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**Introduction**

A key physics topic anticipated at electron-positron colliders is the detailed investigation of Electroweak (EW) symmetry breaking. There are theories beyond the standard model that explain this mechanism, which requires modification in fermion coupling to weak bosons. ILC can play a central role in such investigation, as it can measure its coupling with higher precision than ever before.

**Theory**

**Differential Cross Section**

The differential cross section of $e^+e^- \rightarrow f\bar{f}$ can play a central role in such investigation, as it can measure its coupling with higher precision than ever before.

\[
\frac{d\sigma}{d\cos \theta} = \frac{1}{\pi} \left[ \phi_f(1-\mathcal{P}_f) + \cos^2 \theta \right] + 2i\sigma_f - \mathcal{P}_f \cos \theta \tag{1}
\]

where $\theta$: The production angle of the fermion $\phi_f$: Total cross section of $e^+e^- \rightarrow f\bar{f}$ $\mathcal{P}_f$: Electron beam helicity (Left: negative; Right: positive) Asymmetry parameters $\sigma_f$ are defined as:

\[
\sigma_f = \frac{\eta_f}{\eta_f + \sigma_f} \frac{d\sigma}{d\cos \theta} \tag{2}
\]

with $\eta_f, \eta_f$ being vector and axial vector coupling constants, respectively.

**ILC & ILC**

**International Linear Collider (ILC)**

- Center of mass energy: 250 GeV, 500 GeV, 1 TeV (to be extended)
- Well defined initial states with controllable beam polarization (L80%, R30%)
- Clean events with less backgrounds compared to hadron colliders

**TPC**

The time projection chamber (TPC) is the central detector in ILC.

- When a charged particle crosses the chamber, the ionized gas will create a thread of electrons which drift to the TPC endplate.
- The time and charge of each hit are recorded.
- From these, the track parameters and ionization energy loss (dEdx) can be measured.

**Process**

The analysis focuses on $e^+e^- \rightarrow s\bar{s}$ production at high effective centre-of-mass energy.

- $E_{CM} = 250$ GeV
- Integrated Luminosity $20 fb^{-1}$
- Full Geant4 simulation of ILC.

**Results for $e^+e^- \rightarrow s\bar{s}$**

Figure 7 Schematic diagram of s\bar{s} production after its hadronization. Neutral kaons are being ignored for the time being. In reality, these jets will include mixture of pions and proton even in the pure s\bar{s} events.

**Particle ID**

dEdx vs track momentum can be approximated by the Bethe-Bloch formula, which is unique to different particles.

\[
\frac{d\sigma}{dE/dx} = \frac{\alpha^2}{E_{cm}} \frac{1}{1 + (E_{cm}/\Gamma_{B})^2} \frac{1}{(1 + \cos^2 \theta)^2} \tag{3}
\]

**Conclusion & Outlook**

**Conclusion**

Reconstruction of strange quark pair charges at ILC for both 250 GeV scenario was examined. Such process requires precise selection in Kaons using dEdx information. For this analysis, we were able to achieve $\sim 85\%$ purity for the kaon identification in pure s\bar{s} samples.

**Outlook**

Prospects include full background samples (u,d,s) and optimization of kaon selection as currently sacrifice efficiencies in exchange of purity.

**References**


On behalf of the ILC Concept Group