Contribution ID: 20

Jet Origin ID and Its Impact on Higgs factory and High Energy frontier

Saturday, 13 July 2024 09:00 (45 minutes)

To enhance the scientific discovery power of high-energy collider experiments, we propose and realize the concept of jet-origin identification that categorizes jets into five quark species (b; c; s; u; d), five corresponding antiquarks, and the gluon.

Using state-of-the-art algorithms and simulated v^-vH , $H \rightarrow jj$

events at 240 GeV center-of-mass energy at the electron-positron Higgs factory, the jet-origin identification simultaneously reaches jet flavor tagging efficiencies ranging from 67% to 92% for bottom, charm, and strange quarks and jet charge flip rates of 7%–24% for all quark species.

We apply the jet-origin identification to Higgs rare and exotic decay measurements at the nominal luminosity of the Circular Electron Positron Collider and conclude that the upper limits on the branching ratios of $H \rightarrow s^-s; u^-u; d^-d$ and $H \rightarrow sb; db; uc; ds$ can be determined to $2 \times 10-4$ to $1 \times 10-3$ at 95% confidence level. The derived upper

limit for $H \rightarrow s^-s$ decay is approximately 3 times the prediction of the standard model. We also discuss its impact on other physics measurements at High energy frontier.

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Session Classification: 人工智能和机器学习的应用

Track Classification: 人工智能和机器学习的应用