



A_RD_03

R/D for the High Power Couplers for ILC



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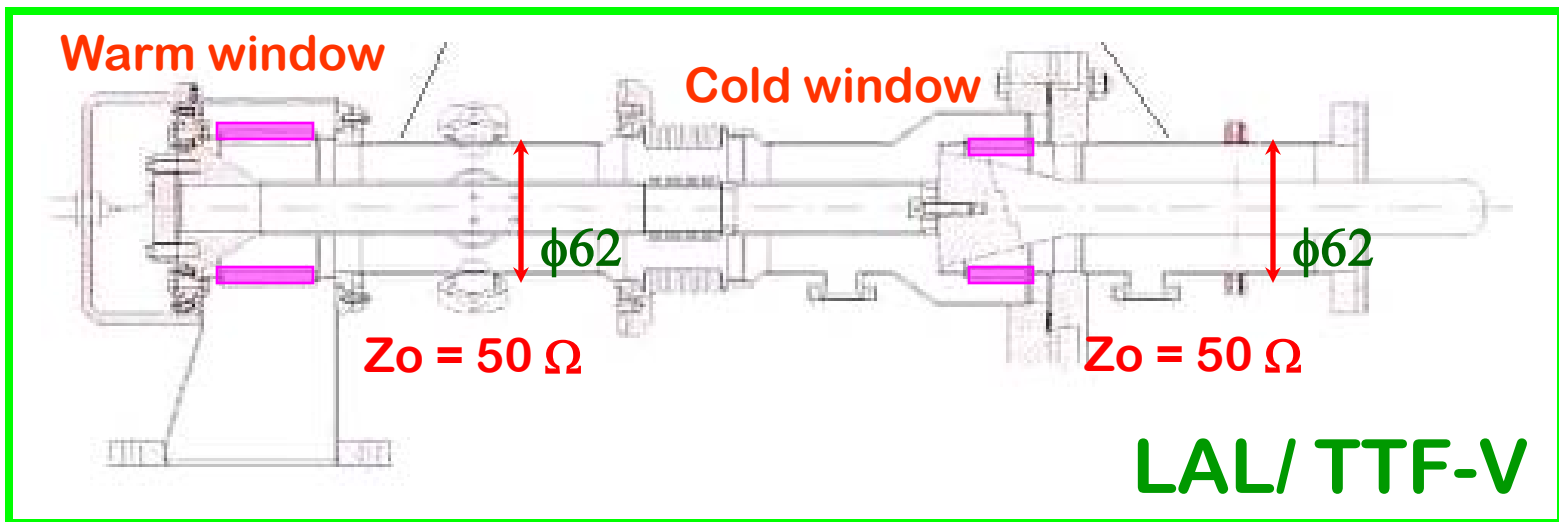
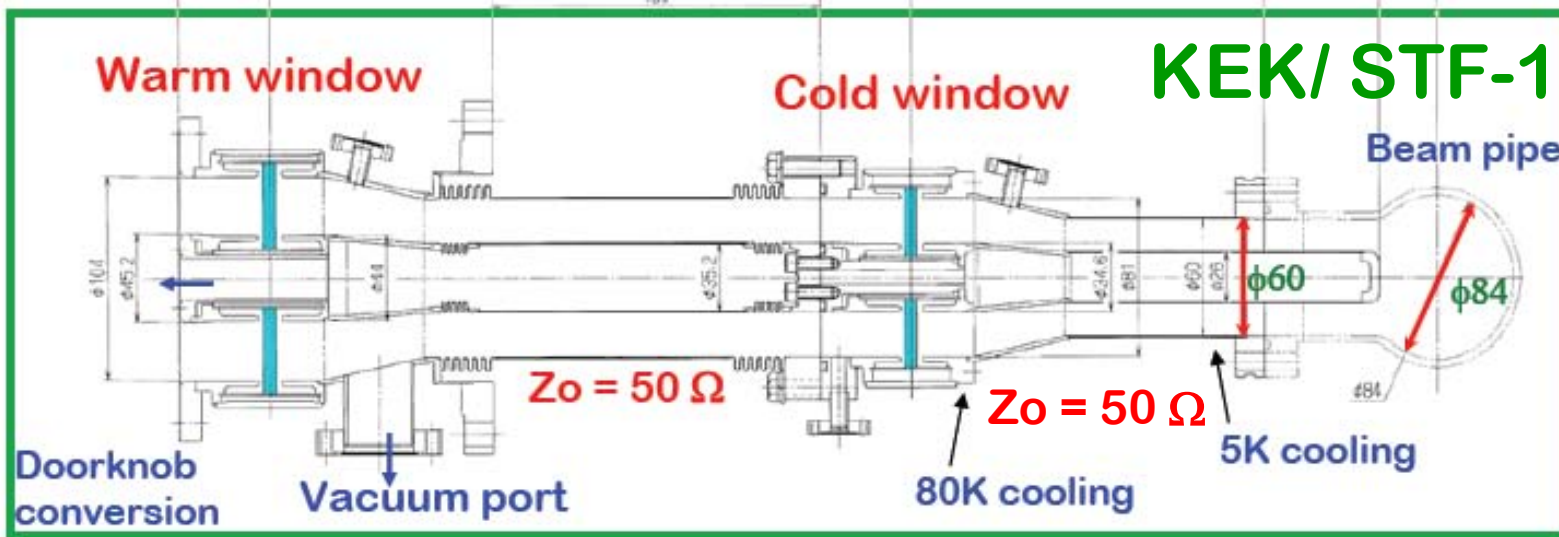
Acknowledgements

- LAL-Orsay Team;
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- KEK-STF Team;
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Toshio SHISHDO,
Ken WATANABE,
Yasuchika YAMAMOTO

- Introduction
- Activities of Input Couplers at LAL
- Activities of Input Couplers at KEK
- Plan of Coupler R & D in 2012'
- Summary

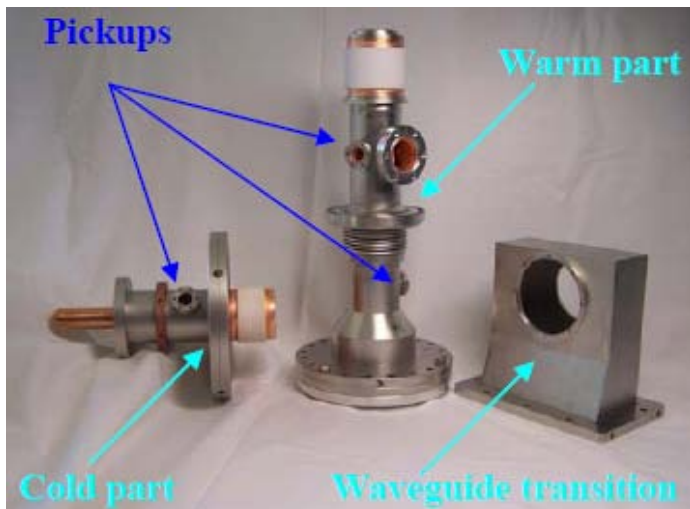
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Introduction (1)



Introduction (2)

LAL TTF-V couplers conditioned at KEK.



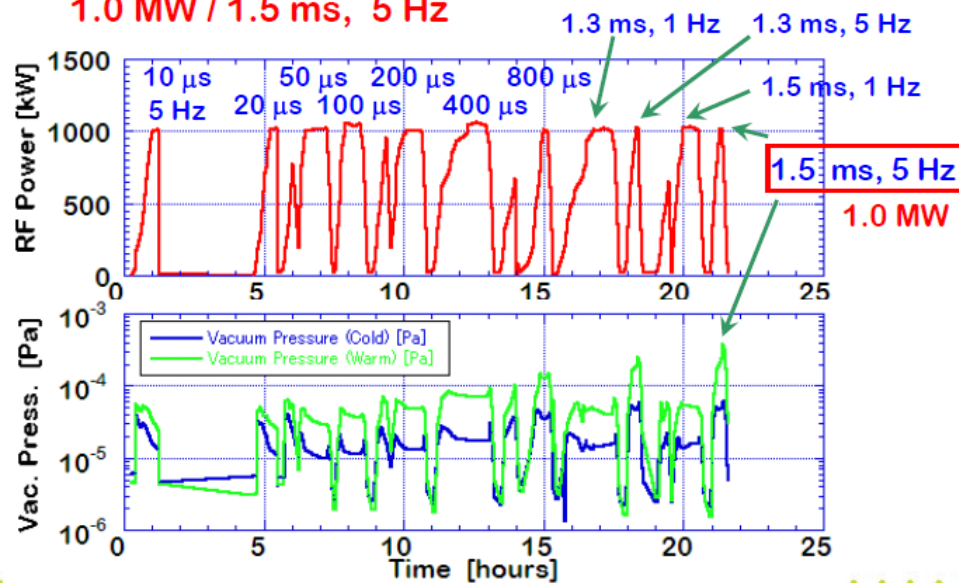
Step 1 : Target for XFEL (Feb. 2009)
 400 μ s, 1.0 MW
 1.5 ms, 0.5 MW, 5 Hz

Step 2 : Target for ILC (Mar. 2009)
 400 μ s, 2.0 MW, 5 Hz

Step 3 : Target for ILC (May. 2009)
 1.5 ms, 1.0 MW, 5 Hz

Step 3 ; Target for ILC (May, 2009)

1.0 MW / 1.5 ms, 5 Hz



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TTF-3 coupler

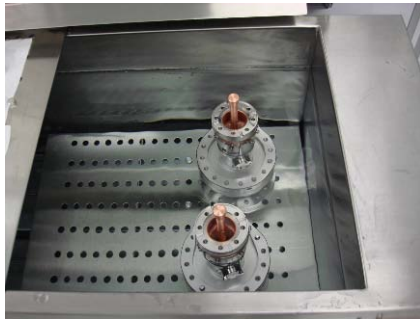


- Working on TTF3 conditioning procedure improvement:
 - Decreasing time duration (handling, assembly and in-situ baking improvement)
 - Conditioning 2 coupler pairs in series
 - Delivering conditioned couplers for Flash machine-DESY.

- Performing XFEL couplers Industrialisation phase.

Coupler Activities at LAL (2)

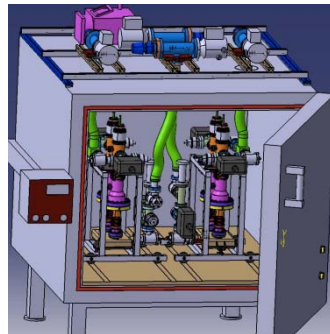
Automation of coupler cleaning procedure: design of washing machine



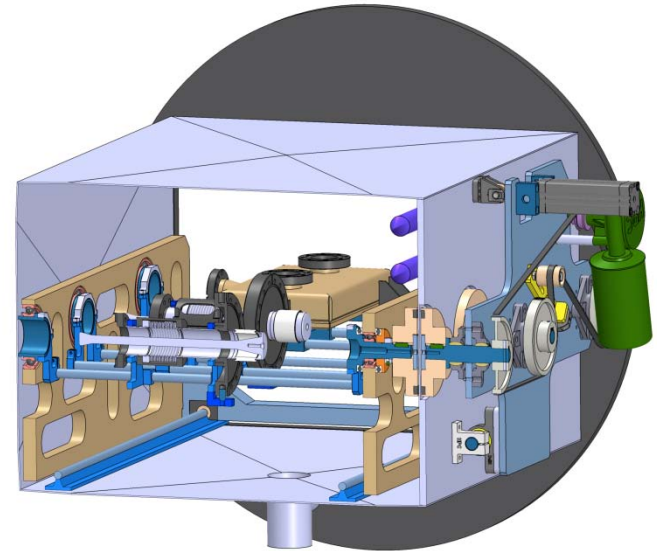
Ultrasonic cleaning: 1h



Drying cycle and cleaning quality test: 48h



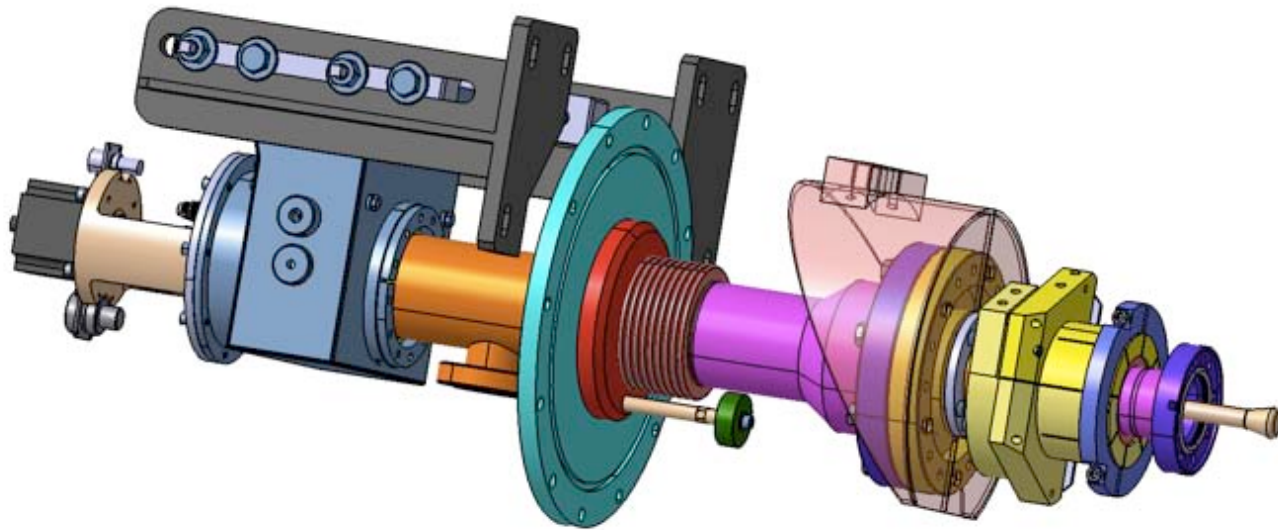
In situ backing: 75h



- Reduce time procedure & work in hidden time
- Improve procedure repeatability
- Suppress pollution risk between the steps

The main coupler activity at LAL in the last two year: Contribution to the XFEL project by assuming the following tasks:

- Industrial monitoring and coupler fabrication control at production sites.
- RF conditioning of the 800 produced couplers at LAL.



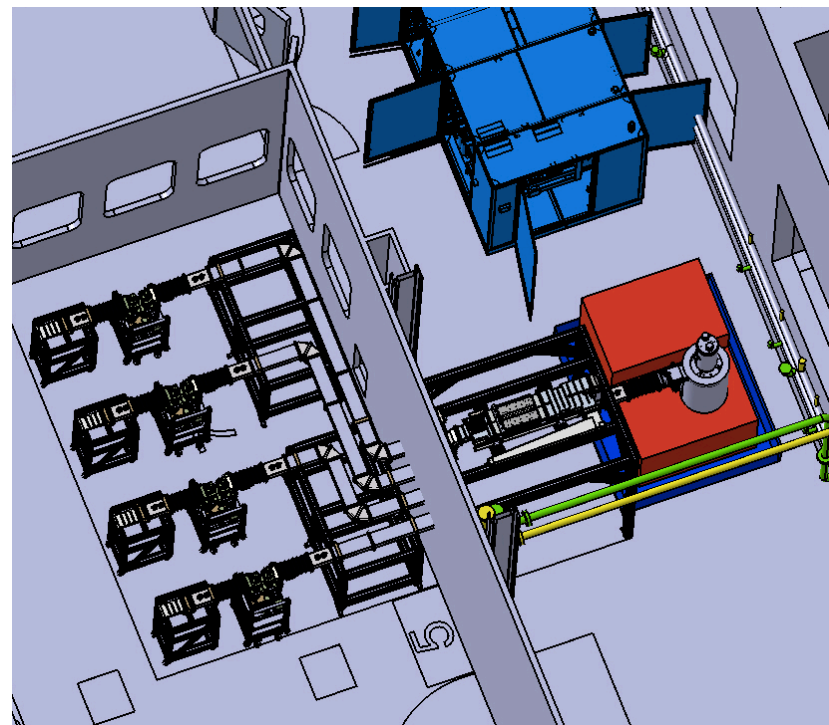
Coupler Activities at LAL (4)

All process steps will take place in an ISO5 clean room (70 m²):

- Leak test at reception,
- Couplers in-situ baking (75h),
- RGA connection and gas analysis (24h),
- Antenna tuning,
- RF conditioning (24 to 30h),
- Pumping system removal and couplers disassembly,
- Packaging in boxes and shipping.

A 6-7 days process  8 couplers treated simultaneously.

Installation of an RF station delivering 5MW allowing 4 coupler pairs conditioning in the same time:



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Coupler Activities at KEK (1)

KEK-STF activities on cryomodule tests

- **STF - 0.5 : (2007)**
 - 1 nine-cell cavity, 1 STF-1 coupler
- **STF - 1.0 : (2008)**
 - 4 nine-cell cavities, 4 STF-1 couplers
- **S-1 Global : (2010)**
 - 4 nine-cell cavities, 4 TTF-3 couplers,
+ 4 nine-cell cavities, 4 STF-2 couplers
- **Quantum-Beam : (2012)**
 - 2 nine-cell cavities, 2 STF-2 couplers
- **STF - 2 : (2014)**
 - + 8 nine-cell cavities, 8 STF2 couplers

Coupler Activities at KEK (2)



Four STF-1 couplers (fixed coupling)



Two STF-2 couplers for S1-G (variable coupling)



Eight STF-2 couplers for STF-2 #1



Six CW couplers for cERL



Coupler Activities at KEK (3)

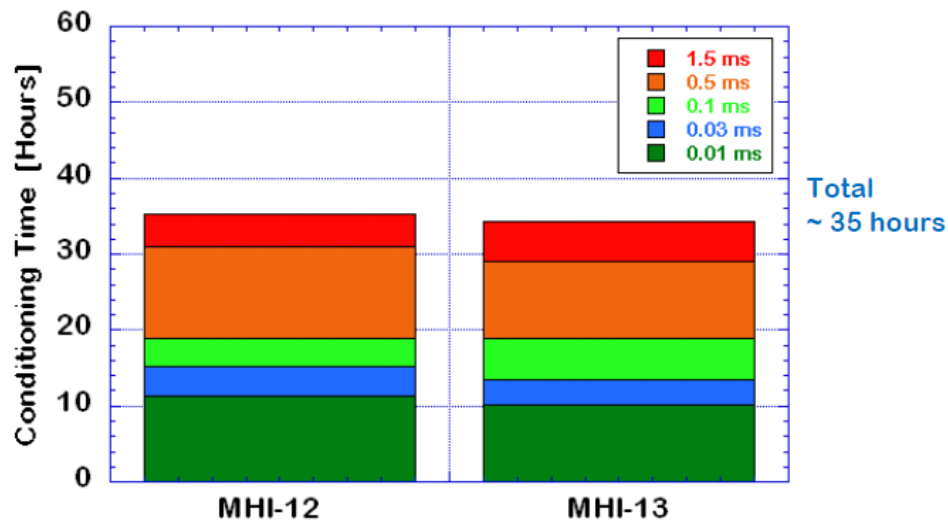
Assembly of capture cryomodule for QB accelerator (Oct. 2011)



(Dec. 2011)



Conditioning : 10 μ s, 30 μ s, 100 μ s, 500 μ s \rightarrow Prf = 400 kW
1.5 ms \rightarrow Prf = 260 kW

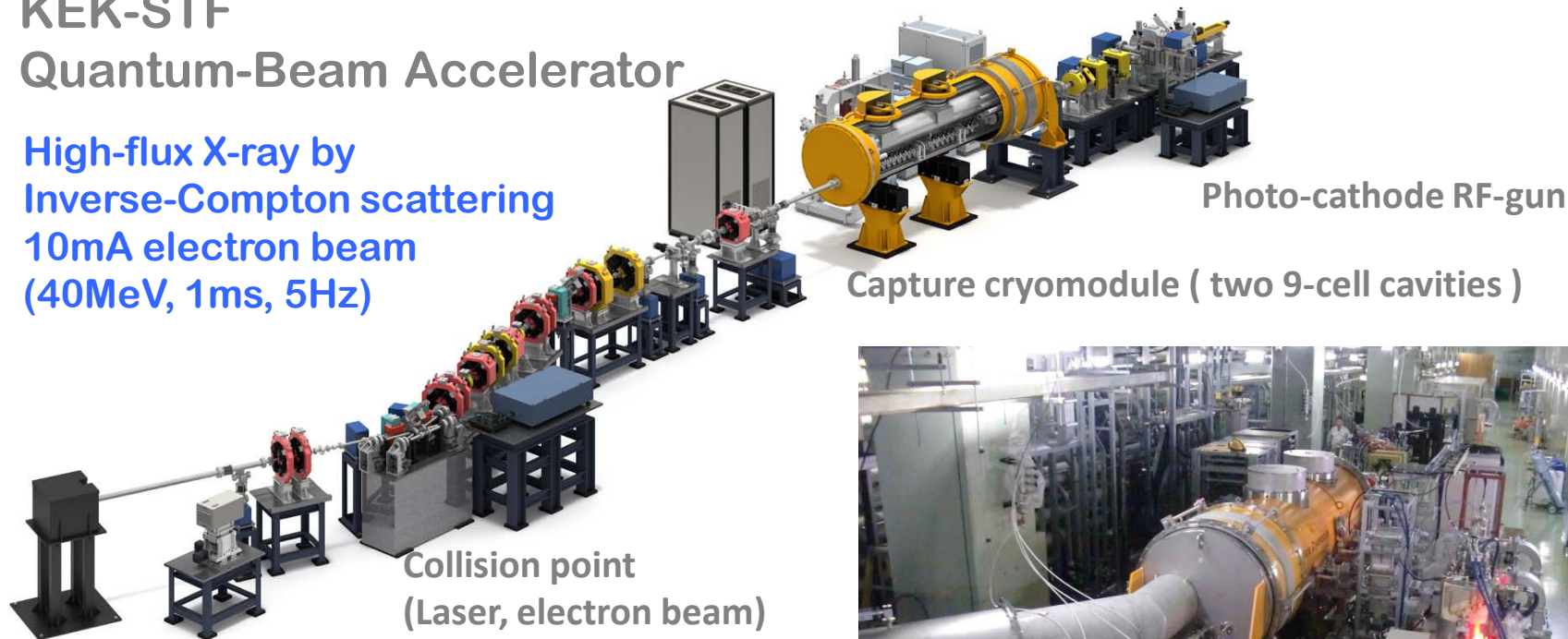




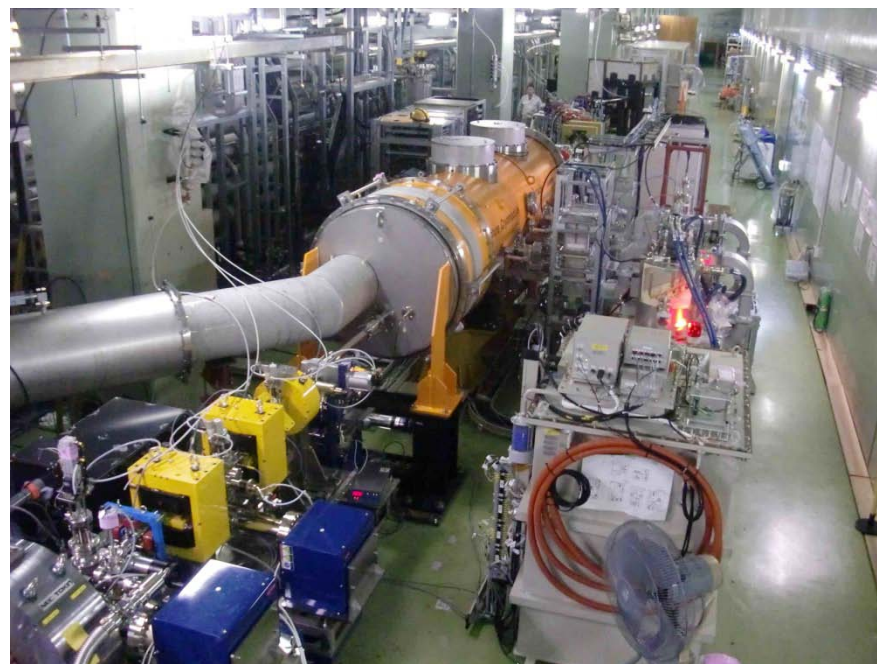
Coupler Activities at KEK (4)

KEK-STF
Quantum-Beam Accelerator

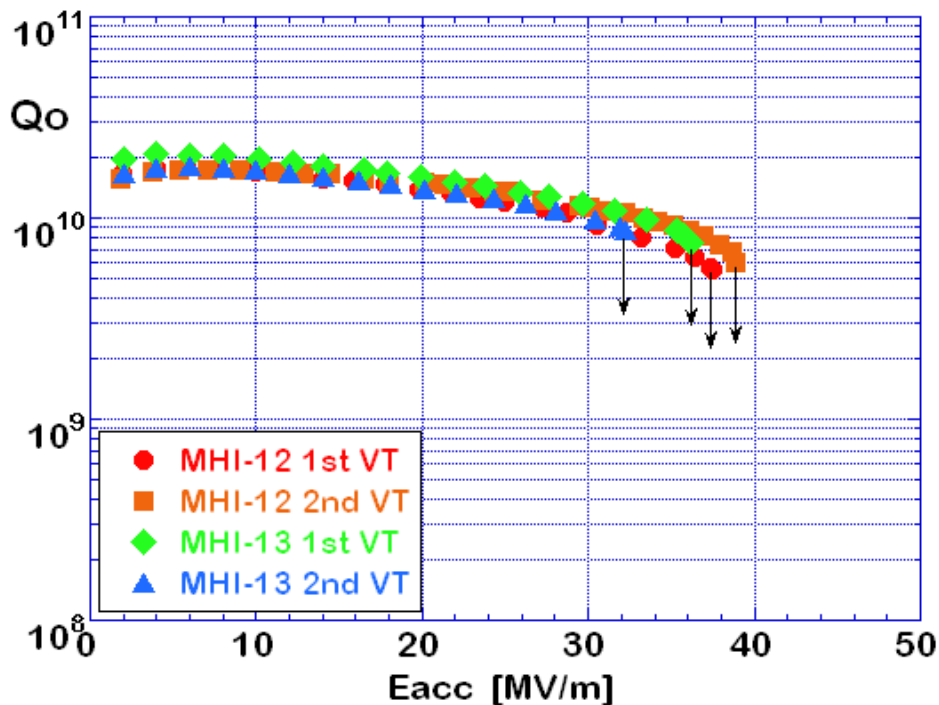
High-flux X-ray by
Inverse-Compton scattering
10mA electron beam
(40MeV, 1ms, 5Hz)



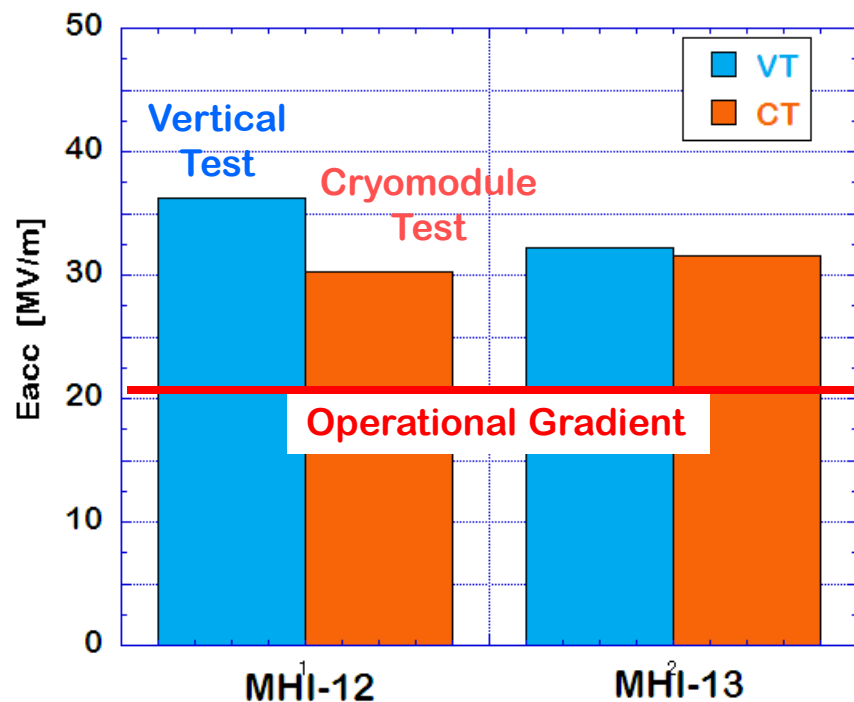
2011, Dec : Cryomodule completed.
2012, Feb : Cool-down started,
Mar : High power tests,
Apr : First beam acceleration.



VT Results of MHI-12 and MHI-13 for Capture Cryomodule



Comparison of cavity performance between V.T and C.T



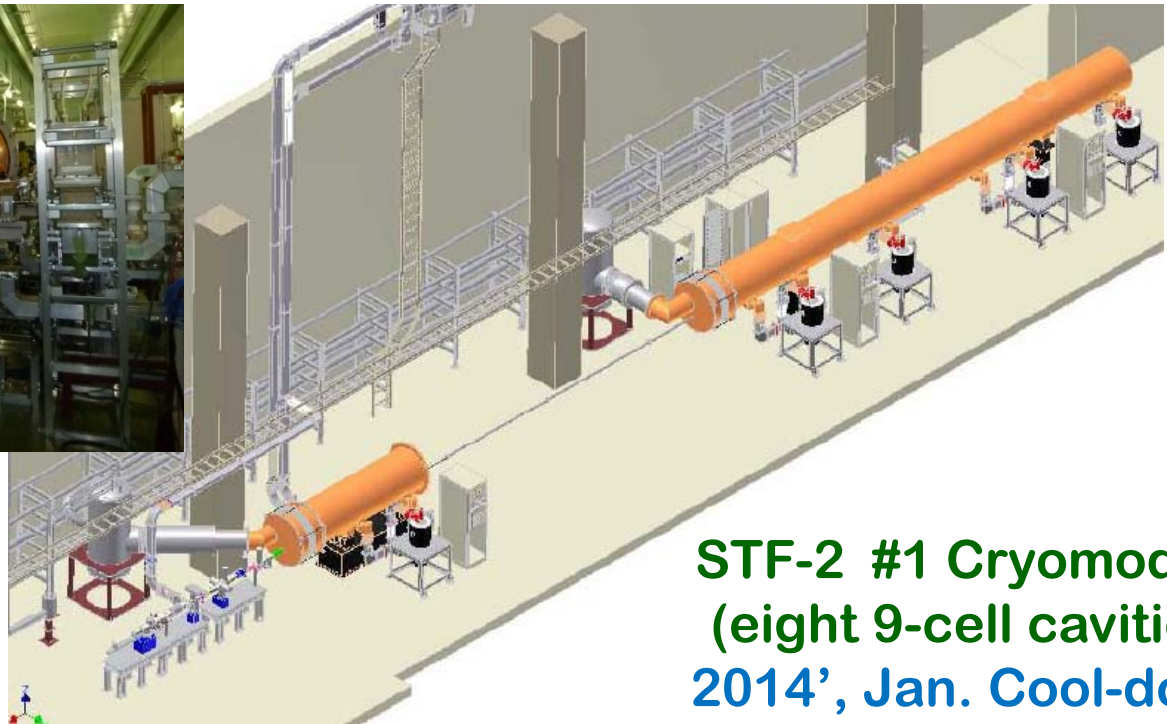


Coupler Activities at KEK (6)

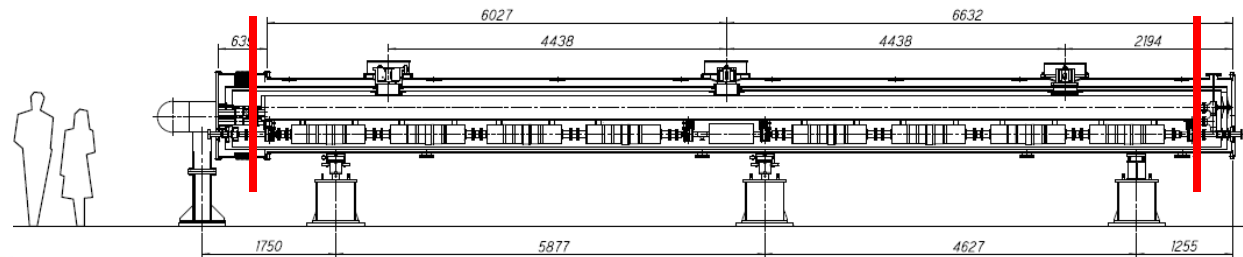
STF-2 Project at KEK



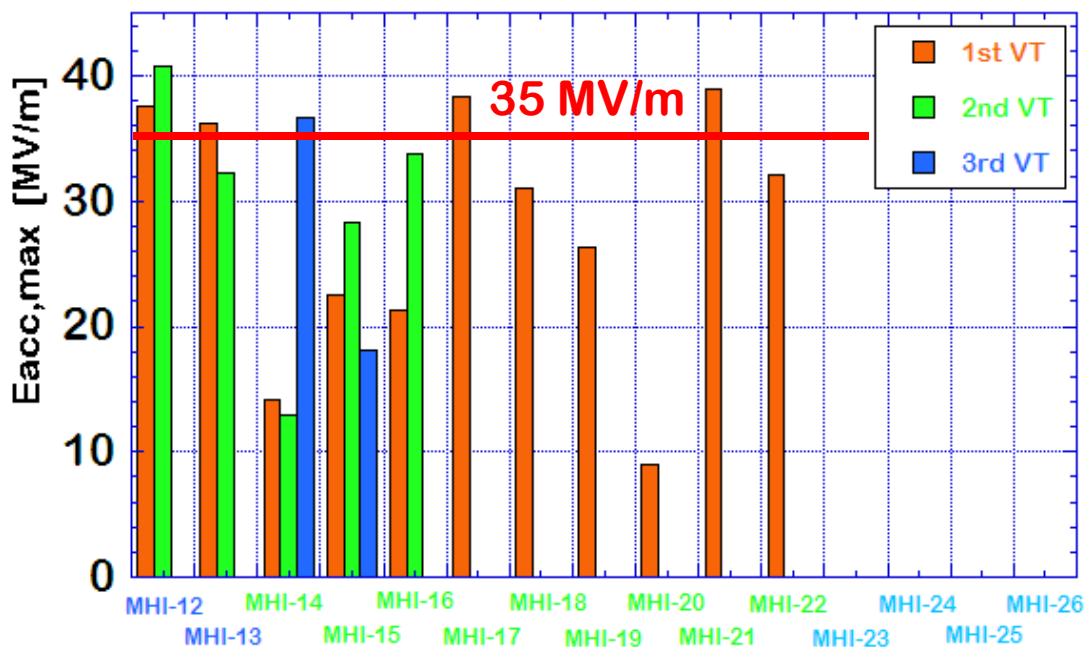
Capture Cryomodule
(two 9-cell cavities)
2012', Feb. Cool-down



STF-2 #1 Cryomodule
(eight 9-cell cavities)
2014', Jan. Cool-down



V.T results of 11 cavities for STF-2 Project



Capture
Cryomodule

STF-2 #1
Cryomodule

STF-2 #2
Cryomodule

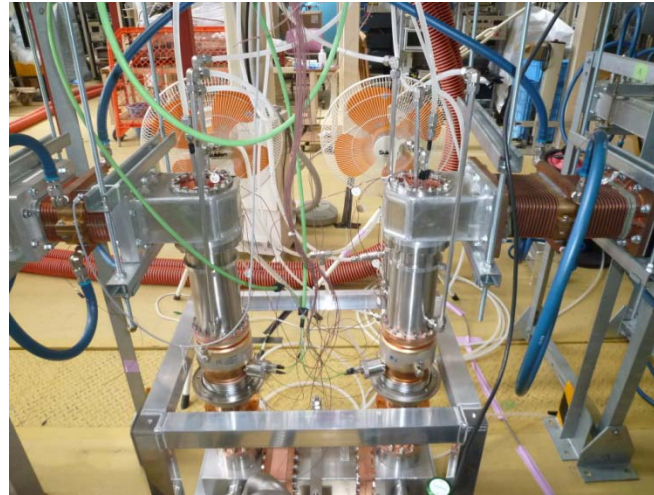
High Pressure Gas Tests



Eight STF-2 couplers



Coupler Activities at KEK (8)



Conditioning
up to **200 kW**
(2 ms, 5 Hz),
and
40 kW (CW)

CW Input Couplers
for cERL
Injector Cryomodule



(Apr. 2012)

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Plan of Coupler R/D in 2012'

- **LAL :**

- Conditioning of XFEL couplers.

- Automatic coupler cleaning machine.

- Plasma cleaning of couplers.

- **KEK :**

- Beam operation of QB cryomodule.

- Conditioning of 8 couplers for STF-2 #1.

- Conditioning of cERL CW couplers at RT.

- High power tests of cERL Injector module.

- **Activities on coupler developments in both LAL and KEK have been continued, vigorously.**
- **Collaborative work on coupler conditioning was successfully carried out.**
- **Discussion on the conditioning results between LAL and KEK was very fruitful.**



**Thank you
for your attention...**