

# Higgs Properties at a Linear Collider

## Interim Report

Gavin Murdoch, 0900886  
School of Physics & Astronomy  
University of Glasgow  
Glasgow

February 7, 2013

### Project Aim

The main aim is to study the properties of the Higgs particle and  $WW$  fusion in electron-positron collisions at a linear collider. The project will focus on the direct reconstruction of the  $H \rightarrow b\bar{b}$  decay mode, as this has the highest branching ratio for a Higgs of mass around 120 GeV as discovered at CERN.

### Progress

Developed an understanding and I am now comfortable using the Marlin framework, ROOT to create suitable histograms conveying particle properties, and modifying the analysis module to reconstruct particles and obtain physics properties from them.

The analysis module originally reconstructed particles in Monte Carlo (MC) simulated events using Higgs-strahlung datasets at 350 GeV and was firstly used to reconstruct a  $Z$  particle from a  $Z^0 \rightarrow e^-e^+$  decay. The module has been modified to also reconstruct a  $Z$  particle from a  $Z^0 \rightarrow \mu^-\mu^+$  decay.

I have moved on to implement flavour tagging, first at MC truth level. Currently the invariant mass of the reconstructed Higgs boson in the MC simulated events from its two b jets, and its two c jets (from the decay mode of  $H \rightarrow c\bar{c}$ ) have been determined. Suitable Gaussian fits were applied to the invariant mass distributions to find the peak for these decay modes, with suitable errors quantified.

The required processor has been sourced and included in the module which will allow flavour tagging and vertex information to be obtained from the reconstructed data in the datasets. This will allow the analysis of purity, efficiency and performance.

### Plan

The aim is to now implement a neural network flavour tagging processor to separate background and signal events, and to find how well the reconstructed particles compare with the “true” underlying particles.

I will move on to look at the  $WW$  fusion process at a higher centre-of-mass energy and aim to construct a full Higgs cross-section analysis.