Higgs Signal optimisation

Joe Bentley and Jake Lane

Summary

1. General background on Higgs
2. How Higgs signals are simulated
3. How the Higgs signal is optimised
4. Problems in optimisation and improvements
5. Possible expansions of the project

Background

The Higgs boson is produced in many channels.

Background

The Higgs boson is produced in many channels. The most common in proton collider experiments is 'gluon gluon Fusion' (ggF)

Background

The Higgs boson is produced in many channels. The most common in proton collider experiments is 'gluon gluon Fusion' (ggF) The Higgs decays in a very short period of time in many channels, the most common is 2 bottom quarks, but we investigate the decay into 2 photons (the diphoton channel.) This has a branching fraction of order of 10^{-3} but is much easier to detect experimentally.

Simulation

The Higgs events and background events are simulated using PYTHIA. The simulation consists of a text file of the Energy and momentum (4 momentum) of each photon in each event (read collision.) We will use 1 simulation of Higgs events (which still have background in them) and 1 simulation of background events.

Simulation

The Higgs events and background events are simulated using PYTHIA. The simulation consists of a text file of the Energy and momentum (4 momentum) of each photon in each event (read collision.) We will use 1 simulation of Higgs events (which still have background in them) and 1 simulation of background events. We need to filter out all of the combined events so that the statistical significance, Σ, is as high as possible.

$$\Sigma \equiv \frac{S}{\sqrt{S+B}} \tag{1}$$

Where S is the number of filtered signal (from the simulation) events and B is the number of filtered background events (also simulated.)