PANIC2021 Conference



Contribution ID: 265

Type: Poster

Higgs searches in $t\bar{t}\phi$ production at the LHC

Tuesday 7 September 2021 11:14 (1 minute)

A new reconstruction method to explore the low mass region in the associated production of top-quark pairs $(t\bar{t})$ with a generic scalar boson (ϕ) at the LHC is proposed, using dileptonic final states of the $t\bar{t}\phi$ system with $\phi \rightarrow b\bar{b}$. The new method of mass reconstruction shows an improved resolution of at least a factor of two in the low mass region when compared to previous methods, without the loss of sensitivity of previous analyses. It turns out that it also leads to an improvement of the mass reconstruction of the 125 GeV Higgs for the same production process. We use an effective Lagrangian to describe a scalar with a generic Yukawa coupling to the top quarks. A full phenomenological analysis was performed, using Standard Model background and signal events generated with MadGraph5_aMC@NLO and reconstructed using a kinematic fit. The use of CP-sensitive variables allows then to maximize the distinction between CP-even and CP-odd components of the Yukawa couplings. Confidence Levels (CLs) for the exclusion of ϕ bosons with mixed CP (both CP-even and CP-odd components) were determined as a function of the top Yukawa couplings to the ϕ boson. The mass range analysed starts slightly above the Υ mass up to 40 GeV, although the analysis can be used for an arbitrary mass. If no new light scalar is found, exclusion limits at 95% CL for the absolute value of the CPeven and CP-odd Yukawa are derived. Also, we show that CP-searches are virtually impossible for ϕ boson masses above a few hundred GeV in the dileptonic channel, by computing CLs, as a function of luminosity, for the exclusion of different signal hypotheses with scalar and pseudoscalar bosons with masses that range from m = 40 GeV up to 200 GeV. Finally, we analyse how these limits constrain the parameter space of the complex two-Higgs doublet model (C2HDM).

Primary author: CAPUCHA, Rodrigo (Centro de Física Teórica e Computacional, FCUL)
Presenter: CAPUCHA, Rodrigo (Centro de Física Teórica e Computacional, FCUL)
Session Classification: Poster Session I

Track Classification: Energy frontier physics beyond the standard model