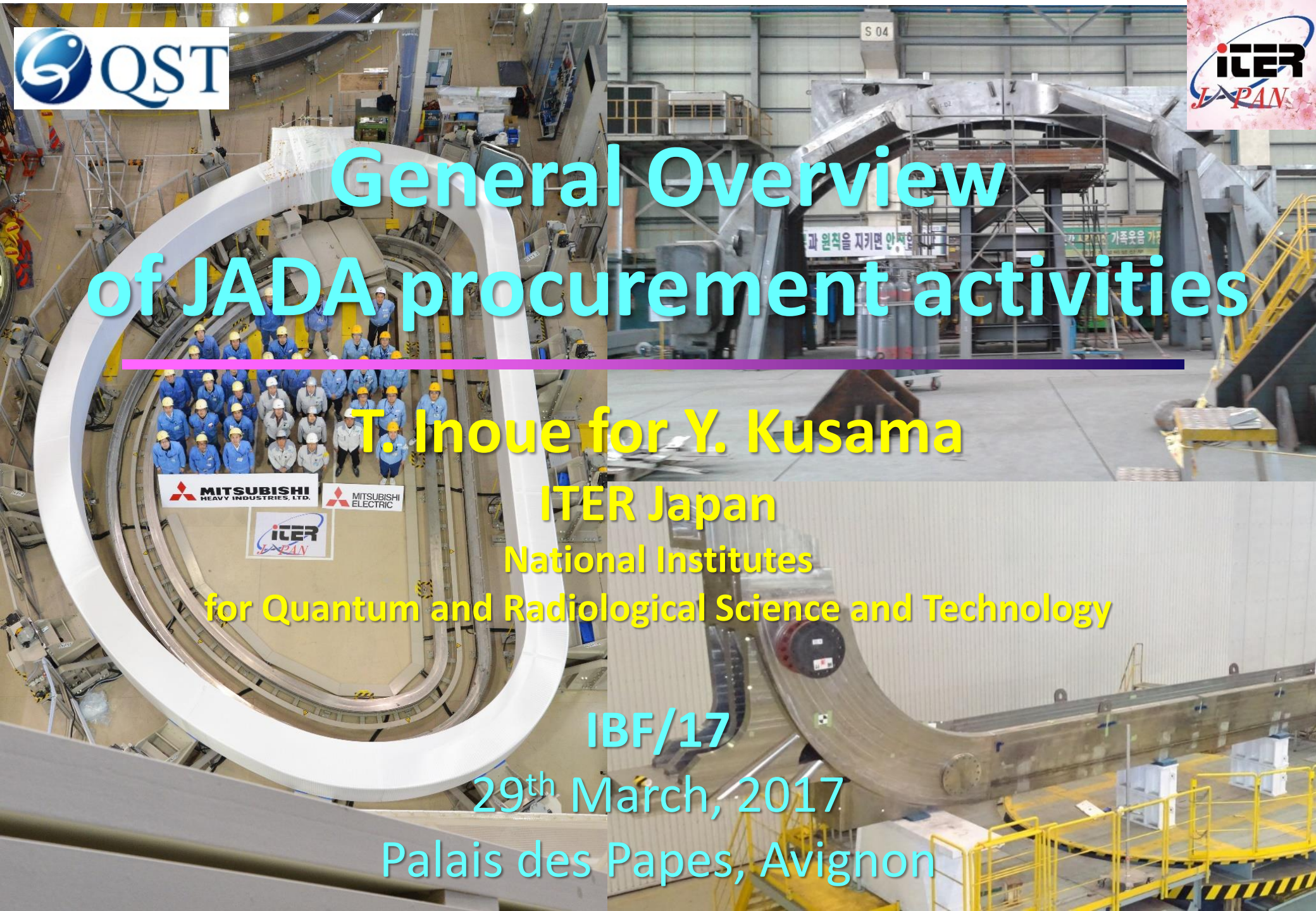


General Overview of JADA procurement activities

T. Inoue for Y. Kusama

ITER Japan

National Institutes for Quantum and Radiological Science and Technology

IBF/17

29th March, 2017

Palais des Papes, Avignon

Contents

- **Introduction:** Road map to fusion energy
- **In-kind Procurement by Japan**
  - ITER components to be procured by Japan
  - Procurement Arrangement status
  - Procurement progress
- **Expected contracts**
  - Procurement to be launched
  - On-site activities
  - Support by European companies
- **Summary**

Roadmap to Fusion Energy

3rd phase of the fusion R&D plan by the Atomic Energy Commission, June 1992

Plasma Experiment Phase

Scientific feasibility

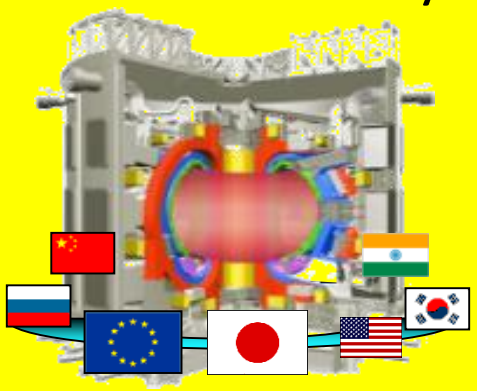
JT-60

Experimental Reactor Phase

Scientific/Technical Feasibility

ITER

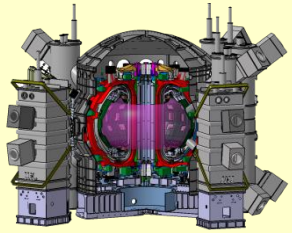
- 500 MW Fusion power
- Continuous fusion burning



Broader Approach (BA) Activities

June 2007 ~

[Naka, Ibaraki]



- Satellite Tokamak (JT-60 Superconducting)

[Rokkasho, Aomori]

- IFMIF
- Prototype reactor design
- Simulation research

Prototype Reactor Phase

Technical demonstration
Econimical Feasibility

Prototype

- **Power Generation**
- **Economical Prospect**

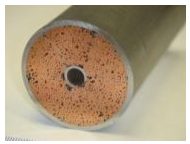
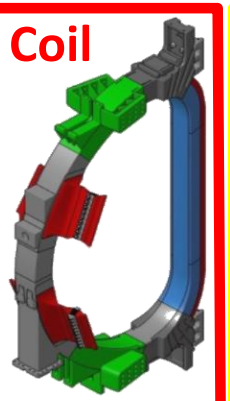
ITER is the core machine in 3rd phase of the fusion R&D plan, and it is an "experimental reactor of Japan" being constructed in France under international collaboration.

1985~ | 2007~ | Middle of 21st century

In-Kind Procurement by Japan

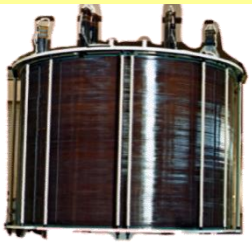
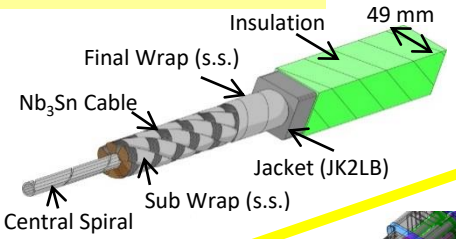
Toroidal Field (TF) Coil

TF Conductors: 25%
TF winding, assembly: 47%
TF Structures: 100%

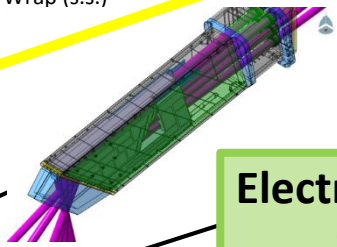
Center Solenoid (CS) Coil

CS conductors: 100%

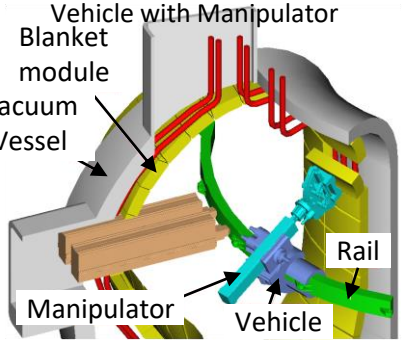
Diagnostics

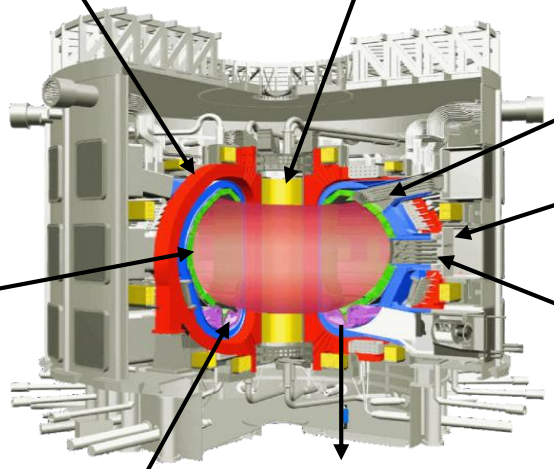
(under design)
Micro Fission Chamber
Poloidal Polarimeter
Edge Thomson Scattering
Divertor Impurity Monitor
IR Thermography
Thermocouples
Upper Port Integration
Lower Port Integration



Blanket Remote Handling System (under design)

Vehicle with Manipulator





Electron Cyclotron H&CD

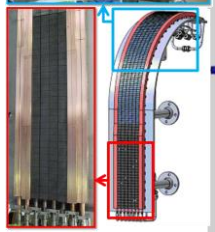
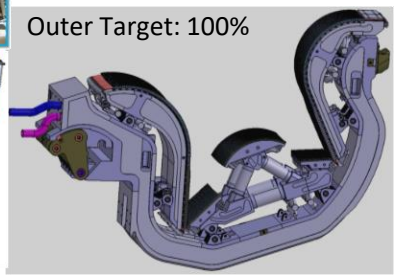
Equatorial Launcher
Gyrotron

Neutral Beam H&CD

HV Bushing: 100%
1 MV Power Supply HV part: 100%)
1 MeV Accelerator: 33%

Divertor

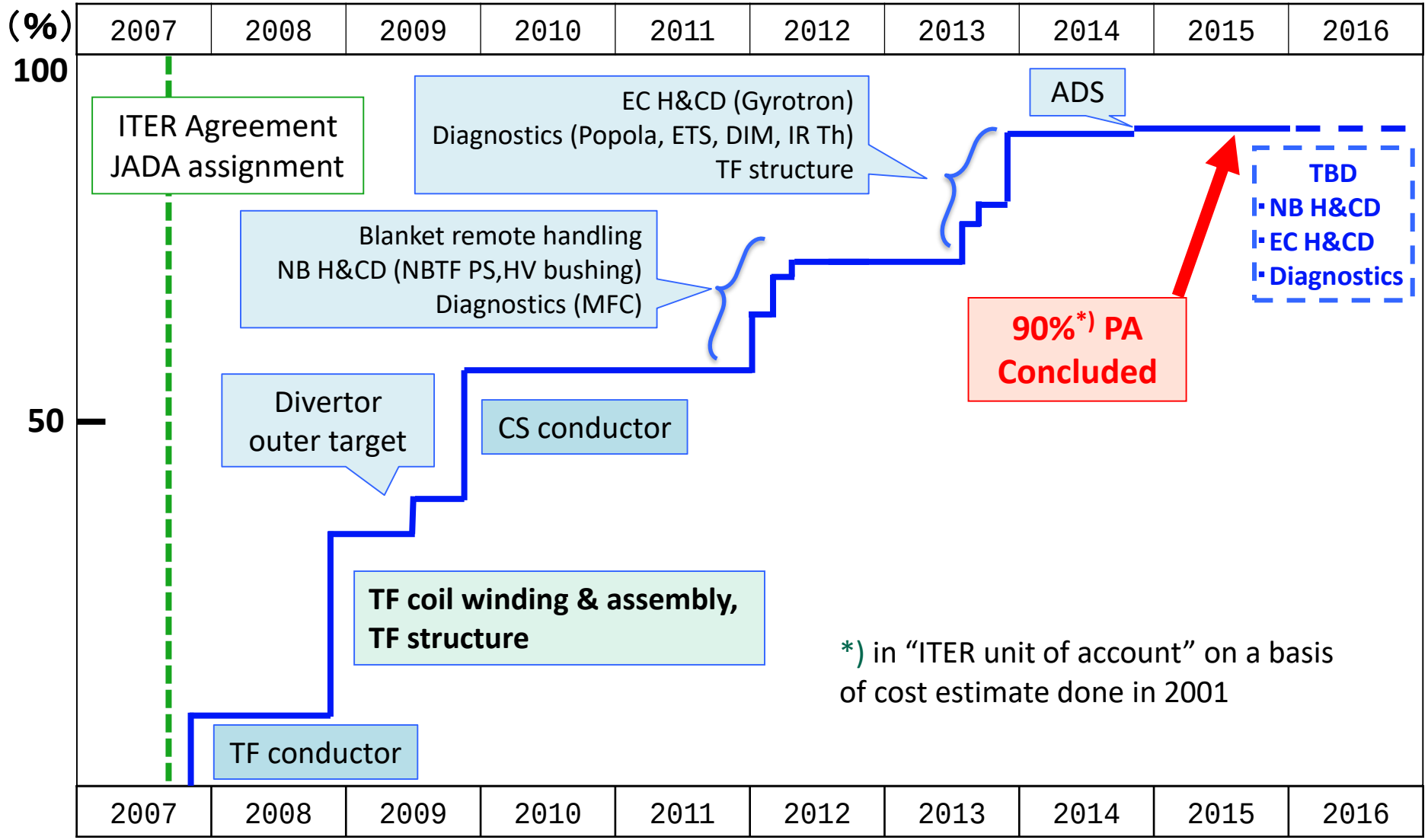
Outer Target: 100%

Detritiation System

(ADS, under design)

Procurement Arrangement

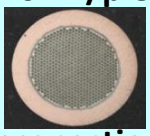


JADA has signed 12 PAs, corresponding to about 90% in credit value out of total Japanese contribution to the ITER in-kind procurement.

TF and CS conductors

Strand

(~20km/piece)



cross section
(ø0.82mm)

strand wound in spools

Total Manufacturing:
23,000 km (~100ton)

Cable

Total Manufacturing:
760m 24 units
415m 9 units

Cable wound in a spool

Conductor

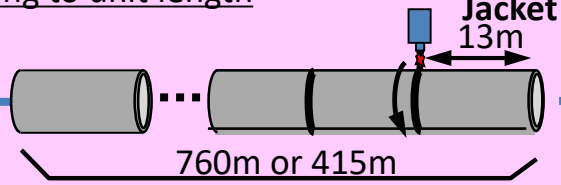
- 760 m（7.3 ton）x 24 units: completed
- 415 m（4.0 ton）x 9 units: completed

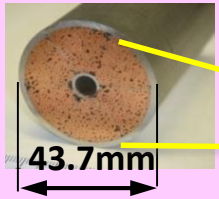
Overview of conductor manufacturing factory

Jacket for TFC
(13m/piece)

welding to unit length

X-ray inspection



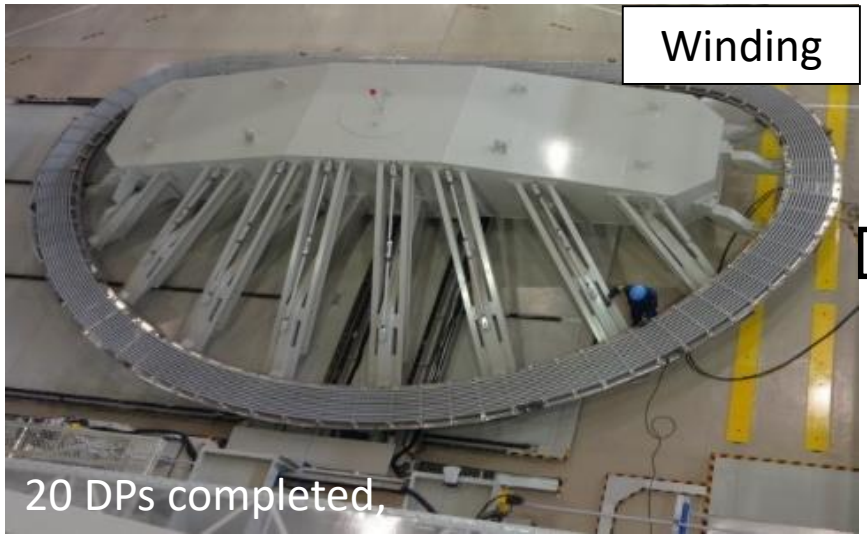


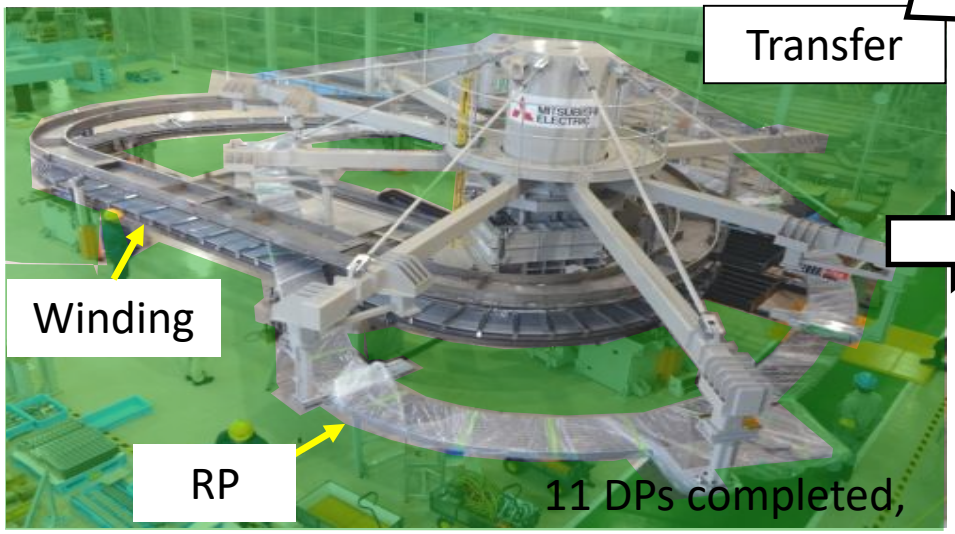
Cable pulling to jacket (<4ton)
Compaction
Winding for transportation

Final shape of a TF conductor

JA has successfully completed procurement of all TF conductors.
84% CS conductors has completed, and 69% already shipped to US.

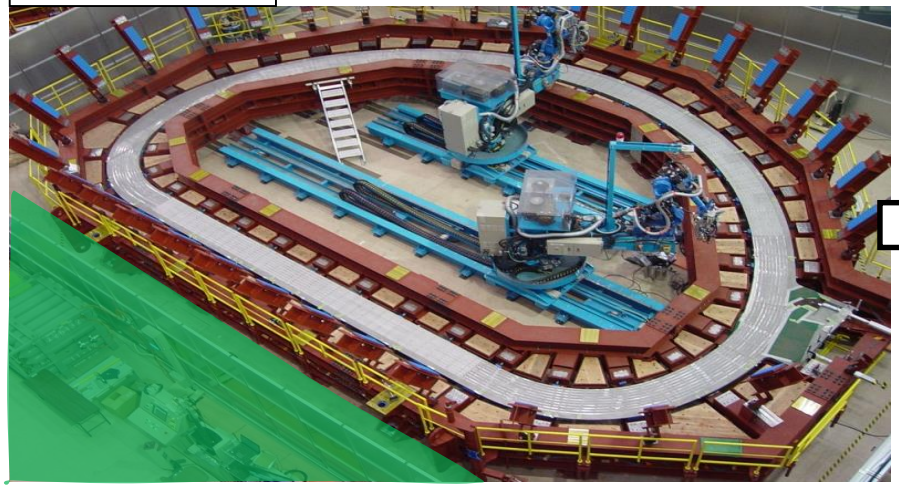
TF Coil Winding (MHI)





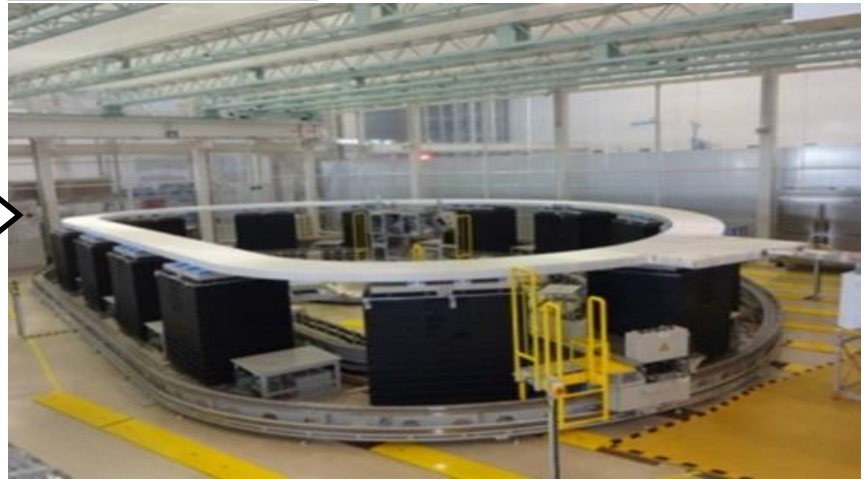
TF Coil Winding (MHI)

CP Welding



9 DPs completed,

DP Insulation



7 DPs completed,

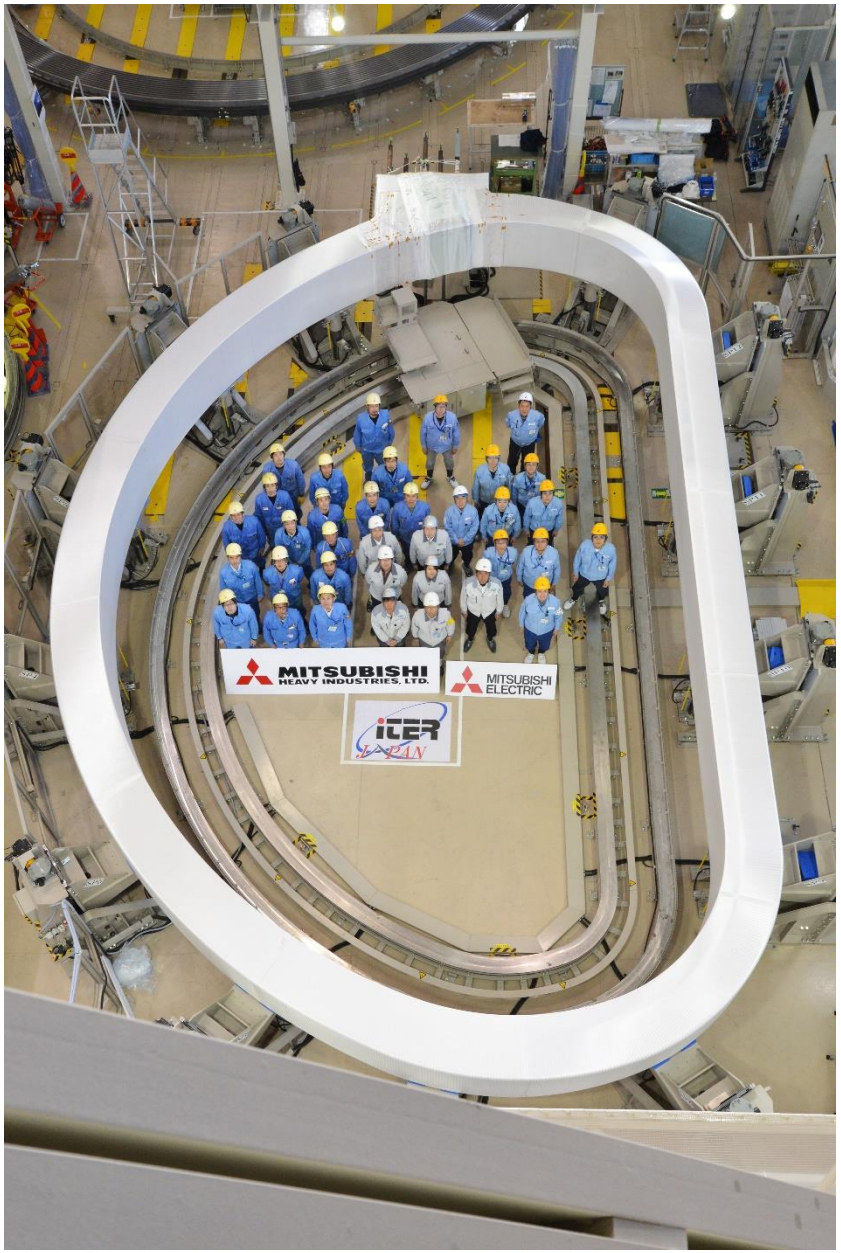
DP Impregnation

7 DPs completed,

DP Stacking

First 7 DPs stacked for TF#1 in Dec. 2016.

TF coil winging (MHI)



Insulation wrapping of first 7 DPs stacked for TF#1 was completed in Jan. 2017, which is accomplishment of one of IC milestones in time.

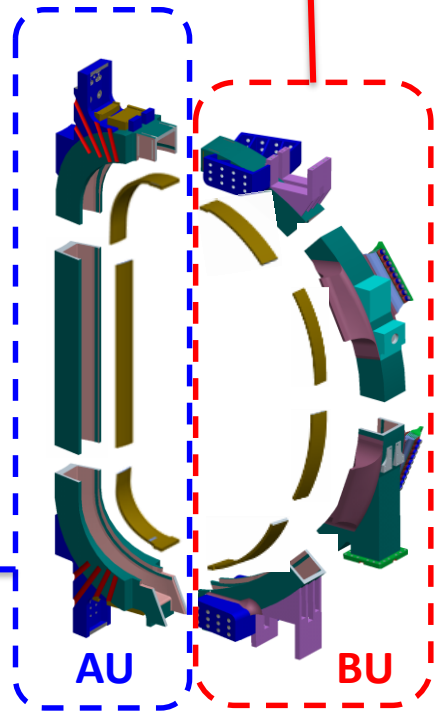
TF coil winging (Toshiba)

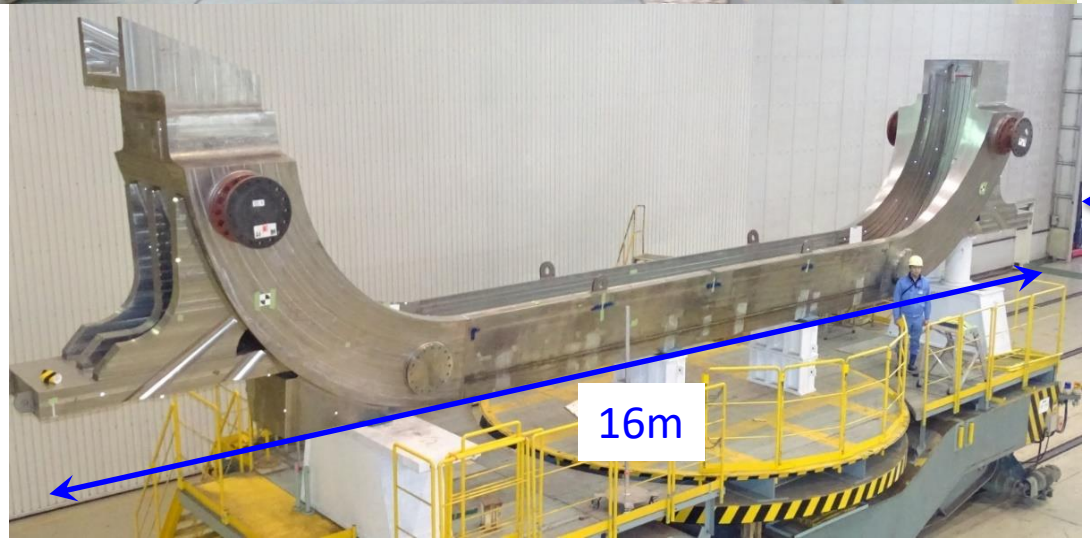
2nd manufacturing line in Toshiba has fully commissioned for series production of TF coils.

TF coil structure

First TF coil structure is to be completed soon by MHI and HHI.

Outboard Sub-assembly (HHI)
(consisting of 4 Basic Segments)
Waiting for final weld connection.



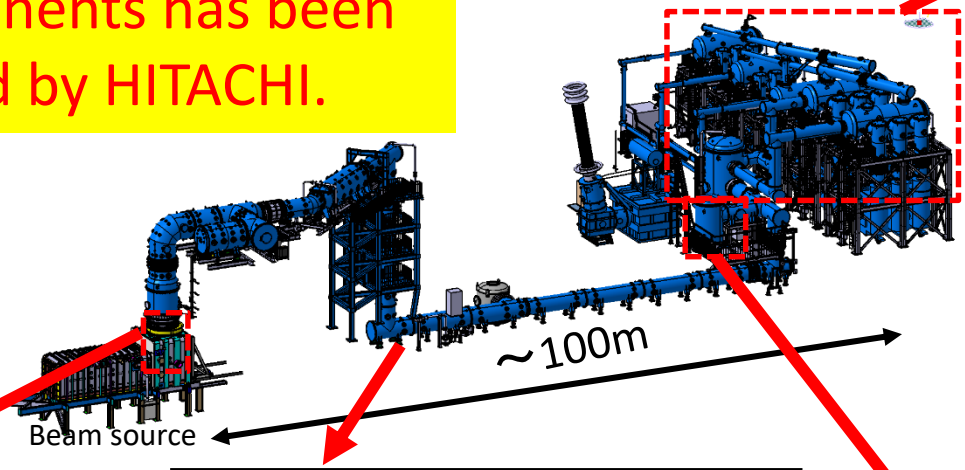


Inboard Sub-assembly (MHI)
(consisting of 3 Basic Segments)

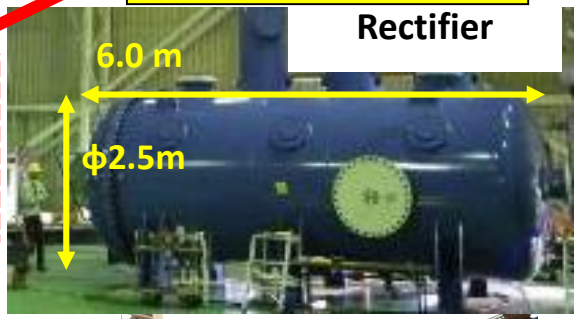
Neutral Beam Test Facility

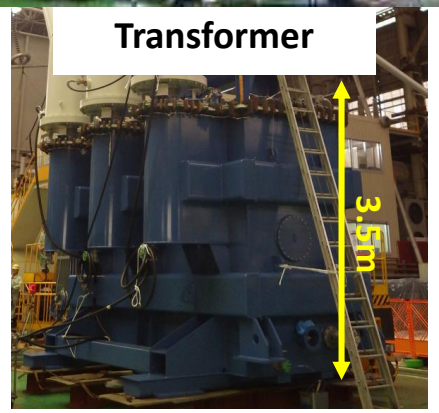
ITER Japan has contributed in construction of ITER NB Test facility at Padua Italy, to fulfill the requirement of ITER NB system.

The HV PS components has been almost completed by HITACHI.

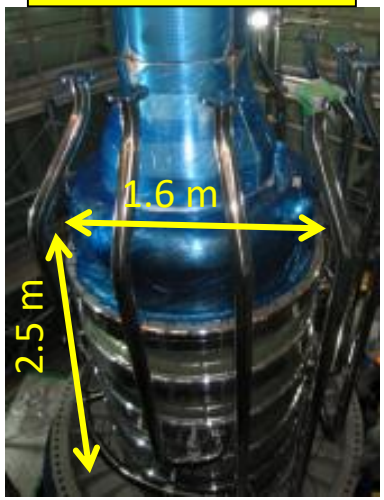


DC generators

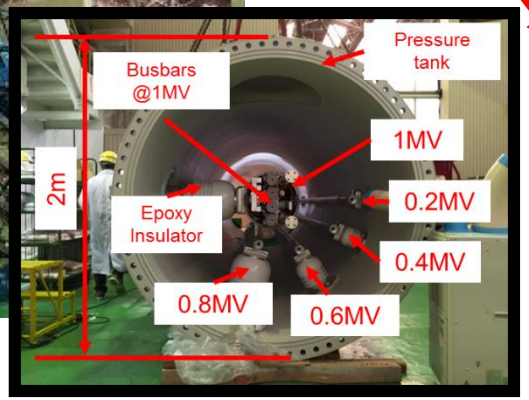




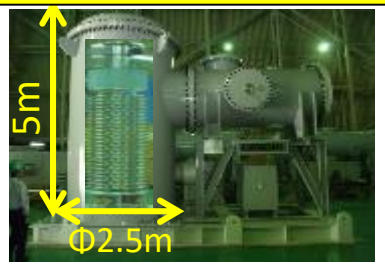
HV bushing



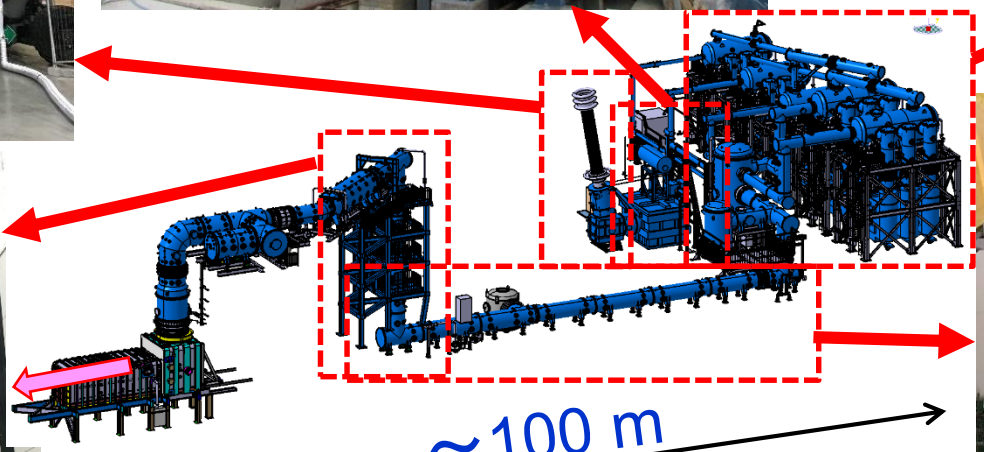
1MV transmission line (TL)



Test power supply



Neutral Beam Test facility

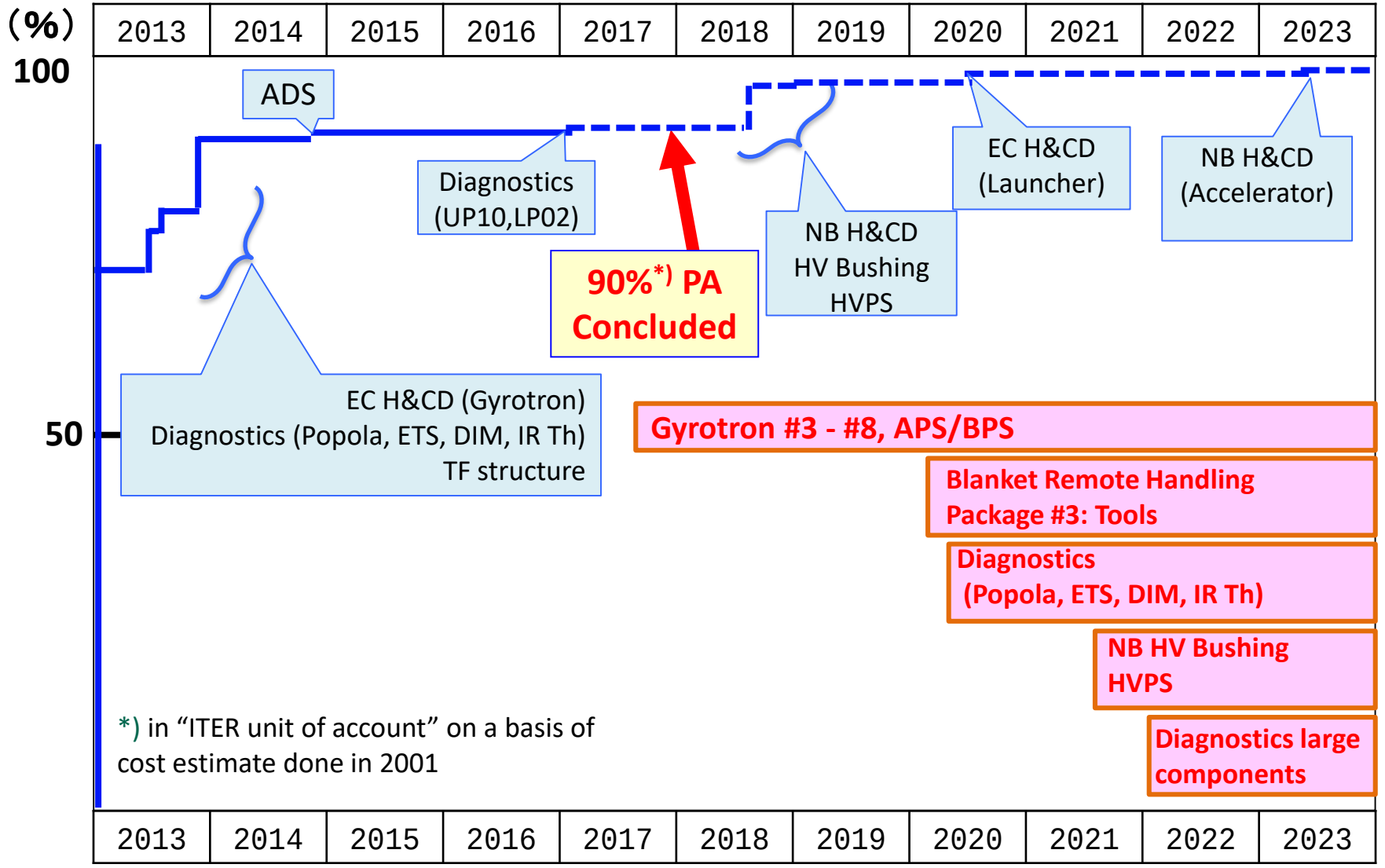


Almost all components have been already installed at NBTF site at Padua Italy.

170 GHz 1 MW Gyrotron

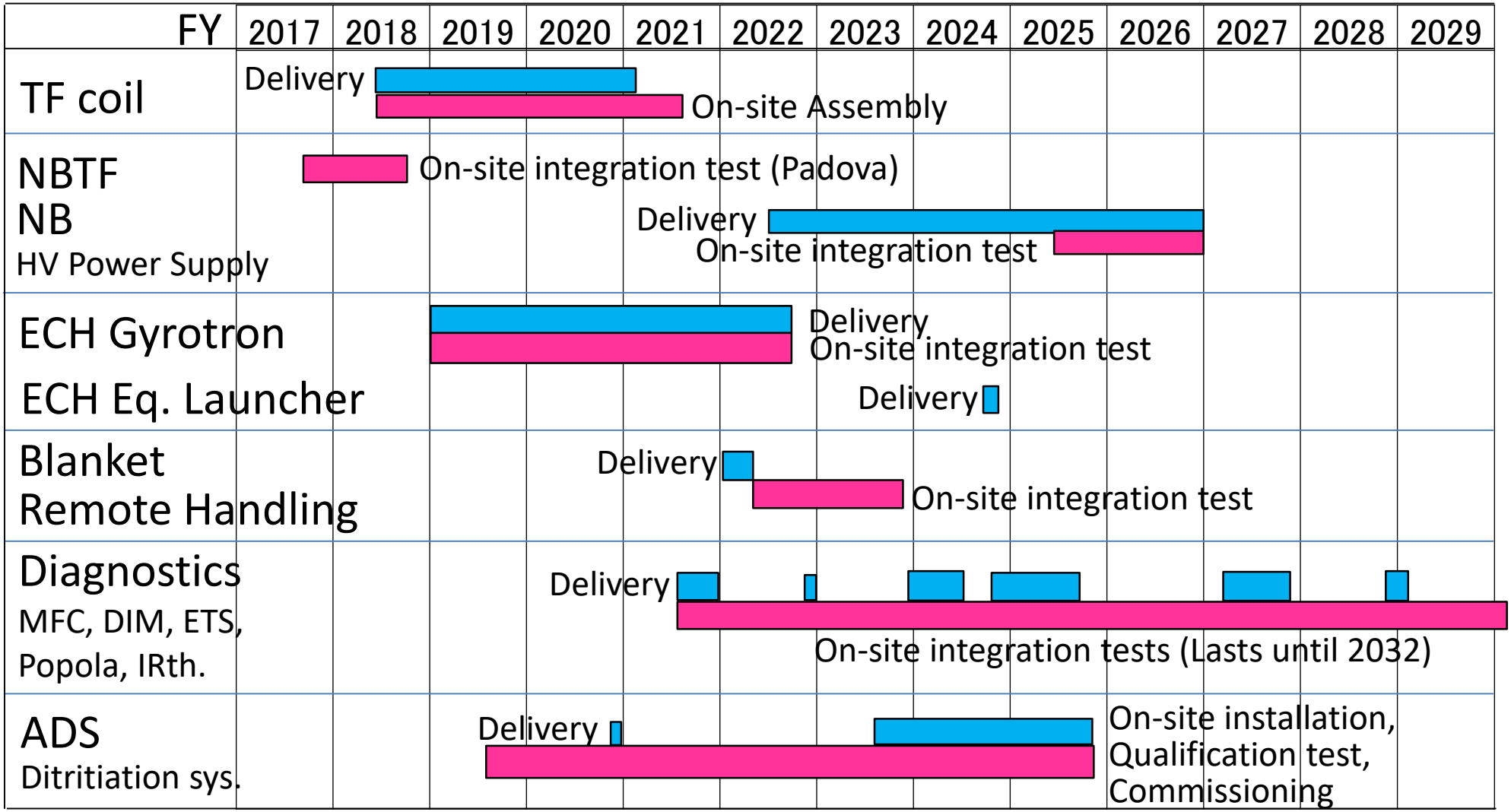
- ✓ Major requirement of ITER Gyrotron already achieved (1 MW for 1,000 s, efficiency > 50%, 5 kHz modulations, etc.).
- ✓ First Gyrotron for ITER has been delivered to QST Naka in December 2016 (on schedule). The gyrotron is to be shipped to ITER site after high power test at Naka.

Future Procurement Arrangement



JADA expects 3 PAs to be signed in next several years, followed by contract awards for manufacturing of various components.

Delivery and On-site activities



JADA on-site activities from receipt on-site till completion of Integration tests etc. since mid. 2018 to 2032, requires support of European companies.

Support by EU companies

- Most of the on-site assembly, installation works are to be carried out by IO. The on-site integration test etc. shall be carried out under initiative of IO. **JADA supports the IO activities sending scientists and engineers for supervisory.**
- For this activities JADA expects following support from EU companies:
  - ✓**Interpreter**, with good understanding of related technology,
  - ✓Engineer with experience of **crane handling of heavy weight components** (for TF coil, NB HVPS),
  - ✓**Electric/mechanical engineer** capable of assembly of HV components (for NB HVPS),
  - ✓Mechanical engineer for **precision instruments** (for ECH gyrotron, laucher, Blanket RH, Diagnostics),
  - ✓**Plant engineer** (for ADS).

Contribution of Foreign Company

Current contribution of Foreign Company to the JADA in-kind components for ITER are as follows:

- **Tungsten mono blocks for Divertor Outer Target** *1
  - mono blocks (JFY2009, 2010, 2014) **: AT&M and TLWM (CN)**
- **Fabrication of TF Coil structure**
  - TF Coil structure Materials :
    KIND (Germany)*2, Industeel (France)*2, FAV (Italy) *3
  - TF Coil structure (Phase III) **: HHI (Korea)** *4
- **CS strand and cable for CS1U Module and CS2U Module**
  - (6 x 933m + 628m) : **Kiswire Advanced Technology (Korea)** *4
- **Blanket Remote Handling System**
  - **Review and design of part of BRHS : PAR system (USA)** *4

Note
***1: contract with JADA through Japanese company, Marubeni Utility Service.**
***2: contract with JADA through Japanese company, MHI, e-Energy /HHI, Toshiba.**
***3: contract with JADA through Japanese company, e-Energy /HHI.**
***4: contract with JADA through Japanese company, e-Energy.**

Summary

- The procurement of **TF Coil conductor** was completed.
- The **TF Coil conductor winding** has been completed for first 7 DPs of TF coil No.1.
- **1 MV HV power supply components** and **HV bushing** were manufactured and 80% of them have been installed at **NBTF** site at Padua, Italy.
- **170 GHz, 1 MW gyrotrons** #1 and #2 have been manufactured.
- Fabrications are in progress for **TF Coil, TF Coil structures, CS conductor**.
- Design and Qualification are on-going for **Blanket remote handling system, Launcher of EC system, Diagnostics** and **ADS**.

- **JADA is looking for good European companies which can support our on site activities.**

Procurement Procedure of JADA

- Procurement of in-kind components of ITER is being processed according to the procurement procedure and regulations of JAEA.
- Contract process of JAEA is general competitive bidding for ensuring the transparency of contract .*1, *2
- Solicitation of comments on reference specifications (draft) is performed to finalize reference specification
- Before the Call for Tender, information for bidding is published on Official Gazette based on Governmental Procurement
- After tendering, technical review will be done for the selection of supplier.

■Note

*1: Suppliers who join the bidding of JAEA contract need the registration process to Contract Dept. of JAEA before bidding.

*2: The bidding specifications shall be written in Japanese language.

Procurement Procedure of JAEA

Selection of Supplier

- Technical evaluation will be done for the selection of supplier by review of the documents.
- The following required items and criteria for evaluation will be specified in the reference specifications.
  - Record of supply for the applicable product to JAEA or other organizations;
  - Record of supplying similar products to JAEA or other organizations;
  - the tender evaluation criteria specified in the PA;
  - the required features of the Supplier's QA system; and
  - characteristics of the required manufacturing facilities.
- The criteria for selection will be determined according to the PA or agreement with IO. Criteria will be included in the reference specification.

JADA Project Management

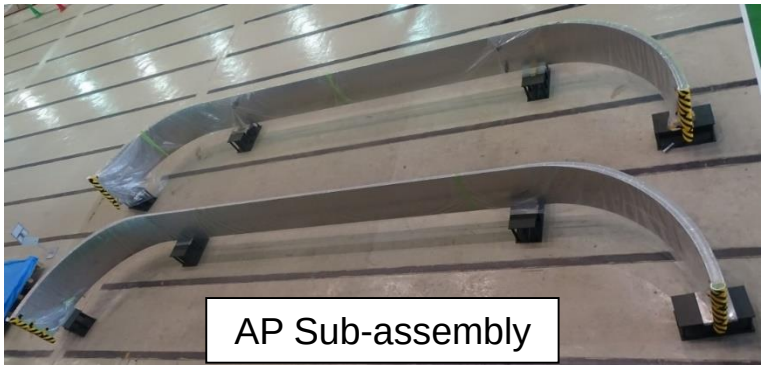
JADA has implemented the following project management tools/methods for smooth execution of Procurement of ITER components:

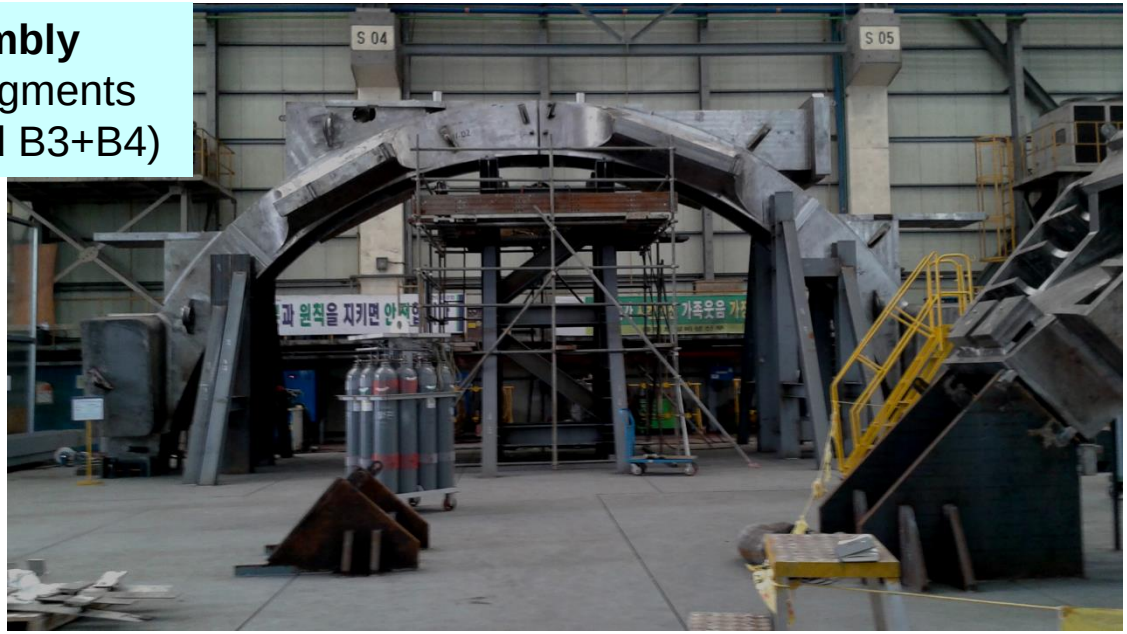
1. **Schedule monitoring**
   - Primavera (DWS, between IO and JADA) and
   - Microsoft Project (monitoring of detailed resource loaded activity between JADA and Supplier)
2. **Requirement management**
   - Compliance matrix
3. **PA follow-up meeting**
   - Every 2weeks, for each PA, held with procurement Gr. (PBS) and Support Gr. (Project Management)
   - Status of design/manufacturing and schedule
   - Achievement of Milestones on DWS (AWP/SMP/CDWS)
   - Resource availability/adequacy of each activity
   - Risk management table with prevention/mitigation actions
4. **Domestic Design review**
   - Dry-run held before CDR/PDR/FDR in IO
   - Review all technical/managerial materials, and confirm the design maturity

This Project management is successful, achieving 93% of AWP SMP (100% taking into account "obsolete") and 100% of AWP CDWS in 2014.

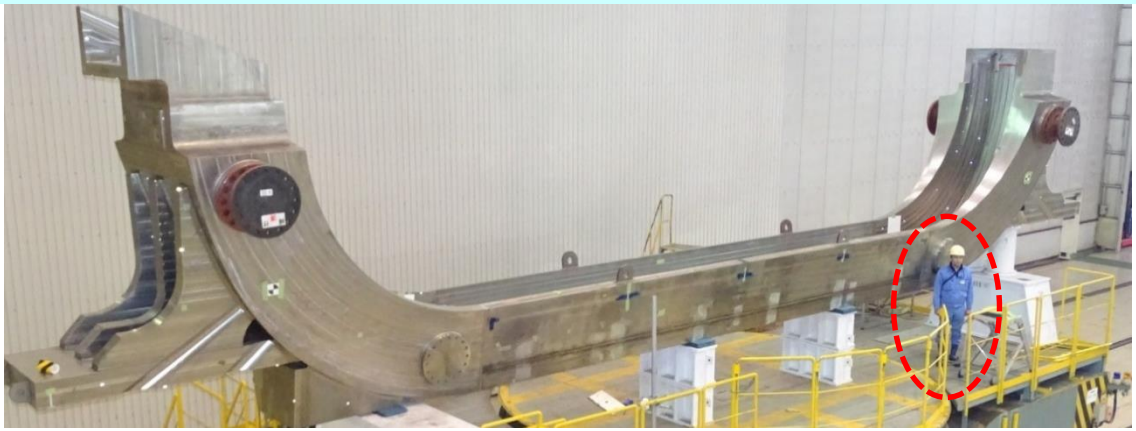
TF Coil Structures

Outboard Sub-assembly
(consisting of 4 Basic Segments
before welding B1+B2 and B3+B4)





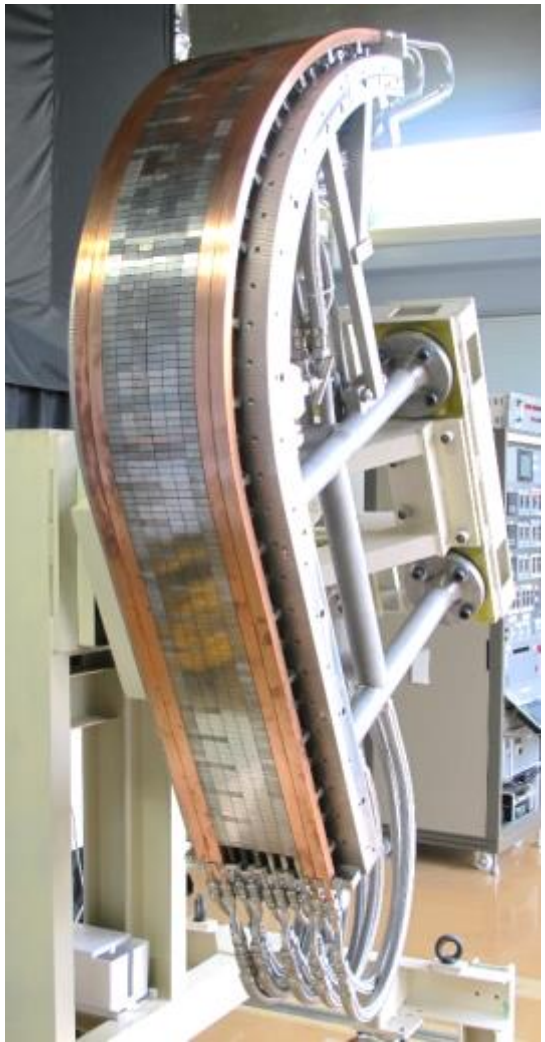
Inboard Sub-assembly (consisting of 3 Basic Segments)



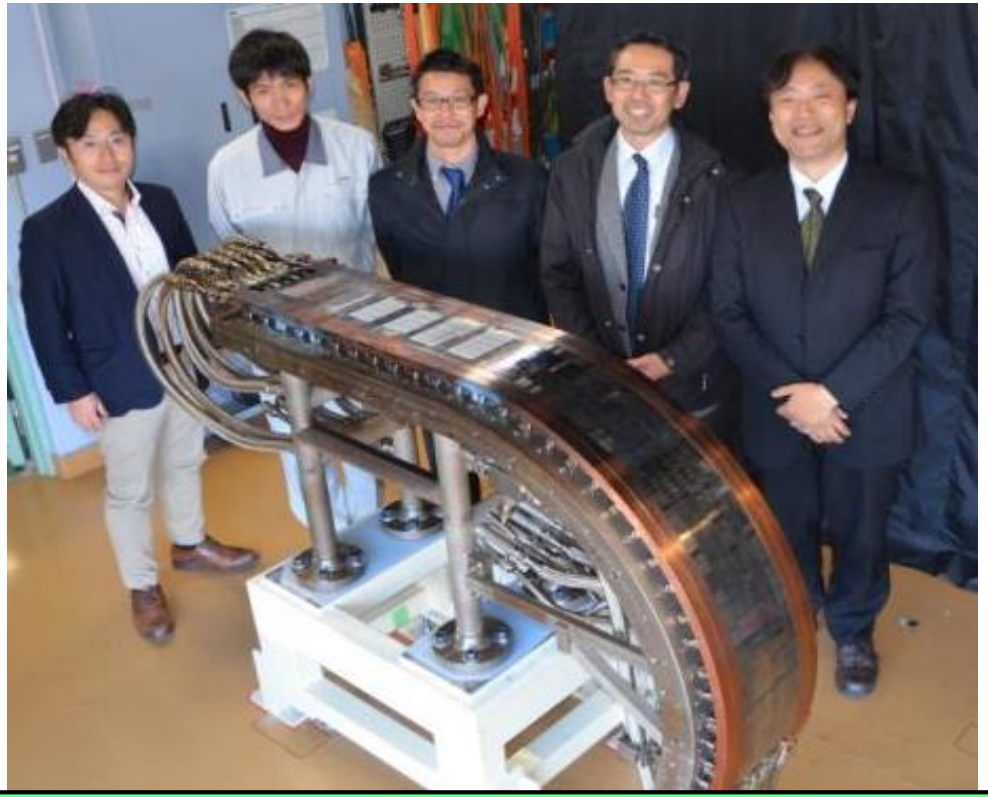
The sub-assemblies have been welded within required tolerance.

Full Tungsten Divertor Outer Vertical Target Prototype Plasma Facing Units

(1) Completion of manufacturing of full tungsten OVT prototype PFUs (Mar. 2015)



(2) Successful completion of high heat flux test (Dec. 2015)



(1) Manufacturing of full tungsten OVT prototype PFUs has been completed.

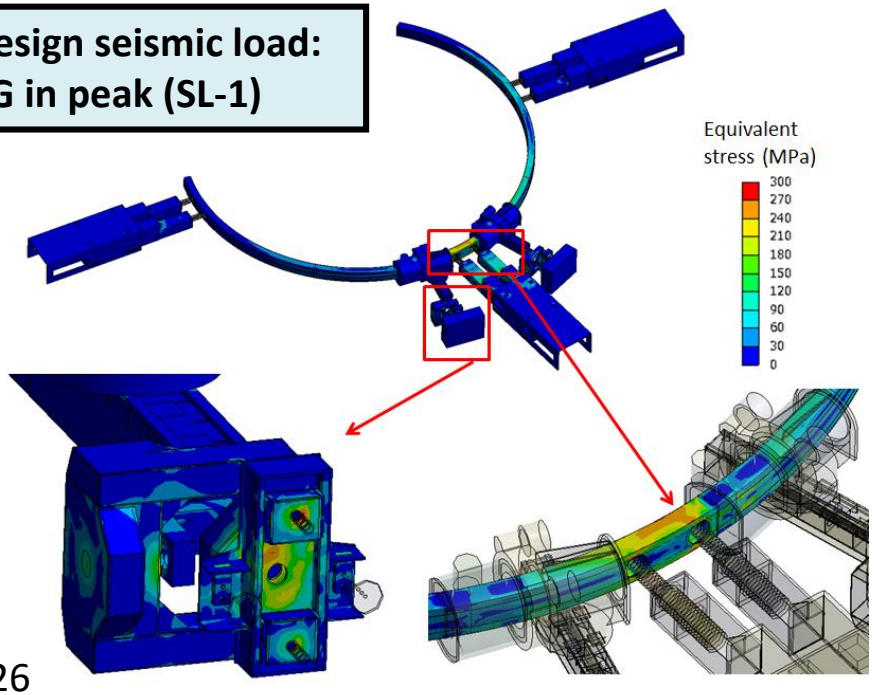
(2) High heat flux test of the prototype PFUs has been completed, and JADA has successfully been qualified in December 2015. ⇨ See Shimizu, IVC session on Day 3

Blanket RH System

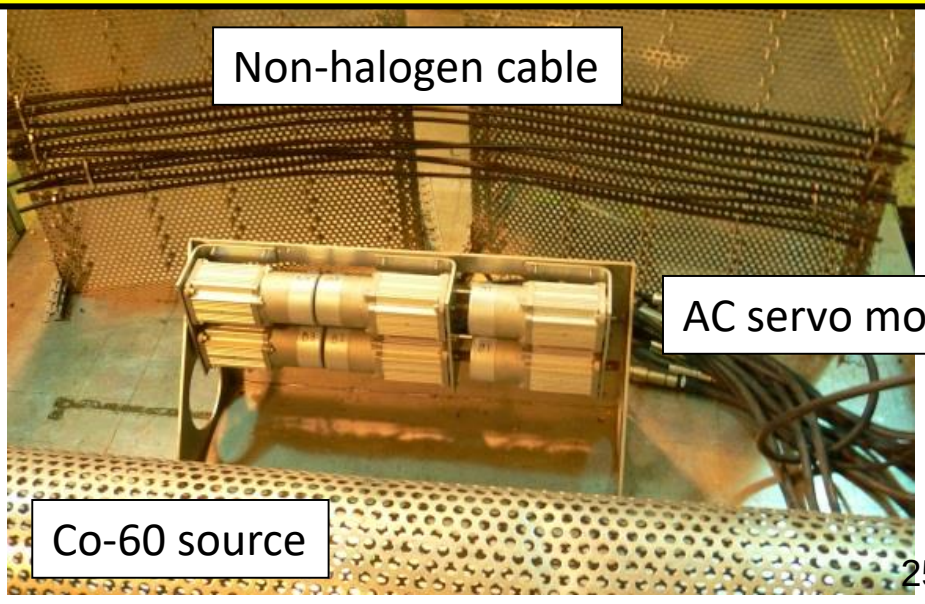
- ✓ PAs signed in Dec. 2011.
- ✓ Final Design Review for Package 1 (Vehicle and Manipulator) was closed in Jan. 2015.
- ✓ Final Design for other components in progress for FDRs to be held in 2017 and 2018.
- ✓ Manufacturing contract for Procurement Package 1 was awarded in Feb. 2015. Manufacturing design is on-going.
- ✓ Call for tender is on-going for manufacturing contract for Procurement Package 2 (rail deployment system).

Design on-going including structural analysis.

Design seismic load: 5G in peak (SL-1)



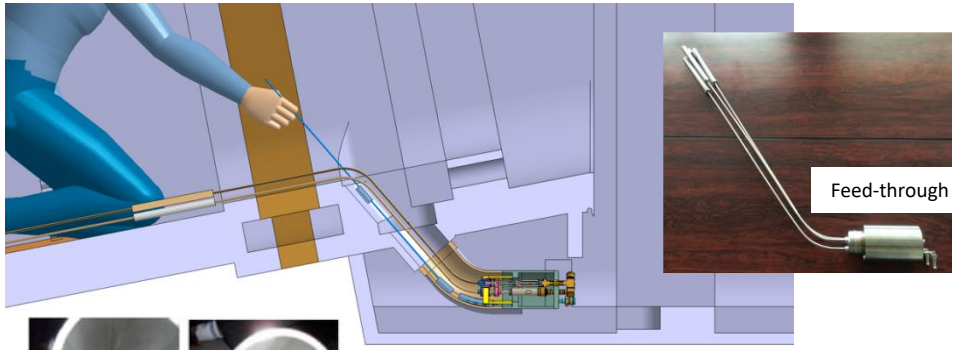
Test for design justification is also on-going such as irradiation test.
AC Servo motors confirmed to work after 8MGy irradiation (ITER requirement: 1MGy)



25/26

Diagnostics : MFC and Popola

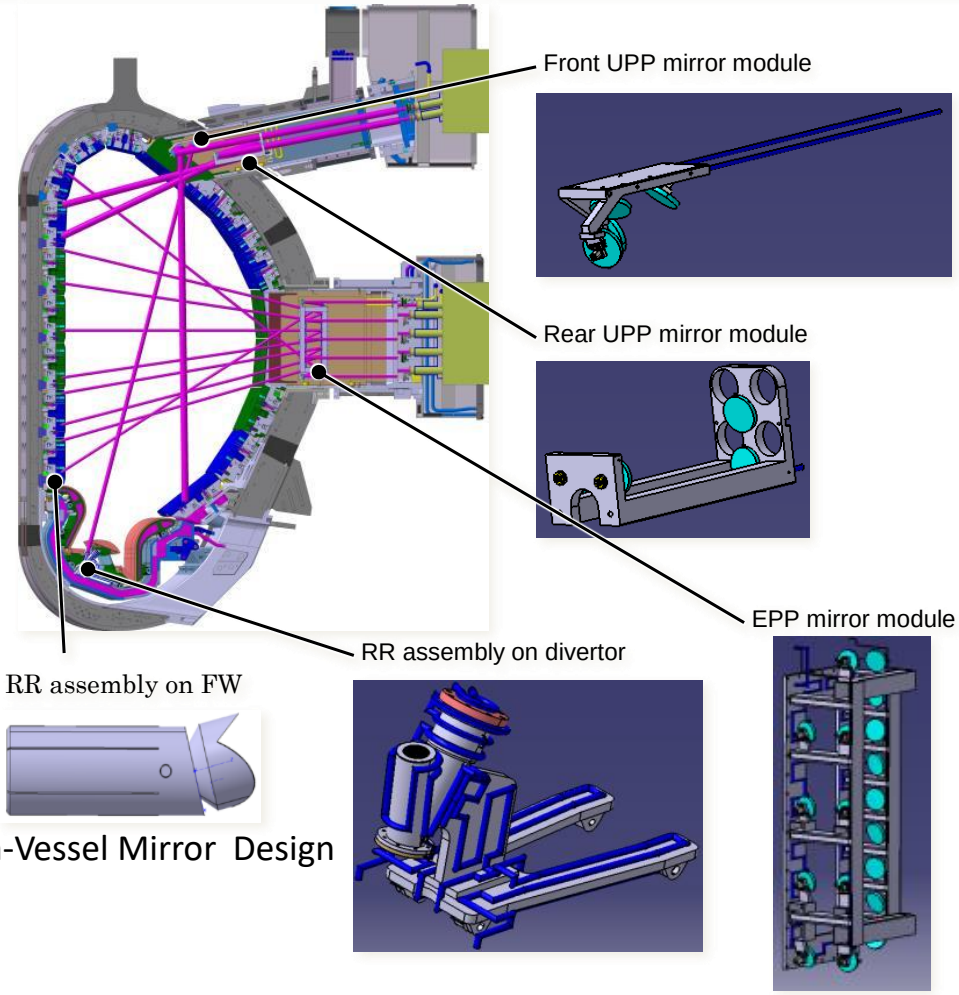
R&D for Vacuum Feed-through (SIC) of Micro Fission Chamber in progress.



Radiography Test by inserting film detected welding defects.

New building for development of ITER diagnostic systems was constructed in March 2015.

Preliminary Design Review of Poloidal Polarimeter was held in Nov. 2015



In-Vessel Mirror Design