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Muon Digitization

Complete:

Explains the algorithms used to digitize the Muon subdetectors.

Contacts

- **DT Detector Physics Group**: https://twiki.cern.ch/twiki/bin/view/CMS/MuonDPGDT
- **CSC Detector Physics Group**: https://twiki.cern.ch/twiki/bin/view/CMS/MuonDPGCSC
- **RPCDetector Physics Group**: https://twiki.cern.ch/twiki/bin/view/CMS/MuonDPGRPC

Introduction

Each of these digitizers starts with a collection of PSimHits from GEANT4, which represent a particle which enters and exits the gas volume. They reside in the SimMuon package.

DT Digitization

CSC Digitization

One weakness of the current CSC simulation is that the readout doesn't require the presence of an LCT. Each layer in a chamber is digitized independently, based on the presence of a trigger primitive (a wire digi or a comparator digi) in that layer. This can lead to different efficiencies than what actually occur in the detector.

Wire Hit Simulation

The first step in simulating CSC response is to convert the PSimHit into a line of 60-100 ionization clusters in the gas, including a simulation of soft delta rays. These ionization clusters are drifted to the nearest anode wire, using parametrized functions for drift distance and drift time. Once the ionization cluster reaches the wire, it creates an avalanche of charge, which is represented by the CSCDetectorHit class.

Strip Hit Simulation

Each wire hit then induces a distribution of charge on the five nearest cathode strips, distributed by the Gatti function. These charges are also represented by the CSCDetectorHit class.

Wire Electronics Simulation

Each wire CSCDetector hit in a channel is converted to an amplified pulse shape and superimposed. If a channel exceeds an eight-sigma threshold over the noise, a wire digi is created. A wire digi consists of an array of sixteen bits, which represent 25 ns bunch timings. The timing is adjusted so that the ALCT trigger primitives that result from these digis are centered in the sixth time bin.

Strip Electronics Simulation

The simulation of the cathode signals relies heavily on the Conditions database for many parameters:

- pedestals
- pedestal widths

- correlated noise matrices
- crosstalk levels
- gains

The strip digi output is an array of 8 or 16 samples, each representing a 50 ns time bin. 2 ADC counts represent 1 fC of charge. Typical pedestals are 600 ADC counts, signals are around 170 ADC counts, and noises are typically around three ADC counts. Strip-to-strip crosstalk is typically around 10% on the rising slope of the signal, and 4% at the peak.

Comparator digis, used for triggering, are created when a strip is a local maximum over a threshold. Their timing is adjusted to center the timing of the subsequent Cathode LCT into the sixth time bin.

RPC Digitization

Review status

Reviewer/Editor and Date (copy from screen)	Comments
KatiLassilaPerini - 23 Jan 2007	created template page

Responsible: Main.RickWilkinson
Last reviewed by: Most recent reviewer

-- RickWilkinson - 03 Apr 2008

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