TPOL full MC Status
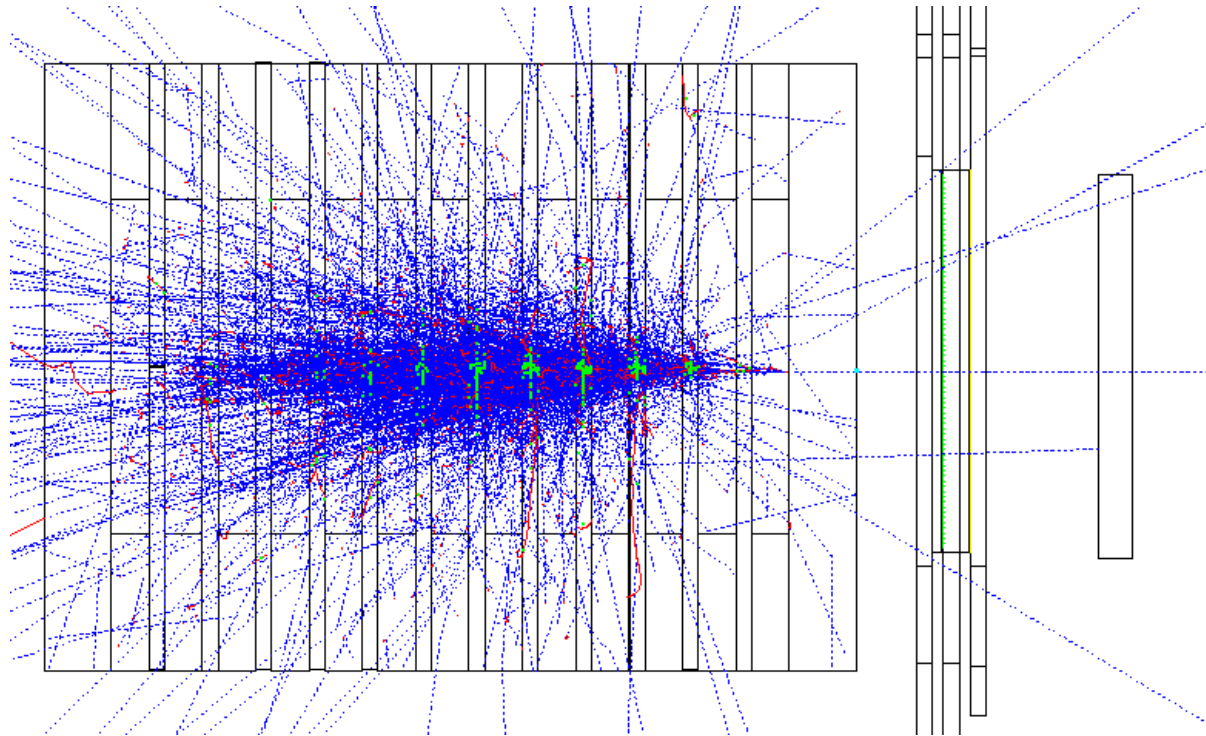
Robert Ciesielski

Introduction

$$\eta = \frac{E_U - E_D}{E_U + E_D}$$

Calorimeter   Silicon Detector   Preshower
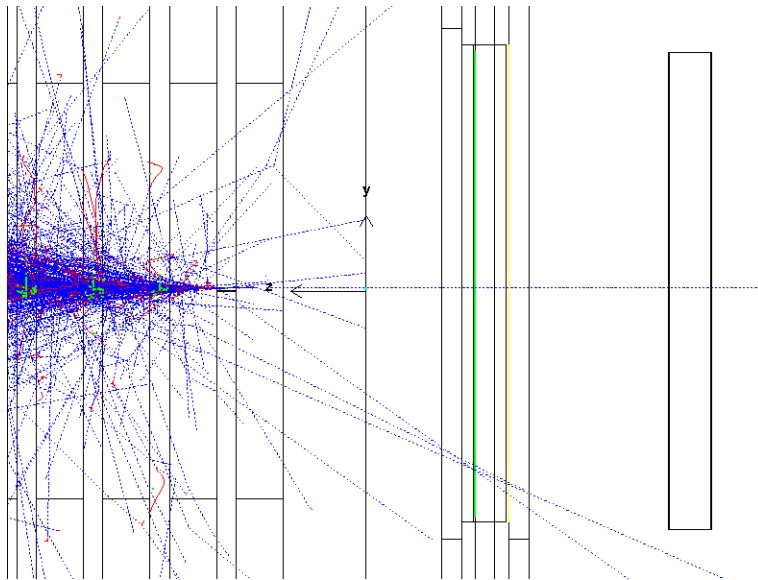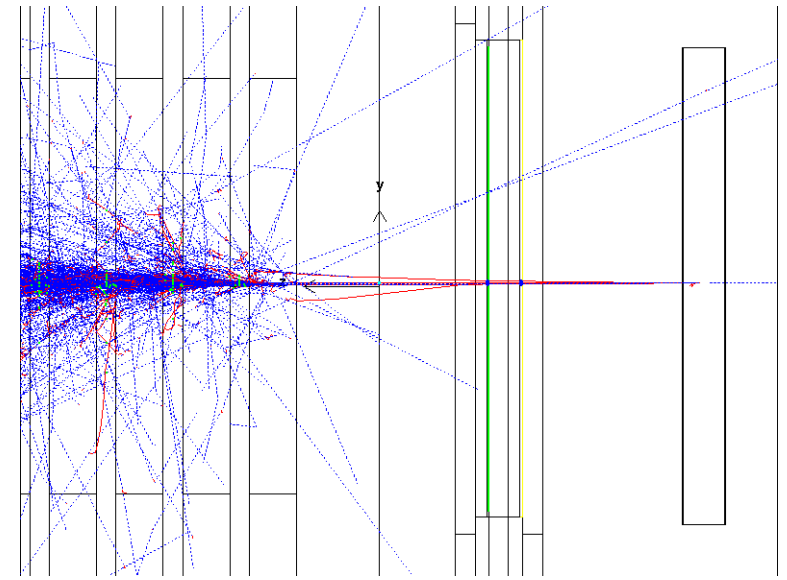   (Converter)
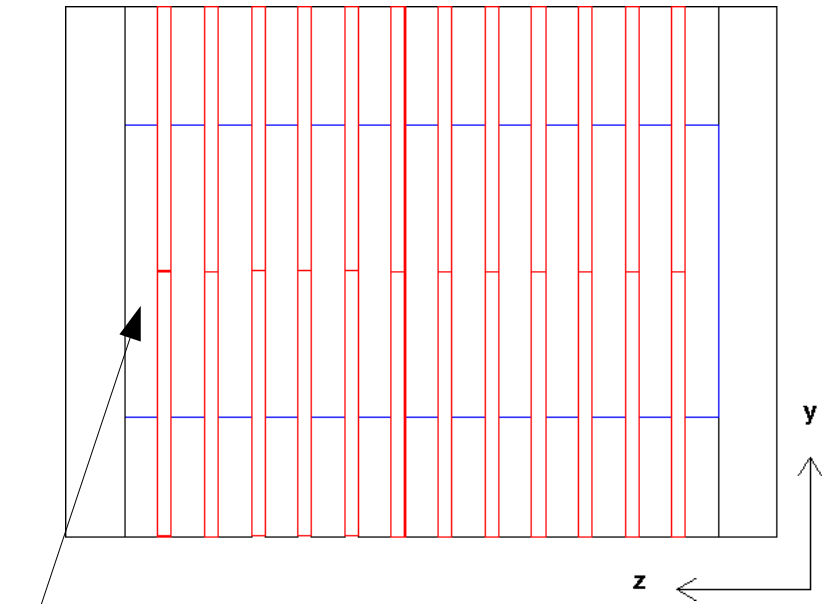
Introduction

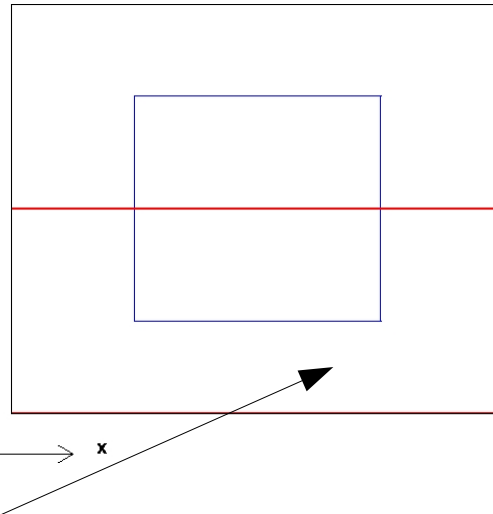non converting   converting photon

Main reason for the :

- In Blanka's analysis (measurement of eta-y transformation with the silicon detector) the result obtained for converting photons should be extrapolated to non-converting photons. Blanka wants to check the universality of the measured eta-y curve
- Need MC that can simulate the showering
- To minimise systematics need the reliable Monte Carlo simulation that describes well the data (check position reconstruction with the calorimeter, eta-y curve)

Geant 3.21 Simulation

$$\eta = \frac{E_U - E_D}{E_U + E_D}$$

768 (Y) and 256 (X) silicon strips

Tungsten absorber in the center, surrounded by Lead absorber

12 optically decoupled SCSN-38 scintillator plates

- Kinematics according to Compton cross section
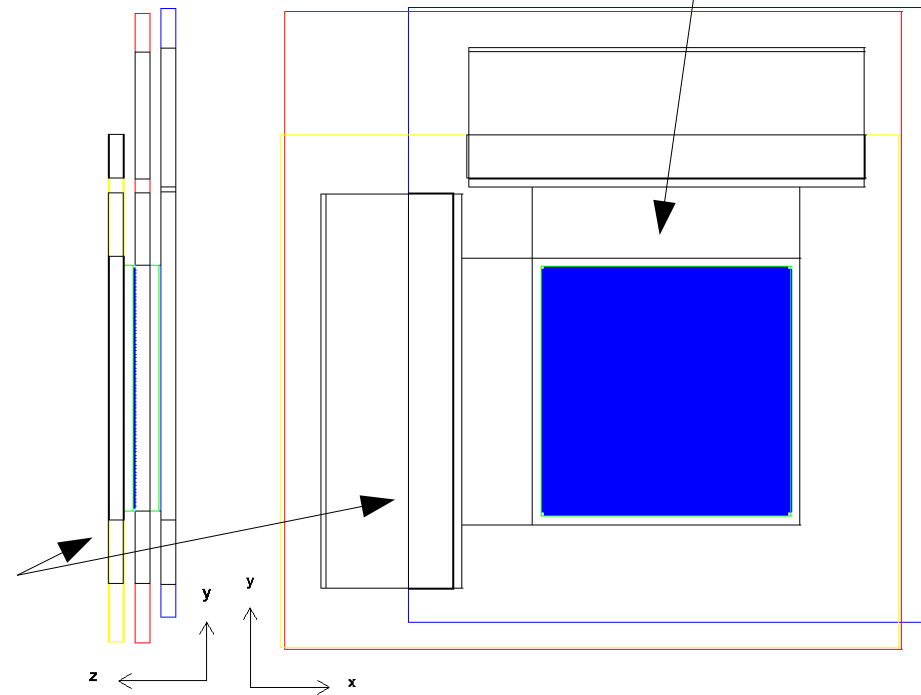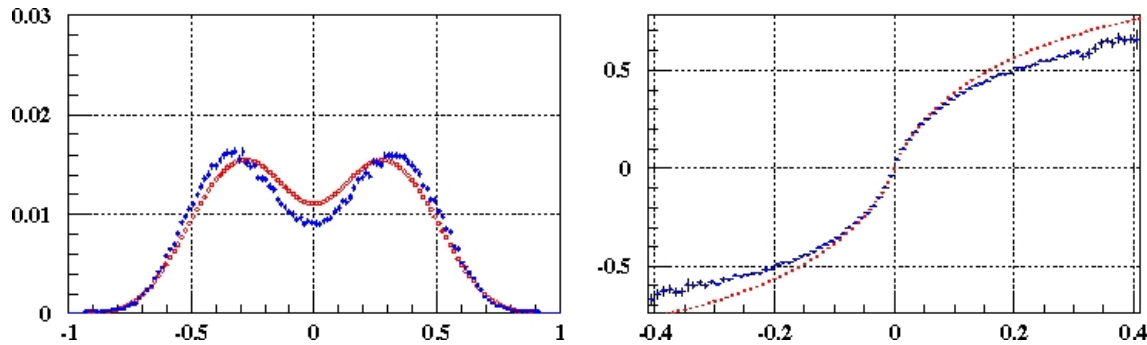- Realistic vertex description (e-gamma interaction)
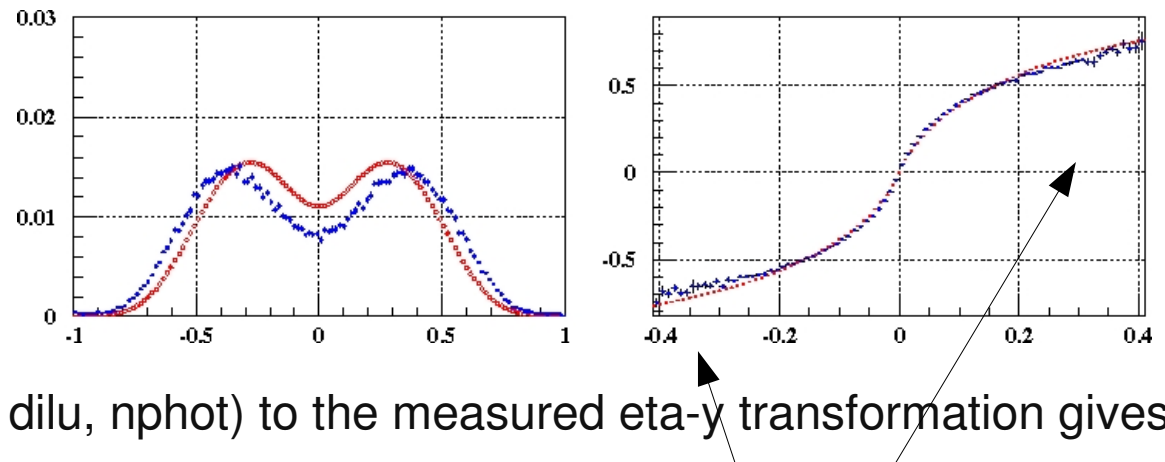- Detailed detector geometry

Support structure

Digitisation of Calorimeter Signal

Red – data
Blue - MC

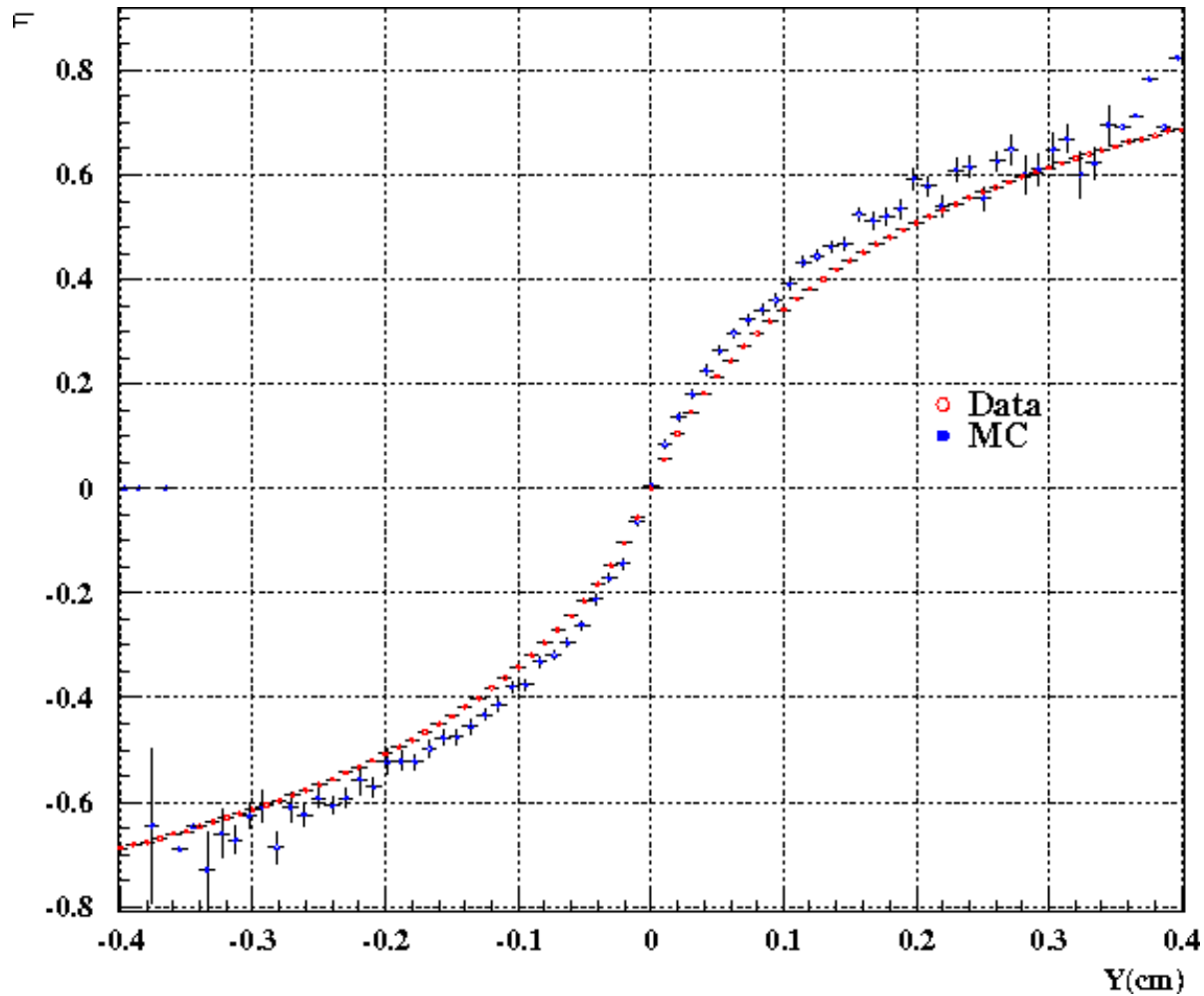The former development (CVS Repository) frozen at the stage of:
- satisfactory eta description
- eta-y transformation far from the one measured in data

Tunning of digitisation parameters (diff, dilu, nphot) to the measured eta-y transformation gives:
- worse eta description
- better eta-y transformation (still not following the data at higher |y|)

Calorimeter Signal
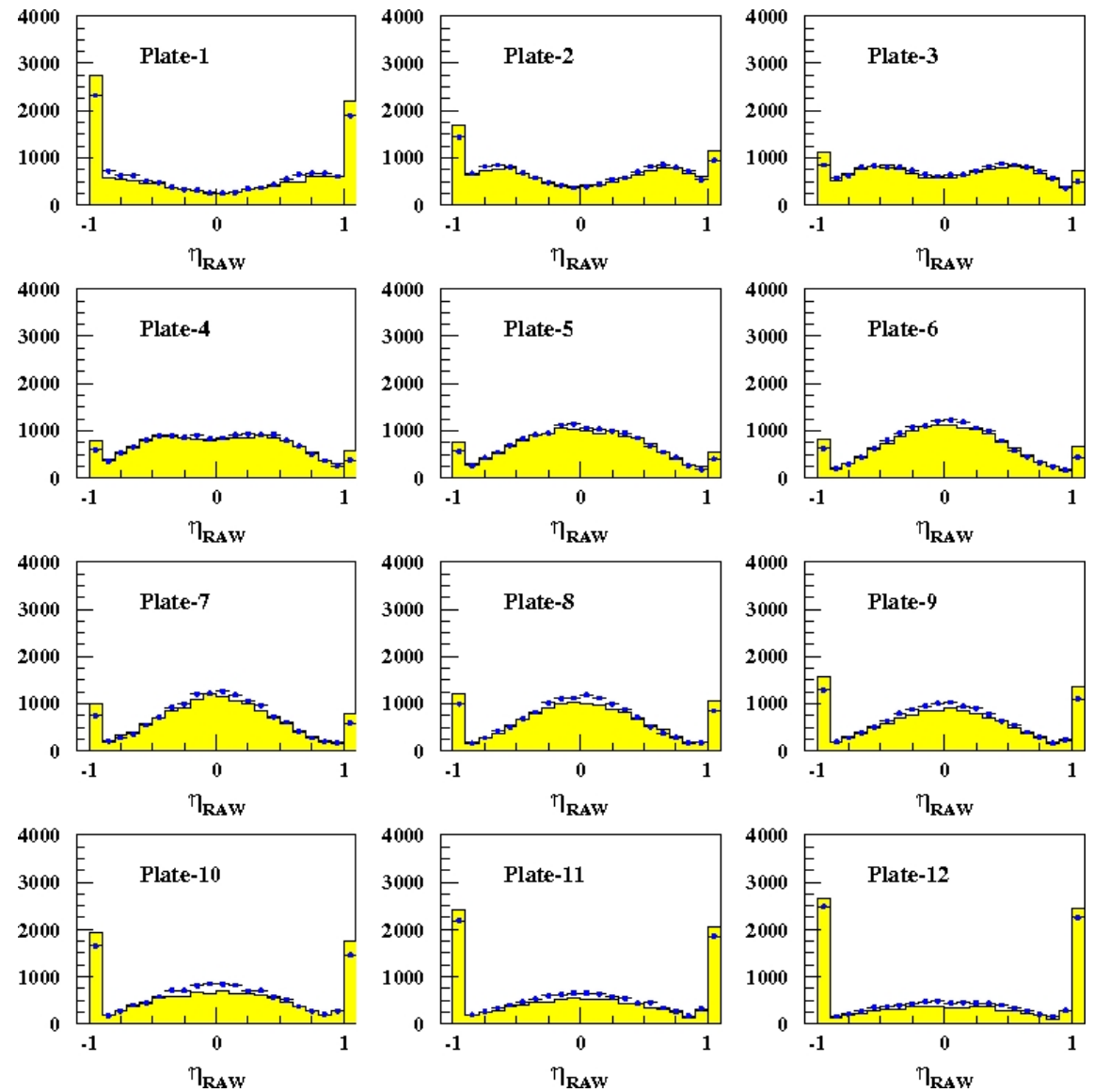

$$\eta = \frac{E_U - E_D}{E_U + E_D}$$

Turn off the digitisation and look at the "raw" eta-y curve (Eu=Ed=energy loss deposits in SCIN)
For given y, the absolute value of "raw" eta for MC higher than for the data

Calorimeter Signal

Shower development in Geant?
or
Z-axis dependent light collection?
(attenuation along WLS)

Shower Simulation

Geant running with default tracking parameters:
- CUTGAM=CUTELE=0.001 GeV (1 MeV)
  (EM shower cut off)
- EPSIL=0.01 cm (spatial resolution)
- ILOSS = 2 (energy loss without generation of delta-e, full Landau-Vavilov-Gauss fluctuations)
- DEEMAX, STEMAX, STMIN calculated by Geant
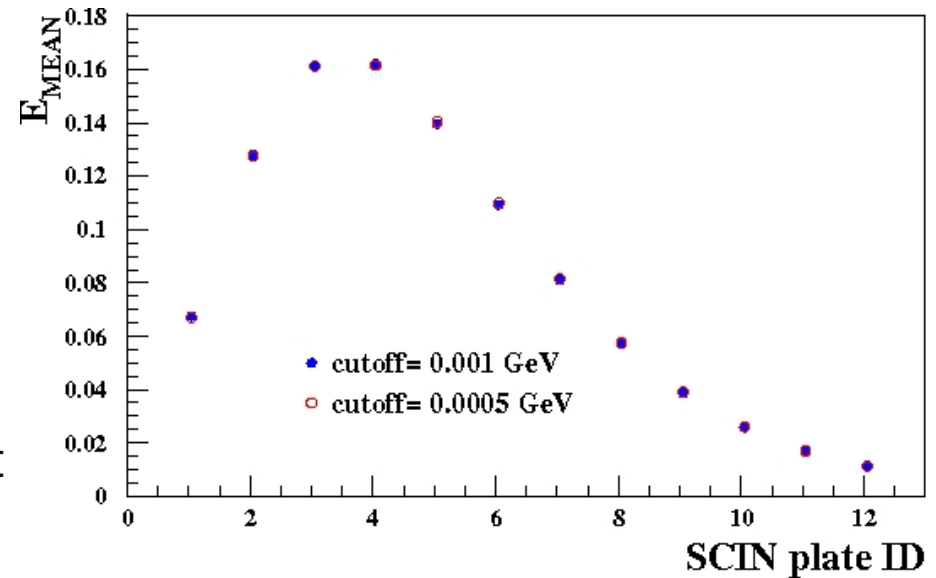
Studied the influence of the parameters on eta and eta-y curve. Changed to:

- CUTGAM=CUTELE=0.0005 GeV (0.5 MeV)
  (possible even less... but time consuming)
- EPSIL=0.001 cm
- ILOSS =1 (full delta-e generation+Landau fluct.)

Example for shower cut off (|eta| towards the center)
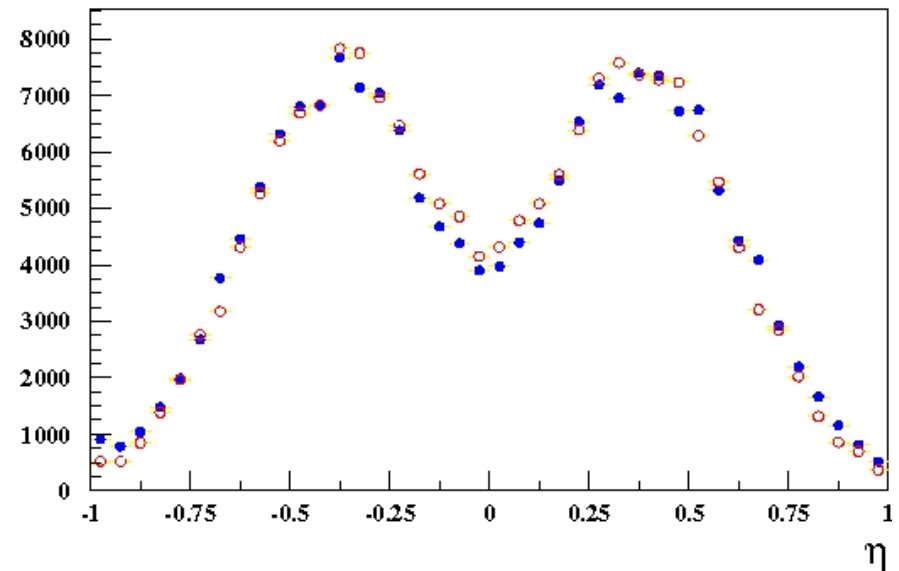
Digitisation Models

Rather difficult
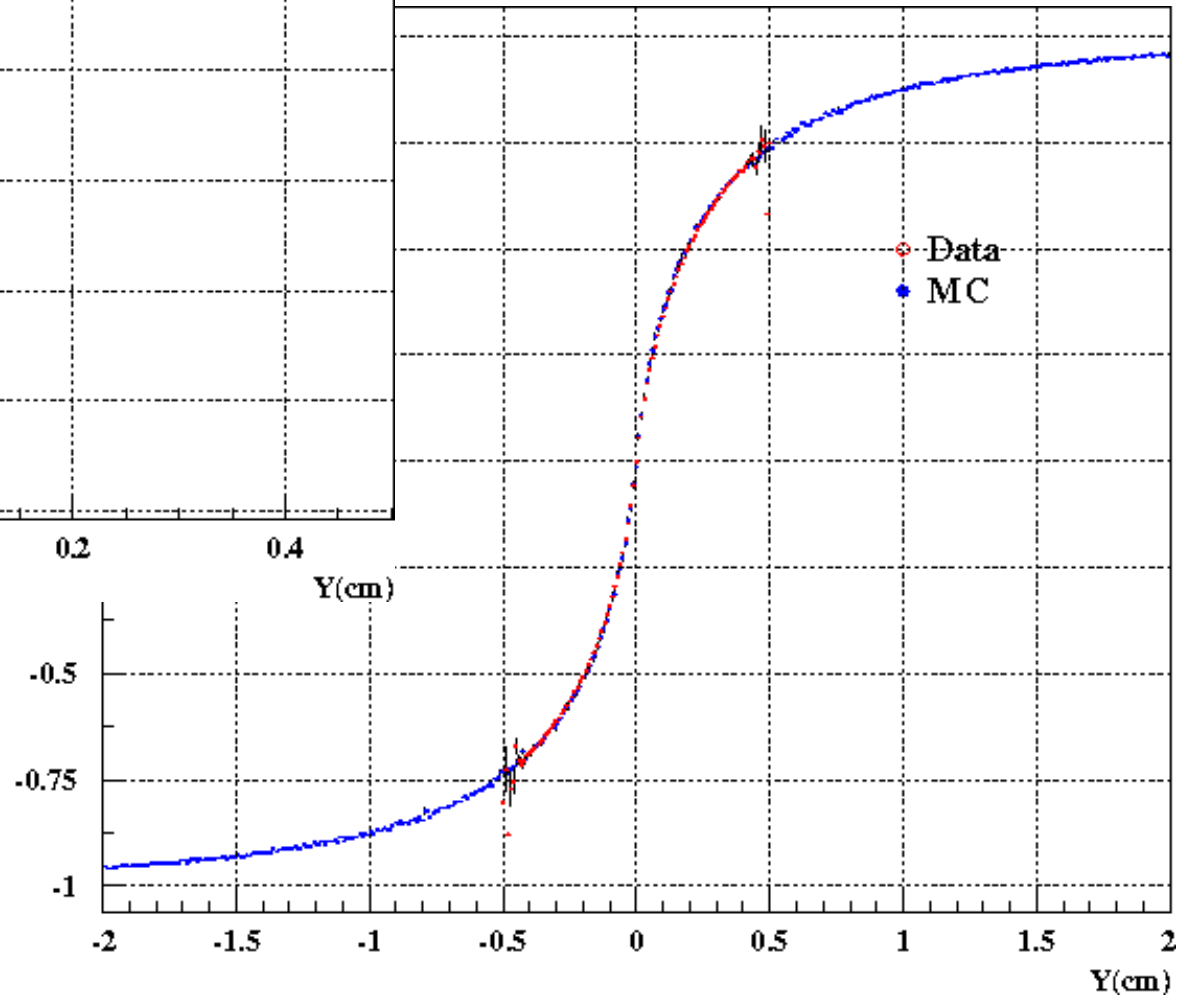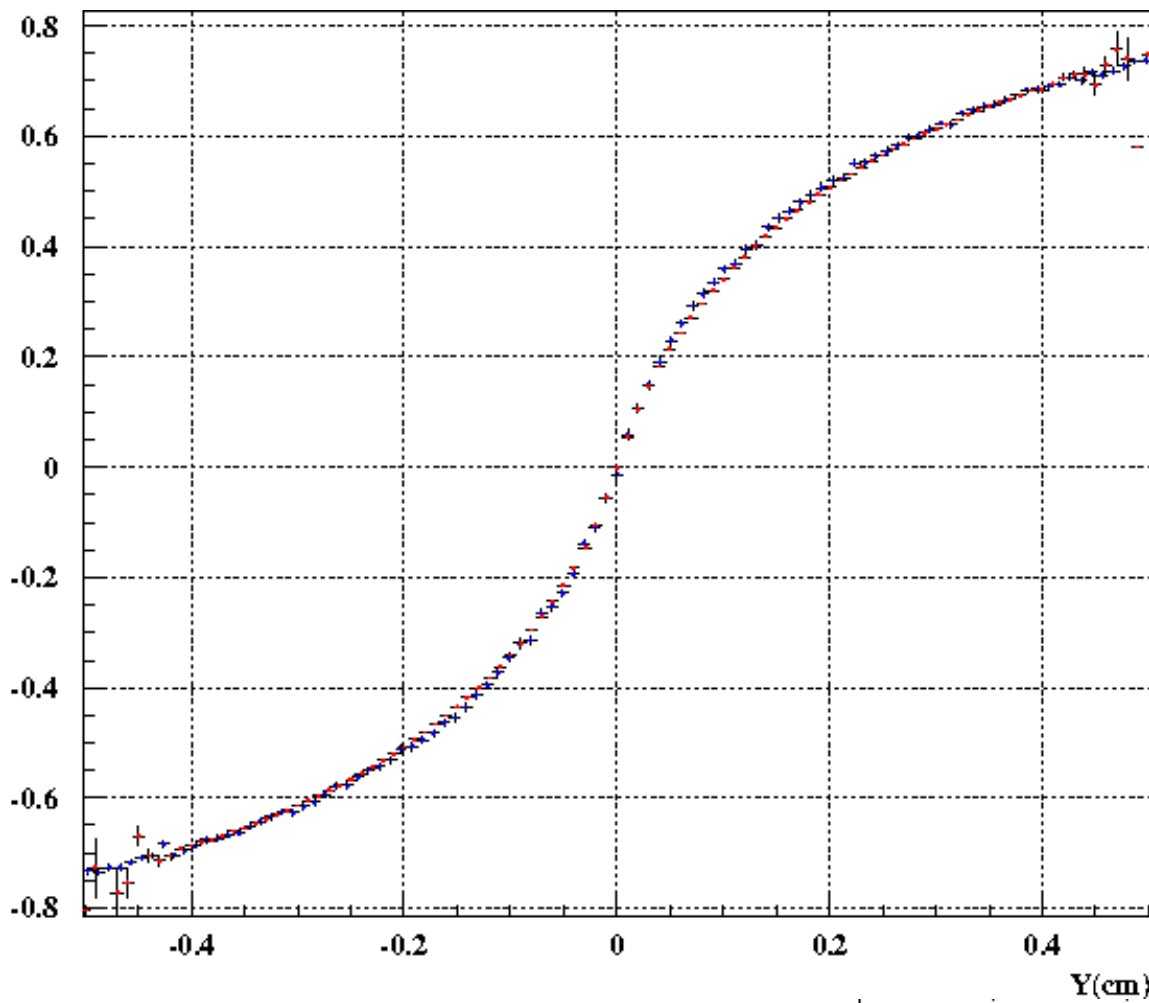(energy sharing between UP/DOWN/LEFT/RIGHT+reflections)

- Calculate E fraction going to U/D/L/R according to the angle at which the WLS is seen from the hit
- To account for attenuation, correct U by the distance of the hit to the WLS (1 parameter)
- Assume no energy leaks between U/D (~100% reflectivity of foil)
- One parameter for D light reflection and attenuation when arriving at U
- Common parameter for L and R light reflection and attenuation when arriving at U
- 1 parameter for photon statistics (to obtain 200 gammas/GeV at PMT)
- 1 parameter for attenuation along WLS

-> Fit the eta-y distribution of the data
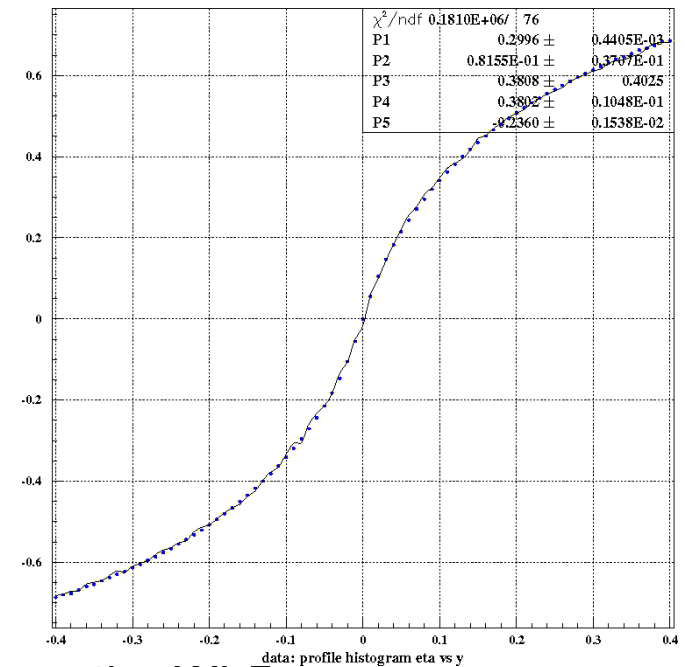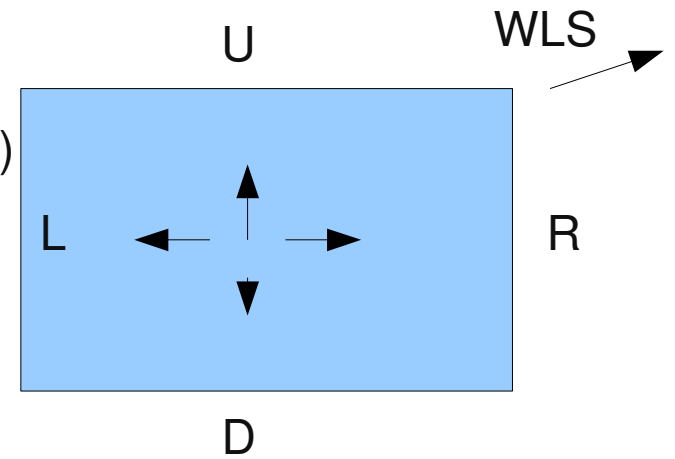
In addition, working on the effective parametrisation for the light collection efficiency as a function of the distance from the WLS.
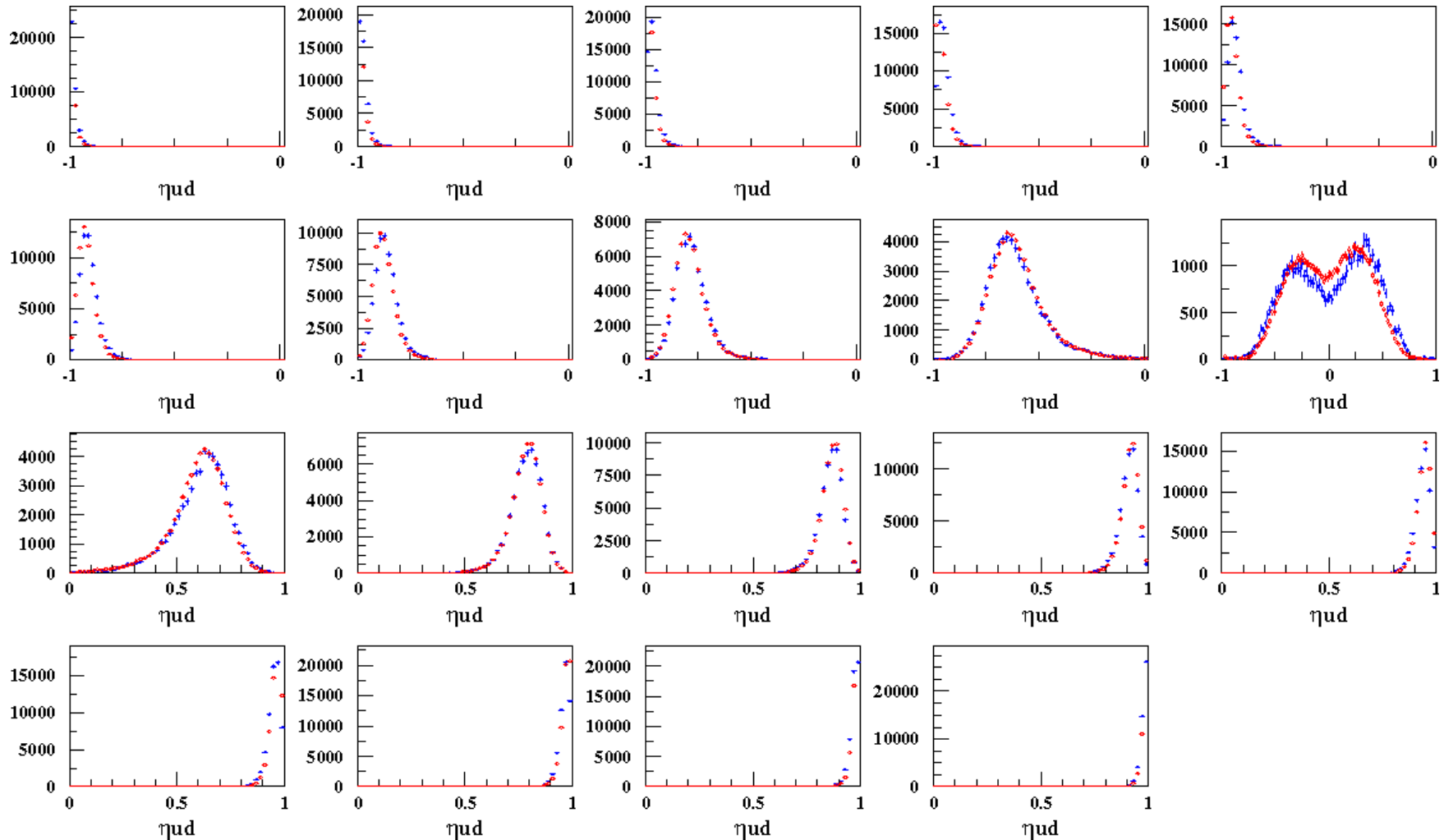

χ^2/ndf	0.1810E+06/	76
P1	0.2996 ±	0.4405E-03
P2	0.8155E-01 ±	0.3707E-01
P3	0.3808 ±	0.4025
P4	0.3802 ±	0.1048E-01
P5	-0.2360 ±	0.1538E-02

data: profile histogram eta vs y
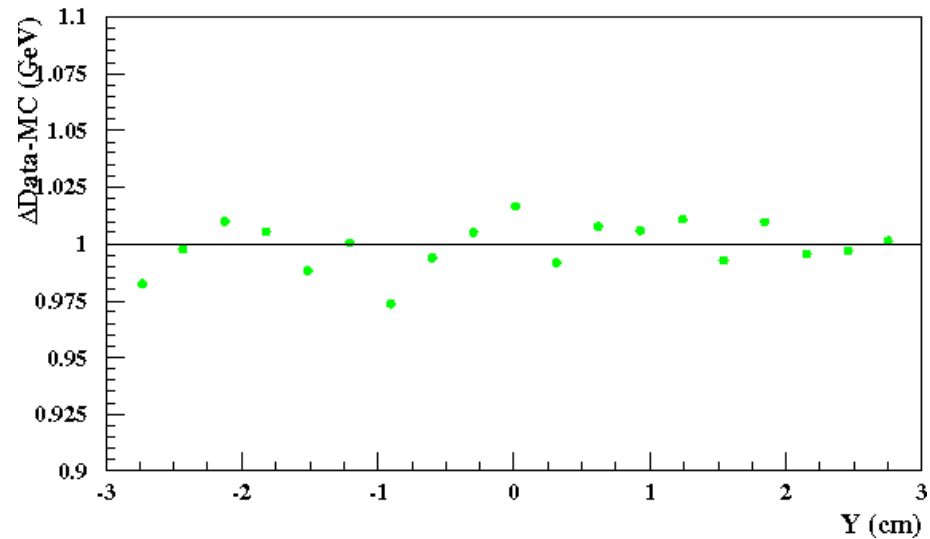
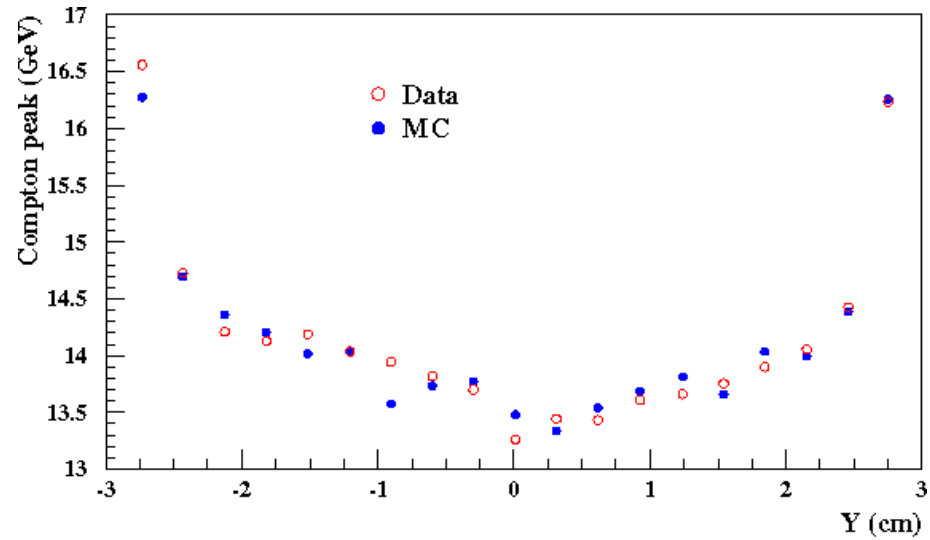# Eta-y (MC vs data)

Improved.

MC Comparison to Table Scan data

Eta in bins of y. Starting at -2.7cm, step increasing by 0.3mm

MC Comparison to Table Scan data

Compton peak as a function of y

Summary

- Effort to improve detailed Geant Monte Carlo simulation (digitisation)
- Realistic eta-y curve in the MC available -> Blanka study
- Results promising, will be final soon:
  - fitted to low eta range (|eta|<0.4)
  - should be studied in the entire eta-y range

- Study the energy resolution and correlation with eta -> Stefan
- Systematic studies for polarisation measurement