

# WP5: Detector Performance and Cost

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University  
of Glasgow

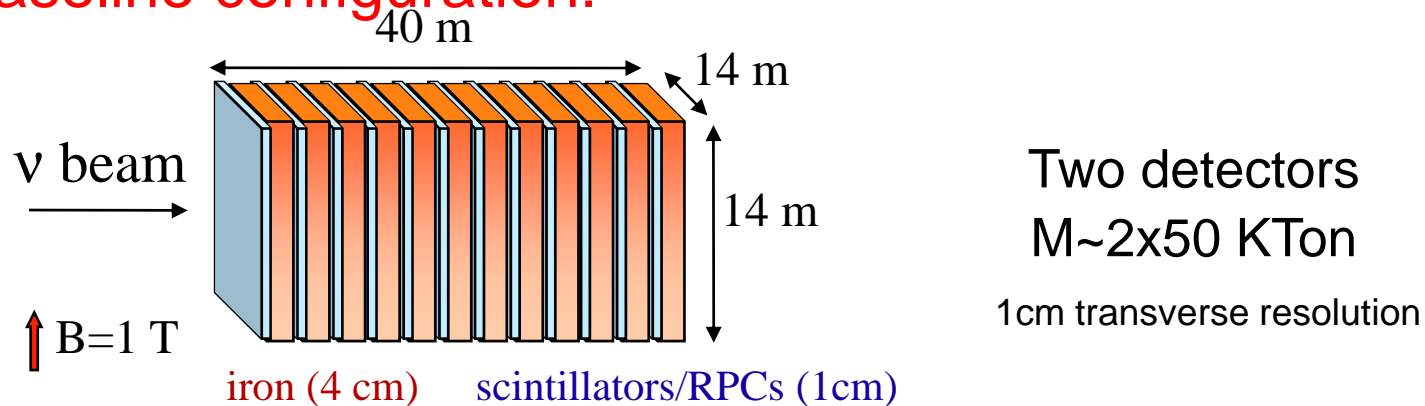
## Aims of WP5

- Define the baseline detector options needed to deliver the physics for each of the neutrino facilities.
- 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) and Emulsion Detectors for the platinum and silver channels
  - Define beam instrumentation and 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)

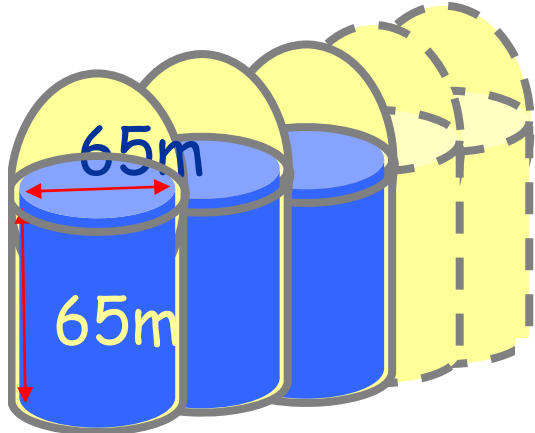
## Baseline configuration:



However, already moving away from this (3cm Fe+2cm scint), how big, 100kton?

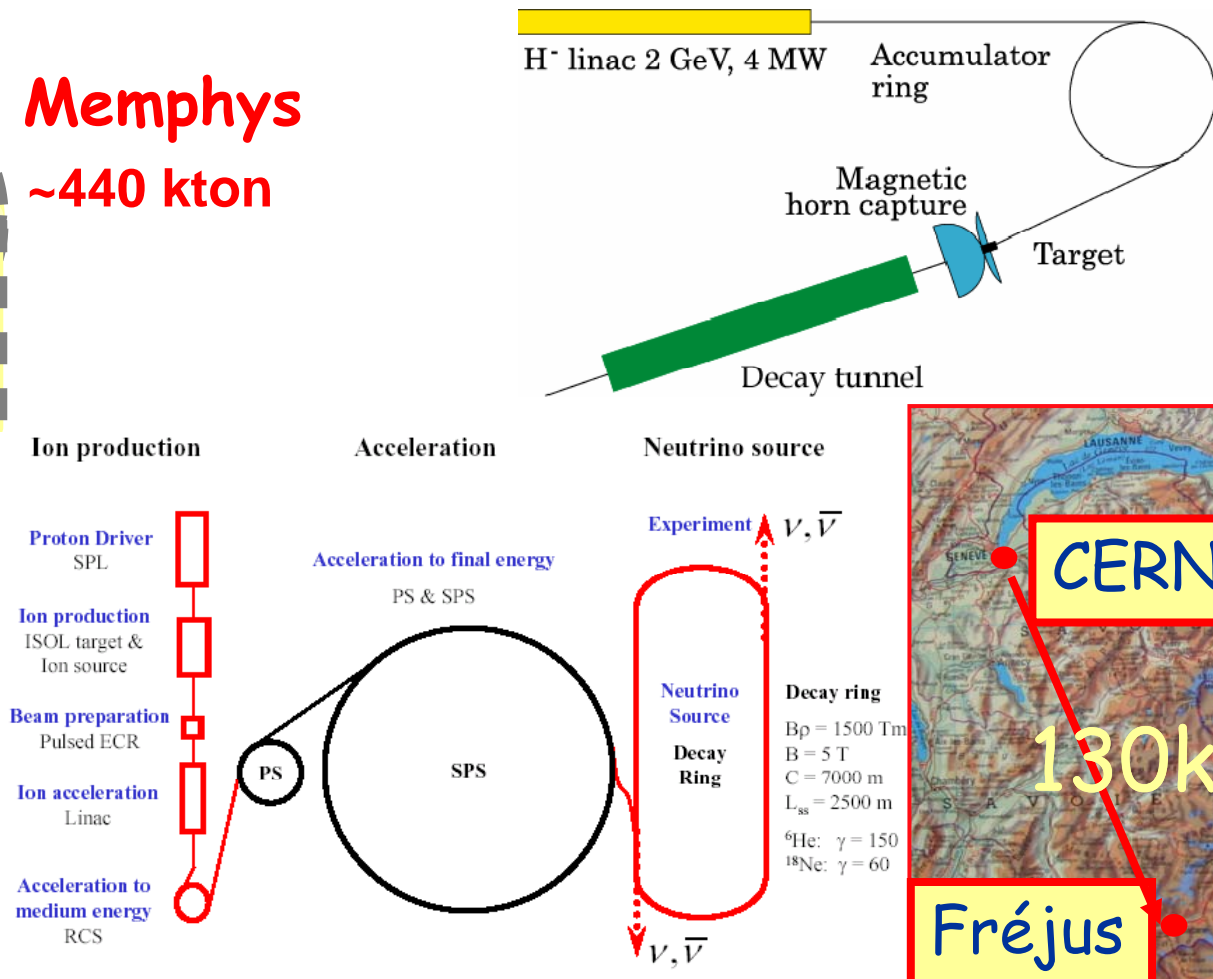
# Tasks of WP5

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



Water Cherenkov modules at Fréjus

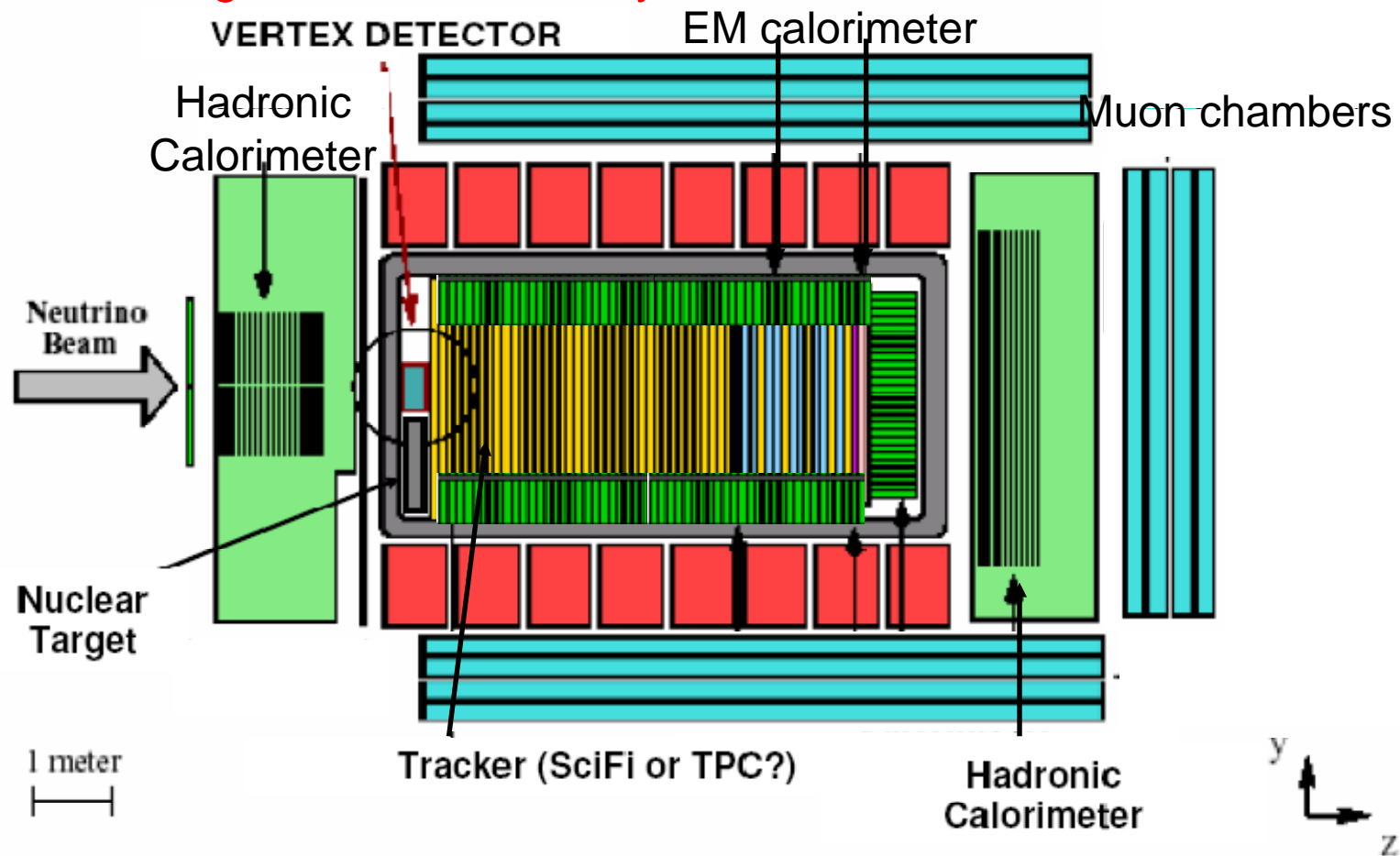
**Memphys**  
~440 kton



# 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)

No, real design of near detector yet but could look like this:



# Institutions

- Univ. of Glasgow: 36 person-months
  - Coordination WP5
  - MIND task
  - Near detector task
- IFIC (CSIC & Univ. Valencia): 47 person-months
  - MIND task
- CNRS (Paris APC): 44 person-months
  - Water Cherenkov task
- Univ of Sofia: 55 person-months
  - Near detector task
- Additional partners: access to travel money
  - Univ. Geneva: beam diagnostics Neutrino Factory
  - Fermilab: T ASD
  - ...other additional partners? Propose Brunel and INO

## Deliverables WP5

- **Deliverables** (brief description and month of delivery)
  - D3: Report on the detector performance of baseline scenarios, 12 months
  - 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
  - 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)
  - M1.1: Review 1<sup>st</sup> year milestones, deliverables & costs by Governing Board, 12 months (all WP)
  - **M5.1: Review detector performance for Neutrino Factory, 12 months (WP5)**
  - M6.1: Update Physics potential, 12 months (WP6,5,2)
  - M1.3: Review interim milestones, deliverables & costs by Governing Board, 24 months (all WP)
  - **M5.2: Review of systematic errors for all detectors, 24 months (WP5)**
  - M6.2: Review of systematic errors in all facilities. Unified treatment, 24 months (WP6,5)
  - M6.4: Physics performance of all facilities with update of fluxes, 24 months (WP6,5,4)
  - **M5.3: Choice of optimal baseline scenarios for all facilities, 36 months (WP5)**
  - M6.5: Theoretical impact of future measurements in physics of flavour and choice of optimal baseline scenarios for all facilities, 36 months (WP6,5)
  - **M5.4: Comparison of detector performance for all facilities, 40 months (WP5)**
  - M6.6: Comparison of physics performance of all facilities , 43 months (WP6,2,3,4,5)
  - M1.5: Final comparison of all facilities, 46 months (WP1)



# Synergy with IDS Neutrino Factory

- IDS Neutrino Factory meetings:
  - Defined MIND (+ TASD) tasks:
    - Established full simulation/reconstruction framework (Event Simulator, event transport - GEANT4, digitisation, pattern recognition and reconstruction).
    - Questions: backgrounds, efficiency, parameters to be optimised?
    - Prototyping programme (DEVDET?) in parallel to validate simulations, technological feasibility and cost
  - Near Detector Tasks:
    - Simulation of near detector and optimisation of layout (vertex detector, tracker, magnet, other sub-detectors)
      - **Flux determination with inverse muon decays, etc.**
      - **Analysis of charm using near detector**
      - **Determination of systematic error from near/far extrapolation**
      - **Expectation of cross-section measurements**
    - Test beam and prototypes to validate technology (eg. vertex detectors)
    - Other physics studies: PDFs, etc. (engage with theory community)

# Synergies for Water Cherenkov

- Synergies with:
  - Laguna Design Study
  - Existing water Cherenkov detectors (ie. SuperKamiokande, T2K ...)
  - Synergy with other MegaTonne water Cherenkov groups around the world (UNO, HyperKamiokande)
  - Share expertise and share simulations?
- Share experience with phenomenology community working on Super-Beam and Beta-Beam scenarios

## WP5 Meetings:

- Next workshop should be in June 09 to monitor progress before NUFACT08.
- Followed by IDS-NF meeting, Mumbai, October 09