Comparison of Baseline and High Rate Runs

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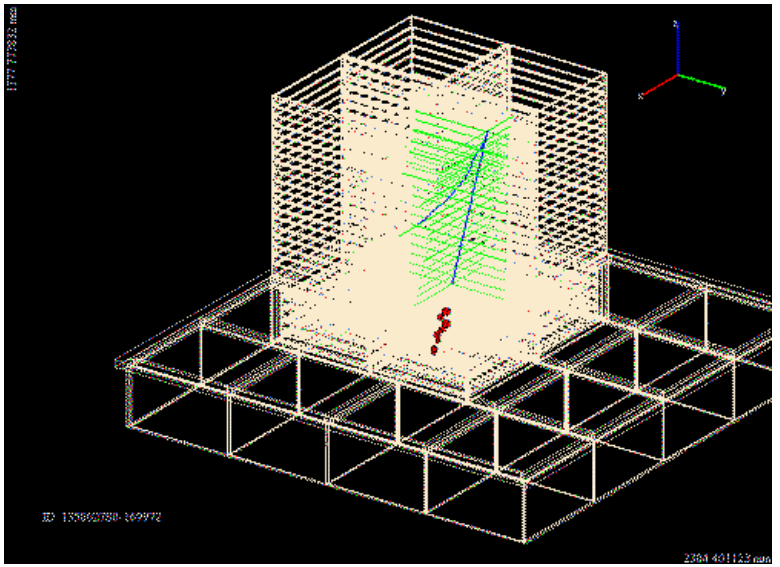
Instrument Analysis Workshop IV



July 15th, 2005

What are the "high rate" runs?

- Runs where an external pulser triggers the instrument at a given nominal rate (1, 5, 10, 20 KHz). The instrument is also allowed to trigger by the conventional 3-in-a-row, Cal_Lo and Cal_Hi.

What are the high rate runs useful for?

- To probe the behavior of the instrument in the high rate triggering regime:
  - Does the electronics or the reconstruction get affected by the large number of events or by the small time interval between them?
  - What is the deadtime? (not covered in this talk–See Warren's)

What is this talk about?

- Compare the contents of the relevant Merit and Svac ntuple variables and study any differences encountered.

Data:

2-towers end2end runs:

135002172	20 KHz Run
135002132	10 KHz Run
135002052	Baseline

Select events that you want to compare:

0^{th} order Cut: Tkr opens the trigger window

(GemConditionsWord&2)&&GemCondArrivalTimeTkr==0

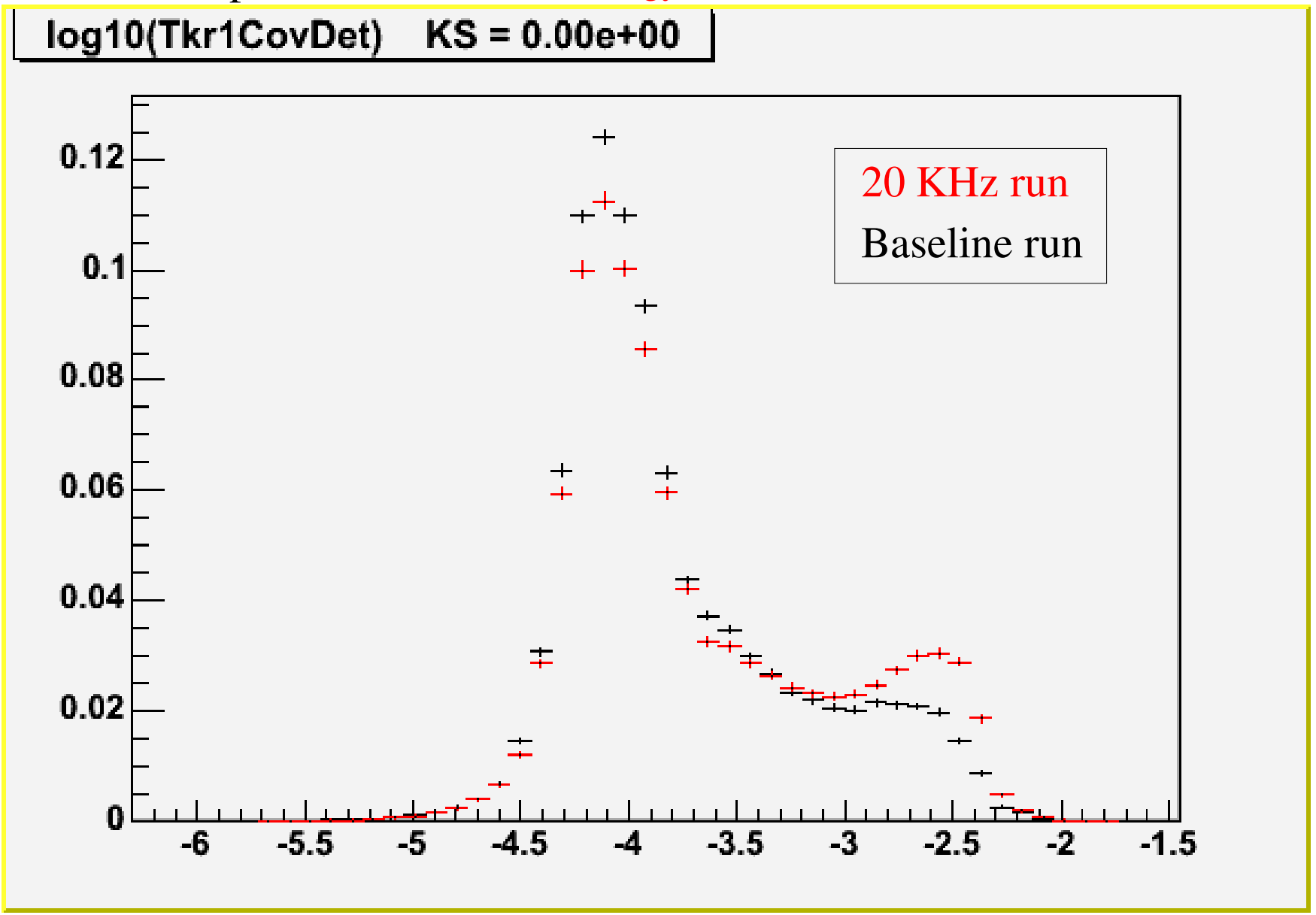
on top of the 0^{th} cut, these are very important cuts:

"1 Track"	->	To get rid of showers
Energy in Cal	->	No particles stop in the Tkr

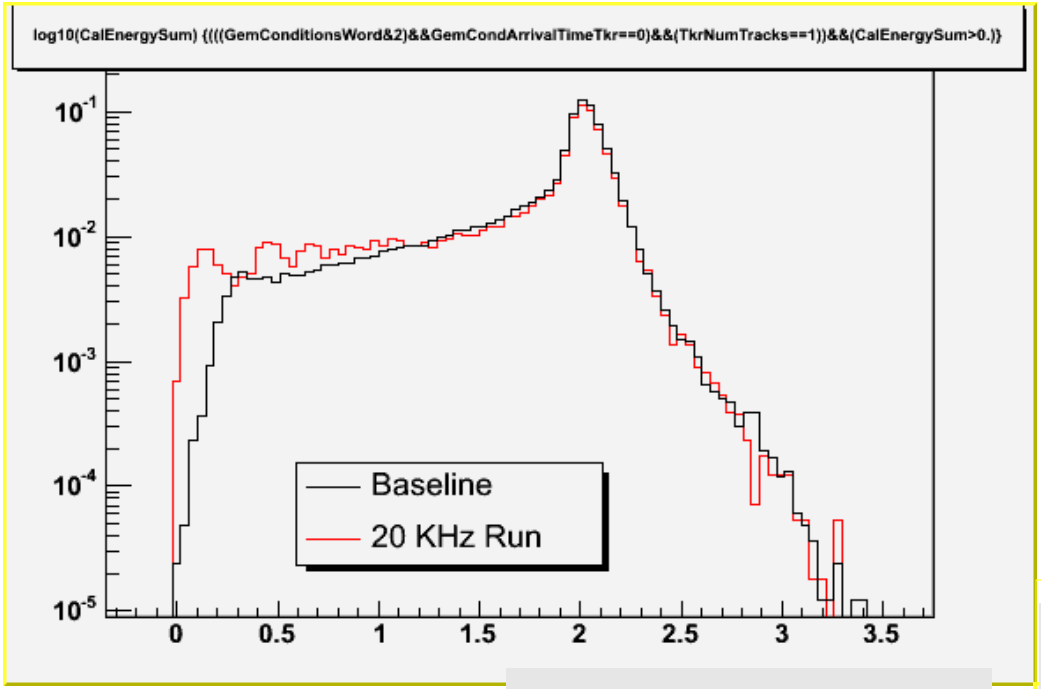
The cut you use determines what kind of questions you can ask...

- For plenty of the ntuple variables, the distributions were not consistent:

Cut = tkropens + 1 track + CalEnergySum>0



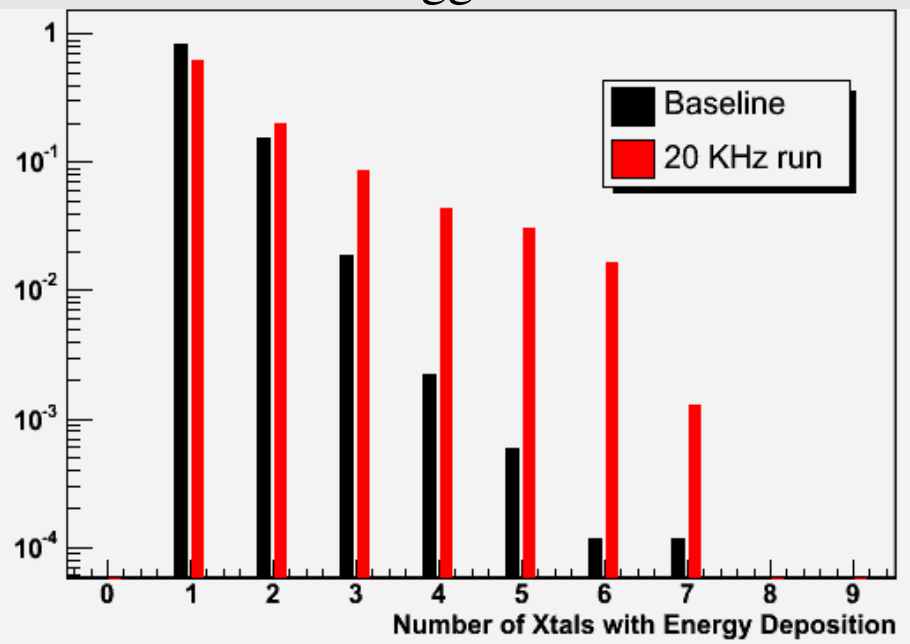
Looking into the Cal



log10(CalEnergySum)

- For high rate runs there are a more events with CalEnergySum < ~10 MeV

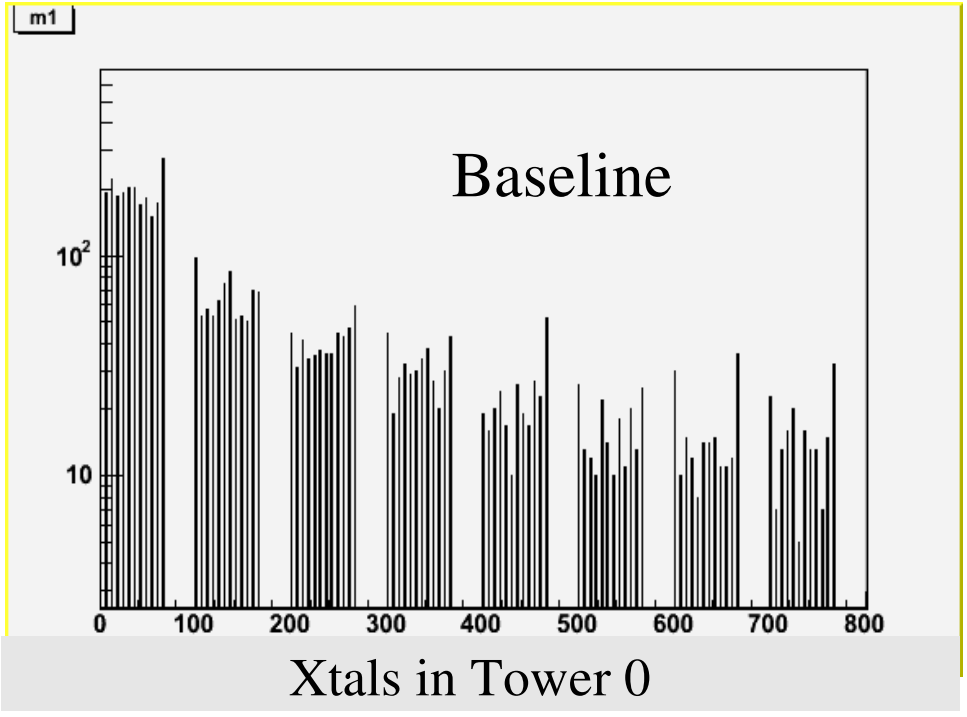
Cut= 0 < CalEnergySum < 10 MeV
+ Tkr triggers + 1 track



- More Xtals go over threshold for the high rate runs.

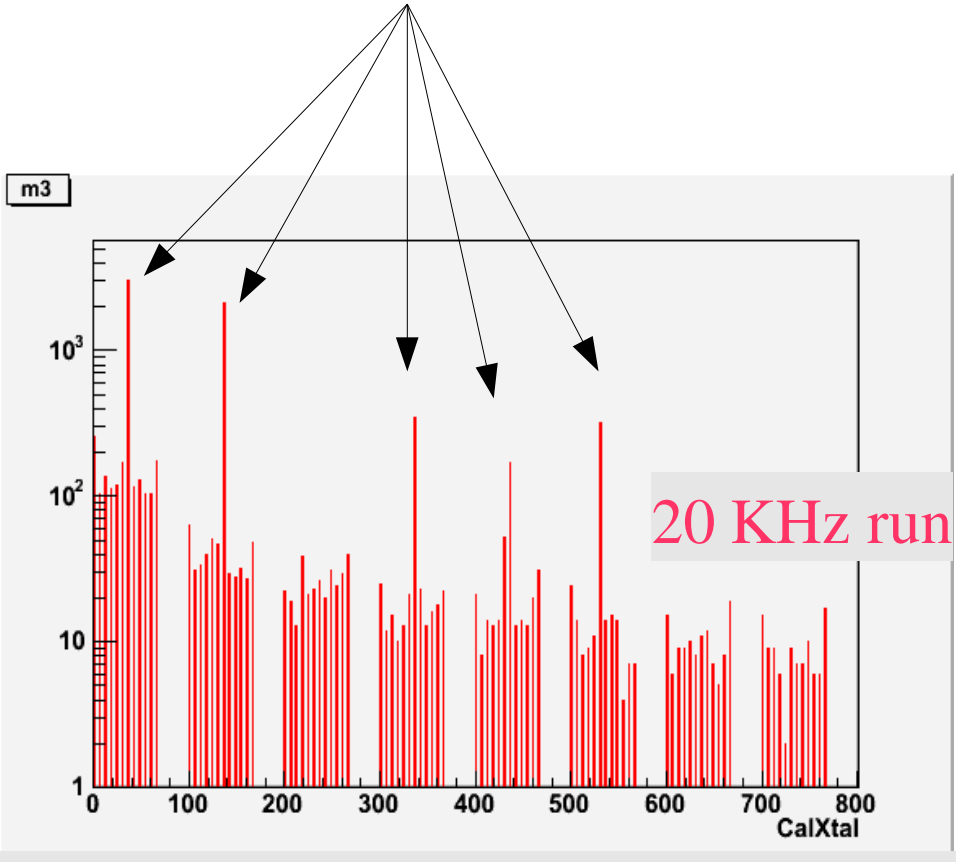
Looking into individual Xtals

- How many times does every xtal go over threshold when the total energy in the CAL is less than 10 Mev?



Xtals in Tower 0

A few xtals are picking up noise during the high rate runs



Xtals in Tower 0

* See Eric/Sasha 's presentation about shaped readout noise

So, what is going on?

➔ When making a Cal Energy cut, the "noisy" xtals introduce a bias:

Consequences of "CalEnergySum > 0" cut:

For baseline Run -> All events hit the Cal

For high Rate Run -> Mixture with small fraction of events that miss the Cal

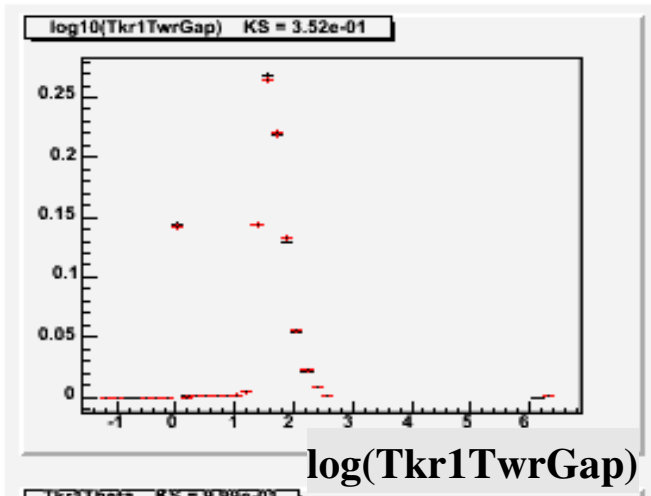
➔ Ways to get over this:

- Not to use the "CalEnergySum > 0" cut
- Select events with long GemEventDeltaTime

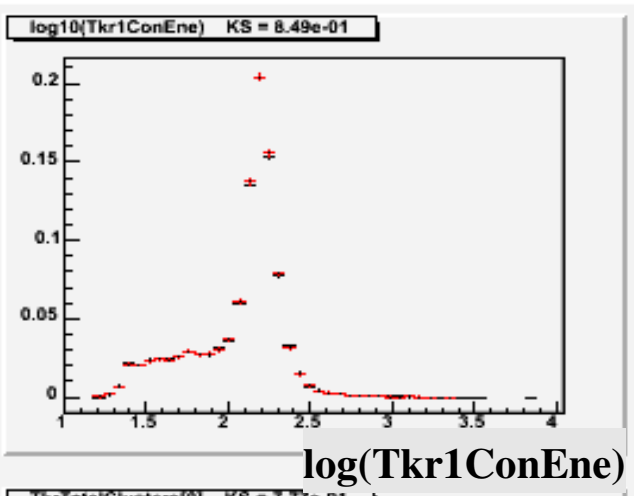
  Done and it works well. However it defies the purpose of using the high rate runs to probe the instrument. You want events that are close in time!

- *Dismiss events with energy 0 < E < 10 MeV in the "noisy" xtals.*

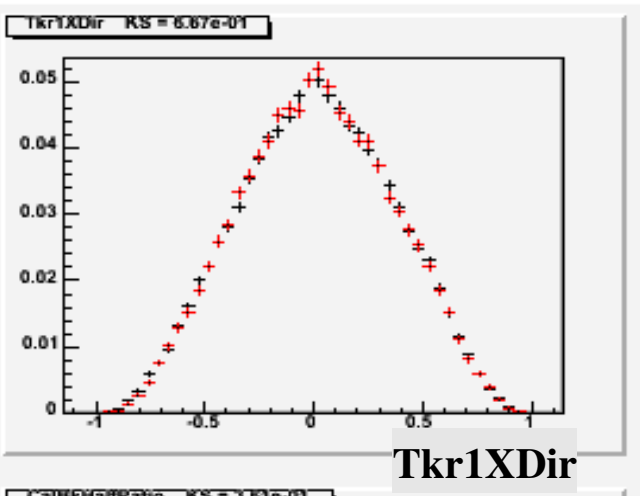
A quick taste of the obtained distributions:



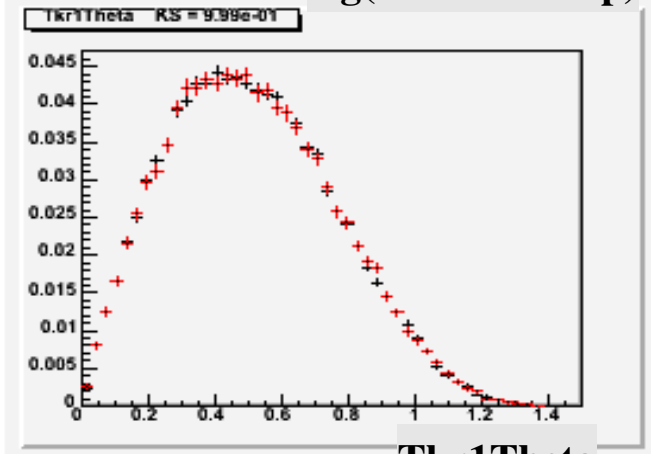
log(Tkr1TwrGap)



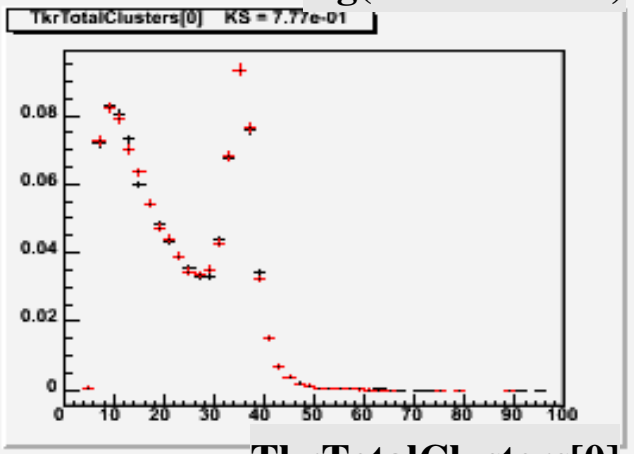
log(Tkr1ConEne)



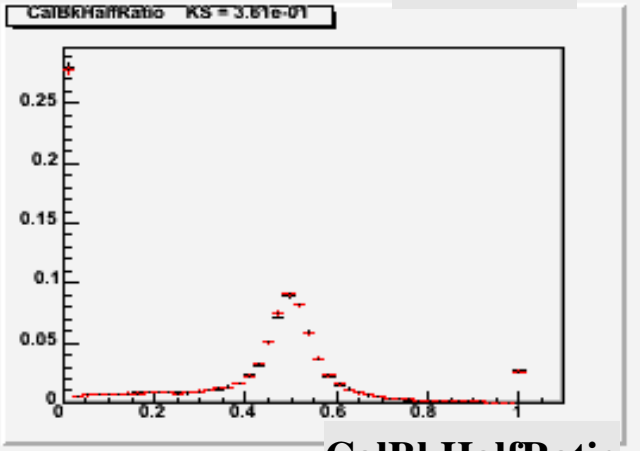
Tkr1XDir



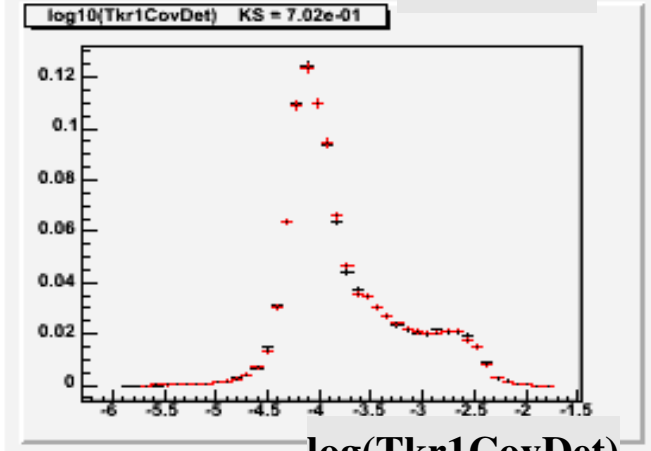
Tkr1Theta



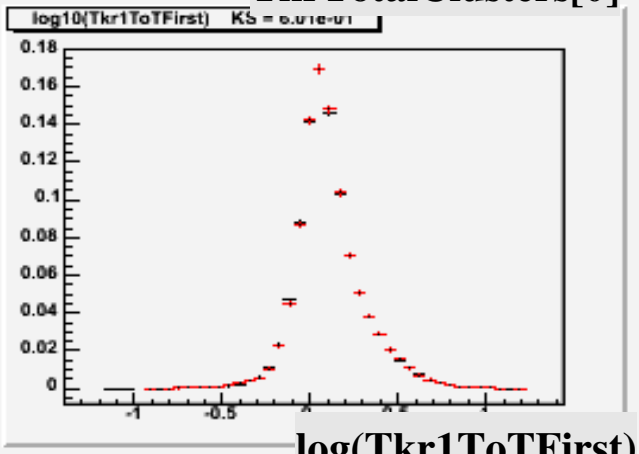
TkrTotalClusters[0]



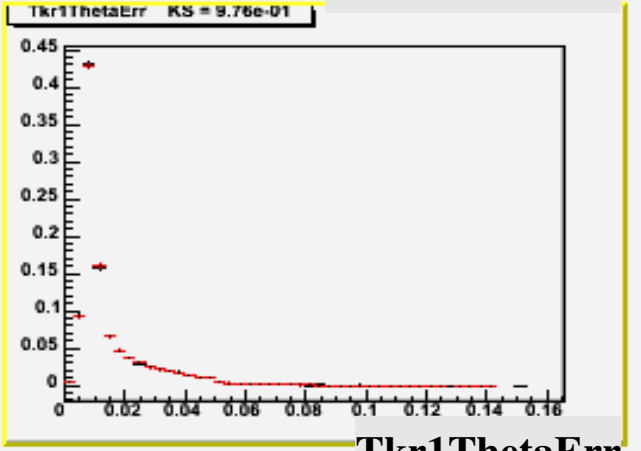
CalBkHalfRatio



log(Tkr1CovDet)

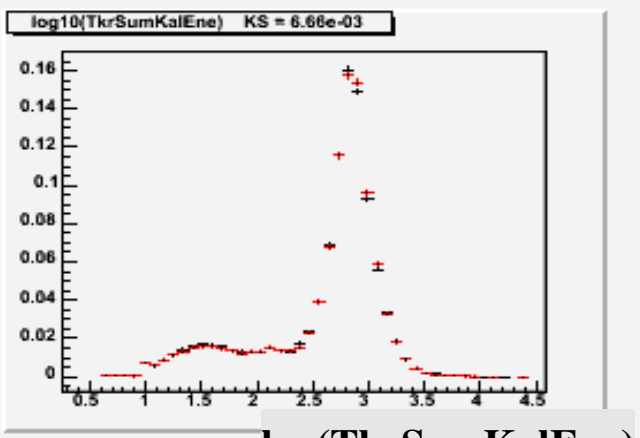


log(Tkr1ToTFirst)

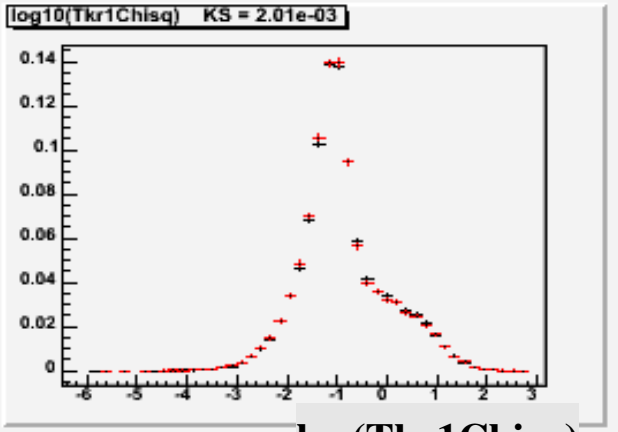


Tkr1ThetaErr

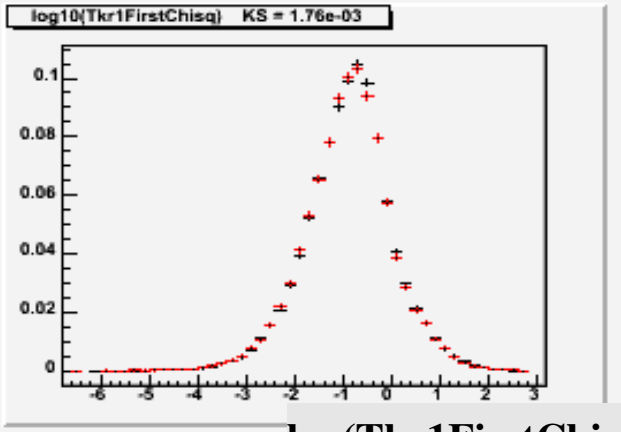
From ~120 svac/merit variables analyzed, these are the WORST looking:



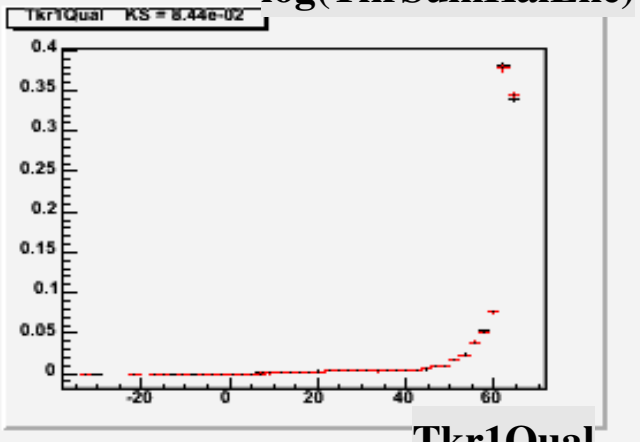
log(TkrSumKalEne)



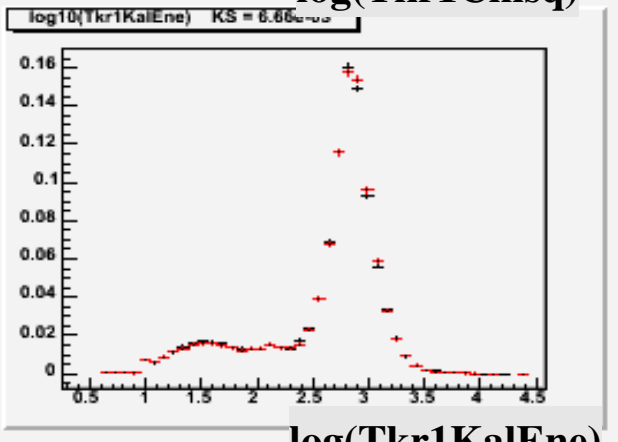
log(Tkr1Chisq)



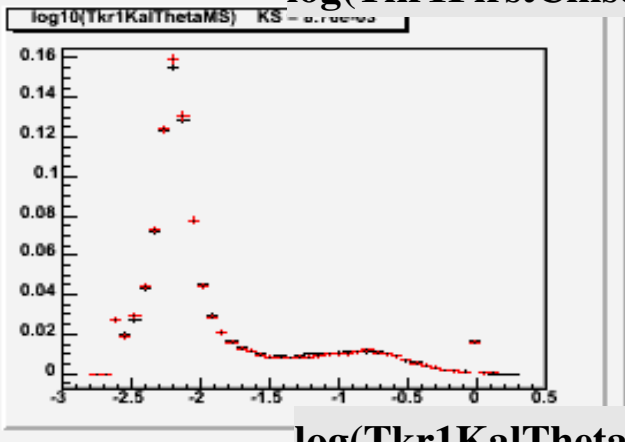
log(Tkr1FirstChisq)



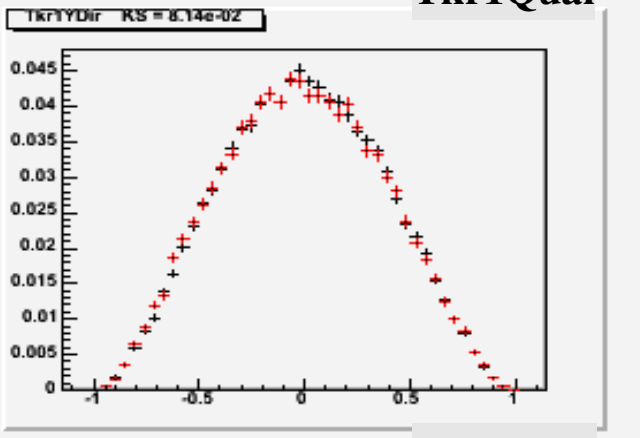
Tkr1Qual



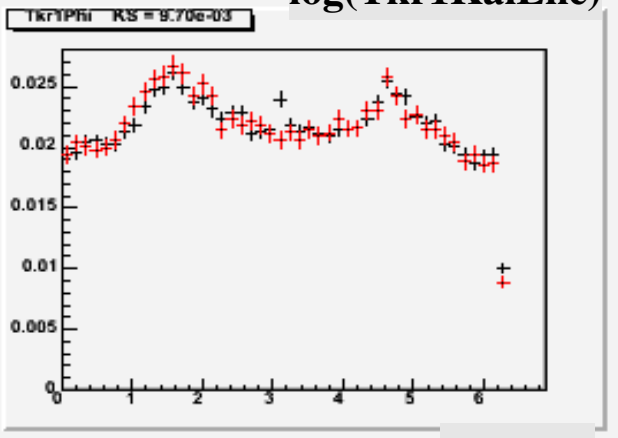
log(Tkr1KalEne)



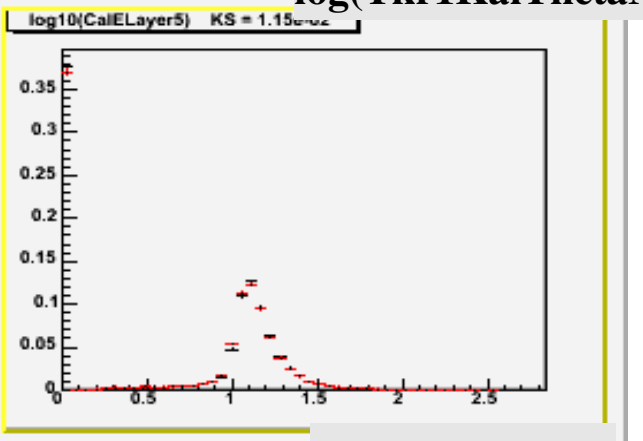
log(Tkr1KalThetaMS)



Tkr1YDir



Tkr1Phi



log(CalELayer5)

Results

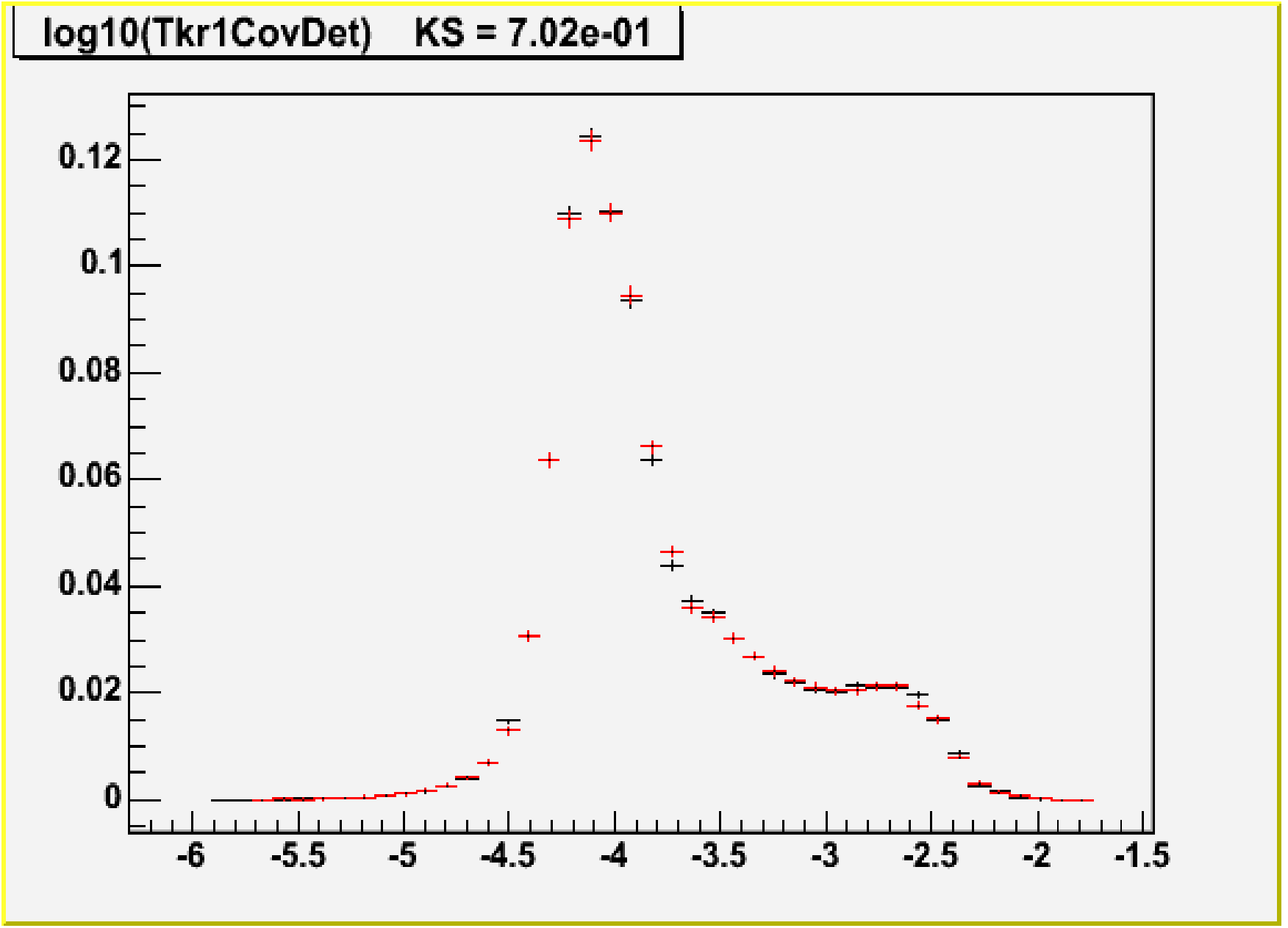
- ~120 svac/merit ntuple variables were studied.
- The vast majority show good consistency between baseline and high rate runs.
- A few distributions have low KS values (< 0.1). The disagreement is not alarming.

Summary

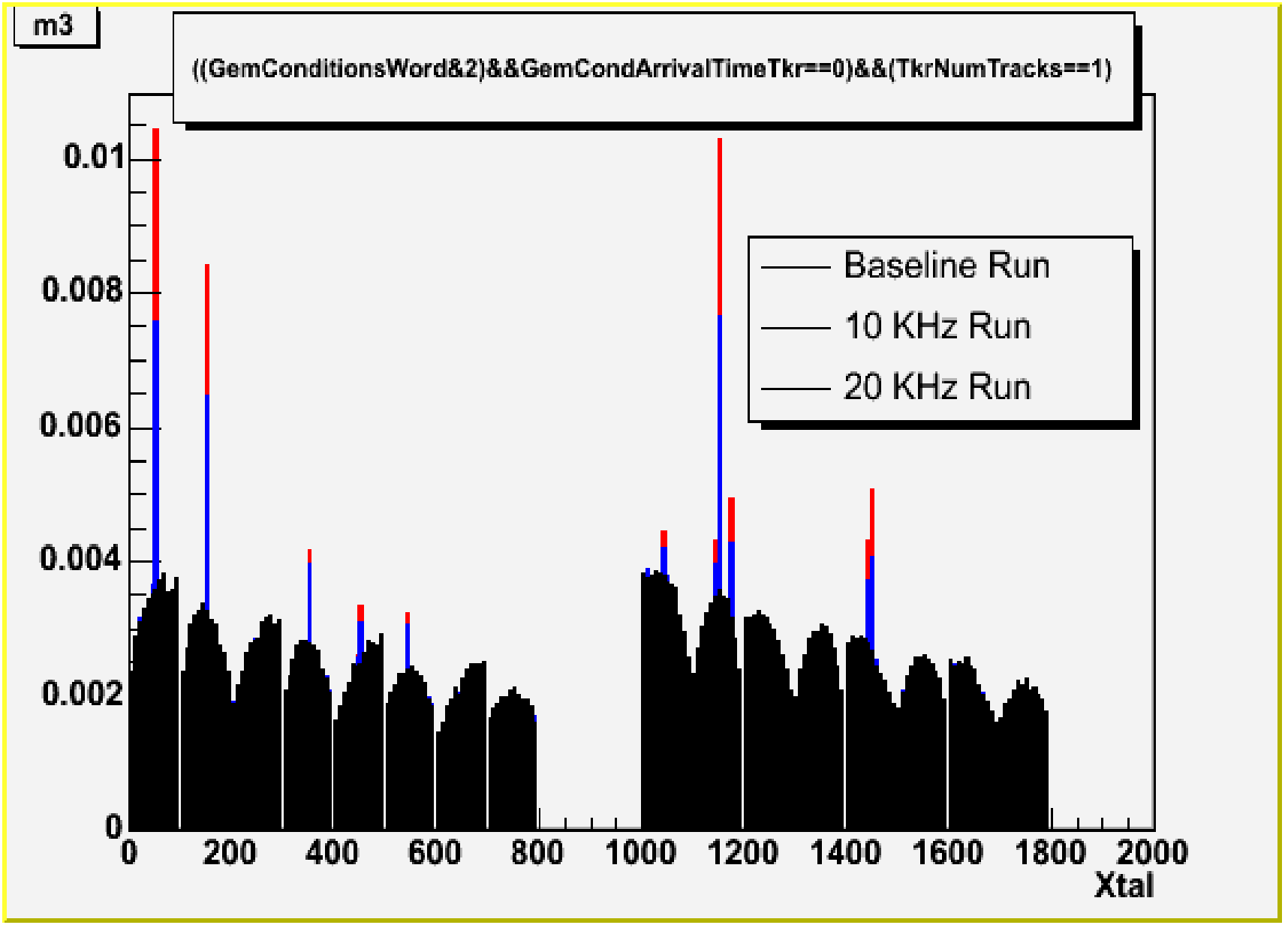
- A systematic effect caused by the high trigger rate was found during this analysis by just looking at a few and very fundamental distributions.
- No evidence was found suggesting that a high trigger rate dramatically affects the performance of the instrument.

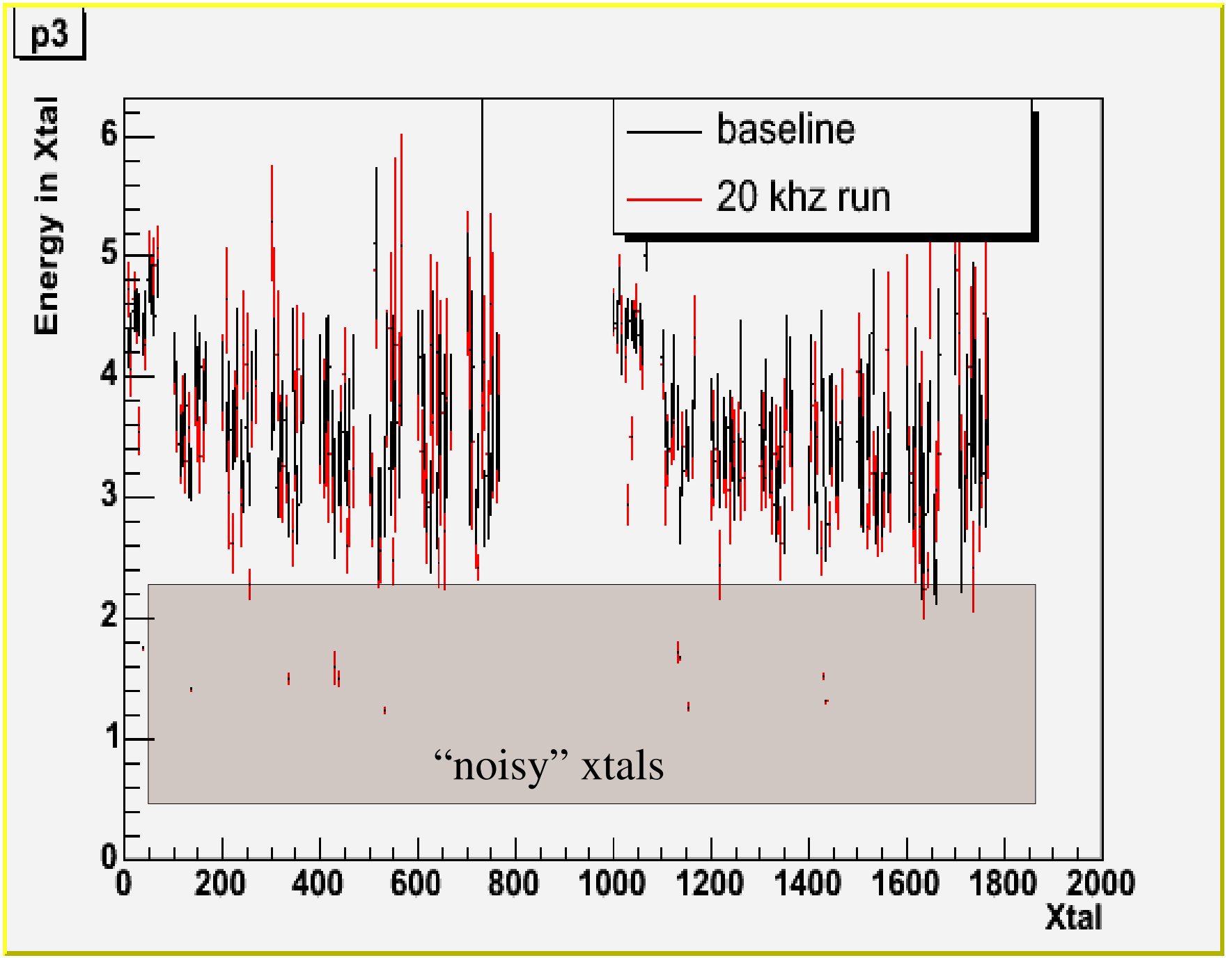
BACKUP SLIDES

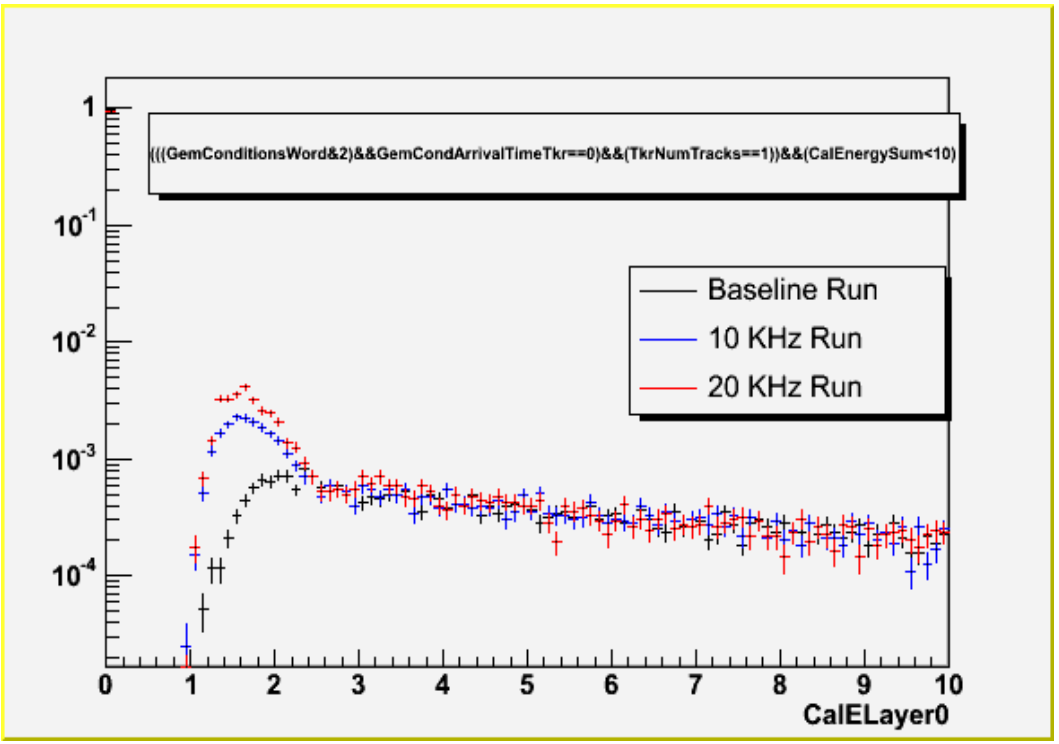
Cut = tkropens + 1 track + CalEnergySum > 0 + No “noisy” xtals

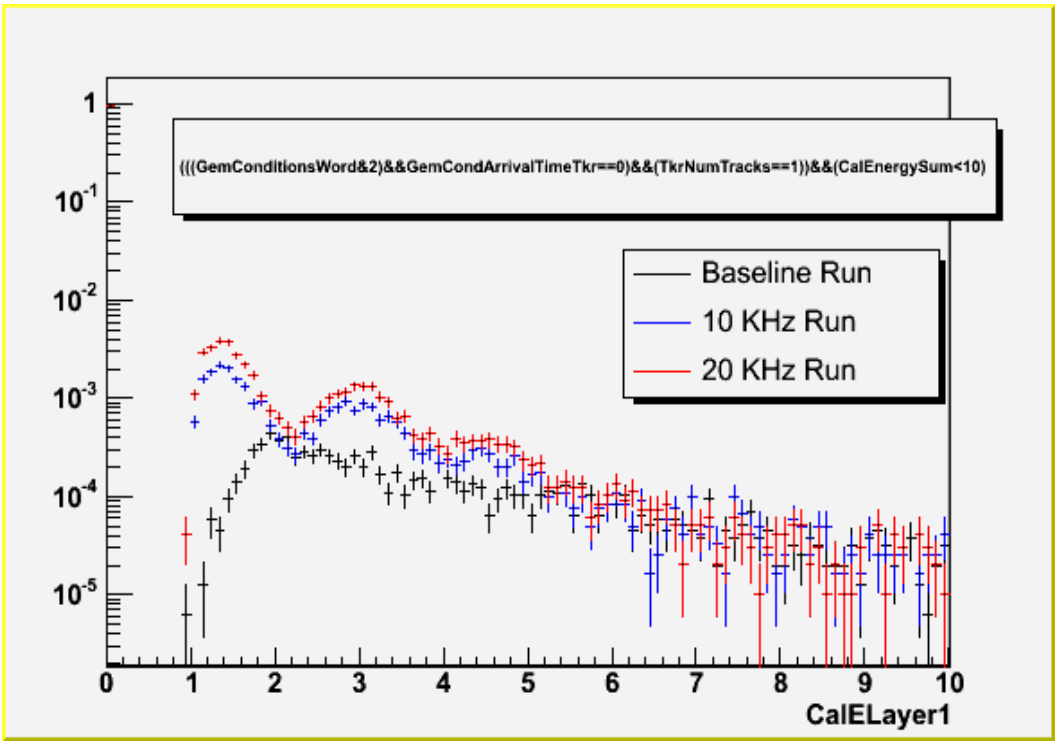


Xtals Multiplicity – Two towers




p3
Energy in Xtal
baseline
20 khz run
"noisy" xtals
0
1
2
3
4
5
6
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Xtal


(((GemConditionsWord&2)&&GemCondArrivalTimeTkr==0)&&(TkrNumTracks==1))&&(CalEnergySum<10)
Baseline Run
10 KHz Run
20 KHz Run
CalELayer0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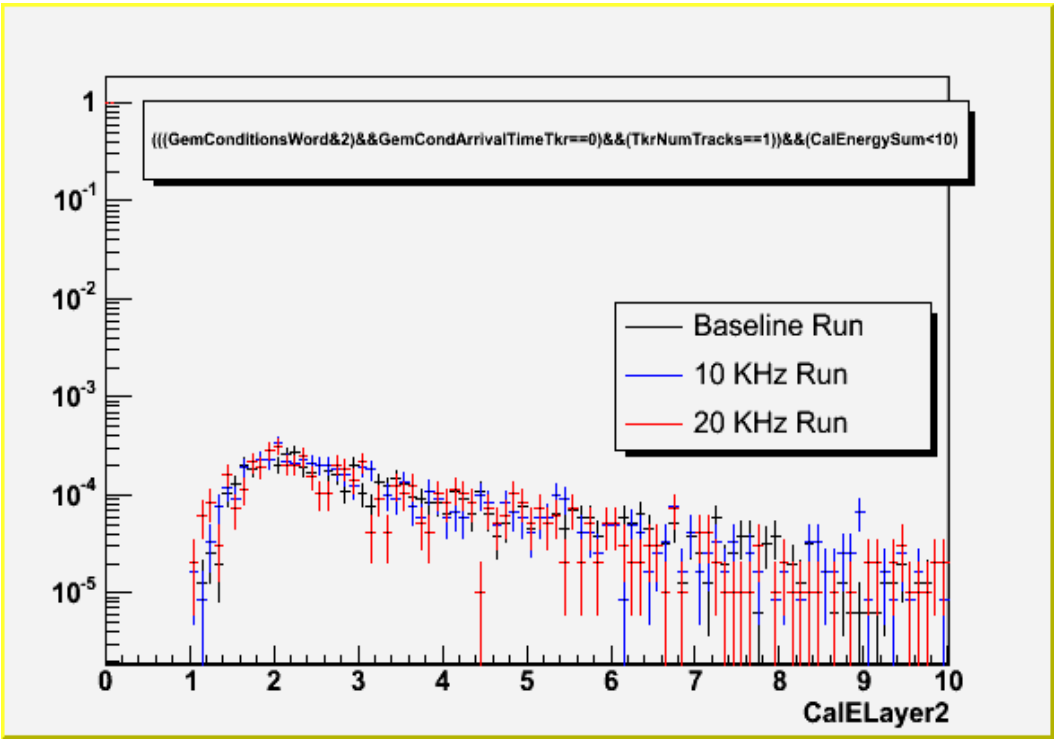
Baseline Run
10 KHz Run
20 KHz Run
CalELayer1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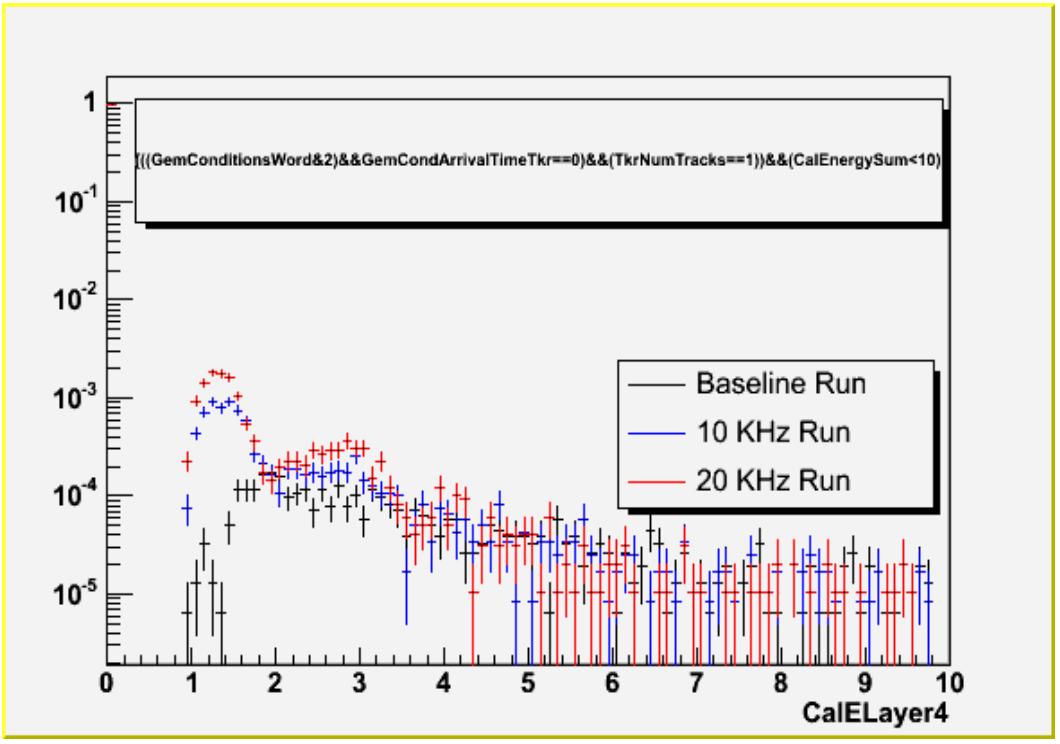
Baseline Run
10 KHz Run
20 KHz Run
CalELayer2


(((GemConditionsWord&2)&&GemCondArrivalTimeTkr==0)&&(TkrNumTracks==1))&&(CalEnergySum<10)
Baseline Run
10 KHz Run
20 KHz Run
CalELayer4