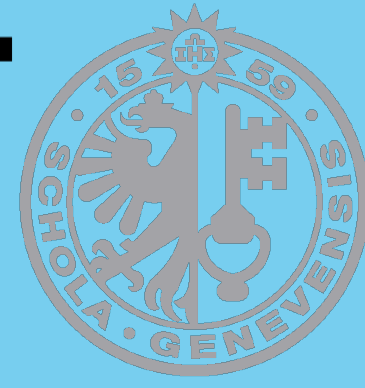
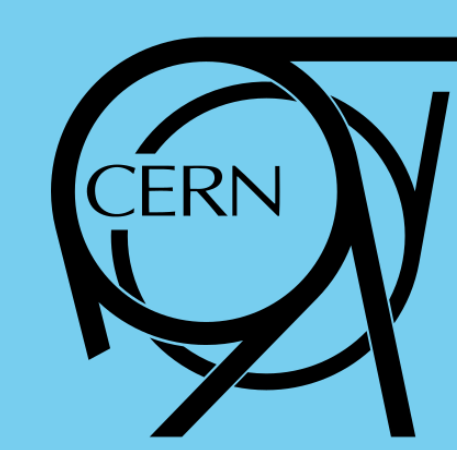


# BABY MIND EXPERIMENT



UNIVERSITÉ  
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## MOTIVATION

- Baby MIND is a muon spectrometer that will measure the momentum and identify the charge of muons produced in charged current neutrino interactions in WAGASCI targets. It consists of magnetized iron plates interleaved with scintillating modules. One challenge the detector aims to address is that of keeping high charge identification efficiencies for momenta as low as 300 MeV/c where multiple scattering in the steel plates degrades the momentum resolution.
- The WAGASCI target modules are designed as grids of scintillating plastic, filled with water, and will provide precision measurements of the ratio of cross sections in water and plastic in order to reduce systematic errors for T2K. It is also R&D for the proposed ND280 upgrade

## DESIGN AND CONSTRUCTION

- The design of Baby MIND detector, unlike the classical monolithic MIND type detectors, is completely modular. New magnetization scheme has been developed for this purpose. All the access restriction and installation requirements in Japan has been addressed with this design. A total of 33 magnets and 18 scintillating modules compose Baby MIND.



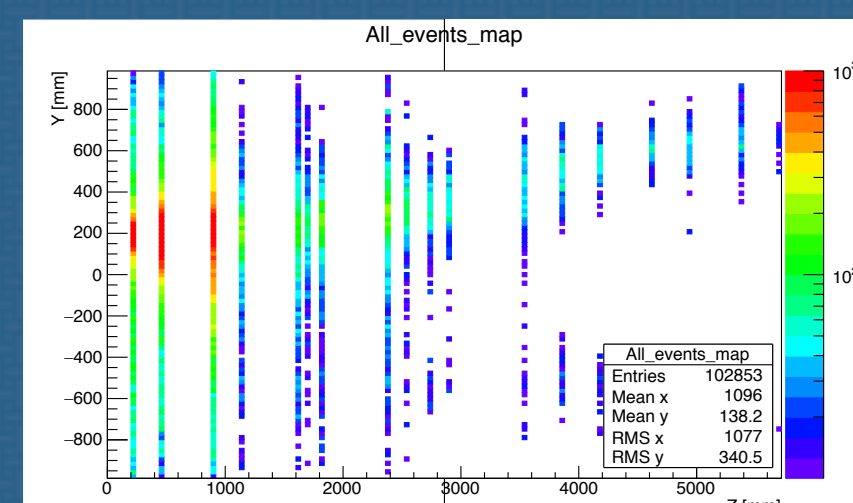
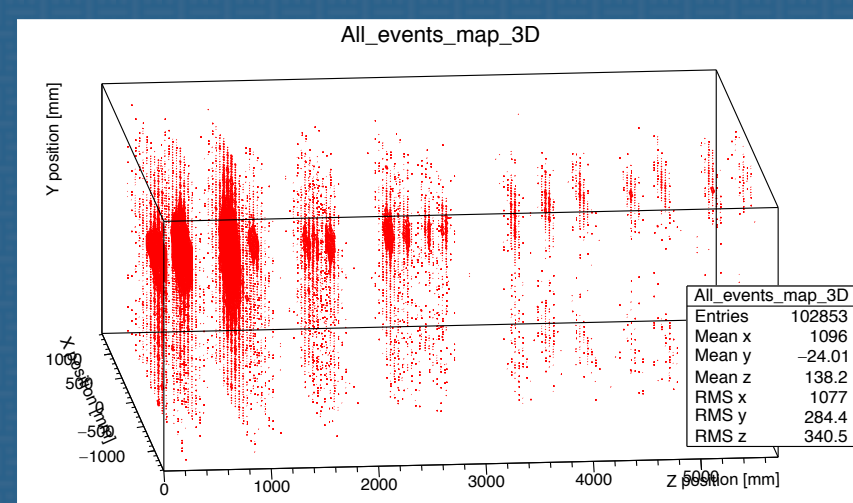
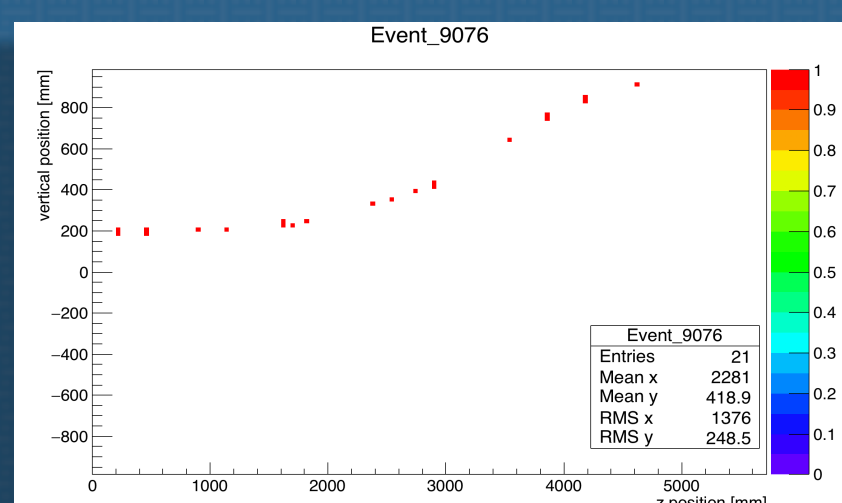
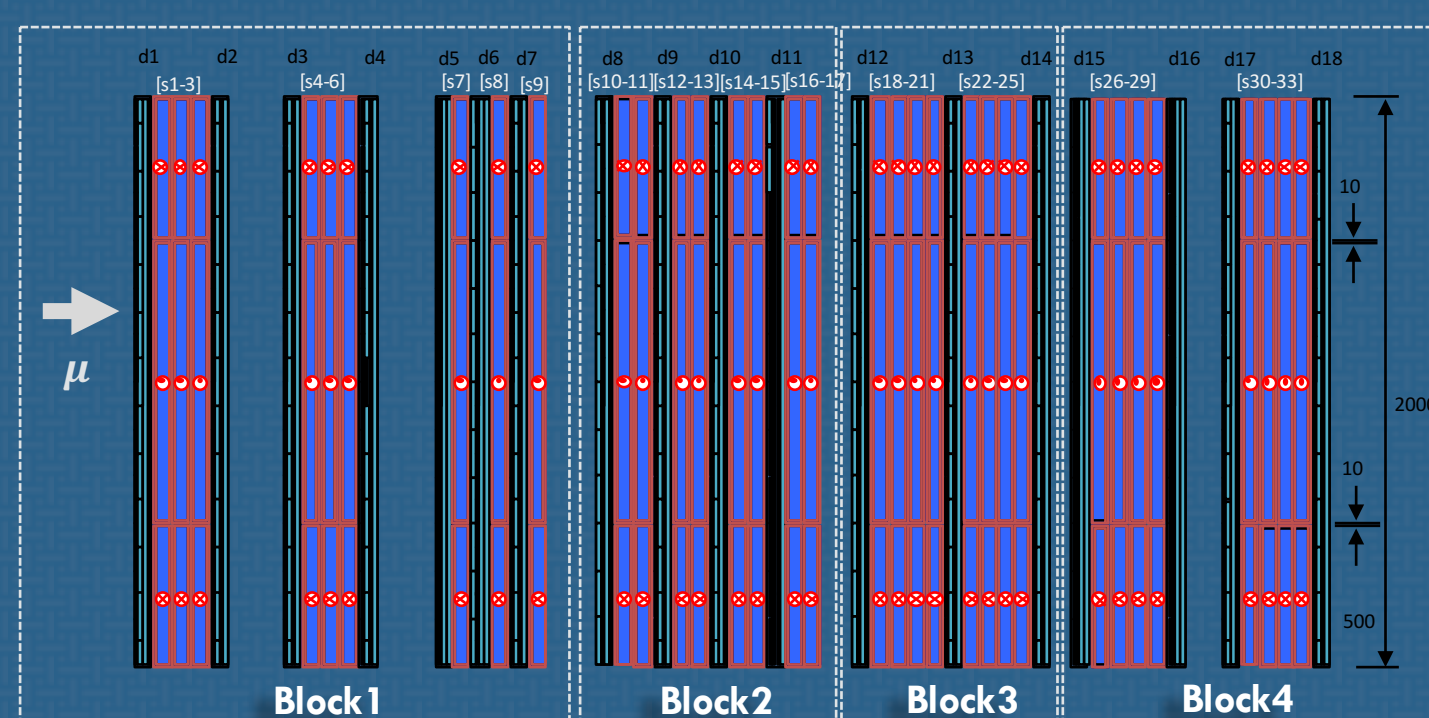
One of the four blocks of Baby MIND detector containing 8 magnetic modules and 4 scintillating modules (~20 tons).



Construction of (up) magnetic module and (down) scintillating module at CERN.

## BEAM TEST 2017 RESULTS

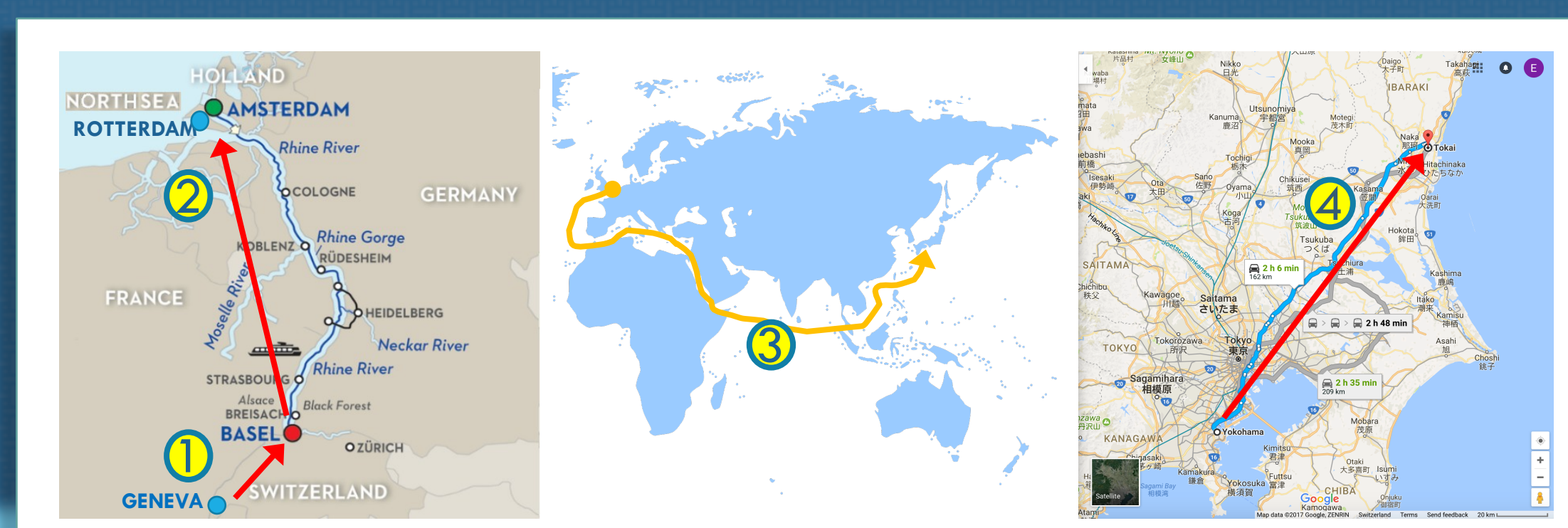
- The detector performance has been tested in T9 beamline at CERN in summer 2017. The 1.5T magnetic field bends the charged particles beautifully promising a high efficiency for charge identification. beam momentum has been varied between 0.5 GeV/c and 5 GeV/c. Some preliminary beam profiles and muon tracks is presented.



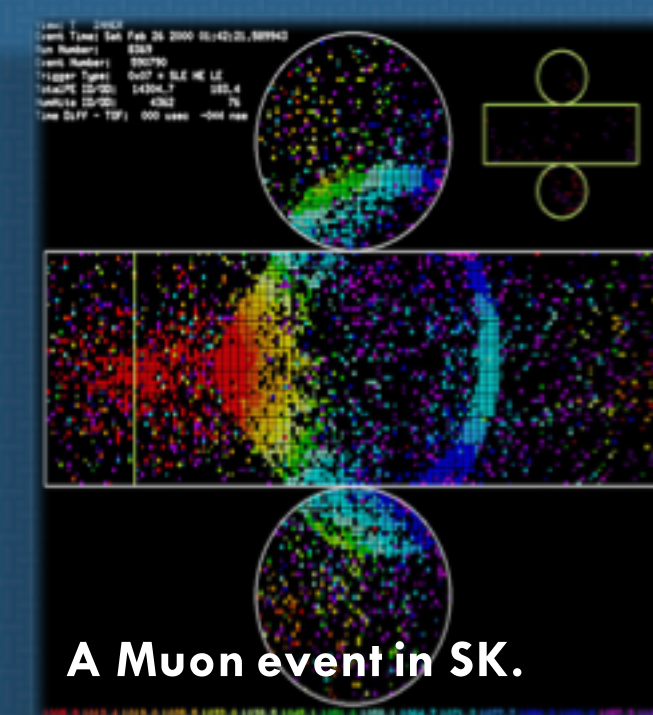
(Left) A Muon track of ~2 GeV/c entering Baby MIND and bending upwards in the central magnetic region and bending downwards in the upper magnetic region. (center) 3D and (Right) 2D events displays for a beam of 2 GeV/c muons.

## BABY MIND FROM GENEVA TO TOKAI

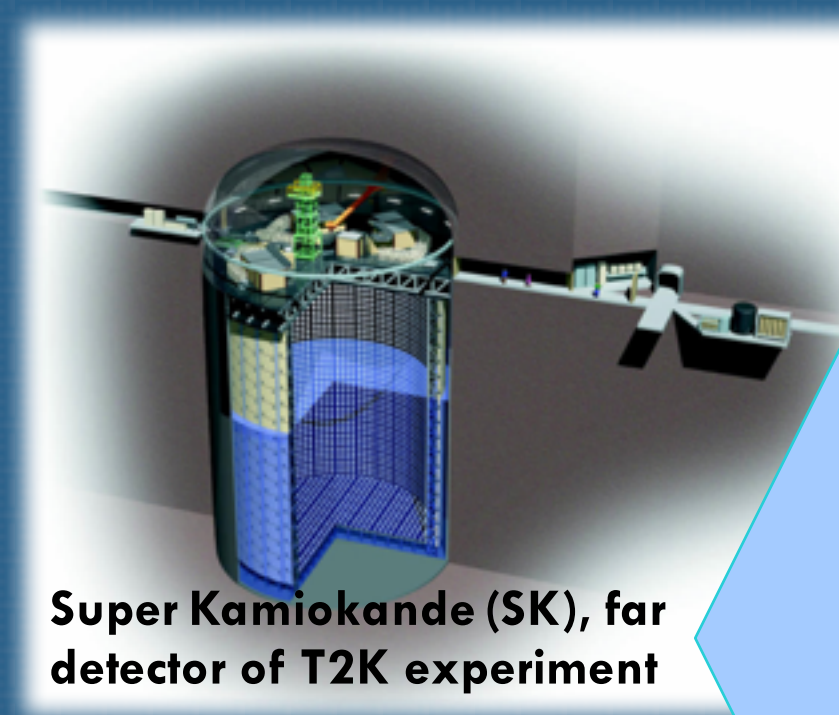
- The detector will be shipped to Japan end of October 2017. The installation and commissioning phases are scheduled for January-May 2018.
- WAGASCI and Baby MIND will begin to take combined data after the T2K summer 2018 shutdown.



Baby MIND poster presented at NuFACT 2017 Conference, Uppsala, Sweden, 25-30 September 2017

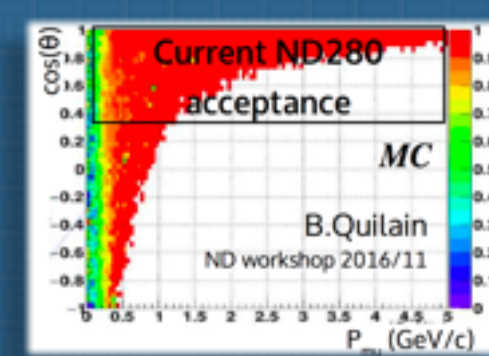
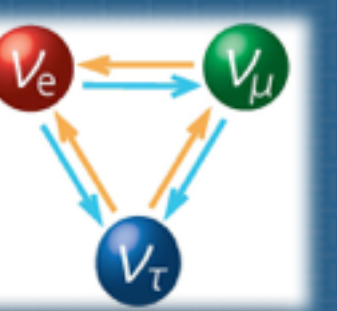


A Muon event in SK.

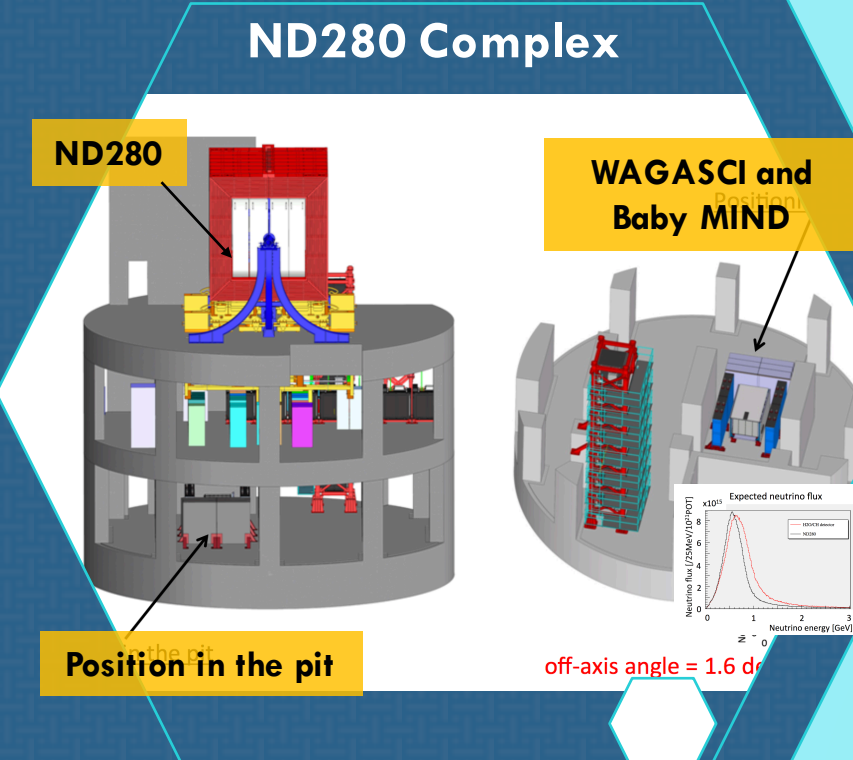


Super Kamiokande (SK), far detector of T2K experiment

### T2K Experiment



Current ND280 acceptance



Position in the pit

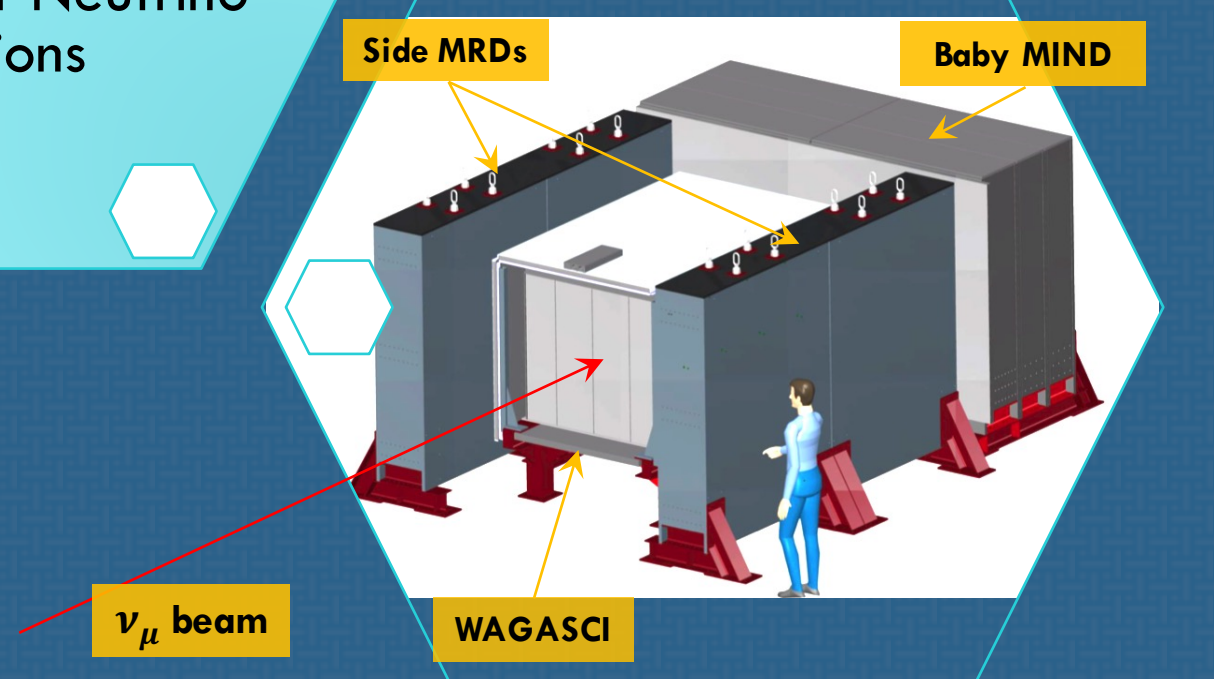
### T2K experiment

studies Neutrino oscillations by comparing the results of a near detector and a far detector, 295 km a part.

### WAGASCI Modules

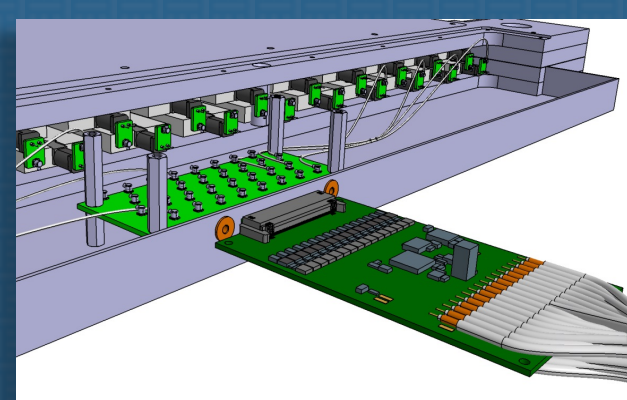
are grids of plastic scintillators filled with water or hydro carbon as a target for Neutrino interactions

### WAGASCI Experiment

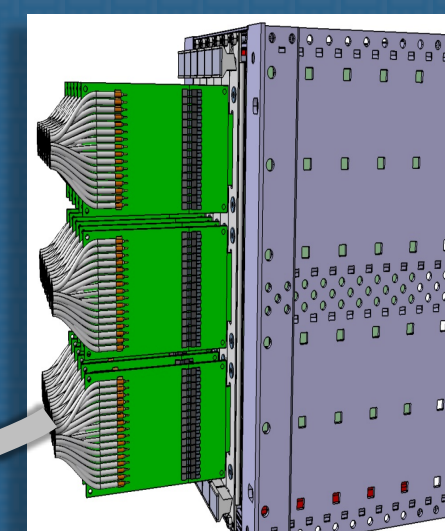


## READOUT SYSTEM

- The Front-End electronic board has been designed based on CITIROC ASICs and USB3 readout. Custom made cable bundles and mini crates hosting the FEBs provides an excellent environment to take the data from 4000 channels of the detector.



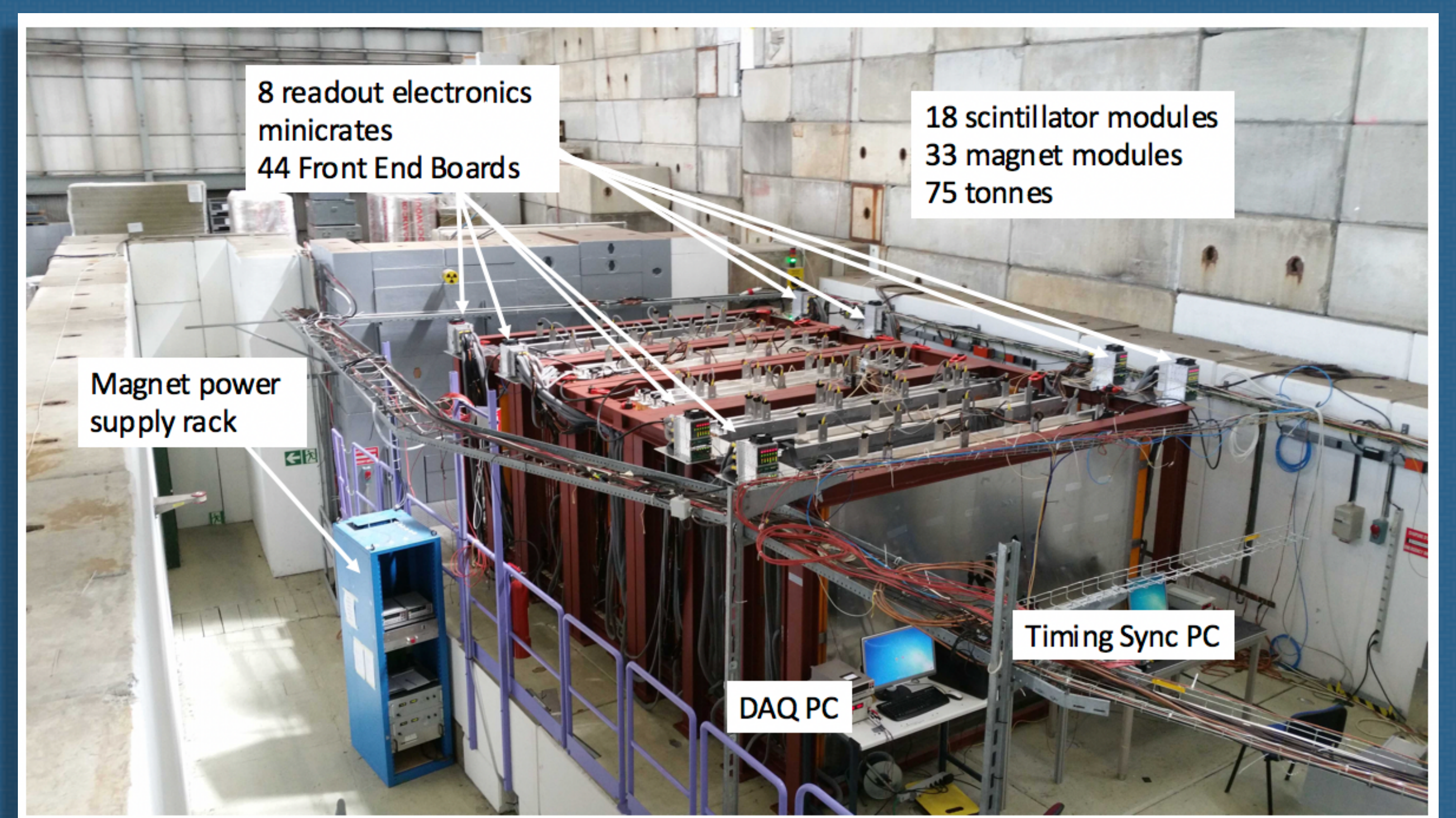
5 meters Cable bundles connect 32 MPPC channels from the scintillating module to the FEB on the mini crate.



A Mini crate hosting 6 FEBs.



Baby MIND Front-End electronic Board (FEB).



Baby MIND detector during tests at T9 beam line, CERN. 33 magnet modules (66 tons of steel) have been powered by a 140A current (10kW), providing homogenous 1.5 T magnetic fields. 8 synchronized mini crates transfer the signal of all channels from 44 FEBs to two separate PCs via USB3 connection.

## PROJECT TIMELINE

Baby MIND Timeline	2015	2016	2017	2018
Project approval				
Prototyping				
Construction				
Beam tests				
Shipping to Japan				
Installation				
Commissioning				