

Higgs BR at a 350 GeV CLIC

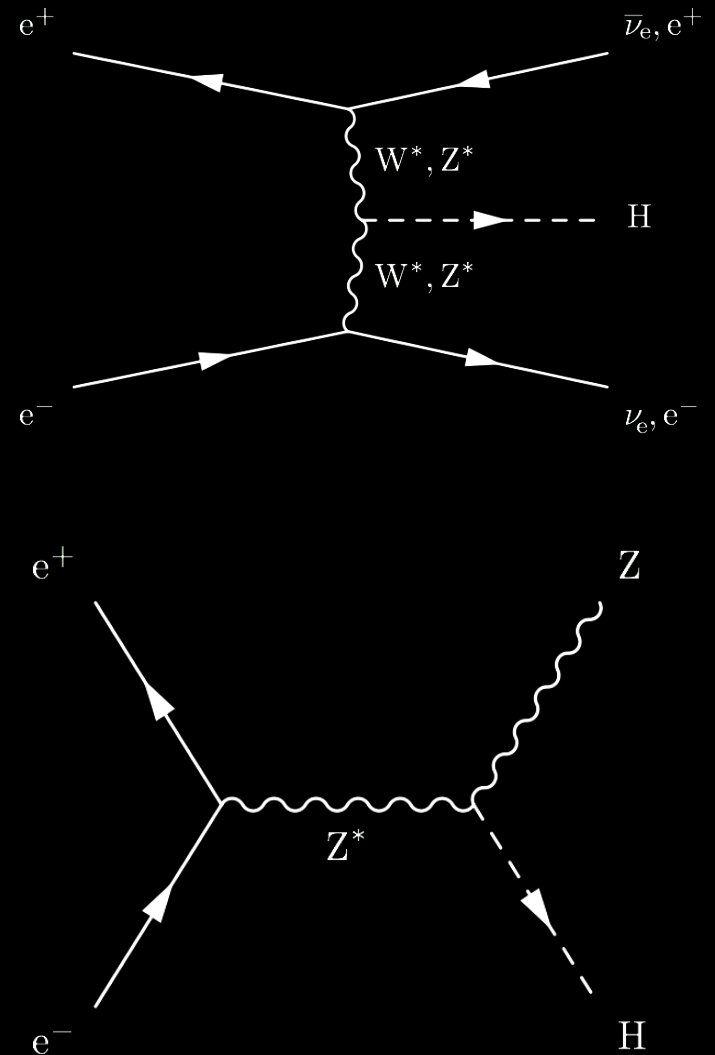
Victoria Martin, Jonatan Rostén (Edinburgh)
Jan Strube (CERN)

Signal Overview

126 GeV SMHiggs
Branching ratios

Decay Channel	BR
bb	56.0%
WW*	23.3%
gg	8.5%
$\tau\tau$	6.1%
ZZ*	2.9%
cc	2.8%

Two signal diagrams:



Introduction

Motivation:

- Measure the b and c Yukawa couplings and branching ratio of $H \rightarrow$ gluons with high precision
- Measurement of $\sigma(H\nu\nu)/BR(H \rightarrow WW)$
- Benchmark of the VTX

Prior Art: (ILD @ ILC w/ SB2009 beams)

<http://arxiv.org/pdf/1207.0300.pdf>

Achieved Results at a 350 GeV ILC

Measurement of

$$\sigma \times \text{BR}(H \rightarrow bb): 1.0\%$$

$$\sigma \times \text{BR}(H \rightarrow cc): 6.2\%$$

$$\sigma \times \text{BR}(H \rightarrow gg): 7.3\%$$

All with 250 fb^{-1} and $-80\%/+30\%$ e^-/e^+ polarization

List of Considered Channels

Channel	Cross section (fb)
Higgs + 2 leptons	17
Higgs + missing energy	51
Higgs + 2 jets	96

Channel	Cross section (fb)
2 jets	25000
2 jets + missing energy	320
2 jets + lepton + missing energy	7400
2 jets + 2 leptons	18000
2 leptons + missing energy	8400
4 jets	5800
4 leptons	18000
WWZ	10
top pairs	169 (Whizard 2)

Notes:

mH = 126 GeV
 500 GeV machine run at 350 GeV
 Energy of leptons or jets > 10 GeV
 Inv. mass of lepton, jet pairs > 10 GeV

Notes:

mH = 12000 GeV
 500 GeV machine run at 350 GeV
 Energy of leptons or jets > 10 GeV
 Inv. mass of lepton, jet pairs > 10 GeV
 leptons include τ

Analysis Strategy (for the BR)

1. Reconstruct events with PandoraPFA and LCFIVertexPlus
2. Event Classification:
 - hadronic decay - 4-jet topology
 - invisible decay - 2 jets + missing E_T
 - Both, s-channel and t-channel
 - leptonic decay - 2 leptons + 2 jets
3. Flavor tagging of the jets
 - Template fit on the LCFIPlus flavor tag of the jets
 - Assumes negligible Higgs BR to light jets

A word on the total Higgs width

Total Higgs width has information about possible invisible decays

Can be measured (to some precision) with recoil method

Better way:

$$BR(x) = \Gamma_x / \Gamma_{\text{tot}} \quad \Gamma_x \propto g_{HXX}^2$$

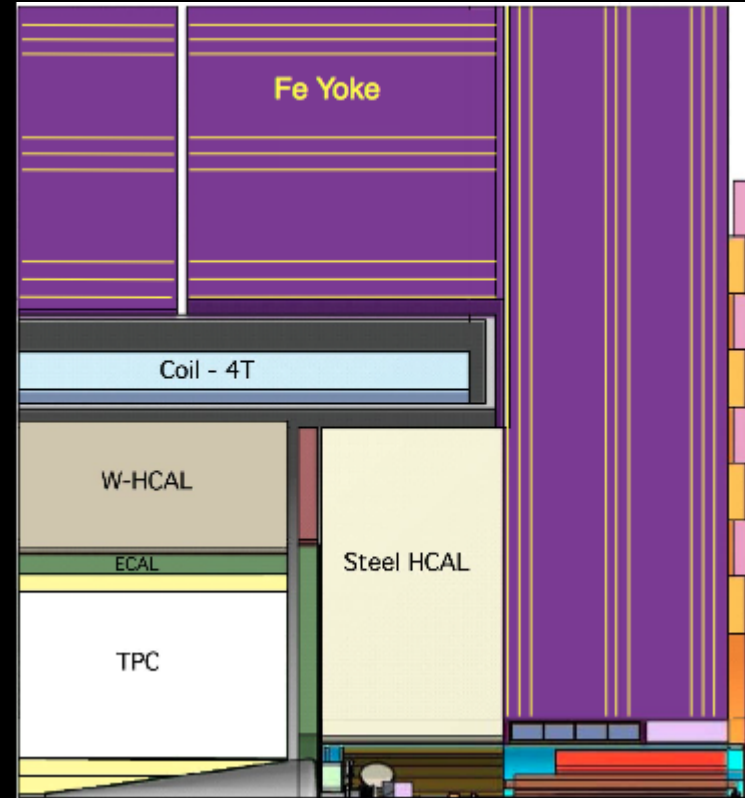
$$\text{In particular: } \Gamma_{\text{tot}} \propto \sigma(H\nu\nu) / BR(H \rightarrow WW)$$

Achievable precision: Could expect 10% or better

Planning Stage

(Large fraction of) Samples exist

- Have correct beam-related background
- Simulated with CLIC_ILD_CDR500
 - Already has optimized radius of inner VTX layer
- Unpolarized beams



Current Status

Request for the remaining samples has been submitted.

First face-to-face meeting planned for next week.

Analysis chain is up and running for both parties. We had a first look at the data.
Lots more to come.

Backup

Material

[http://lhc-ilc.physik.uni-bonn.
de/thesis/Masterarbeitduerig.pdf](http://lhc-ilc.physik.uni-bonn.de/thesis/Masterarbeitduerig.pdf)