



CMS Higgs Searches: Signal and Background Generators

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CMS Higgs Searches: Generators

Background processes:

- WW/WZ/ZZ --> Pythia, NLO@NLO for WW
- W+jets/Z+jets/ttbar/V+gamma --> Pythia, Madgraph, Alpgen
- QCD, photon+jets --> Pythia
- single-top --> Madgraph, NLO@NLO (the last one is used in less extent)

Higgs:

- Higgs signal --> Mainly Pythia reweighting the Pt spectrum from MC@NLO (we can't directly use MC@NLO because the spin correlations aren't properly treated).
- There are also some processes produced with Powheg, e.g. qqH, H->WW->qqln. However the reweighting procedure is only done in some analyses (e.g. H->WW), but the effect is only a few percent.



SM Cross-Sections

http://ceballos.web.cern.ch/ceballos/hwwlnln/cross_sections_backgrounds.txt

process	ECM=14TeV	ECM=10TeV	ECM=7TeV	comment
W->l ν	3*20283.7	3*14253.7	3*9679.9	MCFM NLO
DY(20-inf)->l l	3*3259.7	3*2323.6	3*1606.6	MCFM NLO
WW	112.5	71.4	42.9	MCFM NLO
WZ	51.0	31.4	18.3	MCFM NLO
ZZ	15.6	9.9	5.9	MCFM NLO
ttbar	918	415	165	MCFM NLO
Wt	56.1	26.0	10.5	MCFM NLO
tq-t_channel	244.6	130.5	62.8	MCFM NLO
tq-s_channel	11.9	7.6	4.6	MSTW 2008 NNLO
W(->l ν)+gamma	54.7*1.8	35.4*1.8	23.2*1.8	NLO k-Factor from Bauer
Z(->l l)+gamma	17.5*1.8	11.3*1.8	7.3*1.8	NLO k-Factor from Bauer

Notice: l includes all lepton flavors

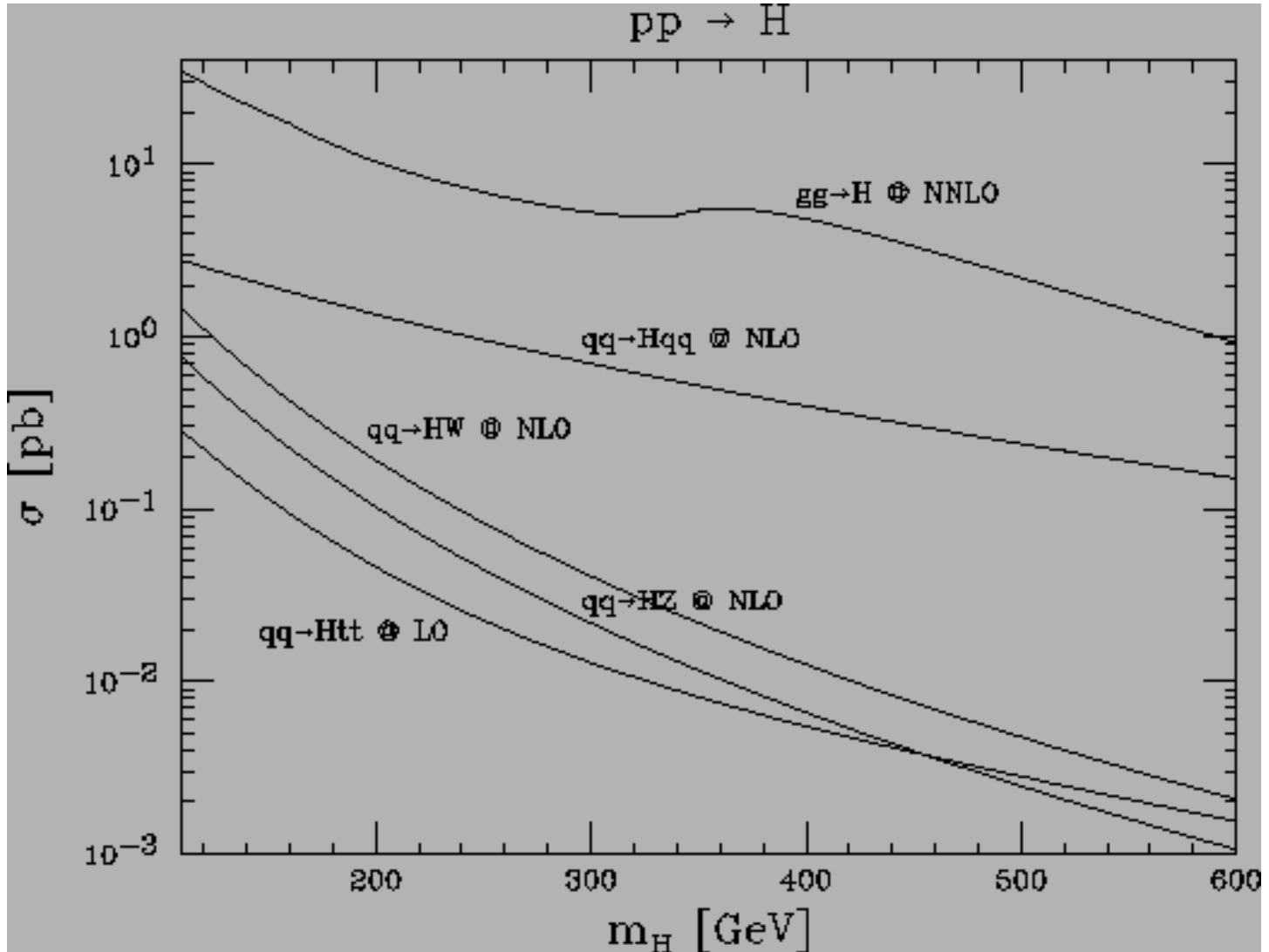
BR(W->l ν)=0.1080

BR(Z->l l)=0.033658



SM Higgs x-sec @ 7 TeV: Overview

<http://wwweth.cern.ch/HiggsCrossSections>





SM Higgs x-sect: processes

Four main Higgs production mechanisms at the LHC

1. Gluon-Fusion (GF).

(N)NLO cross-sections for Higgs production in the Gluon-Fusion channel computed using the tool HIGLU [<http://people.web.psi.ch/spira/higlu>] (NLO) and HggTotal (NNLO) for Higgs masses from 105-600 GeV.

2. Vector-Boson-Fusion (VBF)

NLO cross-sections for Higgs production in Vector-Boson-Fusion computed using the tool VV2H

[<http://people.web.psi.ch/spira/vv2h/>] for Higgs masses from 105-600 GeV.

3. associated production with a top-pair (Htt)

LO cross-sections for Higgs production in association with a top-pair computed using the tool HQQ [<http://people.web.psi.ch/spira/hqq/>] for Higgs masses from 105-600 GeV.

4. associated production with Z/W (HV)

NLO cross-sections for Higgs production in association with a W or a Z boson computed using the tool V2HV [<http://people.web.psi.ch/spira/v2hv/>] for Higgs masses from 105-600 GeV.

SM Higgs x-secs: Input Parameter Values

Parameter	Description	Value
m_c	Charm Mass	1.4 GeV
m_b	Bottom Mass	4.6 GeV
m_t	Top Mass	170.9 GeV
m_W	W Boson Mass	80.41 GeV
m_Z	Z Boson Mass	91.187 GeV
Γ_W	W Boson width	2.06 GeV
Γ_Z	Z Boson width	2.49 GeV
$\sin^2 \theta_W$	Weinberg angle	0.2315
G_f	Fermi Constant	1.16639D-5

The default PDF sets used in all the computations are the CTEQ6 PDF sets, where we use CTEQ6M(L1) for the NLO(LO) computations.

The only exception is the NNLO calculation for the GF process, where the newest MSTW2008 NNLO PDF sets were used.

The parameters used in these sets are summarized below

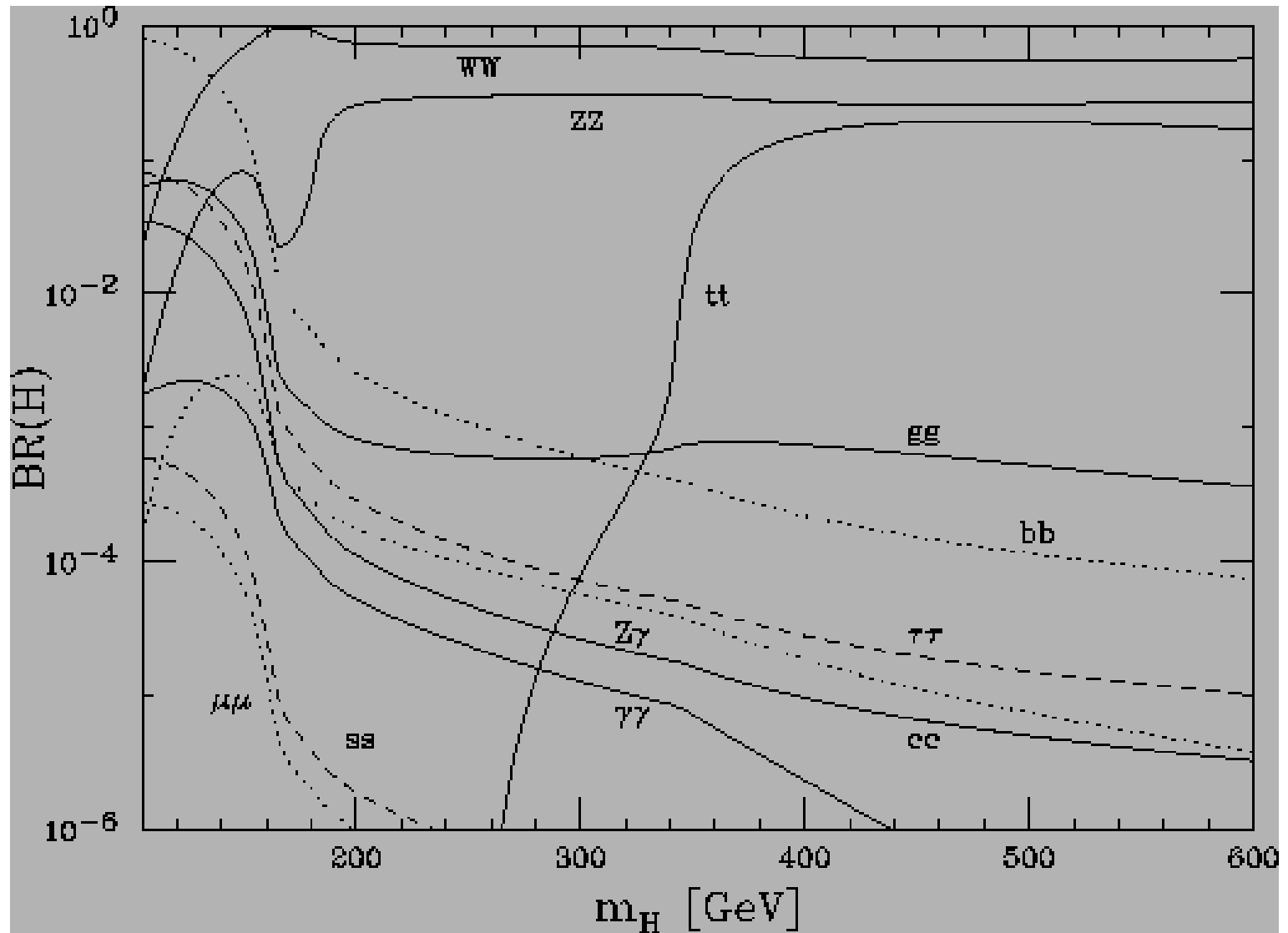
Parameter	LO Value	NLO Value	NNLO Value
Λ_5^{QCD}	0.165 GeV	0.226 GeV	
$\alpha_s(m_Z)$	0.130	0.118	0.117



SM Higgs Branching Ratios

computed using the tool HDECAY v.3.4

<http://people.web.psi.ch/spira/hdecay/>





MSSM Higgs x-sects and decay BR

For MSSM Higgs production cross section
and branching ratios
FEYNHIGGS is used

<http://www.feynhiggs.de/>



More detailed information can be provided when we agree on what is needed