Lab 7

Ondrea Robinson

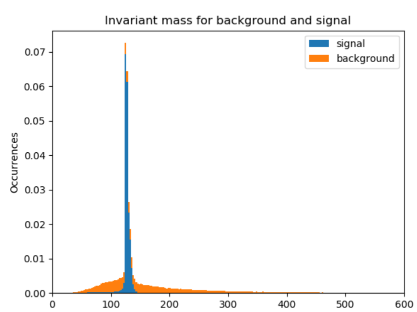
November 24, 2019

This lab is a write-up of my exploration of the data so far. Most of the analysis is focused on distinguishing significant factors in the data and finding cuts to separate signal data from the background.

1 Part I

First let's look at mass. We look at the two distributions of mass for the signal and background and it's very clear that the signal is peaked around one specific mass value while the background is more gently distributed over a wider range. Below is a stacked histogram of the two data sets:

```
figure()
x = [signal_dict['mass'], backg_dict['mass']]
labels = ['signal', 'background']
plt.hist(x, 300, stacked=True, density=True, label=labels)
plt.xlim(0, 600)
plt.title('Invariant mass for background and signal')
plt.xlabel('Mass')
plt.ylabel('Occurrences')
plt.legend()
plt.show()
```



We also want to know how other variables correlate to mass for the two data sets that way we can see where to cut the mass. We can do a scatter plot of mass vs each other variable to see if there's a common range for the signal versus the background. Here's the code for the plots and the 14 plots:

```
keys = signal_dict.keys()
backmass = backg_dict['mass']
sigmass = signal_dict['mass']
titles = ['Transverse Momentum', 'Psuedorapidity', 'Azimuthal Angle', 'Invariant
          '2-point ECF Ratio', '3-Point ECF Ratio', '3 to 2 point ECF Ratio', 'A
          't1','t2','t3','t21', 't32', 'KtDeltaR']
j=0
for i in keys:
    backg = backg_dict[i]
    signal = signal_dict[i]
    figure()
    plt.scatter(backmass, backg)
    plt.scatter(sigmass, signal)
    plt.xlabel('Mass')
    plt.title('Mass vs ' + titles[j])
    plt.ylabel('Occurences')
    plt.show()
    j=j+1
```

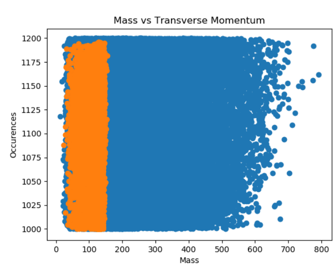


Figure 1

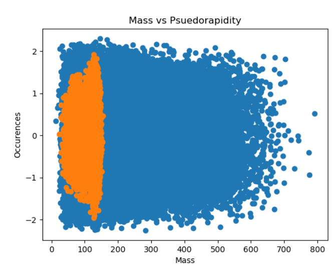


Figure 2

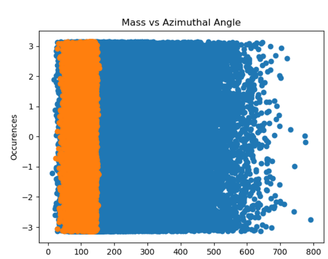


Figure 3

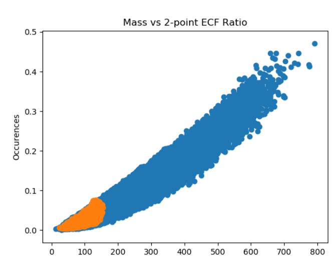


Figure 4

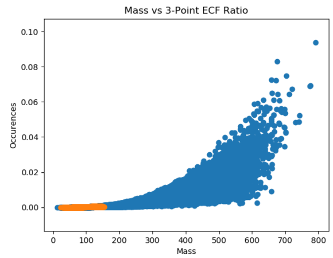


Figure 5

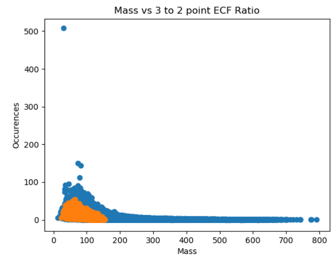


Figure 6

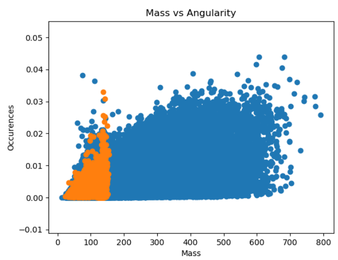


Figure 7

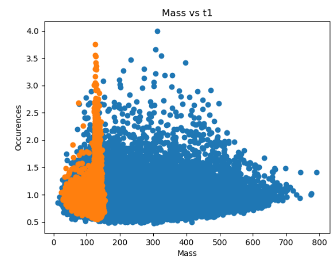


Figure 8

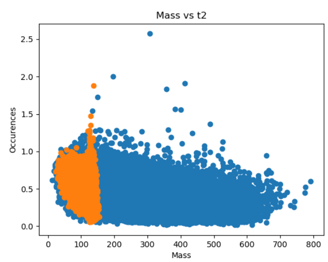


Figure 9

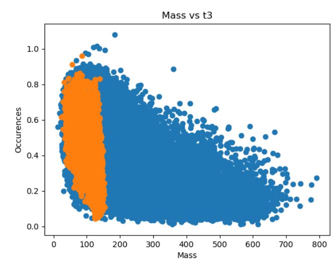


Figure 10

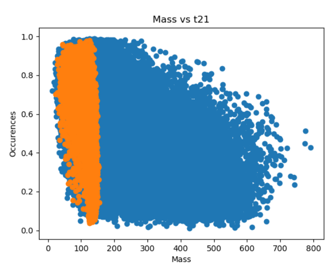


Figure 11

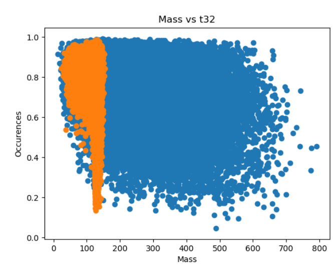


Figure 12

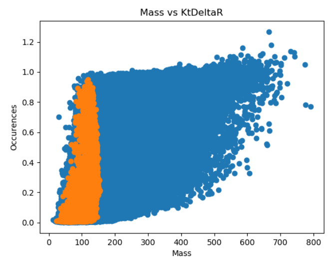


Figure 13

The clearest value where we can make a cut is at 150 mass units. Almost all signal mass values fall below this value with background primarily greater than. This is the exploration that I have done for lab 7.