

**ERL meeting
02/20/2007**

STF status & schedule

Hitoshi Hayano, KEK

STF development plan update

Phase 1 (2005 -2007),

for quick startup of ILC SCRF, **infra-structure** development

subdivided to

Phase 0.5 : 1 cavity in each short cryostat (cool down:Mar.2007)

Phase 1.0 : 4 cavities in each short cryostat (cool down:Sep.2007)

Phase 1.5 : replacement of 4? cavities by improved new 4? cavities
(cool down:Apr.2008)

Phase 2 (2007 - 2009),

develop **ILC Main Linac RF unit**

start design Apr. 2007

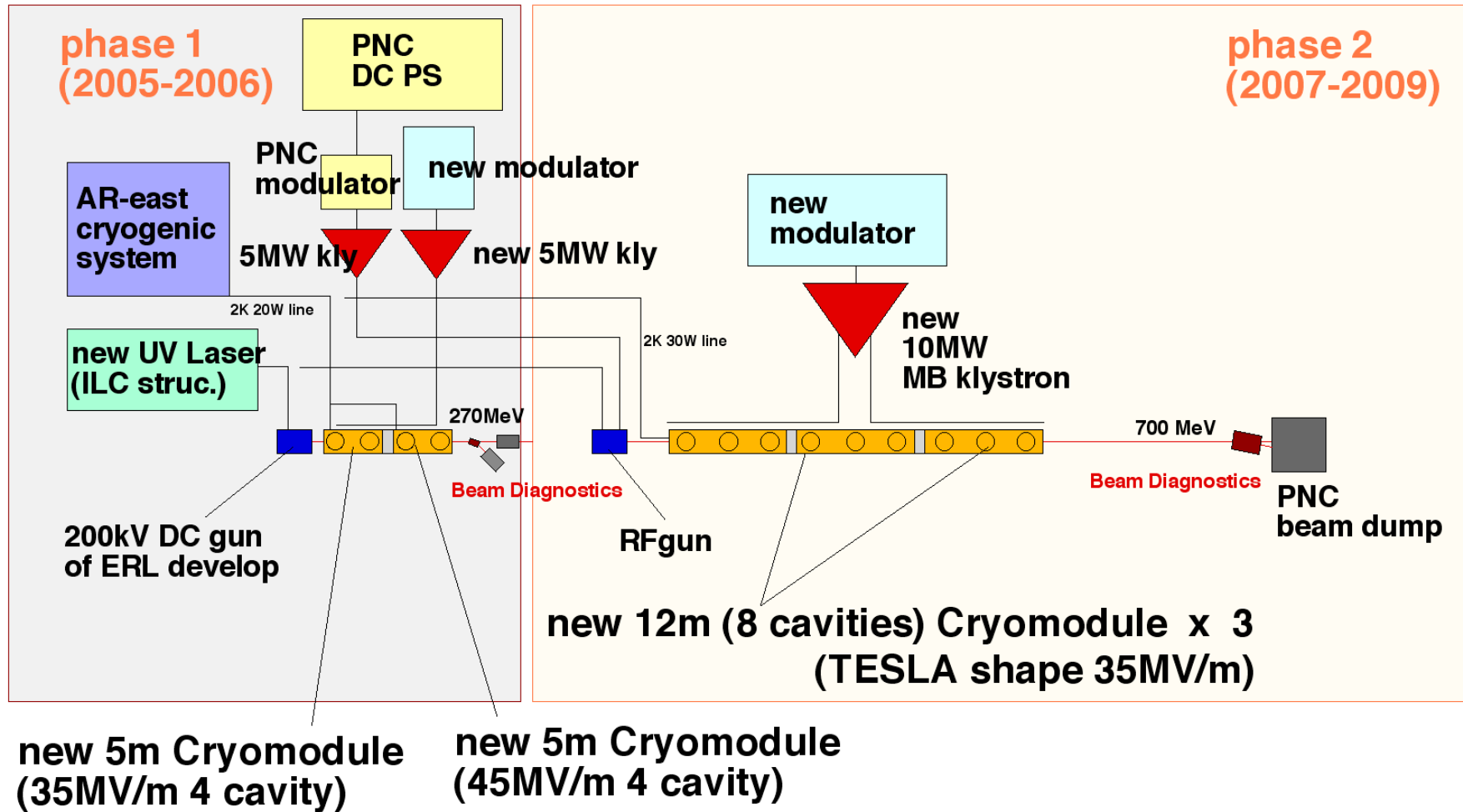
fabrication in 2008 and 2009

completion end of 2009

GDE S0 task (2006 - 2009)

develop **ILC performance cavity**

Plan of Superconducting RF Test Facility (STF)





Cryogenic liquefier

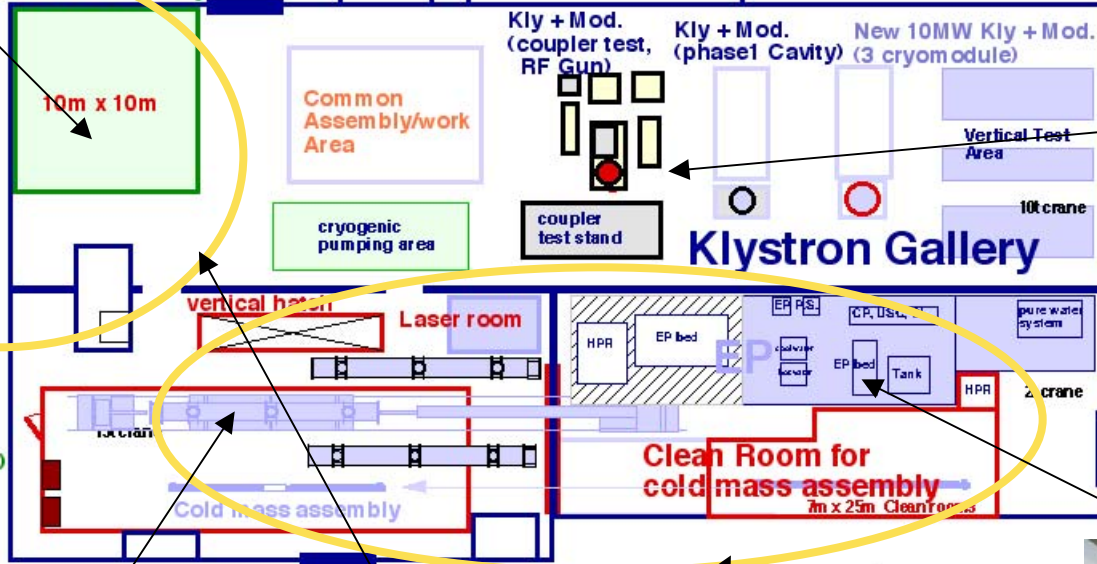
STF Building plane view

STF棟 (旧陽子リニアック棟) 平面図

Cryogenic System (from AR East)



Control Room

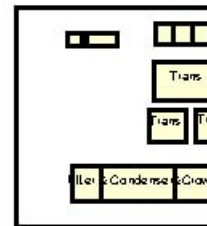


Klystron Gallery

Cavity Process (EP) & assemble Area (clean rooms)

Cryogenic Compressor (from AR-East)

Cryomodule Assemble Area



For EP, Clean Room

Infra-structure for SC-RF production

SC Infra-structure

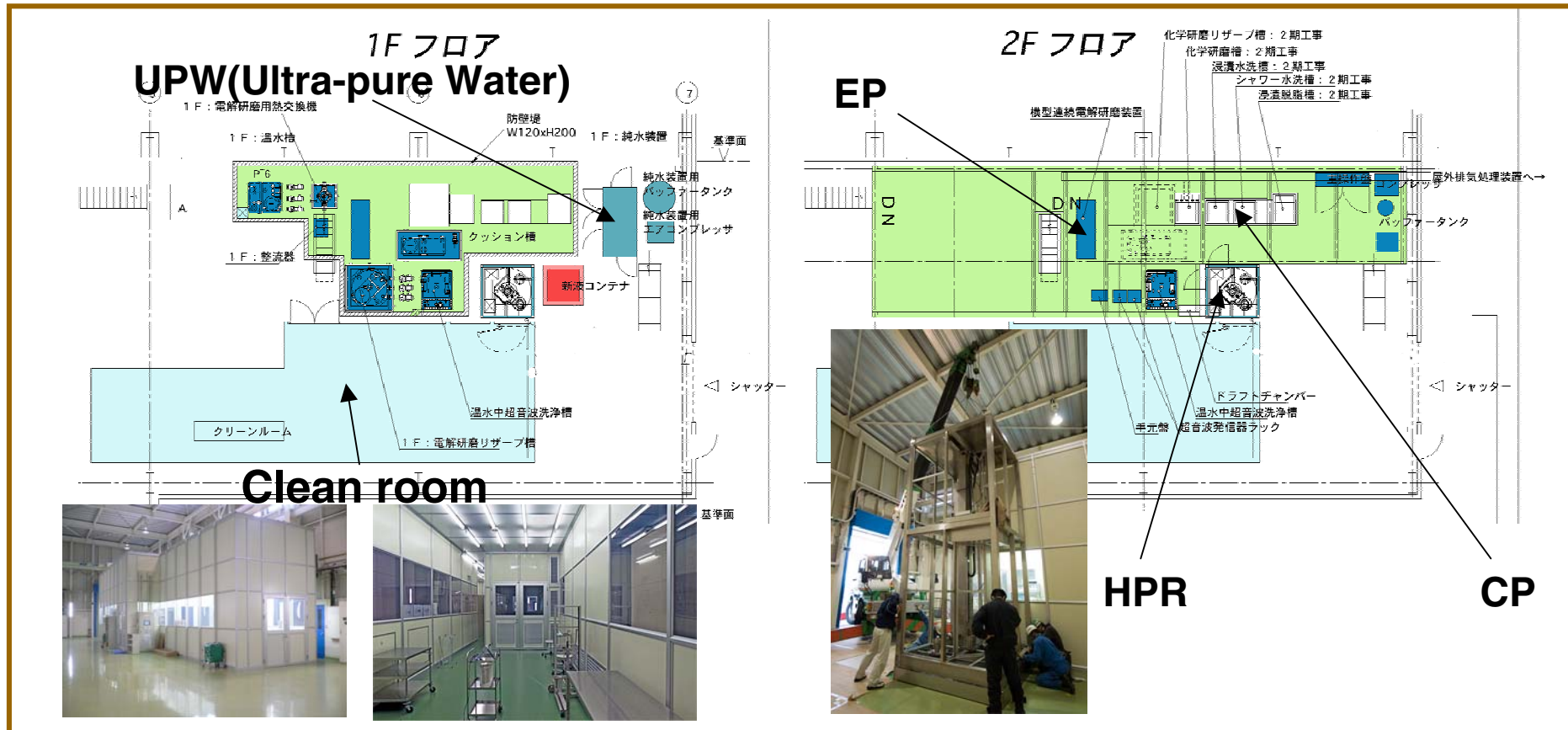
Clean room: in operation for use of short cryomodule assembly.

UPW: in operation.

HPR: under construction. will be completed in Jan. 2007.

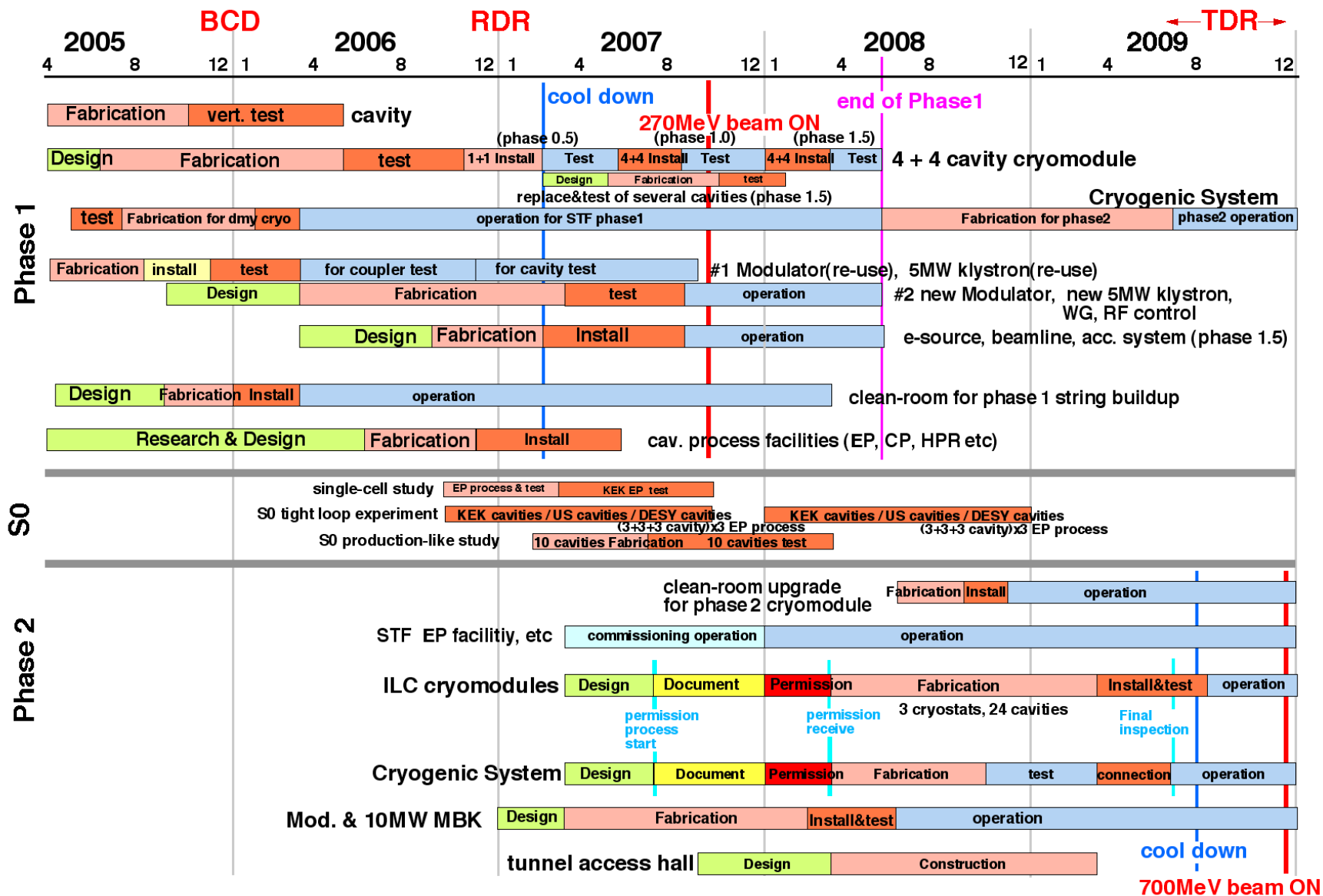
EP: under construction. will be completed in Mar. 2007.

CP & acid tank system: will be constructed in JFY2007.



STF long-term Plan

H. Hayano 01192007



Outline of JFY2006 R&D

High Gradient Linac

1. Cavity R&D

TESLA-style 9 cell cavities

two disk window input couplers

slide jack tuners

LL 9 cell cavities

capacitive coupling input coupler

coaxial ball-screw tuners

surface treatment study using LL single cell

2. STF (Superconducting RF Test Facility)

cryomodule assembly

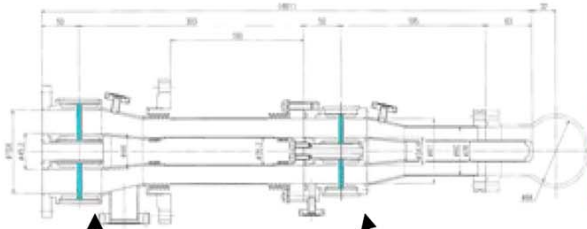
cryogenic transfer line construction

5MW RF power system

Beam line design and construction

TESLA style Baseline Cavity Package

Two Disk Window Input Coupler



Warm Window Cold Window



Warm Coupler & Cold Coupler



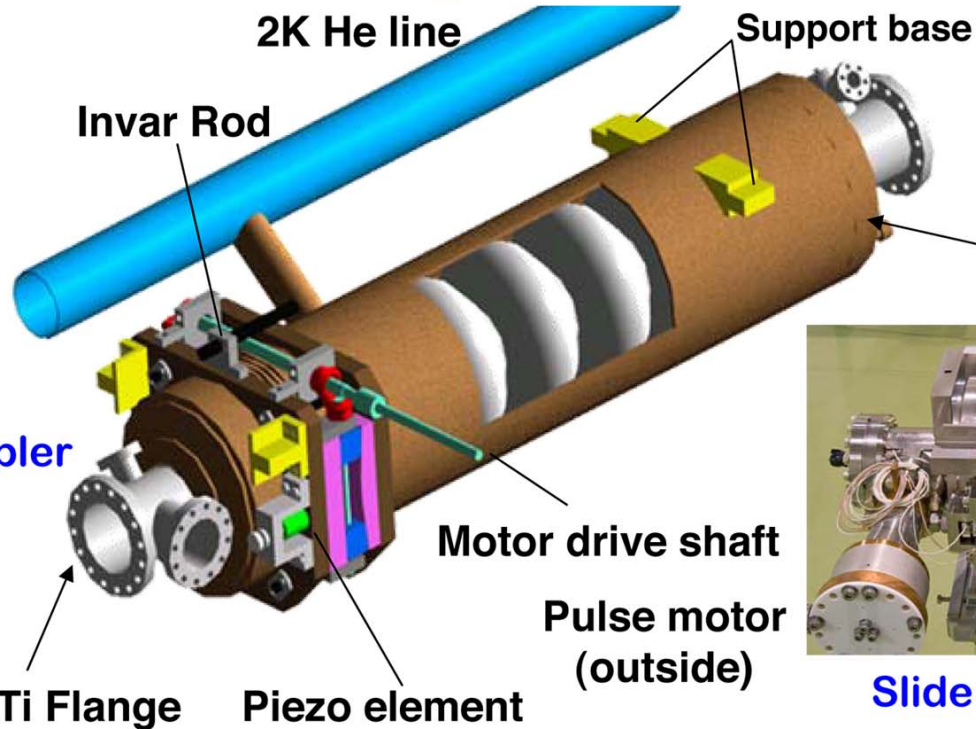
HOM Coupler



a Cavity covered with Ti Jacket

2K He line

Support base



Invar Rod



3 Cavities (Vertical test)

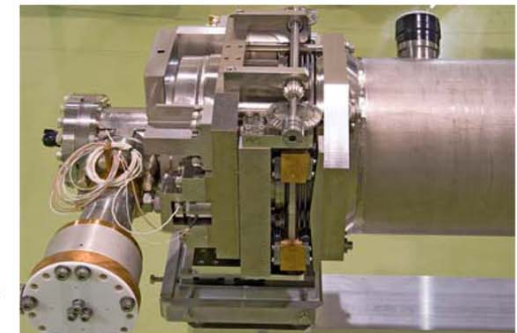
Titanium Jacket

Motor drive shaft

Pulse motor (outside)

Nb/Ti Flange

Piezo element



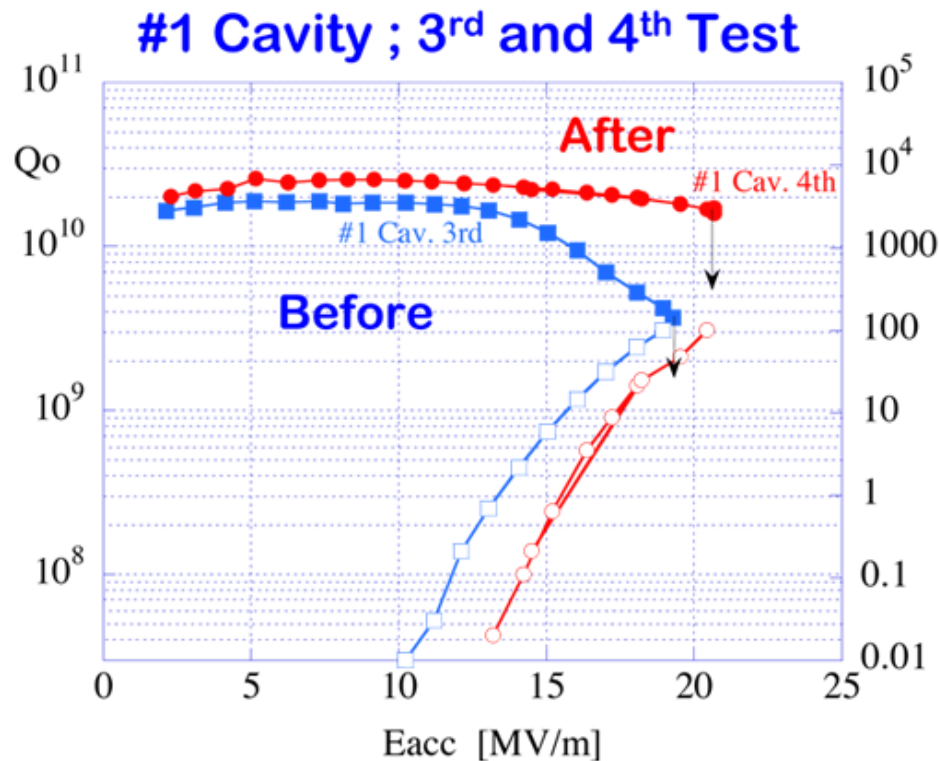
Slide Jack Tuner

Total 4 9-cell cavity were fabricated.

TESLA style Baseline Cavity Package

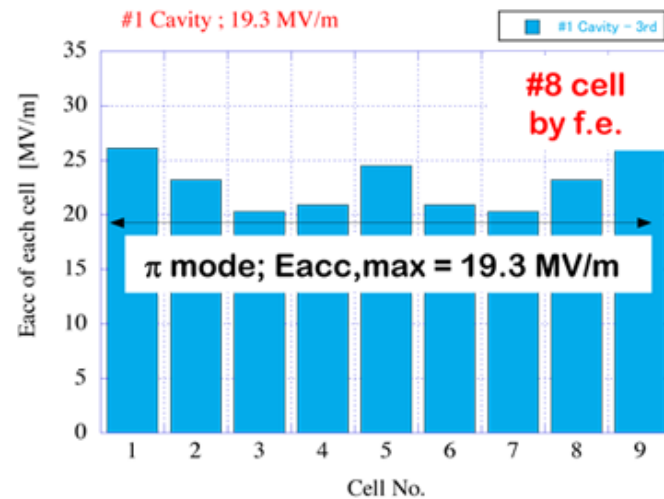
#1 Cavity Performance

Comparison before/after 2nd B.P.
 (additional surface removal of ~250 μm)

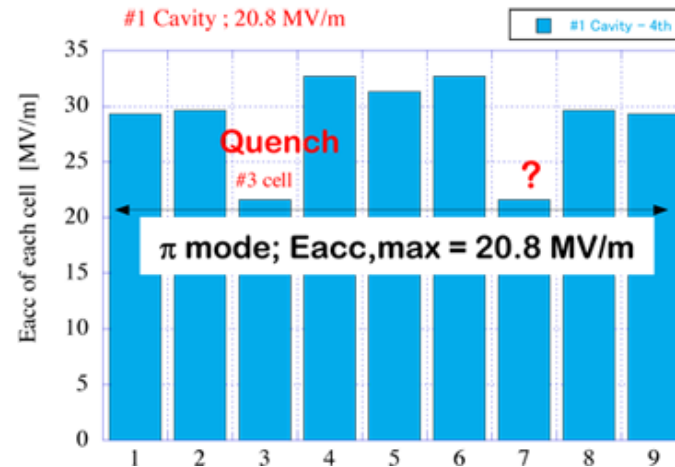


One cell is limited at ~20 MV/m (? #7),
 but others are ~30 MV/m.

#1 Cav. 3rd



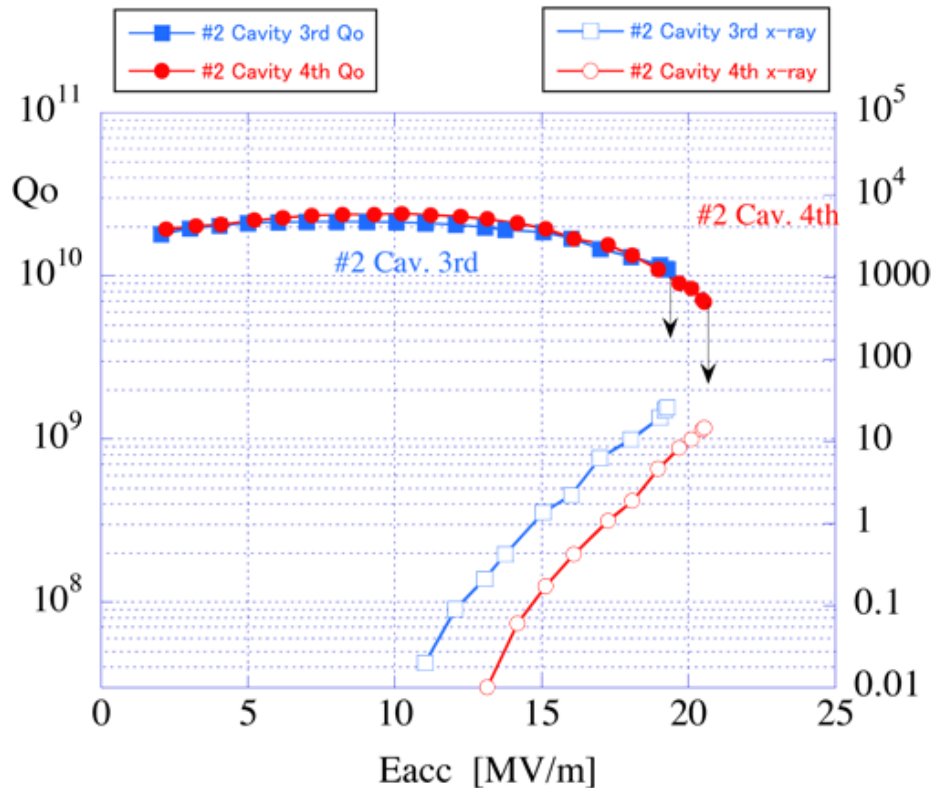
#1 Cav. 4th aft. 2nd Barrel Polishing



TESLA style Baseline Cavity Package

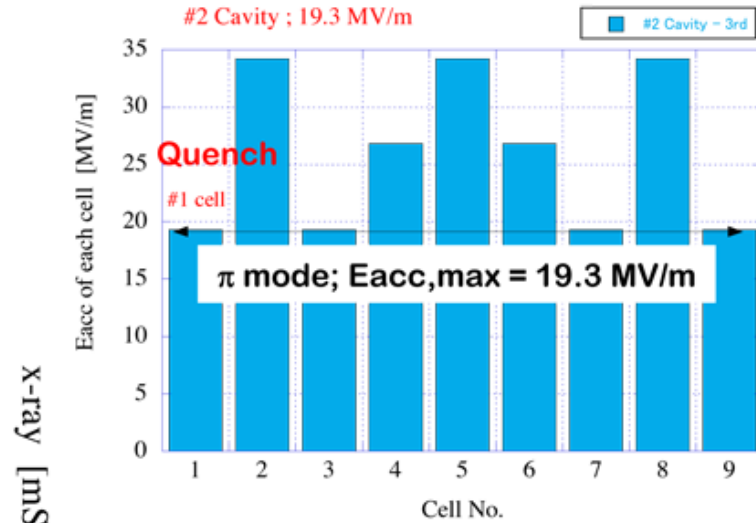
#2 Cavity Performance

#2 Cavity ; 3rd and 4th Test

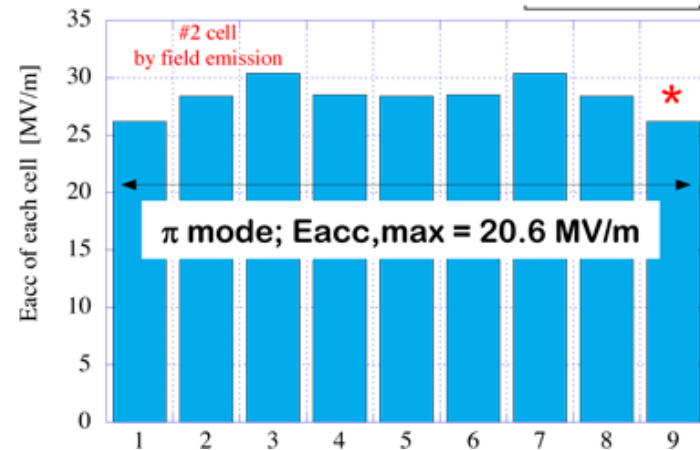


If no field emission,
Eacc,max~25 MV/m (#9) will be possible.

#2 Cav. 3rd



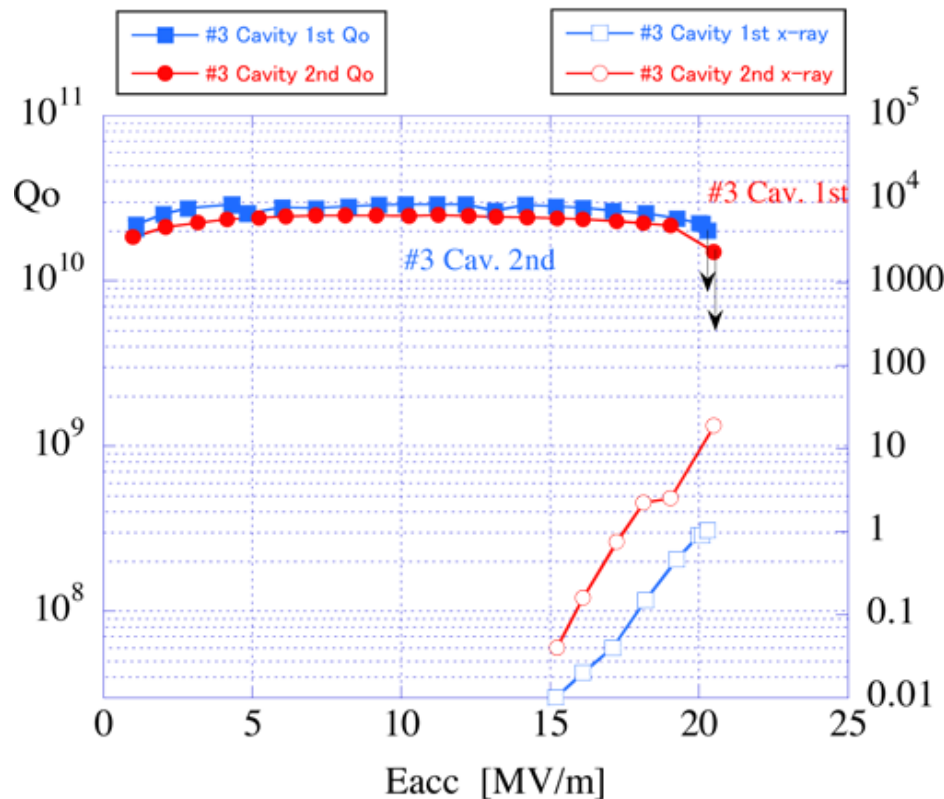
#2 Cav. 4th aft. 2nd Barrel Polishing



TESLA style Baseline Cavity Package

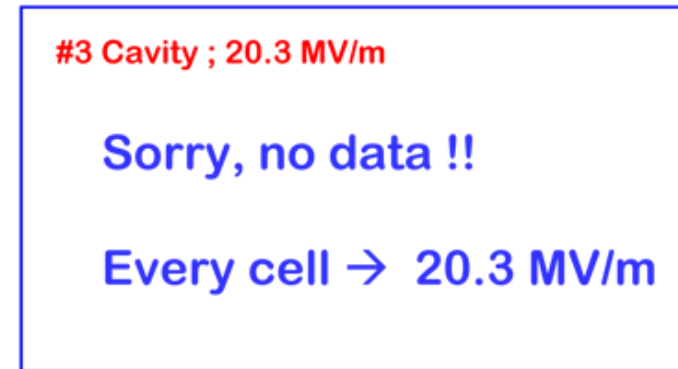
#3 Cavity Performance

#3 Cavity ; 1st and 2nd Test

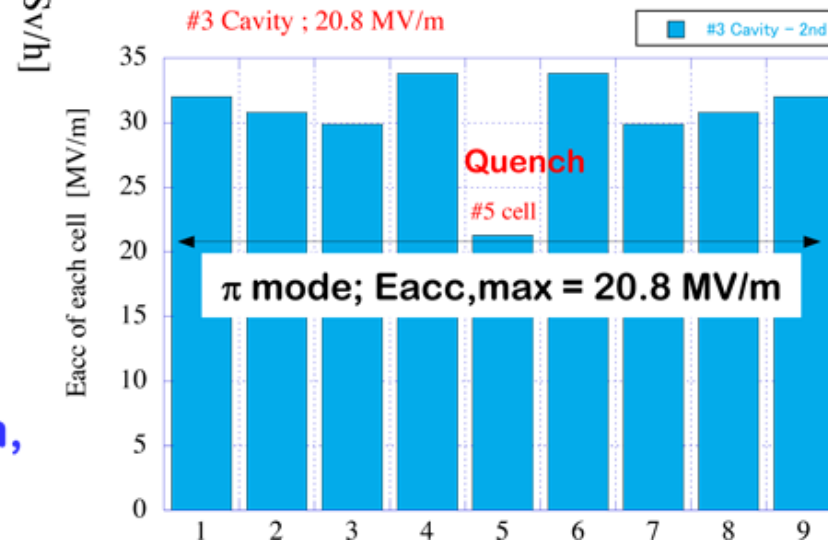


Only one cell is limited at ~21 MV/m, but others are ~ 30 MV/m.

#3 Cav. 1st



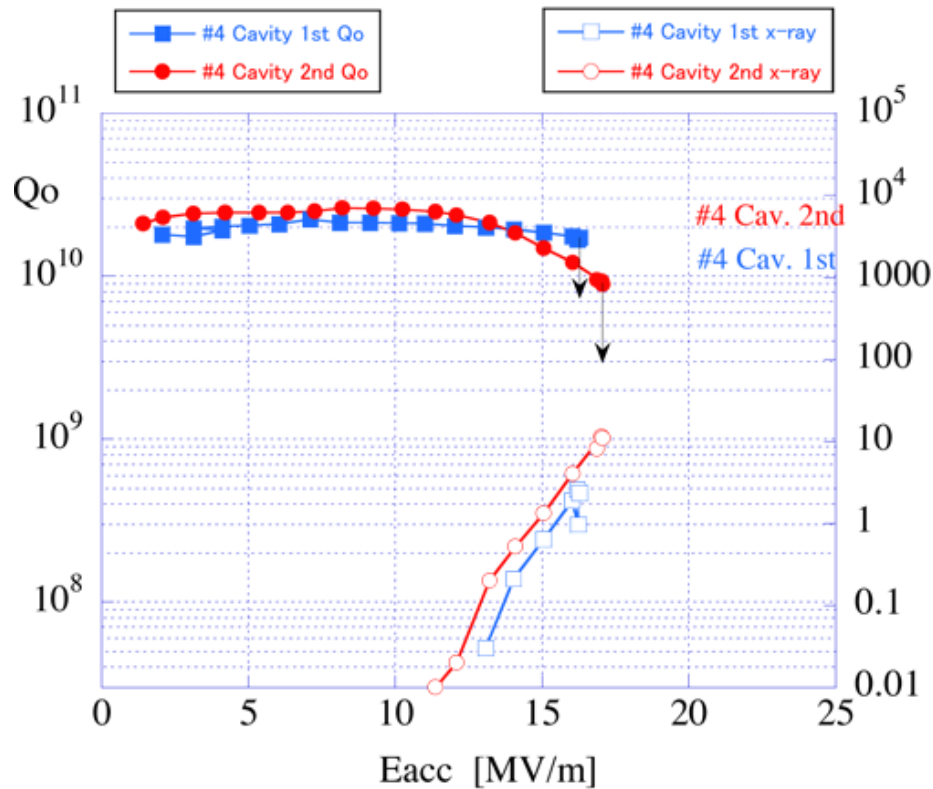
#3 Cav. 2nd aft. 2nd Barrel Polishing



TESLA style Baseline Cavity Package

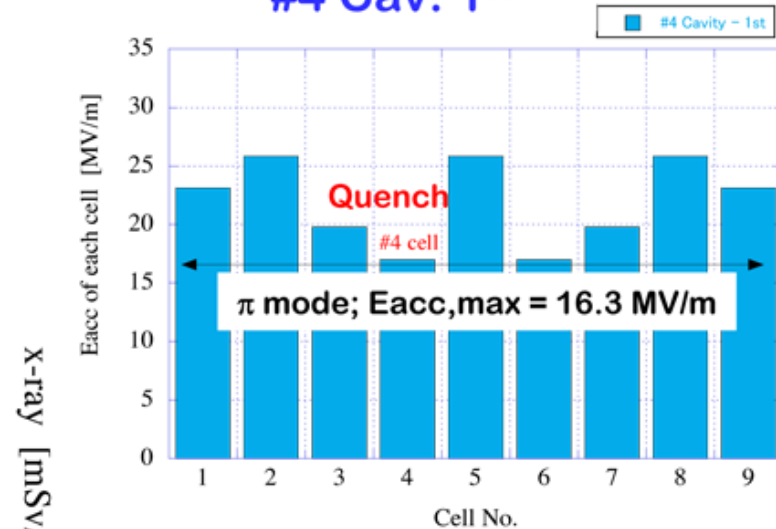
#4 Cavity Performance

#4 Cavity ; 1st and 2nd Test

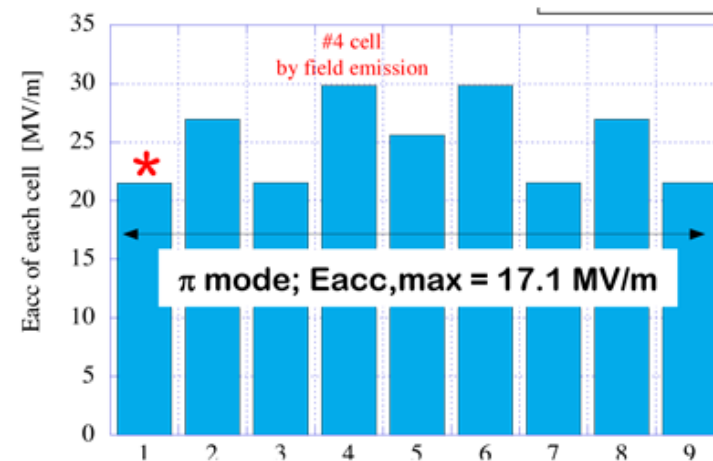


Even if no field emission, $E_{acc,max}$ is still limited at ~ 20 MV/m (#1).

#4 Cav. 1st

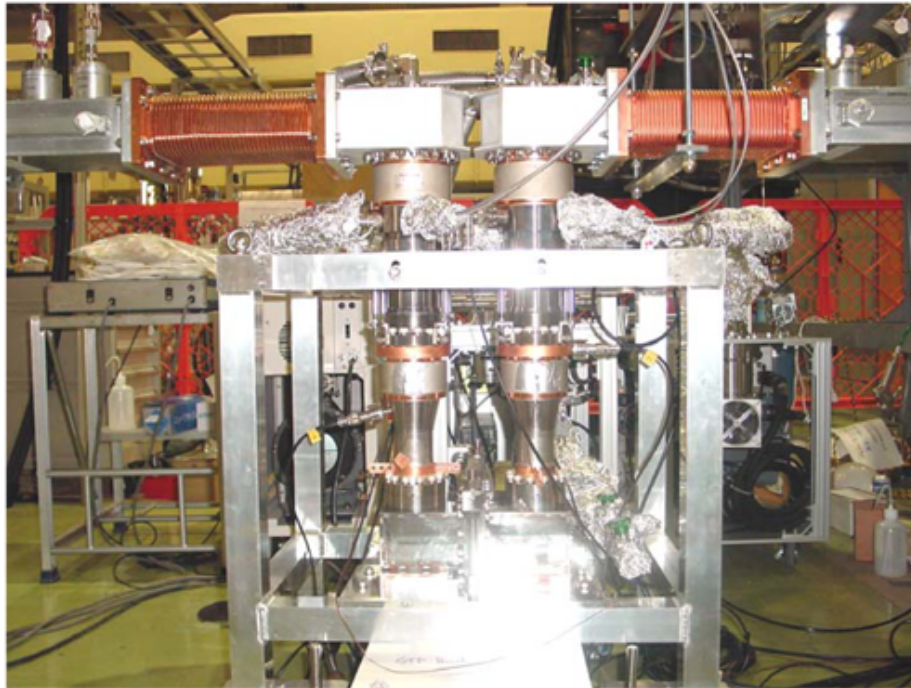


#4 Cav. 2nd aft. 2nd Barrel Polishing



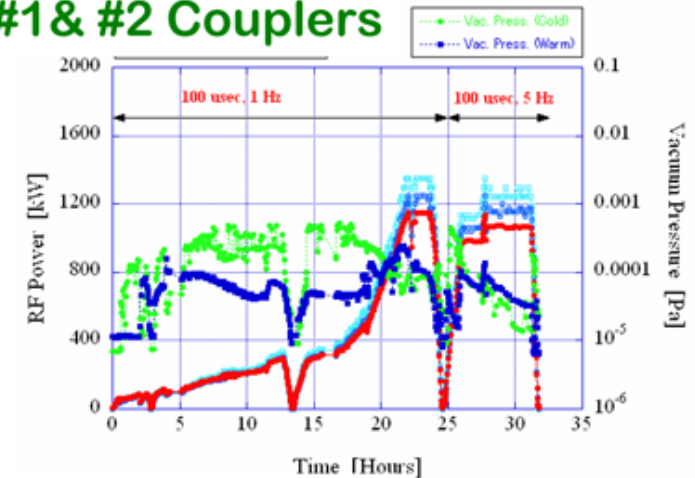
TESLA style Baseline Cavity Package

Input Coupler Performance

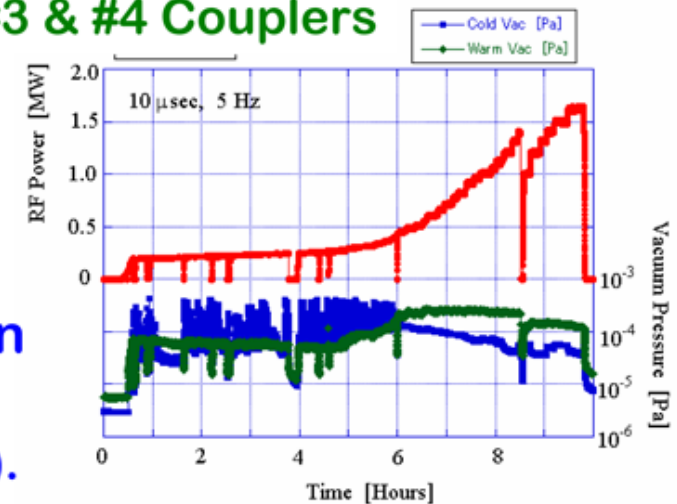


Four input couplers have been successfully processed up to **1.0 MW** in a pulsed operation of **1.5 msec** and **5 Hz**, without any troubles. Total processing time is **~ 50 hours**, (very careful).

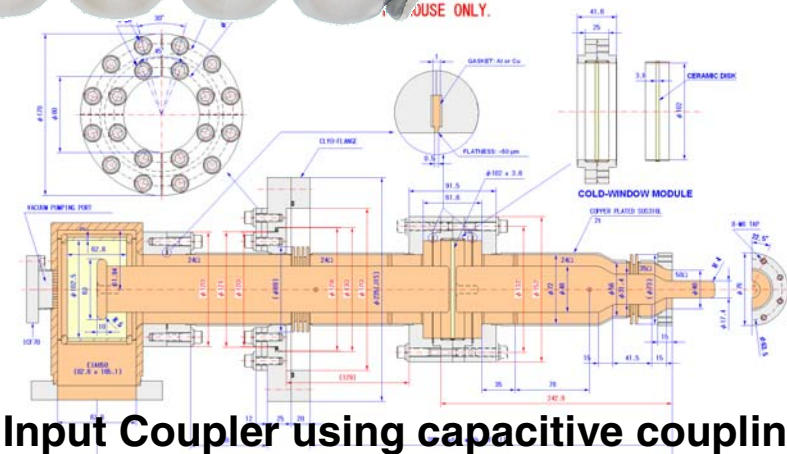
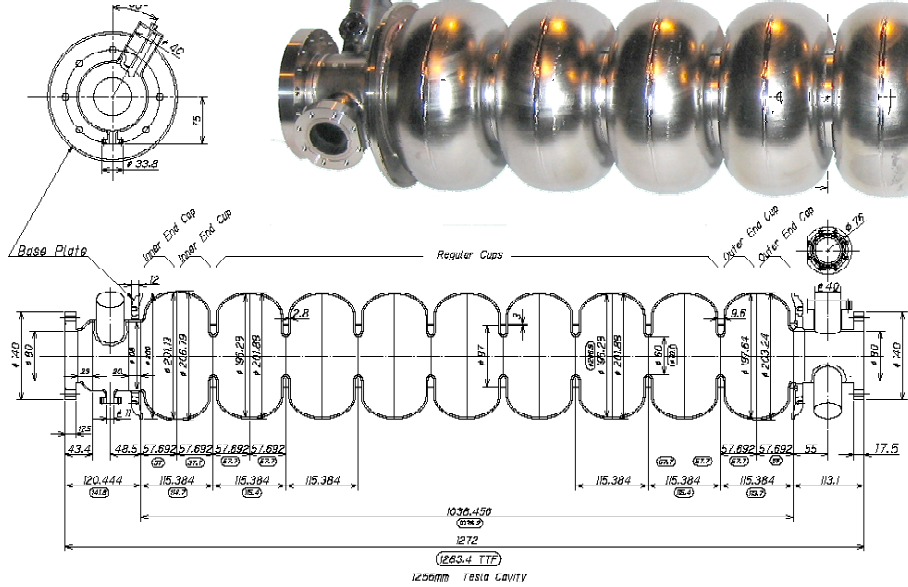
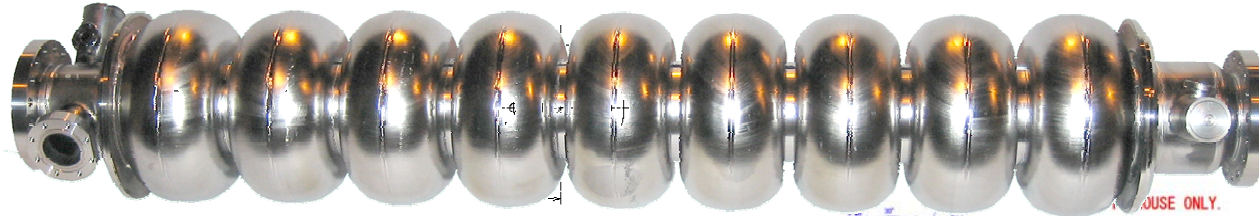
#1 & #2 Couplers



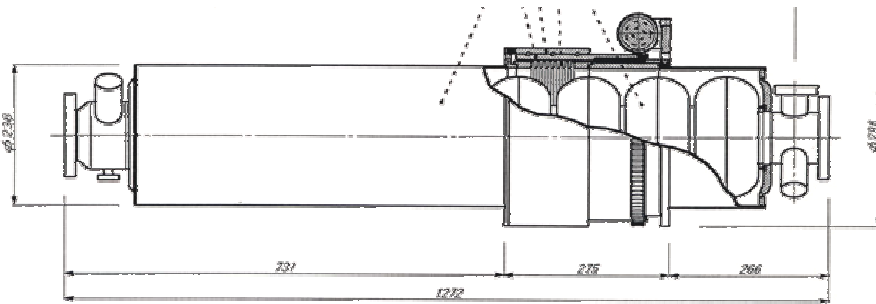
#3 & #4 Couplers



LL ICHIRO cavity package for High Gradient



Input Coupler using capacitive coupling



Coaxial ball screw tuner

Dia:276mm

Lead: 40mm

Ratio: 21:1

Tuner test stand

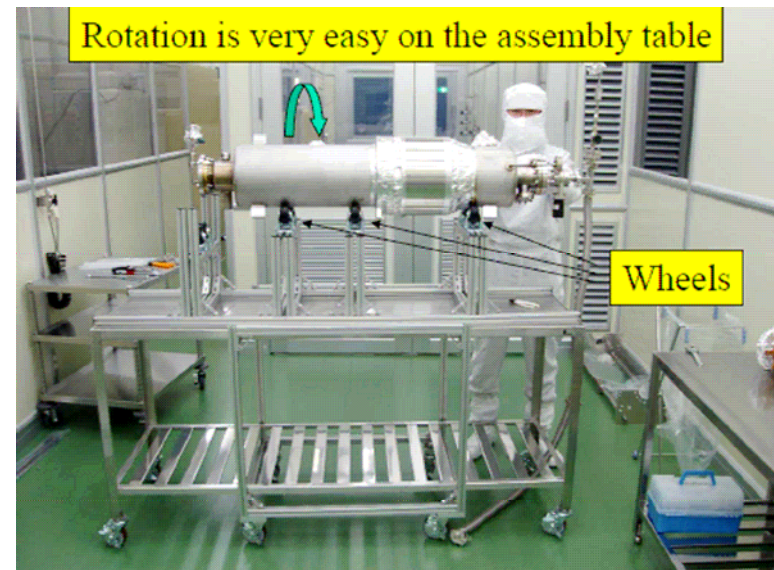
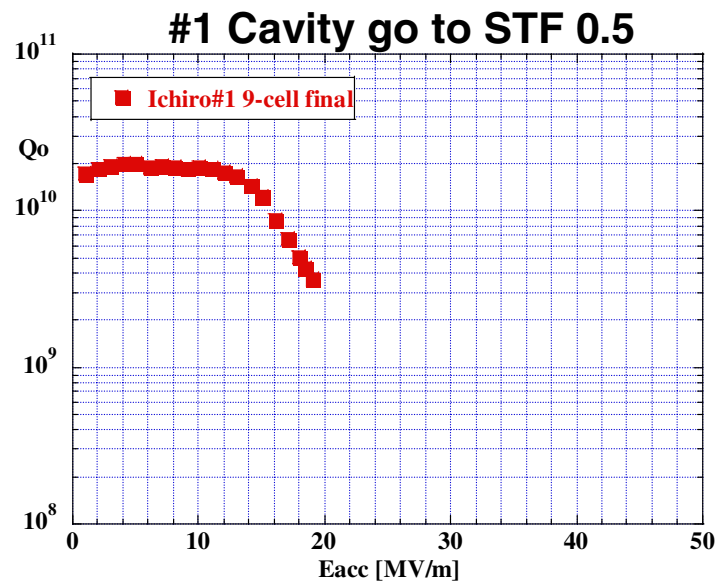


KEK/Hitachi

LL ICHIRO cavity package for High Gradient

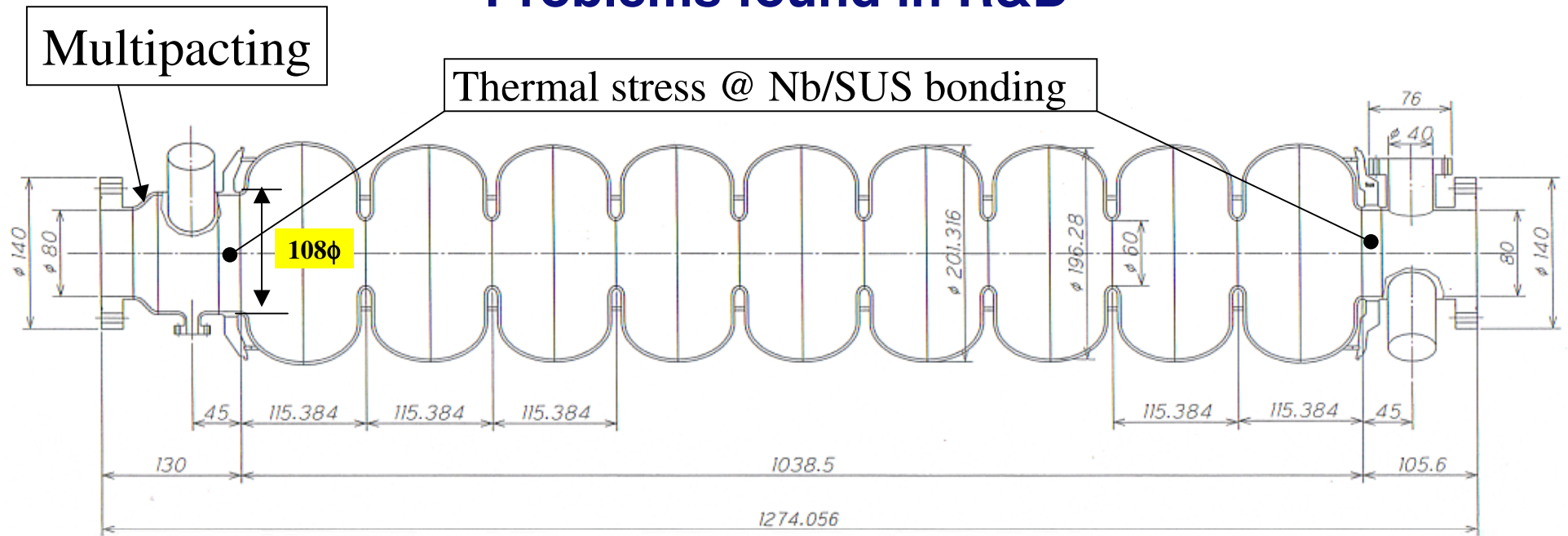
Gradient Performance

	END group	Eacc,max [MV/m]	Qo @ low-field	Status
Ichiro#0	Straight BP	29.3	2.0E10	Repaired for S0 study
Ichiro#1	Full	19.5	2.0E10	Installed to STF 0.5
Ichiro#2	Full	12.4	1.2E10	Repaired for S0 study
Ichiro#3	Full	Not yet measured		Used for tuner test



LL ICHIRO cavity package for High Gradient

Problems found in R&D



Problems on Ichiro 9-cell cavities (Ichiro#0, #1, #2, #3)

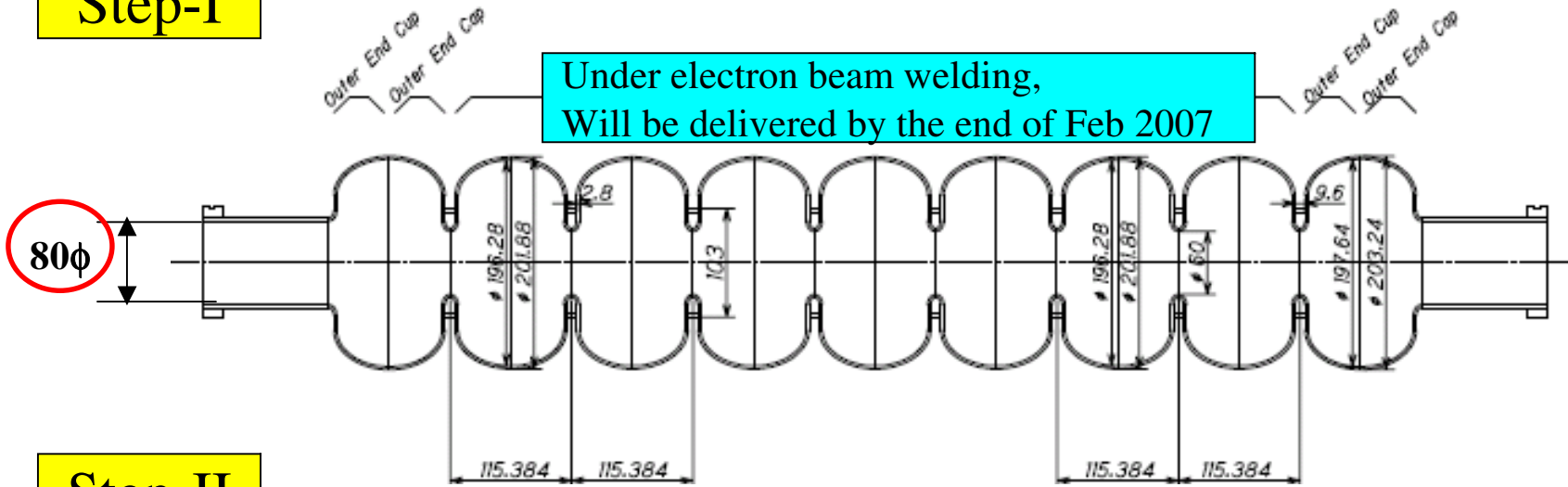
- 1) Low Q → understood
- 2) Multipacting at tapered beam tube → under testing with single cell cavities
- 3) Thermal stress on the Nb/SUS bonding → Analyzed
- 4) Too much coupling to fundamental at HOM pickup ports → under re-designing
- 5) Field Emission

LL ICHIRO cavity package for High Gradient

Improving Steps for New Design

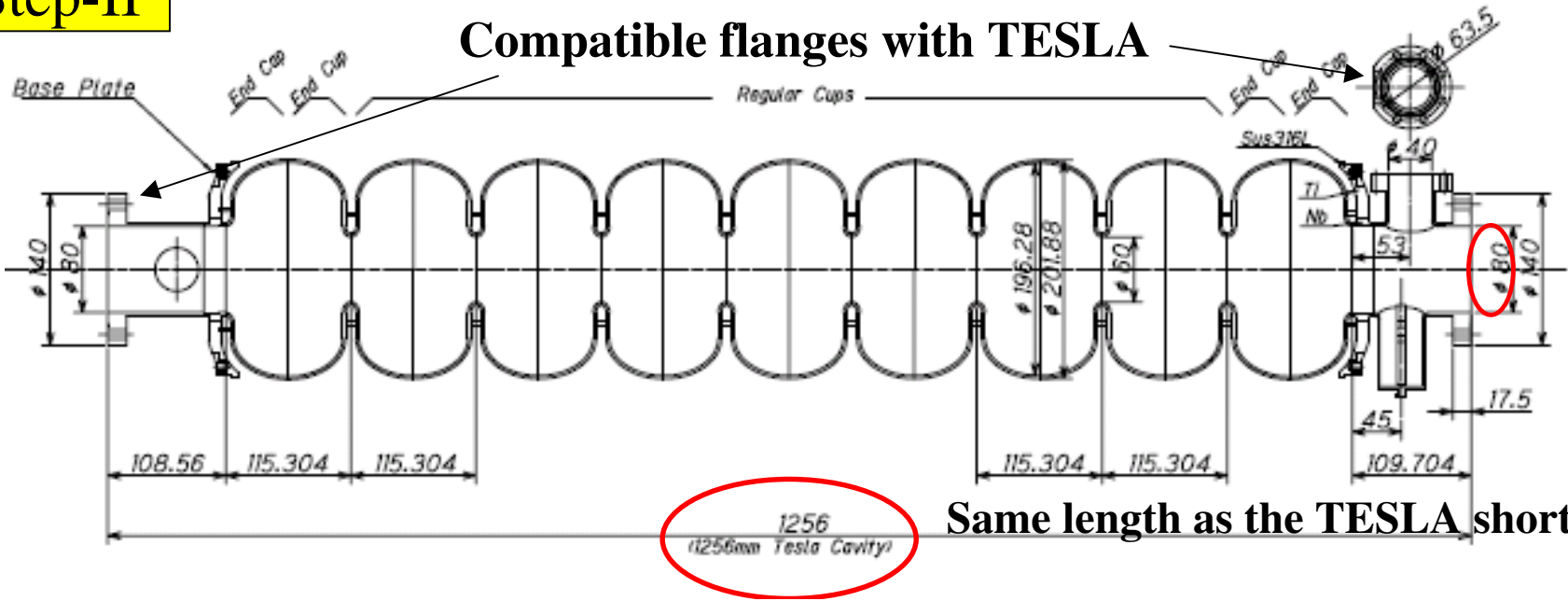
Step-I

Under electron beam welding,
Will be delivered by the end of Feb 2007



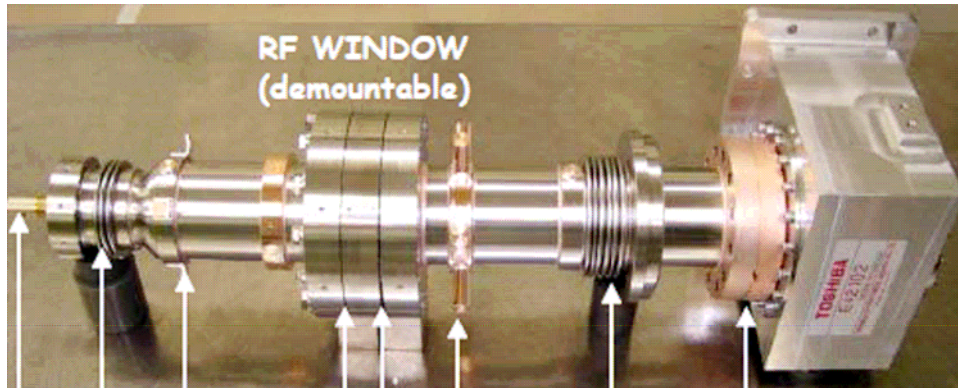
Step-II

Compatible flanges with TESLA

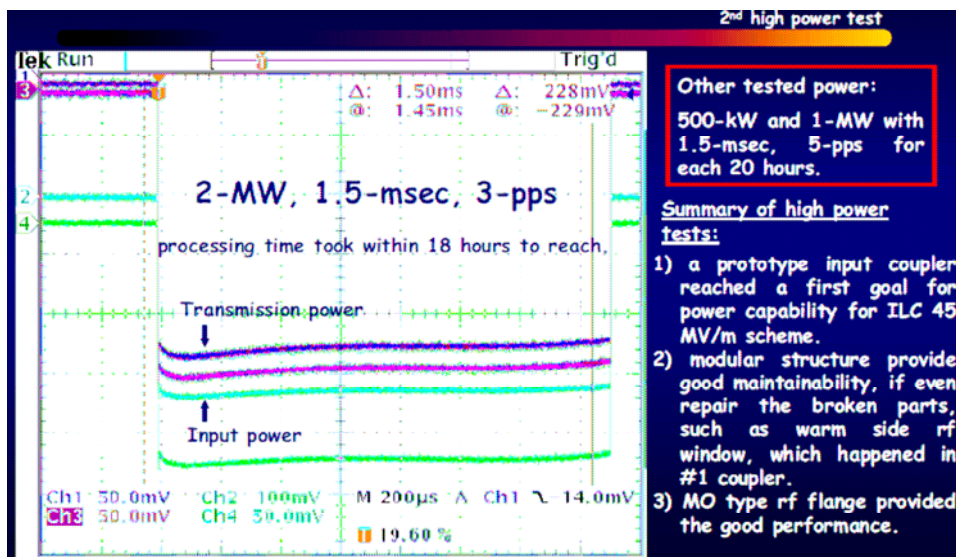


LL ICHIRO cavity package for High Gradient Input Coupler Performance

By H.Matsumoto and S.Kazakov

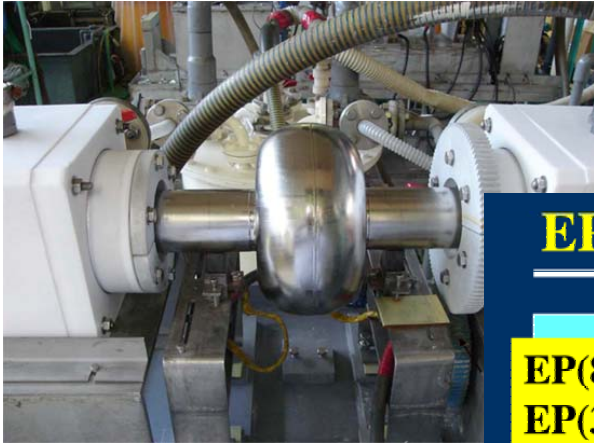


**Successfully demonstrated
the high power performance
up to 2MW!**



The specification: 500kW,
1.5msec, 5Hz
@ 45MV/m operation

Cavity treatment study using Single cell



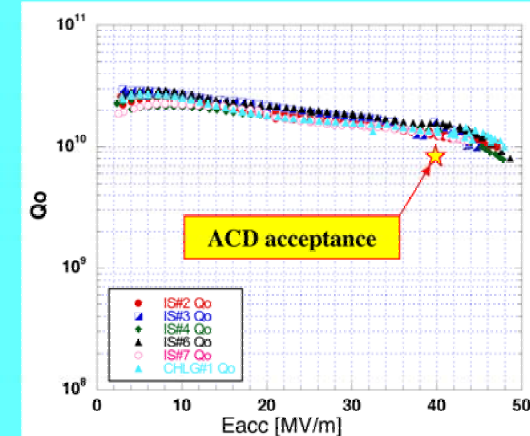
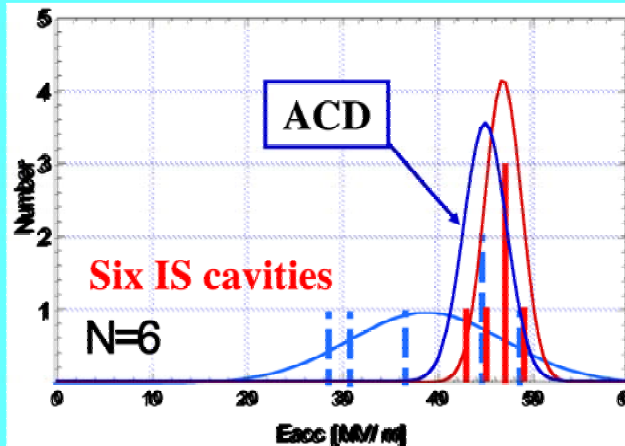
Ichiro single cell
in EP bed

Statistics : 6 Ichiro single cell cavities

EP(80 um) + EP(20um) + EP(3 um, fresh EP acid)

**EP(80 um, tank) + EP(20 um, tank) +
EP(3µm, fresh EP acid) + HF + HPR +
Baking**

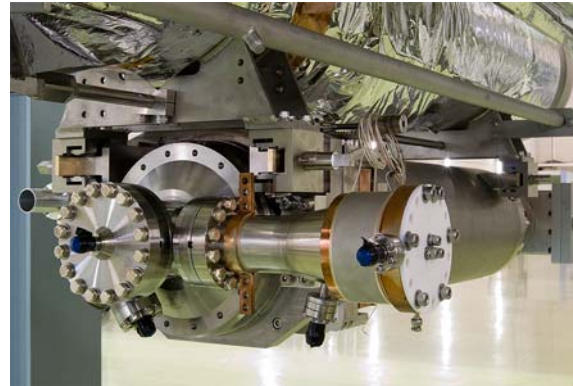
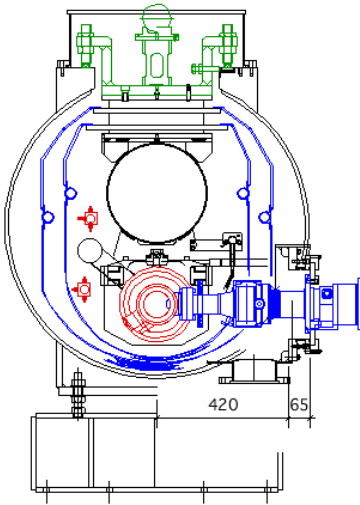
**Ave. Eacc = 46.7 ± 1.9 MV/m
Scattering 5%**



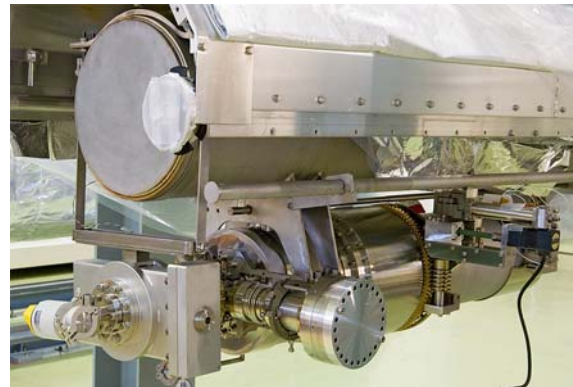
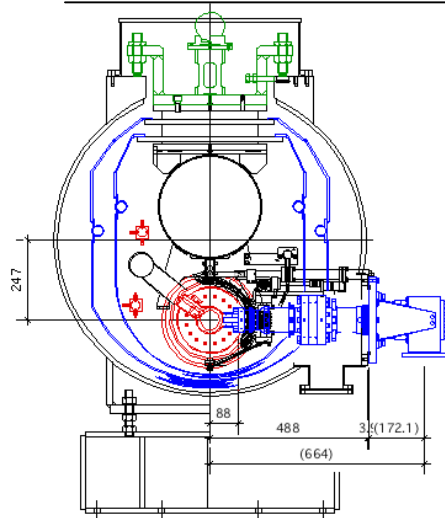
First trial yield rate (Eacc > 40 MV/m) = 100%

Cavity Installation into Cryomodule

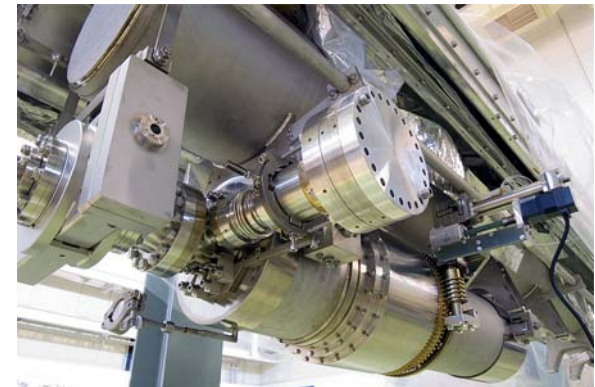
One TESLA-like Cavity, One LL-type cavity are installed into STF phase1 cryomodule. (STF Phase 0.5)



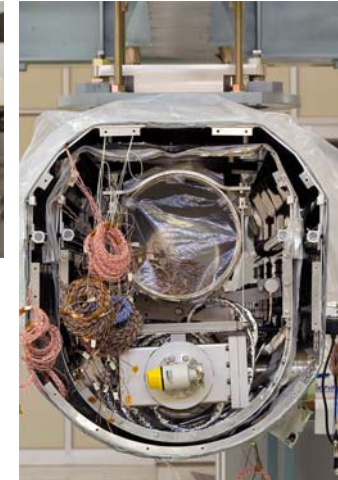
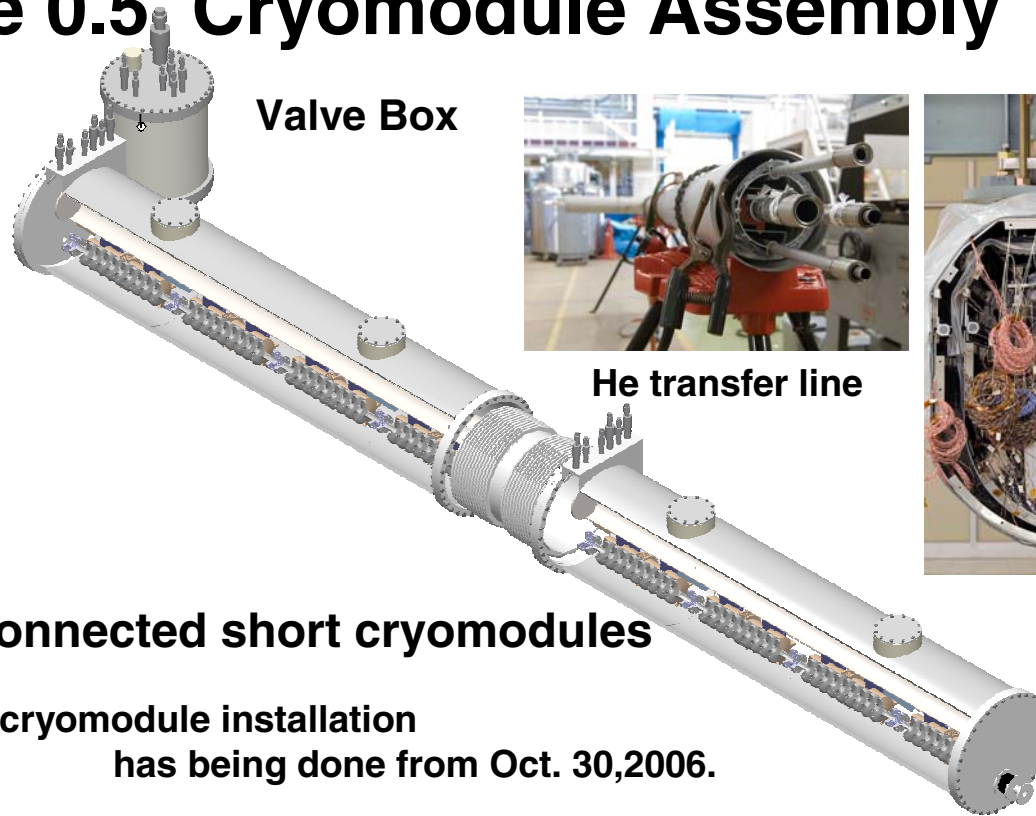
TESLA-like Cavity



LL type Cavity



STF phase 0.5 Cryomodule Assembly



connected short cryomodules

**cryomodule installation
has being done from Oct. 30,2006.**



**insertion of cold mass into cryomodule vacuum vessel,
in Dec.13,2006.**

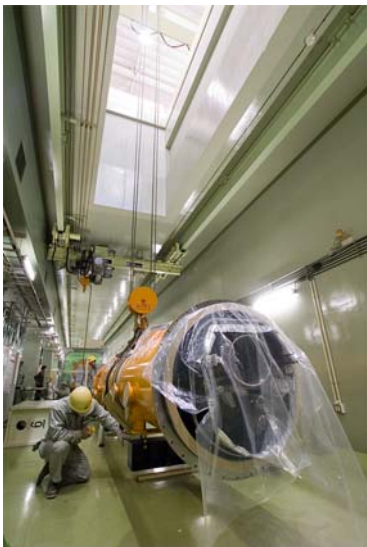
STF phase 0.5 Cryomodule into Tunnel



carrying down
the cryomodule



cryomodule sit in the tunnel



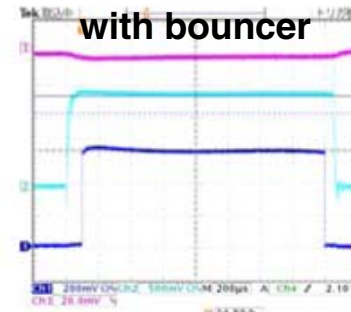
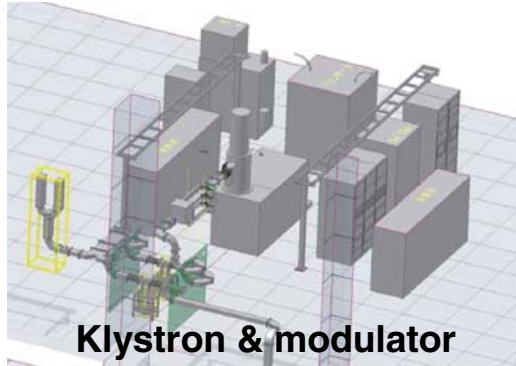
Beam pipe connection



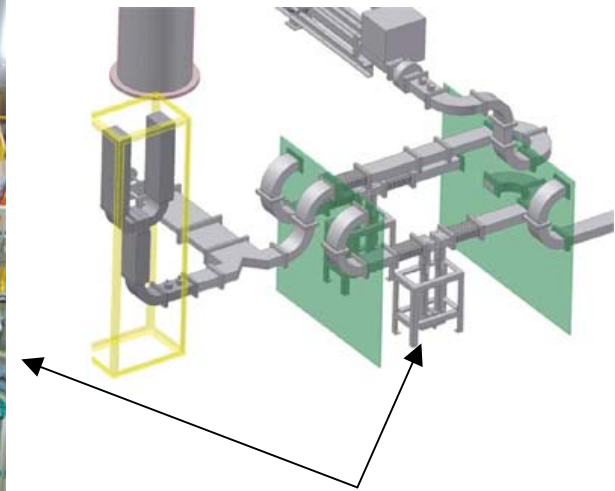
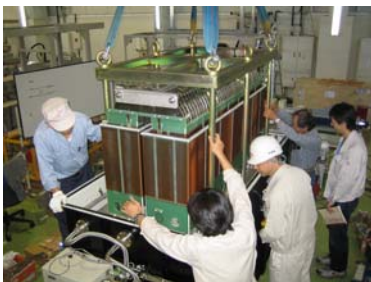
Downstream module installation

RF power source of STF phase 1

Reuse an old TH2104A 5MW klystron, driven by an existing PNC modulator by adding a bouncer circuit and a new pulse transformer.



Pulse transformer installation



Coupler HP test setup

3MW operation power which is limited by IGBT protection voltage setting

10MW Multi-beam Klystron

1 vertical Toshiba MBK was ordered with collaboration with SLAC.

Delivery will be summer 2007.

KEK will help initial process at Toshiba.

SLAC will receive them, and acceptance test will be done.



10MW
Toshiba-MBK
E3736

#2 Modulator for 5MW and 10MW klystron

Modulator for TH2104A 5MW klystron, and future 10MW MBK test, was procured. KEK acceptance test will be in March 2007.

This is bouncer-type modulator with pulse trans.

KEK-SRF 2007 schedule

