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Decoding Photons: Physics in the Latent Space of a BIB-AE Generative Network

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Given the increasing data collection capabilities and limited computing resources of future collider experiments, interest in using generative neural networks for the fast simulation of collider events is growing. In our previous study, the Bounded Information Bottleneck Autoencoder (BIB-AE) architecture for generating photon showers in a high-granularity calorimeter showed a high accuracy modeling of various global differential shower distributions. In this work, we investigate how the BIB-AE encodes this physics information in its latent space. Our understanding of this encoding allows us to propose methods to optimize the generation performance further, for example, by altering latent space sampling or by suggesting specific changes to hyperparameters. In particular, we improve the modeling of the shower shape along the particle incident axis.

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