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Search for new particles decaying into $Z\gamma$ final states in proton-proton collisions at $\sqrt{s} = 13\,\text{TeV}$

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Summary. — A combination of 13 TeV searches for new high-mass resonances decaying to Z boson and a photon, where the Z decays leptonically as well as hadronically, is presented. These analyses use the Run2 2016 data collected by the CMS detector from pp collisions at $\sqrt{s} = 13\,\text{TeV}$, corresponding to an integrated luminosity of about $13\,\text{fb}^{-1}$.

1. – Analysis description

This contribution describes briefly the results of a search for heavy resonances with a mass between 300 GeV and 3 TeV decaying to $Z\gamma$, with the Z further decaying into leptons (e, μ) or hadrons. The search is based on 13 TeV proton-proton collisions data collected by the CMS experiment in 2016 and presented to the ICHEP conference. The search strategy measures the non-resonant background directly on data, and looks for localized excesses, in the jet-photon or lepton pair-photon invariant-mass spectrum, similarly to what was done in [1]. Searches for resonances decaying to $Z\gamma$ have also been performed at $\sqrt{s} = 13\,\text{TeV}$ with less data [2, 3]. The search is designed to look for a resonance appearing on top of a smooth $Z\gamma$ invariant-mass spectrum obtained with an energetic photon and a Z-candidate reconstructed in the decay mode $Z \rightarrow ll$ (where l stands for electrons or muons) or $Z \rightarrow qq$. In the hadronic Z decay mode, Z bosons coming from massive resonances can be very energetic such that the decay products are merged into a single massive jet. Jet substructure tecniques based on pruned jet mass [4] and NSubjettiness [5] are used to identify massive jets from $Z \rightarrow qq$ decays from hadronization of single quark/gluon jets. The search in the leptonic Z decay mode has the lowest SM background and has higher sensitivity for signal masses below 1 TeV, while for higher masses the hadronic Z decay channel dominates the sensitivity.

The two analyses look for an energetic Z and a γ in the final state and the fit is performed "*à la* dijet" using an empirical function to describe both signal and background.

As shown in fig. 1 and fig. 2, where the invariant-mass spectra of the $Z + \gamma$ system for both analyses are reported, data points are well described by the MC distributions.

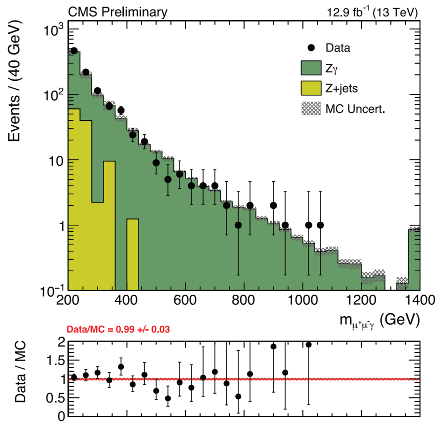

Fig. 1. – $\mu\mu + \gamma$ invariant mass spectrum.

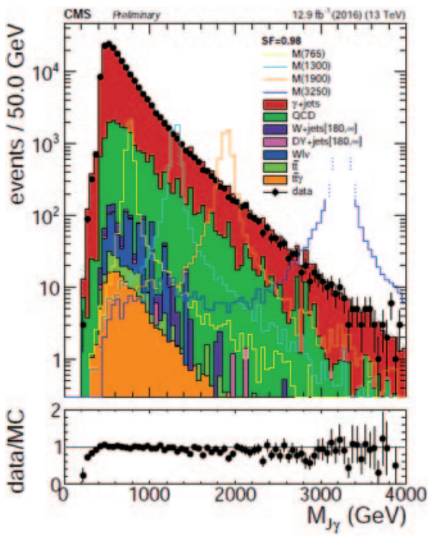

Fig. 2. – AK08 + γ invariant mass spectrum.

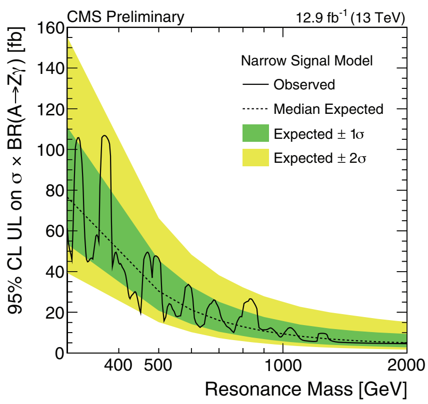

Fig. 3. – Leptonic search limit.

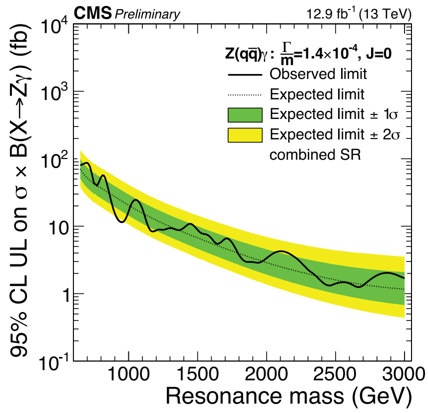

Fig. 4. – Hadronic search limits.

No evidence for new physics is found and upper limits on the cross-section are set, as shown in figs. 3, 4.

REFERENCES

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