

Beam Test Data Analysis

Hit Multiplicity and shower study in Gamma runs

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Data Samples

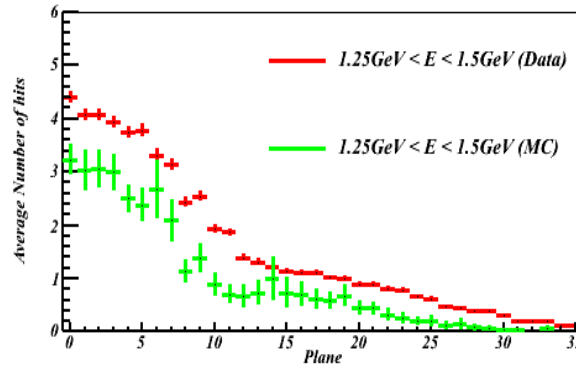
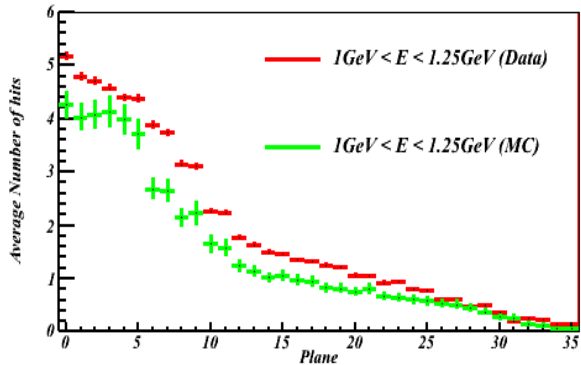
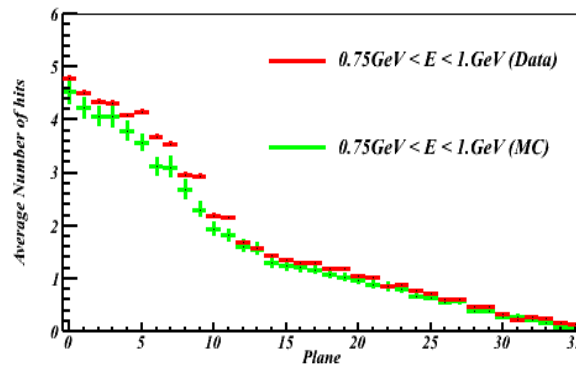
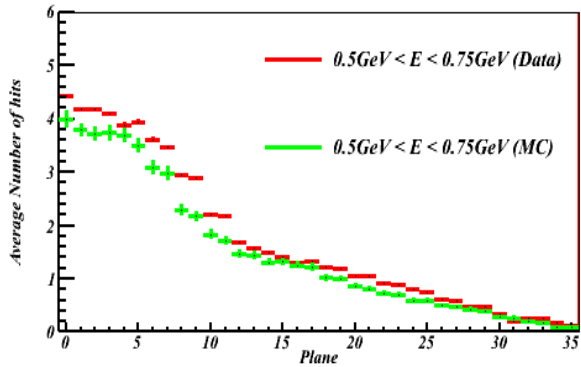
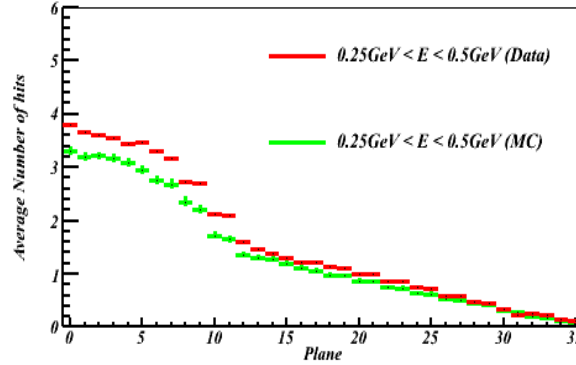
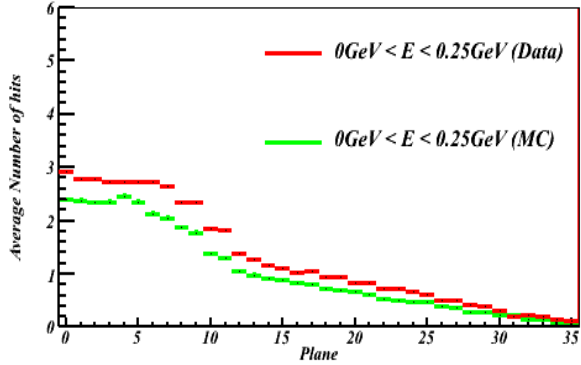
- **Data from SVAC & MERIT n-tuples (v1r030603p9)**
- **Gamma runs (tagged and full brems)**
 - **Cuts:**
 - Vertex ==1**
 - CalEneSum > 0**
 - Tkr1LastLayer == 0**
 - TAG_NUM_CLUSTER_LAYER ==1(First two SSDs)**

Data Samples

PS tagged photons @ 0 degree TWR 2

<i>Momentum (GeV)</i>	<i>Runs</i>	<i>MC</i>
0.5	1255->1258	136- 150
1	1208-1209-1210- 1310-1311	135 - 147
1.5	1332-1334-1335- 1338	144
2.5	1176->1180	134 - 141

Hit Multiplicity @ 0 degree (Twr 2)



Hit Multiplicity layer by layer for tagged gamma runs and MC comparison in different energy bins

WARNING !!
BAD Dump position

Data Samples

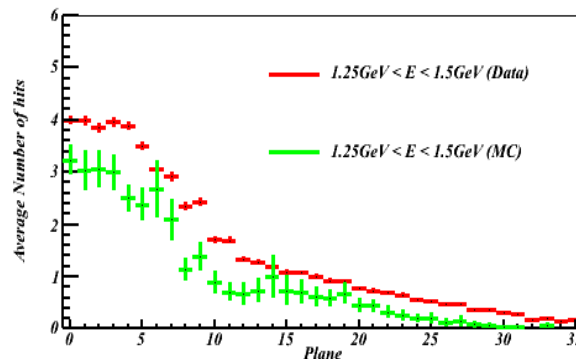
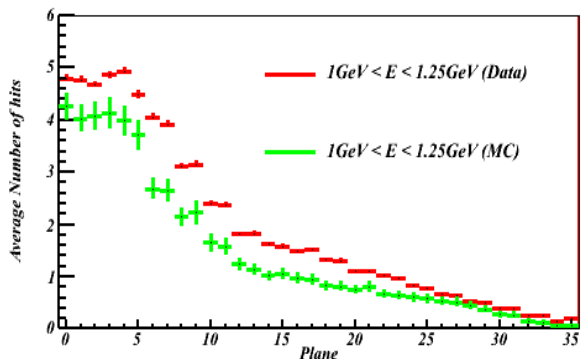
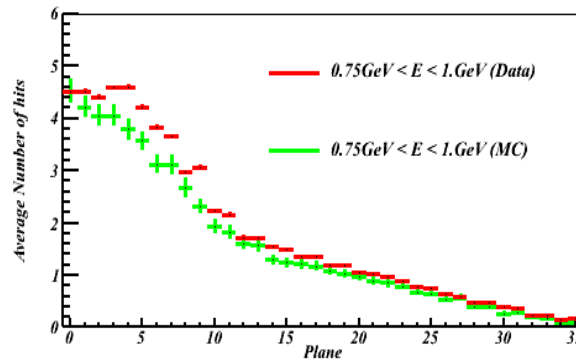
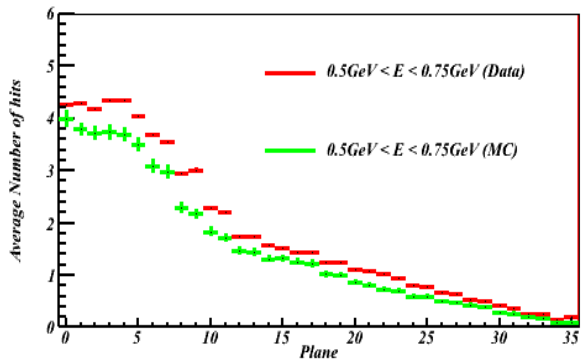
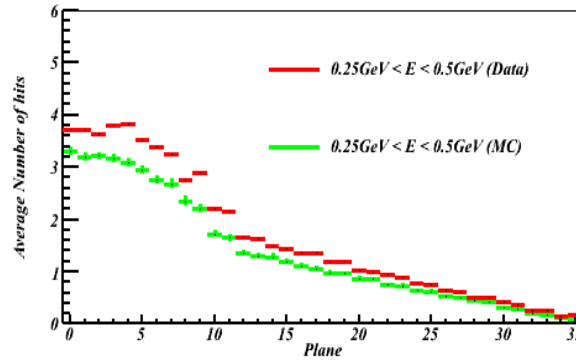
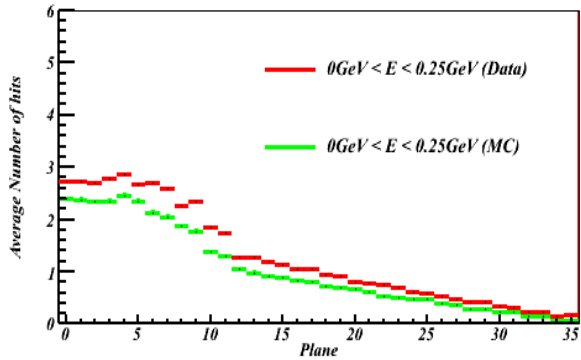
PS tagged photons @ 0 degree TWR 3

<i>Momentum (GeV)</i>	<i>Runs</i>	<i>MC (same TWR 2)</i>
0.5	1597->1599- 1604->1606	136 - 150
1	1533-1536	135 - 147
1.5	1555->1558	144
2.5	1439-1441-1442- 1443- 1457	134 - 141

Full Brems photons @ 0 degree - TWR 2

<i>Momentum (GeV)</i>	<i>Runs</i>	<i>MC</i>
2.5	1181->1190	129

Hit Multiplicity @ 0 degree (Twr 3)



Hit Multiplicity layer by layer for tagged gamma runs and MC comparison in different energy bins

Svac + Merit + Recon ROOT n-tuples

Vertex ==1

CalEneSum > 0

TAG_NUM_CLUSTER_LAYER ==1 (First two SSDs)

Vertex (VtxX0 and VtxY0) and Y-Z Beam position

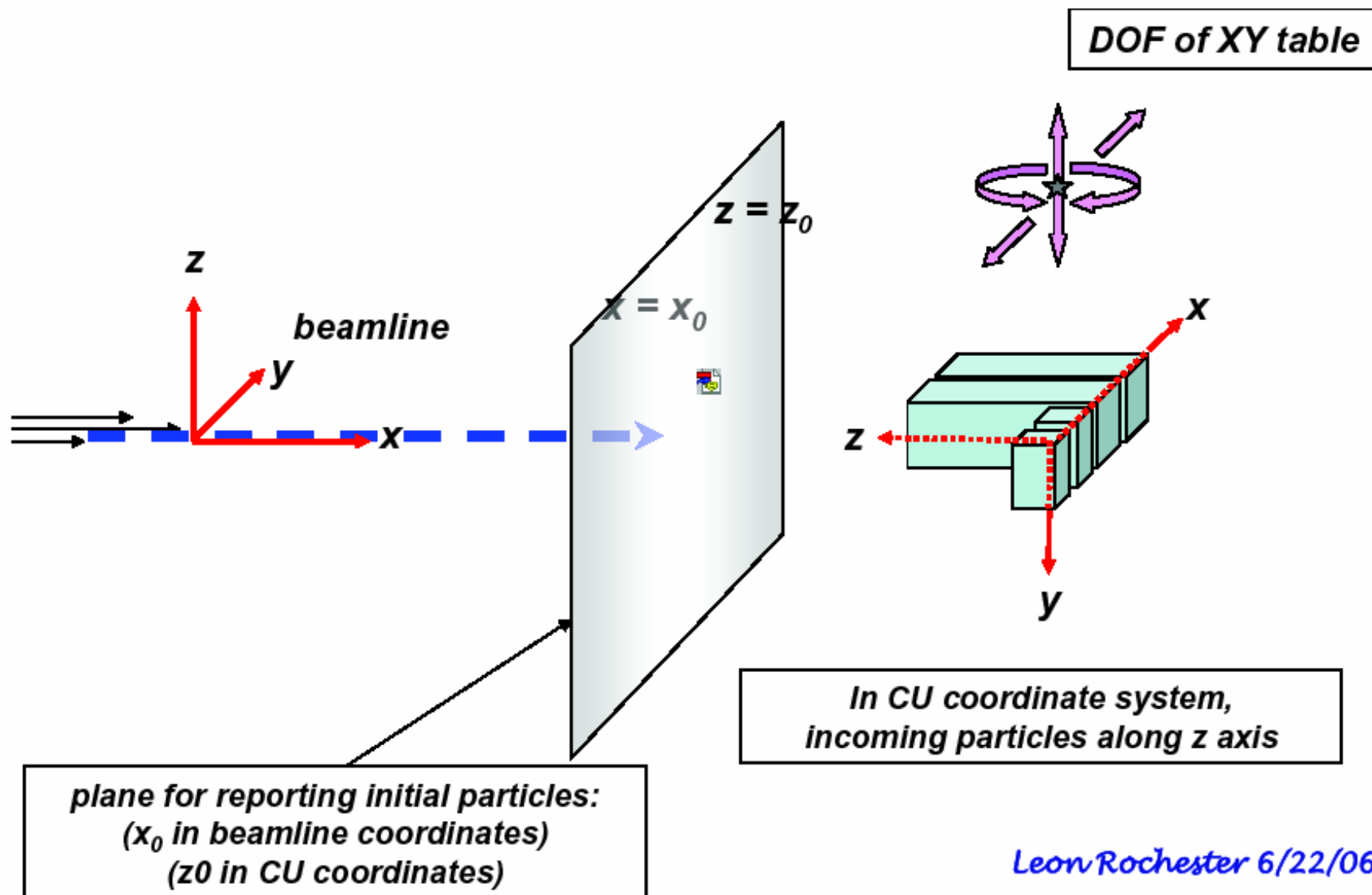
(TAG_XYZ[3][4]) in “coincidence” (Hit Tower selection)

(of course, for Full Brems runs we have no TAG_XYZ info)

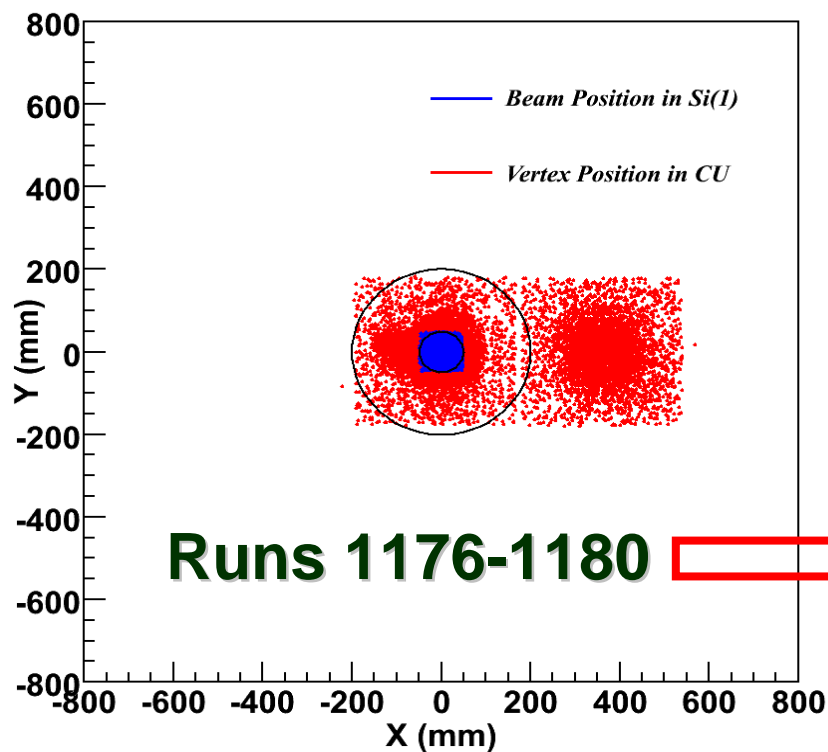
(15% of events selected)

- **getTrackCol**
- **getClusCol**
- **getVertexCol**

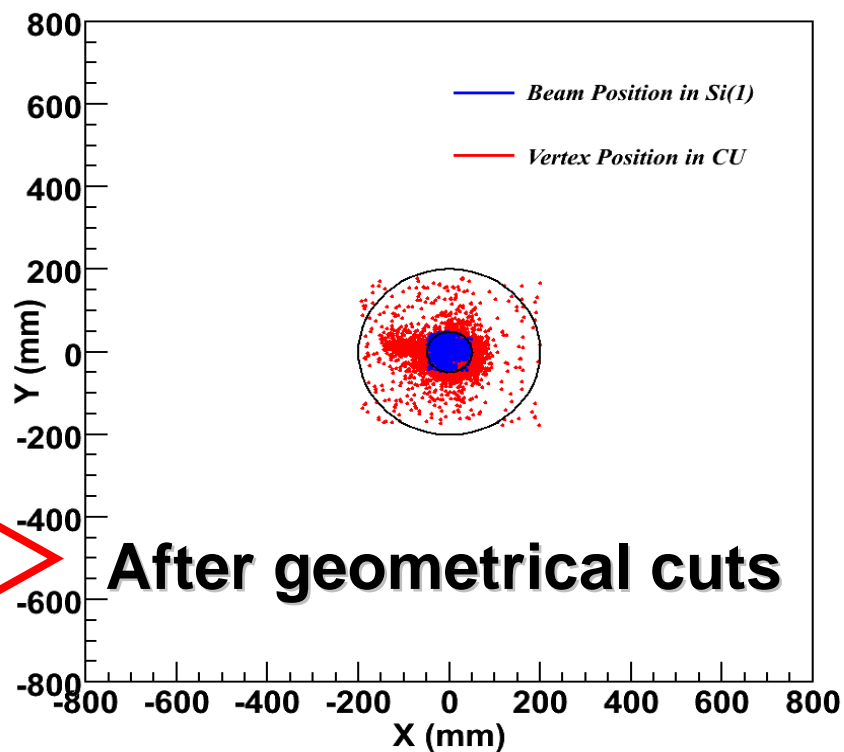
CU on the Beamline



First Vertex (VtxX0 and VtxY0) and Beam position in “coincidence”- TW2



Runs 1176-1180



After geometrical cuts

Vertex Position (VtxX0 and VtxY0) in CU (RED)

Y-Z Beam position (TAG_XYZ[1][0], TAG_XYZ[2][0]) (BLUE)



Hit Tower selection

Transverse Shower Analysis

We studied following distributions with current cuts optimized for gammas analysis:

- Cluster Distance (see Nicola talk)
- Average Cluster Size
- Max Cluster size

with respect

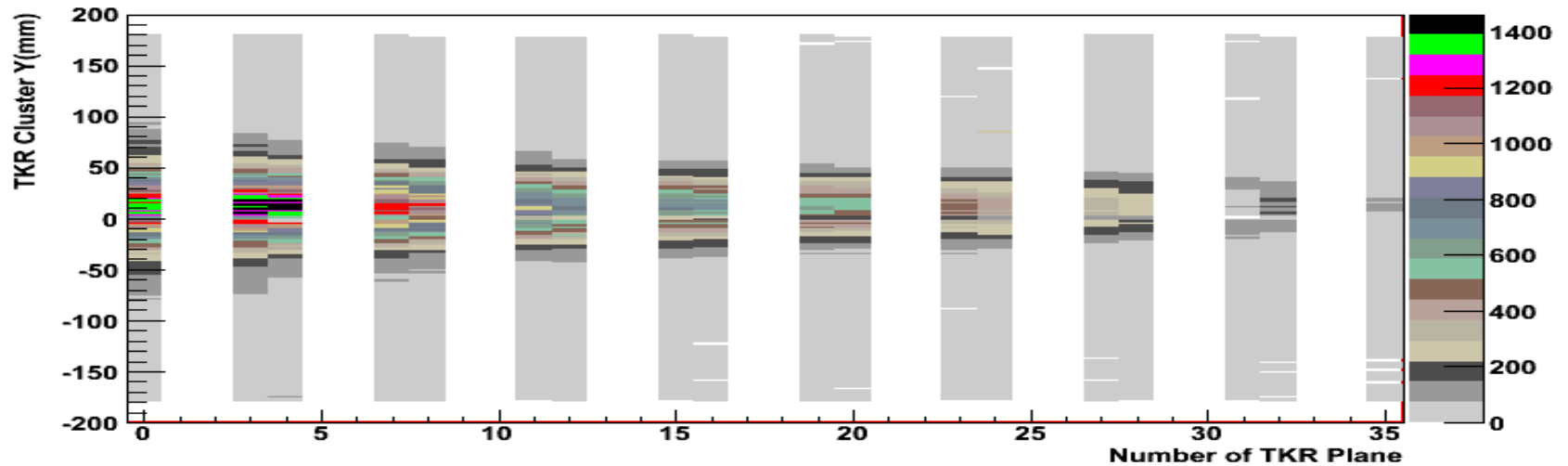
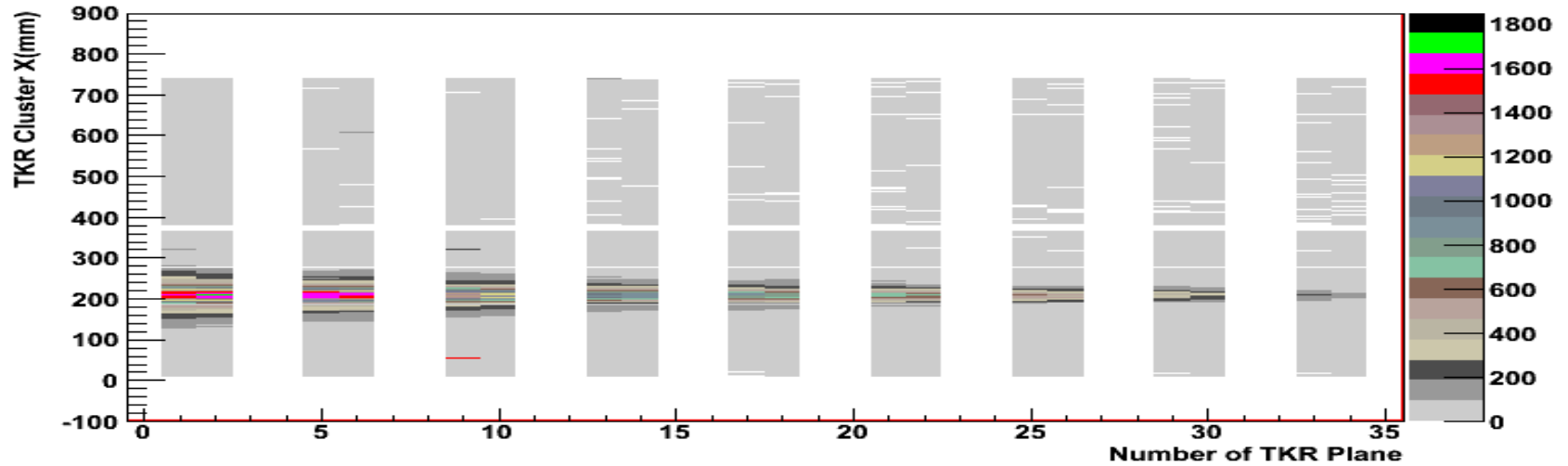
- first Vertex direction and shower axis
- X and Y view

For :

- Runs 1176-1180 (Tag Gammas - beam 2.5 GeV – TW2)
- Runs 1181-1190 (Full Brems - beam 2.5 GeV – TW2)
- Runs 1439- 1441->1443-1457 (Tag Gammas - beam 2.5 GeV - TW3)

Runs 1176-1180 (tag gammas TW2)

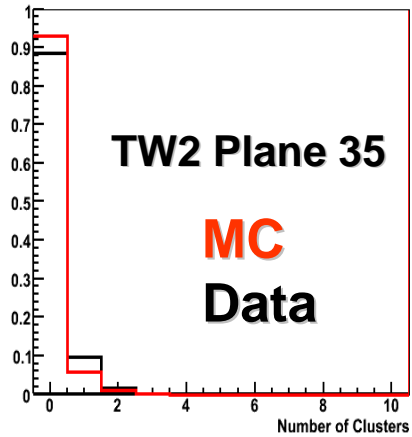
beam 2.5 GeV



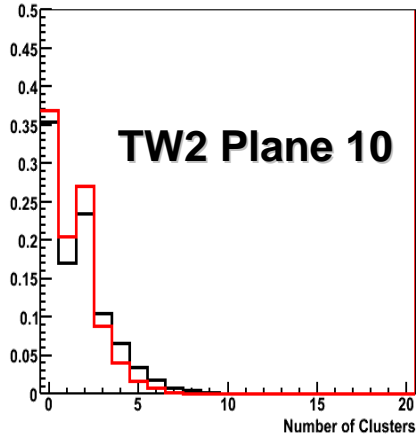
Number of Clusters and Cluster size

Runs 1176-1180 (beam 2.5 GeV)

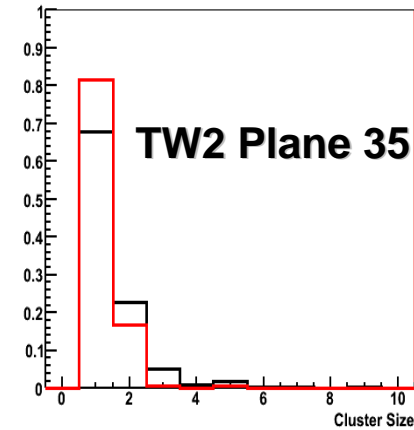
Number of Cluster Distributions Tower 2 Plane 35



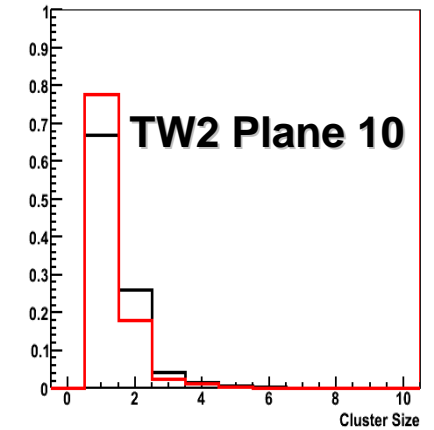
Number of Cluster Distributions Tower 2 Plane 10



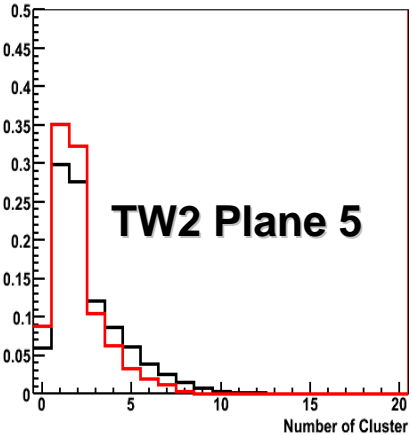
Cluster Size Distributions Tower 2 Plane 35



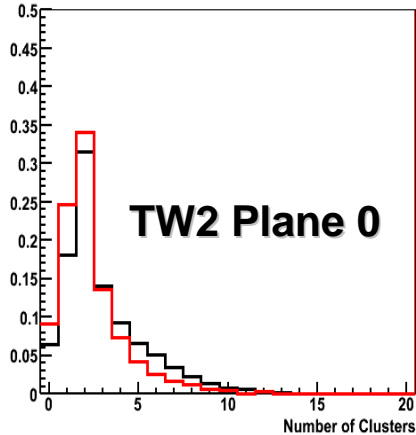
Cluster Size Distributions Tower 2 Plane 10



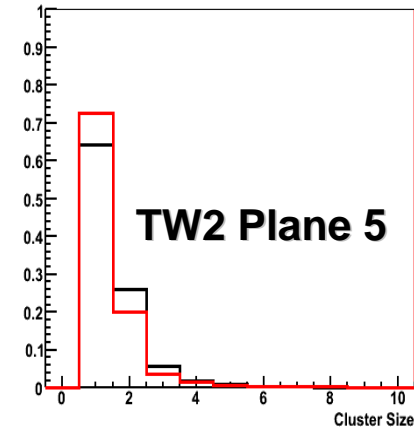
Number of Cluster Distributions Tower 2 Plane 5



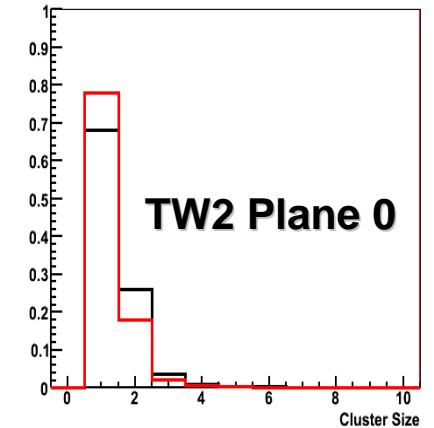
Number of Cluster Distributions Tower 2 Plane 0



Cluster Size Distributions Tower 2 Plane 5



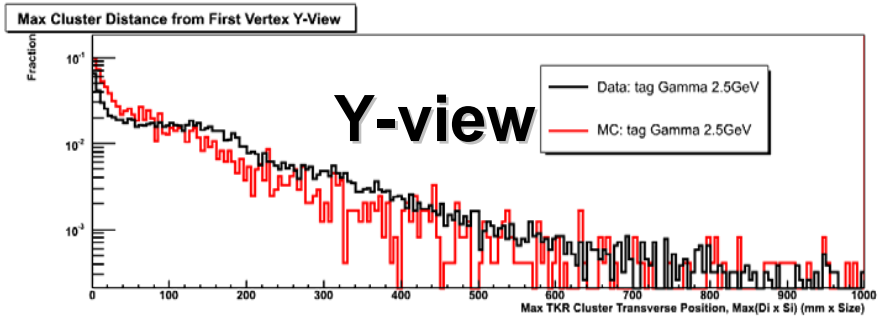
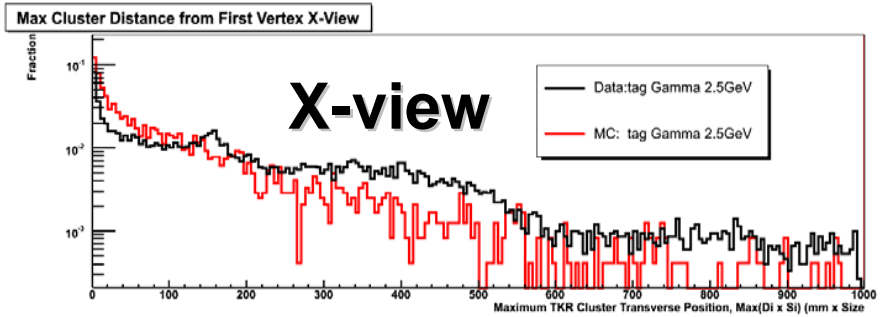
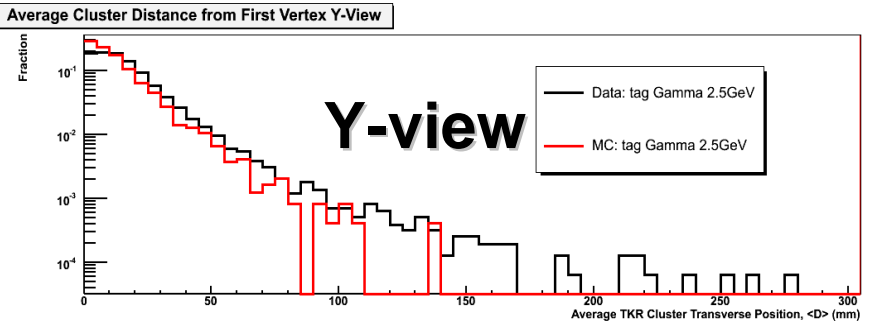
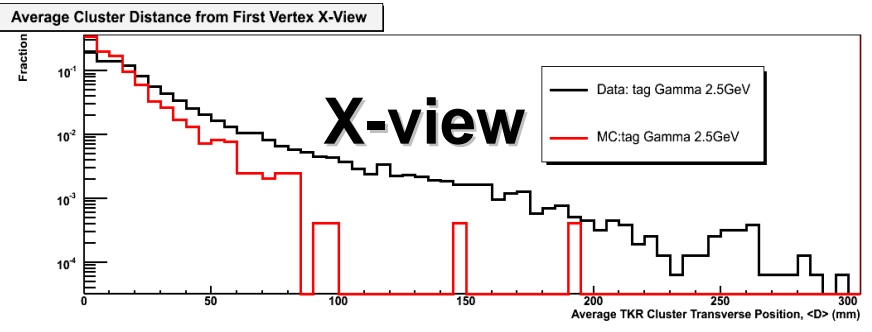
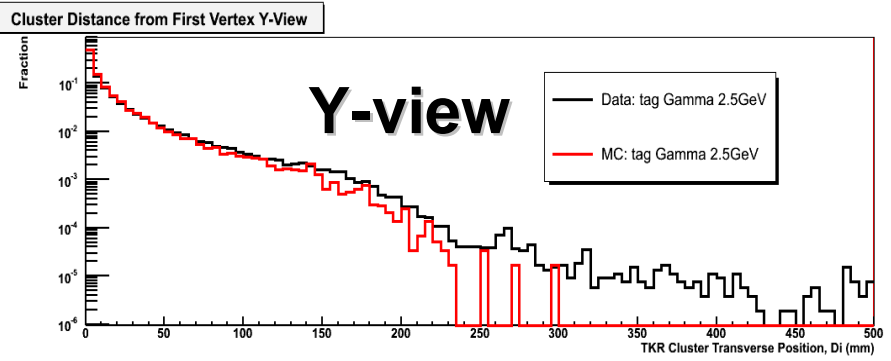
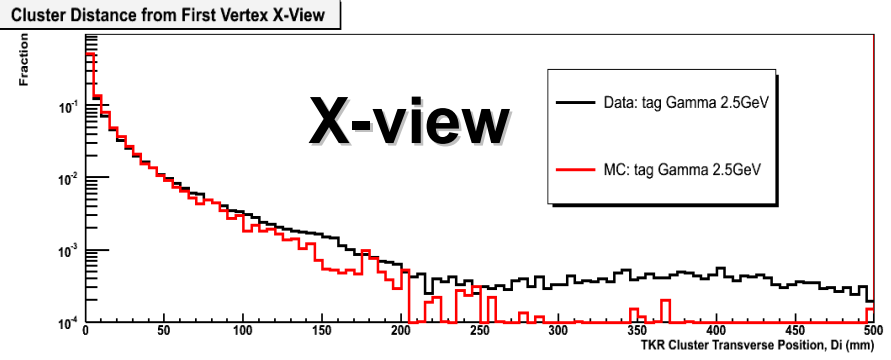
Cluster Size Distributions Tower 2 Plane 0



MC
Data

Transverse shower with respect “First vertex”

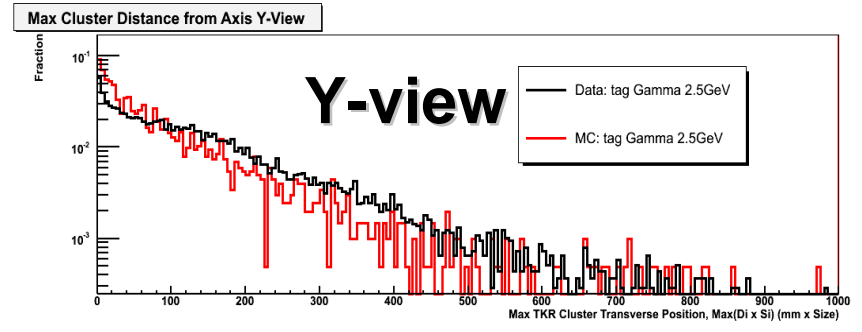
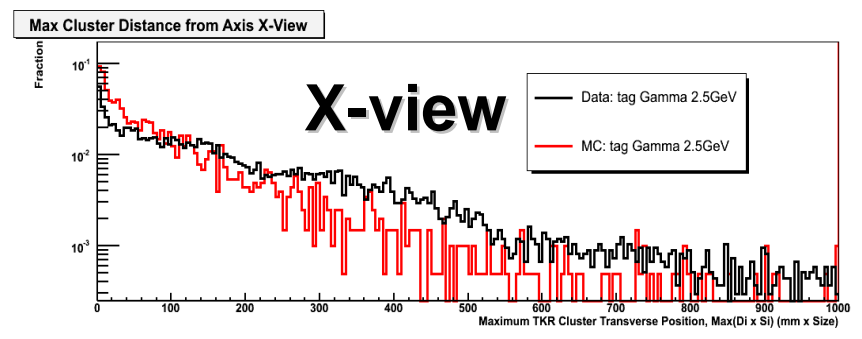
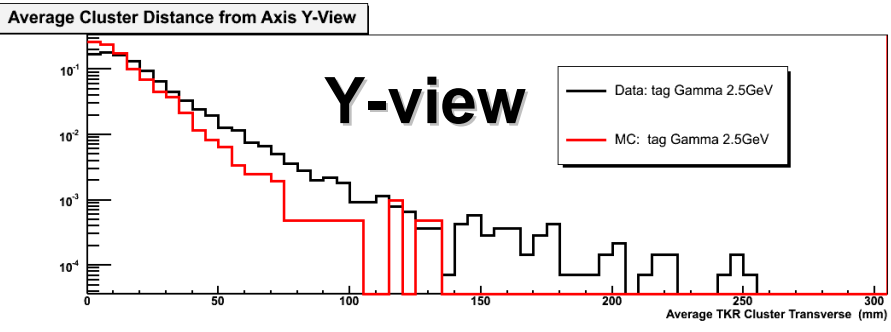
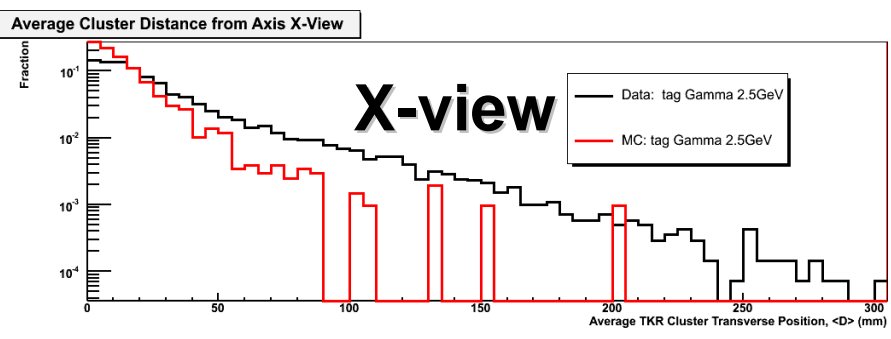
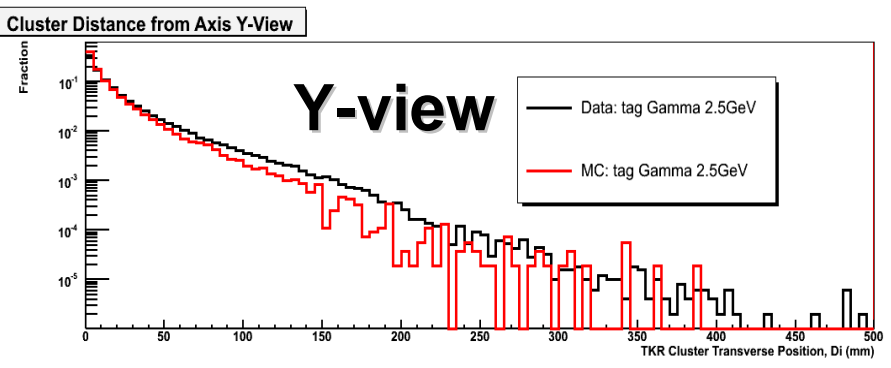
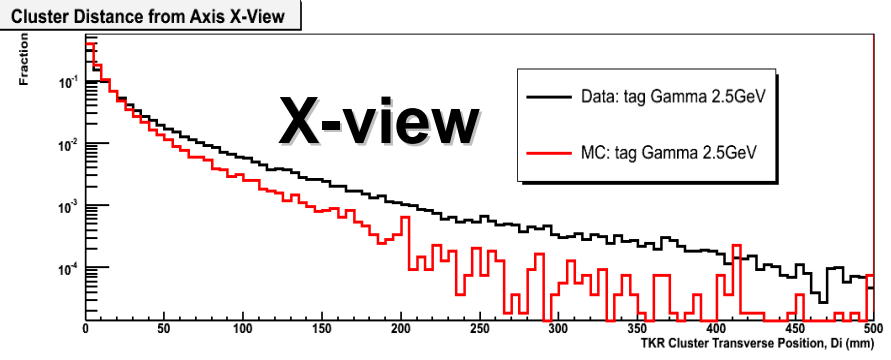
Runs 1176-1180



MC
Data

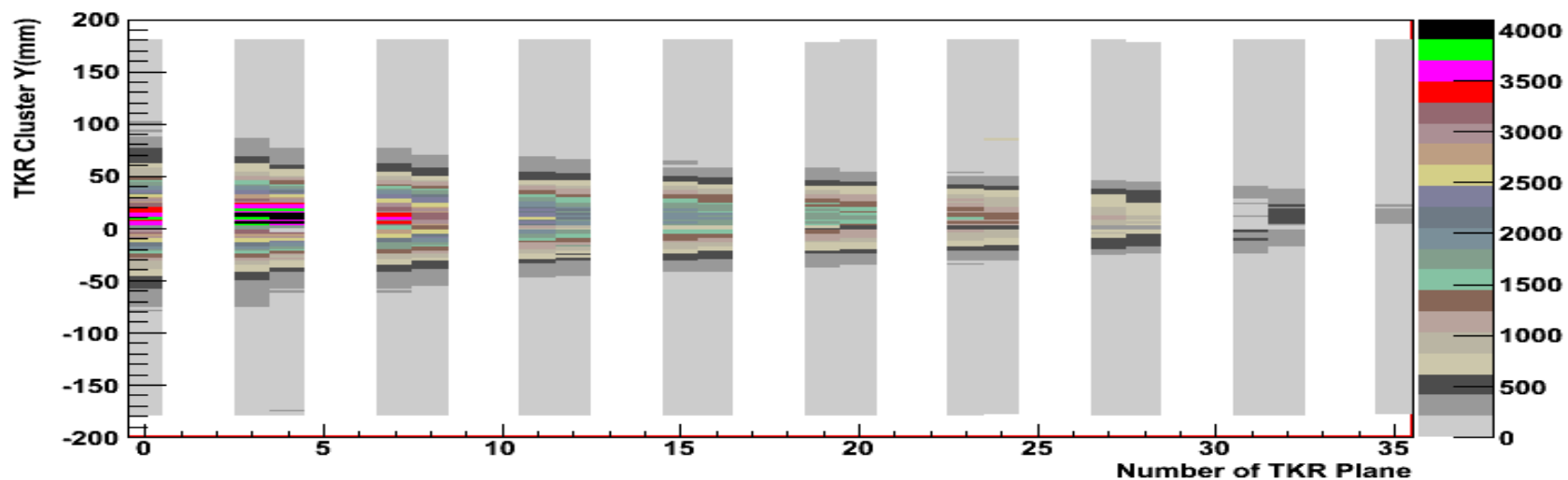
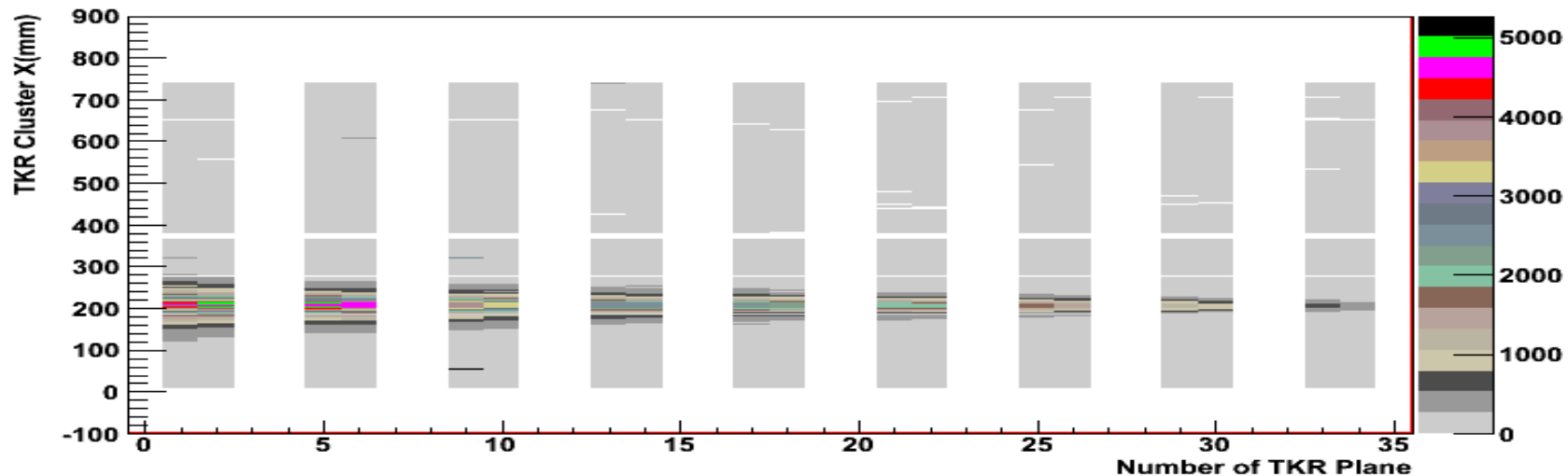
Transverse shower with respect “Shower Axis”

Runs 1176-1180



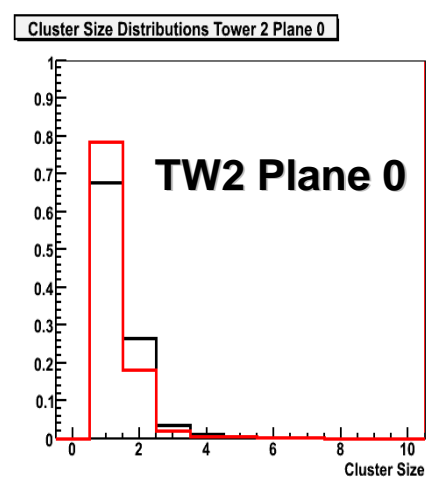
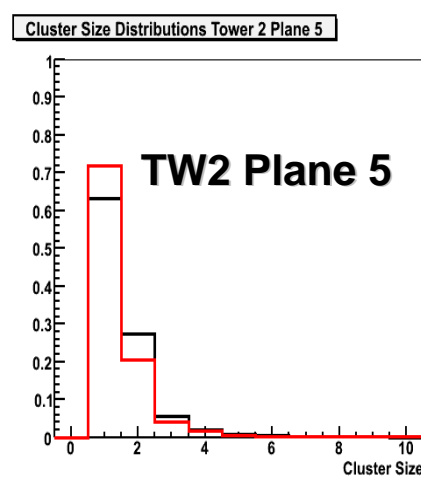
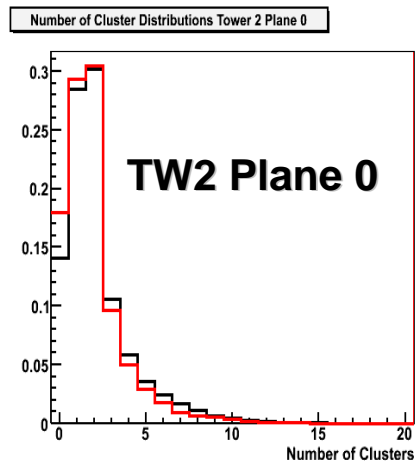
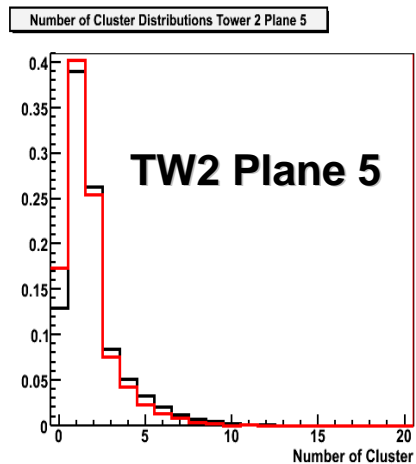
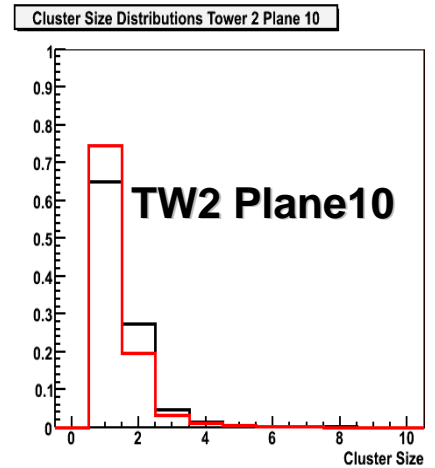
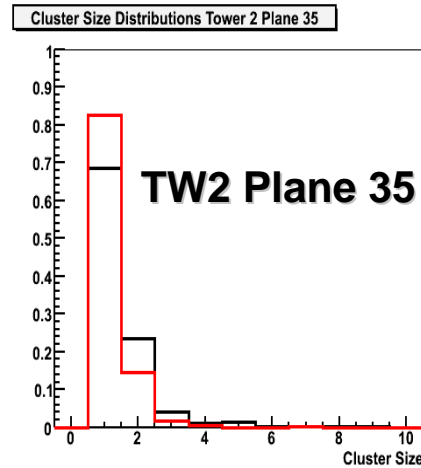
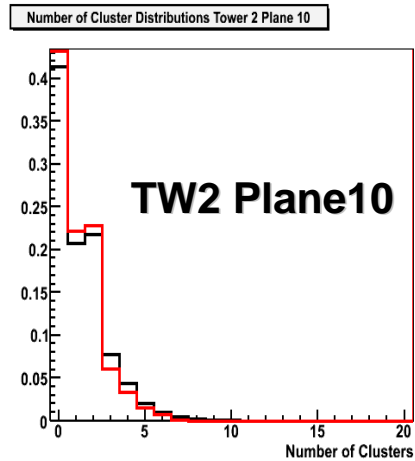
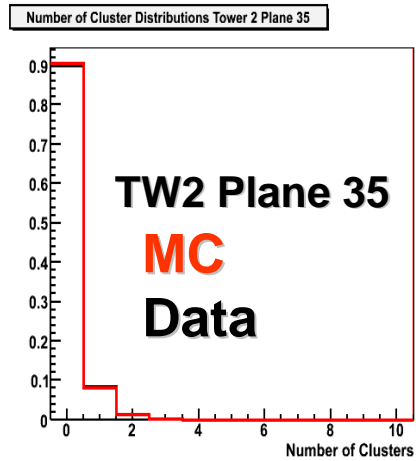
Runs 1181-1190 (Full Brems TW2)

beam 2.5 GeV

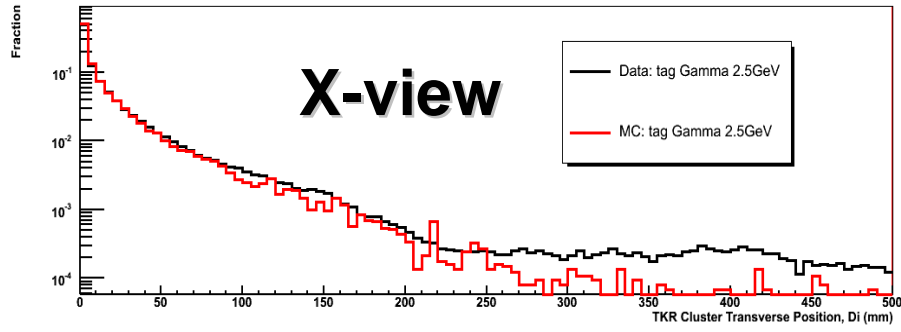


Number of Clusters and Cluster size

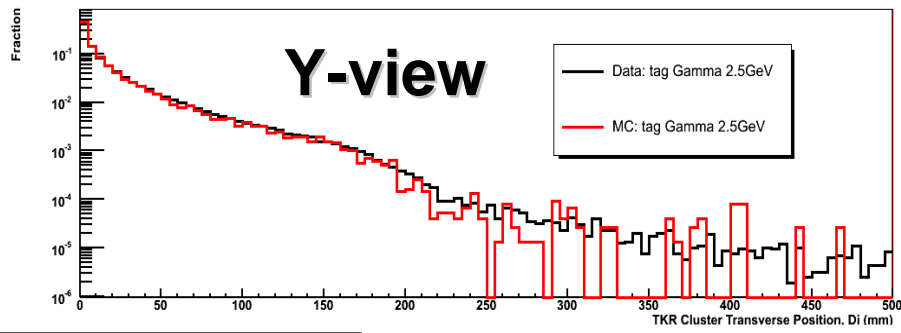
Runs 1181-1190 (beam 2.5 GeV)



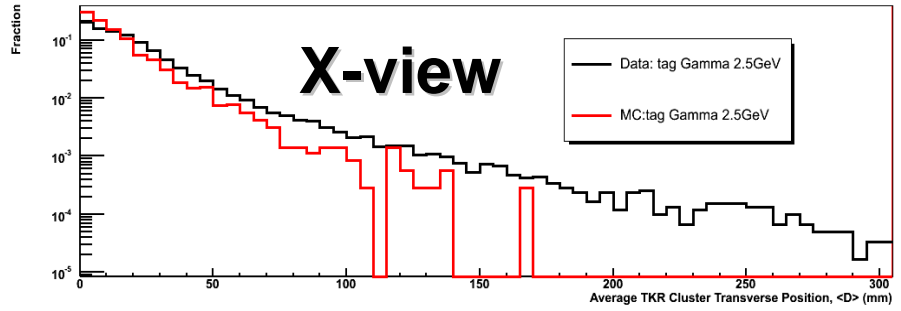
Cluster Distance from First Vertex X-View



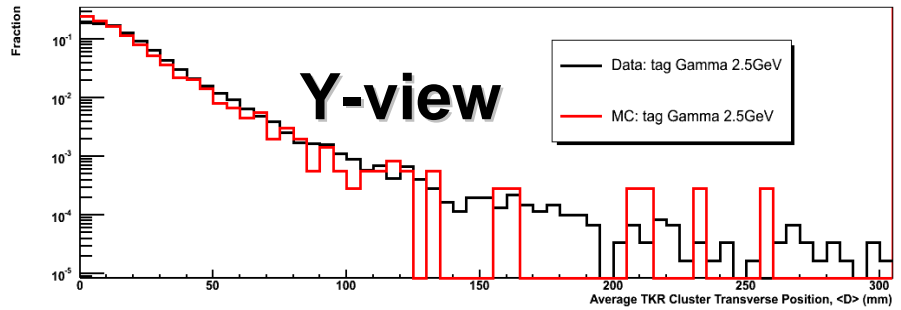
Cluster Distance from First Vertex Y-View



Average Cluster Distance from First Vertex X-View



Average Cluster Distance from First Vertex Y-View

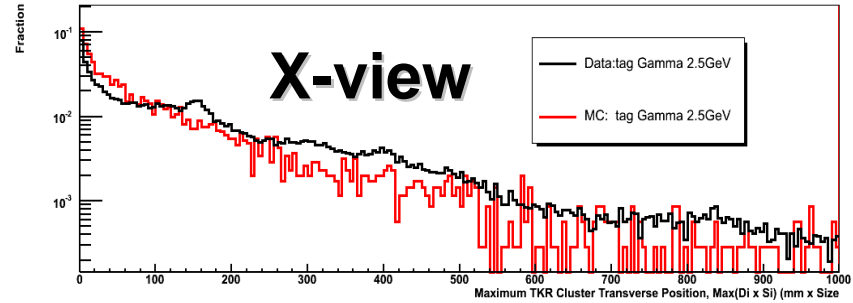


MC
Data

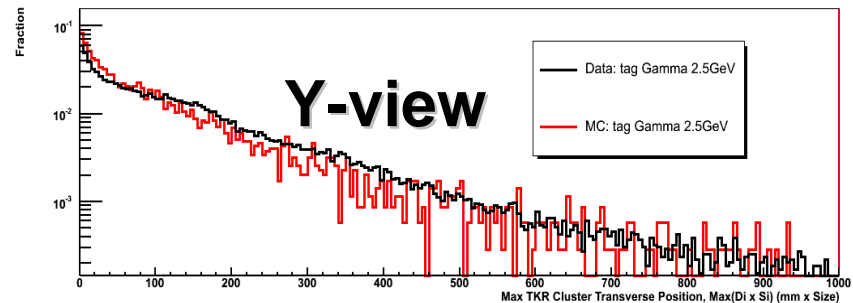
Transverse shower with respect "First vertex"

Runs 1181-1190

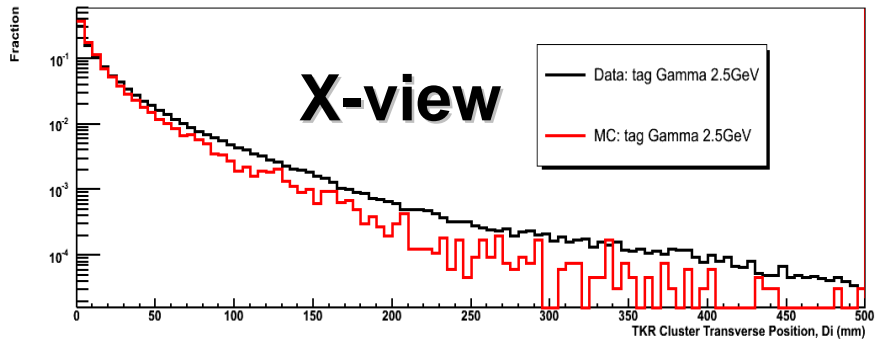
Max Cluster Distance from First Vertex X-View



Max Cluster Distance from First Vertex Y-View



Cluster Distance from Axis X-View

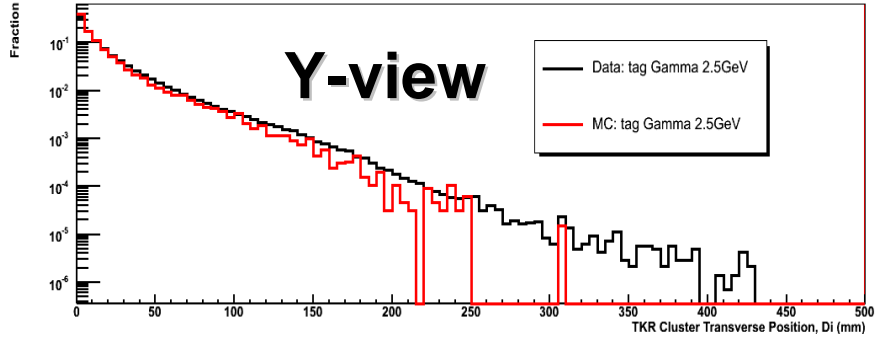


MC
Data

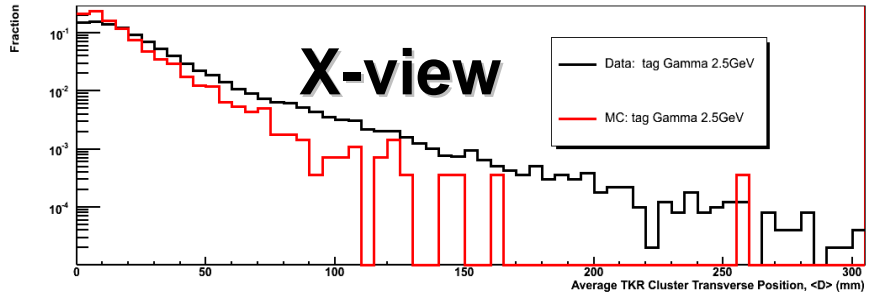
Transverse shower with respect “Shower Axis”

Runs 1181-1190

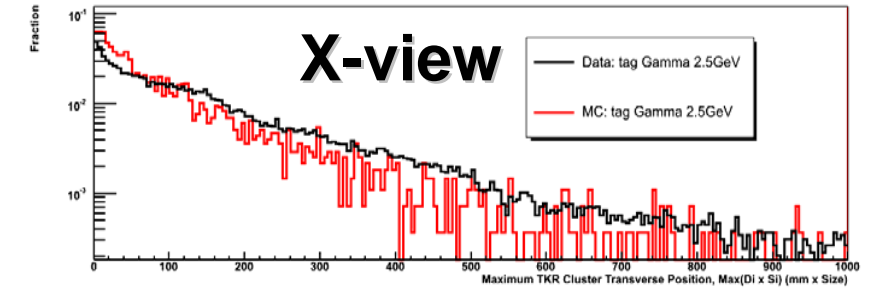
Cluster Distance from Axis Y-View



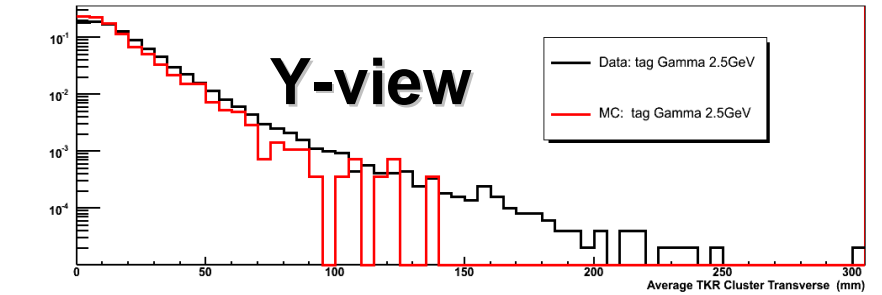
Average Cluster Distance from Axis X-View



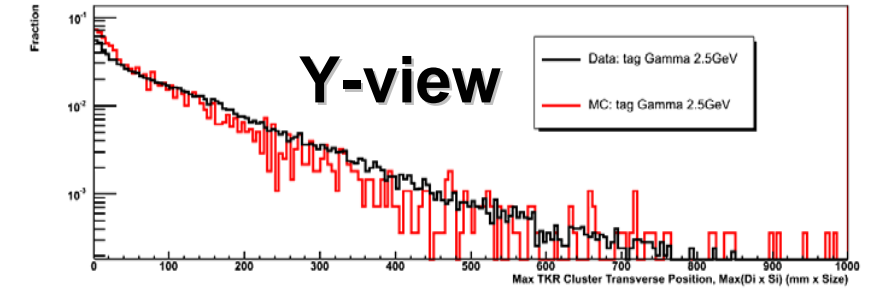
Max Cluster Distance from Axis X-View



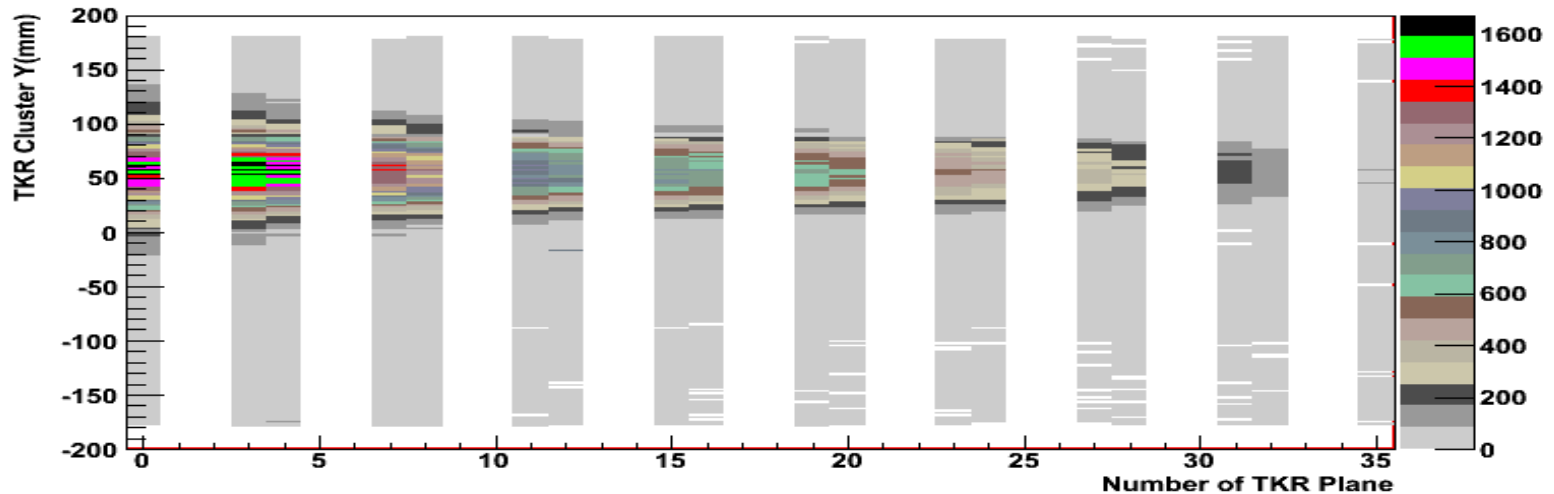
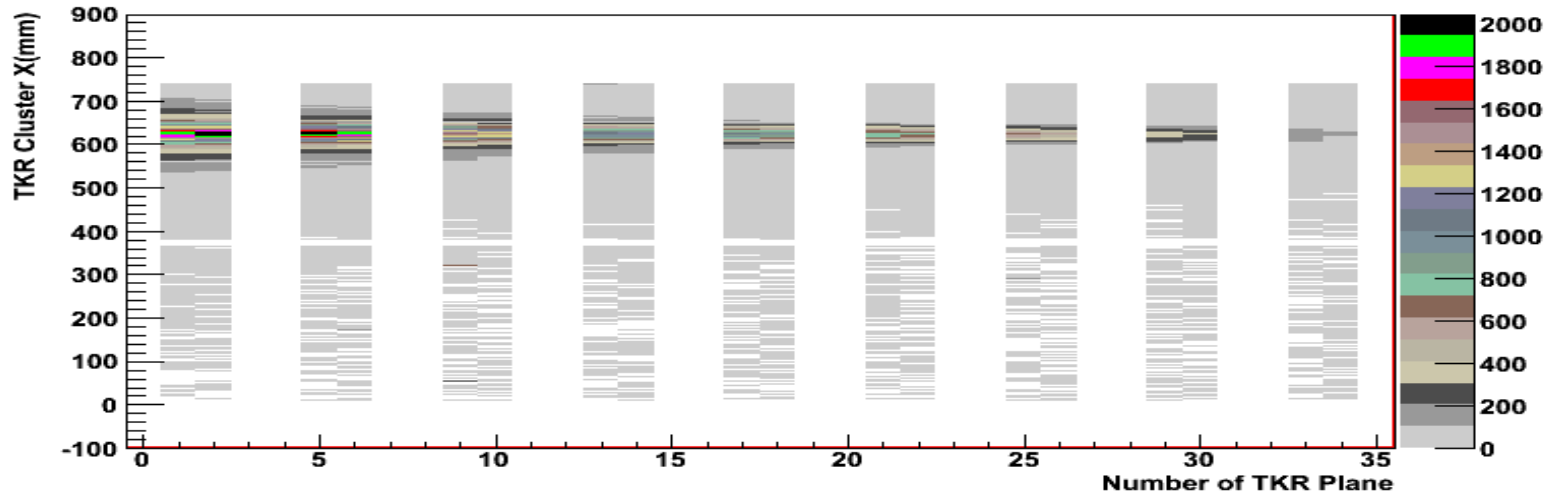
Average Cluster Distance from Axis Y-View



Max Cluster Distance from Axis Y-View

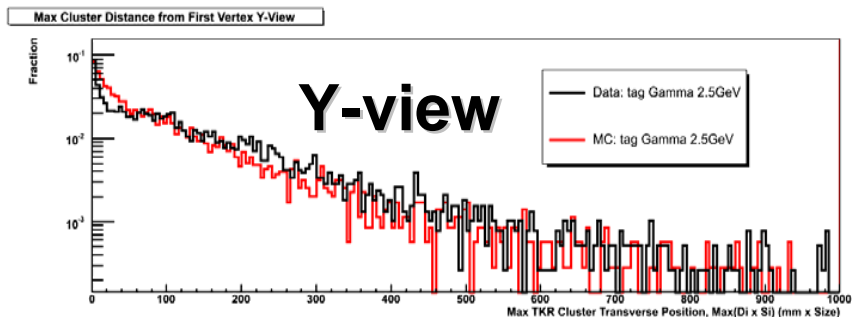
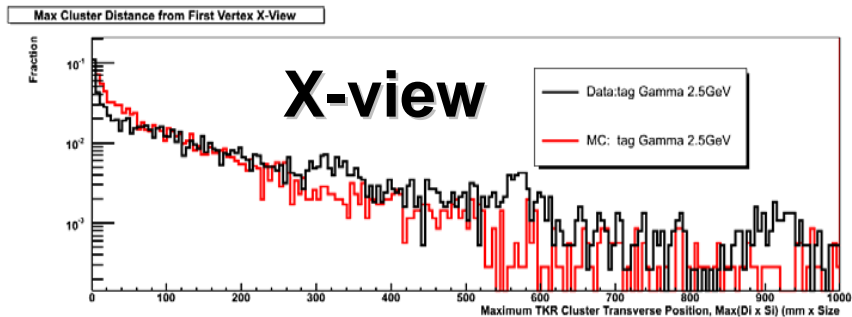
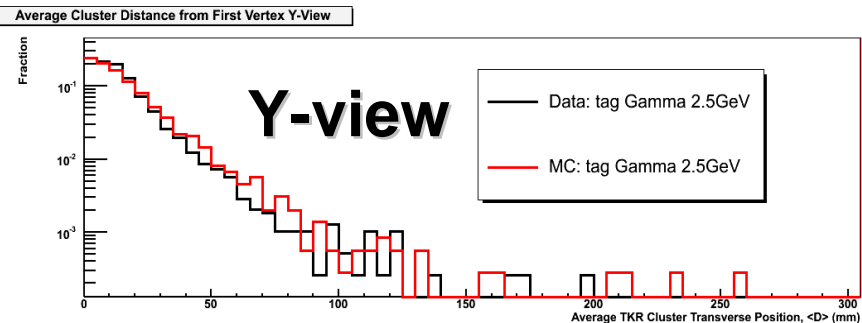
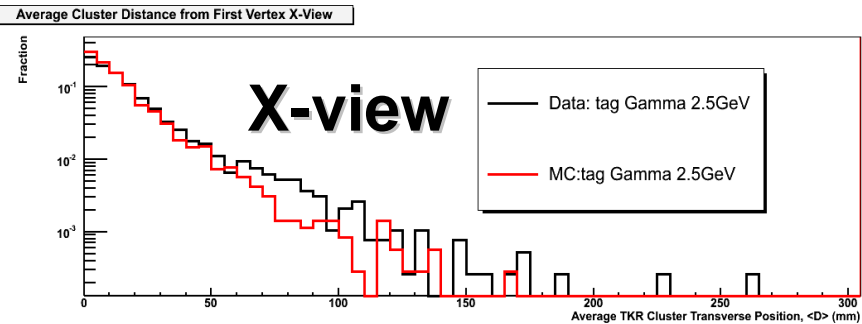
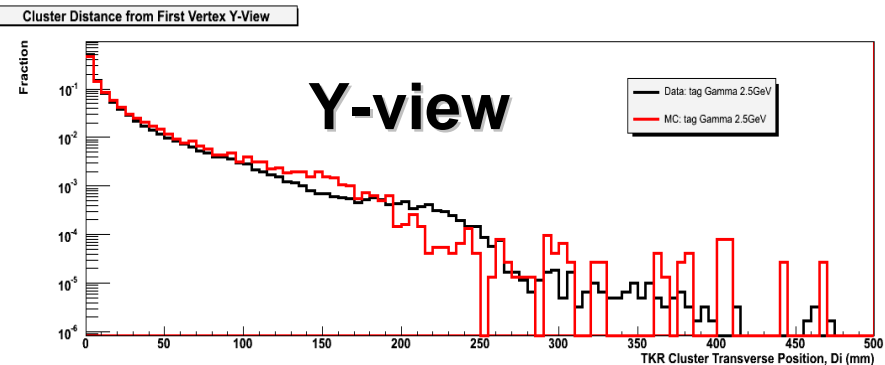
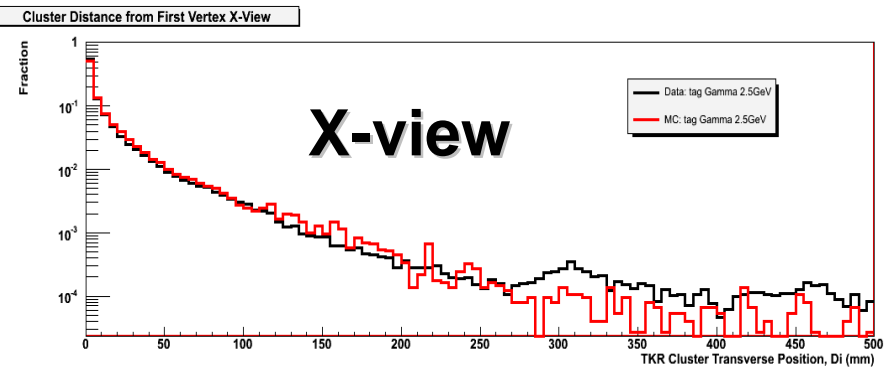


Runs 1439->1443 (Tag Gammas TW3) beam 2.5 GeV

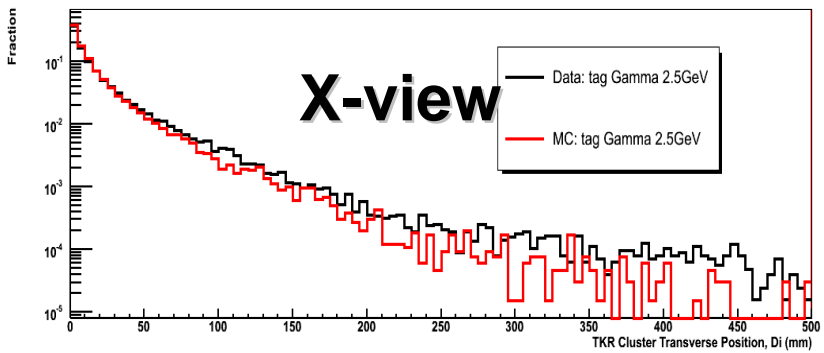


MC
Data

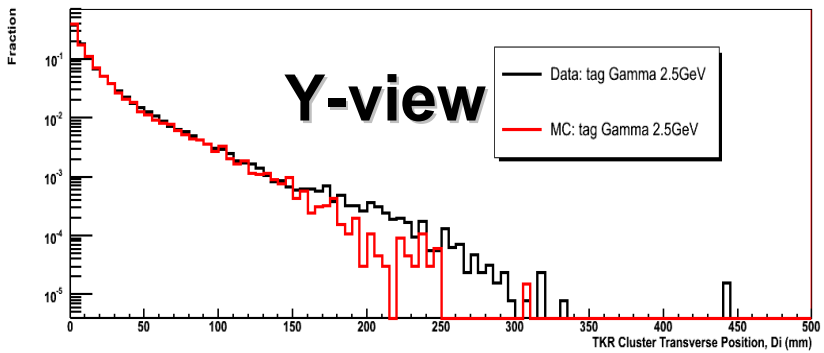
Transverse shower with respect “First vertex” Tag Gammas TW3



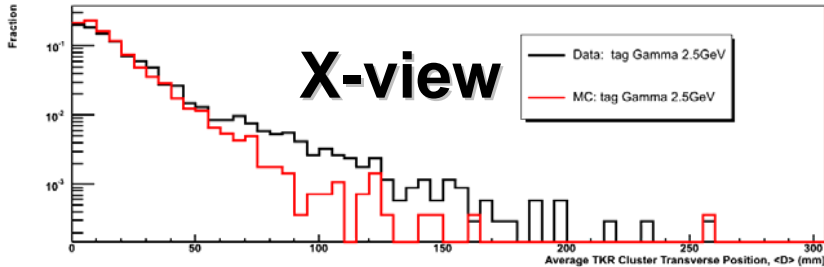
Cluster Distance from Axis X-View



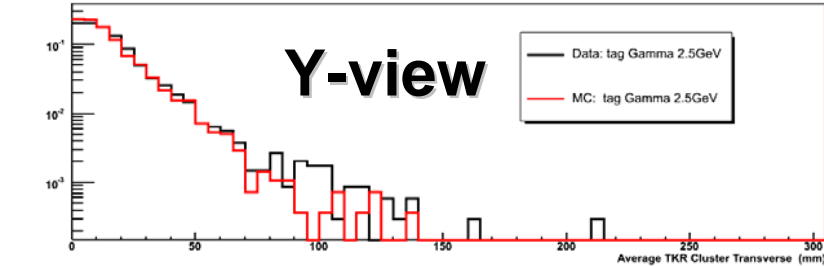
Cluster Distance from Axis Y-View



Average Cluster Distance from Axis X-View



Average Cluster Distance from Axis Y-View

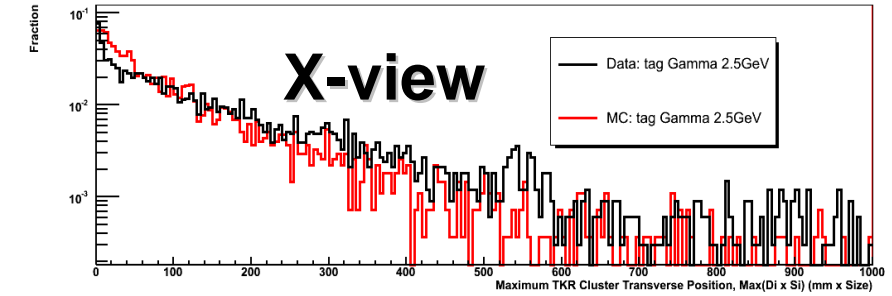


MC
Data

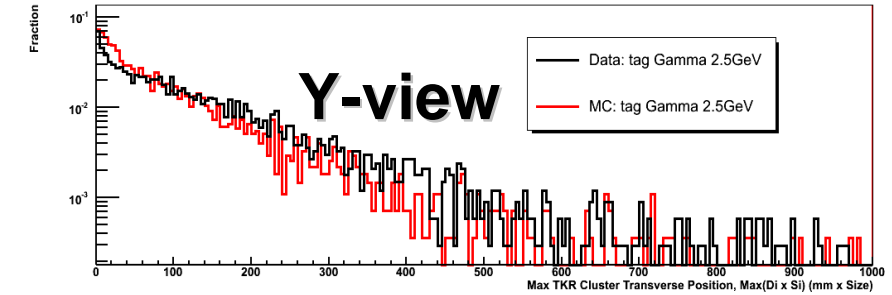
Transverse shower with respect "Shower Axis"

Tag Gammas – Tw3

Max Cluster Distance from Axis X-View



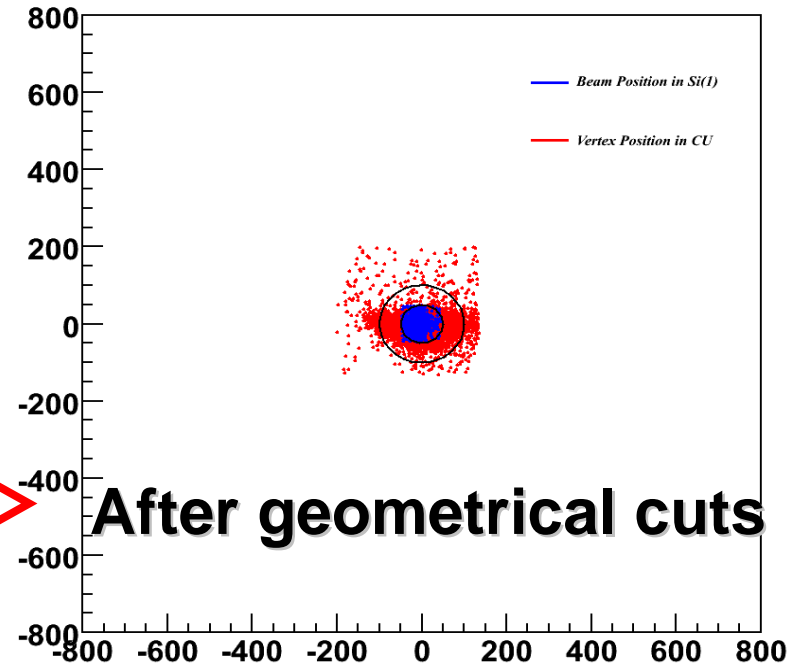
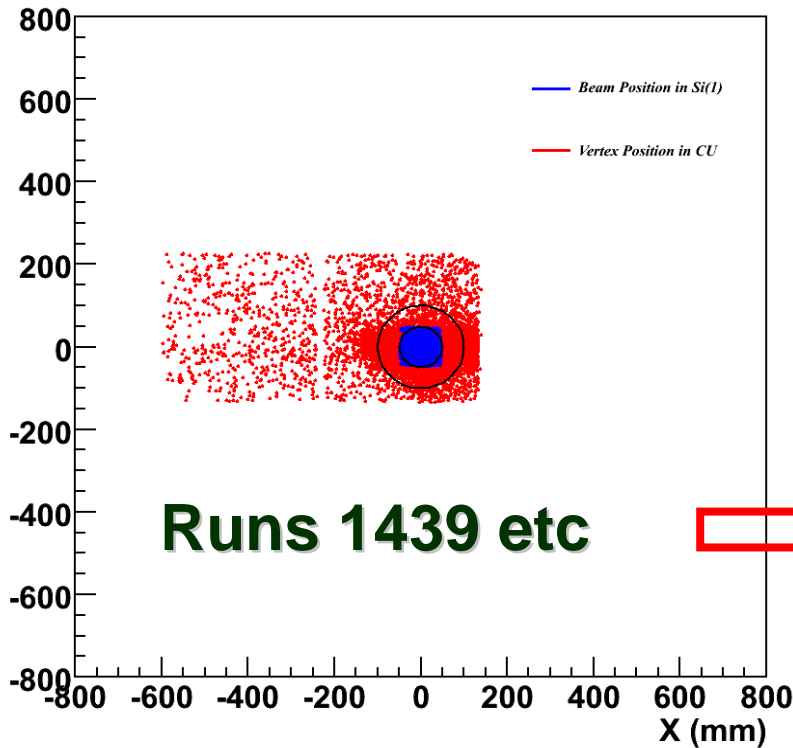
Max Cluster Distance from Axis Y-View



Conclusions

- **Data-MC discrepancies for gammas seem to be smaller than for electrons**
 - The current MC includes thicker W layers that increases the conversion probability for gamma
- **The EM shower is narrower in the MC, even though is less than the electron case**
- **The geometrical cuts on the input vertex position cannot remove the pion punch through tower3**
 - We can cut this clusters by adding further geometrical cuts
- **It is not so easy to well separate all effect for the gamma events (for instance, the contribution the upstream materials ...)**

First Vertex (VtxX0 and VtxY0) and Beam position in “coincidence”- TW3



Vertex Position (VtxX0 and VtxY0) in CU (RED)

Y-Z Beam position (TAG_XYZ[1][0], TAG_XYZ[2][0]) (BLUE)



Hit Tower selection