Nosecone Calorimeter Simulation

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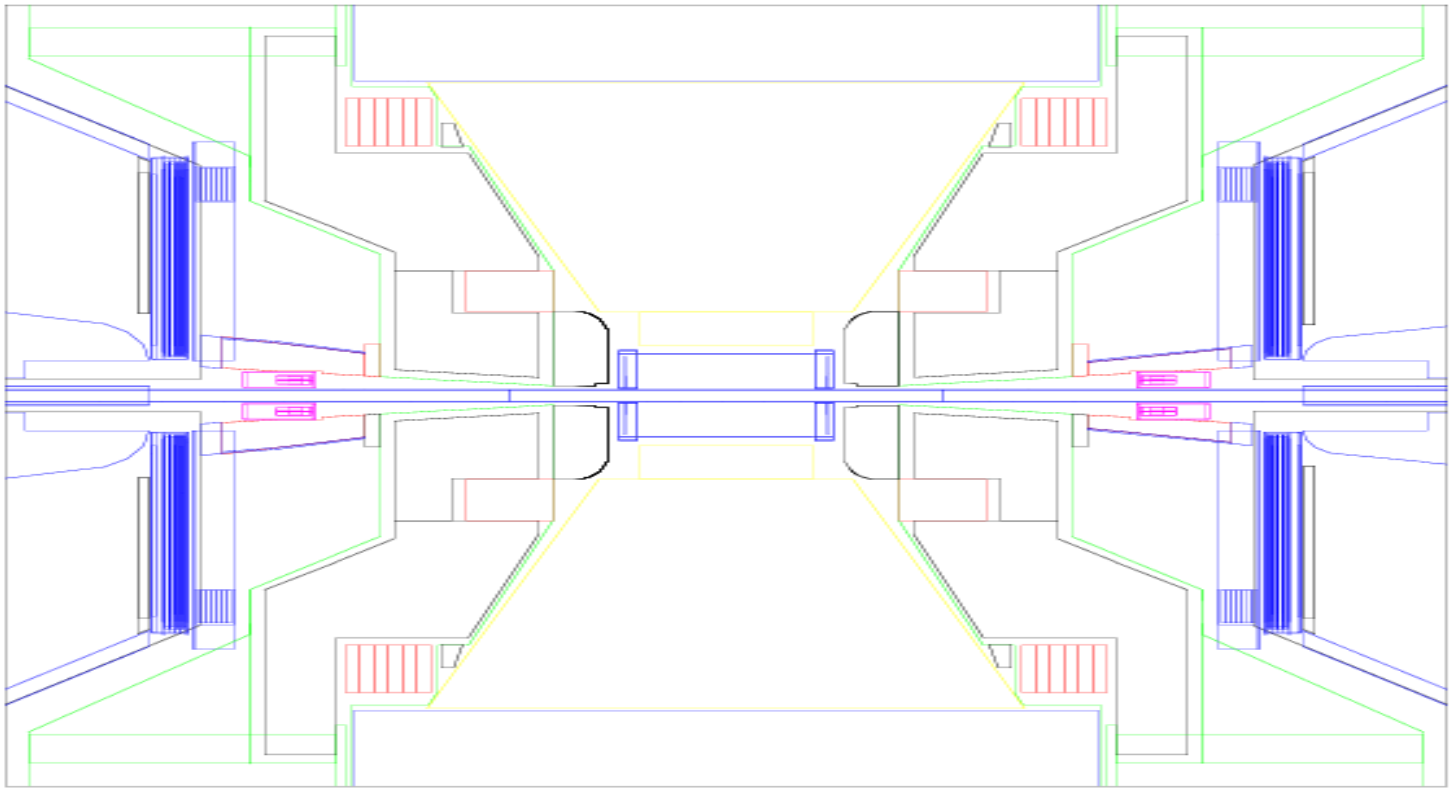
Outline

- Forward calorimeter for PHENIX upgrade
- Geometry and composition
- Simulation of performance
- Resolutions
- Event display
- Summary

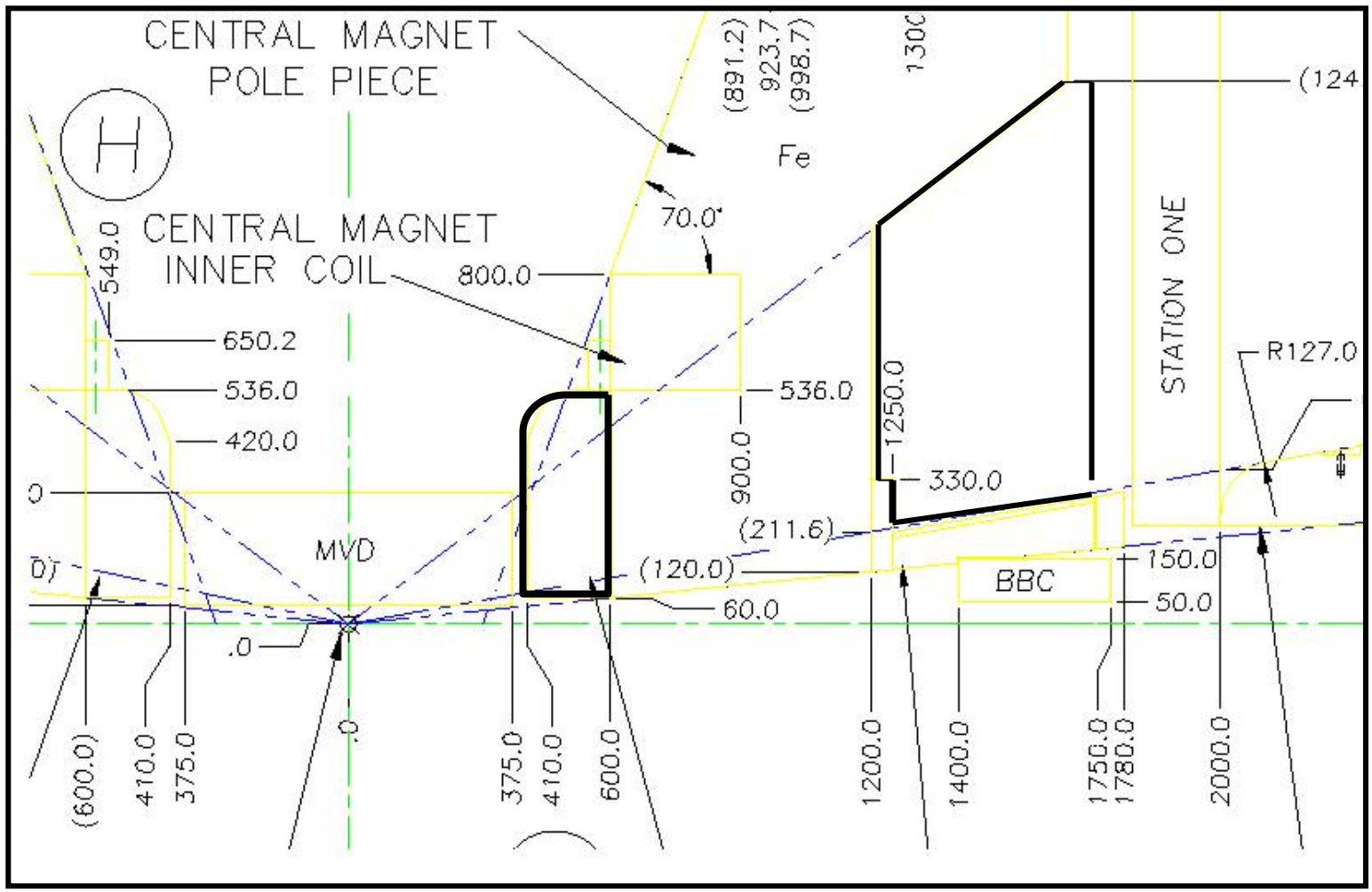
PISA View of PHENIX



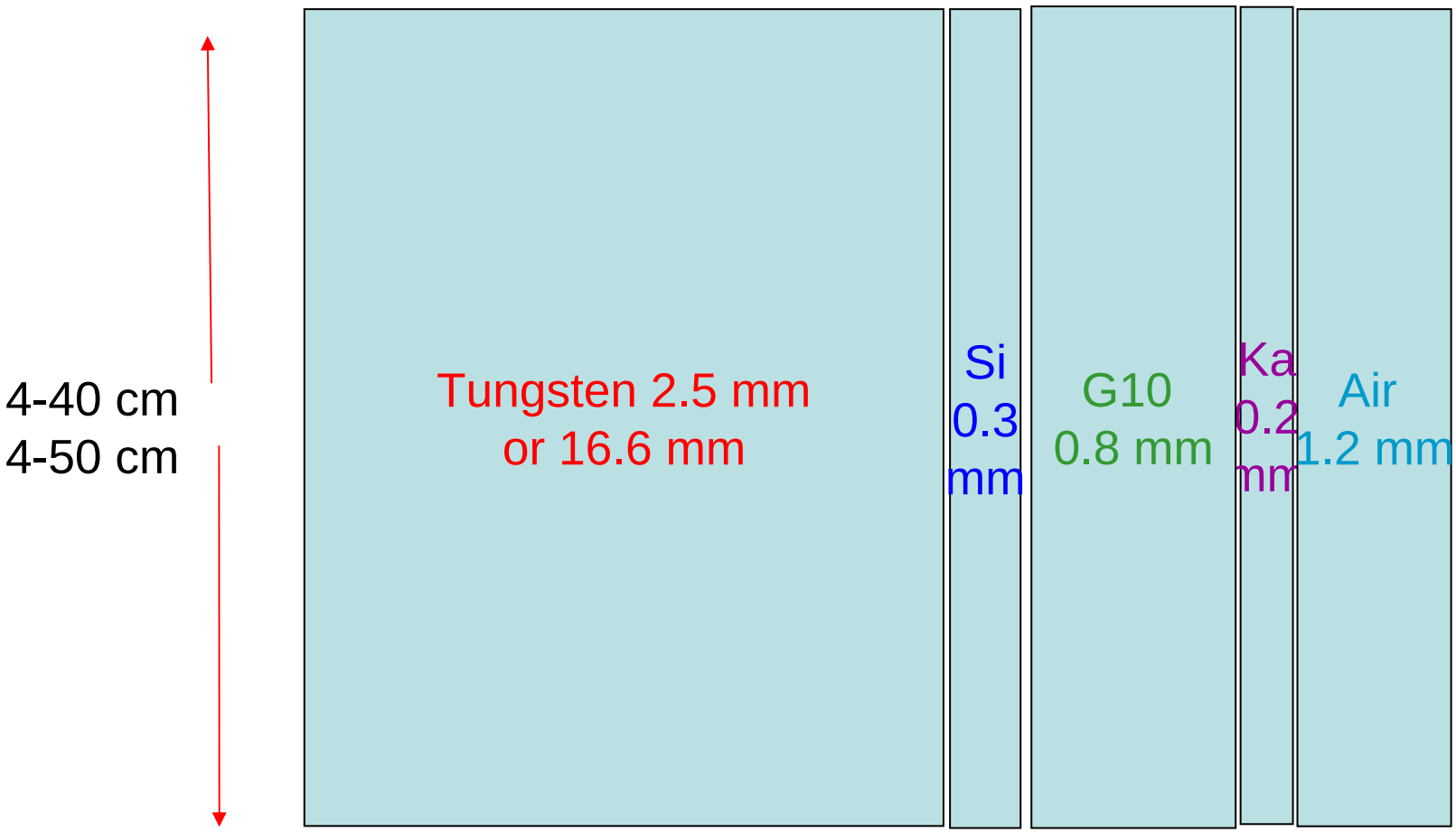
$J/\Psi \rightarrow \mu^+\mu^-$ Yield and Resolutions

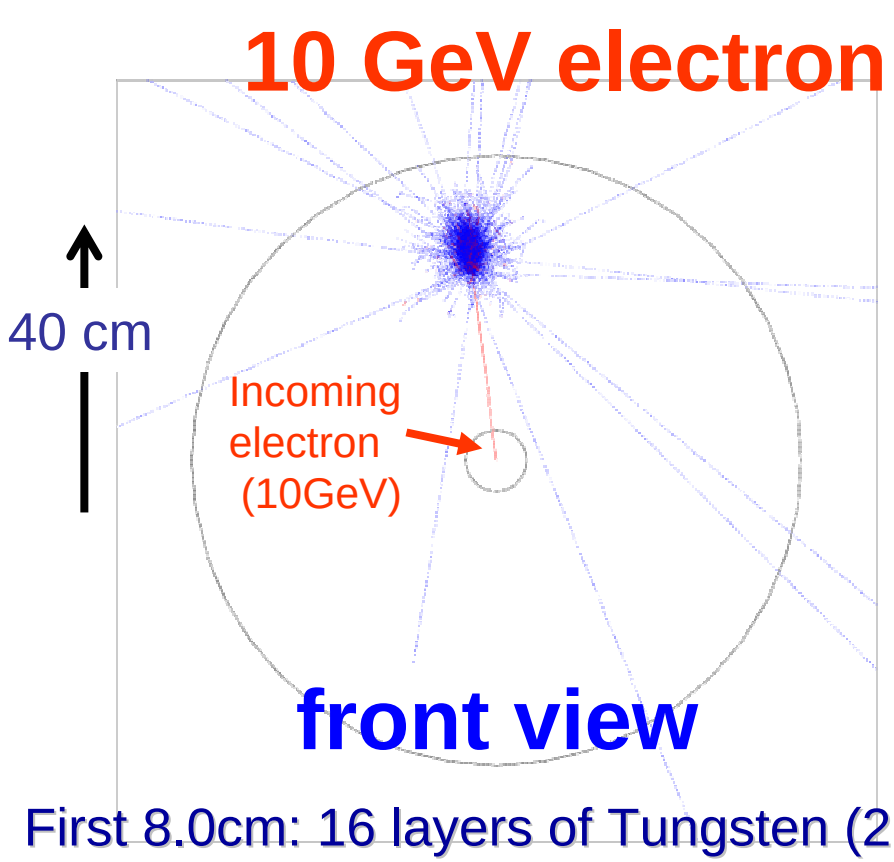
Nosecone	HCAL	J/Ψ Width GeV/c^2	Signal events	λ	x_0
Cu 19 cm	No	155+/-10	176+/-13	4.84	47.4
W 9 cm	No	163+/-11	165+/-13	4.52	59.8
W 7 cm	No	155+/-13	160+/-13	4.31	54.1
W 9 cm	Yes	175+/-12	153+/-12	5.84	73.8
W 7 cm	Yes	162+/-12	140+/-12	5.63	68.1

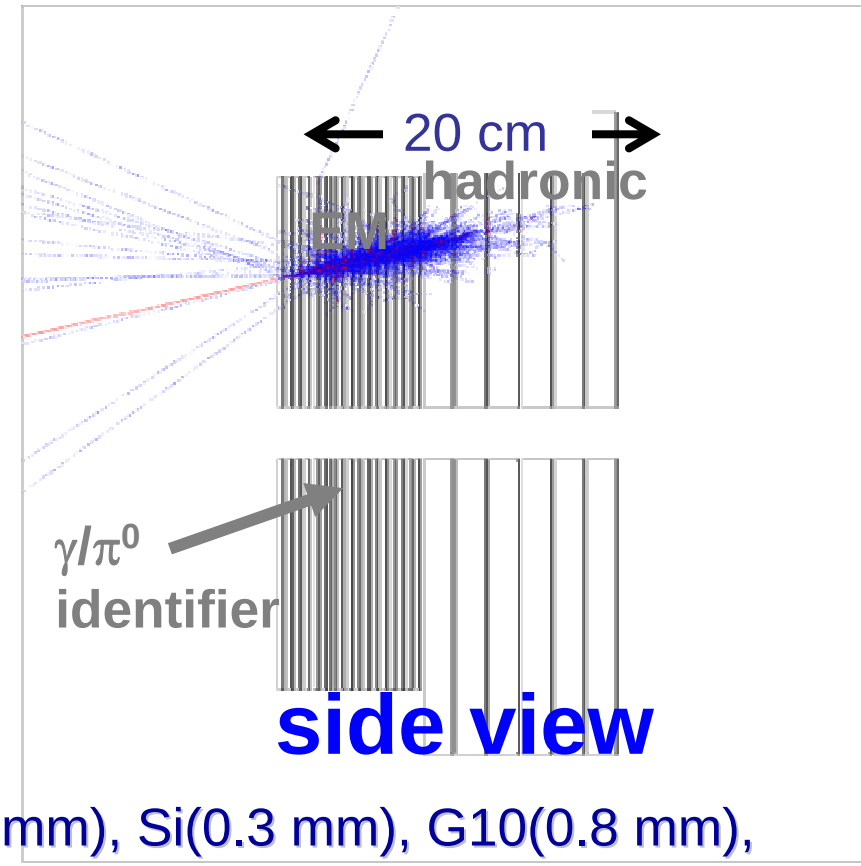
Details of the Geometry



Materials used in NCC

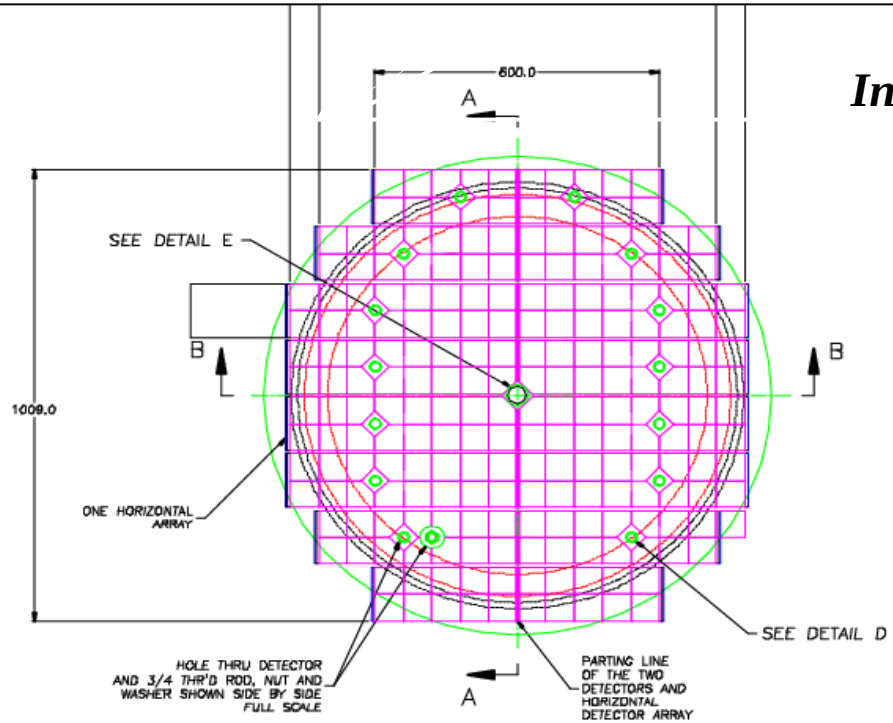




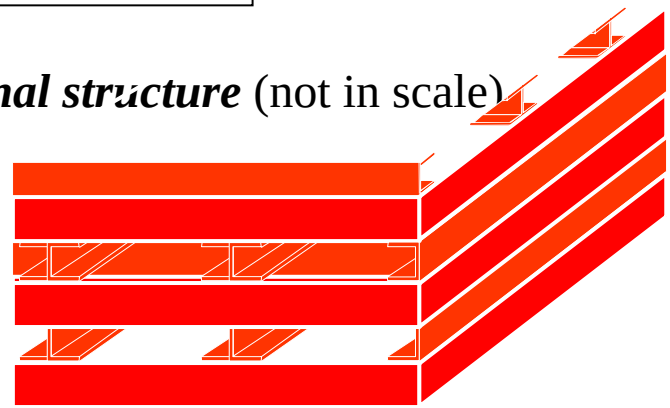


- First 8.0cm: 16 layers of Tungsten (2.5 mm), Si(0.3 mm), G10(0.8 mm), Kapton (0.2 mm) and Air(1.2 mm).
  - After first 6 layers there is a 0.5mm thick double layer of Si,G10,Kapton,Air (this is the γ/π^0 identifier).
- Second half has a 6 layers with same sequence of materials, only thickness of Tungsten 16.6 mm.

How to build this calorimeter …..



Internal structure (not in scale)



Tungsten plates 2.5 mm

Spacers glued to W

Constrains:

-Structure in place prior to SVT installation;

-Easy access for repairs/replacements;

-Minimal power consumption – no forced cooling;

-Compact signal processing plant – no competition for the real estate on magnet pole;

Number of channels

- Section 1, 2 and 3 : Pad size 15 x 15 mm
- +/-36 cm 2304x16=36864
- +/-48 cm 4096x6=24576
- Total number of channels 60840
- γ/π^0 identifier 60mm/32
- 1 strip =1.875 mm 384x2=768

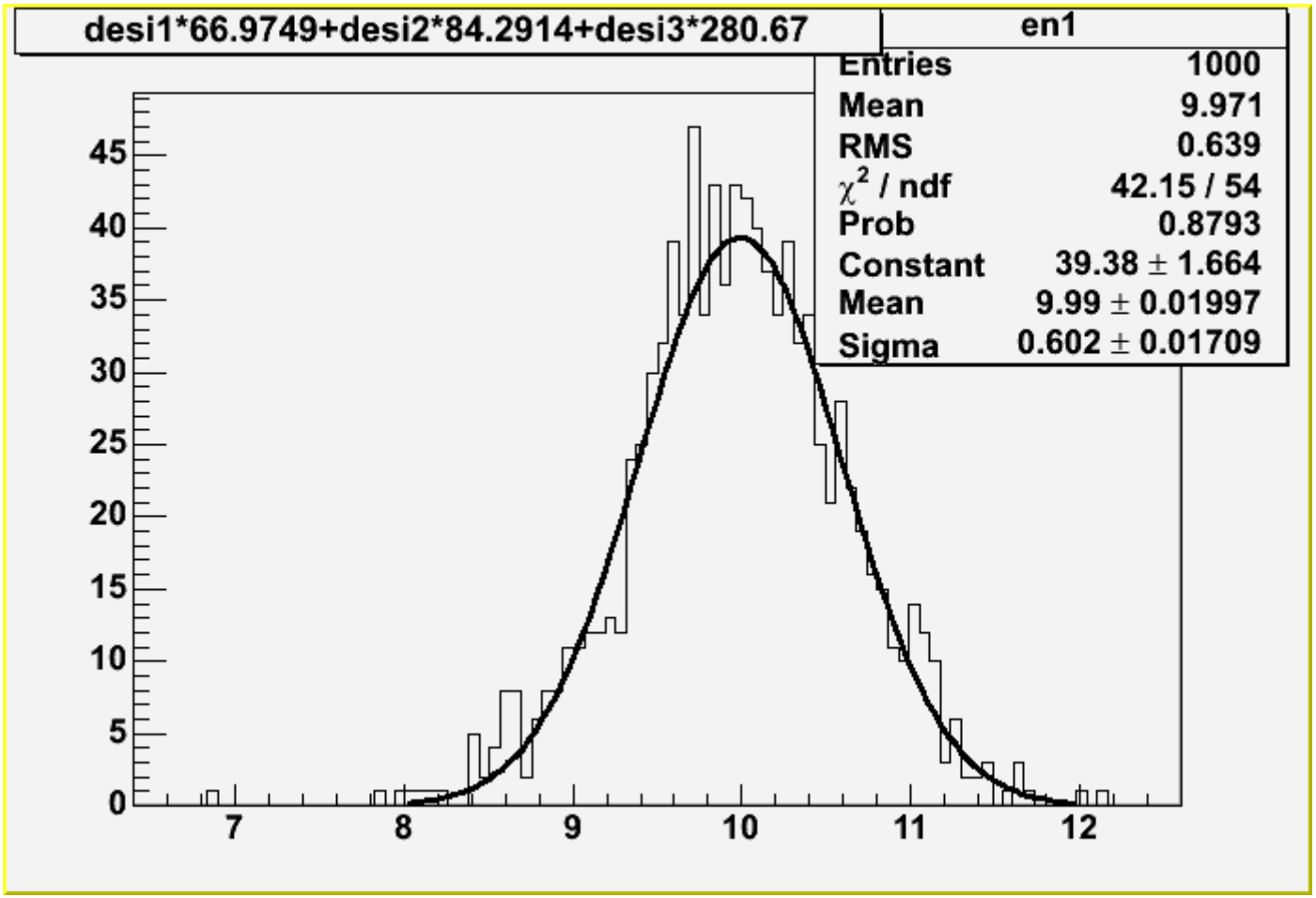
Energy Reconstruction

- $E = \alpha_1 E_1 + \alpha_2 E_2 + \alpha_3 E_3$

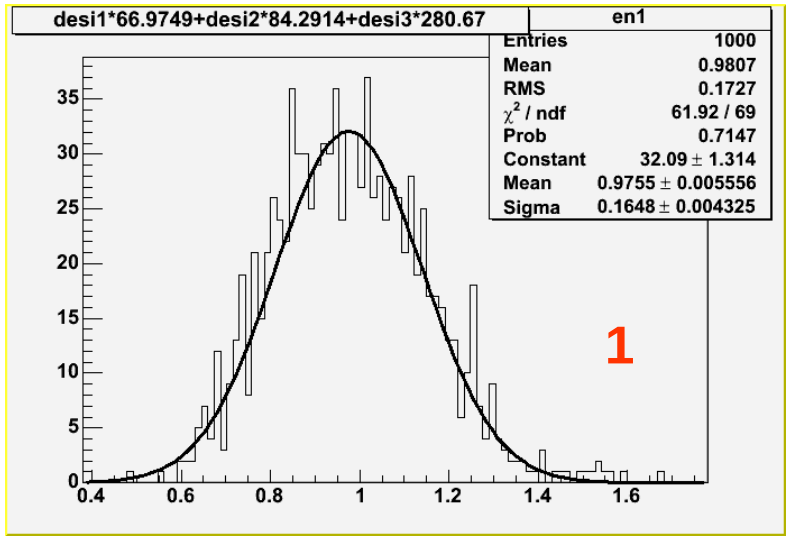
  $\Phi = (\Sigma_\iota \alpha_\iota E_\iota - E)^2$
- $d\Phi/d\alpha_1 = 0 \quad d\Phi/d\alpha_2 = 0 \; d\Phi/d\alpha_3 = 0$
- System of Linear equations

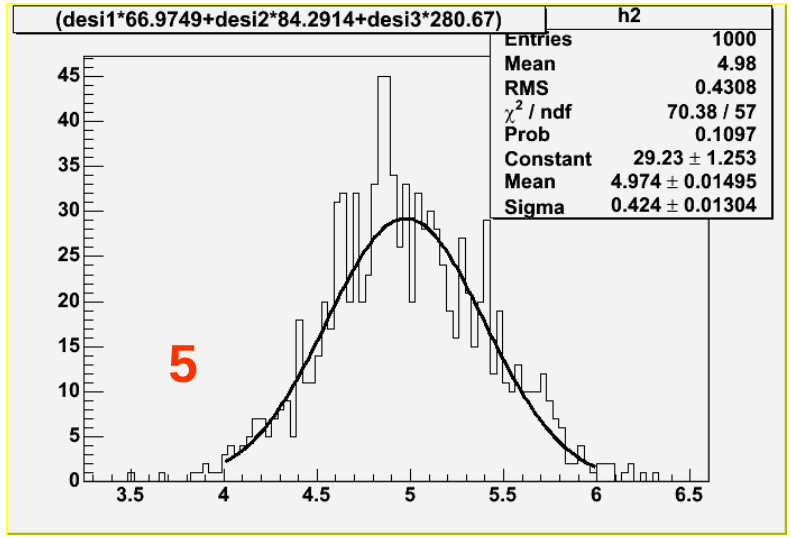
  $\alpha_1 = 66.97$, $\alpha_2 = 84.29$, $\alpha_3 = 280.67$

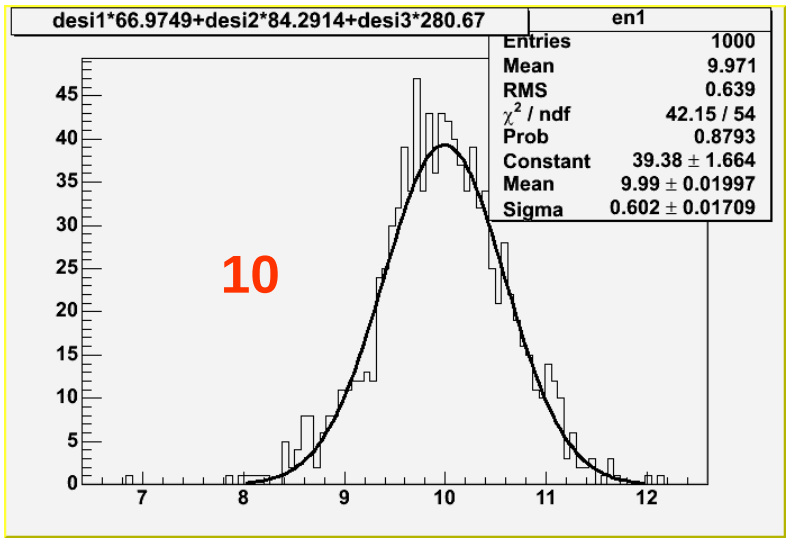
Resolution for 10 GeV electron

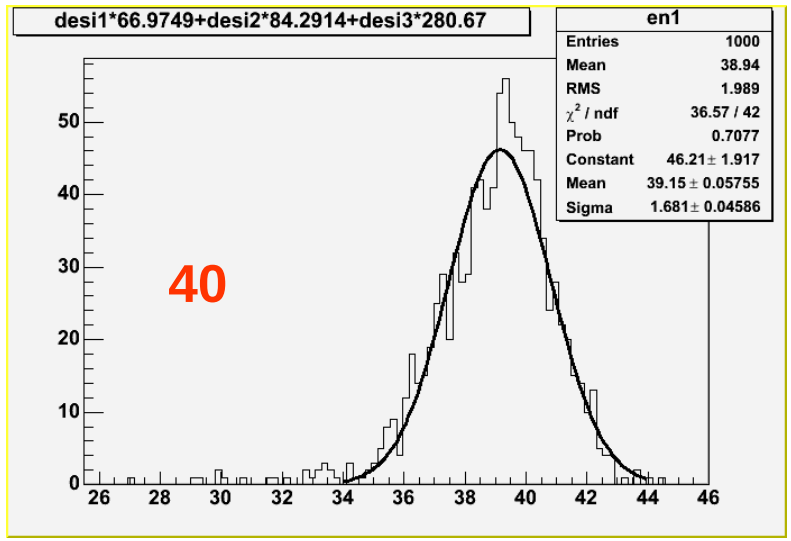


Resolution for 1,5,10,40 GeV electron

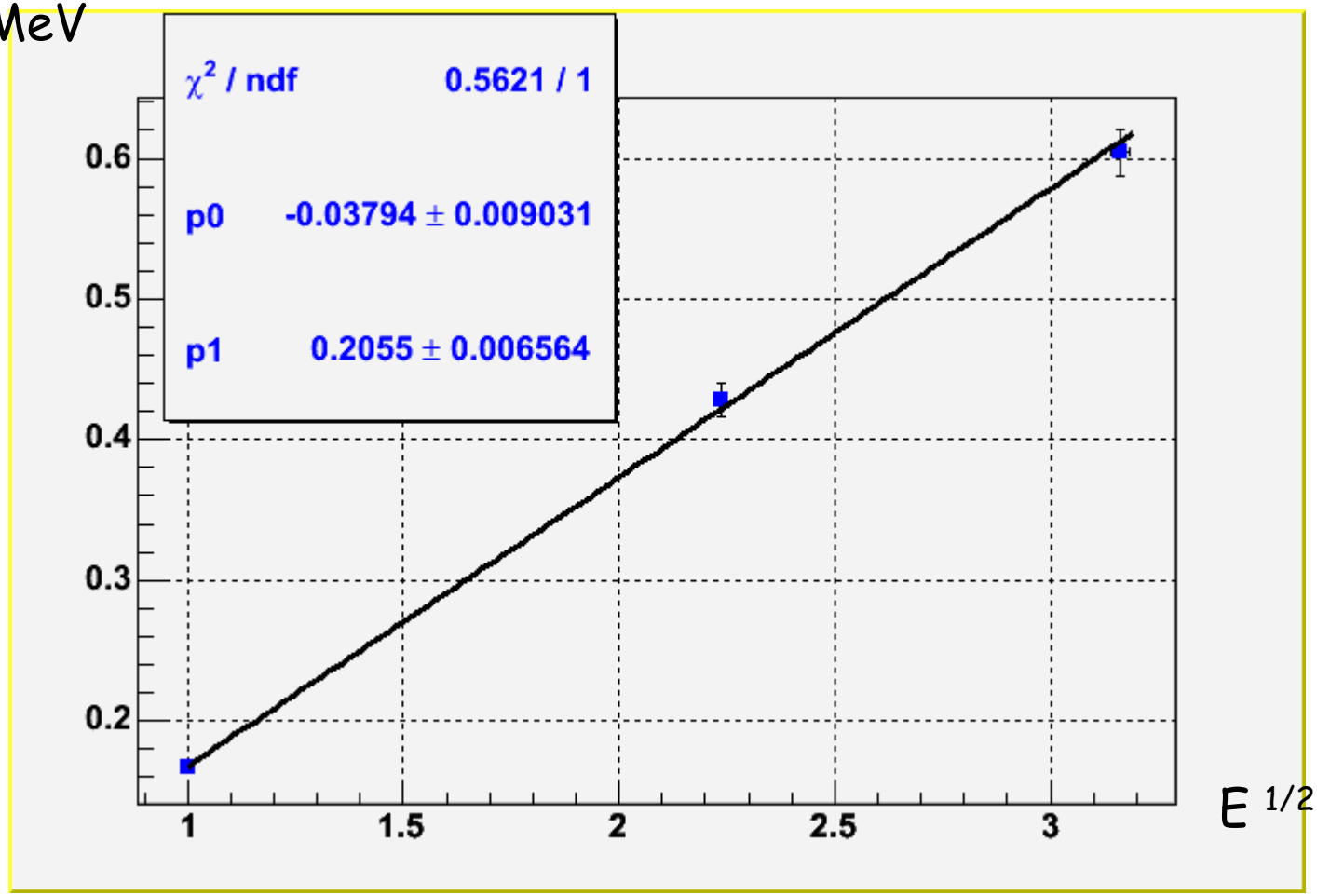




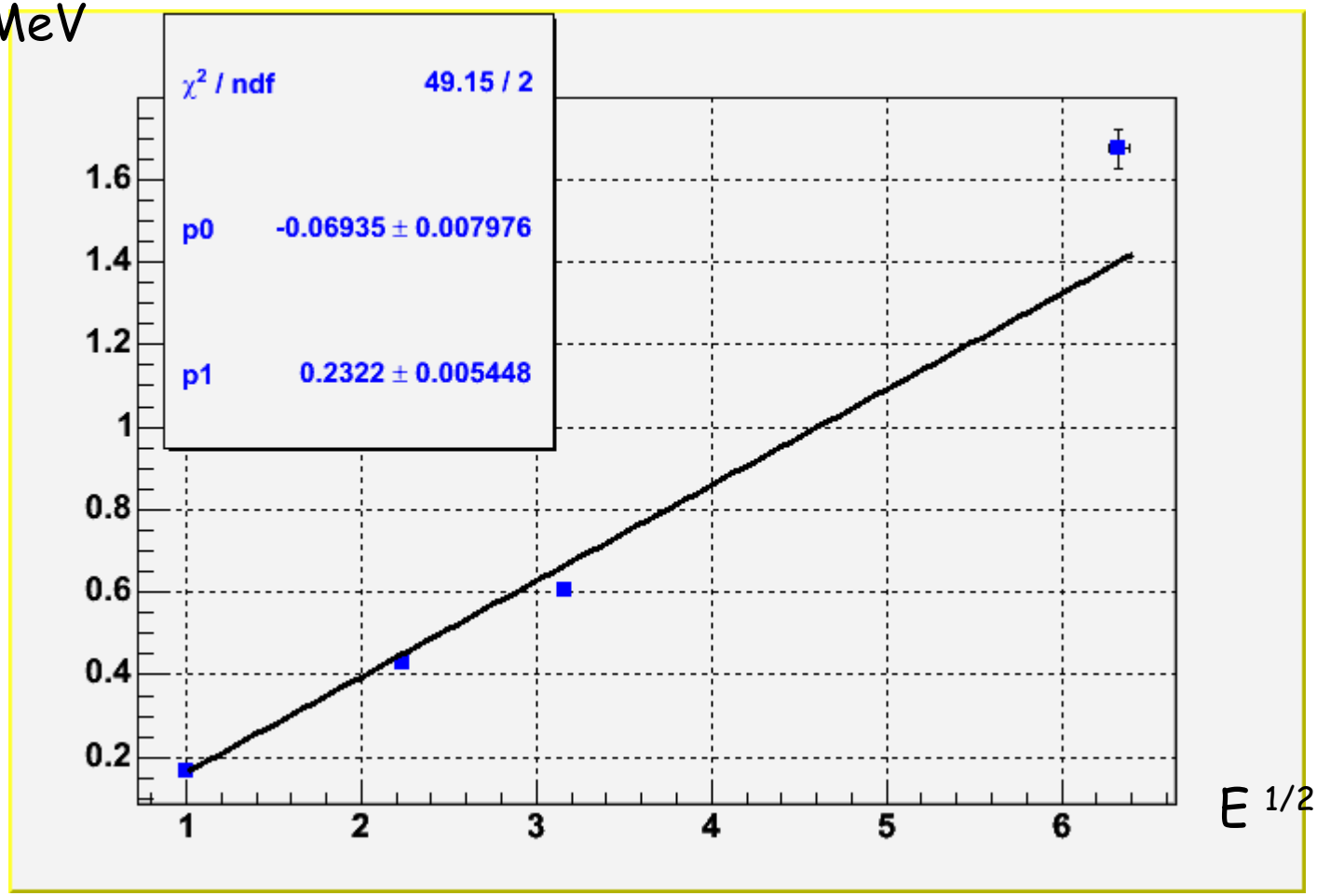




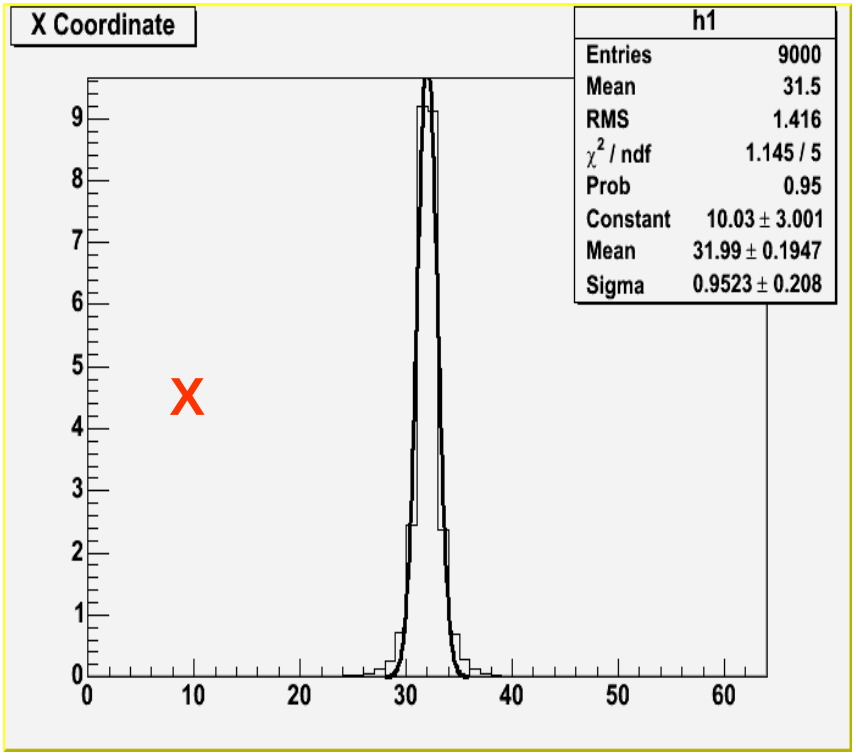
Energy Resolution

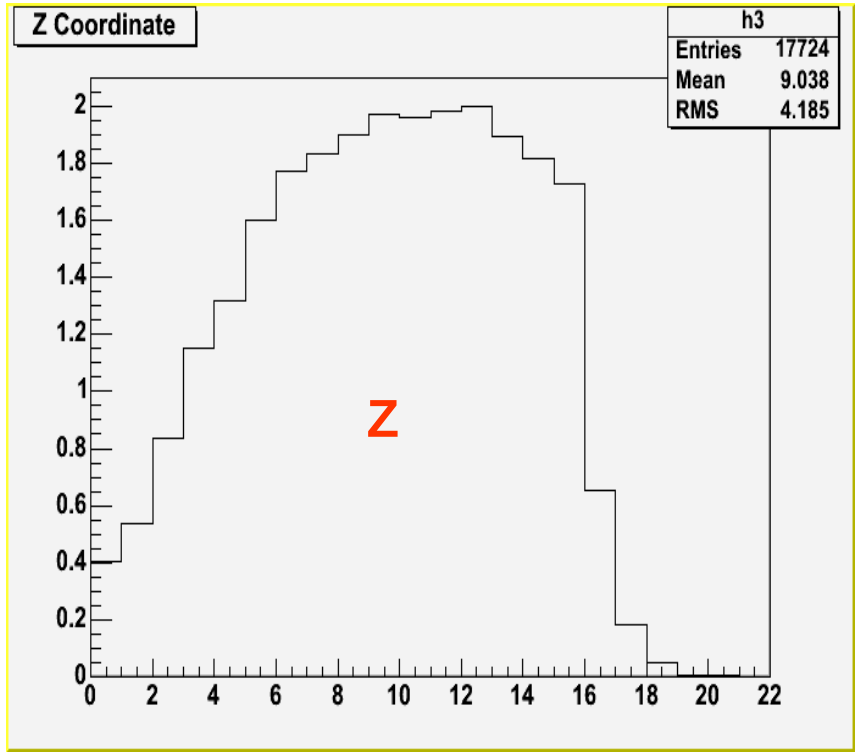


Energy Resolution

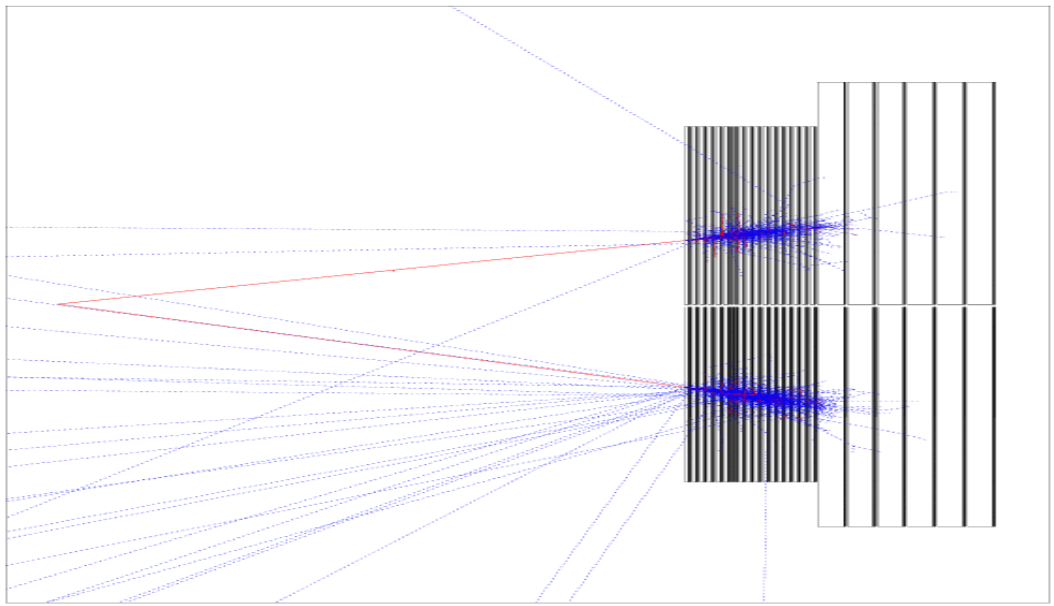


Shower profiles for 10 GeV electron

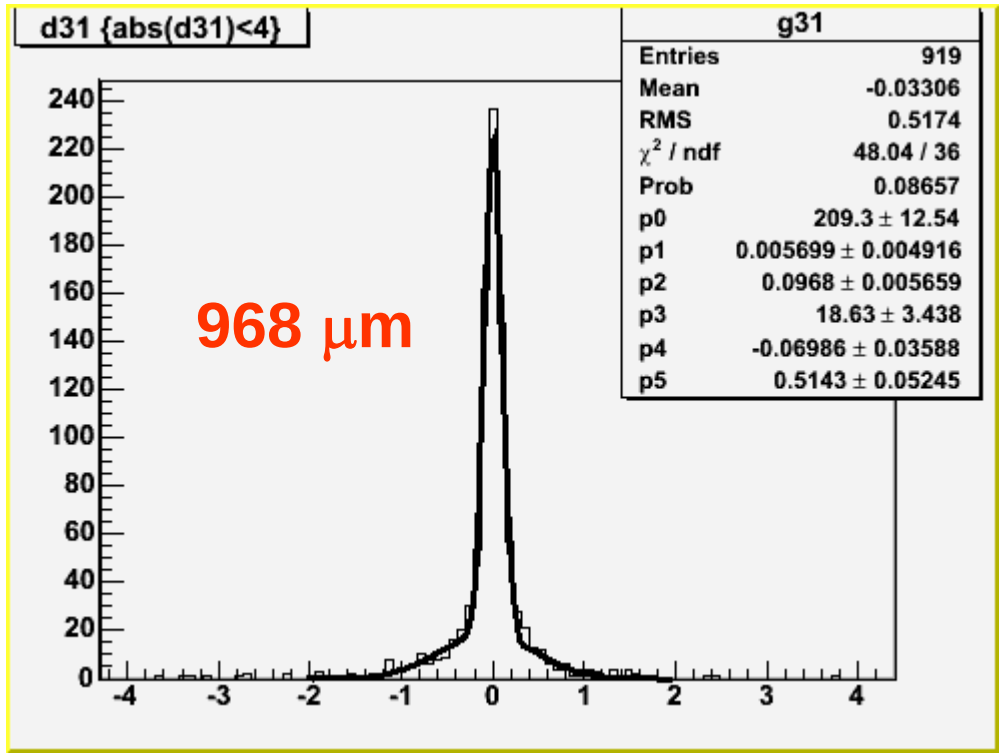




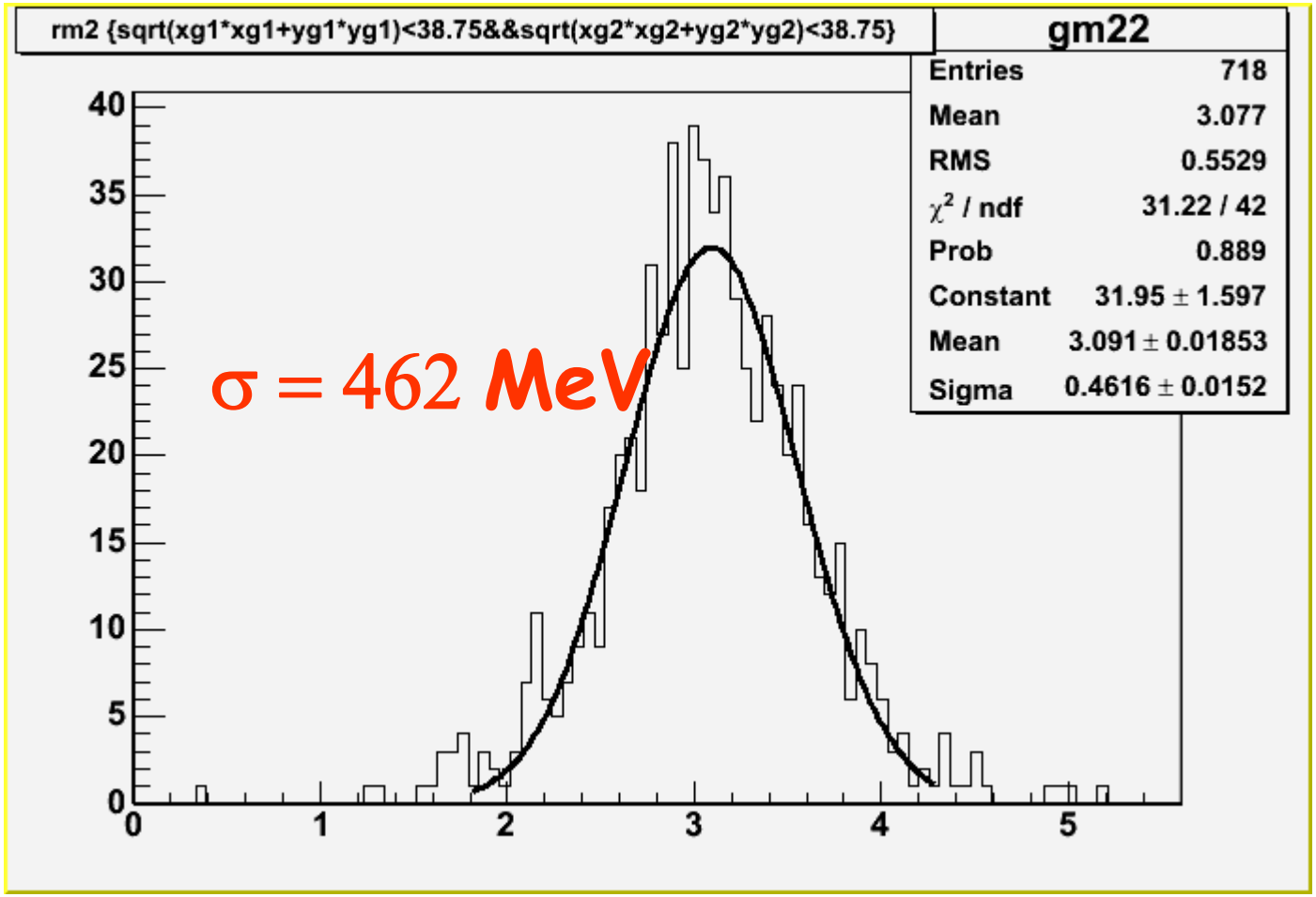
$J/\Psi \rightarrow e^+e^-$ in NCC



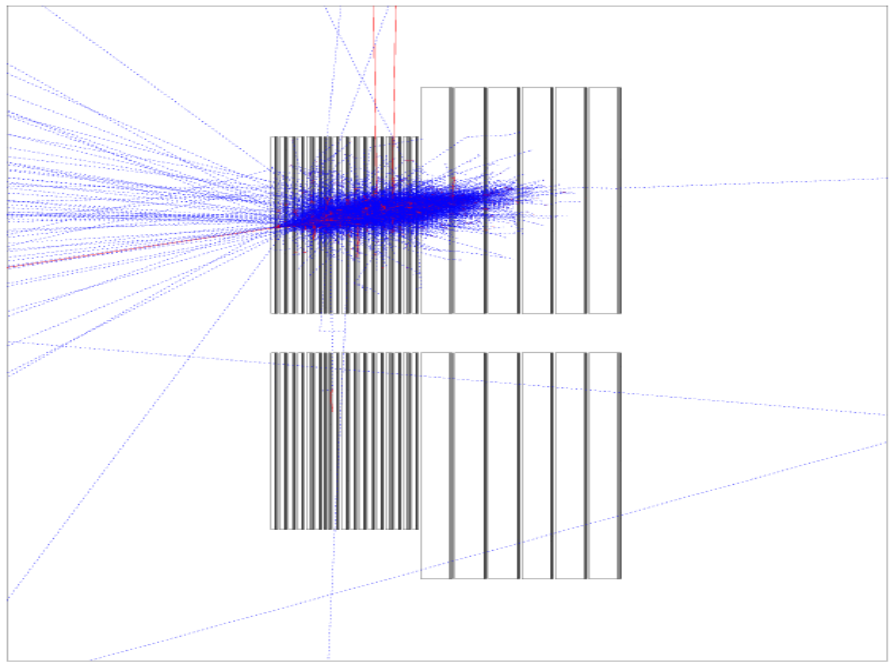
Coordinate resolution for J/Ψ–>e^+e^-



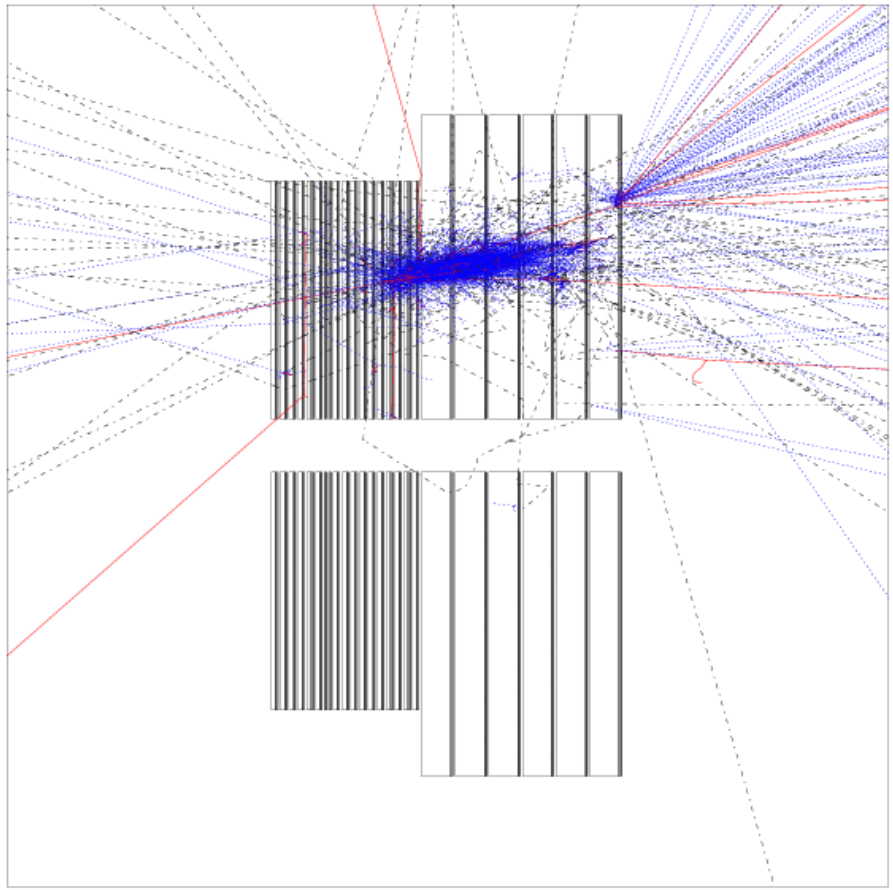
J/Ψ–>e^+e^- mass spectrum



40 GeV electron display



40 GeV pion display



Summary

- Geant3 based NCC simulation code was developed
- NCC resolution ~ (20-23)%/$E^{1/2}$ obtained
- Written a simple cluster searching and reconstruction code, allowing energy reconstruction in NCC
- Coordinate resolution of the γ detector < 1 mm
- J/Ψ-> ee decay and reconstruction by the NCC was performed. 72% of events were reconstructed: σ = **462 MeV**
- **Code will be included in PISA**

J/Ψ->$\mu^+\mu^-$ Mass spectrum