Use of Machine Learning for gamma/hadron separation with HAWC (Flash poster talk)

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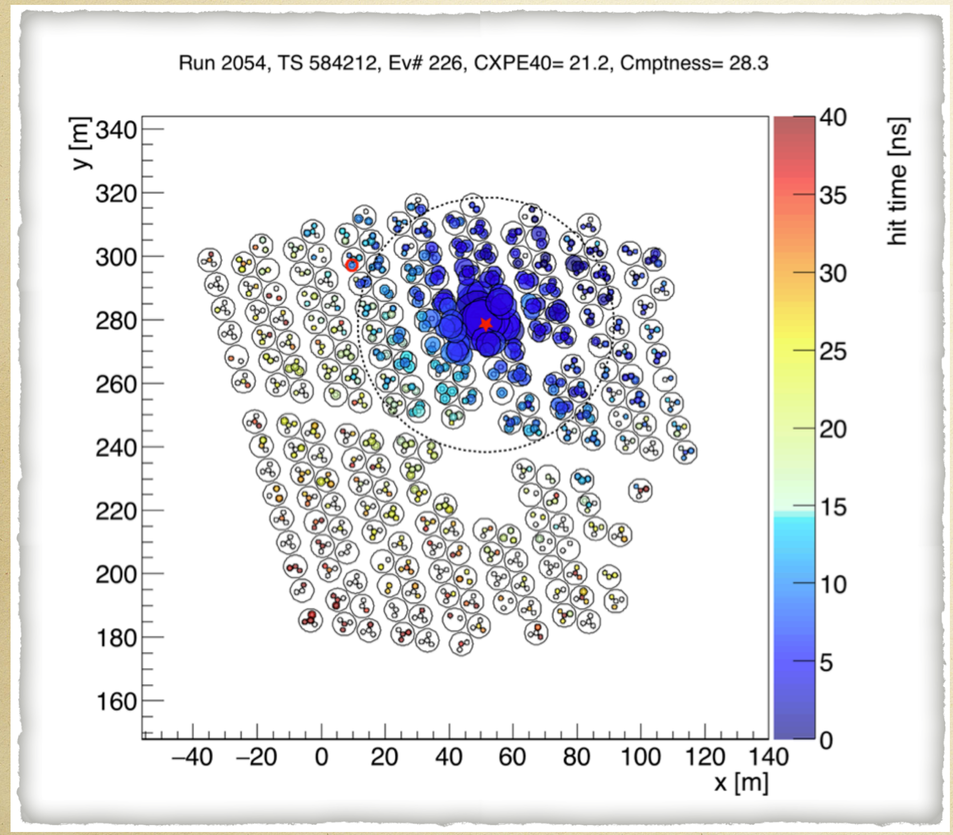
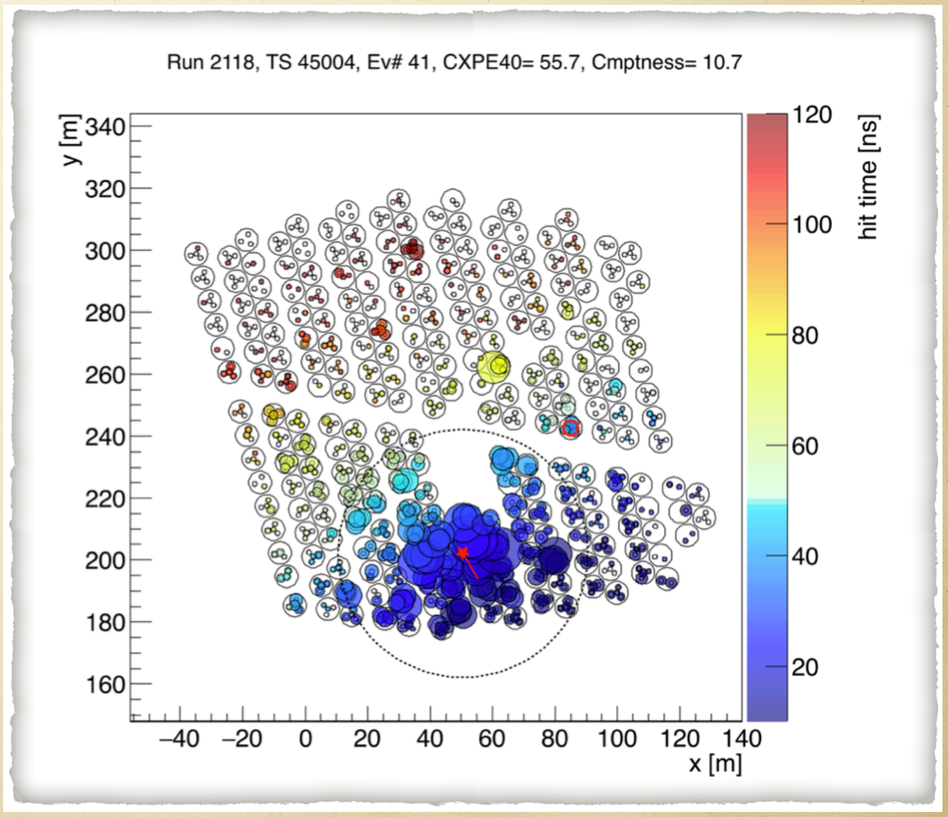
Gamma or Hadron?

Very low flux of gamma-ray



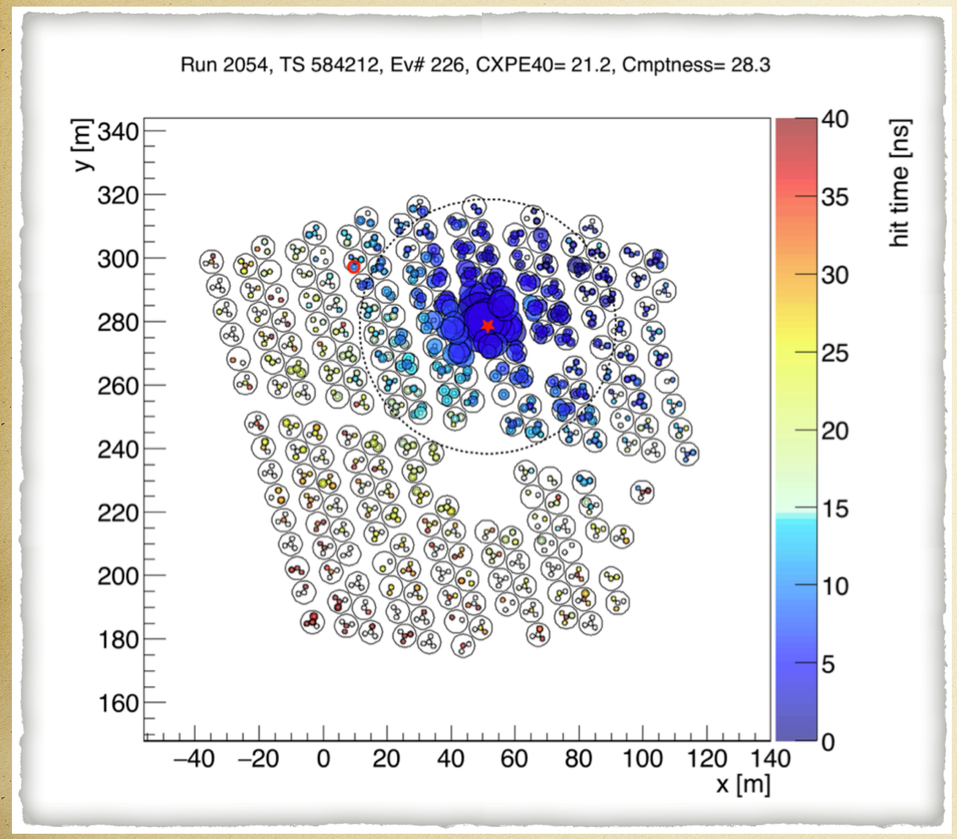
?

A huge flux of cosmic ray (hadrons)



Pretz, J. (2016). Highlights from the High Altitude Water Cherenkov Observatory. PoS(ICRC2015). https://doi.org/10.22323/1.236.0025

Gamma or Hadron?

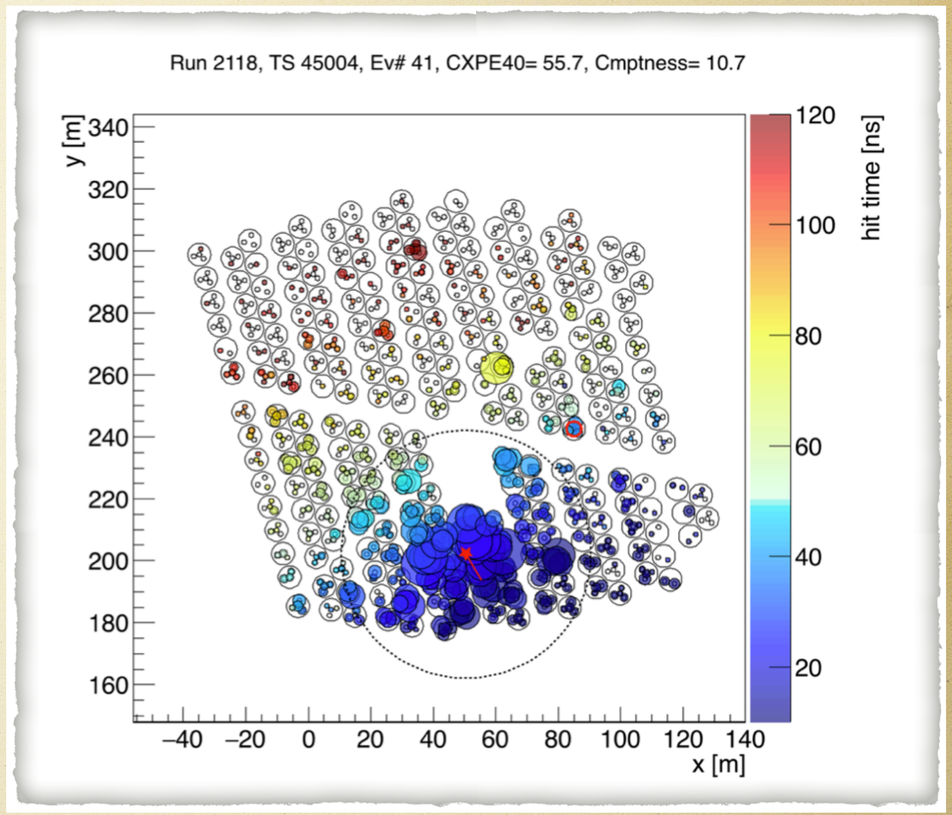


Information

G/H Model

Hadron

Gamma



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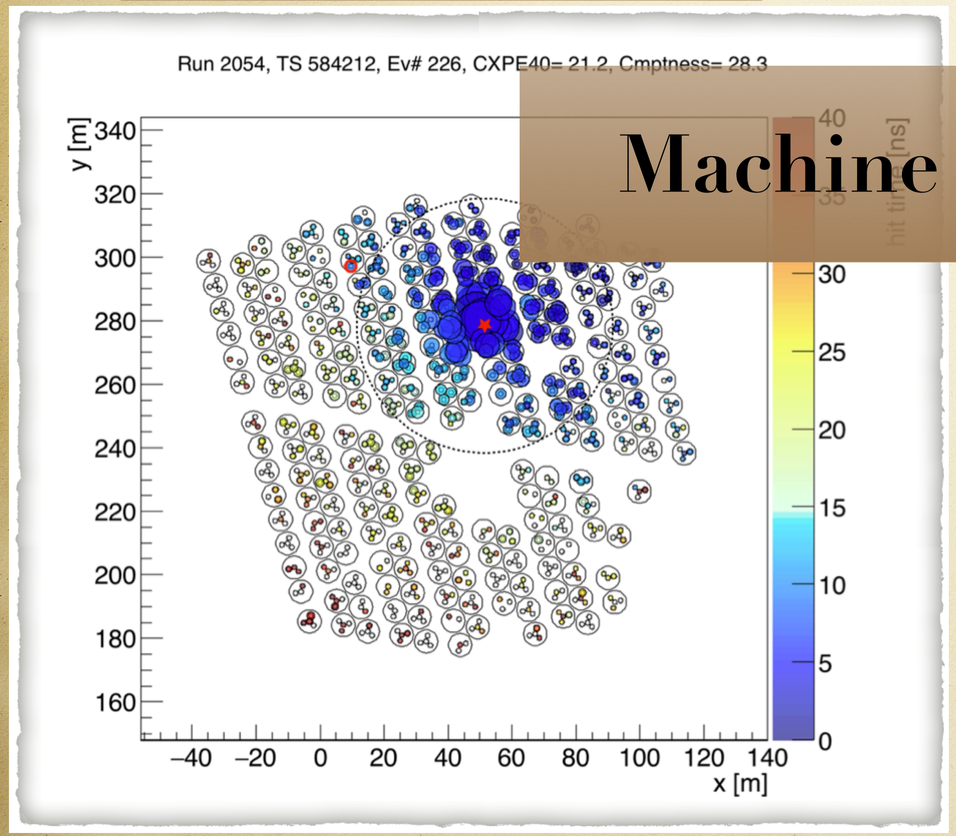
Gamma or Hadron?

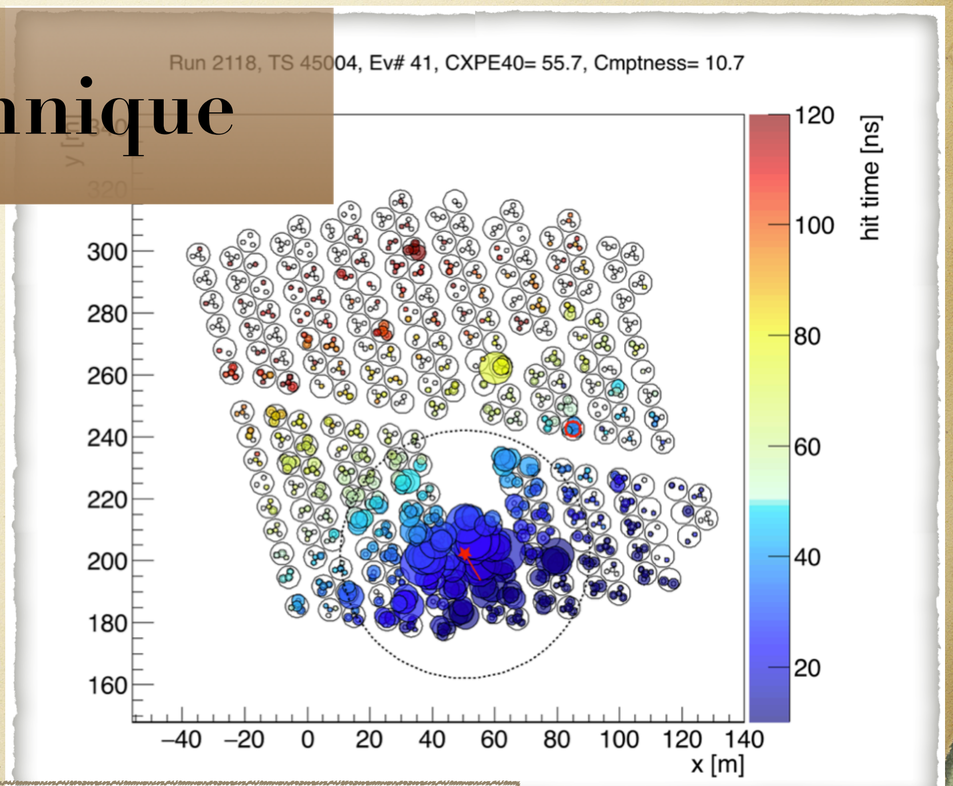
Neural Network

Boosted Decision Tree

Machine Learning Technique



G/H Model



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Testing state using simulation data

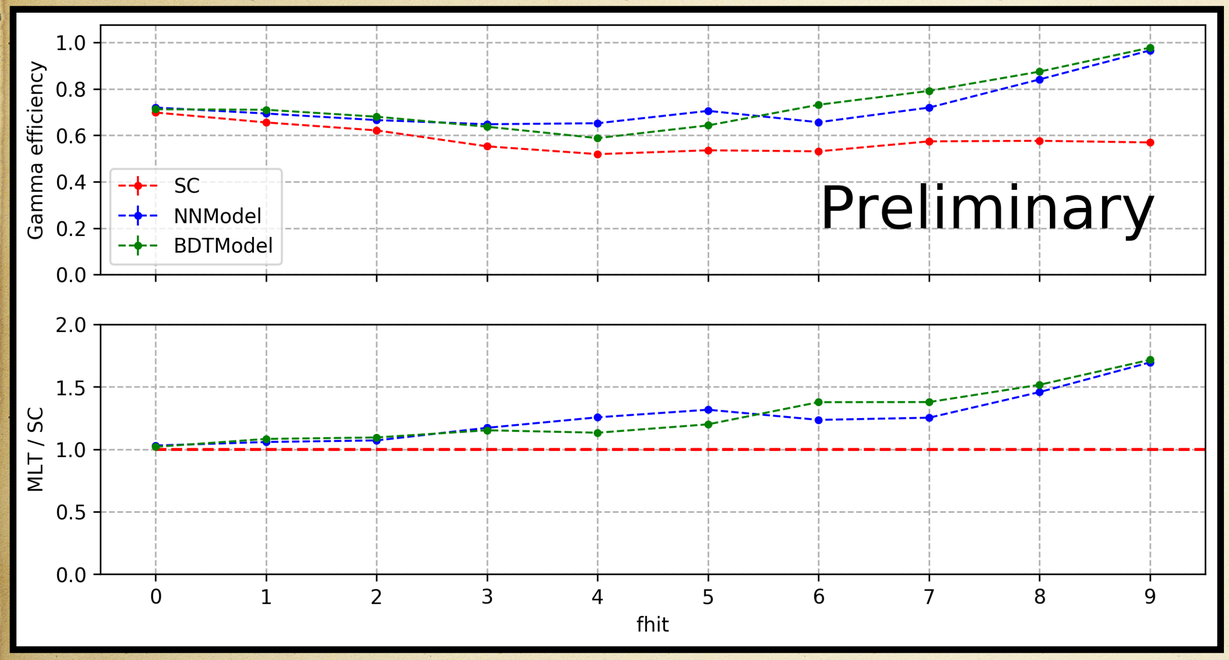

Figure 3: Top panel shows the gamma efficiency for three G/H separation method. On the bottom show the comparison between MLT and SC.

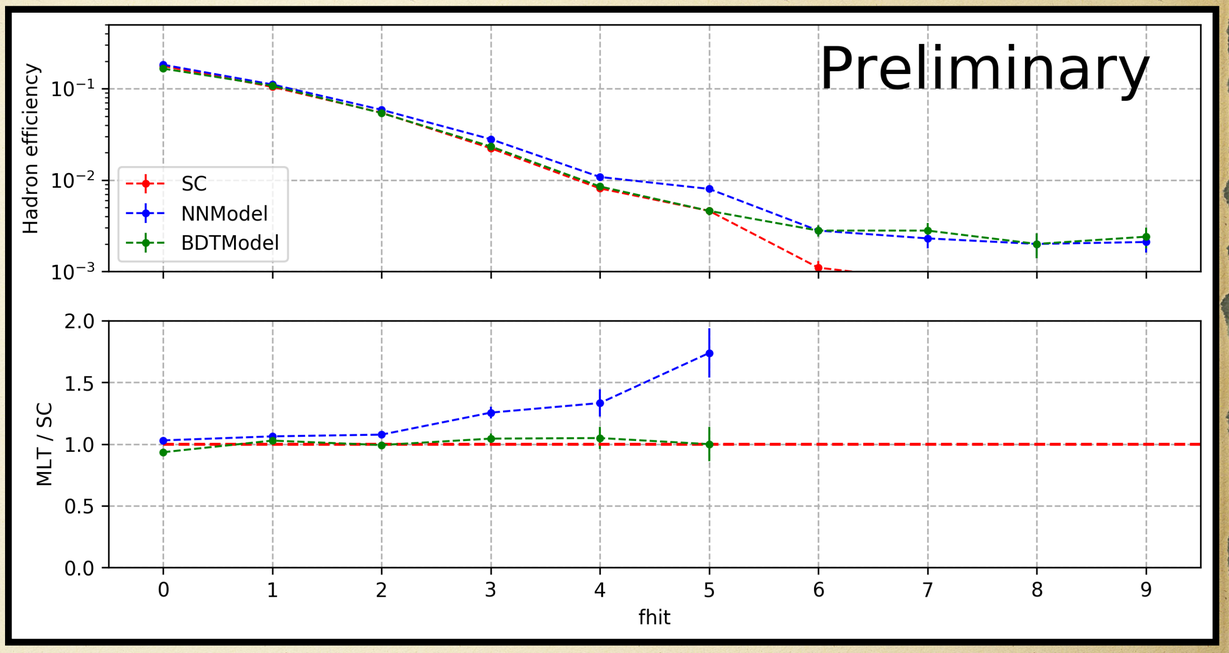

Figure 4: Idem to Figure 3 but here shows the hadron efficiency.

The MLT have a greater performance on gamma efficiency but SC is the best in high fhit.

Testing state using Crab Nebula data

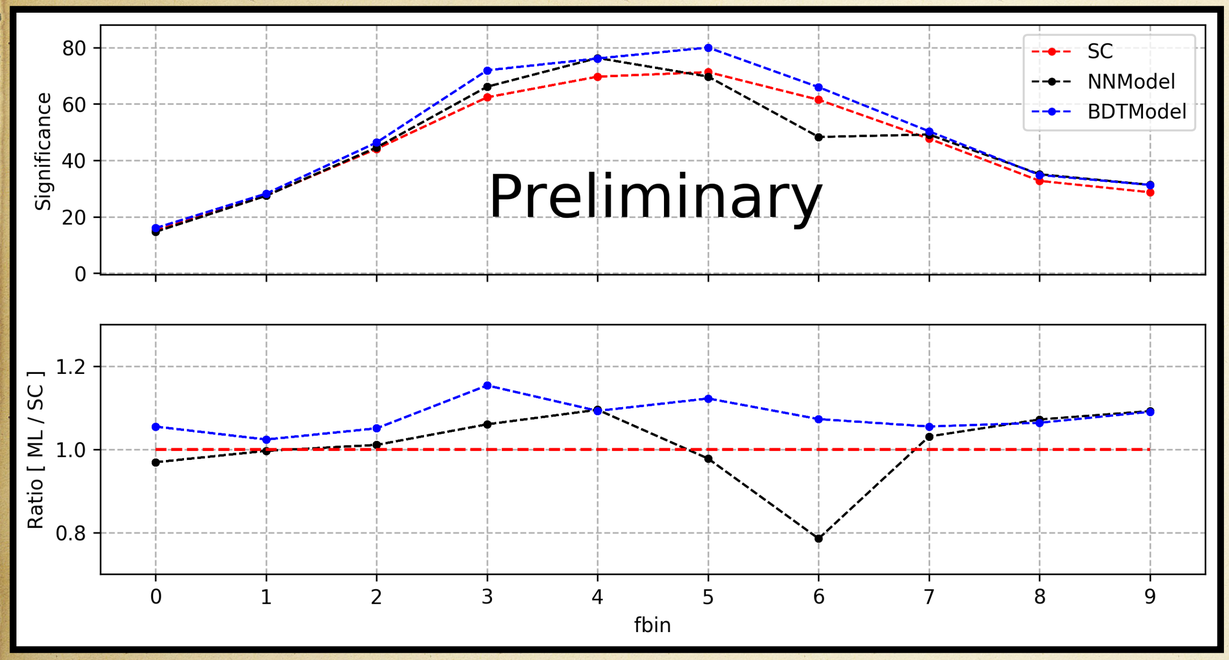

Figure 5: Top panel show the significance on the Crab using the G/H separation model as a function of fbin

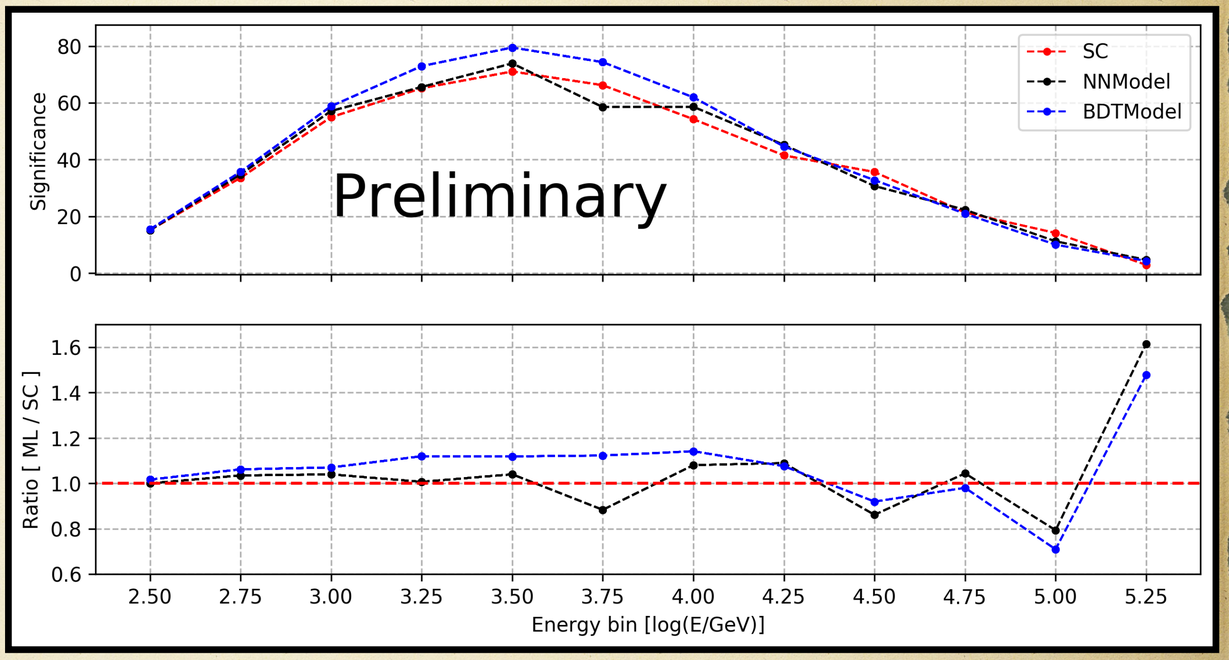

Figure 6: Idem to Figure 5 but here report for each energy bin.

The best model is the BDTModel, and its improvement depends on energy events or fbin.