Higgs Signal optimisation

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Summary

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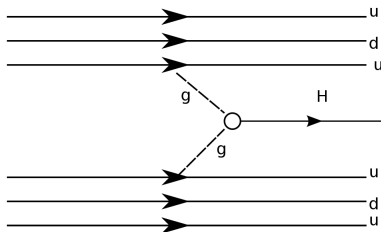

Figure : Gluons fusing into a Higgs at a proton-proton interaction

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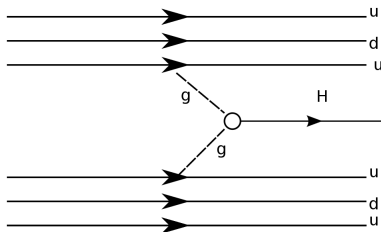

Figure : Gluons fusing into a Higgs at a proton-proton interaction

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.)
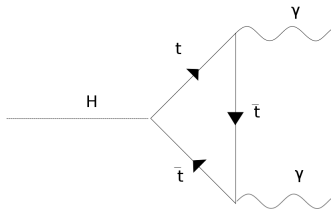
Figure : Decay of Higgs into 2 photons

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.

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

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

Selection cuts

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1. Number cut so that only events with 2 or more photons are counted
2. 2 Transverse momentum, p_T, cuts so that 1 photon has a larger p_T than p_{T1} and the other has a $p_T > p_{T2}$
3. 2 Energy E cuts, in a similar principle to the p_T cuts
4. Cuts for the angular difference between the 2 photons derived from the difference in azimuthal angle $\Delta\phi^2$ and the difference in pseudorapidity, $\Delta\eta^2$