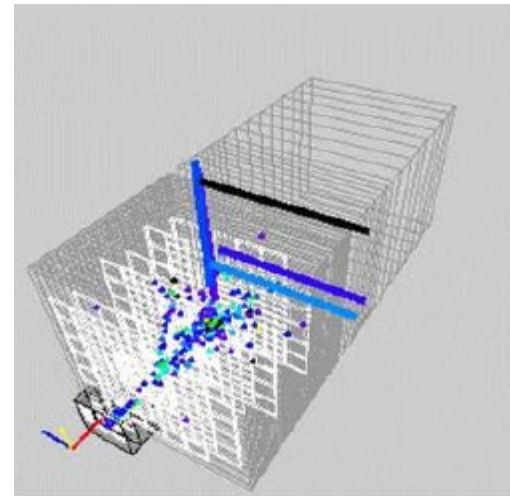




Analysis of electromagnetic showers in CALICE Analog Hadron Calorimeter prototype (AHCAL)

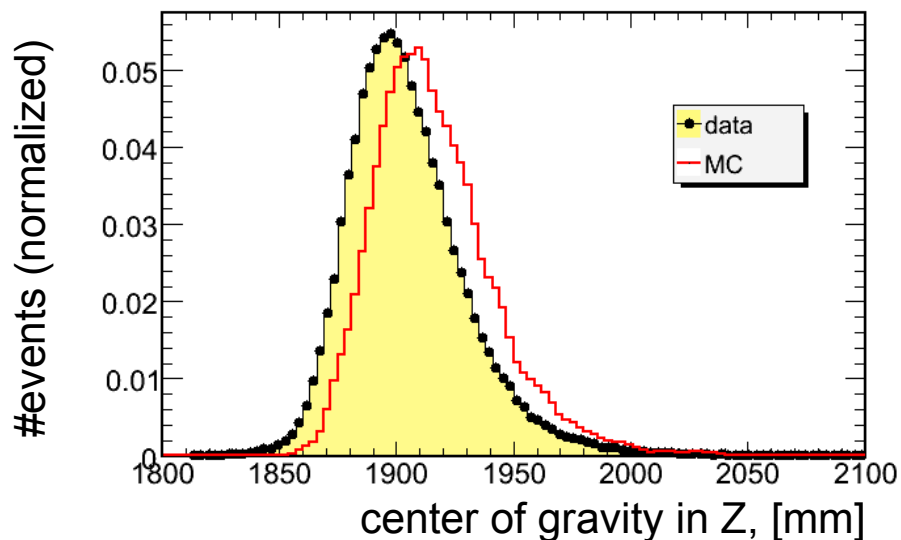
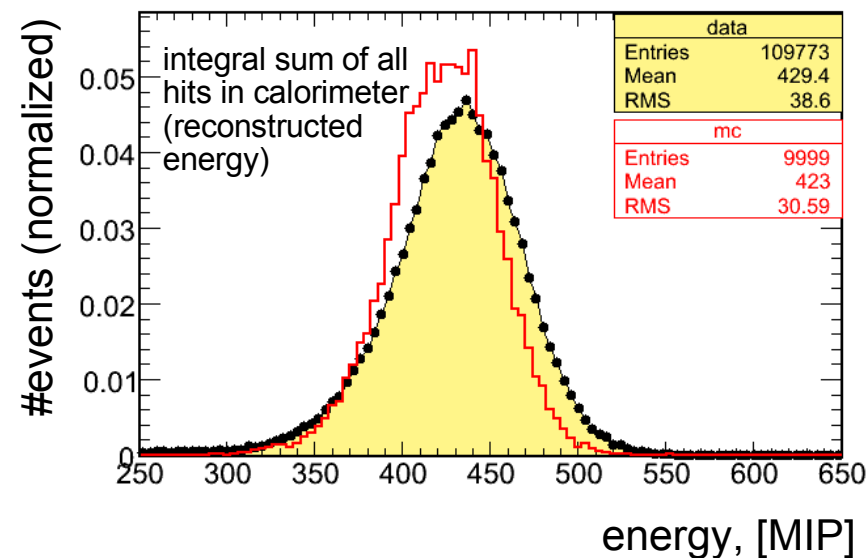
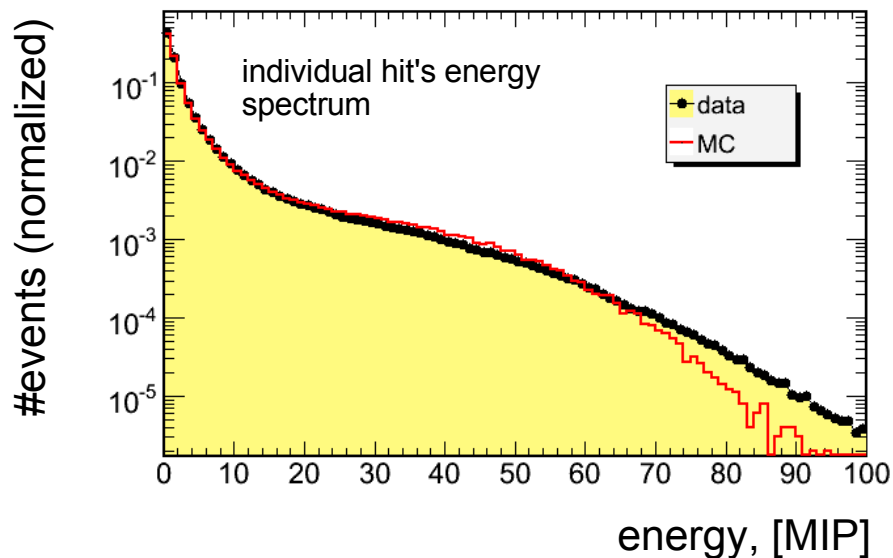
Sergey Morozov

DESY, Hamburg



Analysis of electromagnetic showers in CALICE AHCAL prototype

exp (black) and MC (red) with re-scaled saturation and temperature correction



The main problem of MC so far:

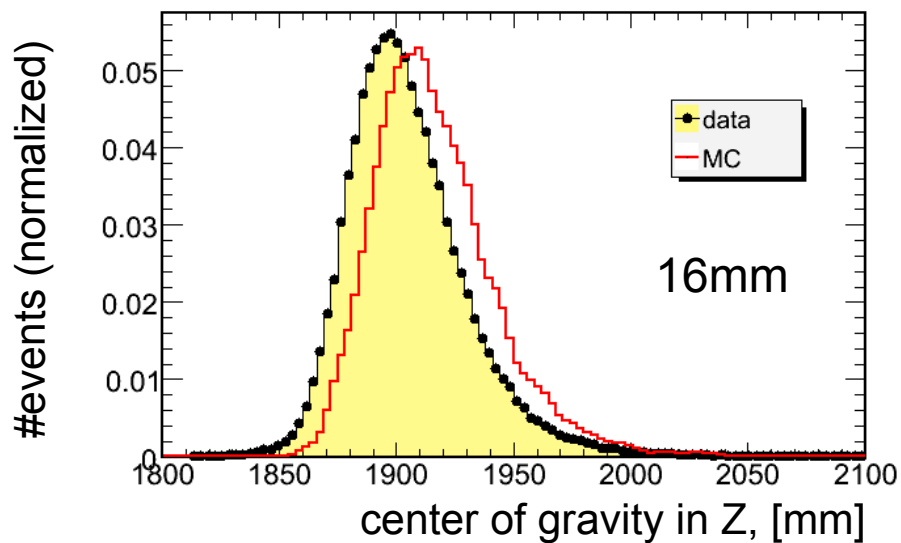
- the geometrical position of an e/m shower is shifted w.r.t. the data.

Uncertainties in integral spectrum (1.5%) is within expected region (2% expected).

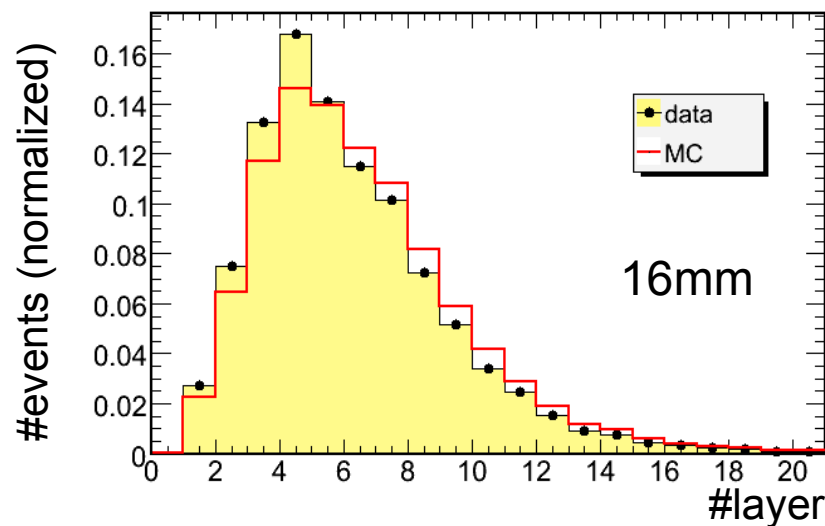
Analysis of electromagnetic showers in CALICE AHCAL prototype

exp (black) and MC (red) + measured thickness of each layer (new Layers)

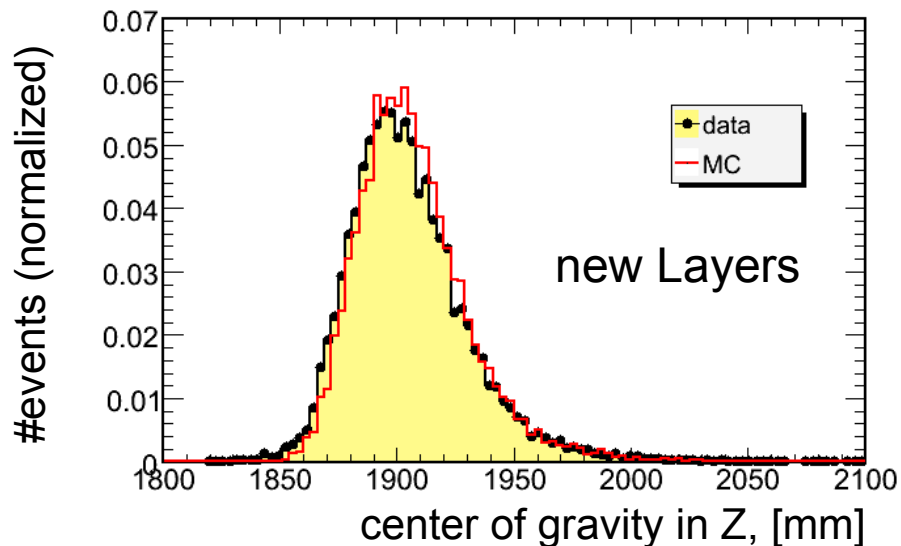
shower center of gravity in Z (beam) direction



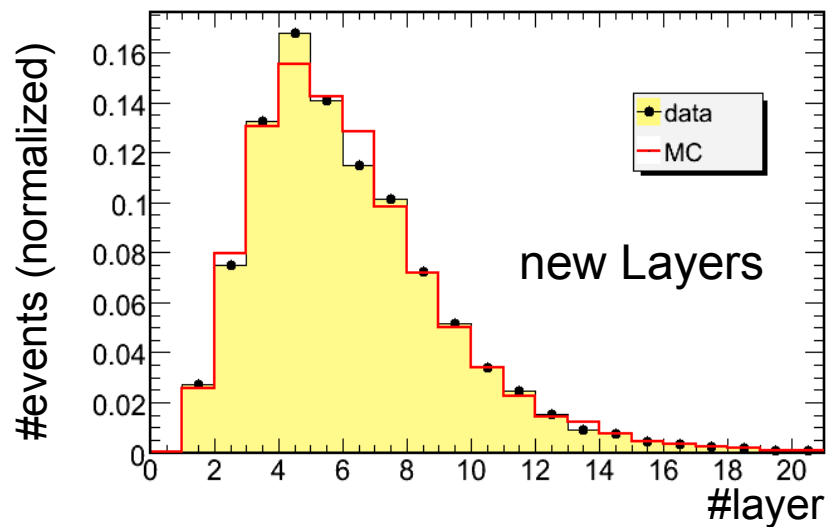
energy profile of a shower



shower center of gravity in Z (beam) direction



energy profile of a shower

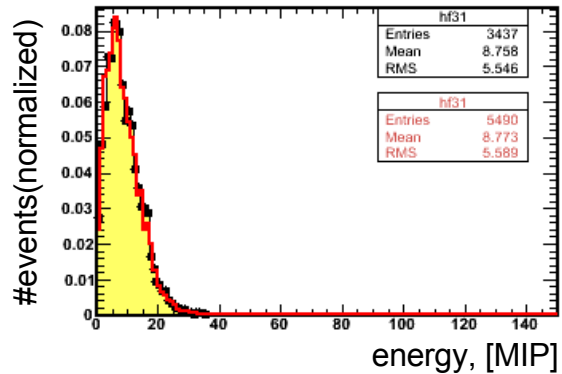


Analysis of electromagnetic showers in CALICE AHCAL prototype

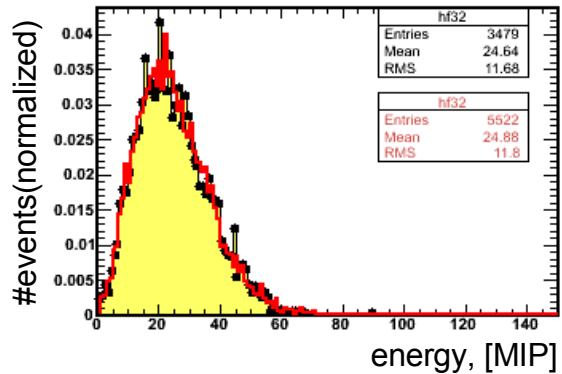
tile in the shower core (49/52) for various layers

all corrections included data (black) and MC (red)

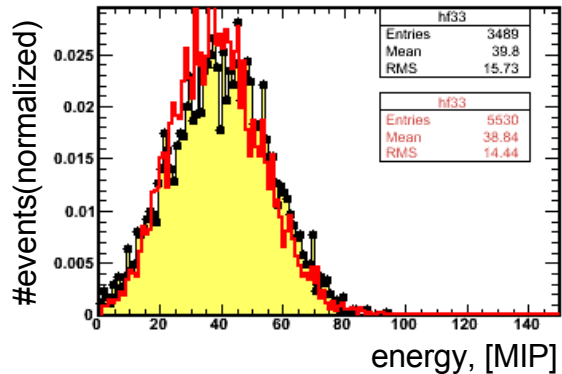
49/52 Layer 1



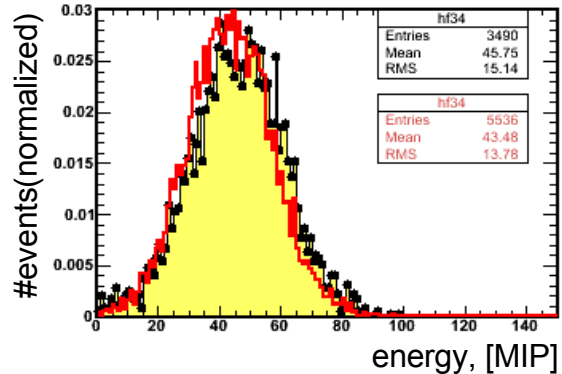
49/52 Layer 2



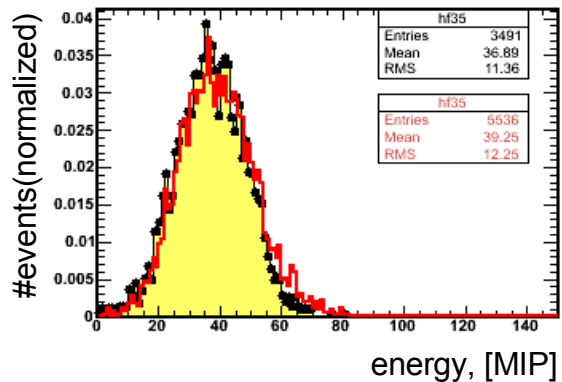
49/52 Layer 3



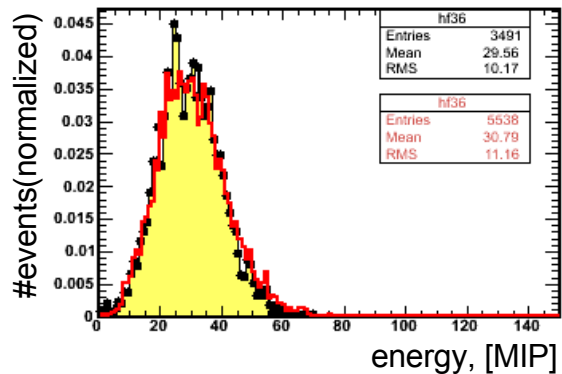
49/52 Layer 4



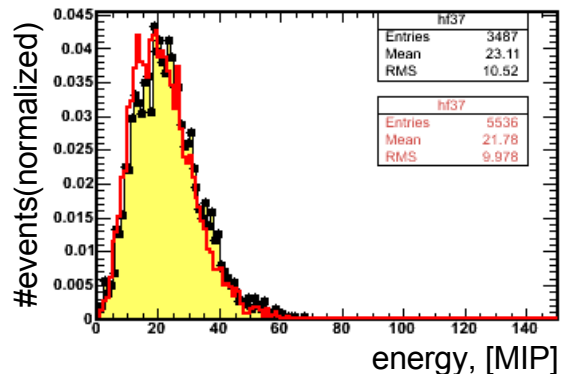
49/52 Layer 5



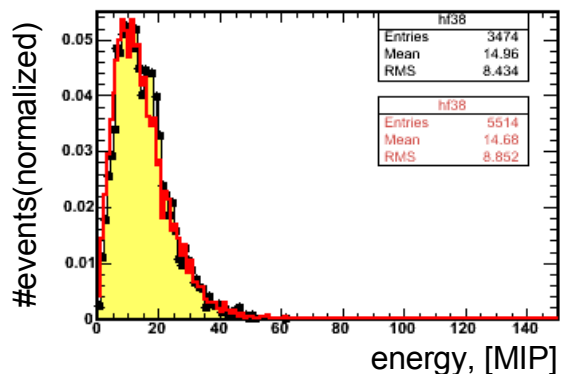
49/52 Layer 6



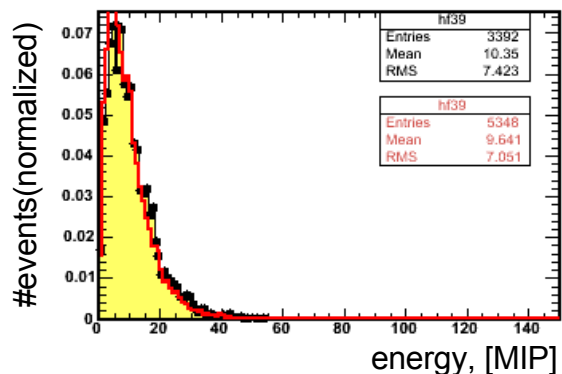
49/52 Layer 7



49/52 Layer 8



49/52 Layer 9

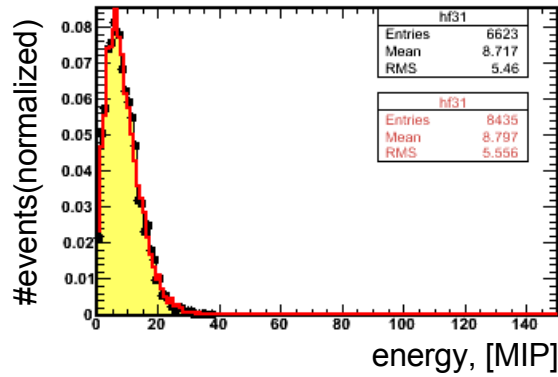


Analysis of electromagnetic showers in CALICE AHCAL prototype

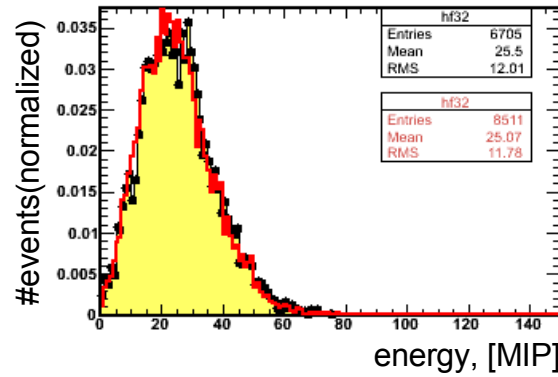
tile in the shower core (52/52) for various layers

all corrections included data (black) and MC (red)

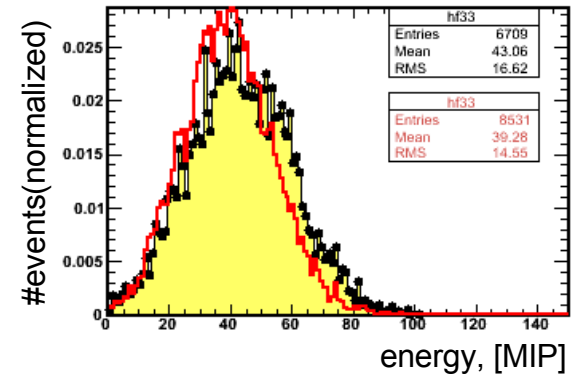
52/52 Layer 1



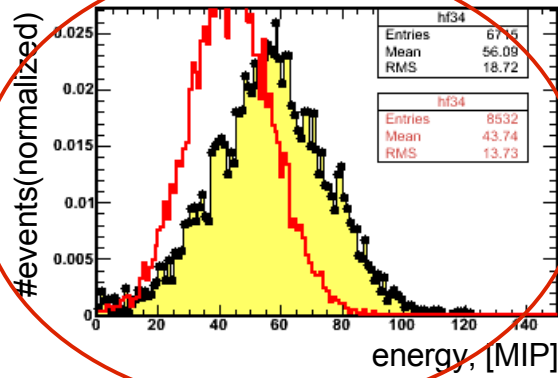
52/52 Layer 2



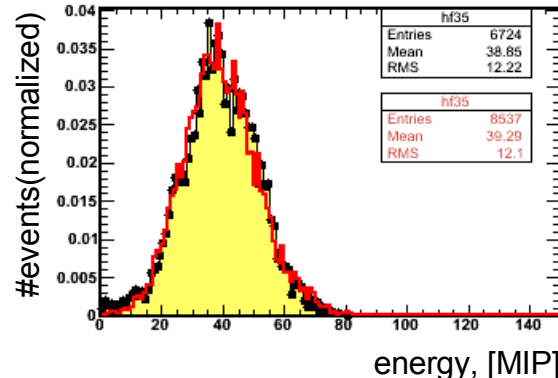
52/52 Layer 3



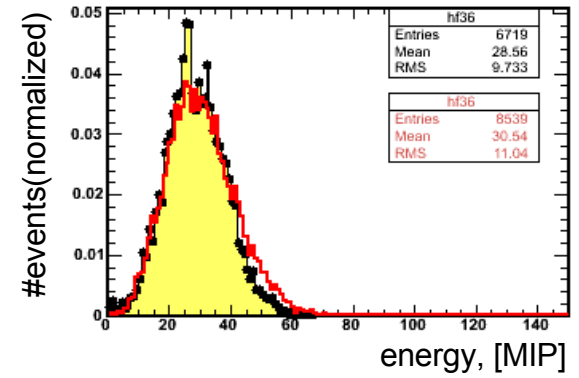
52/52 Layer 4



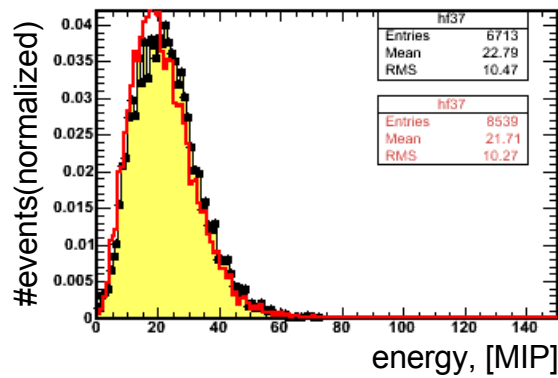
52/52 Layer 5



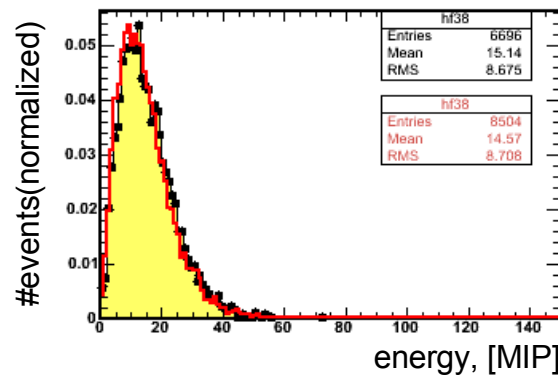
52/52 Layer 6



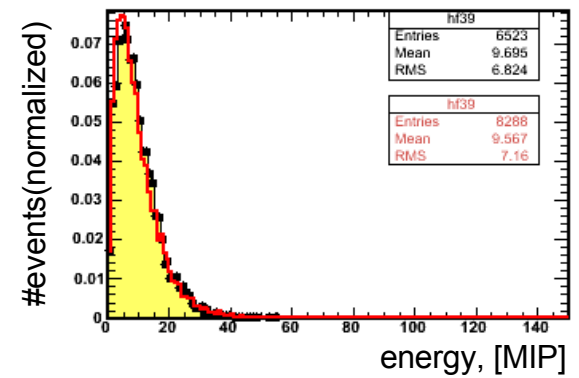
52/52 Layer 7



52/52 Layer 8



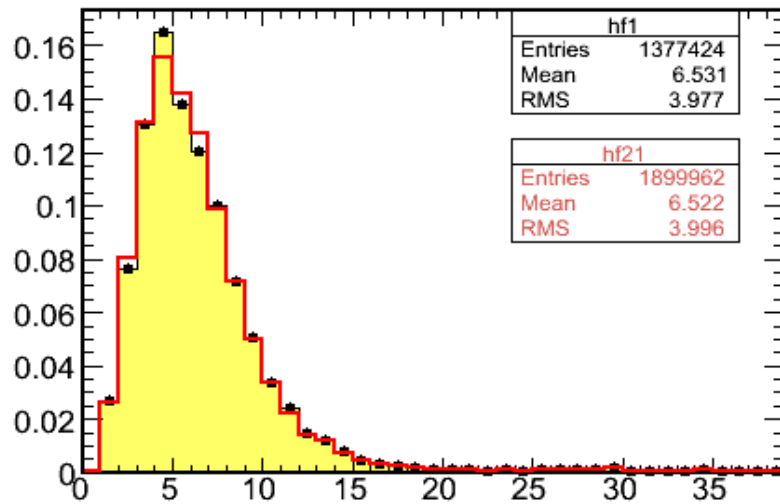
52/52 Layer 9



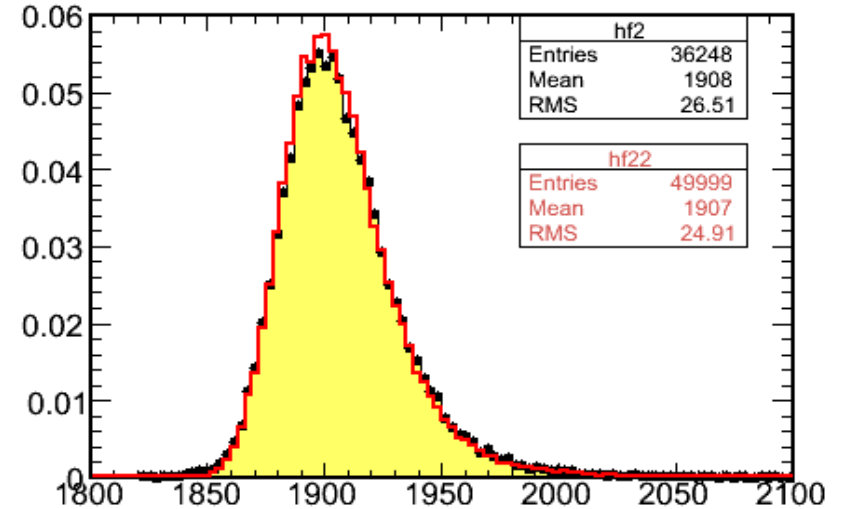
Analysis of electromagnetic showers in CALICE AHCAL prototype

exp (black) and MC (red) + measured thickness of each layer (new Layers)

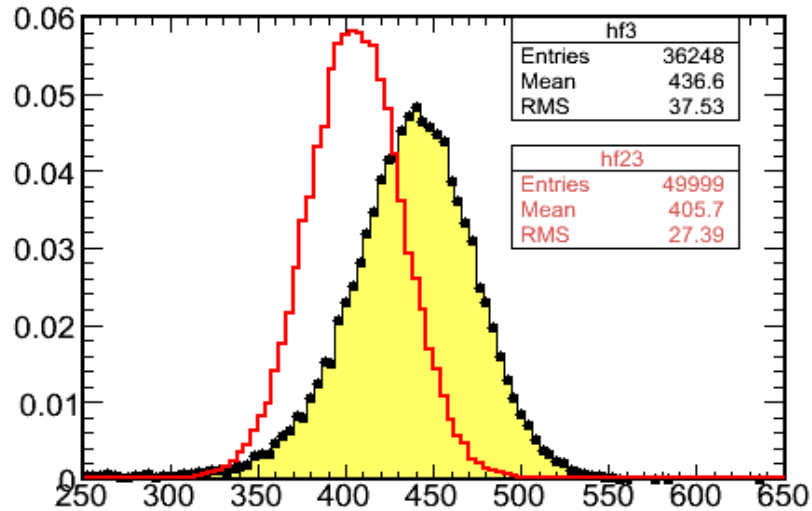
ahc_energyPerLayer_data



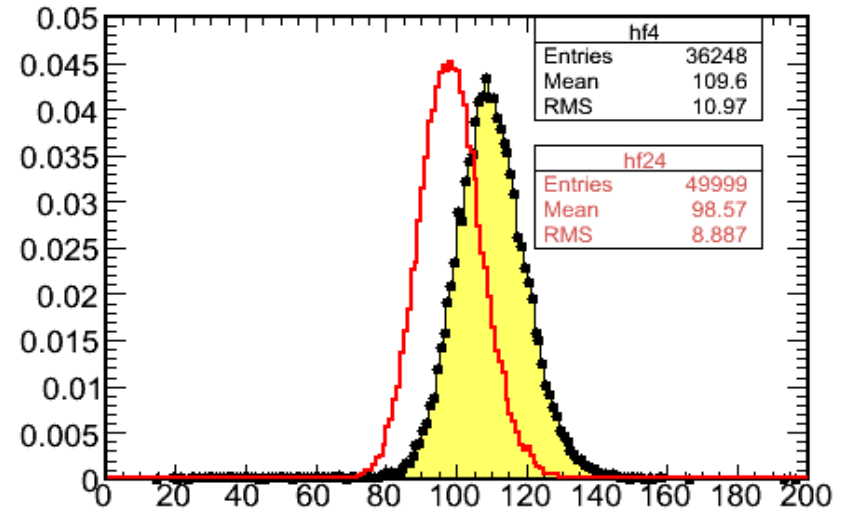
ahc_cogZ



ahc_energySum_data

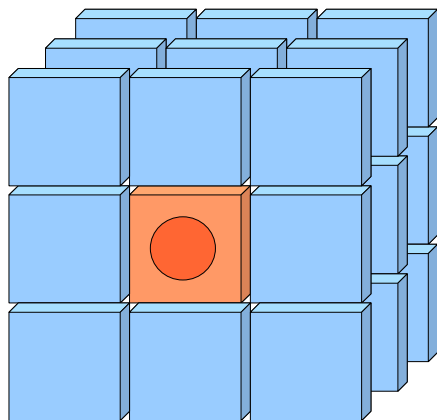


ahc_nHits_data

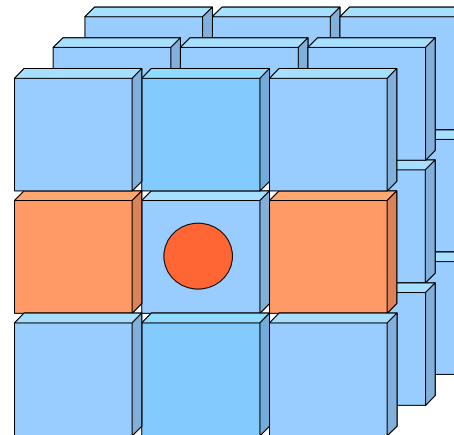


Analysis of electromagnetic showers in CALICE AHCAL prototype

Check the 3x3 tile tower in a core of a shower



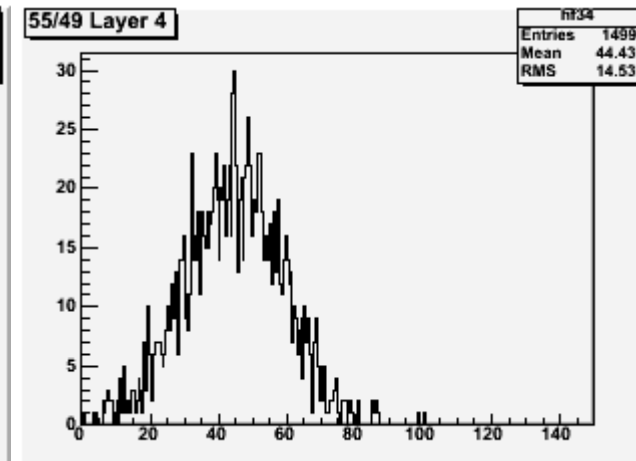
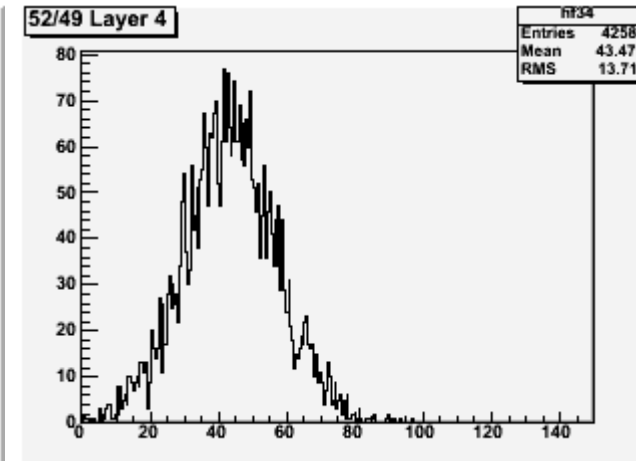
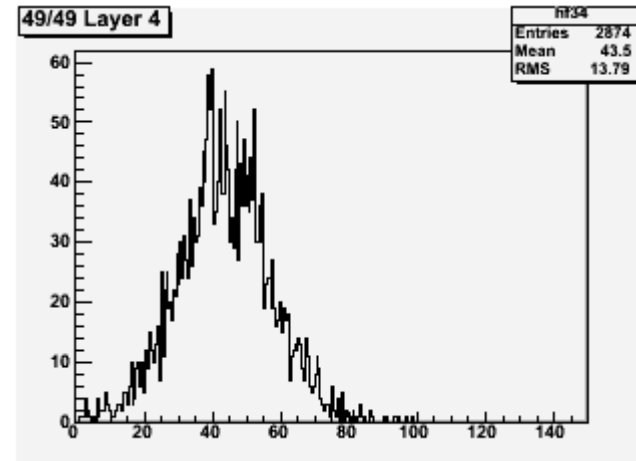
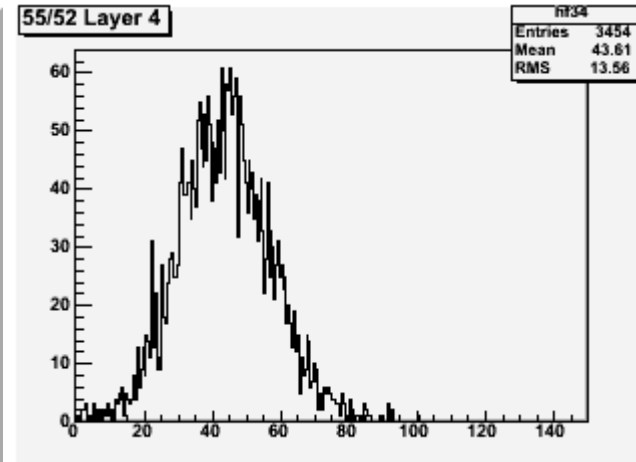
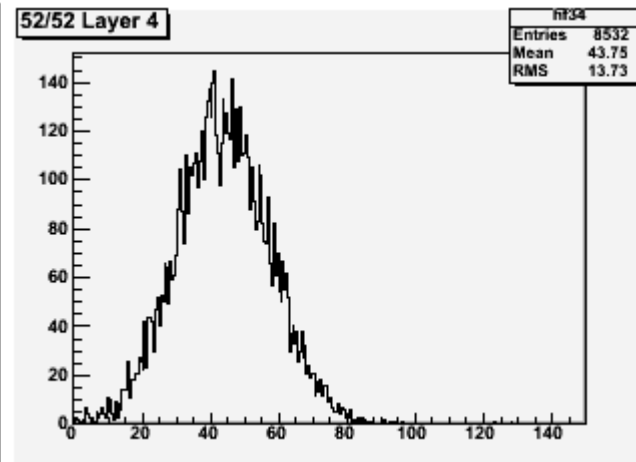
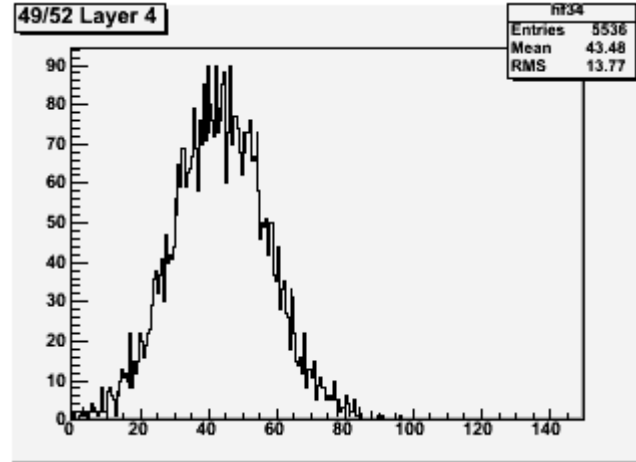
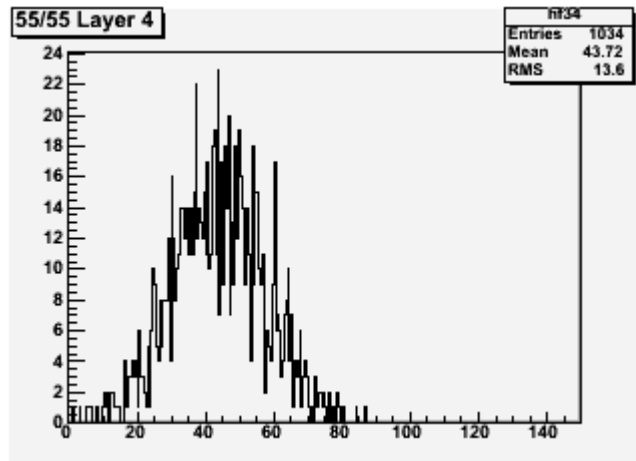
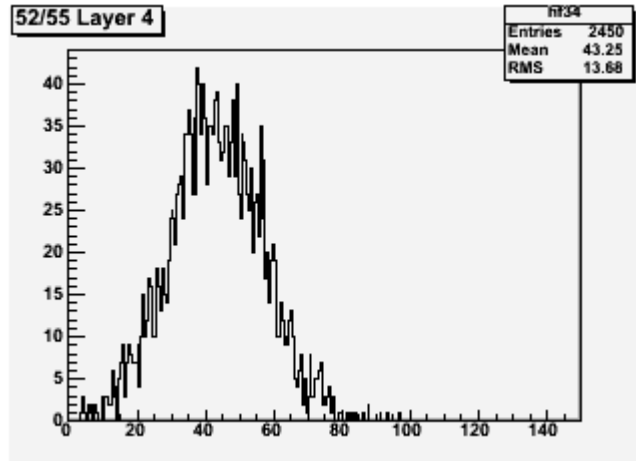
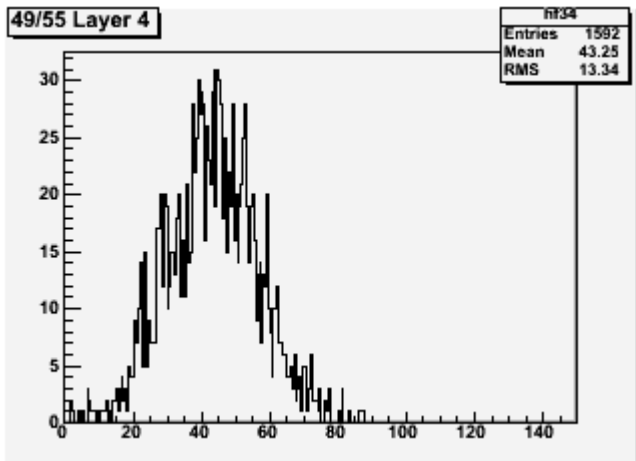
“in center” - beam spot 1cm
of radius in the center of tile



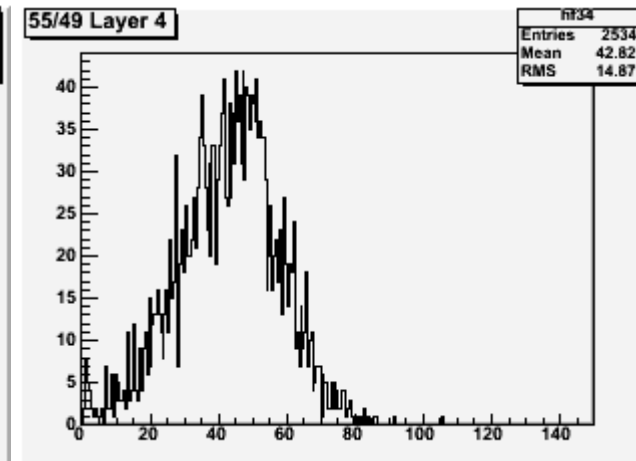
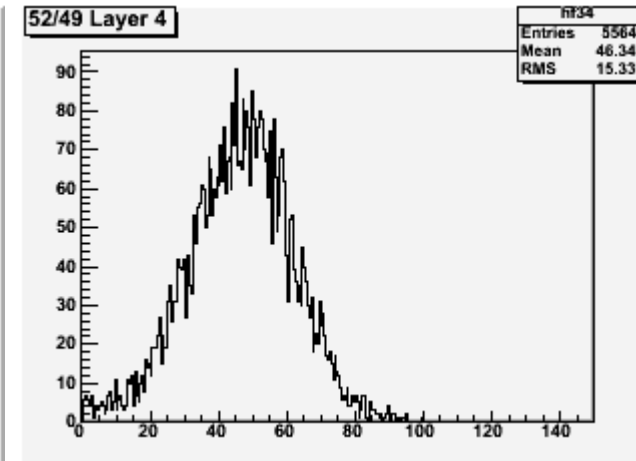
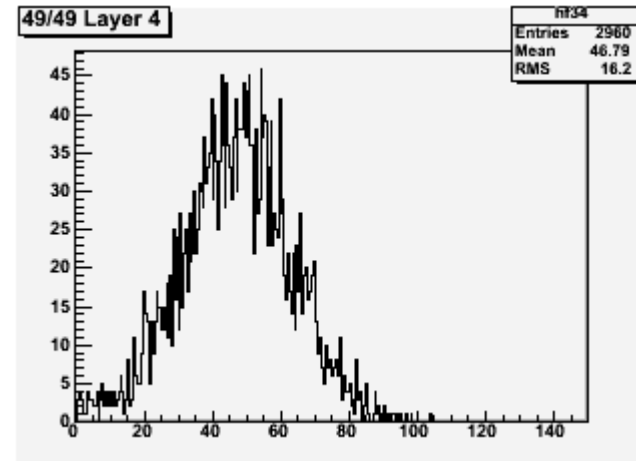
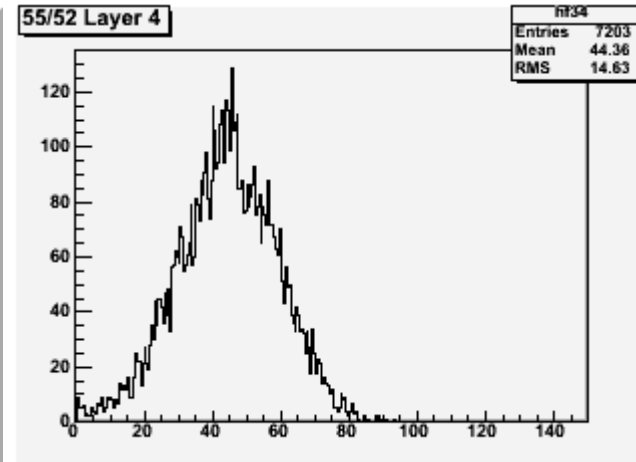
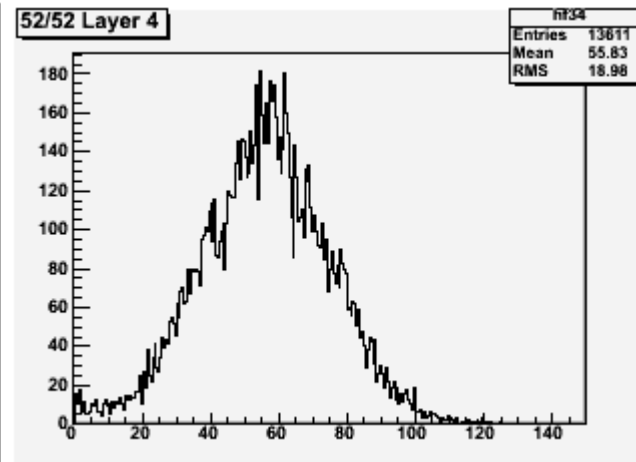
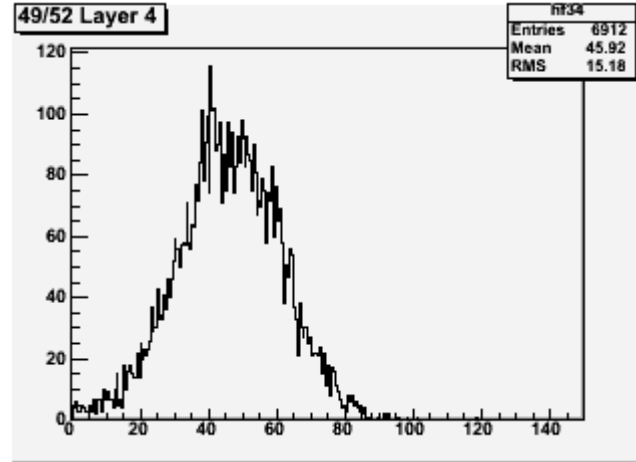
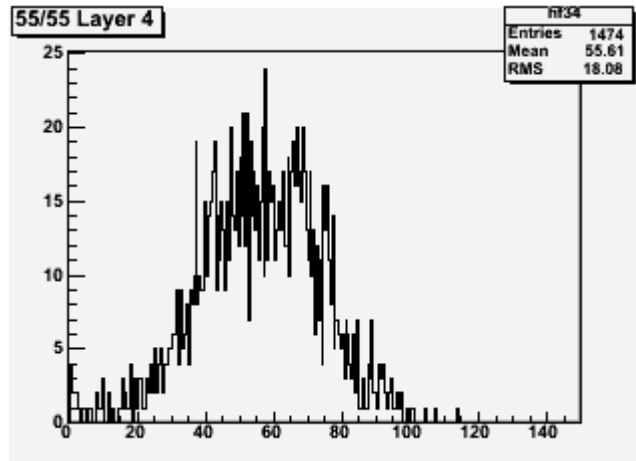
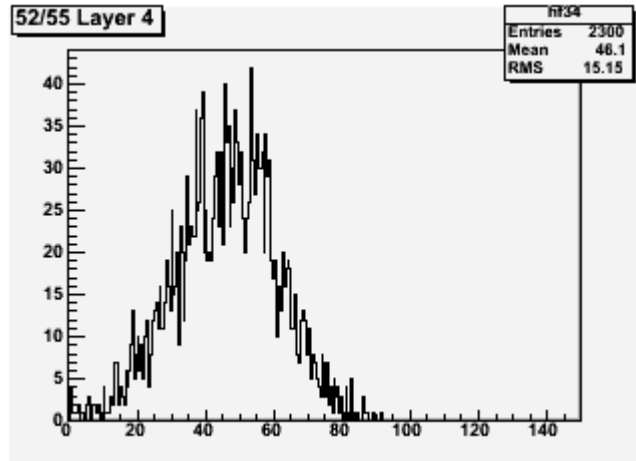
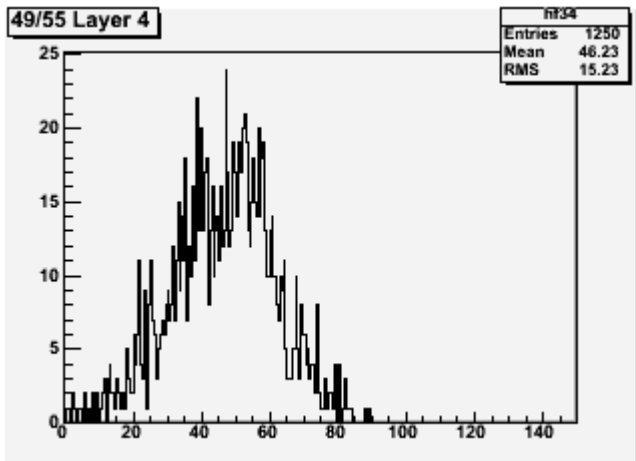
“in neighbour” - beam spot is on
neighbour tile (see a “halo” signal)

- compare the individual tile-spectra for each tile from the tower and compare them
- “in center” - check the saturated spectra
- “in neighbour” - check the MIP calibration probable shift (?)

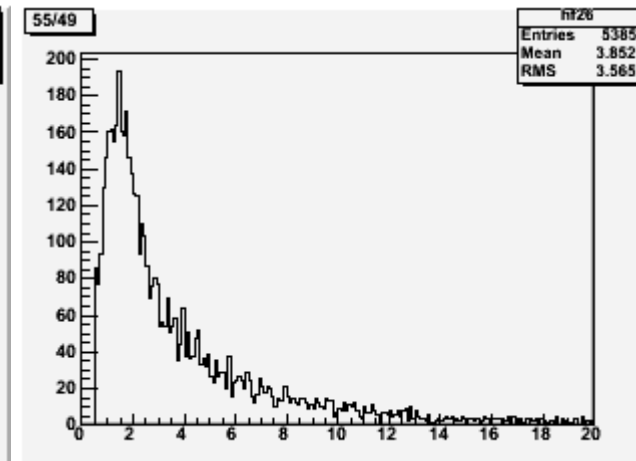
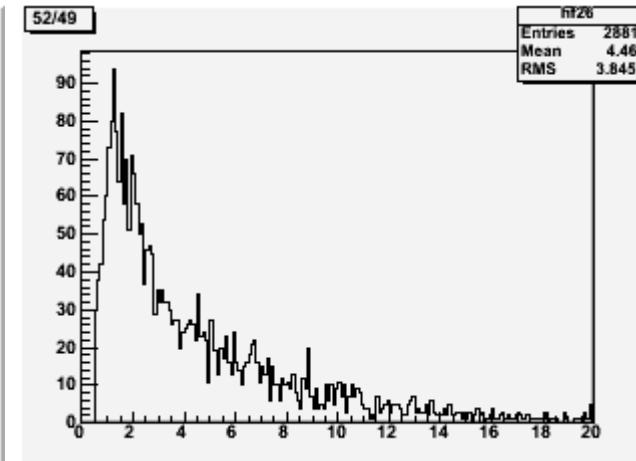
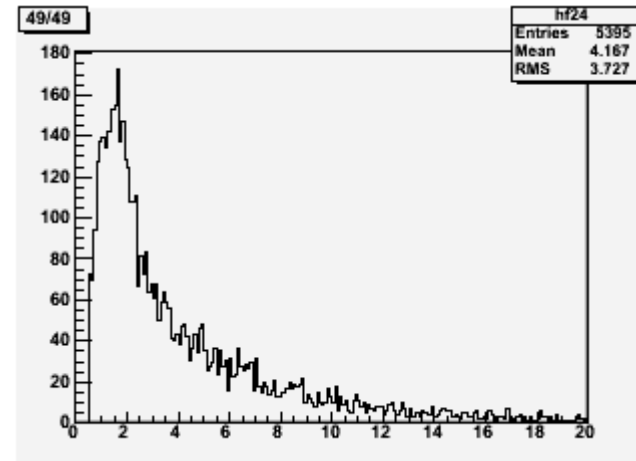
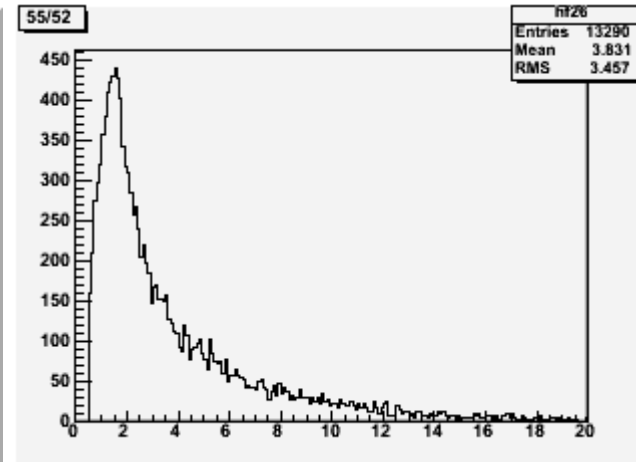
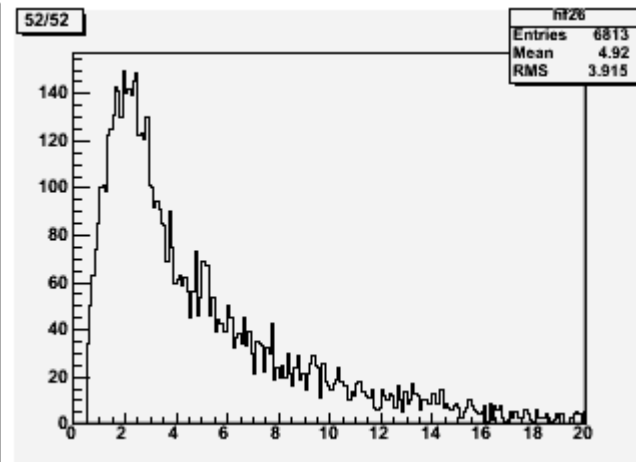
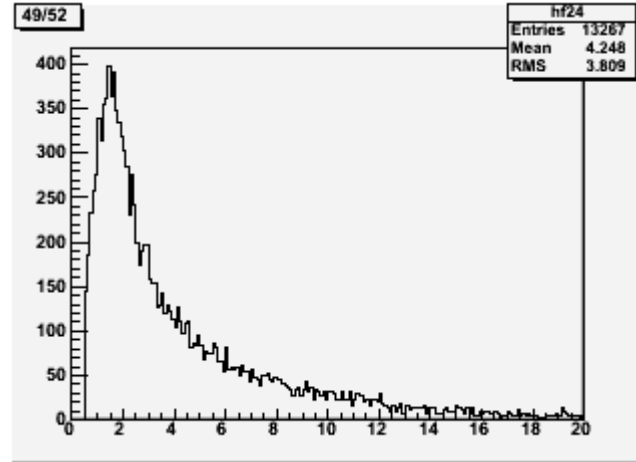
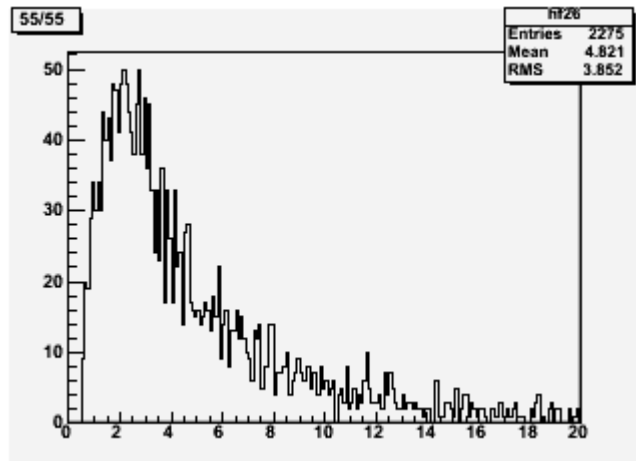
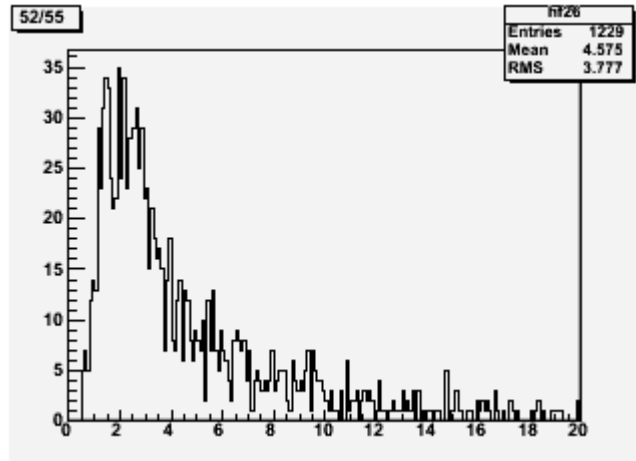
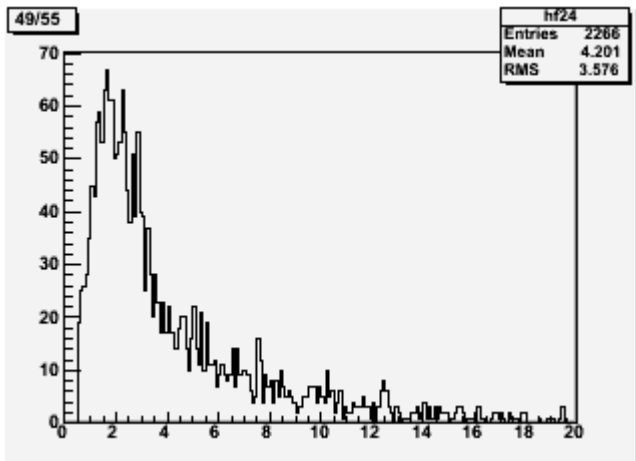
Analysis of electromagnetic showers in CALICE AHCAL prototype 10Gev, MC, "in center"



Analysis of electromagnetic showers in CALICE AHCAL prototype 10Gev e+, data, "in center"



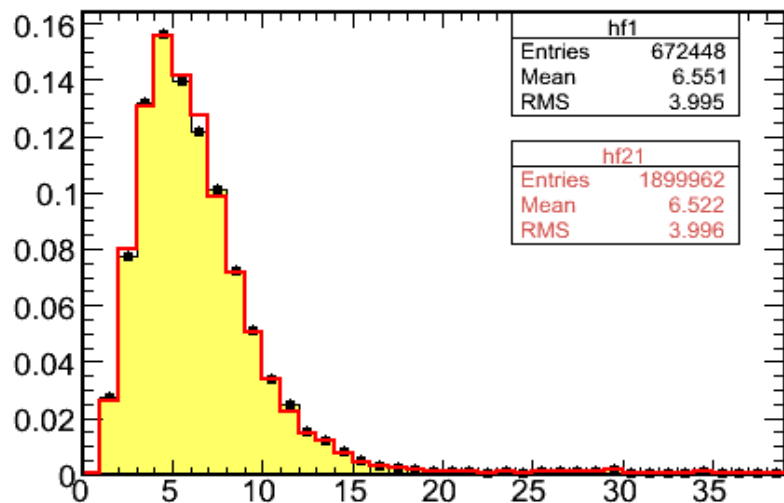
Analysis of electromagnetic showers in CALICE AHCAL prototype 10Gev e+, data, "in neighbour"



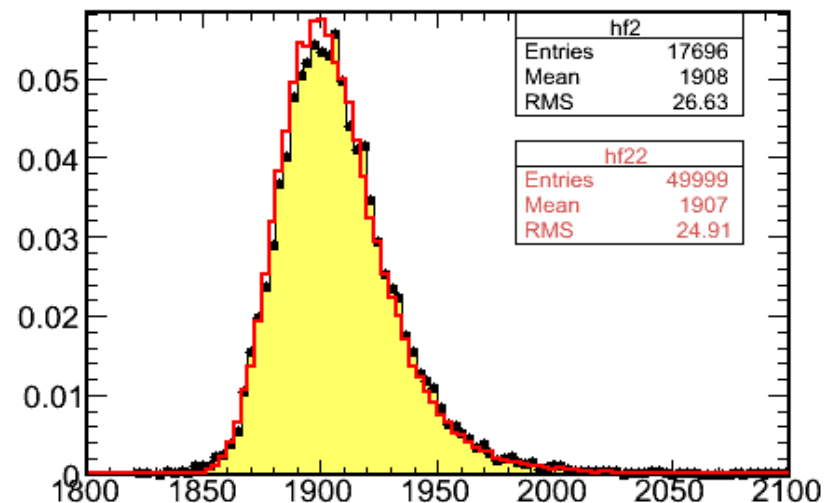
Analysis of electromagnetic showers in CALICE AHCAL prototype

Try to correct MIP values: layer 4 : mip(52/52) *= 1.3, mip(55/55) *=1.3

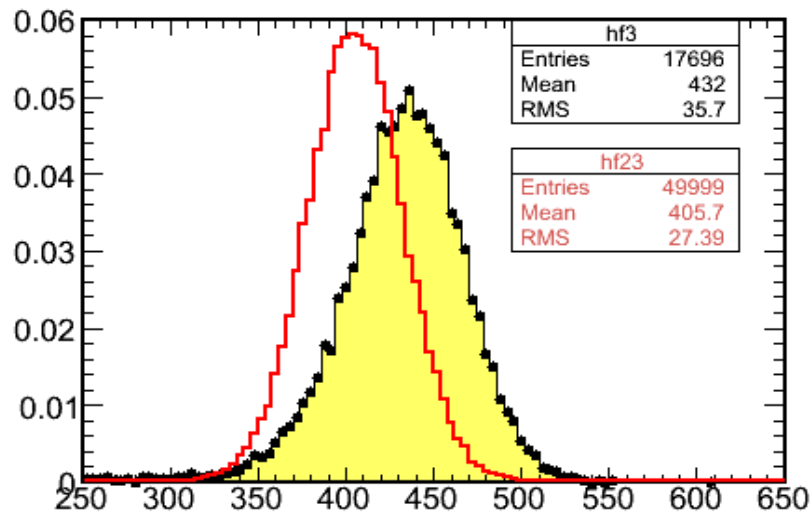
ahc_energyPerLayer_data



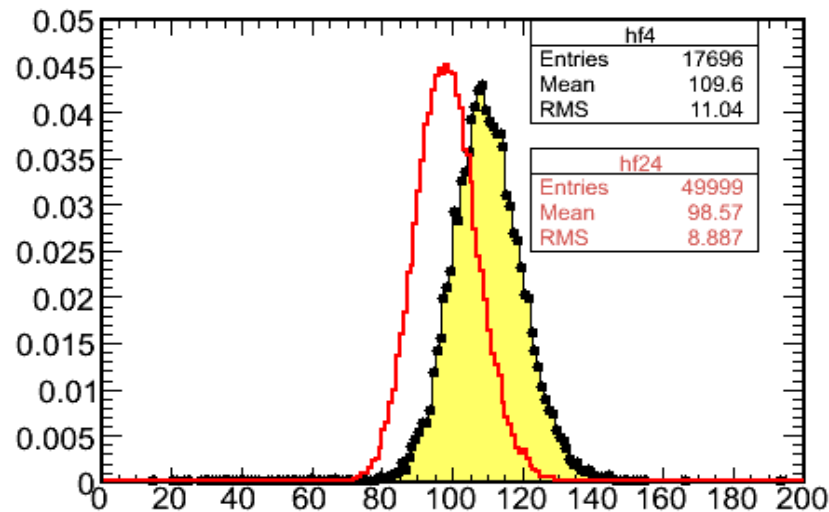
ahc_cogZ



ahc_energySum_data



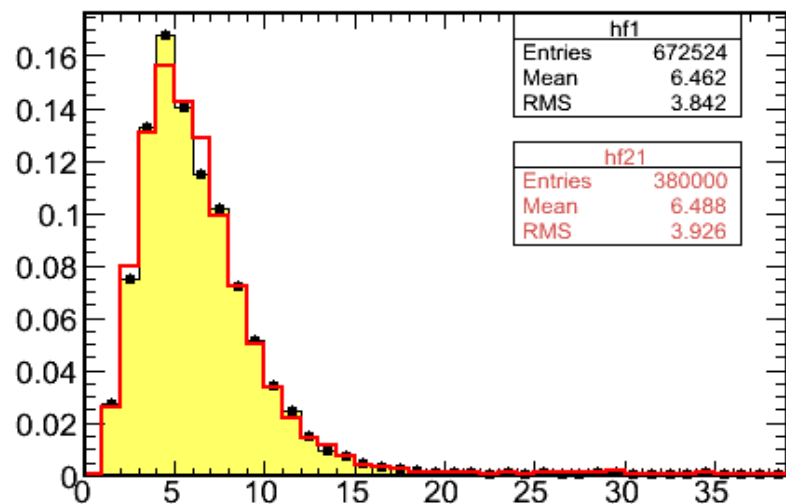
ahc_nHits_data



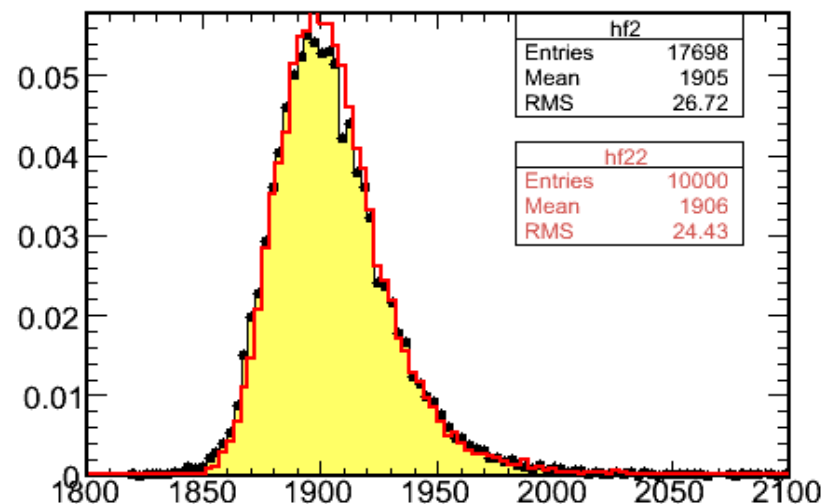
Analysis of electromagnetic showers in CALICE AHCAL prototype

Try to correct MC for an optical crosstalk : new xtalk = 16 % (was 10%)

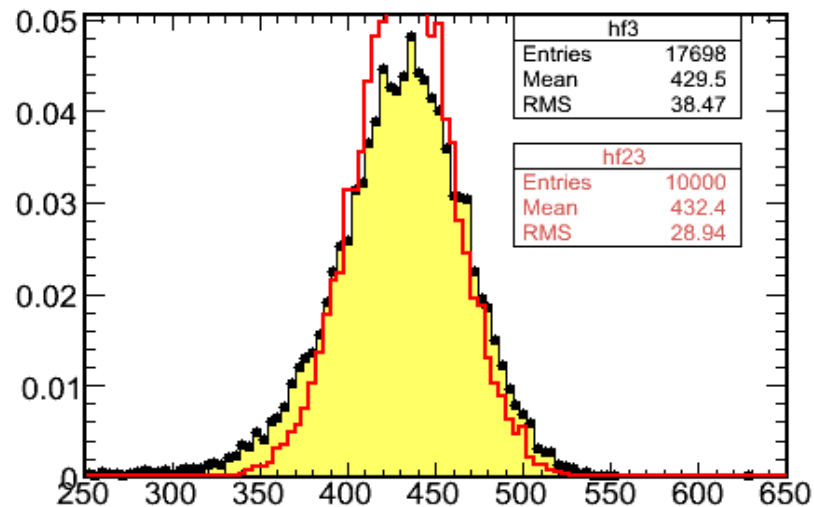
ahc_energyPerLayer_data



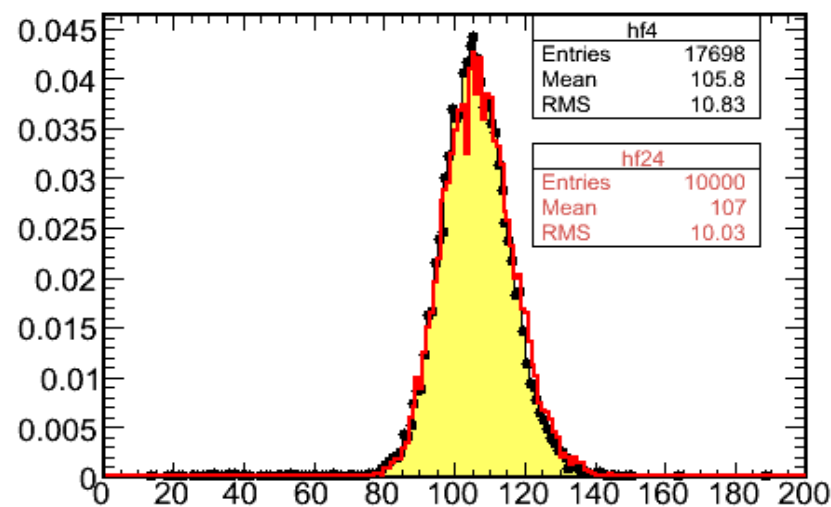
ahc_cogZ



ahc_energySum_data



ahc_nHits_data



Summary & Outlook

- new Mokka model with real layer thicknesses is introduced. Monte Carlo study of this model shows quite good agreement for geometrical e/m shower positions in AHCAL as well as longitudinal profile.
- some tiles show more energies as predicted with comparison data and MC. Simple correction of MIP values doesn't work enough (other effects?)
- further studies are needed to find the reason of energy differences for the tile spectra