

CHAPTER 1

INTRODUCTION

1.1 Charged Higgs studies

1.1.1 production

- produced mainly through top quark decays (top- \rightarrow bottom, Higgs-plus)
 - production cross section heavily influenced by top quark production cross section
- top quarks obtained through SM $t\bar{t}$ production at LHC
 - also through single top production (give diagrams for both processes)
- production classified between high-mass and low-mass
 - low mass is from $t\bar{t}$, one top quark decaying to a bottom quark and forming a charged higgs. Another quark may decay similarly emitting a W instead
 - high mass has two contributing diagrams
 - * $b\bar{b}$ quark absorbs a gluon and decays to a $t\bar{t}$ in association with a higgs (5 flavor scheme)
 - * $b\bar{b}$ and $t\bar{t}$ production from two gluons (dont understand this diagram yet)
 - * Why are these considered high mass??

1.1.2 decay channel

- have to define a $\tan\beta$ variable
- In all regions of $\tan\beta$ the higgs to $\tau\nu$ is very significant

- for low $\tan\beta$ it is dominant
- this is the choice for the decay channel
 - limits at 7 TeV $\text{BR}(\text{Higgs to } \tau\tau)$ was assumed at 100%. Was this across all $\tan\beta$?
- Signal is then characterised by the following:
 - low mass:
 - * two b-jets
 - * hadronic tau
 - * missing E_T
 - * hadronic W (decay branching fraction higher than leptonic)
 - high mass is similar, but b-jet multiplicity is forgiven to allow for 5 flavor scheme diagram