Search for New Resonance in Photon and Jet final state using CMS Data

Jyoti Babbar, Panjab University, India
On behalf of CMS Collaboration

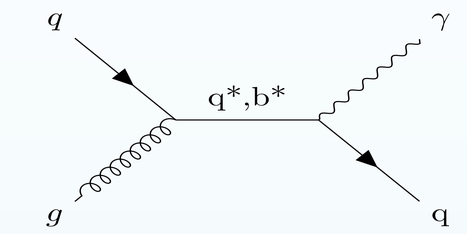
Abstract

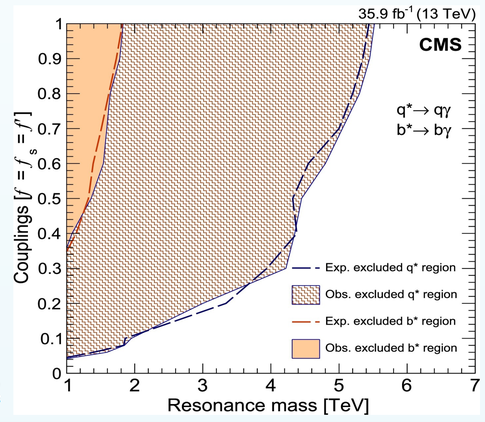
Several theoretical models of beyond the standard model physics predict the production of new resonances at hadron collider experiments. The analysis presented is focused on the search for quantum black holes and the existence of substructure of light and heavy flavor quarks in the photon + jet final state, using proton-proton collisions at a center of mass energy of 13 TeV using the data collected by the CMS detector in the LHC Run-2 period. The analysis sensitivity is interpreted in the parameters of the considered models.

Introduction

- The composite model predicts the substructure of light and heavy flavor quarks resulting in new resonances
- The Quantum Black Hole (QBHs) are defined as the quantum analogs of the black holes as their masses and Schwarzschild radius reaches/approaches quantum gravity scale.
- The LHC phenomenology also predicts the production of QBH at the LHC
- The ADD (with 6 extra dimensions) and RS (with 1 extra dimension) well know models for the QBH are explored
- The CMS data of the year 2016, 2017 and 2018 corresponding to the integrated luminosity of 137 fb^{-1} is analyzed
- Search for substructure of the light and heavy flavor quarks and the production of the QBH's

arxiv:1711.04652

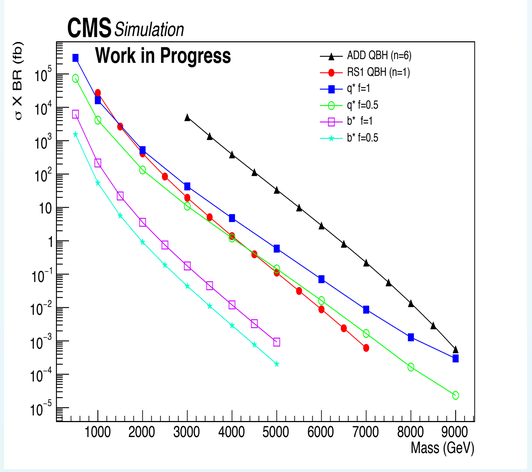


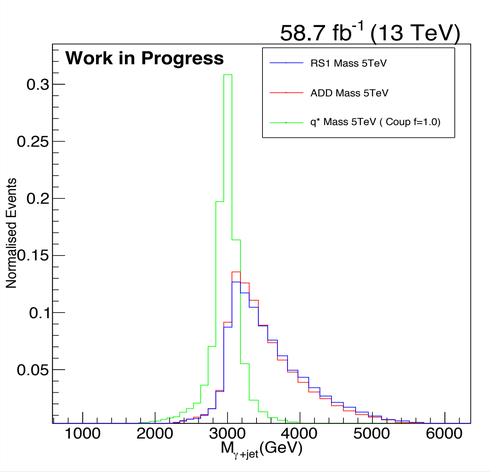


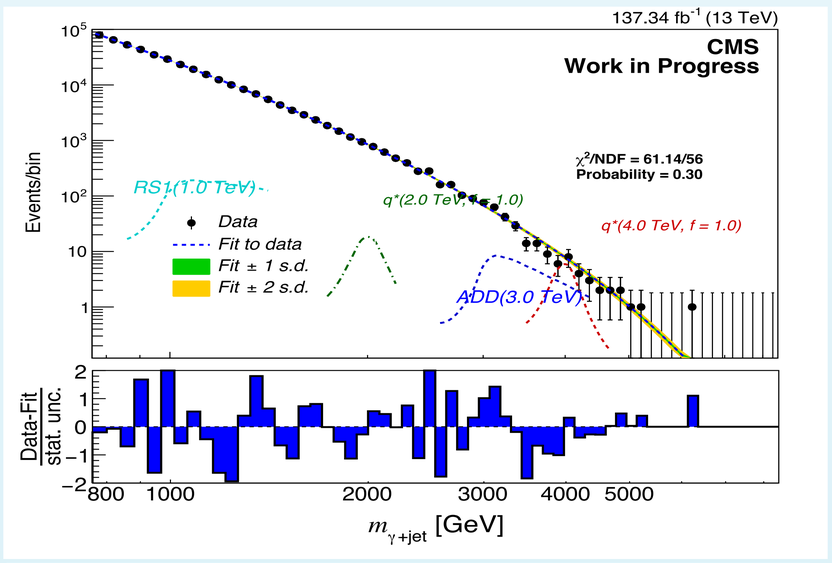
Methodology

- The search for resonance is performed by looking for mass bump hunt in the invariant mass distribution of new resonant particle.
- The photon with pT > 240 GeV and jet pT > 170 GeV are selected, with the $|\Delta\eta| >$ 1.5 between photon and jet
- **The final state particles satisfy the invariant mass threshold > 761 GeV**
- The heavy flavor quarks passes Deep Neural network discriminator
- The main background are the Standard Model (SM) GJet, QCD multi jet and electroweak processes with the major contribution from the SM GJet processes.
- **The invariant mass distribution is fitted with the polynomial function to look for any excess of events**

$$\frac{d\sigma}{dm} = \frac{P_0(1+m/\sqrt{s})^{P_1}}{(m/\sqrt{s})^{P_2+P_3 ln(m/\sqrt{s})}}$$

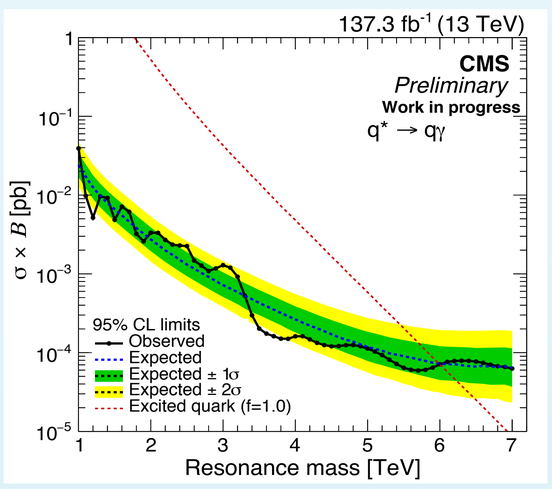


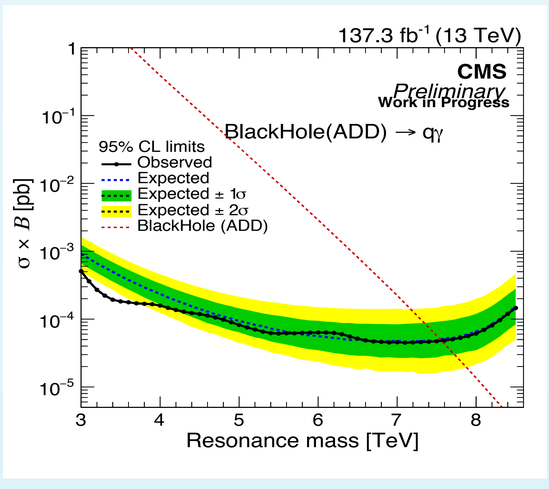


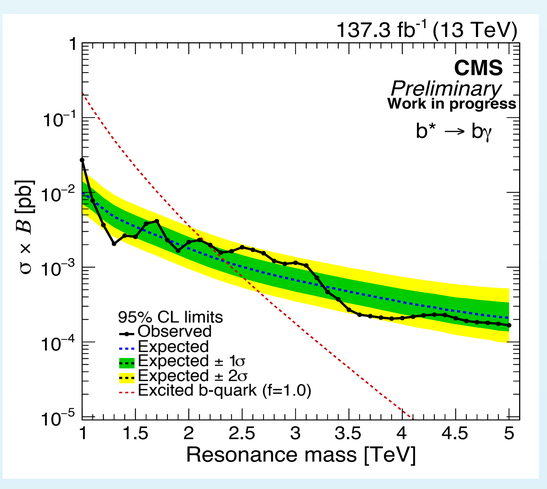


Results

- No signal excess is observed and lower mass exclusion limit are set
- Results are presented in terms of **exclusion limits** at 95% confident level







Acknowledgements

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References

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