CENuM Workshop 07/04

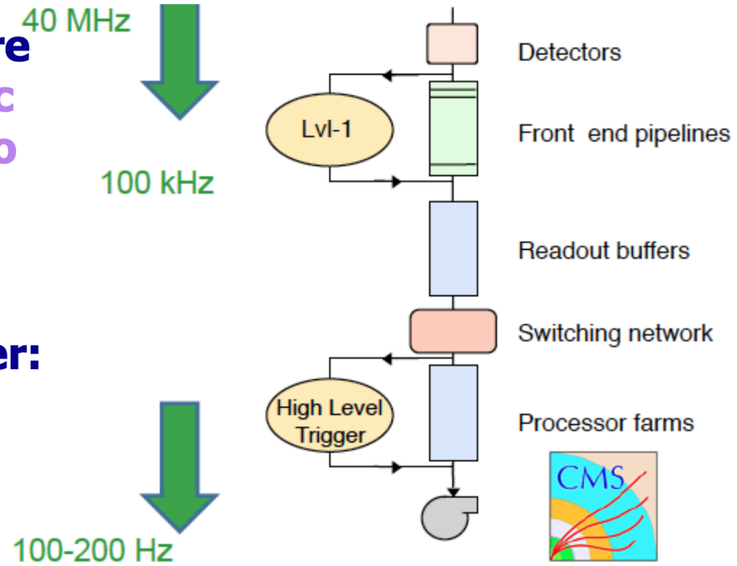
HLT Study for CMS Run3 Preparation

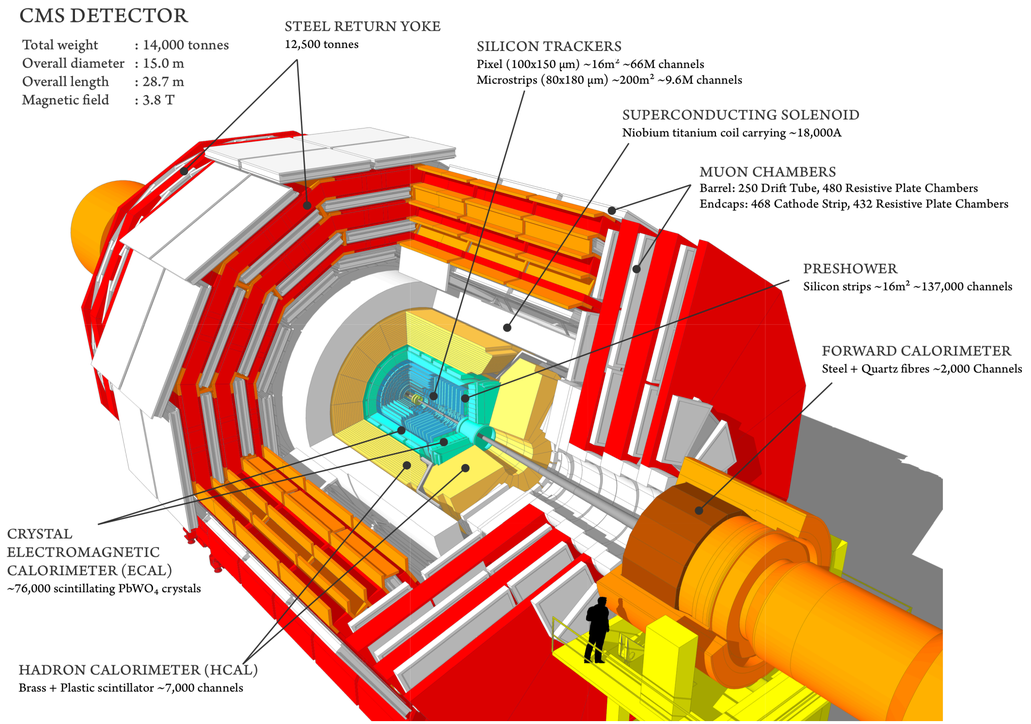
Soohwan Lee Korea University 2020/07/04

Trigger System in CMS

- **L1: hardware, firmware**
  Quick readout of specific detectors (no tracker, no [yet] Muon iso)
- **L1 Latency: 3.2 μs**

- **HLT: High Level Trigger:**
  software based (~10k CPUs) look at full event content of L1 selected events
- **Mean time per event HLT: 150 ms (depending on CPU)**



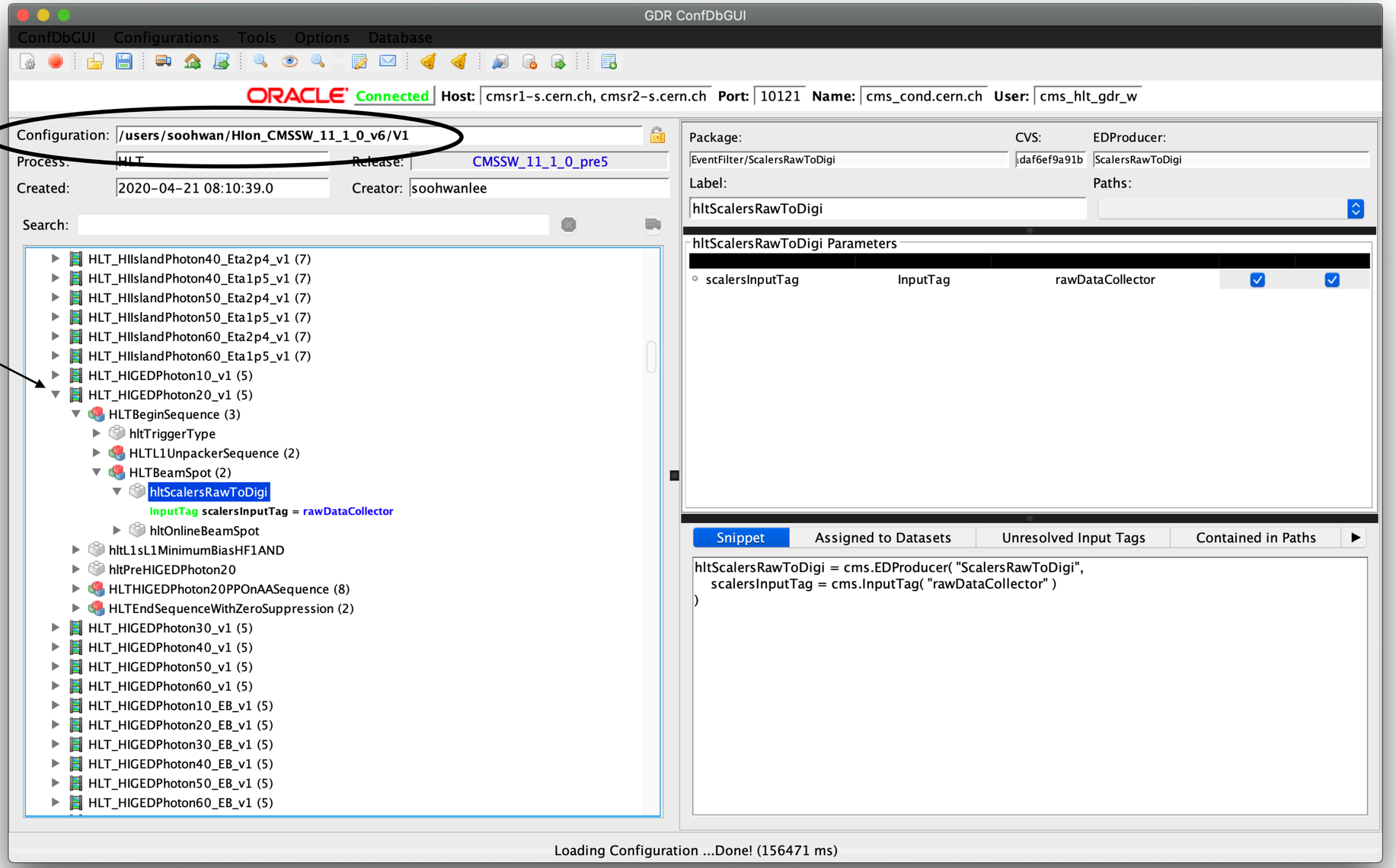


- Particles are reconstructed (event)
- Input around 100 KHz, after selection of possible physics object candidate output in ~1 KHz.
- Higher lumi in Run3 means larger data stream, must have efficient HLT system to effectively acquire useful data

HLT Trigger Paths

Configuration path

Photon Trigger



HLT re-emulation

- Reproduce events with RAW data with variable presets.
  - Change Global Tags for calibration
  - https://twiki.cern.ch/twiki/bin/view/CMS/HIRunPreparations2021HLT
  - Currently charge of Muon, E/γ triggers.

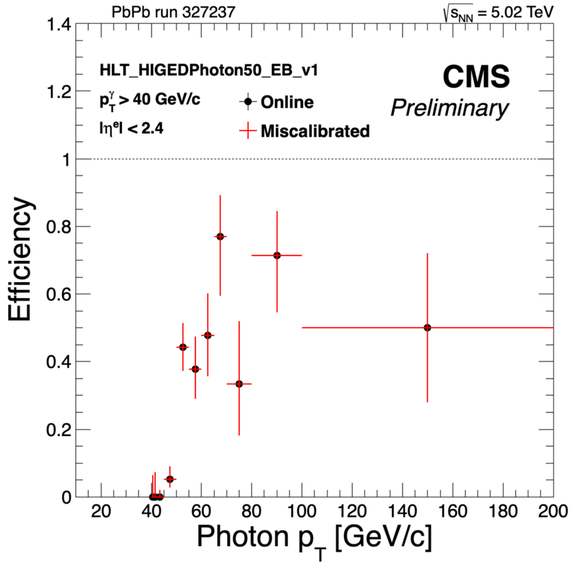
HLT Efficiency

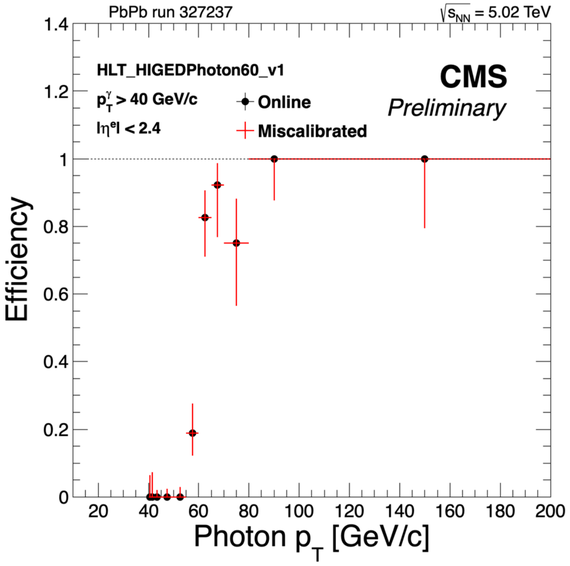
- Ideal trigger signal will spike up at threshold
- Realistically especially in online triggering is loose.
  - Compare efficiencies of various triggers in specific CMSSW version to check performance
  - Studies with different global tags
- Codes from Jaebeom and André.

Efficiency Results

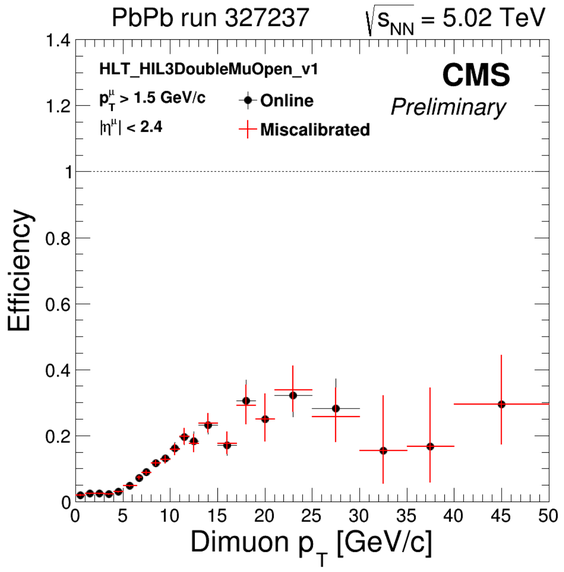
Run 327237

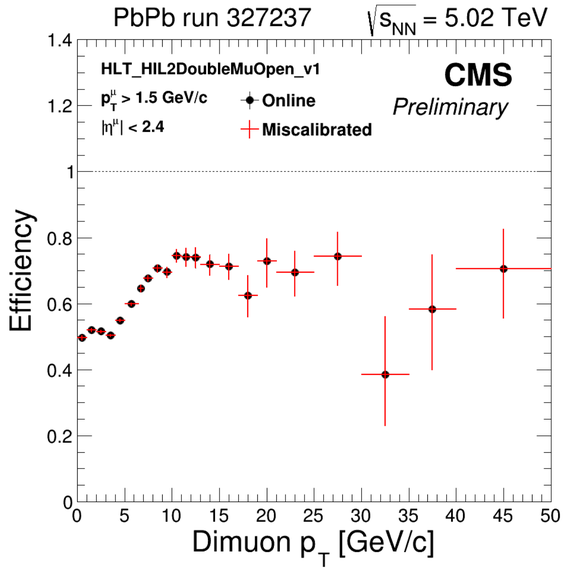
- Online globaltag: 103X_dataRun2_HLT_v1
- Miscalibrated online globaltag: 103X_dataRun2_HLT_ForHITestsV3_v1
- Track Miscalibration only
  - Miscalibrated Tag : less precise calibration tags (early Run2 calibration)



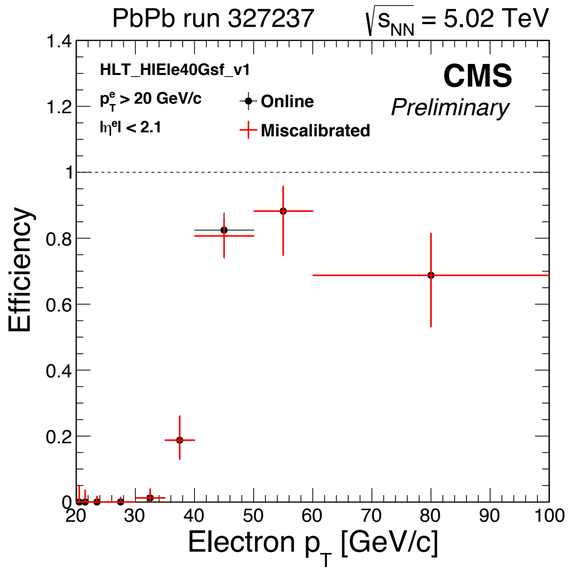


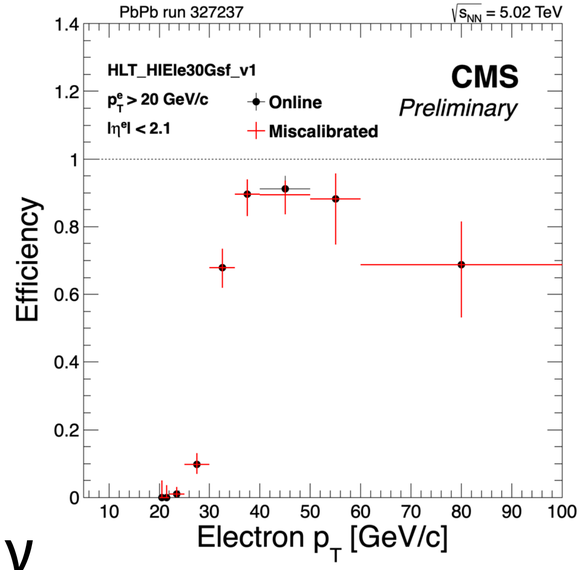
Electron





Muon





γ

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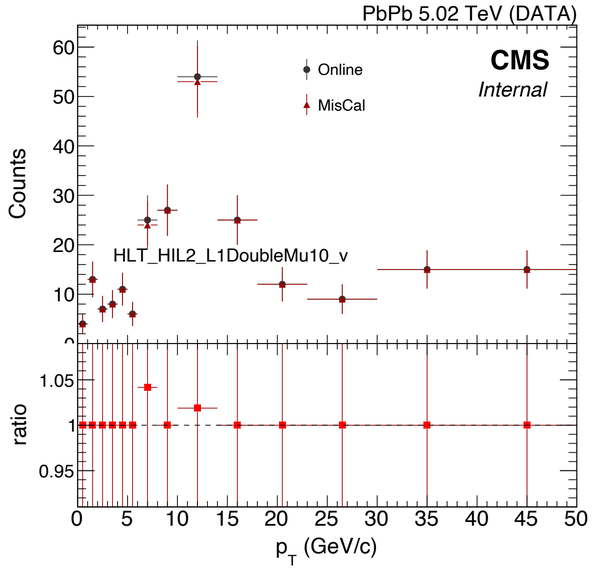
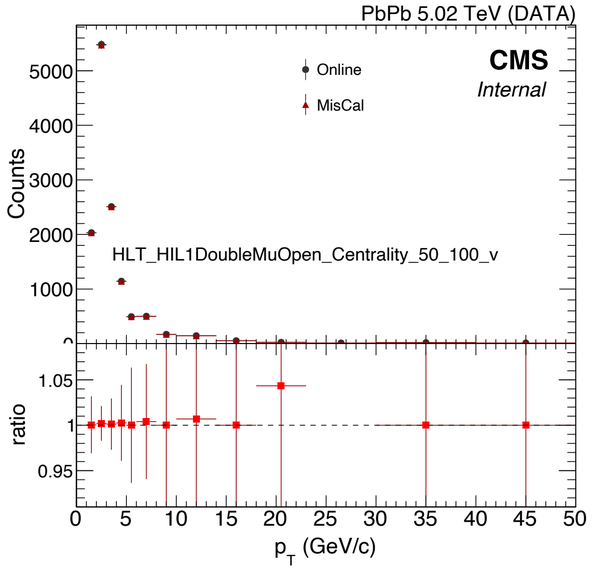
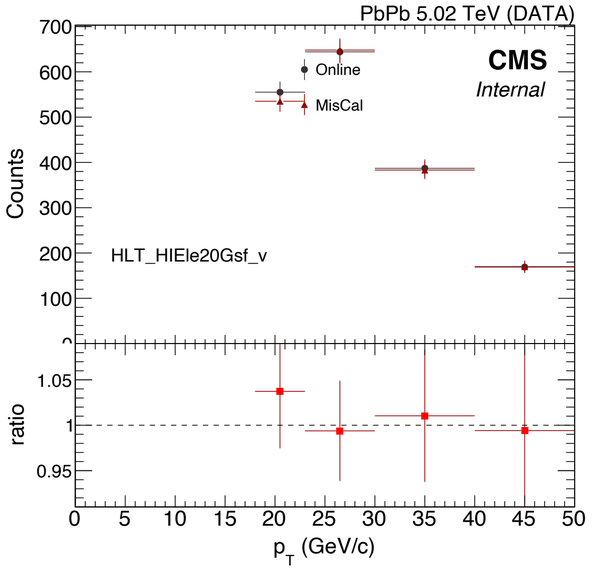
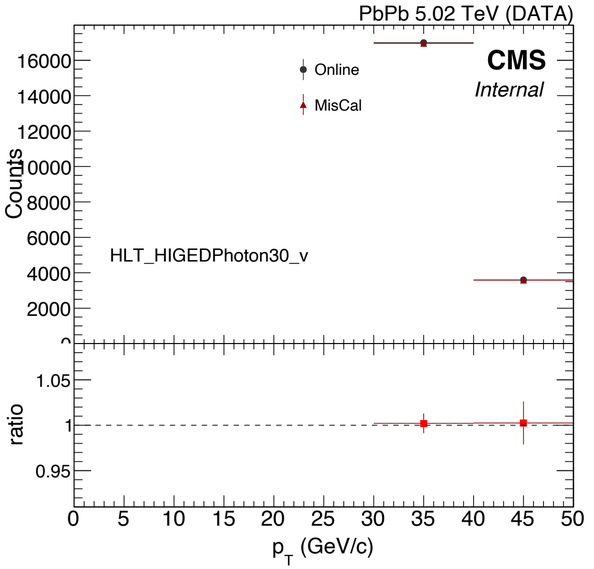
Object Ratio Plots

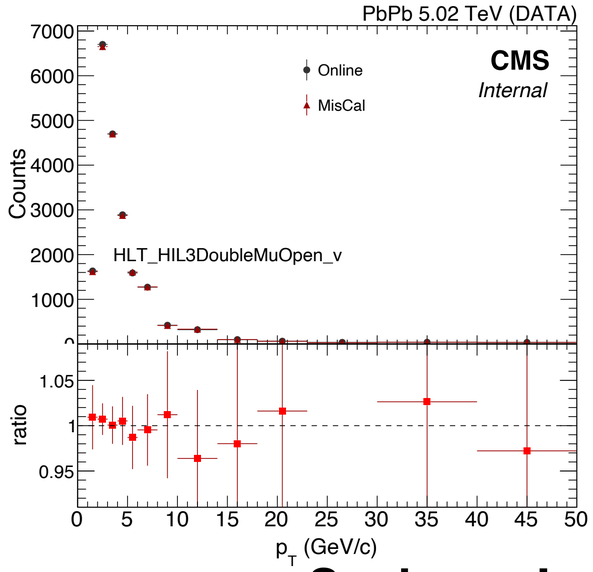
- Check number of particles match event selection in both reco tree and analyzed hltTree.

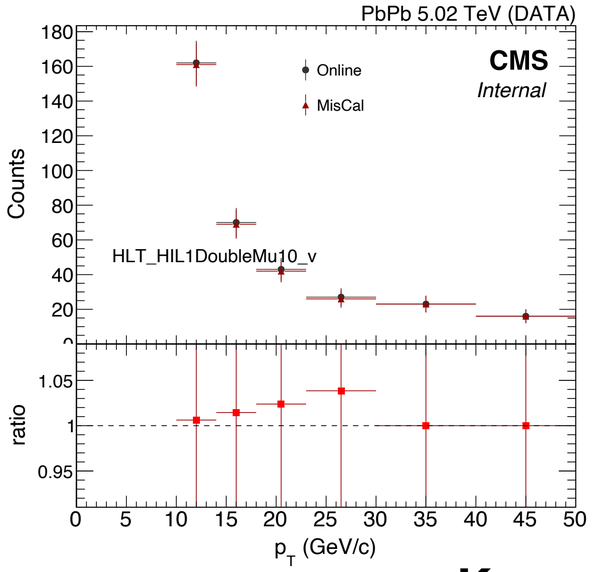


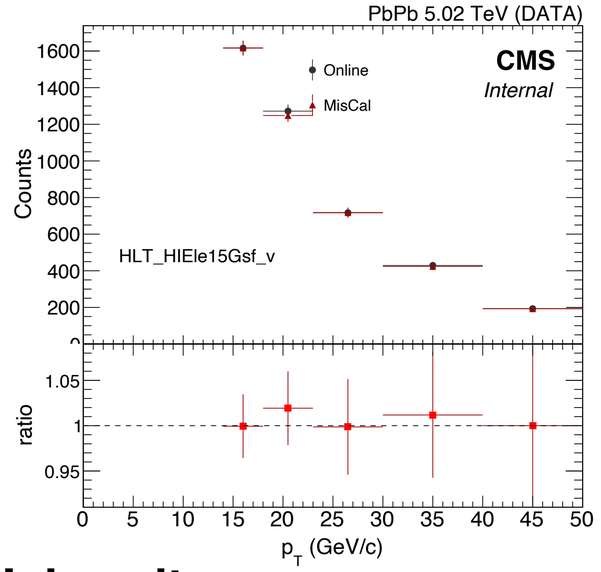








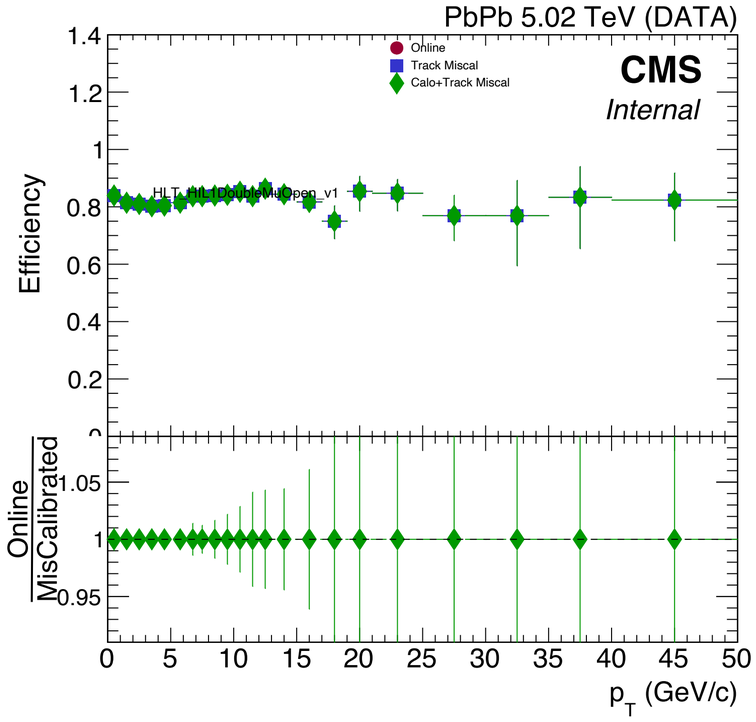


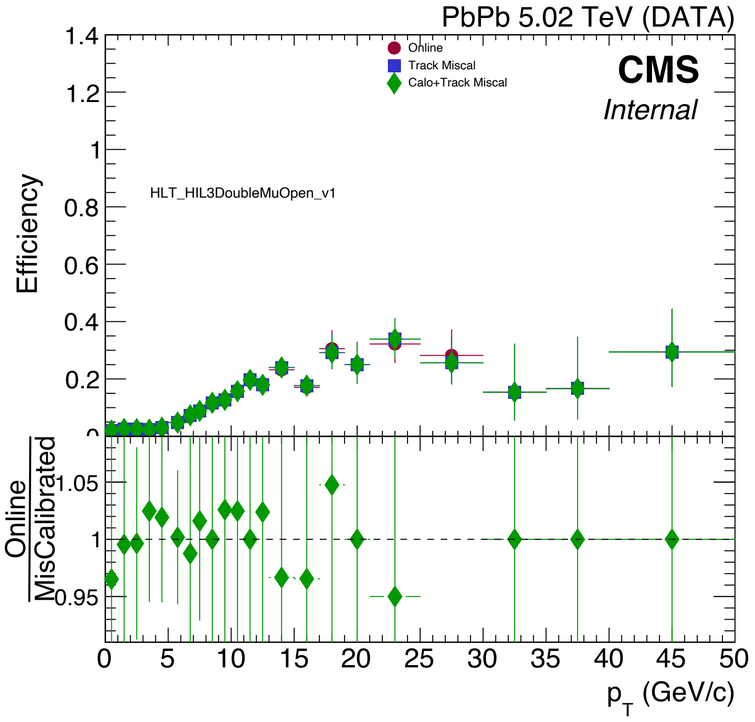


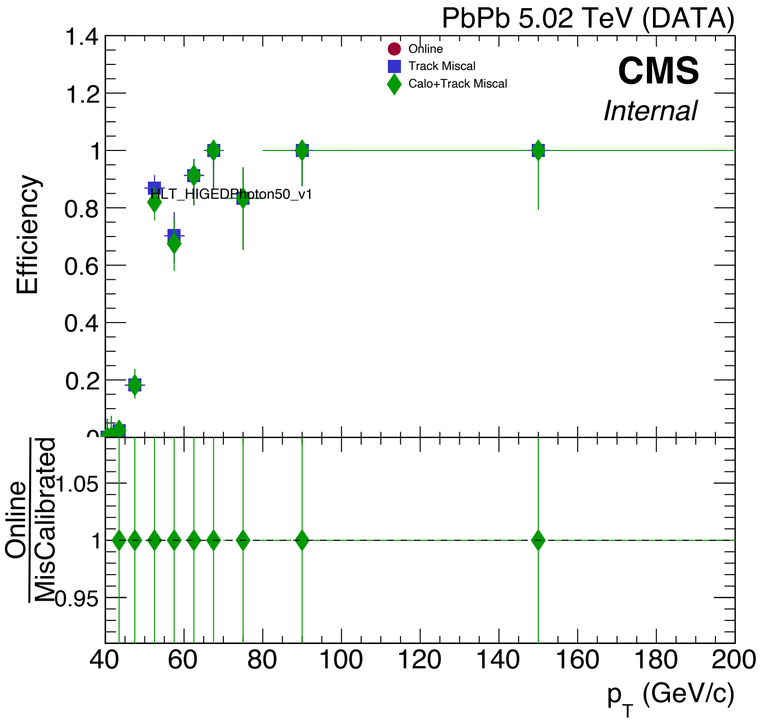
Efficiency Results

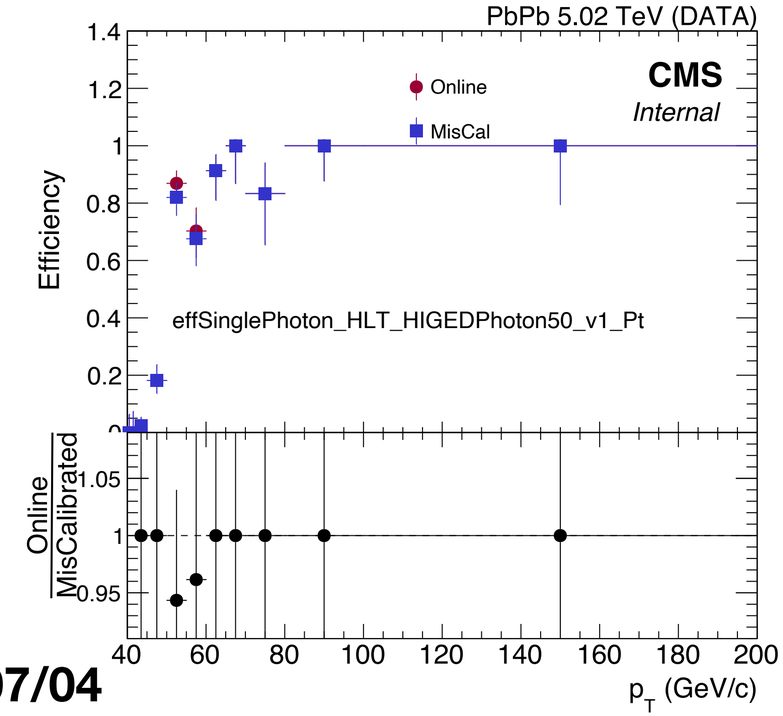
Run 327237

- ECAL + Track Miscalibration in HLT, L1 Calo emulation









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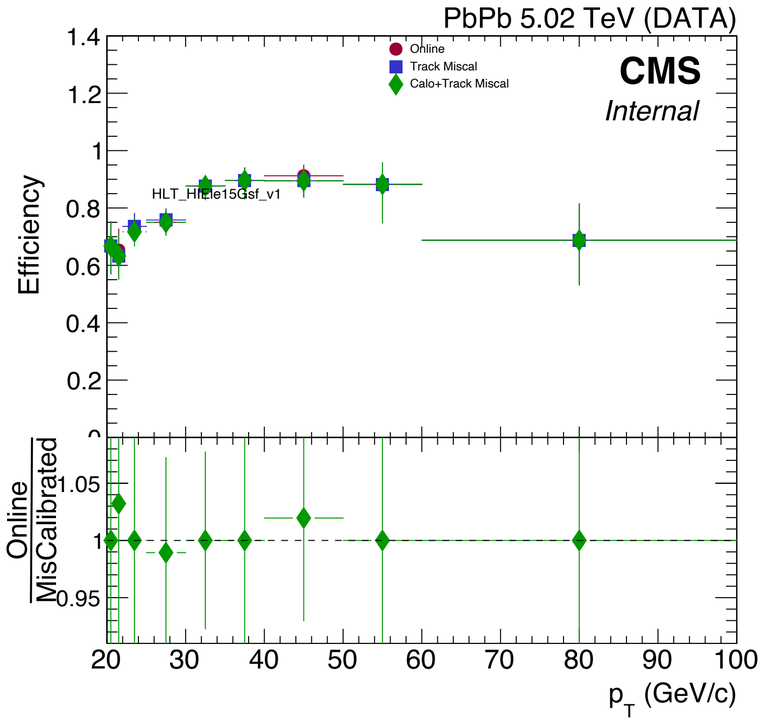

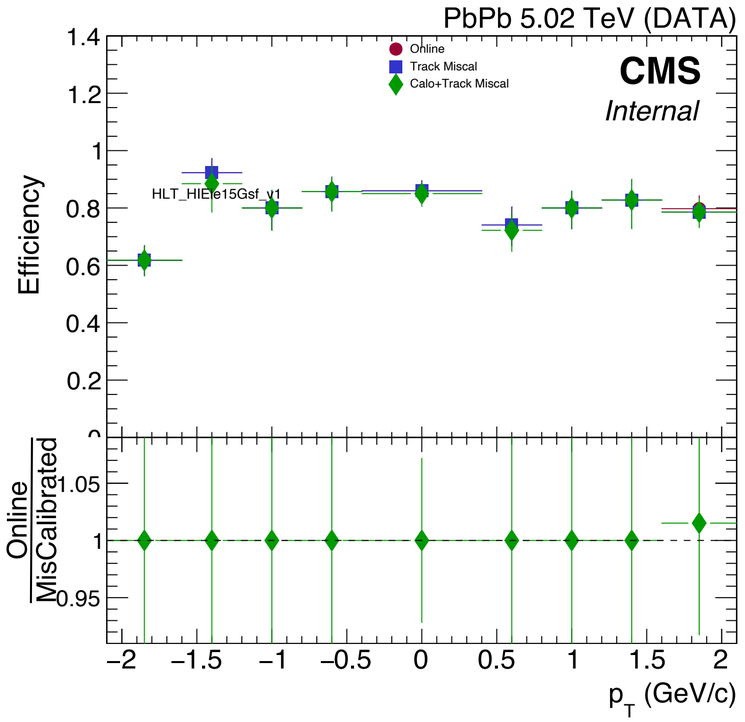

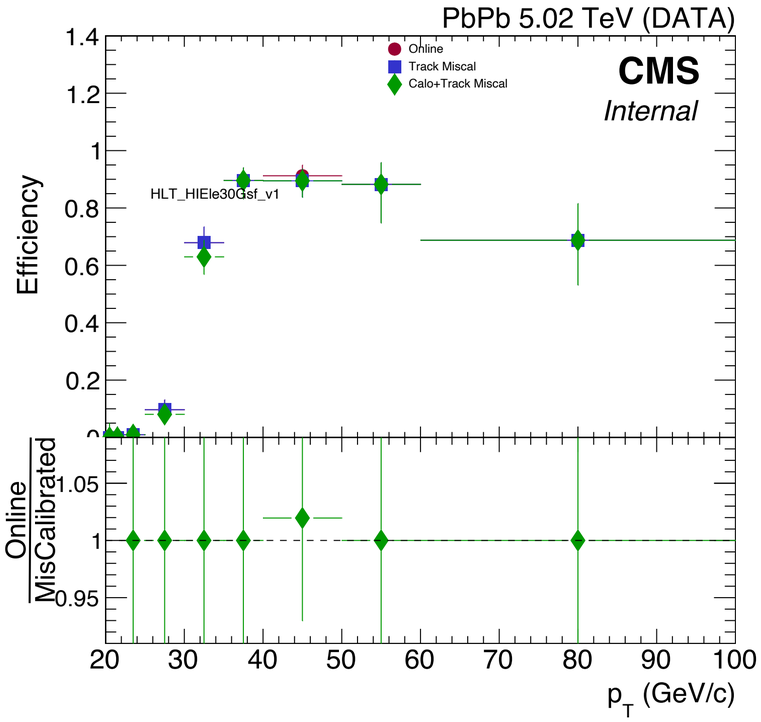

Summary

- HLT study is required to prepare for bigger data stream in Run3, scheduled in 2022.
- HLT study on miscalibrated track, calorimeter:
  - Miscalibration effect is insignificant according to 2018 Run2 data

Future Plans

- HLT Trigger performance study until Run3.
- Start working on analysis.

감사합니다