QVAE w/ Pegasus

Nov 24th

- QVAE
    - Architectures
        - CNN
        - FCN
    - Energy incidence
        - Condition on encoder and decoder
        - Condition on encoder
        - Unconditionalized
        - Modulated energy => Can lead to learning how to modulate more features, position of voxels, angles, etc.
    - Results/metrics
        - Energy histogram
        - Sparsity histogram
        - Conditionalized energy and sparsity histogram (NOT GOOD)
- RBM
    - Topology
        - Chimera-like
        - Pegasus
    - Metrics
        - Energy distribution for encoded and RBM Gibbs samples
        - Zais and Zrais estimates for partition function => log-likelihood of model
    - Dwave
        - Sehmi’s method
        - Fast stein. Not robust but could be helpful?
        - Hao’s method
- Theory. Work in progress

- In the previous slides (Nov 17th), we showed that in the case of the Fully connected Encoder/Decoder, the RBM energy histogram for encoded data overlapped with the Gibbs samples RBM energy histogram. This is desirable in our models.

- For the CNN we did not see any overlap but the sample calorimeter data was decent.

- In the following models we changed the last activation function in the encoder to a PReLU and we removed the batch norm. What we observe is overlap between the encoded data and the Gibbs sample data, as desired.

- We also compute the Log-Likelihood (LL) for trained models and random models. Recall that the RBM is trained via LL maximization, while the approximate posterior is trained via KL divergence (i.e., the approximate posterior tries to match the prior (i.e., the RBM)). Hence, we expect the LL of a trained model to be larger than that of a random model.

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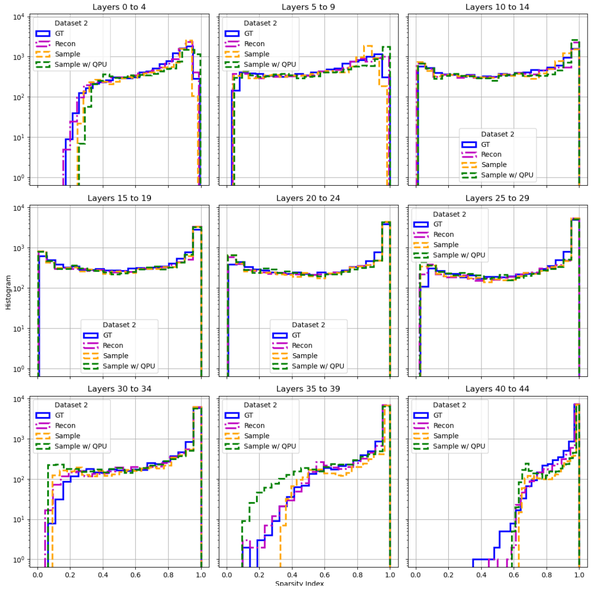
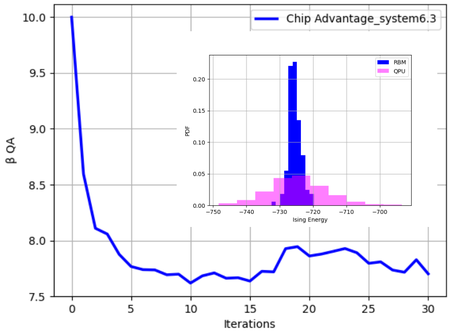
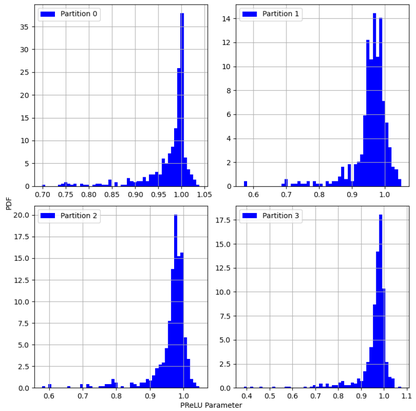
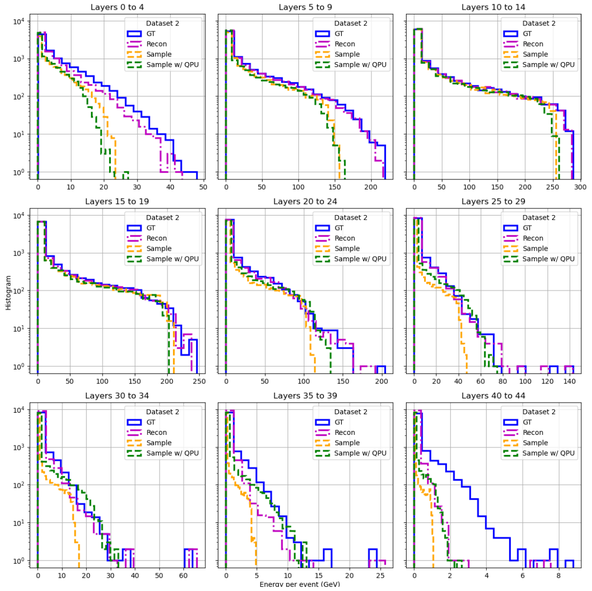
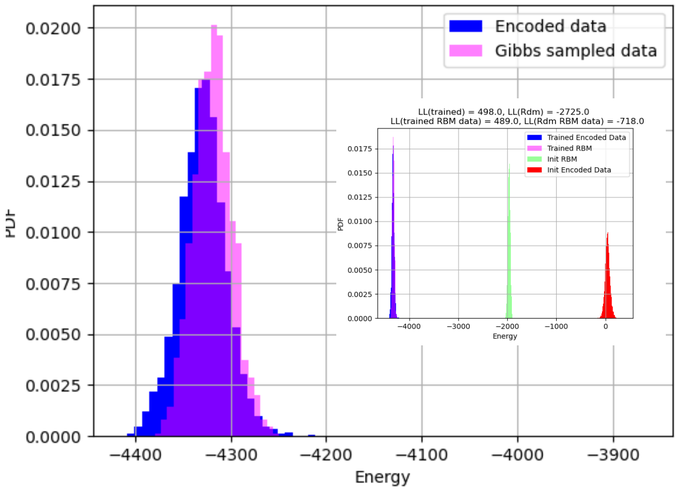
CNN + fully conditioned+scaled data

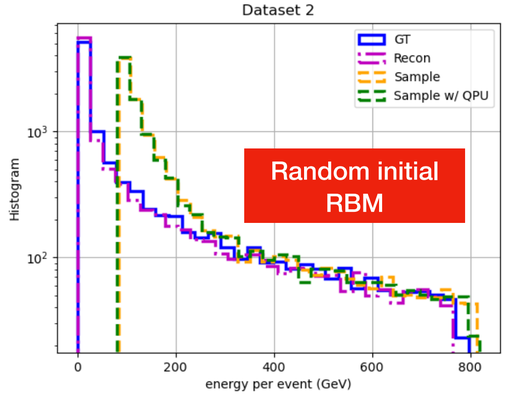


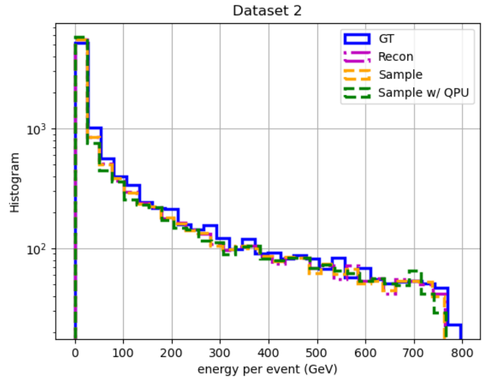


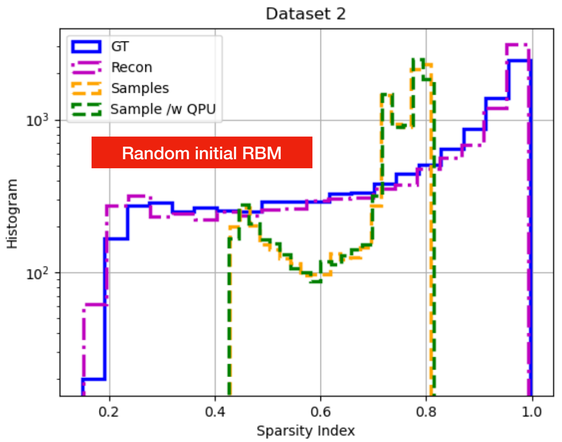












LL(Trained) = Trained model Log-likelihood evaluated on the encoded validation dataset.
LL(Trained RBM data) = Trained model Log-likelihood evaluated on Gibbs sampled data.
LL(Rdm) = Random RBM model Log-likelihood evaluated on the encoded validation dataset.
LL(Rdm RBM data) = Random RBM model Log-likelihood evaluated on on Gibbs sampled data.
We expect LL(trained) ~ LL(trained RBM data) > LL(Rdm RBM data) > LL(Rdm)

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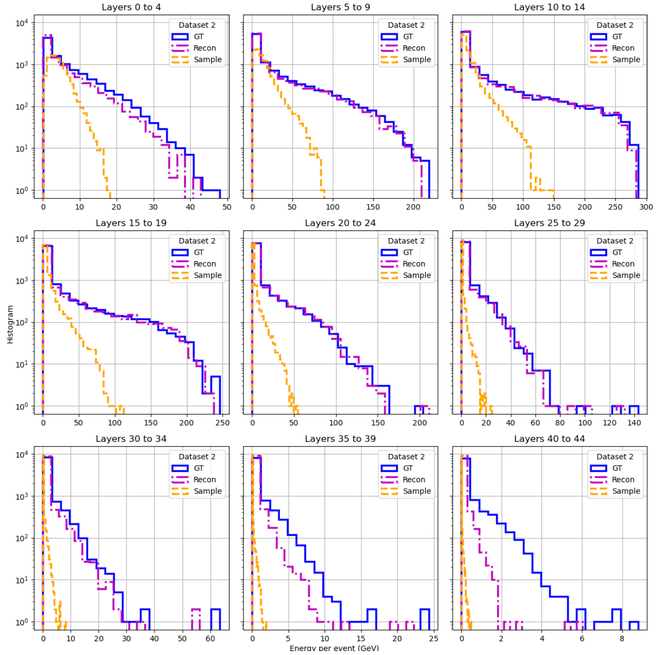
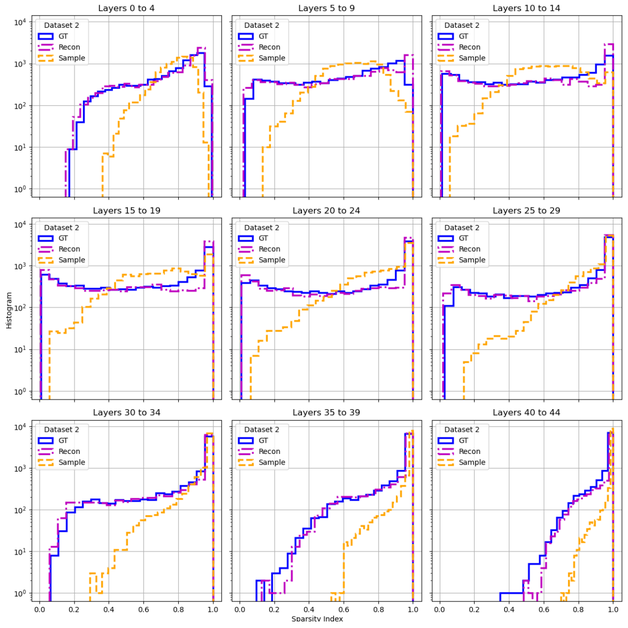
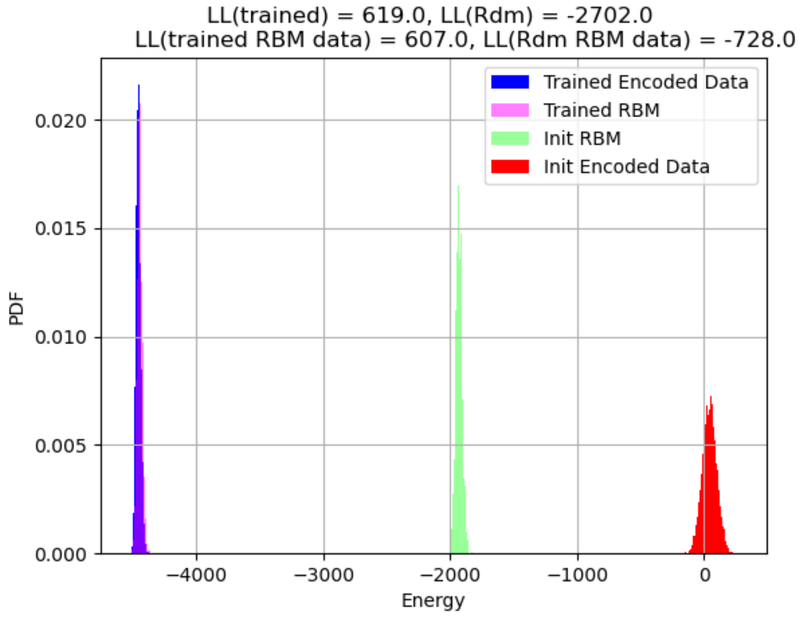
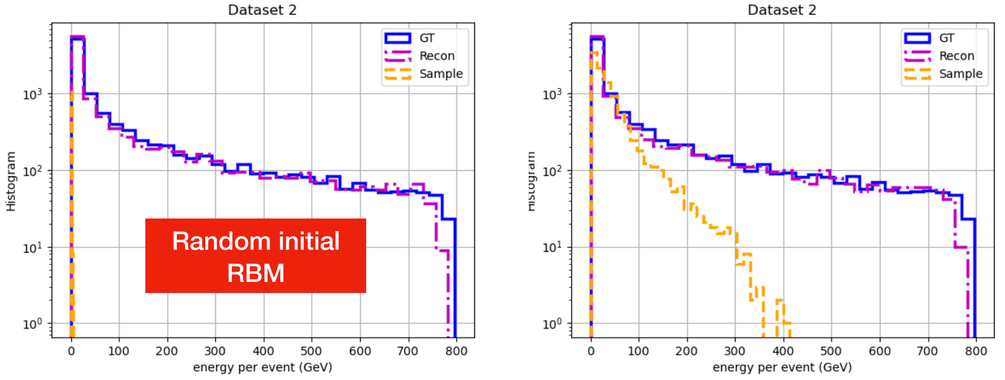
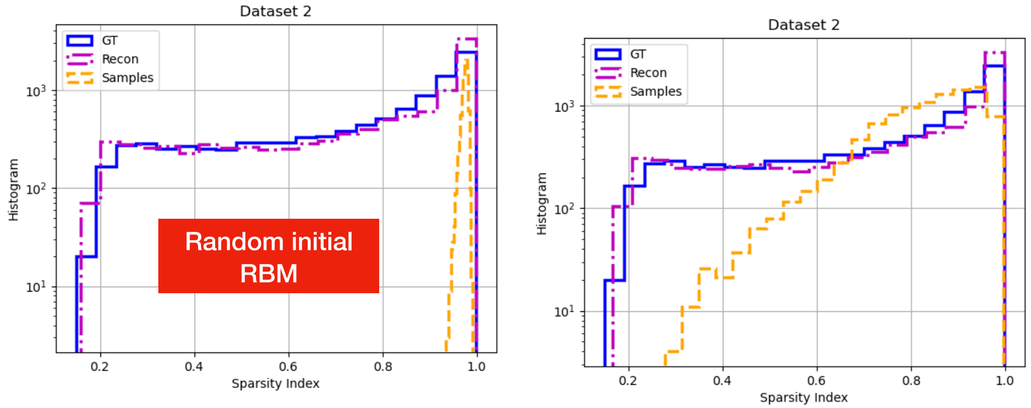
CNN+Unconditioned+scaled data











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CNN+Enc
cond+scaled data