

HPS MC Needs and Wants

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Status of MC Samples

- MC samples have been produced for 2019 and 2021 calibration.
 - 2019 MC:
 - Samples: ap-beam, tritrig-beam, rad-beam, BH-beam, wab-beam, FEE, and some pure signal samples
 - Details: <https://confluence.slac.stanford.edu/display/hpsg/2019+MC+Samples>
 - 2021 MC:
 - Samples: tritrig-beam, wab-beam, ap-beam, Moller-beam, FEE
 - Details: <https://confluence.slac.stanford.edu/display/hpsg/2021+MC+Samples>
- 2016 MC:
 - Final samples for bump hunt and vertex search analyses: <https://confluence.slac.stanford.edu/display/hpsg/pass4+for+2016+MC>
 - SIMP: /sdf/group/hps/users/bravo/run/simpPrep/output/recon/2pt3

Needs for Next Pass of 2019 and 2021

Basically, softwares are ready to produce next pass of MC samples, but some configurations need to be updated/determined.

- Detector alignment
- Beam rotation and target offsetting based on updated alignment. We have already developed codes to extract beam rotation parameters using three-prong tridents. For 2021, we also can determine beam rotation parameters using Moller events

Software Update/Development

- WAB biasing and new chains with container (Omar)
- Lower pSum limit in MagGraph for SIMP? It works to lower such limit from 1 GeV to 0.86 GeV for tritrig of 2016 MC.
- Application of OSG?

Making MC Match with Data: Smearing for Hits from SLIC

- For Ecal and Hodoscope, digitized hits are used as input of two systems: the trigger system and the reconstruction system

- Smearing for Ecal hits before digitization:

```
double noiseSigma = Math.sqrt(Math.pow(getNoiseConditions(hit.getCellID()) *  
getGainConditions(hit.getCellID()) * EcalUtils.MeV, 2) + hit.getRawEnergy() *  
EcalUtils.MeV / pePerMeV);  
double noise = RandomGaussian.getGaussian(0, noiseSigma);
```

- No smearing for Hodoscope hits so far

- For SVT, digitized hits are readout as input of the reconstruction system. Smearing in digitization:

```
private void addNoise(SiSensor sensor, int channel, double[] signal) {  
    for(int sampleN = 0; sampleN < 6; sampleN++) {  
        signal[sampleN] += RandomGaussian.getGaussian(0, ((HpsSiSensor)  
sensor).getNoise(channel, sampleN));  
    }  
}
```

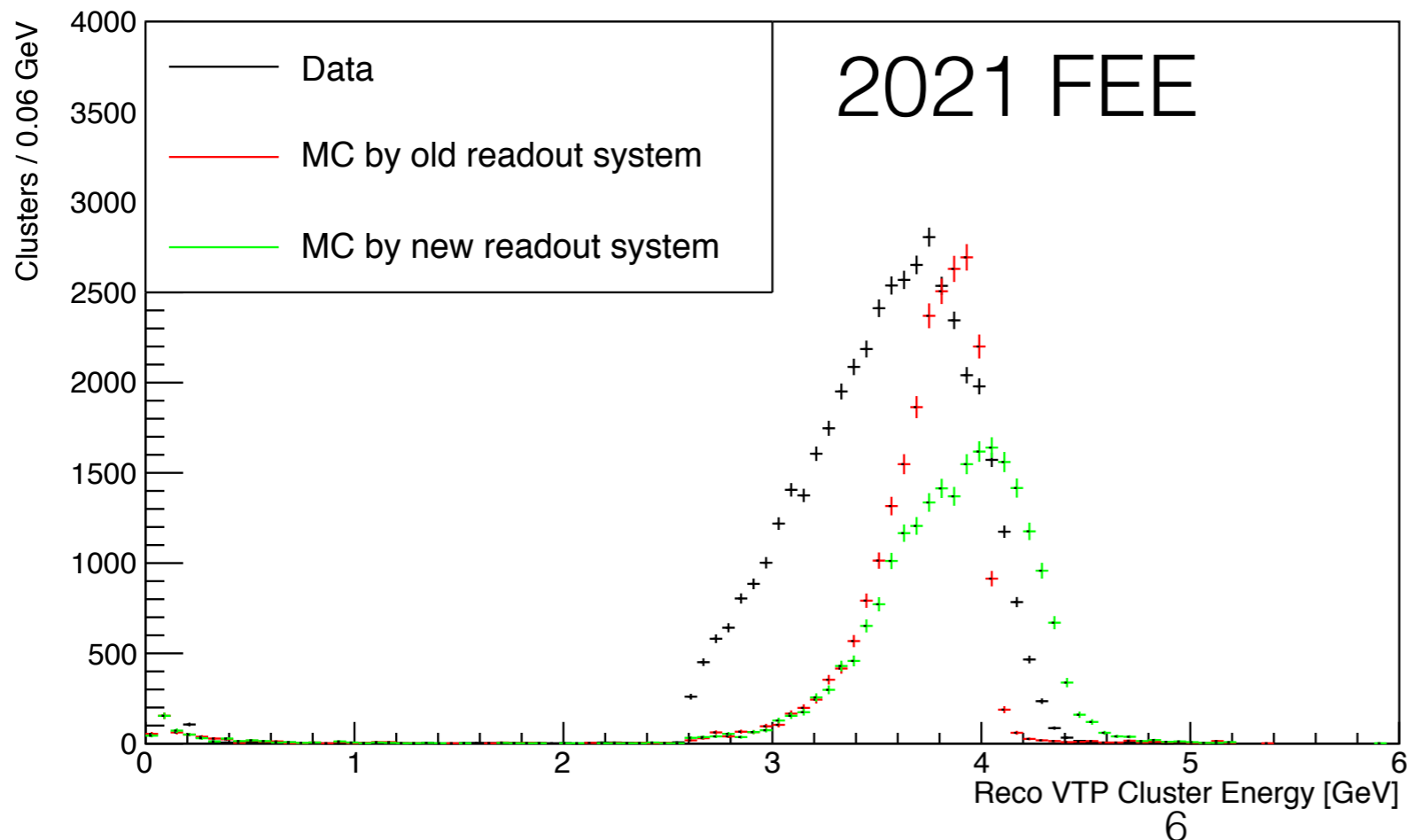
Making MC Match with Data: Ecal Hit Energy

Old readout system applied in 2016



New readout system applied in 2019 and 2021

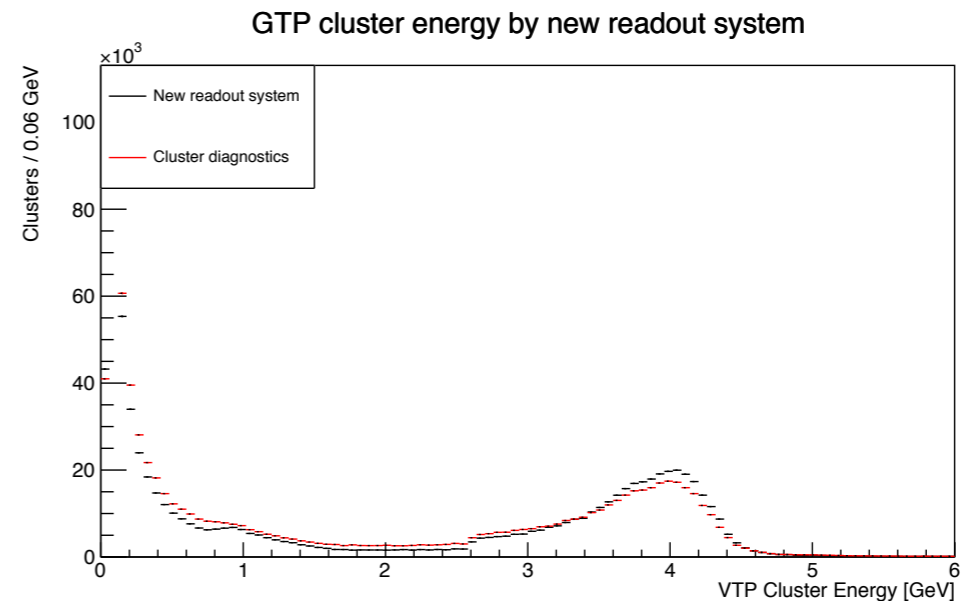
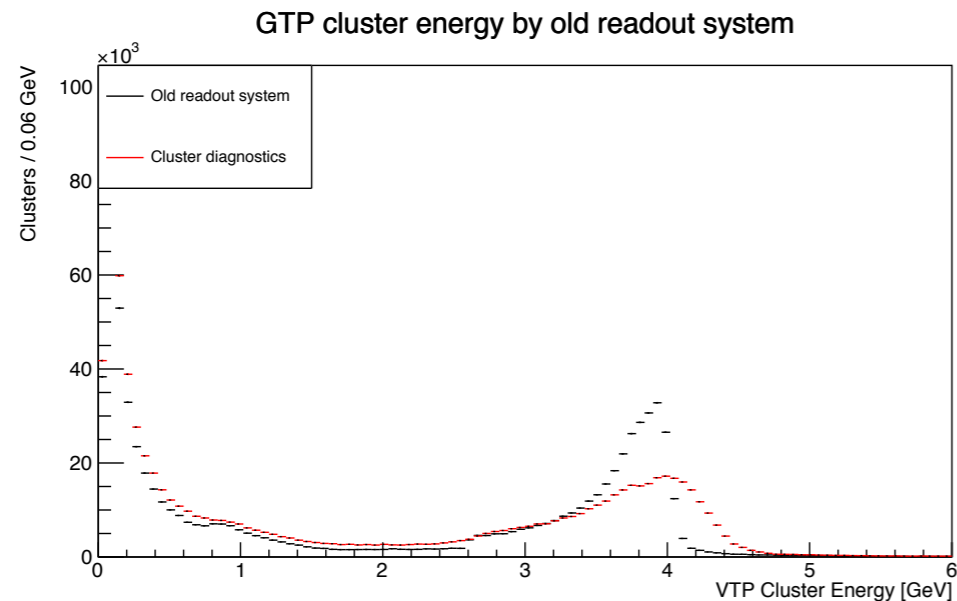
After cleanup



What causes peak difference between data and sample?

- Different GTP clustering algorithm?
- Ecal simulation in SLIC does not match well with real experiment?

Making MC Match with Data: Check GTP Clustering Algorithm

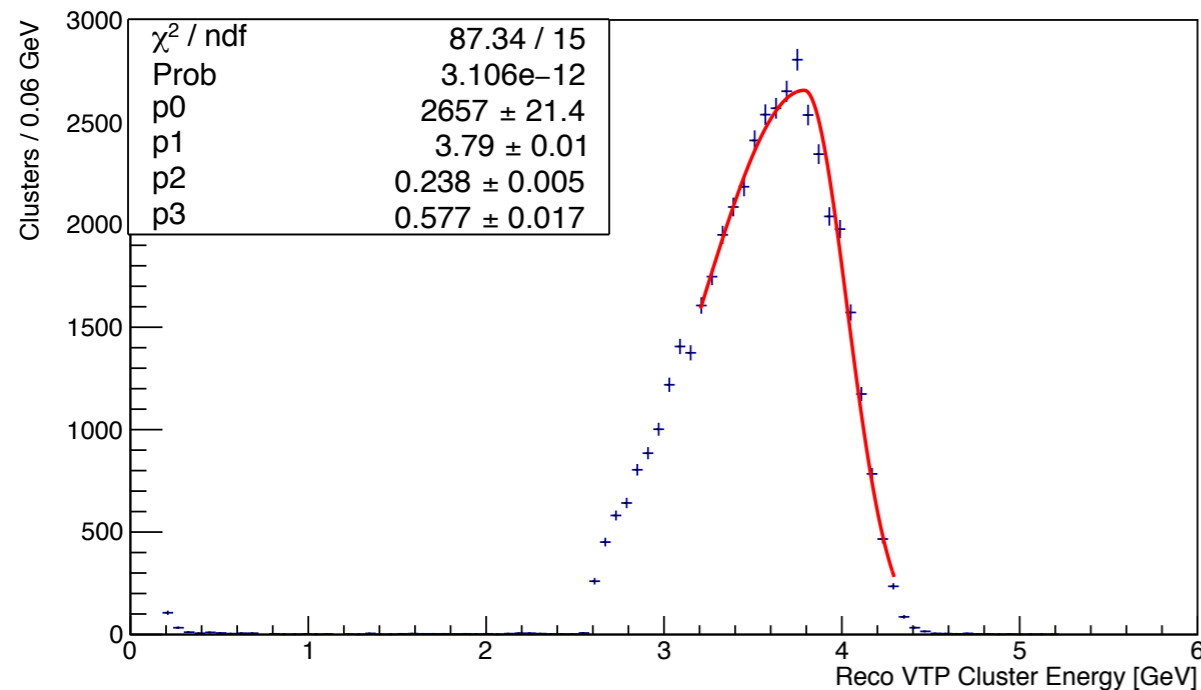


- GTP clustering algorithm is perfectly consistent between hardware and trigger diagnostic system.
- To check if GTP clustering algorithm is consistent between hardware and software readout system, we input ADC sample from software readout into trigger diagnostic system.
- There is big difference for GTP cluster energy between the old readout system and the diagnostics system. It is because the trigger system in the old readout system applies pedestals and gains from DB, while the diagnostics system applies pedestals and gains from DAQ configuration, like hardware.
- Difference of GTP cluster energy between the new readout system and the trigger diagnostic system is because that algorithm in readout is simplified, but basic logic is the same between each other.
- So difference for peak of GTP cluster energy between software (new readout system) and hardware showed in the last slide is because Ecal simulation does not match well with real experiment

Making MC Match with Data: Fit

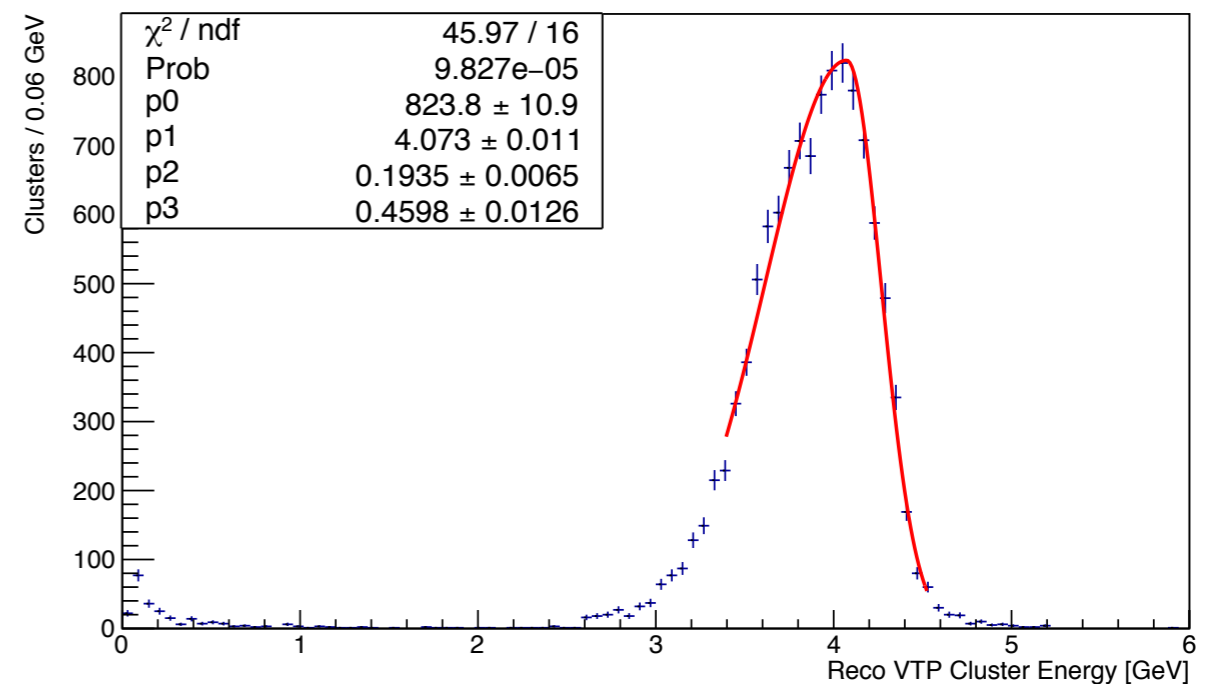
hardware

feeDataAna_VTPClusterEnergy_with_Ecal_VTP_cluster_matching_h



new readout system

feeMCAna_VTPClusterEnergy_with_Ecal_VTP_cluster_matching_h



- In reconstruction, Ecal energy correction applies different configuration for data and MC.
- However, uncorrected Ecal energy causes that simulated triggers do not match well with experimental triggers.

Making MC Match with Data: How to Relief Effects of Uncorrected Ecal Energy on Software Trigger?

- Does any changes for Ecal hits in the digitization system need corresponding changes for configuration of MC Ecal cluster correction in reconstruction?
- If we only concern about effects on trigger system, we may take correction for GTP clusters. It will not affect reconstruction.
- Need a study to figure out how to take such correction to let GTP clusters match well between software and hardware.

Making MC Match with Data: Hodoscope

- Hodoscope has not joined analysis with reconstruction data so far.
- But Hodoscope, like Ecal, is critical to form single triggers for 2019 and 2021.
- Need a study to evaluate consistence of Hodoscope hits between hardware and software.

Making MC Match with Data: Time Resolution

Need to discuss with Ecal and SVT experts

- Ecal: time walk, RF, pulse model, else?
- SVT: ?

Candidate to be Focus on HPS MC

- We have a lot things for HPS MC:
 - We will have a few studies to let MC match with data.
 - Softwares need to be maintained, updated, and developed.
 - Validation and test for new chains with container suggested by Omar.
 - For MC production, when producing large-scale samples with all necessary types for analysis, we need to frequently submit and monitor jobs, report progress, and fix issues. It will last a few weeks, or even a few months, depending on requirement of statistics.
- I only have limited time to work on HPS MC in part, while Cam, Jeremy, Omar, Norman, Sarah, etc, also partly participate HPS MC. But we need a person to be focus on HPS MC. Who will be proper candidate?