Magnetized Iron Neutrino Detector (MIND)

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Magnetized Iron Neutrino Detectors

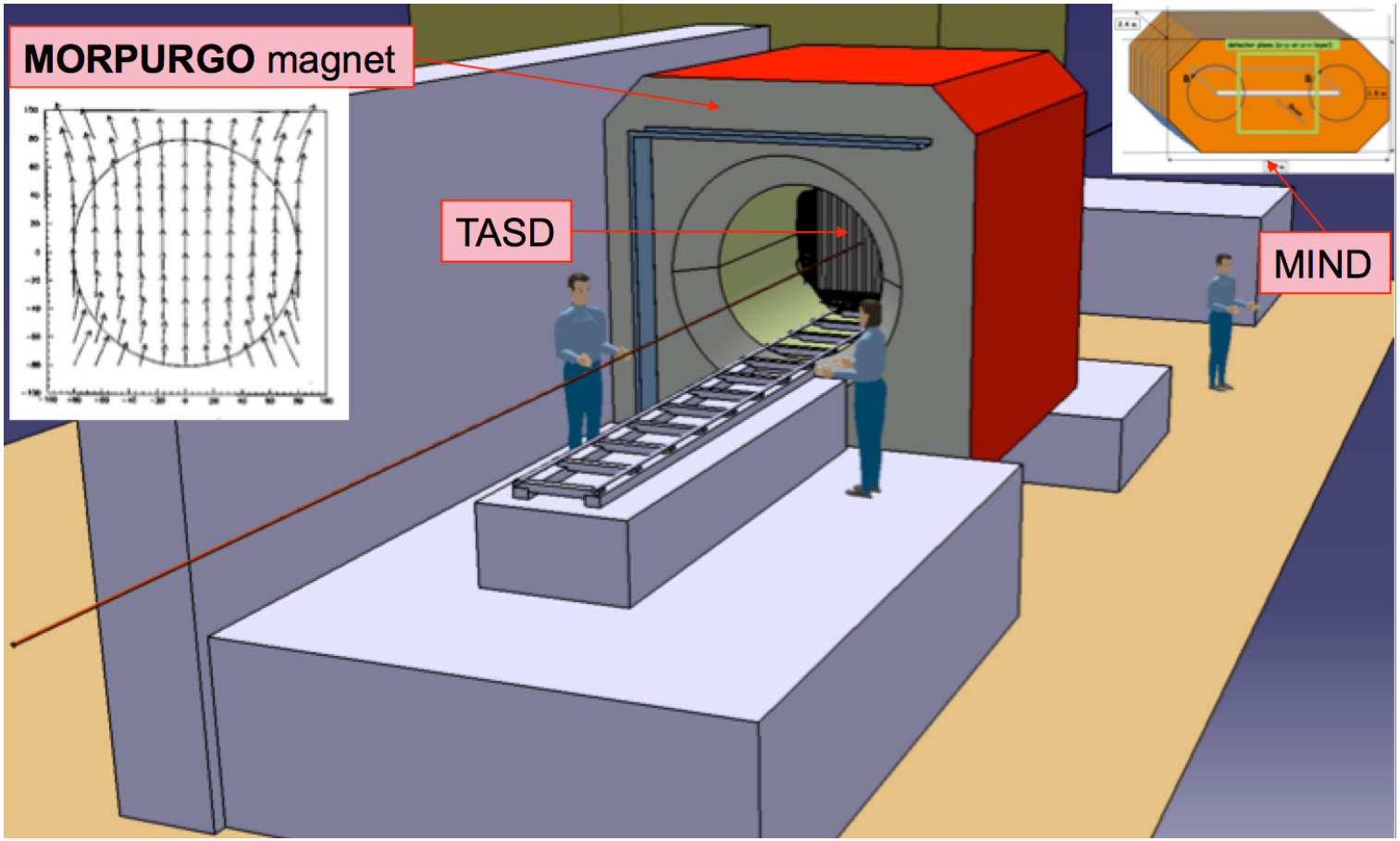
- MINDs past/present/future: CDHS/MINOS/LBNO/νSTORM/Neutrino Factory
  - Compact (high density), high stats;
  - Good event containment;
  - Good charge ID (one "obvious" way to get charge info, B field;
  - Relatively cheap (CHF/ton), robust, maintainability;
  - Ideal for ν_μ studies with $E > 1GeV$.
- Not great for $E < 1GeV$, or for ν_e, or for reconstructing complex vertex:
  - ... but can be used as a tail catcher to reconstruct high E μ from events occurring upstream in higher spatial res. (sub)detectors.

MIND (& TASD) prototyping

- Totally Active Scintillating Detector (TASD):
  - Stopping properties of π and μ (MICE EMR at RAL);
  - e and μ charge separation inside a B field, in particular e charge ID in ν_e interactions for the platinum channel at a NF: 0.5 - 5 GeV/c (MORPURGO).
- MIND:
  - μ charge ID, for wrong sign μ signature of a ν oscillation event: golden channel at νSTORM, NF: requires correct sign background rejection of 1 in 10^4: test beam 0.8 to 5 GeV/c (babyMIND);
  - Hadronic shower reconstruction for identification of charged current ν interactions and rejection of neutral current ν interactions: test beam p/π 0.5 to 9 GeV/c (babyMIND).
- Technology:
  - Better computing and new software tools are leading to better capabilities for event reconstruction BUT... Need test beam data to benchmark new reconstruction techniques;
  - Improvements in components (e.g. photosensors, electronics);
  - Review and update costing models for planned large detectors.

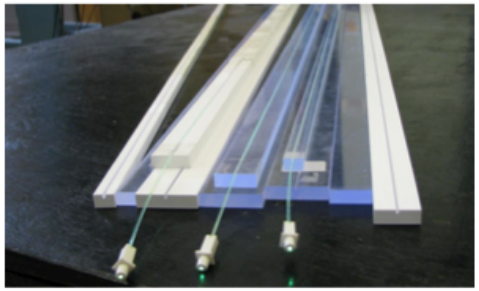
MIND and TASD: H8 beamline in North Area

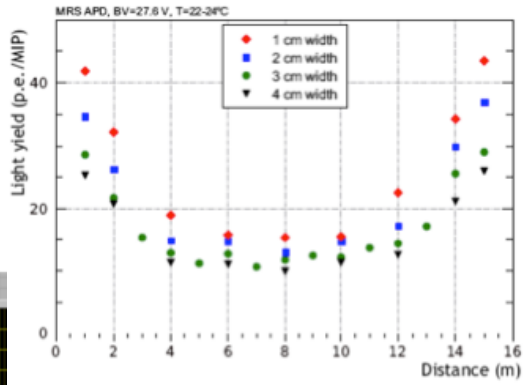
- Beam tests 2015;
- Requires beamline (studied by AIDA WP8.2.1).

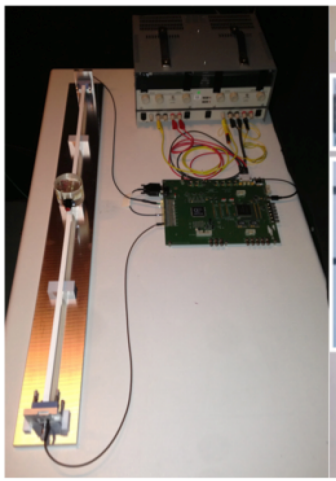


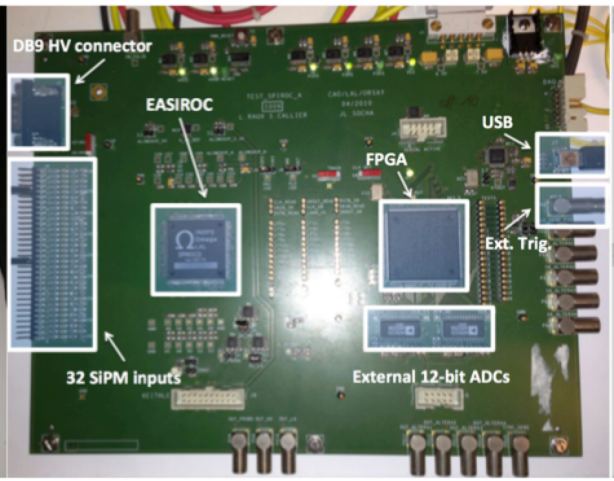
Plastic scintillator bars with SiPM readout

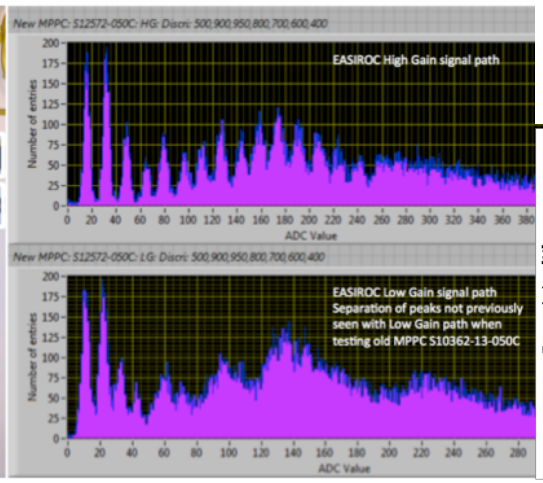
- Extruded scintillator slabs produced by Uniplast + connectors INR;
- Kuraray Y11 wavelength shifting fiber;
- Optical glue tests and selection;
- Photosensor comparison (Advansid, Hamamatsu, KETEK, SensL);
- Electronics.

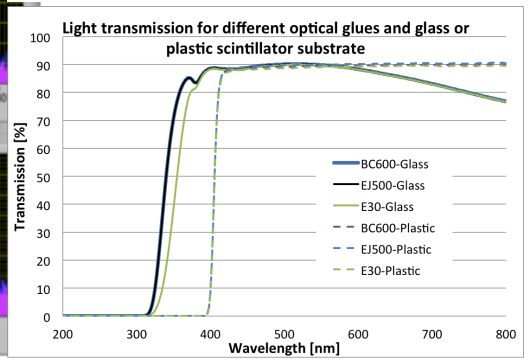




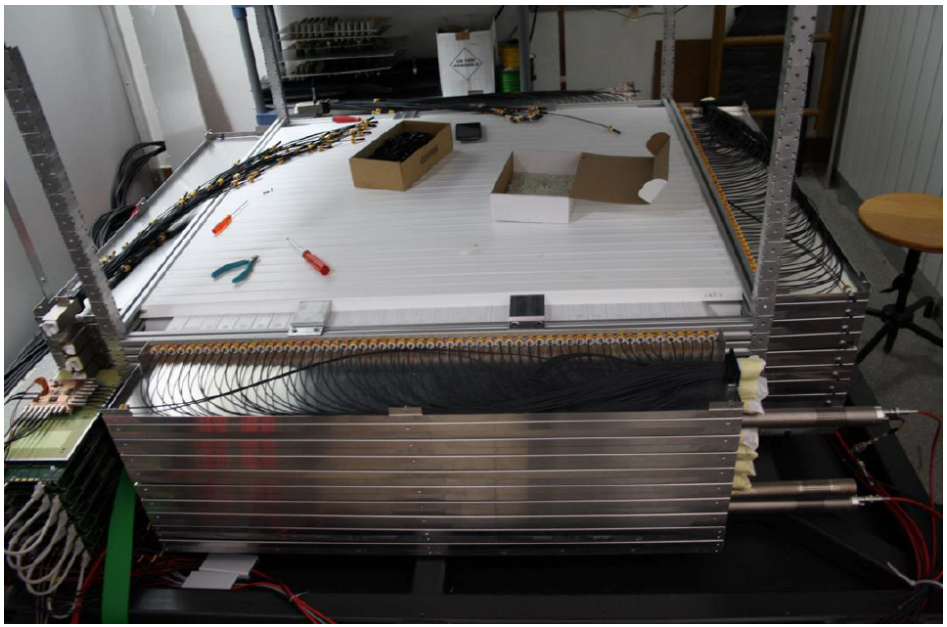


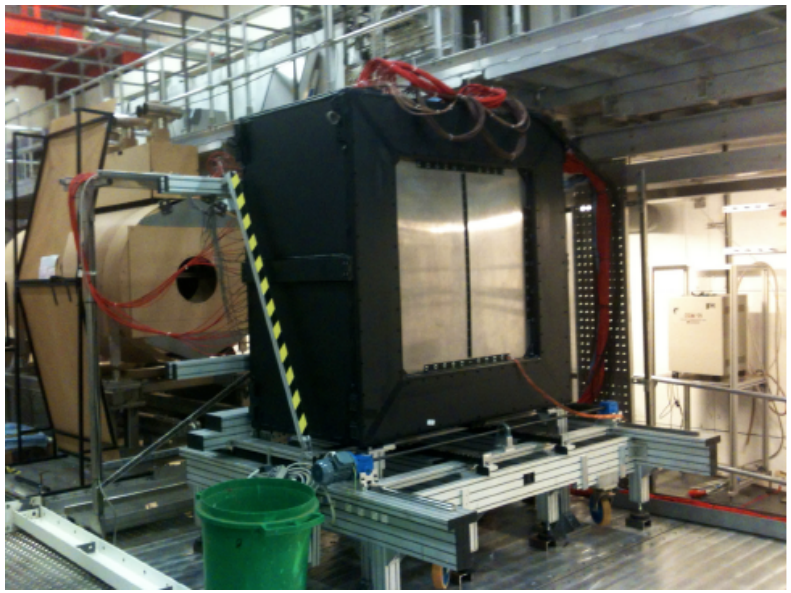


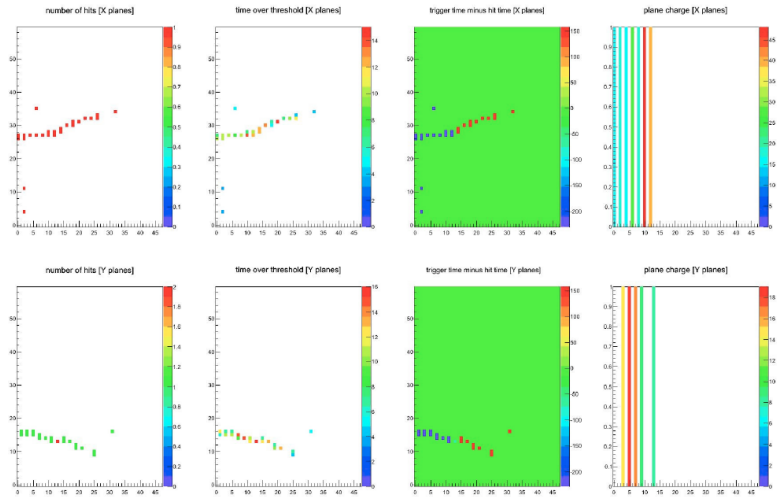




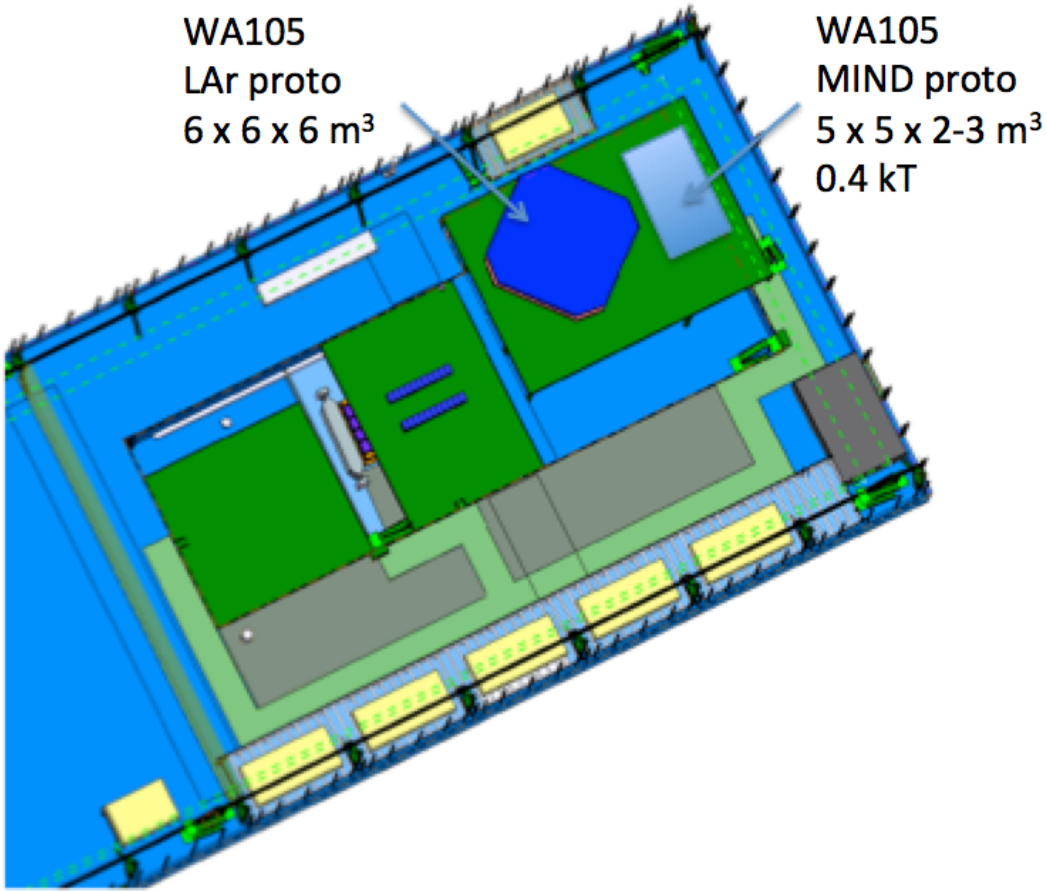
MICE Electron Muon Ranger (EMR): commissioned at UNIGE summer 2013, installed at RAL September 2013







MIND downstream of LAr at EHN1: WA105, being discussed for MoU



Summary

- Several future facilities plan MIND-type detectors.
- Potential of new software reconstruction techniques is highlighted in Neutrino Factory and νSTORM analyses:
  - Must be benchmarked against test beam data on hardware that is well characterized.
- Advances in technology (e.g. photosensors, electronics must be tracked in order to:
  - better gauge potential gains these bring to the field;
  - update costing models for the large detectors.
- We plan beam tests of MIND-type detectors in the near term 2015-2020:
  - at the H8 beamline in the North Area;
  - at the new EHN1 facility in combination with LAr under WA105.