# Pion rejection in EEEMCal: an initial look

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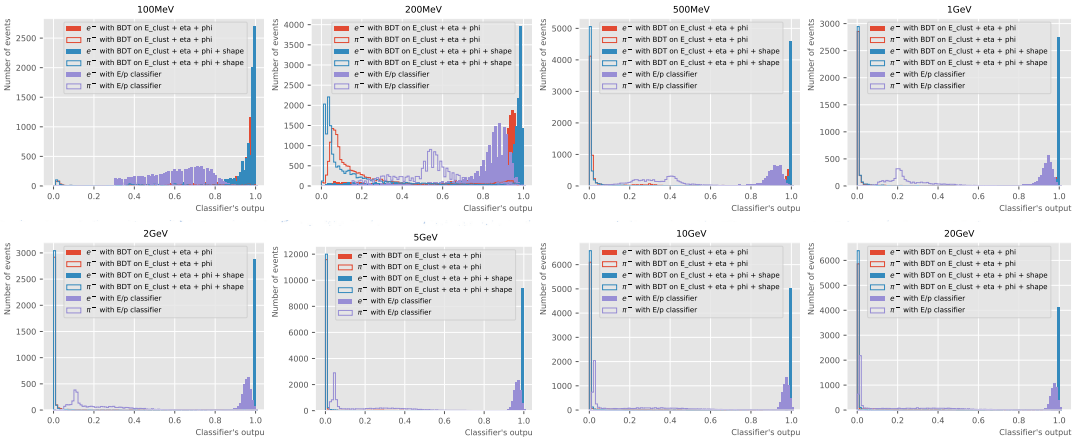
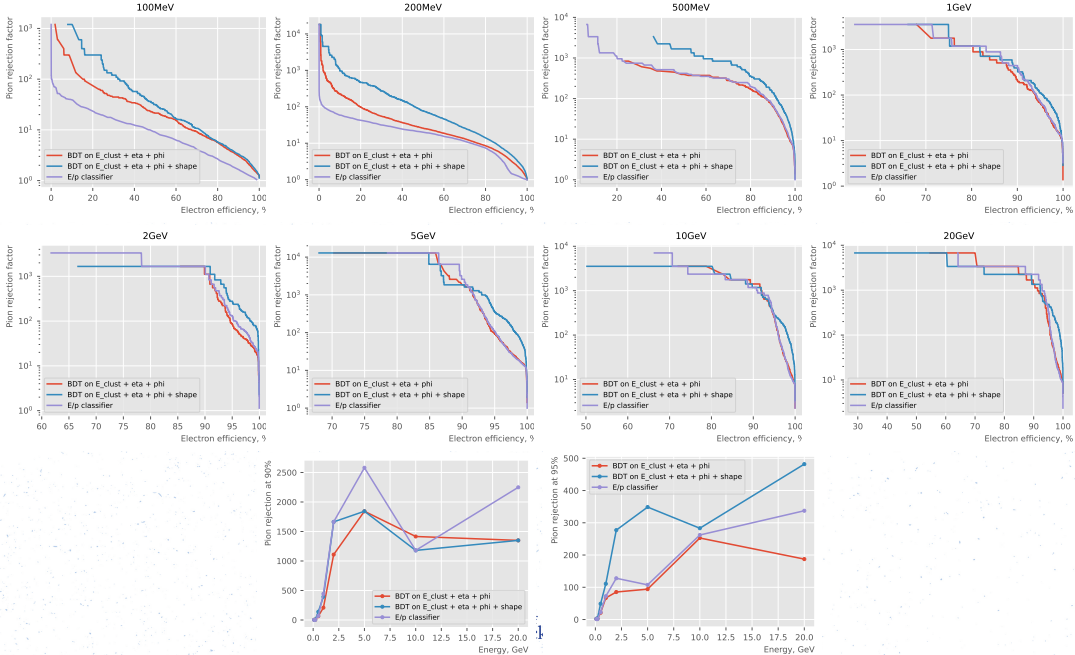
Changes since last time

1. Implemented $E/p$ classifier (here, $E$ is a leading cluster's $E_{\text{dep.}}$)
2. Enabled early stopping in BDT training
3. Changed $\eta_{\text{thrown}}$ selection cut interval from $[-3.5, -2.0]$ to $[-3.2, -2.2]$

This still uses 24.04.0 campaign, samples are pre-selected to satisfy the $\eta_{\text{thrown}}$ cut and have at least 1 cluster


100MeV
200MeV
500MeV
1GeV
2GeV
5GeV
10GeV
20GeV
Number of events
Classifier's output
e⁻ with BDT on E_clust + eta + phi
π⁻ with BDT on E_clust + eta + phi
e⁻ with BDT on E_clust + eta + phi + shape
π⁻ with BDT on E_clust + eta + phi + shape
e⁻ with E/p classifier
π⁻ with E/p classifier


100MeV
200MeV
500MeV
1GeV
2GeV
5GeV
10GeV
20GeV
Pion rejection factor
Electron efficiency, %
Pion rejection at 90%
Pion rejection at 95%
Energy, GeV
BDT on E_clust + eta + phi
BDT on E_clust + eta + phi + shape
E/p classifier

# Conclusion

1. Poor statistics 1k - 10k particles samples give large statistical uncertainty for rejections at 1k
2. Like we saw in the SciGlass studes, ML outperforms $E/p$ only when requesting high electron efficiency