

Third MODE Workshop on Differentiable Programming for Experiment Design



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Energy Regression conditioned on Longitudinal Calorimeter Segmentation

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In this work, we use machine learning to optimize the design of a hadronic calorimeter to be used in the upcoming Electron Ion collider to be built in Long Island's Brookhaven National Laboratory over the next decade. We use a full GEANT4 simulation of the calorimeter to train surrogate models that are conditional on the set parameters. We use a deep neural network trained to predict the truth energy of incoming particles that is conditioned on longitudinal segmentation of the calorimeter. We can then do gradient optimization to find the optimal set of detector parameters. We show how we can optimize the detector parameters in terms of the predicted, or reconstructed, energy resolution, and compare the performance of our model to standard reconstruction techniques.

Primary author: TORALES ACOSTA, Fernando

Presenter: TORALES ACOSTA, Fernando

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