

Lepton ID Update

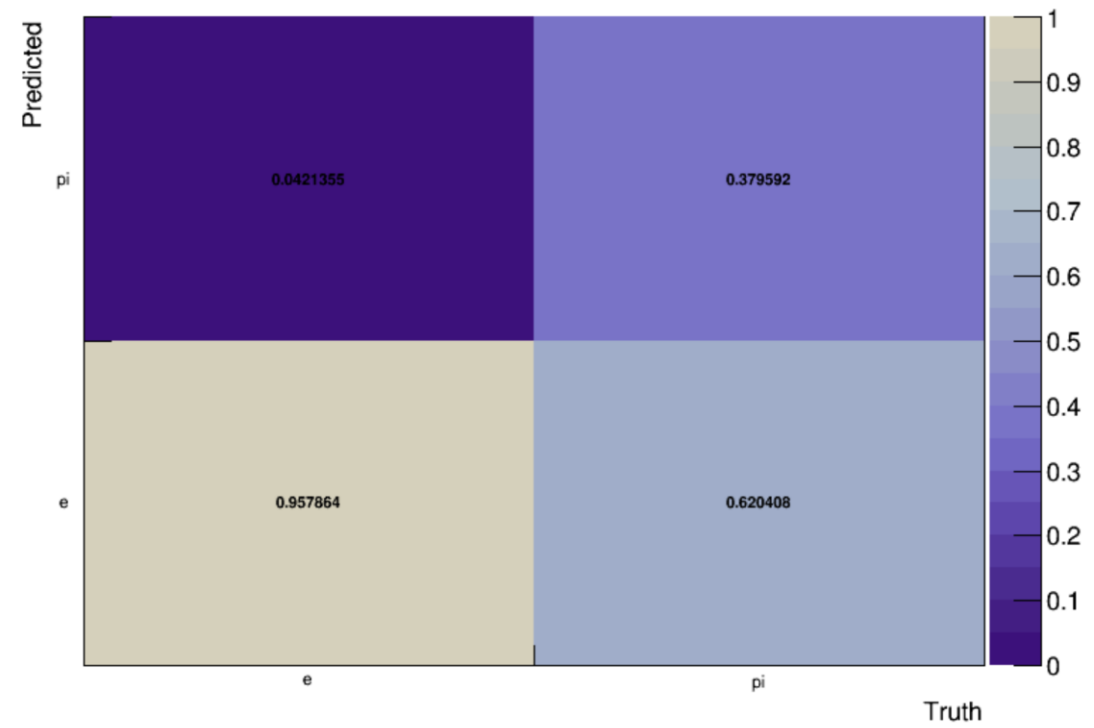
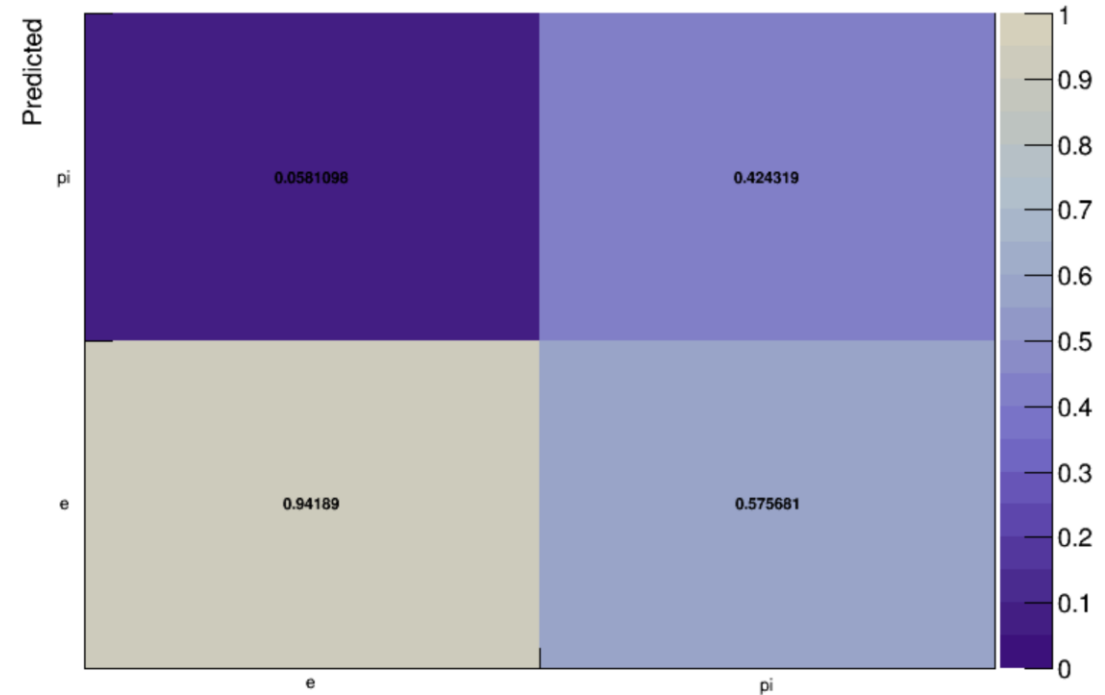
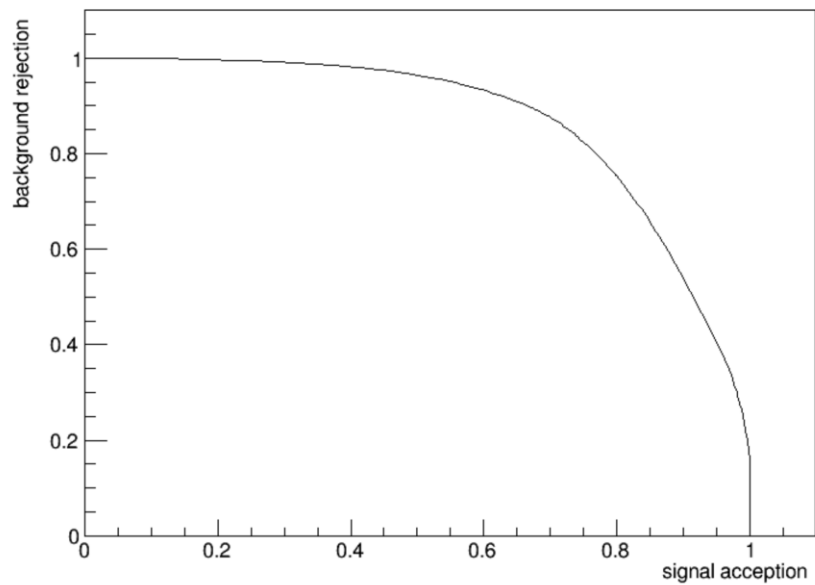
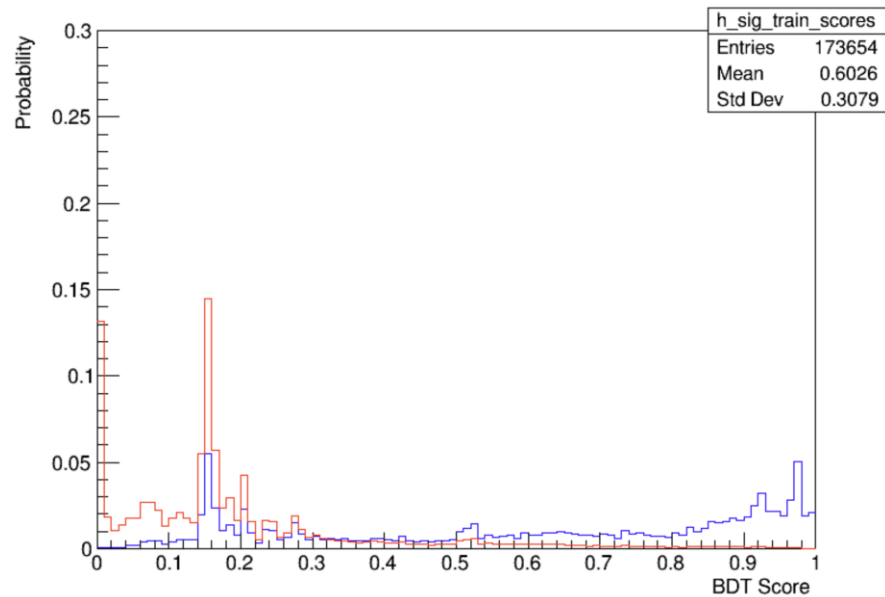
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Nanjing University

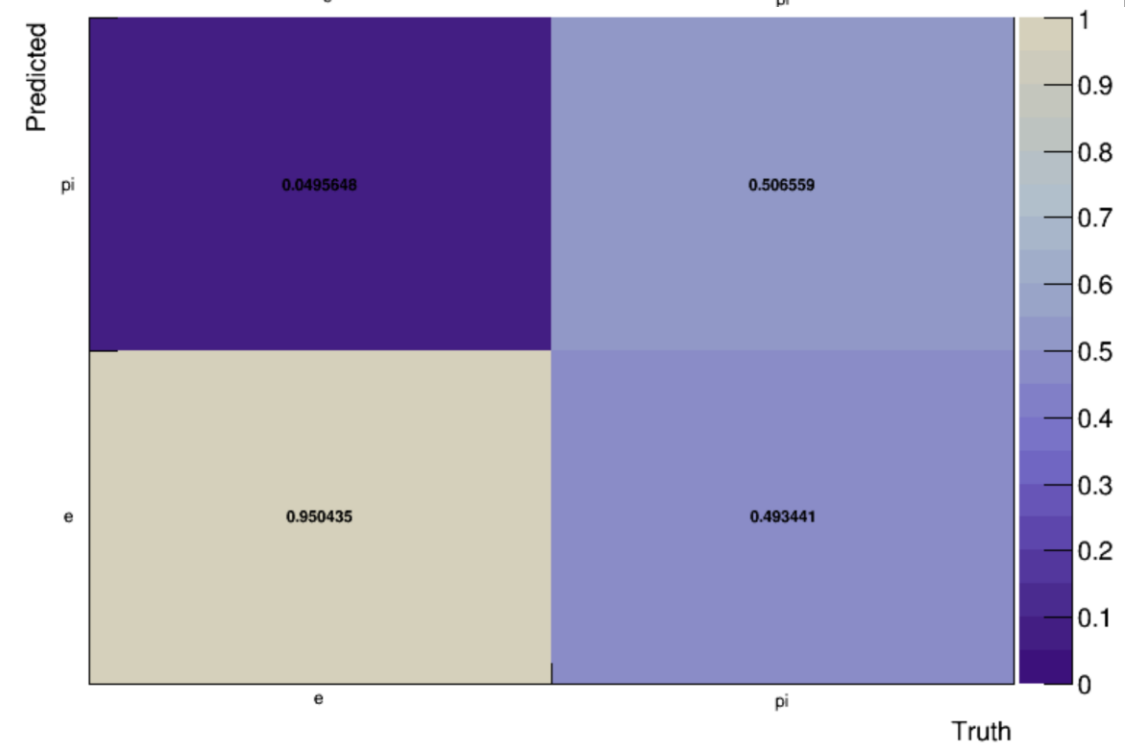
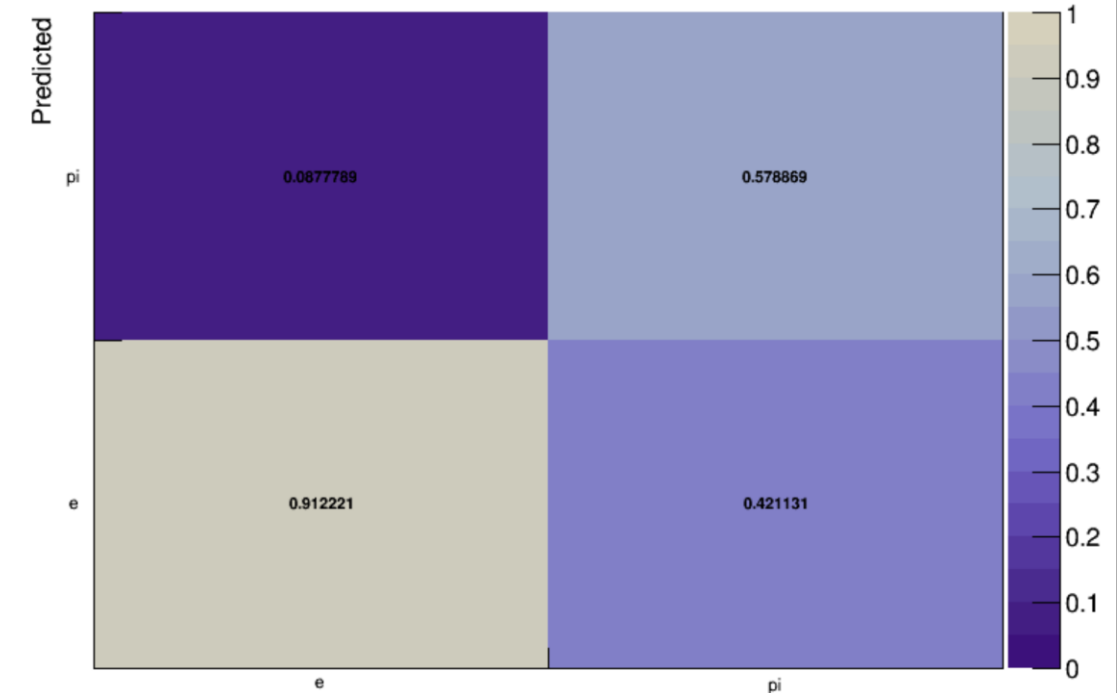
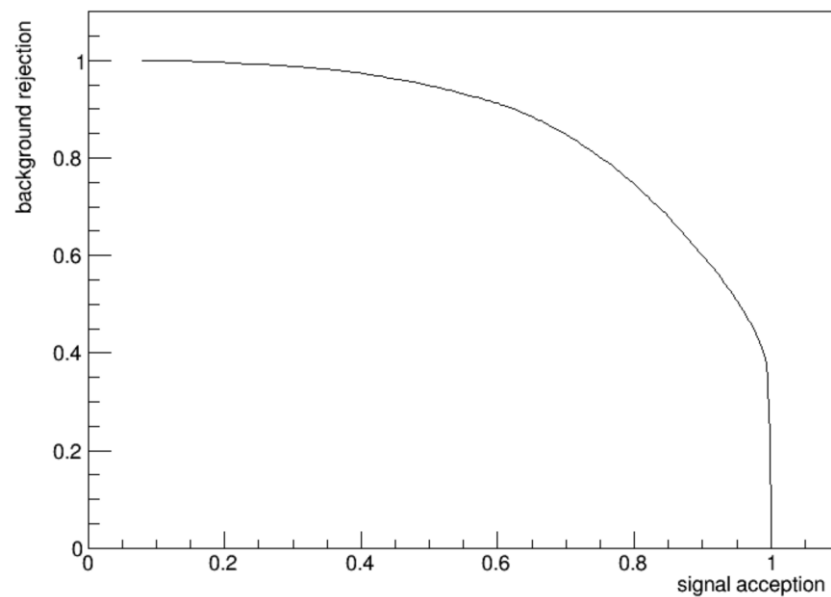
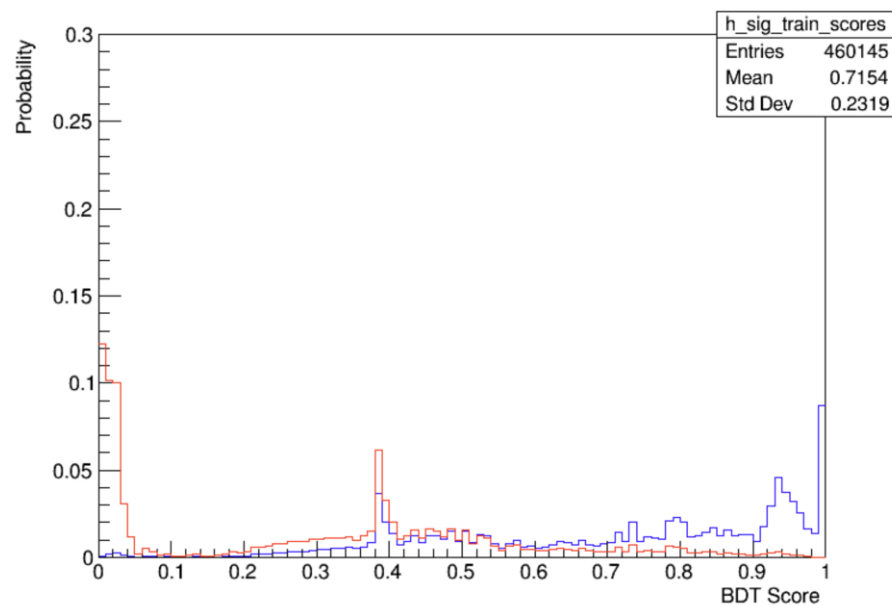
Updates

- 1. Use ee->HX samples provided by Geliang
- 2. Try to use XGBoost to do leptonID
 - Use binary classification to distinguish electron and pion ($<1\text{GeV}$)
 - Remove information from muon detector
 - Check ID performance at 5~6GeV and 10~11GeV

$0 \sim 1 \text{ GeV}, \text{abs}(\cos \theta) > 0.85$

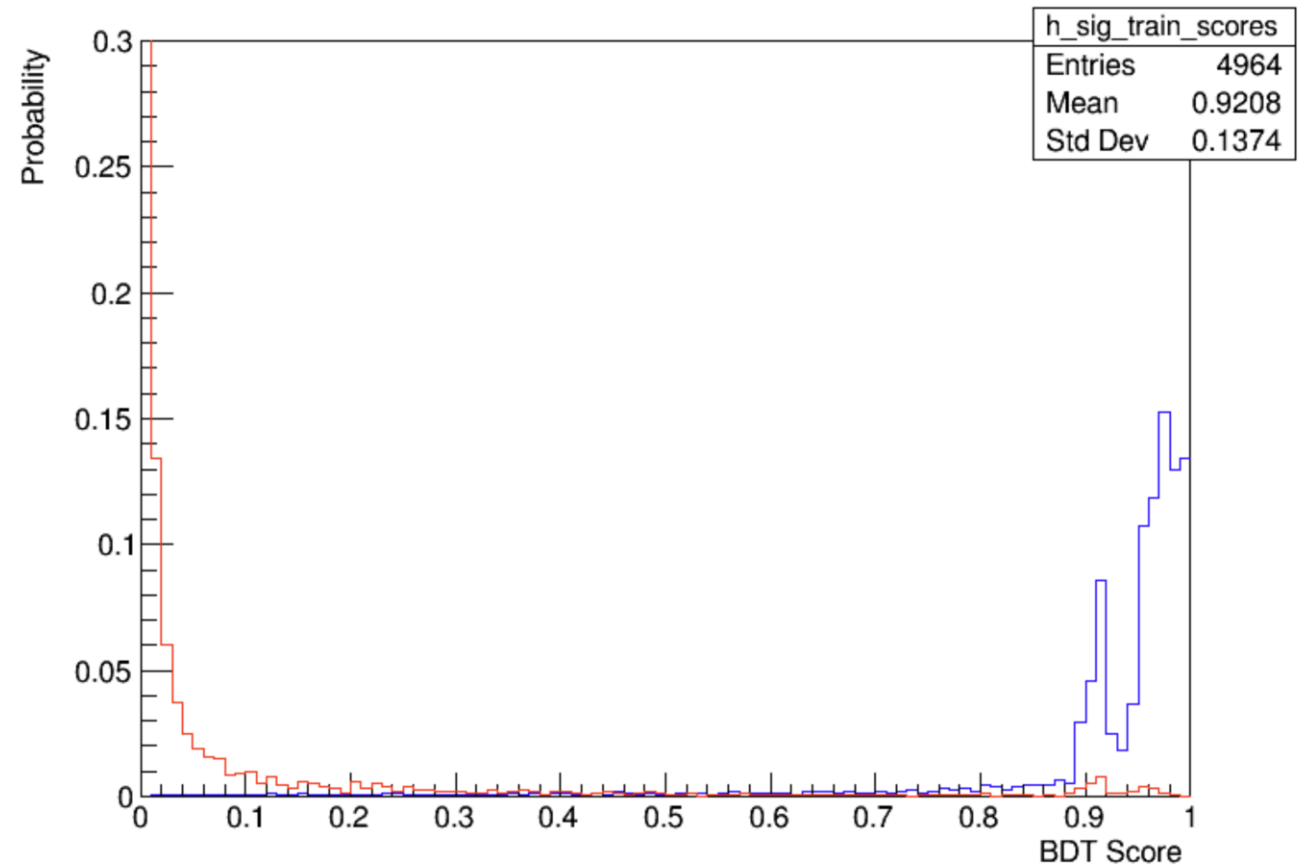


0~1Gev, $\text{abs}(\cos \theta) < 0.85$

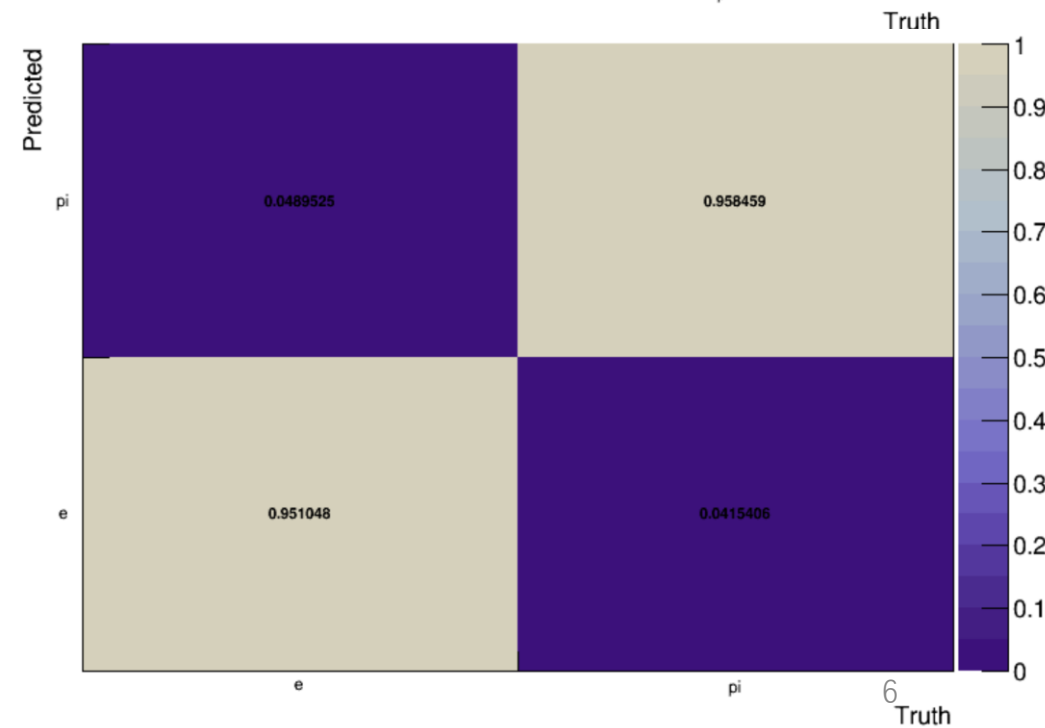
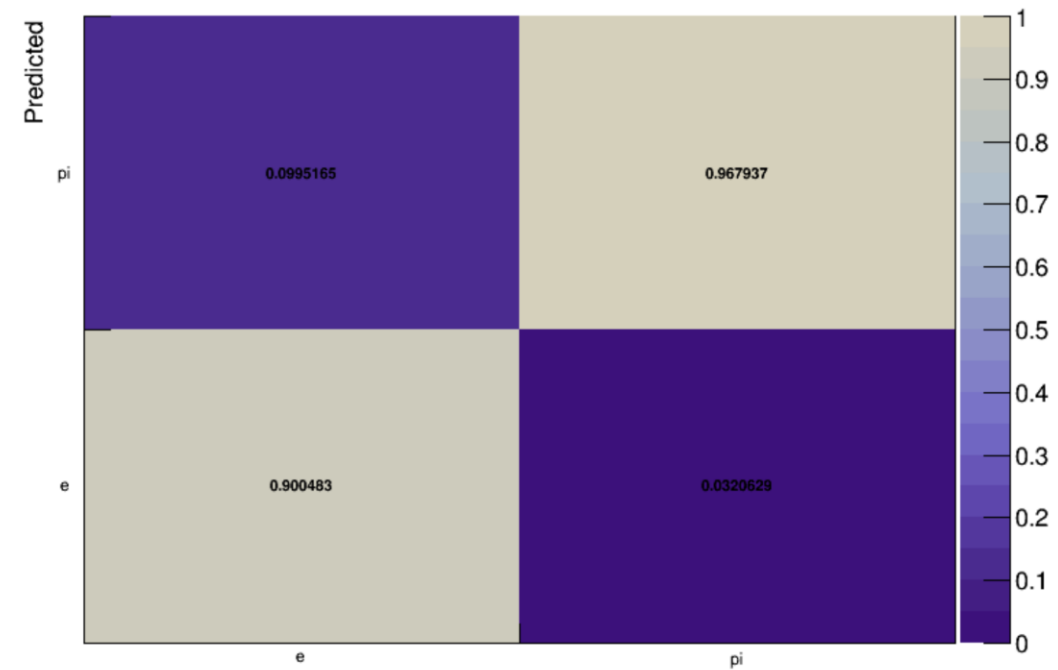
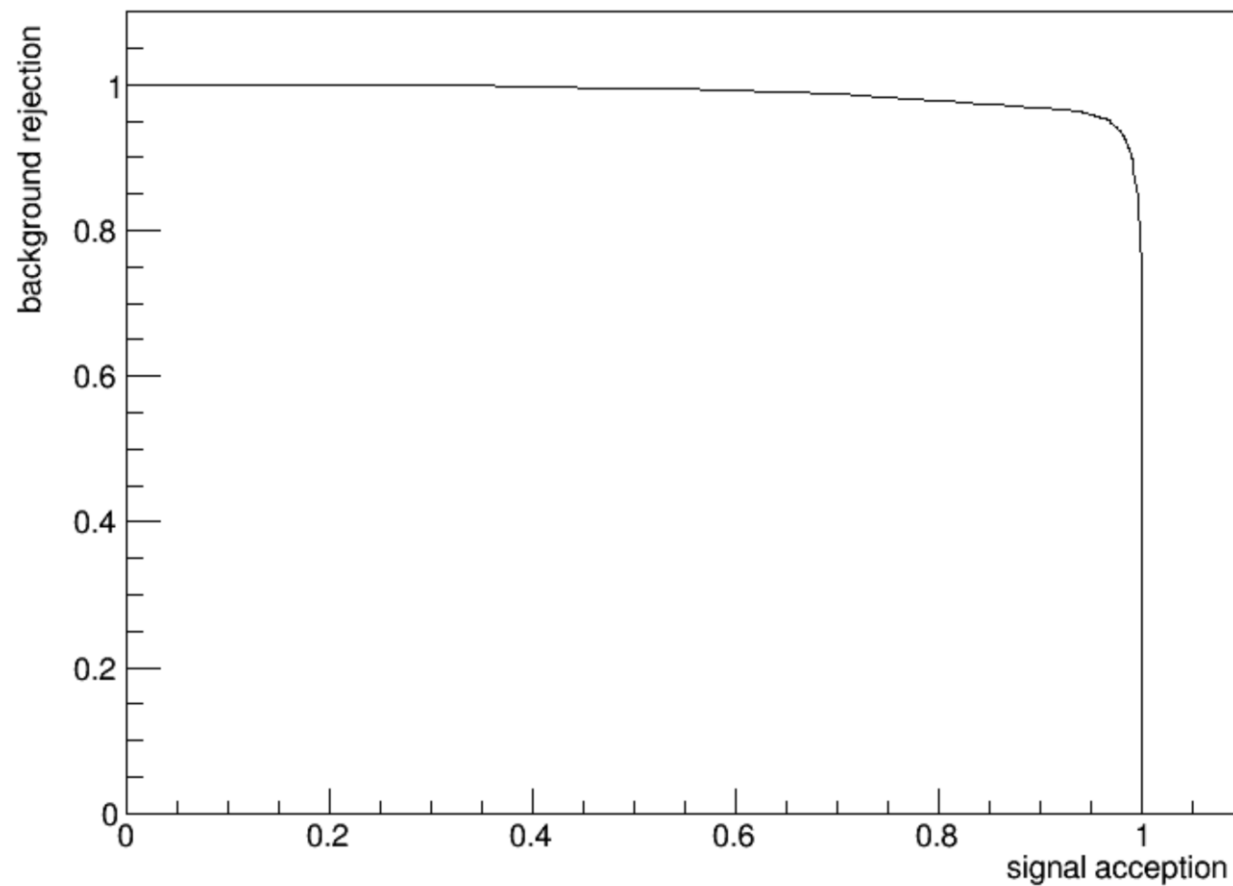


5~6Gev, $\text{abs}(\cos \theta) > 0.85$

```
total:19845
total e:9928
total pi:9917
number of e in Tof: 1972, 19.86%
number of pi in Tof: 8304, 83.74%
number of e in Dndx: 2122, 21.37%
number of pi in Dndx: 7981, 80.48%
number of e in Eecal: 5328, 53.67%
number of pi in Eecal: 8632, 87.04%
number of e in Eecalp: 5328, 53.67%
number of pi in Eecalp: 8632, 87.04%
number of e in Ehcal: 7747, 78.03%
number of pi in Ehcal: 9594, 96.74%
number of e in Rhad: 7747, 78.03%
number of pi in Rhad: 9594, 96.74%
number of e in Rhad_moliere: 1588, 16.00%
number of pi in Rhad_moliere: 7632, 76.96%
```

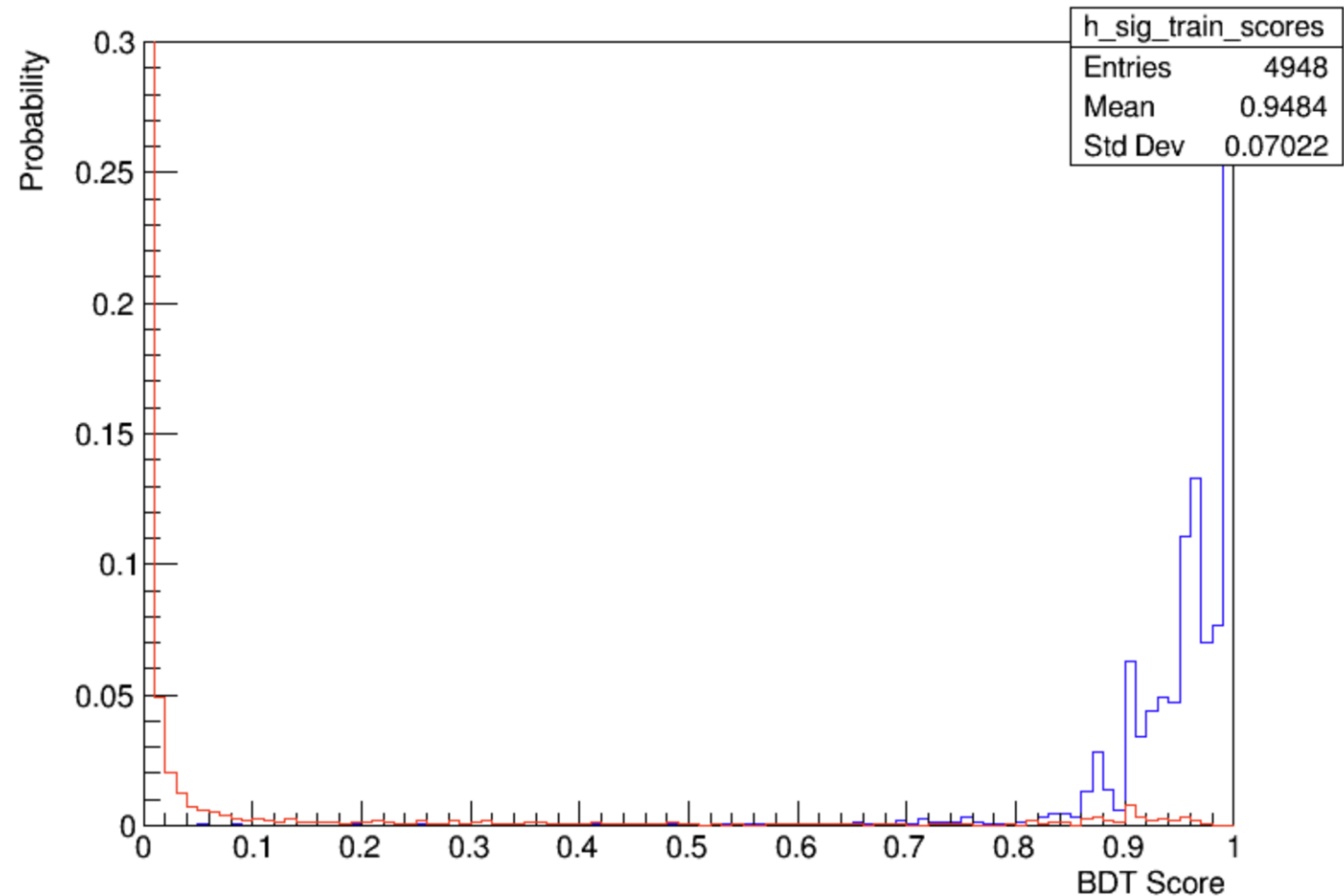


5~6Gev, $\text{abs}(\cos \theta) > 0.85$

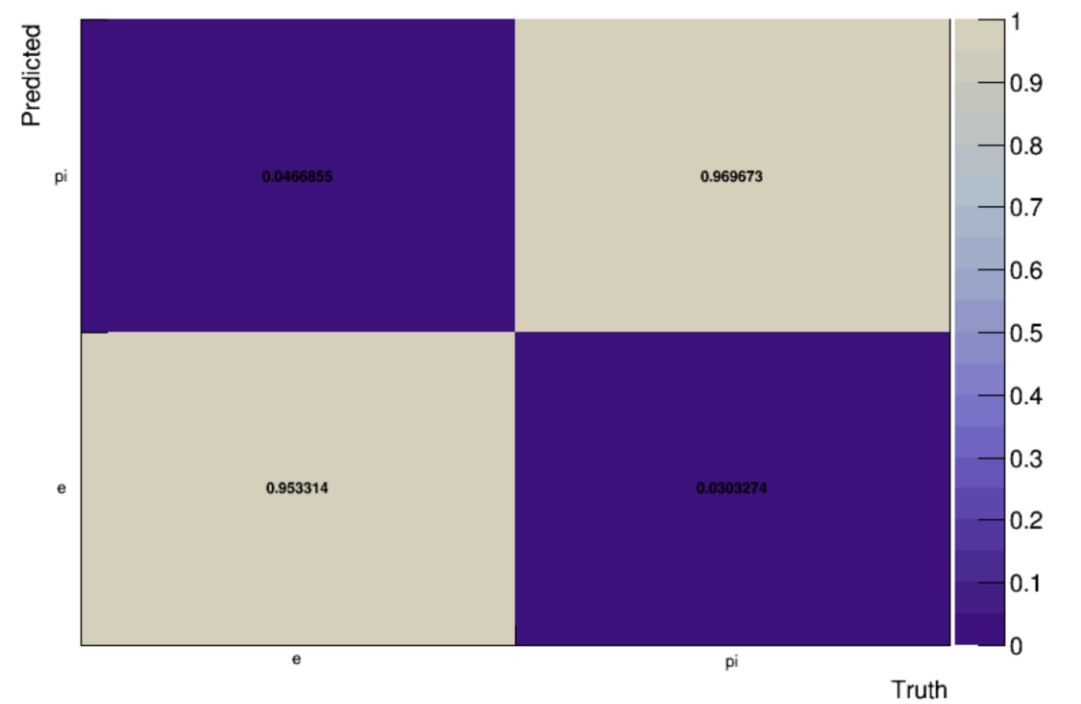
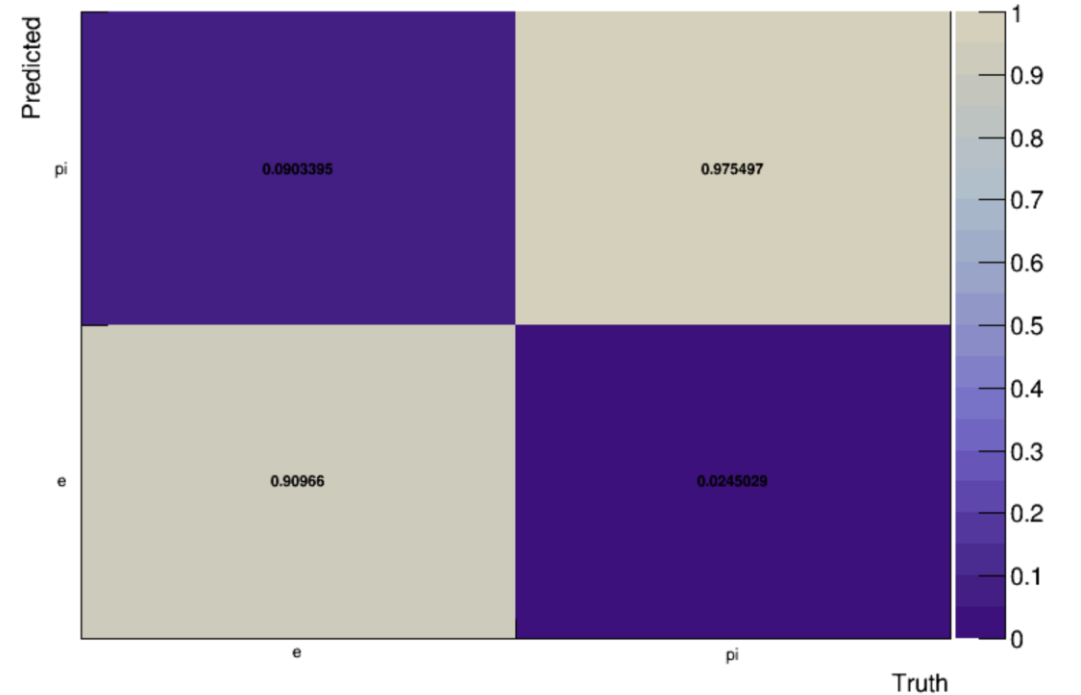
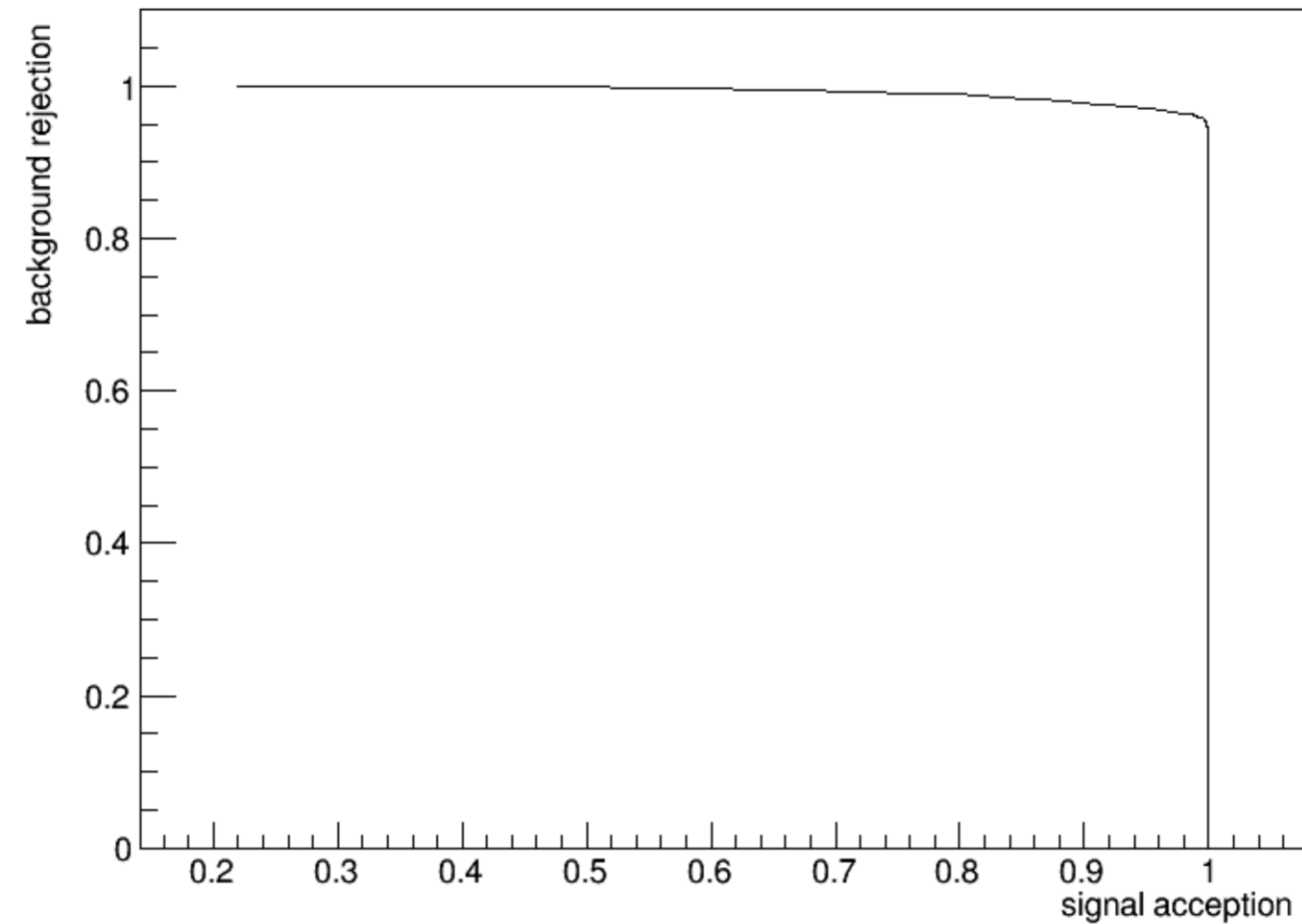


5~6Gev, $\text{abs}(\cos \theta) < 0.85$

```
total:19853
total e:9896
total pi:9957
number of e in Tof: 3587, 36.25%
number of pi in Tof: 9188, 92.28%
number of e in Dndx: 3757, 37.96%
number of pi in Dndx: 9387, 94.28%
number of e in Eecal: 6399, 64.66%
number of pi in Eecal: 9379, 94.20%
number of e in Eecalp: 6399, 64.66%
number of pi in Eecalp: 9379, 94.20%
number of e in Ehcal: 7675, 77.56%
number of pi in Ehcal: 9732, 97.74%
number of e in Rhad: 7675, 77.56%
number of pi in Rhad: 9732, 97.74%
number of e in Rhad_moliere: 1715, 17.33%
number of pi in Rhad_moliere: 7705, 77.38%
number of sig is 9896
number of bkg is 9957
```

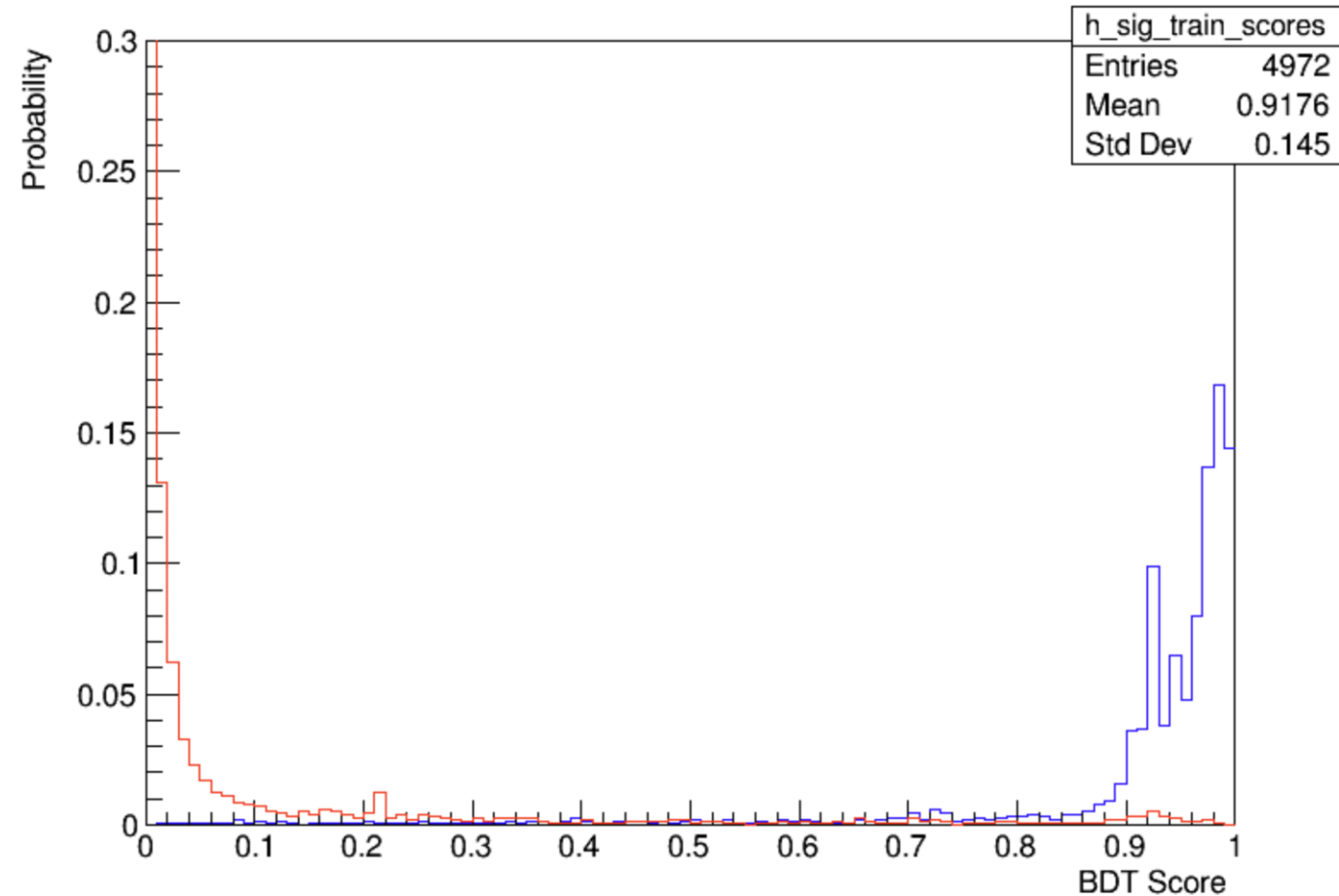


5~6Gev, $\text{abs}(\cos \theta) < 0.85$

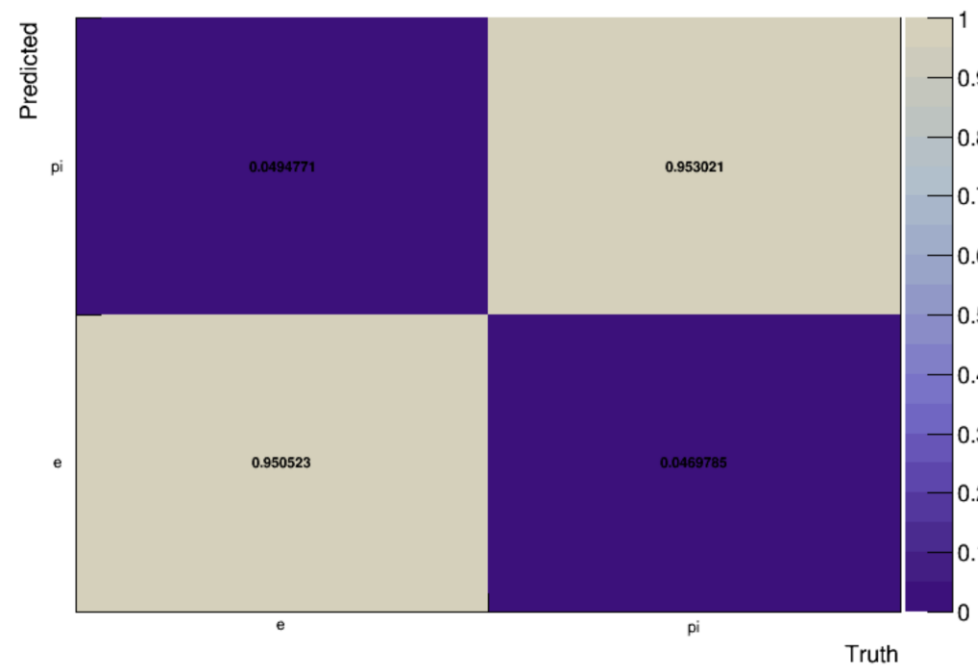
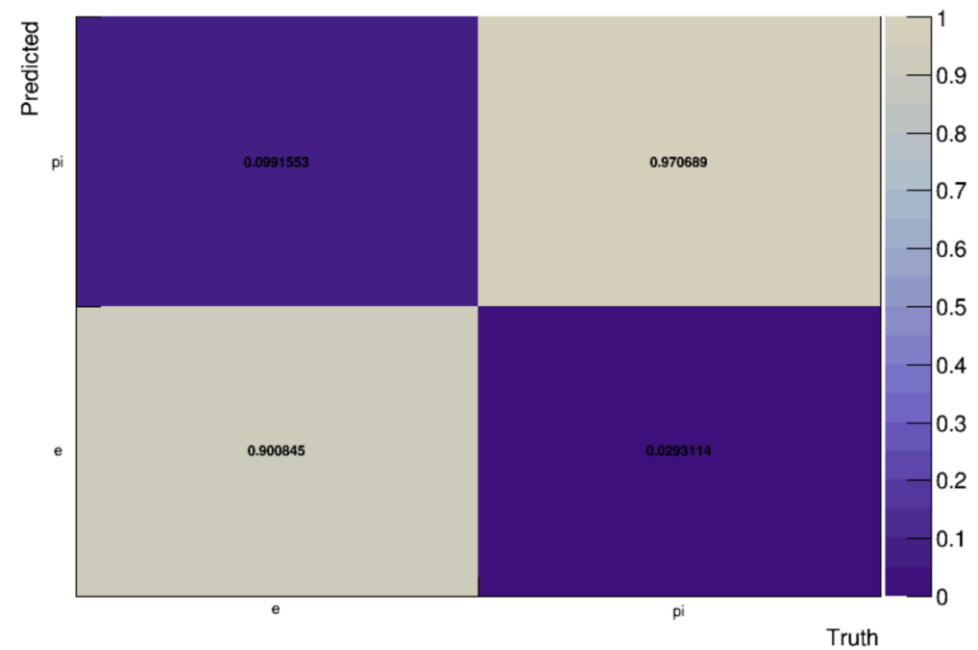
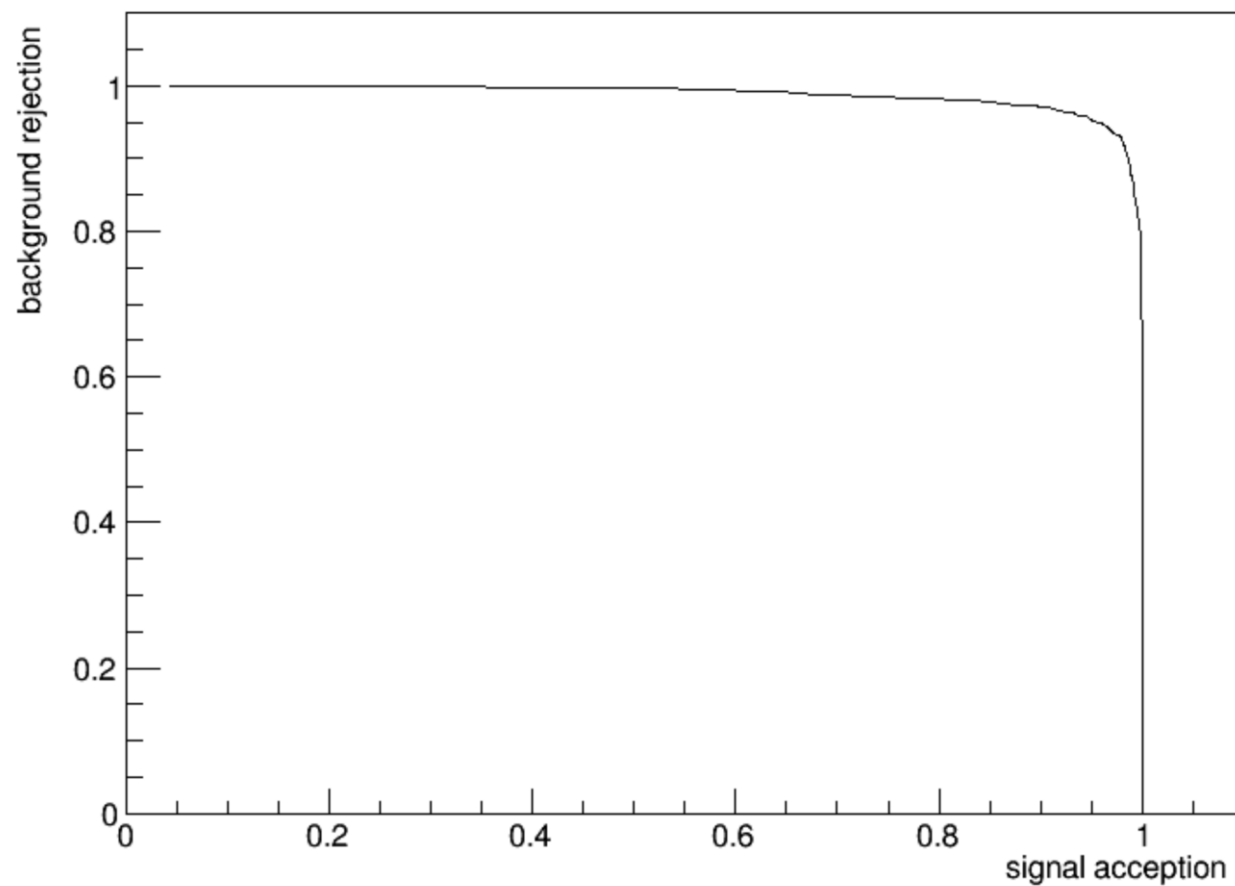


10~11GeV, $\text{abs}(\cos \theta) > 0.85$

```
total:19905
total e:9944
total pi:9961
number of e in Tof: 3142, 31.60%
number of pi in Tof: 8557, 85.91%
number of e in Dndx: 3294, 33.13%
number of pi in Dndx: 8100, 81.32%
number of e in Eecal: 7070, 71.10%
number of pi in Eecal: 8788, 88.22%
number of e in Eecalp: 7070, 71.10%
number of pi in Eecalp: 8788, 88.22%
number of e in Ehcal: 7392, 74.34%
number of pi in Ehcal: 9783, 98.21%
number of e in Rhad: 7392, 74.34%
number of pi in Rhad: 9783, 98.21%
number of e in Rhad_moliere: 2305, 23.18%
number of pi in Rhad_moliere: 6517, 65.43%
```

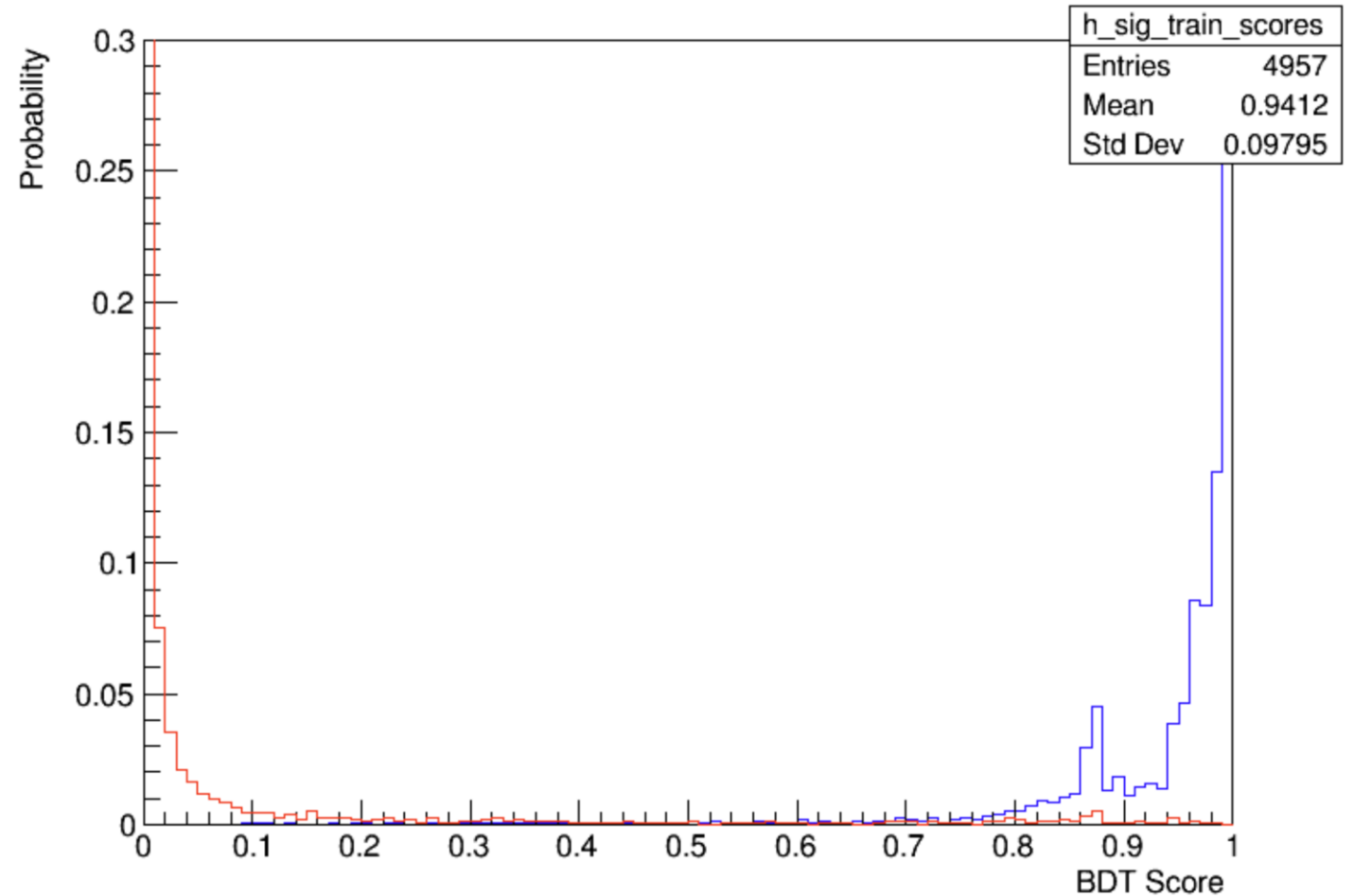


10~11GeV, $\text{abs}(\cos \theta) > 0.85$

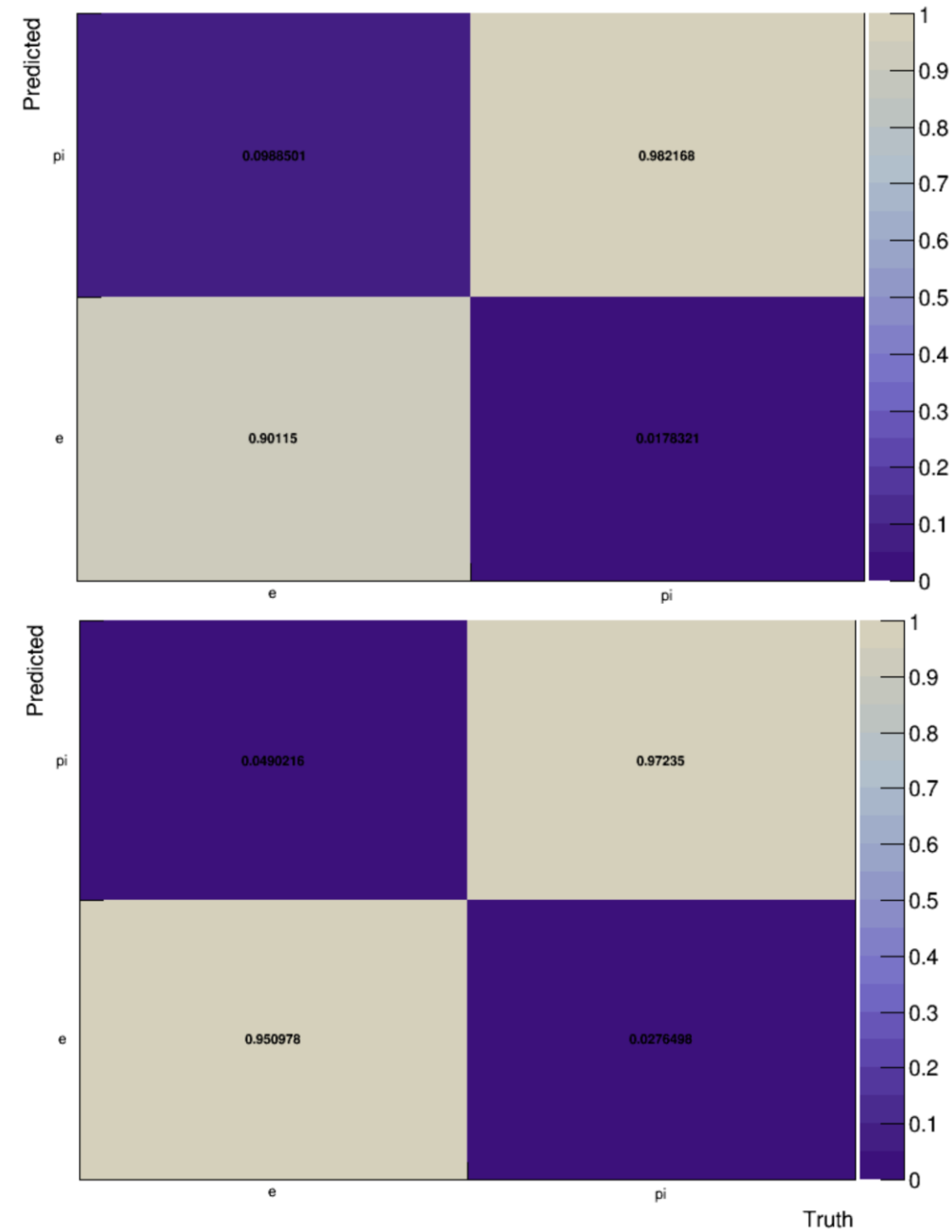
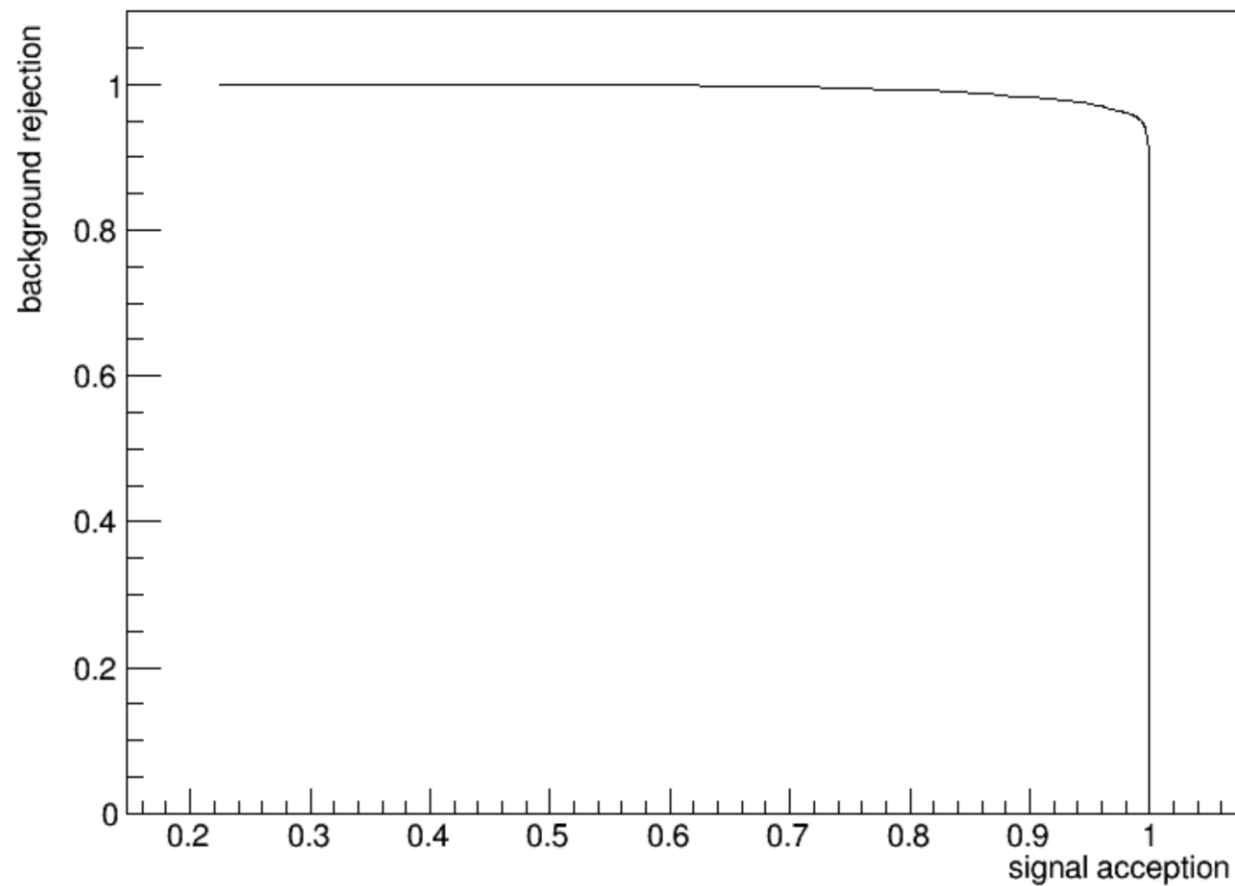


10~11GeV, $\text{abs}(\cos \theta) < 0.85$

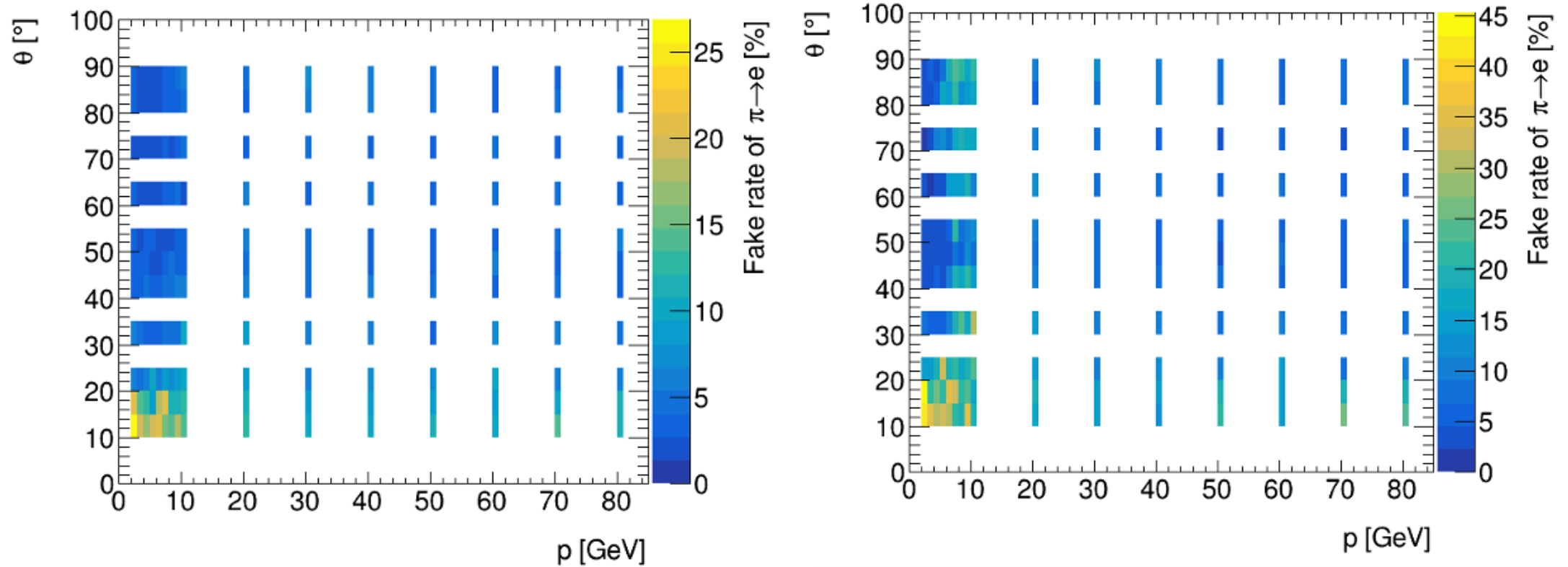
```
total:19895
total e:9914
total pi:9981
number of e in Tof: 4959, 50.02%
number of pi in Tof: 9320, 93.38%
number of e in Dndx: 5223, 52.68%
number of pi in Dndx: 9485, 95.03%
number of e in Eecal: 8264, 83.36%
number of pi in Eecal: 9456, 94.74%
number of e in Eecalp: 8264, 83.36%
number of pi in Eecalp: 9456, 94.74%
number of e in Ehcal: 7410, 74.74%
number of pi in Ehcal: 9864, 98.83%
number of e in Rhad: 7410, 74.74%
number of pi in Rhad: 9864, 98.83%
number of e in Rhad_moliere: 2365, 23.86%
number of pi in Rhad_moliere: 6786, 67.99%
```



$10 \sim 11 \text{ GeV}, \text{abs}(\cos \theta) < 0.85$



eID, 90% WP (left) and 95% WP (right)
(2025.3.28)



```
144M May 15 15:01 pid_E240_eeHX_10_P_.root  
694M May 15 14:57 pid_E240_eeHX_1_P_10.root  
715M May 15 14:32 pid_E240_eeHX_0_P_1.root
```

```
root [1] pid -> GetEntries()  
(long long) 31555760
```

0~1GeV

```
root [1] pid -> GetEntries()  
(long long) 21630900
```

1~10GeV

```
root [1] pid -> GetEntries()  
(long long) 3828106
```

>10GeV

Summary

- Work to do:
 - 1. Try other ways on low momentum particles ID
 - 2. Use Xgboost in e/mu/pi/K/p ID

