Low energy ER/NR discrimination

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Data and MC samples

For Data:

- Bkg runs (Golden Runs in run2) : 11289-12191
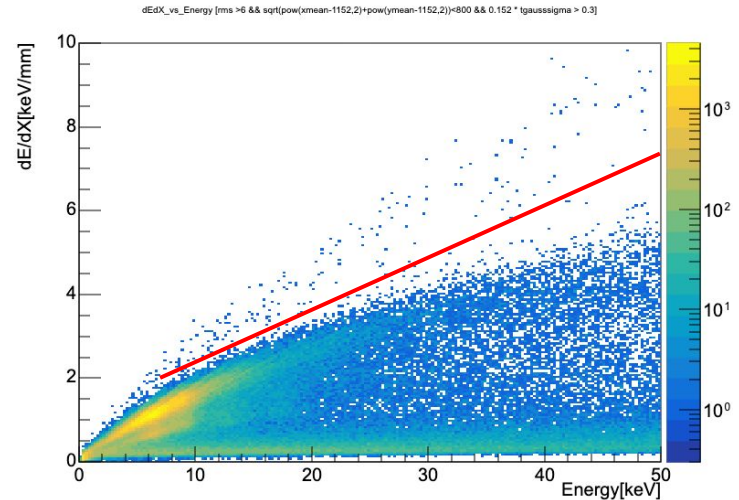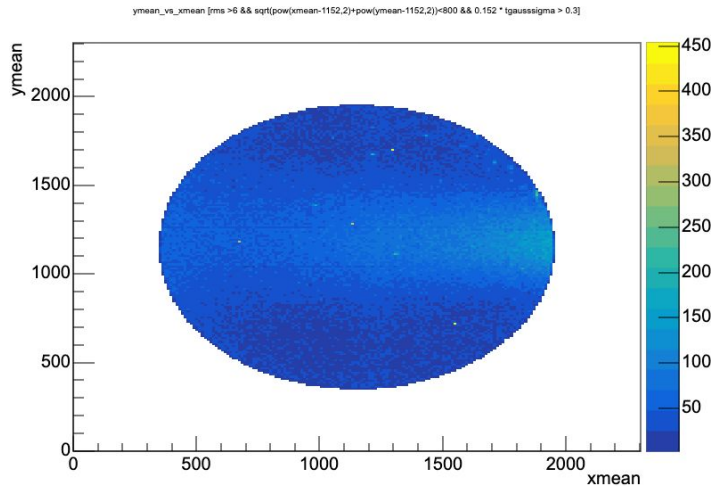- Fe data (LY runs in run2) : 8882-9850

MC samples:

- ER simulations : 2 - 50 keV
- NR simulations : 3 - 60 keV

Selections

cut0 = "rms >6 && sqrt(pow(xmean-1152,2)+pow(ymean-1152,2))<800 && 0.152 * tgausssigma > 0.3"
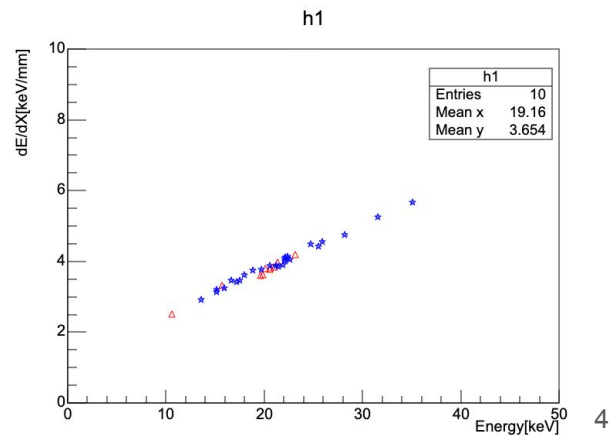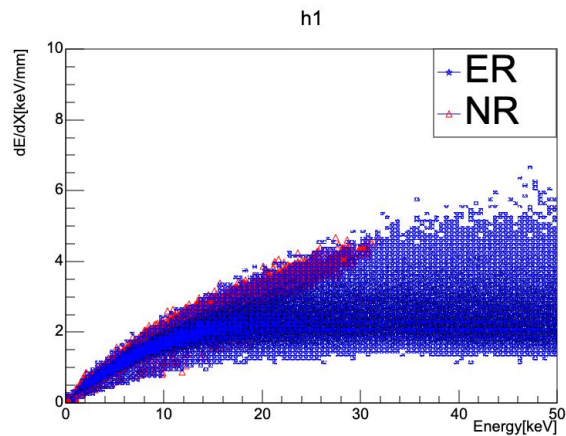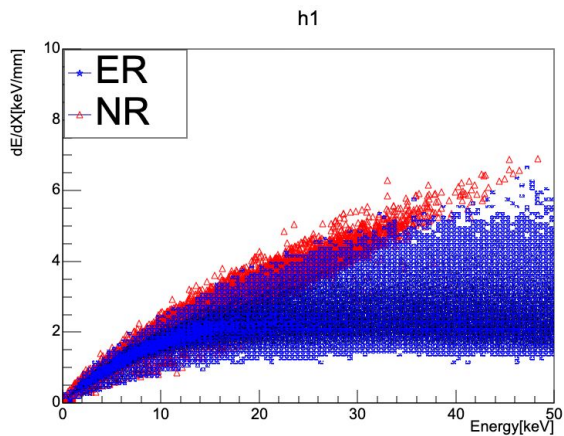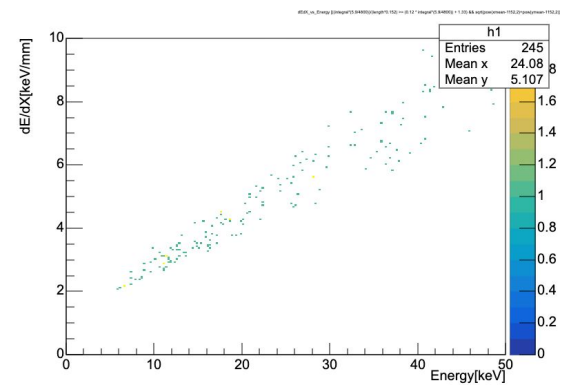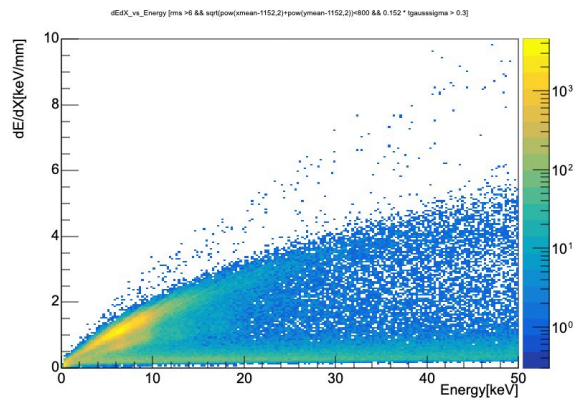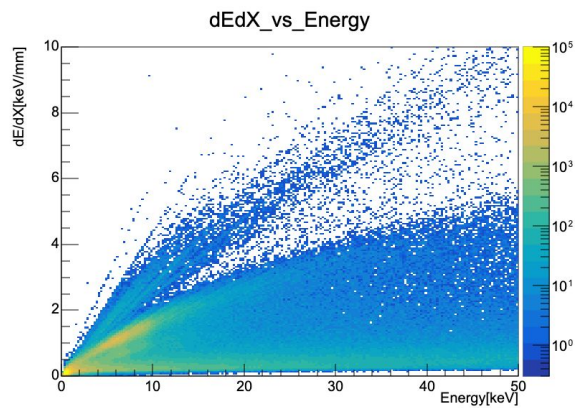
cut1 = "((integral*(5.9/4800))/(length*0.152) >= (0.12 * integral*(5.9/4800)) + 1.33) && rms >6 && sqrt(pow(xmean-1152,2)+pow(ymean-1152,2))<800 && 0.152 * tgausssigma > 0.3 "
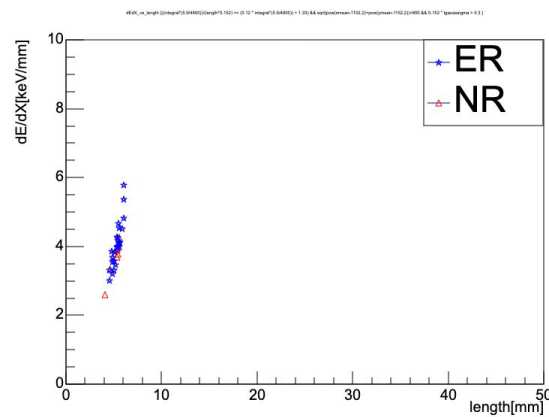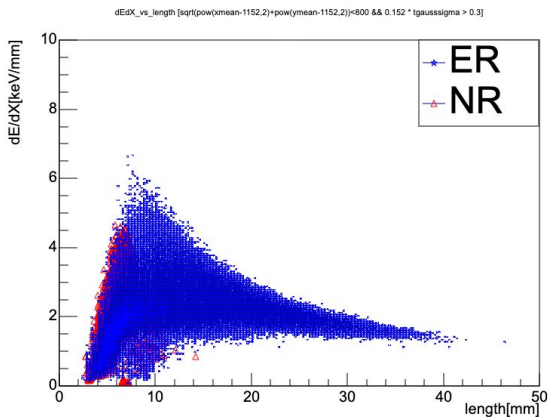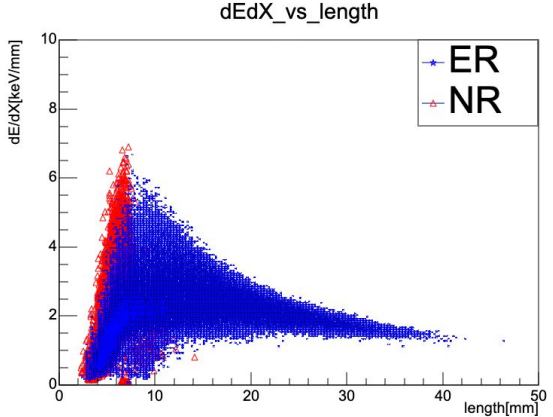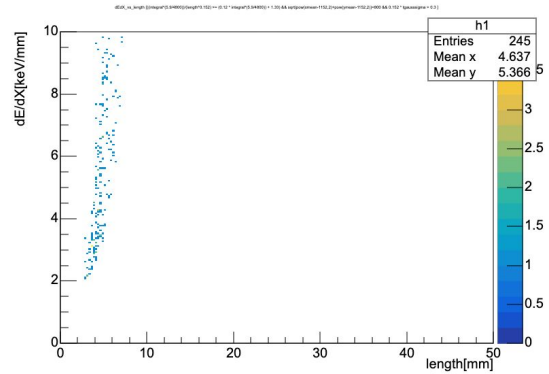

3

Ionization Pattern
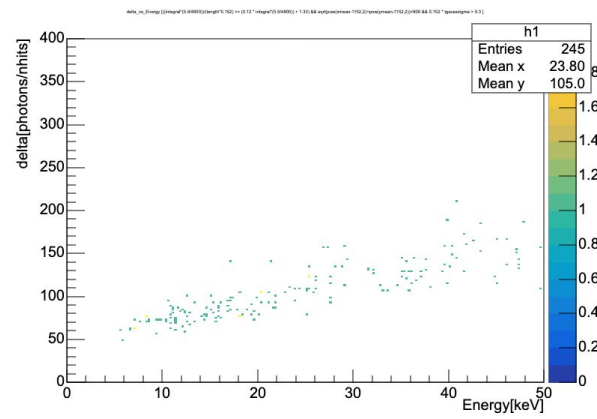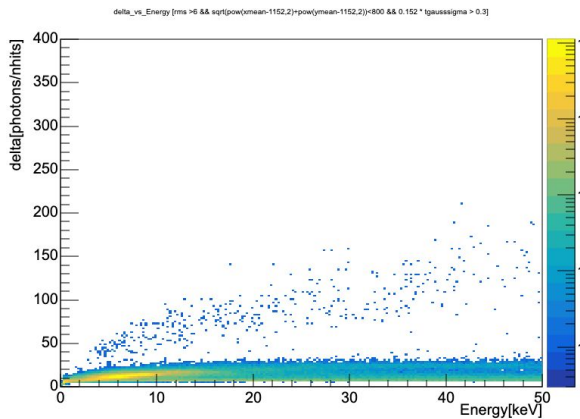
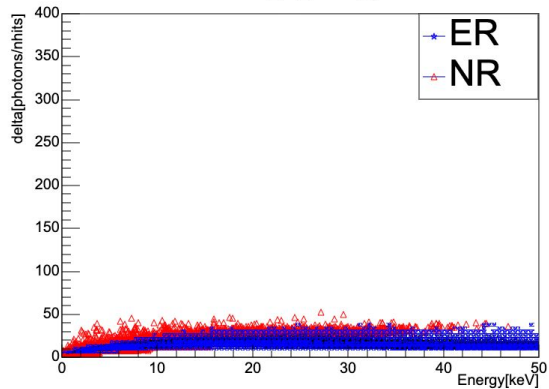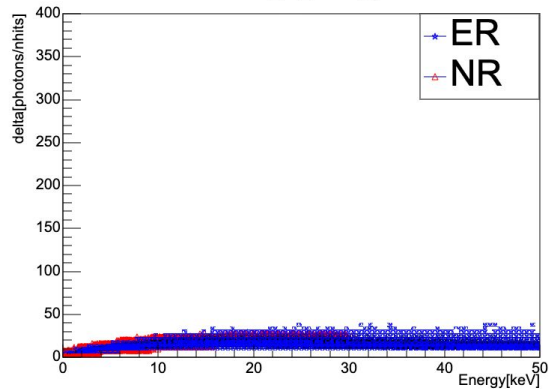**Col 1:** W/O cut **Col 2:** cut0   **Col 3**: cut1

Energy release along the length
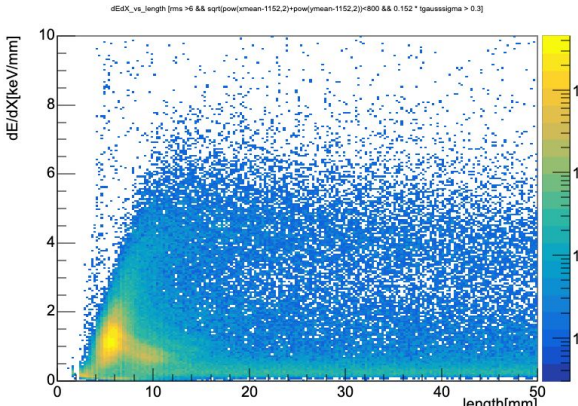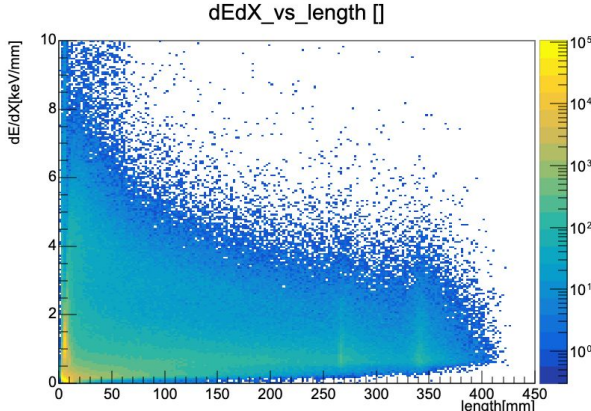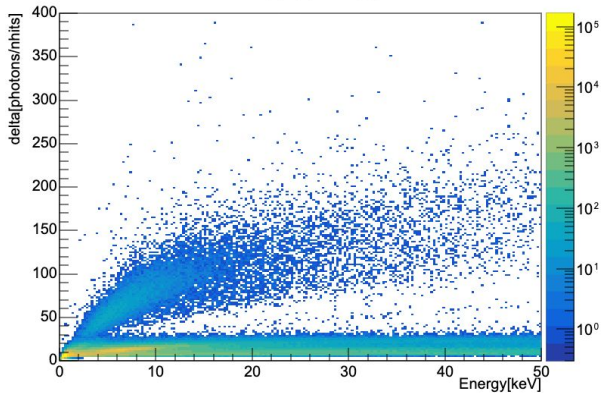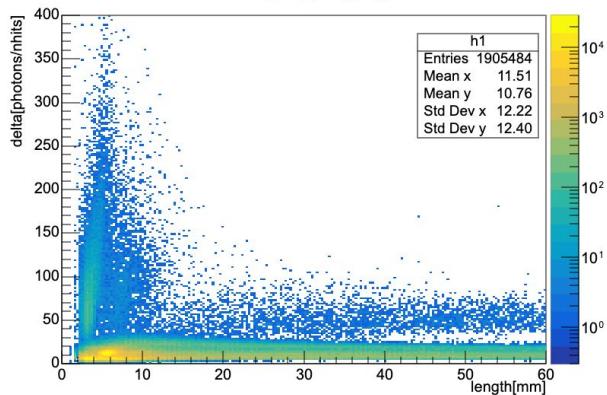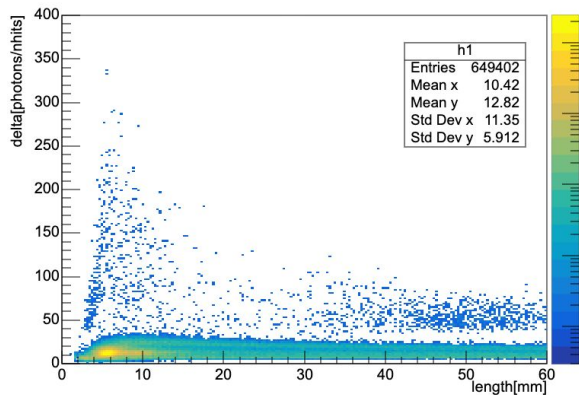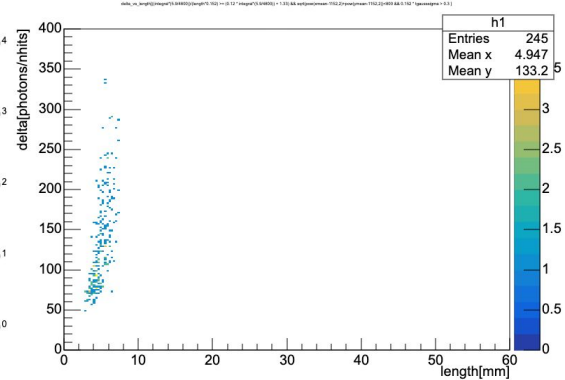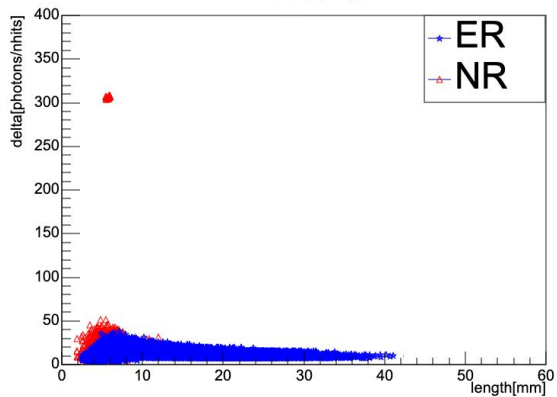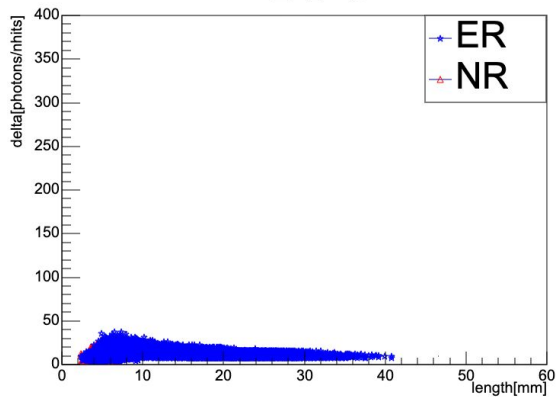
Delta vs Energy

Delta vs length

SDCD vs energy

Integral

Saturation in NR simulation
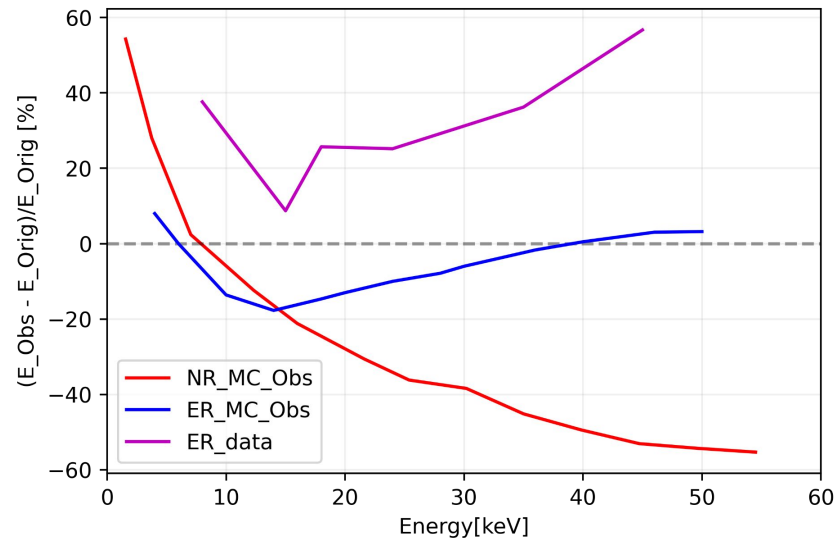
Linearity without calibration
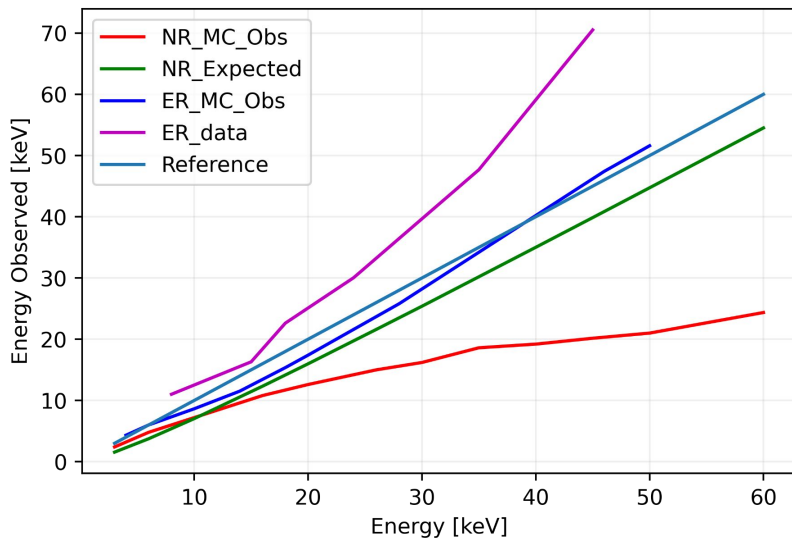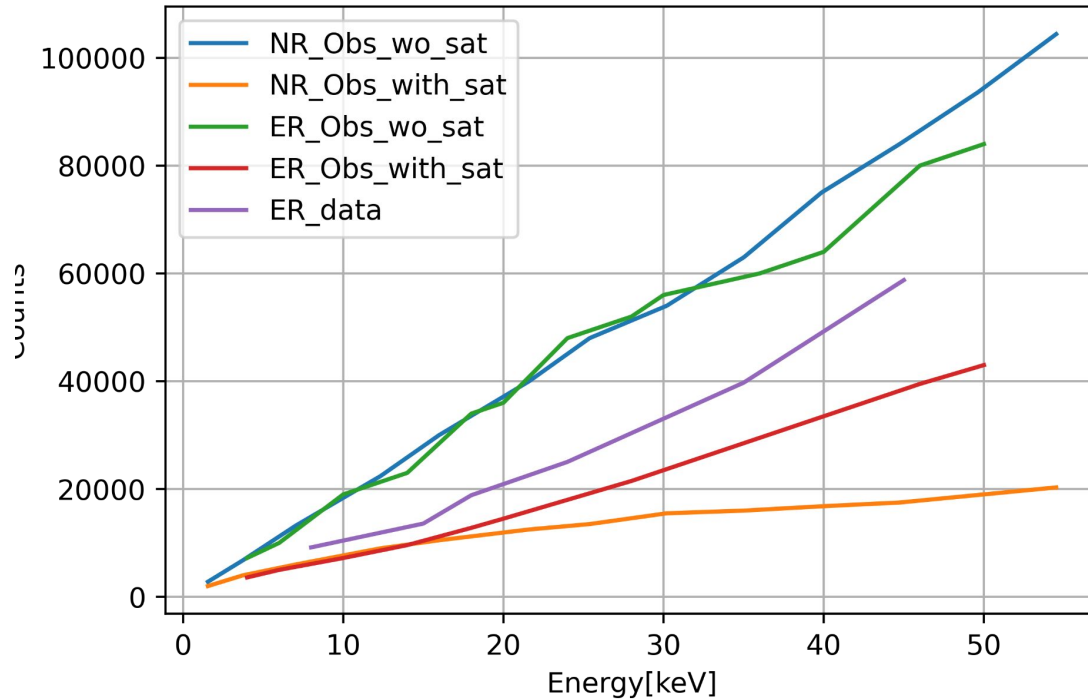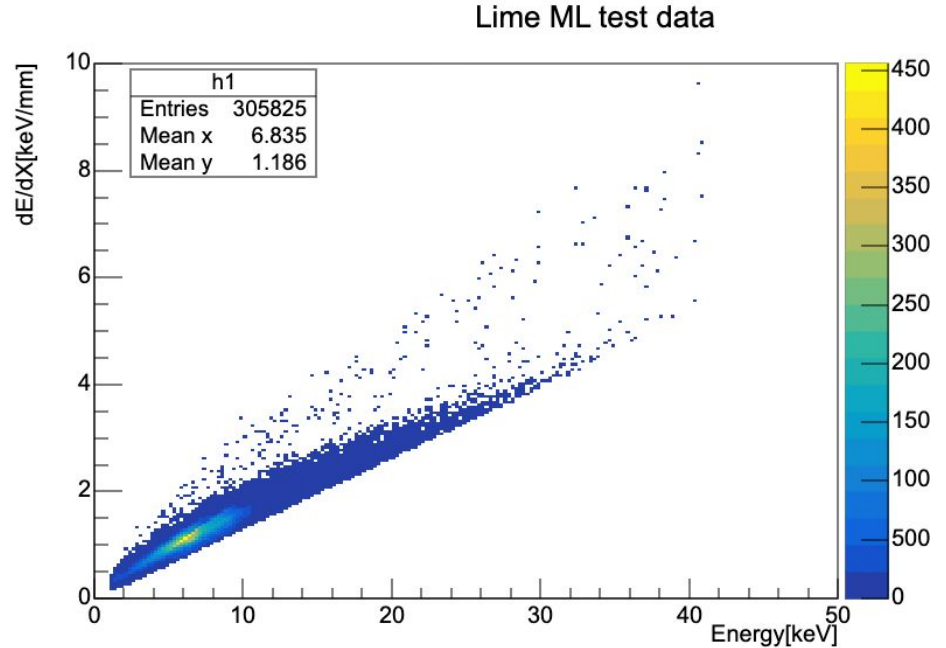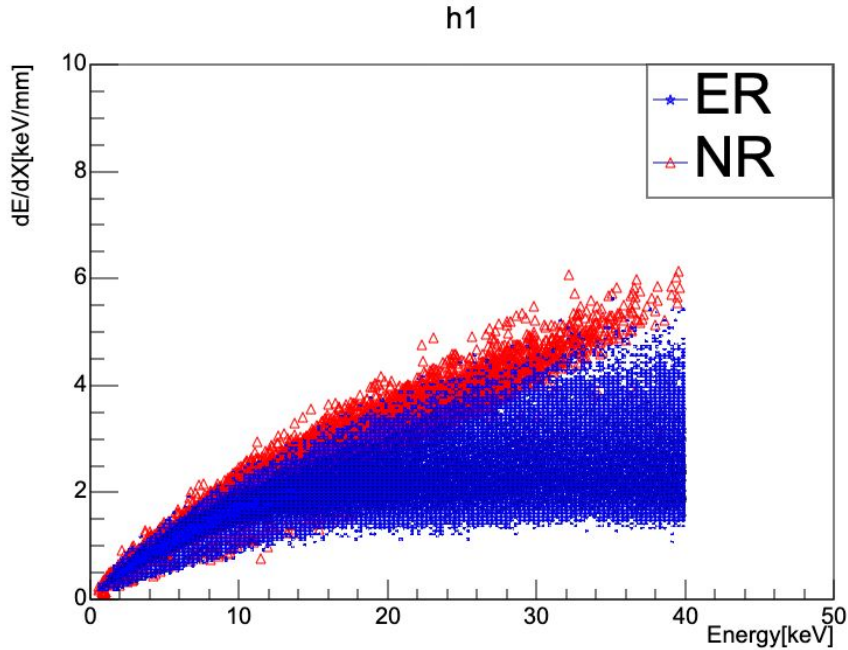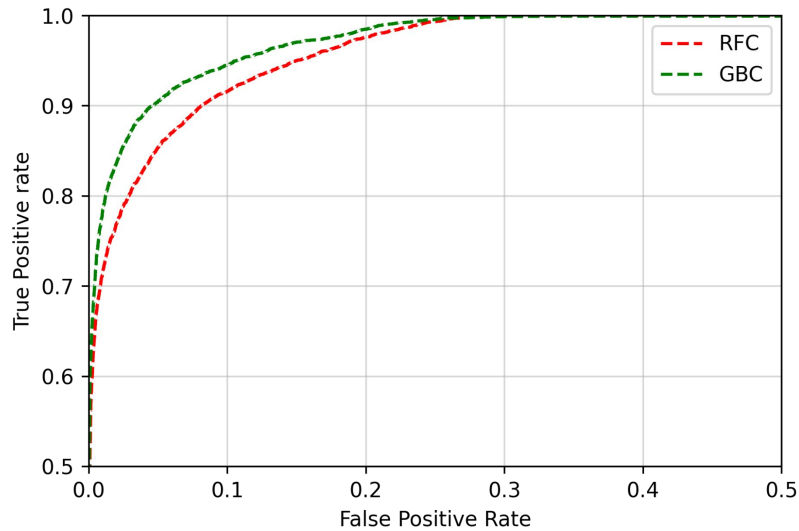
Testing ML algorithms on lime data

ML Input and Lime testing data

Lime data is selected with the cut :"rms >6 && sqrt(pow(xmean-1152,2)+pow(ymean-1152,2))<800 && 0.152 * tgausssigma > 0.3 && redpixIdx>=0 && integral*(6/5000)<40"

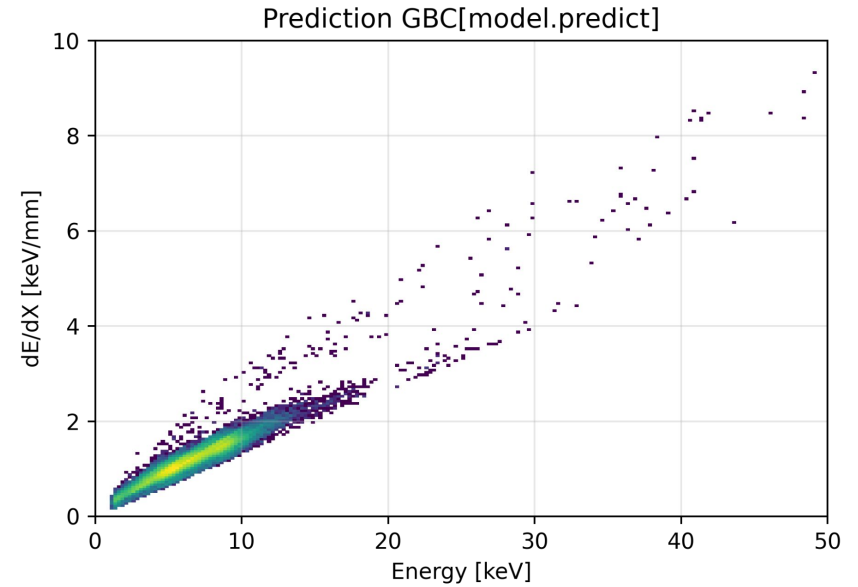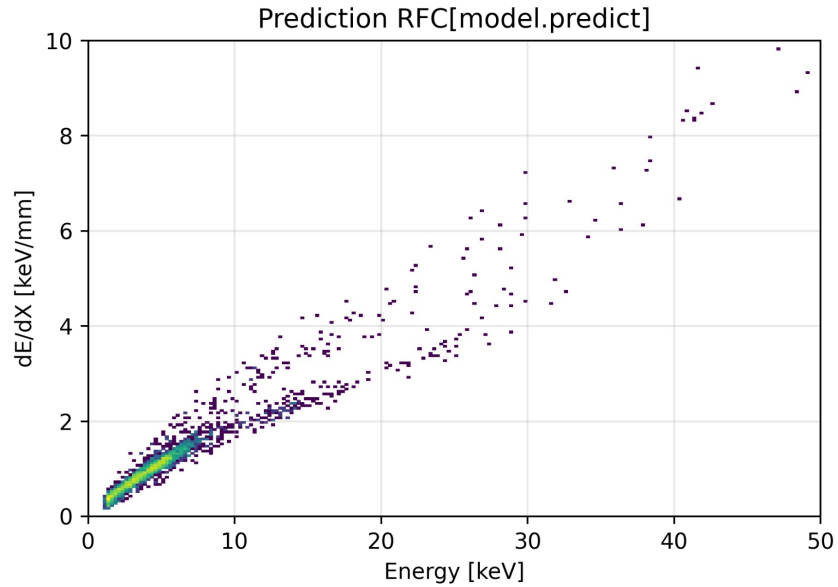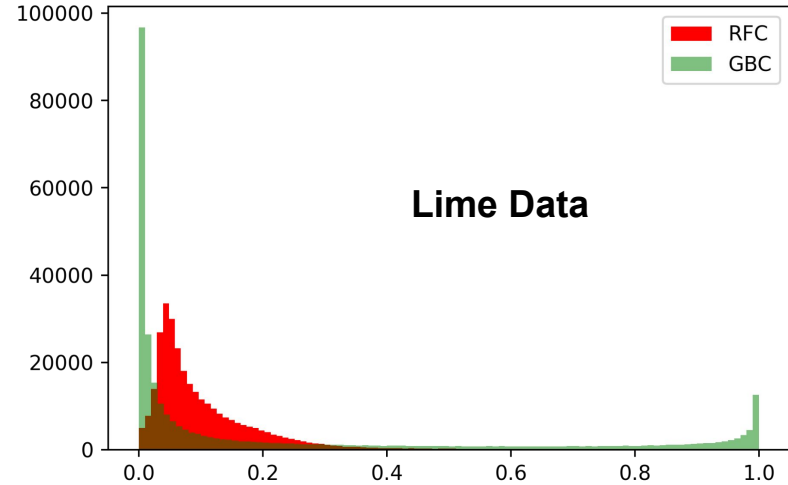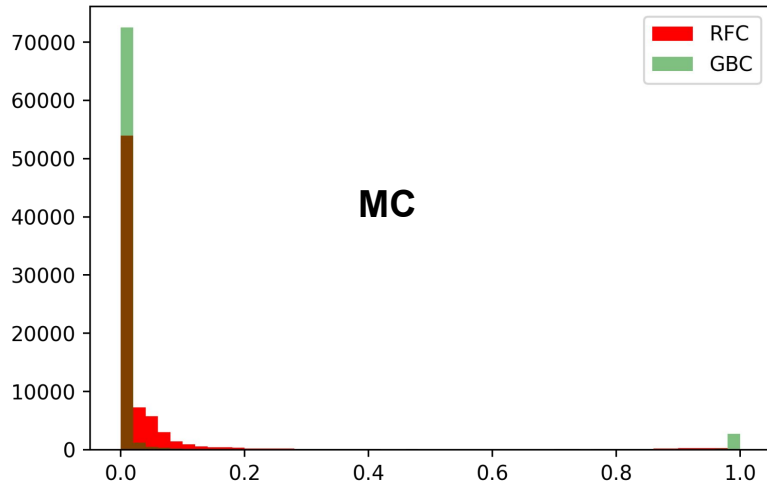# ML analysis
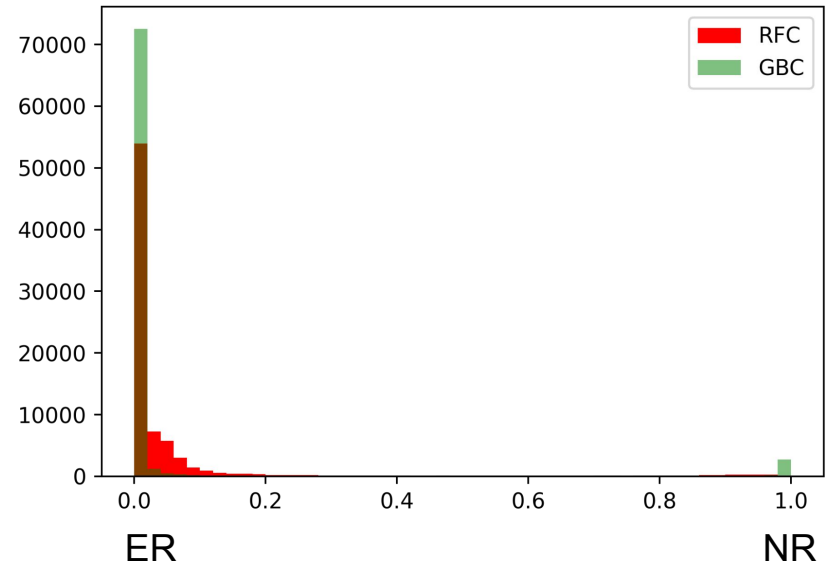
Confusion Matrix
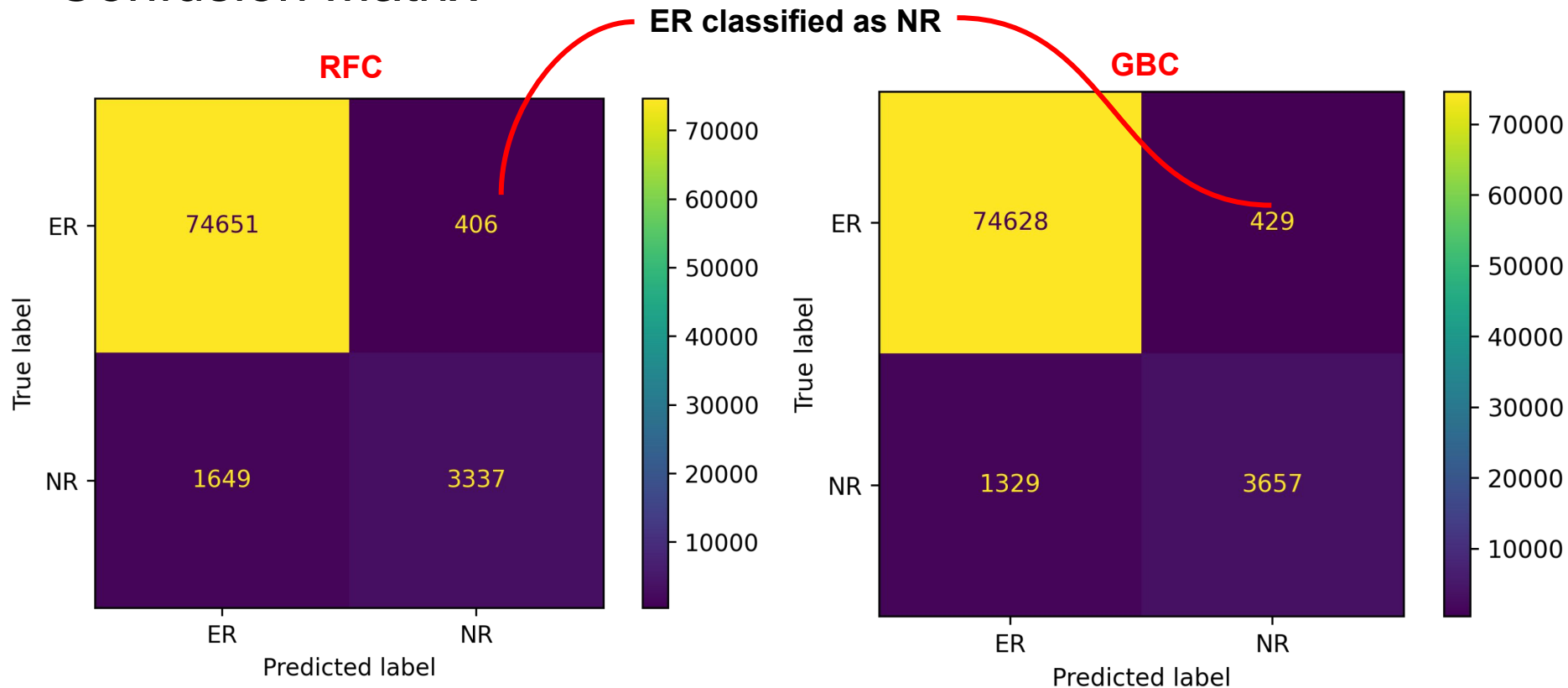
Predictions
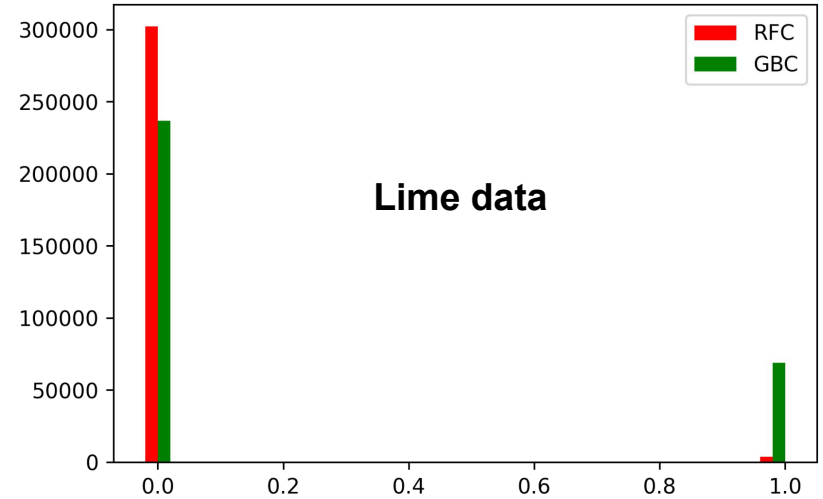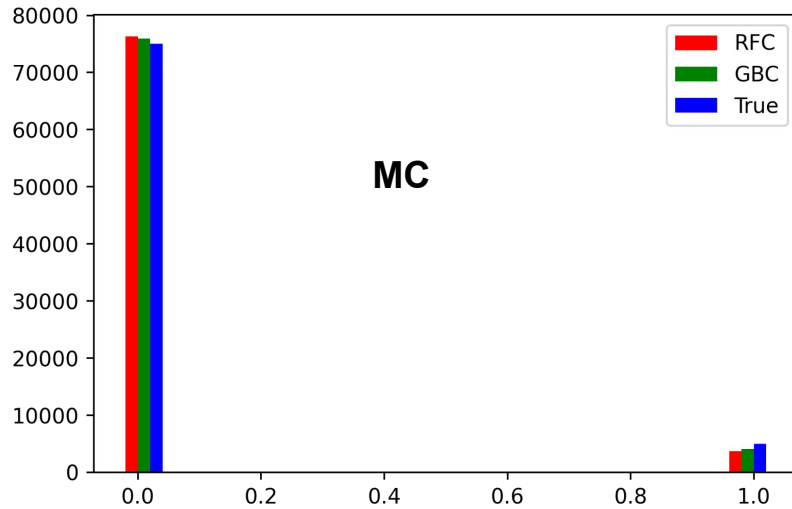
This prediction is using model.predict() method. This method classifies the events into two classes using the threshold which maximises the diagonal elements of CM.

NR events with predict

Prediction RFC[model.predict]
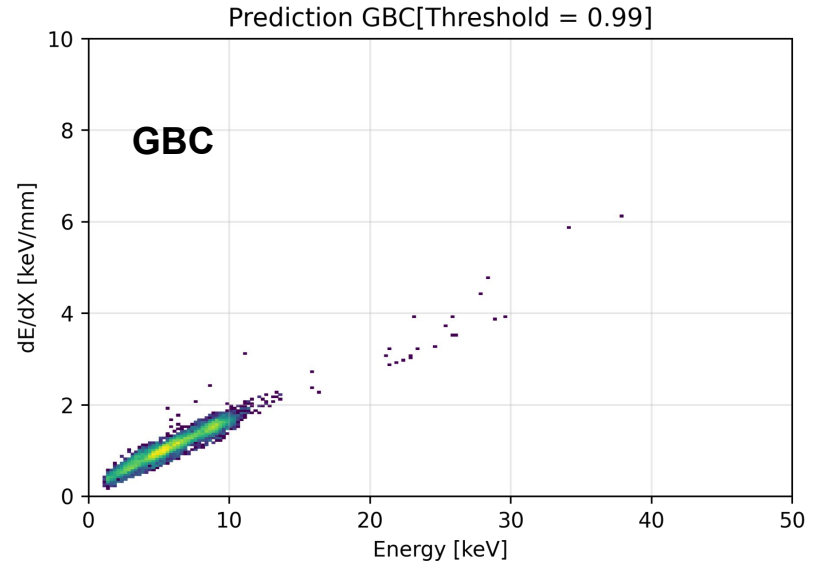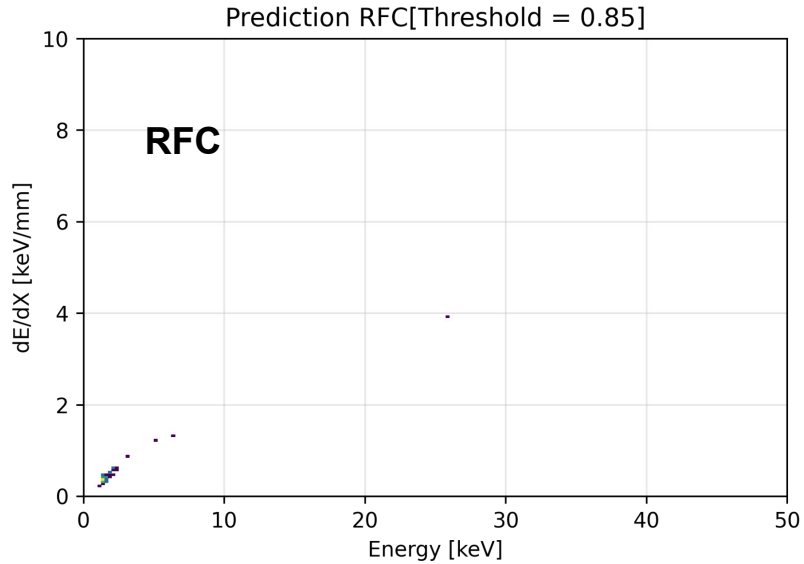
Prediction GBC[model.predict]
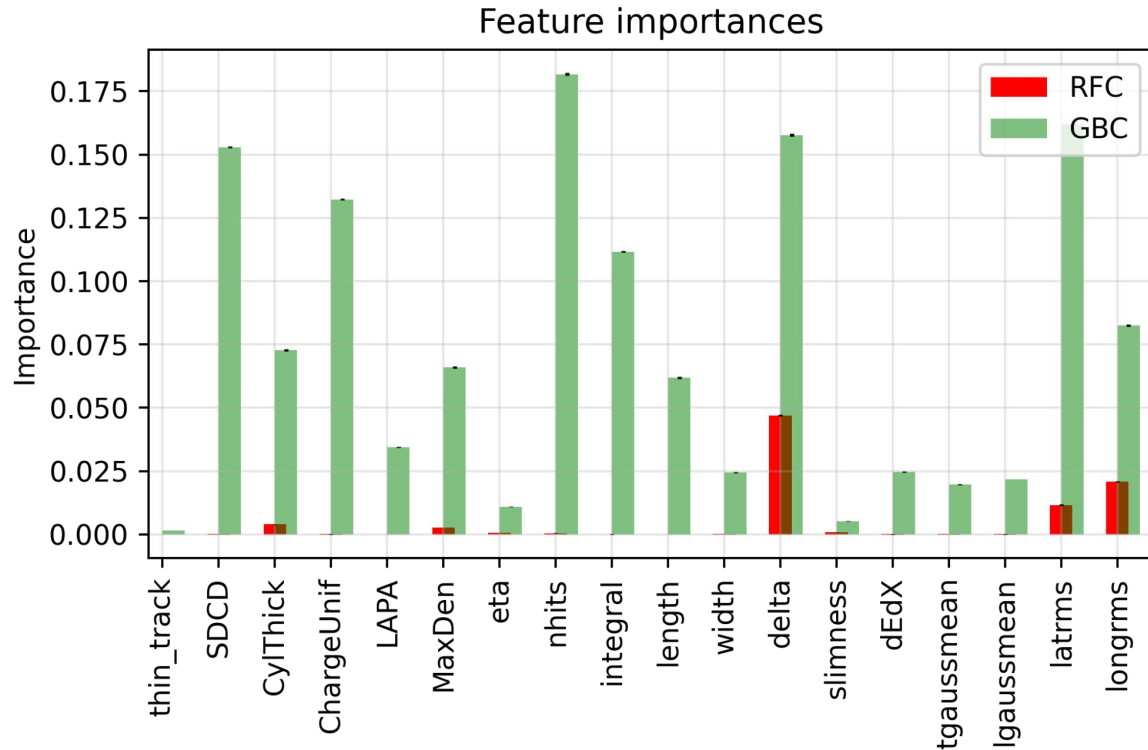
Probability Prediction

This prediction is using model.predict_proba() which gives a probability of each event to be in a given class.

Predicted NR events with variable threshold
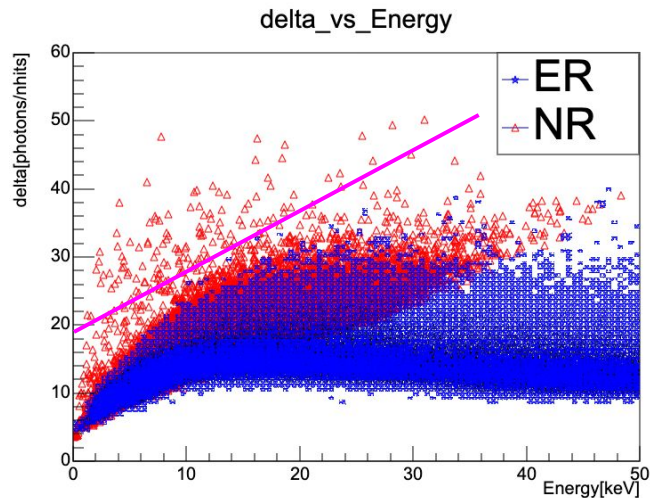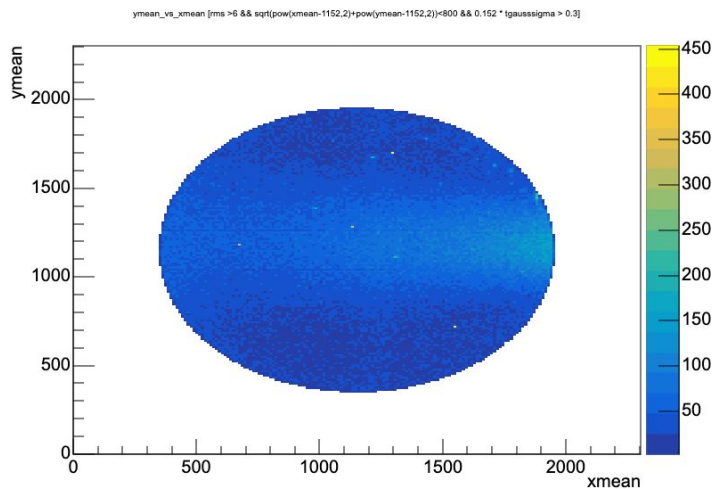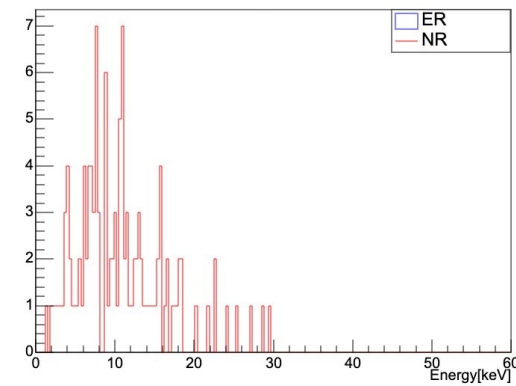
Feature Importance
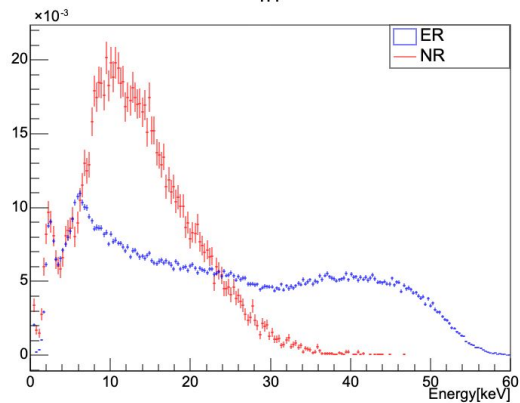

Feature importances

NR with MC selection

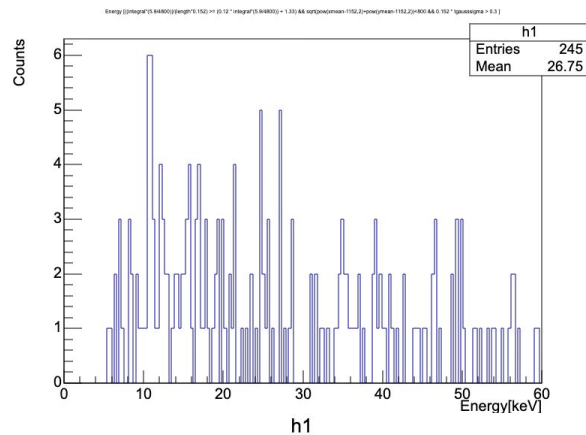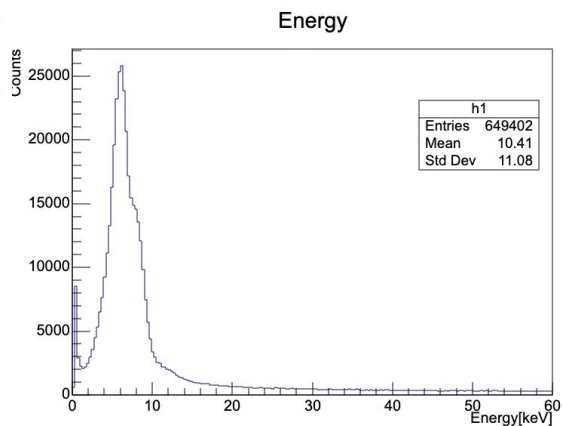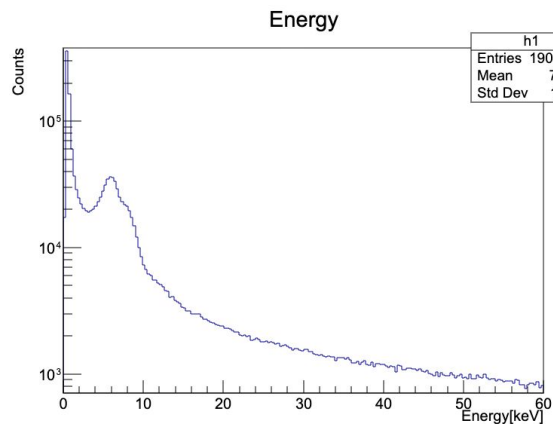# Selections

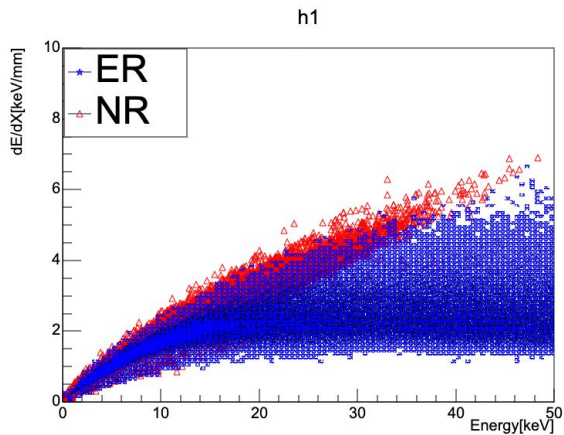**cut0** = "rms >6 && sqrt(pow(xmean-1152,2)+pow(ymean-1152,2))<800 && 0.152 * tgausssigma > 0.3"

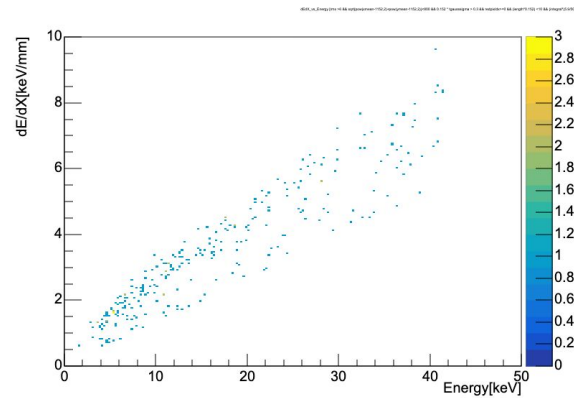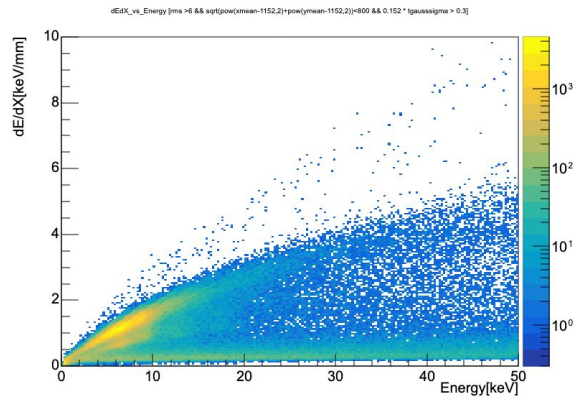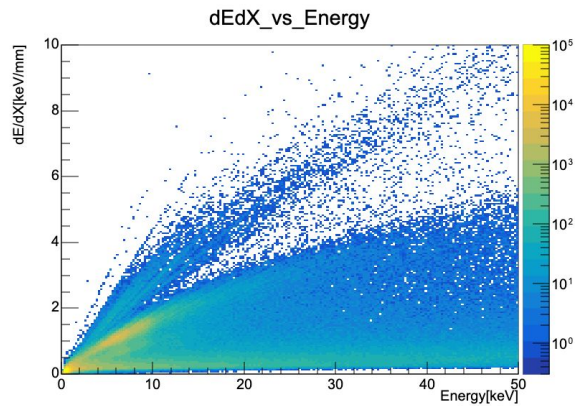**cut1 =** "rms >6 && sqrt(pow(xmean-1152,2)+pow(ymean-1152,2))<800 && 0.152 * tgausssigma > 0.3 && redpixIdx>=0 && (length*0.152) <10 && (integral*(5.9/5000))<=40 && delta>= (0.83*integral*(6/5000))+20"
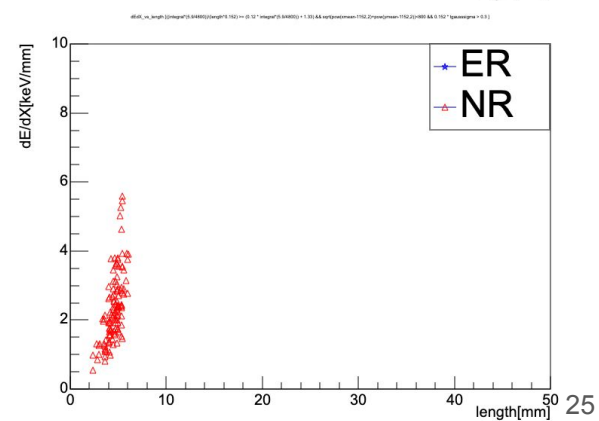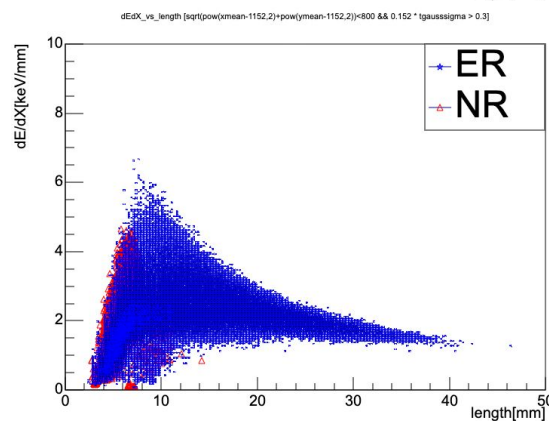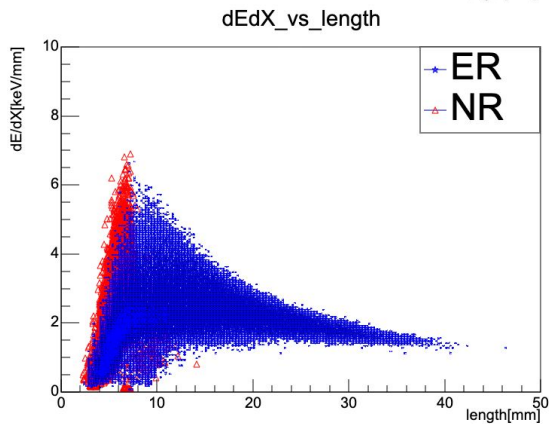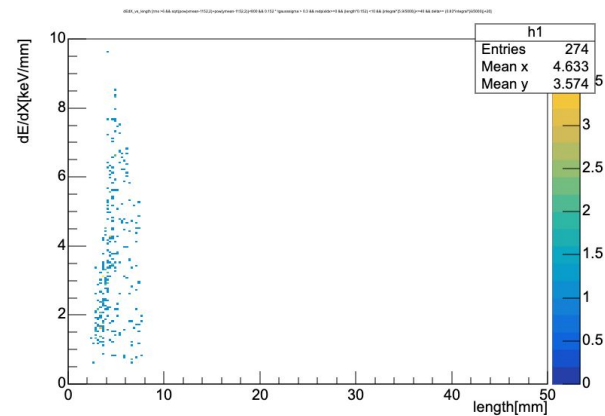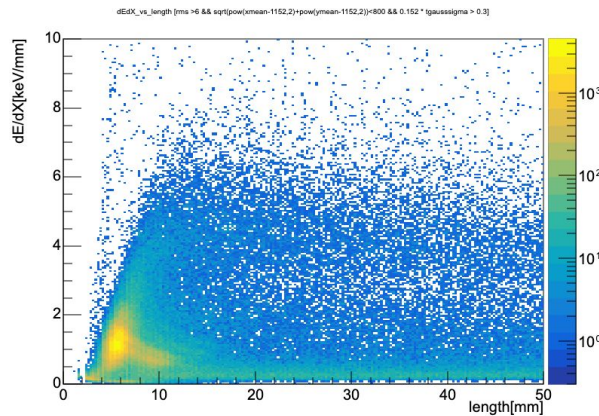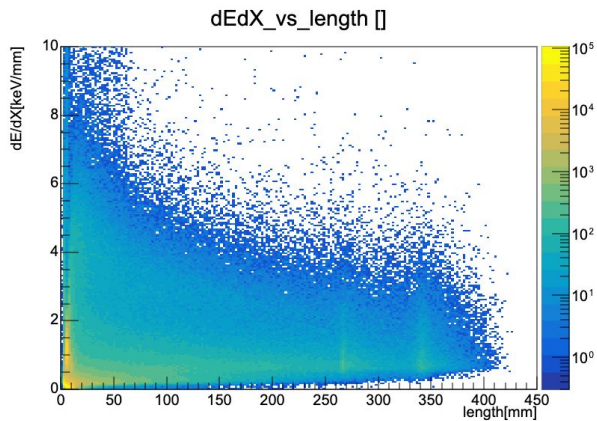
Integral
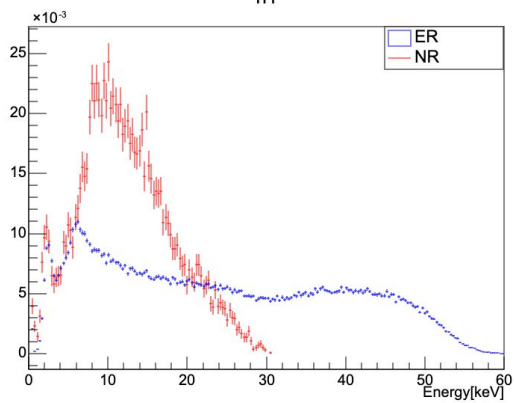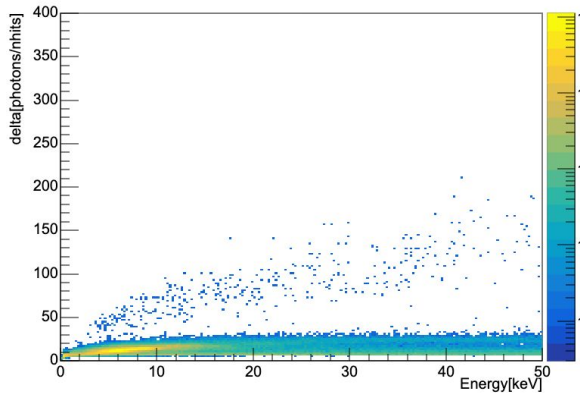
Ionization Pattern
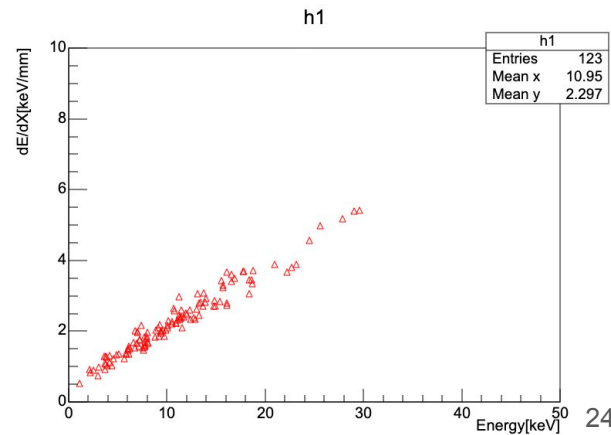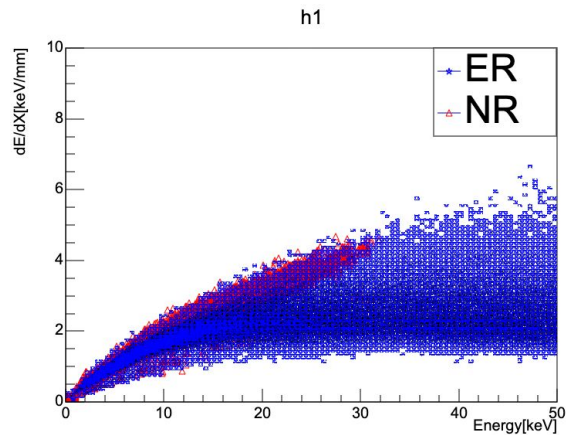
Energy release along the length
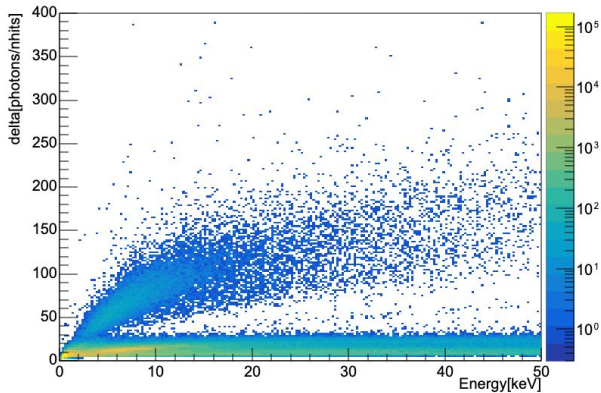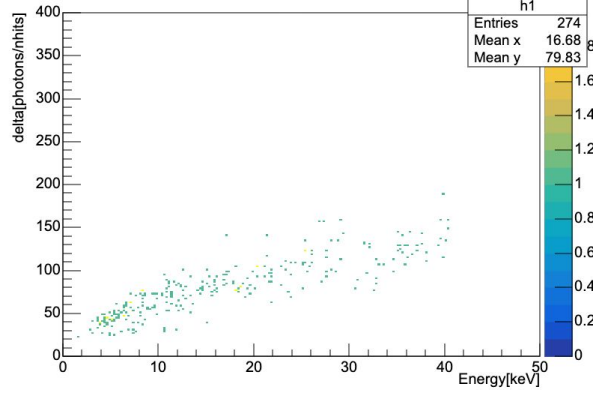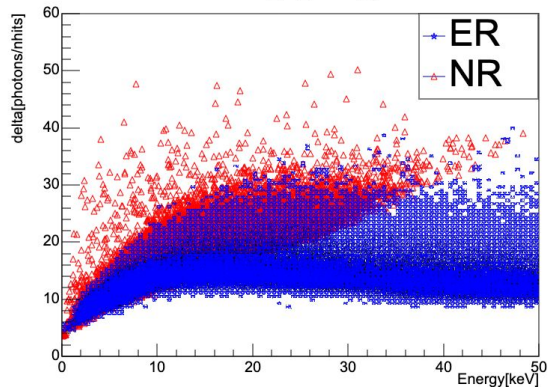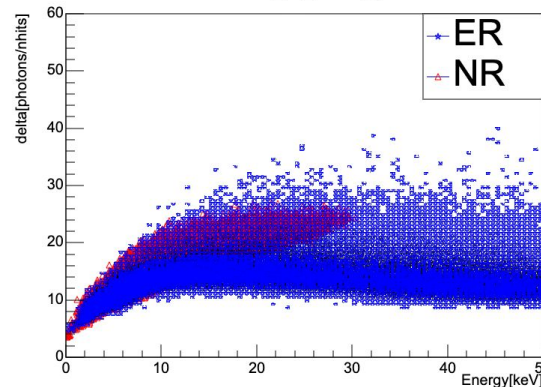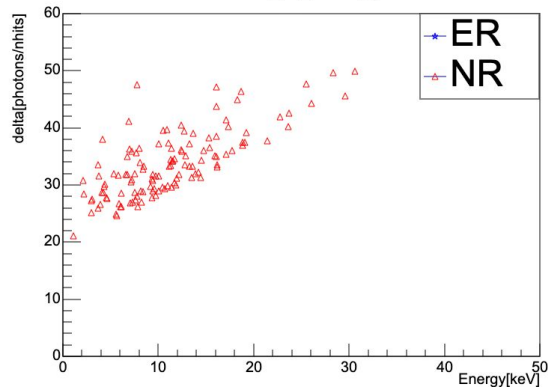
Delta vs Energy
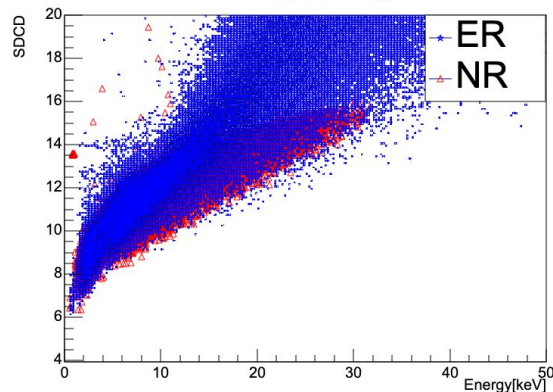
SDCD vs energy
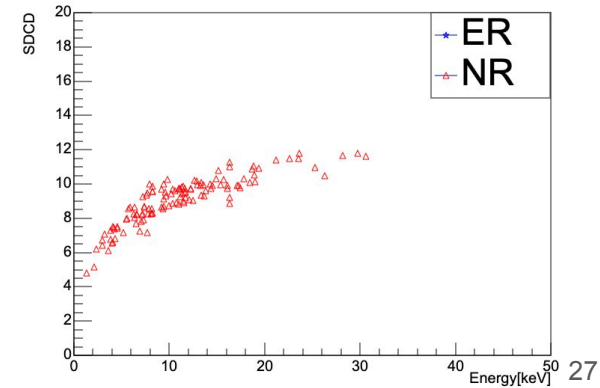
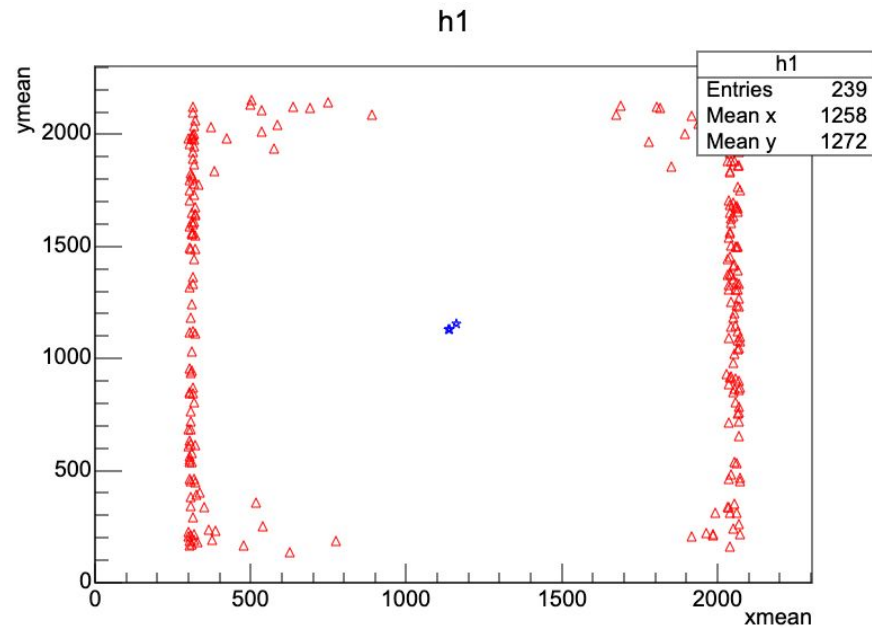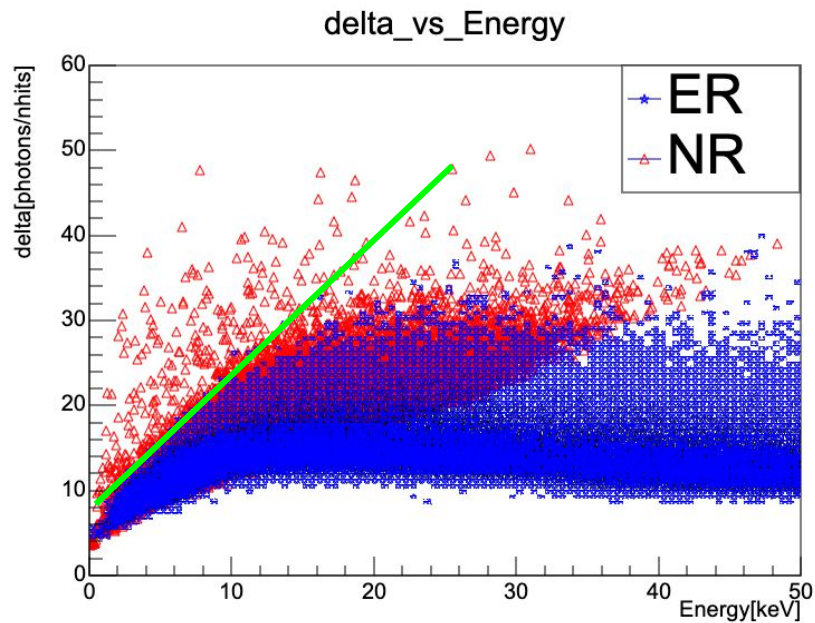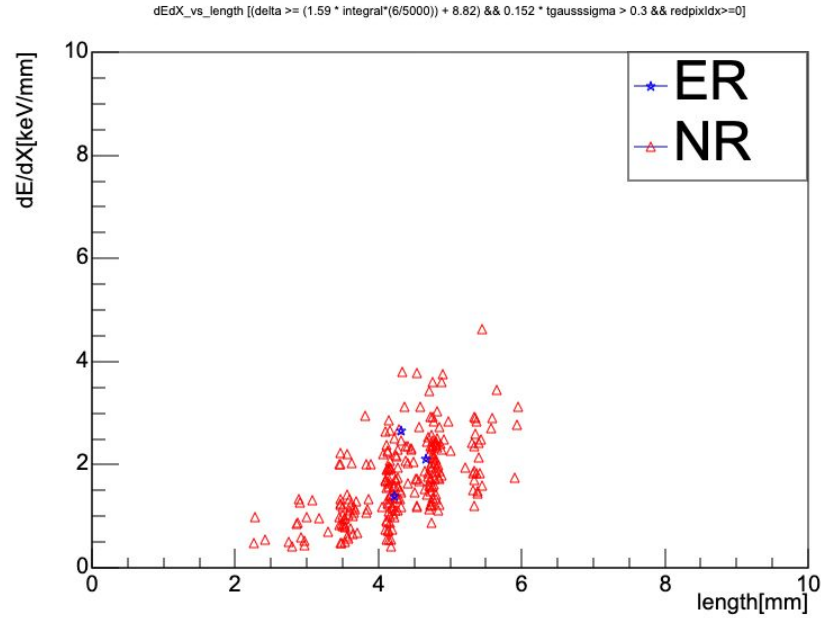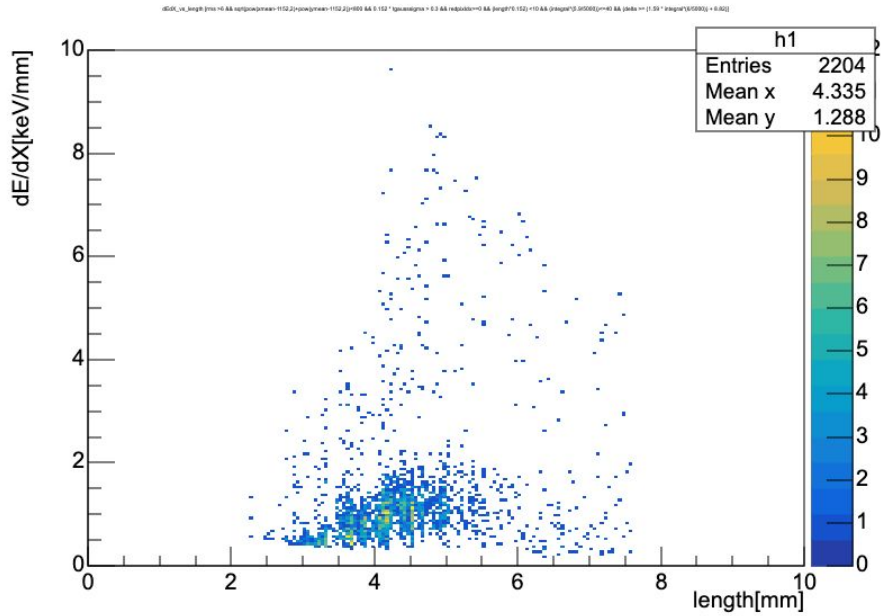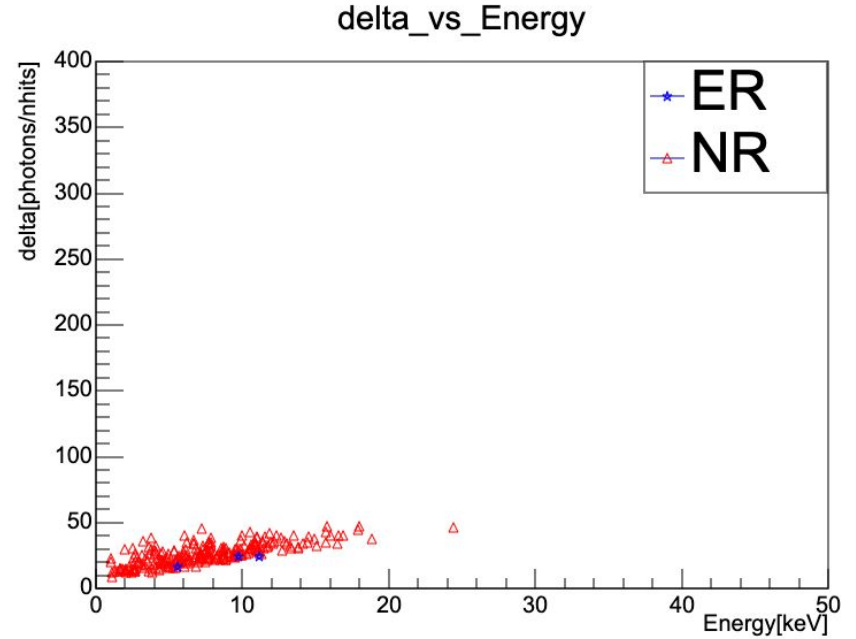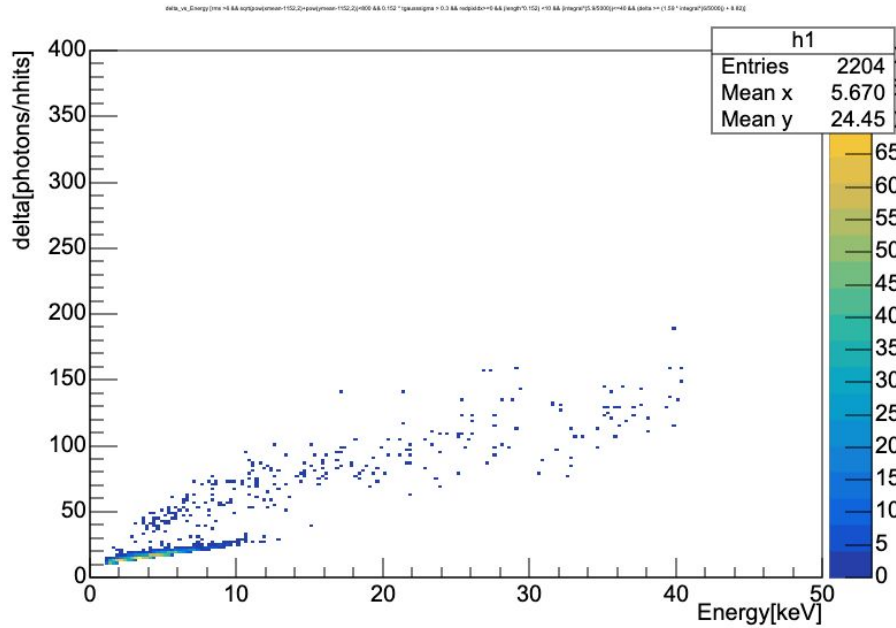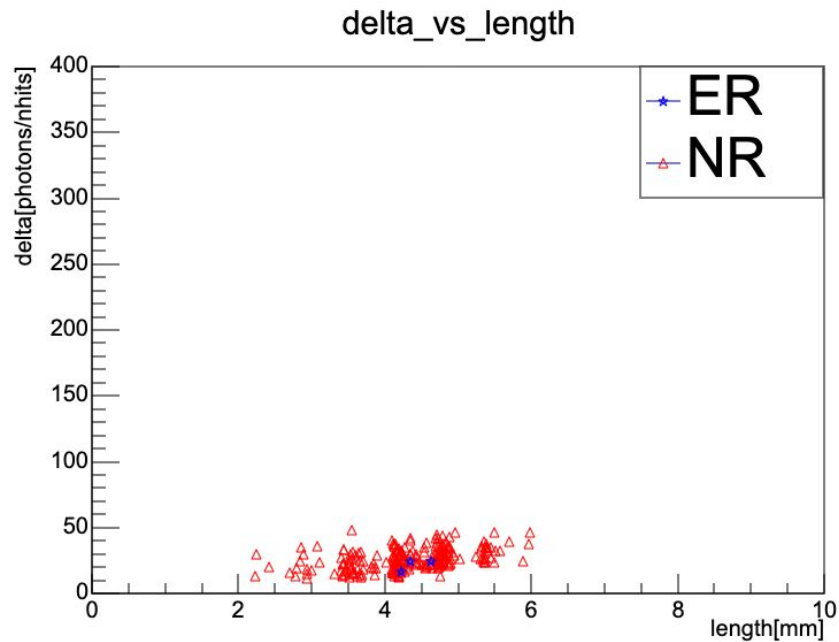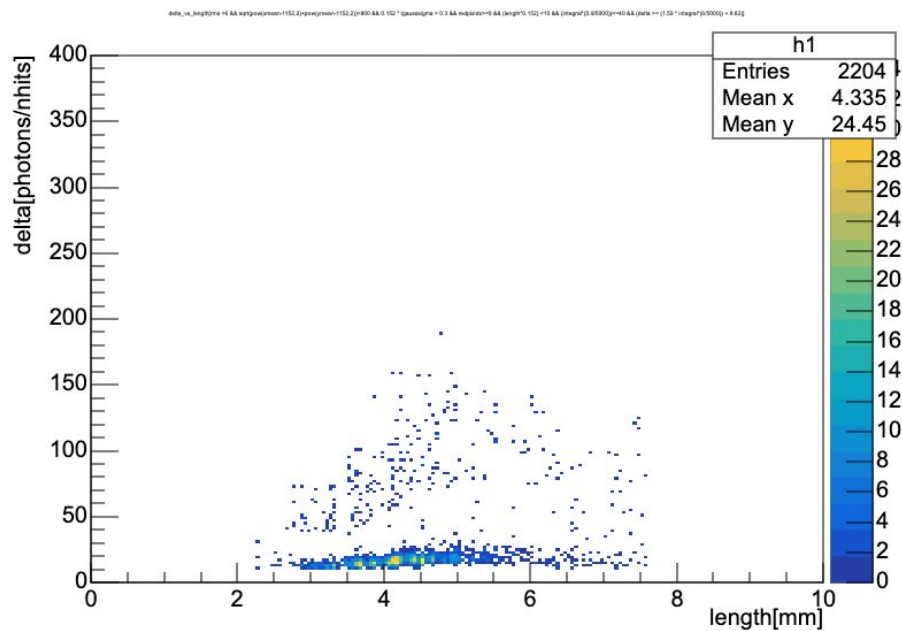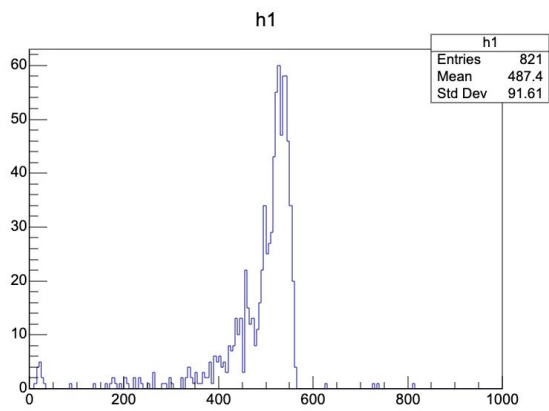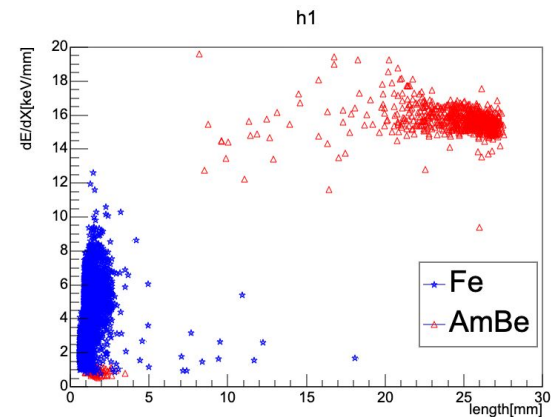# Position of the selected events in cut1
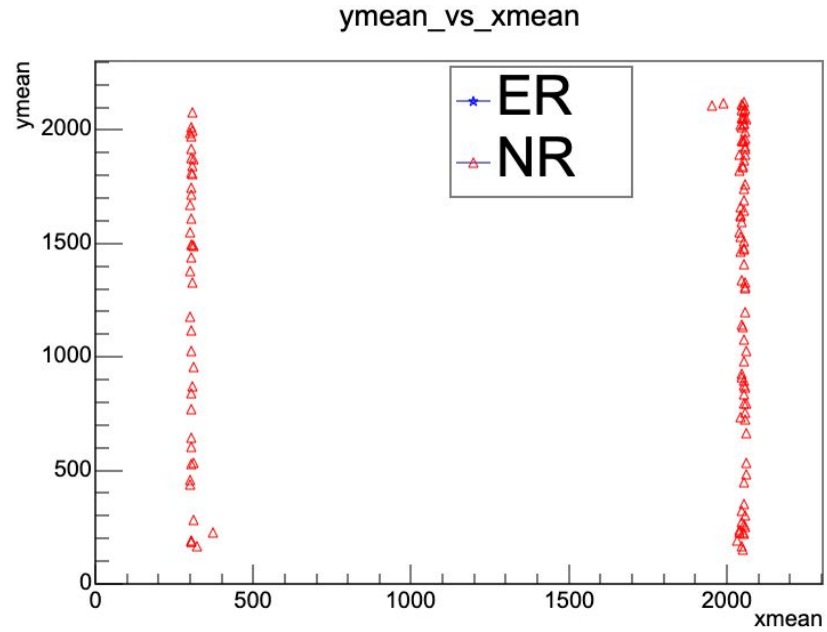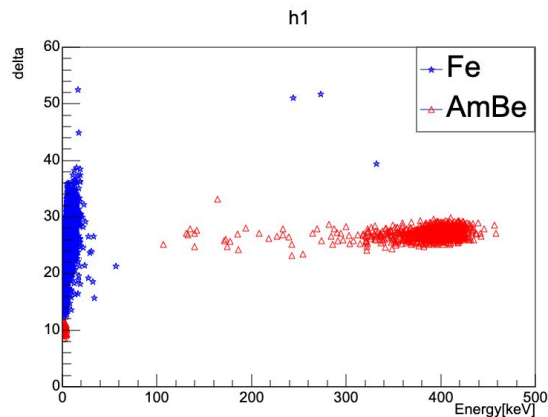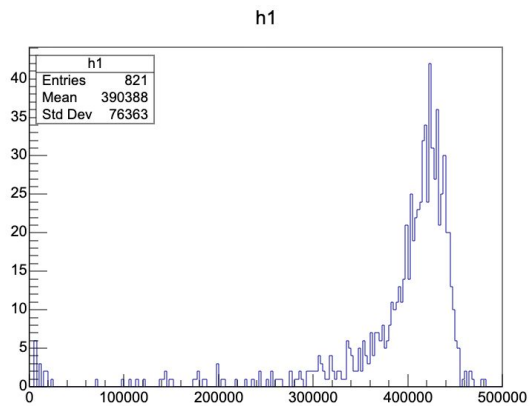
Selecting New cut on MC

dEdX vs energy
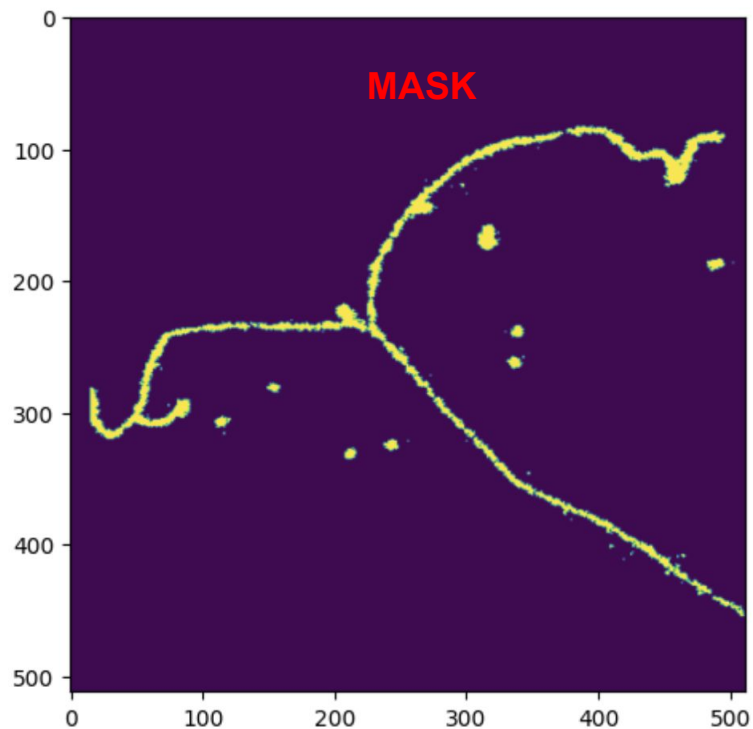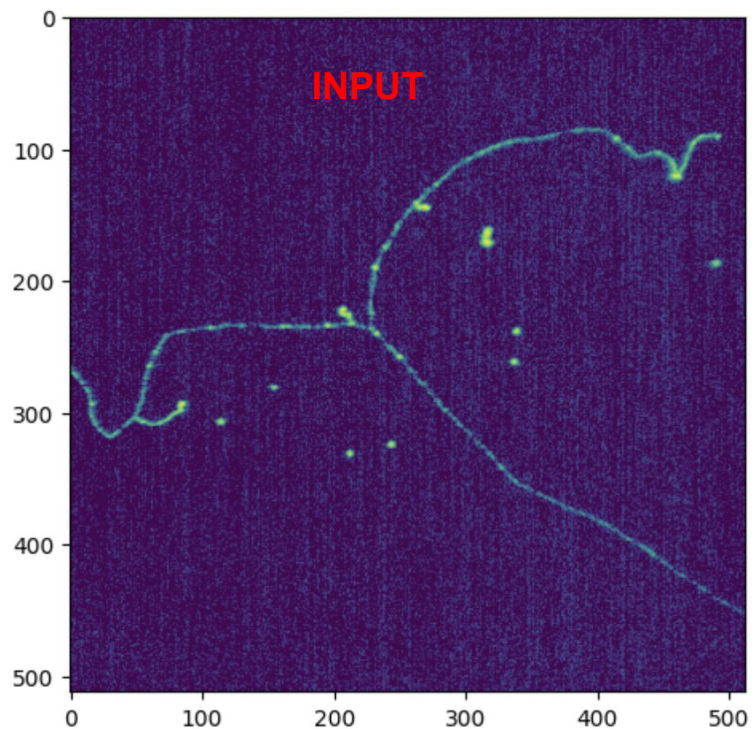
dEdX vs length

Delta vs energy
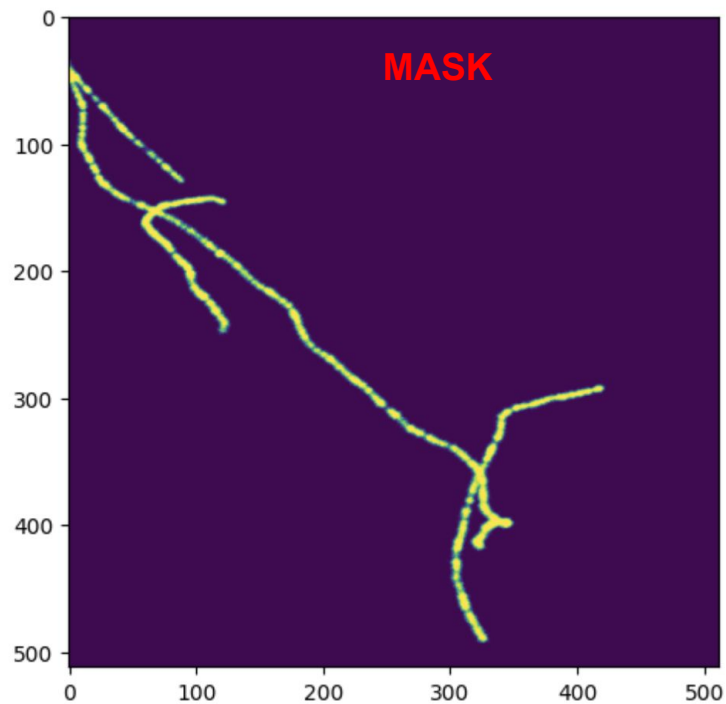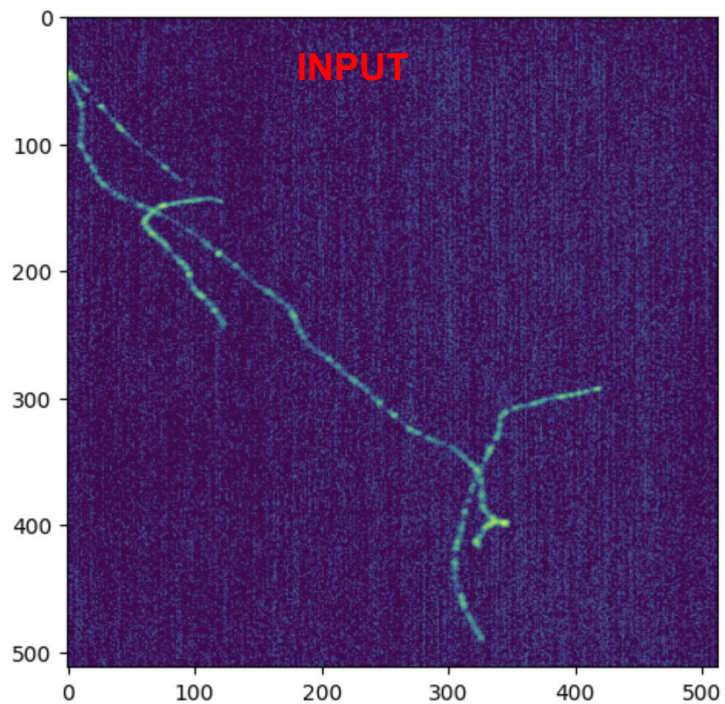
Delta vs length

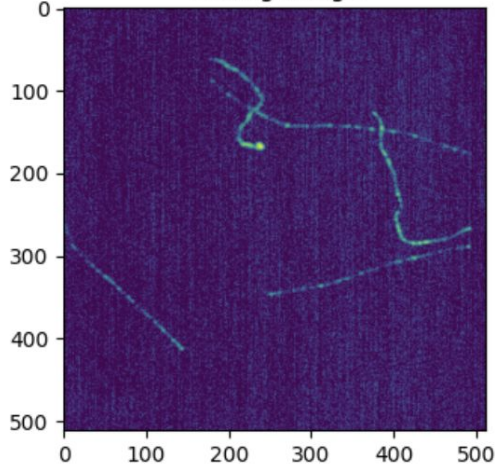# Alpha Analysis
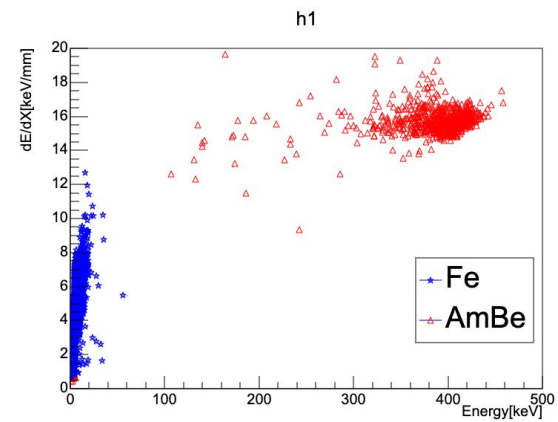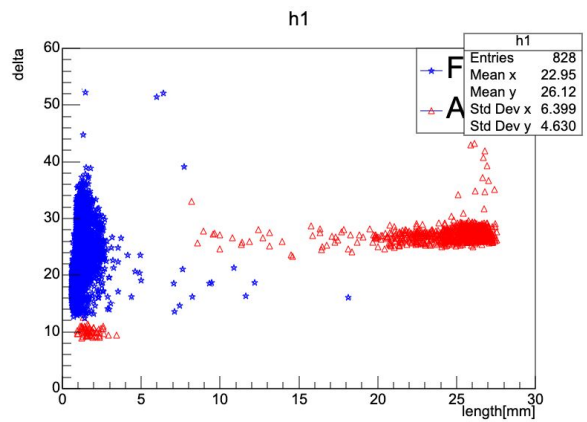
Denoiser Network

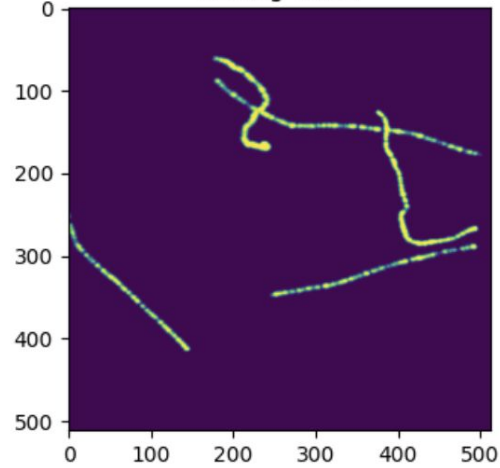# Input and Target (Lime data)

Simulated high energy tracks

Prediction by the network
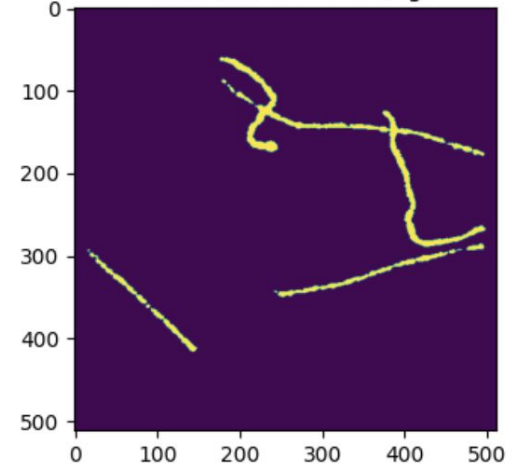
Simulation

Prediction on lime data

Lime Data