VII. Cost and Schedule

The detailed cost and schedule for E889 is contained in a formal Conceptual Design Report (CDR) being submitted by Brookhaven National Laboratory to DOE as a line-item request for a new construction start in FY97. The schedule is based on this construction start but assumes a reasonable amount of R&D funds (~$4M) in FY96 to do detailed studies of critical items necessary for the construction start in FY97. The present schedule (Fig. 1) shows that, with the requested funding profile, the new neutrino beam and the detector tanks at 3km and 24km would be operational in FY99, and the full contingent of 4 detectors operational about 1 year later.

If the experiment were not constrained by the FY97 construction start, the schedule could be advanced by approximately 6 months. Similarly, if R&D funding is not available in FY96, then the schedule will slip by about 6 months.

The cost estimate summarized here was developed using the Work Breakdown Schedule (WBS) structure shown in Fig. 2. The project was divided into 4 distinct and logically separate pieces. WBS 1.1 contains all civil construction associated with the construction of the new neutrino beamline and the preparation of all the detector sites together with the installation of the detector tanks and the ancillary support buildings. These estimates were developed by the BNL Plant Engineering Division which routinely handles such projects at the laboratory. WBS 1.2 contains all technical work related to extracting the proton beam from the AGS, transporting it to the neutrino target, focussing the produced mesons with a magnetic horn system and the electronics for monitoring the beam system. These estimates were developed by the AGS department which has built many external beam lines and constructed and operated a similar neutrino line in the past. WBS 1.3 contains the active elements (photomultiplier tubes) in the detector system, the associated electronics and DAQ systems necessary for the experiment. These estimates were developed by the physicists in the collaboration based on previous experience in other large water Cherenkov systems such as Kamiokande, LSND and SNO. WBS 1.4 contains all the EDIA for each of the aforementioned subsystems and the overall project management and QA functions. Full documentation is available for all estimates in the CDR.

The base cost for all conventional construction, detector systems, particle beam systems, and project support necessary for the complete experiment is $46.5M in FY 95 dollars. The project period covers the U.S. fiscal years FY 1997-99. The estimated average overhead is $14M (26.6%) due to recent changes in DOE orders relating to construction projects, and

the estimated summed contingency is \$8.7M (14.8%), relative to the base cost. With these costs included, the total comes to \$67.7M. Finally, distributing the costs by fiscal year and allowing for escalation, the total project cost becomes \$76.6M. The summary cost details are found in Vol.1, Section 5 of the Conceptual Design Report (CDR) for the Long Baseline Neutrino Oscillation Experiment (BNL project No. 97-CH-114, March 1995). Further cost estimate details are found in Vol. 2 of the same report.

In connection with costs, it should be emphasized that the experiment will be run in a mode new to BNL. It will receive the fast extracted proton beam on the neutrino target approximately 20 hours per day when the AGS is not filling RHIC. The method and speed of accomplishing the transition from heavy ion RHIC injection to proton injection for E889 has been studied and no serious obstacles encountered. The method will be explored in practice in the near future. The incremental cost of this mode of operation relative to the cost of the current AGS-HEP operation is principally for electrical power to the components of the neutrino beam line and the AGS magnets operated without a flat-top for fast extraction. This incremental cost will be a small fraction of the present AGS-HEP operating budget.