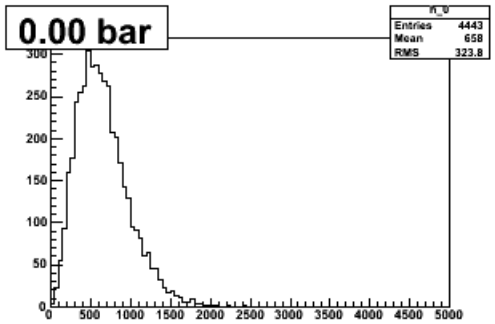
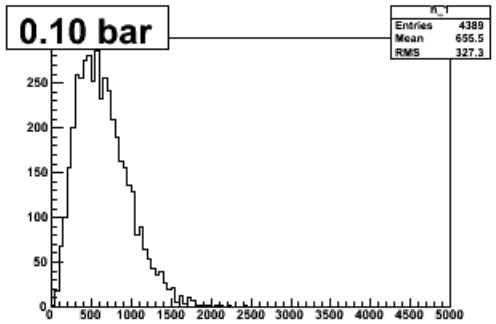
Data/MC energy discrepancy and scaling factor and extra material

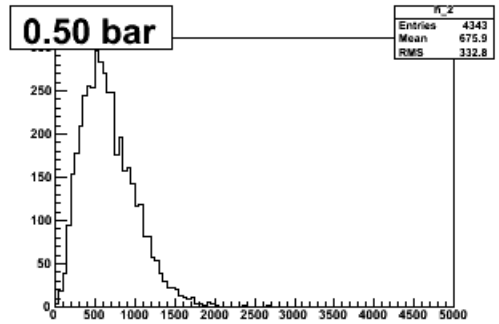
Extra material along the beamline

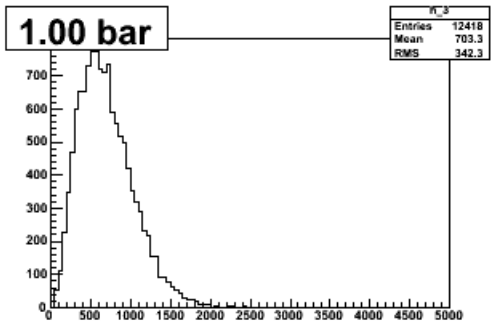
- The idea is not new :
  - but adding extra material along the beam line could not solve the problem since data/MC is always greater than 1 (should be less than 1 after the shower maximum)
  - the only solution was to apply a global scaling factor AND look for some extra material. But this solution was not studied.
- Retriggered by :
  - CALICE people telling Berrie that they need 0.1 X0 to get agreement (running at H6 at the same time we were running at H4)
  - Johan had simulations with 0bar and 1bar in the Cherekov
- Idea : using the pressure in the Cherenkov to look at the effect of extra material along the beamline
- Johan produced a lot of pressure scans (Thanks !!!)
  - 10 GeV (0,30deg)
  - 50 GeV (0,10,20,30deg)
  - 100 geV (0,30deg)

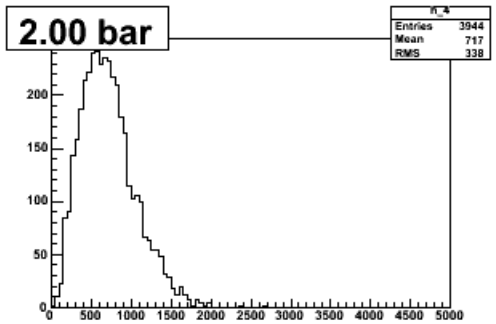
100 GeV 0 deg layer 0

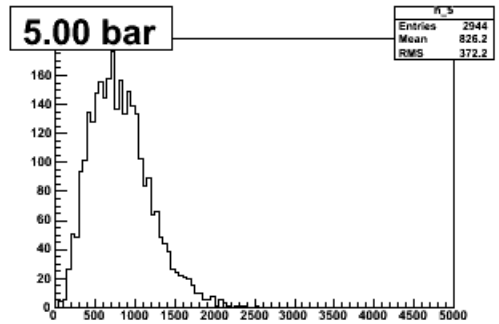


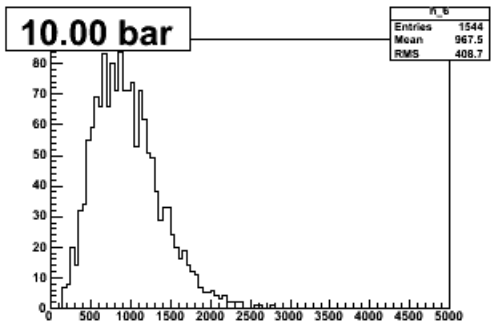


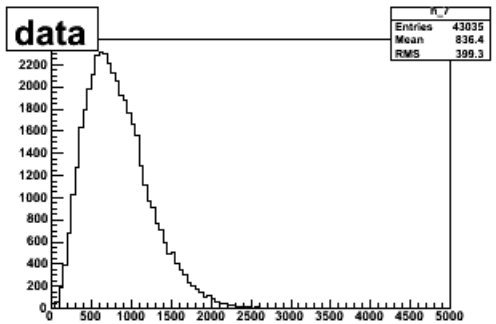


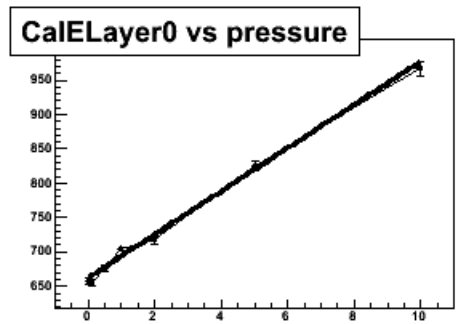




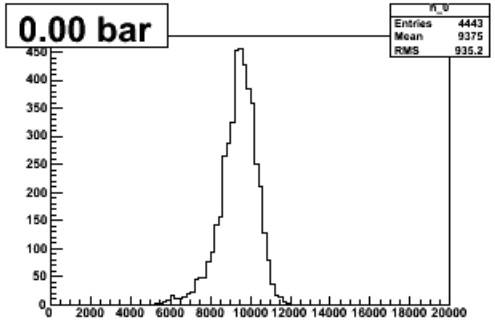


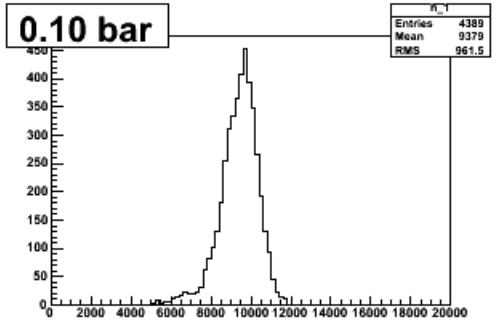


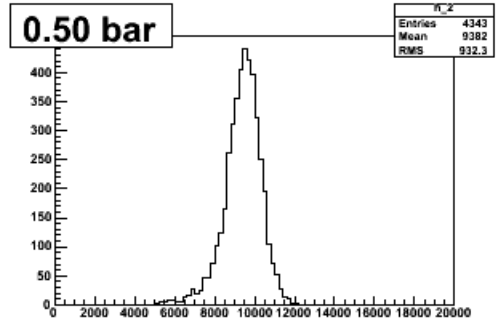


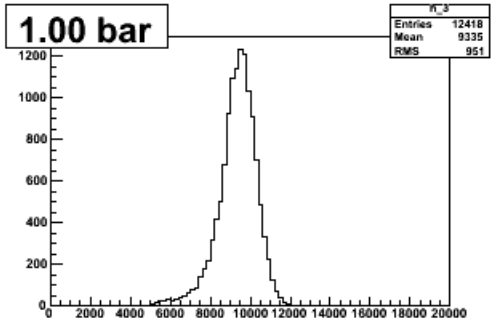


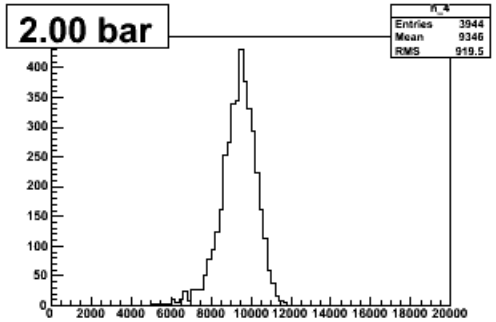
100 GeV 0 deg layer 7

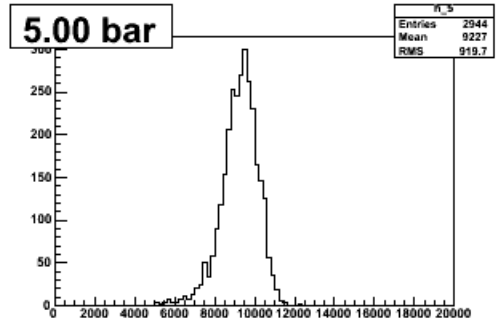


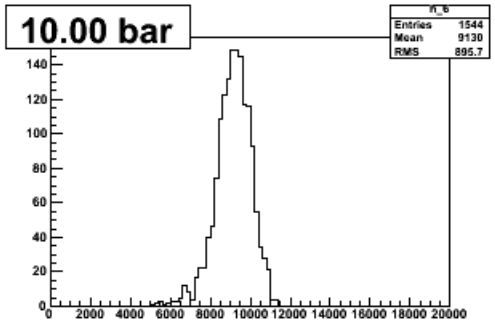


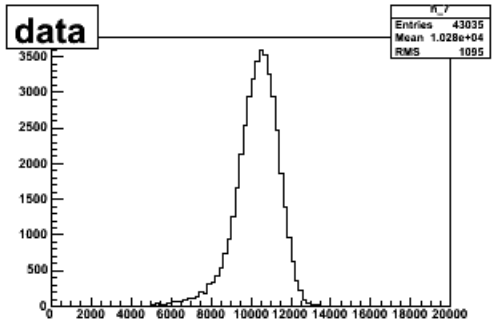


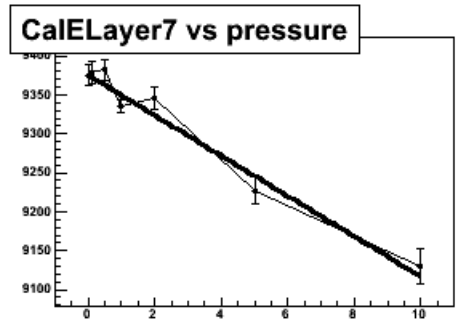








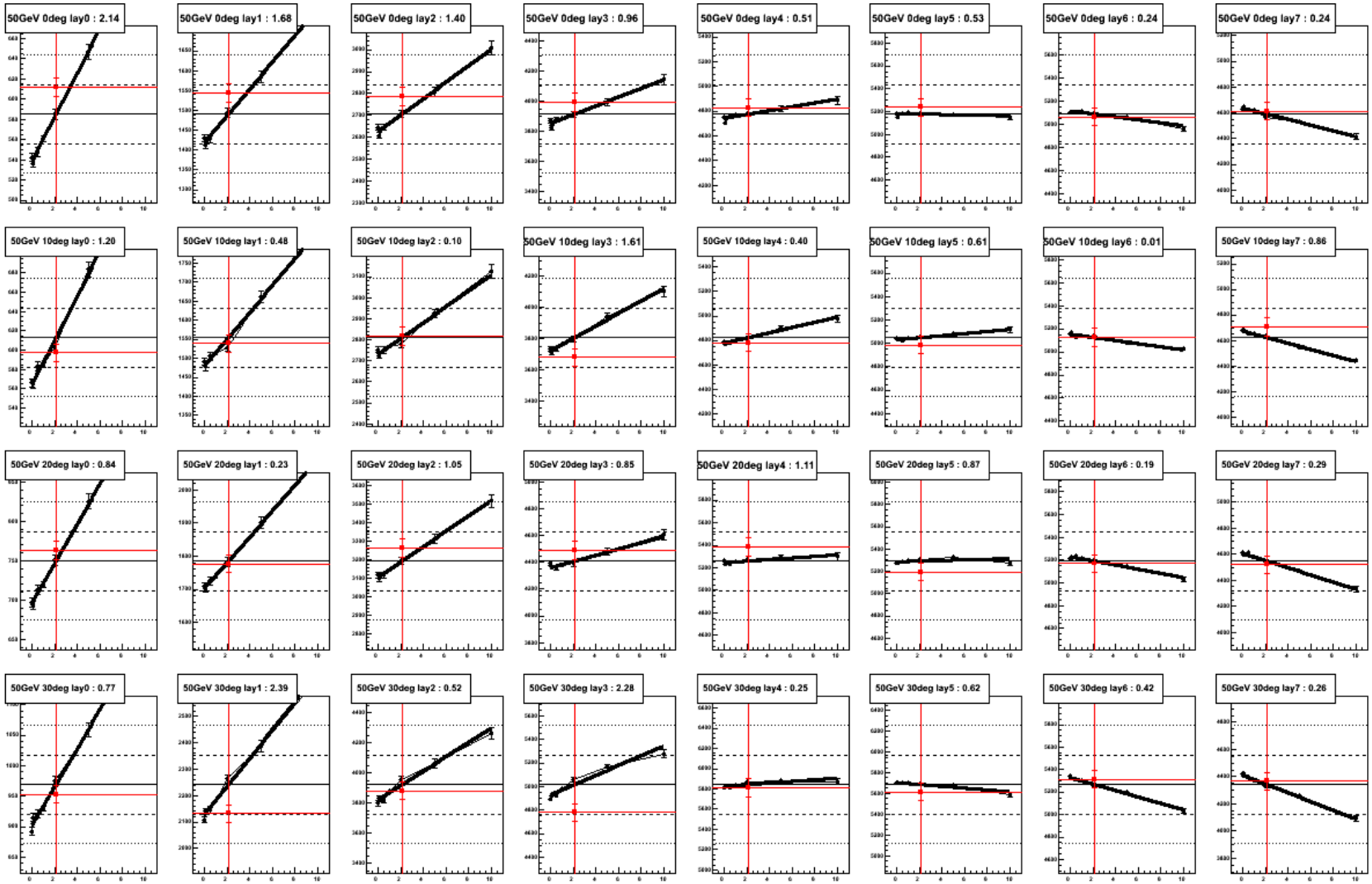




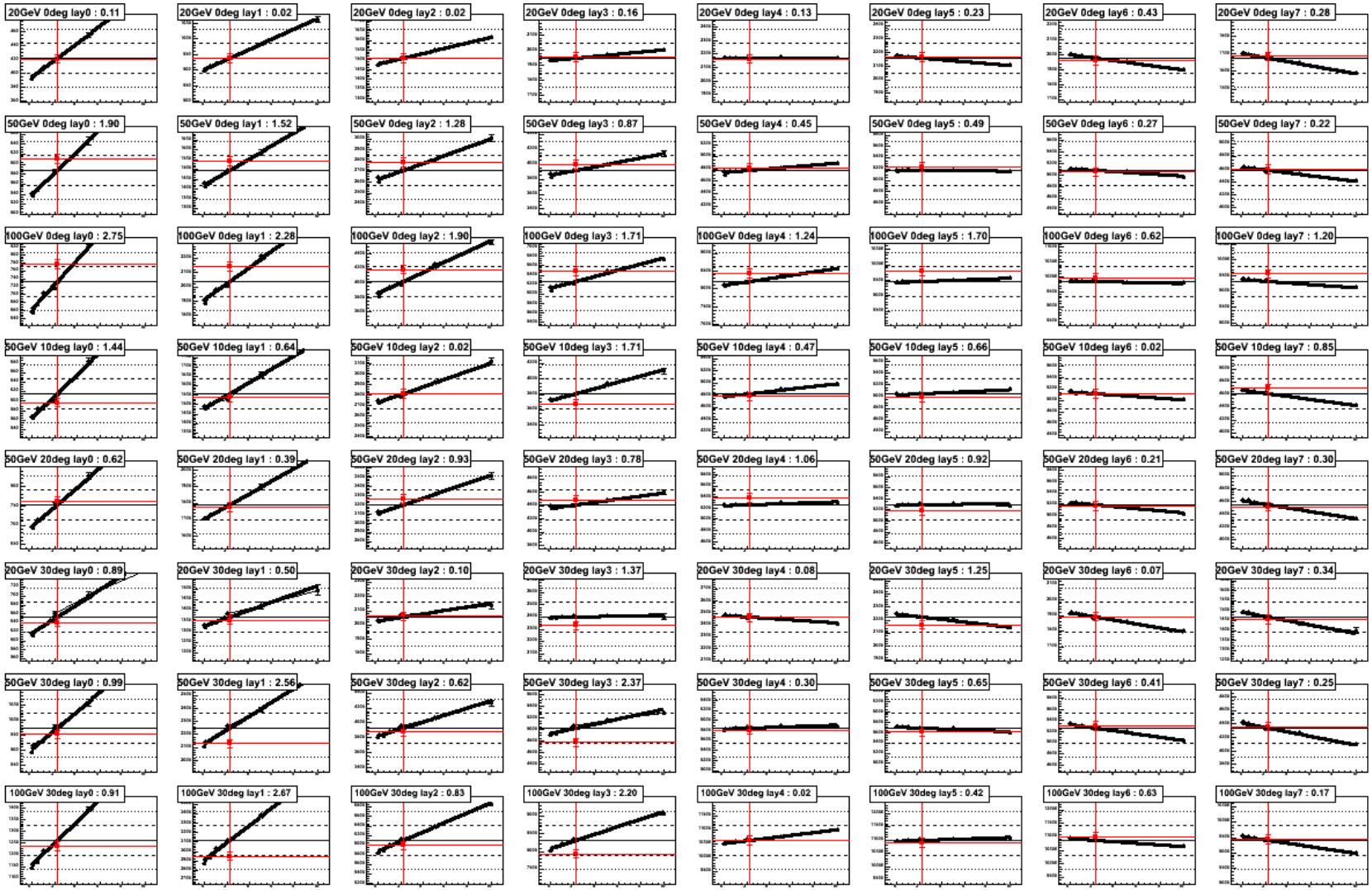
Using minuit to determine the scaling factor and the pressure

- Minimizing the sum of (a*Edata-Efit(pressure)) over all configs and layers
- Two parameters :
  - A global scaling factor for data
  - The Cherenkov pressure (1 bar corresponds very roughly to 0.1 X0)
- Errors :
  - I started with using the real errors but ended up with huge chisquares
  - So I chose 1.5% error for data and MC (~ setting the same weight to all configs and layers, and at least I get reasonable chisquares...)

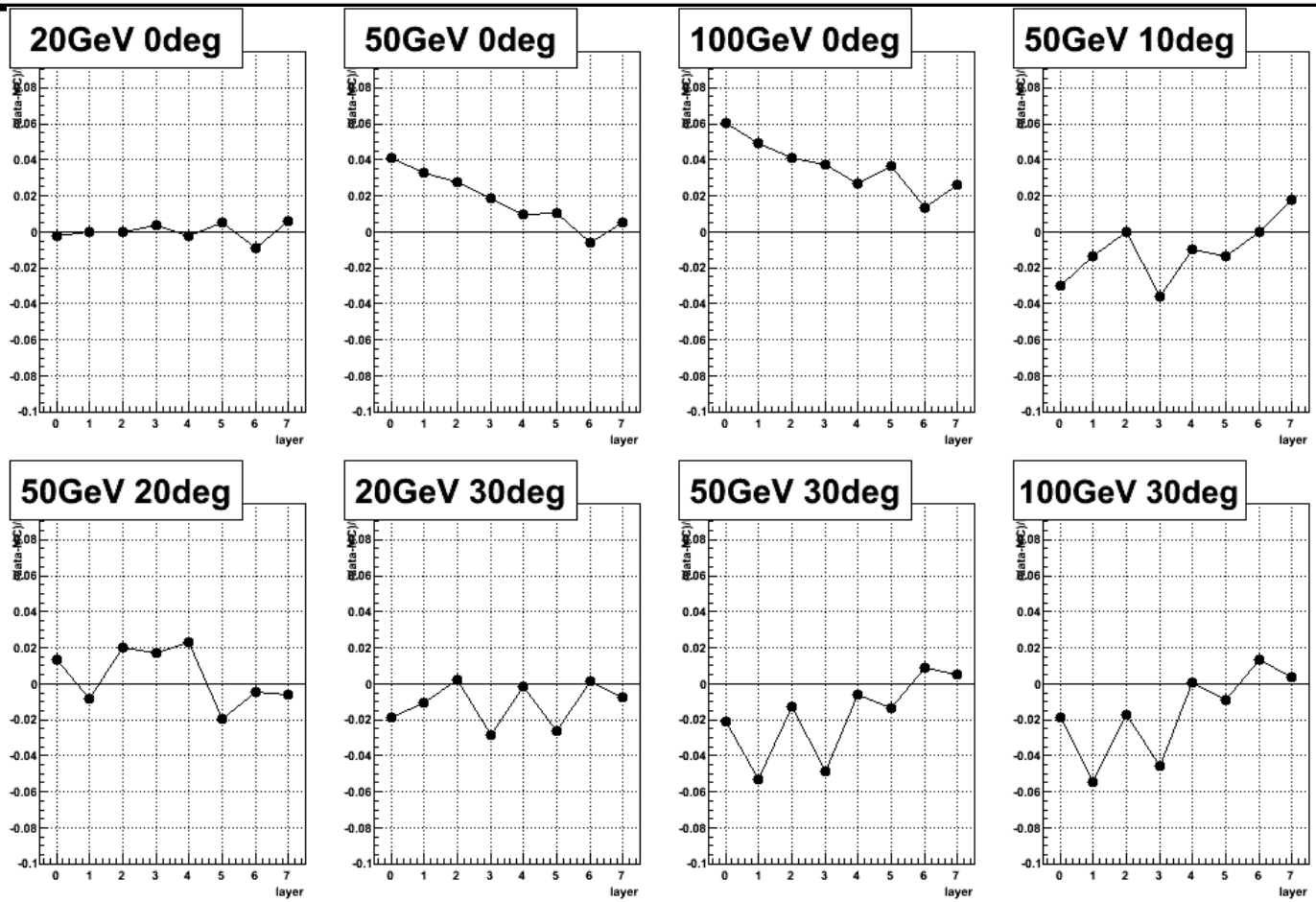
Only 50 GeV (0,10,20,30 deg)



All available configs : pressure = 2.25 +- 0.2, a = 0.93+-0.003

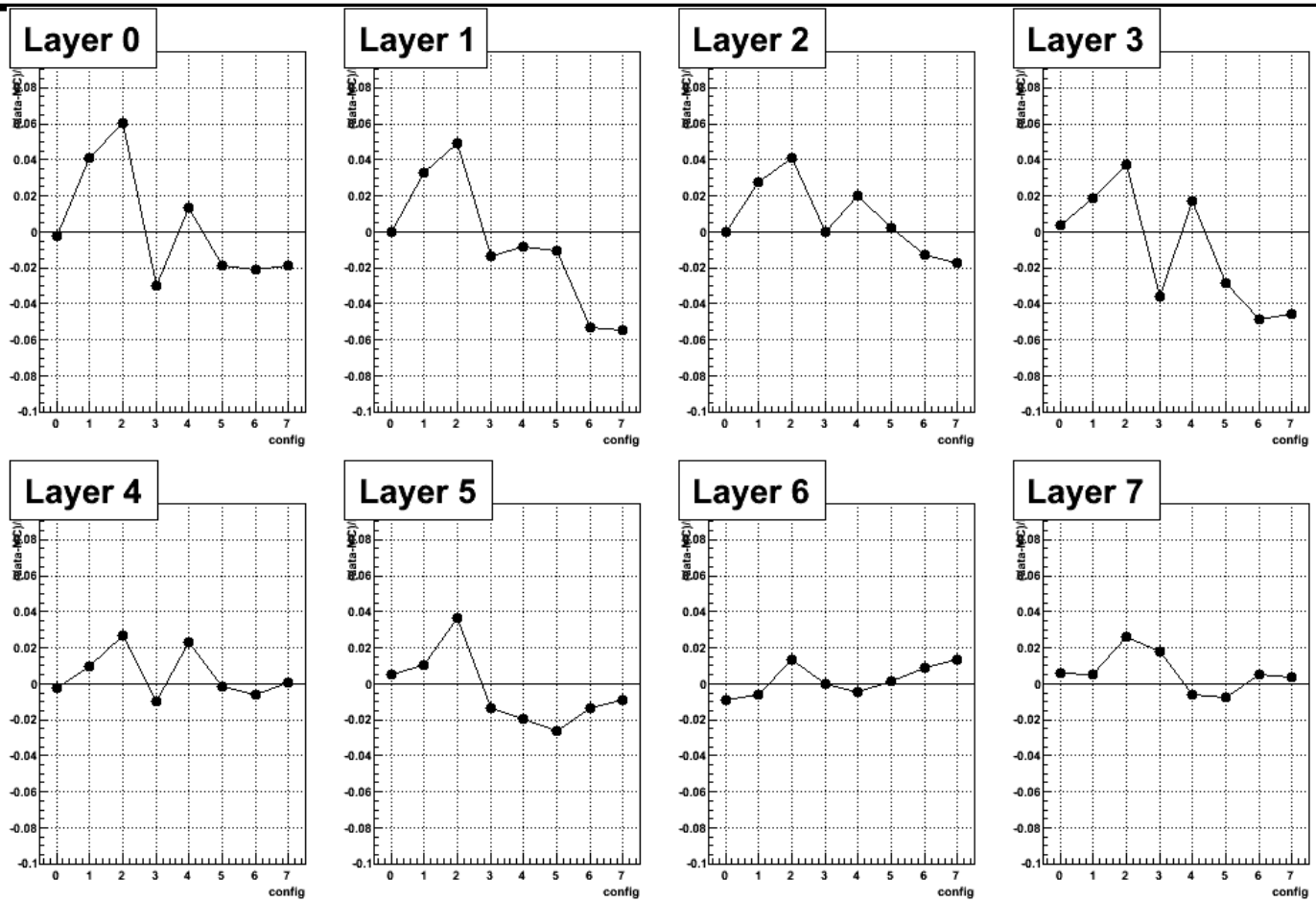


« Residuals » for each CONFIG as function of layers



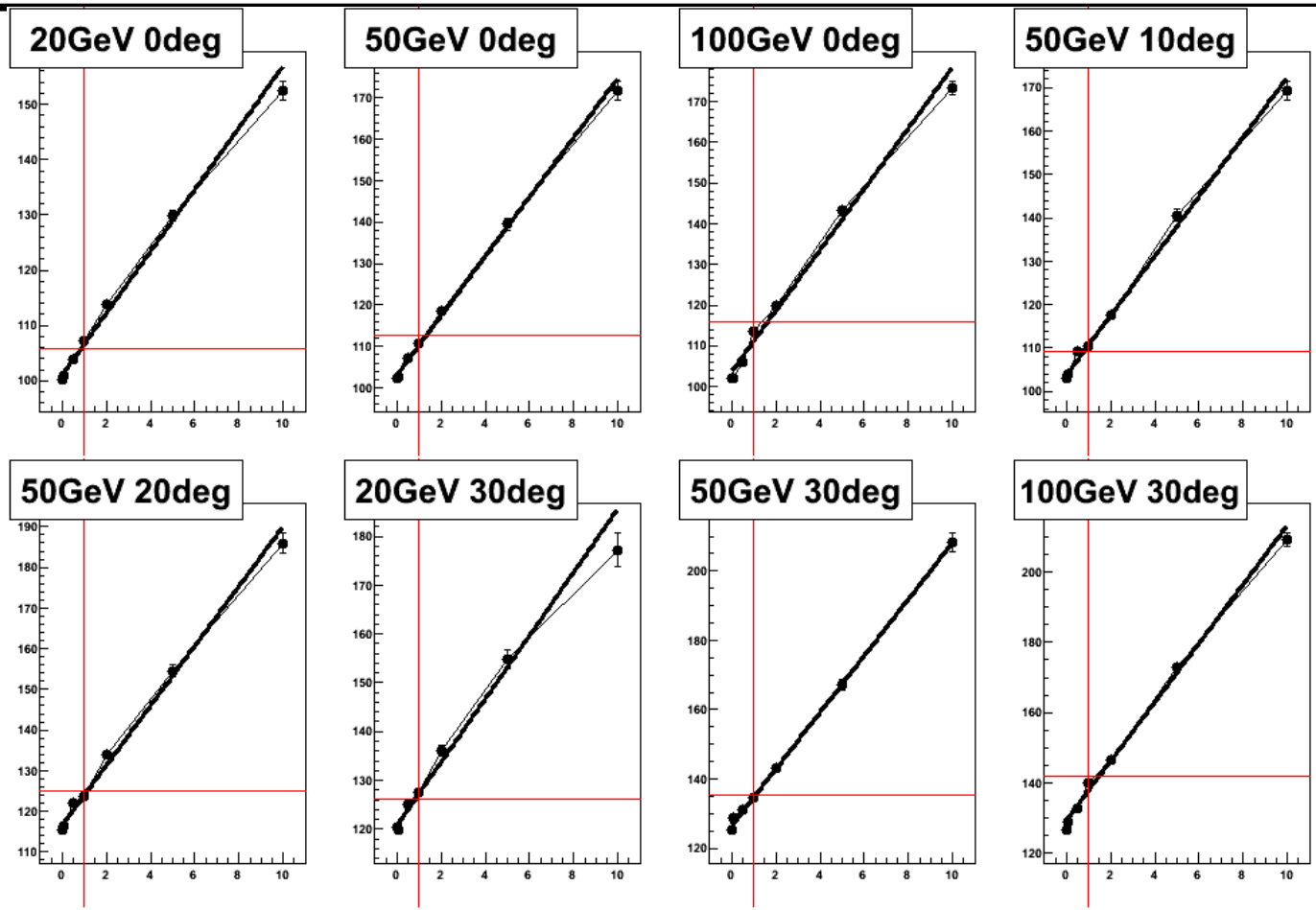
- ~>0 at 0 deg, ~<0 at 30 deg : incompatible with extra X0 along the beamline + extra X0 in the CU (which would be sensitive to theta)

« Residuals » for each LAYER as function of config



- >0 and <0 for each layer : rules out the possibility to have one scaling factor per layer (which would have been hard to justify…)

TkrTotalHits is fine with 1bar



- Mean TkrTotalHits as function of pressure (MC black). Horizontal red line gives mean value for data. Vertical red line = 1 bar.

Conclusions

- I have also tried a scaling factor = a+bE+cE*E. But it does not help.
- Adding ~1.2 bar (~~~ 0.1X0) helps but not so much (maximum discrepancy : 12 to 6%)
- Interesting to look at 200 and 280 GeV
- Problem : TkrTotalHits and CalTransRms varies with the pressure and 2.2 bars is not a good solution…
  - TkrTotalHits : 1 bar seems ok (no more discrepancy ???)
  - CalTransRms : would require >10 bars…