EXCERPT

Physics Advisory Committee

October 19-21, 2006

Comments and Recommendations

P-960 (Rajendran Raja) Main Injector Particle Production (MIPP)

The MIPP experiment studies particle production cross sections from beams of protons, antiprotons, $K^{\pm}$, and $\pi^{\pm}$ in the energy range 5-85 GeV. The spectrometer system includes a TPC, ToF detectors, differential Cerenkov, and RICH counters to identify and measure the momenta of the produced particles. The experiment was approved in November 2001 (P-907) and acquired data in a production run during the period January 2005 – March 2006. The collaboration is currently analyzing the 31 million events collected during this run (About 14 million of these triggers were collected in special runs with the analysis magnet off and with no TPC data).

The present apparatus is limited by the TPC electronics to an acquisition rate of about 30 Hz. The present proposal includes upgrading the electronics to enable data acquisition at 3 kHz, which would yield 5 million events per day. Two coils of the Jolly Green Giant TPC magnet failed near the end of the previous run and must be replaced with new coils for further running. The beamline would also be upgraded to allow running at lower momenta down to 1 GeV/c. In addition, the trigger, drift chamber, ToF/CKOV and calorimeter electronics would be upgraded.

The collaboration has proposed using the upgraded spectrometer to perform an expanded program of measurements, collecting 250 million events in a period of 50 days of running. These measurements include production from the NuMI target as well as hydrogen and a variety of nuclear targets. The NuMI target studies are intended to provide data as input to neutrino flux calculations for the MINOS, MINERνA, and NOνA experiments. Other measurements would provide input data to simulation programs such as those used to design and analyze hadronic calorimeters or to reproduce high-energy cosmic air shower data. A tagged neutral beam capability would enable studies relevant to ILC calorimeter design. In addition, the data could be useful for refining phenomenological QCD models of particle production, and possibly searching for new baryon resonances such as those predicted in flux-tube models of quark interactions.

In general, the Committee believes that the program of studies proposed by the collaboration can be very valuable in providing input to simulation programs and decreasing uncertainties in the neutrino fluxes at NuMI, but the Committee was not convinced that the value of the proposed measurements justifies the upgraded running. The proponents will need to provide more detailed quantitative information about the impact of the proposed measurements. For example, how much would the new data reduce the systematic errors in extracting neutrino oscillation parameters from MINOS and NOνA? What is the sensitivity to new baryon resonances? How would cross section measurements quantitatively impact the performance of simulation programs? Based on the material presented, the Committee judged the "service" measurements to be more compelling than the QCD phenomenology studies.

It would be desirable to see more results from the existing dataset before committing to an upgrade and additional running time. The Committee also has some concerns about the current collaboration's capacity to mount such a substantial hardware upgrade, acquire a much larger dataset, and then analyze such a vast quantity of data.

The Committee recommends that a decision on P-960 be deferred at this time. The collaboration should demonstrate that the existing data can provide high-quality physics results with substantial impact. The case for additional measurements should be developed further to provide more convincing quantitative justification for the proposed program. The collaboration should strengthen their manpower for executing the new program. When these points are addressed, it would be appropriate for the proposal to be reconsidered.