MSSM Higgs search and implications from 126 GeV resonance: Introduction

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Overview

- This is a very short introduction trying to summarize the main issues on which the ATLAS Higgs community would like to get some more information
- Certainly we want to hear more about how a SM-Higgs-like resonance at 126 GeV affects the neutral and charged MSSM Higgs searches, but also about
  - Search interpretation
  - New search channels

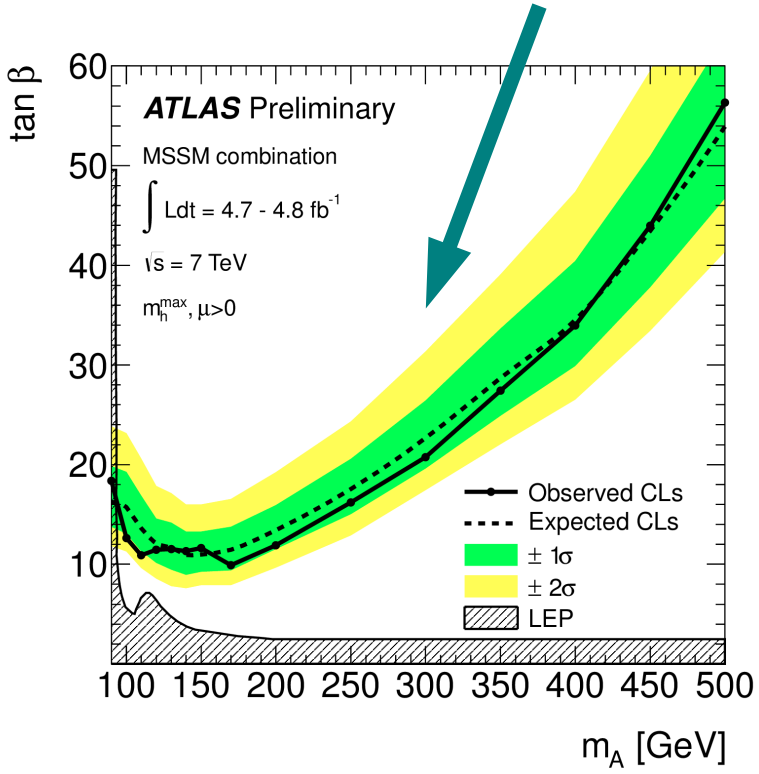
MSSM Higgs searches

- Interpretation of the search results

(1)

Are current benchmark scenarios adequate?
If not, **which are the new benchmarks that we have to use**?

So far all searches use ***mhmax, μ>0***



(2)

Do we need alternative ways to interpret our results?

e.g. mA limits for certain scenaria, tanβ limits?
Which variables should we scan should we want 2D scans assuming mh or mH ~ 126 GeV?

(3)

What is the status of the MSSM Higgs in the theory community after the 126 GeV discovery

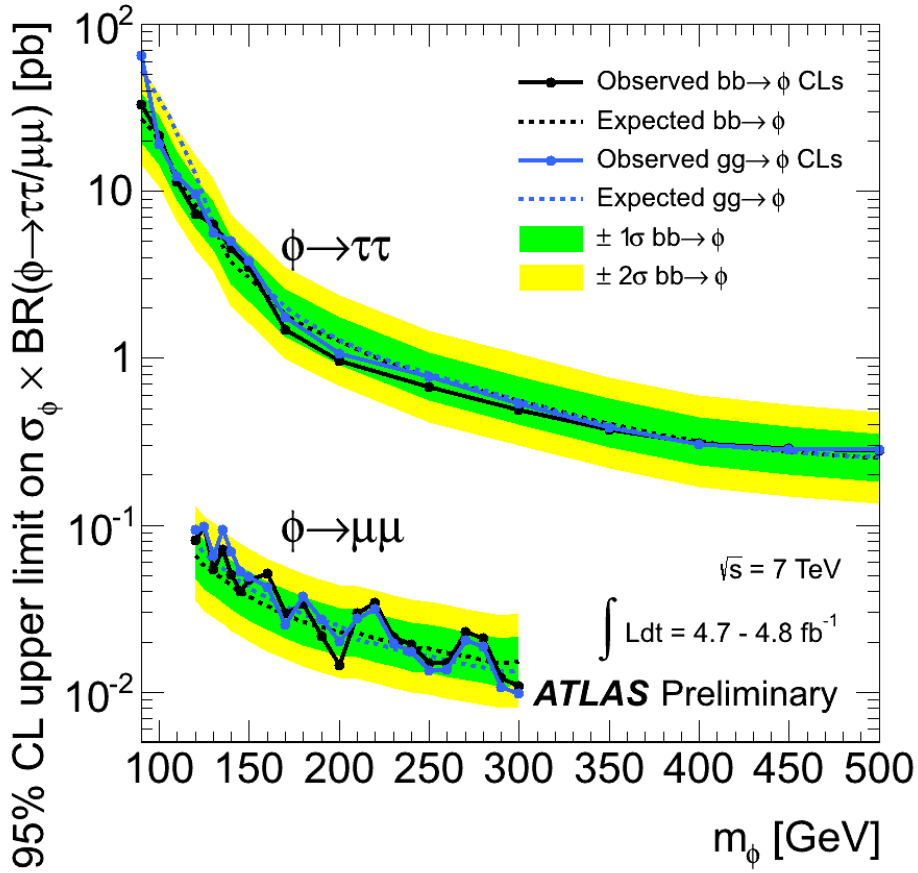
MSSM Higgs searches

- Cross-section limits **(4)**

How useful they are?

How meaningful is their calculation?

Separate the two production mechanisms and treating them as independent of each other. Use samples produced at a certain scenario and a certain tanβ

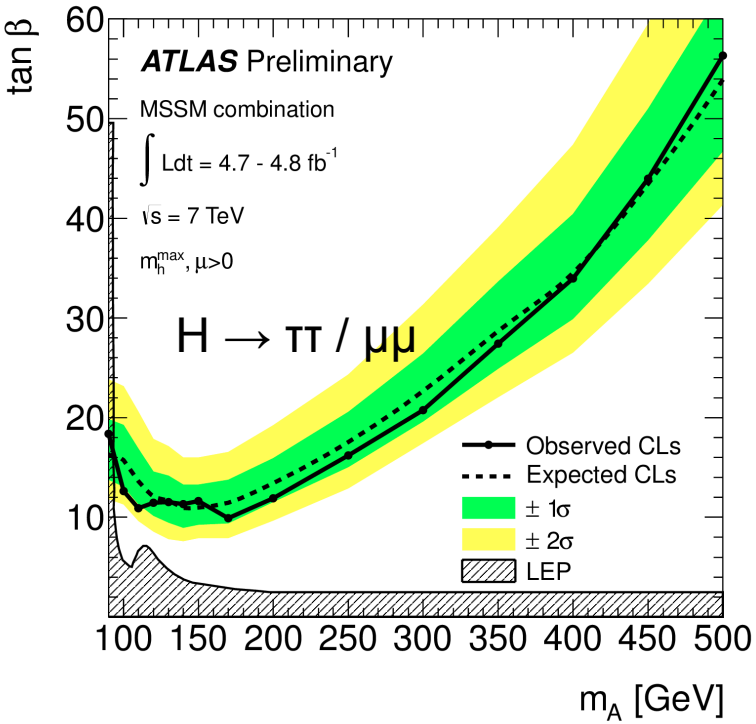


MSSM Higgs searches

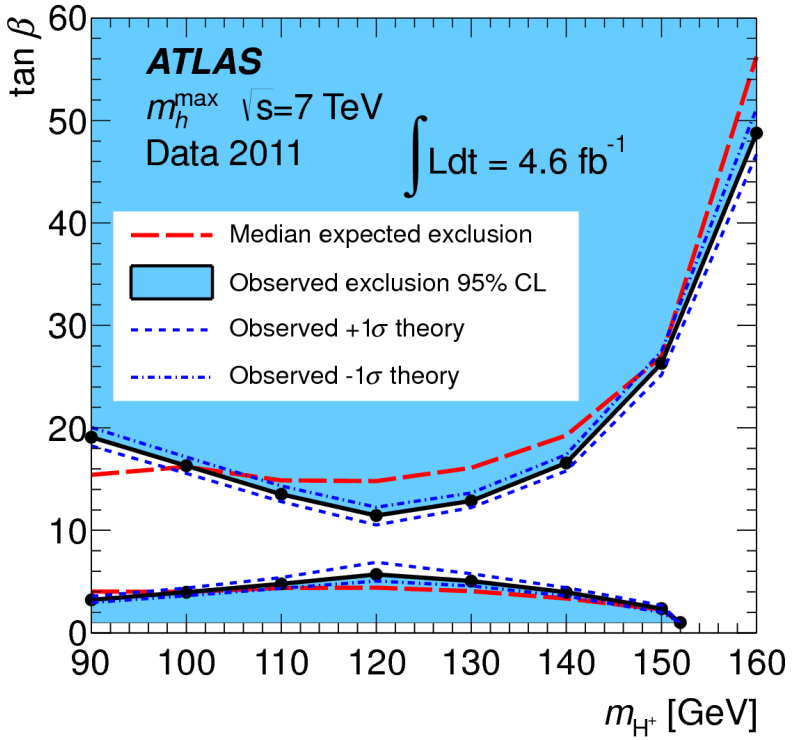
- Theory uncertainties **(5)**

How to use them? Currently two trends:

Use them in the limits as all the rest of the systematic uncertainties



Display the effect on the limit if the theoretical prediction is shifted by ±1 σ

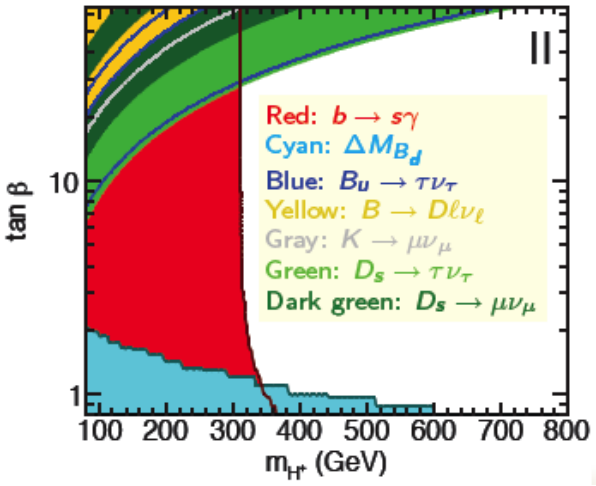


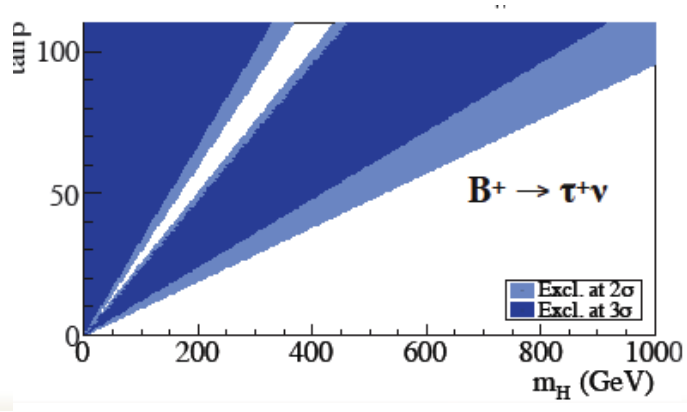
Other Topics

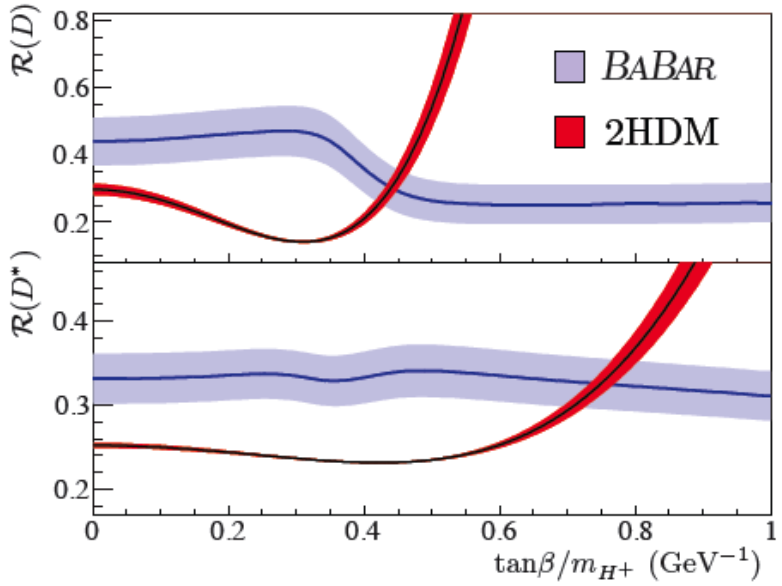
- NMSSM **(6)**
  - Further possible channels in the NMSSM Higgs searches?
  - Current NMSSM-inspired searches:
    $a_1 \rightarrow \mu\mu$; $h \rightarrow a_1\, a_1 \rightarrow \gamma\gamma + \gamma\gamma$; $h \rightarrow a_1 W$, $a_1 \rightarrow \mu\mu$
- Other channels
  - Higgs in cascades? **(7)**
  - $H \rightarrow \gamma\gamma$ at the mass range beyond the SM search?
    Higgs to top pairs? **(8)**

Other Topics

- There is a large variety of flavour physics results relevant to BSM Higgs searches
- Should they affect our searches and how? Or they are too much dependent on the the higher-order corrections to be of any use?







Most Recent (N)MSSM Higgs ATLAS Results

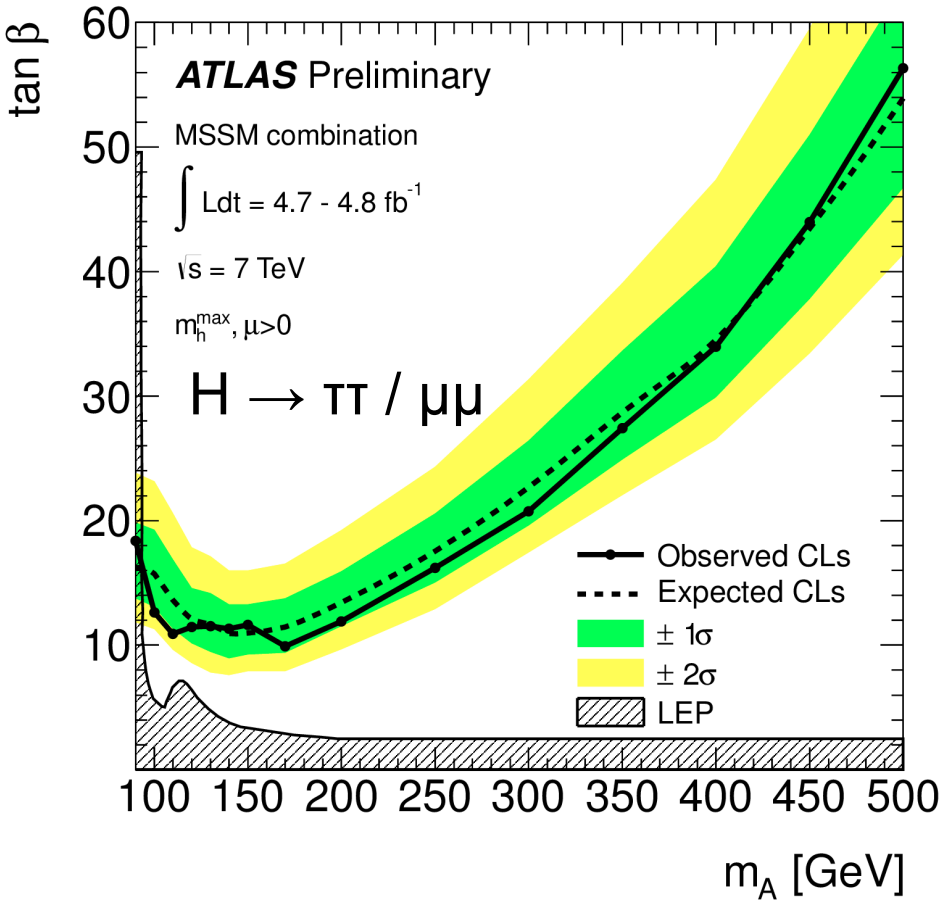
All plots that have been shown so far and all ATLAS searches mentioned can be found in the following:

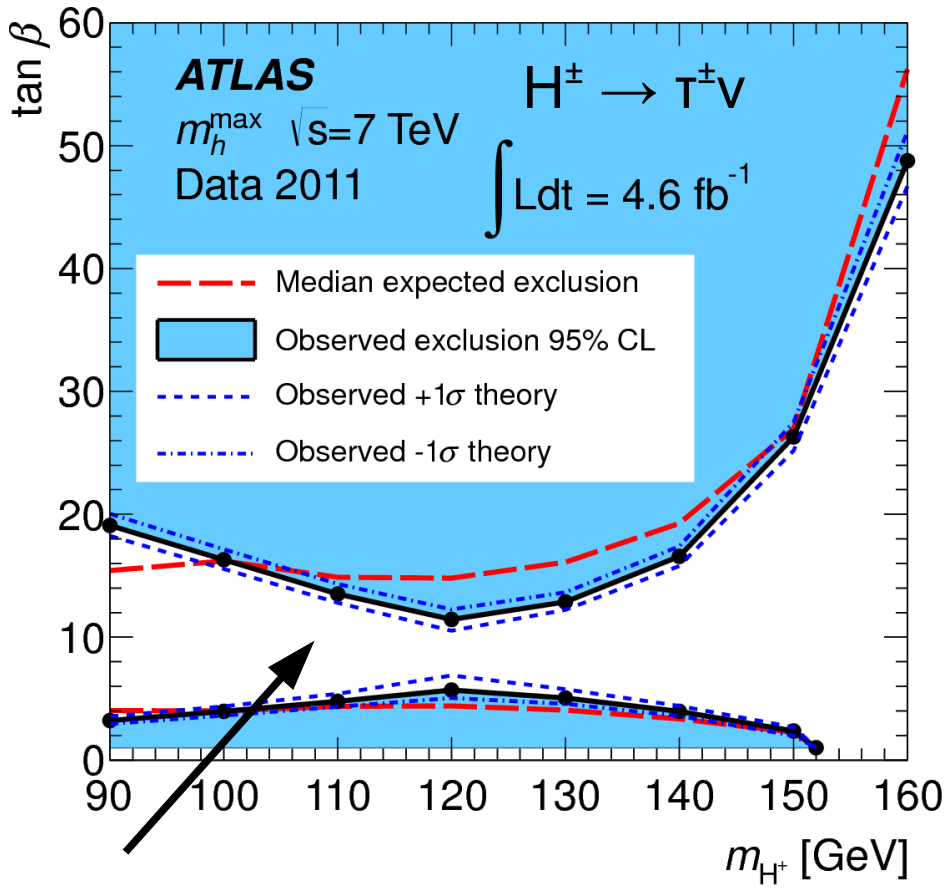
Channel	Lumi	Reference
MSSM $H \to \tau\tau$ / $\mu\mu$	4.7–4.8 fb^{-1} (7 TeV)	ATLAS-CONF-2012-094
MSSM $H^+ \to \tau^+\nu$	4.7 fb^{-1} (7 TeV)	JHEP 1206 (2012) 039
MSSM $H^+ \to cs$	0.035 fb^{-1} (7 TeV)	ATLAS-CONF-2011-094
Light scalar Higgs: $a1 \to \mu\mu$	0.039 fb^{-1} (7 TeV)	ATLAS-CONF-2011-020
$H \to a_1 a_1 \to \gamma\gamma + \gamma\gamma$	4.9 fb^{-1} (7 TeV)	ATLAS-CONF-2012-079
Planned searches: $H^+ \to tb$, $H^+ \to a_1 W$, $H^+ \to WZ$		

Click on the report number to see the plots and the public document

Current Status & Future Prospects

Reminder of current situation



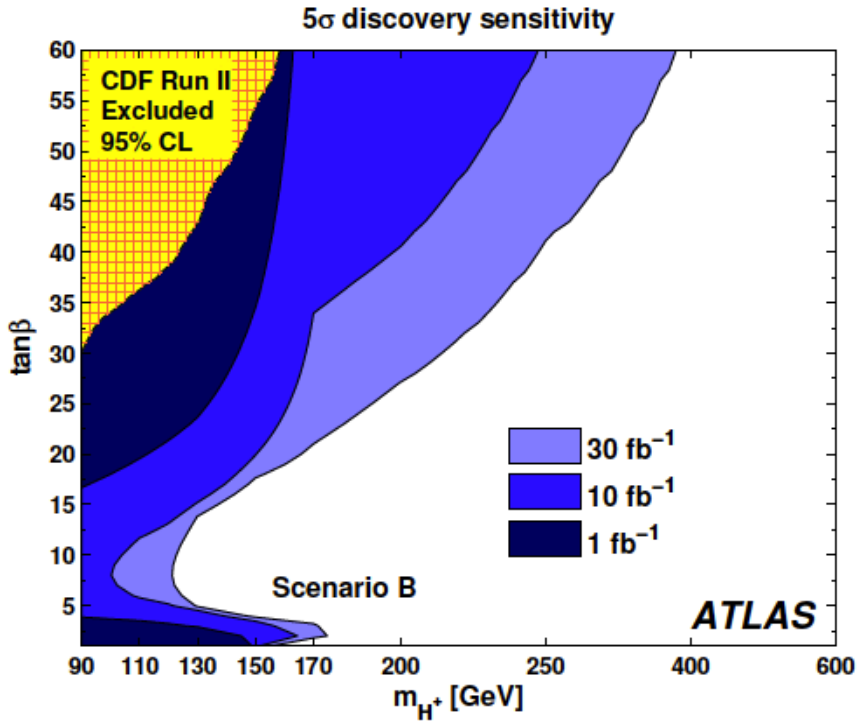


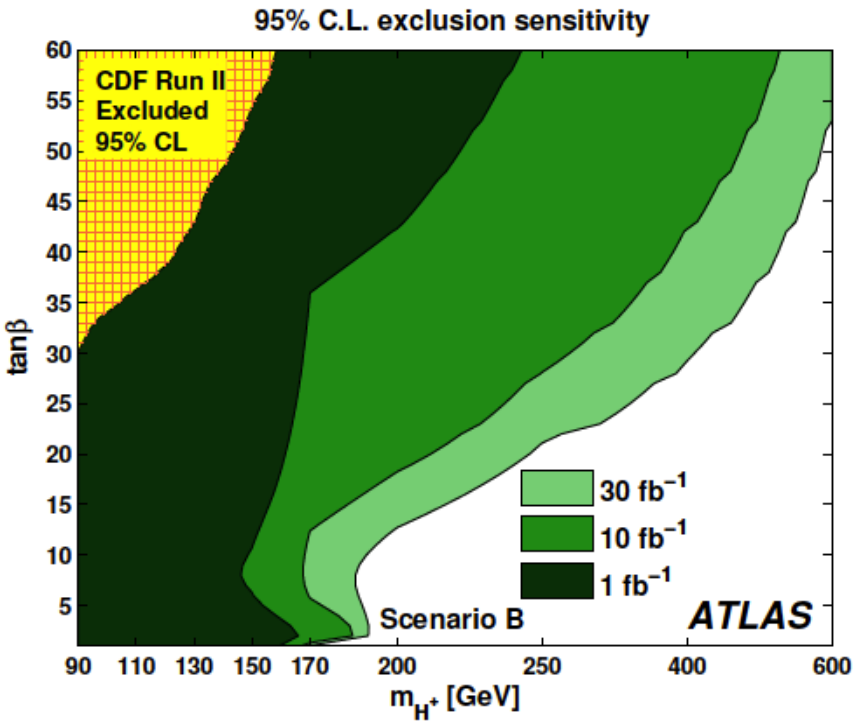
The gap will close completely soon!

Similar results from CMS

Current Status & Future Prospects

Prospects for Charged Higgs Searches

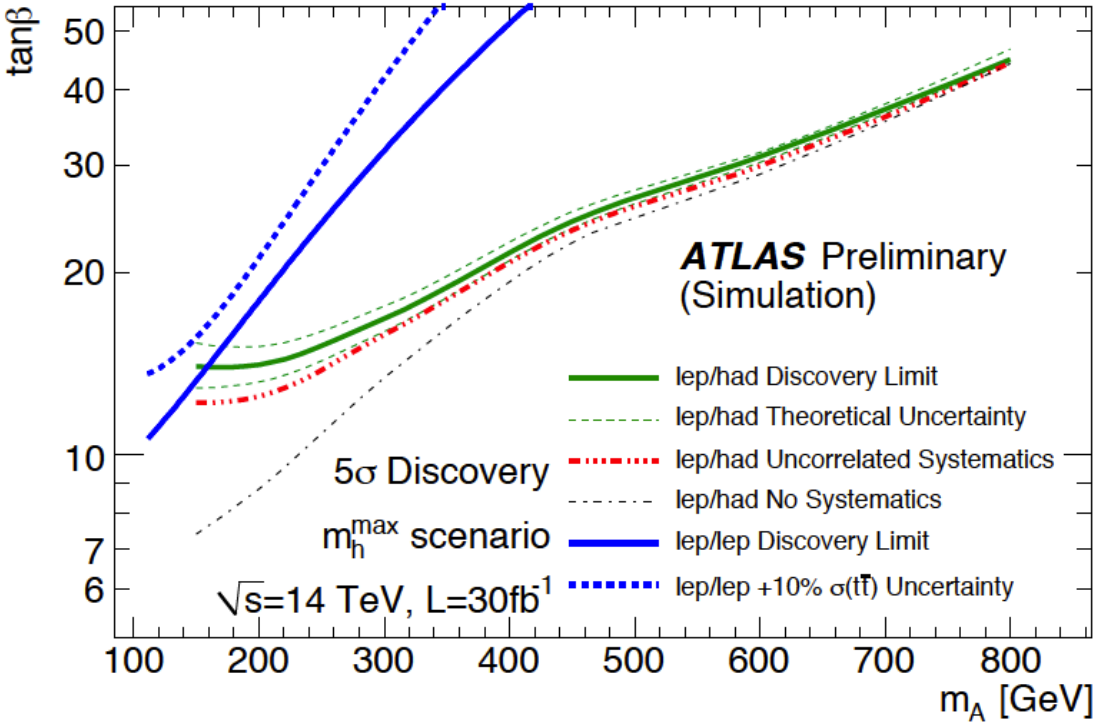


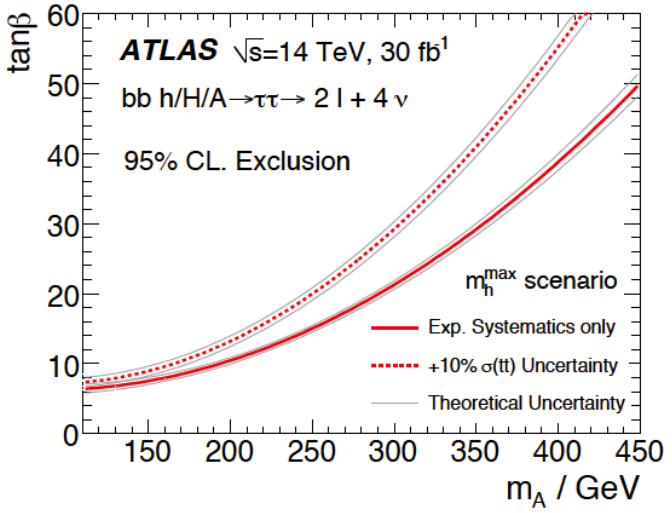


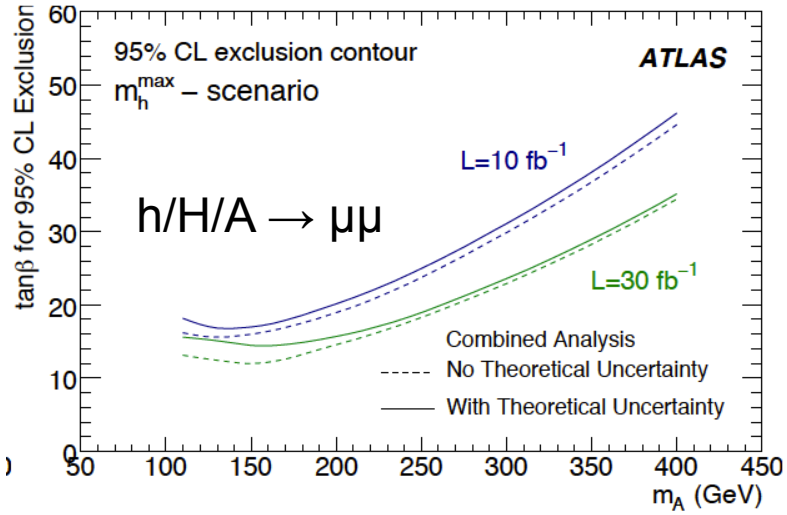
CSC Note, mh-max scenario, $\sqrt{s}$ = 14 TeV

Current Status & Future Prospects

Prospects for Neutral Higgs Searches







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