# Way to get truth of Calo cluster

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# CaloSvtxTruthEval

- I’m building a class for getting truth information of Calo cluster and SVTX track.

- I’d like to share how to connect Calo cluster and G4particle

# Flowchart of Calo Cluster to G4Particle

**RawClusterContainer**

Get list of RawCluster

**RawCluster**

Get list of RawTower key and decode them to phi/eta bin

**TowerInfoContainer**

Get TowerInfo which has corresponding phi/eta bin

**TowerInfo**

Get G4Hit list which compose that tower

**PHG4Hit**

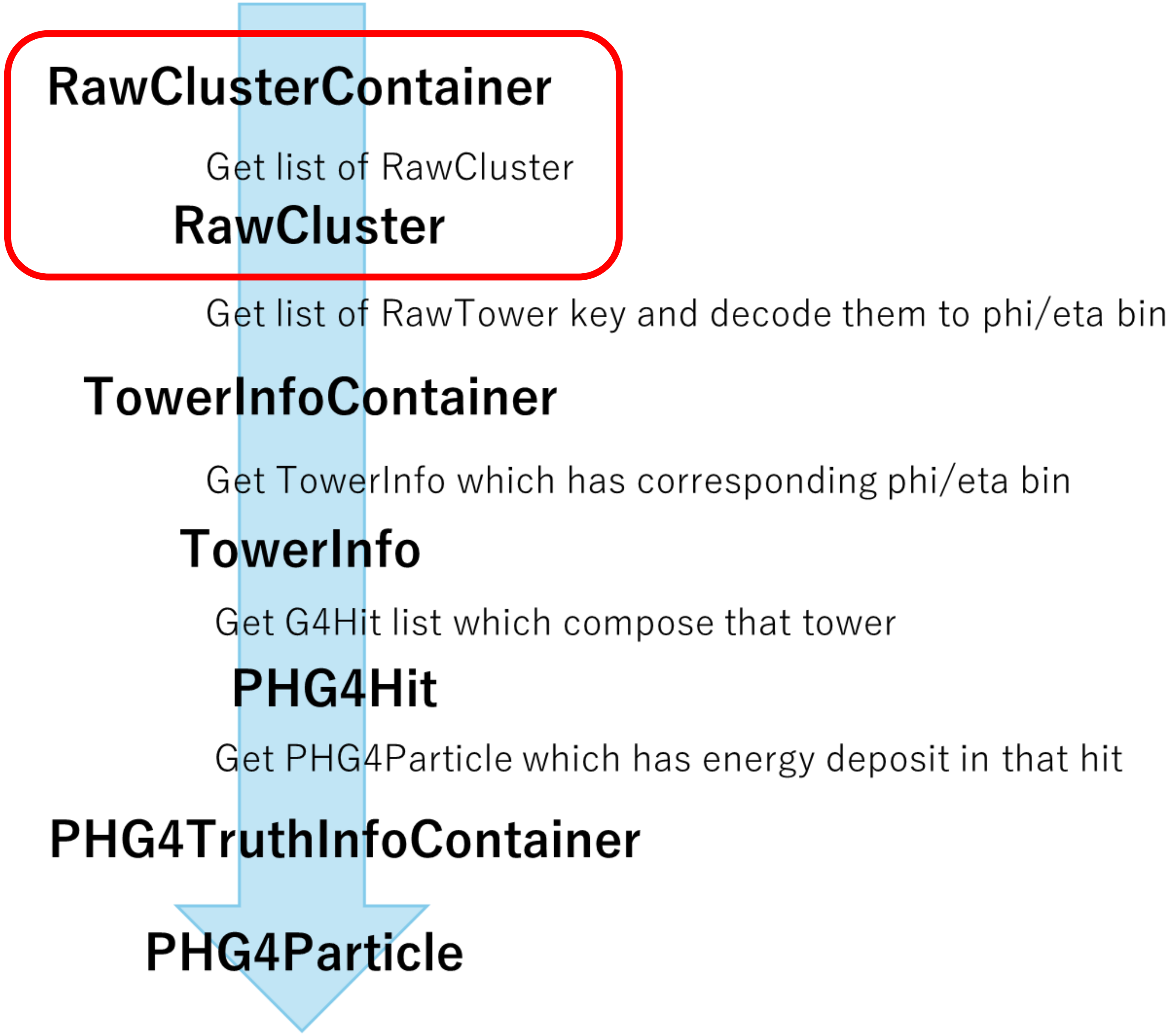
Get PHG4Particle which has energy deposit in that hit

**PHG4TruthInfoContainer**

**PHG4Particle**

# Flowchart of Calo Cluster to G4Particle

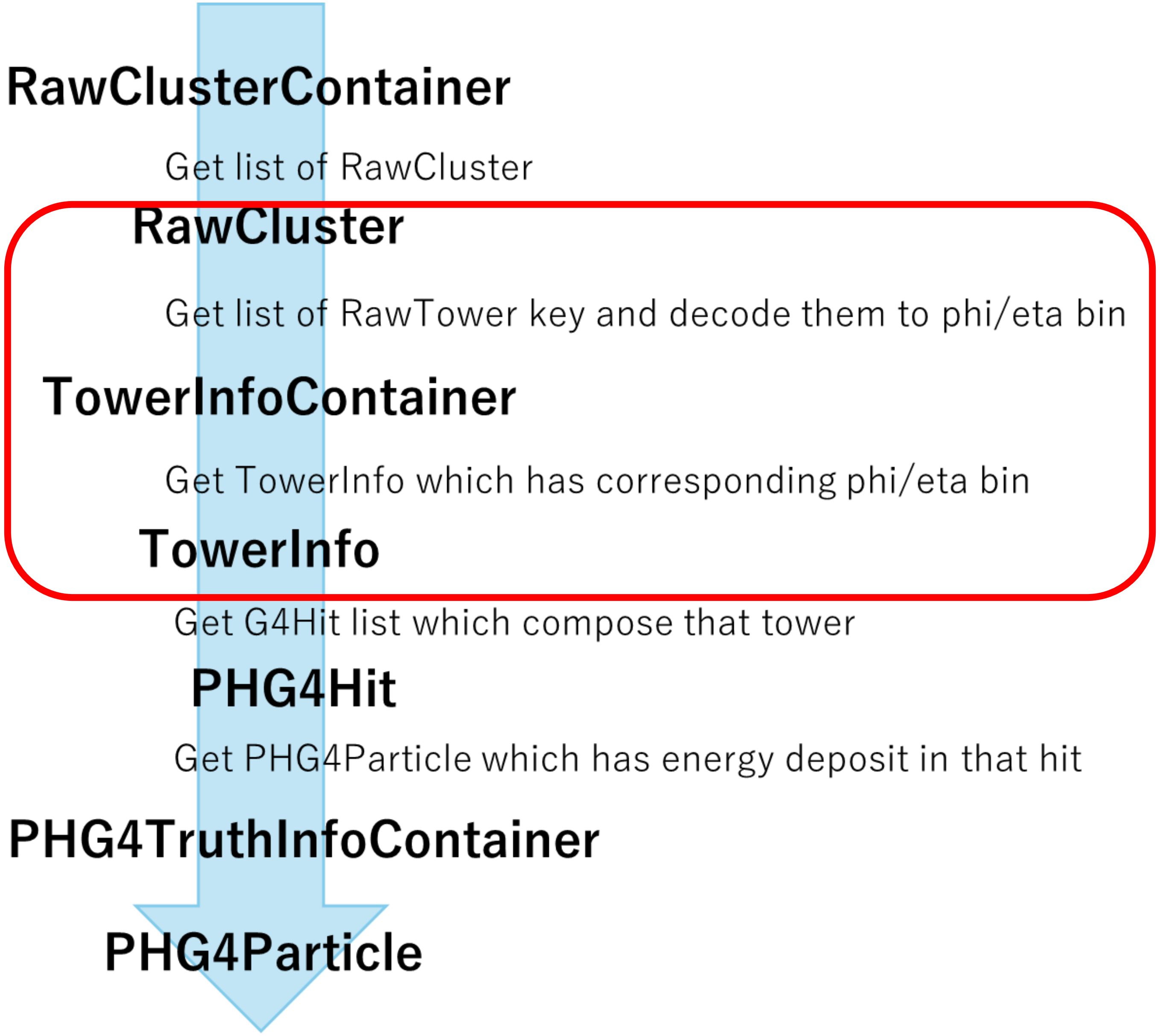
- offline/packages/CaloBase/RawClusterContainer.h
- Use
  - ConstRange getClusters() const;



# Flowchart of Calo Cluster to G4Particle

- offline/packages/CaloBase/RawClusterv1.h
- offline/packages/CaloBase/RawTowerDefs.h
- offline/packages/CaloBase/TowerInfoDefs.cc
- offline/packages/CaloBase/TowerInfoContainerSimv1.h

- Details in next slides



# RawTower and TowerInfo

- There are two types of class to use Tower, **RawTower** and **TowerInfo**.
- Nowadays they use only **TowerInfo** but **RawCluster** only have keys for **RawTower**.

- To convert keys for **RawTower** to for **TowerInfo**, it is necessary to decode **RawTower** key and get phi/eta bin of tower.
- Then, encode them to **TowerInfo** key.

# RawCluster to TowerInfo

- RawCluster::get_towers()
  - This return a list of RawTowerDefs::key

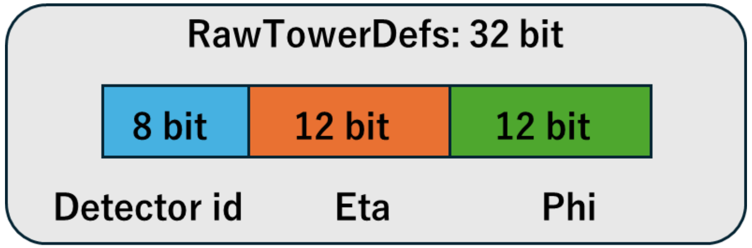
- Eta = RawTowerDefs::decode_index1(key);
- Phi = RawTowerDefs::decode_index2(key);

- TowerInfoDefs::key = TowerInfoDefs::encode_emcal(Eta, Phi);

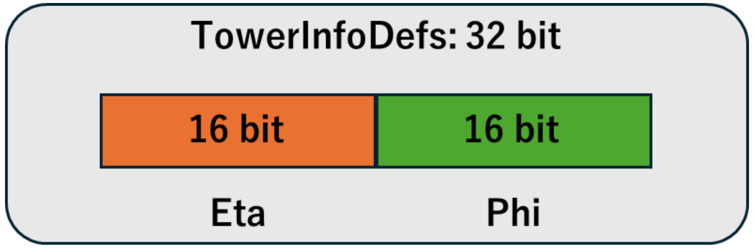
    - Ref: calibrations/calorimeter/calo_emc_pi0_tbt/pi0EtaByEta.cc

# Key type conversion from RawTower to TowerInfo

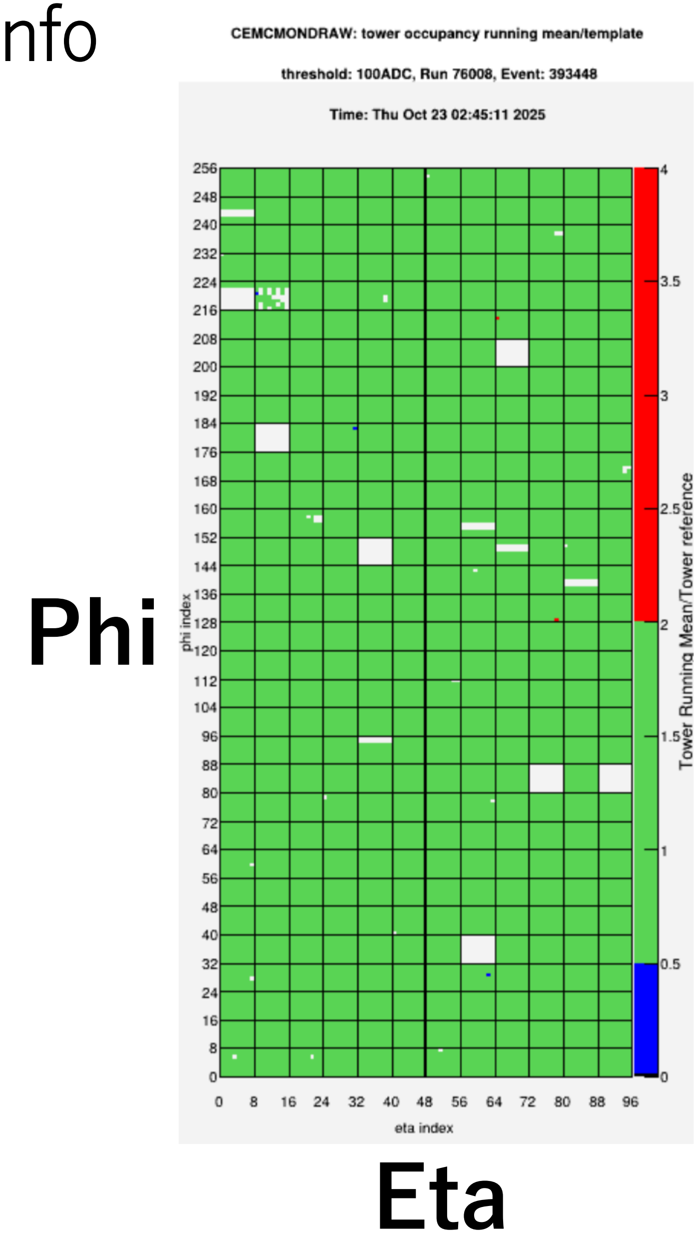
- Key in “RawTowerDefs”
- For EMCal, id = 1
-   OHCal, id = 2
-   IHCal, id = 3




- Key in “TowerInfoDefs”




- **Eta/Phi in two different Defs are the same**



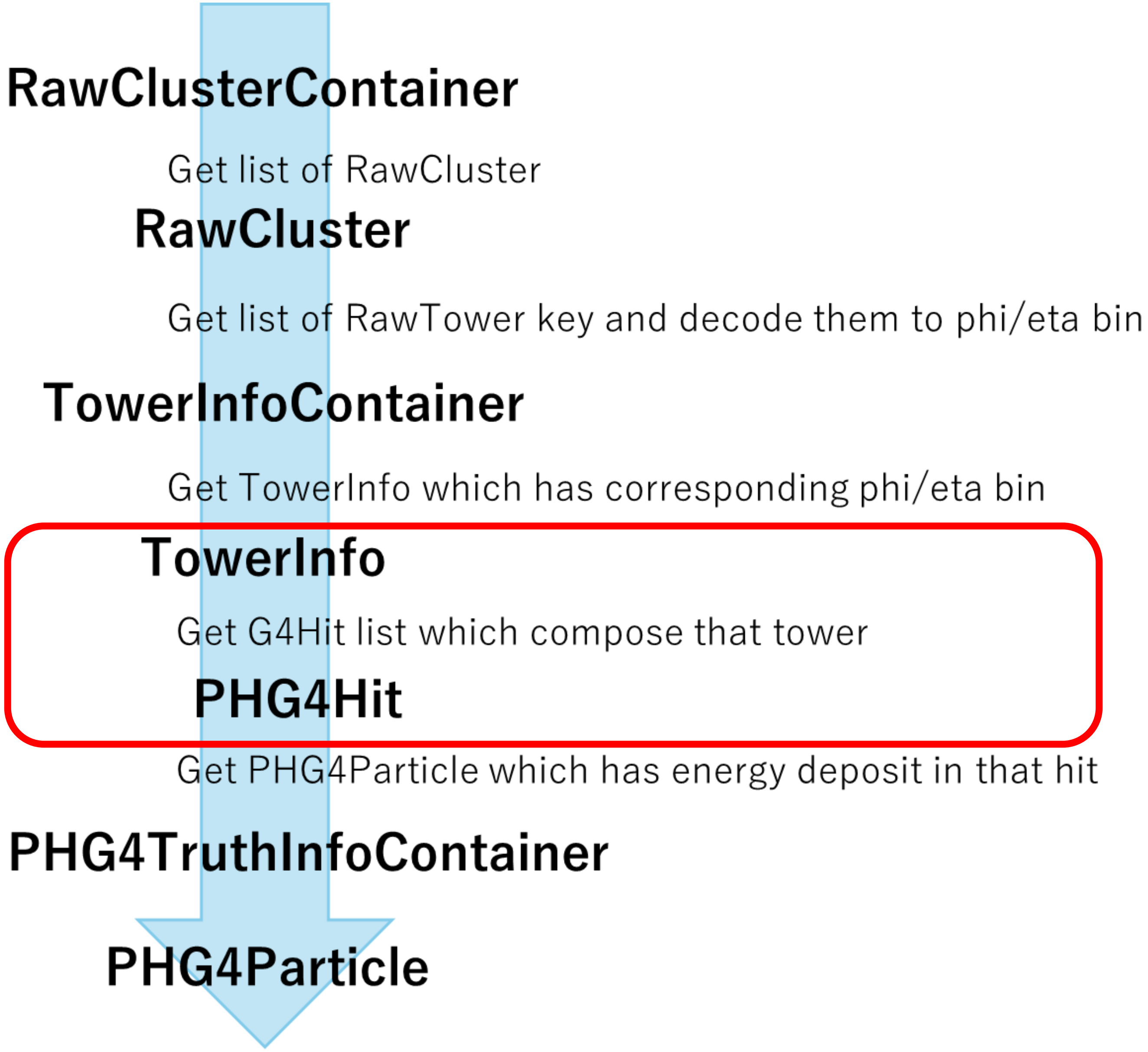
# RawCluster to TowerInfo

- With TowerInfoDefs::key,

- TowerInfoSimv1* TowerInfoContainerSimv1::get_tower_at_key(key)
  - This return a corresponding TowerInfo

# Flowchart of Calo Cluster to G4Particle

- offline/packages/CaloBase/TowerInfo.h
- EdepMap& TowerInfo::get_hitEdepMap();
  - This return a list of G4Hit and energy deposit.



# Flowchart of Calo Cluster to G4Particle

- simulation/g4simulation/g4main/PHG4Hit.h
- simulation/g4simulation/g4main/PHG4TruthInfoContainer.h

- Get PHG4Particle with
  - int track_id = g4hit->get_trkid();
  - PHG4Particle* particle = truthInfo->GetParticle(track_id);

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**PHG4TruthInfoContainer**

**PHG4Particle**

# SvtxTruthEval.h/CaloTruthEval.h

- Currently I’m planning to follow those two function.

- Those do
  - Return a truth particle for giving cluster
  - Return all clusters for giving particles

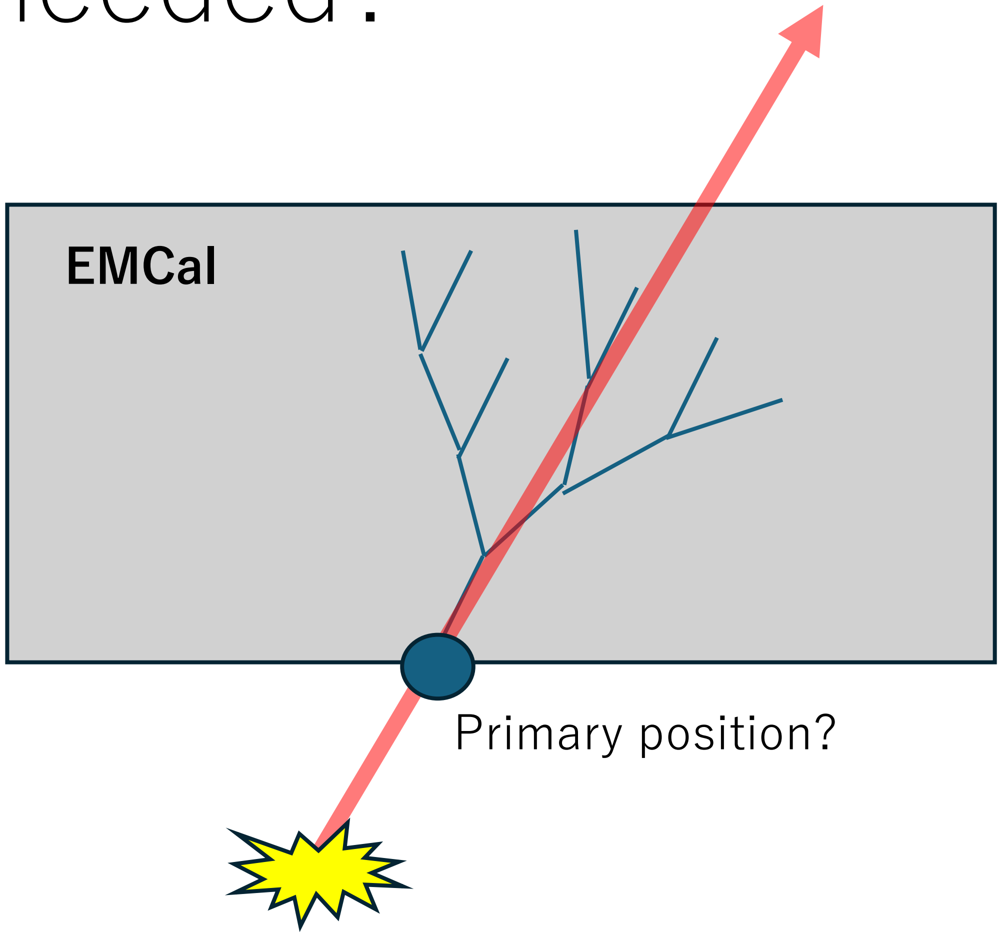
# What kind of function is needed?

- getAllClusters(particle)
- getEMCalCluster/getHCalCluster(TrkrCluster)
- getTruthParticle(cluster)
- getPrimaryParticle(CaloCluster)

# What kind of function is needed?

- getPrimaryPosition(CaloCluster)

    - I think it is possible with G4Hit



# Back up

**RawClusterContainer**

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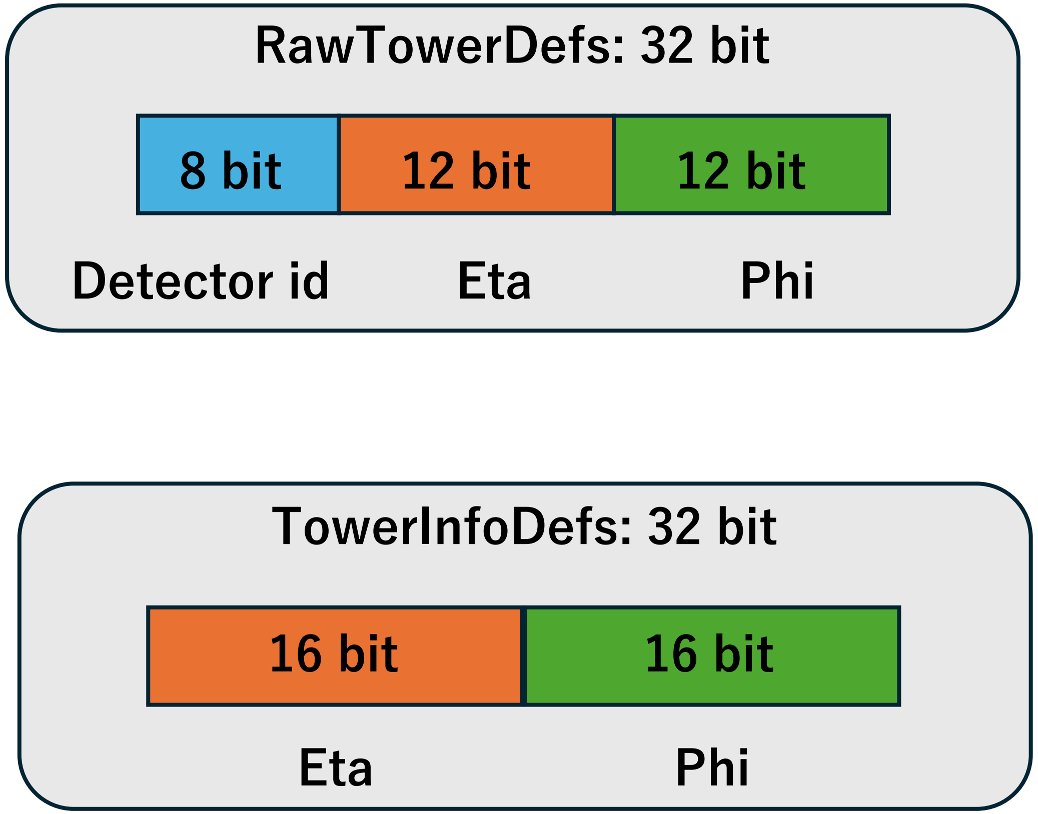
RawTowerDefs: 32 bit
8 bit
12 bit
12 bit
Detector id
Eta
Phi
TowerInfoDefs: 32 bit
16 bit
16 bit
Eta
Phi