

A_R&D_3

R&D on High Power Couplers for the ILC

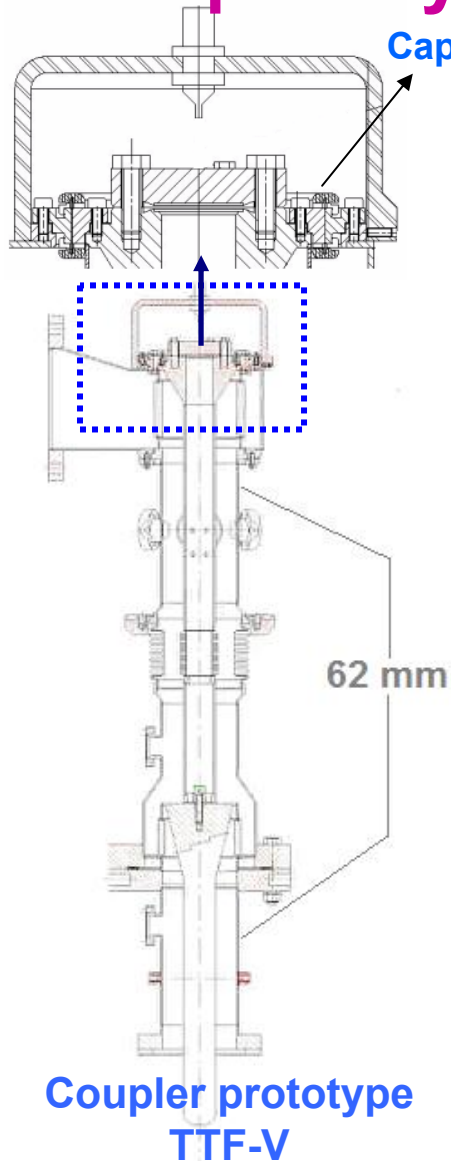
Hassen JENHANI (LAL/IN2P3/CNRS)

Eiji KAKO (KEK, Japan)

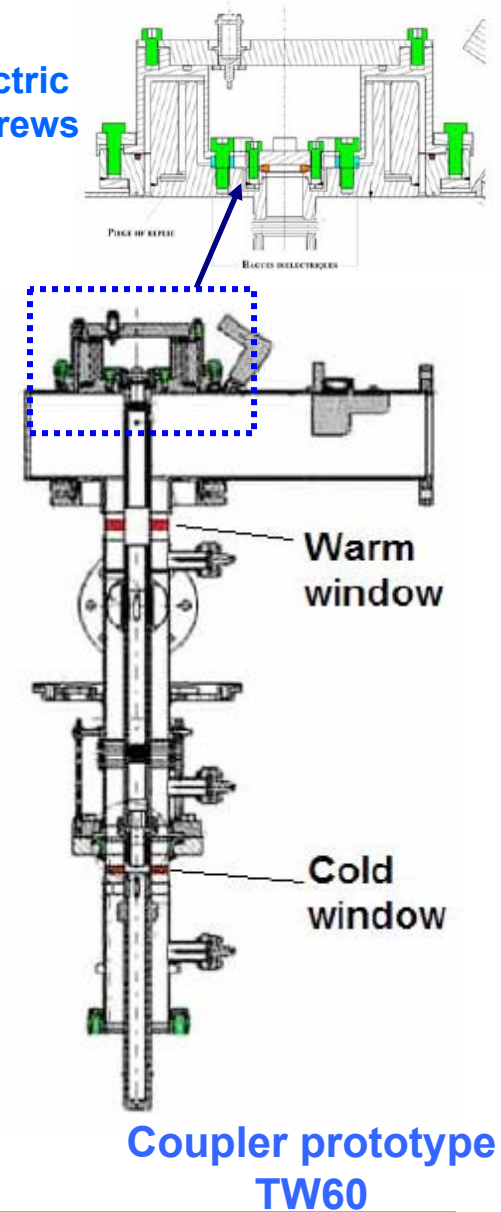
Outline

- Activities on Input Couplers at LAL
- Activities on Input Couplers at KEK
- Collaboration Perspective in FY08'

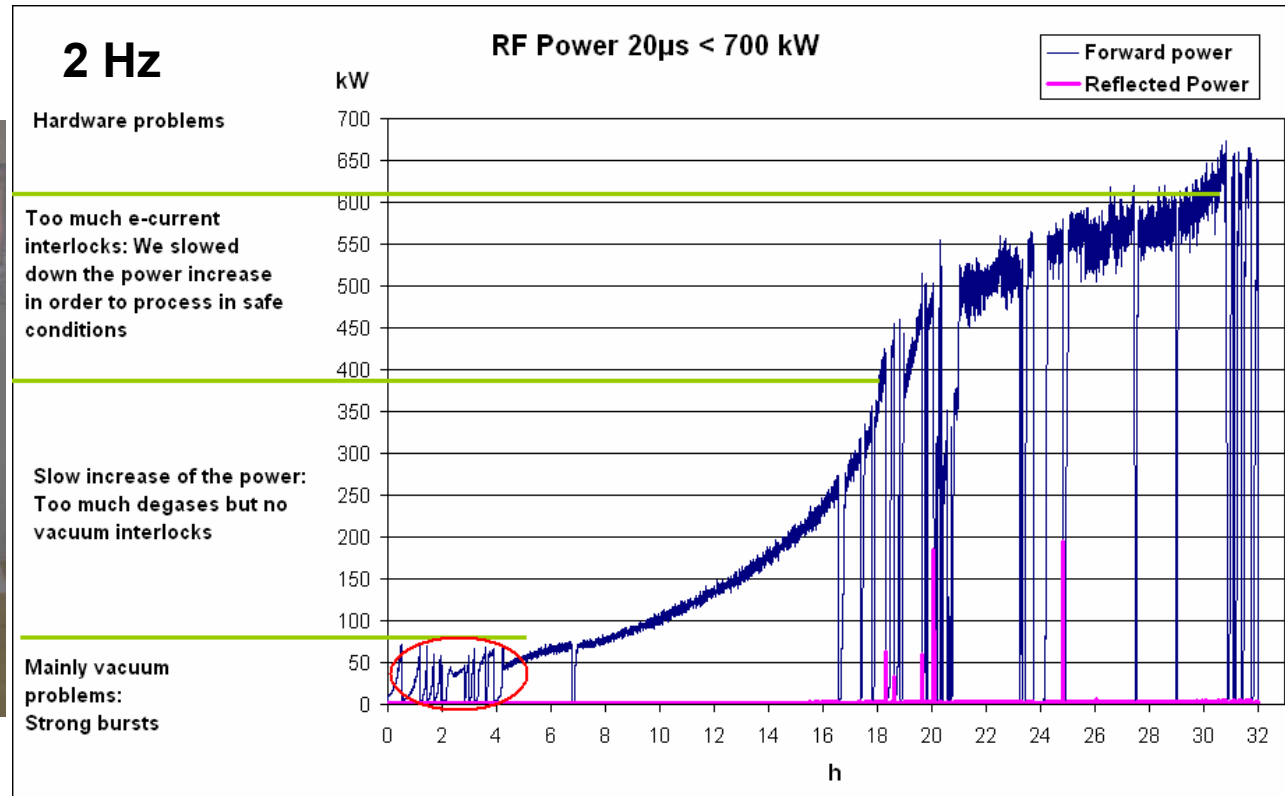
LAL prototypes: TTFV & TW60



Insulation using dielectric ring and insulating screws

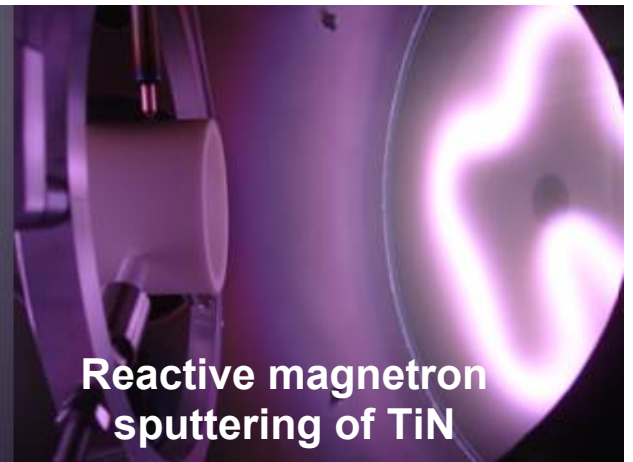
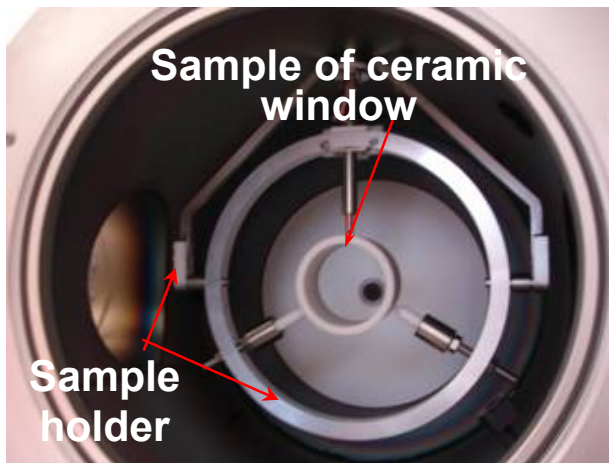
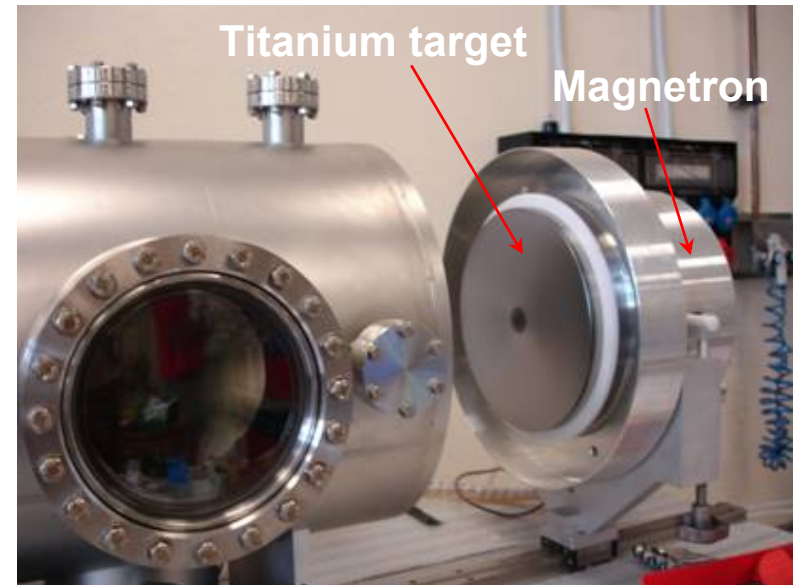


TW60 coupler processing



The processing of TW60 was interrupted by the RF Power Source HV hardware fail.

The sputtering machine for ceramic coupler windows at LAL



Study of TiN coating on ceramic windows

TiN_x thick layer deposition (800 nm)
on ceramic disk



TiN stoichiometry
(Samples analyzed by XRD and SIMS)



TiN thin layer deposition (10 to 20 nm)
on ceramic disk using the same
parameters



Optimal thickness will be determined
by tg δ measurements and multipacting
tests



Deposition on cylindrical ceramic
windows (internal and external surfaces)

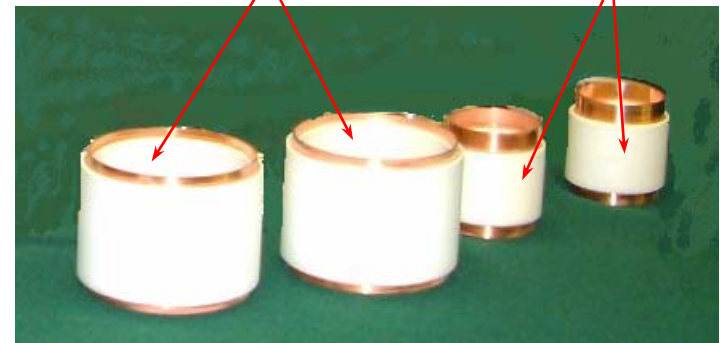
Samples : Ceramic windows
(97,6% Al₂O₃)



Disk planar window (Test
Ceramic)

Warm windows
($\varnothing = 75$ mm, h= 57 mm)

Cold windows
($\varnothing = 47$ mm, h= 48 mm)



TTF-III coupler window types

TiN deposition studies

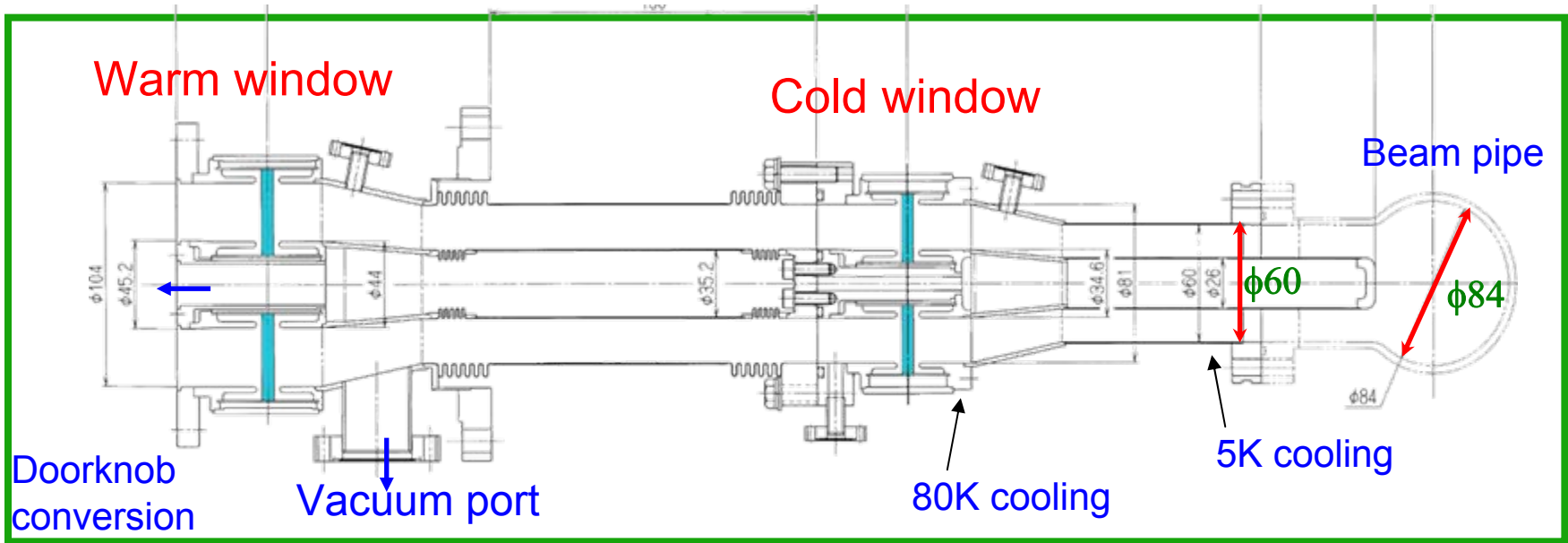
At LAL

- ✓ Profilometer : Film thickness measurements (for thick layer deposition)
- ✓ Scanning Electron Microscope + Energy Dispersive X-ray Spectrometer (SEM/EDX) : morphology, thickness estimation, cartography & the sample chemical composition.
- ✓ Dielectric characterization: RF losses measurements using a cavity resonator ($\tan \delta$).
- ✓ Multipacting measurements: DESY design multipacting resonator (under study)
- ✓ Diffractometer (already ordered): thickness estimation of the deposit layer & stoichiometry determination.

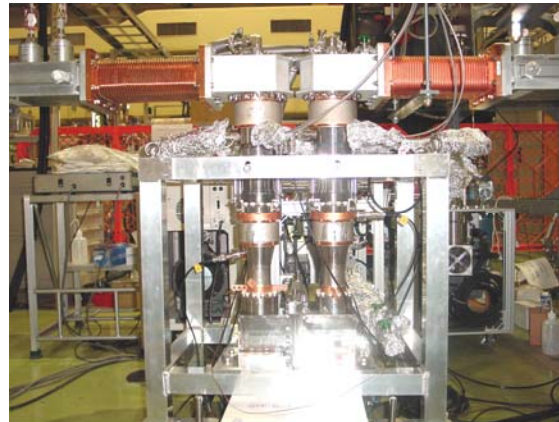
Outside:

- ✓ RBS & SIMS : Elementary analysis of the deposited TiN (surface and bulk).

Input Couplers for STF-BL Cavities at KEK



Fabrication

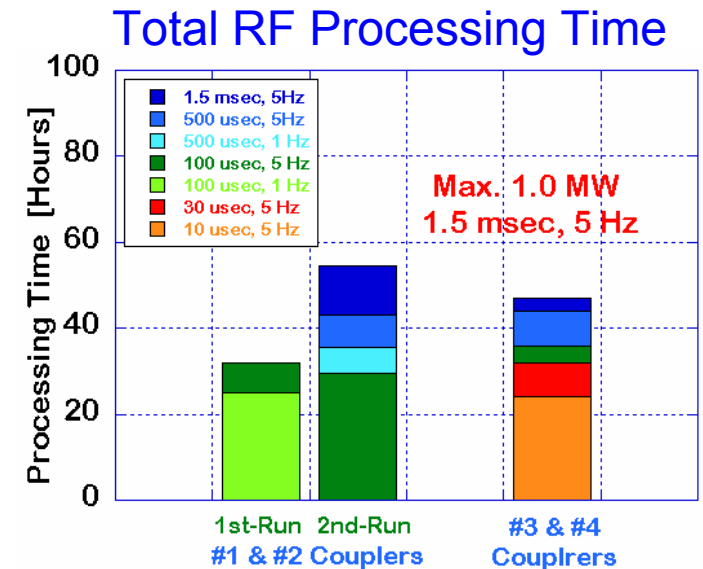
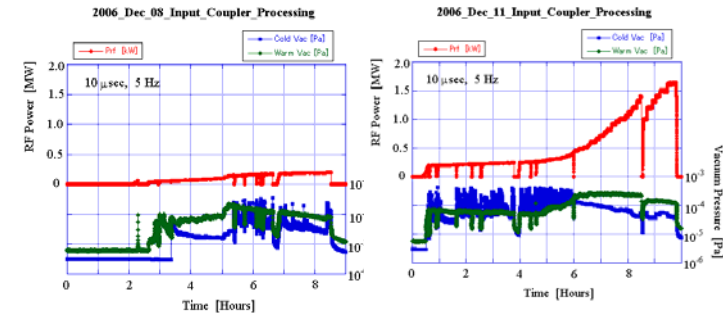
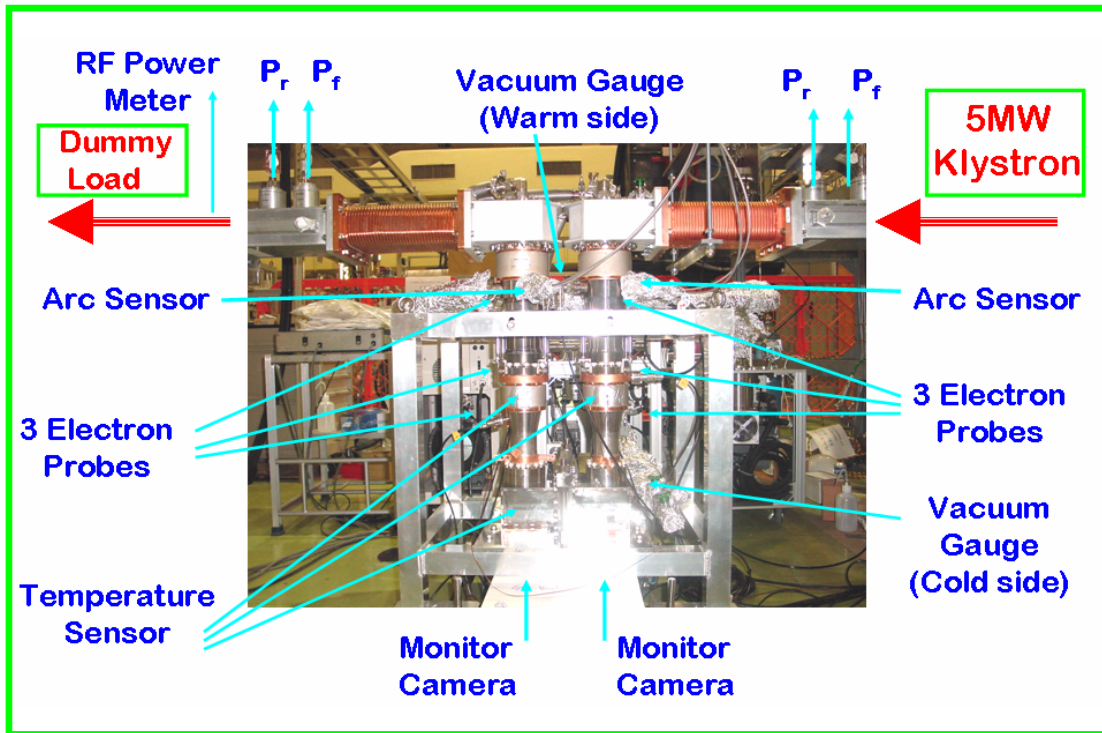


Processing at Test Stand



Cryomodule Tests

RF Processing at Test Stand



Short Pulse ; **Max. 1.9 MW**
 1.0 MW, 1.5 ms, 5 Hz ; **~ 50 hrs.**
Very Careful Conditioning !!

RF Processing in Cryomodule at 300 K

Arc Sensor Doorknob

July, 2007'

Electron Probe
(warm window)

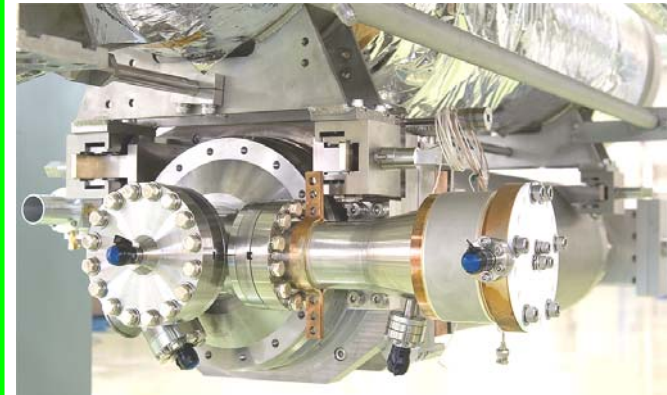
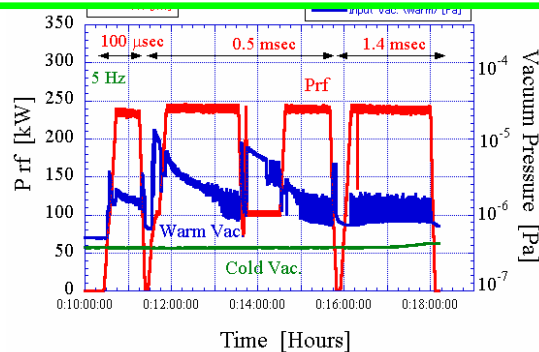
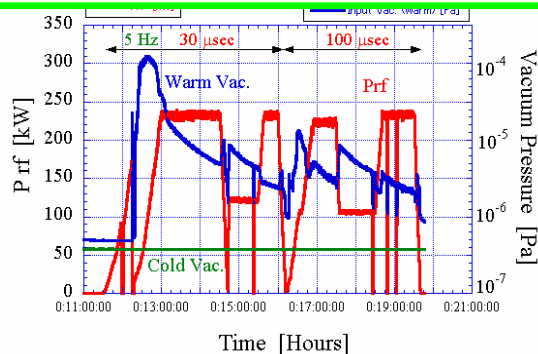
Pumping System

Vacuum Gauge

Pulse Signal Power Meter
P-in, P-ref P-in, P-ref

500kW
Circulator

Flexible Waveguide



5 Hz Operation

1. 30 μsec, 235 kW, for 5 h.
100 μsec, 235 kW, for 3.5 h.
2. 100 μsec, 240 kW, for 1 h.
0.5 msec, 240 kW, for 4.5 h.
1.4 msec, 240 kW, for 2 h.
3. 1.5 msec, 250 kW, for 7 h.

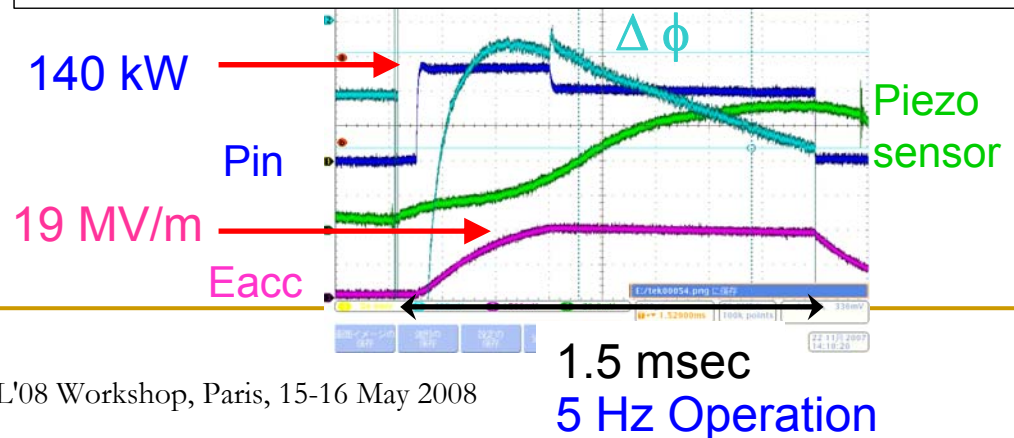
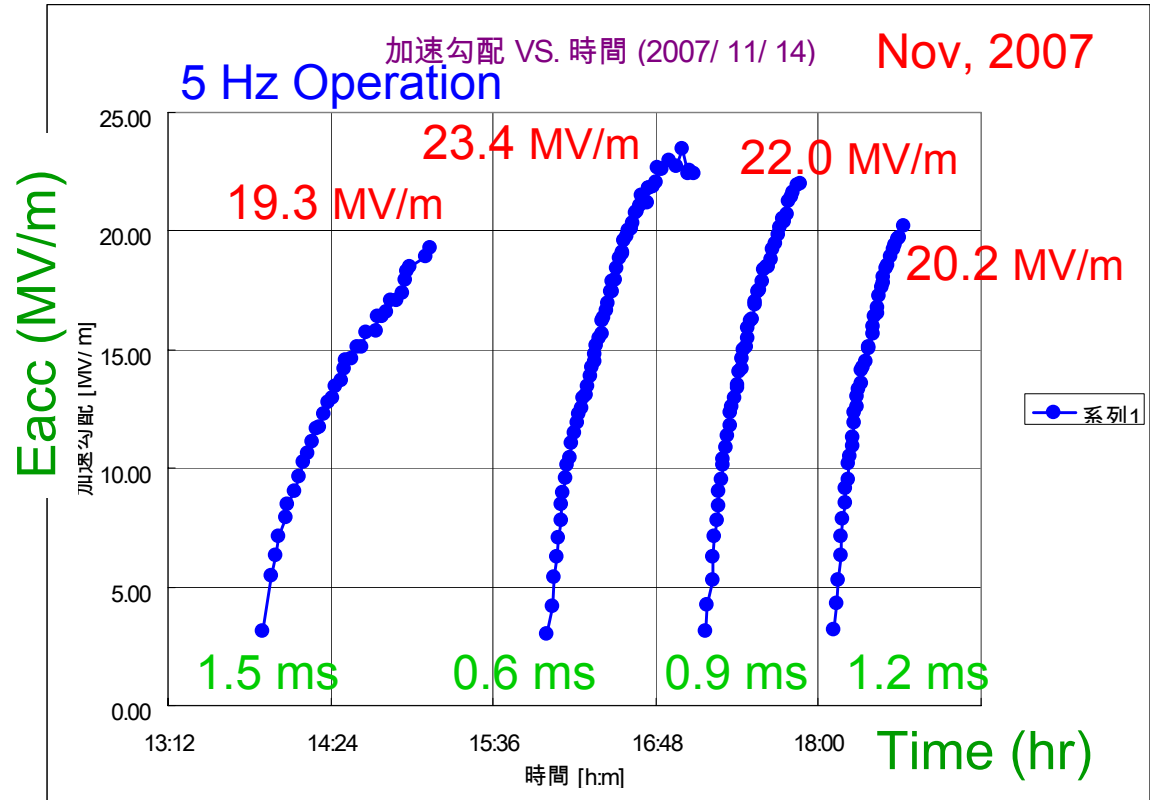
Total ; 23 hours (3 days)

Very Careful Conditioning !!

High Power Tests of one Cavity at 2 K



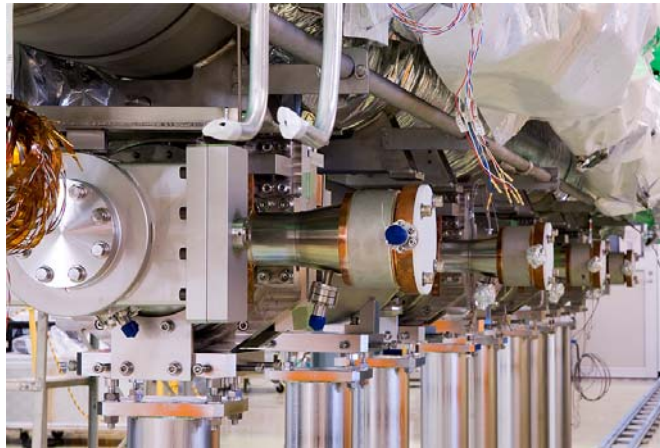
October, 2007'



Cryomodule Tests of Four Cavities



January, 2008'



March, 2008'



Schedule in 2008'

- Apr. Installation into STF tunnel.
- May. First cool-down start.
- June Warm coupler assembly.
RF processing at 300 K.
- July Second cool-down start.
High power tests at 2 K.

Collaboration activities in 2007

LAL :

Visit to KEK (from 7th May 2007 to 14th May 2007): Hassen JENHANI

Collaboration meeting at KEK

KEK :

Visit to Orsay (from 20th Aug. 2007 to 1st Sept. 2007): Shuichi NOGUCHI and Eiji KAKO

Collaboration meeting at LAL

Planning efforts for future experiments

Discussions and information exchanges concerning technological aspects

Collaboration teams

LAL coupler team:

Hassen Jenhani (Leader),
Pierre Lepercq,
Alessandro Variola,
Mickael Lacroix & Walid Kaabi

KEK coupler team:

Eiji Kako (Leader)
Shuichi Noguchi
Hitoshi Hayano

LAL and KEK coupler teams collaboration (1)

An interesting interaction between LAL and KEK coupler groups is now well established. Detailed discussions and know-how exchanges on coupler designs and conditioning experiences were carried. We still motivated to maintain this collaboration and enlarge its aspects.

Three major coupler activities will take place at LAL and KEK in 2008:

1. A new optimisation of the global conditioning time of the TTF-III couplers is under study at LAL.
Two coupler pairs will be conditioned simultaneously in string disposition and two others in parallel disposition.

LAL and KEK coupler teams collaboration (2)

We will try to compare the conditioning time in each case and the different scenarios that can occur in order to choose the best coupler conditioning configuration for XFEL.

Test of two XFEL coupler pairs made by two different industries and comparison of the results.

2. The TiN sputtering bunch for coupler ceramic windows has been operational since Jan. 2008.

Planar and cylindrical windows will be used for the different sputtering tests.

A characterisation of the TiN layers will be carried out.

3. LAL will participate to the KEK “couplers-cavities” RF high power cold test that will take place in 2008.

Conditioning tests of prototype couplers, TTF-V or TW60, will be carried out at KEK in 2008.