Daily Research Logs

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Contents

Chapter 1

September 2010

1.1 6263 Log (Septemper 29, 2010)

1.1.1 Goals

1. Catch up with Maria
2. Get some rest

1.1.2 Summary List

1. Back from vacation. Trying to catch up.
2. Copied exotica hotline code to CMSDetNoiseLine package. Nothing modified.
3. Setup new logbook in latex.
4. Start reading exotica hotline code.

1.1.3 Latex logbook

The main goal is to have a logbook that is easily searchable and scalable. Original handwritten logbooks have the advantage of sketching ideas, but is not suitable for searching or write texts with a lot of revisions. In the near future I might start using scanners to scan sketches as pictures and include them in the latex logbook. To make it scalable, each day is to have its own tex segment which can be included in a tex file that does the structuring. The title and (sub-) sections are newly defined commands that can be reassigned in the structuring tex file.

The structure of each day is as follows:

1. Daily goals.
2. Summary of things done.
3. For each non-trivial item, write something about it.
4. Meeting notes.
5. Anything else worth noting.
6. Reflection. What was done and what could be done better.
7. Progress on studying, summary on paper reading.
8. Minimum goal for the next workday.

Not all of them need to be filled in.

1.1.4 Reading exotica hotline code

The code is in package `UserCode/ExoticaHotLine/src/HotlineSkimCode/RecoSkim`. In the final configuration file, each filter is a module, and there are various paths assembling them together. In the end the events are kept using the `SelectEvents` field in `PoolOutputModule`.

Even though it need not be the case, it appears that all the filters are implemented together as a `EDFilter` named `RecoSkim`. Different filters are the same module with different parameters. For Hcal noise we definitely can implement multiple filter modules.

There are two modules in the hotline code directory. One is the aforementioned `RecoSkim` filter, which looks like basic cut-based selections with cut values specified in the configuration file. The other one is an analyzer `HotlineSummary`, and it appears to be printing various summary values from edm collections. The printout is long....this module is probably only for debugging purposes.

1.1.5 Reflection

Need to think through the purpose of hcal noise hotline. I want to be able to estimate noise rate (of various type) for any given run from the hotline. Also it will be good to include some kind of correlation with beam luminosity and/or triggers.

On latex logbook, need to think about possible types of extensions and how to implement them. In principle the current framework should be enough.

1.1.6 Goals for next work day

1. Skim through Hcal noise meetings
2. Skim through vecbos meetings
3. Catch up with progress on the candle note and make a list of items to do
4. Move the daily latex logbook to svn
5. Catch Maria

1.2 6264 Log (Septemper 30, 2010)

1.2.1 Goals

1. Go through vecbos meetings in september
2. Go through Hcal meetings in september
3. Move the logbook to subversion
4. Make a list of things to do for the candle note

1.2.2 Summary List

1. Skimmed through vecbos meetings in espace and V+Jet meetings
2. Skimmed through hcal WG meetings and DPG meetings
3. Moved logbook to subversion
4. Update VecbosApp to newest version, test run on the current muon list (up to run 144114). No obvious problem spotted.

1.2.3 Go through vecbos meetings in September

1.2.3.1 Espace meetings

1. September 8, "Thresholds" by Maria Spiropulu. Default value: CaloJet 30, UncorrectedCalo 20, Track 15, PF 30
2. September 8, "Lucas Fit" by Lukas Vanelderen.
   (a) Fit MT for W, t+X, other
   (b) Fix shape to MC for W, t+X, and float the other
   (c) "W and top+X separated well and unbiassed from other"
   (d) Fit W+LF vs. W+HF with t+X, and use the HF fraction from MC to recover W yield
3. September 15, "btag" by Lukas Vanelderen. Control sample for HF from data. Need to read about b-tagging algorithms.
4. September 15, "Vecbos Meeting" by Matthias Ulrich Mozer. Revisit uncertainties on AlphaL and AlphaR.
   (a) Traditional fit: fix alpha to best known value, and redo fit with different alpha to get uncertainty
   (b) Nuisance parameter: constrain alpha by a gaussian centered at the best known value.
   (c) 7-fit plot.
5. September 22, "Vecbos Meeting". "W and Z + jets" by E. di Marco in General EWK meeting.
6. September 22, "Vecbos Meeting". Lukas updated results on WJet fit.

7. September 22, "Vecbos Meeting". Will Reece updated on trigger efficiencies.

8. September 29, "W fit strategy, flavor part" by Lukas Vanelderen. Estimate PDF from b-tag variables from control samples for t+X and W+LF. Seems to have problem in the 2Jet bin.

1.2.3.2 V+Jet meetings

1. September 7. Lukas on fit strategy in W+Jets (sane as the one in espace). Z candle analysis status report (with toys).

2. September 21, "Introduction on Zbb issues and current plans" by Alexandre Nikitenko. Z+b is similar to H+b

3. September 21, "Task list overview" by Vitaliano Ciulli and Ilaria Segoni.

4. September 28, "Report on Zbb analysis" by Anne-Marie Magnan.

5. September 28, "Report on Zb(b) analysis" by Natalie Heracleous.

6. September 28, "Update on Z(ee)+jets and W(enu) +jet studies" by Sarah Malik. (....)

7. September 28, "Status on PFlow Z+Jets Analysis" by Anil Pratap Singh.

1.2.4 Go through Hcal meetings on noise

1.2.4.1 Hcal Noise WG

1. September 9, "HF Flags in 3_8 (slides for Maria)". Some notes on HF reconstruction and flagging.

2. September 9, "Isolated Noise Filtering" by John Paul Chou. Summary of the isolation-based noise filter. Performance on ttbar and Ztautau. Suggests going on to JetID. Reviewed reconstruction chain.

3. September 9, "HPD Pulseshape Discriminators" by Jason St. John. Included HE. MC shape needs work.

4. September 9, "Hits in a Jet" by Hongxuan Liu. Good hits and PMT window hit could overlap.

5. September 9, "HBHE Timing and Noise Studies" by Phil Dudero. Derive time envelope from collisions. Plots for time envelope with/without low energy hits as well as square filter (energy independent).

6. September 9, "Impact on MET due to ECAL masked/dead cells" by Hongxuan Liu. Jet response 2% quantile map. Holes correspond to dead cells. Jet energy recovery algorithm.

7. September 23, "Isolated Noise Filter: Performance" by John Paul Chou. Update his filter to be used as a hit cleaner and not a event filter.

8. September 23, "HBHE Timing and Noise Studies" by Phil Dudero. Some error/problem two weeks ago. Updated square filter results.

1.2.4.2 Hcal DPG

Note: Talks that have nothing to do with noise are omitted here.

1. September 13, "HCAL QIE Offsets" by a list of people. The new setting is consistent with old setting (with a overall constant shift) for HB and HE.
2. September 13, "HCAL Noise" by Maria. A summary to be used in Bodrum.
3. September 27, "TP Energy Scale" by Patrick Tseng. He recalibrated and checked TP energy.
4. September 27, "QIE hardware offset and time reco" by Pawel de Barbaro. Validated new QIE settings. Overall good. Time spread is smaller. Some channels (not many) are off.
5. September 27, "Precise time correction" by Jeremiah Mans. An independent analyses to derive time corrections. Compared with those from Pawel et al. and looked at channels that disagree.
6. September 27, "An Isolated HB/HE Noise Filter" by John Paul Chou. Same talk as in Hcal noise WG.
7. September 30, "Phi calibration of HB, HE - initial results" by Igor Vodopiyanov. Intercalibration using non-ZS data. Not clear from the presentation what "E1" is.

The QIE hardware timing offset is adjusted since runs 146XXX!

1.2.5 Updating VecBosApp to newest version and test run on data (2.66/pb)

1. Everything went fine on cvs update and merging versions.
2. Test run on ZJetsMADGRAPH sample, all jobs finished successfully, though castor was busy for one job. Rerun does the job.
3. Copying from castor back to local disk gives "`. : Invalid argument`". Maybe castor was extremely busy.
4. ps. the error means that disk quota was exceeded.
5. No problem spotted in ZJetsMADGRAPH sample from the QM plots.
6. Test run on current dataset (up to run 144114, 2.66/pb reported). While submitting jobs, encountered one instance of "LSF js on lxbsp0901.cern.ch: LFS js: no AFS token" error. It doesn't seem to be related to the updating of VecBosApp. It doesn't seem to be affecting anything either. Jobs are successful.
7. The castor-friendly safety sleep time (10s) is getting annoying now that there is more statistics. Let's try to reduce it to 3 seconds.
8. Data looked OK at first glance.
9. The mass of any two global muons looks nice, see figure 1.1.

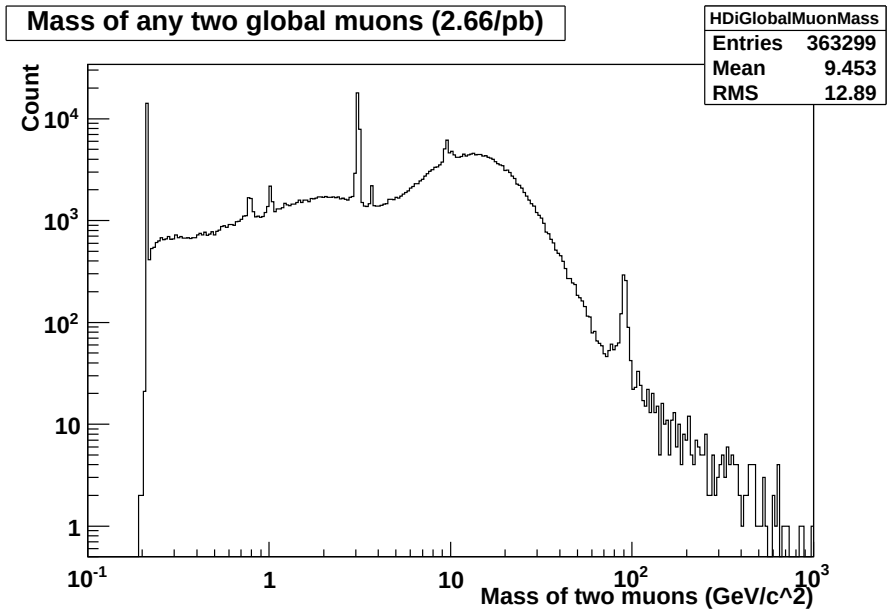

Figure 1.1: Mass of any two global muons from all processed data so far (up to run 144114). Peaks from right to left are speculated to be Z (~90), Upsilon family (~10), J/Psi(1s, 2s) (~3), phi (~1), rho/omega (0.7~0.8), and muonium (~0.2). (ps. The last one was just kidding. It's probably from doubly reconstructed ghost muons. Though further investigation is needed.)

1.2.6 Meeting notes

1.2.6.1 Caltech group meeting

1. There is some narrow peak discovered (!?)
2. Maria: the comment system needs to be rethought. Actual commitment is needed. Comments on physics, not styles.
3. Artur gave a presentation on the recent drama on Hcal. Accidental unmasking of hcal bad channels, severity level in HLT
4. Piotr reports on the peak of opposite-sign dimuons around 244 GeV.
5. Update from Jan. Z$\rightarrow \mu\mu$ vs. $\mu\mu + \gamma$, Energy scale of photon.
6. Action items for next Tuesday to be emailed out by Dorian

1.2.7 Reflection

To fully understand hcal noise, we need to have real categories (instead of the simplistic ion/hpd/rbx picture), and monitor the change over time to obtain a control sample estimate of the amount of noise of each type for all RBXs.

1.2.8 Goals for next work day

1. Sort out goals for Hcal noise line
2. Make sure how prescale works with multiple triggers
3. Make a list of to-do items for candle analysis
4. Review/summarize progress so far on pulse shape variables
5. Check strategy on Z shape fit, find out ways to contrain RooFormulaVar

Chapter 2

October 2010

2.1 6265 Log (October 1, 2010)

2.1.1 Goals

1. Check the opposite-sign dimuon spectrum and note anything interesting, especially the "muonium" peak.
2. How does the trigger prescale work?
3. Sort out the purpose of Hcal noiseline and how/what to implement
4. Summarize work on noise characterization so far
5. Make a list of to-do items on candle note
6. How to do the fit on Z shape?

2.1.2 Summary List

1. Noiseline meeting. Not too productive without a clear-cut goal.
2. Checked quickly opposite-sign di-muon mass spectrum.

2.1.3 Opposite-sign dimuon (global) spectrum

The result of almost all data is shown in figure 2.1. I still need to think about the overall underlying shape of the curve. For example, what is the wide bump around 2 GeV and 14 GeV. The resonances are nice however. The tail also bends after the Z peak.

2.1.4 Work so far on noise characterization

2.1.4.1 Things tried

1. First three TS should be compatible to zero.
2. The maximum N continuous time slices. Generalization of E2.
3. Number of time slices required to achieve P%. Useful to pick out sharp noise and broad noise.
4. RMS vs. mean of the 10 TS.
5. Linear fit of the pulse shape. Potentially useful to pick out flat pulses.
6. Two-step fit.

2.1.4.2 Late pulses - produced at interaction

Skimmed through PDG tables and estimate what might be late, and how much energy they will deposit. Assume distance to go is 1.4m. See table 2.1 for numbers.

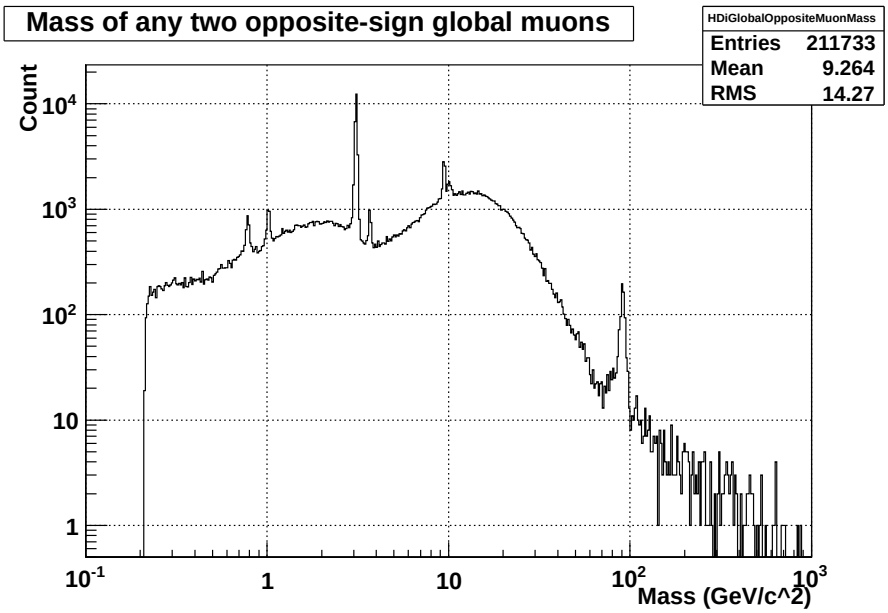

Figure 2.1: Opposite-sign dimuon (global) mass spectrum for almost full statistics (full = 2.66/pb). The last job is still running, and I don't think it matters for this. The muonium peak goes away, which is nice.

Particle	Mass (GeV)	τ (ns)	min(β)	max delay (ns)	Energy (GeV)
$\pi+$	0.13957	26.033	0.176	26.45	0.142
$K+$	0.493677	12.38	0.353	13.23	0.528
K_{0L}	0.497614	51.16	0.0908	51.37	0.500
p	0.938	∞	0.000	∞	0.938
n	0.940	∞	0.000	∞	0.940
$\Omega-$	1.67245	0.0821	0.9998	4.667	95.08
Ξ_0	1.31486	0.29	0.998	4.676	21.20
Ξ_-	1.32171	0.1639	0.9994	4.670	37.656

Table 2.1: Table for maximum delay (constrained by particle lifetime) of particles produced at interaction point and travelled 1.4 m. The "maximum delay" is calculated using the mean lifetime. Other particles decay too quickly, the delay would be tiny.

Out of these, only $\pi+$, $K+$, K_{0L}, proton and neutron have the chance to reach 1.4m at 12.5 ns or more. The equivalent energy deposited would be 0.15, 0.53, 0.54, 1.01, 1.01 GeV, respectively. Longer time delay means smaller energy - these are the ballpark numbers we expect. If the allowed length is 3m, then the energy deposited will be 0.23, 0.82, 0.83, 1.56, 1.57 GeV. So from the slow (relatively) stable particles produced at interaction we expect O(1 GeV) energy deposit at most, if they were half TS or more late.

2.1.4.3 Late pulses - decay-in-flight

The idea here is that there might be some heavy stuff produced at small β, and decay after a while to light, energetic particles. Lab frame lifetime is $\gamma\tau$, and let's take an assumption that the decay product is extremely energetic, ie, $\beta \sim 1$. Let's do the calculation when the parent particle stays on average 12.5 ns in lab frame, and the minimum required energy of it.

$$\begin{aligned} T &= 12.5ns \\ \gamma &= \frac{T}{\tau} \\ \beta &= \sqrt{1-\gamma^{-2}} = \sqrt{1-\frac{\tau^2}{T^2}} \\ \text{Distance travelled} &= \beta\gamma c\tau = \beta cT = \beta \times 3.74m \end{aligned}$$

Unless τ is close enough to T, the particle won't stay in the detector for 12.5 ns. Which means that under the assumption that the decay product is relativistic, decay-in-flight particles will at most deposit same order of energy as the ones produced at production. If the decay product has classical velocity, it won't deposit much energy anyways.

2.1.4.4 Other items - moved to next work day to think about

After the afternoon noiseline meeting, it seems that I have a lot on my plate already. Let me make a definite plan on how to tackle each of them first....

1. Late pulses - late hadronic/EM shower-developement....what's the typical shower develop time? What's the chance that a shower fragment makes an ion-feedback noise?

2. Out-of-time pulses - radiation from other sub-detectors...how is the strength of radiation related to dosage history (for different material)? What's the expected dosage for certain instantaneous luminosity? Can we estimate the radiation from the environment? What's the radiation content? Mostly photons? How about hadrons?

3. Out-of-time pulses - beam background

4. Out-of-time pulses - cosmic muons

5. Things that might worth trying

2.1.5 Meeting notes

2.1.5.1 6265 Morning Noiseline Meeting

1. Maria had a car accident. I hope it's not too serious.
2. The main thing to clarify is the purpose of the noiseline. Everything goes from there.
3. Adi mentioned a few possible use cases:
   (a) Find noise that won't be caught otherwise
   (b) Correlation between detectors (more like DQM plots)
   (c) Radiation damage?
4. What I want is some kind of noise trend monitoring, finer than the current ion/HPD/RBX categories
5. To begin with, Artur will send me examples of DQM codes so that I can play with it.

2.1.5.2 6265 Afternoon Noiseline Meeting

1. Until we have the first result, the noiseline should be the same as exotica hotline - keep events so that we can look at it. We want to integrate into DQM and P5 event display.
2. Have one firework display that constantly show noises + physics. (And one for normal events, one for exotica hotline.)
3. Eventually it will become a skim.
4. To start with, we should see what is meaningful. Find noise overlapping with physics signature (muons, etc.).
5. Artur: integrate into Hcal DQM?
6. JetMET? Homework for Artur?
7. What is Muon DPG doing? Homework for Piotr.
8. Now we should put whatever we have in (HCAL, ECAL).
9. Maria: We need to think about the workflow to rereco without noise cleaning.
10. How to catch new forms of noise?
11. Piotr will show dimuon results! He will check noise in muon system and report.
12. Exotica hotline spots possible types of new noise, and we follow up on them.
13. Integrate Shuichi's monitoring to DQM?
14. Run first on exotica hotline files and see how many we keep.

15. As a first step, try to run the exotica hotline workflow.
16. Aim to have a prototype in the next two weeks.
17. Artur wants to have Hcal noise DQM done in the next two weeks. (Attack for bonus point!)

2.1.6 To-do's for next week

2.1.6.1 Z+Jet Candle

1. Find Matthias and update on the status of fit...strategy, etc.
2. Find out how to constrain `RooFormulaVar` to be greater than zero.
3. Check out a copy of the Z candle note and make a list of items to produce (and automize).
4. Check with Maurizio and see if I miss anything.

2.1.6.2 W+Jet Fit Without b-tagging

1. Check with Chris to discuss on the strategy. Maybe there is a working fit from electrons.

2.1.6.3 Hcal Noise Characterization

1. Continue doing subtraction from noise sample.
2. Make a signal root file and see where the signal lands.
3. Get the most recent timing correction from Jeremy et. al.
4. Condense into a few categories of noise shape and make `EDFilter` of them.
5. Then it's ripe to integrate into DQM

2.1.6.4 Hcal Noiseline Project

1. Check out the exotica hotline twiki (https://twiki.cern.ch/twiki/bin/view/CMS/ExoticaHotline) and follow the steps to get a working version.
2. Read and make a map of various paths in the exotica hotline to see what physics signatures are included.
3. Check what kinds of noise cleaning are done in the hotline.
4. If noise filter is not there, include a simple one (ICHEP JP filter) to start.

2.1.6.5 Hcal DQM Integration

1. Get code structure from Artur, make a working private copy.
2. Learn how the structure is in the DQM.
3. Add a simple practice plot to the structure.
4. Somehow find out where Shuichi's code is, and extract the requirements on different categories.
5. Put Shuichi's monitoring tool into DQM plots.
6. Integrate ICHEP JP filter variables into this private DQM.
7. Integrate JP isolation filter-related variables into this private DQM.

2.1.7 Reflection

2.1.8 Goals for next work day

See the previous section "To-do's for next week"