Monday 27 April 2009

09:00->11:00  Calorimeter Trigger Upgrade (Convener: Sridhara Dasu)

09:00  SLHC Calo Trigger Overview (20')
09:20  SLHC Calo Trigger Primitives (20')
09:40  SLHC Calo Trigger Hardware (20')
10:00  SLHC Calo Trigger Firmware (20')
10:20  SLHC Calo Trigger Simulation (20')
10:40  SLHC Calo Trigger Tau Simulations (20')

11:00  break (30')
Calorimeter Trigger Evolution

Step 1 (2009)

ETCC: TPGs
HTR: TPGs
SLB
RMC
RCT
Cu

GCT: Sources
GCT: Main

GCT/ uTCA
GT/GMT

Step 2: ↓ OR

ETCC: TPGs
HTR: TPGs
SLB
oSLB
RMC
RCT

GCT: Sources
GCT: Sources

GCT/ uTCA
GT/GMT

Step 3

ETCC: TPGs
HTR: TPGs
uTCA-HTR: TPGs
SLB
oSLB
RMC
RCT

GCT: Sources
GCT: Sources

GCT/ uTCA
GT/GMT

Step 4

ETCC: TPGs
uTCA-HTR: TPGs

oSLB
RCT

GCT: Sources
GCT: Sources

GCT/ uTCA
GT/GMT

Matrix & Aux Cards

RCT/ uTCA

Cu
Simulation Program

- Developed SLHC trigger algorithm simulation program to work within CMSSW
  - Compare LHC and SLHC algorithm performance
- Developing HCAL Trigger Primitives Upgrade
  - University of Iowa in collaboration with MN, MD, BU
- Interface with track trigger simulation program
  - Studies for Phase II of upgrade

Firmware & Hardware Program

- Firmware development in collaboration with experts from Wisconsin and Maryland EE departments
  - Feasibility of implementing new algorithms
  - Systematic improvements in methodologies
- Prototyping of $\mu$TCA cards with new FPGAs began with last portions of LHC calorimeter trigger
Yesterday’s Summary

SLHC Calorimeter Trigger simulation is in place

• Early results indicate meet Phase I requirements of x2 reduction

More studies and improvements on the way

• Trigger Primitives upgrade with regard to new HCAL readout
• Trigger Algorithm threshold/cut optimization
• Jet reconstruction alternatives

Lining up with Tracking Trigger Simulation

• Is improved position in SLHC-CT sufficient to get x10 reduction in rate for Phase II?

Hardware & Firmware development

• Continuously verifying that algorithms are implementable within FPGA bandwidth and processing constraints
• Improved methodologies for tracking firmware changes
• Prototypes with new FPGAs in µTCA formfactor being built

We are preparing for CD0 review
Commitments to SLHC-CT

University of Wisconsin
  • Overall design, hardware, firmware, simulations

University of Iowa
  • Interface to Trigger Primitives Generators, Simulations

Texas A&M University
  • Simulations (especially tau for phase II)

University of Minnesota, University of Maryland
  • HCAL Trigger Primitives (in HCAL project)

Princeton University? Boston University?
  • Institutional commitment is still pending

Non-US participants on Trigger Projects
  • Imperial College, London, UK, (Full calorimeter trigger)
  • Bristol University, UK (Simulations primarily)
  • LIP, Lisbon, Portugal (Trigger Primitives and DAQ, oSLB)
  • Ecole Polytechnique, Palaiseau, France (ECAL Trigger Primitives)
University of Wisconsin

- Prepare firmware for AUX card
- Procure and evaluate Matrix card and $\mu$TCA crate
- Develop overall design following the evolution constraints and FPGA firmware evaluation from EE team
- Design, build and evaluate prototype V5 or V6 based processor card
- Develop, synthesize, simulate and evaluate firmware in hardware
- Continue simulation code development and studies

University of Iowa

- Develop software for interface to Trigger Primitives Generators
- Evaluate benefits of additional TPG info from HCAL

Texas A&M University

- Continue tau simulations – rates for cross triggers with muons/electrons
- Track matching and isolation requirements …
Calorimeter information for Muon trigger

- In the current trigger calorimeter trigger provides MIP and Isolation bits to the muon trigger
- In the current HLT substantial reduction in rate at level-2 trigger is due to calorimeter isolation
- Most analyses (EWK) use calorimeter isolation
- Likely that isolation will degrade with increased pile-up
- However, it will still be used
- Improved position information from SLHC-CT could benefit isolation
- Someone should study this in simulation
  - Specify what is needed

Interface to Track trigger

- Simulation and specification of how calorimeter objects are combined with track information
  - Track matching, Isolation, Primary vertex / luminous region reduction