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Higgs Width and Couplings at Muon Colliders with Forward Muon Detection

We propose a novel method using the ZZ -fusion channel and forward muon detection at high-energy muon colliders to address the challenge of the Higgs coupling-width degeneracy. Our approach enables inclusive Higgs rate measurement to 0.75% at 10-TeV muon collider, breaking the coupling-width degeneracy. Results indicate the potential to refine Higgs coupling to sub-percent levels and estimate its total width within (-0.41%, +2.1%). Key insights include the effectiveness of forward muon tagging in signal-background separation despite broad recoil mass distribution due to muon energy reconstruction and beam energy spread. The study emphasizes the significance of muon rapidity coverage up to $|\eta(\mu)| < 6$, enhancing measurement precision. Our findings highlight the unique capabilities of high-energy lepton colliders for model-independent Higgs coupling determination and lay the groundwork for future advancements in muon collider technology and Higgs physics research.

Primary authors: LYU, Kunfeng; LI, Peiran (University of Minnesota); LIU, Zhen (University of Minnesota)

Presenter: LI, Peiran (University of Minnesota)

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