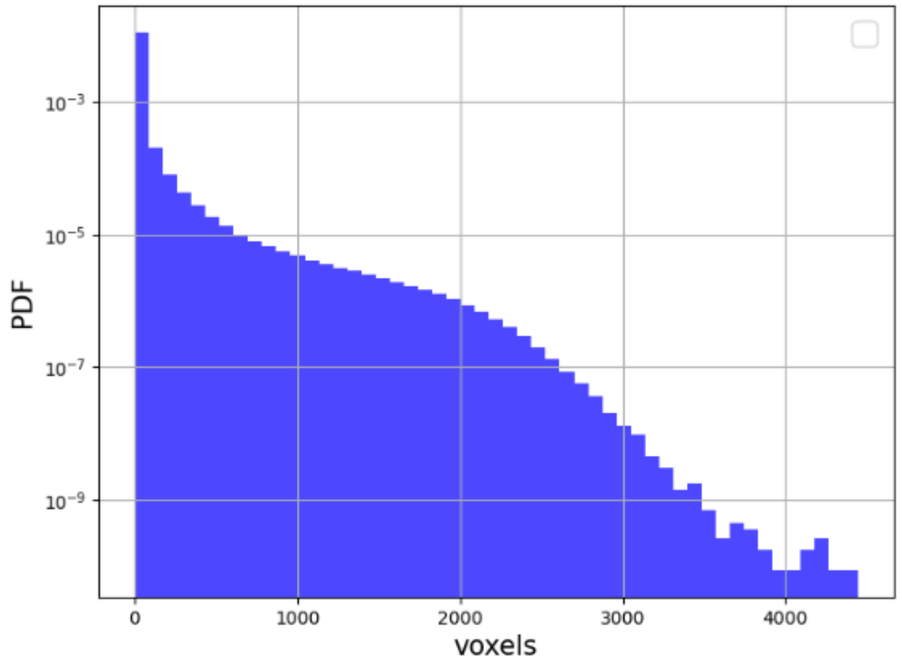
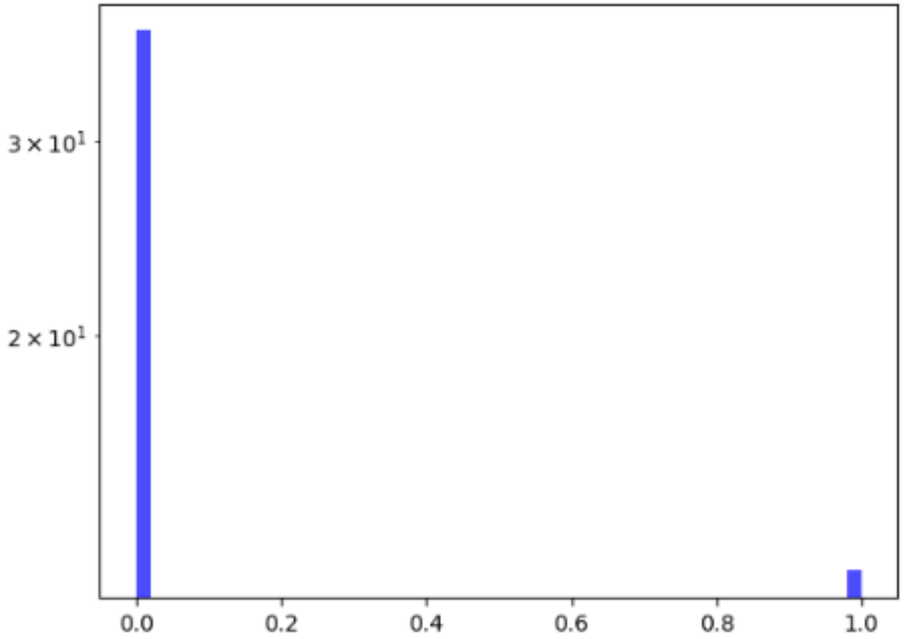
QVAE w/ Pegasus & Zephyr

Jun 3

DATA PREPROCESSING

$\{\{v_i^{(\alpha)}\}_{i=1}^{6480}\}^{100,000}$: Dataset (where i tags the voxel and α tags the datapoint)





Data preprocessing How we do it:

$\{\{v_i^{(\alpha)}\}_{i=1}^{6480}\}^{100,000}$: Dataset (where i tags the voxel and α tags the datapoint)

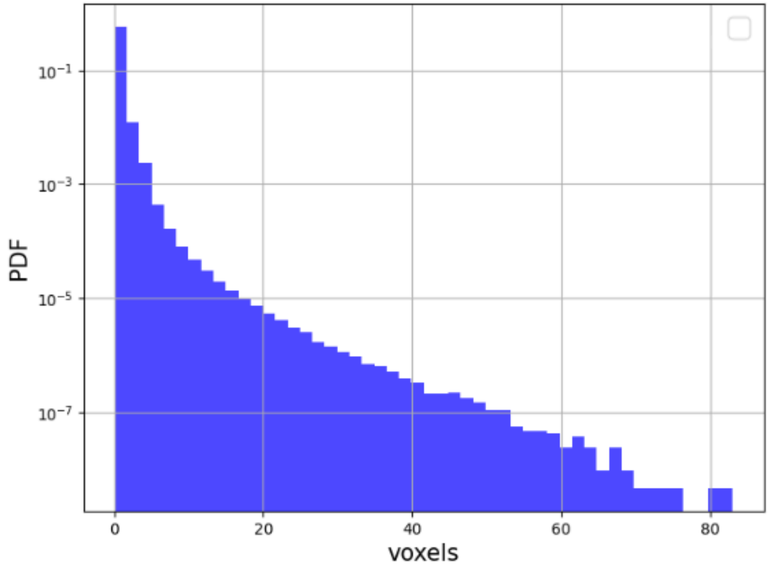
Steps:

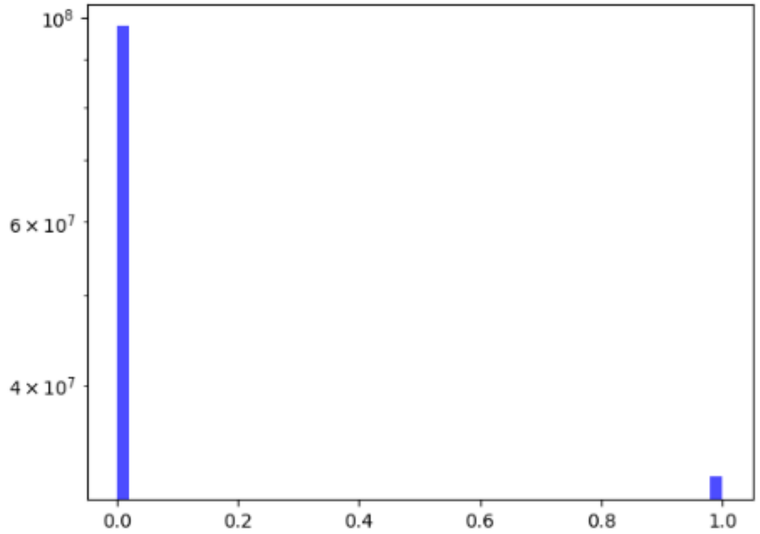
- Standardize the dataset
  but removing the zero values.

$$\nu_i = \frac{\nu_i - \mathbb{E}_\alpha\left[v_i^{(\alpha)}\right]}{\mathbb{E}_\alpha\left[\left(v_i^{(\alpha)} - \mathbb{E}_\beta\left[v_i^{(\beta)}\right]\right)^2\right]}$$

- Rescale by shifting towards positive values
  except those zero values voxels

$$u_i = \nu_i + \text{abs}(\min_\alpha(\nu_i^{(\alpha)})) + \delta$$





Data preprocessing

How CaloDiff does it:

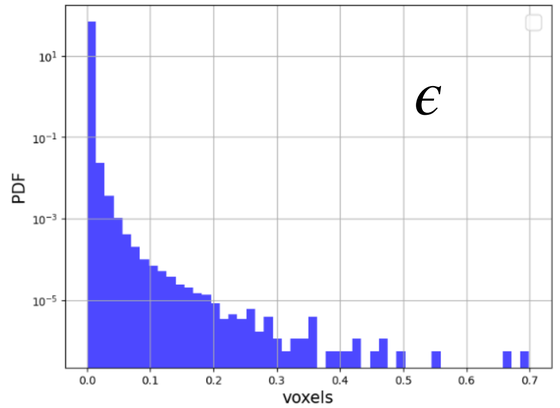
$\{v_i\}_{i=1}^{6480}$: shower

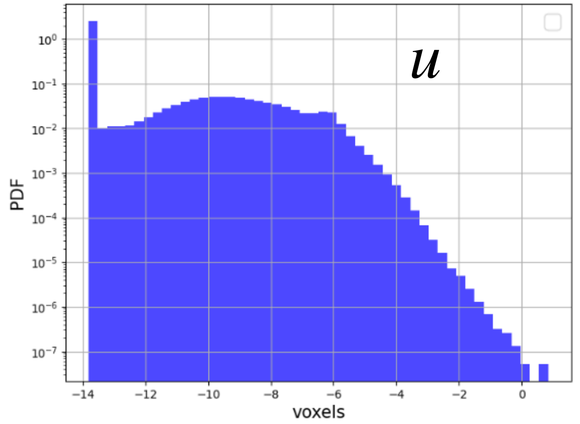
$\epsilon_i = \dfrac{v_i}{E_{inc}}$: reduced deposited energy in voxel ith

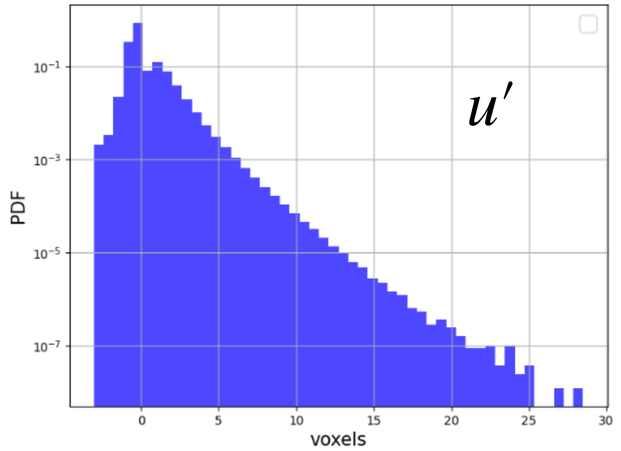
$x_i = \delta + (1 - 2\delta)\epsilon_i$ $\qquad\qquad$ $\delta = 10^{-6}$

$u_i = \log \dfrac{x_i}{1 - x_i}$

$u_i' = \dfrac{u_i - \langle u_i \rangle}{\sigma_{u_i}}$







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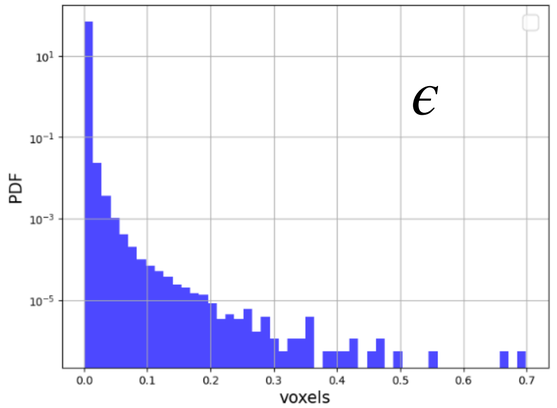
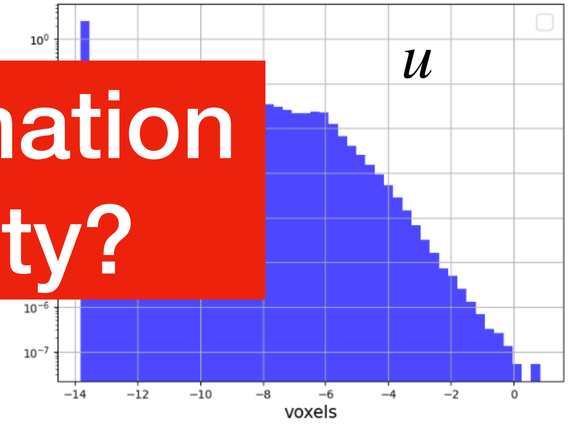
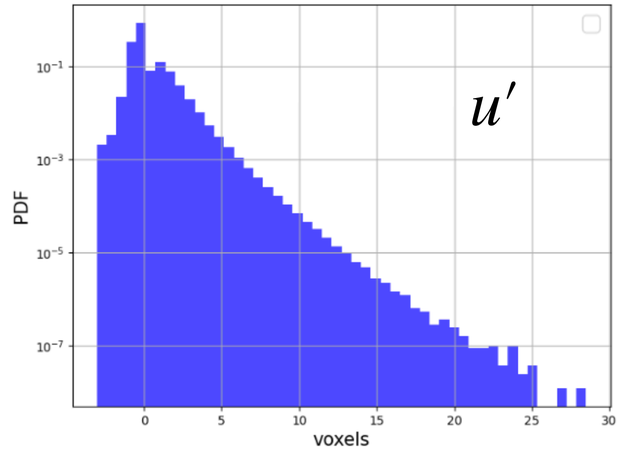
Can we use this transformation and preserve the sparsity?







DATA PREPROCESSING

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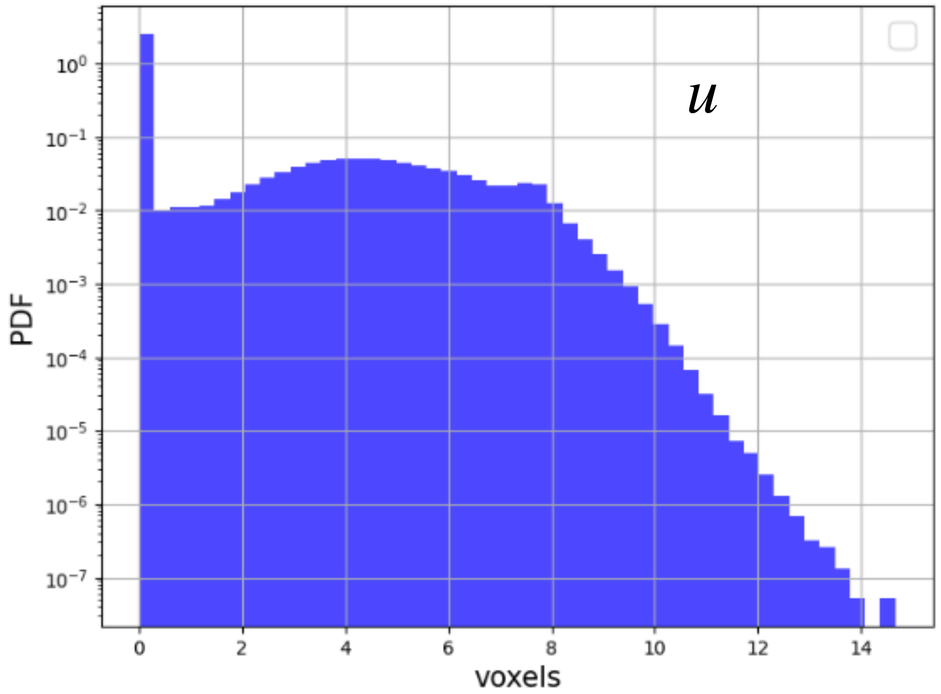
$u_i = \log \frac{x_i}{1 - x_i} - \log(\delta/(1 - \delta))$



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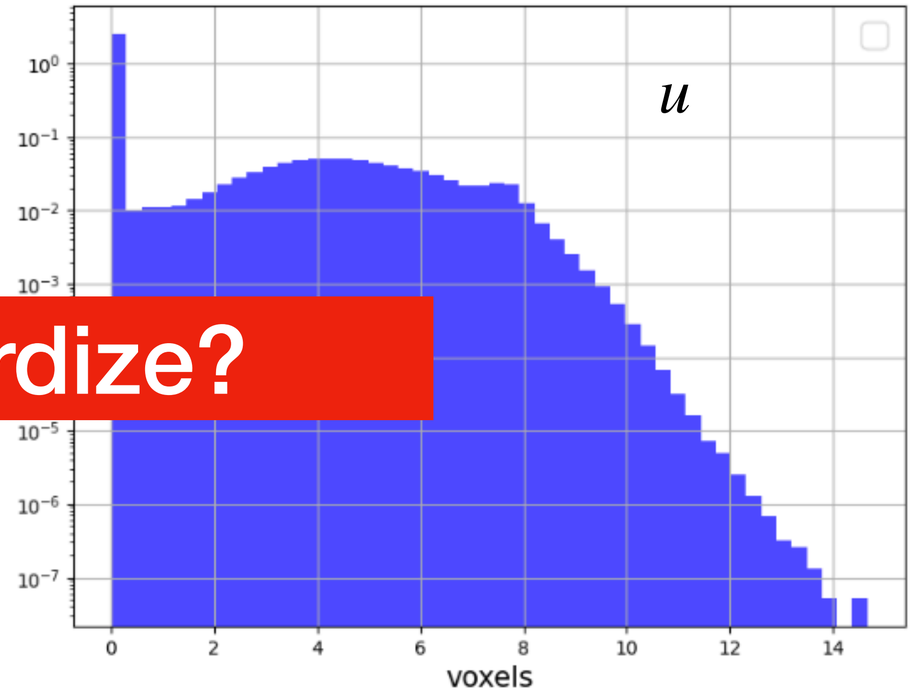
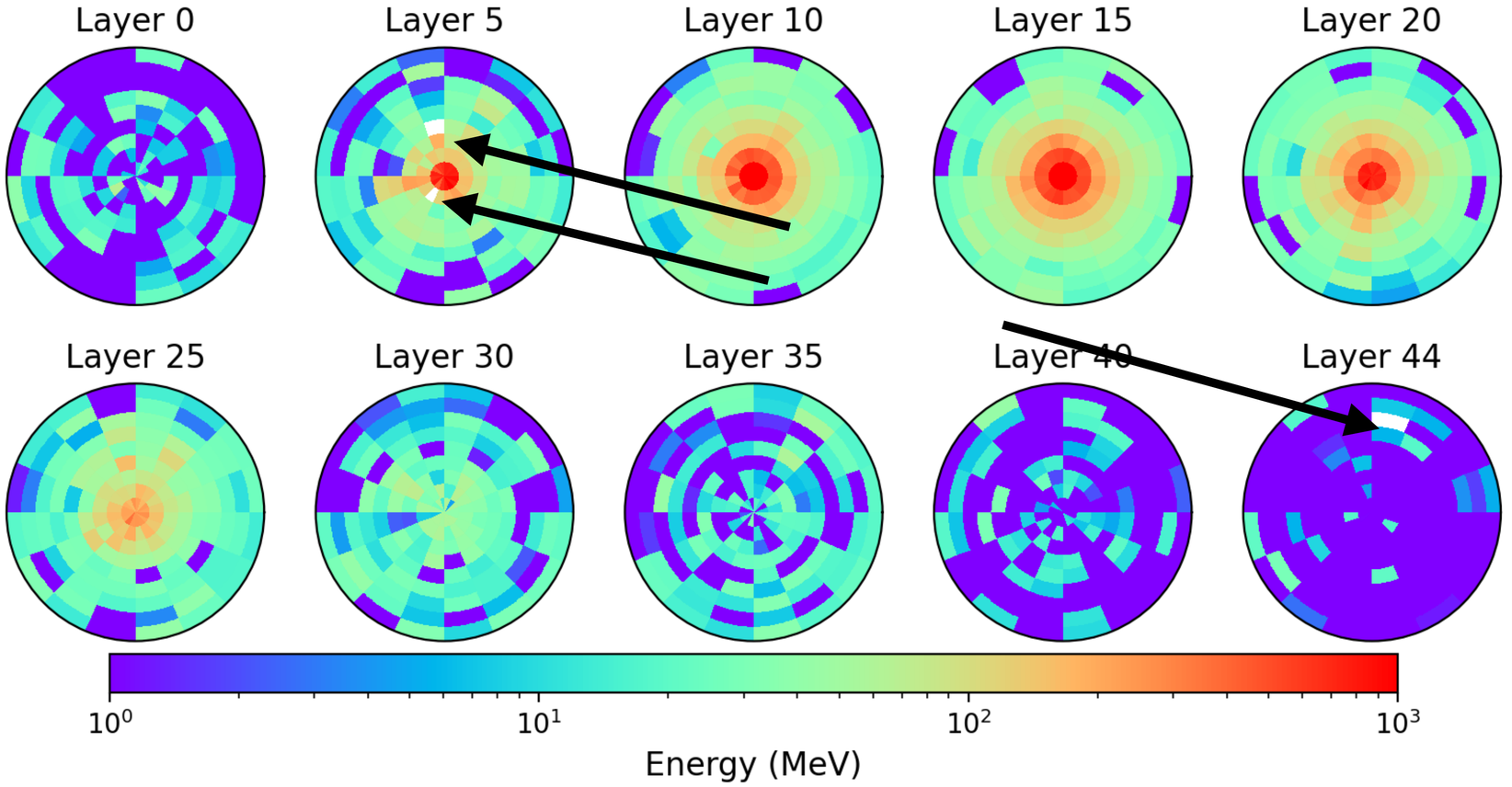
Should we standardize?



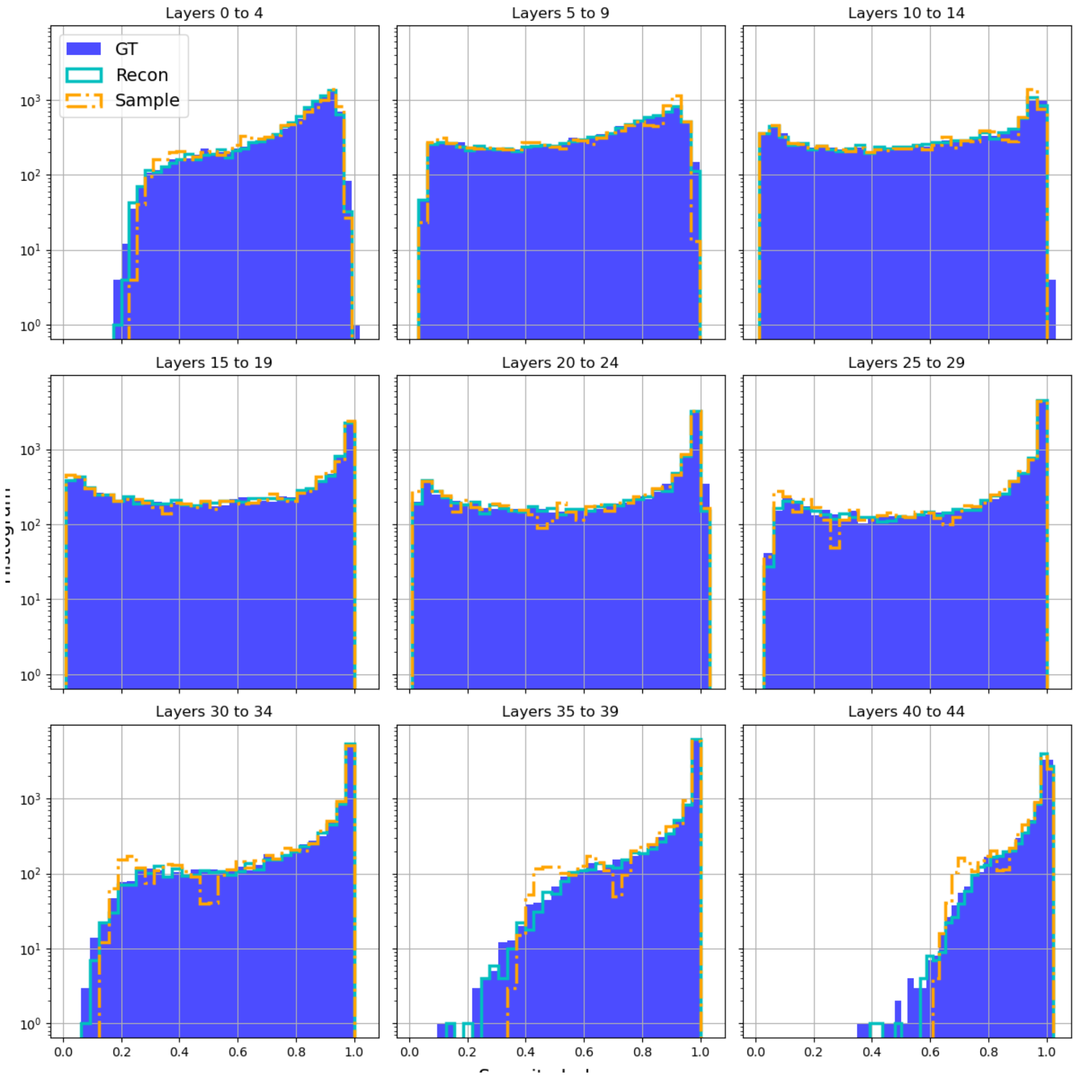
DATA PREPROCESSING

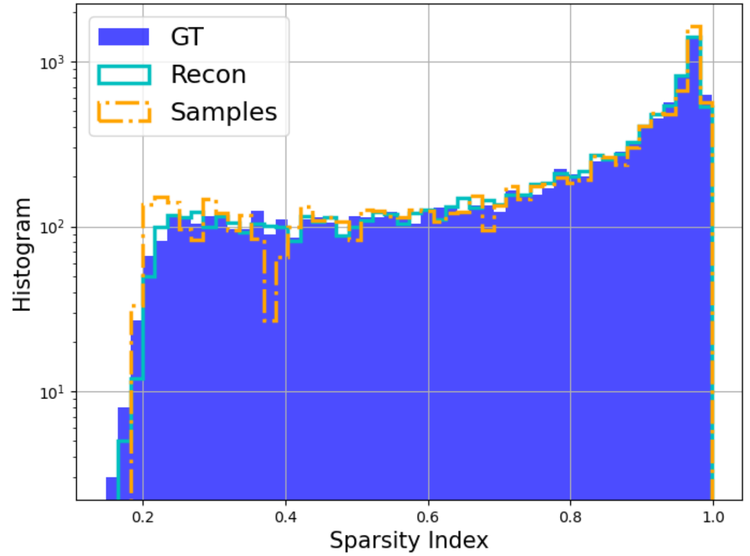


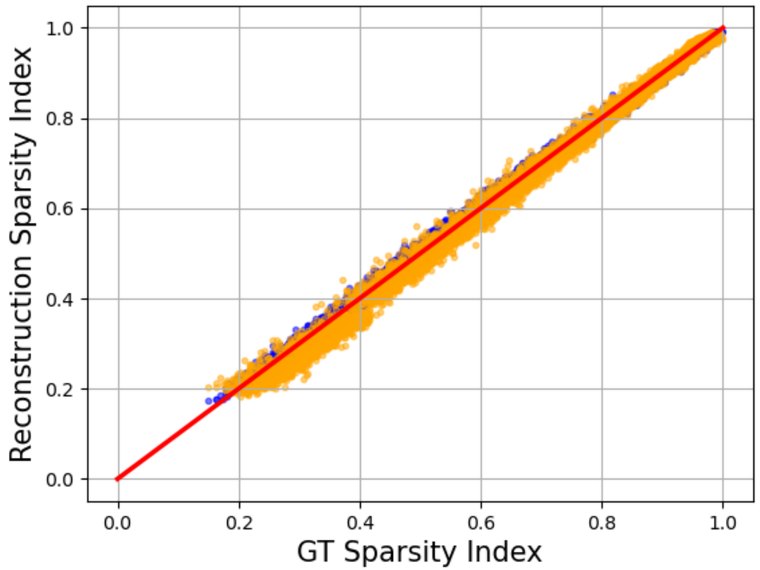
$$\nu_i = \frac{\nu_i - \mathbb{E}_\alpha\left[v_i^{(\alpha)}\right]}{\mathbb{E}_\alpha\left[\left(v_i^{(\alpha)} - \mathbb{E}_\beta\left[v_i^{(\beta)}\right)^2\right]\right]}$$

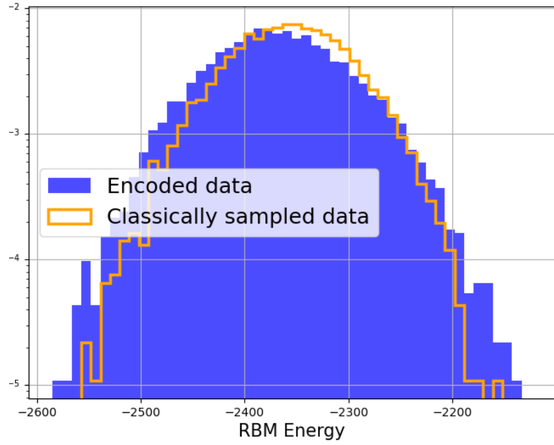
$$u_i = \nu_i + \text{abs}(\min_\alpha(\nu_i^{(\alpha)})) + \delta$$

RESULTS AFTER 30 EPOCHS









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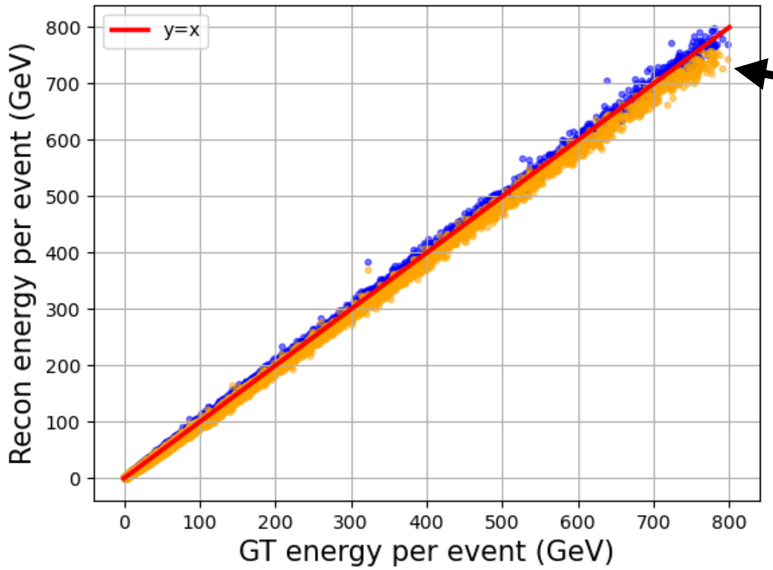
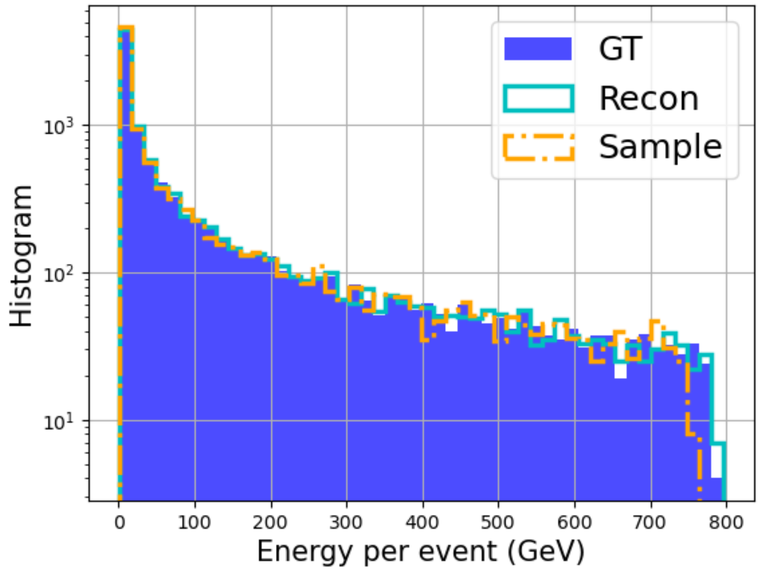
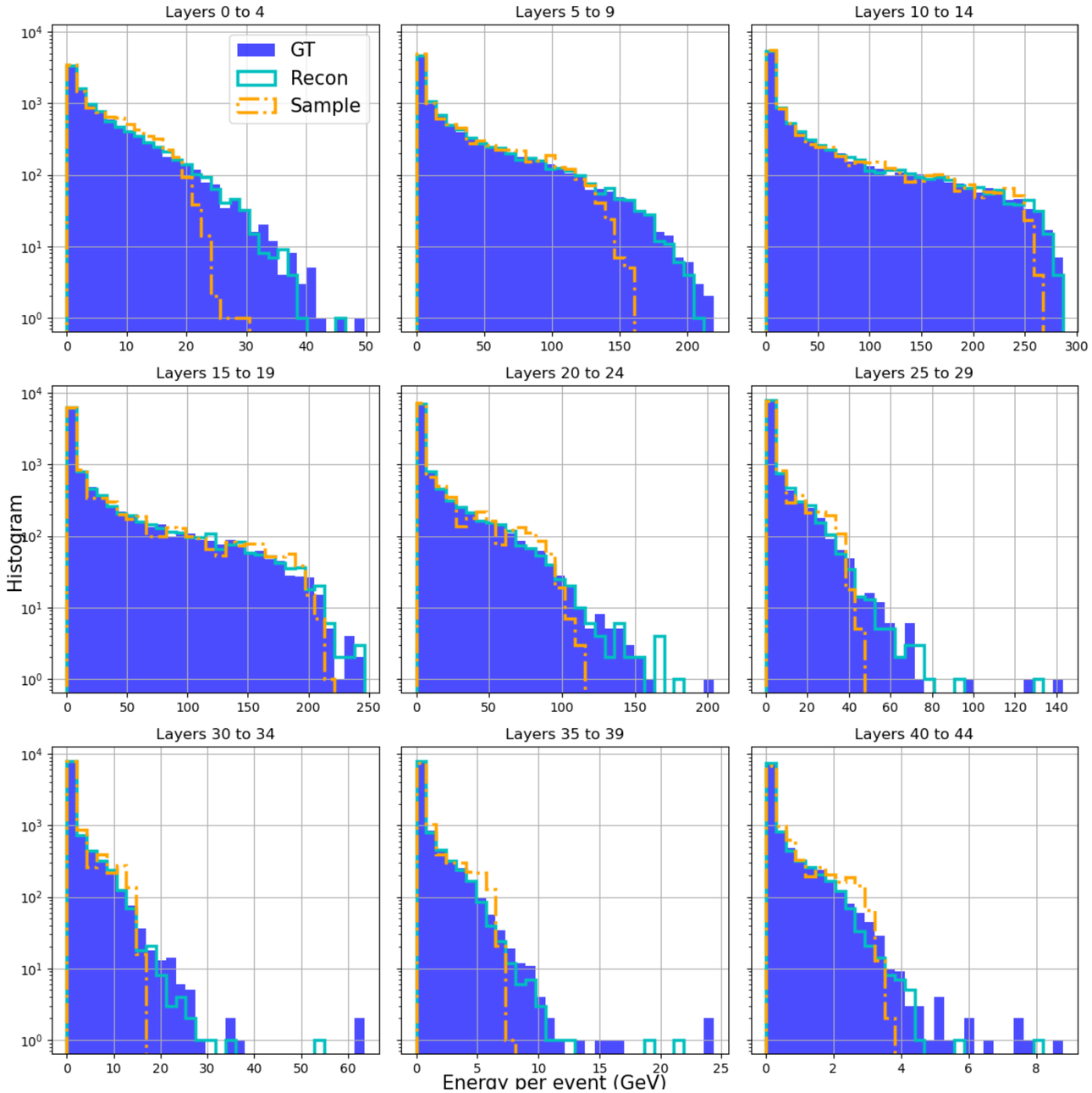


HPARAM TUNING





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