Momentum evaluation with nuclear emulsion spectrometers: Monte Carlo preliminary results

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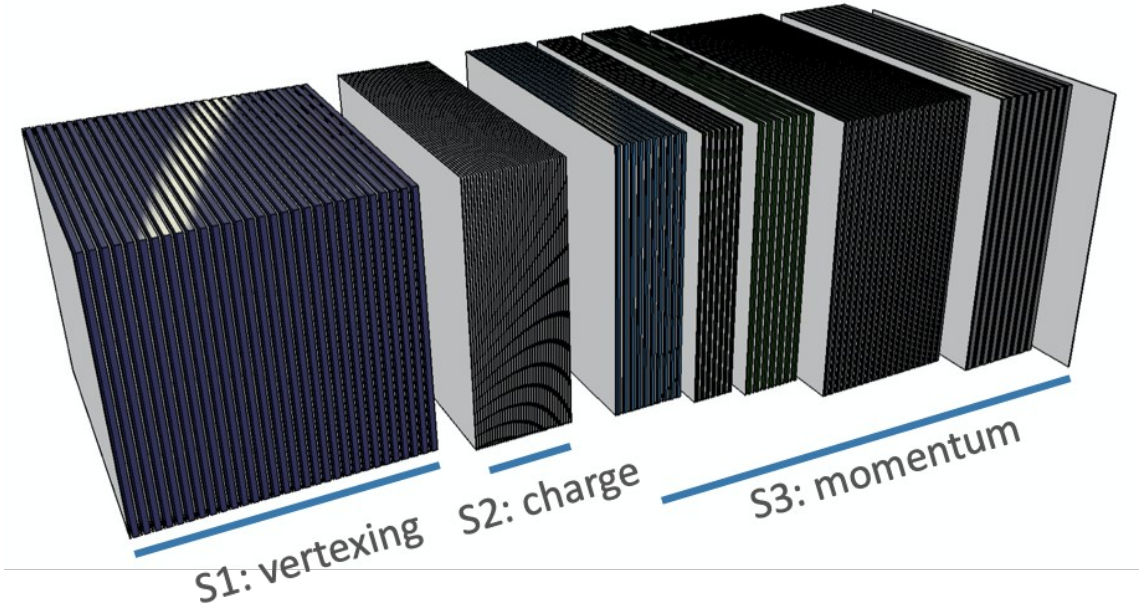
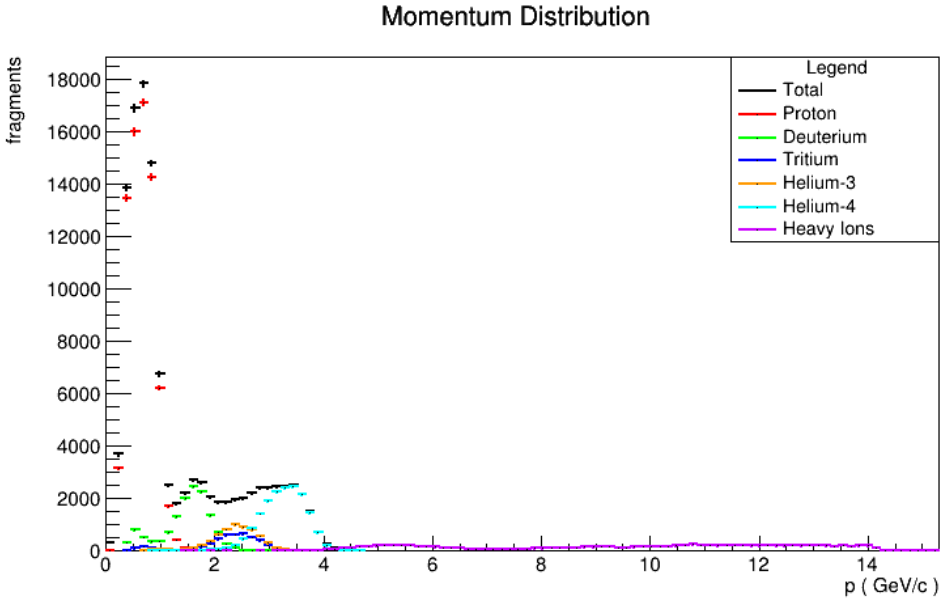
GSI Configurations



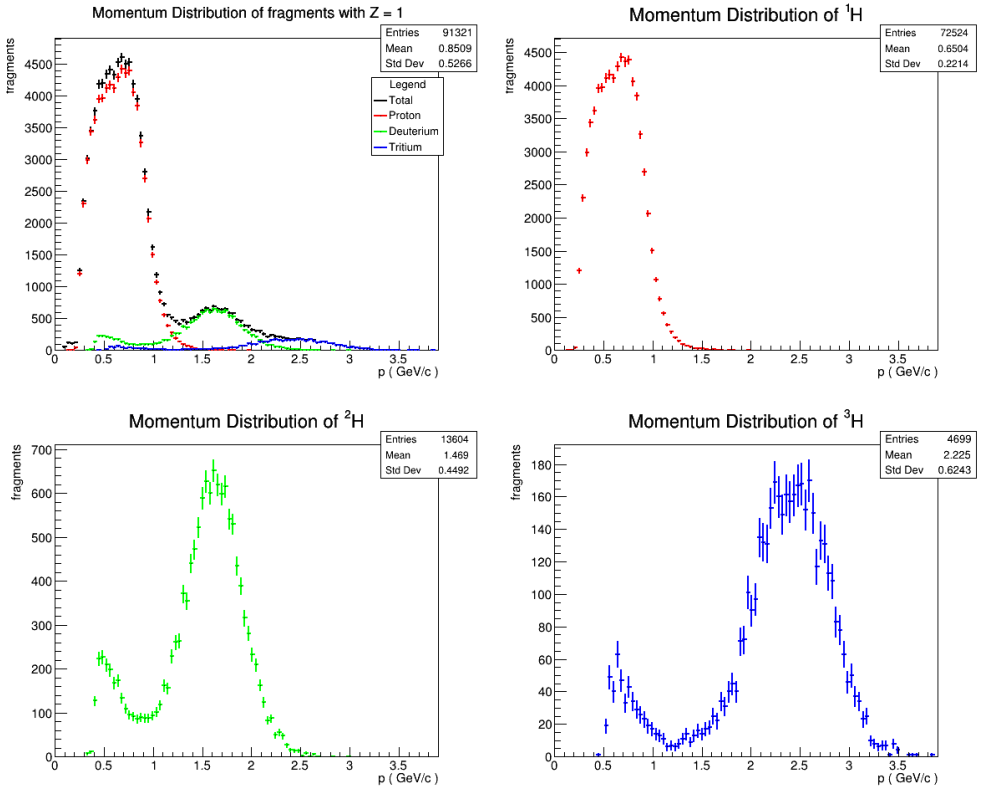
TARGET \ BEAM	2019	
	Oxygen 200 MeV/n	Oxygen 400 MeV/n
Carbon	GSI1	GSI3
Polyethylene	GSI2	GSI4

GSI3: MC Momentum Distributions



Starting from the GSI3 configuration, the distributions of the main features used by the TMVA algorithms were studied.

GSI3: Primary Fragments with Z = 1

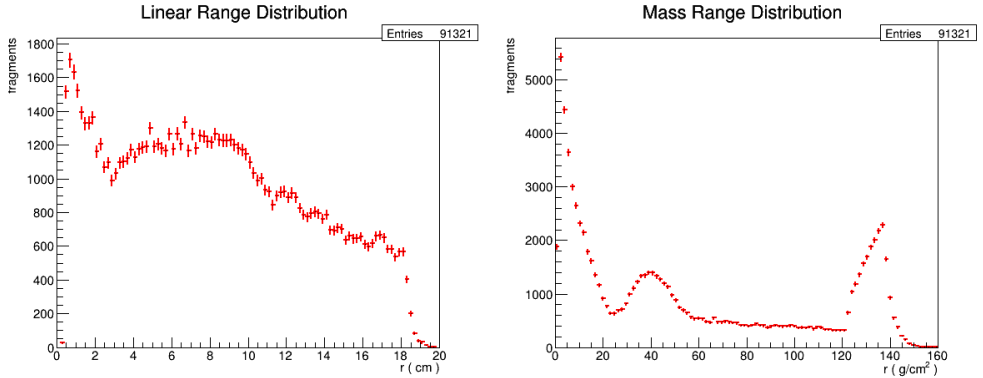


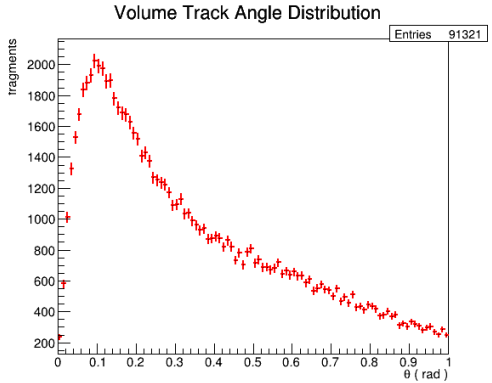
The momentum distribution has different shape for different isotopes.

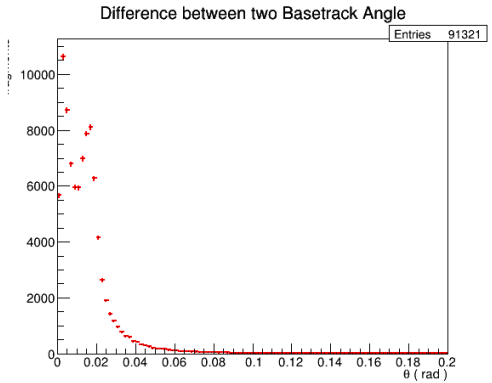
The peaks of the distributions are at:

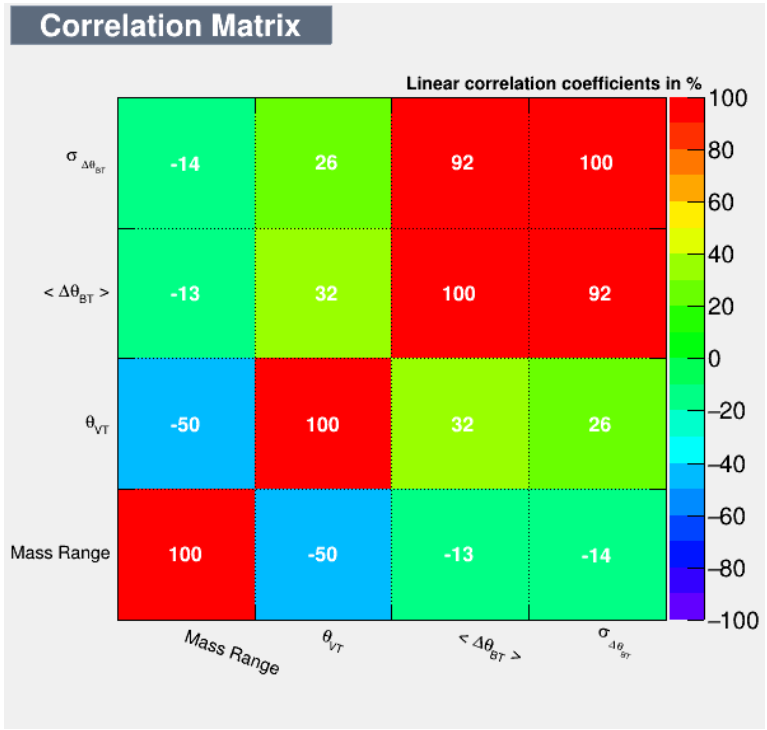
- 0.745 ± 0.001 GeV/c for ^{1}H;
- 1.606 ± 0.003 GeV/c for ^{2}H;
- 2.411 ± 0.007 GeV/c for ^{3}H.

GSI3: Input Features at the TMVA Algorithms for Z = 1

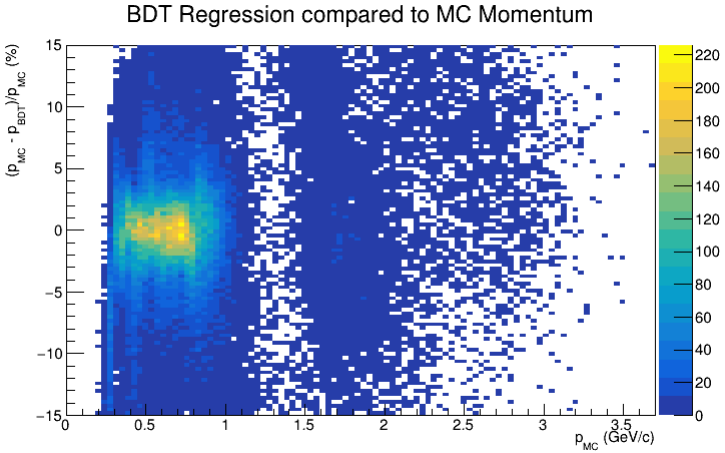


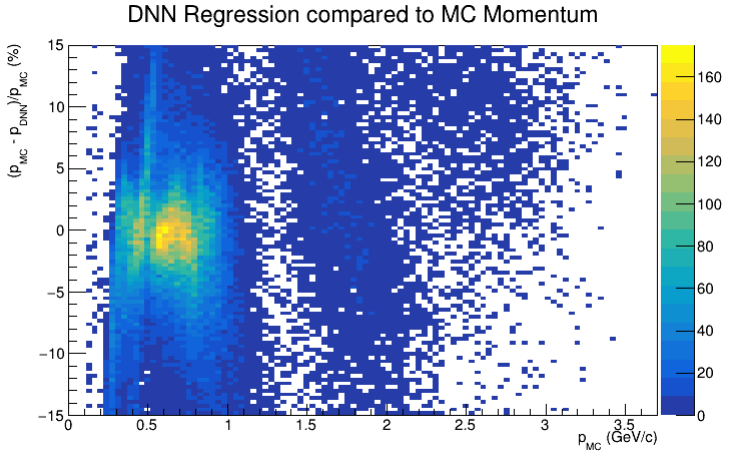


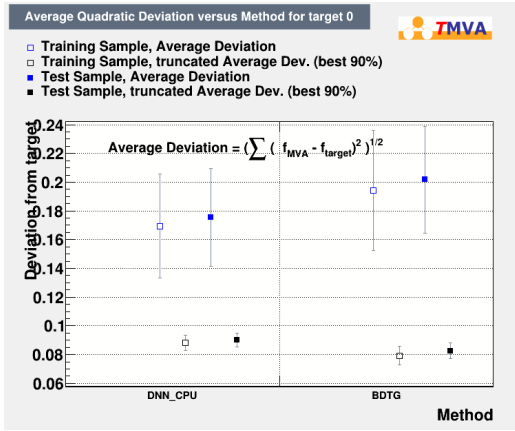




GSI3: TMVA Output for Z = 1



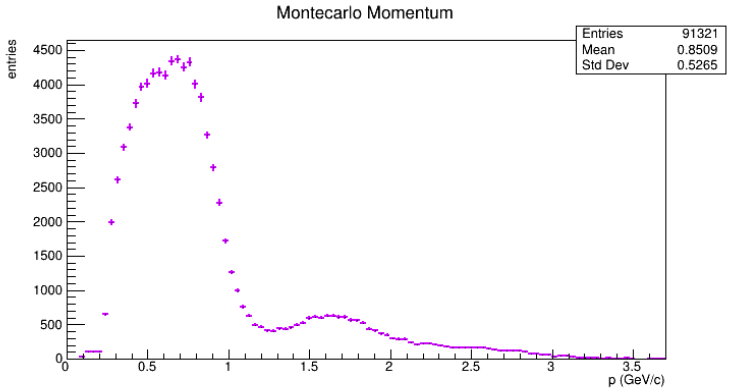


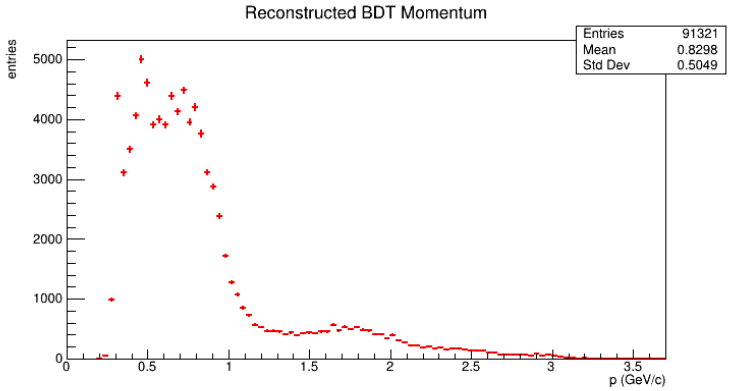


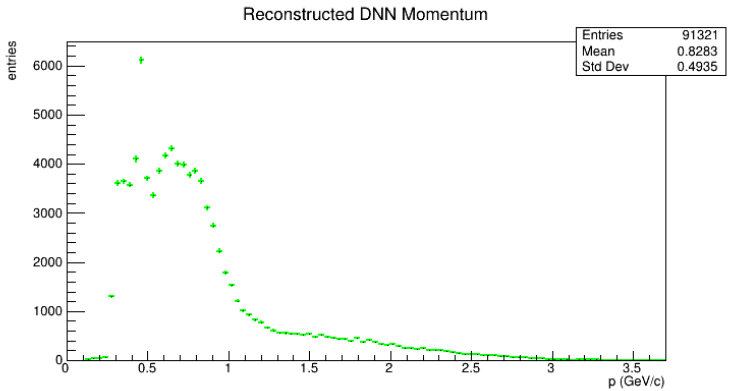
Fraction of fragments which is reconstructed within the 5% error:

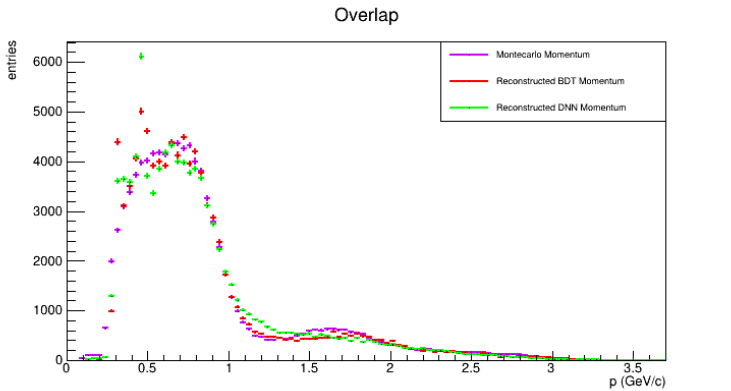
- BDT 60.3% of fragments;
- DNN 53.2% of fragments.

GSI3: Distributions Comparison for Z = 1

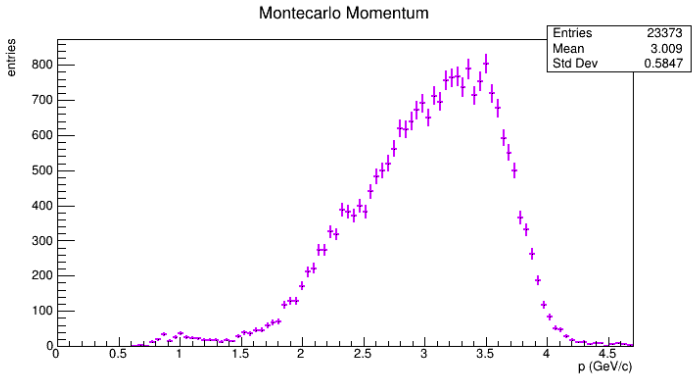


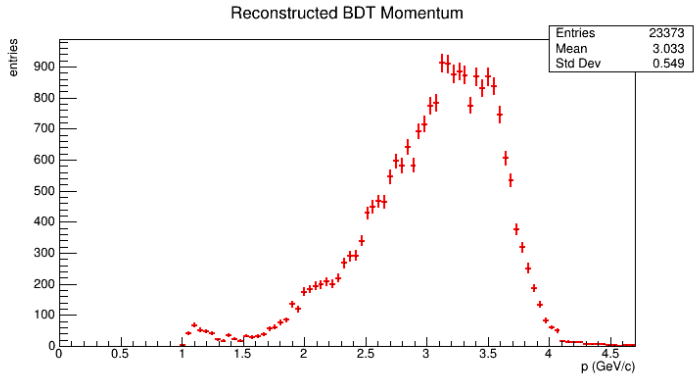


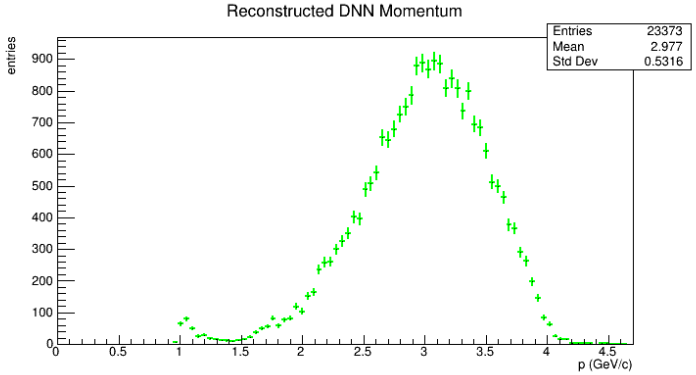


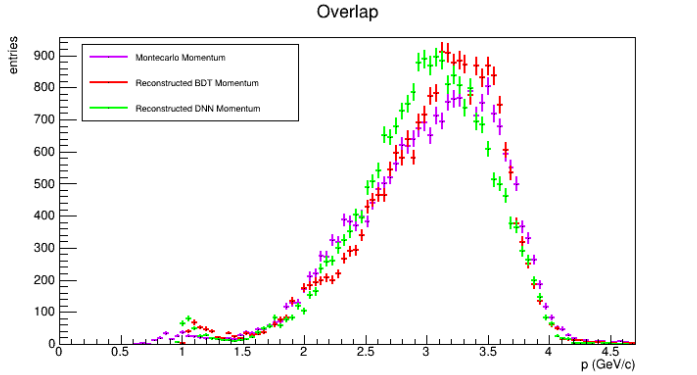


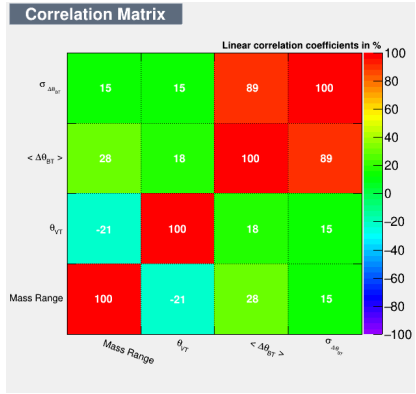
GSI3: Primary Fragments with Z = 2



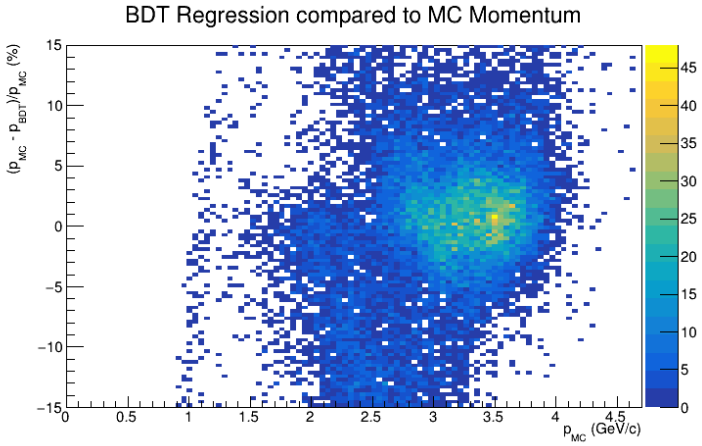


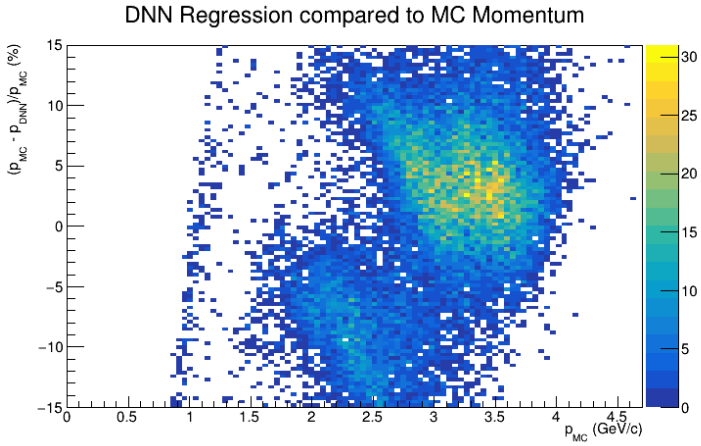


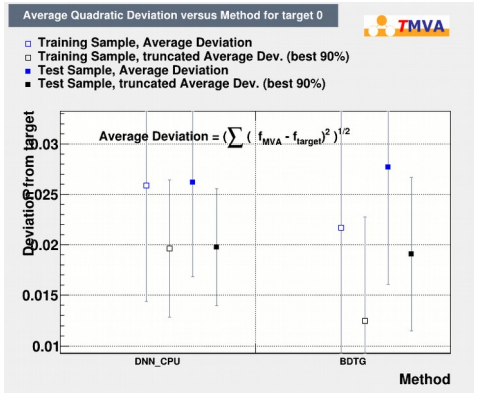




GSI3: TMVA Output for Z = 2



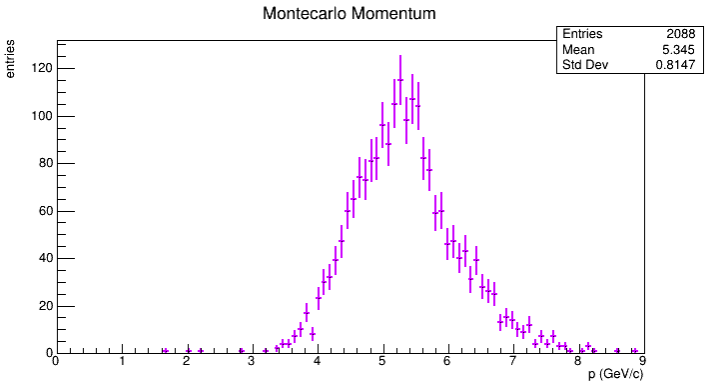


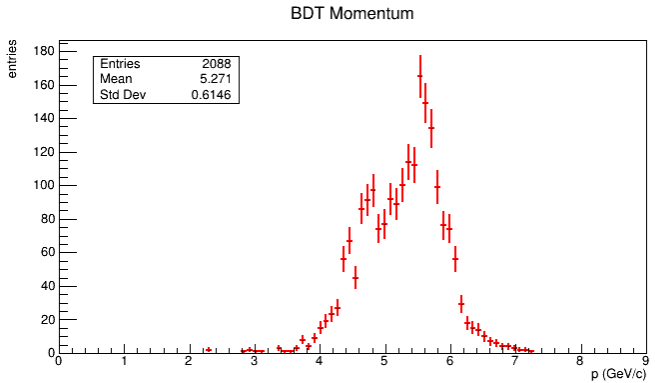


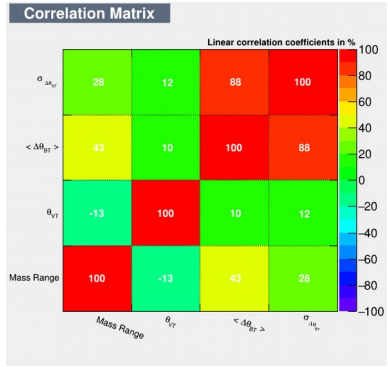
Fraction of fragments which is reconstructed within the 5% error:

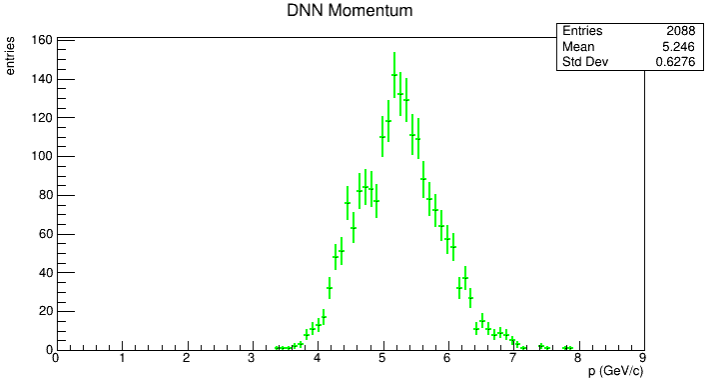
- BDT 58.2% of fragments;
- DNN 44.3% of fragments;

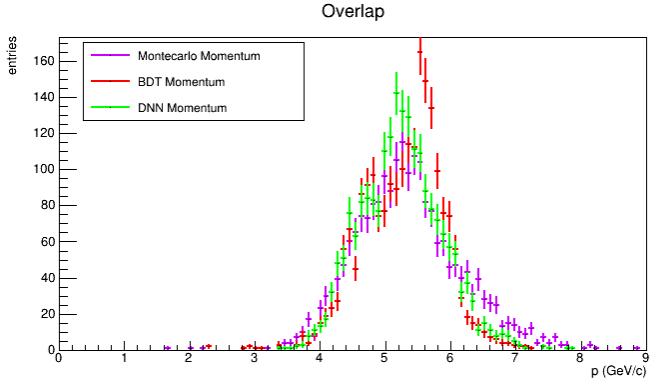
GSI3: Primary Fragments with Z = 3

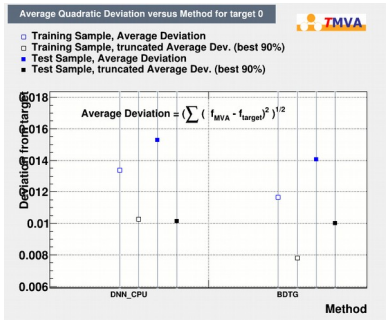




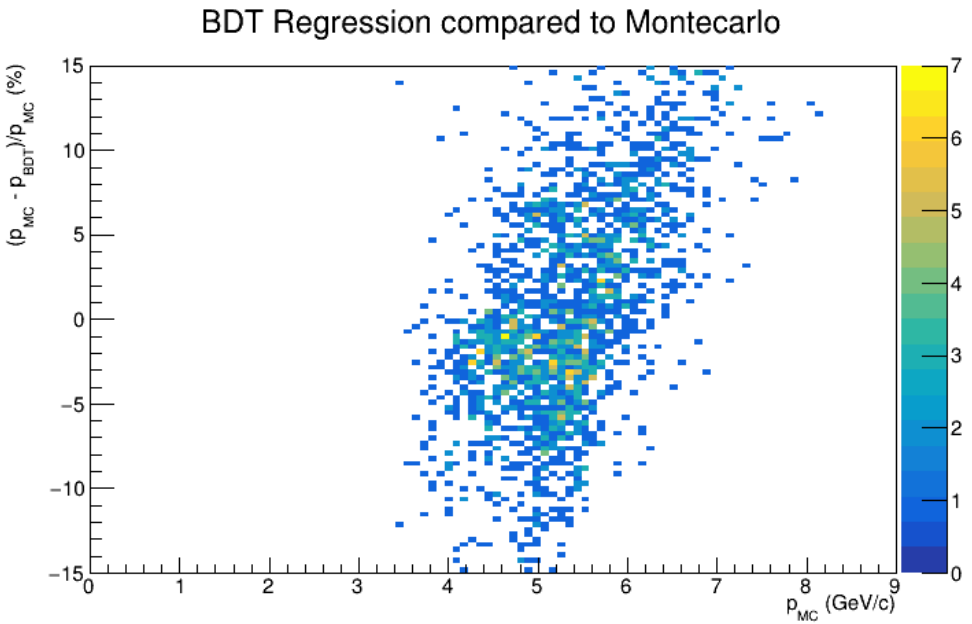


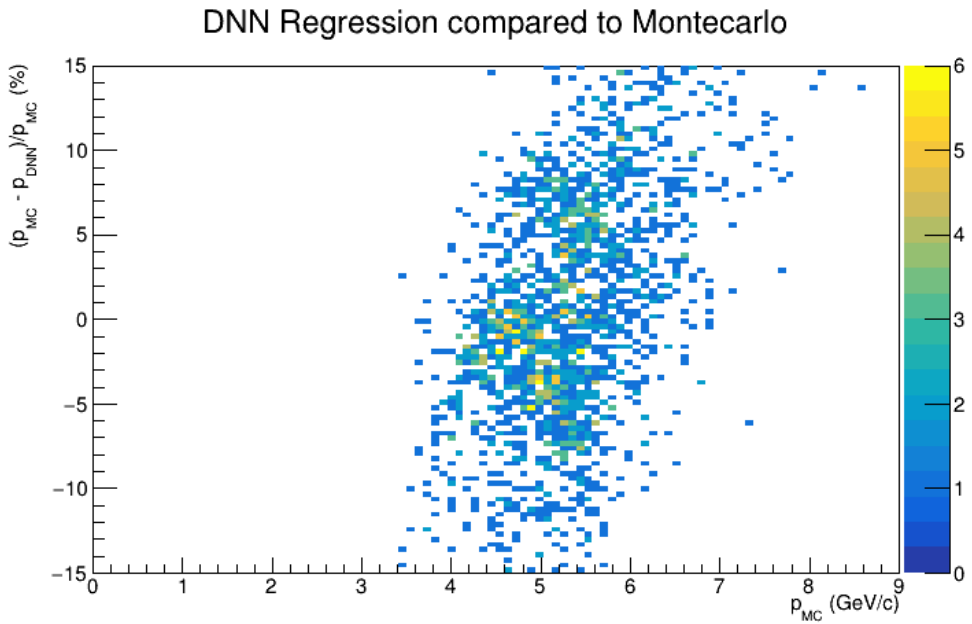






GSI3: TMVA Output for Z = 3

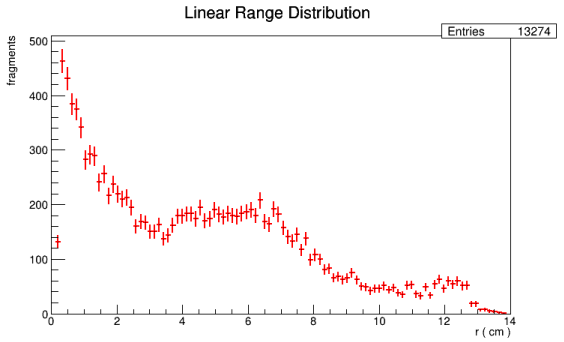


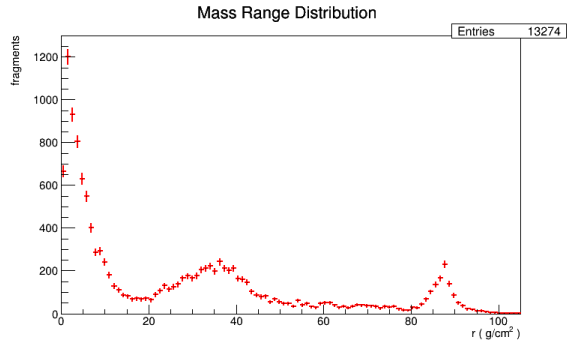


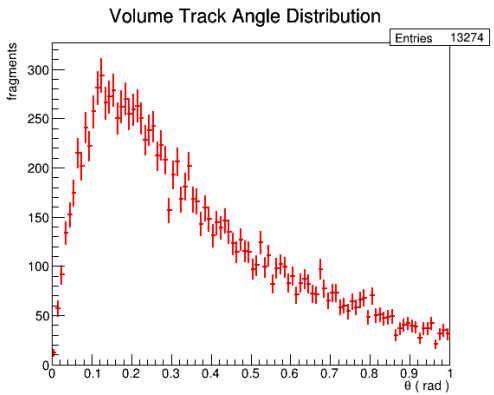
Fraction of fragments which is reconstructed within the 5% error:

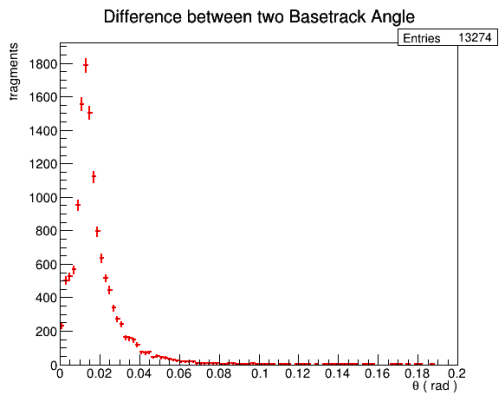
- BDT 51.9% of fragments;
- DNN 46.1% of fragments;

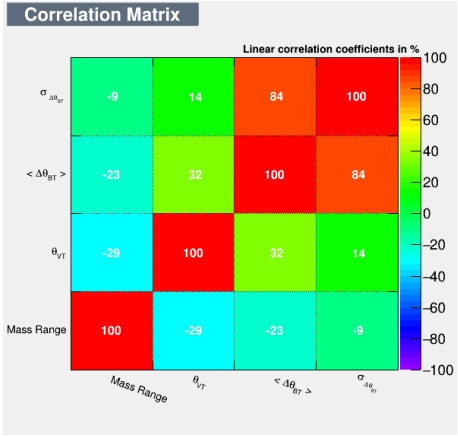
GSI1: Input Variables for Z = 1



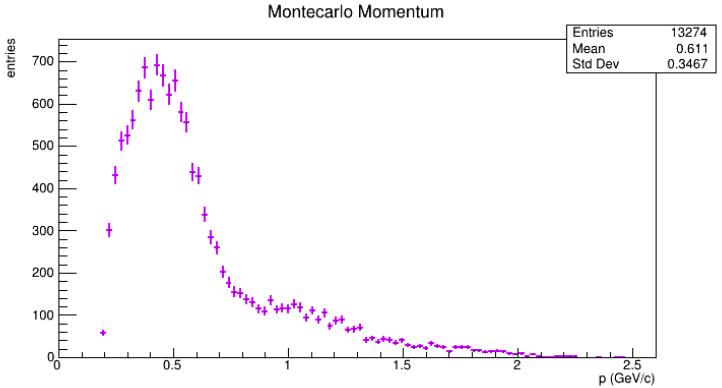


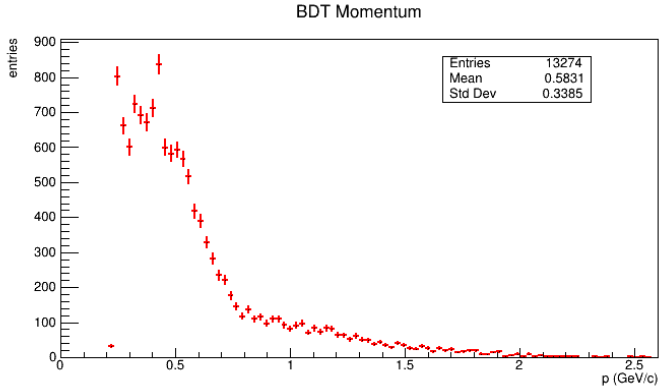


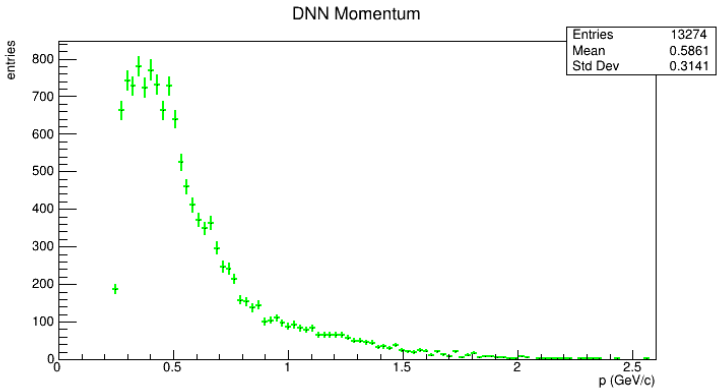


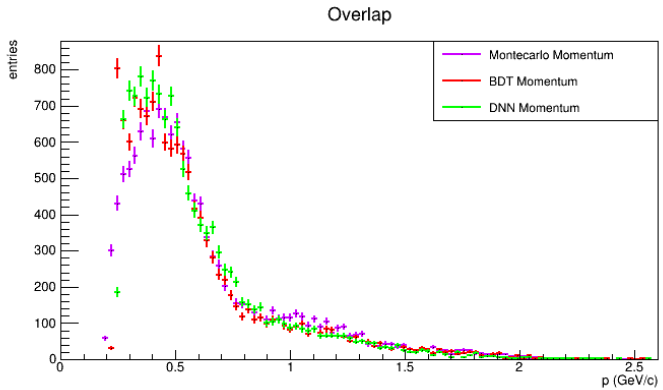


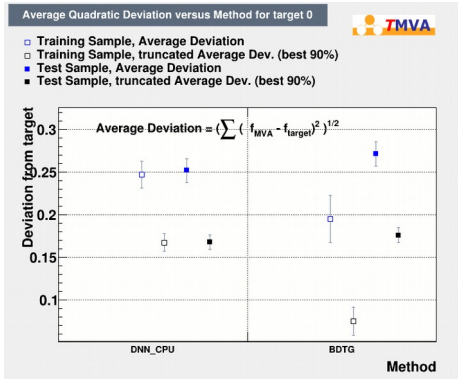
GSI1: Primary Fragments with Z = 1



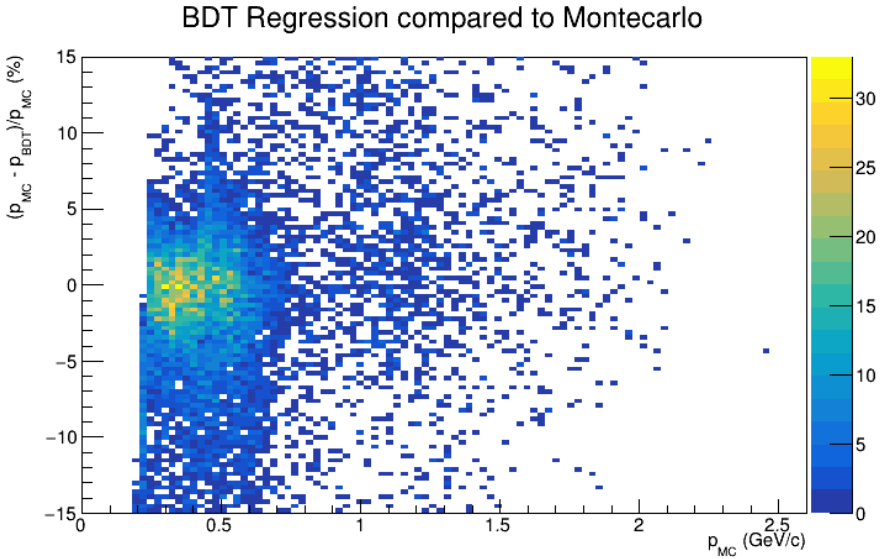


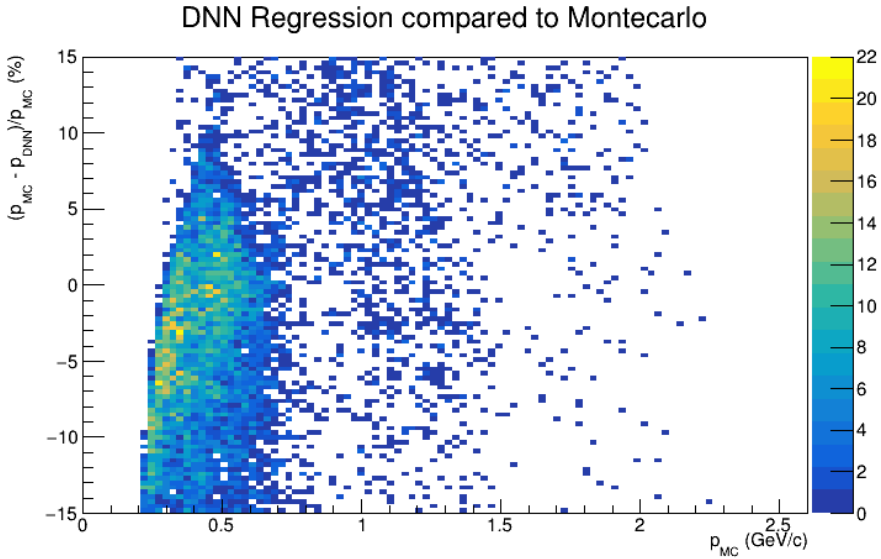






GSI1: TMVA Outputs for Fragments with Z = 1

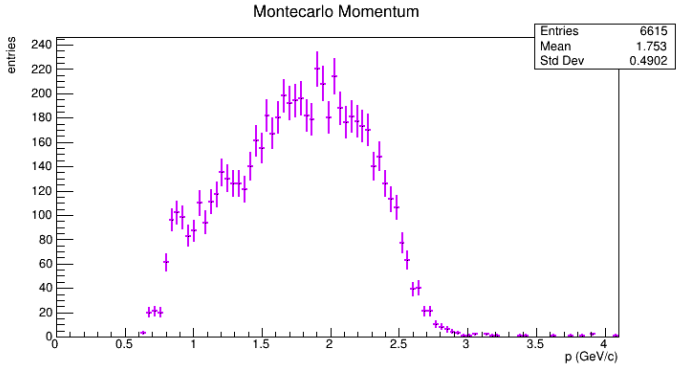


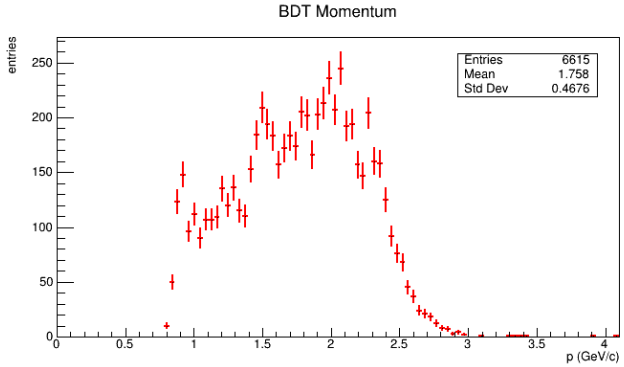


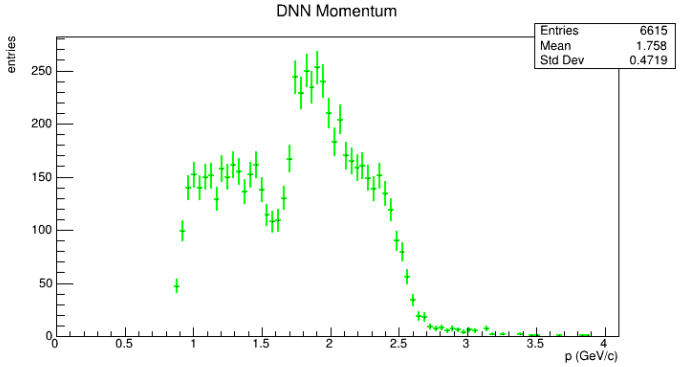
The fraction of fragments which is reconstructed within the 5% error is:

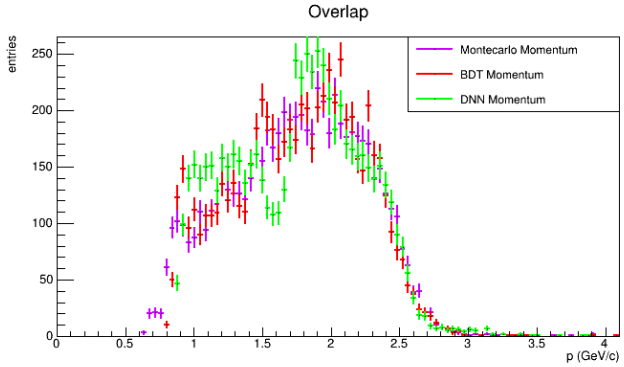
- BDT 49.5% of fragments;
- DNN 30.2% of fragments.

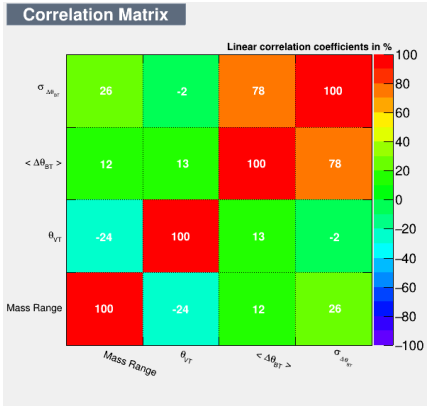
GSI1: Primary Fragments with Z = 2

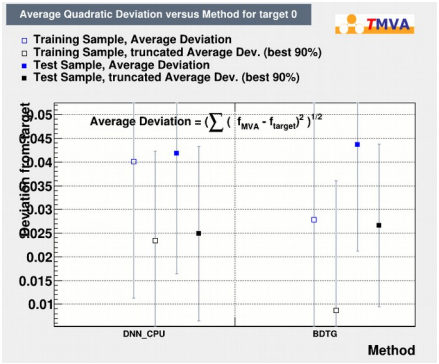




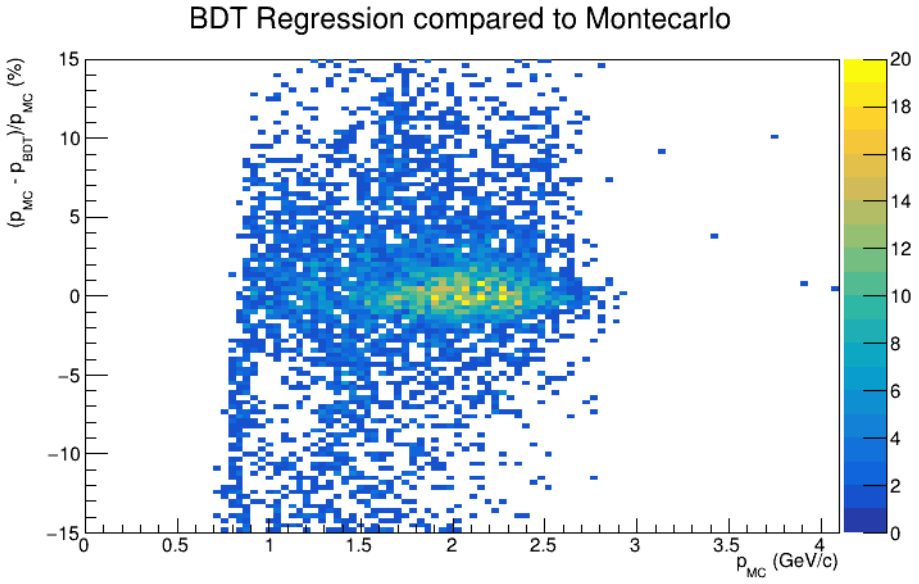


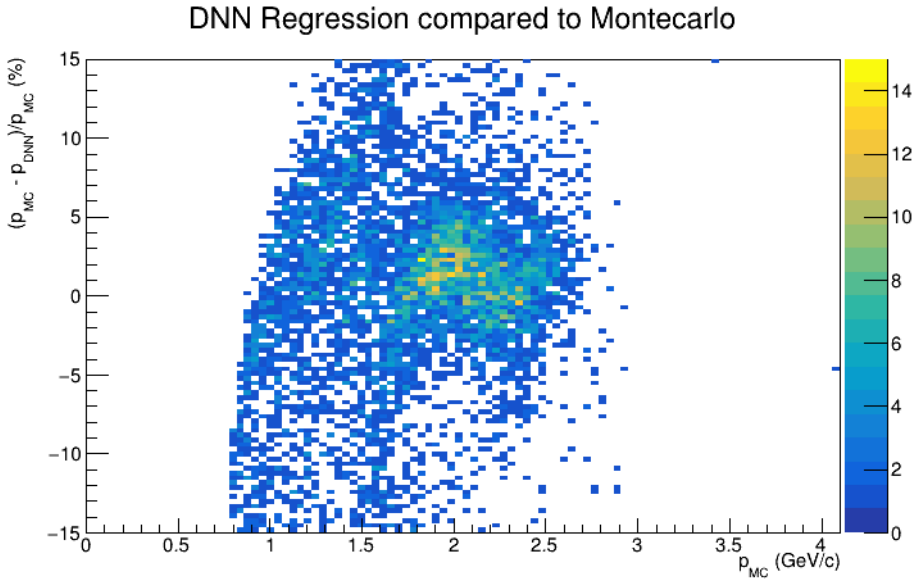






GSI1: TMVA Results for Z = 2

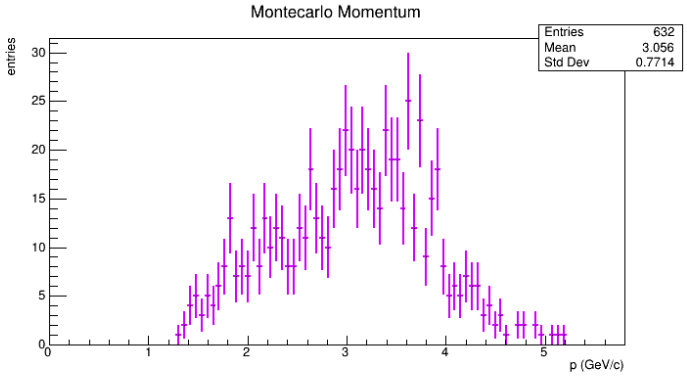


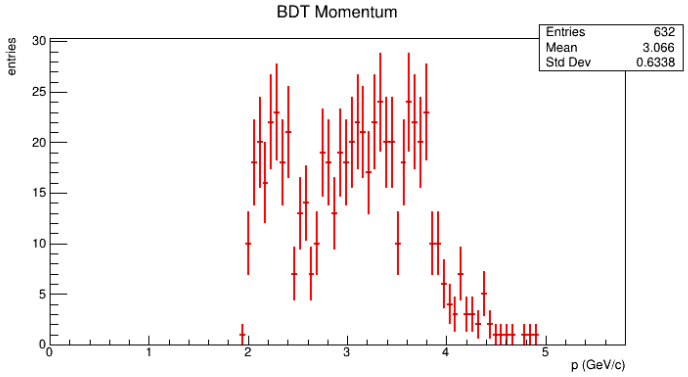


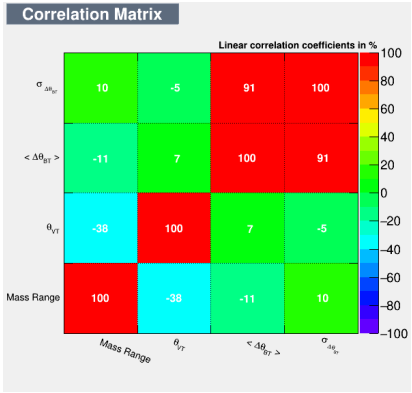
Fraction of fragments which is reconstructed within the 5% error:

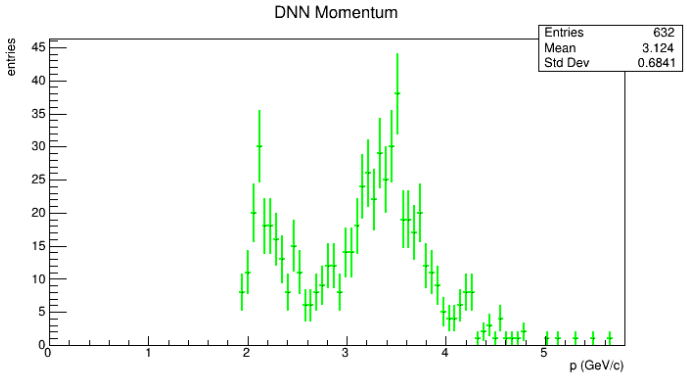
- BDT 65.1% of fragments;
- DNN 56.9% of fragments.

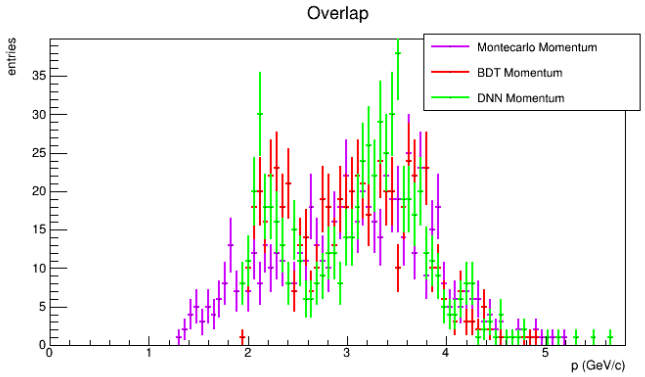
GSI1: Fragments with Z = 3

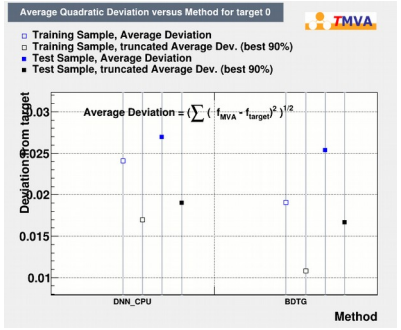




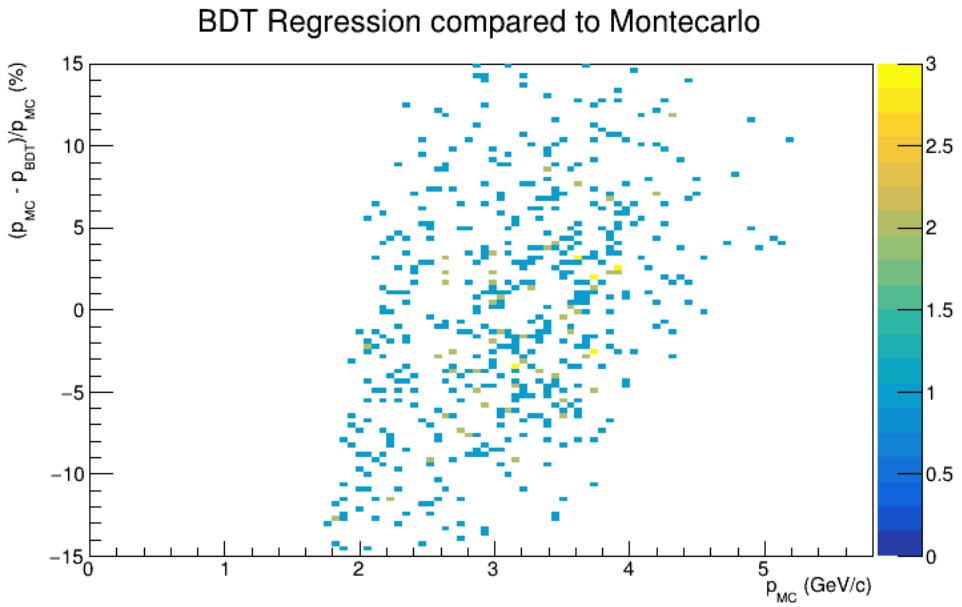


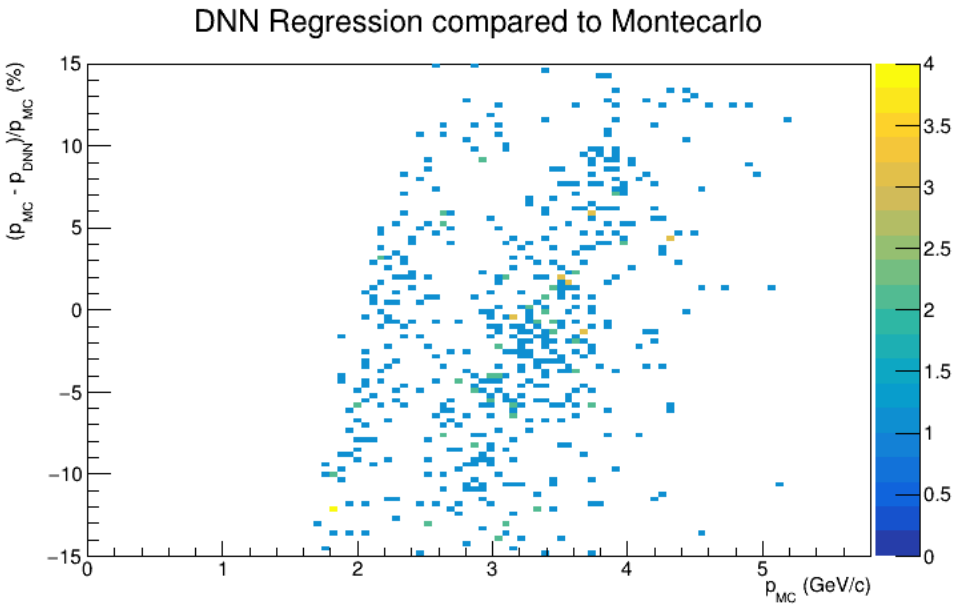






GSI1: TMVA Output for Z = 3





Fraction of fragments which is reconstructed within the 5% error:

- BDT 46.8% of fragments;
- DNN 40.8% of fragments.

Conclusions

- The momentum of nuclear fragments can be evaluated by TMVA algorithms with a precision (with MC true) of 5% at least in the 50% of fragments;
- Boosted Decision Tree algorithm seems to be the one which better reproduces the MC momentum distribution.
- Next step is to test the trained algorithm on the Monte Carlo reconstructed.

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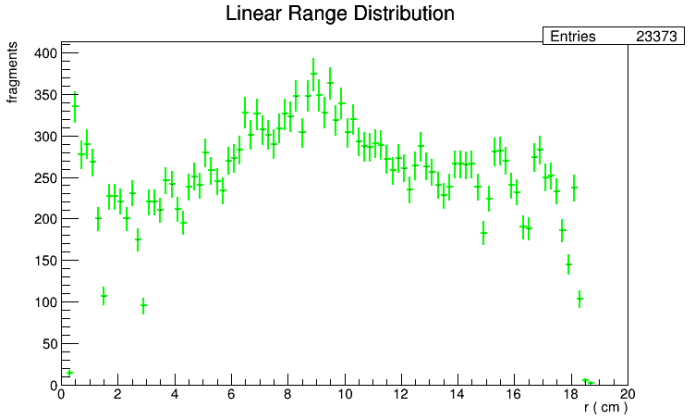
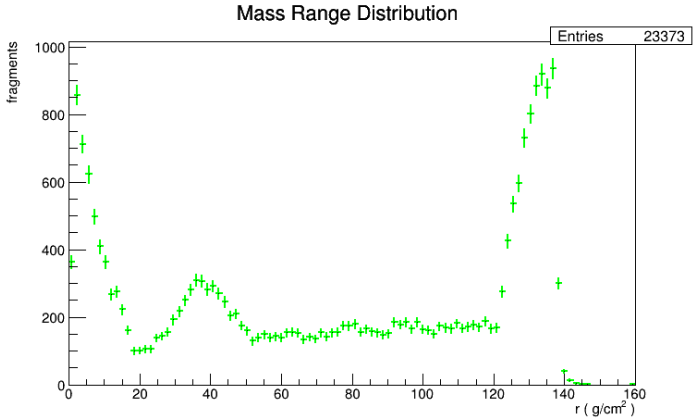
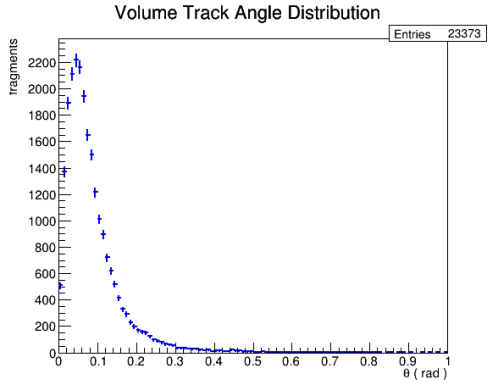
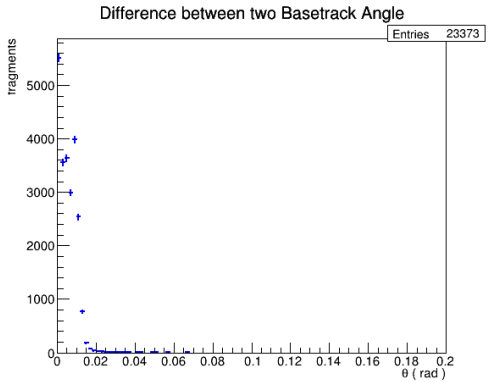
GSI3: Input Variables for Z = 2

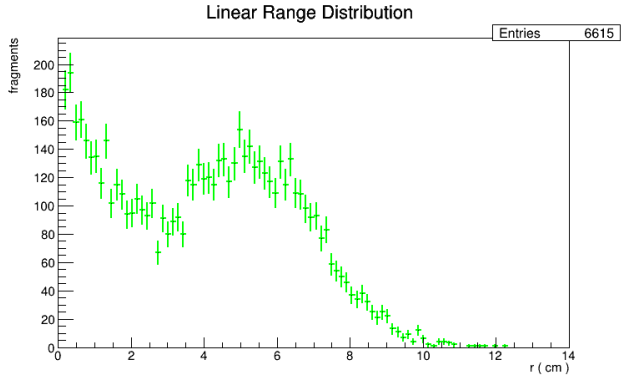


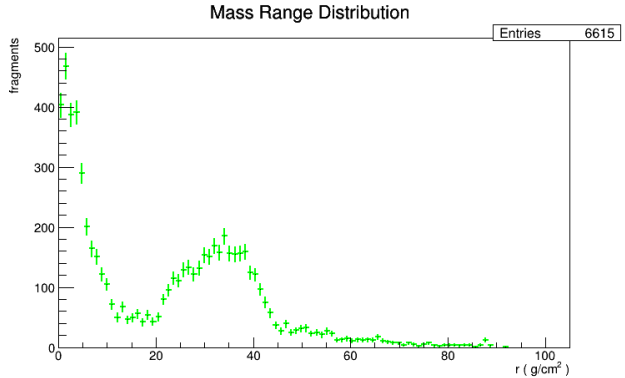


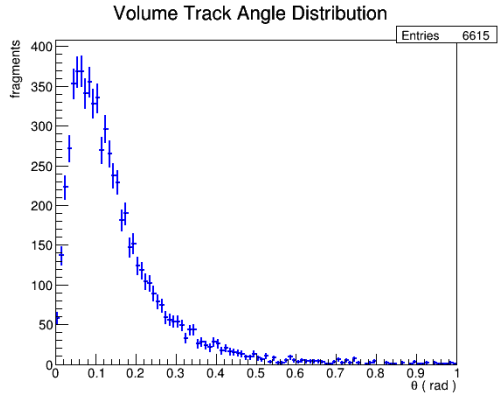


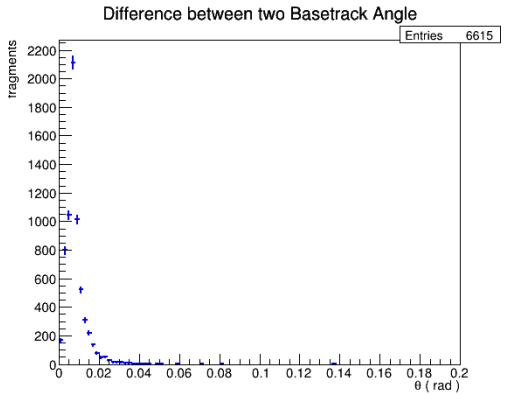


GSI1: Input Variables for Z = 2









GSI1: Input Variables for Z = 3