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The Baby MIND spectrometer for the J-PARC T59(WAGASCI) experiment

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The Baby MIND detector under construction at CERN will measure the momentum and charge of muons from neutrino interactions in the WAGASCI neutrino targets. The WAGASCI experiment, referred to as T59 at J-PARC, will measure the ratio of neutrino interaction cross-sections on water and plastic using a three-dimensional grid structure providing large angular acceptance. The Baby MIND consists of 33 steel magnet modules, each approximately 2 tonnes, interleaved with 18 scintillator modules. The novel magnetisation scheme is a significant departure from more classical approaches for magnetised iron neutrino detectors. Due to handling constraints at J-PARC, narrow shaft, each magnet module is individually magnetised. This provides far greater modularity and flexibility in the layout, with greater possibilities to surround other neutrino targets such as water Cherenkov, liquid argon or plastic scintillators. The use of such magnetised iron plates would not usually be considered for muon momenta below 1 GeV/c due to multiple scattering in the steel. By optimising the layout, the Baby MIND can determine the charge of muons with good efficiencies down to 400 MeV/c. Custom readout electronics was developed based on the CITIROC ASIC and has trigger and synchronisation features optimised for operation at J-PARC. This presentation will cover the design and construction of the Baby MIND detector, and measurements of charge identification efficiencies from the latest campaign of beam tests at the CERN PS.

Experimental Collaboration

NP05 CERN Neutrino Platform, J-PARC T59 WAGASCI

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