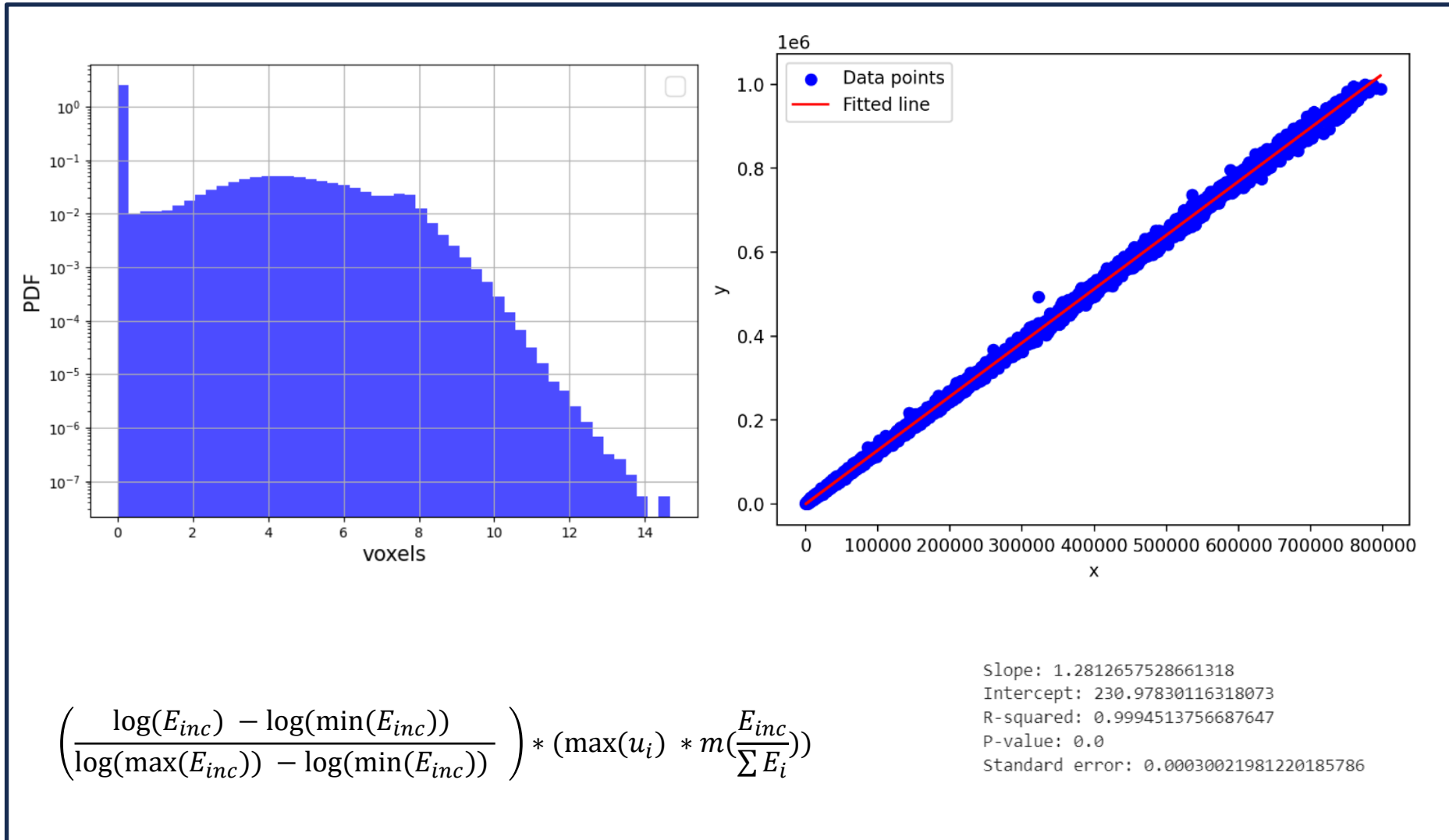
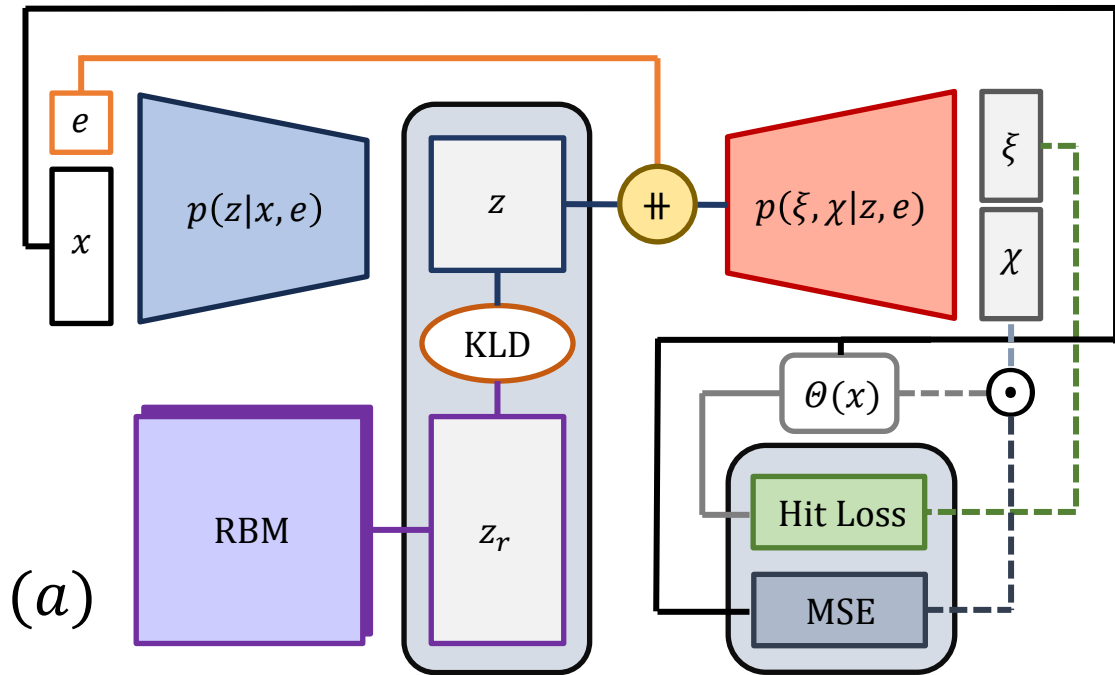


Incident Energy Mapping

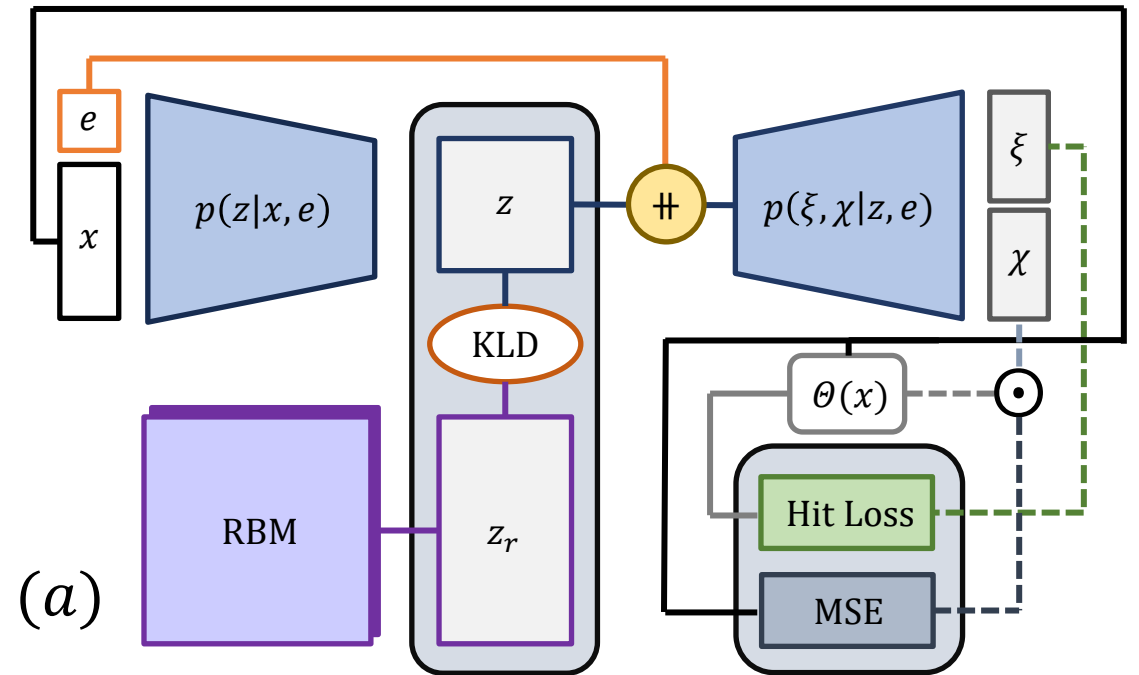


Model Architecture Flowchart Diagrams

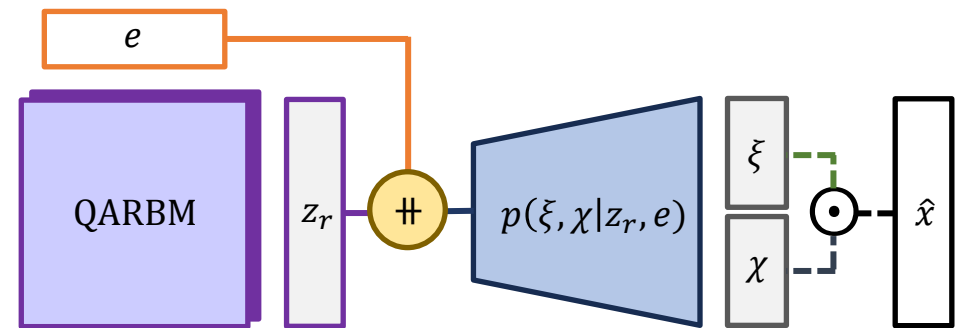


a) Model Overview Flowchart

b) QA-RBM Generation Flowchart

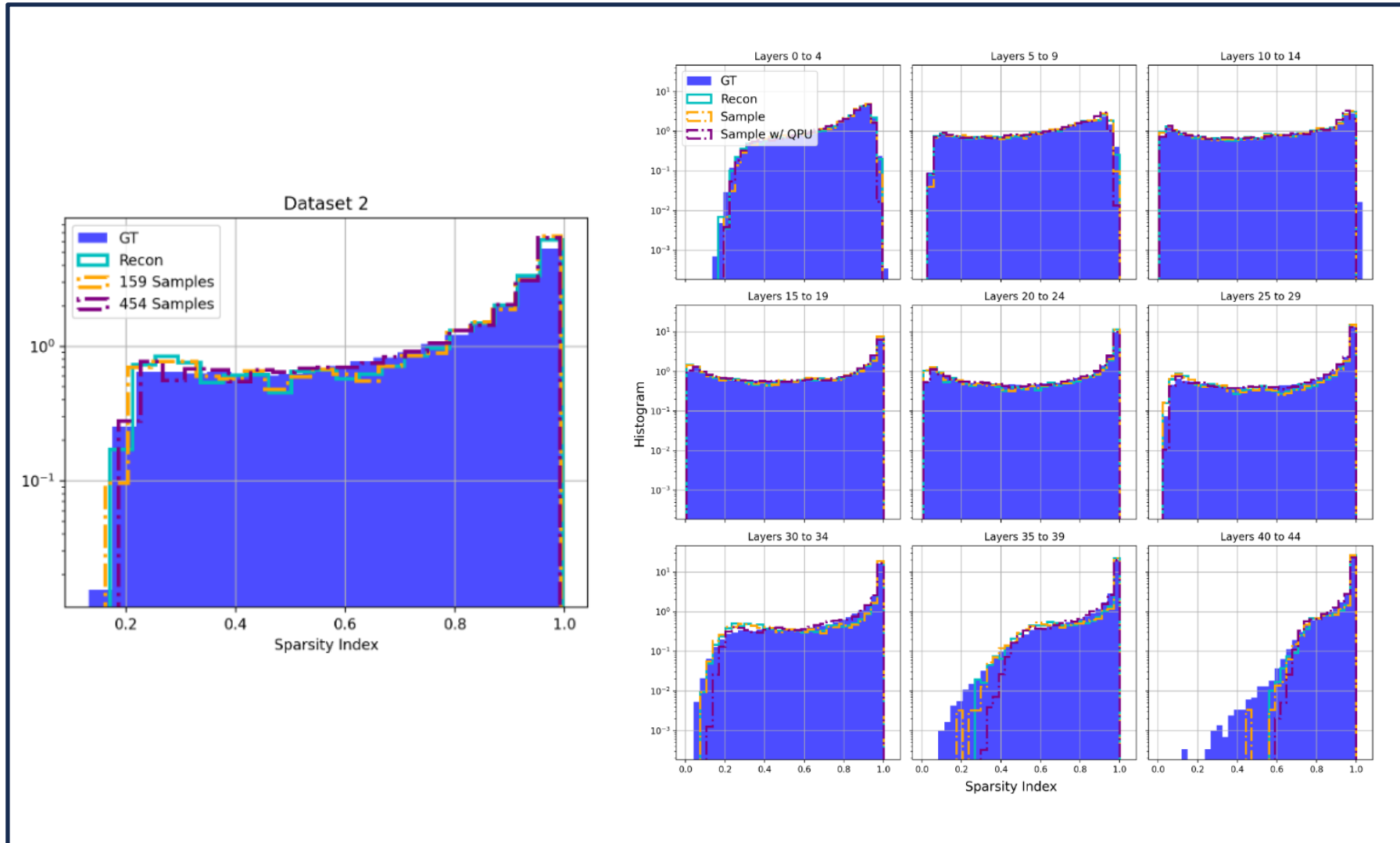


(b) QA-RBM Generation Flowchart

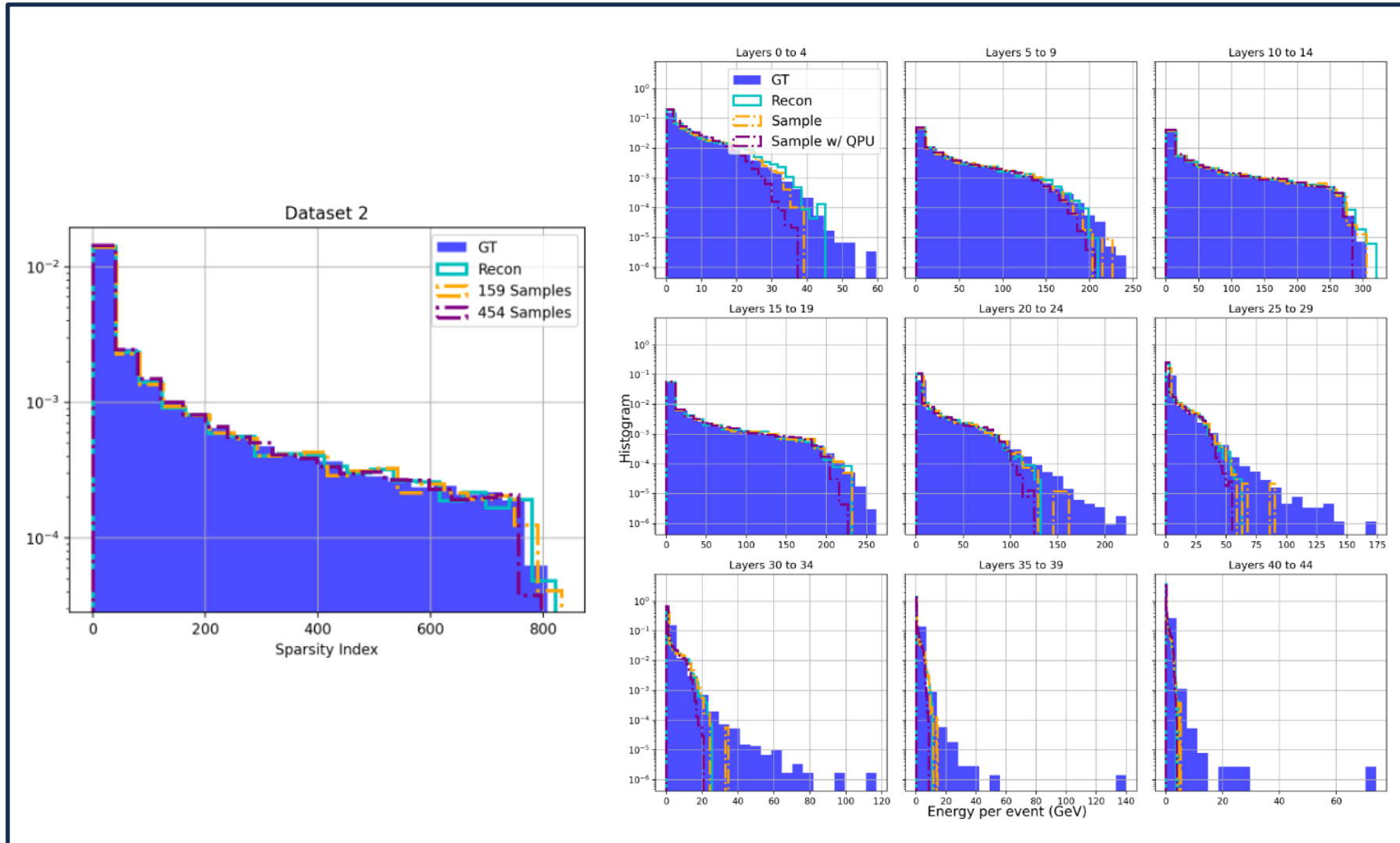


Sparsity Index Histograms – Model 166 (Sample)

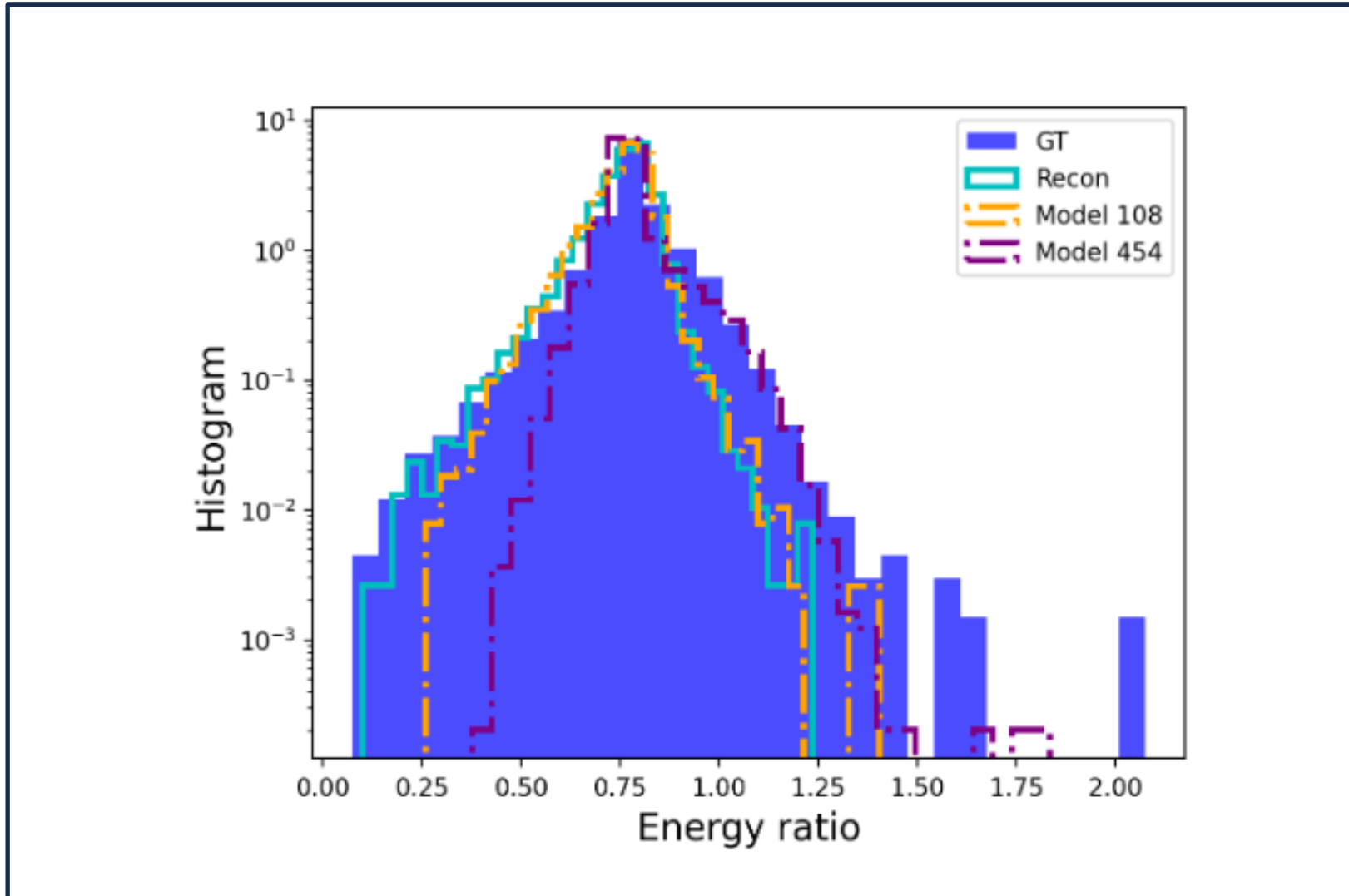
denim-smoke-166 9 sub decoders on 0.005 on Zephyr Topology



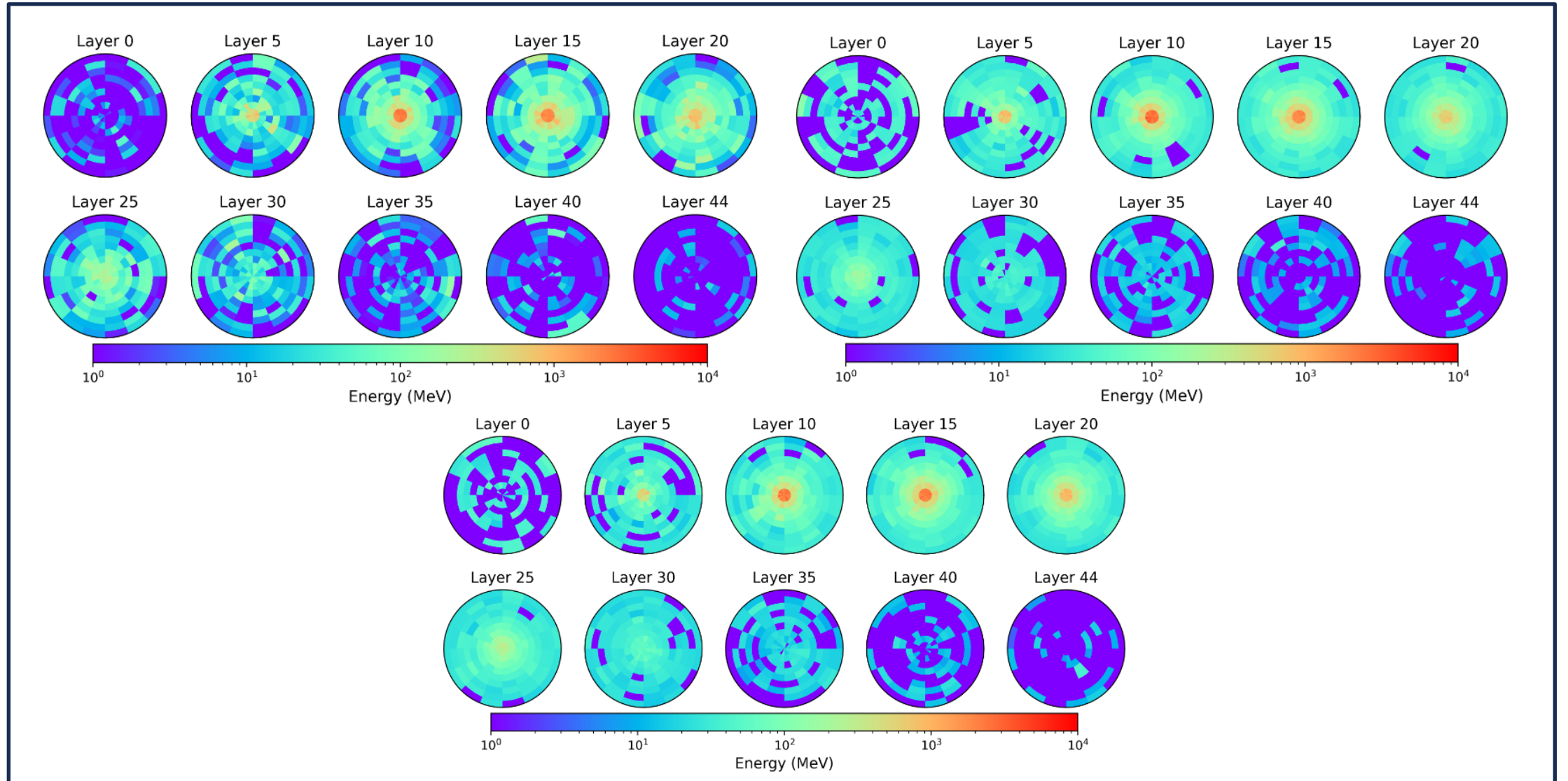
Energy Histograms – Model 166 (Sample)



Energy Ratio – Model 166 (Sample)

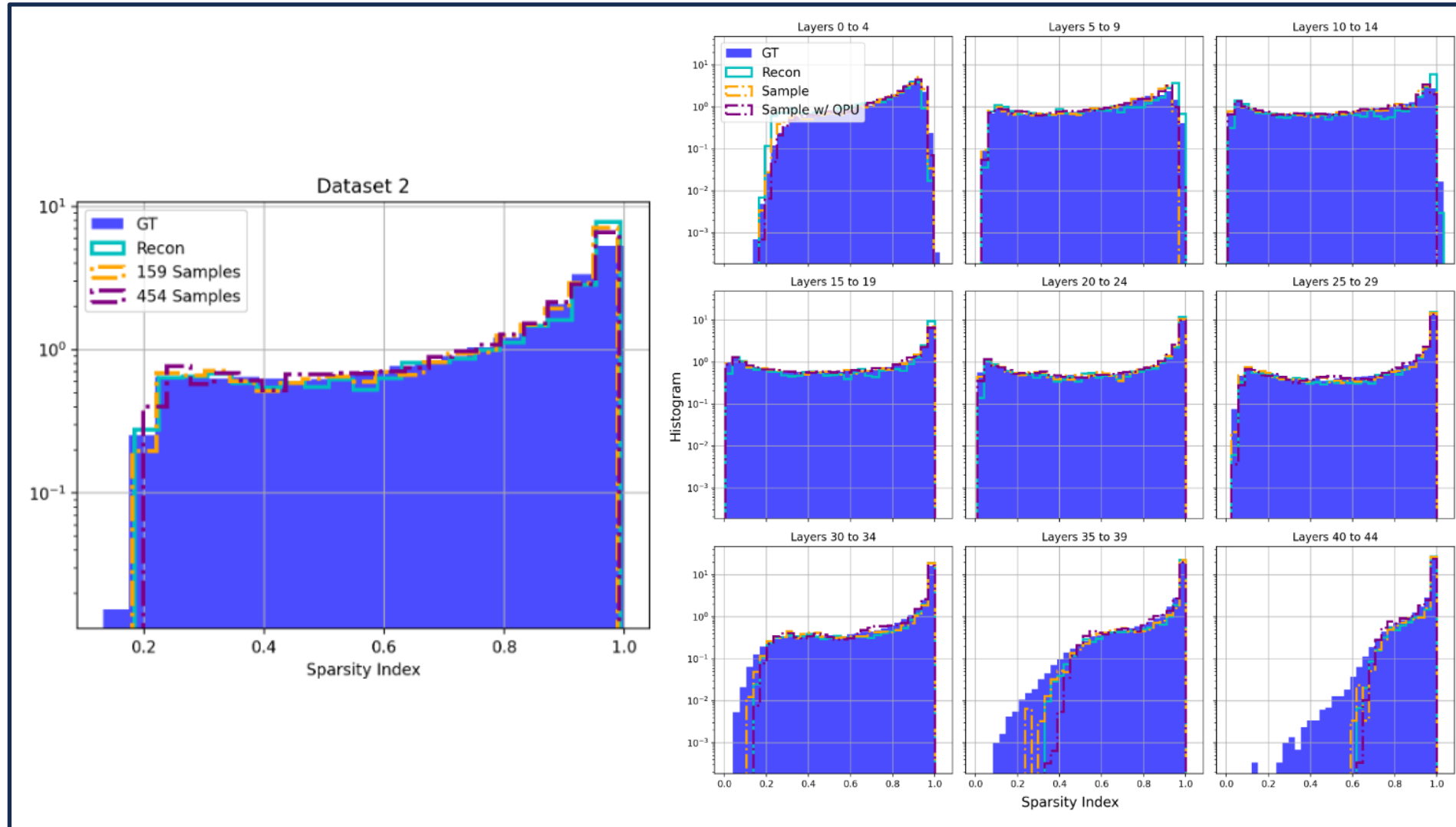


Model 166 Energy Layers

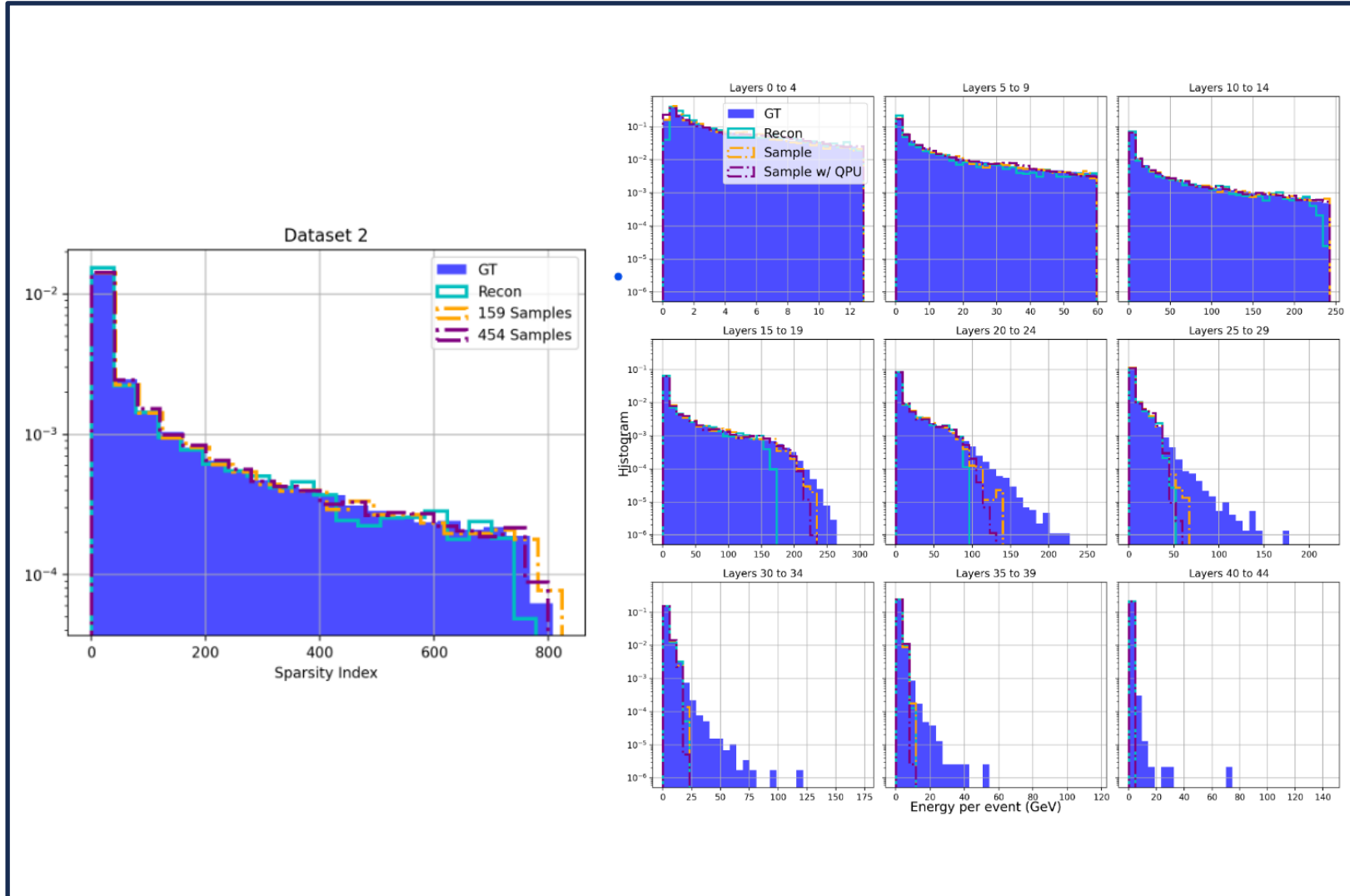


Sparsity Index Histograms – Model 178 (Sample)

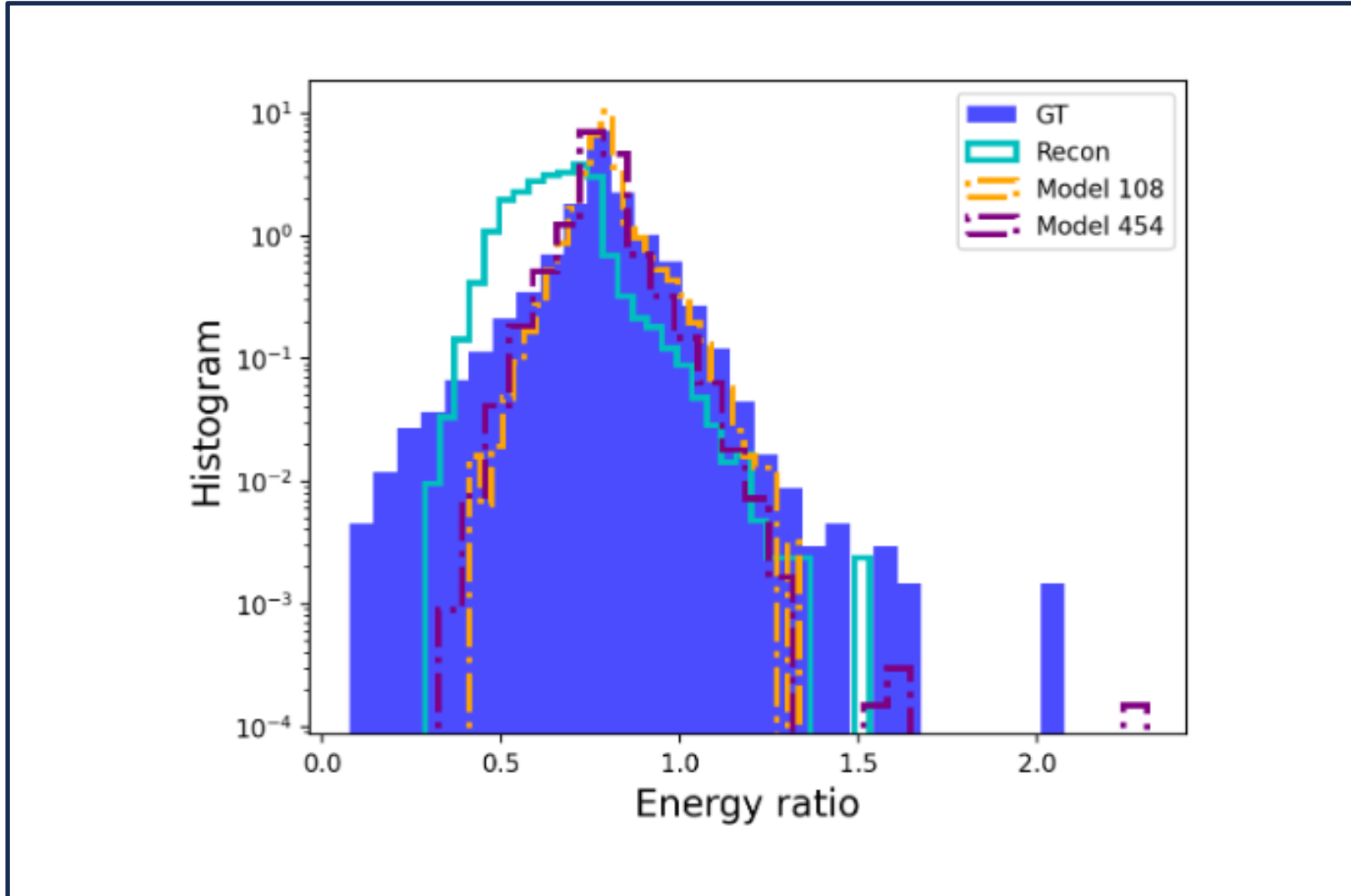
smooth-water-178 [25,5,5,5,5 heavy-sided sub decoders on 0.005 on Zephyr Topology



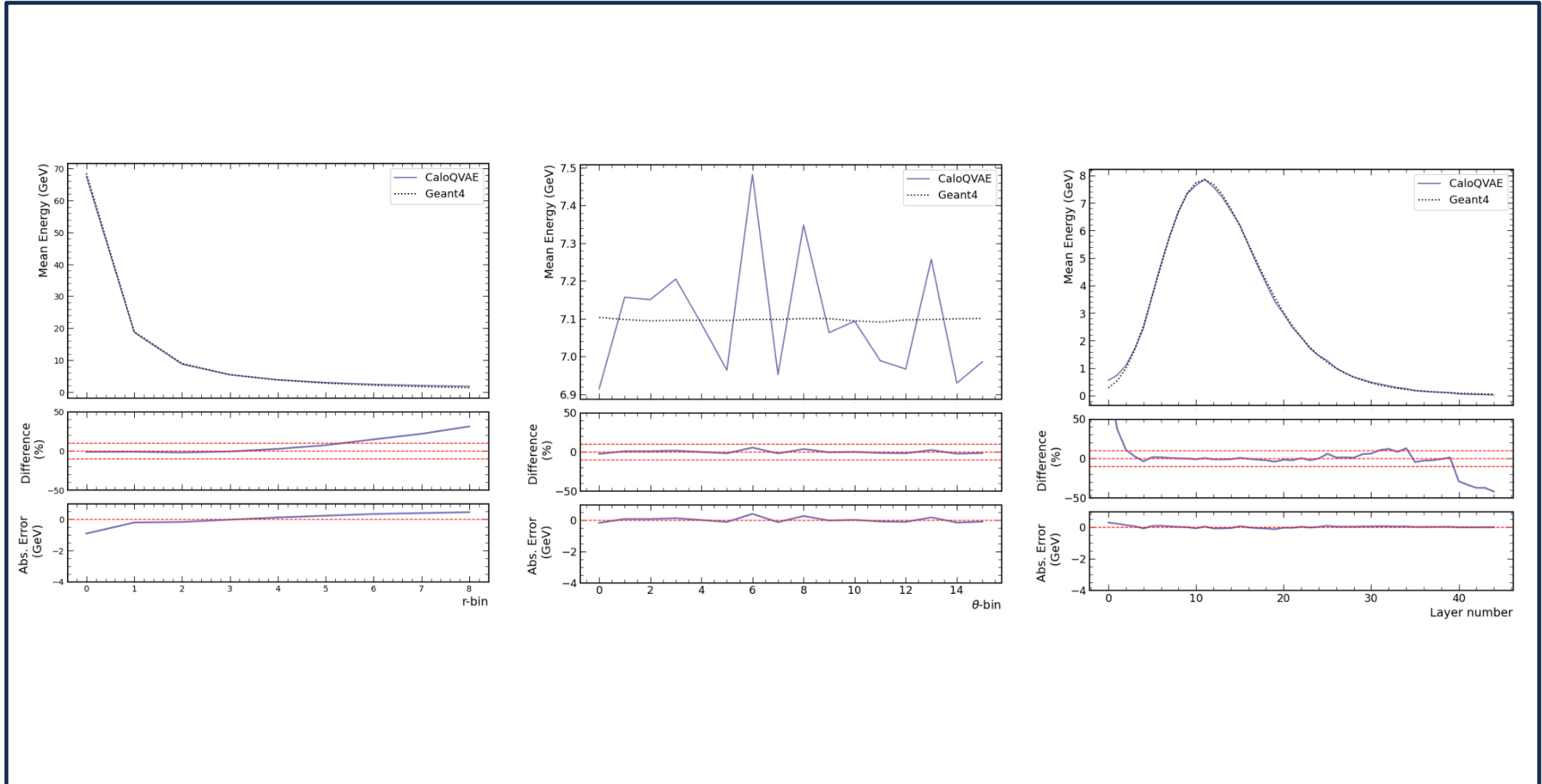
Sparsity Index Histograms – Model 178 (Sample)



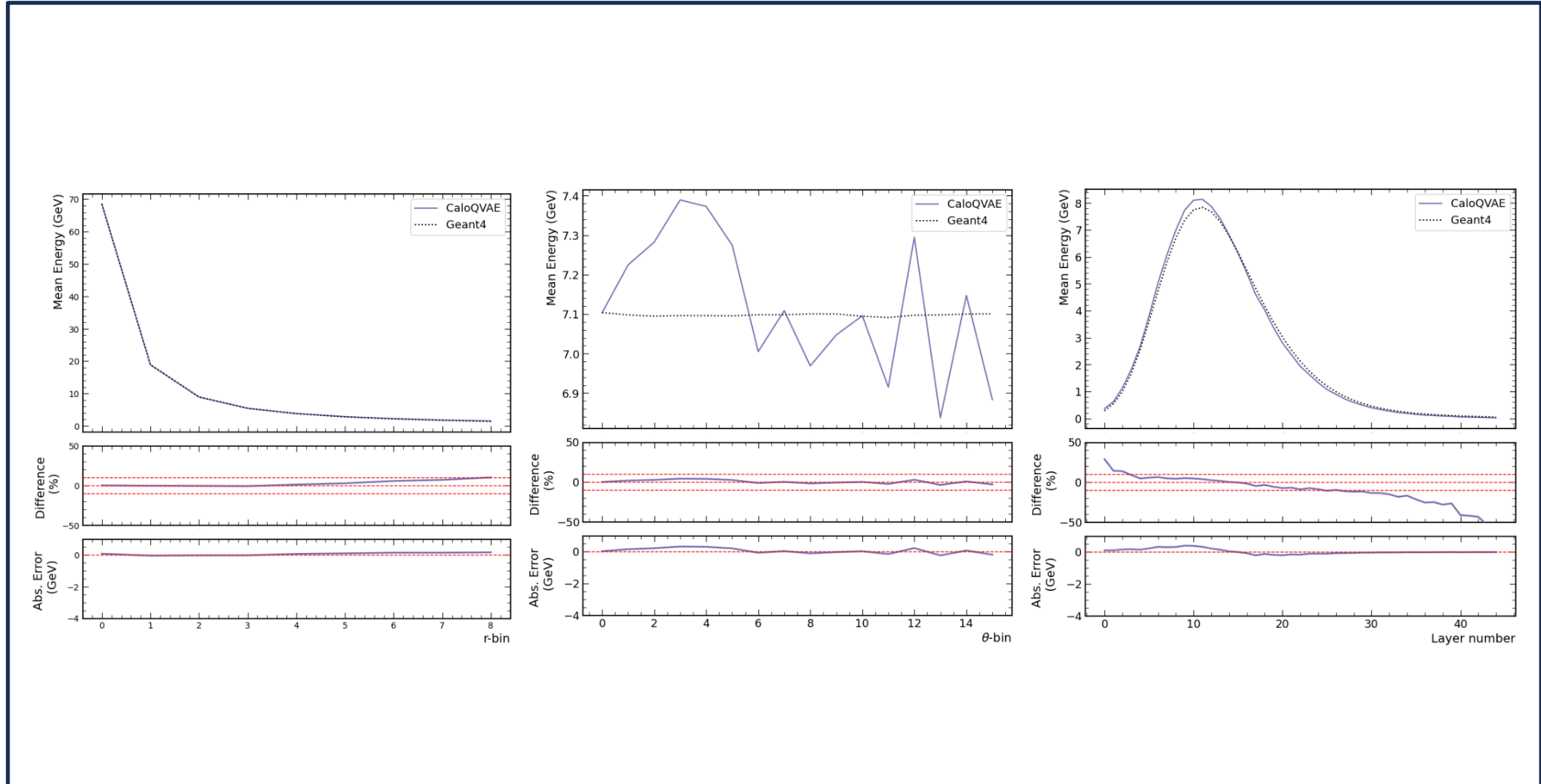
Energy Histograms – Model 178 (Sample)



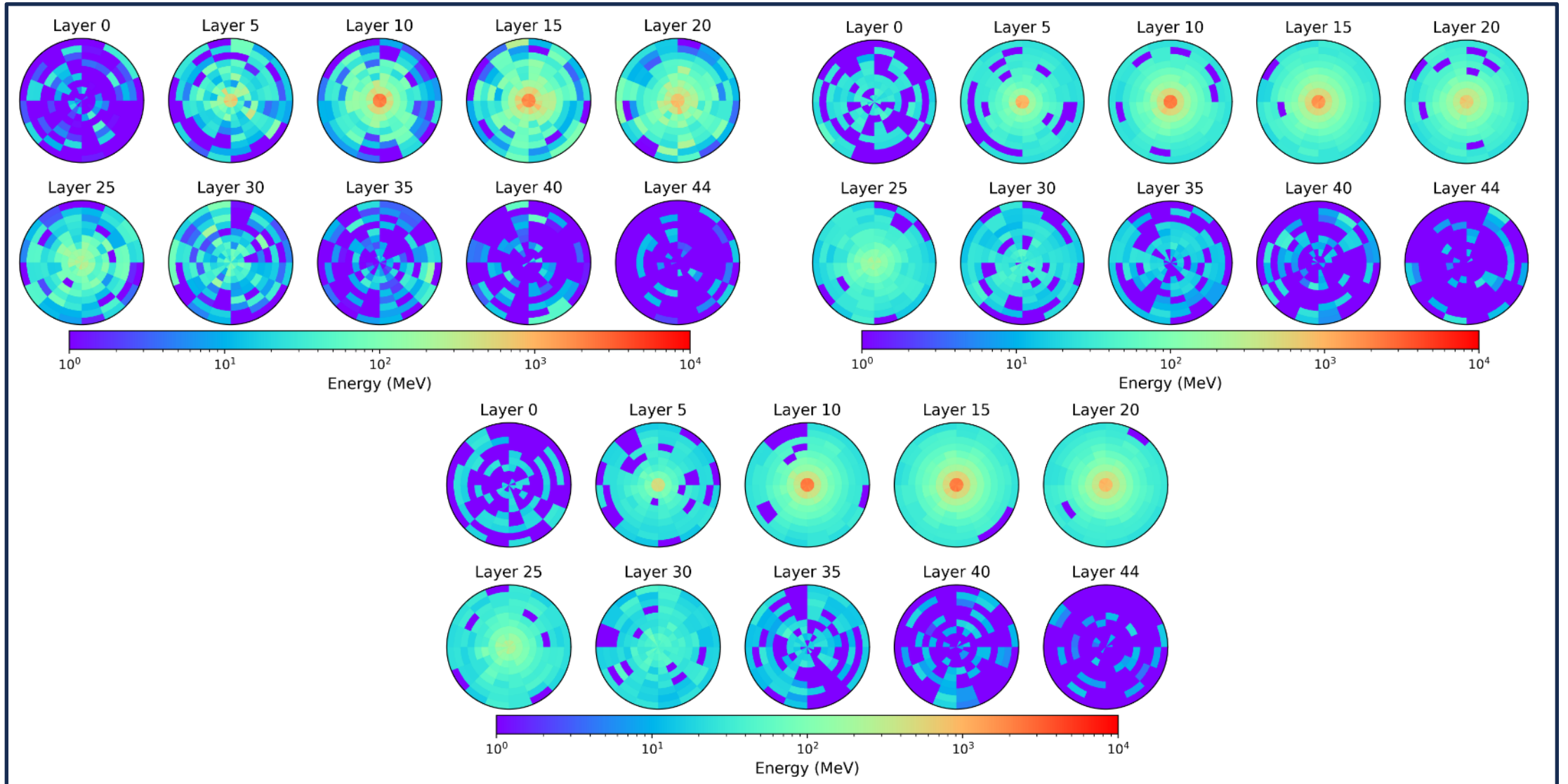
Mean Energy Plots – Model 166



Mean Energy Plots – Model 178



Model 166 Energy Layers



Implementation of 3D Convolutions!!

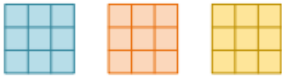

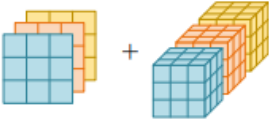
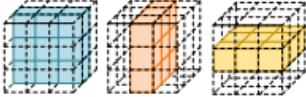
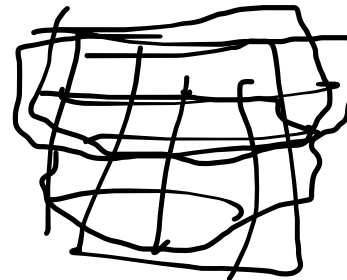
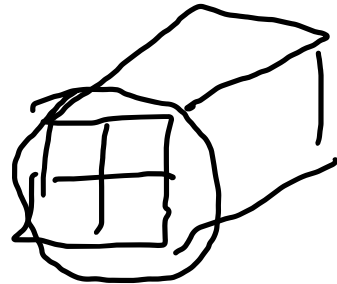
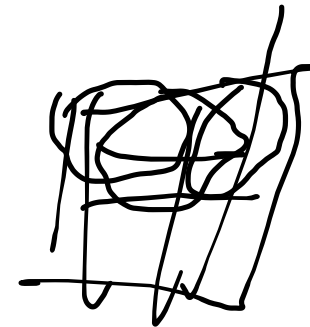
	Pros	Cons
<p>2D Convolutions</p> 	2D pretrained weights on large 2D datasets	Natively 2D representations
<p>3D Convolutions</p> 	Natively 3D representations	Lack of 3D pretrained weights on large datasets
<p>Hybrid (2D +3D)</p> 	2D + 3D representations	<ul style="list-style-type: none"> a. 2D representation within 2D parts b. Lack of 3D pretrained weights c. Redundant multi-stage / multi-stream models
<p>ACS Convolutions</p> 	<ul style="list-style-type: none"> a. Natively 3D representations b. 3D pretrained weights on large 2D datasets c. Converting ANY 2D model into a 3D model seamlessly without extra computation costs 	

Diagram Models of Calorimeters



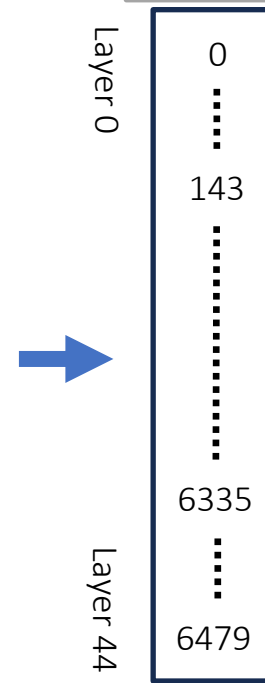
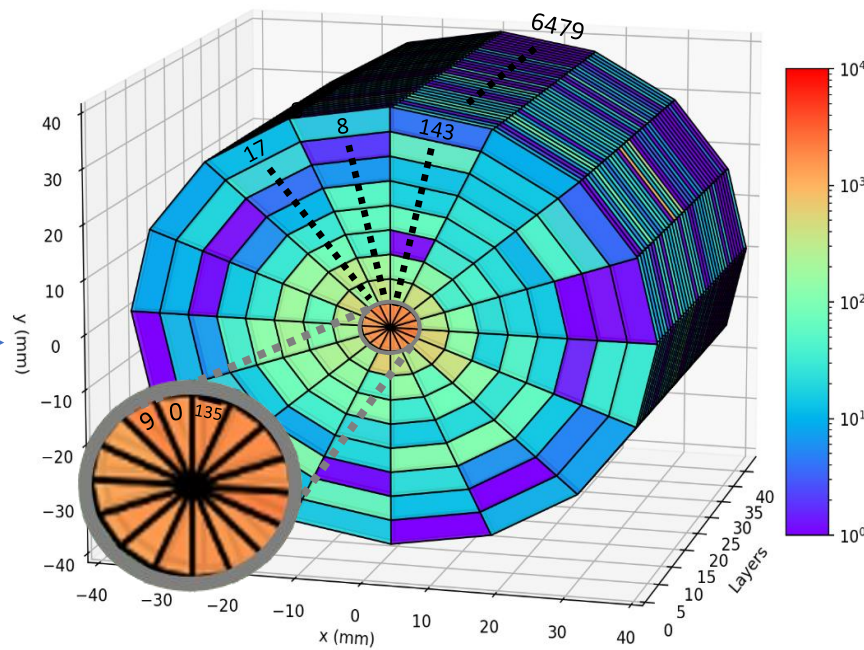
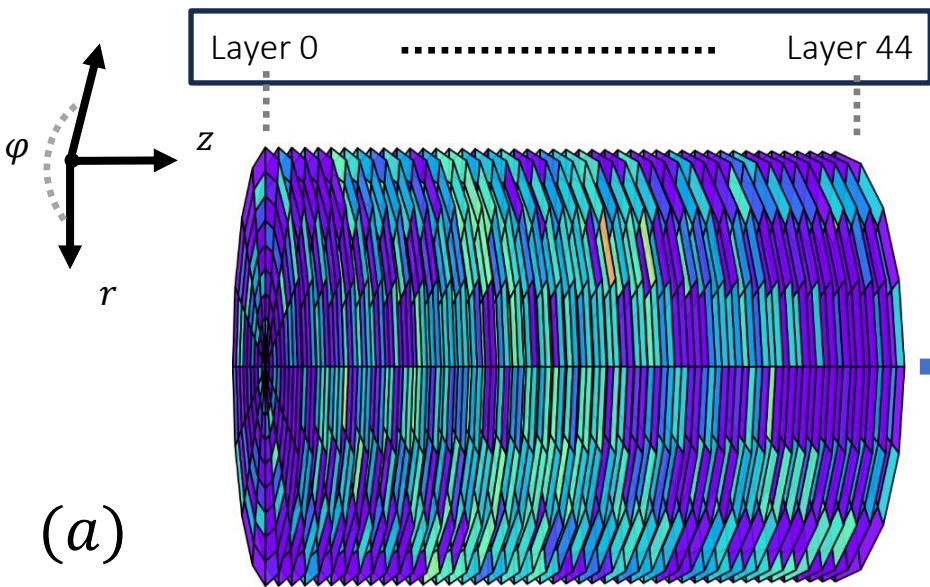
(a)



Layer Mapping

Voxel Mapping

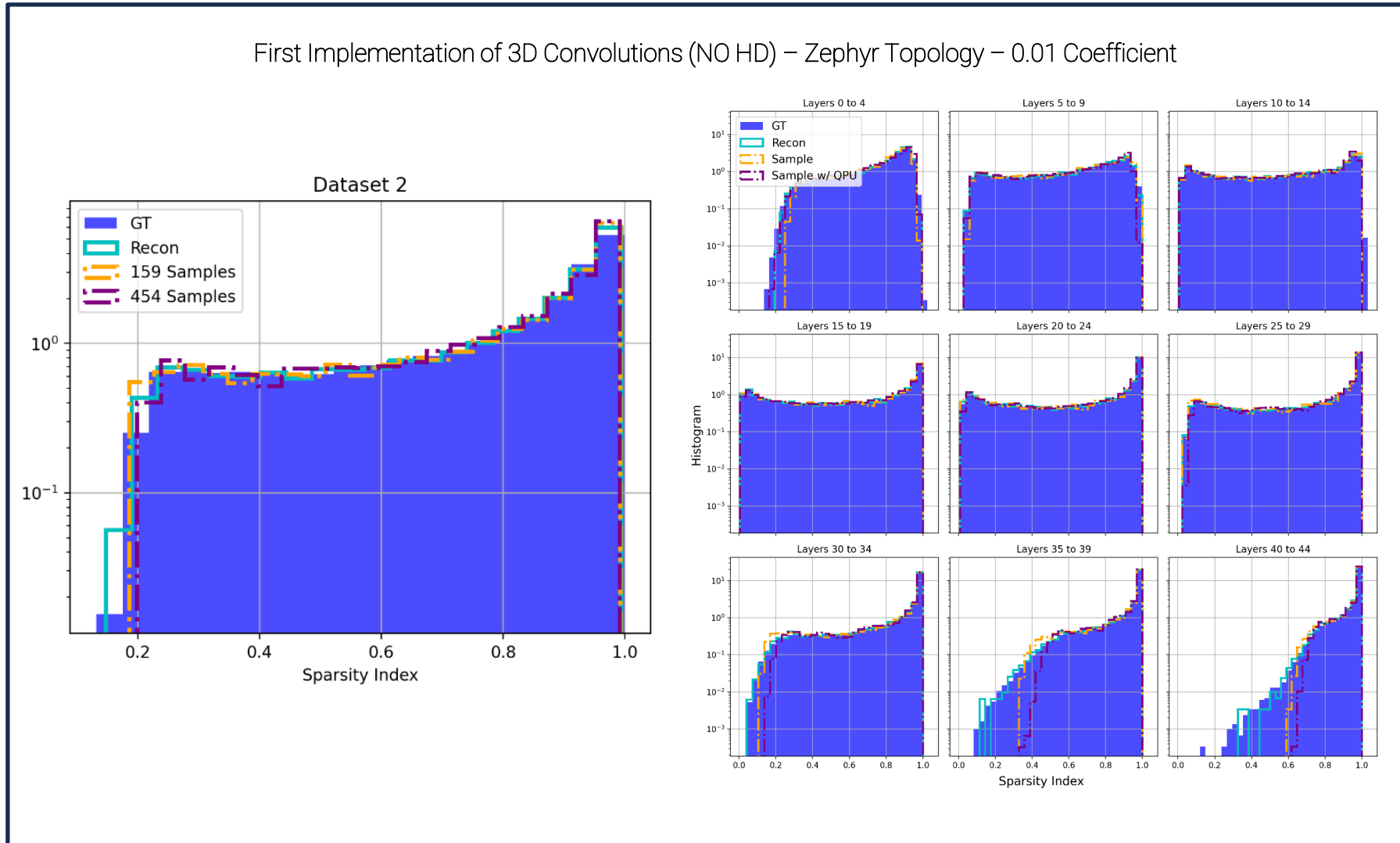
Voxel Encoding



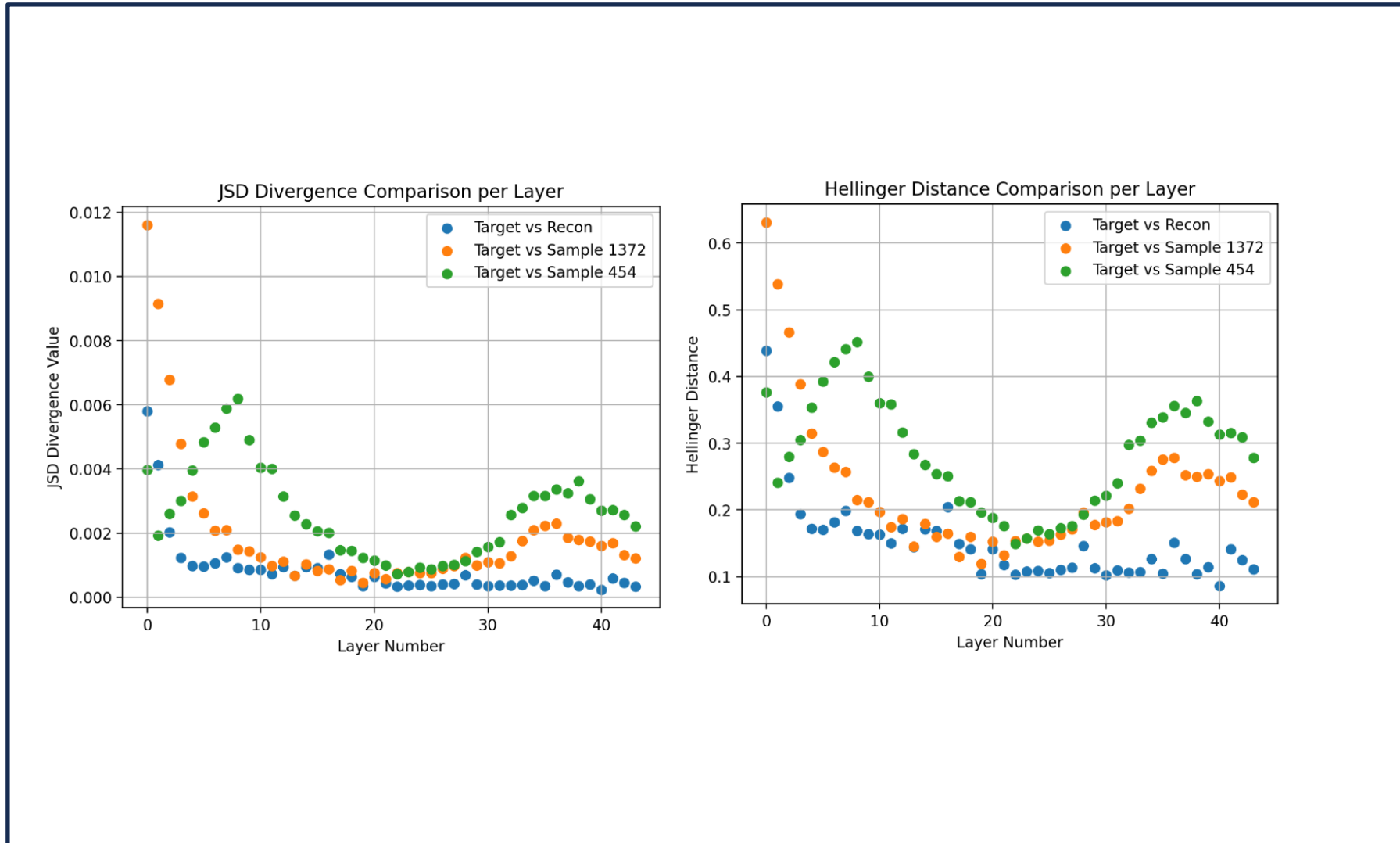
(a)

Conv2d (45, 64 (h, w))

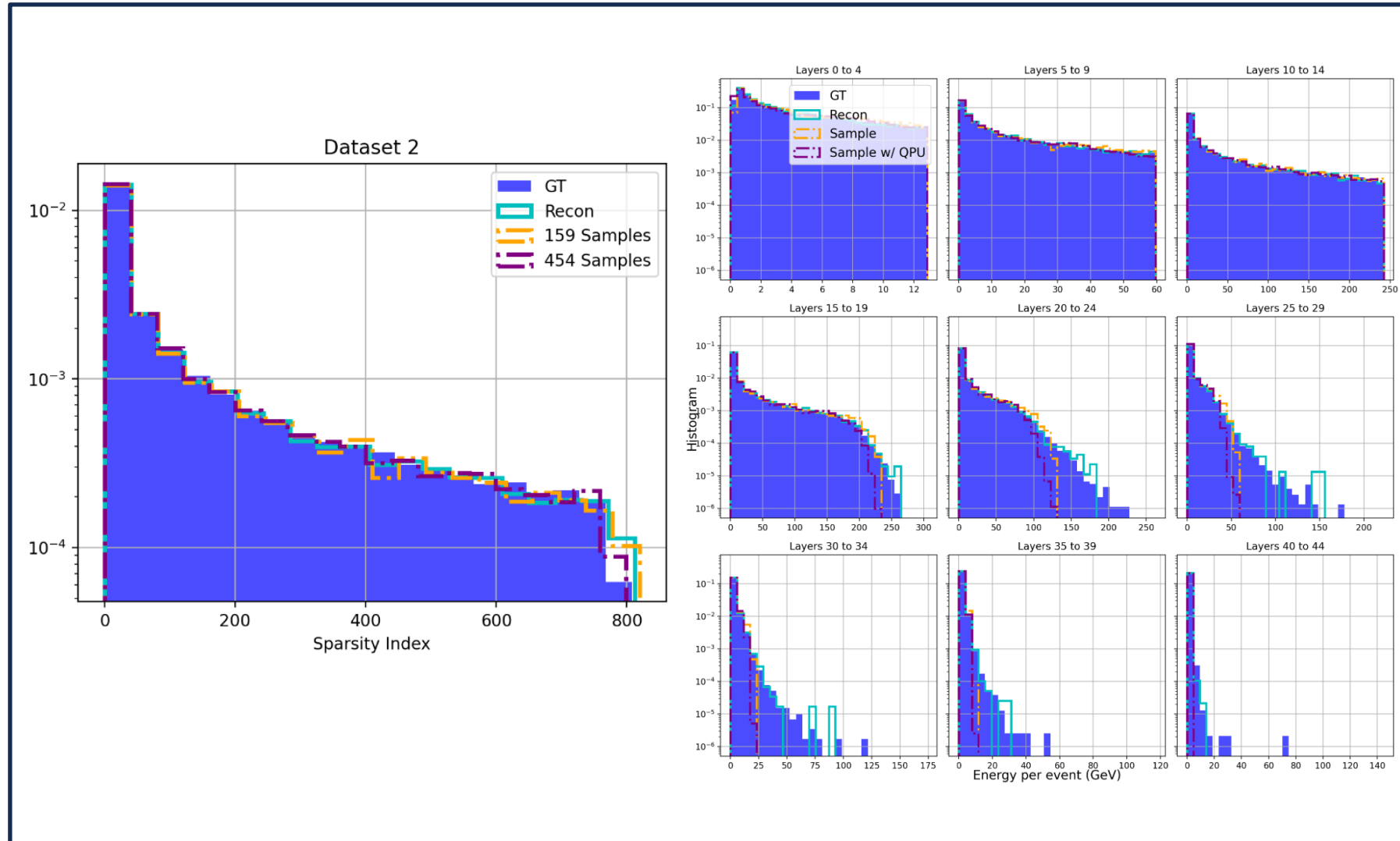
Sparsity Index Histograms – Model 204 (Sample)



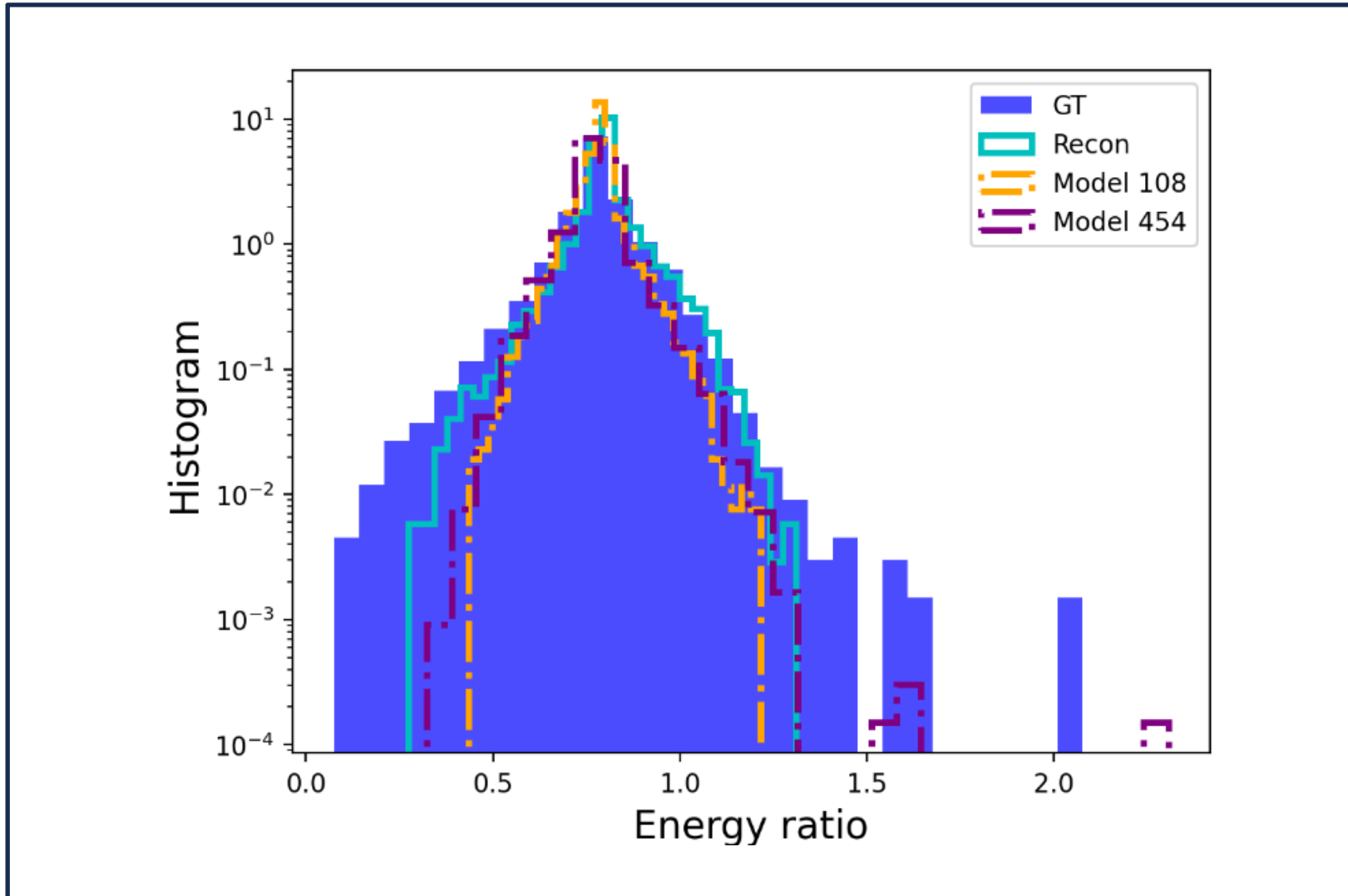
Energy Histograms – Model 204 (Sample)



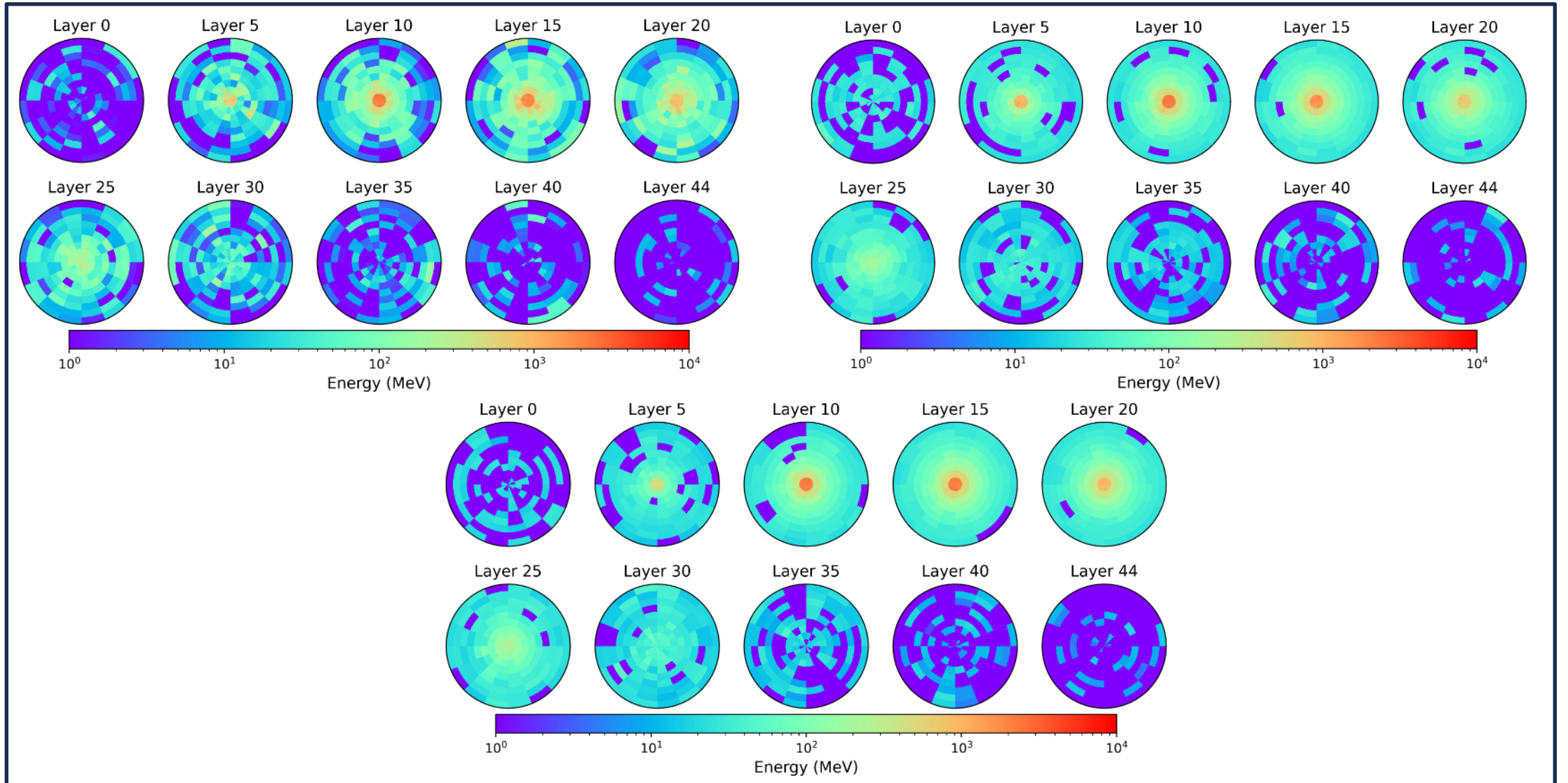
Energy Histograms – Model 204 (Sample)



Energy Histograms – Model 204 (Sample)



Model 204 Energy Layers



Looking Forward!!

- Combine 3D Convolutions with Hierarchical Decoder
- Conduct Granularity or Similarity Analysis along the Z-direction of the shower
- Try pooling layers, and different down and up sampling techniques (up sample + convolutions vs transpose convolutions)