

dE/dx PID Study

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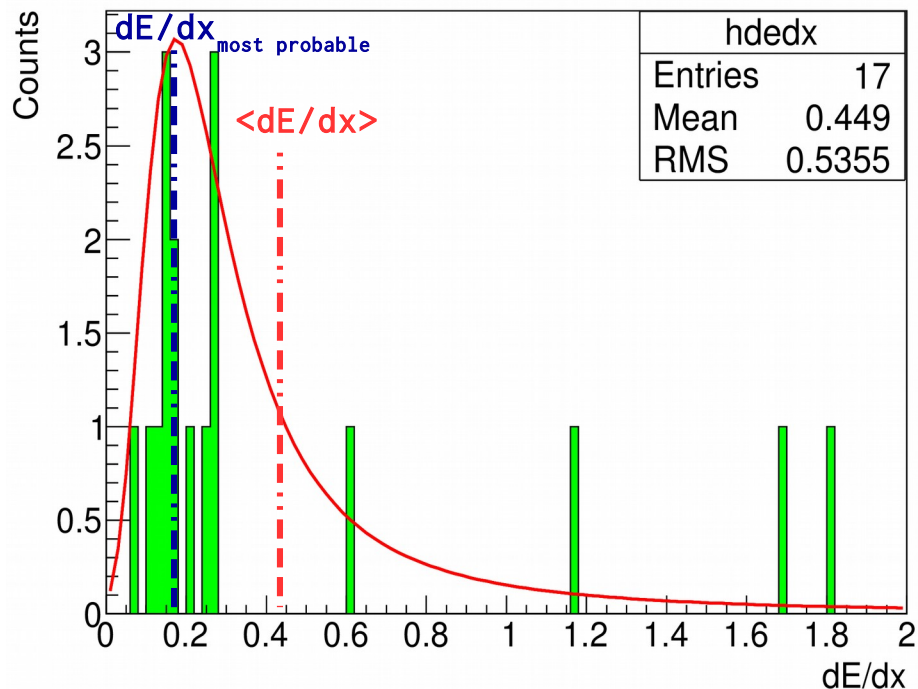
GlueX Collaboration Meeting

May 16, 2017

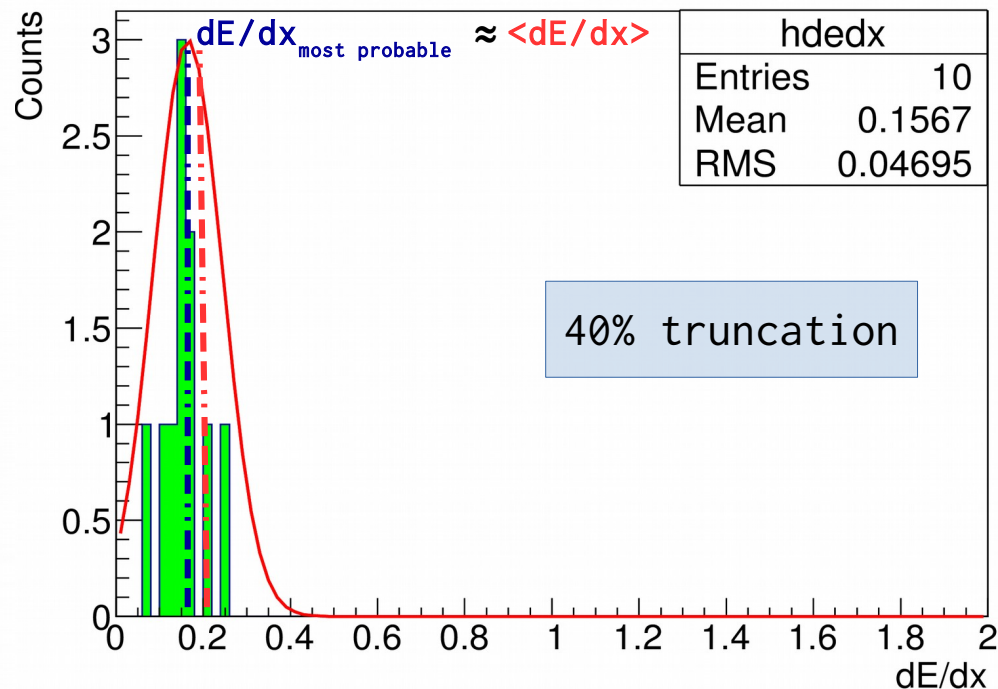
Motivation

- **Goal:** Achieve the optimal separation of different particle types using dE/dx
 - Estimate dE/dx mean value and eventually the width.
- **Method:** Truncated mean
 - ➔ Drop some hits with largest dE/dx values from the track
 - ➔ Optimize truncation by:
 - 1st method: best resolution.
 - 2nd method: Strongest separation power
 - 3rd method: lowest mis-id

dE/dx for one track in CDC



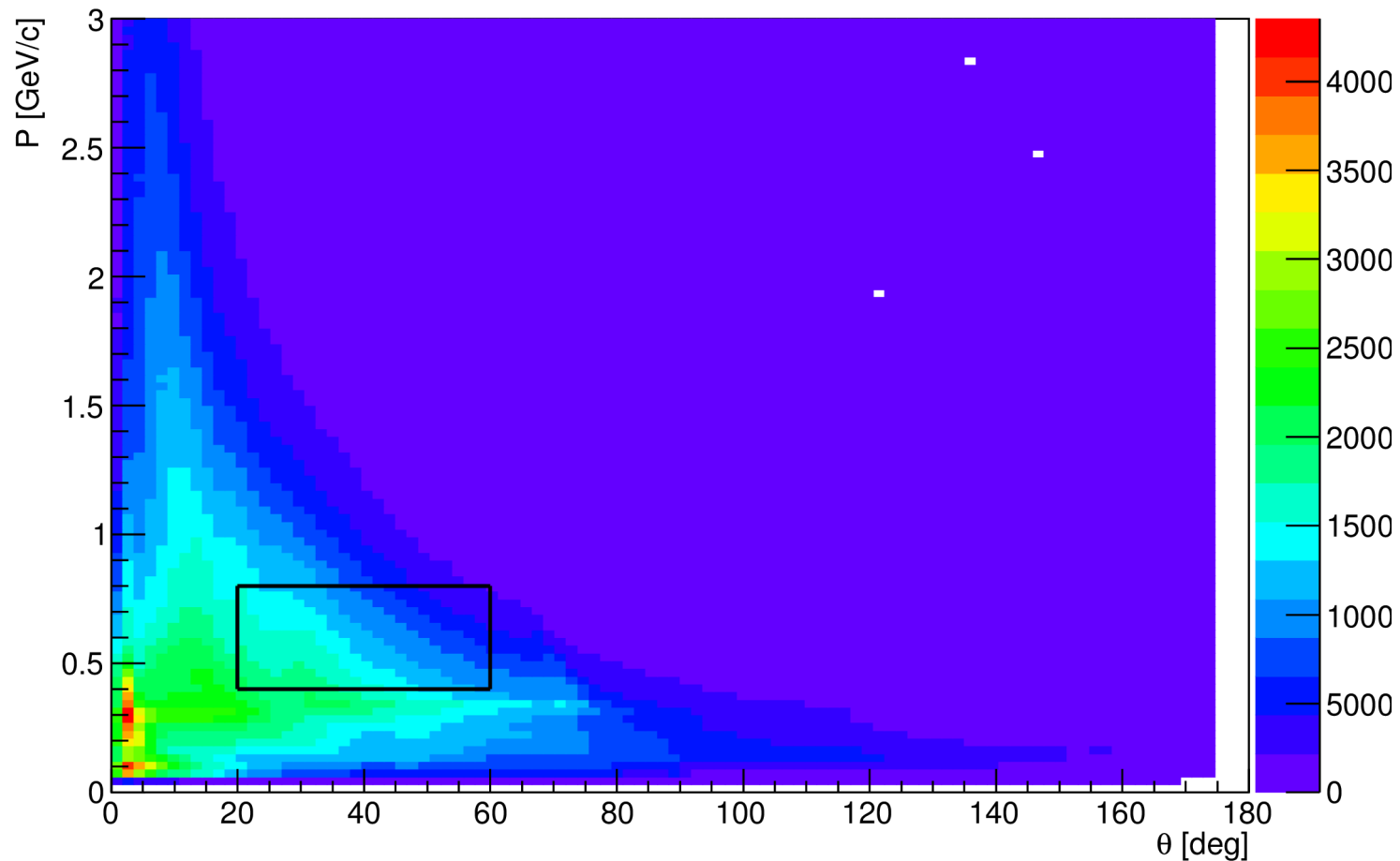
dE/dx for one track in CDC



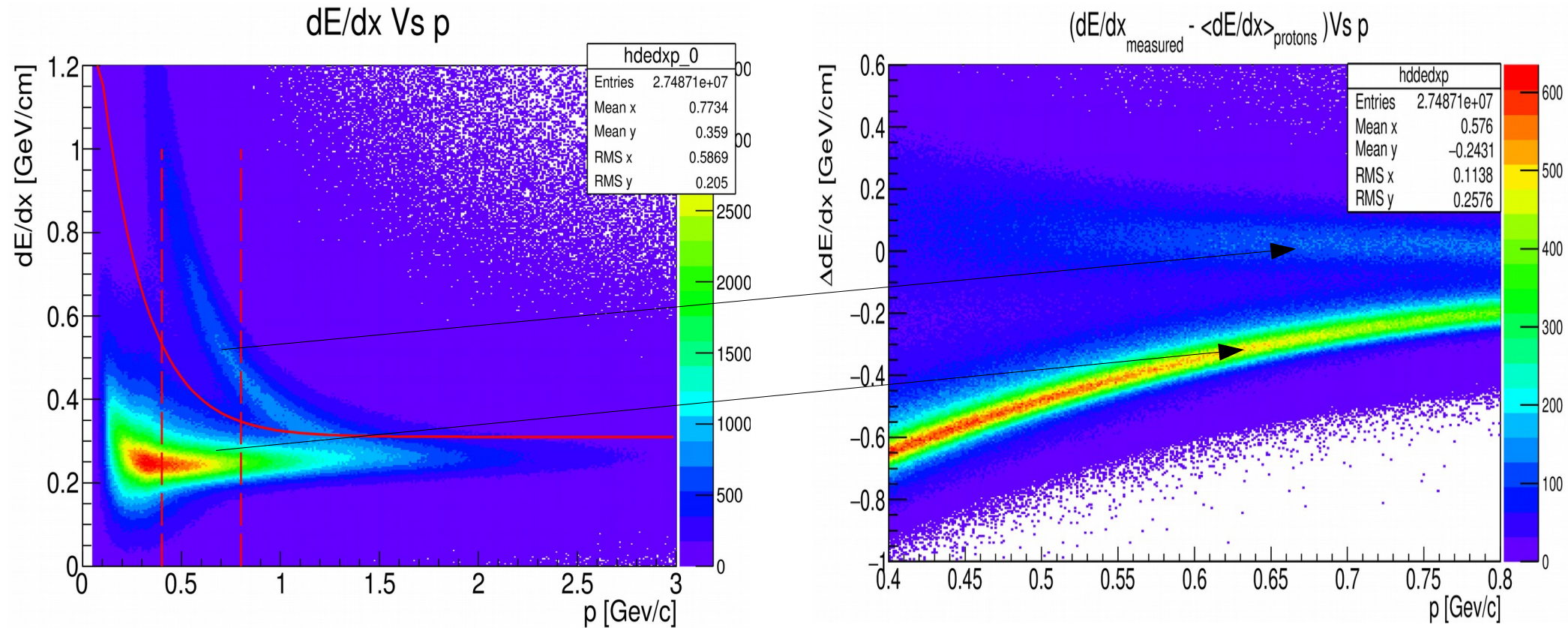
Procedure

- Spring 2016 data, runs: 011529_001 - 011529_010.
- All the tracks in the CDC
- Truncation dependence on P (0.4 - 0.8 GeV/c) & θ (20° - 60°)

Momentum Vs θ

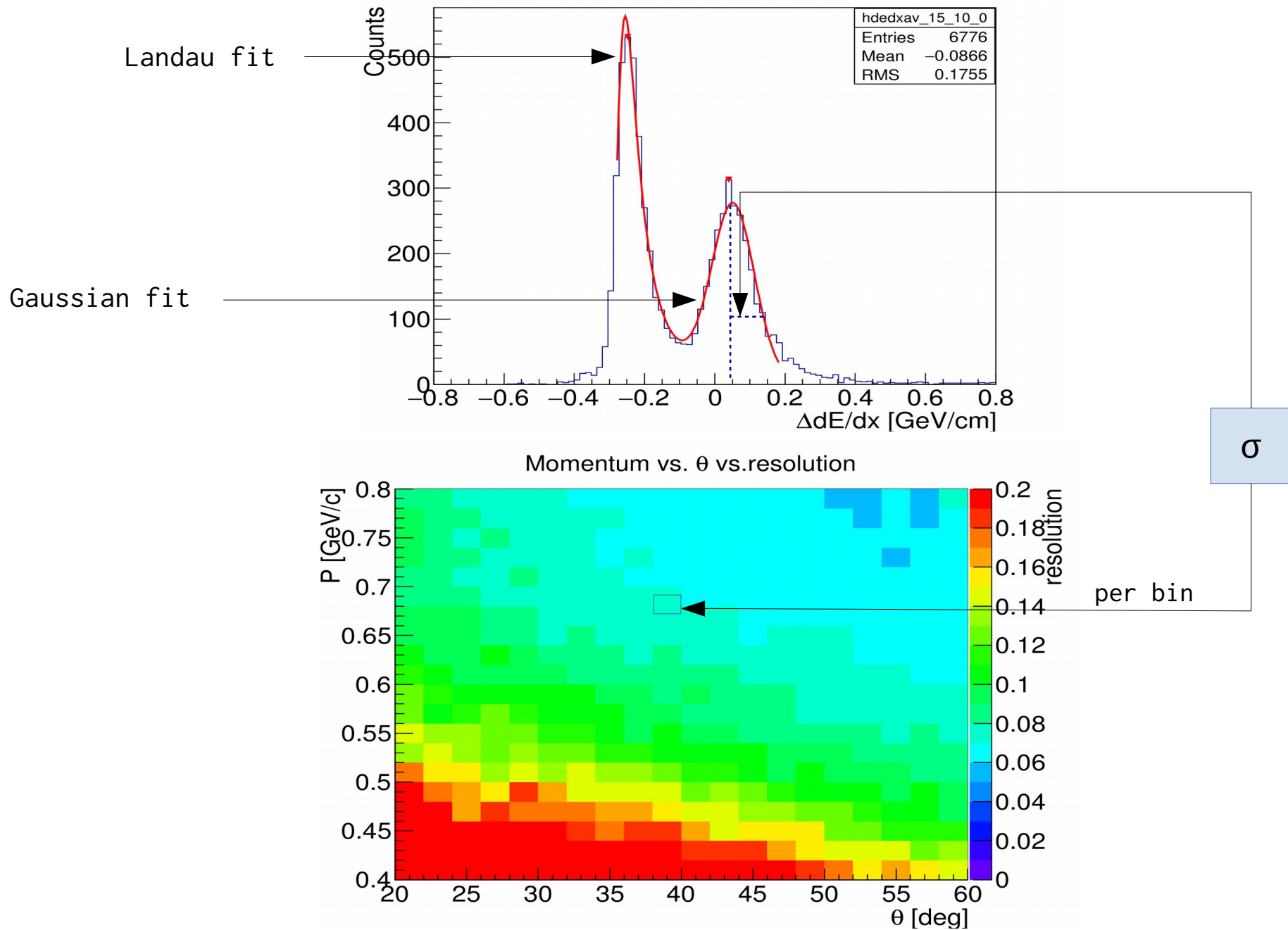


- 1st Step: Select the protons.



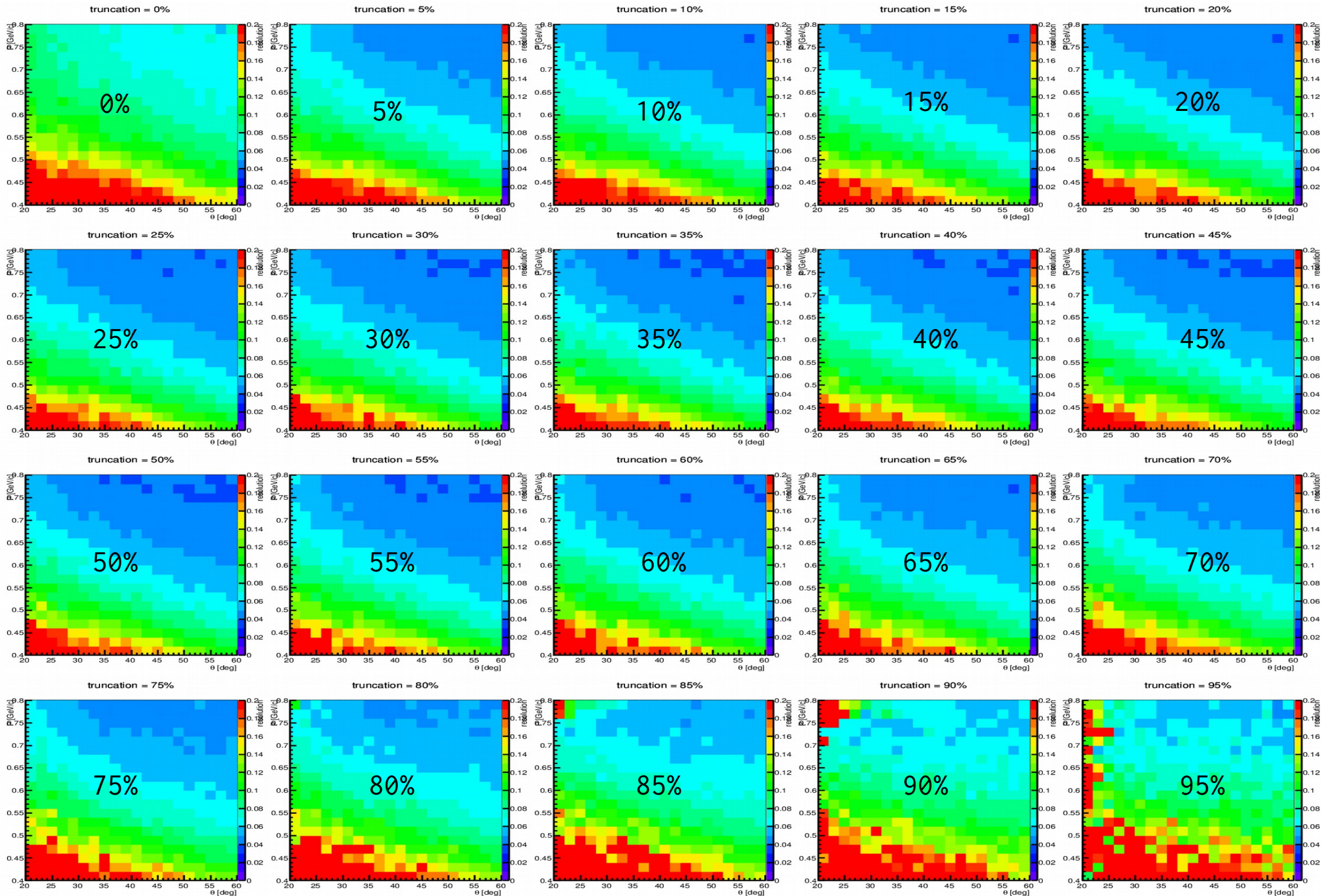
Resolution

- 1st method: best resolution => optimal truncation.



Resolution

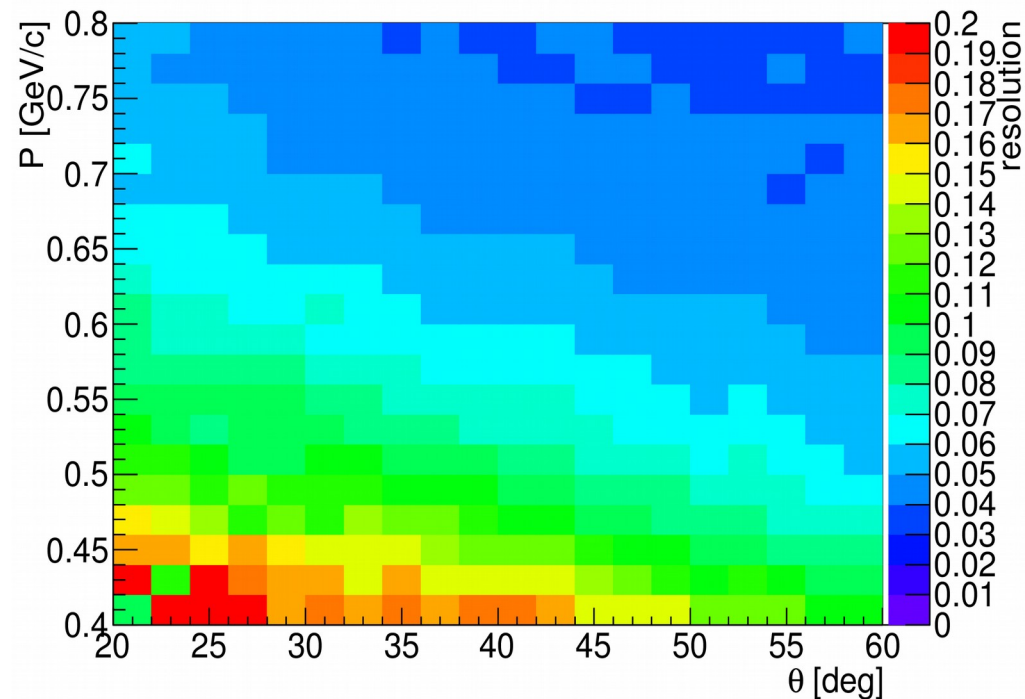
- 1st method: best resolution => optimal truncation.



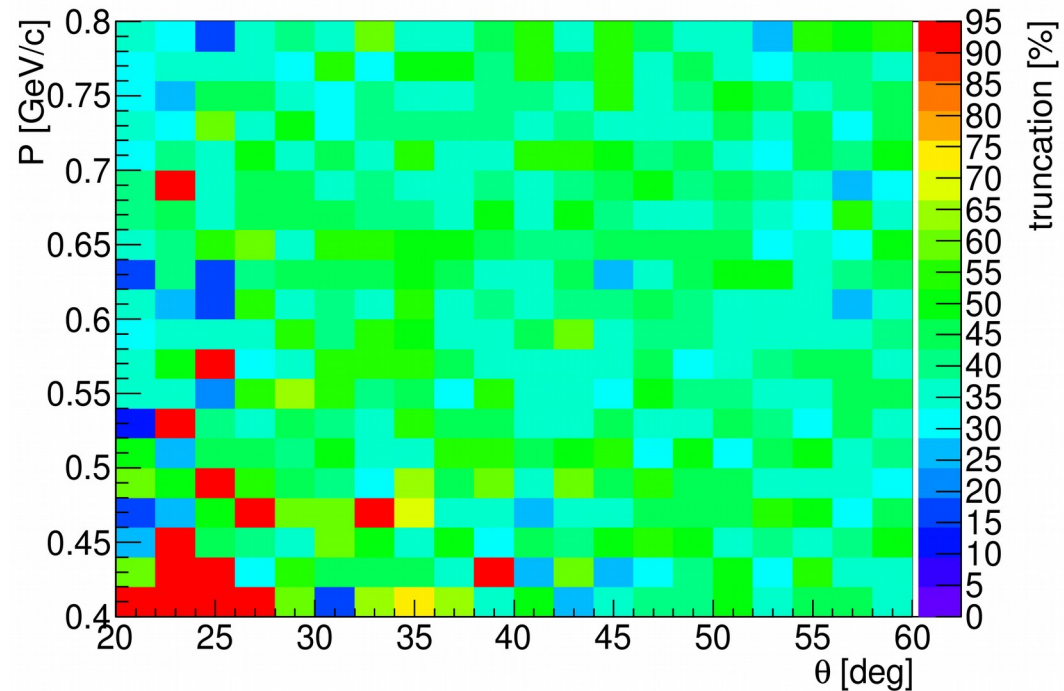
Resolution

- 1st method: optimal truncation ~35%

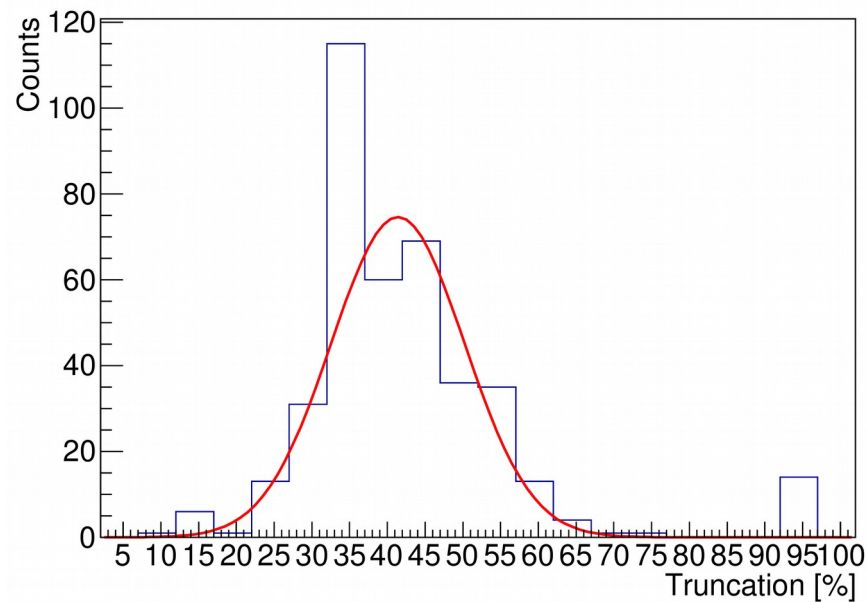
Momentum vs. θ vs. optimal resolution



Momentum vs. θ vs. optimal truncation (resolution)

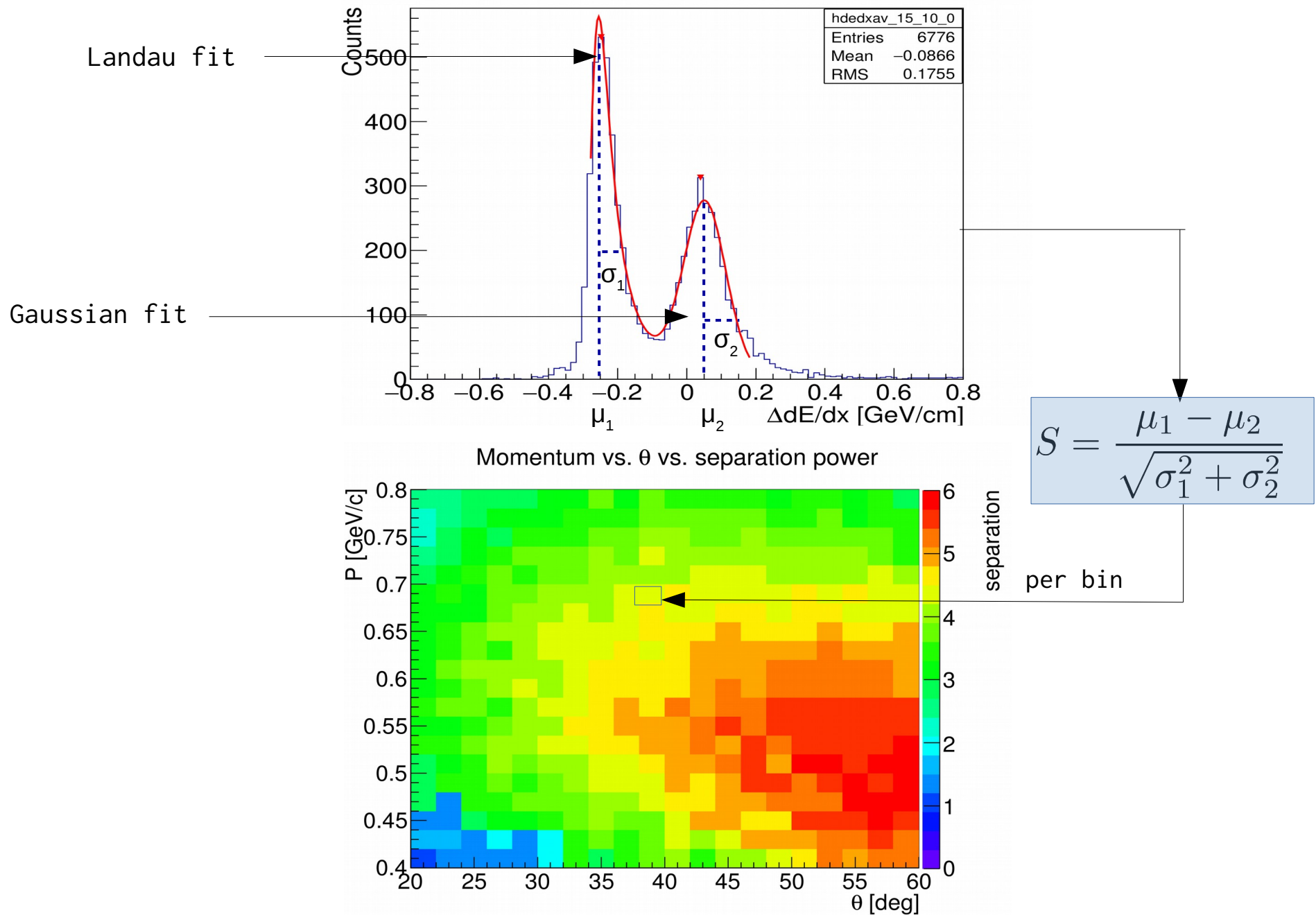


optimal truncation (based on resolution)



Separation Power

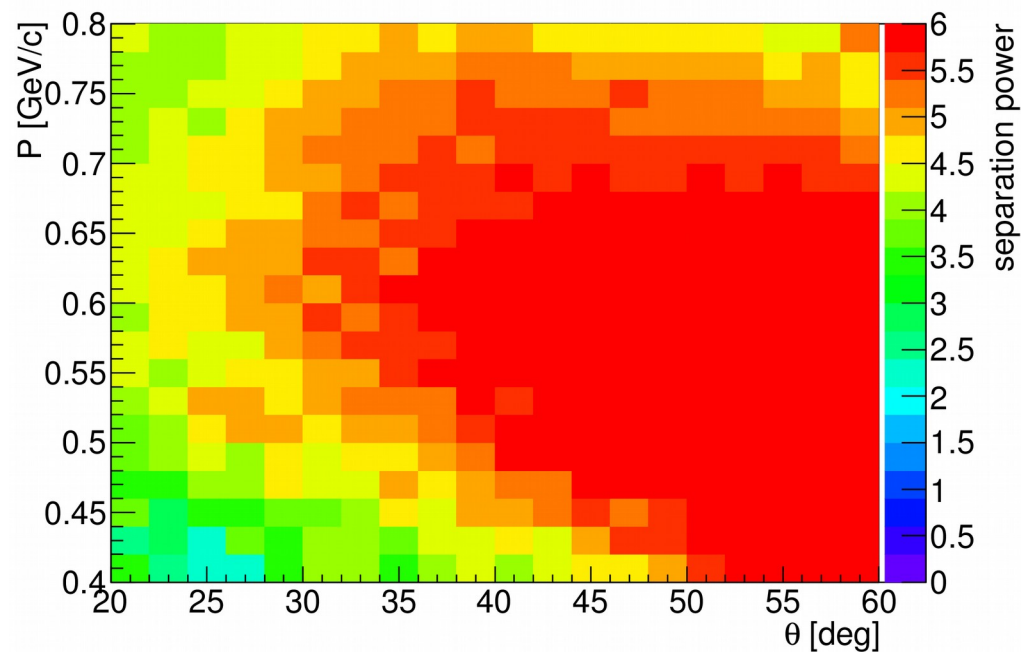
- 2nd method: strongest separation power => optimal truncation.



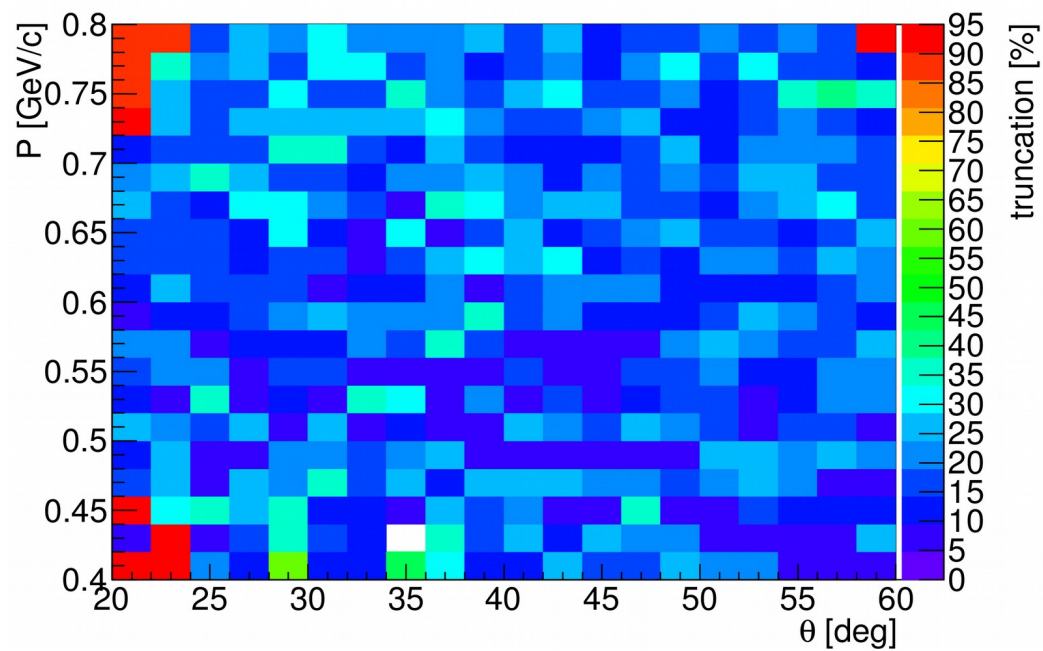
Separation Power

- 2nd method: optimal truncation ~15%

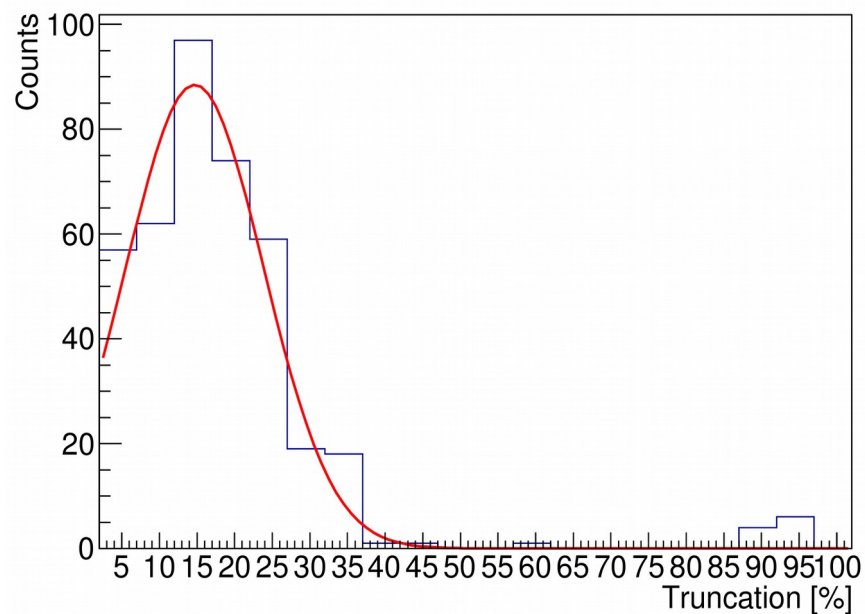
Momentum vs. θ vs. optimal separation power



Momentum vs. θ vs. optimal truncation (separation power)

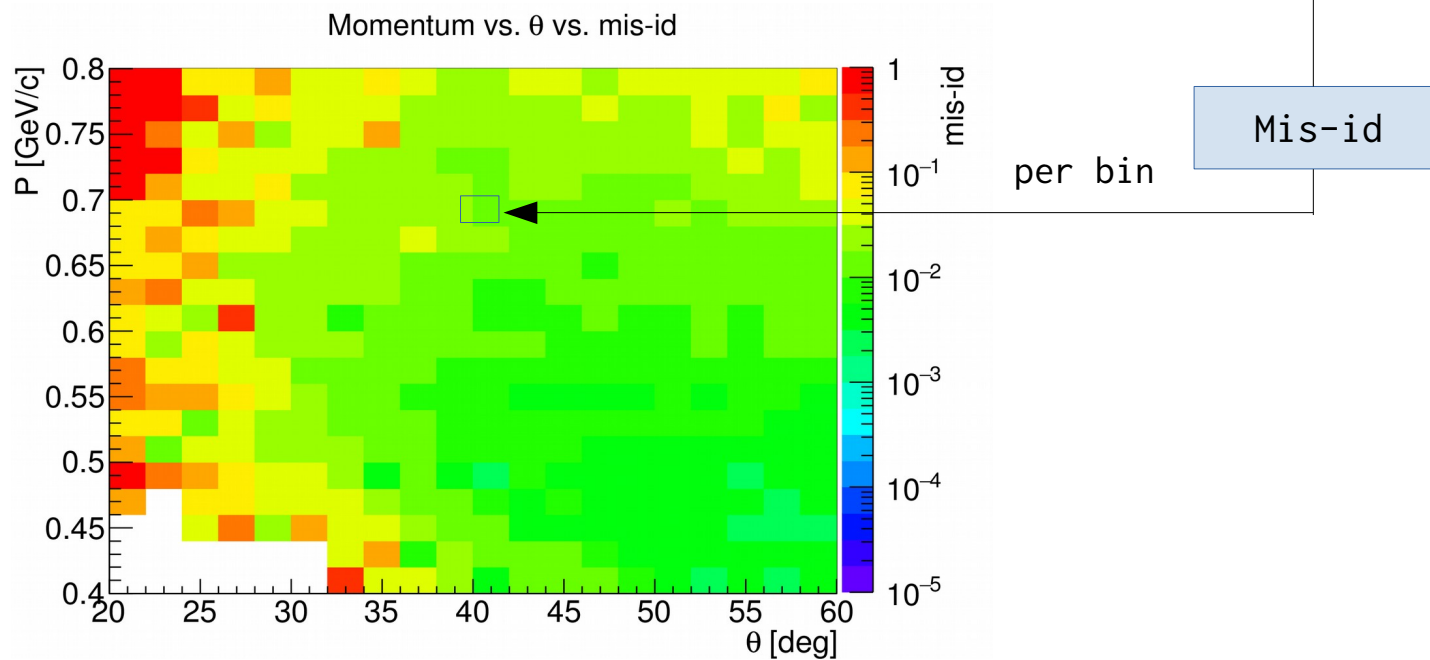
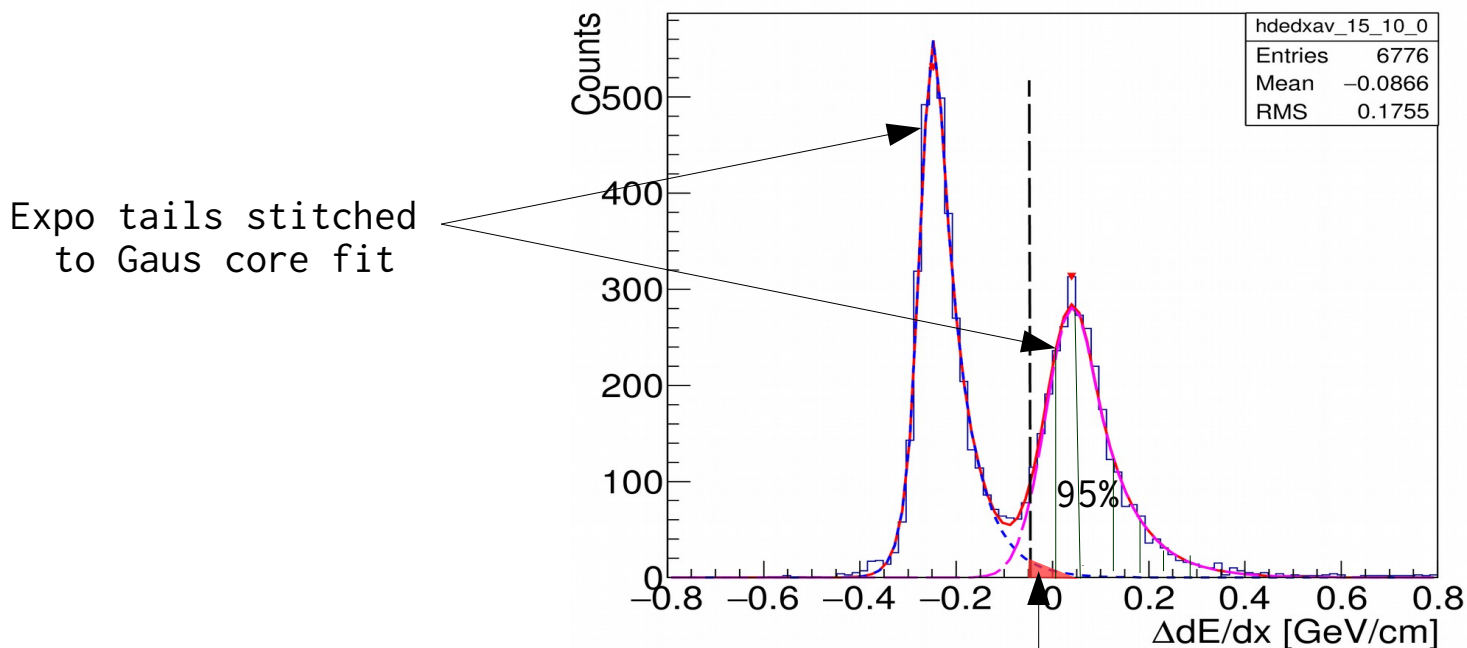


optimal truncation (based on separation power)



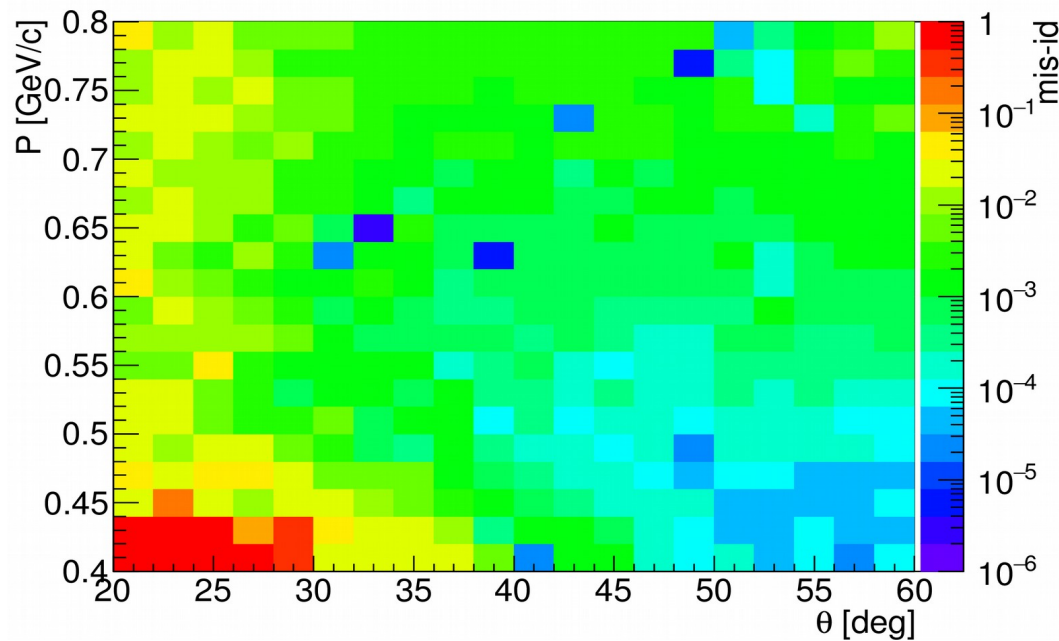
Mis-id

- 3rd method: lowest mis-id => optimal truncation.

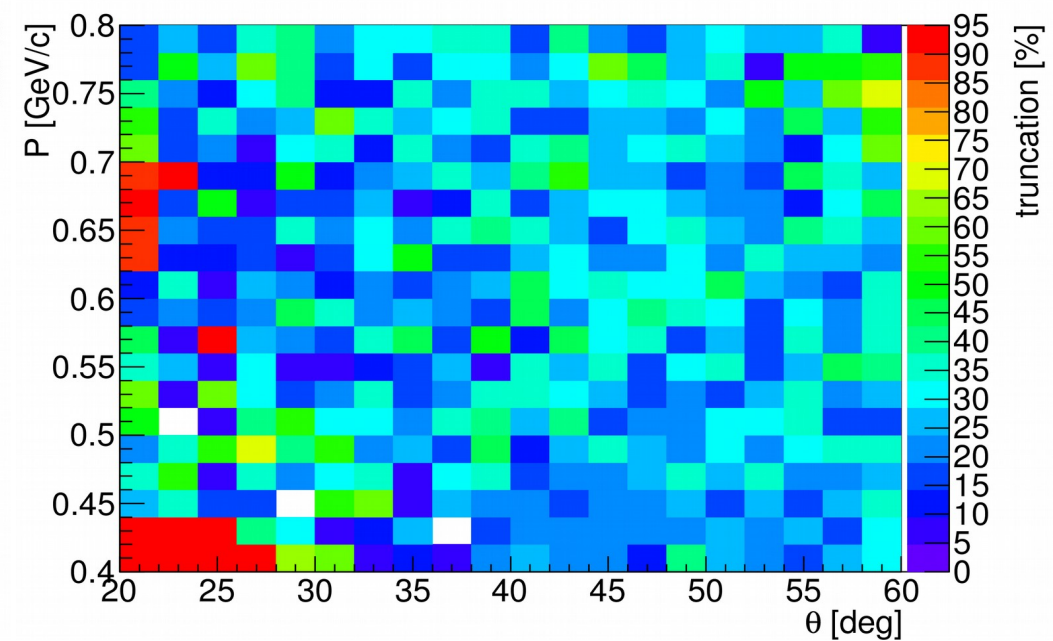


- 3rd method: optimal truncation ~25%

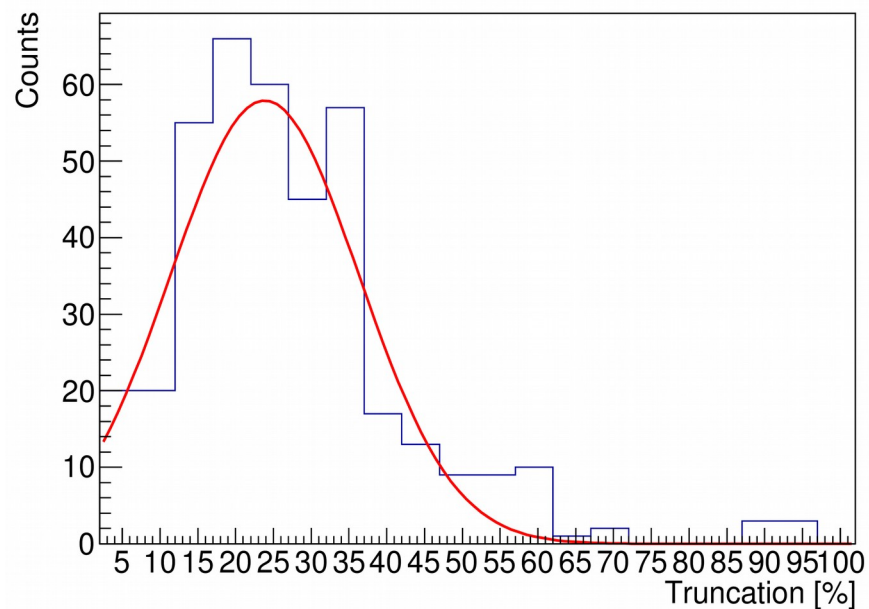
Momentum vs. θ vs. optimal mis-id



Momentum vs. θ vs. optimal truncation (mis-id)



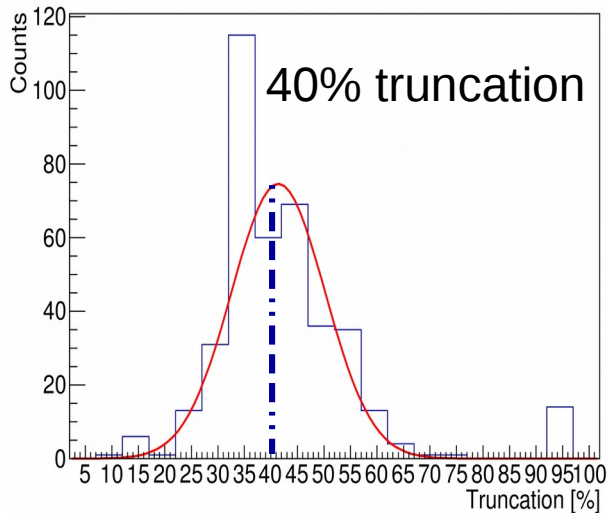
optimal truncation (based on mis-id)



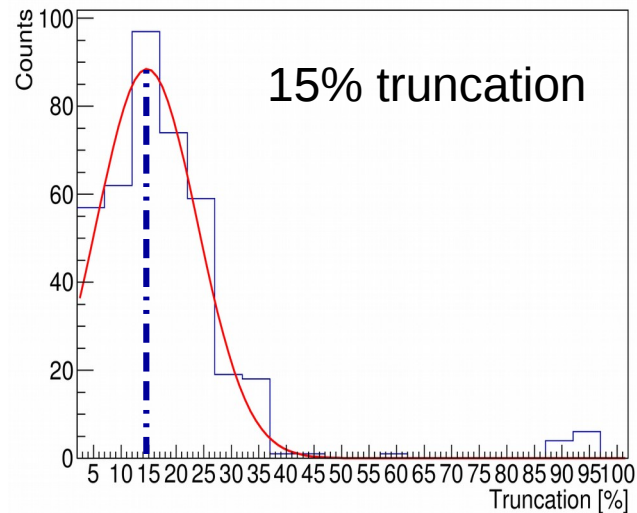
Results & perspectives

- The dE/dx optimal truncations found are different from the currently used one (50%).
- The dE/dx optimal truncation is different for each classifier.

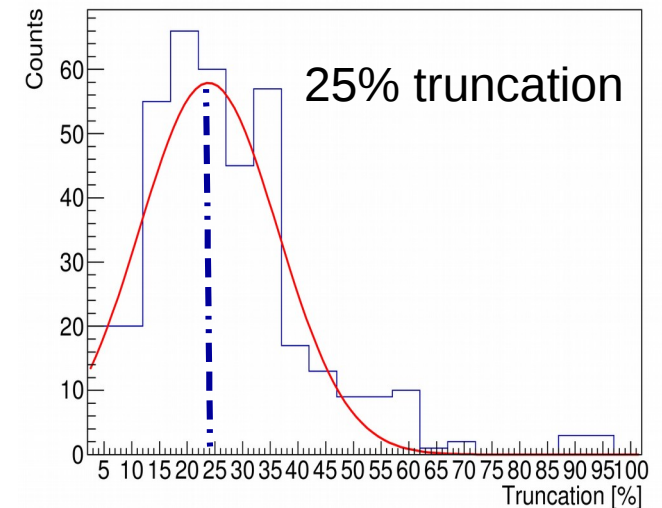
optimal truncation (based on resolution)



optimal truncation (based on separation power)



optimal truncation (based on mis-id)



Next:

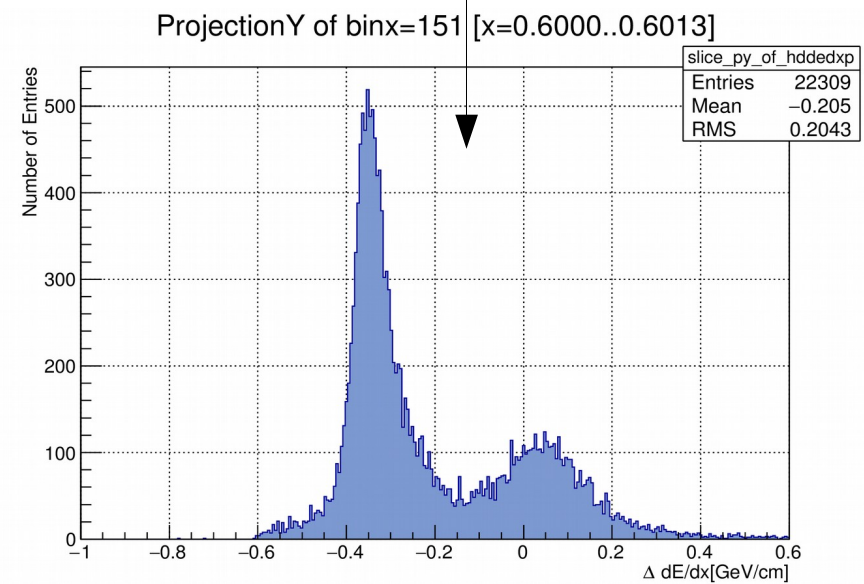
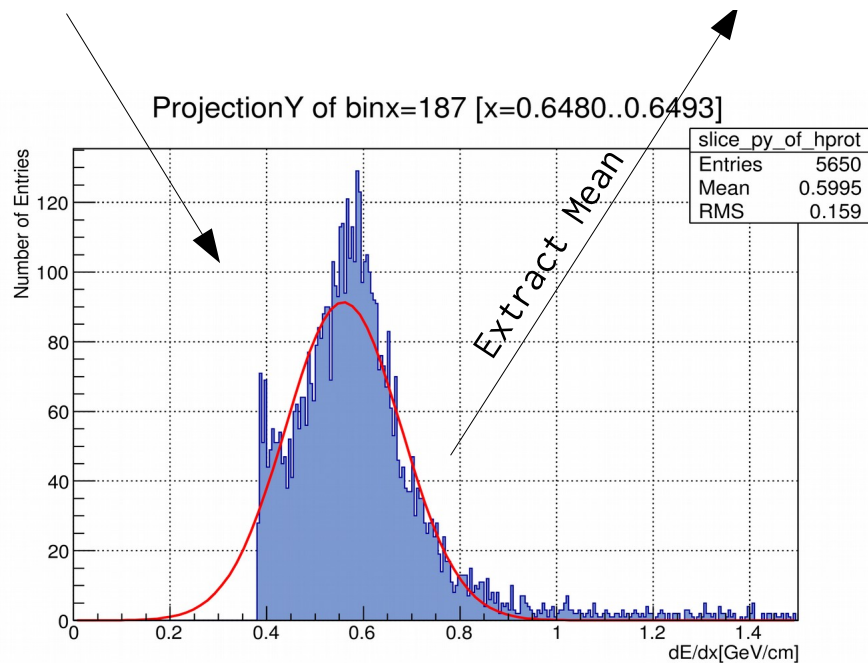
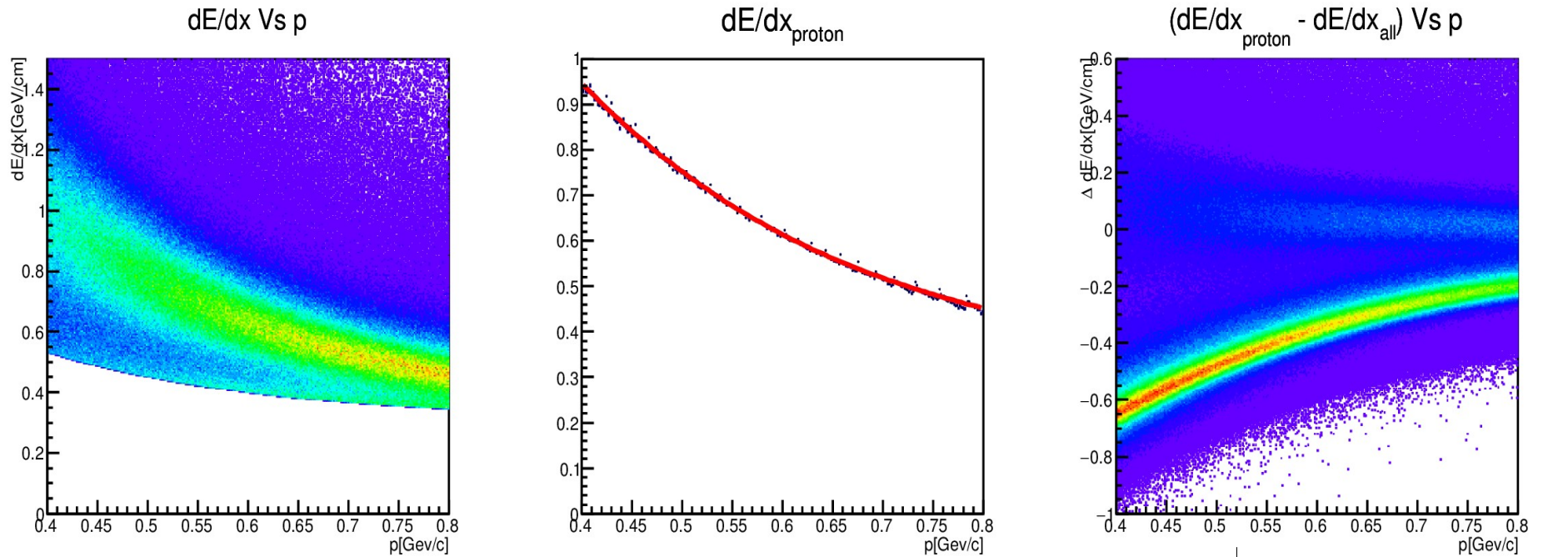
- Study the optimal truncation in exclusive channels:
 - Clean samples of different particles to improve separation power.
- Study the potential of a double truncated mean method.
- Study other possible calibration that might be needed (e.g.: entrance angle & space-charge effect).
- Determine dE/dx resolution for different momenta and particle types.

Thank you for your attention

Backup

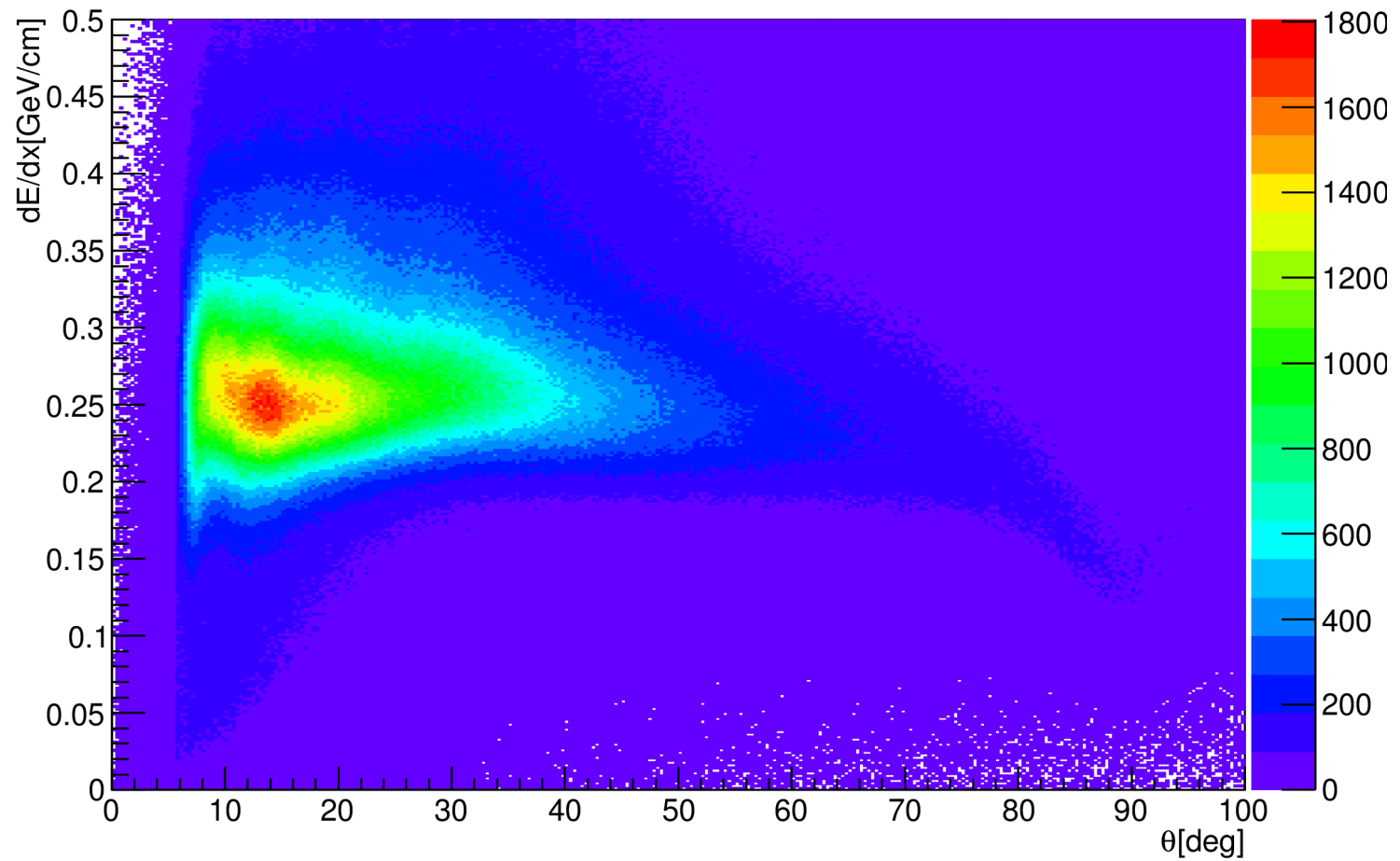
Procedure

- 2nd step: extract the expected dE/dx for protons



- dE/dx vs. θ

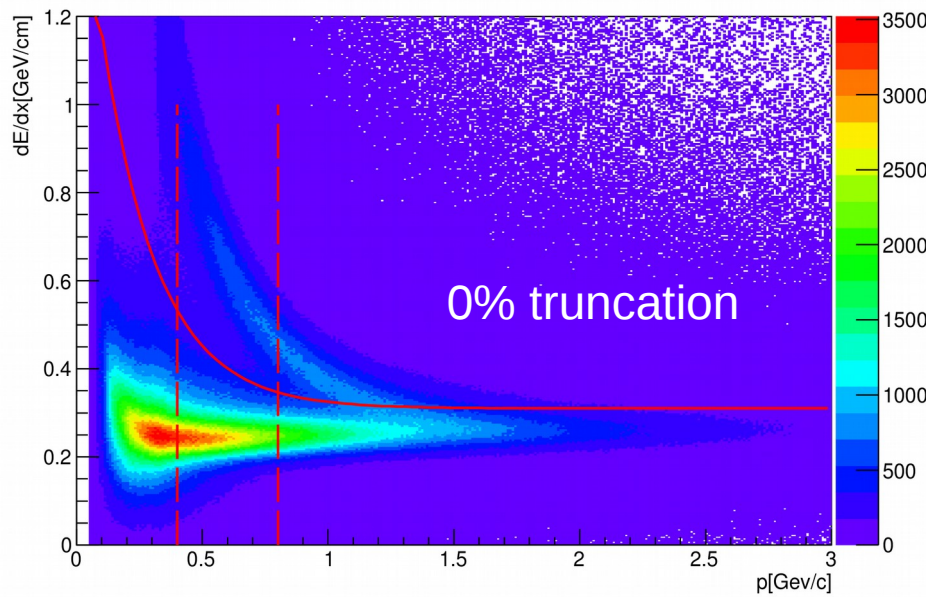
dE/dx Vs θ



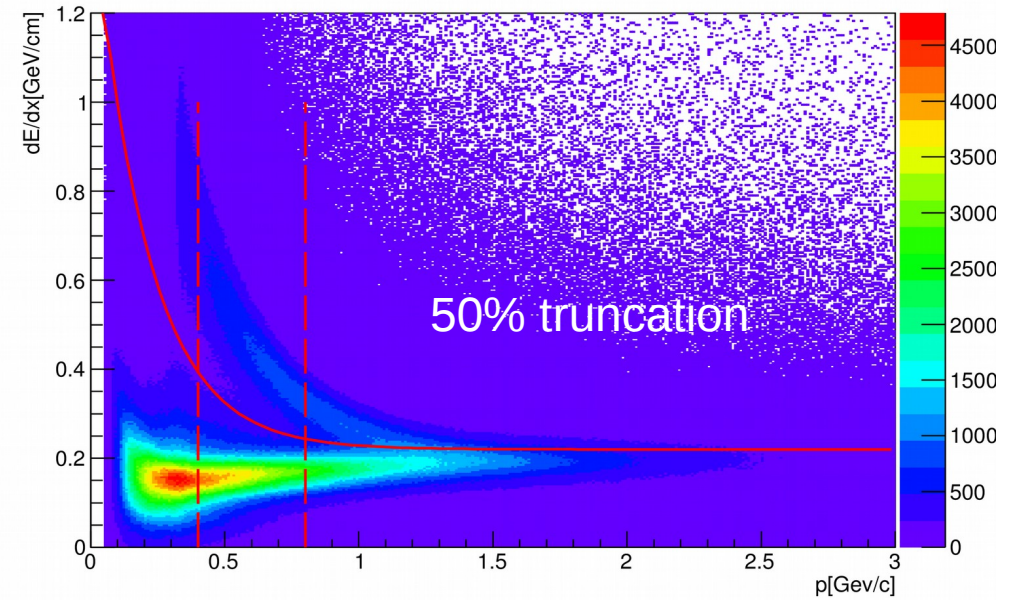
Procedure

- dE/dx dependence of truncation (different cuts)

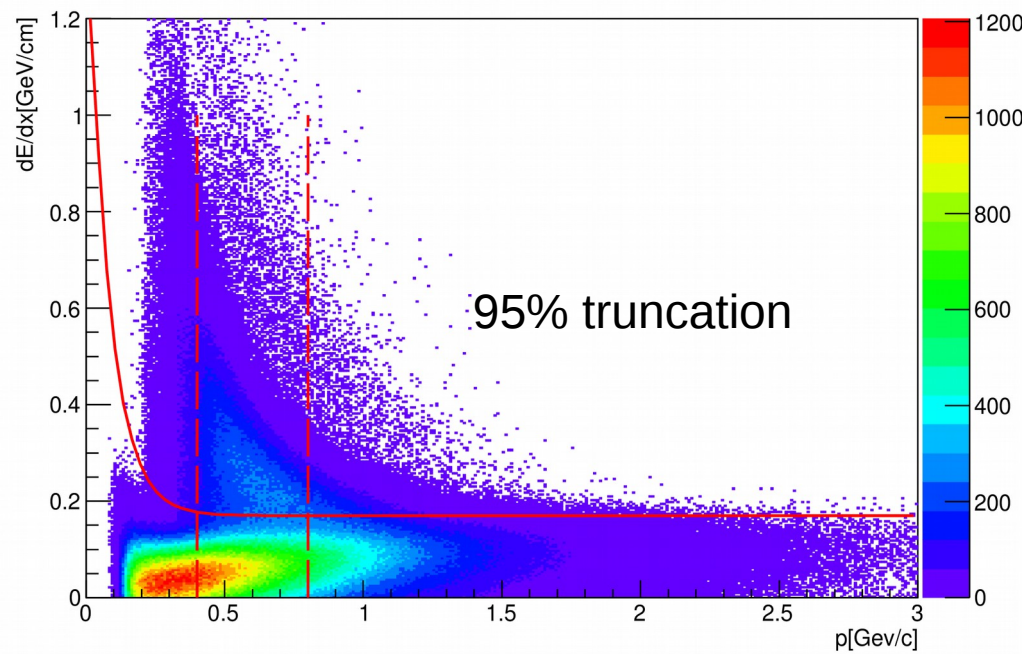
dE/dx Vs p



dE/dx Vs p

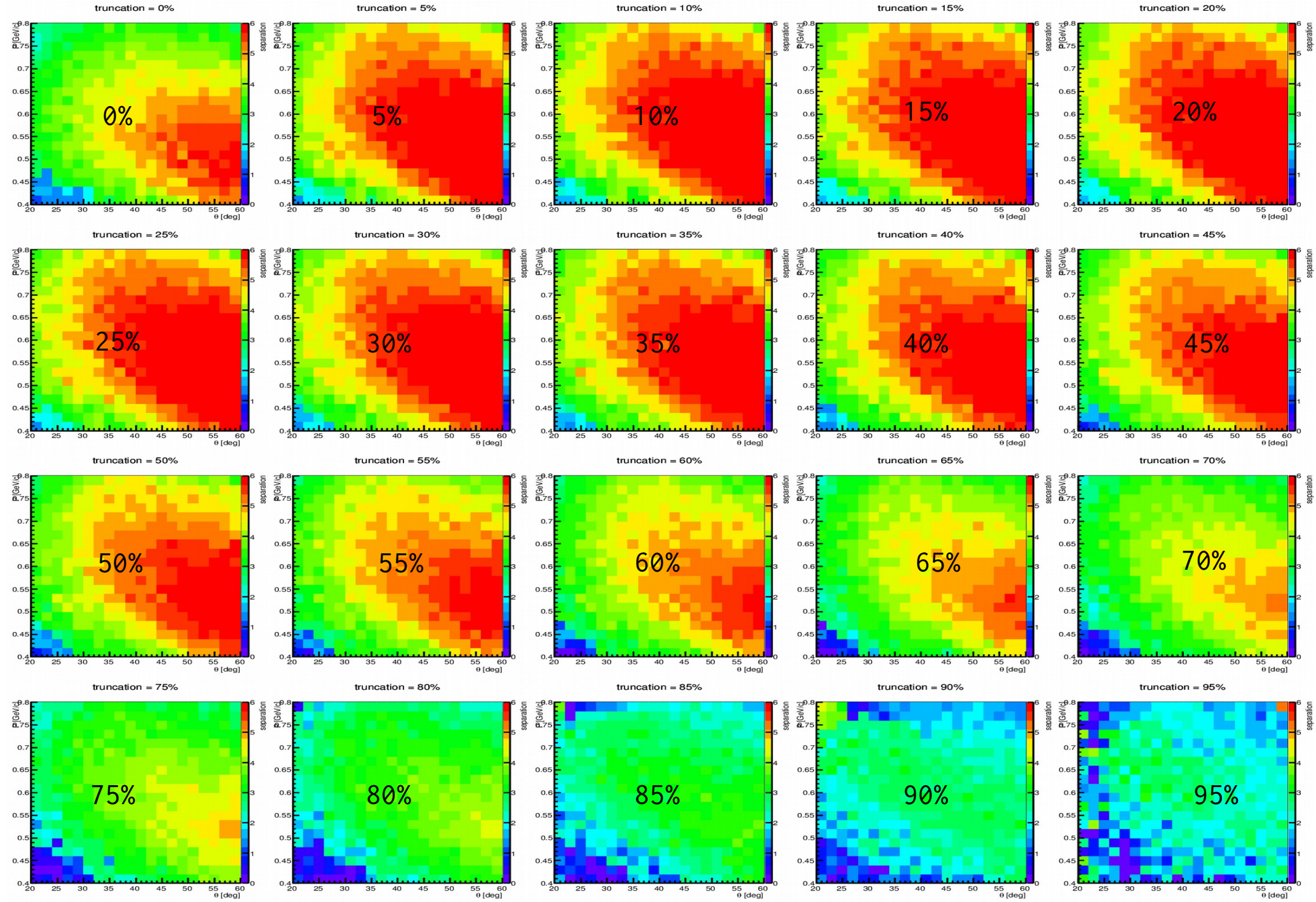


dE/dx Vs p



Separation Power

- 2nd method: strongest separation power => optimal truncation.



Mis-id

- 3rd method: lowest mis-id => optimal truncation.

