Advances and Performance of Input Couplers at KEK

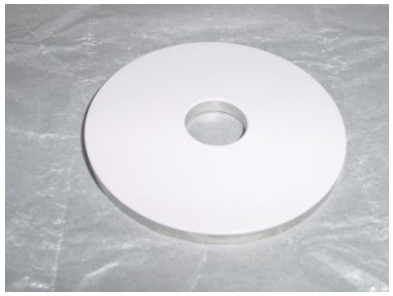
E. Kako, S. Noguchi, M. Sato, T. Shishido,
Y. Yamamoto, K. Watanabe (KEK, Japan)
H. Jenhani (LAL-Orsay), Zhao T.X. (IHEP-Beijing)

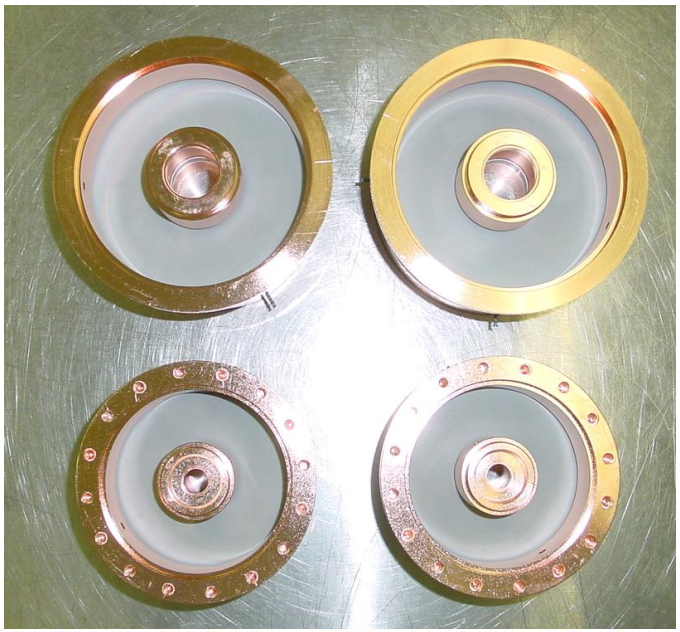
Outline

- Introduction
- STF-I Couplers for STF-1 at KEK
- STF-II Couplers for S1-G at KEK
- LAL TTF-V Couplers at KEK
- cERL Injector Couplers at KEK
- Summary

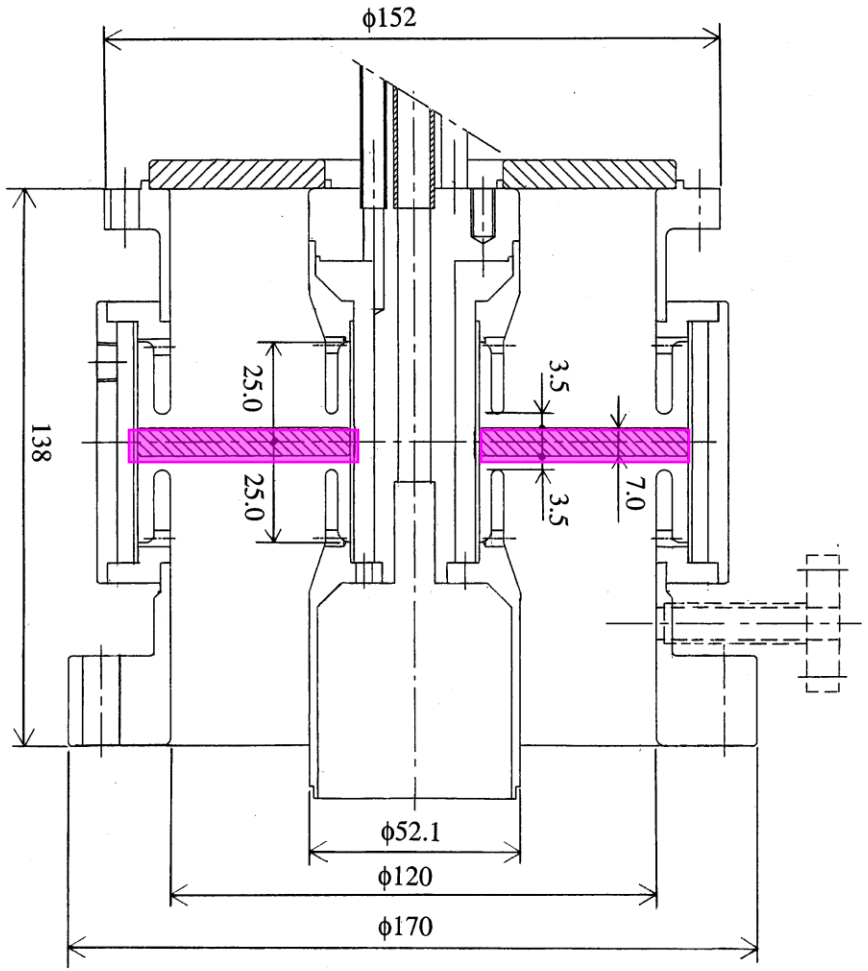
Coaxial Disk RF Windows (1)

Tristan-type Coaxial Disk Ceramics RF Window





972 MHz RF Window



Coaxial Disk RF Windows (2)

805 MHz Pulsed Coupler for SNS (ORNL)

Test Stand : 2 MW
Cryomodule : 550 kW
1.3 ms, 10~30 Hz

972 MHz Pulsed Coupler for ADS (KEK/JAERI)

Test Stand : 2.2 MW
Cryomodule : 350 kW
3.0 ms, 25 Hz

Coupler Activities at KEK (1.3 GHz)

STF-I Couplers

STF-II Couplers

TTF-V Couplers

cERL-Injector Couplers

Required RF Power Level

. for XFEL (TTF-III coupler)

Test stand : 1 MW (<400μs), 500 kW (1.3ms, 2/4 Hz)
Cryomodule : 250 kW (<400μs), 125 kW (1.3ms, 2 Hz)
Beam operation : 122 kW (1.4ms, 10Hz) at 23.6 MV/m

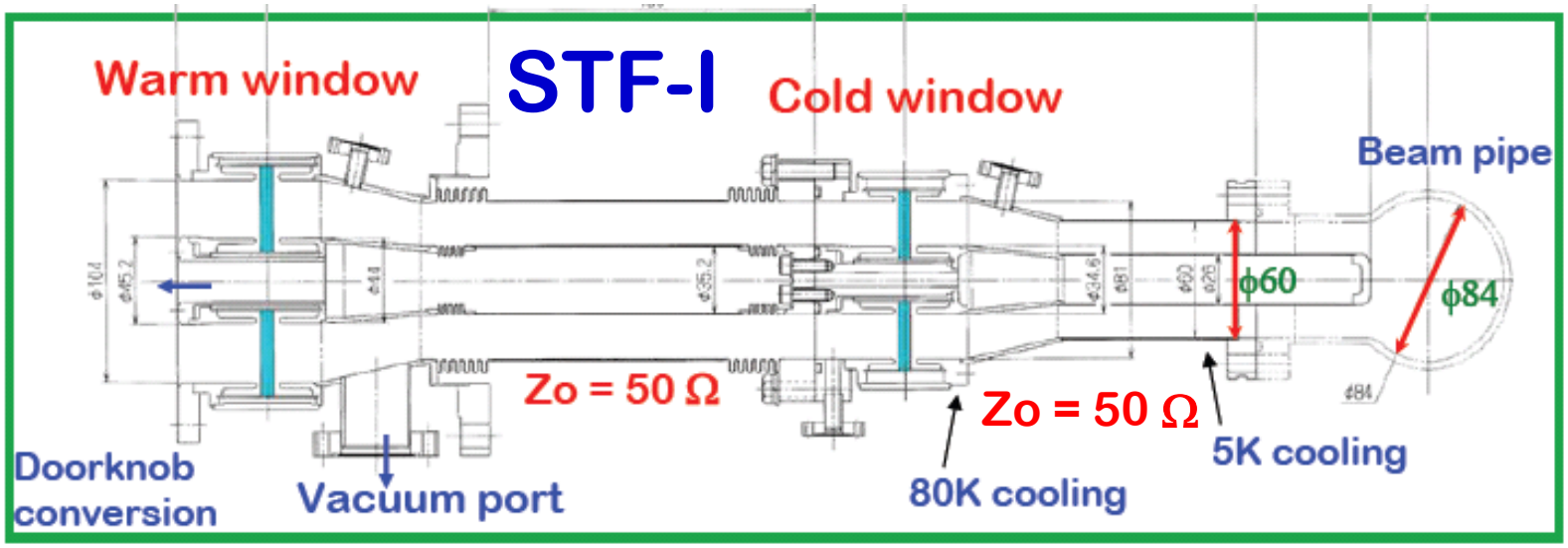
. for ILC (STF-I,STF-II coupler & TTF-V Coupler)

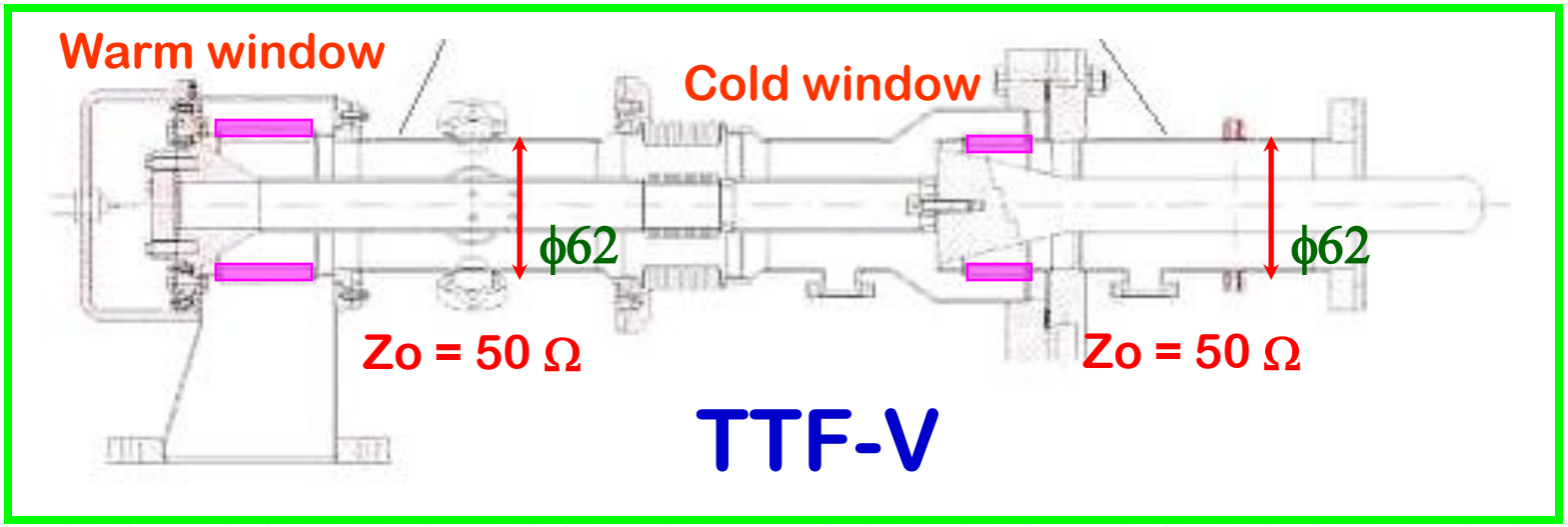
Test stand : 2 MW (<500μs), 1 MW (1.6ms, 5 Hz)
Cryomodule : 500 kW (<500μs), 250 kW (1.6ms, 5 Hz)
Beam operation : 350 kW (1.6ms, 5Hz) at 31.5 MV/m

. for cERL-injector

Test stand : 200 kW (CW)
Cryomodule : 50 kW (CW)
Beam operation : 170 kW (CW) at 14.5 MV/m

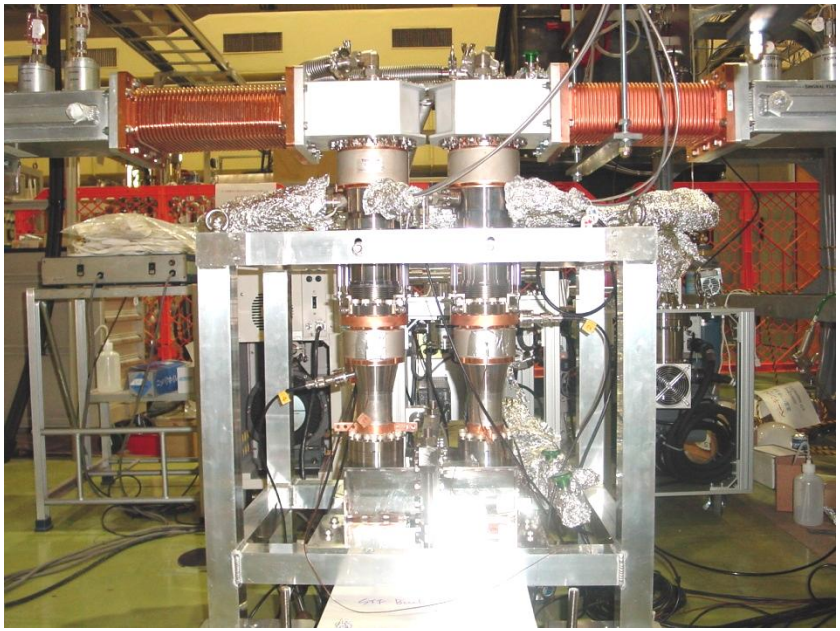
STF-I Coupler and TTF-V Coupler



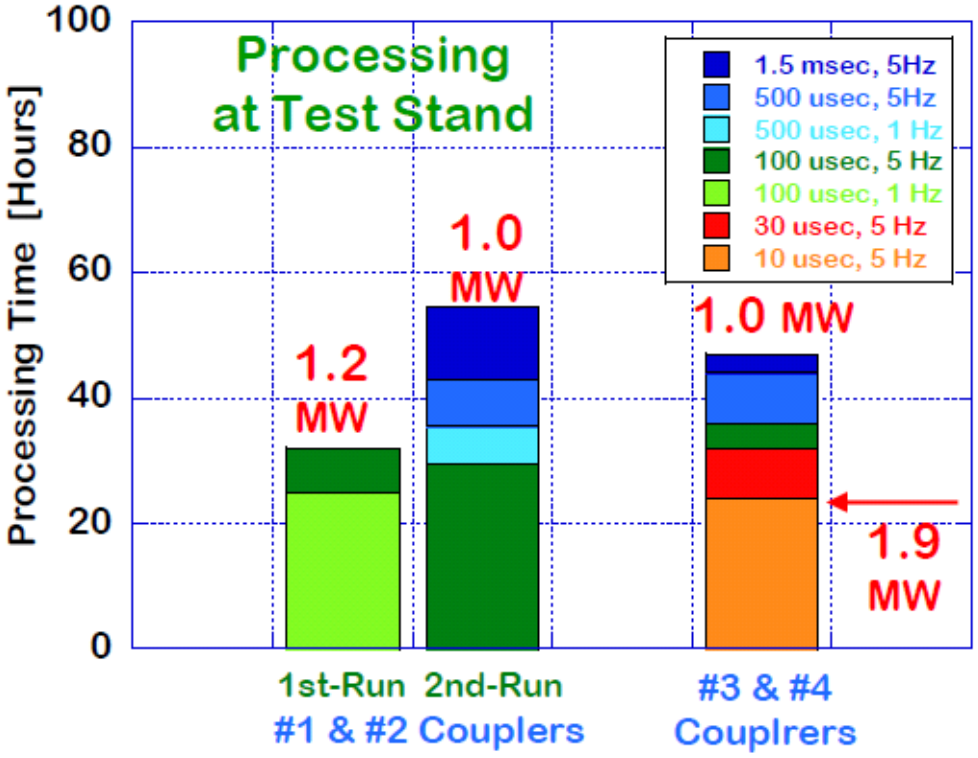


STF-I Couplers at KEK (1)

Coupler processing at the test stand



Sept - Dec., 2006

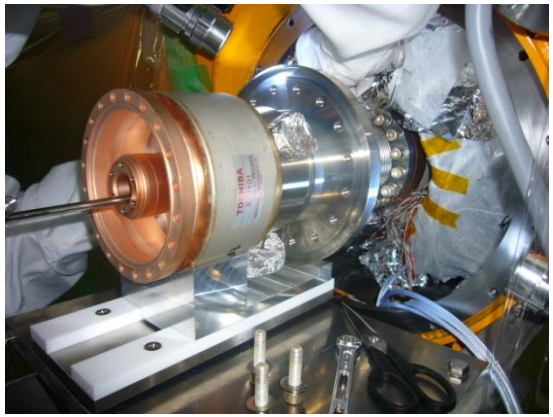


At the Test Stand
under matching condition

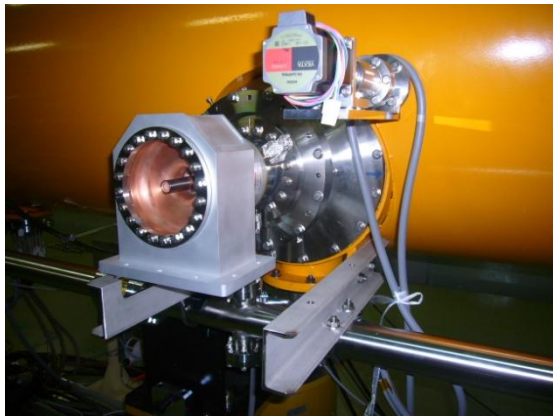
STF-I Couplers at KEK (2)

Assembly of STF phase-1 Cryomodule ; Jan.~Apr. 2008

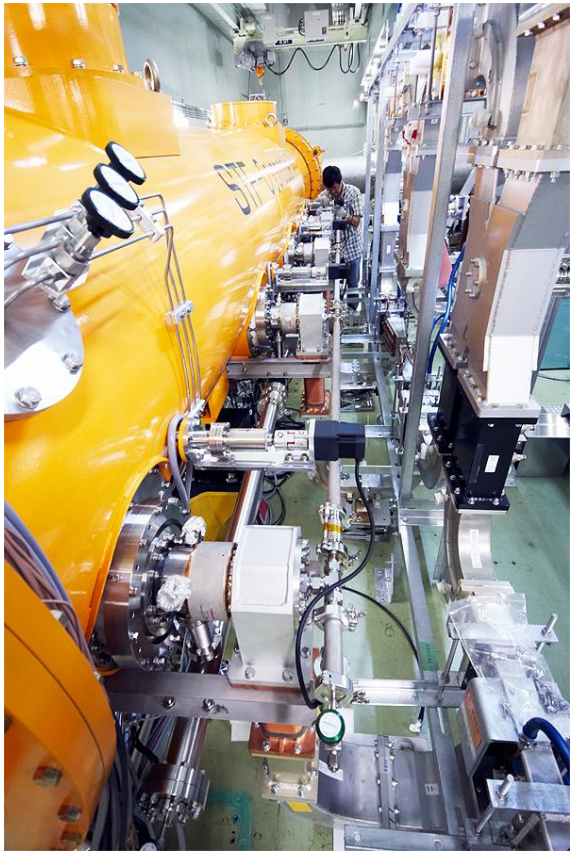
String assembly of four cavities & Installation of cold couplers



Installation of warm coupler



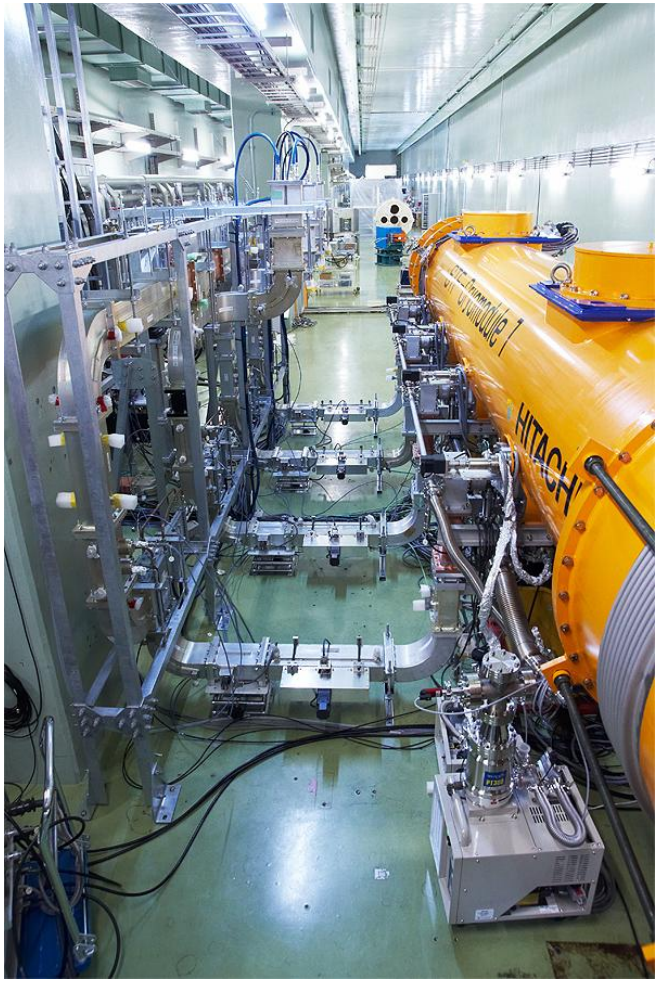
Attachment of doorknob WG

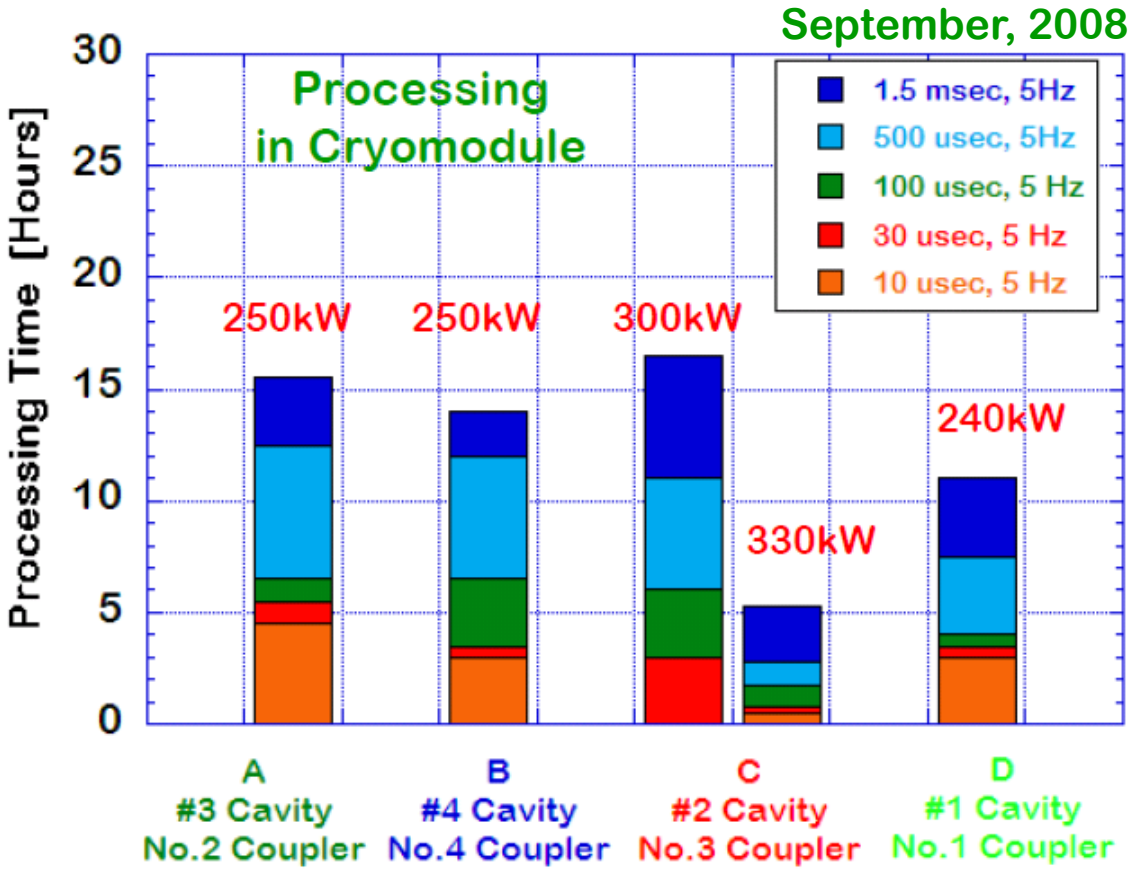


Connection with high power rf system

STF-I Couplers at KEK (3)

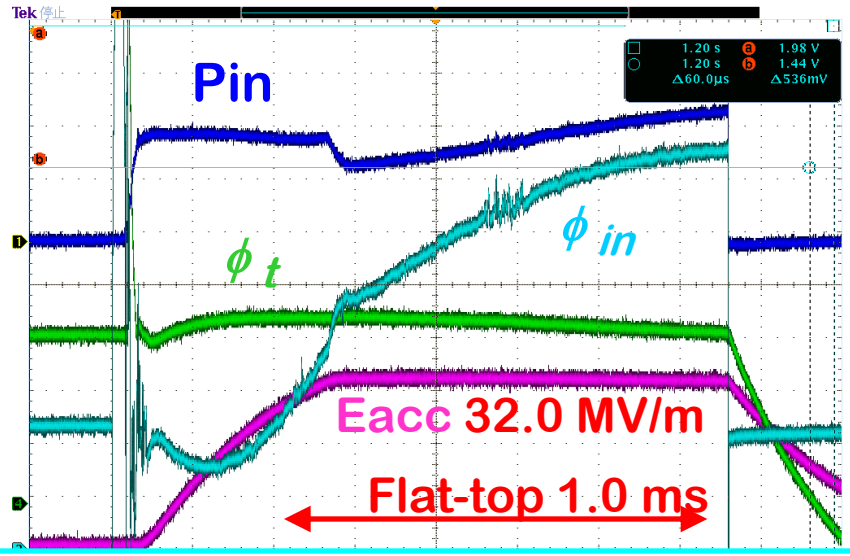
Coupler processing in the cryomodule at room temp.





In the cryomodule
under total reflection condition

STF-I Couplers at KEK (4)



Max. Input RF Power into Cavity

A/#3 Cavity : 220 kW @ 27.7 MV/m

B/#4 Cavity : 210 kW @ 27.3 MV/m

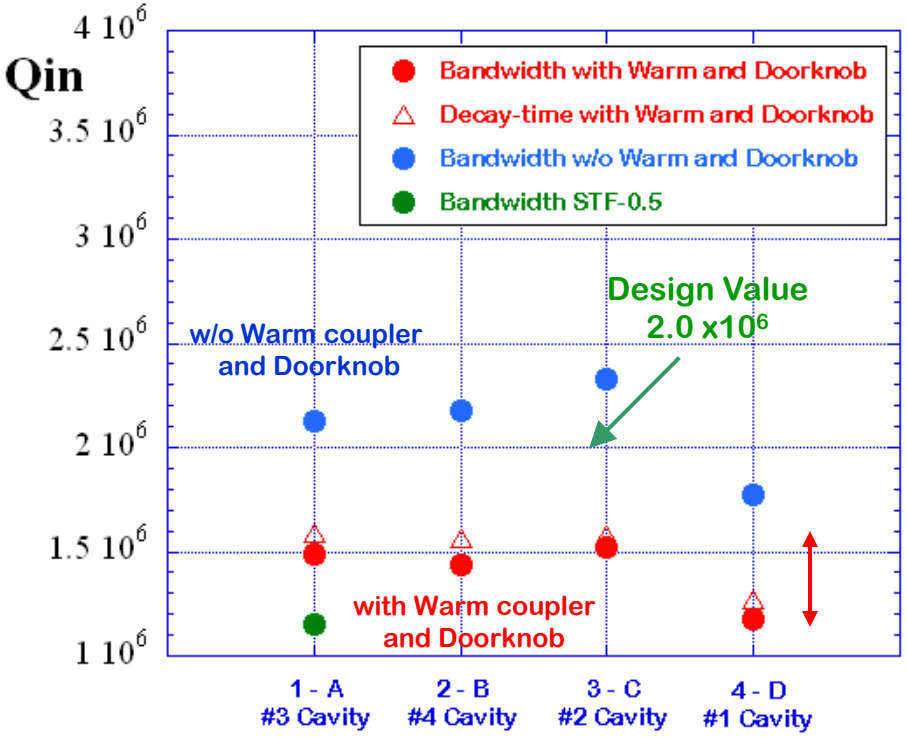
C/#2 Cavity : 360 kW @ 33.9 MV/m

D/#1 Cavity : 190 kW @ 24.6 MV/m

After warm-up to room temperature,

C/#2 Cavity : 625 kW (1.5 ms, 5 Hz)

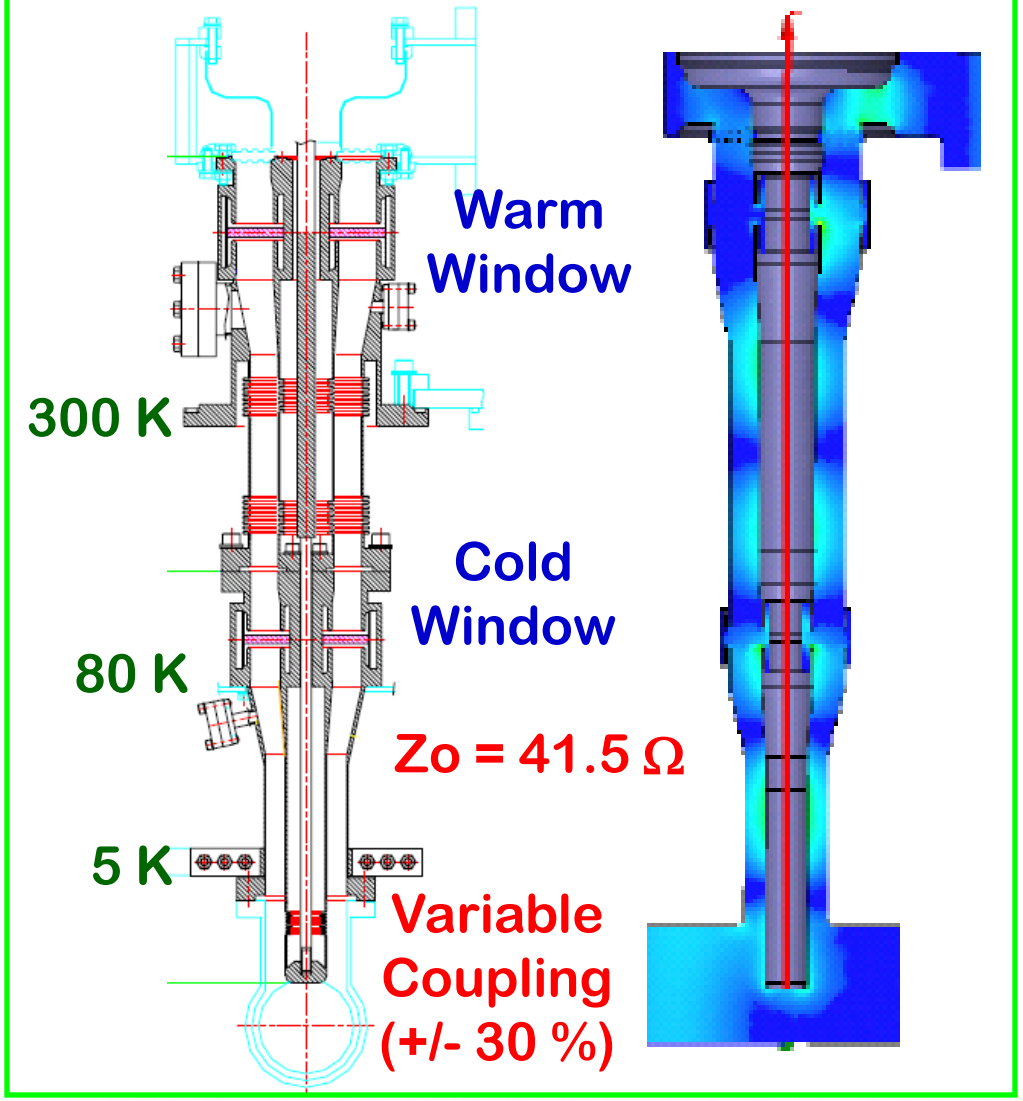
Qext of Input Couplers



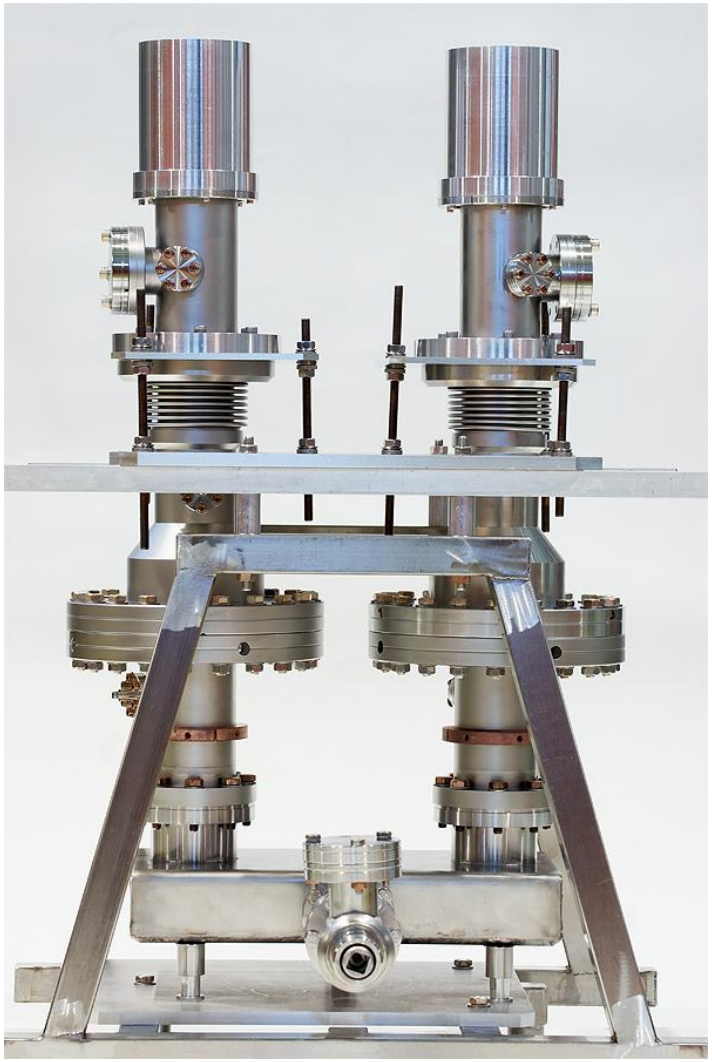
Qin = 1.2 ~ 1.5 x10^6

Deviation ~30 %

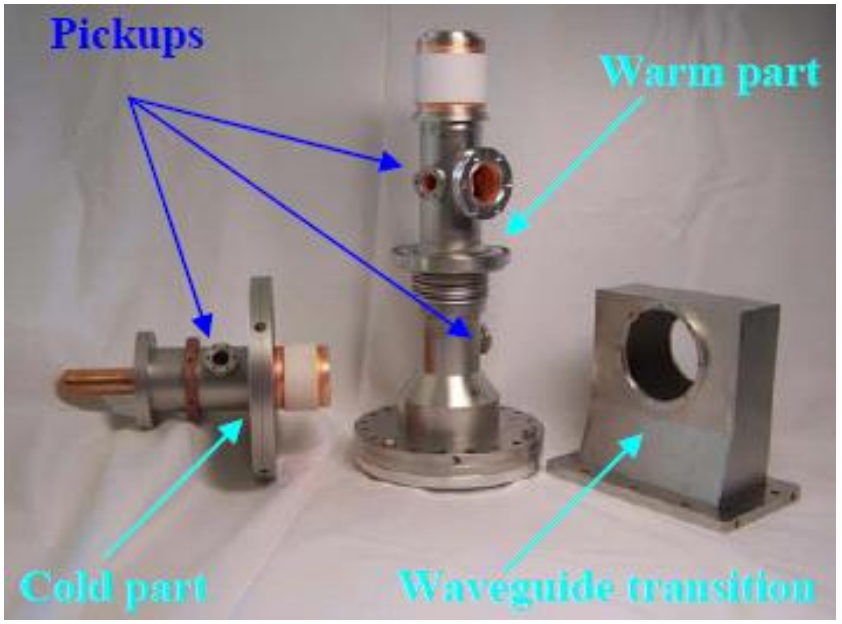
STF-II Couplers for S1-Global



TTF-V Couplers at KEK (1)



FJPPL Collaboration between KEK and LAL



TTF-V couplers ;
Original RF design by DESY,
Mechanical design by LAL,
Fabrication by RI (ACCEL).

TTF-V Couplers at KEK (2)

TTF-V at LAL (#1 and #2)

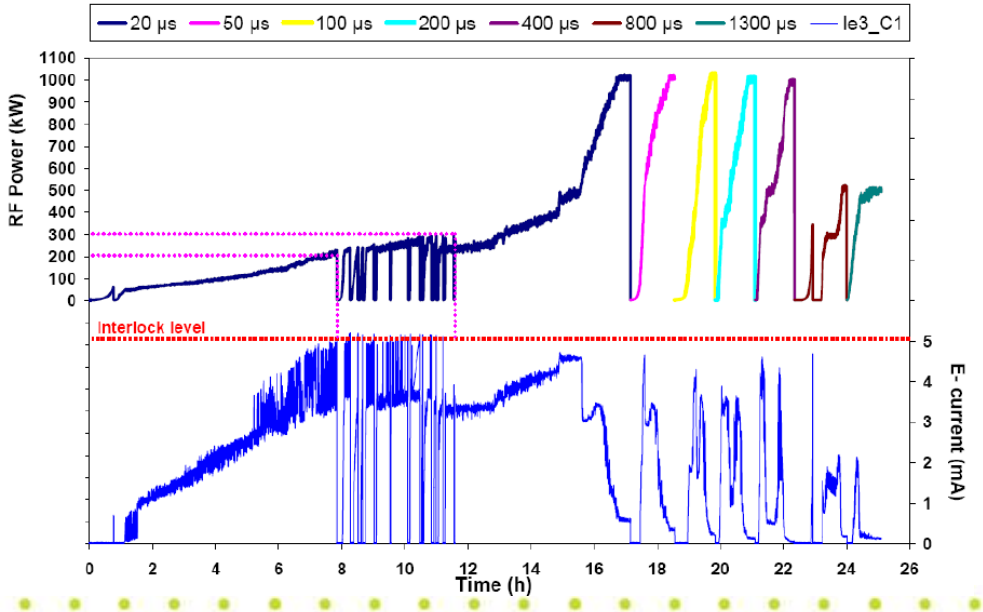
1.0 MW / 400 μs, 2 Hz
0.5 MW / 1.3 ms, 2 Hz

Total processing time ~ 25 hours

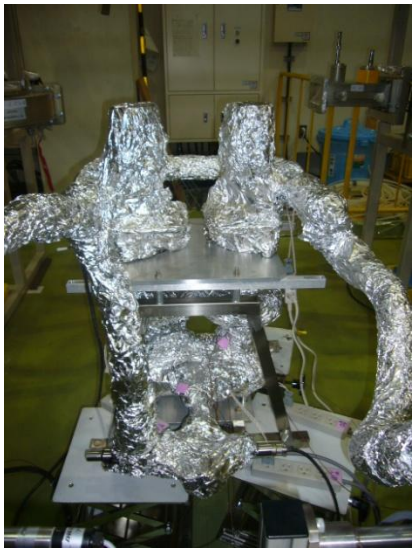
→

TTF-V at KEK (#3 and #4)

2.0 MW / 400 μs, 5 Hz
1.0 MW / 1.5 ms, 5 Hz



TTF-V Couplers at KEK (3)



January, 2009

Assembly in clean room ;
pumping ports & vacuum gauges

↓

Baking at 130°C for 60 h

↓

Set-up of
High Power Test Stand

Step 1 : Target for XFEL (Feb. 2009)

400 μs, 1.0 MW

1.5 ms, 0.5 MW, 5 Hz

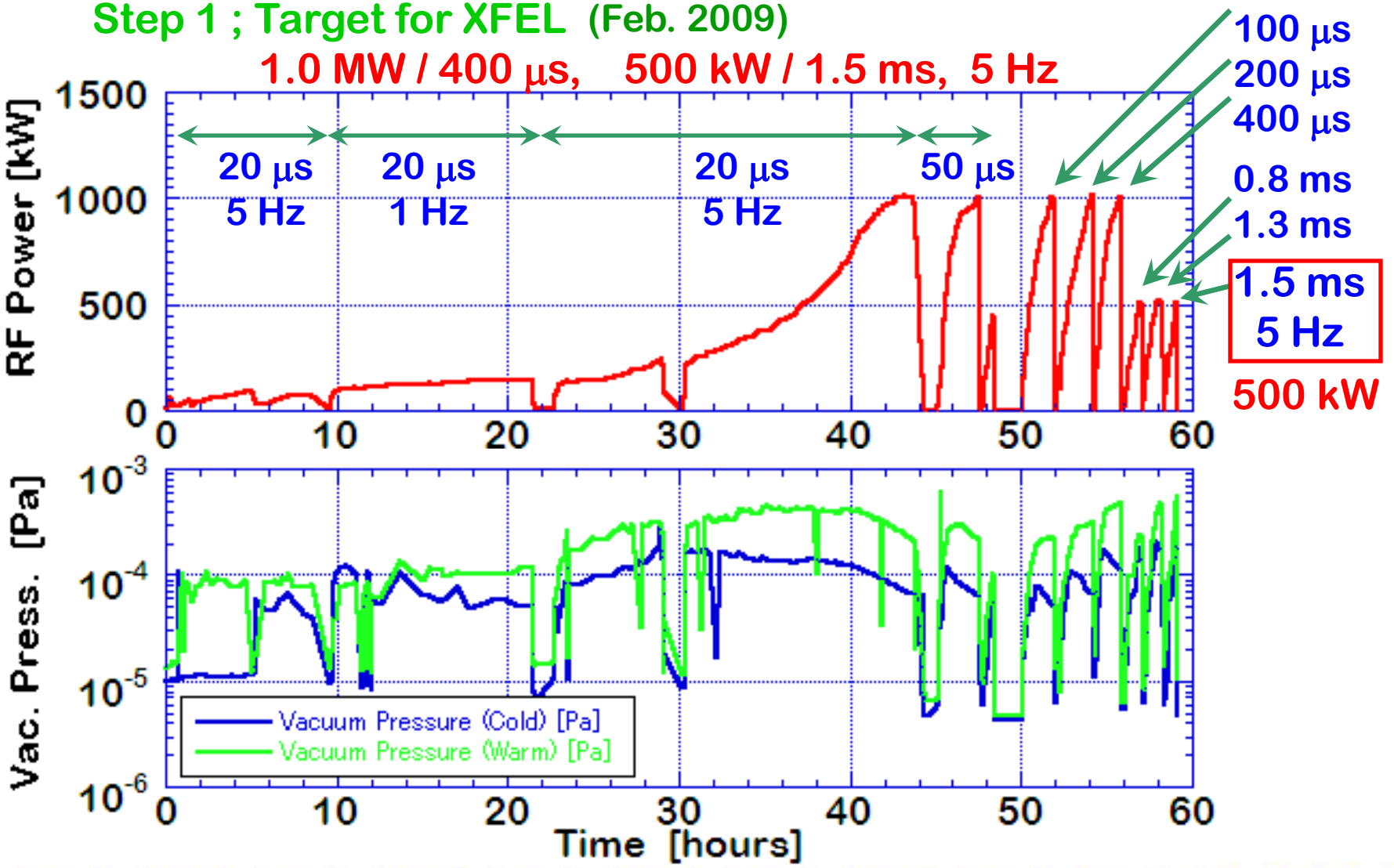
Step 2 : Target for ILC (Mar. 2009)

400 μs, 2.0 MW, 5 Hz

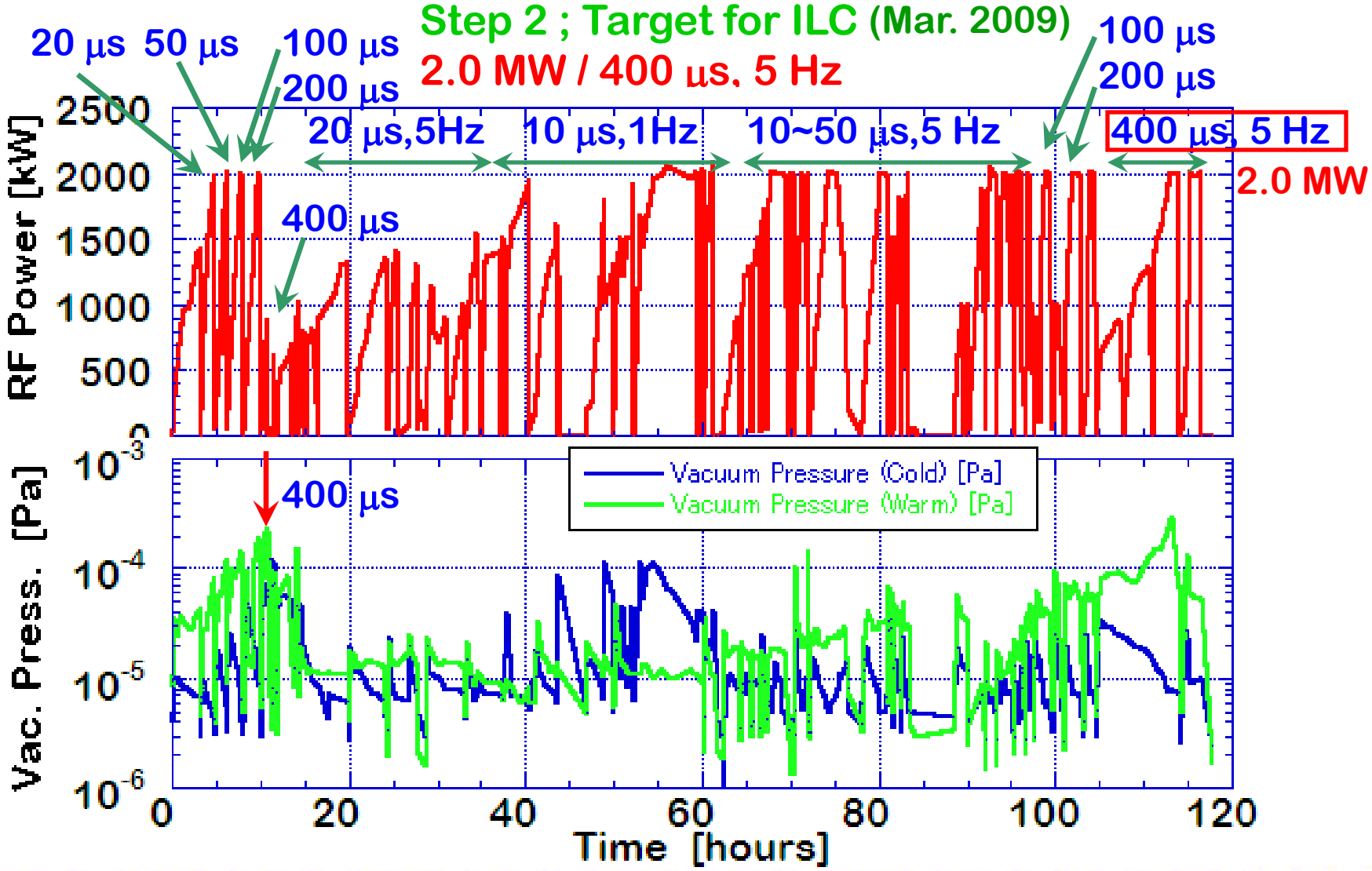
Step 3 : Target for ILC (May. 2009)

1.5 ms, 1.0 MW, 5 Hz

TTF-V Couplers at KEK (4)



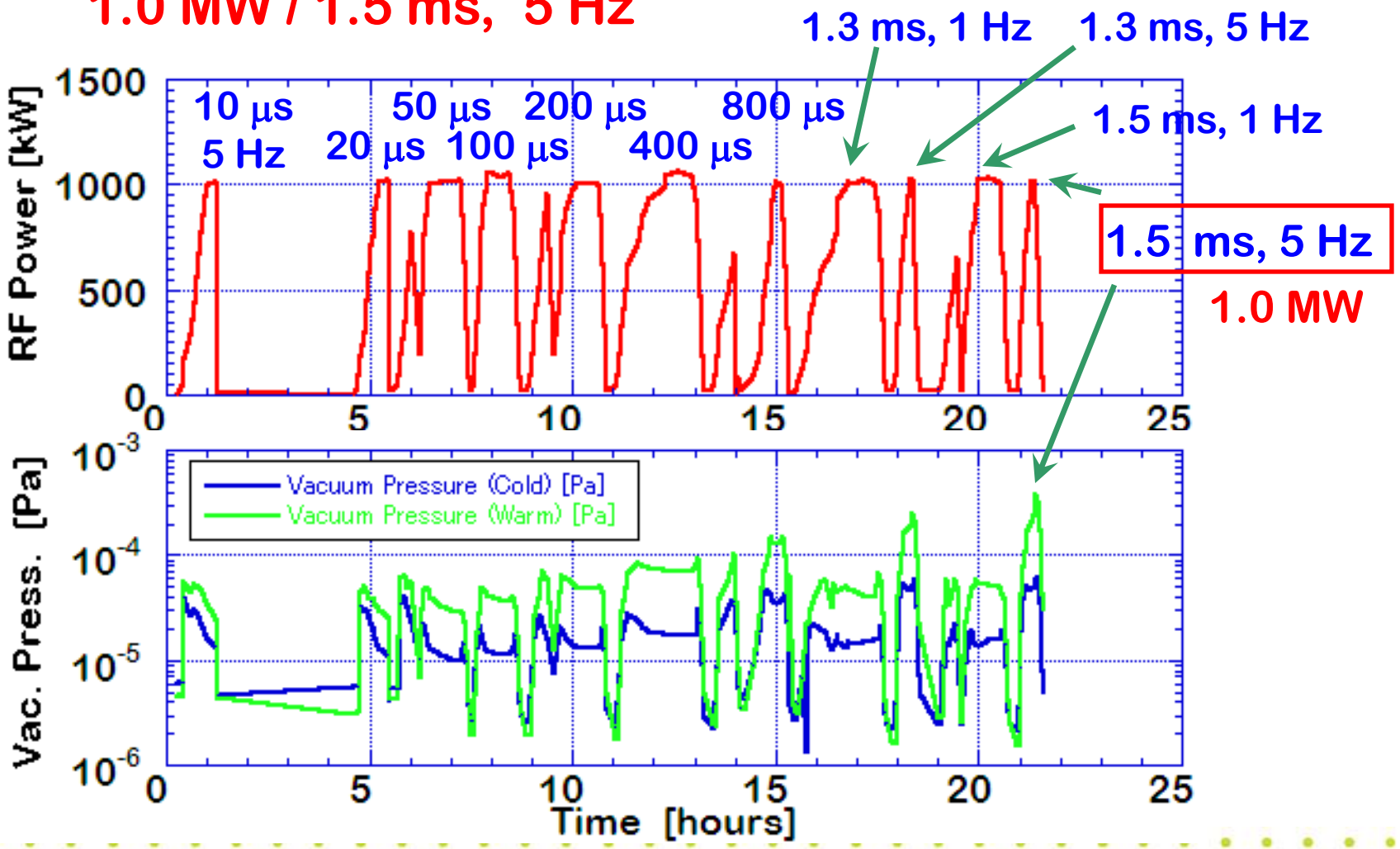
TTF-V Couplers at KEK (5)



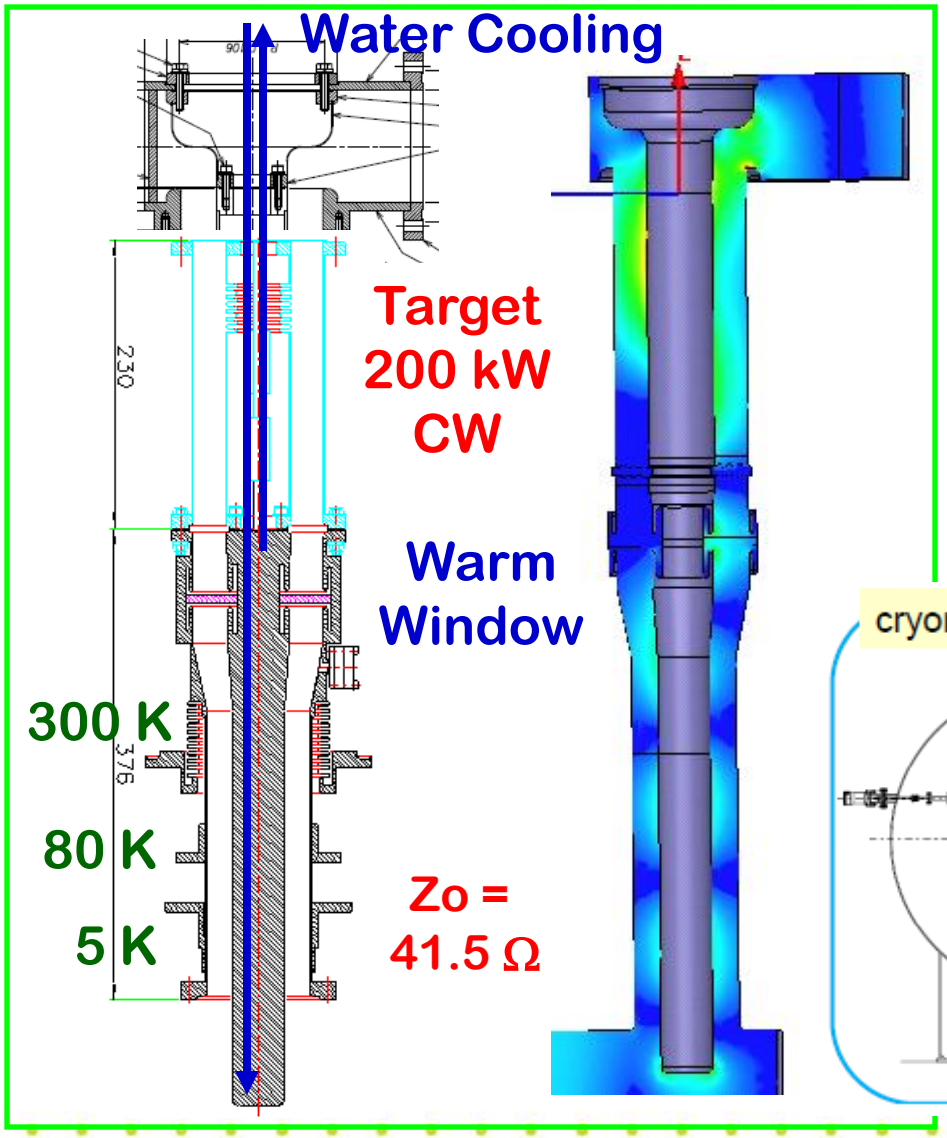
TTF-V Couplers at KEK (6)

Step 3 ; Target for ILC (May, 2009)

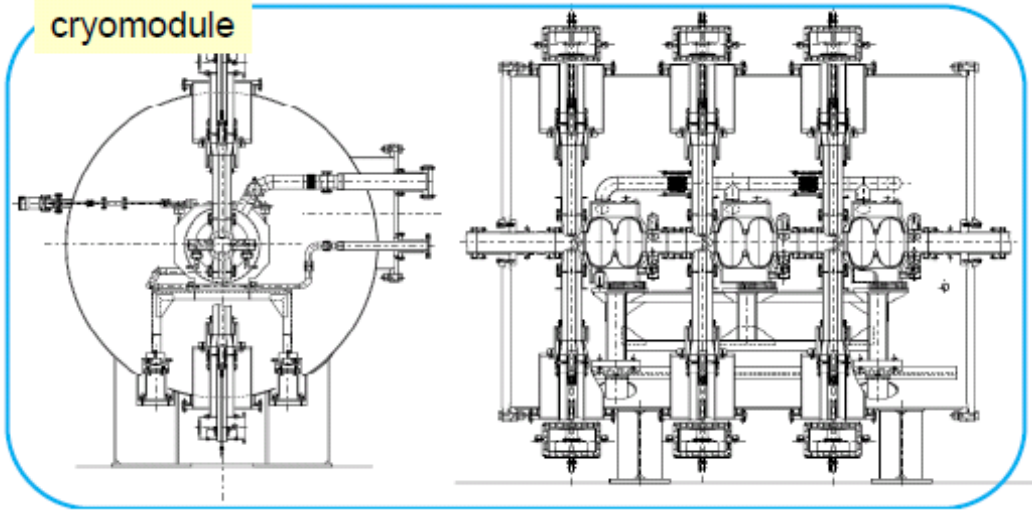
1.0 MW / 1.5 ms, 5 Hz



ERL-Injector Couplers at KEK



2 Input Couplers / Cavity



SUMMARY

- Four STF-I input couplers had been operated at the rf power level of 200~360 kW in the cryomodule tests at 2 K. One coupler was processed in the cryomodule at room temperature up to 625 kW in the 1.5ms and 5 Hz pulsed operation.
- LAL TTF-V input couplers were successfully processed up to the rf power level of the ILC target, 2 MW (400 μs) and 1 MW (1.5 ms, 5 Hz).
- RF processing of the STF-II input couplers for S1-G and ERL-injector couplers will be started in the next month.

Conditioning of LAL TTF-V Input couplers at KEK-STF

Acknowledgement
Wolf-Dietrich Moeller (DESY)

Thank you for your attention.....