Energy Method Selections

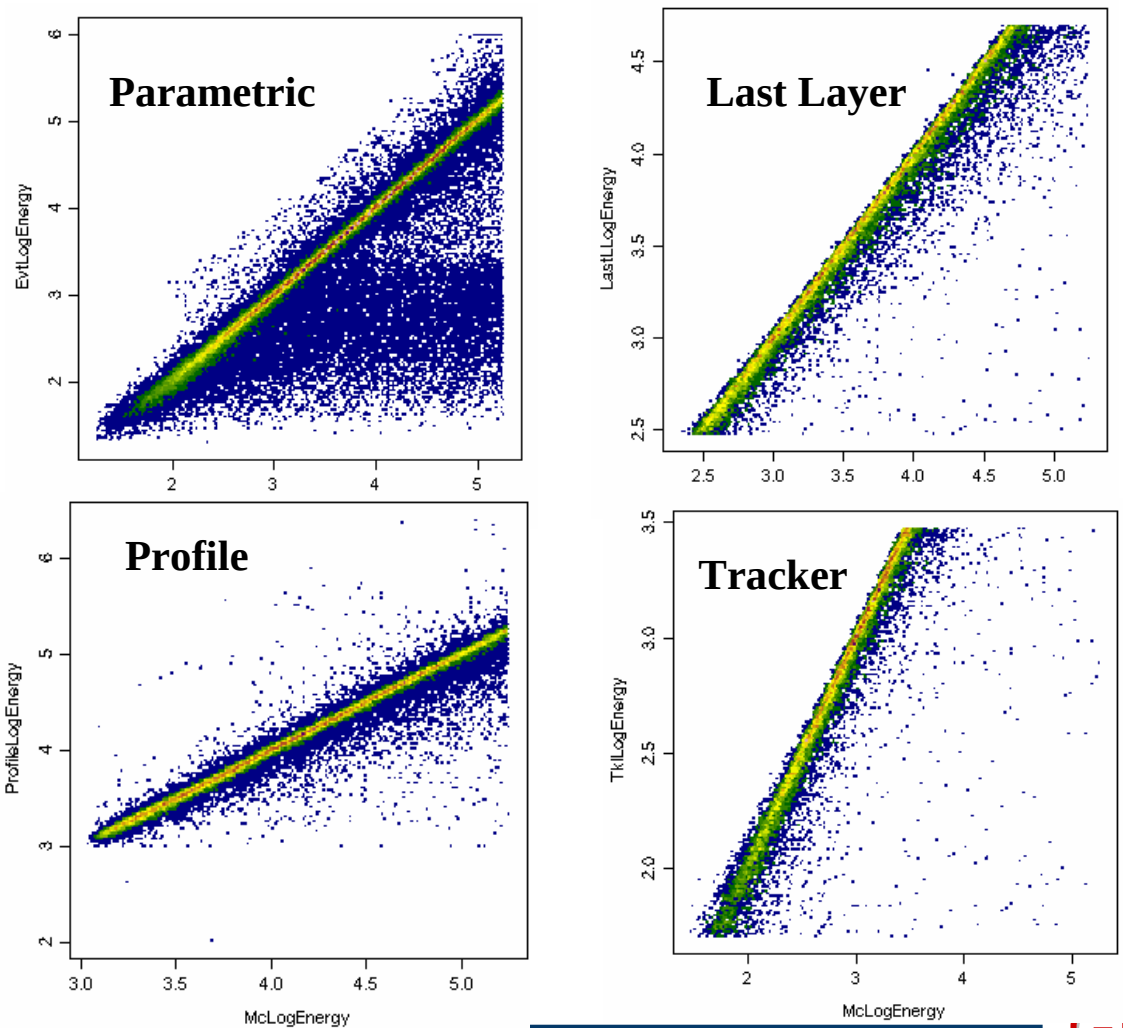
Data Set: All Gamma (GR-HEAD1.615)

4 Methods

3 Only cover a part of Glast Phase Space

Each describes its "quality" using different variables

How to choose which to use for each event?



Begin comparison by determining the Correction method that results in the energy closest to the MC Truth

Results summarized in the following table:

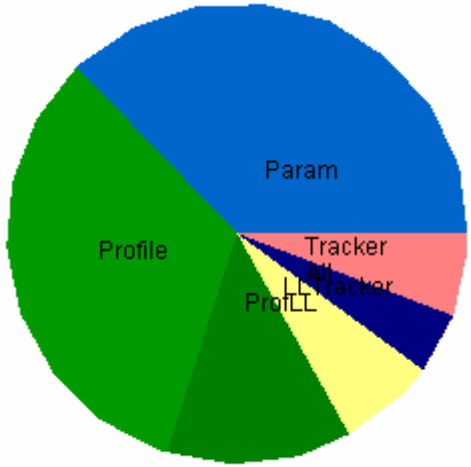
Method	% Computed	% Best Est.
Parametric	100	63.6
Profile	49.9	24.7
Last Layer	23.4	5.5
Tracker	16.5	6.3

Only Parametric Available: 37.7%

This tends to be the Local Land Fill (City Dump!)
Unfortunately there are too many events here to simply throw out.

Intercomparison Method: For each event determine the Energy Correction Method that gives an energy closest to the MC Truth.

Not all Methods report an energy for all events



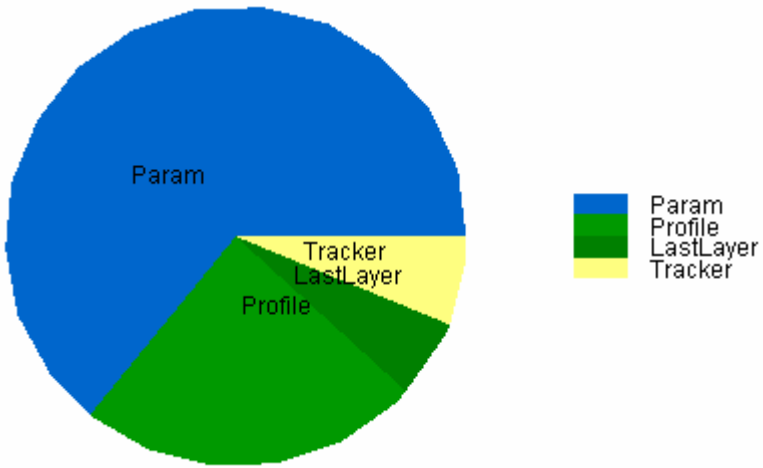
Break into classes according to which Energy Corr. methods were calculated:

1) **Param - Parametric only**
2) **Profile - Profile & Parametric**
3) **Tracker – Tracker & Parametric**
4) **Last Layer – Last Layer & Parametric**
5) **ProfLL – Profile, Last Layer & Param.**
6) **LLTracker – Last Layer, Tracker & Param.**

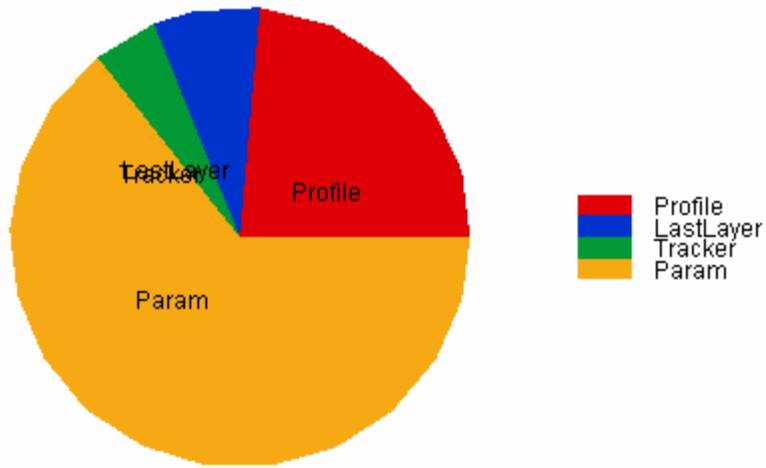
Perform a CT based selection independently for each catagory: 5 CTs

Combine CTs to compute a BestEnergy for the event.

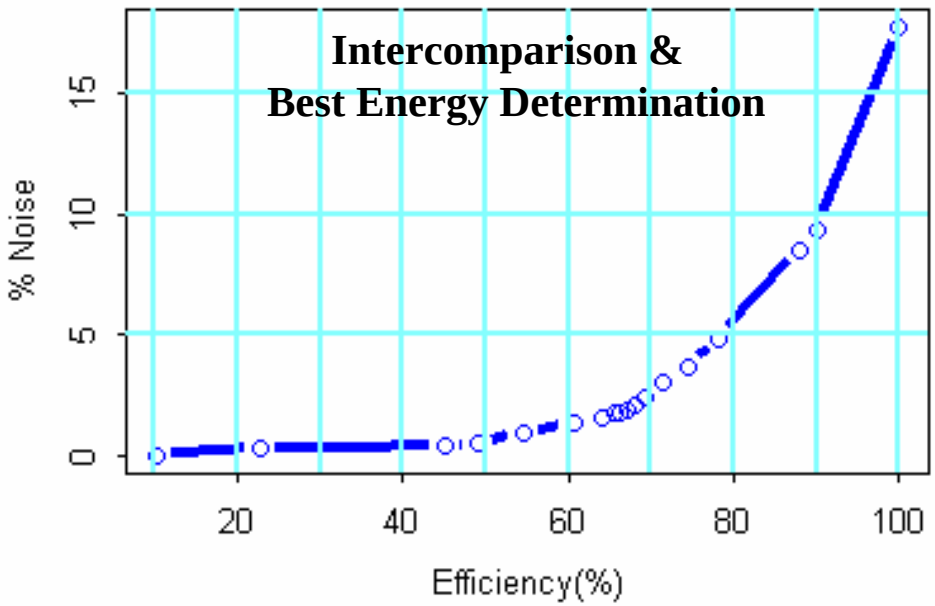
MC Truth

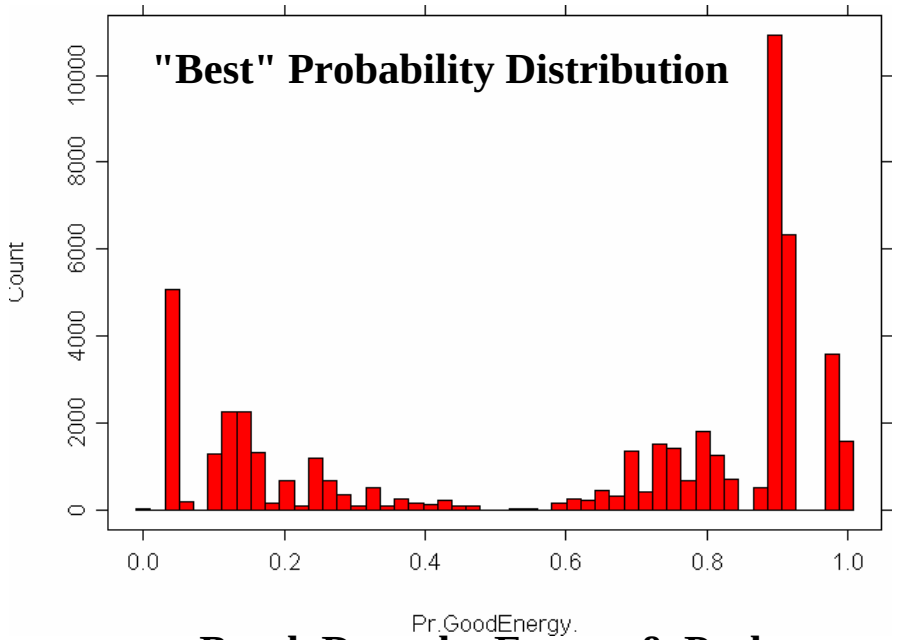


CT Prediction

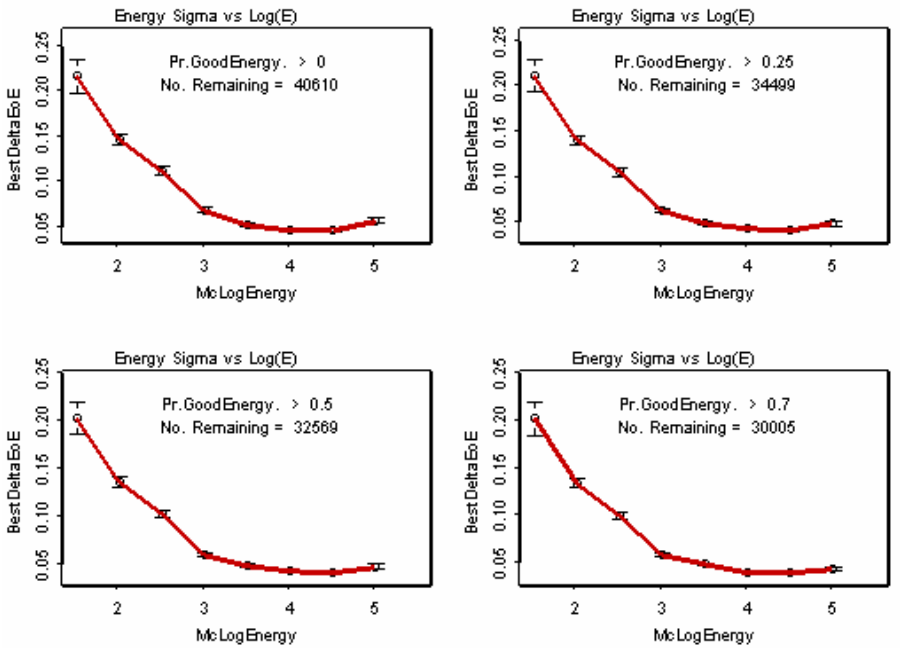


Then build 3 more CTs Clipped the tails....

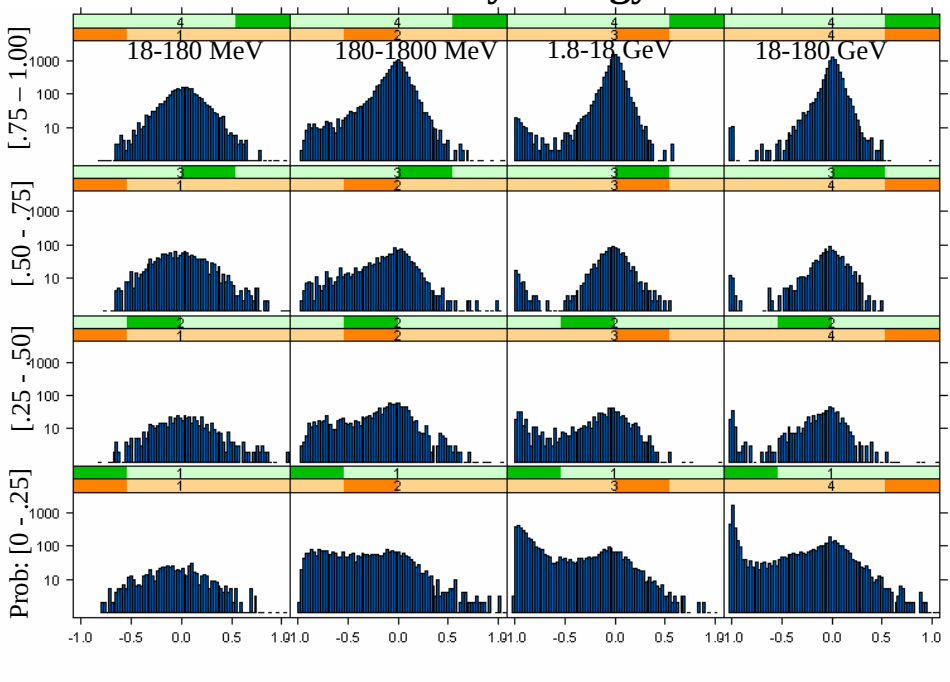




Resolutions for Different Prob. Cuts



Break Down by Energy & Prob



Intercomparison Method Conclusions

1) The best energy resolution is achieved by combining all the results

2) The Last Layer / Tracker methods have the smallest overshoot problems
- **Cover the smallest phase-space**
- **Based on observed correlations**

3) Profile Fit demonstrates that a detailed fit to the 3D energy depositions works and accomplishes in a single approach both inter tower gaps and leakage corrections.

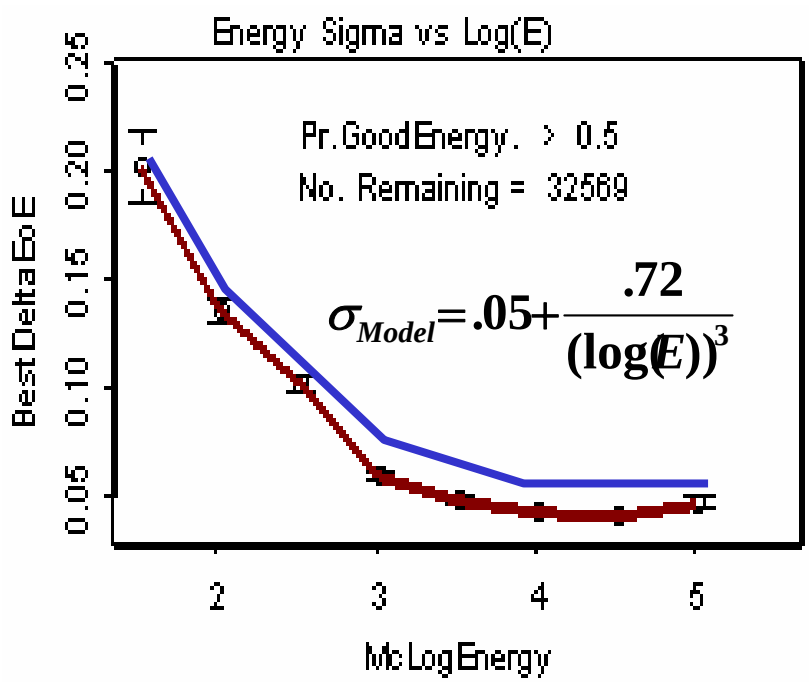
4) Parametric method provides a floor from which to improve.
- **Assumes a factorized model of inter tower gaps and leakage correction.**

5) Intercomparison Method suffers from:
- **Irregularity of which methods are available event-to-event**
- **Each Method has its own self description indicating how well it did (e.g. Profile has a χ^2, Last Layer has a relative energy error, etc.)**
- **The above leads to ambiguities and complexity**
  ... total of 8 CT's!

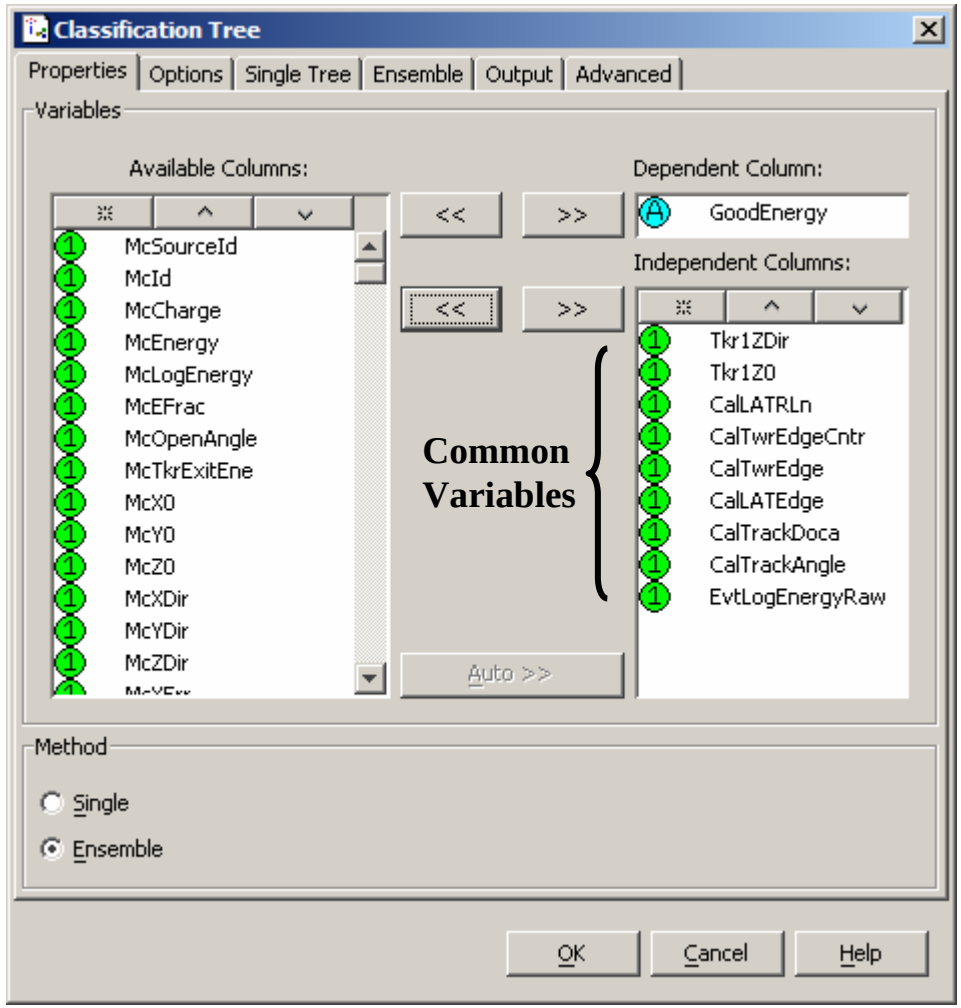
Alternative: Direct Comparison Against an External Resolution Model

Second Method: **Compare each Energy Correction Method against a common External model. Select Method with the highest probability in each event for both the energy & final probability of being "Good"**

Resolution Model: Parametric Rep. of Data



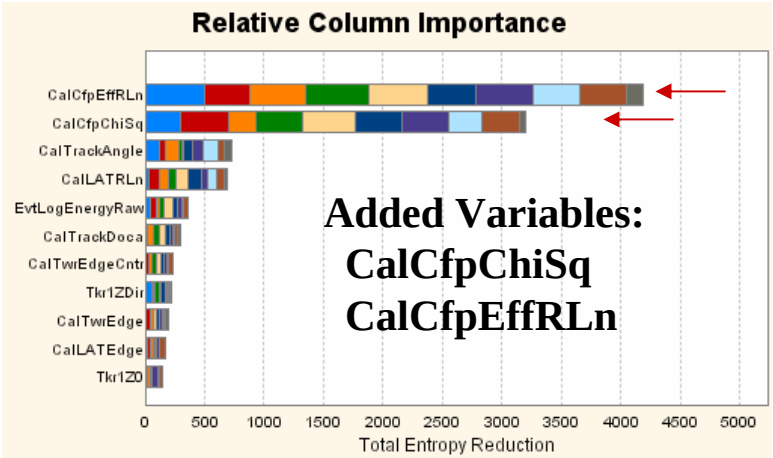
$$Good \equiv \frac{\Delta E}{E_{MC}} \leq N \cdot \sigma_{Model}$$

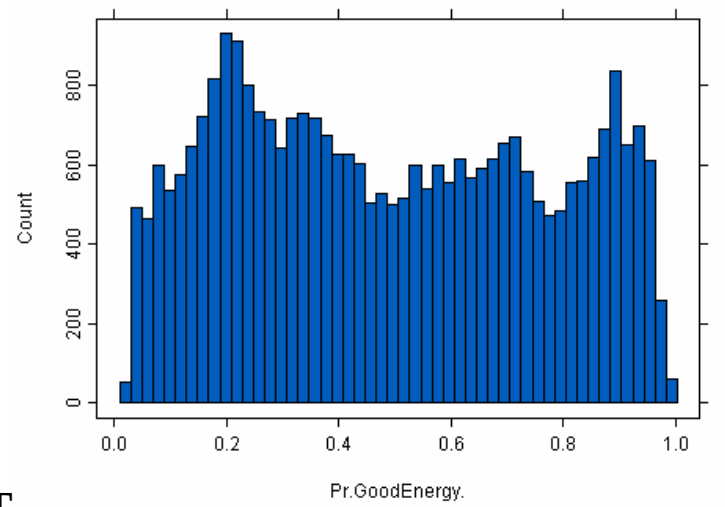


The Resulting 4 CTs

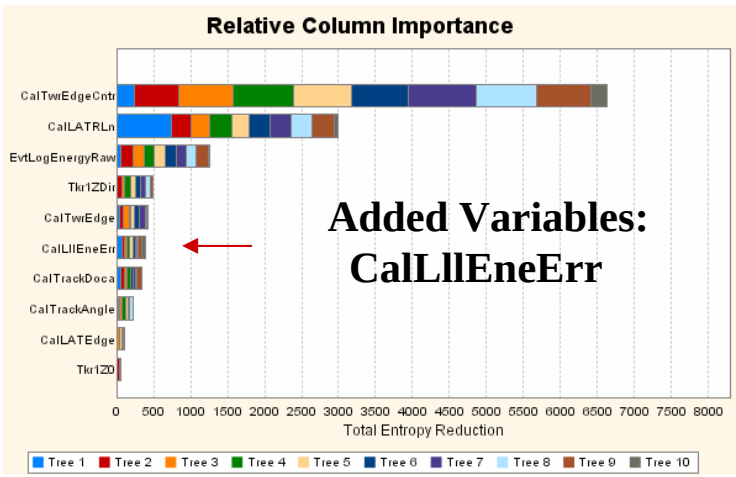
← Indicates Added Variables

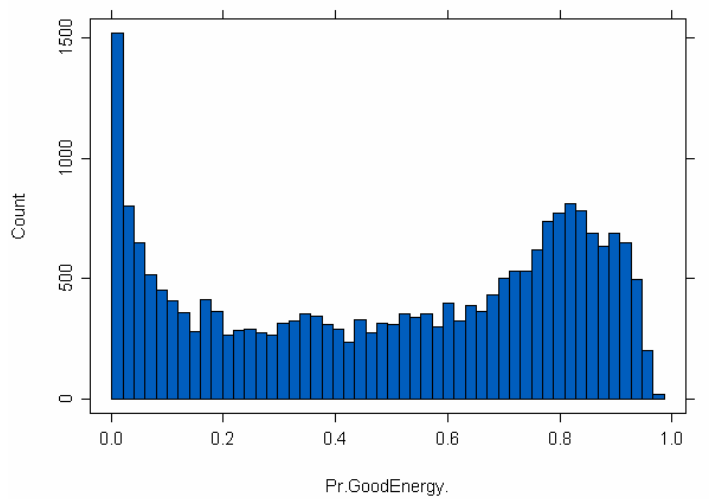
Profile CT



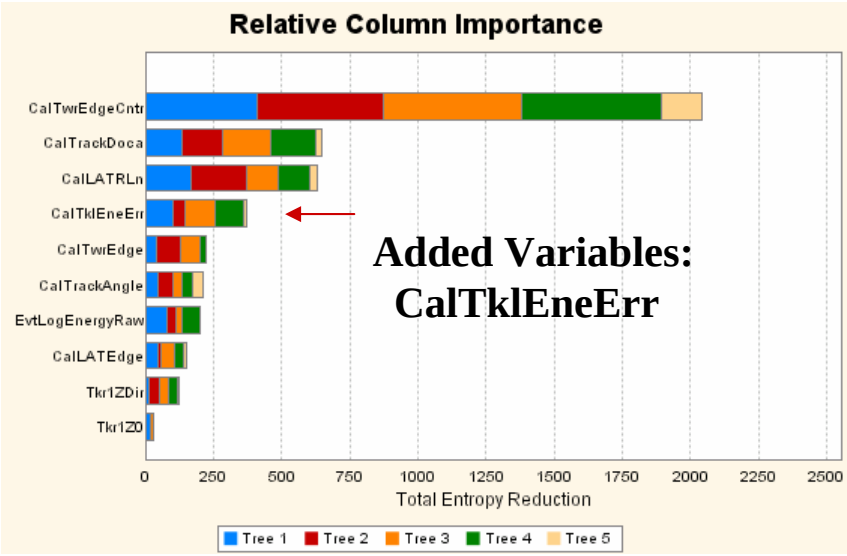


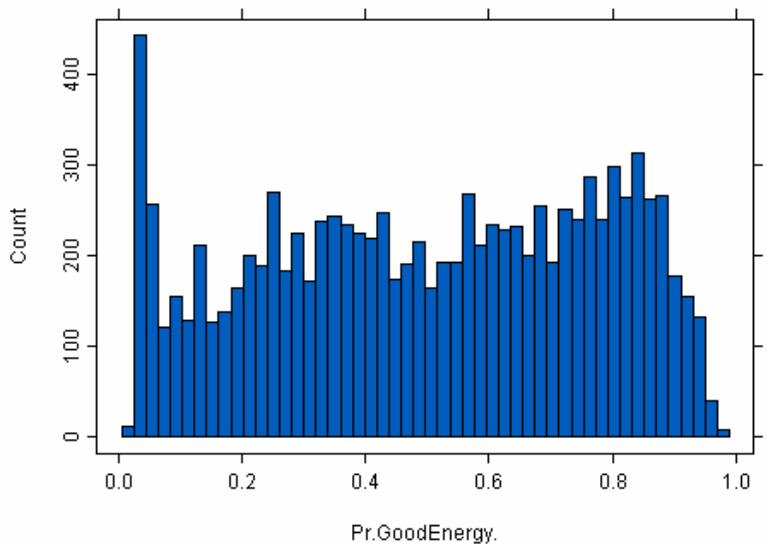
Last Layer CT



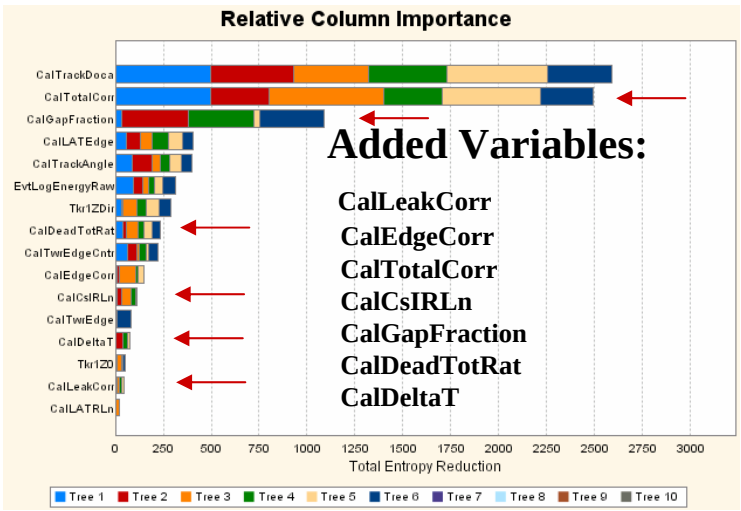


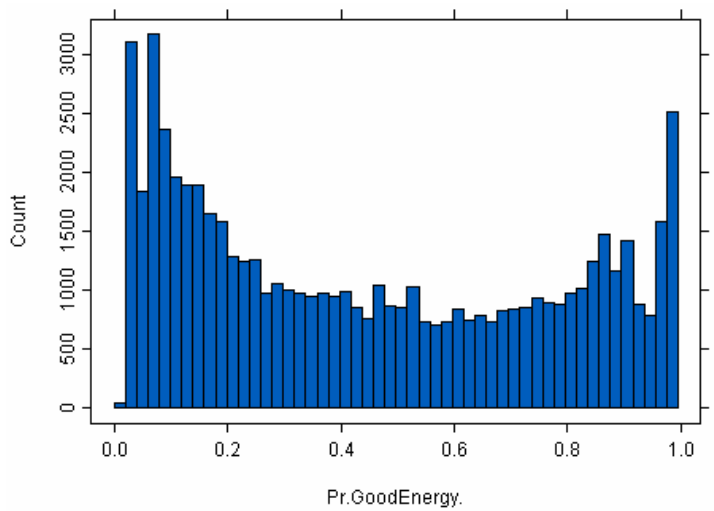
Tracker CT

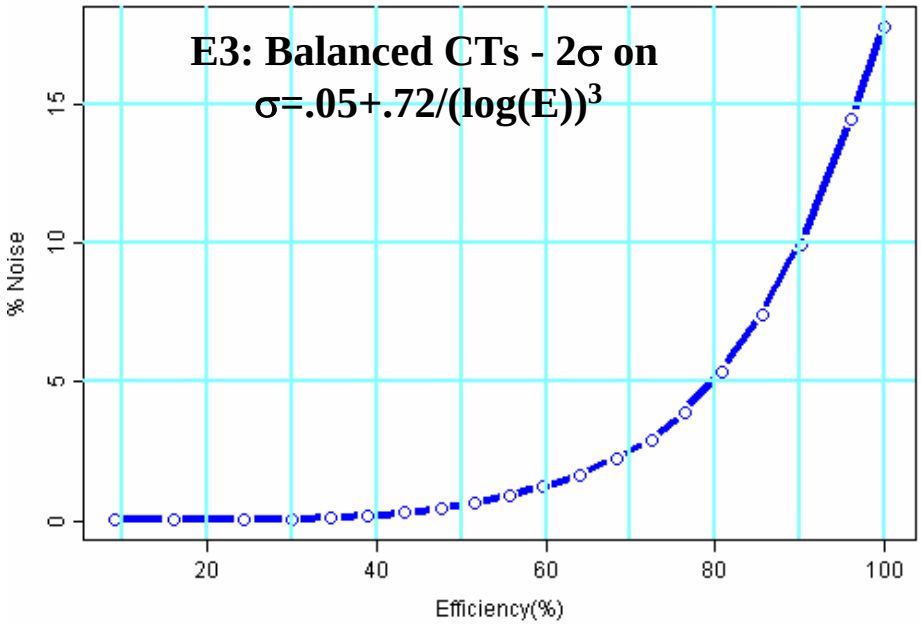


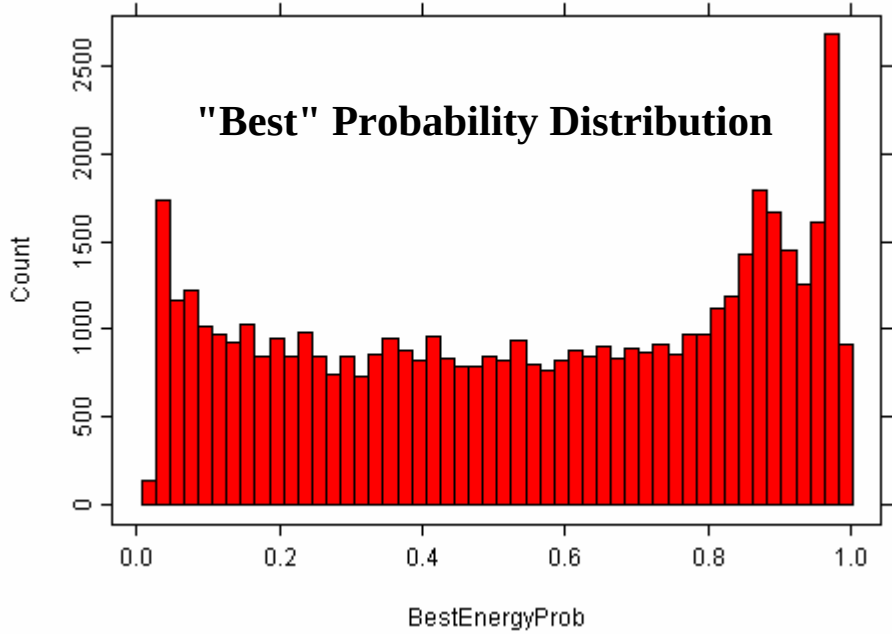


Parametric CT

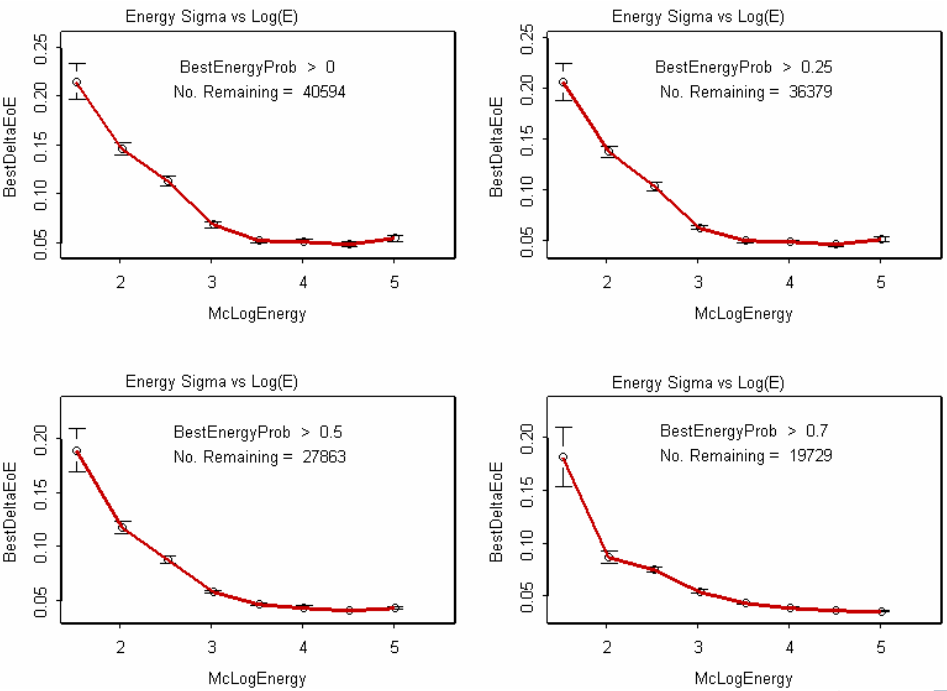




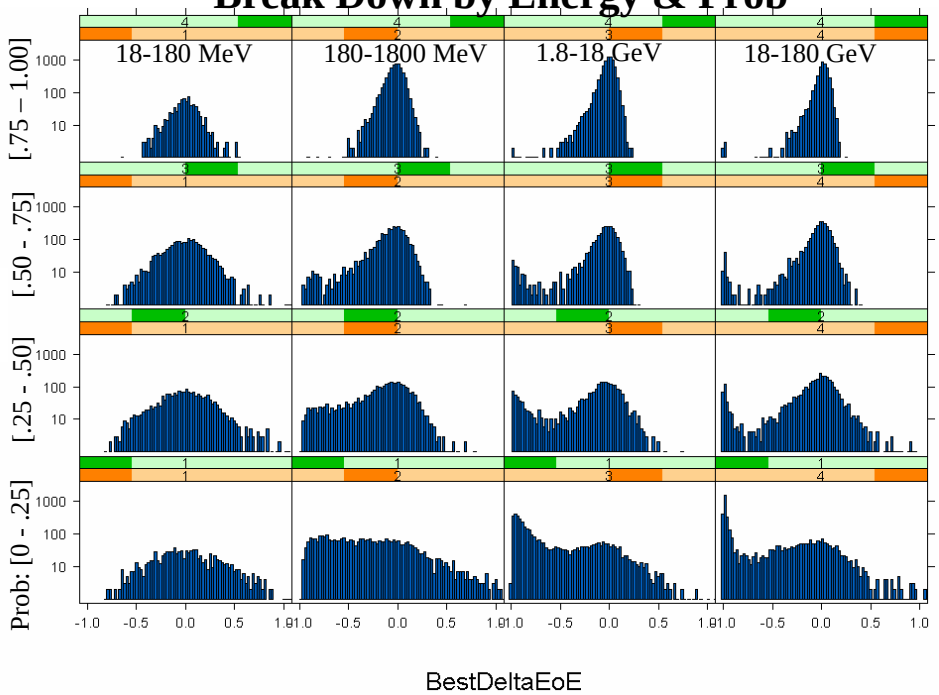


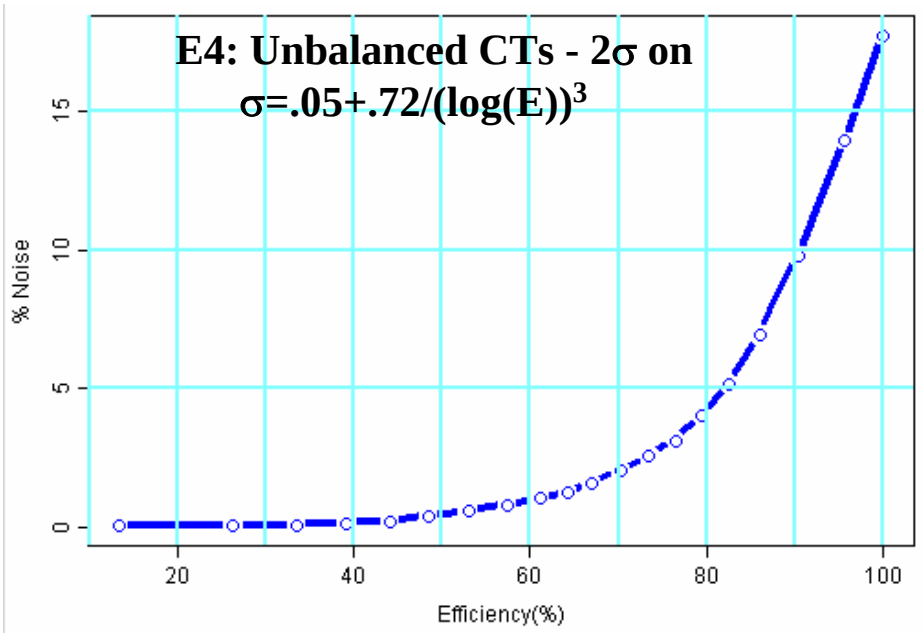


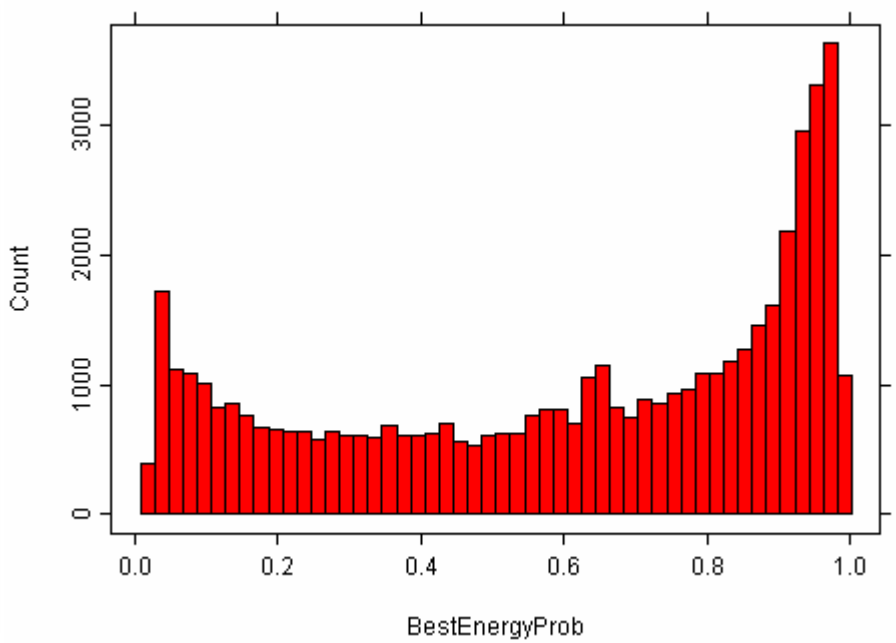
Resolutions for Different Prob. Cuts

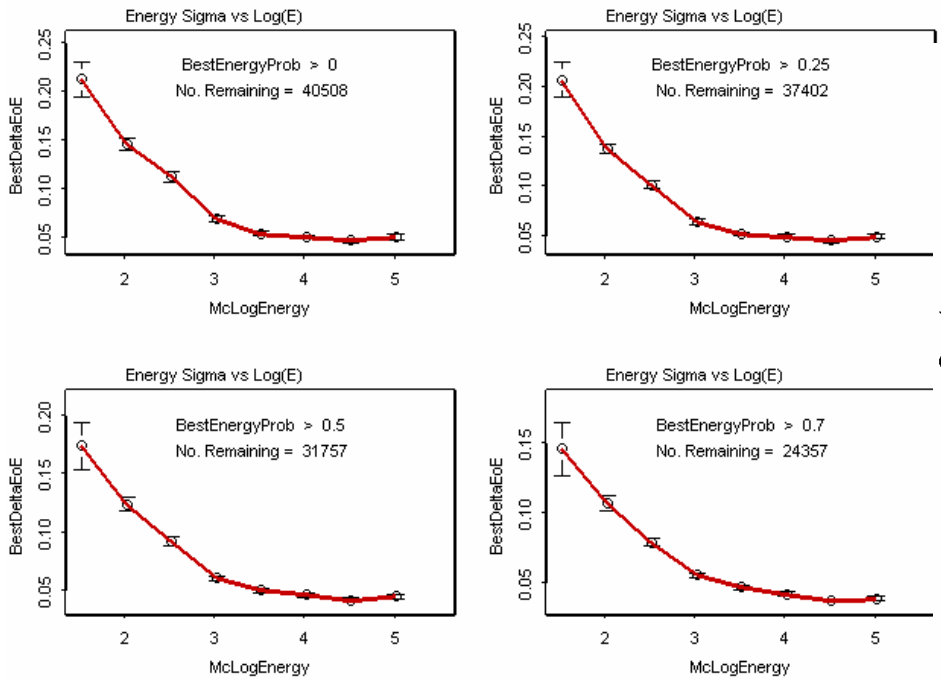


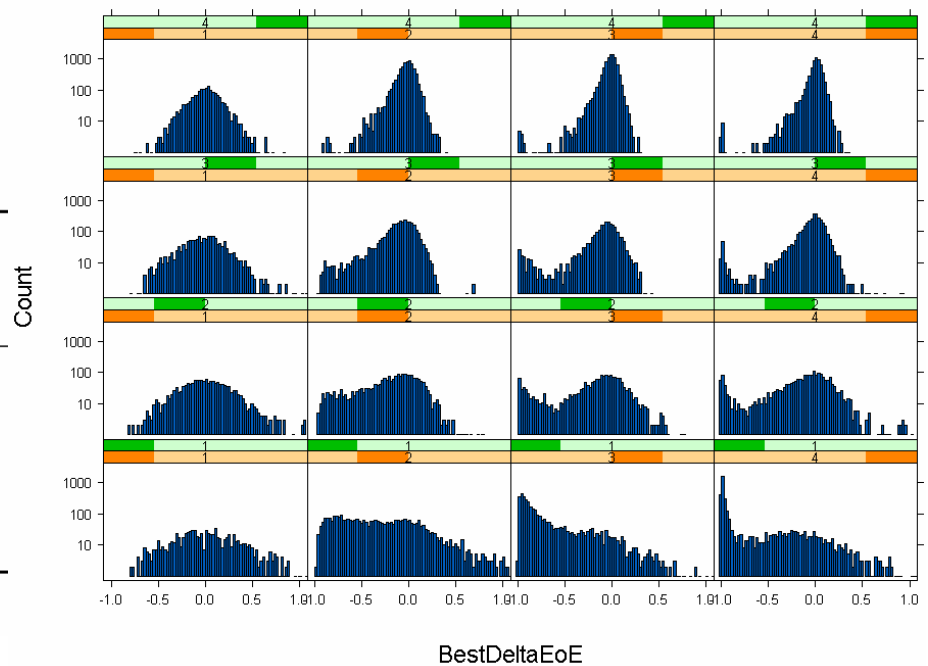
Break Down by Energy & Prob

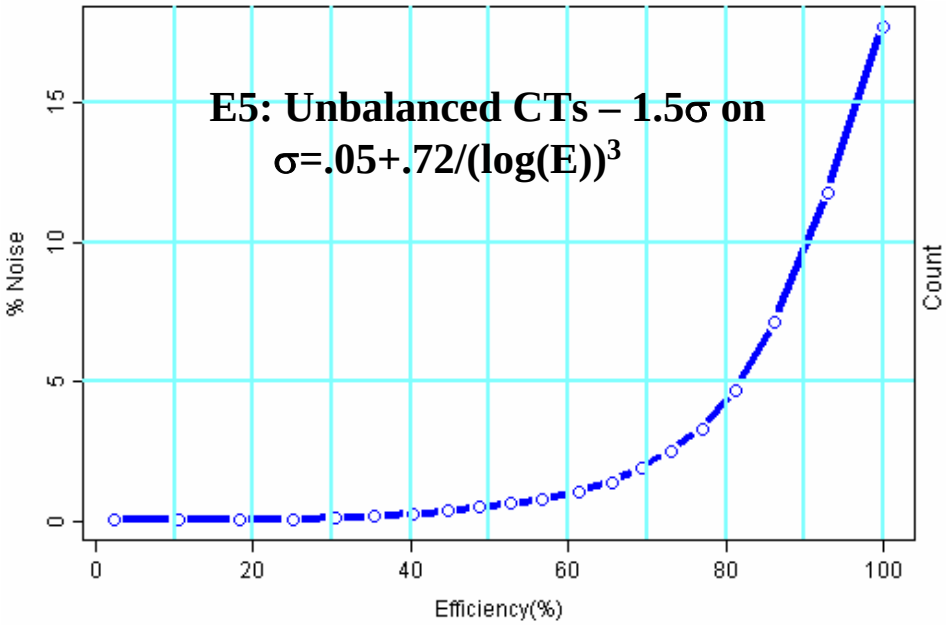


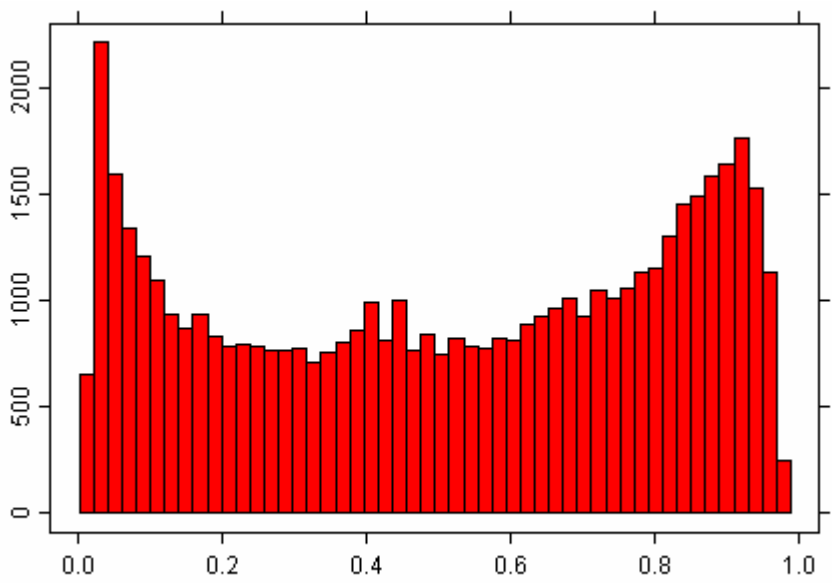

E4: Unbalanced CTs - 2σ on
σ=.05+.72/(log(E))^3
% Noise
Efficiency(%)

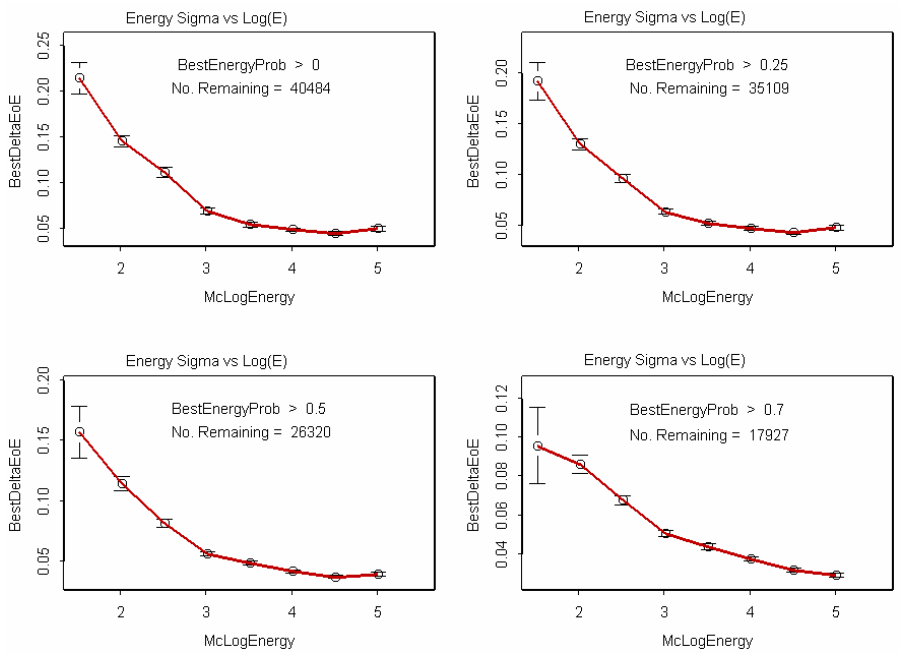

Count
BestEnergyProb

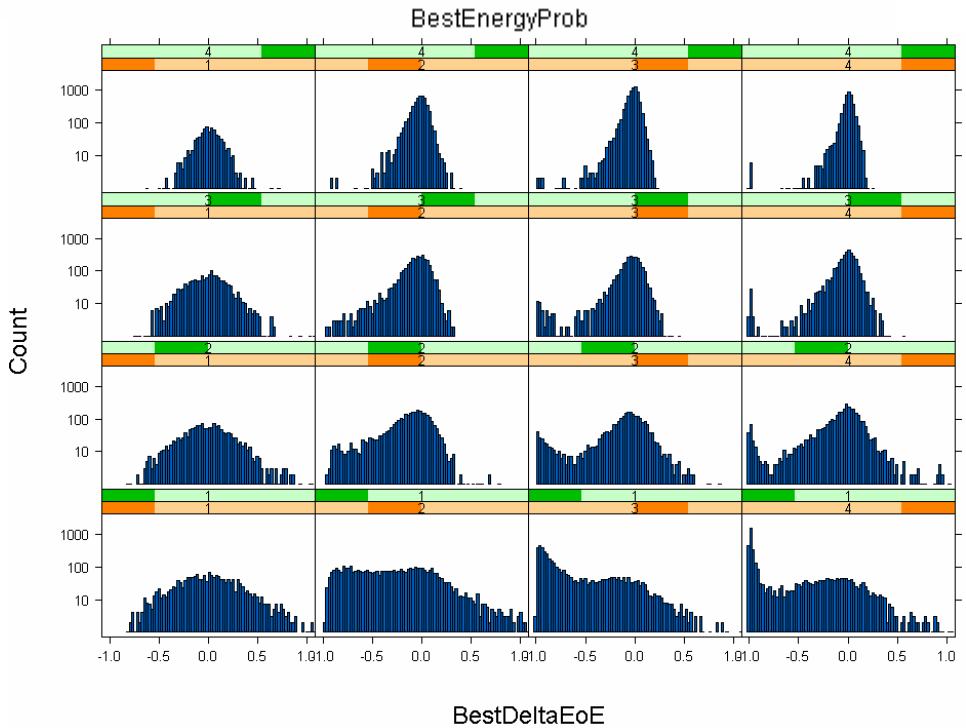

Energy Sigma vs Log(E)
BestEnergyProb > 0
No. Remaining = 40508
Energy Sigma vs Log(E)
BestEnergyProb > 0.25
No. Remaining = 37402
Energy Sigma vs Log(E)
BestEnergyProb > 0.5
No. Remaining = 31757
Energy Sigma vs Log(E)
BestEnergyProb > 0.7
No. Remaining = 24357
BestDeltaEoE
McLogEnergy

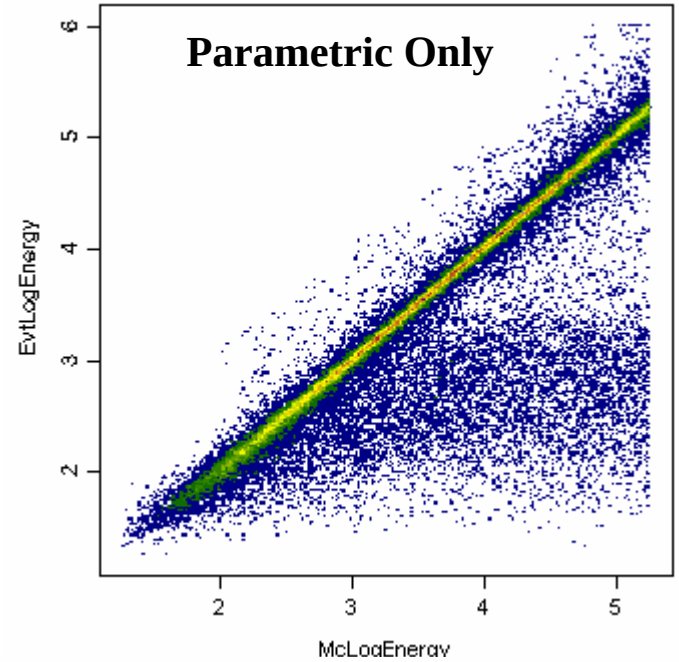

Count
BestDeltaEoE

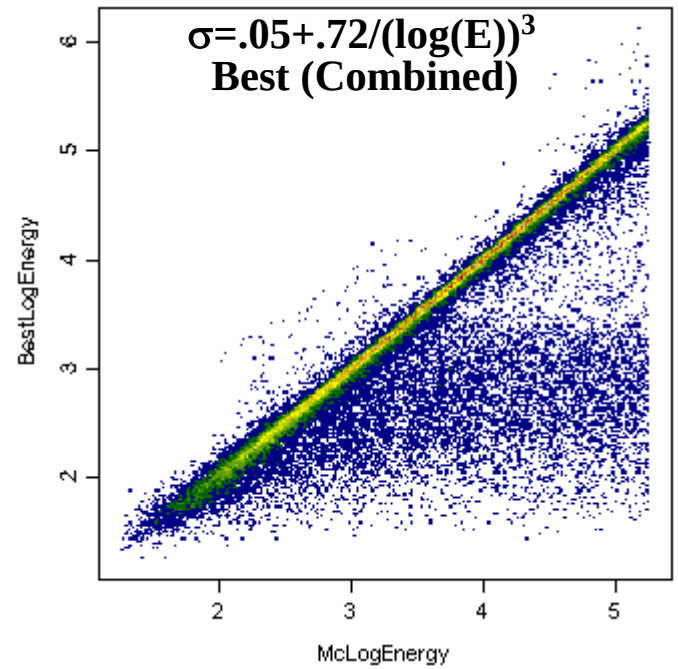

E5: Unbalanced CTs – 1.5σ on
σ=.05+.72/(log(E))^3
% Noise
Efficiency(%)

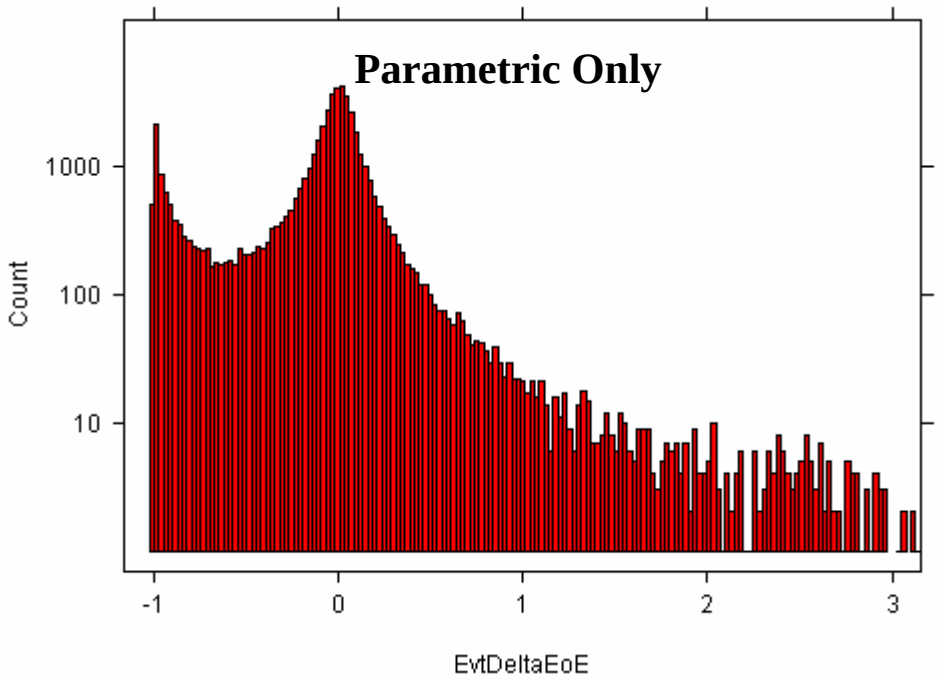

Count

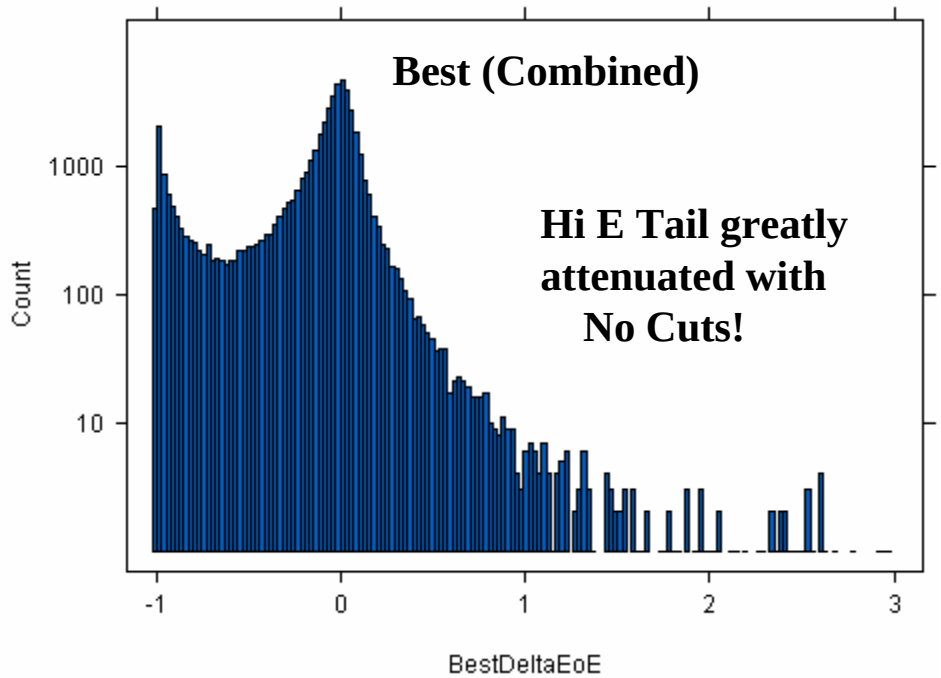

Energy Sigma vs Log(E)
BestEnergyProb > 0
No. Remaining = 40484
Energy Sigma vs Log(E)
BestEnergyProb > 0.25
No. Remaining = 35109
Energy Sigma vs Log(E)
BestEnergyProb > 0.5
No. Remaining = 26320
Energy Sigma vs Log(E)
BestEnergyProb > 0.7
No. Remaining = 17927
BestDeltaEoE
McLogEnergy

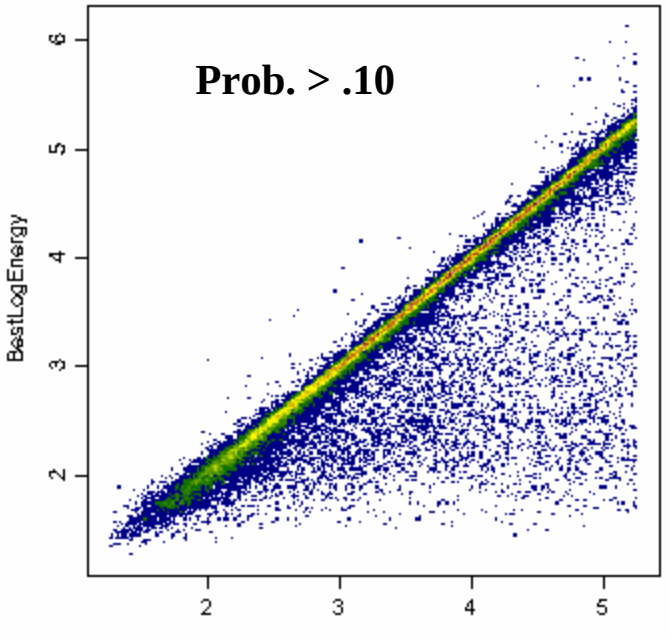

BestEnergyProb
Count
BestDeltaEoE

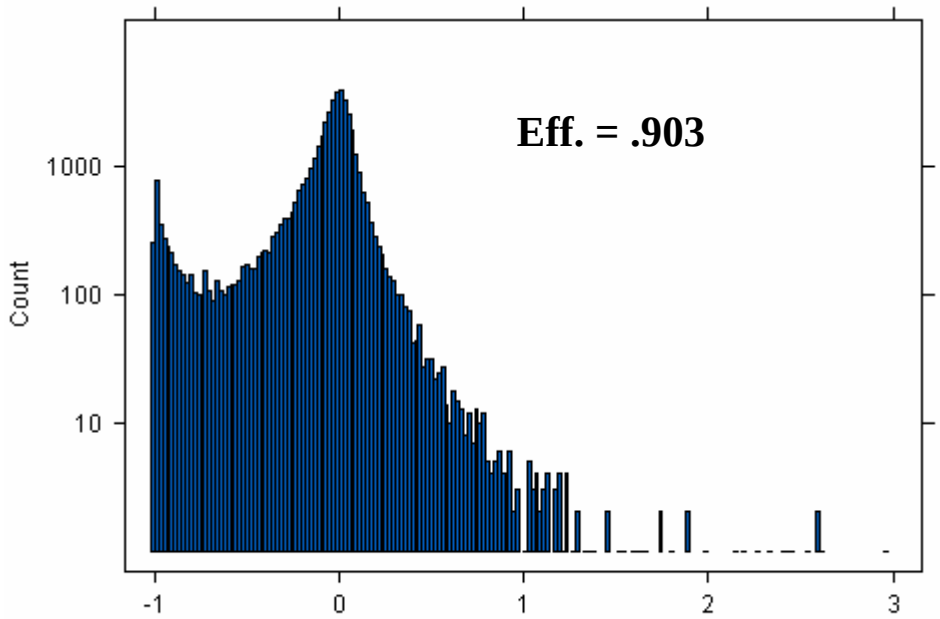

Parametric Only
EvtLogEnergy
McLogEnergy

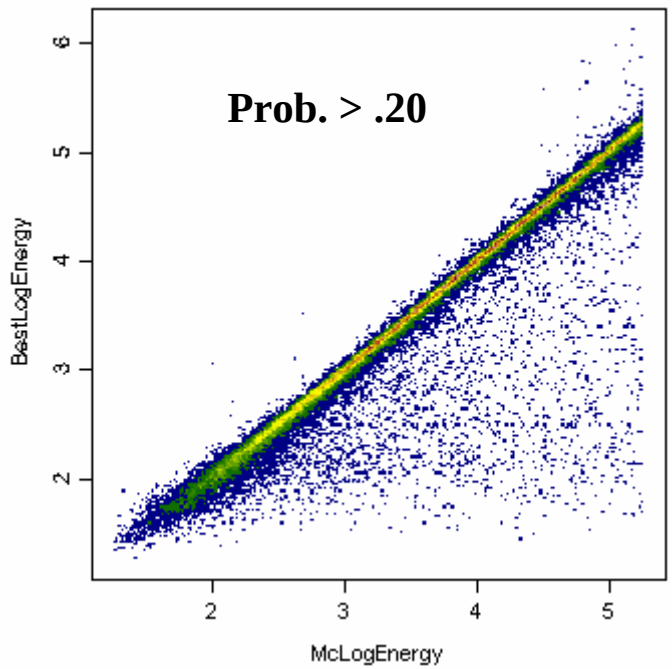

E4: Unbalanced CTs - 2σ on
σ=.05+.72/(log(E))^3
Best (Combined)
BestLogEnergy
McLogEnergy

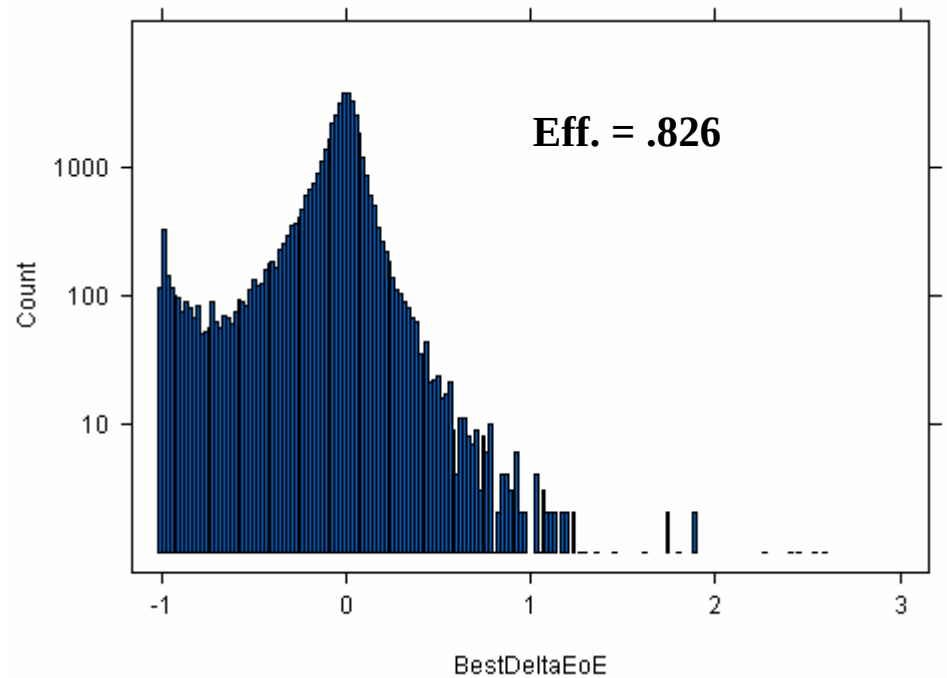

Parametric Only
Count
EvtDeltaEoE

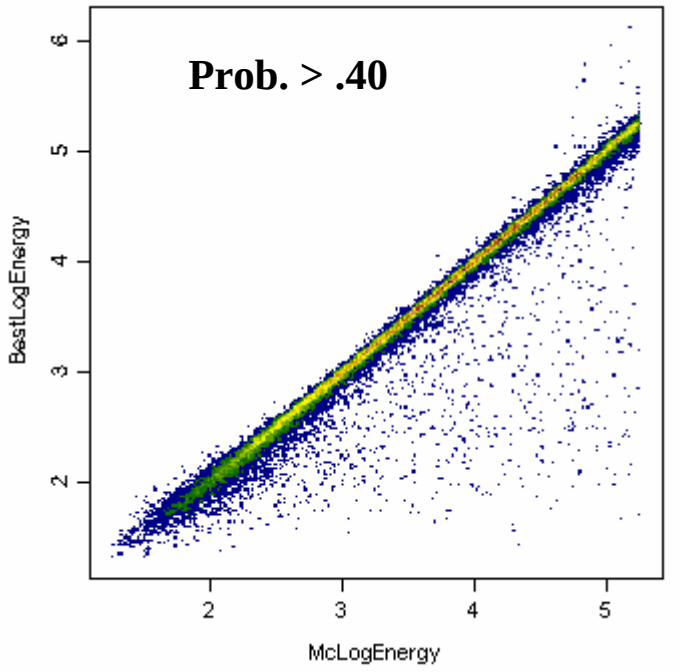

Best (Combined)
Hi E Tail greatly
attenuated with
No Cuts!
Count
BestDeltaEoE

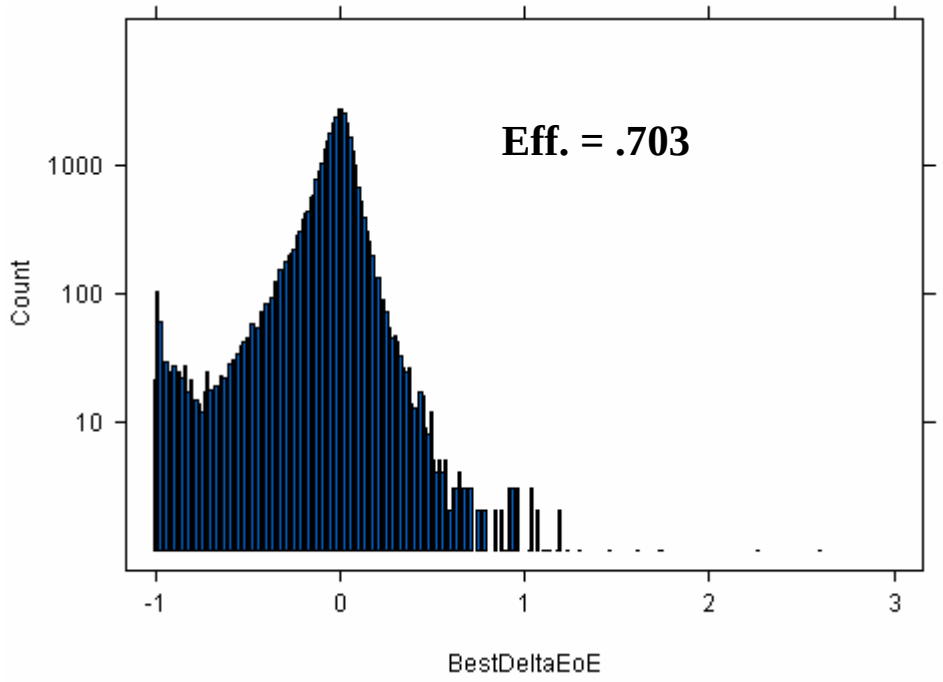

Prob. > .10
BestLogEnergy
2
3
4
5
6


Eff. = .903
Count
1000
100
10
-1
0
1
2
3


Prob. > .20
BestLogEnergy
McLogEnergy
2
3
4
5
6


Eff. = .826
Count
1000
100
10
-1
0
1
2
3
BestDeltaEoE





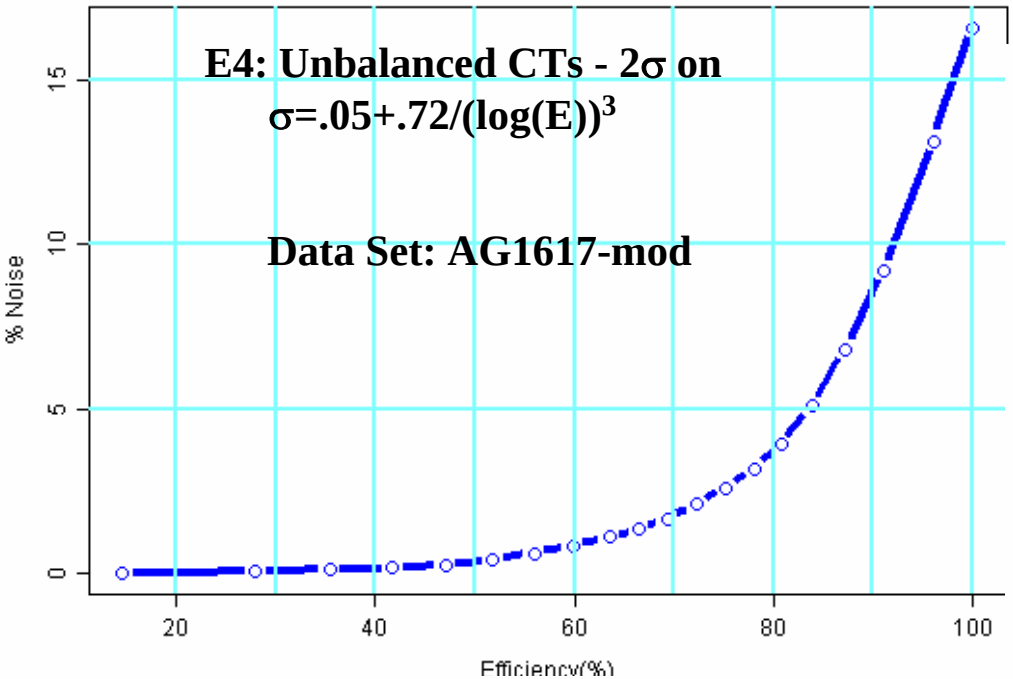
Conclusions

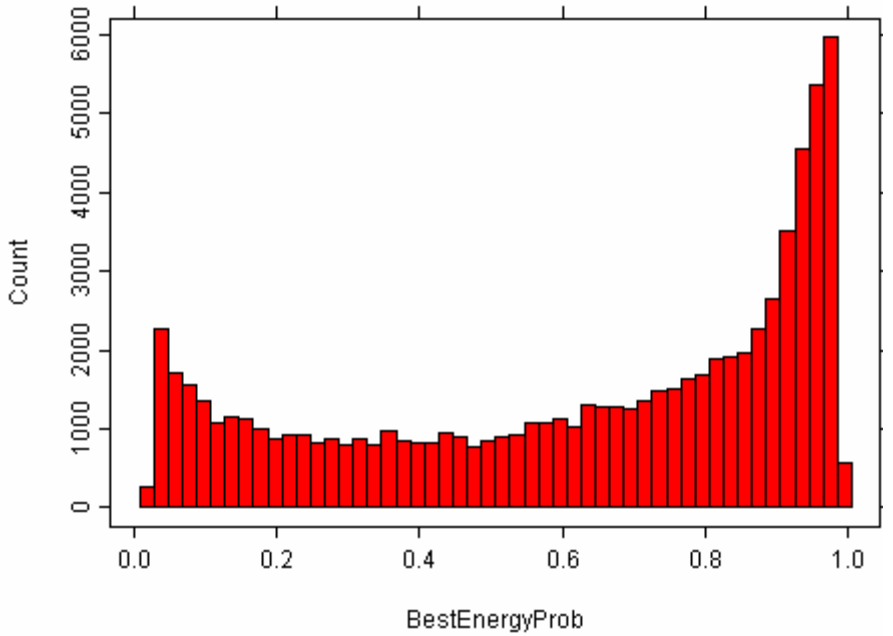
The Direct Comparison Method Offers

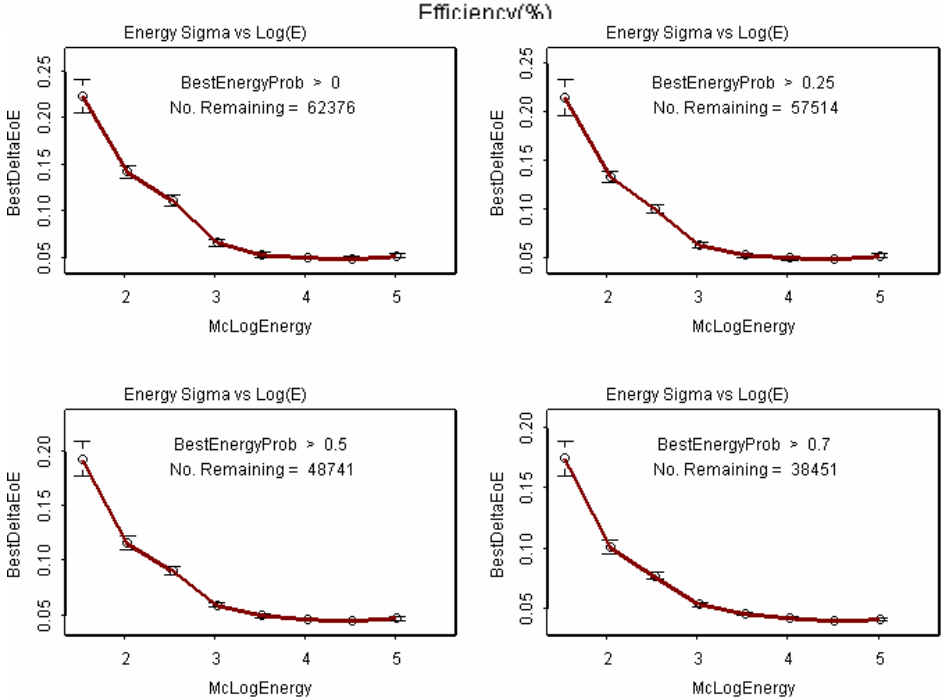
- **Simplicity**
- **Avoids the Ambiguities of the Intercomparison Method**
- **Results in a smooth loss in efficiency as the Prob. Cut in increased**
- **Overall – seems to be the Method of Choice (for now!)**

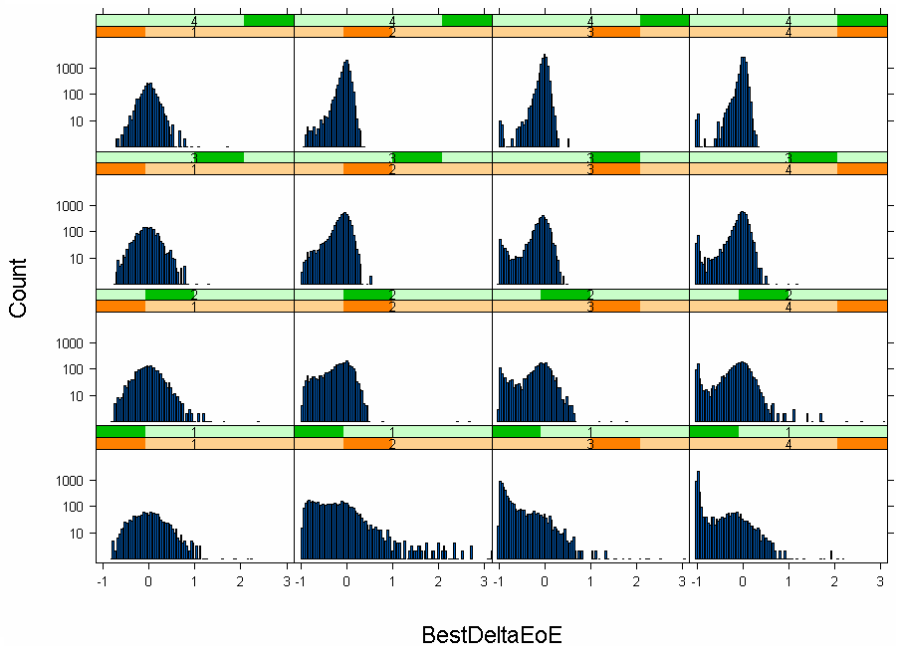
E4: Unbalanced CTs - 2σ on $\sigma=.05+.72/(\log(E))^3$

Data Set: AG1617-mod



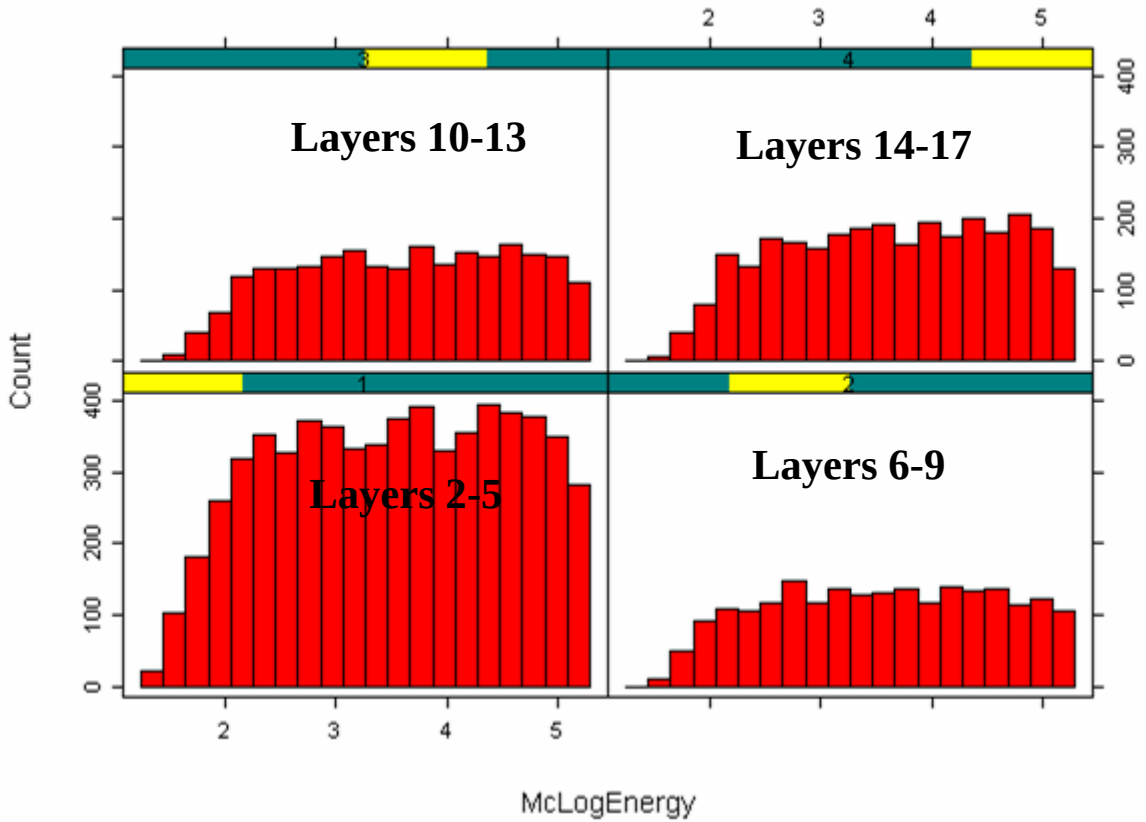






And.....

cos(θ) < -.9



Previously Observed Fall-off at Hi Energy is GONE!!!!

Conclusion: AG1617-mod results very similar to those gotten with AG1615