



Ensuring the Quality of Long Term Data

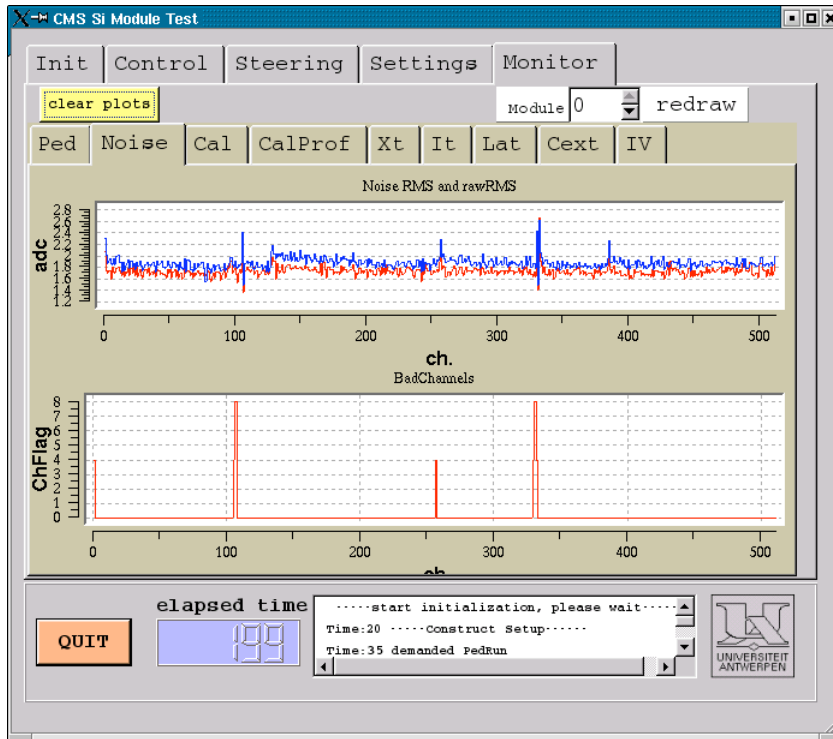
Patrick Gartung
UC Riverside



Lt Console



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Check the noise at start of run!
High noise (>3 ADC) will indicate is system is noisy or a module is unbiased

• From now on use the real module ID!

- Lt stores this as the module object ID (modid) and uses them to name root and xml files
- Rename old root files for a module to avoid overwriting during a second run
- Re-analysis tools use modid to name xml files and insert modid as the object id in the xml files
- Use 30200020005000 not 5000_july4_0



Qualification Scenarios



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- **There are two official scenarios adopted from the TIB community**
 - **One that does 1 thermal cycle in ~12 hours (night.It)**
 - Turns off APV's for 1 hour in cold
 - **One that does 9 thermal cycles in ~3 days (3day.It)**
 - Turn off APV's for 1 hour in cold several times
 - **One that does thermal cycles for two days and holds the modules cold for one day (3day-1daycold.It)**
 - **Both require a settings.xml file which contains**
 - A setting which turns off the APV's
 - Settings which make the pedestal higher in inverter-on modes to prevent the calibration pulse shapes from being clipped
 - **See <http://hep.ucsb.edu/people/gartung/gartung.html> for links to these files**



Lt Generated XML files



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- **Lt produces xml with bad channel flags based on very loose cuts**
- **Check the number of bad channels**
 - “grep NBadCh *.xml”
 - **A large number of bad channels could indicate:**
 - The module became unbiased during the run
 - (CMSSubtractedNoise > 3.0 ADC)
 - The output of the APV drifted out of range of the FED
 - (CMSSubtractedNoise < 0.6 ADC)
- **Check the Common Mode Noise**
 - “grep avgcmn *.xml”
 - Avgcmn > 1.0 indicates indicates high raw noise
- **These XML files cannot be uploaded to the database because some fields are calculated or filled incorrectly by Lt**



Report Generation



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- **Bad channel lists and plots produced by running a Root macro over Lt root file**
 - **Newest version will handle 4 or 6 chips**
- **Run macro on each record for first, cold and last with a shell script**
- **Marco and script are available on my website**
- **Need to modify macro to automatically find all three records instead of using shell script**
 - **There is an object (Summary/TNCdb) to identify first,cold and last records**
- **Need macro to plot interesting quantities like $I(t)$, IV curves, average noise(t), average CMN ...**
- **This can be used as a tool to identify bad Lt data**



Defect Analyzer



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- **Installed at both sites in /home/xdaq/DefAna**
- **Re-analyzes Lt root file to:**
 - Refit calibration pulse profiles if requested
 - Re-calculate averages and fill histograms
 - Re-apply cuts to determine bad channels
 - Produce correct xml files for upload to database
 - Produce bad channel lists and plots like ARCS macro if requested
- **I have written two wrapper scripts in DefAna/exe**
 - “analyze-fit {path to root file}” re-fits calibration pulse profiles then flags bad channels and generates xml files
 - The refit takes a long time and is only needed for root files produced before June (when I fixed a bug in the fitting routine)
 - “analyze-nofit {path to root file}” flags bad channels and generates xml files without re-fitting
 - This should be the script run by default



Data Quality Assurance



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- **Generate the xml files with Defect Analyzer**
- **Check that the bad channel list matches the ARCS bad channel list**
 - Sometime this is the only way to tell if a module was mislabeled!
- **Check that the bad channel lists are consistent across all three records**
 - “grep BadChList *.xml”
- **If the lists differ greatly investigate:**
 - Common Mode Noise “grep avgcmn *.xml”
 - **If avgcmn >1 you have to reject the It test data because the system is too noisy**
 - Noise flags “grep badchped *.xml”
 - Calibration profile flags “grep badchcalprof *.xml”
 - **A large number of flags could indicate a noisy system, unbiased modules or pedestal out of range of FED**
- **When in doubt retest the module!**



Bad Channel Cuts



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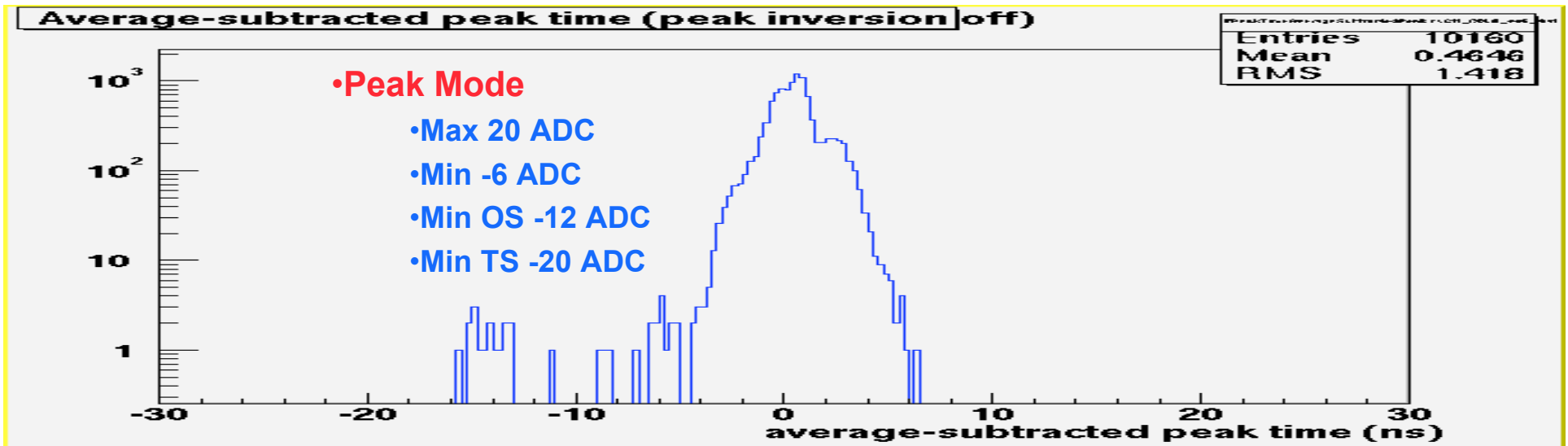
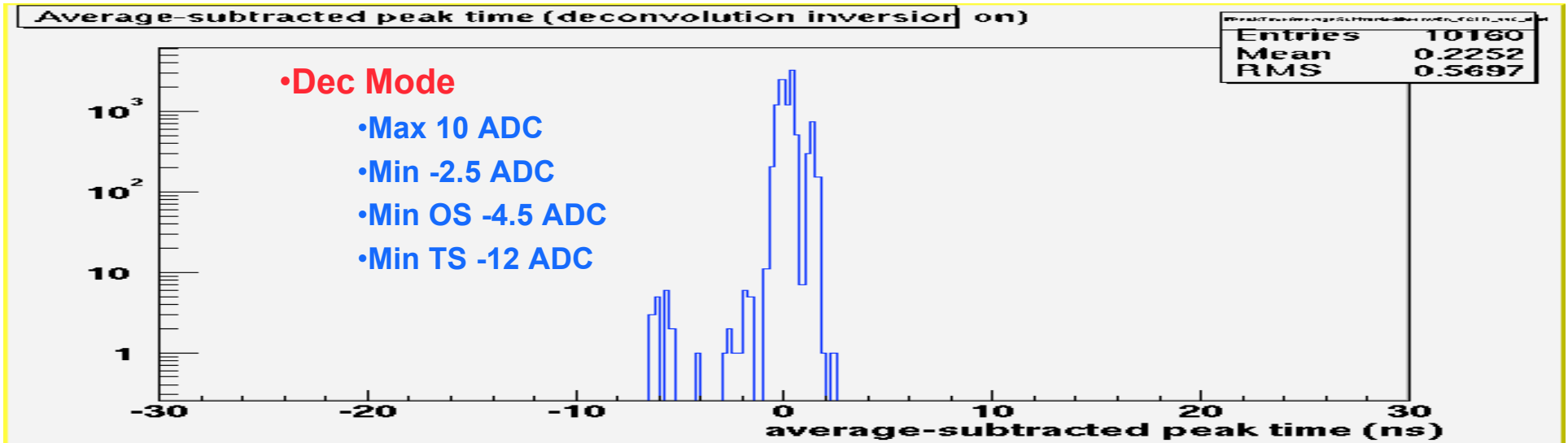
- **Cut configuration files**
 - **Defect Analyzer**
 - DefAna/config/defanaset-nofit.xml or
 - DefAna/config/defanaset-fit/xml
 - **Root macro**
 - In run_ltmacro change the cut value for all three records
- **Cuts used**
 - **Average-subtracted rise-time of calibration pulse**
 - **Average-normalized pulse height of calibration pulse**
 - **Average-subtracted CMS noise**



Rise Time



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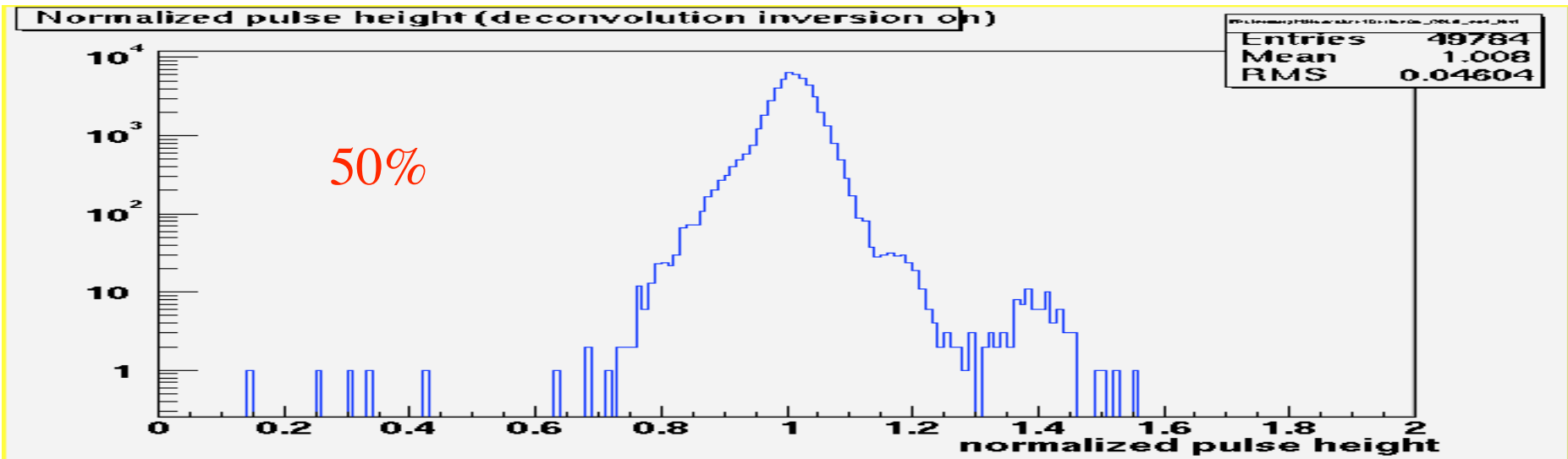
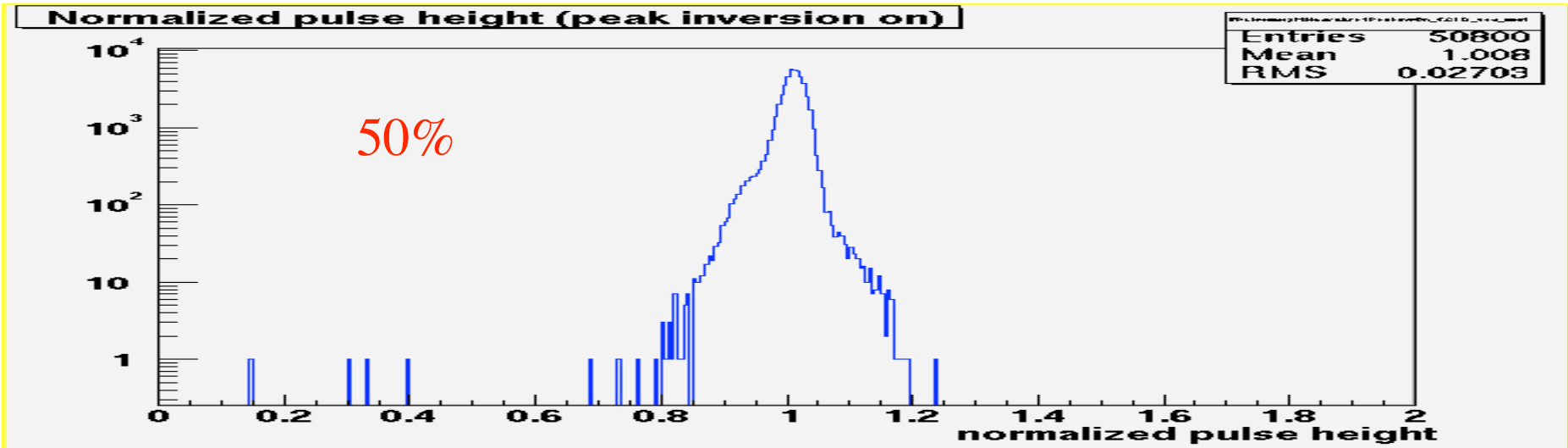




Pulse Height



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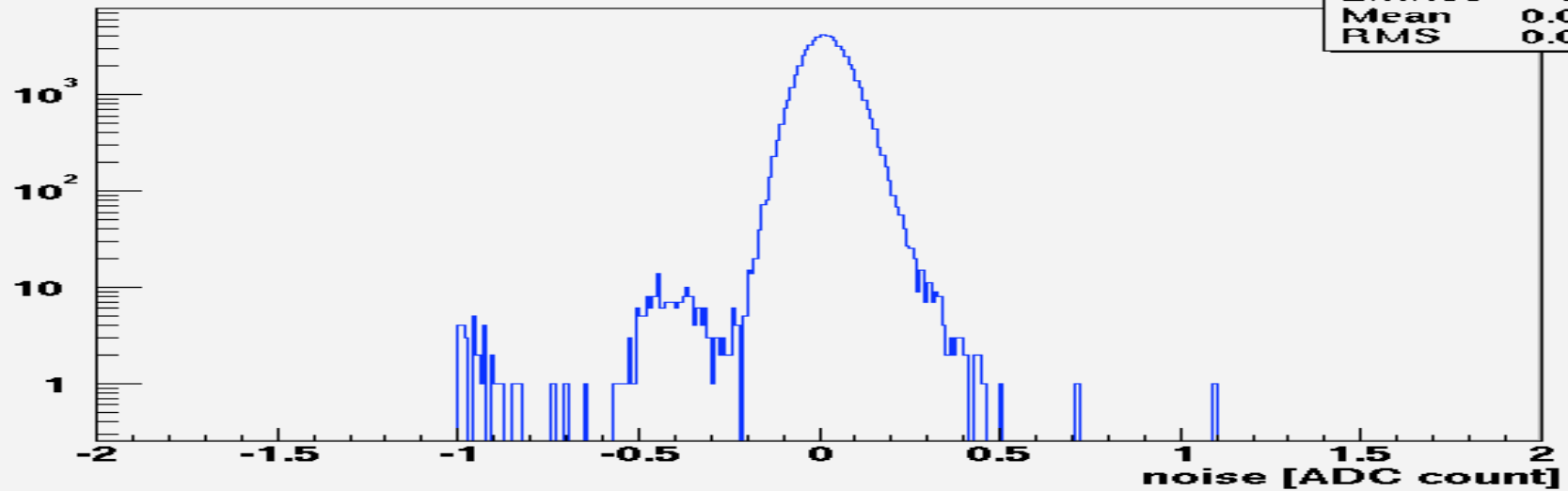


CMS Noise

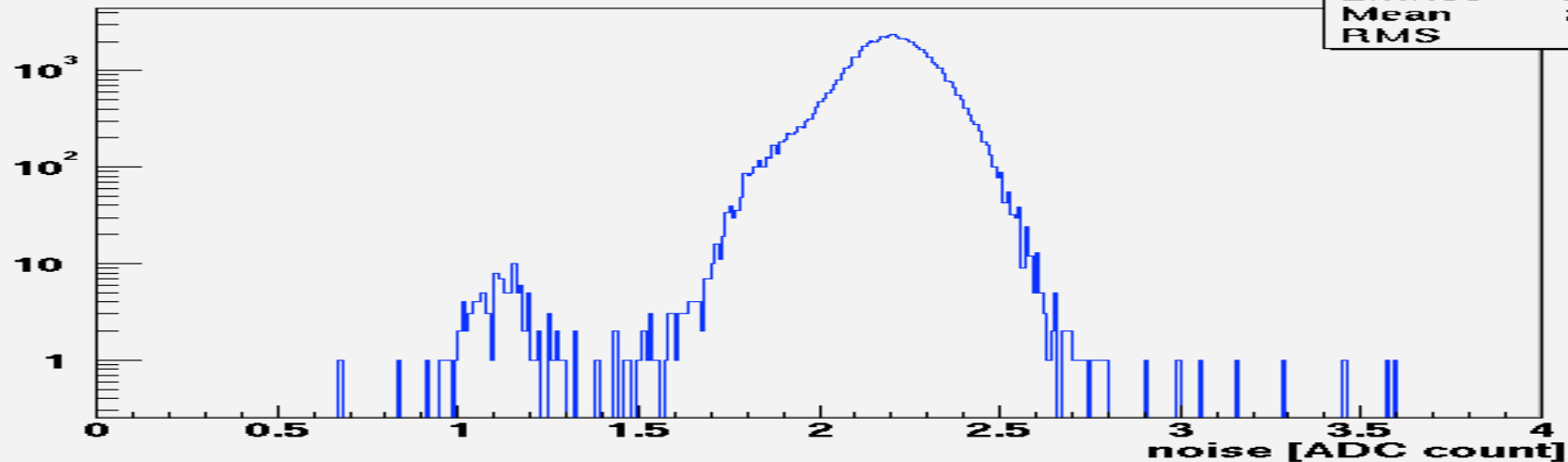


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Average-subtracted Noise (deconvolution inversion on)



Noise (deconvolution inversion on)

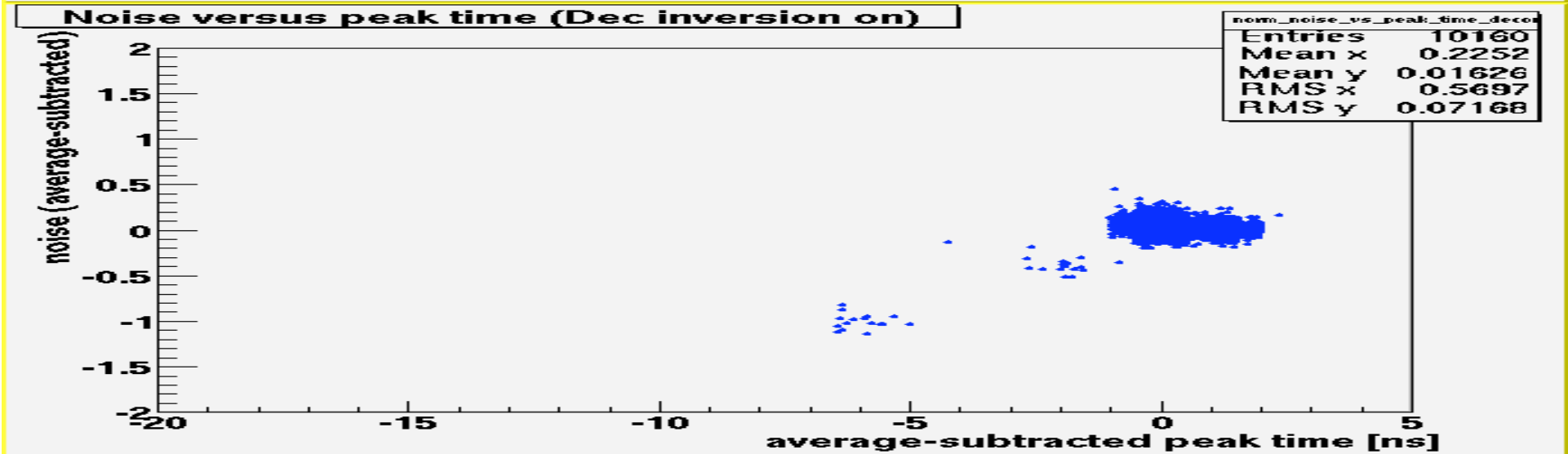
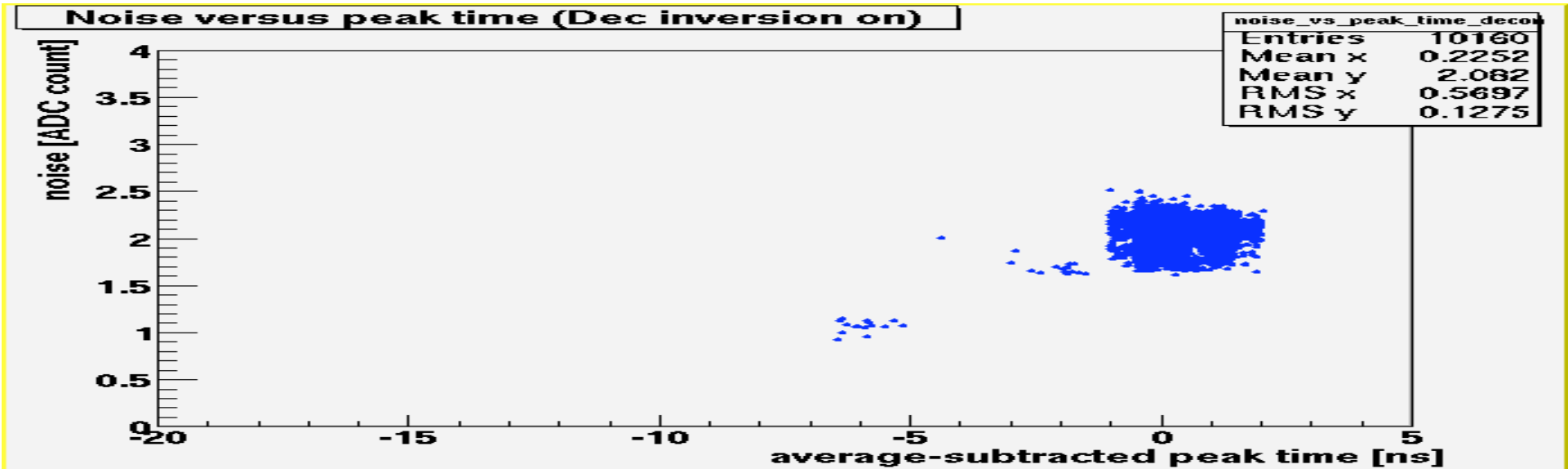




Noise vs PeakTime



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Noise Cuts



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- **“Relative” - Average Subtracted**
 - Max $\min(\text{AVG}+1.0, 3.0)$ ADC
 - Min $\text{AVG}-0.25$ ADC
 - Min OS $\text{AVG}-0.5$ ADC
 - Min TS $\max(\text{AVG}-1.0, 0.6)$ ADC
- **Absolute cuts are problematic in cold box**
 - Dec average CMS noise increases ~ 0.25 ADC from $+20\text{C}$ to -20C
 - Peak average CMS noise decreases ~ 0.05 ADC
- **If the cut is not working adjust it!**
 - Cuts might be changed for different types of modules (ss4, ss6, TEC...)



Uploading to the Database



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- **Check the object id in the xml file**
- **Upload using the big browser GUI or command line tool**
- **As an exercise I generated and uploaded xml files from UCSB and Fermilab LT root files**
 - I removed “bad data” from most of the UCSB files and some of the Fermilab files
 - From the UCSB data I removed calibration profiles from inverter modes because the pulse shape was clipped in the cold and last record
 - From the Fermilab data I removed data from modes where the CMN was high (mostly PeakInvOn in cold)
 - Fermilab 30200020007501-30200020007601 (not inclusive)
 - UCSB 30200020005001-30200020005294 (not inclusive)
 - Most of these modules are not production modules so Lt grading is not critical (I will check the ones that are.)



What to work on next



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- **Report generator for modules**
 - This can be done by extending Defect Analyzer
- **XML generator for Rod Test root files**
 - This is already be worked on in Defect Analyzer
- **Report/plots/bad channel list generator for rods**
 - Extend what is already available in Defect Analyzer
- **I prefer to work on Defect Analyzer since it keeps everything is one package and I have been able to easily extend it to add the cuts I needed**
 - See talk by L. Neukermans during the Module Test Meeting of the June CMS week
- **Volunteer to help Wim and Lionel with Defect Analyzer**