Introduction to WP5

EuroNu Meeting, RAL
20 January 2010
Paul Soler

Outline WP5 Plenary Session

- P. Soler: Introduction
  - Review of Milestones and Deliverables
- A. Cervera: MIND Status
  - Description of latest MIND analysis
- N. Vassilopolous: Water Cherenkov Status
  - Description of latest results on Water Cherenkov simulations
- R. Tsenov: Near Detector status
  - Description Near Detector baseline and IMD analysis

Aims of WP5

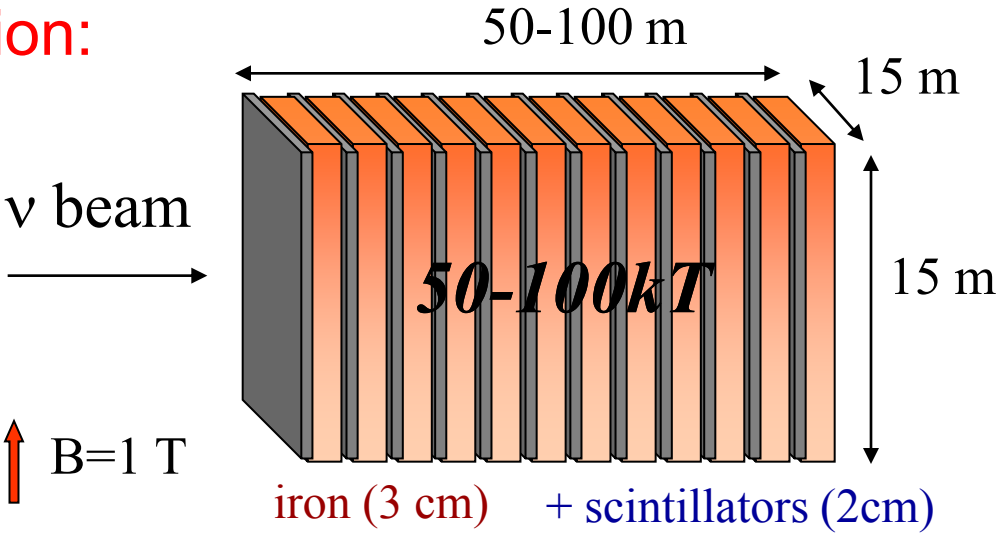
- Define the baseline detector options needed to deliver the physics for each of the neutrino facilities and determine their cost.
- Priorities include baseline detector options from ISS
  - Magnetised Iron Neutrino Detector (MIND) for the golden channel at a Neutrino Factory,
  - Water Cherenkov detector for the Super-Beam and Beta Beam facilities
  - Performance of a near detector at each of the facilities for absolute flux normalisation, measurement of differential cross sections and detector backgrounds.
- Desirable studies: extensions to the baseline options
  - Totally Active Scintillator Detector (TASD). Emulsion Detectors and Liquid Argon detectors for the platinum and silver channels
  - Define shielding requirements for the near detector.

Tasks of WP5

1. Coordination task: Leading the WP, with responsibility for the coordination work (Glasgow, Valencia)
2. MIND task: Simulation of the magnetic iron neutrino detector (MIND), Neutrino Factory baseline from ISS, including implementation of a toroidal field, optimisation of the geometry, event selection, efficiency as a function of threshold, background evaluation and cost estimate (Valencia, Glasgow)

Baseline configuration:

Two detectors
M~50-100 KTon



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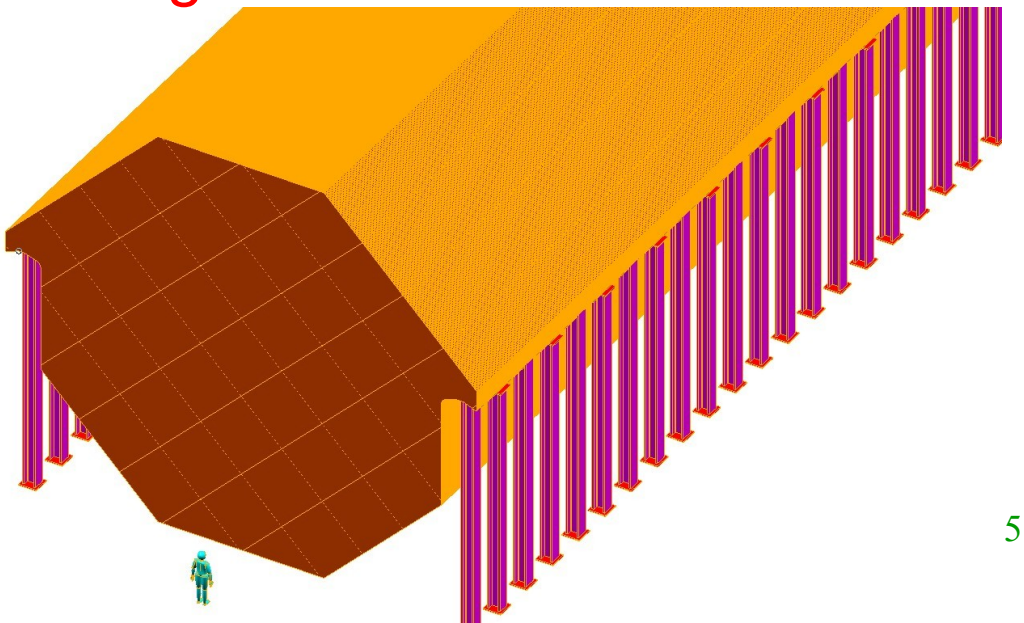
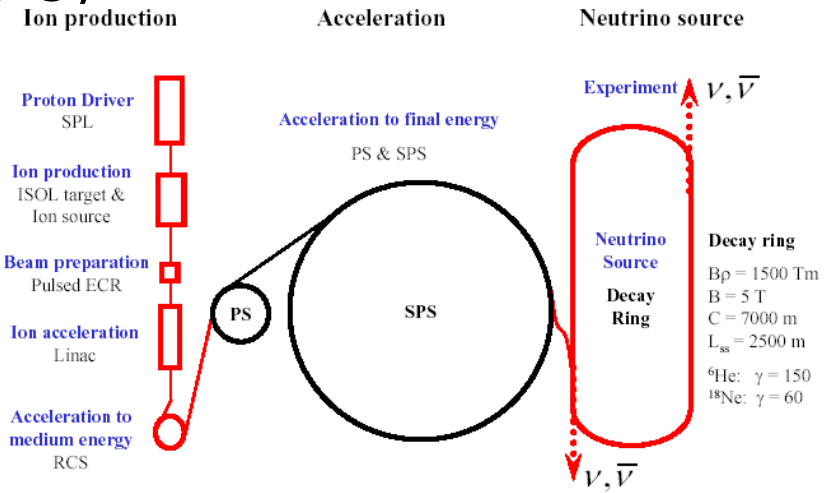
Moving towards engineering solution:

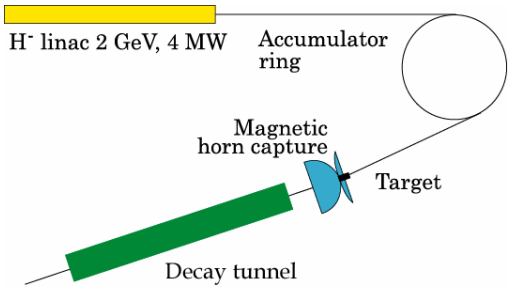
Two detectors
M~50-100 KTon



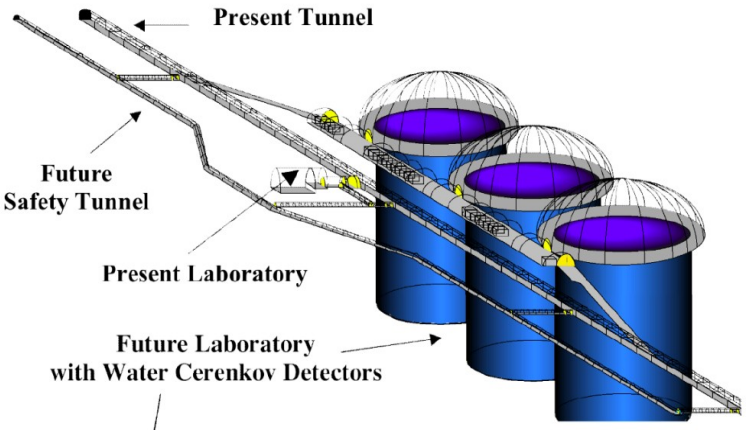
Tasks of WP5

3. Water Cherenkov task: Define performance of water Cherenkov detectors for Super-Beam and Beta Beams, from CERN to Frejus as a function of threshold and background, and cost estimate (Paris, APC)





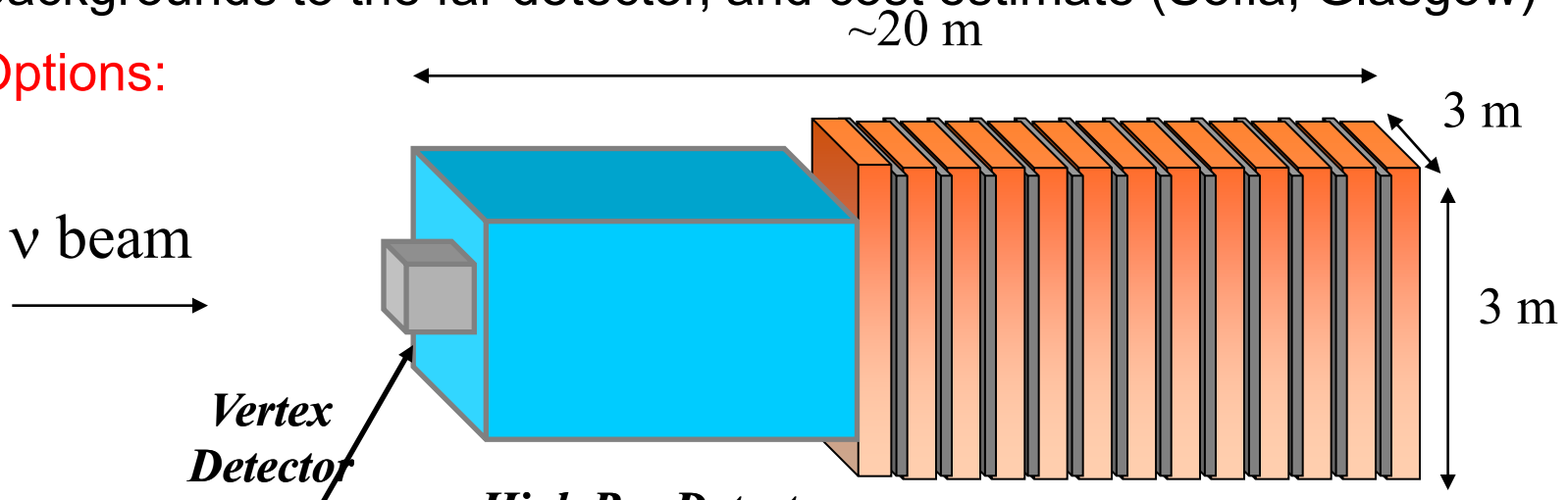
Memphys
~440 kton

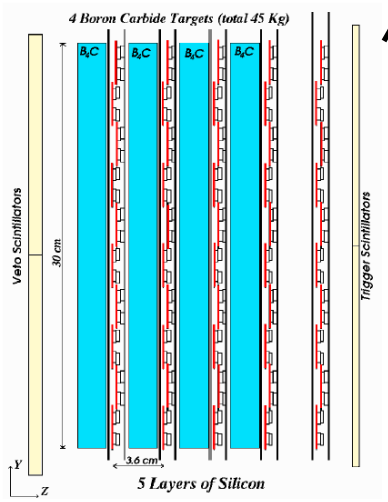


Tasks of WP5

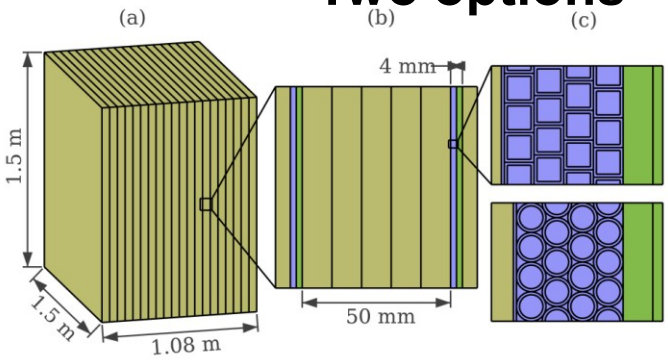
4. Near detector task: Design for the near detector in order to measure the absolute flux normalisation, differential neutrino cross sections, backgrounds to the far detector, and cost estimate (Sofia, Glasgow)

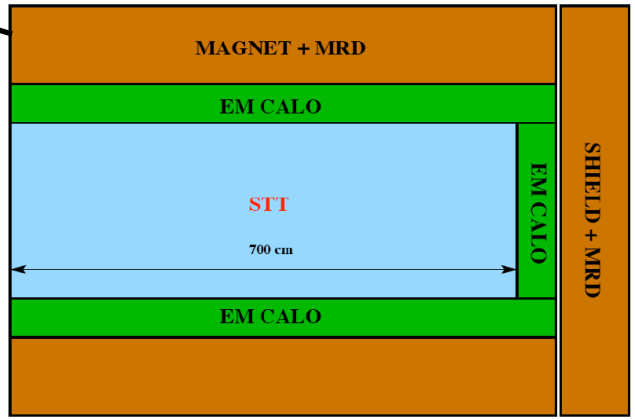
Options:





Two options





Deliverables WP5

- **Deliverables** (brief description and month of delivery)
  - D3: Report on the detector performance of baseline scenarios, 12 months - Done
  - D9: Contribution to the Interim report (all WP). It will summarize the detector potential of the revised baseline scenarios, including systematic errors (near and far detectors), 24 months - Done
  - D13: Project review documentation (all WP), 36 months
  - D16: Report on the detector optimization of the near and far detectors, choice of baseline detectors and first estimate of cost, 36 months
  - Comparison between facilities (WP1), 46 months
  - D21: Contribution to the final report (all WP), 48 months.

Milestones WP5

- **Milestones** (brief description and month of delivery)
  - M5.1: Review detector performance for Neutrino Factory, 12 months (WP5) - Done
  - M5.2: Review of systematic errors for all detectors, 24 months (WP5) – Done (but preliminary results)
  - M5.3: Choice of optimal baseline scenarios for all facilities, 36 months (WP5)
  - M5.4: Comparison of detector performance for all facilities, 40 months (WP5)

Progress towards D13, D16 and M5.3

- Next milestones and deliverables: September 2011
  - D13: Project review documentation (all WP), 36 months
  - D16: Report on the detector optimization of the near and far detectors, choice of baseline detectors and first estimate of cost, 36 months
    - Excellent progress in delivering full performance and systematic errors for MIND: migration matrices for MIND published (if EuroNu ended today this task could be signed off, but there is always room for improvement)
    - Near detector concept and ideas are progressing well: tau/charm vertex detector+scintillating fibre tracker+muon spectrometer (mini-MIND) is probable design (straw tube tracker is alternative). Flux errors from IMD determined. However, need to have similar level of maturity to MIND (ie. migration matrices) to optimize this detector
    - Water Cherenkov: baseline design fixed (except for size/number PMTs and height of caverns) but need migration matrices for signal and background (PID misidentification and π^0) neutrino events

Progress towards D13, D16 and M5.3

- Next milestones and deliverables: September 2011
  - M5.3: Choice of optimal baseline scenarios for all facilities, 36 months (WP5)
    - Baseline of MIND in good shape but need to change to octagonal geometry with toroidal field
    - Baseline near detector progressing but need migration matrices (for flux errors, cross-section errors, near/far extrapolation, charm/tau idedntification)
    - Water Cherenkov baseline (ie Memphys) nearly frozen but need migration matrices for perforrmance determination
- Cost:
  - Need to cost the three detector systems
  - Started already looking at broad costs, scaling from previous detectors
  - Need access to costing tool to progress on WBS
  - Need access to engineers to perform detailed costing