indeed."
  Author: "S. Joosten, S. Li"
  Members:
    - uint32_t          type              // 0 (does not have good track fit), 1 (has good track fit)
    - uint32_t          nStates           // Number of tracking steps
    - uint32_t          nMeasurements     // Number of hits used
    - uint32_t          nOutliers         // Number of hits not considered
    - uint32_t          nHoles            // Number of missing hits
    - uint32_t          nSharedHits       // Number of shared hits with other trajectories
  VectorMembers:
    - float             measurementChi2   // Chi2 for each of the measurements
    - float             outlierChi2       // Chi2 for each of the outliers
  OneToManyRelations:
    - edm4eic::TrackParameters trackParameters // Associated track parameters, if any
    - edm4eic::Measurement2D measurements      // Measurements that were used for this track
    - edm4eic::Measurement2D outliers          // Measurements that were not used for this track
```

Add:

OneToOneRelation:

- edm4eic:TrackSeed seed // Seed associated with this trajectory

No objections