A STUDY OF ANGULAR CORRELATIONS IN $\Phi \to ZZ \to e^+e^-\mu^+\mu^-$*

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This article describes a study of a measurement at the CMS detector of the CP-parity of the Higgs boson Φ using angular correlations in the $\Phi \to ZZ \to e^+e^-\mu^+\mu^-$ process. It will be shown that a measurement of the ξ parameter describing a generalized ΦZZ coupling, will be feasible at CMS.

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1. Introduction

The most general ΦVV coupling ($V = W^{\pm}, Z^0$) for spin-0 Higgs Φ could be found in the Ref. [1–4]. In the present analysis we study a simplified version of the coupling with a SM like scalar and a pseudoscalar contributions. We introduce parameter $\xi \in [-\pi/2, \pi/2]$ such that for $\xi = 0$ the coupling is scalar, for $\xi = \pm\pi/2$ is pseudoscalar and for intermediate values has mixed parity.

A detailed description of the analysis can be found in the Ref. [6, 7].

2. Determination of the parameter ξ

The parameter ξ was determined by maximisation of the likelihood function constructed from angular distributions and invariant mass distribution of four leptons. The mass distribution distinguishes between signal and background, while angular ones are used to find value of the ξ parameter. For each value of the parameter ξ and for each Higgs-boson mass[1] we performed 200 pseudo-experiments for the luminosity $\mathcal{L} = 60\,\mathrm{fb}^{-1}$ to reconstruct a value of ξ with its uncertainty (Fig. 1). In the analysis the SM signal x-sec and Br were used as a reference. However, both of

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[1] The analysis was performed for scalar, pseudoscalar and CP-violating states ($\tan\xi = \pm 0.1, \pm 0.4, \pm 1$ and ± 4) and three masses: $M_\Phi = 200$, 300 and 400 GeV/c^2.

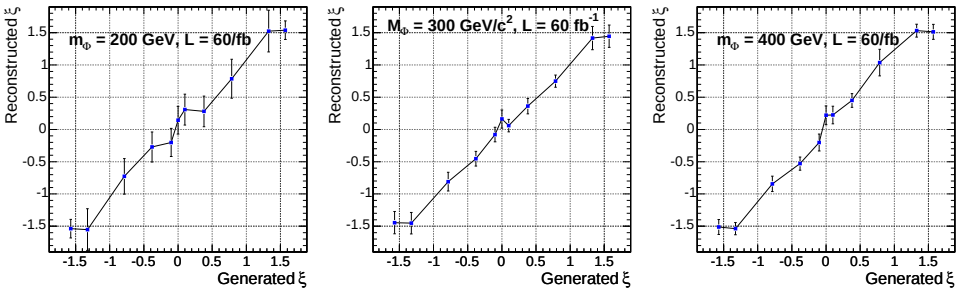

Fig. 1. Reconstructed value of the parameter ξ as function of its generated value. The SM signal cross-section and branching ratio were used.

them may change for other Higgs models. Therefore, an influence of factor $C^2 = (\sigma \times \mathrm{Br})/(\sigma_{\mathrm{SM}} \times \mathrm{Br}_{\mathrm{SM}})$ on the accuracy of the ξ measurement and thus, on possibility to exclude the SM-scalar Higgs was studied (Fig. 2).

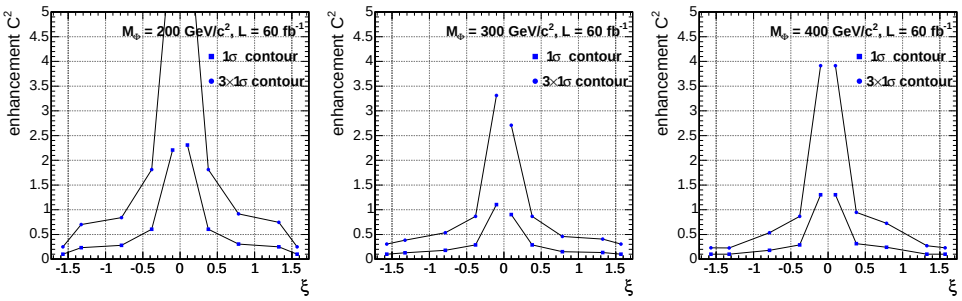

Fig. 2. The minimal value of the factor C^2 needed to exclude the SM scalar Higgs boson at $N\sigma$ level ($N = 1, 3$) as a function of the parameter ξ.

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