

$H \rightarrow ZZ \rightarrow llqq$ update

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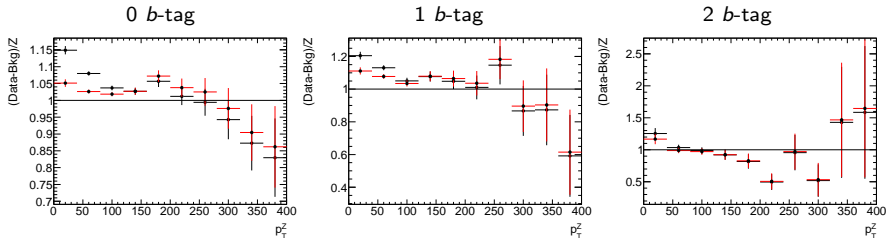
7th August 2013
 $H \rightarrow ZZ \rightarrow llqq$ Meeting

Introduction

- Update on $\Delta\phi_{jj}$ reweight
- $\Delta\phi_{jj}$ cut after p_T^{jet}/p_T^Z cuts
- Look at effect of optimised cuts on distributions
 - Any sculpting?
 - Do we still have sufficient stats. in the SBs?

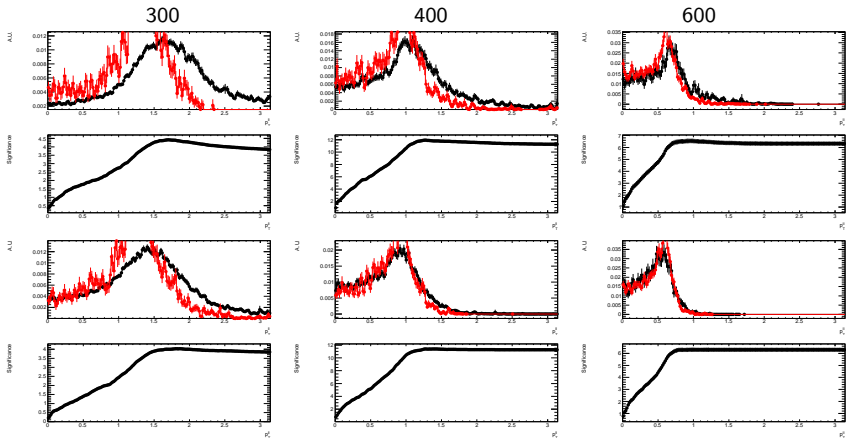
$\Delta\phi_{jj}$ reweight

- Reweight updated to correctly preserve normalisation:
 - $0.8918 + 0.0632\Delta\phi_{jj}$
- Reweight (red) mostly improves low p_T^Z but does help at high p_T^Z too (esp. 0 tag)
 - May still need p_T^Z reweight (but plots before optimised cuts)



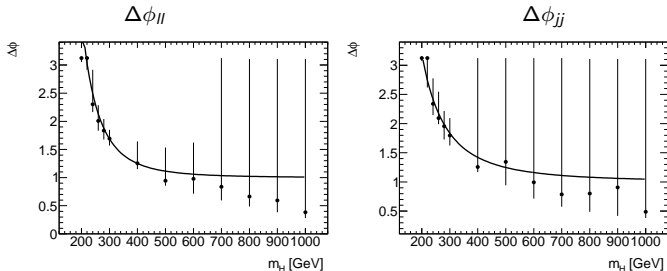
$\Delta\phi$ cut optimisation

- Optimisation of $\Delta\phi_{ll}$ (top) and $\Delta\phi_{jj}$ (bottom) cuts after p_T^{jet}/p_T^Z
 - Some gain at 300-400 GeV from $\Delta\phi_{ll}$, but already gone by 600 GeV
 - Little gain from $\Delta\phi_{jj}$ except <300 GeV



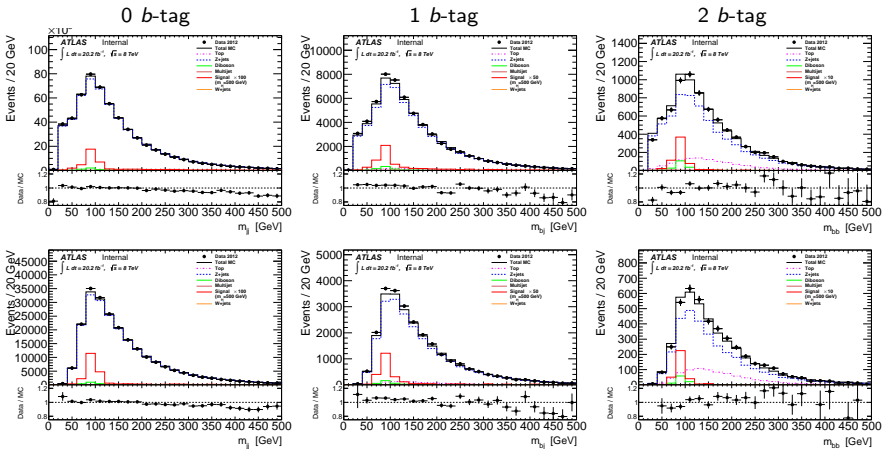
$\Delta\phi$ cut optimisation

- No gain in applying $\Delta\phi_{ll}$ ($\Delta\phi_{jj}$) from 700 (400) GeV
 - Reminder: point is max signif. but errors indicate where signif. same within uncertainty
- Can apply function tending to 1 so no affect at high m_{llqq}



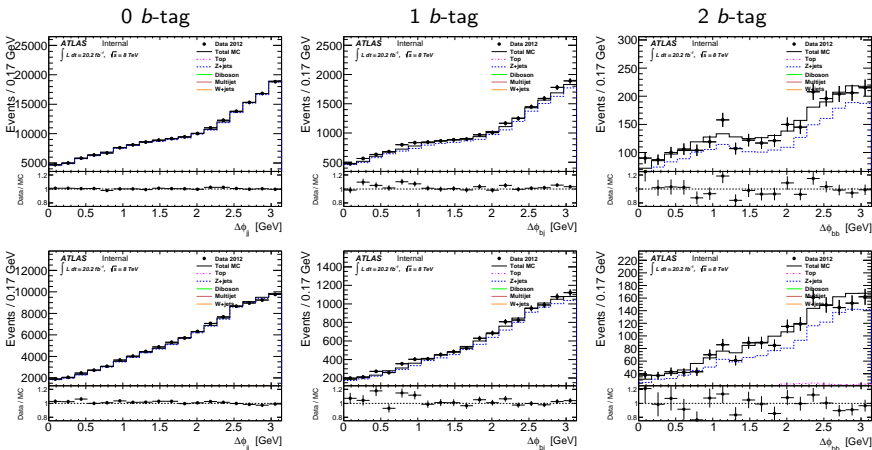
- Can gain from $\Delta\phi_{ll}$ in intermediate m_H .
- To my mind little to be gained from $\Delta\phi_{jj}$ but can apply on both:
 - $9.69513e7 \times 1/m_{llqq}^{3.28031} + 1$ (combined)

- Before (top) and after (bottom) $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts
- Note, we only go up to 150 GeV for SBs



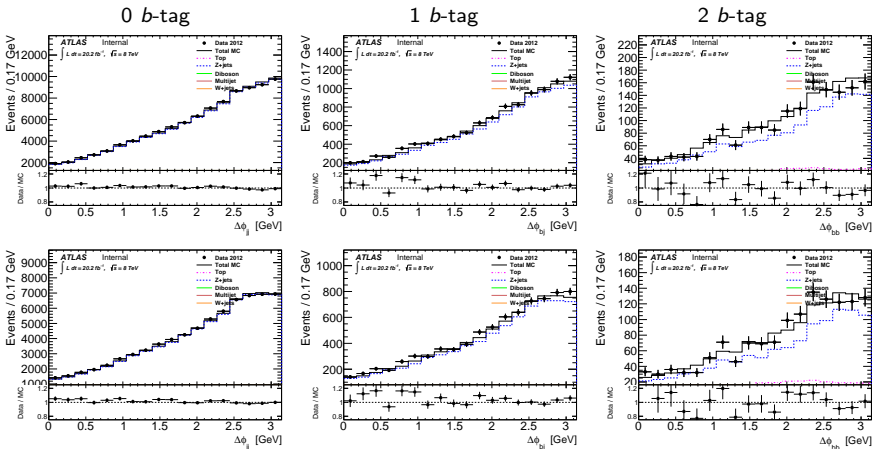
$\Delta\phi_{jj}$ (SB)

- SB before (top) and after (bottom) $p_T^{\text{jet}}/p_T^Z(m_{llqq})$ cuts
 - No significant change to $\Delta\phi_{jj}$ modelling after reweight



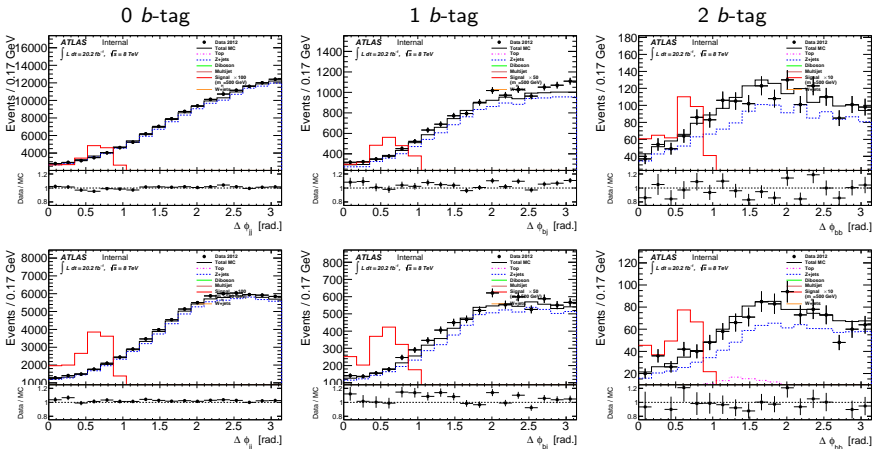
$\Delta\phi_{jj}$ (SB)

- SB before (top) and after (bottom) $\Delta\phi_{jj}(m_{llqq})$ cut
- No significant change to $\Delta\phi_{jj}$ modelling after reweight



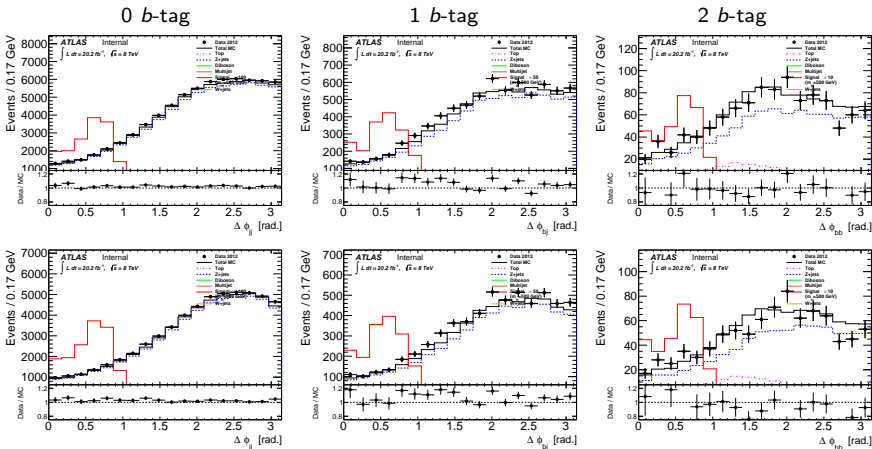
$\Delta\phi_{jj}$ (SR)

- SR before (top) and after (bottom) $p_T^{\text{jet}}/p_T^Z(m_{llqq})$ cuts
 - No significant change to $\Delta\phi_{jj}$ modelling after reweight



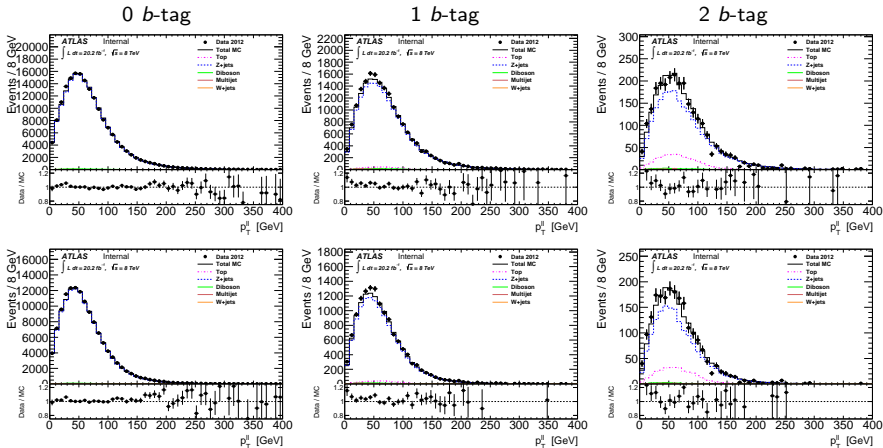
$\Delta\phi_{jj}$ (SR)

- SR before (top) and after (bottom) $\Delta\phi_{jj}(m_{llqq})$ cut
 - No significant change to $\Delta\phi_{jj}$ modelling after reweight



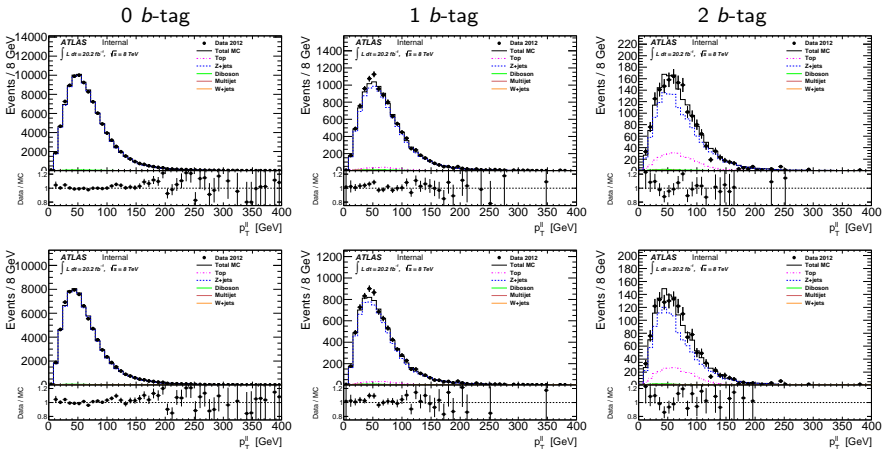
p_T^Z (SB)

- SB before (top) and after (bottom) $p_T^{\text{jet}}(m_{llq\bar{q}})$ cuts



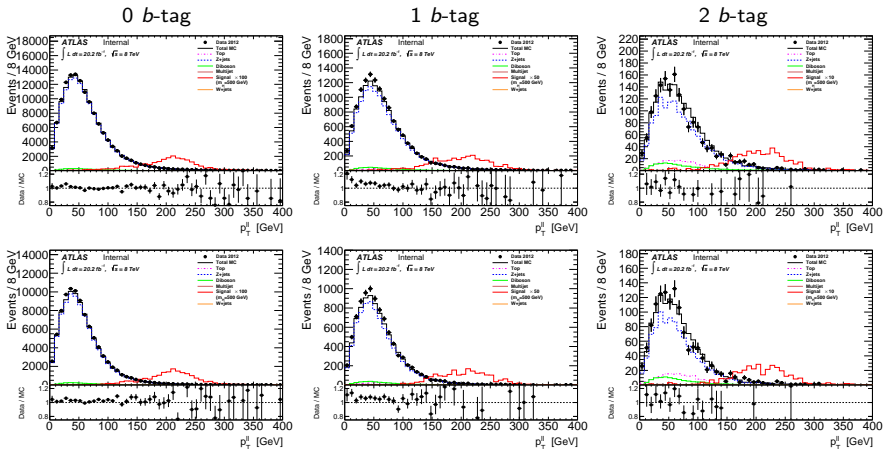
p_T^Z (SB)

- SB after $p_T^Z(m_{llqq})$ (top) and $\Delta\phi_{jj}(m_{llqq})$ (bottom) cuts



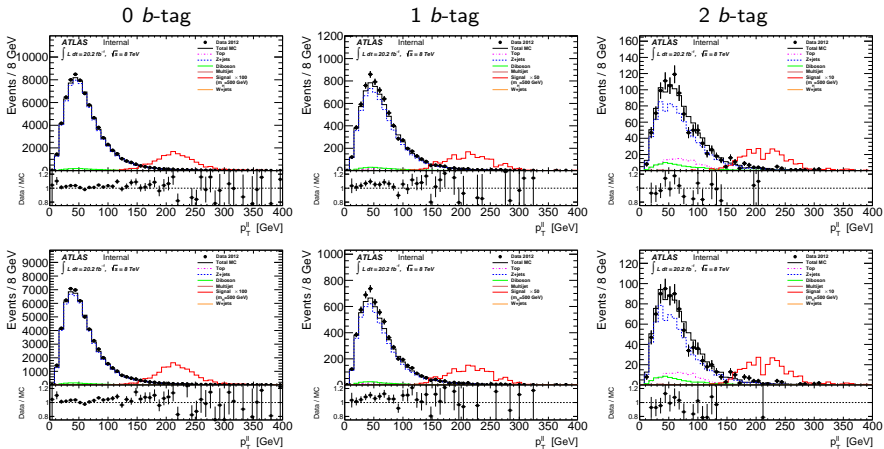
p_T^Z (SR)

- SR before (top) and after (bottom) $p_T^{\text{jet}}(m_{llqq})$ cuts



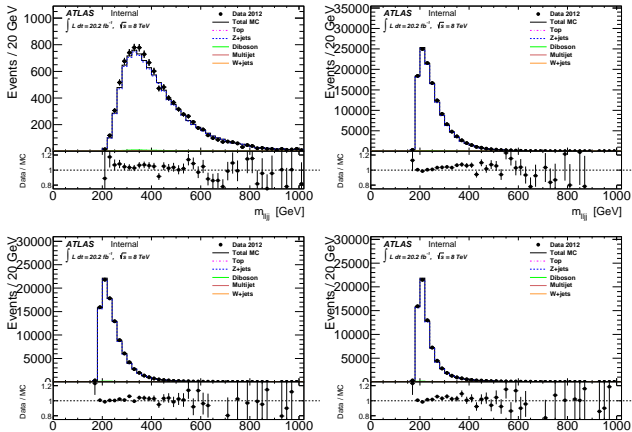
p_T^Z (SR)

- SR after $p_T^Z(m_{llqq})$ (top) and $\Delta\phi_{jj}(m_{llqq})$ (bottom) cuts



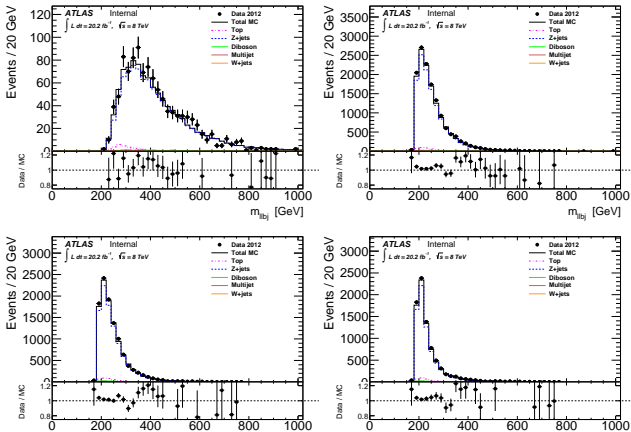
SB m_{lljj} (0 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts
 - Statistics still OK (better then old high m_H)
 - Does p_T^{jet} cut introduce bias?



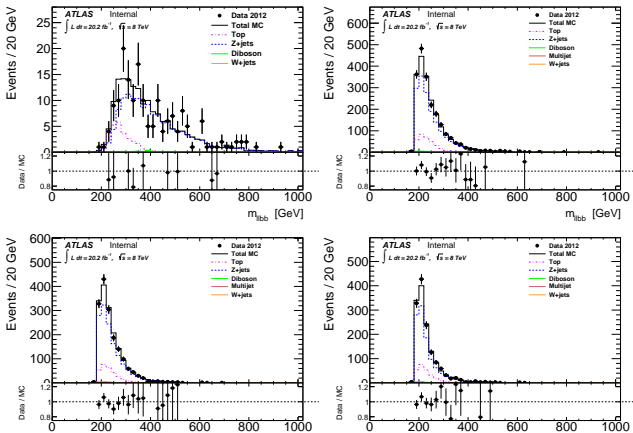
SB m_{lljj} (1 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts
 - Statistics still OK (better then old high m_H)
 - Does p_T^{jet} cut introduce bias?



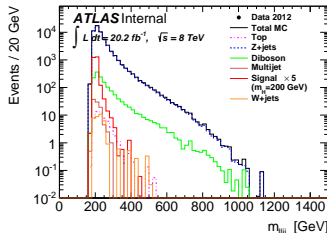
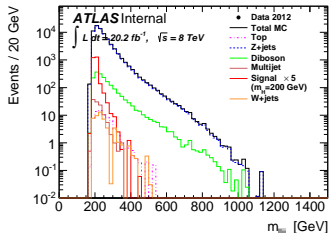
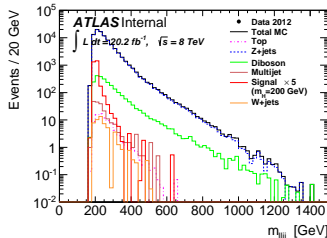
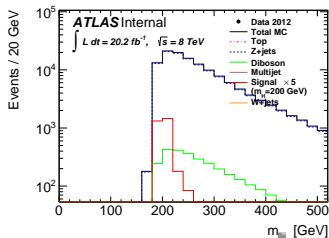
SB m_{lljj} (2 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts
 - Statistics still OK (better then old high m_H)
 - Does p_T^{jet} cut introduce bias?



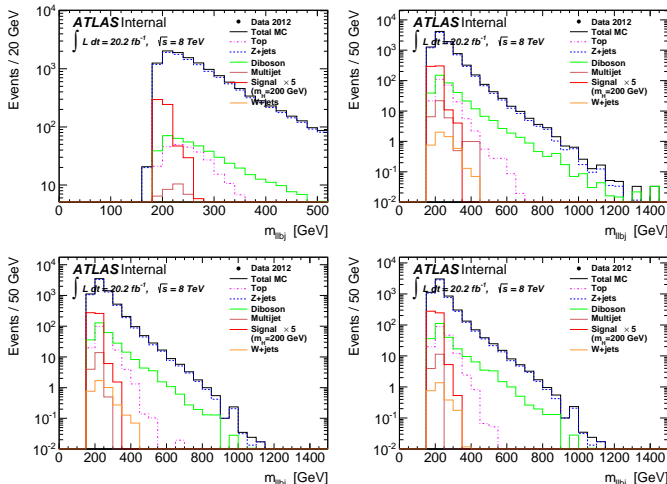
m_{lljj} for $m_H = 200$ GeV (0 tag)

- Baseline cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



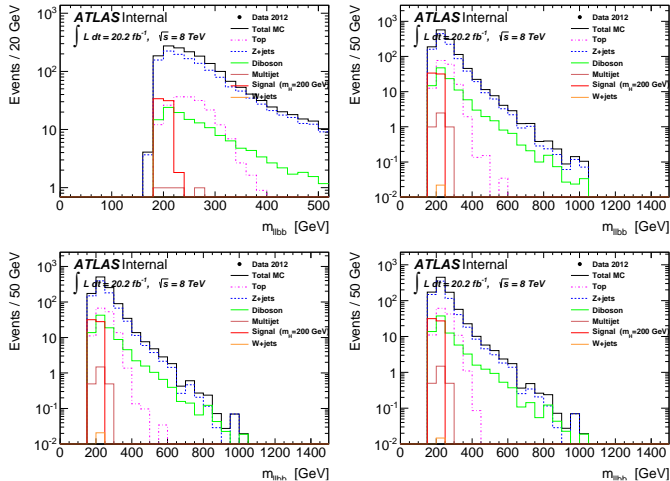
m_{lljj} for $m_H = 200$ GeV (1 tag)

- Baseline cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



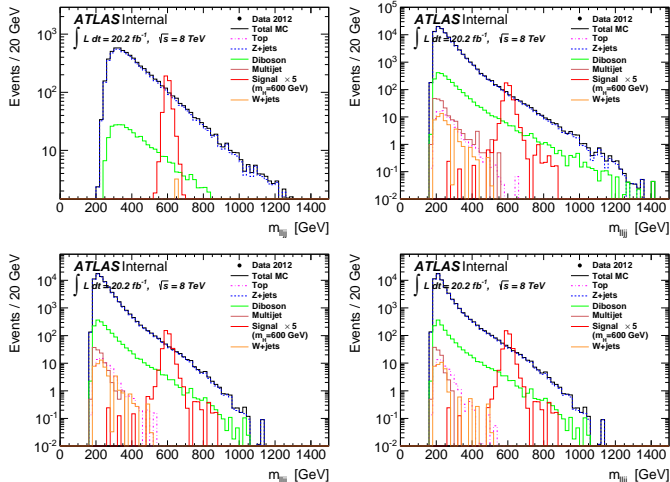
m_{lljj} for $m_H = 200$ GeV (2 tag)

- Baseline cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



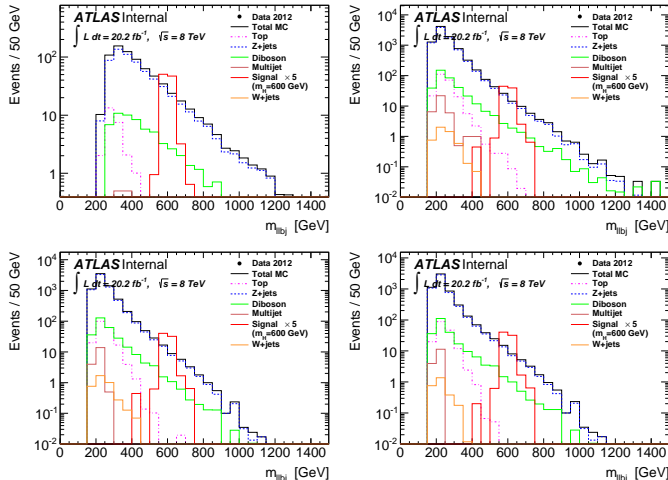
m_{lljj} for $m_H = 600$ GeV (0 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



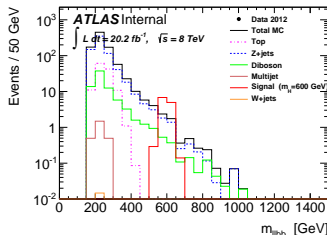
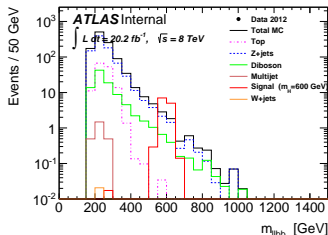
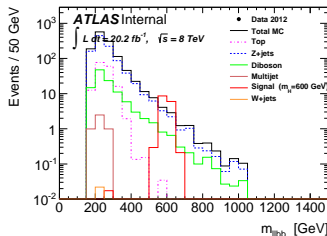
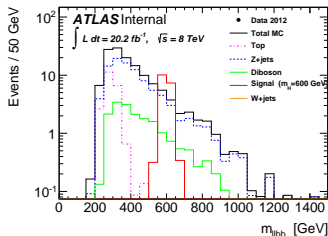
m_{lljj} for $m_H = 600$ GeV (1 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



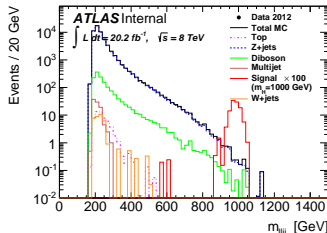
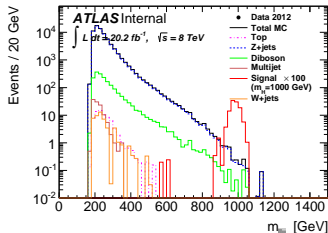
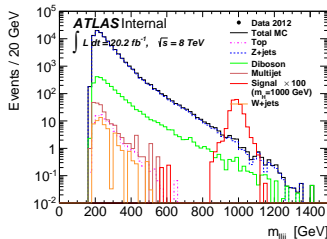
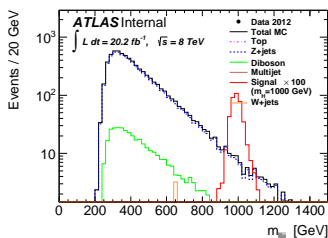
m_{lljj} for $m_H = 600$ GeV (2 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



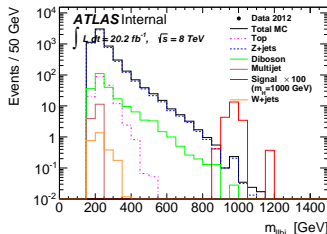
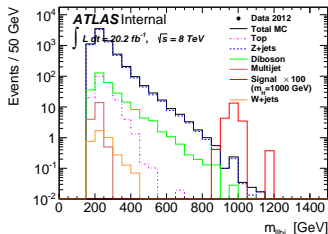
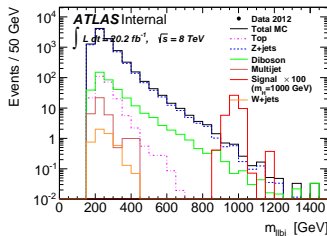
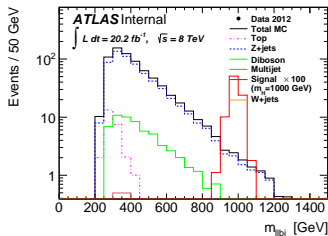
m_{lljj} for $m_H = 1$ TeV (0 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



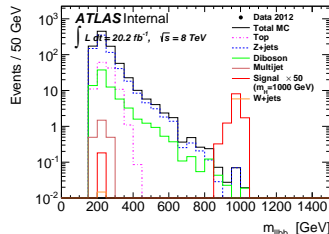
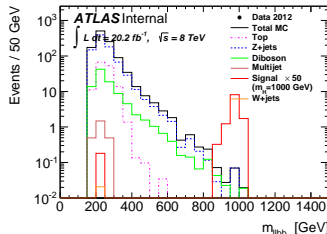
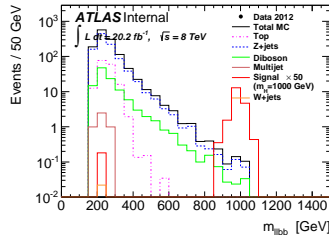
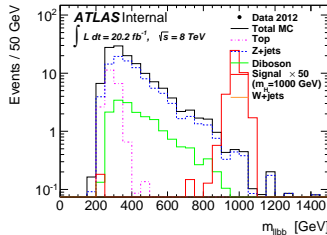
m_{lljj} for $m_H = 1$ TeV (1 tag)

- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



m_{lljj} for $m_H = 1$ TeV (2 tag)

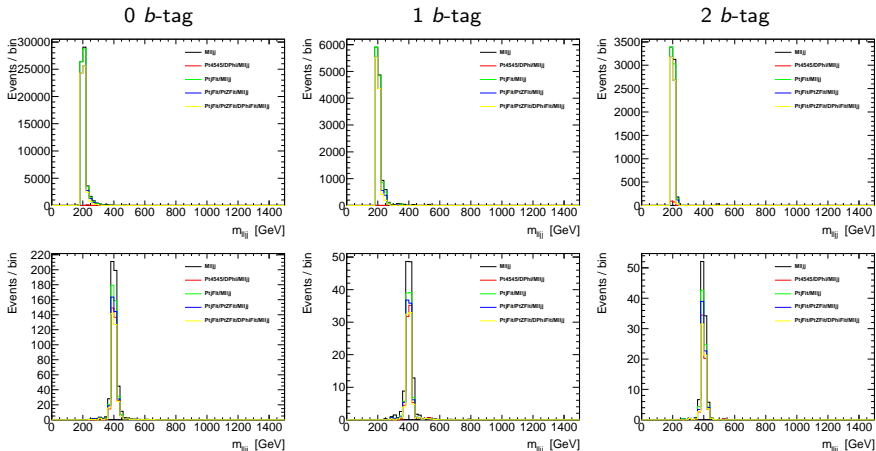
- Old high m_H cuts (TL) and as apply $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts



Signal m_{lljj} (1)

Comparison of signal shape for the various cuts

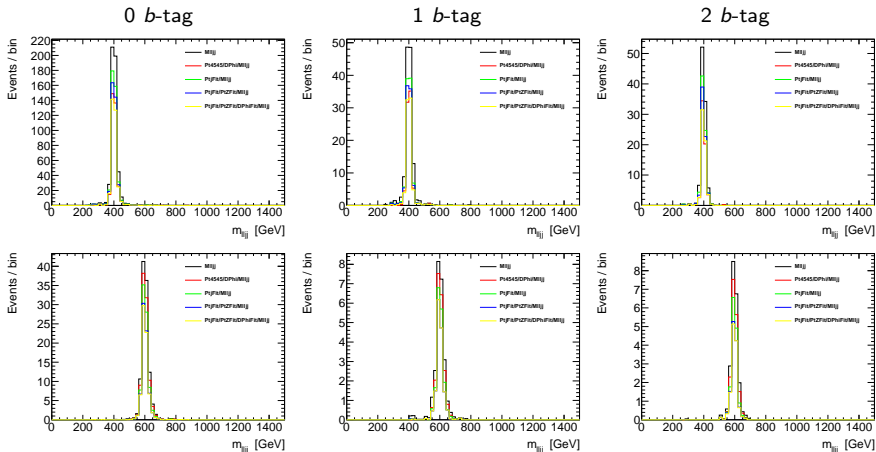
- No obvious signs of sculpting; p_T^{jet} cut maybe seems a little light for 1 TeV



Signal m_{lljj} (2)

Comparison of signal shape for the various cuts

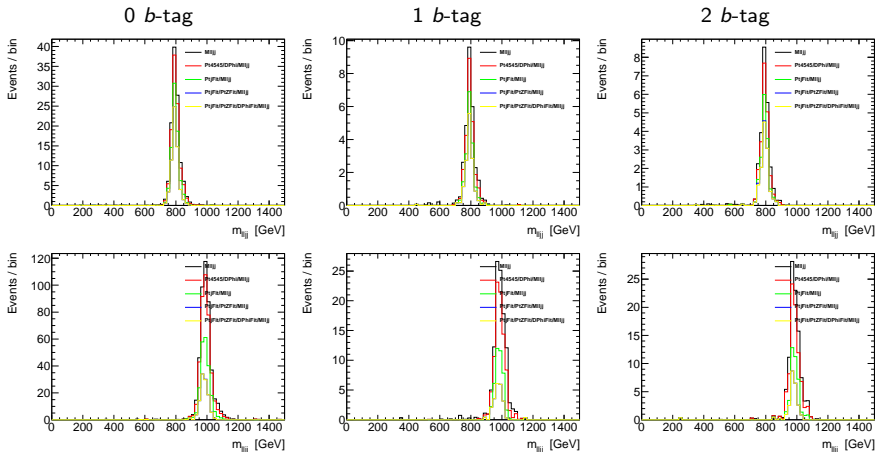
- No obvious signs of sculpting; p_T^{jet} cut maybe seems a little light for 1 TeV



Signal m_{lljj} (3)

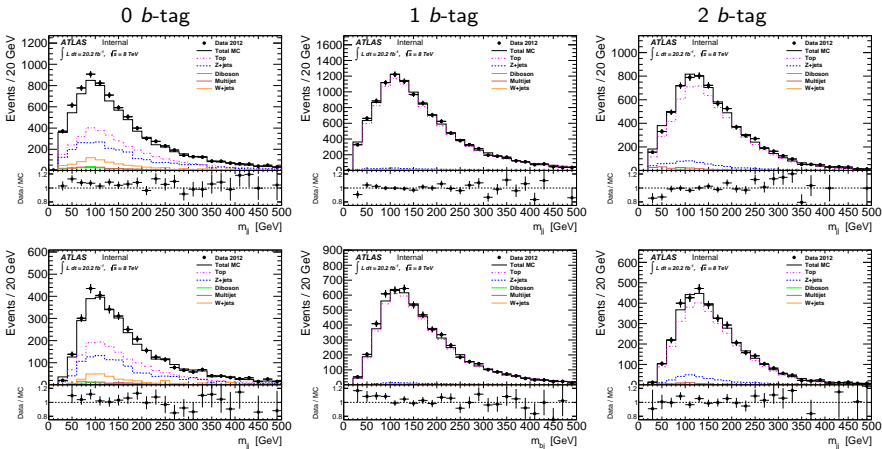
Comparison of signal shape for the various cuts

- No obvious signs of sculpting; p_T^{jet} cut maybe seems a little light for 1 TeV



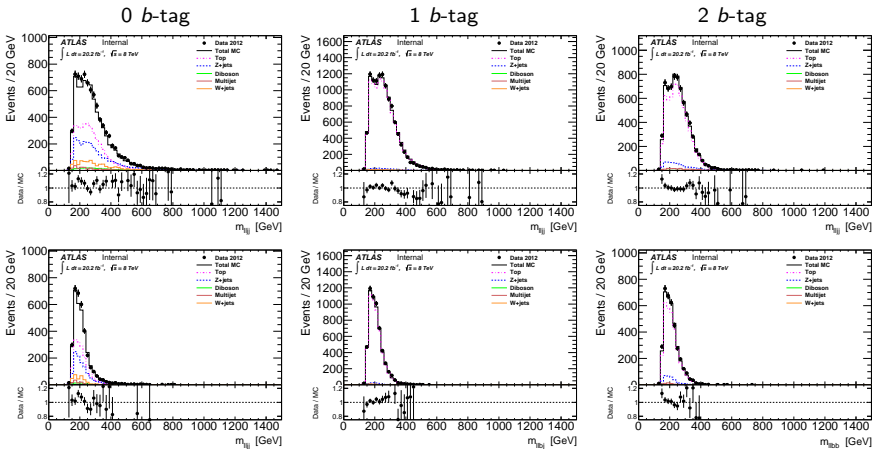
m_{ll} SB: m_{jj}

- Before (top) and after (bottom) $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts
- Reverse E_T^{miss} for 0/1 tag



m_{ll} SB: m_{lljj}

- Before (top) and after (bottom) $p_T^{\text{jet}}/p_T^Z/\Delta\phi(m_{llqq})$ cuts
- Reverse E_T^{miss} for 0/1 tag



Summary

- Agreed last week to update baseline to include (twiki updated):
 - $p_T^{\text{jet}} > 20, 45$ as default cut (rising for higher m_H)
 - $\Delta\phi_{jj}$ reweight ($0.8918 + 0.0632\Delta\phi_{jj}$)
 - $50 < m_{jj} < 70$ and $105 < m_{jj} < 150$ GeV as SBs
- Shall we add $p_T^{\text{jet}}(m_{llqq})$ and $p_T^Z(m_{llqq})$ cuts to this
 - No obvious biases/mismodelling
 - p_T^{jet} maybe a little tight at highest m_H
- Need to double-check $\Delta\phi$ cuts
- Next step: background modelling