Geometry needs for PFA

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The copy of this talk one can find at the http://www.desy.de/˜morgunov

Introduction – “GEANE”

This package was developed at mids of 80’s

The present Package allows the user to calculate the average trajectories of particles and to calculate the transport matrix as well as the propagated error covariance matrix. It makes use of a set of routines worked out by the European Muon Collaboration [1] and it is integrated to the GEANT3 system [2] with expected applications in both simulation and reconstruction context.

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Further development will concern the improvement of the error matrix by taking into account the Landau tail in the fluctuation of the energy loss, the bremsstrahlung and direct pair production of the muons.

This package was never used by any LEP collaboration to my knowledge.

Particle–Flow Reconstruction Aims

Create the best estimation of parameters of all measured particles at the interaction point using the whole information read by detector.

PFA will make prediction for the track trajectory in the calorimeters.
So, we will need a calorimeter structure and calorimeter properties (materials, density, average X0, predicted track energy density, predicted dE/dx ....).

PFA will need of an estimation for track trajectory to escape a calorimeter boundary.

PFA will need to make shower model, which also needs the material properties at the particular point inside a calorimeter.

PFA will need of an estimation for track trajectory to find decays and interaction points in the tracker volume.

Geometry requirements/parameters

1. **Volume/Zone parameters:**
   - **a) Shape (mainly cylinder or polygon but can be also arbitrary oriented plate)**
   - **b) symmetry or two of them for inner and outer radii separately**
   - **c) Starting angle for symmetry**
   - **d) Inner radius**
   - **e) Outer radius**
   - **f) Inner Z coordinate**
   - **g) Outer Z coordinate**
2. **Global detector parameters:**
   - **a) Global sizes**
   - **b) Magnetic field value (if its uniform)**

Detector Parameters

Example of the calorimeter parameters

1. **Number of layers in calorimeter**
2. **Sampling layer thickness**
3. **Minimal layer number**
4. **Maximal layer number**
5. **Absorber layer thickness**
6. **Absorber material**
7. **Detector layer thickness**
8. **Detector material**
9. **Cell size in X and Y (square shape)**

Physics requirements/parameters

This partialy includes the reconstruction tuning parameters.

1. **MIP most probable detector energy (does not include energy lost in absorber)**
2. **Coefficient to convert visible energy into physical energy scale**
3. **Predicted distance to neighbor for this particular zone**
4. **Cell volume including absorber**
5. **Predicted hit amplitude cutoffs for particular range**
6. **MIP most probable physical energy, i.e. including energy lost in absorber**
7. **MIP energy density in whole calorimeter cell volume**

Functionality

1. Get Volume/Zone name/number/pointer for any X,Y,Z point in Reference Frame
   (a point is not a hit in some detector, but just arbitrary 3–D point)
2. Get any required parameter for particular volume/point (should have very easy access to often use)
3. Get a match point for particular trajectory model with some volume boundary (trajectory can be straight line, helix ...)
4.