Auger SD events in AMBER FoV

DATA Sets:
SD: Herald 2011/6/1 – 2011/10/20
Infill: Herald 2011/6/1 – 2011/9/15

pre-Selection criteria:
- Ntanks>4 (necessary to get curvature radius)

Selection:
- shower Impact Angle with AMBER axis < 5 degrees
- Energy>0.3EeV

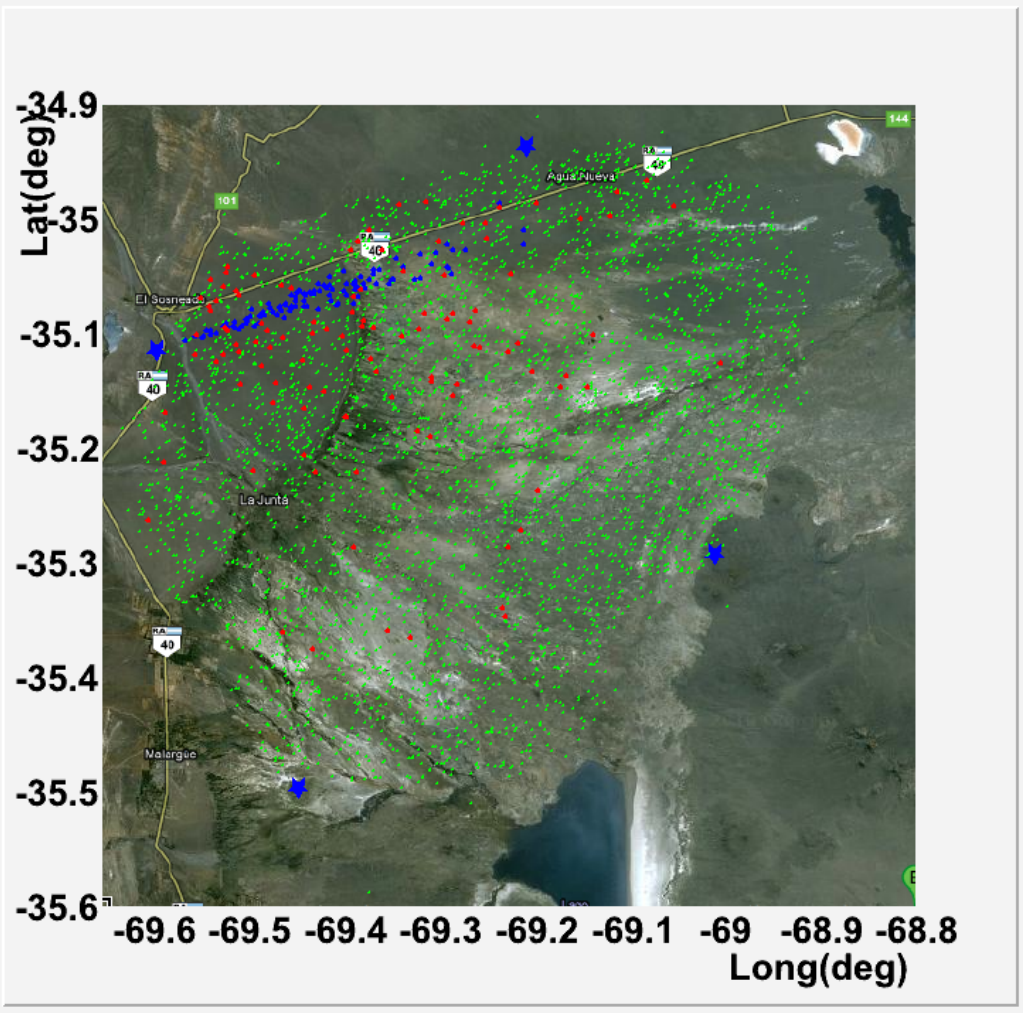
Observables:
- Xmax calculated from shower curvature radius
- Earth curvature not taken into account
- Shower Energy from latest FD calibration (Herald $39)
- Gaisser-Hillas Profile with X_0= -20 g/cm^2, Λ = 70 g/cm^2
- Density profiles from Auger monthly models
- Metrics to sort candidates

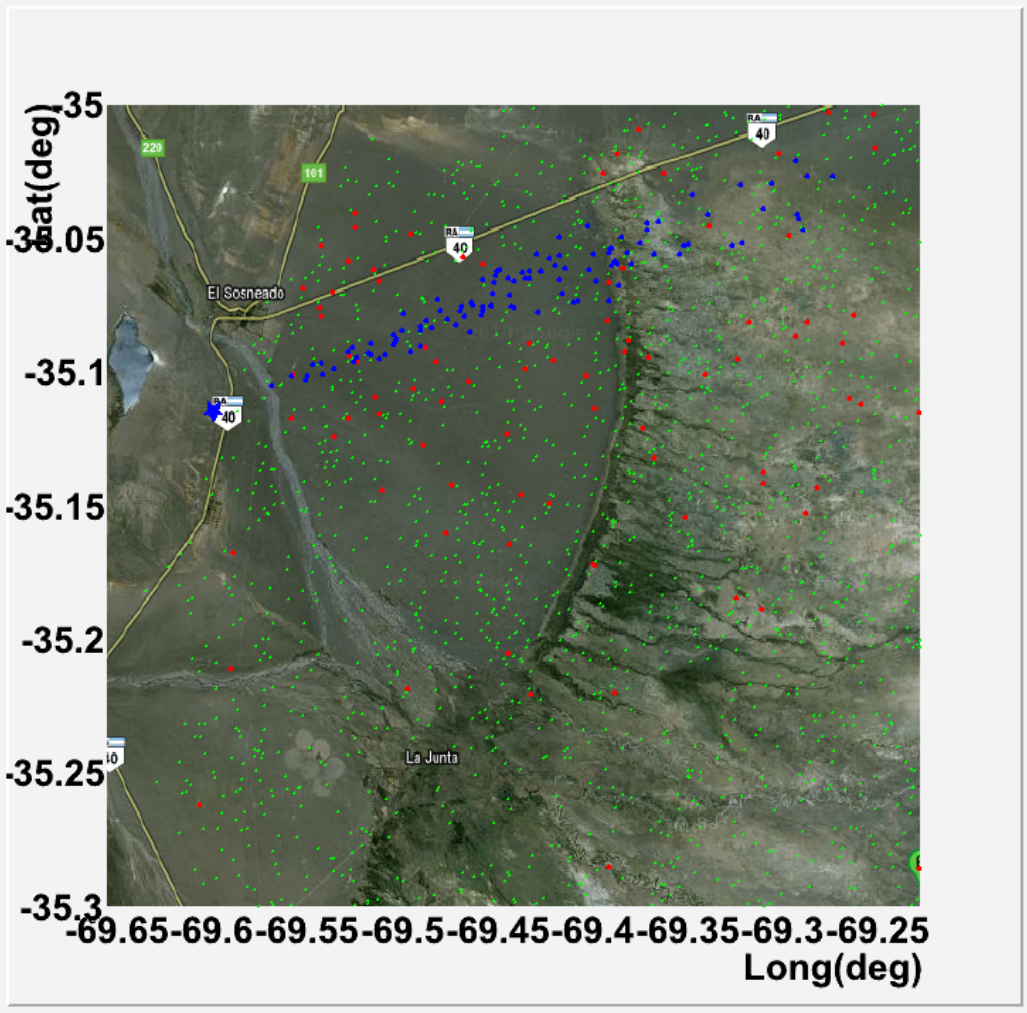
Data Sets

SD	All	Prelim	In Amber FoV	
06/2011	38839	3921	331	
07/2011	39633	4001	374	
08/2011	41244	4104	To be rerun	
09/2011	41186	4096	390	
10/2011	26772	2567	To be run	- Oct.20

Infill	All	Prelim	In Amber FoV	
06/2011	28516	6594	191	
07/2011	32801	8292	189	
08/2011	36825	8990	253	
09/2011	20572	4812	125	- Sept.15
10/2011	-	-	-	

SD, 2011-09





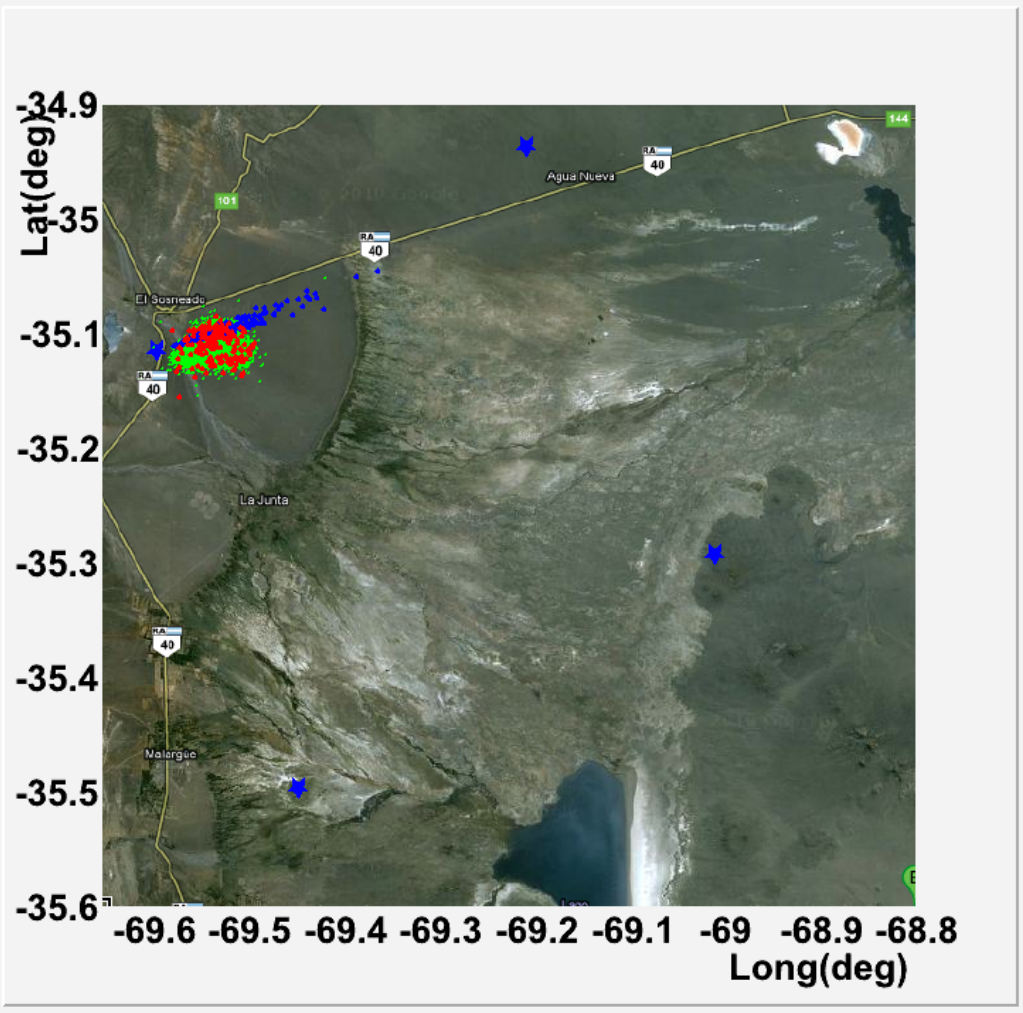
Green Dots: Lat_{core} vs $Long_{core}$ for all data

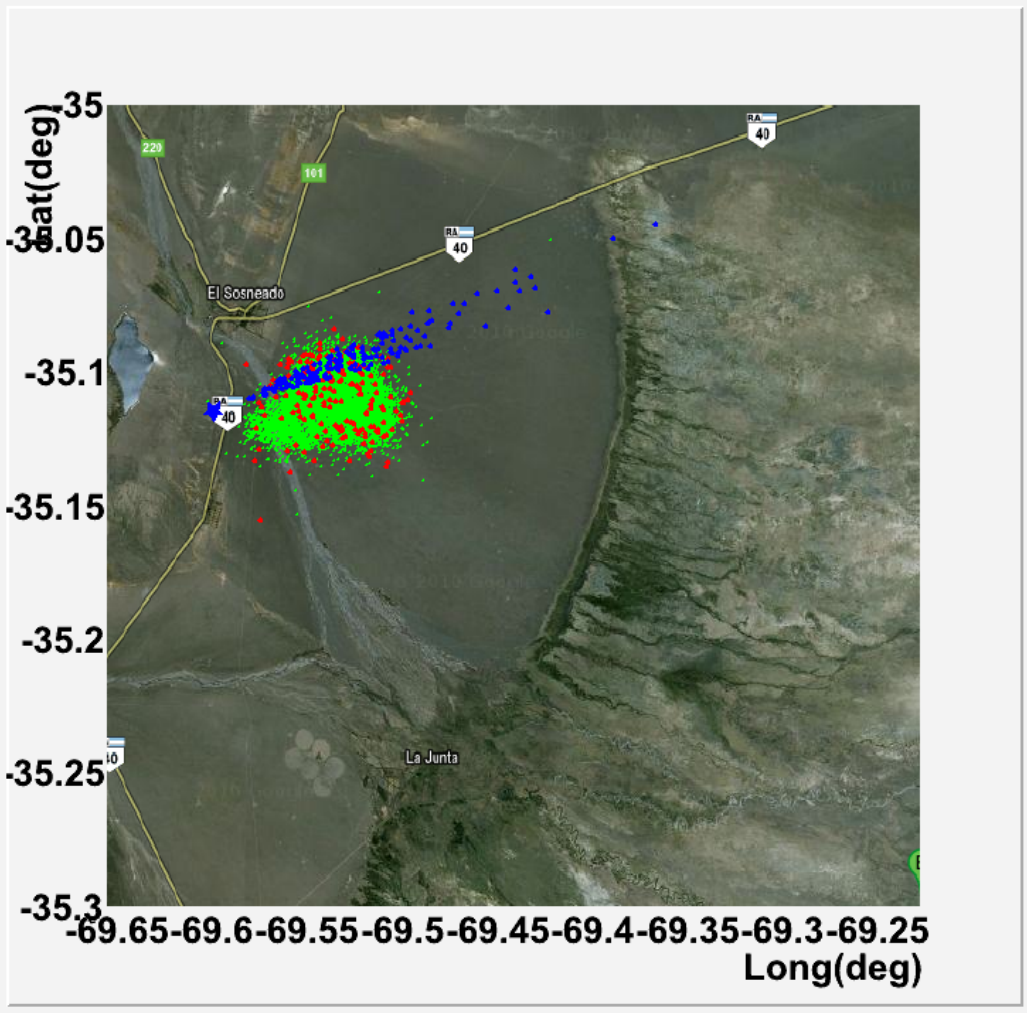
Blue Dots: Lat_{XSA} vs $Long_{XSA}$ for events in AMBER FoV

Red Dots: Lat_{core} vs $Long_{core}$ for events in AMBER FoV

XSA: point of closest distance between Amber FoV and Shower Core

INFILL, 2011-07





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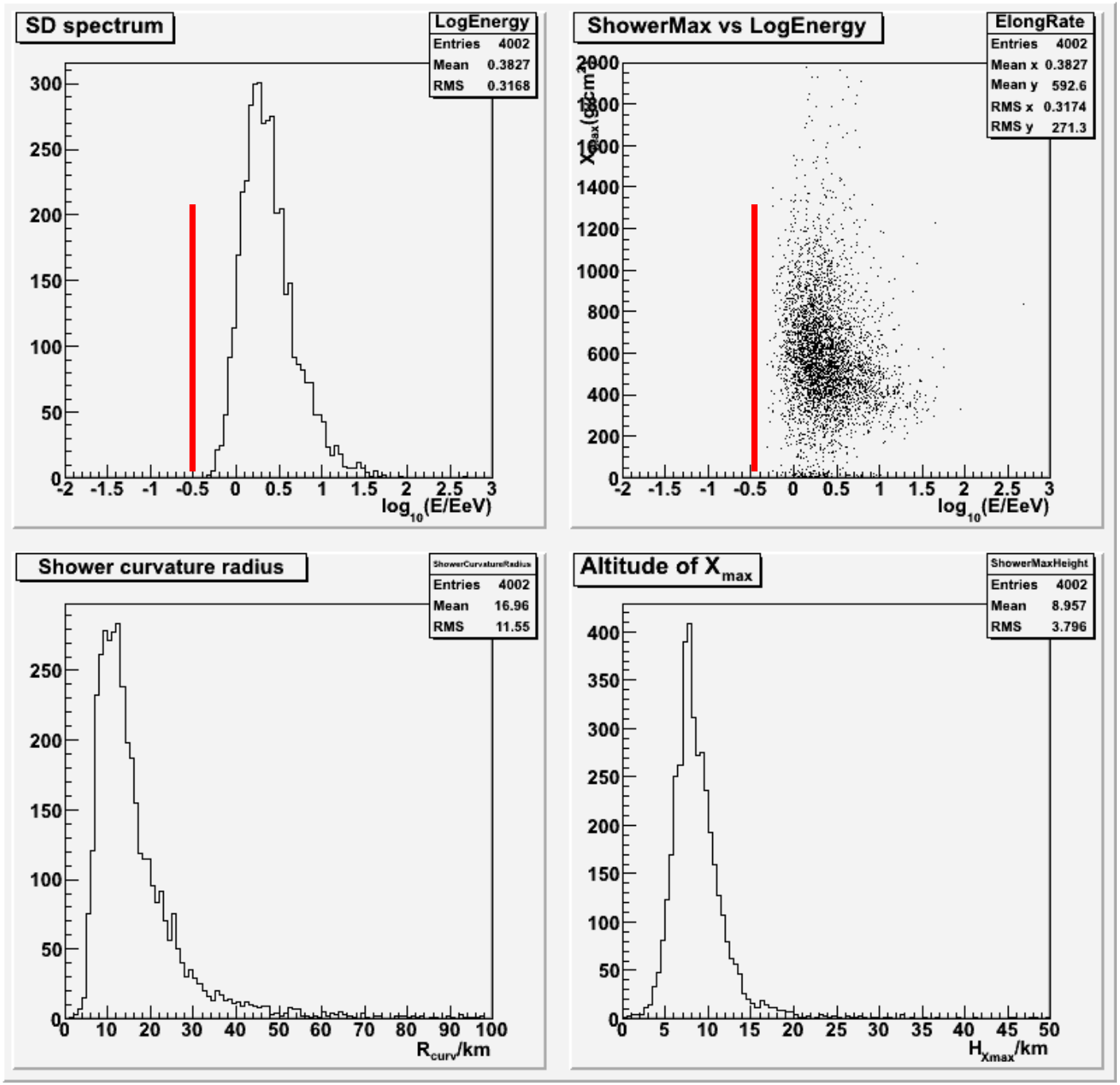
XSA: point of closest distance between Amber FoV and Shower Core

SD, 2011-07

Energy measured by Herald using most recent FD calibration (Cut at 0.3 EeV)

Xmax evaluated from curvature radius of the shower front



SD, 2011-09

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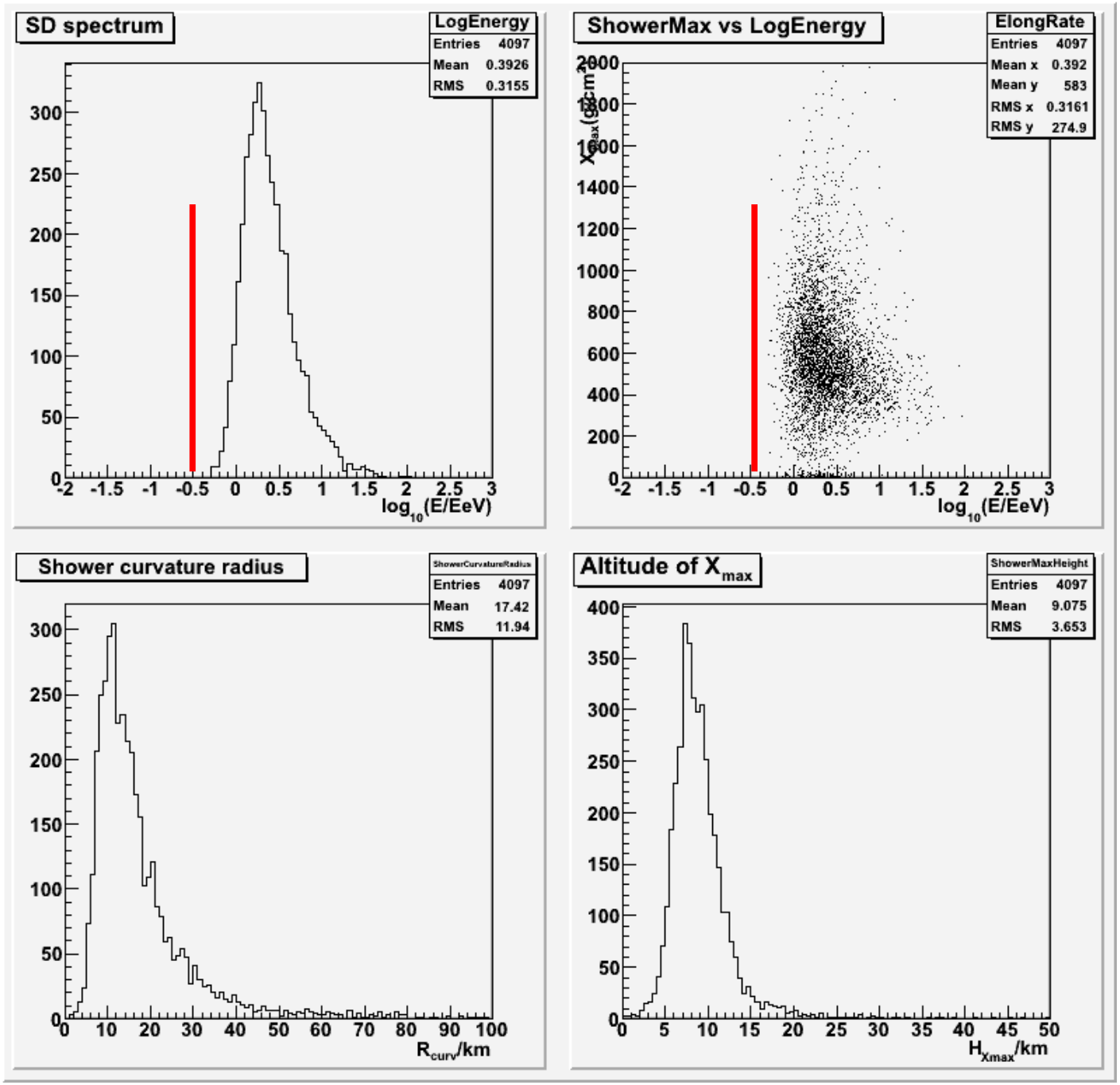
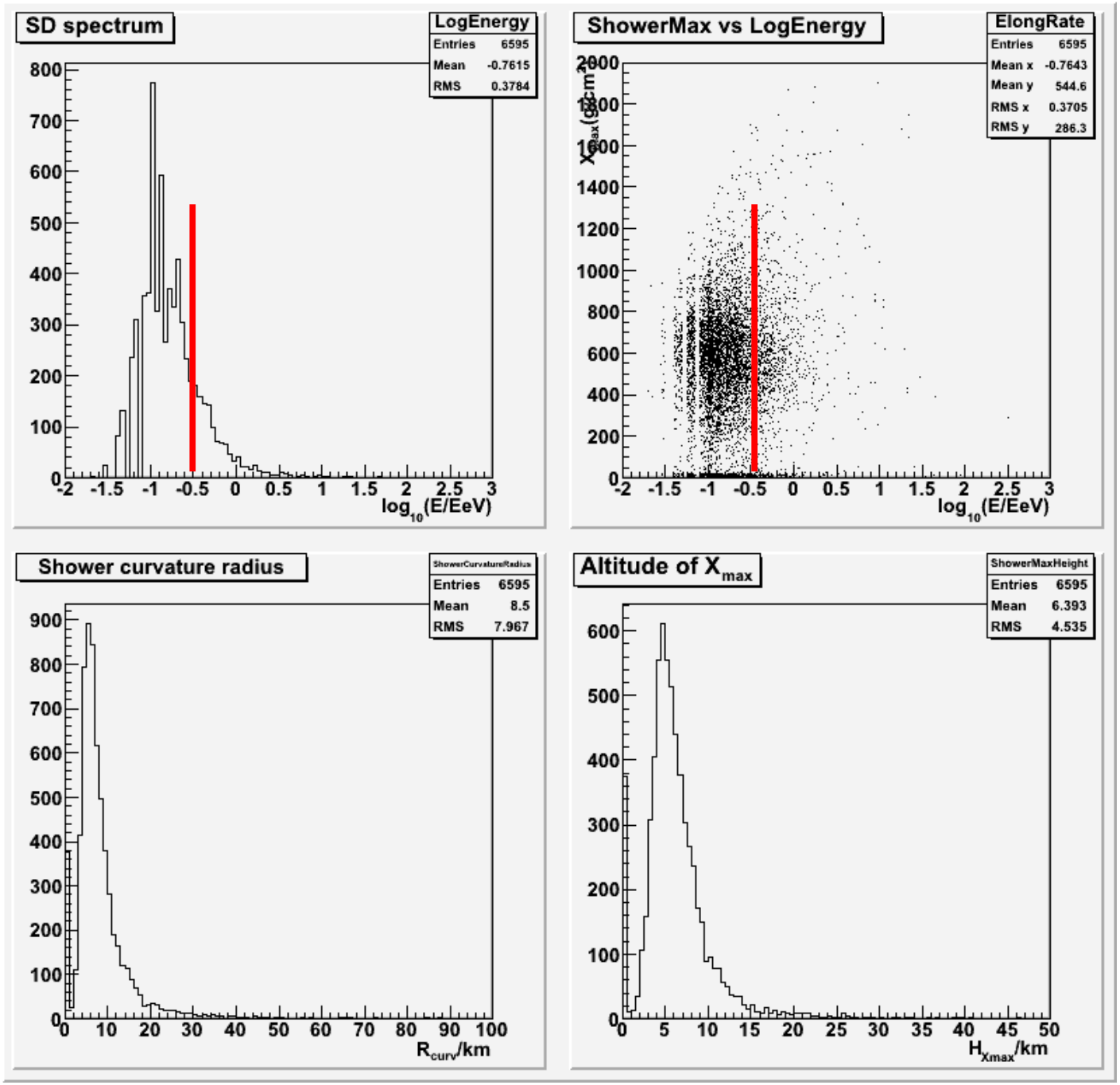


INFILL, 2011-06

Energy measured by Herald using most recent FD calibration (Cut at 0.3 EeV)

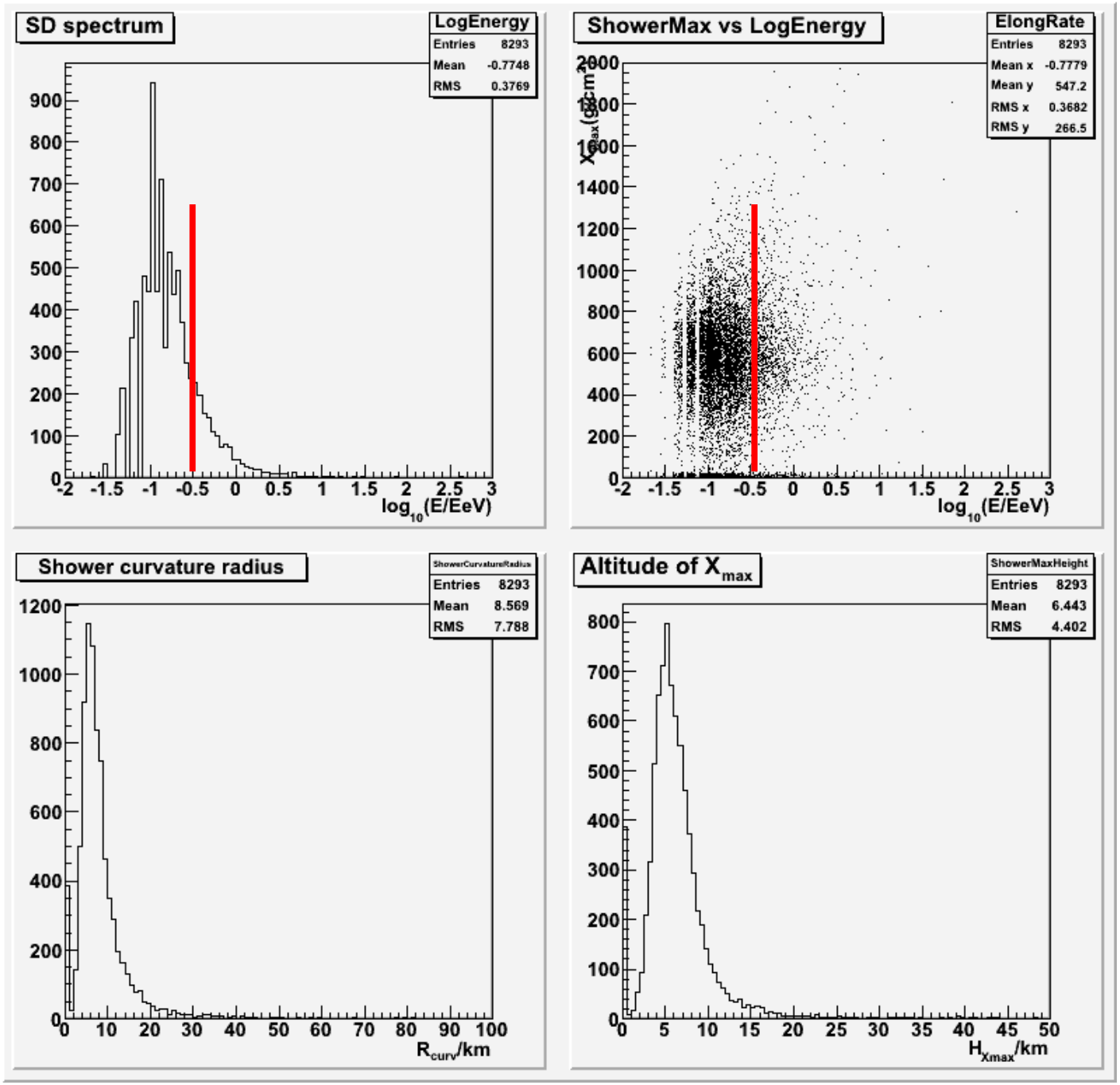
Xmax evaluated from curvature radius of the shower front



INFILL, 2011-07

Energy measured by Herald using most recent FD calibration (Cut at 0.3 EeV)

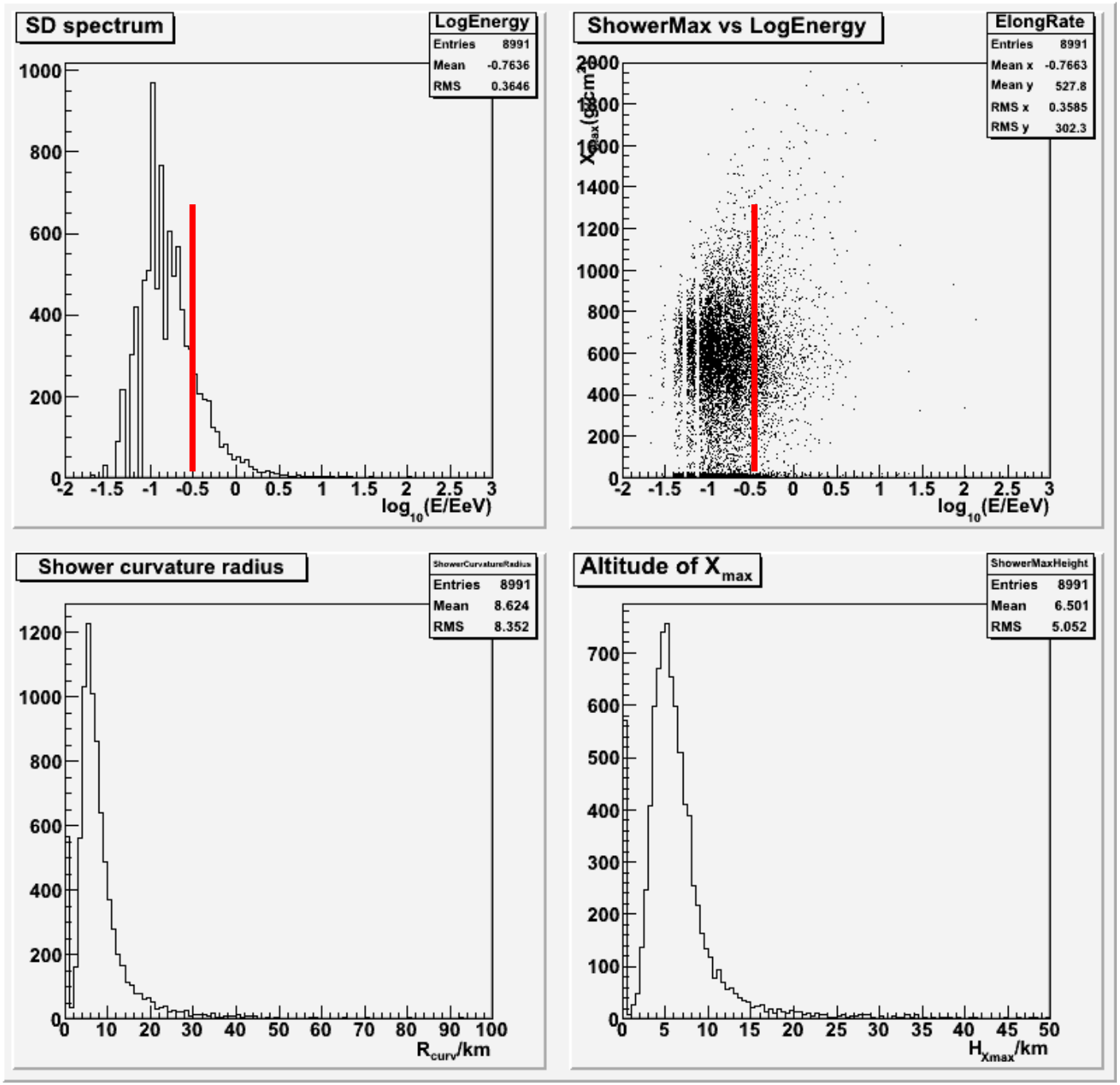
Xmax evaluated from curvature radius of the shower front



INFILL, 2011-08

Energy measured by Herald using most recent FD calibration (Cut at 0.3 EeV)

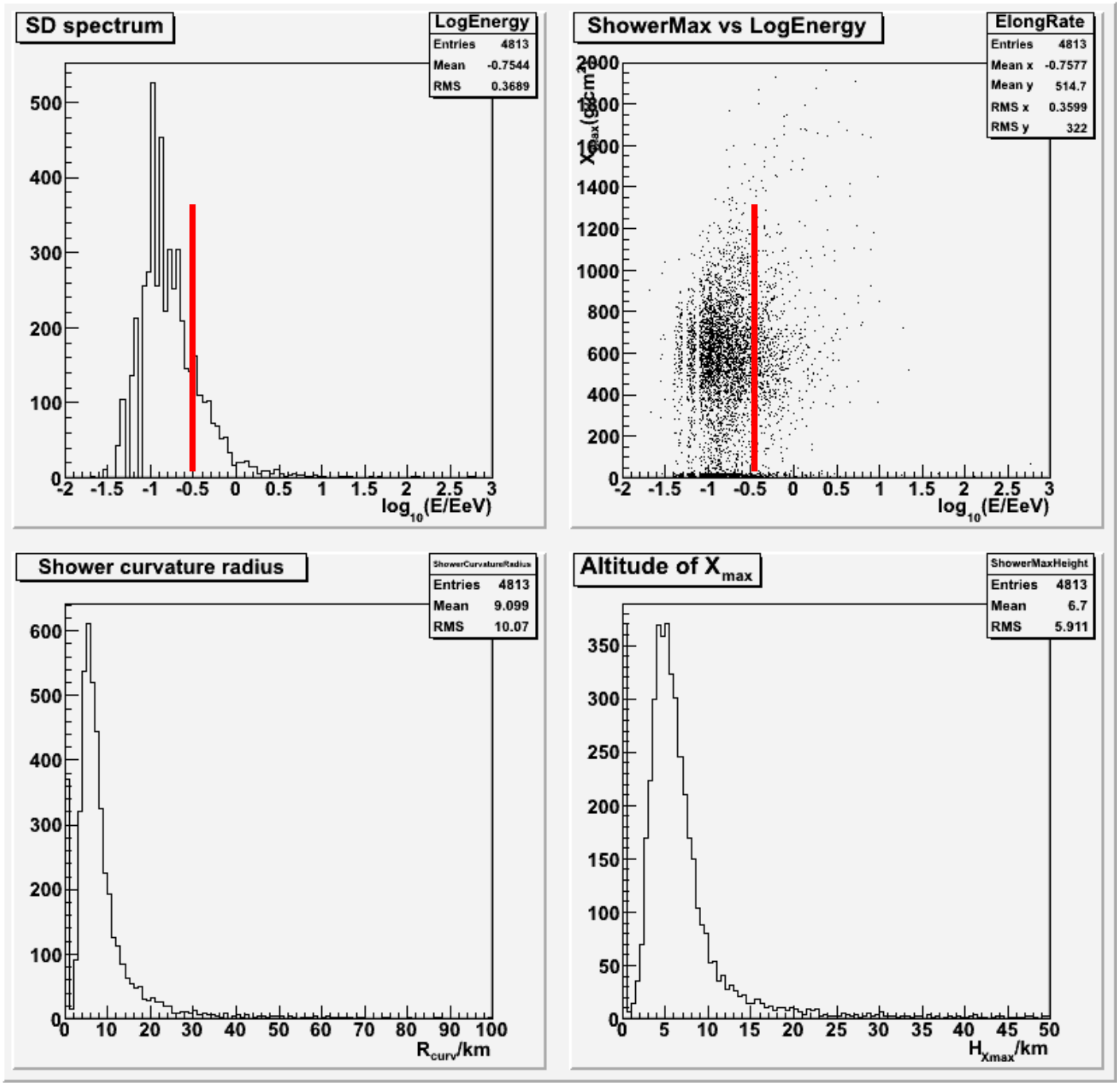
Xmax evaluated from curvature radius of the shower front



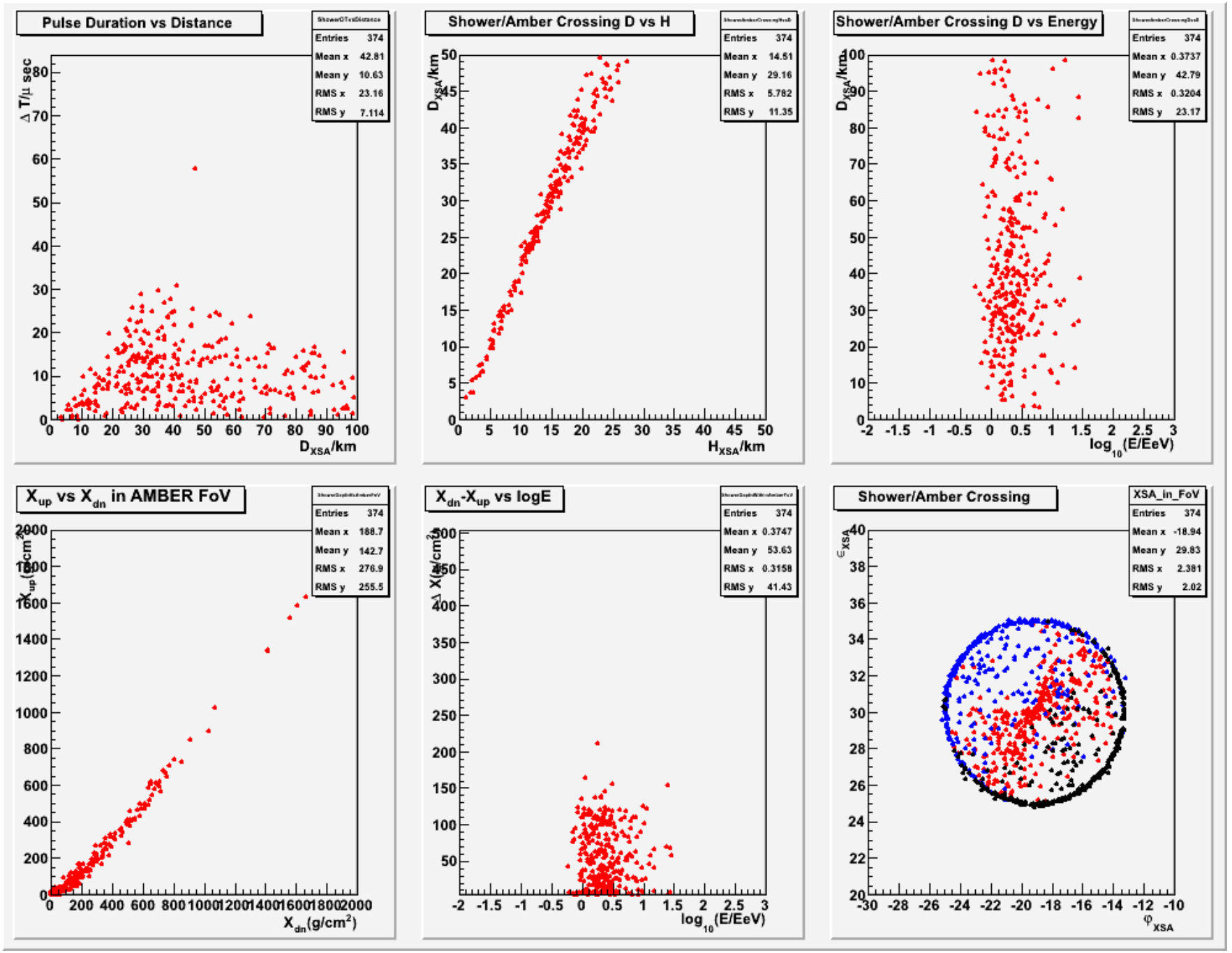
INFILL, 2011-09

Energy measured by Herald using most recent FD calibration (Cut at 0.3 EeV)

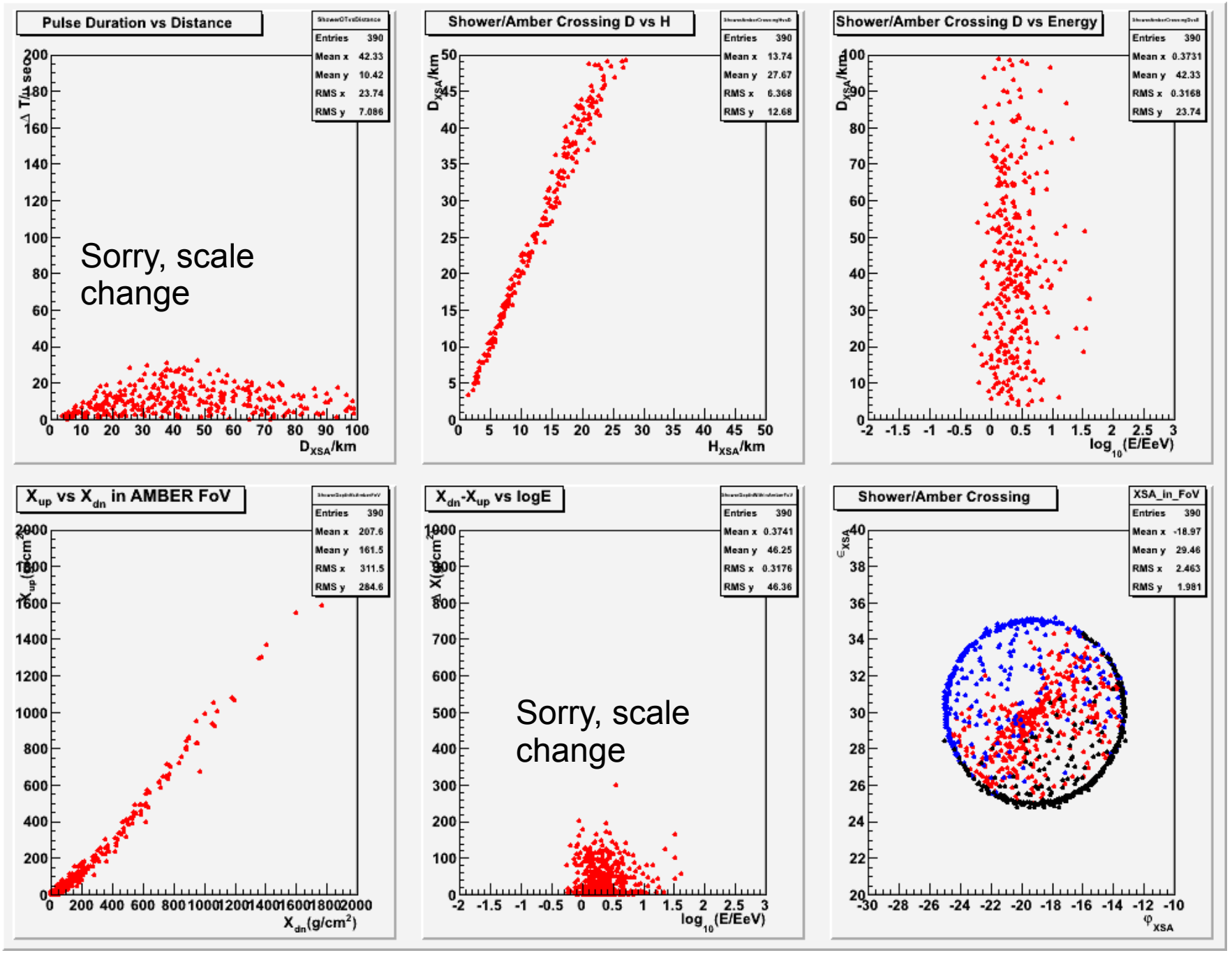
Xmax evaluated from curvature radius of the shower front



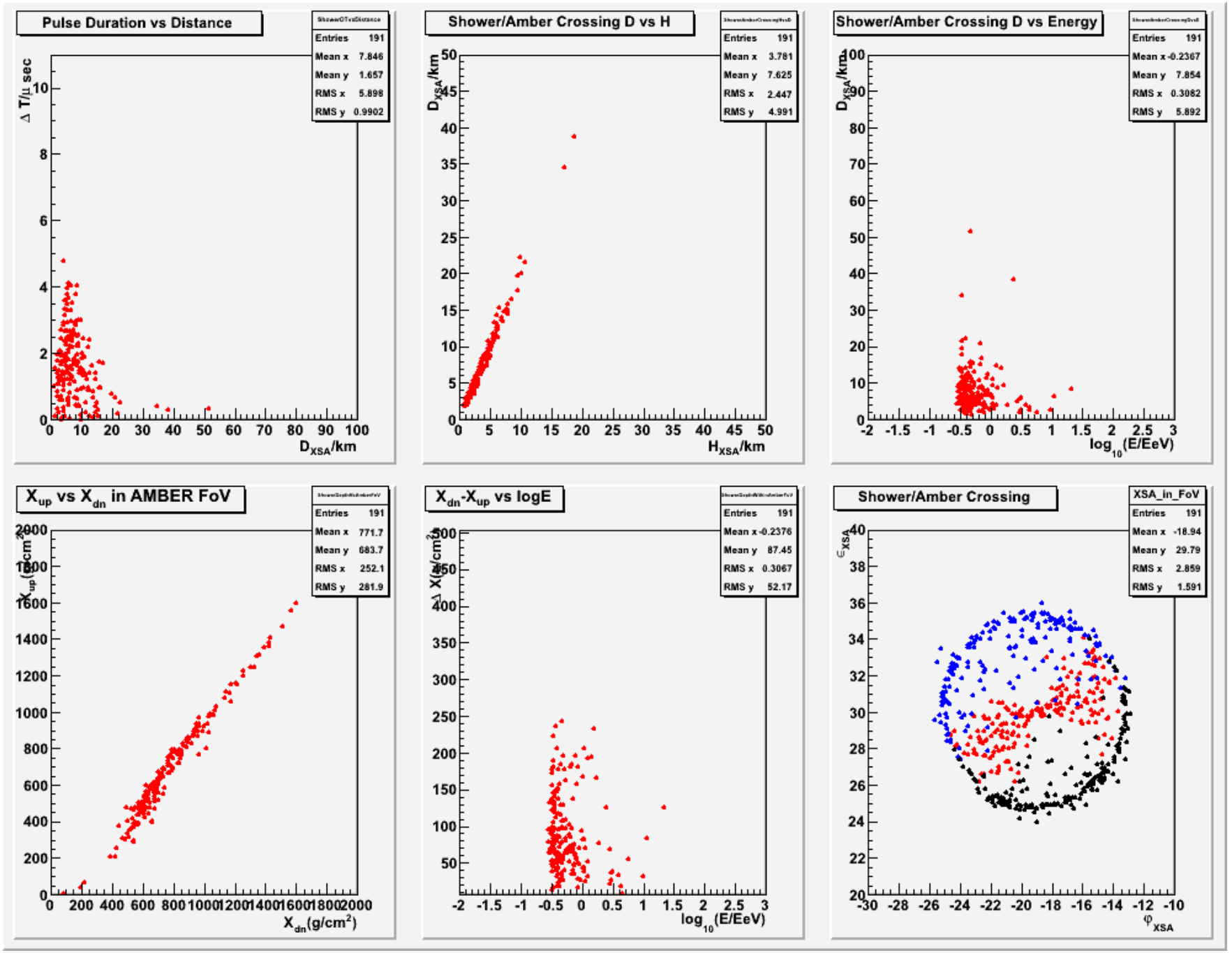
SD, 2011-07


Pulse Duration vs Distance
Entries 374
Mean x 42.81
Mean y 10.63
RMS x 23.16
RMS y 7.114
ΔT/μ sec
D_XSA/km
Shower/Amber Crossing D vs H
Entries 374
Mean x 14.51
Mean y 29.16
RMS x 5.782
RMS y 11.35
D_XSA/km
H_XSA/km
Shower/Amber Crossing D vs Energy
Entries 374
Mean x 0.3737
Mean y 42.79
RMS x 0.3204
RMS y 23.17
D_XSA/km
log10(E/EeV)
X_up vs X_dn in AMBER FoV
Entries 374
Mean x 188.7
Mean y 142.7
RMS x 276.9
RMS y 255.5
X_up(g/cm²)
X_dn(g/cm²)
X_dn-X_up vs logE
Entries 374
Mean x 0.3747
Mean y 53.63
RMS x 0.3158
RMS y 41.43
ΔX(g/cm²)
log10(E/EeV)
Shower/Amber Crossing
XSA_in_FoV
Entries 374
Mean x -18.94
Mean y 29.83
RMS x 2.381
RMS y 2.02
θXSA
φXSA

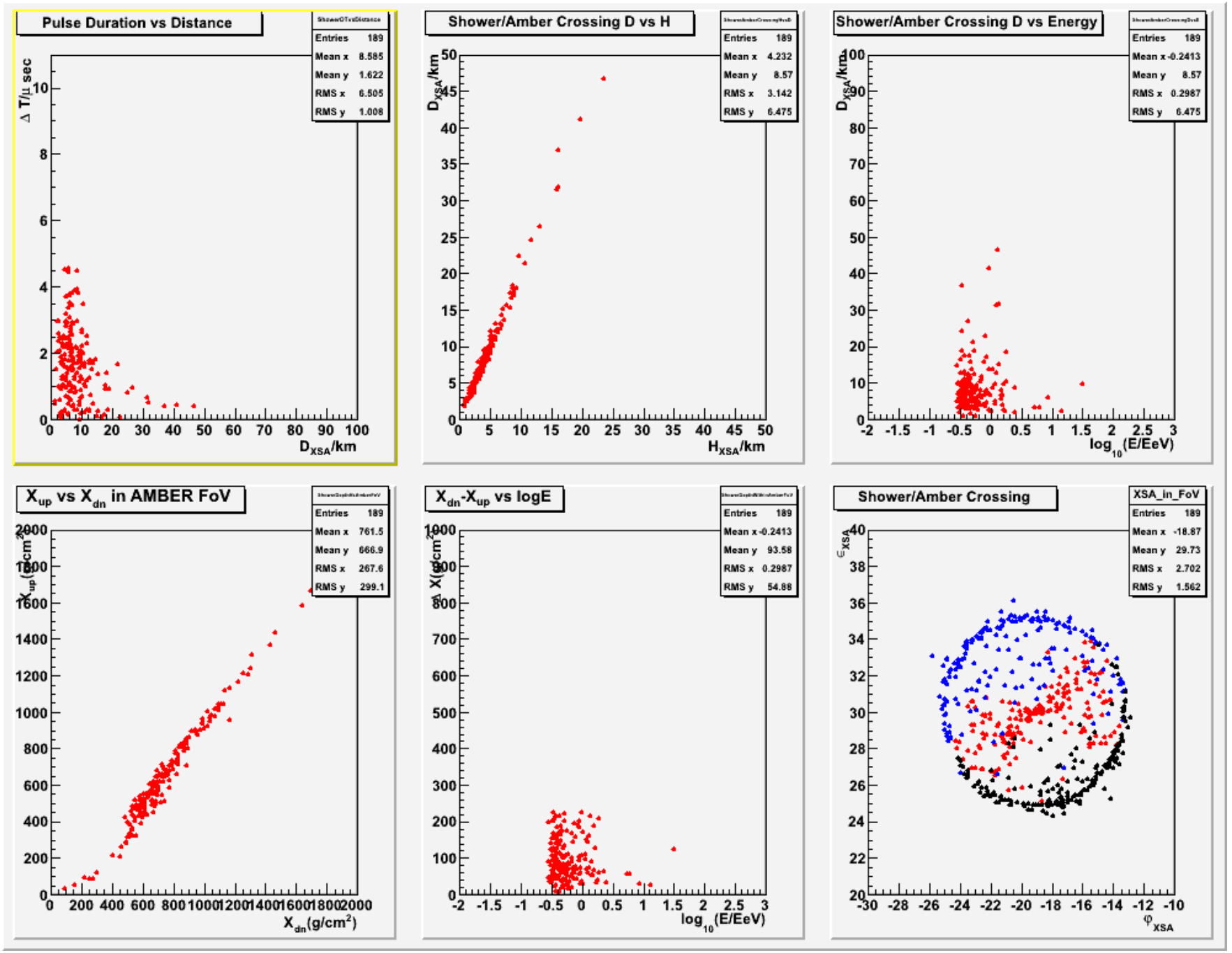
SD, 2011-09


Pulse Duration vs Distance
Entries 390
Mean x 42.33
Mean y 10.42
RMS x 23.74
RMS y 7.086
Δ T/μ sec
D_XSA/km
Sorry, scale change
Shower/Amber Crossing D vs H
Entries 390
Mean x 13.74
Mean y 27.67
RMS x 6.368
RMS y 12.68
D_XSA/km
H_XSA/km
Shower/Amber Crossing D vs Energy
Entries 390
Mean x 0.3731
Mean y 42.33
RMS x 0.3168
RMS y 23.74
D_XSA/km
log10(E/EeV)
X_up vs X_dn in AMBER FoV
Entries 390
Mean x 207.6
Mean y 161.5
RMS x 311.5
RMS y 284.6
X_up(g/cm²)
X_dn(g/cm²)
X_dn-X_up vs logE
Entries 390
Mean x 0.3741
Mean y 46.25
RMS x 0.3176
RMS y 46.36
Δ X(g/cm²)
log10(E/EeV)
Sorry, scale change
Shower/Amber Crossing
XSA_in_FoV
Entries 390
Mean x -18.97
Mean y 29.46
RMS x 2.463
RMS y 1.981
θ_XSA
φ_XSA

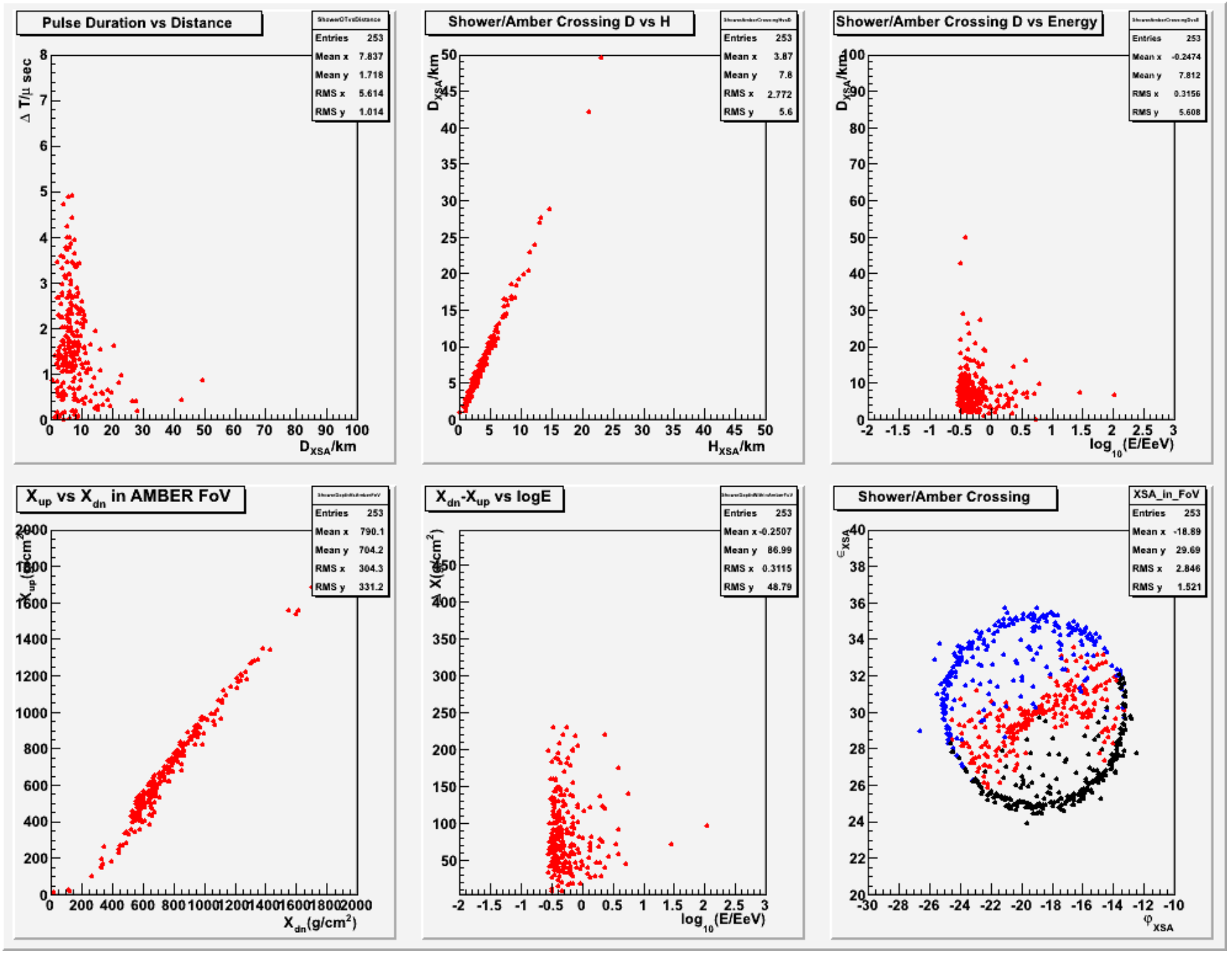
INFILL, 2011-06



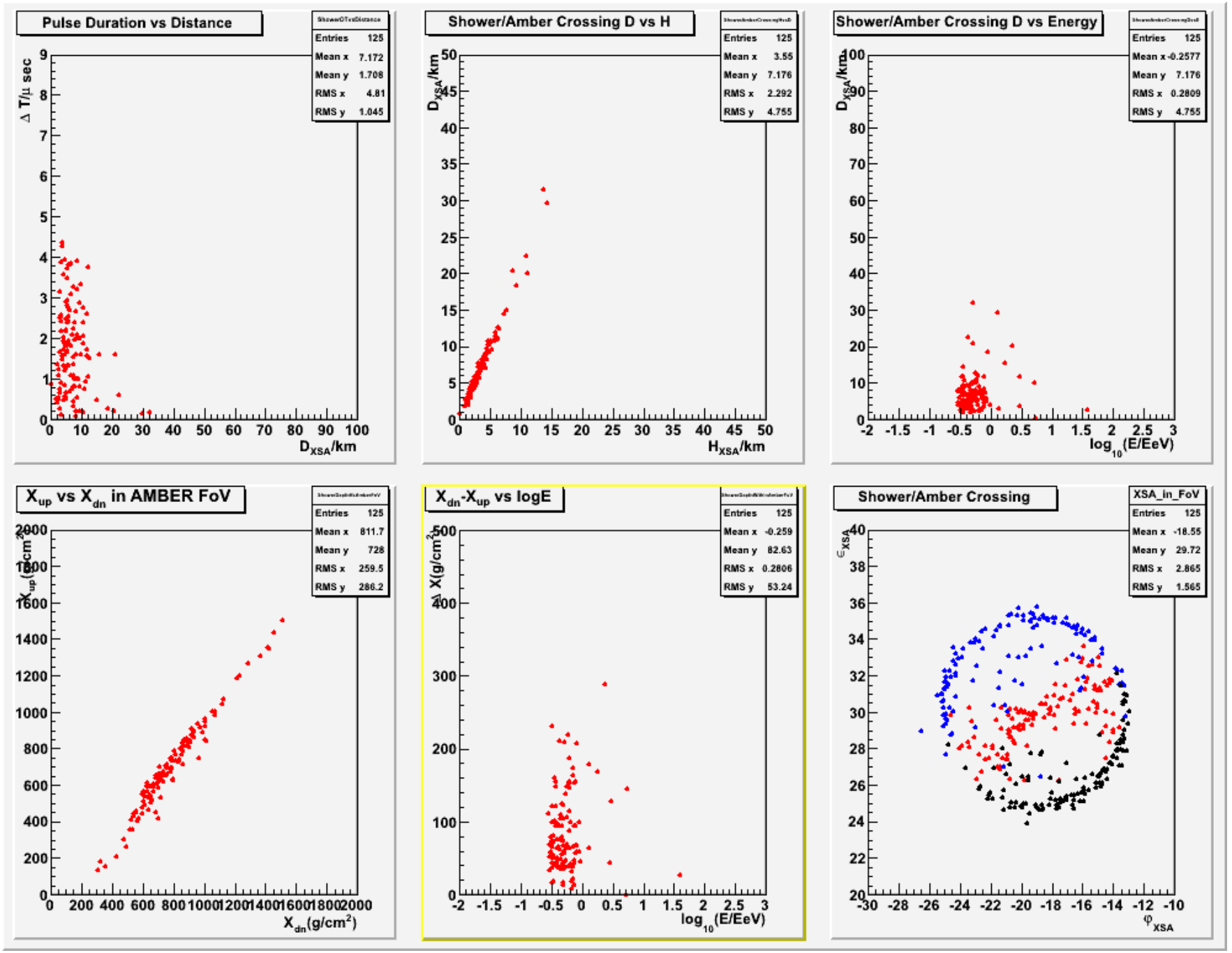
INFILL, 2011-07



INFILL, 2011-08



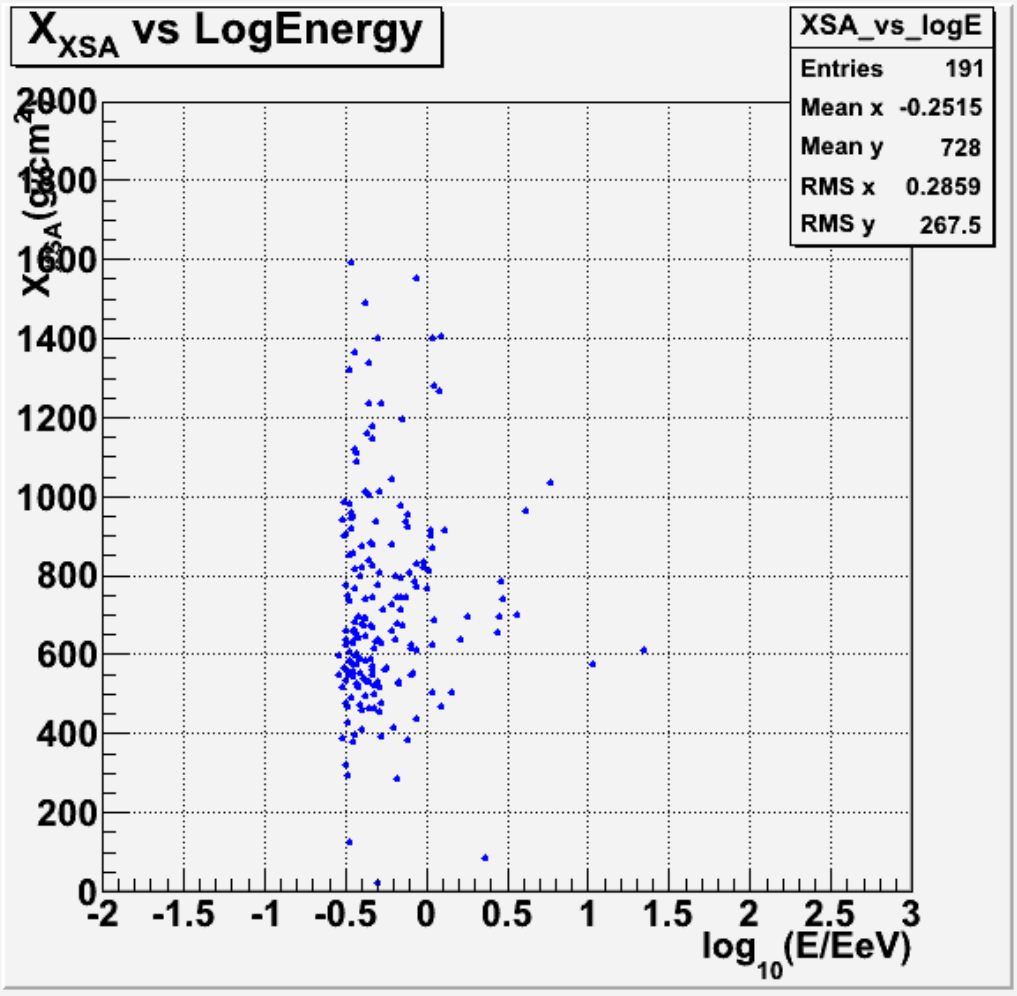
INFILL, 2011-09

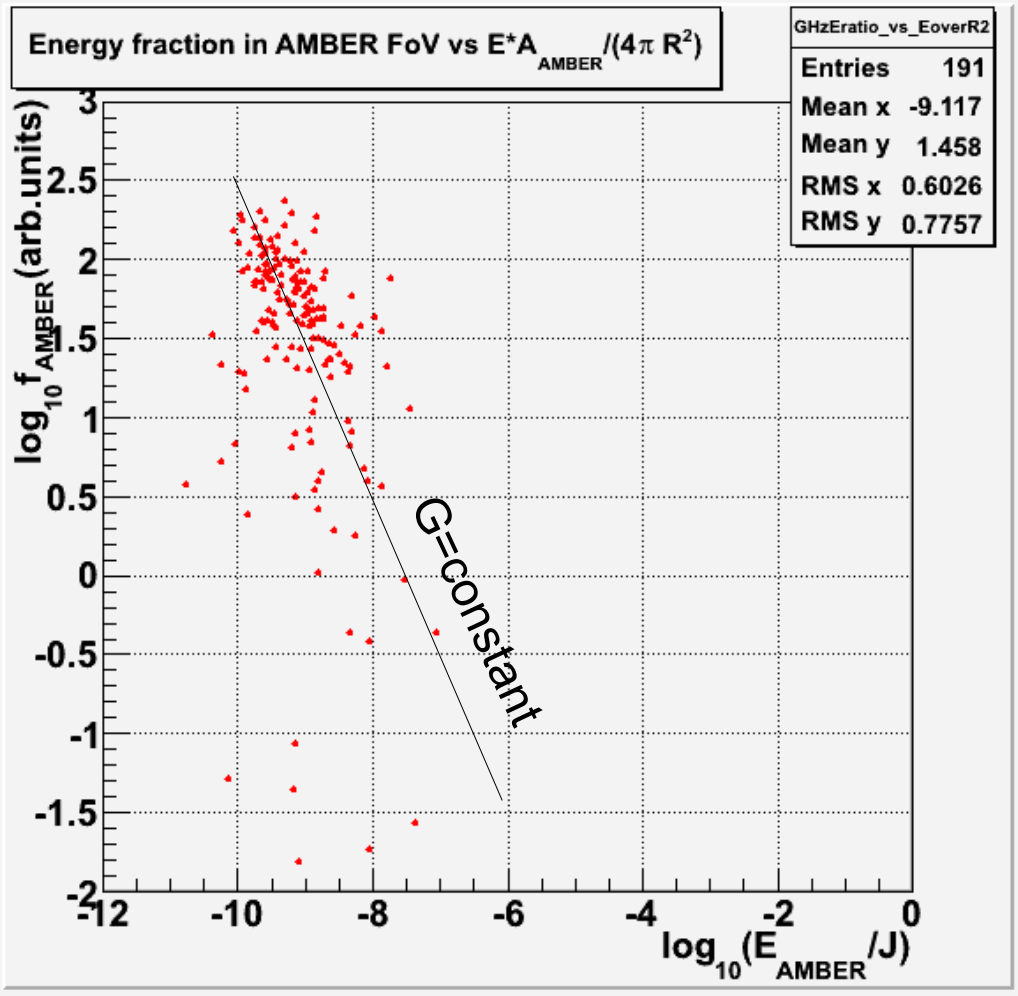


INFILL, 2011-06

Metrics to rank candidates:

$G = f_{AMBER} E_{AMBER}$





- $E_{AMBER} = E_{primary}(A_{AMBER}/4\pi R^2)$;
- $f_{AMBER} = \Delta X_{AMBER} GH(X_{AMBER})/GH(X_{MAX})$

INFILL, 2011-07

Metrics to rank candidates:

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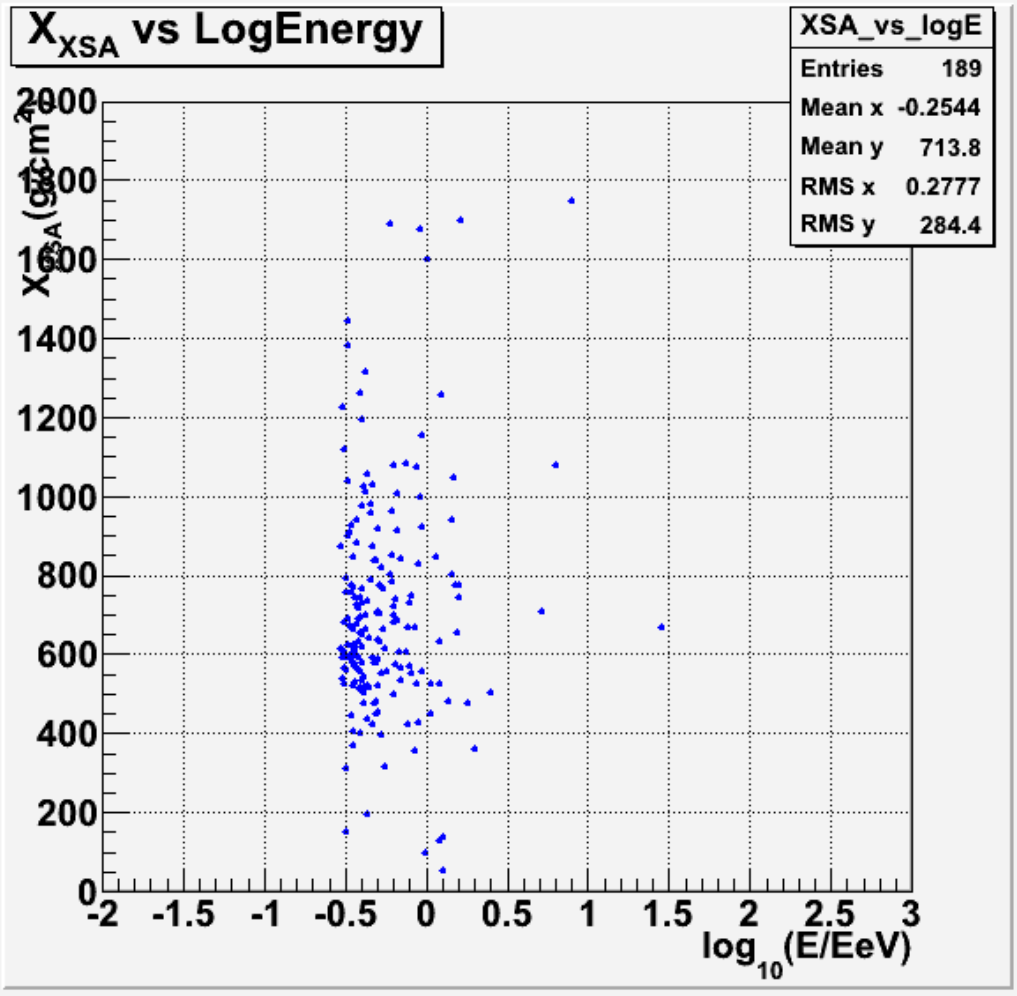

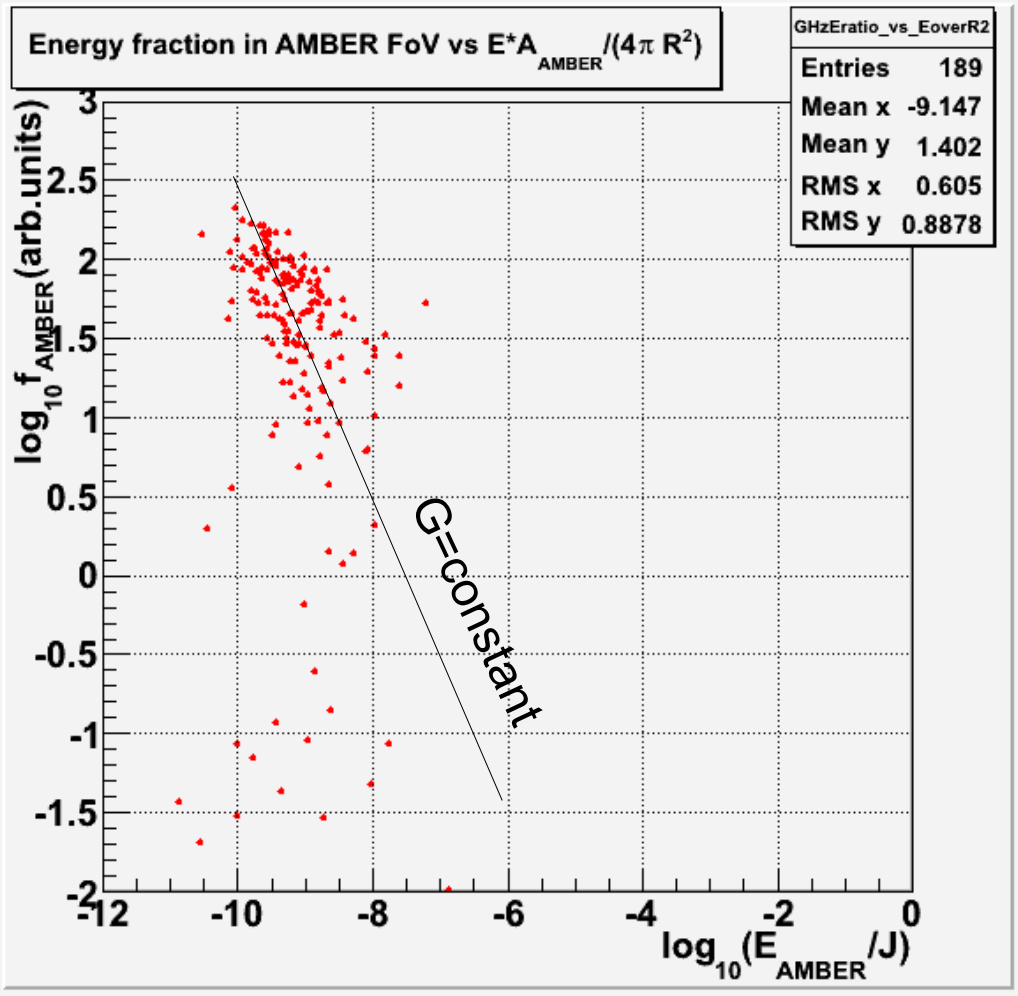

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INFILL, 2011-08

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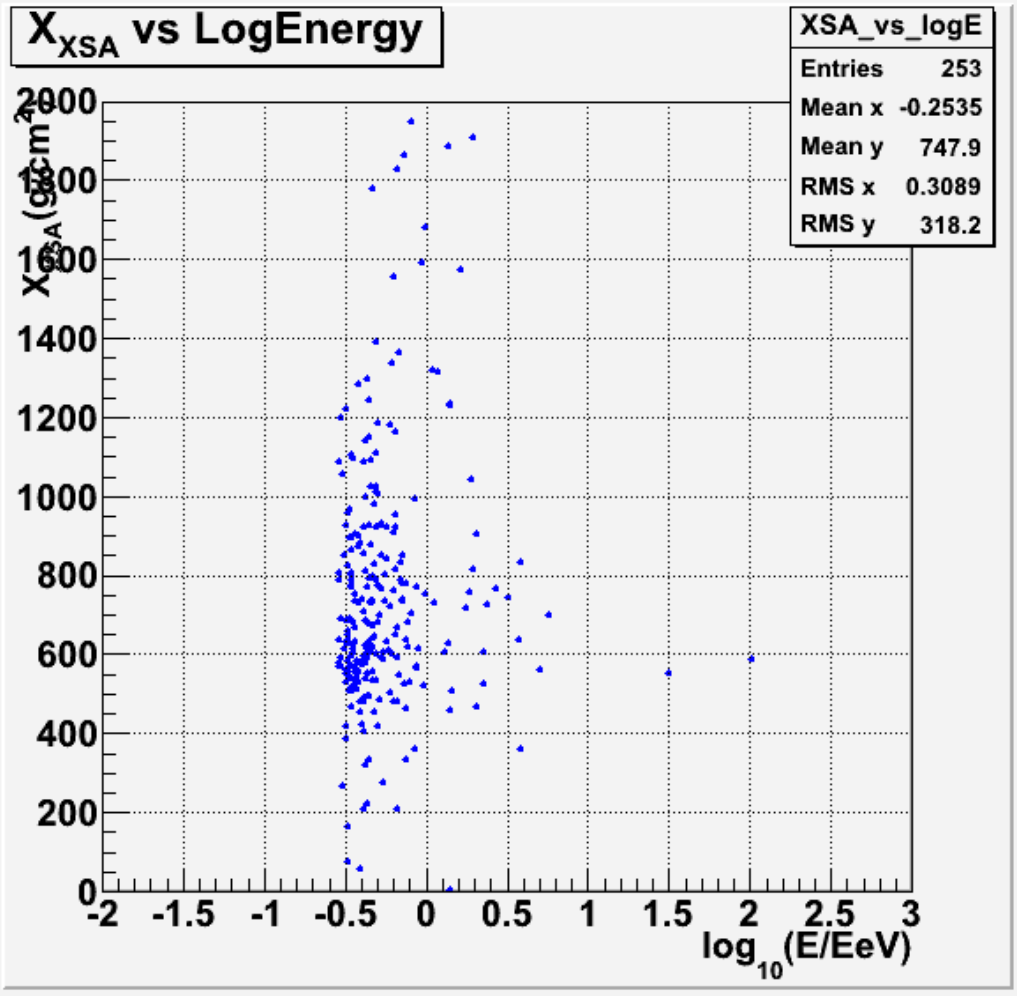

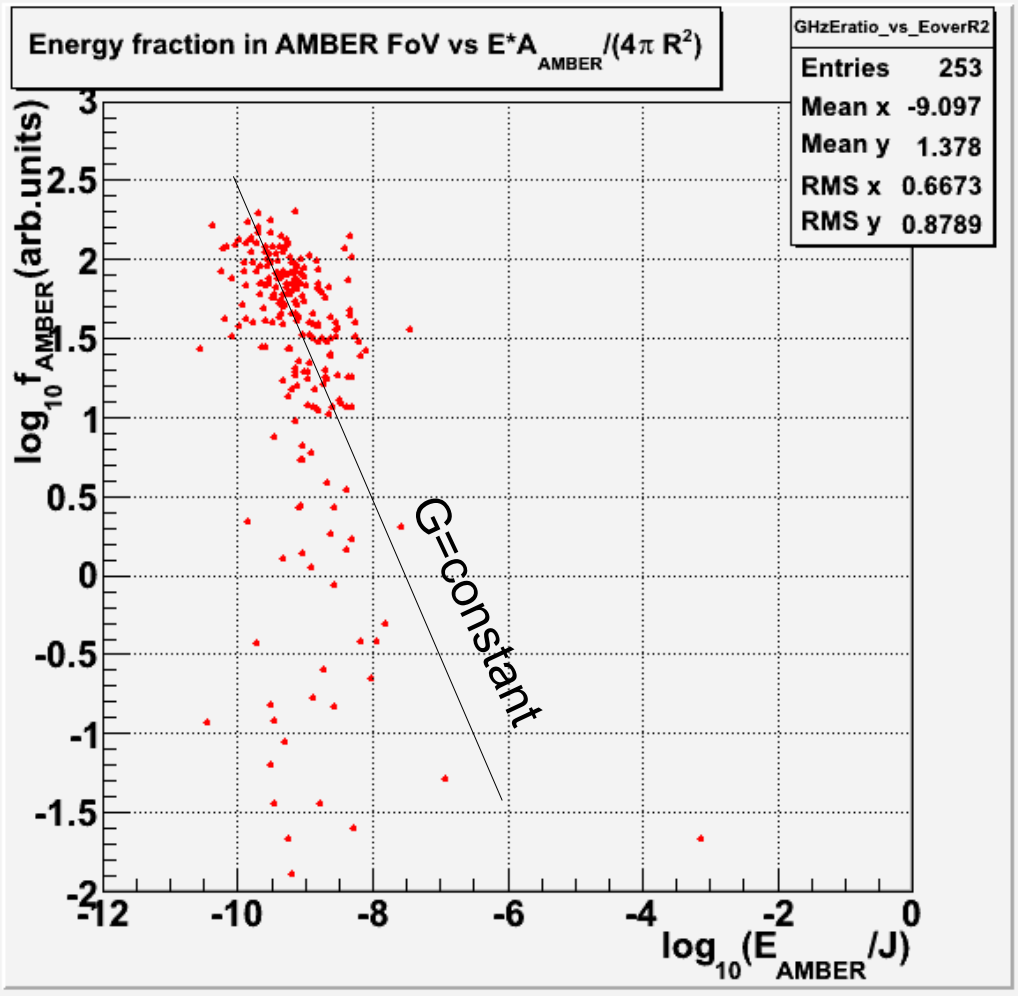

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INFILL, 2011-09

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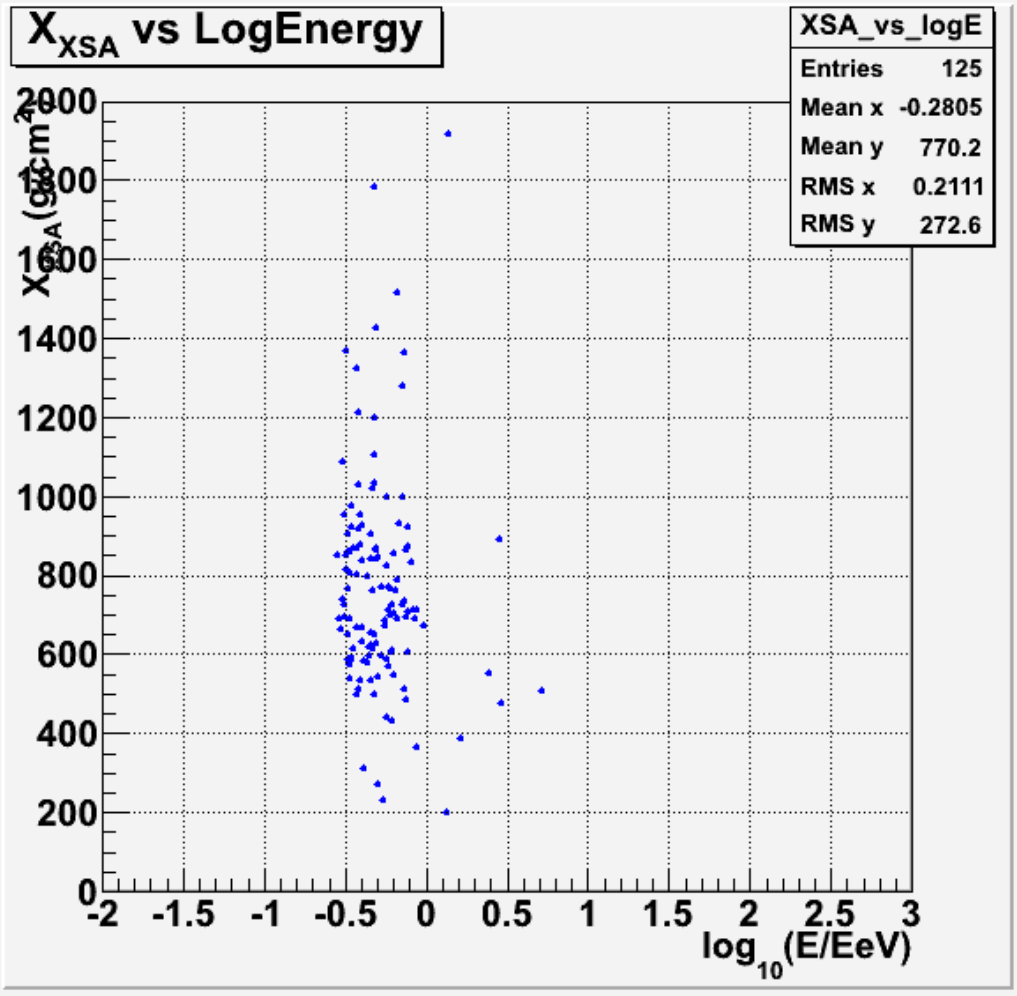

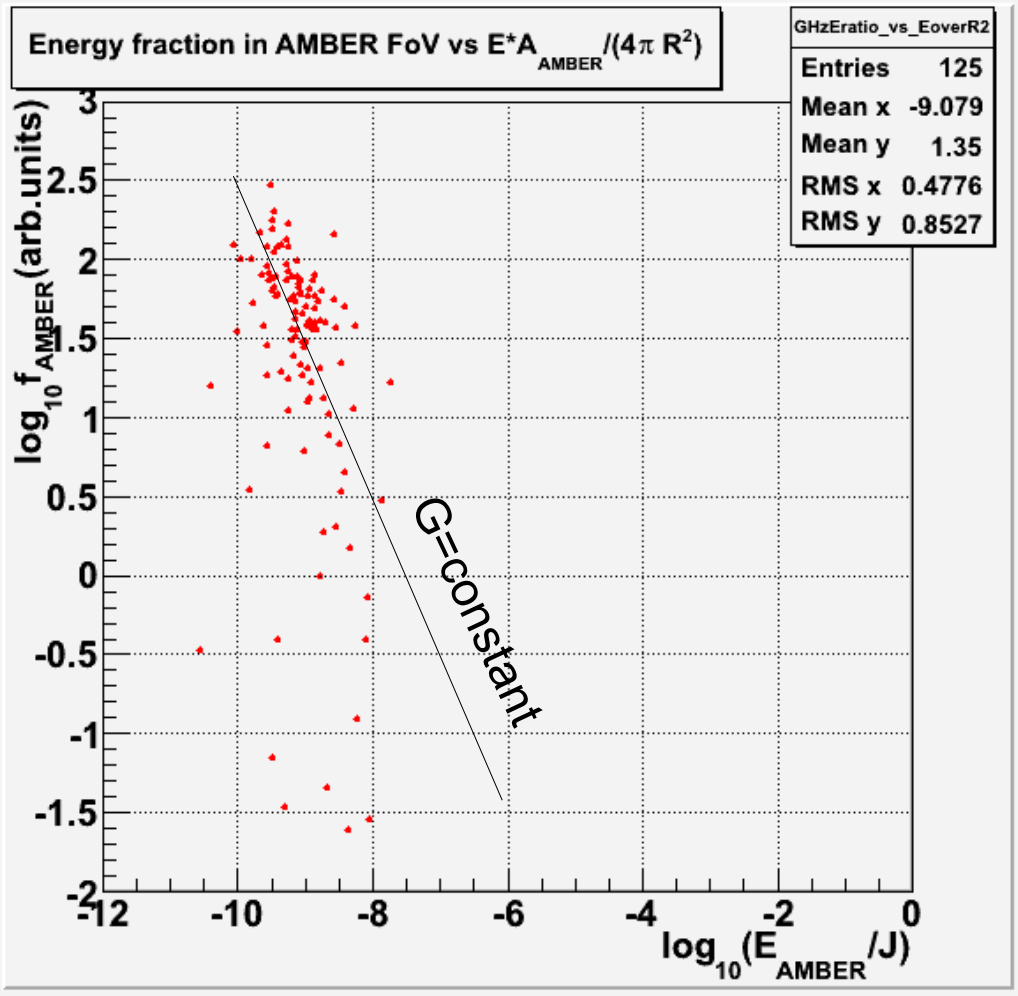

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SD, 2011-07

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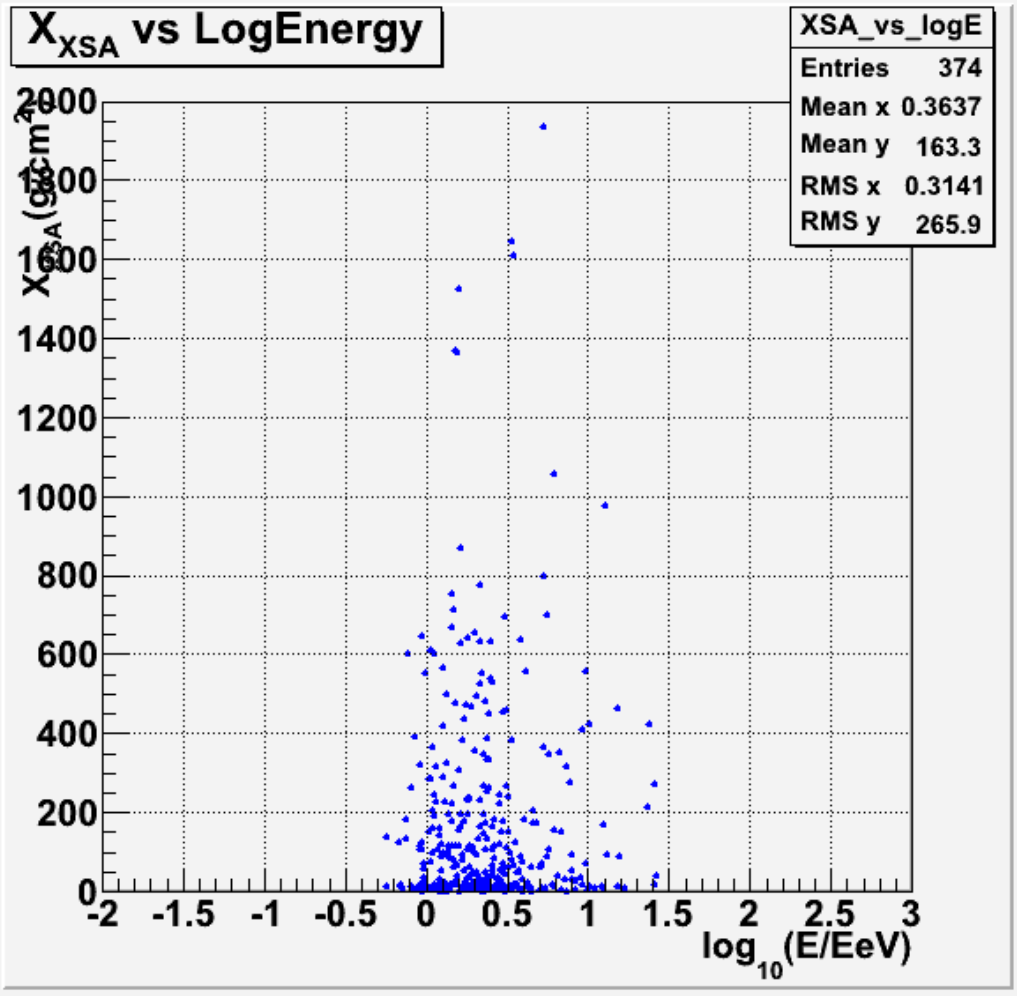

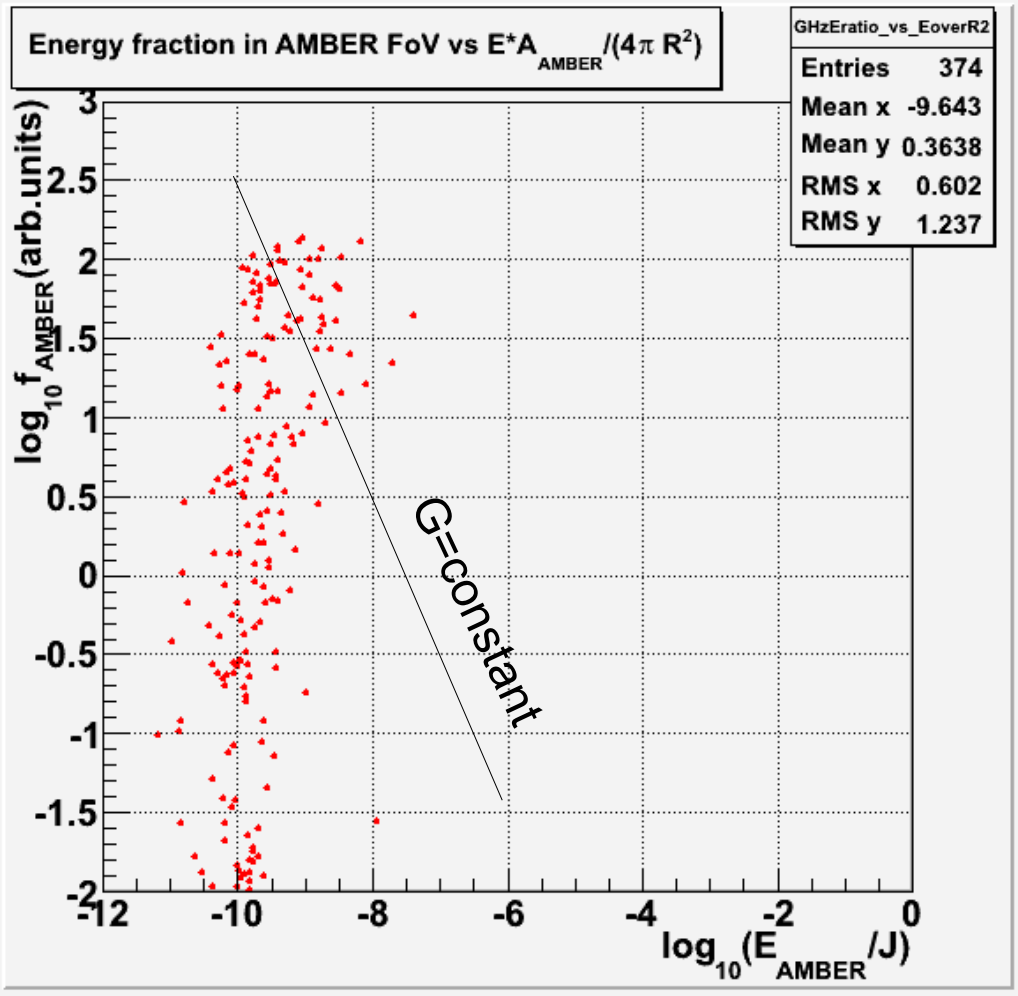

Slant Depth at crossing of ShowerCore and AmberFoV

- $E_{AMBER} = E_{primary}(A_{AMBER}/4\pi R^2)$;
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SD, 2011-07

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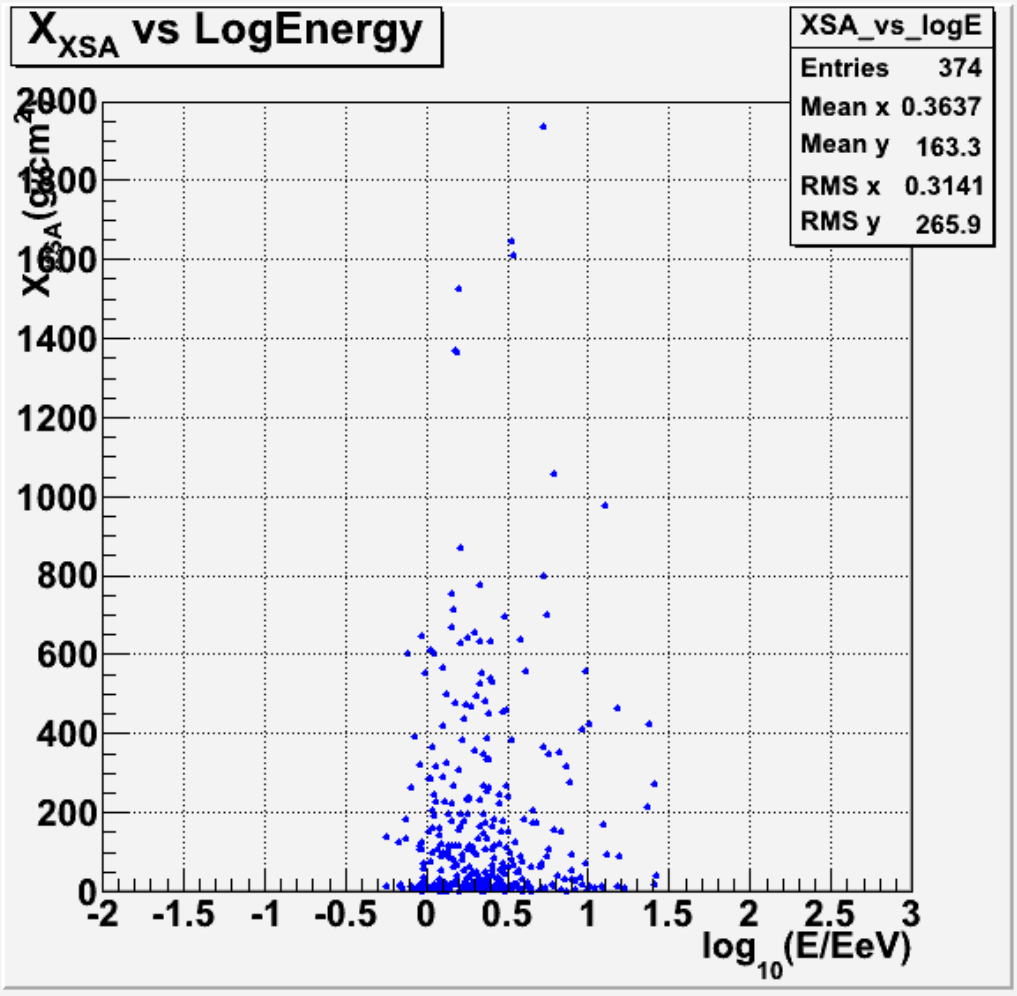

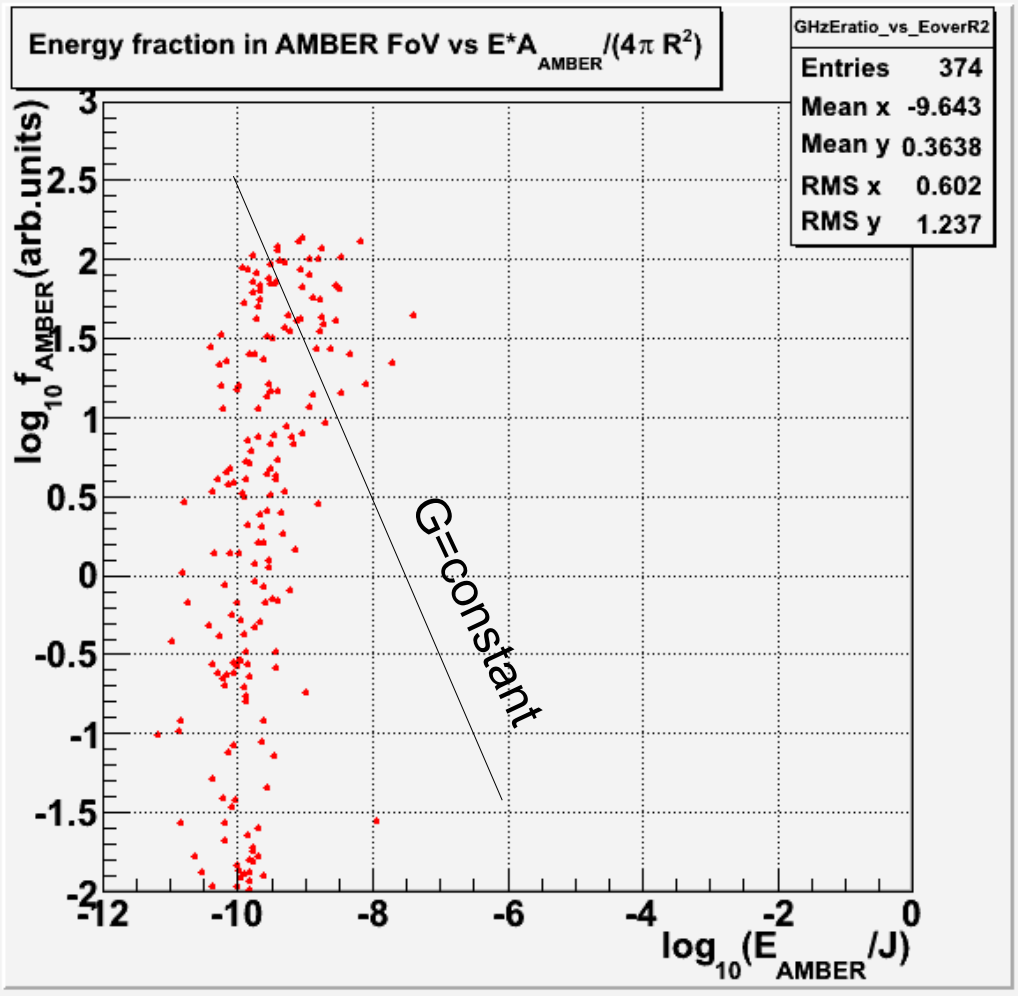

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SD, 2011-09

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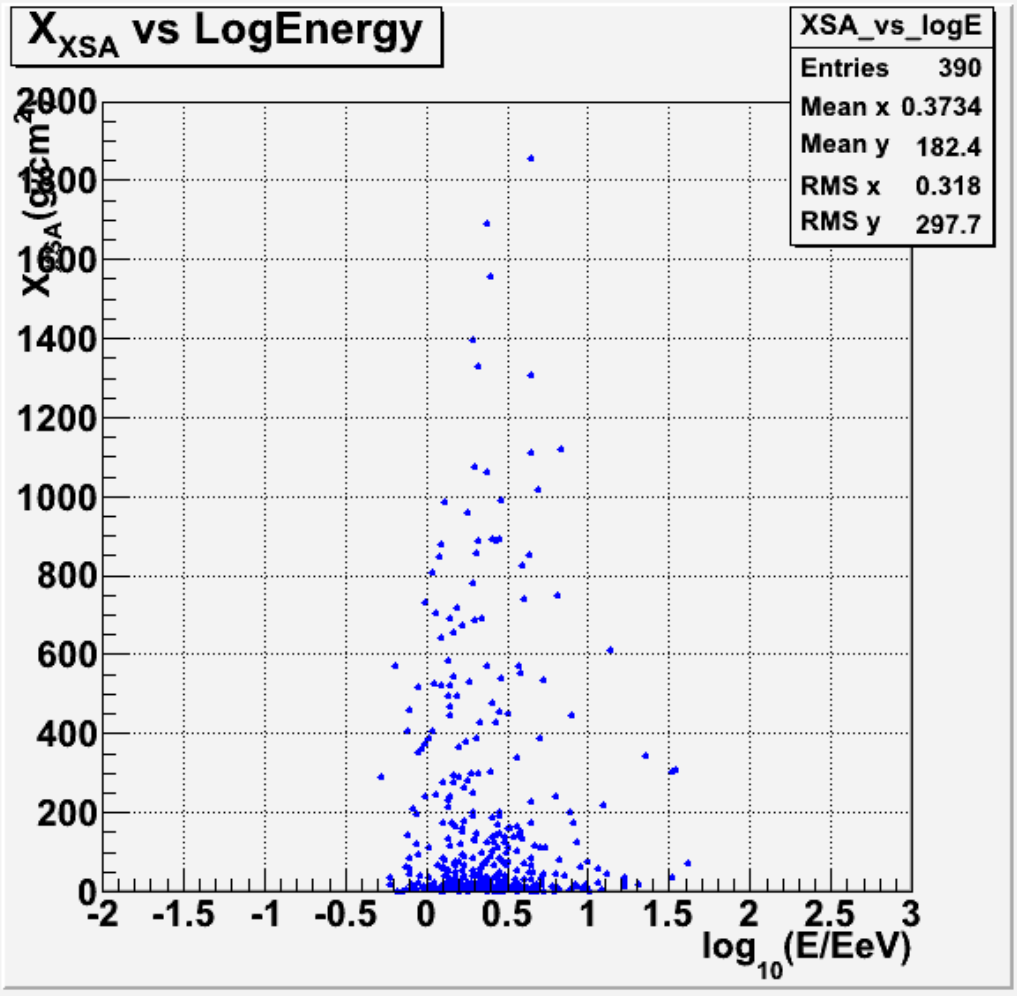

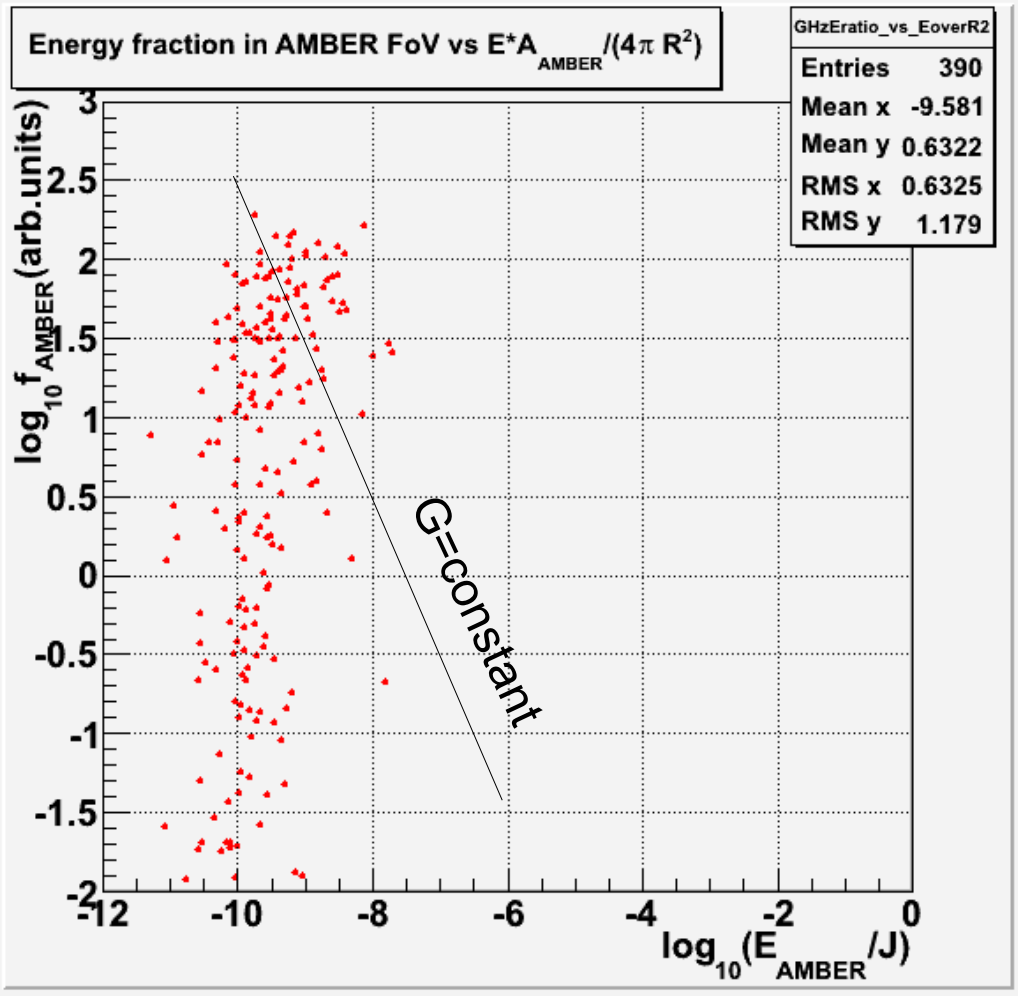

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SD, 2011-09

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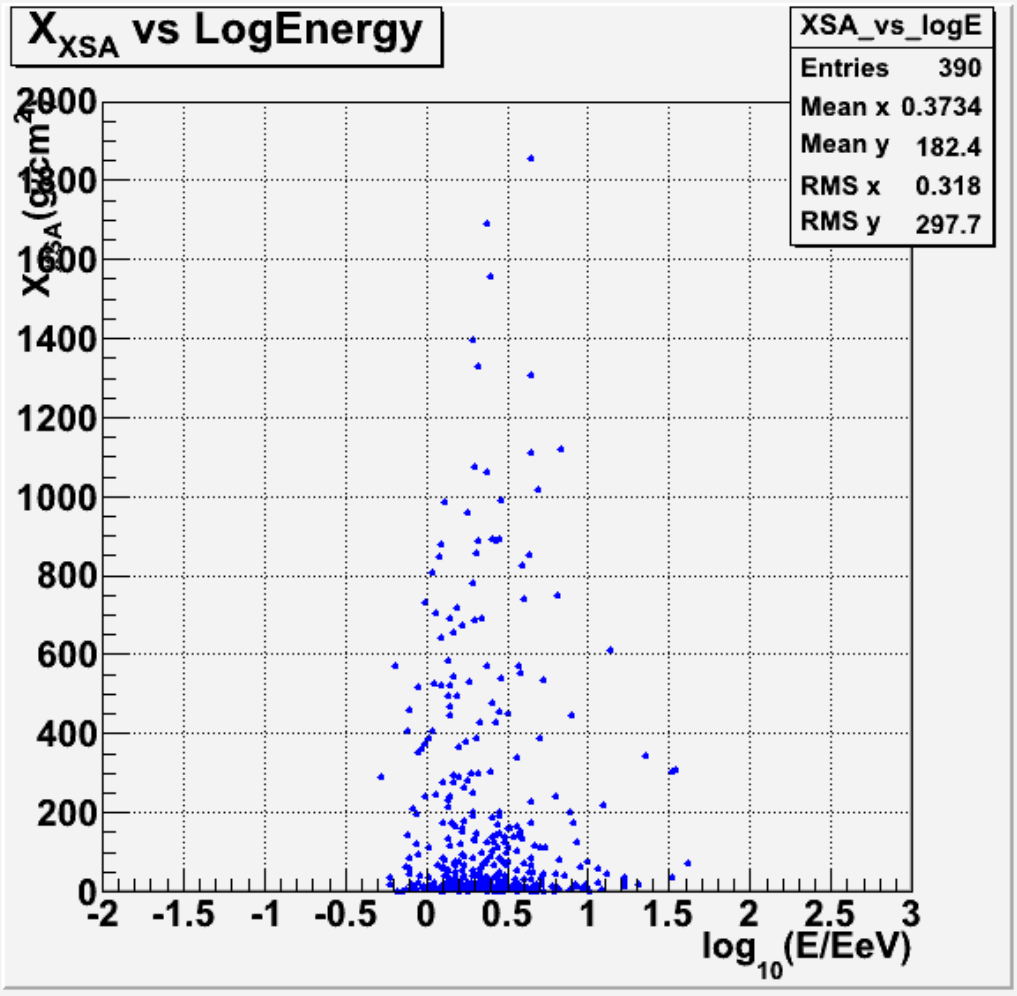

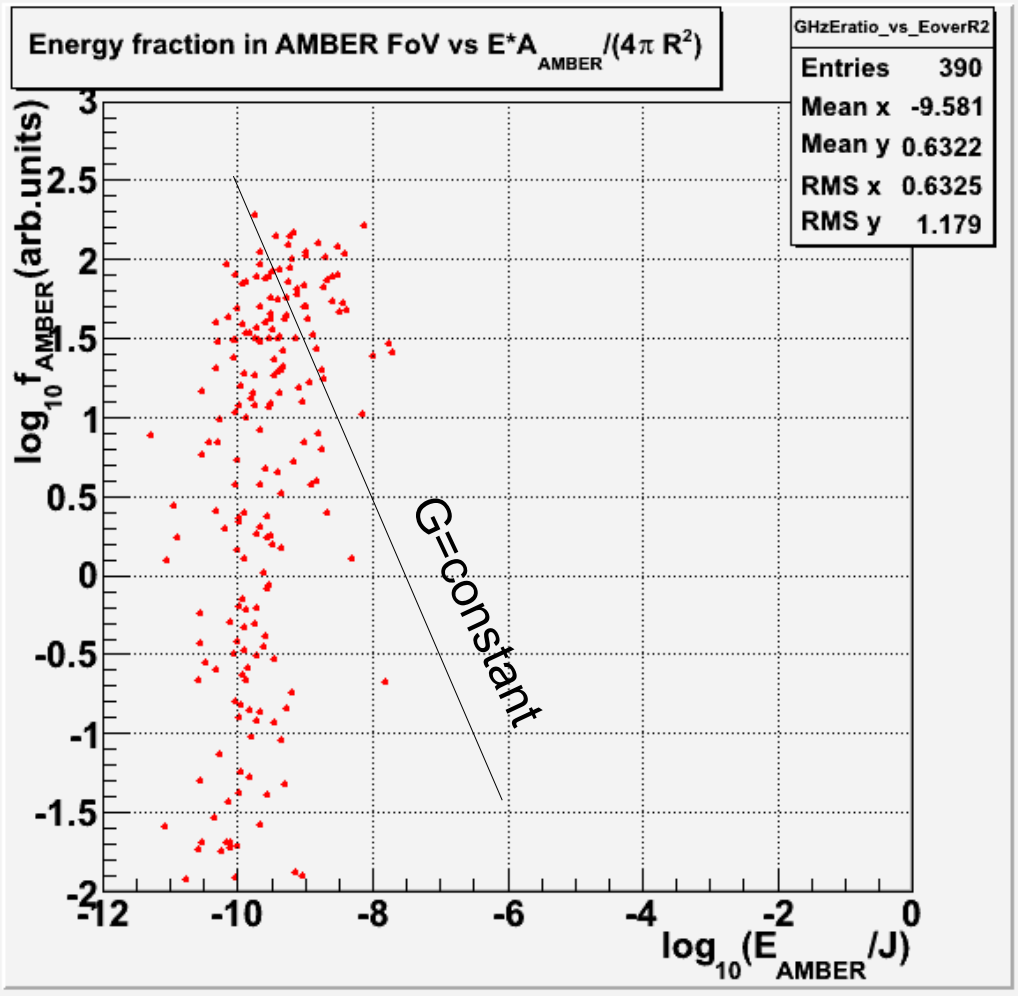

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- $f_{AMBER} = \Delta X_{AMBER} GH(X_{AMBER})/GH(X_{MAX})$

ToDo:

- running Rishi's code to get all AMBER candidate events;

- use G factor to rank candidates

- quantify limits or signal in terms of power density

- Extend analysis to Ntanks = 4, with average estimate on Xmax vs Energy