Status of the T2K experiment

C. Bronner
30 avril 2010

Presentation

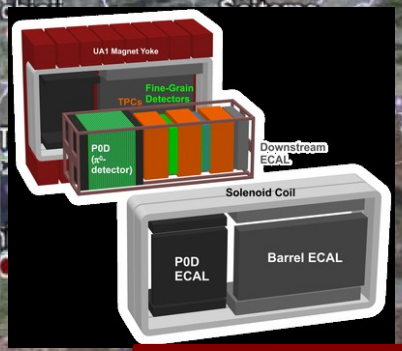
Far detector
Super-Kamiokande
50 kton water Cherenkov

GOALS

Look for appearance $\nu_\mu \rightarrow \nu_e$
- First apparition observation
- Measure θ_{13}

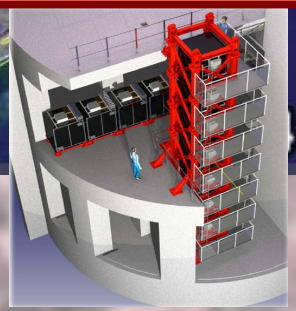
Study disappearance $\nu_\mu \rightarrow \nu_x$
- Improve measure of θ_{23} and Δm^2_{23}

295 km



Neutrino beam production

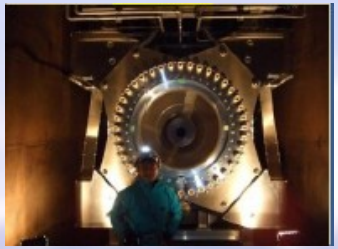
Near detectors



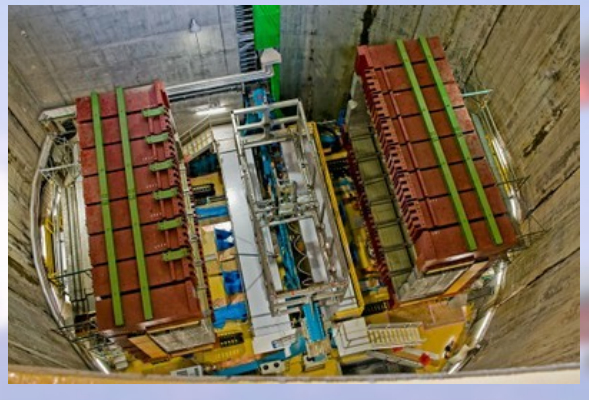
Global view of the experiment

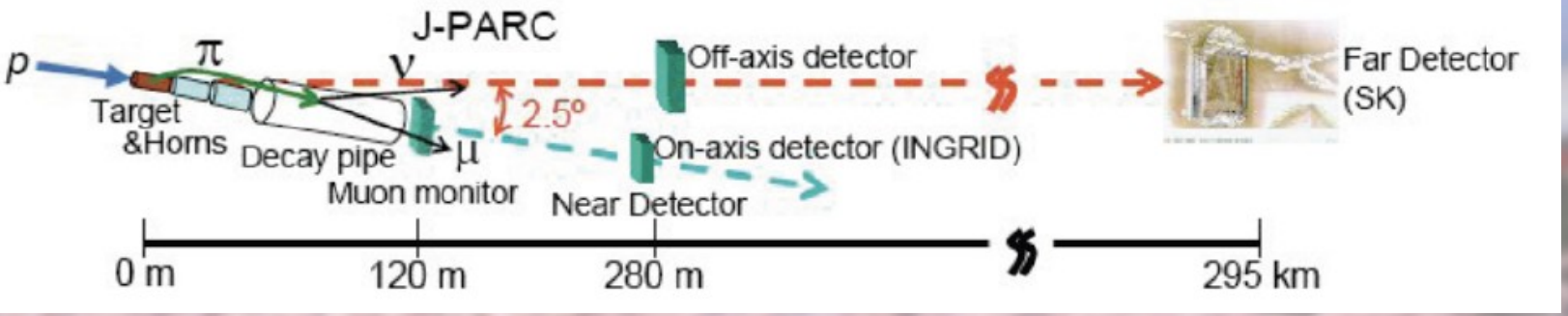
Target

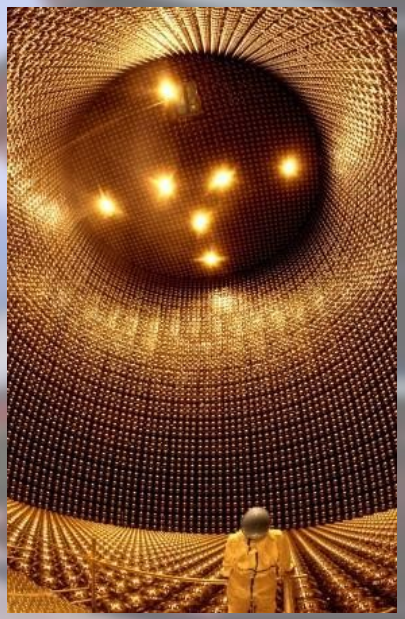
Horns



Off-axis detectors







SK

Decay pipe

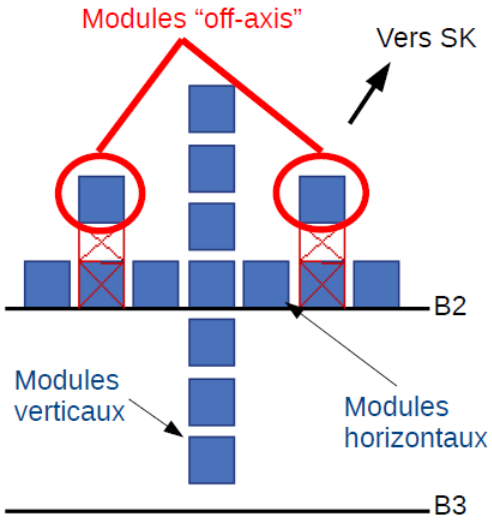
MUMON

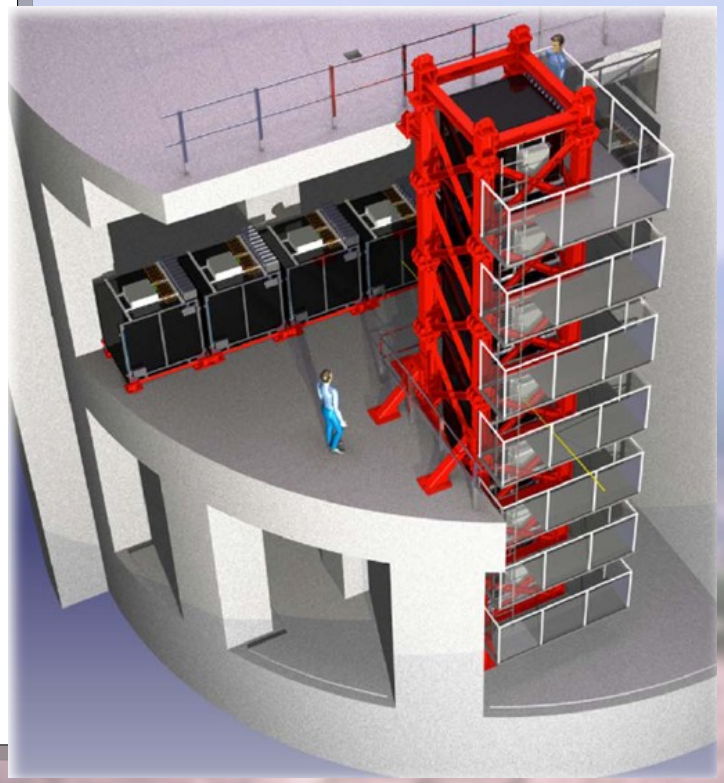
INGRID

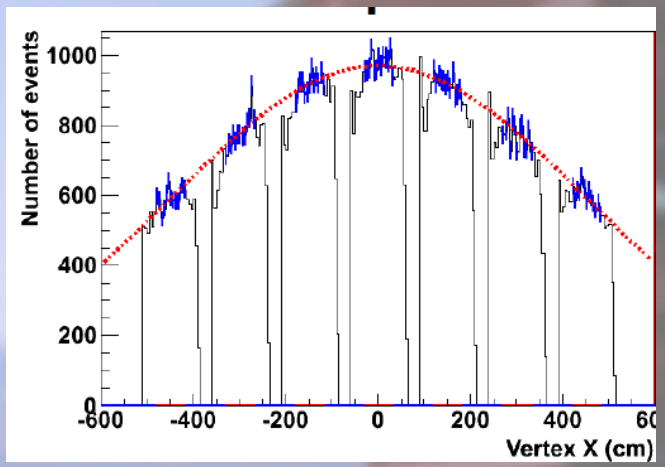
INGRID

On axis detector

7 horizontal modules
7 vertical modules
2 off axis modules





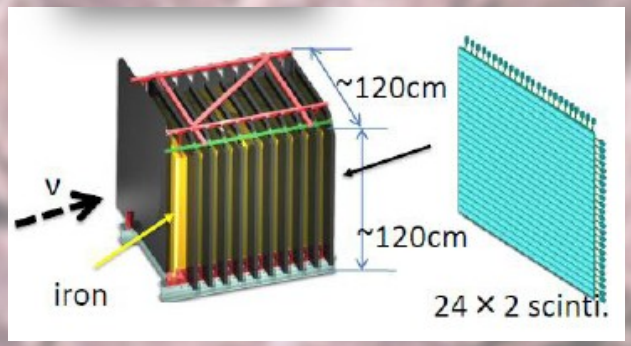


Goals

- Daily profiles for off axis angle
- Study beam symmetry

1 module:

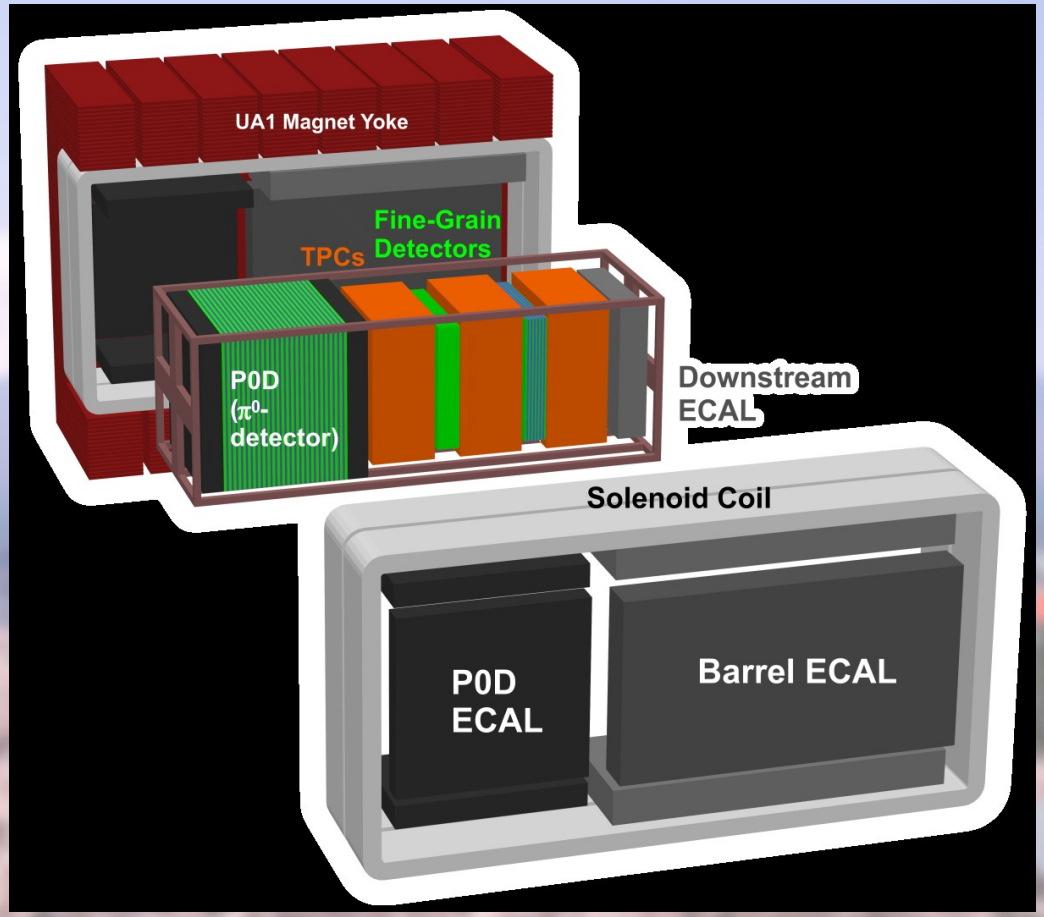
-9 iron targets
-11 tracking planes
(24*2 scintillators)



Required precision

1 mrd on the off axis angle (3σ)
=8 cm on beam center position

Off-axis detectors



Goals

- Measure neutrino flux
  => extrapolate to SK
- Cross section measurements
- Background studies

Super Kamiokande

Far detector of the experiment (295km)
Running since 1996

Water Cerenkov
- 50 kt water (22,5kt fiducial volume)
- 11129 PMT
- Isolated by ~1km rock

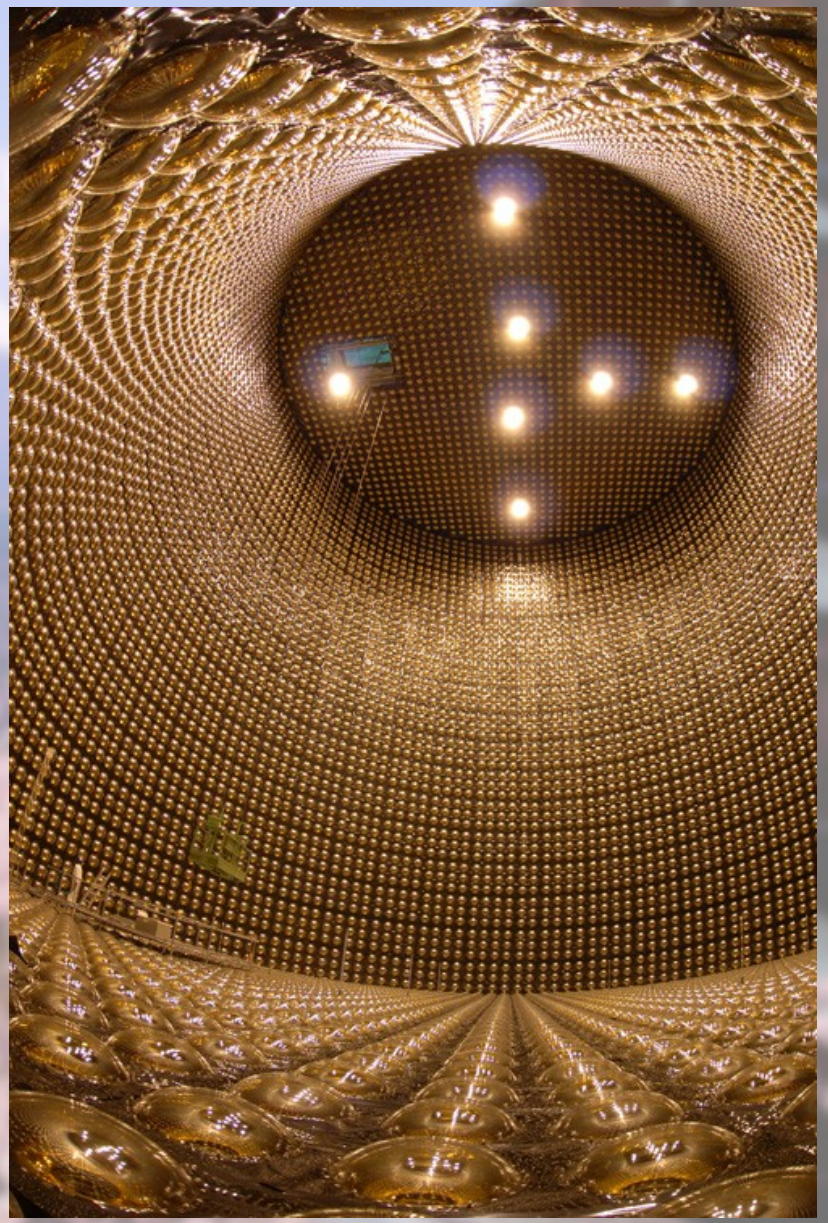


Photo Multiplicater Tube

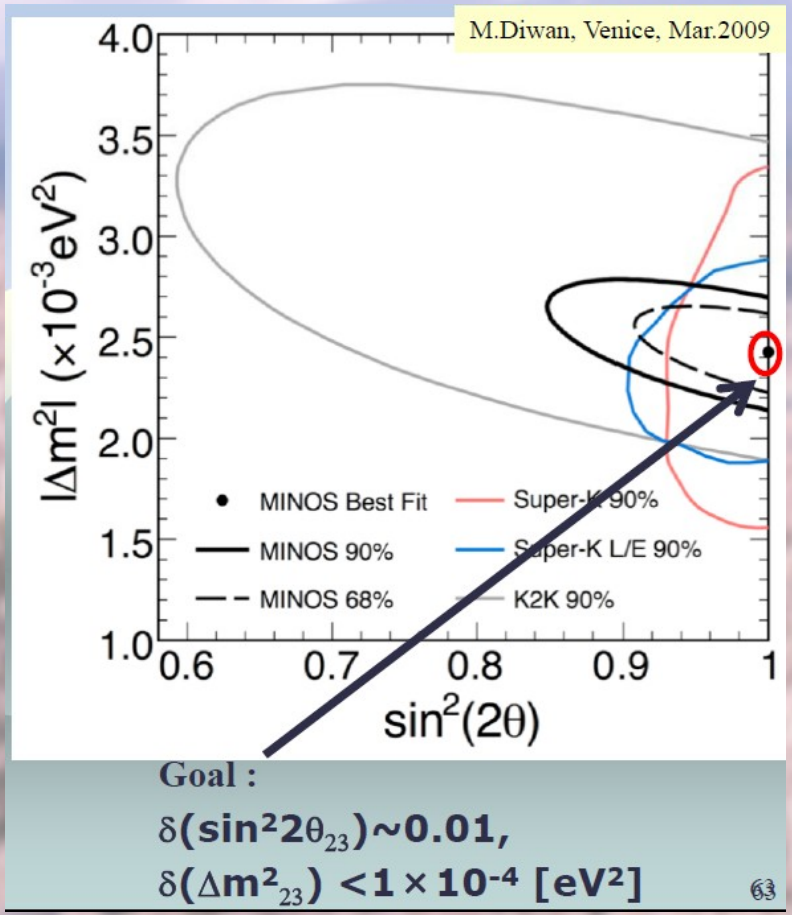
Expected sensitivity

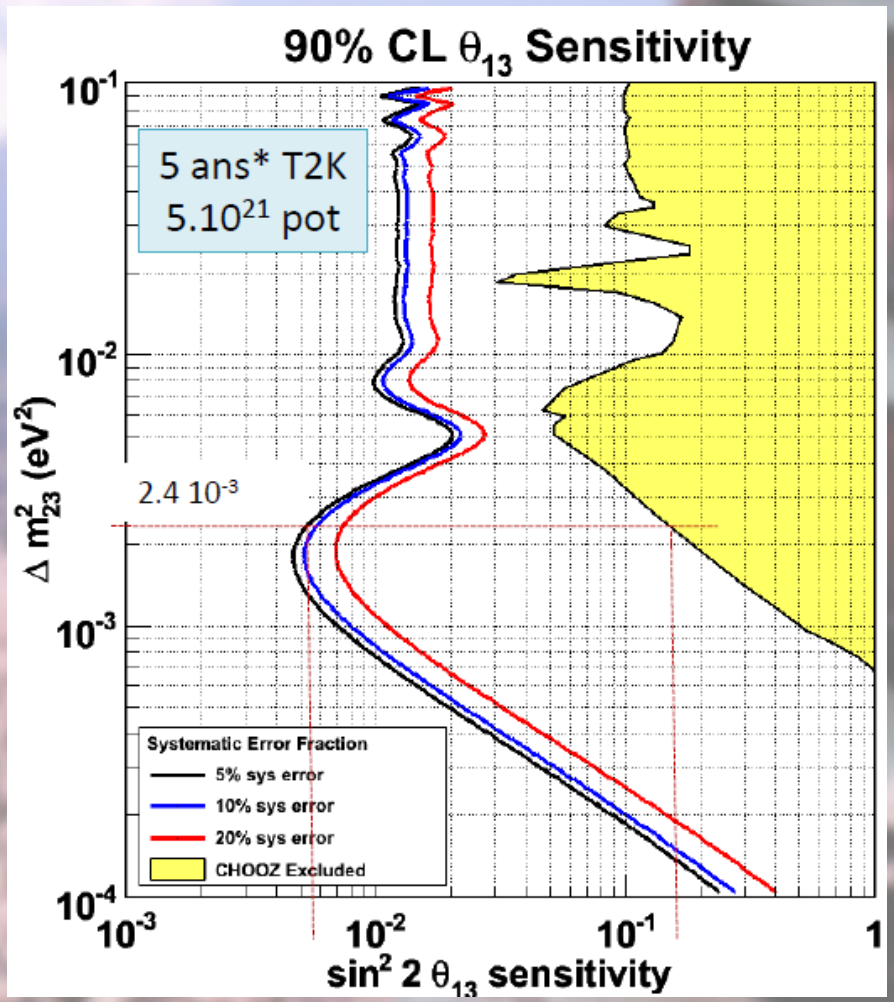
T2K sensitivity

Intensity
1 year = 10^9 s beam time
Over 5 years: $5*10^{21}$ pot

Final sensitivity for θ_{13}:
$\sin^2(2\theta_{13})=6.10^{-3}$ (90% C.L)
if systematics < 10%

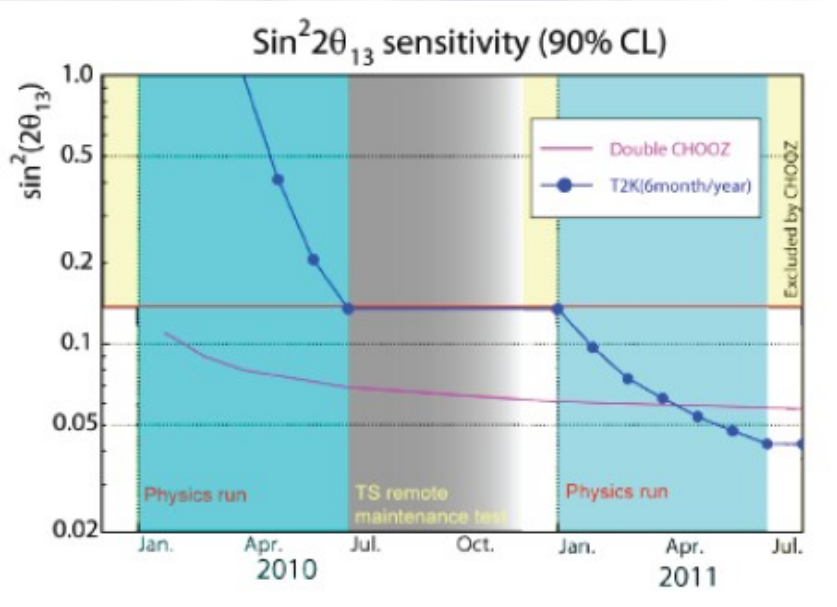
Δm^2_{23} and θ_{23}





Summer 2010

Target for august 2010:
Analysis with intensity ~100kW *10^7s



$\delta(\sin^2 2\theta_{23}) = 6\%$

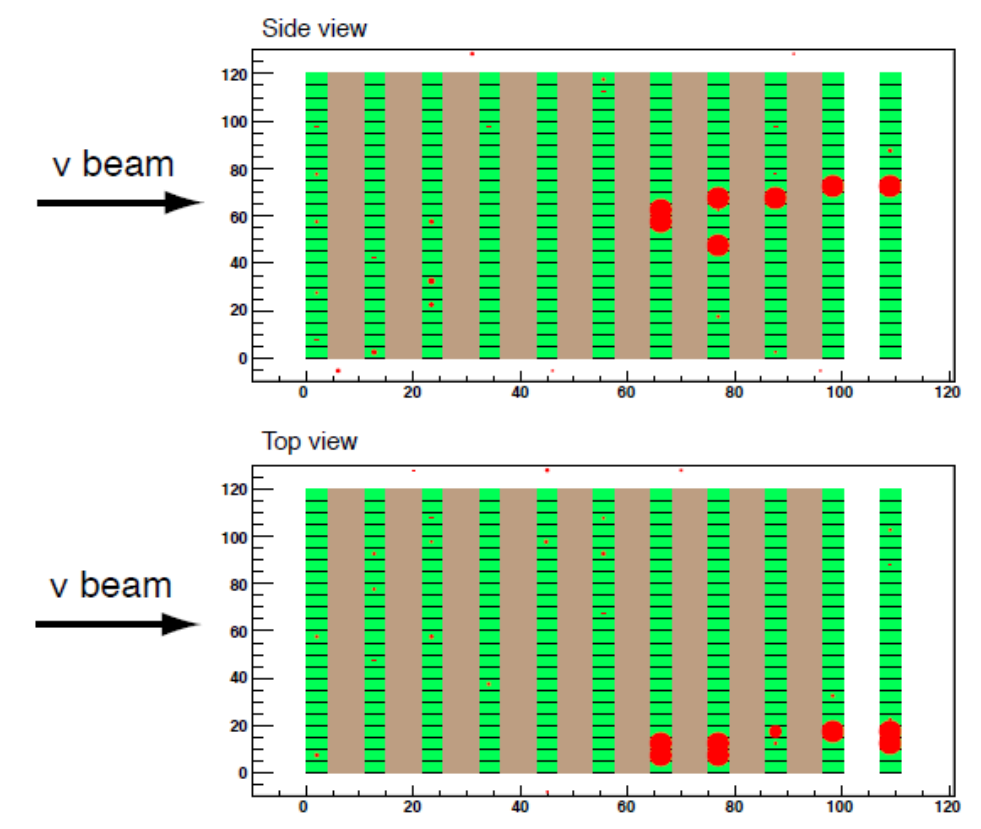
$\delta(\Delta m^2_{23}) = 3.2\ 10^{-4}\ eV^2$

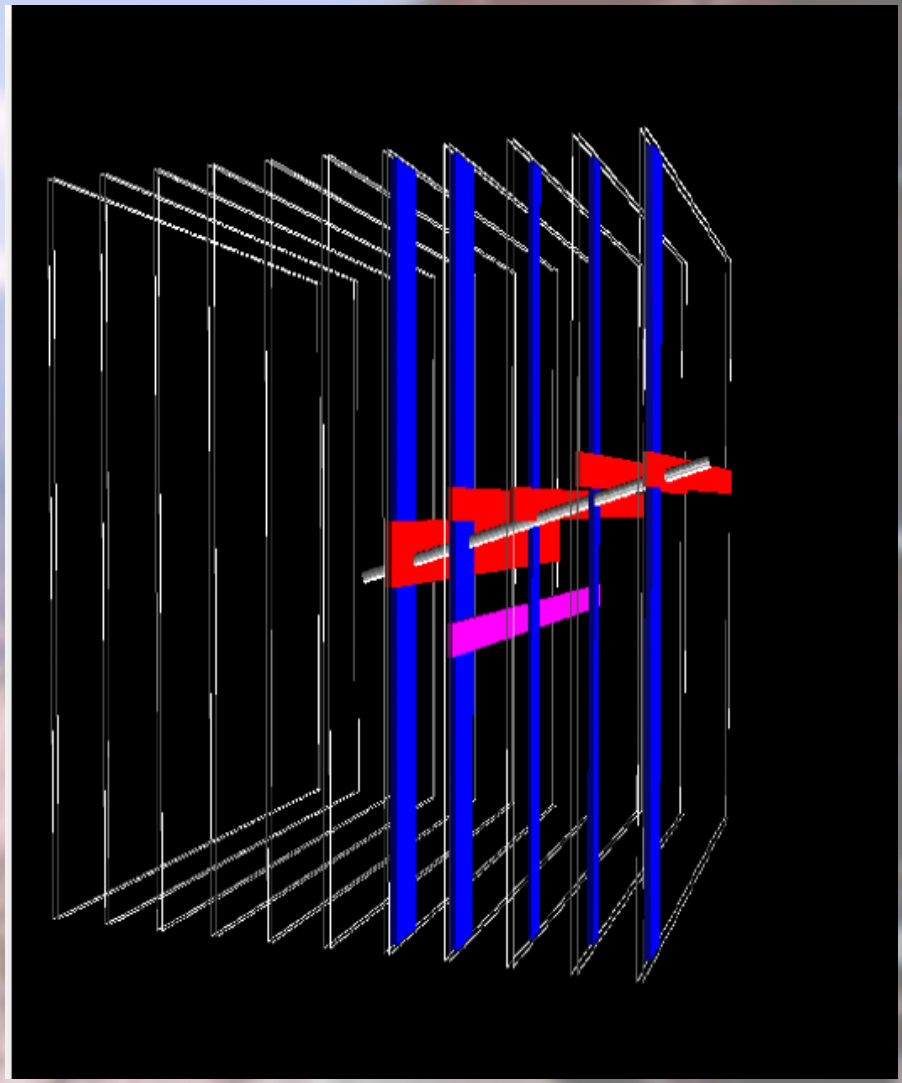
$\sin^2(2\theta_{13}) = 0{,}09$ (90% C.L)
O(CHOOZ limit)


First events

INGRID

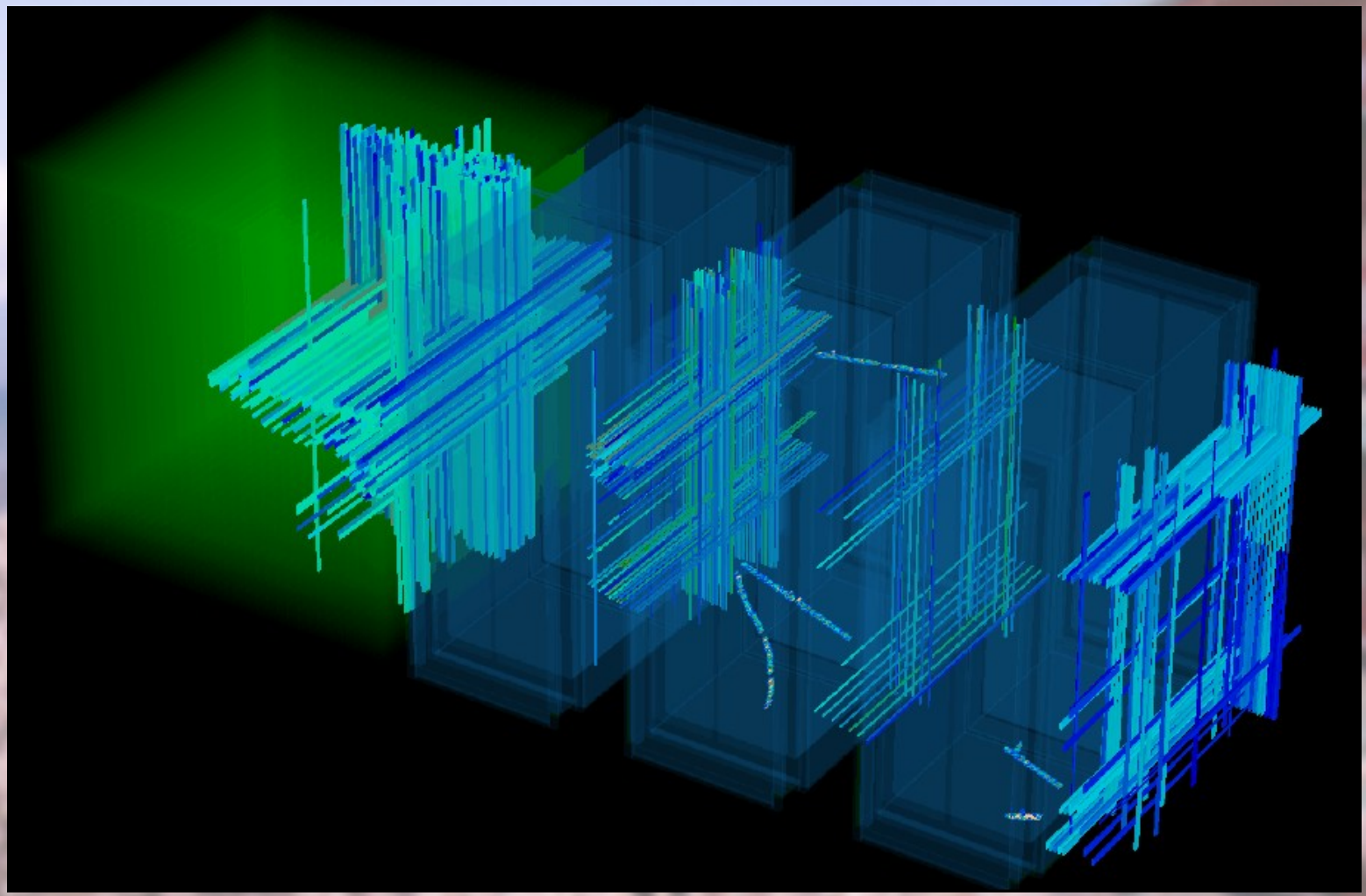
First neutrino candidate in INGRID on 22/09/2009





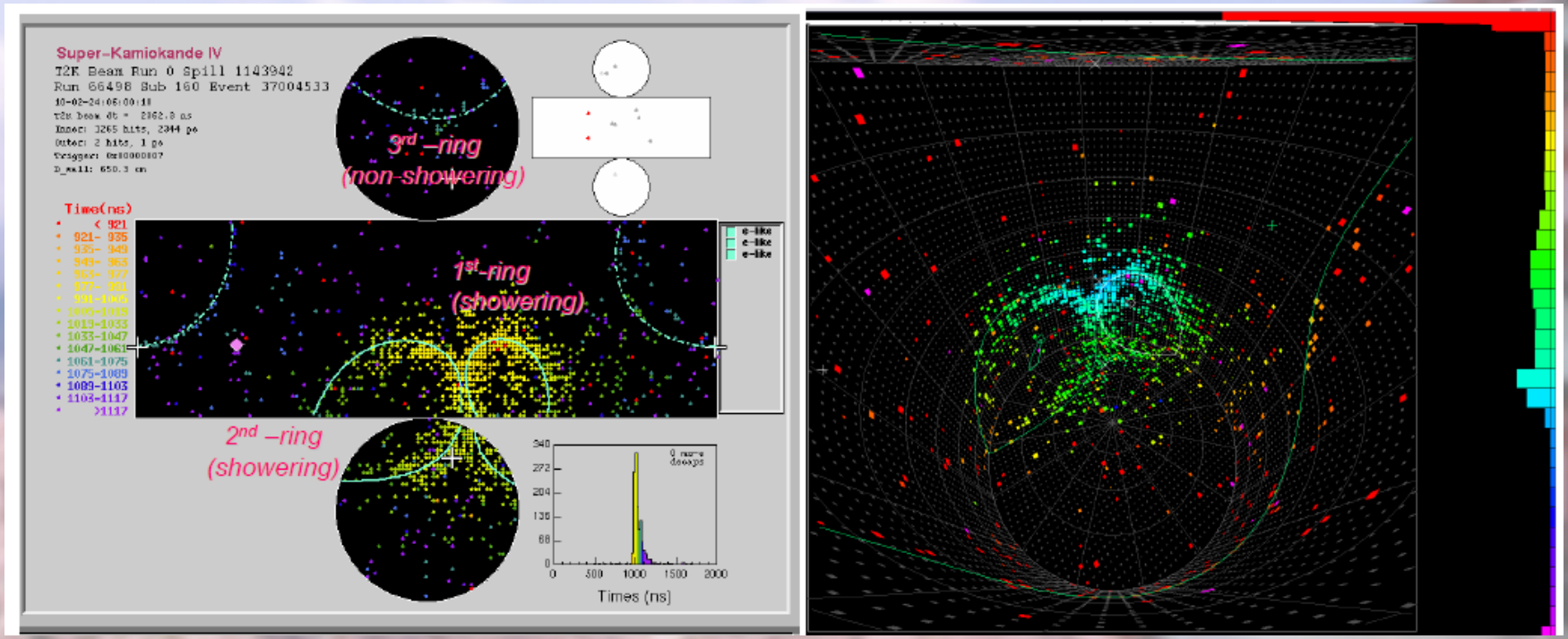
Off-axis

First neutrino event candidate in off-axis detectors on 19/12/2009



Super Kamiokande

First neutrino event candidate in Super Kamiokande on 24/02/2010




Status

Status

- beam commissionning finished

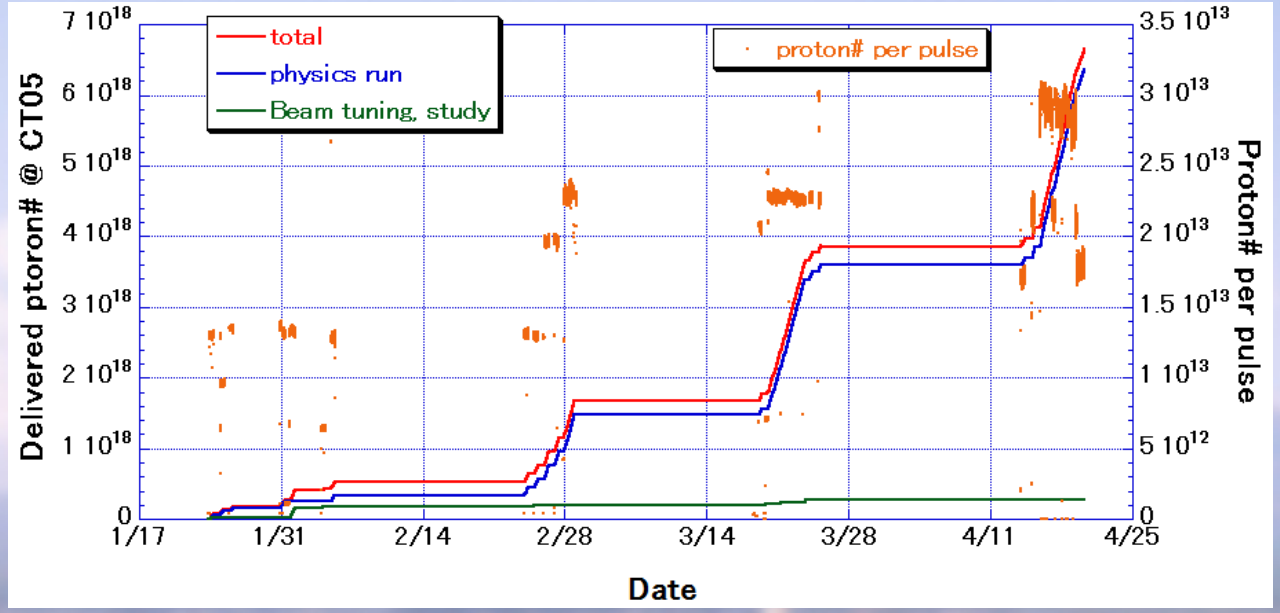
- started taking data from jan 2010, will continue until end of june

- All detectors have seen beam events candidates

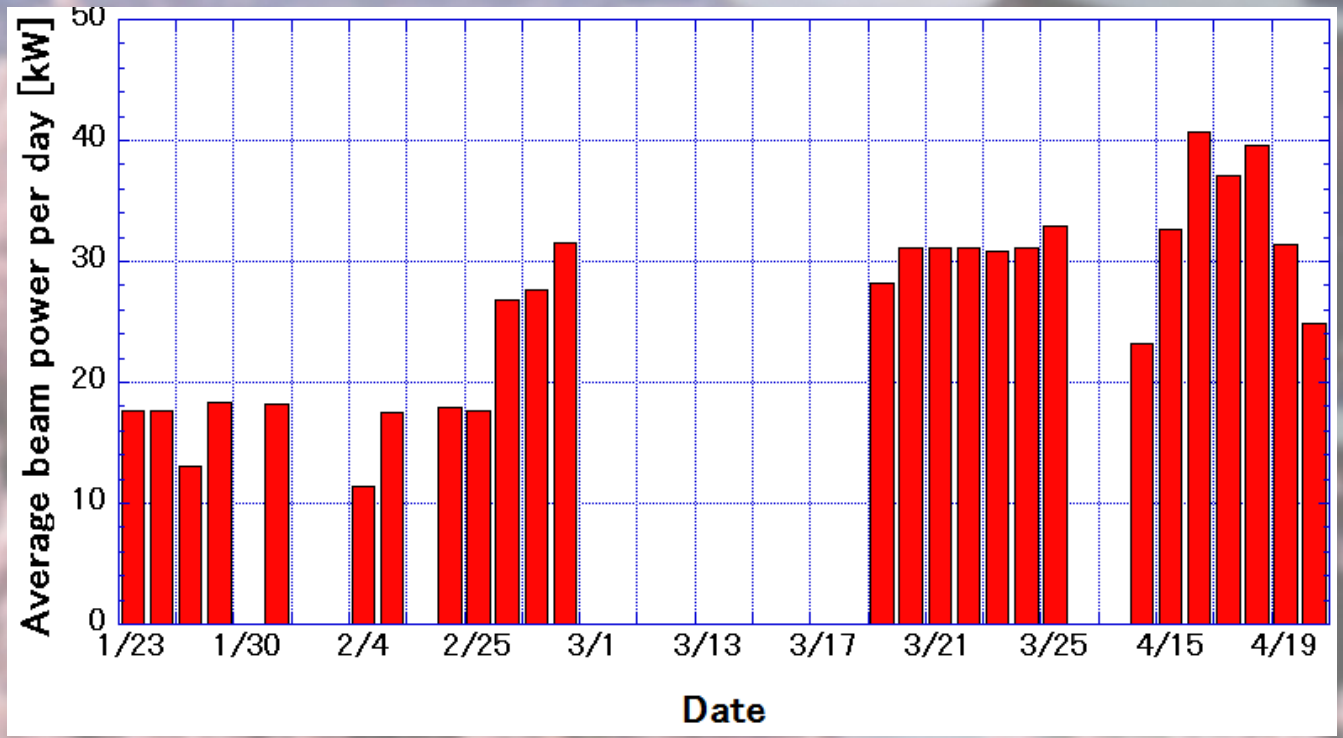
- Next beam period will be Nov 2010 to june 2011

Beam

Protons on target



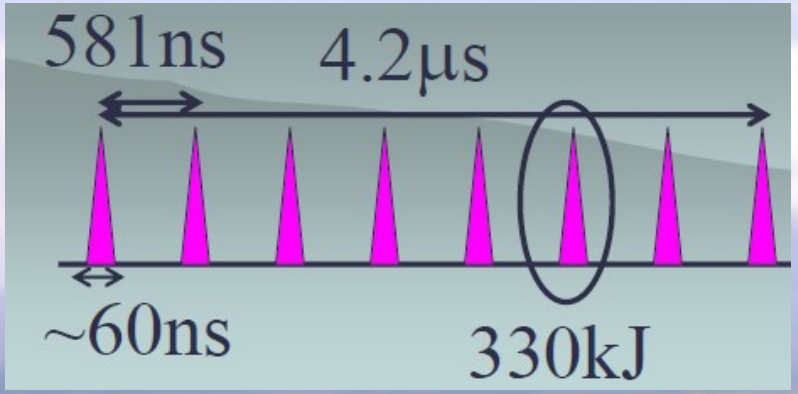
Beam power



Ingrid results

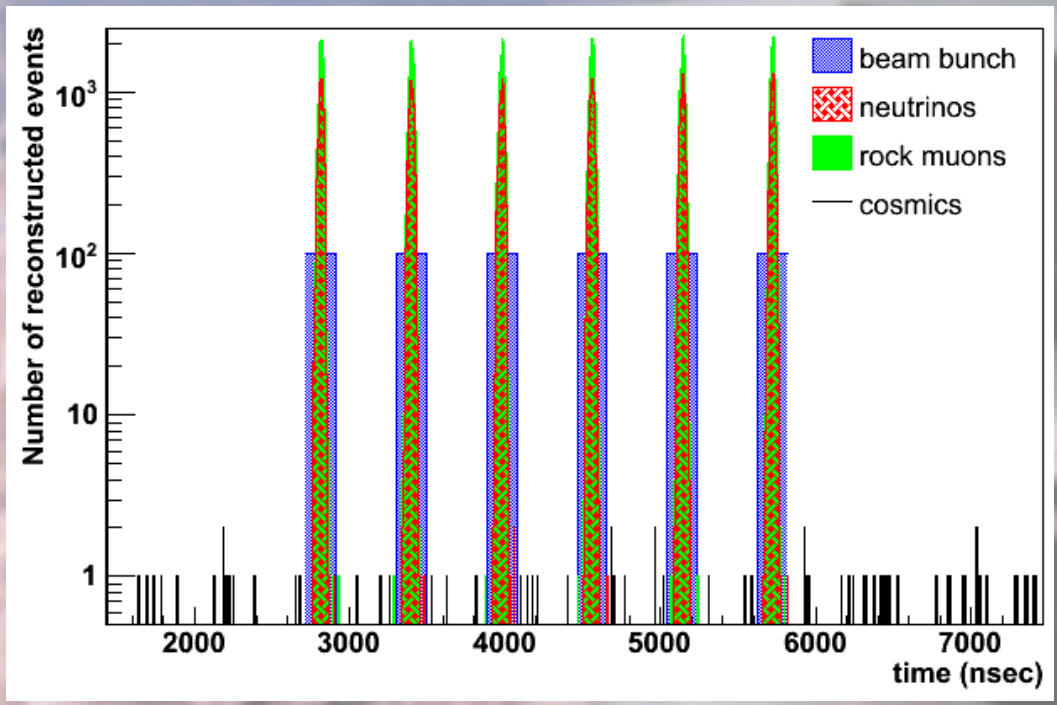
INGRID events timing

Pulsed beam to reduce cosmic noise



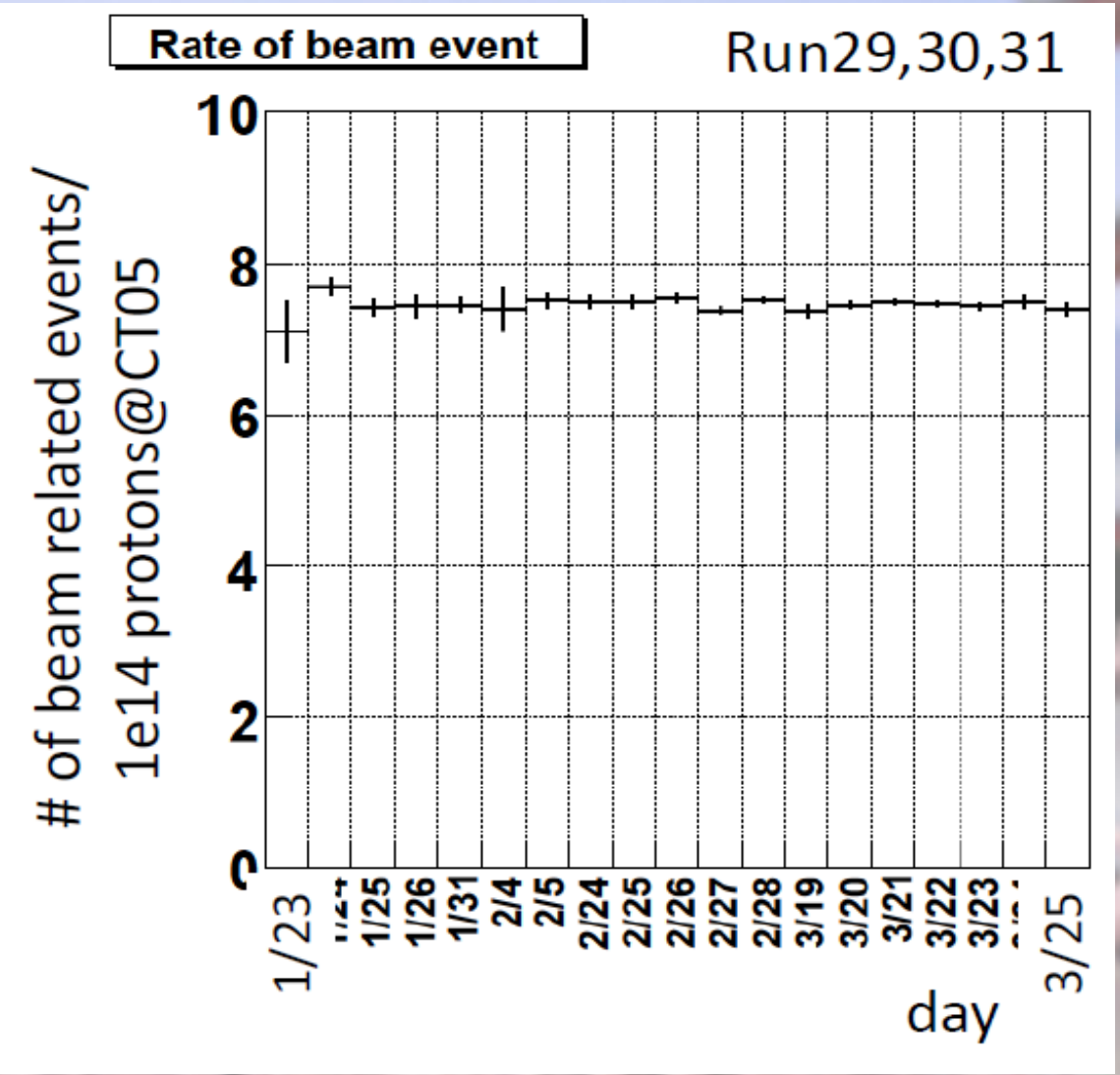
Will be: 8 bunches
Now: 6 bunches

Timing for reconstructed events
6 bunches can be seen

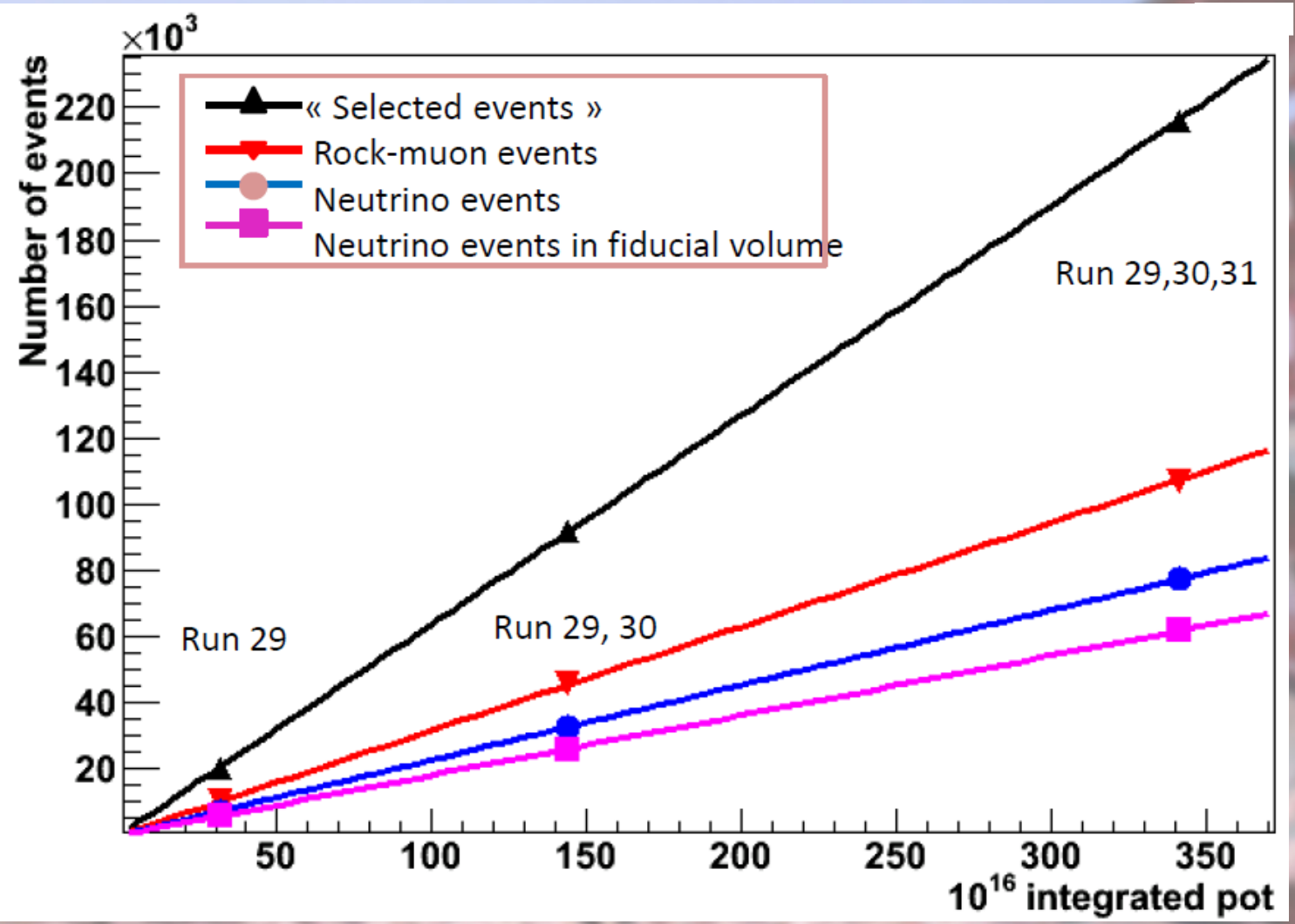


Detector stability

Number of events / number of pot

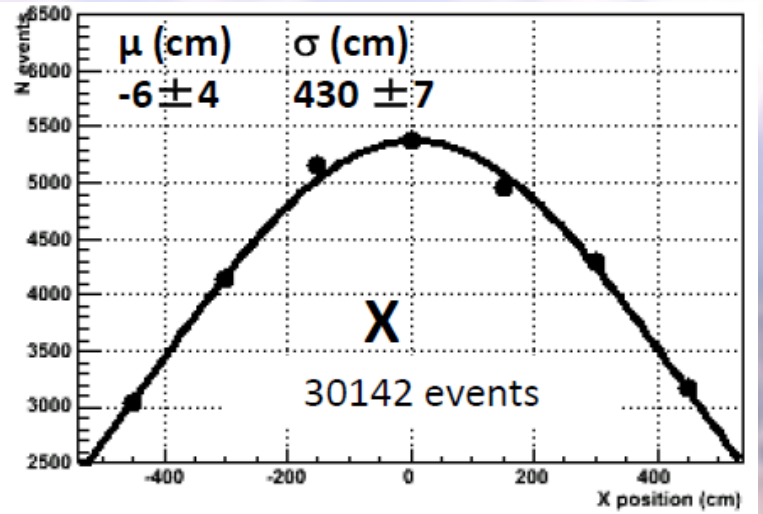


Detector stability

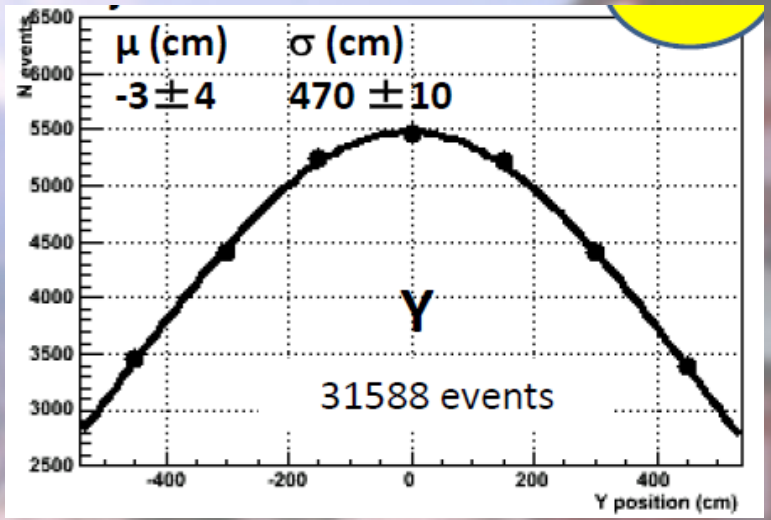


Event profiles

Honrizontal modules



Vertical modules



Only statistical errors
Vertical modules should have ~5% more events than horizontal ones because they are closer to target

All events from beam run of jan-feb-march 2010
3,43.10^{18} pot (~3 days at nominal intensity)

Summary

-Physics runs have started in 2010

-Accelerator power is increasing

-Stable detector operation

-First oscillation results to be presented this summer