

Chapter 1

Higgs Couplings to quarks in MSSM

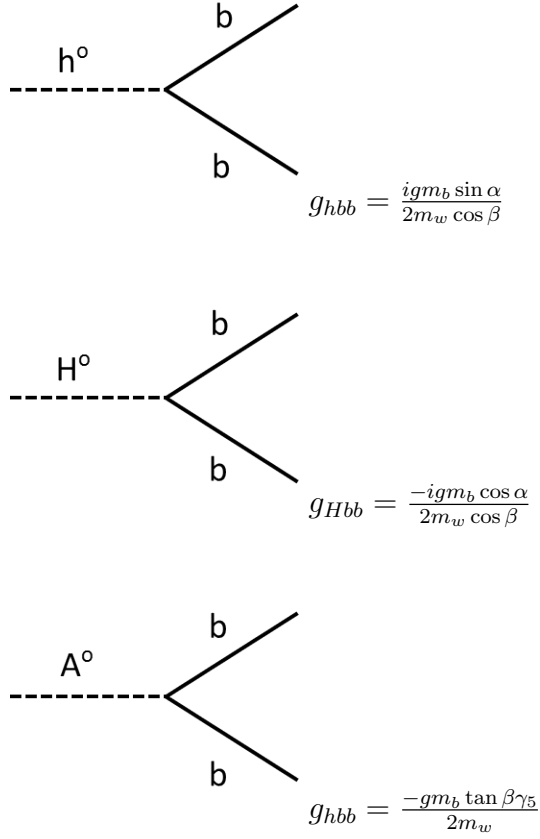
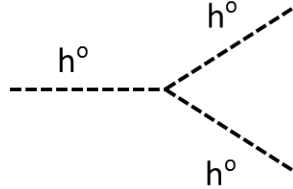


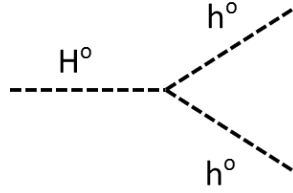
Figure 1.1: Feynman rules for Higgs-quark-quark vertices. Where g is the standard SU(2) gauge group coupling, m_w is mass of W boson m_b is mass of the b quark and α is Higgs mixing angle.[1]

Chapter 2

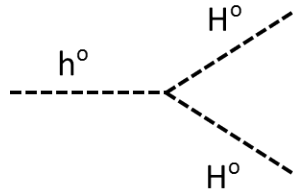
Trilinear Higgs couplings among MSSM neutral Higgs



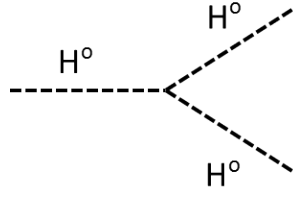
$$g_{hhh} = \frac{-3igm_z \cos 2\alpha \sin (\alpha+\beta)}{2 \cos \theta_w}$$



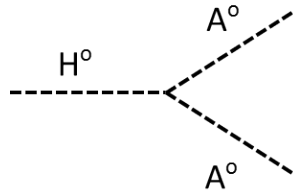
$$g_{HHh} = \frac{-igm_z(2 \sin 2\alpha \sin (\alpha+\beta) - \cos (\beta+\alpha) \cos 2\alpha)}{2 \cos \theta_w}$$



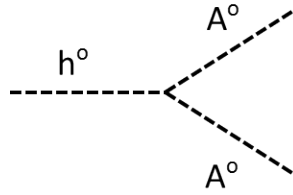
$$g_{hHH} = \frac{igm_z(2 \sin 2\alpha \cos (\alpha+\beta) + \sin (\beta+\alpha) \cos 2\alpha)}{2 \cos \theta_w}$$



$$g_{HHH} = \frac{-3igm_z \cos 2\alpha \cos (\alpha+\beta)}{2 \cos \theta_w}$$



$$g_{hAA} = \frac{-igm_z \cos 2\beta \sin (\alpha+\beta)}{2 \cos \theta_w}$$



$$g_{HAA} = \frac{igm_z \cos 2\beta \cos (\alpha+\beta)}{2 \cos \theta_w}$$

Figure 2.1: Higgs self couplings for the MSSM, Where g is the standard SU(2) gauge group coupling, m_w is mass of W boson m_b is mass of the b quark and α is Higgs mixing angle, β is free parameter in mssm.[1]

Chapter 3

Input parameters for the FeynHiggs

Here are the input parameters we set in file "var.in" to calculate masses and couplings of the cp-even neutral Higgs bosons in the MSSM[2].

$MT = 173.5$: Mass of top quark
 $MSusy = 2000.$: A generic soft-SUSY breaking mass
 $MA0 = 1000.0$: The CP odd Higgs mass
 $Abs(M_2) = 389.$: The SU(2) gaugino mass parameter
 $Abs(MUE) = 1000.$: The Higgs mixing parameter
 $TB = 50.0$: $\tan(\beta)$
 $Abs(Xt) = 4899.$: Alternative stop mixing parameter
 $Abs(M_3) = 1100.$: The gluino mass parameter

Chapter 4

Distributions for production of pseudoscalar pair
via gluon fusion with the $b\bar{b}l j_\tau$ final state.

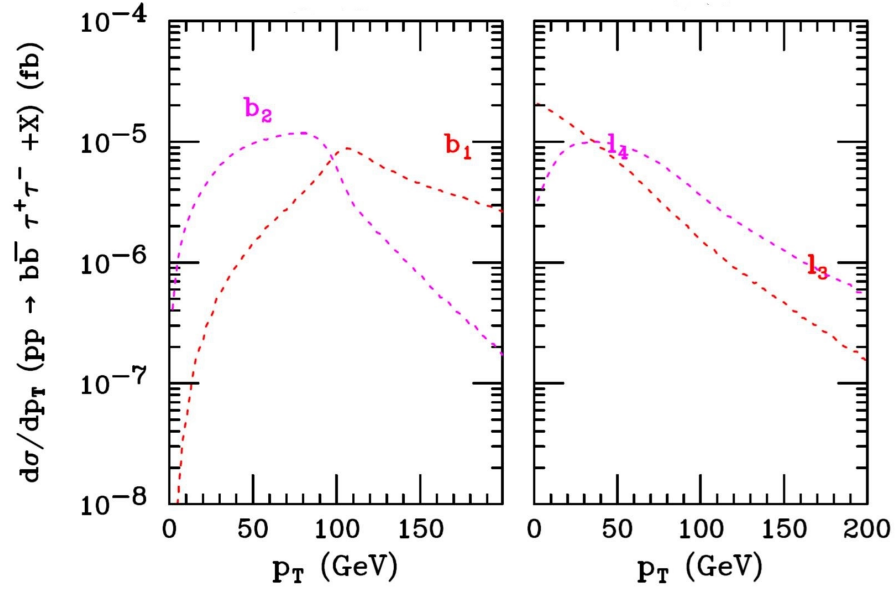


Figure 4.1: Transverse momentum distribution for $b\bar{b}l j_\tau$ from gluon fusion
for MSSM via a pair of pseudo scalars.

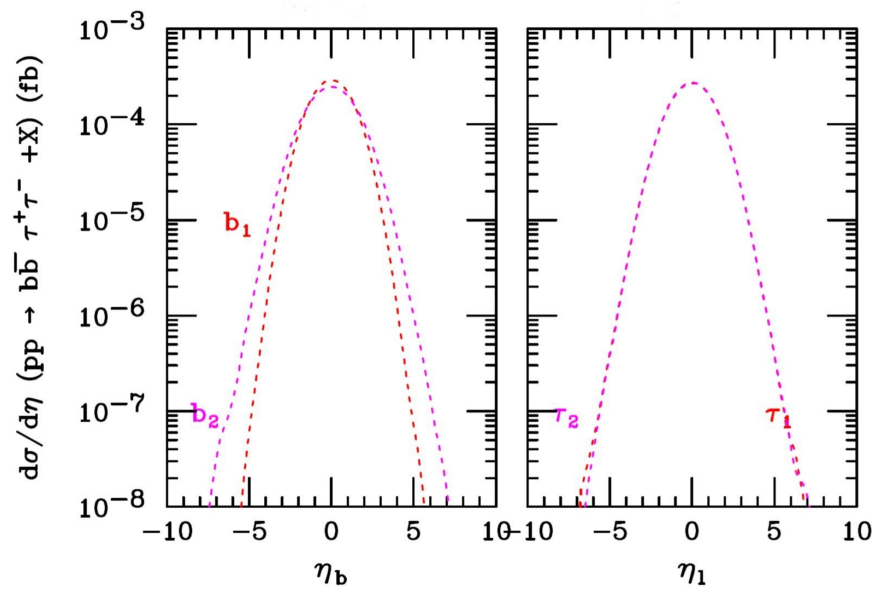


Figure 4.2: Distribution of pseudo rapidity for the final state $b\bar{b}l j_\tau$ for the production of pseudoscalars via gluon fusion

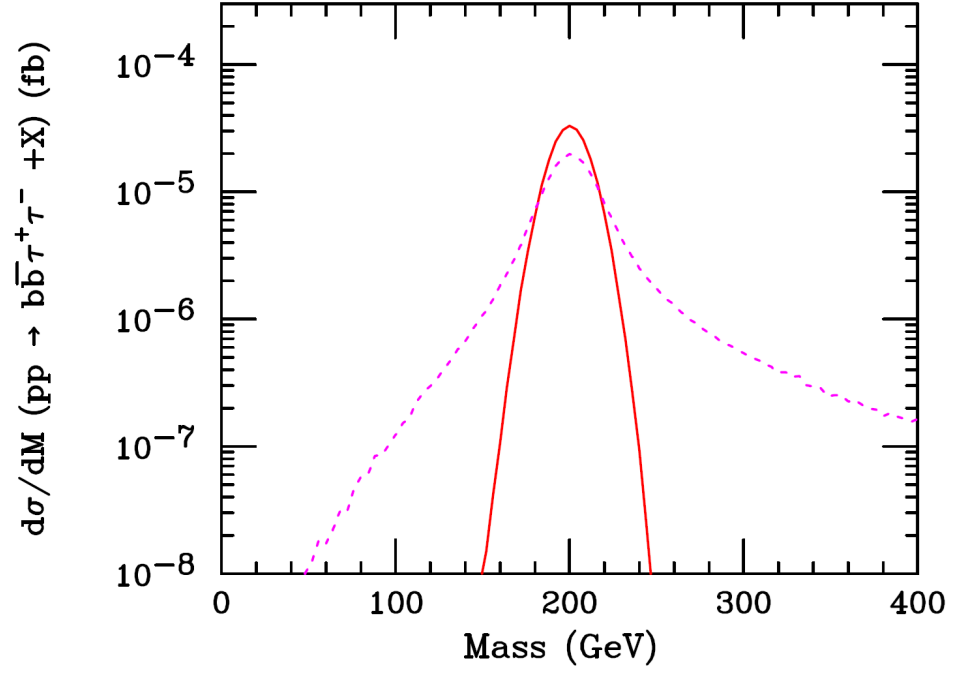
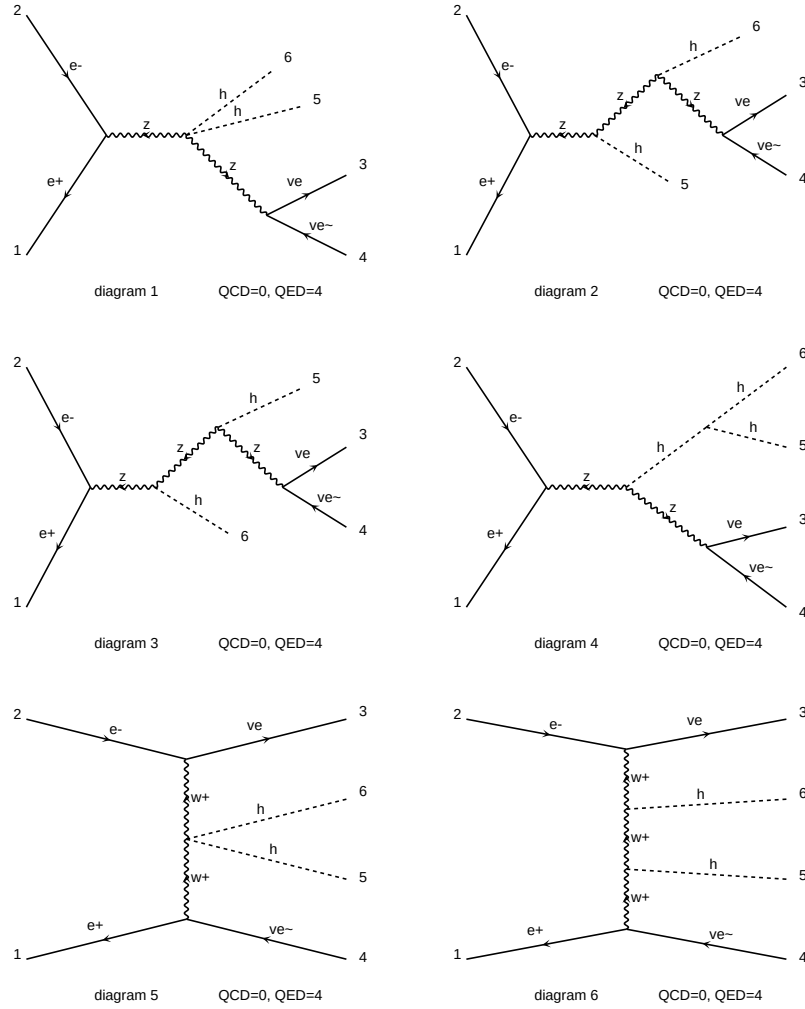


Figure 4.3: Distribution of invariant mass between final state for the production of pseudoscalars via gluon fusion, red line is invariant mass between $b\bar{b}$ and dashed magenta represents the invariant mass between $l j_\tau$.

Chapter 5

Feynman Diagrams of the process $e^+e^- \rightarrow \nu\nu hh + X$

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Diagrams made by MadGraph5

Figure 5.1: Feynman diagrams made by MadGraph5 for the higgs production at ILC via $e^+e^- \rightarrow \nu\nu hh + X$

References

- [1] J. F. Gunion, H. E. Haber, G. Kane, and S. Dawson, *The Higgs Hunter's Guide* (Perseus, Cambridge, MA, 2000).
- [2] S. Heinemeyer, W. Hollik, and G. Weiglein, arXiv:hep-ph/981232001 **1**, (1998).