

Post Processing & Pass4

The time for DC2 is drawing to a close.

However we're still only part ways up the "learning curve" for Bkg. Rej.

Can't quit Now!

This analysis Input: *(repeated)*

- 1) First day of 5B Bkg. Run: dataset v7r3p5 (Includes rocking)
- 2) Extra Galactic Diff: dataset v7r3p5
- 3) All Gamma rep-V7r3p4 dataset, runs 401-800

All these datasets are "CTnew" mean application of the cuts shown by Julie prior to download

Dealing with ACD Ribbons

Ribbon Geometry locations from Joanne:

$Y_{Side} = \min(\text{abs}(\text{Tkr1Y0} - \text{abs}((832.6 - \text{abs}(\text{Tkr1X0})) / \text{Tkr1XDir}) * \text{Tkr1YDir}), 742)$

$Z_{YSide} = \min(\text{abs}(\text{Tkr1Z0} - \text{abs}((832.6 - \text{abs}(\text{Tkr1X0})) / \text{Tkr1XDir}) * \text{Tkr1ZDir}), 800)$

$X_{Side} = \min(\text{abs}(\text{Tkr1X0} - \text{abs}((832.6 - \text{abs}(\text{Tkr1Y0})) / \text{Tkr1YDir}) * \text{Tkr1XDir}), 742)$

$Z_{XSide} = \min(\text{abs}(\text{Tkr1Z0} - \text{abs}((832.6 - \text{abs}(\text{Tkr1Y0})) / \text{Tkr1YDir}) * \text{Tkr1ZDir}), 800)$

$Z_{Top} = \text{ifelse}(\text{abs}(\text{Tkr1X0}) > 503.5, 760.1, \text{ifelse}(\text{abs}(\text{Tkr1X0}) > 179.5, 747.1, 733.7))$

$Y_{SideTop} = \text{abs}(\text{Tkr1Y0} - \text{abs}((Z_{Top} - \text{Tkr1Z0}) / \text{Tkr1ZDir}) * \text{Tkr1YDir})$

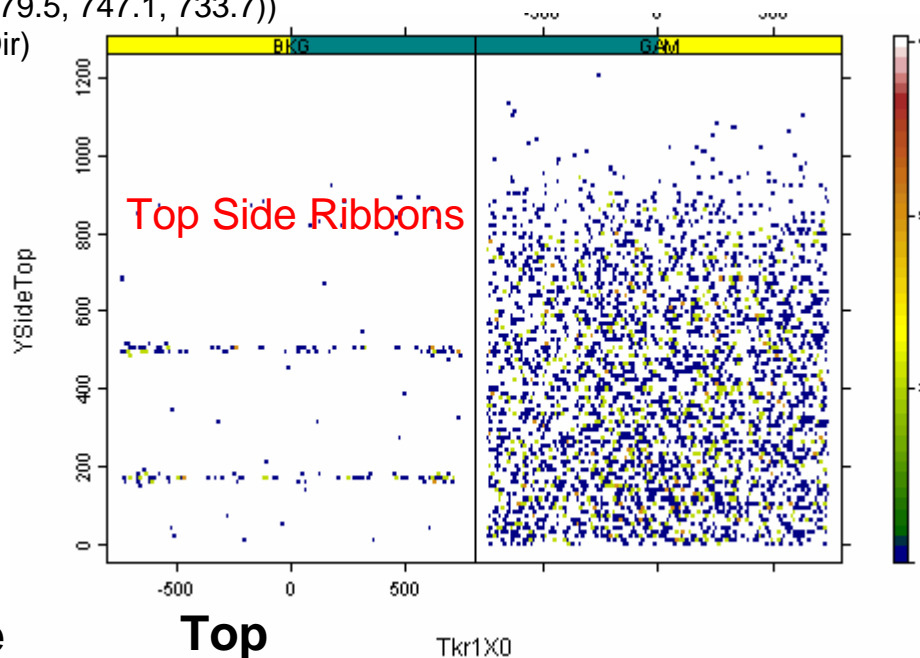
Correlated Events in the Top

$CTBGAM > .35$ &

$McDirErr < .1$

$Tkr1Z0 > 590$

Extend this down the sides
cutting out strips 10 mm wide



Input

Event.Type	
Level Name	Counts
BKG	20406
DIFF	29795
GAM	105090

Y Side

Event.Type	
Level Name	Counts
BKG	19921
DIFF	29334
GAM	103550

X Side

Event.Type	
Level Name	Counts
BKG	19598
DIFF	28878
GAM	102131

Top

Event.Type	
Level Name	Counts
BKG	19442
DIFF	28855
GAM	102044

Tkr1X0

Cut Summary

Bkg: 964 - 4.7%

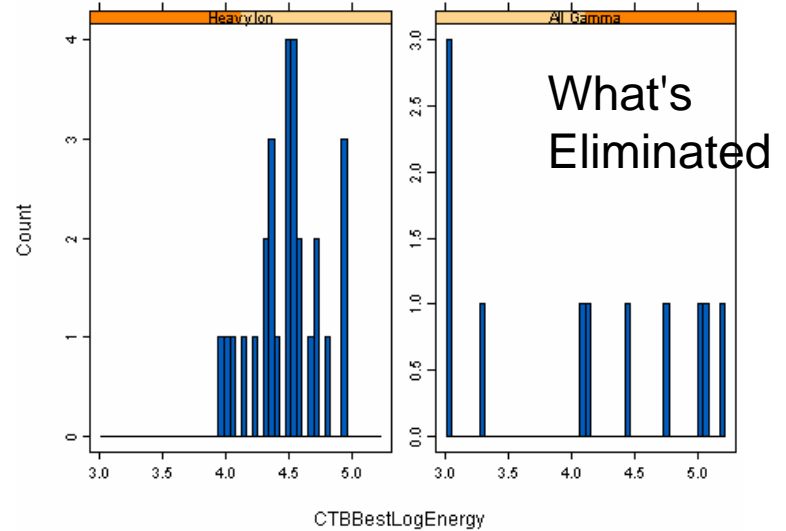
All Gam: 3046 - 2.9%

Heavy Ion Filter

CTBBestEnergy > 1000 & ((CalTransRms - 1.5*Tkr1ToTTrAve) < 5)
& CTBGAM > .5

Event.Type	
Level Name	Counts
BKG	19399
DIFF	28855
GAM	102030

Cut Summary
 Bkg: 43 - .22%
 All Gam: 14 - .014%

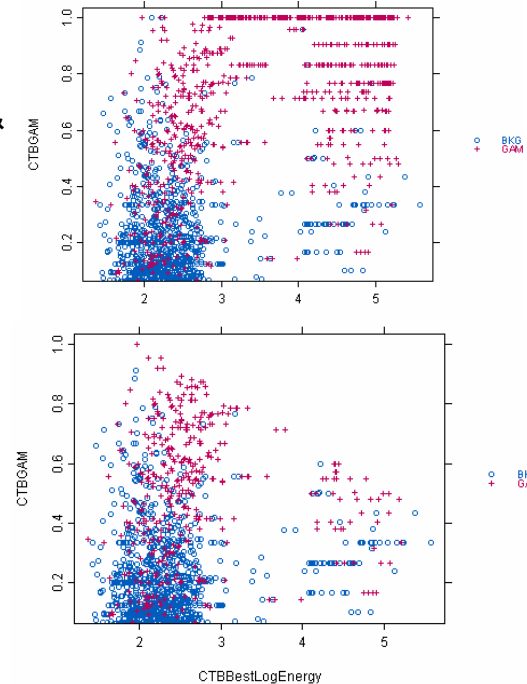


Scrambled Tracks Filter

(Tkr1FirstLayer - Tkr2FirstLayer) <= 0 & Tkr2FirstLayer > 2 & Tkr2TkrHDoca > 10 &
(CTBGAM+.16*CTBBestLogEnergy) < 1.32

Event.Type	
Level Name	Counts
BKG	18115
DIFF	28581
GAM	101595

Cut Summary
 Bkg: 1284 - 6.6%
 All Gam: 435 - .42%



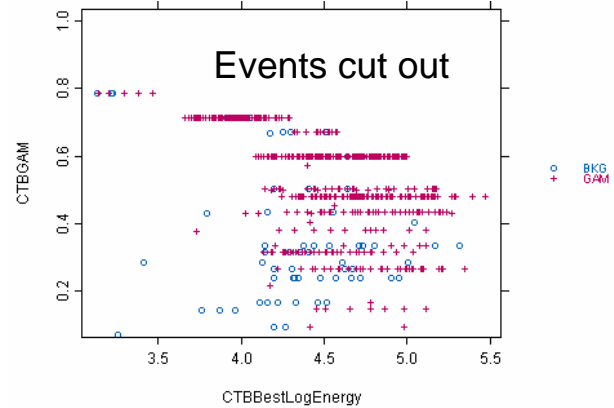
Hi Energy e- Filter

$((\min(\text{abs}(\text{Tkr1XDir}), \text{abs}(\text{Tkr1YDir})) < .01 \ \& \ \text{Tkr1DieEdge} < 10 \ \& \ \text{AcdActiveDist3D} > 0 \ \& \ \text{AcdActDistTileEnergy} > .2) \ | \ (\text{Tkr1SSDVeto} < 7 \ \& \ \text{AcdActiveDist3D} > -3 \ \& \ \text{AcdActDistTileEnergy} > .15) \ | \ (\text{AcdActiveDist3D} > (-30 + 30 * (\text{Tkr1FirstLayer} - 2))) \) \ \& \ (\text{CTBGAM} + .17 * \text{CTBBestLogEnergy}) < 1.75$

Event.Type	
Level Name	Counts
BKG	18028
DIFF	28580
GAM	101004

Cut Summary

Bkg: 87 - .48%
All Gam: 591 - .59%



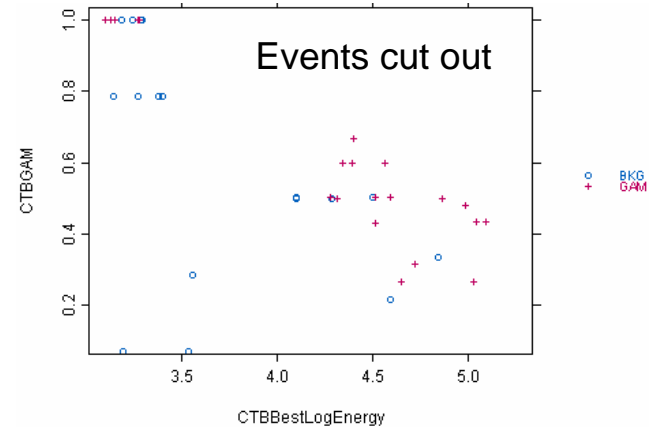
Cosmic Proton Filter

$\text{Tkr1FirstLayer} < 6 \ \& \ \text{AcdActiveDist3D} > -80 \ \& \ ((\text{AcdActDistTileEnergy} + \text{AcdActiveDist3D}/100) > 1)$

Event.Type	
Level Name	Counts
BKG	18008
DIFF	28580
GAM	100983

Cut Summary

Bkg: 20 - .11%
All Gam: 21 - .021%



Global Ribbon Extension & AcdCornerDoca Extension

(AcdRibbonEnergy > .2 & AcdRibbonActDist > -10) |

(AcdCornerDoca > -5 & AcdCornerDoca < 50 & CTBTkrLATEdge < 200)

Event.Type	
Level Name	Counts
BKG	15364
DIFF	26163
GAM	99094

Cut Summary

Bkg: 50 - .33%

All Gam: 439 - .44%

No Plots...

Anti-Correlated Filter

CTBBestEnergy < 500 &

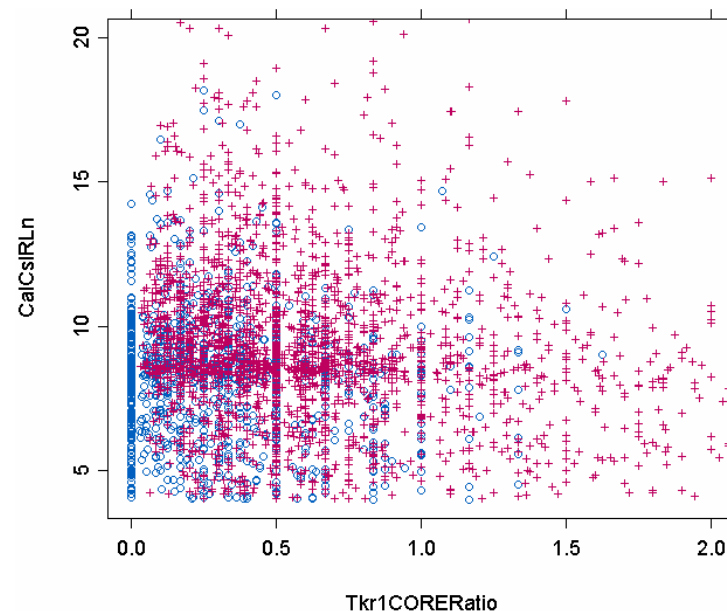
((CalCsIRLn + 2.5*Tkr1CORERatio) < 8 | Tkr1CORERatio < .03)

Event.Type	
Level Name	Counts
BKG	9978
DIFF	21355
GAM	95864

Cut Summary

Bkg: 5386 - 35%

All Gam: 3280 - 3.3%

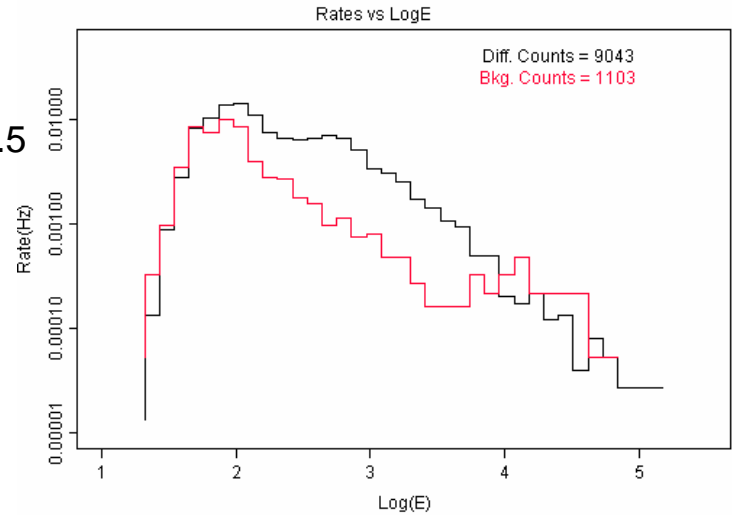
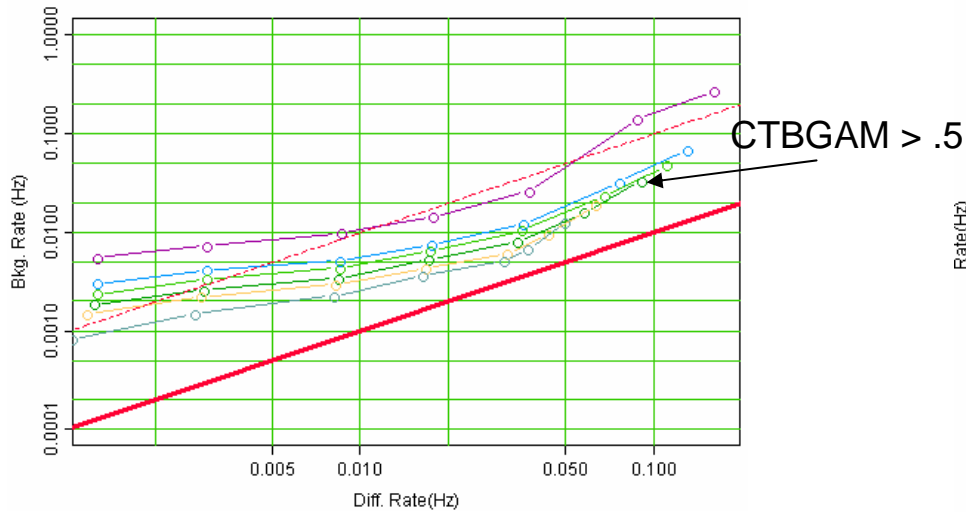


Last – Boost CTBGAM Prob. below 3.2 GeV

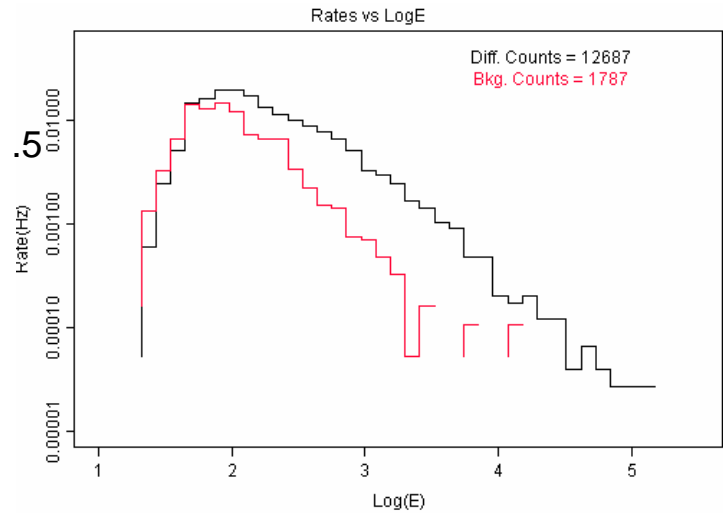
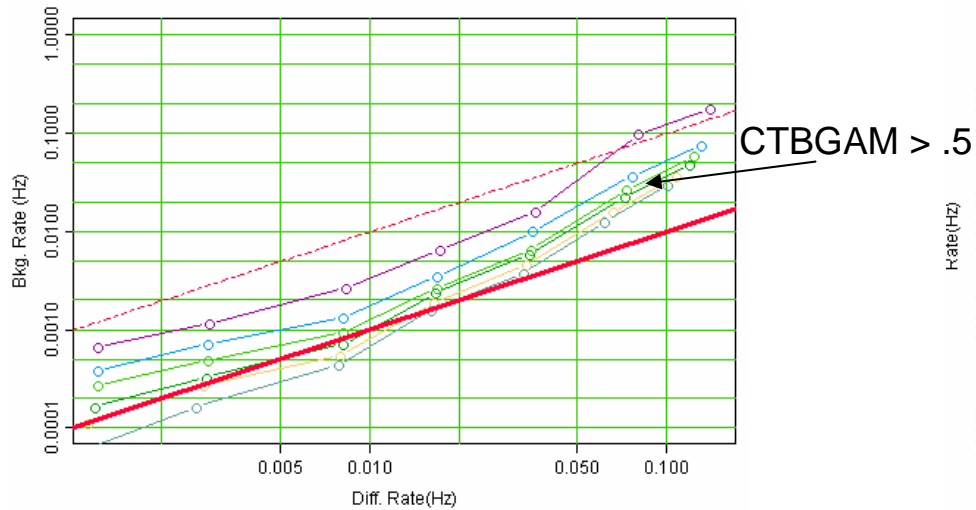
partially fills in dip in sensitivity

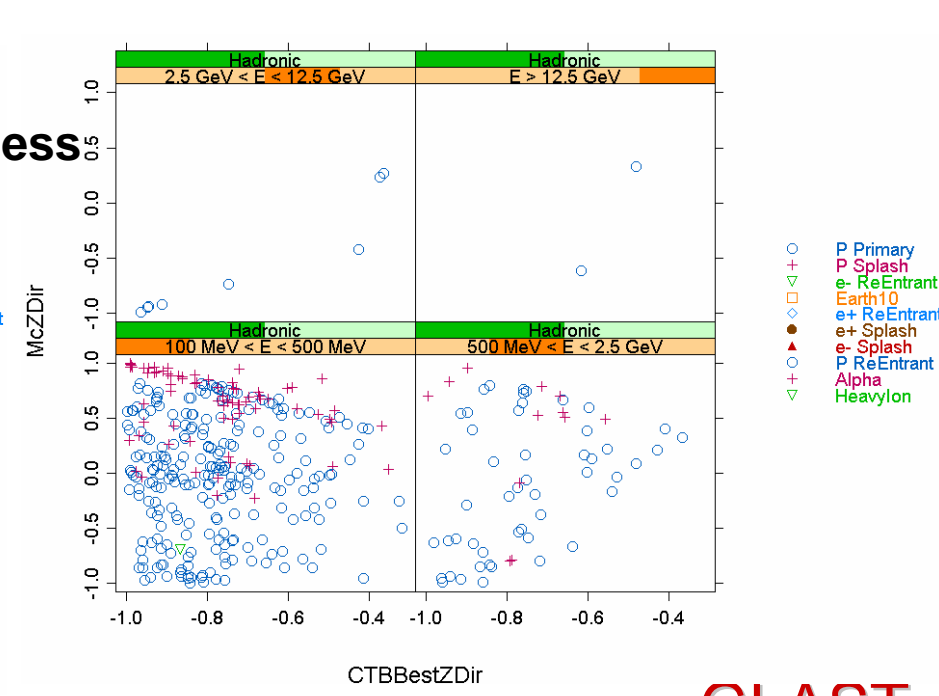
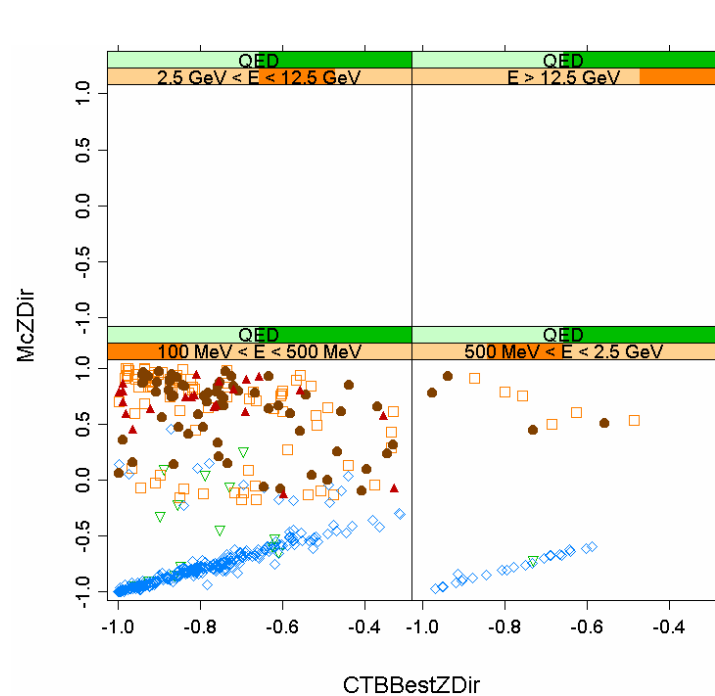
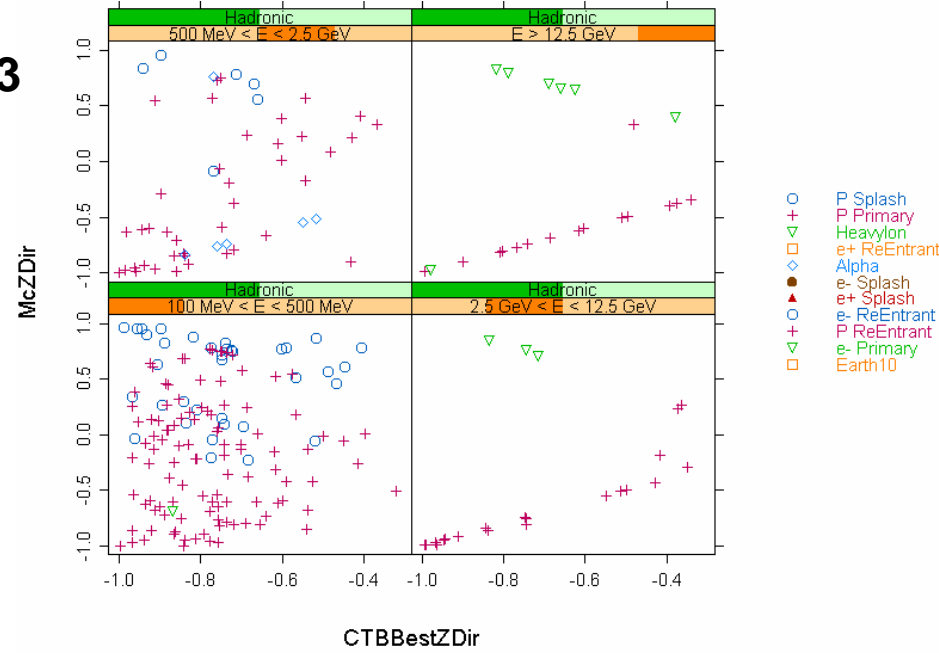
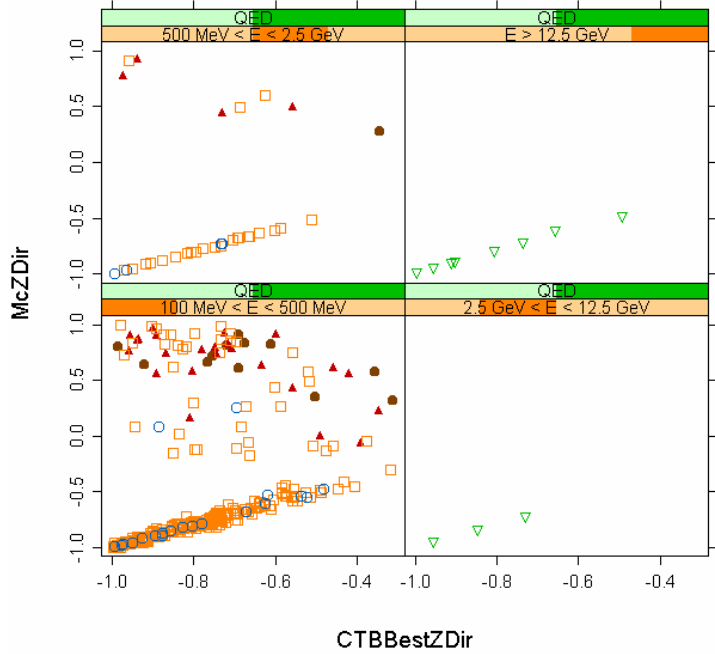
$$\text{CTBGAM} = \text{CTBGAM} * \min(2.0, (3.5 / \min(\text{CTBBestLogEnergy}, 3.5))^2)$$

Base Class 3 – No Post-Processing Filters

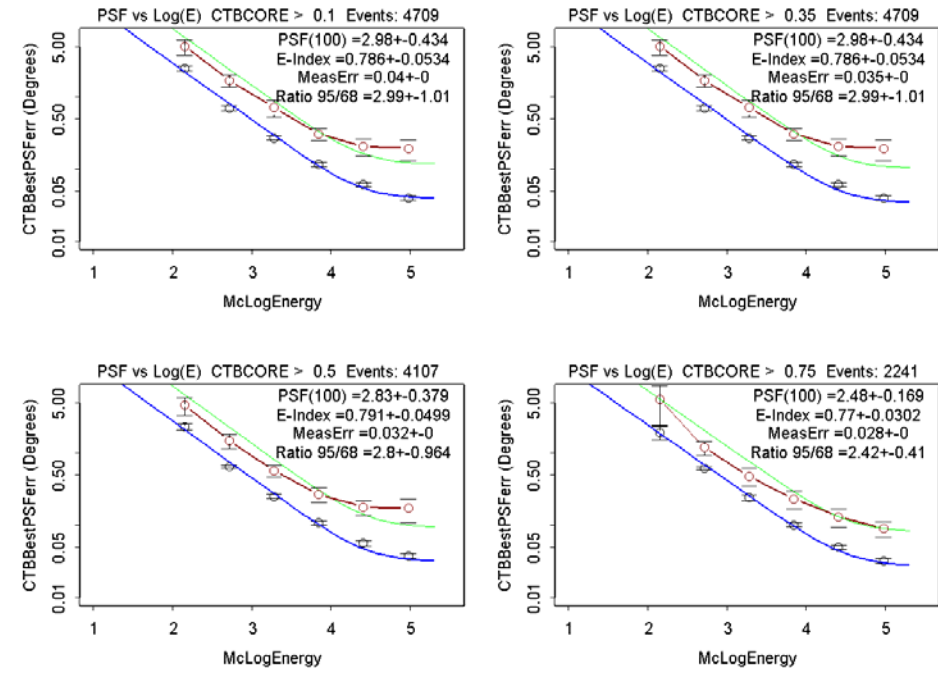
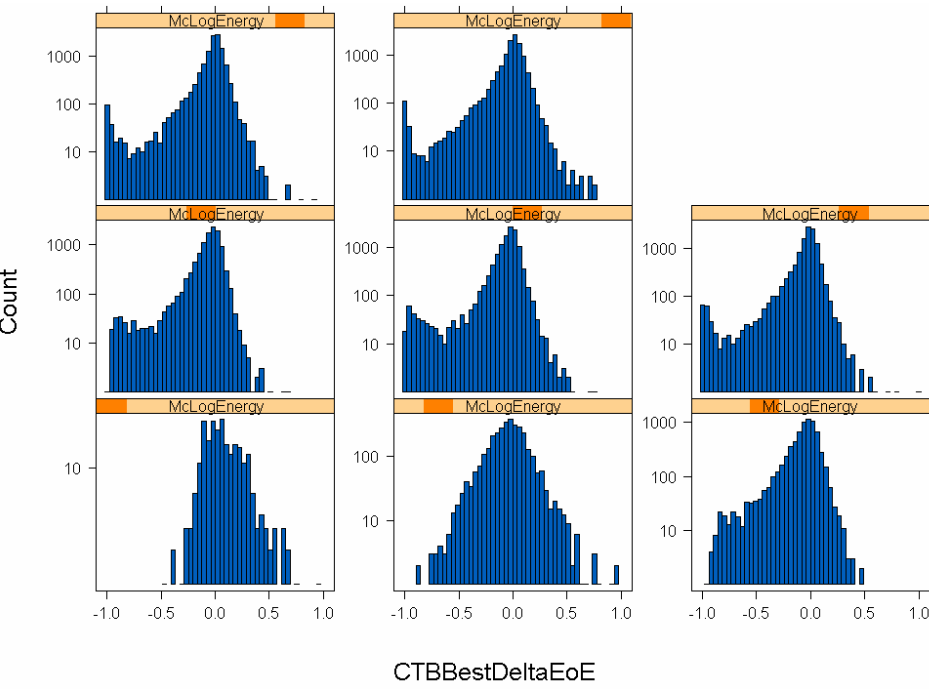
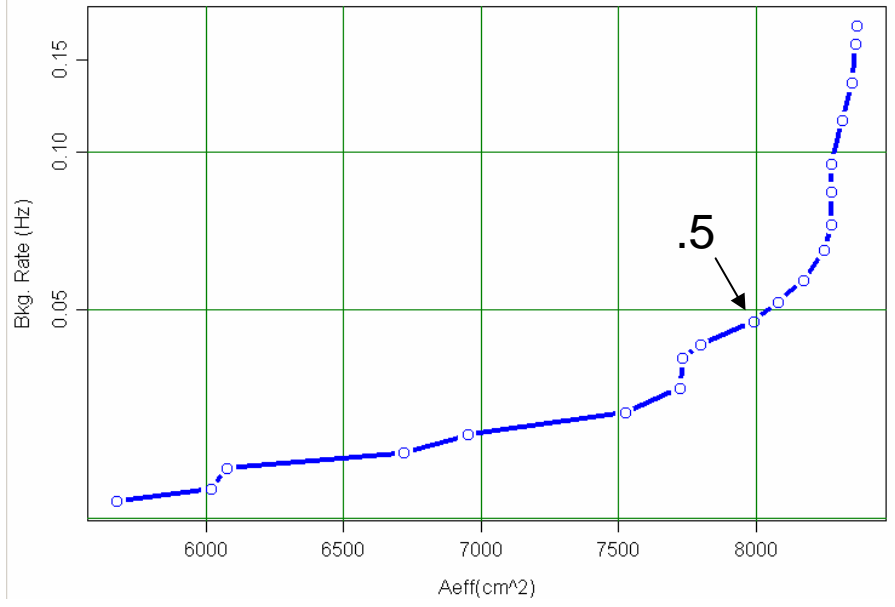
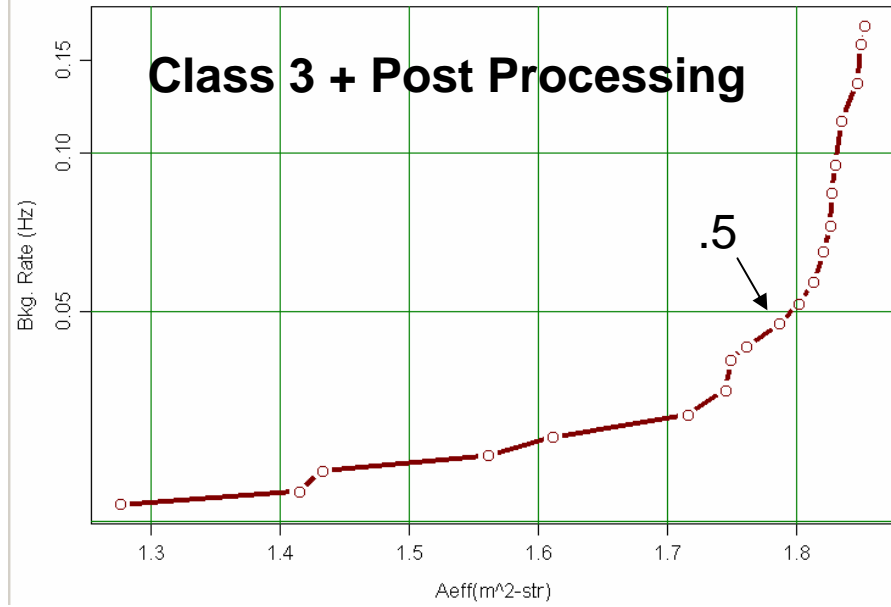


Base Class 3 – Post-Processing Filters & CTBGAM Boost at Low Energy



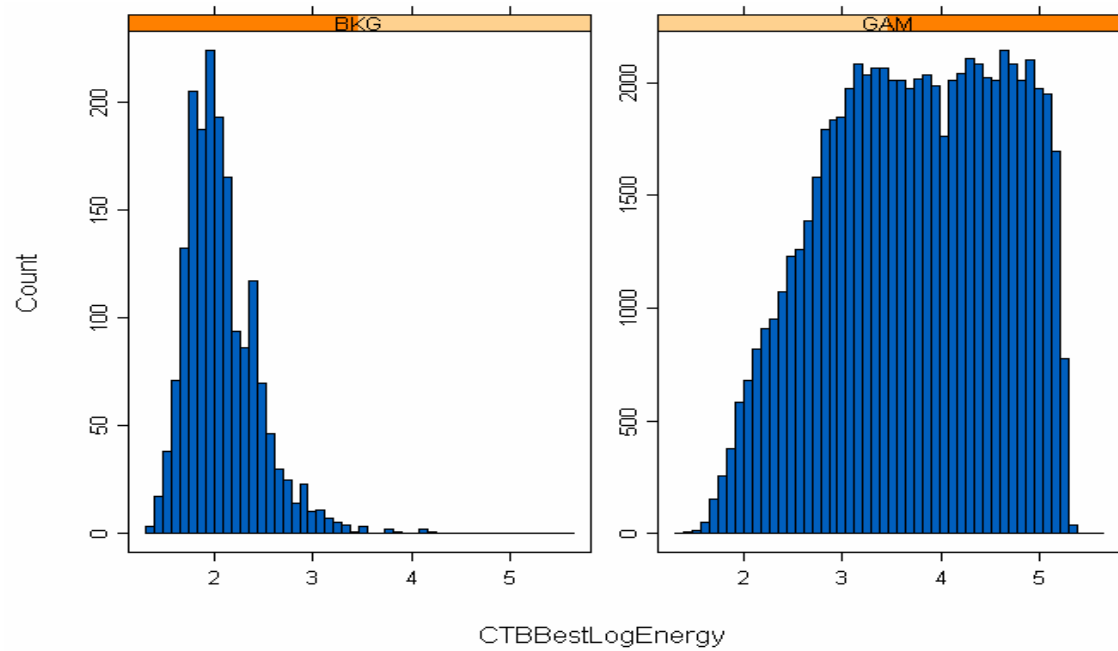


Class 3 + Post Processing



Class 3 + Post Processing

And the spectral response is better behaved....



Pass 4 Punch List

- 1) Change event axis in CalValsCorrTool to Tkr1 definition (thanks – P. Bruel)
- 2) New ACD Variable (addition to AcdValsTool)

Distance of closest approach to an ACD Ribbon

(whether not Ribbon fired)

Suggested Alg.:

- a) determine if trajectory goes out top (0) or which of the 4 sides (1-4).
- b) depending on entering surface – loop over all ribbon segments
- c) keep and report smallest value.

This avoids having to check the POCA for each DOCA calc. and limits the sampled ribbon segments to only those on the entering surface.

Suggested nTuple Var. name: AcdTkrRibbonDoca

- 3) New Tkr. Vars. (Additions to TkrValsTool)

TkrLATEdge = $742 - \max(\text{abs}(\text{Tkr1X0}), \text{abs}(\text{Tkr1Y0}))$

(presently this appears as CTBTrkLATEdge in the nTuple)

Track Dispersion: Mean-square distance between track start locations relative to Tkr1

$$\text{TkrDispersion} = \frac{1}{(N_{\text{Tkr}} - 1)} \sum_2^{N_{\text{Tkr}}} \Delta \vec{X}_i \text{ if } \hat{t}_i \cdot (\Delta \vec{X}_i) > 0 \text{ else } |\Delta \vec{X}_i|^2 - (\hat{t}_1 * \Delta \vec{X}_i)^2$$

where $\Delta \vec{X}_i = (\vec{X}_i - \vec{X}_1)$

If $N_{\text{Tkr}} < 2$ TrkDispersion = 0.

- 4) New Trk-Cal Variables – Where to put them? – Historically these have gone into CalValsTool.

CalTkrXtalDispersion: Dispersion of Cal. Xtals about Tkr1 Trajectory weighted by energy (?)

$$\mathit{CalTkrXtalDispersion} = \frac{1}{E_{\mathit{CalRaw}}} \cdot \sum_{i=1}^{N_{\mathit{Xtals}}} ((\vec{X}_i - \vec{X}_{\mathit{Tkr1}})^2 - ((\vec{X}_i - \vec{X}_{\mathit{Tkr1}}) \cdot \hat{t}_{\mathit{Tkr1}})^2) \cdot E_i$$

CalTkrXtalDispTrunc: Same as above after throughing out 10% furthest (Not largest contributors) tracks

Data Reprocessing Requirements

Data: the All Gamma Run (V7r3p4 which is a repo of v7r3p1) – need 2M

Background: the 5B run using v7r3p5

Diffuse: the 1 day using v7r3p5