EXTRACTION OF SAMPLING FLUCTUATIONS IN BCAL READOUT CELLS

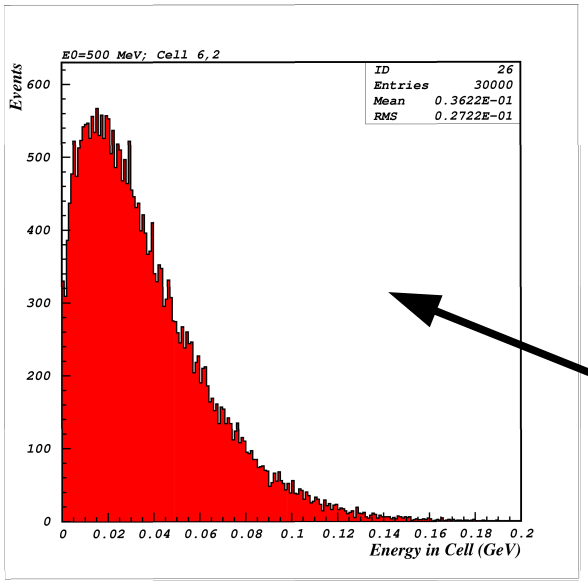
Simulation: Irina Semenova
Analysis: Andrei Semenov
(U. of Regina)

August 19, 2011

VERY PRELIMINARY:

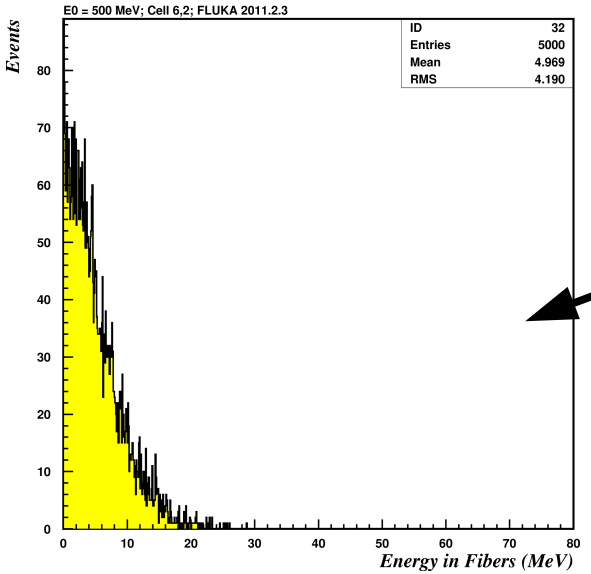
NOT FOR REFERENCES

Method



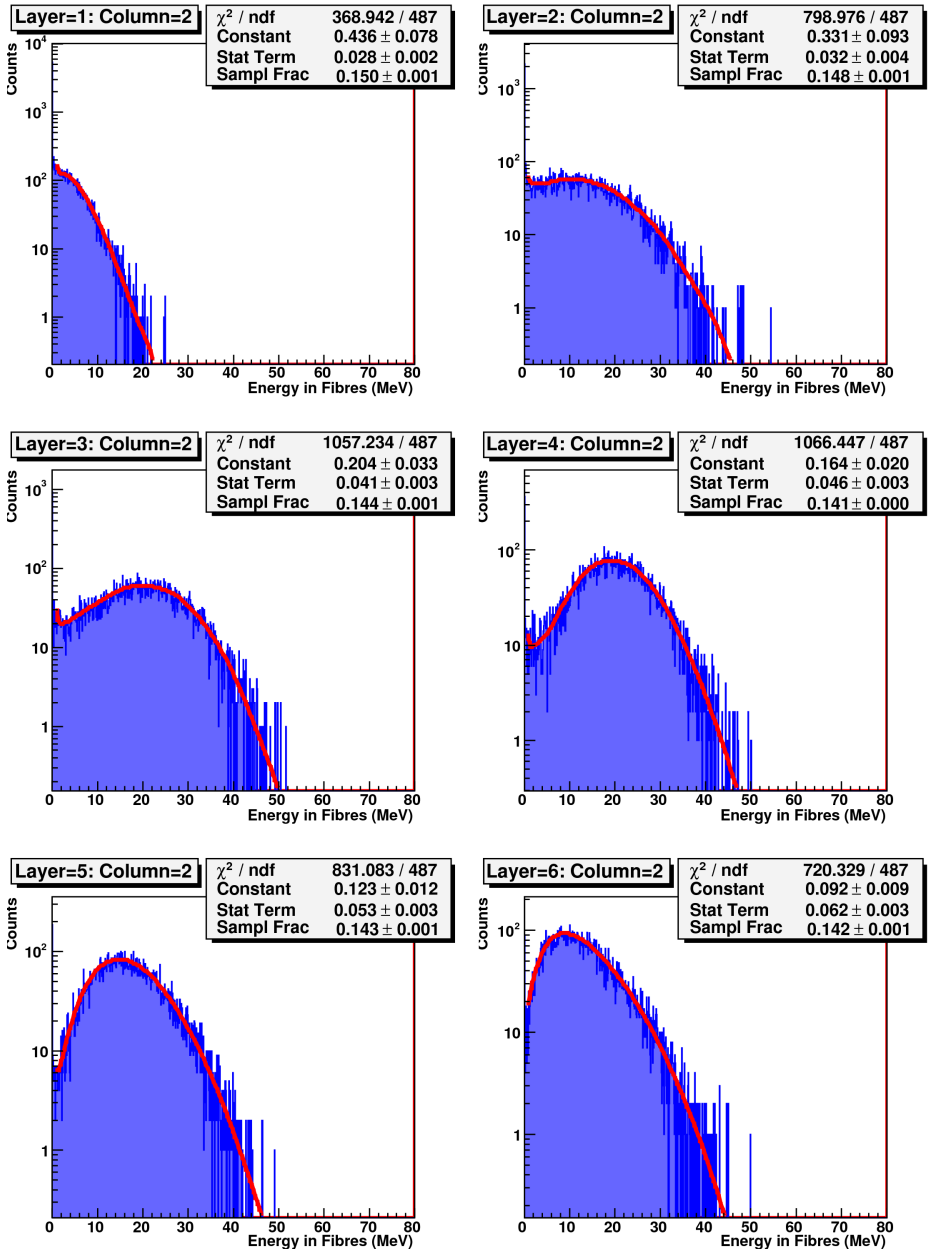
* GEANT: Simulation of energy depositions in the cells of homogeneous BCAL

* Extra-smearing of deposited energies (to address sampling fluctuations) with Poisson distribution



* Fit the resulting spectra to the distributions of energy deposited in fibers (detail BCAL model in FLUKA 2011.2.3)

Results from the Fit



* 90-deg photon emission in the center of column #2

* Fine segmentation

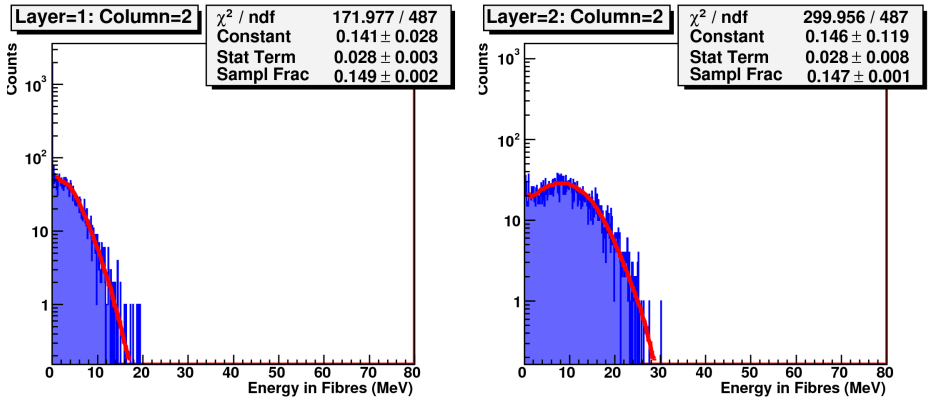
* Sampling fluctuations are represented via statistical term only

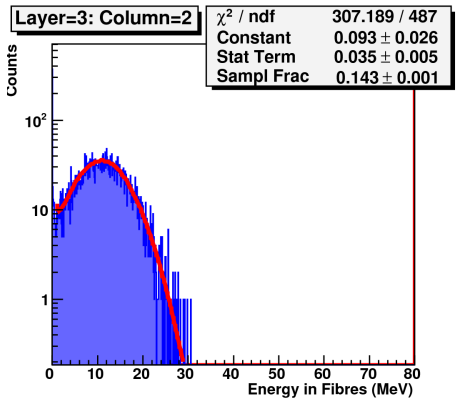
* Statistical Term and Sampling Fraction are free parameters in the fit

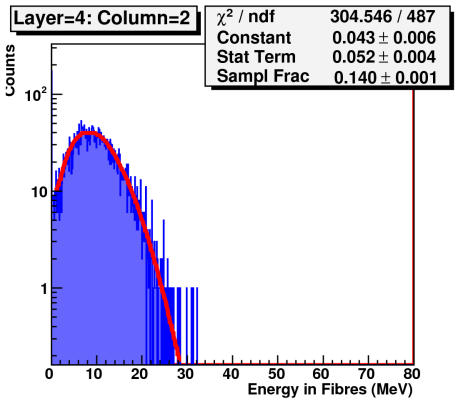
* Sampling Fraction is reasonable for FLUKA simulation with “core-only” fibers in BCAL model

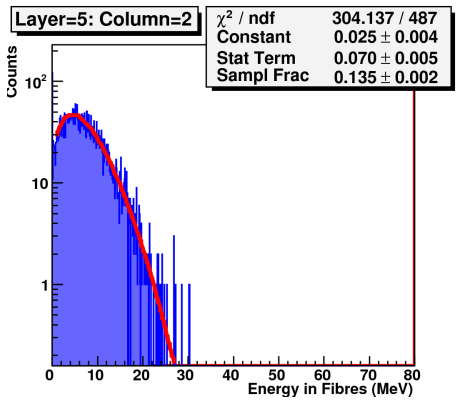
These spectra are for E0=1000 MeV

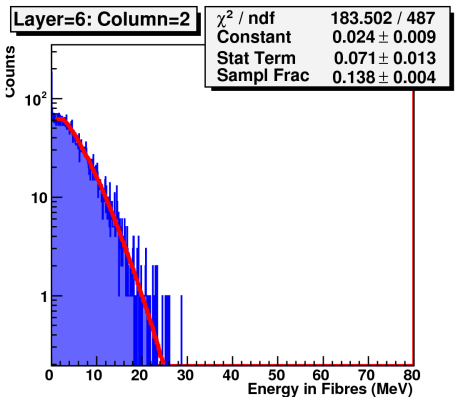
Results from the Fit





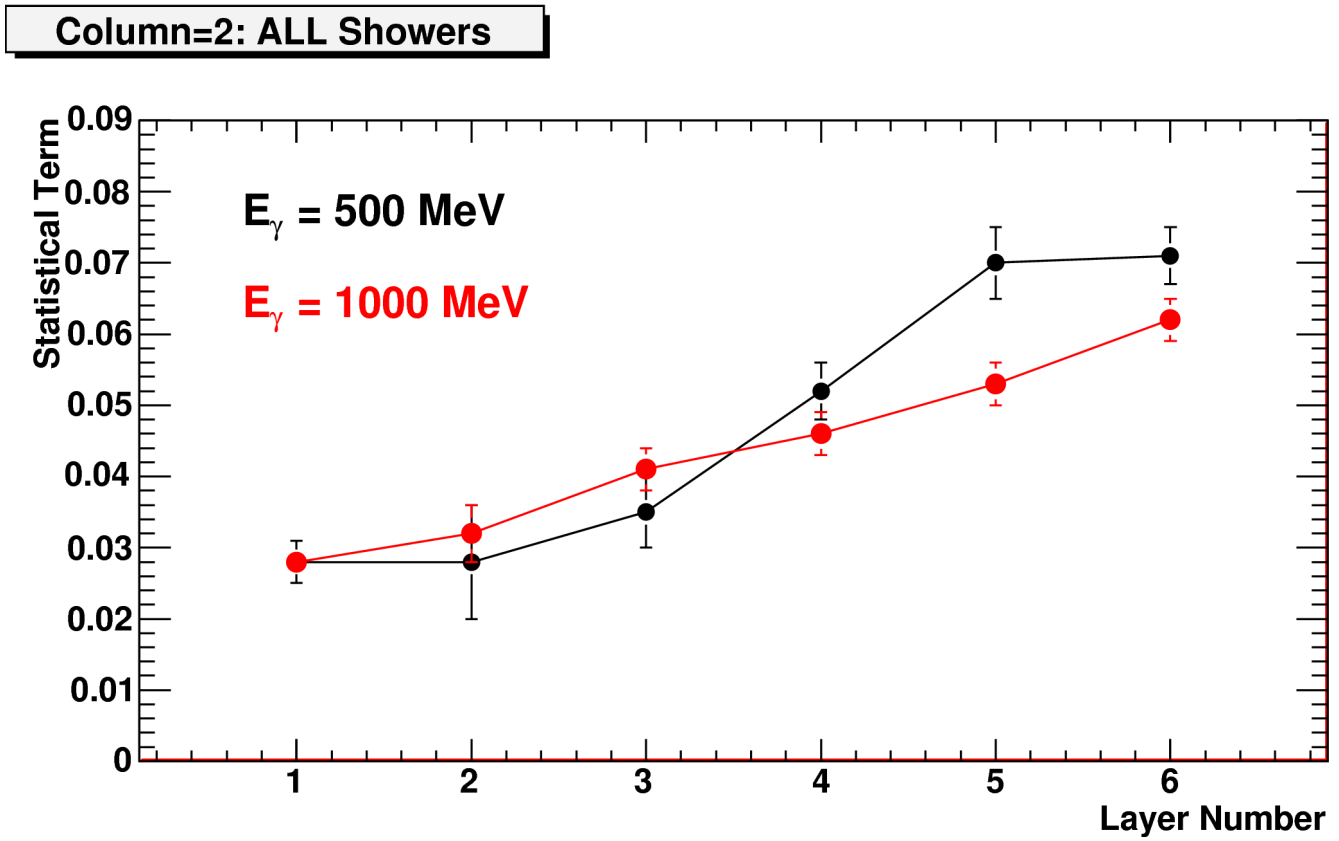






These spectra are for E0 = 500 MeV

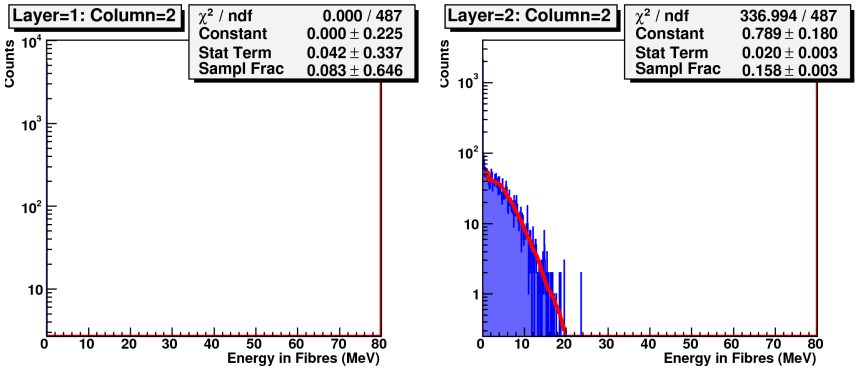
Results from the Fit

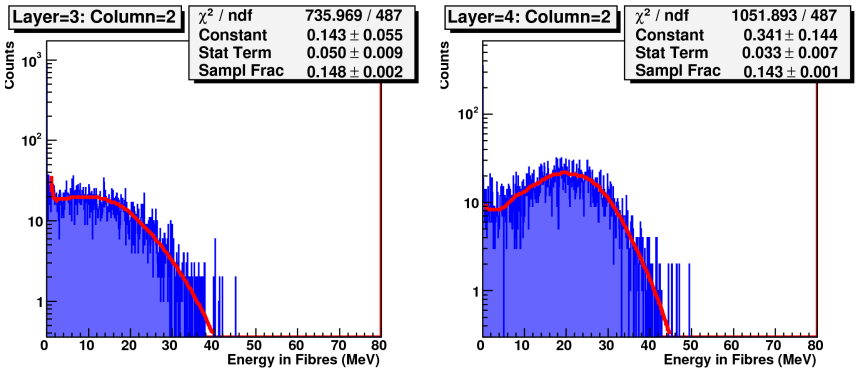


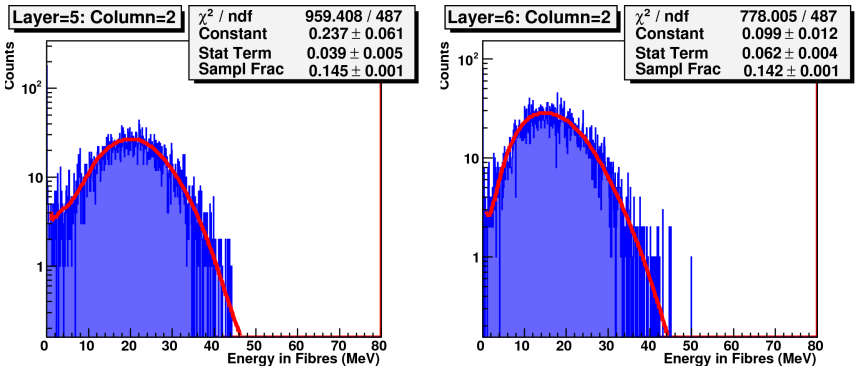
* Statistical coefficient in sampling fluctuations is NOT constant on cell-by-cell basis but increases with shower development (factor 2.4 in 6 inner layers at E0=1 GeV)

* Lower photon energy => Faster shower development => Faster rise of statistical coefficient in sampling fluctuations

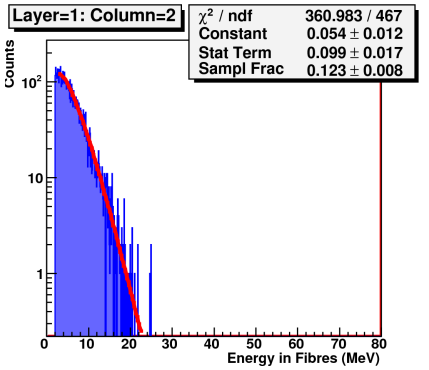
Cut on energy deposited in cell (1,2): E0 = 1000 MeV

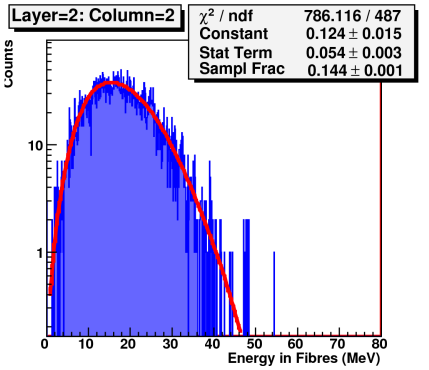


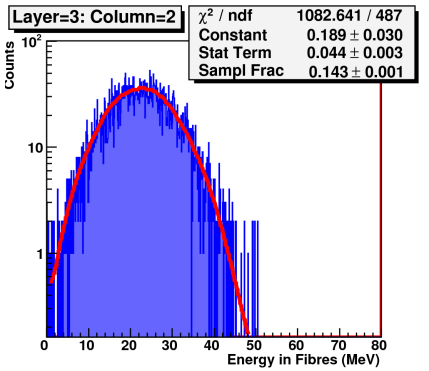


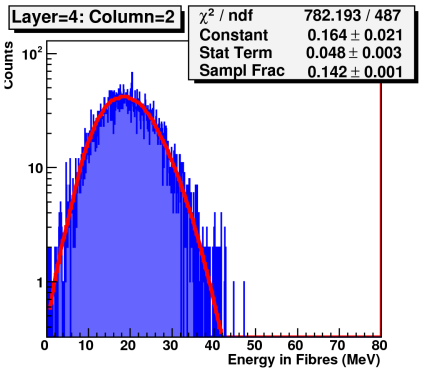


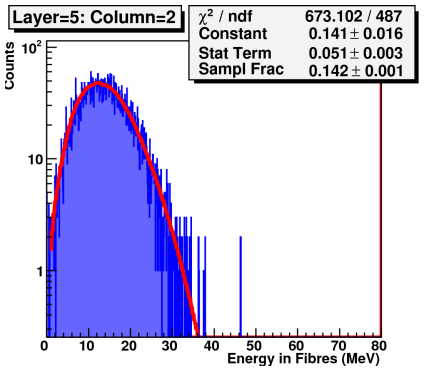
ΔE(1,2) < 0.1 MeV

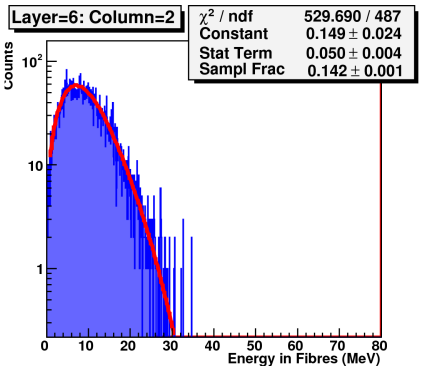






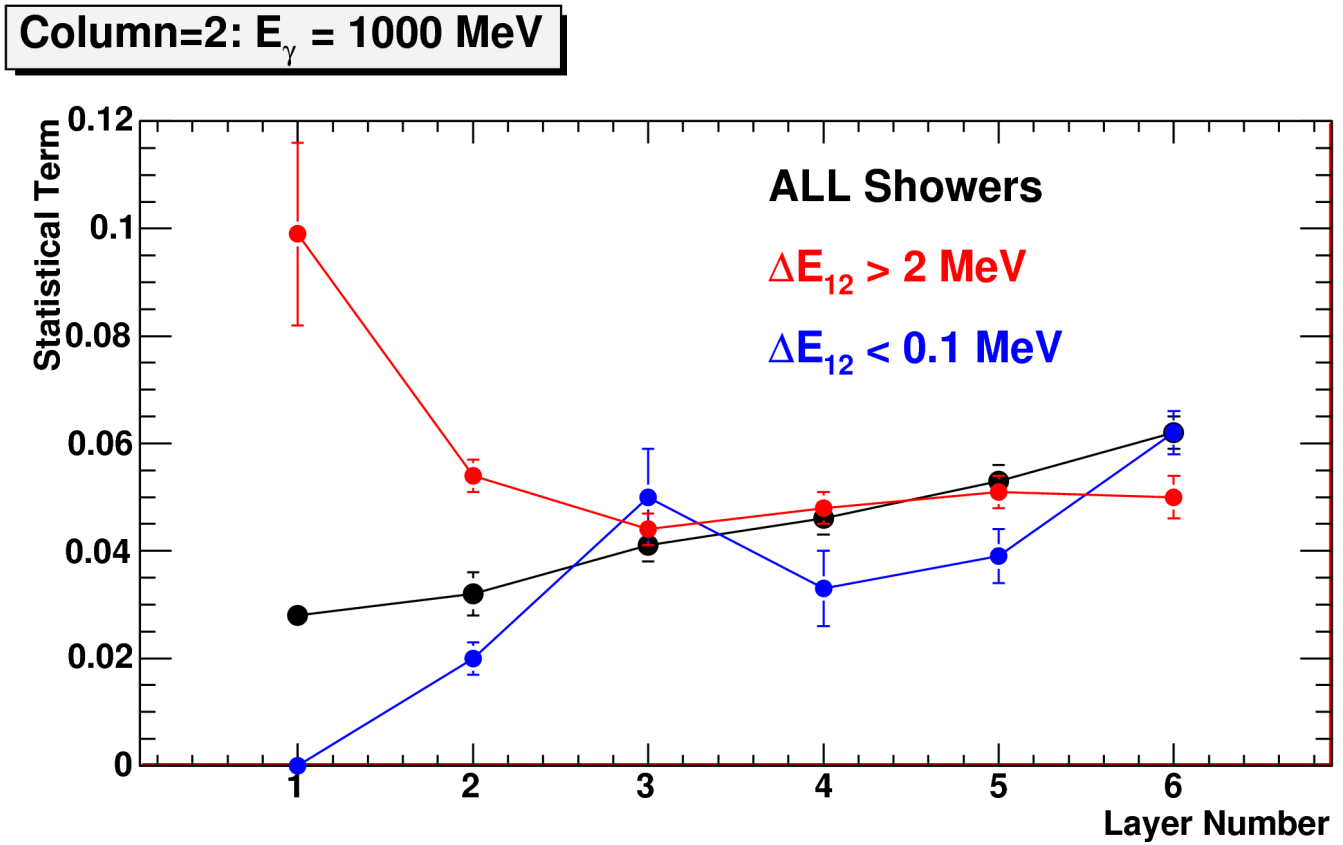






ΔE(1,2) > 2 MeV

Results from the Fit



* Statistical coefficient in sampling fluctuations in the first layers depends on primary photon conversion point

* Statistical coefficient in sampling fluctuations in cell (2,2) is strongly correlated with one in the cell (1,2)

Preliminary Conclusions:

* Statistical coefficient in sampling fluctuations is NOT constant on cell-by-cell basis but increases with shower development (factor 2.4 in 6 inner layers at E0=1 GeV)

* Energy dependence: Lower photon energy => Faster shower development => Faster rise of statistical coefficient in sampling fluctuations

* Shower evolution dependence: Statistical coefficient in sampling fluctuations in the first layers depends on primary photon conversion point

* Statistical coefficient in sampling fluctuations in cell (2,2) is strongly correlated with one in the cell (1,2)

* Sampling fraction for column #2 looks almost stable

* This study was done for “direct-photon-hit” column of inner cells; the study with “side” columns of cell require bigger simulated samples; there are very preliminary indications that sampling fraction might be not constant in “side” cells