August 27, 2005

CURRICULUM VITAE

Name :	Petros-Afentoulis **Rapidis**
Date of Birth :	January 1, 1951
Place of Birth :	Heraklion, Crete, Greece
Citizenship :	Dual national: Greece and U.S.A.
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Education :

Athens College High School, Athens, Greece
Graduated in June 1969
Massachusetts Institute of Technology (1969 - 1973)
B.Sc., Physics, June 1, 1973
Stanford University (1973 - 1979)
M.S., Physics, April 3, 1975; Ph.D., Physics, June 17, 1979
Thesis : *D Meson Production in e^+e^- Annihilation*
Supervisor : Prof. Martin L. Perl

Employment :

October 1974 - May 1979
Research Assistant, Stanford Linear Accelerator Center
May 1979 - July 1982
Research Associate, Fermi National Accelerator Laboratory
July 1982 - August 1985
R.R. Wilson Fellow, Fermi National Accelerator Laboratory
August 1985 - October 1989
Associate Scientist, Fermi National Accelerator Laboratory
October 1989 - March 1997
Scientist I, Fermi National Accelerator Laboratory
March 1997 - present
Scientist II, Fermi National Accelerator Laboratory
May 1997 - May 1999
Deputy Leader, Silicon Detector Center, Fermi National Accelerator Laboratory
June 2000 - June 2002
Co-Leader, D0 Silicon Microvertex Tracker Group
February 2005 - present
Deputy Leader, Liquid Argon TPC Development Group,
Fermi National Accelerator Laboratory

Professional Societies: American Physical Society, Sigma Xi,
American Association for the Advancement of Science

Participation in Conferences

Summer Institute on Particle Physics, 1975, Stanford, California, July 21-31, 1975.

Summer Institute on Particle Physics, 1976, Stanford, California, August 2-13, 1976.

Summer Institute on Particle Physics, 1977, Stanford, California, July 11-22, 1977.

1978 Annual Meeting of the American Physical Society, San Francisco, California, January 23-26, 1978.

Spring Meeting of the American Physical Society, Washington, D.C., April 24-27, 1978.

Summer Institute on Particle Physics, 1978, Stanford, California, July 10-21, 1978.

1979 International Symposium on Lepton and Photon Interactions at High Energies, Batavia, Illinois, August 23-29, 1979.

NATO Advanced Study Institute on Techniques and Concepts of High Energy Physics, St. Croix, Virgin Islands, July 2-13, 1980.

20th International Conference of High Energy Physics, Madison, Wisconsin, July 17-23, 1980.

International Conference of Neutrino Physics and Astrophysics, Wailea, Hawaii, July 1-8, 1981.

Summer Institute on Particle Physics, 1981, Stanford, California, July 27- August 7, 1981.

International Conference of Neutrino Physics and Astrophysics, Balatonfűred, Hungary, June 14-19, 1982.

Europhysics Study Conference on Electroweak Effects at High Energies, Erice, Italy, February 1-12, 1983.

4th U.S. Summer School on High-Energy Particle Accelerators, Batavia, Illinois, August 13-24, 1984.

First Workshop on Antimatter Physics at Low Energy, Batavia, Illinois, April 10-12, 1986.

23rd International Conference of High Energy Physics, Berkeley, California, July 16-23, 1986.

Conference on Physics at Fermilab in the 1990's, Breckenridge, Colorado, August 15-24, 1989.

First Biennial Conference on Low Energy Antiproton Physics (LEAP 90), Stockholm, Sweden, July 2-6 1990.

Joint 1991 International Symposium on Lepton and Photon Interactions at High Energies and Europhysics Conference on High Energy Physics, Geneva, Switzerland, July 25 - August 1, 1991.

1992 Joint April Meeting of the American Physical Society and the American Association of Physics Teachers, Washington, D.C., April 20-24, 1992.

1992 Spring Meeting of the Ohio Section of the American Physical Society, Cincinnati, Ohio, May 8-9, 1992.

Summer Institute on Particle Physics, 1992, Stanford, California, July 13-24, 1992.

26th International Conference on High Energy Physics, Dallas, Texas, August 6-12, 1992.

7th Meeting of the American Physical Society's Division of Particles and Fields, Batavia, Illinois, November 10-14, 1992.

3rd NESTOR International Workshop, Pylos, Greece, October 19-21, 1993.

4th International Conference on Advanced Technology and Particle Physics, Como, Italy, October 3-7, 1994.

Workshop on Physics with e^+e^- Linear Colliders, Gran Sasso, Italy. May 29 - June 3, 1995.

4th International Workshop on Vertex Detectors *Vertex 95*, En Gedi, Israel, June 11-16, 1995.

5th International Workshop on B-Physics at Hadron Machines *Beauty 97*, Los Angeles, California, October 13-17, 1997.

IEEE Nuclear Science Symposium, Toronto, Canada, November 8-14, 1998.

30th International Conference on High Energy Physics, Osaka, Japan, August 25 - September 7, 2002.

Annual Meeting of the Hellenic Society for the Study of High Energy Physics, Patras, Greece, April 25-27, 2002.

2002 European School of High-Energy Physics (formerly the CERN-JINR School of Physics), Pylos, Greece, August 25 - 7 September 7 ,2002 (attended as discussion leader).

2003 International Symposium on Lepton and Photon Interactions at High Energies, Batavia, Illinois, August 11-16, 2003.

19th International Workshop on Weak Interactions and Neutrinos October, WIN'03, Lake Geneva, Wisconsin, October 6-11, 2003.

Conference on Recent Advances in Particle and Astroparticle Physics, Chios, Greece, 1-4 April 2004.

XIII International Symposium on Very High Energy Cosmic Ray Interactions, XIII ISVHECR, Pylos, Greece, 6-12 September 2004.

7th International Workshop on Neutrino Factories and Superbeams, Nufact05, Frascati (Rome), Italy, 21-26 June 2005.

Talks

April 24, 1978 at the 1978 Spring Meeting of the APS in Washington, D.C. . Contributed paper on *Characteristics of D Meson Production in e^+e^- Annihilation.*

May 2, 1978 at Harvard University, Cambridge, Massachusetts. Physics Department seminar on *Recent Results from SPEAR.*

May 5, 1978 at the Fermi National Accelerator Laboratory, Batavia, Illinois. Joint Experimental - Theoretical Physics Seminar ('Wine and Cheese') on *Recent Results from SPEAR.*

October 11, 1978 at Athens University, Athens, Greece. Physics Department seminar on *Recent Results from SPEAR.*

August 7, 1981 at the Stanford Linear Accelerator Center, Stanford, California. Invited talk at the 1981 Summer Institute on Particle Physics on *Recent Results on Total Neutrino and Antineutrino Cross Sections by the CFRR Collaboration.*

June 25, 1982 at the Laboratoire d'Annecy-le-Vieux de Physique des Particules, Annecy-le-Vieux, France. Colloquium on *Recent Results on Neutrino Cross Section and Nucleon Structure Functions by the CFRR Collaboration.*

November 10, 1982 at the University of Chicago, Chicago, Illinois. High Energy Physics Seminar on *Nucleon Structure Function Measurements from the CFRR Neutrino Experiment.*

November 12, 1982 at the Fermi National Accelerator Laboratory, Batavia, Illinois. Joint Experimental-Theoretical Physics Seminar ('Wine and Cheese') on *Results from E616: Neutrino Cross Sections and Nucleon Structure Functions.*

February 2, 1983 at the *Ettore Majorana* Centre for Scientific Culture, Erice, Italy. Invited talk at the Europhysics Study Conference on Electroweak Effects at High Energies on *Measurement of* $sin^2\theta_w$ *in Semileptonic* νFe *and* $\overline{\nu} Fe$ *Interactions.*

April 8, 1985 at Northwestern University, Evanston, Illinois. High Energy Physics Seminar on *The Fermilab Antiproton Source.*

December 11, 1985 at the University of Wisconsin, Madison, Wisconsin. Accelerator Physics Seminar on *Diagnostic Instrumentation for the Fermilab Antiproton Source.*

April 10, 1986 at the Fermi National Accelerator Laboratory, Batavia, Illinois. Invited talk at the First Workshop on Antimatter Physics at Low Energy on *The Fermilab Antiproton Source : Prospects for* $p\overline{p}$ *Experiments.*

April 14, 1986 at Northwestern University, Evanston, Illinois. Physics Department Colloquium on *The Fermilab Antiproton Source and its use in the Study of Charmonium.*

November 16, 1989 at the University of Cininnatti, Ohio. Physics Department Colloquium on *The Fermilab Antiproton Source.*

July 5, 1990 at the First Biennial Conference on Low Energy Antiproton Physics (LEAP 90), in Stockholm, Sweden. Invited Talk on *Low and Medium Energy Antiproton Facilities in the USA.*

April 7, 1992 at the Massachusetts Institute of Technology, Nuclear and Particle Physics Departmental Colloquium on *Study of Charmonium States produced in* $p\bar{p}$ *Annihilation.*

April 21, 1992 at the 1992 Joint Meeting of the American Physical Society and the American Association of Physics Teachers in Washington, D.C. Invited talk on *Formation of Charmonium states in* $p\bar{p}$ *Annihilation.*

May 9, 1992 at the 1992 Spring Meeting of the Ohio Section of the American Physical Society in Cincinnati, Ohio. Invited talk on *New Results in Charmonium Physics.*

July 18, 1992 at the Stanford Linear Accelerator Center, Stanford, California. Invited talk at the 1992 Summer Institute on Particle Physics on *Precision Charmonium Spectroscopy at Fermilab Antiproton Accumulator.*

December 3, 1992 at Syracuse University, New York. Physics Department Colloquium on *Antiprotons at Fermilab, but not at the Tevatron!.*

April 2, 1993 at Northern Illinois University, DeKalb, Illinois. Physics Department Colloquium on *Antiprotons at Fermilab, but not at the Tevatron!.*

October 20, 1993 at Pylos, Greece. Invited talk at the 3rd NESTOR Workshop on *Overview of the Fermilab Long Baseline Neutrino Experimental Program.*

April 11, 1994 at the University of Illinois, Urbana, Illinois. High Energy Physics Departmental Seminar on *Precision Charmonium Spectroscopy with* $p\overline{p}$ *Annihilations at the Fermilab Antiproton Accumulator.*

October 19, 1994 at the University of Crete, Heraklion, Crete, Greece. Physics Department Colloquium on *Charmonium Formation in* $p\overline{p}$ *Annihilations at the Fermilab Antiproton Accumulator.*

June 12, 1995 at the 4th International Workshop on Vertex Detectors *Vertex 95*, En Gedi, Israel, June 11-16, 1995, on *The Silicon Vertex Detector for the DØ Upgrade.*

April 13, 1996 presentation to the Fermilab Program Advisory Committtee on *Possibilities for Low Energy* $\overline{p}$ *Physics at Fermilab.*

October 15, 1997 at the 5th International Workshop on B-Physics at Hadron Machines *Beauty 97*, Los Angeles, California, October 13-17, 1997, on *The Silicon Vertex Detector for the DØ Upgrade.*

August 27, 2000 at the International Conference on High Energy Physics, Osaka, Japan, on *The Silicon Vertex Detector for the DØ Upgrade.*

April 26, 2002 invited talk at the Annual Meeting of the Hellenic Society for the Study of High Energy Physics, Patras, Greece, on *Physics at the Tevatron Collider, Status and Future Prospects.*

August 25 to September 7, 2002. Discussion leader at 2002 European School of High-Energy Physics (formerly the CERN-JINR School of Physics), Pylos, Greece.

8 October 2003. Invited talk at the 19th International Workshop on Weak Interactions and Neutrinos October, WIN'03, Lake Geneva, Wisconsin, on *B-physics results from the CDF and DØ Collaborations (excluding lifetime measurements).*

1 April 2004. Invited talk at the Conference on Recent Advances in Particle and Astroparticle Physics, Chios, Greece, on *Tevatron Run II, Status and Recent Results.*

10 September 2004. Invited talk at the XIII International Symposium on Very High Energy Cosmic Ray Interactions, (XIII ISVHECR), Pylos, Greece, on *Tevatron Results.*

Research Experience[1]

During my last year as an undergraduate I worked with the medium-energy electron scattering group at M.I.T. . There I participated in the construction of the 600 MeV Bates Electron Linac. In particular, I worked on the magnetic field mapping of the beam switchyard magnets, and I constructed and tested a plastic scintillator hodoscope to be used as the focal plane detector of the spectrometer of the linac.

For the last three year of my graduate studies I worked with the experimental group E at the Stanford Linear Accelerator Center, under the supervision of Prof. Martin L. Perl. My experience there included work on the Mark I magnetic detector at SPEAR (Expt. SP-17) as well as work with the Lead-Glass Wall addition to the Mark I (Expt. SP-26). My major contributions to the experiment were :

I participated in the building, testing, and operation of the magnetostrictive readout wire spark chambers of the Lead-Glass Wall.

I built and tested a modular CAMAC system used in the monitoring of the high voltage of the 320 phototubes of the Lead-Glass Wall.

I made significant contributions to the software and interfacing to the on-line Sigma-5 computer (including interfacing to CAMAC, data acquisition, and on-line monitoring of the experiment).

I supervised the off-line data processing on the SLAC IBM 370 system, which included minor alterations to the code used for pattern recognition and track fitting.

Even though my first work[1] at SLAC was on topics related to the search for (the as of then undiscovered) heavy lepton, my interest turned to the study of charmed meson production in e^+e^- annihilation. Thus my thesis[46] was on the general characteristics and dynamics of D meson production in e^+e^- collisions. In particular, I studied the inclusive production of D mesons[43][45]. This work included the discovery[27] of the $\psi''(3772)$, the

[1] **References to specific items from my publications list implies that I was a major contributor in the work described in that publication.**

investigation of its properties, the measurement of the cross section for the reaction $e^+e^- \rightarrow D+$anything, and the measurement of the momentum spectrum of D's produced at the highest energies attainable at SPEAR ($E_{c.m.}$= 7 GeV/c^2). This last measurement allowed for a glimpse of the charmed quark fragmentation function.

After receiving my doctorate I joined Fermilab as a research associate, a position which I occupied for four years. My immediate supervisors at Fermilab during that time were Drs. Drasko Jovanovich, and H. Eugene Fisk. During that time I was associated with Experiments E616, E595, E701, and E744 .

Experiments E616, E701, and E744 were a programmatic series of runs by a Columbia, Chicago, Caltech, Fermilab, Rochester, and Rockefeller collaboration studying neutrino-nucleon scattering; the senior scientist was Prof. Frank Sciulli. The objectives of that effort were:

an accurate measurement (better than 5%) of the total cross section,

the determination of the nucleon structure functions,

the study of neutral currents and a measurement of $\sin^2\theta_{\rm w}$,

the study of dimuons produced in neutrino interactions,

the study of possible neutrino oscillations.

Experiment E616 used the Lab E detector, a large iron-scintillator calorimetric target followed by an iron toroid magnetic spectrometer. We collected more than 150,000 events during the 1979-80 run with the dichromatic (narrow band) neutrino beam. Results on total cross sections, neutral currents, structure functions, and on dimuon production have been reported. One of the most significant result of E616 has been the measurement of cross sections for charged current neutrino-nucleon interactions[53][55][68] that are higher than the ones measured in earlier experiments. Subsequent re-measurements by our rival European experiment have strikingly confirmed our results.

Besides helping run the experiment, my major contributions and responsibilities in E616 were :

The upkeep and upgrading of the spark chamber system, consisting of 60 3m×3m chambers. The upgrading of this system allowed it to operate efficiently at a rate of 50 Hz.

The initial data reduction and data manipulation.

The construction, maintenance, and calibration of many devices[59] used in monitoring the secondary particle flux in the decay region of Fermilab's dichromatic neutrino beam. These devices (which included a Cherenkov counter[54], beam current transformers, ionization chambers, a resonant RF cavity, and segmented ion chambers) were essential to the success of the experiment, since they allowed us to infer the neutrino flux at our detector and determine the absolute value of the cross section. The calibration of the ion chambers and the RF cavity involved setting up what would best be described as three small experiments in both the test beam at Fermilab, and in the primary extracted proton beam[53]. This effort, which I orchestrated and to a large extent designed, took more than three months and involved 3-4 physicists and graduate students.

The study of multimuon production. I initiated this effort and the initial selection of dimuon candidates was performed by Dr. Fukushima and myself. This data sample, combined with the data of E701 has been analyzed and was the thesis topic of one of the graduate students in the experiment. Results from this analysis[63] included the determination of the strange quark content of the nucleon ($\kappa = 2s/(\overline{u} + \overline{d}) = 0.52 \pm 0.17$), and the observation of a puzzling signal of same sign dimuons (7 ± 5 events over background), which has not been confirmed by subsequent experiments.

The study of neutral current interactions. Together with a few physicists from the U. of Chicago we picked up this orphan piece of analysis. This work[56][61][67], which was the thesis topic of P. Reutens, lead to an accurate measurement of $\sin^2\theta_{\rm w} = 0.242 \pm 0.015$.

Experiment E701 had as its objective the investigation of neutrino oscillations through the use of two detectors placed at different locations along the narrow band neutrino beam (the original Lab E apparatus, located 1100m

downstream of the decay region, and a similar smaller apparatus located 350m upstream of Lab E).

The ratio of the neutrino cross sections measured in the two detectors as a function of neutrino energy ($30 < E_\nu < 230$ GeV) was used to search for oscillatory behaviour. Since this ratio is largely free of systematic errors, we were sensitive to neutrino oscillations with $30 < \Delta m^2 < 1000 eV^2/c^4$ and $\sin^2(2\theta) > 0.02 - 0.40$. No oscillations were observed[60].

Experiment E701 also accumulated a large amount of data that were used to perform the same kind of analysis as for E616; this work included a new measurement of the neutrino nucleon cross section[68].

Experiment E744 was the first neutrino scattering experiment to take data in the higher energy regime allowed in the Tevatron. The apparatus was upgraded by replacing the spark chambers with 160 planes of $3m \times 3m$ drift chambers. This upgrade was motivated primarily by the need to decrease the dead-time; with the drift chambers up to 30 events in 1 ms can be recorded. Data using the quad triplet neutrino beam were taken in the summer of 1985, some 1.7 million charged current events have been analyzed. Even though I contributed significantly to the design, construction, and testing of the drift chambers, due to other obligations I did not participate in the analysis of E744 data.

Experiment E595 was a Caltech, Fermilab, Rochester, and Stanford collaboration; the spokesman was Prof. Arie Bodek. This experiment was essentially a beam-dump experiment. We studied the production of prompt muons in hadronic interactions with the Lab E apparatus augmented by a variable density target calorimeter. An earlier phase of this experiment established the existence of a prompt muon signal in p Fe interactions by extrapolating the observed muon production off finite density targets to one of infinite density. The observed signal was at a level expected from the production of charmed particles ($\approx 15\mu b$). Experiment E595 extended the measurements to a lower p_T region and to π^--Fe interactions. Even though I was interested in the physics of this experiment, due to my commitments to experiment E616 I did not contribute significantly to the analysis effort. My major contribution was in the running of the experiment and in the (previously mentioned) upgrade of the spark chamber system that enabled E595 to significantly decrease its dead time.

For the years 1985-1990 I was associated with the Tevatron I section at Fermilab. This section, headed by Dr. John Peoples, Jr., was the group that designed, built, and commissioned the Fermilab Antiproton Source. Since I joined this group after the antiproton source had been largely designed, my major contribution was in the design and construction of diagnostic instrumentation[72]. This included devices for the two storage rings that comprise the Antiproton Source (e.g. a 'D.C.' current transformer based on a magnetic modulator[93], transverse and longitudinal Schottky pickups, a beam loss monitoring system), as well as the various beamlines in the source. In the process, much to my delight, I had to learn the intricacies of strong-focusing circular accelerators and of stochastic cooling[75]. I find it gratifying that these instruments are still in daily use measuring the beam intensity of the accumulated antiproton beam, its longitudinal (energy) profile, its betatron tunes, and the beam transfer efficiency.

As an outcome of this accelerator related work, I became one of the proponents[71] of E760, an experiment at Fermilab that was approved in December 1985. This experiment was a collaborative effort of physicists from Fermilab, Ferrara, Genova, Irvine, Northwestern, Penn State and Torino. We used a hydrogen gas jet as an internal target in the Fermilab Antiproton Accumulator Ring. We studied $p\overline{p}$ interactions with $E_{c.m.} \approx 2 - 4GeV/c^2$. Our objective was to study the charmonium states produced, identified through their very characteristic electromagnetic decays into a high mass e^+e^- pair or a high mass $\gamma\gamma$ pair. This allowed the study of charmonium even in the presence of a hadronic background of ~ 70 mbarn which is at least four orders of magnitude larger than the rate for charmonium production.

E760 combined the best features of accelerator physics and experimental physics. The continuously stochastically cooled beam of antiprotons had an extremely narrow momentum spread ($dp/p \sim 0.01\%$) which implied a center-of-mass energy resolution of 160 keV/c^2 ! In addition the beam energy could be controlled in a very precise manner. As a result, we were able to measure with excellent accuracy the widths and masses of the χ_{c1}, χ_{c2} states[76] [77], to directly measure (i.e. a measurement based on the line shape) the width of the J/ψ and ψ' states[80], and to measure the mass of the J/ψ. Branching ratios for these states to decay inclusively into J/ψ, as well as branching ratios to $p\overline{p}$ have also been reported. Additionally, we reported the first measurement of the proton electromagnetic form factor for large time-like momentum transfers[78].

A notable goal of E760 was the search for the 'missing' $h_c[1^1P_1]$ state of charmonium[79]. We reported an observation for that state that has since not been confirmed in the mode we searched for it ($J/\psi\pi^0$). Definite observations of this state in other modes have been recently reported by E835, the continuation of E760 (Andreotti *et al., Phys. Rev.* **D72**,032001,(2005)), and the CLEO group (Rubin *et al.*, hep-ex/05080307 (2005)). As a result now the spectrum of charmonium is better known than the spectrum of positronium(!), and the fact that the mass of this state lies very close to the center-of-gravity mass for the χ_c states shows that simple single gluon exchange can describe the spectrum of charmonium, as expected by QCD. In addition E760 measured the $\gamma\gamma$ decay of the χ_{c2}, and the η_c, and has reported measurements of light quark resonances produced in $p\overline{p}$ annihilation.

The precision results obtained in E760 constitute a stringent and significant test of QCD. It is no accident that what is probably the best determination of α_s, the strong coupling constant, is extracted from Lattice QCD calculations using our charmonium masses as input data (see El-Khadra *et al., Phys. Rev. Lett.* **69**, 729 (1992)).

I took a leadership role in E760. I was involved in the analysis of the results mentioned above, but more importantly I was involved in all aspects of the experiment from the first day. I wrote a good part of the proposal to the Program Advisory Committee at Fermilab. I was one of the designers and the physicist in charge of building the E760 central electromagnetic calorimeter[85]. This was a a large cylindrical array of some 1280 lead glass blocks, used in detecting high energy electrons and photons, and cost in excess of $1,500,000$ \$; I was involved in the procuring of the glass, supervised its machining, its testing, specified the electronics used in its readout, and directed its construction. In this capacity I had to work with two engineers, four technicians, two physicists, and four graduate students. Further down the line, I was instrumental in running the Antiproton Source for E760 and devising techniques used in measuring its energy[75]. I also directed the installation of the gas jet apparatus used as the target; this was a system comprising of 13 turbomolecular pumps and their ancillary equipment.

As a result of my intimate involvement with E760 and the Antiproton Source I was invited to present our results to various conferences[86], to lead study groups on antiproton physics[73] [74], and was delegated to be the Fermilab representative the PSSC (Proton Synchrotron Scientific Committee) of CERN at its long range planning meeting of September 12-16, 1990 at

Cogne, Italy. In addition, together with Prof. Cester of the University of Torino, we were asked to contribute a review[88] on *Charmonium Formation in $p\overline{p}$ Annihilations* for the 1994 volume of the *Annual Review of Nuclear and Particle Physics*.

In 1991 I proposed, together with Dr. Hsueh, an experiment[92] to search for CP violation in the decays of $\Lambda\overline{\Lambda}$ pairs produced in $p\overline{p}$ annihilations. Consideration of this experiment, which is very demanding since it needs 10^9 hyperon pairs to achieve its sensitivity goal, and will probably need a small dedicated storage ring, was indefinitely postponed given its relatively high cost and is now dormant.

For the period 1993-2004 I was associated with the DØ experiment at Fermilab. This experiment studies high energy $p\overline{p}$ collisions at $E_{c.m.} \approx 2$ TeV. I joined the Upgrade effort of DØ[111][167], which involved the addition of a magnetic tracker to the existing excellent calorimetric detector of DØ. The most important part of this new tracker was the Silicon Microvertex Tracker (SMT), which measures tracks with a resolution of $\sim 20\mu$m and allows secondary vertex reconstruction with a similar resolution. The total system consists of some 600 silicon strip detectors with some 792576 channels. Roughly half of these silicon strip detectors are double-sided ones. Special integrated circuit amplifier/digitizer chips, the so called SVX2 chip, (each reading 128 channels) are used for readout and digitization.

I was involved in the design of the detector and was originally assigned the task of the mechanical integration of the system. This was a formidable task indeed, since the alignment requirements for this meter long device are in the tens of microns. In this capacity I had to become familiar not only with silicon detector technology, but also with precision machining, temperature compensated materials, precision aligning, manipulating, and measuring equipment (e.g. co-ordinate measuring machines, x-y-z moving tables, microscopes, probing stations). I had to specify and procure such equipment, and to instrument a test station. In this work I designed and implemented a test system for strip detectors using fiber optics and a pulsed infrared laser[94].

As time progressed, we identified the SVX2 as a particularly capricious piece of electronics - it was prone to failure, had extremely tight operating margins, and on occasion exhibited pathological behavior. Given this and the complexity of the readout system I argued for and finally carried out an extensive test of the whole system. This so called '10% test' in reality involved

more like 20% of the final system and exercised not only the electronics, but also the mechanical and thermal components of the final setup and significant aspects of the DØ data acquisition system. It is acknowledged within the SMT group that this test, which occupied besides myself a post-doc and a graduate student for a full year, was a crucial step that assured the successful operation of the complete device[137].

I led the effort of commissioning and operating the SMT for two years and I was heavily involved with it as an *eminence grise* ever since it was installed (in 1999), to the detriment of any major physics analysis work. During this period we have discovered that a significant portion ($\approx 15\%$) of the SVX2 chips have failed for reasons that have been very hard to identify.

These failures, together with the need for better efficiency for b-tagging, and larger data acquisition bandwidth moved us to propose an upgraded SMT[154] for the next run of the Tevatron, the RunIIb period. The new SMT would have beeen read out by a new generation of readout chip, the SVX4, which is built in a much more robust fashion than the SVX2. I was heavily involved in the specification, design, and testing of this new chip. In this I worked together with two graduate students and two post-docs. The operation of the chip proved almost flawless and the upgraded SMT was moving along at a good clip, when in a completely bizarre fashion the previous Fermilab Director cancelled this part of the upgrade for apparently no good reason.

For two years I served as the Deputy Group Leader of the Silicon Detector Center at Fermilab, the organization charged with bringing together the required resources to build the silicon vertex detectors for CDF, DØ, BTev (the B physics experiment at the Tevatron), and the US portion of the CMS silicon tracker. In this capacity I have supervised 36 technicians, four engineers, and six draftsmen; I was actively involved in the budgeting process for the Center, which during these years had an annual capital equipment budget of approximately $300,000 and an annual operating budget (excluding salaries) of $250,000.

The SMT is now successfully used to tag B particles and early results on B-production and lifetimes are being reported at conferences. I have been involved with this phase of the DØ analysis[180] and I was invited to give a summary talk on b-physics at the Tevatron at a conference (WIN'03). DØ now looks forward to the detailed study of the decays of the B hadrons which will allow for another way to probe the mysterious phenomenon of CP

violation.

I was also involved in the work of the QCD group looking into the production of jets with large rapidity gaps[118] at DØ. This process allows for the study of the exchange of a color-singlet object between the two interacting particles ($p\overline{p}$). In the limit of low momentum transfer (i.e. in diffractive processes) the exchanged object is the so-called 'Pomeron', an elusive quasi-particle that models the exchange of a whole series of soft particles. Such a study may provide the best path towards exploring the nature of the Pomeron.

This last involvement has led me to become in December 2001 the 'godparent' of the Forward Proton ID group. In this capacity I served as the internal referee for the analysis of the data coming out of the Forward Proton Detector - a set of hodoscopes inside that can come very close to the beam axis (using the so called 'Roman Pots') and measure protons scattered with very small momentum transfer.

The cancellation of the DØ Run IIb silicon upgrade affected me seriously, and I started looking for alternative avenues of research. As of early 2005 I have switched my research interest to neutrino physics and the study of neutrino oscillations. As mentioned earlier I have participated in the early 1980's in a neutrino oscillation experiment, but at that time I must say I did not believe that neutrinos had mass - a belief based on the fact that a massless fermion provides some kind of a rationale for a parity non-symmetric world. It was that belief, my disillusionment with the engineering style of neutrino physics during the intervening years, and my deep involvement with the accelerator and the Fermilab Antiproton Source that drove me away from the study of these light fermions.

The renaissance of neutrino physics - heralded by the Kamiokande discoveries - has reignited my interest in that field and I have been following it with quite some interest. As a result I was one of the group that proposed a massive detector for Fermilab's off-axis neutrino beam [189], a detector based on a large Liquid Argon Time Projection Chamber with a target mass in the range of 15 to 50 ktons.

This proposal has been met with some enthusiasm and encouragement from Ferilab's management. I am now a leading member of a small group of physicists from the Laboratory and from the university community that are designing such a detector and charting out a plan for research and development for this new detector breed. We are requesting R&D funds of 5M$

over the next four years to be followed by an 100M$+ construction program for the final large detector. We are submitting a document[190] arguing for such a program to the recently established U.S. NuSAG panel (Neutrino Science Assessment Group) that will advise the U.S. funding agencies on such matters.

Distinction

For the period of 1982-1985 I was appointed as the third R.R. Wilson Research Fellow at Fermilab. This is the highest distinction that the Laboratory can bestow to a young scientist.

Teaching Experience

I was a teaching assistant for three academic years. During my Junior year at M.I.T. I taught the self-paced version of the sophomore course in quantum mechanics. During my first two years at Stanford I taught laboratory and discussion sections in the sophomore level courses in mechanics, electromagnetism, and thermal physics. I was also a grader for problems for the graduate course in statistical mechanics at Stanford.

For the period of August 25 to September 7, 2002 I served as a discussion leader for graduate students at 2002 European School of High-Energy Physics (formerly the CERN-JINR School of Physics).

Other Activities

During the year 1980-1981 I was the chairman of the Fermilab Physics Colloquium Committee. I take pride in the fact that the colloquia for that year were one of the better series we have had.

Publications

[1] **The Search for Heavy Leptons and Muon - Electron Differences.**
By M.L. Perl, and P.A. Rapidis (SLAC), SLAC-PUB-1496, Sept. 1974. Revised version of review paper originally presented at the Muon Physics Conference, Colorado State Univ., Sep 6-10, 1971. Reprinted in *'Reflections on Experimental Science', World Scientific Series in 20th Century Physics, Volume 14* by M.L. Perl, World Scientific, Singapore, 1996.

[2] **Discovery of a Narrow Resonance in e^+e^- Annihilation.**
J.-E. Augustin *et al.*, *Phys. Rev. Lett.* **33**,1406 (1974).

[3] **Discovery of a Second Narrow Resonance in e^+e^- Annihilation.**
G.S. Abrams *et al.*, *Phys. Rev. Lett.* **33**,1453 (1974).

[4] **Search for Narrow Resonances in e^+e^- Annihilation in the Mass Region 3.2 to 5.9 GeV.**
G.S. Abrams *et al.*, *Phys. Rev. Lett.* **34**,762 (1975).

[5] **Decay of ψ(3684) into ψ(3095).**
G.S. Abrams *et al., Phys. Rev. Lett.* **34**,1181 (1975).

[6] **Quantum Numbers and Decay Widths of the ψ(3095).**
A.M. Boyarski *et al., Phys. Rev. Lett.* **34**,1357 (1975).

[7] **Limits on Charmed-Meson Production in e^+e^- Annihilation at 4.8-GeV Center-of-Mass Energy.**
A.M. Boyarski *et al., Phys. Rev. Lett.* **35**,195 (1975).

[8] **Quantum Numbers and Decay Widths of the ψ(3684).**
V. Lüth *et al., Phys. Rev. Lett.* **35**,1124 (1975).

[9] **ψ(3684) Radiative Decays to High-Mass States.**
G.J. Feldman *et al., Phys. Rev. Lett.* **35**,821 (1975), Erratum-*ibid.* **35**,1184 (1975).

[10] **Evidence for Anomalous Lepton Production in e^+e^- Annihilation.**
M.L. Perl *et al., Phys. Rev. Lett.* **35**,1489 (1975).

[11] **Azimuthal Asymmetry in Inclusive Hadron Production by e^+e^- Annihilation.**
R. Schwitters *et al., Phys. Rev. Lett.* **35**,1320 (1975).

[12] **Observation of an Intermediate State in ψ(3684) Radiative Cascade Decay.**
W.M. Tanenbaum *et al., Phys. Rev. Lett.* **35**,1323 (1975).

[13] **Evidence for Jet Structure in Hadron Production by e^+e^- Annihilation.**
G. Hanson *et al., Phys. Rev. Lett.* **35**,1609 (1975).

[14] **Determination of the G Parity and Isospin of ψ(3095) by Study of Multipion Decays.**
B. Jean-Marie *et al., Phys. Rev. Lett.* **36**,291 (1976).

[15] **Observation of the Decay ψ(3684) $\rightarrow$ ψ(3095) η.**
W.M. Tanenbaum *et al., Phys. Rev. Lett.* **36**,402 (1976).

[16] **Observation of a Resonance at 4.4 GeV and Additional Structure Near 4.1 GeV in e^+e^- Annihilation.**
J. Siegrist *et al., Phys. Rev. Lett.* **36**,700 (1976).

[17] **Observation in e^+e^- Annihilation of a Narrow State at 1865 MeV/c^2 Decaying to $K\pi$ and $K\pi\pi\pi$.**
G. Goldhaber *et al., Phys. Rev. Lett.* **37**,255 (1976).

[18] **Observation of a Narrow Charged State at 1876 MeV/c^2 Decaying to an Exotic Combination of $K\pi\pi$.**
I. Peruzzi *et al., Phys. Rev. Lett.* **37**,569 (1976).

[19] **Properties of Anomalous $e\mu$ Events Produced in e^+e^- Annihilation.**
M.L. Perl *et al., Phys. Lett.* **63B**,466 (1976).

[20] **Radiative Decays of ψ(3095) and ψ(3684).**
J.S. Whitaker *et al., Phys. Rev. Lett.* **37**,1596 (1976).

[21] **Inclusive Anomalous Muon Production in e^+e^- Annihilation.**
G.J. Feldman *et al., Phys. Rev. Lett.* **38**,117 (1977), Erratum-*ibid.* **38**,576 (1977).

[22] **Evidence for Parity Nonconservation in the Decays of the Narrow States near 1.87 GeV/c^2.**
J. Wiss *et al., Phys. Rev. Lett.* **37**,1531 (1976).

[23] **Mesonic Decays of the ψ(3095).**
F. Vannucci *et al., Phys. Rev.* **D15**,1814 (1977).

[24] **Observation of the Decay $D^{*+} \to D^0\pi^+$.**
G.J. Feldman *et al., Phys. Rev. Lett.* **38**,1313 (1977).

[25] **Spin Analysis of Charmed Mesons Produced in e^+e^- Annihilation.**
H.K. Nguyen *et al., Phys. Rev. Lett.* **39**,262 (1977).

[26] **K^0 Production in e^+e^- Annihilation.**
V. Lüth *et al., Phys. Lett.* **70B**,120 (1977).

[27] **Observation of a Resonance in e^+e^- Annihilation Just above Charm Threshold.**
P.A. Rapidis *et al., Phys. Rev. Lett.* **39**,526 (1977), Erratum-*ibid.* **39**,974 (1977).

[28] **D and D^* Meson Production near 4 GeV in e^+e^- Annihilation.**
G. Goldhaber *et al., Phys. Lett.* **69B**,503 (1977).

[29] **Electron - Muon and Electron - Hadron Production in e^+e^- Collisions.**
A. Barbaro-Galtieri *et al., Phys. Rev. Lett.* **39**,1058 (1977).

[30] **D Meson Production and Decay in e^+e^- Annihilation at 4.03 and 4.41 GeV C.M. Energy.**
M. Piccolo *et al., Phys. Lett.* **70B**,260 (1977).

[31] **Radiative Decays of the ψ(3684) into High-Mass States.**
W.M. Tanenbaum *et al., Phys. Rev.* **D17**,1731 (1978).

[32] **A Search for Neutral Heavy Leptons.**
D.I. Meyer *et al., Phys. Lett.* **70B**,469 (1977).

[33] **Properties of the Proposed τ Charged Lepton.**
M.L. Perl *et al., Phys. Lett.* **70B**,487 (1977).

[34] **Study of D Mesons Produced in the Decay of the ψ(3772).**
I. Peruzzi *et al., Phys. Rev. Lett.* **39**,1301 (1977).

[35] **Observation of D^0 Meson Decay into $K^-\pi^+\pi^0$.**
D.L. Scharre *et al., Phys. Rev. Lett.* **40**,74 (1978).

[36] **Inclusive Baryon Production in e^+e^- Annihilation.**
M. Piccolo *et al., Phys. Rev. Lett.* **39**,1503 (1977).

[37] **Measurement of Semileptonic Decays of D Mesons to Electrons at the ψ(3772).**
J.M. Feller *et al., Phys. Rev. Lett.* **40**,274 (1978).

[38] **Anomalous e^+e^- and $\mu^+\mu^-$ Events Produced in e^+e^- Annihilation.**
F.B. Heile *et al., Nucl. Phys.* **B138**,189 (1978).

[39] **Baryonic Decays of the ψ(3095).**
I. Peruzzi *et al., Phys. Rev.* **D17**,2901 (1978).

[40] **Observation of $\mu 3\pi$ Events in e^+e^- Annihilation.**
J. Jaros *et al., Phys. Rev. Lett.* **40**,1120 (1978).

[41] **Inclusive Electron Production in Multiprong Events Produced by e^+e^- Annihilation.**
J.M. Feller *et al., Phys. Rev. Lett.* **40**,1677 (1978), Erratum-*ibid.* **41**,518 (1978).

[42] **Inclusive γ and π^0 Production in e^+e^- Annihilation.**
D.L. Scharre *et al., Phys. Rev. Lett.* **41**,1005 (1978).

[43] **Inclusive Production of D-Mesons in e^+e^- Annihilation at 7 GeV.**
P.A. Rapidis *et al., Phys. Lett.* **84B**,507 (1979).

[44] **Inclusive Studies of D-Meson Decays at the ψ(3772).**
V. Vuillemin,*et al., Phys. Rev. Lett.* **41**,1149 (1978).

[45] **Inclusive Production of D and K Mesons in e^+e^- Annihilation.**
M. Piccolo *et al., Phys. Lett.* **86B**,220 (1979).

[46] **D Meson Production in e^+e^- Annihilation.**
By P.A. Rapidis (SLAC), SLAC Report No. 0220, June 1979. 103pp. Ph.D. Thesis.

[47] **Hadron Production by e^+e^- Annihilation at Center-of-Mass Energies between 2.6-GeV and 7.8-GeV. I. Total Cross Section, Multiplicities, and Inclusive Momentum Distributions.**
J. Siegrist *et al., Phys. Rev.* **D26**,969 (1982).

[48] **Hadron Production by e^+e^- Annihilation at Center-of-Mass Energies between 2.6-GeV and 7.8-GeV. II. Jet Structure and Related Inclusive Distributions.**
G. Hanson *et al., Phys. Rev.* **D26**,991 (1982).

[49] **A Study of the Forward Production of Charm Particle Pairs in p-Fe and π^--Fe interactions.**
A. Bodek *et al., Phys. Lett.* **113B**,77 (1982).

[50] **Limits on $D^0 - \overline{D^0}$ Mixing and Bottom Particle Production Cross Section from Hadronically Produced Same-Sign Dimuon Events.**
A. Bodek *et al., Phys. Lett.* **113B**,82 (1982).

[51] **Forward Production of Charm States and Prompt Single Muons in 350 GeV p-Fe Interactions.**
J.L. Ritchie *et al., Phys. Lett.* **126B**,499 (1983).

[52] **Forward Production of Charm States and Prompt Single Muons in 278 GeV π^--Fe Interactions.**
J.L. Ritchie *et al., Phys. Lett.* **138B**,213 (1984).

[53] **Recent Results on Total Neutrino and Antineutrino Cross Sections the CFRR Collaboration.**
By B.C. Barish *et al.,* Presented by P.A.Rapidis at the 9th SLAC Summer Inst. on Particle Physics, Stanford, Calif., July 27 - August 7, 1981. Published in *Proceedings of Summer Institute on Particle Physics, July 27 - August 7, 1981, The Strong Interactions,* SLAC Report No. 245, Ed. by A. Mosher, (January 1982), p. 641.

[54] **Observation of Light Below Cherenkov Threshold in a 1.5 Meter Long Integrating Cherenkov Counter.**
A. Bodek *et al., Z. Phys. C - Particles and Fields* **18**,289 (1983).

[55] **Measurement of the Rate of Increase of Neutrino Cross Sections with Energy.**
R. Blair *et al., Phys. Rev. Lett.* **51**,343 (1983).

[56] **Measurement of $\sin^2\theta_{\rm w}$ in Semileptonic ν Fe and $\overline{\nu}$ Fe Interactions.**
By R.E. Blair *et al.,* Presented by P.A. Rapidis at the Europhysics Study Conference on Electroweak Effects at High Energies, February 1-12, 1983, Erice, Italy. Published in the *Proceedings of the First Europhysics Study Conference on Electroweak Effects at High Energies*, Ed. by H. Newman, Plenum, NY, 1985, p. 87.

[57] **Limit on Muon-Neutrino Oscillations in the Mass Range $30 < \Delta m^2 < 1000 eV^2/c^4$.**
By I.E. Stockdale *et al., Phys. Rev. Lett.* **52**,1384 (1984).

[58] **Nucleon Structure Functions from High-Energy Neutrino Interactions with Iron and QCD Results.**
D. MacFarlane *et al., Z. Phys. C. - Particles and Fields* **26**,1 (1984).

[59] **Monitoring and Calibration System for Neutrino Flux Measurement in a High-Energy Dichromatic Beam.**
R. Blair *et al., Nucl. Instrum. Methods.* **226**, 281 (1984).

[60] **Search for Muon Neutrino and Antineutrino Oscillations in the Mass Range $15 < \Delta m^2 < 1,000 eV^2/c^4$.**
By I.E. Stockdale *et al., Z. Phys. C - Particles and Fields* **27**,53 (1985).

[61] **Measurement of $\sin^2\theta_{\rm w}$ and ρ in Deep Inelastic Neutrino-Nucleon Scattering.**
P.G. Reutens *et al., Phys. Lett.* **152B**, 404 (1985).

[62] **Hadron Shower Punchthrough for Incident Hadrons of Momentum 15-GeV/c, 25-GeV/c, 50-GeV/c, 100-GeV/c, 200-GeV/c, and 300-GeV/c.**
F.S. Merritt *et al., Nucl. Instrum. Methods. A* **245**, 27 (1986).

[63] **Neutrino Production of Dimuons.**
K. Lang *et al., Z. Phys. C - Particles and Fields* **33**,483 (1987).

[64] **Search for Neutral Heavy Leptons from ν-N Scattering.**
S.R. Mishra *et al., Phys. Rev. Lett.* **59**,1397 (1987).

[65] **Nucleon Structure Functions from High-Energy Neutrino Interactions.**
E. Oltman *et al., Z. Phys. C - Particles and Fields* **53**,51 (1992).

[66] **A Measurement of TeV Muon Energy Loss in Iron.**
W.K. Sakumoto *et al., Phys. Rev.* **D45**, 3042 (1992).

[67] **A Measurement of the Neutral Current Electroweak Parameters using the Fermilab Narrow Band Neutrino Beam.**
P.G. Reutens *et al., Z. Phys. C - Particles and Fields* **45**,539 (1990).

[68] **Measurement of the Inclusive Charged Current Cross-Section for Neutrino and Anti-Neutrino Scattering on Isoscalar Nucleons.**
P.S. Auchincloss *et al., Z. Phys. C - Particles and Fields* **48**,411 (1990).

[69] **Calibration of the CCFR Target Calorimeter.**
W.K. Sakumoto *et al., Nucl. Instrum. Methods.* **A294**, 179 (1990).

[70] **A Study of Wrong Sign Single Muon Production in Muon - Neutrino - Nucleon Interactions.**
S.R. Mishra *et al., Z. Phys. C - Particles and Fields* **44**,187 (1989).

[71] **The Fermilab Antiproton Source : Prospects for $p\bar{p}$ Experiments.**

By P.A. Rapidis (Fermilab), Presented at the First Workshop on Antimatter Physics at Low Energy, Batavia, Illinois, April 10-12, 1986. Published in *Proceedings of the First Workshop on Antimatter Physics at Low Energy,* Fermilab Publication, Ed. by B. E. Bonner and L. S. Pinsky , (1986), p. 83.

[72] **The Fermilab Antiproton Source : Recent Performance and Improvements.**
By P.A. Rapidis *et al.,* Presented at the 1st European Particle Accelerator Conference, Rome, Italy, June 7-11, 1988. Published in *EPAC, European Particle Accelerator Conference*, Ed. by S. Tazzari, World Scientific, Singapore, 1989, p. 404.

[73] **Experiments with Anti-Protons: Summary of the Working Group's Activities.**
By P.A. Rapidis (Fermilab), in *Proceedings of the Workshop on Physics at the Main Injector, May 16-18, 1989, Batavia, Illinois*, Ed. by S.D. Holmes and B.D. Winstein, Fermilab, 1989 p. 165.

[74] **$p\overline{p}$ Accumulator Physics.**
By P.A. Rapidis (Fermilab), and G.A. Smith (Penn State U.), editors for the $\overline{p}$ Accumulator Physics Group, in *Proceedings of Physics at Fermilab in the 1990's, August 15-24, 1989, Breckenridge, Colorado*, Ed. by D. Green and H. Lubatti, World Scientific Publishers, Singapore, 1990, p. 474.

[75] **Energy and Energy Width Measurement in the FNAL Antiproton Accumulator.**
By M. Church, S. Hsueh, P. Rapidis, and S. Werkema. Published in *Conference Record of the 1991 IEEE Particle Accelerator Conference, May 6-9, 1991, San Francisco, California*, p. 108.

[76] **Precision Measurements of Charmonium States Formed in $\overline{p}p$ Annihilation.**
T.A. Armstrong *et al., Phys. Rev. Lett.* **68**, 1468 (1992).

[77] **Study of the χ_{c1} and χ_{c2} Charmonium States Formed in $\overline{p}p$ Annihilations.**
T.A. Armstrong *et al., Nucl. Phys.* **B373**, 35 (1992).

[78] **Proton Electromagnetic Form Factor in the Timelike Region from 8.9 to 13.0 GeV^2.**
T.A. Armstrong *et al., Phys. Rev. Lett.* **70**, 1212 (1993).

[79] **Observation of the $^1P_1$ State of Charmonium.**
T.A. Armstrong *et al., Phys. Rev. Lett.* **69**, 2337 (1992).

[80] **Measurement of the J/ψ and ψ' resonance parameters in $\overline{p}p$ annihilation.**
T.A. Armstrong *et al., Phys. Rev.* **D47**, 772 (1993).

[81] **Study of the Angular Distribution of the Reaction $\overline{p}p \to \chi_{c2} \to J/\psi\gamma \to e^+e^-\gamma$.**
T.A. Armstrong *et al., Phys. Rev.* **D48**, 3037 (1993).

[82] **Measurement of the $\gamma\gamma$ Partial Width of the χ_{c2} Charmonium Resonance.**
T.A. Armstrong *et al., Phys. Rev. Lett.* **70**, 2988 (1993).

[83] **Evidence for $\eta\eta$ Resonances in Antiproton - Proton Annihilations at $2950 < \sqrt{s} < 3620$ MeV.**
T.A. Armstrong *et al., Phys. Lett.* **B307**, 394 (1993).

[84] **Production of the $f_2(1520)$ Resonance in Antiproton - Proton Annihilations at $\sqrt{s} = 2950$ and 3526 MeV.**
T.A. Armstrong *et al., Phys. Lett.* **B307**, 399 (1993).

[85] **The E760 Lead Glass Central Calorimeter: Design and Initial Test Results.**
L. Bartoszek *et al., Nucl. Instrum. Meth.* **A301**, 47 (1991).

[86] **Precision Charmonium Spectroscopy at the Fermilab Antiproton Accumulator.**
By P.A. Rapidis (Fermilab), Presented at the 1992 Summer Institute on Particle Physics, Stanford, California, July 13-24, 1992. Published in *Proceedings of the Summer Institute on Particle Physics, July 13-24, 1992, The Third Family and the Physics of Flavor*, edited by L. Vassilian, SLAC, 1993, p. 469.

[87] **Study of the $\eta_c(1^1S_0)$ State of Charmonium Formed in $p\overline{p}$ Annihilations and a Search for the $\eta_c'(2^1S_0)$.**
T.A. Armstrong *et al., Phys. Rev.* **D52**, 4839 (1995).

[88] **Charmonium Formation in $p\overline{p}$ Annihilations.**
R. Cester (U. of Turin), and P.A. Rapidis (Fermilab), *Ann. Rev. Nucl. Part. Sci.*, **44**, 329 (1994).

[89] **Observation of the Radiative Decay $J/\psi \to e^+e^-\gamma$.**
T.A. Armstrong *et al., Phys. Rev.* **D54**, 7067 (1996).

[90] **Measurement of the Branching Ratios $\psi' \to e^+e^-$, $\psi' \to J/\psi\pi\pi$, and $\psi' \to J/\psi\eta$.**
T.A. Armstrong *et al., Phys. Rev.* **D55**, 1153 (1997).

[91] **Two Body Final States Produced in $p\overline{p}$ Annihilations at 2.911 GeV $\leq \sqrt{s} \leq$ 3.686 GeV.**
T.A. Armstrong *et al., Phys. Rev.* , **D56**, 2509 (1997).

[92] **Search for Direct CP Violation in $p\overline{p} \to \overline{\Lambda}\Lambda \to \overline{p}\pi^+p\pi^-$**
S. Y. Hsueh, and P.A. Rapidis (Fermilab), *Fermilab Proposal P-859* , January 1992, unpublished.

[93] **SQUID Based Beam Current Meter.**
M. Kuchnir, J.D. McCarthy, and P.A. Rapidis (Fermilab). *et al., IEEE Transactions on Magnetics* **MAG-21**,997 (1985).

[94] **Pulsed Laser for Testing Silicon Strip Detectors.**
M. Vaz (Rio de Janeiro, CBPF & Rio de Janeiro U.), S. Cihangir, and P.A. Rapidis (Fermilab), FERMILAB-TM-1849, Jul 1993. 16pp.

[95] **Search for Heavy W Bosons in 1.8 TeV $p\overline{p}$ Collisions.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Lett.* **B358**, 405 (1995).

[96] **Jet Production via Strongly-Interacting Color-Singlet Exchange in $p\overline{p}$ Collisions.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* , **76** 734 (1996).

[97] **Top Quark Search with the DØ 1992−1993 Data Sample.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev.* **D52**, 4877 (1995).

[98] **Limits on the $ZZ\gamma$ and $Z\gamma\gamma$ Couplings in $p\overline{p}$ Collisions at $\sqrt{s} =$ 1.8 TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **75**, 1028 (1995).

[99] **Transverse Energy Distributions within Jets in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Lett.* **B357**, 500 (1995).

[100] **Second Generation Leptoquark Search in $p\overline{p}$ Collisions at $\sqrt{s} =$ 1.8 TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **75**, 3618 (1995).

[101] **W and Z Boson Production in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **75**, 1456 (1995).

[102] **Search for Squarks and Gluinos in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **75**, 618 (1995).

[103] **Measurement of the $WW\gamma$ Gauge Boson Couplings in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **75**, 1034 (1995).

[104] **A Study of the Strong Coupling Constant using W-Jets Processes.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **75**, 3226 (1995).

[105] **Search for W Boson Pair Production in $p\overline{p}$ Collisions at $\sqrt{s} =$ 1.8 TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **75**, 1023 (1995).

[106] **Observation of the Top Quark.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **74**, 2632 (1995).

[107] **Search for Light Top Squarks in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **76**, 2222 (1996).

[108] **Search for $\tilde{W}_1\tilde{Z}_2$ Production via Trilepton Final States in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **76**, 2228 (1996).

[109] J/ψ **Production in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Lett.* **B370**, 239 (1996).

[110] **Search for Right-Handed W Bosons and Heavy W' in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **76**, 3271 (1996).

[111] **The DØ Upgrade.**
S. Abachi *et al.* (DØ Collaboration), Submitted to International Europhysics Conference on High Energy Physics (HEP 95), Brussels, Belgium, 27 Jul - 2 Aug 1995, in *International Europhysics Conference on High Energy Physics (HEP 95): Proceedings*, edited by J. Lemonne, C. Vander Velde, and F. Verbeure, World Scientific, Singapore, 1996.

[112] **Studies of Topological Distributions of Inclusive Three- and Four-Jet Events in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev.* **D53**, 6000 (1996).

[113] **The Azimuthal Decorrelation of Jets Widely Separated in Rapidity**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **77**, 595 (1996).

[114] **The Isolated Photon Cross-Section in the Central and Forward Rapidity Regions in in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **77**, 5011 (1996).

[115] **Search for Anomalous WW and WZ Production in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **77**, 3303 (1996).

[116] **Search for Additional Neutral Gauge Bosons.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Lett.* **B385**, 471, (1996).

[117] **Measurement of the W Boson Mass.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **77**, 3309 (1996).

[118] **Jet Production via Strongly-Interacting Color-Singlet Exchange in $p\overline{p}$ Collisions.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **76**, 734 (1996).

[119] **Search for a Fourth generation Charge $-1/3$ Quark via Flavor Changing Neutral Current Decay.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **78**, 3818 (1997).

[120] **Limits on Anomalous $WW\gamma$ Couplings from $p\overline{p} \to W\gamma + X$ Events at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **78**, 3634 (1997).

[121] **Search for Diphoton Events with Large Missing Transverse Energy in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **78**, 2070 (1997).

[122] **Search for Top Squark Pair Production in the Dielectron Channel.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev.* **D57**, 589 (1998).

[123] **Study of the $ZZ\gamma$ and $Z\gamma\gamma$ Couplings in $Z(\nu\nu)\gamma$ Production.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **78**, 3640 (1997).

[124] **Direct Measurement of the Top Quark Mass.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev. Lett.* **79**, 1197 (1997).

[125] **Study of Gauge Boson Pair Production and Trilinear Couplings.**
S. Abachi *et al.* (DØ Collaboration), *Phys. Rev.* **D56**, 6742 (1997).

[126] **Cross Section for b-Jet Production in $\overline{p}p$ Collisions at $\sqrt{s} = 1.8$ TeV.**
B. Abbott *et al.*,*Phys. Rev. Lett.* **85**, 5068 (2000)

[127] **Ratios of Multijet Cross Sections in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
B. Abbott *et al.*, *Phys. Rev. Lett.* **86**, 1955 (2001)

[128] **Ratio of Jet Cross Sections in $p\overline{p}$ Collisions at $\sqrt{s} =$ 630 GeV and 1800 GeV.**
B. Abbott *et al.*, *Phys. Rev. Lett.* **86**, 2523 (2001)

[129] **Search for Large Extra Dimensions in Dielectron and Diphoton Production.**
B. Abbott *et al.*, *Phys. Rev. Lett.* **86**, 1156 (2001)

[130] **Quasi-model-independent Search for New High p_T Physics at D0.**
B. Abbott *et al.*, *Phys. Rev. Lett.* **86**, 3712 (2001)

[131] **Inclusive Jet Production in $p\overline{p}$ Collisions.**
B. Abbott *et al.*, *Phys. Rev. Lett.* **86**, 1707 (2001)

[132] **Search for Electroweak Production of Single Top Quarks in $p\overline{p}$ Collisions.**
B. Abbott *et al.*, *Phys. Rev.* **D63**, 031101 (2001)

[133] **Measurement of the Angular Distribution of Electrons from $W \to e\nu$ Decays Observed in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
B. Abbott *et al.*, *Phys. Rev.* **D63**, 072001 (2001)

[134] **Differential Cross Section for W Boson Production as a Function of Transverse Momentum in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
B. Abbott *et al.*, *Phys. Lett.* **B513**, 292 (2001)

[135] **Measurement of the Ratio of Differential Cross Sections for W and Z Boson Production as a Function of Transverse Momentum in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
V. M. Abazov *et al.*,*Phys. Lett.* **B517**, 299 (2001)

[136] **Search for Single Top Quark Production at D0 Using Neural Networks.**
V. M. Abazov *et al.*, *Phys. Lett.* **B517**, 282 (2001)

[137] **The DØ Silicon Microstrip Tracker: Construction and Testing.**
P. A. Rapidis , in *High Energy Physics, ICHEP 2000, Proceedings of the 30th International Conference on High-Energy Physics , Osaka, Japan, 27 Jul - 2 Aug 2000* , Edited by C. .S. Lim and T. Yamanaka, World Scientific, Singapore, 2001, p. 1238-1239.

[138] **Search for New Physics using QUAERO: A General Interface to D0 Event Data.**
V. M. Abazov *et al.*,*Phys. Rev. Lett.* **87**, 231801 (2001)

[139] **Ratio of Isolated Photon Cross Sections in $p\overline{p}$ Collisions at $\sqrt{s}$ = 630 GeV and 1800 GeV.**
V. M. Abazov *et al.*,*Phys. Rev. Lett.* **87**, 251805 (2001)

[140] **Search for Heavy Particles Decaying into Electron-positron Pairs in $p\overline{p}$ Collisions.**
V. M. Abazov *et al.*, *Phys. Rev. Lett.* **87**, 061802 (2001)

[141] **Search for First-generation Scalar and Vector Leptoquarks.**
V. M. Abazov *et al.*, *Phys. Rev.* **D64**, 092004 (2001)

[142] **High-p_T Jets in $p\overline{p}$ Collisions at $\sqrt{s}$ = 630 GeV and 1800 GeV.**
B. Abbott *et al.*, *Phys. Rev.* **D64**, 032003 (2001)

[143] **Quasi-model-independent Search for New Physics at Large Transverse Momentum.**
B. Abbott *et al.*, *Phys. Rev.* **D64**, 012004 (2001)

[144] **Subjet Multiplicity of Gluon and Quark Jets Reconstructed with the $k_\perp$ Algorithm in $p\overline{p}$ Collisions.**
V. M. Abazov *et al.*, *Phys. Rev.* **D65**, 052008 (2002)

[145] **Search for Minimal Supergravity in Single-electron Events with Jets and Large Missing Transverse Energy in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
V. M. Abazov *et al.*, *Phys. Rev.* **D66**, 112001 (2002)

[146] **Improved W Boson Mass Measurement with the DØ Detector.** V. M. Abazov *et al.*,*Phys. Rev.* **D66**, 012001 (2002)

[147] **Direct Measurement of the W boson decay width.**
V. M. Abazov *et al.*, *Phys. Rev.* **D66**, 032008 (2002)

[148] **Direct Search for Charged Higgs Bosons in Decays of Top Quarks.**
V. M. Abazov *et al.*, *Phys. Rev. Lett.* **88**, 151803 (2002)

[149] **Search for Leptoquark Pairs Decaying to $\nu\nu+$ jets in $p\overline{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
V. M. Abazov *et al.*, *Phys. Rev. Lett.* **88**, 191801 (2002)

[150] **Search for the Scalar Top Quark in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
V. M. Abazov *et al.*, *Phys. Rev. Lett.* **88**, 171802 (2002)

[151] **The Inclusive Jet Cross-section in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV using the $k_\perp$ Algorithm.**
V. M. Abazov *et al.*,*Phys. Lett.* **B525**, 211 (2002)

[152] **Search for R-parity Violating Supersymmetry in Two-muon and Four-jet Topologies.**
V. M. Abazov *et al.*,*Phys. Rev. Lett.* **89**, 171801 (2002)

[153] **Search for the Production of Single Sleptons through R-parity Violation in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
V. M. Abazov *et al.*, *Phys. Rev. Lett.* **89**, 261801 (2002).

[154] **Run IIb Upgrade - Technical Design Report - DØ Collaboration.**
V. M. Abazov *et al.*, *Unpublished*, FERMILAB-PUB-02-327-E, (2002)

[155] **Multiple jet production at low transverse energies in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
V. M. Abazov *et al.*, *Phys. Rev.* **D67**, 052001 (2003).

[156] **$t\bar{t}$ Production Cross Section in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8$ TeV.**
V. M. Abazov *et al.*, *Phys. Rev.* **D67**, 012004 (2003)

[157] **Search for Large Extra Dimensions in the Monojet $+\not{E}_T$ Channel at DØ.**
V. M. Abazov *et al.*, *Phys. Rev. Lett.* **90**, 251802 (2003).

[158] **Observation of diffractively produced W and Z bosons in $p\bar{p}$ collisions at $\sqrt{s} = 1.800$ GeV .**
V. M. Abazov *et al.* , *Phys. Lett.* **B574**, 169 (2003).

[159] **Observation and properties of the $X(3872)$ decaying to $J/\psi\ \pi^+\pi^-$ in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **93**, 162002 (2004).

[160] **Search for doubly charged Higgs boson pair production in the decay to $\mu^+\mu^+\mu^-\mu^-$ in $p\overline{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **93**, 141801 (2004).

[161] **Search for Pair Production of Light Scalar Top Quarks in $p\overline{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **93**, 011801 (2004).

[162] **Combination of CDF and DØ results on W boson mass and width.**
V. M. Abazov *et al.* , *Phys. Rev.* **D70** , 092008 (2004).

[163] **Search for 3- and 4- body decays of the scalar top quark in $p\overline{p}$ collisions at $\sqrt{s} = 1.8$ TeV .**
V. M. Abazov *et al.* , *Phys. Lett.* **B581**, 147 (2004).

[164] **Search for new particles in the two-jet decay channel with the DØ detector.**
V. M. Abazov *et al.* , *Phys. Rev.* **D69**, 111101 (2004).

[165] **Search for narrow $t\bar{t}$ resonances in $p\overline{p}$ collisions at $\sqrt{s} = 1.8$ TeV .** V. M. Abazov *et al.* , *Phys. Rev. Lett.* **92**, 221801 (2004).

[166] **SVX4: A New Deep-Submicron Readout IC for the Tevatron Collider at Fermilab.**
B. Krieger *et al.*, *IEEE Trans. Nucl. Sci.* **51**, 1968 (2004).

[167] **The Upgraded DØ Detector,**
V. M. Abazov *et al.*, FERMILAB-PUB-05-341-E, Jul 2005; to appear in *Nucl. Instrum. Meth.* ; arXiv:physics/0507191.

[168] **Search for Right-Handed W Bosons in Top Quark Decay.**
V. M. Abazov *et al.*, *Phys. Rev.* **D72**, 011104 (2005).

[169] **Measurement of the $p\overline{p} \to W\gamma + X$ cross section at $\sqrt{s} = 1.96$ TeV and $WW\gamma$ anomalous coupling limits.**
V. M. Abazov *et al.* , *Phys. Rev.* **D71**, 091108 (2005)

[170] **Study of $Z\gamma$ events and limits on anomalous $ZZ\gamma$ and $Z\gamma\gamma$ couplings in $p\overline{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **95**, 051802 (2005).

[171] **Measurement of inclusive differential cross sections for $\Upsilon(1S)$ production in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 232001 (2005).

[172] **Search for first-generation scalar leptoquarks in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev.* **D71**, 071104 (2005).

[173] **First measurement of $\sigma(p\bar{p} \to Z) \times Br(Z \to \tau\tau)$ at $\sqrt{s} = 1.96$ TeV.**
V. M. Abazov *et al.* , *Phys. Rev.* **D71**, 072004 (2005).

[174] **A search for anomalous heavy-flavor quark production in association with W bosons.**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 152002 (2005).

[175] **Measurement of the top quark mass in all-jet events.**
V. M. Abazov *et al.*, *Phys. Lett.* **B606**, 25 (2005).

[176] **A measurement of the ratio of inclusive cross sections $\sigma(p\bar{p} \to Z + b - jet)/\sigma(p\bar{p} \to Z + jet)$ at $\sqrt{s} = 1.96$ TeV.**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 161801 (2005).

[177] **Measurement of the W W production cross section in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 151801 (2005).

[178] **Search for $Wb\bar{b}$ and WH production in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 091802 (2005).

[179] **Measurement of the Λ_b^0 lifetime in the decay $\Lambda_b^0 \to J/\psi\ \Lambda^0$ with the DØ detector.**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 102001 (2005).

[180] **Measurement of the ratio of B^+ and B^0 meson lifetimes.**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 182001 (2005).

[181] **Search for the flavor-changing neutral current decay $B_s^0 \to \mu^+\mu^-$ in $p\bar{p}$ collisions at $\sqrt{s} = 1.96$ TeV with the DØ detector.**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 071802 (2005).

[182] **Measurement of the B_s^0 lifetime in the exclusive decay channel $B_s^0 \to J/\psi\ \phi$.**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 042001 (2005) .

[183] **Measurement of dijet azimuthal decorrelations at central rapidities in $p\overline{p}$ collisions at $\sqrt{s} = 1.96$ TeV .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 221801 (2005).

[184] **Search for supersymmetry with gauge-mediated breaking in diphoton events at DØ .**
V. M. Abazov *et al.* , *Phys. Rev. Lett.* **94**, 041801 (2005).

[185] **A precision measurement of the mass of the top quark.**
V. M. Abazov *et al.* , *Nature* **429**, 638 (2004).

[186] **Helicity of the W boson in lepton + jets $t\bar{t}$ events.**
V. M. Abazov *et al.* , *Phys. Lett.* **B617**, 1 (2005).

[187] **Report of the APS Neutrino Study Reactor Working Group**, E. Abouzaid *et al.*, Unpublished report LBNL-56599 (Oct. 2004) ; *http://www.slac.stanford.edu/spires/find/hep/www?r=lbnl-5659*

[188] **The neutrino factory and beta beam experiments and development.**
C. Albright *et al.* [Neutrino Factory/Muon Collider Collaboration], Unpublished report BNL-72369-2004, FERMILAB-TM-2259, Nov 2004; arXiv:physics/0411123.

[189] **FLARE: Fermilab liquid argon experiments.**
L. Bartoszek *et al.*, Unpublished FERMILAB-PROPOSAL-0942, Aug 2004; arXiv:hep-ex/0408121.

[190] **A Large Liquid Argon Time Projection Chamber for Long-baseline Off-axis Neutrino Oscillation Physics.**
D. Finley *et al.*, submission to NuSAG, Aug 2005 ; to appear in arXiv:physics ; see http://www-lartpc.fnal.gov/texfiles/LArTPC.pdf. See also the presentation to NuSAG by B. Fleming at http://www.hep.net/nusag_pub/NuSAG_Fleming.pdf.