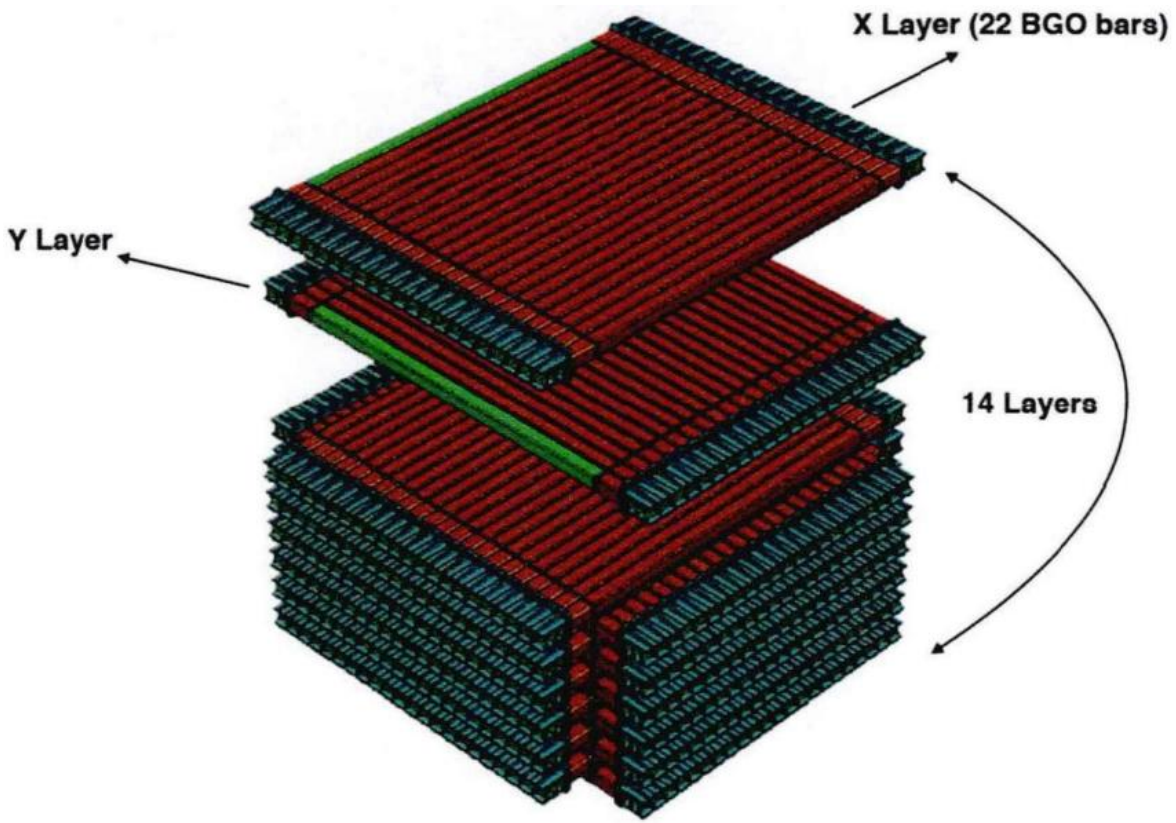
CNN-^{56}Fe能量重建分析

Lin Zhou

DAMPE&CNN



- 共14层BGO晶体，将奇数层与偶数层晶体分成两部分
- X direction：22*7 矩阵
- Y direction：22*7 矩阵
- 对这两部分先分开进行卷积池化，最后再打平排列起来，输入神经网络training

DAMPE&CNN

每个事件有两张矩阵：

- BGO_even：形状 (22, 7)，偶数层
- BGO_odd：形状 (22, 7)，奇数层

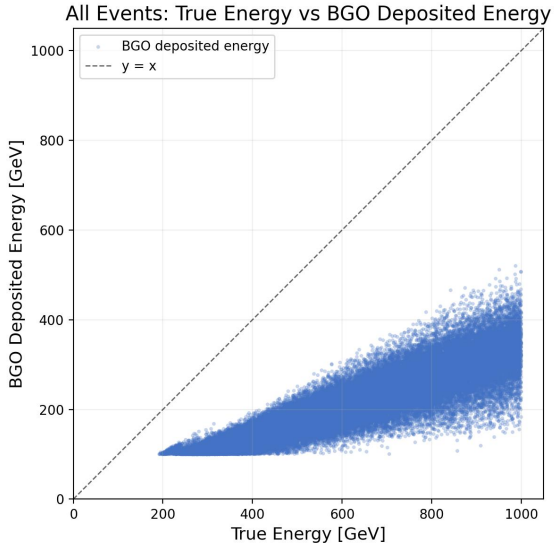
偶数层和奇数层各有一套独立参数的 CNN，结构相同，但卷积权重不共享。两个分支各输出 3072 个特征，拼接后为 6144 个特征，考虑BGO Total energy，全连接层输入维度为 6145

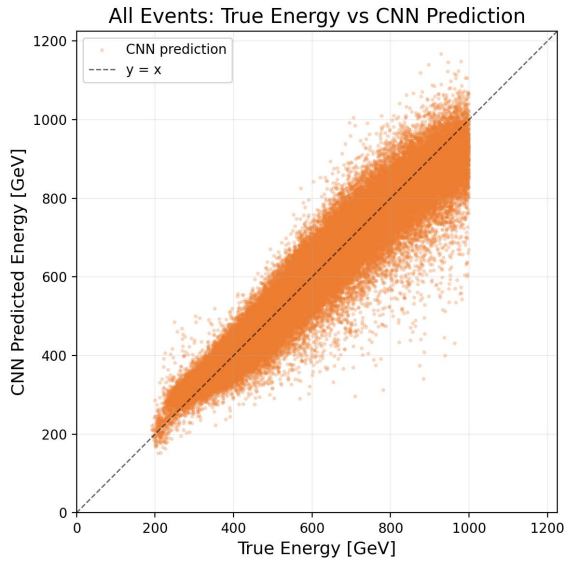
- 先后经过三次卷积。第一层提取局部能量模式，后两层逐步组合这些模式，形成更复杂的特征。卷积核都是 3×3，默认步长为 1

- 全连接部分有 2 个隐藏层，分别是：
  - 第 1 个隐藏层：512 个神经元
  - 第 2 个隐藏层：128 个神经元
  - GELU作为激活函数，之后是 1 个输出层，用来输出能量预测值

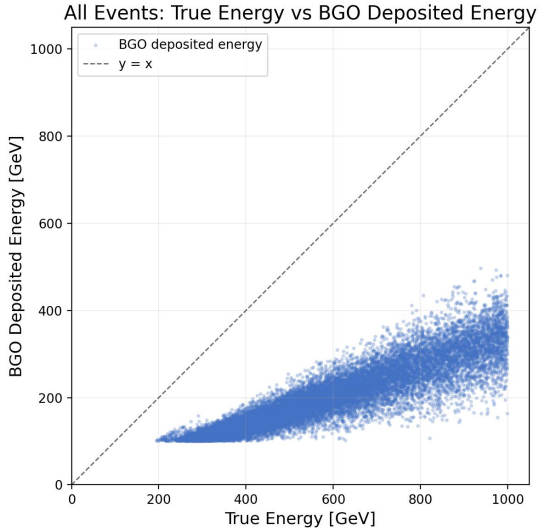
100GeV-1TeV

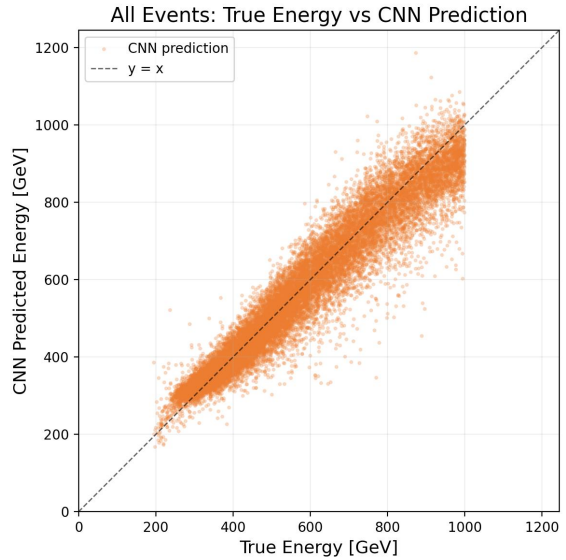
Training data



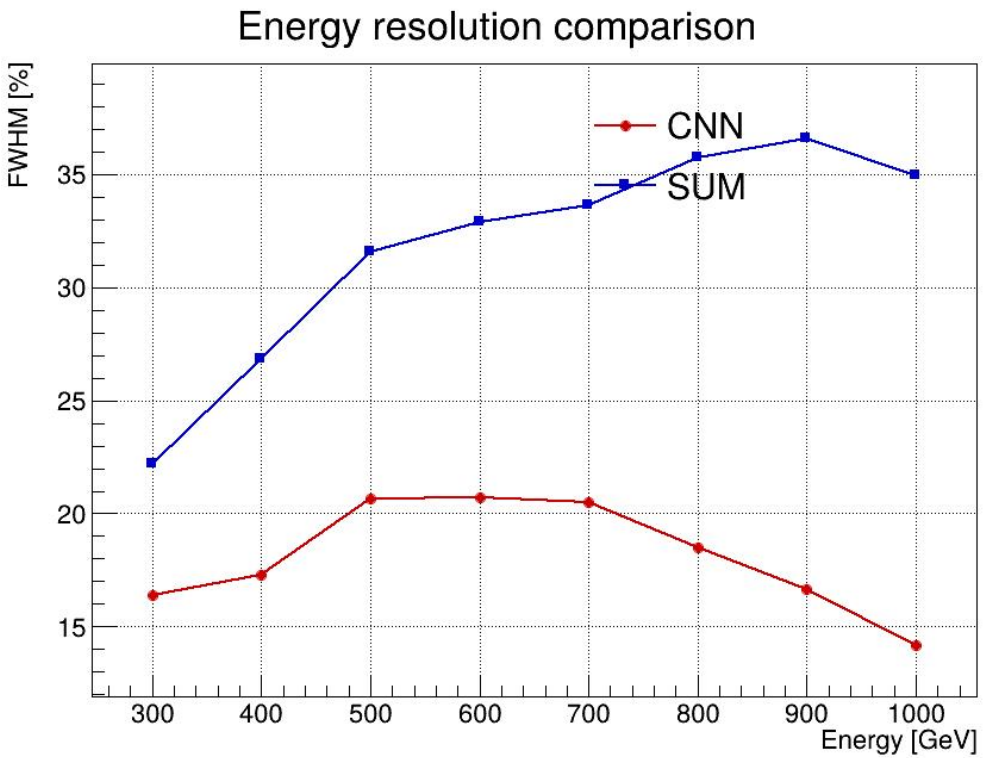


Testing data

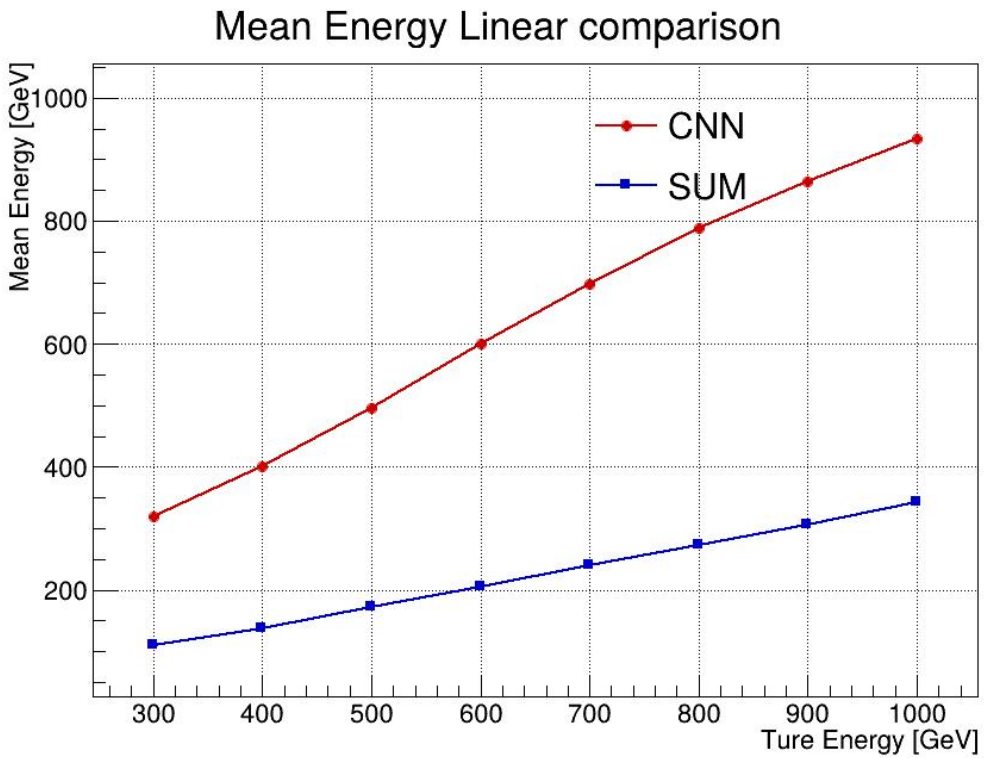




100GeV-1TeV



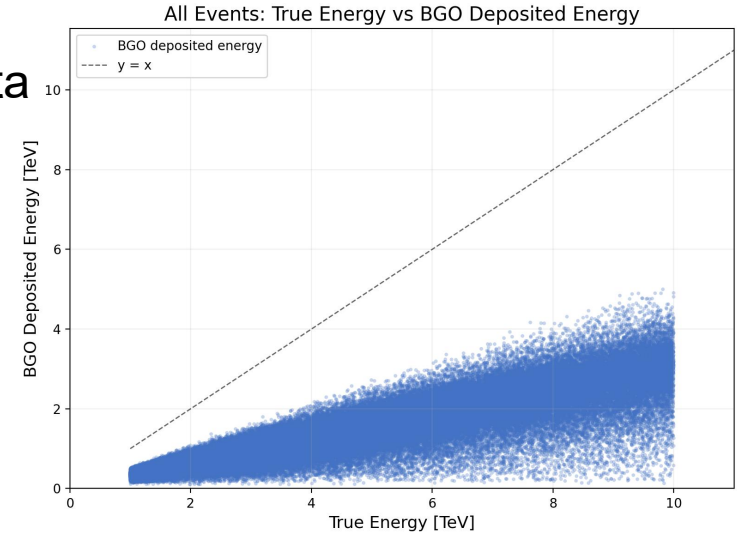
能量分辨率

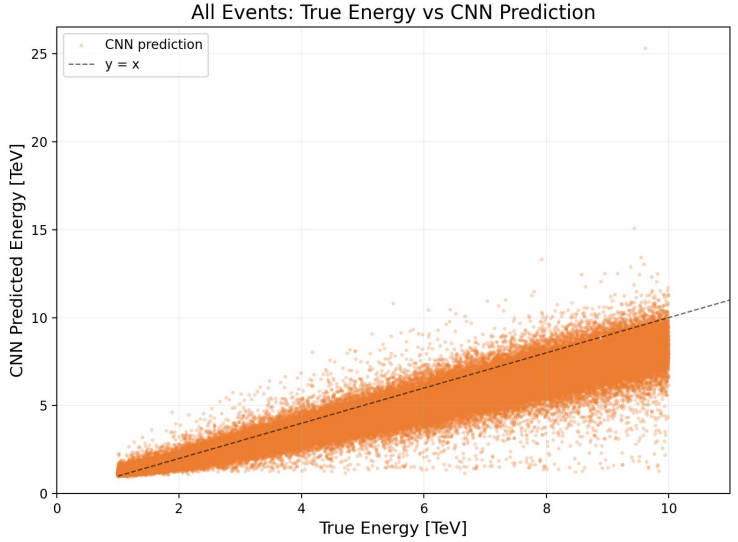


能量线性响应

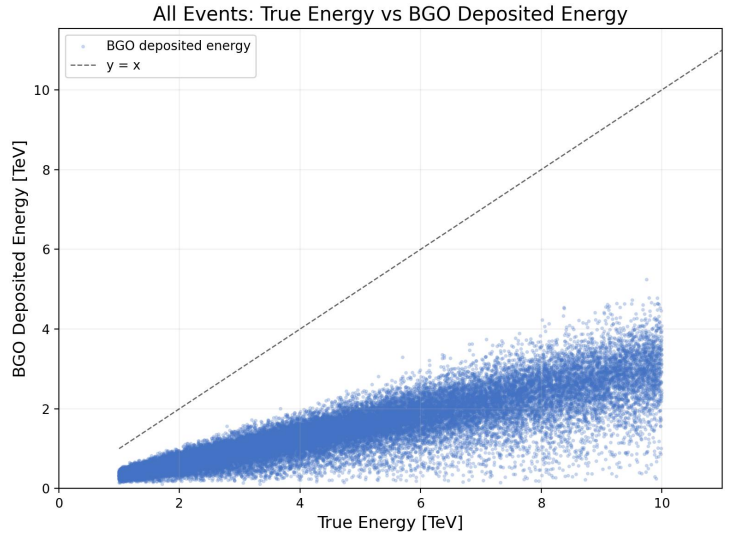
1TeV-10TeV

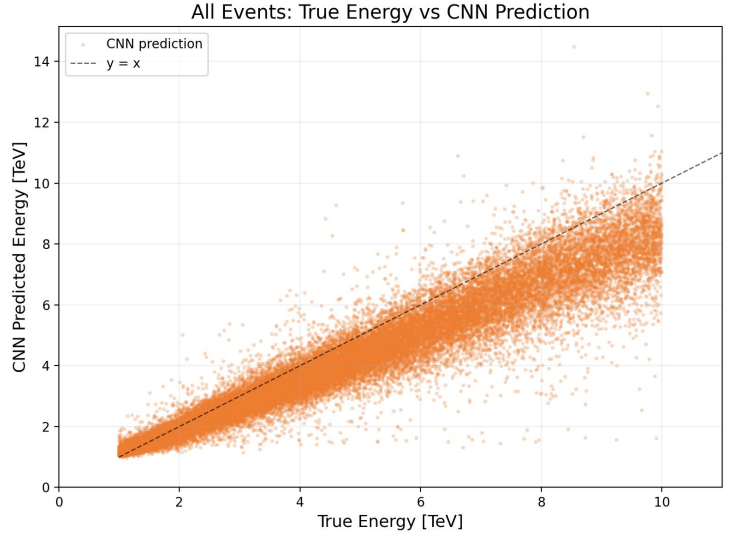
Training data



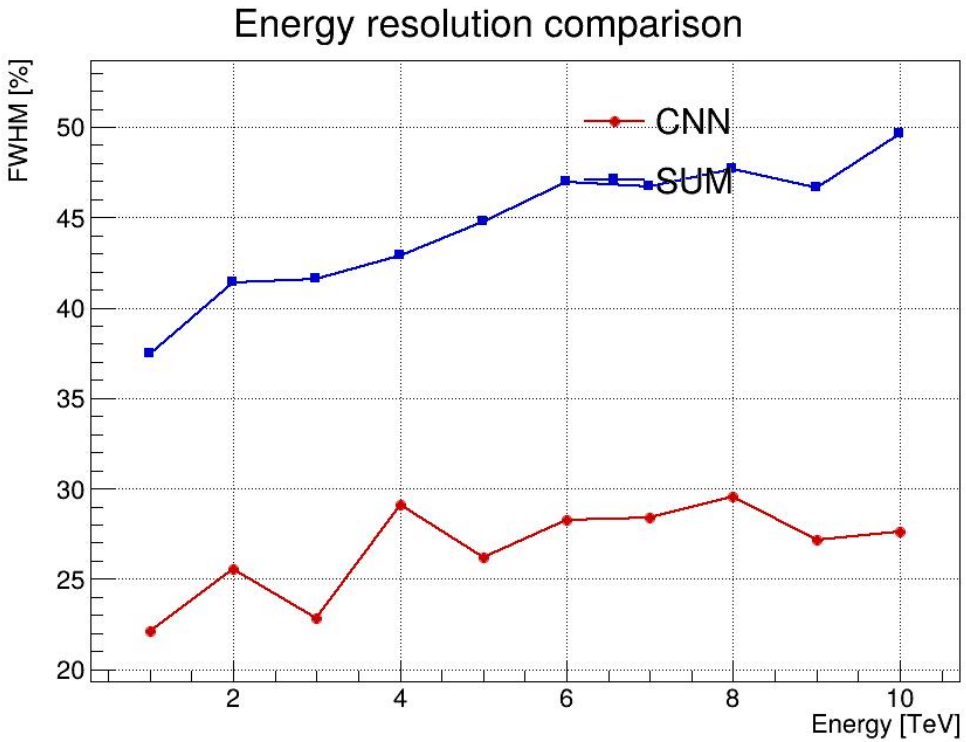


Testing data

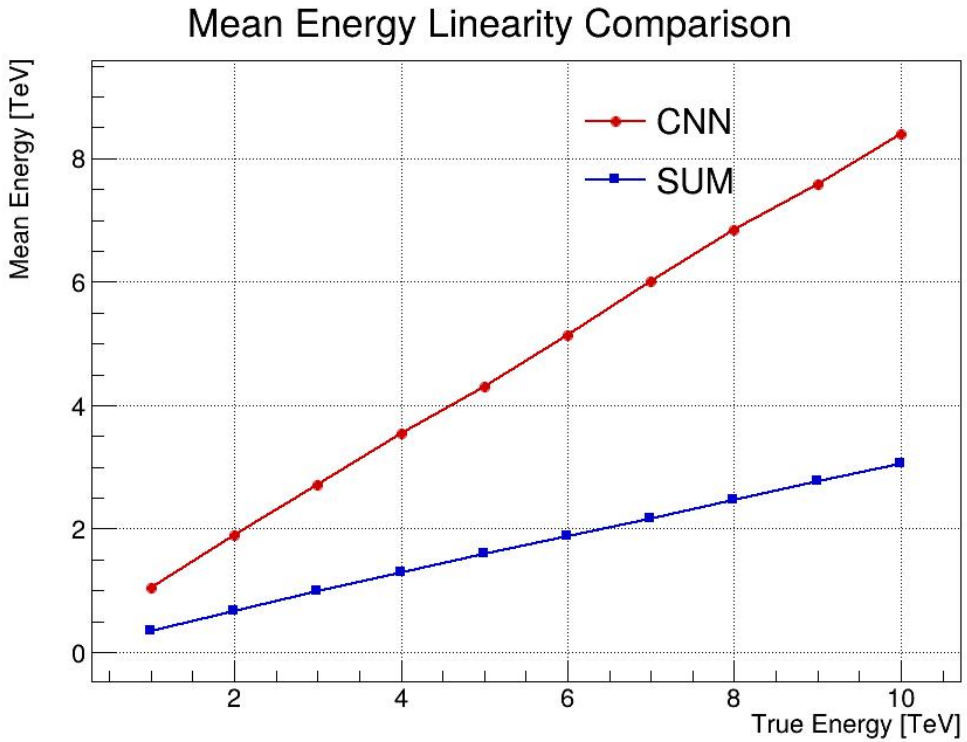




1TeV-10TeV



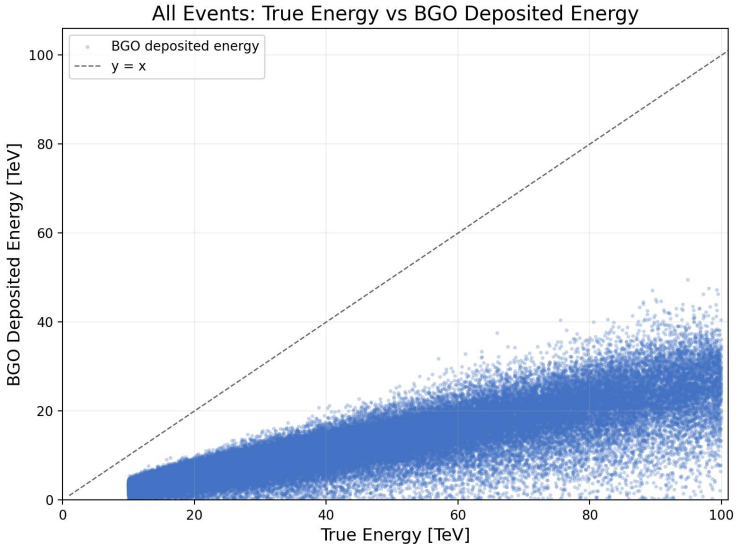
能量分辨率

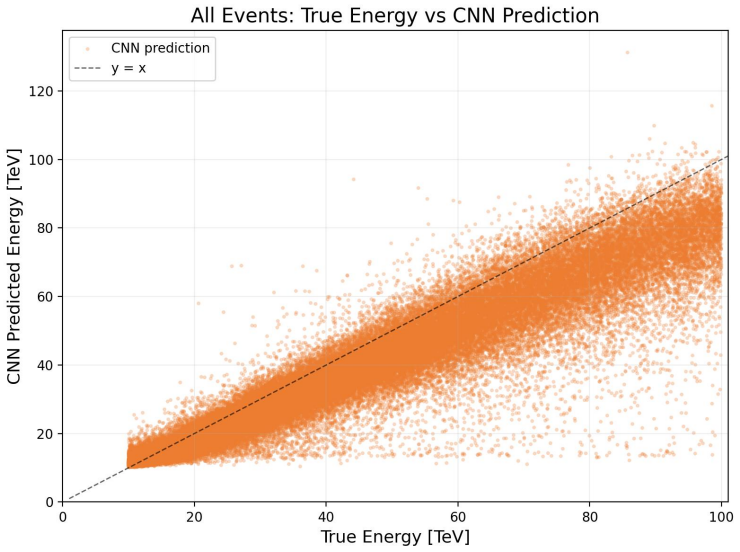


能量线性响应

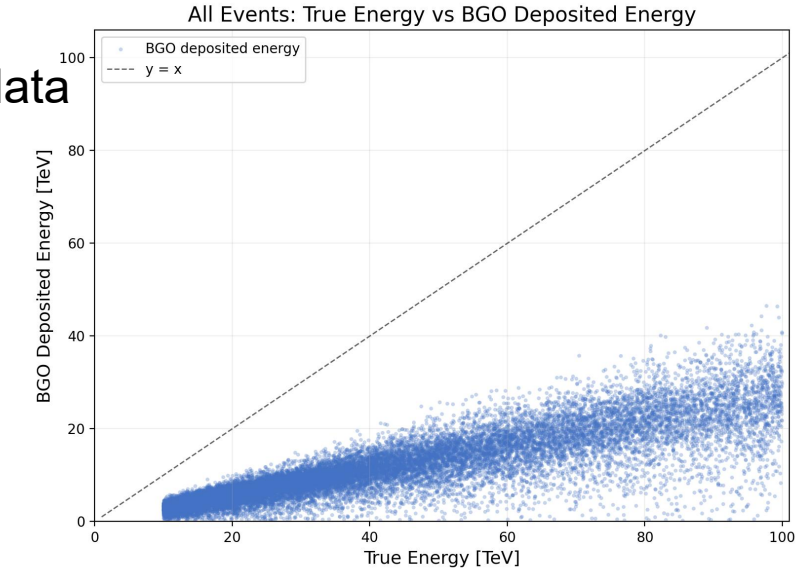
10TeV-100TeV

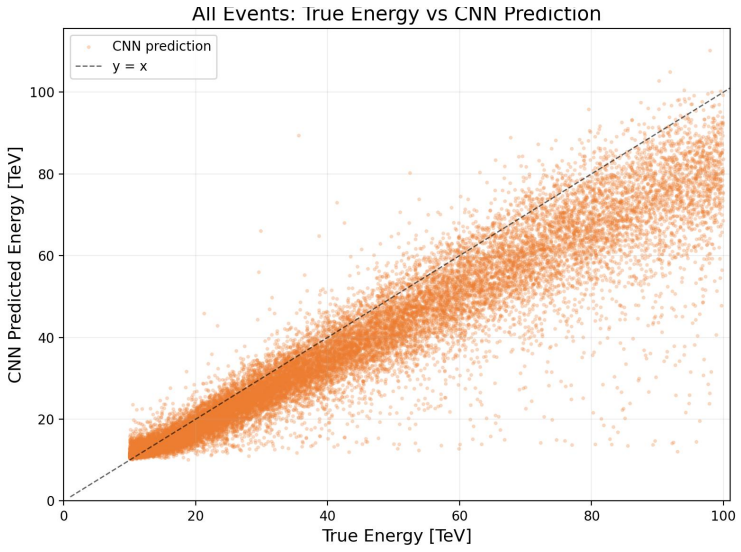
Training data



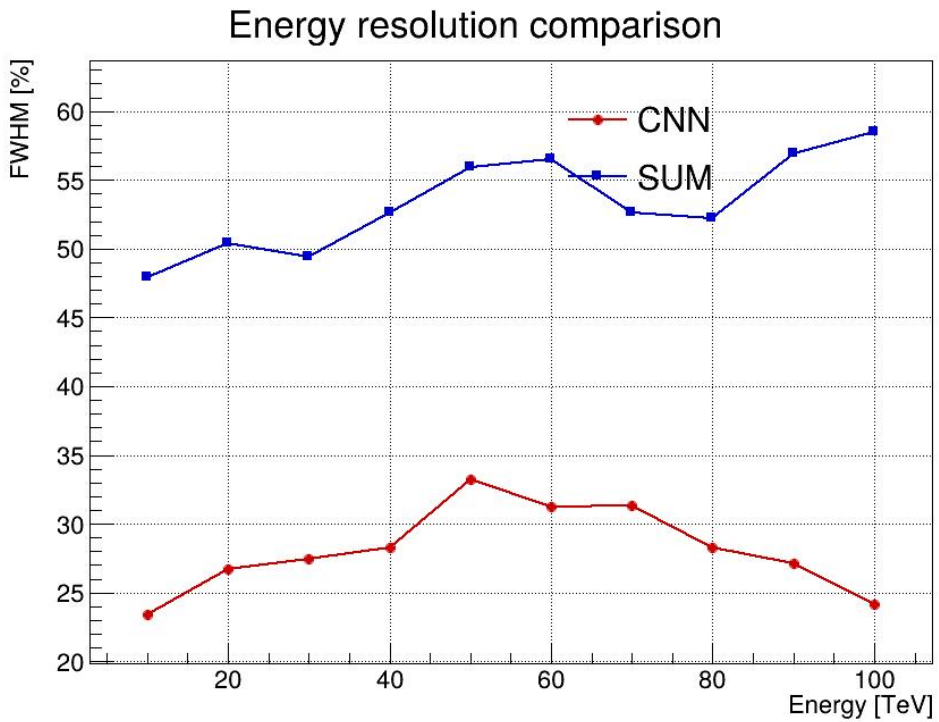


Testing data

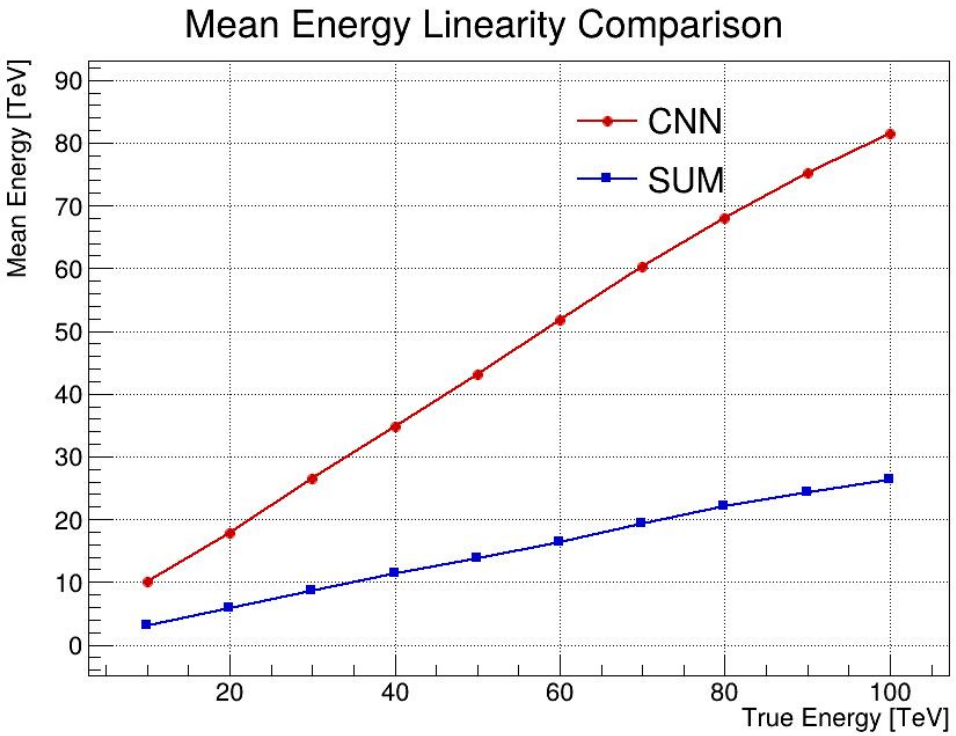




10TeV-100TeV



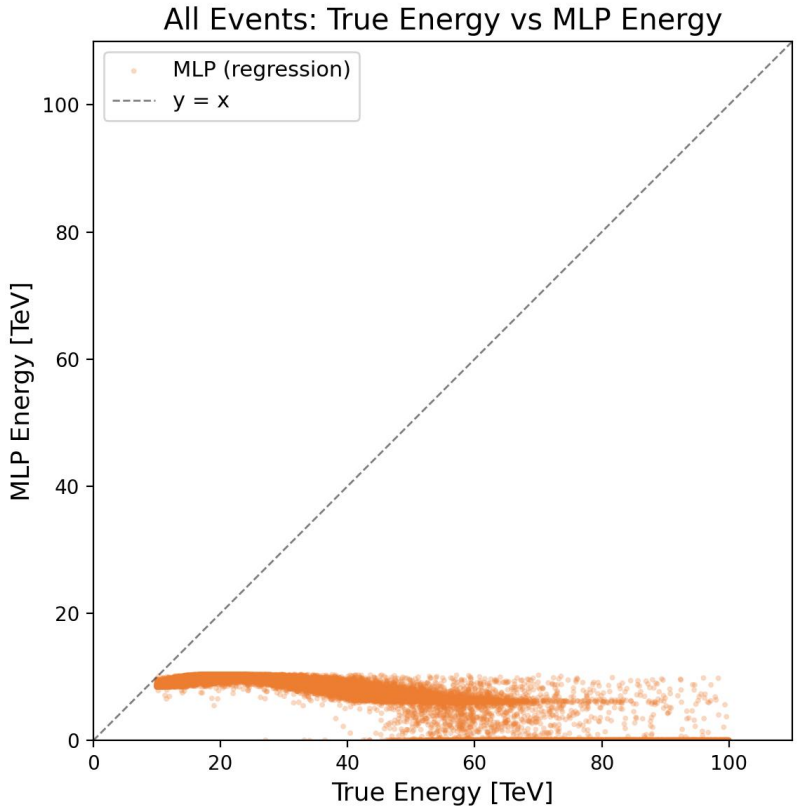
能量分辨率



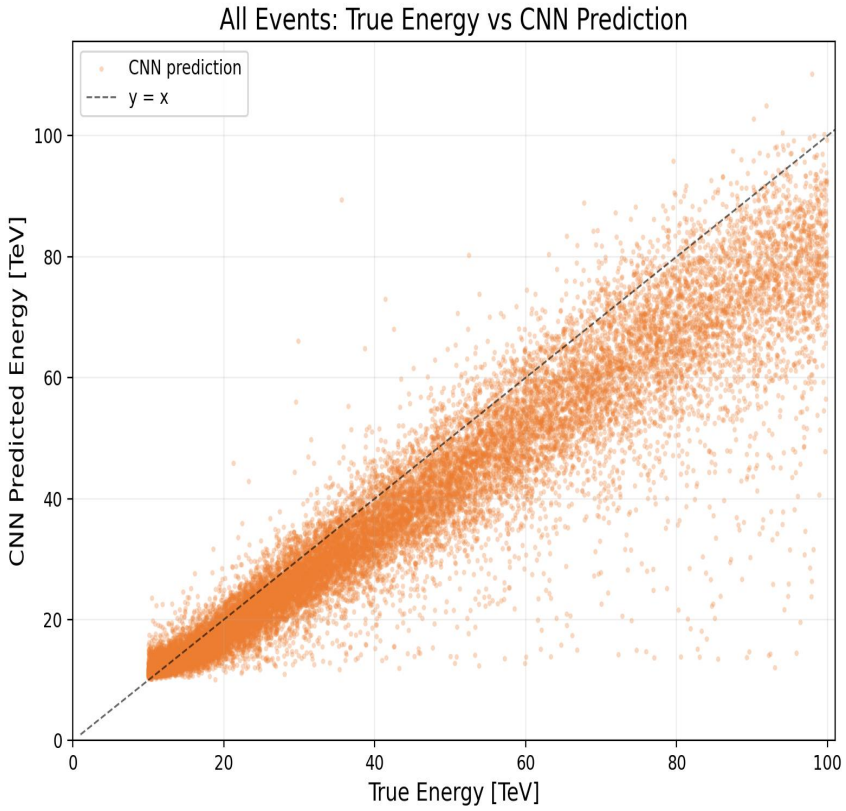
能量线性响应

CNN vs MLP

- 10T-100T CNN training 效果更好



MLP



CNN

Future plan

- 尝试GNN
- ……

