Trigger simulation of the Pixel Test (ATLAS)

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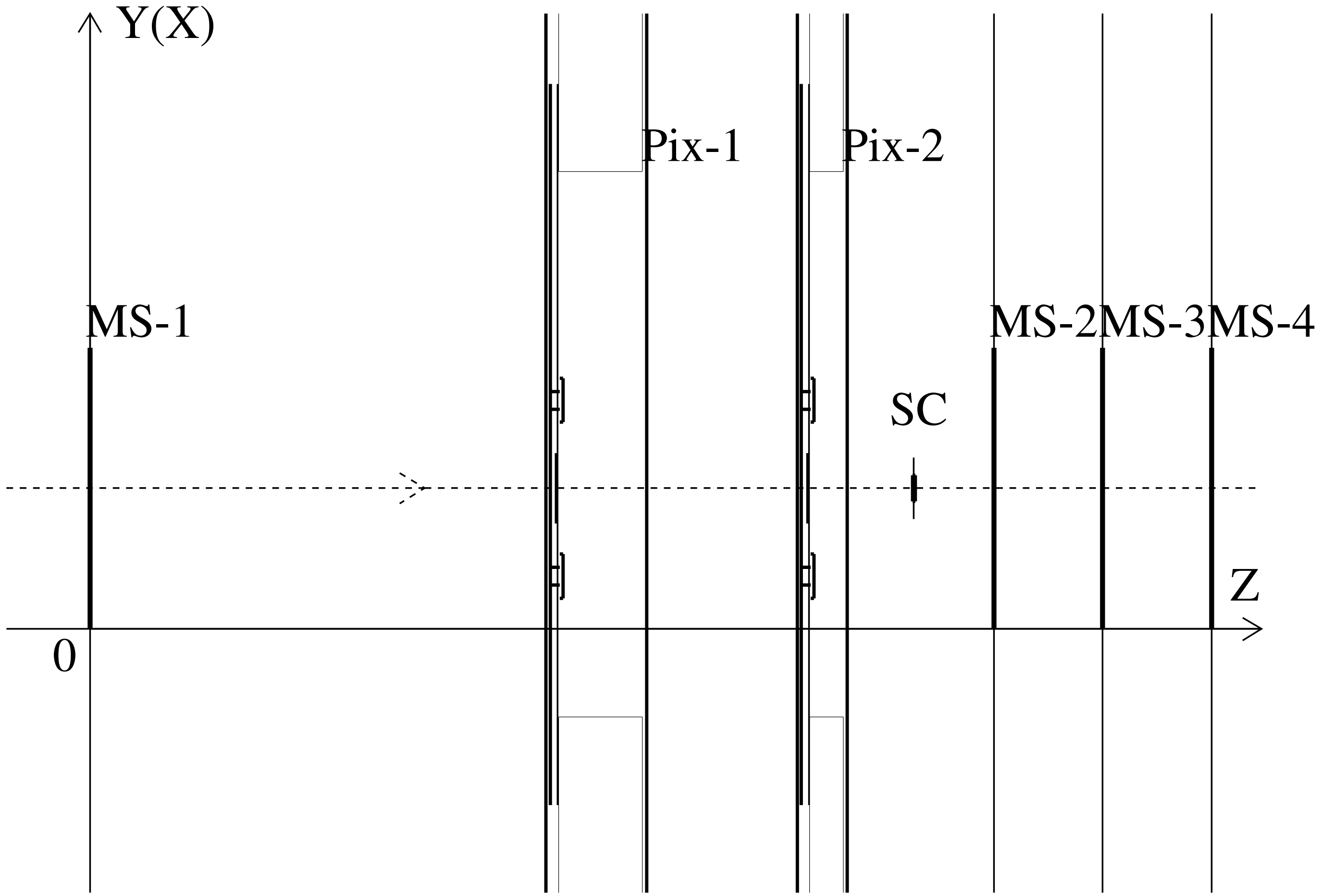
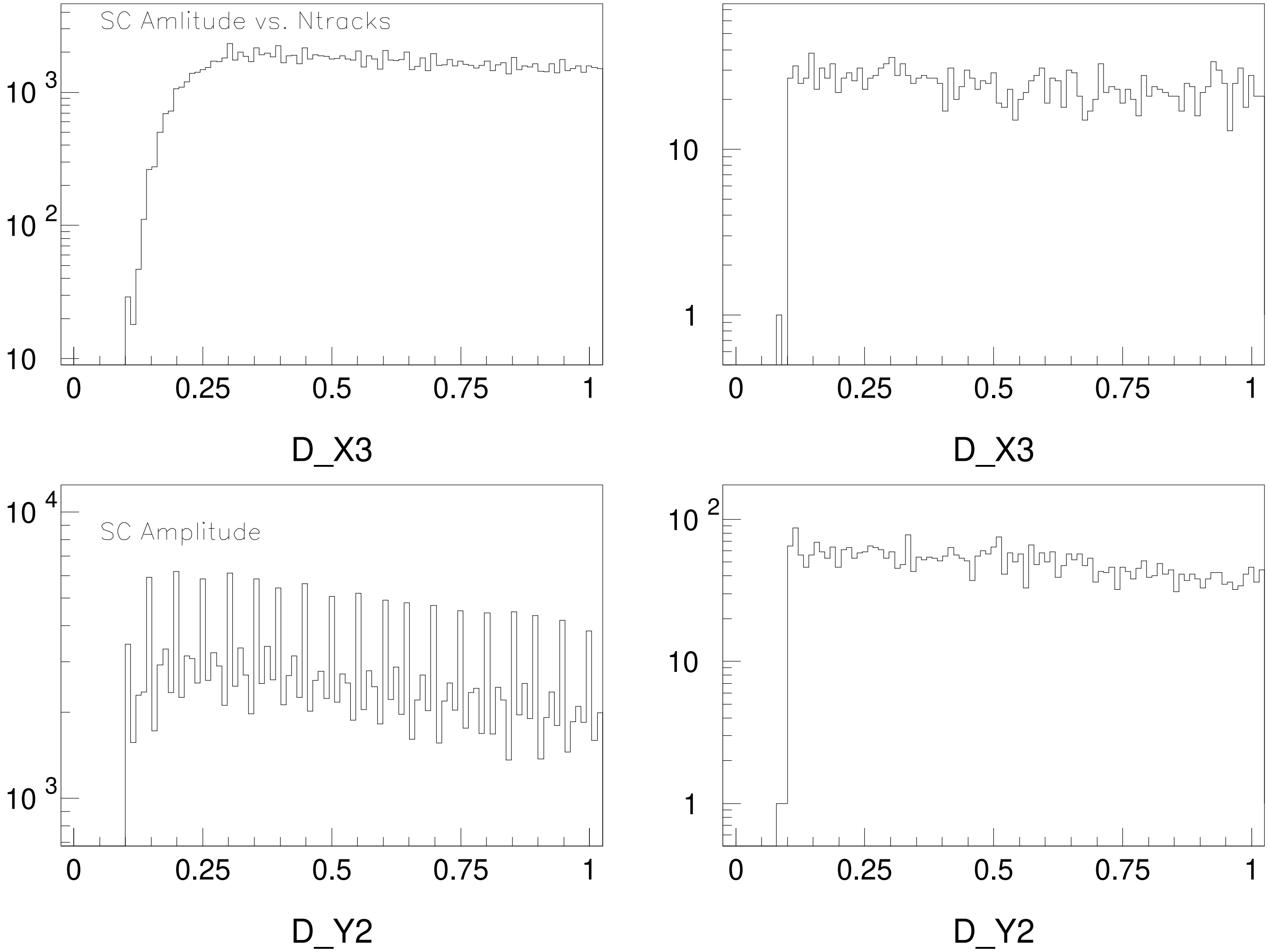
Geant 4

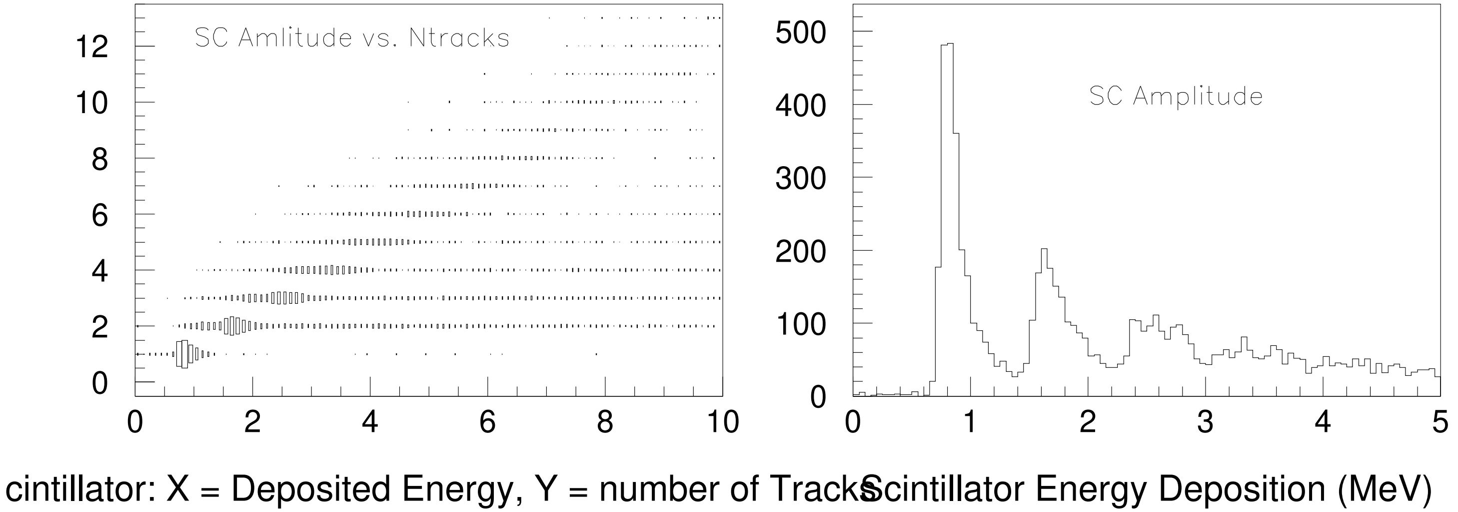
Based on:

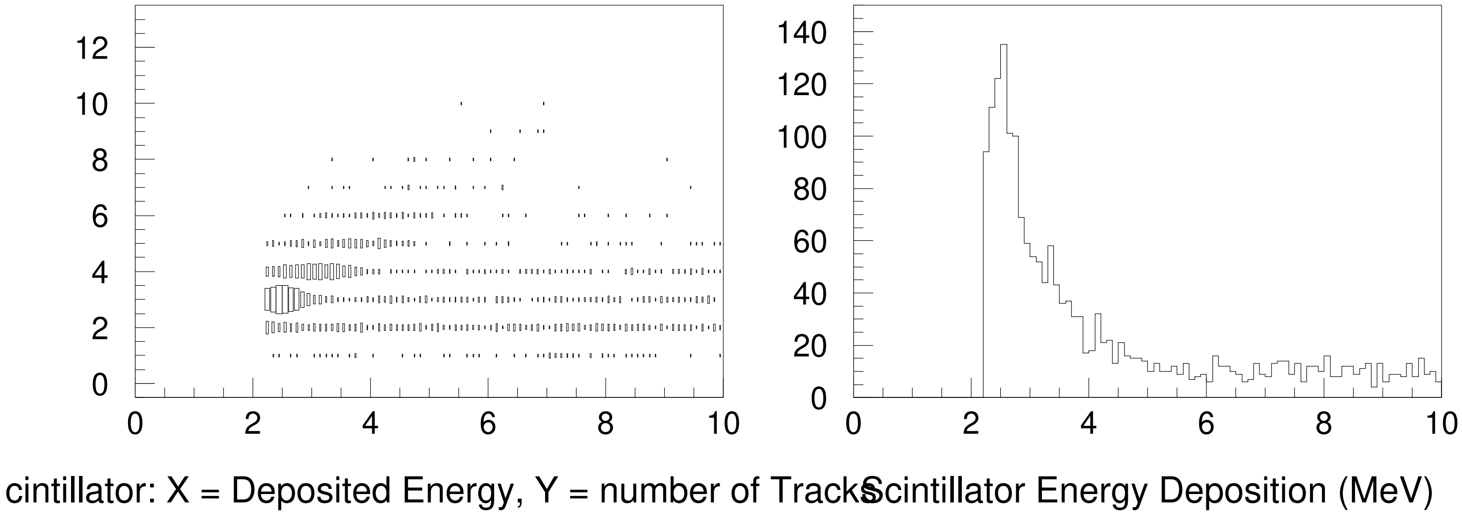
- D.Barberis, M.Cervetto, B.Osculati "Hadronic Interactions in Pixel Detectors"
- Improved simulation procedure of A.Ribon

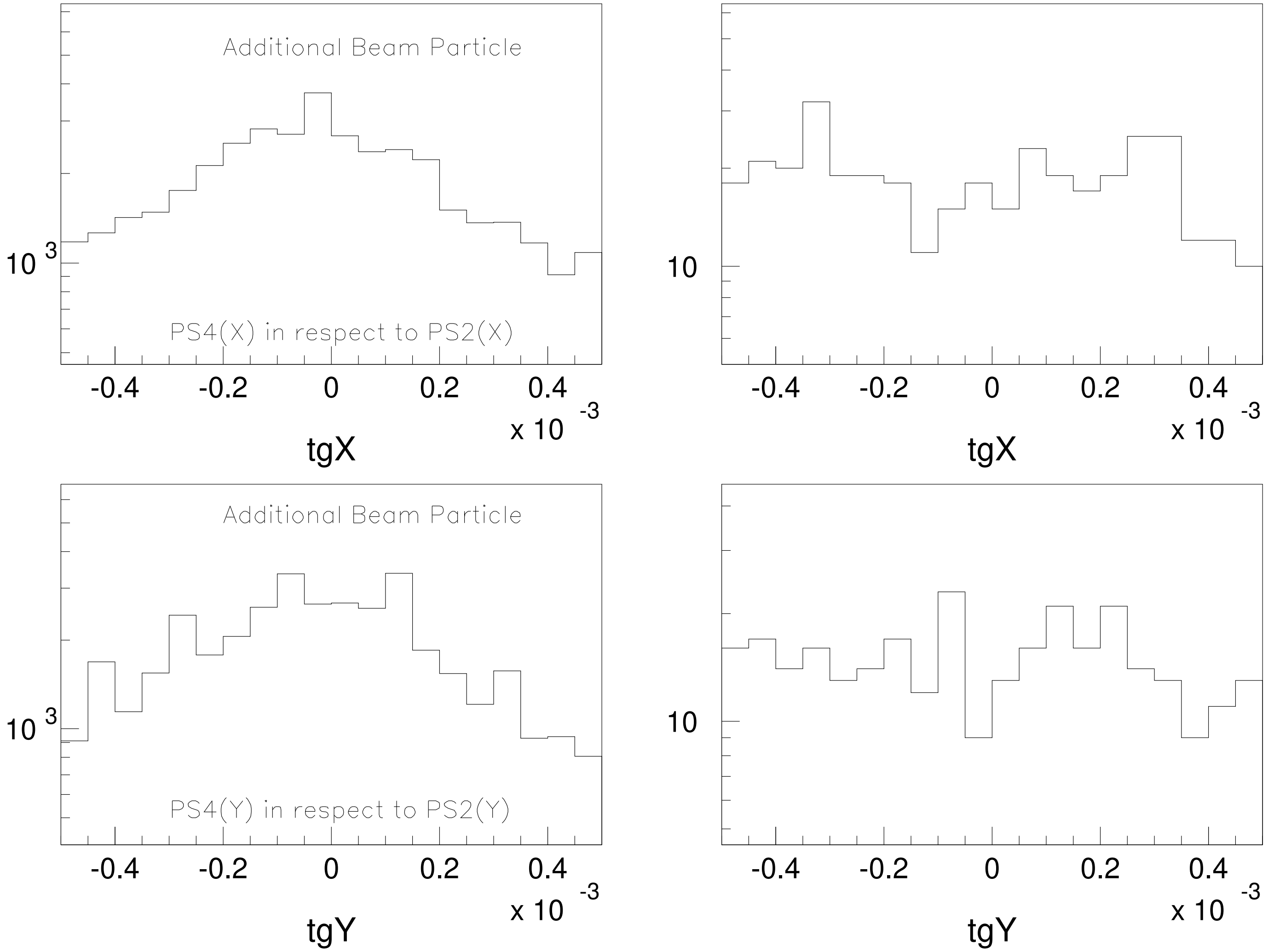

Y(X)
Pix-1
Pix-2
MS-1
MS-2
MS-3
MS-4
SC
Z
0

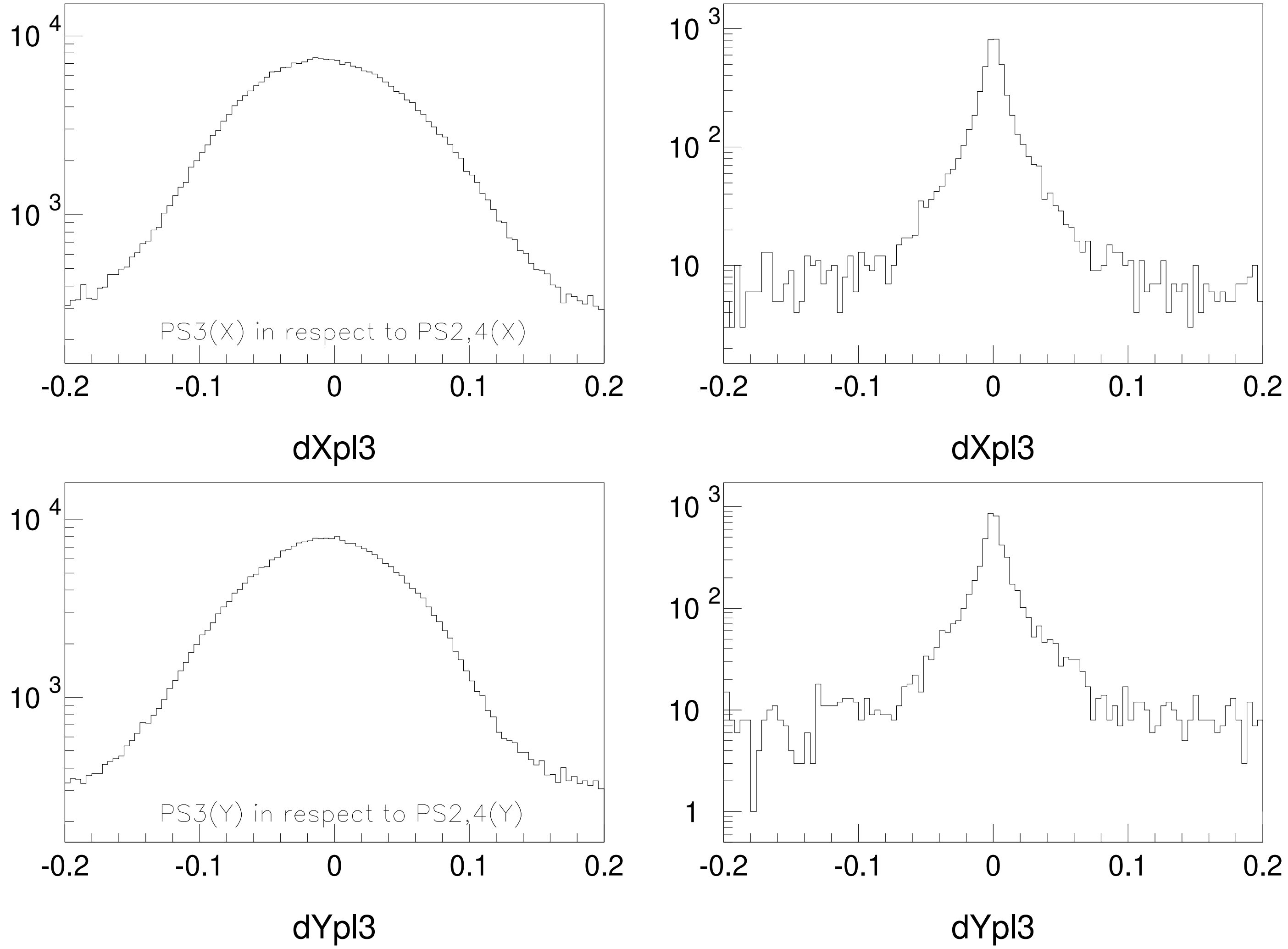
- Self defining geometry (X and Y projections are treated separately).
- Scintillator is active and its amplitude defines the trigger.
- Tuning of the MS4 position by passing tracks (MS2 is fixed).
- Tuning of the MS2 position by straight tracks.
- Tuning of the MS1 position by the 2-3-4 vertex position.
- Events with passing particles are ignored in data (can be improved).
- Vertex reconstruction Step 1: all straight 2-3-4 tracks.
- Vertex reconstruction Step 2: suppression of not-in-vertex tracks.
- Vertex reconstruction Step 3: use Z-positions for 1-2-3-4 tracks.
- Pixel cloth, screws and dimensions of SC (3x7 not 15x15 mm^2).
- The numbers of X- and Y-tracks not coincide because of interactions.
- MS energy loss and interactions in the MS detectors from amplitudes.


SC Amlitude vs. Ntracks
10 3
10 2
10
0
0.25
0.5
0.75
1
D_X3
10
1
0
0.25
0.5
0.75
1
D_X3
10 4
SC Amplitude
10 3
0
0.25
0.5
0.75
1
D_Y2
10 2
10
1
0
0.25
0.5
0.75
1
D_Y2

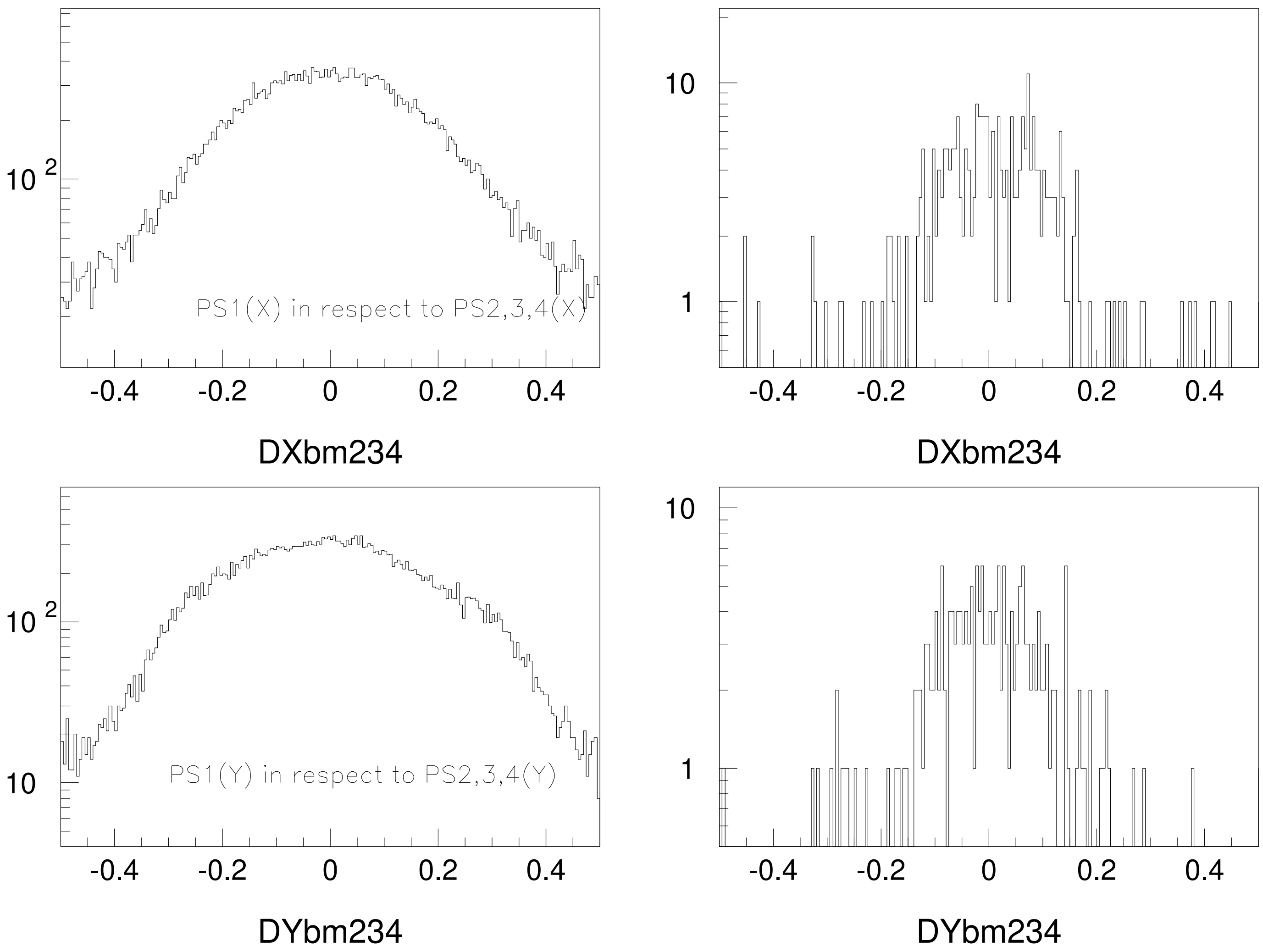

SC Amlitude vs. Ntracks
SC Amplitude
cintillator: X = Deposited Energy, Y = number of Tracks
Scintillator Energy Deposition (MeV)

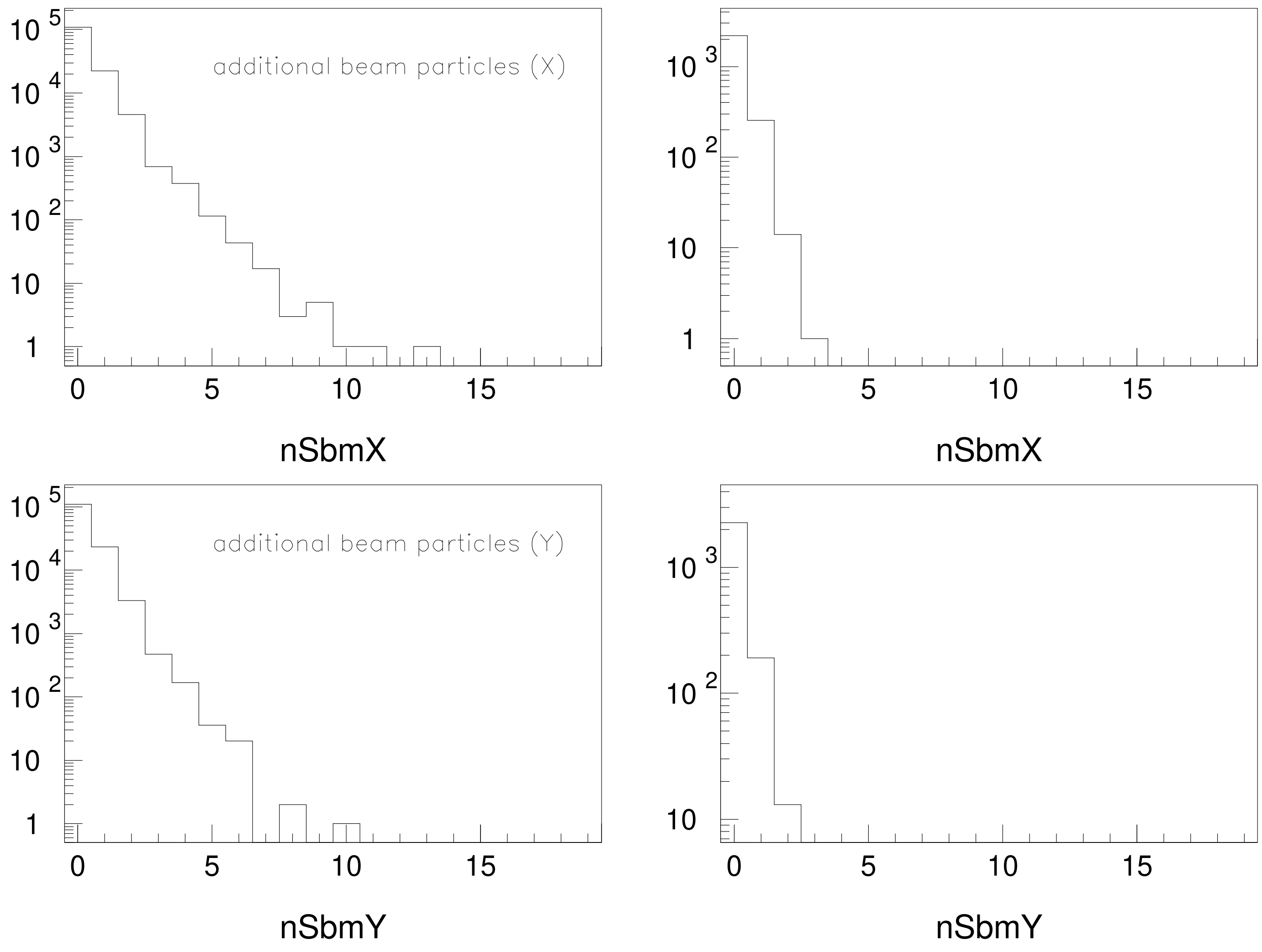

cintillator: X = Deposited Energy, Y = number of Tracks
Scintillator Energy Deposition (MeV)

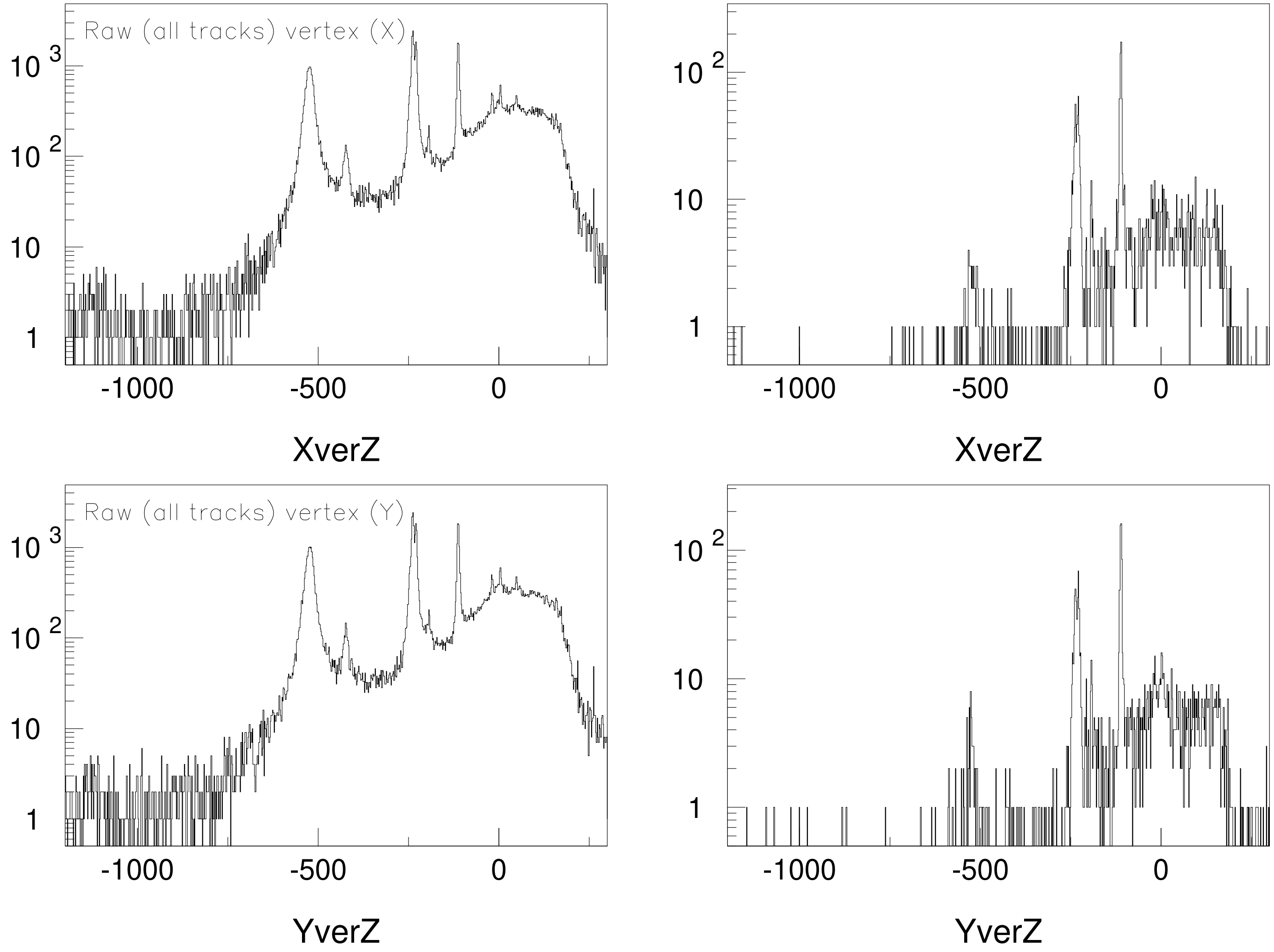

Additional Beam Particle
PS4(X) in respect to PS2(X)
10^3
-0.4 -0.2 0 0.2 0.4
x 10^{-3}
tgX
10
-0.4 -0.2 0 0.2 0.4
x 10^{-3}
tgX
Additional Beam Particle
PS4(Y) in respect to PS2(Y)
10^3
-0.4 -0.2 0 0.2 0.4
x 10^{-3}
tgY
10
-0.4 -0.2 0 0.2 0.4
x 10^{-3}
tgY



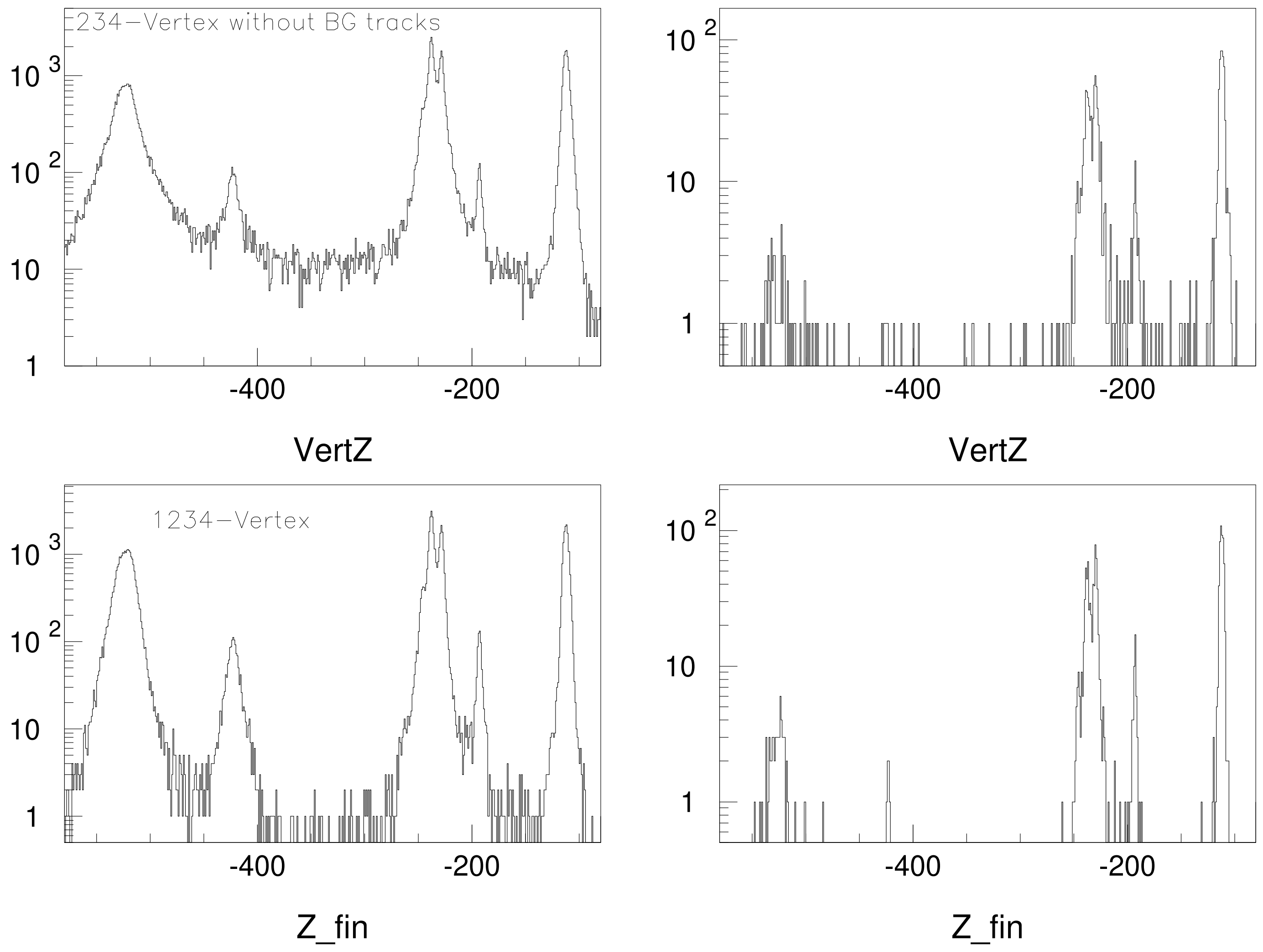
PS3(X) in respect to PS2,4(X)
dXpl3
dXpl3
PS3(Y) in respect to PS2,4(Y)
dYpl3
dYpl3


10 2
PS1(X) in respect to PS2,3,4(X)
-0.4 -0.2 0 0.2 0.4
DXbm234
10
1
-0.4 -0.2 0 0.2 0.4
DXbm234
10 2
10
PS1(Y) in respect to PS2,3,4(Y)
-0.4 -0.2 0 0.2 0.4
DYbm234
10
1
-0.4 -0.2 0 0.2 0.4
DYbm234

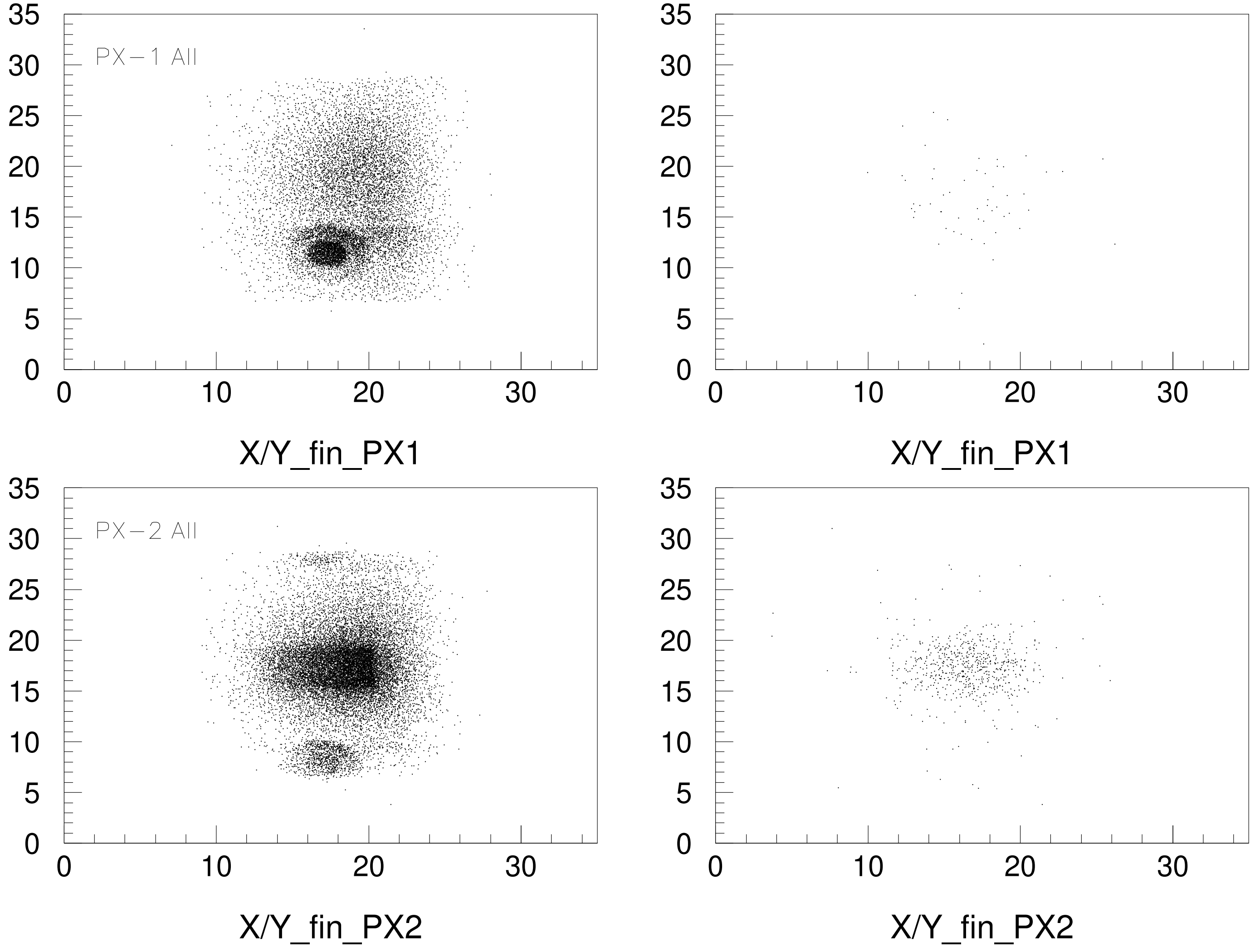

additional beam particles (X)
nSbmX
nSbmX
additional beam particles (Y)
nSbmY
nSbmY

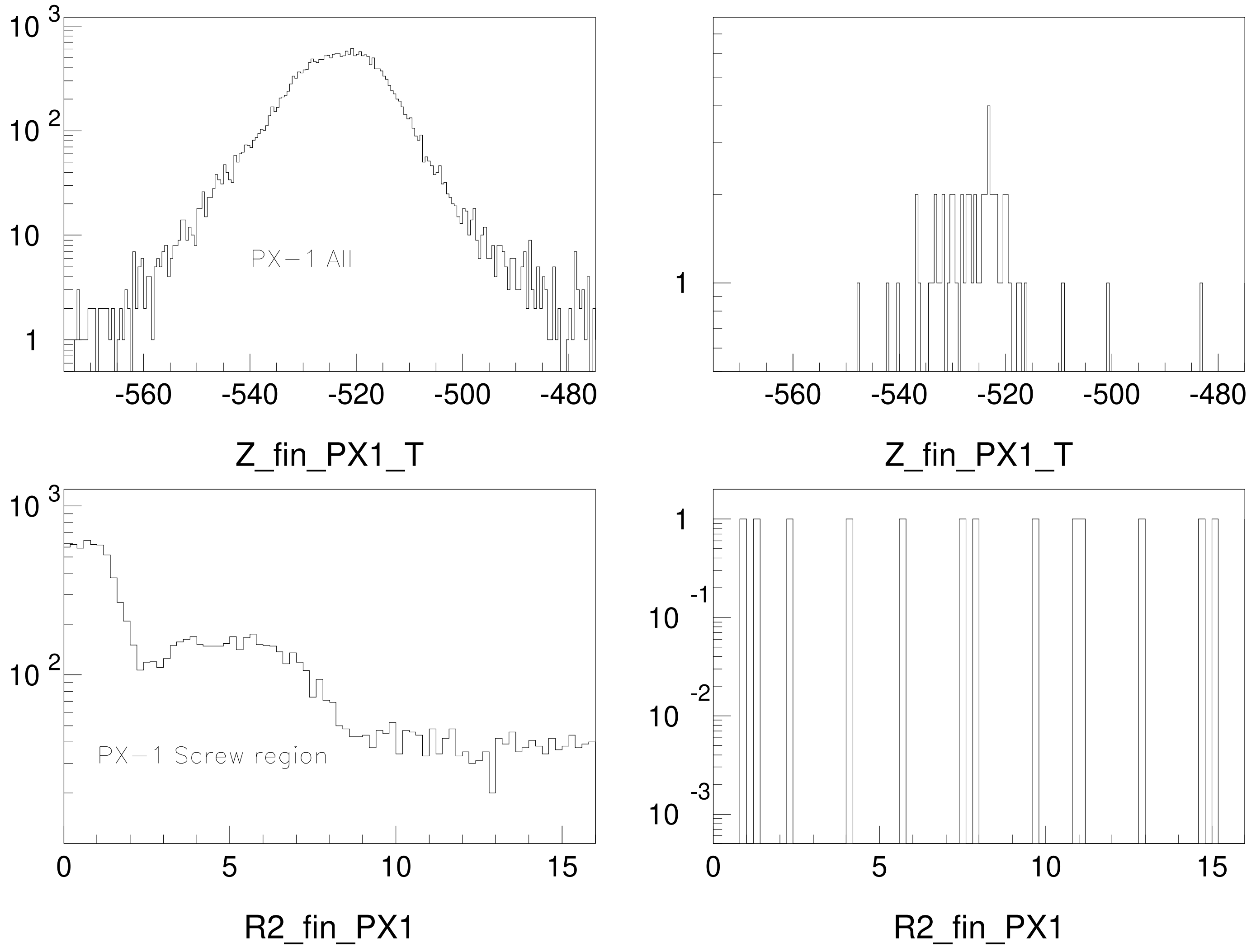


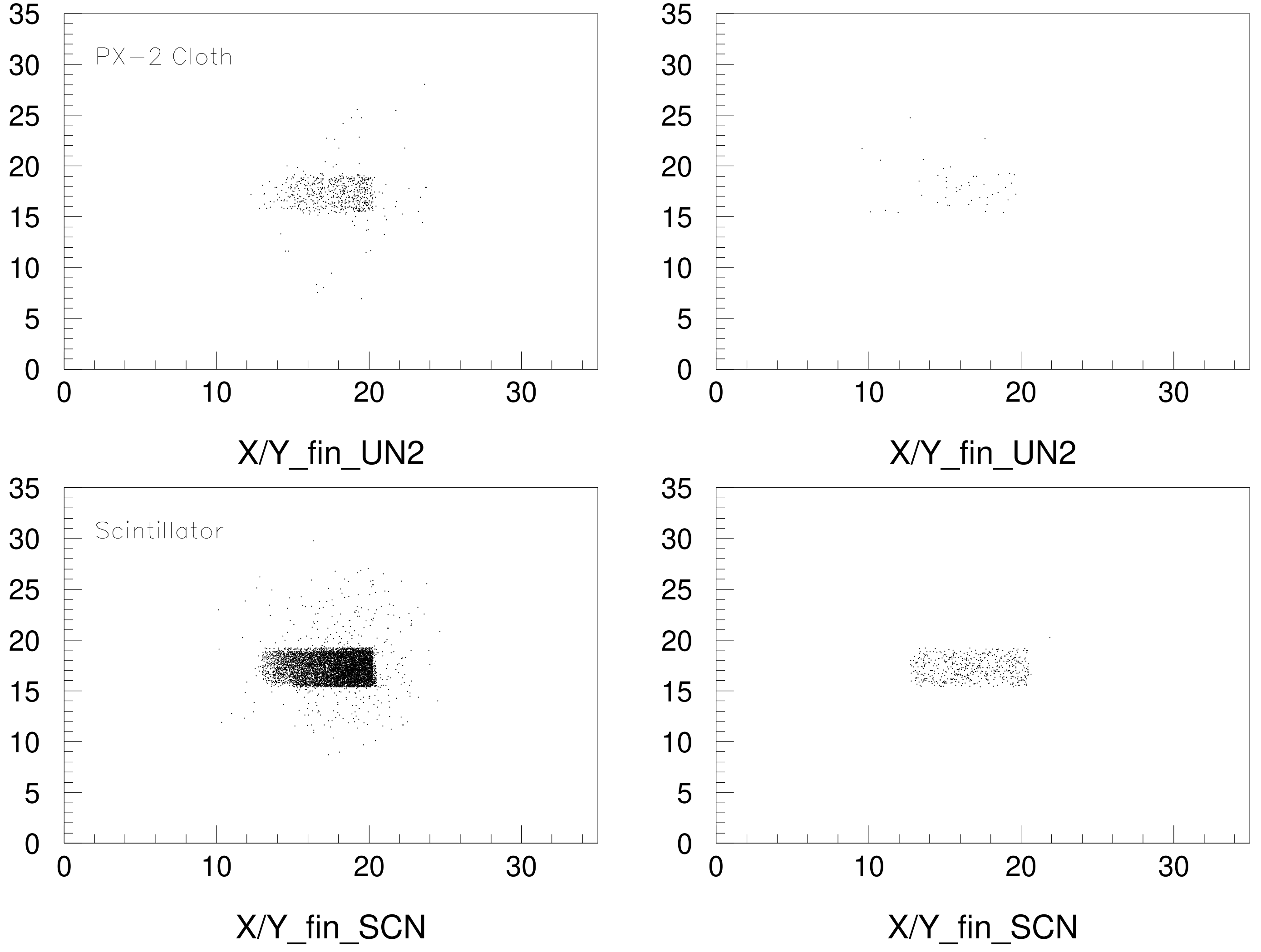
Raw (all tracks) vertex (X)
10^3
10^2
10
1
-1000
-500
0
XverZ
10^2
10
1
-1000
-500
0
XverZ
Raw (all tracks) vertex (Y)
10^3
10^2
10
1
-1000
-500
0
YverZ
10^2
10
1
-1000
-500
0
YverZ

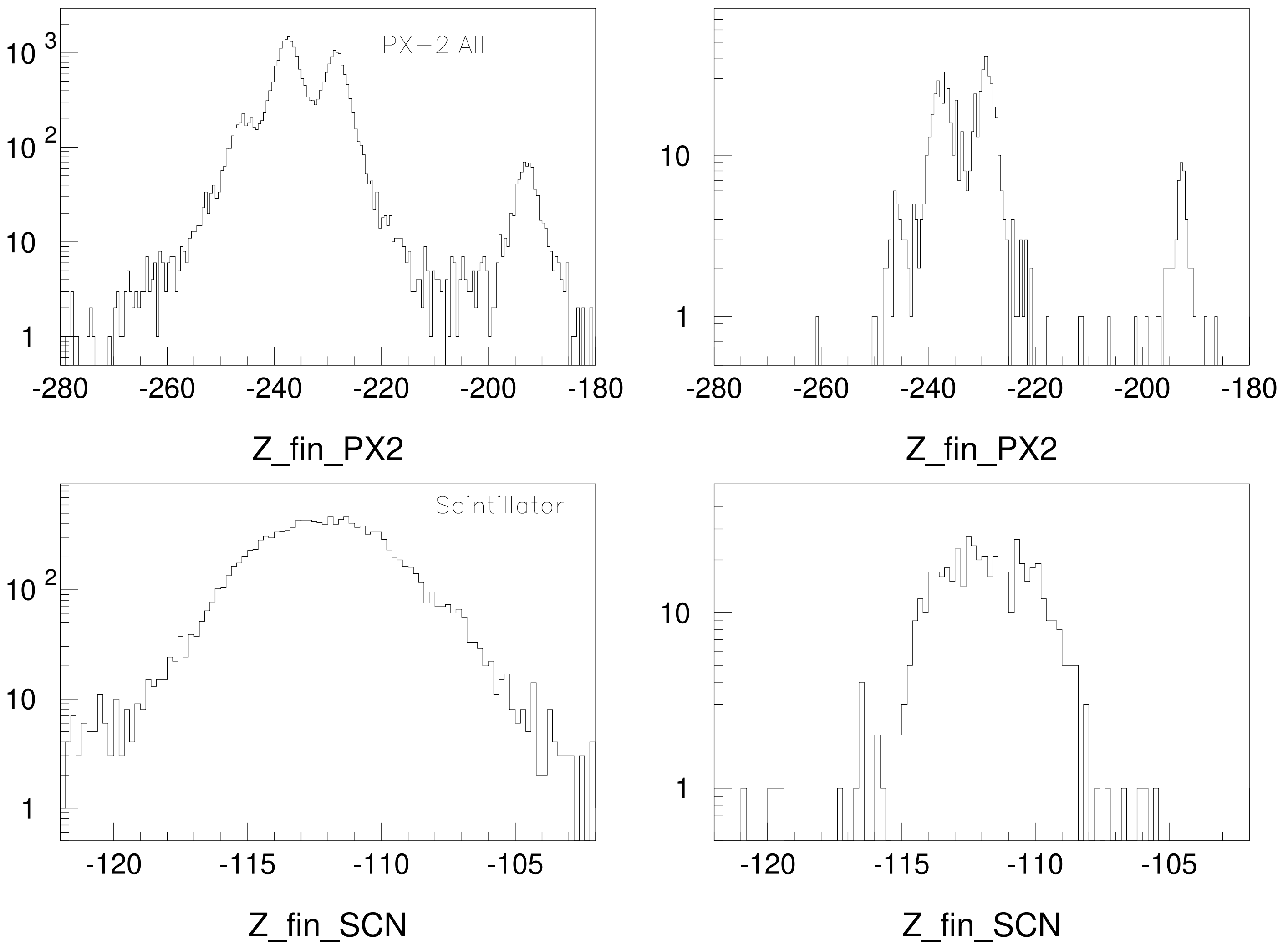

234−Vertex without BG tracks
10 3
10 2
10
1
-400
-200
VertZ
10 2
10
1
-400
-200
VertZ
1234−Vertex
10 3
10 2
10
1
-400
-200
Z_fin
10 2
10
1
-400
-200
Z_fin

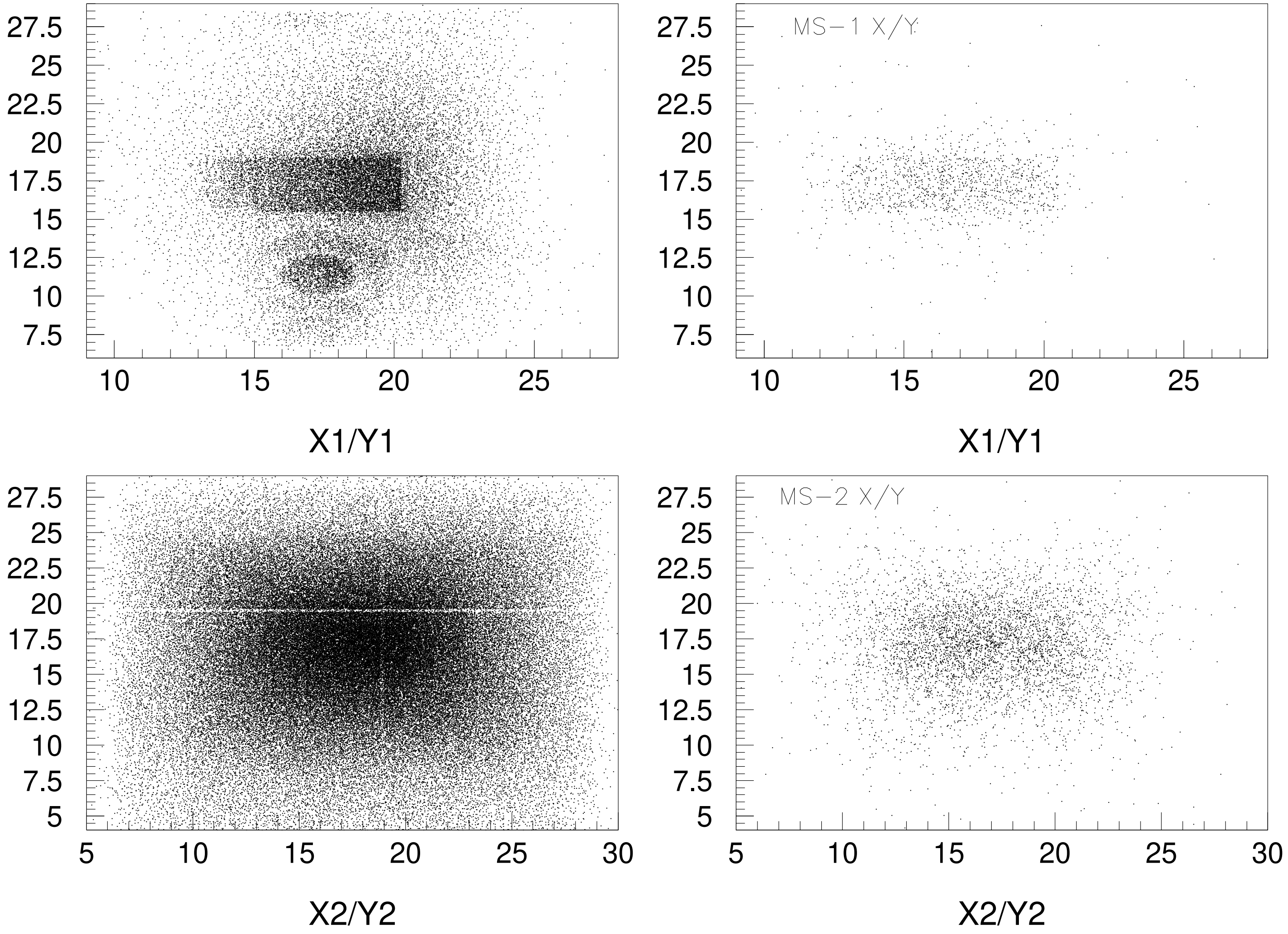
Trigger simulation of the Pixel Test (ATLAS)

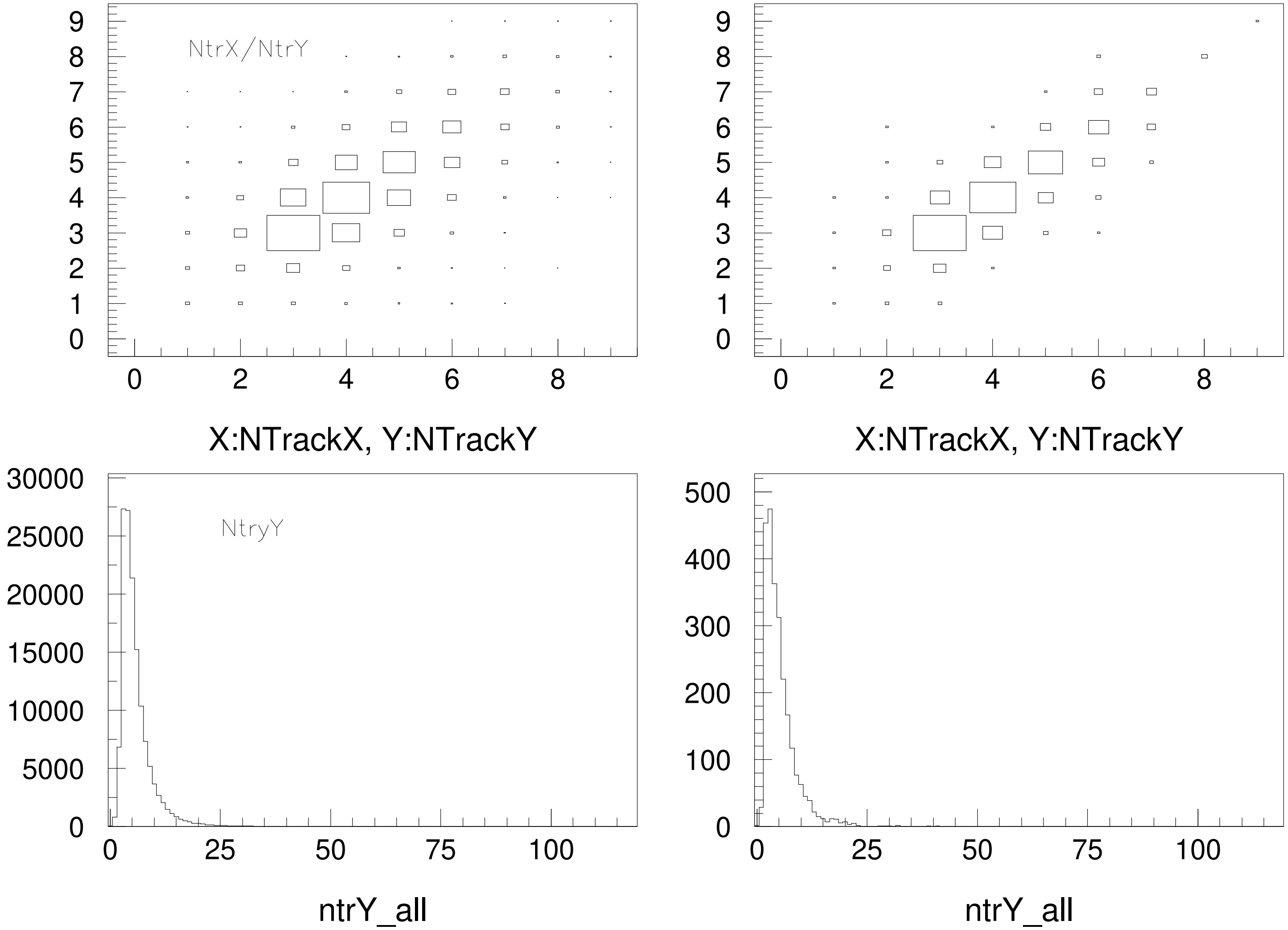


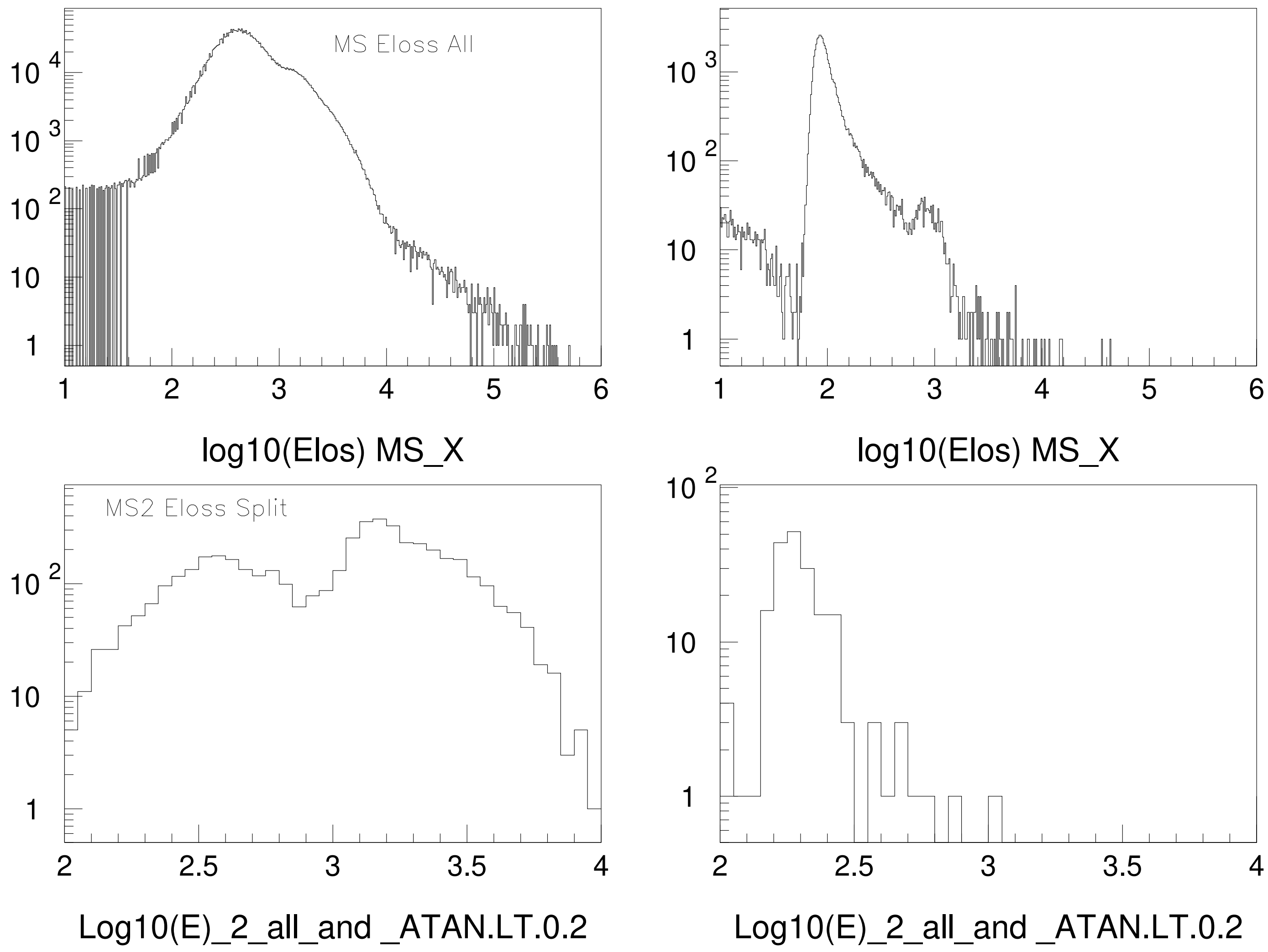

10 3
10 2
10
1
PX−1 All
-560
-540
-520
-500
-480
Z_fin_PX1_T
1
-560
-540
-520
-500
-480
Z_fin_PX1_T
10 3
10 2
PX−1 Screw region
0
5
10
15
R2_fin_PX1
1
10 -1
10 -2
10 -3
0
5
10
15
R2_fin_PX1


PX−2 Cloth
X/Y_fin_UN2
X/Y_fin_UN2
Scintillator
X/Y_fin_SCN
X/Y_fin_SCN


PX−2 All
10 3
10 2
10
1
-280
-260
-240
-220
-200
-180
Z_fin_PX2
10
1
-280
-260
-240
-220
-200
-180
Z_fin_PX2
Scintillator
10 2
10
1
-120
-115
-110
-105
Z_fin_SCN
10
1
-120
-115
-110
-105
Z_fin_SCN


MS−1 X/Y
MS−2 X/Y
X1/Y1
X1/Y1
X2/Y2
X2/Y2


NtrX/NtrY
X:NTrackX, Y:NTrackY
X:NTrackX, Y:NTrackY
NtryY
ntrY_all
ntrY_all


MS Eloss All
10 4
10 3
10 2
10
1
1 2 3 4 5 6
log10(Elos) MS_X
10 3
10 2
10
1
1 2 3 4 5 6
log10(Elos) MS_X
MS2 Eloss Split
10 2
10
1
2 2.5 3 3.5 4
Log10(E)_2_all_and _ATAN.LT.0.2
10 2
10
1
2 2.5 3 3.5 4
Log10(E)_2_all_and _ATAN.LT.0.2

Conclusion

- Old simulation triggered by Pixels is substituted by the SC trigger.
- More information is necessary to simulate better PX screws and cloths.
- Simulation of MS detectors must be improved to reproduce interactions in the planes of the double sided detectors.
- Simulation of the cross-talk bridges between MS clusters.
- Simulated interactions in PX1 are underestimated (must not be active).
- Reconstruction and simulation of the active Pixel2 must be done.
- Backward particles from interactions in the Scintillator can be reconstructed by the backward MS1,PX2 telescope.
- These data must be simulated by G4(LHEP,QGSC,QGSP), FLUKA and CHIPS.