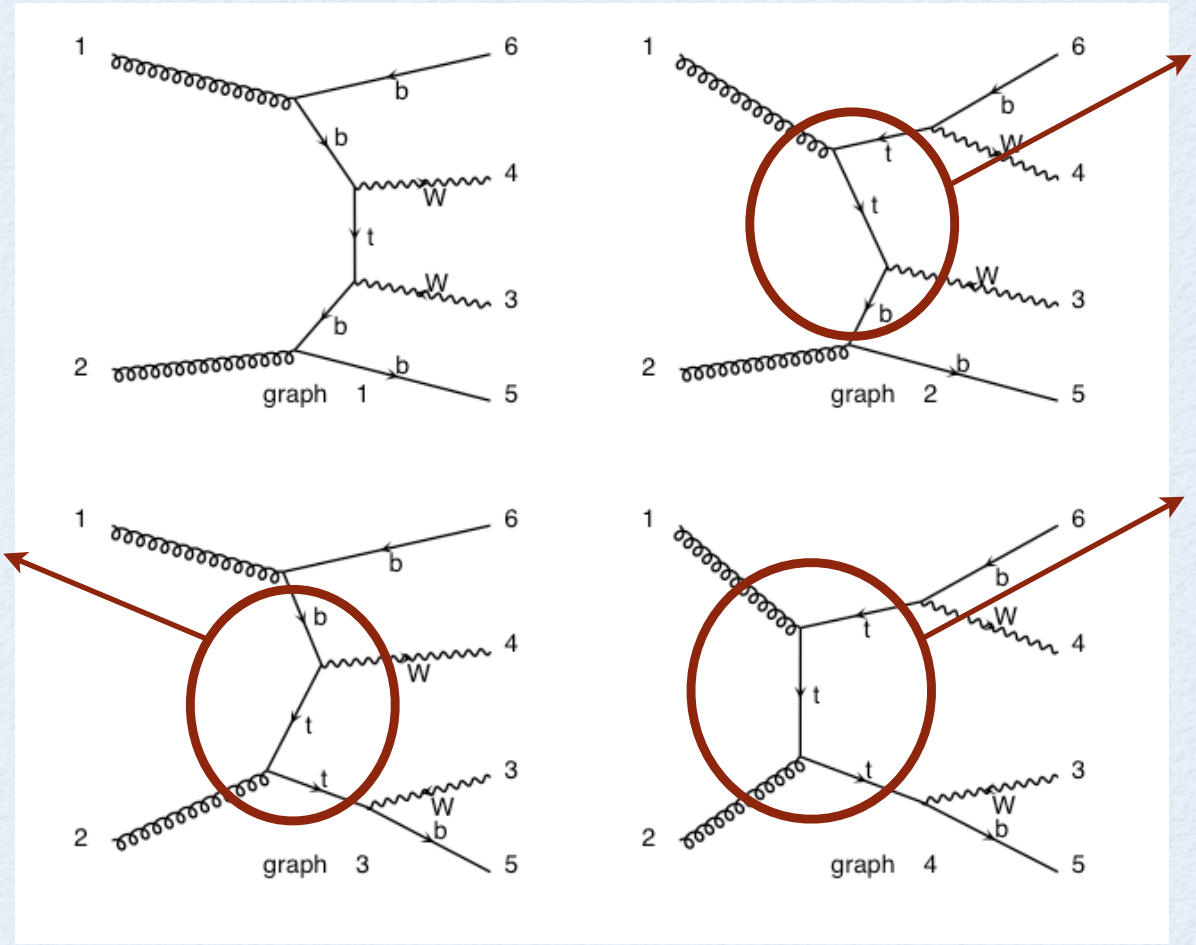
TOP BACKGROUNDS TO $GG \rightarrow H \rightarrow WW$

Fabio Maltoni & John Campbell
CERN

with Sasha, Anne-Silvie, Marco

How do we think about it?

$$pp \to W^+W^-b\bar{b}$$



$g\bar{b} \to \bar{t}W^+$

$bg \to tW^-$

$gg \to t\bar{t}$

FIRST POSSIBILITY

USE: $pp \to W^+W^-b\bar{b}$

- The complete set is gauge invariant (e.g. overall width scheme)
- Double-resonant, single-resonant, non-resonant diagrams are present.
- Interference is correctly included

BUT

☹ NLO corrections are not known

☹ Large logs of mb/(mt+mw)

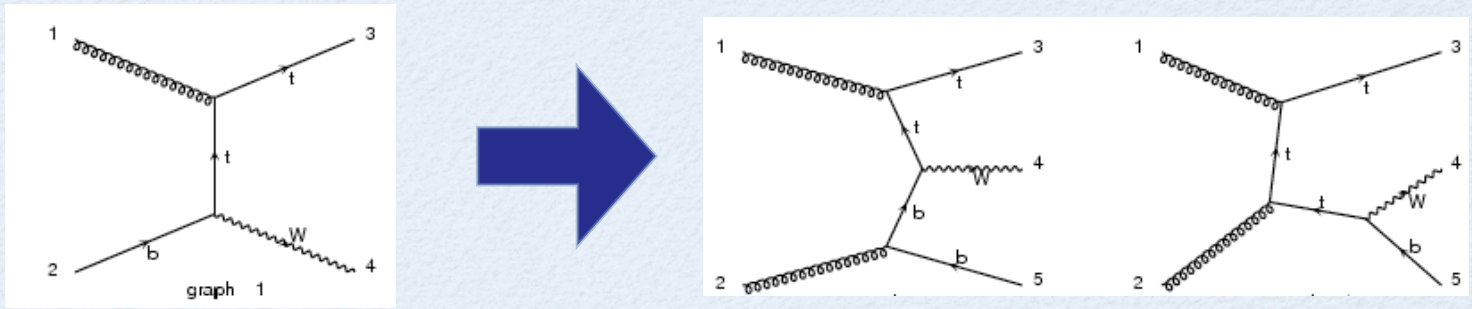
SECOND POSSIBILITY

USE: $t\bar{t} + tW$

- NLO corrections are known for both tt and tW (Campbell, Tramontano, be ready soon)
- large logs are resummed into the b-pdf

BUT

☹ NLO tW contains LO tt !!



Avoid double counting:

1. in a gauge invariant way
2. in a event generator friendly way

SECOND POSSIBILITY

USE: $t\bar{t} + tW$

Avoid double counting:
1. in a gauge invariant way
2. in a event generator friendly way

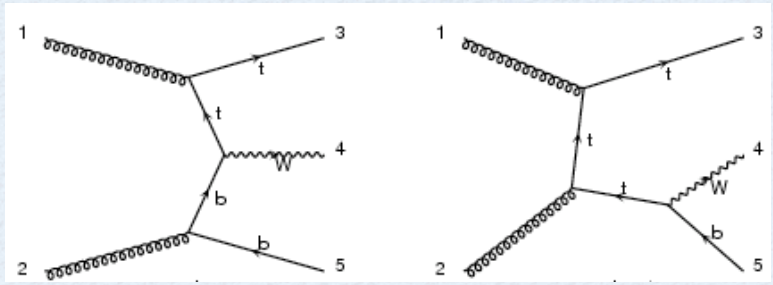
Available proposals are not completely satisfactory:

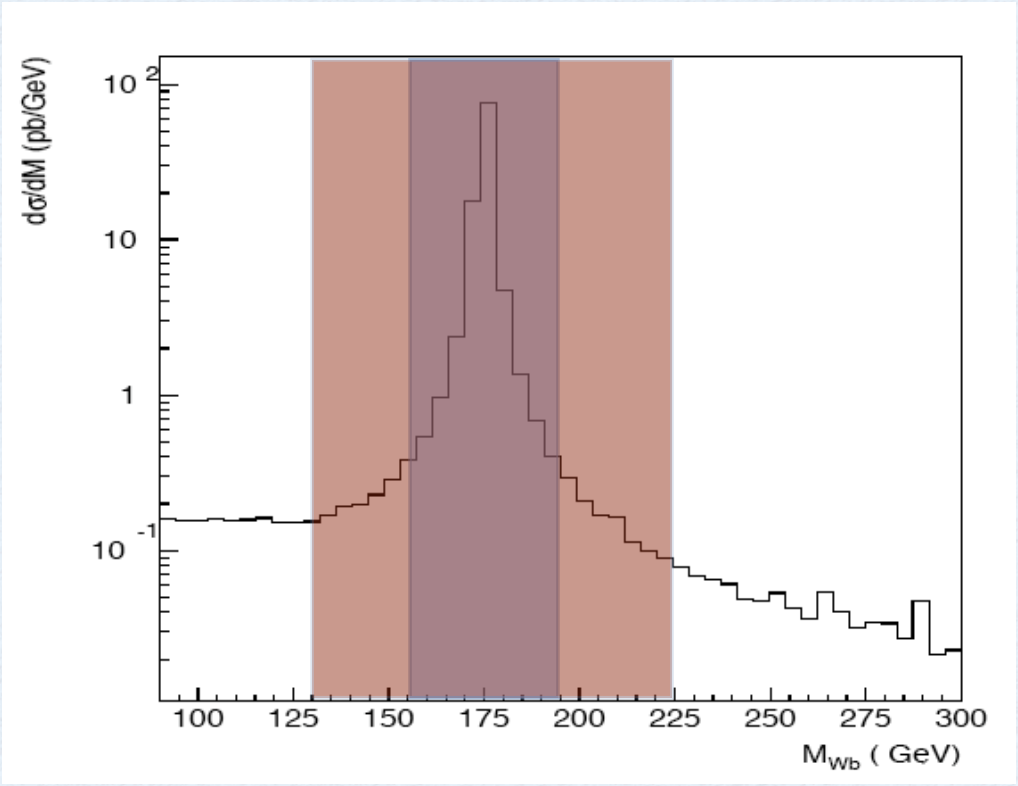
Tait (2001) : zero width, analytic approach not suitable for event generators.

$$\sigma(gg \to tWb)_{singletop} = \sigma(gg \to tWb)_{total} - \sigma(gg \to t\bar{t}) * Br(t \to Wb) - interf[t\bar{t} \otimes tWb],$$

Belyaev and Boos (2000): subtraction not gauge invariant if width not zero. Window mass cut is not effective (results depend very much on the window width)

SECOND POSSIBILITY





B&B suggested to use a mass window of about 12 Γtop so to reproduce the Tait's zero-width result and have a generator friendly definition.

The problem is that the size of the window, at fixed width, depends on the interference term ⇒ gauge dependence

Our conclusion is that this is not an effective way to define tW events!

OUR PROPOSAL FOR TW

To measure (=define a NLO) tW

- We subtract tt point-by-point in the phase space:

$$\sigma(gg \to tWb)_{singletop} = \sigma(gg \to tWb)_{total} - \sigma(gg \to t\bar{t}) * Br(t \to Wb) - interf[t\bar{t} \otimes tWb],$$

- and impose a jet veto on the spectator b.

Features:

1. this makes the interference tt contribution much smaller.
2. the gauge violations are negligible.
3. It can be directly used for estimating the background to the Higgs!

FIRST POSSIBILITY

$$pp \to W^+W^-b\bar{b}$$

	tt	tWb	tt+tWb	WbWb	R
NO CUTS	557	37	594	590	1
VETO	6.3	2.4	8.7	9.4	0.93