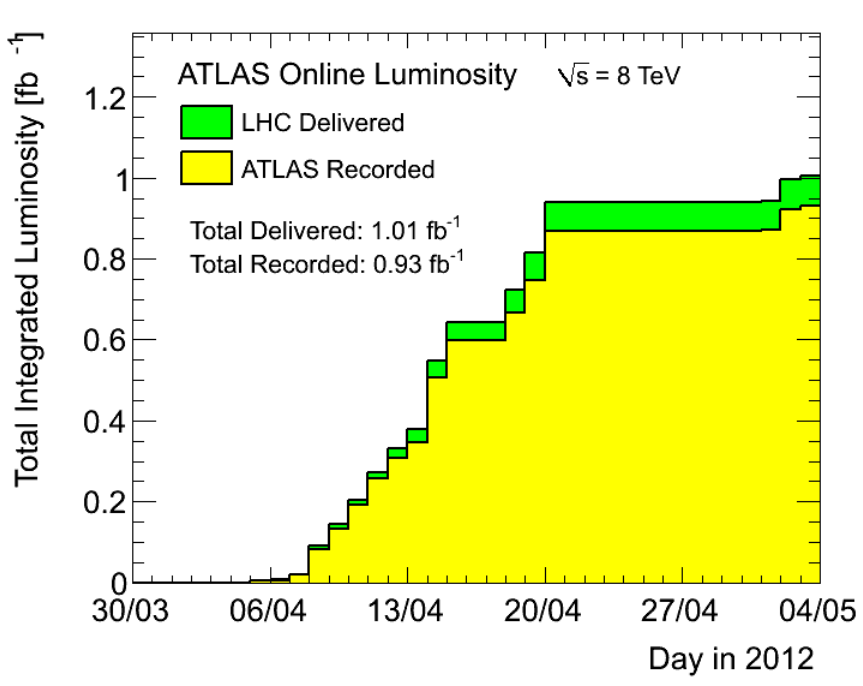
Introduction

Ricardo Gonçalo (RHUL)

Higgs Weekly Meeting – 3 May 2012

News! News! News!

- Peak <evts>/bunch crossing 20 – 29
- Peak stable lumi $5x10^{33}cm^{-2}s^{-1}$
- Lumi with stable beams $0.93fb^{-1}$
- ≈ $0.13fb^{-1}$ collected since technical stop
- (Emanuel) After cuts adjusted high rate in b-tag triggers



News! News! News!

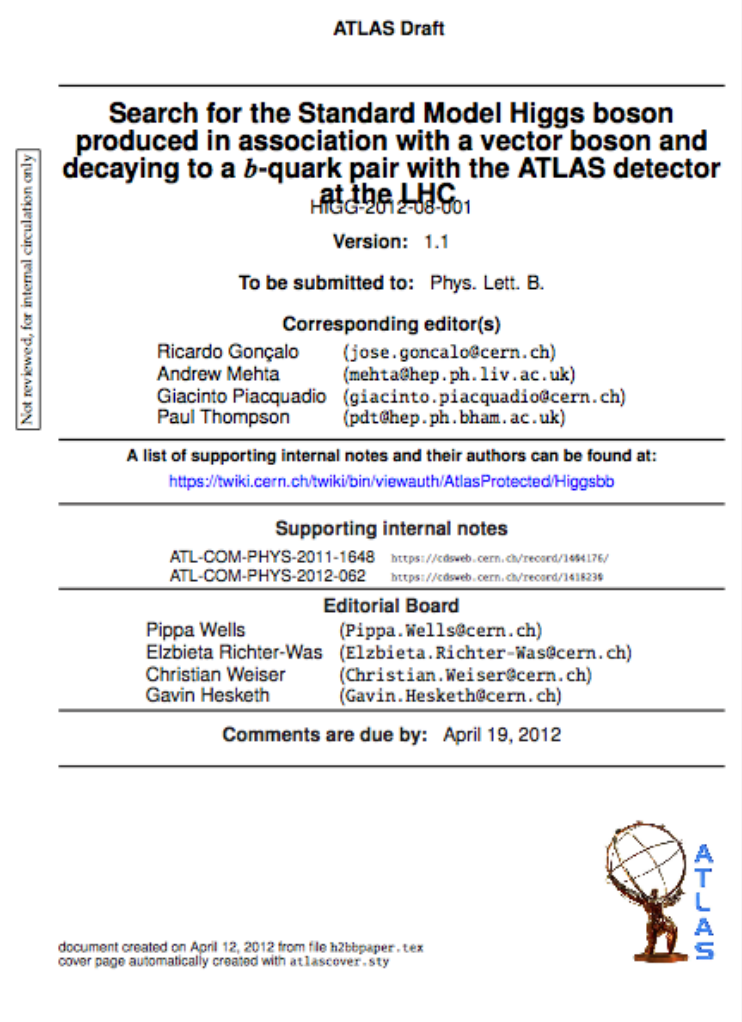
- H->bb analysis approved by to go for second circulation
- https://cdsweb.cern.ch/record/1440266

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

- Due to SVN problems, moved to: atlasusr/jgoncalo/ATL_COM_PHYS_2011_1648

- Should go for 2nd circulation soon
  - Updated version next few days

- 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/1464176/
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

- Not much progress… but need to put something on paper before 10th (in 1 week)
  - Cannot make fully detailed note
  - Not 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
  - MSSM bH/A->bbb
  - MWT? VBF?

- Due to SVN problems, moved to: atlasusr/jgoncalo/ATL_COM_PHYS_2012_416

- CDS record (skeleton only): 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.

Higgs Subconveners Meeting

- Combination:
  - Will use new asymptotic bands only in the combination paper, won't change ongoing papers
  - Background modelling workshop on Wednesday

- MC
  - New problem found in Py8 H->WW->tautau->llvvvv: polarization of Ws now ok, but tau polarization still wrong; will also affect H->ZZ->4tau
  - In Pow+Py6, some Z in H->ZZ have negative mass
  - MC@NLO WW had problems (now fixed and being re-launched)
  - Py8 inclusive dibosons (inclusive, all decay modes incl. hadronic and vv) ready for validation

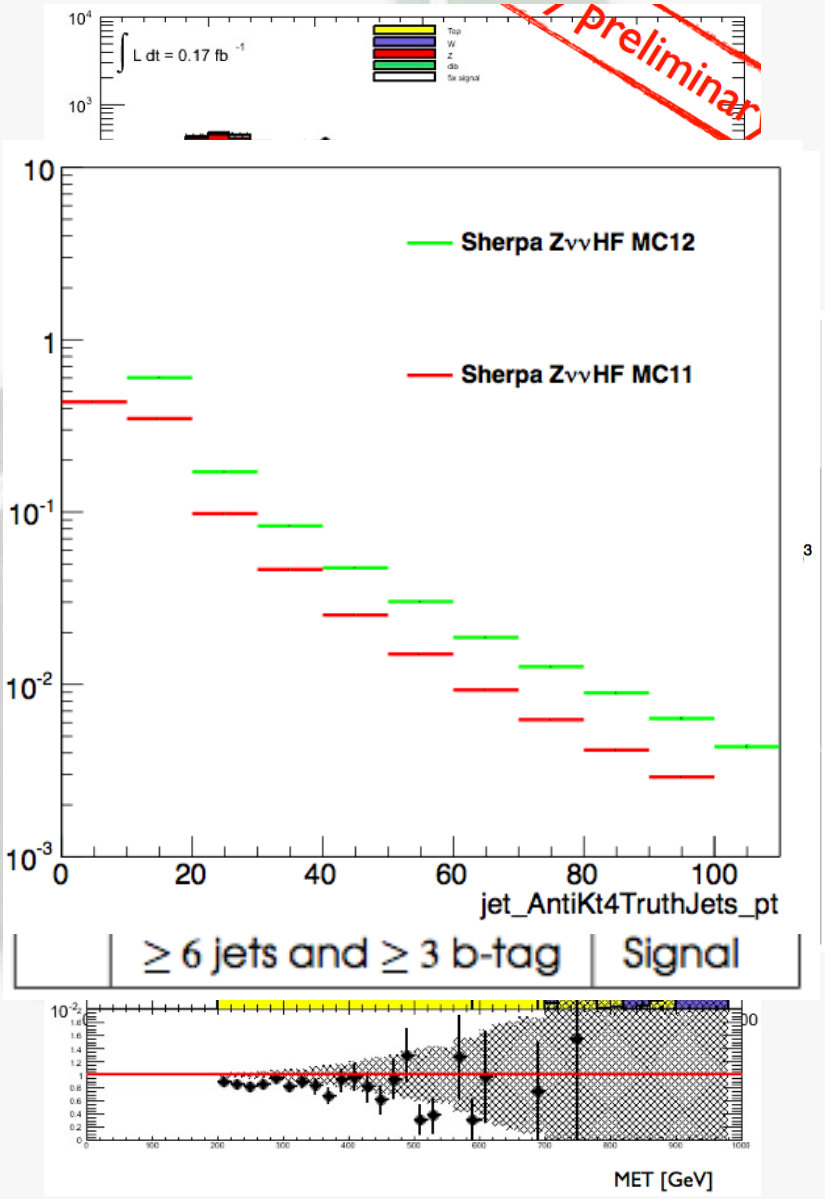
News & activity

MC requests:

- W/Z+h.f. – asking for large AFII Sherpa samples
  - Possible problem: looks like a p_T^{jet}>20GeV truth-level cut
- A few other ongoing requests

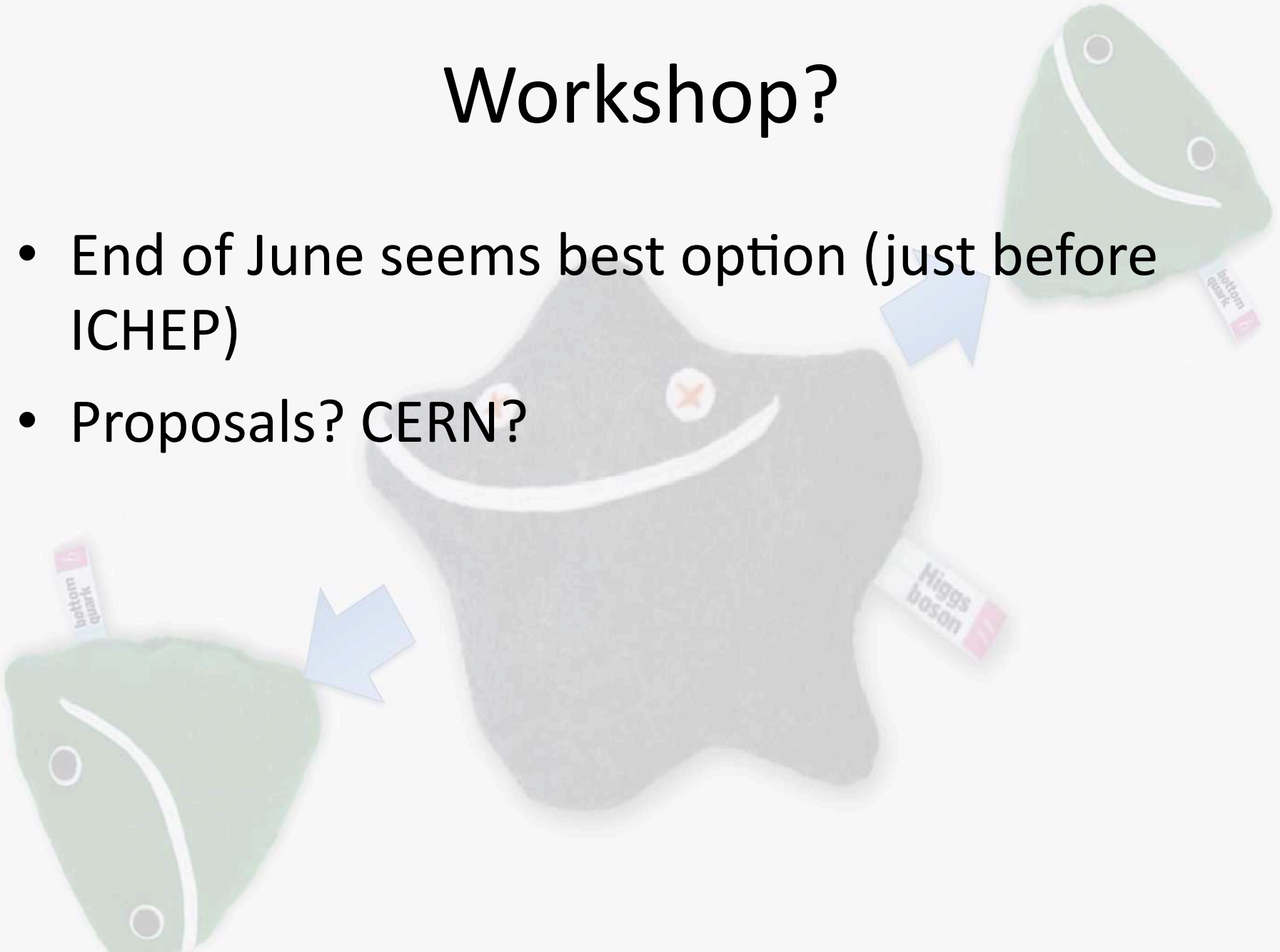
Other channels:

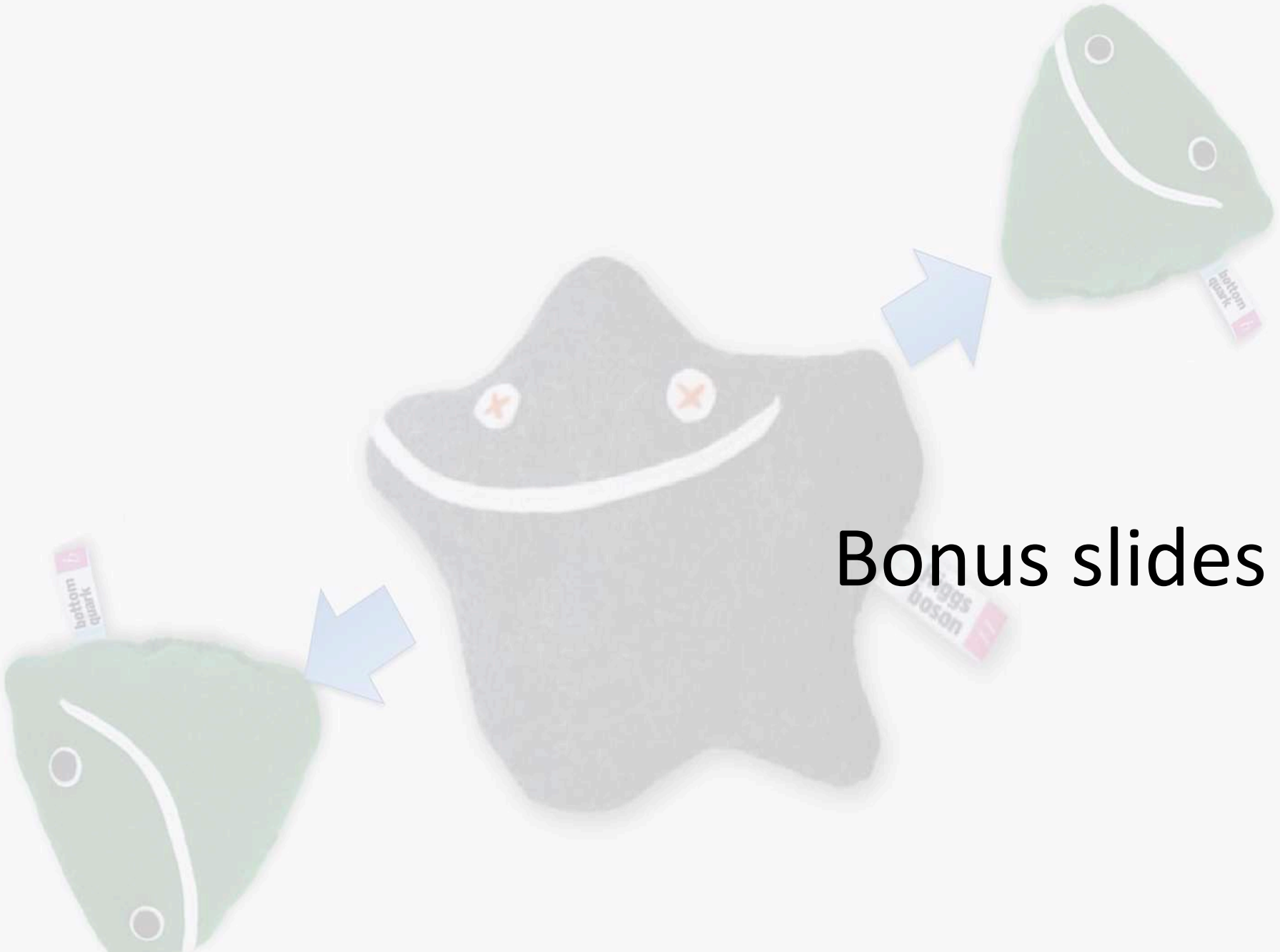
- Boosted H->bb – aim for results in Summer
  - Improvement on inclusive sensitivity clear
  - Ongoing: progress in cut-flow comparison
- ttH working for 2011 analysis in mid May
  - Ongoing: control region checks, estimating model uncertainties; detailed systematics with rel.16 (b-tagging is dominant)
  - From 1-b control region: scale top down by 25%
- Walking technicolor analysis with Exo group:
  - Preliminary results shown some sensitivity with ≈zero effort:
  - https://indico.cern.ch/conferenceDisplay.py?confId=187283
  - Waiting for MC for 1 model point to see if we have exclusion: all channels
- WZ->lvbb: use as a calibration for H->bb mass peak
  - Simple mods from existing analysis
  - Expect preliminary results today
- First look at 2012 data – exploratory
  - Using PDF reweighting
  - Needed to scale down MC by 20% (lumi? Pileup? JES?)
- Other:
  - bA/H->bbb: ongoing – MC requests
  - VBF H->bb: ongoing



Workshop?

- End of June seems best option (just before ICHEP)
- Proposals? CERN?





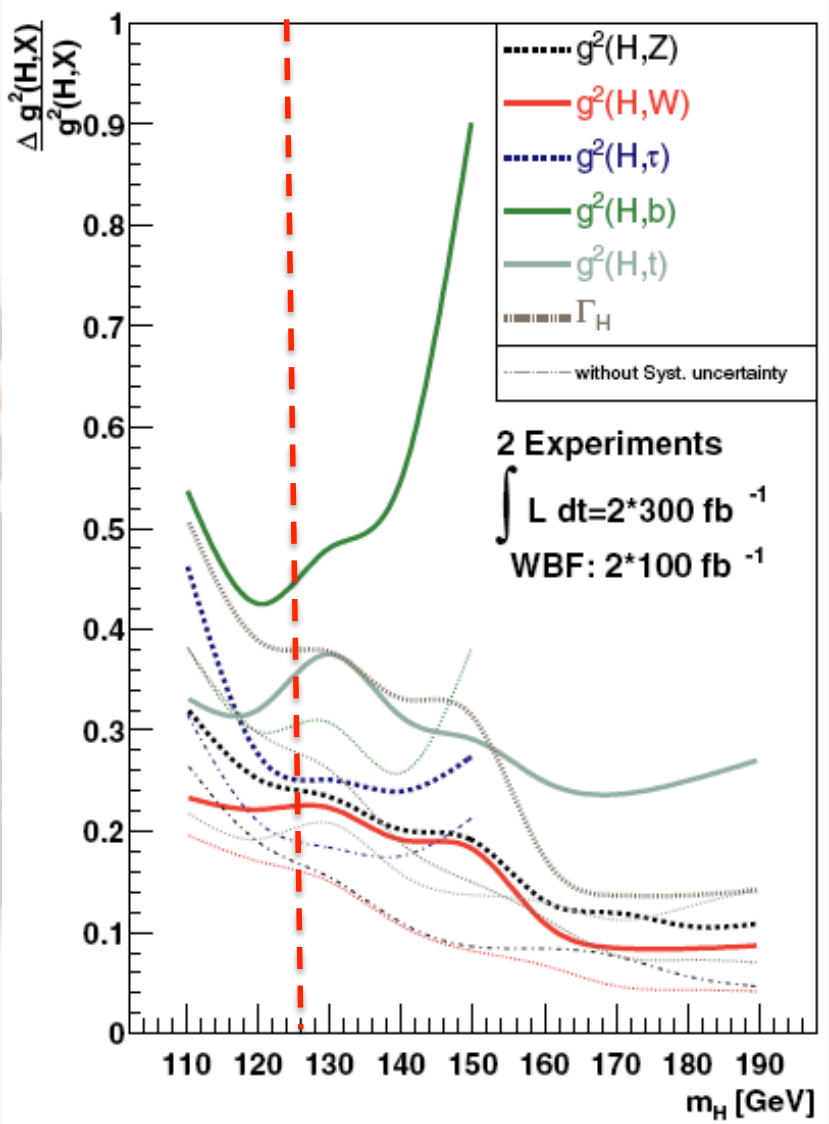
Bonus slides

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

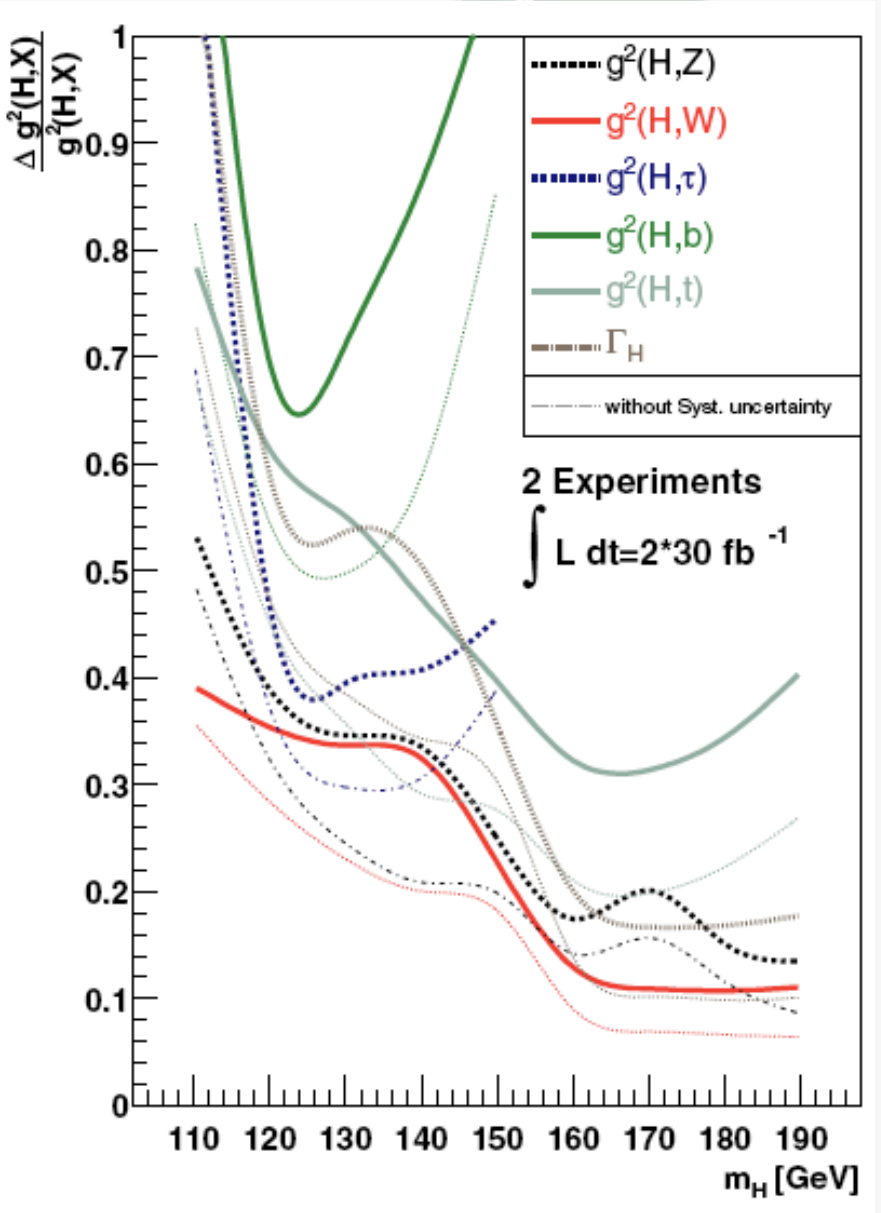
- Fit Higgs couplings using all available final states and injecting some theory assumption, i.e. $\Gamma_V \leq \Gamma_V^{SM}$ (V=W,Z)
- $\Delta g^2_{VV}/g^2_{VV}$ can be determined with an uncertainty of ~ 20% (2x300/fb)
- $\Delta g^2_{bb}/g^2_{bb}$ can be determined with an uncertainty of ~ 40% (2x300/fb)
- 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

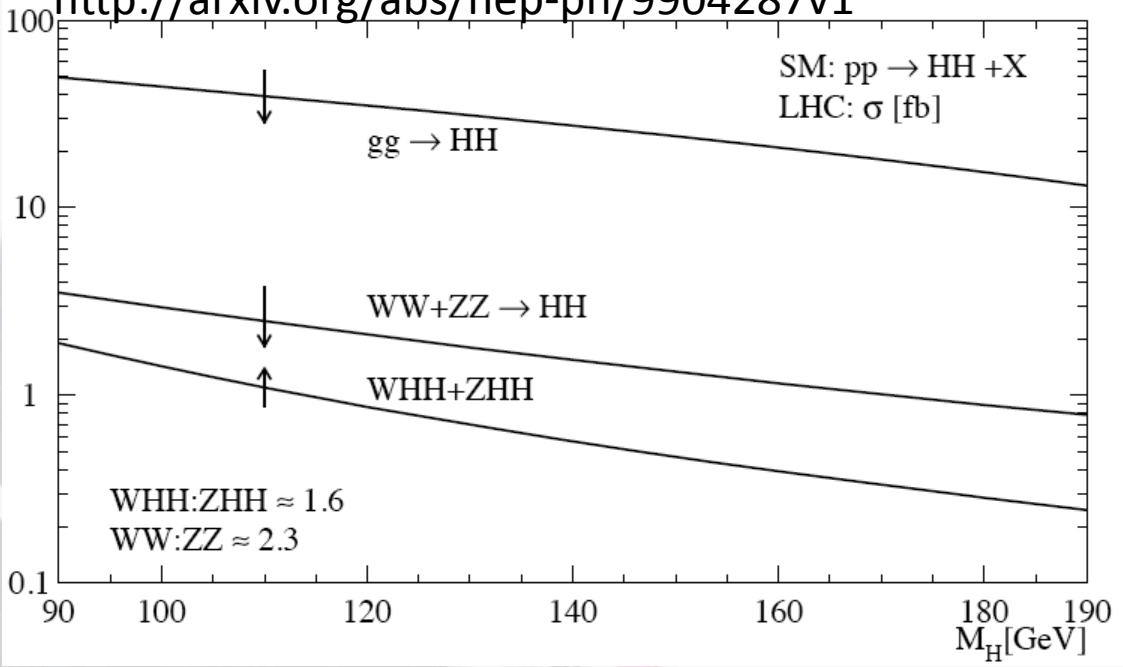
- Fit Higgs couplings using all available possible final states and injecting some theory assumption, i.e. $\Gamma_V \leq \Gamma_V^{SM}$ (V=W,Z)
- $\Delta g^2_{VV}/g^2_{VV}$ can be determined with an uncertainty of ~ 35% (2x30/fb)
- $\Delta g^2_{bb}/g^2_{bb}$ can be determined with an uncertainty of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