Kristian Hahn

University of Pennsylvania
Fermilab - CDF - M.S. 318
P.O. Box 500
Batavia Il, 60510

Work: (630) 840 2389
Fax: (630) 840 6315
Home: (773) 868 0915
kristian@hep.upenn.edu

Education

Ph. D. Candidate Expected Spring 2006
Department of Physics and Astronomy
University of Pennsylvania, Philadelphia, PA
Thesis Advisor: Prof. Nigel Lockyer
Thesis Title: *Search for Lepton Flavor Violation in High Mass Electron-Muon Events from Proton-Antiproton Collisions at $\sqrt{s}$ = 1.96 TeV*

B.S.E. May 1999
Department of Chemical Engineering
University of Pennsylvania, Philadelphia, PA

Research Experience

Dissertation, *Collider Detector at Fermilab*, University of Pennsylvania

The Collider Detector at Fermilab (CDF) is a general purpose apparatus designed to study proton-antiproton interactions at the Fermilab Tevatron. With a 1.96 TeV center of mass energy, the Tevatron is the world's highest energy accelerator and offers a unique opportunity to search for physics beyond the Standard Model.

- Analysis
  - Thesis work includes a search for lepton flavor violation in high invariant mass electron-muon events. Results confirm Standard Model predictions and lead to constraints on parameters relevant to supersymmetric models of R-parity violating sneutrino decay and E6 models of lepton flavor violating Z' boson decay.
  - Working on a related search in the high invariant mass electron-tau and muon-tau channels. R-parity violating supersymmetric and lepton flavor violating Higgs and E6 Z' models predict pronounced effects in the tau decay modes. I am studying new techniques for electron and tau identification that will increase sensitivity to these processes.

- Level 2 Trigger PULSAR Upgrade – The CDF trigger is the heart of the experiment's data acquisition system. The Level 2 trigger system receives data from Level 1 Trigger subsystems at ~40kHz, uses this information to perform initial event reconstruction and passes data from interesting events upstream for full reconstruction at ~300Hz. The original implementation of the Level 2 trigger used various interface boards to receive data from Level 1 and a custom DEC alpha processor board to execute the Level 2 trigger algorithms. The PULSAR upgrade improves the performance and reliability of the Level 2 trigger, employing a versatile VME board (the PULSAR) to interface with the Level 1 subsystems and high-speed optical interconnects (S-Link) to offload trigger algorithm processing to commodity PCs running Linux.
    - Ported the CDF Level 2 Trigger software from the DEC alpha to multi-processor SUN Sparcs and dual-processor PCs running a standard distribution Linux operating system. I modified the software to utilize multiple CPUs through process scheduling and interrupt targeting. Using these techniques, the trigger algorithms have performed significantly better on the PC relative to the alpha and overall system latency was reduced to ~20μs. With such performance, use of a more specialized and costly "real-time" operating system has not been necessary.
    - Researched several PC architectures to determine which was best suited to the needs of the project. I conducted I/O latency studies to show that the AMD system architecture I recommended out-performed Intel Xeon based systems. The Level 2 Trigger uses AMD systems currently.
    - Wrote software to enable data transfer between PCs and PULSARs using CERN S-Link PCI cards, designed and implemented a message passing system to control processes in a multi-threaded, dual CPU environment and overhauled the trigger software framework to improve clarity and maintainability.
    - Played an integral role in debugging and commissioning the PULSAR system, from first test-stand studies with a PC and PULSAR to full system installation.
- ASDQ Daughterboards – The Amplifier/Shaper/Discriminator/Charge Encoder (ASDQ) chip is a custom integrated circuit designed at the University of Pennsylvania to read out channels of the CDF Central Outer Tracker (COT), an open-cell drift chamber. These chips are mounted on daughterboards that attach to the COT sense wires.
    - Tested all ASDQ daughter boards used in the experiment and compiled a list of individual ASQD chip response characteristics for calibration.
    - Discovered failures in a significant number of boards received from the manufacturer. I identified a particular defective component as the source of the failures and replaced these on every board.

Research Assistant, ATLAS Experiment, University of Pennsylvania

The ATLAS detector is a next-generation apparatus that will record proton-

antiproton collisions with a center of mass energy of 14 TeV at the CERN Large Hadron Collider (LHC) in Switzerland. The University of Pennsylvania developed the Amplifier/Shaper/Discriminator/Baseline Restorer (ASDBLR) and Digital Time Measurement Readout (DTMROC) chips used to read out the Transition Radiation Tracker (TRT) subdetector. I worked with the University of Pennsylvania ATLAS group for one year as a post-baccalaureate Research Assistant and assisted in summer 2001 test beam as a graduate student.

- Tested ASDBLR/DTMROC performance in the spring 2000 test beam at CERN. I helped a University of Pennsylvania staff scientist develop and maintain the data acquisition system used by the TRT group in test beam studies.
- Assumed primary responsibility for the installation and operation of the data acquisition system during the summer 2001 test beam at CERN.

Teaching Experience

Teaching Assistant 2000-2001

University of Pennsylvania, Department of Physics and Astronomy

- Taught introductory-level laboratories for undergraduate students.
  - Chairman's Teaching Award recipient.

Presentations

- CDF Weekly Meeting, “Beam Test Results for the Level-2 Upgrade”, 8/2004
- CDF Collaboration Meeting, “R-Parity Violating Sneutrino Search”, Sitges, Spain, 6/2005

Publications

Publicly Available

- “Search for High Mass Resonances Decaying to emu in ppbar Collisions at sqrt(s) = 1.96 TeV”, Phys. Rev. Lett., 2005 (*to be submitted*)
- “CDF Level 2 Trigger Upgrade – The Pulsar Project”, Nuclear Science Symposium Conference Record, 2004 IEEE

CDF Internal

- “Search for High Mass Resonances in the e-mu Channel”, CDFnote 7747, 7/2005
- “A Search for RPV Sneutrino Decay to emu”, CDFnote 7616, 4/2005
- “System Tests and Timing Studies of the PULSAR/PC Design”, CDFnote 6846, 1/2004
- “L2 Algorithm Studies for the RunIIb Upgrade”, CDFnote 6620, 7/2003
- “RunIIb Upgrade for the CDF L2 Decision Crate”, CDFnote 6259, 1/2003

References

Professor Nigel Lockyer (lockyer@rutherford.hep.upenn.edu)
Department of Physics and Astronomy
University of Pennsylvania
209 S. 33rd Street
Philadelphia, PA, 19104
(215) 573-3652

Associate Professor Joe Kroll (kroll@surf.hep.upenn.edu)
Department of Physics and Astronomy
University of Pennsylvania
209 S. 33rd Street
Philadelphia, PA, 19104
(215) 573-6380

Scientist Ted Liu (thliu@fnal.gov)
Fermilab
P.O Box 500
Batavia IL, 60510

Assistant Professor Peter Wittich (wittich@lepp.cornell.edu)
214 Newman Lab
Cornell University
Ithaca, New York 14853-2501