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Probing New Physics with Flavor Tagging at FCC-ee

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Leveraging recent advancements in machine learning-based flavor tagging, we develop an optimal analysis for measuring the hadronic cross-section ratios R_b , R_c , and R_s at the FCC-ee during its WW, Zh, and $t\bar{t}$ runs. Our results indicate up to a two-order-of-magnitude improvement in precision, providing an unprecedented test of the SM. Using these observables, along with R_ℓ and R_t , we project sensitivity to flavor non-universal four-fermion (4F) interactions within the SMEFT, contributing both at the tree level and through the renormalization group (RG). We highlight a subtle complementarity with RG-induced effects at the FCC-ee's Z-pole. Our analysis demonstrates significant improvements over the current LEP-II and LHC bounds in probing flavor-conserving 4F operators involving heavy quark flavors and all lepton flavors. As an application, we explore simplified models addressing current B-meson anomalies, demonstrating that FCC-ee can effectively probe the relevant parameter space. Finally, we design optimized search strategies for quark flavor-violating 4F interactions.

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