The International Design Study for the Neutrino Factory

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Scope and organization of the study

The International Design Study for the Neutrino Factory
- 52 institutes from the Americas, Asia, and Europe (as part of EURONu)
- 126 physicists and engineers
- Launched in 2007 as successor of the International Scoping Study of a future Neutrino Factory and superbeam facility (ISS)
  - https://www.ids-nf.org/wiki/FrontPage

Organization
- Steering group
- Three working groups
  - Physics and performance evaluation
  - Accelerator
  - Detector

The Interim Design Report (2010/11): A step on the way to the RDR. Defines the baseline accelerator facility and neutrino detectors to be taken forward to the RDR

Accelerator development

Proton Driver Options:
- Rapid Cycling Synchrotron or NS-FFAG (ISIS-upgrade)
- Superconducting Proton Linac (CERN-SPL / Fermilab-ProjectX)

Target Concept
- SC-1
- SC-2
- SC-3
- SC-4
- SC-5

Decay Ring Optics and Matching
- Longitudinal Phase Space: (a) before acceleration, (b) after acceleration (bunch compression) through the LINAC
- Transverse Optics for the LINAC, (b) After acceleration

Superconducting Transmission Line
- Developed for VLHC
- Single-turn 100kA sufficient to meet field requirements
- Smaller hole (less dead region)
- No heating

Physics and performance evaluation

Sensitivity studies
- Study/optimization of physics reach:
  - $\theta_{13}$
  - Mass hierarchy
  - CP violation
  - Non-standard physics
  - ...

Simulation tools
- Mostly using GLoBES
- Reproducible
- Documented

Results for Standard Oscillations

Results for Non-Standard Oscillations

Sensitivity to sterile neutrinos

Detector development

100 kT Magnetized Iron Neutrino Detector (MIND)
- Follows the example of MINOS
- 15m x 15m cross-section
- Recent Studies have shown much improved $E_e$ threshold turn-on
- R&D on magnetization needed
- Large excitation current for large plates
- R&D on Magnet and photodetectors for the scintillator readout still needed
- SIFP candidate photodetector

Field Map

100kA Test Loop

The test apparatus used at 100kA for developing the superconducting line.