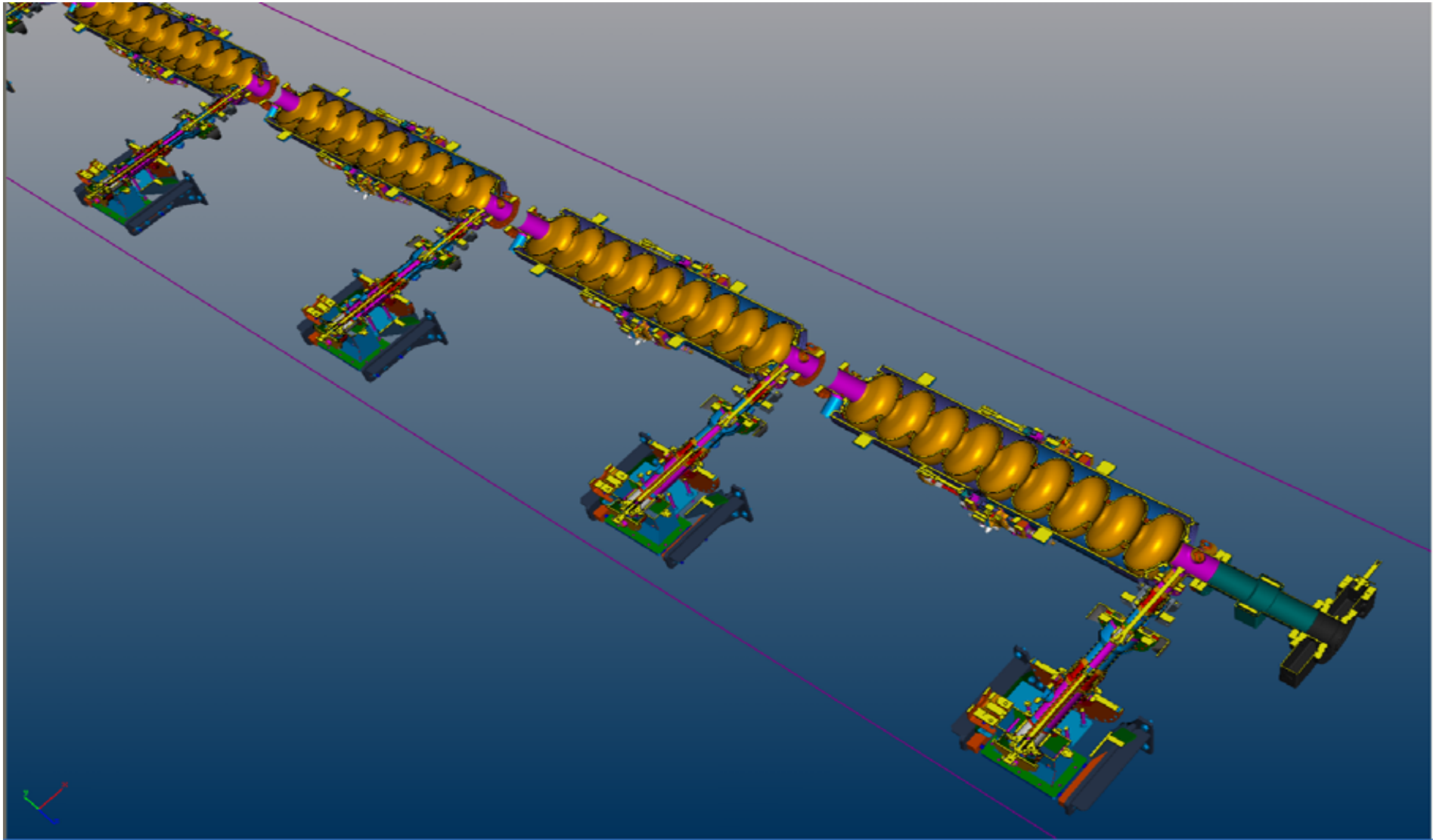
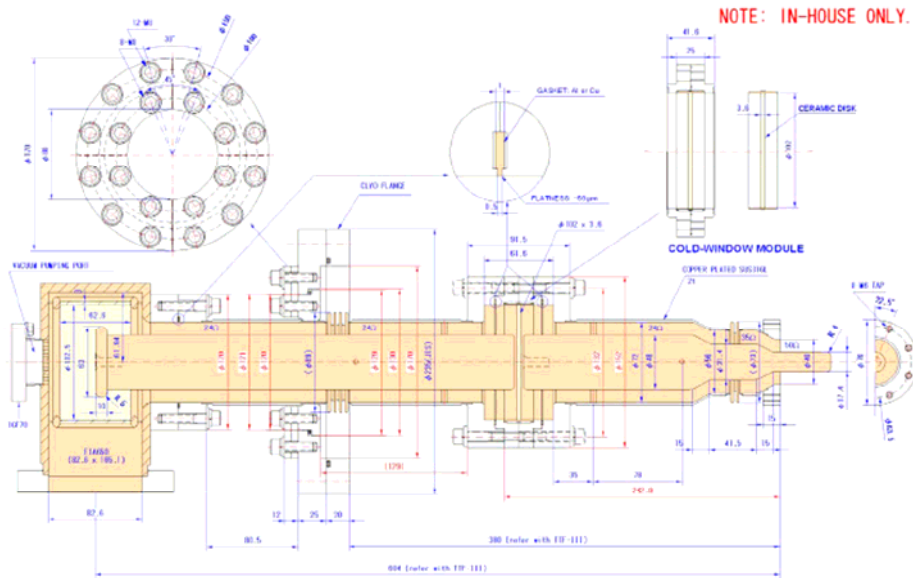


# **11. RF Input Coupler**

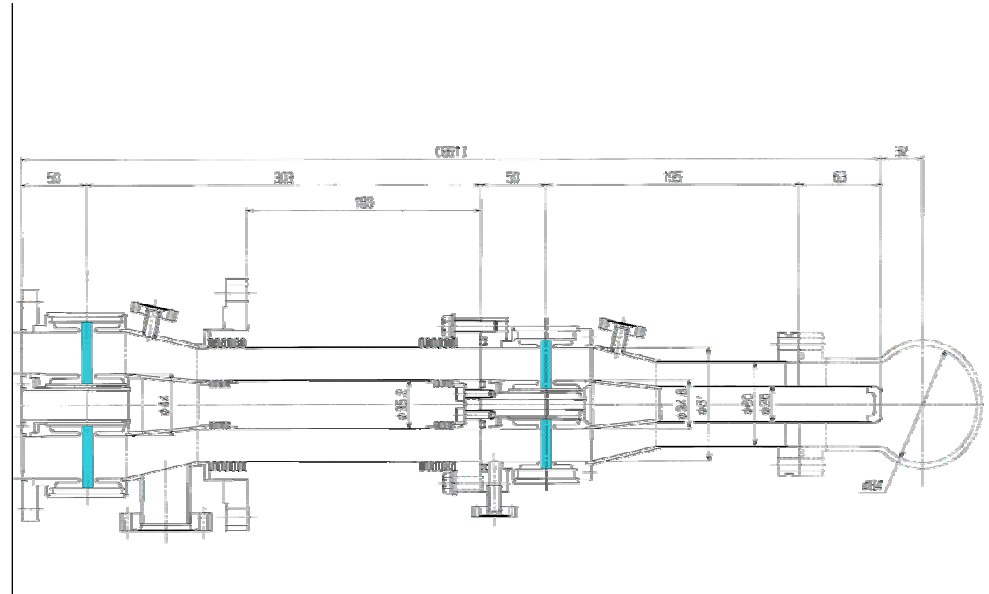


# Three types developed for ILC

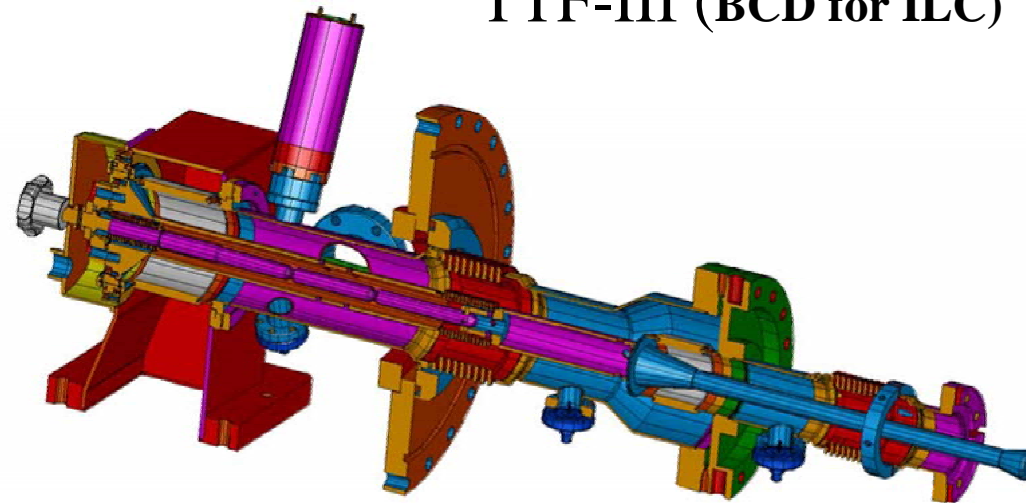
## CC-coupler



## Double disk windows



## TTF-III (BCD for ILC)



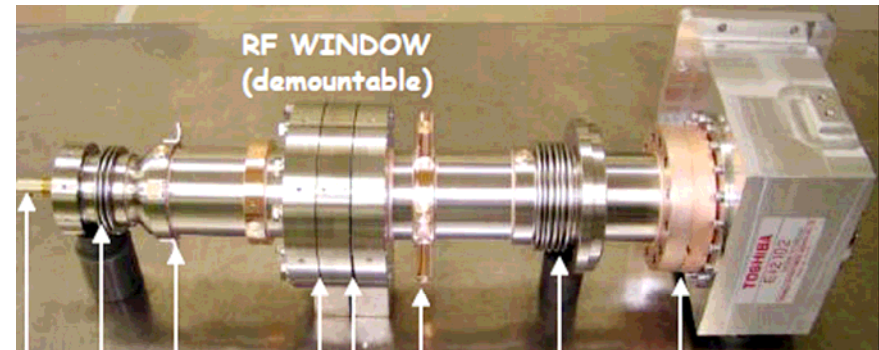
# Input Coupler Designs

			CC-coupler	STF-BL	TTF-III
Designed RF Power [kW]			500 (2000)	350(1300)	250(1000)
Pulse width [ms]			1.3 (1.5)	1.3(1.5)	1.3
Repetition [Hz]			5	5	10
Average rf power [kW]			3.25	2.3	3.2
RF processing time [hr]			16	50	20
Thermal Loss [W]	80K	Static	1.24	5	6
		Dynamic	1.5	3	3
	5K	Static	0.54	1.1	0.5
		Dynamic	2.0	0.2	0.1
	2K	Static	1.8e-4	0.05	0.06
		Dynamic	0.18	0.03	negligible

Can be reduced the dynamic loss at 5K and 2K in CC-coupler by using higher RRR cooper material, for example RRR=40.

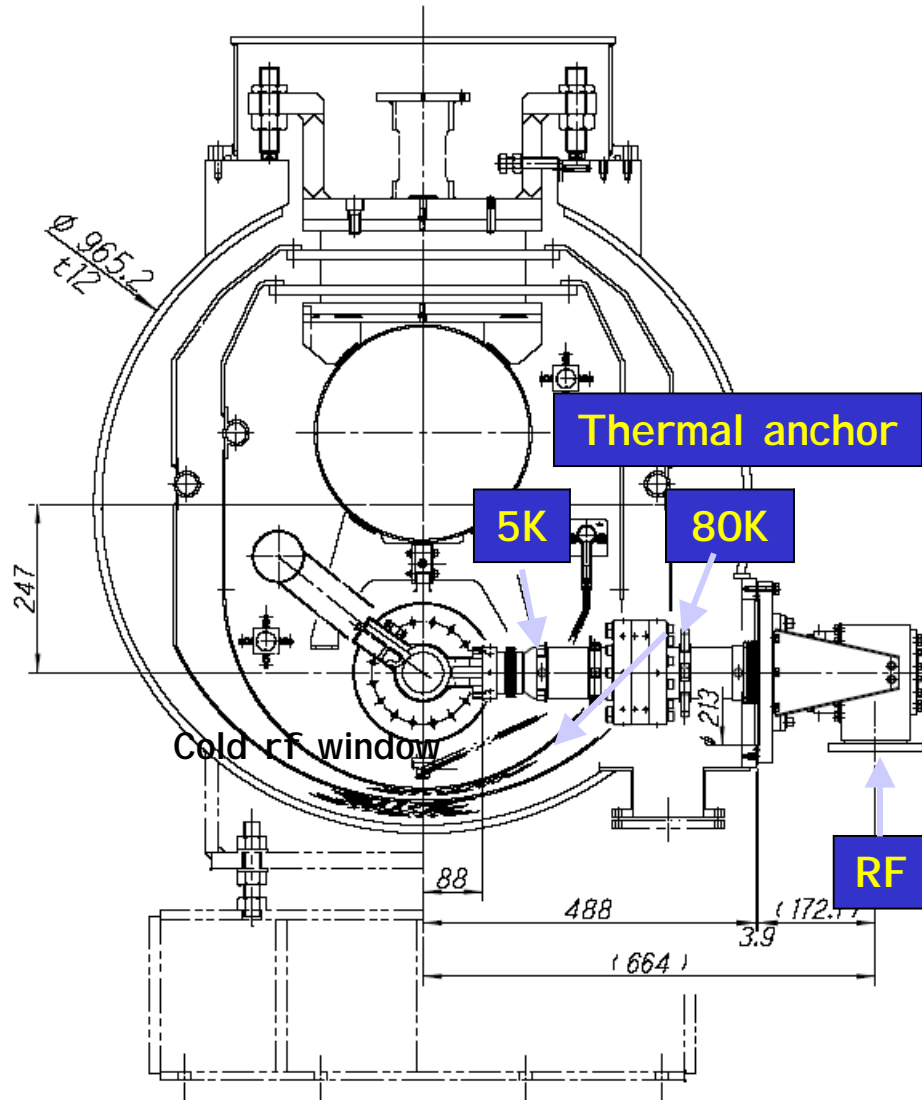
# Input Coupler Design @ KEK

By Matsumoto and Kazakov @ KEK



Major Parameters

Input rf power: 500 kW  
 Pulse width: 1.3 msec  
 Repetition rate: 5 Hz  
 Average rf power: 3.25 kW



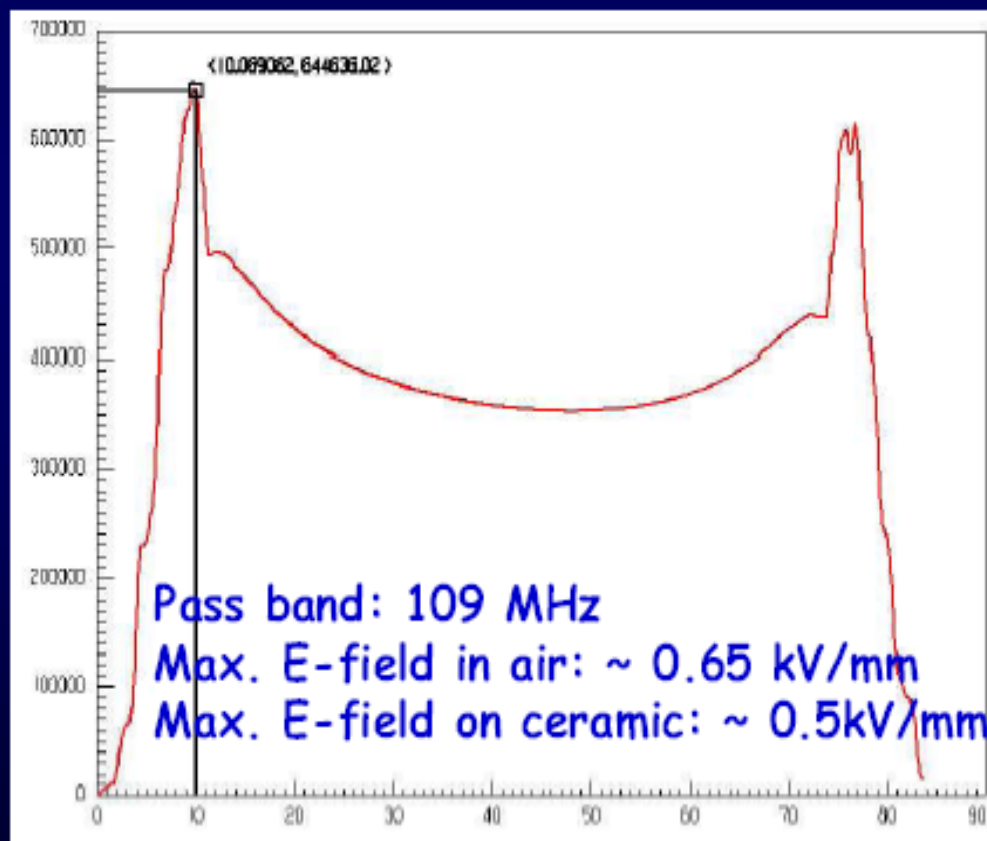
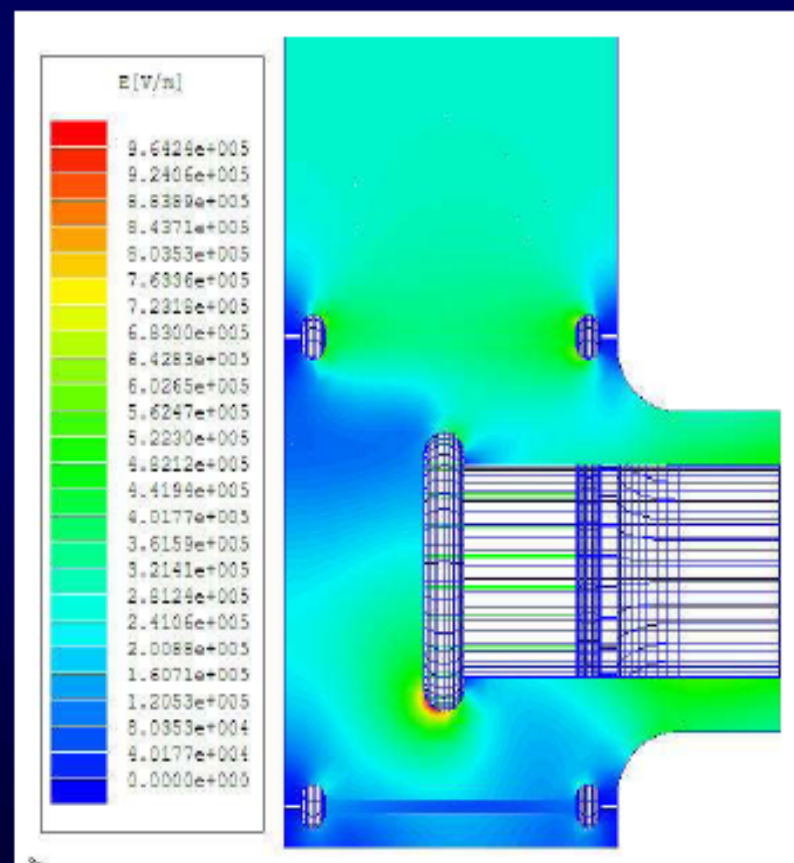
Thermal loss [W]

	80K	5K	2K
Static:	1.24	0.54	2.6x1e-4
Dynamic:	2.14	2.88	0.25
Total:	3.38	3.42	~0.25

RRR: 3.5 (measured data)

# ELECTRIC FIELD GRADIENT AT INPUT POWER OF 500-KW

Maximum electric field gradient  
in the air side for warm window.

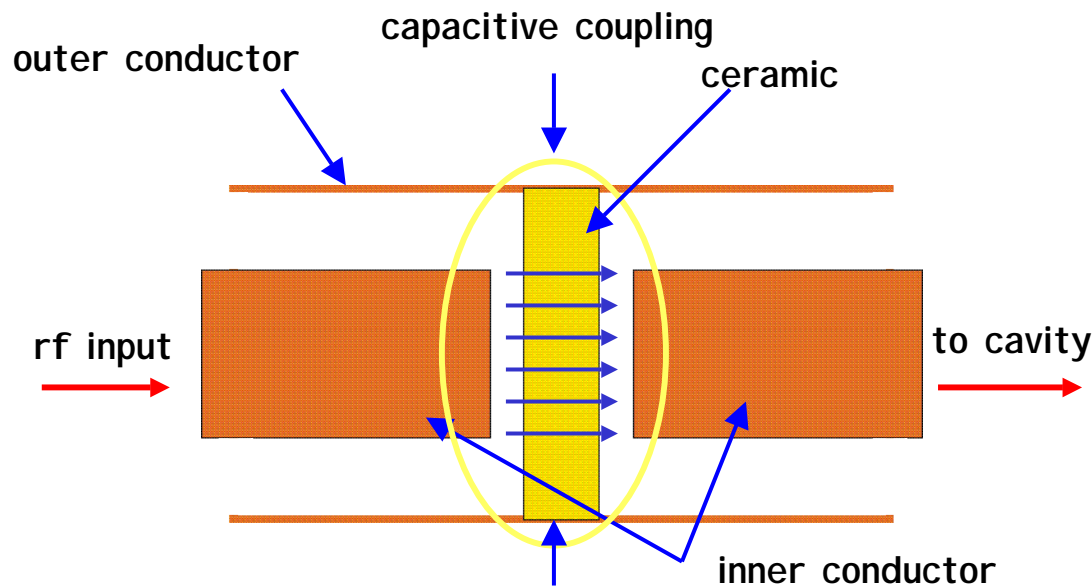


# Capacitive Coupling Coaxial Line for Input Coupler

Capacitive coupling coaxial line should have advantages; By H.Matsumoto and S.Kazakov

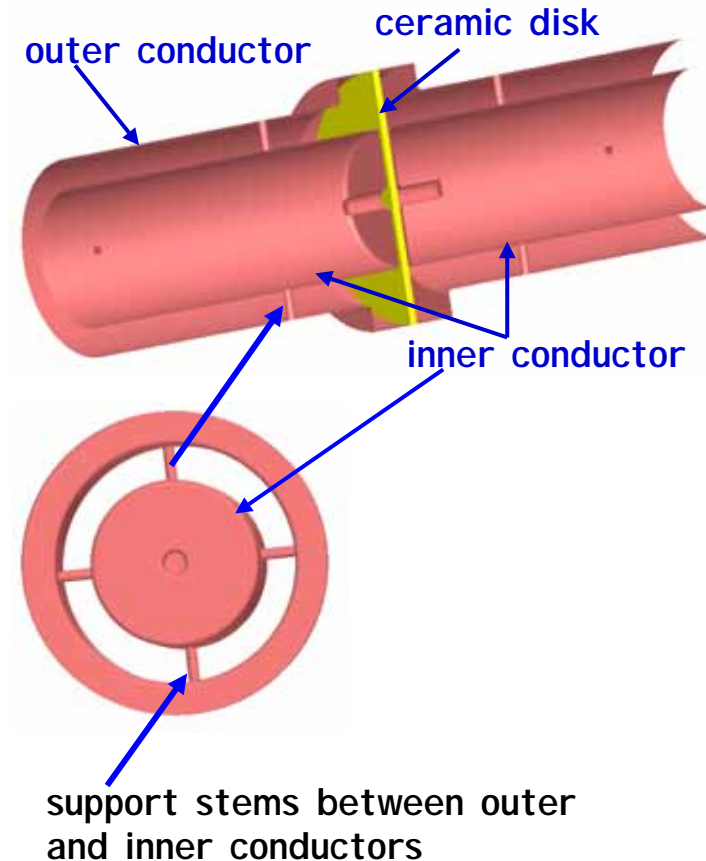
- 1) Good thermal insulation ability between the warm and the cold sides.
- 2) Reduce the brazing difficulty for the ceramic window.

## Concept of capacitive coupling coaxial line



Easy to braze between cooper and ceramic disk.

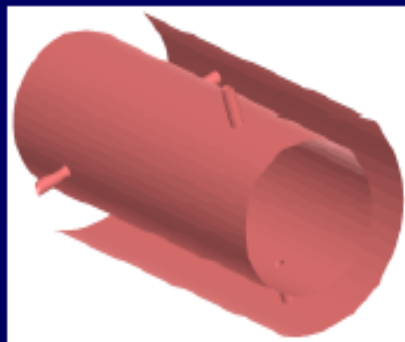
**Well established in warm technology**



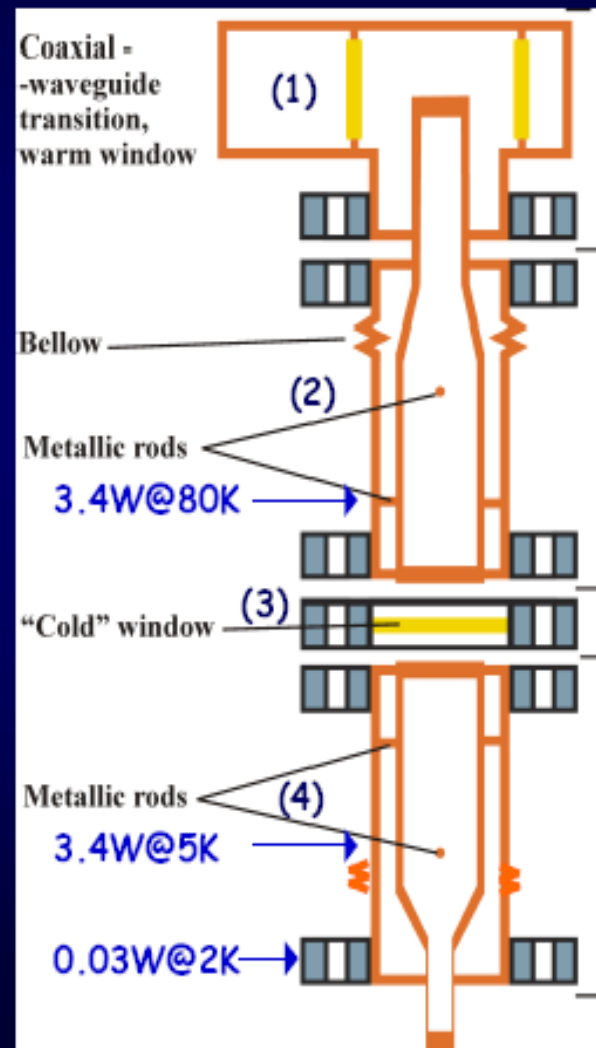
# INDUSTRIALIZATION with MODULAR STRUCTURE

Input coupler comprises of four modules:

- 1) coaxial transformer
- 2) coaxial line
- 3) rf window
- 4) antenna at cold side



Each pair of rods is mounted in the gap between the inner- and outer-conductors, and are rotated 90 degrees from each other.



- [1] The complete input coupler can be divided into four relatively simple parts to **ease fabrication and assembly**. If we assume that the inner conductors are not attached rigidly to the waveguide, we **need only two**
- [2] **bellows to absorb the movement of the coaxial line** due to thermal contact and expansion between cool down and warm up.
- [3] **technical requirements dose not overlap for each parts.**

- [4] **technical requirements dose not overlap for each parts.**

Average power: 3.25-kW (500-kW, 1.5-msec, 5-pps) RRR: 3.5 (measured data for copper plated layer)



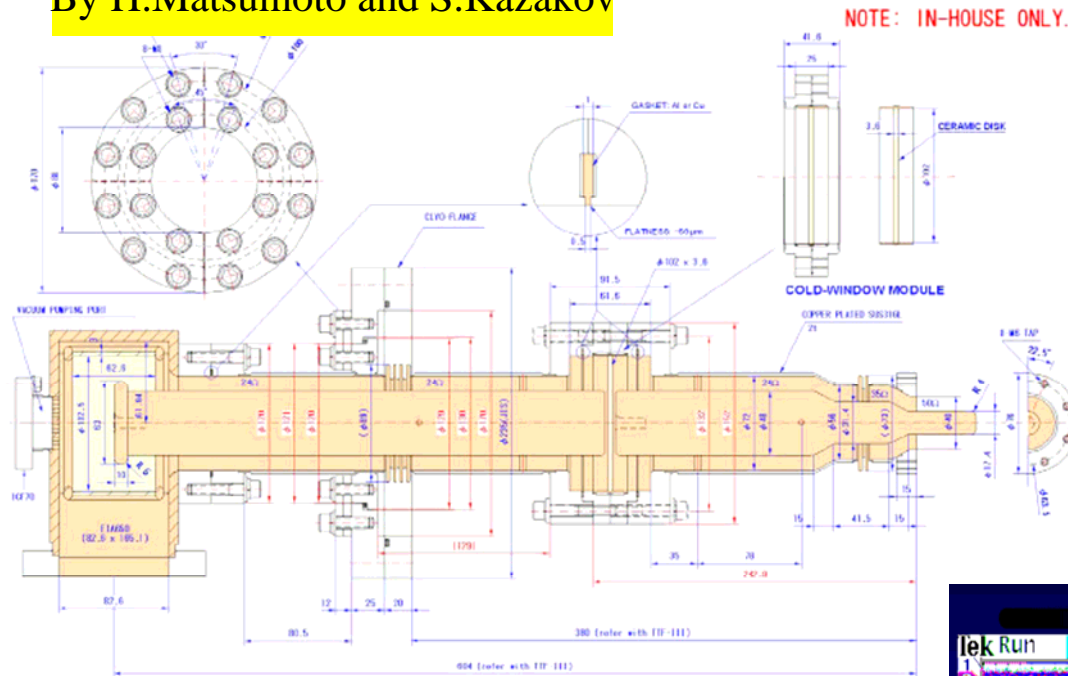
# 500kW Input coupler high power test stand @ STF

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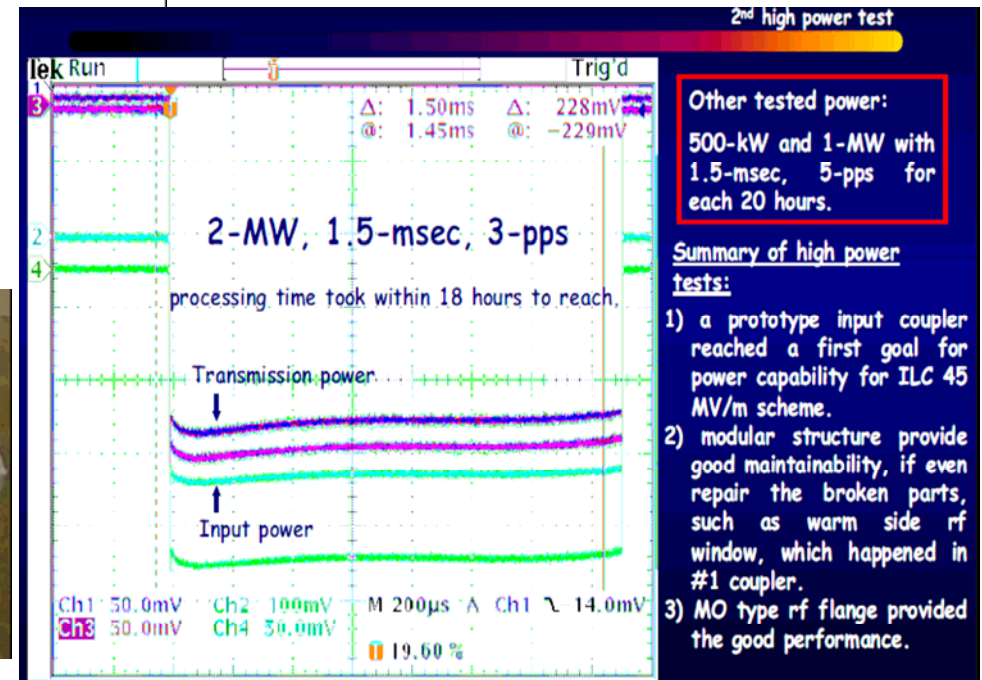
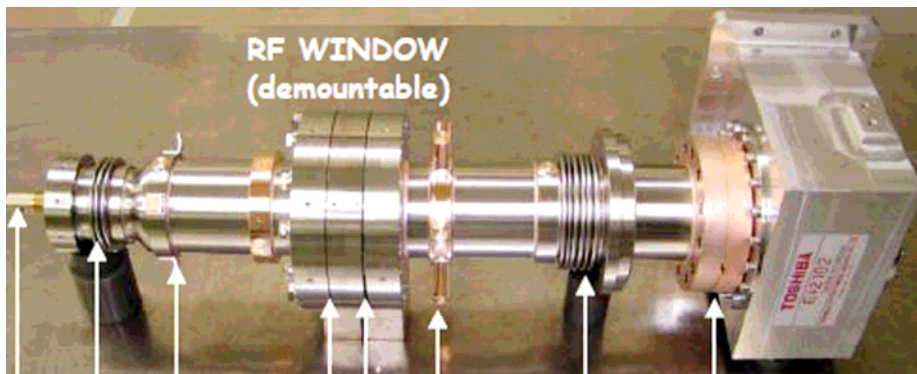
# Coaxial capacitive input coupler

By H. Matsumoto and S. Kazakov



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

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



**Ichiro #1 cool down  
test in cryomodule.**

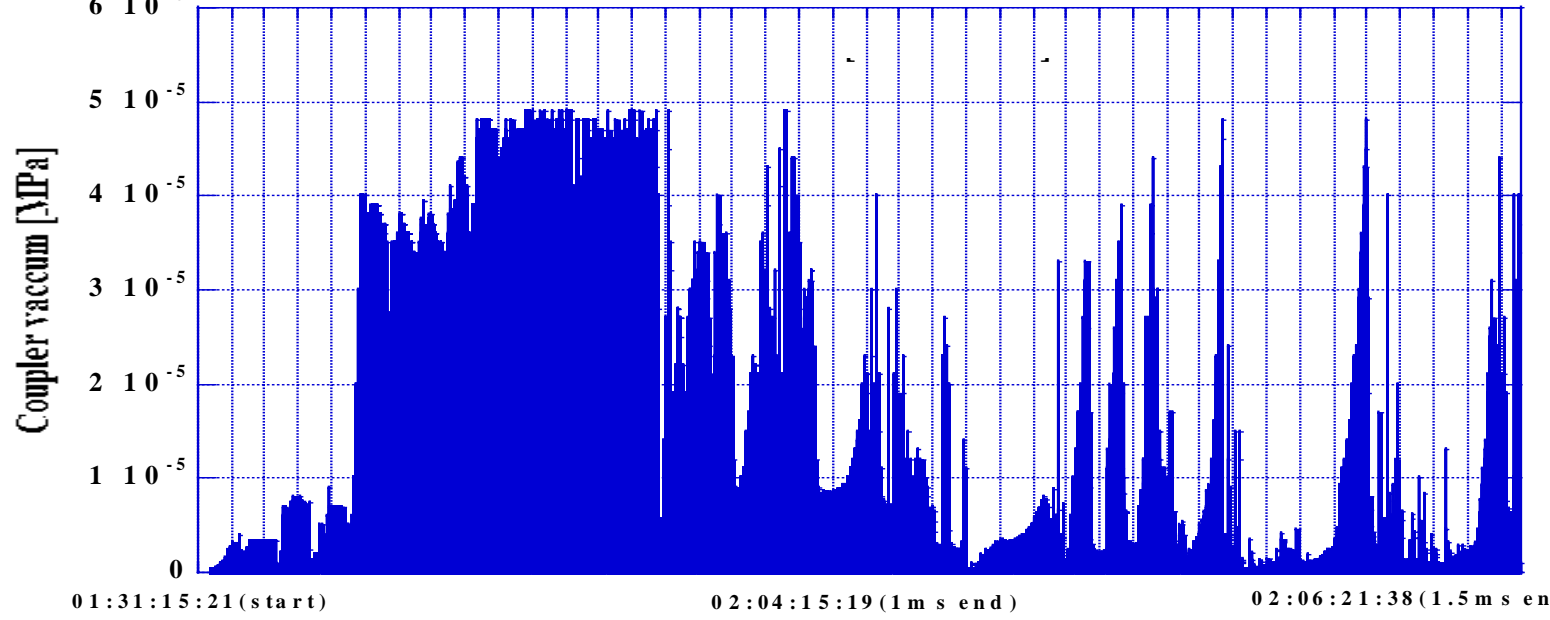
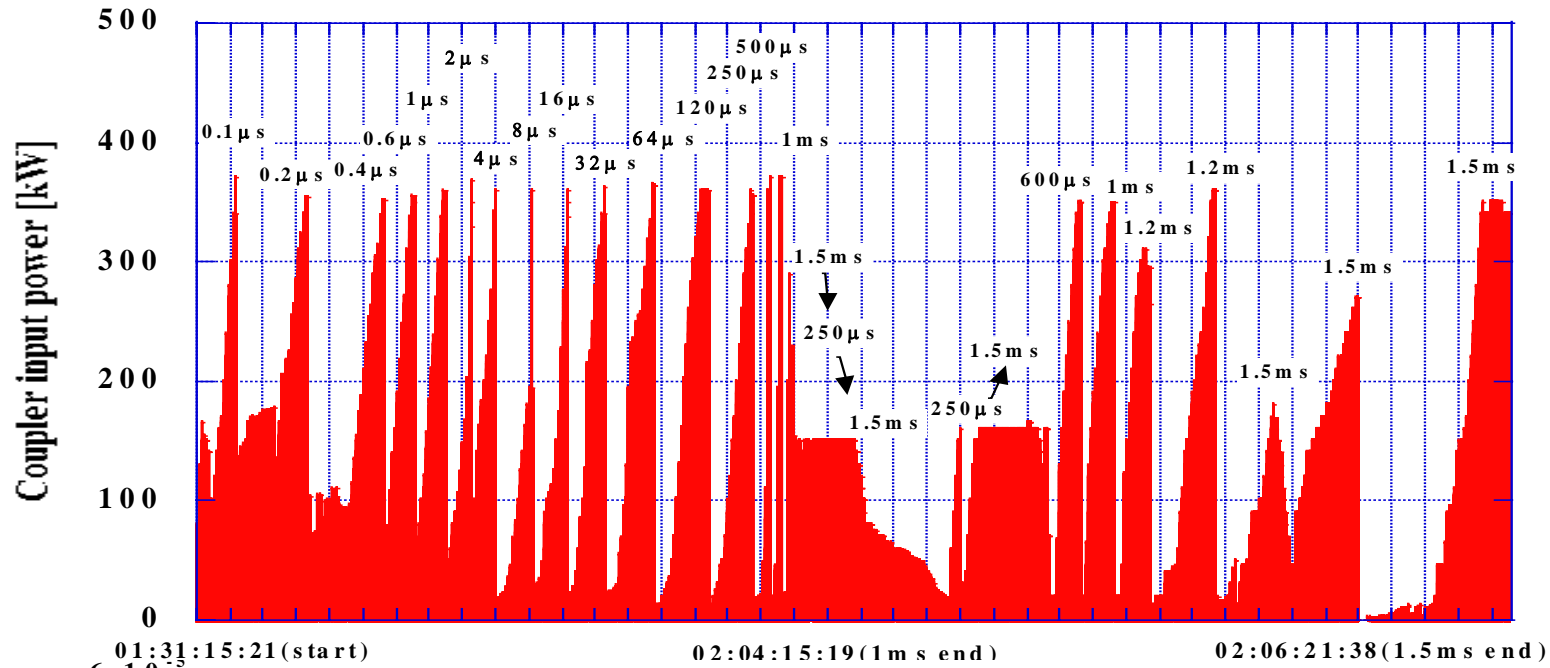
**試験日程: Feb. 13 to  
Mar. 31, 2008**



**試験項目:  
Heat load measurement,  
Ball-screw tuner test,  
coupler performance test,  
cavity performance test (it was 19.5MV/m in VT),  
etc.**

**From Hayano-san's slide**

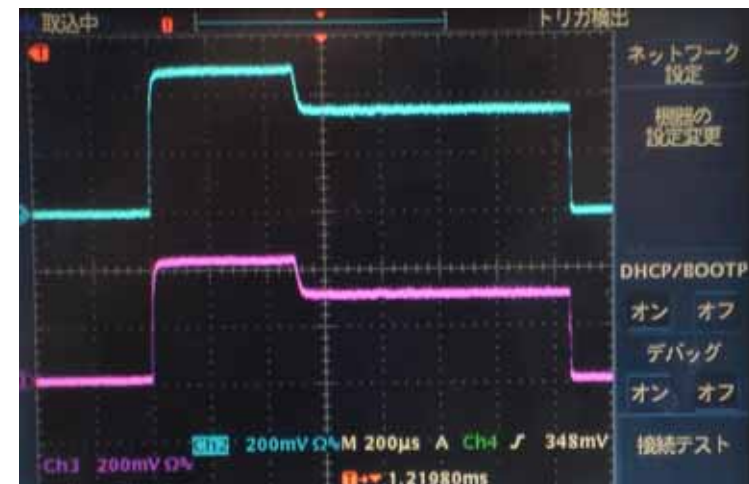
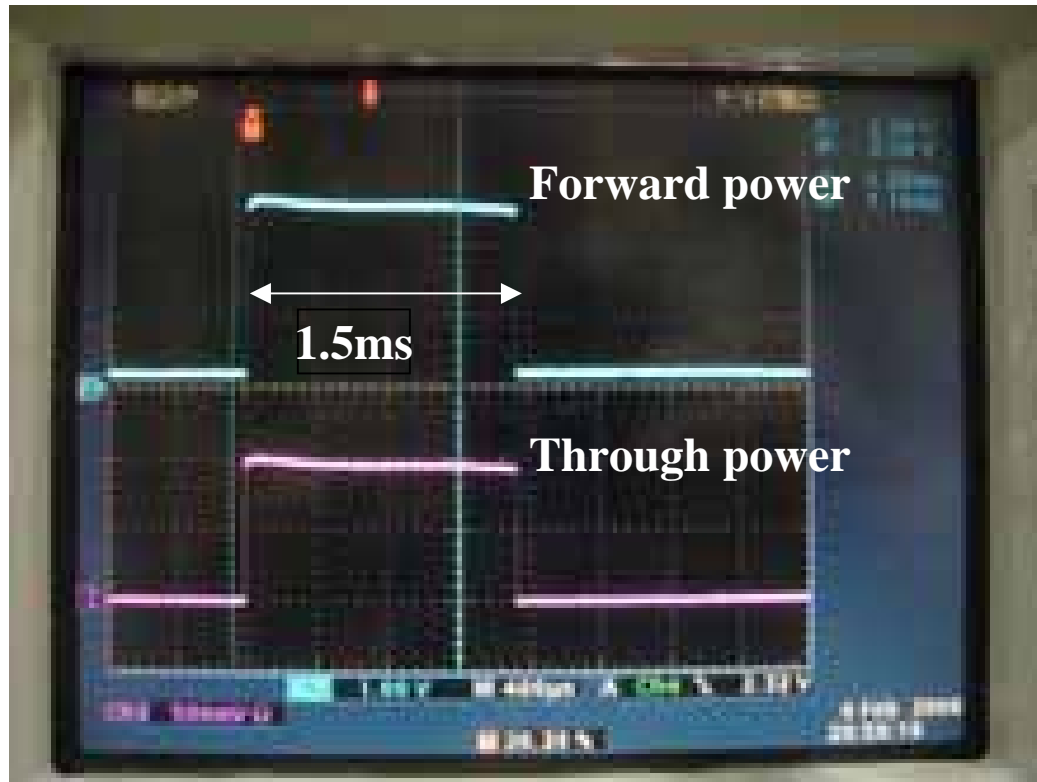
# Coupler Aging @ R.T. in STF module



Time [M:d:m:h:m]

# Succeeded Coupler Performance in STF module

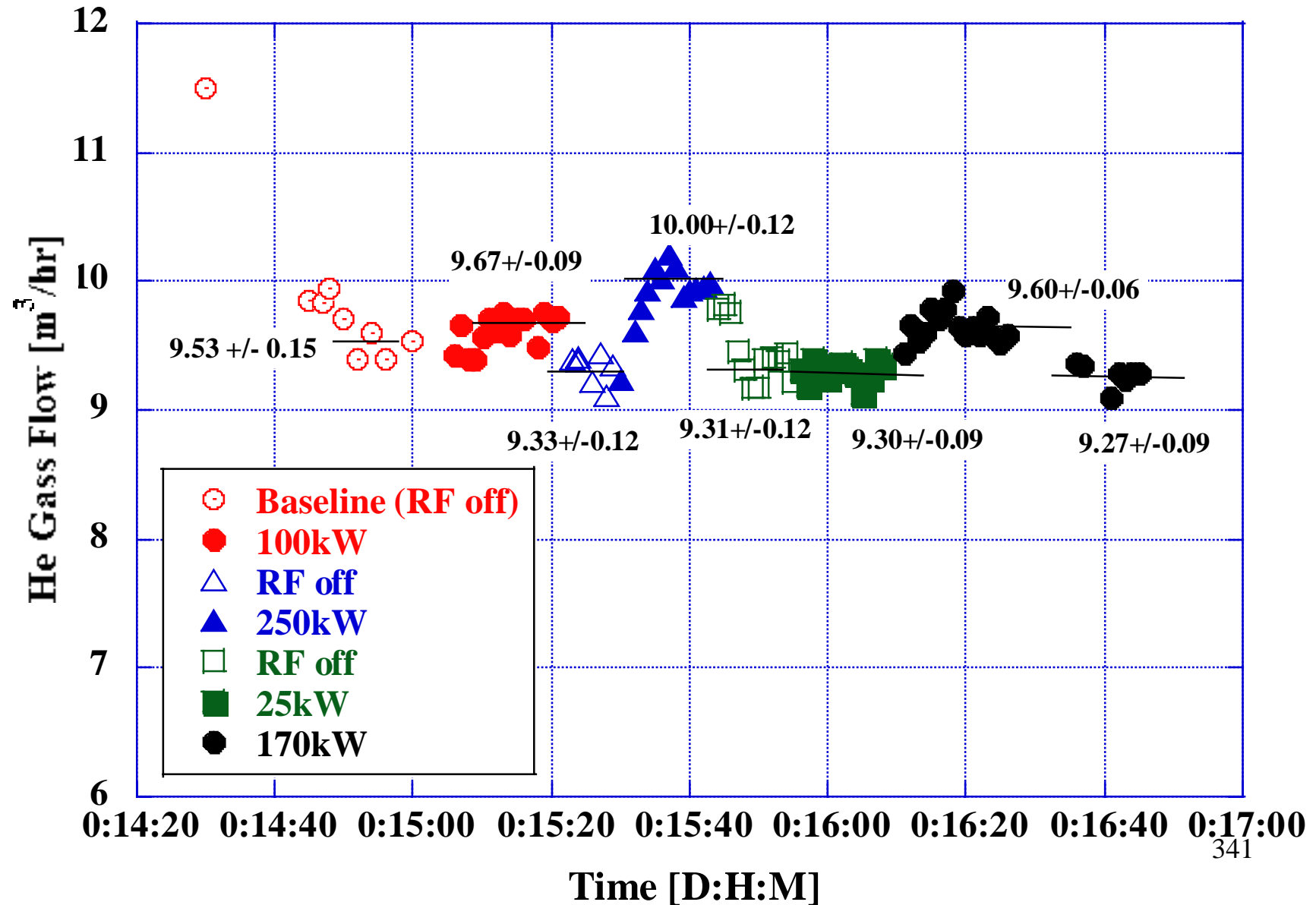
Pulse width 1.5ms, Coupler input power 350kW



$f=1300.000\text{MHz}$ , 5pps

Input couplerは空洞装着前、4ヶ月間クリーンルーム大気に曝されていたためめにエージングに多少時間がかかったが、無事目標性能を到達した。

# Coupler 2K dynamic loss measurement

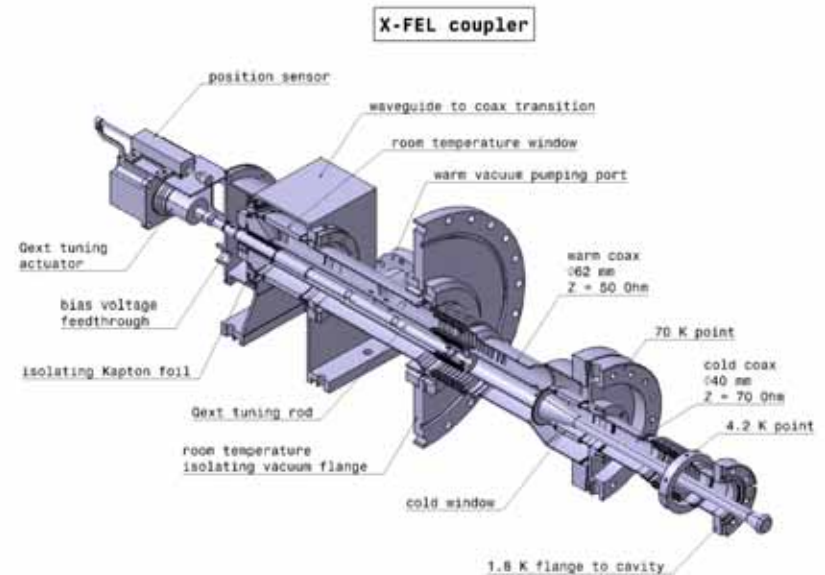
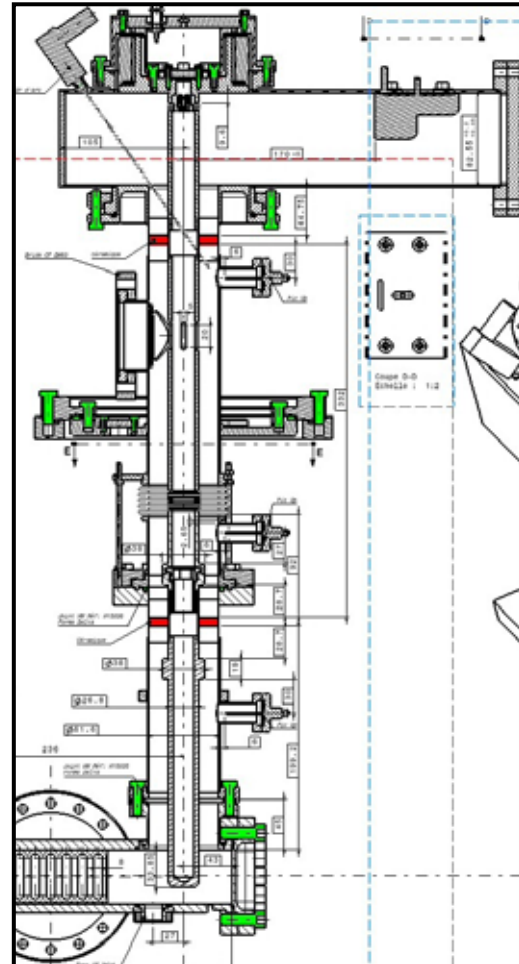
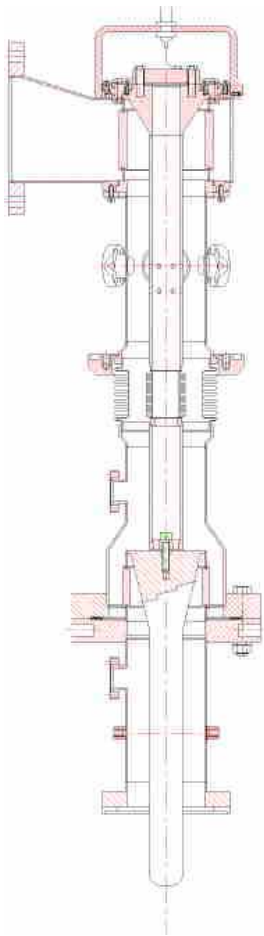


# 2K dynamic loss of Input coupler

	<b>Coupler Dynamic loss to 2K Table operation [W]</b>	<b>Coupler Dynamic loss to 2K Full operation [W]</b>
<b>25kW</b>	<b>0 + 0.22/- 0</b>	
<b>100kW</b>	<b>0.35 ± 0.22</b>	
<b>170kW</b>	<b>0.34 ± 0.16</b>	
<b>250kW</b>	<b>0.72 ± 0.25</b>	

# Progress with Input Coupler @ LAL

- Selected recent progress on CARE SCRF:  
3 new prototype designs of power couplers from LAL-Orsay:



- To be built in industry and tested in 2006.



# TTF III Coupler Processing Times in CHECHIA

Data from D. Kostin –DESY-

B: baked @150C (all others - not baked)  
 OA: warm part opened to air for 24hr, not baked @150C

