

Back Ground Rejection Status

for

DC2

a la Ins. Miner Analysis

First Look at glast-ts production 3-Oct-2005

Series 1: 409160 in tuple / 123556 after RF (only FilterStatus _HI == 0 used by TB)
(This series does not have the single tile energy vars)

after Act.Dist&SSDVeto: 82306

after GoodEnergyProb > .1: 81674

Series 2: 408151 in tuple / 123120 after RF

after Act.Dist&SSDVeto: 82440

after GoodEnergyProb > .1: 81795

Series 3: 409098 in tuple / 123110 after RF

after Act.Dist&SSDVeto: 82349

after GoodEnergyProb > .1: 81746

Each series equals .01 days or ~ 864 sec. on orbit with 744 per series live time due to the SAA
– the 3 together represent 2232 sec.

The following is from Toby's e-mail dated 4-Oct-05 5:33 pm

	Series incoming	triggers	downlink
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1	38191926	6100518	409281
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2	38053681	6078677	409415
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3	38130276	6093686	409221
---	----------	---------	--------

4	37845955	6054390	406189
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total	152221838	24327271	1634106
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Rates		8177 Hz	549 Hz
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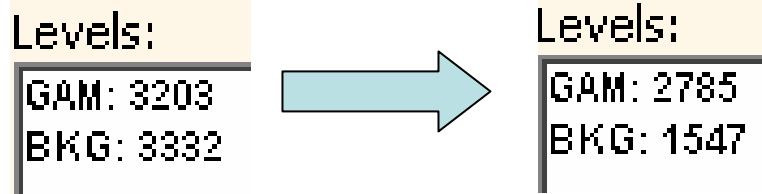
Note: that the numbers I see are a little different in the incoming ntuples – Toby says this is due to him taking numbers from the logs rather than the tuples and failed jobs don't get counted properly.

Total live time = 2976 sec. for the 4 series

Vtx Topologies, THICK Radiators, CalEnergyRaw < 350 MeV

(Note I'm trying breaking the lowest energy bin into THICK & THIN radiators at Steve's suggestion)

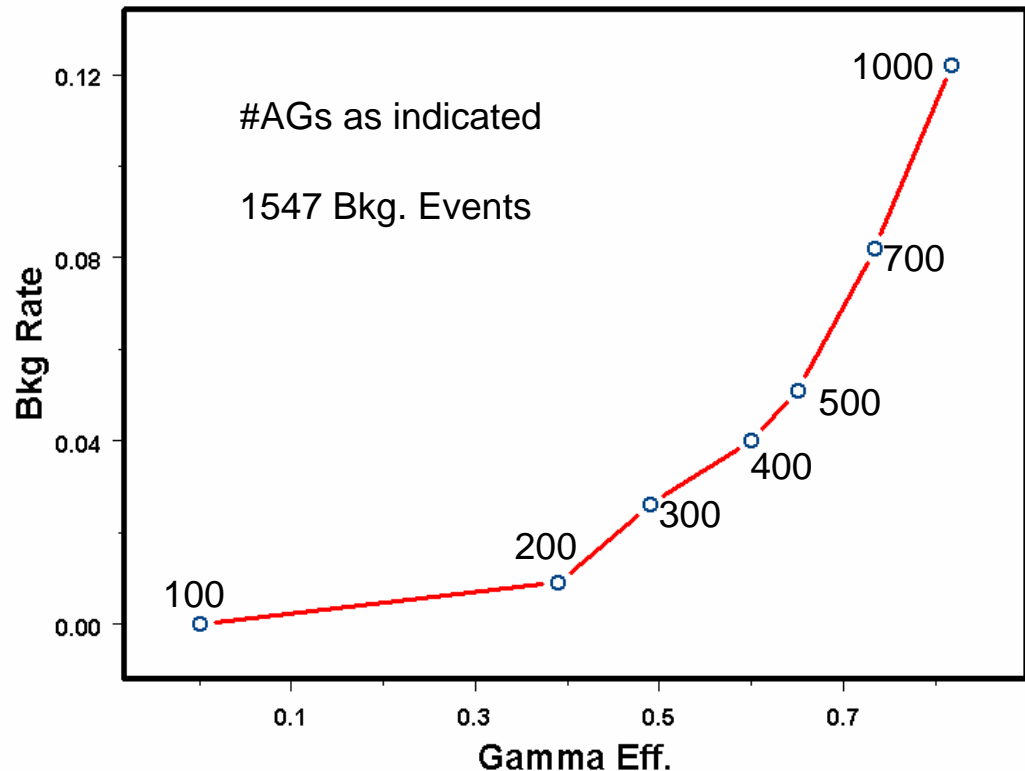
Prefilter: Exclude $\text{AcdUpperTileCount} > 0 \mid \text{AcdLowerTileCount} > 1 \mid \text{AcdRibbonActDist} > -1999$
 where $\text{UpperTileCount} = \text{Top} + 0 + 1 + 2$ and $\text{LowerTileCount} = 3$



By Varying the # of AGs used to train the CT, the relative efficiency of the selection of Bkg and AGs changes.

These are for $\text{Prob}(\gamma) > .50$

The nominal rate for Bkg. in each channel must be kept to $< .03 \text{ Hz}$

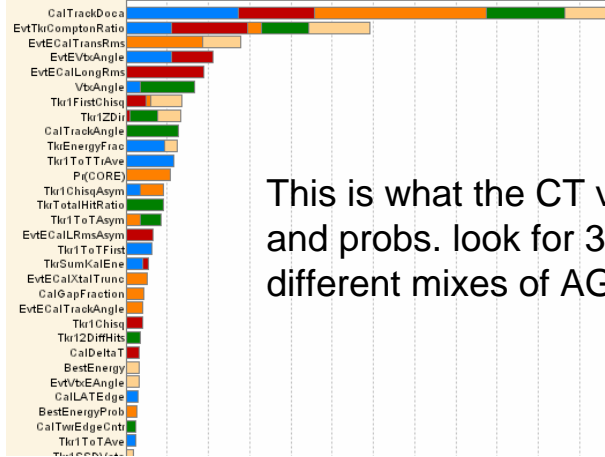


By changing the number of AGs - its equivalent (? similar at least) to weighting the events - except for the statistical fluctuations.

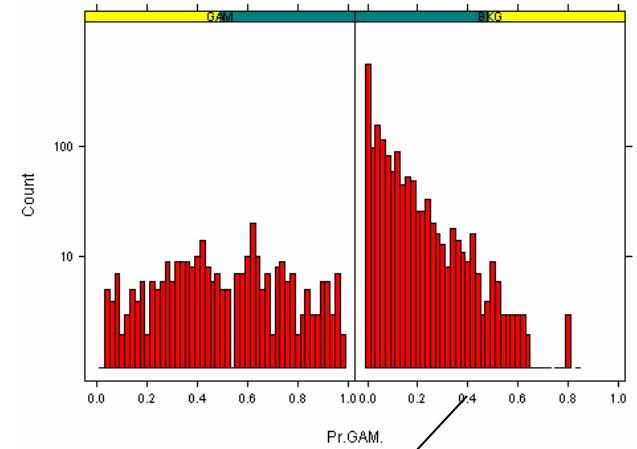
300 AGs

	γ	Bkg
All	249	892
Pr > .5	144	39
Eff	.58	.044

BestEnergy > 100 MeV



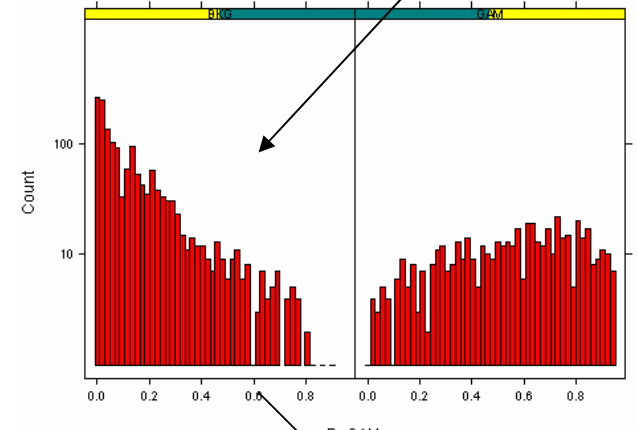
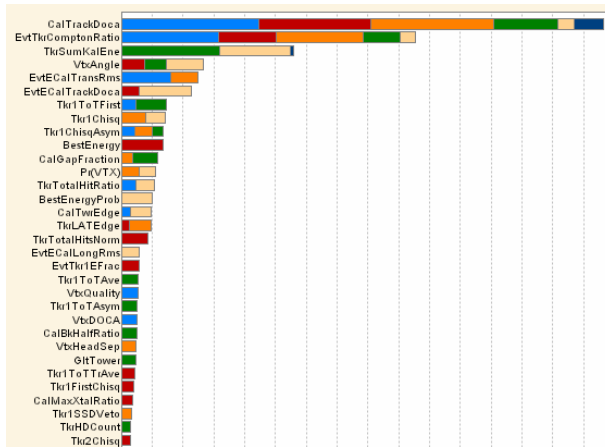
This is what the CT vars. and probs. look for 3 different mixes of AGs



500 AGs

	γ	Bkg
All	397	892
Pr > .5	258	57
Eff	.65	.064

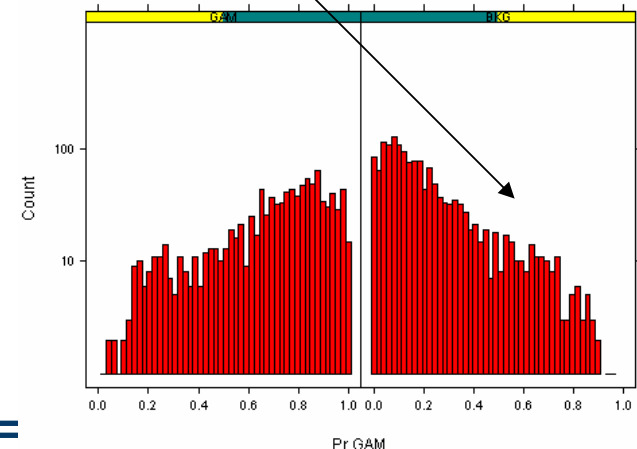
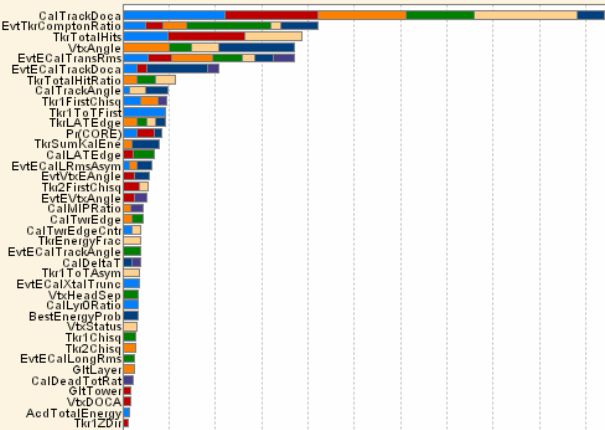
BestEnergy > 100 MeV



1000 AGs

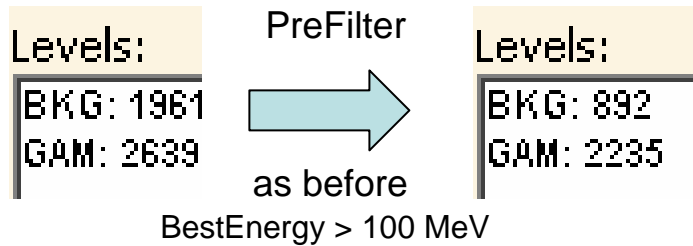
	γ	Bkg
All	812	892
Pr > .5	721	150
Eff	.89	.168

BestEnergy > 100 MeV



ST

Try Training CTs using BestEnergy > 100 MeV

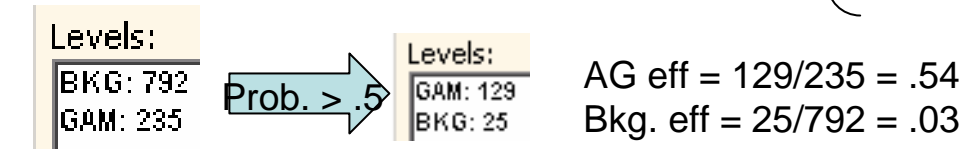
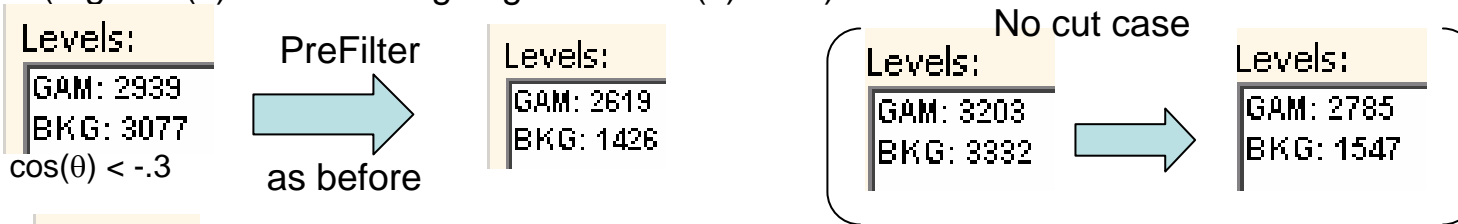


	γ	Bkg
All	200	892
Pr > .5	98	36
Eff	.49	.040

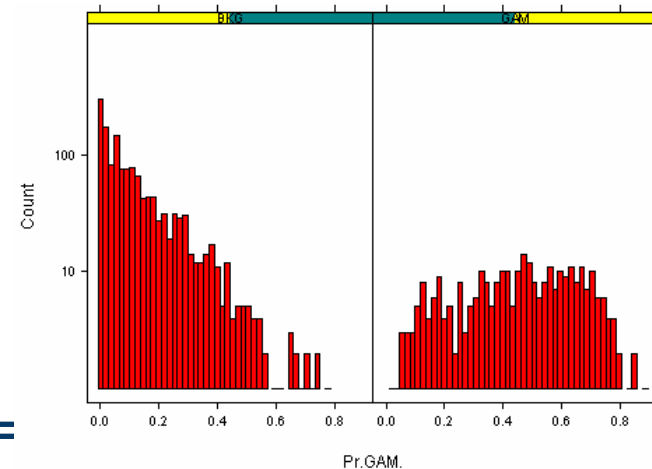
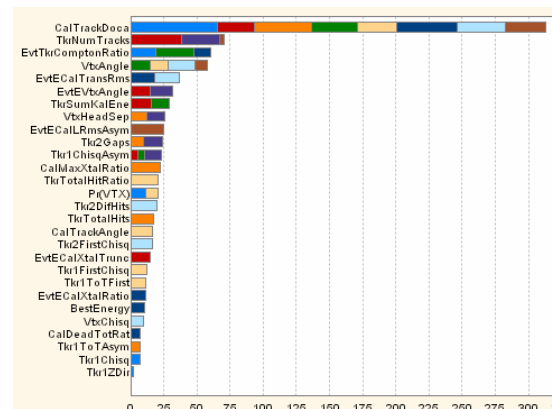
	γ	Bkg
All	400	892
Pr > .5	289	63
Eff	.72	.071

This is marginally worse... so I will included all events to train CTs

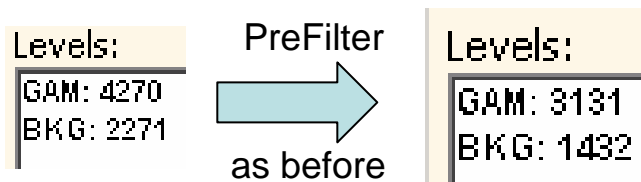
The event mix changes with $\cos(\theta)$ as well. We'll probably de-select on events near the edge of the FoV (e.g. $\cos(\theta) < -.3$ rather going out to $\cos(\theta) < -.2$)



CT Variables and Prob for Vtx, Thick, < 350 MeV

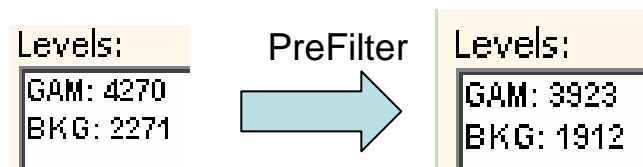


VTX, THIN, CalEnergyRaw < 350 MeV, $\cos(\theta) < -0.3$



This is much worse in terms of efficiencies –

THICK	THIN
$\epsilon_{AG}: .87$	$\epsilon_{AG}: .73$
$\epsilon_{Bkg}: .46$	$\epsilon_{Bkg}: .63$

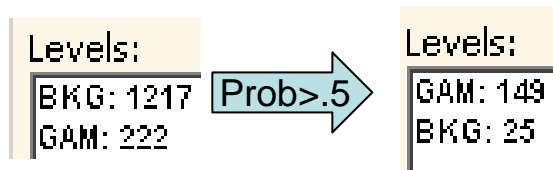


THIN

$\epsilon_{AG}: .92$
$\epsilon_{Bkg}: .84$

Still its bad - but????
This PreFilter is considerably worse for the THICK events then the one dev. for it. THICK and THIN seem to be just DIFFERENT

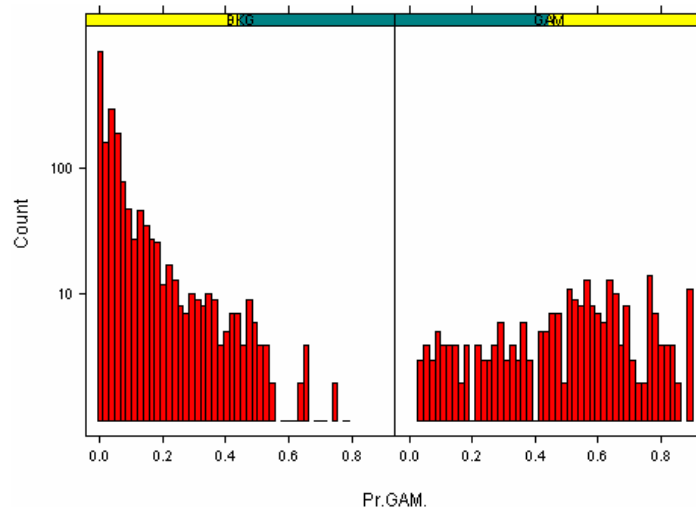
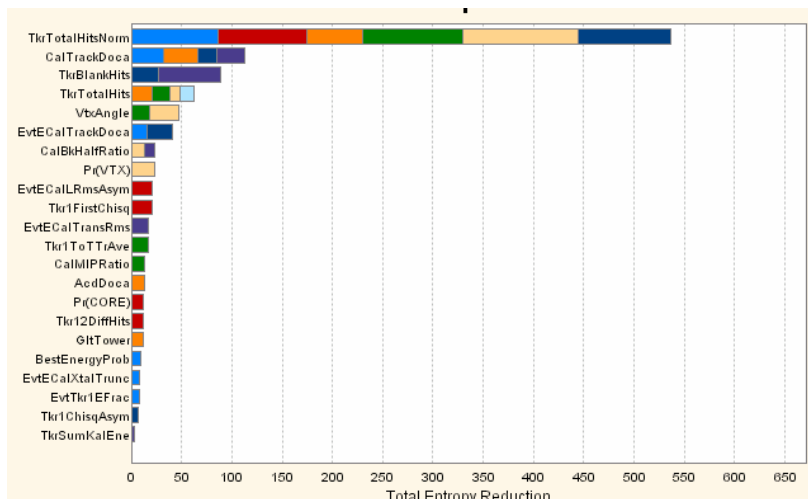
$\text{AcdActiveDist} > -199 \mid \text{AcdRibbonActDist} > -1000$



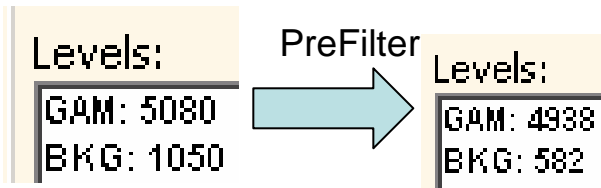
THIN

$\epsilon_{AG}: .67$
$\epsilon_{Bkg}: .02$

$\cos(\theta) < -0.3$ && BestEnergy > 100 MeV



VTX, All Layers, 350 < CalEnergyRaw < 3500, cos(θ) < -.3



AcidActiveDist > -199 & AcidRibbonActDist > -1990

All Layers

ϵ_{AG} : .97

ϵ_{Bkg} : .55

This γ ineff. is consistent with conversions in blanket and tiles

Input Node - VTX CT

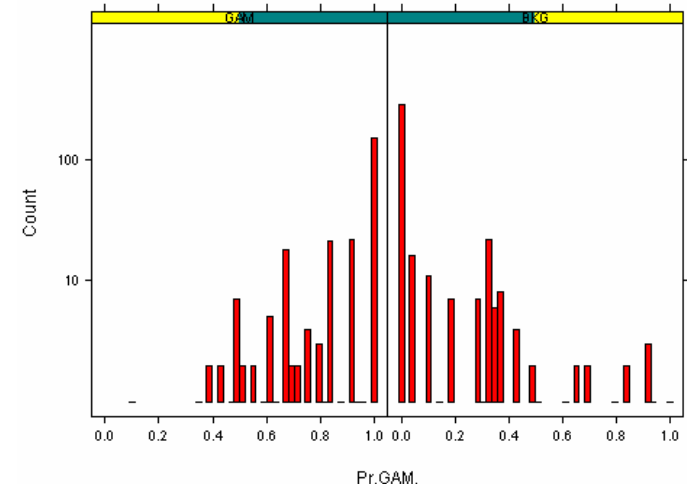
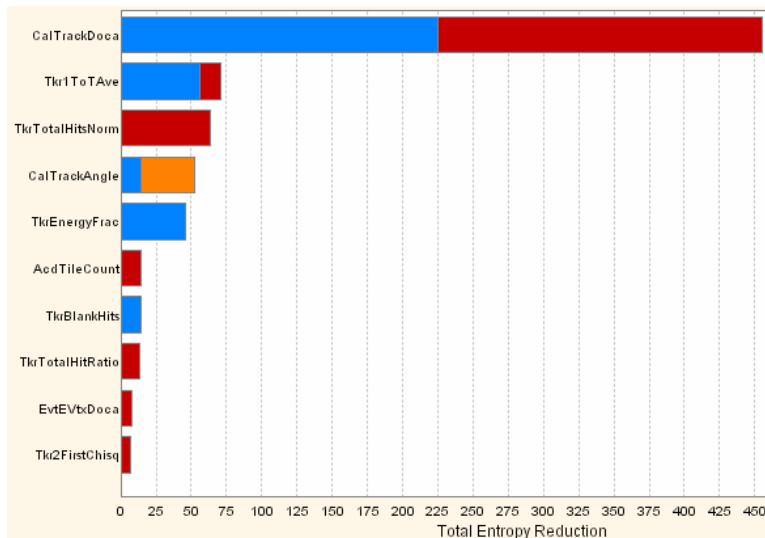
		Predicted		Totals
		GAM	BKG	
Observed	GAM	236	14	250
	BKG	14	366	380
Totals		250	380	630

All events now have BestEnergy > 100 and cos(θ) < -.3

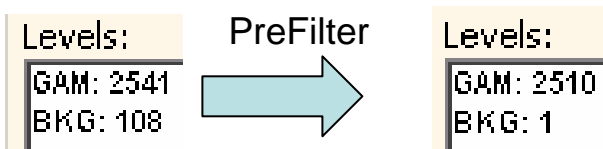
	Observed		Overall
	GAM	BKG	
% Agree	94.4%	96.3%	95.6%

Positive Category - GAM

Recall	Precision	F-Measure
94.4%	94.4%	94.4%



VTX, All Layers, 3500 < CalEnergyRaw, cos(θ) < -.3



AcidActiveDist > -10 | CalTrackAngle > .5
| CalTrackDoca > 40

The Remaining Bkg Event

#	Variable	Mean
1	McId	11.00
2	McCharge	-1.00
3	McEnergy	10,452.20
4	McZDir	-0.58
5	McDirErr	3.23E-4
6	TkrNumTracks	10.00
7	Tkr1Chisq	1.92
8	Tkr1Hits	18.00
9	Tkr1FirstLayer	8.00
10	Tkr1SSDVeto	0.00
11	AcidTotalEnergy	6.09
12	AcidTileCount	4.00
13	AcidDoca	138.04
14	AcidActiveDist	-200.00
15	EvtRun	214,710.00
16	EvtEventId	2,692.00
17	EvtElapsedTime	199,885,000.00
18	EvtLiveTime	199,885,000.00
19	BestEnergy	10,461.30
21	BestEnergyProb	0.96
22	AcidRibbonEnergy	0.00
23	AcidDocaTileEnergy	0.18
24	AcidActDistTileEne...	0.00
25	AcidUpperTileCount	3.00
26	AcidLowerTileCount	1.00
27	AcidTotalTileCount	4.00

e⁻ (e⁻ Splash)
Event Well Reconstructed
This is NUTS!
The event clearly has to be pointing at an ACD Side tile and there is no SSD Veto.
The Doca Calc. says the event had a track well within a tile – so why is the ActiveDistance set to its rogue value?

EvtRun	214,710.00
EvtEventId	2,692.00
EvtElapsedTime	199,885,000.00

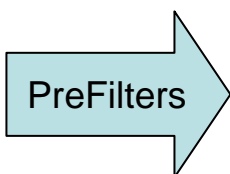
This is a glast-ts generated event.
Can Toby find it?
(It comes from either series 2 or 3)

We NEED a picture of it!

Vtx Topology Summary (All numbers for BestEnergy > 100 MeV & BestZDir < -.3)

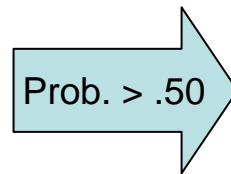
Levels:

BKG: 4333
GAM: 13894



Levels:

GAM: 13074
BKG: 2390



Levels:

GAM: 10344
BKG: 65

Background Rejection Path (BR.Path) not yet determined

Level Name	Counts
VTX&CAL_Hi	2541/108
VTX&CAL_Med	5080/1050
VTX&CAL_Low	6273/3175

(γ /Bkg)

BR.Path
All Gamma

Level Name	Counts
VTX&CAL-Hi	2510
VTX&CAL-Med	4933
VTX&CAL-Low	5631

BR.Path

Level Name	Counts	Loss
VTX&CAL-Hi	2510	.013
VTX&CAL-Med	4474	.120
VTX&CAL-Low	3360	.465

Background Source Breakdown

Level Name	Counts
Earth10	452
e+ReEnt	1062
ProtonPrimary	2301
e-Splash	388
Alpha	83
HeavyIon	47

BR.Path
Background

Level Name	Counts
VTX&CAL-Hi	1
VTX&CAL-Med	380
VTX&CAL-Low	2009

BR.Path

Level Name	Counts
VTX&CAL-Hi	1
VTX&CAL-Med	14
VTX&CAL-Low	50

SourceType

Level Name	Counts
e-Splash	172
ProtonPrimary	1387
e+ReEnt	491
Earth10	314
HeavyIon	13
Alpha	13

SourceType

Level Name	Counts
e-Splash	4
e+ReEnt	25
Alpha	3
ProtonPrimary	25
Earth10	8

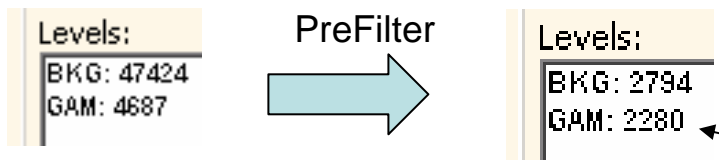
MIP Finder Failure

HeavyIons have gone away

GLAST

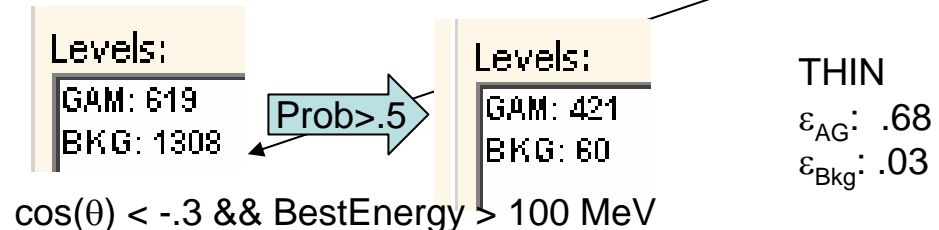
1Tkr, THICK layers, CalEnergyRaw < 350 MeV cos(θ) < -.3

Desperation: This is the toughest subclass. In DC1 we had to through all these away. This is better but clearly not there yet.

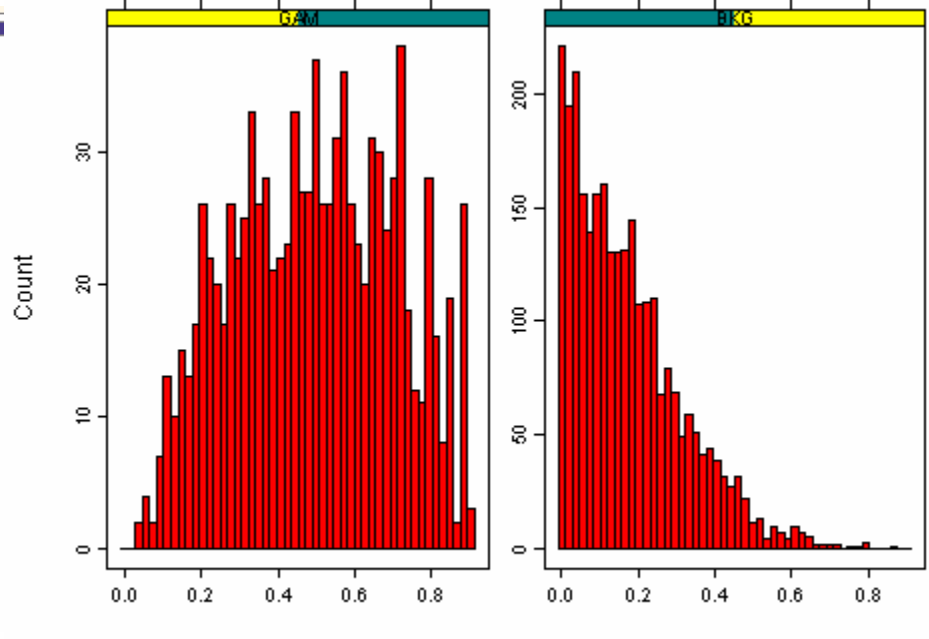
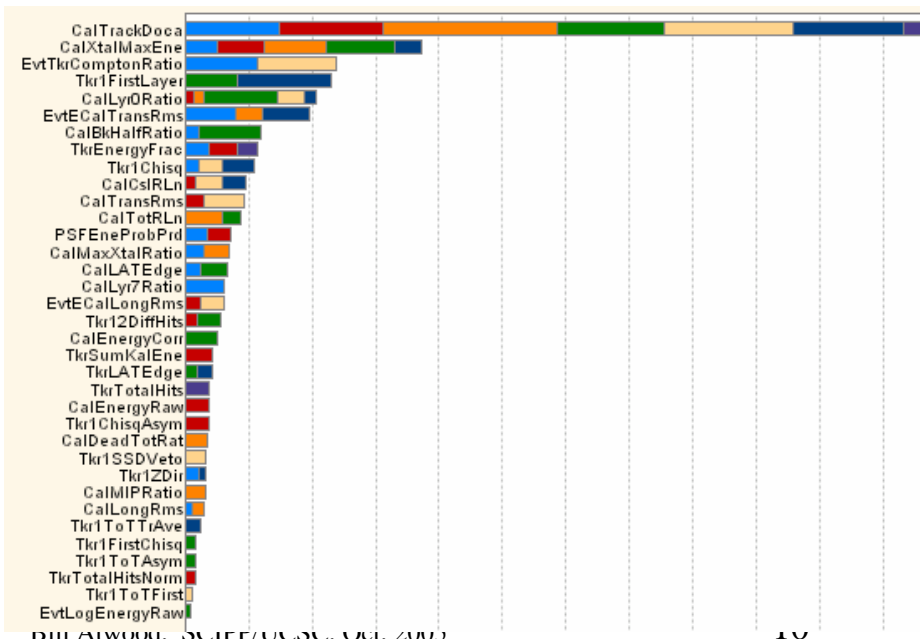


$\text{AcdActiveDist} > -199$ | $\text{AcdRibbonActDist} > -1999$ |
 $\text{AcdDoca} < 1999$ | $\text{CalTrackDoca} > 200$ |
 $\text{EvtECalTransRms} > 2.5$ | $\text{CalMaxXtalRatio} > .8$ |
 $\text{Tkr1FirstChisq} > 2.5$ | $\text{Tkr1ToTTrAve} > 2$

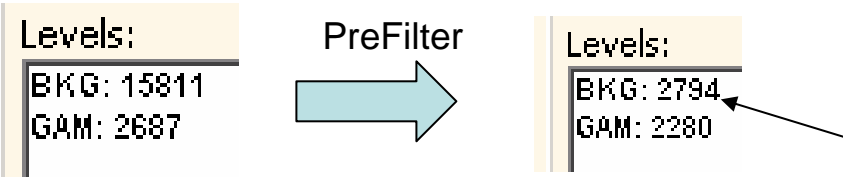
Note that ~ 50% of the events are below BestEnergy < 100 MeV



cos(θ) < -.3 && BestEnergy > 100 MeV



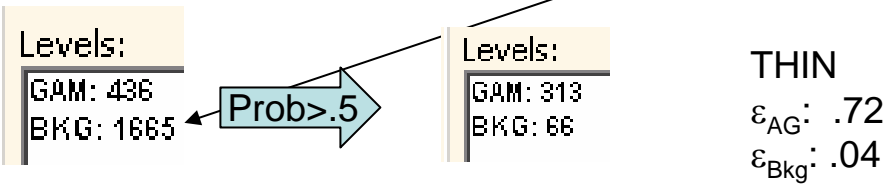
1Tkr, THIN layers, CalEnergyRaw < 350 MeV cos(θ) < -.3



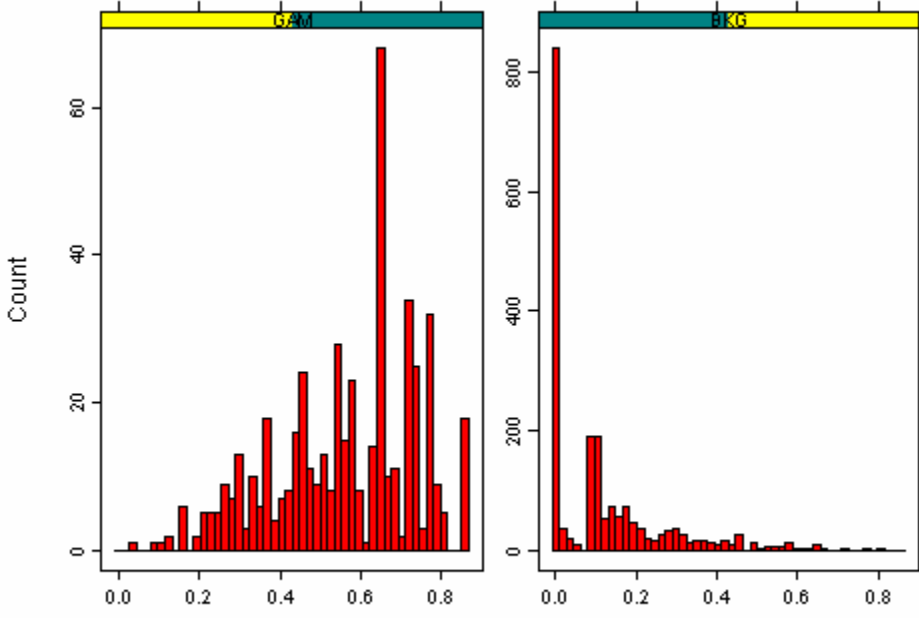
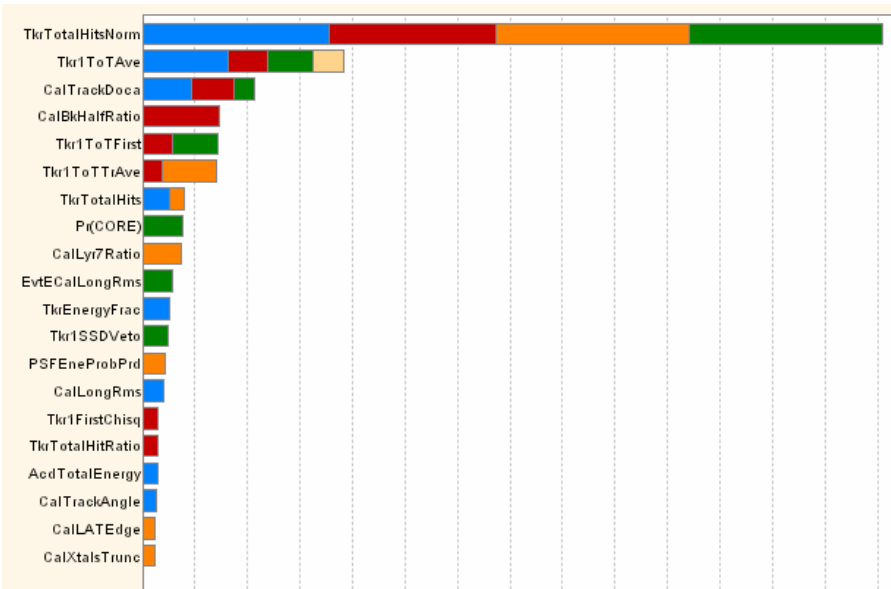
Desperation: This is the 2nd toughest subclass.

AcidActiveDist > -199 | AcidRibbonActDist > -1999 |
CalTrackDoca > 200 | EvtECalTransRms < .8

Note that ~ 40% of the events are below BestEnergy < 100 MeV



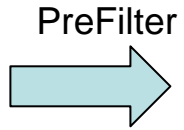
cos(θ) < -.3 && BestEnergy > 100 MeV



1Tkr, All layers, 350 MeV < CalEnergyRaw < 3500 MeV

$\cos(\theta) < -.3$

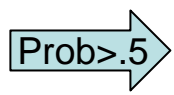
Levels:
GAM: 5944
BKG: 17242



Levels:
GAM: 5157
BKG: 650

AcidActiveDist > -199 | AcidRibbonActDist > -1900 |
CalTrackDoca > 40 | CalTrackAngle > .5 |
CalXtalRatio > .85

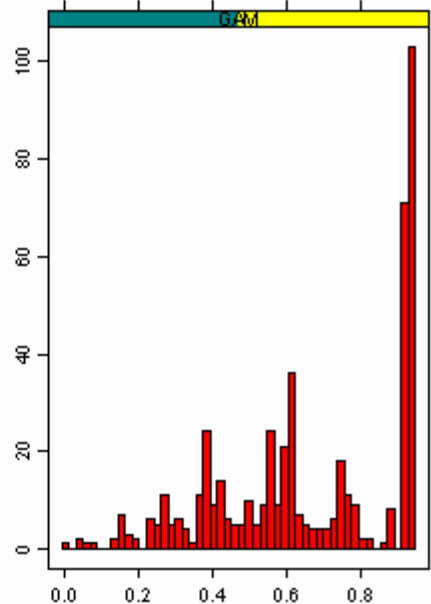
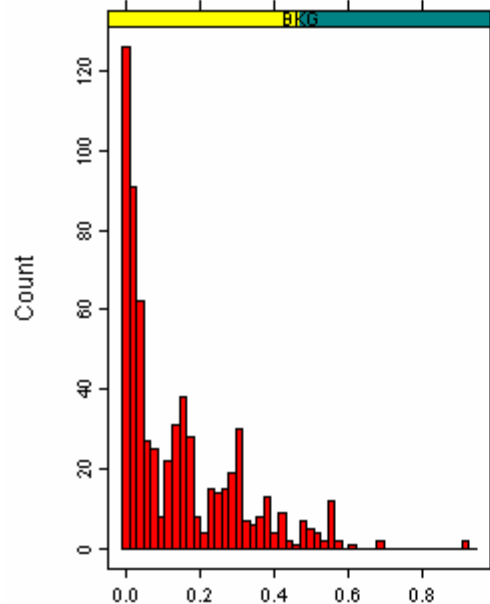
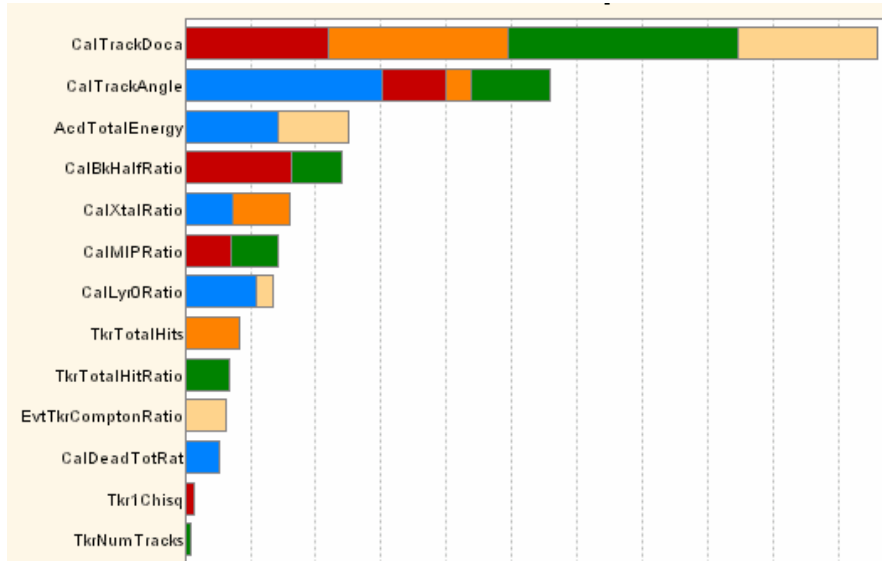
Levels:
BKG: 650
GAM: 500



Levels:
BKG: 26
GAM: 363

All Layers
 $\epsilon_{AG}: .73$
 $\epsilon_{Bkg}: .04$

$\cos(\theta) < -.3$ && BestEnergy > 100 MeV

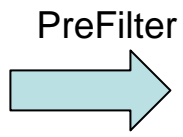


Re-Make of
1Tkr Cal_Hi

1Tkr, All layers, CalEnergyRaw > 3500 MeV

$$\cos(\theta) < -.3$$

Levels:
BKG: 8932
GAM: 15098



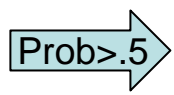
Levels:
GAM: 14532
BKG: 689

This PreFilter was not done properly first time around. Here's a re-do

$$\text{CalTrackDoca} > 30 \mid \text{CalTrackAngle} > .3$$

Leaving out all ACD vars. in PreFilter

Levels:
BKG: 689
GAM: 300

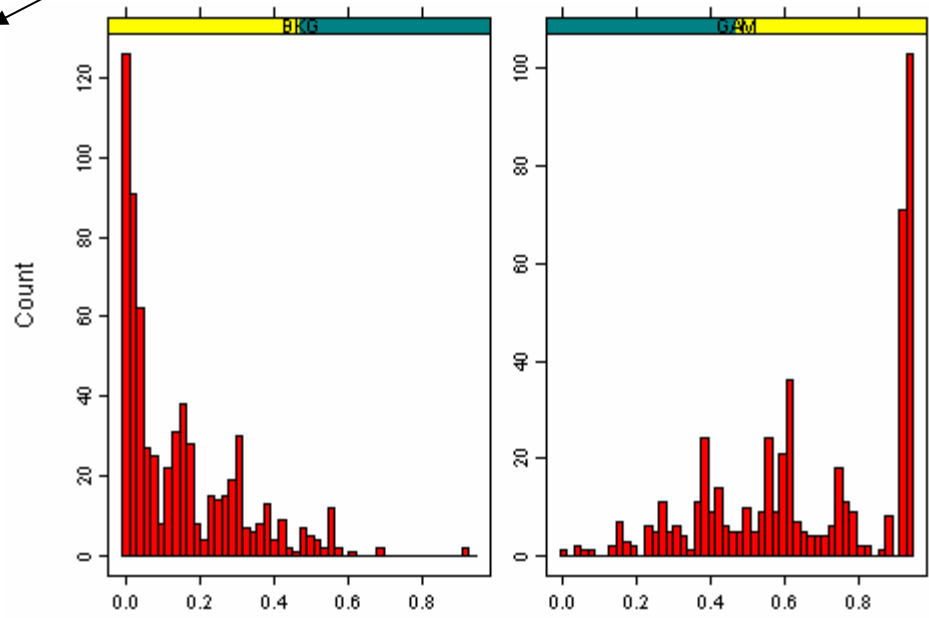
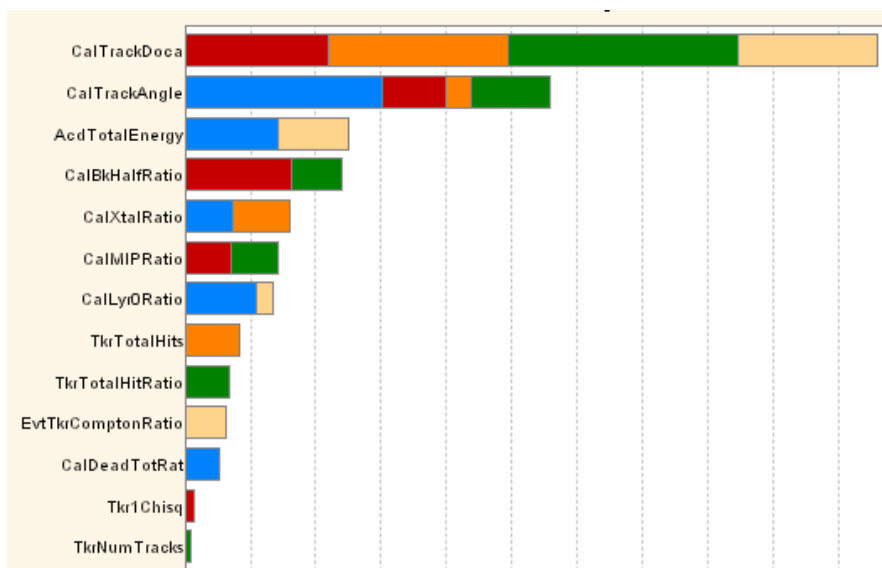


Levels:
GAM: 293
BKG: 10

All Layers
 $\epsilon_{AG}: .98$
 $\epsilon_{Bkg}: .015$

Note however that the CTs insist on using the ACD.

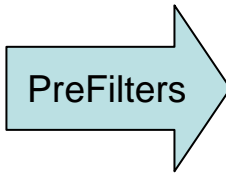
$$\cos(\theta) < -.3 \ \&\& \ \text{BestEnergy} > 100 \text{ MeV}$$



1Tkr Topology Summary (All numbers for BestEnergy > 100 MeV & BestZDir < -.3)

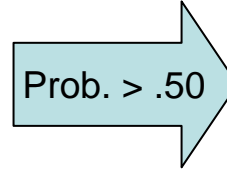
Levels:

GAM: 25933
BKG: 59337



Levels:

GAM: 22358
BKG: 4312



Levels:

GAM: 19382
BKG: 162

Background Rejection Path (BR.Path) not yet determined

Level Name	Counts
1Tkr&CAL_Hi	15098/8932
1Tkr&CAL_Med	5944/17242
1Tkr&CAL_Low	4891/33163

(γ /Bkg)

BR.Path

All Gamma

Level Name	Counts
1Tkr&CAL-Hi	14532
1Tkr&CAL-Med	5157
1Tkr&CAL-Low	2669

BR.Path

Background

Level Name	Counts
1Tkr&CAL-Hi	689
1Tkr&CAL-Med	650
1Tkr&CAL-Low	2973

BR.Path

Level Name	Counts	Loss
1Tkr&CAL-Hi	13969	.075
1Tkr&CAL-Med	3605	.394
1Tkr&CAL-Low	1808	.641

BR.Path

Level Name	Counts
1Tkr&CAL-Hi	10
1Tkr&CAL-Med	26
1Tkr&CAL-Low	126

SourceType

Level Name	Counts
e-Splash	13
ProtonPrimary	60
HeavyIon	2
e+ReEnt	58
Alpha	6
Earth10	23

MIP Finder Failure

Note how much larger the Bkgs are w.r.t. Vtx except for CalEnergyRaw > 3500 MeV
Background Source Breakdown

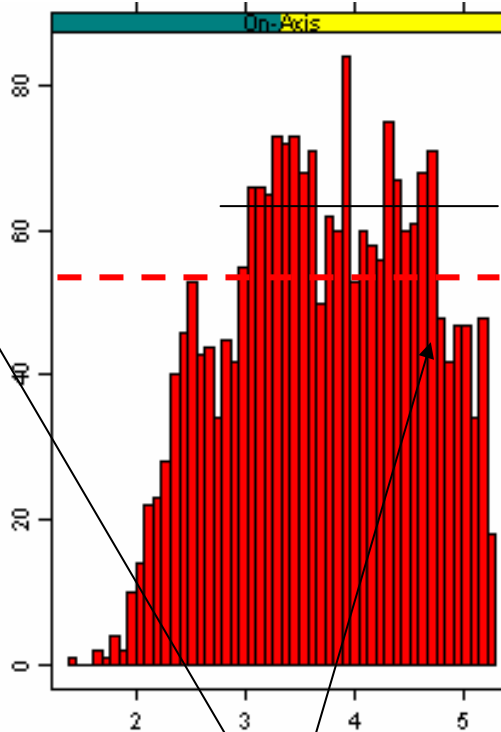
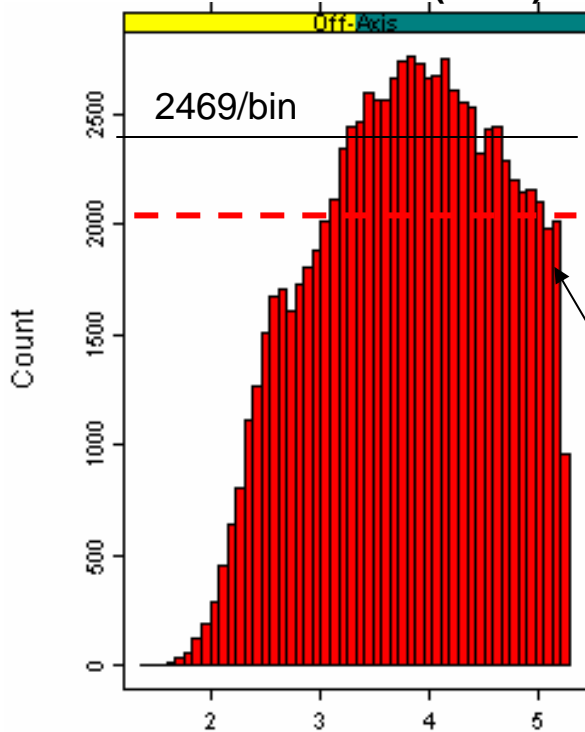
Level Name	Counts
e+ReEnt	9722
ProtonPrimary	38742
e-Splash	4065
HeavyIon	1497
Earth10	4771
Alpha	540

SourceType

Level Name	Counts
HeavyIon	186
ProtonPrimary	2591
e-Splash	329
e+ReEnt	708
Earth10	488
Alpha	10

v7r2 SLAC 2M All Gamma Run

Pr(GAM) > .50



Number > 1 GeV = 1726 in 28 bins

62/bin x 50 bins = 3100

$3100 / (2 \times 10^6 / 100) \times 6 \text{ m}^2$

$\langle N_{\text{BIN}} \rangle * 150 = A_{\text{eff}} (\text{cm}^2)$

or $N_{>1\text{GeV}} * 5.36 = A_{\text{eff}} (\text{cm}^2)$

$A_{\text{eff}} = 9300 \text{ cm}^2$

SRD Limit

Number > 1 GeV = 70883 in 28 bins

(2531) x 50 Bins = 113500

$113500 / 2 \times 10^6 \times 37.7 \text{ m}^2\text{-str}$

$\langle N_{\text{BIN}} \rangle * .943 \times 10^{-3} = A_{\text{eff}} \times \Delta\Omega (\text{m}^2\text{-str})$

or $N_{>1\text{GeV}} * 3.37 \times 10^{-5} = A_{\text{eff}} \times \Delta\Omega (\text{m}^2\text{-str})$

$A_{\text{eff}} \times \Delta\Omega = 2.39 \text{ m}^2\text{-str}$

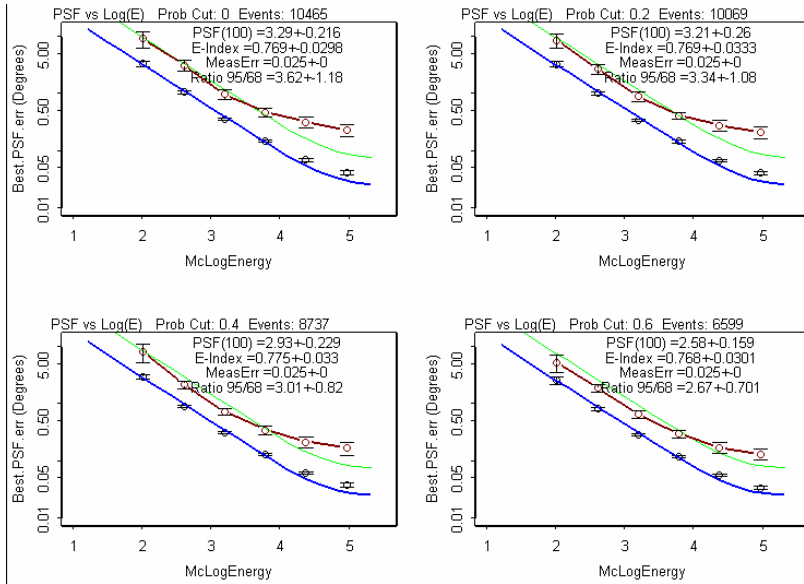
McLogEnergy

Background: 319 Events or .16 Hz
(SRD ~ .03 Hz)

Fall-off past 10 GeV improved – however this results from the CTs using AcdActiveDist to kill the high energy cosmic electron component in the background – it may be a fact of life for now...

Near On-Axis

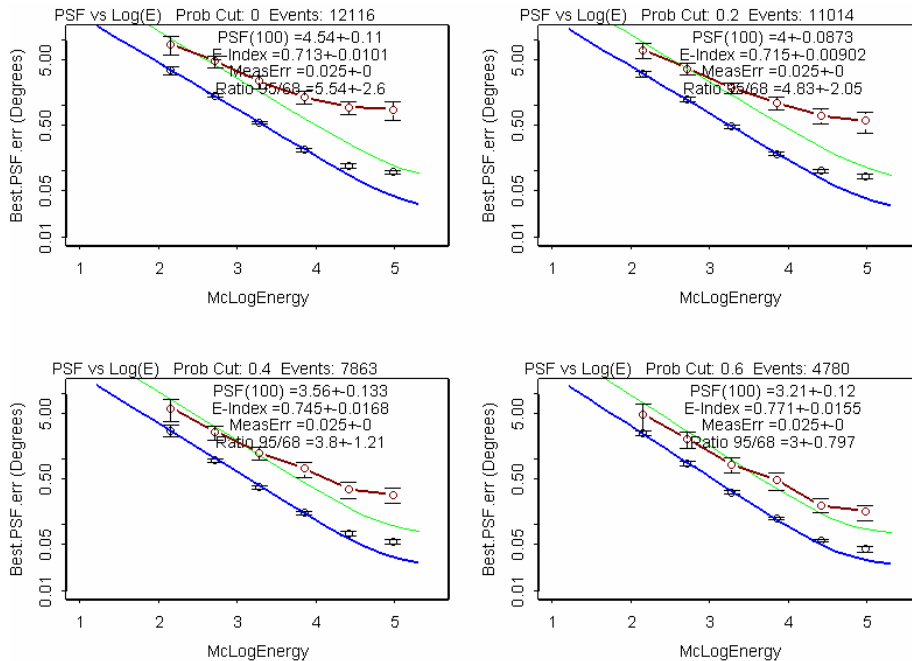
$$\cos(\theta) < -.9$$



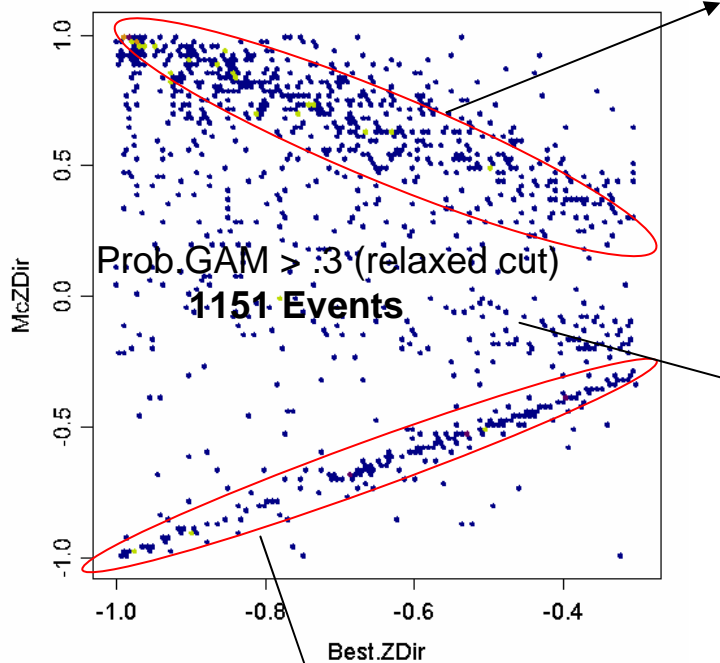
These basically meet the SRD

Edge of FoV

$$\cos(\theta) > -.6$$



Residual Background Dissection



Direction Anti-Correlated events: 416 Events

Event.Class PSF Class		BR.Path		SourceType	
Level Name	Counts	Level Name	Counts	Level Name	Counts
Thick-1Tkr	250	VTX&CAL-Med	15	e+ReEnt	83
Thin-VTX	18	VTX&CAL-Low	99	ProtonPrimary	224
Thin-1Tkr	117	1Tkr&CAL-Hi	1	Alpha	3
Thick-VTX	31	1Tkr&CAL-Med	56	e-Splash	27
		1Tkr&CAL-Low	245	Earth10	79

These are dominated by upward moving protons. This is what the MIP Finder was suppose to identify

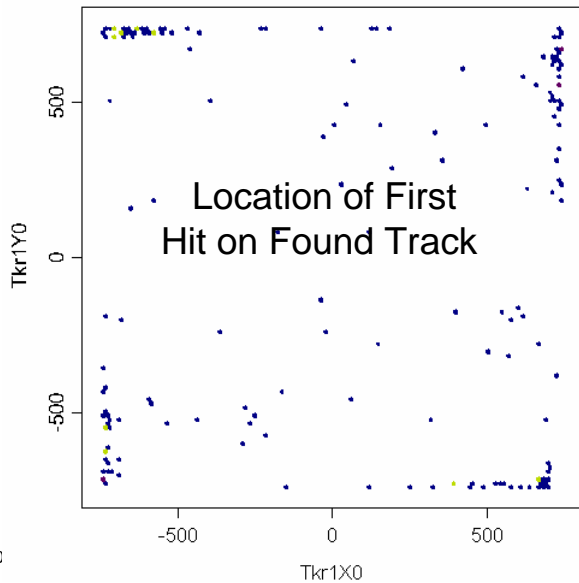
No Correlation: 560 Events – large component of Limb γ s

Event.Class PSF Class		BR.Path		SourceType	
Level Name	Counts	Level Name	Counts	Level Name	Counts
Thick-1Tkr	290	VTX&CAL-Med	43	ProtonPrimary	283
Thin-VTX	36	VTX&CAL-Low	136	e+ReEnt	96
Thick-VTX	63	1Tkr&CAL-Hi	2	HeavyIon	3
Thin-1Tkr	171	1Tkr&CAL-Med	38	e-Splash	30
		1Tkr&CAL-Low	341	Earth10	148

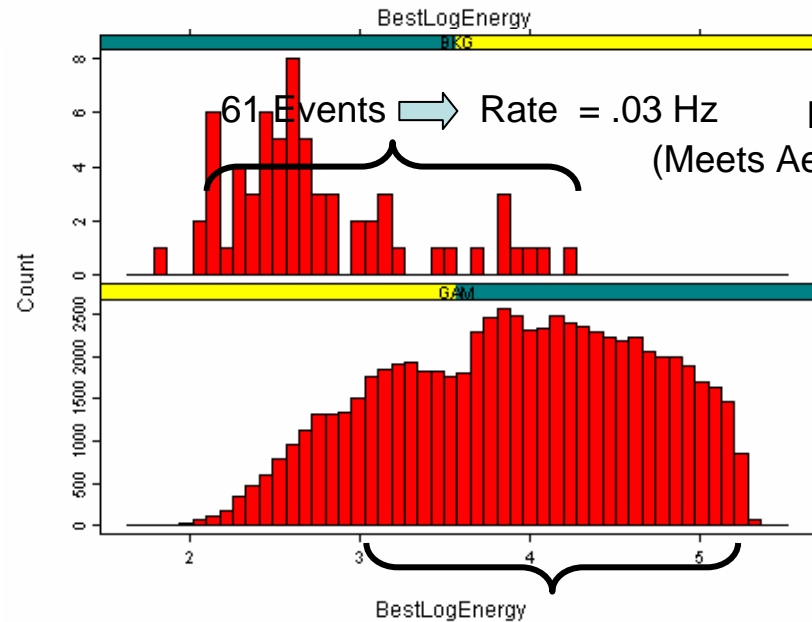
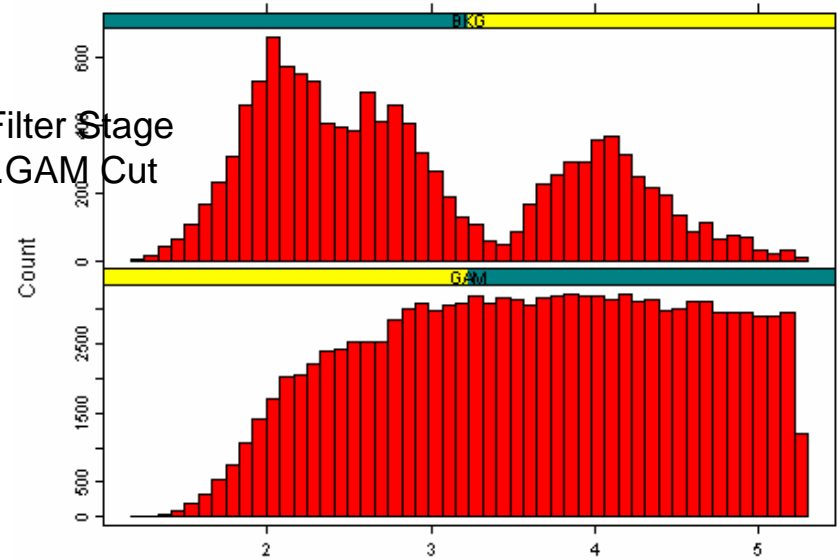
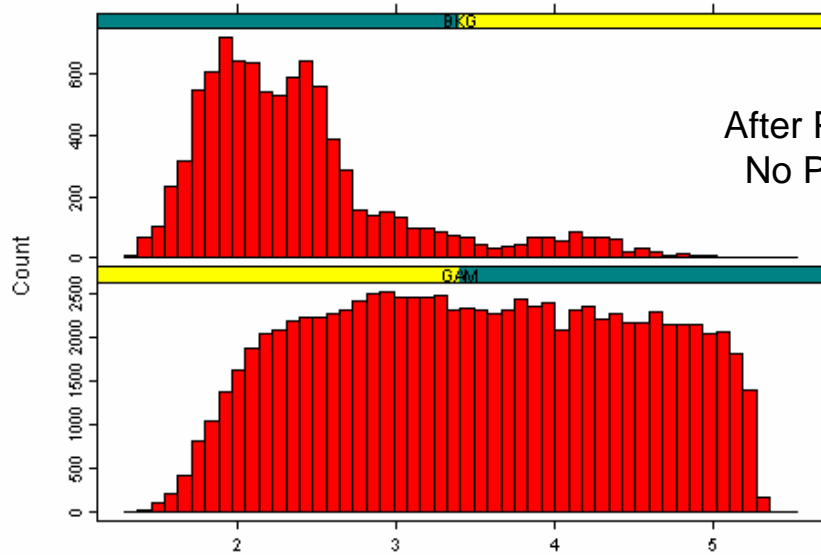
Direction Correlated events: 175 Events

Event.Class PSF Class		BR.Path		SourceType	
Level Name	Counts	Level Name	Counts	Level Name	Counts
Thick-1Tkr	54	VTX&CAL-Hi	2	ProtonPrimary	50
Thin-1Tkr	98	VTX&CAL-Med	13	e+ReEnt	88
Thin-VTX	12	VTX&CAL-Low	40	Alpha	18
Thick-VTX	11	1Tkr&CAL-Hi	12	e-Splash	19
		1Tkr&CAL-Med	34		
		1Tkr&CAL-Low	74		

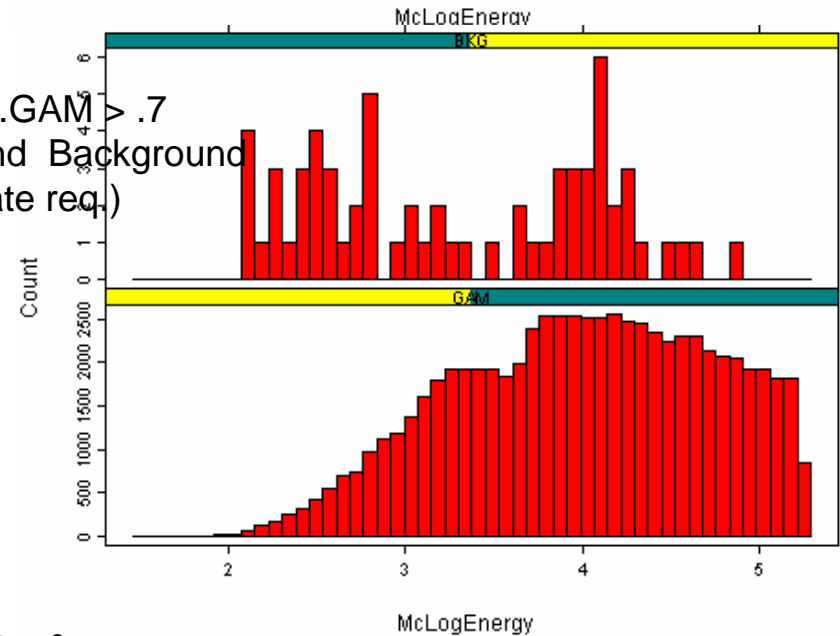
Come in through the corners and there is a definite handedness this suggest a ERROR IN THE ACD CODE / GEOMETRY



Event Spectra both MC Truth and as Reconstructed



Prob.GAM > .7
(Meets Aeff and Background rate req.)



62352 events > 1 GeV

$A_{\text{eff}} \times \Delta\Omega = 2.1 \text{ m}^2\text{-str}$