S1-GLOBAL Collaborative Efforts
8-Cavity-Cryomodule:
2 FNAL, 2 DESY and 4 KEK

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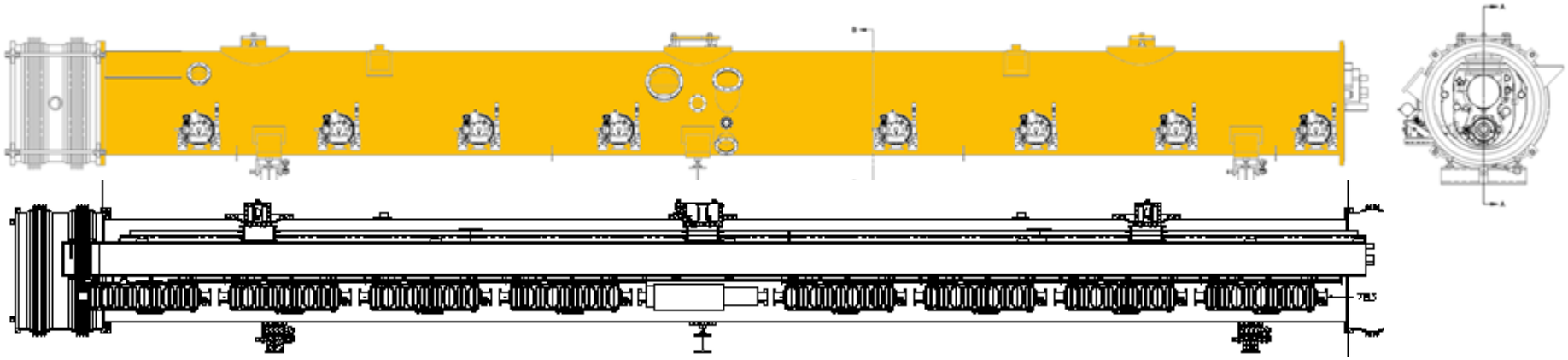
Introduction

Basic design of the ILC cryomodule:

- ILC main linac consists of 1815 cryomdules
  - 9 cavities in the 11830 mm cryomodule
  - 8 cavities and 1 quadrupole package in the module center
- Design accelerating gradient of cavities = 31.5 MV/m

As the R&D of ILC Main Linac in the GDE activities:

1. High gradient test of 9-cell cavity → S0
2. Cryomodule test (cavity-string) → S1
3. Beam test by an accelerator unit (Cryomodule string) → S2



S1-Global Cryomodule

The main target of the S1-Global:

- **Operating a cryomodule with an average accelerating gradient of 31.5 MV/m**
- **Construction of the cryomodule under the international research collaboration**

S1-Global International Collaborative Framework

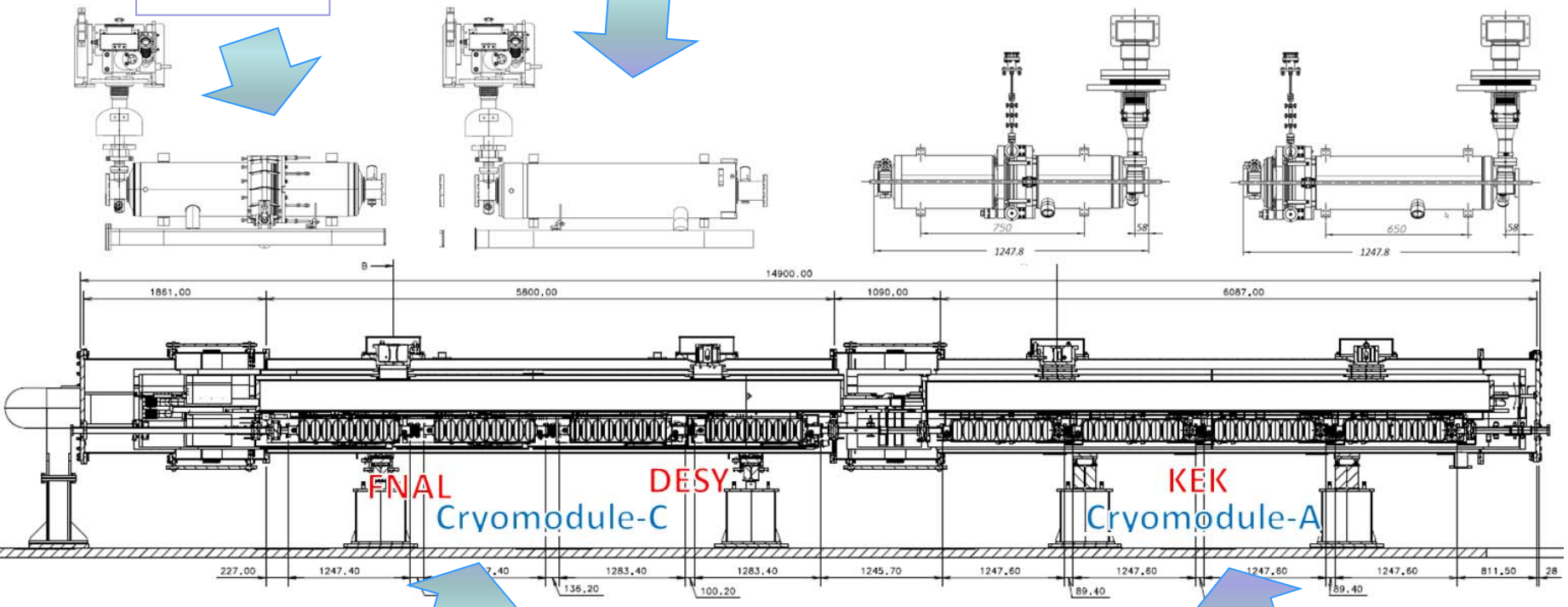
- **INFN: Design and construction Module-C and production of the blade tuners for the FNAL cavities.**
- **FNAL: Two TESLA type cavities, power coupler and integration of the INFN blade tuners in the cavity packages.**
- **DESY: Two TESLA type cavities, including Saclay-type tuners, and power couplers.**
- **SLAC: Power distribution system for Module-C , and aging of FNAL couplers.**
- **KEK: Four TESLA-like cavities, with two types of tuner design, Module-A for KEK cavities, power distribution for Module-A, and infrastructure for tests.**

S1-Global Cryomodule Overview

FNAL
INFN
SLAC

DESY

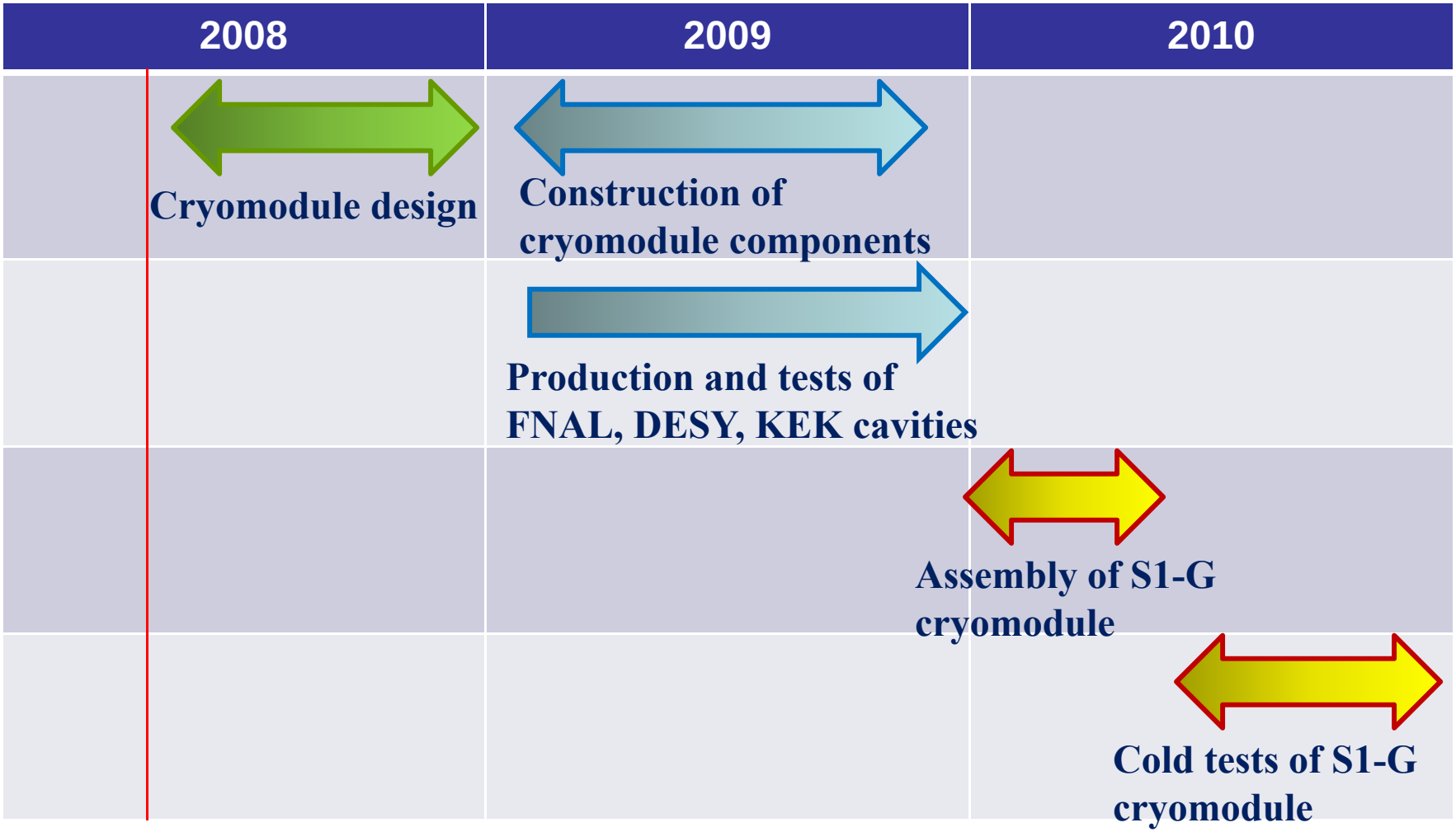
KEK



INFN

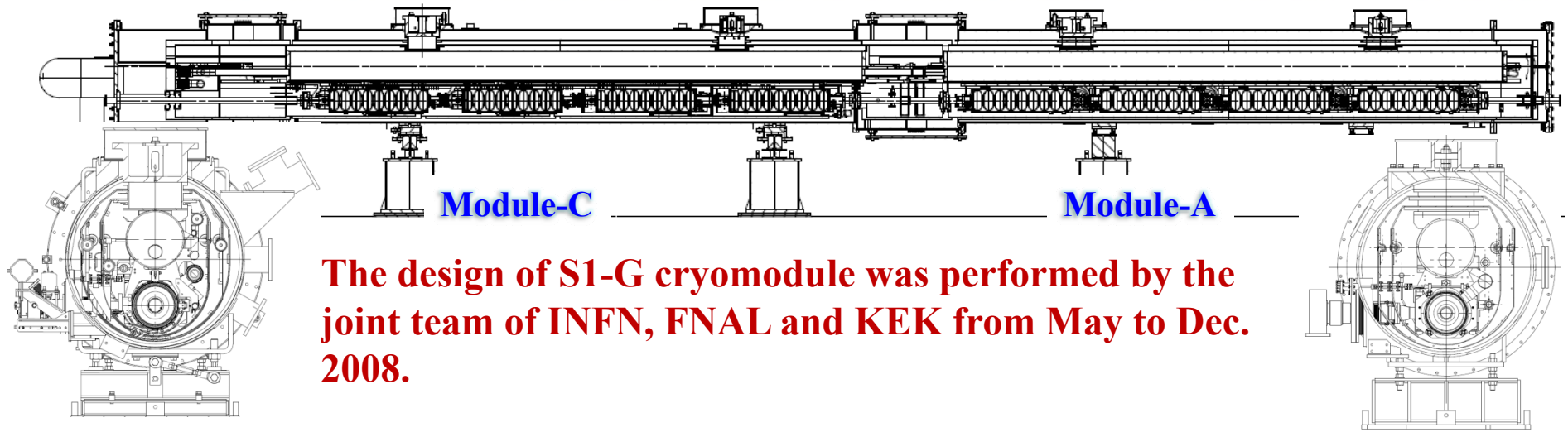
KEK

S1-G Cryomodule Schedule



Proposal of S1-G Cryomodule @ SC ML Tech. Mtg. at FNAL

Design of S1-G Cryomodule

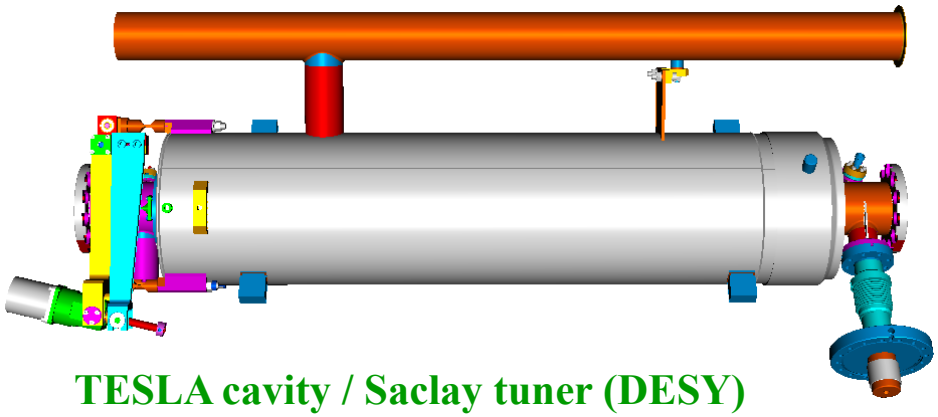


The design of S1-G cryomodule was performed by the joint team of INFN, FNAL and KEK from May to Dec. 2008.

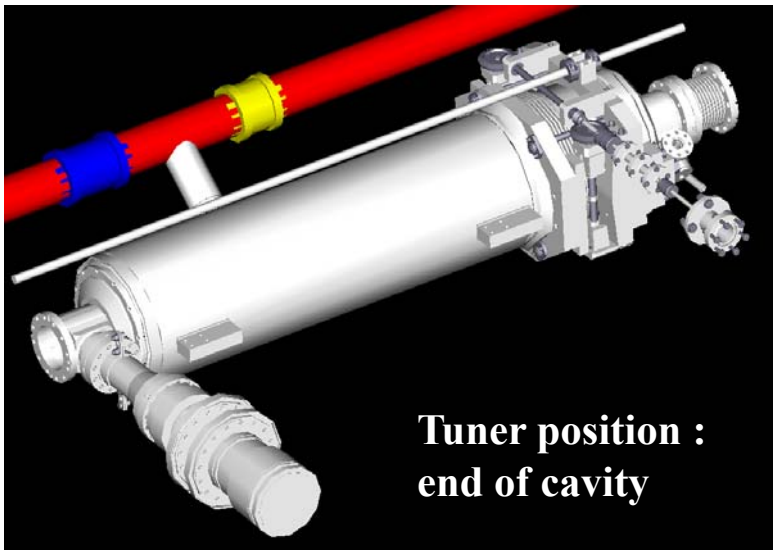
Features of S1-G cryomodule

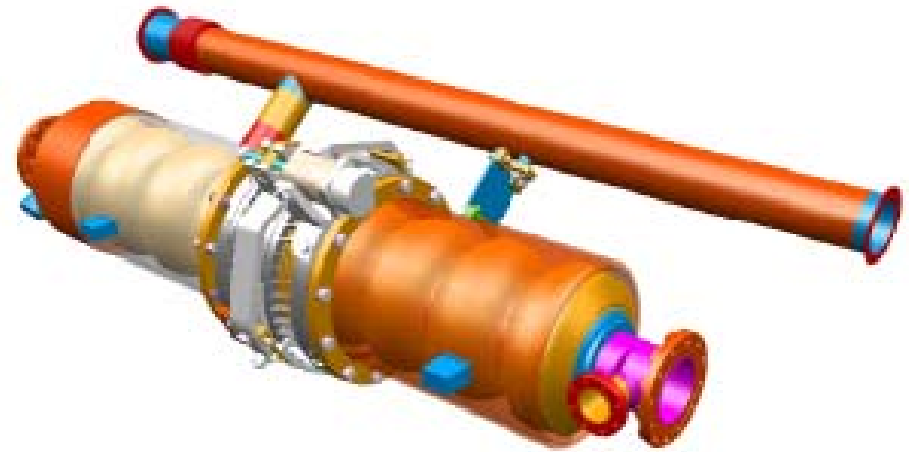
1. **The total length of the S1-G modules including end cans was designed to be 14.9 m.**
2. **The mechanical and thermal designs of the 6-m cryomodules were based on the design of the DESY TTF-III cryomodule.**
3. **S1-G cryomodule consists of two 6-m cryomodules:**
   - **DESY/FNAL cavities in Module-C**
   - **KEK cavities in Module-A**
4. **Four different types of cavity package:**
   - **FNAL: Tesla type cavity, Blade tuner, outer magnetic shield, L=1247.4 mm**
   - **DESY: Tesla type cavity, Saclay tuner, outer magnetic shield, L=1283.4 mm**
   - **KEK: Tesla like cavity, Slide jack tuner, inner magnetic shield, L=1247.6 mm**

Four types of cavities for S1-G Cryomodule

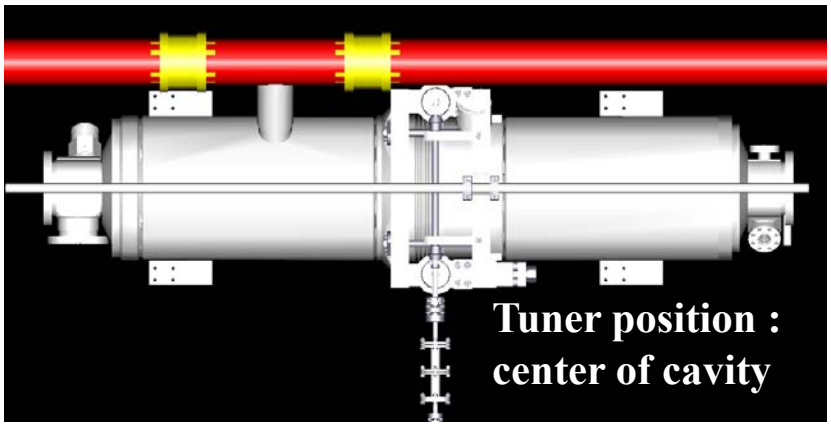


TESLA cavity / Saclay tuner (DESY)
Cavity Length = 1283.4 mm





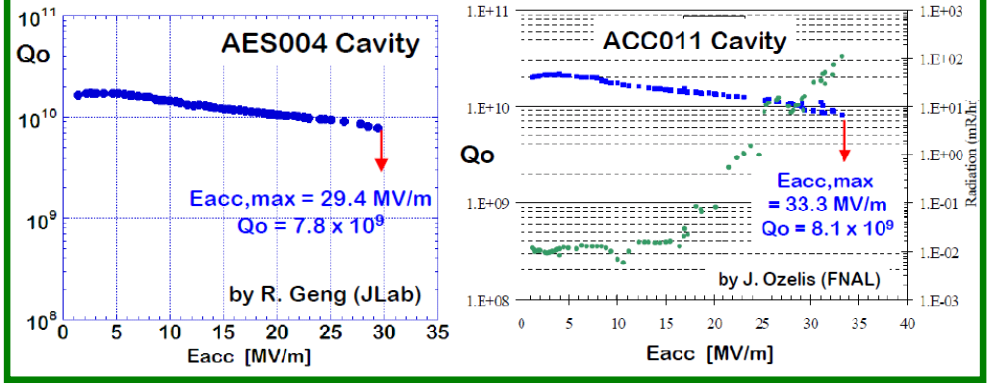
TESLA cavity / Blade tuner (FNAL)
Cavity Length = 1247.4 mm



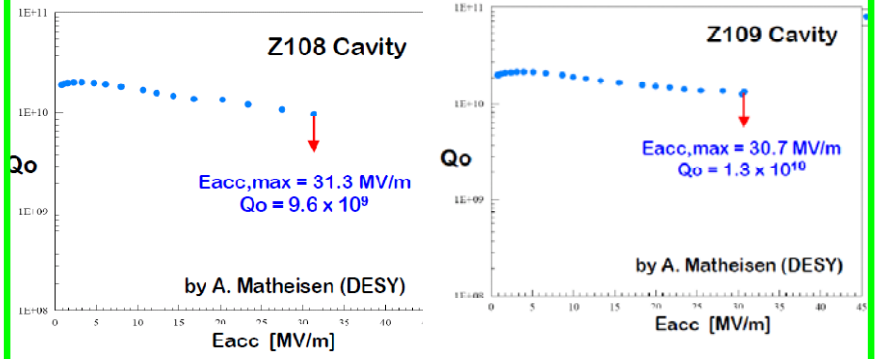
KEK cavity / Slide Jack tuner
Cavity Length =1247.6 mm

Cavity Performance

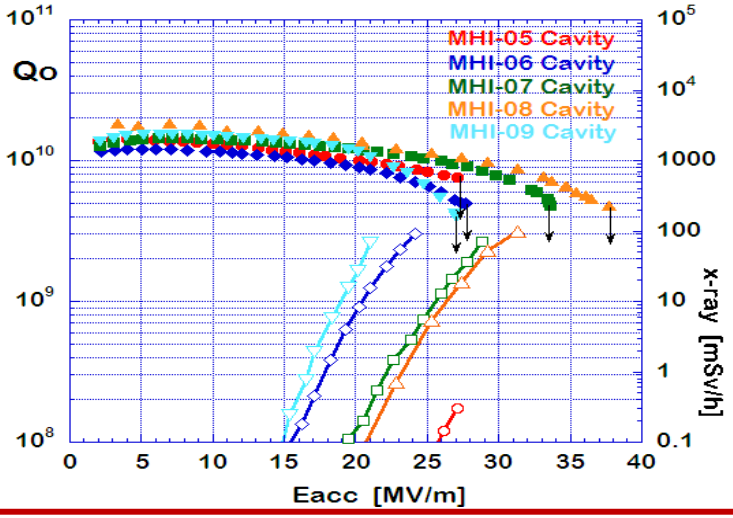
Two cavities from FNAL



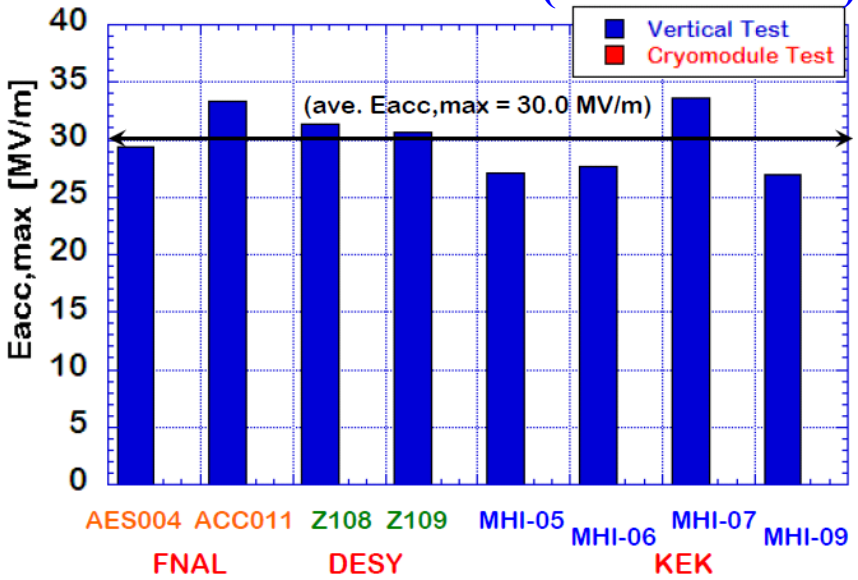
Two cavities from DESY



Four cavities from KEK



8 Cavities for S1-Global (ave. 30 MV/m)



Construction of S1-Global Cryomodule (1)

Construction of Module-C components by INFN/Italy

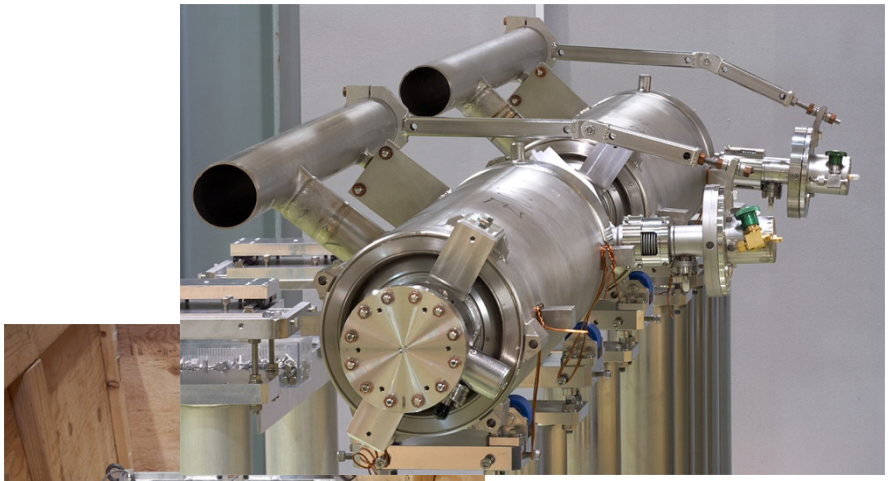
Assembling sensors on GRP by KEK team

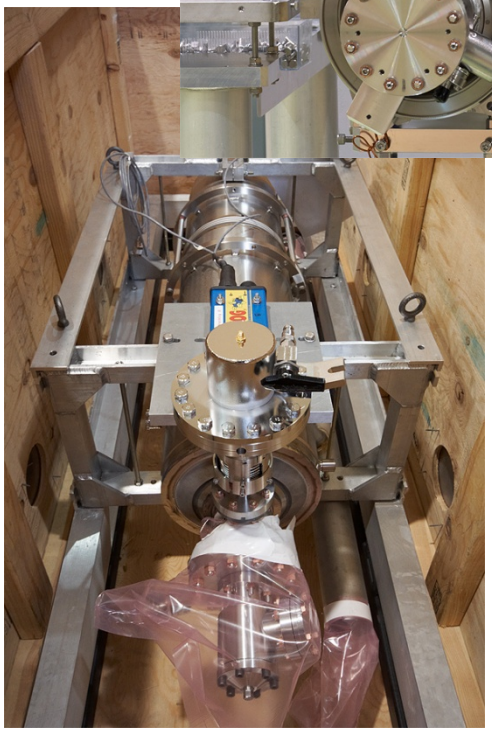
2009, July

Construction of S1-Global Cryomodule (2)

Vacuum vessel and cold components from INFN/Italy

Two cavities from DESY/Germany

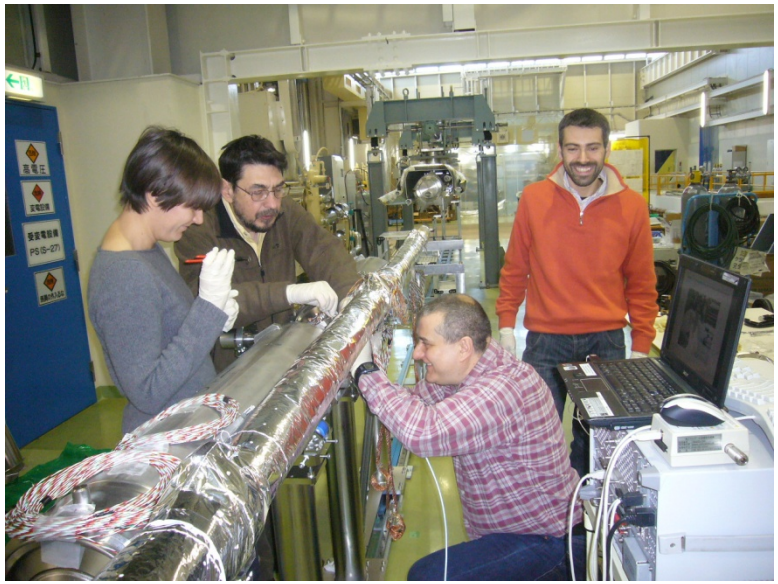




2009, December

Construction of S1-Global Cryomodule (3)

Assembly of DESY/FNAL four cavities

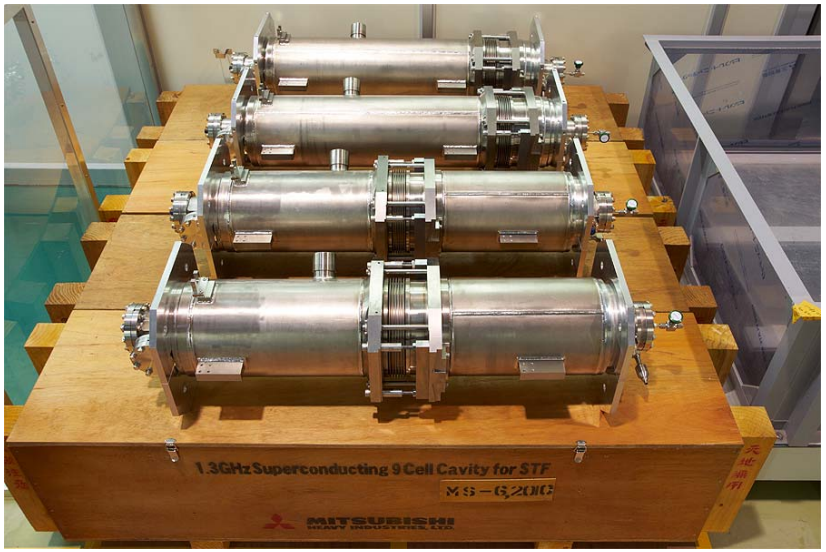


2010, January

Tuner assembly by INFN/FNAL

Construction of S1-Global Cryomodule (4)

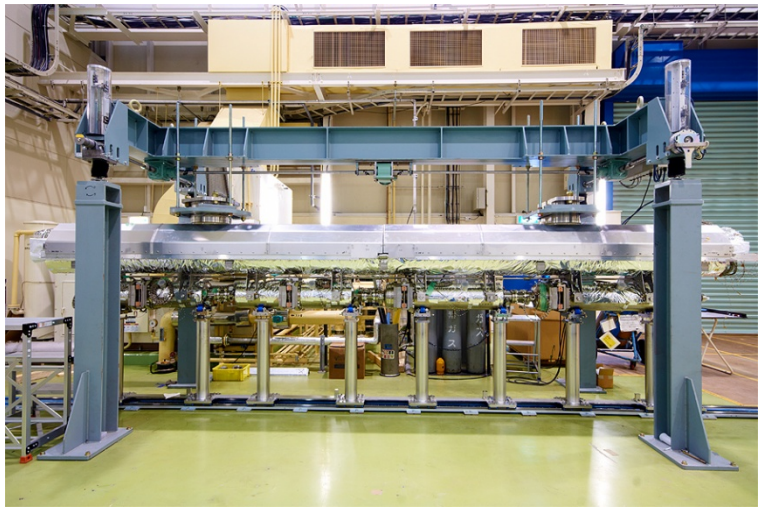
Assembly of four KEK cavities

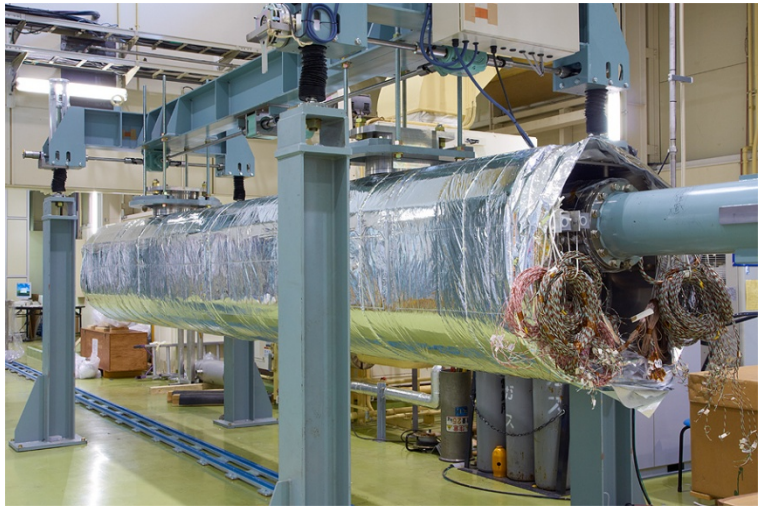


2010, February

Construction of S1-Global Cryomodule (5)

Assembly of cold mass





2010, March

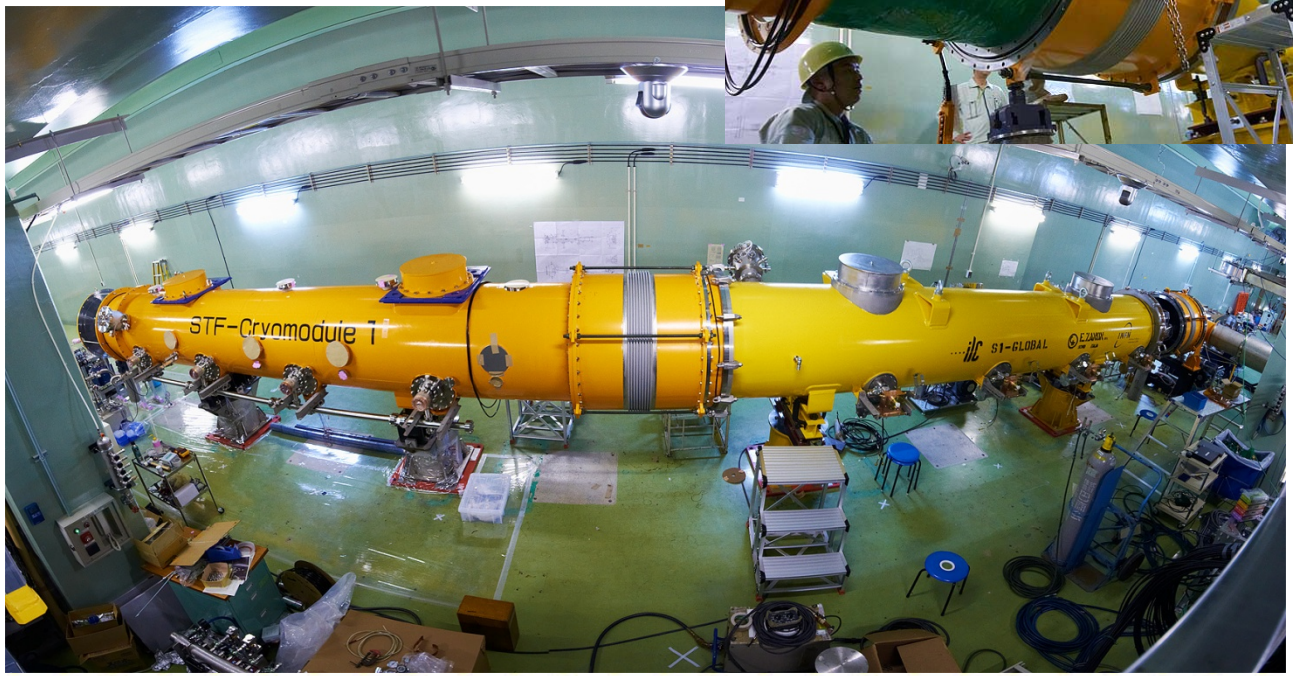
2010, April

Construction of S1-Global Cryomodule (6)

Assembly of DESY/FNAL/KEK warm couplers

DESY/FNAL warm couplers

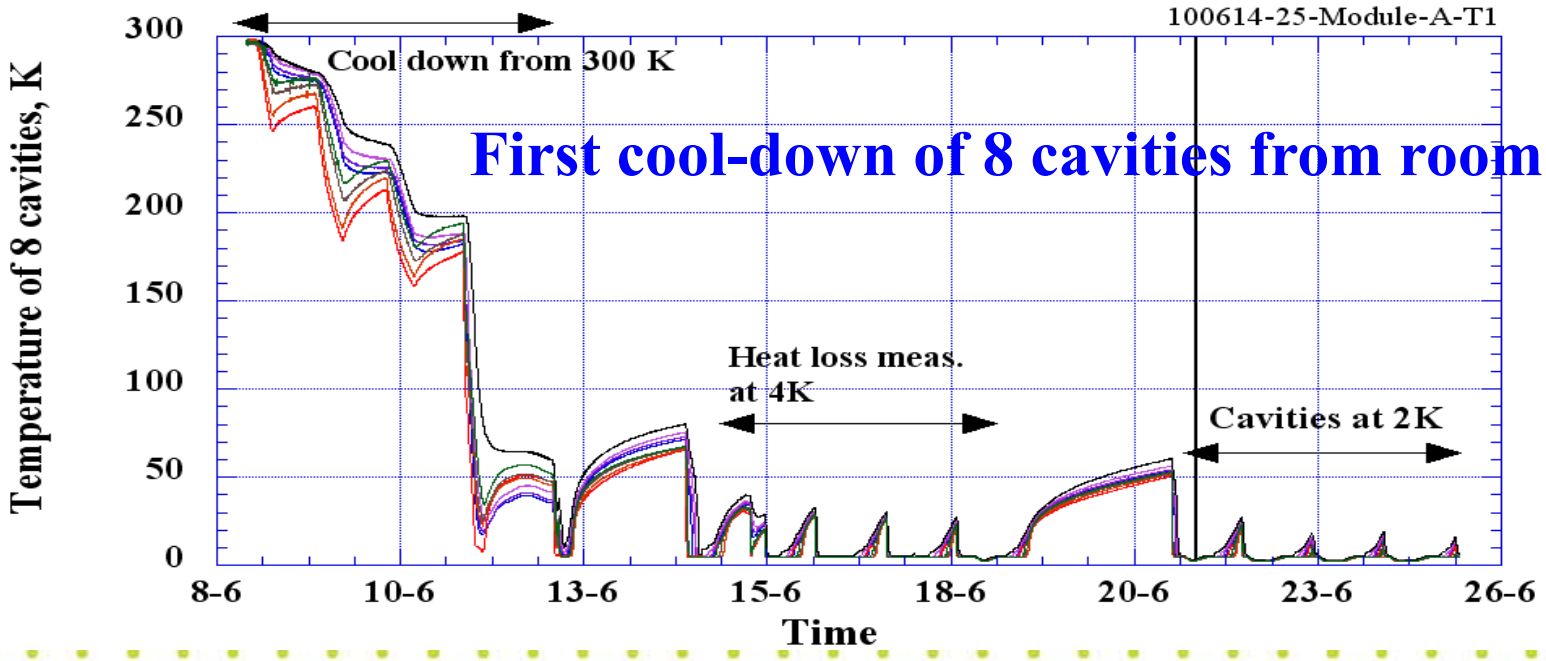
Connection of Module-A and C



2010, May

Cold Test of S1-G Cryomodule

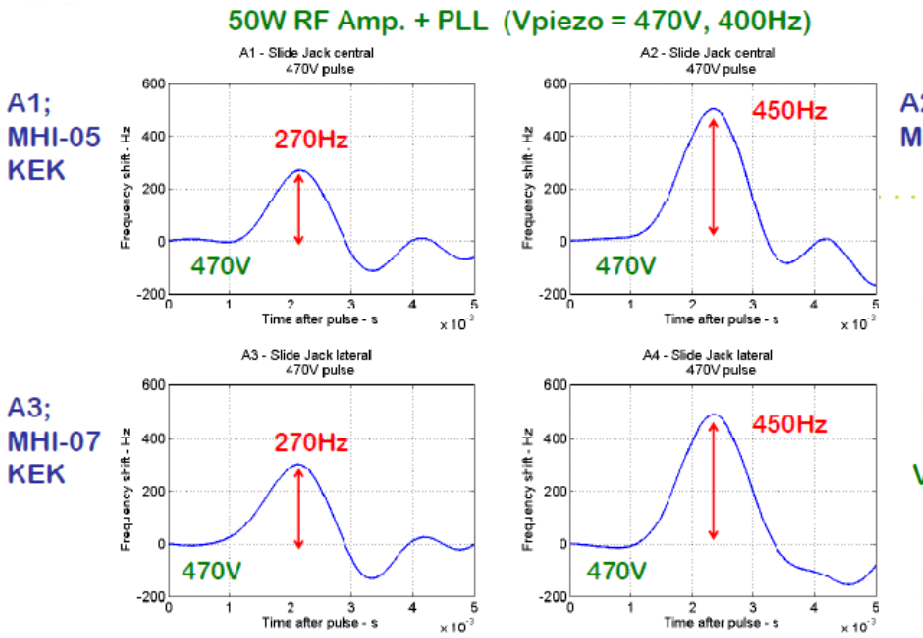
June	July	August	Sept.	Oct.	Nov.	Dec.
Low power RF test Heat loss measurement		Summer shut down	High gradient test	Lorentz Detuning Dynamic loss meas. Heat loss meas.		DRFS



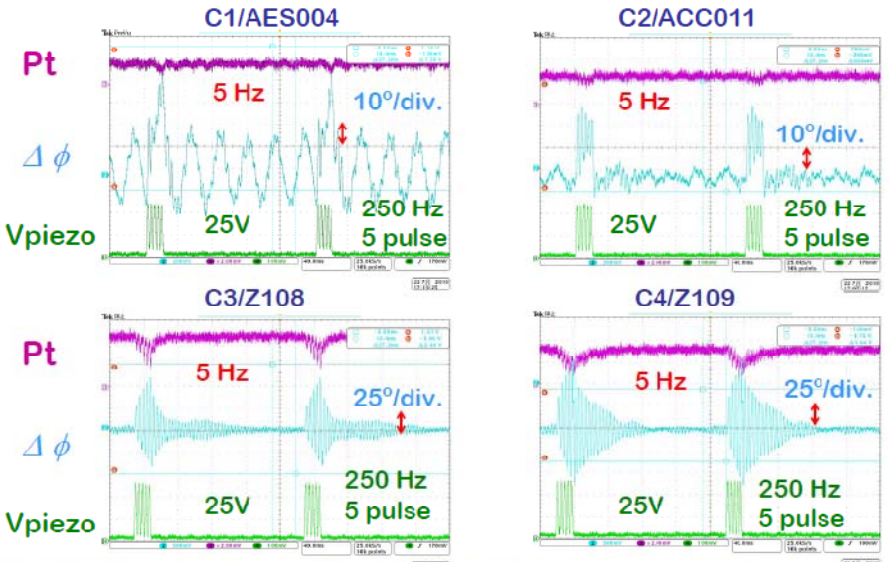
First cool-down of 8 cavities from room temp.

Tuner test

Single pulse response (Cryo-A) by Piezo tuner



Mechanical vibration mode (Cryo-C) by 5 continuous pulses of Piezo



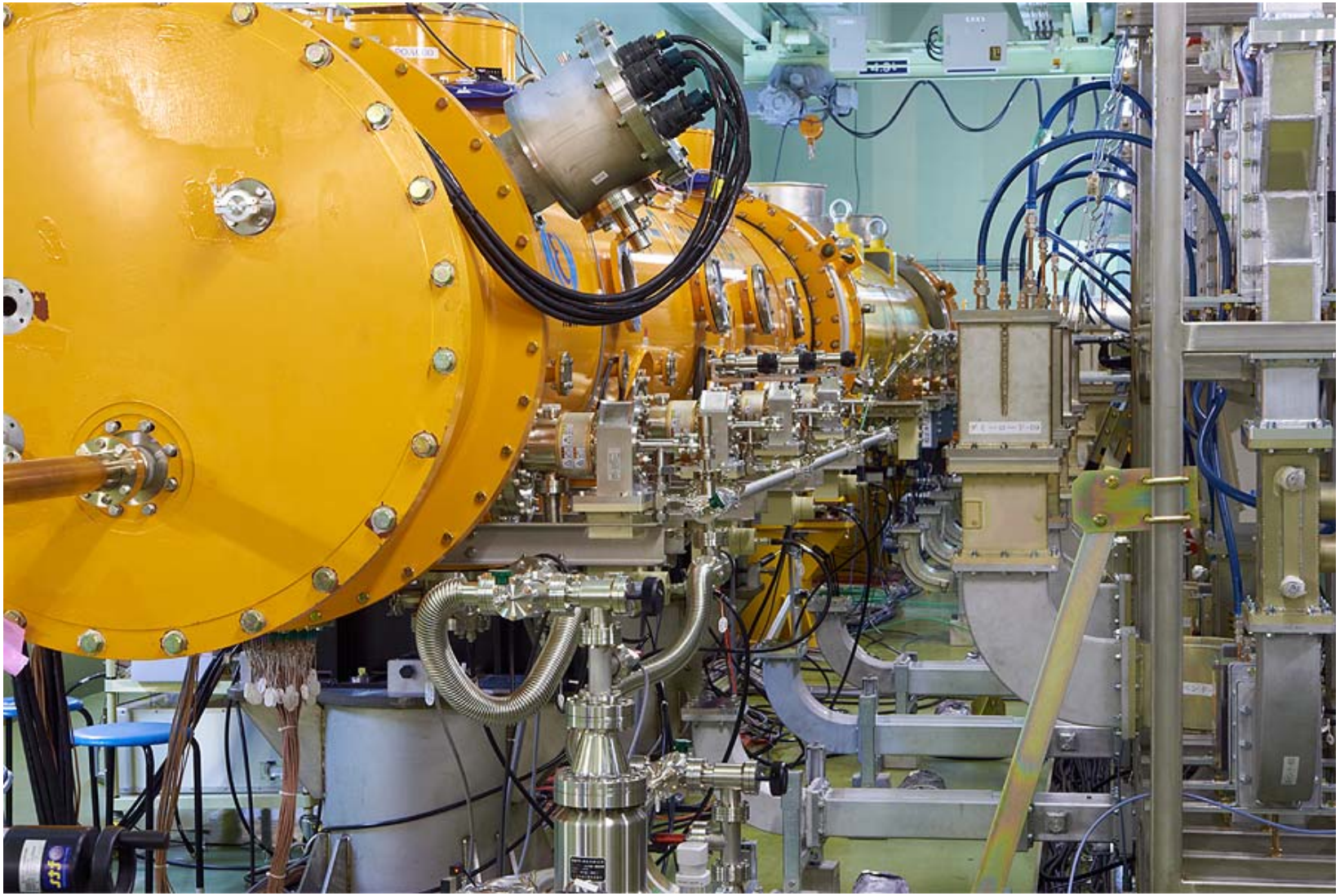
Scheduled tests at the 2nd term

The second cold test term: 15 weeks from Sept. to Dec.

- Static heat loss measurements at 4K and 2K
- High gradient test (individual cavities)
- Lorentz detuning measurements and compensation
- Dynamic heat load measurements at single cavity, four cavities and eight cavities
- LLRF
- Distributed RF system (DRFS) test

At the end of December, the cold tests of S1-Global cryomodule will be completed.

Ready for High Power Test, Now



Summary

- As the leading project of ILC, the S1-Global cryomodule was successfully constructed on schedule under the international research collaboration of INFN, DESY, FNAL, SLAC and KEK.
- In the 1st cold test, the S1-G cryomodule was cooled down to 2 K, and all functions were confirmed.
- The S1-G cryomodule has started to be cooled down again, and the cold tests will be continued until the end of this year.

Thank you for your attention.
Thanks to S1-Global cryomodule team.