ZDC - EIC

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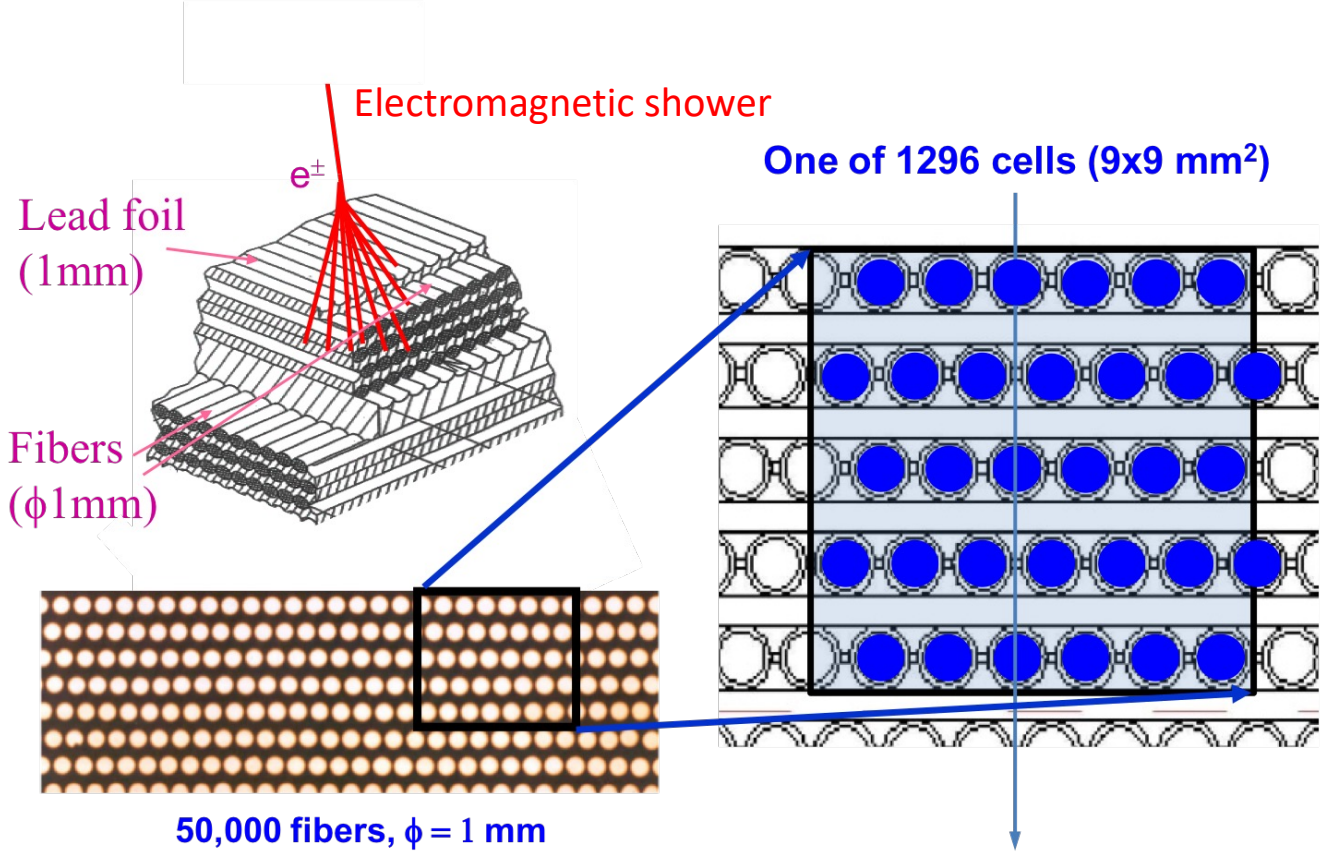
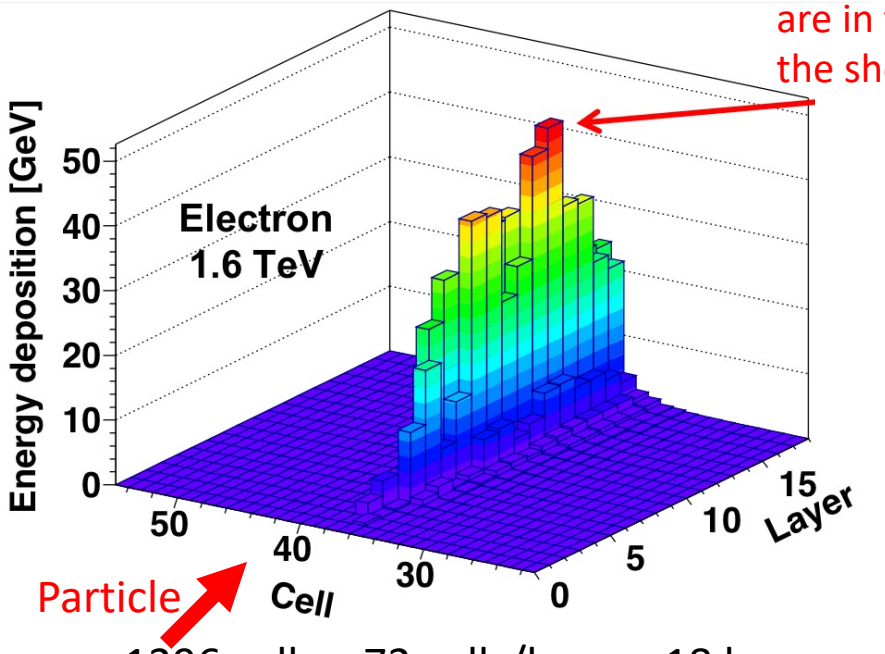
AMS Electromagnetic Calorimeter (ECAL)



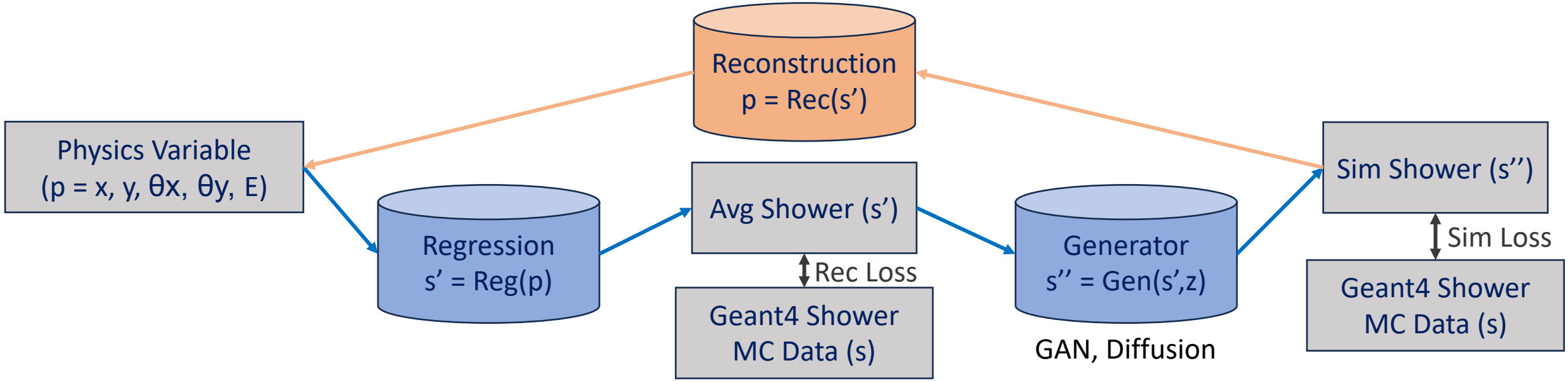
Highest enegy cells are in the core of the shower.

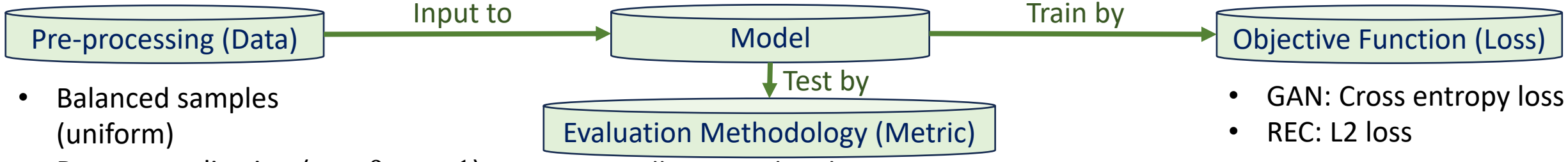


1296 cells = 72 cells/layer x 18 layers

Direction Projection of Layers (10 in Z-Y, 8 in Z-X)

Y	Y	X	X	Y	Y	X	X	Y	Y	X	X	Y	Y	X	X	Y	Y

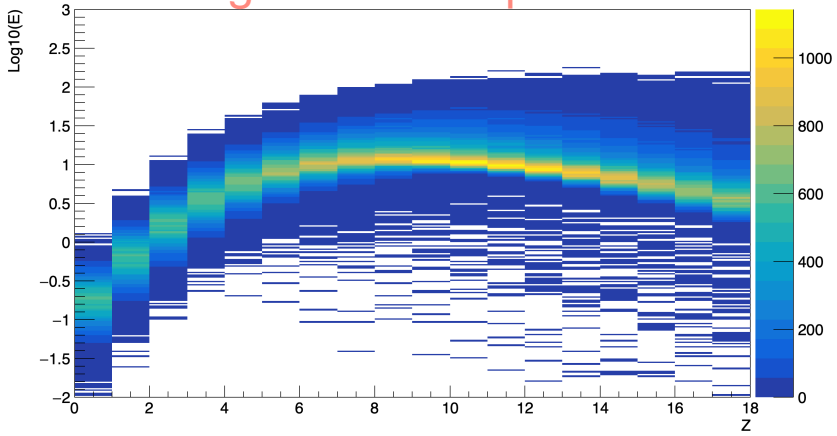




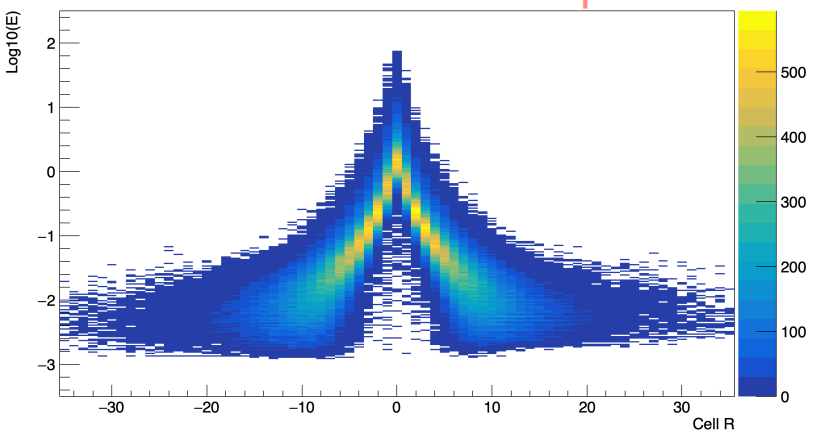
- Balanced samples (uniform)
- Data normalization ($\mu = 0, \sigma = 1$)

- GAN: Cross entropy loss
- REC: L2 loss

e-, 100GeV Longitudinal Shape



Transverse Shape



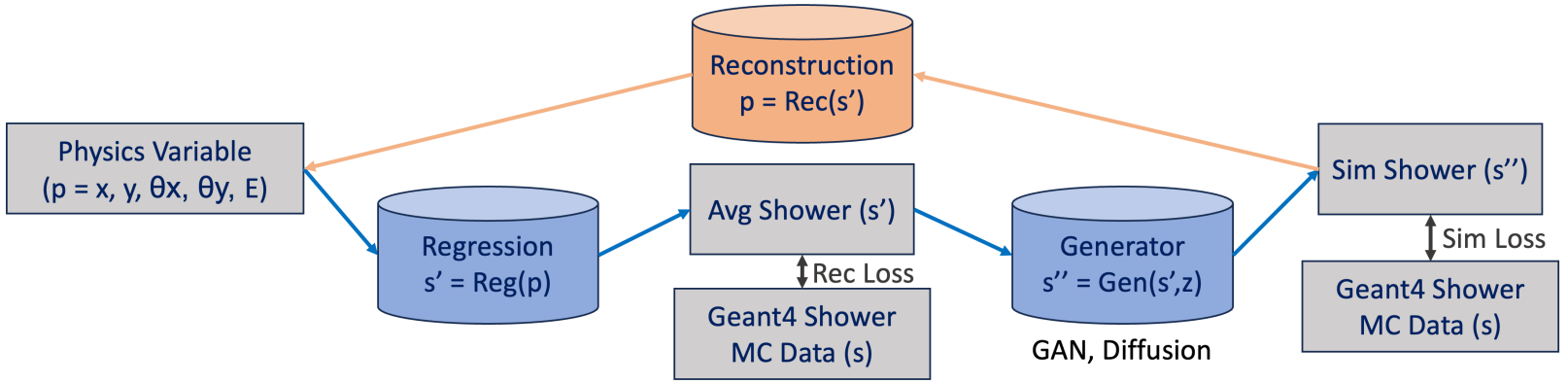
The longitudinal shower profile is described by the Gamma distribution:

$$\frac{dE}{dt}(t) = E_0 \frac{(\beta t)^{\beta T_0} \beta e^{-\beta t}}{\Gamma(\beta T_0 + 1)}, \quad (1)$$

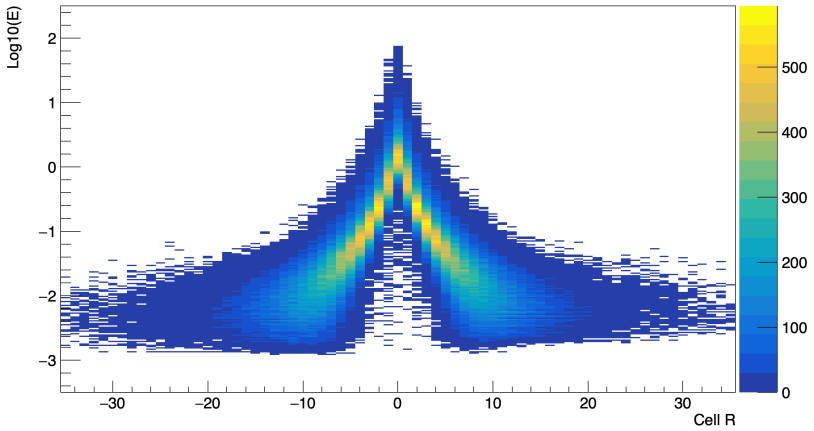
using parameters described above. The scale parameter β is found to be constant over the wide energy range, therefore it is fixed in the present analysis. Individual shower parameters E_0 and T_0 are obtained from a fit to observed energy depositions in the ECAL cells of that shower. Fig. 7 shows the high quality of the description of electron showers over a wide energy range by the model based on Eq. (1).

At a given shower depth, the transverse shower shape as a function of the distance from the shower axis r is described by the sum of a narrow core and a wide tail:

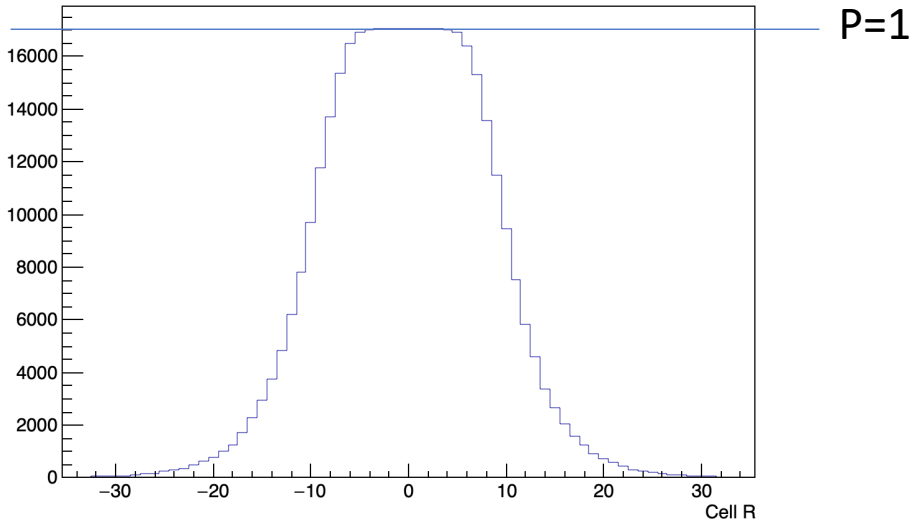
$$\frac{dE}{dr}(t, r) \propto Q_C \frac{2rR_C^2}{(r^2 + R_C^2)^2} + (1 - Q_C) \frac{2rR_T^2}{(r^2 + R_T^2)^2}, \quad (2)$$


Reconstruction
p = Rec(s')
Physics Variable
(p = x, y, θx, θy, E)
Regression
s' = Reg(p)
Avg Shower (s')
Rec Loss
Geant4 Shower
MC Data (s)
Generator
s'' = Gen(s',z)
GAN, Diffusion
Sim Shower (s'')
Sim Loss
Geant4 Shower
MC Data (s)

Value

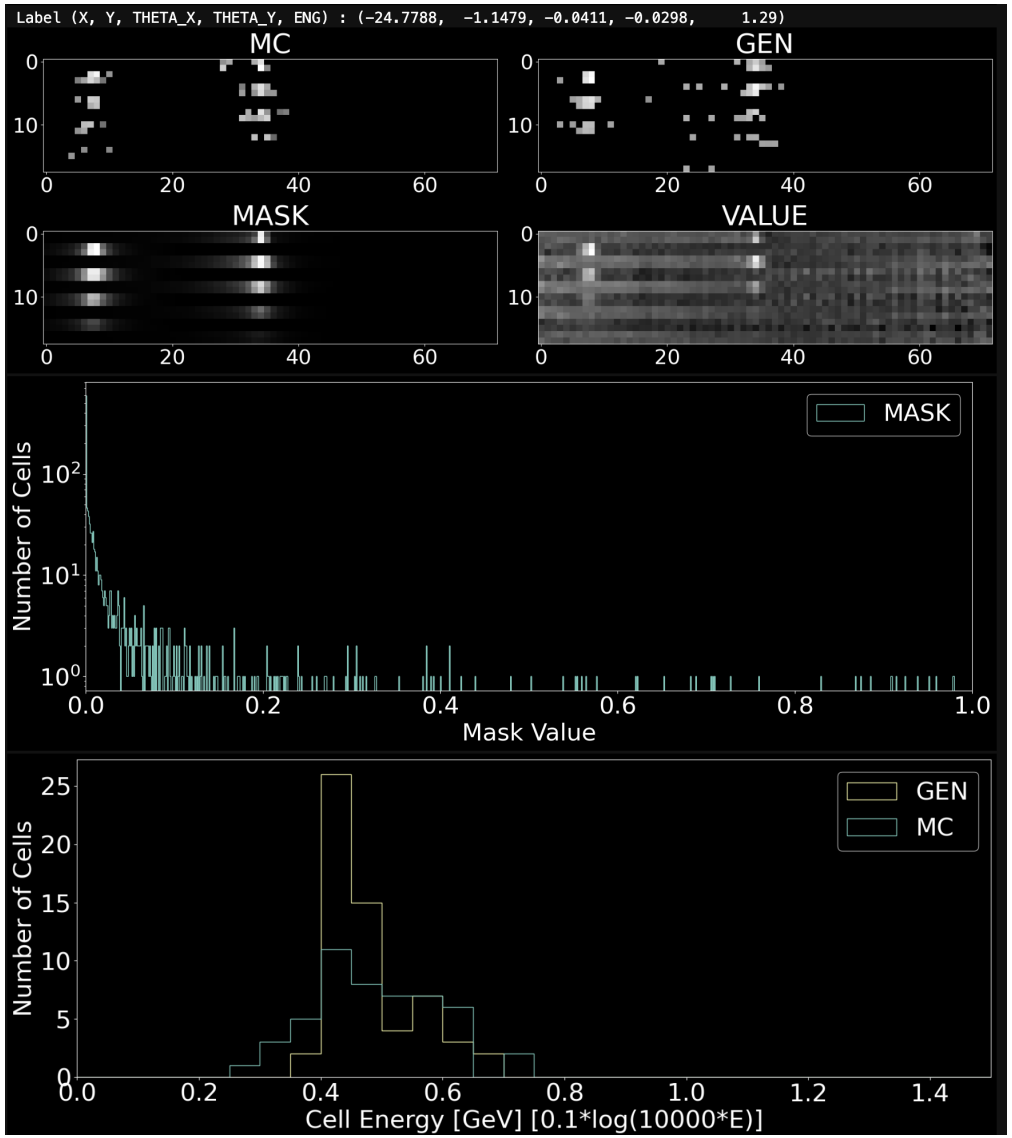

Log10(E)
Cell R

Mask

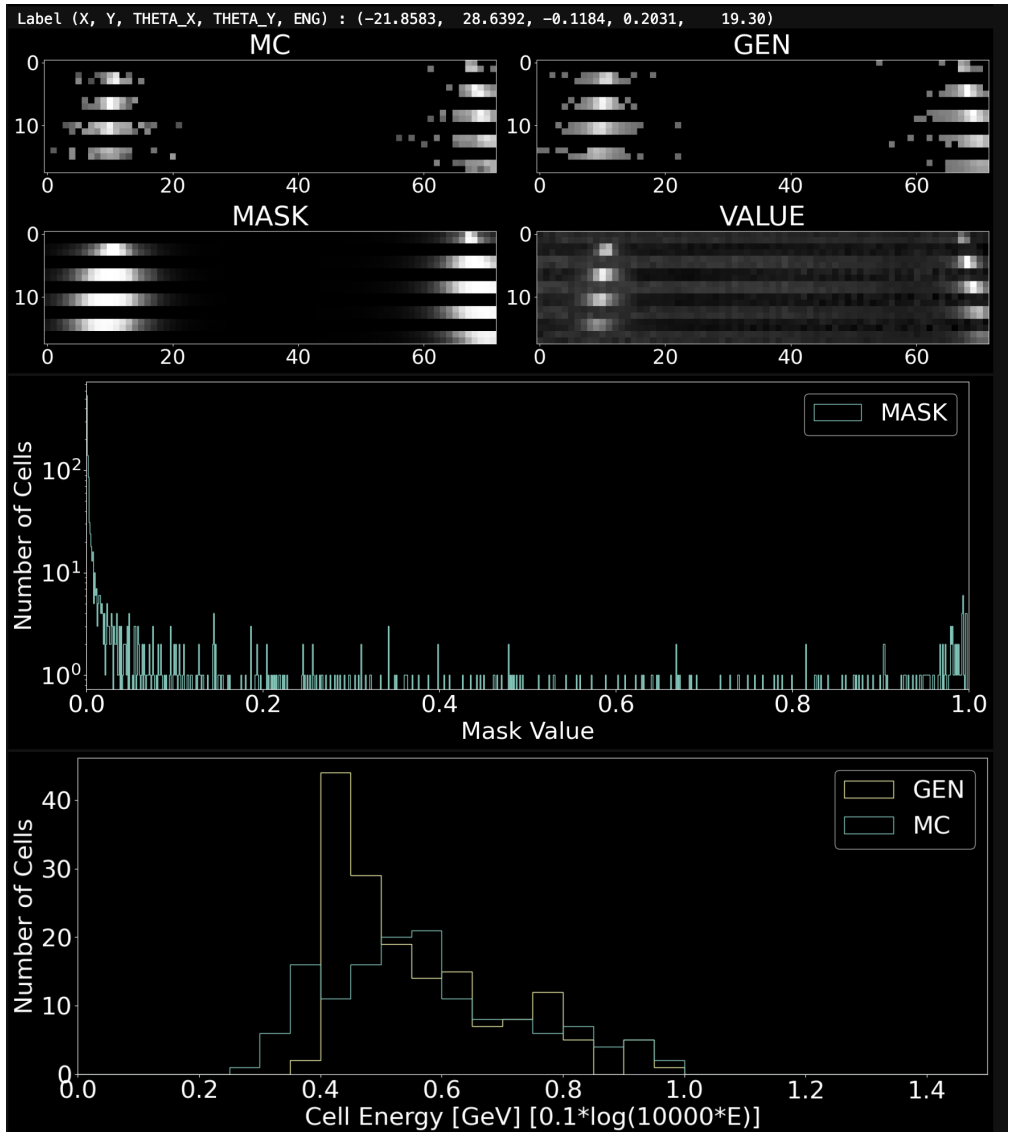

P=1
Cell R

Generator

1.29 GeV

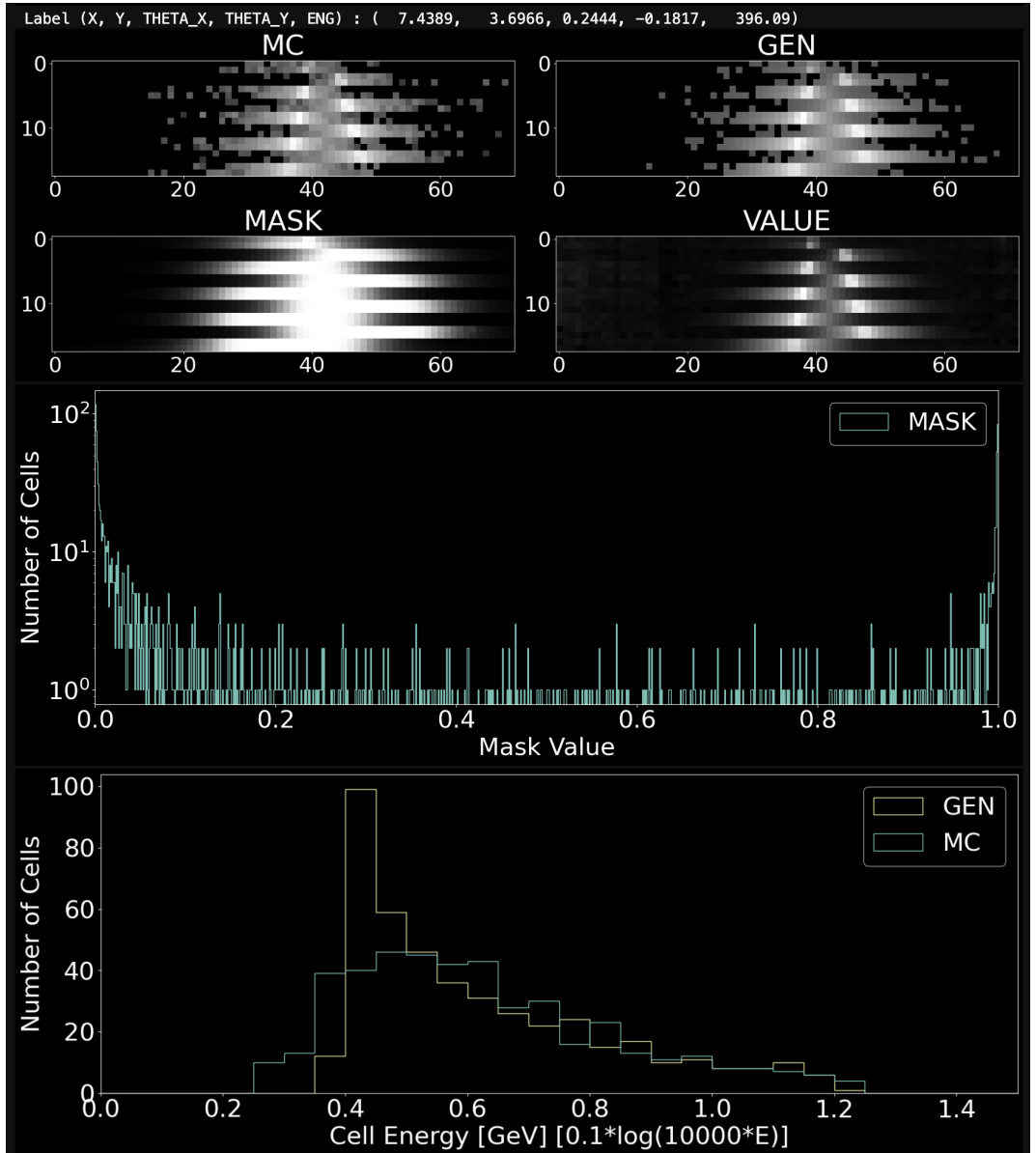


19.30 GeV

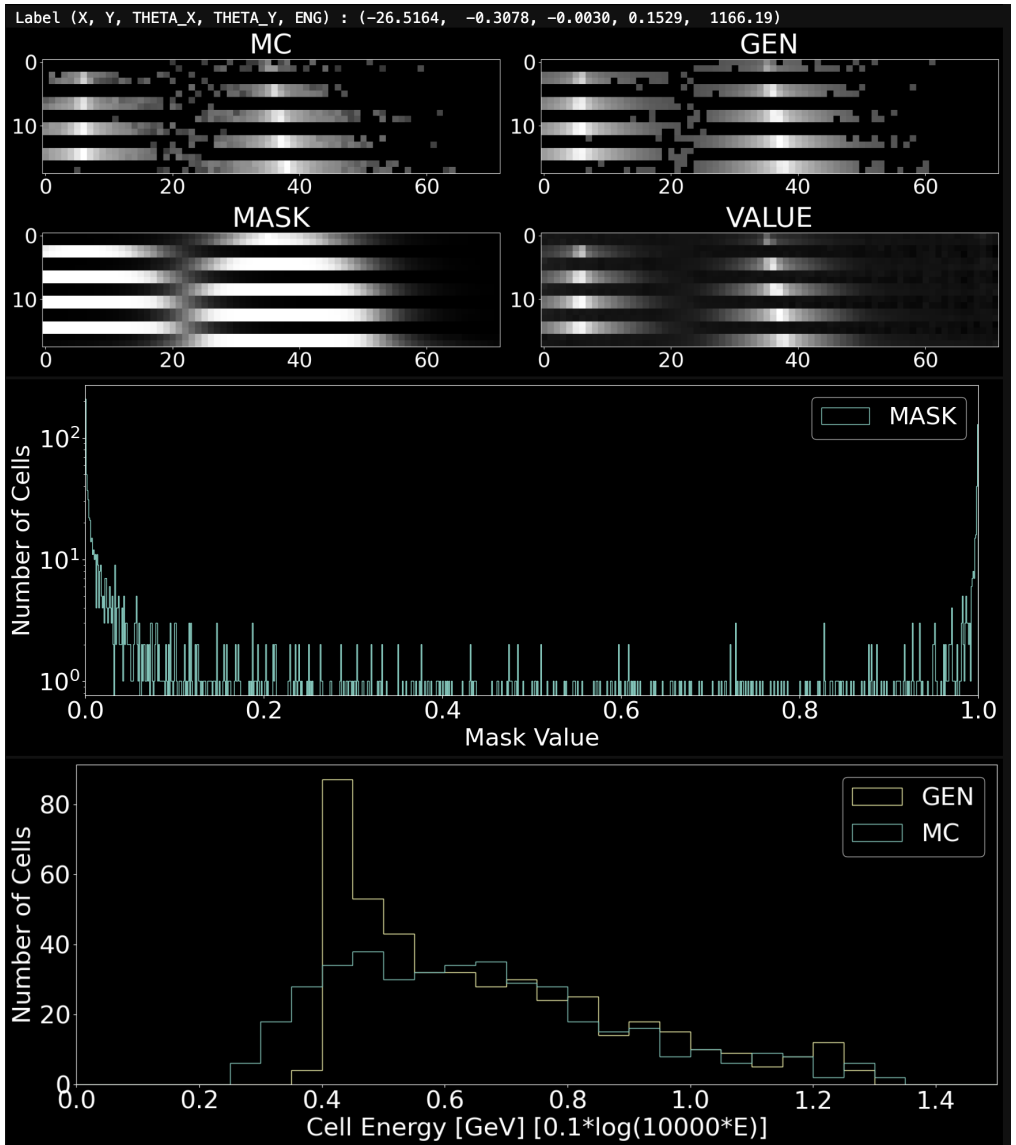


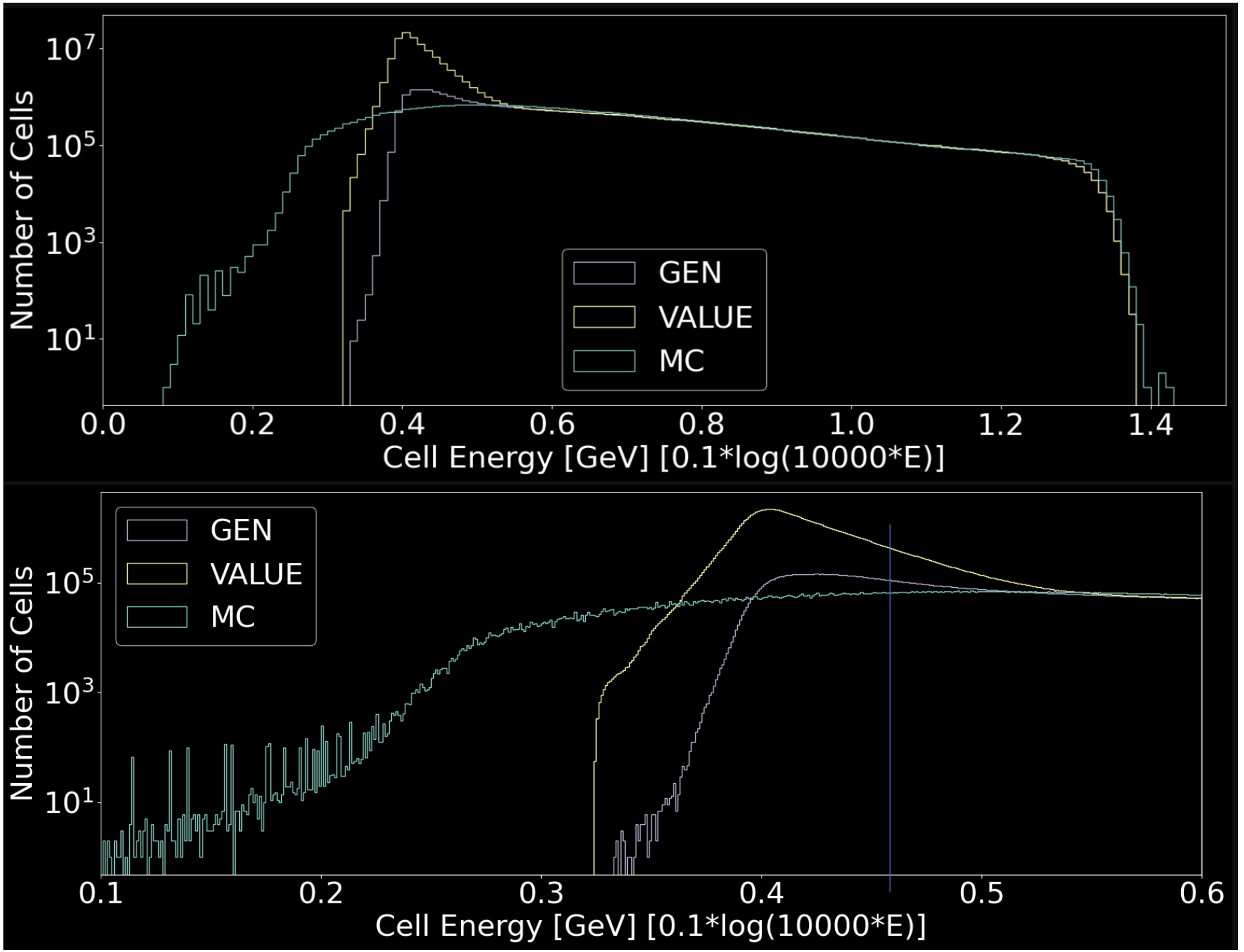
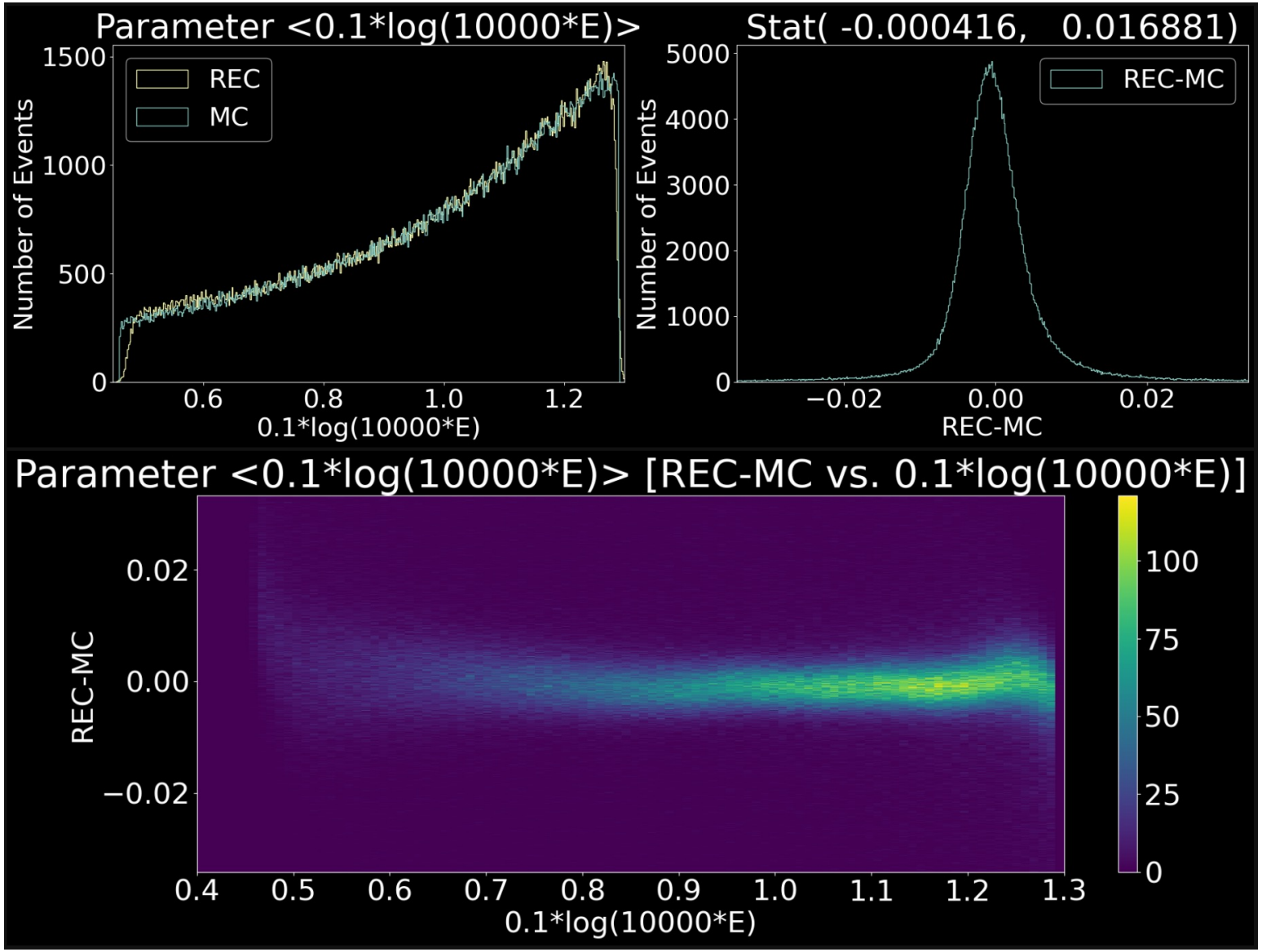
Generator

396 GeV



1166 GeV




Number of Cells
10^7
10^5
10^3
10^1
GEN
VALUE
MC
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Cell Energy [GeV] [0.1*log(10000*E)]
Number of Cells
10^5
10^3
10^1
GEN
VALUE
MC
0.1
0.2
0.3
0.4
0.5
0.6
Cell Energy [GeV] [0.1*log(10000*E)]

Reconstructor