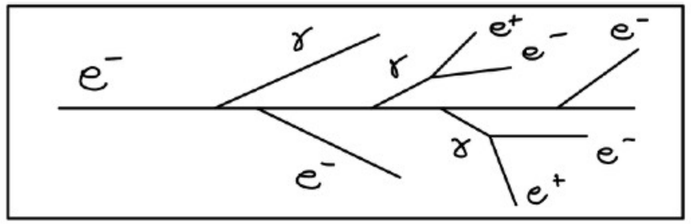
Pre Training

Maschine Learning Input

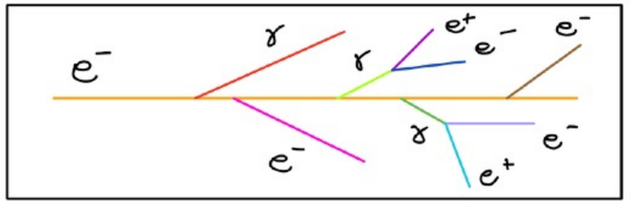
Goal: Learning the Fundamental Structure of Particle Interactions Input of the model:

- **Voxel Energy, Voxel ID Labels, Global Event Features**

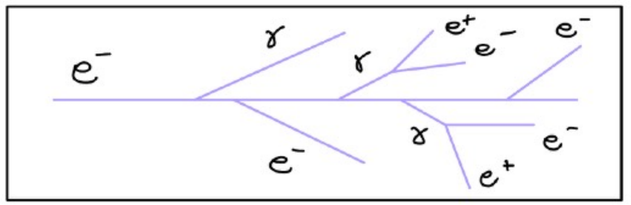
Toy Representation EM Shower



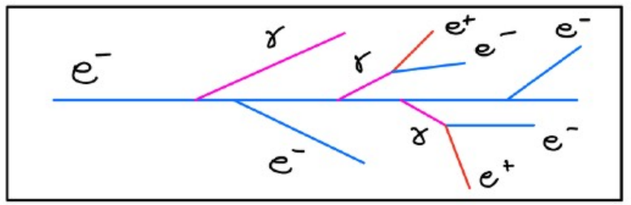
- ***hit_track_id***: Groups hits from the *same particle* as it propagates



- ***hit_primary_id***: Groups *all hits* that descend from the *same primary particle*

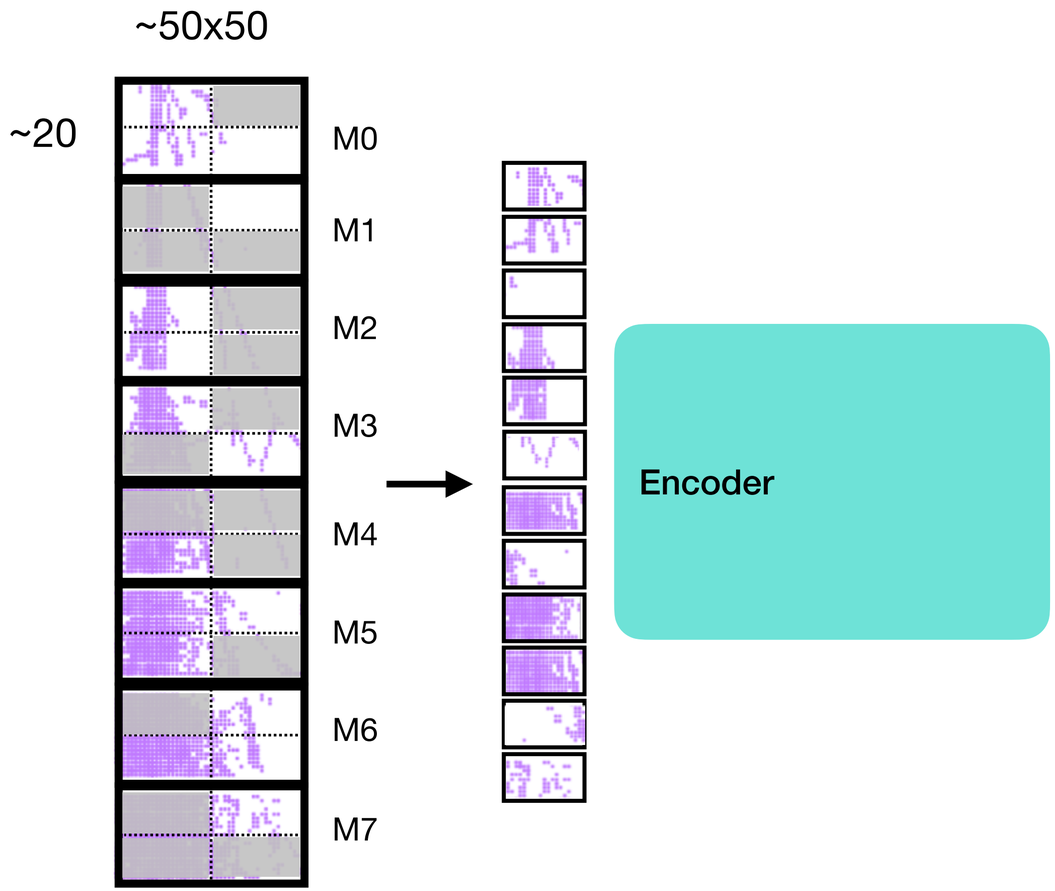


- ***hit_pdg***: physics-based grouping, groups hits by PDG code

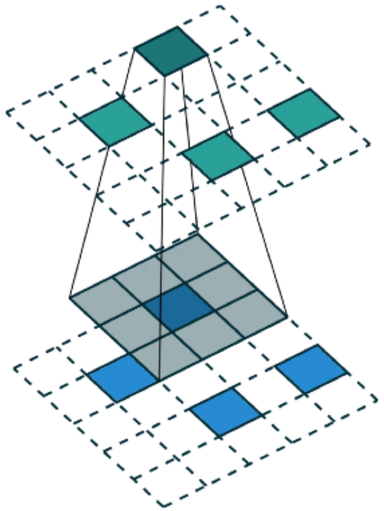


Pre-Training

Sparse Submanifold Neural Network



- **SCNN**: Creates a vector embedding for every patch in the input



SCNN reduces the spatial coordinates while increasing the feature dimensions.

It performs convolution only on active voxels, effectively ignoring the vast empty regions typical in detector data.