Readout Updates for Application of the DAQ Configuration

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How to Access DAQ Configuration

- Parser for the 2019 DAQ configuration banks: EvioDAQParser2019

  - The parse has been developed to parse DAQ configuration banks in evio files. Note: only the first file of each run includes the DAQ configuration banks.

  - To apply the parser in the readout system, information of DAQ configuration banks are stored in hps-java/record-util/src/main/resources/org/hps/record/daqconfig2019 as the txt format (file name: ${DAQ_version}_${crate_num}.txt).

  - Format of DAQ configuration files is not completely consistent with format of DAQ configuration banks in evio files. Therefore, we can not directly use DAQ configuration files as resources since they are not available for the parser.

  - In the parser EvioDAQParser2019, we just need to set "***private boolean saveConfigBank = true;*** " (false by default) in the line 45, and then txt files with DAQ configuration banks will be produced when the first evio file of a run is input of hps-java.

- The DAQ configuration management system can help us to access all parameters in the DAQ configuration.

Updates for Gains and Pedestals in Readout

- Before updates, gains and pedestals applied in the whole readout system are from DB.

- During DAQ of experiments, the trigger system applies ADC samples from Ecal and Hodo to produce triggers. Gains and pedestals for the trigger production are set in a DAQ configuration.

- However, gains and pedestals in the DAQ configuration are not completely consistent with the realistic.

- In the readout system, ideally, we should set realistic gains and pedestals for digitization, while set the same gains and pedestals in the DAQ configuration for the trigger system.

- Gains and pedestals in DB should be closer to the realistic than gains and pedestals in the DAQ configuration since they are extracted from experimental data.

- Therefore, in the readout system after updates, we apply gains and pedestals from DB for digitization, and apply gains and pedestals from the DAQ configuration in the trigger system.

- For each driver, which could apply DAQ configuration, a listener is added into the DAQ management system by a setter. We can set states (false by default) for the setters in readout steering files to optionally apply the DAQ configuration. So all previous stuffs relative to the old readout system are not affected.

- Note: For channels at two-hole tiles of Hodo, gains from DB should be scaled by a factor (1.25/2) when cluster construction, while gains in the DAQ configuration have been scaled by the factor.

- Idea for update of smearing: Gains and pedestals are randomized by Gaussian (mean = gain/pedestal, sigma = their variance), event by event. Random gains and pedestals are applied for digitization in readout. In DB, it seems that we have variances of pedestals for all of Ecal, Hodo, and SVT. Can we also add variances of gains for all of detectors?

Updates for other Parameters

- Before updates, parameters, such as parameters for pulse integration (NSB, NSA, window), parameters for Ecal GTP clustering and Hodo pattern building, and parameters for cuts of triggers, etc, are set in steering files.

- After updates, such parameters could be obtained directly from the DAQ configuration by the DAQ management system.
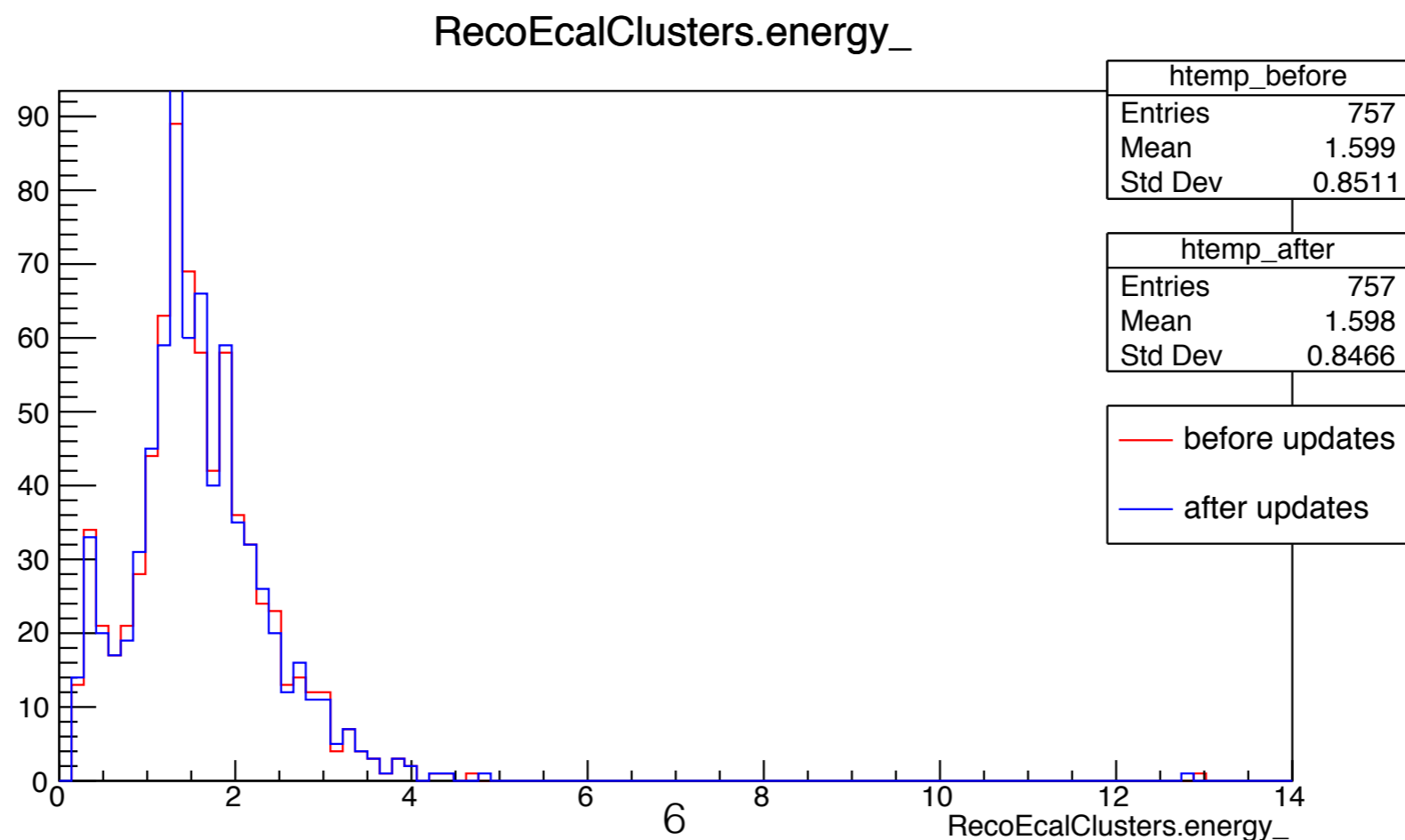
How to Run the Updated Readout System

- We run the updated readout system by the same command as before. No need any changes for commands in old scripts or hps-mc job system, and nothing changed for outputs with implementation of them.

- The readout steering files for 2019 have been updated so that DAQ configuration is applied.

  - Run number in command is mapped to corresponding DAQ version, like DB.

  - The DAQ version hps_v12_1 is applied for the "ideal" run 1194550 by default.

  - All DAQ versions for good runs (https://confluence.slac.stanford.edu/pages/viewpage.action?pageId=271582294) are included in resources. If a run number, without matched DAQ version included in resources, an exception message will be displayed. Like for run 10000, the message will be

```
java.lang.RuntimeException: No corresponding DAQ configuration file for run 10
000 in hps-java/record-util/src/main/resources/org/hps/record/daqconfig2019.
 Please change run number or set the system property -DdefaultDAQVersion2019 t
o apply the default DAQ version hps_v12_1.
```

  - If the system property (-DdefaultDAQVersion2019) is set, the DAQ version hps_v12_1 is applied if no matched DAQ version for a run number.

Test

- Samples for test: 10k tritrig MC events by MadGraph.

- Produced triggers by readout could be slightly different between before and after updates since pedestals and gains in DAQ are applied in the trigger system after updates and energy of Ecal hits is randomly smeared by noise. For this test, produced triggers are 423 for both before and after updates.

- Results of Ecal reconstruction are compared. Results should have slight difference between before and after readout updates since energy of Ecal hits is randomly smeared by noise before digitization.

RecoEcalClusters.energy_

htemp_before	
Entries	757
Mean	1.599
Std Dev	0.8511

htemp_after	
Entries	757
Mean	1.598
Std Dev	0.8466

— before updates

— after updates

Summary

- The 2019 DAQ configuration system is updated to be applied into the readout system. Basically, all necessary 2019 DAQ version are added into resources of hps-java.

- The readout system is updated to apply DAQ configuration by the readout system.

- Nothing needs to be changed for commands in old scripts or hps-mc job system, and nothing will be changed for outputs with implementation of them.

- The steering files for 2019 readout have been updated to apply DAQ configuration by setters.