The Braidwood Collaboration

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Previous Research Activities of Group Members

The collaboration involves physicists from an unusually wide range of backgrounds including neutrino physics (accelerator, reactor, and non-accelerator based experiments), collider physics, and fixed-target accelerator physics. It also includes members of the BNL nuclear chemistry group, with expertise in synthesis of liquid scintillators. In the following sections, we summarize the previous research activities of collaboration members.

Argonne National Laboratory

The Argonne group has mainly been working on MINOS for the last four years. Group members have made important contributions to the conception of the experiment, beam design, project management, and technology decisions. Scintillator module construction techniques were designed at ANL and the module factory for near detector modules was located at ANL. Cosmic ray analysis is underway. Also, the group has recently completed analysis on the Soudan 2 experiment, including results on nucleon decay, atmospheric neutrino oscillations and searches for astrophysical sources of neutrinos.

Brookhaven National Laboratory

The BNL group, led by Hahn, joined the GALLEX collaboration at the Gran Sasso Laboratory in 1986. GALLEX, which extended the energy range of radiochemical solar neutrino experiments down to the pp neutrinos, verified the neutrino deficit that had been observed by the Chlorine Experiment and Kamiokande. GALLEX ended in 1998. In 1996, the Group joined the SNO collaboration in Sudbury, Canada. More recently, the Group (a) has been doing R&D on the LENS project to develop a real-time detector for ultra-low energy solar neutrinos by using an indium-loaded ($\sim$ 8%) liquid scintillator, and (b) has been participating in planning for the BNL Long Baseline muon-neutrino oscillation project.

The University of Chicago

The Chicago group members have been involved in 1) the KTeV experiment at Fermilab, 2) the OPAL experiment at the CERN LEP facility, and 3) the ATLAS experiment at the CERN LHC. Blucher has been spokesman of KTeV (E832) since 1997. His group has led the analysis of the direct CP violation parameter ϵ'/ϵ, and performed the recent determination of the CKM parameter $|V_{us}|$ based on measurements of the 6 largest K_L branching fractions and semileptonic form factors. He was also coleader of the APS Neutrino Study Reactor Working Group. The OPAL measurements have included many high precision tests of the electroweak theory, including the determination of the W-boson mass. Involvement in this experiment ended this year. The ATLAS experiment is under construction with startup planned in 2007. The Chicago group has finished construction of readout electronics for the hadron calorimeter and is now involved in the installation of the detector and in the preparation of analysis software.

Columbia University

The Columbia group has mainly been working on MiniBooNE for the last four years. Prof. Conrad is co-spokesperson for the experiment. MiniBooNE, a low energy neutrino experiment using the Fermilab 8 GeV proton booster accelerator, is set up to search for neutrino oscillation in the region of the LSND anomaly and to make precise measurements of neutrino cross sections. Data-taking began two years ago and first neutrino oscillation results are expected in 2005. Also, the group has continued data analysis on NuTeV. New results were presented on structure functions, including a new NLO analysis of the strange quark sea, and on updated information on the weak mixing angle.

Fermi National Accelerator Laboratory

This group of experimentalists has not worked together in the past. However, it has a great deal of experience that will add directly to the support of this proposal. Members have worked on complex detector systems (HJ at D0), underground tunneling at LHC, SSC and NuMI (CL), management of large projects (DF) and neutrino and charm production experiments (RS).

Kansas State University

Kansas State group members have made major contributions to measurements of neutrino oscillations, neutrino charm production, precision neutral current cross sections, and rare processes on FNAL E531 (Stanton), FNAL E815-NuTeV (Bolton), FNAL E831-DONUT (Stanton), and KAMLAND (Horton-Smith).

Massachusetts Institute of Technology

Over the past years, members of the group have collaborated on SLD (Cowan, Osborne, Taylor, Yamamoto) at SLAC and L3 (Fisher) at CERN. Group members are currently working on Babar (Cowan, Sciolla, Sekula, Taylor, Yamamoto) at SLAC and AMS (Fisher) at MIT, as well as the development of Gas Electron Multipliers for the NLC (Fisher).

University of Michigan

B. Roe was PI for the Michigan effort on L3. The group built 100,000 wires of PWT for the hadron calorimeter and produced more Ph.D. theses than any other L3 institution except for MIT. He is presently working on the MiniBooNE experiment, expecially on the event reconstruction and particle ID, as well as on beam MC and muon measurements in the hadron shield.

Oxford University (United Kingdom)

The Oxford SNO group provided the collaboration's SNOMAN Monte Carlo and analysis code. The group had major involvement in data-cleaning, phototube, electronic and timing calibrations, and the RAL computing farm was used to process most of the calibration data and as part of the data analysis chain. The group also designed and built the light concentrators for the SNO PMTs. The Oxford group made major contributions in determining the background due to photodisintegration via radioassays and Cerenkov light signals. N. Tagg has been part of the Oxford participation in MINOS, which has been closely involved in detector component production and testing; notably PMTs, front-end electronics, and timing systems. They have been heavily involved in Monte Carlo, reconstruction, database, and calibration software. Oxford has also been pursuing analysis of calibration data as well as neutral-current beam analyses.

University of Pittsburgh

The Pitt group's main activity has been designing the beam monitoring system hardware and commissioning the near detector for MINOS. In addition, group members are involved in ongoing analyses on two neutrino experiments: NuTeV (Naples) and DONUT (Paolone). Paolone has been spokesman for DONUT since 1997. These analyses include a search for exotic heavy neutral particles produced in the beam dump and analysis of a larger tau-neutrino interaction sample. Naples made major contributions to NuTeV calibration and analyses; she has led neutrino oscillation measurements for both $\nu_\mu \to \nu_\tau$ and $\nu_e \to \nu_\tau$ and is currently leading analysis on structure functions.

Saint Mary's University of Minnesota

The group has worked on education and outreach and phototube testing for MiniBooNE, and drift chamber construction for NuTeV.

University of Sussex (United Kingdom)

The University of Sussex MINOS group coordinates all aspects of detector calibration, from cosmic muons to magnetic field calibration. The group's primary activity is the energy scale calibration, which is paramount to the CC-spectrum measurement. The group designed and developed a sophisticated light-injection calibration system for the detectors, which was delivered on time, to specification, and approximately 30% under budget, and which is acknowledged within the collaboration as an extraordinarily powerful and flexible tool for understanding and debugging the detectors.

University of Texas at Austin

The Texas group has primarily been involved in SNO, although the group is relatively new to Texas. Klein arrived from the University of Pennsylvania two years ago, where he designed the SNO trigger system and served as SNO's physics analysis coordinator. SNO is now in its third phase and the Texas group is focusing on a search for the MSW effect, which will require pushing SNO's energy threshold as low as possible. To accomplish this goal, they are contributing to the improvements to the SNO energy calibration, the position reconstruction of events, and the reduction and measurement of low energy backgrounds.

University of Washington

Washington has been involved in SNO and a proposed direct mass experiment, KATRIN. They played a major role in the design, instrumentation, and installation of ^{3}He proportional counters as part of SNO's third phase. The low background techniques gained in the fabrication of these counters could be extended to the current efforts of the Braidwood experiment.