Semi-Supervised Learning and the G/H Boundary

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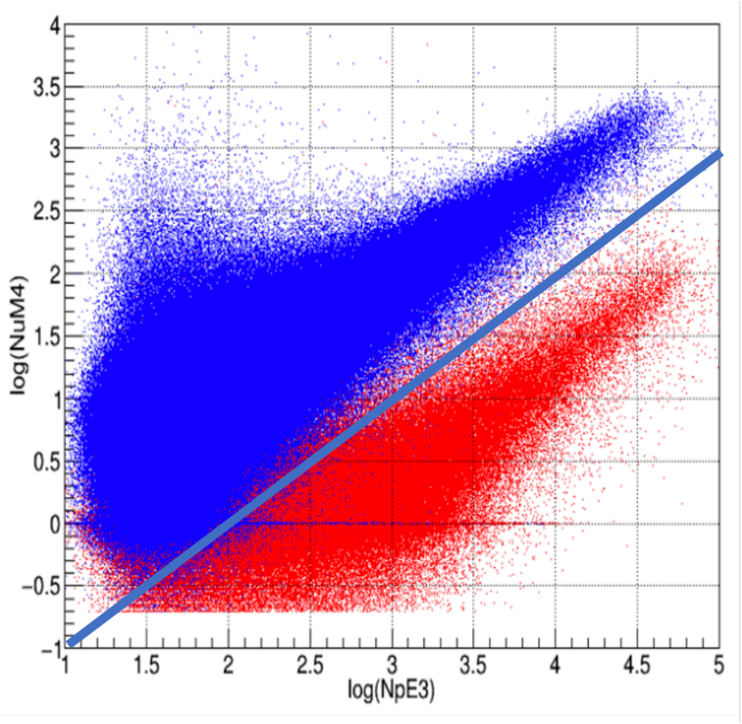
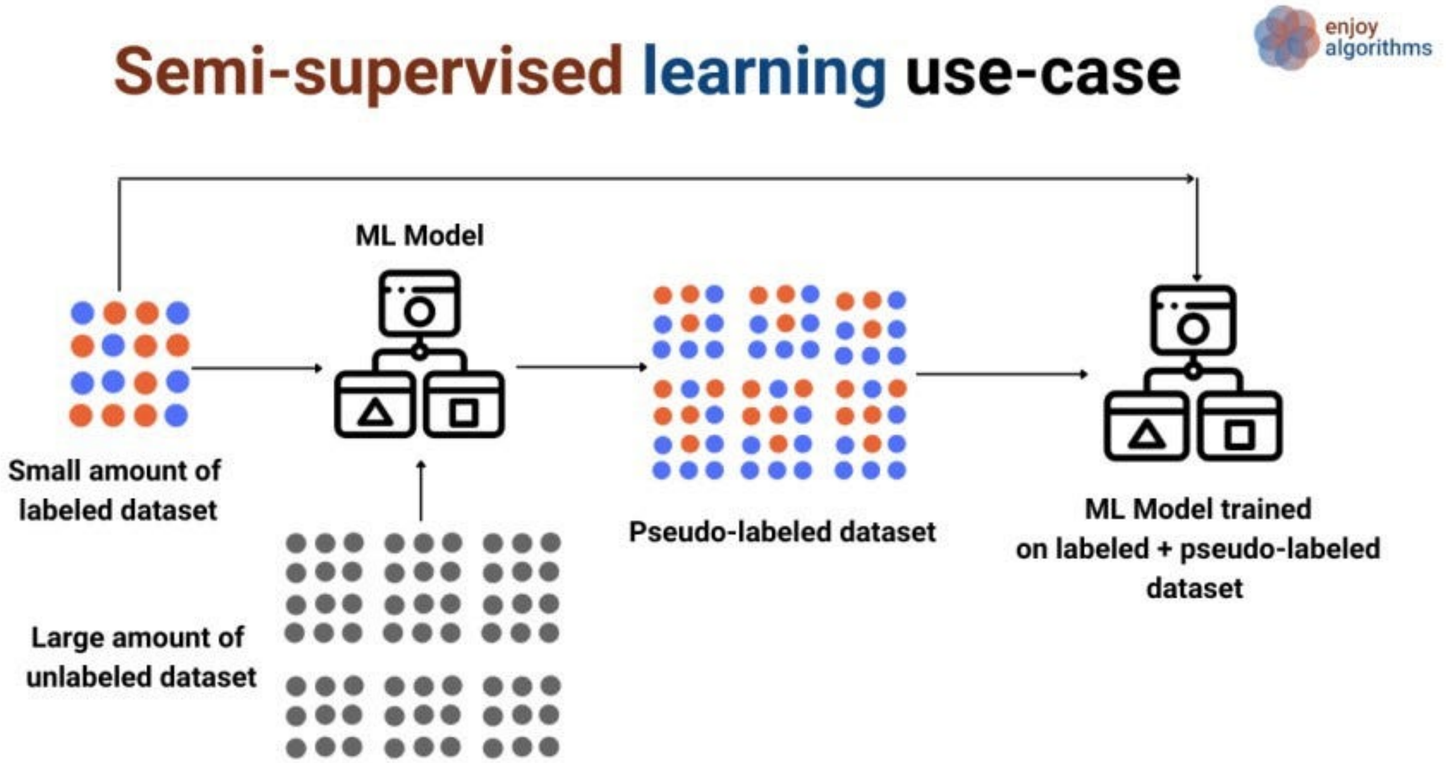
Introduction

- Investigation of using Semi-Supervised Machine Learning methods on discriminating between Gamma/Hadrons on LHAASO-KM2A
  - Current method (Q-Cut) uses a ratio between the number of muons and electron to determine gammas from hadrons
- Tested on observed data from 1 Jan - 21 Jan 2025

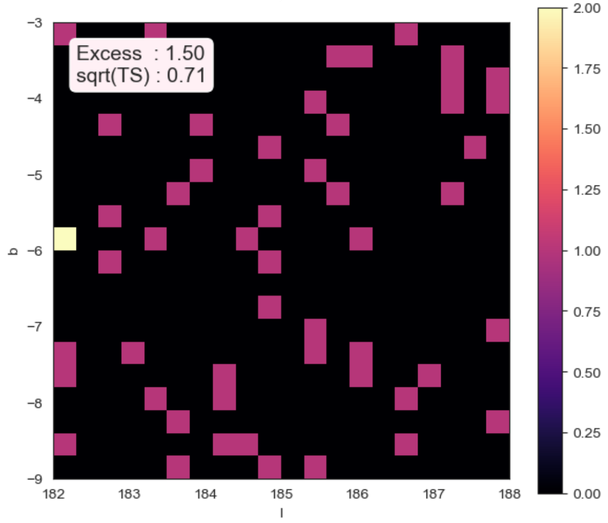
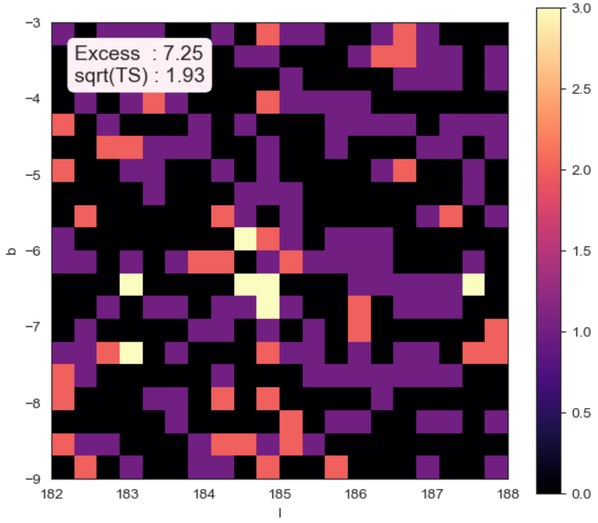
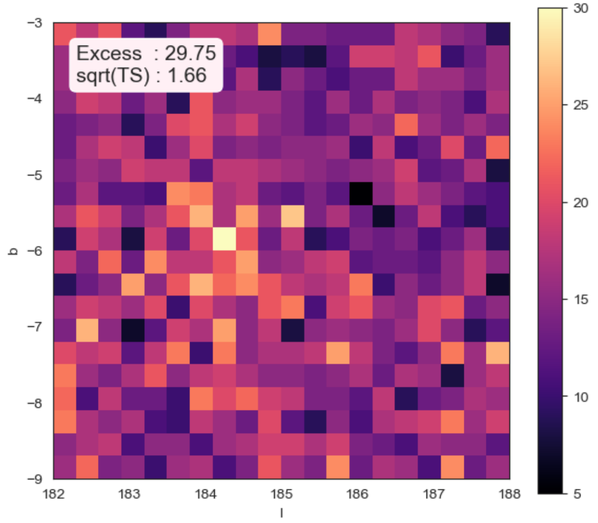
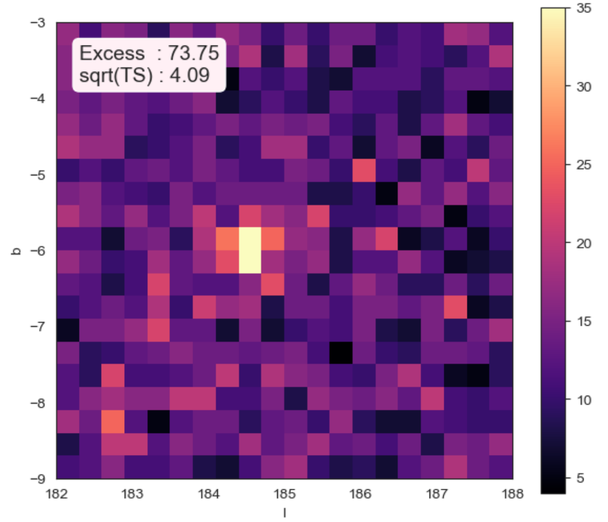
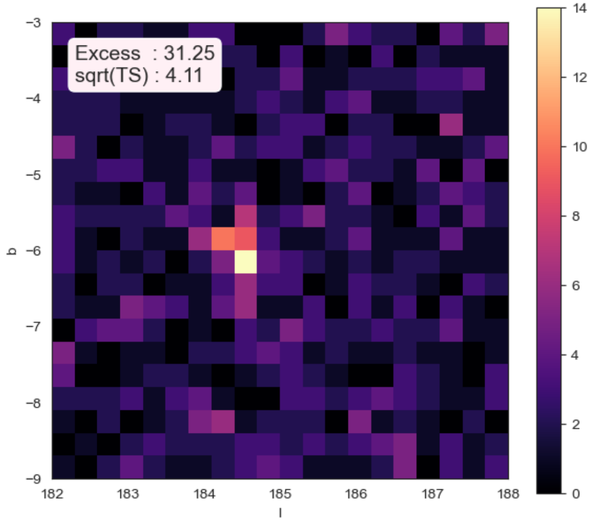
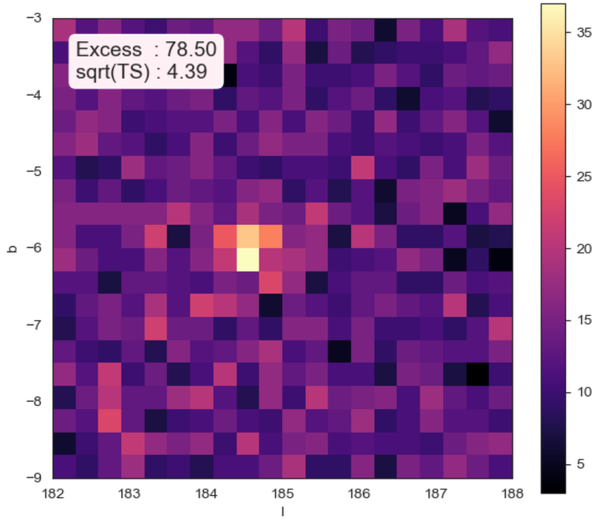


ML : Semi-Supervised Learning

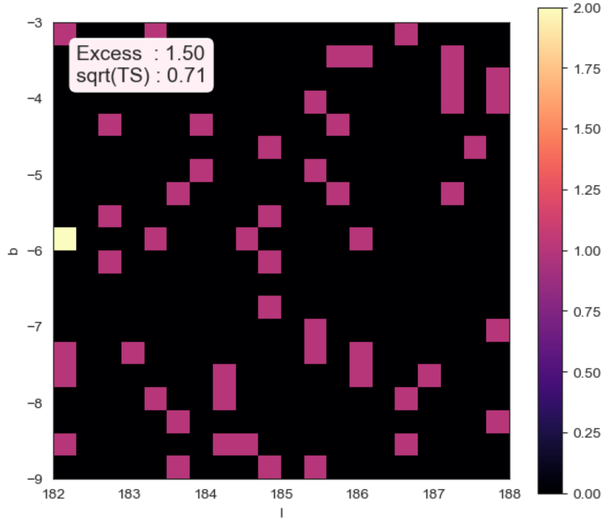
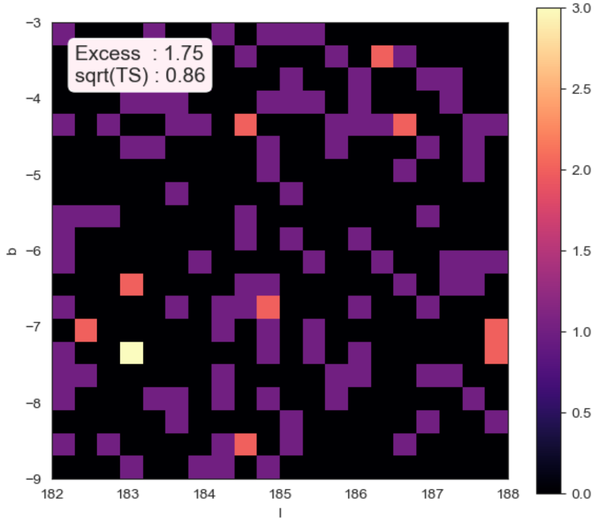
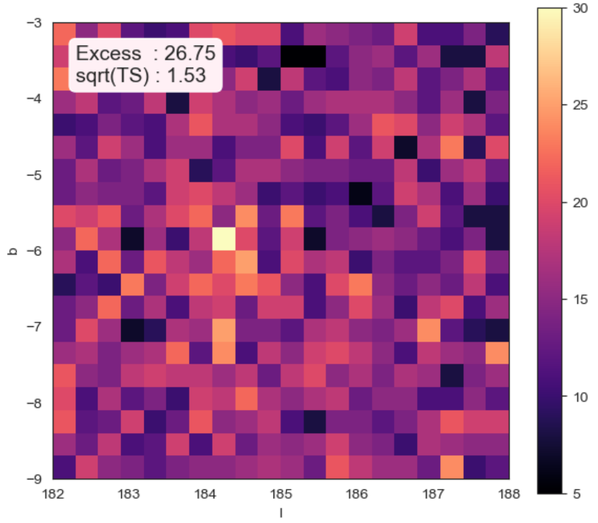
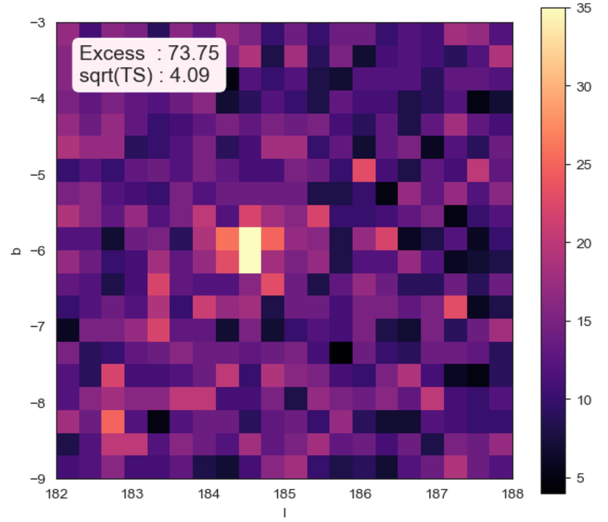
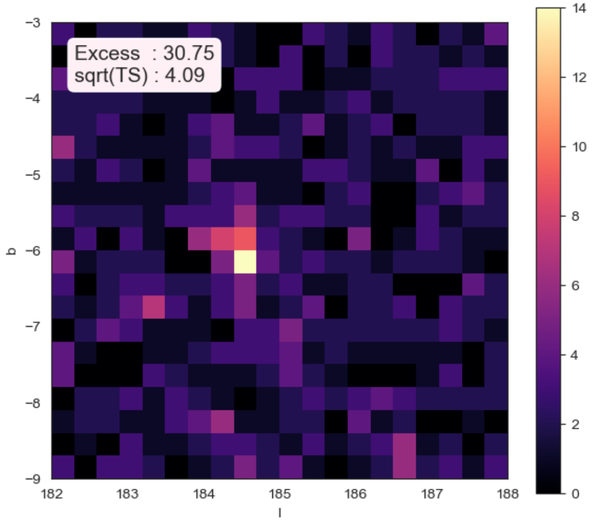
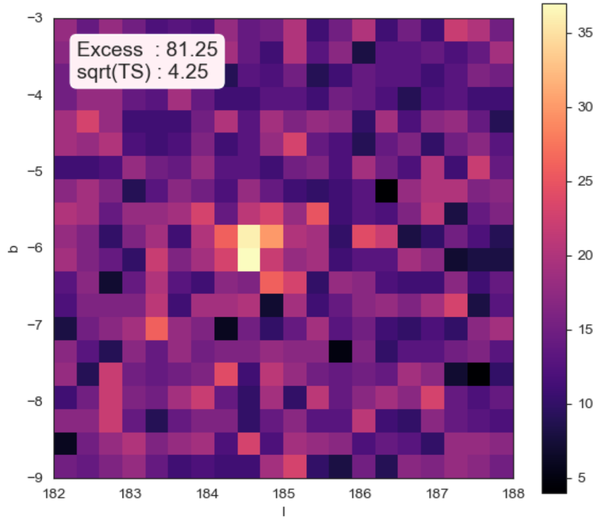
- The ML models used in conjunction are Multi-Layer Perceptron Neural Network (MLP NN) and Boosted Decision Tree (XGB)
- For supervised learning (SL) :
  - Simulated gammas [0], observed hadrons [1]
- For semi-supervised (SSL) :
  - Simulated gammas [0], observed hadrons [1], observed unknown [-1]



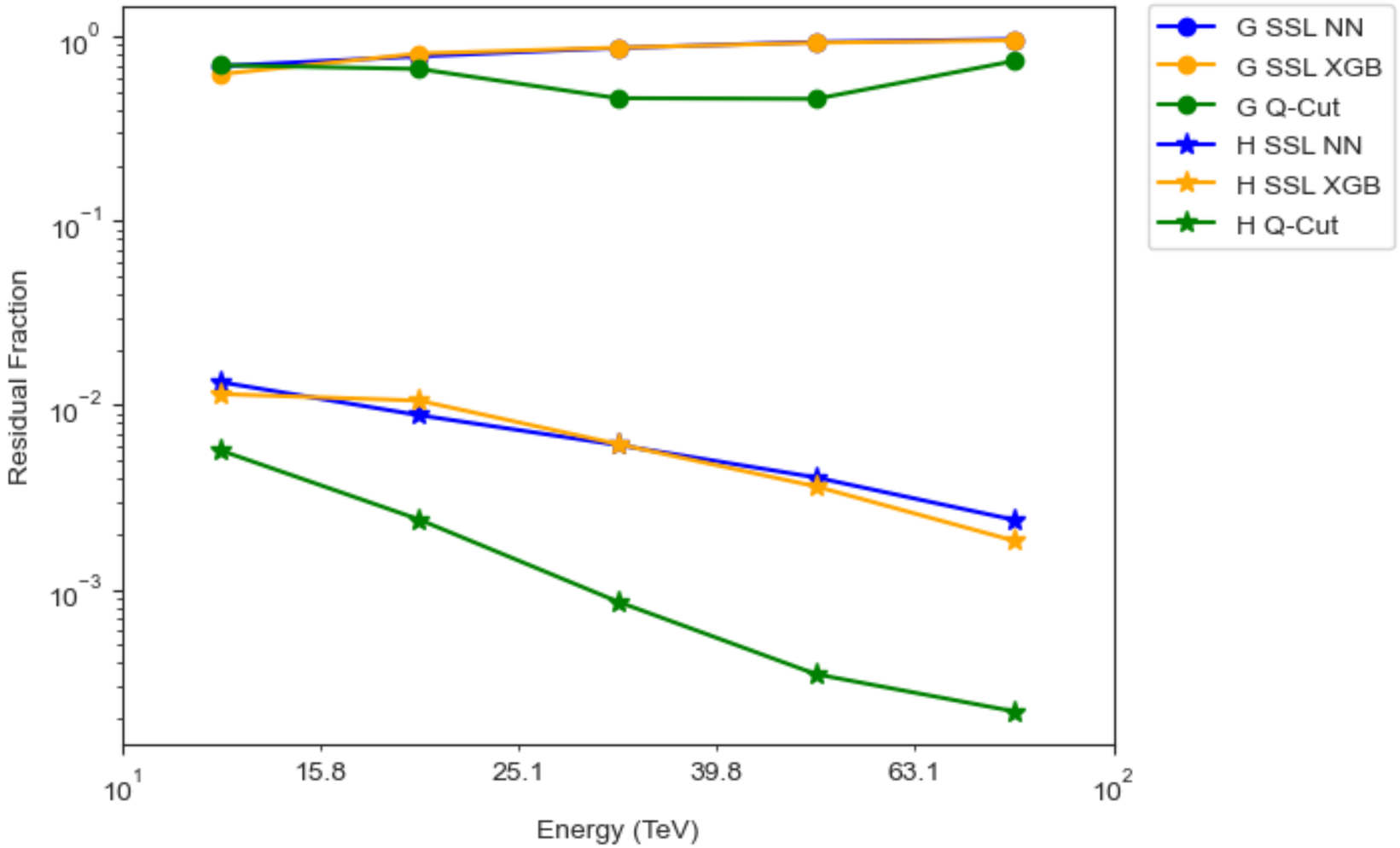
Crab Results : Neural Network

	Q-Cut	NN	SSL NN
10-25 TeV			
25-100 TeV			

Crab Results : Boosted Decision Tree

	Q-Cut	XGB	SSL XGB
10-25 TeV			
25-100 TeV			

Gamma Residual Fraction



Thanks!