

CENuM Workshop 07/04

HLT Study for CMS Run3 Preparation

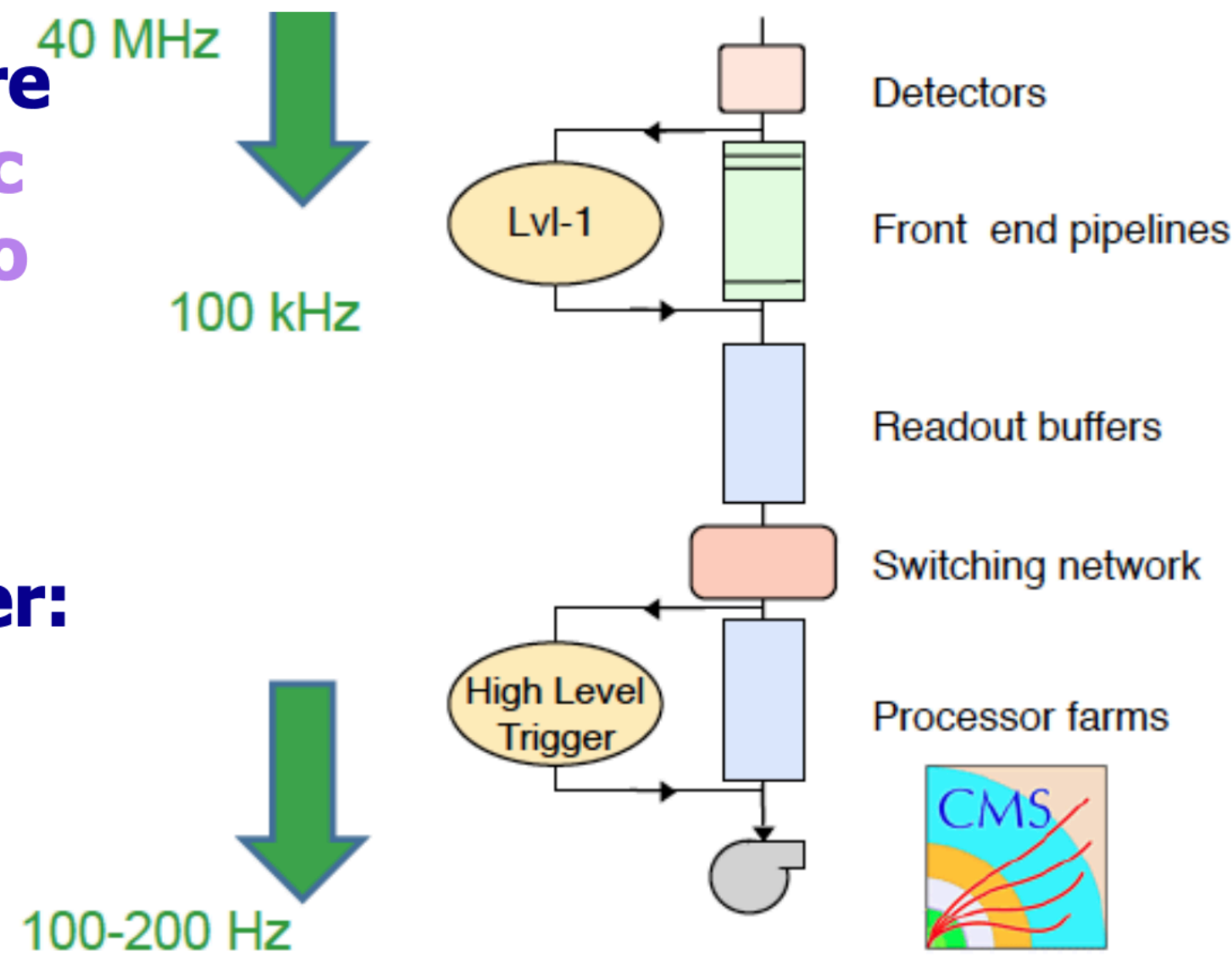
Trigger System in CMS

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

- **L1 Latency: $3.2 \mu s$**

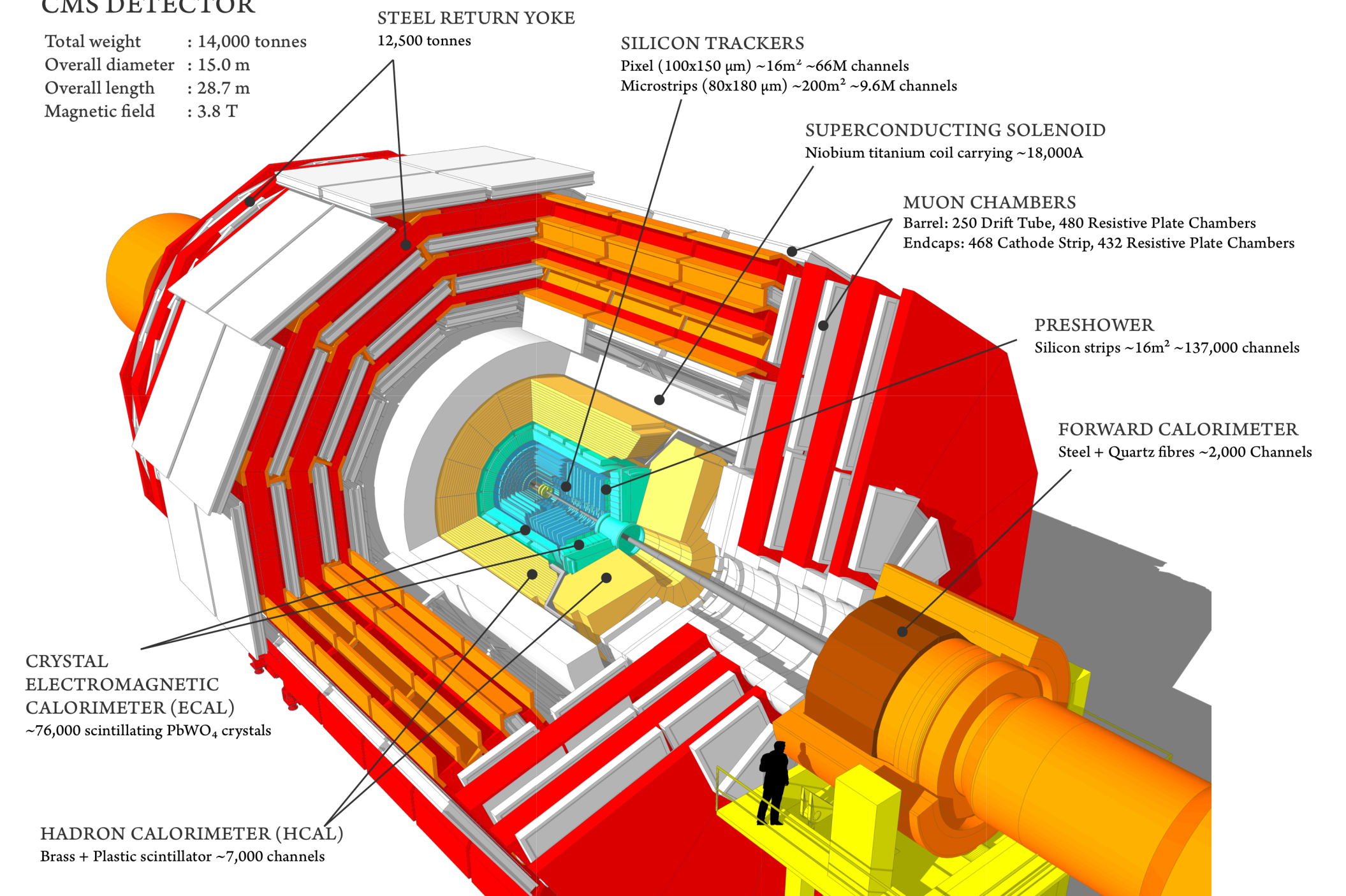
- **HLT: High Level Trigger:** software based ($\sim 10k$ CPUs) look at full event content of L1 selected events

- **Mean time per event HLT: 150 ms (depending on CPU)**



CMS DETECTOR

Total weight : 14,000 tonnes
Overall diameter : 15.0 m
Overall length : 28.7 m
Magnetic field : 3.8 T



- 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

GDR ConfDbGUI

ConfDbGUI Configurations Tools Options Database

ORACLE Connected Host: cmsr1-s.cern.ch, cmsr2-s.cern.ch Port: 10121 Name: cms_cond.cern.ch User: cms_hlt_gdr_w

Configuration: /users/soohwan/Hlon_CMSSW_11_1_0_v6/V1

Process: HLT Release: CMSSW_11_1_0_pre5

Created: 2020-04-21 08:10:39.0 Creator: soohwanlee

Search:

- ▶ HLT_HllslandPhoton40_Eta2p4_v1 (7)
- ▶ HLT_HllslandPhoton40_Eta1p5_v1 (7)
- ▶ HLT_HllslandPhoton50_Eta2p4_v1 (7)
- ▶ HLT_HllslandPhoton50_Eta1p5_v1 (7)
- ▶ HLT_HllslandPhoton60_Eta2p4_v1 (7)
- ▶ HLT_HllslandPhoton60_Eta1p5_v1 (7)
- ▶ HLT_HIGEDPhoton10_v1 (5)
- ▶ HLT_HIGEDPhoton20_v1 (5)
- ▼ HLTBeginSequence (3)
 - ▶ hltTriggerType
 - ▶ HLTL1UnpackerSequence (2)
 - ▼ HLTBeamSpot (2)
 - ▼ hltScalersRawToDigi
 - InputTag scalersInputTag = rawDataCollector
 - ▶ hltOnlineBeamSpot
- ▶ hltL1sL1MinimumBiasHF1AND
- ▶ hltPreHIGEDPhoton20
- ▶ HLTHIGEDPhoton20PPOnAASquence (8)
- ▶ HLTEndSequenceWithZeroSuppression (2)
- ▶ HLT_HIGEDPhoton30_v1 (5)
- ▶ HLT_HIGEDPhoton40_v1 (5)
- ▶ HLT_HIGEDPhoton50_v1 (5)
- ▶ HLT_HIGEDPhoton60_v1 (5)
- ▶ HLT_HIGEDPhoton10_EB_v1 (5)
- ▶ HLT_HIGEDPhoton20_EB_v1 (5)
- ▶ HLT_HIGEDPhoton30_EB_v1 (5)
- ▶ HLT_HIGEDPhoton40_EB_v1 (5)
- ▶ HLT_HIGEDPhoton50_EB_v1 (5)
- ▶ HLT_HIGEDPhoton60_EB_v1 (5)

Package: EventFilter/ScalersRawToDigi CVS: daf6ef9a91b EDProducer: ScalersRawToDigi

Label: hltScalersRawToDigi Paths:

hltScalersRawToDigi Parameters

Parameter	Type	Value	Checked	Checked
scalersInputTag	InputTag	rawDataCollector	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Snippet Assigned to Datasets Unresolved Input Tags Contained in Paths

```
hltScalersRawToDigi = cms.EDProducer( "ScalersRawToDigi",
  scalersInputTag = cms.InputTag( "rawDataCollector" )
)
```

Loading Configuration ...Done! (156471 ms)

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.

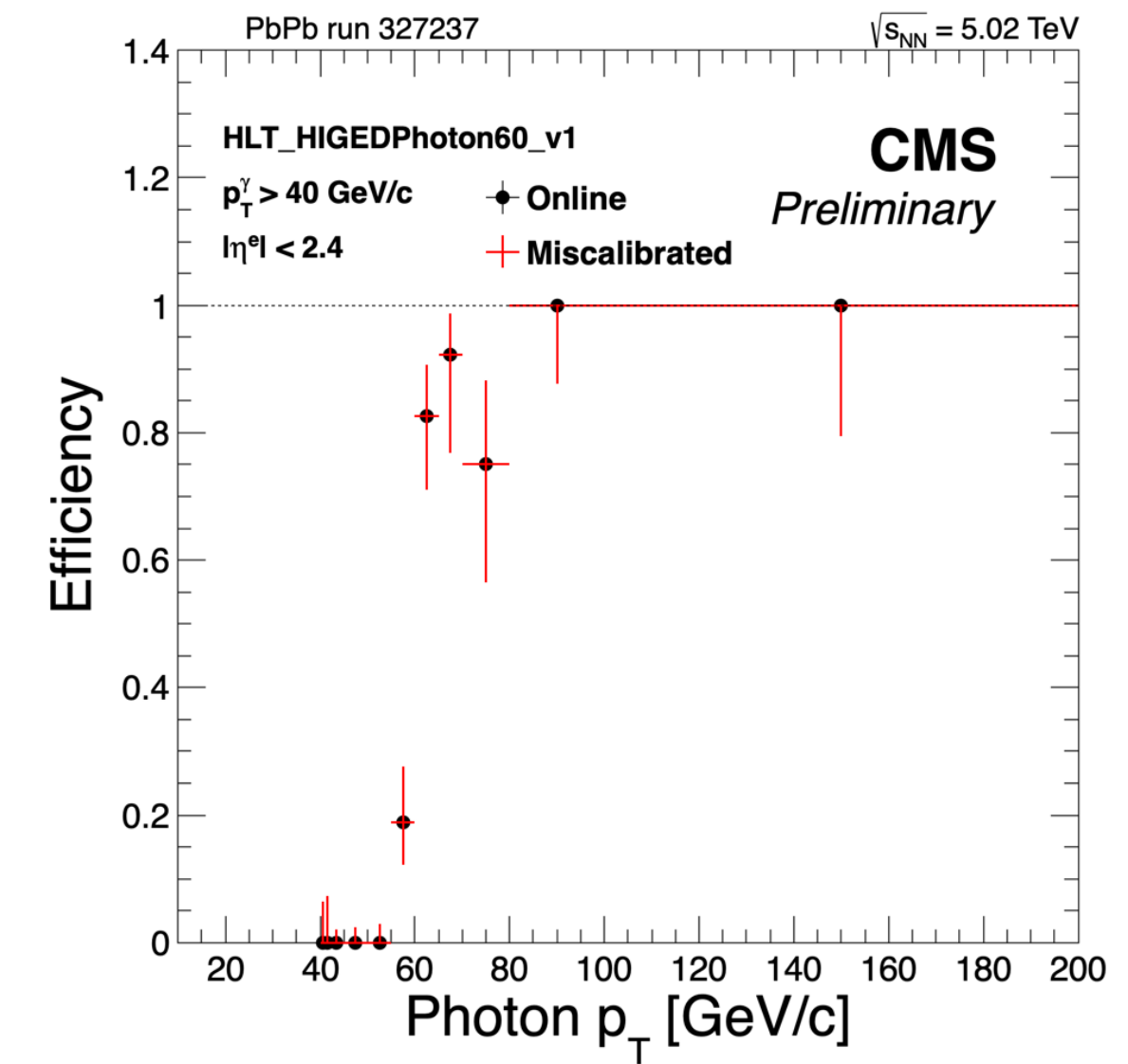
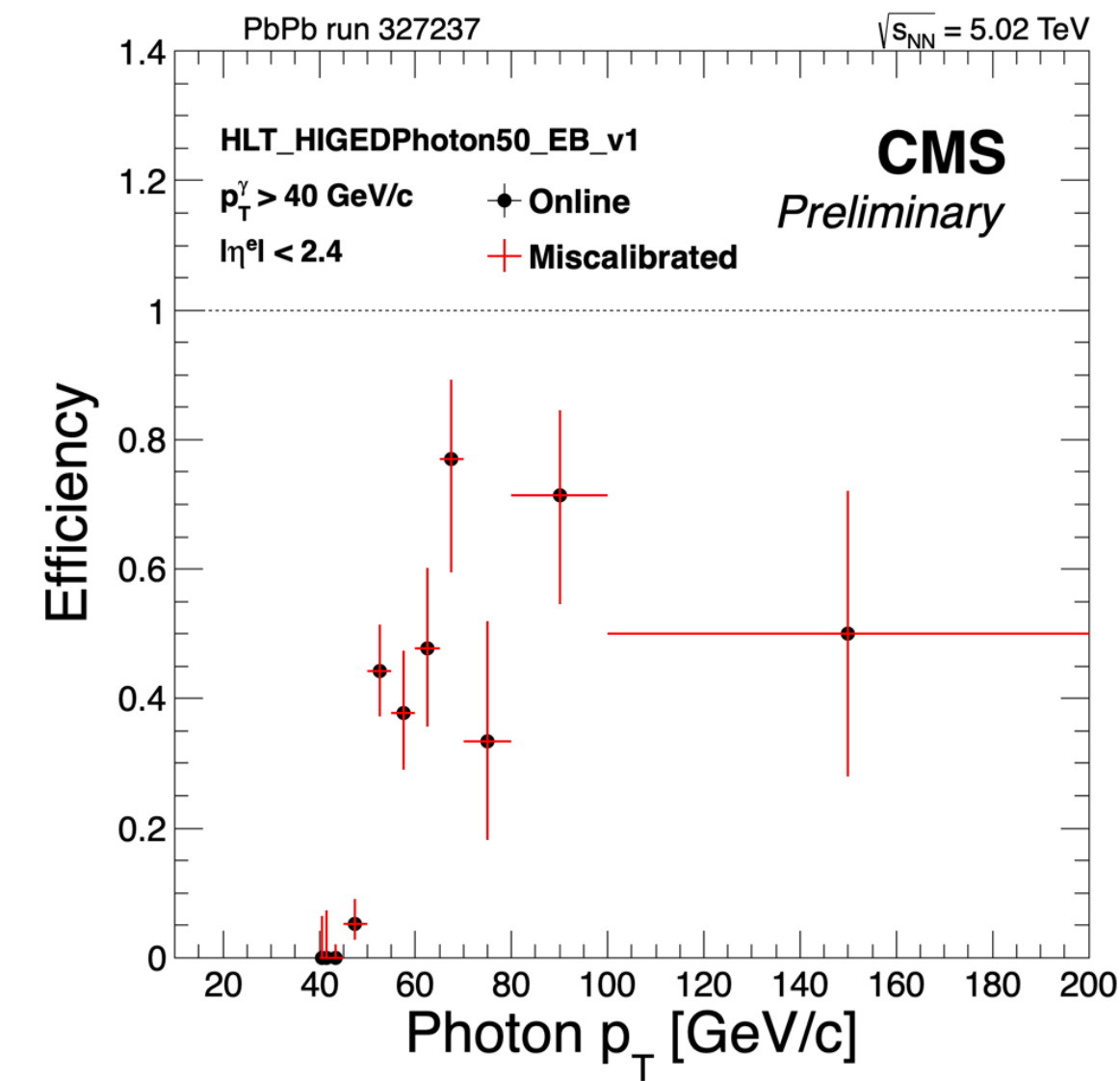
HLT Efficiency

- 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](#).

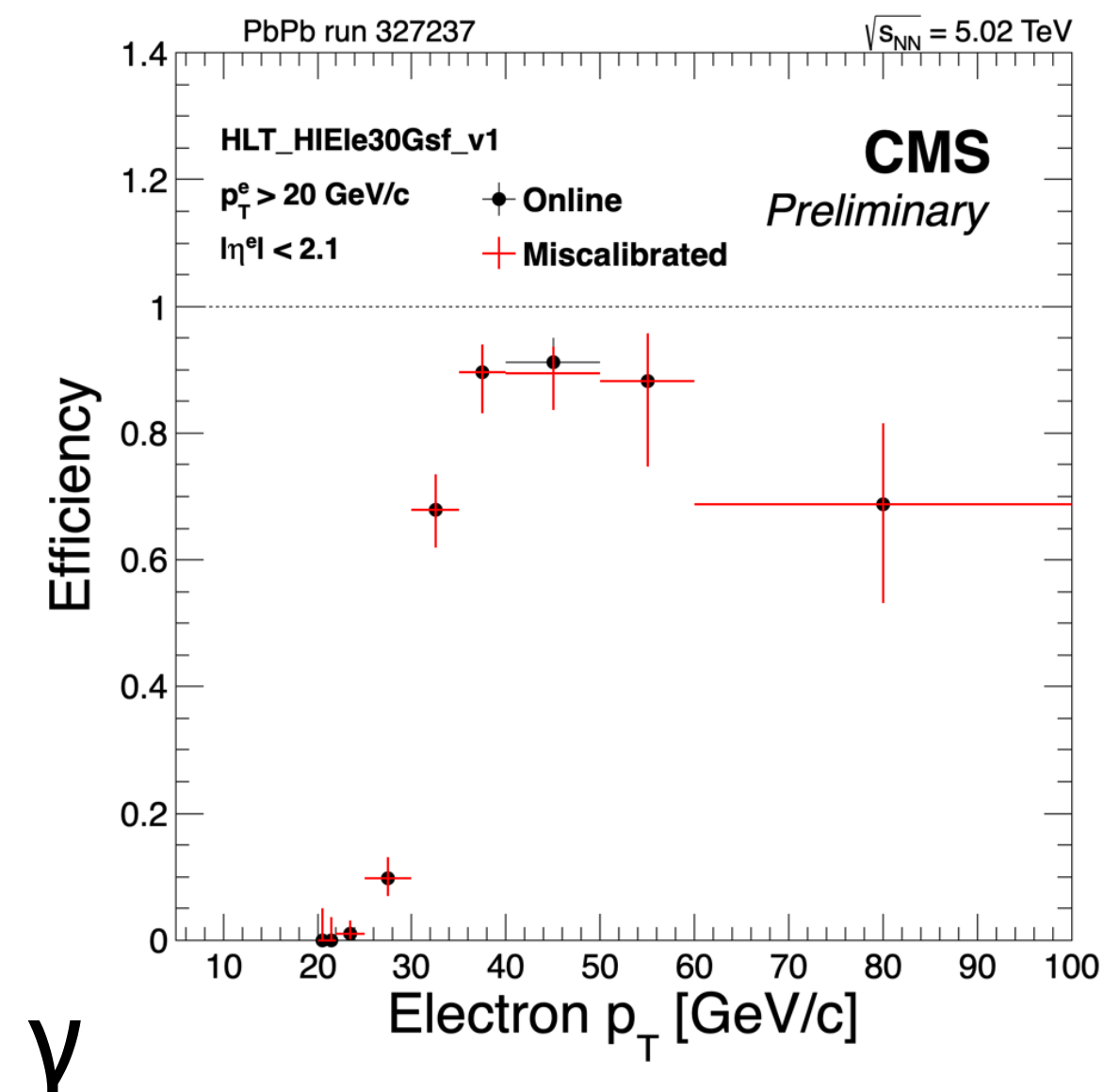
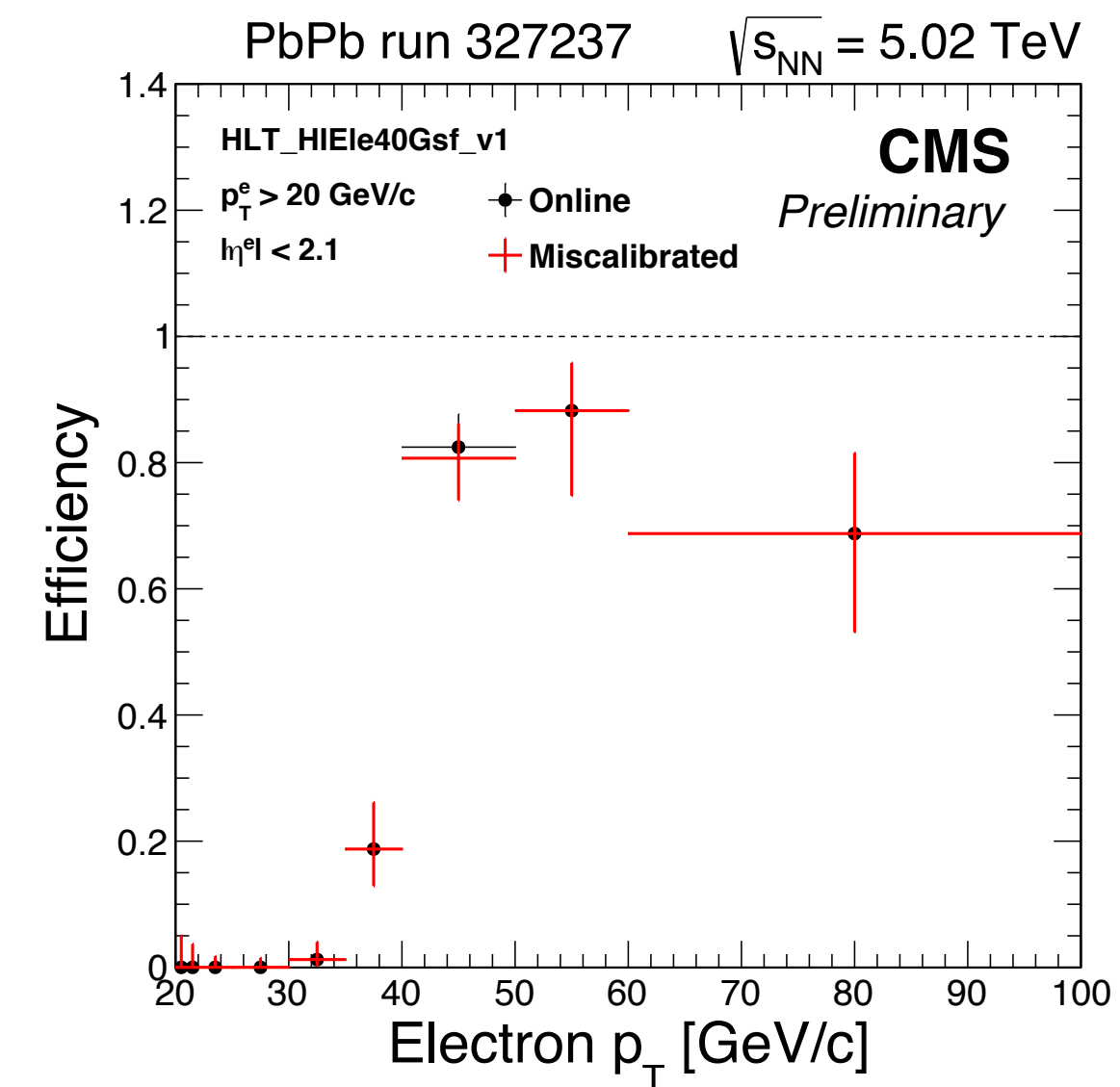
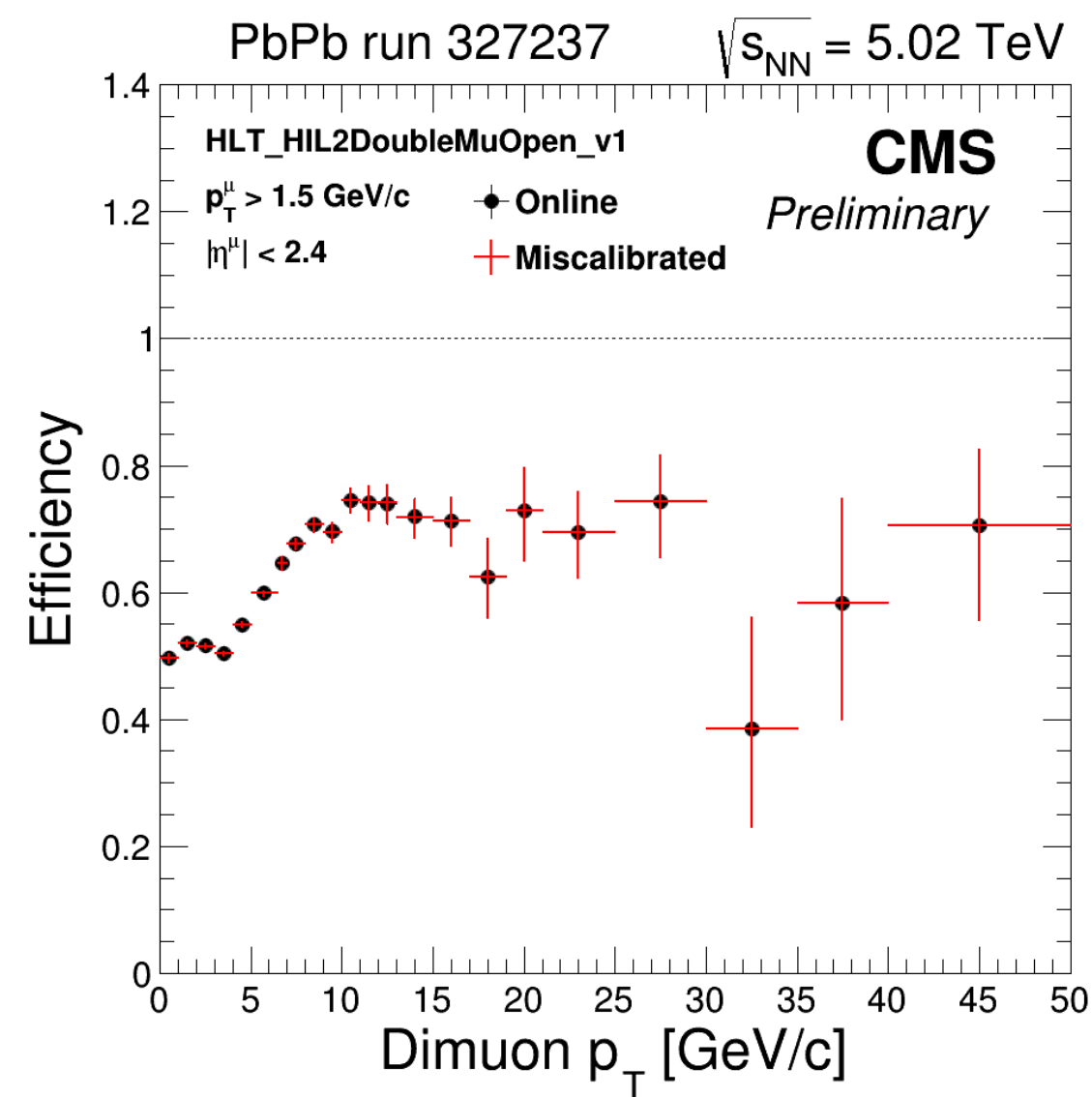
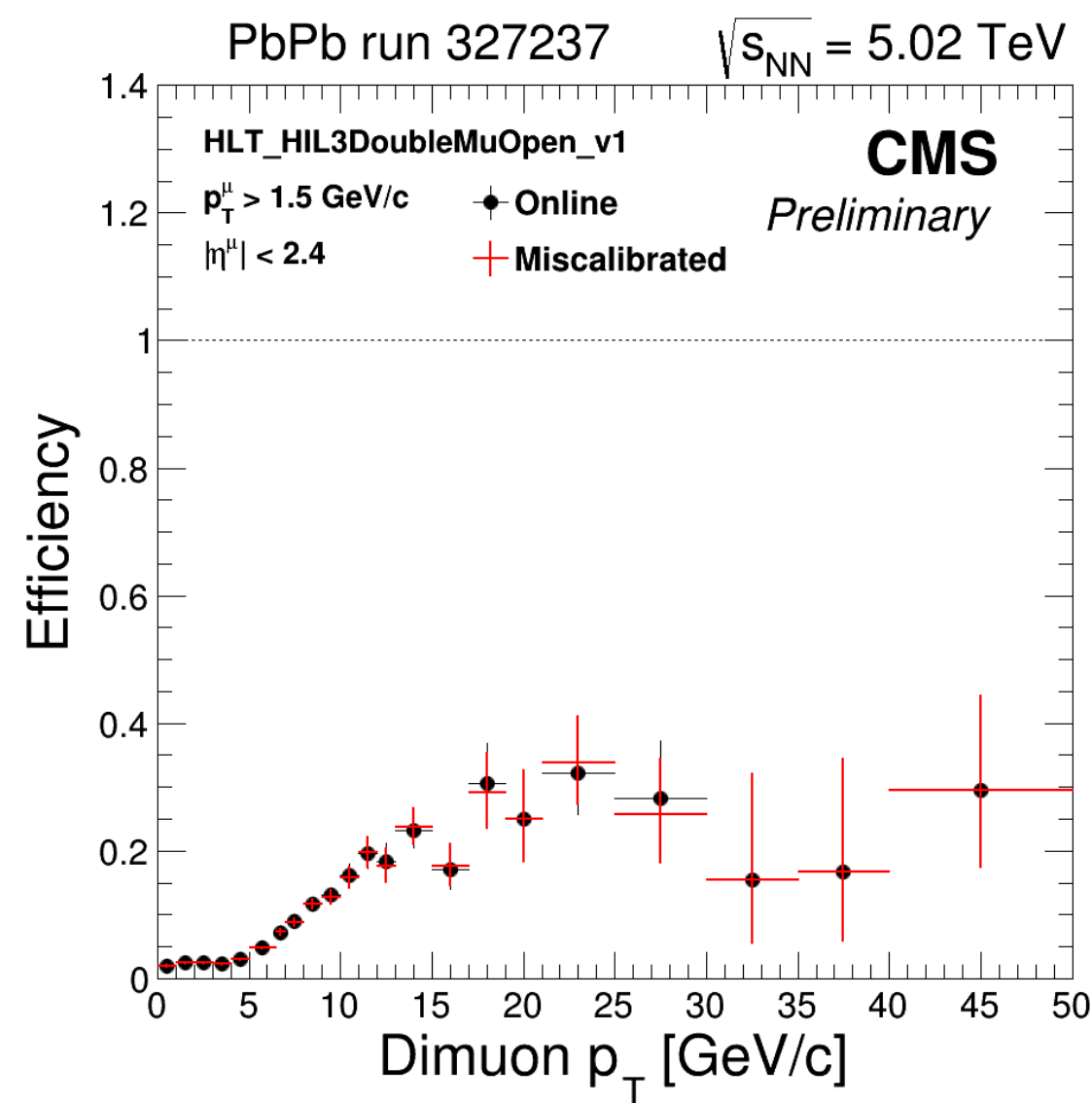
Efficiency Results

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

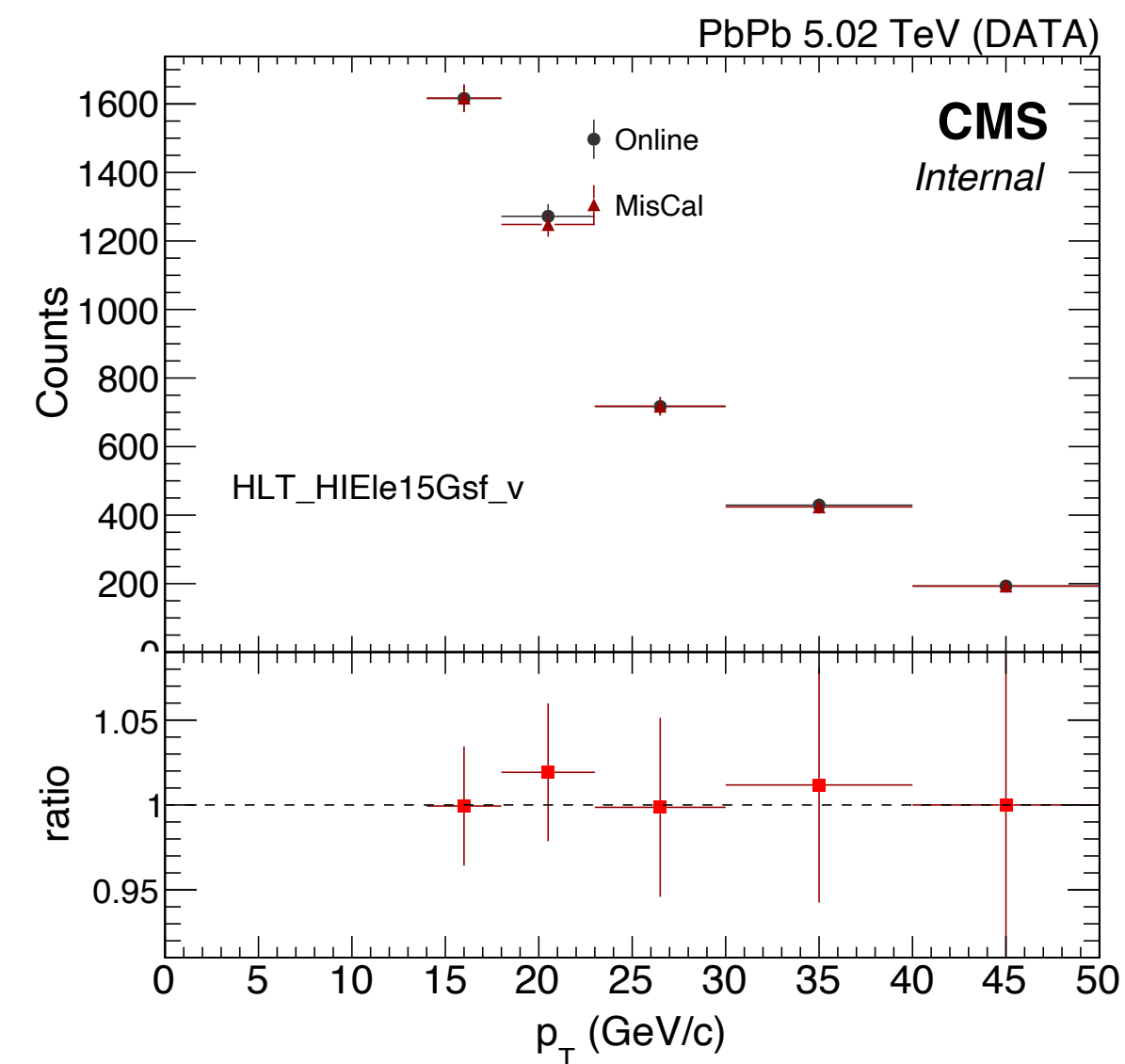
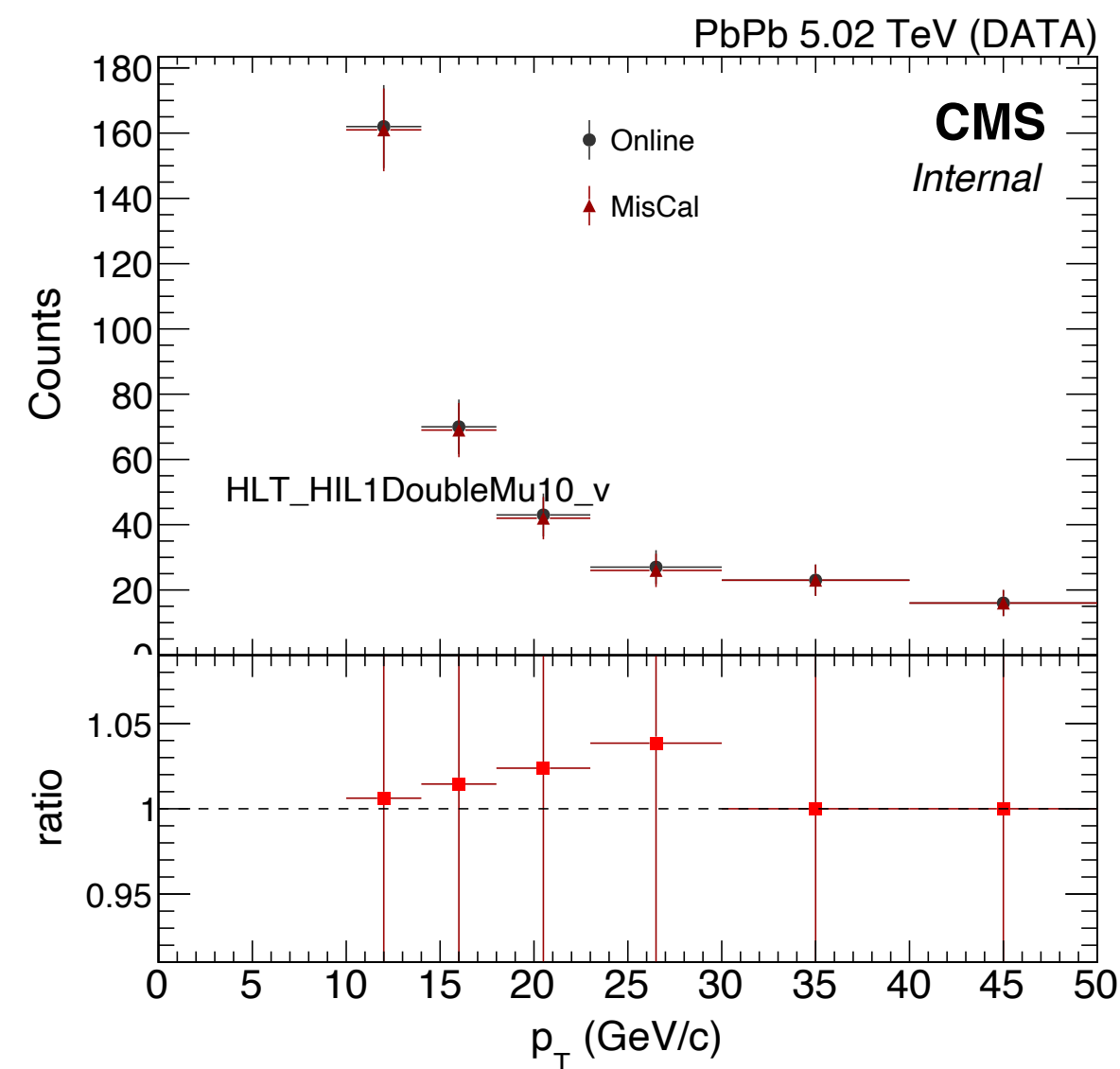
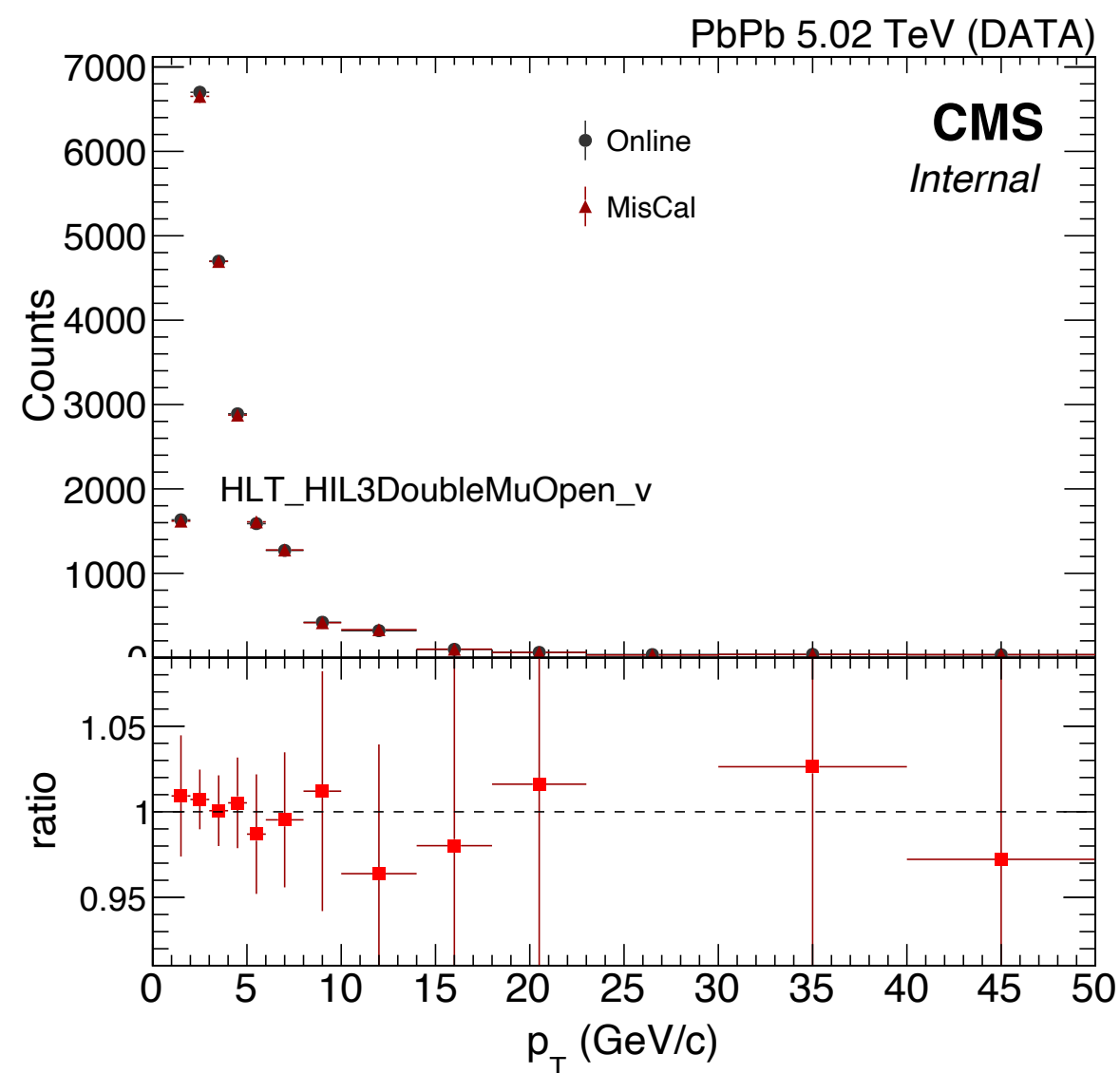
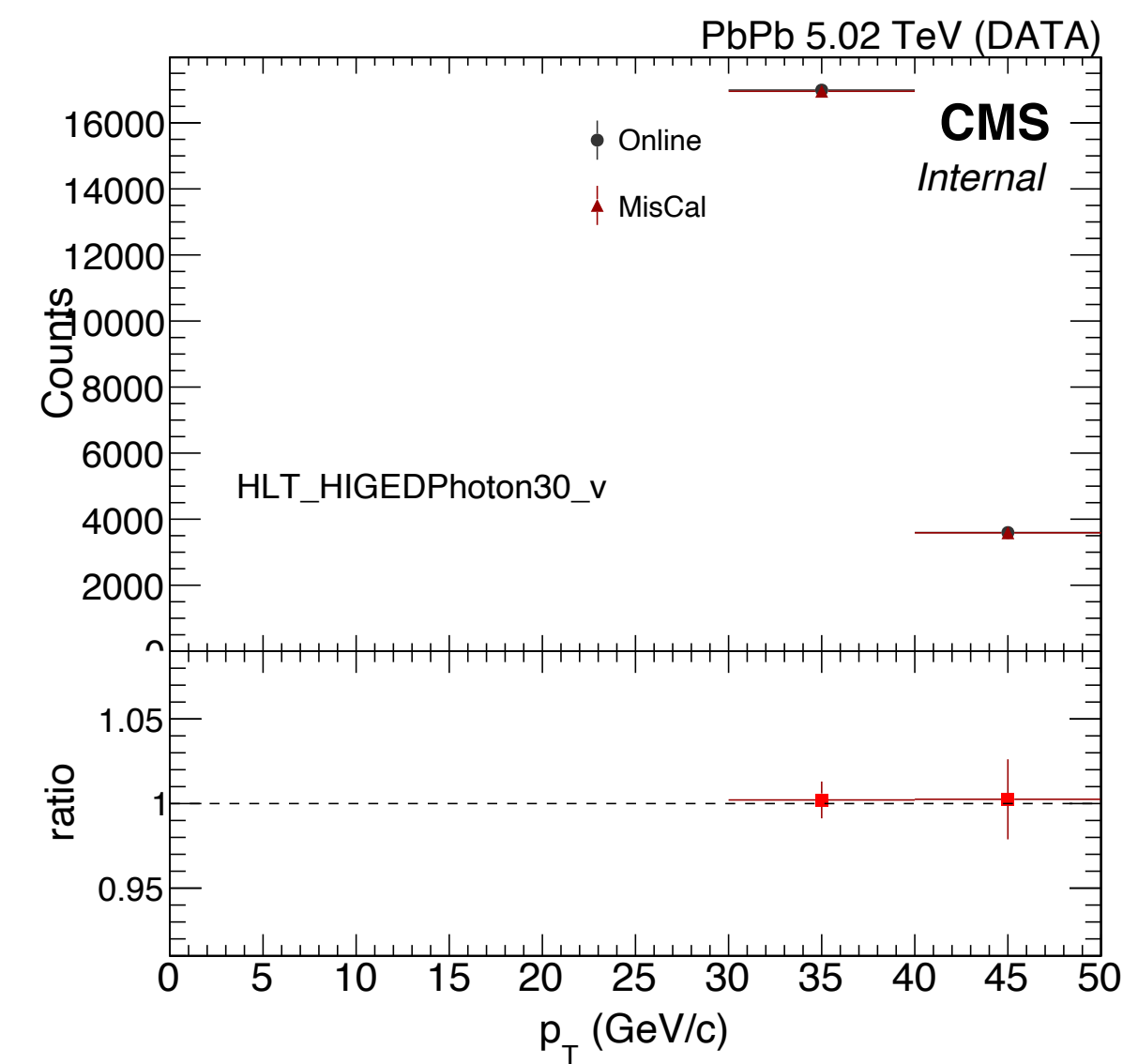
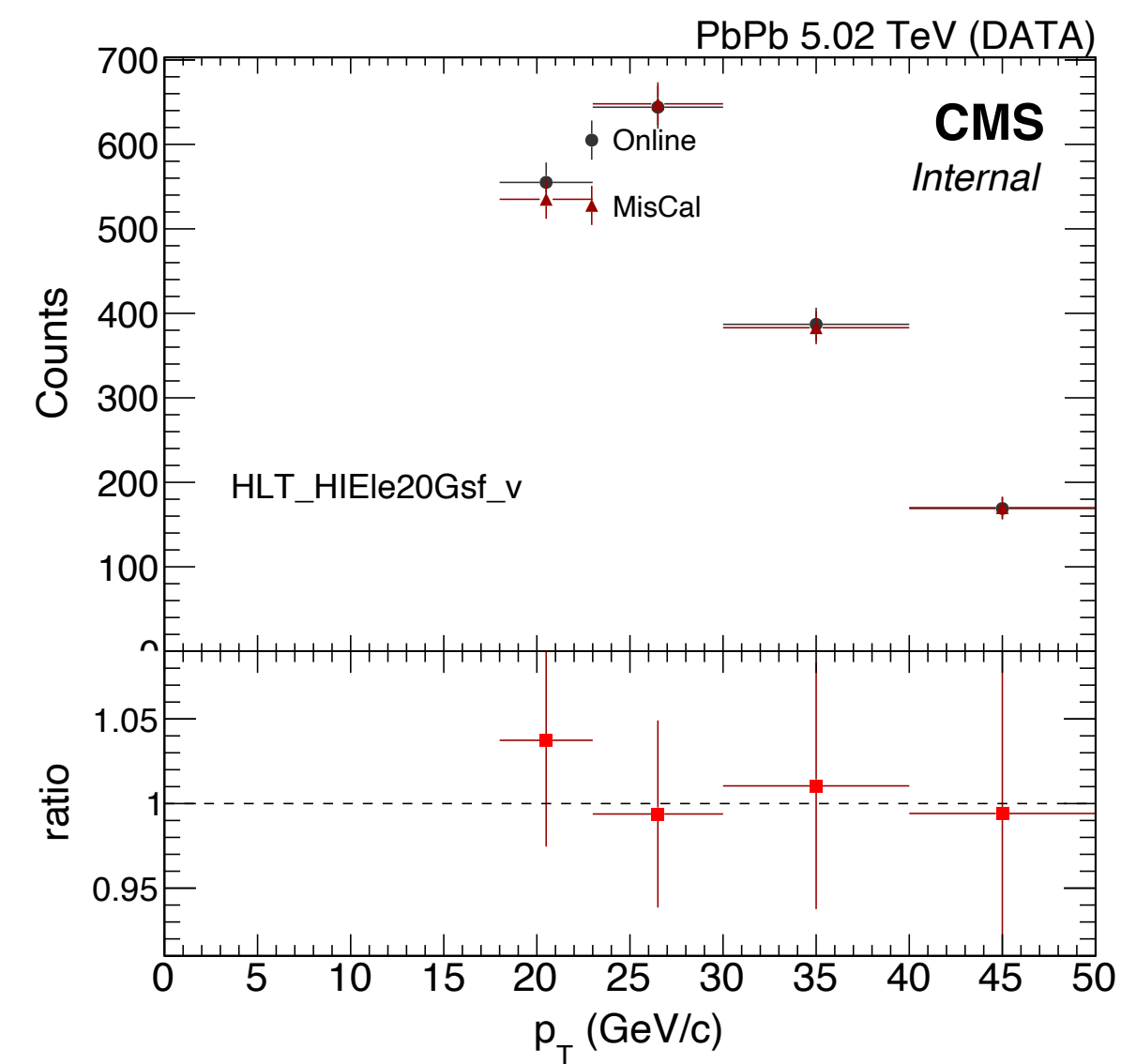
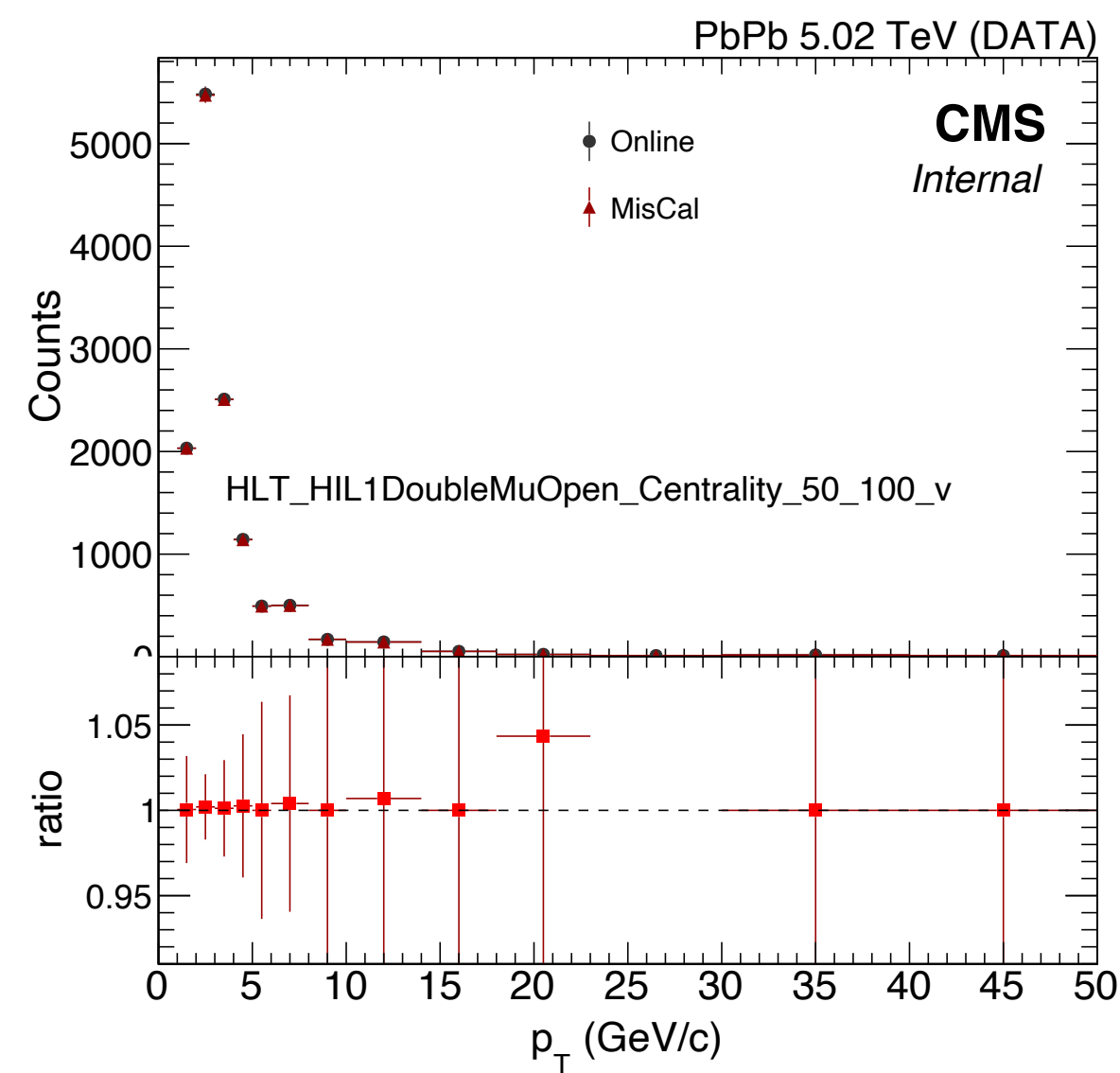
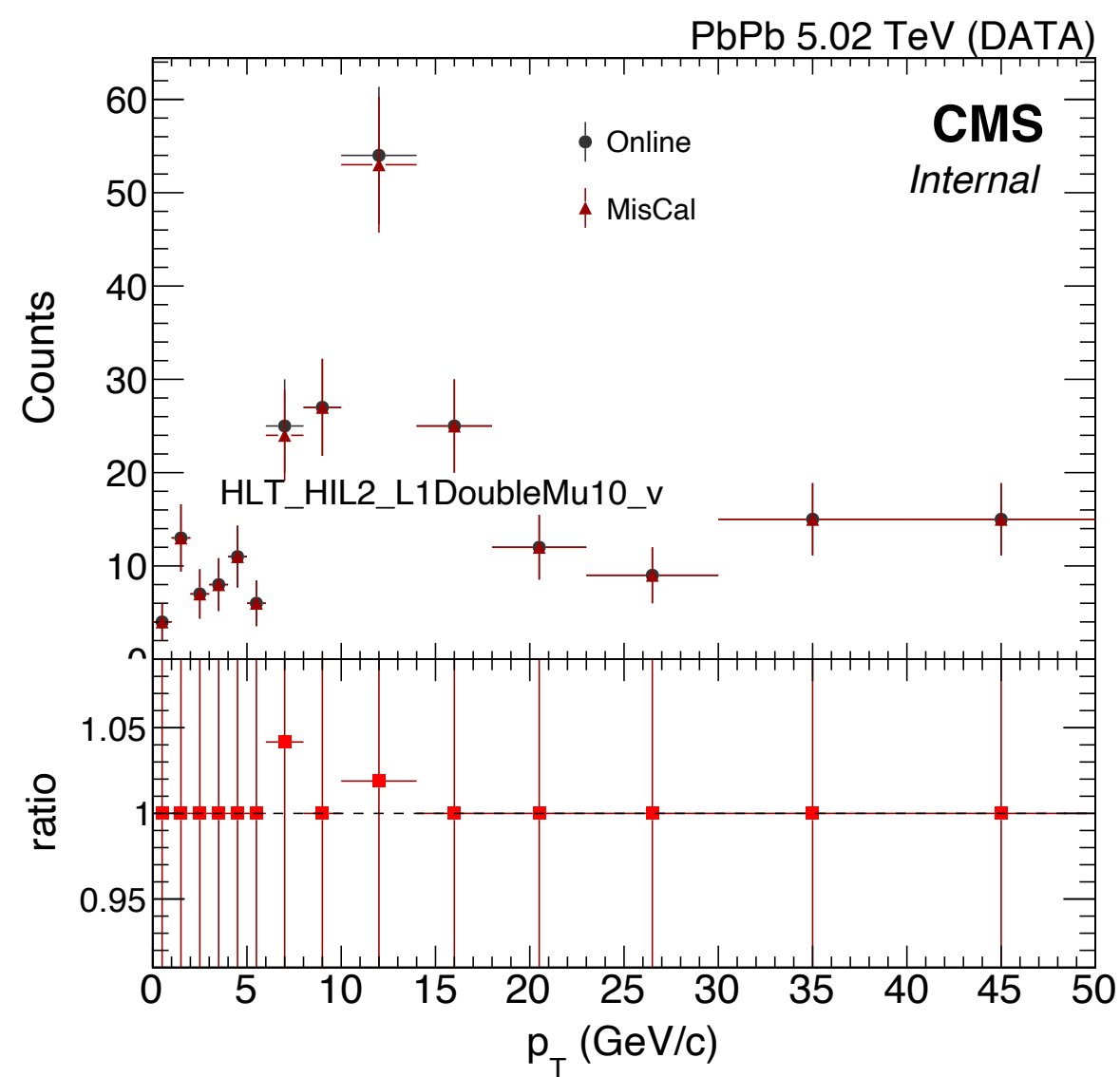


Muon

γ

Object Ratio Plots

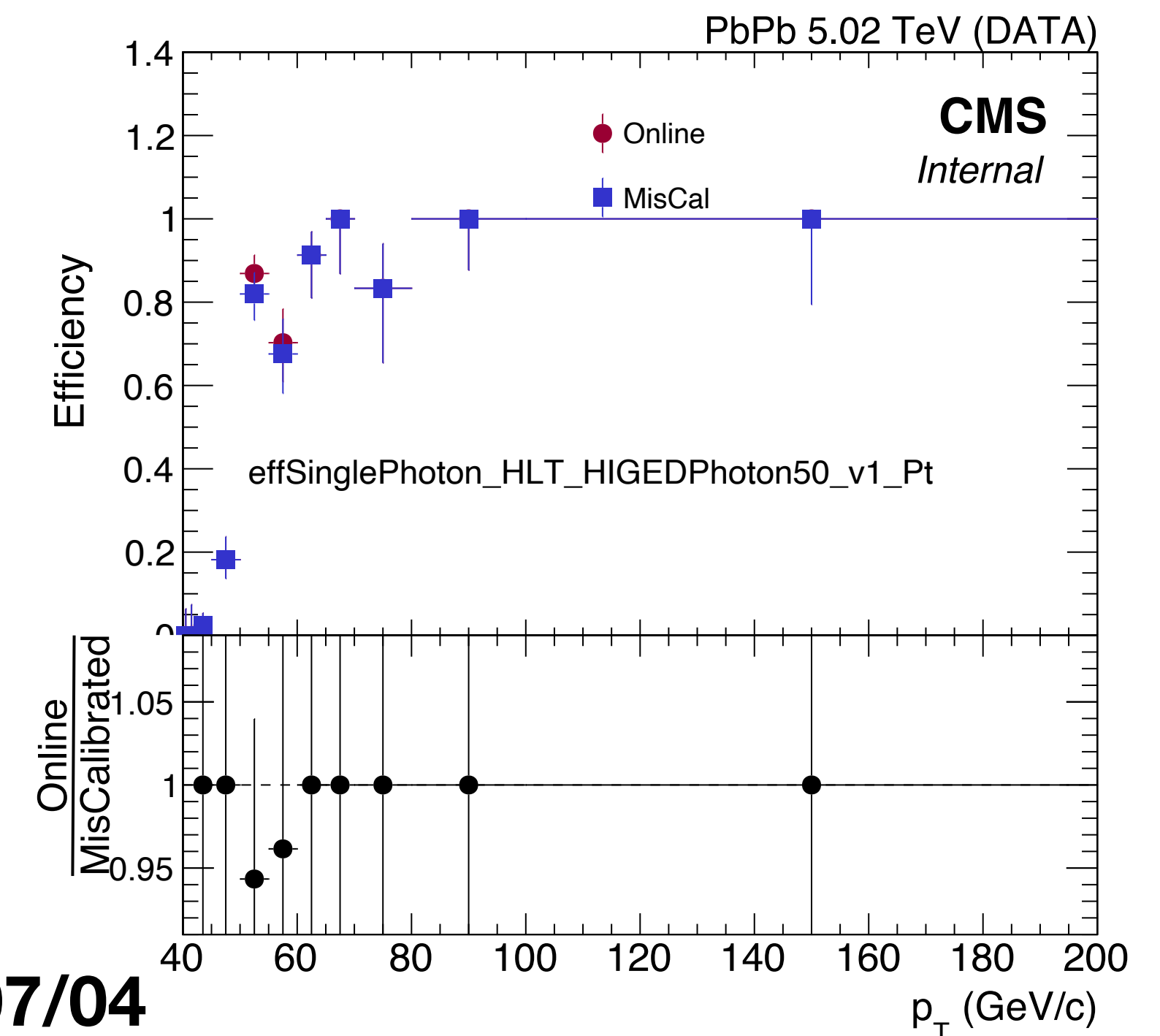
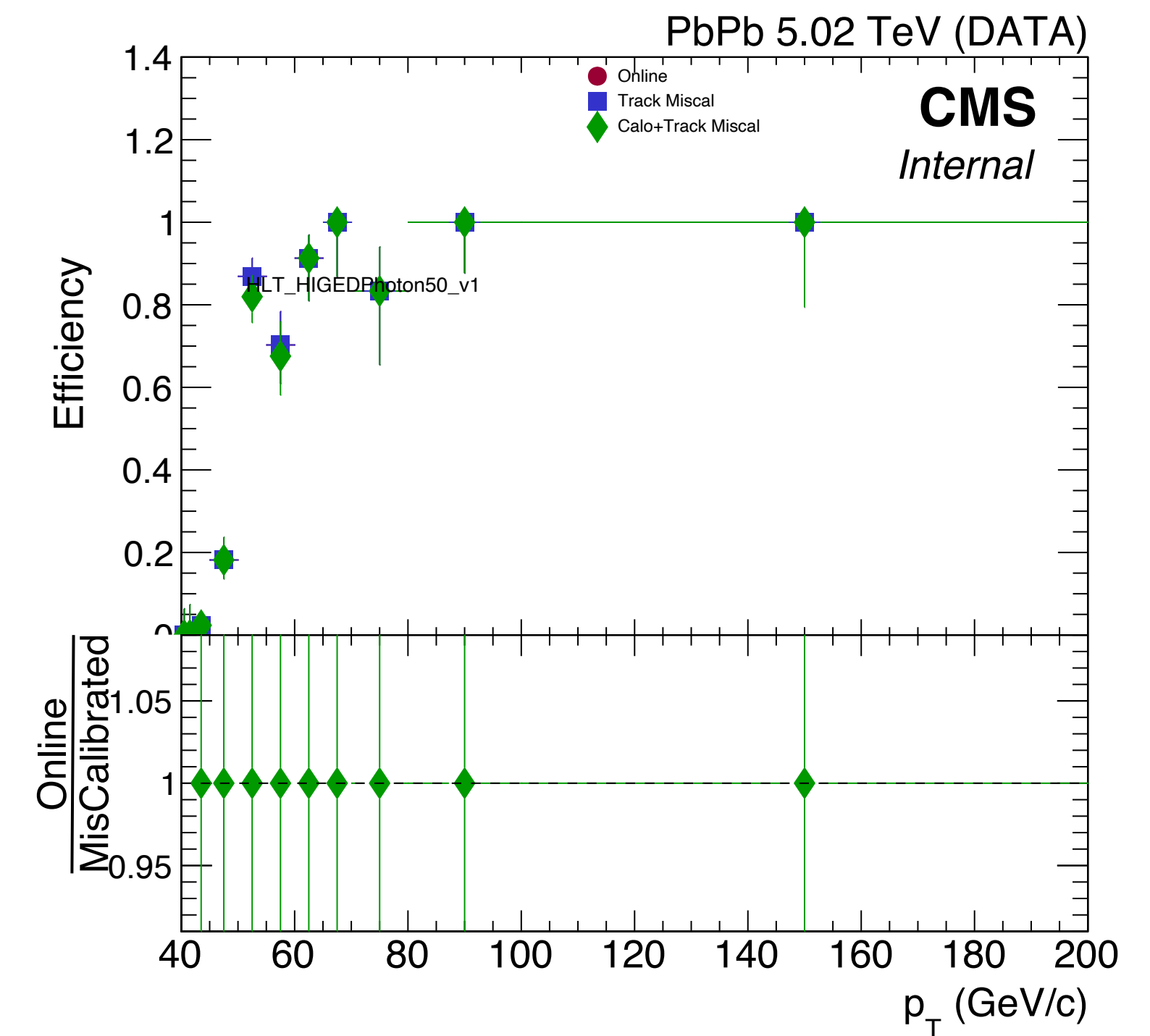
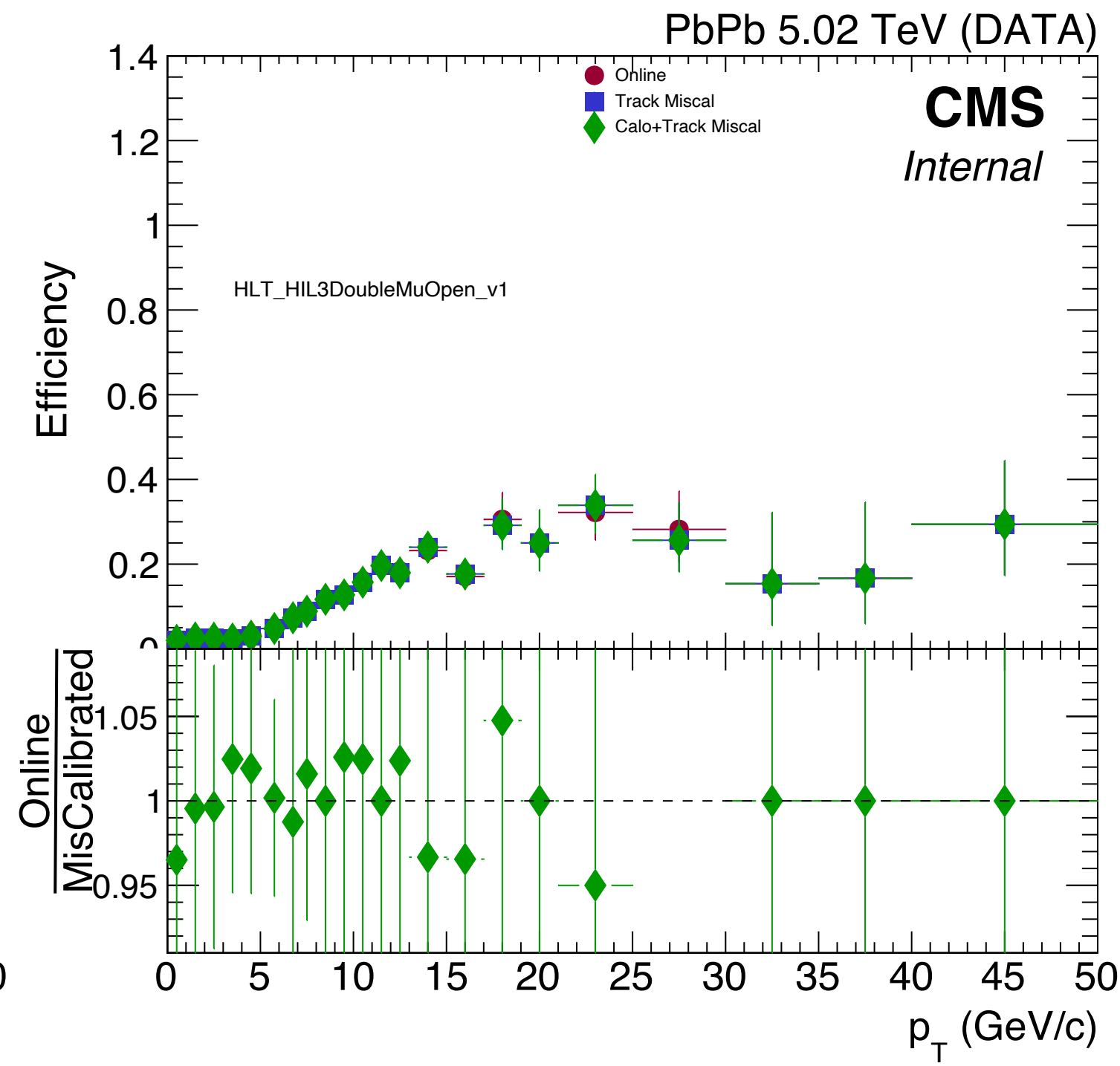
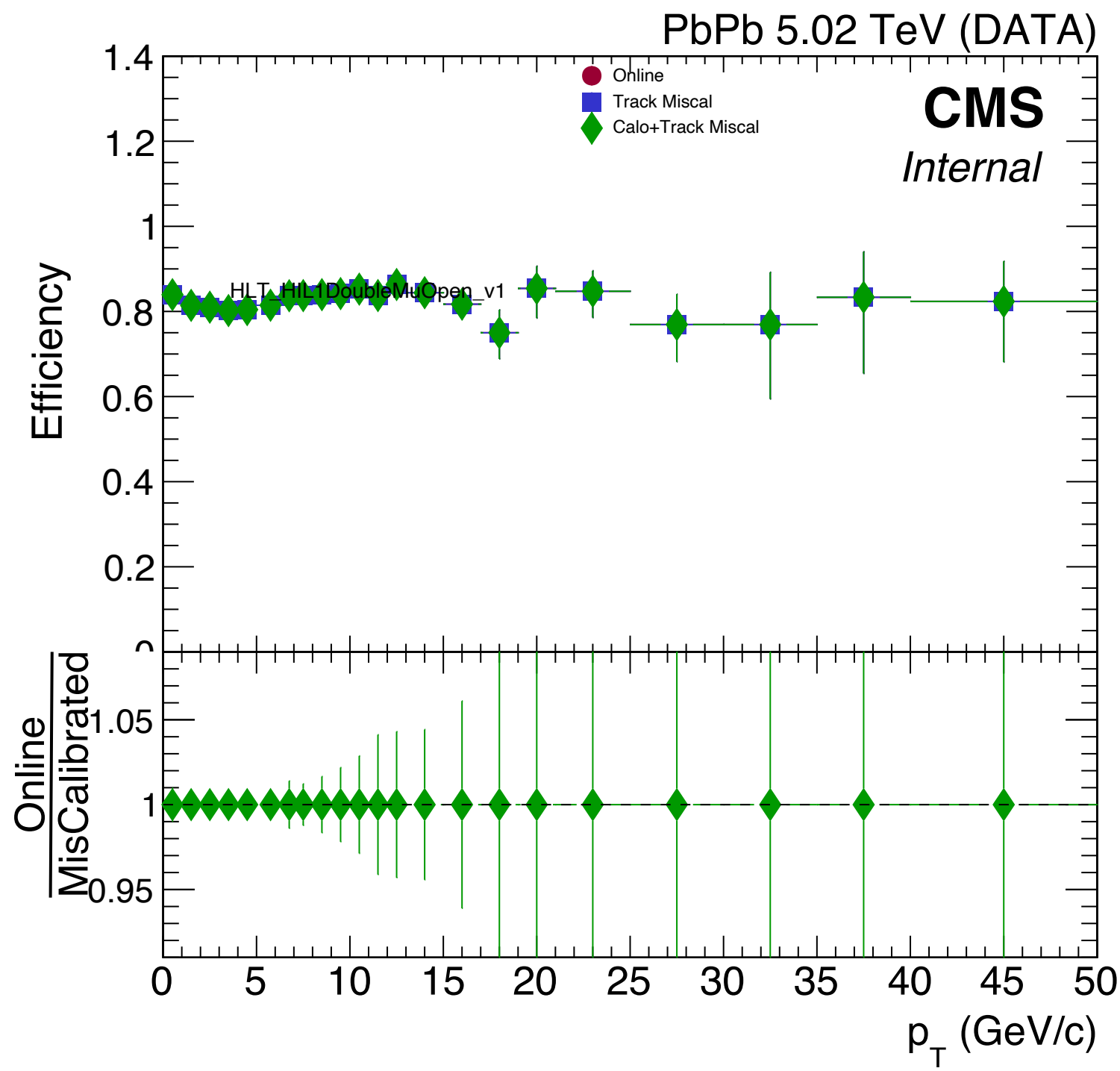
- Check number of particles match event selection in both reco tree and analyzed hltTree.



Efficiency Results

Run 327237

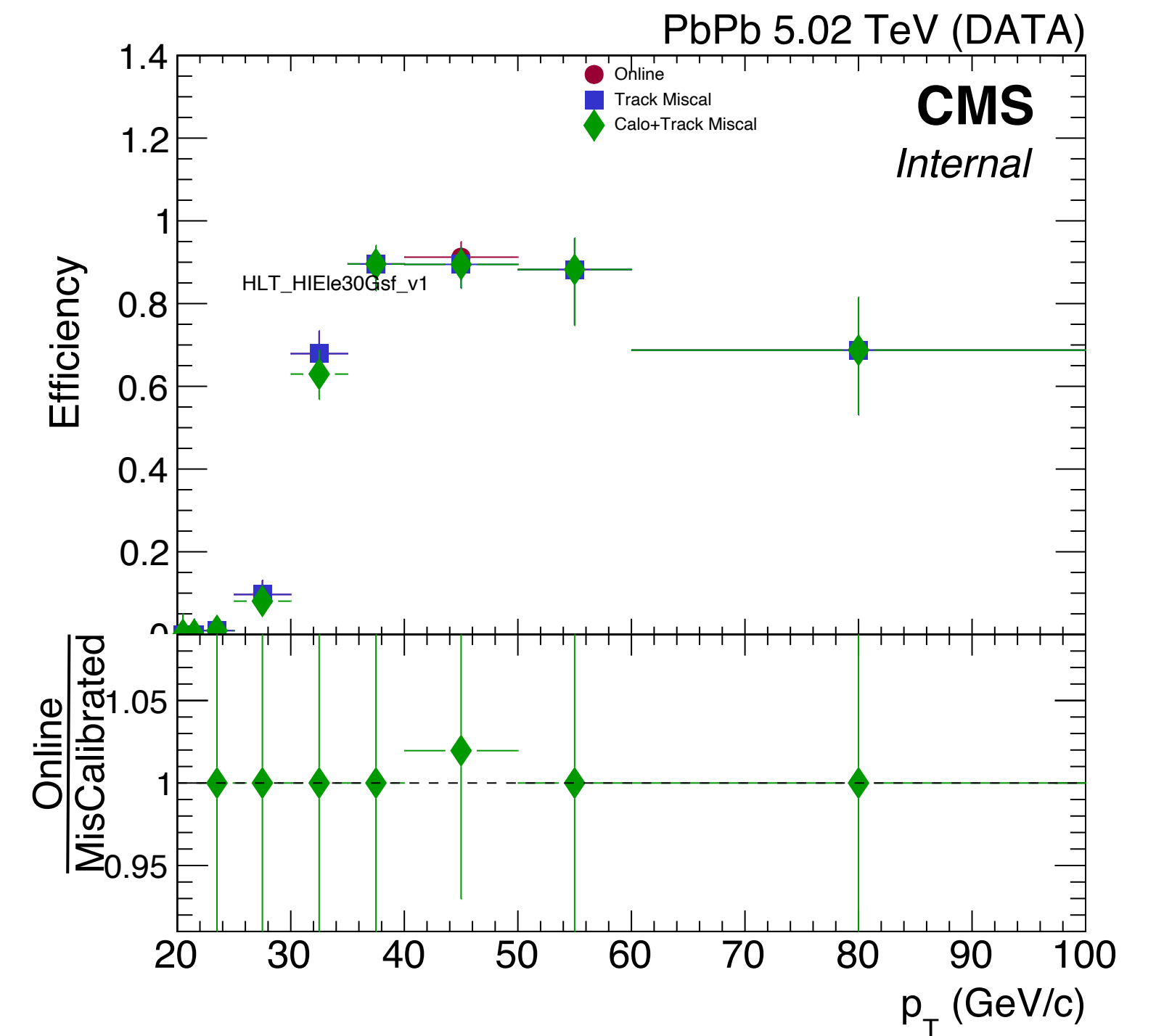
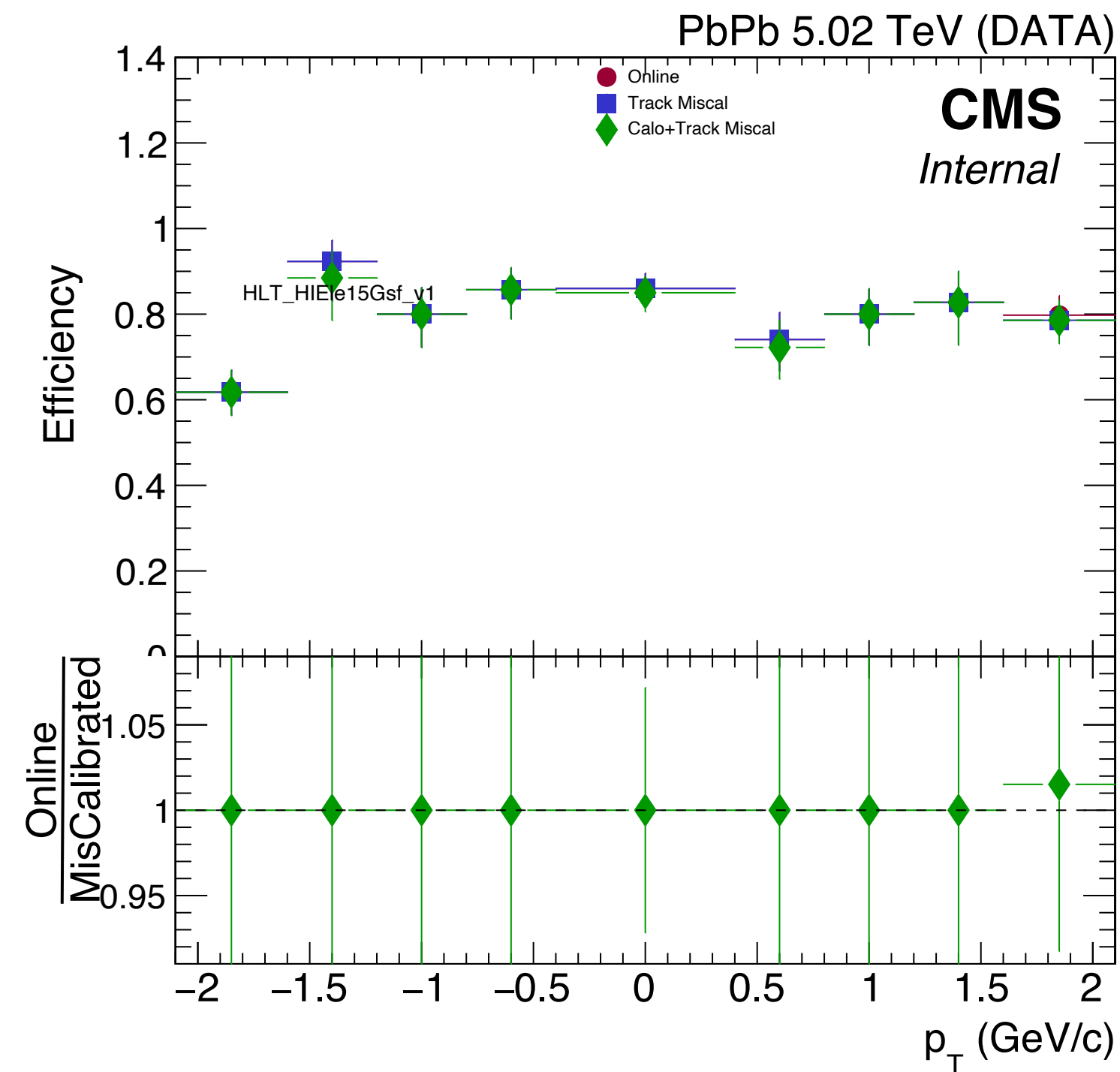
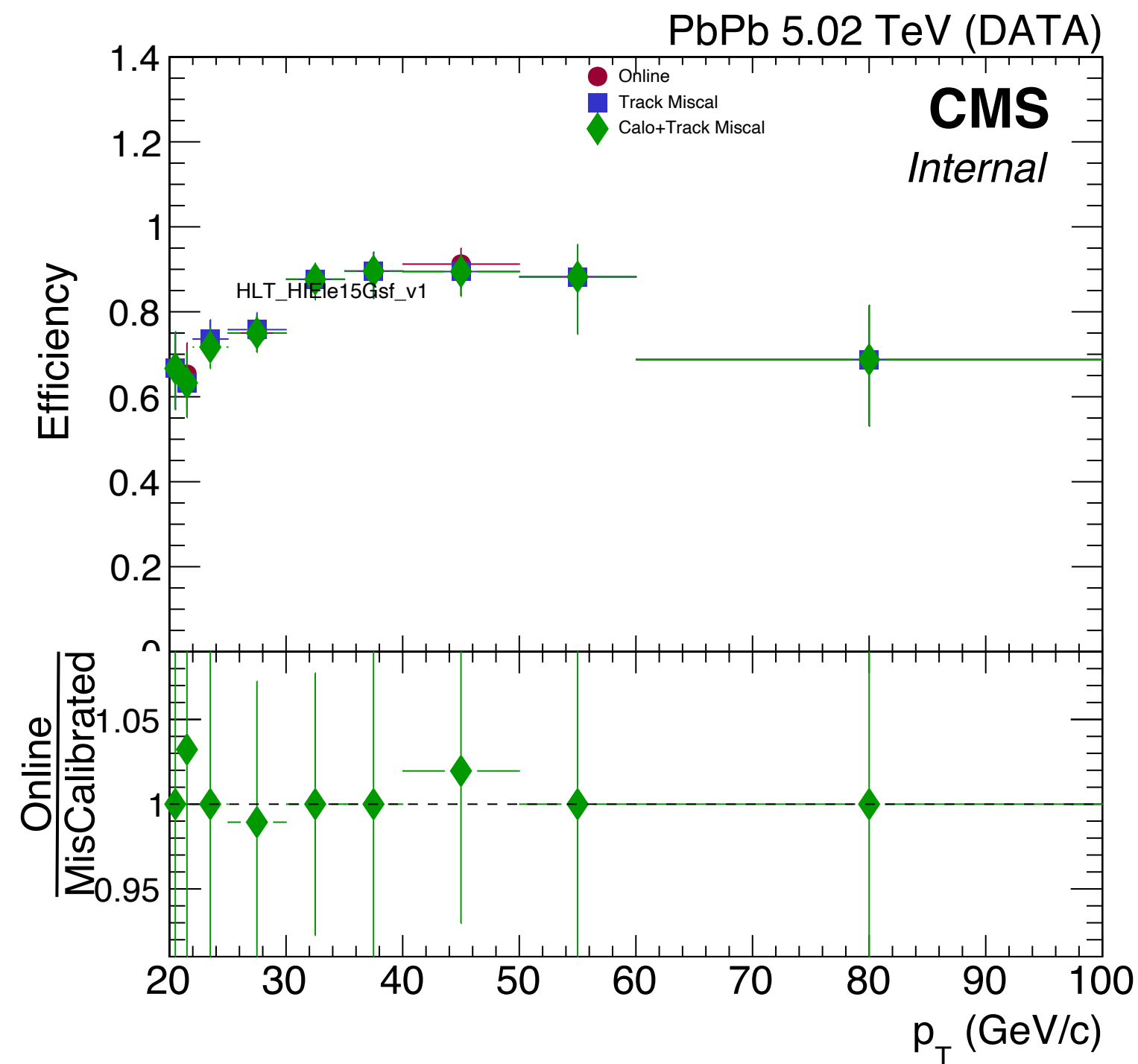
- ECAL + Track Miscalibration in HLT, L1 Calo emulation



Efficiency Results

Run 327237

- ECAL + Track Miscalibration in HLT, L1 Calo emulation



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