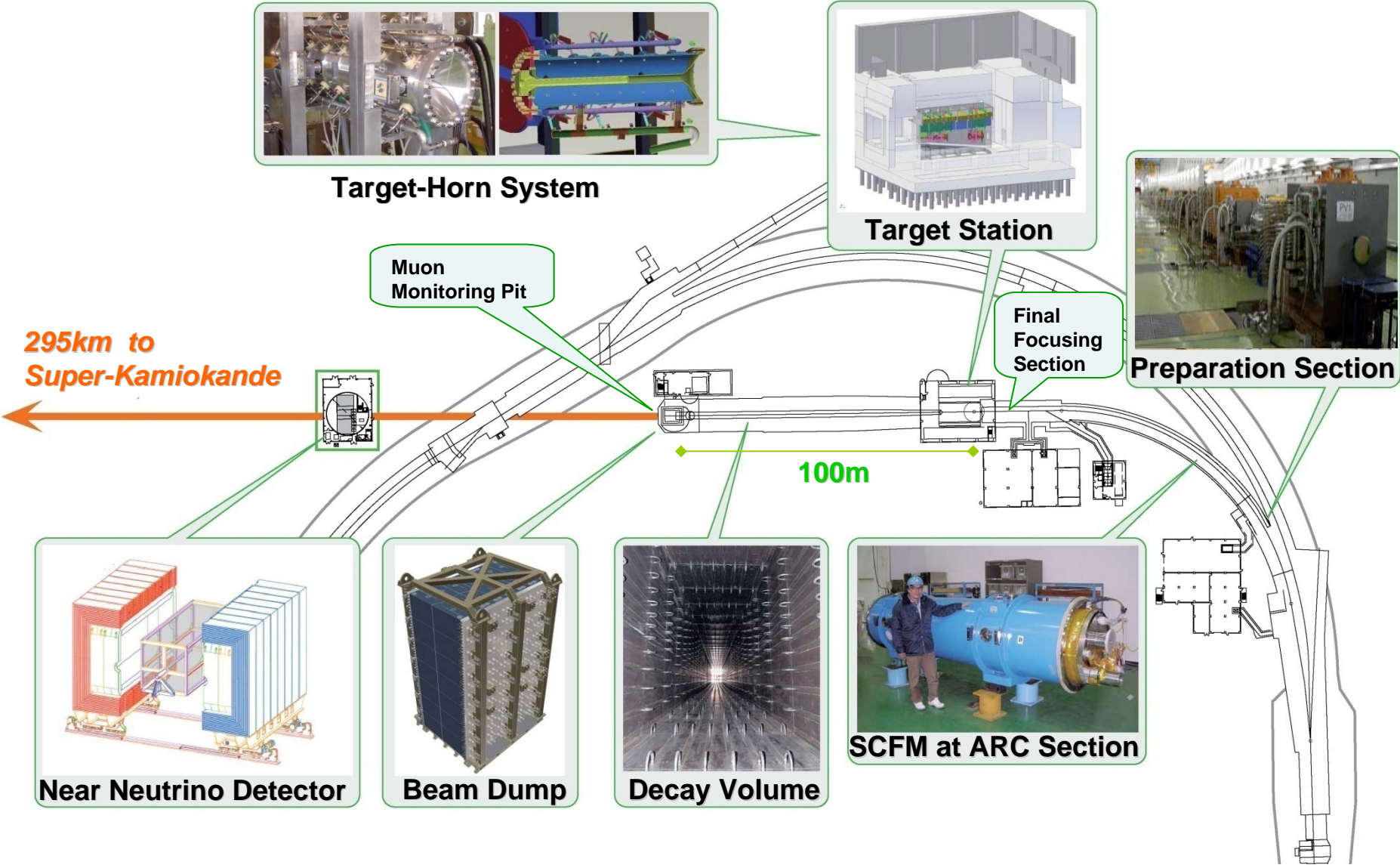


E11(T2K): beam line and neutrino facility

T. Nakadaira
(KEK)

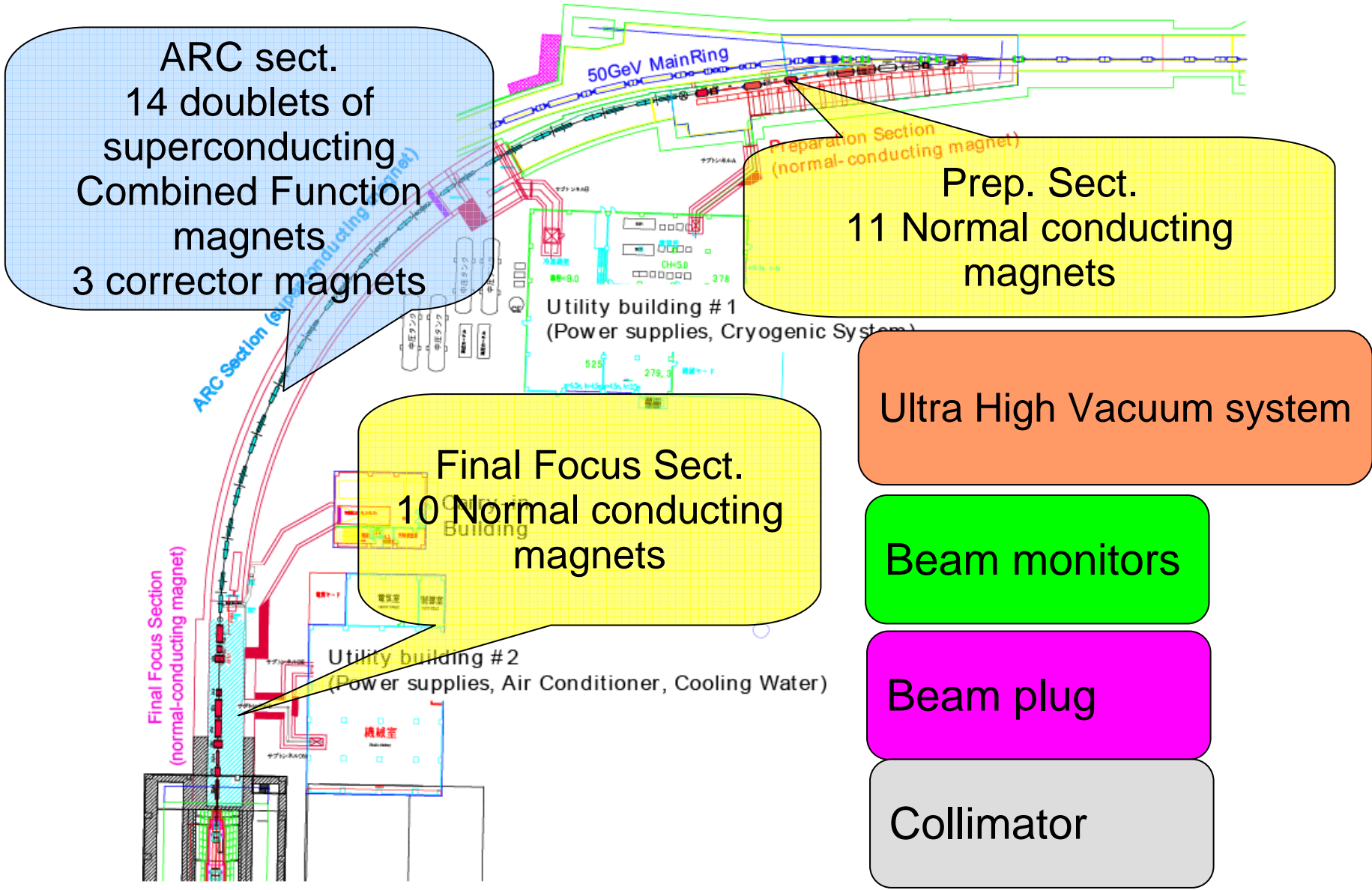
For T2K collaboration

The Neutrino Beam-Line



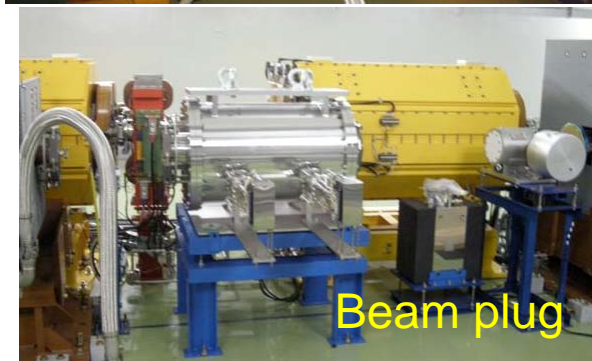
Construction: Apr. 2004 ~ Mar. 2009 (5yrs)

Primary beam beamline components



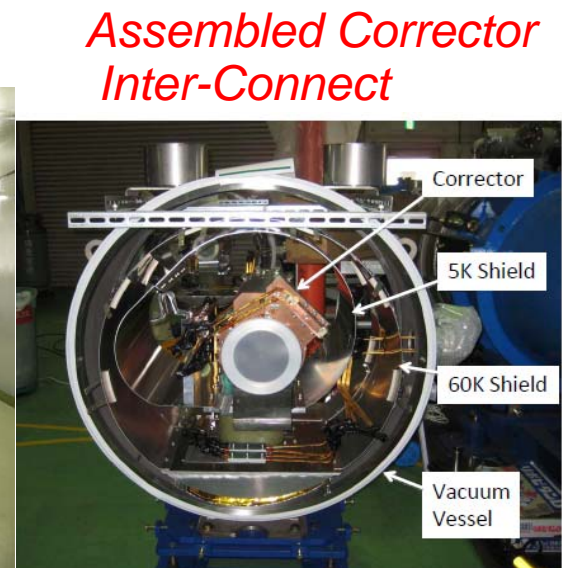
NC magnet / Vacuum/ Beam plug / Collimator

- Normal conducting magnets:
 - Excitation test will start next week.
- Vacuum
 - Installation of all the ducts/valves/pumps for will finish in this month.
 - Controllers become ready in early Nov.
 - Evacuation test will be finished by the end of Nov.
- Beam plug
 - Installed.
 - Controllers to be made in Dec.
(No move in MR operation from Dec.)
- Collimators
 - Installation is postponed.
No collimator at Day-1.



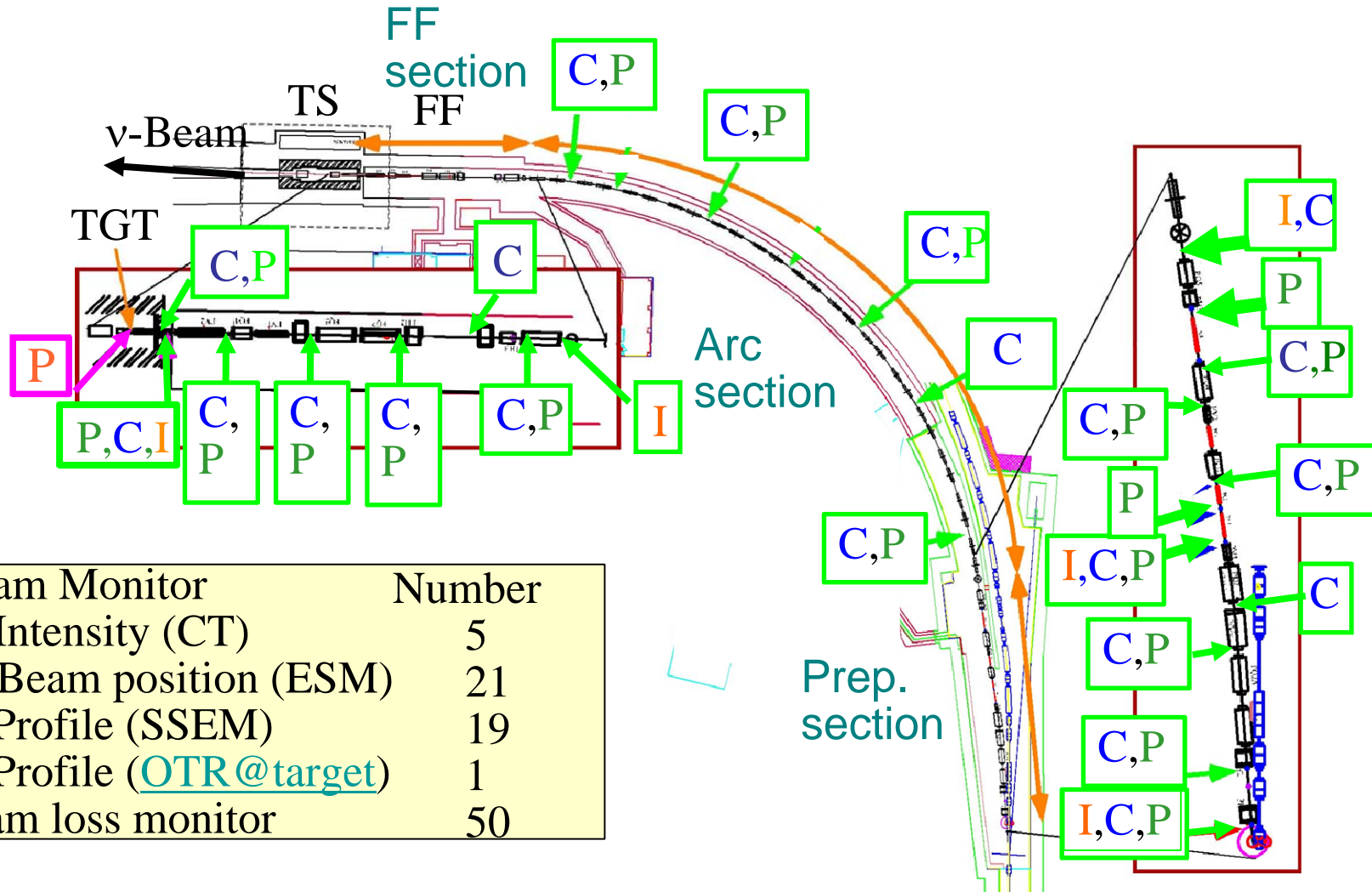
Superconducting magnets

- Installation is finished by the end of Jul. and aligned.
 - 28 Superconducting Combined function magnets
 - 3 SC Corrector magnets made by BNL
 - Interconnects (beam monitors, relief-valves) & Feedbox
- Schedule:
 - Airtight test of the cooling system in early Nov.
 - evacuation start in mid Nov.
 - cooling of the magnets will be started in Jan.



Beam monitors

Numbers and Locations are finalized



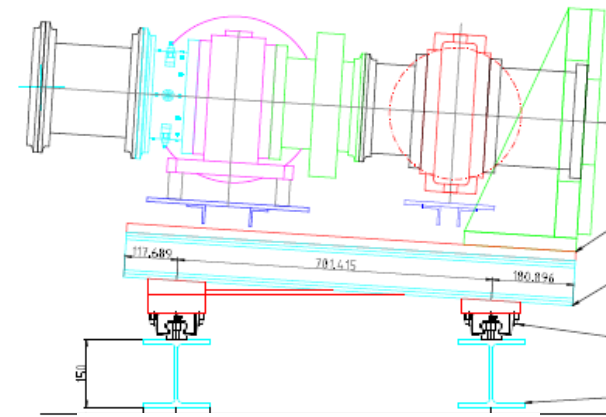
Beam monitors

- Intensity: CT
 - Performance is tested in test-bench.
 - Flat frequency response: 1k ~ 60M Hz
 - Linearity up to 90A(peak):
5uC(integrated)
 - 4: Installed, 1: ready to install
- Position: ESM
 - All (21) ESMs are manufactured and calibrate in test-bench with ~200um accuracy
 - 19: installed and aligned with ~100um accuracy



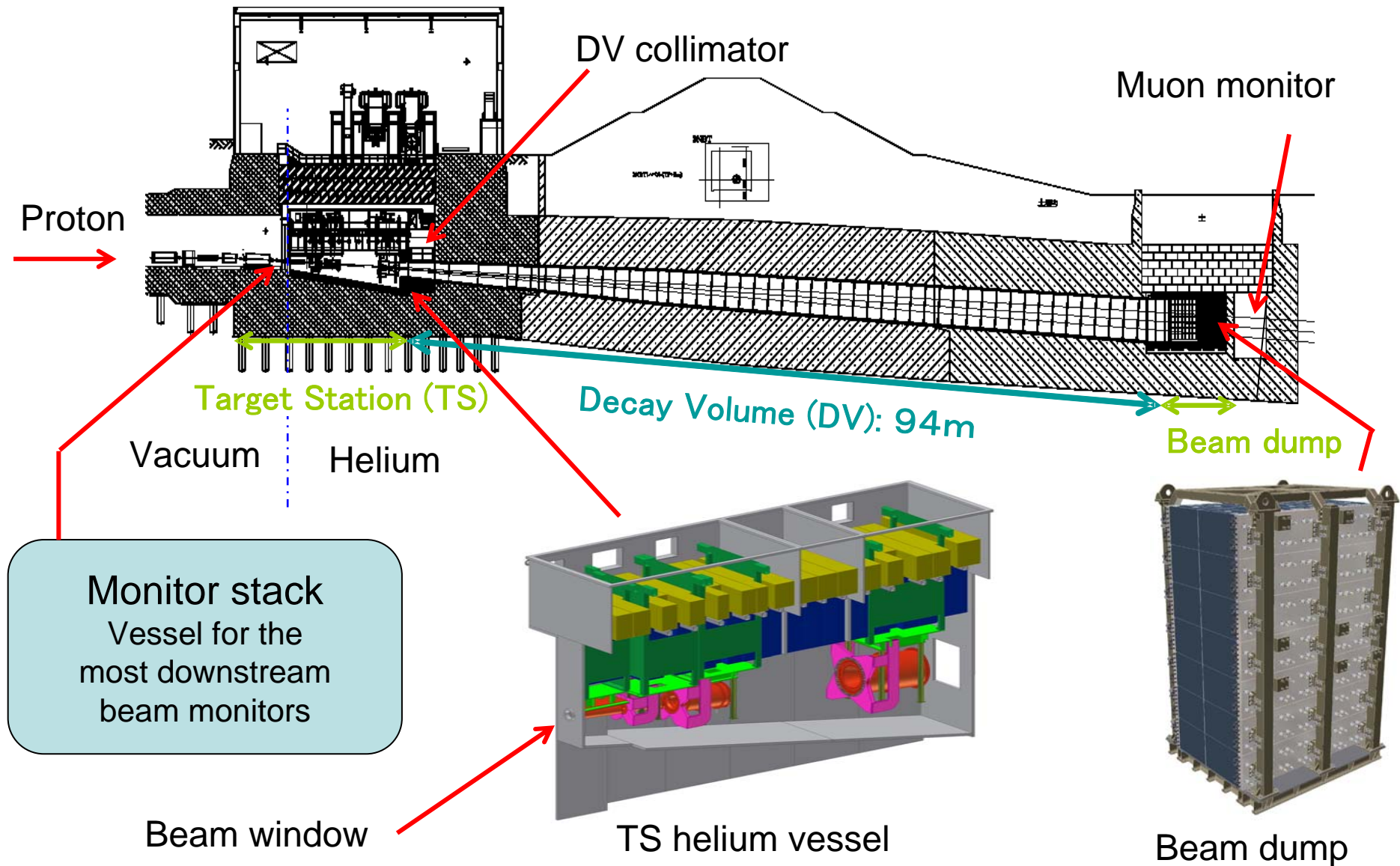
Beam monitor (Cont'd)

- Profile: SSEM
 - Jun. ~ Jul.: Cryogenic test on moving mechanism (80K)
 - **Moving system modified:**
 - All SSEMs installation will be finished by end of Oct.
- Most downstream part of FF sec.
 - Radiation level will be high
 - Quick maintenance mech. needed.
 - Installation: Mar. 2009.
- Beam loss monitor:
 - Commercial products:
 - Installation : early Nov.



CT+ESM+SSEM
+gate valve

Secondary Beam line



Target Station

- Building were completed on June 30th.
- Installation works started on July 1st and will finish in Dec.
 - Iron shields have been installed
 - Concrete shields for service pit and storage area for radioactive waste have been installed.
 - DV collimators have been installed.
 - Cooling tubes will be installed by end of Oct.



DV collimators & cooling tubes



Side iron shields



43ton Crane

Stage for horns

He vessel

Oct. 7, 2008

Beam window, Monitor stack and Maintenance room

Monitor stack
(Vessel for the most downstream monitor)
made by TRIUMF



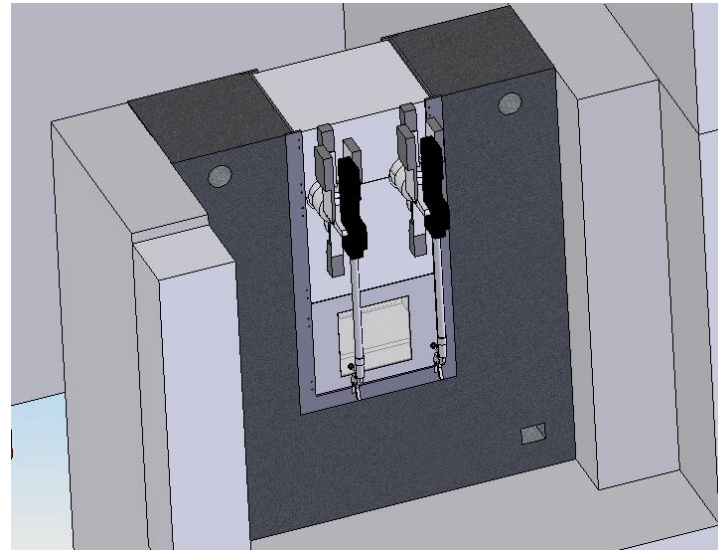
installed on Aug. 21st

Beam window
made by RAL



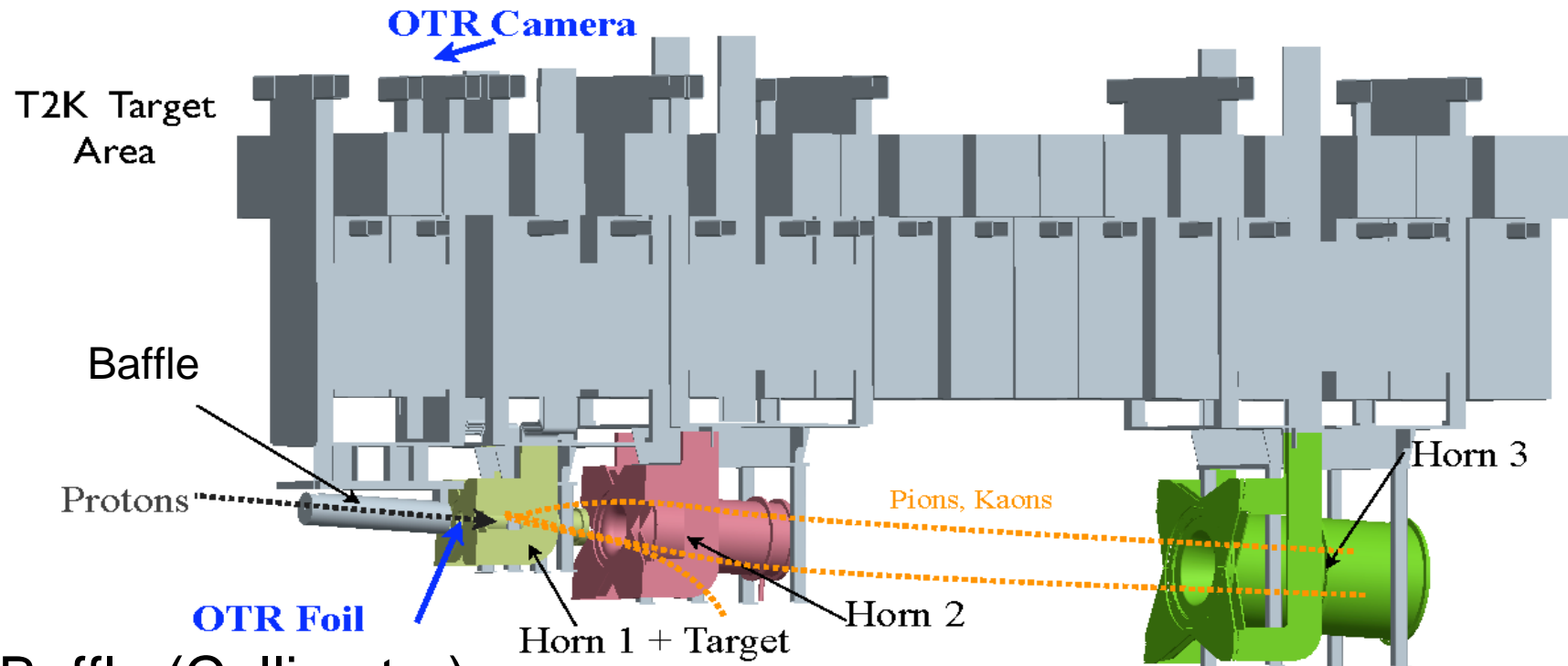
will be installed
on Oct. 18th

Maintenance room: Manipulators and
Lead-glass window from TRIUMF



will be
completed
in Nov.

Components in TS He vessel



- Baffle (Collimator)
- 3 horns Suspended by support module.
- Target ... installed in the 1st horn.
- OTR (Optical Transition Radiation monitor): attached to 1st horn frame

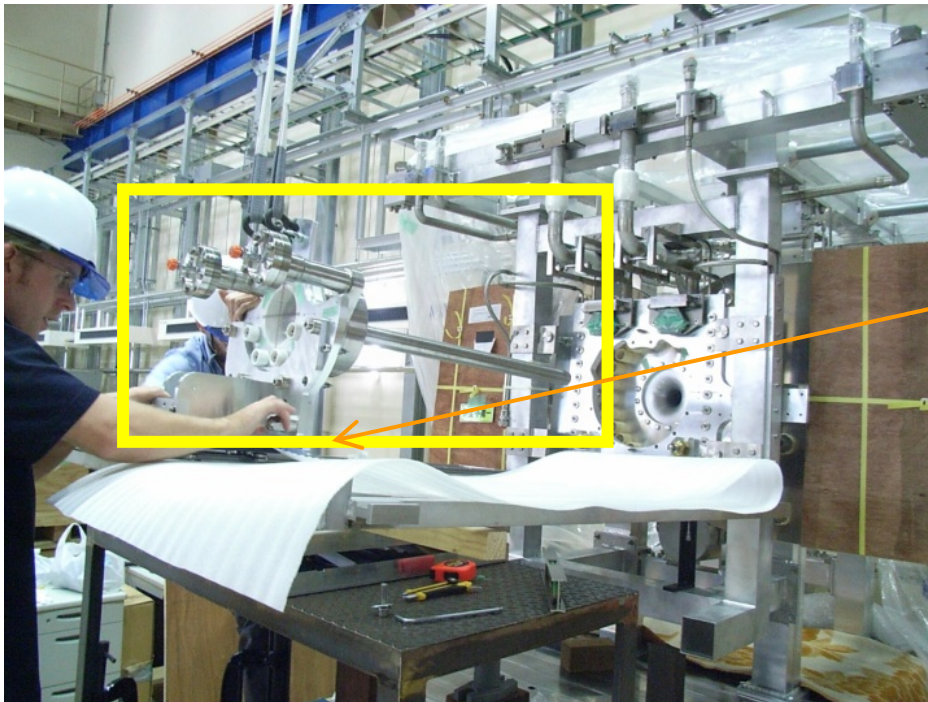
Baffle (Collimator at TS)

- Baffle is made by RAL.
- Assembled with support structure at TS ground floor in Sep.
 - The alignment within 0.3mm accuracy was achieved.
- Successfully installed in TS He vessel
 - No conflict with other components



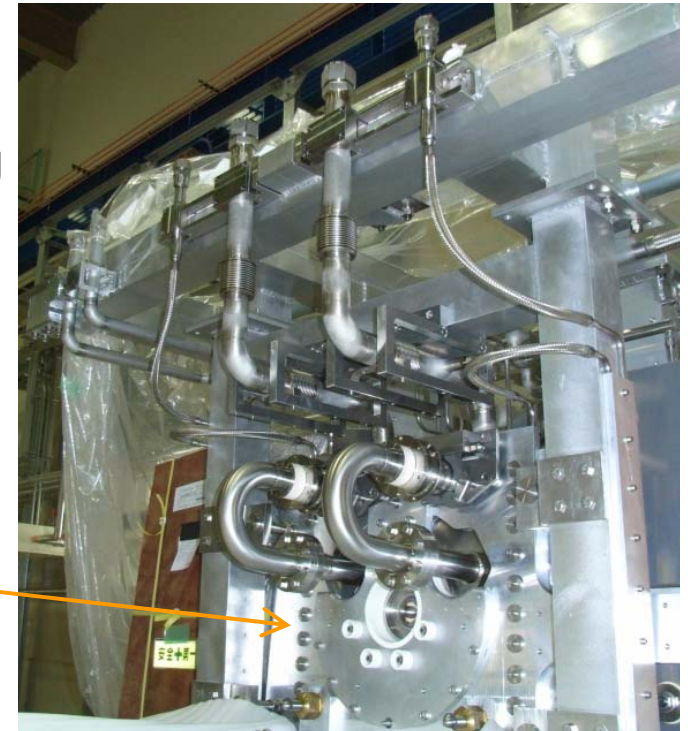
Target installation to 1st horn

- UK contribution
 - Support structure
 - Remote maintenance mechanism
- Installed in 1st horn in Sep. @ LINAC
 - Using the prototype of the remote maintenance tool
- Finalized remote maintenance tool will be delivered and tested in TS in Nov.



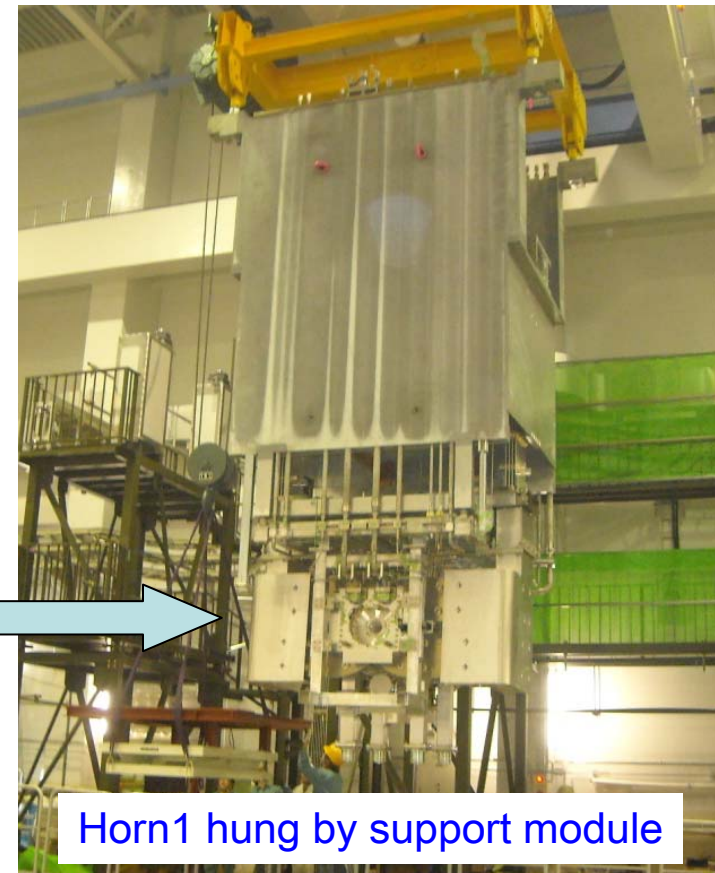
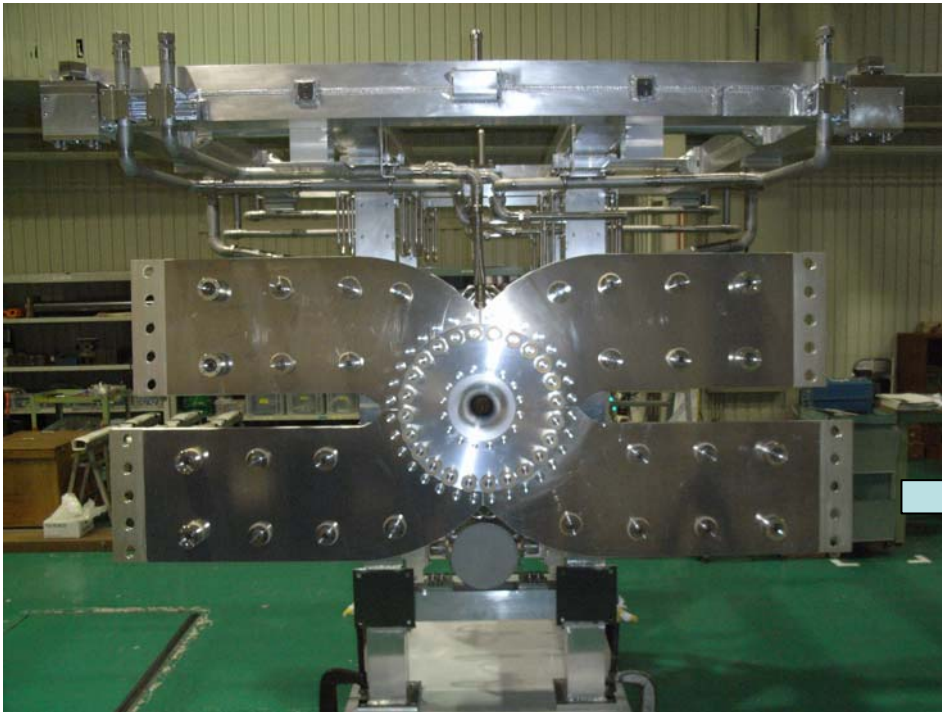
Target sliding
Mechanism
(linear guide)

Installed
Target



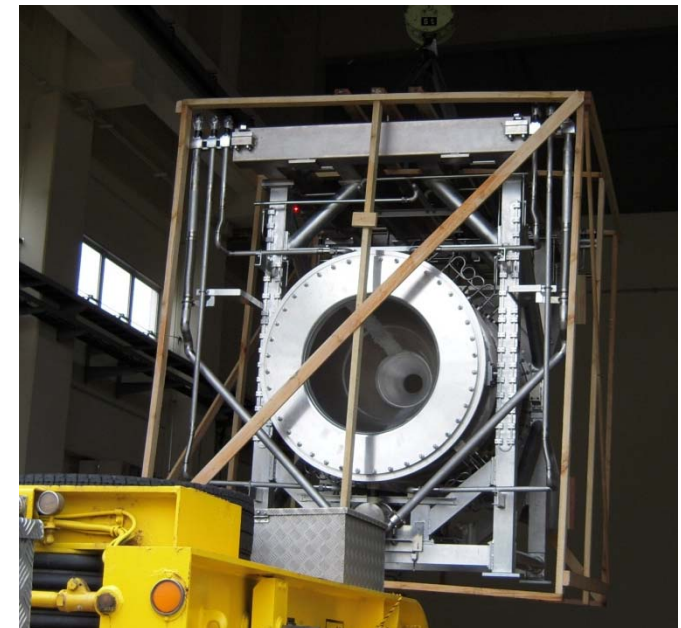
1st Horn Assembly and Alignment

- Striplines were assembled and covered by aluminum ducts.
- The alignment within 0.3mm accuracy was achieved.
- Target will be installed before test operation. (Mid. Oct)
- 1 week test operation in late October.



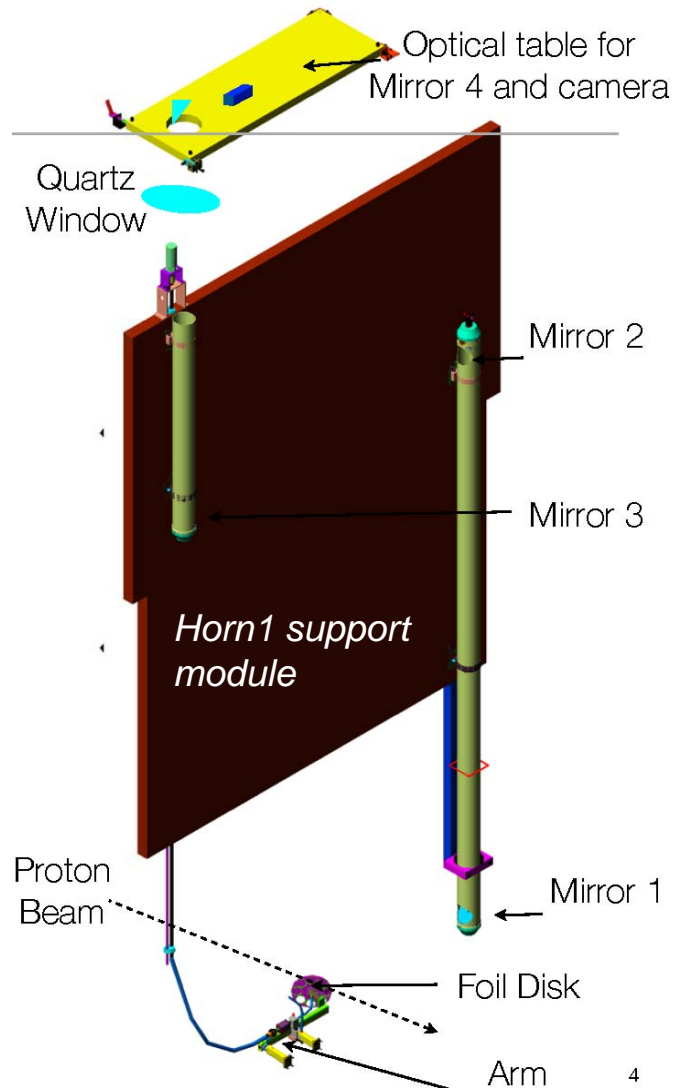
2nd Horn, 3rd Horn

- **2nd Horn: US contribution**
 - Delivered to KEK at Mid. Jun.
 - Test operation @ KEK (Tsukuba).
 - Mid. Aug ~ Early Oct.
 - ~ 230k pulses.
 - Measured magnetic field agrees with the design value in 1% level.
 - Distortion due to pulse is consistent with the expectation by simulation.
- **3rd Horn:**
 - Already delivered.
 - Assembly and alignment will be started in mid. Nov.

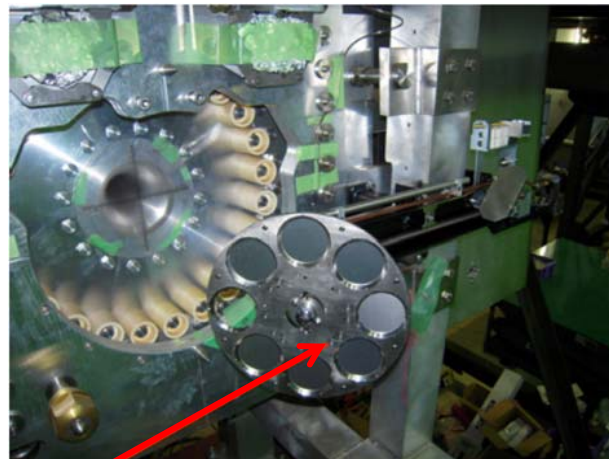


OTR (Optical Transition Radiation Monitor)

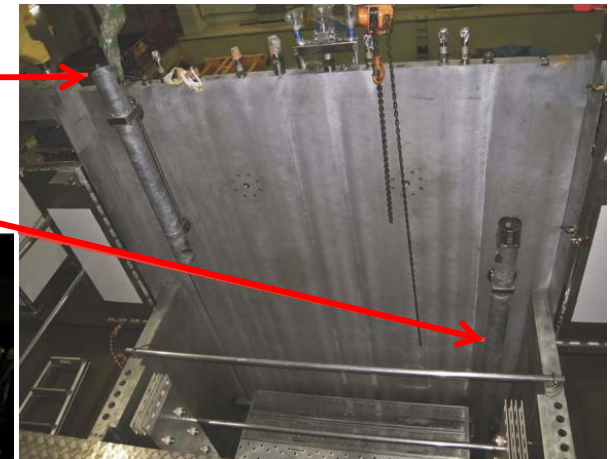
- Canada contribution.
- Beam monitor at the ~30cm upstream of target.
- Installation will be done by Mid. Oct..
- Optical table installation in TS Helium vessel is scheduled in Dec.
- Cabling will be done in Jan. 2009.



Tubes for optical path



Foil Disk

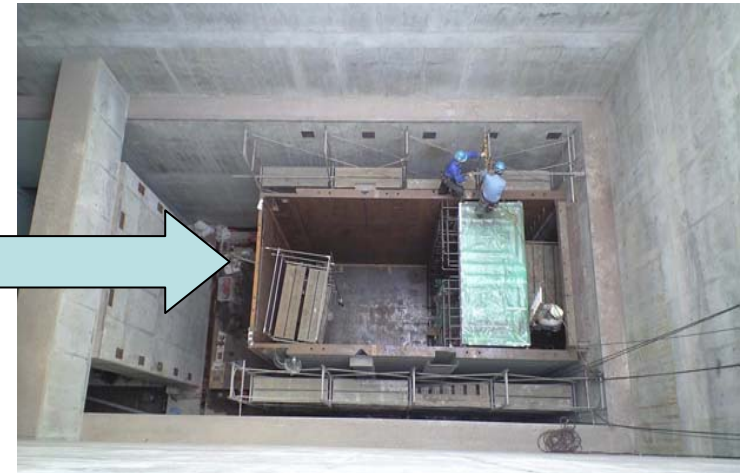
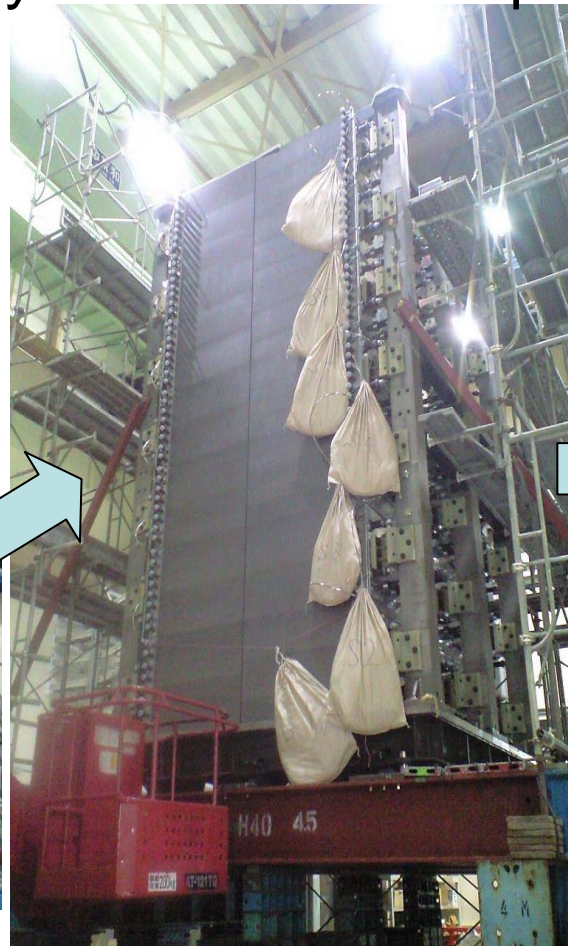


Schedule for TS work

- TS helium vessel
 - Installation work around TS helium vessel will be finished in Oct.
 - Vacuum test of helium vessel will be performed in late Dec.
- Baffle, horns (w/ target, OTR)
 - Installation into TS helium vessel from mid. Nov. to early Dec.
 - Each horn will be operated at the ground floor before installation.
 - All the wiring and plumbing will be done by Jan.
 - Horn electricity, Cooling water horn and target, Helium tube for target and beam window, Thermocouples, etc
 - Horn commissioning in He vessel from Jan ~ Feb.
- Upper concrete shielding in TS will be installed in Feb.

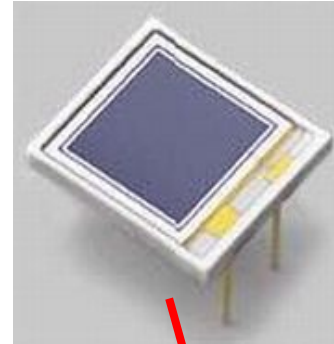
Beam dump

- Assemble of He vessel started in Aug.
- Hadron absorber was completed in early Oct.
→ **Installation to He vessel in 18th Oct.**
- All beam dump system will be completed in Jan.



Muon monitor

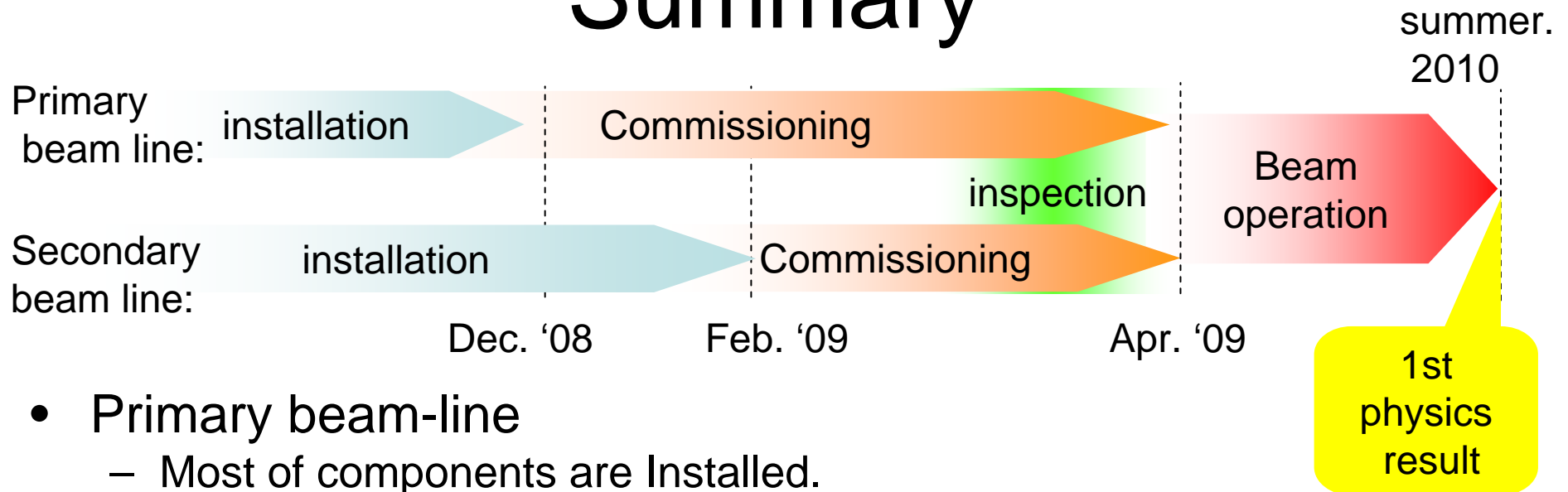
- Si PIN-diode (50ch)
- Ionization chamber(49ch)
 - All chamber modules are completed.
 - Calibration w/ electron beam at Kyoto. U will be done in Nov.
- Installation
 - Nov. : Support structure
 - Dec. : Chambers, silicon
 - Jan. : HV Cabling / Connection to DAQ
 - Feb. : Gas system (He/Ar)



DAQ / Interlock

- Beam line-DAQ
 - Hardware Integration work is in progress.
 - Dedicated Network become available.
 - Timing signal from MR become available.
 - Almost all the online software is prepared.
 - Data taking sequence works well.
 - Network transfer to final storage at KEK is tested. (~660Mbbs)
 - System commissioning from Dec.
- Interlock: Personal Protection System
 - Primary beam-line (as a part of MR-PPS)
 - Operation from Dec.
 - Secondary beam-line: (TS + NU3)
 - Construction: Oct ~ Jan.
 - Operation: Apr.~

Summary



- Primary beam-line
 - Most of components are Installed.
→ Commissioning will start in Nov.
- Secondary beam-line
 - Heavy Installation work in Oct. ~ Nov.
 - Commissioning of Horns will be starts in Feb.
- DAQ/Interlock
 - All the hardware is prepared. → System commissioning in Dec

Neutrino beam-line construction on schedule for the commissioning from Apr.

→ 1st physics result in 2010 summer with $100\text{kW} \times 10^7 \text{sec}$ beam