

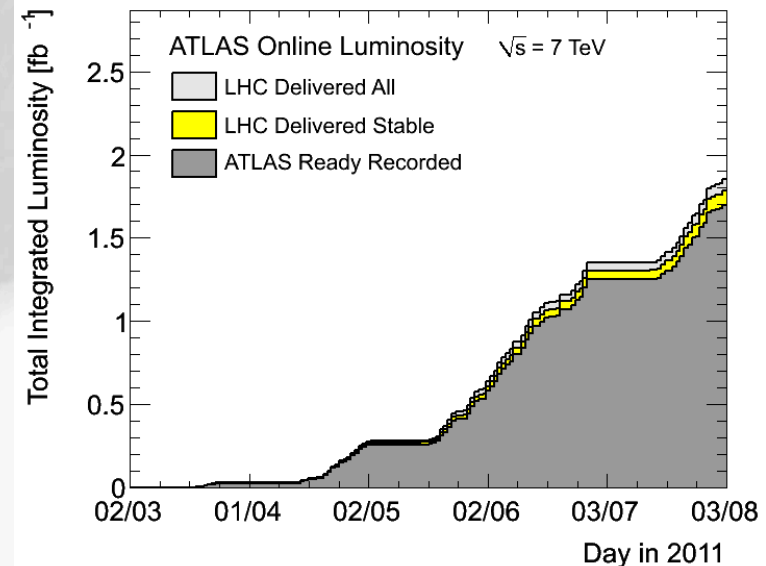
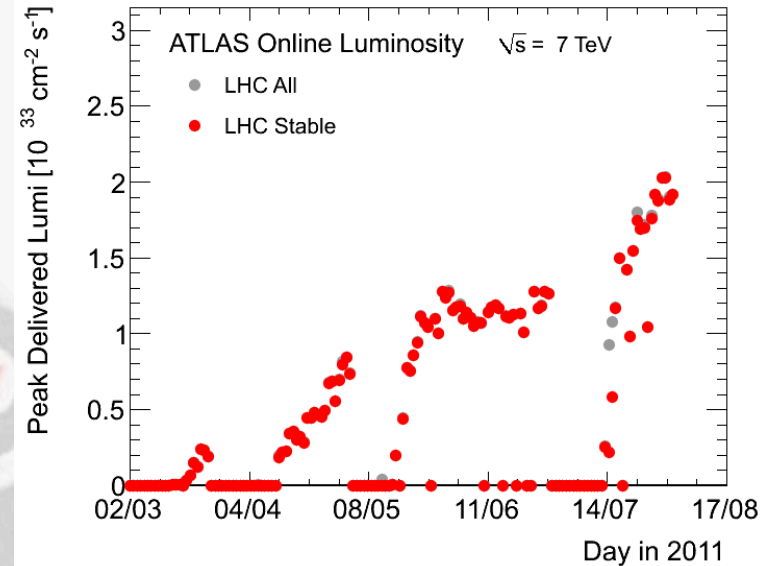
H->bb Weekly Meeting



Ricardo Gonalo (RHUL)
HSG5 H->bb weekly meeting, 2 August 2011

News! News! News!

- Peak stable lumi up to $2 \times 10^{33} \text{cm}^{-2} \text{s}^{-1}$
- 1.7fb^{-1} with stable beams collected so far
- Peak pileup around 11
- 1380 bunches in the machine – maximum for 50ns



H->bb Posters

- Patricia won **best poster prize** at EPS! **Congratulations!**
- Koloïna could not make it to Lepton-Photon, but Dilip Jana will present our poster at the conference. Many thanks!



Boosted VH Data Format

- Had a phone meeting on Friday last week to discuss a common D3PD format for boosted VH analyses
- Will use “official” Jet/ETmiss D3PD maker code by Bertrand Capleau to produce SM W/Z D3PDs including jet substructure variables
 - <https://twiki.cern.ch/twiki/bin/view/AtlasProtected/GroomedJetsD3PD>
 - Filtered Cambridge-Aachen jets and their constituent jets etc
 - Need to run b-tagging on sub-jets
 - Edinburgh (Robert H.) working on this with help from UCL
- Then the idea is to make data skims to ease running on new data

Data skims for H->bb

- We need to have data skims to avoid pain of running over too much data – both for inclusive and boosted analyses (ZH inclusive already using HSG2 skims)
- Plan to join the DPD train:
 - The code to produce DAODs or D3PDs should be in AtlasPhysics cache and fully tested
 - The production needs to be done with a single Reco_trf.py instruction (fully tested standalone)
 - Write the data to Higgs group space
 - DPD production done in Tier1 from AODs
 - Skims should be small enough for this to make sense
- Once code is running, need to get the ok from the Higgs conveners and production manager
- Should test asap on rel.16 AODs to be ready for production after reprocessing



Data reprocessing and MC11

- Tier0 will move to rel.17 soon – possibly 24th August to allow for rel.16 data for LP2011
- After that, all 2011 data will be reprocessed with rel.17
- We should move to rel.17 and MC11 asap



Rumours...

- Word on the street is that CMS may send H->bb results to LP2011 which are very competitive with ours
- Means we need to keep working hard to improve existing analyses and add more channels



No meeting next week...

- I'll be on holidays with no internet
- Hold the fort until I'm back and keep up the good work!

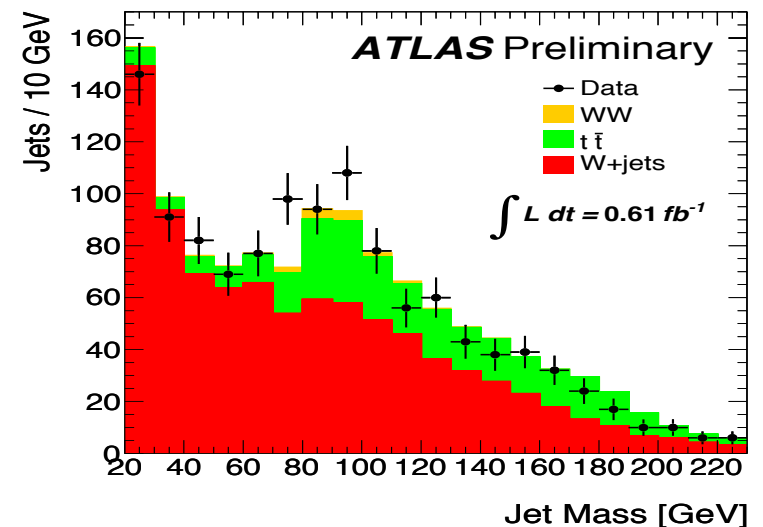
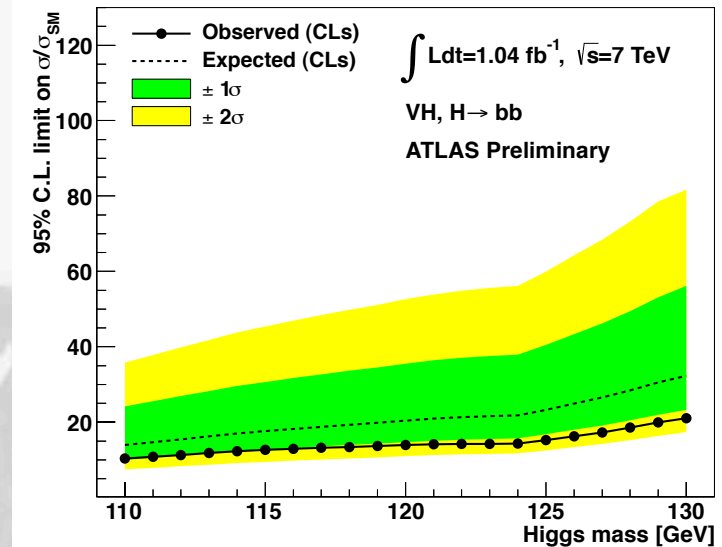


Backup Slides



General Impressions

- Very good that we presented these results for several reasons:
 - We showed it can be done!... (first time for the LHC) And now we have baseline to build on
 - It was nicely done in several ways – data-driven estimates of worst backgrounds etc
 - We showed that boosted VH is within reach – boosted VH plot got lots of attention! Now we need to deliver on the promise
 - Important to have a cross check for $H \rightarrow \gamma\gamma$
 - Results included in ATLAS SM Higgs combination
- What is missing:
 - Real sensitivity – we're only at 10-15 times the SM
- The way forward:
 - Space for improvement in WH/ZH
 - Include other channels
 - Try to move higher in mass reach (but cannot do much)
 - See next slides...
- Concerns
 - Current results: small screw-up in limits (obs vs exp) needs to be understood
 - Near future: not much time! Waiting to see how much low mass excluded by Tevatron
 - Sociological: need to keep focused on this – need to get activity going again after EPS madness



Post-mortem of WH/ZH results

- M_{bb} resolution is extremely poor
 - Should try to get a peak, but this needs work on jet (and b-jet) energy scale
 - Try to think about this together with jet/ E_T^{miss} people
 - Could we improve other things in jet reco to improve m_{bb} ?
 - In ZH \rightarrow llbb could try to use ll vs bb p_T balance to do in-situ calibration?
- B-tagging systematic uncertainty dominates by far
 - 16% vs 7-9% for JES and \approx 1-2% others
 - Should be possible to improve this, since the error is dominated by the statistics used in b-tagging studies
 - Would improve limits by up to 25-30%
 - Think about this with b-tagging people
- Limits: must get help from roostats experts to understand the difference between expected and observed
- WH cuts on exactly 2 jets
 - A lot of signal is lost there – can it be improved?
- WH backgrounds:
 - Top and W+jets background estimate using simultaneous template fit to m_{bb} sidebands (<80GeV and 140-250GeV)
 - Probably should try to also constrain jet energy scale from this fit
 - JES changes m_{bb} distribution and could affect normalization of backgrounds
 - In light of H \rightarrow WW results, should move upper sideband to e.g. 160-250GeV – at $m_H=150$ GeV, $\sigma \cdot BR$ already 1/10 of value at 115GeV, but H \rightarrow WW and H \rightarrow bb resolution is very broad
 - Can top background be reduced further?
- ZH background from Z+bb seems irreducible – can it be improved?

WH/ZH analysis plans

- We can still try to improve cut based analysis:
 - Get a m_{bb} peak, improve b-tagging systematics, constrain JES in WH, etc...
 - Reduce top background in WH:
 - Try using looser leptons or extending lepton id to forward region to veto $tt \rightarrow l\nu l\nu bb$
 - Loosen jet η cut (at $|\eta| < 2.5$ now) and maybe p_T cut to veto $tt \rightarrow l\nu jjbb/jjjjjbb$
 - But... must keep pileup and JVF in mind
- Reduce Z+bb background in ZH? Would probably need a clever new variable like $\cos^*\theta$
- Then clearly we should include multivariate methods
 - Used intensively by Tevatron
 - e.g. use NN to target top background – may allow to relax 2-jet cut in WH
 - NN may also help in rejecting Z+bb background in ZH?
 - See if MV method can improve existing b-tagging
- Add more channels!
 - Can something be done with ZH $\rightarrow \nu\nu bb$? Very good channel in Tevatron, but complex and mature analysis
 - Academia Sinica group plans to work on this But trigger is the crucial part
 - Boosted VH is clearly the next thing to push! WH $\rightarrow l\nu bb$ and ZH $\rightarrow llbb$, but also ZH $\rightarrow \nu\nu bb$
 - UCL and Edinburgh working on this – should be enough manpower now, but need to get results soon
 - ttH has been slowly building up in Glasgow – will push for this to happen together with Chris

Technical issues

- ZH benefitted from HSG2 DAOD skims, but WH suffered from painful running on data
- Need to push for WH skims – will follow up with Kostas & Co.
- In contrast to other groups we don't have an error due to LO/NLO on the signal. Need to get NLO signal MC
- Also need to re-do WH samples at 110 and 140 since the current ones were done with a lepton filter by mistake
- Should also other mass points:
- Get 135 for WH and ZH since we have 130 and 140
- Should we try to extend to 150 GeV in light of H->WW results? Almost no sensitivity, but could prove useful later