

# Search for Contact Interaction in dilepton events from pp collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector

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## 1 Introduction

A wide range of new physics phenomena such as quark/lepton compositeness, extra dimensions and new gauge bosons can produce modifications to the dilepton mass spectra predicted by the standard model (SM). The expected form of these deviations is often either a resonance or an excess in the number of events in the spectra at high mass. ATLAS [1] has searched for such an excess in dilepton events produced in  $\sqrt{s} = 7$  TeV proton-proton collisions at the LHC, interpreting the data in the context of contact interactions (CI) assuming left-left isoscalar model (LLIM) [2],[3],[4].

Under LLIM scheme, the differential cross section for the process  $q\bar{q} \rightarrow \ell^+\ell^-$  can be written as

$$\frac{d\sigma}{dm_{\ell\ell}} = \frac{d\sigma_{DY}}{dm_{\ell\ell}} - \eta_{LL} \frac{F_I(m_{\ell\ell})}{\Lambda^2} + \frac{F_C(m_{\ell\ell})}{\Lambda^4}, \quad (1)$$

where  $m_{\ell\ell}$  is the final-state dilepton mass and  $\eta_{LL}$  is LLIM parameter defining interference type (destructive or constructive).  $\Lambda$  is the contact interaction scale. The expression above includes a SM Drell-Yan (DY) term, as well as DY-CI interference ( $F_I$ ) and pure contact interaction ( $F_C$ ) terms calculated with a coupling  $g^2 = 4\pi$  (see Ref. [4] for the full form of this expression). The analysis uses early 2011 run data amounting to 1.08 and 1.21 fb<sup>-1</sup> of  $pp$  collisions recorded by the ATLAS detector for final states with electron and muon pairs, respectively.

## 2 Results

Events were selected by requiring that they pass the single electron (muon) trigger with a transverse momentum  $p_T$  threshold of 20 (22) GeV. This analysis follows the same event selection as the search for new heavy resonances described in Ref. [5].



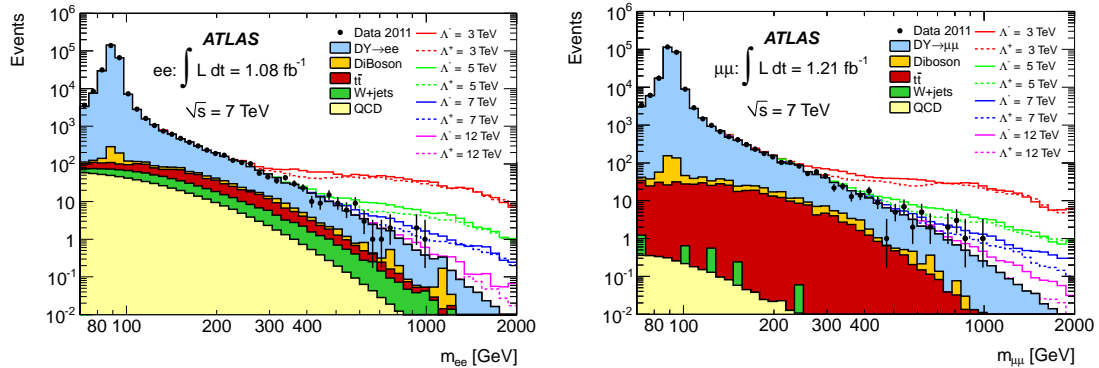


Figure 1: Dielectron (left) and dimuon (right) invariant mass distributions for data (points) and Monte Carlo simulation (histograms) [6]. The open histograms correspond to the distributions expected in the presence of CI with different values of  $\Lambda$  for both constructive (solid) and destructive (dashed) interference.

Figure 1 displays the dielectron and dimuon mass spectra for all selected events with invariant mass greater than 70 GeV along with the SM (including mass dependent NNLO k-factors) and expected CI contributions for four values of  $\Lambda$  for both constructive ( $\Lambda^-$ ) and destructive ( $\Lambda^+$ ) interference.

The observed limits [6] (at 95% CL) with a flat prior of  $1/\Lambda^2$  are  $\Lambda^- > 10.1$  TeV ( $\Lambda^+ > 9.4$  TeV) in the electron channel and  $\Lambda^- > 8.0$  TeV ( $\Lambda^+ > 7.0$  TeV) in the muon channel for constructive (destructive) interference and are obtained using Bayesian Analysis Toolkit (BAT) [7]. The resulting combined limits are  $\Lambda^- > 10.2$  TeV and  $\Lambda^+ > 8.8$  TeV for the same prior.

## References

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