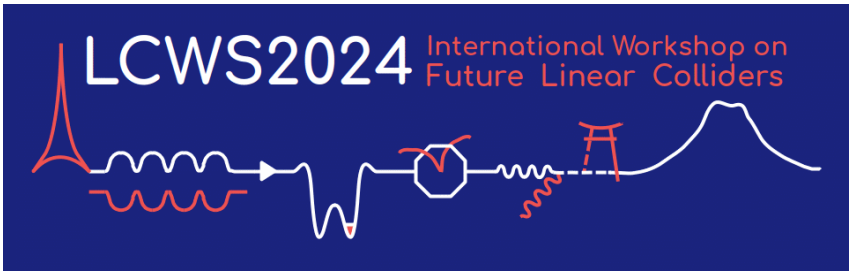

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Application of Particle Transformer to quark flavor tagging in the ILC project

Tuesday 9 July 2024 14:40 (20 minutes)

International Linear Collider (ILC) is a next-generation e+e- linear collider to explore Beyond-Standard-Models by precise measurements of Higgs bosons. Jet flavor tagging plays a vital role in the ILC project by identification of H->bb,cc,gg,ss to measure Higgs coupling constants and of HH->bbbb and bbWW which are the main channels to measure the Higgs self-coupling constant.
Jet Flavor Tagging relies on a large amount of jet information such as particle momenta, energies, and impact parameters, obtained from trajectories of particles within a jet. Since jet flavor tagging is a classification task based on massive amounts of information, machine learning techniques have been utilized for faster and more efficient analysis for the last several decades.
In recent years, a novel machine learning architecture from natural language processing called Transformer has been developed, and it has been showing state-of-the-art performances in multiple fields. Particle Transformer (ParT) is a software that applies the Transformer architecture to jet analysis, including jet flavor tagging. In this study, we apply ParT to ILD full simulation data to improve the efficiency of jet flavor tagging.
Our research focused on evaluating the performance of ParT compared to the previously used flavor tagging software, LCFIPlus, and optimizing network architectures and input parameters. Specifically, we verified performance stability through multiple training runs, assessed the performance when independently embedding charged particles and neutral particles, and evaluated the dependence on data size and number of learnable parameters. We will also report on the status of performance study of strange tagging using ParT with ILD full simulation, which can be applied on analysis of Higgs-strange coupling.

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