

The $gg \rightarrow WW$ background

Calculations from two groups:

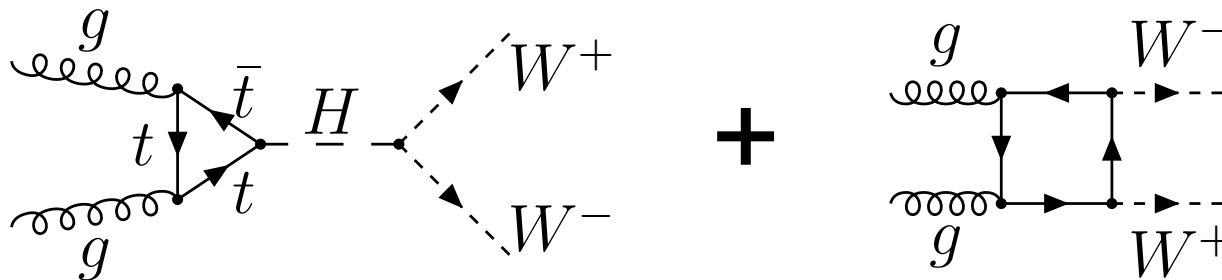
- T. Binoth, M. Ciccolini, N. Kauer, M. Krämer
(hep-ph/0503094) :

Off-shell W s, only light quarks in the loop

- P. Marquard, J. J. van der Bij (M. Dürrssen, K. Jakobs)
(hep-ph/0504006) :

On-shell W s, heavy quark loop

Context: Background process to $gg \rightarrow H \rightarrow WW$



Effects of differences in codes

- Off-shell effects:

No WW resonance visible

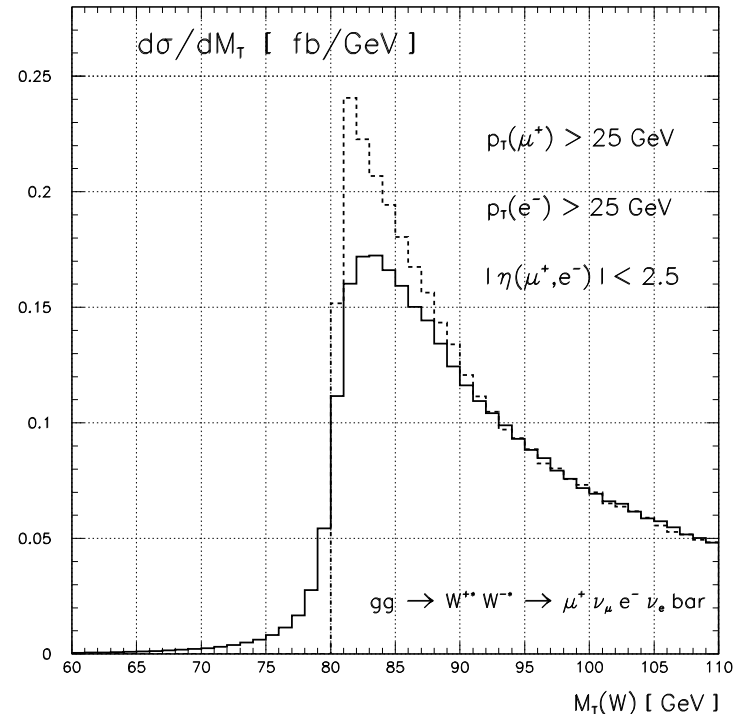
(2 neutrinos in final state)

→ Effect is experimentally not visible, but might have effect on the Higgs signal due to interference at WW threshold

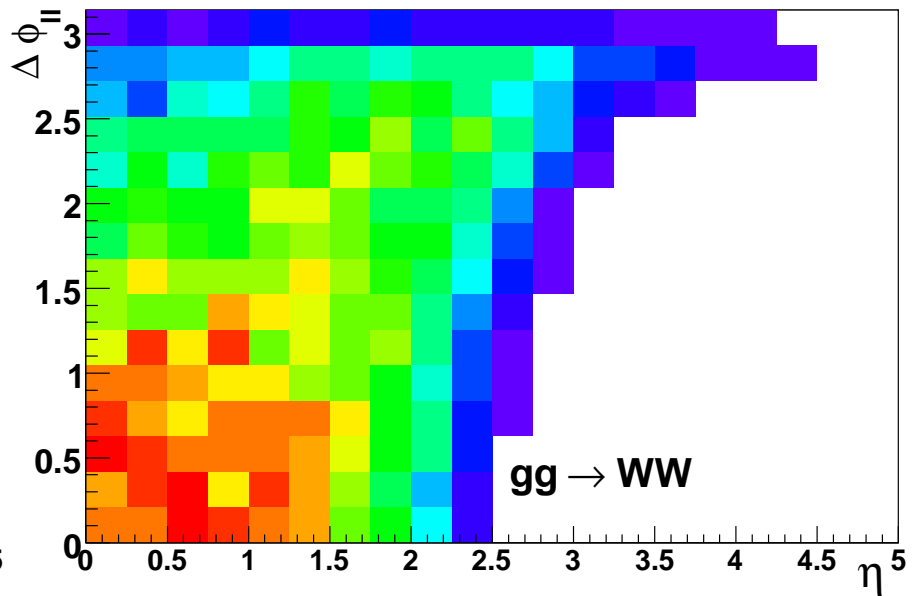
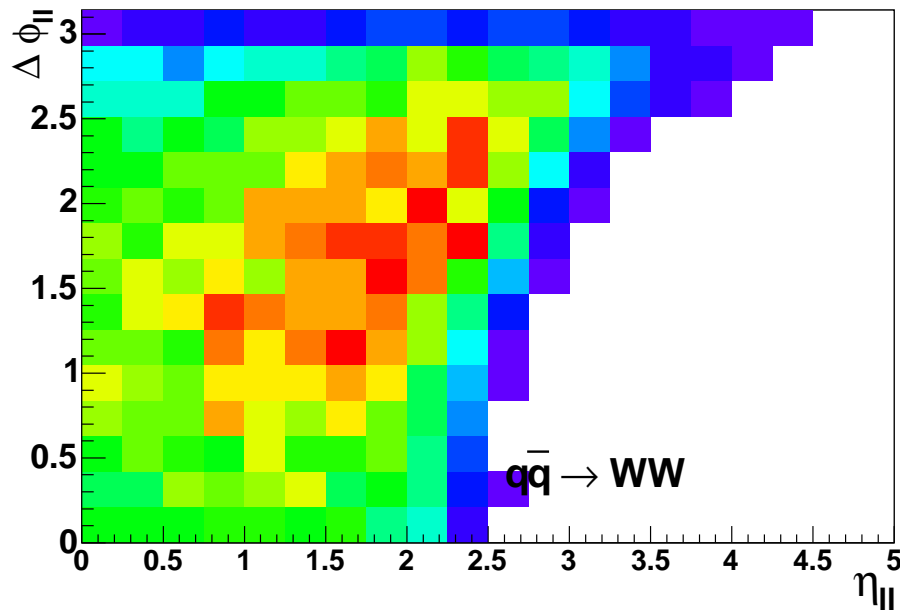
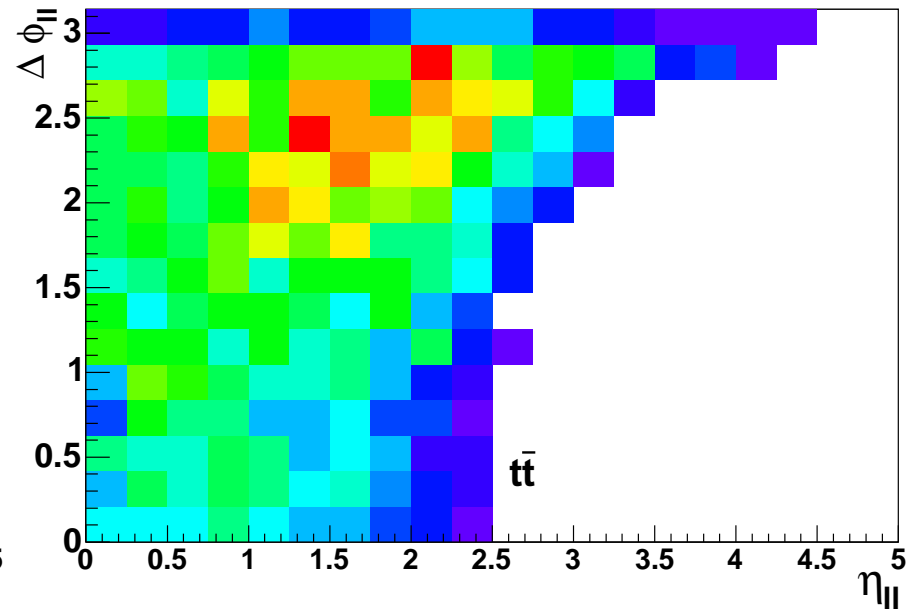
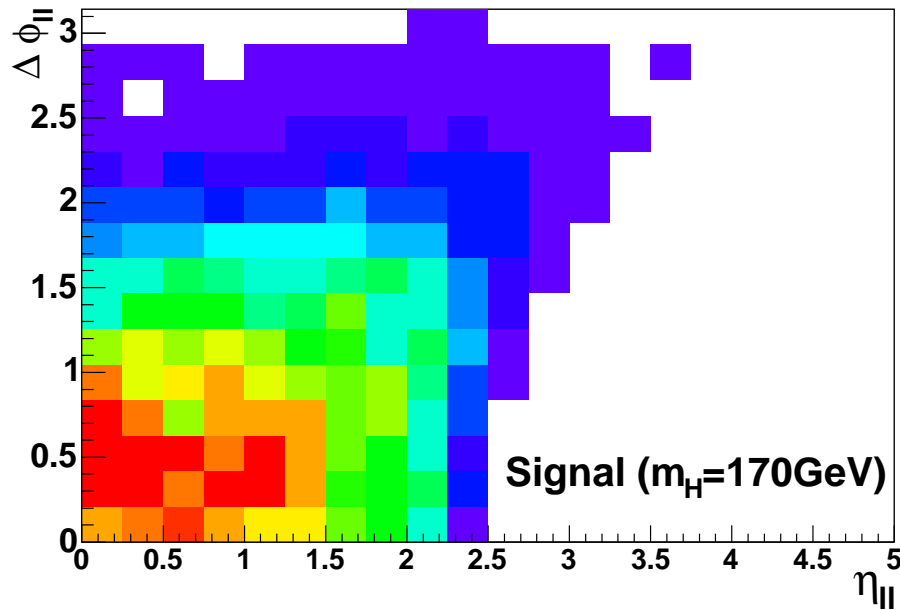
→ to be investigated

- heavy quarks in loops:

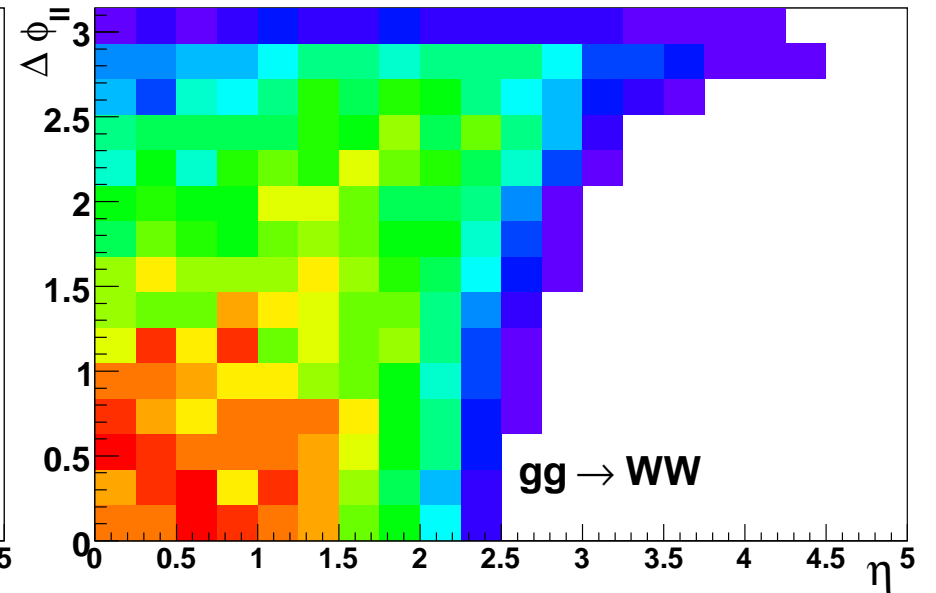
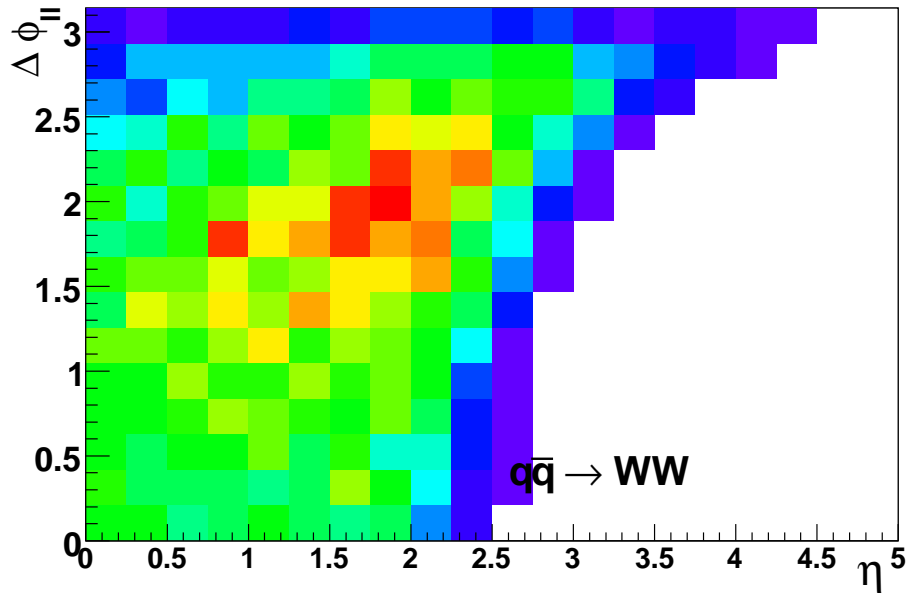
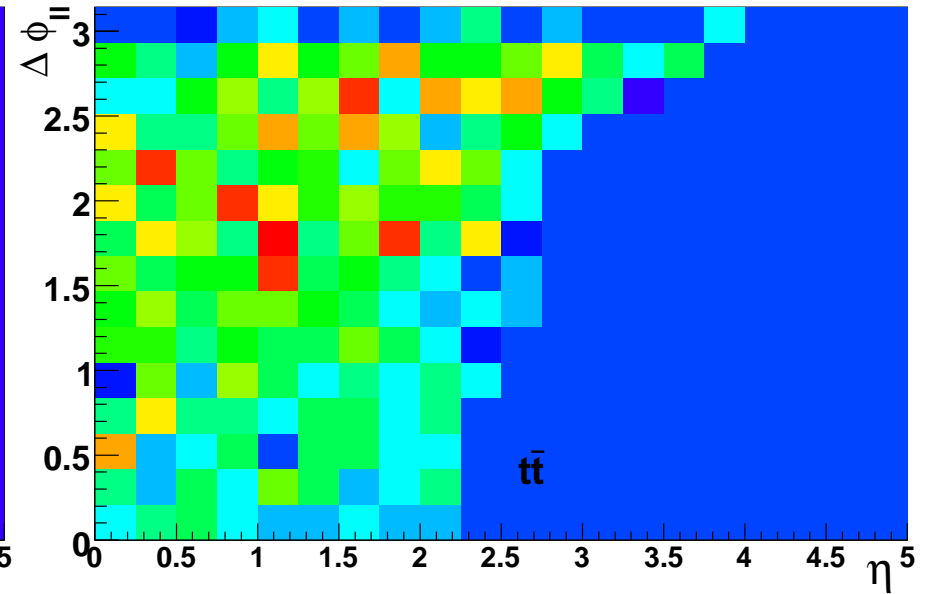
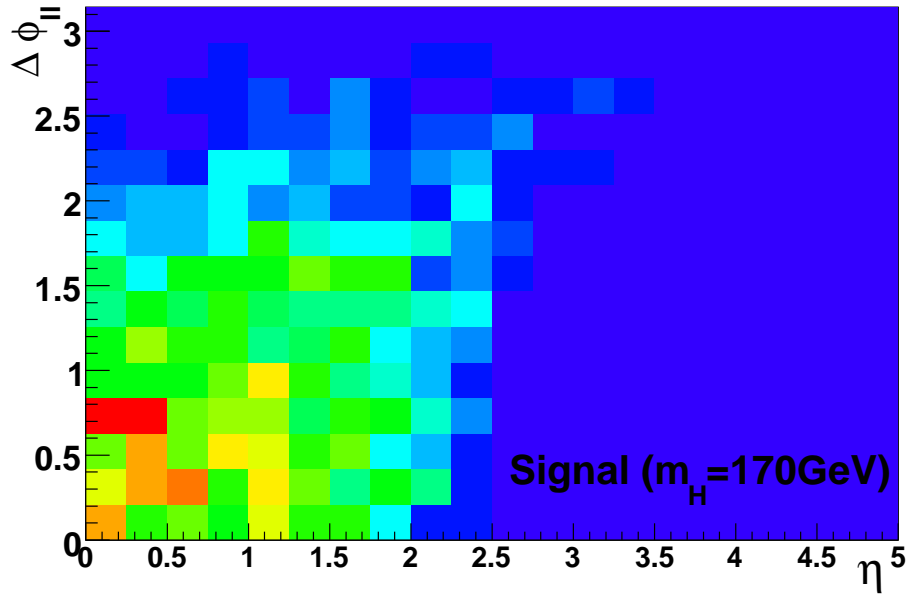
total cross section increased by 10%, shapes almost unchanged



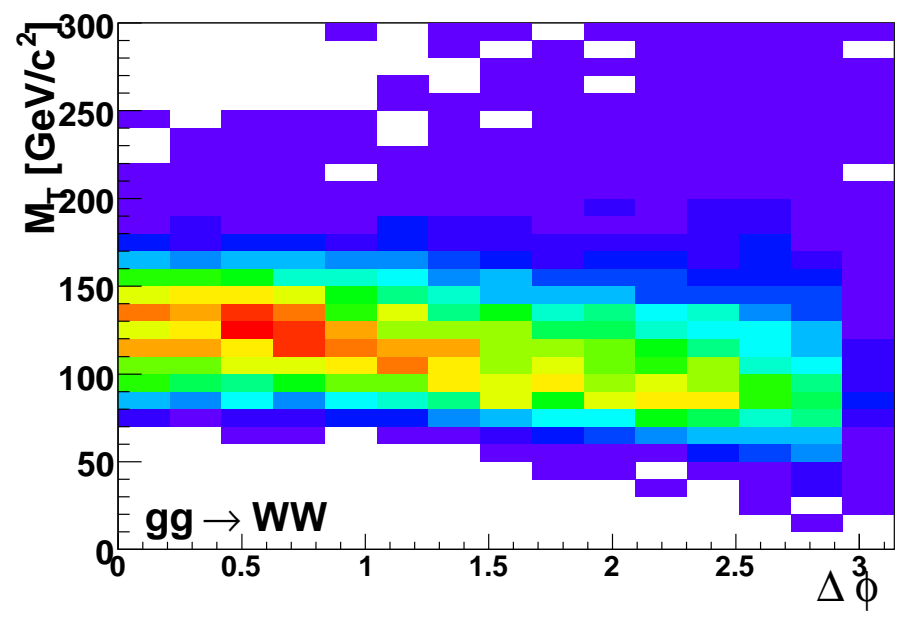
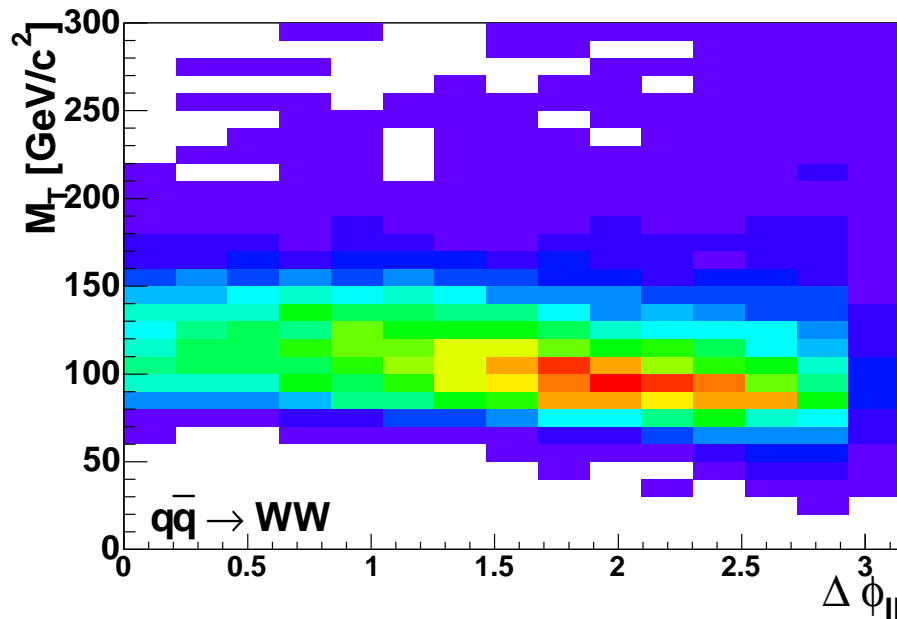
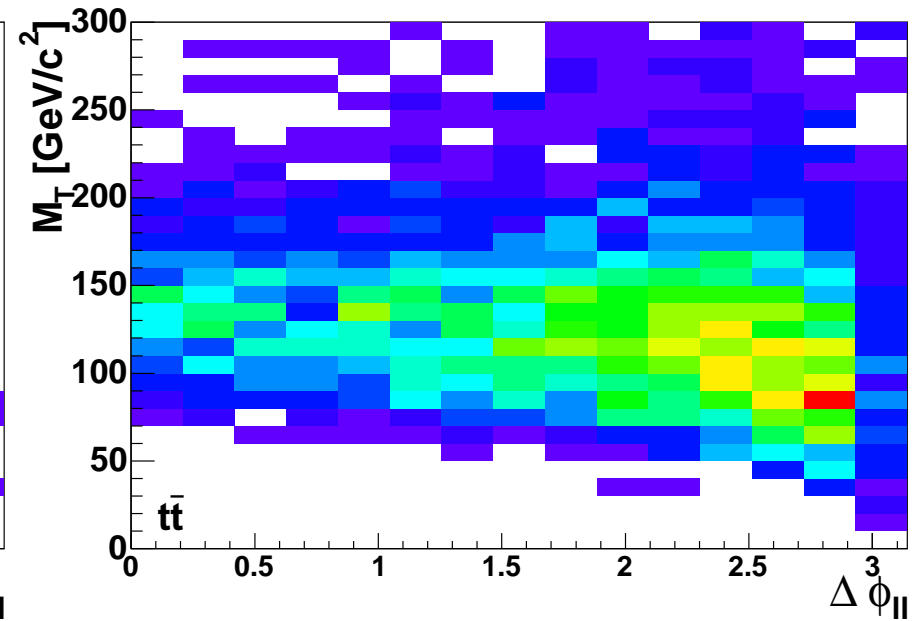
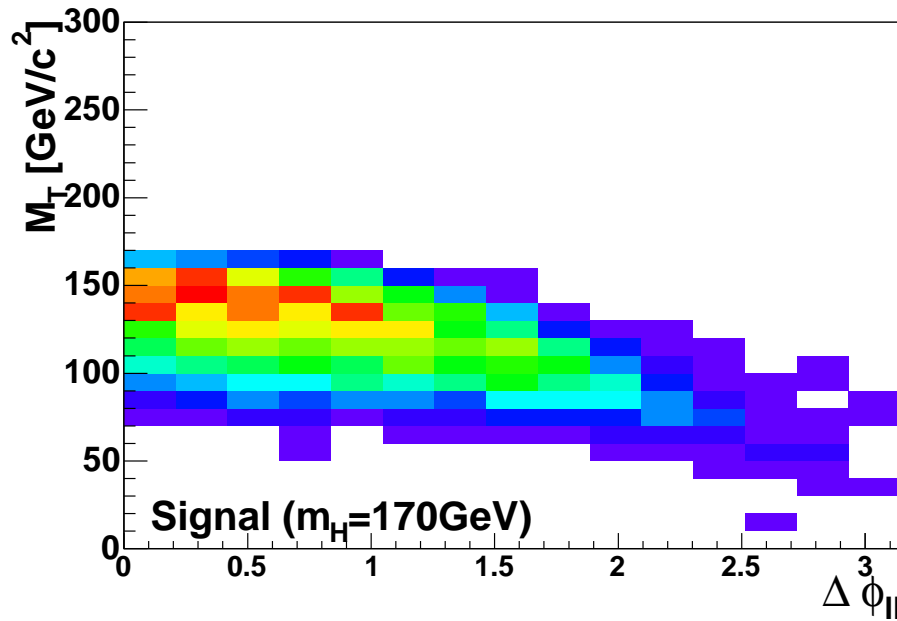
Comparison : $\Delta\Phi_{ll}$ vs. η_{ll} (Pythia)



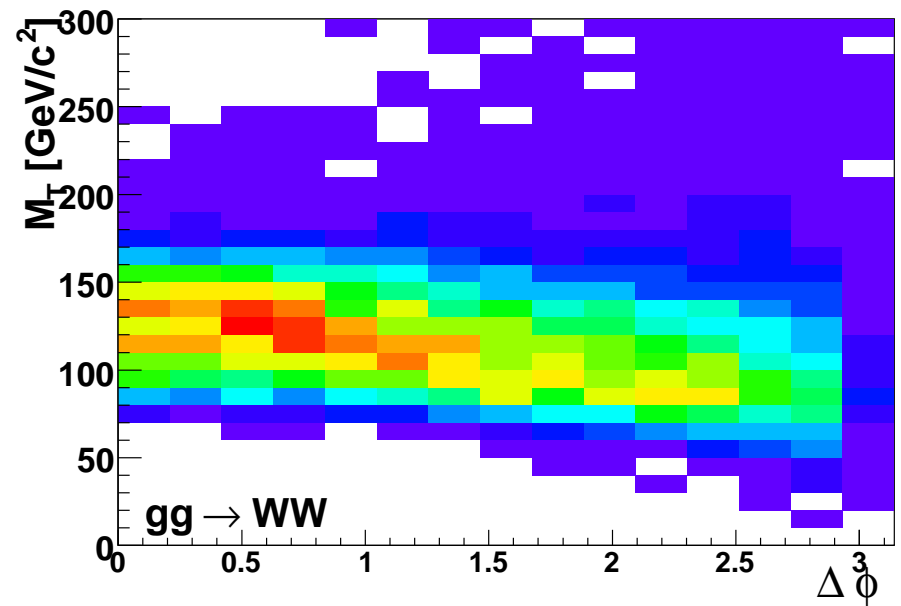
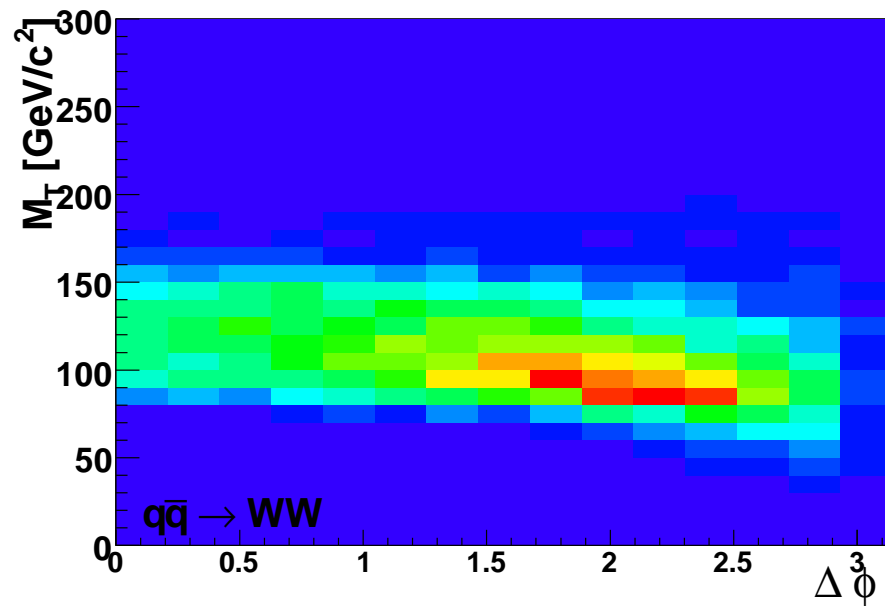
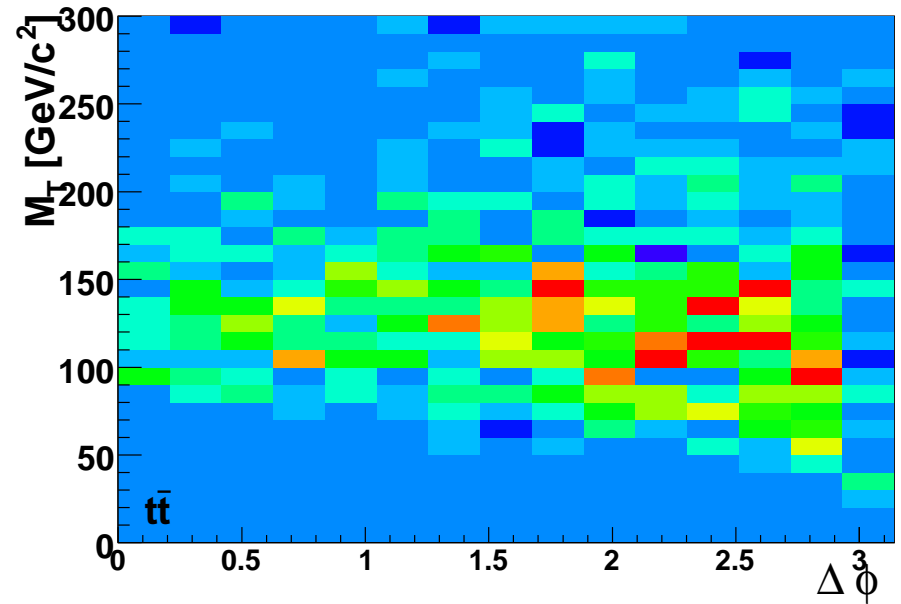
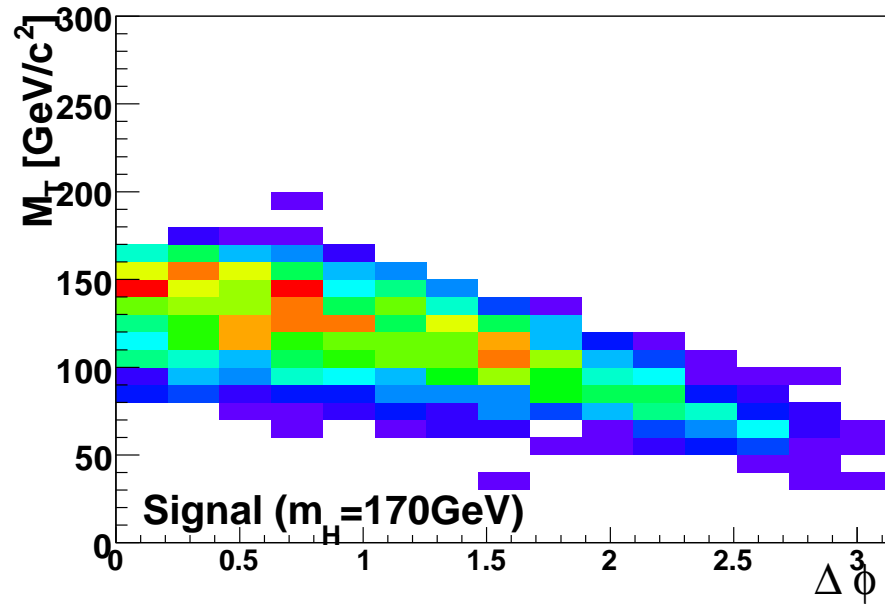
Comparison : $\Delta\Phi_{ll}$ vs. η_{ll} (MC@NLO)



Comparison : M_T vs. $\Delta\Phi_{ll}$ (Pythia)

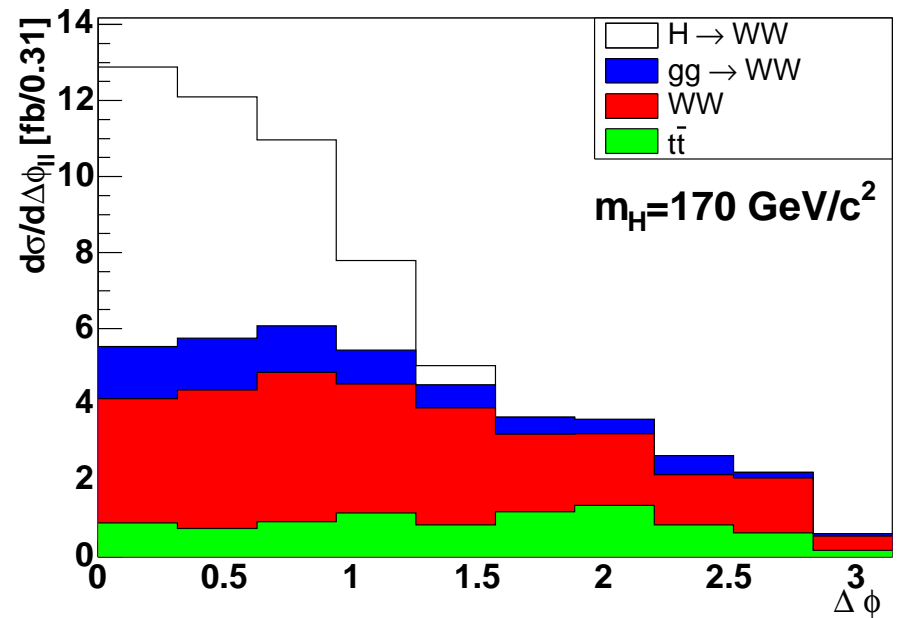
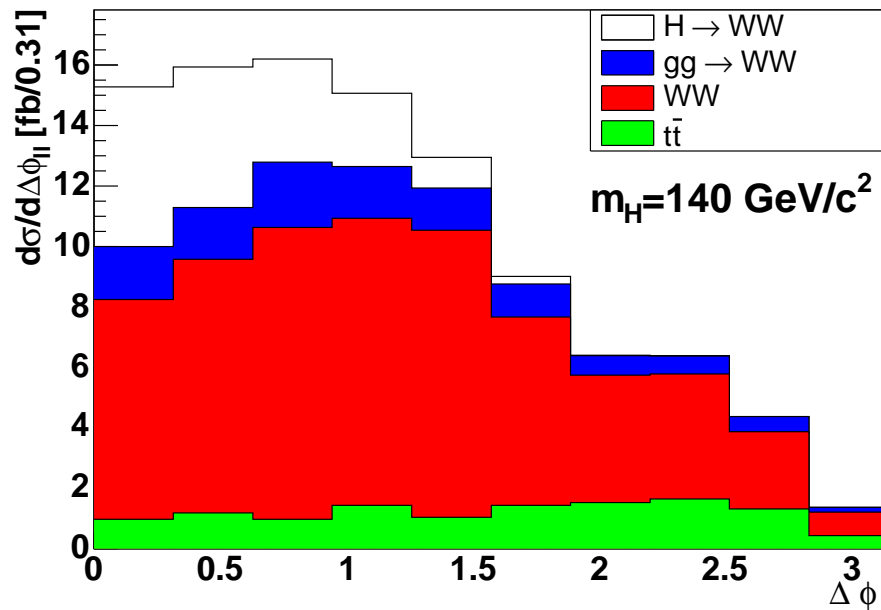


Comparison : M_T vs. $\Delta\Phi_{ll}$ (MC@NLO)



Results for $gg \rightarrow WW$ (Pythia)

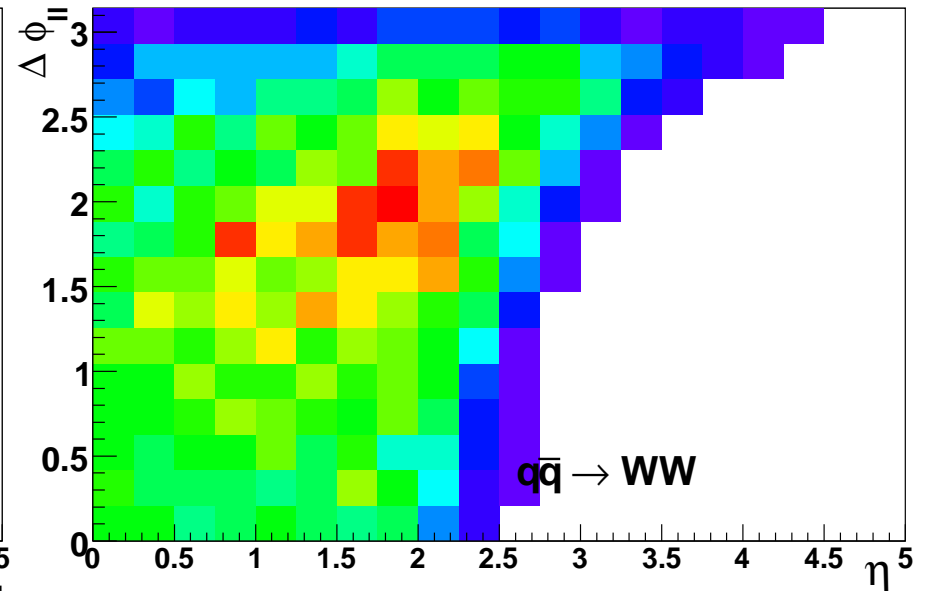
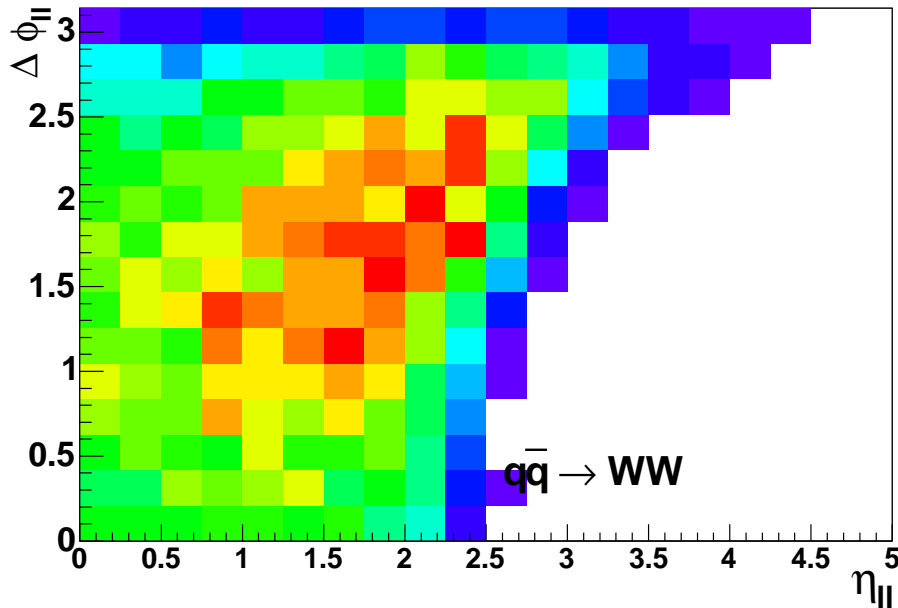
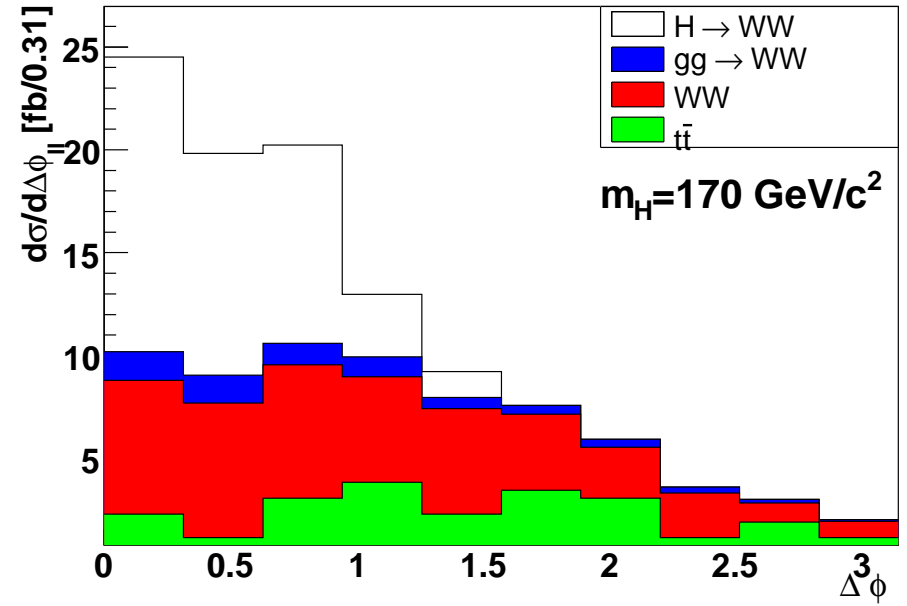
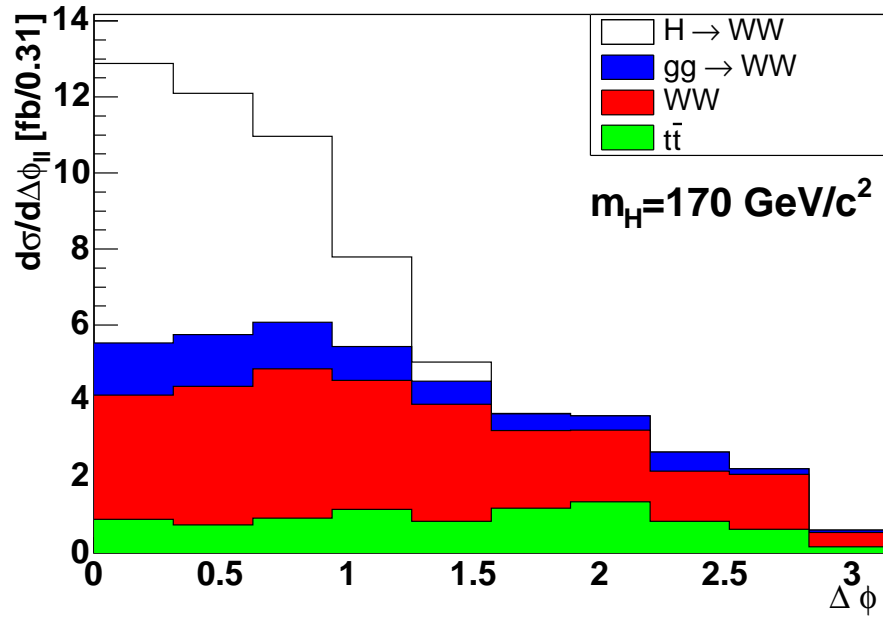
- $gg \rightarrow WW$ background is only 5% of the $q\bar{q} \rightarrow WW$ (LO) before cuts.
- After all cuts the $gg \rightarrow WW$ background is about 30% of the $q\bar{q} \rightarrow WW$ (LO) background.
- Shape is very signal like, all tails are on top of the dominant part of $q\bar{q} \rightarrow WW$. Experimental normalization will be hard.



Comparison Pythia/MC@NLO

Pythia

MC@NLO



Signature and basic cuts (gg \rightarrow H \rightarrow WW)

Signature : 2 Leptons and missing P_T , no jets

| | |
|-----------------------------------|---|
| Cuts | |
| Leptons | $p_T(l_1) > 20 \text{ GeV}, p_T(l_2) > 10 \text{ GeV}$ |
| p_T^{miss} | $p_T^{\text{miss}} > 40 \text{ GeV}$ |
| Jet Veto (against $t\bar{t}$) | b-Jets ($\epsilon_b=0.6$) : $p_T > 20 \text{ GeV}$ Jets : $p_T > 40 \text{ GeV}$ $ p_T(l_1) + p_T(l_2) + p_T^{\text{miss}} < 60 \text{ GeV}$ |
| Z Veto | $m_Z - 10 \text{ GeV} < m_{ll} < m_Z + 10 \text{ GeV}$ |
| Z \rightarrow $\tau\tau$ Veto | $\Delta\phi_{ll} > 3.0; \Delta\phi_{ll} > 2.0$ für $x_1, x_2 > 0$ |
| $\Delta\eta(l_1, l_2)$ | $\Delta\eta(l_1, l_2) < 1.5$ |
| $\eta(l_1 + l_2)$ | $\eta(l_1 + l_2) < 1.47$ |
| $M_T(l_1+l_2, p_T^{\text{miss}})$ | $m_H - 30 \text{ GeV} < M_T < m_H$ |
| $\Delta\phi(l_1, l_2)$ | $\Delta\phi(l_1, l_2) < 1.0$ |