

Thesis subject proposal

« Study of the Higgs self-coupling in the $HH \rightarrow bb \gamma \gamma$ reconstructed mode, with CMS »

DESCRIPTION OF THE TOPIC

The limits for the observation of the production of resonant and non-resonant Higgs pair reconstructed into two b-jets and two photons ($HH \rightarrow bb \gamma \gamma$) are published for the RUN-1 LHC data at 8 TeV (Search for two Higgs bosons in final states containing two photons and two bottom quarks in proton-proton collisions at 8 TeV, V. Khachatryan et al. (CMS Collaboration), Phys. Rev. D 94, 052012 (2016)). The channel $HH \rightarrow bb \gamma \gamma$ ongoing reconstruction using all of RUN-2 data at 13 TeV, with the CMS detector will allow the study of the Higgs self coupling, and its coupling to the top quark. The parametrisation of the nonresonant cross section production in the effective field theory allows to search for anomalous couplings and new physics beyond the standard model (see figure).

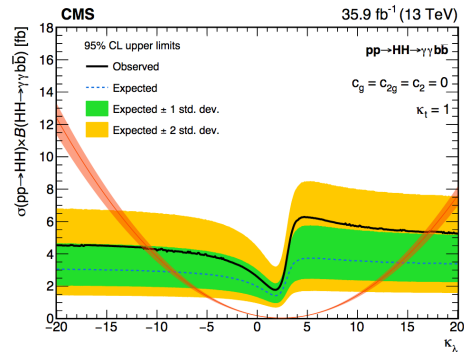


FIG. 10. Observed and expected 95% C.L. upper limits on the product of cross section and the branching fraction $\sigma(pp \rightarrow HH) \mathcal{B}(HH \rightarrow \gamma \gamma b \bar{b})$ for the nonresonant BSM analysis, performed by changing only κ_λ , while keeping all other parameters fixed at the SM predictions.

GROUP/INSTITUTION/SUPERVISION

DESCRIPTION

The candidate will take part of the activity of the CMS-LLR/IN2P3/CNRS research group. The expertise of the latter lies within the electromagnetic calorimeter subdetector trigger system and data analysis, hence its outstanding contribution to the CMS collaboration analysis effort, and in particular to the Higgs discovery via the four leptons channel. The group is also involved in the High Granularity Calorimeter project. The latter will replace the current calorimeters in the forward region.

TASK DESCRIPTION

The candidate will be involved in the analysis of the LHC 13 TeV RUN-2 data. (S)he will also perform Monte Carlo simulations in order to study the signal and control the backgrounds foreseen for the $HH \rightarrow bb \gamma \gamma$ channel in the CMS detector. Contribution to the electromagnetic calorimeter detector performance is also expected to get the candidate acquainted with one of the key instruments in the reconstruction of the events in the studied channel.

EDUCATION AND REQUIRED COMPETENCES

A Master-2 degree in particle physics is required.

COMPÉTENCES ACQUIRED DURING THE THESIS

The candidate will use the analysis framework of the CMS collaboration to which (s)he is expected to contribute. The candidate will be partly working at CERN, where (s)he will collaborate with the other members of the analysis working group among which many PhD students and post-docs, and benefit from the CERN scientific rich environment. The candidate will also work with the LLR-Ecole Polytechnique team that collaborated to the discovery of the Higgs boson.

CONTACTS

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BIBLIO

<https://arxiv.org/pdf/1806.00408v1.pdf>