0.1 Overview of activity and main contributions

The hadronic calorimeter is essential in all hadronic analyses, and therefore it is important to understand noise behavior. While there are a lot of man-power looking at the forward calorimeter, comparatively not so much was done for the barrel and encap calorimeters ($|\eta| < 3$) over the year. It is a good opportunity to make important contributions, and a number of people from Caltech were actively participated in the study of calorimeter noise. The main contributions are as follows:

1. Helped validating of default Hcal baseline noise filter used in all ICHEP (10') analyses.
2. Developed a new fit-based filter on a channel-by-channel basis that utilized only pulse shape information.
3. Developed a section in Hcal DQM specialized in monitoring noise.
4. Helped development of a simple pulse shape filter which will soon be deployed online to help physics analyses that uses MET trigger pathways as their main source of signal.

A few items will be elaborated a bit more in the following sections.

0.2 New fit-based filter development

All other filters uses either hit multiplicity or high-level informations (ie., other subdetectors). While they are efficient in rejecting noise from hadronic calorimeter, it is possible to further improve noise rejection on top of all other filters. We developed a set of fit-based pulse shape filters. Since the input information is orthogonal to all other filters, by construction we will be able to do better by applying it alongside with others. The discriminants are constructed by doing various fits on the 10 time samples read out in each channel, and compare the chi2 values and fit parameters to each other. The filter is shown to work well in 2010 dataset as well as 2011 first data, even though the cut envelopes need to be tuned. Attached figure 1 are the performance on 2011 first data with 75ns bunch spacing running. On the left the rejection power after each step of cut on a noise-enriched dataset is shown. Missing transverse energy from all channels versus that constructed by channels passing all cuts are shown on the right-hand side. As all events are occupying the lower half of the plane, the transverse missing energy always decreases after applying the cuts, thereby demonstrating safety of the filter. All results are summarized in an analysis note AN-2011-116.

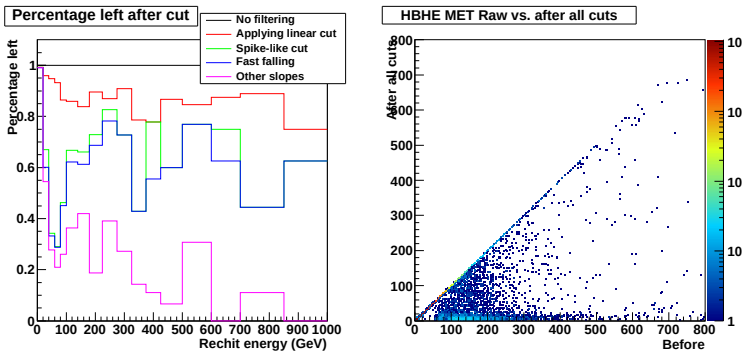

Figure 1: Performance of fit-based discriminants on 2011 first data (75ns), as evaluated in terms of missing transverse energy constructed using hadronic calorimeters only.

0.3 Hcal noise DQM (data quality monitoring)

Following the development of new fit-based filters and proved that it is indeed safe and useful as a first-pass noise cleaning, we have developed a section in the DQM to monitor noise offline, so that when there is something bad happening people can spot the problem(s) faster. It includes sub-sections on all existing filters, as well as detector maps of problematic channels.

0.4 Development of simple pulse shape filter to be used online

As instantaneous luminosity and number of colliding bunches increases, Hcal noise contribution starts to get significant in certain trigger pathways. For example in missing transverse energy triggers, after the noise killer is introduced in the electromagnetic calorimeter, most of what remains are noise from hadronic calorimeter. The high noise rate causes triggers with lower threshold to be prescaled, endangering signal collection for some physics analyses. Unfortunately the fit-based filters are consuming too much CPU time in online environment (in the high level trigger farm), a more simpler filter has to be developed. Towards the end of last year, Jason St. John has proposed to use a simple pulse shape variable to do noise rejection. It uses information from the central two time samples, and it is much safer from out-of-time pileup even if LHC runs with 50ns bunch spacing. We plan to implement the filter as a test trigger to study its performance and safety on physics, and if everything looks fine it will be turned on by default in the missing energy pathways.