Measurements of the Higgs boson in the WW decay channel with the ATLAS detector

**Introduction**
- Measurements of production rates in the $gg → H$ (ggF) and $qar{q} → H$ (VBF) processes at 125 GeV Higgs boson in the $H → WW^* → ℓνℓν$ channel ($ℓ = e, μ$) combining 4.6 fb$^{-1}$ of data at 7 TeV from 2011 and 20.7 fb$^{-1}$ of data at 8 TeV from 2012 with the ATLAS detector at the LHC.
- The signal significance, strength ($σ⋅ℬ$), and cross-section times branching ratio ($m_r = m_H > 125$ GeV)

**WW Background Estimation**
- The WW background is normalized by control regions in the 0 and 1-jet channels.
- The control regions are defined by removing the $Δφ_{ℓℓ}$ cut and, for 0-jet, $50 < m_{cr} < 160$ GeV, for 1-jet, $m_{cr} > 80$ GeV.

**Z/γ* Background Estimation**
- DF: $Z/γ^* → ℓνℓν$ is normalized in a CR.
- SF: uses $f_{recoil}$, the ratio of recoil momentum and $p_T$, to reduce the DY background.
- SF: the DY in the signal region is estimated using $f_{recoil}$ efficiencies in data in DY rich and DY free regions.

**Results**

<table>
<thead>
<tr>
<th>Year</th>
<th>$m_H = 125$ GeV</th>
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<tbody>
<tr>
<td>2011 + 2012</td>
<td>$μ_{max} = 1.01 ± 0.02$ (stat.) ± 0.19 (theor. syst.) ± 0.12 (exp. syst.) ± 0.04 (lumi.)</td>
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<tr>
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<td>$μ_{ave} = 1.01 ± 0.05$</td>
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<td>Obs. significance of 3.8 s.d.</td>
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<td>Obs. VBF significance of 2.5 s.d.</td>
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Signal strength split by production
- $μ_{ave}$ = 1.66 ± 0.79
- $μ_{ave}$ = 0.82 ± 0.36

8 TeV Cross-section
- $(σ → 3ℓ)_{VBF} = 6.0 ± 1.6$ pb
- $(σ → 3ℓ)_{g(15) → ℓνν}$ = 4.8 ± 0.7 pb

**Top Background Estimation**
- Top in the 0-jet bin is estimated using inclusive-jet top dominated data, multiplied by the simulated fraction of top events without reconstructed jets, corrected by a b-tagged CR.
- Top in the 1-jet bin is normalized in a CR (below) requiring 1 b-tagged jet and dropping the $Δφ_{ℓℓ}$ and $m_{cr}$ requirements.

**W+jets and non-WW Diboson Estimation**
- The W+jets estimate is data-driven, taken from a CR with one lepton failing the ID selection. A fake-factor is used to go from the CR to the SR.
- Other W* backgrounds are estimated by Monte Carlo.

**References**

Jonathan D. Long (University of Michigan), for the ATLAS Collaboration