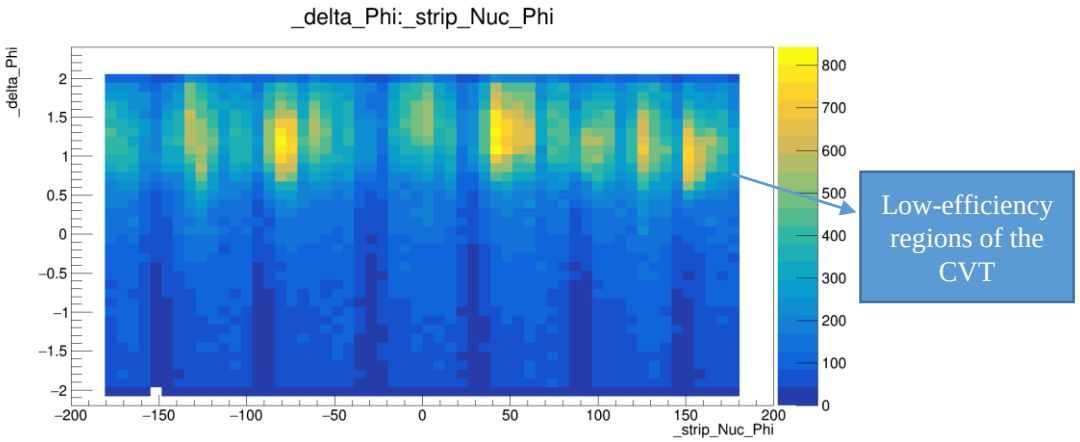
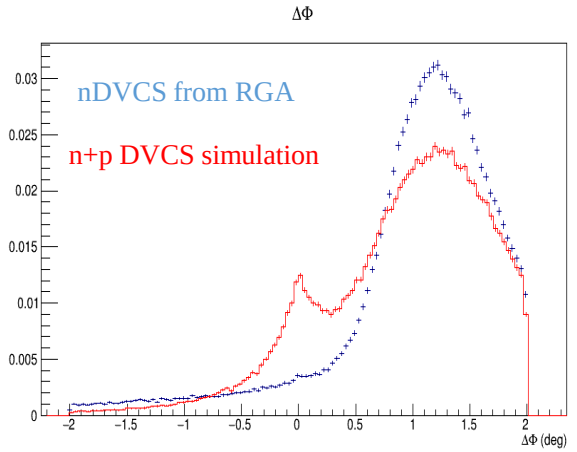
Proton contamination removal from CND neutrons

- The tracking of the CVT is neither 100% efficient nor uniform
- In the dead regions of the CVT protons have no associated track and thus can be misidentified as neutrons
- Protons roughly account for more than >40% contamination in the “nDVCS” signal sample

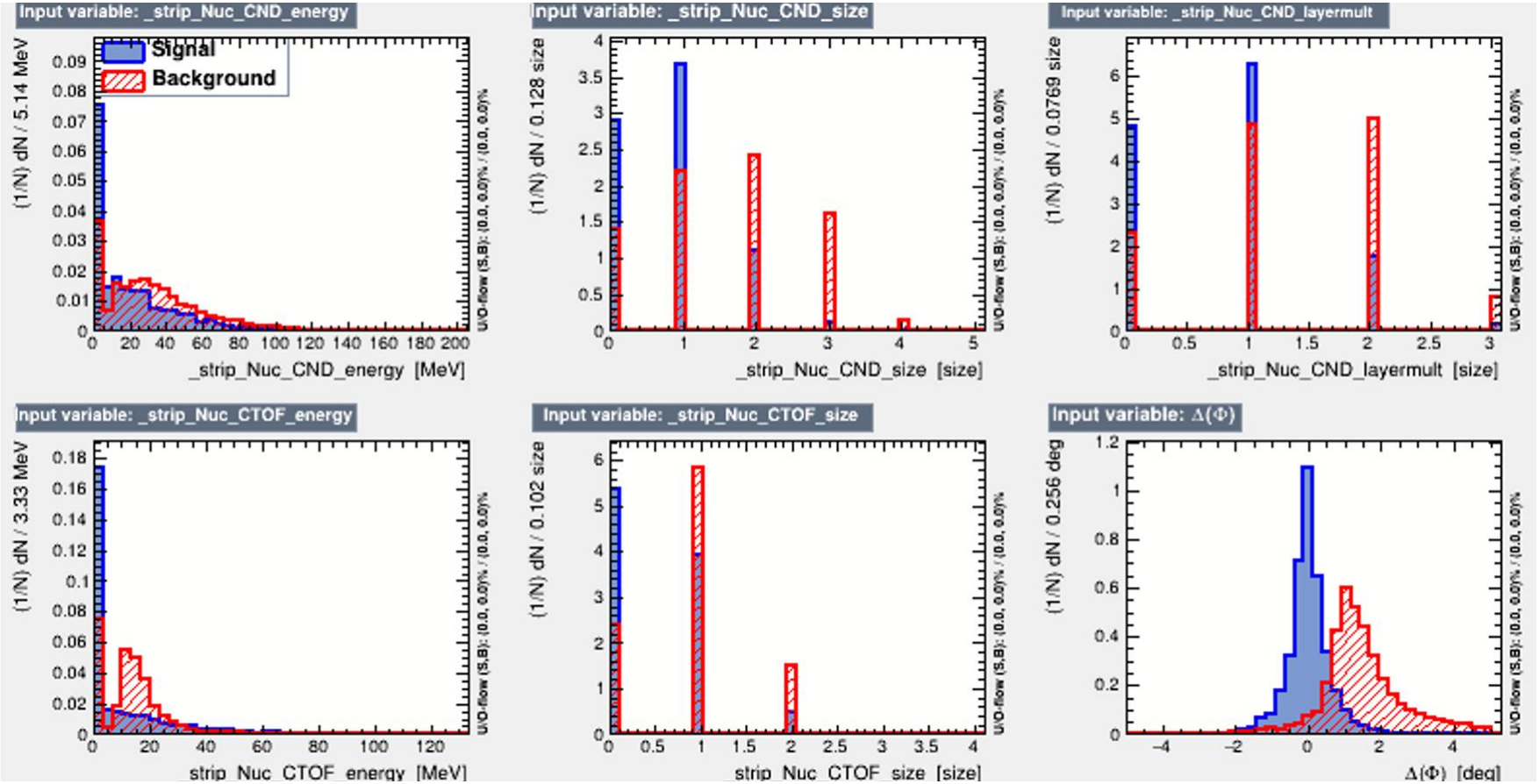
Current approach, based on Machine Learning & Multi-Variate Algorithms:

- We reconstruct nDVCS from proton-data (RG-A) requiring neutron PID from the EB
  - Most of those neutron are actually misidentified protons
- We use this sample to determine the characteristics of fake neutrons in low- and high-level reconstructed variables
- Based on those characteristics we subtract the fake neutrons contamination from nDVCS in RG-B
- As a « signal » sample in the training of the ML we use $ep \rightarrow en\pi^+$ events from RG-A



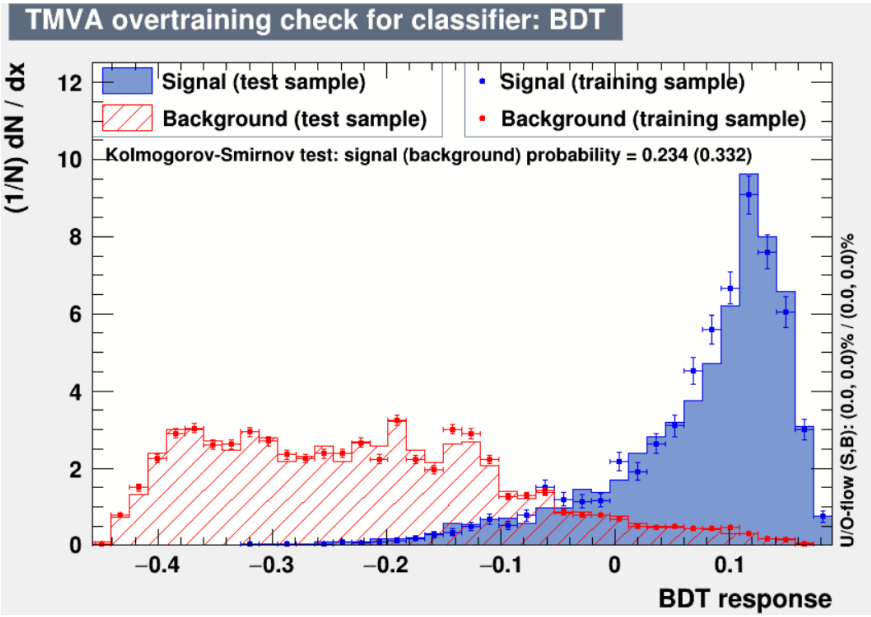


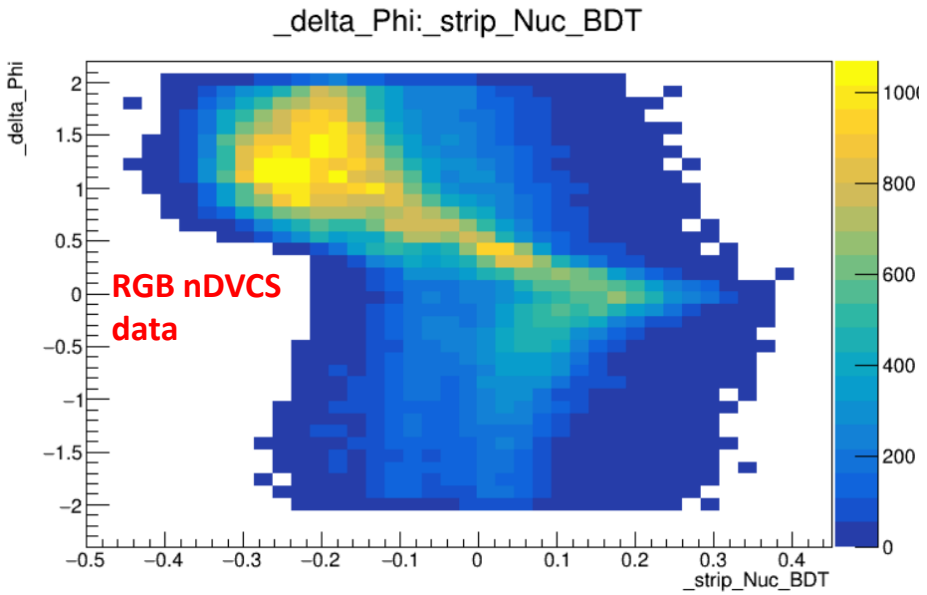
Training variables for the ML algorithm

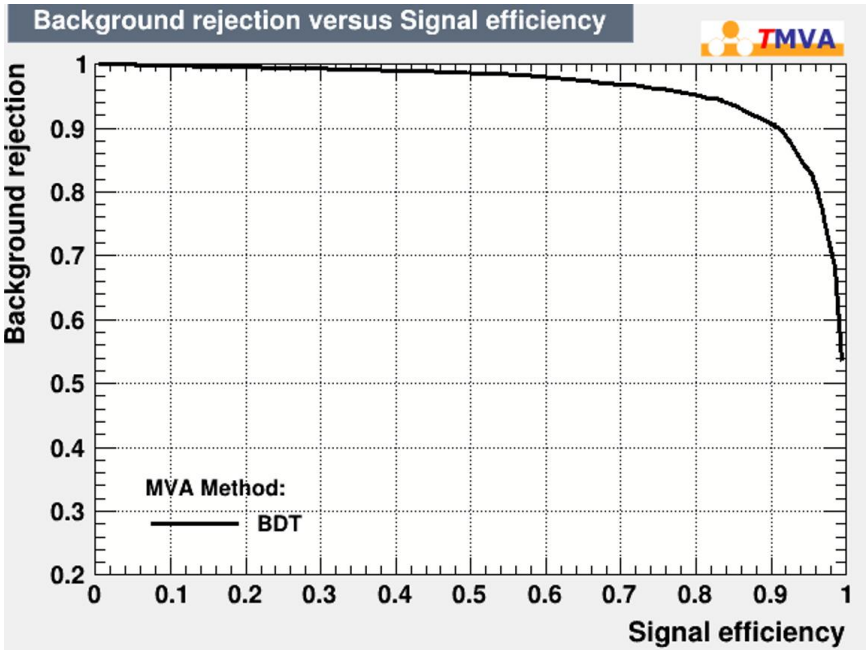


- Using detector variables (CTOF and CND) and one exclusivity variable ($\Delta\phi$)
- Some of the fake neutrons are due to too tight matching cuts in the old CND clustering algorithm (this has been corrected and the corrected version will be used for pass2 cooking)
- In order to recover the track information for these fake neutrons, a search has been performed near the CND cluster of the fake neutron for any positive track: if found, reclustering is perfomed offline for both the CND and the CTOF

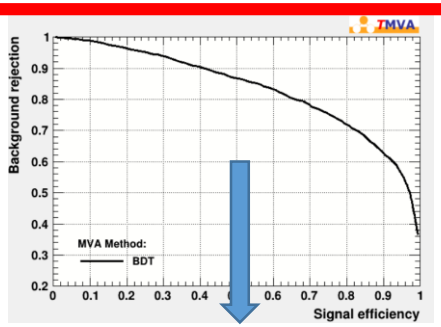
Tool performance







For comparison



Removing $\Delta\phi$ from training: still good performance but not enough

In the Pass-2 reconstruction, each layer in the cnd will have its own cluster and we estimate the performance to be much higher with only detector variables

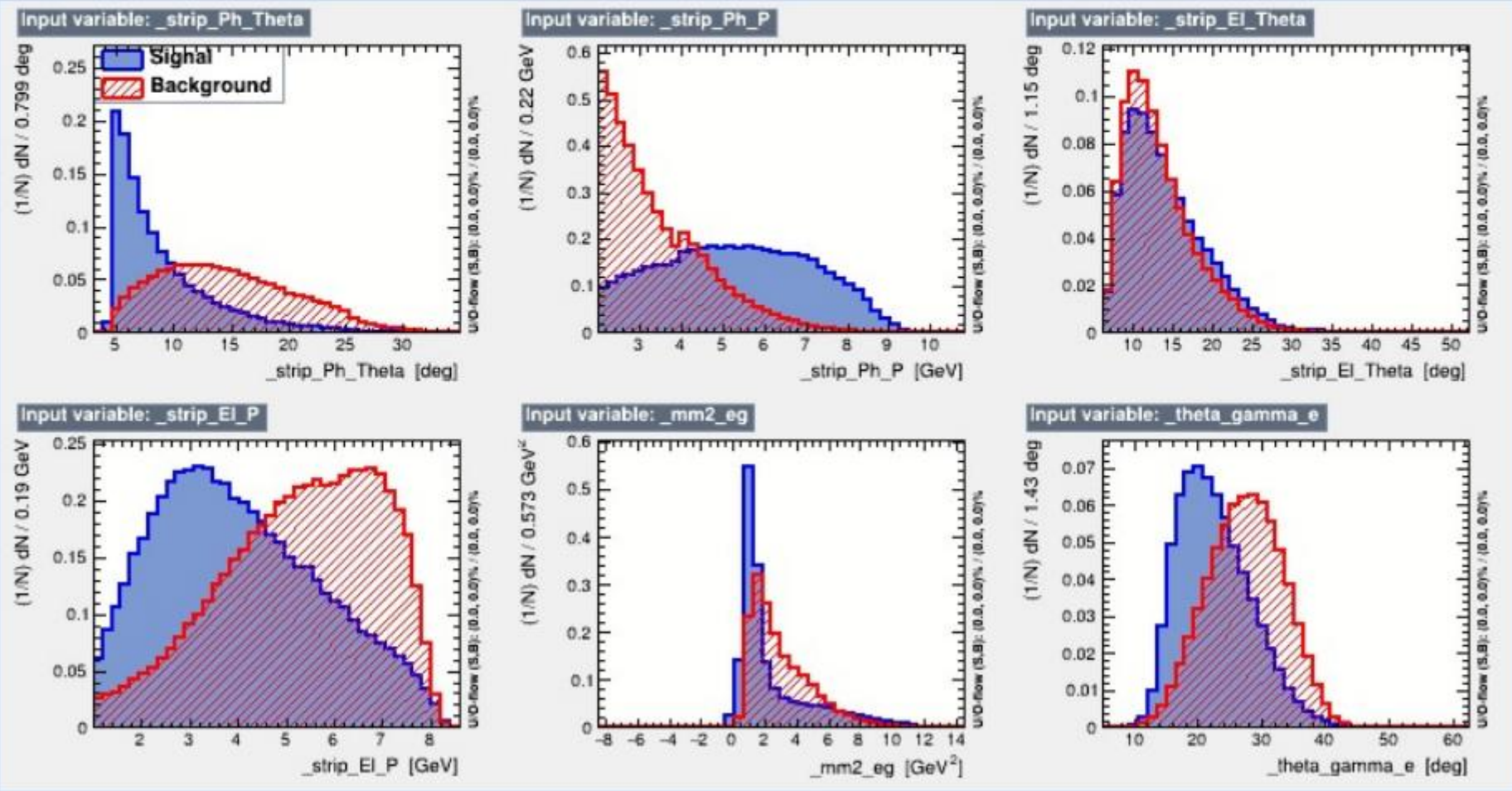
DVCS without Proton

Training of a MVA analysis based on ML techniques

Signal: DVCS simulation in RGH config.

Background: pi0 simulation as DVCS in RGH config.

Feasibility study for pDVCS in RGH current setup without Central Detector

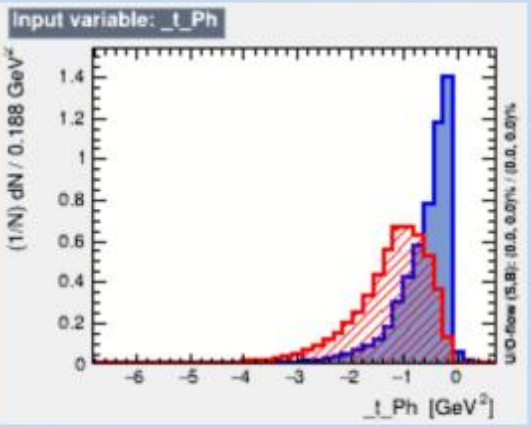


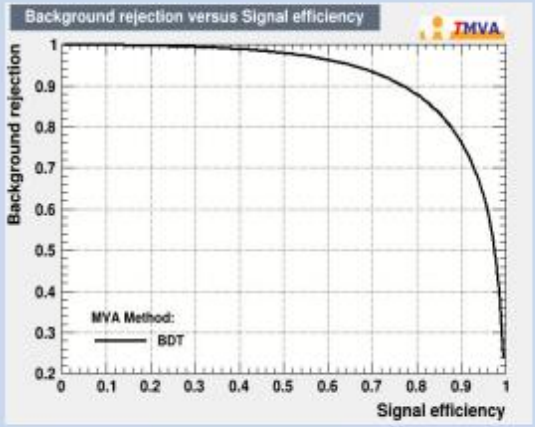
Exclusive Events

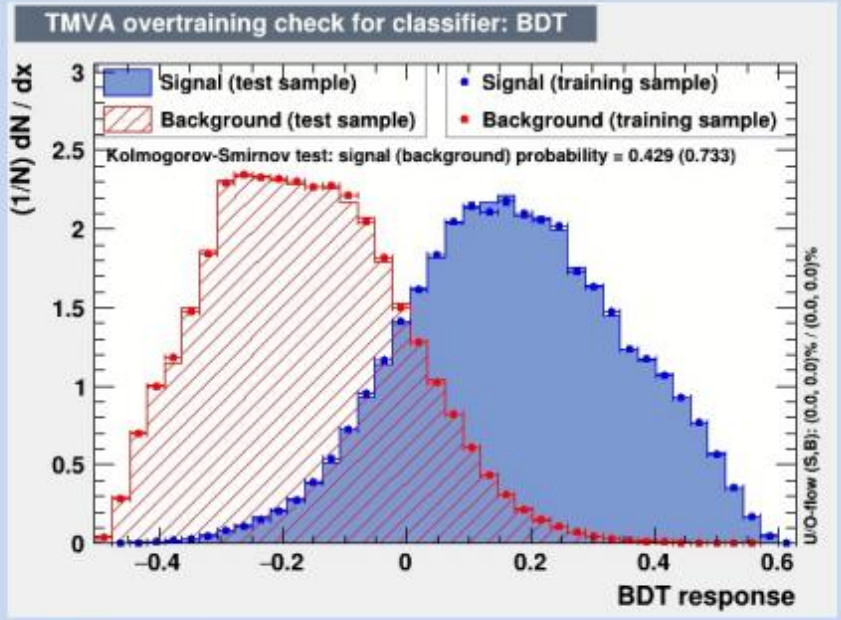
Classifier response assessment with

data from RGA, to be extended to RGB and RGC

alternative background subtraction methods







Results similar to RGA analysis note