

DOE/ER/10690-13

Final Technical Report
DOE Contract DE-AS09-80ER10690
Support of Experimental High Energy Physics Research
at the
University of South Carolina
1980-1992

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Abstract

Twelve years of support by the U. S. Department of Energy have turned a two man team with no equipment and no graduate students working on a single experiment into an active group of four professors, one post-doctoral research associate and three graduate students working with appropriate equipment on three major experiments and several other projects.

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1 Introduction

Part of the U. S. Department of Energy's mission is the support of High Energy Physics in the United States. It does this by building and supporting the great laboratories such as the Stanford Linear Accelerator Laboratory and Fermi National Accelerator Laboratory, to name just two. It also supports the university groups who design, build and operate the detectors used at the laboratories to do the intended research. The two go hand-in-hand to provide an active pool of individuals competent to do research in this most fundamental of all areas.

The group at the University of South Carolina is one of the university groups supported by the U.S. D.O.E. Like the others, it has benefitted from long term support via annual contract extensions, about a third of which were submitted to external review. During the course of this contract, the group at the University of South Carolina has grown from two professors with no equipment and no graduate students to an important component of the Department of Physics and Astronomy. It is now comprised of four professors, one postdoctoral research associate and three graduate students, and the group now has equipment appropriate to the research being carried out. Members of the group participate in three forefront experiments and are engaged in development work applicable to future experiments.

The three major experiments are the AMY experiment at KEK in Tsukuba, Japan, Experiment E687 at the Fermi National Accelerator Laboratory, Batavia, Illinois and Experiment E789, also at FNAL. The AMY experiment was designed to investigate a new energy region in e^+e^- annihilation. Among other things, this experiment showed that the mass of the top quark, if it exists, had to be greater than 60 GeV, a new lower limit at the time.

Experiment E687 was designed to study all aspects of charm physics using charm particles produced by a high energy photon beam.

Experiment E789 was designed to study rare two-body decays of B mesons, in particular $B \rightarrow \pi K$, $B \rightarrow \pi\pi$ and $B \rightarrow KK$. Rare two-body decays of charm mesons were also of interest.

The AMY collaboration was still taking data at the end of the reporting period. Both E687 and E789 collaborations had completed data taking and were in the process of analyzing their data.

2 ARGUS

Two South Carolina professors, C. Darden and R. Childers, were heavily involved in the commissioning and running of the ARGUS experiment. This experiment was a new effort by the DASP II collaboration. In fact, some of the interesting DASP II results came out during the time the group was gearing up to run ARGUS. The ARGUS activity occurred through most of the 1980's and both Darden and Childers spent much time at the experiment contributing hardware expertise. The collaboration produced more than 100 publications during the time the two were involved. Some of the important physics results published during this time period was the first observation of $B^0 - \bar{B}^0$ mixing, precise measurements of the mass of the $\Upsilon(2S)$, observation of $B \rightarrow J/\psi + X$, and copious work involving beauty and charm spectroscopy.

3 AMY

C. Rosenfeld joined the group in 1986, bringing with him his responsibilities on the AMY experiment. The AMY detector occupies the Oho experimental hall of the TRISTAN e^+e^- collider at the Japanese National Laboratory for High Energy Physics in Tsukuba. With the help of a postdoc (A.T.M. Wang) and three students (S. Lusin, S. Wilson and L.Y. Zheng) he built the high voltage distribution and preamplifier system for the central drift chamber and a track trigger processor, which was the mainstay of the trigger system from the inception of data-taking in 1987. In 1991 the group upgraded the trigger processor and adapted it to utilize the second generation endcap detectors. USC's trigger system was highly successful. It enabled the experiment to accept even events in which only a single charged track was visible without stressing the 3 Hz capacity of the data acquisition system.

The theory of electroweak interactions tells us that the interference between γ -mediated and Z -mediated amplitudes produces dramatic asymmetries in angular distributions in the energy range covered by TRISTAN. USC students have pursued the study of these asymmetries, S. Lusin in the dilepton final states $\mu^+\mu^-$ and $\tau^+\tau^-$, and L. Zheng in the $c\bar{c}$ final state. Dr. Lusin has completed his Ph.D. dissertation, and Ms. Zheng is preparing hers. The AMY collaboration has 27 publications and is still pursuing several analysis efforts.

4 Fermilab Fixed Target Experiments

The group was involved with two Fermilab fixed target experiments during the grant period: E789 and E687. C. Darden and R. Childers became involved with E789 in 1990. They officially withdrew from ARGUS the following year in order to devote more attention to their new experiment. J. Wilson joined the group in 1990 and moved to Fermilab where he began working on the RICH detector of E789. He also continued his involvement on E687.

E789 was approved to search for $B \rightarrow \pi^+\pi^-$ and $B \rightarrow K^+K^-$ using B mesons produced by a high intensity 800 GeV proton beam. Running conditions were changed due to safety concerns and were not favorable for this search, so the emphasis was changed to do cross section measurements for beauty and charm mesons at 800 GeV. At the close of the contract work was proceeding on three topics: cross-section measurements using $B \rightarrow J/\psi$, cross-section measurements using $D \rightarrow K\pi$, and a measurement of the X_F dependence of J/ψ production at high X_F .

The intent of E687 was to study as many aspects of charm physics as possible using an open geometry fixed target spectrometer in a high energy photon beam. The reconstructed charm sample amassed by E687 was the largest in the world at the time and allowed the best lifetime measurements of mesons and baryons to date (first measurements of Ξ_c and Ω_c lifetimes). Several semileptonic form factors and branching ratios were measured for D^+ , D^0 , and D_s . Studies of charm photoproduction dynamics were undertaken with our sample of fully reconstructed charm pairs. We also undertook searches for CP violation and other rare processes. At the end of the grant in early 1992 many of these investigations were underway but were published only in 1993 and 1994.

5 Infrastructure

An important aspect of building up the size and responsibilities of the group was the acquisition of various items of infrastructure. The group now has a reasonable amount of electronic test equipment which was purchased for the AMY trigger project. This included CAD software and hardware used for in house electronic design and testing. We now have a small microVax cluster, several RISC workstations and a number of Apple Machintosh computers, all fully networked to HEPnet and the Internet.

6. Publications coauthored by members of the South Carolina high energy group, 1980–1993. Entries except those marked with † are included in the collection of reprints furnished with this report.

6.1 DASP-II publications coauthored by C.W. Darden, R.L. Childers, and other group members.

A Determination of the Total Width of the $\Upsilon(9.46)$ Meson.

H. Albrect *et al.*

Physics Letters 93B, 500 (1980).

Inclusive Hadron Production in the Υ -Region.

H. Albrect *et al.*

Physics Letters 102B, 291 (1981).

The Hadronic Cross-Section of Electron-Positron Annihilation at 9.5 GeV and the Υ and Υ' Resonance Parameters.

H. Albrect *et al.*

Physics Letters 116B, 383 (1982).

6.2 ARGUS publications coauthored by C.W. Darden, R.L. Childers, and other group members.

Branching Ratio and Mass Spectrum of the Decay $\Upsilon' \rightarrow \Upsilon \pi^+ \pi^-$.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 134B, 137 (1984).

A Precision Measurement of the Υ' Meson Mass.

ARGUS Collaboration and Crystal Ball Collaboration (D.P. Barber *et al.*).

Physics Letters 135B, 498 (1984).

Evidence for F^* Meson Production in e^+e^- Annihilation at 10 GeV Center-of-Mass Energy.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 146B, 111 (1984).

Production and Decay of the Charged D^* Meson in e^+e^- Annihilation at 10-GeV Center-of-Mass Energy.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 150B, 235 (1985).

Production and Decay of the F Meson in e^+e^- Annihilation at 10 GeV Center-of-Mass Energy.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 153B, 343 (1985).

Search for Narrow States Coupling to τ Pairs in Radiative Υ Decays.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 154B, 452 (1985).

Search for Fractionally Charged Particles Produced in e^+e^- Annihilation.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 156B, 134 (1985).

Observation of Antideuteron Production in Electron-Positron Annihilation at 10 GeV Center of Mass Energy.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 157B, 326 (1985).

Direct Evidence for W Exchange in Charmed Meson Decay.

ARGUS Collaboration (H. Albrect *et al.*).

Physics Letters 158B, 525 (1985).

- Radiative Decays of the $\Upsilon(2s)$ Into the Three χ_b States.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters 160B, 331 (1985).
- Observation of B -Meson Decay Into J/ψ .
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters 162B, 395 (1985).
- An Upper Limit on the Mass of the Tau Neutrino.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters 163B, 404 (1985).
- A Determination of the Muon Pair Branching Ratio of the Υ' Meson.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z.Phys.C28, 45 (1985).
- Upper Limit for the Emission of Monoenergetic Photons in $\Upsilon(1s)$ - and $\Upsilon(2s)$ -Meson Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z.Phys. C29, 167 (1985).
- Search for Gluinos in Decays of the $\chi_b(1^3P_1)$ Meson.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters 167B, 360 (1986).
- Observation of F Decays into $\bar{K}^*K$
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters 179B, 398 (1986).
- Search for Exotic Decay Modes of the $\Upsilon(1s)$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters 179B, 403 (1986).
- Determination of the Branching Ratio for the Decay $B^0 \rightarrow D^{*-}\pi^+$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters 182B, 95 (1986).
- Observation of a New Charmed Meson.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physical Review Letters 56, 549 (1986).
- An Upper Limit for Two-Jet Production in Direct $\Upsilon(1S)$ Decays
 ARGUS Collaboration (H. Albrecht *et al.*).
 Zeitschrift fur Physik C31, 181 (1986).
- Measurement of Tau Decays into Three Charged Pions
 ARGUS Collaboration (H. Albrecht *et al.*).
 Zeitschrift fur Physik C33, 7 (1986).
- Observation of Octet and Decuplet Hyperons in e^+e^- Annihilation at 10 GeV Centre-of-Mass Energy.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B183, 419 (1987).
- Reconstruction of B Mesons
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B185, 218 (1987).
- Evidence for the Decay $\tau^- \rightarrow \nu_\tau \omega \pi^-$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B185, 223 (1987).
- Search for Lepton-Number and Lepton-Flavour Violation in Tau Decays
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B185, 228 (1987).

- Observation of Inclusive D_s Production in B Meson Decay
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B187, 425 (1987).
- Observation of $B^0-\bar{B}^0$ Mixing.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B192, 245 (1987).
- Search for the Decay $D_s \rightarrow \rho^0 \pi$ as Evidence for Quark Annihilation.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B195, 102 (1987).
- Search for the Decay $\tau^- \rightarrow \nu_\tau \eta \pi^-$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B195, 307 (1987).
- First Observation of $\gamma\gamma \rightarrow \omega \rho^0$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B196, 101 (1987).
- Measurement of the Decay $B^0 \rightarrow D^{*\mp} l^\pm \nu$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B197, 452 (1987).
- First Observation of $\gamma\gamma \rightarrow K^{*0} \bar{K}^0$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B198, 255 (1987).
- First Observation of $\gamma\gamma \rightarrow \omega\omega$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B198, 577 (1987).
- Determination of α_s from a Measurement of the Direct Photon Spectrum in $\Upsilon(1S)$ Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B199, 291 (1987).
- An Upper Limit on $D^0-\bar{D}^0$ Mixing.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B199, 447 (1987).
- B Meson Decays into Charmonium States.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B199, 451 (1987).
- Measurement of $\eta' \rightarrow \pi^+ \pi^- \gamma$ in $\gamma\gamma$ Collisions.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B199, 457 (1987).
- A Measurement of the Tau Lifetime.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B199, 580 (1987).
- The Decay $D^0 \rightarrow \bar{K}^0 \phi$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 33C, 359 (1987).
- The Hadronic Transitions from $\Upsilon(2S)$ to $\Upsilon(1S)$
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 35C, 283 (1987).
- An Improved Upper Limit on the ν_τ -Mass from the Decay $\tau^- \rightarrow \pi^- \pi^- \pi^- \pi^+ \pi^+ \nu_\tau$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B202, 149 (1988).

- Observation of the Charmed Baryon Λ_c in e^+e^- Annihilation at 10 GeV.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B207, 109 (1988).
- Measurement of $D_s^* - D_s$ Mass Difference.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B207, 349 (1988).
- Observation of Charmless B Meson Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B209, 119 (1988).
- Search for D^0 Decays into Lepton Pairs.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B209, 380 (1988).
- Search for the Decay $B \rightarrow K^* \gamma$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B210, 258 (1988).
- Observation of Inclusive B Meson Decays into Λ_c^+ Baryons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B210, 263 (1988).
- Lifetimes of Charmed Mesons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B210, 267 (1988).
- A Search for $\omega\phi$ and $\phi\phi$ Production in the Reactions $\gamma\gamma \rightarrow K^+K^-\pi^+\pi^-\pi^0$ and $\gamma\gamma \rightarrow 2K^+2K^-$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B210, 273 (1988).
- Observation of the Charmed Baryon Σ_c in e^+e^- Annihilations.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B211, 489 (1988).
- First Observation of $\gamma\gamma \rightarrow K^{*+}K^{*-}$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B212, 528 (1988).
- B Meson Decays to $D\pi$ and $D\rho$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B215, 424 (1988).
- Observation of the Orbitally Excited $\Lambda(1520)$ Baryon in e^+e^- Annihilation.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B215, 429 (1988).
- Hyperon Production in e^+e^- Annihilation at 10 GeV Center of Mass Energy.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Zeitschrift für Physik C39, 177 (1988).
- Measurement of the Decays $\tau^- \rightarrow K^{*-}\nu_\tau$ and $\tau^- \rightarrow \rho^-\nu_\tau$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 41C, 1 (1988).
- Upper Limits for the Decay of τ -Leptons into η -Mesons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 41C, 405 (1988).
- ARGUS: A Universal Detector at DORIS II.
 ARGUS Collaboration (H. Albrecht *et al.*).
 NIM A275, 1 (1989).

- A Measurement of $\gamma\gamma \rightarrow \rho^+\rho^-$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B217, 205 (1989).
- Measurement of D^{*+} Polarization in the Decay $\bar{B}^0 \rightarrow D^{*+} \ell^- \bar{\nu}$
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B219, 121 (1989).
- Observation of the $D^{*0}(2459)$ in e^+e^- annihilation.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B221, 422 (1989).
- Measurement of the Decay $B^0 \rightarrow D^- \ell^+ \nu_\ell$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B229, 175 (1989).
- Search for $b \rightarrow s\gamma$ in Exclusive Decays of B Mesons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B229, 304 (1989).
- Observation of a New Charmed-Strange Meson.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B230, 162 (1989).
- Observation of $\Delta(1232)^{++}$ Production in e^+e^- Annihilations Around 10 GeV.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B230, 169 (1989).
- Observation of the Charged Isospin Partner of the $D^*(2459)^0$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B231, 208 (1989).
- Resonance Decomposition of the $D^*(2420)^0$ Through a Decay Angular Analysis.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B232, 398 (1989).
- Measurement of the Lifetime Ratio $\tau(B^+)/\tau(B^0)$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Physics Letters B232, 554 (1989).
- Inclusive ϕ -Meson Production in Electron-Positron Interactions in the Energy Region of the Υ -Resonances.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 41C, 557 (1989).
- Search for Exclusive Radiative Decays of $\Upsilon(1S)$ and $\Upsilon(2S)$ Mesons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 42C, 349 (1989).
- Measurement of Inclusive B Meson Decays into Baryons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 42C, 519 (1989).
- Two-Photon Production of Final States with a $p\bar{p}$ Pair.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 42C, 543 (1989).
- Results on Baryon Antibaryon Correlations in e^+e^- Annihilation.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 43C, 45 (1989).
- Measurement of D^0 decays into $\bar{K}^0\omega$, $\bar{K}^0\eta$, and $\bar{K}^{*0}\eta$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 43C, 181 (1989).

- Inclusive Production of Charged Pions, Charged and Neutral Kaons and Antiprotons in e^+e^- Annihilation at 10 GeV and in Direct Upsilon Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 44C, 547 (1989).
- Observation of Semileptonic Charmless B Meson Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B234, 409 (1990).
- Study of Antideuteron Production in e^+e^- Annihilation at 10 GeV Centre-of-Mass Energy.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B236, 102 (1990).
- Search for Hadronic $b \rightarrow u$ Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B241, 278 (1990).
- Observation of the Decay $D_S^+ \rightarrow \eta' \pi^+$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B245, 315 (1990).
- Determination of the Michel Parameter in Tau Decay.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B246, 278 (1990).
- Measurement of Ξ_c Production in e^+e^- Annihilation at 10.5 GeV Center-of-Mass Energy.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B247, 121 (1990).
- Study of Inclusive Semileptonic B Meson Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B249, 359 (1990).
- Determination of the Tau-Neutrino Helicity.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B250, 164 (1990).
- A Study of Cabibbo-Suppressed D^0 Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 46C, 9 (1990).
- Inclusive π^0 and η Meson Production in Electron Positron Interactions at $\sqrt{s}=10$ GeV.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 46C, 15 (1990).
- Measurement of K^+K^- Production in $\gamma\gamma$ Collisions.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 48C, 183 (1990).
- Exclusive Hadronic Decays of B Mesons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 48C, 543 (1990).
- Search for $b \rightarrow s$ gluon in B Meson Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B254, 288 (1991).
- Reconstruction of Semileptonic $b \rightarrow u$ Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B255, 297 (1991).
- Observation of the Decays $D_s^- \rightarrow \phi e^- \bar{\nu}$ and $D^- \rightarrow K^{*0} e^- \bar{\nu}$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B255, 634 (1991).

- Observation of the Decay $\tau \rightarrow \rho\pi\nu_\tau$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B260, 259 (1991).
- Search for $b \rightarrow sX^+X^-$ in Exclusive Decays of B Mesons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B262, 148 (1991).
- A Spin Parity Analysis of $\gamma\gamma \rightarrow \rho^+\rho^-$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B267, 535 (1991).
- Observations of Λ_c^+ Semileptonic Decay.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B269, 234 (1991).
- Study of pp and $\Lambda\Lambda$ Production in e^+e^- Annihilation at 10 GeV Center of Mass Energy.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 49C, 349 (1991).
- Observation of Spin-Parity 2^+ Dominance in the Reaction $\gamma\gamma \rightarrow \rho^0\rho^0$ Near Threshold.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. 50C, 1 (1991).
- Inclusive Production of D^0 , D^+ , and D^{*+} (2010)⁺ Mesons in B Decays and Nonresonant e^+e^- Annihilation at 10.6 GeV.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. C52, 353 (1991).
- † A Measurement of $\tau(B^+)/\tau(B^0)$ from the Lepton and Dilepton Rates in $\Upsilon(4s)$ Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 DESY-91-056, Jun 1991.
- A Measurement of Asymmetry in the Decay $\Lambda_c^+ \rightarrow \Lambda\pi^+$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B274, 239 (1992).
- First Evidence of χ_c Production in B -Meson Decays.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B277, 209 (1992).
- A Measurement of the Inclusive Semileptonic Decay Fraction of Charmed Hadrons.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Phys. Lett. B278, 202 (1992).
- The Measurement of D_s^+ and D^+ Meson Decays Into $K^{*+}K^{*0}$.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. C53, 361 (1992).
- Measurement of Exclusive One-Prong and Inclusive Three-Prong Branching Ratios of the τ Lepton.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. C53, 367 (1992).
- Production of D_s^+ Mesons in B Decays and Determination of f_{D_s} .
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. C54, 1 (1992).
- Measurement of R and Determination of the Charged-Particle Multiplicity in e^+e^- Annihilation at $\sqrt{s}$ Around 10 GeV.
 ARGUS Collaboration (H. Albrecht *et al.*).
 Z. Phys. C54, 13 (1992).

A New Determination of the $B^0 \bar{B}^0$ Oscillation Strength.

H. Albrecht *et al.* (ARGUS Collaboration).
Z. Phys. C55, 357 (1992).

6.3 AMY publications coauthored by C. Rosenfeld and other group members.

Measurements of R and a Search for Heavy-Quark Production in e^+e^- Annihilation at $\sqrt{s} = 50$ and 52 GeV.

H. Sagawa *et al.* (AMY Collaboration).
Physical Review Letters 60, 93 (1988).

Search for Isolated Leptons in Low Thrust e^+e^- Annihilation Events at $\sqrt{s} = 50$ and 52 GeV.

S. Igarashi *et al.* (AMY Collaboration).
Physical Review Letters 60, 2359 (1988).

Experimental Mass Limit for a Fourth Generation Sequential Lepton from e^+e^- Annihilations at $\sqrt{s} = 56$ GeV.

G.N. Kim *et al.* (AMY Collaboration).
Physical Review Letters 61, 911 (1988).

Measurements of Cross Sections and Charge Asymmetries for $e^+e^- \rightarrow \tau^+\tau^-$

and $e^+e^- \rightarrow \mu^+\mu^-$ for $\sqrt{s}$ from 52 to 57 GeV.

A. Bacala *et al.* (the AMY Collaboration).
Physics Letters B218, 112 (1989).

Measurements of the e^+e^- Total Hadronic Cross Section and a Determination of M_Z and $\Lambda_{\overline{MS}}$.

T. Mori *et al.* (the AMY Collaboration).
Physics Letters B218, 499 (1989).

Search for the Substructure of Leptons in High Energy QED Processes at TRISTAN.

S.K. Kim *et al.* (the AMY Collaboration).
Physics Letters B223, 476 (1989).

Search for Non-Minimal Higgs Production in e^+e^- Annihilations at $\sqrt{s} \sim 56$ GeV.

E. Low *et al.* (the AMY Collaboration).
Physics Letters B228, 548 (1989).

Experimental Evidence for the Non-Abelian Nature of QCD from a Study of Multi-jet Events Produced in e^+e^- Annihilations.

I.H. Park *et al.* (the AMY Collaboration).
Physical Review Letters 62, 1713 (1989).

A Search for Unstable Neutral Leptons in e^+e^- Annihilations at $\sqrt{s}$ from 50 to 60.8 GeV.

N.M. Shaw *et al.* (the AMY Collaboration).
Physical Review Letters 63, 1342 (1989).

Comparison of Quark and Gluon Jets Produced in High Energy e^+e^- Annihilations.

Y.K. Kim *et al.* (the AMY Collaboration).
Physical Review Letters 63, 1772 (1989).

Search for a Fourth-Generation Charge $-1/3$ Quark.

S. Eno *et al.* (the AMY Collaboration).
Physical Review Letters 63, 1910 (1989).

Measurement of the $e^+e^- \rightarrow b \bar{b}$ Forward-Backward Charge Asymmetry between $\sqrt{s} = 52$ and 57 GeV.

H. Sagawa *et al.* (the AMY Collaboration).
Physical Review Letters 63, 2341 (1989).

- A Search for SUSY Particles in e^+e^- Annihilations at $\sqrt{s}=50-60.8$ GeV.
Y. Sakai *et al.* (the AMY Collaboration).
Physics Letters B 234, 534 (1990).
- A Search for Leptoquark and Colored Lepton Pair Production in TRISTAN.
G.N. Kim *et al.* (the AMY Collaboration).
Physics Letters B 240, 243 (1990).
- Observation of Anomalous Production of Muon Pairs in e^+e^- Annihilation into Four-Lepton Final States.
Y.H. Ho *et al.* (the AMY Collaboration).
Physics Letters B 244, 573 (1990).
- A Measurement of the Photon Structure Function F_2 .
T. Sasaki *et al.* (the AMY Collaboration).
Physics Letters B 252, 491 (1990).
- Multihadron-event Properties in e^+e^- Annihilation at $\sqrt{s} = 52-57$ GeV.
Y.K. Li *et al.* (the AMY Collaboration).
Physical Review D 41, 2675 (1990).
- Charged-particle Multiplicities in e^+e^- Annihilations at $\sqrt{s} = 50-61.4$ GeV.
H.W. Zheng *et al.* (the AMY Collaboration).
Physical Review D 42, 737 (1990).
- Mass Limits of Charged Higgs Boson at Large $\tan\beta$ from e^+e^- Annihilations at $\sqrt{s} = 50-60.8$ GeV.
J.R. Smith *et al.* (the AMY Collaboration).
Physical Review D 42, 949 (1990).
- Measurements of R for e^+e^- Annihilation at the KEK Collider TRISTAN.
T. Kumita *et al.* (the AMY Collaboration).
Physical Review D 42, 1339 (1990).
- Forward-Backward Charge Asymmetry in $e^+e^- \rightarrow$ Hadron Jets.
D. Stuart *et al.* (the AMY Collaboration).
Physical Review Letters 64, 983 (1990).
- Search for Charged Heavy Leptons with Arbitrary Neutrino Masses in e^+e^- Annihilations at $\sqrt{s} = 50-60.8$ GeV.
G.N. Kim *et al.* (the AMY Collaboration).
International Journal of Modern Physics 6, 2583 (1991).
- The Design of the AMY Central Drift Chamber and Performance in a 3 Tesla Magnetic Field.
K.Ueno, H.W. Zheng, C. Back, D. Blanis, S. Eno, T. Haelen, Y.H. Ho, Y.K. Kim, T. Mori, S.L. Olsen, N.M. Shaw, E.H. Thorndike, J. Edwards, C. Rosenfeld, Y. Higashi, and Y. Kobayashi.
Nuclear Instruments and Methods in Physics Research A 323, 601 (1992).
- Evidence for Hard Scattering of Hadronic Constituents of Photons in Photon-Photon Collisions at TRISTAN.
R. Tanaka *et al.* (the AMY Collaboration).
Physics Letters B 277, 215 (1992).
- Search for Anomalous $\gamma\gamma$ Production at TRISTAN.
K.L. Sterner *et al.* (the AMY Collaboration).
Physics Letters B 303, 385 (1993).
- Measurement of α_s from the Moment of Particle Momenta Within Jets from e^+e^- Annihilation.
K.B. Lee *et al.* (the AMY Collaboration).
Physics Letters B 313, 469 (1993).

6.4 E687 publications coauthored by J.R. Wilson.

Measurement of Λ_c^+ and D_s^+ Lifetimes.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B251, 639 (1990).

A Measurement of the D^0 and D^+ Lifetimes.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B263, 584 (1991).

Description and Performance of the Fermilab E687 Spectrometer.

P.L. Frabetti *et al.* (the E687 Collaboration).
Nuclear Instruments and Methods in Physics Research A320, 519 (1992).

Measurement of the Decays $D^0 \rightarrow \pi^+\pi^+\pi^-\pi^-$, $D^0 \rightarrow K^-K^+$, and $D_s^+ \rightarrow \phi\pi^+\pi^+\pi^-$.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B281, 167 (1992).

Study of $D^0 \rightarrow K_s^0\pi^+\pi^-$ and $D^0 \rightarrow K_s^0K^+K^-$ in High Energy Photoproduction.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B286, 195 (1992).

A Wide Band Photon Beam at the Fermilab Tevatron to Study Heavy Flavors.

P.L. Frabetti *et al.* (the E687 Collaboration).
Nuclear Instruments and Methods in Physics Research A329, 62 (1993).

First Evidence of $\Omega_c^0 \rightarrow \Omega^- \pi^+$

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B300, 190 (1993).

Analysis of the Decay Mode $D^+ \rightarrow \bar{K}^{*0} \mu^+ \nu$.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B307, 262 (1993).

Studies of $D\bar{D}$ Correlations in High Energy Photoproduction

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B308, 193 (1993).

A Measurement of $\Gamma(D_s^+ \rightarrow \phi \mu^+ \nu) / \Gamma(D_s^+ \rightarrow \phi \pi^+)$

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B313, 253 (1993).

Evidence of the Cabibbo-Suppressed Decay $\Lambda_c^+ \rightarrow p K^- K^+$.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B314, 477 (1993).

Study of $D^0 \rightarrow K^- \mu^+ \nu$ in High Energy Photoproduction.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B315, 203 (1993).

A Measurement of Elastic J/ψ Photoproduction Cross Section at Fermilab E687.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physics Letters B316, 197 (1993).

Measurement of the Mass and Lifetime of the Ξ_c^+ .

P.L. Frabetti *et al.* (the E687 Collaboration).
Physical Review Letters 70, 1381 (1993).

Measurement of the Λ_c^+ Lifetime.

P.L. Frabetti *et al.* (the E687 Collaboration).
Physical Review Letters 70, 1755 (1993).

Measurement of the Lifetime of the Ξ_c^0 .
P.L. Frabetti *et al.* (the E687 Collaboration).
Physical Review Letters 70, 2058 (1993).

Precise Measurement of the $D_s^\pm$ Meson Lifetime.
P.L. Frabetti *et al.* (the E687 Collaboration).
Physical Review Letters 71, 827 (1993).

6.5 Publications and reports on Fermilab E789 and miscellaneous other topics coauthored by various group members.

CAMAC Staggered Memory Look-up Module and ECL Fan-in for Fast Trigger Applications.
C. Rosenfeld, A.T.M. Wang, S.R. Wilson, L.Y. Zheng, and K.W. Broome.
IEEE Transactions on Nuclear Science 39, 848 (1992).

Nuclear Effects on Heavy Quark Production. Results from Fermilab Experiments E772 and E789.
M.J. Leitch *et al.* (the E772 and E789 Collaborations).
Nuclear Physics A544, 197c (1992).

High Sensitivity search for a 17 keV Neutrino. Negative Indication with an Upper Limit of 0.095%.
H. Kawakami, S. Kato, T. Ohshima, C. Rosenfeld, H. Sakamoto, T. Sato, S. Shibata, J. Shirai, Y. Sugaya, T. Suzuki, K. Takahashi, T. Tsukamoto, K. Ueno, K. Ukai, S. Wilson, and Y. Yonezawa.
Physics Letters B287, 45 (1992).

† Preliminary Results from Fermilab E789.
J.C. Peng *et al.*
Dallas HEP 1992, 1050 and Moriond 1992, Hadronic, 489.

† Performance of a Prototype SDC Shower-Maximum Detector
SDC-92-343.

Particle Identification in SDC: Shower Maximum and Preshower Detectors.
P. Cushman, representing the Shower Maximum Subsystem.
The Third International Conference on Calorimetry (Corpus Christi, Sept 29 - Oct 2, 1992)
SDC-92-344

Effect of a Preshower Detector on Calorimetry Performance.
M. Hulbert *et al.*
Nuclear Instruments and Methods in Physics Research A335, 427 (1993).

No 17-keV Neutrino: Admixture < 0.073 -Percent (95-Percent C.L.).
T. Ohshima, H. Sakamoto, T. Sato, J. Shirai, T. Tsukamoto, Y. Sugaya, K. Takahashi, T. Suzuki, C. Rosenfeld, S. Wilson, K. Ueno, Y. Yonezawa, H. Kawakami, S. Kato, S. Shibata, and K. Ukai.
Physical Review D47, 4840 (1993).

Beauty and Charm Production from Fermilab Experiment 789.
D.M. Jansen *et al.* (the E789 Collaboration).
Moriond 1993, Hadronic, 345.

A Fast Ring-Imaging Cherenkov Counter for a Fixed-Target Heavy-Quark Experiment.
D.M. Kaplan, L.D. Isenhower, M. Atac, C.N. Brown, C.W. Darden.
Fermilab-Conf-93-148, presented at the 1st Workshop on RICH Detectors (RICH 93), Bari, Italy, June 2-5, 1993. Published in Nuclear Instruments and Methods in Physics Research A343, 316 (1994).