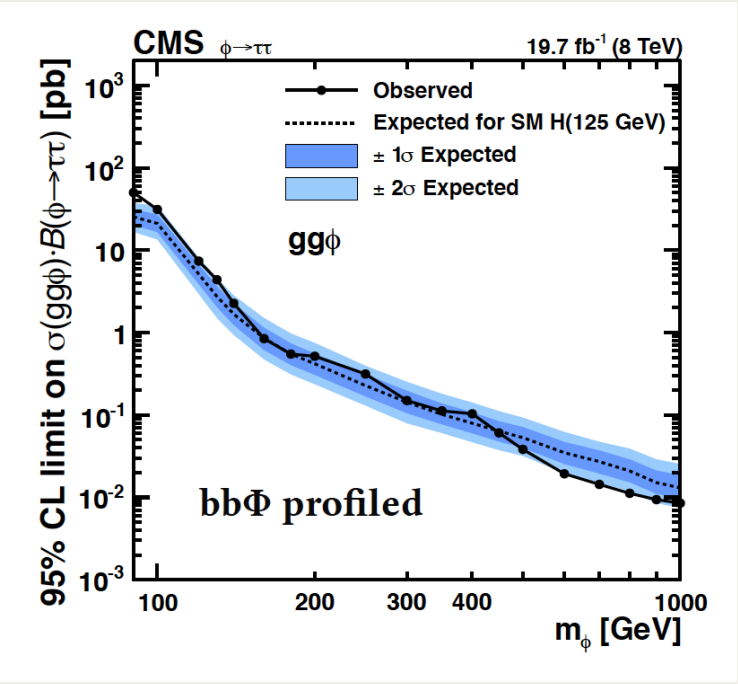
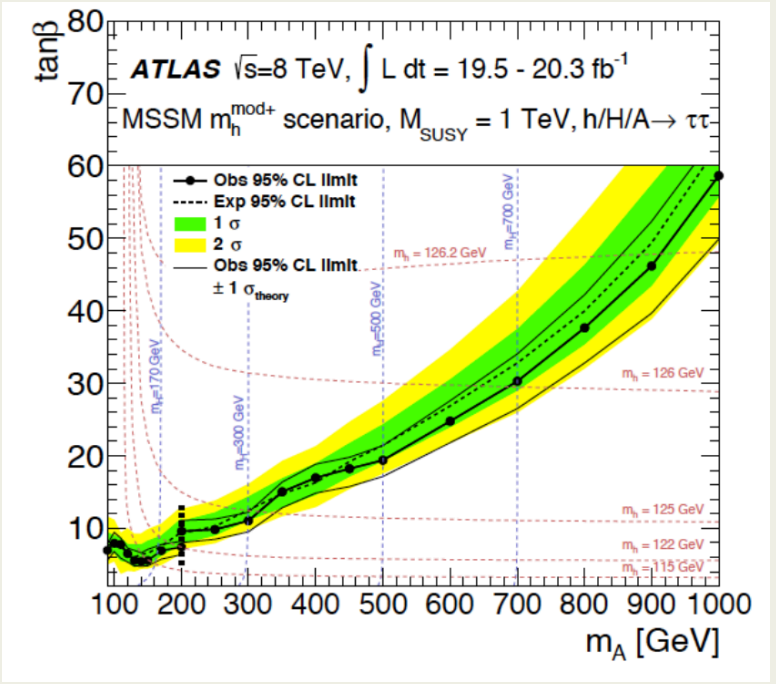
EXOTIC PRODUCTION AND EXTENDED HIGGS SECTORS

Discussion Session

HEAVY HIGGS BOSONS: A/H/h→ττ

- Results both model independent and MSSM benchmark scenarios
  - No hints of extended Higgs Sector yet
- Moving to 2015, and taking into account the picture that Run I provides
  - What's the theoretical wish list on this channel for 2015?
  - Any missing deliverables from the experiments?





ELECTROWEAK SCALE PHYSICS

Search for Electroweak Scale Physics in the Higgs Sector

- Higgs Rate Measurements
- Search for Additional States Directly in the Higgs Sector
- Searching for New Physics Produced in Association with Higgs
- Search for Additional States Related to the Higgs Sector
- Searching for New Physics Produced from Decay of Higgs
- Precision Higgs Measurements to Search for New Physics

When searching for new Higgs bosons, how to make sure we have a broad coverage?

Benchmarks vs Simplified models?

SUSY HIGGS SECTOR

- As always, most important and useful is model-independent limits on $\sigma \times \mathrm{BR}$.

Theorists LOVE model-independent limits.

How to properly define model-independent limits?

(Are there truly model-independent limits?)

ALIGNMENT VS DECOUPLING:

Alignment Limit:

h mass Eigenstate || Expectation Values

$\cos(\beta - \alpha) = 0$

h couplings = h_{SM} couplings

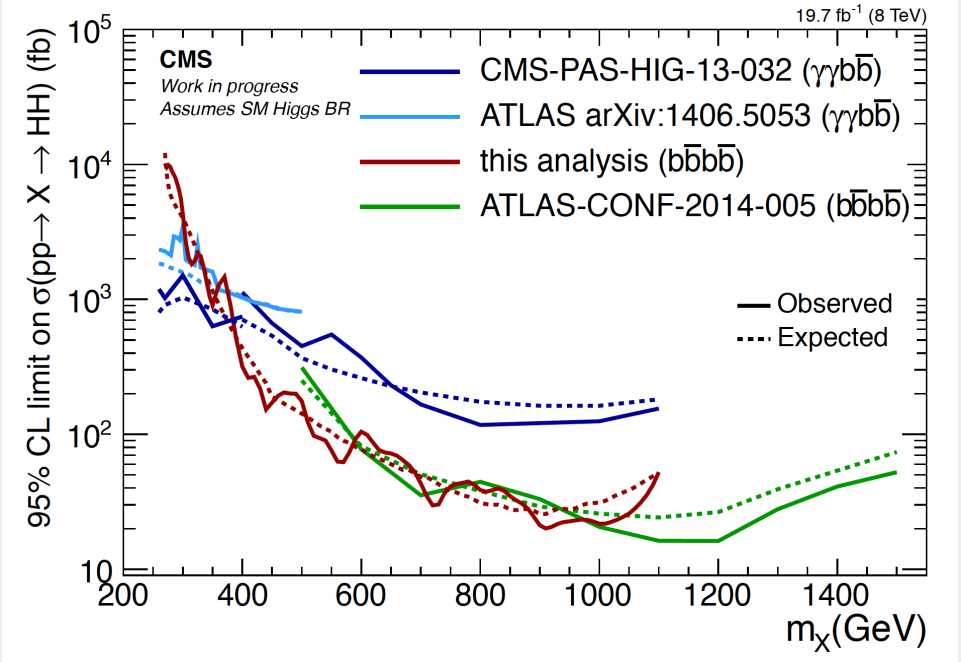
When will we know whether we are in decoupling or alignment regime? Will we know with confidence in Run II??

What happens to alignment when you go beyond 2HDM/MSSM?

For example, is there an alignment limit in the SU(2) triplet models?

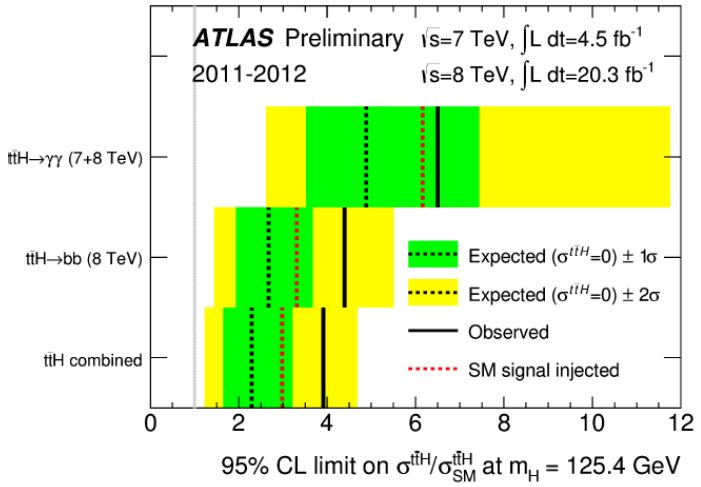
DI-HIGGS RESONANCE

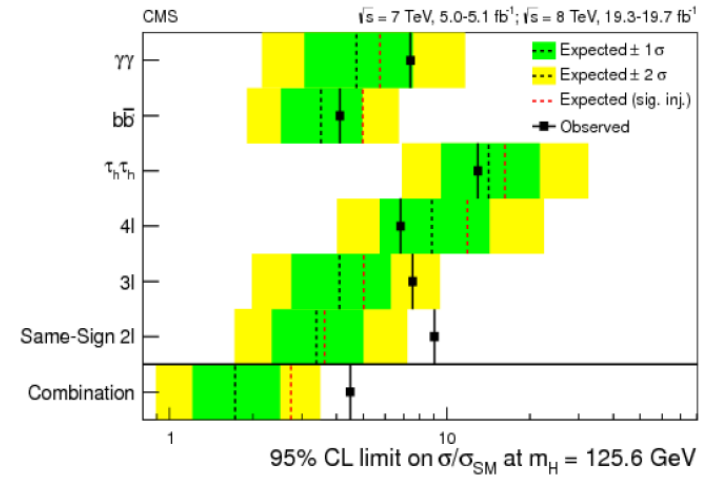
- Important channel that is well-motivated from the "alignment limit."
- Both scalar->hh and spin-2 -> hh are searched for
- Combination of CMS and ATLAS already a feature of many Run1 results
- **Propects for combination in the context of today results, for instance in hh searches?**



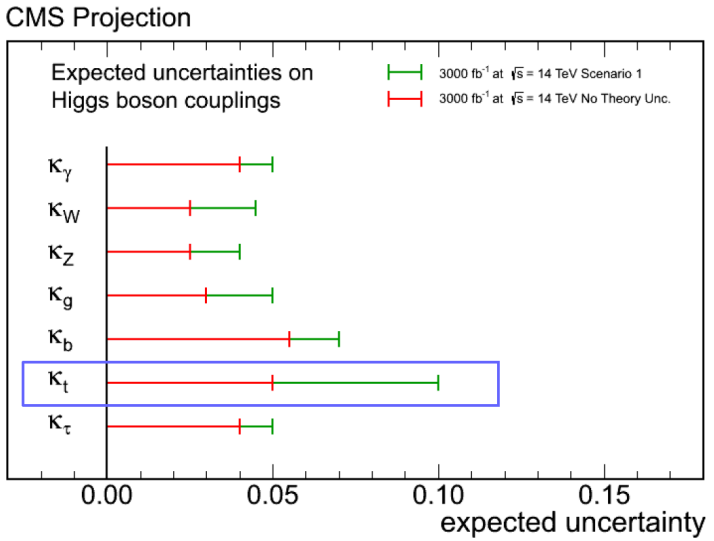
How much is limiting the narrow width approximation?
Is the vbf production mechanism worth to be investigated?

TTH / TH





- ttH and tH will be key in Run 2
- Yesterday's discussion focused on reducing the theoretical uncertainties
- **Turning the question: If the excess persists, what can we learn from it?**



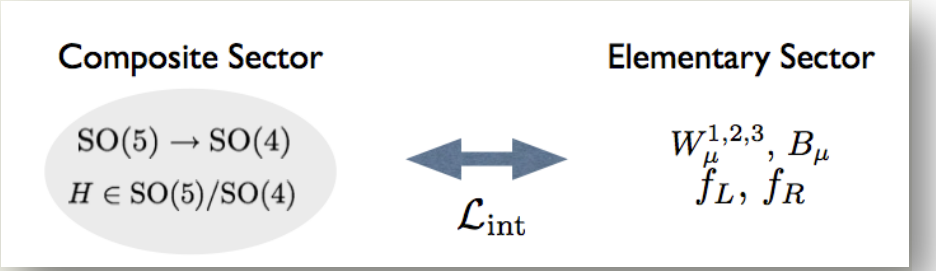
Generically, find $t\bar{t}H$ theory systematics dominate HL-LHC precision
Scale, PDF uncertainties on signal comparable

COMPOSITE HIGGS

From H.-C. Cheng

Composite Higgs from Top Condensation

From A. Wulzer:



Which "composite Higgs" model??

Is there a smoking-gun signal or litmus test at Run II (or beyond)?

RARE HADRONIC HIGGS DECAYS

- Higgs decays to heavy quarkonia and the Hcc, Hbb couplings
- Measuring the Higgs Yukawa matrix with decays to light mesons

Only accessible at HL-LHC and beyond ?

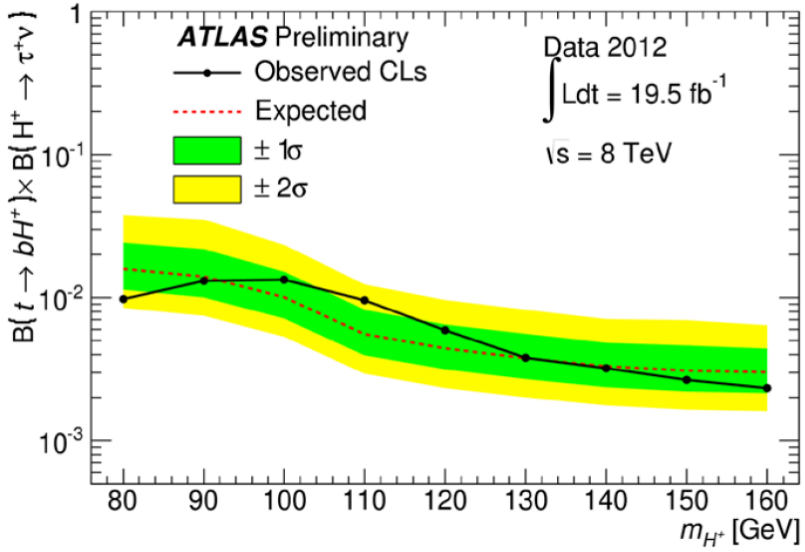
Would it be feasible/possible to design a special purpose detector to focus on the "soft stuff"?

(Could be used to search for exotic decays of h(125) too!)

CHARGED HIGGS

- Echoing the request in the ATLAS talk: lack of reliable computations to close the gap between 160 and 200 GeV

$m_{H^+} < m_t$



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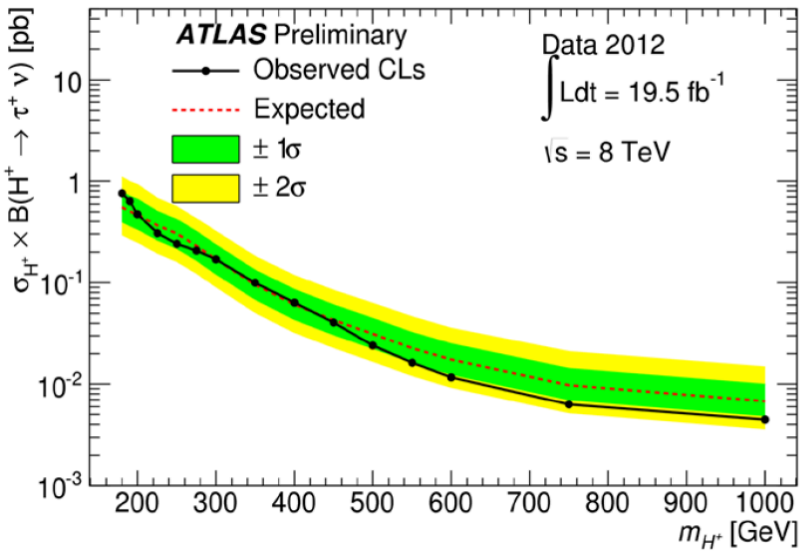

- In a more general way: what are the **prospects for new computations?**