299. Search for Higgs Pair Production via $\gamma\gamma WW^*(\rightarrow l\nu jj)$ Channel using 13.3 fb^{-1} of pp colision data recorded at $\sqrt{13}$ TeV with the ATLAS Detector

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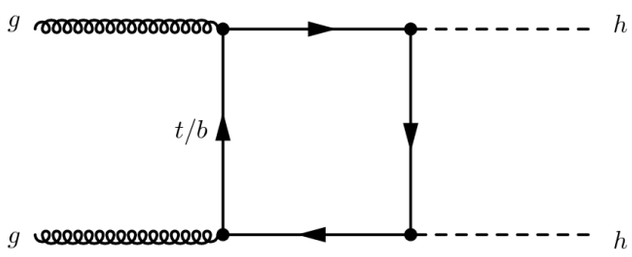
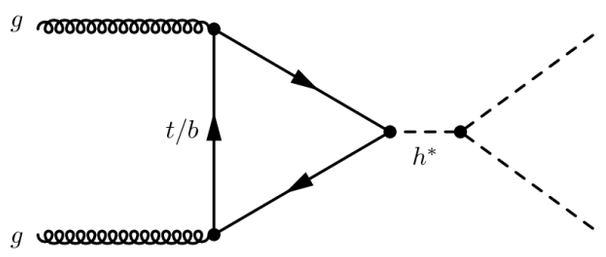
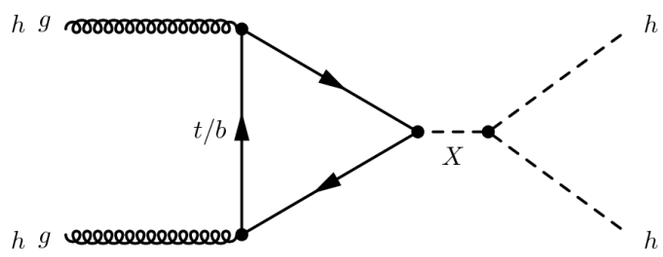
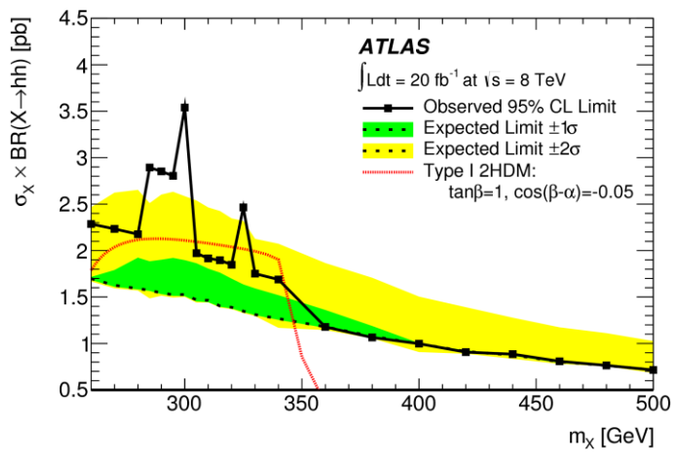






Introduction

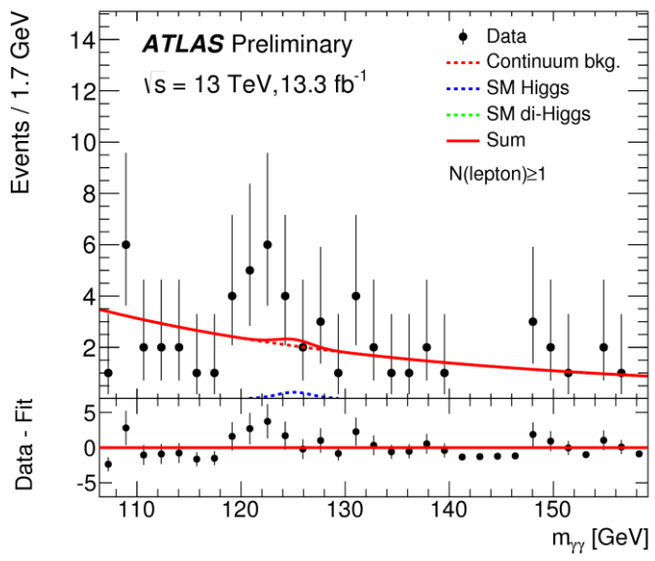
- **Why do we explore this search:** in the Standard Model (SM), Higgs pair production cross section is too small. Nevertheless, several Beyond SM processes (for instance the right top diagram) are able to enhance the production cross section. In run1, some deviation from SM prediction was observed in $hh \rightarrow \gamma\gamma b\bar{b}$ channel at around 300 GeV with the ATLAS detector
- **Why do we choose the $\gamma\gamma WW^*$ channel:** large branch ratio from $h \rightarrow WW^*$ and clean signature from $h \rightarrow \gamma\gamma$
- A search using 13.3 fb^{-1} Run2 data to look for the Higgs pair production

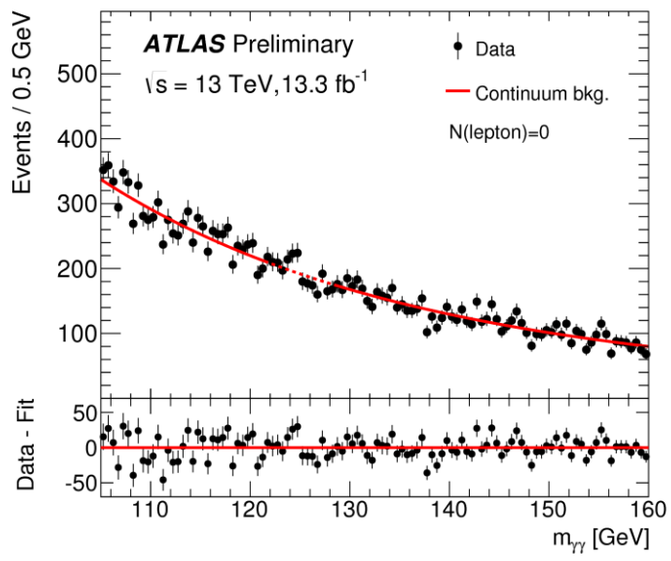


Analysis strategy

- A counting experiment
- Two isolated photons
- $p_T(\gamma_1)\ (p_T(\gamma_2))/\ m_{\gamma_1\gamma_2} > 0.35\ (0.25)$
- $m_{\gamma_1\gamma_2} \in [105, 160]$ GeV
- At least two central jets ($|\eta| < 2.5$)
- Veto events with b-jets
- At least one lepton
- Tight mass window
  - $|m_{\gamma\gamma} - 125.09| < 2\sigma_{\gamma\gamma}, \sigma_{\gamma\gamma} = 1.7$ GeV

- **Back ground estimation**
- All Higgs related processes are estimated from MC using state-of-art calculations for the cross sections.
- Continuum background is estimated by a data-driven method
  - $N_{continuum}^{background} = N_{sideband} \times \frac{\epsilon_{\gamma\gamma}}{1-\epsilon_{\gamma\gamma}}$
  - Obtain the $N_{sideband}$ from left plot
  - Obtain the $\epsilon_{\gamma\gamma}$ from right plot

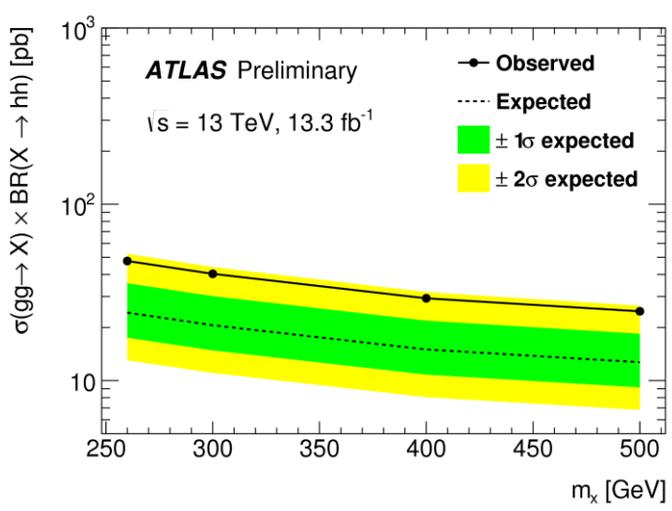




Results

- No significant excess observed at 13.3 fb-1 data.
- The 95% CL upper limit is set on the cross section of Higgs pair production for both non-resonance and resonance searches

Process	Number of events	
Continuum background	7.26	± 1.23
SM single-Higgs	0.616	± 0.115
SM di-Higgs	0.0187	$\pm 0.002\,24$
Observed		15



Reference: ATLAS-CONF-2016-071