

τ reconstruction and identification using machine learning technique with Dual-Readout Calorimeter at future e^+e^- colliders

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Dual-readout calorimeter (DRC) has been developed by DREAM and RD52 collaborators for last 20 years. It offers high-quality energy measurement for electromagnetic particles, hadrons and jets which is essential for the successful future lepton collider experiment [1]. CEPC (China) and FCC-ee (CERN) projects, the next e^+e^- colliders for Higgs factory and other electroweak processes, are under discussion by world-wide HEP community as a next generation experiment. The DRC has been proposed as a calorimeter of the IDEA detector concept published in Conceptual Design Reports of both future collider projects [2, 3]. The DRC would meet sufficient performance required by the CEPC and FCC-ee to achieve high precision measurements and indirect new physics searches.

τ lepton has a mass of 1.777 GeV, which is the heaviest lepton in the Standard Model (SM). It approximately decays leptonically with 35% and hadronically with 65%. The typical hadronic τ decays have a signature with one or three charged pions with neutral pions. The τ lepton plays a very important role in the SM as well as Beyond the Standard Model (BSM) searches at the future e^+e^- colliders. Therefore understanding the τ lepton's behavior and developing efficient reconstruction algorithm via the detector subsystems especially the calorimeter detector are essential to

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probe various important physics programs such as Higgs, electroweak, and new BSM phenomena via τ channel.

In this study, we develop the baseline algorithm of the τ reconstruction and identification using the DRC detector information. To improve the efficiency and discriminant power of the algorithm, the machine learning technique will be applied. Particularly, the following items are under consideration:

- baseline reconstruction algorithm for τ leptonic and hadronic decays
- discriminant identification from major backgrounds such as quark or gluon jets, isolated electrons or muons,
- applying deep machine learning technique such as multiclass DNN for efficient identification.

References

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