A brief update on TOA threshold study and selecting scattered electrons from PYTHIA data

Feb 18 (Tue)
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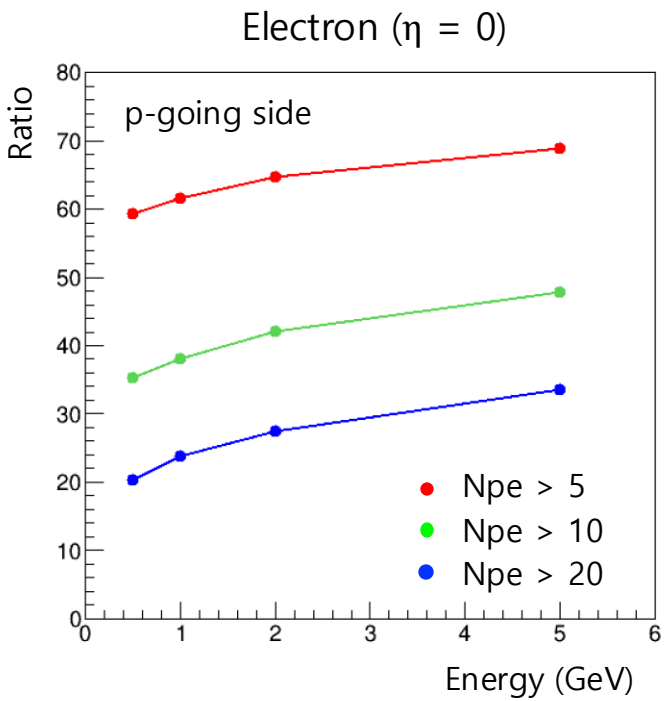
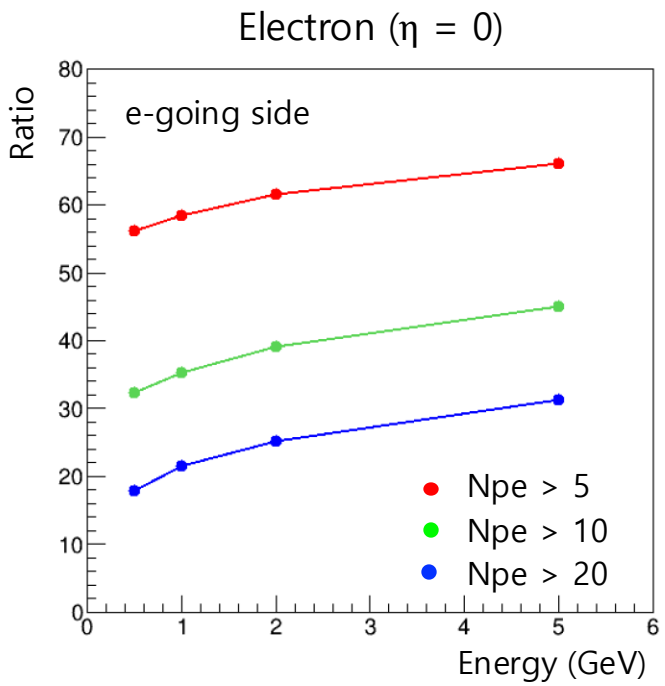
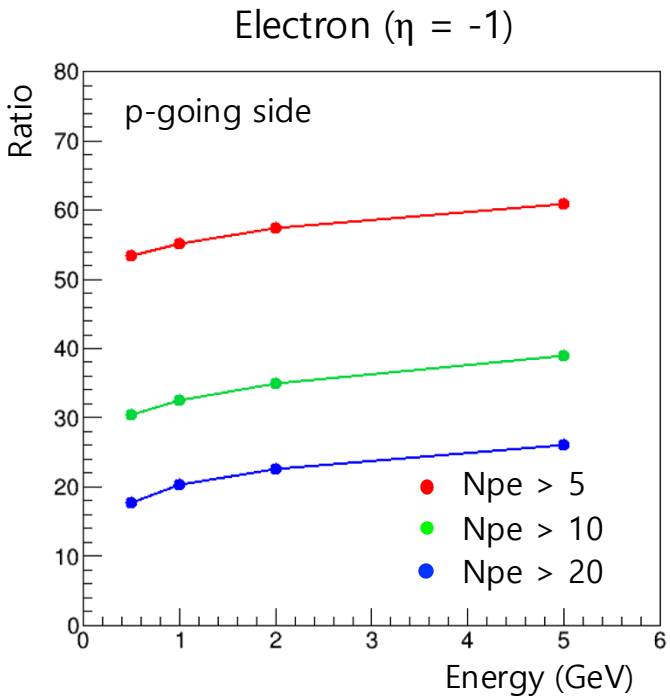
Ratios of channels that have TOA values

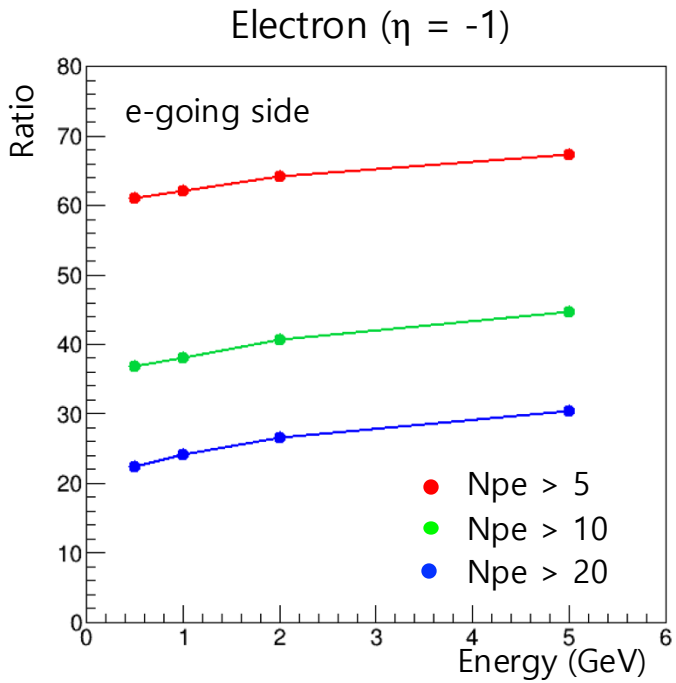




- The attenuation and Poisson smearing effects were applied, but the threshold was not applied.
- The ratio is defined by N_{ch} (Npe>A) / N_{ch} (Npe>0), where A is 5, 10, or 20.
- Npe > 20 is too strict and ~65% of the channels that have finite Npe is expected to have TOA when Npe = 5 is the TOA threshold.

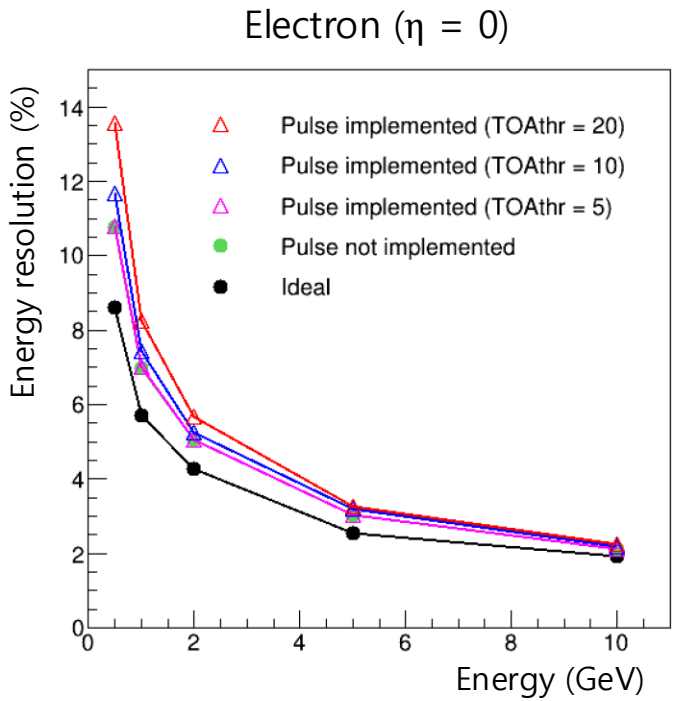
Ratios of channels that have TOA values





- When η changes from 0 to -1, ratios in p-going side decrease by ~5% and those in e-going side increase by ~5%.

Energy resolutions with different TOA thresholds



- Now, the original threshold of Npe = 5 was applied.
- The case where the TOA threshold is Npe = 5 shows almost the same performance with the one where the pulse is not implemented. → This is reasonable.
- The energy splitting will be studied with the TOA threshold of Npe = 5.

Selection of the scattered electron

MC particles

```
arrayNum: 0     generatorStatus: 4     pdg: 2212     daughters_begin: 0     daughters_end: 2
arrayNum: 1     generatorStatus: 61    pdg: 1        daughters_begin: 2     daughters_end: 3
arrayNum: 2     generatorStatus: 63    pdg: 2203     daughters_begin: 3     daughters_end: 7
arrayNum: 3     generatorStatus: 4     pdg: 11       daughters_begin: 7     daughters_end: 8
arrayNum: 4     generatorStatus: 21    pdg: 11       daughters_begin: 8     daughters_end: 10
arrayNum: 5     generatorStatus: 21    pdg: 1        daughters_begin: 10    daughters_end: 12
arrayNum: 6     generatorStatus: 23    pdg: 1        daughters_begin: 12    daughters_end: 13
arrayNum: 7     generatorStatus: 62    pdg: 1        daughters_begin: 13    daughters_end: 17
arrayNum: 8     generatorStatus: 1     pdg: -211     daughters_begin: 17    daughters_end: 17
arrayNum: 9     generatorStatus: 2     pdg: 213      daughters_begin: 17    daughters_end: 19
arrayNum: 10    generatorStatus: 1     pdg: 2112     daughters_begin: 19    daughters_end: 19
arrayNum: 11    generatorStatus: 1     pdg: 211      daughters_begin: 19    daughters_end: 19
arrayNum: 12    generatorStatus: 1     pdg: 11       daughters_begin: 19    daughters_end: 19
arrayNum: 13    generatorStatus: 1     pdg: 211      daughters_begin: 19    daughters_end: 19
arrayNum: 14    generatorStatus: 2     pdg: 111      daughters_begin: 19    daughters_end: 21
arrayNum: 15    generatorStatus: 1     pdg: 22       daughters_begin: 21    daughters_end: 21
arrayNum: 16    generatorStatus: 1     pdg: 22       daughters_begin: 21    daughters_end: 21
```

Link to daughter particles

```
arrayNum: 0     daughters_index: 1
arrayNum: 1     daughters_index: 2
arrayNum: 2     daughters_index: 5
arrayNum: 3     daughters_index: 8
arrayNum: 4     daughters_index: 9
arrayNum: 5     daughters_index: 10
arrayNum: 6     daughters_index: 11
arrayNum: 7     daughters_index: 4
arrayNum: 8     daughters_index: 6
arrayNum: 9     daughters_index: 12
arrayNum: 10    daughters_index: 6
arrayNum: 11    daughters_index: 12
arrayNum: 12    daughters_index: 7
arrayNum: 13    daughters_index: 8
arrayNum: 14    daughters_index: 9
arrayNum: 15    daughters_index: 10
arrayNum: 16    daughters_index: 11
arrayNum: 17    daughters_index: 13
arrayNum: 18    daughters_index: 14
arrayNum: 19    daughters_index: 15
arrayNum: 20    daughters_index: 16
```

- Data in .../24.12.0/DIS/18x275/minQ2=1/ was used.
- The scattered electron was found by following the daughter particles of the electron beam.

Selection of the scattered electron

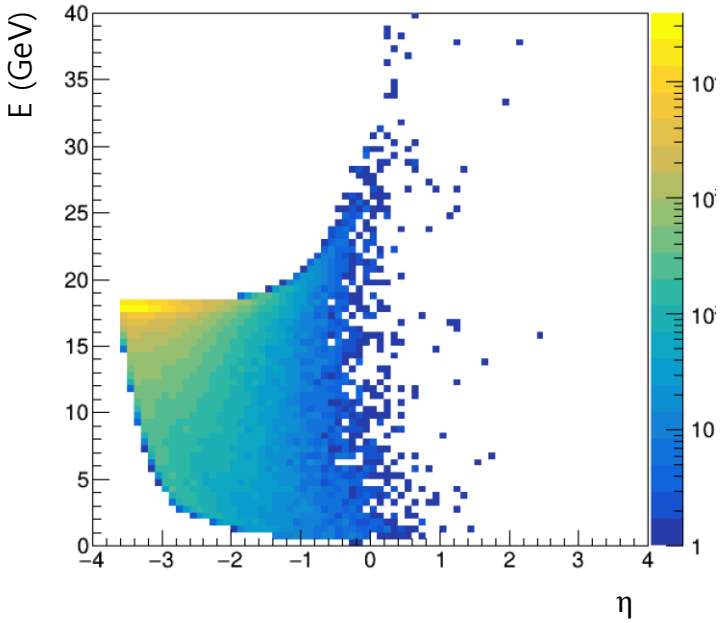
MC particles

```
arrayNum: 0     generatorStatus: 4     pdg: 2212     daughters_begin: 0     daughters_end: 2
arrayNum: 1     generatorStatus: 61     pdg: 2     daughters_begin: 2     daughters_end: 3
arrayNum: 2     generatorStatus: 63     pdg: 2101     daughters_begin: 3     daughters_end: 7
arrayNum: 3     generatorStatus: 4     pdg: 11     daughters_begin: 7     daughters_end: 8
arrayNum: 4     generatorStatus: 21     pdg: 11     daughters_begin: 8     daughters_end: 10
arrayNum: 5     generatorStatus: 21     pdg: 2     daughters_begin: 10     daughters_end: 12
arrayNum: 6     generatorStatus: 23     pdg: 2     daughters_begin: 12     daughters_end: 13
arrayNum: 7     generatorStatus: 62     pdg: 2     daughters_begin: 13     daughters_end: 17
arrayNum: 8     generatorStatus: 1     pdg: 211     daughters_begin: 17     daughters_end: 17
arrayNum: 9     generatorStatus: 1     pdg: -211     daughters_begin: 17     daughters_end: 17
arrayNum: 10     generatorStatus: 2     pdg: 213     daughters_begin: 17     daughters_end: 19
arrayNum: 11     generatorStatus: 1     pdg: 2112     daughters_begin: 19     daughters_end: 19
arrayNum: 12     generatorStatus: 1     pdg: 11     daughters_begin: 19     daughters_end: 20
arrayNum: 13     generatorStatus: 1     pdg: 211     daughters_begin: 20     daughters_end: 20
arrayNum: 14     generatorStatus: 2     pdg: 111     daughters_begin: 20     daughters_end: 22
arrayNum: 15     generatorStatus: 1     pdg: 22     daughters_begin: 22     daughters_end: 23
arrayNum: 16     generatorStatus: 1     pdg: 22     daughters_begin: 23     daughters_end: 23
arrayNum: 17     generatorStatus: 0     pdg: 22     daughters_begin: 23     daughters_end: 23
arrayNum: 18     generatorStatus: 0     pdg: 22     daughters_begin: 23     daughters_end: 23
```

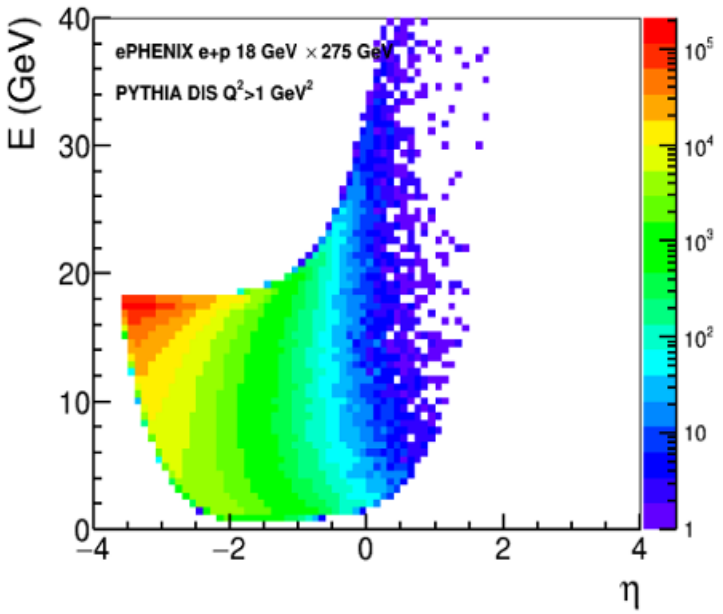
- The daughter particles were not followed if the generatorStatus was 0.

E vs. η distribution

This study



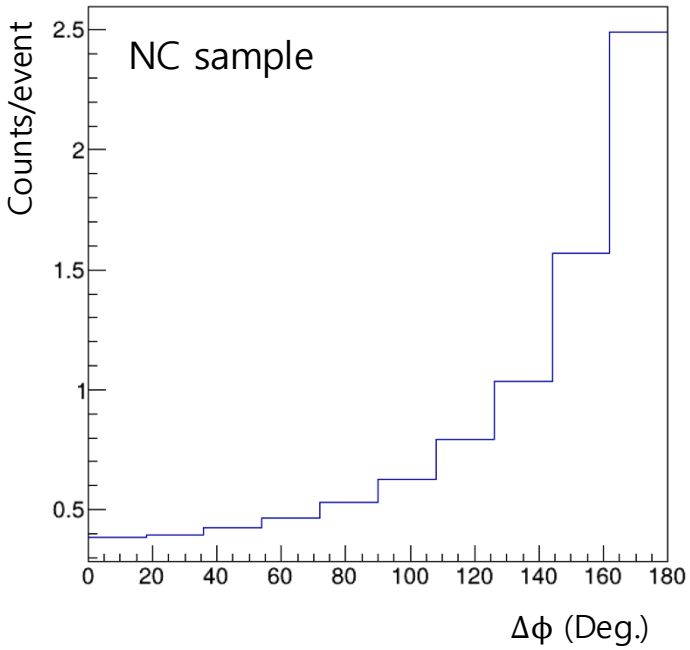
PDR2 review



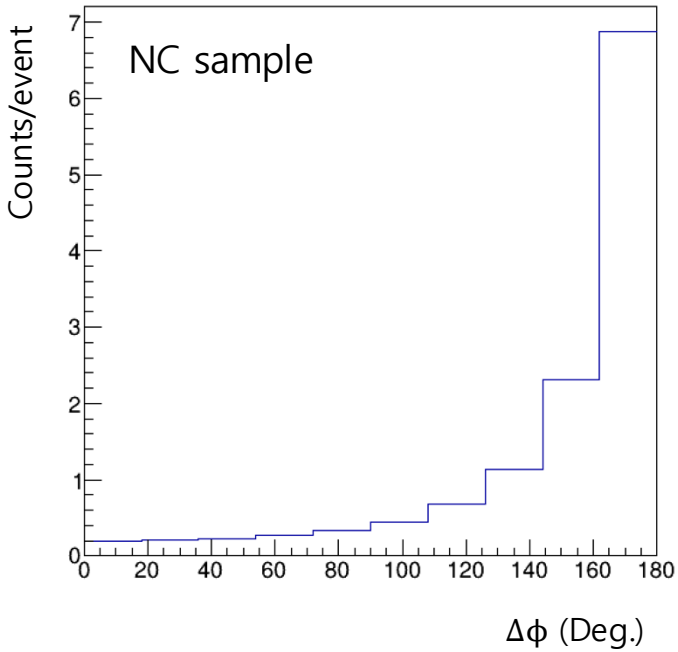
- We can see similar E vs. η distribution with the one presented for PDR2 review.
- It seems that the scattered electrons were selected correctly.

Δϕ distribution

18 x 275 (Q^2_{min} = 1 GeV^2)



18 x 275 (Q^2_{min} = 1000 GeV^2)



- We expect energy reconstruction of ~20-25% of the scattered electrons will be interrupted by other particles.
- How much the energy resolution gets worse and how it can be solved will be studied.
- Do we have any edm4hep PYTHIA data in EIC repository?