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End-to-End Object Reconstruction in a Sampling-Calorimeter using YOLO

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The upcoming silicon-based sampling calorimeters, such as the high-granularity calorimeter of the CMS experiment, will have unprecedented granularity in both the lateral and longitudinal dimensions. We expect these calorimeters to greatly benefit from machine learning-based reconstruction techniques. With the novel idea of interpreting the multiple sampling layers of calorimeters in the $\eta - \phi$ plane as colors in an RGB image. A convolutional neural network-based object detection framework, You Only Look Once, in short YOLO, was used for particle reconstruction in a fast (~ 1 ms on NVIDIA RTX 4090) and efficient manner. This study goes over the excellent performance of the model in reconstructing particles, e.g., muons, electrons/photons, and their direction in the $\eta - \phi$ plane, with excellent pileup rejection at 200 pileup interactions. The presentation also goes over the future perspectives of energy reconstruction with minimal modifications.

Primary authors: Prof. MOHANTY, Gagan (Tata Institute of Fundamental Research); Dr DAS, Indraneel (Imperial College London); SURYADEVARA, Pruthvi (Tata Institute of Fundamental Research); Prof. DUGAD, Shashi (Tata Institute of Fundamental Research)

Presenter: SURYADEVARA, Pruthvi (Tata Institute of Fundamental Research)

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