

Flash Talk for the poster

Estimating K_L^0 identification efficiency of KLM detector in Belle II experiment using sPlot



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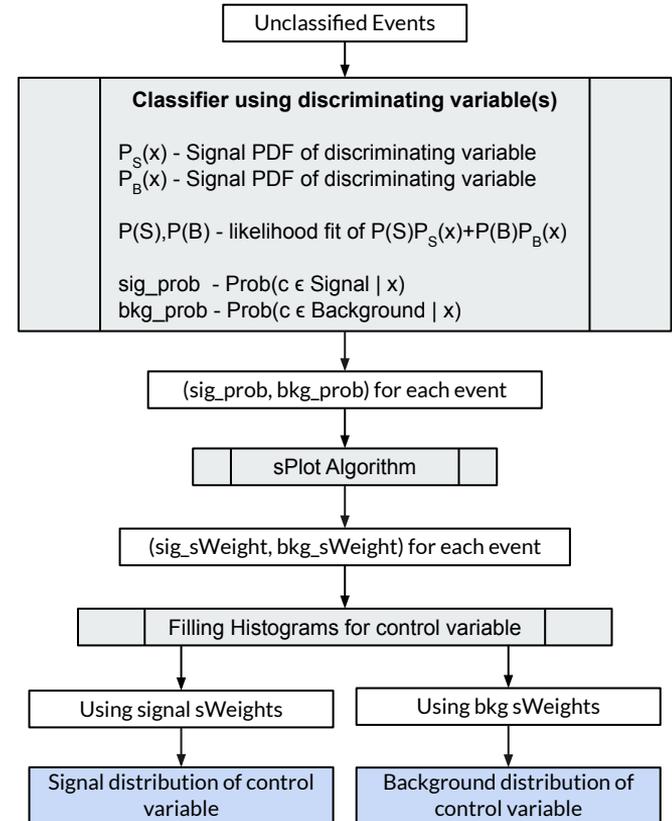
Abstract

K_L^0 particles are identified by the energy deposits in the KLM, the outermost detector in the Belle II experiment. However, photons, neutrons and other neutral hadrons can also deposit some energy in the KLM detector. Here we present a statistical technique using sPlot, to distinguish between the patterns of energy deposits in KLM from K_L^0 vs other backgrounds. This technique allows one to make a robust determination of K_L^0 identification efficiency in the KLM detector.

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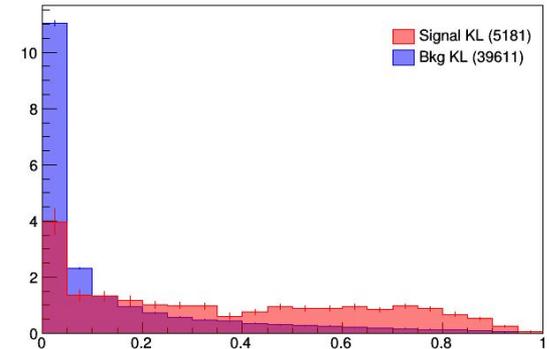
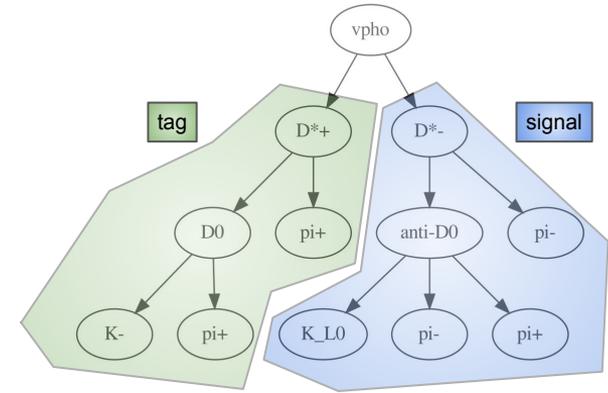
sPlot method for unfolding signal and background distributions

- sPlot lets us obtain distributions of some *control variable* for signal and background events or particle candidates separately without explicitly requiring us to mark them as signal or background.
- We use one (or more) *discriminating variable(s)* to calculate the probabilities of each event/candidate to be a signal or a background one.
- The sPlot algorithm converts these signal and background probabilities to corresponding *sWeights*.
- Filling a histogram with all the events/candidates in the dataset weighted by their *signal sWeights* yields the *signal distribution* of our control variable. Similarly, if they are weighted by background *sWeights*, we get the background distribution of that variable.



Estimating K-long ID efficiency using sPlot

- We use the **mass difference (Δm)** between signal side D^{*-} and D^0 as our **discriminating variable**.
- We obtain the signal and background PDFs of Δm from the D^{*-} and D^0 masses computed using some “pure” signal and background K-long candidates.
- The “**pure**” signal and background K-long candidates are chosen based on **some strict cuts on the proximity** with the “correct” direction and magnitude of the K-long momentum, calculated using momentum conservation.
- We use those signal and background PDFs with the sPlot algorithm to obtain the signal and background **sWeights** for **all reconstructed K-long candidates** in the dataset and plot the distributions of **K-long ID**, our **control variable**, for **true vs. fake** K-long candidates.



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