

# Using Geant4 labels to classify hadronic showers

2 months internship by Yaroslav Nikolaiko

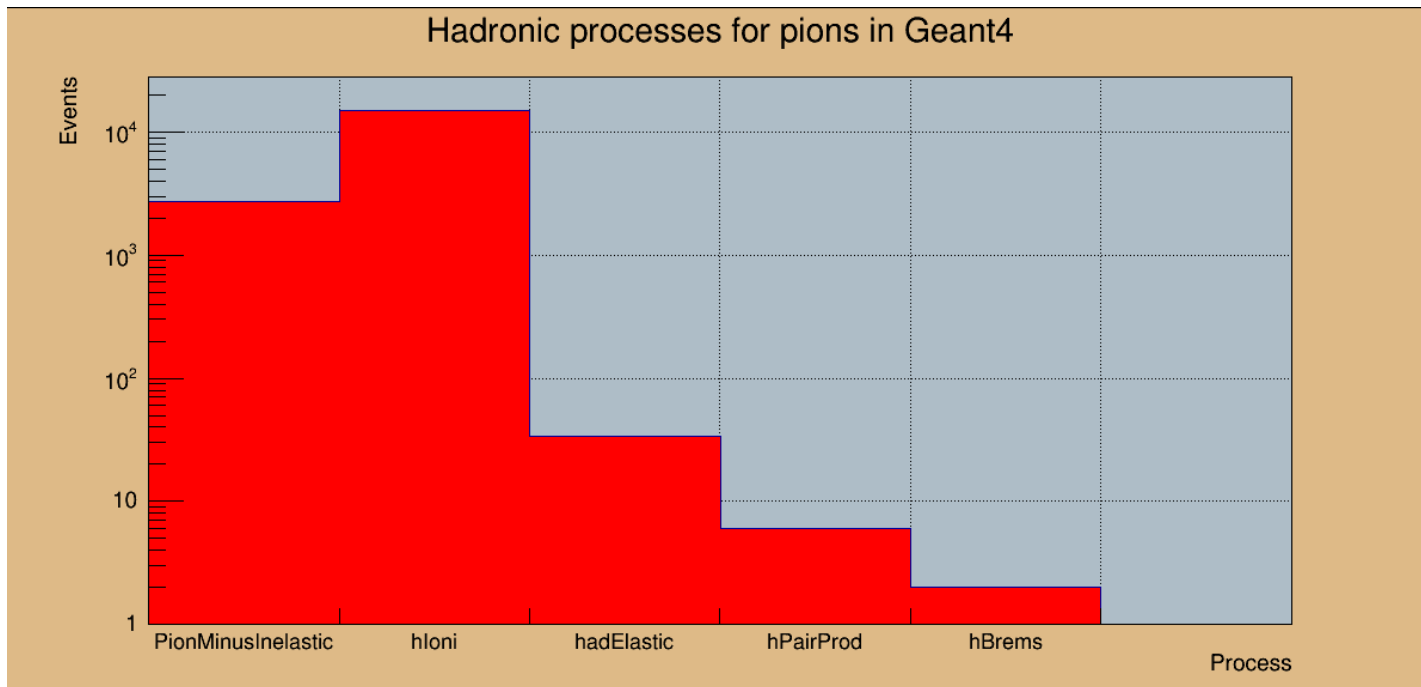


# Introduction

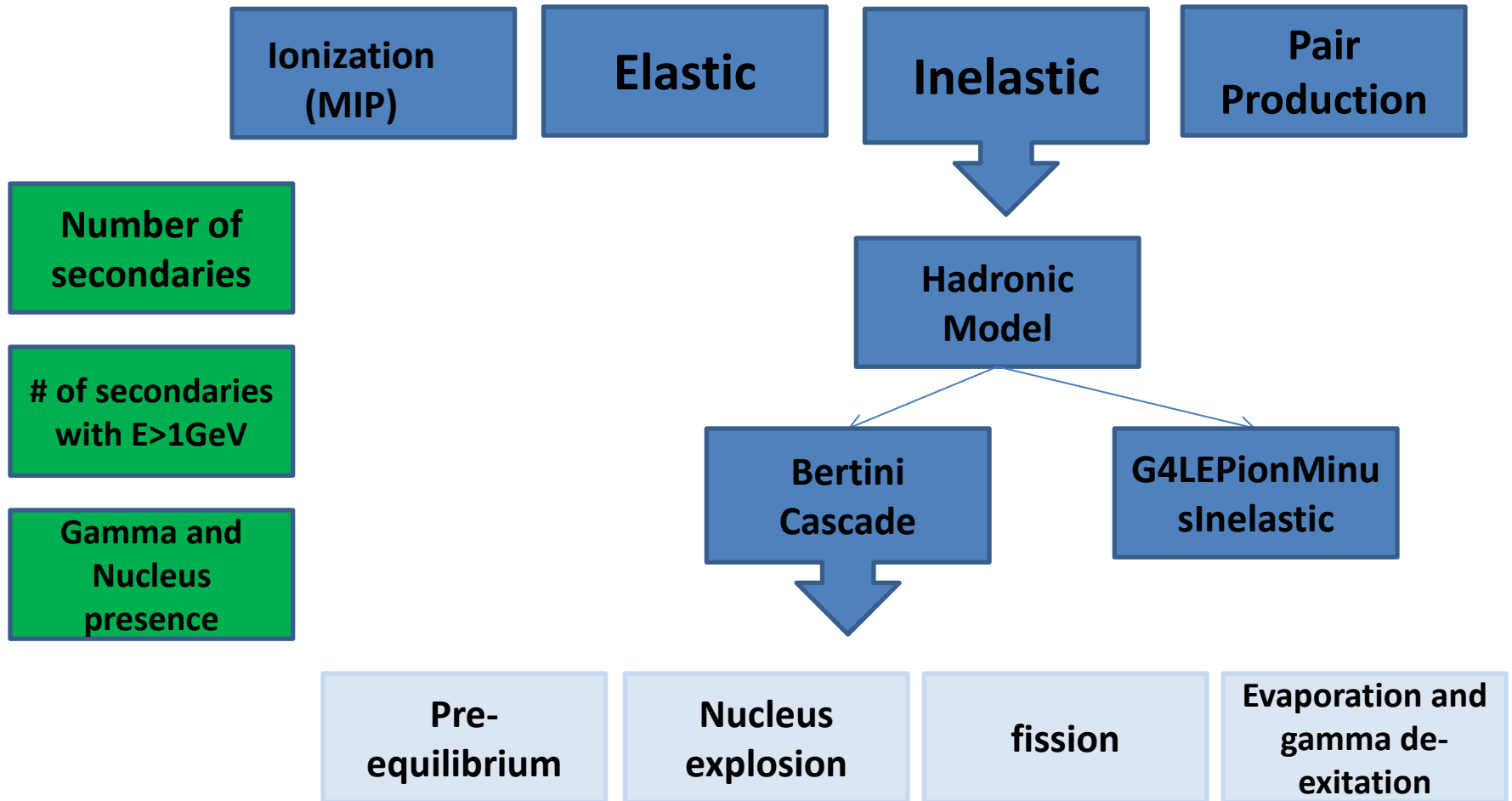
- In the context of using machine learning techniques to characterize hadronic interactions in the ECAL, investigate the information available in Geant4 and supply useful physics labels and observables

# Data set

- Testbeam Monte Carlo pi- at 10 GeV, QGSP\_BERT

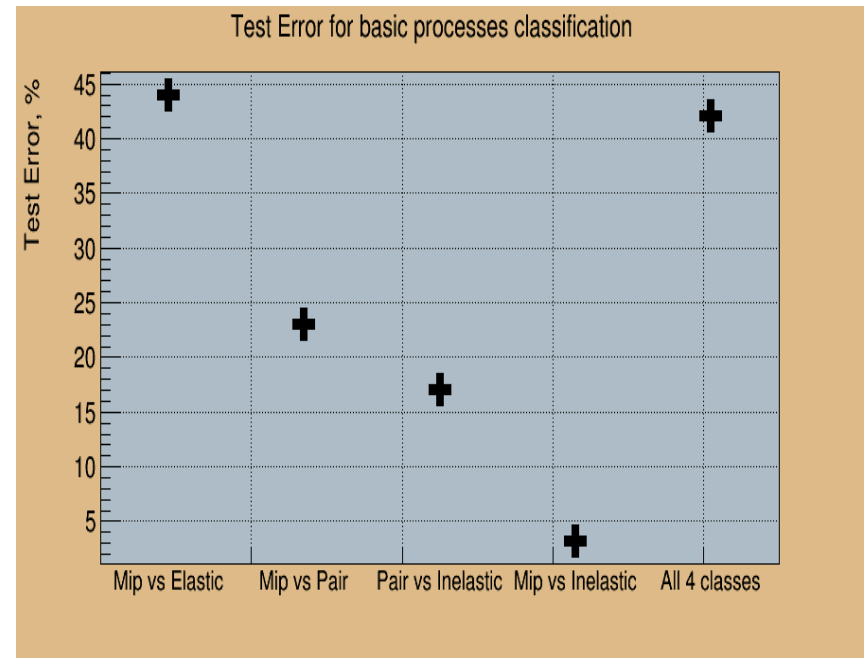


# Geant4 setup and observables



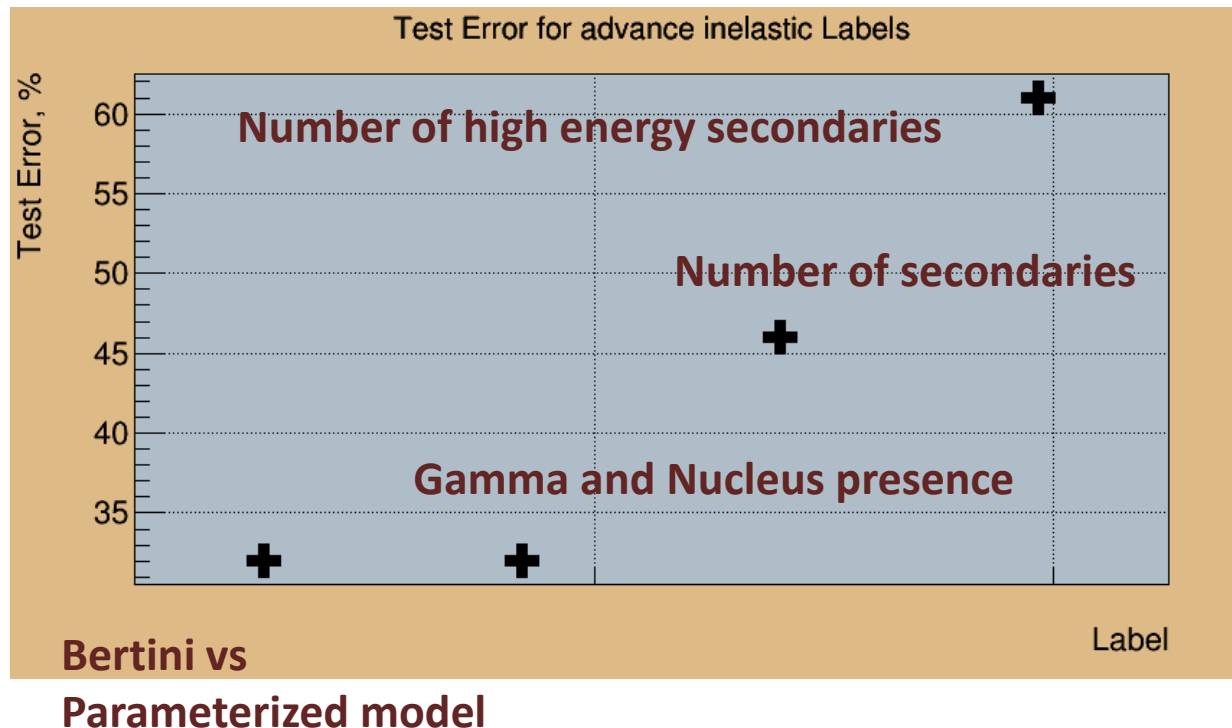
# Results with Multiboost

- Supervised learning setup
- Simple single stump learner
- Input features: combination of energy per layer, energy difference, radius per layer etc.
- Input labels: MIP, elastic, pair production and inelastic



# Results with Multiboost

Similar test with different labels: model, gamma and nucleus presence, number of secondaries, number of high energy secondaries



# Summary

- The architecture of the Geant4 kernel was explored and the basic labels extracted.
- Supervised learning setup was tested for hadronic interaction classification and for details of inelastic interactions.
- Collaboration with AppStat group on deep learning (provide input features)
  
- To be continued...