Search for a Standard Model Higgs-like boson decaying into WW → lνqq̄ in exclusive jet bins in pp collisions at √s = 8 TeV

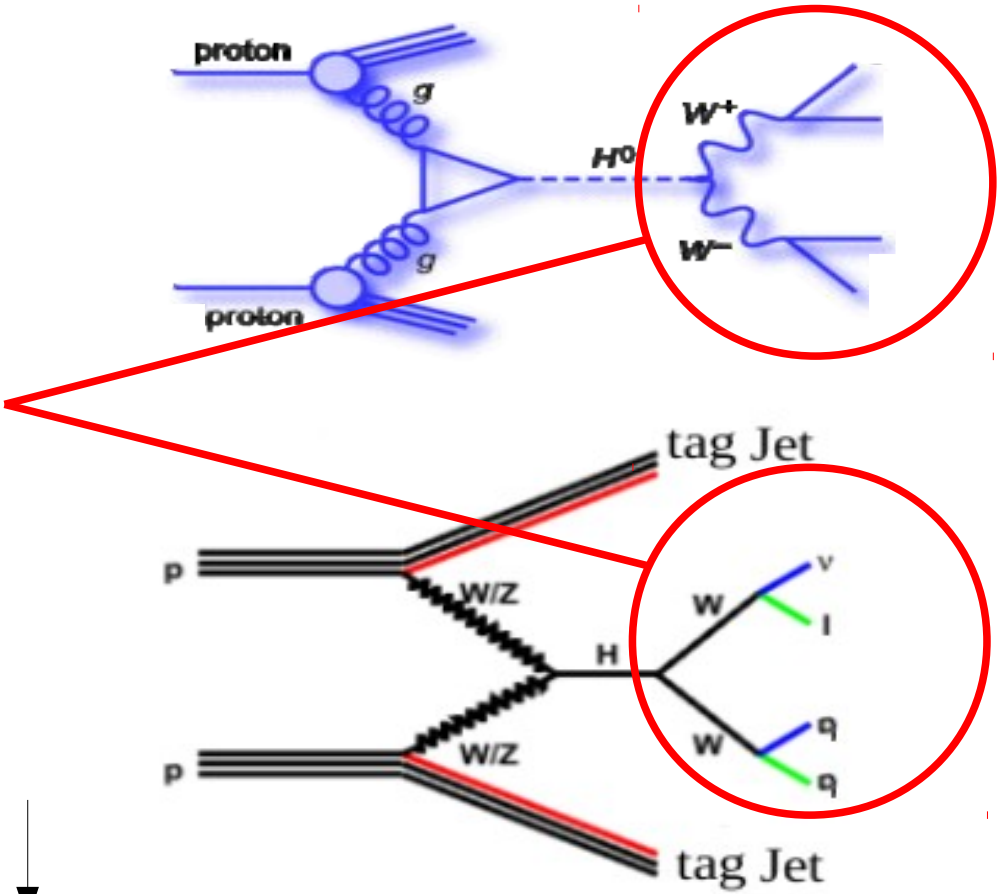
Speaker: Luca Brianza[1]

[1] *INFN and University of Milano Bicocca*

H → WW → lνJ analysis features

Search for scalar boson resonances decaying into WW in the high mass region (600 GeV – 1 TeV)

Signal: ggF, VBF



Signature:

WW → {l + MET} + Merged Jet

- W → l ν → High p_T lepton + Missing energy
- W → q q' → Hadronization → 2 jets → 'merged' into a single jet (due to the high boost)

Possible to measure the WW invariant mass spectrum:

- Need p and E of: lepton, neutrino, merged jet
- Only one unknown variable: p_z of the neutrino
- It can be computed imposing a constraint: m(lν) = m_W

Jet bin categories

H → WW → lvJ(jj) restart after previous inclusive analysis (CMS- HIG-13-008)

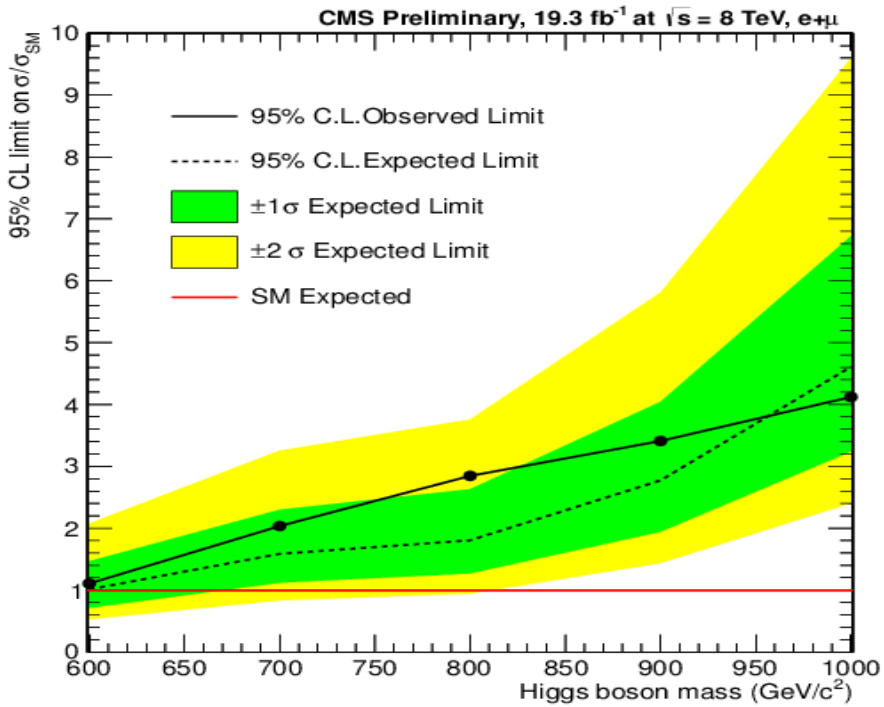
- ***Goal:*** split the analysis in jet bins in order to have a dedicated VBF search and improve the sensitivity by means of combination

Two categories:

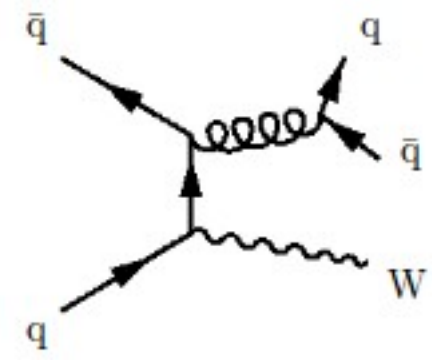
- 0-1 jet bin: maximum one jet (pT>30 GeV) in addition to the "merged" jet

- 2-jet bin: at least two jets (pT>30 GeV) in addition to the "merged" jet (dedicated VBF search)

Previous limit:

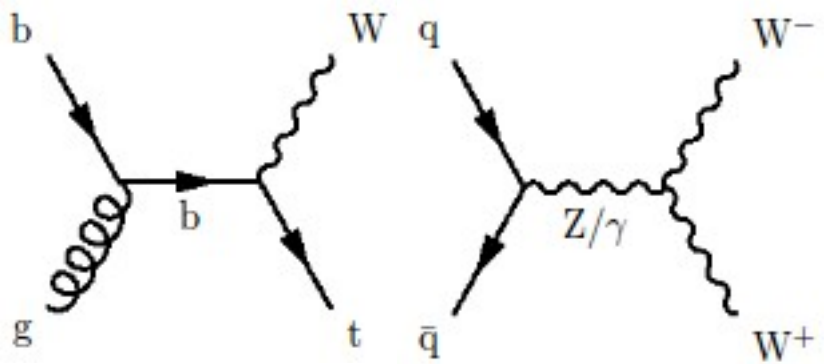


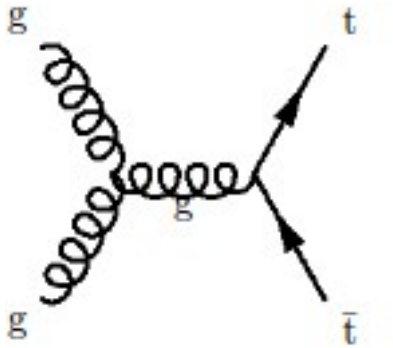
Backgrounds



- **W+jets:** The dominant bkg (especially in the 0-1 jet bin category) shape and normalization exctracted from data

- **Single top, VV:** shape and normalization from MC





- **Ttbar:** large contribution especially in the 2-jet bin category shape and normalization from MC

Event selection & cut optimization

Event Selection:

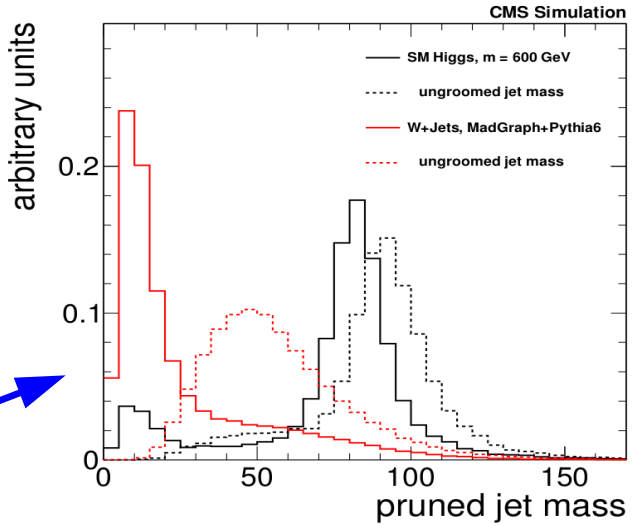
Leptons: pT(μ,e) > 30 (35) GeV; veto presence of 2nd μ or e

Missing transverse energy: MET(μ,e) > 50 (70) GeV

Boosted Regime: pT^{Jet} and pT^{lv} > 200 GeV

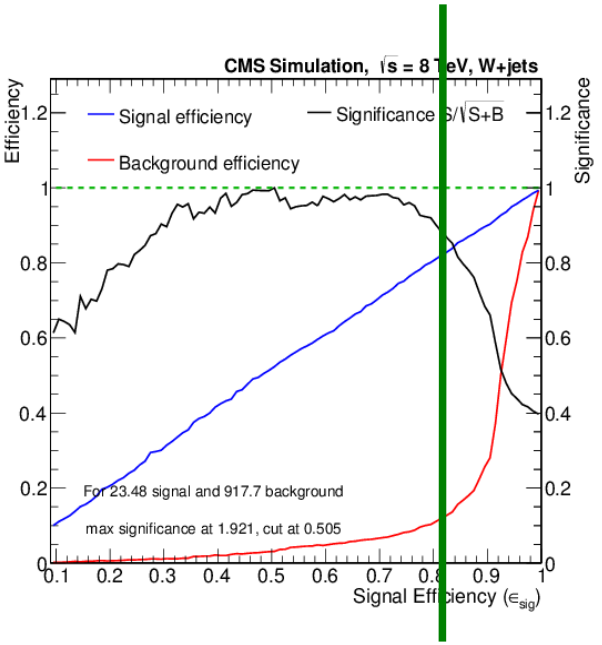
Topological back-to-back angular cuts

Merged jet: cluster with CA8, ***pruned mass*** [65,105] GeV
N-subjettiness (one-pass kT) $\tau_2/\tau_1 < 0.5$;

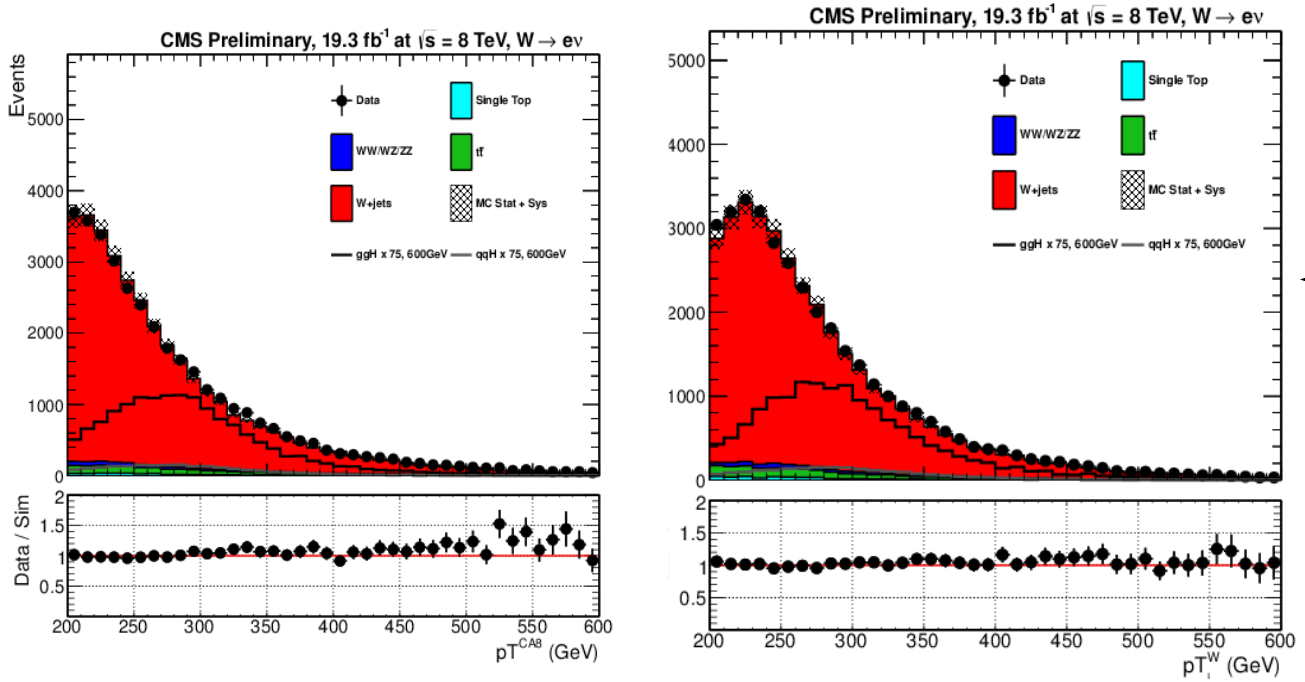


To reduce ttbar bkg:
Veto presence of b-jets using CMS AK5 jets (w.p: CSV medium)

VBF cuts:
Δη>3.0 && Mjj>250 GeV
(signal eff: ~82%)



MC-data comparison at preselection level

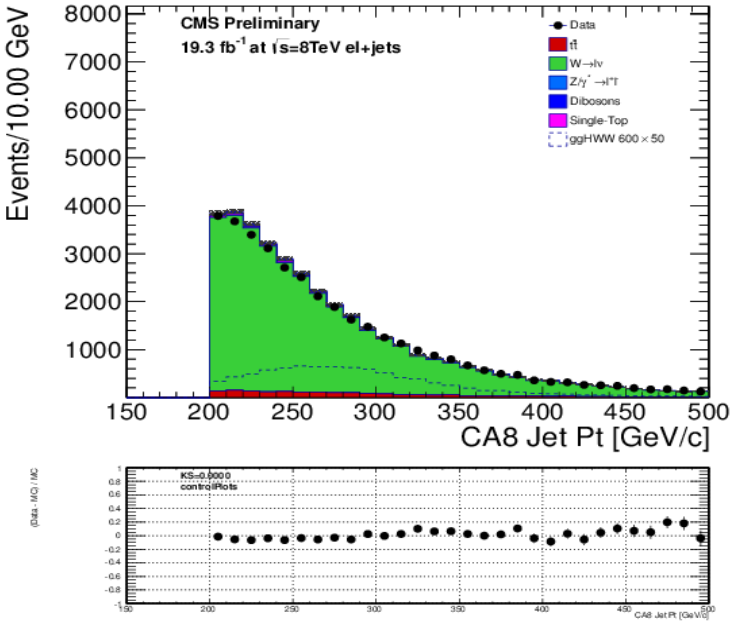


Good agreement between data and MC

For the Ttbar bkg:

checked the data / MC agreement in a top-enriched region, in order to validate the use of the MC (Mww) shapes also for the Ttbar

→ **OK!**



W+jest Bkg: normalization procedure

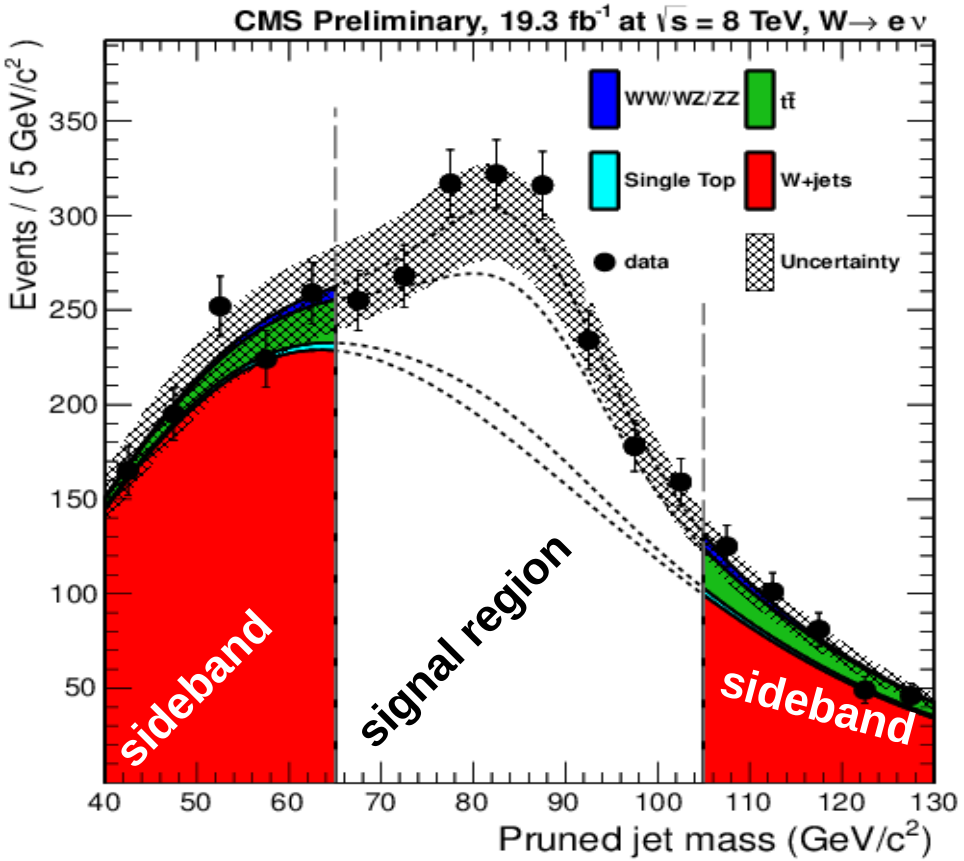
Ttbar, VV, Single top:
Normalization and shape in Mj fixed from MC

→

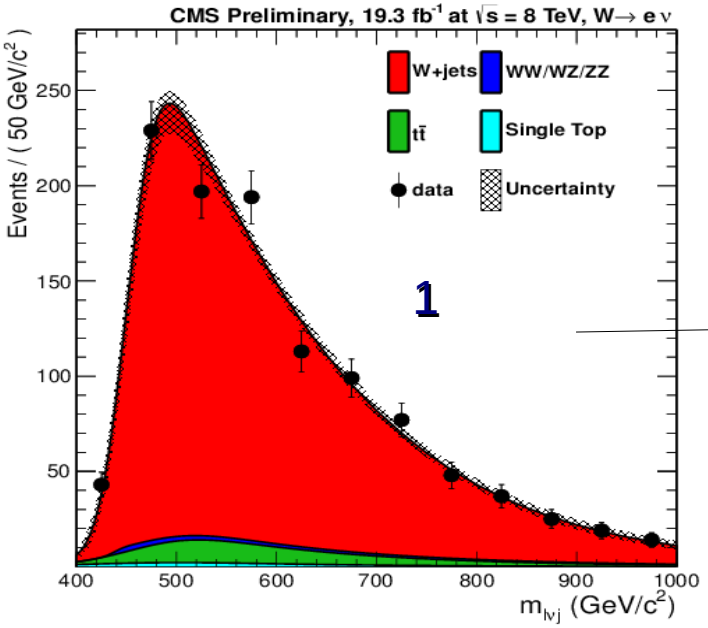
Fit on data in the sideband → extraction of W+jets normalization

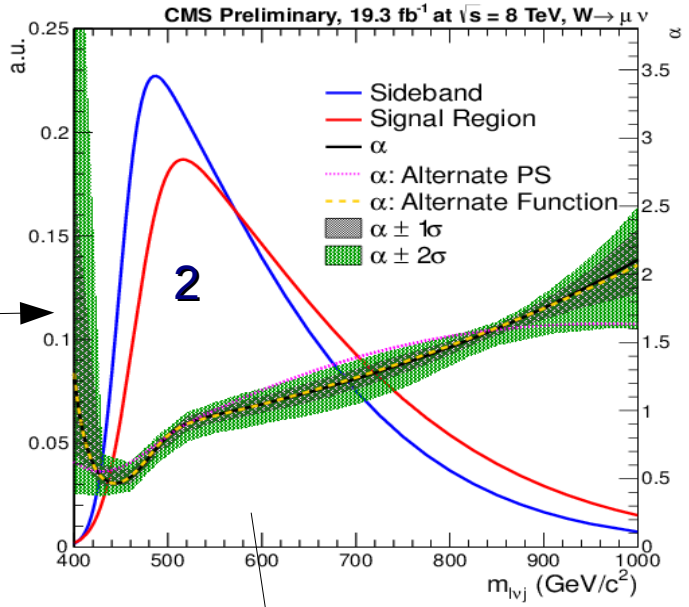
→

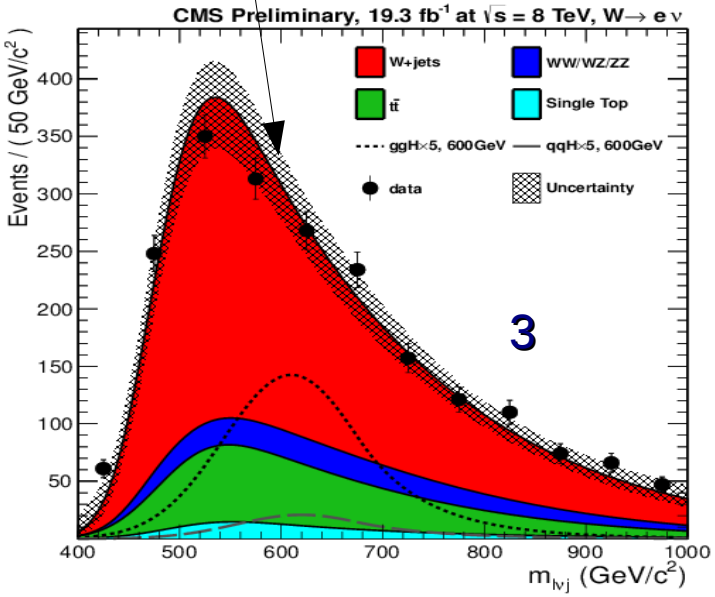
Extrapolation of W+jets normalization to the signal region



Mlvj shape: W+jets estimation







Procedure:

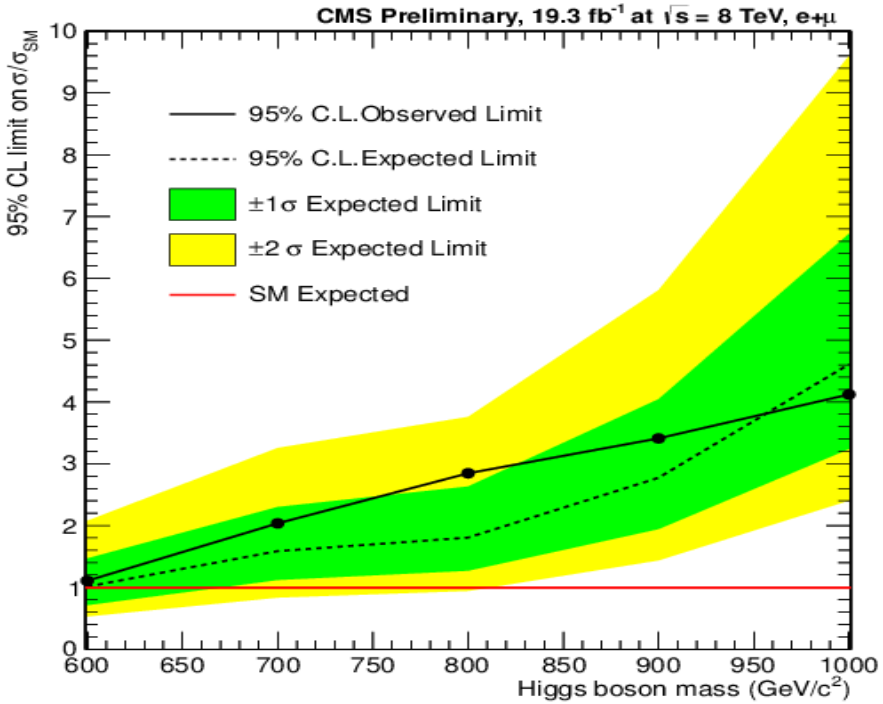
1) **Extraction of the sideband shape**: fit on data, subtracting the other backgrounds (fixed after fit on MC)

2) **Extrapolation factor**: $$\alpha = \frac{F_{W+Jets}(Signal\ Region)^{MC}}{F_{W+Jets}(Sideband)^{MC}}$$

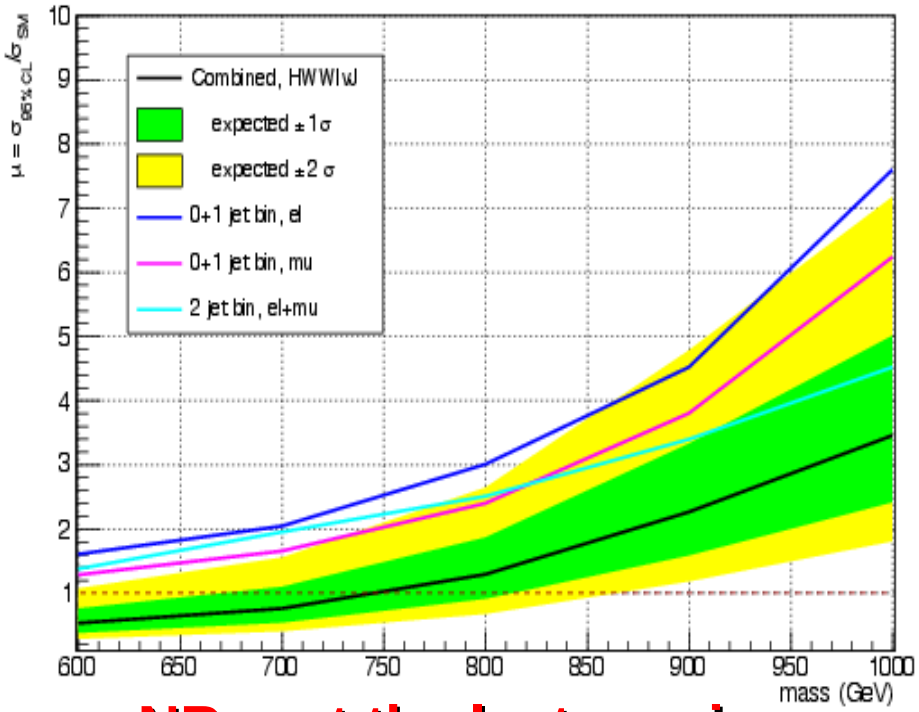
3) **Extrapolation to the signal region**:
F_{W+jets} (signal region) = α • F_{W+jets} (sideband)

Expected limit for the SM case

Inclusive analysis (HIG-13-008)



This analysis



NB: not the last version..

→ **Big improvement!**