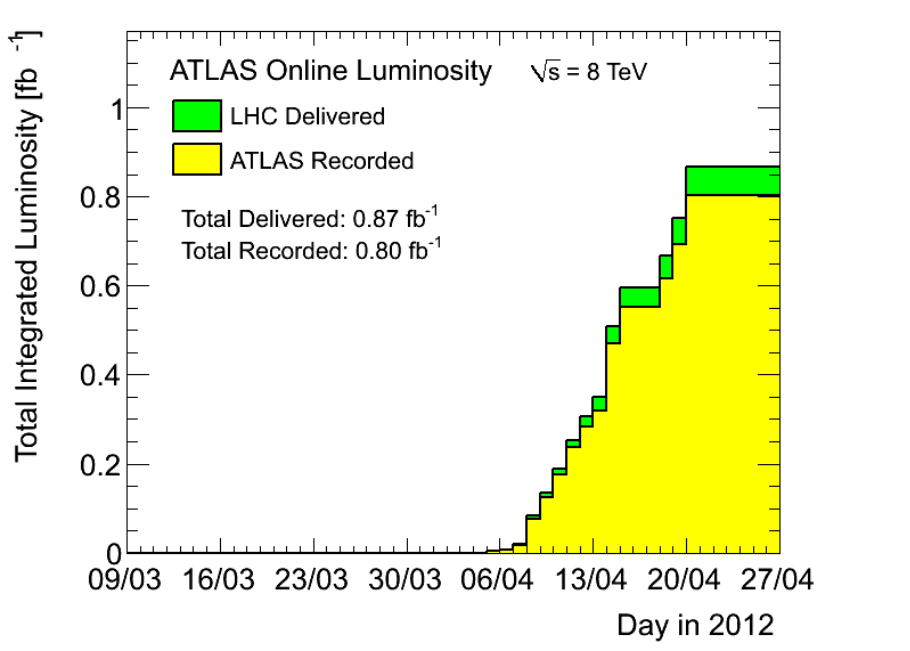
Introduction

Ricardo Gonçalo (RHUL)

Higgs Weekly Meeting – 19 April 2012

News! News! News!

- LHC: technical stop
  - Peak <evts>/bunch crossing 20 – 25
  - Peak stable lumi $5.12 \times 10^{33} cm^{-2} s^{-1}$
  - Lumi with stable beams $0.80 fb^{-1}$
  - ≈ $0.15 fb^{-1}$ collected since last week



News! News! News!

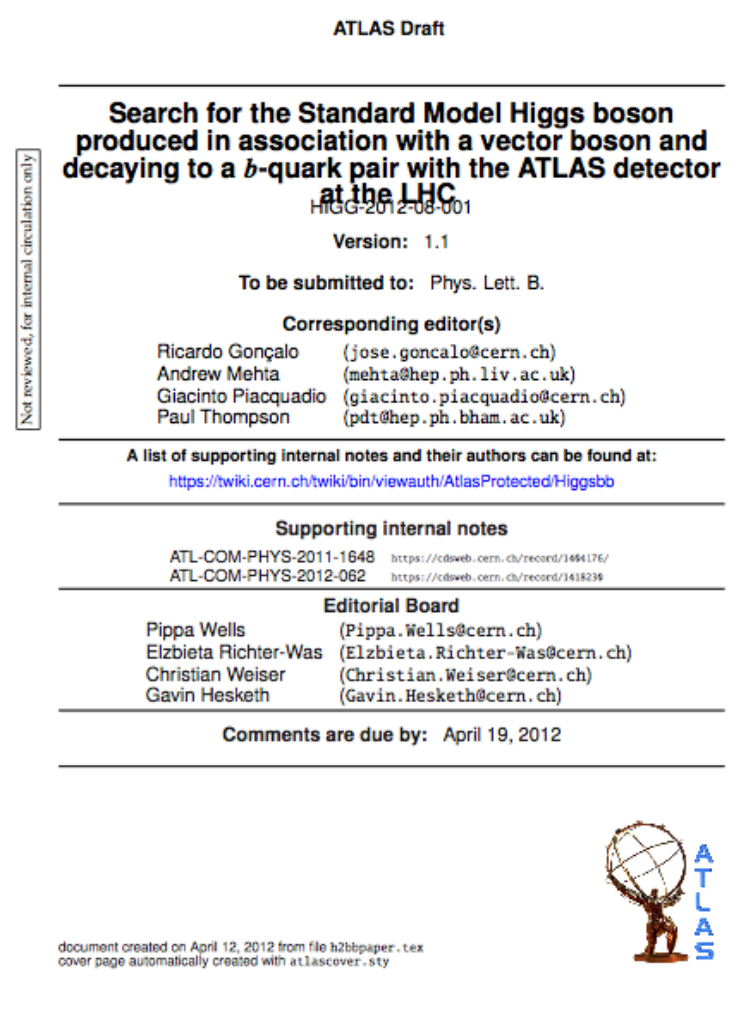
- H->bb analysis approved by to go for second circulation
- https://cdsweb.cern.ch/record/1440266

- Current version in CDS for last updates and reading by EB
- https://cdsweb.cern.ch/record/1439564?ln=en

- Should be circulated soon (next few days)

- **Congratulations everyone! ☺**

- What next:
  - Second circulation
  - 1 week of comments by collaboration and management
  - Second reading
  - Send to journal
  - More comments…
  - Publication!



ATLAS Draft

Not reviewed, for internal circulation only

Search for the Standard Model Higgs boson produced in association with a vector boson and decaying to a b-quark pair with the ATLAS detector at the LHC

HIGG-2012-08-001

Version: 1.1

To be submitted to: Phys. Lett. B.

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A list of supporting internal notes and their authors can be found at:

https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/Higgsbb

Supporting internal notes

ATL-COM-PHYS-2011-1648 https://cdsweb.cern.ch/record/1404176/
ATL-COM-PHYS-2012-062 https://cdsweb.cern.ch/record/1418239

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Comments are due by: April 19, 2012

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Internal note with 2012 plans - I

- After discussing with Sandra and Eilam:
  - Cannot make fully detailed note
  - We don't have enough information to predict 2012 changes
  - Argument was taken into account
  - Should still make "declaration of intentions" for 2012 analyses
  - Useful to prepare roadmap but no legal bound to detailed cuts (impossible)
  - To be ready for 10th May

- Content:
  - WH/ZH
  - Boosted VH
  - ttH
  - MWT? VBF? MSSM bH?

- I will prepare note and send questions/ sections to each analysis group
- ATL-COM-PHYS-2012-416

Draft version 1.0

ATLAS NOTE

ATLAS-COM-PHYS-2012-416

April 19, 2012

Plans for $H \to b\bar{b}$ searches in ATLAS in 2012

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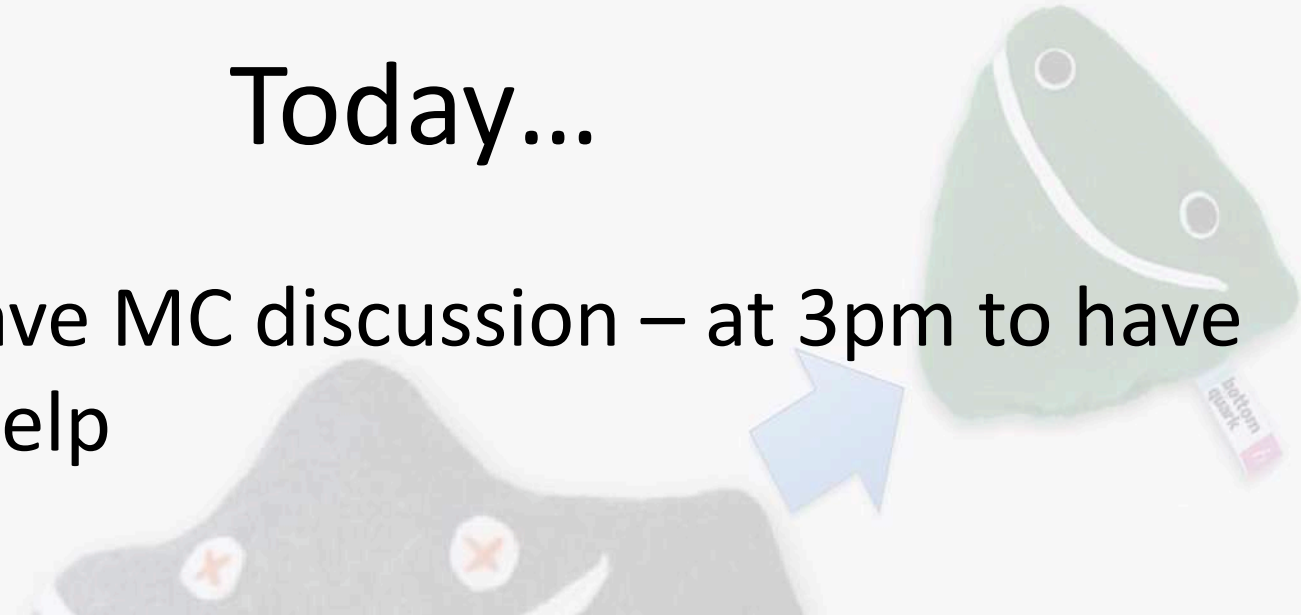
Abstract

This note documents the plans for improving current searches for $H \to b\bar{b}$ and feasibility studies for new analyses for the remainder of the 2012. It includes analyses of both the 2011 LHC running period at $\sqrt{s} = 7$ TeV and the 2012 running at 8 TeV.

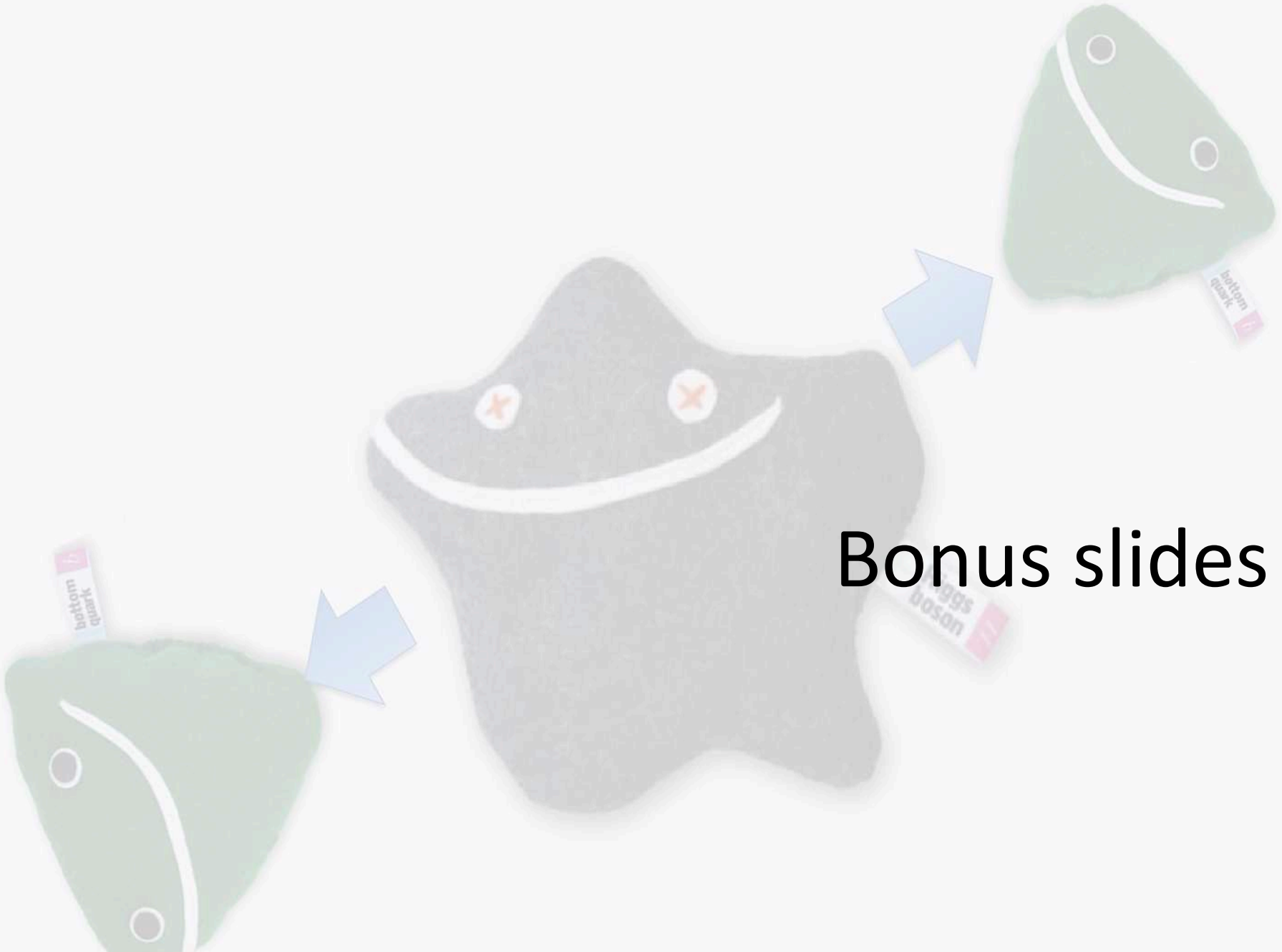
Today…

- Need to have MC discussion – at 3pm to have Tatsuya's help



Thursday, 26 April 2012

14:00 - 14:15	Introduction *15'* Speaker: Ricardo Jose Morais Silva Goncalo (University of London (GB))
14:20 - 14:35	Update on the bH(bb) analysis *15'* Speaker: Caitlin Malone
14:40 - 14:55	Bonn BDT analysis update *15'* Speaker: Jan Therhaag (Universitaet Bonn (DE))
15:00 - 15:15	Monte Carlo discussion *15'* Speaker: Ricardo Jose Morais Silva Goncalo (University of London (GB))
15:20 - 15:35	b-jets properties in boosted Higgs scenario *15'* Speaker: Remi Zaidan (University of Iowa (US))
15:40 - 15:55	Update on HSG5 D3PDs *15'* Speakers: Dr. Robert Duane Harrington Jr (University of Edinburgh), Mr. William Panduro Vazquez (Imperial College London)



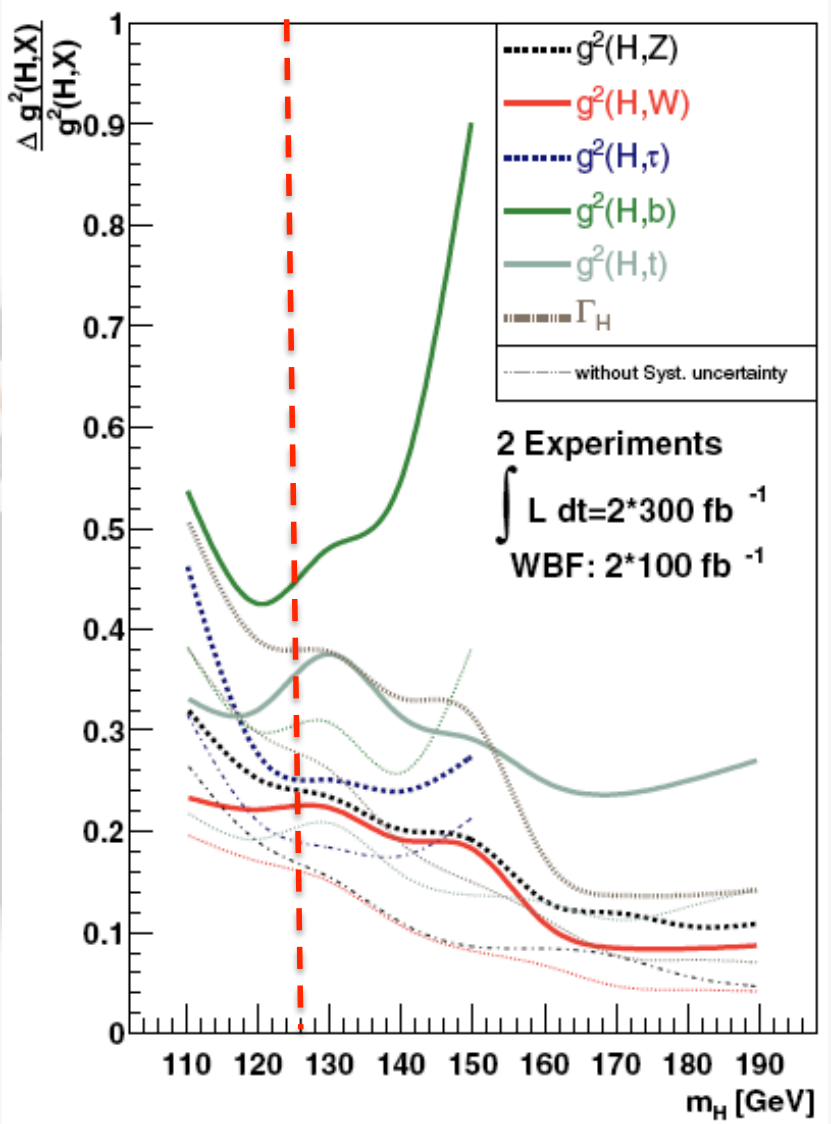
Bonus slides

Planning for 2012 analyses

- No rest for the weary!…
- Next issue for the whole group is an internal note on plans for 2012 analyses
  - The plan is not completely clear to me yet (e.g. which MC to use)
  - But main goal is to make unbiased decisions:
  - Decide on cuts and strategy before looking at new data
- Should take this as an opportunity to think ahead:
  - Boosted VH analyses and how to merge with inclusive
  - ttH, VBF, BSM analyses (see e.g. Javier and Merlin's talk today)
  - Use of MVAs (see e.g. Jan's talk today)
  - Study trigger constraints and where we can gain signal (ongoing)
  - Needs from MC: generators, where MC improvements can help most – e.g. W+jets background, N_{jets} and p_T^W description, where can theory help?
  - CP performance gains needed: b-tagging, bJES, MET (see e.g. Jike's and David's talk)
    - Remember WH/ZH analyses are now systematics limited!
  - How to optimize analyses to prepare for 125GeV Higgs property measurements?

Higgs couplings

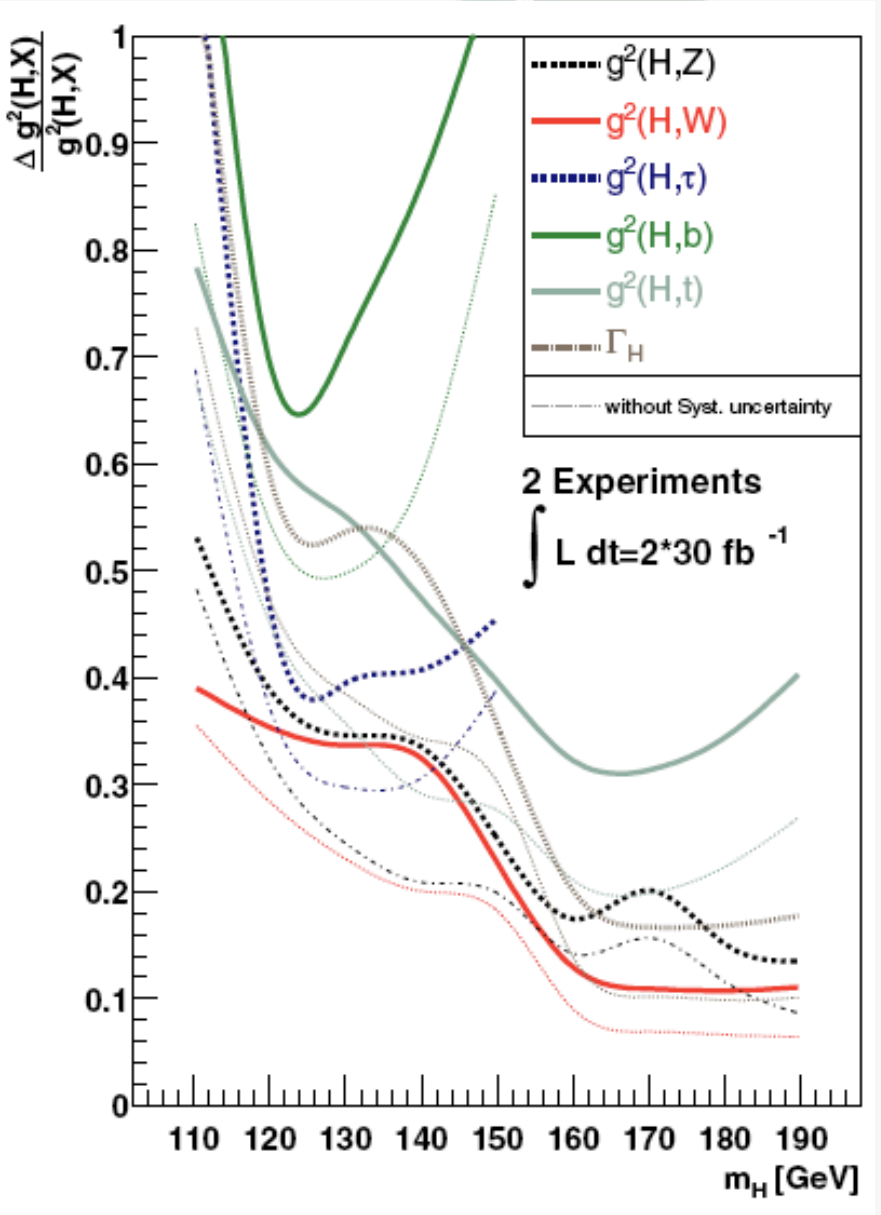
- Fit Higgs couplings using all available final states and injecting some theory assumption, i.e. $\Gamma_V \leq \Gamma_V^{SM}$ (V=W,Z)
- $\Delta g^2_{VV}/g^2_{VV}$ can be determined with an uncertainty of ~ 20% (2x300/fb)
- $\Delta g^2_{bb}/g^2_{bb}$ can be determined with an uncertainty of ~ 40% (2x300/fb)
- Find the optimal point in the luminosity-pileup plane to perform the best measurements in particular for H→bb and H→ττ?



M. Dührssen PHYSICAL REVIEW D 70, 113009 (2004)

Higgs couplings with up to 2012 data

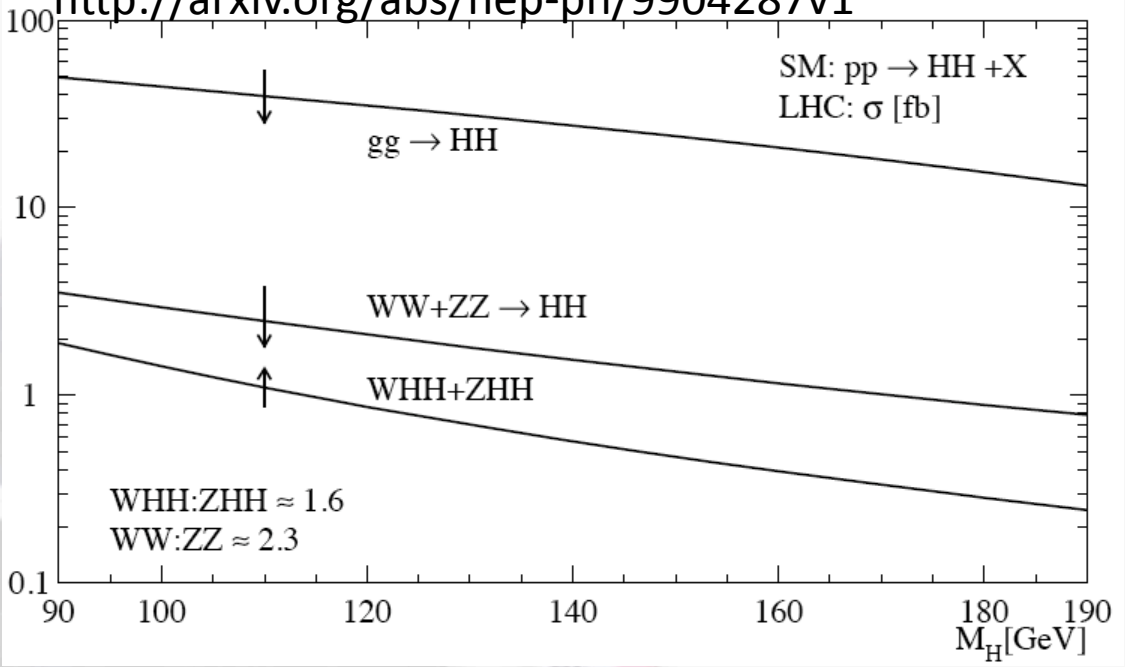
- Fit Higgs couplings using all available possible final states and injecting some theory assumption, i.e. $\Gamma_V \leq \Gamma_V^{SM}$ (V=W,Z)
- $\Delta g^2_{VV}/g^2_{VV}$ can be determined with an uncertainty of ~ 35% (2x30/fb)
- $\Delta g^2_{bb}/g^2_{bb}$ can be determined with an uncertainty of ~ 65% (2x30/fb)



Higgs self-couplings

- A complete verification of the Standard Model prediction requires the measurements of the Higgs self-couplings.
  - Trilinear and quartic interactions
- Direct trilinear interaction: H*→HH
  - SM: $g = 3m^2_H/v$
- Processes of interest: gg → HH, VBF qq→qqHH, associated production (ttH,VH)
  - Most interesting final state so far studied: HH→WWWW→lvjj lvjj

http://arxiv.org/abs/hep-ph/9904287v1



- ggF cross section: ~30/fb
- Quartic interactions: very likely not feasable at the LHC/HL-LHC, but it is worth to review this process as well
  - SM: $g = 3m^2_H/v^2$

Recent internal studies done in ATLAS by A. Dahlhoff and M. Duhrssen (based on fast simulation).