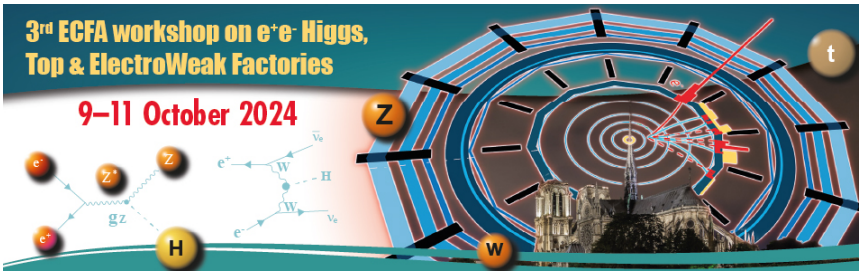

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Jet Flavour Tagging at FCC-ee with a Transformer-based Neural Network: DeepJetTransformer

Thursday 10 October 2024 15:55 (20 minutes)

Jet flavour tagging is crucial in experimental high-energy physics. A tagging algorithm, DeepJetTransformer, is presented, which exploits a transformer-based neural network that is substantially faster to train.

The DeepJetTransformer network uses information from particle flow-style objects and secondary vertex reconstruction as is standard for b- and c-jet identification supplemented by additional information, such as reconstructed V^0s and $K^{\pm}/\pi^{\pm}$ discrimination, typically not included in tagging algorithms at the LHC. The model is trained as a multiclassifier to identify all quark flavours separately and performs excellently in identifying b- and c-jets. An s-tagging efficiency of 40% can be achieved with a 10% ud-jet background efficiency. The impact of including V^0s and $K^{\pm}/\pi^{\pm}$ discrimination is presented.

The network is applied on exclusive $Z \to q\bar{q}$ samples to examine the physics potential and is shown to isolate $Z \to s\bar{s}$ events. Assuming all other backgrounds can be efficiently rejected, a 5σ discovery significance for $Z \to s\bar{s}$ can be achieved with an integrated luminosity of 60 nb^{-1}, corresponding to less than a second of the FCC-ee run plan at the Z resonance.

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