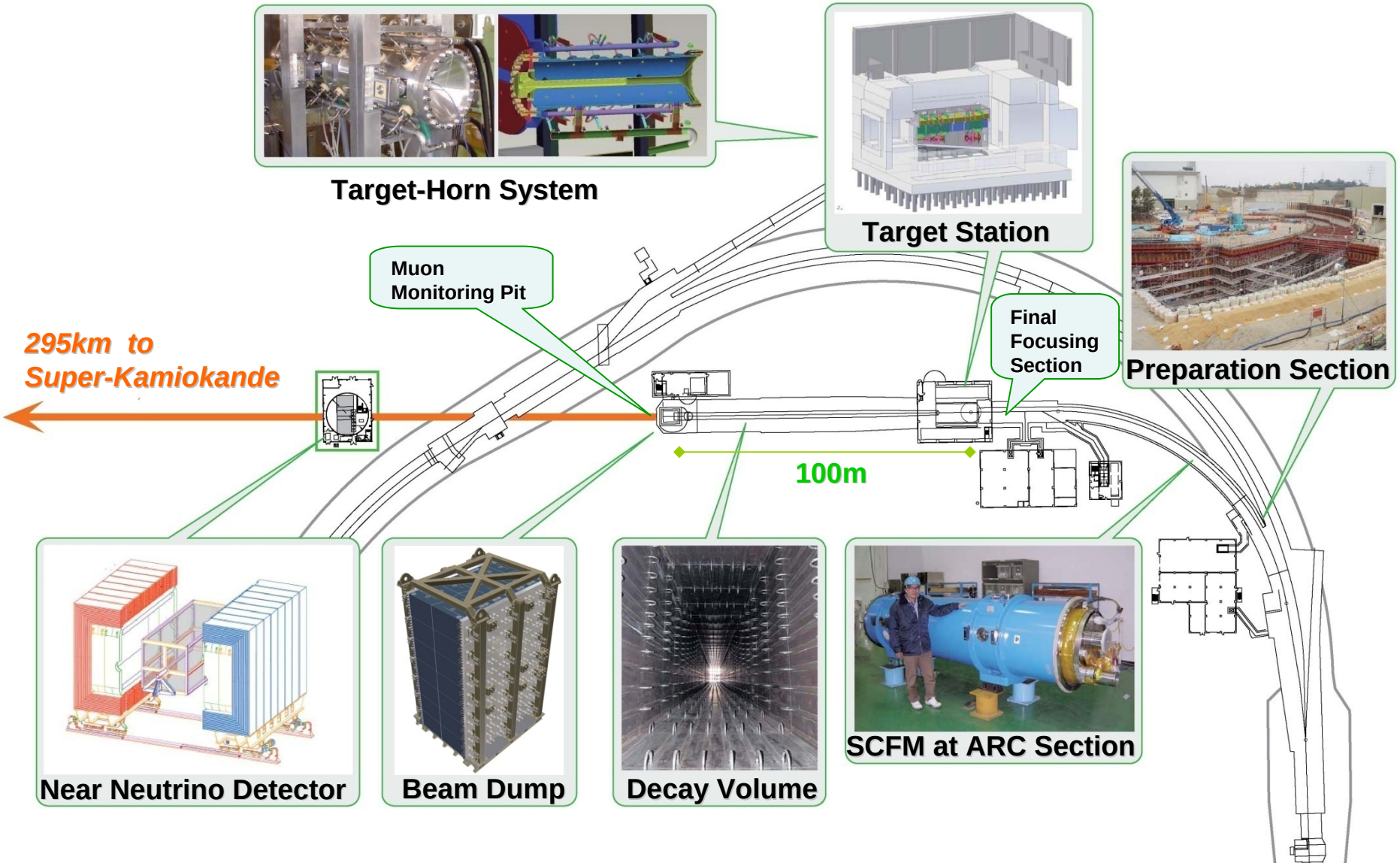
Jul.6,2007
J-PARC PAC

Status of Neutrino Beamline Construction

T.Kobayashi

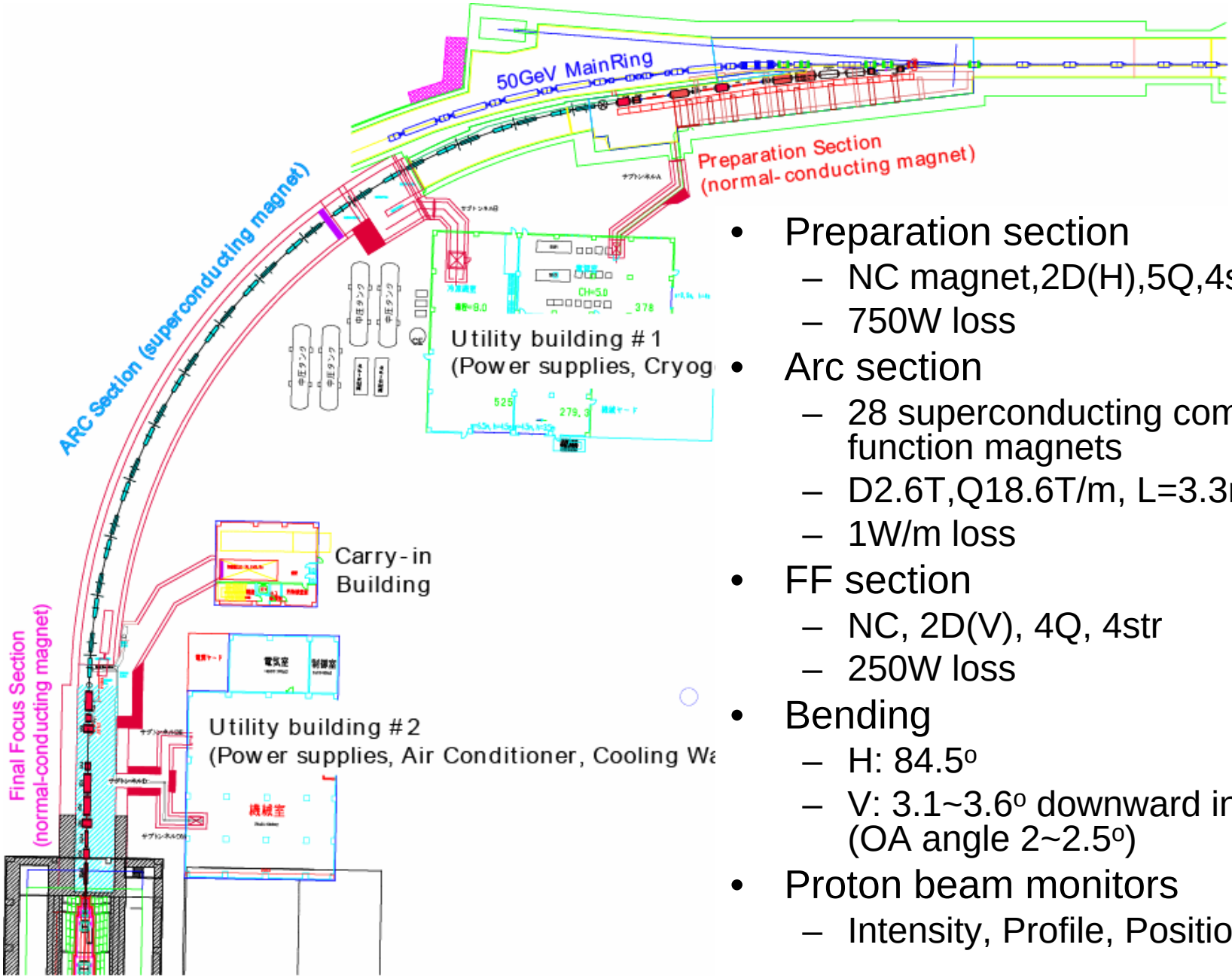
IPNS, KEK

The Neutrino Beam-Line



Construction: Apr. 2004 ~ Mar. 2009 (5yrs)

Primary beam line



- Preparation section
  - NC magnet,2D(H),5Q,4str
  - 750W loss
- Arc section
  - 28 superconducting combined function magnets
  - D2.6T,Q18.6T/m, L=3.3m
  - 1W/m loss
- FF section
  - NC, 2D(V), 4Q, 4str
  - 250W loss
- Bending
  - H: 84.5^{o}
  - V: 3.1~3.6^{o} downward in FF sect. (OA angle 2~2.5^{o})
- Proton beam monitors
  - Intensity, Profile, Position, Loss

Tunnel for Primary Beam-line

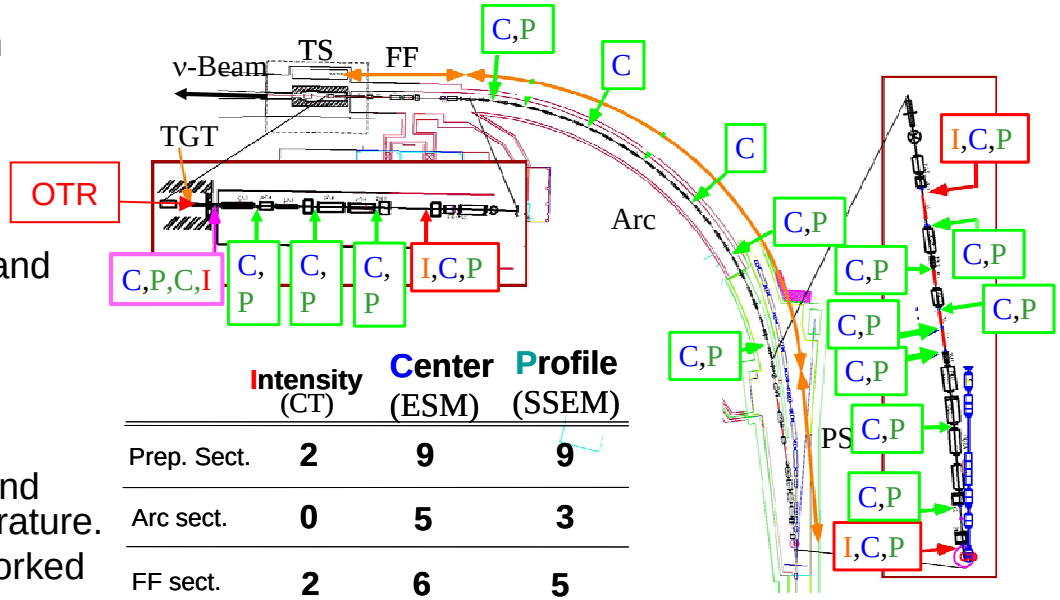
Completed in Dec. 2006

Primary line components

- Superconducting combined function magnets
  - Mass production started in FY2005
  - 17 (/28) mags completed
  - 6 (/14) “doublets” (2mag in 1 cryostat) completed
  - Installation in FY2008
- Cryogenics
  - Design completed, contract made
  - Manufacturing started in FY2006(~2008)
- Normal-conducting magnets
  - Installation in July,2007 for preparation section
  - Fabrication of FF magnets in progress, and to be installed in FY2008.
- Power supply
  - All are re-use of KEK-PS beam line
  - Refurbishments being done.
- Vacuum
  - Beam pipe installed in magnets for prep. sec
  - Intra-magnet beam pipe being designed.
- Beam plug
  - ready for installation in coming summer
- Collimator
  - re-examining aperture due to optics change.

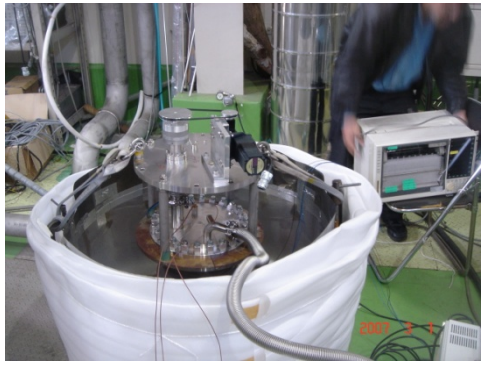
Beam Monitors

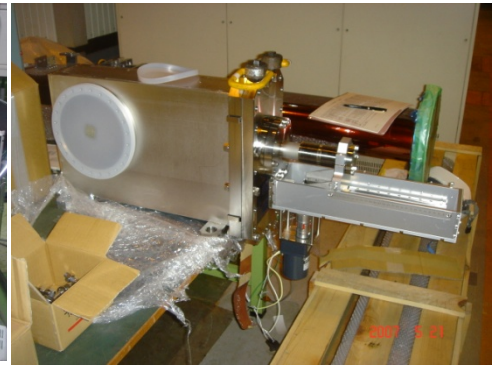
- Configuration
  - Position : Electro-static monitor (ESM)
  - Profile : Segmented Secondary Emission Monitor (SSEM), *OTR*
  - Intensity : CT
  - Loss monitors (BLM): Ion. Chamber
- ESM
  - ESM#0 and ESM #1 successfully made and tested
  - Bidding for all Prep ESMs in progress
- SSEM
  - Chamber bidding be placed soon
  - Moving mechanisms for SC part tested and moved smoothly at liquid-nitrogen temperature.
  - Moving mechanism for warm part also worked
  - To be adopted with several minor modifications.
- CT
  - Prototype made and tested w/ pulse&beam
  - Final design to be done
- Loss
  - Commercially available Gas Ionisation Chamber (used by J-PARC acc group)
  - Performance tested with beam



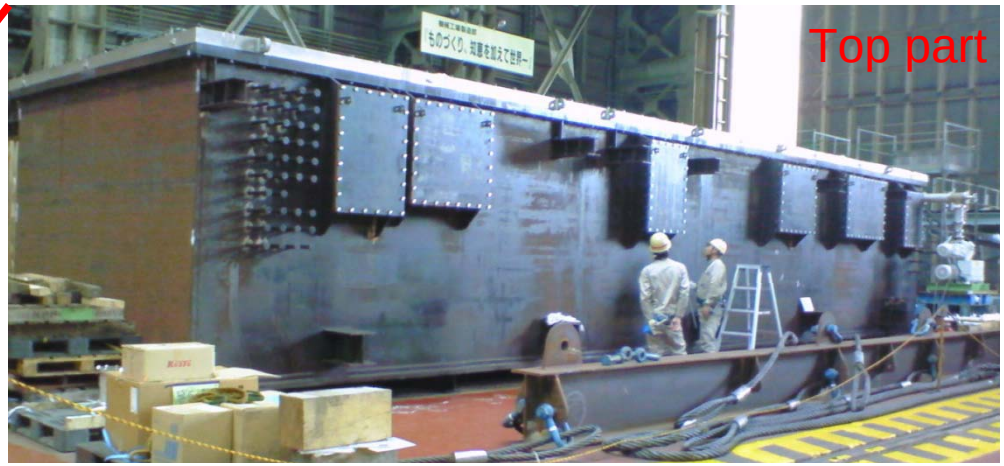
	Intensity (CT)	Center (ESM)	Profile (SSEM)
Prep. Sect.	2	9	9
Arc sect.	0	5	3
FF sect.	2	6	5

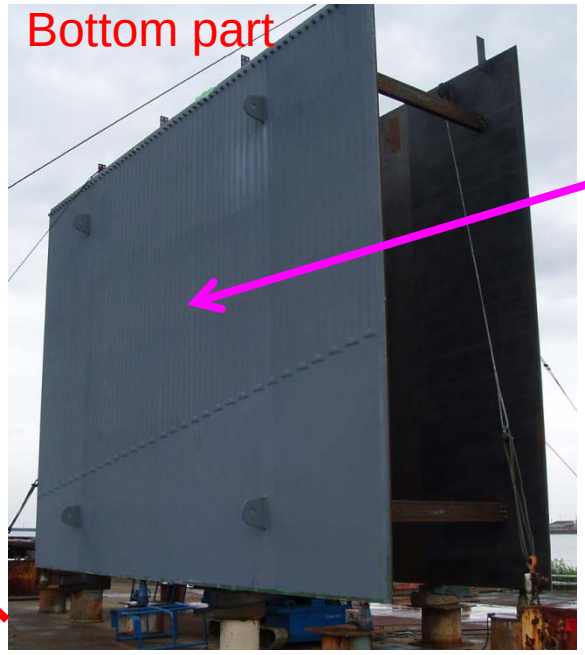
Beam loss monitor will be placed along the beam line.





Target Station



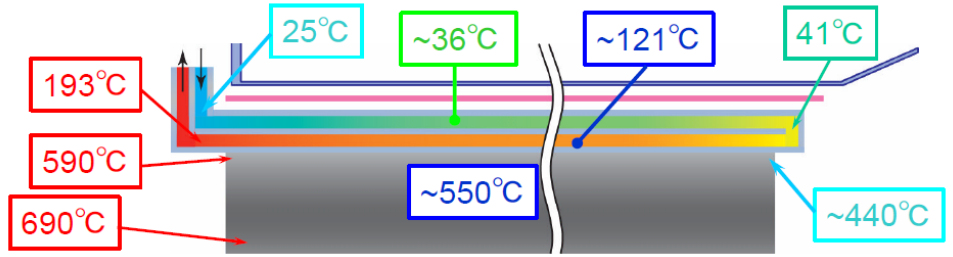


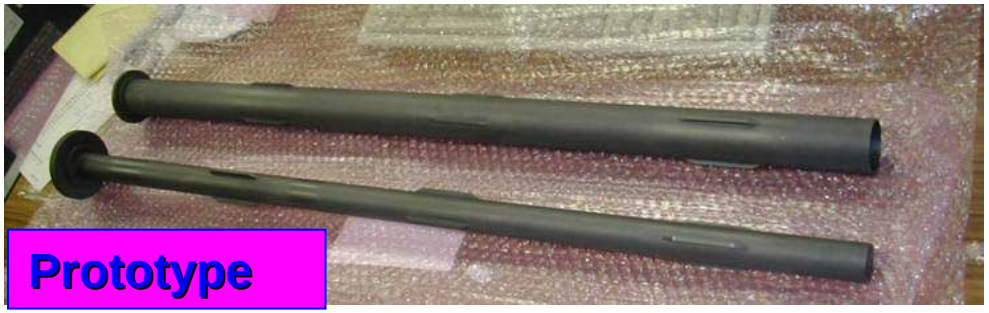
- Civil construction of underground part will finish soon.
- He vessel will be installed from Aug. 2007.

- Helium vessel is being manufactured at the factory.

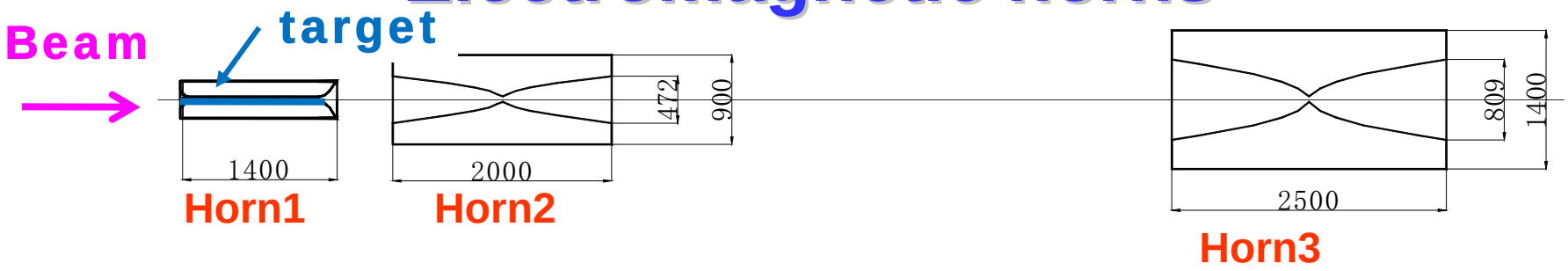
Target

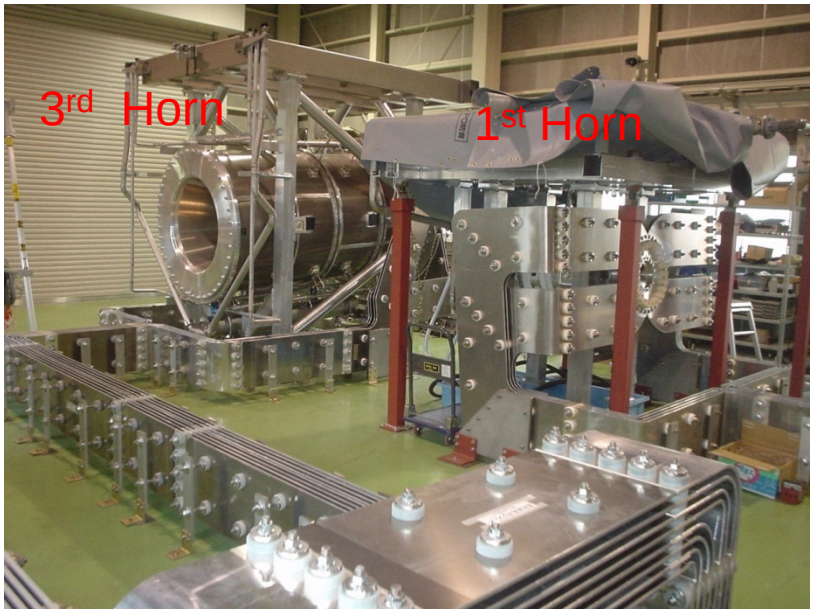
- Graphite 26mm(D)x900mm(L)
- Heat load: 58kJ/spill (~20kW)
- Thermal shock (ΔT~200K) ~ 7MPa (<Tensile strength 37MPa)
- Forced flow Helium gas cooling
- Remote maintenance
- The target full prototype is being manufactured.
- The He circulation system achieved >200m/s flow at the (imitated) target surface.
- Installation in FY2008





Electromagnetic horns





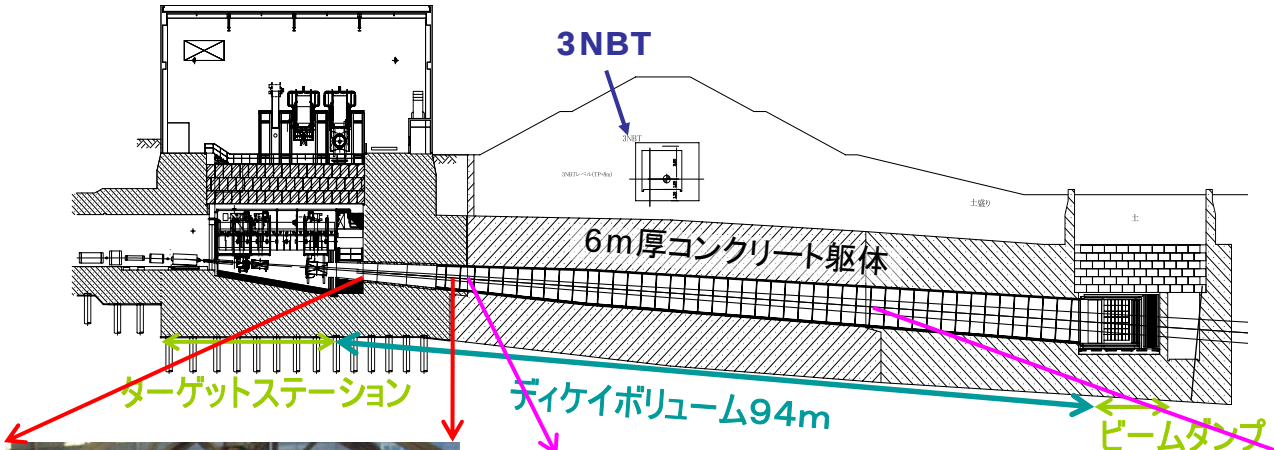
- As endurance test, 1st horn prototype have been operated with 8.5E5 pulses without serious troubles.
- The 3rd Horn was produced and connected serially with the 1st horn.
- The long term test at 320kA with this configuration just started and will continue until the end of August.
- The 320kA operation with full setup at Fuji-Hall is being prepared.

•The support module for the 3rd horn was produced.

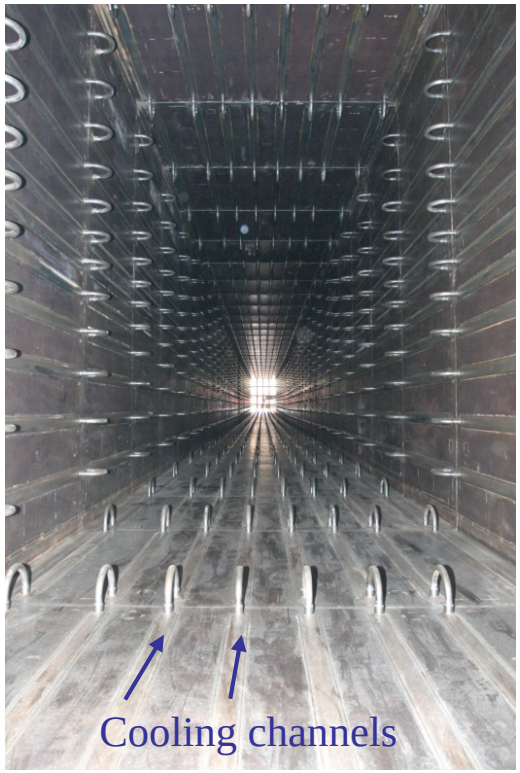
This 12tons iron box hangs the 3rd horn.

Decay Volume

- 94m-L iron helium vessel cooled by water
- 6m concrete shields
- ~150kW heat on iron walls and concrete
- Middle part (50m-L) was already constructed.
- Construction of most upstream and downstream parts just started.



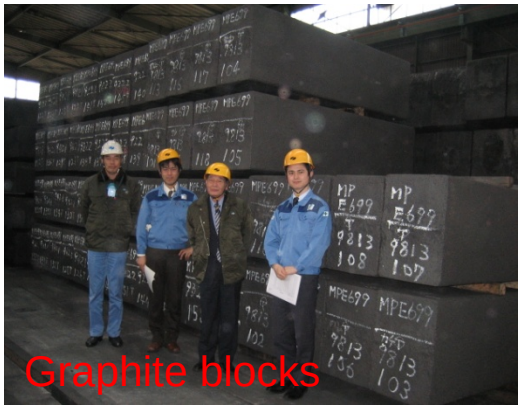
Most upstream part



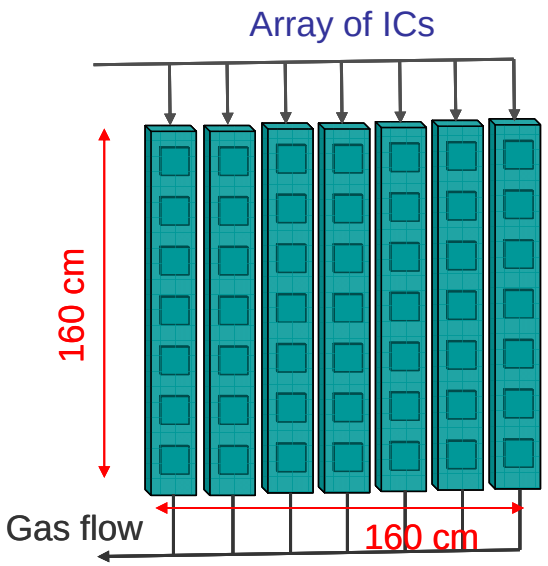
Middle part (50m-L)

Beam Dump / Muon Monitor

Beam dump



Muon monitor



- 98 graphite blocks cooled by Al modules.
- Production of Graphite blocks finished.
- First module was assembled.
- Machining of graphite blocks: FY2007
- Production of cooling modules: FY2007
- Fabrication of He vessel plates: FY2007
- Assemble/installation: FY2008

- Two Independent System
  - Semiconductor detector array
  - Ionization chamber array
- Spill –by-spill monitor for the muon profile center
- Prototype being tested w/ beam

Hadron production measurements at CERN-SPS
NA61 (SHINE) experiment

- Spectrum at far site is different from near site even w/o oscillation
  - Effect of non-point-like source
- (Possible) T2K analysis

Exp'ed flux at SK

$$\Phi_{SK}^{\exp} = R_{F/N} \cdot \Phi_{ND}^{obs}$$

σ, ε ⇒ SK exp'ed obs.

⇔ Osc?

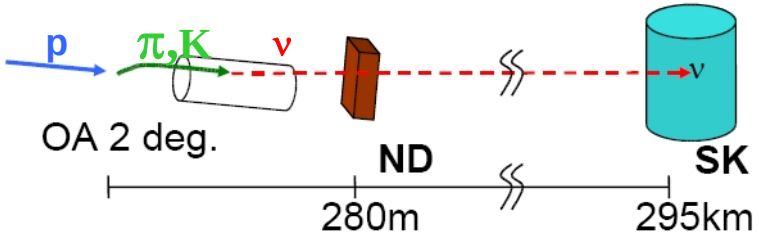
SK observation

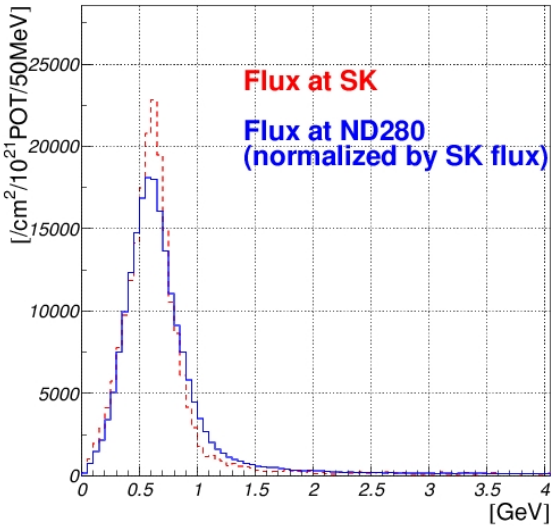
Far/Near ratio

$$R_{F/N} = \Phi_{SK} / \Phi_{ND}$$

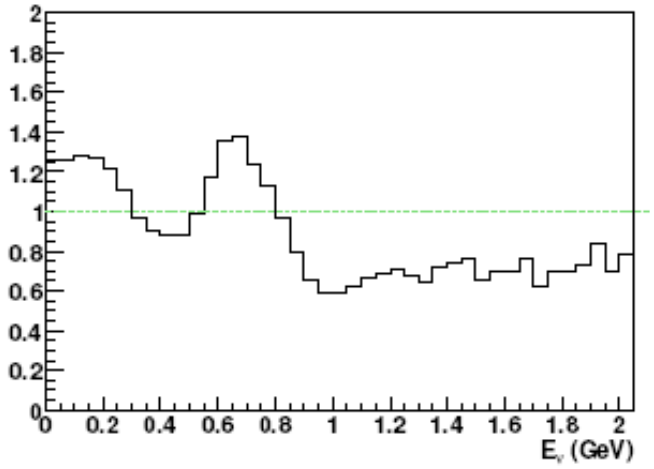
Determined by Hadron prod. (&geometry)

no measurement of particle production off carbon with 30 (,40,50) GeV protons ➔ NA61



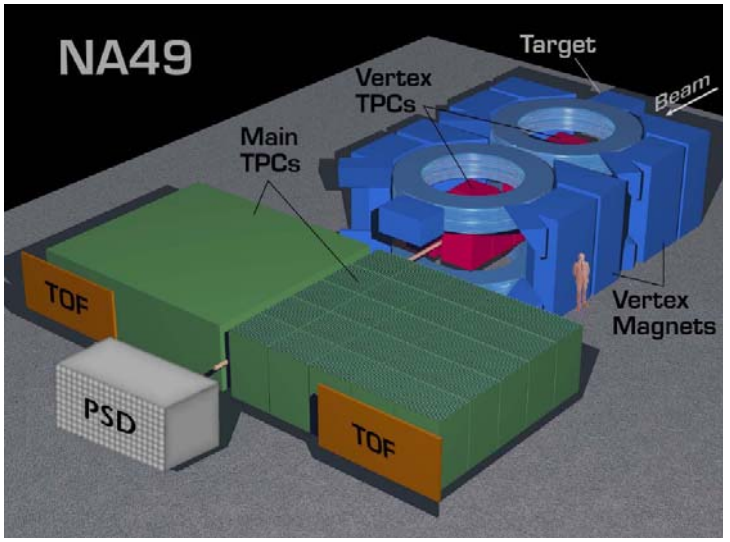


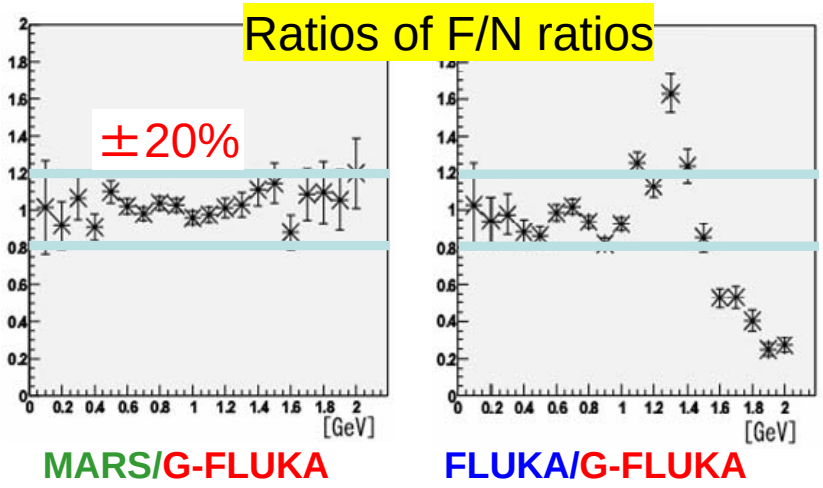
Far/Near ratio



CERN SPS NA61 experiment

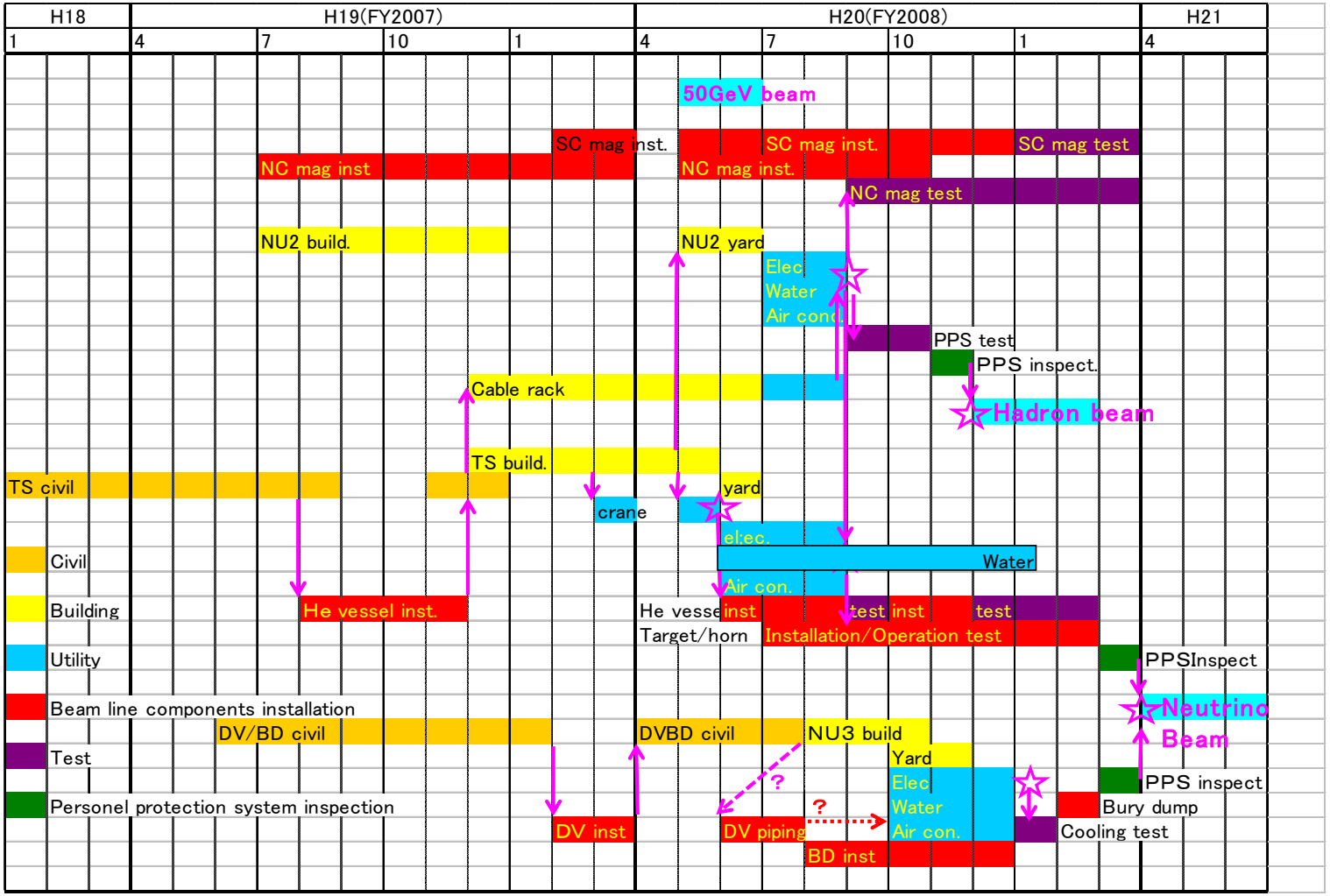
- Physics goals
  - **p+C for T2K**
  - Heavy Ion physics
  - Provide data for cosmic ray air shower exp.
- Detector
  - Existing at CERN SPS 2ndary beam line
  - Used by NA49 (Heavy ion)
  - TOF being upgraded
- Beam
  - **2007: Sep.27~Oct.29(29days) exclusively for T2K**
  - 2008~ : T2K+other phys (being reviewed)





	T2K goal	Error from F/N ratio	
		If δR~20%	w/ NA61
$\delta(N_{bg})$ for ν_e app.	10%	15%	<4%
$\delta(\sin^2 2\theta_{23})$	1%	1.5~3%	0.5%
$\delta(\Delta m_{23}^2)[10^{-4}eV^2]$	1	0.5~1	0.15

Construction schedule



- So many works need to be done in a very short period
  - Careful scheduling both on facility/equipments must be done
- Being worked out inside nu group & with facility dept./company

To start commissioning in April 2009

Summary

- Beam will start in Apr. 2009
- Beam line construction is on schedule
  - Although very tight.
- No fatal problem so far
- Superconducting/normal magnets are being manufactured
- Production of other components are in progress or in preparation
- Almost all components will be installed in FY2008