The ALICE – High-Level Trigger

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The High-Level Trigger (HLT)

- Highest trigger in ALICE trigger hierarchy
- Main physics goals are
  - *Trigger* on basis of on-line reconstruction and analysis
  - *Select* physics region of interest within event
  - *Compress* event without loss of physics information
- PC farm – several hundreds of off-the-shelf PCs foreseen
- On-line reconstruction
  - Use of Hardware co-processors
  - Organized in several hierarchical levels, according to the detector readout structure
  - Result in form of off-line Event-Summary-Data (ESD)
- On-line analysis on event-by-event basis

HLT Architecture

- Large PC cluster
- Data received from detector via optical links into Front-End-processor nodes
- Dedicated Software Framework to transport & aggregate data in cluster
  - Made of independent components talking via defined interface
- Reconstruction/analysis code part of ALICE Offline code
- Output to DAQ via optical links
  - Decision & additional data
  - Similar to detectors

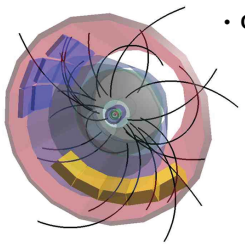
Hardware Status

2008 Run Setup

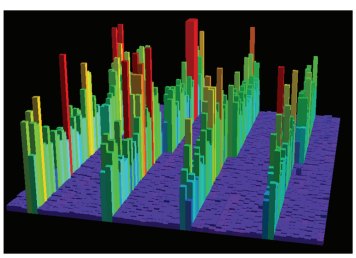
- 87 Frontend PCs
  - 696 GB memory
  - 348 CPU cores
  - 174 H-RORCs
  - 348 DDL links
- 16 Computing PCs
  - 256 GB memory
  - 128 CPU cores
- Full network infrastructure
  - (heavy ion ready)
- Full service infrastructure
  - (heavy ion ready)

HLT Software Status

- Involved Detectors
  - DiMUON (MUON Trigger / MUON Tracker)
  - FMD (Forward Multiplicity Detector)
  - PHOS (PHOton Spectrometer)
  - SDD (Silicon Drift Detector)
  - TPC (Time Projection Chamber)
  - TRD (Transition Radiation Detector)



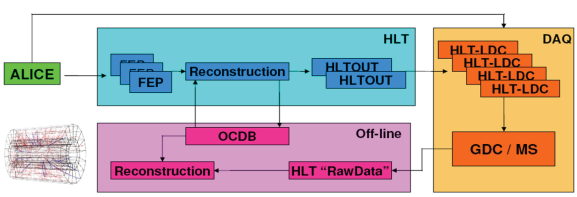
- Calibration
  - Detector calibration algorithms inserted to HLT
    - Produces off-line calibration
    - Calibration output forwarded to off-line OCDB
  - On-line calibration
    - Calibrate HLT on the fly
    - Via on-line calibration algorithms running
      - On physics
      - On intermediate calibration events (eg. TPC LASER events)
      - On "LIVE" values from the DCS (Detector Control System)



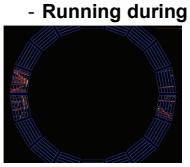
- First and Second Level Reconstruction tested and in use
- Interfaces to all on-line systems tested and in use
- Trigger infrastructure in place

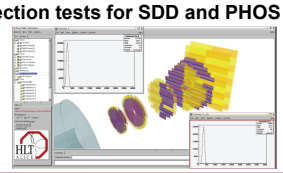
Experiences from Runs in 2008

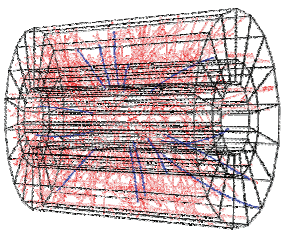
- ALICE commissioning 2008
  - HLT was successfully commissioned within the ALICE data stream
  - Trigger decisions were applied
  - Reconstructed events send to permanent storage



- ALICE cosmic data-taking 2008
  - HLT was running during cosmic runs in several partitions in parallel
  - On-line reconstruction is running for
    - DiMuon, PHOS, TPC, TRD, FMD
  - AliEVE was used as on-line event display
- LHC first beam
  - Running during injection tests for SDD and PHOS

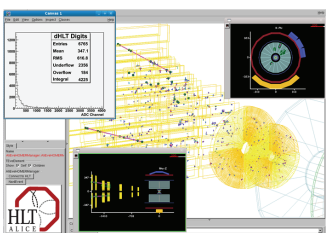






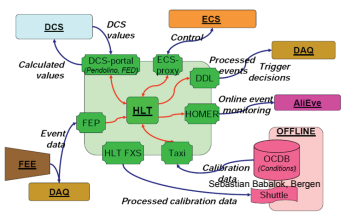
Reconstruction Rates

- The limit introduced by the framework to transport & aggregate the data in the cluster itself had been measured with 8 kHz.
- For simulated p-p data
  - DiMuon – 1,2 kHz *at* 160 MB/s
  - PHOS – 2,1 kHz *at* 80 MB/s
  - TPC – 600 Hz *at* 70 MB/s
- Data compression
  - SSD (lossless)
    - 400 MB/s to 16 MB/s at 800 Hz.



HLT Interfaces

- HLT has interfaces to most other online systems in ALICE



Outlook

- Preparing for
  - ALICE commissioning June/July 2009
  - pp Run period 2009/2010
  - HI Run 2010
- Insert physics triggers
  - High pt Jet Trigger
  - D0 Trigger
  - DiMuon Trigger
  - High pt tracks Trigger

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