Charged Hadron Identification with dE/dx and Time-of-Flight at Future Higgs Factories
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**Specific Energy Loss dE/dx**

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**dE/dx Example: Had. W-decay Separation**

Separate $W \rightarrow d+u$ from $W \rightarrow s+c$ via abundance and momentum of kaons vs. pions, compare to default flavour tag. Helps determination of CKM matrix, in particular $V_{cs}$.

**ECal**

Designed for Particle Flow

Momentum resolution:

$$\sigma_{1/pt} = 2 \times 10^{-5} \text{ GeV}^{-1}$$

Jet energy resolution:

$$\sigma_{E, \text{jet}} < 3.5\% \text{ over 100 GeV}$$

TOF Example: Kaon Mass

Separate $W \rightarrow d+u$ from $W \rightarrow s+c$ via abundance and momentum of kaons vs. pions, compare to default flavour tag. Helps determination of CKM matrix, in particular $V_{cs}$.

**TOF Example: Kaon Mass**

Translate $\beta$ into mass, use dE/dx to reduce background, fit mass. ILC 2 $ab^{-1}$ @500 GeV gives statist. precision of 10 keV, better than current PDG uncert. of 13 keV.

**Time-of-Flight**

Measure timing from IP to ECAL $\rightarrow$ velocity in $\beta$. ECAL time: average of 10 hits closest to track. Get separation power, covers dE/dx blind spots.

**TOF: Ongoing Development**

Novel approaches for TOF estimator:

- fit the propagation velocity,
- calibrate wrt. number of hits in showers, assess $p$ at IP or EP.

**References**


B. Dudar e.a.: Prospects of fast timing […], arXiv:2105.12495