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Global Particle ID Software in LHCb

Introduction

This page contains technical information on the global Particle ID software in LHCb.

*** UNDER CONSTRUCTION ***

Sub-Detector Particle Identification in Brunel

Particle Identification starts with the sub detector specific reconstruction phases that run during normal processing in Brunel. These run algorithms specific to each sub-detector and store their final results in various summary objects in the T.E.S.

RICH

The main output of the RICH processing are RichPID data objects. These summarise the particle identification results for each track. The results are presented in the form of a delta log likelihood value for each mass hypothesis, that gives the overall change in the global event log likelihood when the track hypothesis is changed from the pion mass hypothesis, to the hypothesis in question.

More details can be found on the RichSoftware pages.

MUON

The output from the Muon system PID algorithms are MuonPID data objects, which like the RICH summarise the PID information for each track.

More details can be found on the MuonSoftware pages.

CALO

See Calorimeter Objects Tools Group documentation

Particles and

At the end of the Brunel event processing, a final stage is run which forms ProtoParticle data objects. These objects are designed to represent a single reconstructed object (charged or neutral) in LHCb and to summarise all the quantities associated to that object. These ProtoParticles are stored in the final DSTs at the end of processing.

During processing in DaVinci, when the DSTs are read back in for physics analysis, one of the first steps that is needed is to produce Particle candidates from the ProtoParticles. Each ProtoParticle can be made into zero, one or many ProtoParticles (with different PID types) depending on the PID information stored in the ProtoParticle and the PID selection cuts that are applied. This step is generally referred to as the 'ParticleMaker' step. For charged ProtoParticles, the CombinedParticleMaker is generally used, whilst for neutrals there are a selection of possible Particle Makers.

Global Particle ID

One task of the Global PID group is to study how best to merge all the sources of PID information (RICH, CALO, MUON etc.) to provide the best overall particle ID estimators.

DC04

Global PID and the CombinedParticleMaker was first introduced during the analysis of the DC04 data. In this implementation, it was only possible to make selections based on cuts on the 'CombinedDLL' values. The original study was performed by Roger Forty. For further information, see these emails from Roger.

DC06

During the transition to the DC06 software framework, several changes were made to how the ProtoParticles are created and used :-

- Firstly, they are now created (as originally intended) at the end of the processing in Brunel. In DC04 they are actually produced at the start of each event in DaVinci.
- The amount of information stored in the ProtoParticle was extended.

For details on the new syntax and available selection criteria, please refer to the CombinedParticleMaker and ProtoParticleFilters twiki pages.

Combined PID Tuning

Tuning of the combined PID is an ongoing effort. To aid this an algorithm has been written which dumps the PID information in the charged ProtoParticles, together with some useful tracking variables and the true MC type, to an ntuple. The algorithm is available in the Rec/GlobalReco package (available in the default DaVinci job) and is called ChargedProtoParticleTupleAlg[?].

In the fullness of time, details on the PID performance and tunings will be posted here.

ChrisRJones - 17 Nov 2006 MarcoCattaneo - 15-May-2012

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