

Critical Decision 4
Approve Project Completion
for the
Main Injector Experiment v-A (MINERvA) Project
at the
Fermi National Accelerator Laboratory
Office of High Energy Physics
Office of Science

Purpose

The purpose of this paper is to document the review by the Office of Science Energy Systems Acquisition Advisory Board-equivalent for Critical Decision 4 (CD-4), "Approve Project Completion" for the Main Injector Experiment v-A (MINERvA) Project at the Fermi National Accelerator Laboratory (Fermilab).

Project Description

MINERvA is a compact, fully active neutrino detector designed to study neutrino-nucleus interactions with unprecedented detail. The detector is in the Neutrinos at the Main Injector (NuMI) beam line directly upstream of the Main Injector Neutrino Oscillation Search (MINOS) Near Detector. MINERvA is unique in the worldwide neutrino program. The NuMI beam intensity provides an opportunity for precision neutrino interaction measurement and a wide range of neutrino energies.

MINERvA's active detector is scintillator read out by multi-anode photo-multiplier tubes (PMTs). The detector design includes thin modules hung like files on a stand. These modules are attached together to form the completed detector. The baseline number, 108, modules are on the completed detector. In addition, the 6 spare modules have been installed. Modules include an Outer Detector, which is alternating layers of iron and scintillator and an Inner Detector, which is a hexagon made of triangular shaped scintillator strips. Each scintillator strip has a wave length shifting fiber installed in the center. The wave length shifting fiber connects to a clear fiber and then to a PMT. The baseline detector requires 483 PMTs for full instrumentation.

Project History

The MINERvA timeline is as follows:

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|--|----------------|
| • Fermilab PAC Stage 1 Approval | April 2004 |
| • CD-0 Granted | June 2006 |
| • DOE Combined CD-1/2/3a Review | December 2006 |
| • CD-1/2/3a Granted | March 2007 |
| • DOE CD-3b Review | August 2007 |
| • CD-3b Granted | November 2007 |
| • Began Physics run with Full Detector | March 23, 2010 |
| • CD-4 Review | May 12, 2010 |
| • CD-4 ESAAB | June 28, 2010 |

Project CD-4 Requirements

Technical requirements for CD-4 for MINERvA were established in the Project Execution Plan (PEP). Commissioning goals were established for Detector Modules, Electronics and DAQ Readout Chain, Nuclear Targets Complete, PMTs and PMT Boxes, and Clear Fiber Cables.

Detector Modules - The technical goal for this subsystem was to have 108 loaded frames of the Detector Modules assembled and mapped. Of these 86 frames (80% of the total baseline production) must have at least 119 scintillator strips per plane sensitive to a radioactive source (93% of strips per plane). Each plane has 127 strips. This number was chosen so as to permit no more than one broken connector on a plane.

The MINERvA Project has assembled and mapped 114 tracker and calorimeter modules, the baseline 108 plus 6 spares, as well as 6 nuclear target modules. All modules have been installed on the detector. A quality control check has been established for sensitivity to a radioactive source and 187 of 195 planes pass (95%). The MINERvA collaboration has established that these modules are sensitive to events in a neutrino beam as well as a radioactive source. The project has therefore met and exceeded the requirement established in the PEP

Electronics and DAQ Readout Chain – The technical goal for this subsystem was to read out radioactive source data through the entire MINERvA Electronics and DAQ chain for one module. The MINERvA Project not only demonstrated the electronics and DAQ readout for one module's response to a radioactive source, but also the readout of the entire detector's response to a neutrino beam.

Nuclear Targets - The technical goal for this subsystem was to assemble carbon, steel, and lead targets and that each target pass inspection. These targets have been built and have passed inspection. Furthermore, they have actually been mounted on the detector stand. Hence, this requirement has been fulfilled.

PMTs and PMT Boxes - The technical goal for this subsystem was to have at least 449 PMTs (95% of the total deployed) and their associated bases, boxes, and electronics that pass the PMT and PMT box testing criteria. The MINERvA Project produced more (470) than the requisite number of PMT boxes and ancillary components specified in the technical requirements that passed the testing criteria.

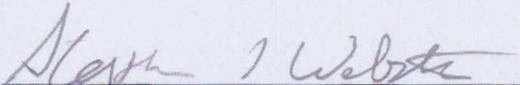
Clear Fiber Cables - This technical goal for this subsystem was to have 3,784 clear fiber cables (100% of total deployed) produced and tested; and for at least 80% of the cables, 8 of 8 fibers pass quality control tests. Cables for the full MINERvA detector have been produced and tested. Overall, between 94-98% of the cables met the quality control criteria for all 8 fibers and all of the cables deployed meet the criteria. A total of 4,113 clear fibers have passed all tests.

Project Completion

MINERvA was baselined with a Total Project Cost of \$16.8M. The baseline schedule for CD-4 completion was the end of the 4th quarter FY2010. Contingency at baselining was a total of \$4.24M, or 34%. Contingency at project close out is estimated to be \$1.5M. The project is projected to close out 3 months early. A punch list of activities are still occurring, primarily production of spare components and mothballing of the factories used for production.

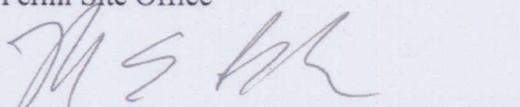
The detector is fully installed and in operations. At the time of baselining it was determined that installation of the detector was to be off project because it was not certain that the detector could be installed while MINOS was in operations. Not only have all commissioning goals been completed, as verified by the SC CD-4 review conducted on May 12, 2010, but the detector is fully installed, in operations, and collecting data. The review committee determined that the MINERvA Project had met all CD-4 requirements established by DOE Order 413.3A and the MINERvA Project Execution Plan. This determination was documented by a signed review summary.

Submitted by:



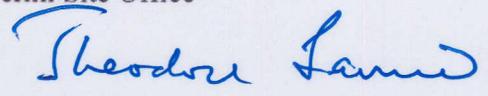
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