

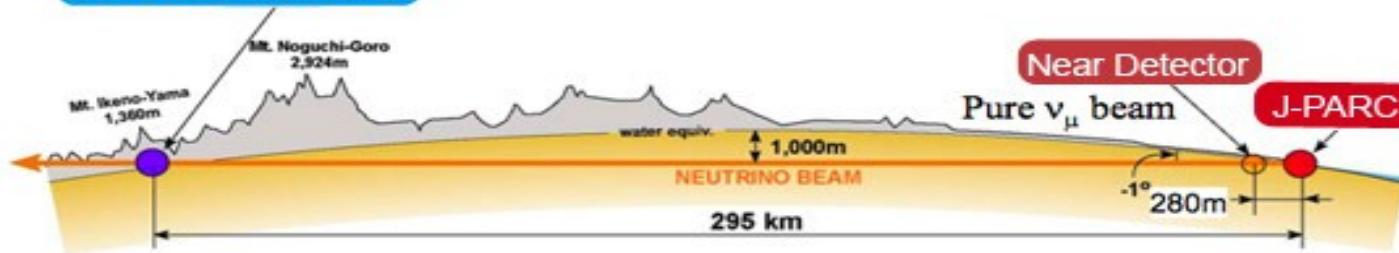
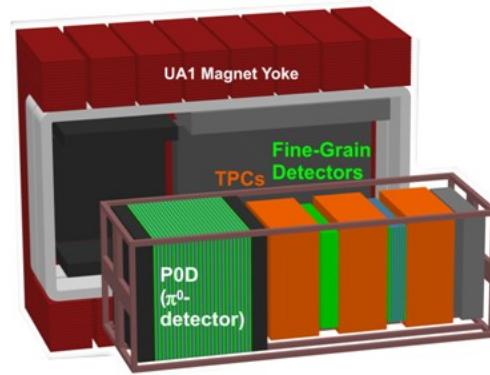
# T2K status

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Marco Zito  
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GDR  
Strasbourg, 29 octobre 2009

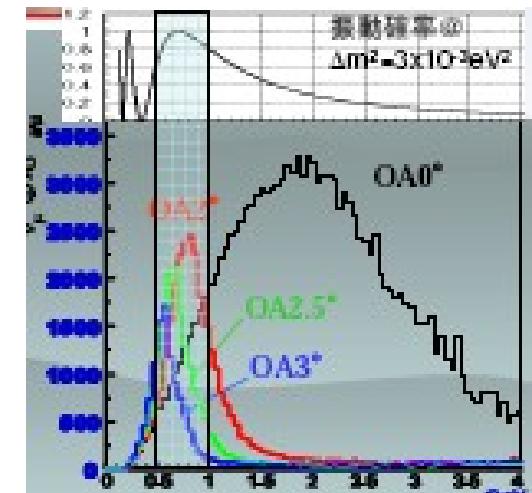
# Tokai to Kamioka (T2K) long baseline neutrino oscillation experiment



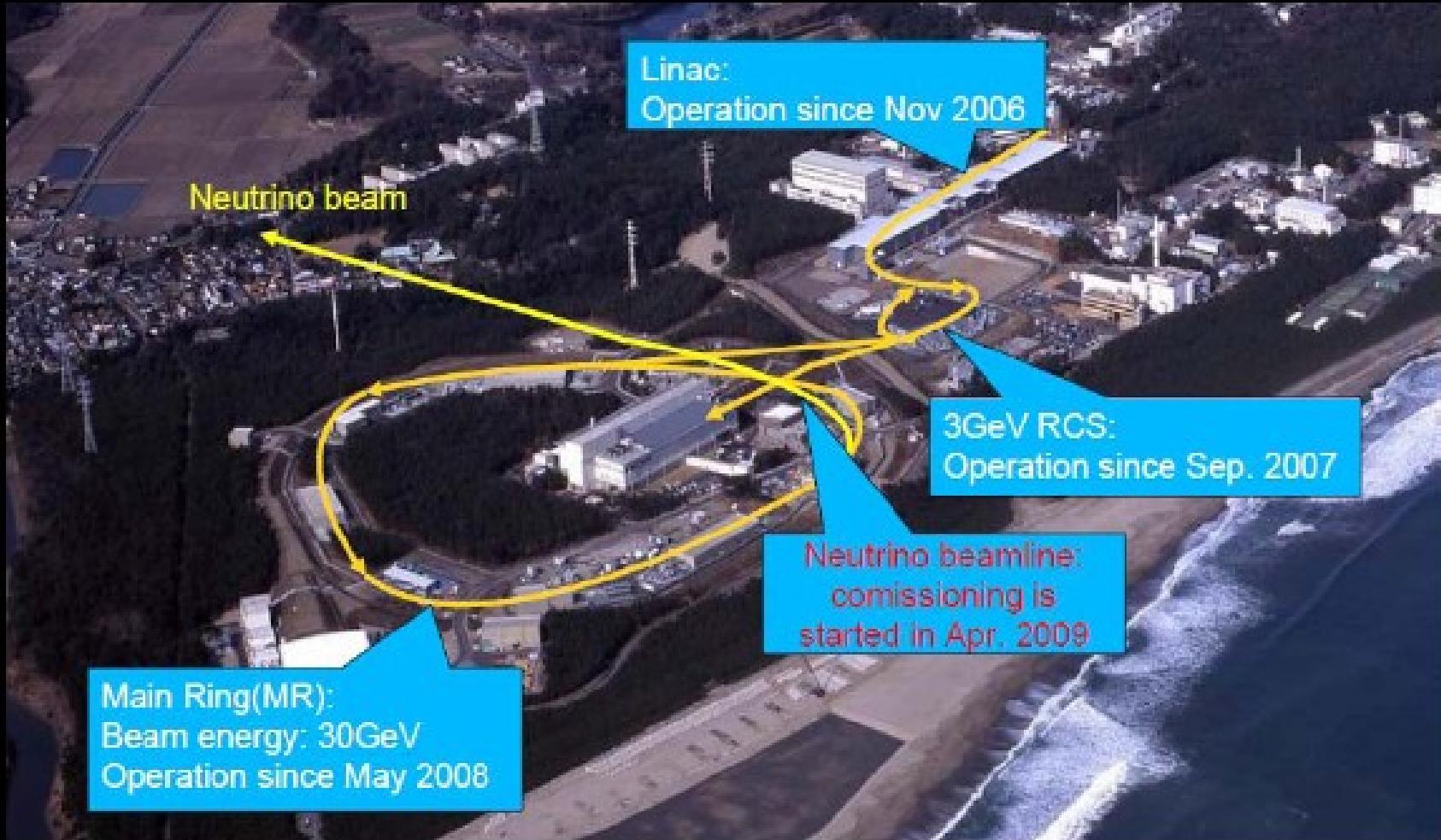
- Intense proton beam from JPARC
- Off-axis by 2.5 deg
- Tuned at osc. max
- Goals:
  - discover  $\nu_e$  appearance
  - Precise measurement of  $\nu_\mu$  disapp.
- SK: 1600 CC/yr/22.5kt

First off axis beam!

Zito



# JPARC accelerator complex



# Neutrino beamline

Neutrino monitor build.



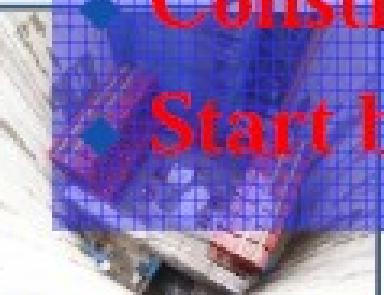
Electromagnetic horn



Graphite target



- ◆ 5 year construction 2004-2009
- ◆ Construction completed on schedule!
- ◆ Start beam commissioning in April 2009!



UA1 magnet donated  
from CERN installed in  
Apr-Jun, 2008 on  
schedule



Beam dump completed



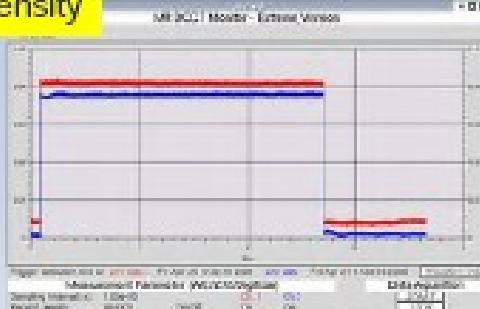
Target station completed

Primary proton beam line  
completed



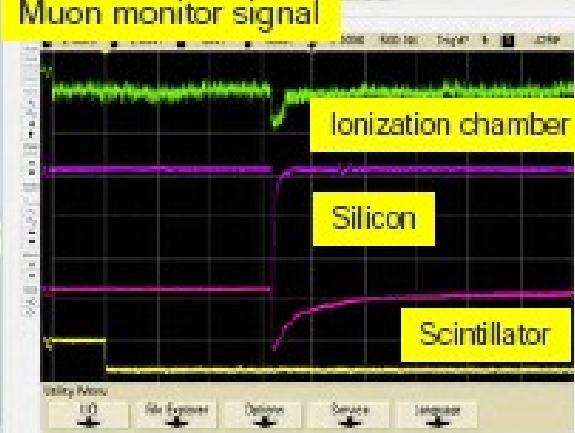
# T2K beamline started operation!

## MR intensity

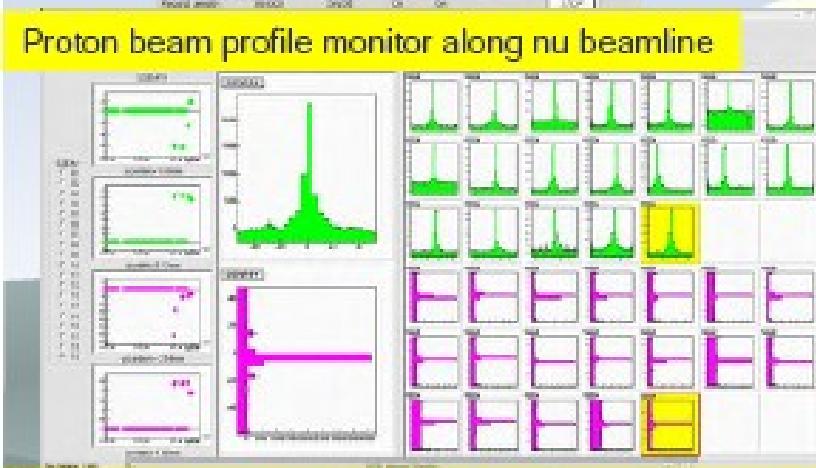


After ~10 shots for tuning, proton beam hit around target center

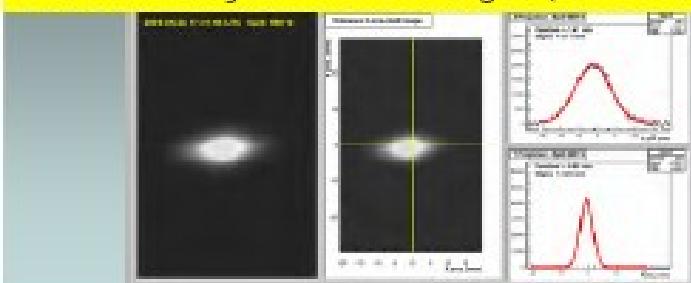
### Muon monitor signal



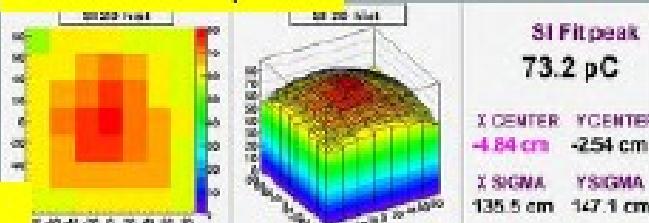
Proton beam profile monitor along nu beamline



OTR detector just in front of target (fluorescence plate)



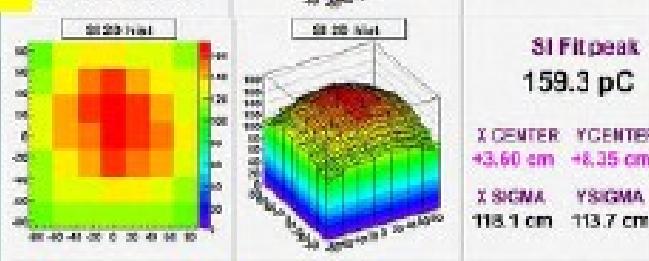
## Muon monitor profile



SI Fitpeak  
73.2 dB

X CENTER Y CENTER  
-4.84 cm -254 cm  
X SIGMA Y SIGMA  
135.5 cm 167.1 cm

SI Fitpeak



Horn  
Off

Horn  
250kA

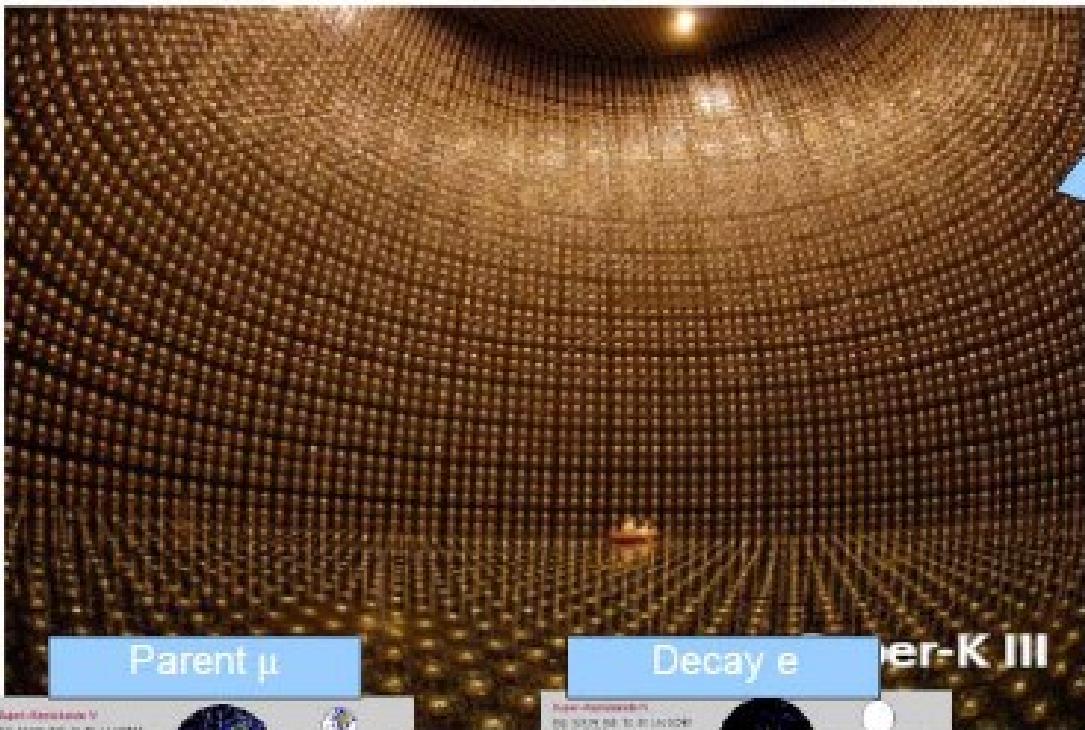
10

G

octobre 2009

Marco Zito

# Far Detector: Super-Kamiokande



•50kt Water Cherenkov detector  
•20"PMT x 10,000  
+Anti counter x 2000



**Parent  $\mu$**       **Decay e**      **Super-K III**

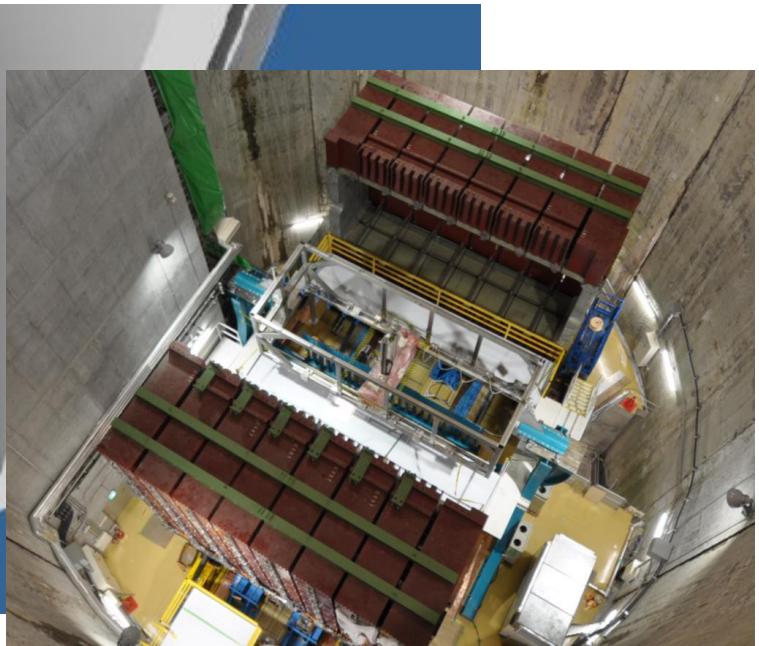
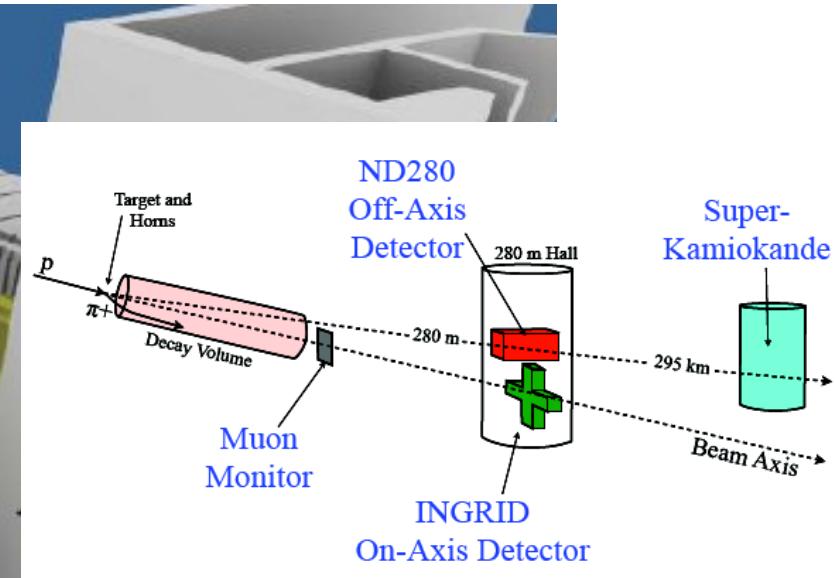
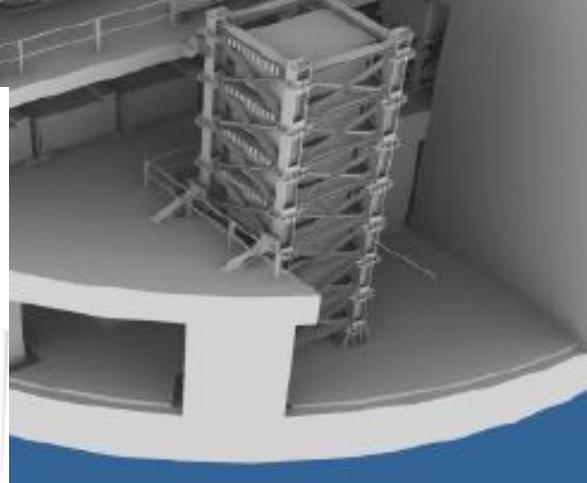
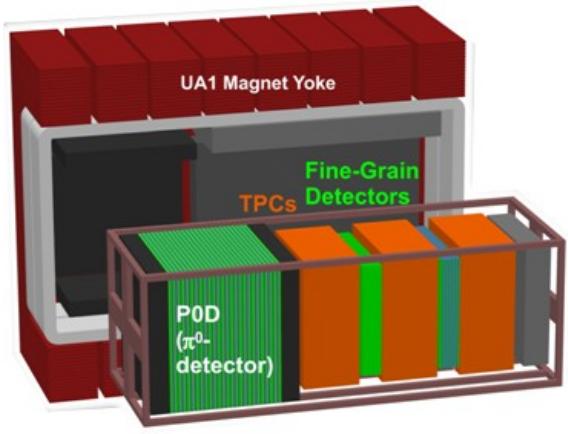
$\sim 3.4\mu\text{s}$

New electronics installed in summer of 2008. (SK-IV)  
- Stable and dead time less DAQ  
→ e.g. improvement of decay-e tagging efficiency  
- Ready for T2K experiment

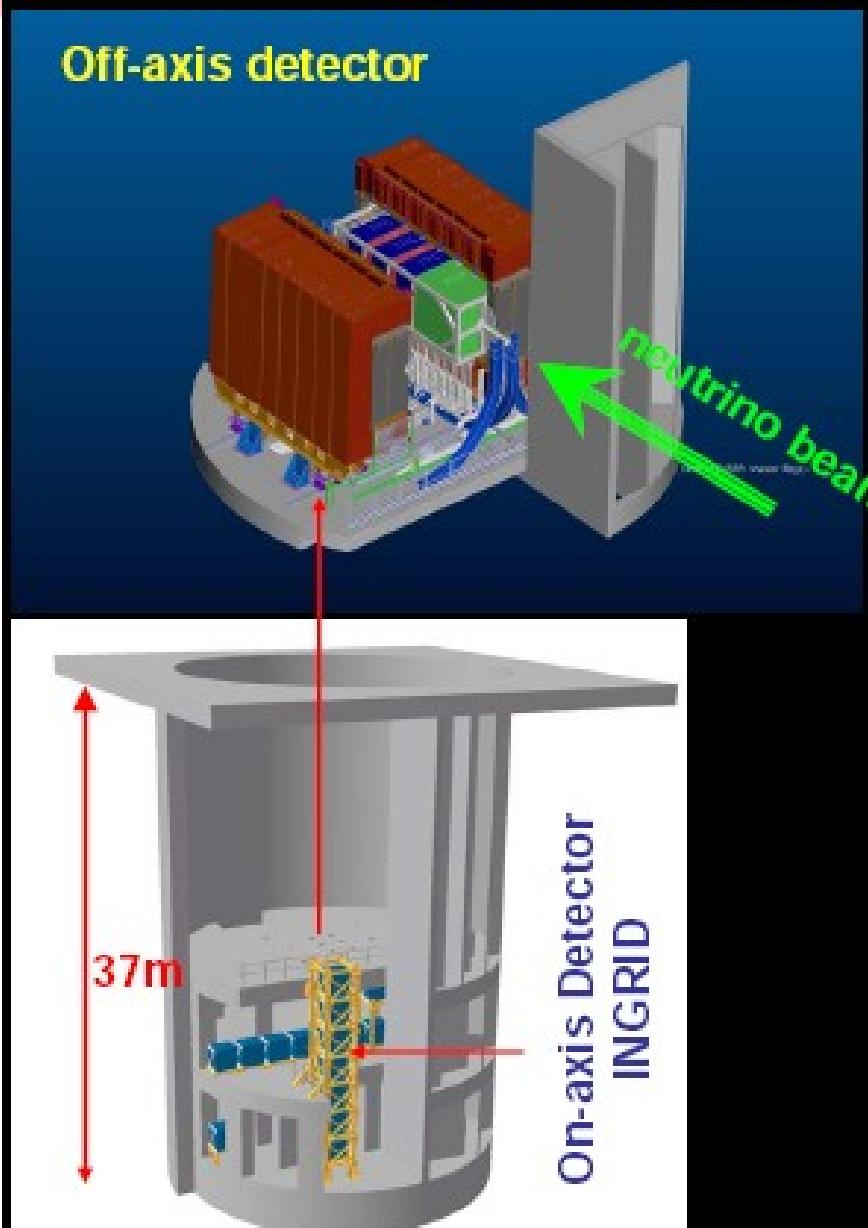
The diagram illustrates the transition from the Super-K III detector to the Super-K IV detector. On the left, labeled "Parent  $\mu$ ", is a screenshot of the Super-K III software interface showing a particle track and a histogram. An arrow labeled " $\sim 3.4\mu\text{s}$ " points to the right, where a similar screenshot for "Decay e" is shown, also with a histogram. The background features a close-up view of the detector's internal structure.

# T2K Near Detector: ND280

## ND280 Construction Status Report



# The near detector: ND280



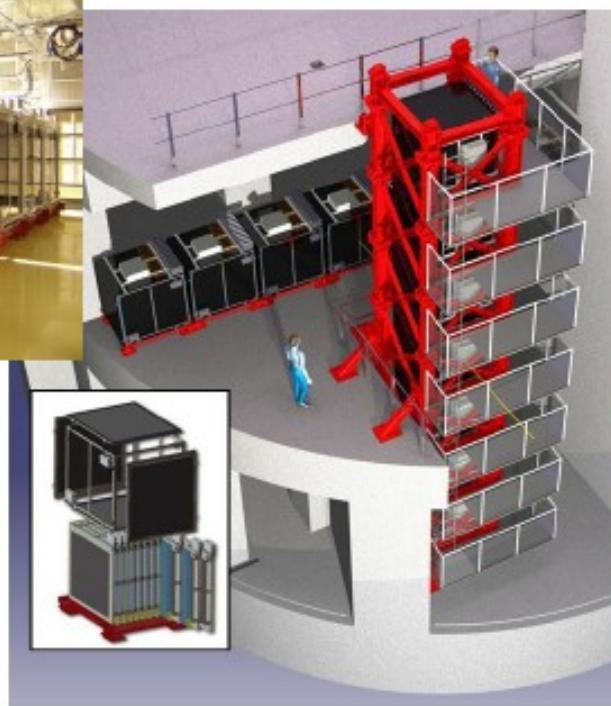
## INGRID

- **fully installed and operational**
- **Refurbished UA1 magnet: operational, field mapped**
- **SMRD: fully installed, commissioning**
- **POD: fully installed, commissioning**
- **FGD: installation this week**
- **DS ECAL: installation next week**
- **TPCs: 2 of 3 at JPARC, installation in October; third one in construction**
- **Barrel ECAL, POD ECAL: in construction, installation in 2010**

# Installation to NM pit

7/6 ~ 7/16 for horizontal modules

8/2 ~ 8/11 for vertical modules



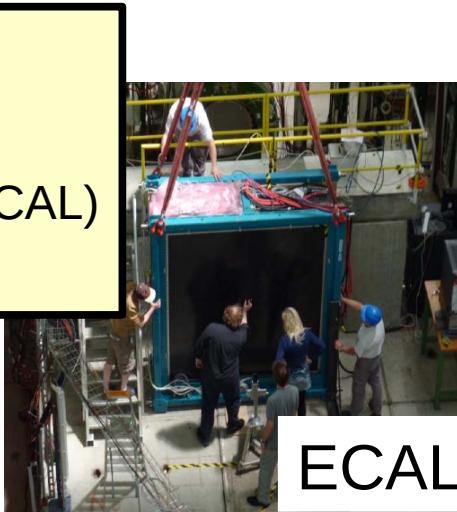
All horizontal and vertical modules were Installed.

(2 off-axis modules will be constructed and installed next year.  
Schedule is presented by next speaker.)

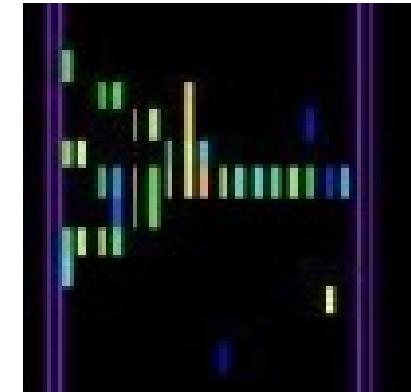
# T2K ND280 scintillator detectors

ND280 detectors:

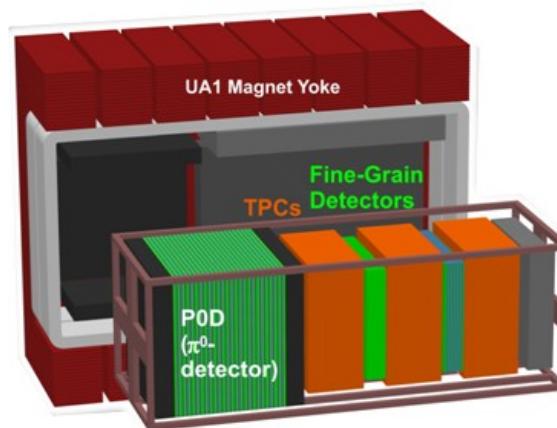
- Test beam performed
- Construction finished (except ECAL)
- Installed in JPARC



ECAL



P0D

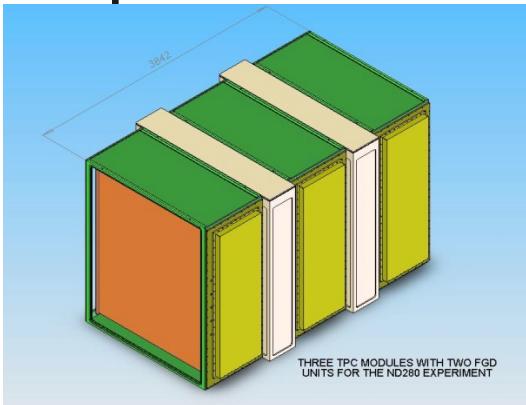


Marco Zito



SMRD

# T2K ND280 Tracker



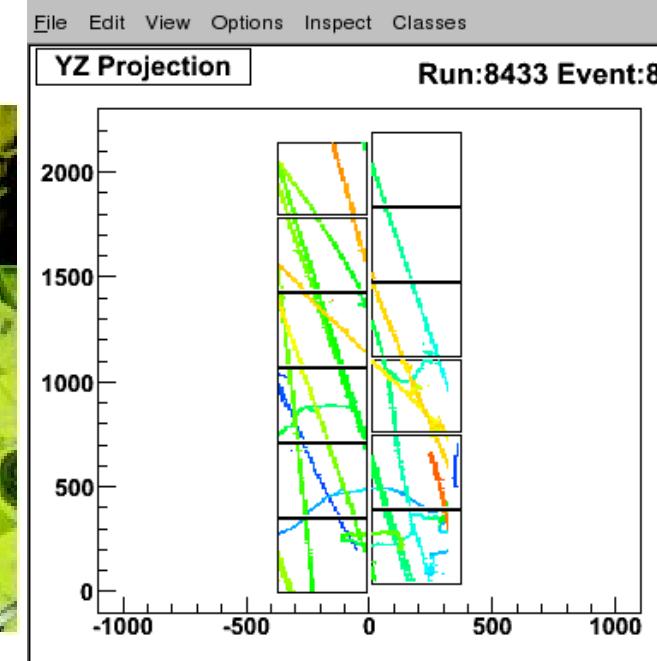
2 Active targets (FGD)  
1 cm\*\*2 scint. Bars  
Read out with MPPC



3 TPC equipped with Micromegas det.  
9m\*\*2 sensitive area 120 k channels



GDR, Strasbourg,  
octobre 2009

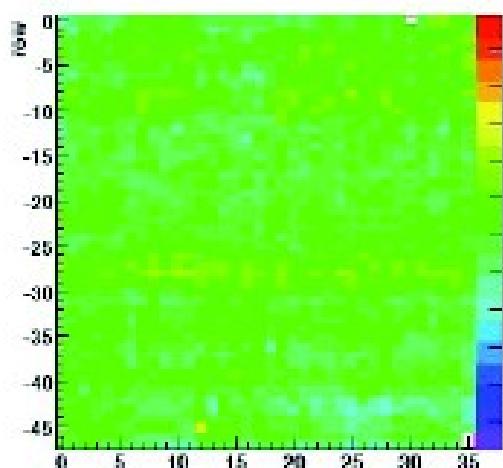




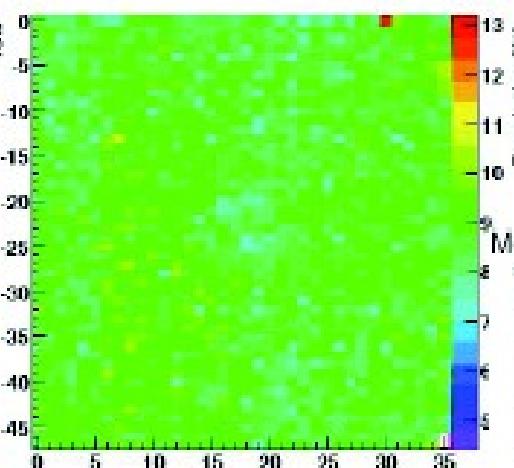
# Micromegas module calibration on test bench

1726 pads scan @ -350 V

Map of the gain (mean value)



Map of the resolution (sigma)



1 FEC dead ch.

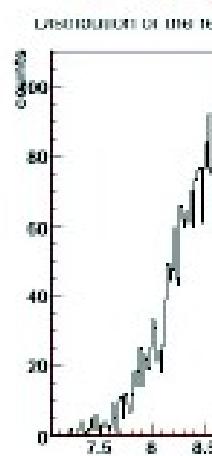
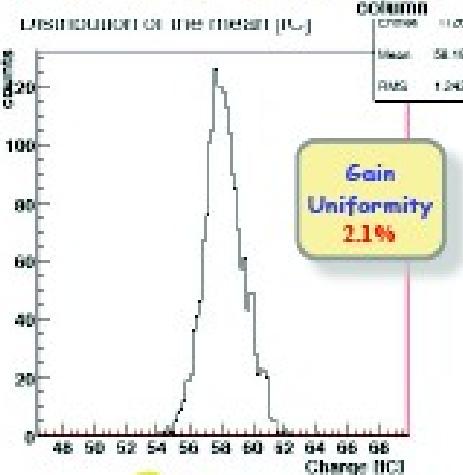
**55Fe spectrum**

MM036, 350V



$\sigma(E)/E = 8.8\%$   
20.6% FWHM

**Spark monitoring**



7 modules over 84 were rejected (83% yield)  
Only 12 dead pads over the 132902 pads  
Gain uniformity over the active area of a module : ~2.8 %  
Gain uniformity : 7%  
5.9 keV resolution :  $\Delta E/E = 9.0\%$   
5.9 keV resolution uniformity : 2.5 %  
~0.1 spark/h @ 1500 gain (-350 V)

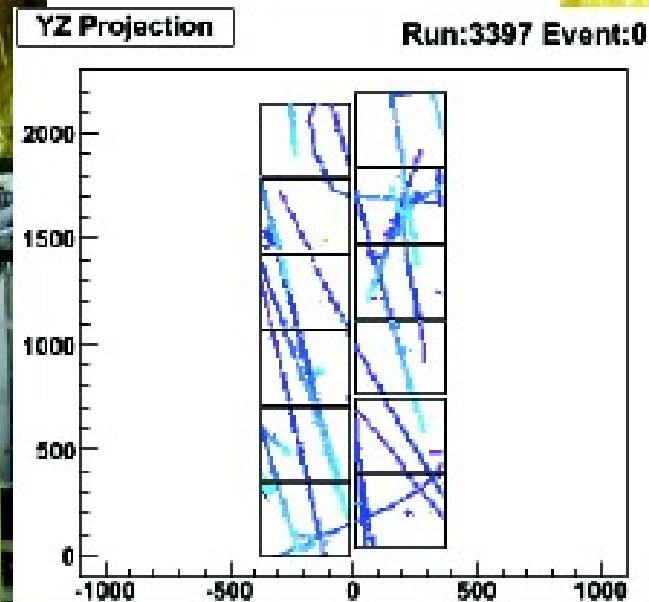


irfu



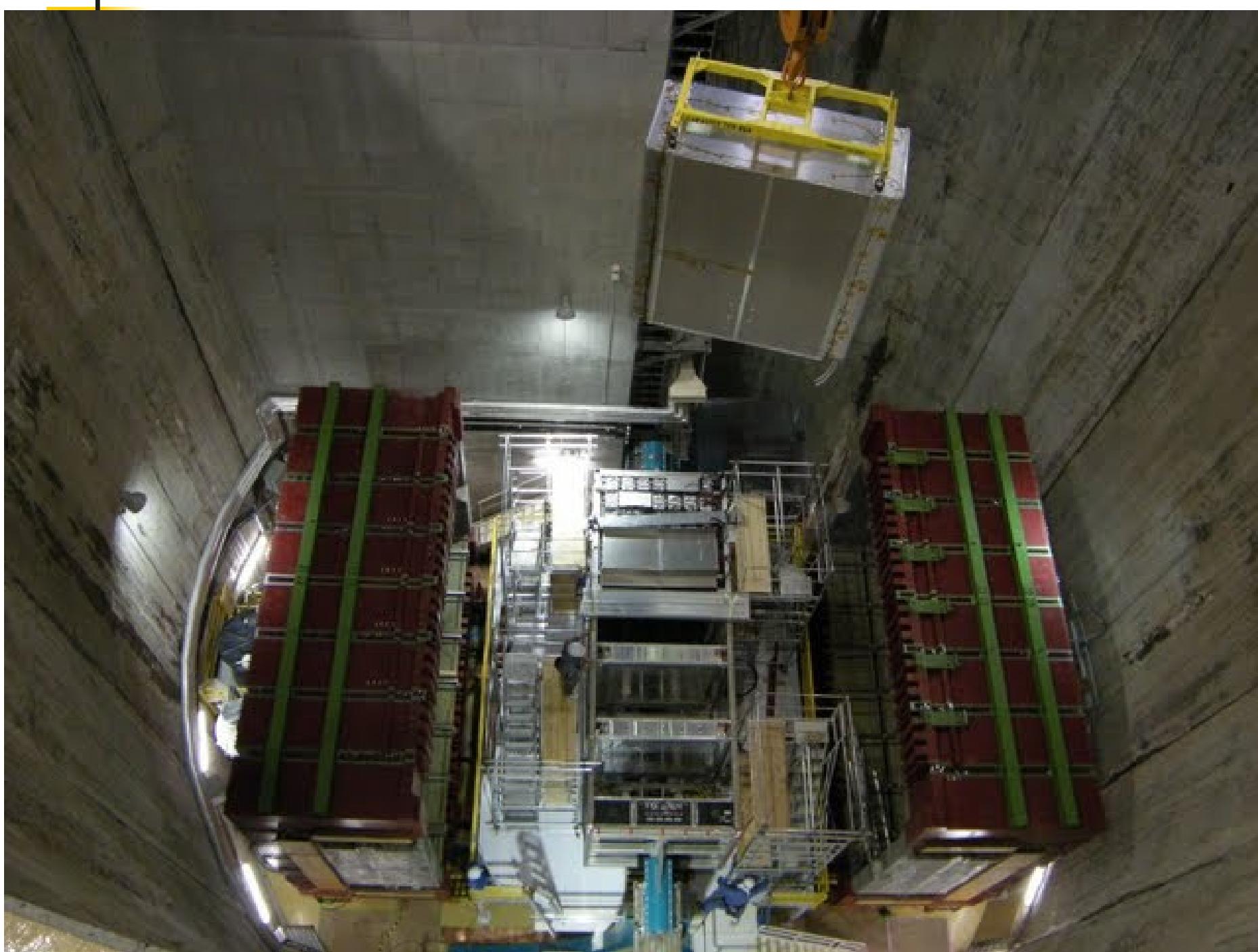
# Full TPC cosmics & beam tests @ Triumf

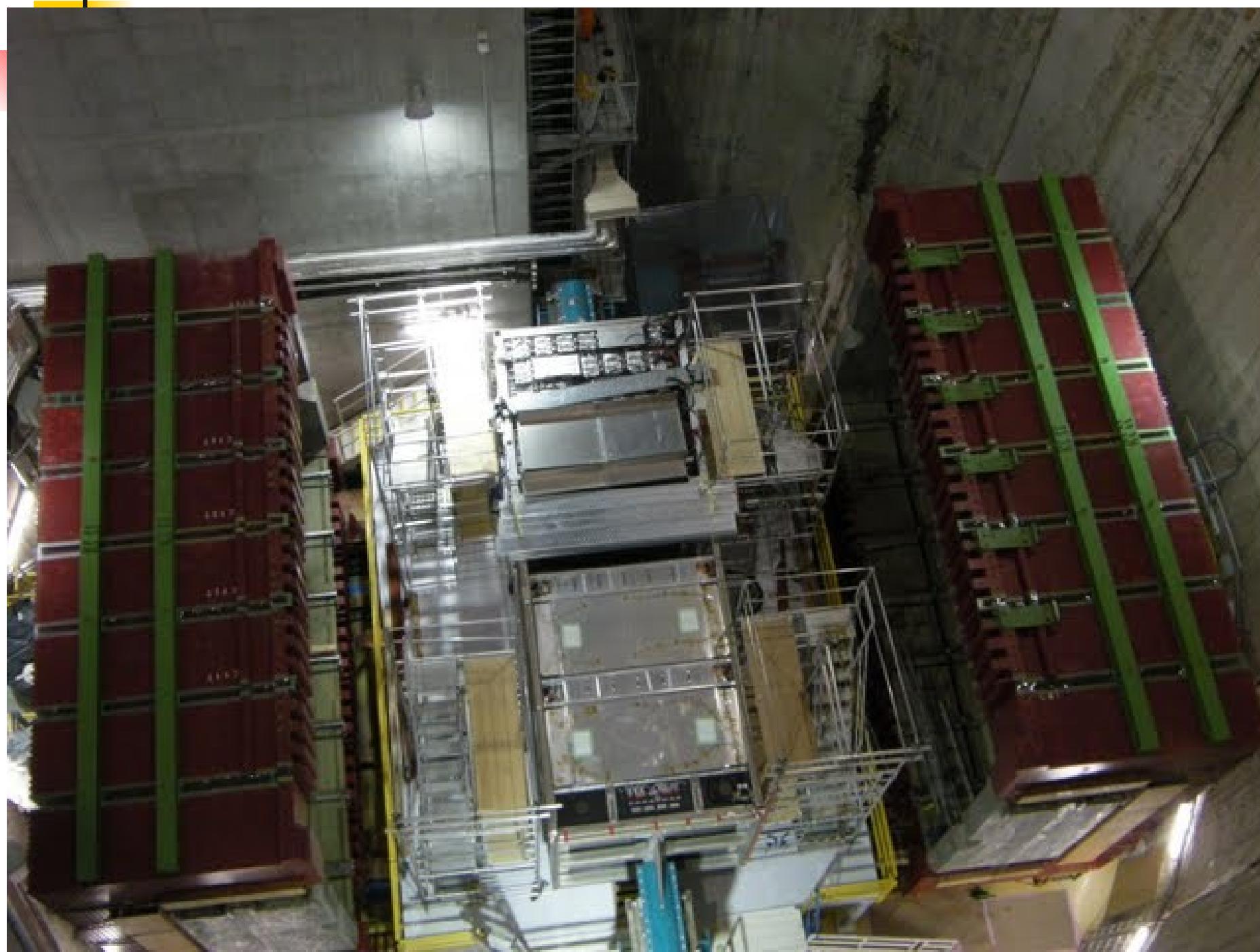
first 2 TPCs integration & tests:  
48 bulk-micromegas + FEE + mechanicals  
6 m<sup>2</sup> bulk micromegas  
82848 electronics channels



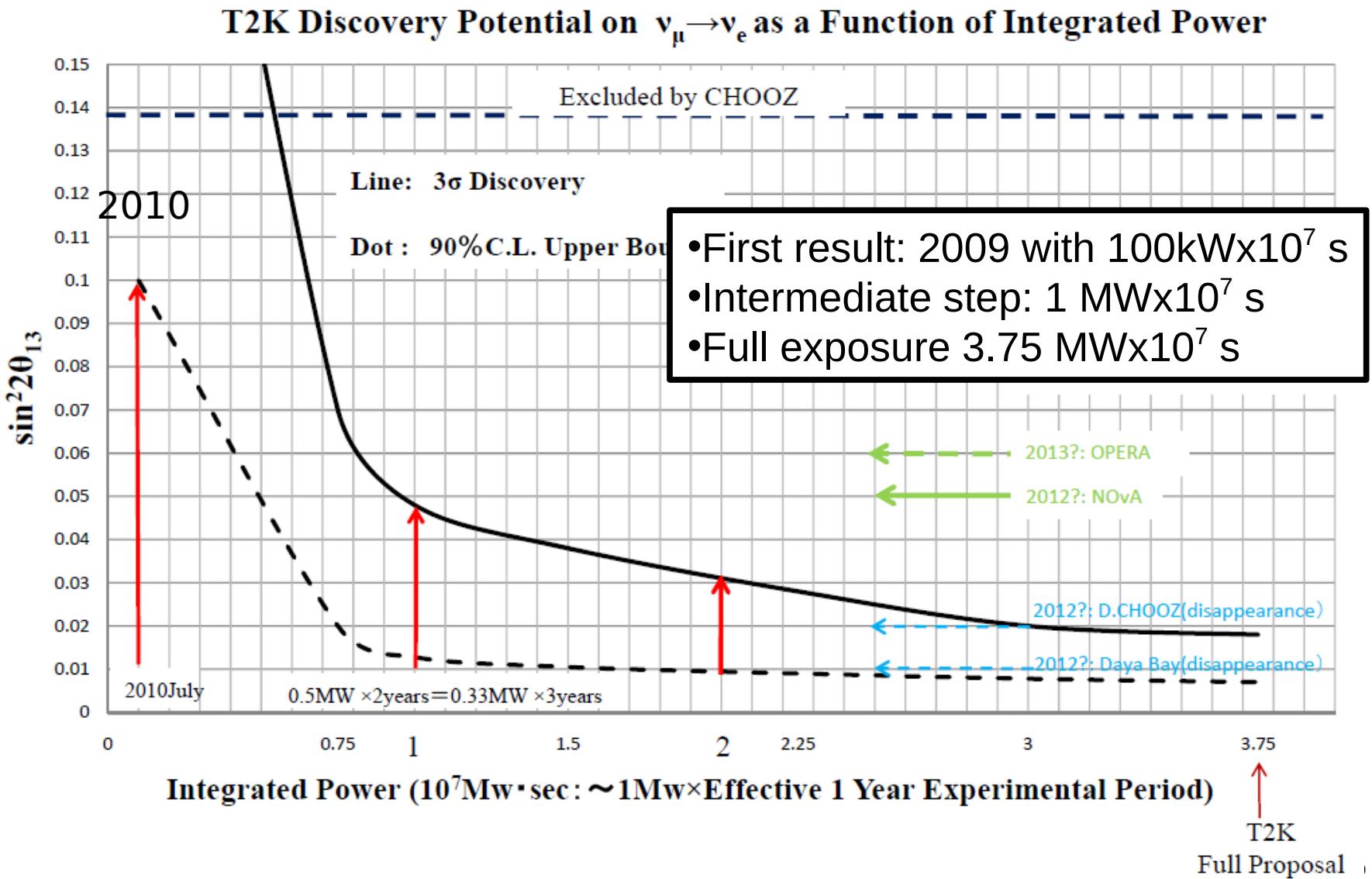
-2 TPCs @ JPARC (Tokai) :  
Ready to be installed in basket  
- Micromegas integration on 3<sup>rd</sup> TPC  
starts Oct. 9th @ Triumf

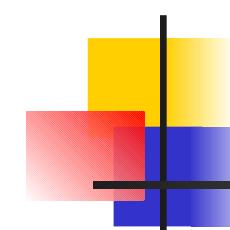






# T2K discovery potential and plan





# Conclusions

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- T2K beam commissioning in April 2009
- Near detector installation almost completed ( $3^{\text{rd}}$  TPC + (partially) barrel Ecal in December)
- November-December: beam and detector commissioning
- Physics run in January 2010
- Request to JPARC:  $100\text{kW} \times 10^{**7} \text{s}$  in 2010

# T2K $\nu_e$ appearance sensitivity

- Five years at 750 kW
- For  $\delta=0$
- Sensitivity (90%CL) below  $10^{-2}$

