

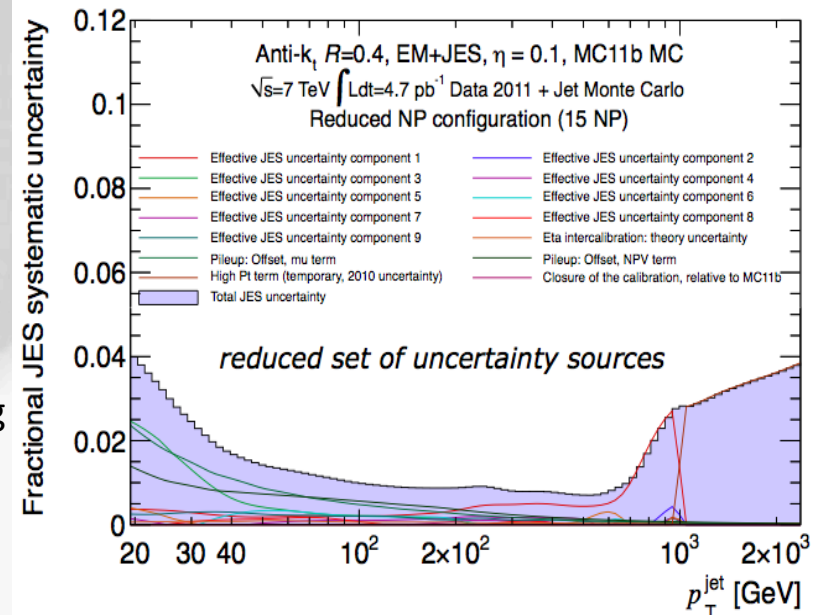
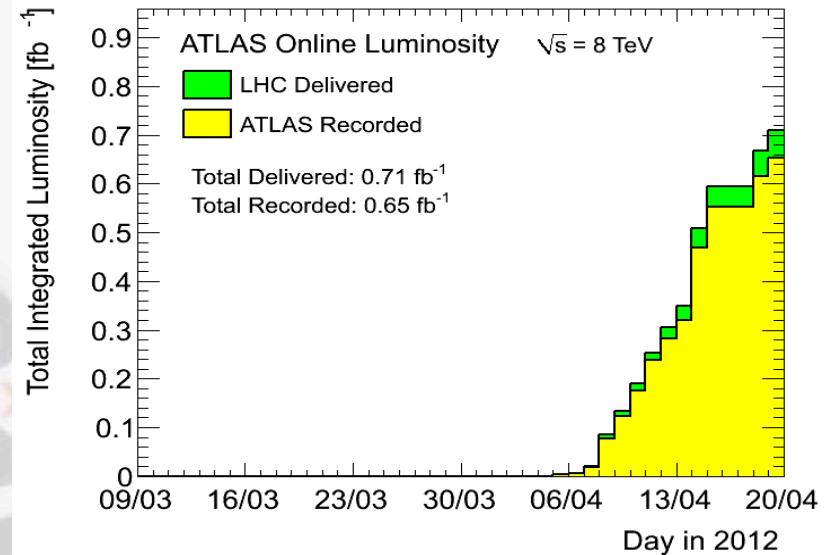
# Introduction



Ricardo Gonalo (RHUL)  
Higgs Weekly Meeting – 19 April 2012

# News! News! News!

- LHC 2012 8TeV run going well
  - Running with 1092 bunches
  - Will get to 1380 soon
  - Peak  $\langle \text{evts} \rangle / \text{bunch crossing}$  20 – 25
  - Peak stable lumi  $5.06 \times 10^{33} \text{cm}^{-2} \text{s}^{-1}$
  - Lumi with stable beams  $0.65 \text{fb}^{-1}$
  - $\approx 0.41 \text{fb}^{-1}$  collected since last week
  - UFOs (not the little green men) again becoming a problem
- Good Run List:
  - AllGood may become the default
    - Excludes all intolerable defects in ID, Calo, MS
    - AllGoodTight excludes also tolerable – bigger losses
  - For us this seems fine since we use  $\approx$ everything
  - Losses of 1 – 5% seen, depending on channels
- New Jet calibration:
  - Very nice improvement! And very important for us!
  - Discussion in jet group to find practical way of using calibration – many nuisance parameters
    - <https://indico.cern.ch/conferenceDisplay.py?confId=161254>
    - <https://indico.cern.ch/conferenceDisplay.py?confId=161253>




# 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,  $N_{\text{jets}}$  and  $p_T^W$  description, where can theory help?
  - CP performance gains needed: b-tagging, bJES, MET (see e.g. Jake's and David's talk)
    - Remember WH/ZH analyses are now systematics limited!
  - How to optimize analyses to prepare for 125GeV Higgs property measurements?

# Internal note with 2012 plans - I

- Need to detail analysis selection and optimization for 2012 for all analyses to be published this year
- WH/ZH
- Boosted VH
- ttH
- MWT? VBF? MSSM bH?
- Prepared skeleton note
- [ATL-COM-PHYS-2012-416](#)
- One chapter for each of WH/ZH, ttH and VBF (?)
- Tentative index in next pages

Draft version 1.0

 **ATLAS NOTE**  
ATLAS-COM-PHYS-2012-416  
April 19, 2012



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

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**Abstract**

This note documents the plans for improving current searches for  $H \rightarrow b\bar{b}$  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.



# Internal note with 2012 plans - II

- WH/ZH
- Two parts: inclusive and boosted
- Plus a section on combining analyses
- Concentrate on possible improvements
- List optimized analysis
- Think about how to merge boosted analysis
- Think about MC needs

<b>2</b>	<b>WH/ZH, <math>H \rightarrow b\bar{b}</math> Searches</b>	
2.1	Review of current results	.....
2.1.1	Review of systematic uncertainties	.....
2.1.2	Determination of sources of background	.....
2.1.3	Improvements in theory uncertainties	.....
2.2	Possible improvements of current analyses	.....
2.2.1	Improvements in jet energy reconstruction	.....
2.2.2	$b$ -jet energy reconstruction	.....
2.2.3	Improvements in $b$ -jet tagging	.....
2.2.4	$E_T^{\text{miss}}$ reconstruction	.....
2.2.5	Kinematic fit?	.....
2.2.6	Multivariate analysis?	.....
2.3	Jet-substructure analyses	.....
2.3.1	Definition of analysis selection	.....
2.3.2	Data and Monte Carlo samples	.....
2.3.3	$b$ -tagging in jet substructure analyses	.....
2.3.4	Validation: $Z \rightarrow b\bar{b}$ observation?	.....
2.3.5	Estimation of backgrounds	.....
2.3.6	Sensitivity of jet-substructure analyses	.....
2.4	Merging inclusive and jet-substructure analyses	.....
2.4.1	Making inclusive and jet-substructure analyses exclusive	.....
2.5	New issues for 2012 data	.....
2.5.1	Effects of pileup	.....
2.5.2	Effects of the higher beam energy	.....
2.5.3	Effects of the new trigger menu	.....
2.6	Summary of proposed analyses for 2012 data	.....
2.6.1	Trigger menu for 2012 data	.....
2.6.2	Optimized analysis selection	.....
2.6.3	Effects of pileup	.....
2.7	Monte Carlo needs for 2012 data analysis	.....
2.7.1	$ZH \rightarrow \ell^+ \ell^- b\bar{b}$ analysis	.....
2.7.2	$WH \rightarrow \ell \nu b\bar{b}$ analysis	.....
2.7.3	$ZH \rightarrow \nu \bar{\nu} b\bar{b}$ analysis	.....

# Internal note with 2012 plans - III

- ttH:
- Parallel to note in preparation

## 3 $t\bar{t}H, H \rightarrow b\bar{b}$ Searches

3.1	Introduction . . . . .
3.1.1	Signal and major backgrounds . . . . .
3.1.2	Exotic scenarios . . . . .
3.1.3	Analysis strategy . . . . .
3.1.4	Monte Carlo . . . . .
3.2	Event selection and eeconstruction . . . . .
3.2.1	Trigger . . . . .
3.2.2	Jet reconstruction . . . . .
3.2.3	$b$ -jet tagging . . . . .
3.2.4	$E_T^{\text{miss}}$ reconstruction . . . . .
3.2.5	Modelling of the background . . . . .
3.2.6	Event reconstruction . . . . .
3.2.7	Cut-based analysis . . . . .
3.2.8	Kinematic fit . . . . .
3.2.9	Artificial neural net based analysis . . . . .
3.3	Systematic uncertainties . . . . .
3.4	Determination of exclusion limits . . . . .
3.5	Issues for 2012 data . . . . .
3.5.1	Monte Carlo needs for 2012 data analysis . . . . .
3.5.2	Effects of pileup . . . . .
3.5.3	Effects of the higher beam energy . . . . .
3.5.4	Effects of the new trigger menu . . . . .

# Monte Carlo

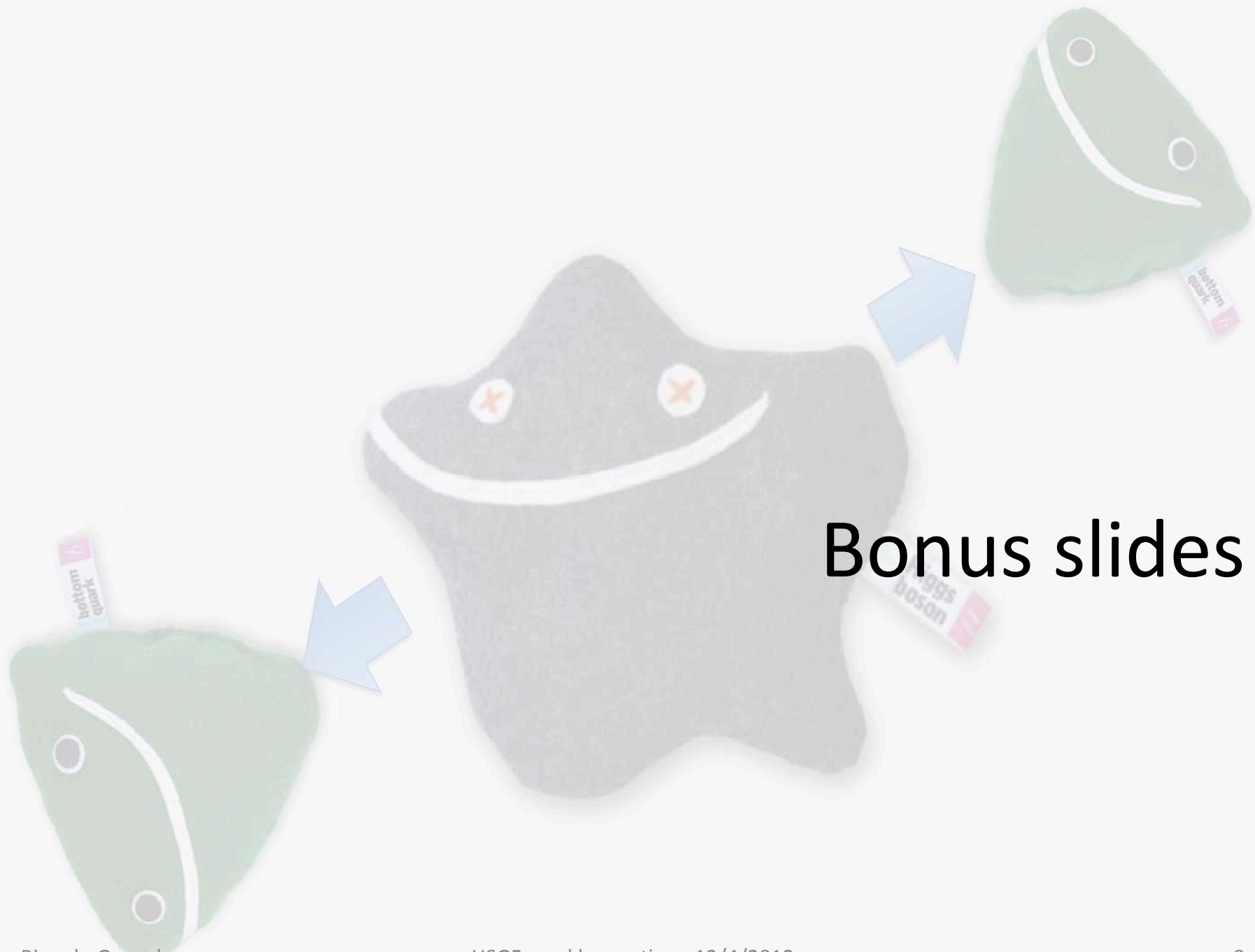
- For now need to use existing 7TeV MC
- Sample being generated for beginning of May:



# Boosted VH and ttH

- Need to press on... time running short
- Boosted VH:
- Propose to make weekly working meeting
- Can use existing slot of Edinburgh+UCL?
- ttH:
- Same thing... time runs short





# Bonus slides

# News! News! News!

- H→bb analysis approved by Higgs group
- Circulated today (1/2h ago)!  
<https://cdsweb.cern.ch/record/1440266>
- Congratulations everyone! 😊
- What next:
  - One week of comments
  - First reading
  - Second period of comments by collaboration and management
  - Second reading
  - Send to journal
  - More comments...
  - Publication!

ATLAS Draft

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**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>

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**Supporting internal notes**

ATL-COM-PHYS-2011-1648 <https://cdsweb.cern.ch/record/1444176/>  
ATL-COM-PHYS-2012-062 <https://cdsweb.cern.ch/record/1418238>

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