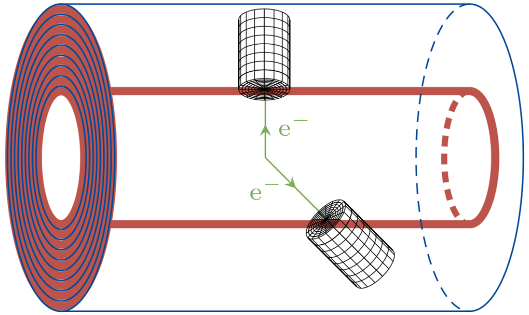
Fast Shower Simulation for Future Detectors

Cinyu Zhu | 08.08.2024

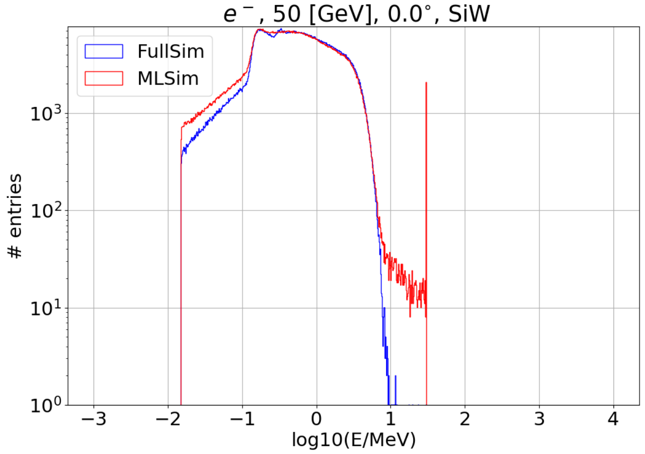


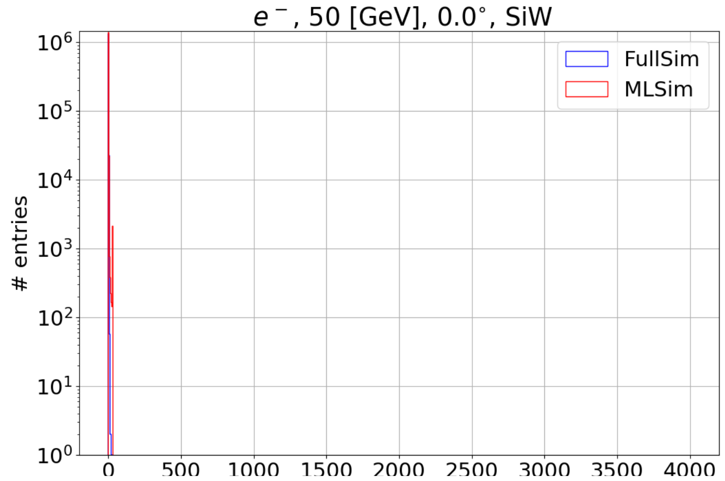
CaloDiT

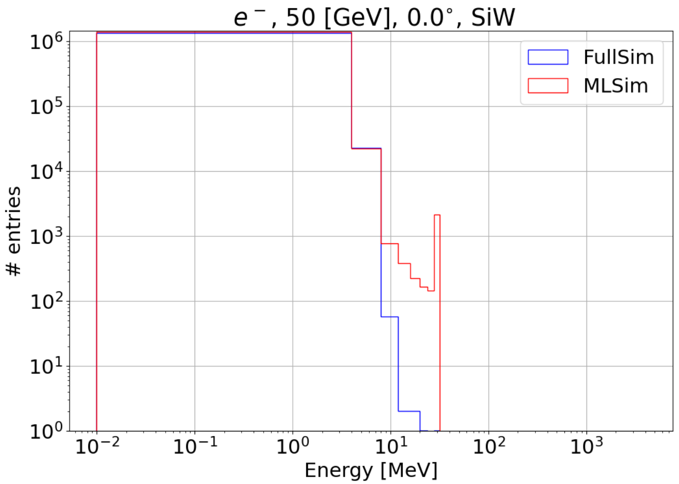
training result in virtual mesh

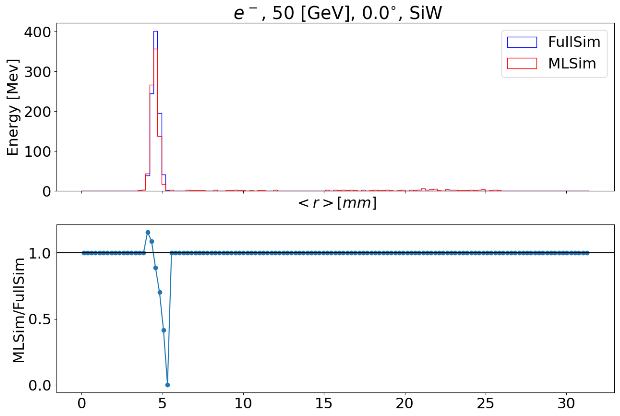
validation for the torch script model

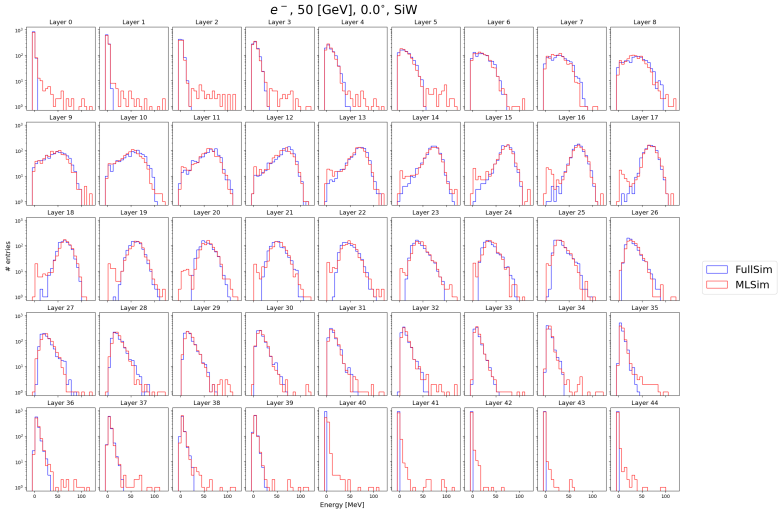
Full Sim vs. Torch script

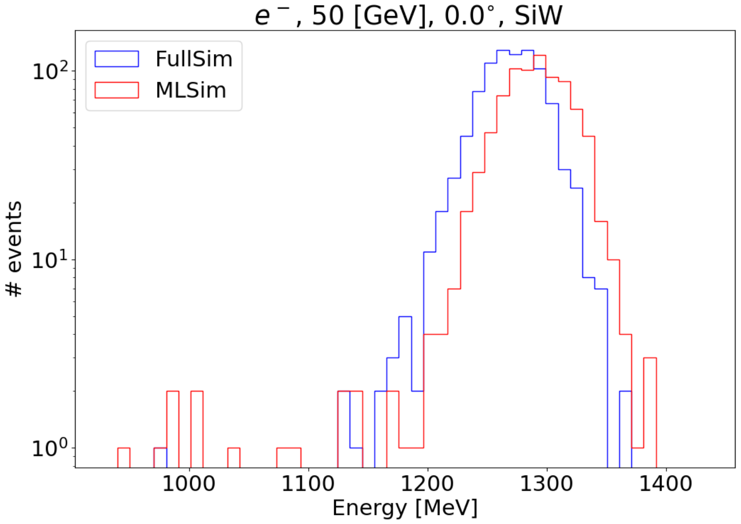


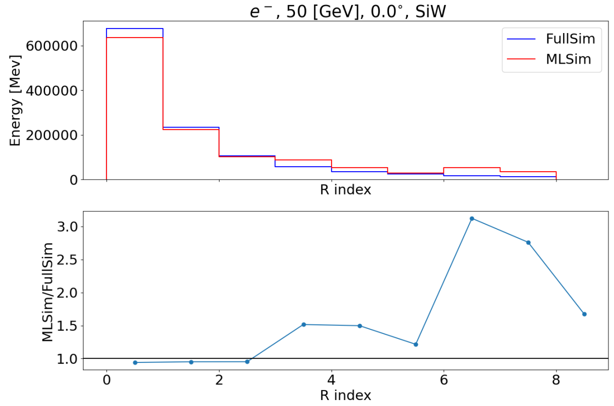






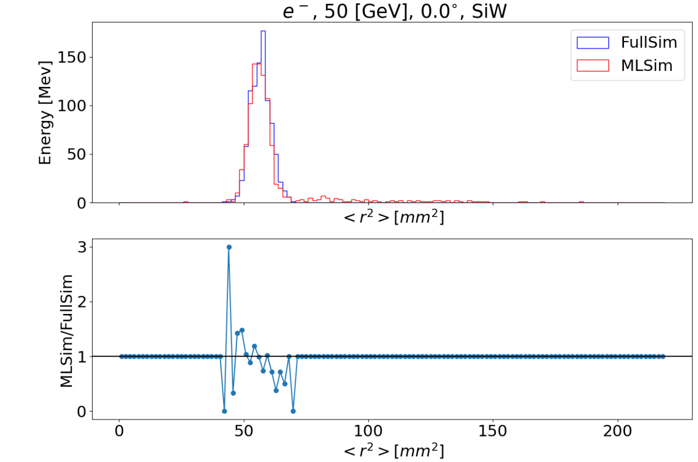


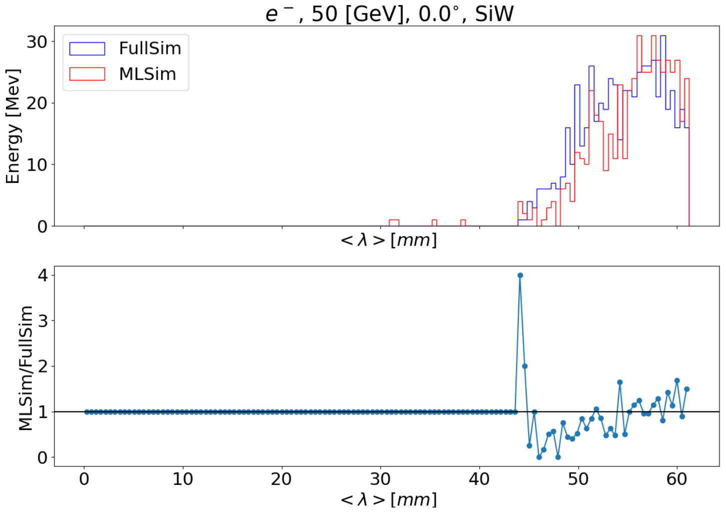


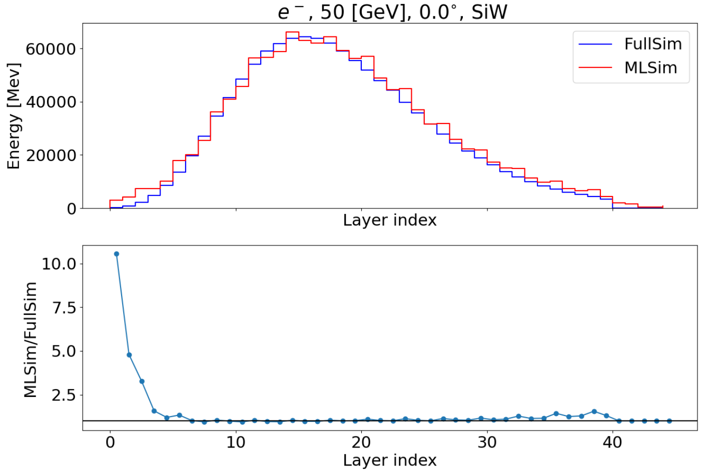


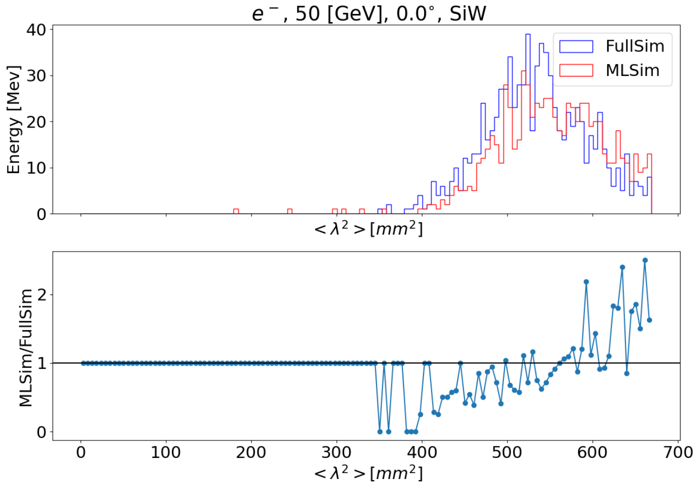
validation for the torch script model

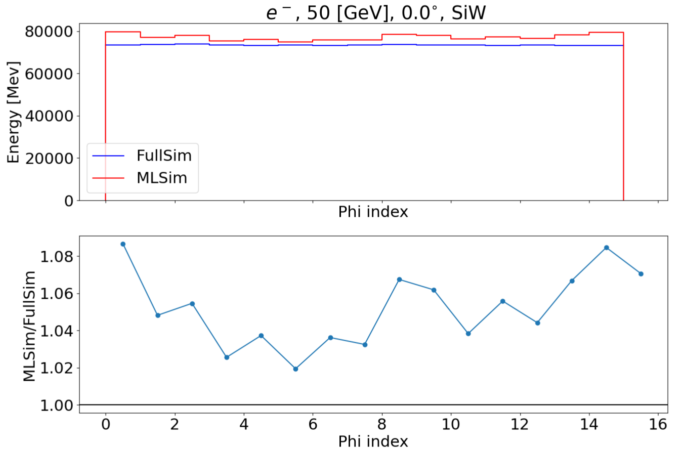
Full Sim vs. Torch script

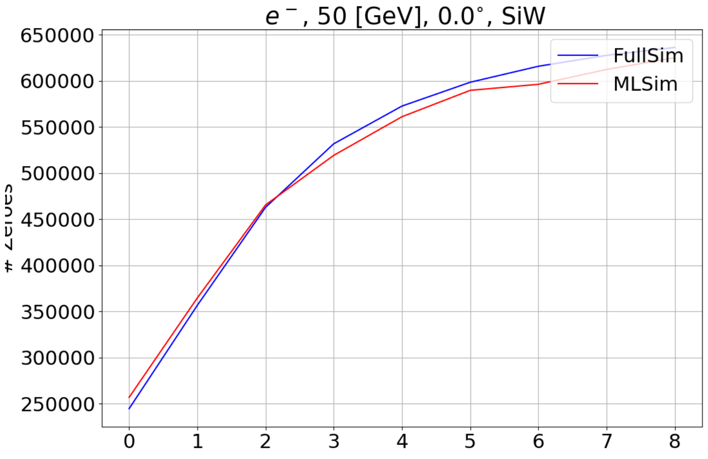


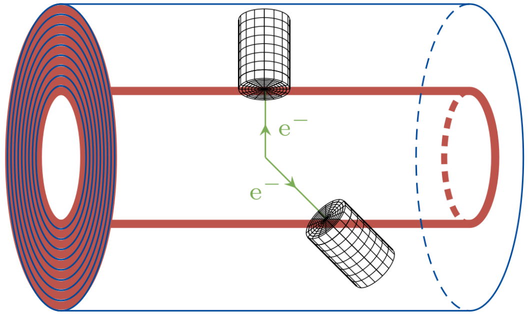












CaloDiT

improved training result

Current Stage

train PyTorch CaloDiT model with validated result ✅

wrap the preprocessing, 400 diffusion steps, postprocessing together ✅

and convert to TorchScript/ONNX ✅

- for TorchScript:

can do inference in Python environment, result validated, but take ~30G memory

in DDML (ubuntu OS), killed in the inference stage because out of memory

in DDML (almalinux OS), error before inference `runtime_error: Geant4Handle: Failed to create object of type Par04CylindrialScoringMeshVAEBarrelParallelONNXModel`

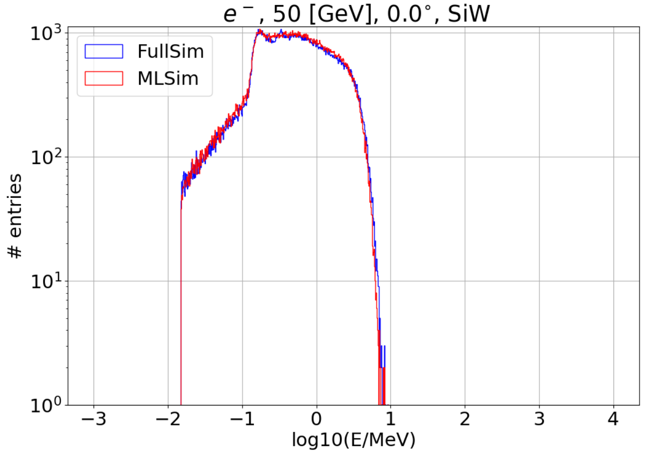
- for ONNX:

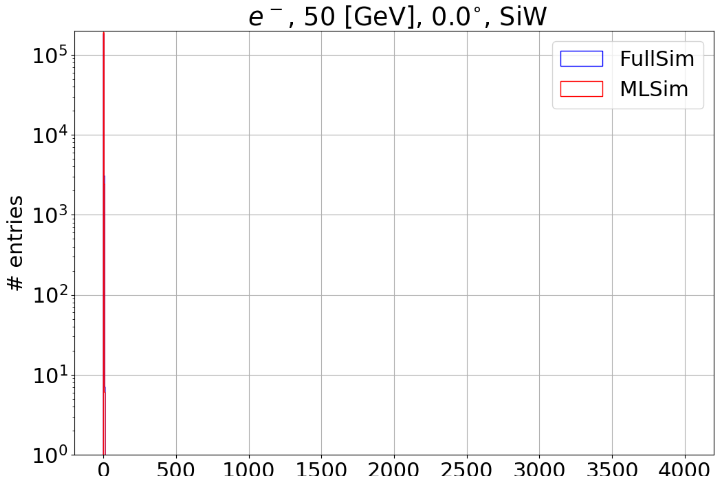
GPU inference gives a correct result

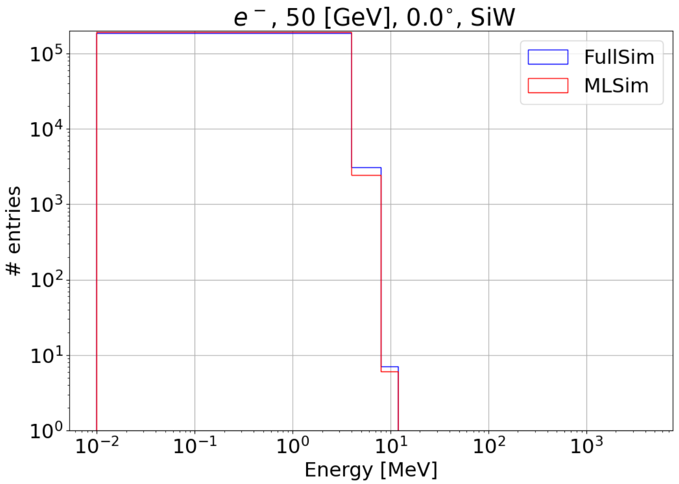
CPU inference gives a wrong result (but DDML can only run with CPU)

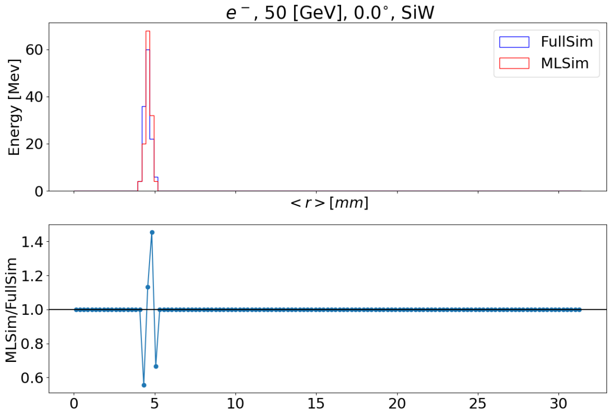
validation for the torch script model

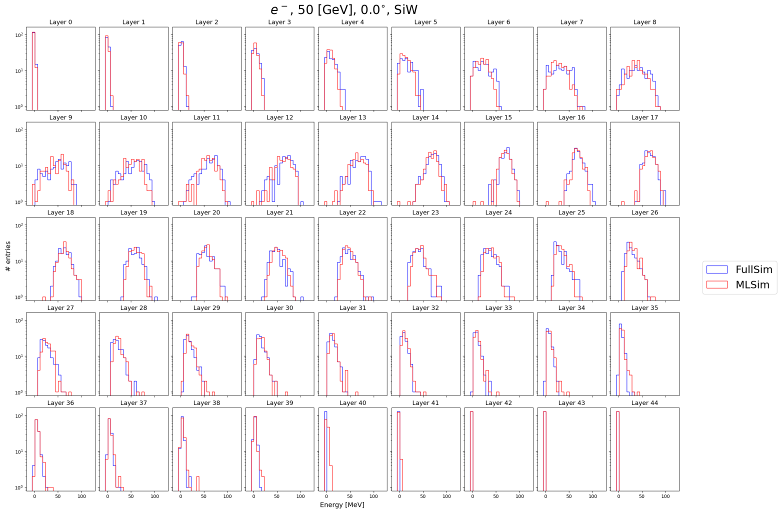
Full Sim vs. Torch script (same for ONNX in GPU)

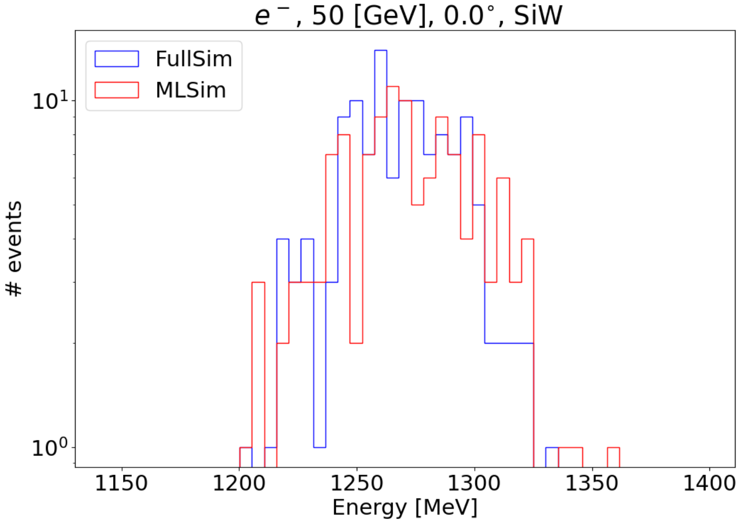


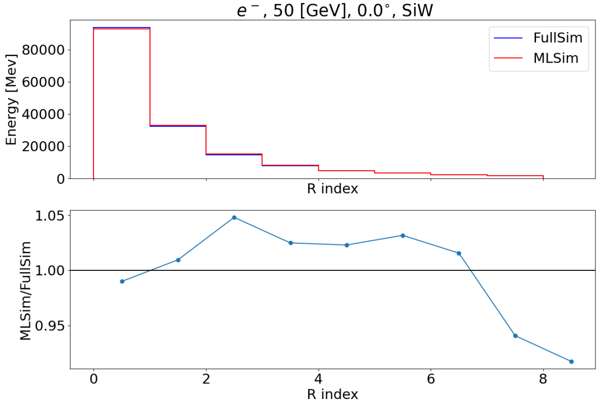






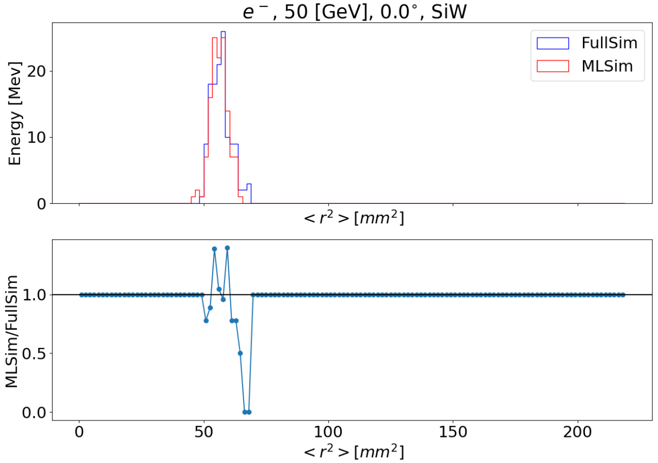


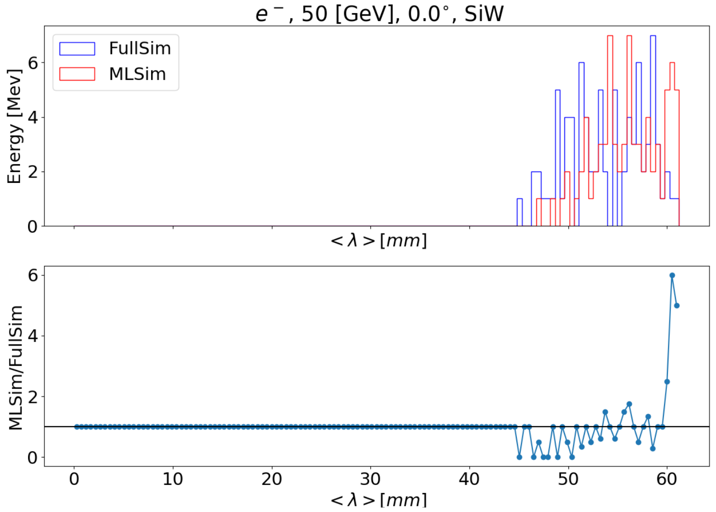


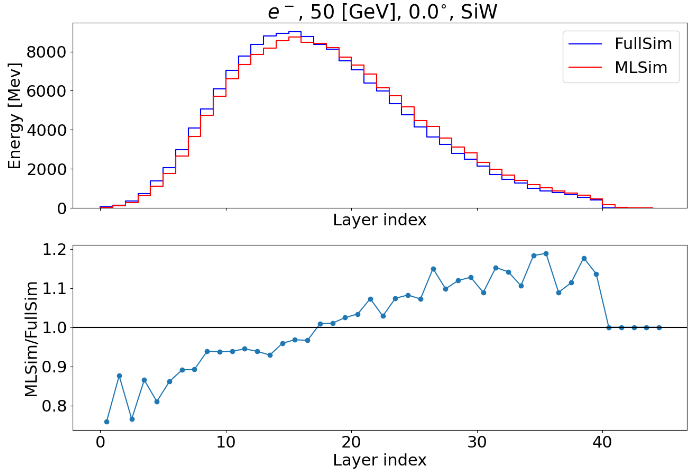


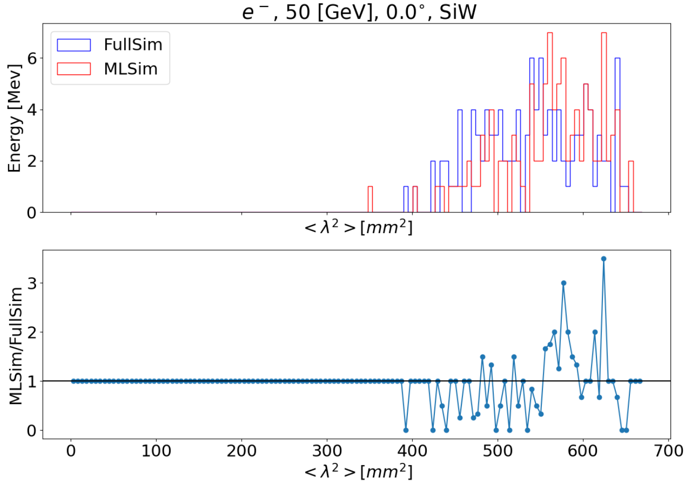
validation for the torch script model

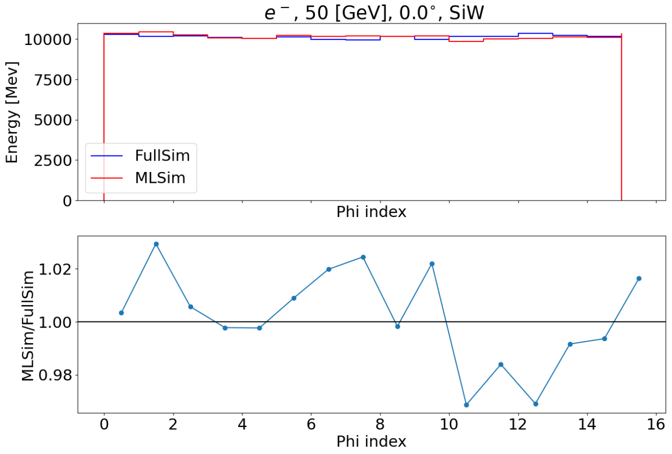
Full Sim vs. Torch script (same for ONNX in GPU)

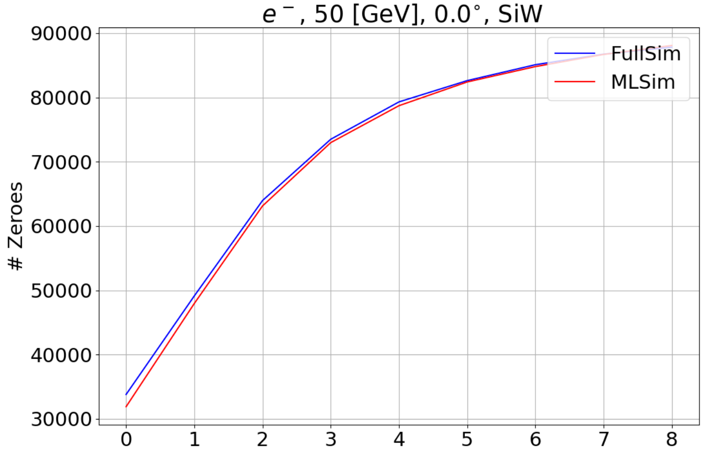






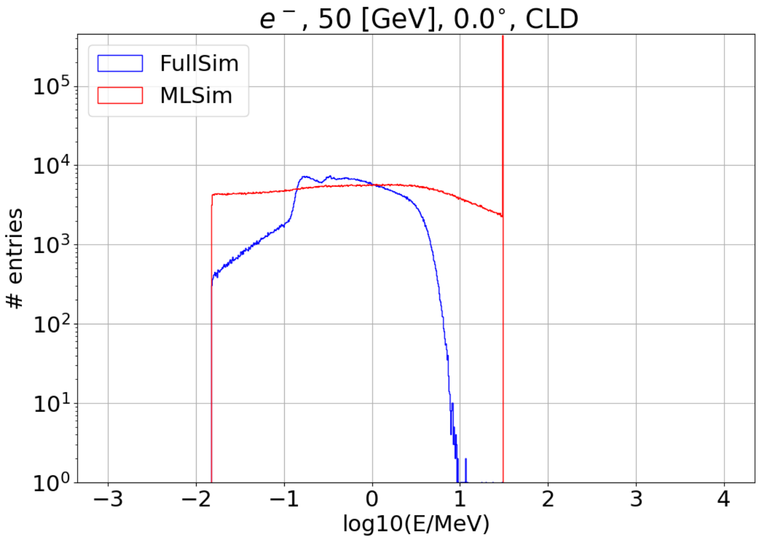


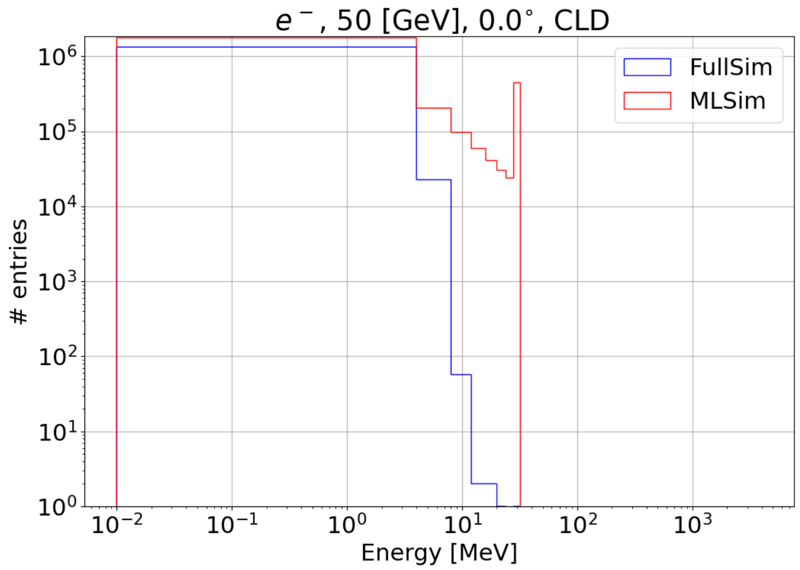


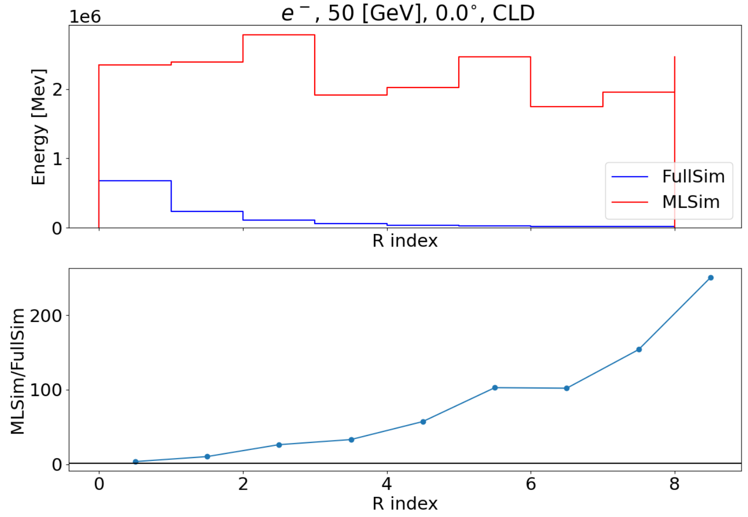


validation for the torch script model

Full Sim vs. ONNX in CPU (completely nonsense)







TODOs:

No available model for DDML for now

after we have a good enough model:

- inference in the DDML framework, put hits in CLD detector geometry ✅
- generate *.slcio file, check event display ✅
- generate *_edm4hep.root file for analysis ✅
- plot and check distributions in CLD geometry (in progress)
- put hits in CLD readout cells and run reconstruction? (if we can)