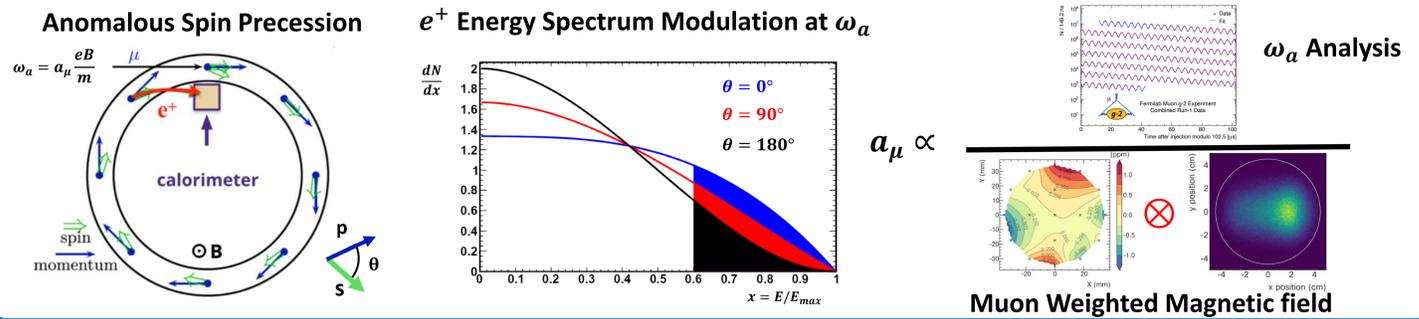
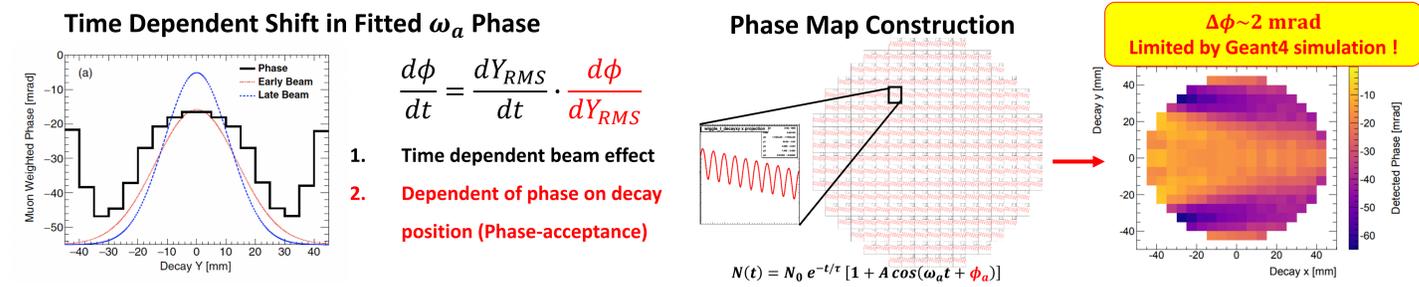


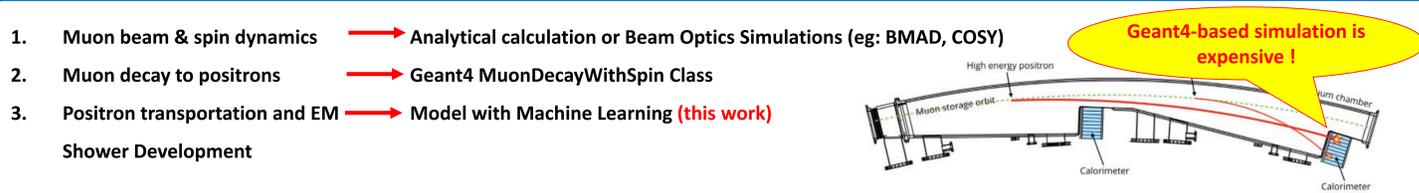
Measurement of Muon's Magnetic Anomaly



Phase-Acceptance Systematic Correction to ω_a



Fast Simulation of Muon Storage Ring



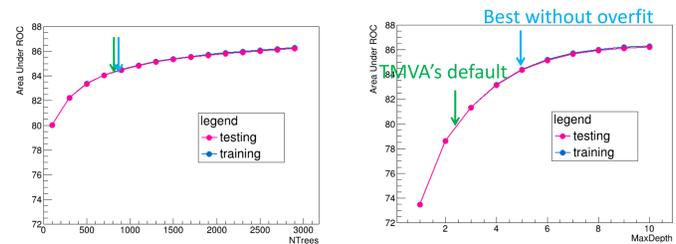
Calorimeter Acceptance via Boosted Decision Tree Algorithm

- Train BDT to classify T-methods e^+ events (hit and deposit $>1.6 \text{ GeV}$) given position and momentum

✓ Goal: achieve high Signal to Background separation (quantified by Area Under ROC curve)

- Process training data into total of 5M events

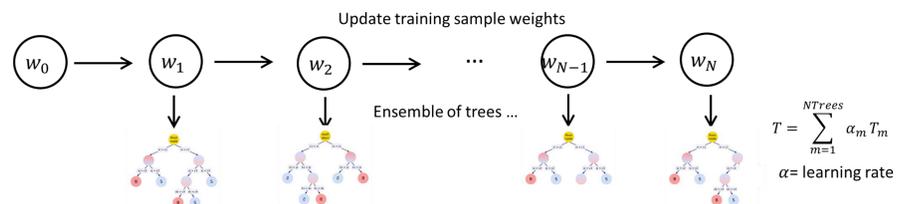
- ✓ 2.5M for Signal and Background
- ✓ 1.25M for training, the rest for testing
- ✓ Independent 1M events for application



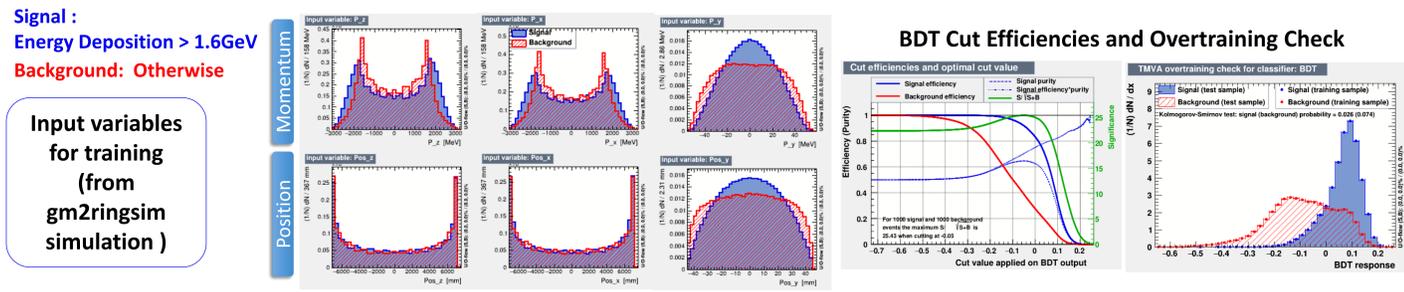
- Model: Adaptive Boosted Decision Trees (AdaBoost) provided by ROOT::TMVA.

Hyperparameters: $N_{Trees}=850$ $MinNodeSize=2.5\%$ $MaxDepth=5$ $AdaBoostBeta=0.5$
UseBaggedBoost BaggedSampleFraction=0.5 SeparationType=GiniIndex nCuts=20

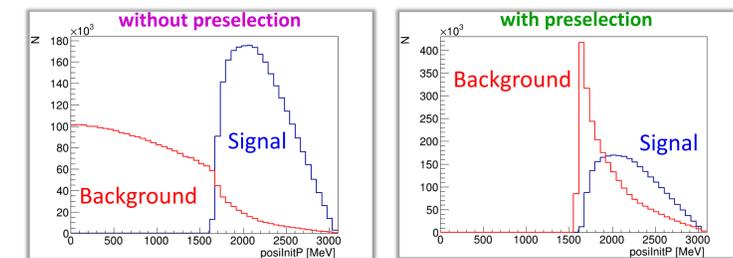
- AdaBoost's sample weights are updated iteratively. Misclassified samples have larger weight.



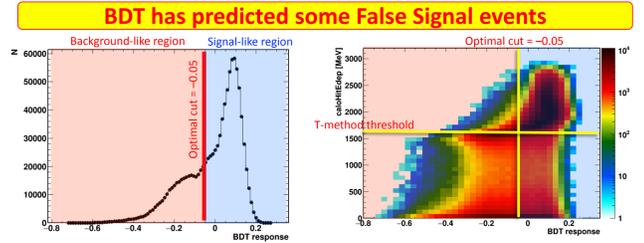
Training and Application Results



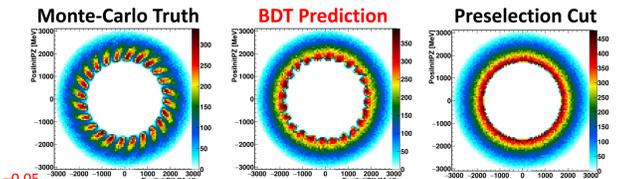
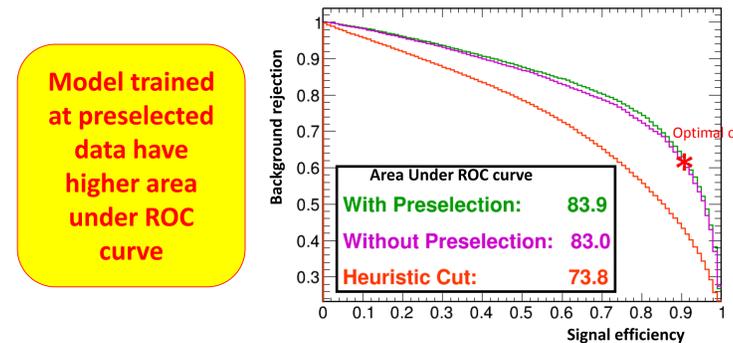
Training With Data Preselection Cut: Energy $> 1.6 \text{ GeV}$



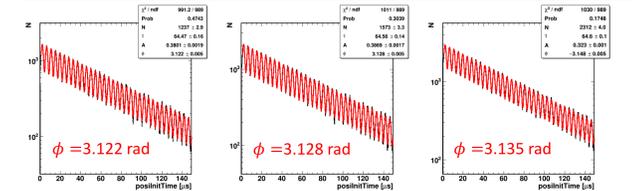
BDT Application



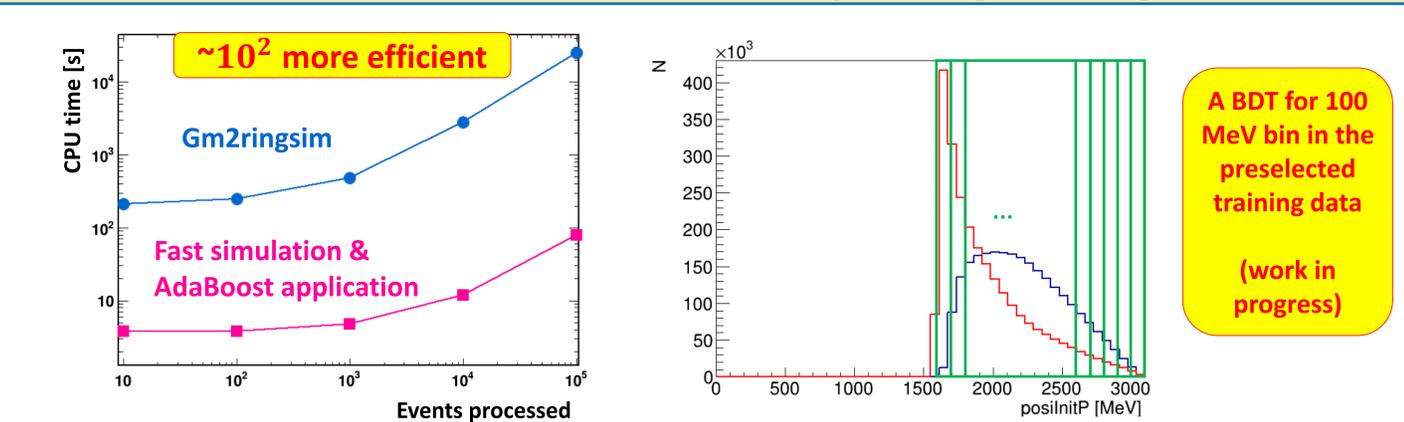
Receiver Operating Characteristic Curves



The fitted phase from BDT is close to MC truth



Performance Benchmark and Upcoming Training



References

- A. Hoecker et al. TMVA: The toolkit for multivariate data analysis, (Preprint arXiv:physics/0703039) (2007)
- B. Roe et al. Nuclear Instruments and Methods in Physics Research, A 543 (2005) 577–584
- T. Albahri et al. (Muon g-2 Collaboration) Phys. Rev. D **103**, 072002 (2021)
- T. Albahri et al. (Muon g-2 Collaboration) Phys. Rev. Accel. Beams **24**, 044002 (2021)

