



NOvA

NuMI Off-Axis ν_e Appearance Experiment

DRAFT

Technical Design Report

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Preface

This Technical Design Report (TDR) describes the preliminary design of the NOvA accelerator upgrades, NOvA detectors, detector halls and detector sites. Compared to the March 2006 and November 2006 NOvA Conceptual Design Reports (CDR), critical value engineering studies have been completed and the alternatives still active in the CDR have been narrowed to achieve a preliminary technical design ready for a Critical Decision 2 review.

Many aspects of NOvA described in this TDR are complete to a level far beyond a preliminary design. In particular, the access road to the NOvA Far Detector site in Minnesota has an advanced technical design at a level appropriate for a Critical Decision 3a review. Several components of the accelerator upgrade and new neutrino detectors also have advanced technical designs appropriate for a Critical Decision 3a review.

Chapter 1 is an Executive Summary with a short description of the NOvA project.

Chapter 2 describes how the Fermilab NuMI beam will provide a narrow band beam of neutrinos for NOvA.

Chapter 3 gives an updated overview of the scientific basis for the NOvA experiment, focusing on the primary goal to extend the search for $\nu_\mu \rightarrow \nu_e$ oscillations and measure the $\sin^2(2\theta_{13})$ parameter. This parameter has not been measured in any previous experiment and NOvA would extend the search by about an order of magnitude beyond the current limit. A secondary goal is to measure the dominant mode oscillation parameters, $\sin^2(2\theta_{23})$ and Δm^2_{32} to a more precise level than previous experiments. Additional physics goals for NOvA are also discussed.

Chapter 4 describes the Scientific Design Criteria which the Fermilab accelerator complex, NOvA detectors and NOvA detector sites must satisfy to meet the physics goals discussed in Chapter 3.

Chapter 5 is an overview of the NOvA project. The changes in the design relative to the NOvA CDR are discussed.

Chapter 6 summarizes the NOvA design performance relative to the Design Criteria set out in Chapter 4.

Chapter 7 presents the Work Breakdown Structure dictionary at Level 3.

Chapters 8 through 17 then take each Level 2 WBS element of the NOvA project and present each part of the design in more detail than the overview given in Chapter 5. Specific technical design criteria are delineated for each part of the project in addition to the scientific design criteria outlined in Chapter 4. Changes in the design since the NOvA CDR are discussed in detail. The work remaining to bring each part of this preliminary design to a final design is outlined.

Chapter 18 presents the Scope, Cost and Schedule for the NOvA Project.

Appendix A is a guide to other NOvA Project documentation with links to those documents.