MC simulation for GaAs sensor and Tungsten for e^- at 4 GeV

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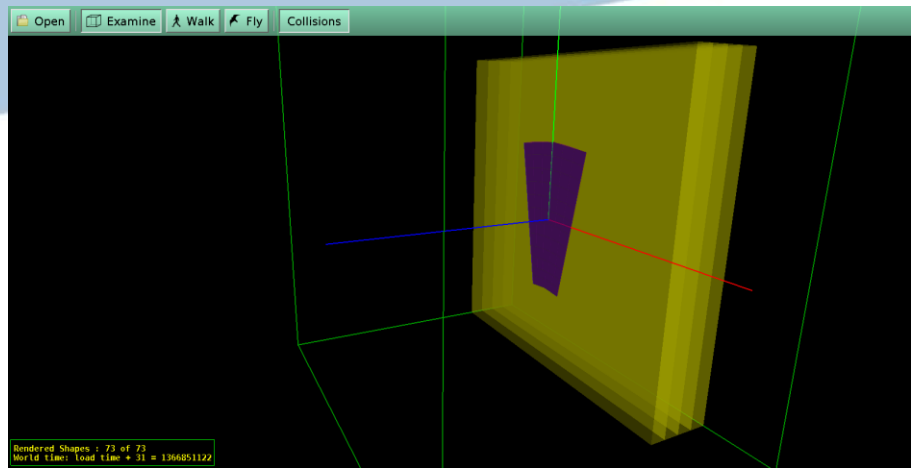
Outline

- ✓ Simulation set-up
- ✓ Longitudinal distribution of the EM shower
- ✓ Transversal distribution of the EM shower
- ✓ Conclusions

Monte Carlo simulation with Geant4



set-up geometry

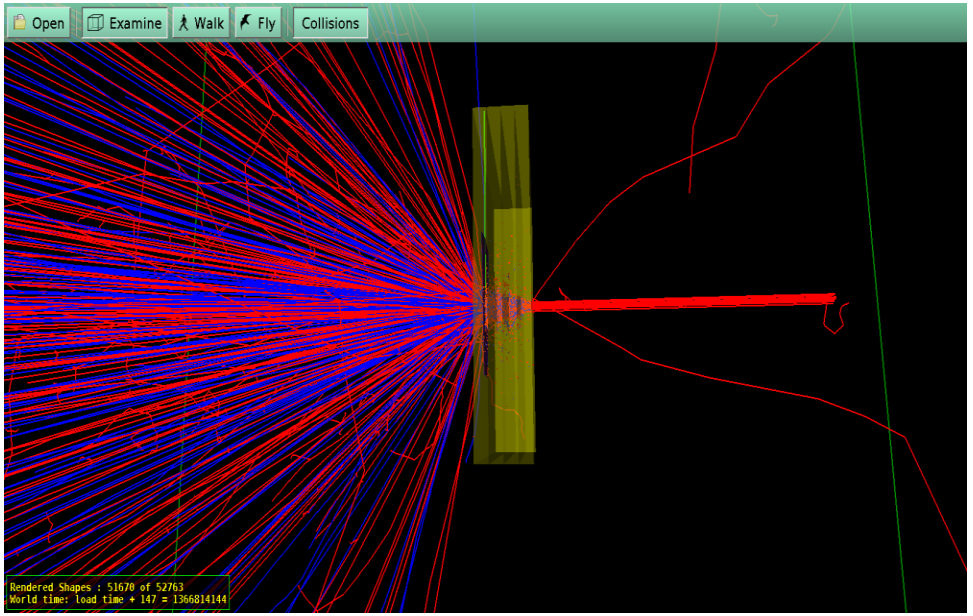
- 300 μm $GaAs$ sensor
- 2 plate Ni = 100 μm
- tungsten plate thickness, t = $2X_0$, for tungsten X_0 = 0,3504 cm

Particle Gun definition:

- incident particles: e-
- beam energy: 4 GeV
- Gauss distribution of beam with σ = 3 mm

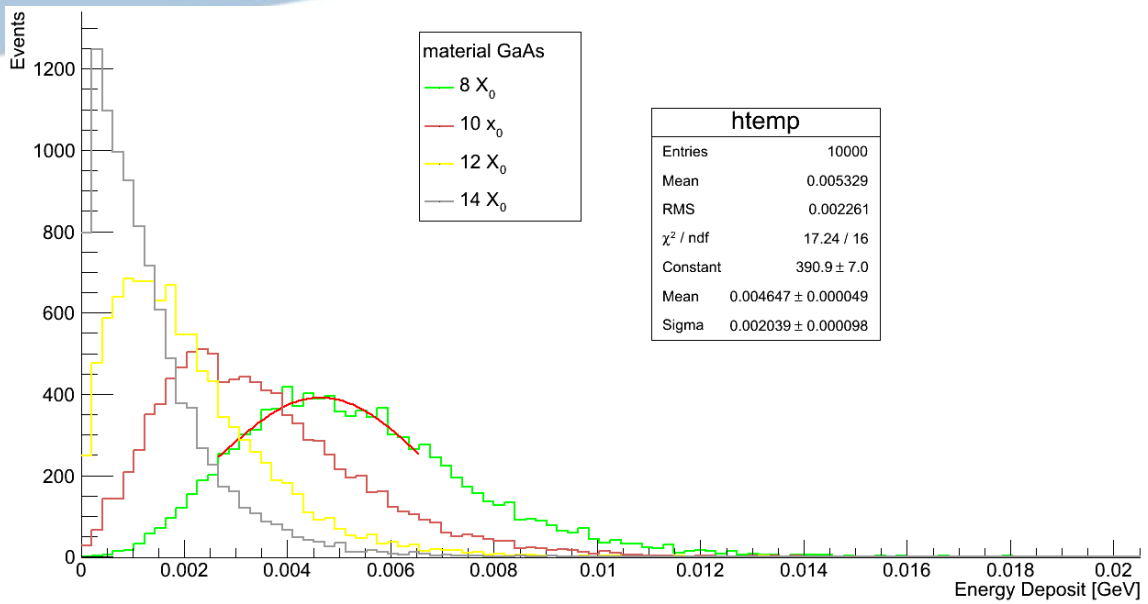
Tracking Cuts

- applied only for GaAs sensor
- we used *fStopAndKill* method to stop any gamma particles

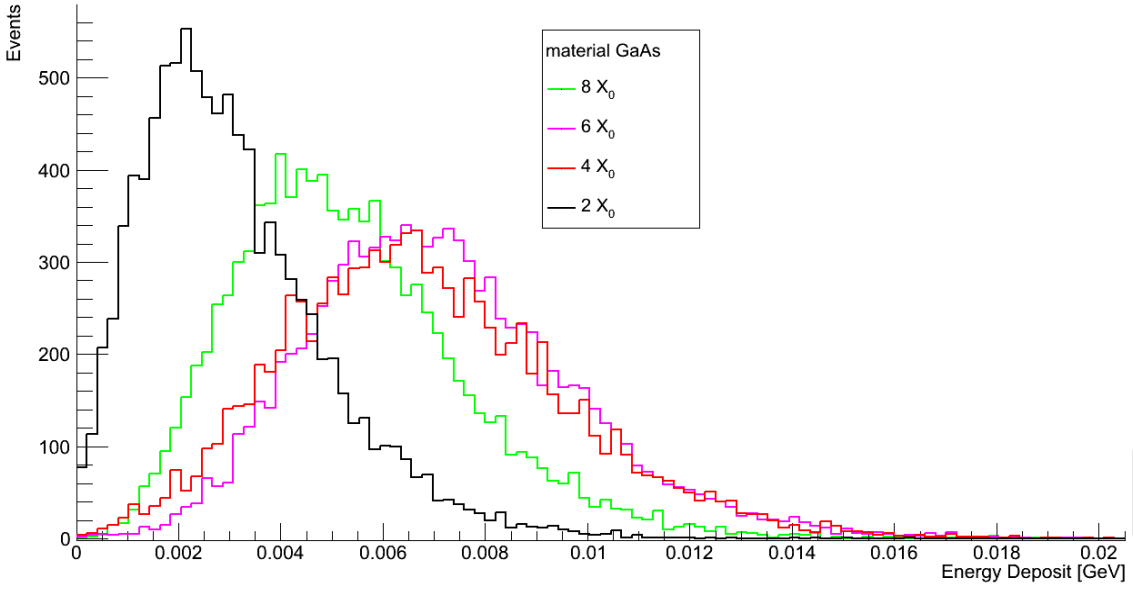


Tracking example for 8 X_0 tungsten

Longitudinal distribution of energy deposited by shower



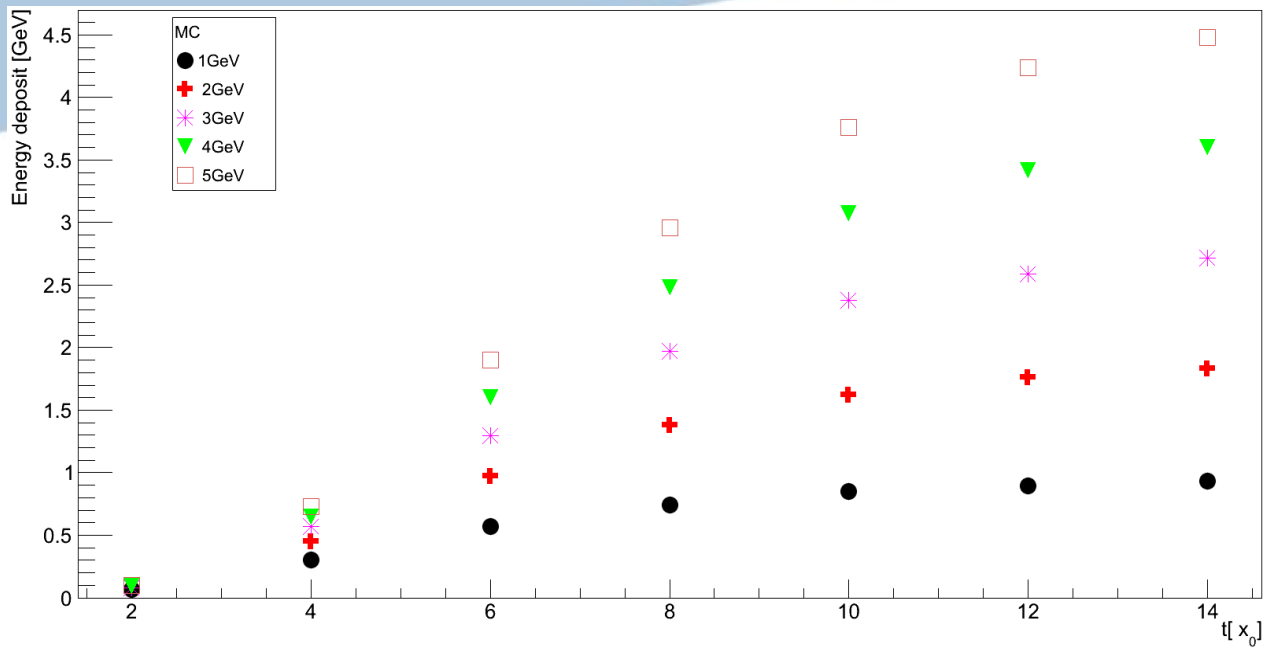
- in GaAs
- For $2X_0$, $4X_0$, ... , $14X_0$ tungsten

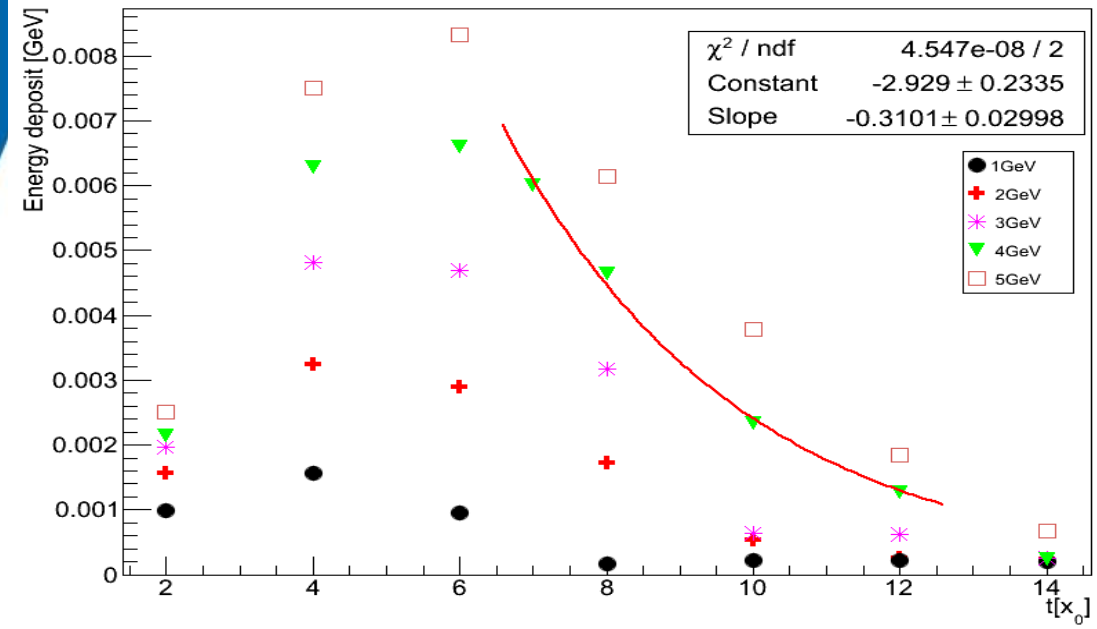


- MPV of energy deposited was determened by Gauss fit
- Geant4 dosen't correctly determine the energy loss for thin thickness materials

Energy deposited by shower

Tungsten
- Energy deposited for $2X_0$, $4X_0$, ... , $14X_0$
- for :
  - e^-, e^+,
  - γs

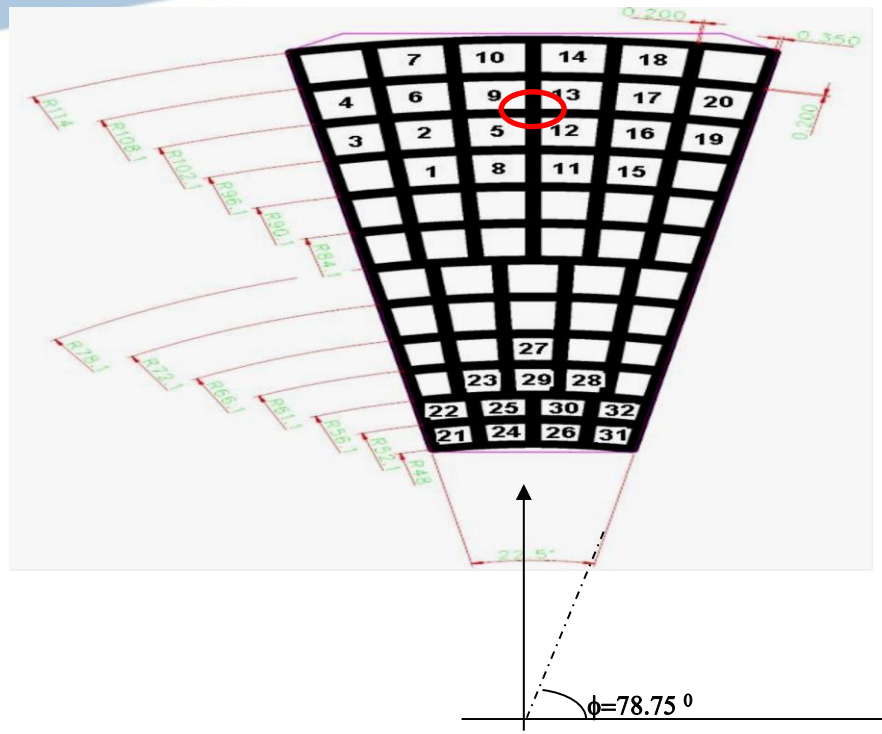




GaAs sensor
- Energy deposited for $2X_0$, $4X_0$, ... , $14X_0$ tungsten
- for :
  - e^-, e^+,

experimental longitudinal attenuation coefficient $\lambda_{long\ data}$ =0,23

Radial shower development



✓ **Beam**

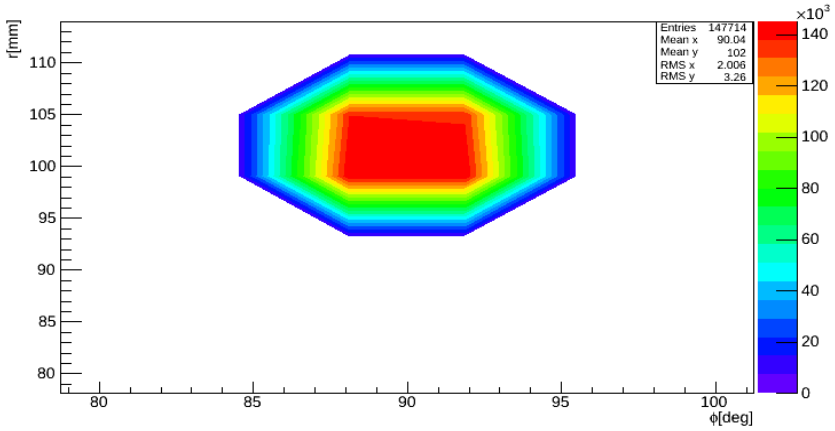
- projection on sensor: square L=7mm
- intensity: Gaussian, σ = 3.5

✓ **No noise included**

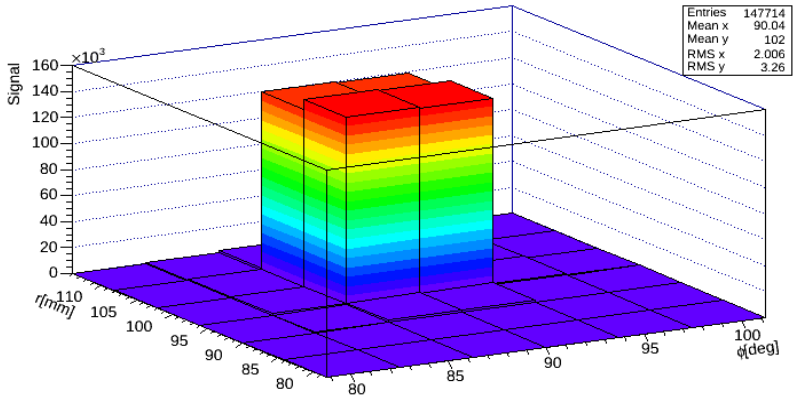
✓ **For GaAs**

1. e^+, e^-, gamma
2. Only e^+ and e^- were taking into account

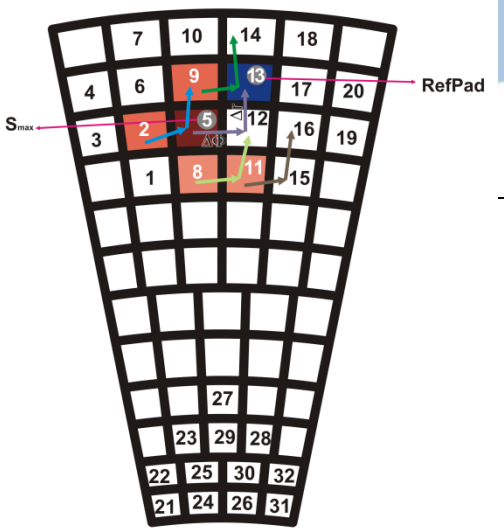
✓**Ei(r,Φ) - Distribution of Energy deposition on i-th pads**



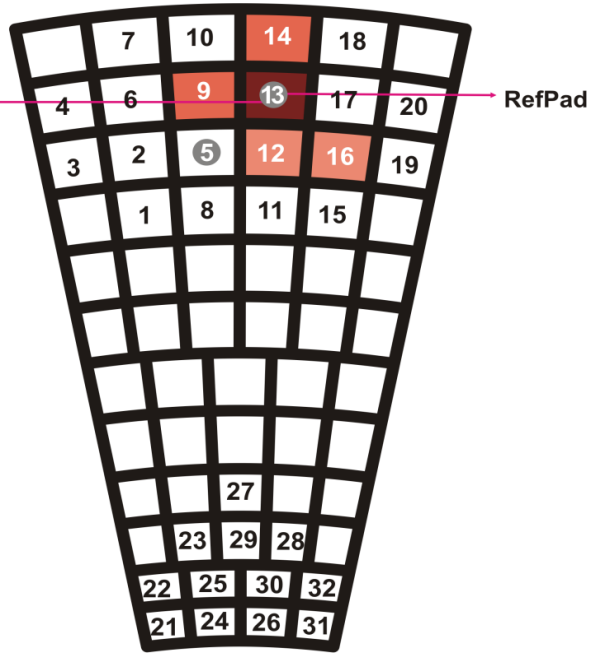
Ei(Φ, r) for $4X_0$



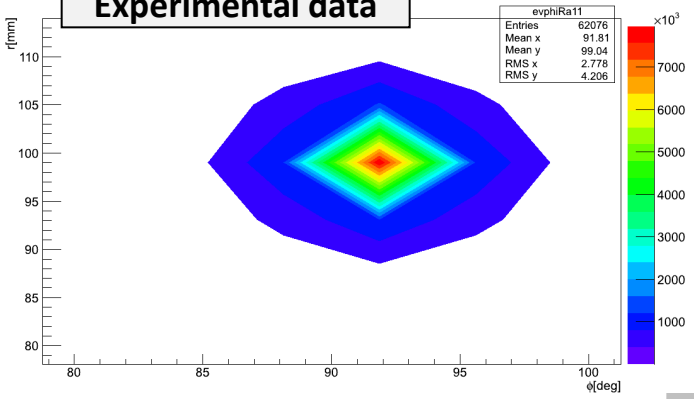
EM – Radial shower analyses



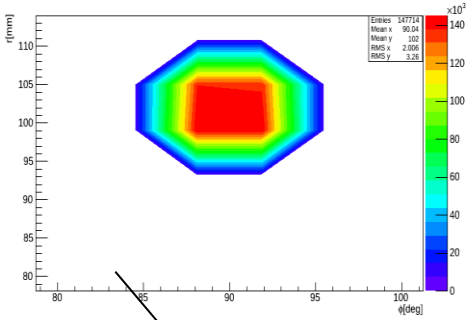
R(ΔΦ) . T(Δr)

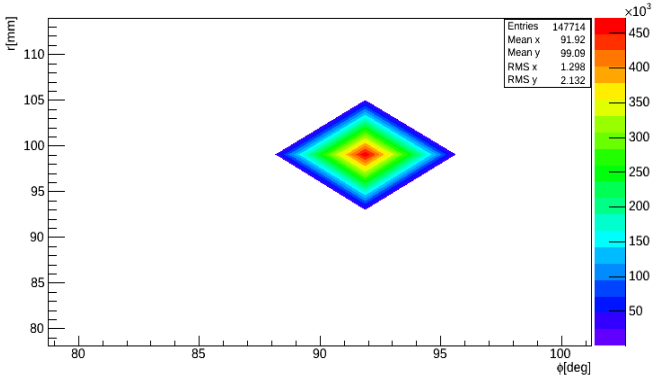


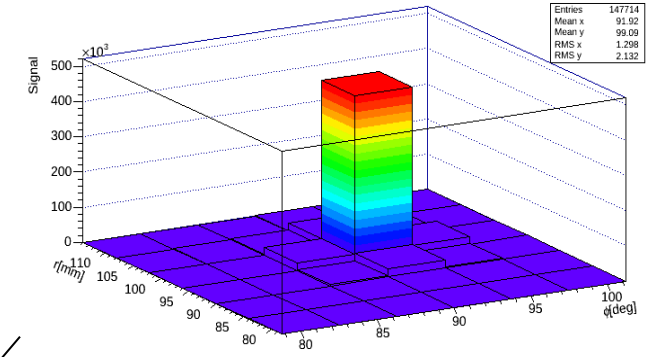
Experimental data



$E_i(\Phi, r)$ for $4X_0$, 4Pads







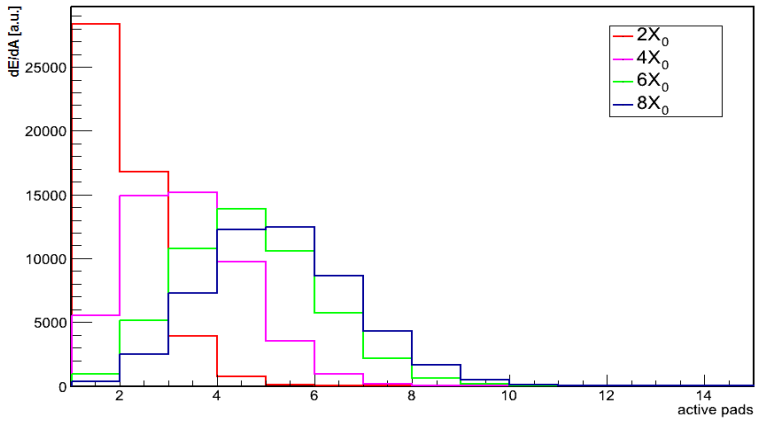
MC data before R(ΔΦ) . T(Δr) transformation

MC data after R(ΔΦ) . T(Δr) transformation

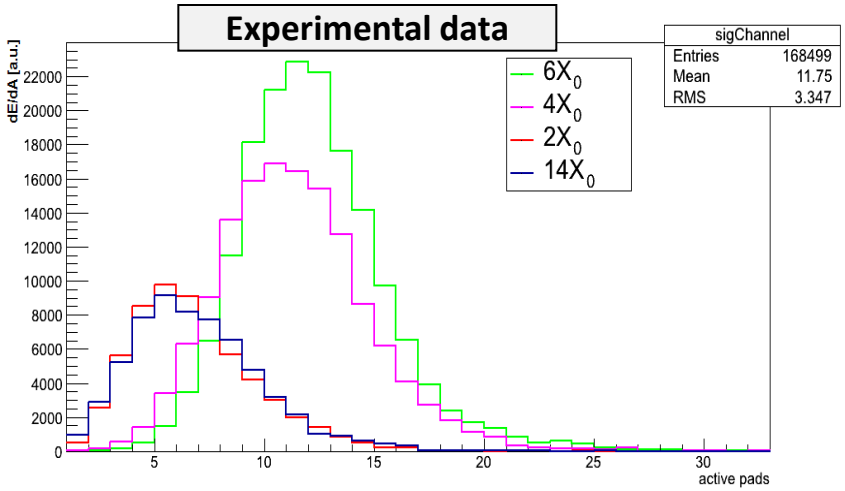
EM – Radial shower analyses

Density energy distribution of the active pads for t = $2X_0$, $4X_0$, $6X_0$, $8X_0$

MC data

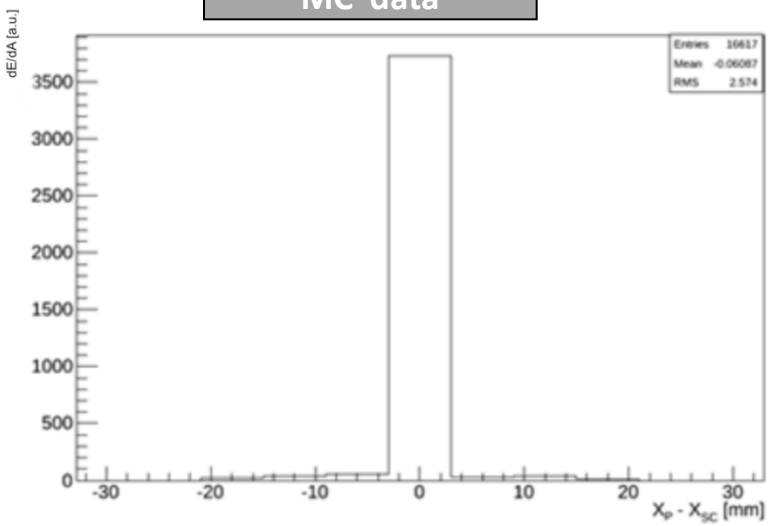


Experimental data

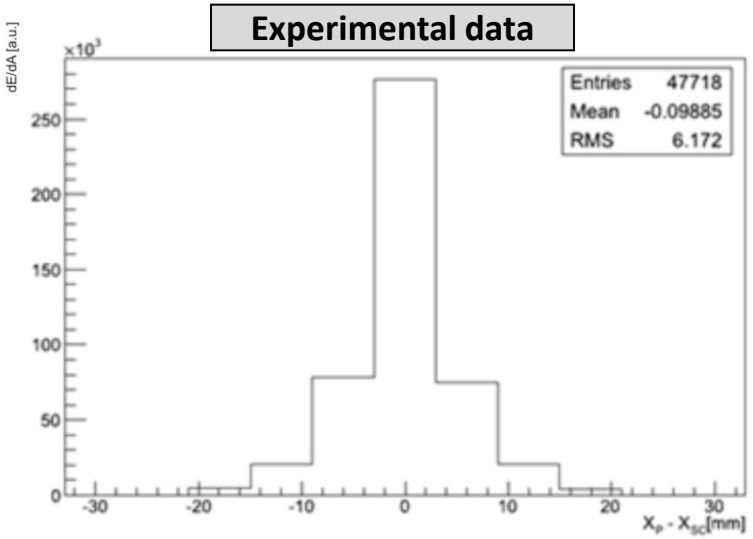


Shower distribution along a X direction for t = $6X_0$:

MC data



Experimental data



Conclusion

- ✓ Test-beam 2011 set-up geometry was implemented in Geant4;
- ✓ It were studied the longitudinal and transversal shower evolution for 4 GeV incident electrons
- ✓ It was developed the same analysis method as with experimental data
- ✓ The future plan:
  - Implemented more realistic behaiviour of GaAs sensor
  - Implemented the fluctuation of the energy loss for this GaAs ($300\mu m$)

THANK YOU FOR ATTENTION!