



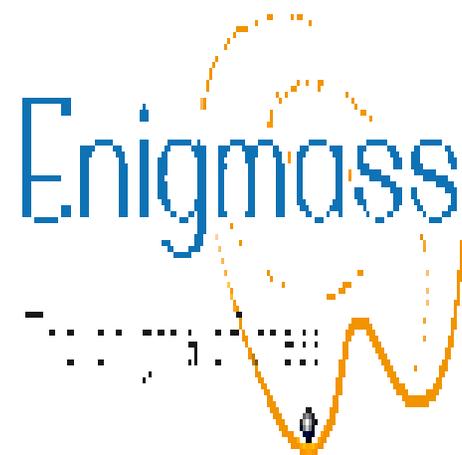
iHIGGS

Collaborative Enigmass Project

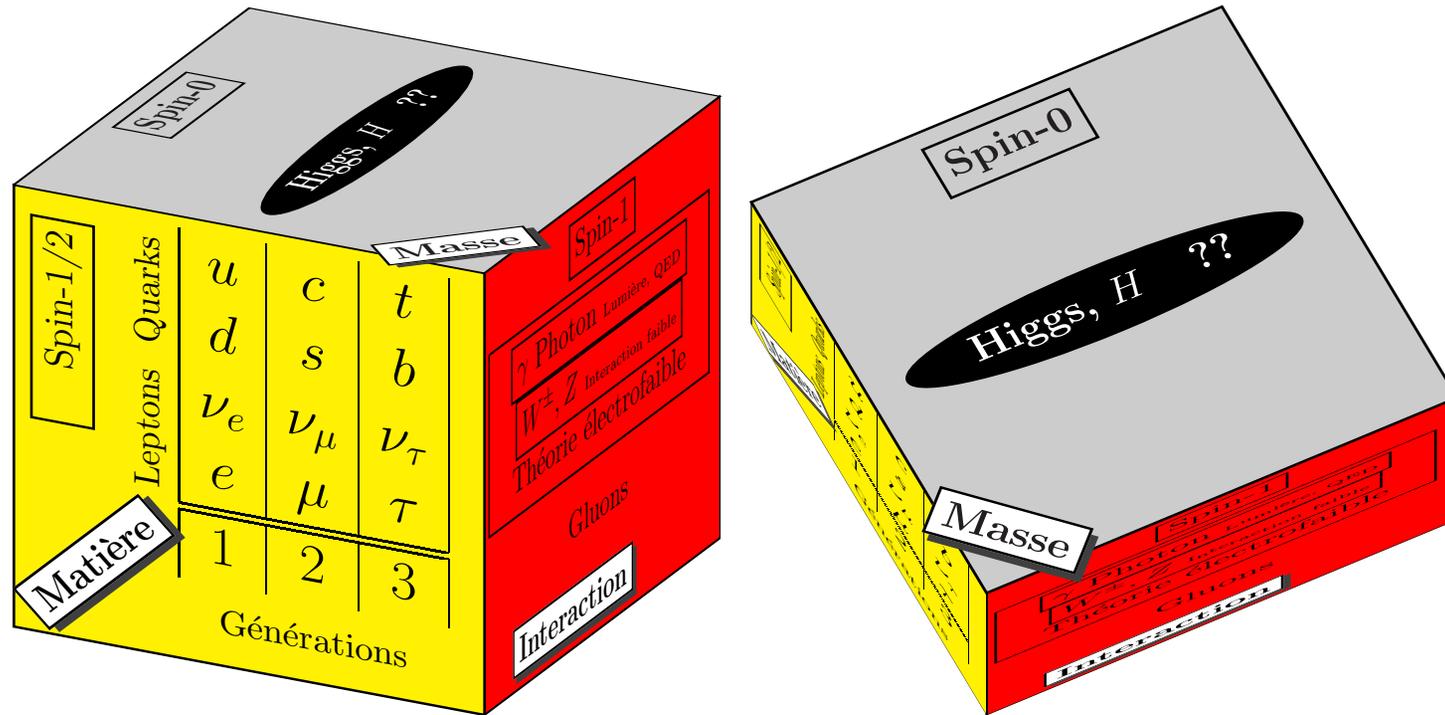
Fawzi BOUDJEMA

LAPTh-Annecy

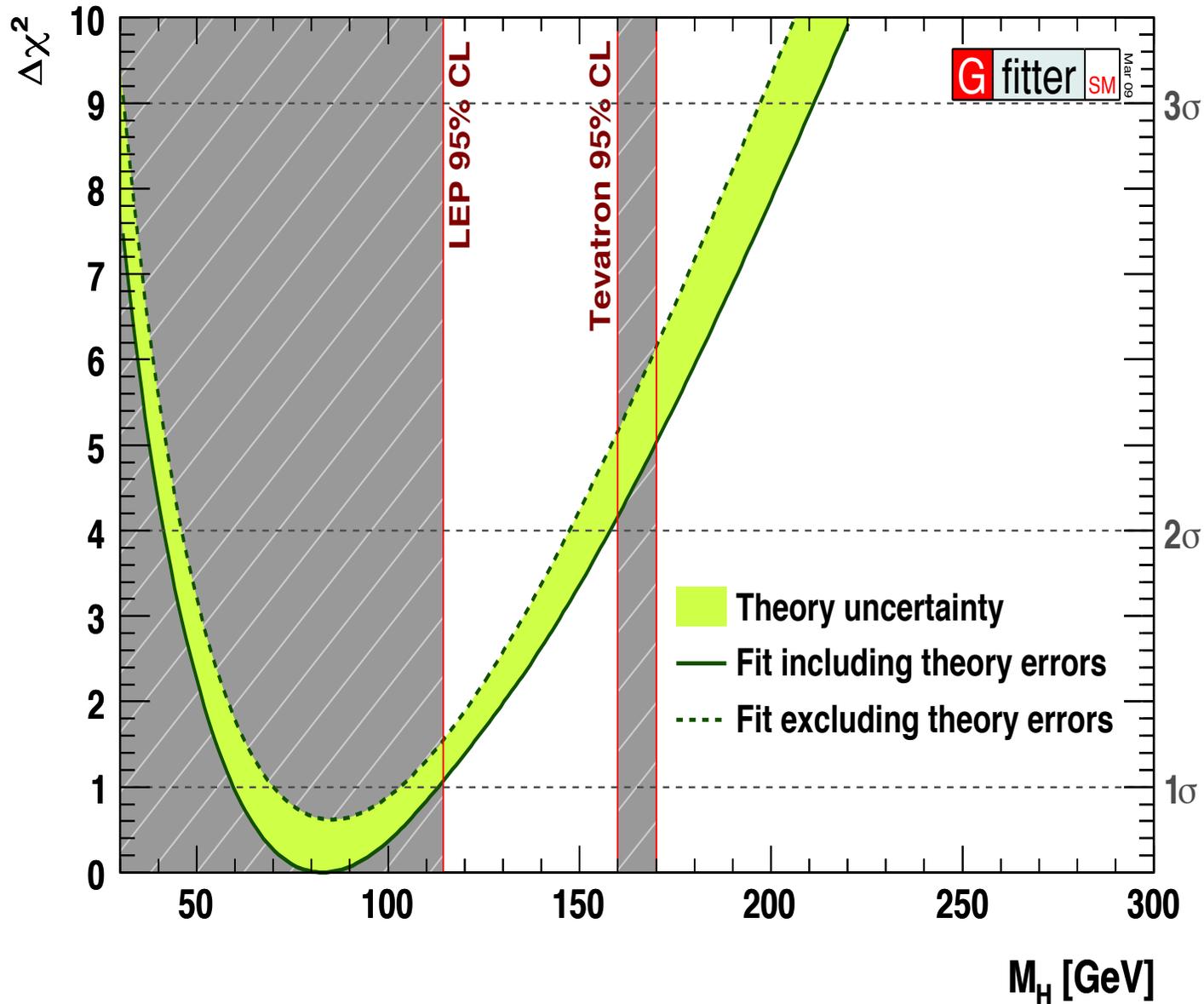
2012-2013 Higgstoric year



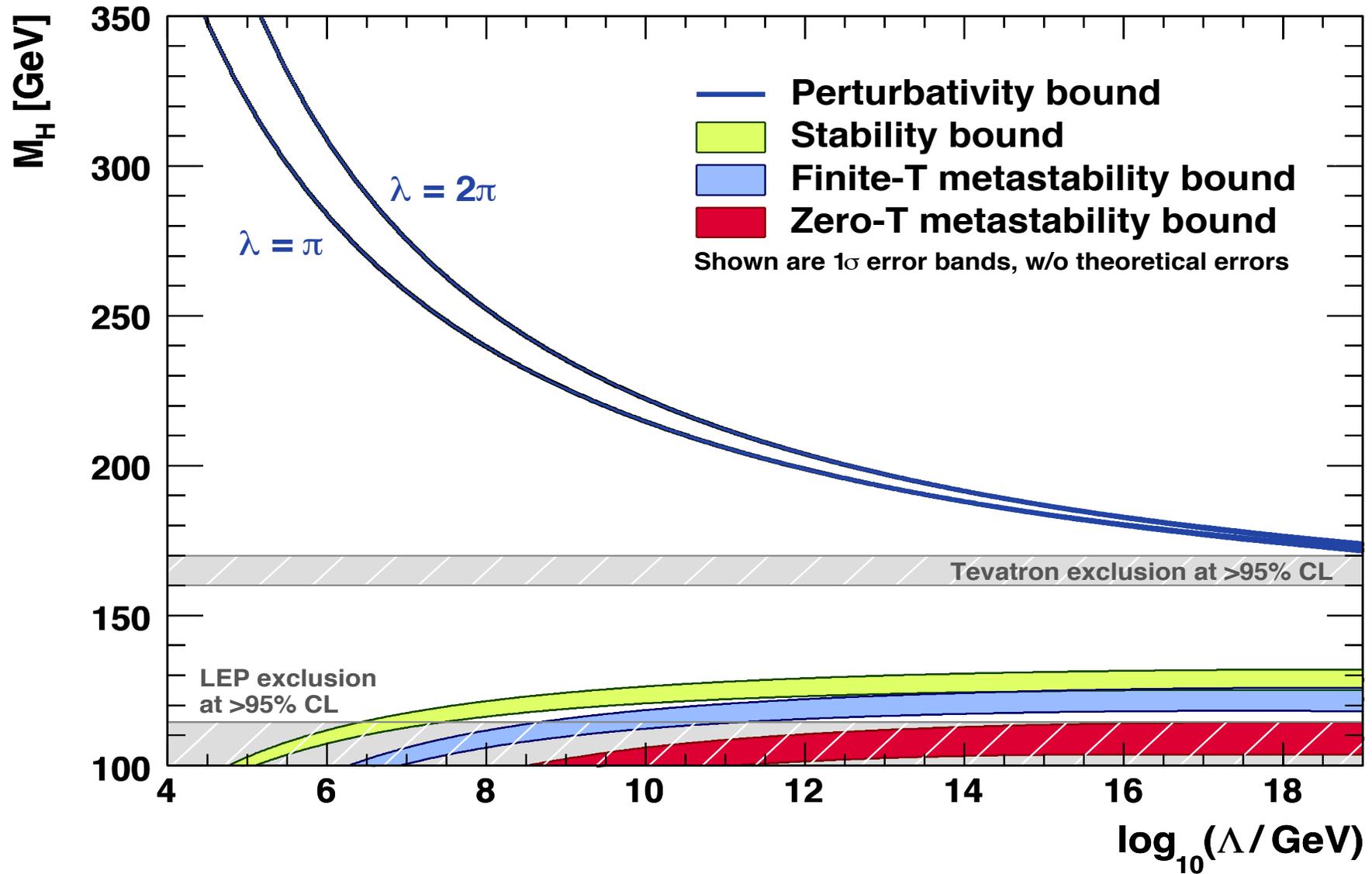
The Standard Model, what's missing?



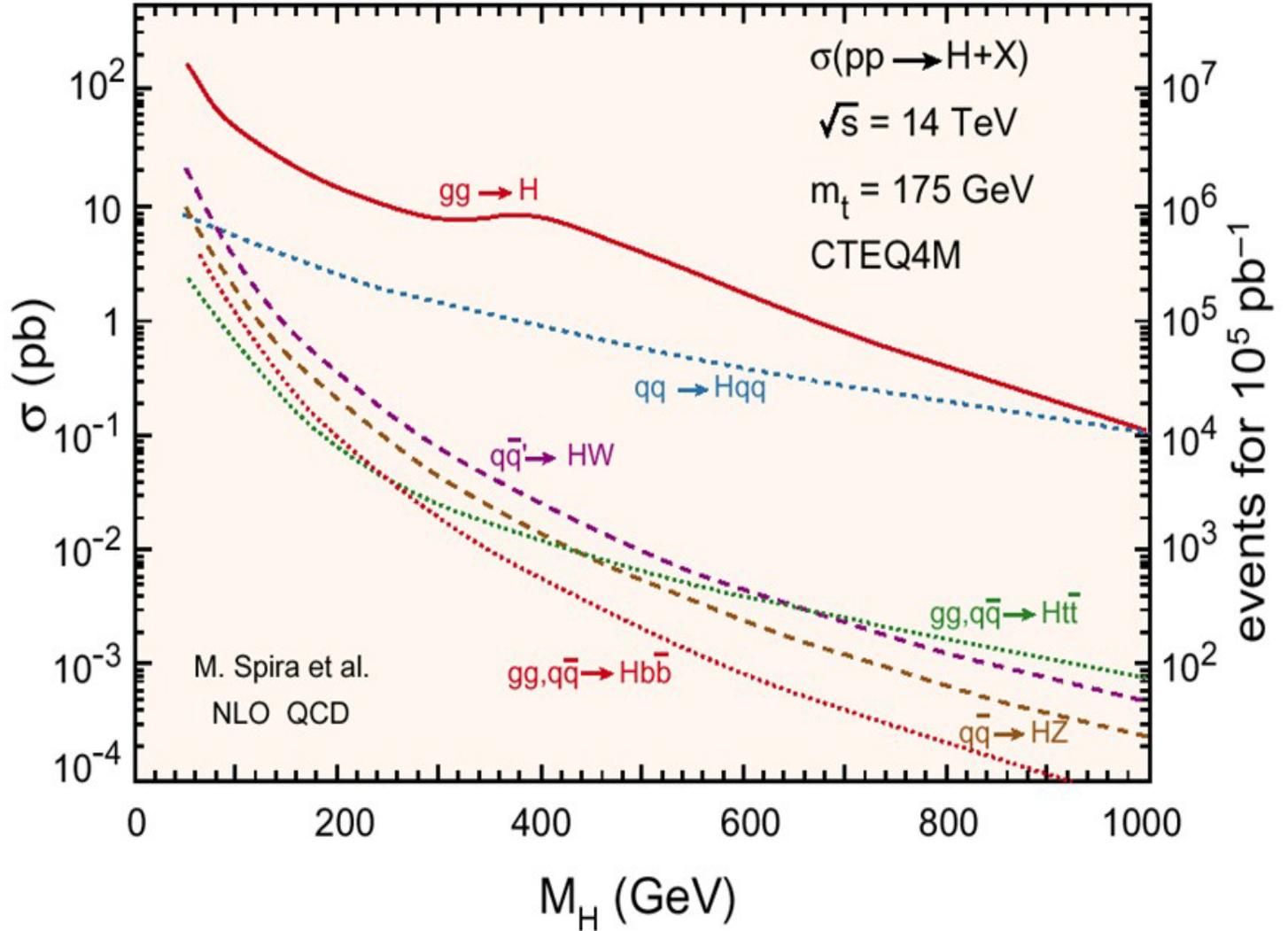
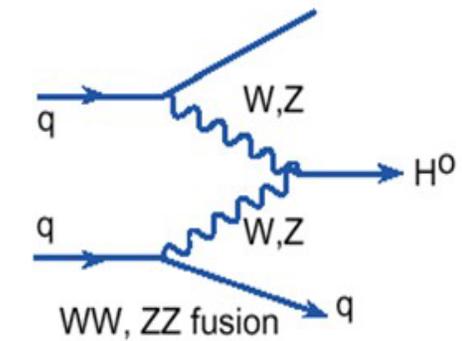
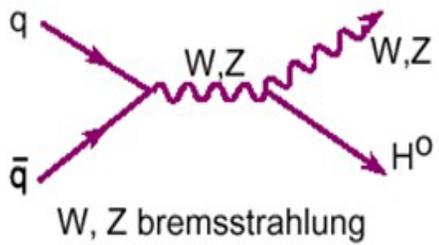
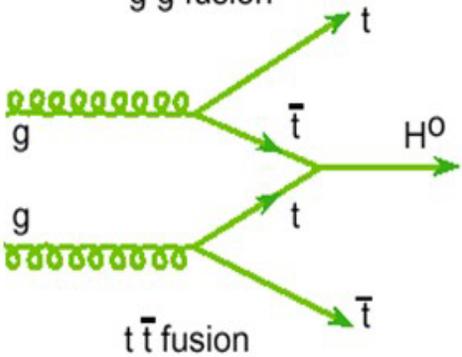
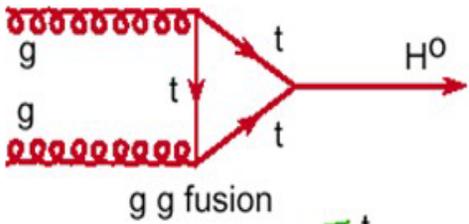
Indirect limit Blue band limit 2009



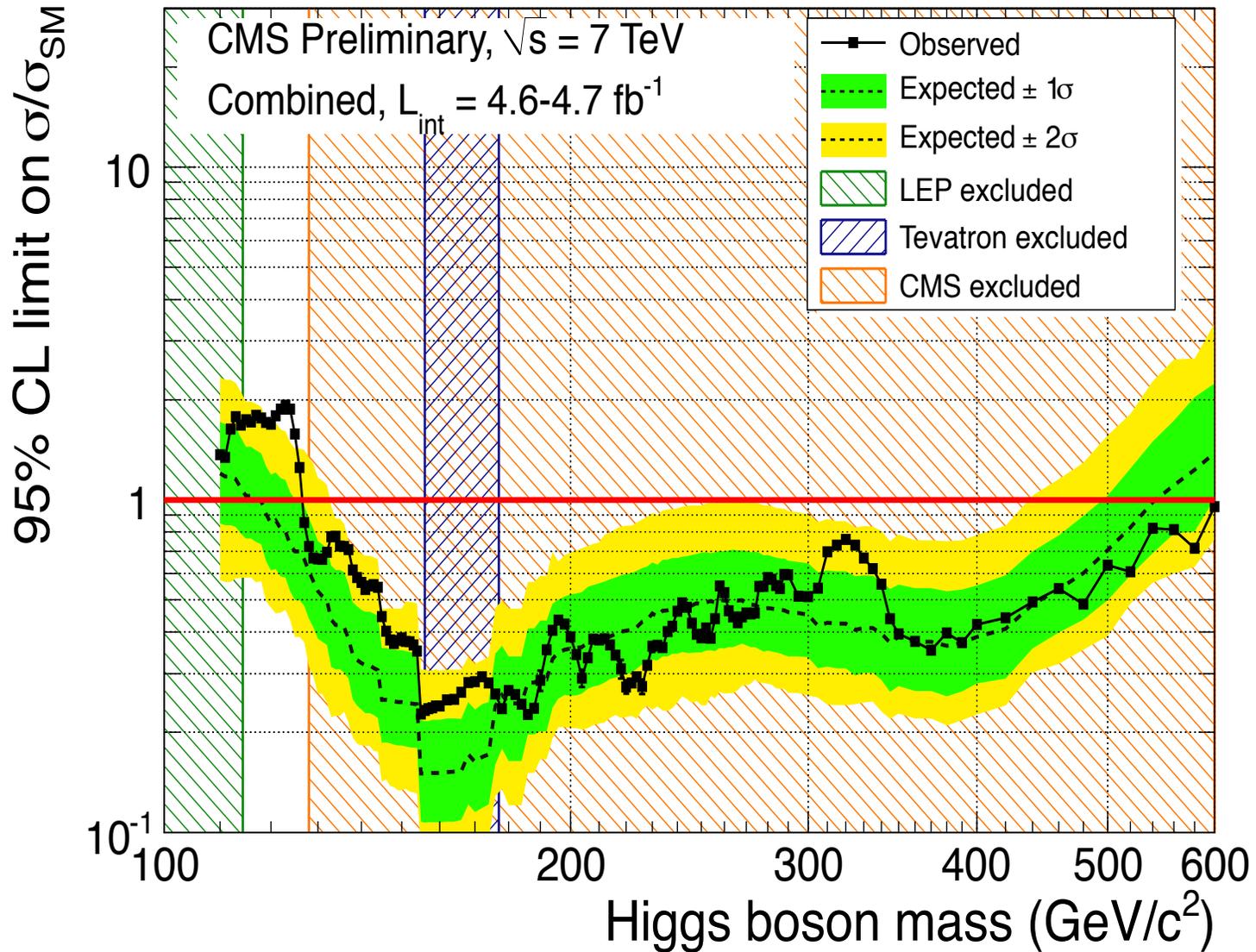
Higgs Bounds from Stability and Perturbativity



Project: How to reconstruct the different channels?

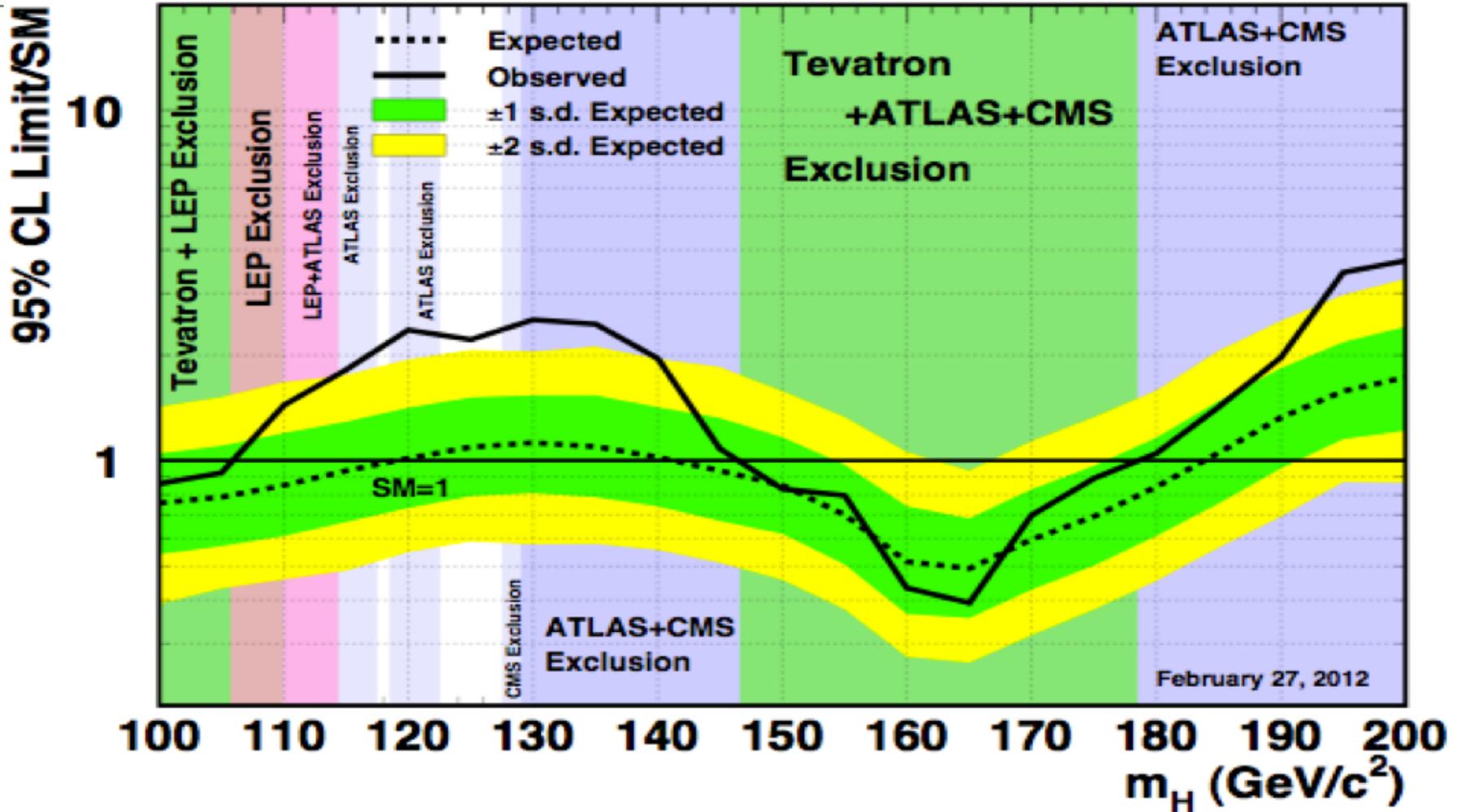


in CMS, exclusion



Tevatron Propaganda Plot: Look there effect

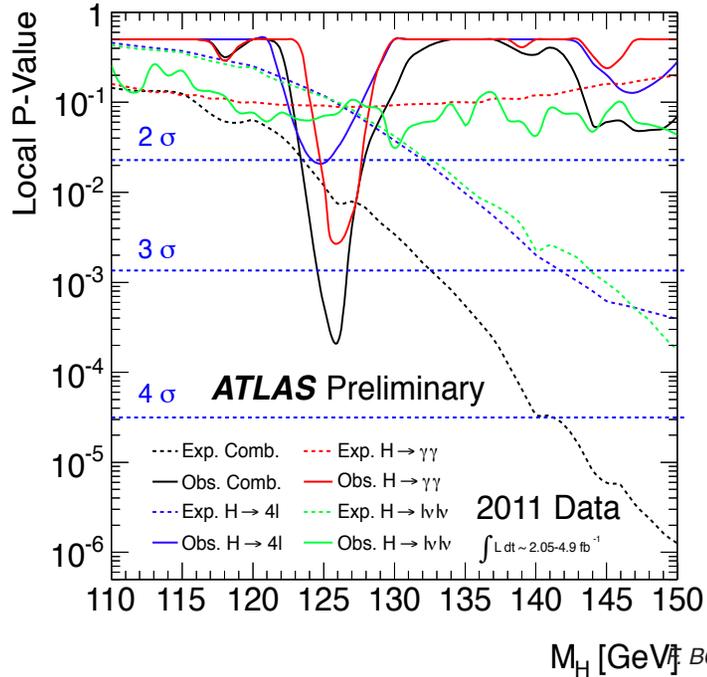
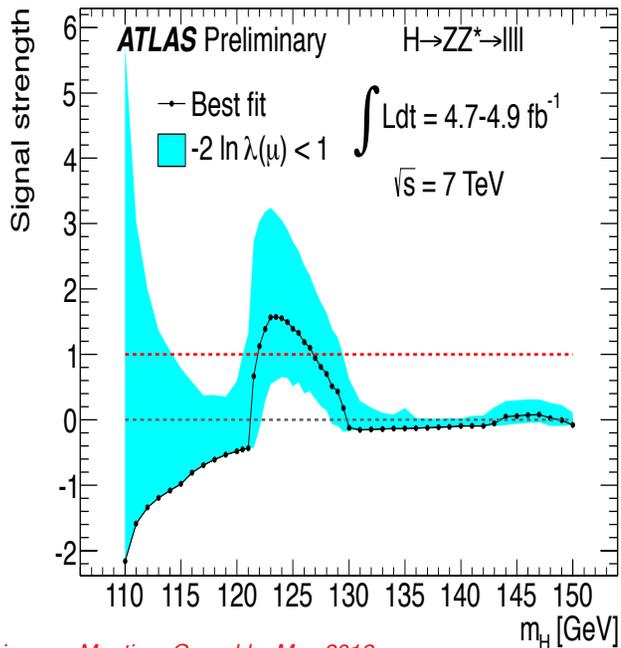
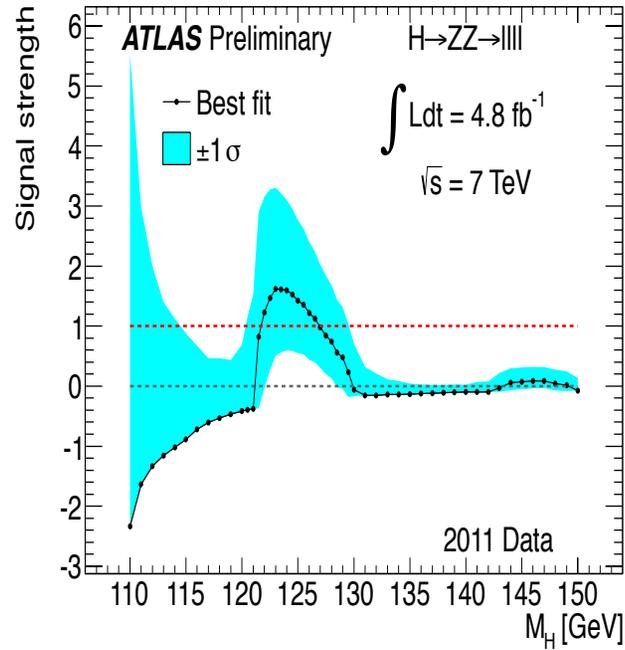
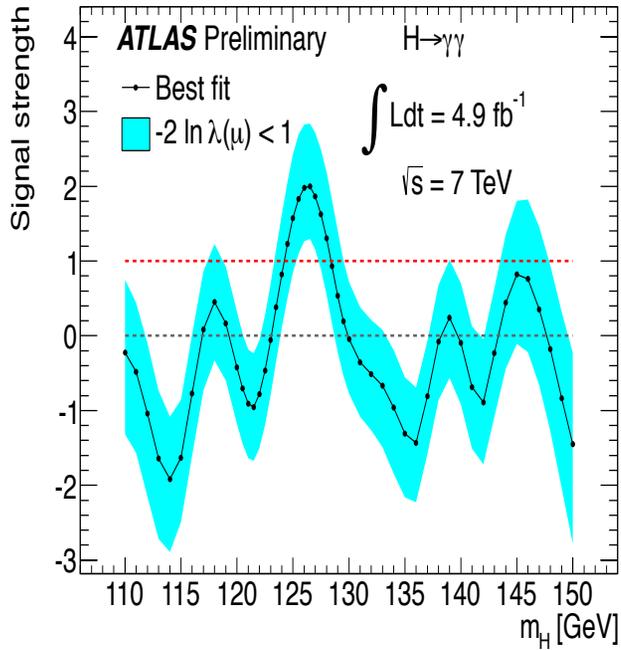
Tevatron Run II Preliminary, $L \leq 10.0 \text{ fb}^{-1}$

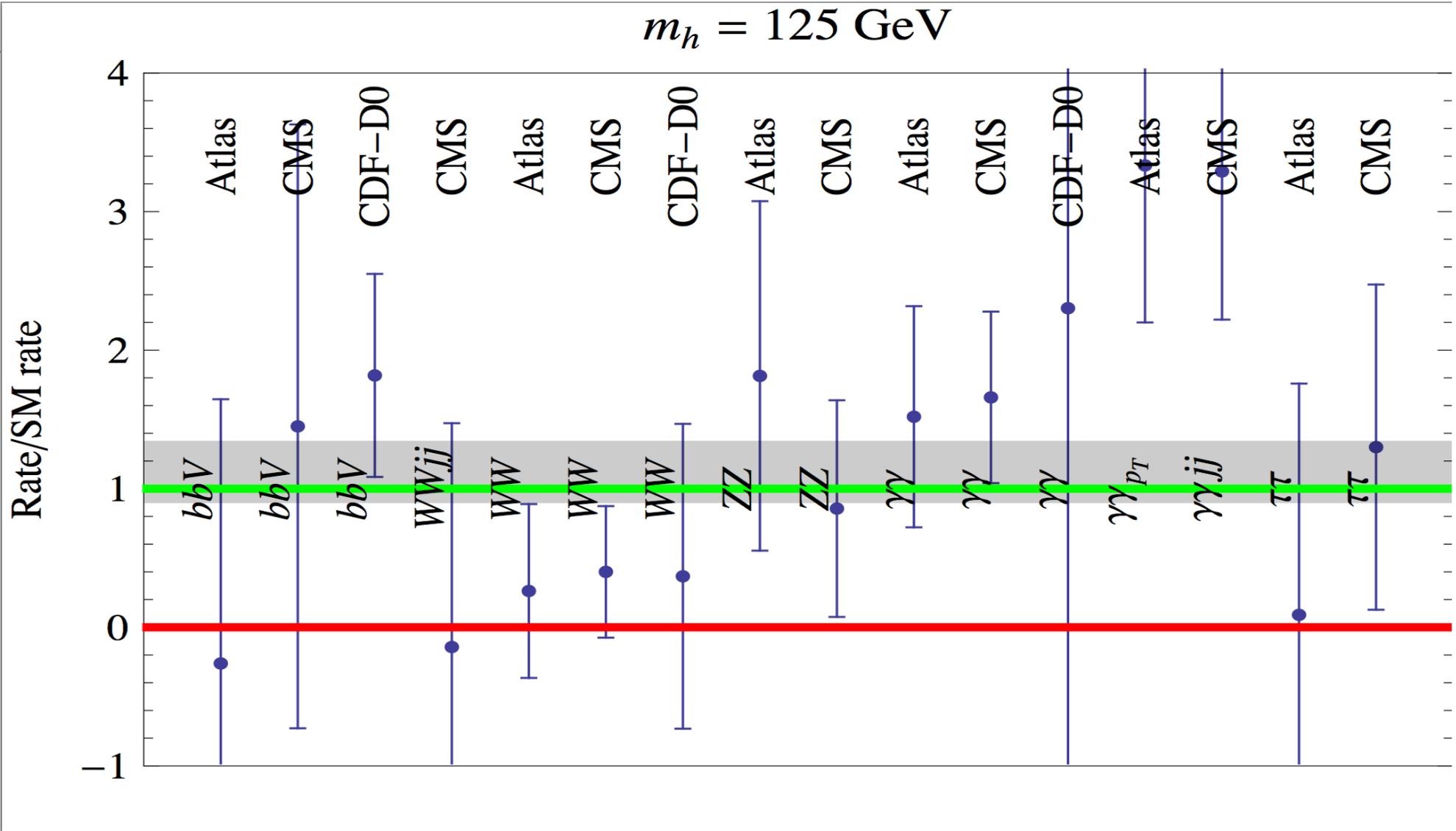


First glimpse?

Dec. 2011-Feb 2012
First evidence of a Higgs

Higgs 2011-2012





Model independent approach, efficiencies crucial. Need experimental help

ATLAS LAPP People are a great help. Some have shown interest. Not just for the supposed signal, but also on a long term strategy

Even if it turns out that such signals will fade, important information on Symmetry Breaking.

Data Analysis, Data Interpretation: A group clustered around Sabine K (LPSC), spurred also by Les Houches Meeting 2011 (LH Recomm.), CERN dedicated meetings (not just Higgs)

Example: BMSSM Higgs, Effective field theory approach

- MSSM limitations
 - fine-tuning problem
 - light Higgs constrained $m_h < 135 \text{ GeV}$
- Natural extensions : NMSSM, U(1)'MSSM,
- Effective Field Theory approach

$$M = 1.5 \text{ TeV}$$

$$K = K_{MSSM} + \frac{1}{M} K^{(1)} + \frac{1}{M^2} K^{(2)} + \dots$$

$$W = W_{MSSM} + \frac{1}{M} W^{(1)} + \frac{1}{M^2} W^{(2)} + \dots$$

F. Boudjema, GDLR arXiv:1203.3141

Brignole et al . arXiv:0301121

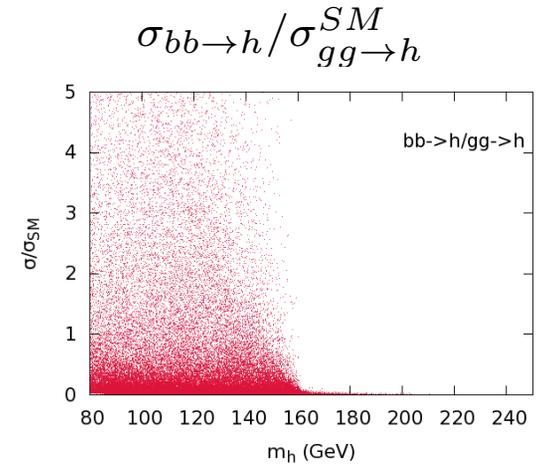
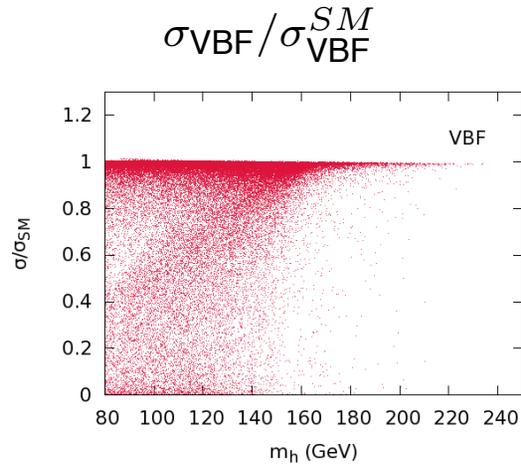
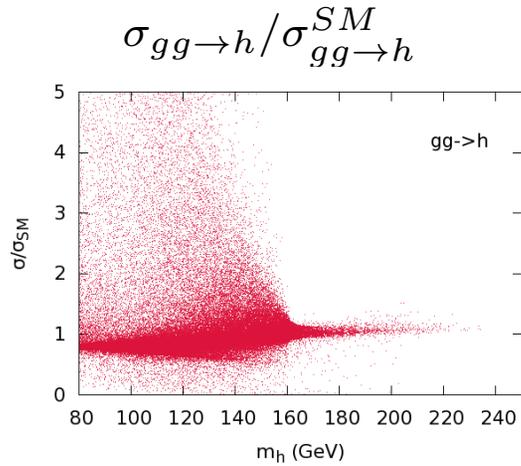
Antoniadis et al. arXiv:0910.1100

Carena et al. arXiv:0909.5434

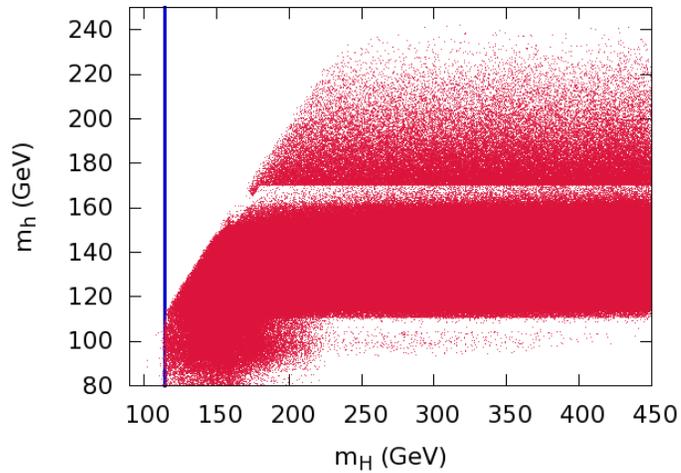
4 Higgses $h/H, A_0, H^+$

BMSSM Higgs Phenomenology, (G. Drieu La Rochelle, FB, 2011)

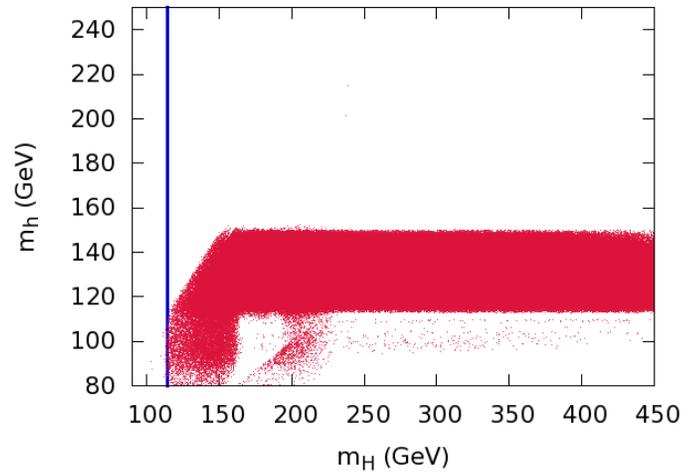
- Main effect : m_h goes up to 250 GeV.
- Couplings also affected



Pre-LHC



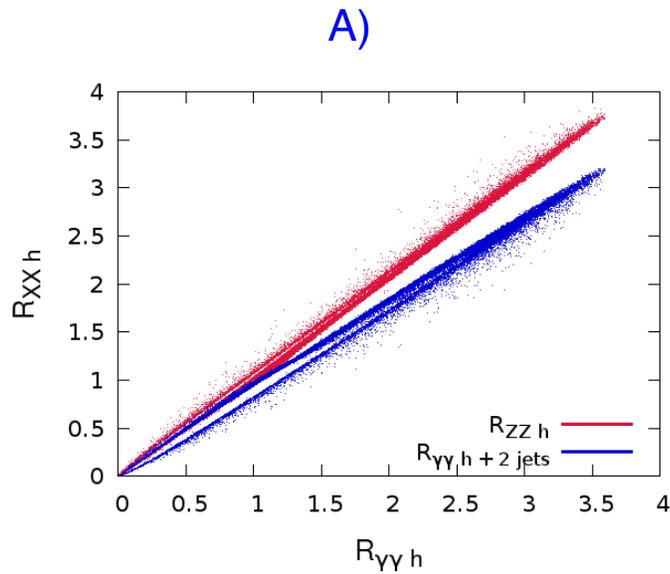
with LHC ($\mathcal{L} = 2.3\text{fb}^{-1}$)



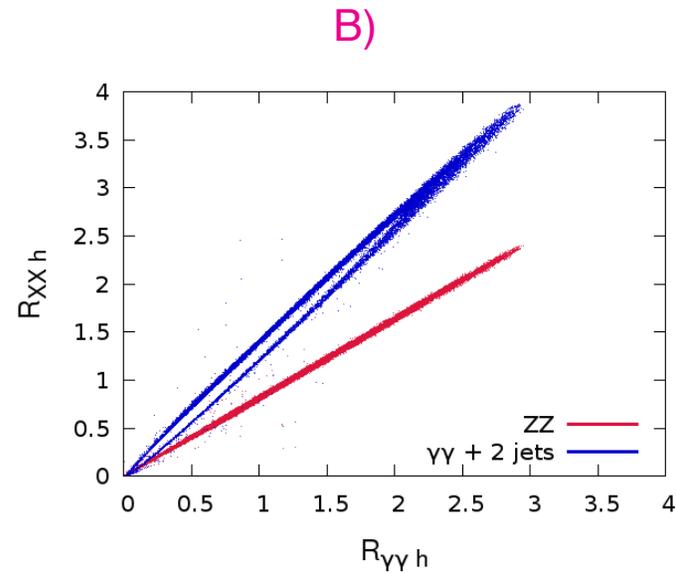
CC

Signal features : case of the light h (II)

- Correlations between $ZZ, \gamma\gamma$ (inclusive) and $\gamma\gamma + 2$ jets



$$m_{\tilde{t}_1} \simeq m_{\tilde{t}_2} \simeq 400 \text{ GeV}$$



$$m_{\tilde{t}_1} = 200 \text{ GeV}$$

$$m_{\tilde{t}_2} = 600 \text{ GeV}$$

- Blue : R_{ZZ} , Red : $R_{\gamma\gamma + 2 \text{ jets}}$.

BMSSM, Summary, An example of a multi prong collaboration

Summary: could be extended to other scenarios

- The BMSSM framework can accommodate $R_{\gamma\gamma + 2 \text{ jets}} > R_{\gamma\gamma} > R_{ZZ}$.
- Correlations among channels will be the most constraining information, since it cannot be too flexible.
- Signal of other Higgses are possible within the next run.
- Consistent with flavour physics and coherent dark matter candidate.

Outlook, an example

- Achieve a more precise use of LHC analyses on the SM Higgs.
- See to what extent this can be related to the direct searches for the stop particle.

ENIGMASS Task force is there: LAPTh, LAPP/ATLAS, LPSC/Th (ATLAS?)

Completely within what we had set ourselves to do in the project