Developing a Framework of Control Plots in H1OO for the Liquid Argon Calorimeter Jet Trigger

Attikis Alexandros Brandstätter Birgit

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Overview

- H1 Experiment
- LAr Calorimeter
- Triggering
- Analysis Framework
- Work and Results
- Summary



H1 Experiment

- One of the main experiments of HERA
 - Collides 920 GeV protons with 30 GeV electrons or positrons
 - Stored in 210 bunches, collision frequency of ~10.4 MHz
- H1 Detector is asymmetric, being more massive in forward direction
 - Aims: to study
 - Internal structure of protons
 - Hadronic recoils
 - Weak neutral and charged currents at high Q²

LAr Calorimeter

- Main H1 Calorimeter
- Structured in eight wheels
- Total of 45,000 channels
- EM cells: Pb-LAr-Pb
- HA cells: SS-LAr-SS
- Ionised Ar atoms and their e⁻⁻ are gathered and converted to analogue signals
- Measured energy used as basis of LAr Trigger



H1 Trigger System

- Three level trigger system
- Filters signals registered in readout channels
- Registers only events of physics interest
- Rejects background events such as:
 - Synchrotron radiation, stray protons, cosmic muons...
- L1 LAr sub-trigger efficiency restricted due to coarse granularity
- Jet trigger complements the LAr trigger
 - Better background rejection power due to finer granularity

H1 Jet Trigger

- Concept of the jet trigger:
- Digitise, weight and sum analogue pulses from EM and HA parts using projective trigger towers
- Search for local maxima by nearest neighbour method
- Sort jets into a list according to E₊
- Discriminate according to energy thresholds
- Build a trigger element (TE) out of jet list to feed the central trigger

H1 Jet Trigger



- Granularity increased from BT level to TT level
- Ability to apply lower energy threshold

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H100 Analysis Framework

- Object orientated data storage and physical analysis framework for H1
- Based on ROOT
- Tasks:
 - Analyse files of data or simulated events
 - Make an event selection
 - Fill histograms
 - Do final calculations
- Provides steering
- Has fast event selection facilities

H1Lt Framework

- Runs alongside the H1OO framework using H1OO packages
- Running controlled by H1Analysis class and its steer class
- H1AnalysisHistManager object used to perform and store histogramsH1Lt used for making control plots for the jet trigger

HistManager {abstract}

- + Fill(int routine) : void
- + GetIndex(TString name) : int

BookHistos() : void

- fHistArray : TObjArray*

Work and Results

- Luminosity run
- Thousand events
- Energy of one channel versus bunch crossing
 - Made for all channels
 - Here for two channels
- Most of the energy in the channel is zero



Work and results

Pedestal

- Small amount of charge used as a reference signal
- For checking integrity and status of channels
- Pedestal run
 - Uses only random trigger
- Mean pedestal per channel to see which channels do not work properly



Work and Results

- RMS of pedestals for each channel
- Find channels with big deviation from mean
- Indicate channels with a high level of noise





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Summary

- Control of correct performance of jet trigger is needed
- Integrity and status of each channel can be checked with pedestal runs
- H100 framework provides facilities to analyse data
- Program writes the extracted pedestal parameters to a file, which can be used to set up online pedestal subtraction
- Histograms for visualising output of channels and detect dead or ill channels

Thank you for your attention!



Attikis Alexandros, Brandstätter Birgit