LOOP INDUCED ZZ/WW PRODUCTION IN MG5/aMC@NLO : HIGGS INTERFERENCE EFFECTS

April 30, 2012

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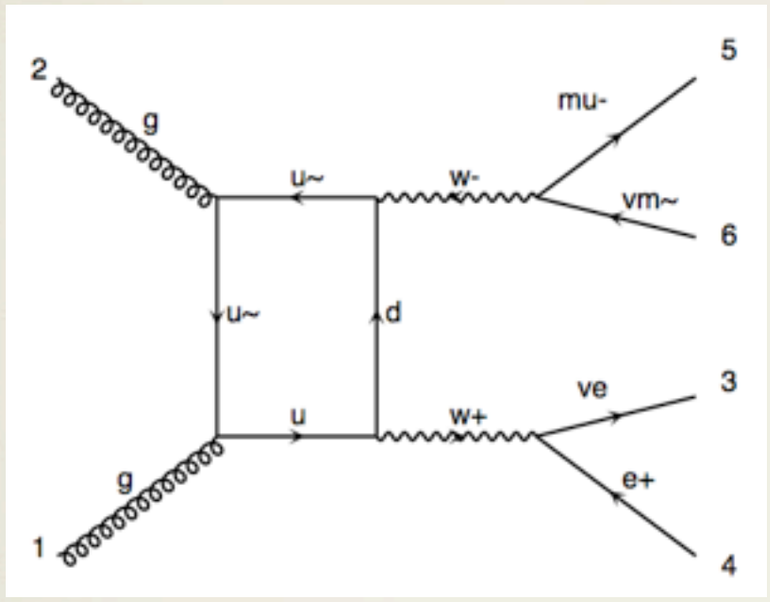
Status report of work in progress

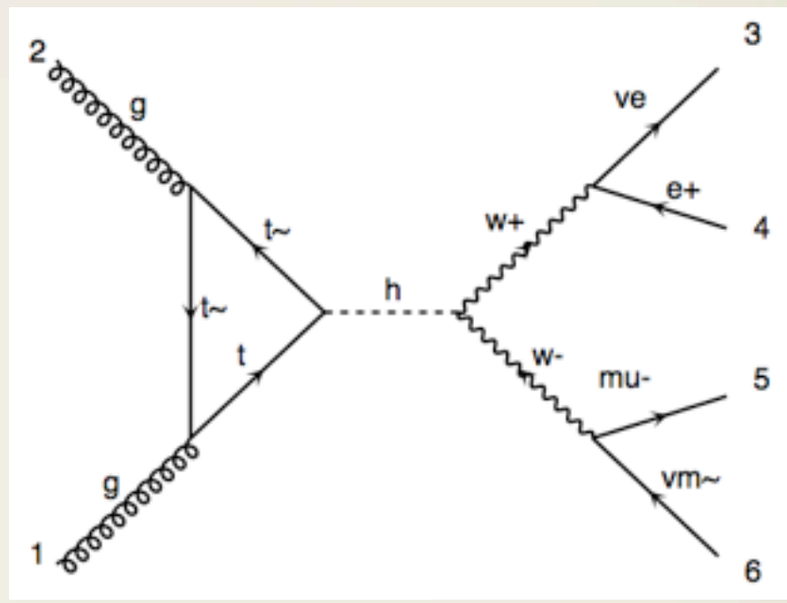
Outline

- $gg \to VV$
- Effects included in aMC@NLO, $gg \to W^+W^-$
- Higgs interference effects, $gg \to W^+W^-$
- $gg \to Z^\circ Z^\circ$
- Conclusions

$gg \to VV$

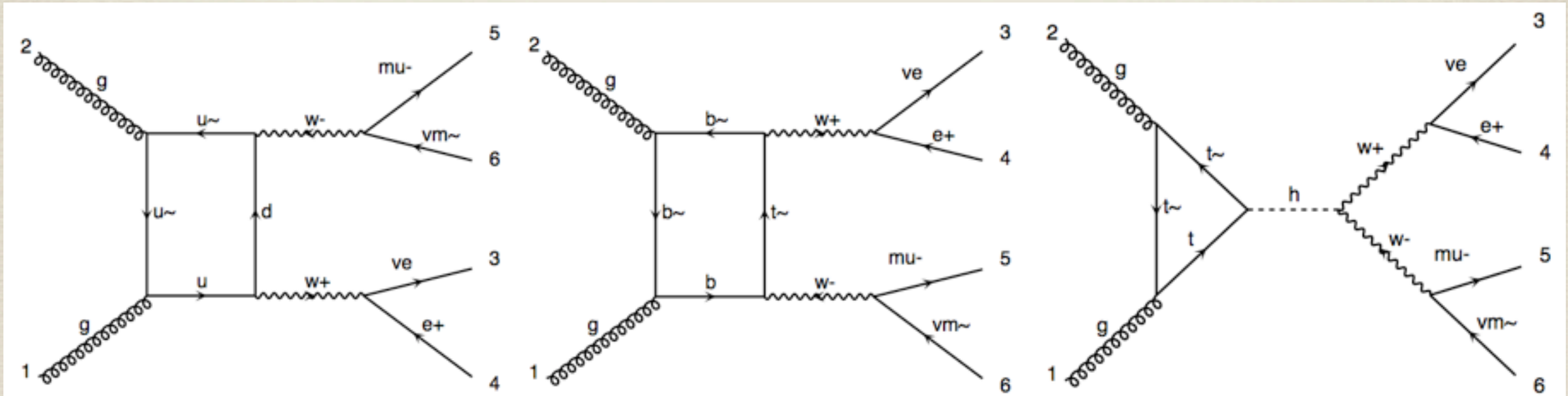
- Two contributions,





- (Destructive/Constructive) interference effects are potentially large, especially for a heavy Higgs boson due to its large width.
- Issue of the width (running/fixed=complex mass) : now it's a fixed width.

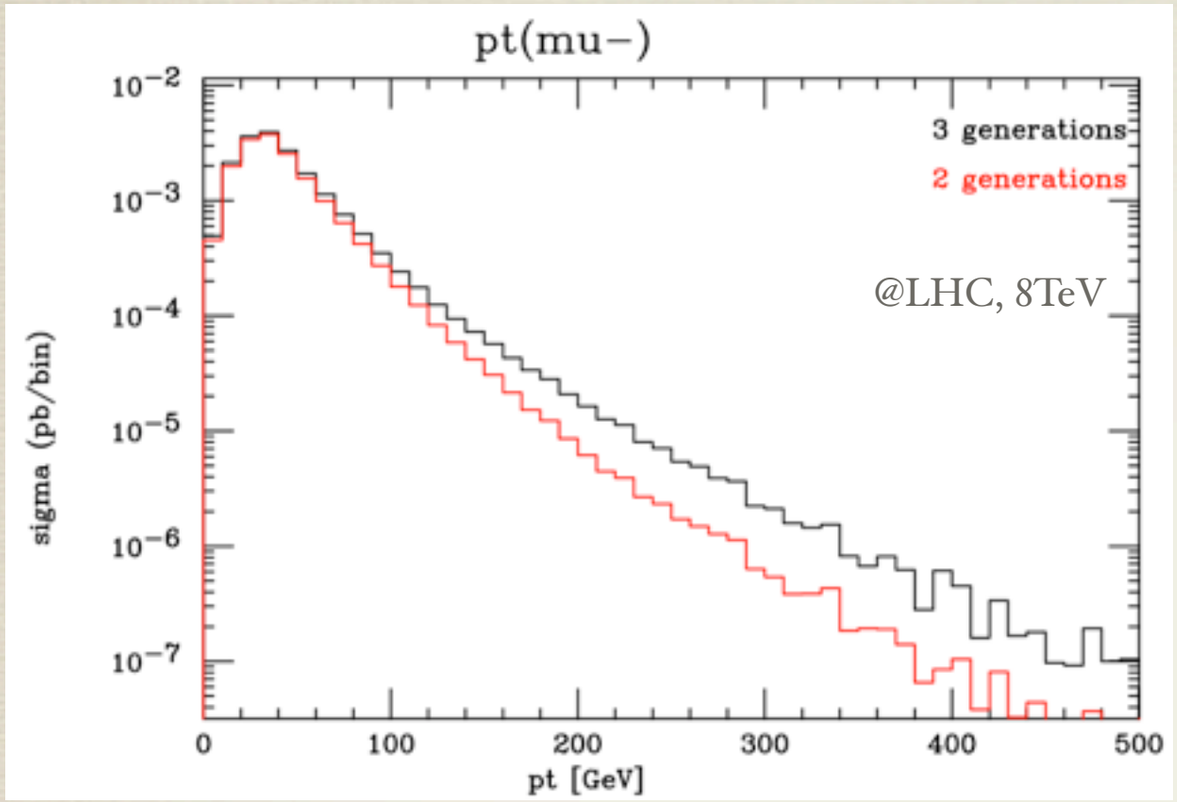
Effects included

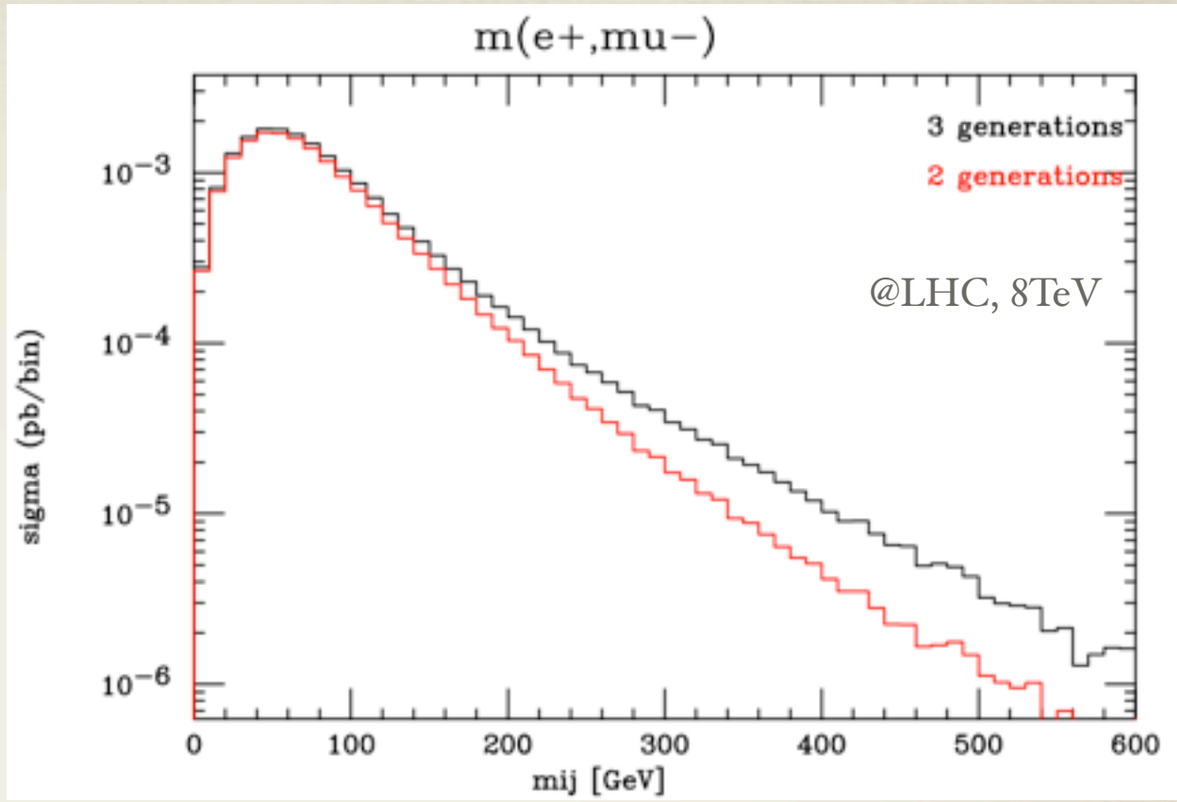


↑ Light quarks

↑ Heavy quarks

$gg \to \nu_e e^+ \mu^- \overline{\nu}_\mu$

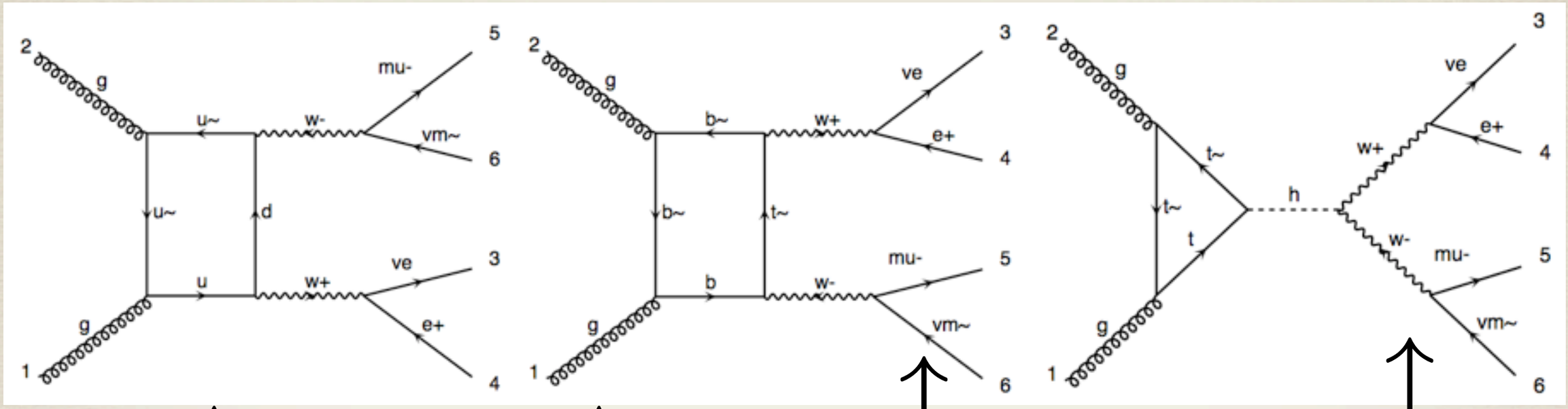




$$
\begin{aligned}
\eta_l &> 3,\ \mathrm{p_{T}}_l > 2\ \mathrm{GeV},\ \text{missing}\ \mathrm{E_T} > 2\ \mathrm{GeV},\\
\mathrm{M_W} &= 80.398\ \mathrm{GeV},\ \Gamma_W = 2.1054\ \mathrm{GeV},\\
\mathrm{M_Z} &= 91.1876\ \mathrm{GeV},\ \Gamma_Z = 2.4952\ \mathrm{GeV},\\
\mathrm{G_F} &= 1.16639 \times 10^{-5}\ \mathrm{GeV}^{-2},\\
\mu_{r=f} &= M_W,\ \text{MSTW2008nlo}
\end{aligned}
$$

The code produces weighted and unweighted events in the LHE format that can be passed to a PS program for showering/hadronization

Effects included



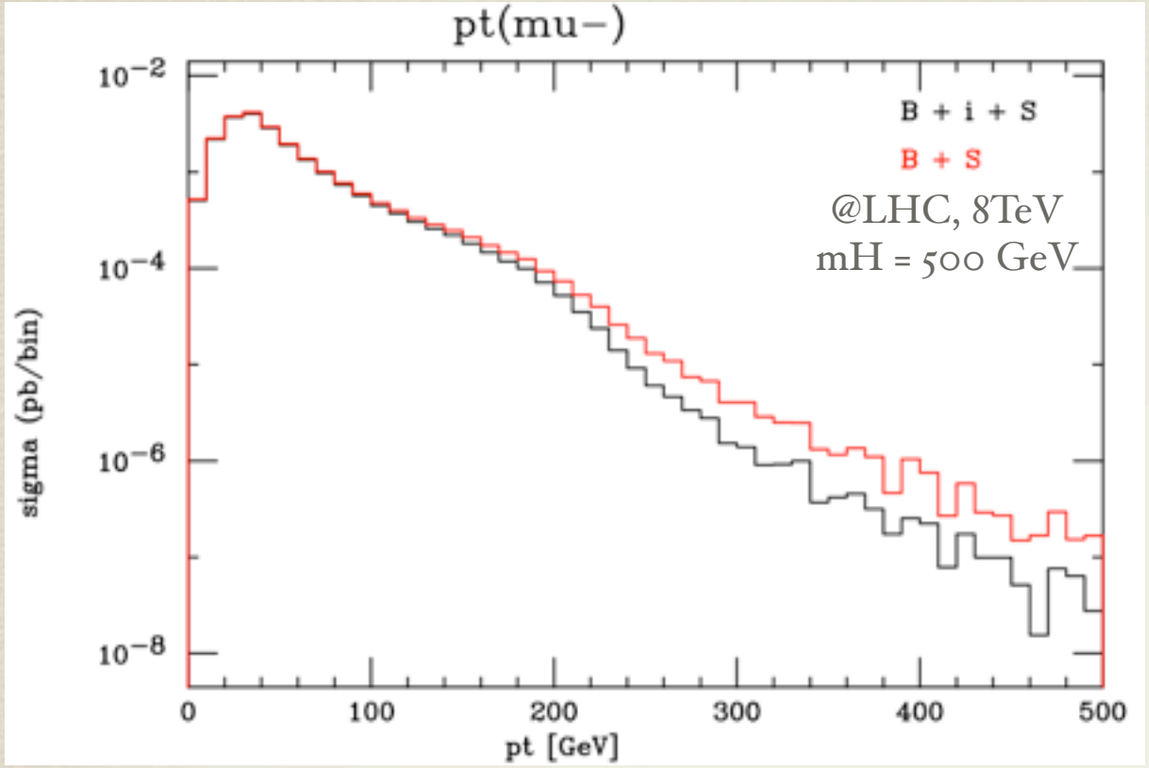
Light quarks

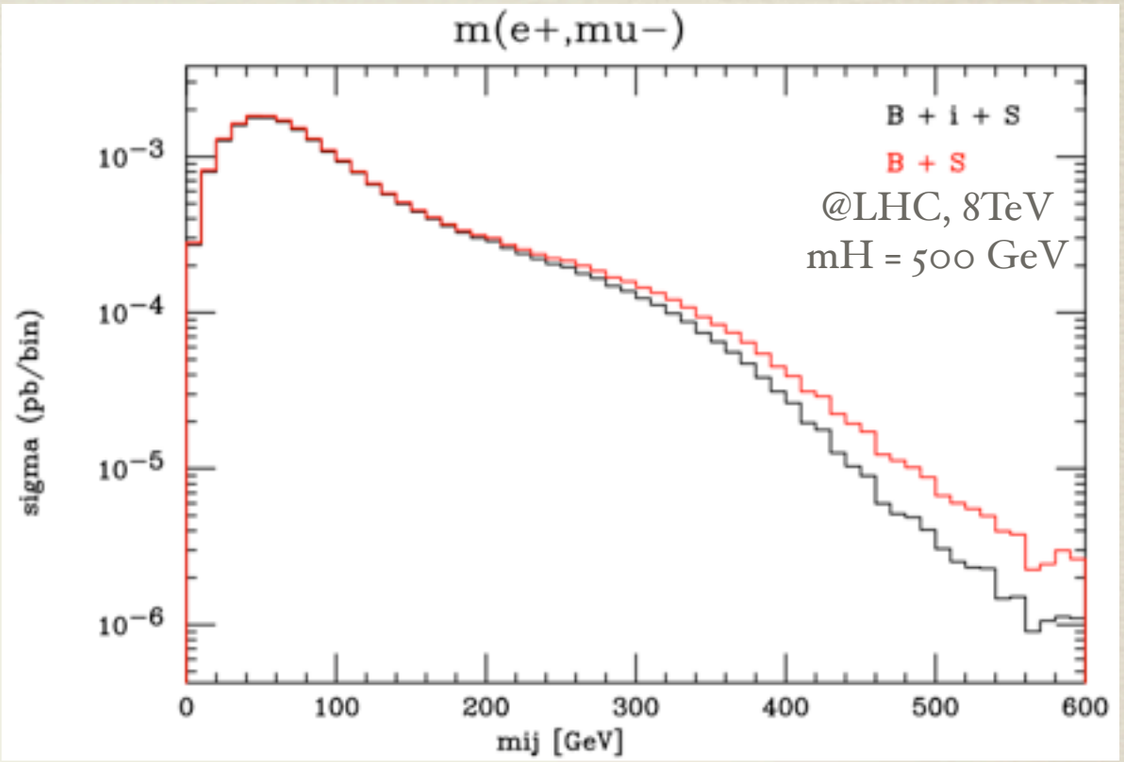
Heavy quarks

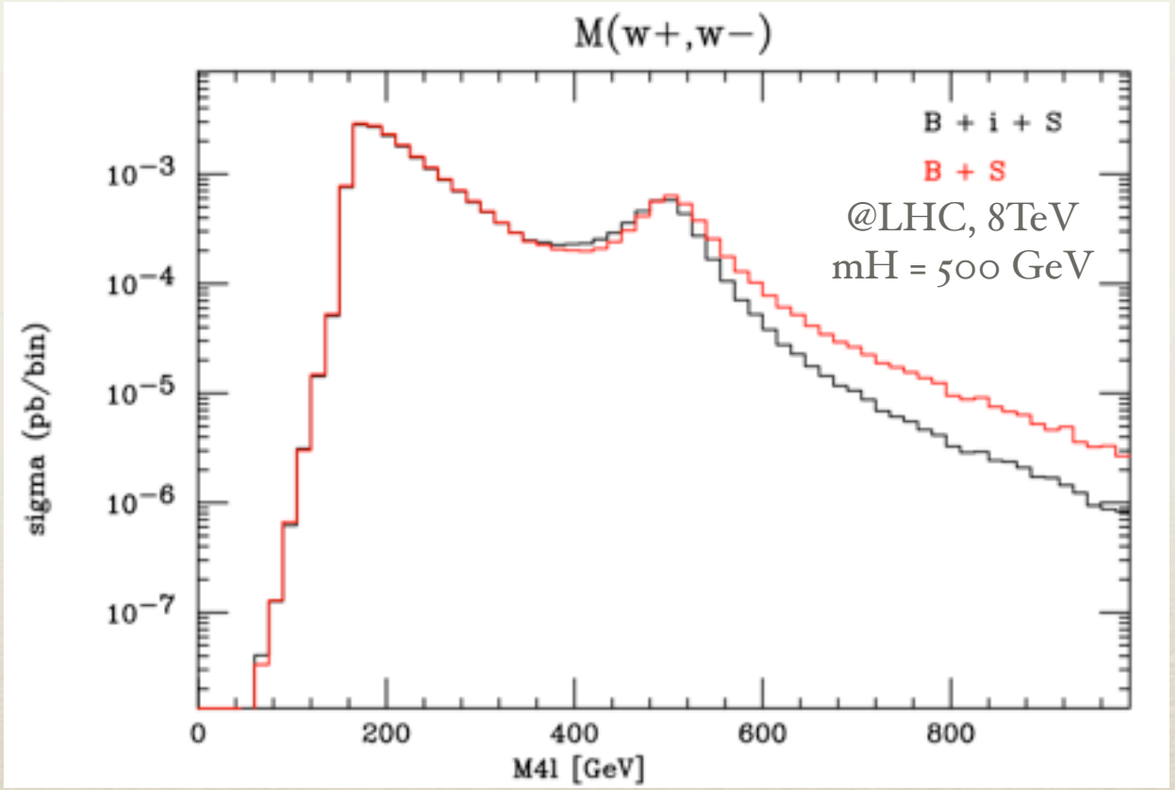
Spin correlations

Off-shell effects

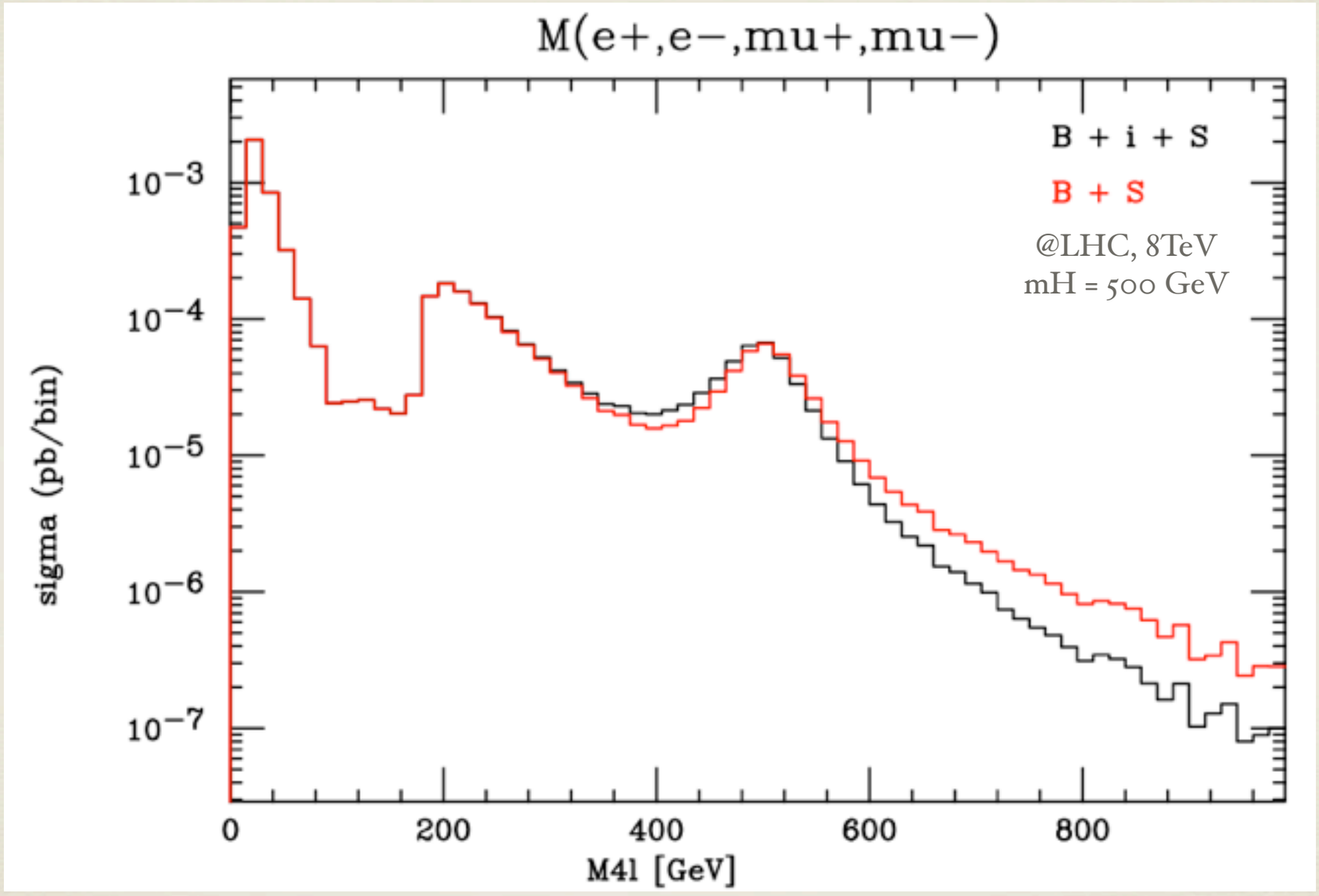
Higgs interference effects



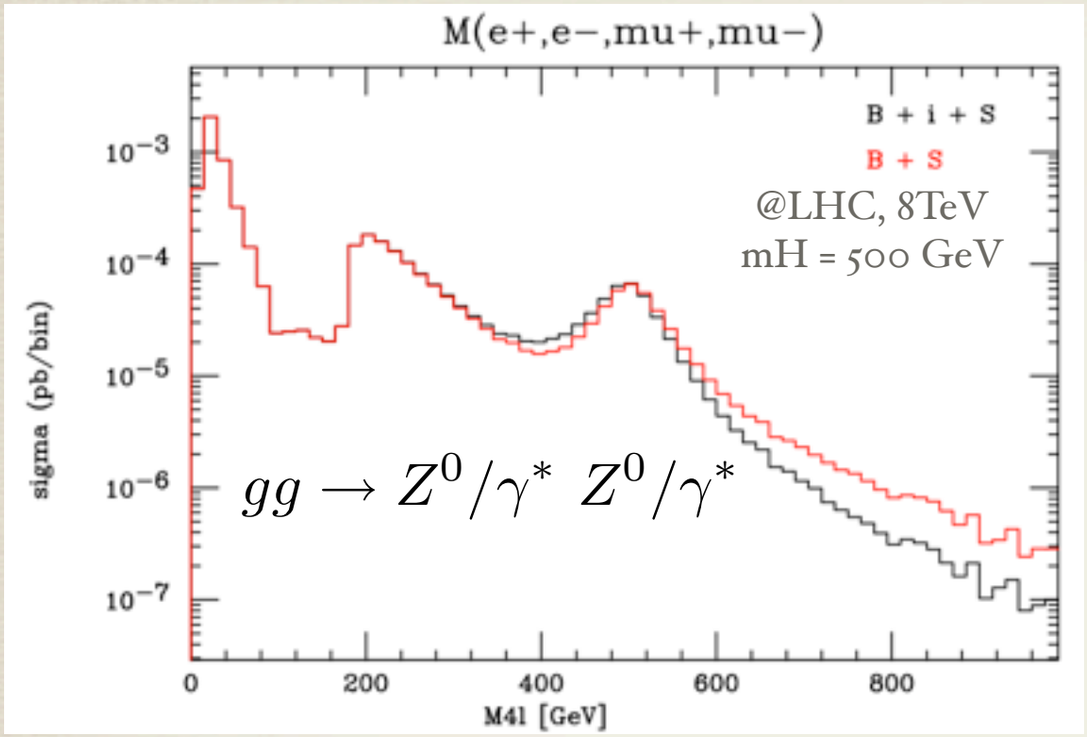


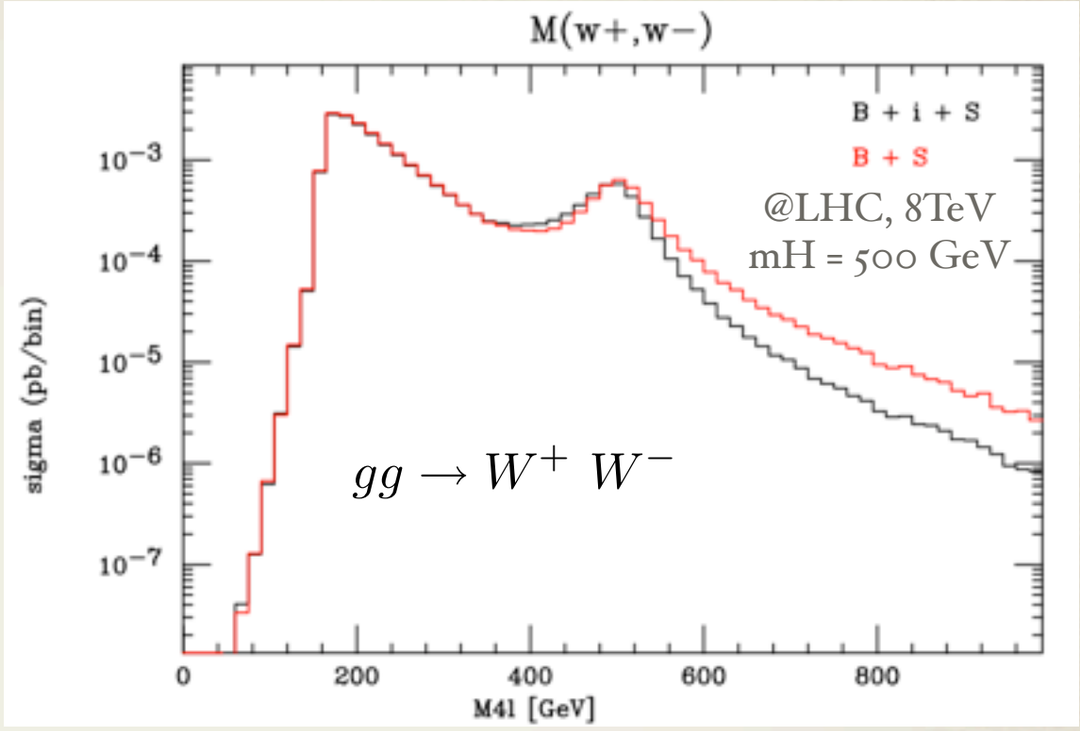


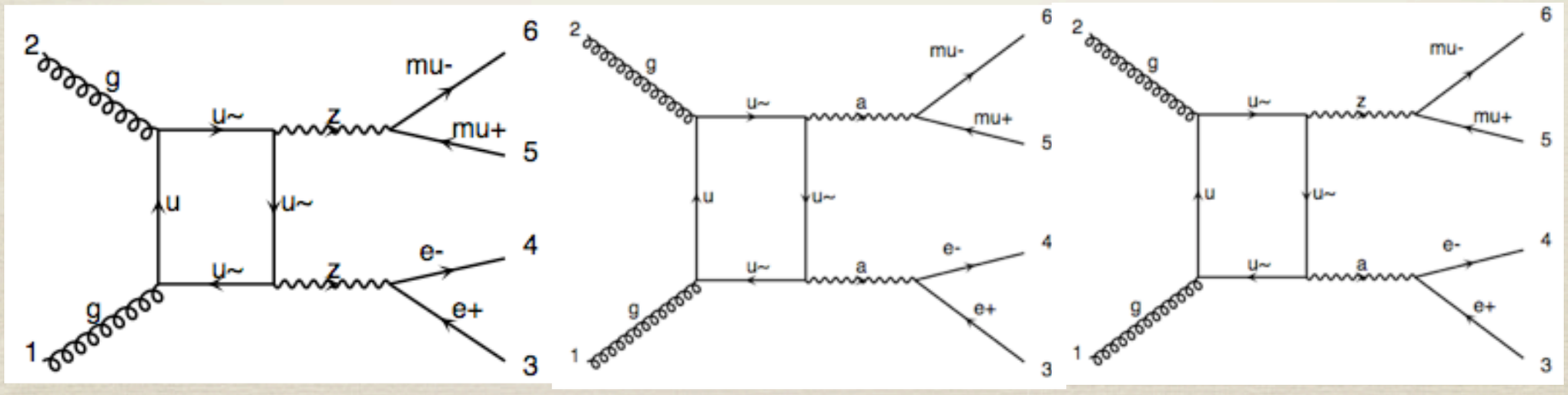
gg → Z°Z°


M(e+,e−,mu+,mu−)
B + i + S
B + S
@LHC, 8TeV
mH = 500 GeV
sigma (pb/bin)
10−3
10−4
10−5
10−6
10−7
0
200
400
600
800
M4l [GeV]

$gg \to Z^0/\gamma^*\ Z^0/\gamma^*$ interference effects







Status

- gg → VV is automatically generated by MadLoop and cross-checked at the matrix element level with MCFM.
- Finite top mass effects are included as well as spin correlations, off-shell effects and interference with the Higgs signal.
- Unweighted events can be produced as usual in MG and passed to PS (no matching is needed as these are LO processes)
- Codes to generate unweighted events are **in preparation** for:
  - B + i + S
  - B + i to be used in conjunction with MC@NLO gg → H → VV at NLO.