

Calorimeter Thresholds and You!

Leslie Groer
Columbia University
New York

All DØ Meeting



August 9, 2002

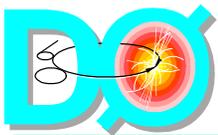


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Calorimeter Thresholds and Unpacking

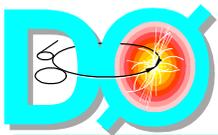
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Why the change?

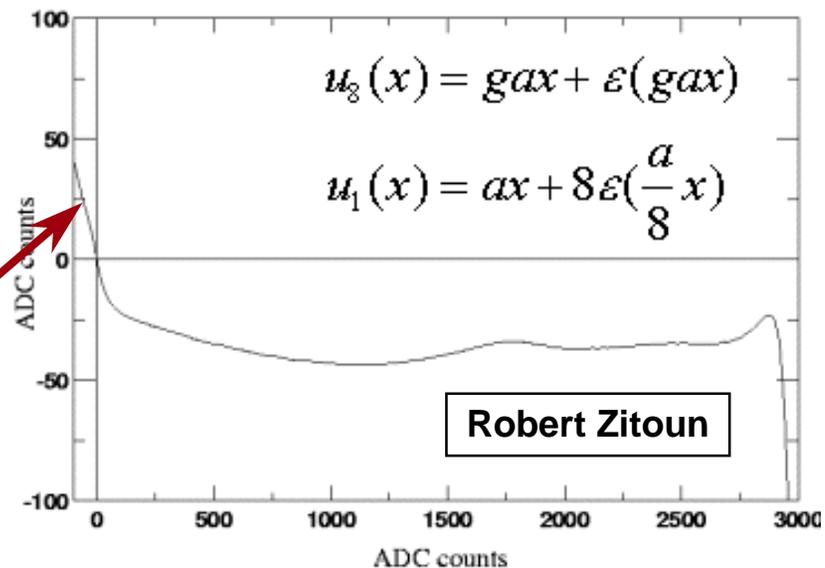
- Threshold of 2.5 originally chosen somewhat at random
- Run 1 noise dominated by Uranium and not electronics – very different regime now
- Jet response, jet widths, taus too skinny etc. all indicate that threshold too high
 - ◆ Convoluted with the fact that 1.5 was used for MC generation with somewhat incorrect noise model and no non-linearity effects
- General consensus from the ID and physics groups that we need to go lower
- Changed threshold on June 26 from 2.5 to 1.5
 - ◆ First run #158062 (global_CalMuon-7.31)
- Emergency meetings held in last few weeks due to pressure on the offline
 - ◆ Occupancies gone from 5% to 15%
 - ◆ NADA, clustering, jet finding algorithms scale as N^α where $\alpha \sim 2-3$
- Will briefly show some of the initial studies and work to relieve pressure on the offline farms
- Calorimeter Task Force

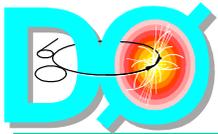




Non-linearity a non-issue

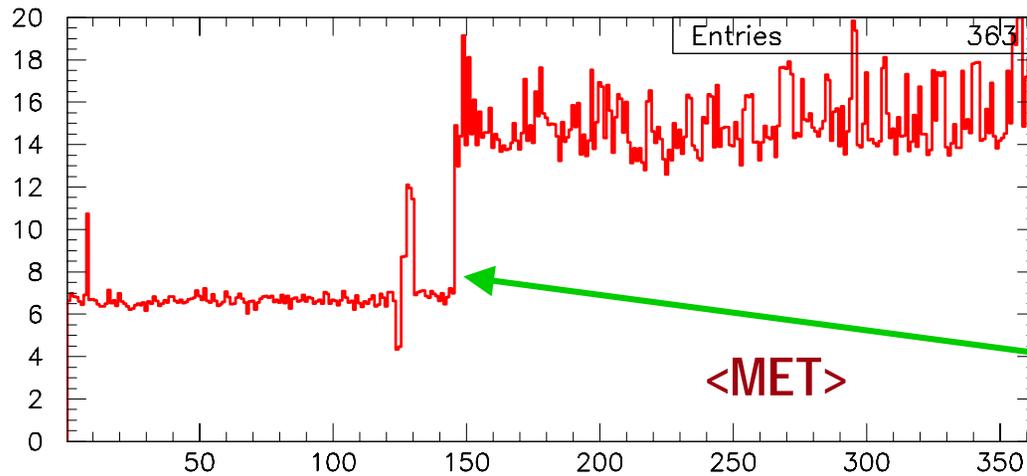
- Not all the charge gets stored in the SCA's near the edges of its voltage rails (i.e. very low or very high values)
- This means the gain is different for the first few 100's of ADC counts out of ~4000 counts (about a factor of 1.5)
 - ◆ $< \sim 0.5-1$ GeV
- The "non-linearity" is introduced to account for the different gains to convert ADC \rightarrow GeV
- In the regime of no-signals, close to pedestal, **there is no non-linearity**
- Therefore applying the threshold to the pedestal rms before or after the gain correction **makes no difference** (but it's a lot easier to understand if done before)
- Modeling in the MC is another story...



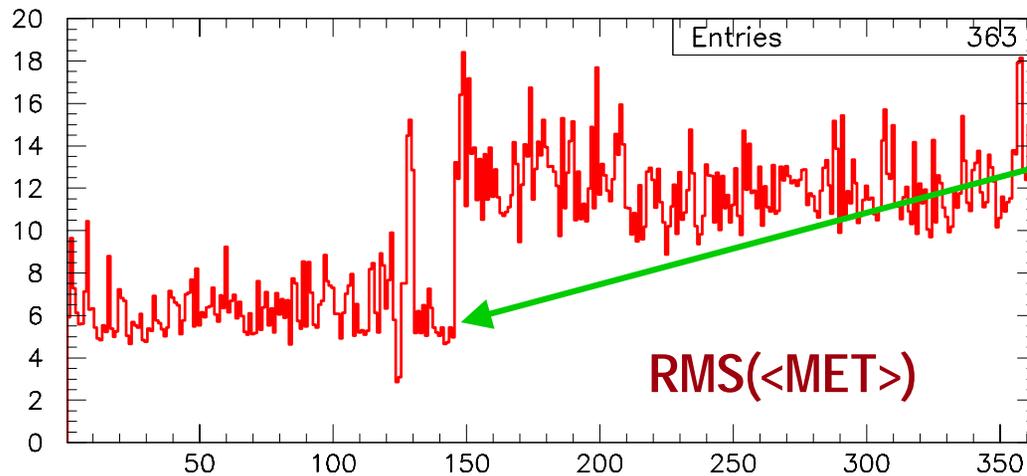


Missing E_T very sensitive

Gregorio Bernardi



Missing ET for selected root-tuple . June-July data p11.09



RMS-set-A (Missing ET) per root-tuple . June-July data METNE-p11.09

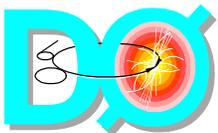
Major change of average missing E_T when going from 2.5 to 1.5 sigma zero- suppression cut: From 6-7 GeV to 14-18 GeV, with a wider scattering from run to run. One entry per root-tuple.

Also true for RMS(MET)

One entry per root-tuple, data from 19th June till 9th of July.

Not shown but MET_x and MET_y are also skewed further at low threshold

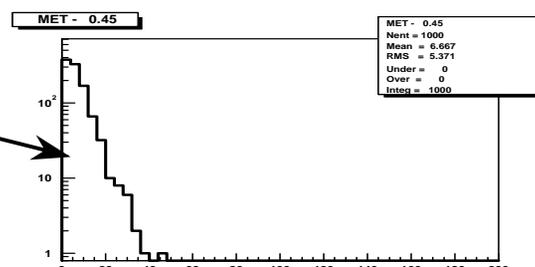
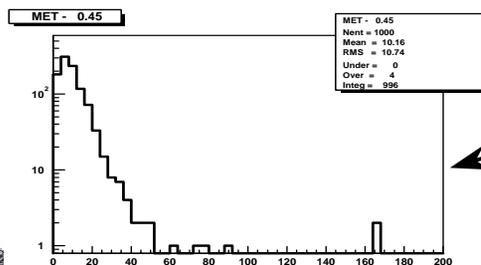
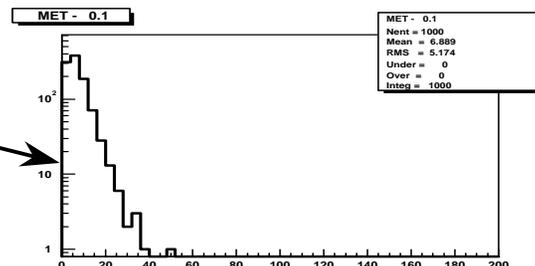
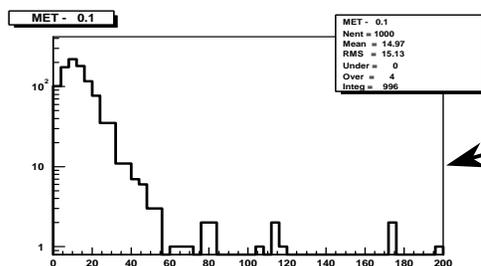
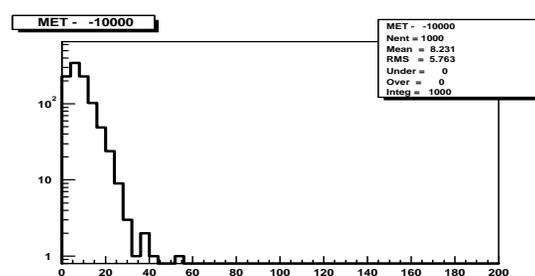
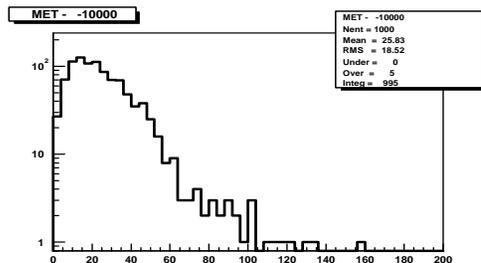
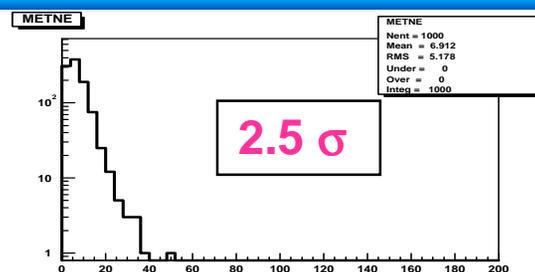
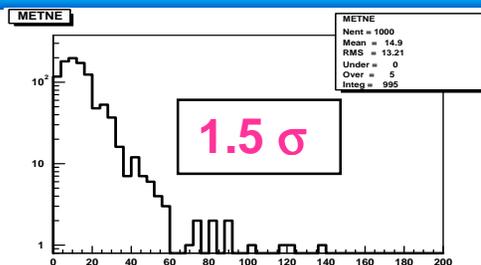




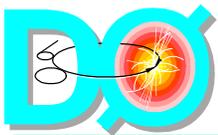
Missing E_T cleanup?

Gregorio Bernardi

Large variation of MET with cell energy cut when using low thresholds

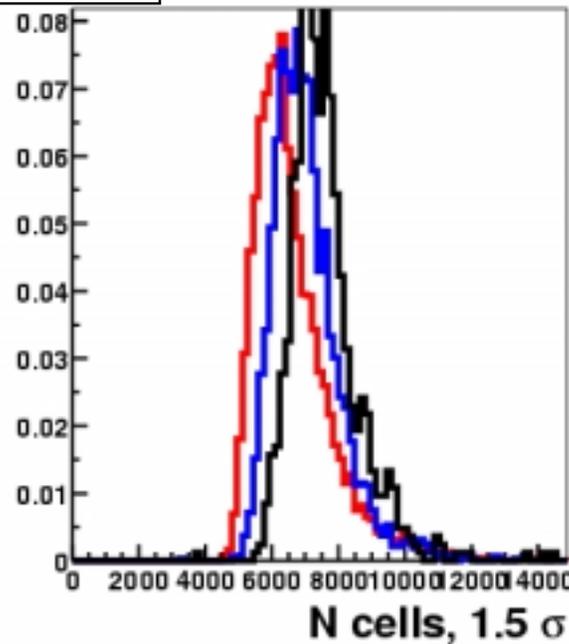
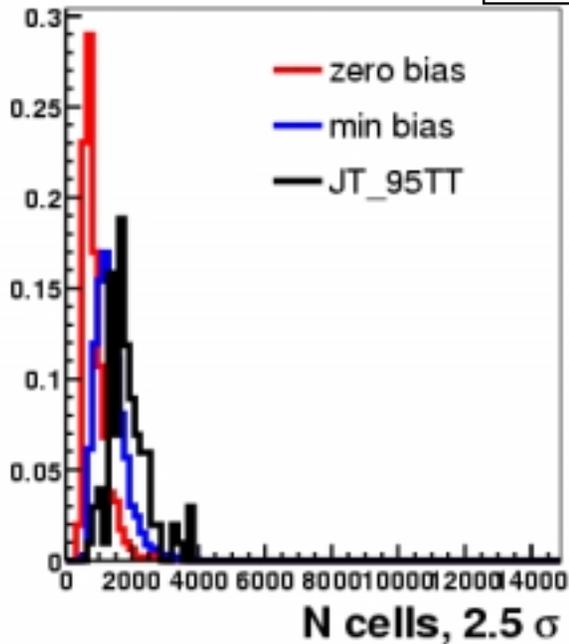


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Calorimeter behavior

Silke Duensing



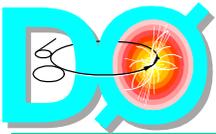
- Daniel Whiteson has been looking for muons in the calorimeter
- Initial results from data for matching rate for tight local muons gives

- ◆ 52% 1.5σ
- ◆ 46% 1.8σ
- ◆ 37% 2.5σ

- Average occupancy up by factor 4-5

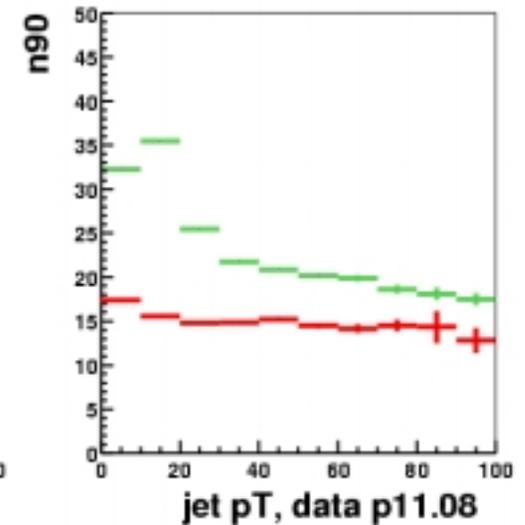
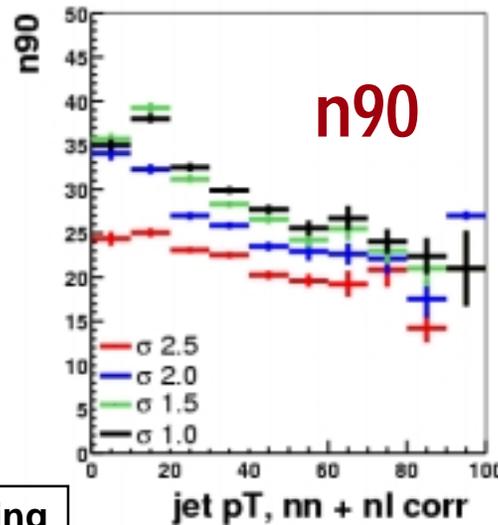
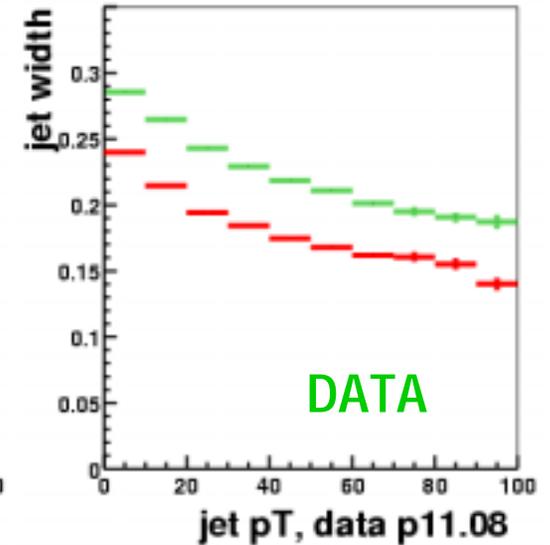
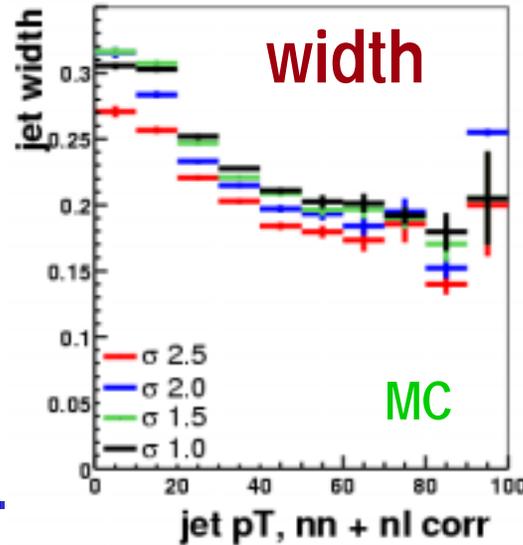
| | <u>2.5 σ</u> | <u>1.5σ</u> |
|-------------|--------------|-------------|
| • Zero-bias | 0.9k | 6.5k |
| • Min-bias | 1.4k | 7.0k |
| • JT_95 | 1.9k | 7.6k |





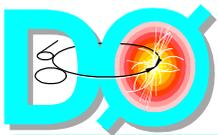
Jet widths

- To correct to data need to add in correct noise modeling to current MC, then apply non-linearity effect and then run through reco where non-linearity correction is applied



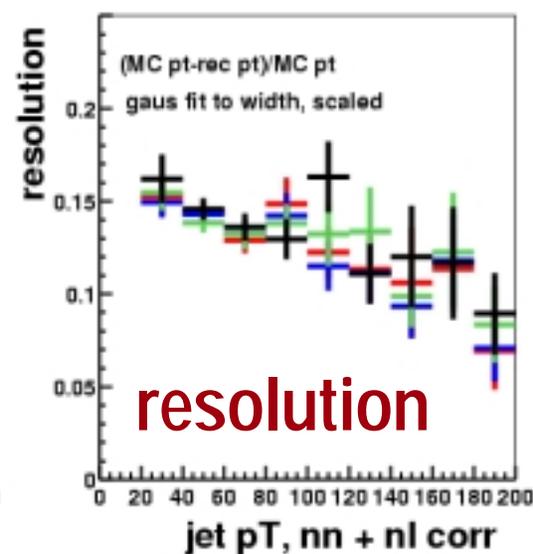
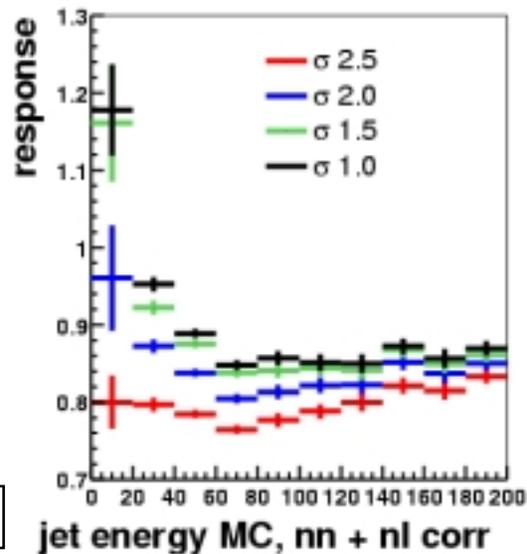
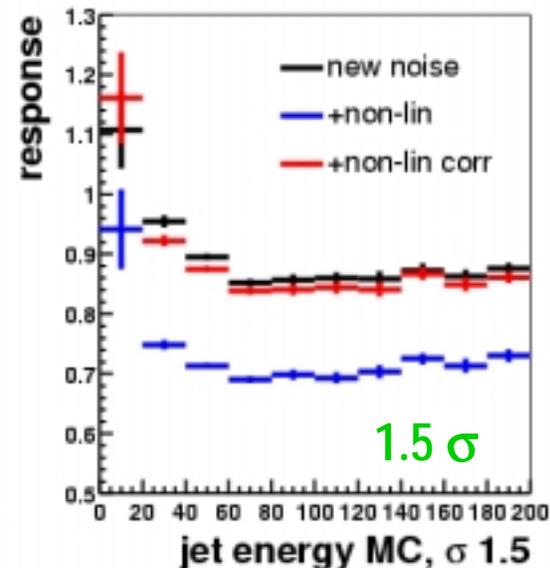
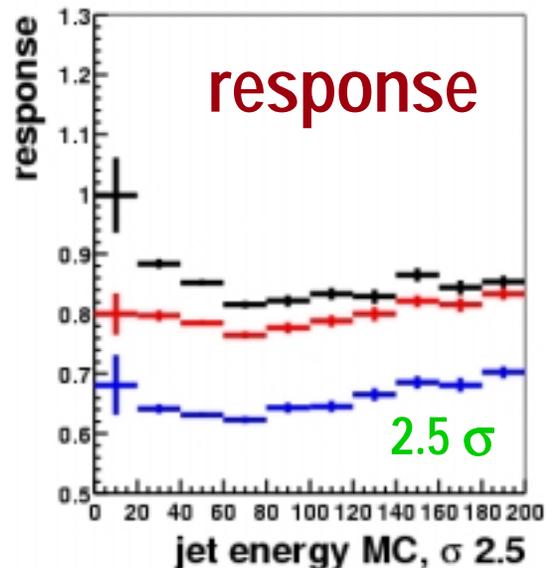
Silke Duensing





Jet response and resolution

- Correct back almost to full MC after simulating correct noise and non-linearity effects and correction in 1.5σ case
- Response improves from 80 to 85% for threshold changes of 2.5 to 1.5 but no obvious effect on resolution for 1000 MC events – need more statistics...



Silke Duensing

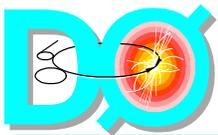
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Calorimeter Thresholds and Unpacking

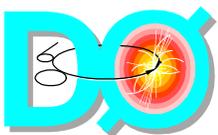
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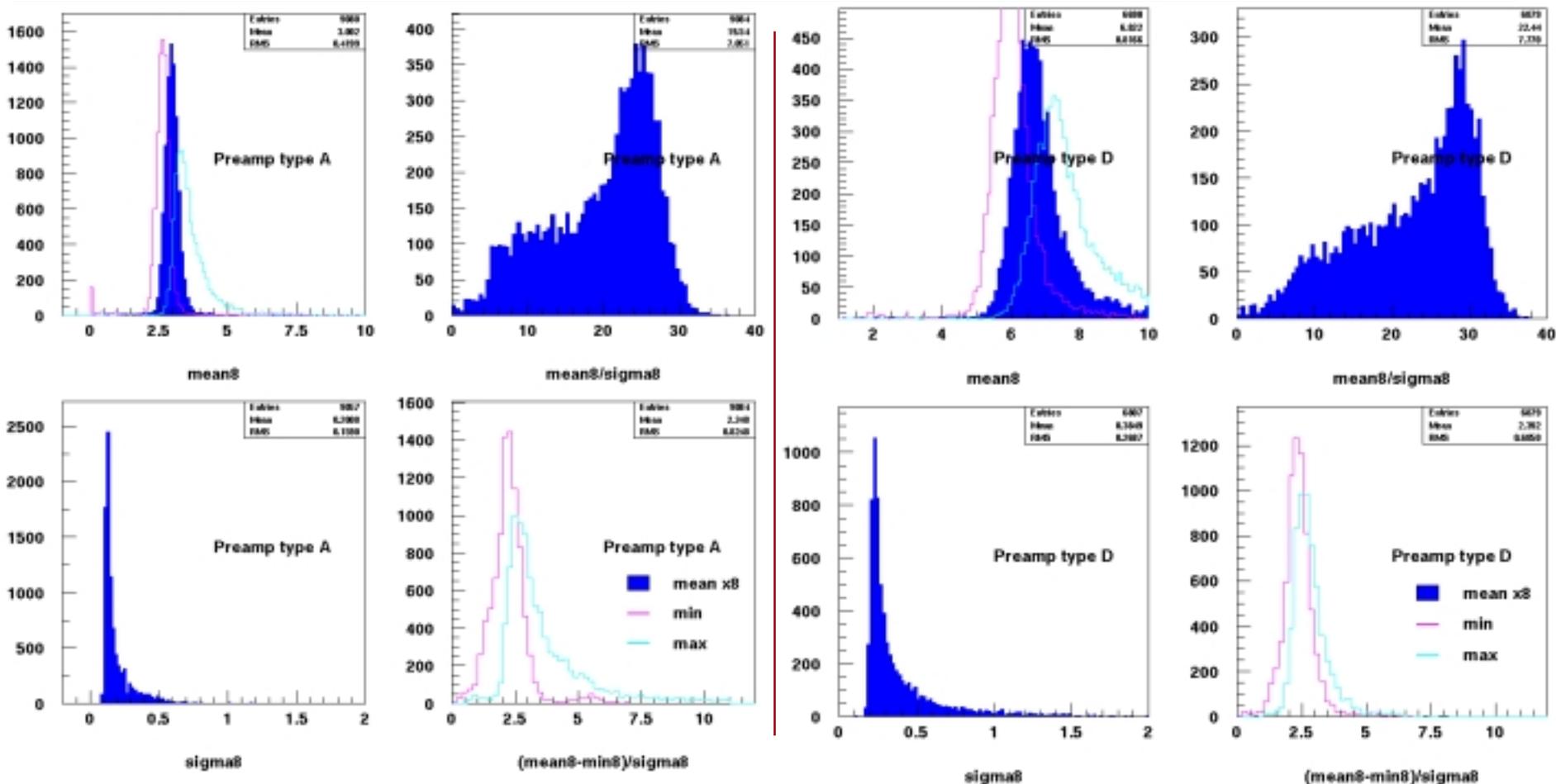
Offline zero suppression

- `calunpdata` package has been modified to apply offline zero suppression similar to the hardware
 - ◆ `calunpdata/rcp/CalUnpToMC.rcp`
`float offline_zero_supp_thresh = 2.5`
- Suppression done in ADC counts before any corrections (non-linearity, gains, etc)
 - ◆ There is also suppression available for MC data which adds to the confusion
- Pedestal threshold file taken from online for a particular calibration run so far
- Questions of stability of rms of pedestals being examined in detail
 - ◆ Insensitive to actual pedestal, only its width
- Harry Melanson will put this on the reco farm within the next few days
- Subset of global data will be reprocessed with different thresholds (1.5, 1.7, 2.0, 2.5) for studies



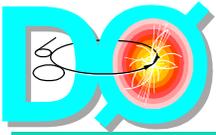


Pedestal rms stability

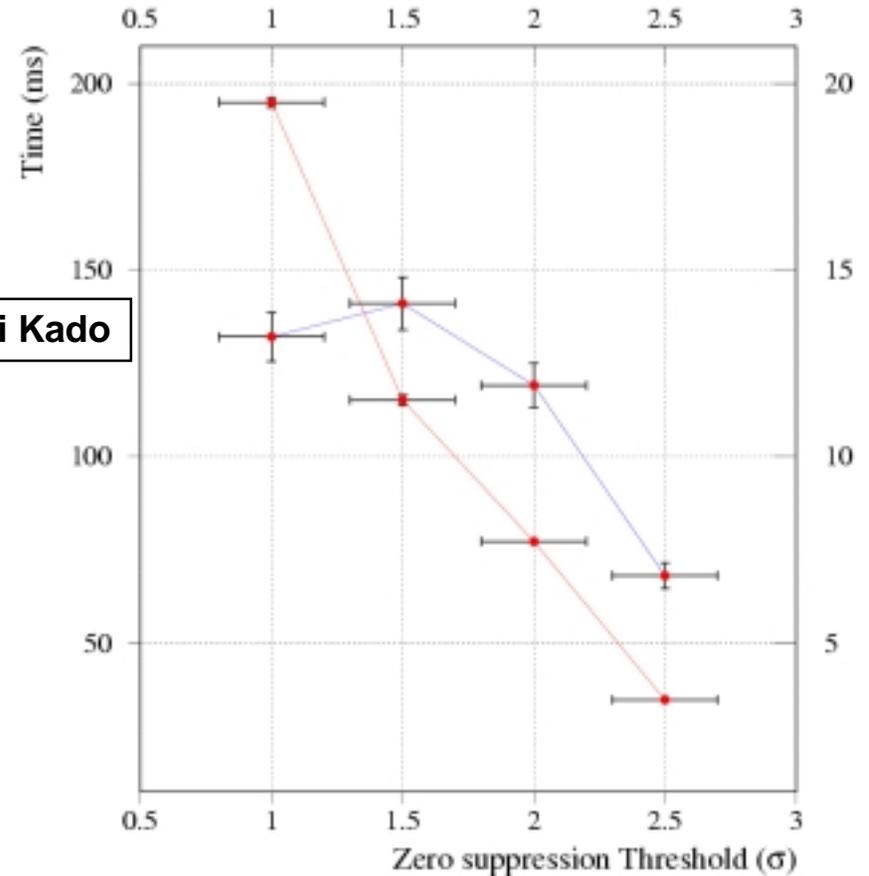
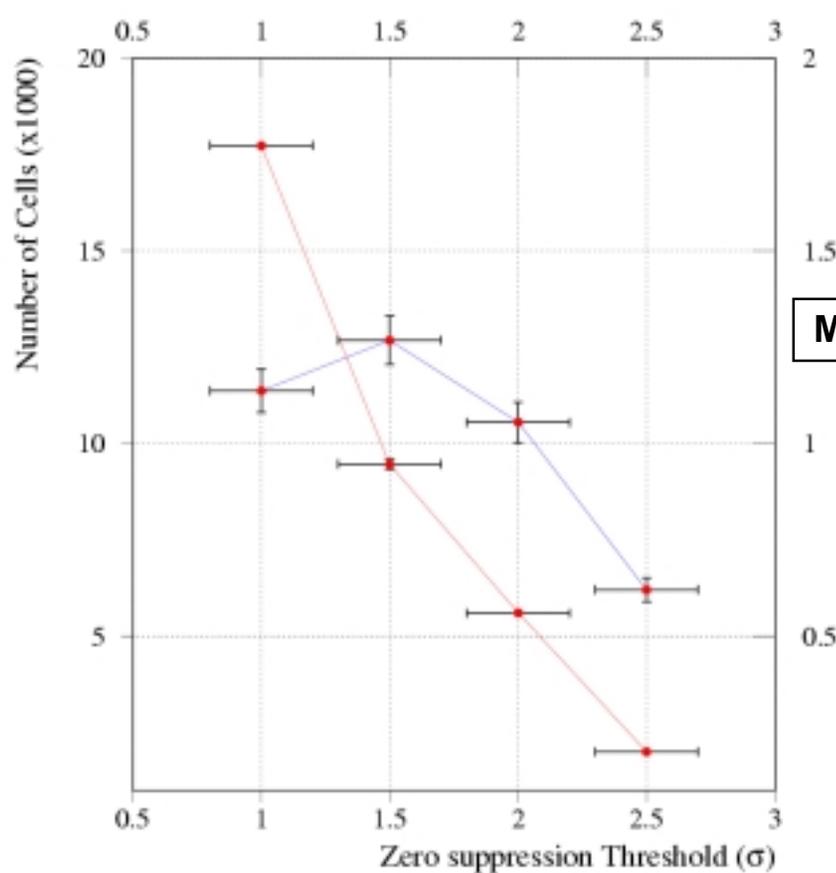


- Studying online zero suppression stability to apply offline
- Could probably implement same thresholds offline as online with not too much work





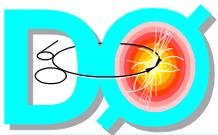
Suppression and L3



Marumi Kado

- The thresholds have ZERO effect on L1 and L2 triggering or readout
- Processing time scales linearly in L3
- Can apply threshold in MeV before apply filtering algorithms
- L3 calorimeter unpacking, clustering etc under review by Marumi for optimization





Calorimetry Task Force

Members:

Gregorio Bernardi*, Volker Buescher, Christophe Clement*, Silke Duensing, Anna Goussiou*, Leslie Groer (co-chair), Marumi Kado, Nirmalya Parua, Serban Protopopescu, Dean Chamberger, Marek Zielinski (co-chair), Robert Zitoun*

* = on vacation this week...

Charge:

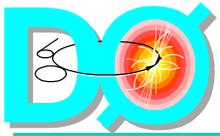
The task force will determine the zero-suppression threshold for the calorimeter readout. In order to fully understand the consequences of the zero-suppression threshold the Monte Carlo should be tuned to observed calorimeter energy and multiplicity distributions. Simulated data and collider data should be used to optimize the reconstruction and properties of physics objects as a function of threshold. Selection of the threshold will also require an understanding of the L3 processing time and the data set size at L3 and off-line all as a function of threshold.

Specifically, the task force should:

1. Characterize the calorimeter performance on the cell level.
2. Characterize particle identification (such as energy response and resolution) as a function of threshold.
3. Tune the Monte-Carlo to the data at the cell and physics object levels.
4. Understand the consequences of the threshold level on L3 computing and data size and offline data size.
5. Recommend a zero-suppression threshold.

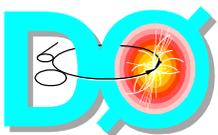
The task force will report to the spokespersons. A preliminary recommendation should be available by October 15th and a final report by January 15, 2003.



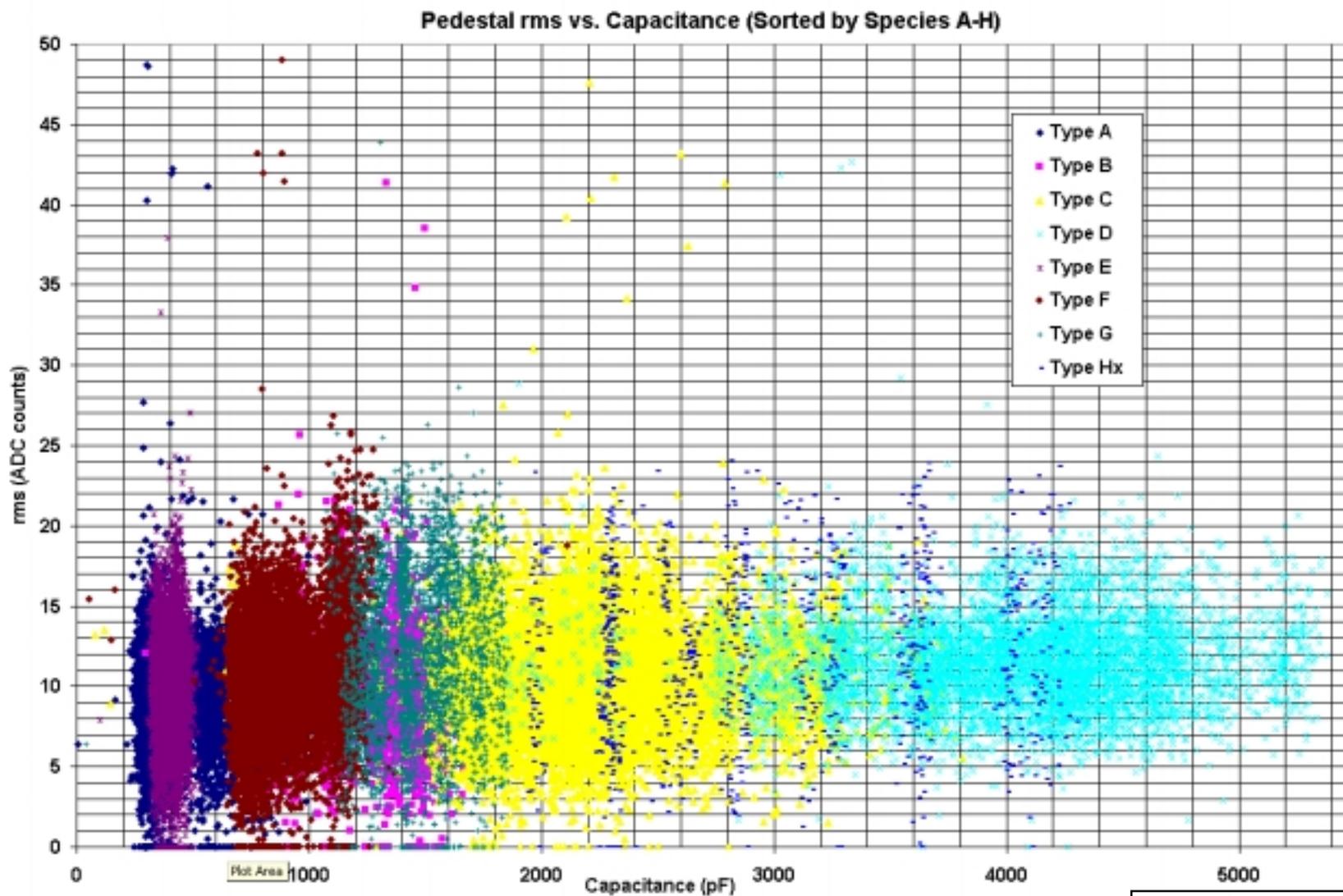


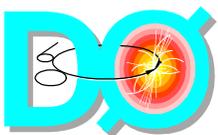
Backups





Pedestal rms vs Preamp cap.

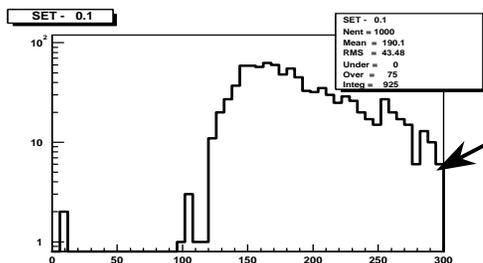
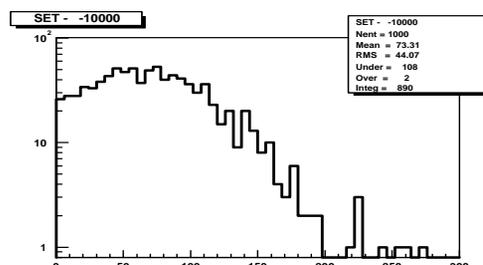
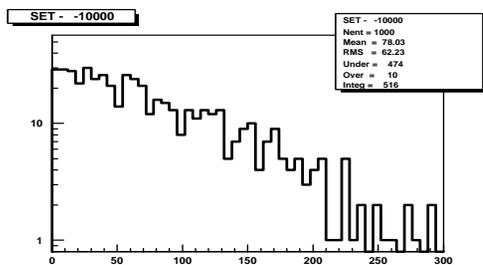
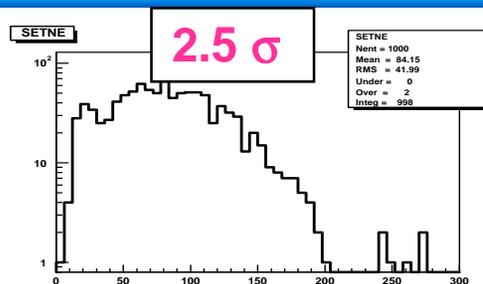
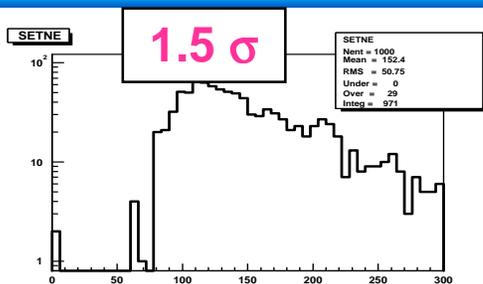




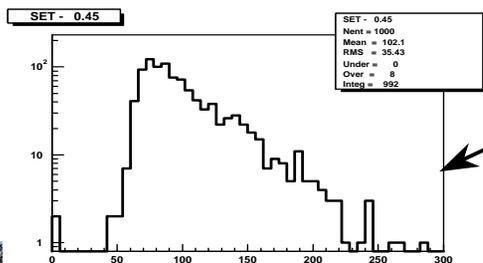
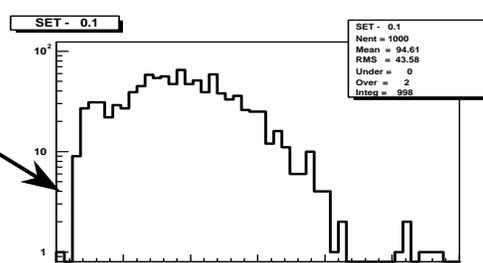
Scalar ET

Gregorio Bernardi

Large variation of Scalar ET with cell energy cut when using low thresholds



100 MeV cell threshold



450 MeV cell threshold

