CERN Gamma Test Beam Simulation Studies

- Estimation of the γ statistics
- Alignment considerations
- Summary

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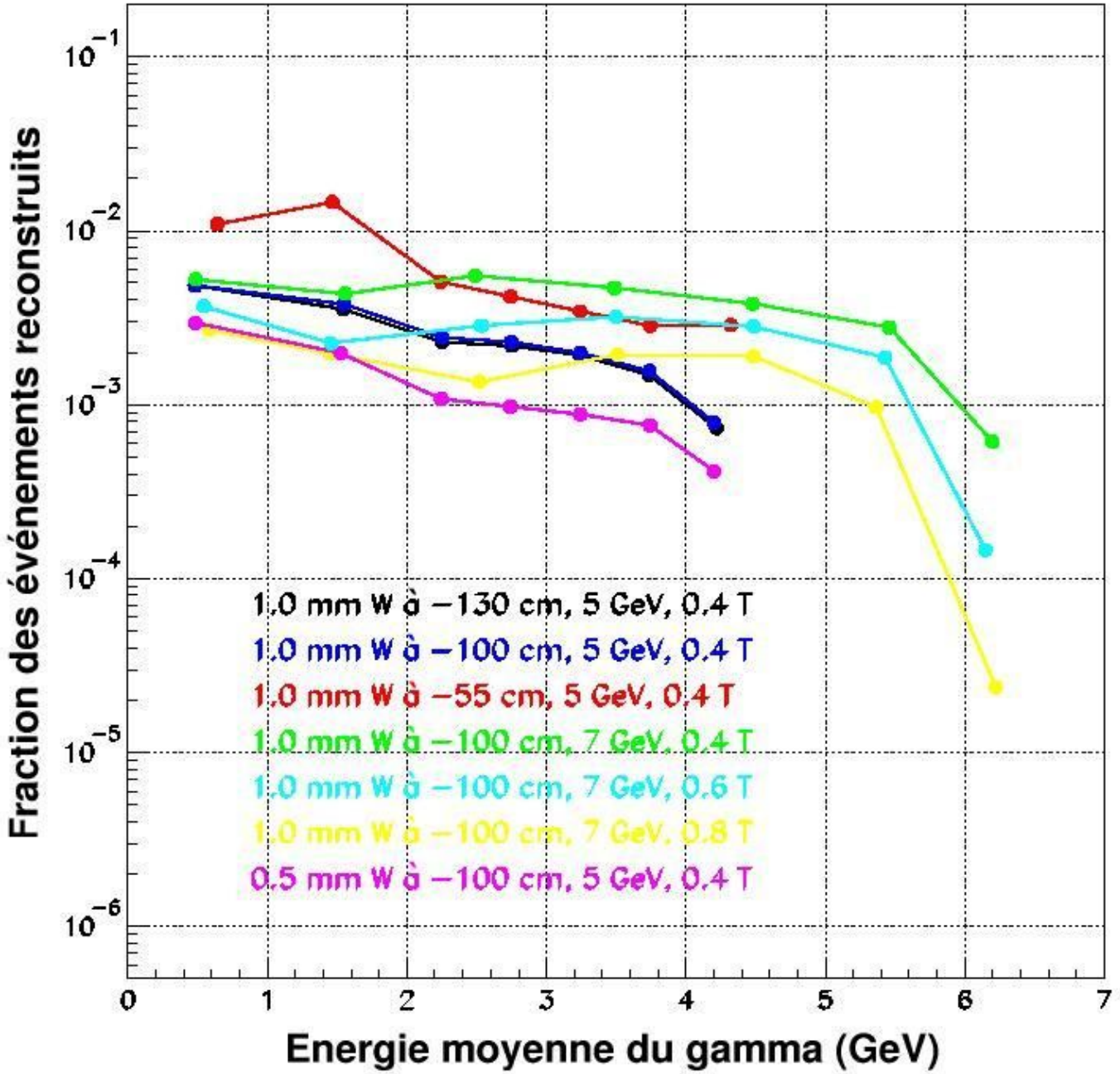
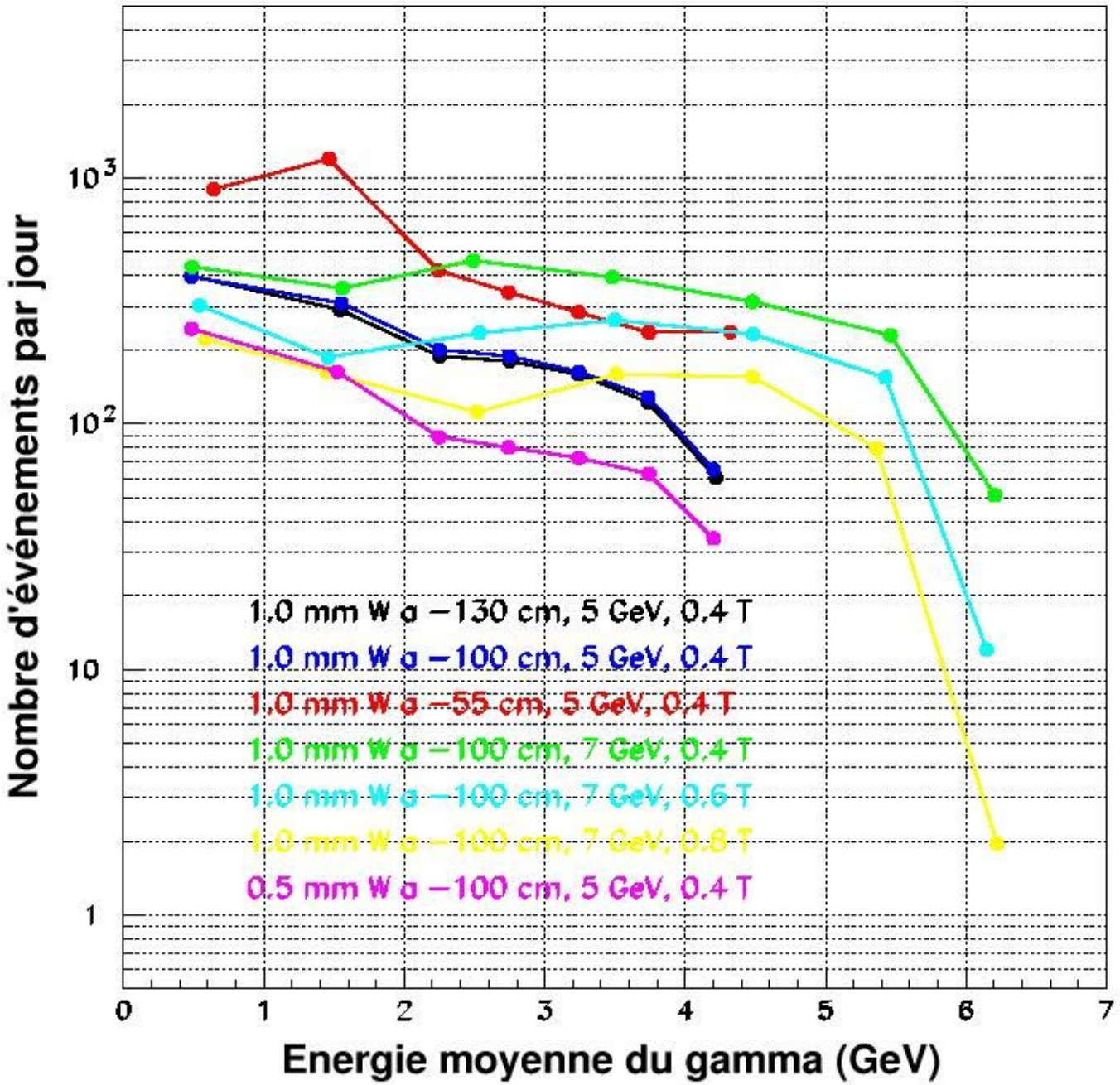
Statistics Estimate

- For 24 hr measurement period
- 1(2) spills per 16.8 s “supercycle”
- Spill length 400 ms
- Maxium particle rate *in silicon* 1 kHz
- Electron composition of beam 5 %
- Cherenkov efficiency 80 %

$\Rightarrow$ 82 285 e^- / 24 h

- Simulated γ detection acceptance


Fraction des événements reconstruits
Energie moyenne du gamma (GeV)
1.0 mm W à −130 cm, 5 GeV, 0.4 T
1.0 mm W à −100 cm, 5 GeV, 0.4 T
1.0 mm W à −55 cm, 5 GeV, 0.4 T
1.0 mm W à −100 cm, 7 GeV, 0.4 T
1.0 mm W à −100 cm, 7 GeV, 0.6 T
1.0 mm W à −100 cm, 7 GeV, 0.8 T
0.5 mm W à −100 cm, 5 GeV, 0.4 T


Nombre d'événements par jour
10^3
10^2
10
1
0
1
2
3
4
5
6
7
Energie moyenne du gamma (GeV)
1.0 mm W a −130 cm, 5 GeV, 0.4 T
1.0 mm W a −100 cm, 5 GeV, 0.4 T
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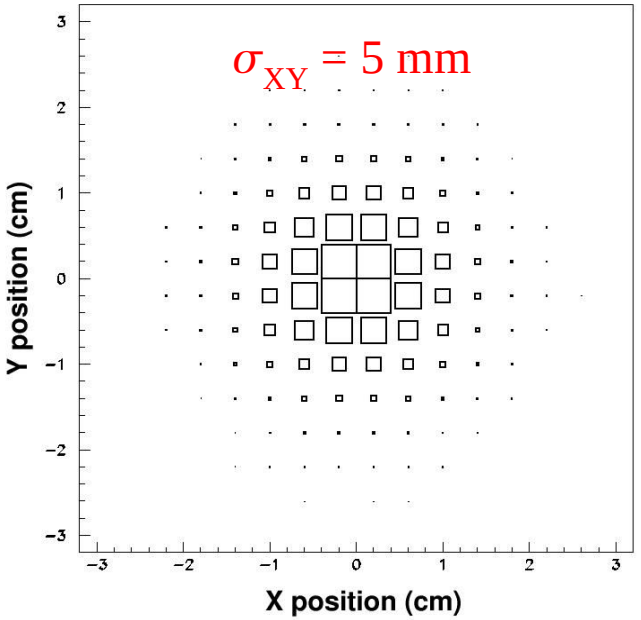
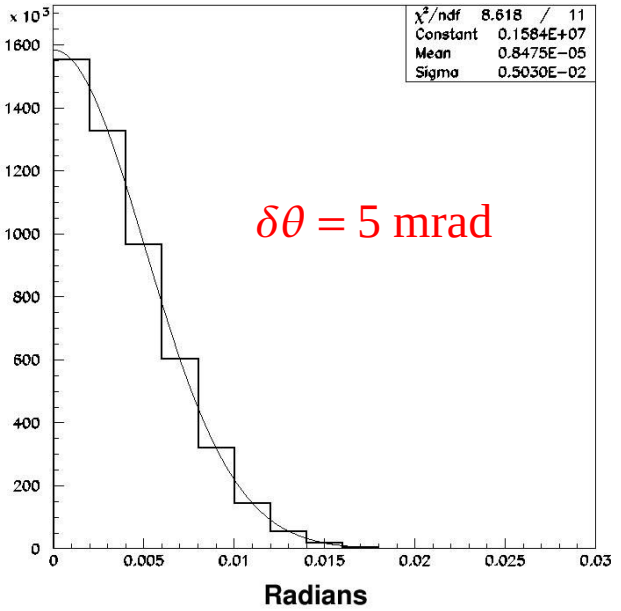
1.0 mm W a −100 cm, 7 GeV, 0.4 T
1.0 mm W a −100 cm, 7 GeV, 0.6 T
1.0 mm W a −100 cm, 7 GeV, 0.8 T
0.5 mm W a −100 cm, 5 GeV, 0.4 T

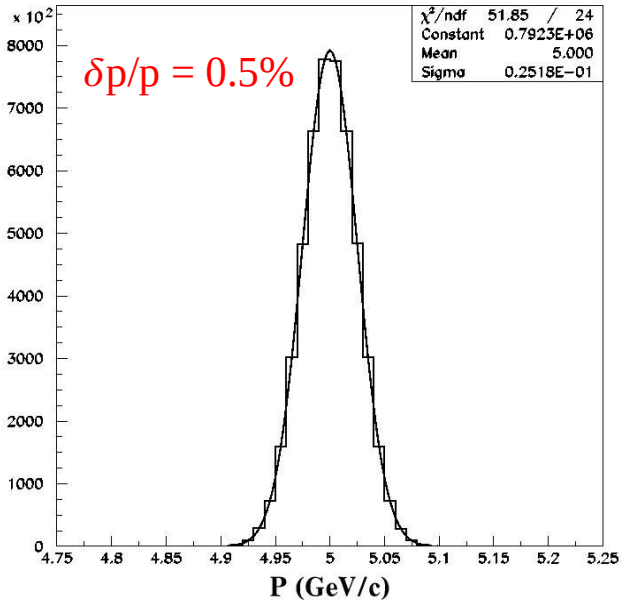
Alignment Study

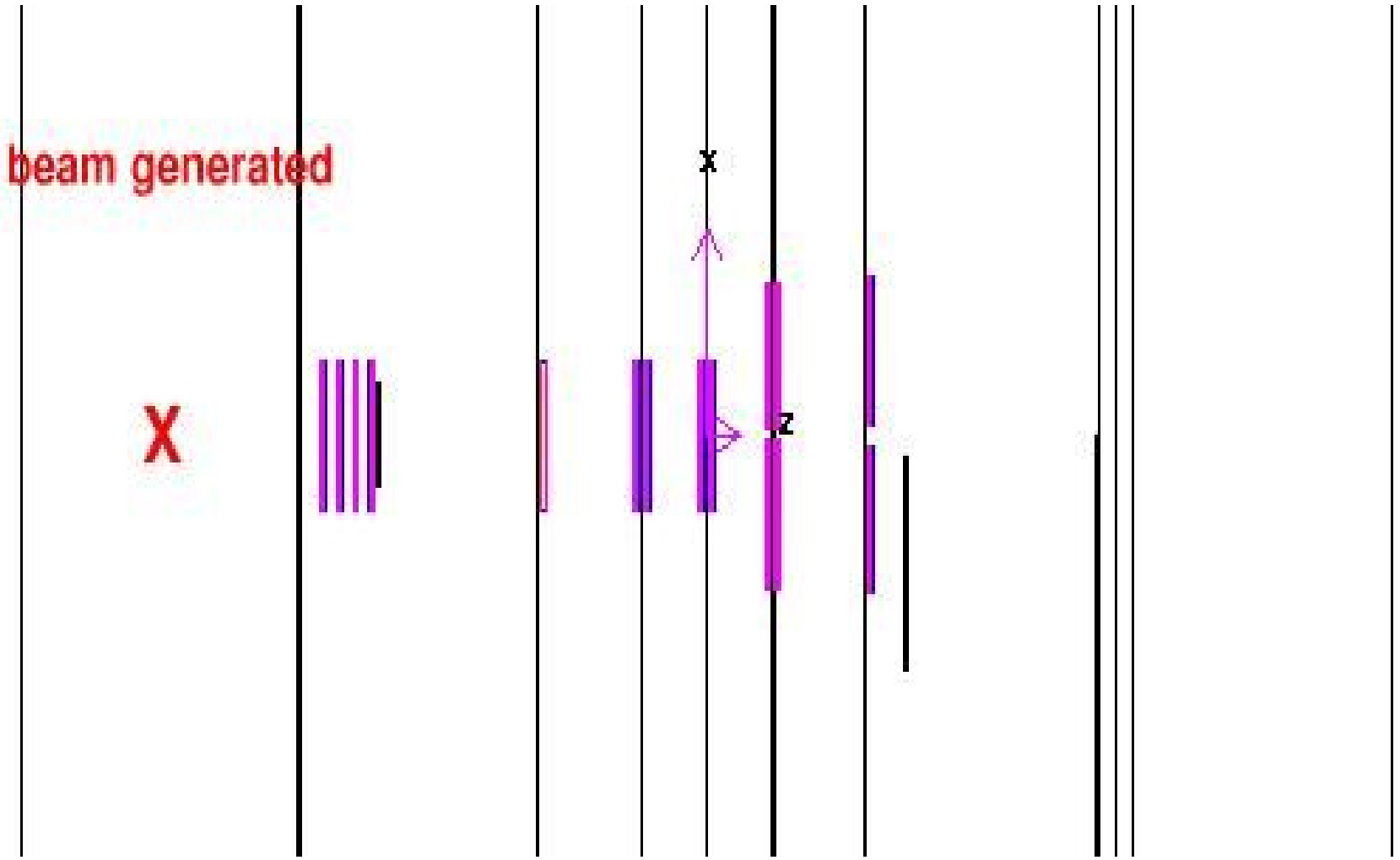
- 11 ladder configuration in magnet
  ladders in layers 6 and 7 separated by 5 mm in X,
  ladders in layer 8 by 10 mm in X
- Without magnetic field
- With/without radiator
- e^-, π^- beam
- Beam distributions generated at -160 cm from magnet center
- Results obtained with 5×10^4 particles, 7 GeV/c beam
- Compare alignment event distributions with distributions of recontsructed γ events for 7 GeV/c *"standard"* configuration (1 mm W radiator, 0.4 T field, ...)

Beam Smearing

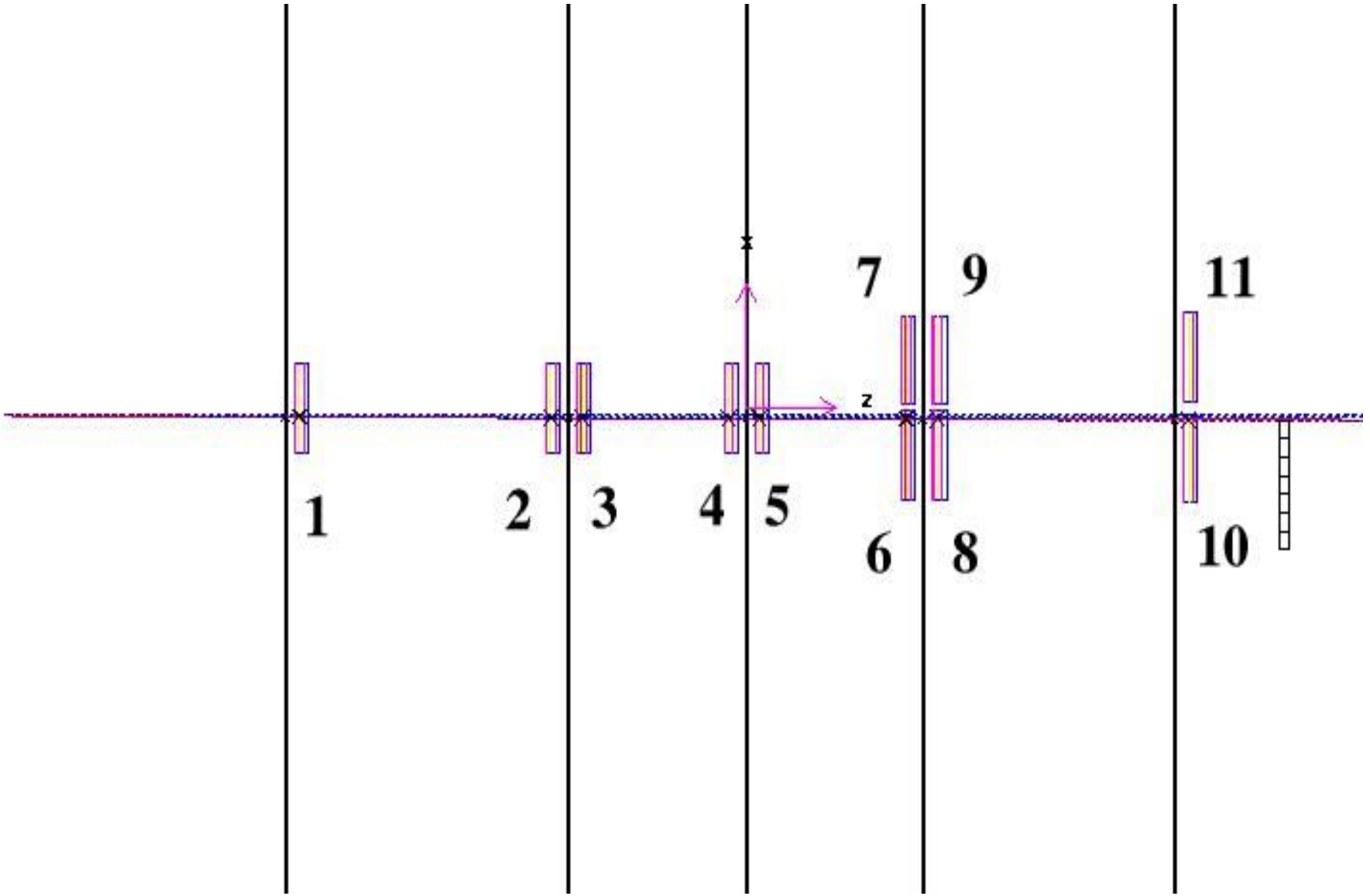




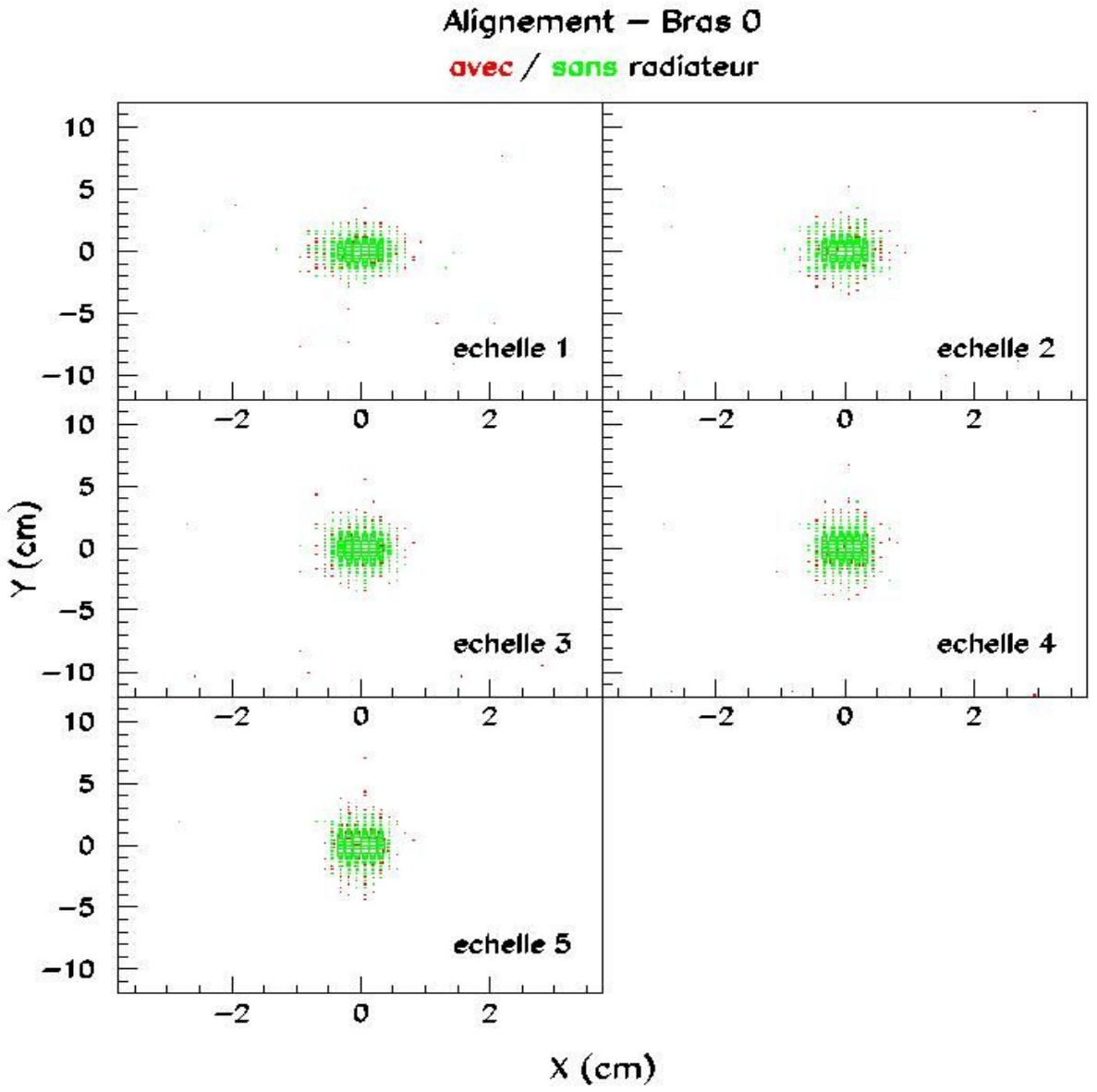



beam generated
X
x
z

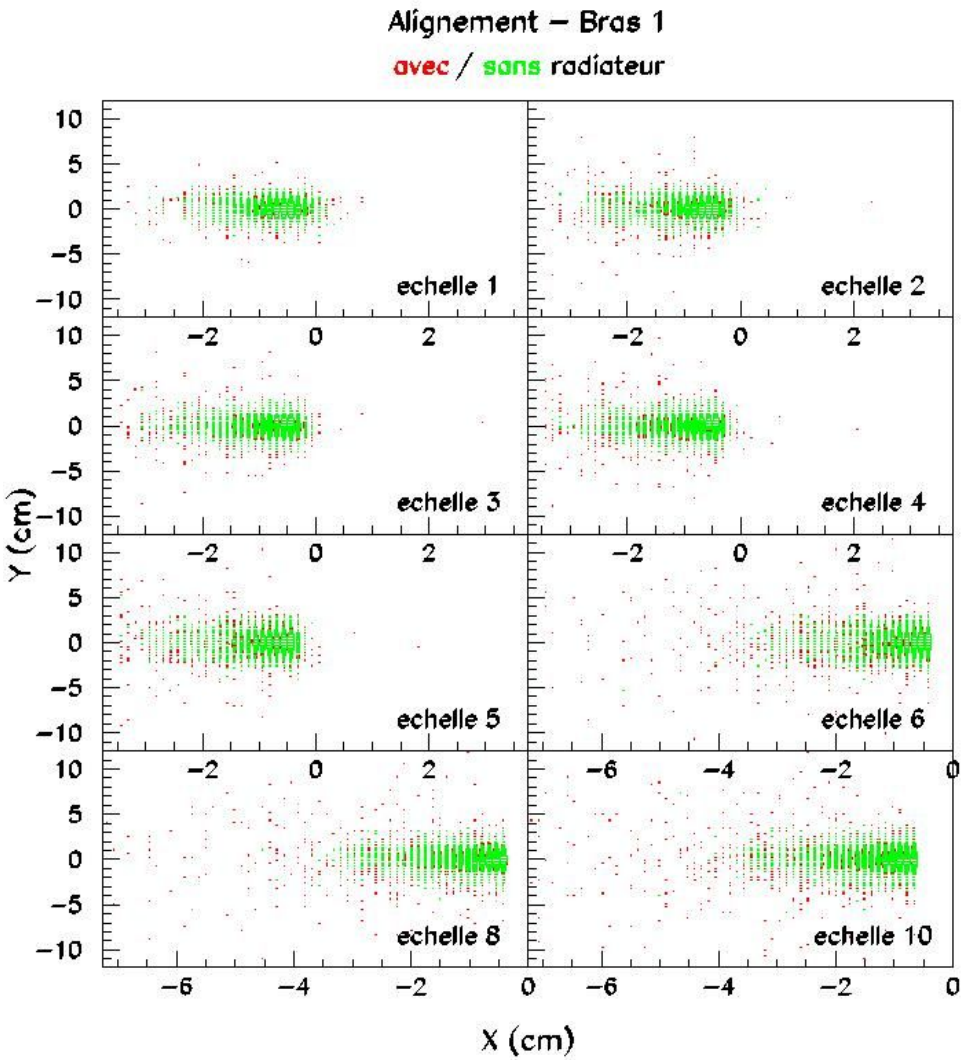
Alignment Event

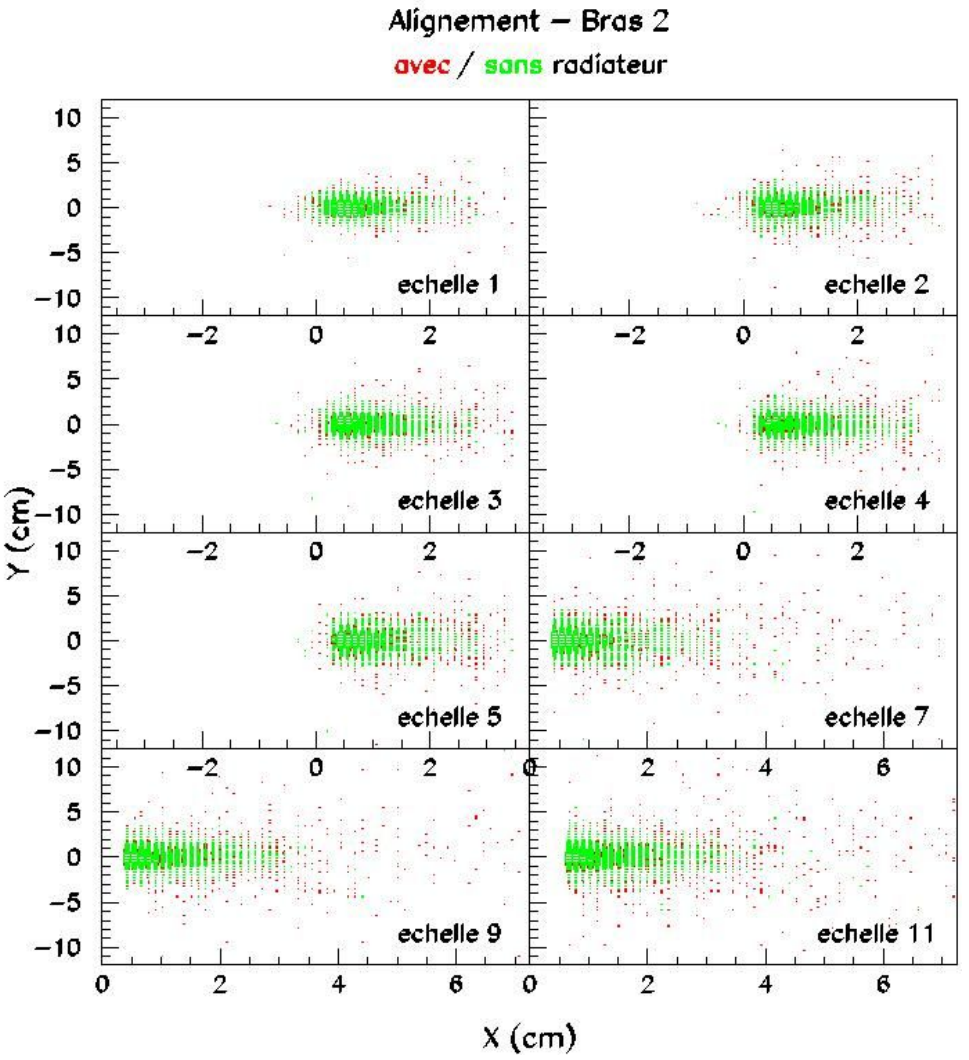


5 Ladder Alignment Events

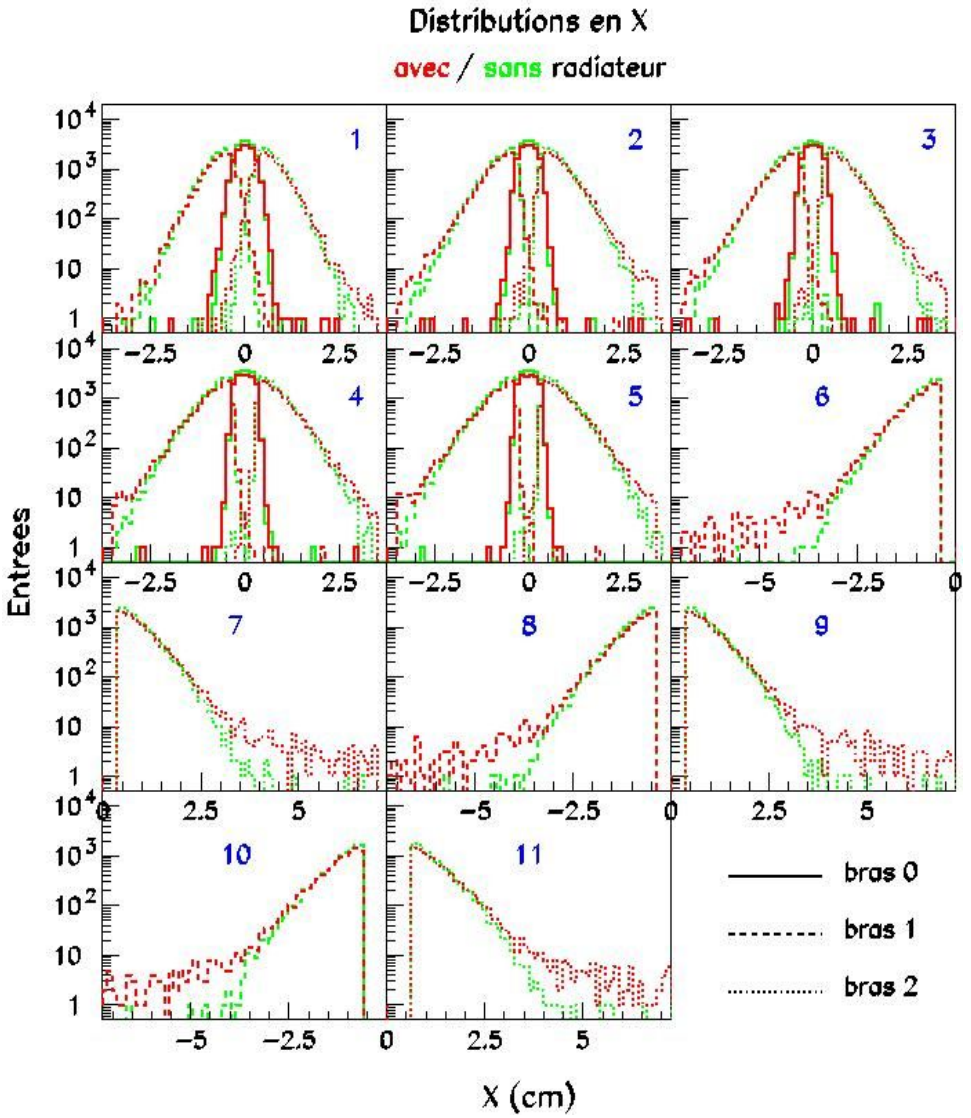


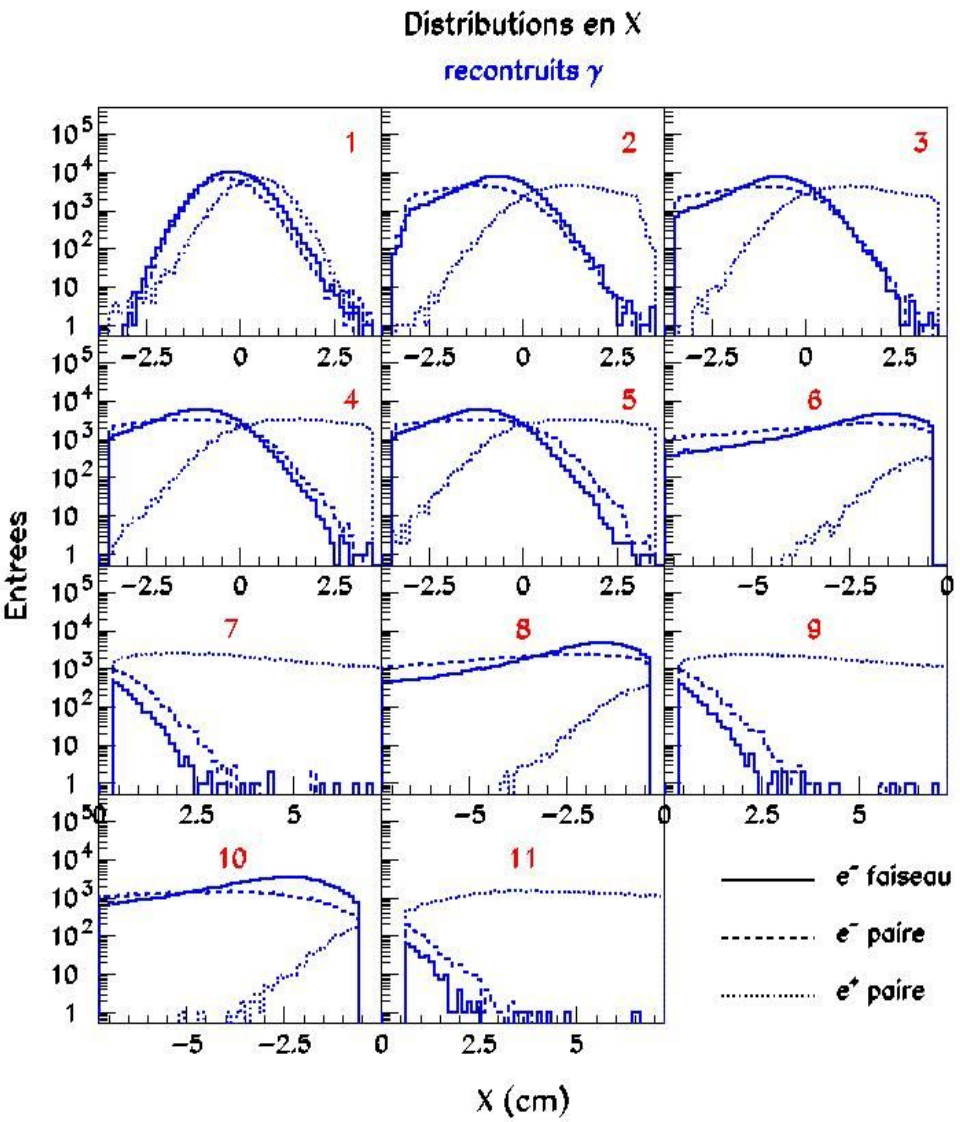
8 Ladder Alignment Events



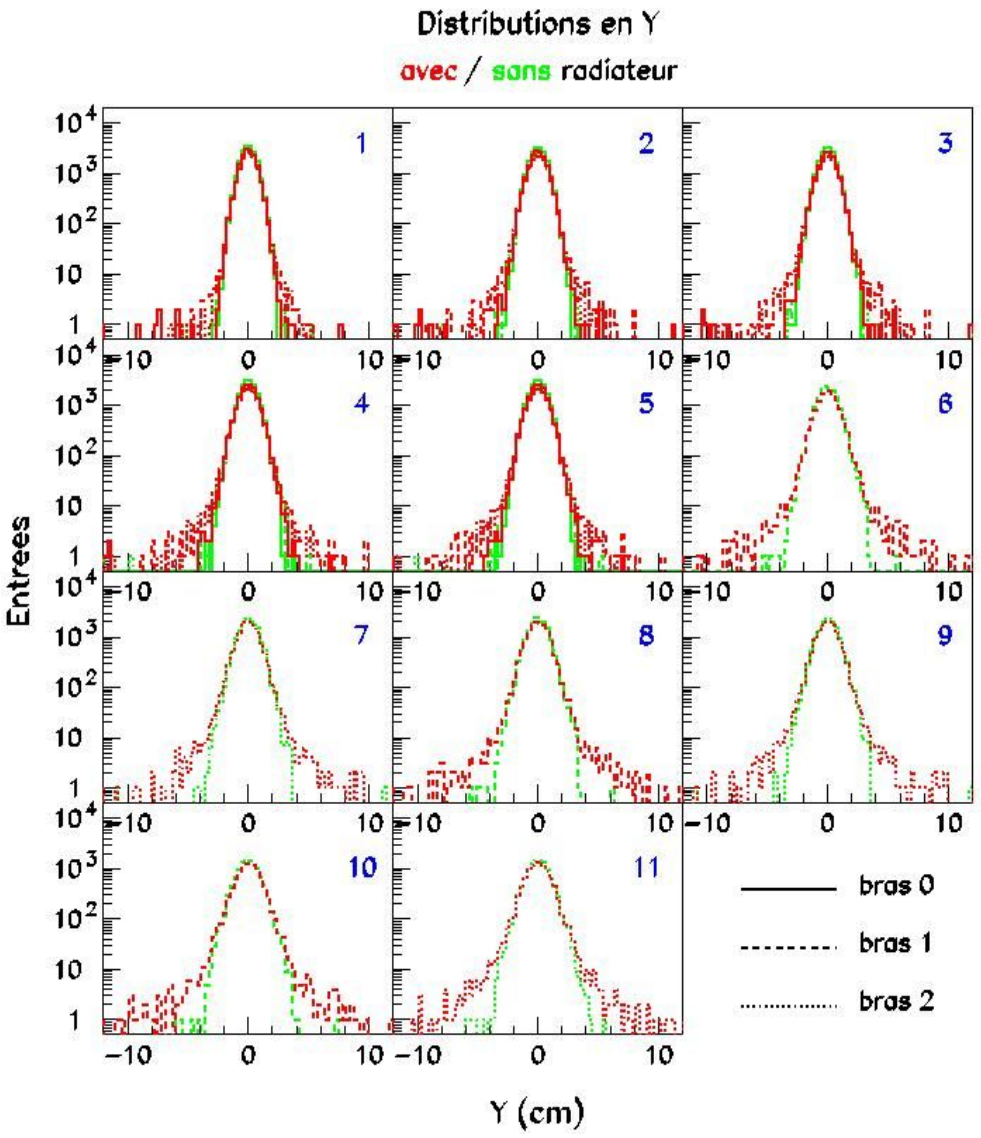


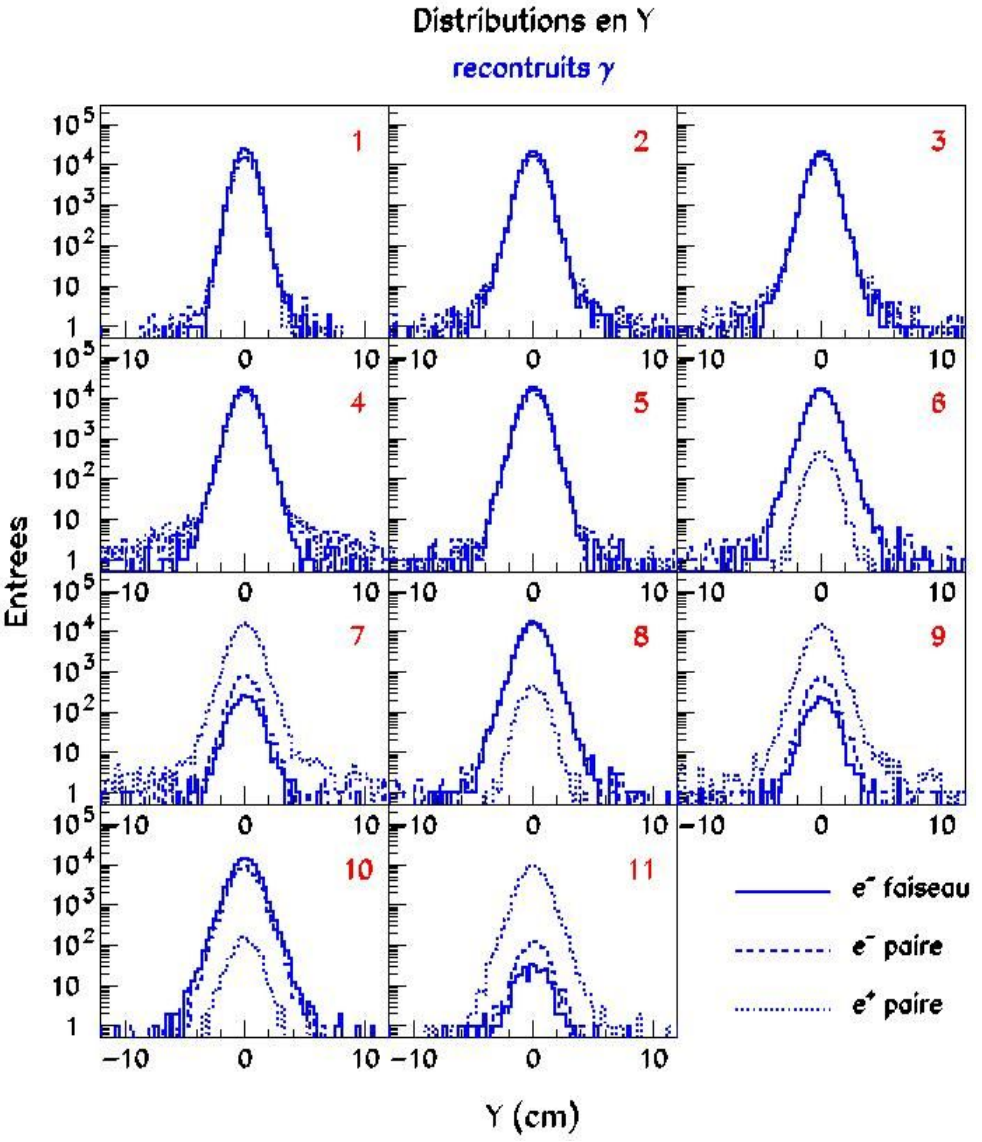
Alignment *versus* γ event distributions (X)



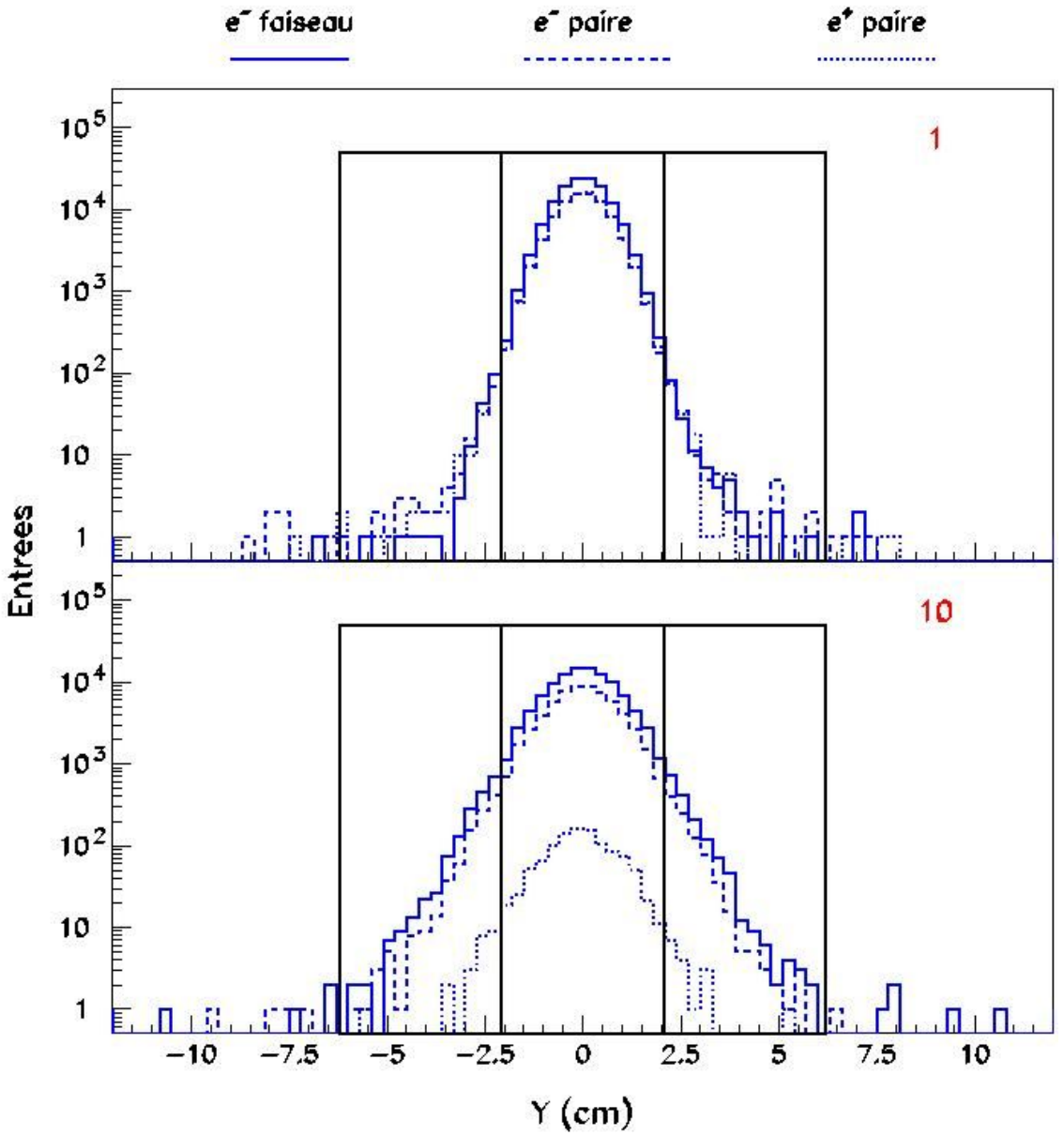


Alignment *versus* γ event distributions (Y)



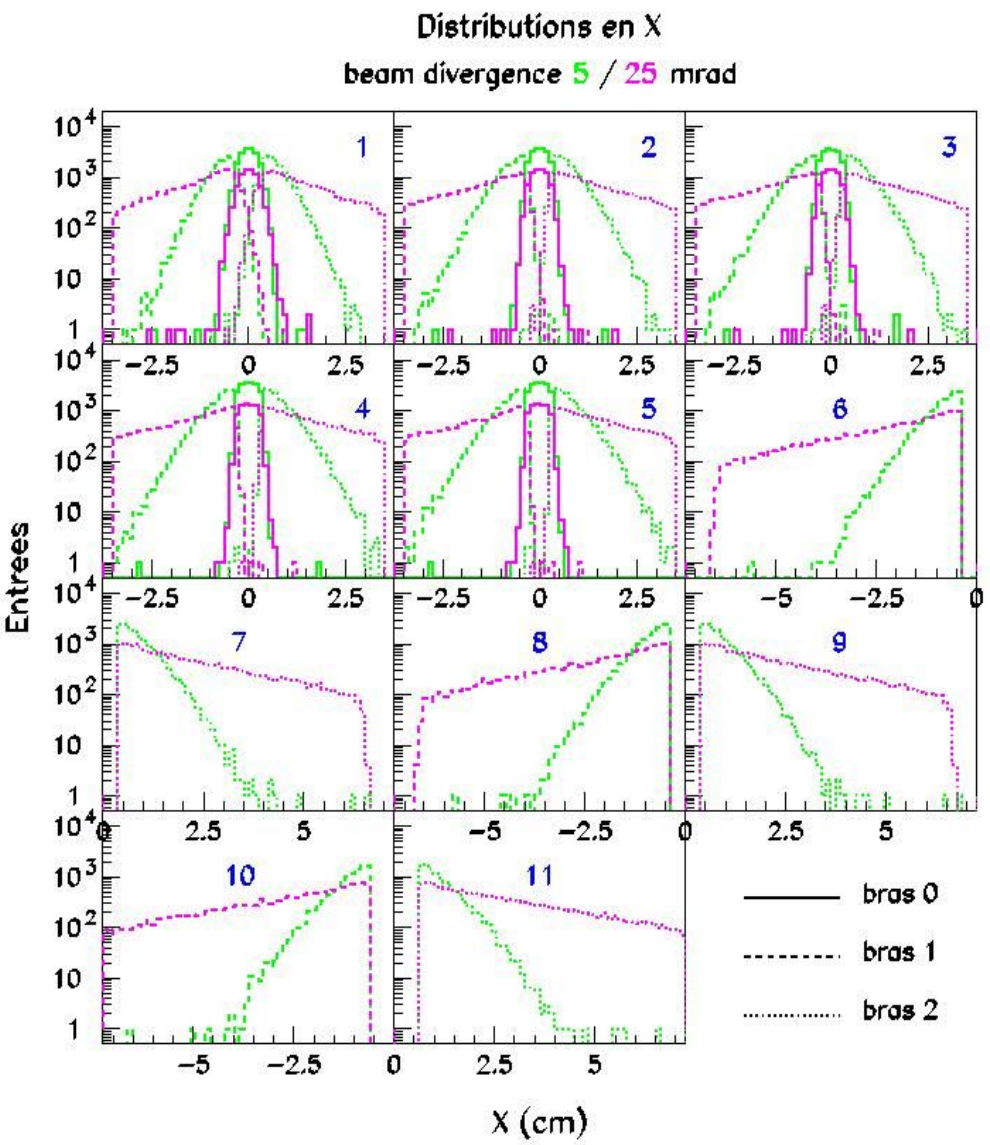


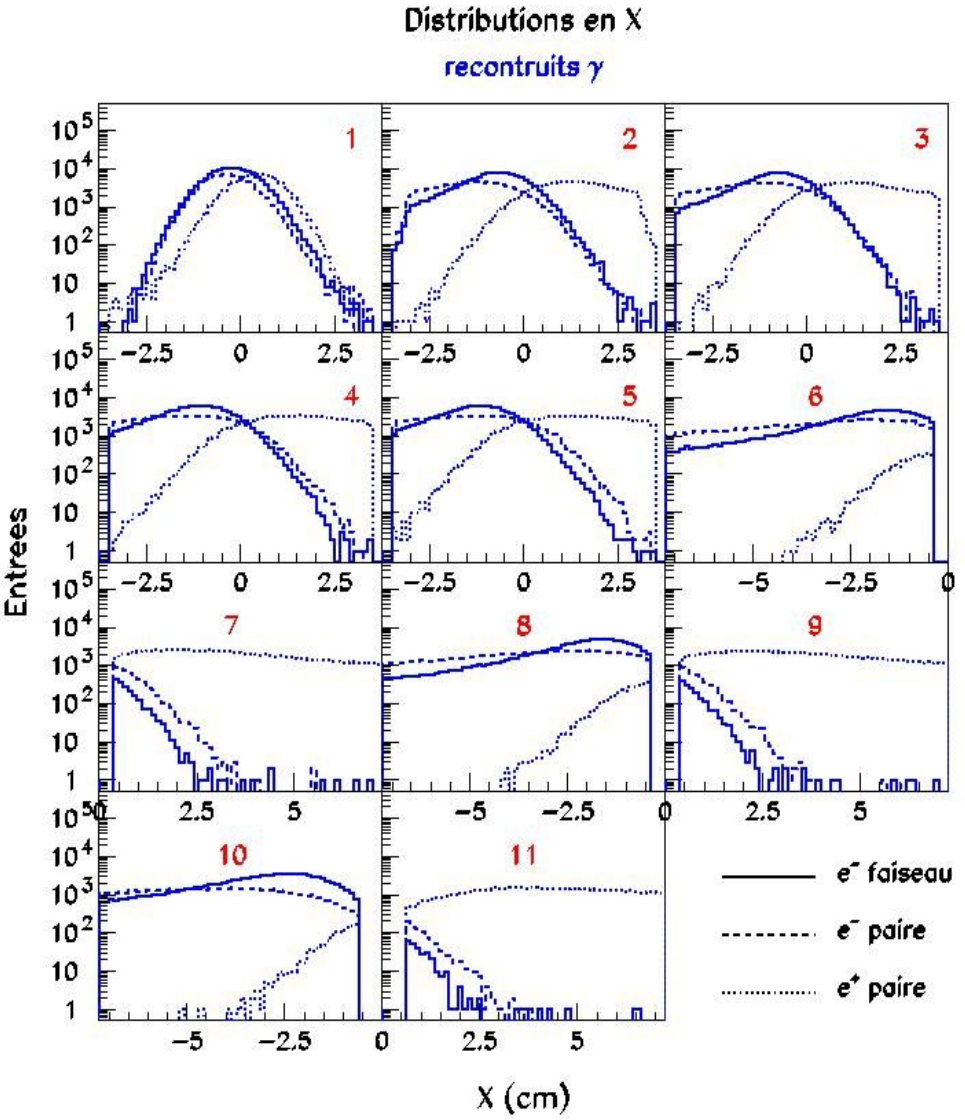
Distributions (Y) at Ladders 1 and 10



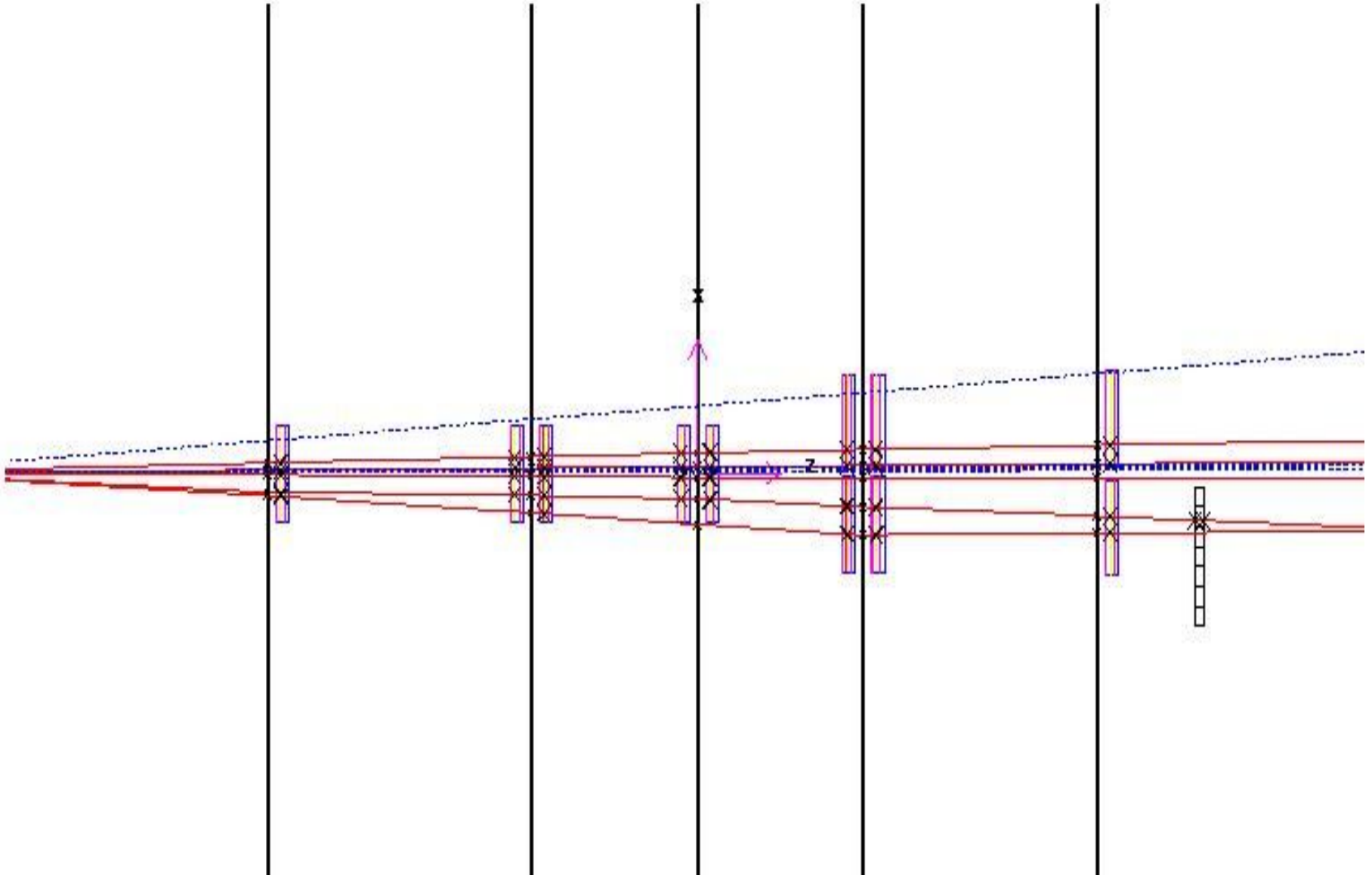
Alignment *versus* γ event distributions (X)

defocused beam $\delta\theta$ = 25 mrad

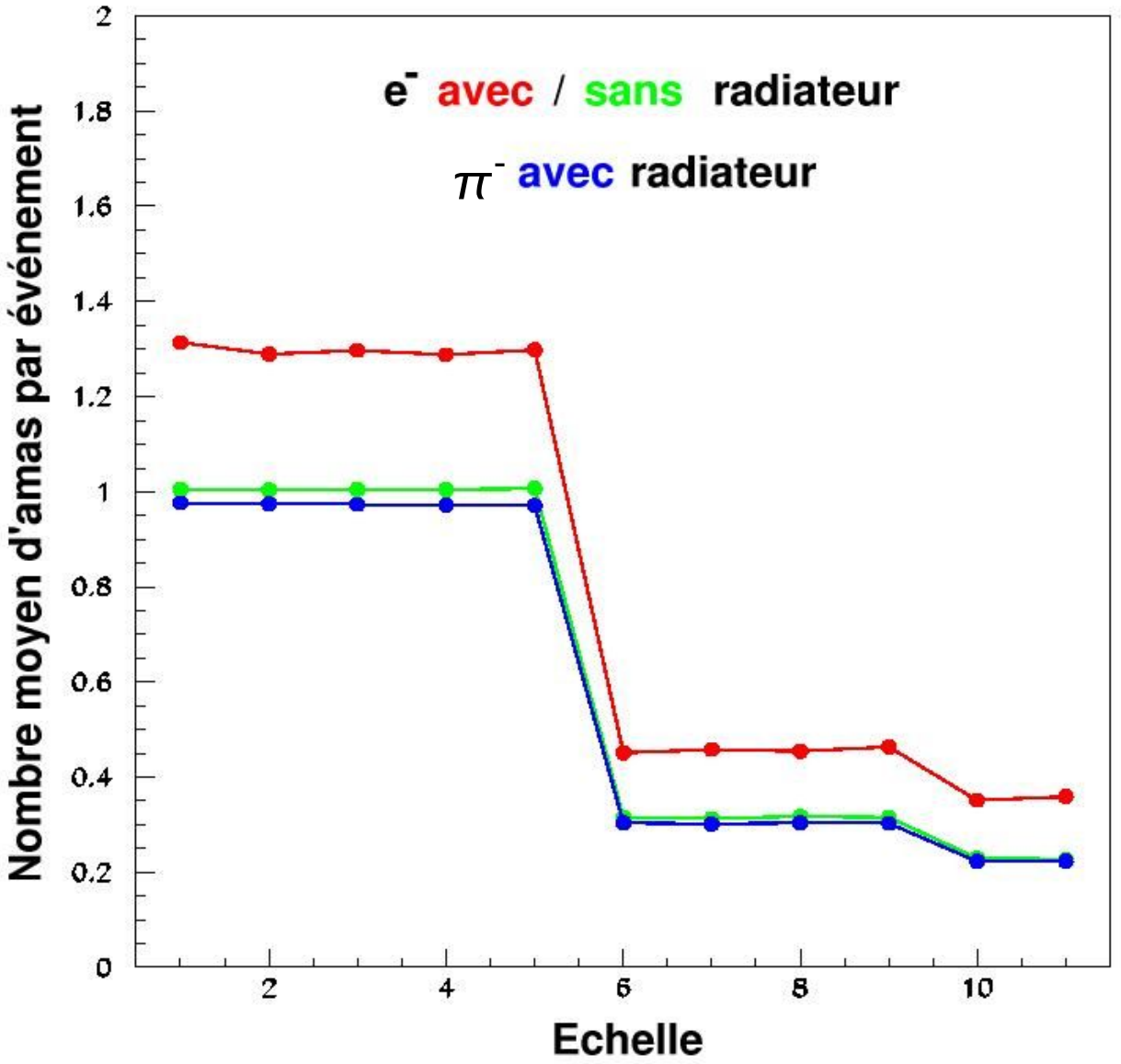




Correlated Alignment Event



Alignment Configurations



Summary

- Estimated statistics for *"standard"* configurations:
  ~14 500 γ's between 2-6 GeV with 7 GeV/c e^-
  ~7 500 γ's between 2-4 GeV with 5 GeV/c e^-
  (corresponding in each case to 240 h of data)

- A possible scenario for alignment (*magnet off*, *radiator in place*):
  1) π^- *"defocused"* beam
  2) e^- *"standard"* beam (correlation data)
  (presented simulation distributions represent the results for 50 000 e^-, or ~15 h of data)

- Low intensity running (< 1 kHz), how?
  If obtained with "defocused" beam, may have an appreciable impact on γ statistics (~ 30 %).