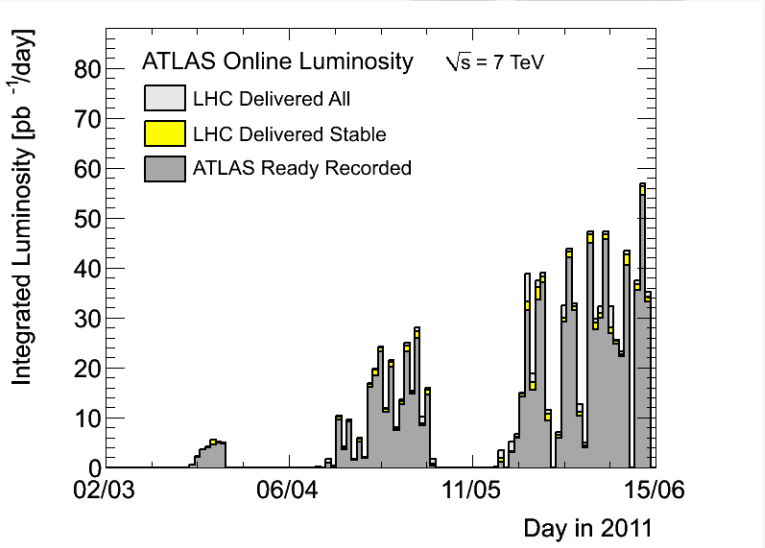
H->bb Note Plans for Summer

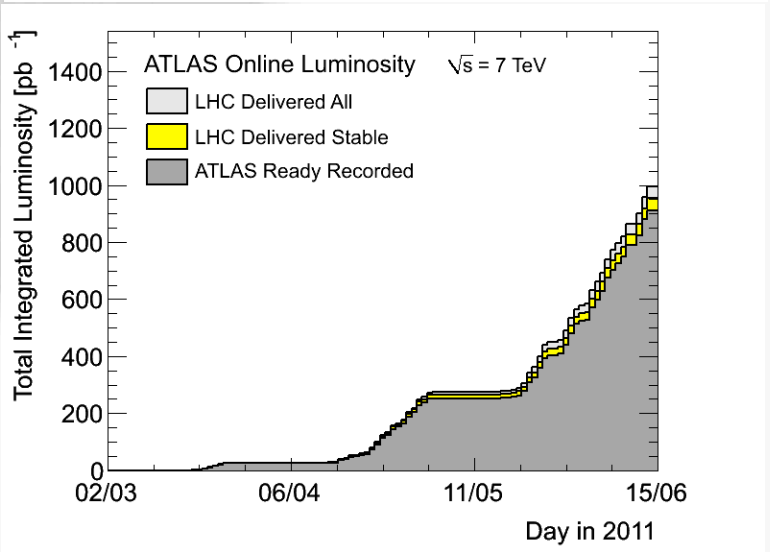
Ricardo Gonçalo (RHUL) on behalf of the HSG5 H->bb group

Higgs Working Group Meeting, 9 June 2011

News! News! News!

- About 0.9 fb^{-1} collected with stable beams so far (0.95 delivered)
- 1042 bunches colliding in ATLAS
- Peak lumi around $1.2x10^{33}cm^{-2}s^{-1}$
- 30 – 50pb^{-1} per day





Trigger News

- Evolution for 2 – 5x10^{33} $cm^{-2}s^{-1}$ being planned – final sign off tomorrow at Trigger General Meeting

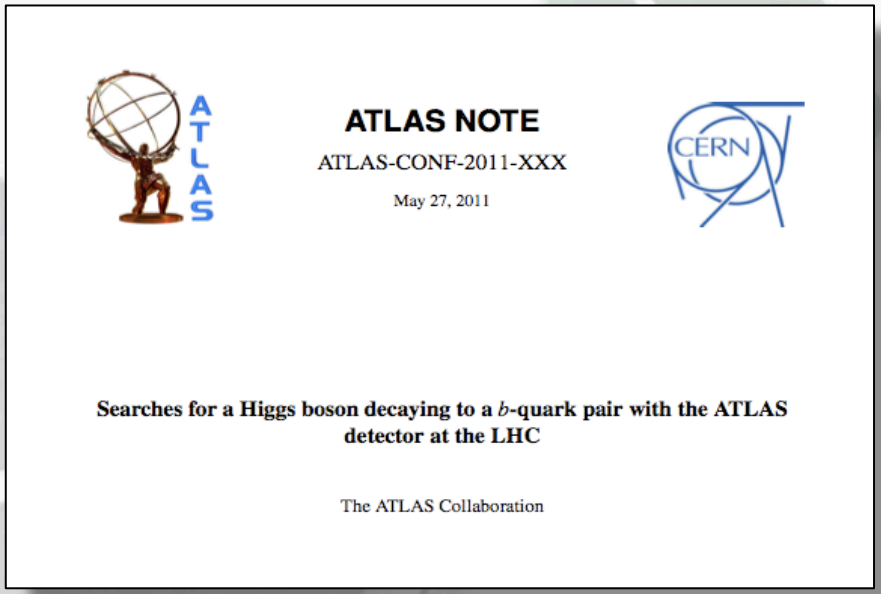
- Strawman plan with detailed prescales can be found here: https://aagaard.web.cern.ch/aagaard/Rates/Evolution50nsVeryTight5e33/

- At 5x10^{33} $cm^{-2}s^{-1}$:
  - mu20(_MG) disabled – new primary will be **mu22**
  - e20_medium1 disabled – new primary will be **e22_medium1**
  - EF_2b10_medium_4L1J10 disabled – should have EF_b10_medium_4j30_a4tc_EFFS or EF_2b15_medium_L1_2J10J50

- **Our feedback** was that we will use EF_e22_medium1 and EF_mu22
  - An alternative would be e20i, but this has L1 isolation and would prevent us from using isolation cut for background estimation

H->bb WH/ZH CONF note plans

- ATL-COM-PHYS-2010-929
- CONF note for EPS
- First H->bb results from ATLAS with real data
- WH and ZH un-boosted channels only, for now
- Expect exclusion limits for WH and ZH in low Higgs mass range
- If all goes well…



ATLAS NOTE

ATLAS-CONF-2011-XXX

May 27, 2011

Searches for a Higgs boson decaying to a *b*-quark pair with the ATLAS detector at the LHC

The ATLAS Collaboration

Editors:
Patricia Conde Muino
Andrew Mehta
Paul Thompson

1. Introduction
2. Data and MC samples
3. Object selection
4. Event selection
5. WH analysis
6. ZH analysis
7. Systematic uncertainties
8. Results
9. Summary

WH/ZH Note: Missing Ingredients

- MC10b:
  - Can move to this essentially now
- b tagging:
  - Need advanced tagger for increased background rejection
  - Efficiency scale factors almost done
  - Calibration & fake rate: preliminary on week of 20th June - will re-do analysis with final numbers
  - IP3D+SV1, 60% efficiency working point
- Jet Vertex Fraction:
  - Fix exists but applicable only to AOD-based analyses – i.e. only one analysis in our group
  - Would like to re-run D3PD production
- Editorial board: Done
  - Richard Bateley (chair)
  - Niels van Eldik
  - Alex Read
  - Emmanuel Lemonier
- QCD background (incl. bb, cc):
  - Almost there, but not quite – remaining features at 10% level
- Systematics:
  - First estimates done – dominated by b-tagging uncertainty (around 30%)
  - Jet energy scale uncertainty still missing – expected of same order
- SM Higgs combination:
  - Need to produce inputs for SM Higgs combination

WH/ZH Note: Outlook

- Skeleton draft of INT note should be available now…
- Then a couple of weeks to finish details of QCD BG determination and interact with Editorial Board
  - Expect some changes to cuts etc during this
- Dataset frozen on 22 June (I think)
- Preliminary b-tagging calibrations around same time
- Aim for Higgs approval at end of June
- Last iteration with final b-tagging calibrations on…
- Circulate note to ATLAS for CONF approval in early July for approval in time for EPS

WH/ZH in SM Higgs Combination

Hello,

A number of Higgs mass points have been for the ATLAS +CMS SM Higgs combination. The suggestion is that all analyses going into the overall Higgs combination should provide their results at these chosen mass points, within their range of sensitivity. See this:

https://indico.cern.ch/getFile.py/access?contribId=2&resId=0&materialId=0&confId=135328

There are 3 things:

1) The step size of the mass points

The choice of mass points for the combination is driven by the H -> gamma gamma and

H -> ZZ -> 4l analyses looking for a narrow peak over a continuum background. The

probe masses in the SM Higgs search should not be much farther apart than the

observable width of the Higgs peak. It is important to note that all analyses going

into the overall Higgs search combination should provide their results for all the

points in their corresponding explored range, without any skips, even if they do

not have the mass resolution as fine as the specified steps.

A total of 173 mass points are proposed between 110-600 GeV, as shown in the

aforementioned document.

2) The cross sections (XS) and branching ratios (BR) at each mass point

Full tables for the Higss XS and BR (with interpolation for missing points) are

being prepared within the LHC Higgs cross section group (Rei Tanaka et al).

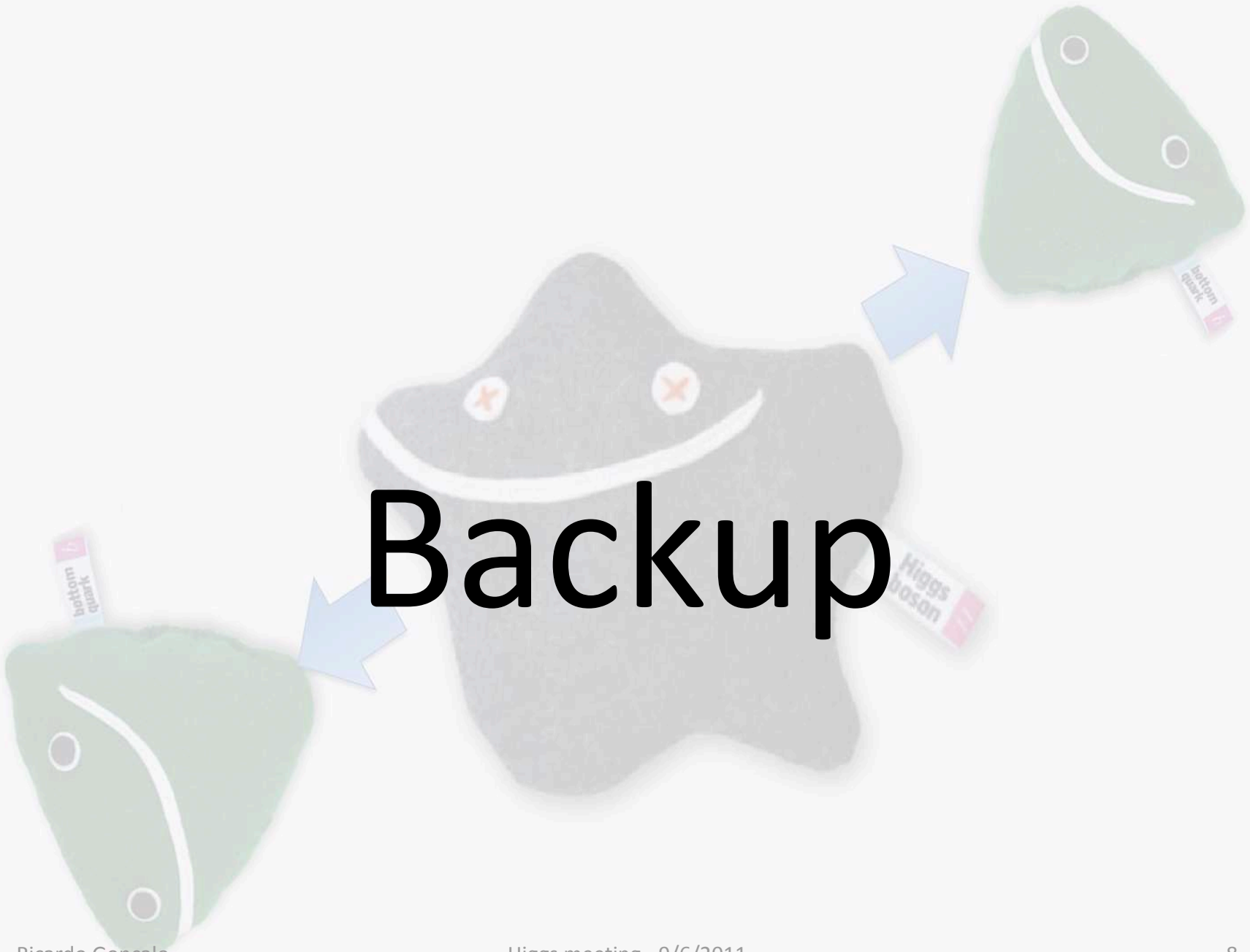
3) Dealing with mass points for which we have no simulation

A few options are proposed in the aforementioned document.

This should be discussed in the Higgs (sub)group(s), in particular item 3).

Regards, Ketevi.

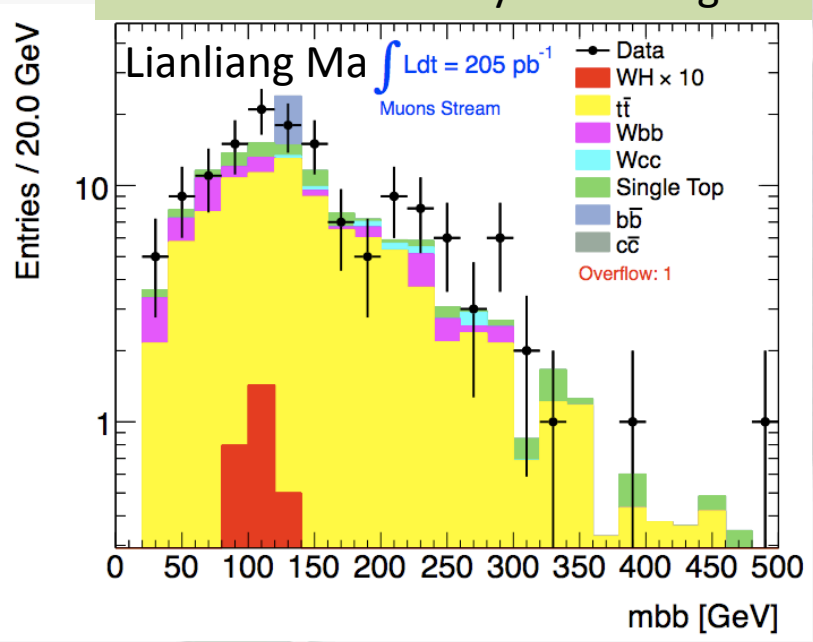
Backup



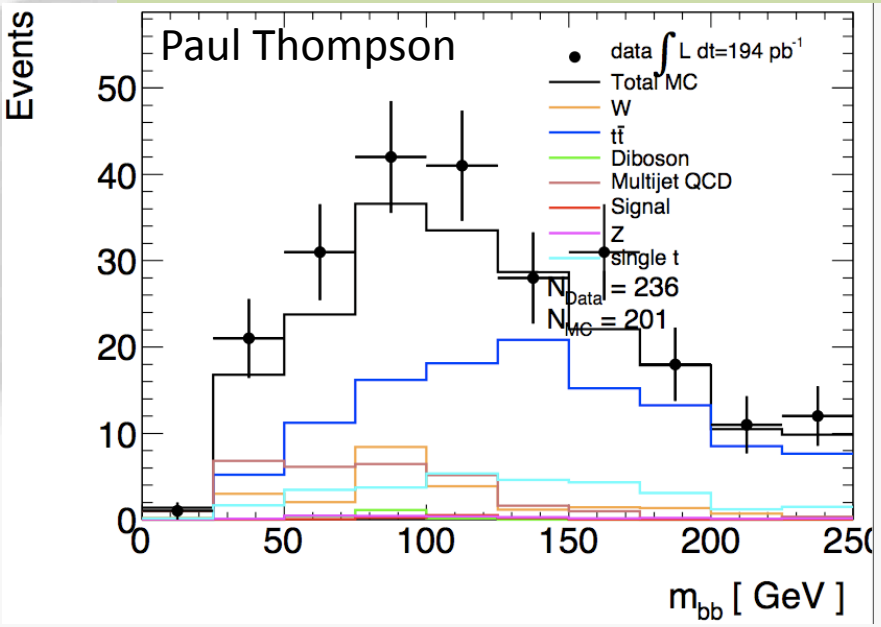
Do we need a JVF cut?

- In principle yes!…
- Need to use cut $N_{jets} = 2$ to suppress tt background; use $N_{jets} = 3$ as tt control region
- So must suppress spurious jets from pileup…

Njets < 4
All backgrounds from Monte Carlo
bb and cc MC clearly not enough



Njets = 2
QCD background from data
Before last scale factor (1-b sideband)

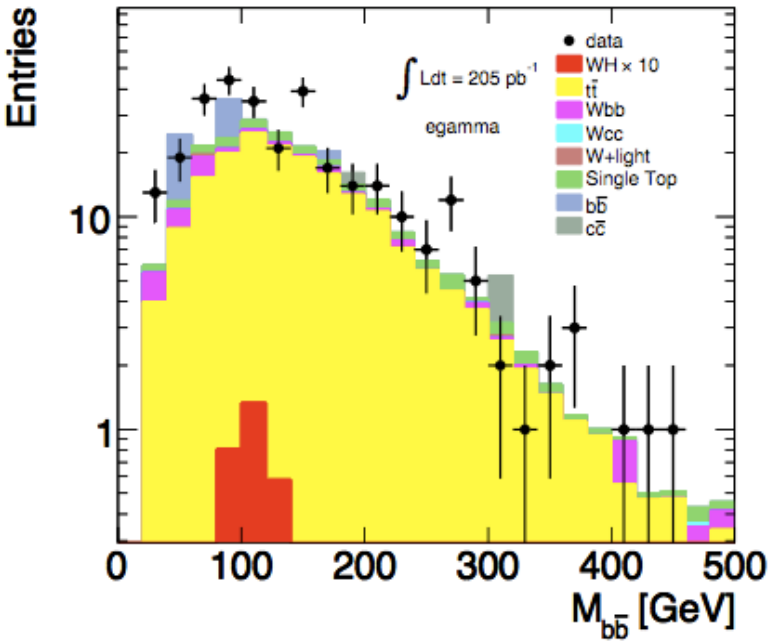


Do we need a JVF cut?

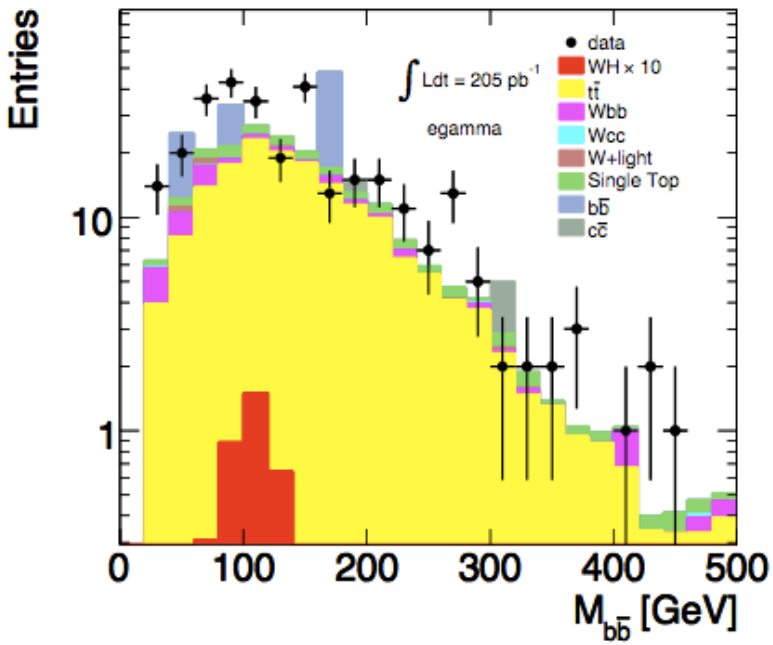
- In fact, not using the Jet Vertex Fraction seems to have a significant effect on Njets
- But a small effect after all cuts…

	data	tt MC
No JVF cut	303	200
JVF > 0.75	300	185

Haifeng Li With JVF



Haifeng Li No JVF



Results so far

- **Before systematic** uncertainties…
- WH: reject around 7x the SM at 95% CL with 1 fb^{-1}
- ZH: reject 12x the SM with 1 fb^{-1} / 3.5x for 10fb^{-1}
  - Note: these are just preliminary numbers, shown in the Dubna workshop, and likely to change significantly after systematics