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Curriculum Vitae

Education

1992–1998: University of Wisconsin, Madison, Wisconsin
Doctor of Philosophy in Physics
1988–1992: Bates College, Lewiston, Maine
Bachelor of Science, *cum laude,* in Physics and Mathematics
Elected to Phi Beta Kappa and Sigma Xi

Academic Appointments

2005–present: Assistant Professor,
University of Colorado, Boulder, Colorado
2003–2005: Research Associate,
University of Colorado, Boulder, Colorado
2000–2002: Research Assistant Professor,
Vanderbilt University, Nashville, Tennessee
1998–2000: Research Associate,
Vanderbilt University, Nashville, Tennessee
1995–1998: Research Assistant
University of Wisconsin, Madison, Wisconsin
1992–1995: Teaching Assistant
University of Wisconsin, Madison, Wisconsin

Research Experience

CMS (2005–present):

In October 2005, the Colorado group was accepted into the CMS experiment at CERN in Geneva, Switzerland. In 2008 the LHC will become the highest energy particle accelerator in the world. The main goals of CMS are to search for the Higgs particle and supersymmetry (SUSY). Finding, or even not finding, these particles will have a profound impact on particle physics. At Colorado, our service committments are in the areas of tracking reconstruction and the forward silicon pixel project. The Colorado group has a wide variety of physics interests including electroweak, SUSY, and b-physics. I am the group leader of the Colorado forward pixel effort and also participate significantly in the tracking work. I also lead the Colorado b-physics group.

Colorado took responsibility for testing and commissioning the prototype forward pixel detector Postdoctoral associate Dinardo spent the second half of 2006 at Fermilab supervising the initial checkout of the detector. In January, 2007 he moved to CERN to supervise the continuing commissioning of this detector plus the production detectors as they arrived over the course of the year. Since only a cursory check of the detector is performed at Fermilab, it falls to the CERN group to perform the full testing and calibration studies. This required assembly of the necessary infrastructure such as racks, power supplies, crates, computers, dry air supplies, chillers as well as running cooling lines, power lines, fibers, etc. Due to his excellent work, Dinardo was put in charge of all forward pixel commissioning activities at CERN. Some of the milestones reached at CERN include: testing and characterization of the prototype and production detector, testing the insertion of the forward pixel detector into the tracker and reading out both detectors with various grounding schemes to check for noise and cross-talk, testing the pilot run detector with a radioactive source using production readout systems, testing the radiation hardness of the detector in a test beam, and extensive testing of the detector at its expected operating temperature (-10°C). The forward pixel detector was successfully installed into CMS in July, 2008 and is working as expected.

The Colorado group designed and constructed five environmental chambers for use in testing and storing the forward pixel detectors. These boxes are 11-feet long and weigh 300 lbs. They contain a large amount of insulation and their own cooling lines to allow the detectors to be stored and tested in a cold environment. They also have a dry air line which is chilled by the cooling lines and are equipped with two humidistats and many RTD's to measure humidity and temperature.

I have been involved in tracking work to reconstruct V^0 particles which decay into two charged tracks a fair distance (∼centimeters) from the production vertex. Graduate student Drell has developed software to reconstruct and save V^0 candidates. Since the normal tracking software requires particle tracks to originate from the interaction point, V^0 reconstruction is generally inefficient. I am working on improving the tracking algorithm to more efficiently reconstruct highly displaced tracks to ameleriorate this problem. Efficient V^0 reconstruction will improve the reach of the b-physics I am pursuing. Postdoc Keith Ulmer and I are developing an analysis of three rare decays: $B^0 \to K^0_S \mu^+ \mu^-$, $B^- \to K^0_S \pi^- \mu^+ \mu^-$, and $\Lambda_b \to \Lambda^0 \mu^+ \mu^-$. Features of these decays are sensitive to physics beyond the Standard Model. Initial studies of the first decay have shown adequate efficiency for a competitive measurement. These analyses can be done with modest amounts of data during the first years of LHC operation. The group will migrate to work on b-tagging in the forward region and future physics work will concentrate on searches for SUSY in the many areas where b-tagging plays an essential role.

BTeV (1999–2005):

The BTeV experiment planned to start in 2009 using a forward spectrometer in Fermilab collision hall C0. BTeV was intended to challenge the Standard Model explanation of CP violation, mixing, and rare decays in the b and c quark systems. While at Vanderbilt I was involved in all aspects of the development of the BTeV muon system. For example, during the summer of 1999 we conducted a beam test at Fermilab which provided valuable information for refining our design. I assembled much of the readout equipment, constructed the trigger, and wrote the data-acquisition software for the beam test. I investigated the efficiency and background rejection of various muon triggers using simulation software, gaining experience in coding and running GEANT and becoming the BTeV muon simulation expert. I also examined the contributions BTeV can make in the field of semileptonic beauty physics. In other areas of BTeV, I helped to ensure the BTeV simulations ran correctly. I also chaired the BTeV web design committee, charged with developing and implementing the BTeV web site. Unfortunately, BTeV was canceled in February, 2005.

FOCUS (1995–present):

FOCUS was used to investigate charm production and decay with a ∼180 GeV photon beam. Data was collected at Fermilab during the 1996/7 fixed-target run, easily meeting the goal of 1 million reconstructed charm decays. During the 15 months of data-taking, I lived at Fermilab and accumulated nearly 100 8-hour shifts, most of them as shift leader. This required ensuring the experiment was working correctly and dealing with any problems that arose.

My main responsibility during the run was the silicon strip detectors which measured the e^+/e^- beam particle momentum. This is used to find the photon energy, essential for many production studies. My responsibility was to ensure it operated correctly throughout the data-taking run. To this end I wrote online monitoring and calibration software with user-friendly GUI interfaces and remained on call during the run to fix hardware problems. I also certified the alignment, momentum calibration, and reconstruction software. This system was critical in diagnosing an accelerator pathology known as "superbuckets" which severely degraded the quality of the data. As part of the solution, I adapted the system to allow the experiment to veto these events. I was also involved in the implementation of four new vertex silicon planes. In addition to hardware work, I wrote the on-line monitoring and control software. This detector dramatically improved the lifetime resolution of the experiment and provided a 40% increase in the $D^0 \to K\pi$ yield.

At Vanderbilt I shared responsibility for running "Skim 1." This required reading 3,000 4.5 GB reconstructed data tapes, performing additional reconstruction, and writing a subset of the data to six separate tapes. Operating continuously, this took several months using a workstation farm and required proficiency in system administrator duties for workstation clusters. Following the reconstruction, I conducted a search for doubly-charmed baryons, that is, baryons with two charm quarks and one light quark. The search was done using 21 possible decay modes of the $\Xi_{cc}^{+}(ccd)$ and $\Xi_{cc}^{++}(ccu)$. Given some reasonable assumptions about production rates and branching fractions, I expected to see a handful of events. No evidence for any events above background was observed, consistent with our uncertainty about the production and decay of these particles.

At Colorado I completed a search for D^0–$\overline{D}^0$ mixing using hadronic decay modes. Observation of charm mixing with the statistics available in FOCUS would likely be a sign of physics beyond the Standard Model. The *right-sign* decay mode $D^0 \to K^-\pi^+$ is Cabibbo favored (CF). The *wrong-sign* decay $D^0 \to K^+\pi^-$ can occur directly as a doubly Cabibbo suppressed decay (DCSD) or by mixing into $\overline{D}^0$ and decaying in the CF mode. By *tagging* the D^0's which come from a D^{*+} decay into $D^0\pi^+$ it is possible to determine the initial flavor of the D^0 and thus determine if a decay is right-sign or wrong-sign. Distinguishing DCSD from mixing requires lifetime information; mixing distorts the D^0 lifetime while DCSD does not. The analysis employed a binned maximum likelihood three dimensional fit which uses the D^0 mass, the D^{*+} mass, and the D^0 lifetime, fitting the right and wrong sign $K\pi$ data simultaneously. Limits on charm mixing and a new measurement of the DCSD decay $D^0 \to K^+\pi^-$ were published in July, 2005.

I also published two results on pentaquark searches. At least 9 experiments have reported observations of a pentaquark at a mass of around $1540\,\mathrm{MeV}/c^2$ decaying to a nucleon and a kaon. Using a FOCUS sample of 63 million K_S^0 candidates I searched for the decay $\Theta(1540)^+ \to pK_S^0$. While FOCUS reconstructs many more K_S^0, $K^*(892)^+$, and $\Sigma(1385)^{\pm}$ decays, no evidence for the $\Theta(1540)^+$ has been found, calling into question the observations reported by other experiments. A paper with upper limits over a broad mass range was publised in July, 2006. I also searched for $\Theta_c(3100)^0 \to D^{*-}p$ which was seen by H1. The FOCUS sample of D^{*+} decays is 30 times larger and much cleaner than the H1 sample. Also, the production mechanism in FOCUS (real photon on nuclear target) is very similar to H1 (virtual photon on proton). Nevertheless, no pentaquark signal was observed with very little background contradicting the H1 evidence. Upper limits on the production of charm pentaquarks decaying to $D^{(*)-}p$ were published in September 2005.

I have contributed extensively to the FOCUS Monte Carlo program. In addition to fixing many bugs, I created part of the trigger simulation, continually update the particle properties table, and tuned the parameters available with PYTHIA to provide a much better match to our data. I have also added elastic and inelastic scattering and ionization energy loss into the simulation. Most recently I discovered an explanation for the low mass tail in fully reconstructed charm decays which has been observed in many experiments over the years. By including a bremsstrahlung-in-decay process, the Monte Carlo provides a much better match to the data mass distribution. This process is implemented using the program PHOTOS.

During the FOCUS analysis and paper review process I have contributed critiques and suggestions more often than anyone else in the collaboration. Several times this has resulted in a significant improvement in the quality of the result.

E791 (1994–present):

The E791 experiment recorded data at Fermilab during the 1991 fixed-target run with a 500 GeV/c π^- beam on platinum and diamond targets. The goal of 100,000 fully reconstructed charm decays was exceeded by a factor of two. I joined the collaboration in 1994, after the data had been collected and reconstructed.

In 1995 I modified the Monte Carlo program to model the time and position dependent inefficiencies in the drift chambers due to the passage of the 2 MHz π^- beam. I was also involved in the analysis and drafting of the E791 charm-pairs paper, published in 1999. In October, 1998 I defended my dissertation, *A Study of D^0 Production from 500 GeV π^-–Nucleon Interactions.* These results, published in 1999, gave total and differential cross sections of neutral D mesons from the highest statistics fixed-target hadroproduced charm sample ever.

Teaching Experience

At the University of Colorado I have taught two semesters of the sophmore lab course, using PowerPoint slides for the lecture for the first time in the course. I taught one semester of junior quantum mechanics where I scanned all of my lecture notes, homework solutions, and exam solutions and made them available on the course website. I have co-taught first and second semester introductory students, in some cases with more than 600 students in a class. I have used active learning techniques in these classes such as classroom response systems (clickers) during lectures and tutorials by McDermott et al. during recitations rather than TA's solving problems on chalkboards. I have also used the computerized homework system at Colorado in these classes.

I worked with one REU undergraduate during the summer of 2006 which led to a publication for her. I currently supervise two graduate students working on the CMS project. I also supervise two postdoctoral researchers, one at Colorado and one at CERN. At Vanderbilt University I was very involved in the work of the two graduate students in the group during my tenure. I have also provided guidance and assistance to a graduate student from a university in Mexico which did not have any faculty members involved in the FOCUS experiment. With my assistance during one summer at Vanderbilt and one summer at Colorado this student was able to finish and publish her analysis and receive her Ph.D.

At the University of Wisconsin I spent seven semesters as a teaching assistant for introductory level physics courses. Each semester I taught two 3-hour laboratory and four 1-hour discussion sessions per week.

Peer Reviewed Publications

One can find a full list of (92) peer reviewed publications at www-hep.colorado.edu/∼stenson/pubs.pdf or www.slac.stanford.edu/spires/find/hep/www?rawcmd=find+au+stenson+and+ps+p+not+tc+conference+paper.

The list of four papers below are the publications for which I performed the entire analysis and wrote the paper.

1. E.M. Aitala *et al.* (E791), *Total forward and differential cross section of neutral D mesons produced in 500 GeV/c π^-–nucleon interactions,* Phys. Lett. **B462** (1999) 225.

2. J.M. Link *et al.* (FOCUS), *Measurement of the doubly Cabibbo suppressed decay $D^0 \to K^+\pi^-$ and a search for charm mixing*, Phys. Lett. **B618** (2005) 23.

3. J.M. Link *et al.* (FOCUS), *Search for a strongly decaying neutral charmed pentaquark*, Phys. Lett. **B622** (2005) 229.

4. J.M. Link *et al.* (FOCUS), *Search for a pentaquark decaying to pK^0_S*, Phys. Lett. **B639** (2006) 604.

The list of four papers below are publications for which I contributed a significant amount of analysis and wrote part of the paper.

1. E.M. Aitala *et al.* (E791), *Correlations between D and $\overline{D}$ mesons produced in 500 GeV/c π^-–nucleon interactions,* Eur. Phys. J. direct **C4** (1999) 1.

2. J.M. Link *et al.* (FOCUS), *Charm-anticharm baryon production asymmetries in photon-nucleon interactions*, Phys. Lett. **B581** (2004) 39.

3. J.M. Link *et al.* (FOCUS), *Study of Cabibbo Suppressed Decays of the D_s^+ Charmed-Strange Meson involving a K_S^0*, Phys. Lett. **660** (2008) 147.

4. J.M. Link *et al.* (FOCUS), *Search for a pentaquark decaying to $\Xi^-\pi^-$*, Phys. Lett. **661** (2008) 14.

Conference Talks

1. "E791: High Statistics Charm Production with a π^- Beam" at Heavy Quarks at Fixed Target, Fermi National Accelerator Laboratory, October, 1998. Proceedings in: Harry W. K. Cheung and Joel N. Butler, editors, *Heavy Quarks at Fixed Target, AIP Conference Proceedings 459*, American Institute of Physics, 1998.

2. "Charm Production from Fermilab Fixed-Target Programs" at XXXIV Rencontres de Moriond (QCD and High Energy Hadronic Interactions), Les Arcs, France, March 1999. Proceedings in: Jean Trân Thanh Vân, editor, *Proceedings of the XXXIVth Rencontres de Moriond, '99 QCD and High Energy Hadronic Interactions*, Thế Giới Publishers.

3. "Hadronic Decays of Charm Particles" at the 9^{th} International Symposium on Heavy Flavor Physics, Caltech, Pasadena, CA – September 2001. Proceedings in: Anders Ryd and Frank C. Porter, editors, 9^{th} *International Symposium on Heavy Flavor Physics, AIP Conference Proceedings 618*, American Institute of Physics, 2002.

4. "BTeV: Status and physics prospects" at the 18th International Workshop on Weak Interactions and Neutrinos, Christchurch, New Zealand – January 2002.

5. "CP Violation in Charm" at the International workshop on Heavy Quarks and Leptons 2002, Vietri sul Mare, Salerno, Italy – May 2002. Proceedings in: G. Cataldi, F. Grancagnolo, R. Perrino, and S. Spagnolo, editors, *Proceedings of Heavy Quarks and Leptons 2002, Frascati Physics Series 28*, INFN Laboratori Nazionali di Frascati, 2002.

6. "Recent Results in Charm Physics" at the American Physical Society April Meeting 2003, Philadelphia, PA – April 2003.

7. "Charm Physics from FOCUS" at the 19th International Workshop on Weak Interactions and Neutrinos, Lake Geneva, WI – October 2003.

8. "A FOCUS Search for Charm Mixing" at the 2004 Meeting of the Division of Particles and Fields of the American Physical Society, University of California, Riverside, CA – August 2004. Proceedings in: Int. J. Mod. Phys. **A20** (2005) 3689.

9. "Search for Pentaquarks and Double-Charm Baryons from FOCUS" at the 2004 Meeting of the Division of Particles and Fields of the American Physical Society, University of California, Riverside, CA – August 2004. Proceedings in: Int. J. Mod. Phys. **A20** (2005) 3745.