Test Results of TTF-V Couplers for ILC

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Context of the Input Power Coupler Activities @ LAL

- **Design and test of alternative Power Coupler Prototypes for ILC**
- **Close collaboration with DESY on Power Coupler R&D and XFEL Coupler Industrialization Studies**
- **The support of the European Community-Research Infrastructure Activity under the FP6 ‘‘Structuring the European Research Area’’ program (CARE).**
- **Collaboration with KEK on “R&D on High Power Couplers for the ILC» in the framework of the FJPPL**

In this framework TTF-V couplers have been :

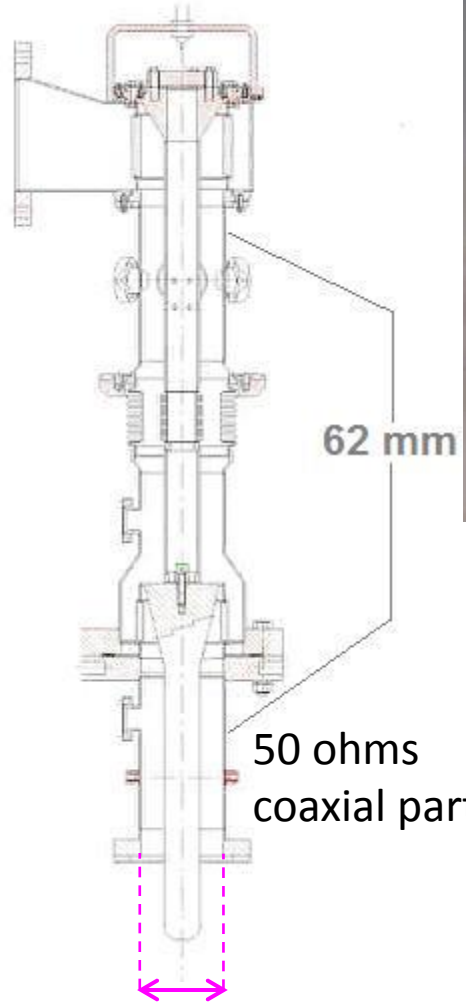
- **Designed:**

  - Based on the TTF-III Coupler Design (Baseline ILC Power Coupler)
  - Design performed by Pierre LEPERCQ (LAL)

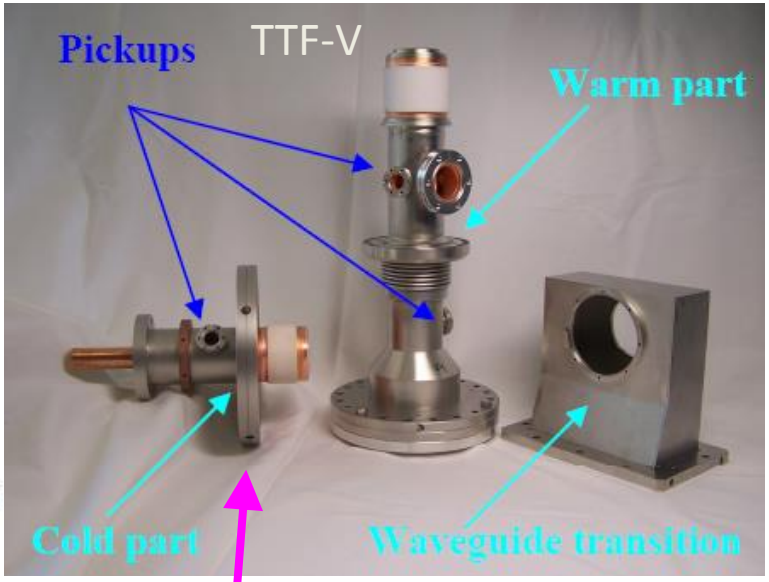
- **Then RF power tested**

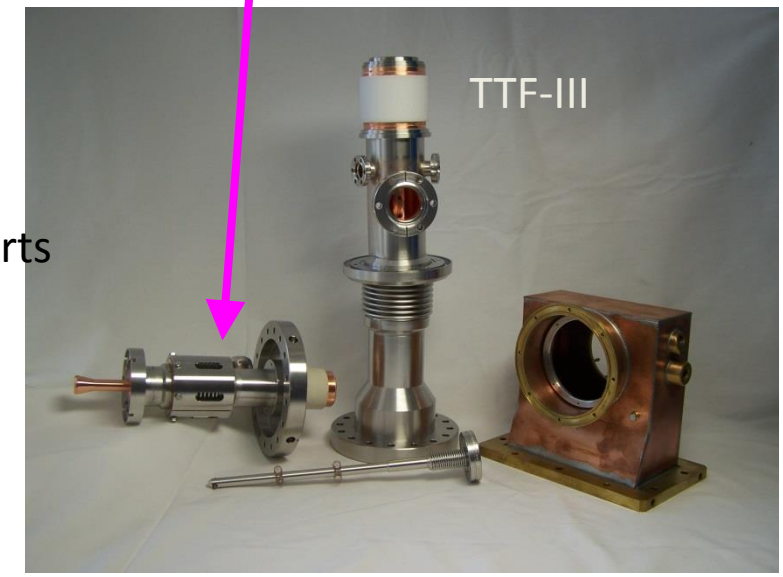
TTF-V Coupler Prototype

Pierre Lepercq RF Studies (LAL)



Coupler prototype TTF-V





- TTF-V is very similar to TTF-III, but, have larger cold part diameter in order to shift multipacting to higher power levels*.
- TTF-V design have been simplified:
  - No bellows in the cold part (fixed antenna penetration)
  - Thermal design is not totally optimized

*Multipacting scaling law in coaxial lines:

$$P_{1\text{-point}} \sim (f \cdot D)^4 \cdot Z$$

$$P_{2\text{-point}} \sim (f \cdot D)^4 \cdot Z^2$$

Main Stages

- 2 pairs of TTF-V manufactured by ACCEL
- New test box designed (LAL) then manufactured by the same manufacturer
- All TTF-V Couplers cleaned using the TTF-III cleaning procedure.
- First Coupler pair RF Power tested @ LAL

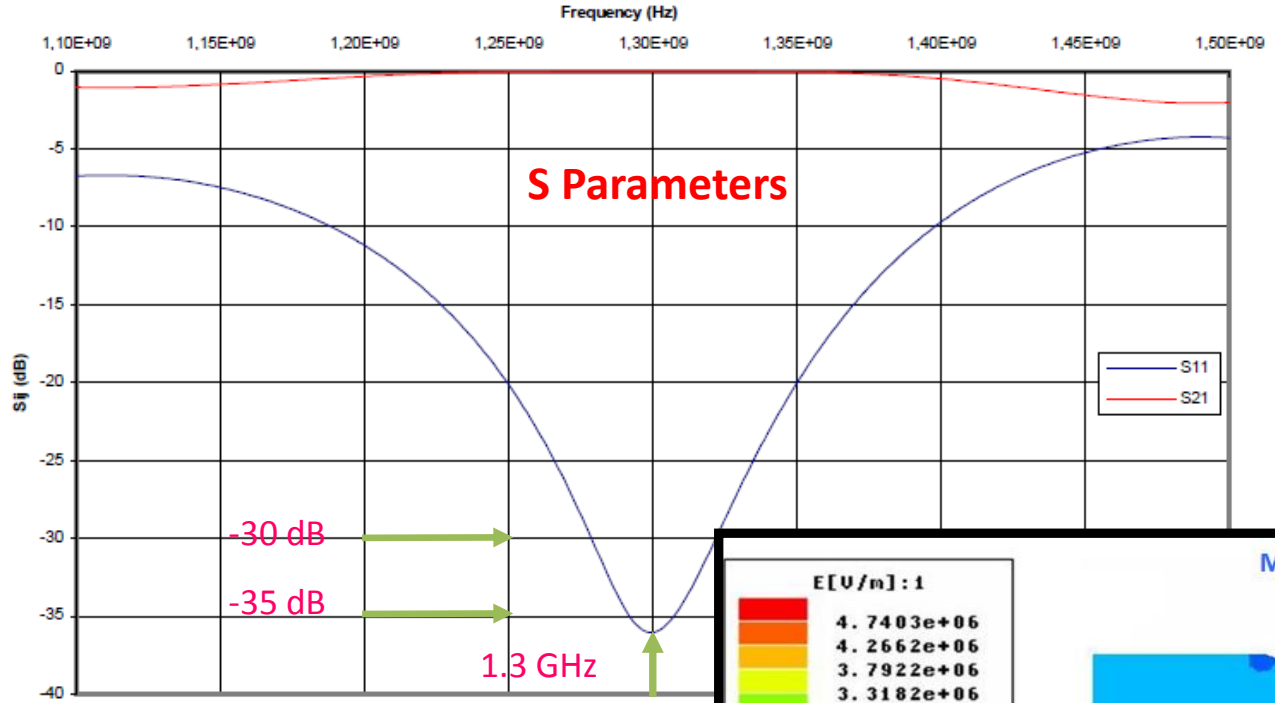
  The goal : RF conditioning using the TTF-III conditioning procedure (**1 MW** for short pulses & 0.5 MW for 1.3 ms pulses)

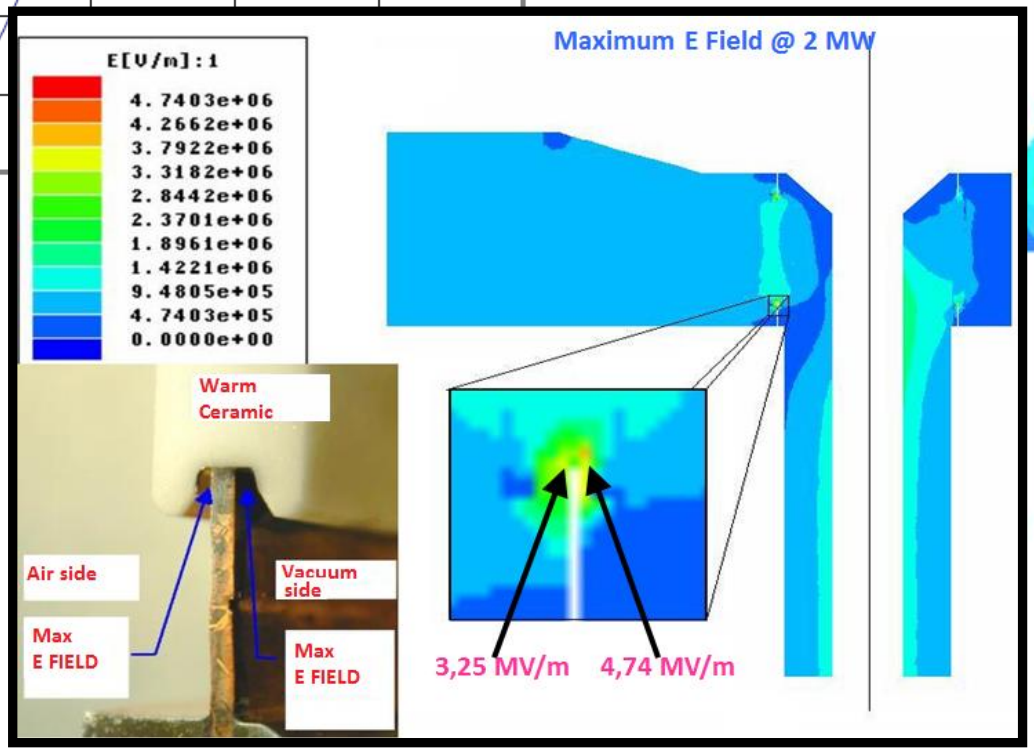
- Second Coupler pair RF Power tested @KEK

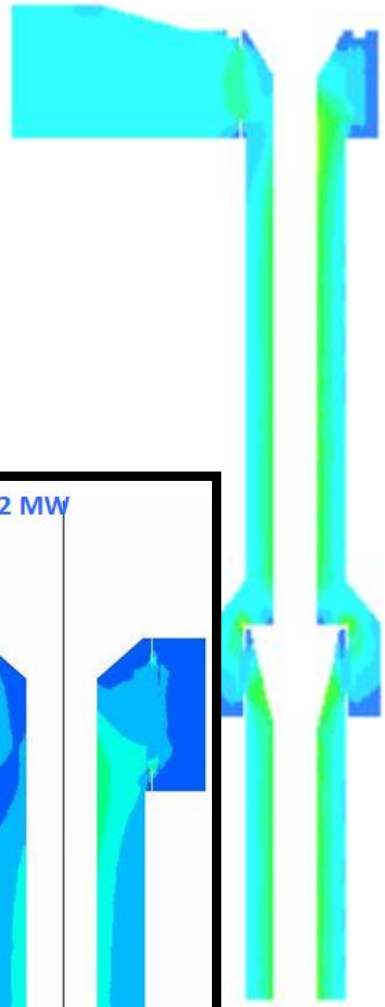
  The goal:
  - RF conditioning using the TTF-III conditioning procedure
  - Then RF conditioning using ILC Power Couplers RF conditioning procedure @ KEK (**2 MW** for short pulses & 1 MW for 1.5 ms pulses)

TTF-V Power Coupler pair

RF Design



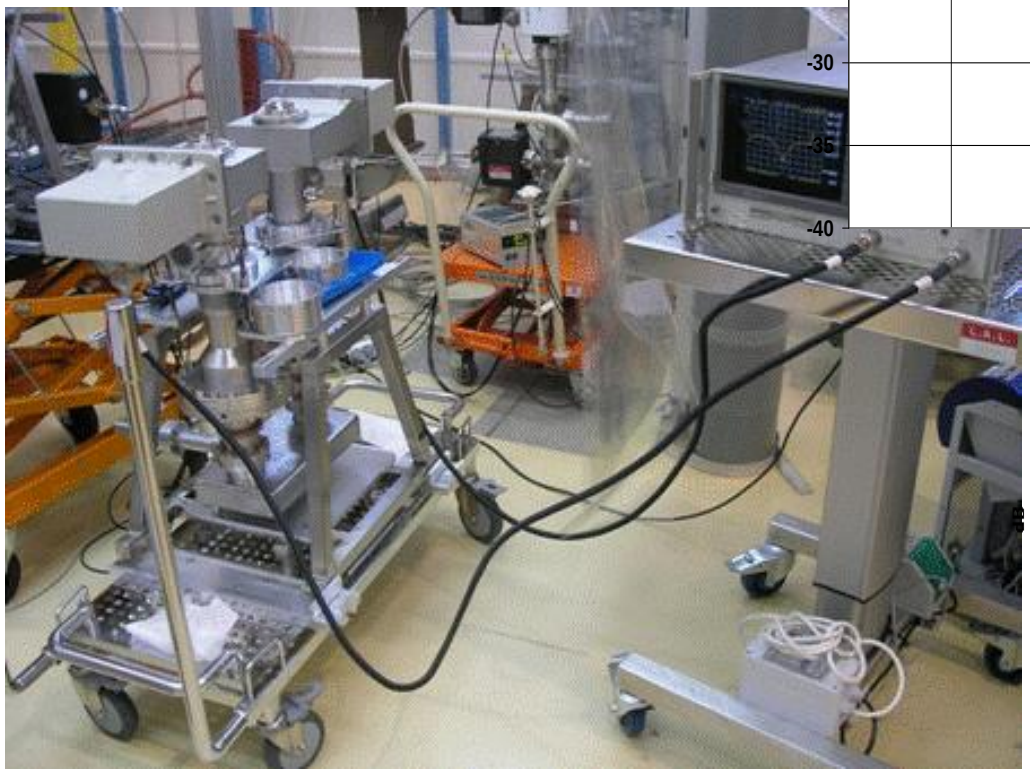


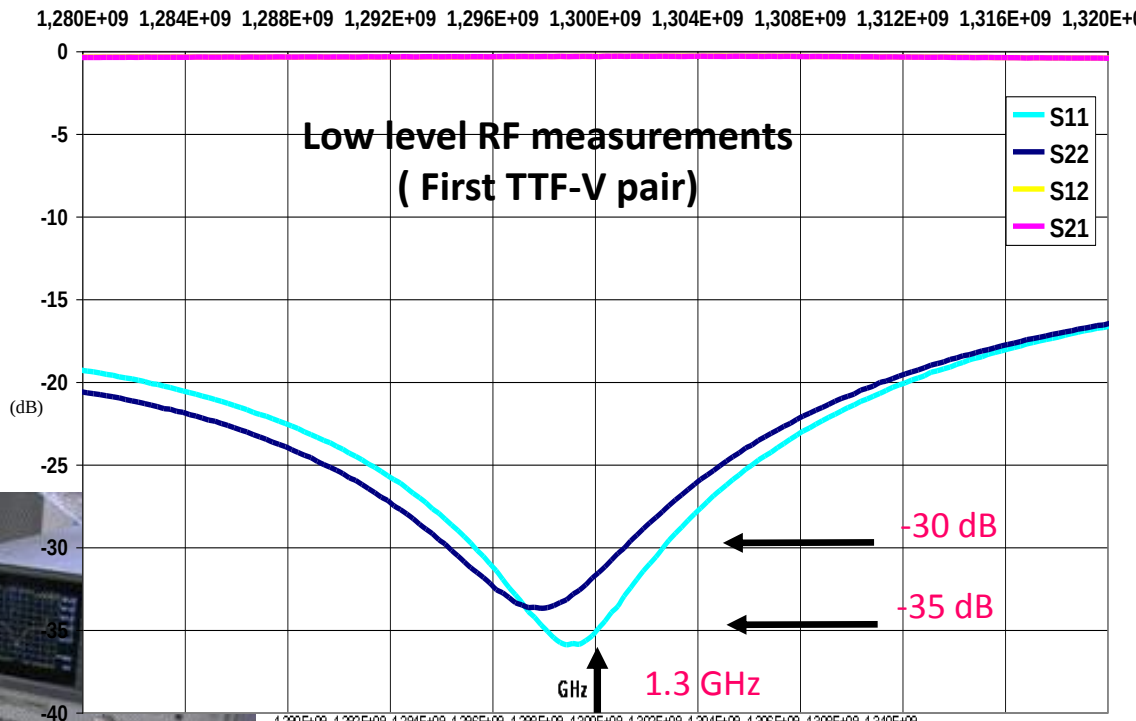


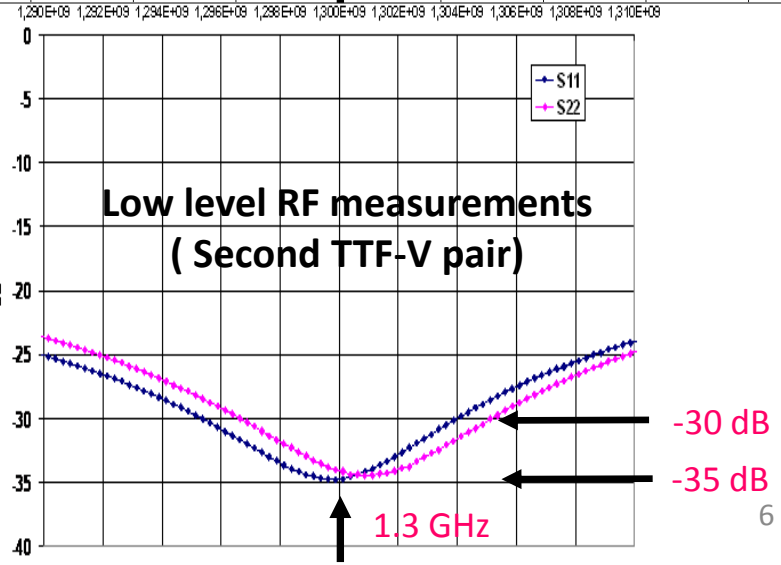
The maximum E field is located near the ceramic window

Low Level RF Measurements

Good Low Level RF measurement results obtained for the two coupler pairs



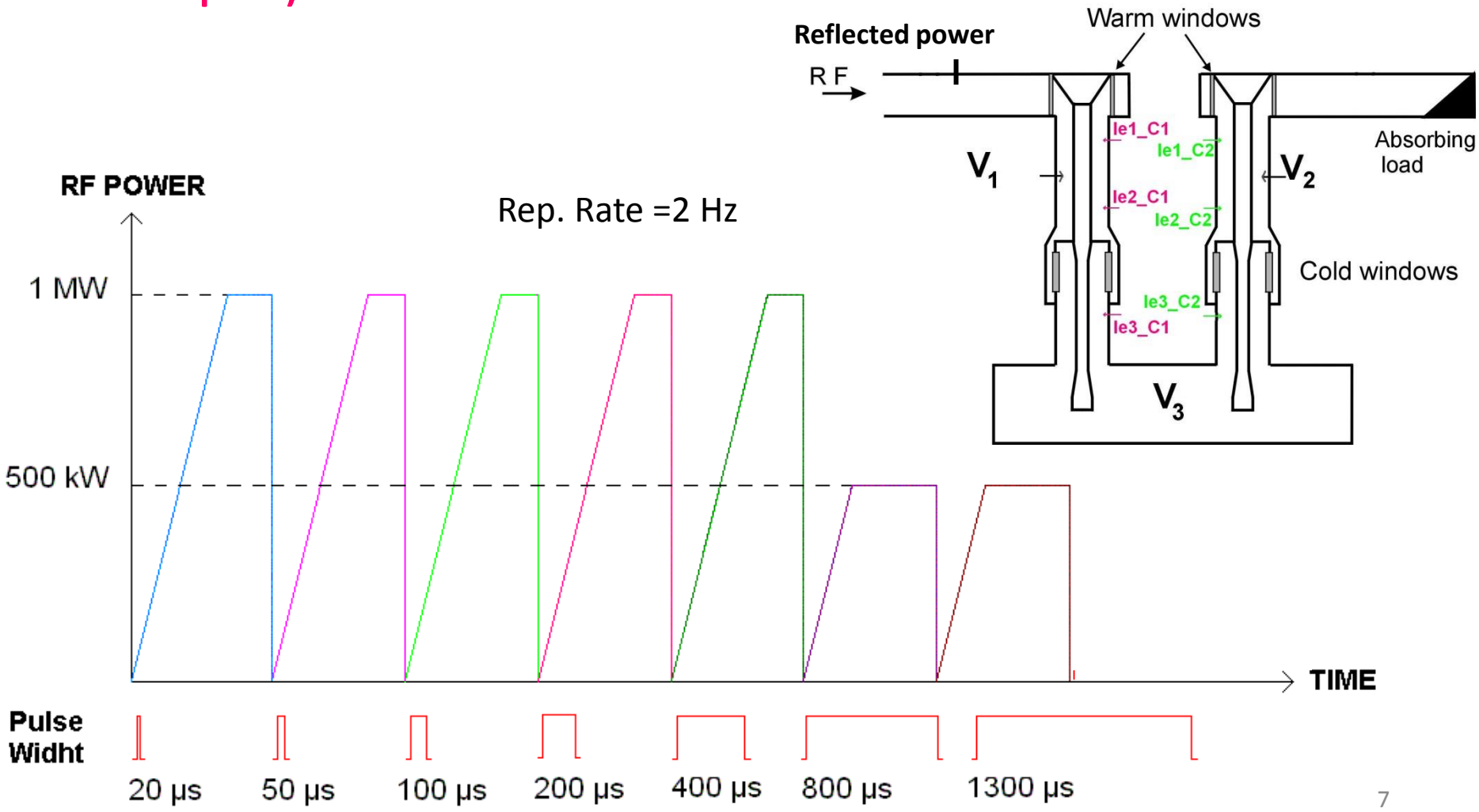




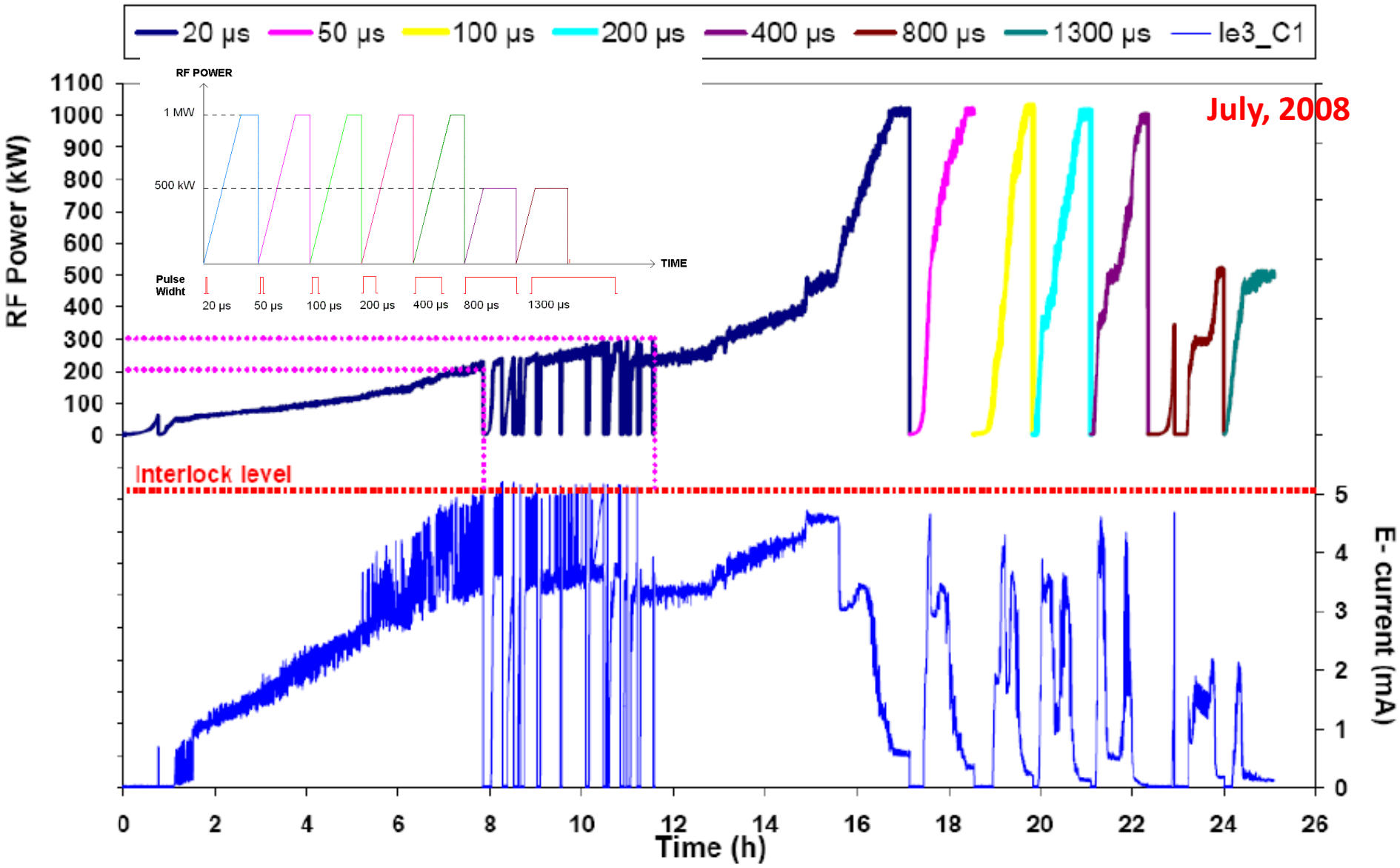
TTF-V RF Conditioning @ LAL (1)

Use of the TTF-III conditioning procedure:

Goal: To reach 1 MW for 400 µs pulses and 0.5 MW for 1300 µs pulses (as for TTF-III couplers).



TTF-V RF Conditioning @ LAL (2)



Easy conditioning in 24 h only

TTF-V RF Conditioning @ KEK (1)

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)

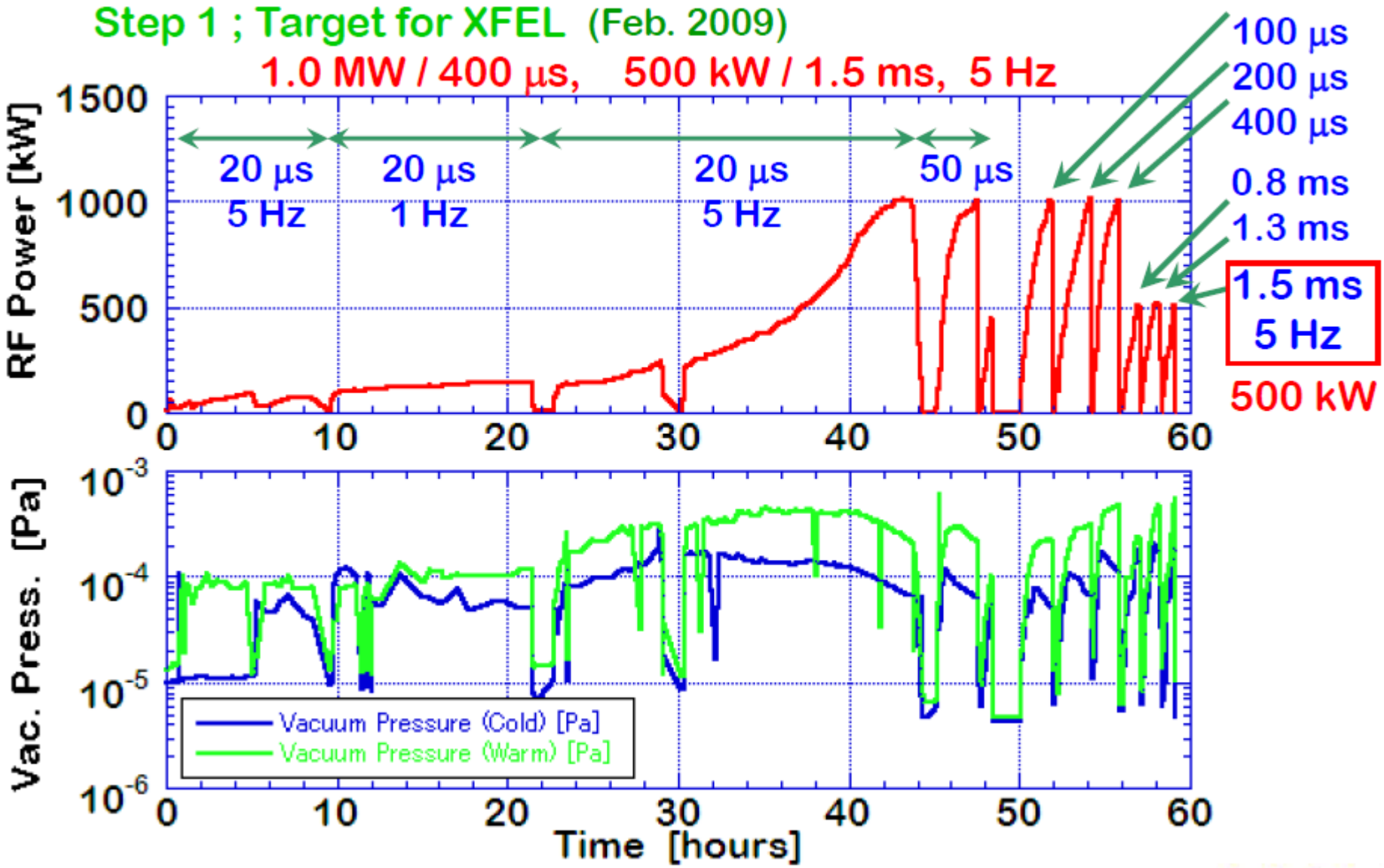
400 μs, 2.0 MW, 5 Hz

Step 3 : Target for ILC (May. 2009)

1.5 ms, 1.0 MW, 5 Hz

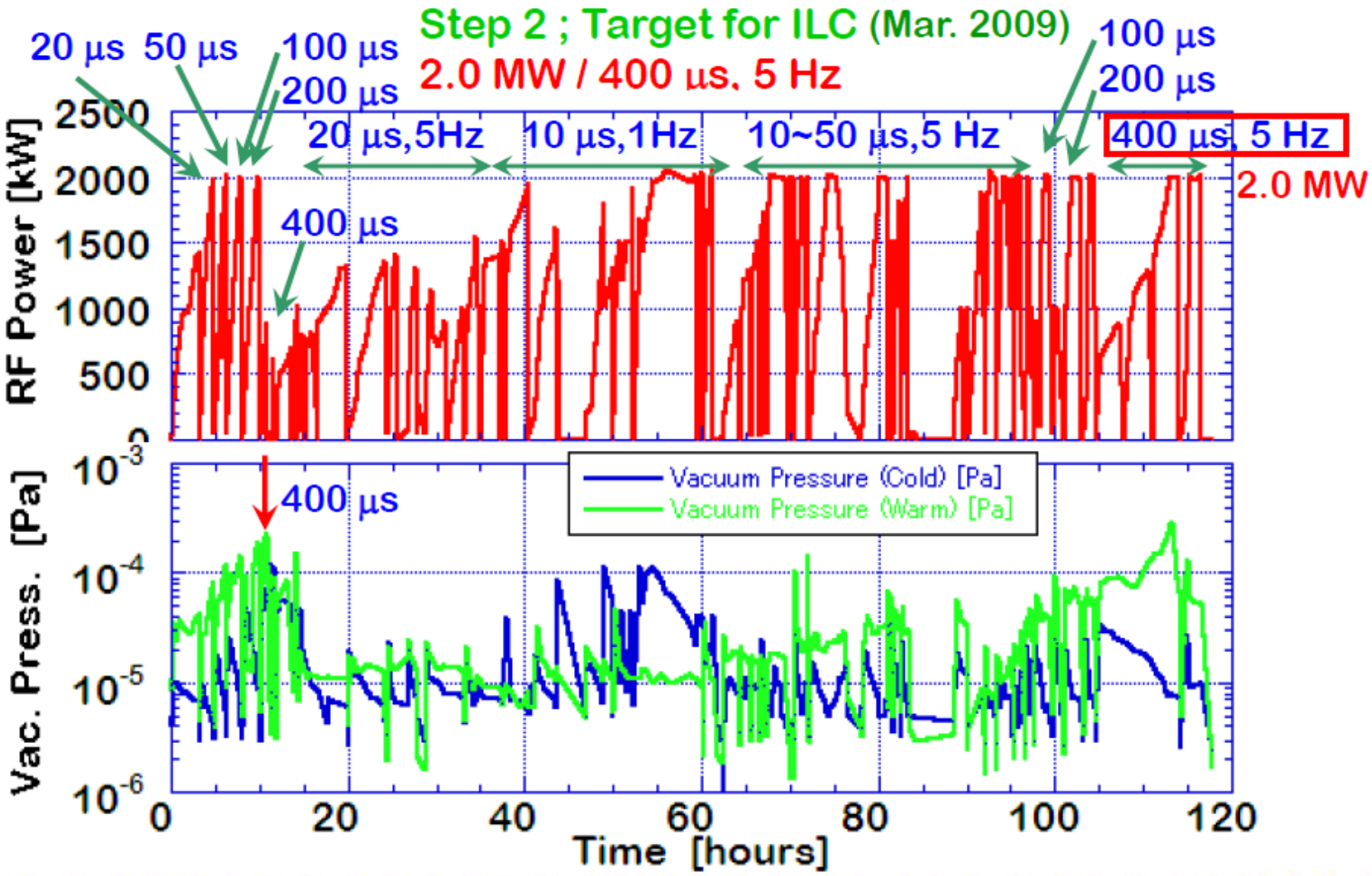
From E. KAKO presentation SRF 2009

TTF-V RF Conditioning @ KEK (2)



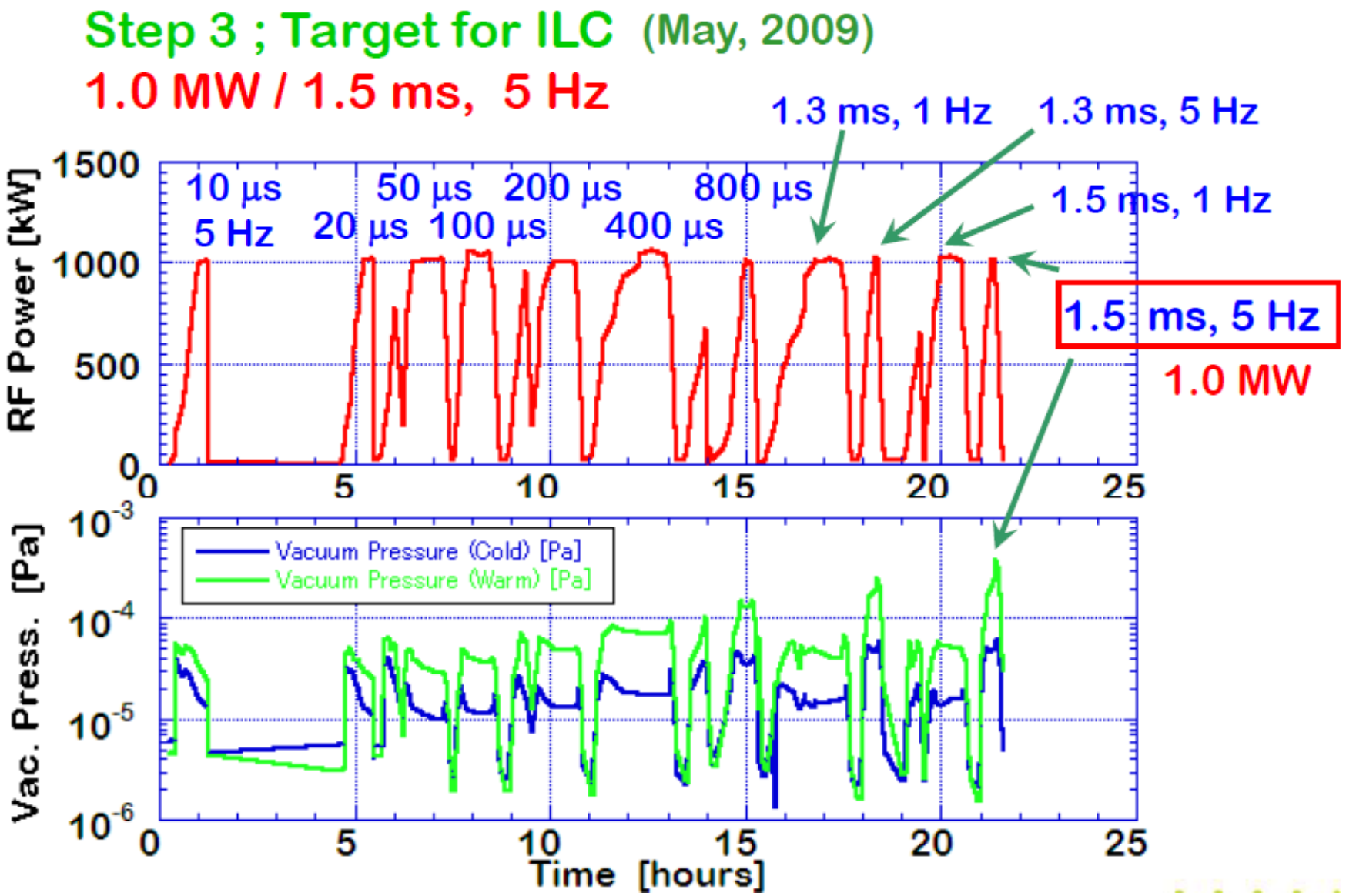
From E. KAKO presentation SRF 2009

TTF-V RF Conditioning @ KEK (3)



From E. KAKO presentation SRF 2009

TTF-V RF Conditioning @ KEK (4)



From E. KAKO presentation SRF 2009

Summary

- TTF-V Coupler have been deigned as an alternative Power Coupler for ILC
- Four TTF-V Couplers and a new Test Box were manufactured
- The first pair of the TTF-V was successfully RF power test @ LAL following the TTF-III conditioning procedure: Conditioning time was about 24h (Comparable to the XFEL Couplers RF conditioning time)
- The second pair of the TTF-V was RF Power processed @ KEK following the TTF-III procedure, then, the ILC RF conditioning procedure:

  ➡ The following RF power levels have been reached:

  - 2 MW/ 400µs / 5Hz
  - 1 MW/ 1500 µs / 5Hz

- Perspectives: Further thermal studies are needed for the TTF-V couplers.

Acknowledgment

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Thanks to our DESY colleagues

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