Calo4pQVAE: Progress and updates

Nov 21 2024

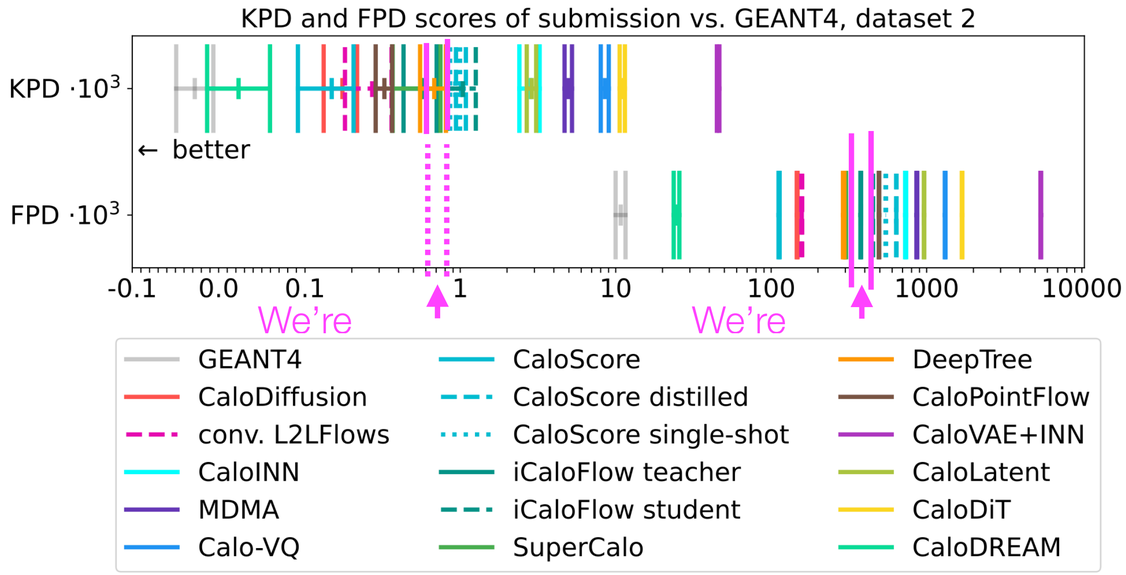
ML4Jets

- Francois Charton (Meta AI Paris) ML4Jets_charton.pdf **Symbolic ML in Physics**
- Jennifer Ngadiuba (FNAL) ML4Jets25-ngadiuba.pdf. **Overview of ML in HEP**
- Yacine Haddad (Northeastern University (US)) Meta-Learning-ML4Jets (1).pdf **Quantum GenAI for Jets. Small scale**
- Ian Pang ML4Jets_AOJ.pdf. **Aspen Open Jets dataset 180M**
- Ryan Roberts (University of California Berkeley (US)) ml4jets_egamma.pdf
- Jonas Simon Spinner lgatr-ml4jets.pdf **Lorentz invariant NNs**
- Dr Darius Faroughy (Rutgers University) ML4JETS_Faroughy_2024.pdf **Methods for particle clouds + discrete features using Gen models**
- Luigi Favaro ml4jets24_calodream_full.pdf
- Sascha Diefenbacher (Lawrence Berkeley National Lab. (US)) ML4Jets_Unfolding_Bridges.pdf **Unfolding using Diff Models. Go from datapoint with detector error to data point without error**
- Vinicius Massami Mikuni (Lawrence Berkeley National Lab. (US)) ML4JetsOmniLearn.pptx-1.pdf **Foundational models for HEP**
- Kevin Thomas Greif (University of California Irvine (US)). ml4jets_vlvld.pdf **Unfolding using latent diffusion models (encoder and dec are transformers)**
- Claudius Krause (HEPHY Vienna) CaloChallenge.C.Krause.pdf **CaloChallenge review paper**

https://indico.cern.ch/event/1386125/timetable/?view=standard

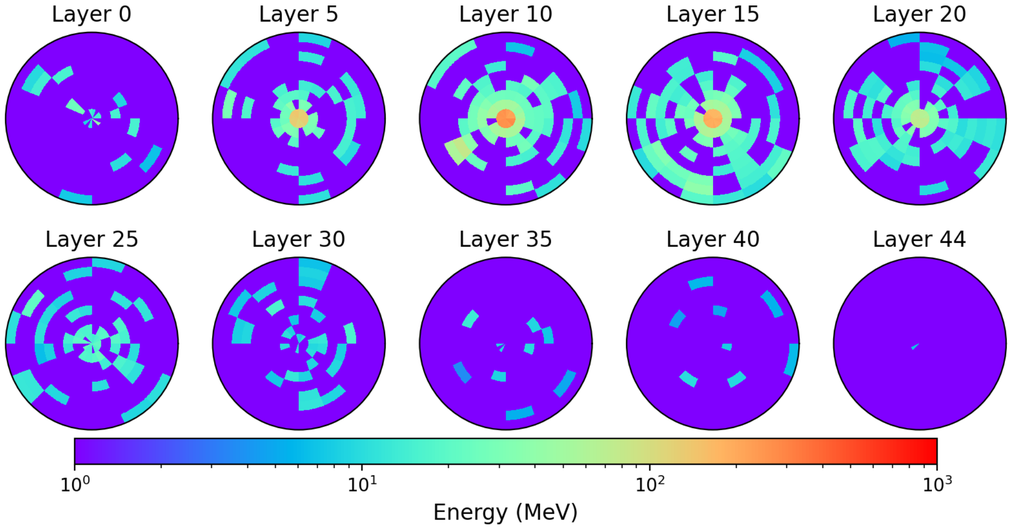
Where are we?

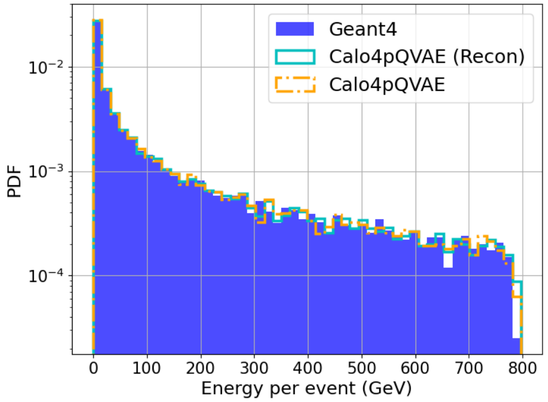
	FPD ($\times 10^3$)	KPD ($\times 10^3$)	Fixed bug	Exact RBM Grad
Pegasus	443.0 ± 2.4	0.84 ± 0.1		
Pegasus	390.4 ± 1.9	0.46 ± 0.05	✅	
Zephyr	380.7 ± 1.1	0.61 ± 0.06		
Zephyr	379.7 ± 1.7	0.57 ± 0.05	✅	
Zephyr	362.7 ± 1.7	0.57 ± 0.08	✅	✅

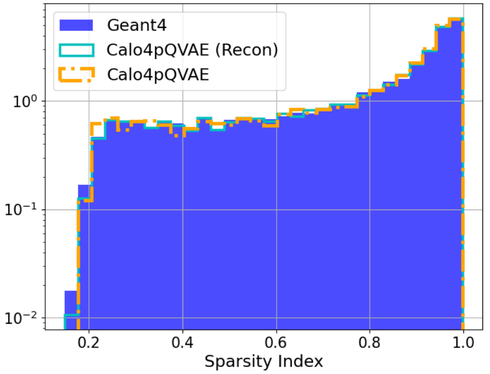


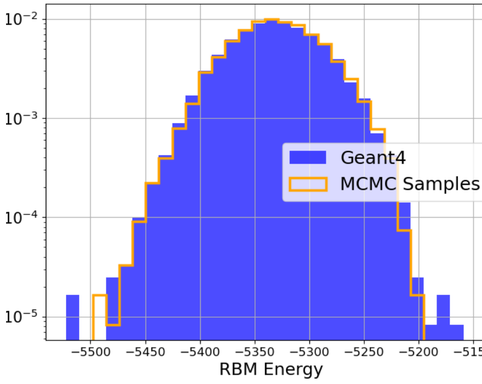
Krause C, Giannelli MF, Kasieczka G, Nachman B, Salamani D, Shih D, Zaborowska A, Amram O, Borras K, Buckley MR, Buhmann E. CaloChallenge 2022: A Community Challenge for Fast Calorimeter Simulation. arXiv preprint arXiv:2410.21611. 2024 Oct 28.

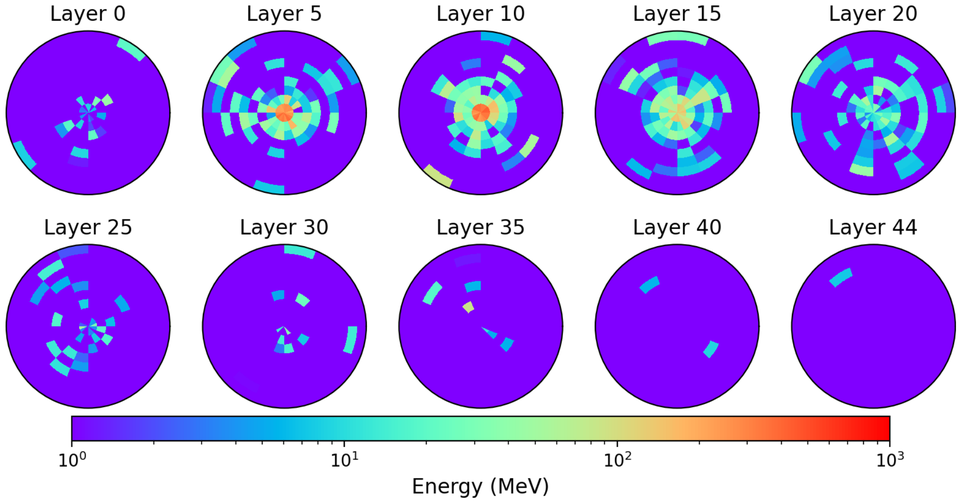
Model to replace the one in PRX draft

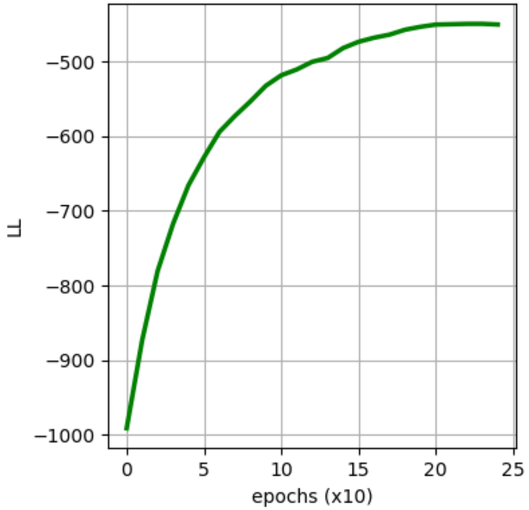


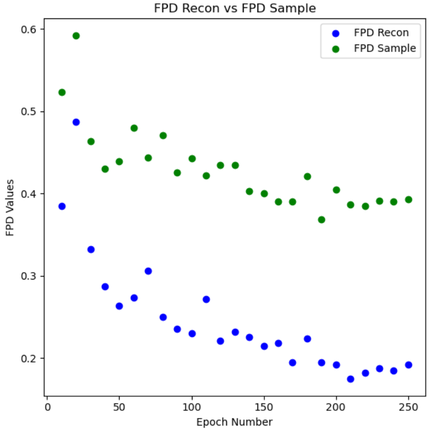


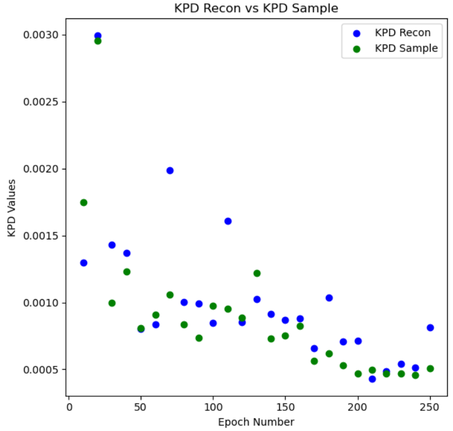












ToDo

- ✓ UNet for CaloQVAE — Ian
- ✓ CaloQVAE w/ linear attention layers — further exploration needed
- ✓ Associative mem in GAN — Coherent samples from Zephyr
- ✓ ATLAS dataset ready
- ✓ What if we add a UNet after our current CaloQVAE pipeline or after the encoder?