UNIVERSITY OF BIRMINGHAM | SCHOOL OF PHYSICS AND ASTRONOMY

March DECAL Update

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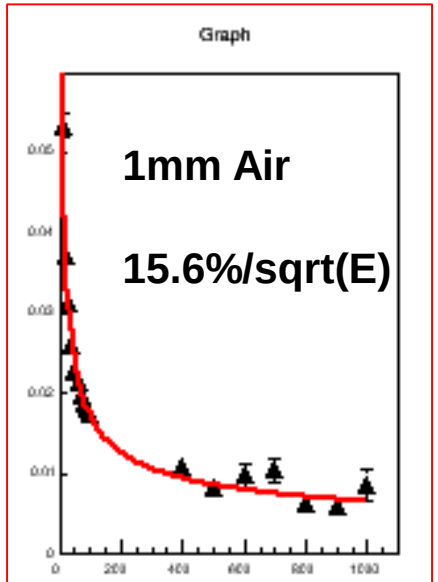
08/03/2017

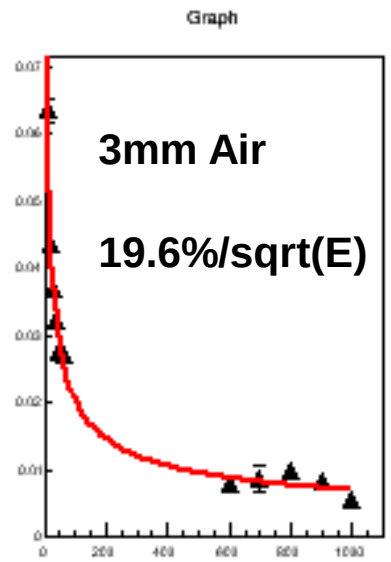
Recap: Effect of adding in air gaps

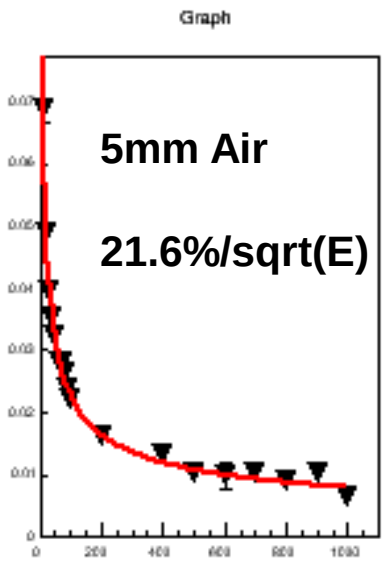
Adding in an air gap degrades the energy resolution but improves linearity up to higher energies. Would expect improved linearity to show improved resolution

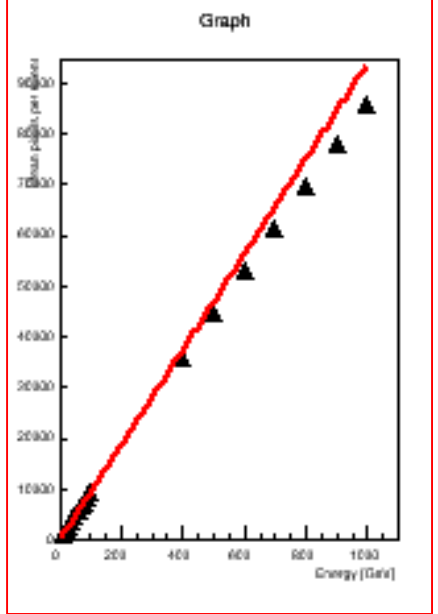
50 Layers, 2.1mm W, 18um epi, 450um substrate

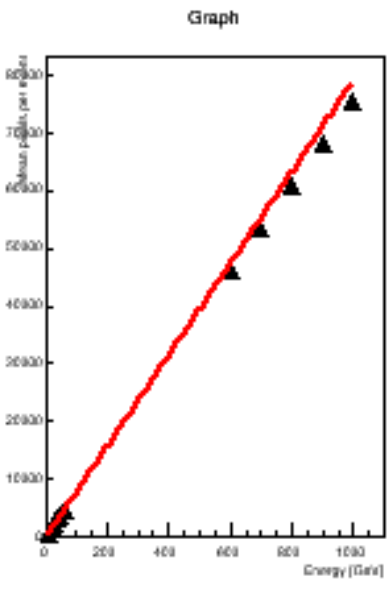
6T Field

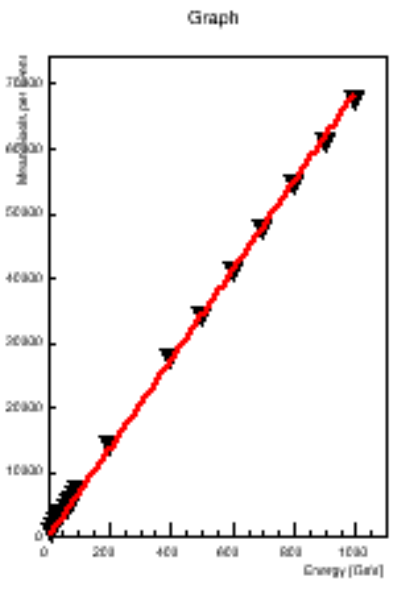






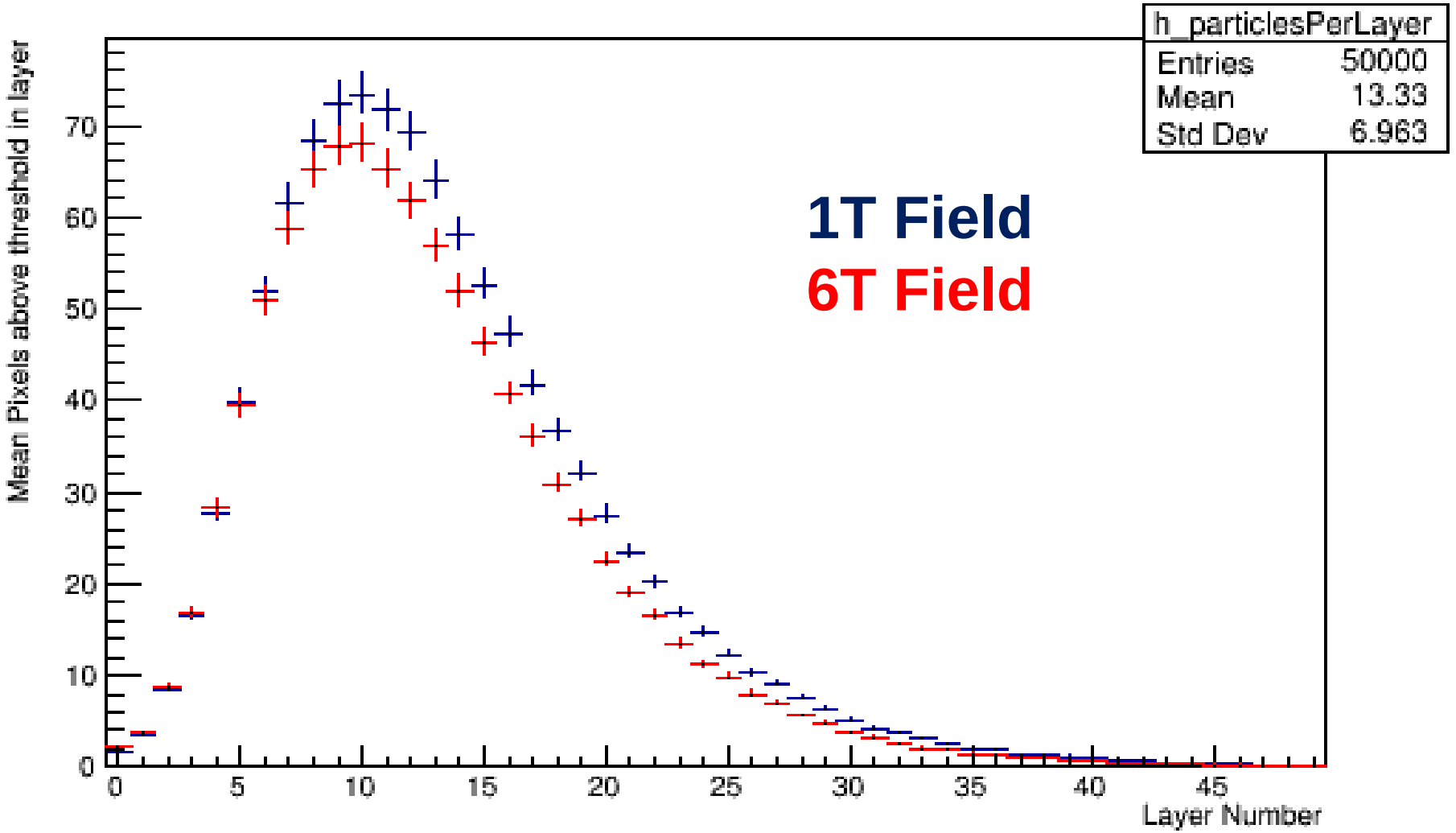






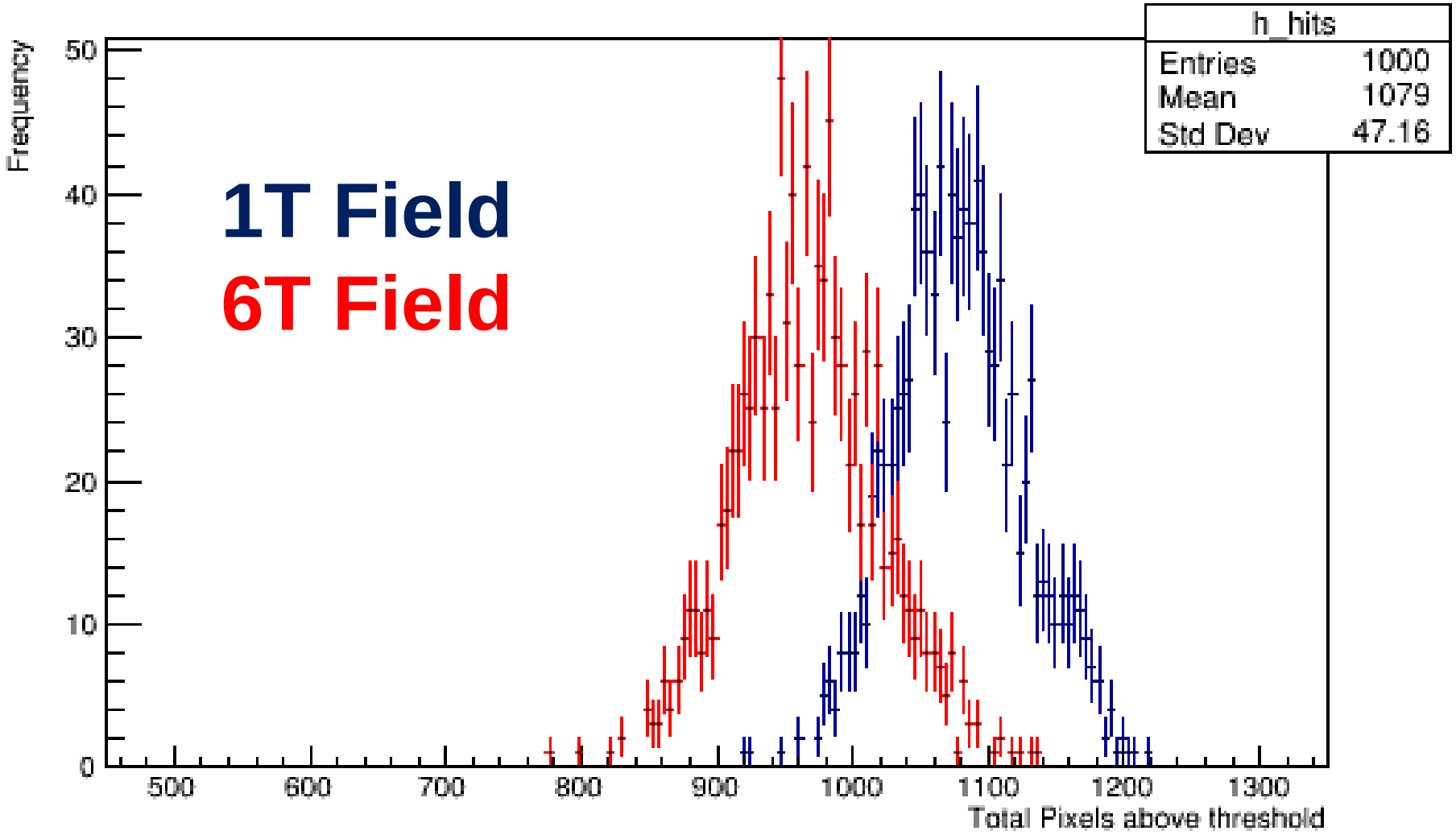
Effect of Magnetic Field

50 Layers, 2.1mm W, 18um epi,
450um substrate, 1mm Air Gap
100 GeV e-



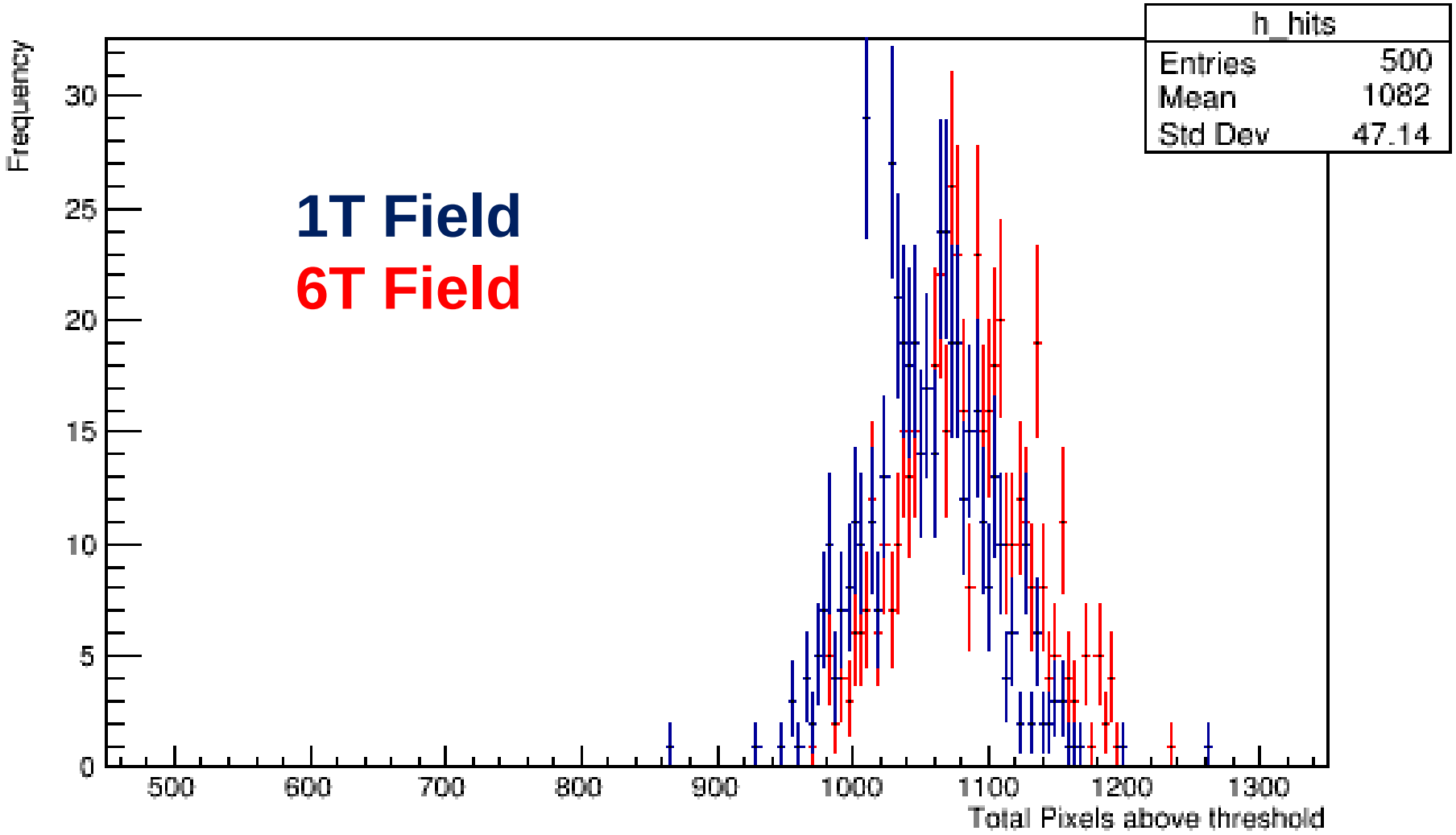
Effect of Magnetic Field

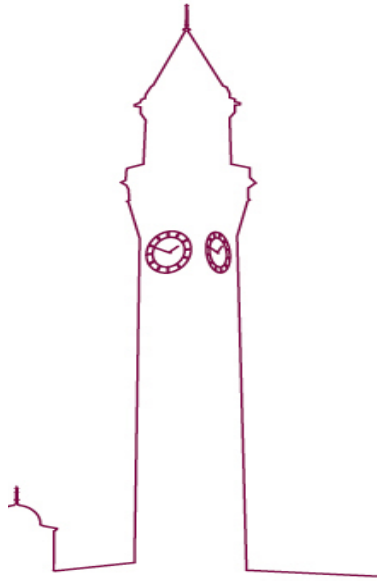
50 Layers, 2.1mm W, 18um epi,
450um substrate, 1mm Air Gap
100 GeV e-



Effect of Magnetic Field

50 Layers, 2.1mm W, 18um epi, 450um substrate, 0mm Air Gap
100 GeV e-

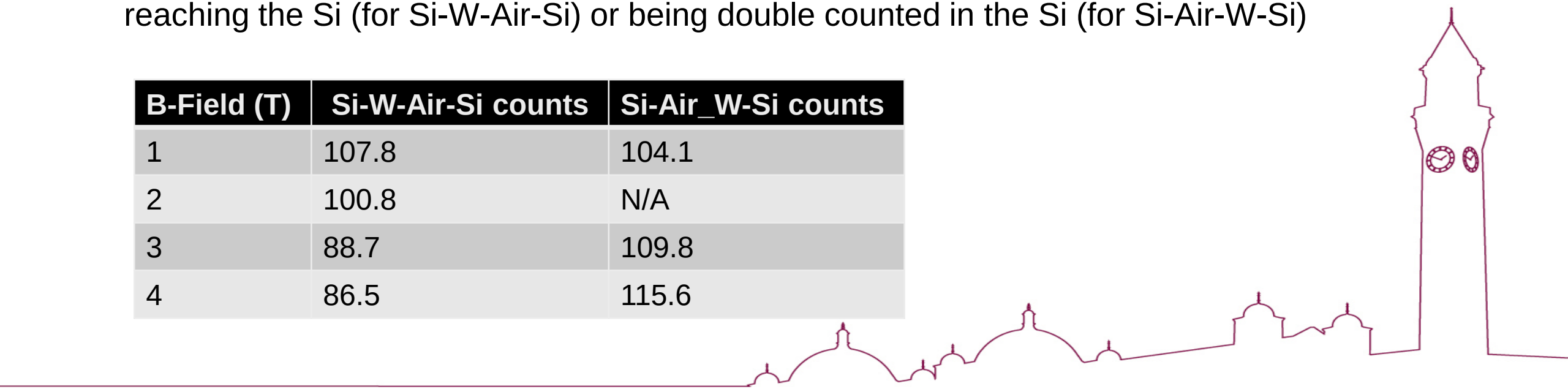




10 GeV electrons

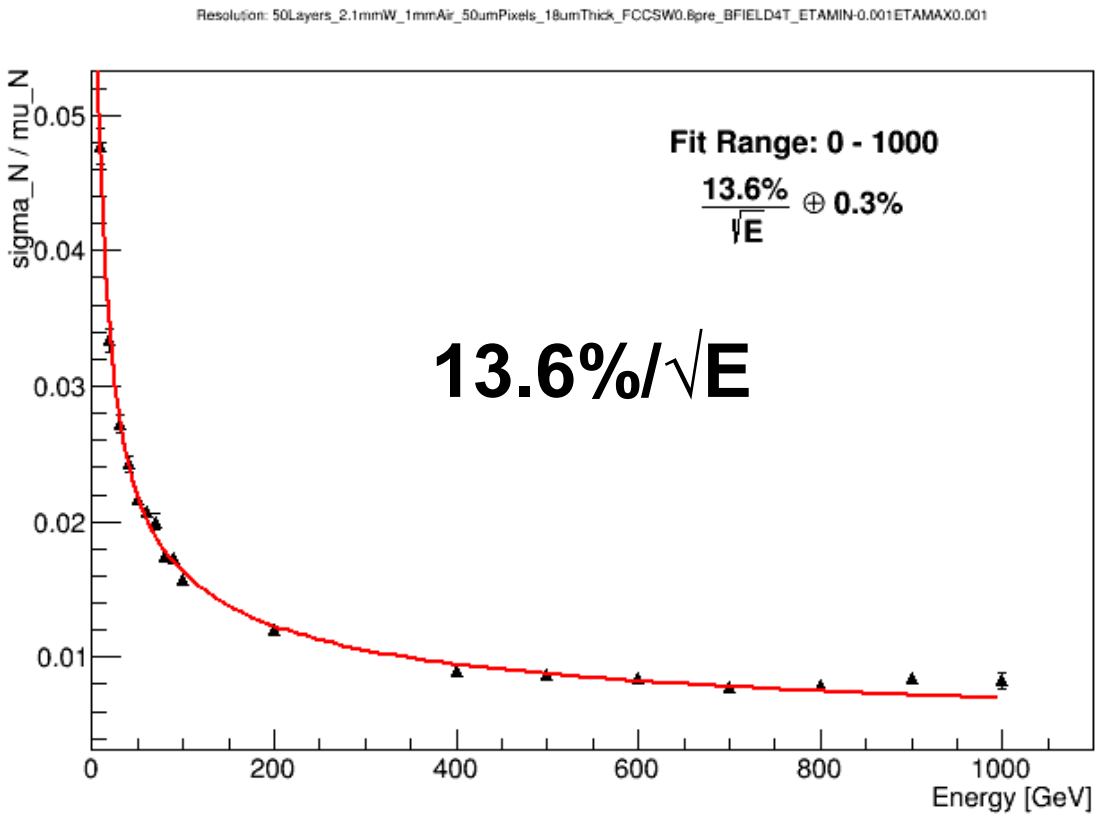
- Previous results are all Si-W-Air-Si ….. W-Air-Si
- What happens if we swap to order to Si-Air-W-Si ….Air-W-Si?
- As we increase the B-Field we see an increase in counts for Si-Air-W-Si and a decrease for Si-W-Air-Si
- This points towards low energy particles curling up in the B-Field and either not reaching the Si (for Si-W-Air-Si) or being double counted in the Si (for Si-Air-W-Si)

B-Field (T)	Si-W-Air-Si counts	Si-Air_W-Si counts
1	107.8	104.1
2	100.8	N/A
3	88.7	109.8
4	86.5	115.6

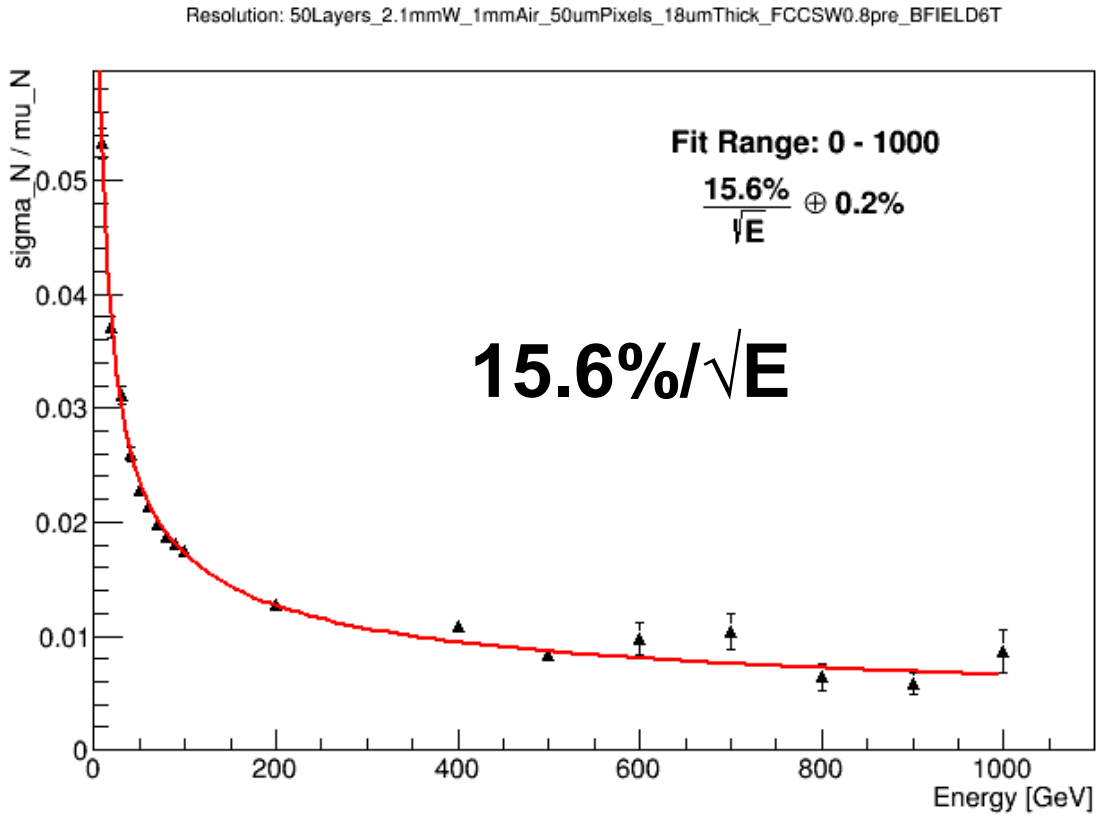


Energy Resolution. 10-1000GeV electrons, 1mm Air gap

- 4T

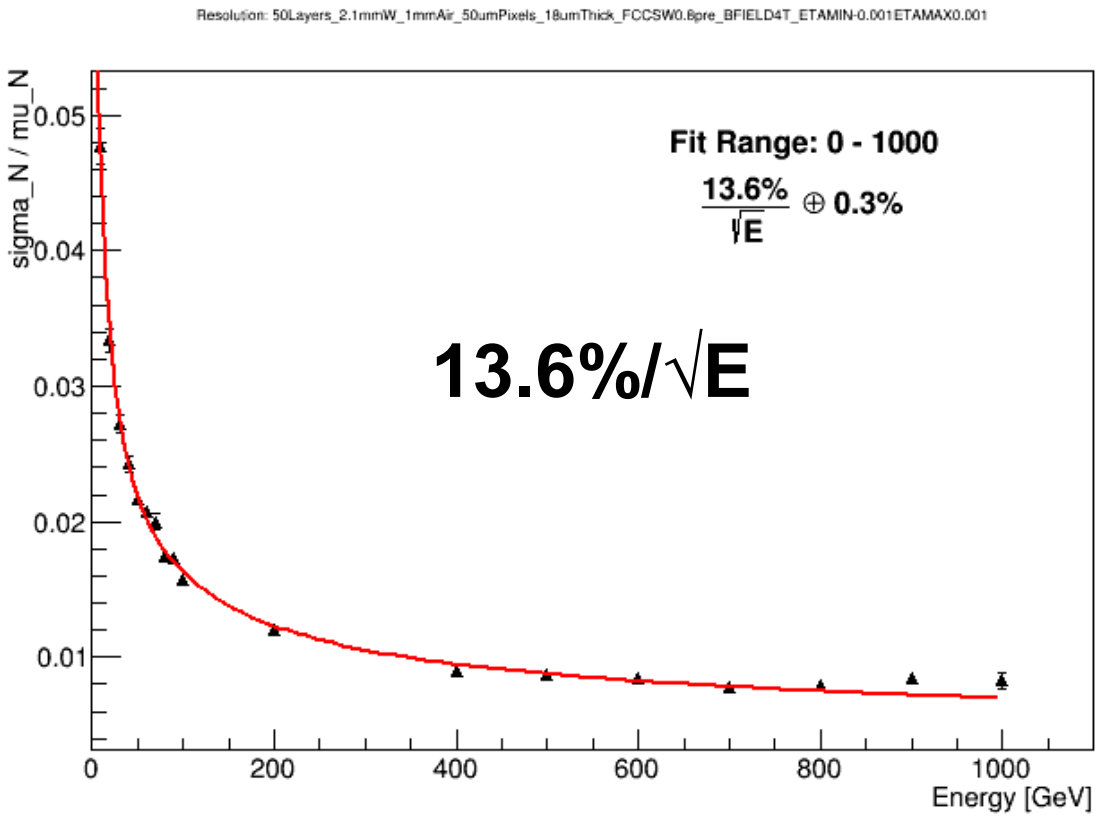


- 6T

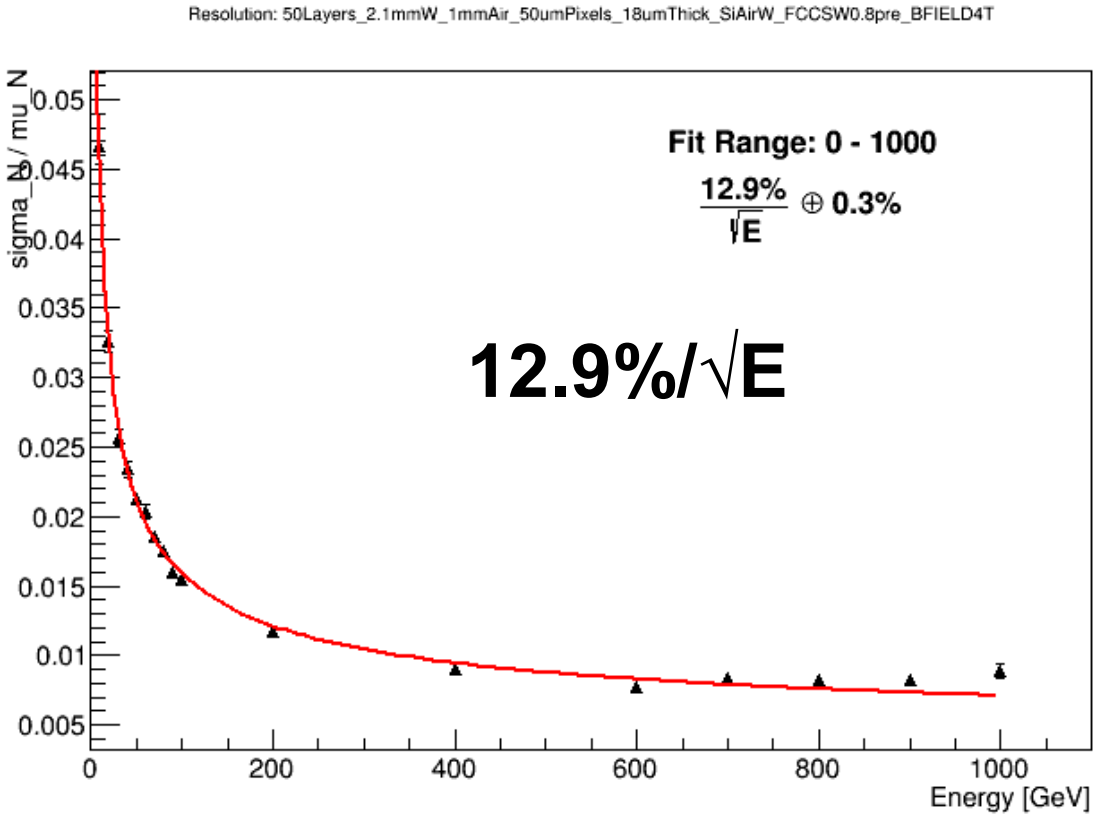


Energy Resolution. 4T 10-1000GeV electrons, 1mm Air gap

- Si-W-Air-Si …. W-Air



- Si-Air-W-Si .. Air-W

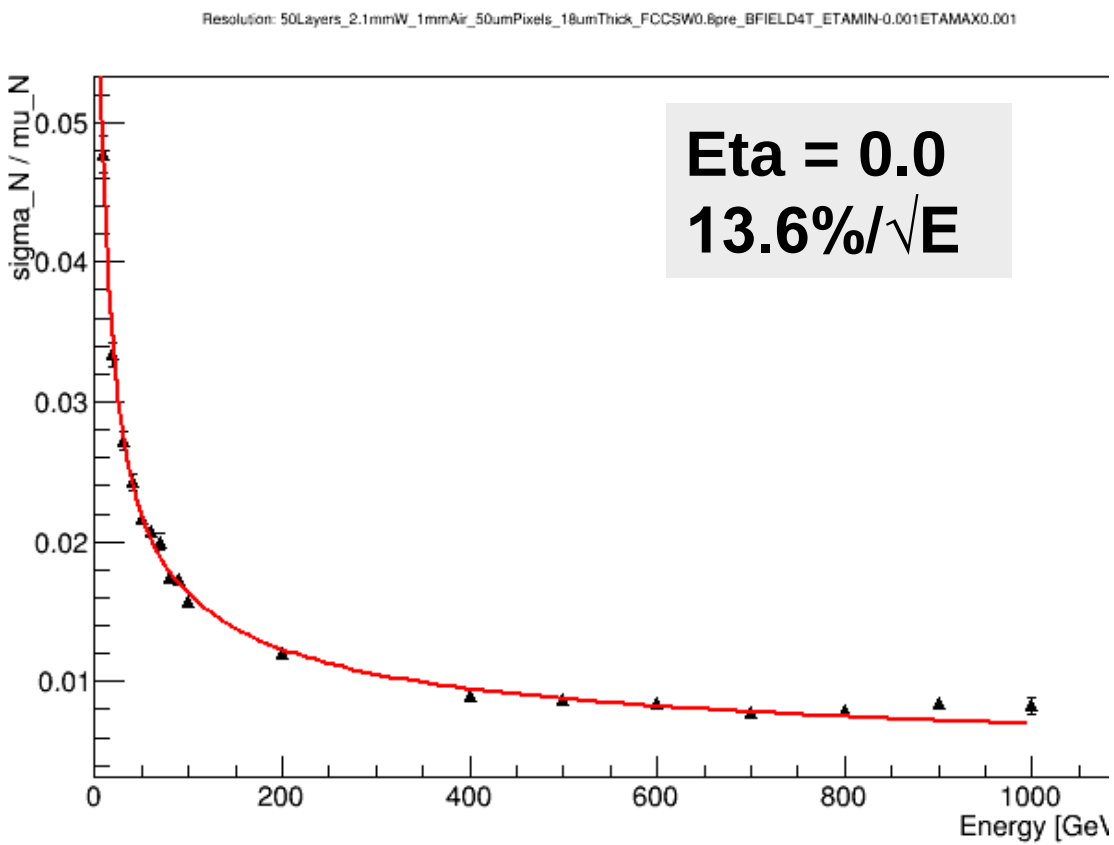


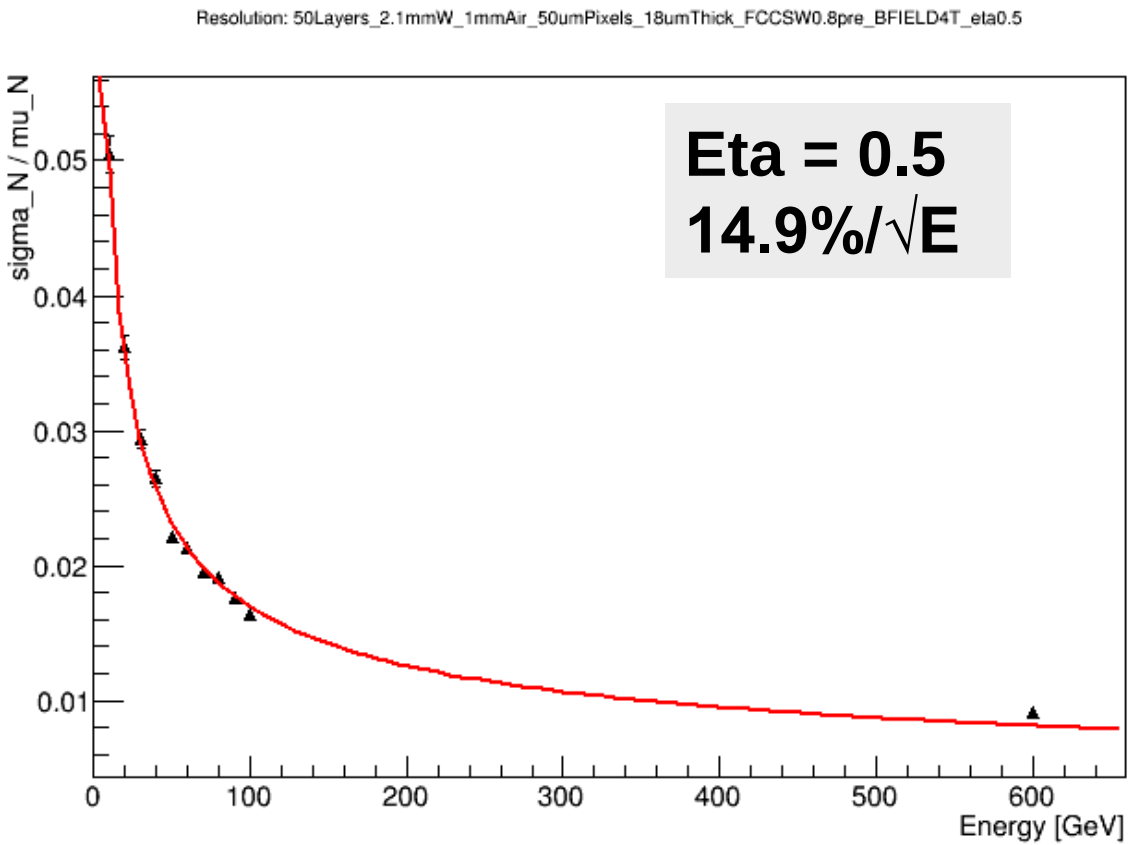
Eta dependency

- For these studies I used the following in the barrel region
  - 50 Layers
  - Si-W-Air-Si …. W-Air orientation
  - 2.1mm W per later
  - 18um epitaxial thickness (sensitive region)
  - 1mm Air Gap
  - XYZ segmentation of 50x50x50 um
  - FCCSW 0.8pre
- Varied the eta to 0, 0.5, 1.0, 1.5

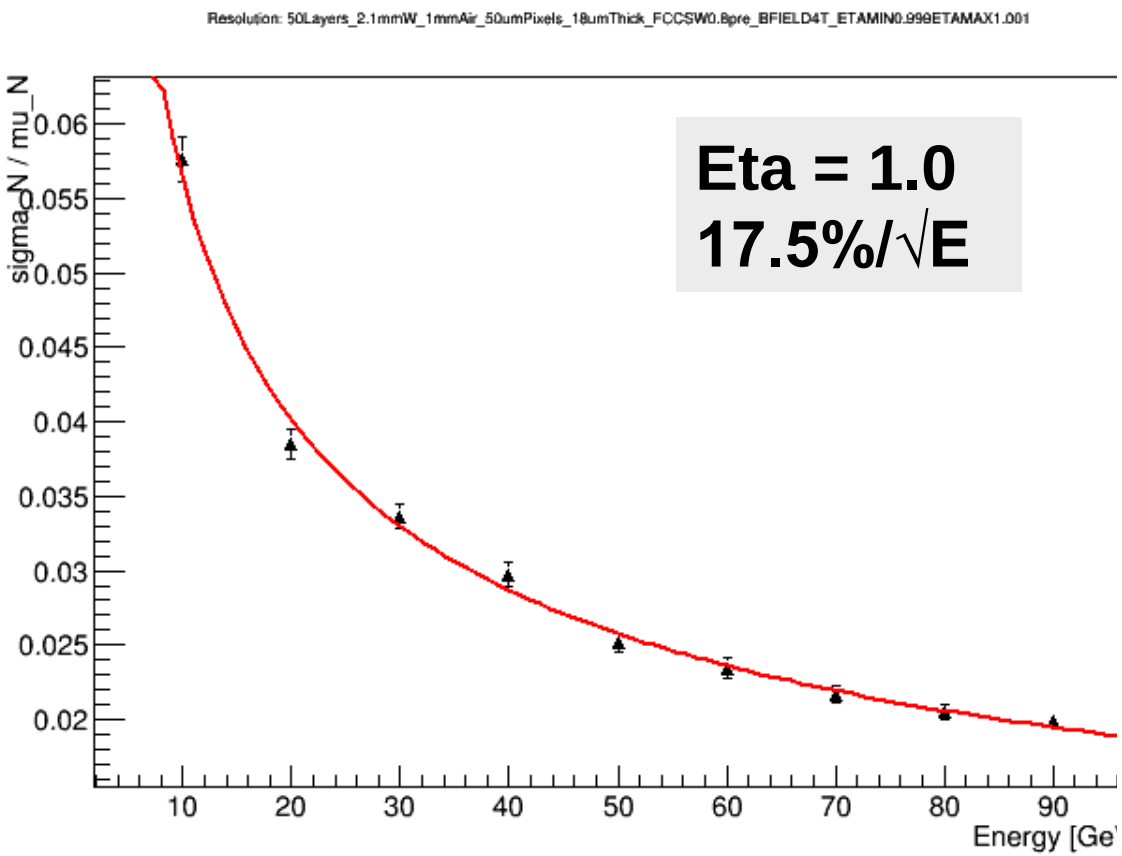
Eta Dependency

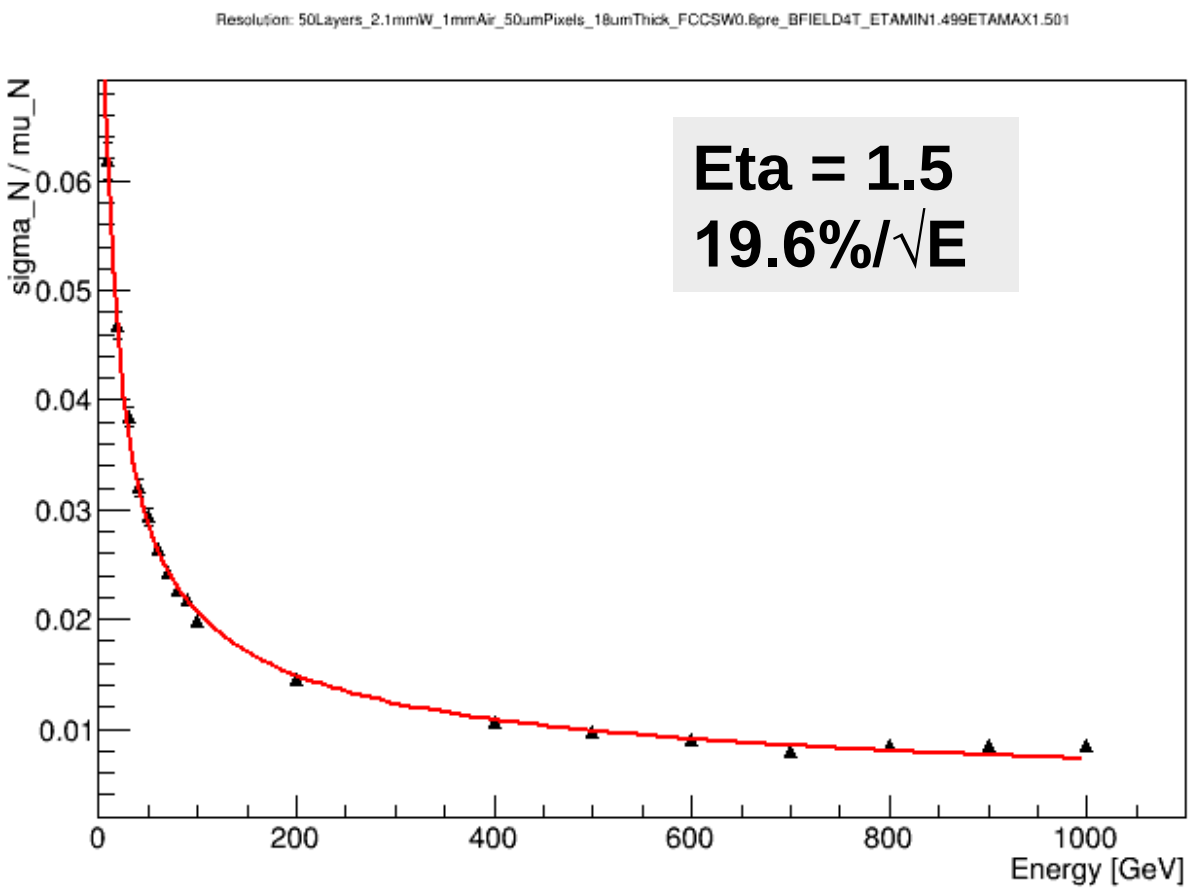
Very preliminary, many points missing due to full disk on lxplus and not had time to rerun missing samples





Eta Dependency





Conclusions

- Increased linearity with air gaps is due to shower radius increasing and reducing the pile-up in a single pixel
- However, due to the magnetic field low energy particles in the shower curl up and are lost, leading to undercounting and reduced energy resolution
- Initial study was at 6T not 4T. Effect is still visible at 4T but energy resolution is effected less
- Changing the orientation of the Air and W layers improves resolution as less particles lost from shower
- Preliminary studies show that the energy resolution decreases as a function of eta due to the extra material
- To do: eta-phi segmentation, energy resolutions with additional parameters, clustering, evaluate to impact on physics.