ATLAS New Dataset

Basic Explore

Basics

Total Events: 127271

Layers: 24

Incident Energy: 15 values (256 MeV ⇔ 4,194,304 MeV)

Energy_layer_i Unit: 1 (E_voxel / E_inc)

Non-zero Layers: 7(5) (0, 1, 2, 3, 12, 13, 14)

Keys:

Energy_layer_i: [127271, N_i]

Incident_energy: [127271]

Binsize_alpha_layer_i: [127271, N_i]

Binsize_radius_layer_i: [127271, N_i]

Binstart_alpha_layer_i: [127271, N_i]

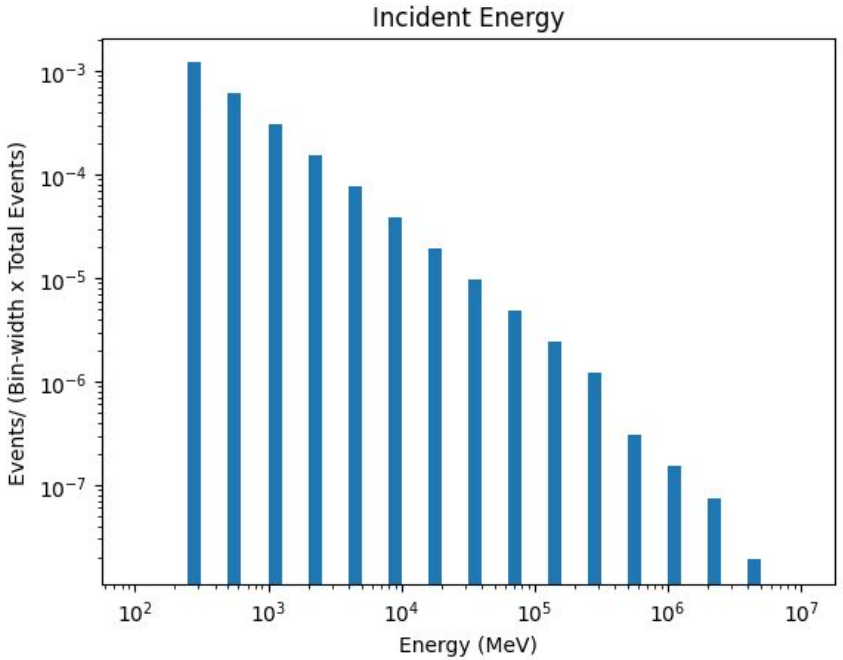
Binstart_radius_layer_i: [127271, N_i]

eta_mod: [127271]

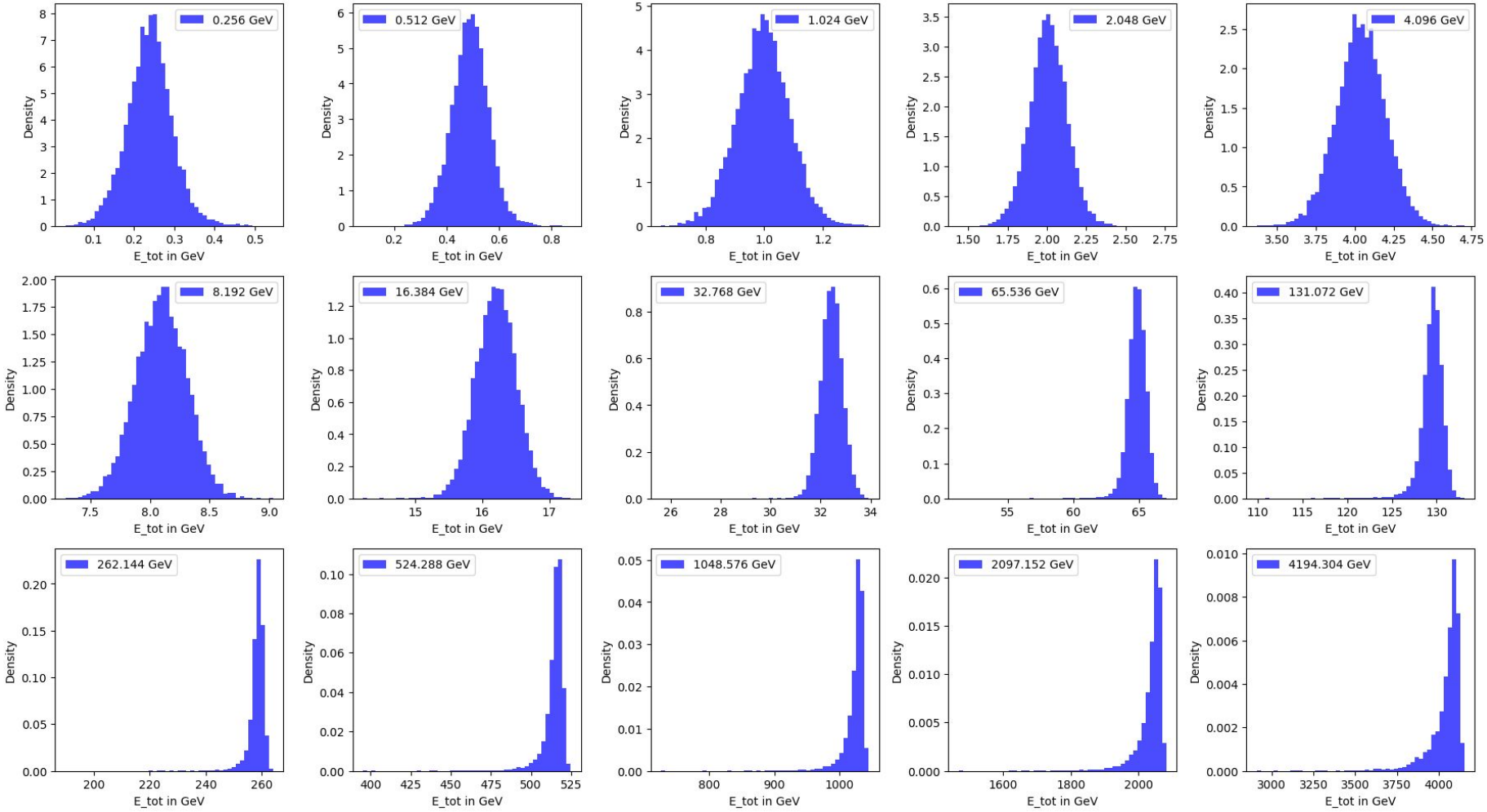
phi_mod: [127271]

Incidental Energy

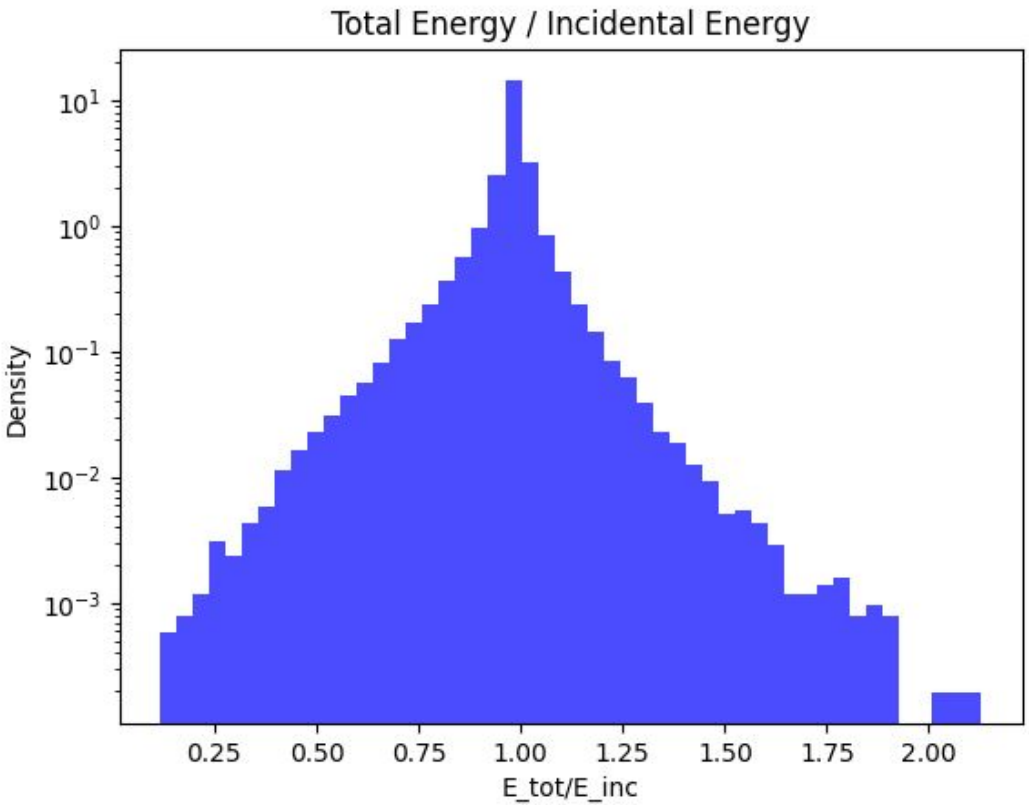
Incident Energy: 256.0, Count: 10000
Incident Energy: 512.0, Count: 10000
Incident Energy: 1024.0, Count: 10000
Incident Energy: 2048.0, Count: 10000
Incident Energy: 4096.0, Count: 10000
Incident Energy: 8192.0, Count: 10000
Incident Energy: 16384.0, Count: 10000
Incident Energy: 32768.0, Count: 9999
Incident Energy: 65536.0, Count: 9996
Incident Energy: 131072.0, Count: 9990
Incident Energy: 262144.0, Count: 9984
Incident Energy: 524288.0, Count: 4970
Incident Energy: 1048576.0, Count: 4992
Incident Energy: 2097152.0, Count: 4844
Incident Energy: 4194304.0, Count: 2496



Energy Responses for 15 incidental energies



Whole Range Energy Response Ratio:



Layer-wise Info

Total Events: 127271

Layers: 24

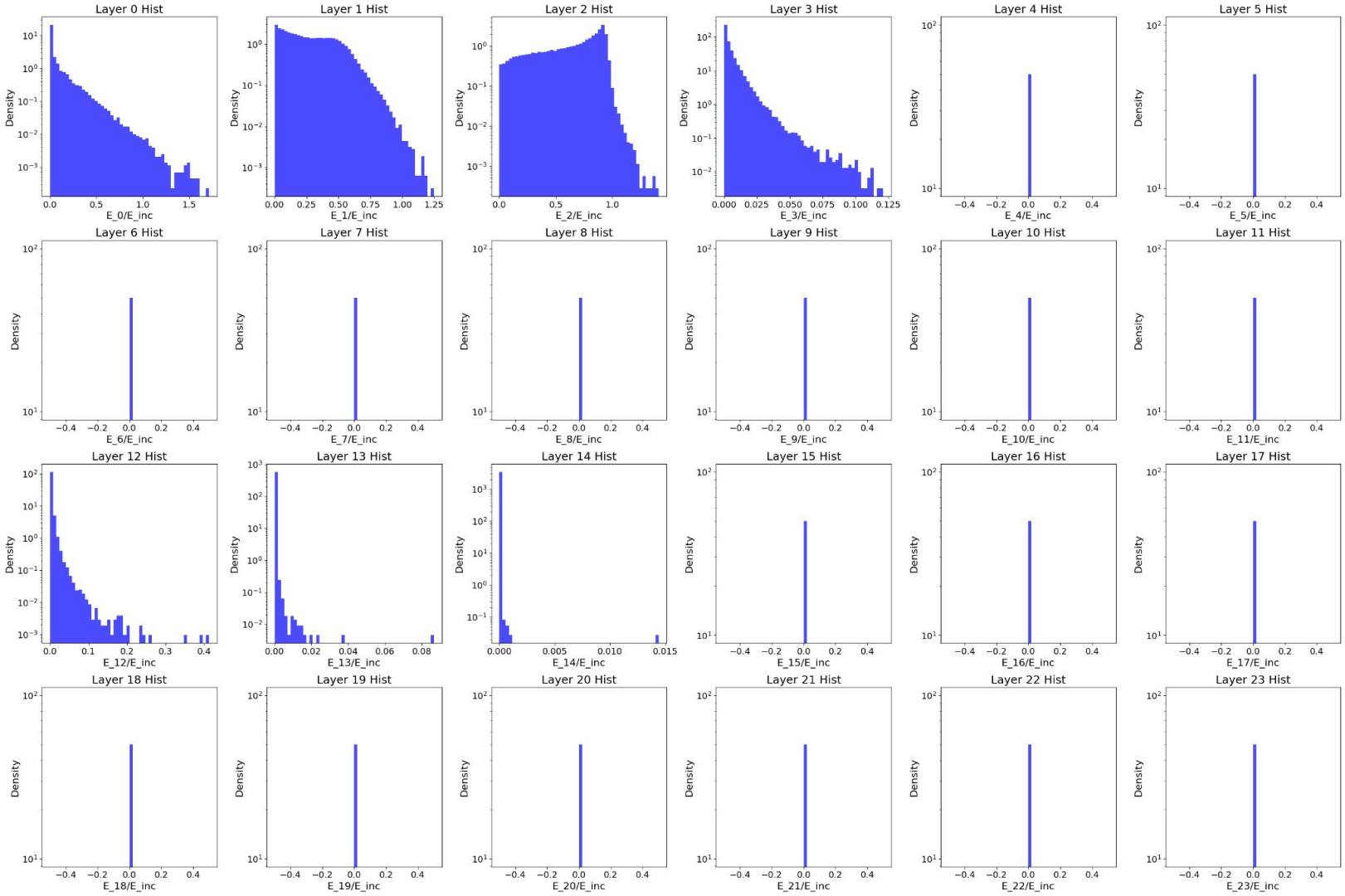
Incident Energy Range: (256 MeV ⇔ 4,194,304 MeV)

Data Unit: 1 (E_voxel / E_tot)

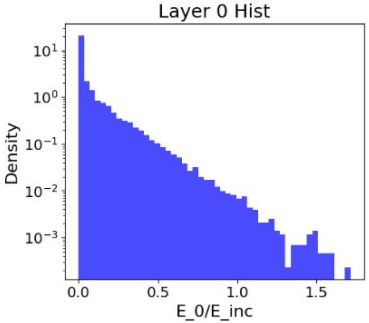
Non-zero Layers: 7 (0, 1, 2, 3, 12, 13, 14)

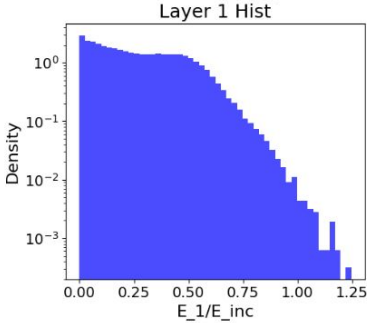
(E_13, E_14 are too small so probably we only train 5 layers)

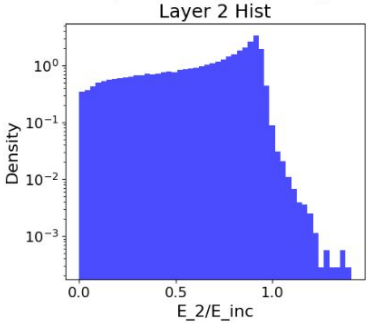
energy_layer_0: torch.Size([127271, 36])
energy_layer_1: torch.Size([127271, 164])
energy_layer_2: torch.Size([127271, 110])
energy_layer_3: torch.Size([127271, 36])
energy_layer_4: torch.Size([127271, 36])
energy_layer_5: torch.Size([127271, 164])
energy_layer_6: torch.Size([127271, 110])
energy_layer_7: torch.Size([127271, 36])
energy_layer_8: torch.Size([127271, 36])
energy_layer_9: torch.Size([127271, 36])
energy_layer_10: torch.Size([127271, 36])
energy_layer_11: torch.Size([127271, 36])
energy_layer_12: torch.Size([127271, 36])
energy_layer_13: torch.Size([127271, 36])
energy_layer_14: torch.Size([127271, 36])
energy_layer_15: torch.Size([127271, 36])
energy_layer_16: torch.Size([127271, 36])
energy_layer_17: torch.Size([127271, 36])
energy_layer_18: torch.Size([127271, 36])
energy_layer_19: torch.Size([127271, 36])
energy_layer_20: torch.Size([127271, 36])
energy_layer_21: torch.Size([127271, 36])
energy_layer_22: torch.Size([127271, 36])
energy_layer_23: torch.Size([127271, 36])

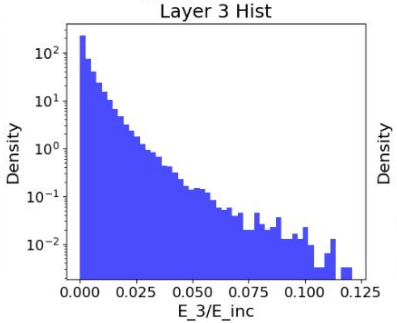

Layer 0 Hist
Density
E_0/E_inc
Layer 1 Hist
Density
E_1/E_inc
Layer 2 Hist
Density
E_2/E_inc
Layer 3 Hist
Density
E_3/E_inc
Layer 4 Hist
Density
E_4/E_inc
Layer 5 Hist
Density
E_5/E_inc
Layer 6 Hist
Density
E_6/E_inc
Layer 7 Hist
Density
E_7/E_inc
Layer 8 Hist
Density
E_8/E_inc
Layer 9 Hist
Density
E_9/E_inc
Layer 10 Hist
Density
E_10/E_inc
Layer 11 Hist
Density
E_11/E_inc
Layer 12 Hist
Density
E_12/E_inc
Layer 13 Hist
Density
E_13/E_inc
Layer 14 Hist
Density
E_14/E_inc
Layer 15 Hist
Density
E_15/E_inc
Layer 16 Hist
Density
E_16/E_inc
Layer 17 Hist
Density
E_17/E_inc
Layer 18 Hist
Density
E_18/E_inc
Layer 19 Hist
Density
E_19/E_inc
Layer 20 Hist
Density
E_20/E_inc
Layer 21 Hist
Density
E_21/E_inc
Layer 22 Hist
Density
E_22/E_inc
Layer 23 Hist
Density
E_23/E_inc

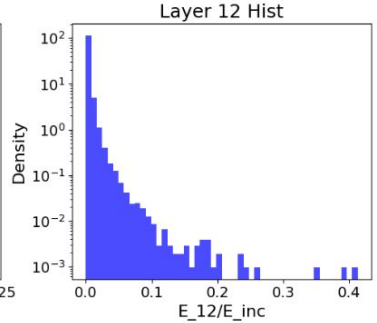
Energy Ratio in Each Layer for whole range Incident Energy



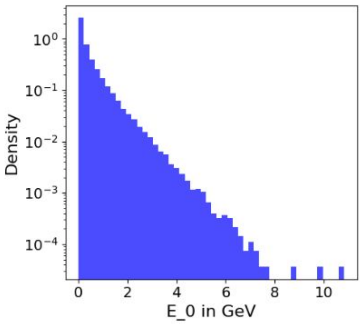


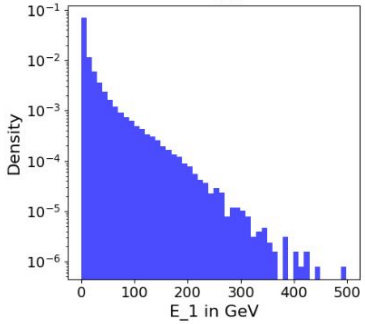


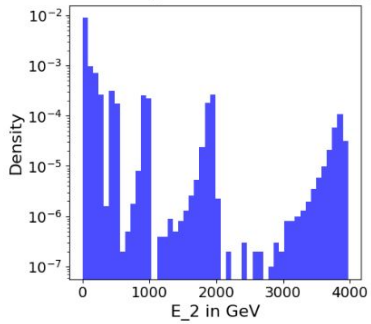


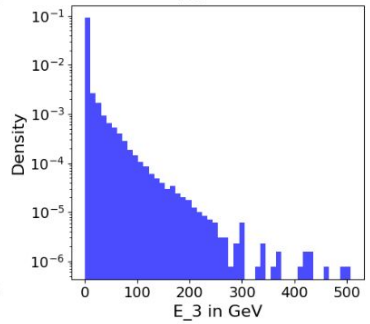


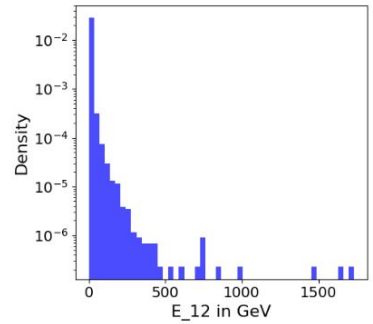
Energy Distribution in Each Layer for whole range Incident Energy

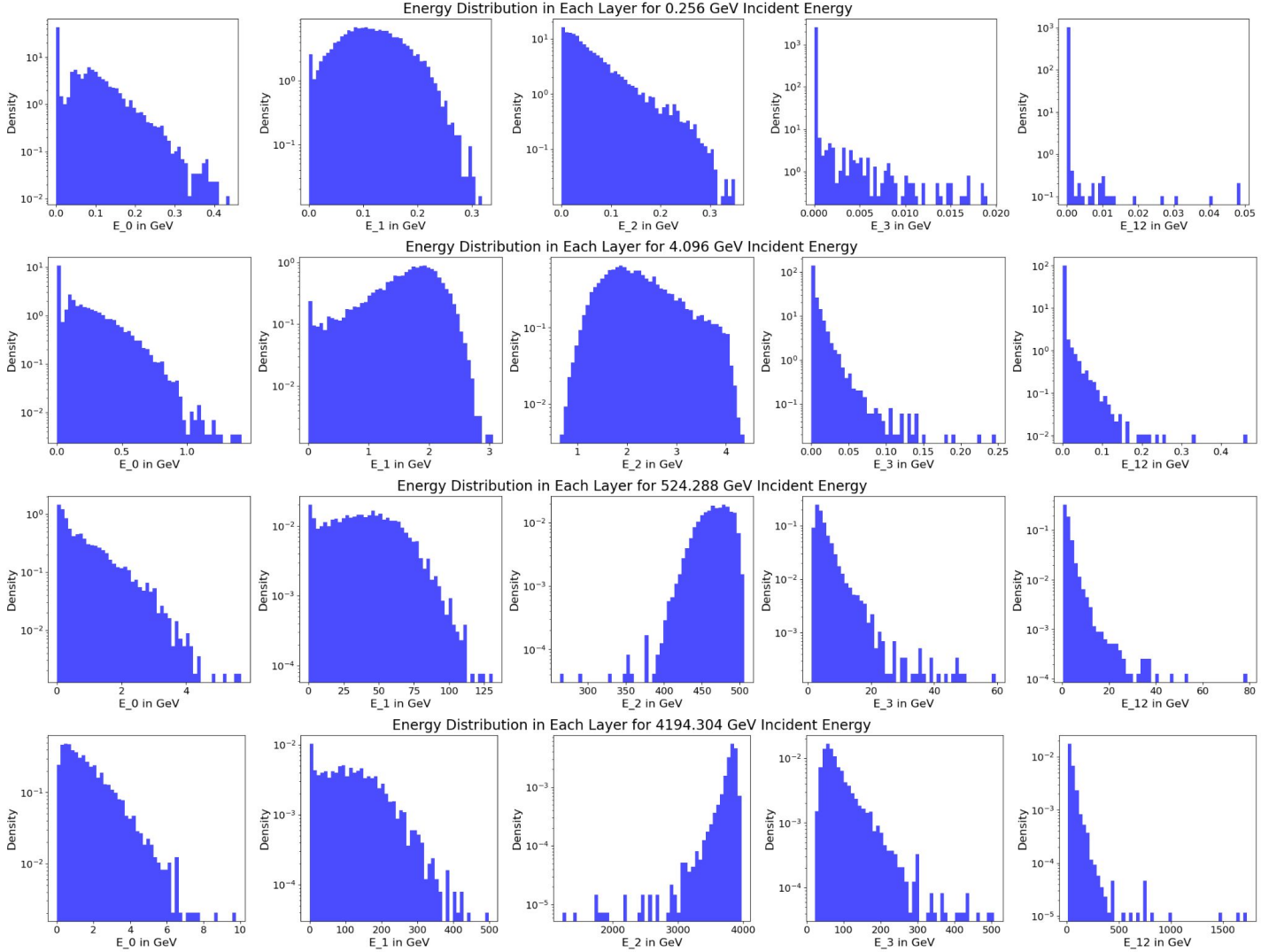


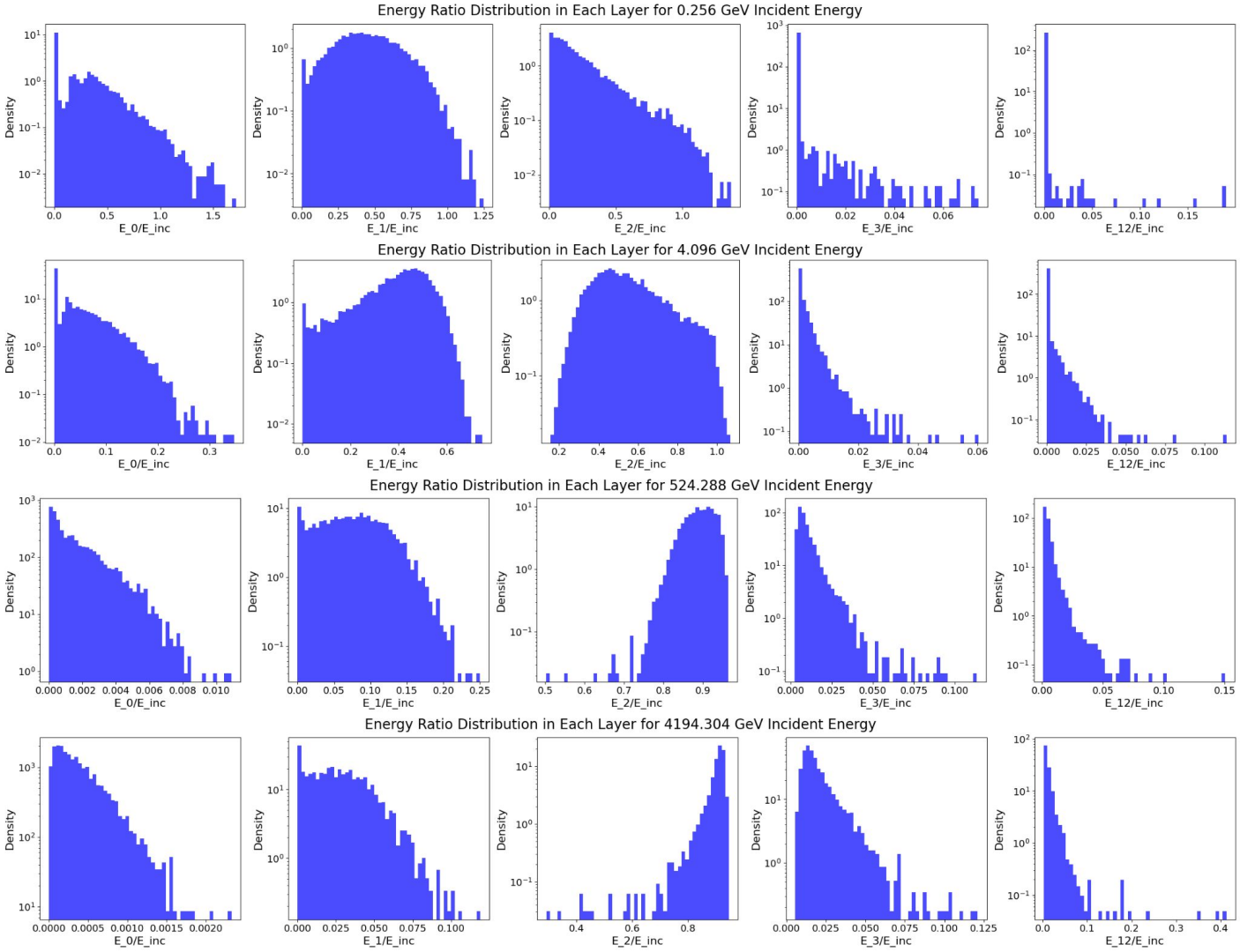


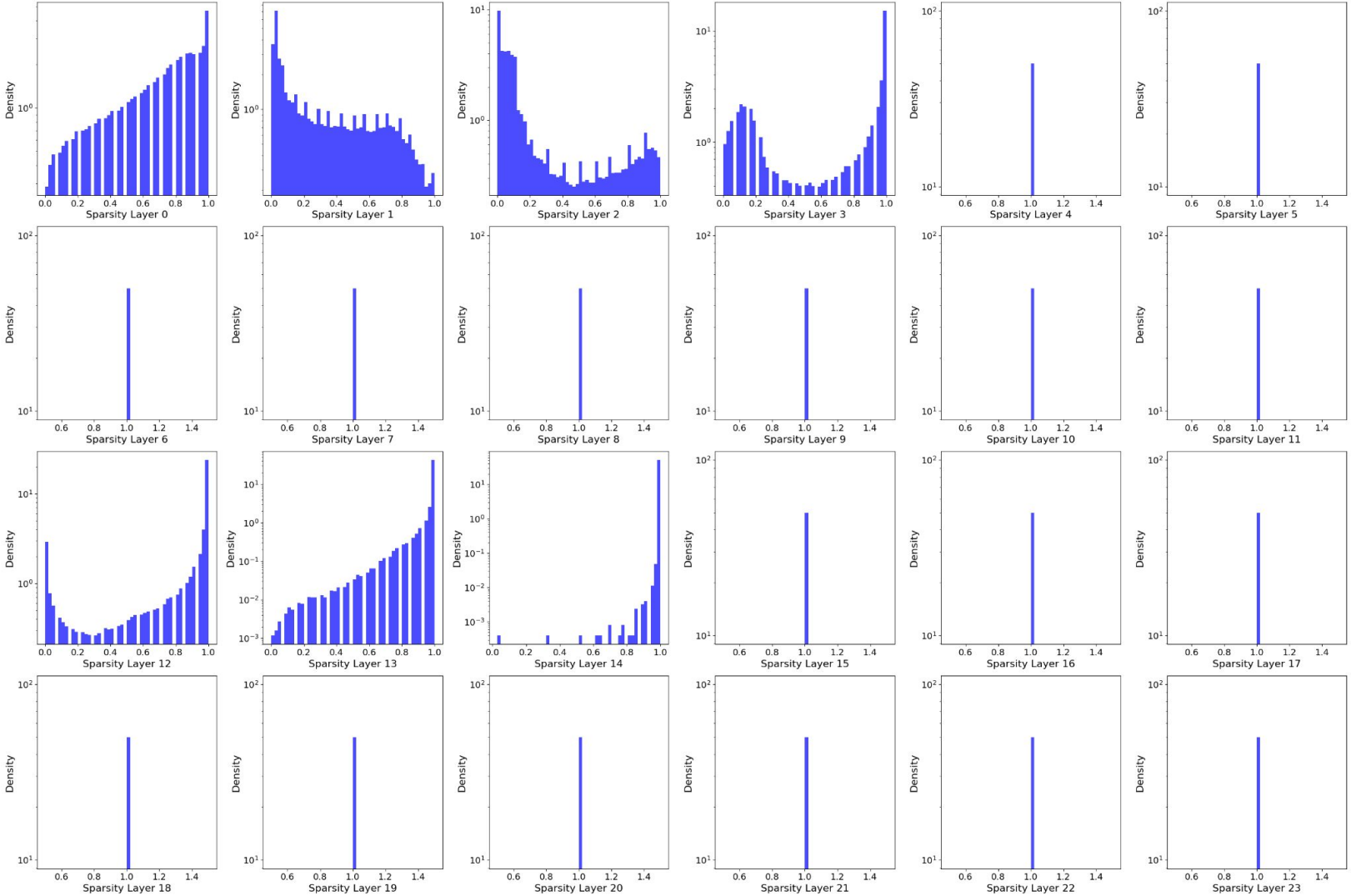






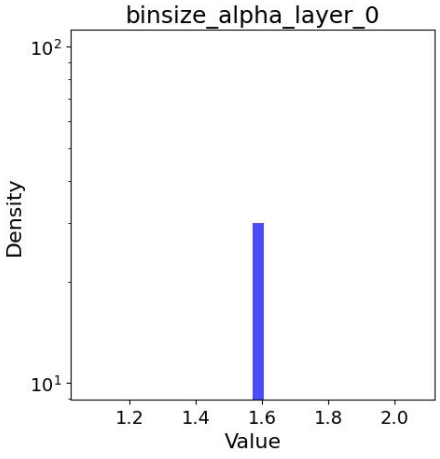

Energy Distribution in Each Layer for 0.256 GeV Incident Energy
Density
E_0 in GeV
E_1 in GeV
E_2 in GeV
E_3 in GeV
E_12 in GeV
Energy Distribution in Each Layer for 4.096 GeV Incident Energy
Density
E_0 in GeV
E_1 in GeV
E_2 in GeV
E_3 in GeV
E_12 in GeV
Energy Distribution in Each Layer for 524.288 GeV Incident Energy
Density
E_0 in GeV
E_1 in GeV
E_2 in GeV
E_3 in GeV
E_12 in GeV
Energy Distribution in Each Layer for 4194.304 GeV Incident Energy
Density
E_0 in GeV
E_1 in GeV
E_2 in GeV
E_3 in GeV
E_12 in GeV

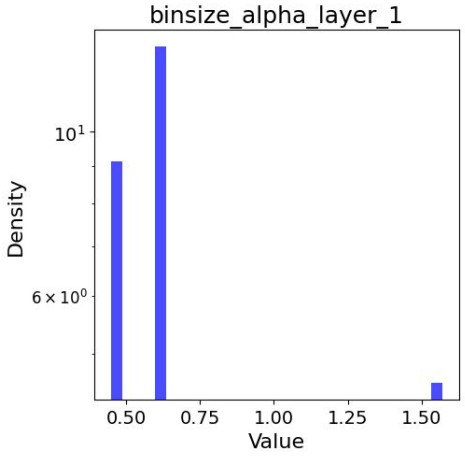

Energy Ratio Distribution in Each Layer for 0.256 GeV Incident Energy
Energy Ratio Distribution in Each Layer for 4.096 GeV Incident Energy
Energy Ratio Distribution in Each Layer for 524.288 GeV Incident Energy
Energy Ratio Distribution in Each Layer for 4194.304 GeV Incident Energy
Density
E_0/E_inc
E_1/E_inc
E_2/E_inc
E_3/E_inc
E_12/E_inc

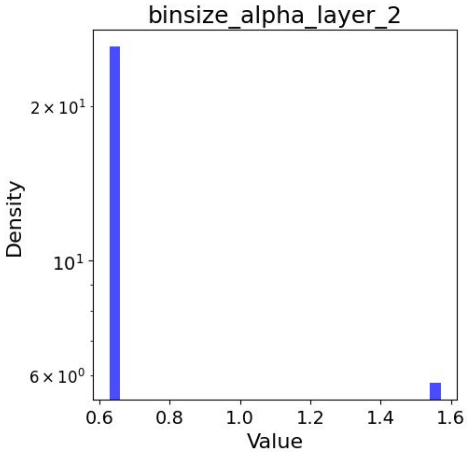

Density
Sparsity Layer 0
Sparsity Layer 1
Sparsity Layer 2
Sparsity Layer 3
Sparsity Layer 4
Sparsity Layer 5
Sparsity Layer 6
Sparsity Layer 7
Sparsity Layer 8
Sparsity Layer 9
Sparsity Layer 10
Sparsity Layer 11
Sparsity Layer 12
Sparsity Layer 13
Sparsity Layer 14
Sparsity Layer 15
Sparsity Layer 16
Sparsity Layer 17
Sparsity Layer 18
Sparsity Layer 19
Sparsity Layer 20
Sparsity Layer 21
Sparsity Layer 22
Sparsity Layer 23

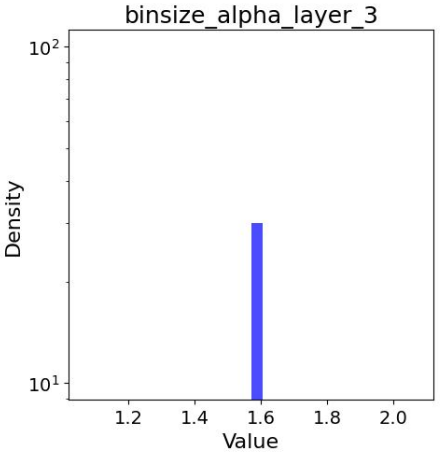
Geometry Info

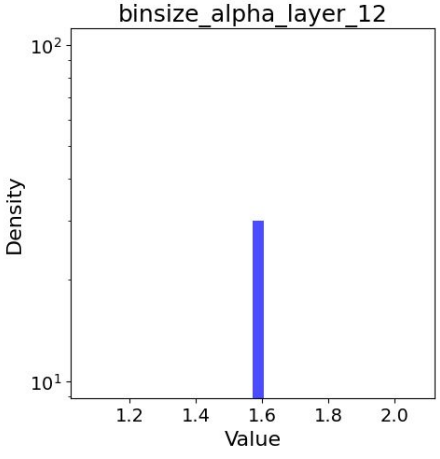
Detailed Description	https://cds.cern.ch/record/2630434/files/ATL-SOFT-PUB-2018-002.pdf
Some Codes	https://gitlab.cern.ch/zhangruiPhysics/FastCaloChallenge/-/blob/master/training/HighLevelFeatures.py?ref_type=heads#L79-112
All my Plots	https://github.com/QaloSim/CaloQVAE/blob/haojia_ML2/notebooks/new_dataset.ipynb

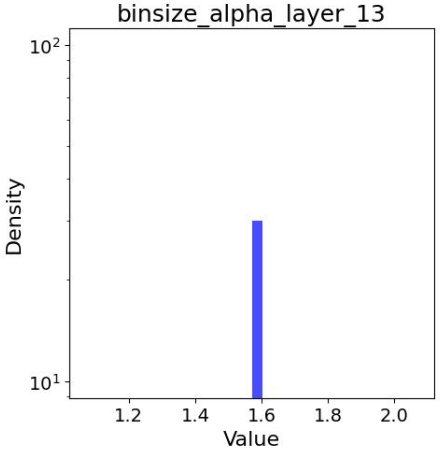

binsize_alpha_layer_0
Density
Value

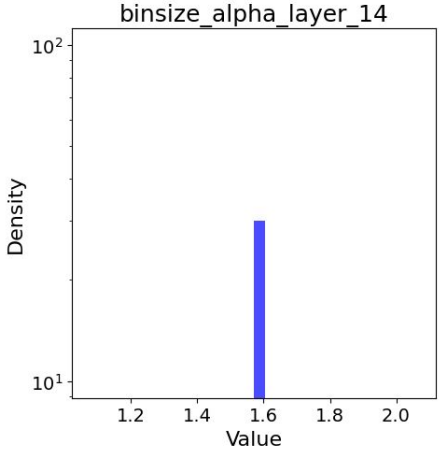

binsize_alpha_layer_1
Density
Value

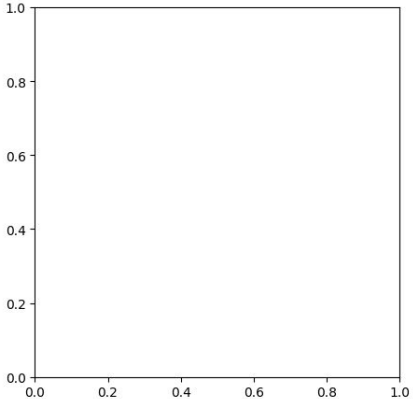

binsize_alpha_layer_2
Density
Value

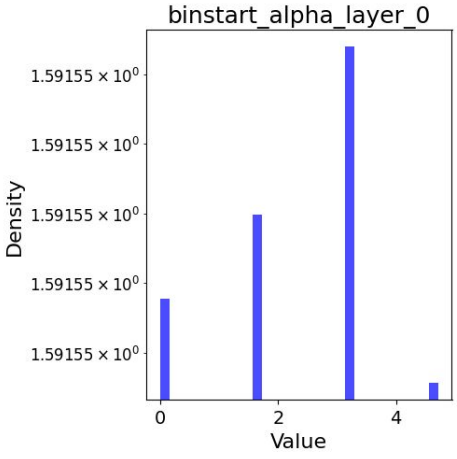

binsize_alpha_layer_3
Density
Value

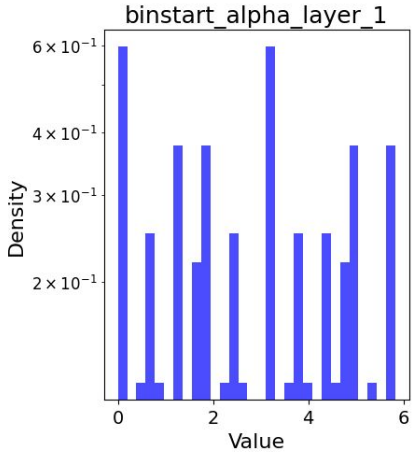

binsize_alpha_layer_12
Density
Value

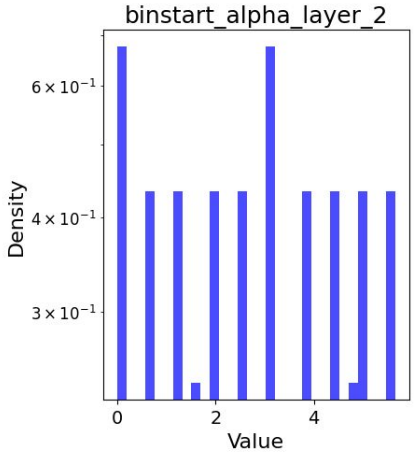

binsize_alpha_layer_13
Density
Value

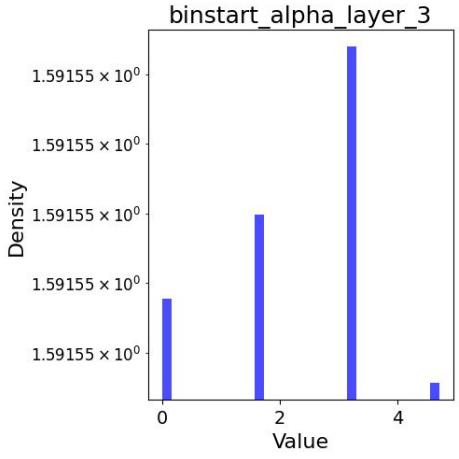

binsize_alpha_layer_14
Density
Value

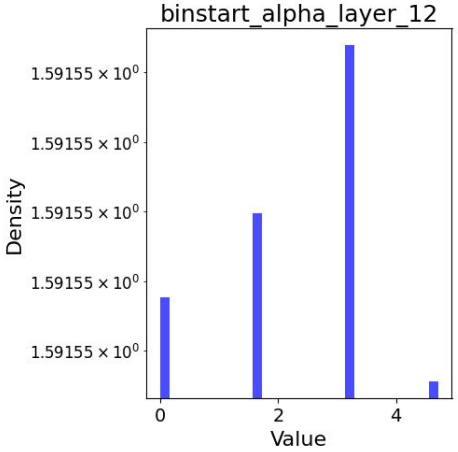


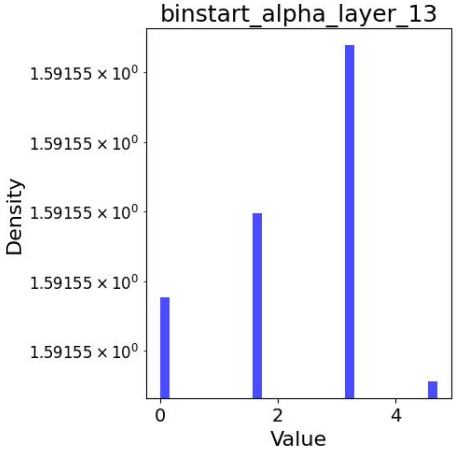

binstart_alpha_layer_0
Density
Value

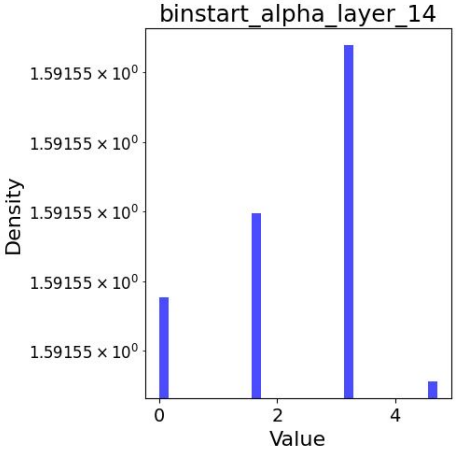

binstart_alpha_layer_1
Density
Value

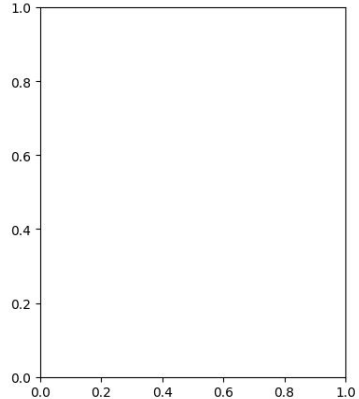

binstart_alpha_layer_2
Density
Value

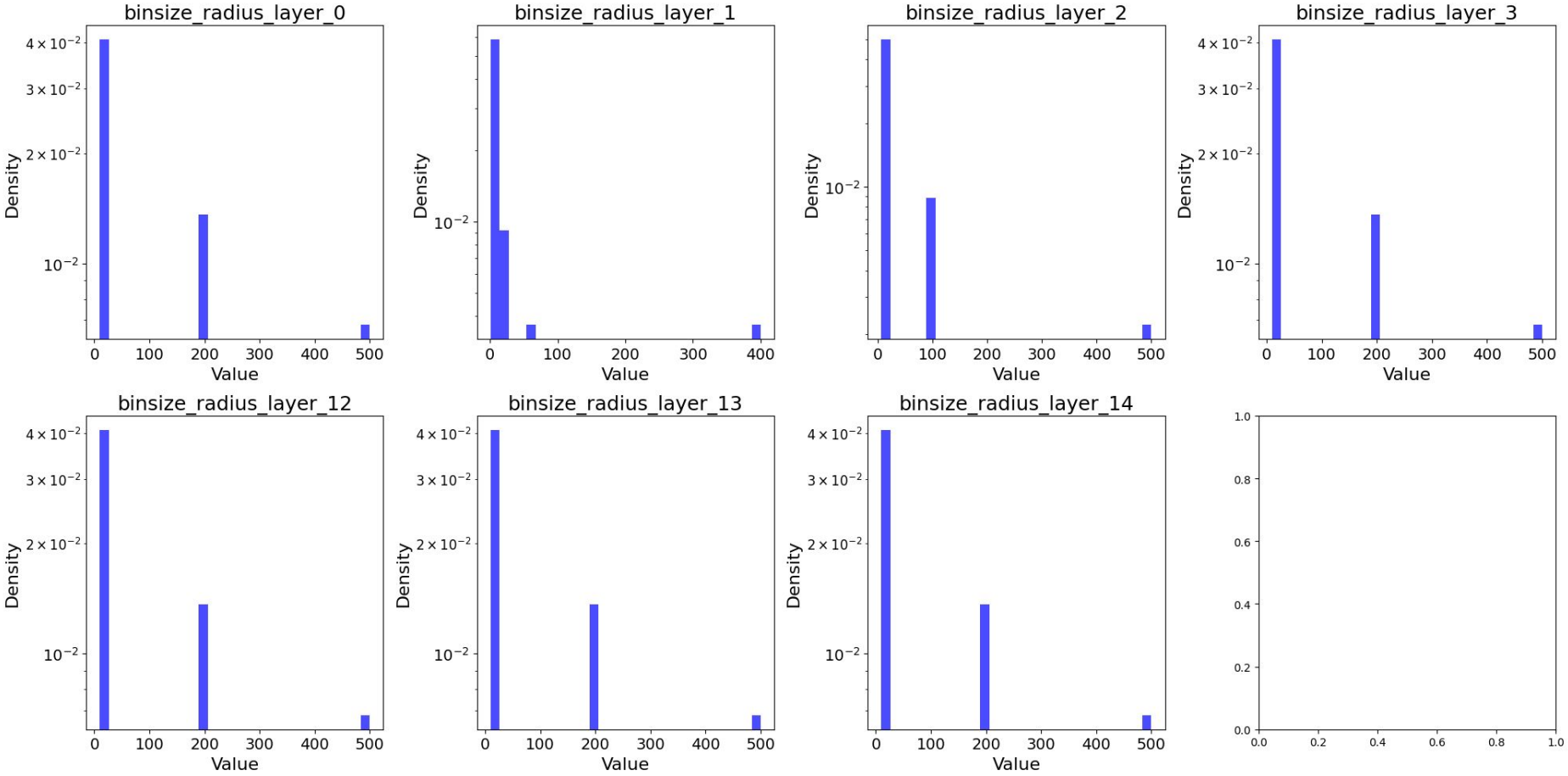

binstart_alpha_layer_3
Density
Value

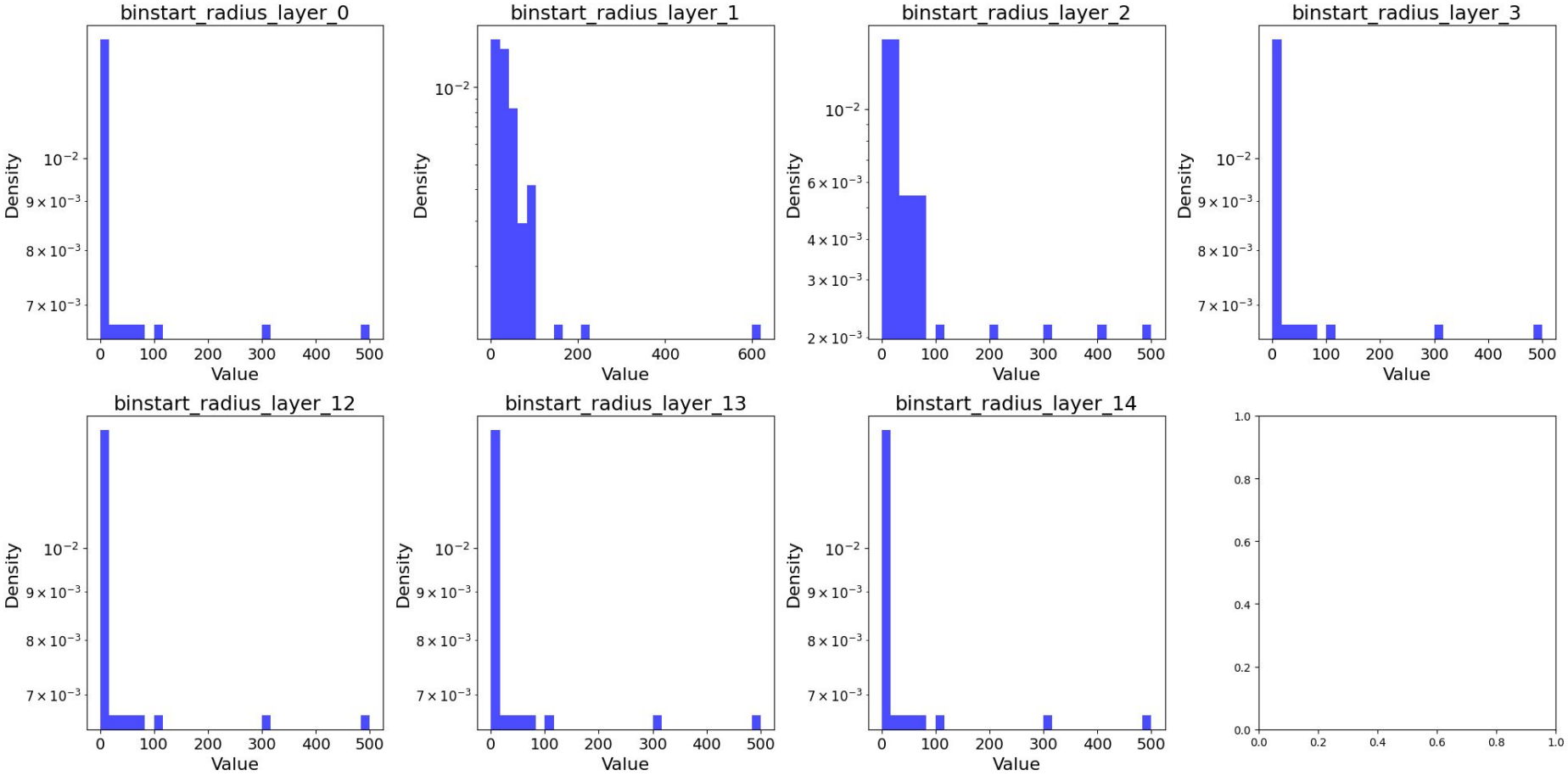

binstart_alpha_layer_12
Density
Value

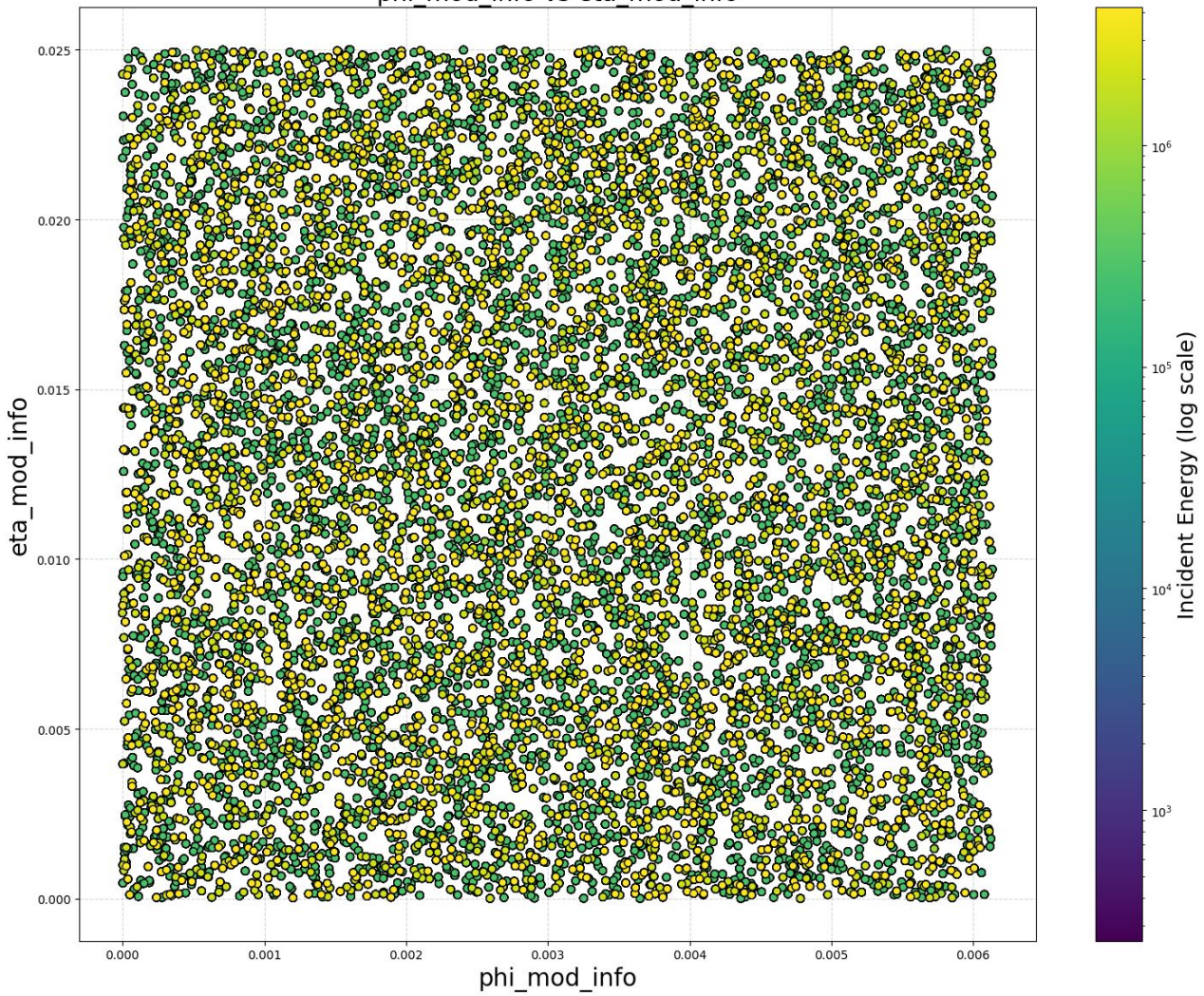

binstart_alpha_layer_13
Density
Value


binstart_alpha_layer_14
Density
Value




binsize_radius_layer_0
binsize_radius_layer_1
binsize_radius_layer_2
binsize_radius_layer_3
binsize_radius_layer_12
binsize_radius_layer_13
binsize_radius_layer_14
Density
Value
4×10^{-2}
3×10^{-2}
2×10^{-2}
10^{-2}
0
100
200
300
400
500
0.0
0.2
0.4
0.6
0.8
1.0

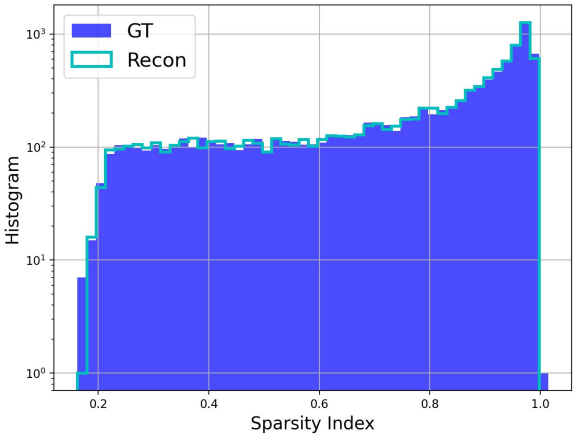

binstart_radius_layer_0
binstart_radius_layer_1
binstart_radius_layer_2
binstart_radius_layer_3
binstart_radius_layer_12
binstart_radius_layer_13
binstart_radius_layer_14
Density
Value

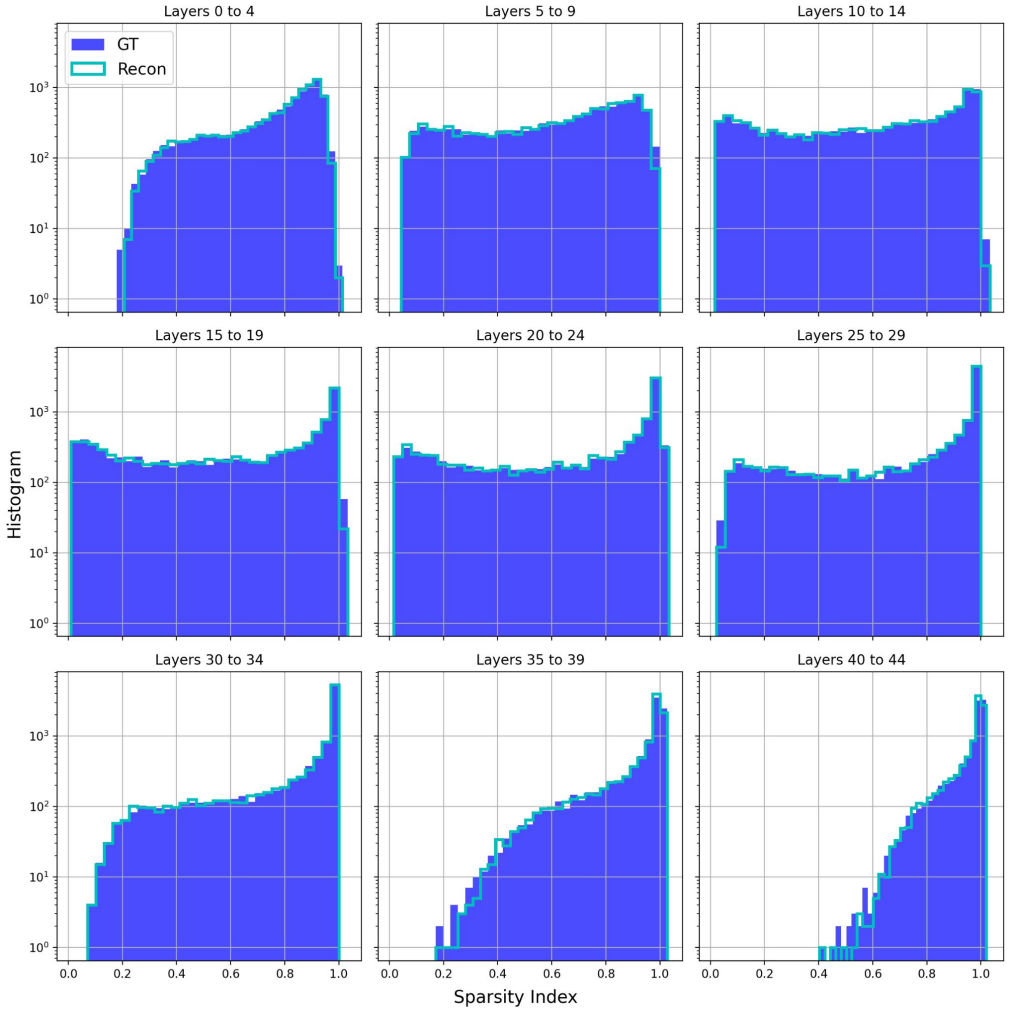

phi_mod_info vs eta_mod_info
eta_mod_info
phi_mod_info
0.025
0.020
0.015
0.010
0.005
0.000
0.000
0.001
0.002
0.003
0.004
0.005
0.006
Incident Energy (log scale)
10^6
10^5
10^4
10^3

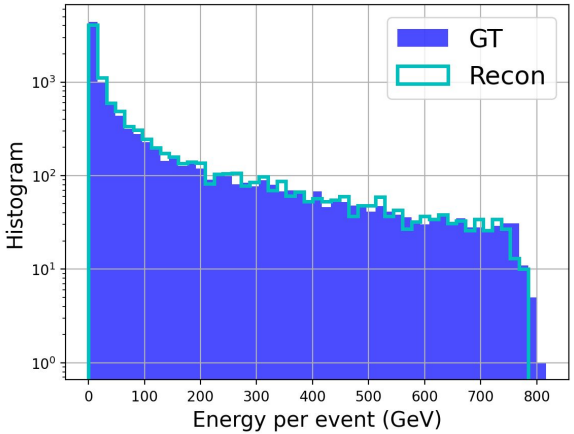
Old Dataset.

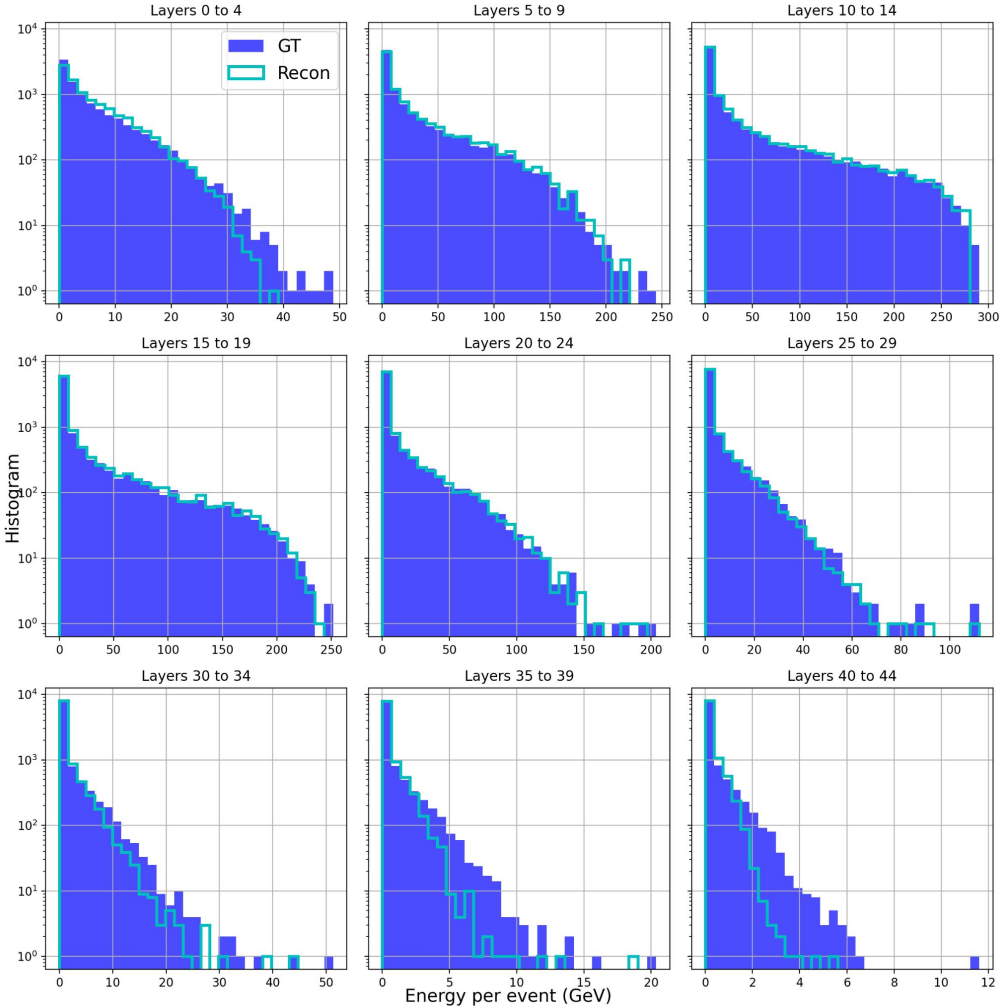
Run:astral-leaf-478

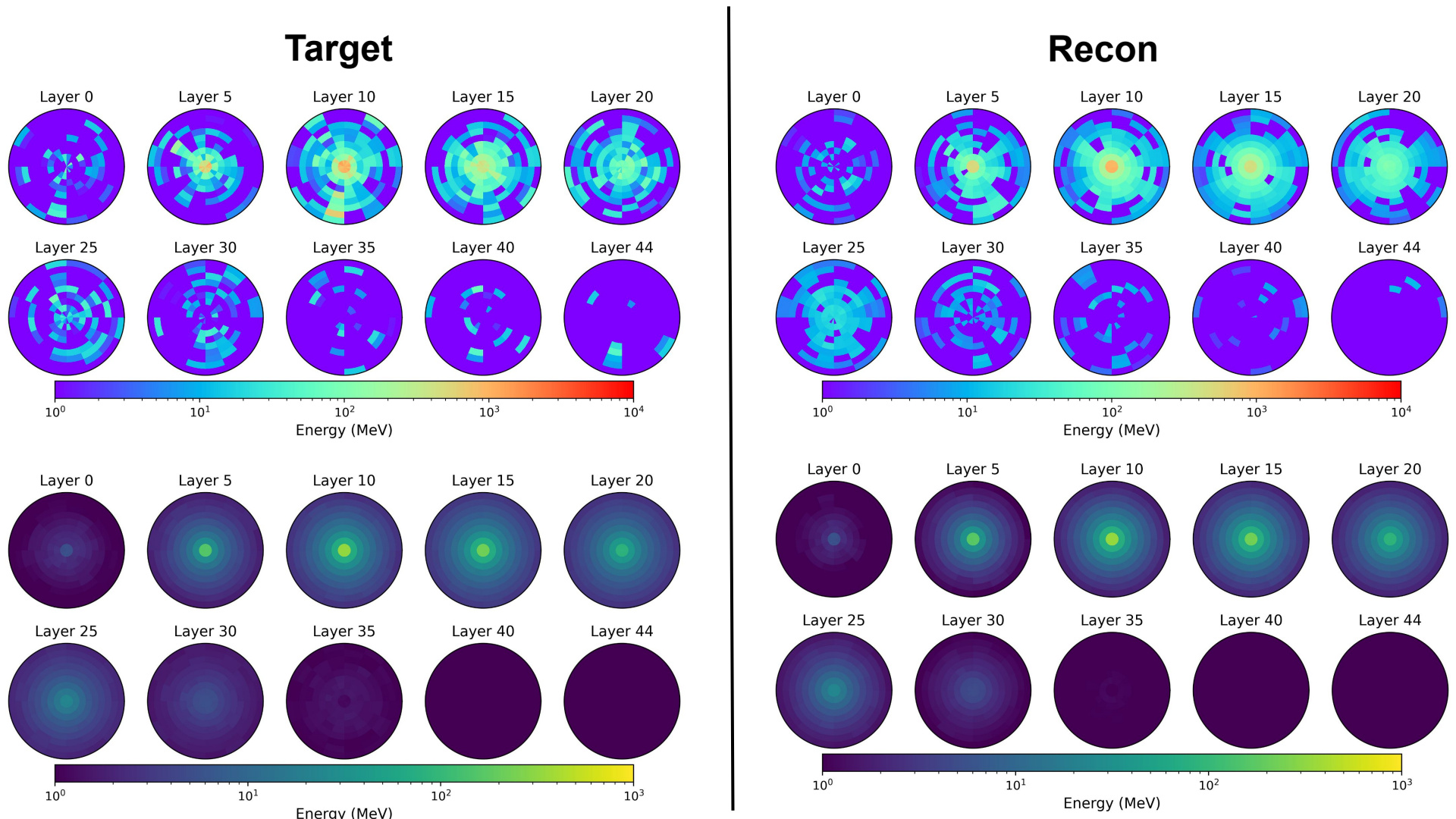
- Self Linear Attention Layers
- Extra Attention layer between incident energy and decoder
- AE_loss = MSE * [exp(a*(input-<input>))+exp(-b*(input-<input>))]


GT
Recon
Histogram
Sparsity Index


Layers 0 to 4
Layers 5 to 9
Layers 10 to 14
Layers 15 to 19
Layers 20 to 24
Layers 25 to 29
Layers 30 to 34
Layers 35 to 39
Layers 40 to 44
GT
Recon
Histogram
Sparsity Index


GT
Recon
Histogram
Energy per event (GeV)

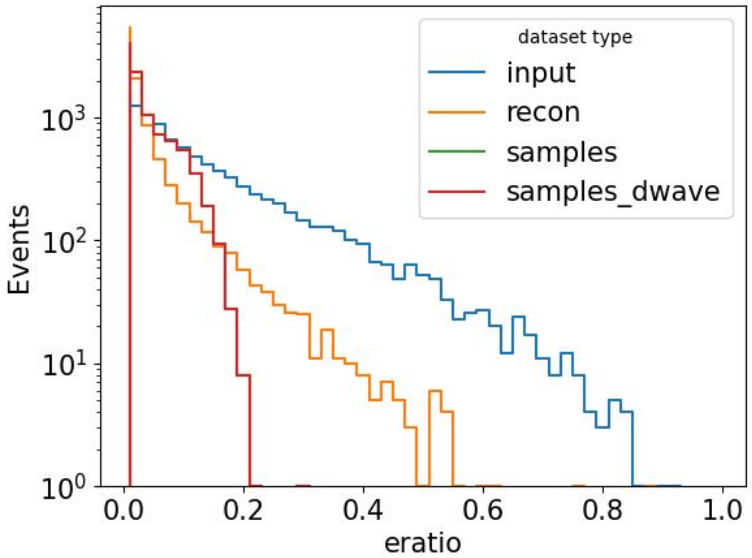

Layers 0 to 4
Layers 5 to 9
Layers 10 to 14
Layers 15 to 19
Layers 20 to 24
Layers 25 to 29
Layers 30 to 34
Layers 35 to 39
Layers 40 to 44
GT
Recon
Histogram
Energy per event (GeV)


Target
Recon
Layer 0
Layer 5
Layer 10
Layer 15
Layer 20
Layer 25
Layer 30
Layer 35
Layer 40
Layer 44
10^0
10^1
10^2
10^3
10^4
Energy (MeV)

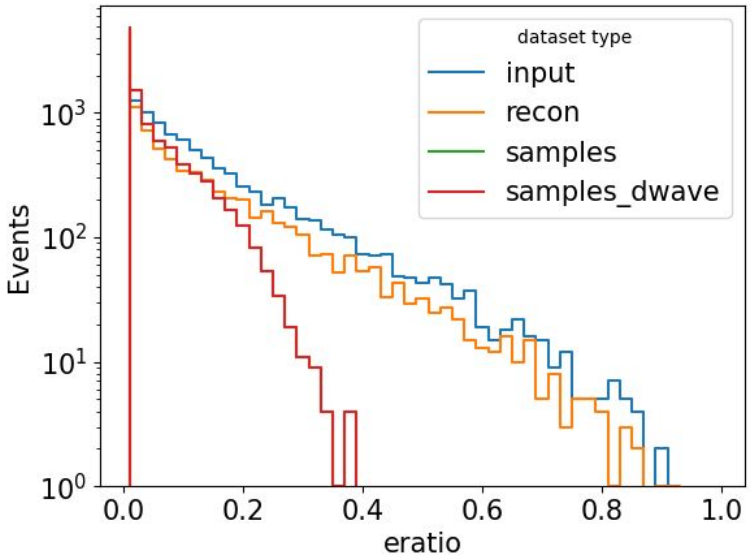
Improvement in E-ratio-hist, surprise!

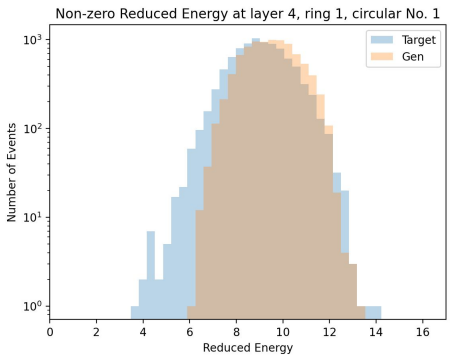
Eratio = (E_max - E_2nd) / (E_max + E_2nd)

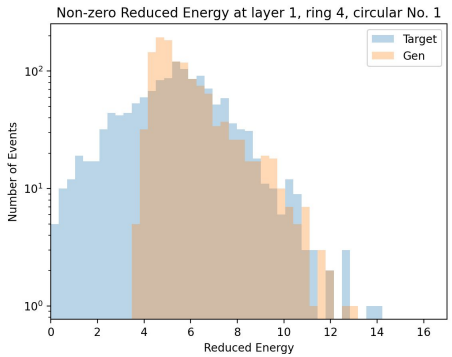
3D nHD 216

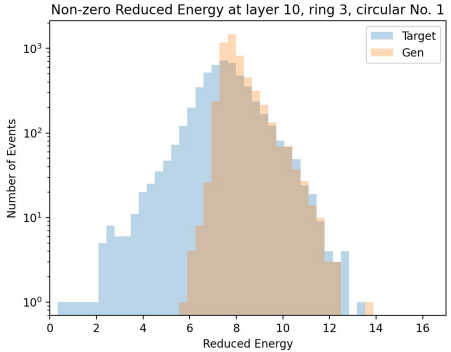


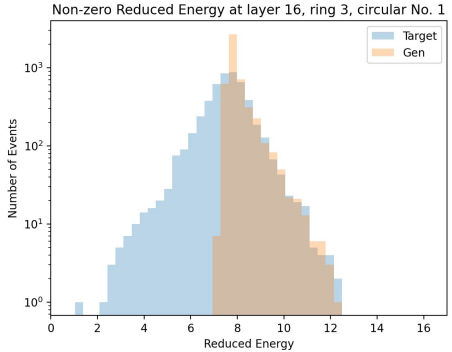
New astral-leaf-478

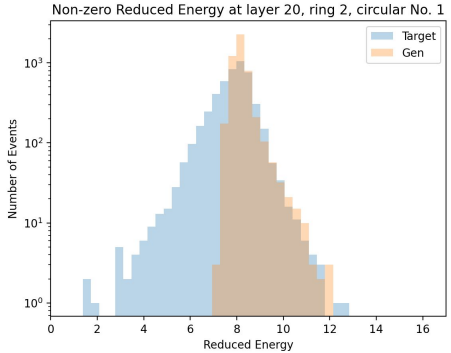


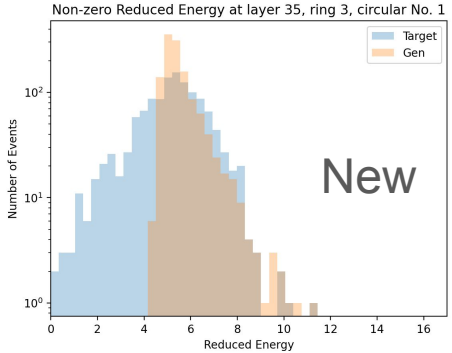

Non-zero Reduced Energy at layer 4, ring 1, circular No. 1
Target
Gen
Number of Events
Reduced Energy

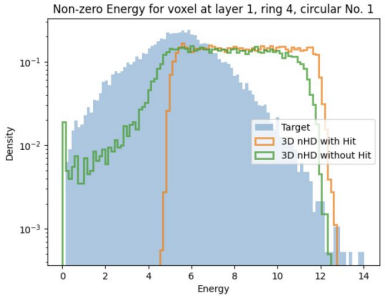

Non-zero Reduced Energy at layer 1, ring 4, circular No. 1
Target
Gen
Number of Events
Reduced Energy


Non-zero Reduced Energy at layer 10, ring 3, circular No. 1
Target
Gen
Number of Events
Reduced Energy

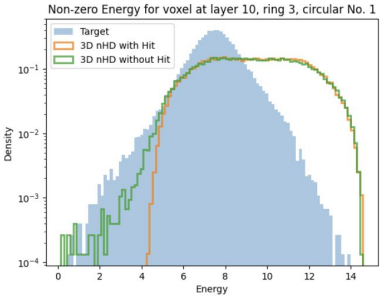

Non-zero Reduced Energy at layer 16, ring 3, circular No. 1
Target
Gen
Number of Events
Reduced Energy

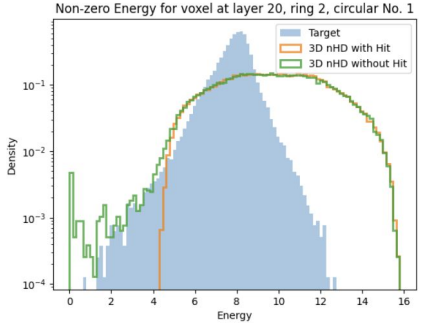

Non-zero Reduced Energy at layer 20, ring 2, circular No. 1
Target
Gen
Number of Events
Reduced Energy

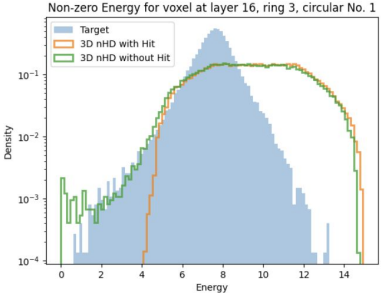

Non-zero Reduced Energy at layer 35, ring 3, circular No. 1
Target
Gen
Number of Events
Reduced Energy
New

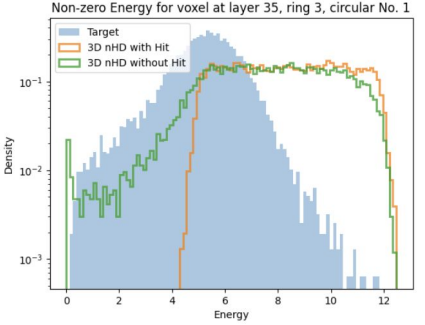

Non-zero Energy for voxel at layer 1, ring 4, circular No. 1
Target
3D nHD with Hit
3D nHD without Hit
Density
Energy

Old


Non-zero Energy for voxel at layer 10, ring 3, circular No. 1
Target
3D nHD with Hit
3D nHD without Hit
Density
Energy


Non-zero Energy for voxel at layer 20, ring 2, circular No. 1
Target
3D nHD with Hit
3D nHD without Hit
Density
Energy


Non-zero Energy for voxel at layer 16, ring 3, circular No. 1
Target
3D nHD with Hit
3D nHD without Hit
Density
Energy


Non-zero Energy for voxel at layer 35, ring 3, circular No. 1
Target
3D nHD with Hit
3D nHD without Hit
Density
Energy

One more thing: E_inc = 900-950 GeV