Tagging boosted jets
Application to $\bar{t}tH$

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$p_T$ distribution

$\frac{1}{\sigma_{tot}} \frac{d\sigma}{dp_T}$

$ttH$: $p_{T,t}$

$ttH$: $p_{T,H}$

$Wjj$: $p_{T,j}$

$WH$: $p_{T,H}$

$ttH$ more often boosted than $WH$ and $Wjj$
reconstructed \( W \) and \( t \)
Reconstructed events for $m_H = 120$ GeV, 1 fb$^{-1}$

<table>
<thead>
<tr>
<th></th>
<th>signal</th>
<th>$t\bar{t}Z$</th>
<th>$t\bar{t}b\bar{b}$</th>
<th>$t\bar{t}$+jets</th>
</tr>
</thead>
<tbody>
<tr>
<td>after kinem cuts</td>
<td>24.1</td>
<td>6.9</td>
<td>191</td>
<td>4160</td>
</tr>
<tr>
<td>after top tag</td>
<td>10.2</td>
<td>2.9</td>
<td>70.4</td>
<td>1457</td>
</tr>
<tr>
<td>after Higgs tag</td>
<td>3.2</td>
<td>0.47</td>
<td>13.8</td>
<td>121</td>
</tr>
<tr>
<td>with 2 $b$ tags</td>
<td>1.0</td>
<td>0.08</td>
<td>2.3</td>
<td>1.4</td>
</tr>
<tr>
<td>with 3$^\text{rd}$ $b$ tag</td>
<td>0.48</td>
<td>0.03</td>
<td>1.09</td>
<td>0.06</td>
</tr>
</tbody>
</table>
Reconstruccion efficiencies (2/2)

Integrated lumi of 100 fb$^{-1}$:

<table>
<thead>
<tr>
<th>$m_H$ (GeV)</th>
<th>$S$</th>
<th>$B$</th>
<th>$S/B$</th>
<th>$S/\sqrt{B}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>120</td>
<td>380</td>
<td>1/3.2</td>
<td>6.2</td>
</tr>
<tr>
<td>130</td>
<td>51</td>
<td>330</td>
<td>1/6.5</td>
<td>2.8</td>
</tr>
<tr>
<td>115</td>
<td>57</td>
<td>118</td>
<td>1/2.1</td>
<td>5.2</td>
</tr>
<tr>
<td>120</td>
<td>48</td>
<td>115</td>
<td>1/2.4</td>
<td>4.5</td>
</tr>
<tr>
<td>130</td>
<td>29</td>
<td>103</td>
<td>1/3.6</td>
<td>2.9</td>
</tr>
</tbody>
</table>

- better significance with 2 $b$ tags
- better $S/B$ for 3 $b$ tags
- ATLAS: 30 fb$^{-1}$, no systematic uncertainties
  ⇒ significance 1.8-2.2σ, $S/B \sim 1/9$. 
Reconstructed Higgs (including 3 $b$ tags)

\[ \frac{d\sigma}{dm_{b\bar{b}}} \ [fb/5 \ GeV] \]

- $t\bar{t}H$
- $t\bar{t}Z$
- $t\bar{t}jj$
- $t\bar{t}b\bar{b}$

- no UE

- with UE

\[ m_{b\bar{b}} \ [GeV] \]

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- $0$.
- $0.6$
- $0.4$
- $0.2$
- $0.0$

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- $30$
- $60$
- $90$
- $120$
- $150$
- $180$

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- $0$
- $0.0$
- $0.2$
- $0.4$
- $0.6$

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- $180$
- $150$
- $120$
- $90$
- $60$
- $30$