CLEO CONF 96-26
ICHEP96 PA05-089

First Measurement of the Ξ_c^0 Decay Asymmetry Parameter in $\Xi_c^0 \to \Xi^- \pi^+$

CLEO Collaboration

(July 23, 1996)

Abstract

Using the CLEO II detector at the Cornell Electron Storage Ring we have measured the Ξ_c^0 decay asymmetry parameter in the decay $\Xi_c^0 \to \Xi^- \pi^+$. We find the preliminary result: $\alpha_{\Xi_c^0} = -0.72^{+0.40+0.28}_{-0.28-0.12}$.

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I. INTRODUCTION

Considerable progress has been made in understanding the interplay between the strong and weak interactions in the weak decays of charm hadrons. This is especially true of charm mesons where extensive experimental data has existed for some time. Charm baryons offer new information for two reasons: firstly, non-factorizable contributions to the decay amplitude are important: W-exchange diagrams can contribute without the helicity suppression that decreases their contribution to pseudoscalar meson decays, and internal W emission is expected to be significant. The relative importance of these effects is believed to be responsible for both the observed lifetime hierarchy of the charm baryons and the relatively shorter lifetime of charm baryons compared to charm mesons. Secondly, parity violation occurs in charm baryon $\frac{1}{2}^+ \to \frac{1}{2}^+ 0$ decays due to the existence of two orbital angular momentum amplitudes of opposite parity. Parity violation is readily observable in these decays due to the interference between the amplitudes and because the decay of the hyperon produced in the charm baryon decay also violates parity. The weak interactions underlying hadronic charm weak decay are straightforward to describe theoretically, but complications arise because the quarks are bound inside hadrons by the strong force. These interactions, which are described by the theory of quantum chromodynamics (QCD), are very difficult to predict using perturbative methods because the strong coupling is large at the typical energies of charm decays. In consequence a variety of models [1] [2] [3] [4] are used to predict both the decay rate and degree of parity violation in the decay. To constrain the models it is important to provide as much experimental information as possible.

In this paper we measure for the first time the degree of parity violation in a singly charmed strange baryon using the decay $\Xi_c^0 \to \Xi^-\pi^+$. The analysis technique is similar to that used in $\Xi^- \to \Lambda\pi^-$ and $\Lambda_c^+ \to \Lambda\pi^+$, both followed by $\Lambda \to p\pi^-$. As these two decays are more familiar we describe them first. In both decays the Λ is produced with a polarization equal to:

$$\mathbf{P_\Lambda} = \frac{(\alpha_B + \hat{\mathbf{\Lambda}} \cdot \mathbf{P_B})\hat{\mathbf{\Lambda}} - \beta_B(\hat{\mathbf{\Lambda}} \times \mathbf{P_B}) - \gamma_B \hat{\mathbf{\Lambda}} \times (\hat{\mathbf{\Lambda}} \times \mathbf{P_B})}{(1 + \alpha_B \hat{\mathbf{\Lambda}} \cdot \mathbf{P_B})} \tag{1}$$

where $\mathbf{P_B}$ is the parent baryon polarization, α_B, β_B and γ_B are the parent baryon asymmetry parameters and $\hat{\Lambda}$ is a unit vector along the Λ momentum in the parent baryon frame [5]. If the parent baryon polarization is unobserved, or if the parent baryon is not polarized, equation (1) reduces to $\mathbf{P_\Lambda} = \alpha_B \hat{\mathbf{\Lambda}}$. The angular distribution of the proton from the decay of the Λ is therefore:

$$\frac{dN}{d\cos\theta_\Lambda} \propto 1 + \alpha_B \alpha_\Lambda \cos\theta_\Lambda \tag{2}$$

where θ_Λ is the angle between the proton momentum vector in the Λ rest frame and $\hat{\Lambda}$, and α_Λ is the Λ decay asymmetry. Since α_Λ is well measured [6] α_B can be determined.

The decay we study in this paper is a three step process: $\Xi_c^0 \to \Xi^-\pi^+$, $\Xi^- \to \Lambda\pi^-$, $\Lambda \to p\pi^-$. The differential rate is given by [7]:

$$\frac{dN}{d\cos\theta_\Xi d\cos\theta_\Lambda} \propto 1 + \alpha_{\Xi_c^0}\alpha_\Xi \cos\theta_\Xi + \alpha_\Lambda(\alpha_\Xi + \alpha_{\Xi_c^0}\cos\theta_\Xi)\cos\theta_\Lambda \tag{3}$$

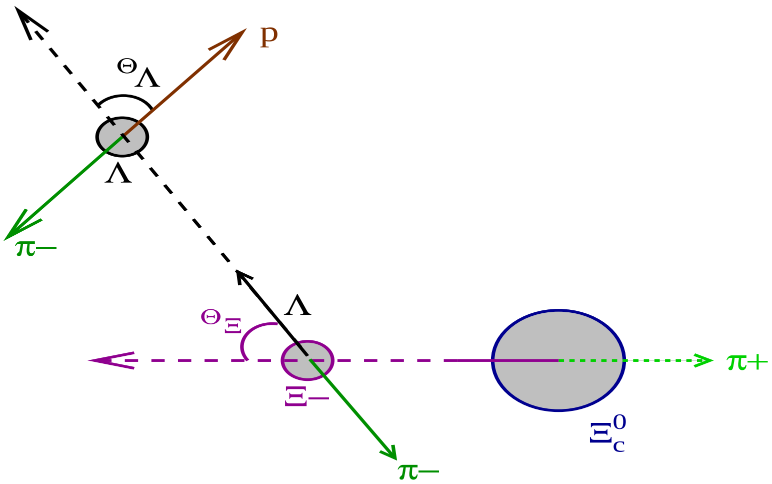

FIG. 1. Definition of the angles θ_Ξ and θ_Λ in $\Xi_c^0 \to \Xi^-\pi^+$. The decay of each particle is drawn in its own rest frame.

where in addition to the terms previously defined: θ_Ξ is the angle between the Λ momentum vector in the Ξ^- rest frame and the Ξ^- direction in the Ξ_c^0 rest frame, see Figure 1 , and $\alpha_\Xi = -0.456 \pm 0.014$ [6].

For this measurement we choose to integrate over $\cos\theta_\Lambda$, then (3) is reduced to:

$$\frac{dN}{d\cos\theta_\Xi} \propto 1 + \alpha_{\Xi_c^0}\alpha_\Xi \cos\theta_\Xi \tag{4}$$

which is analogous to (2) with the substitution of a Ξ^- for the Λ.

In the massless fermion limit the chirality of the weak interaction corresponds to $\alpha = -1$. The interplay between the strong and weak interactions in the weak decay alters the value of α however. The decay asymmetry in $\Lambda_c^+ \to \Lambda\pi^+$ is relatively well measured, [6], [8]. CLEO found $\alpha_{\Lambda_c^+} = -0.94^{+0.21+0.12}_{-0.06-0.06}$ [8], which is remarkably close to the naive V-A expectation. This result had been predicted by HQET in conjunction with the factorization hypothesis [9]. Most pole and quark models [1], [2] also predict large negative values of $\alpha_{\Lambda_c^+}$. For $\Xi_c^0 \to \Xi^-\pi^+$ theoretical predictions cover a larger range: $-1 < \alpha_{\Xi_c^0} < -0.38$ [3] [4].

II. DATA SAMPLE AND EVENT SELECTION

The data sample in this study was collected with the CLEO II detector at the Cornell e^+e^- Storage Ring, CESR, operating at and just below the $\Upsilon(4S)$ resonance. We used a total integrated luminosity of 4.8 fb^{-1} corresponding to approximately 5 million $e^+e^- \to c\bar{c}$ events.

Identification of hadronic particles is achieved by using time-of-flight (TOF) and specific ionization energy loss measurements (dE/dx). By itself, the dE/dx measurement provides 2σ π/K separation up to 0.7 GeV/c. Time-of-flight measurements extend the 2σ π/K separation up to 1.1GeV and 2σ p/K separation up to 1.7 GeV/c. Using the two measurements, we form a joint probability for the particle to be a pion, a kaon or a proton. A charged track is defined to be consistent with a pion (proton) hypothesis if its probability is greater than 0.003. For both pion and protons which enter the drift chambers or the barrel TOF counters, the particle id efficiency, corresponding to the above criteria is about 98 % and nearly independent of the track momentum.

We search for the decay $\Xi_c^0 \to \Xi^-\pi^+$ in $e^+e^- \to c\bar{c}$ events by reconstructing the decay chain $\Xi_c^0 \to \Xi^-\pi^+$, $\Xi^- \to \Lambda\pi^-$, $\Lambda \to p\pi^-$ [1]. Note that CP conservation requires $\alpha_{\Xi_c^0} = -\alpha_{\bar{\Xi}_c^0}$. Since the slope of equation (4) depends on the product $\alpha_{\Xi_c^0}\alpha_{\Xi}$, which has the same sign for particle and anti-particle states, particle and anti-particle distributions can be combined.

III. RECONSTRUCTION OF HYPERONS

The Λ is reconstructed using its decay to $p\pi^-$ with a branching ratio of $(63.9 \pm 0.5)\%$ [6]. To reconstruct the Λ, we use two oppositely charged tracks which originate from a common vertex and interpret the positive and negative charged tracks as a proton and pion respectively. The proton candidate track is required to be consistent with a proton hypothesis. The momentum of the neutral track is calculated by extrapolating the charged track momenta to the secondary vertex. The invariant mass of Λ candidates is required to be within 5.0 MeV/c^2 of the known Λ mass (2.5σ). We reject track combinations which satisfy interpretation as a K_s^0.

The Ξ^- is reconstructed through its decay to $\Lambda\pi^-$ with a branching ratio of $(99.887 \pm 0.035)\%$ [6]. We form Ξ^- candidates by combining each Λ candidate with a negatively charged track consistent with a pion hypothesis. The Ξ^- candidate vertex is formed from the intersection of the Λ momentum vector and the negatively charged track. To obtain the Ξ^- momentum, the momentum of the charged track is recalculated at the new vertex.

We require that the invariant mass of Ξ^- candidates be within 7.5 MeV/c^2 (3σ) of the known Ξ^- mass. We find 10747 ± 130 Ξ^- candidates.

IV. Ξ_c^0 RECONSTRUCTION AND MEASUREMENT OF THE Ξ_c^0 DECAY ANGLE DISTRIBUTION

To reconstruct Ξ_c^0 candidates all Ξ^- candidates are matched to positively charged tracks consistent with a pion hypothesis. Since charm fragmentation is a relatively hard process the Ξ_c^0 spectrum from $e^+e^- \to c\bar{c}$ is also fairly stiff. We therefore use a scaled momentum cut, $x_p > 0.5$ [2] to reduce combinatoric background. This cut also eliminates charmed baryons from decays of B mesons.

Figure 2 shows the invariant mass distribution of all $\Xi^-\pi^+$ combinations corresponding to the Ξ_c^0 candidates found above. The fit is to a double Gaussian and a polynomial distribution, where the double Gaussian shape is fixed from a GEANT [10] based Monte Carlo (MC) simulation of the detector. We require that the invariant mass of Ξ_c^0 candidates be within

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[1] Through out this paper charge conjugate modes are implied

[2] $x_p = \frac{p}{p_{max}} = \frac{p}{\sqrt{E_{beam}^2 - m_{\Xi_c^0}^2}}$

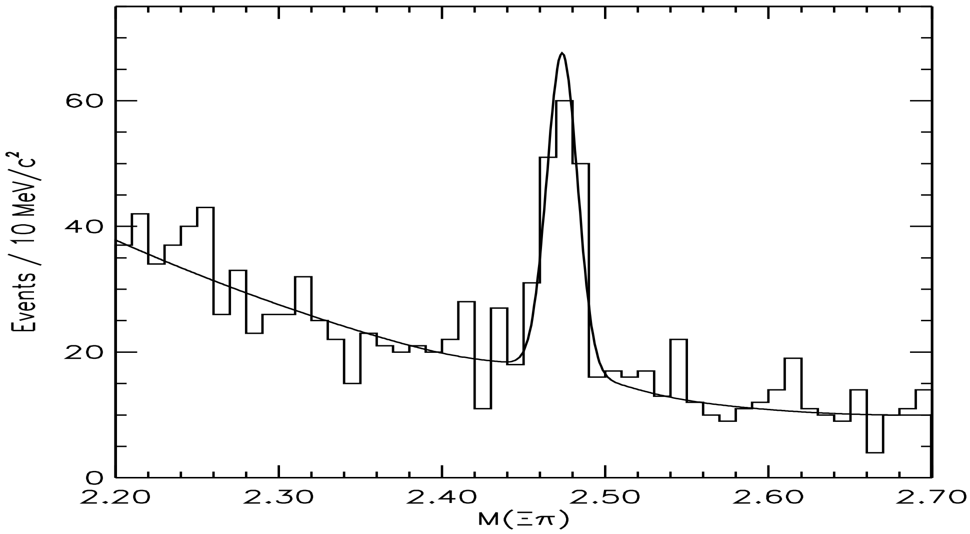

FIG. 2. $\Xi^-\pi^+$ invariant mass distribution

30 MeV/c^2 (3σ) of the known Ξ_c^0 mass. We find 135 ± 15 $\Xi_c^0 \to \Xi^-\pi^+$ candidates. To measure the asymmetry parameter of Ξ_c^0 in $\Xi_c^0 \to \Xi^-\pi^+$, the observable kinematic variable is θ_Ξ, the angle between the direction of the Λ momentum vector in the Ξ^- rest frame and the Ξ^- momentum vector in the Ξ_c^0 rest frame. The Ξ_c^0 4-momentum in the lab frame is obtained from the sum of Ξ^- and π^+ 4-momenta as measured above. Since in general Lorentz transformations do not commute, to preserve the original angular distribution the order of forward Lorentz transforms must follow the original decay order. We first boost all the momentum vectors from the lab frame into the Ξ_c^0 rest frame then into the Ξ^- rest frame.

From MC, the difference between generated and reconstructed values of $\cos\theta_\Xi$ is a double Gaussian distribution offset from zero by +0.029. The resolution in $\cos\theta_\Xi$, defined to be the average of the σ of each Gaussian weighted by the relative area of each Gaussian, is 0.037. The origin of the shift is not understood however it is both smaller than the resolution in this quantity and more than an order of magnitude smaller than the bin size used in the analysis of the signal. The possibility that data may not exhibit the shift observed in the MC is accounted for in the systematic error. The data is divided into 4 $\cos\theta_\Xi$ bins and the $\Xi^-\pi^+$ invariant mass distribution is plotted and shown in Figure 3.

The efficiency is determined from a MC simulation of the signal for a generated value of $\alpha_{\Xi_c^0} = -0.99$. This value of the asymmetry corresponds to the prediction of [3] [4] which is the model that best describes the asymmetry parameter measurements of the Λ_c^+ in $\Lambda_c^+ \to \Lambda\pi^+$ and $\Lambda_c^+ \to \Sigma^+\pi^0$ [8]. The efficiency is weakly dependent on the value of the asymmetry assumed to generate the events, this is taken into account in the systematic error. The yield in each data bin is obtained from a fit to a double Gaussian with means and widths determined from MC and a 2nd order Chebyshev polynomial for the background. The fits to the data have confidence levels above 30%. The raw yield, efficiency and efficiency corrected yield as a function of $\cos\theta_\Xi$ are listed in Table I. The efficiency corrected yields are normalized and plotted as a function of $\cos\theta_\Xi$ in Figure 4. The points are fit using

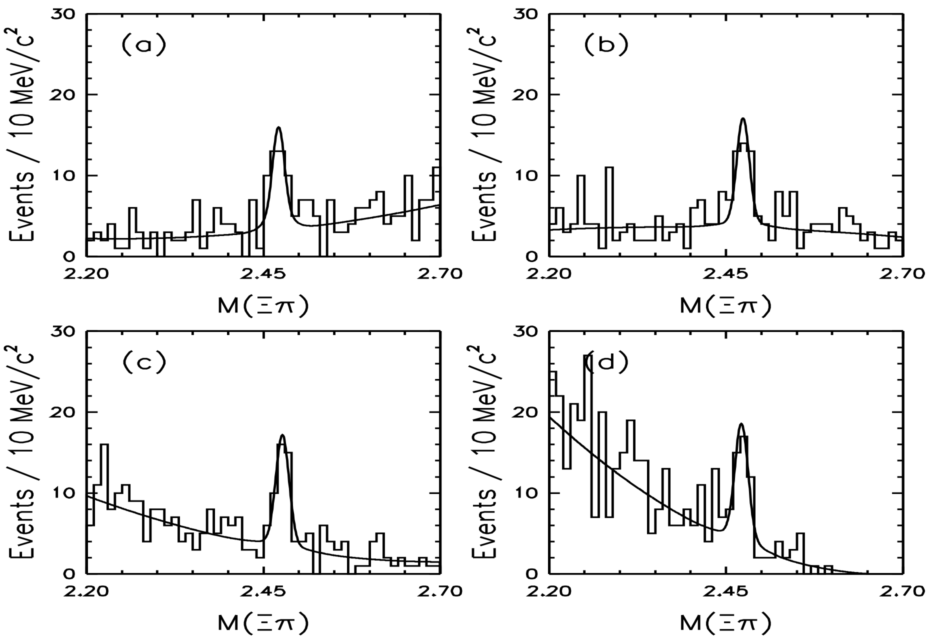

FIG. 3. $\Xi^-\pi^+$ invariant mass distribution in each of 4 $\cos\theta_\Xi$ bins: (a) $-1 < \cos\theta_\Xi < -0.5$ (b) $-0.5 < \cos\theta_\Xi < 0.0$ (c) $0.0 < \cos\theta_\Xi < 0.5$ (d) $0.5 < \cos\theta_\Xi < 1$

TABLE I. The $\Xi_c^0 \to \Xi^-\pi^+$ yield in each $\cos\theta_\Xi$ bin

$\cos\theta_\Xi$	Raw Yield	Efficiency %	Corrected Yield
$-1 < \cos\theta_\Xi < -0.5$	31 ± 7	15.7 ± 0.6	199 ± 46
$-0.5 < \cos\theta_\Xi < 0.0$	34 ± 8	14.6 ± 0.5	234 ± 53
$0.0 < \cos\theta_\Xi < 0.5$	36 ± 8	13.1 ± 0.4	279 ± 61
$0.5 < \cos\theta_\Xi < 1$	39 ± 8	11.7 ± 0.3	332 ± 65

equation (4). The slope is measured to be $\alpha_{\Xi_c^0}\alpha_{\Xi^-} = 0.33 \pm 0.18$ with a confidence level of 99.9%. Using $\alpha_{\Xi^-} = -0.456 \pm 0.014$ we obtain $\alpha_{\Xi_c^0} = -0.72^{+0.40}_{-0.28}$, where the error is statistical only. The asymmetric error arises from the fact that by definition $-1 < \alpha_{\Xi_c^0} < 1$. If we fit the angular distribution to a flat line correscponding to $\alpha_{\Xi_c^0} = 0$, we obtain a confidence level of 35%, therefore we cannot claim a conclusive observation of parity violation, however the central value is in agreement with theoretical predictions.

V. SYSTEMATIC ERRORS

This measurement is insensitive to the presence of production polarization, $\mathbf{P}_{\Xi_c^0}$, of the Ξ_c^0, because parity conservation in the electromagnetic and strong interactions requires Ξ_c^0 production polarization to be normal to the production plane, and charge conjugation invariance requires the sign of the polarization to be the same for particle and anti-particle. Since $\alpha_{\Xi_c^0}$ is CP odd, $(\alpha_{\Xi_c^0}\mathbf{P}_{\Xi_c^0})$ is CP odd so that averaged over charge conjugate states the net polarization is zero. Therefore no systematic error has been included from this source.

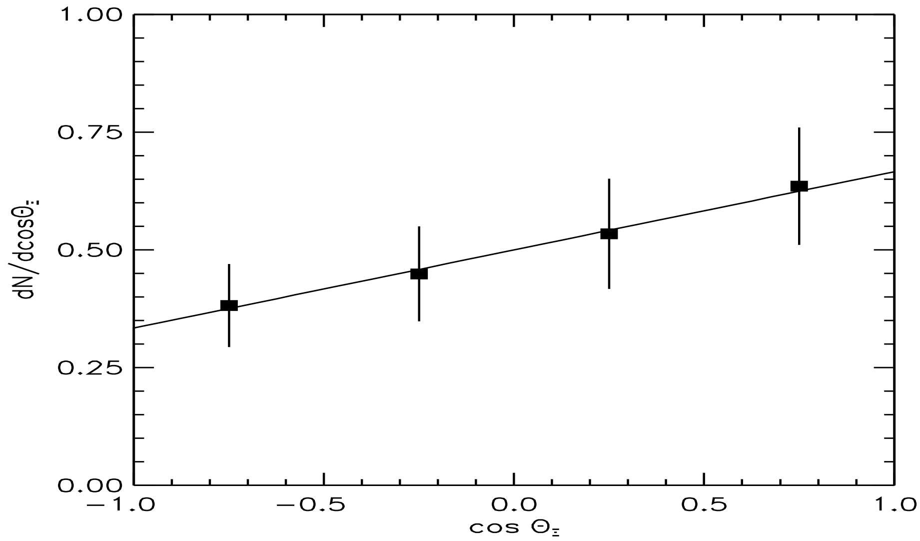

FIG. 4. Efficiency corrected yield vs $\cos\theta_{\Xi}$ for the decay $\Xi_c^0 \to \Xi^-\pi^+$

We have considered the following sources of systematic error and give our estimate of the percentage error on $\alpha_{\Xi_c^0}$ in parentheses. The error due to our choice of momentum and particle identification cuts is estimated by varying these criteria (-10%,+2%). The effect of different fitting techniques on the determination of the yield is estimated by changing the degree of the Chebyshev polynomial and by fitting the signal to a Gaussian instead of a double Gaussian (-1%,+36%). Due to limited data in the sidebands the evaluation of this systematic error is statistically limited. To determine the effect of a statistical fluctuation in the background we fit the lower and upper sidebands to the signal shape, and use the yields so obtained to estimate the background in the signal region (-13%,+0%). To determine the sensitivity of this result to the value of $\alpha_{\Xi_c^0}$ used in the MC, we vary the asymmetry in the range $-1 < \alpha_{\Xi_c^0} < 0$. In all cases we are able to reconstruct the value of $\alpha_{\Xi_c^0}$ (-3%,+10%). The error associated with the uncertainty in the Ξ_c^0 fragmentation function is estimated by varying this function (0,+10%). Possible background from $\Sigma_c^0 \to \Sigma^+\pi^-_{\rm slow}$, $\Sigma^+ \to \Lambda\pi^+_{\rm fast}$ is estimated using a MC simulation (0,+9%). To determine the effect of the unexplained shift between the generated and reconstructed $\cos\theta_{\Xi}$ values, which is only significant if it is not present in the data, we have increased the value of $\cos\theta_{\Xi}$ for each event by 0.03 and repeated the analysis. The result is unchanged and no systematic error is assigned from this source.

To further ensure that there is no gross bias in the analysis we have also determined the product $\alpha_{\Xi^-}\alpha_{\Lambda}$, which is a well measured quantity: $\alpha_{\Xi^-}\alpha_{\Lambda} = -0.293 \pm 0.007$ [6]. Two methods are used: (A) The decay sequence $\Xi^- \to \Lambda\pi^-$, $\Lambda \to p\pi^-$ is reconstructed from Ξ^- that originate on the u, d, s, c continuum. From 2929 ± 67 generic Ξ^- decays we determine $\alpha_{\Xi^-}\alpha_{\Lambda} = -0.246 \pm 0.044$ which is consistent with the world average value. (B) Using exactly the same data sample as for the signal and integrating over $\cos\theta_{\Xi^-}$ in (3) to obtain (2) we measure $\alpha_{\Xi^-}\alpha_{\Lambda} = -0.46 \pm 0.20$ where the error is statistical only. Again the value is consistent with the world average, therefore no systematic error due to bias is ascribed. Adding all sources of systematic error in quadrature we find $\alpha_{\Xi_c^0} = -0.72^{+0.40+0.28}_{-0.28-0.12}$.

VI. SUMMARY AND CONCLUSION

In conclusion, the decay asymmetry parameter of the Ξ_c^0 has been determined to be $\alpha_{\Xi_c^0} = -0.72^{+0.40+0.28}_{-0.28-0.12}$. This is the first measurement of a charm strange baryon decay asymmetry parameter. The data is not yet precise enough to exclude $\alpha_{\Xi_c^0} = 0$ and hence to conclusively demonstrate parity violation, however the central value is in agreement with theoretical expectations.

VII. ACKNOWLEDGMENTS

We gratefully acknowledge the effort of the CESR staff in providing us with excellent luminosity and running conditions. J.P.A., J.R.P., and I.P.J.S. thank the NYI program of the NSF, M.S thanks the PFF program of the NSF, G.E. thanks the Heisenberg Foundation, K.K.G., M.S., H.N.N., T.S., and H.Y. thank the OJI program of DOE, J.R.P, K.H., and M.S. thank the A.P. Sloan Foundation, and A.W., and R.W. thank the Alexander von Humboldt Stiftung for support. This work was supported by the National Science Foundation, the U.S. Department of Energy, and the Natural Sciences and Engineering Research Council of Canada.

REFERENCES

[1] J.G. Körner, G. Krämer, and J. Wilrodt, Z. Phys. **C2**, 117 (1979). T.Uppal, R.C. Verma and M.P. Khanna, Phys. Rev. **D49**, 3417 (1994). G. Kaur and M.P. Khanna, Phys Rev. **D44**, 182 (1991).

[2] H. Cheng and B. Tseng, Phys. Rev. **D46**, 1041 (1992).

[3] Q.P. Xu, and An. N. Kamal, Phys. Rev. **D46**, 270 (1992). P. Żencykowski, Phys. Rev. **D50**, 410 (1994). J.G. Körner and M. Krämer, Z. Phys. **C55**, 659 (1992).

[4] H. Cheng and B. Tseng, Phys. Rev **D48** 4188 (1993).

[5] G. Källen, Elementary Particle Phyics (Addison-Wesley, Reading MA 1964).

[6] Particle Data Group, Phys. Rev. **D50** part I, 1 (1994).

[7] P. Bialas, J.G. J.G. Körner M. Krämer and Z. Zalewski, Z. Phys. **C57** 115 (1995), and private communication.

[8] CLEO Collaboration, M. Bishai *et al.*, Phys. Lett. B **350**, 256 (1995).

[9] J. Bjorken, Phys. Rev. **D40** 1513 (1989). T. Mannel, W.Roberts and Z. Ryzak, Phys. Lett. **B 255** (1990).

[10] GEANT 3.15. R. Brun *et al.*, CERN DD/EE/84-1