Update on Trieste Activities on SVT Rates and Multiplicity Study

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on behalf of Trieste SuperB Group

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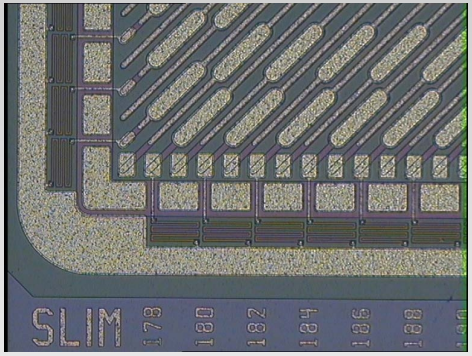
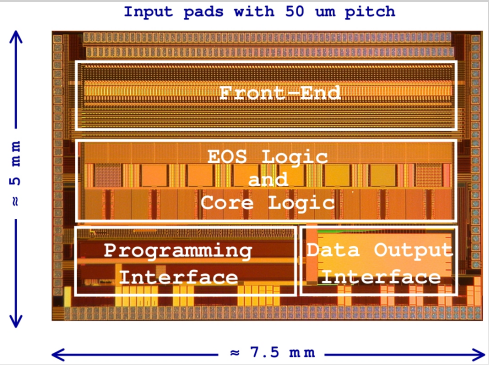


Outline



Telescope Spare Modules and FSSR2 DAQ

SVT Simulation Studies Based on Bruno for e± pairs

- Mean Strip Multiplicity per Cluster
- Strip Multiplicity Distribution per Cluster and Fit
- Strip Rate

- Deposited energy (dE) per Strip Distribution
- Strip Multiplicity and dE per Strip vs Incident Angle

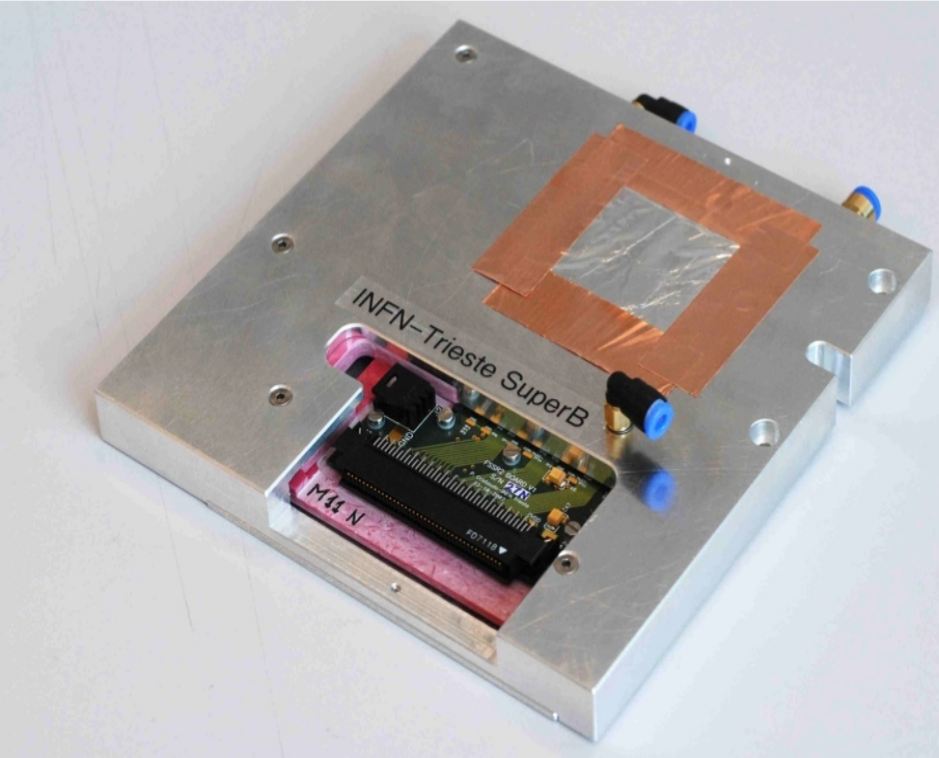
• News since July

- BugFix on Layer 0 Incident Angle

Telescope Spare Modules and FSSR2 DAQ in Trieste

After a long gestation, we managed* to fabricate 5 new telescope modules with FSSR2 readout, in order to a have a 3+3 telescope configuration + spares; 6 were already available and used in 2008-2009 beam tests in a 2+2 configuration.

Efforts were also devoted* to build a reliable FSSR2 DAQ system in Trieste, which is now working and allowed us to test and calibrate all 11 telescope modules plus 3 striplet modules.



The striplet modules (FSSR2 RO) tested in 2008 will be tested again on the beam at larger incidence angles and with lower thresholds.

* = Thanks to Marco Bomben, Luciano Bosisio, Pietro Cristaudo, Dario Iugovaz, Barbara Liberti, Irina Rashevskaya, Lorenzo Vitale + contributions from Pisa (Stefano Bettarini + Alessandro Profeti for the bonding) and Bologna (Mauro Villa for the DAQ)

SVT Simulation Studies Based on Bruno for e± pairs

Layer 0 May Geometry and Incident Angle

- Layer 0 May 2011 Geometry and Incident Angle has been added in Root Macro used for studying strip multiplicity and dE
- We are using full simulated event (BRUNO) with May Layer 0 Geometry:

  - Layer 0 now with 8 module

  - e+e-e+e- (pairs) 1.48M events

with May 2011 Geometry production by Riccardo Cenci

- Data are compared with same values obtained by Riccardo Cenci

- In the following “No Threshold cut” means that we consider only particle with deposited energy higher than zero (dE > 0).

- Particles, which don't deposit energy in SVT (deposited energy = 0), aren't considered.

- Cluster with no deposit energy in SVT are approximaly 0.09 %

Average strip multiplicity

for e± from pairs **per Cluster**

New files - No threshold cut

Layer	RO PitchZ (or +45°) µm	Cenci* <n> Z (or +45°)	<n> Z (or +45°)	RO Pitch ϕ (or -45°) µm	Cenci *<n> ϕ (or -45°)	<n> ϕ (or -45°)
0	50	5.1	5.4	50	4.1	5.4
1	100	3.2	4.7	50	6.5	8.2
2	100	2.9	4.4	55	5.9	8
3	100	2.6	4.8	55	4.9	7.3
4	210	1.3	2.1	100	2	4.2
5	210	1.3	1.9	100	1.8	3.7

* = Values obtained from Riccardo Cenci Presentation showed at Elba 2011 Meeting

Average strip rate

for e± from pairs

New files - No threshold cut

Layer	RO PitchZ (or +45°) µm	Cenci* Rate Z or +45° (MHz / cm^2)	Rate Z or +45° (MHz / cm^2)	RO Pitch ϕ (or -45°) µm	Cenci* Rate ϕ or -45° (MHz / cm^2)	Rate ϕ or -45° (MHz / cm^2)
0	50	29.9	24.3	50	23.3	24.3
1	100	0.7	0.93	50	1.5	1.61
2	100	0.35	0.4	55	0.72	0.73
3	100	0.097	0.12	55	0.19	0.19
4	210	0.0076	0.0036	100	0.012	0.007
5	210	0.0041	0.0024	100	0.006	0.005

* = Values obtained from Riccardo Cenci Presentation showed at Elba 2011 Meeting

Strip Multiplicity Distribution & Fit

Fit Function
Negative Binomial Distribution

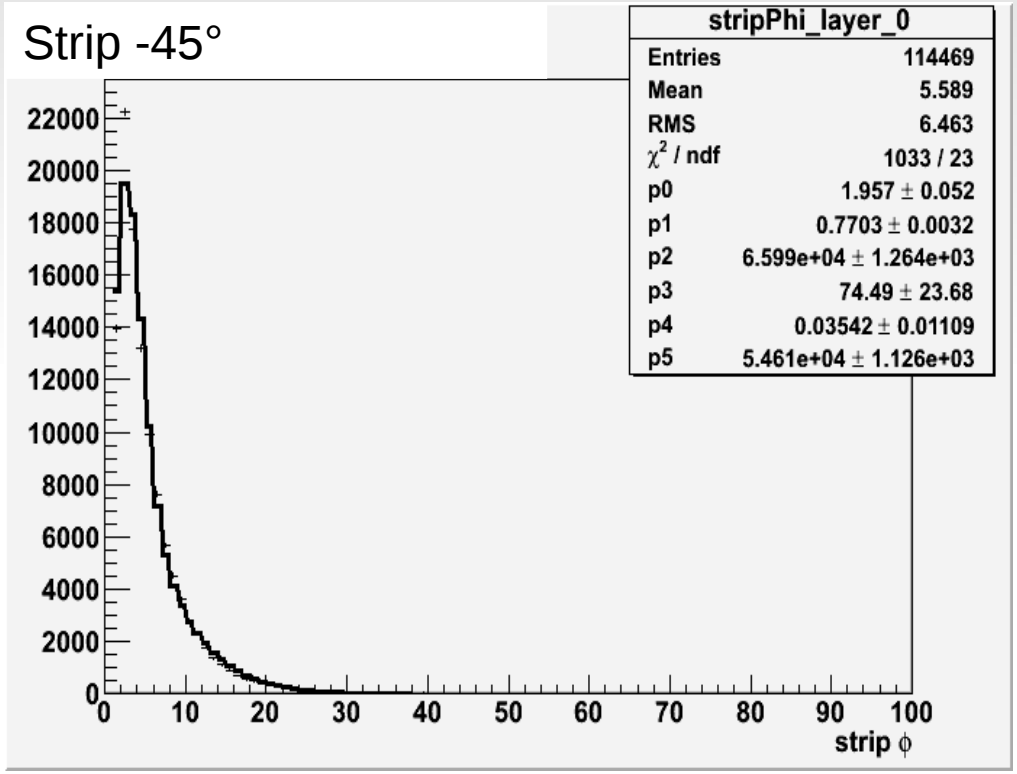
- The goal is to parameterize the Strip Multiplicity Distributions

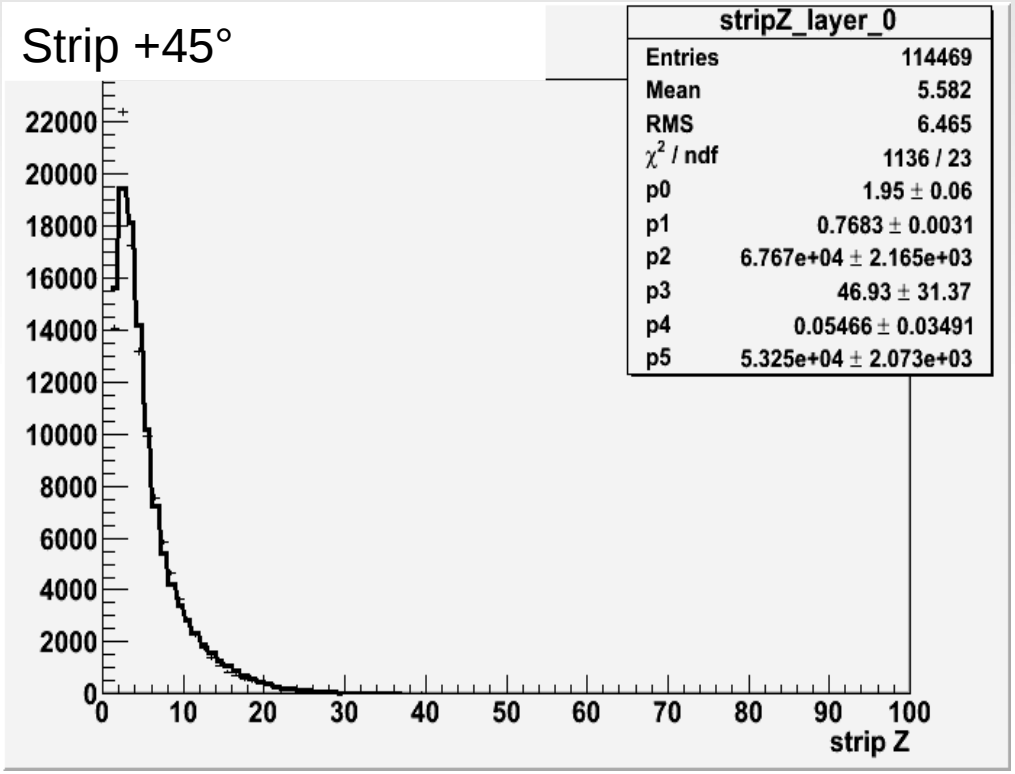
- Double Negative Binomial Distribution used to fit the Distributions

$$f(i) = \left(P2 \cdot \frac{\Gamma(i+P0)}{i!\Gamma(P0)} \cdot (1-P1)^{P0} \cdot P1^{P0}\right) + \left(P5 \cdot \frac{\Gamma(i+P3)}{i!\Gamma(P3)} \cdot (1-P4)^{P3} \cdot P4^{P3}\right)$$

Strip Multiplicity Distribution

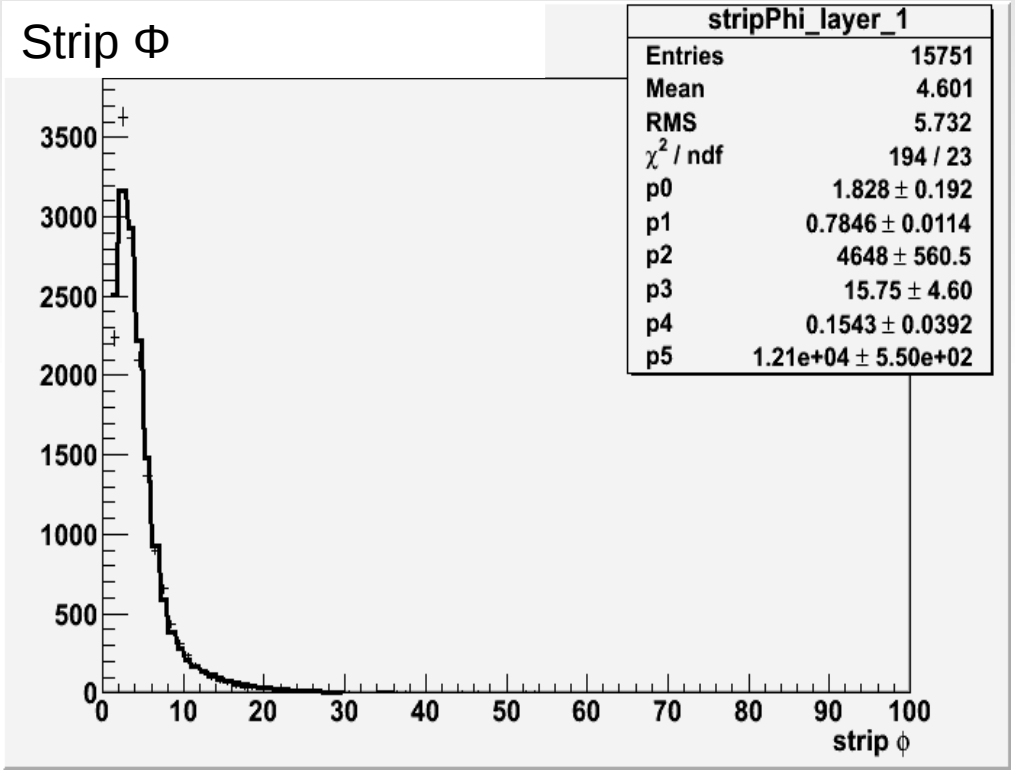
Layer 0

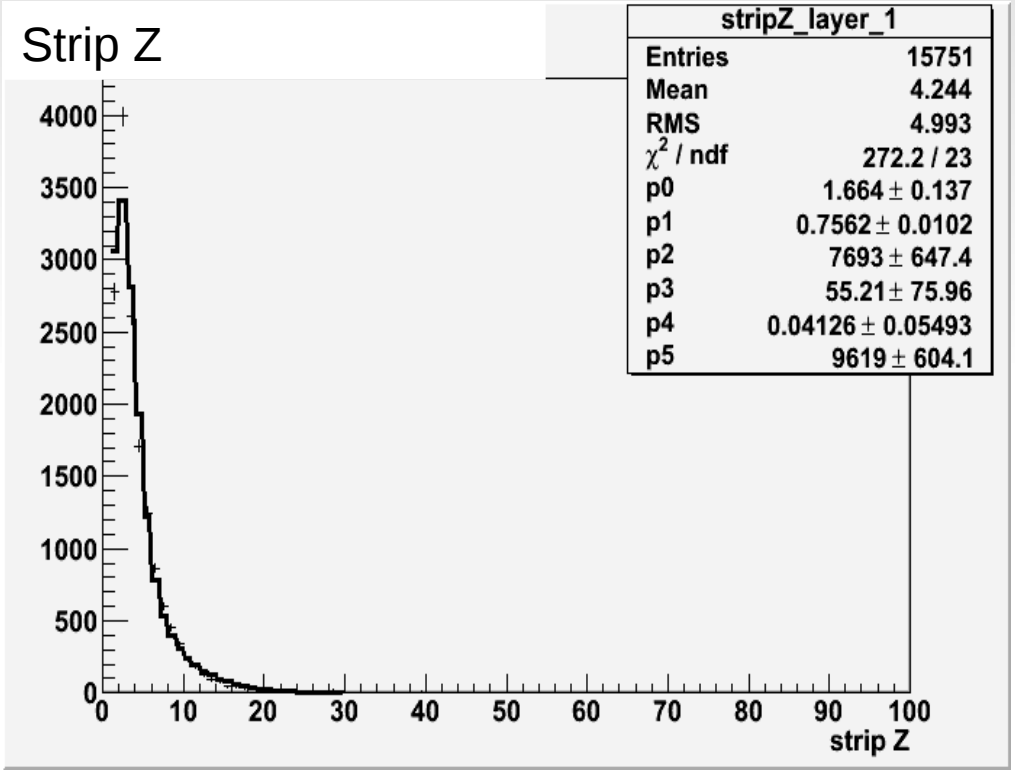




Strip Multiplicity Distribution

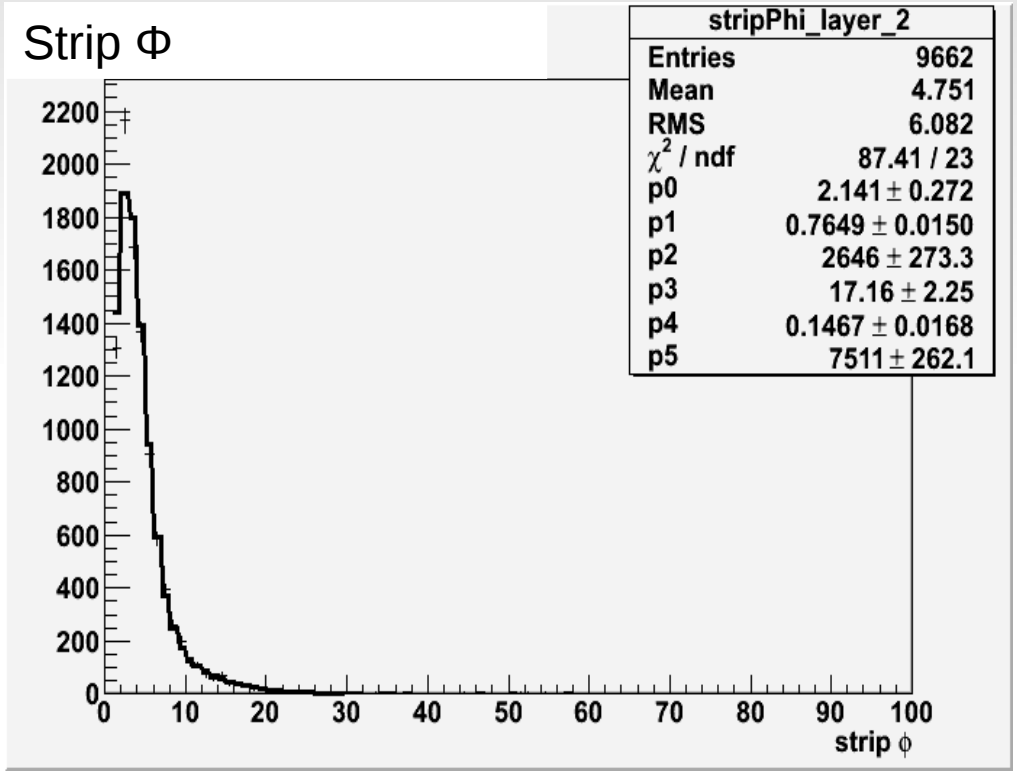
Layer 1

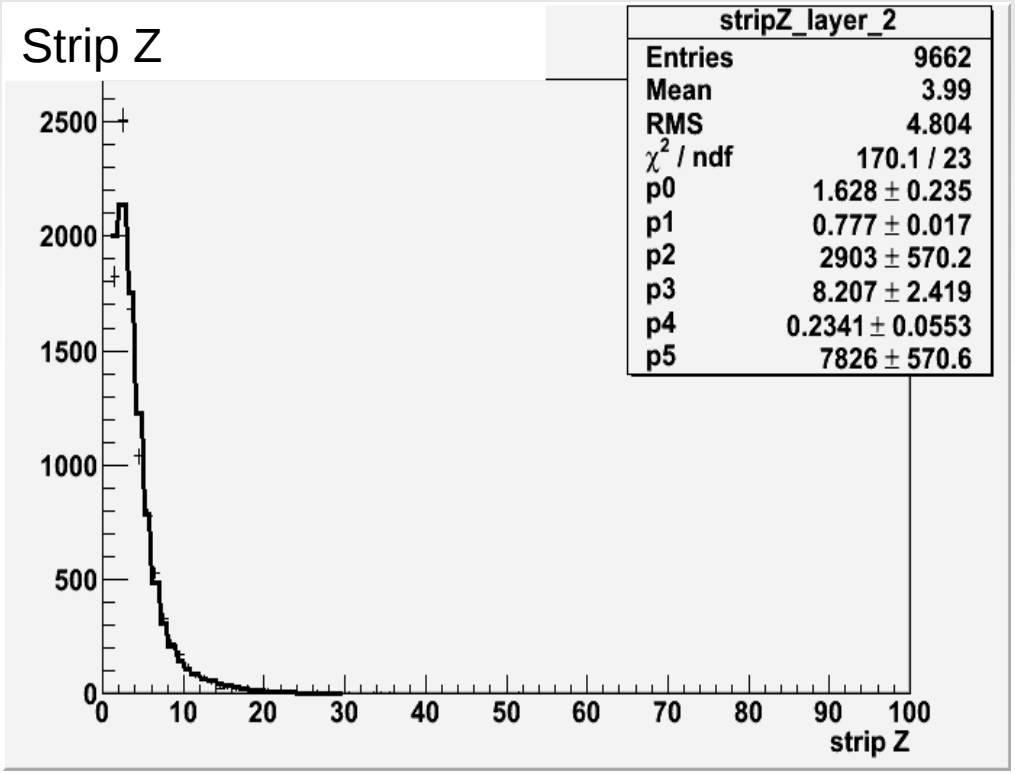




Strip Multiplicity Distribution

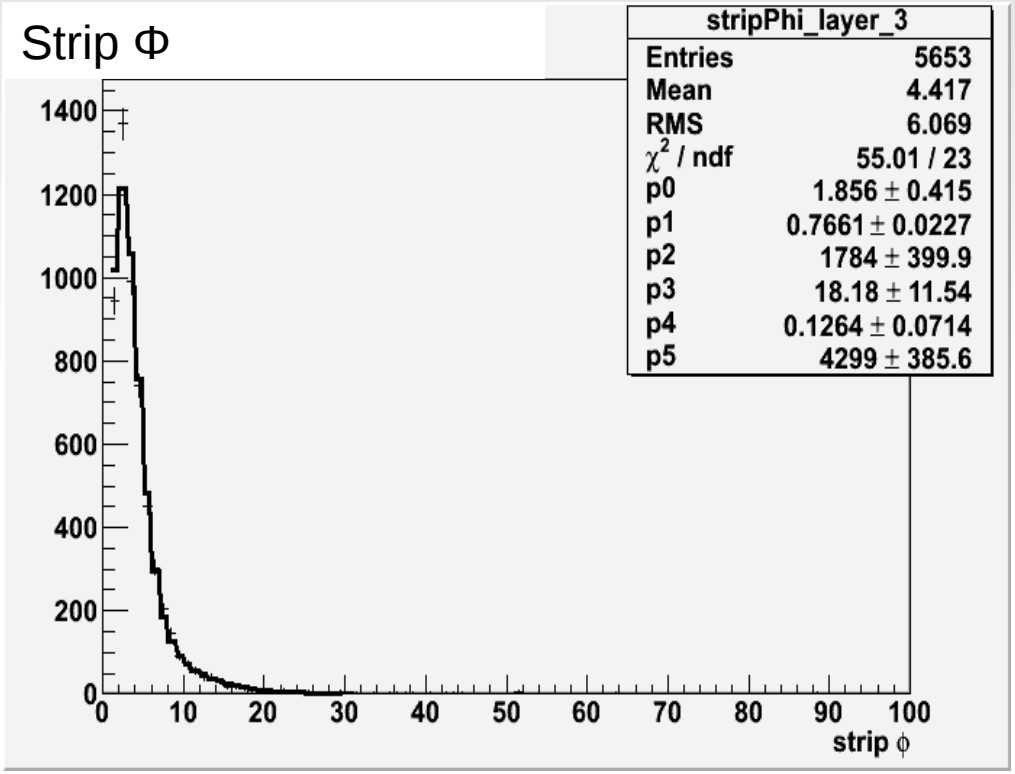
Layer 2

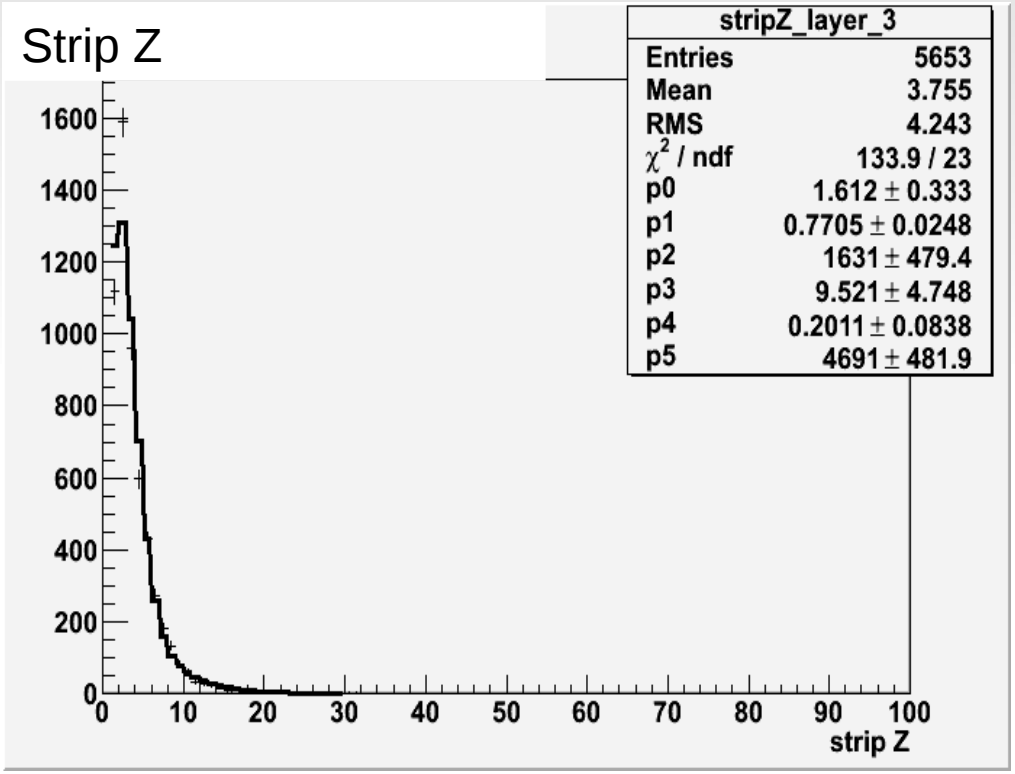




Strip Multiplicity Distribution

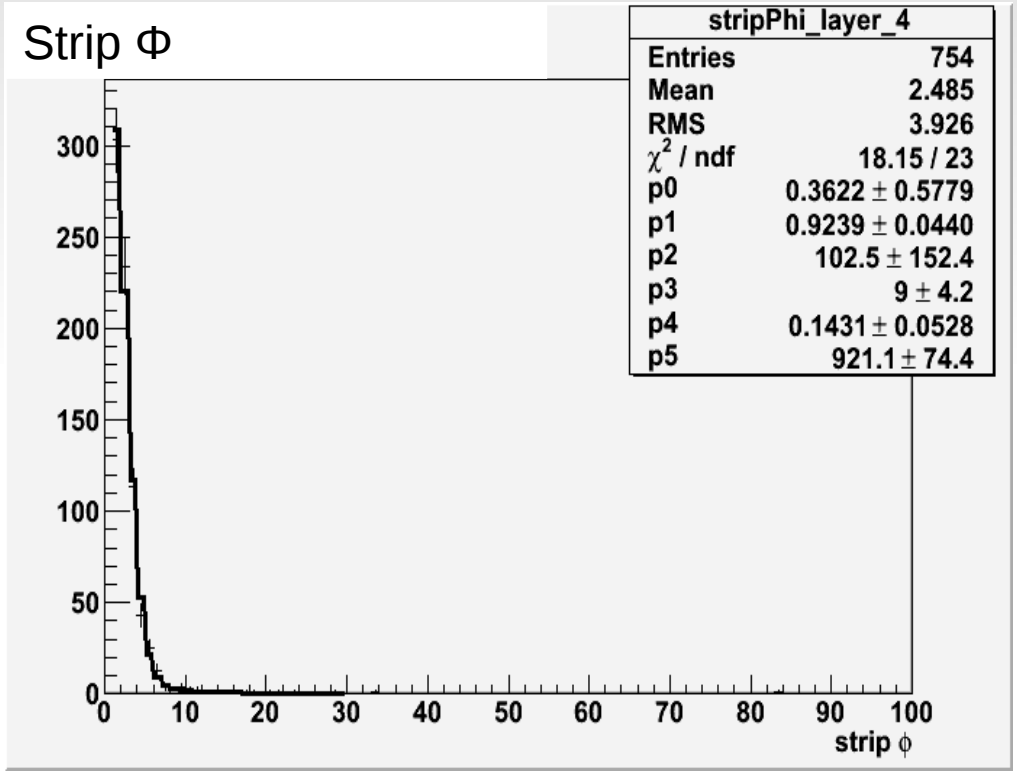
Layer 3

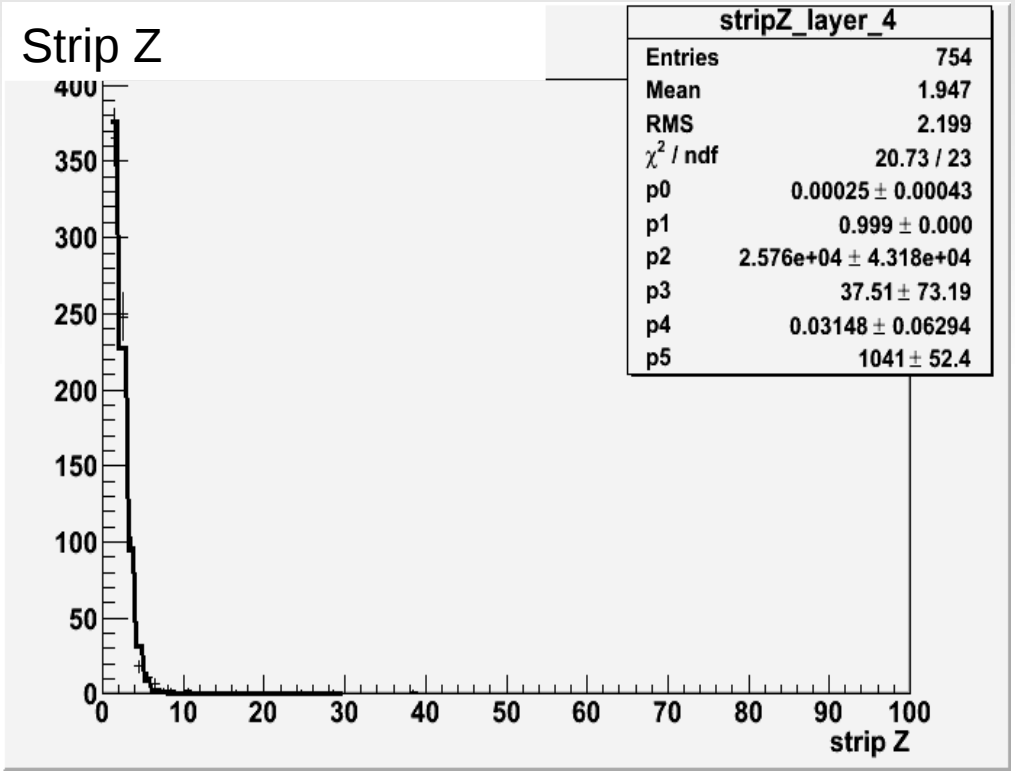




Strip Multiplicity Distribution

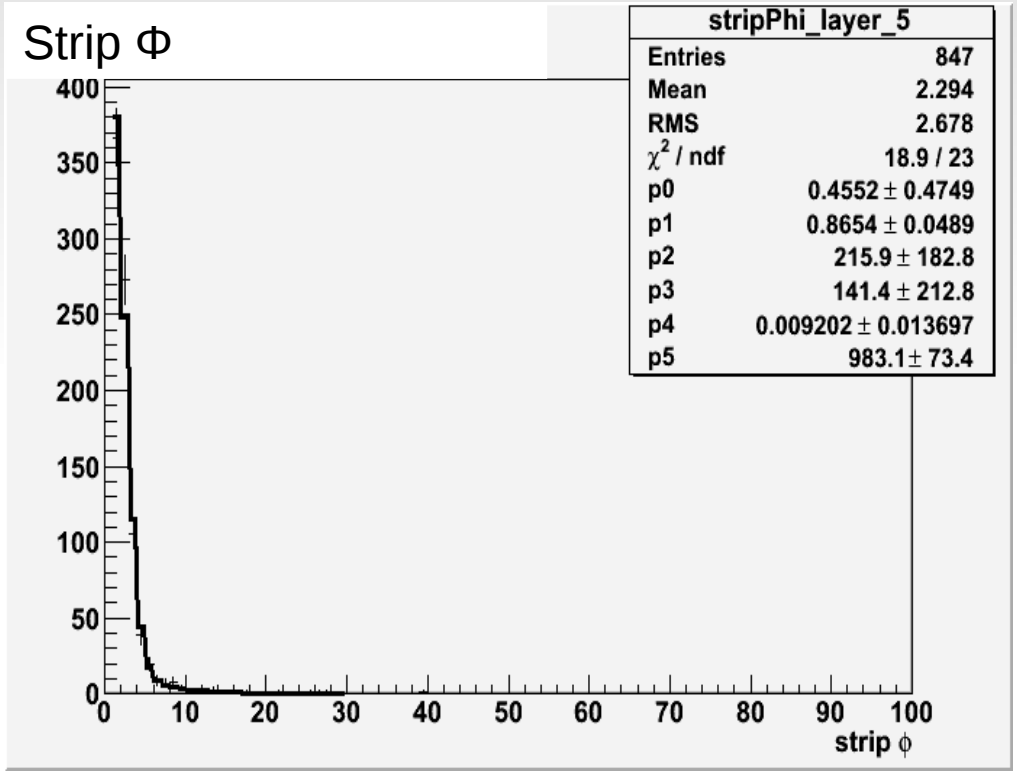
Layer 4

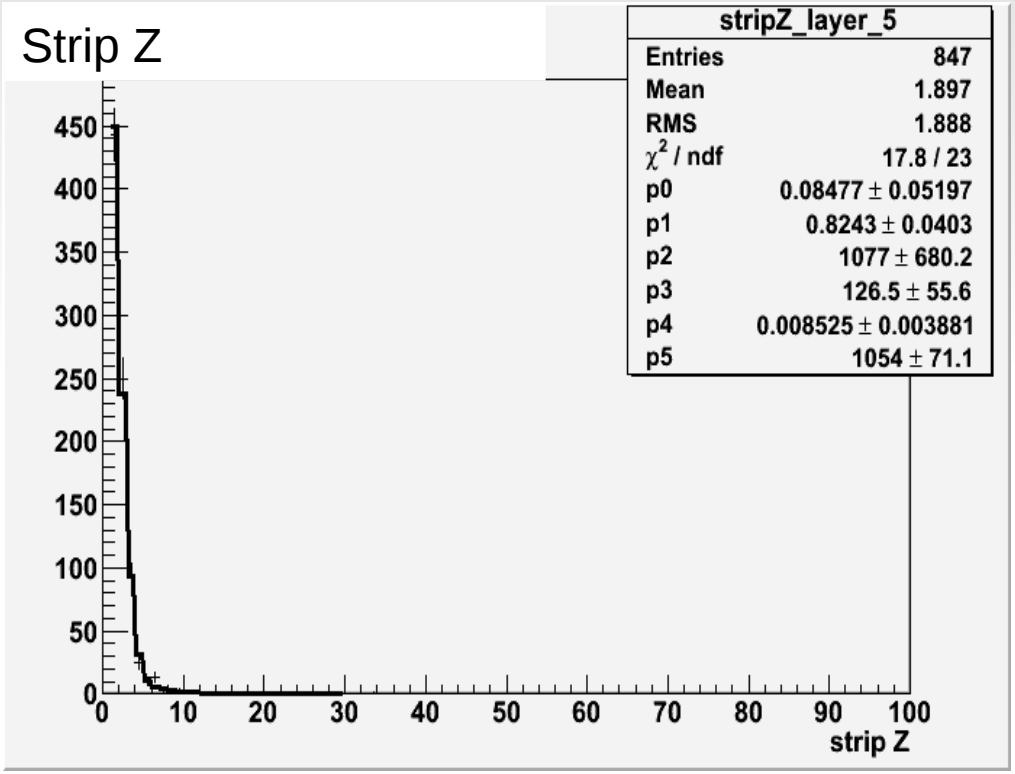




Strip Multiplicity Distribution

Layer 5



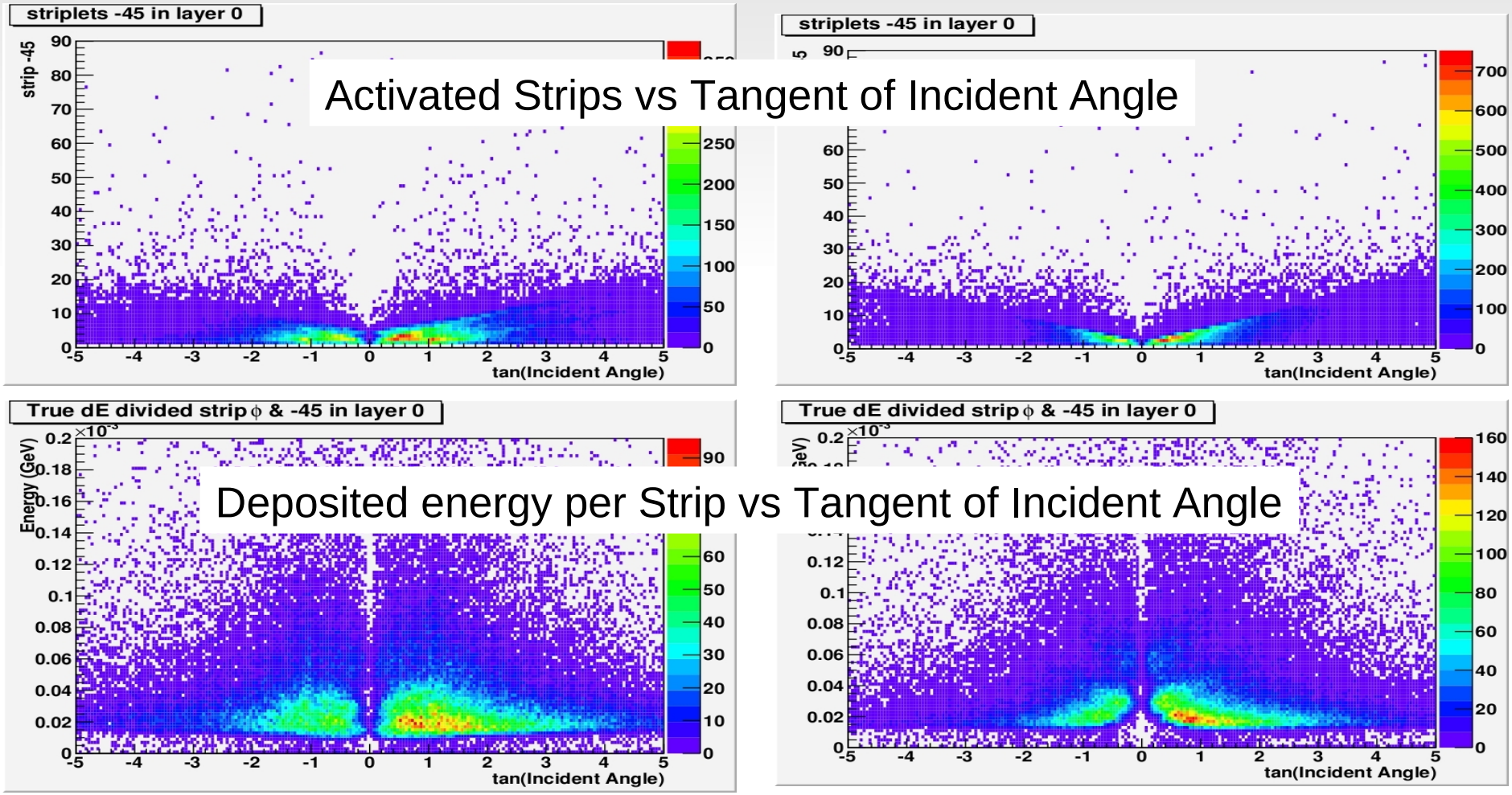


News since July

Found a Bug in the number of wafer in layer 0 in macro used to study data. The bug cause an uncorrect value of incident angle.

Wrong Data

Right Data

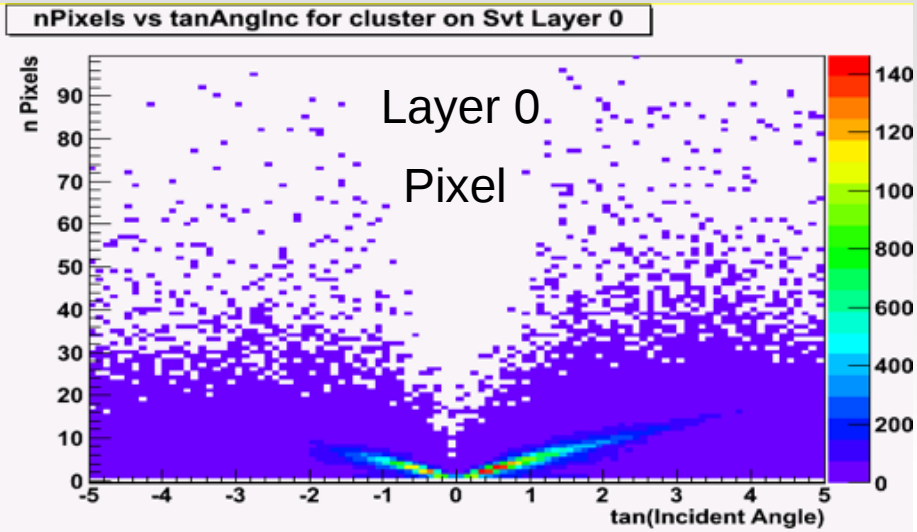


Activated Strips

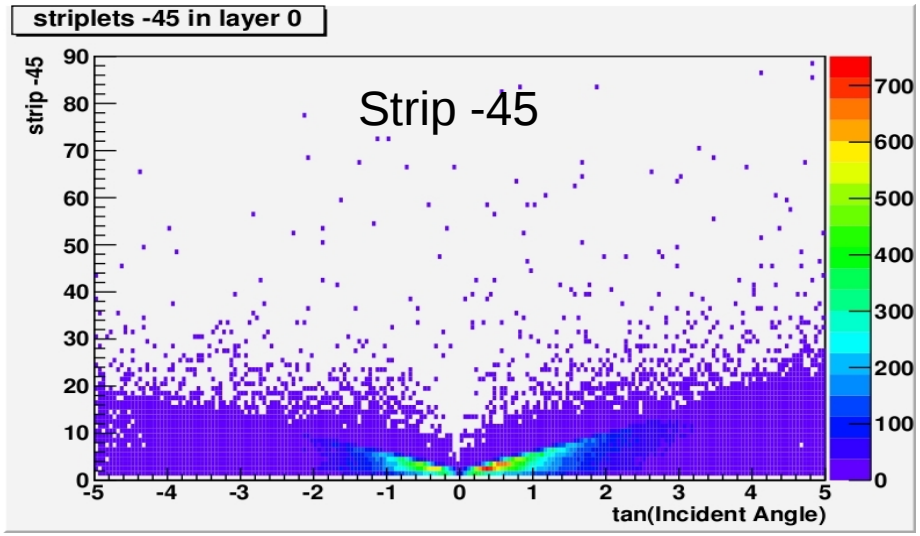
vs

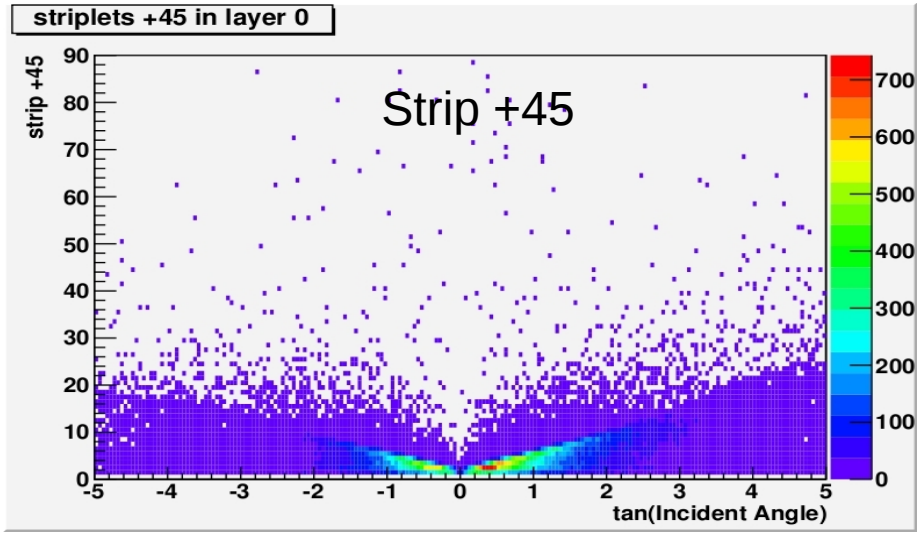
Tangent of Incident Angle

Strip vs Incident Angle
(layer 0)

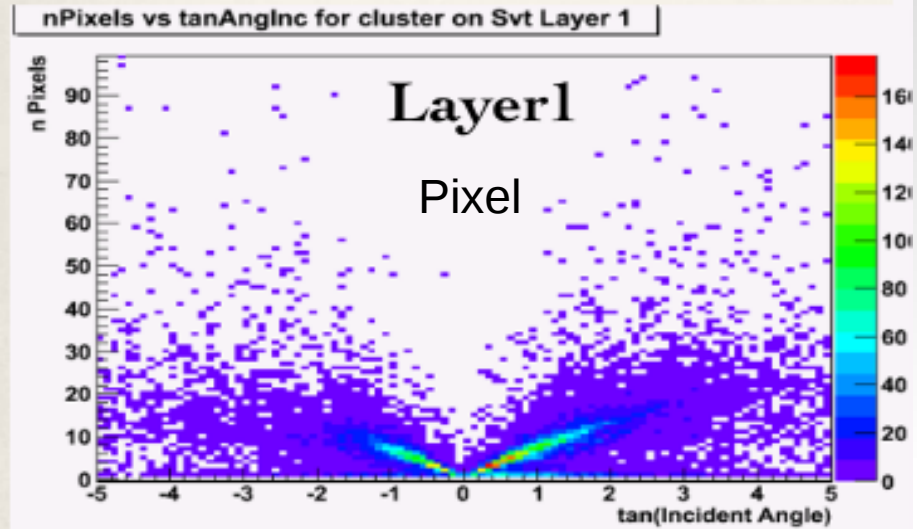


- Activated Striplets in layer 0 (+/- 45° z) vs Tangent of incident angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel

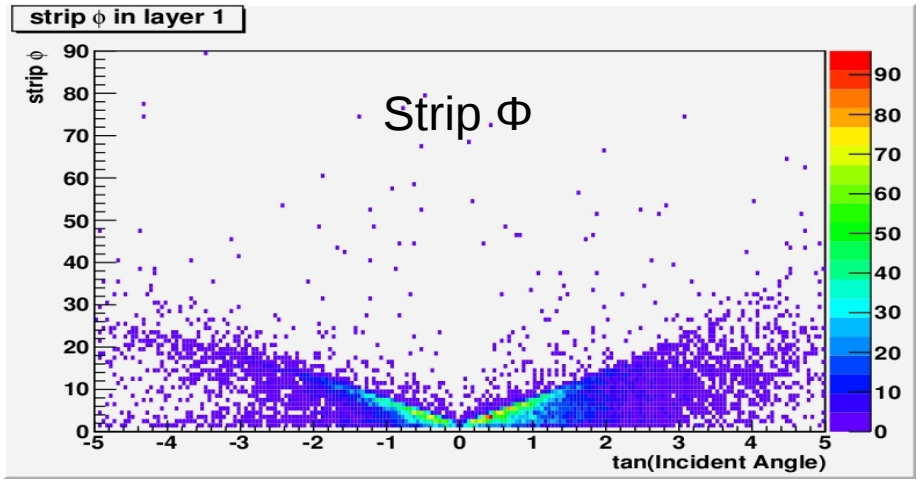


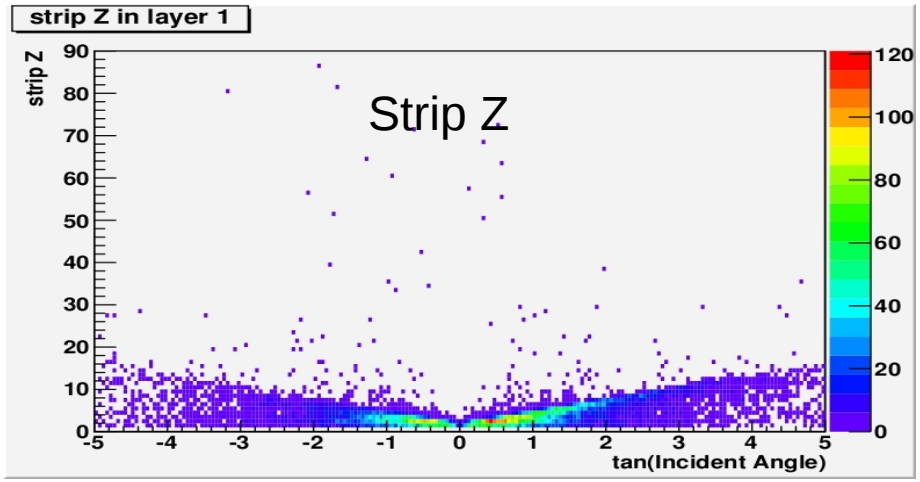


Strip vs Incident Angle
(layer 1)

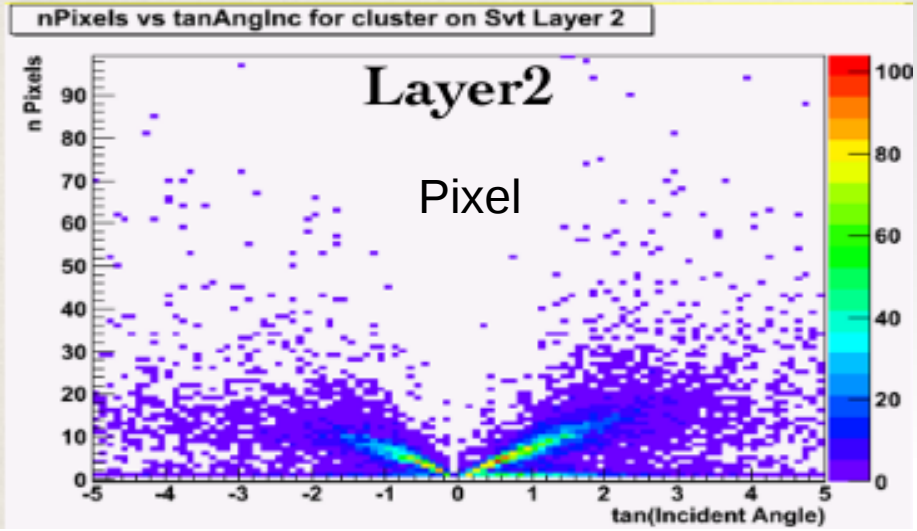


- Activated Striplets in layer 1 (Z & Φ) vs Tangent of Incident Angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel

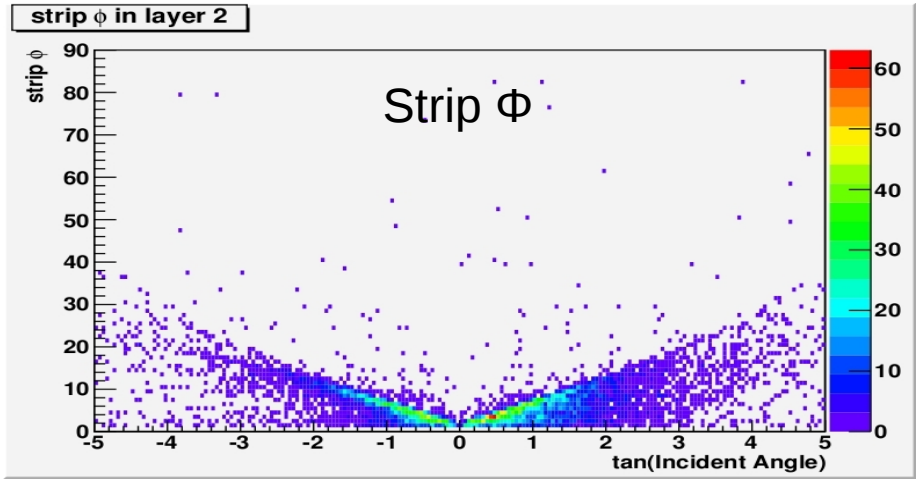


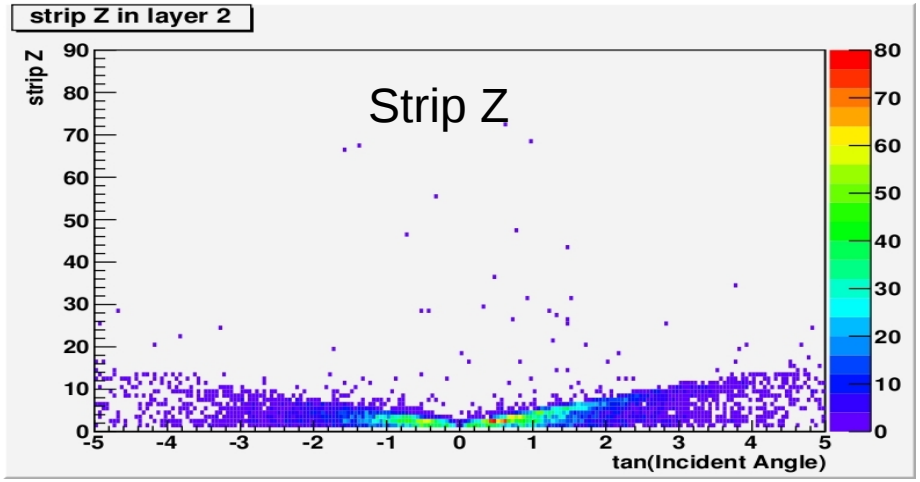


Strip vs Incident Angle
(layer 2)

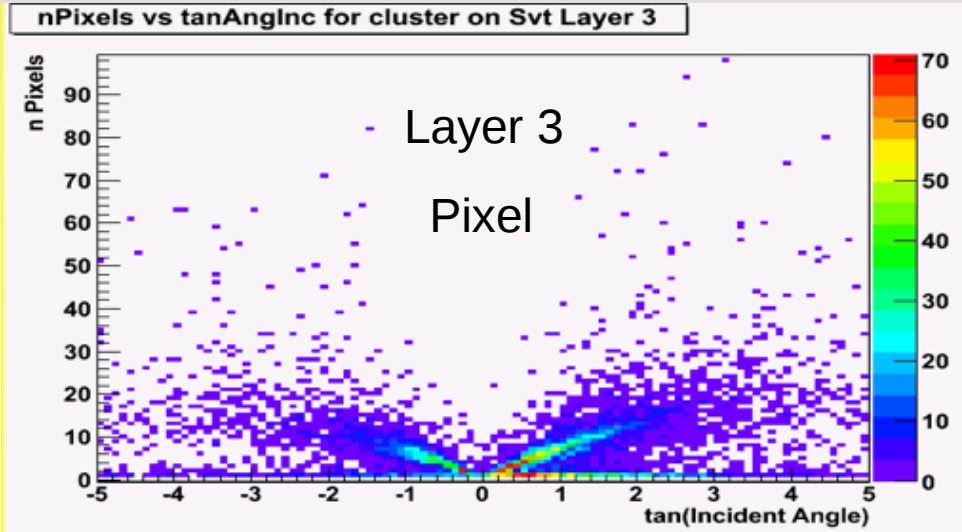


- Activated Striplets in layer 2 (Z & Φ) vs Tangent of Incident Angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel

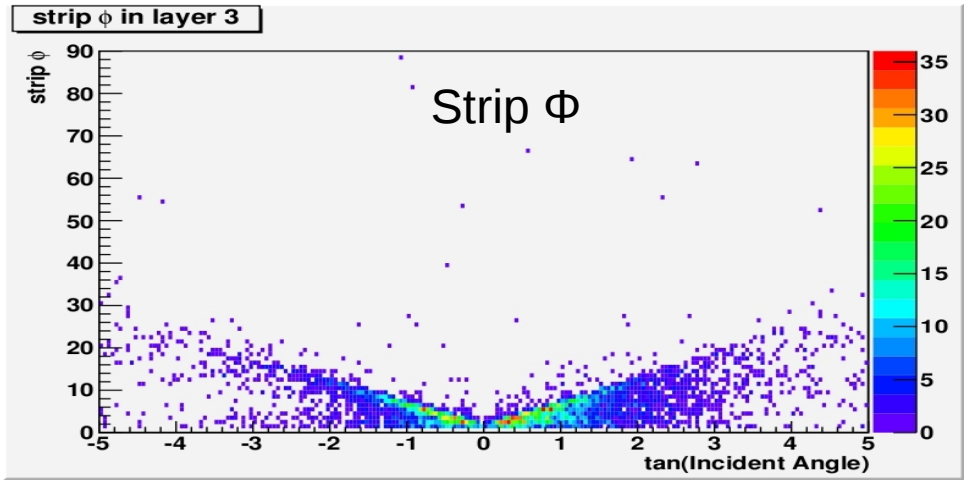


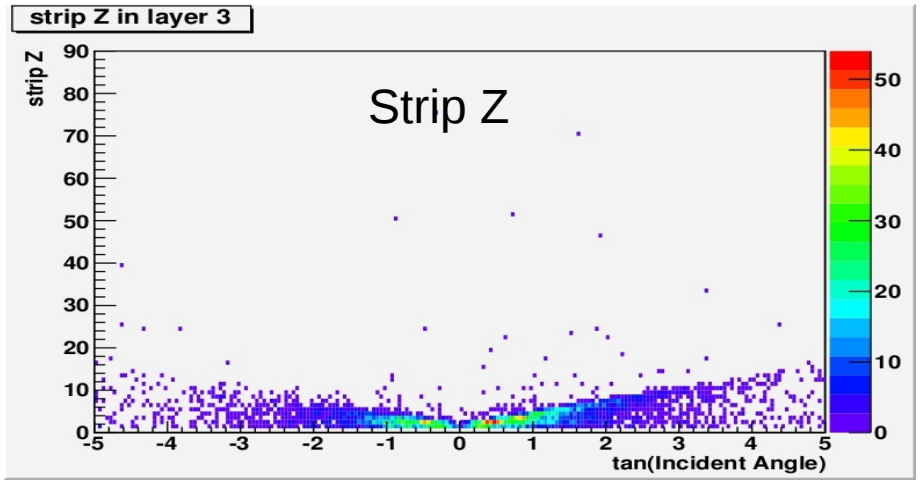


Strip vs Incident Angle
(layer 3)

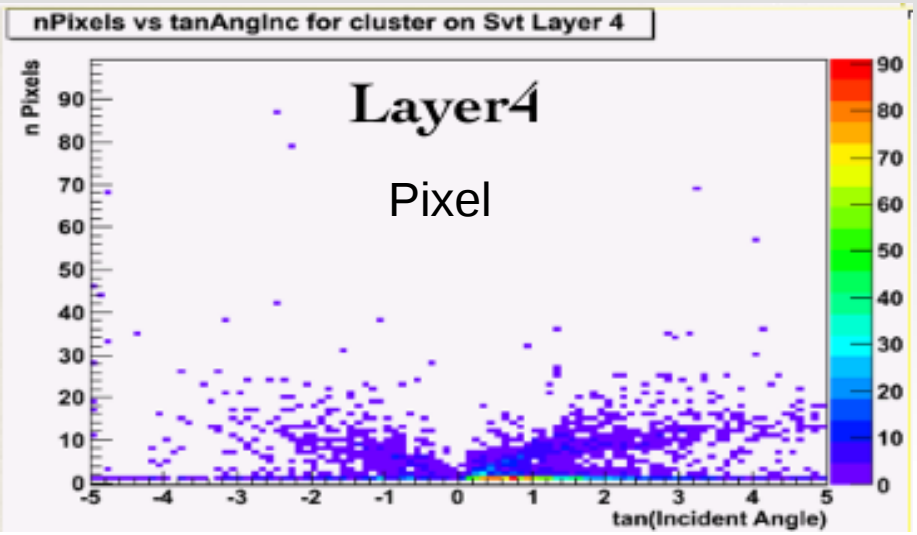


- Activated Striplets in layer 3 (Z & Φ) vs Tangent of Incident Angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel

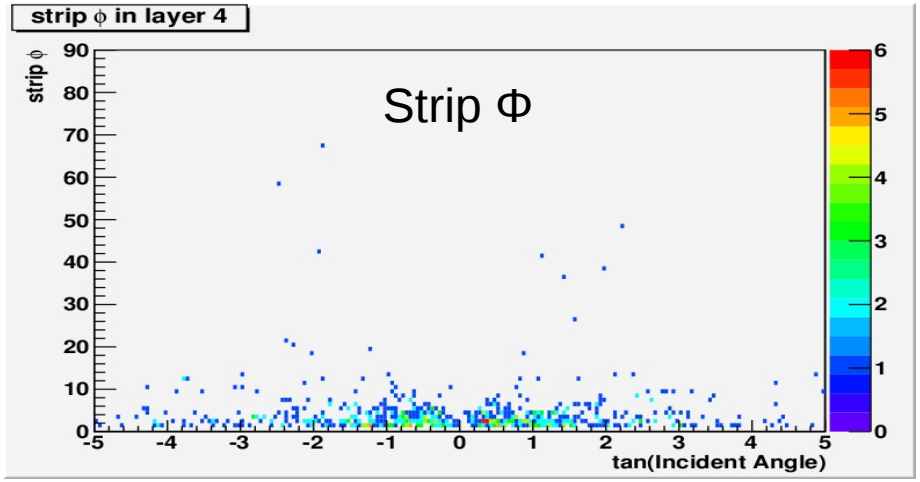


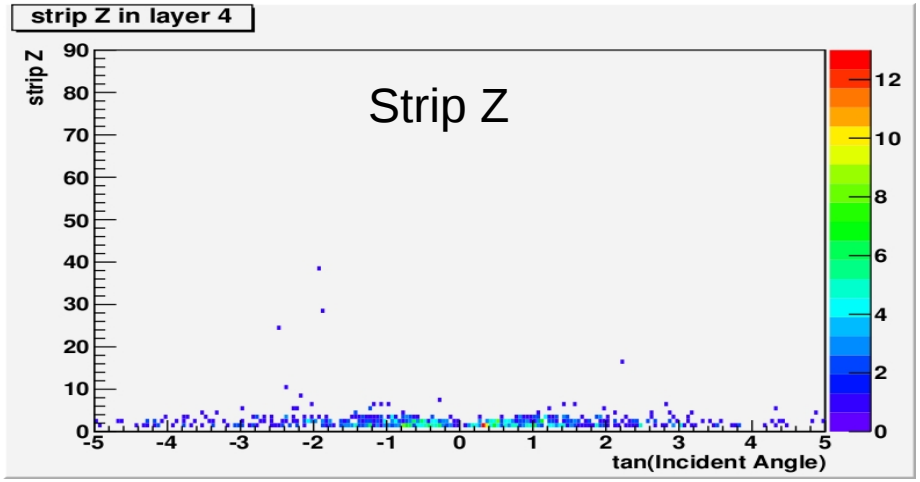


Strip vs Incident Angle
(layer 4)

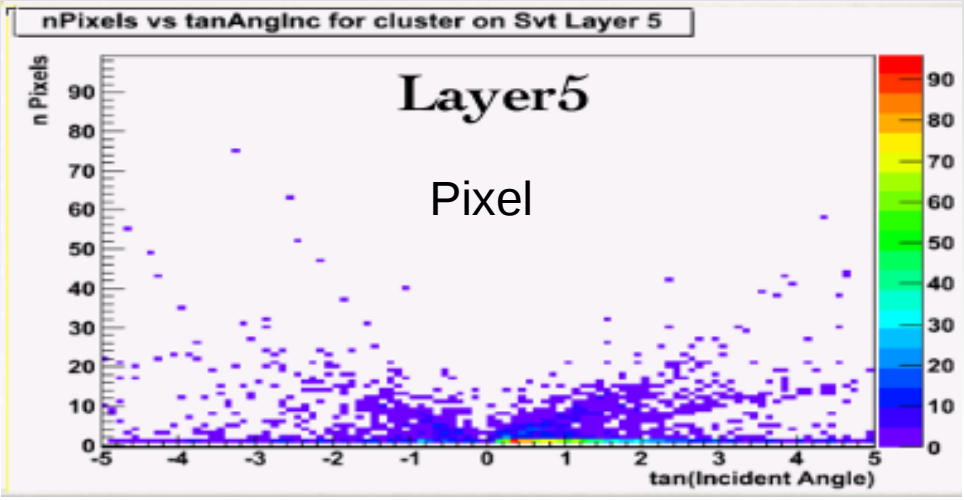


- Activated Striplets in layer 4 (Z & Φ) vs Tangent of Incident Angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel

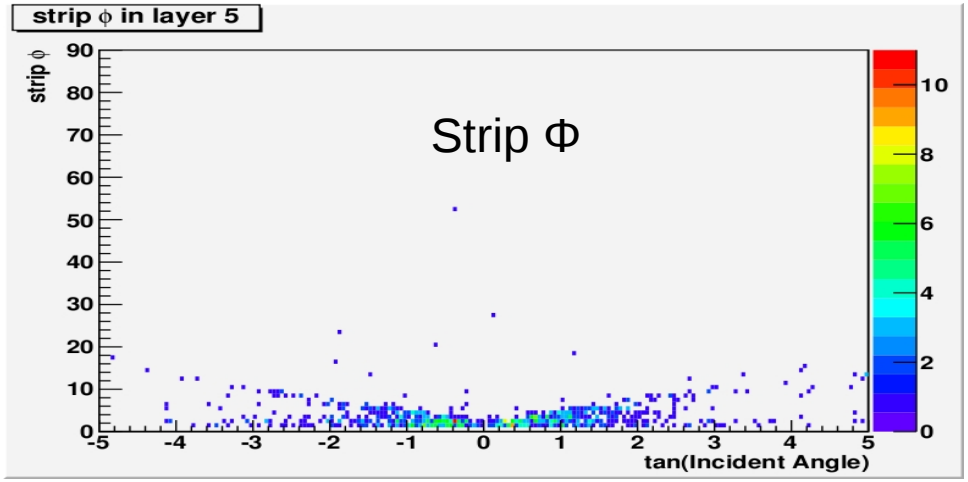


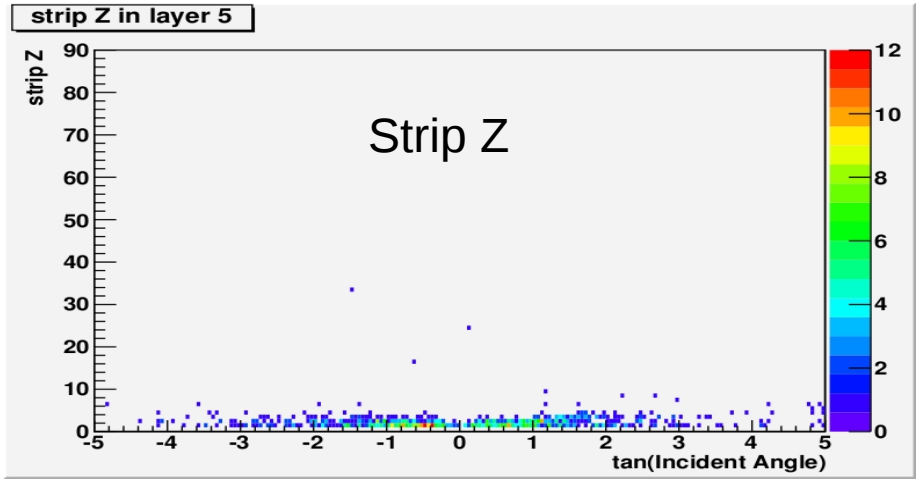


Strip vs Incident Angle
(layer 5)



- Activated Striplets in layer 5 (Z & Φ) vs Tangent of Incident Angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel





Deposited Energy per Strip Distribution

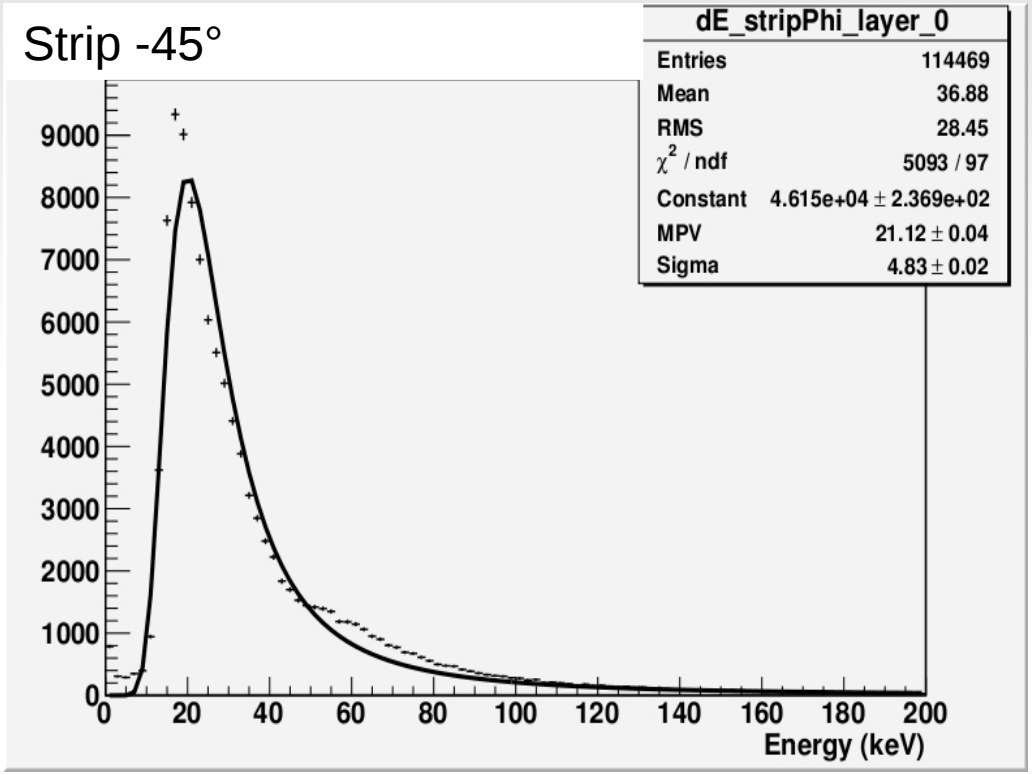
Fit Function
Landau Distribution

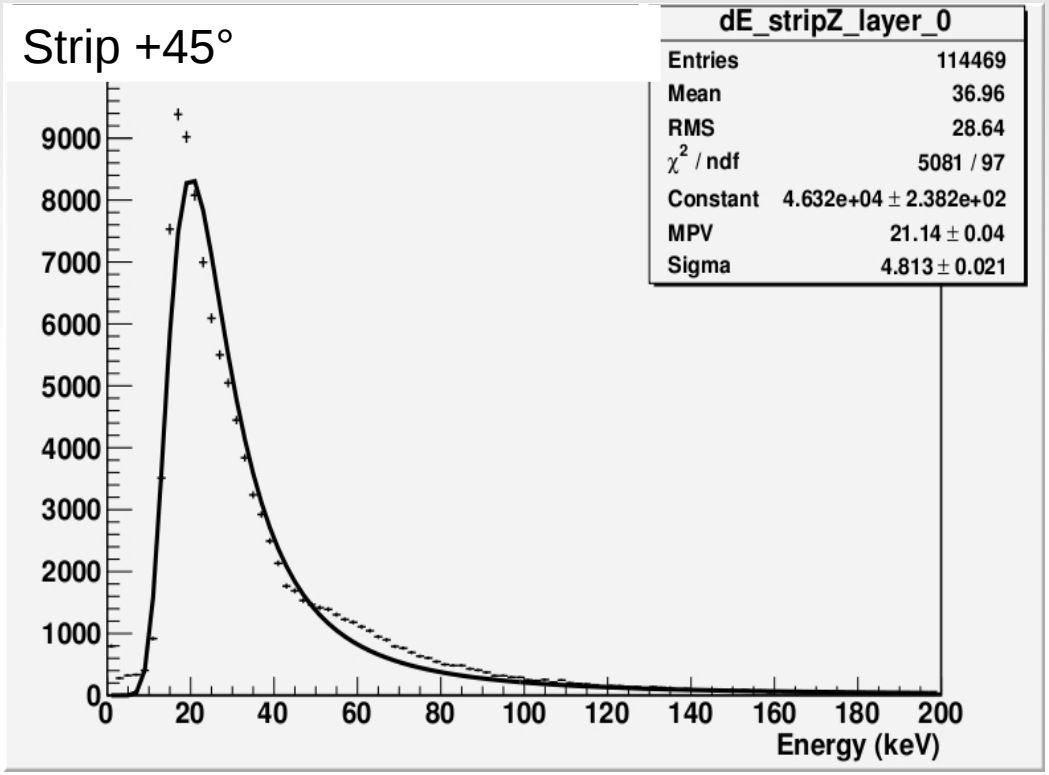
- The goal is to parameterize the Deposited energy per Strip Distributions

- Root Landau Distribution used to fit the Distributions

Deposited Energy per Strip Distribution & Fit

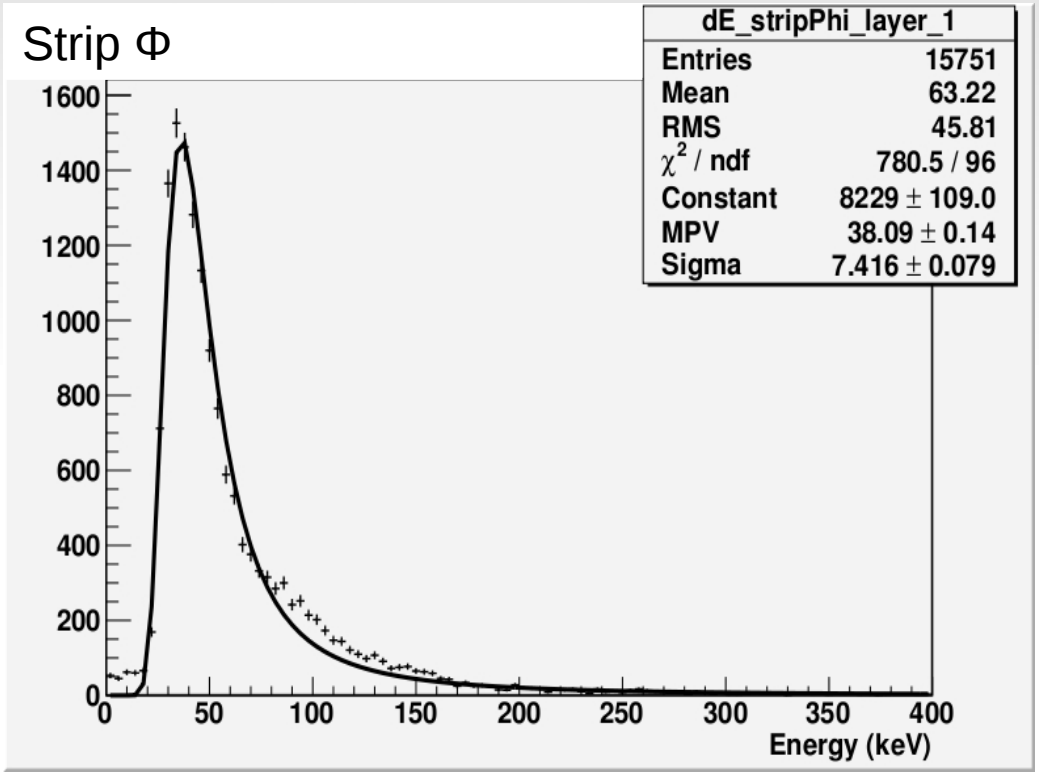
Layer 0

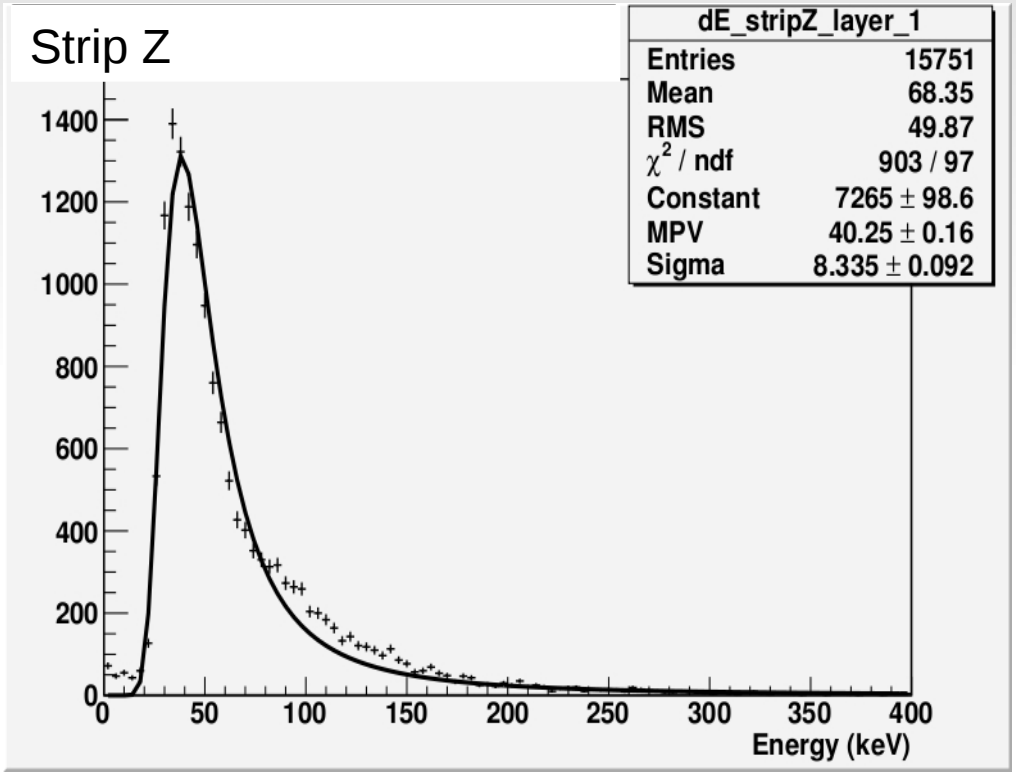




Deposited Energy per Strip Distribution & Fit

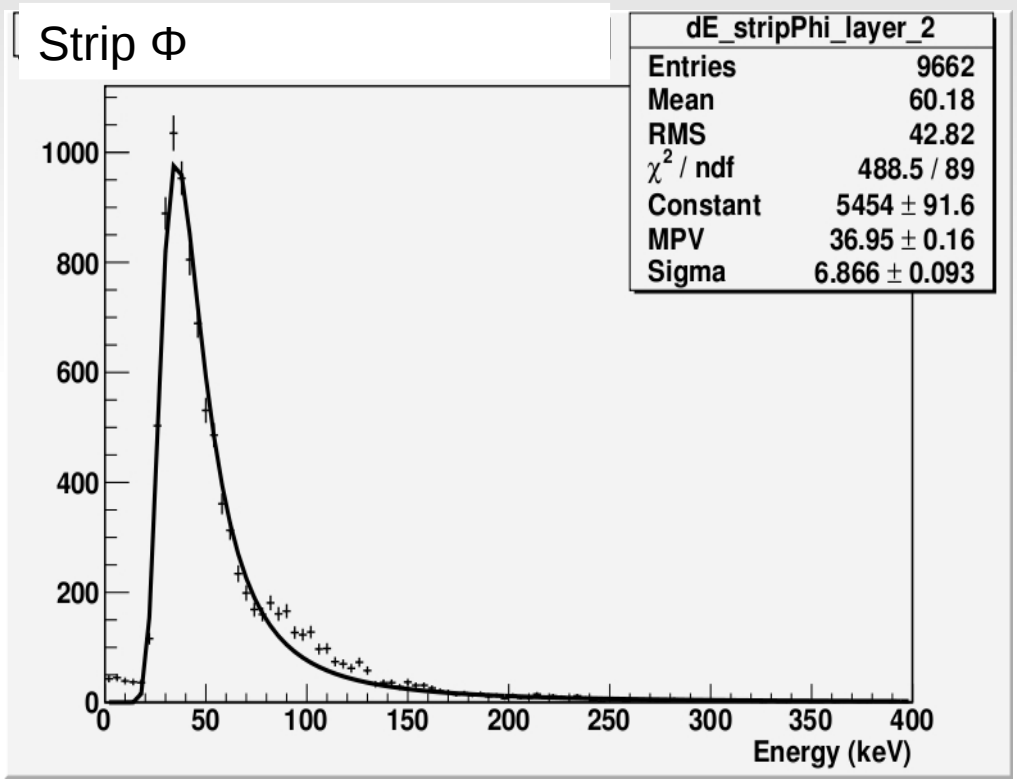
Layer 1

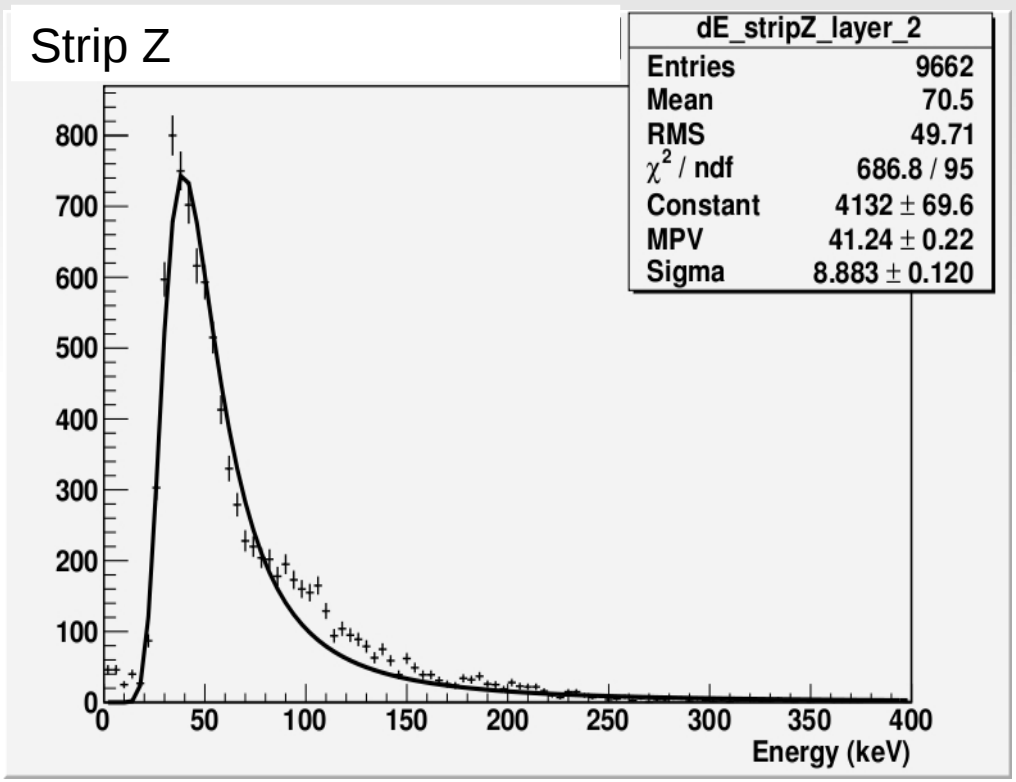




Deposited Energy per Strip Distribution & Fit

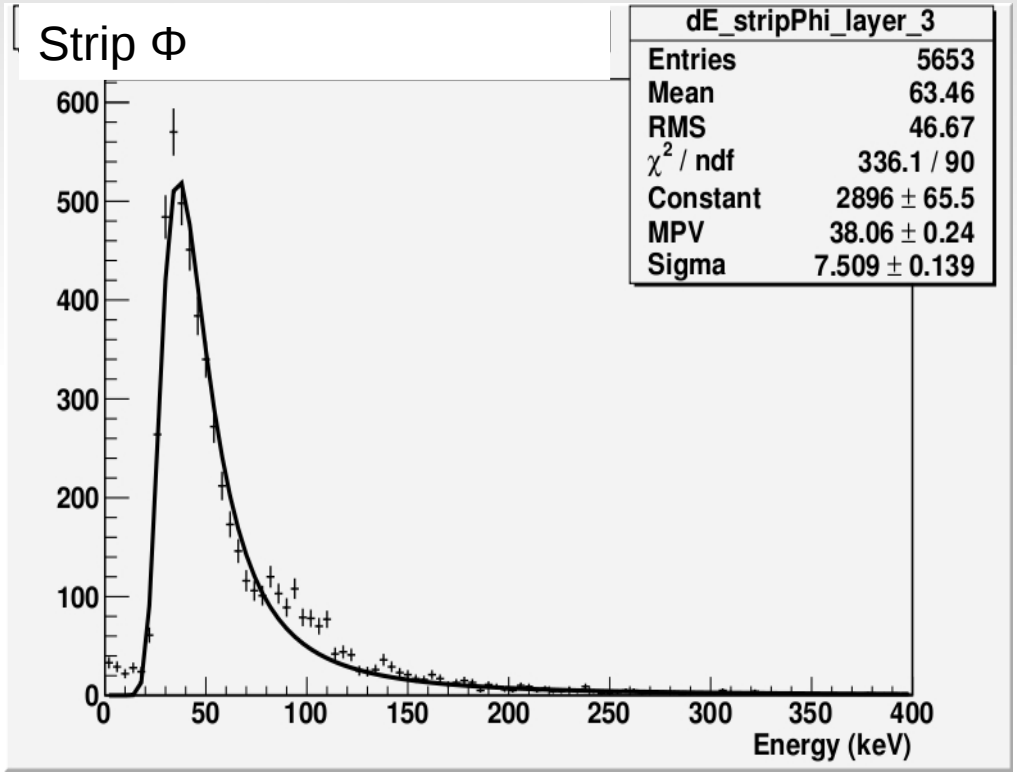
Layer 2

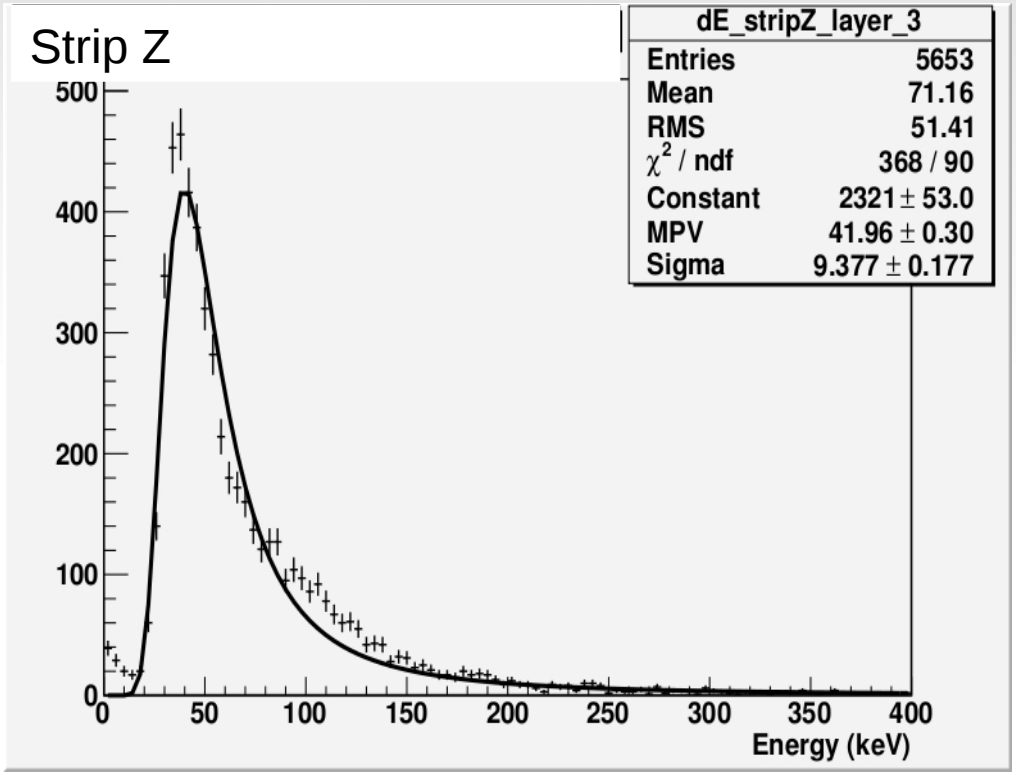




Deposited Energy per Strip Distribution & Fit

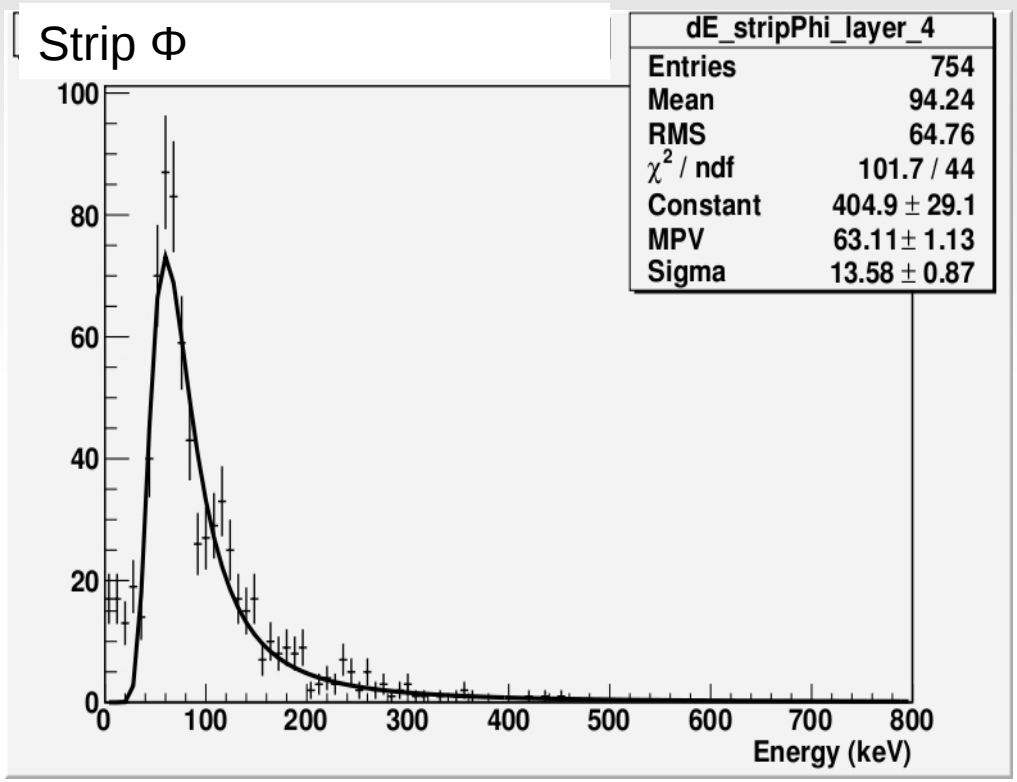
Layer 3

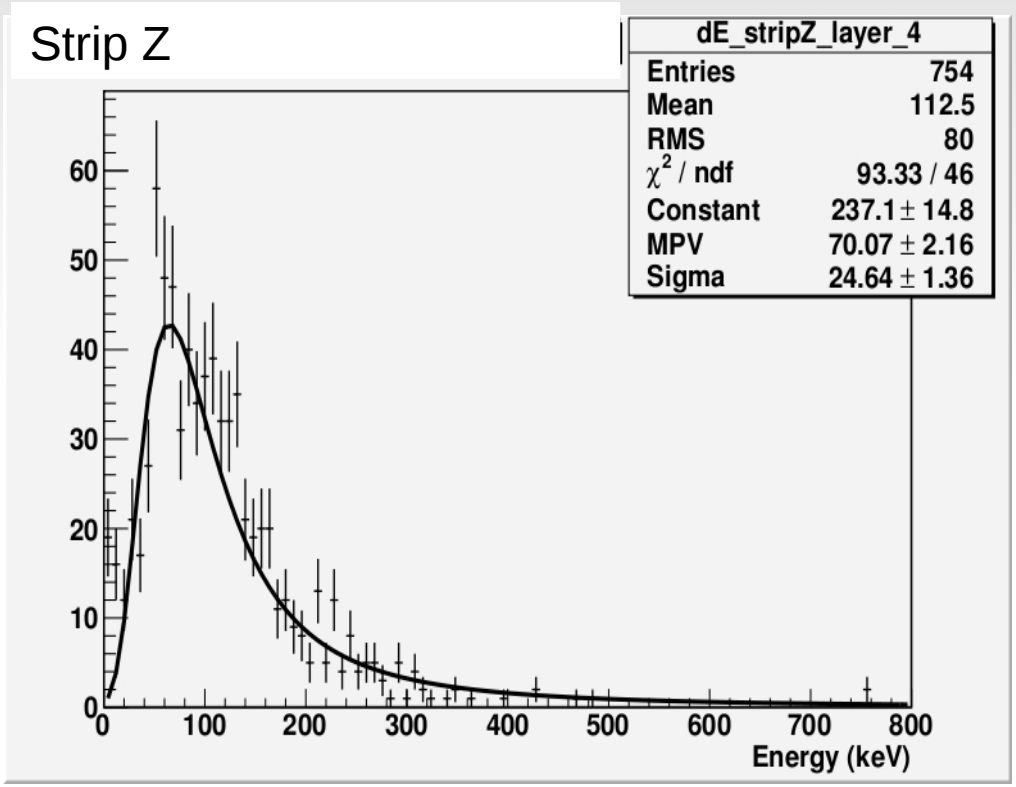




Deposited Energy per Strip Distribution & Fit

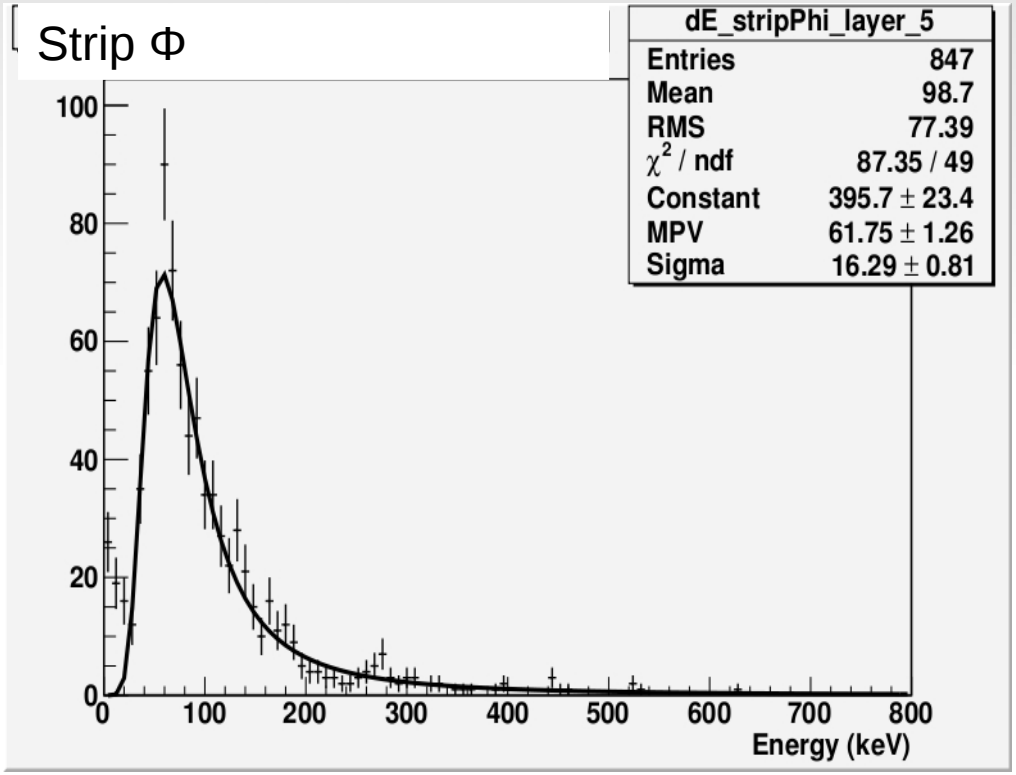
Layer 4

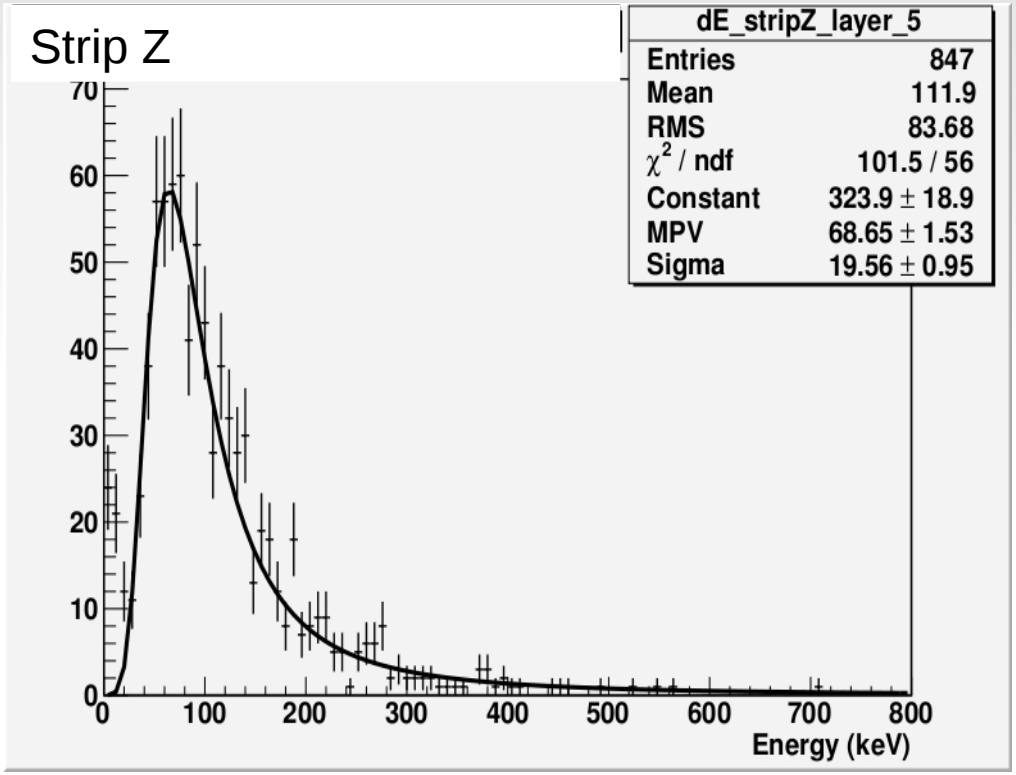




Deposited Energy per Strip Distribution & Fit

Layer 5



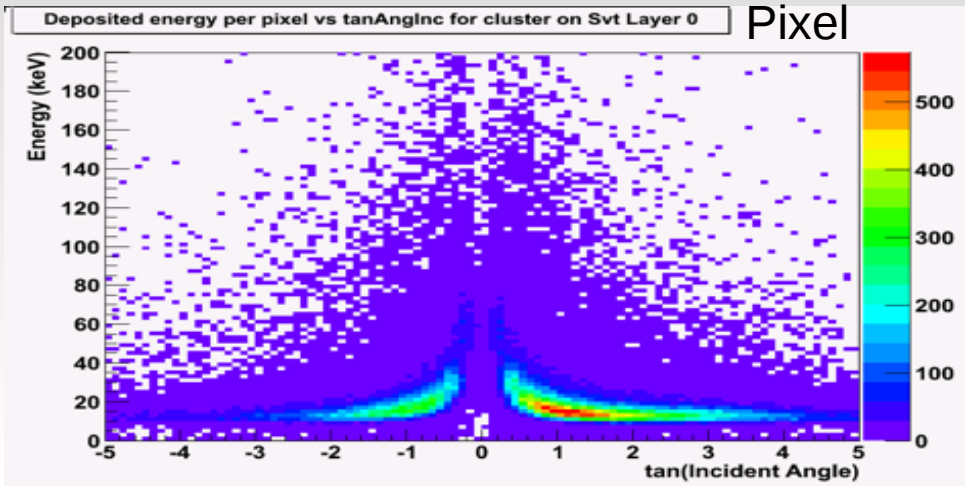


Deposited Energy per Strip

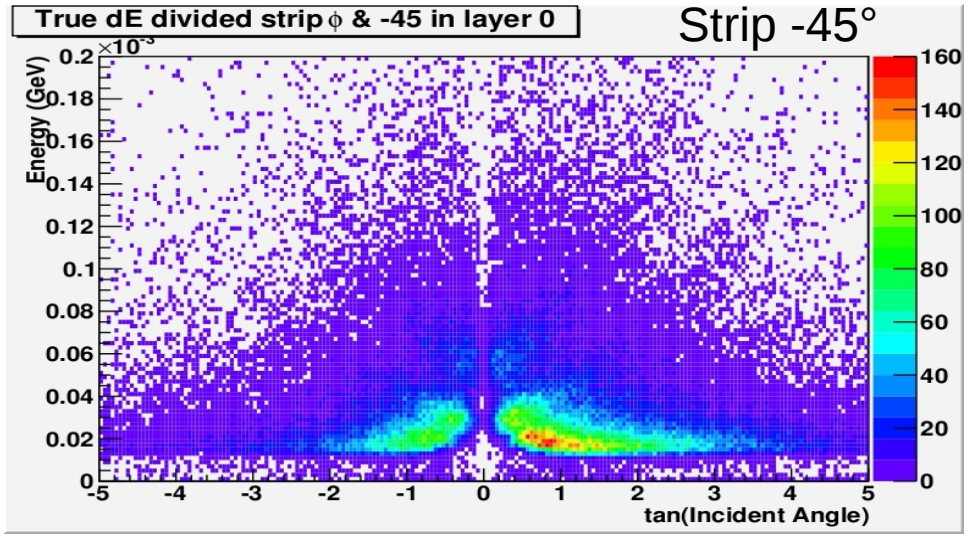
vs

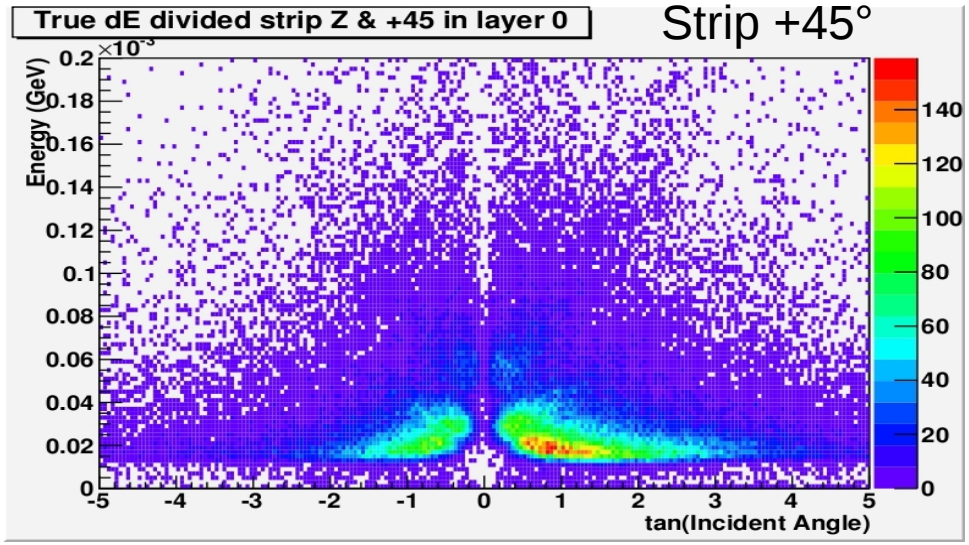
Tangent of Incident Angle

Energy per Strip vs Incident Angle
(layer 0)

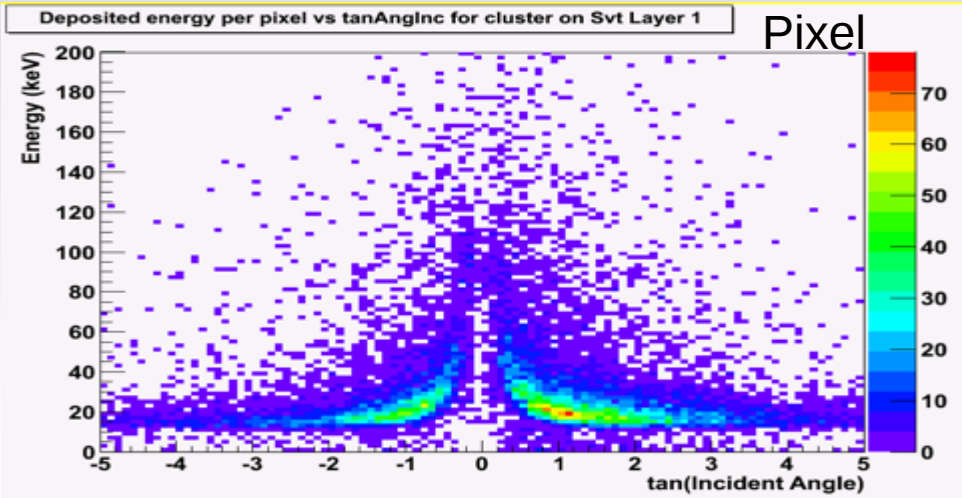


- Deposited energy per strip (+/- 45) in layer 0 vs tangent of incident angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel

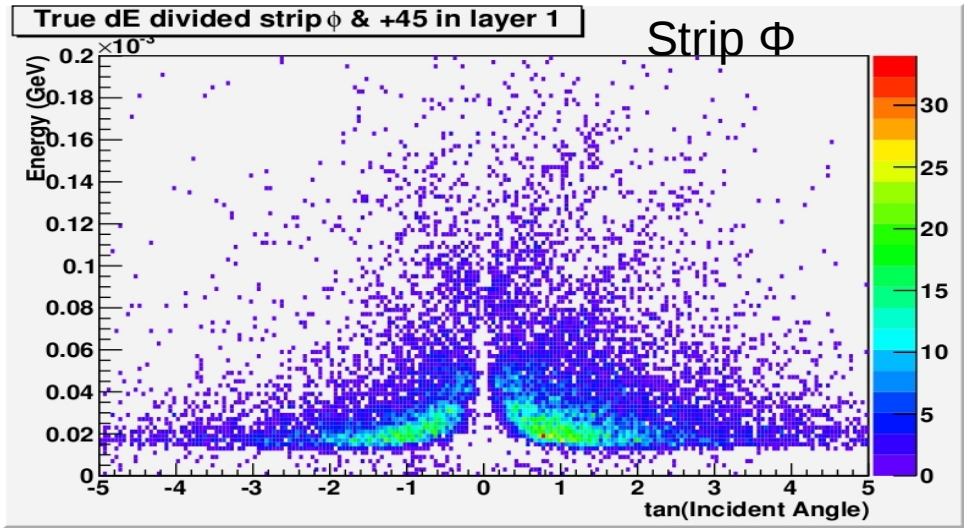


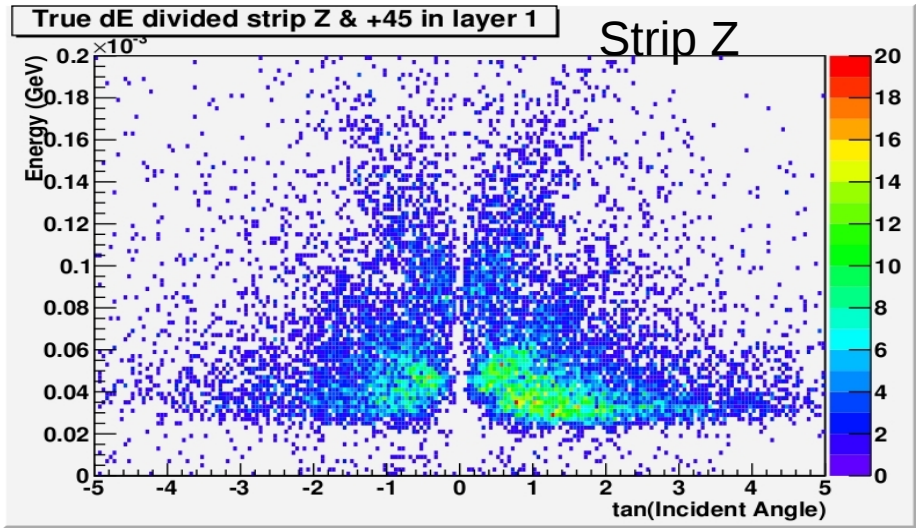


Energy per Strip vs Incident Angle
(layer 1)

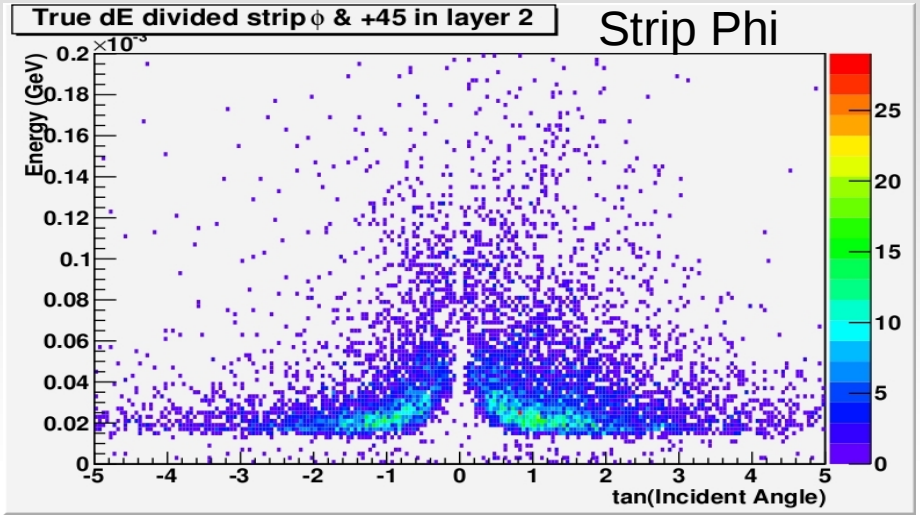


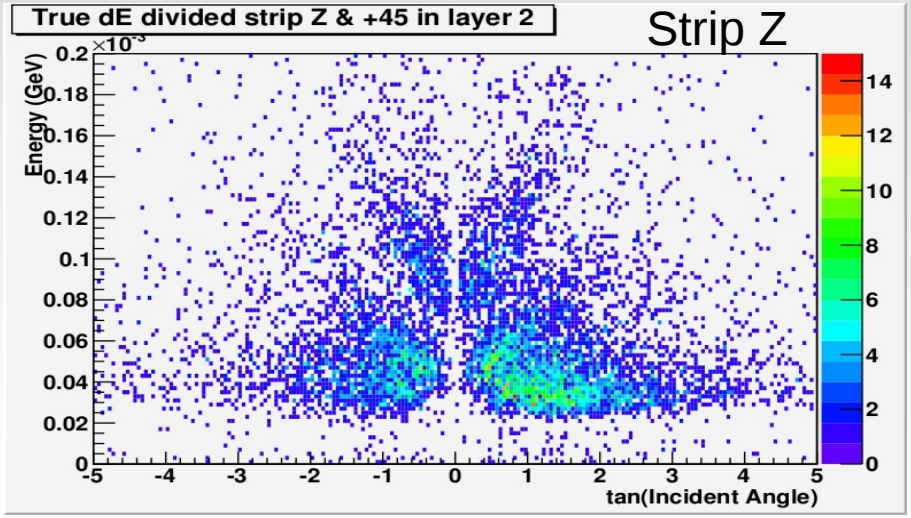
- Deposited energy per strip (Z & Φ) in layer 0 vs tangent of incident angle
- Negative values are for particle going inwards
- Real Geometry Modules for Strip, Cilindric Approximation for Pixel



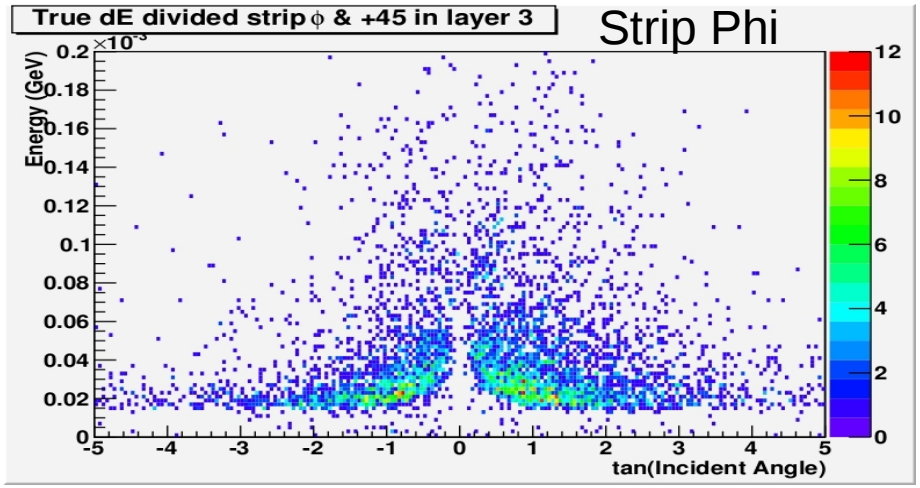


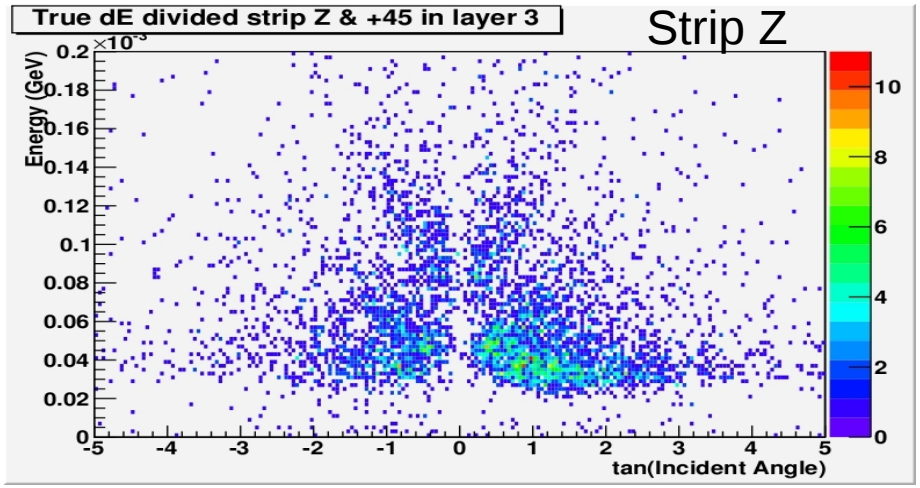
Energy per Strip vs Incident Angle
(layer 2 & 3)





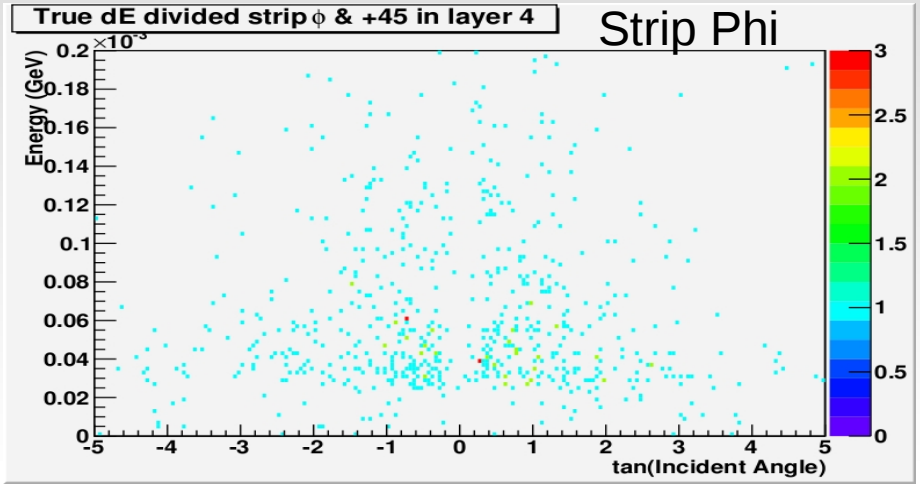
Layer 2

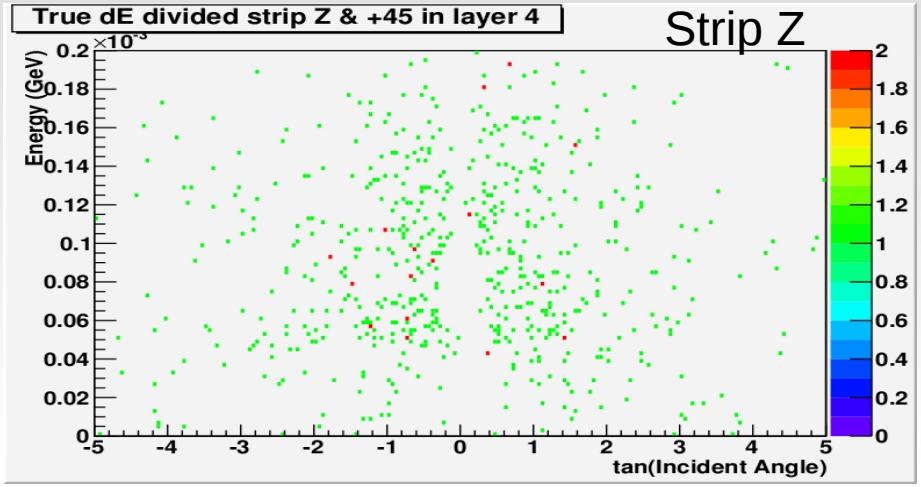




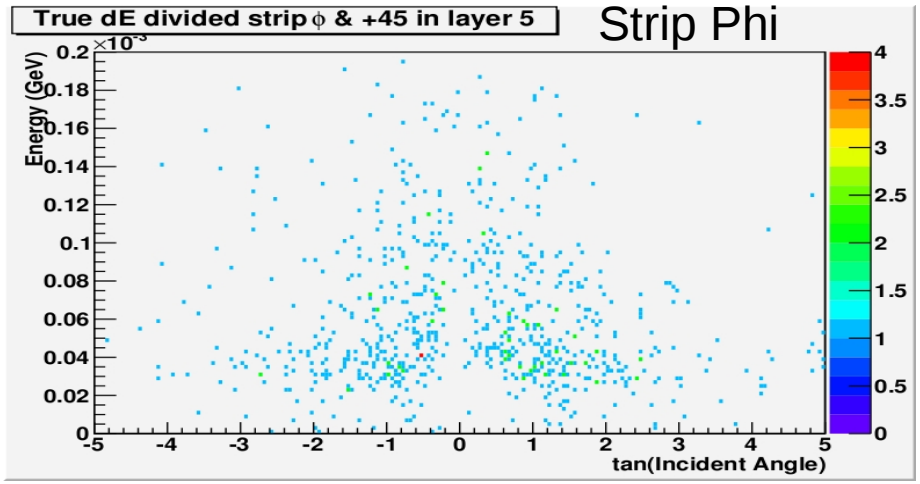
Layer 3

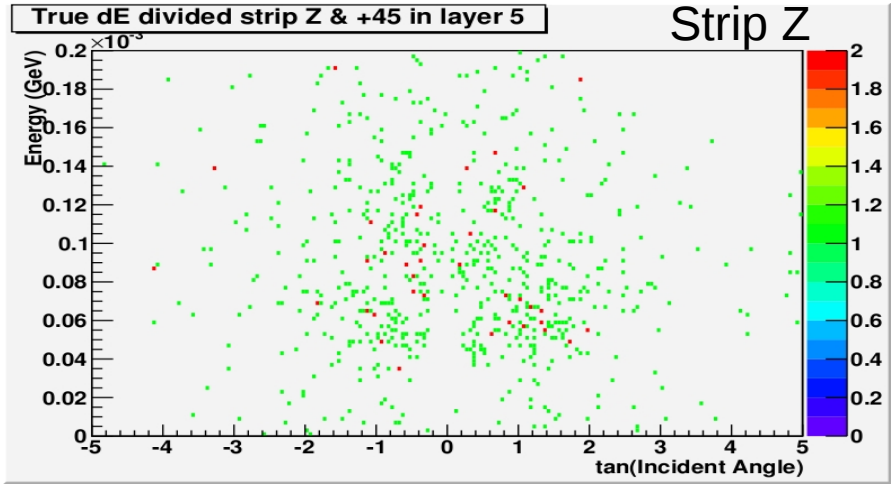
Energy per Strip vs Incident Angle
(layer 4 & 5)



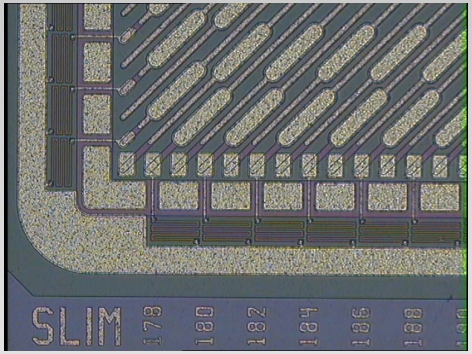


Layer 4

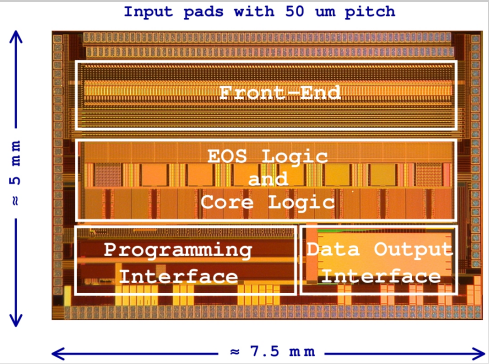




Layer 5



Conclusion



- Telescope Spare Modules and FSSR2 DAQ

- SVT Simulation Studies Based on Bruno, for e± pairs, on Strip Multiplicity, Strip Rate, Depostited energy, etc.

- BugFix on Layer 0 Incident Angle

In progress:

- Improving fit on distributions

- New Production ready to be analyzed

- Test beam

Backup

Average strip multiplicity

for e± from pairs **per Cluster**

New files - No threshold cut – 30 Limited

Layer	RO PitchZ (or +45°) µm	Cenci* <n> Z (or +45°)	<n> Z ** (or +45°)	RO Pitch ϕ (or -45°) µm	Cenci* <n> ϕ (or -45°)	<n> ϕ ** (or -45°)
0	50	5.1	4.9	50	4.1	4.9
1	100	3.1	4	50	6.5	6.7
2	100	2.9	3.7	55	5.9	6.4
3	100	2.6	3.6	55	4.9	5.9
4	210	1.3	1.9	100	2	3.5
5	210	1.3	1.9	100	1.8	3.4

* = Values obtained from Riccardo Cenci Presentation showed at Elba 2011 Meeting

** = Value obtained with a max limit of 30 strip activated per cluster

Average strip rate

for e± from pairs
New files - No threshold cut
90 Limited

Layer	RO PitchZ (or +45°) µm	Cenci* Rate Z or +45° (MHz / cm^2)	Rate ** Z or +45° (MHz / cm^2)	RO Pitch ϕ (or -45°) µm	Cenci* Rate ϕ or -45° (MHz / cm^2)	Rate ** ϕ or -45° (MHz / cm^2)
0	50	29.9	22.9	50	23.3	22.9
1	100	0.7	0.8	50	1.5	1.1
2	100	0.35	0.34	55	0.72	0.53
3	100	0.097	0.088	55	0.19	0.14
4	210	0.0076	0.0032	100	0.012	0.0062
5	210	0.0041	0.0024	100	0.006	0.004

* = Values obtained from Riccardo Cenci Presentation showed at Elba 2011 Meeting

** = Value obtained with a max limit of 90 strip activated per QED event