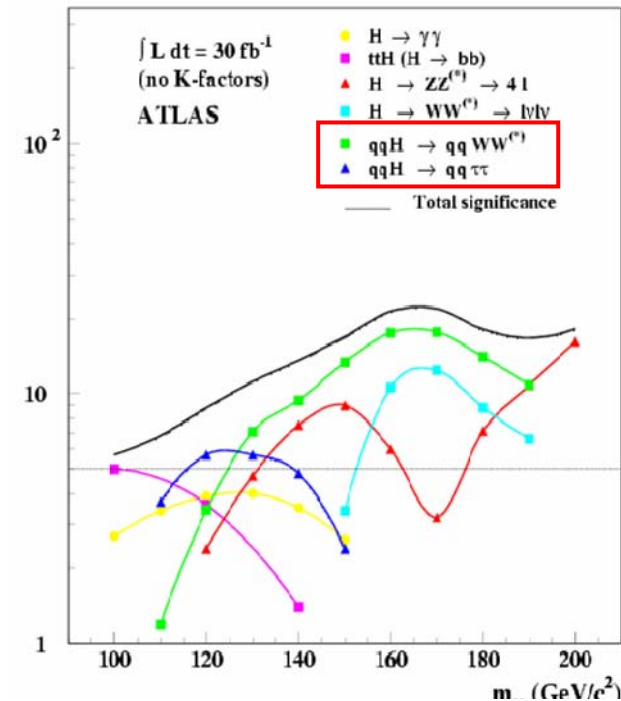
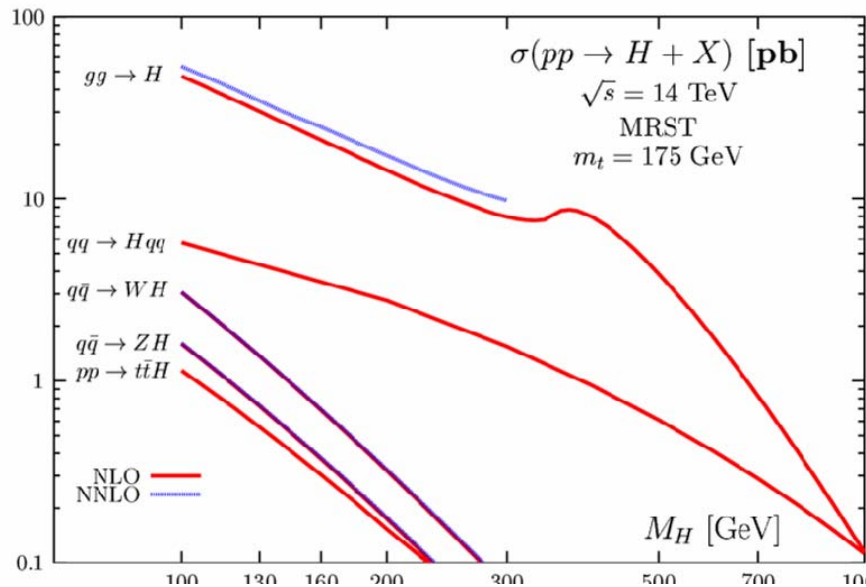
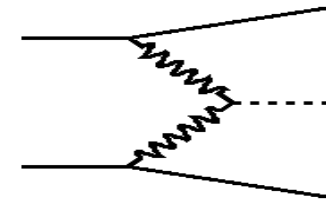


# Higgs via Vector Boson Fusion

- 10-20% of production rate at LHC (at low masses)  
(signal Xsec known at NLO, small K factor)
- specific topology (“tagging jet”, no jet activity in central region)
- significant contribution to discovery potential at low mass
- Study of WW scattering at high mass (see also *BSM/Higgsless discussion*)

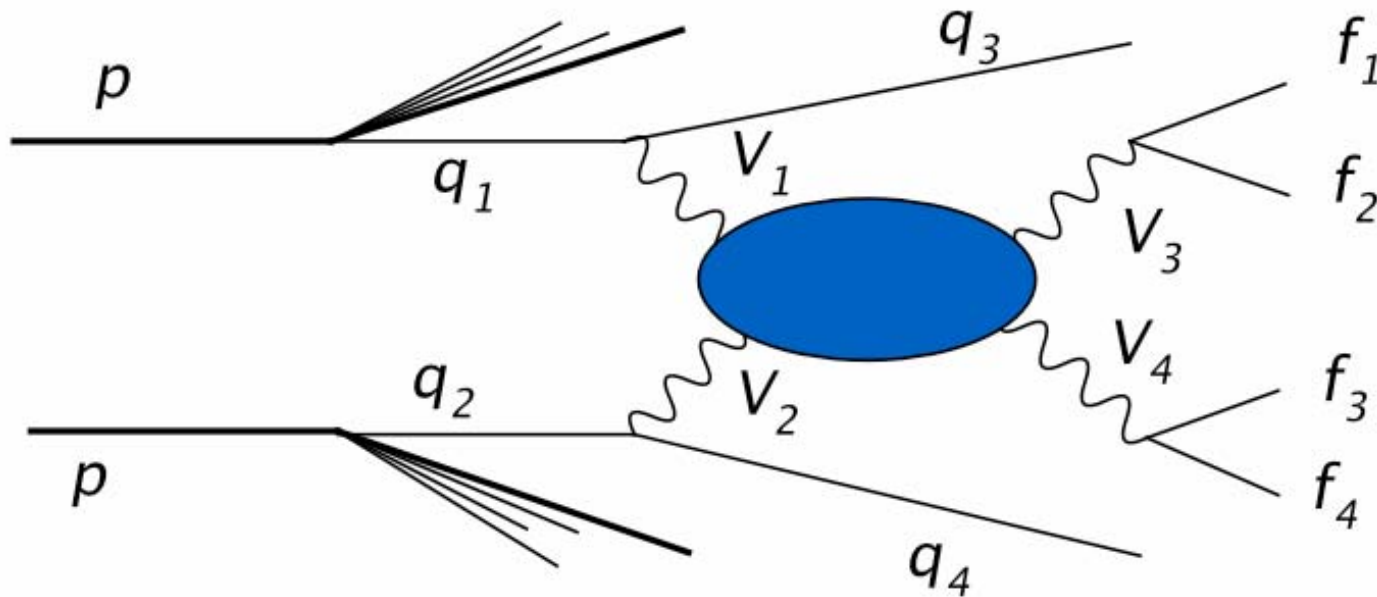


# Description of Electroweak VV scattering (with Phase)

E.Maina

hep-ph/0504009

All  $q_1 q_2 \rightarrow 6$  fermions electroweak processes



(from E.Maina's talk)

An interesting example:

$$\bar{c}s \rightarrow \bar{c}s\bar{s}c\bar{\nu}\mu$$

1046 diagrams

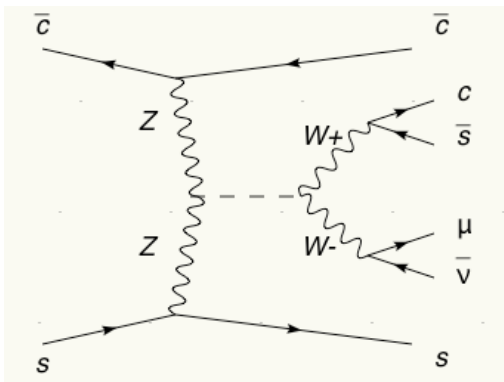
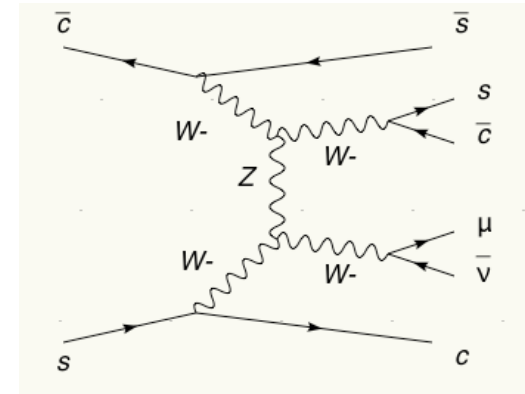
It includes:

- ZZ --> W+W-
- ZW- --> ZW-
- W-Z --> ZW-
- W-W- --> W-W-
- W- --> W-W+W-
- W- --> ZZW-

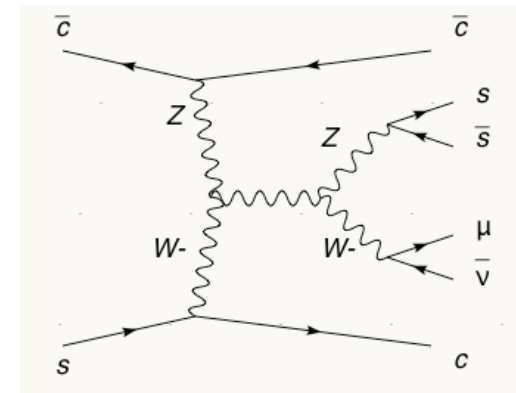
Higgs --> WW

with 2 Higgs --> WW channels

Higgs --> ZZ



Homework: check it out



With C. Mariotti and S. Bolognesi,  
E. Accomando, S. Ballestrero(Torino)

## First look

- $p_T(q, l^{+/-}) > 10 \text{ GeV}$
- $E(q, l^{+/-}) > 20 \text{ GeV}$
- $M(q, q) > 20 \text{ GeV}$
- $\text{Abs}(\eta(q)) < 6.5$
- $\text{Abs}(\eta(l^{+/-})) < 3$
- $\text{Abs}(\eta(jc)) < 3$
- $\eta(jf) > 2$
- $\eta(jb) < -2$

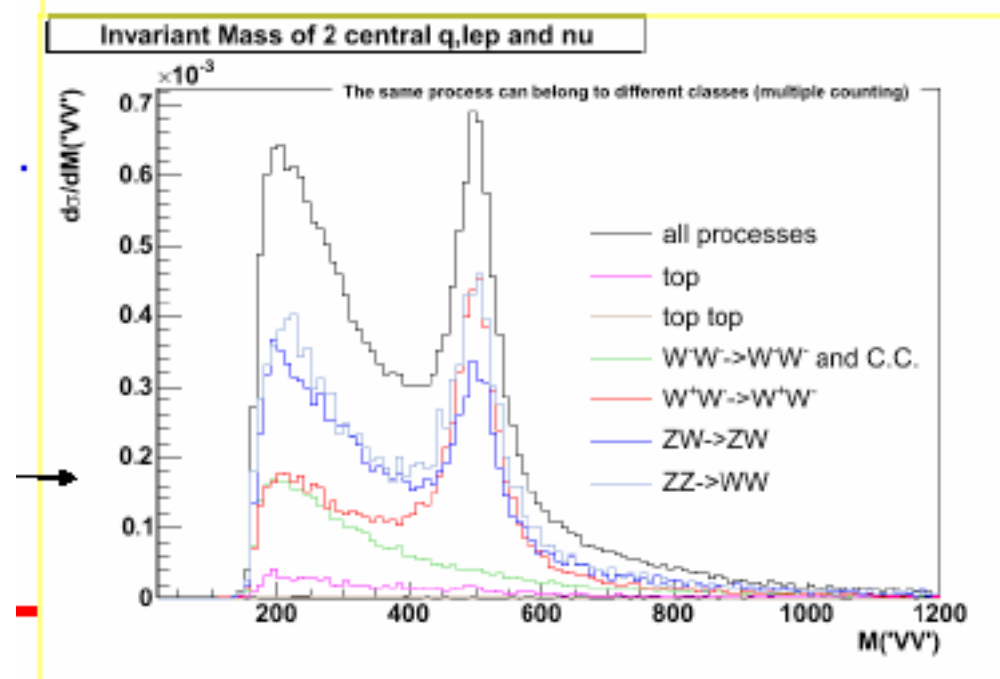
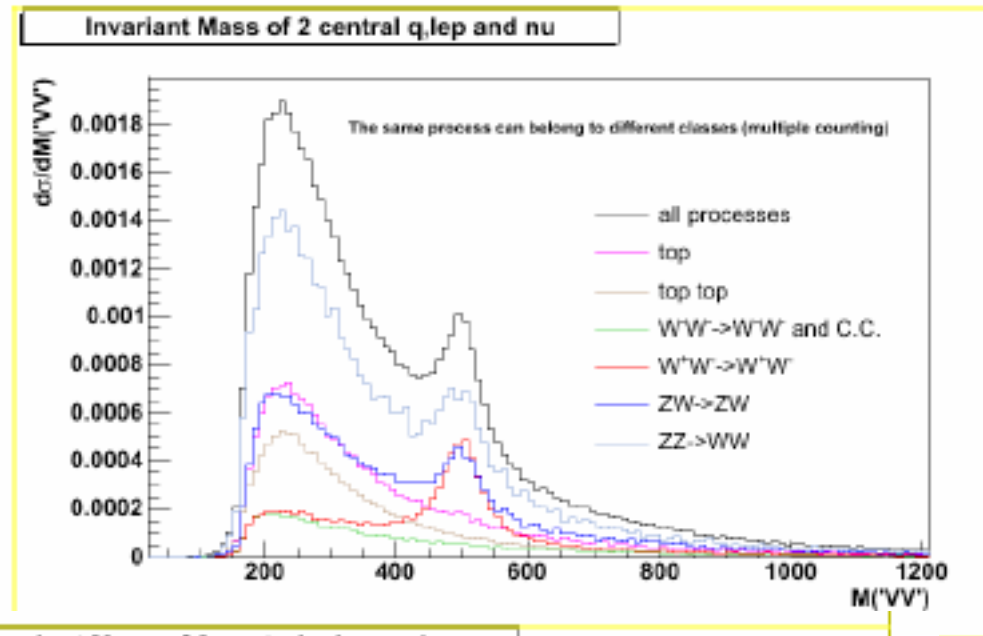
Reject

- $160 < M(b\nu) < 190 \text{ GeV}$
- $160 < M(bqq) < 190 \text{ GeV}$

Require

- $70 < M(qq) < 90 \text{ GeV}$

*(from E.Maina's talk)*



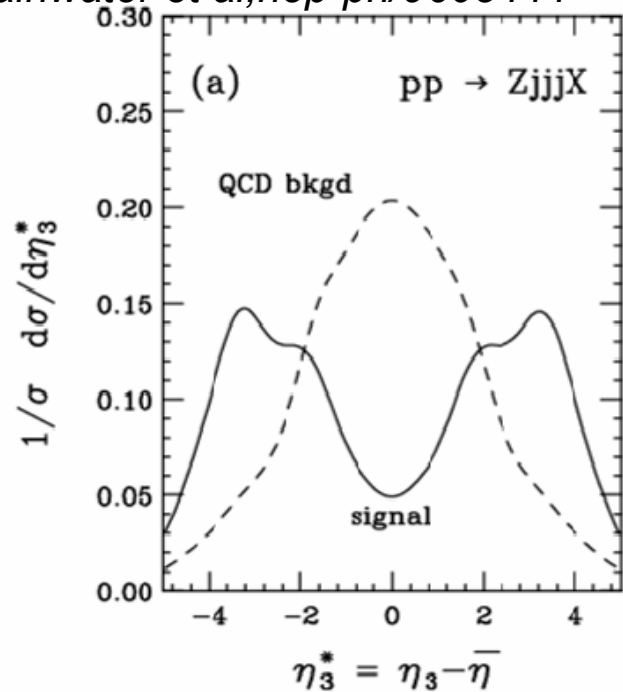
## Low mass Higgs search in VBF production

- $H \rightarrow \tau\tau \rightarrow \text{dilepton or lepton+hadron}$ 
  - main background:  $Z+2 \text{ jets}$  (QCD > EW)
  - main experimental issue: mass resolution ( $\leftrightarrow$  Missing transverse momentum resolution)
  - **Jet veto  $Z+3\text{jets}/Z+2\text{jets}$  after tagging cut (“Zeppenfeld plot”)**
- $H \rightarrow W W^* \rightarrow \text{dilepton}$ 
  - main backgrounds  $t\text{-}\bar{t}$ (+jet),  $t\text{-}W$  (veto jets from top decay),  $WW+2\text{jets}$  (**similar issues as in  $gg \rightarrow H \rightarrow WW^*$** )
  - main issue: background extrapolation from control samples (but better S/B than inclusive  $H \rightarrow WW^*$  channel).
- ( $H \rightarrow \text{gamma gamma}$  )

(note: observing both VBF and  $gg \rightarrow H$  is important for coupling measurements)

# Jet veto in central region to improve S/B

Rainwater et al, hep-ph/9605444



Recent studies based on Sherpa/CKKW, Alpgen+Mangano prescription to generate Z+njets+PS without double counting.

Is this accurate enough? Studies ongoing at Tevatron (see J.Huston's talk in first session), but different  $E_t, m(j-j)$  range

MC@NLO for Z+2j? Will probably not exist soon...

*A.Nikitenko, Les Houches05  
In progress*

Signal loss from jet veto  
=> Underlying event/PileUp  
for low Pt threshold

