Search for New Physics in Dijet Mass Distributions in 0.81 fb^{-1} of pp Collisions at $\sqrt{s}$ = 7 TeV Measured with the ATLAS Detector

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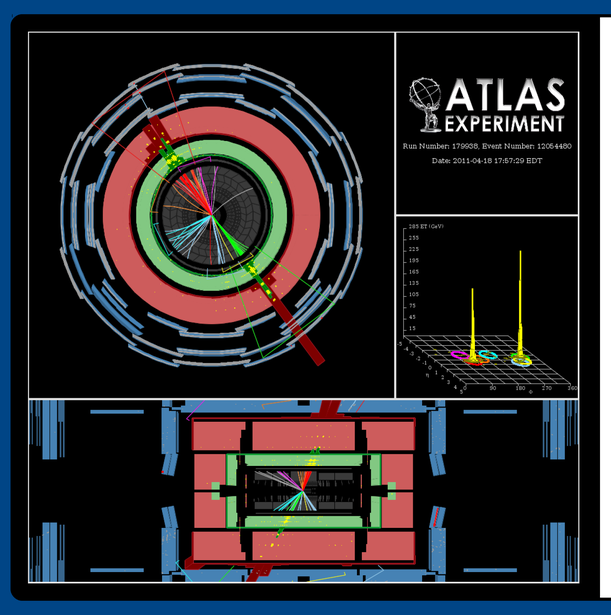
Introduction

- High-energy jet production in pp collisions in Standard Model (SM) described by perturbative QCD
- Dominated by $2 \rightarrow 2$ scattering of parton pairs
- Simplest case: two hard jets (dijet events)
- Here: search for resonances in dijet invariant mass (m_{jj}) spectrum
- Two-fold limit setting:
  - model-dependent: excited quarks (q*), axigluons, color-octet scalars
  - model-independent: Gaussian signal templates

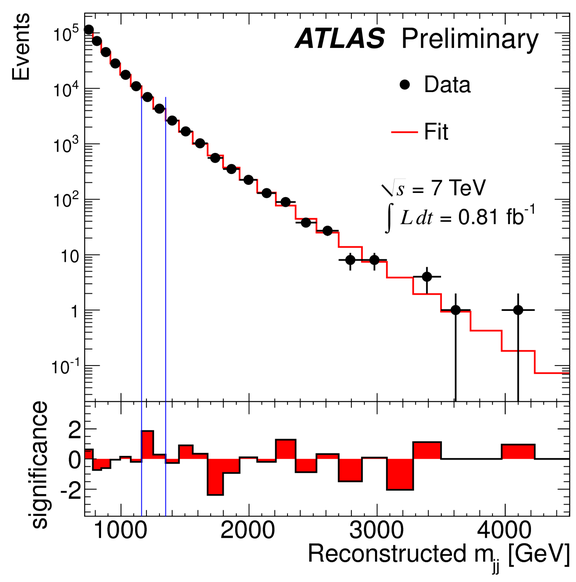


High-energy dijet event candidate

- m_{jj}: 4.04 TeV
- Jet^1 p_T: 1.85 TeV
- Jet^2 p_T: 1.84 TeV

Event selection

- anti-k_T jet algorithm (distance parameter R=0.6)
- Jet trigger with nominal p_T threshold of 180 GeV
- m_{jj} > 717 GeV
- Subleading jet p_T > 30 GeV
- Both leading jets: $|y| < 2.8$ and $|\Delta y| < 1.2$, with jet rapidity y

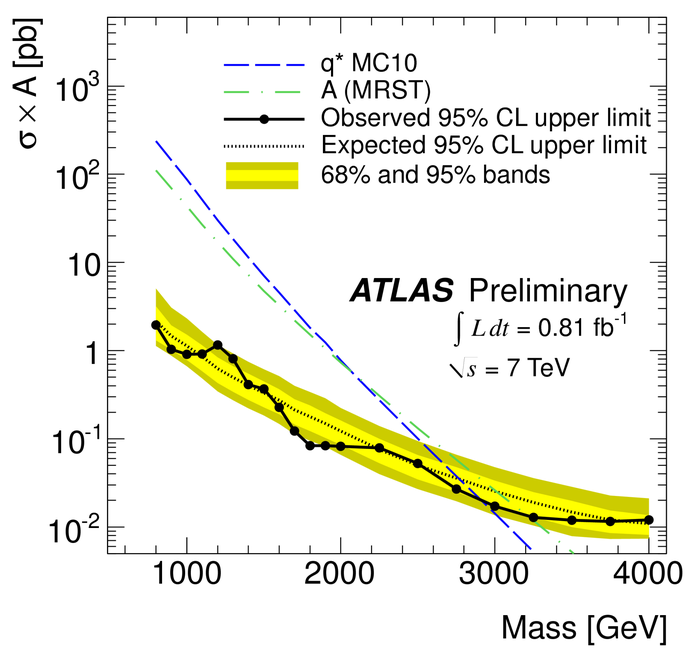


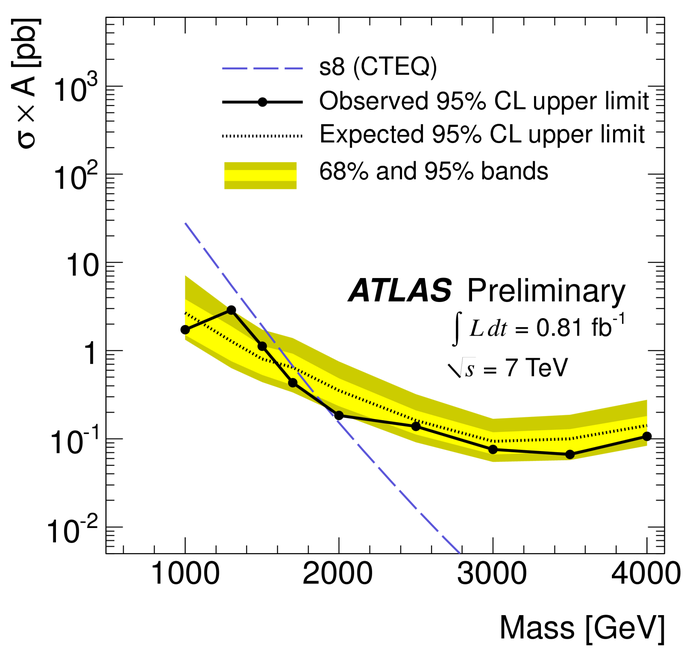
Data comparison to a smooth background

- m_{jj} spectrum fitted to smooth empirical function:
  $f(x) = p_1(1-x)^{p_2} x^{p_3 + p_4 \ln x}$ $\quad x \equiv m_{jj}/\sqrt{s}$
- Statistical tests:
  - χ^2: p-value: 0.35
  - BumpHunter (sensitive to resonances): most significant interval: 1160 - 1350 GeV, p-value: 0.62

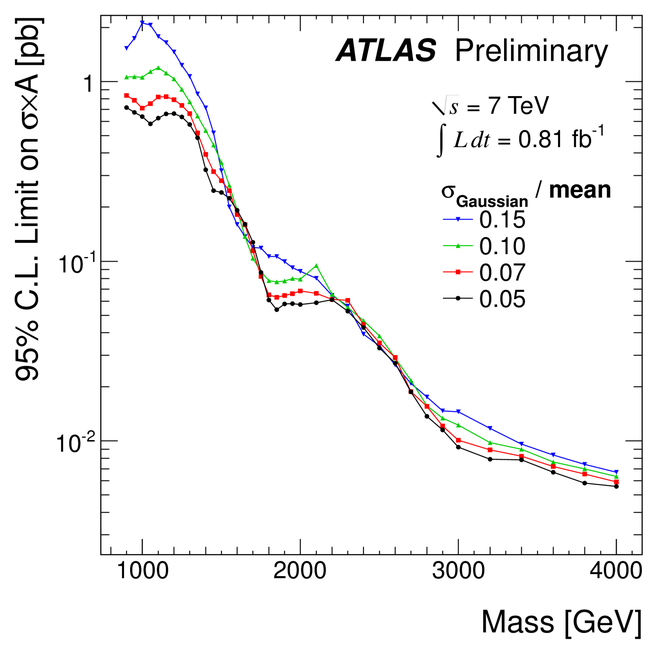
→ Data consistent with SM background, no evidence for new physics

Bayesian 95% credibility upper limits





Model-dependent limits: **excited quarks, axigluons** and **color-octet scalars (s8)**
dominant systematic uncertainties: luminosity, jet energy scale, background fit



Model-independent limits:
Gaussian signal templates, widths between 5% and 15% of the mean

Conclusions

- Limit on color-octet scalar resonances (1.9 TeV) [First time in ATLAS]
- Limits on excited quarks (2.9 TeV) and axigluons (3.2 TeV) [Extension of results from 2010 dataset by about 1 TeV]

Model / Limits	Expected [TeV]	Observed [TeV]
Excited Quark q*	2.77	2.91
Axigluon	3.02	3.21
Color-Octet Scalar	1.71	1.91

References: ATL-COM-CONF-2011-131, New J. Phys. 13 (2011) 053044, arXiv:1101.0390v2