

High Power Test for Plug-compatible STF-Type Power Coupler for ILC

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Abstract

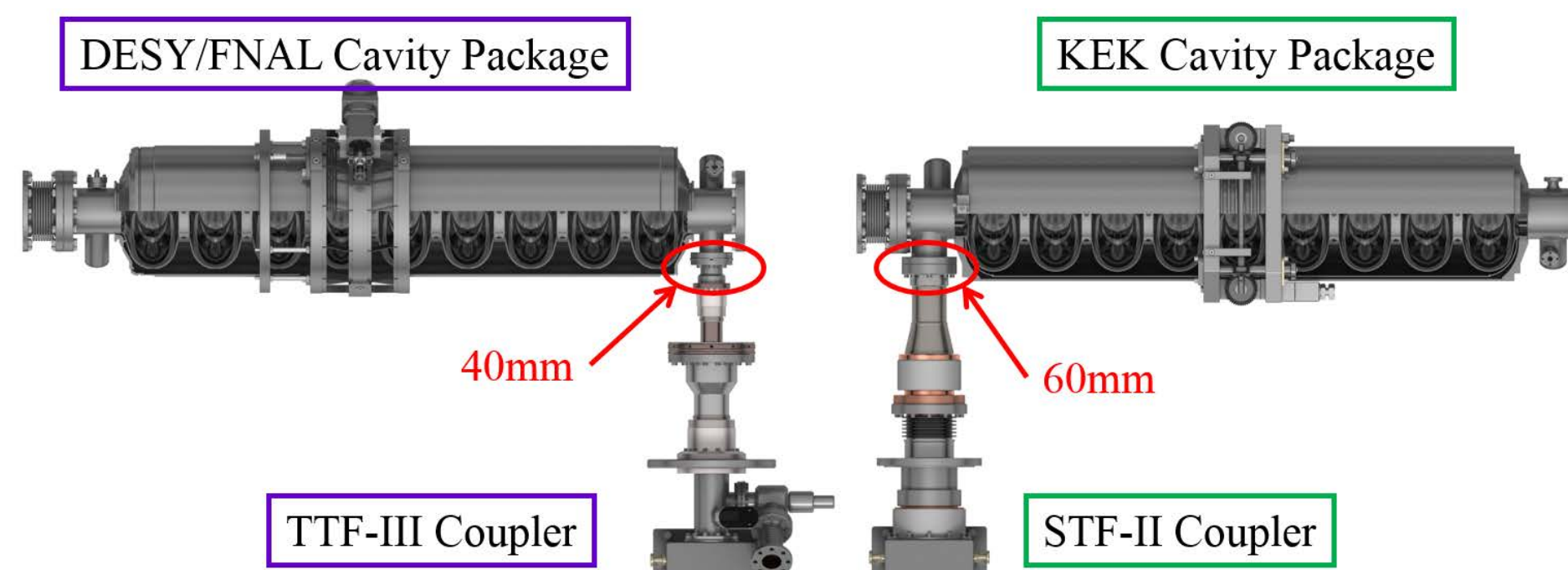
From the view point of plug-compatibility for the power coupler in the International Linear Collider (ILC), recommended by Linear Collider Collaboration (LCC) in 2013, new STF-type power couplers with 40mm of input port diameter were re-designed, fabricated and successfully high-power-tested. Moreover, from the view point of the cost reduction for the ILC, another type of power couplers with Titanium-Nitride (TiN) coating-free ceramic were also fabricated and high-power-tested by the collaboration between CERN and KEK. In this paper, the detailed results for the both power couplers is presented.

Specification & RF Design

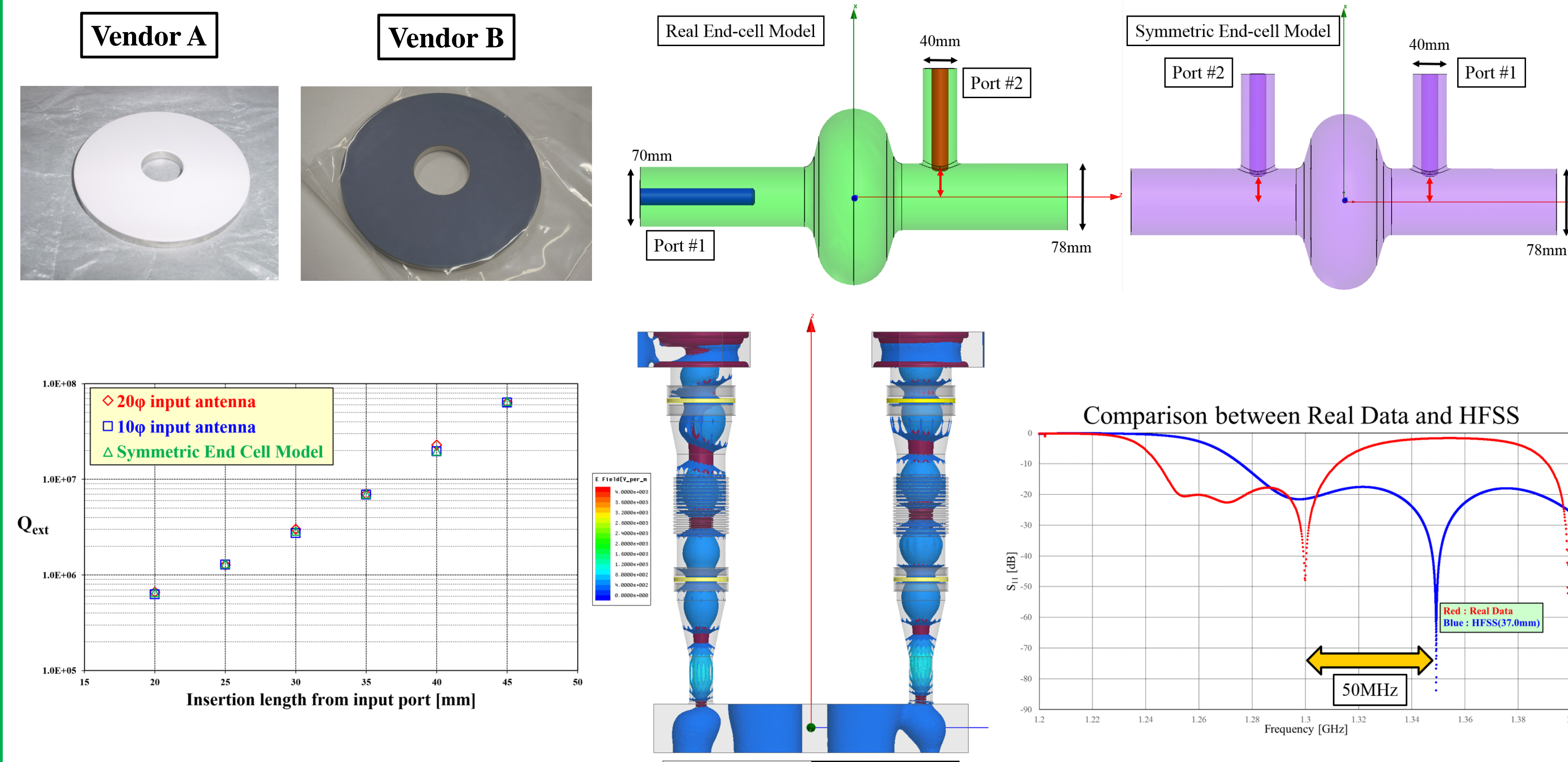
Table 3.7
Main specifications of the input coupler. The parameters represent the approximate maximum expected values during operation, including possible upgrades.

Parameter	Specifications
Frequency	1.3 GHz
Operation pulse width	1.65 ms
Operation repetition rate	5 Hz / 10 Hz
Maximum beam current	8.8 mA
Accelerating gradient of cavity	31.5 MV/m \pm 20%
Required RF power in operation	~ 400 kW
Range of external Q value	(1.0 ~ 10.0) $\times 10^6$ (tunable)
RF process in cryomodule	> 1200 kW for < 400 μ s pulse width > 500 kW for > 400 μ s pulse width > 600 kW for 1.6 ms pulse width
RF process with reflection mode in test stand	< 50 hours in warm state < 20 hours in cold state
RF process time	< 0.01 mW (2K static) 0.07 W (5K static) 0.6 W (40K static) < 0.02 W (2K dynamic) 0.12 W (5K dynamic) 1.6 W (40K dynamic)
Approximate heat loads	2
Number of windows	Required
Bias voltage capability	Required

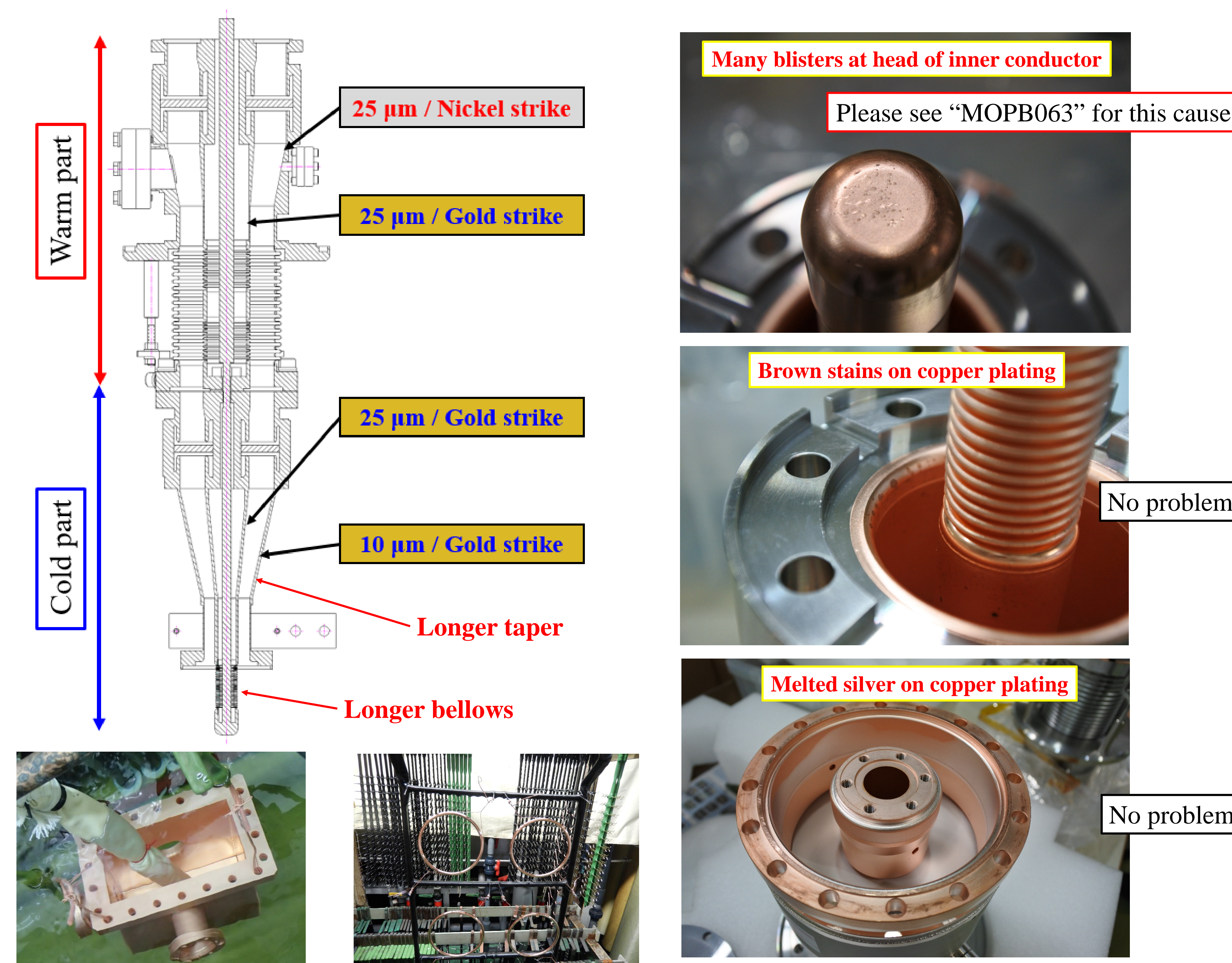
ILC/TDR



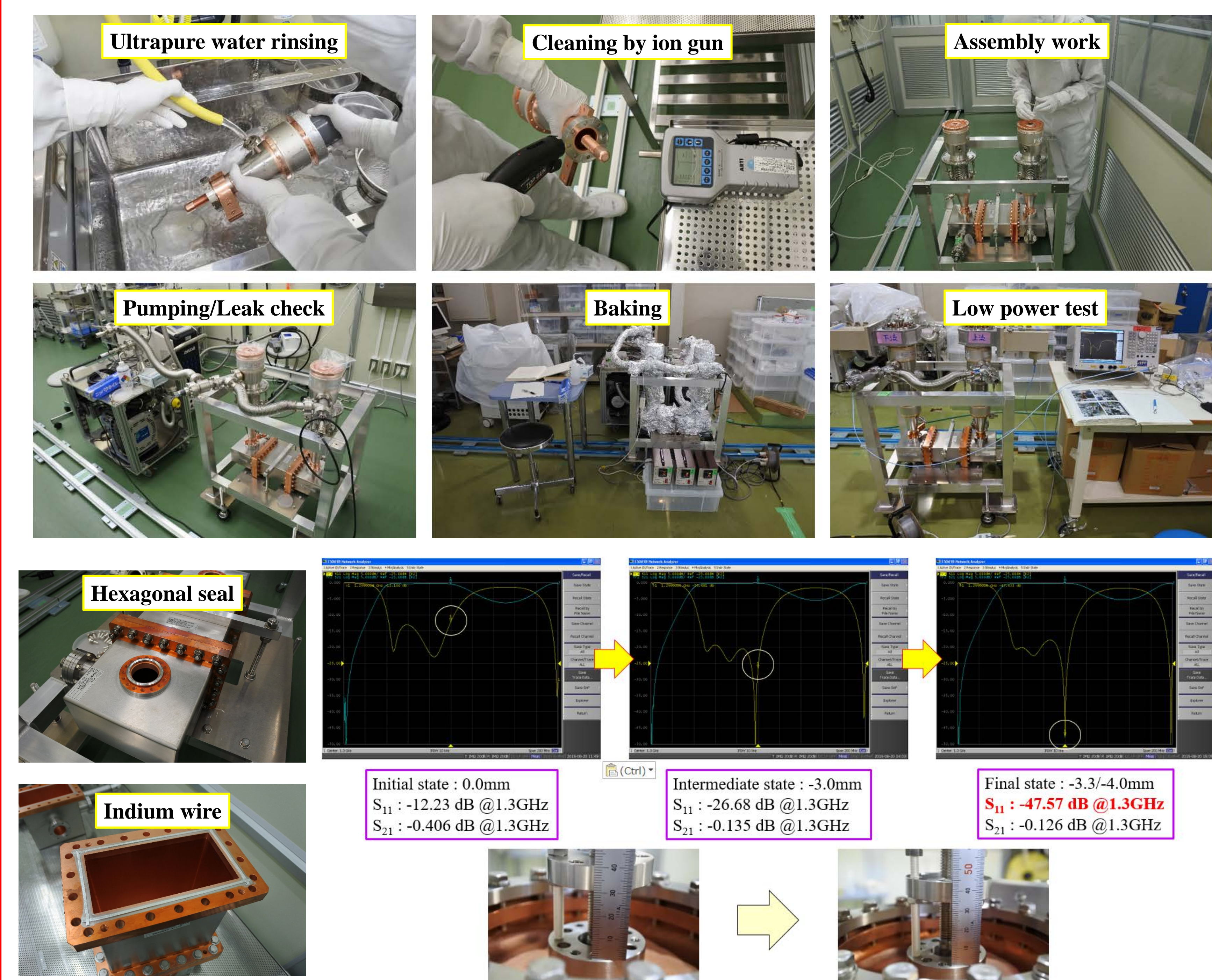
Coupler	Ceramic vendor	Ceramic colour	Coating	Relative permittivity	Dielectric loss tangent	Secondary electron emission coefficient
Warm #1, #2	A	White	TiN	8.8@10GHz	6×10^{-4}	~2.0
Cold #1, #2	A	White	TiN	8.8@10GHz	6×10^{-4}	~2.0
Cold #3, #4	B	Gray	Free	10.0@8GHz	3×10^{-3}	3.2



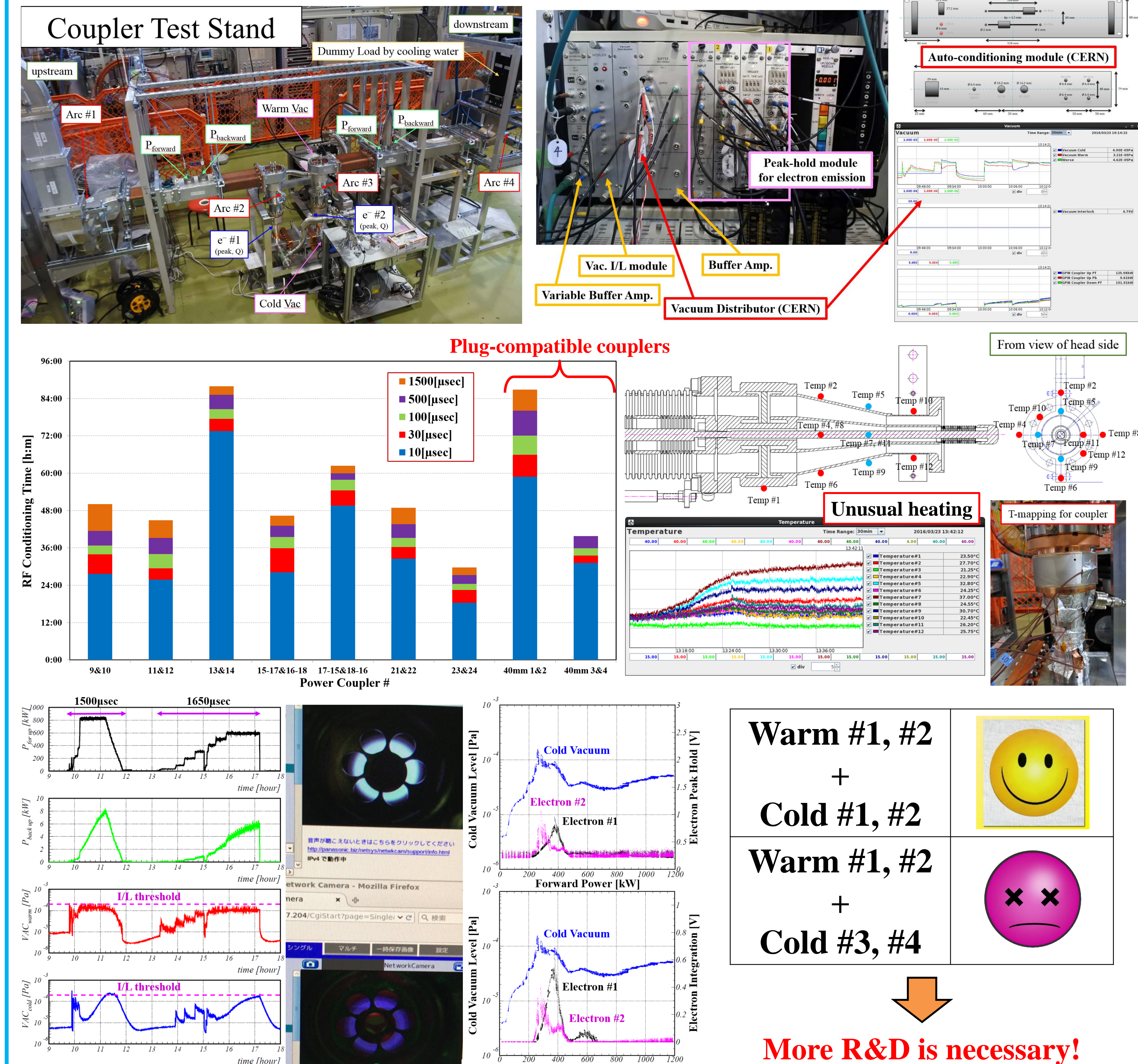
Fabrication & Incoming Inspection



Assembly & Low Power Test



High Power Test at Bench



Conclusion

After the recommendation by LCC in 2013, the plug-compatible STF-type power coupler was designed, fabricated, inspected, assembled, and low/high-power-tested. The result for the TiN-coated ceramic was successful, and however, more R&D is necessary for the coating-free ceramic. Recently, new R&D programs for the STF-type power coupler started, and the first result is presented in this conference. → **MOPB063**