THE ONLINE DQM OF BESIII

Xiaobin Ji
Institute of High Energy Physics, CAS
July 9, 2018
• Introduction to BEPCII and BESIII

• The overview of BESIII DQM

• Summary
Beijing Electron Positron Collider (II)

- Linac
- Storage ring
- BESIII

2004: Start BEPCII upgrade
2009: BESIII data taking

- c.m.s. energy: 2.0 – 4.6 GeV
- \( L_{\text{peak}} = 1.0 \times 10^{33} /\text{cm}^2/\text{s} \)
The BESIII Detector

<table>
<thead>
<tr>
<th>Sub-detectors</th>
<th>Performance</th>
</tr>
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<tbody>
<tr>
<td>MDC</td>
<td>Momentum resolution</td>
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<tr>
<td></td>
<td>dE/dx resolution</td>
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<tr>
<td>EMC</td>
<td>Energy resolution</td>
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<td>Spatial resolution</td>
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<tr>
<td>TOF</td>
<td>Time resolution</td>
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<tr>
<td></td>
<td>Barrel</td>
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<tr>
<td></td>
<td>Endcap</td>
</tr>
<tr>
<td>MUC</td>
<td>9 layers RPC, 8 layers for endcap</td>
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Trigger rate: ~ 4 KHz
Data rate: ~ 40 MB/s
DATA SAMPLES

- 6x10^9
- 5x10^8
- 2.9 fb^{-1}

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- 4040 0.5 fb^{-1}
- 4260 1.9 fb^{-1}
- 4190 – 4280 (8 points) 3.9 fb^{-1}
- 4420 1.0 fb^{-1}
- 4600 0.6 fb^{-1}

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- 4180 3.0 fb^{-1}
- 4360 0.5 fb^{-1}

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R Scan, 1.3 fb^{-1} (130 points)
DATA QUALITY @ BESIII

- Data quality monitoring: Monitor the detector and the data, find problems in time

- BESIII has three level monitoring
  - **DAQ**, no or fast data reconstruction, mainly the hitmap of each sub-system and electronic
  - **DQM**, online full reconstruction, higher level (physics) monitoring
  - **DQA**, offline full reconstruction with updated calibration constants
DQM – HARDWARE AND PLATFORM

- 1 server for DQM system management and virtual machine host
  IBM x3650 M4, 2 Intel Xeon E5-2630 2.3 GHz
- 5 computing nodes for data reconstruction and analysis
  IBM Flex System x240, Intel Xeon E5-2620 2.0 GHz, total 24 cores / node
- 2 client machines (PC) for results display

- OS: SLC6, SLC5
- Language: C++, python, bash
DQM COMPONENTS

- DQM Server
- DQM Clients
- Histogram handling
- Event display
- Histogram display
- Database (MySQL)
- Webpage
• The aim of the data server is to provide data to all DQM clients
• It runs on DAQ machine.
• Sampling (copy) data from DAQ data flow
• Data is transferred to DQM machine through TCP/IP
• Start/stop with run (Controlled by DAQ)
DQM CLIENT

- Main component of DQM system
- Receive data from DQM server
- Using offline software to reconstruct and analyze data
- Results are stored in ROOT histograms
- Publish histograms
HISTOGRAM HANDLING

• Modified from ATLAS tdaq, ROOT based

• **Histogram server**: store all histograms

• **Histogram receiver**: receive published histograms by DQM Client and publish to Histogram server

• **Histogram merger**: merge histograms from all DQM Clients, and publish merged histograms to Histogram server

• **Histogram display**: display selected histograms to shifter
• Modified from ATLAS tdaq, ROOT based

- **Histogram server**: store all histograms
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• DQM is run in stand-by mode, when the data-taking is started, it runs automatically

• **DIM** (Distributed Information Management System) is used to synchronize all components

• After a run is finished, all merged histograms are stored in a root file

• A script is used to monitor the new generated root file

• A separate job will deal with the root file, obtains useful information of the run, and put them in the database (MySQL)

• Users can check these information from the webpage
SELF-MONITORING

• Ganglia is used to monitor the whole DQM system

• Crashed jobs: restart automatically

• Dead jobs: lose response, do not update histogram any more
  • Run number monitoring
  • Job statics, how many events have been processed for each job
  • CPU usage
RESULTS DISPLAY
• BESIII DQM is a lightweight online DQM solution

• Using full reconstructed events to monitor the data

• Separate online DAQ and offline software environment as much as possible

• Expandable

• Successful running at BESIII
Thank You!