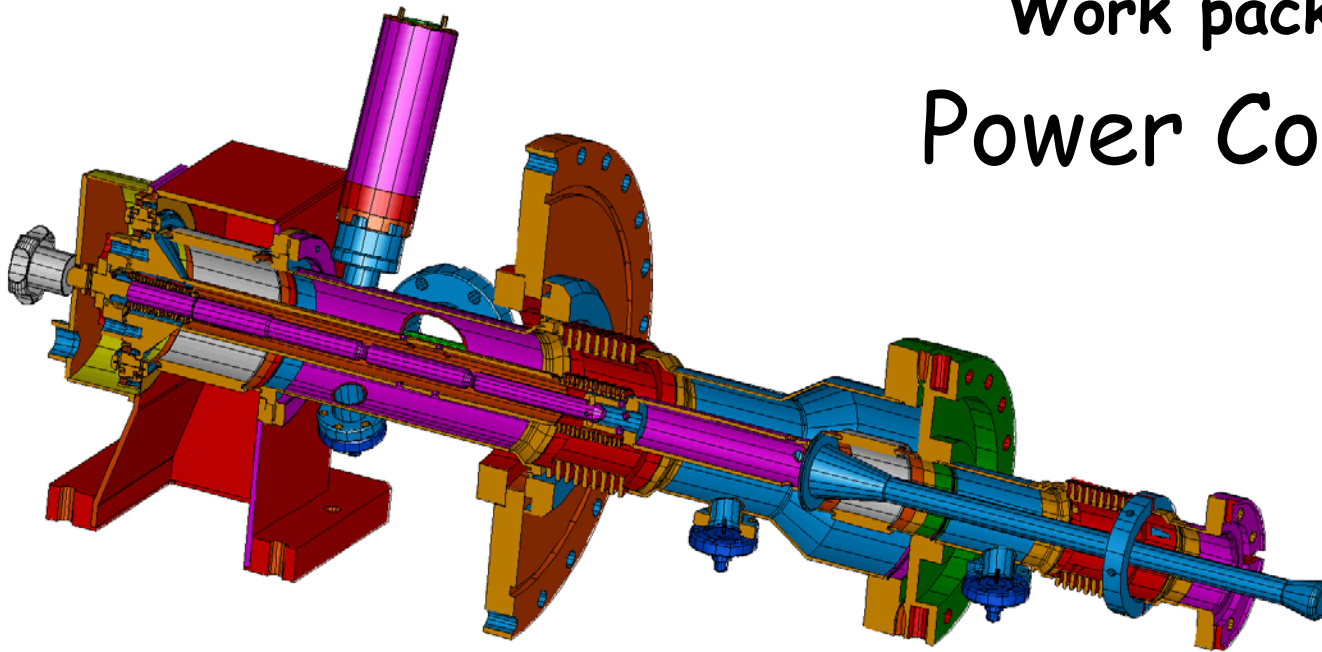


JRA SRF

Work package 7

Power Couplers



Tasks of the work package 7

- 1] Design, construction and validation test of new proto-type power couplers. TTFV, TW60.
- 2] Acquisition of the TiN coating technology know-how.
- 3] Conditioning & associated studies

2007 activity :

- 1] Design, construction and test of new prototype power couplers (TTFV , TW60) .

Analysis of the different Problems:

a lot of different simulations, controls, checks, tests.

TTF5 : Found a solution for high power tests.

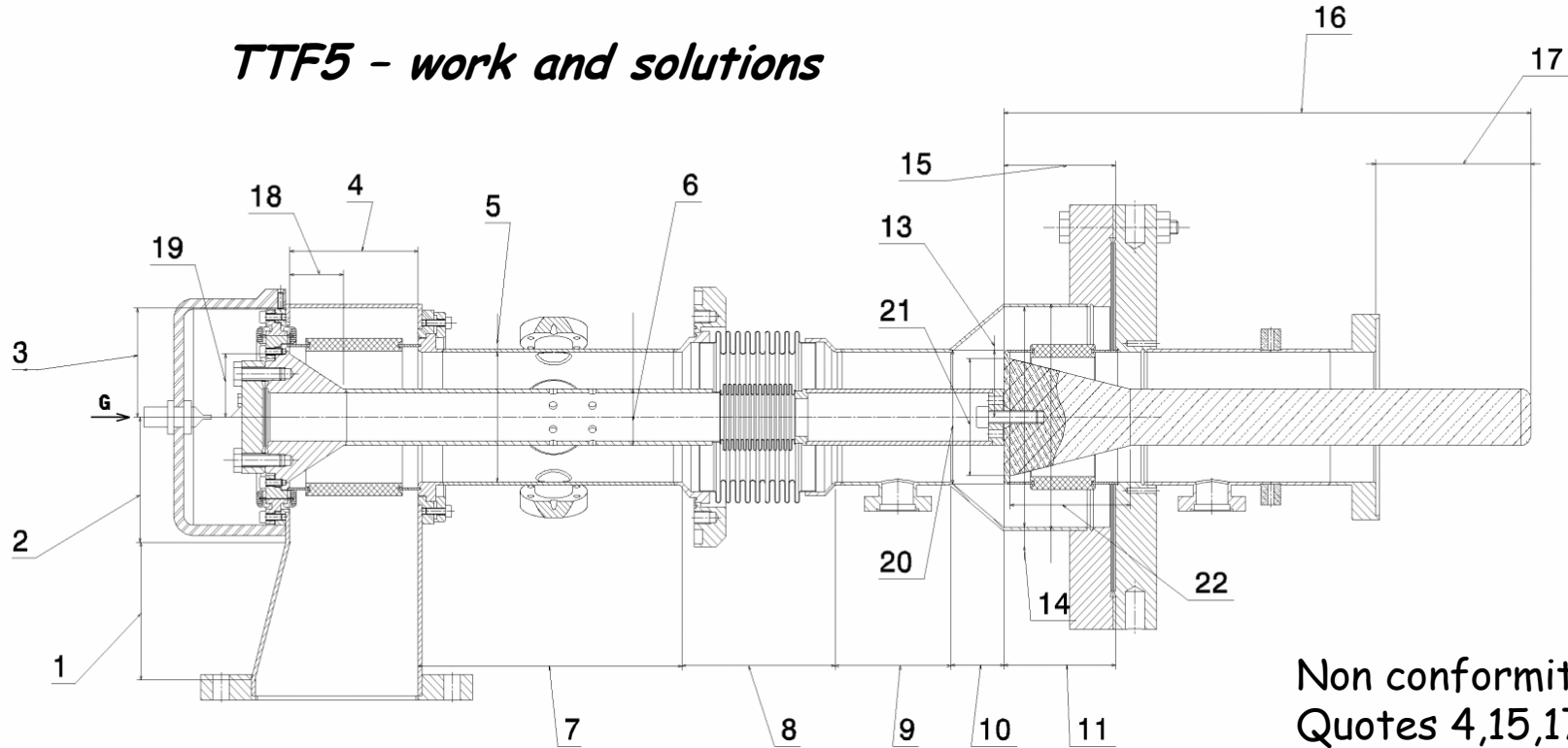
TW60 solutions to correct some mechanical non conformities.

Apply the considered solutions and have all the tests.

Gentleman agreement with the industry to accept the final version of the prototypes

TW60 First High Power test : Promising

TTF5 - work and solutions



Non conformities on Quotes 4,15,17

Problems met due to these non conformities:

- RF frequency mismatch (maybe)
- RF leakages in "warm transition "

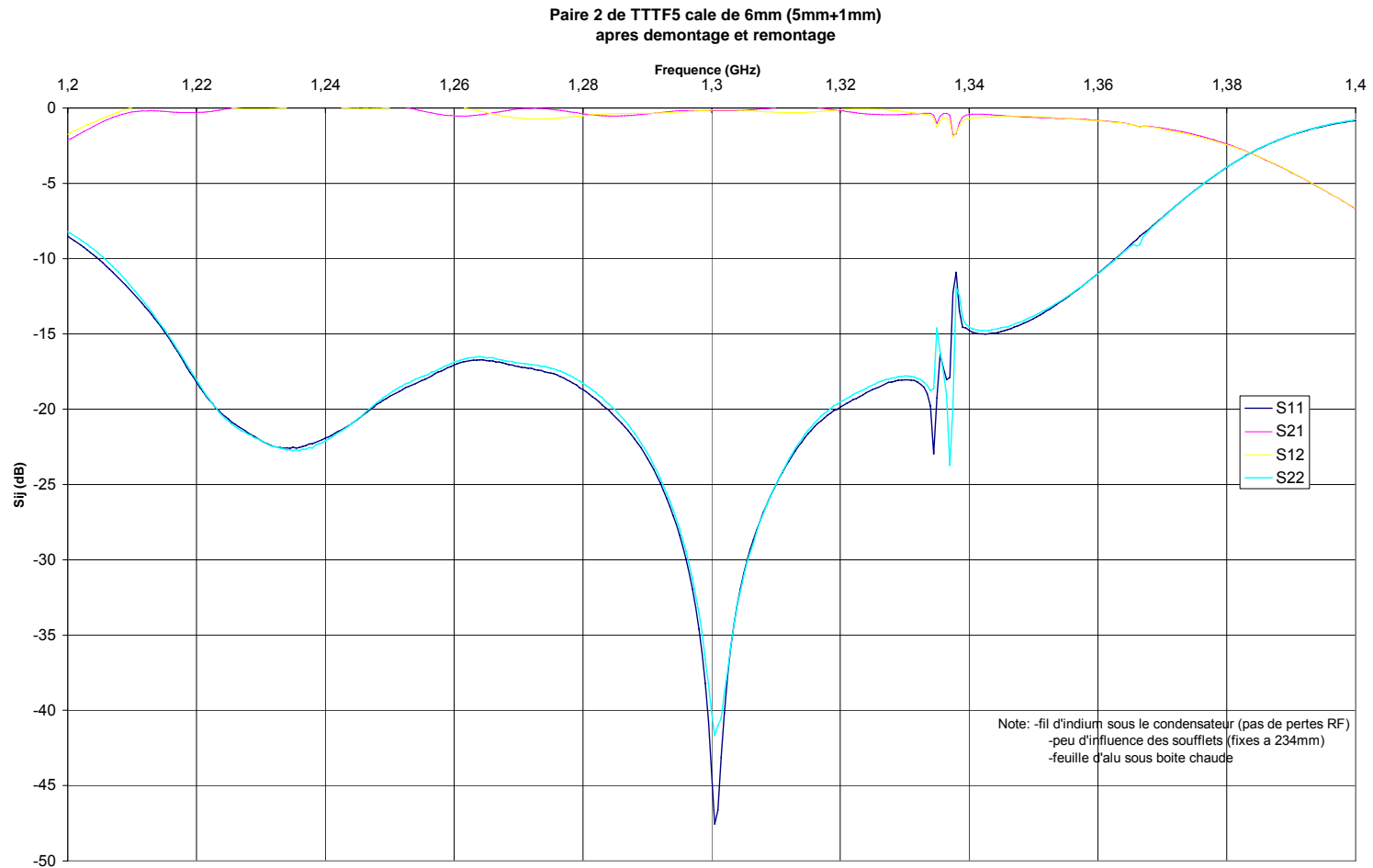
Solutions adopted to solve the non-conformities:

- LAL made seal in indium wire to avoid RF leakages in "warm transition".
- LAL made spacers in order to adjust antenna depth in the test box and to solve frequency mismatch. Solution leak checked (problem of tightness with spacers).
- LAL is making drawings to build a new test box in order to test TTF5 under vacuum and with couplers adjusted at 1,3Ghz.

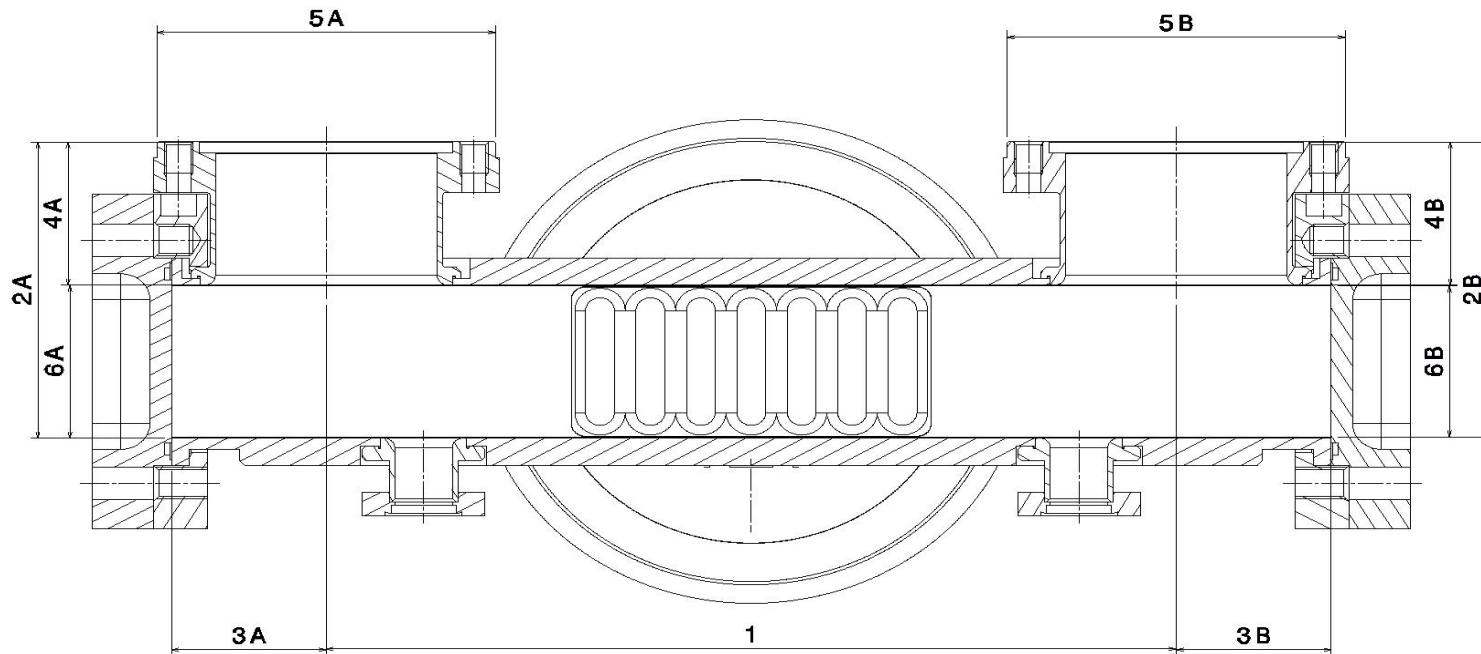
Actual situation:

- TTF5 has been tested at low level with spacers.

TTF5 low level tests: spacers 6 mm for both couplers



Transition box.



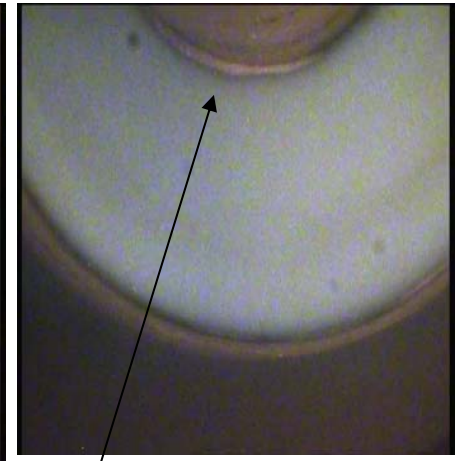
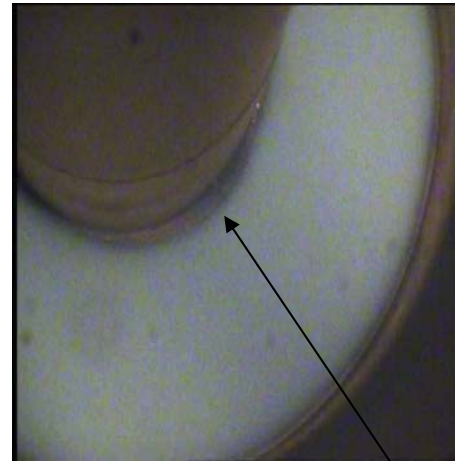
Non conformities on
Quotes 2,3,4,6

Problems met due to these non conformities:

- Tightness between box flange and coupler cold flange
- Rf tolerances. Rf frequency mismatch?

TW60

- Visual anomalies on TW60 couplers:
- TW60 2 Warm part bellow
- Metal on ceramic in the warm window
- We noticed a strong deformation on the bellow of TW60-2 coupler and when we let the part under its own weight the bellow is bent.
- Flakes in copper plating

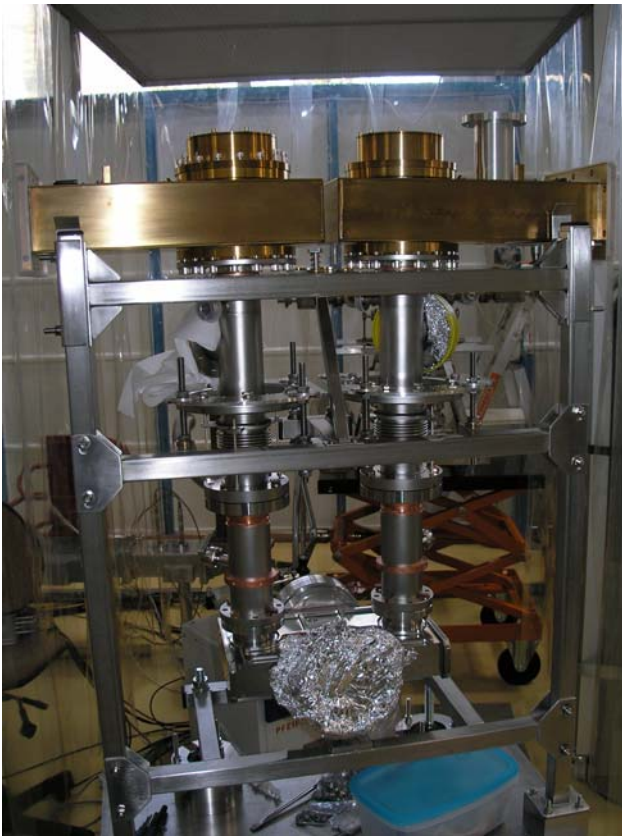


Metal on ceramic

TW60

- Different non conformities in mechanical quotes:
- Problems met due to these non conformities:
- -Parts don't fit together (cold parts with warm parts and cold parts with test box)
- -No tightness between cold parts and warm parts flanges, and between cold parts and test box flanges due to their flatness.
- Solutions adopted to solve the non-conformities:
- -Accel remachined the Cold flanges to adjust the fitting diameter.
- -LAL took the copper off on a local area of the antenna cold-warm transition to reduce the fitting diameter (LAL made this operation only on two couplers to be able to have a first HP test).
- Actual situation:
- -LAL put one pair of TW60 together and made a low power RF test (the first pair of TW60 works very well at 1,3GHz). A first high power conditioning test was performed. Results are promising but we were stopped by the water cut off.
- -Accel re-machined also the second pair.
- -Tightness has been verified
- -Couplers has been sent to LAL and they are actually under visual inspection

Assembly and conditioning of one TW60 coupler pair

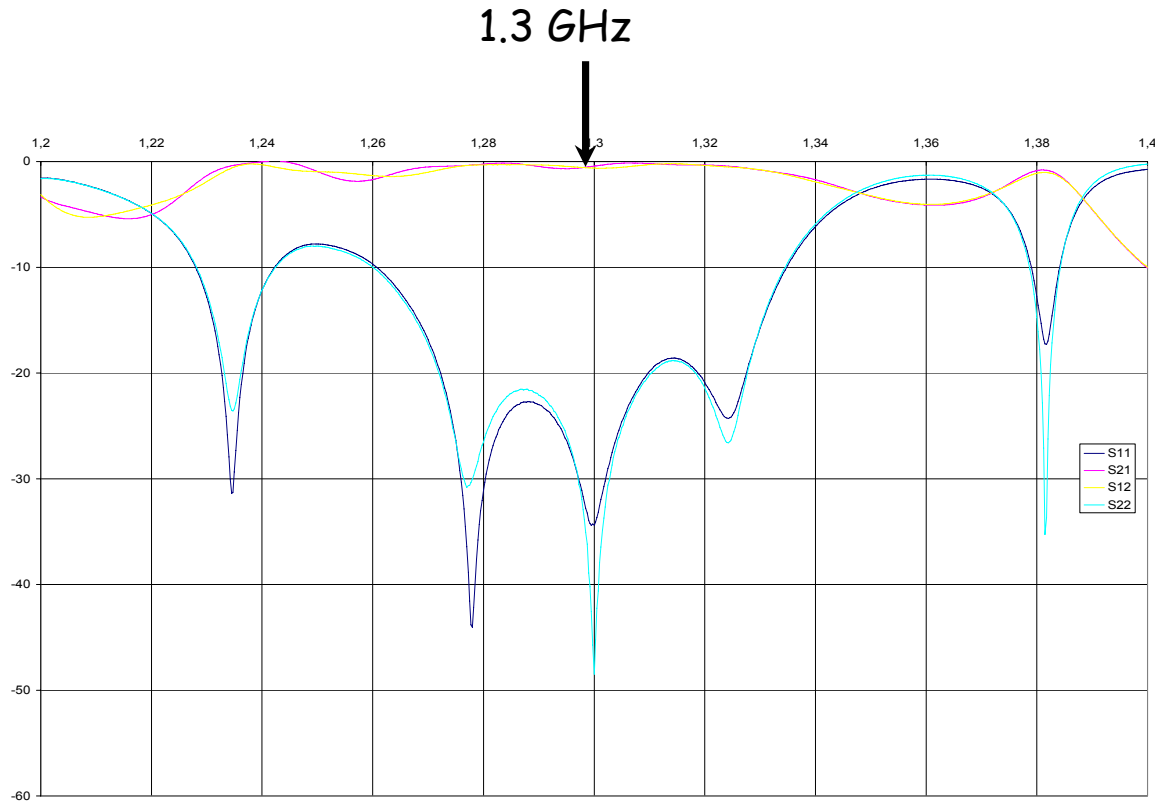


Assembly fulfilled but use of sandpaper : source of surface pollution => Heating after machining

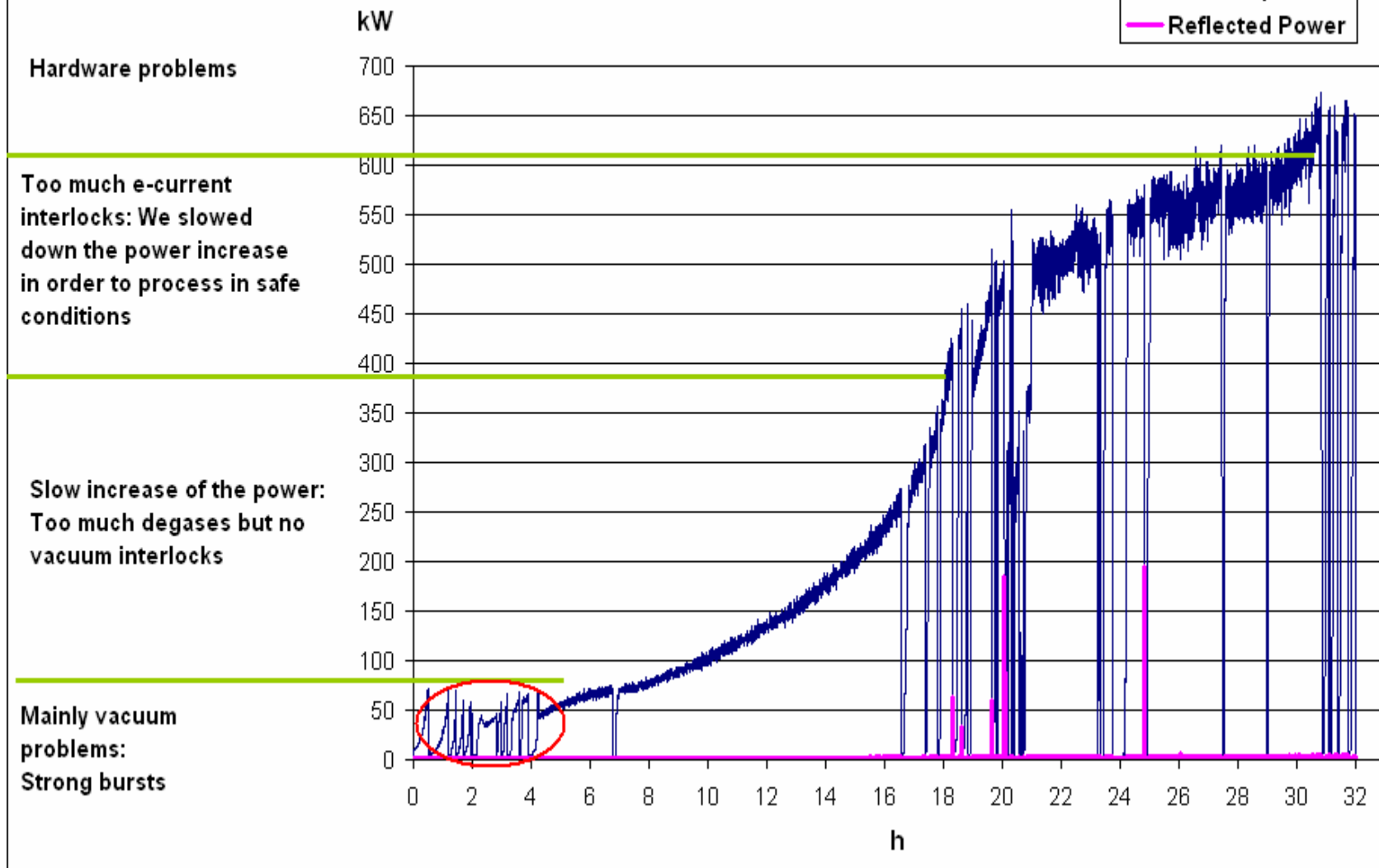
Cleaning using the TTF-III cleaning procedure

Low level RF measurements

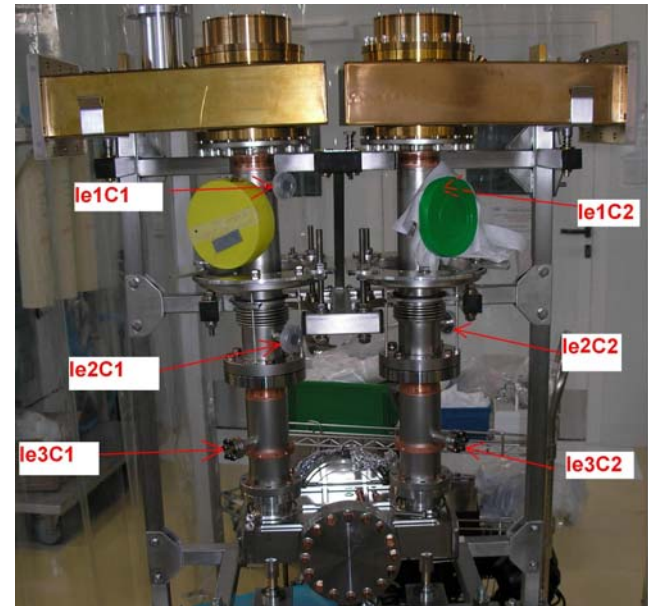
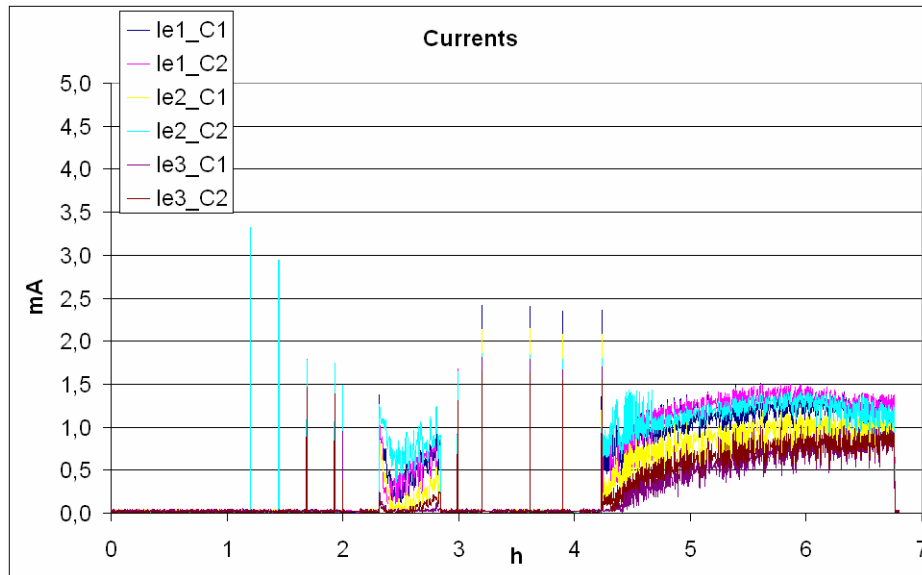
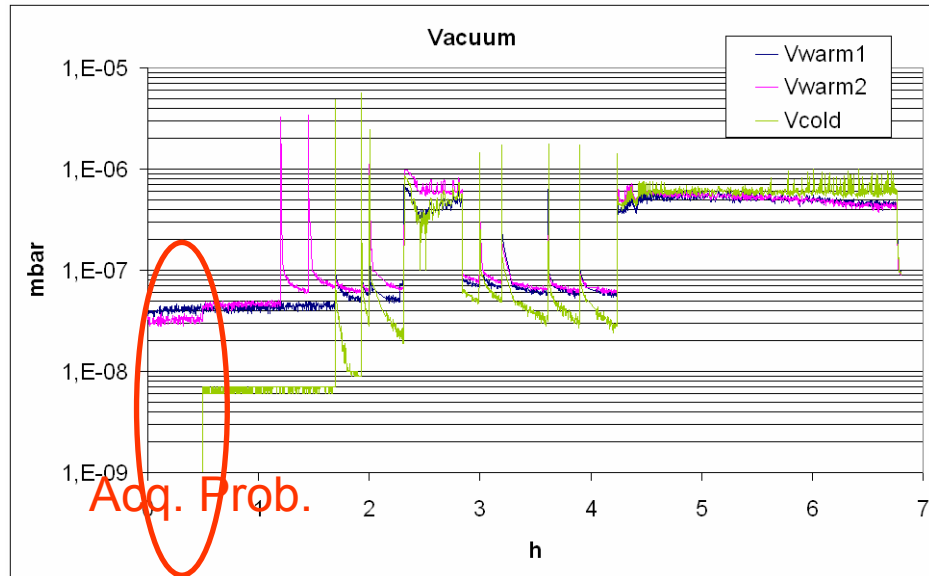
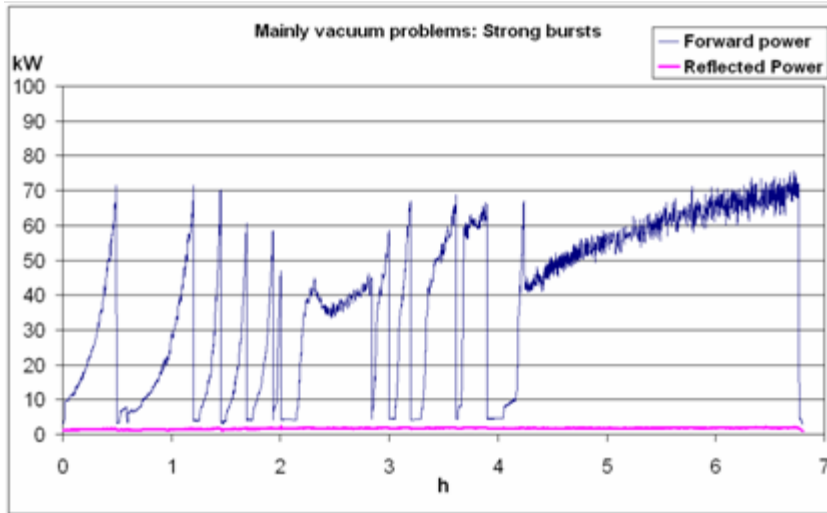
- 40 dB →



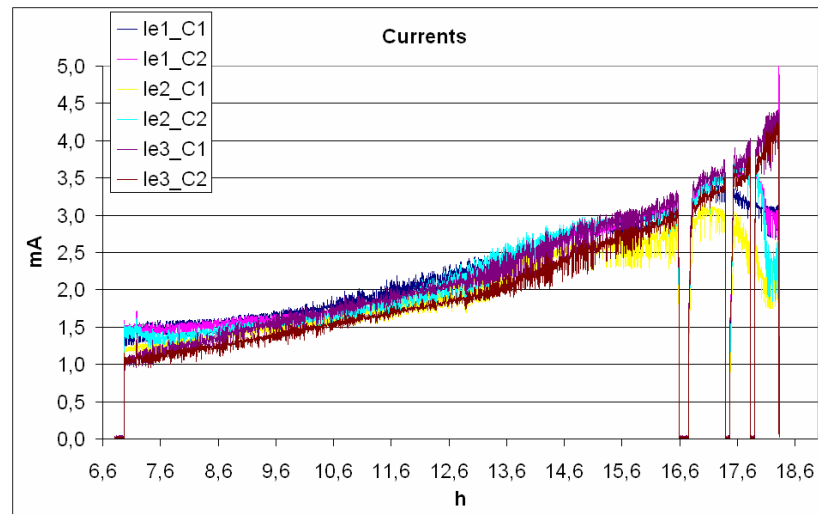
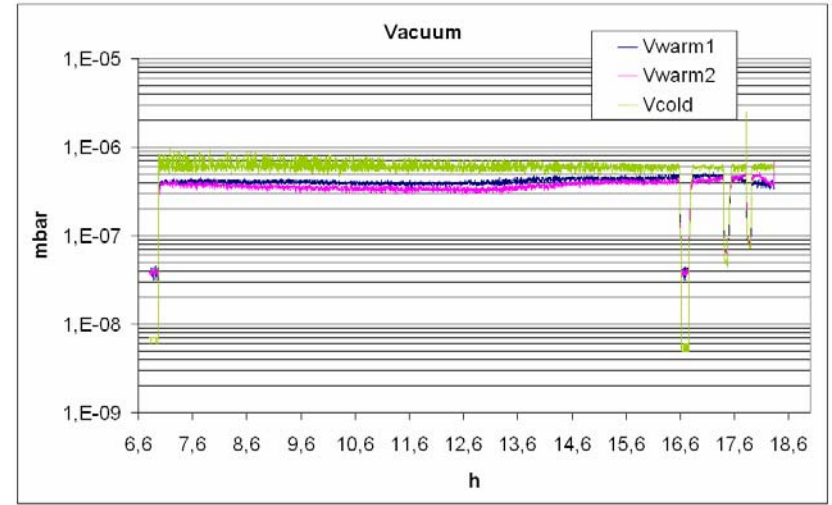
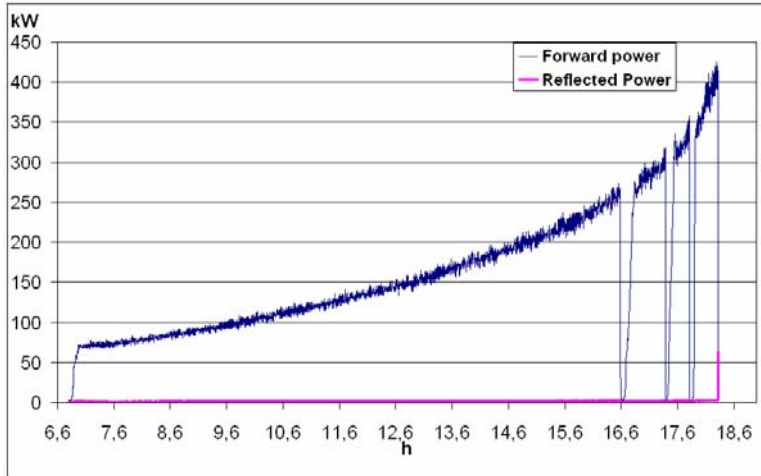
RF Power 20 μ s < 700 kW



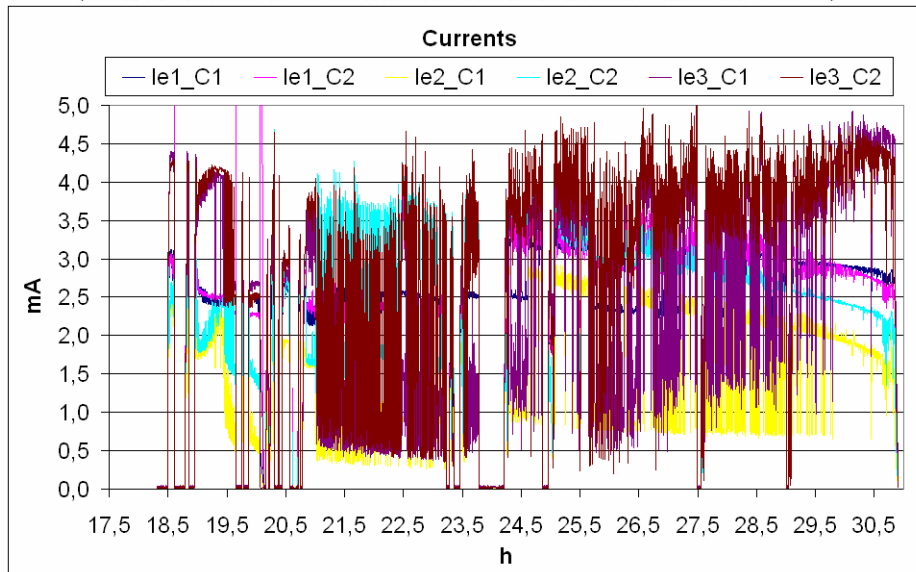
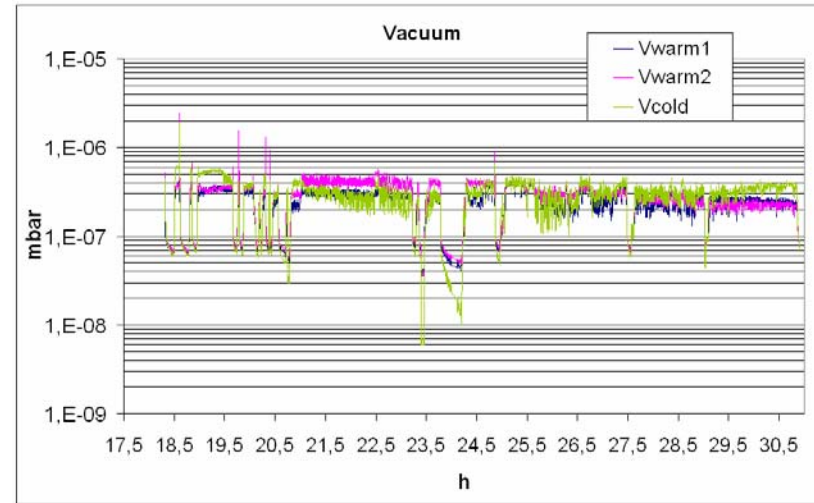
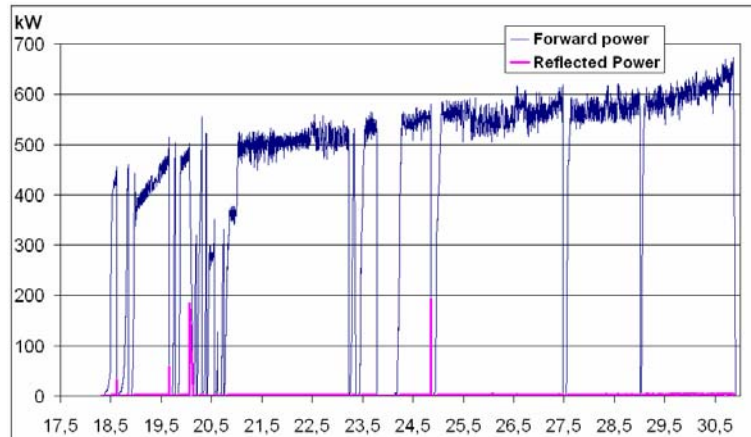
The processing of TW60 will be continued in September 2007



Slow increase of the power: Too much degasing but no vacuum interlock



Too much e-current interlocks: We slowed down the power increase in order to process in safe conditions



We changed the conditioning parameters very often during this step in order to find the way to increase the power.

After this step : many hardware problems (end of conditioning)

Conditioning is now stopped : new cooling water facilities for the modulator

Problems on the couplers station

- ❑ Ampli default (cut of the cooling water - dependence from an external building):
- ❑ Leak on the demineralised water system: we are installing a new tower
- ❑ Communication default between control card (NI card) and the LAL electronic rack :
 - stop during conditioning
 - problems in restart the modulator
 - problems of card detection from the PC when it is connected in that rack.
 - Interlock reflected HF : parasitic signals?
 - Synth default (only once..probably not a big problem....).

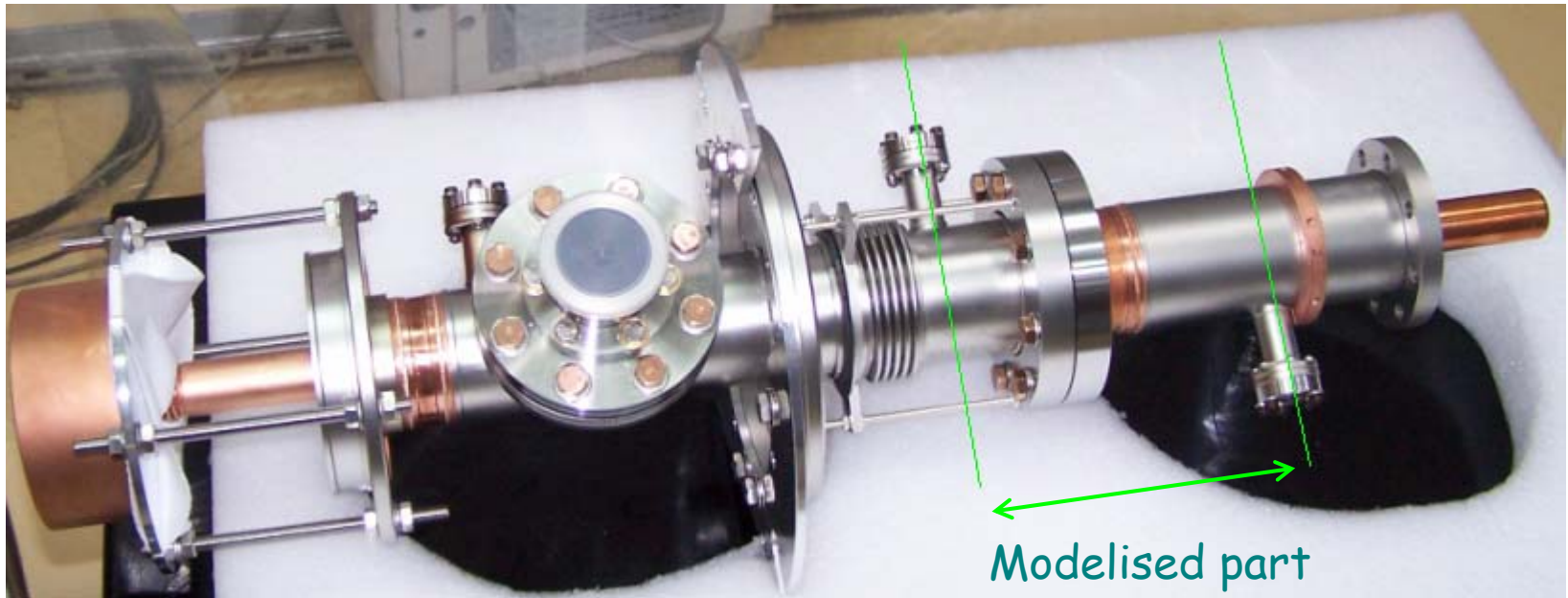
Working to reestablish the coupler test station functionality

With the new cooling water tower we will acquire in independence

Partial conclusions

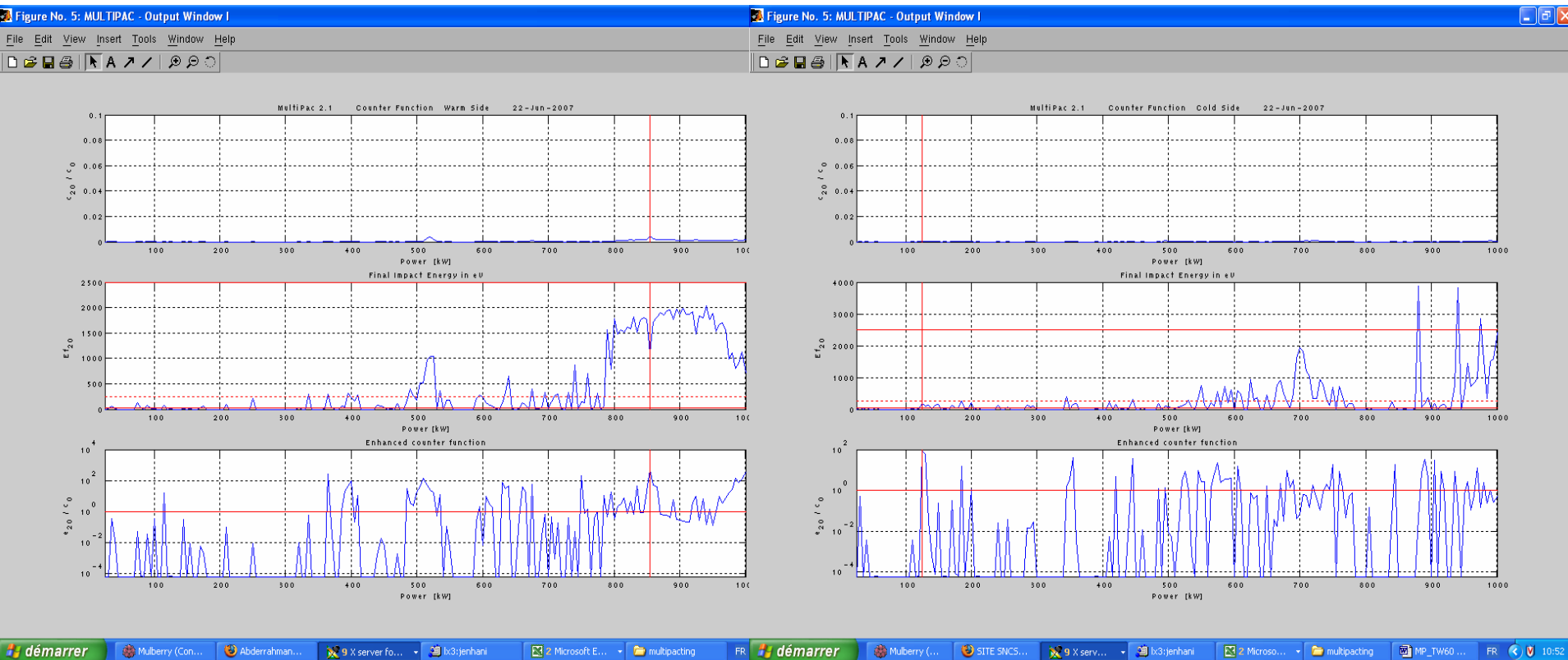
- High priority in the LAL coupler team given to solve the proto problems
- We have still problems in the HF station and in available personnel but we will do our best to restart as soon as possible.
- TTF 5: Low level solution found. New transition box in construction
- TW60: Long "back and forth" process to recuperate the anomalies and non conformities. At present a first pair has been partially conditioned. The second is under visual control but it has been fixed (we hope...)
- We have accumulated a certain delay on the schedule due to these important problems in recuperate the couplers functionalities (we have to add also French bureaucracy...when stuffs are not perfect...). Anyway, unfortunately, the coupler that we will test will not have the "quality assurance" that we hoped.
- We will go on confident to have pretty soon (end of the year) some results for both prototypes

TW60 MP simulations



Simulations results ready. Waiting for clear measurements to establish clear correlations

MP levels - 20 impacts



Warm side - cold window (before bellow)

Cold side - cold window (before pick up)

At present we have not enough exp results to clearly correlate simulations with measurements

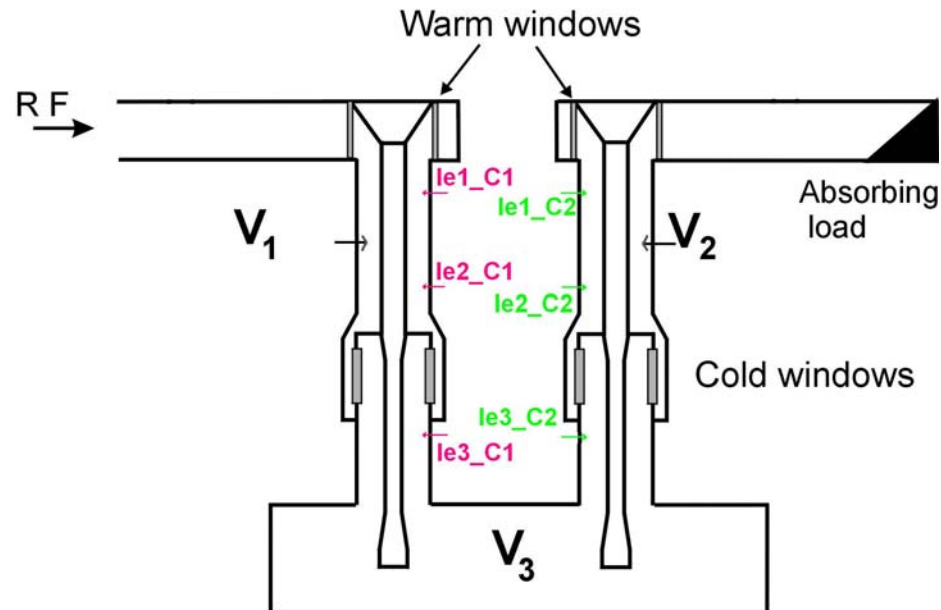
3] Conditioning studies

Antenna DC biased TTF-III coupler

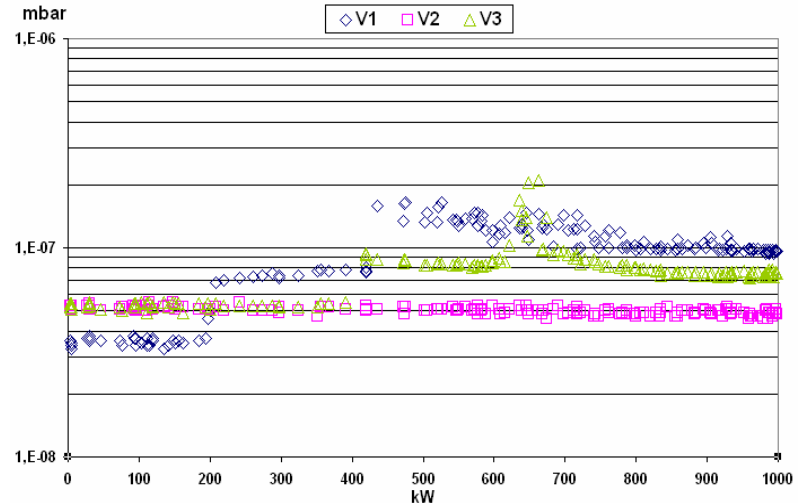
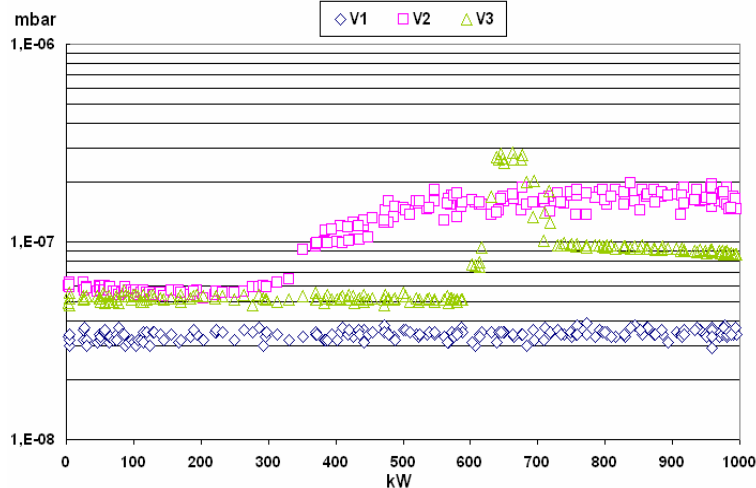
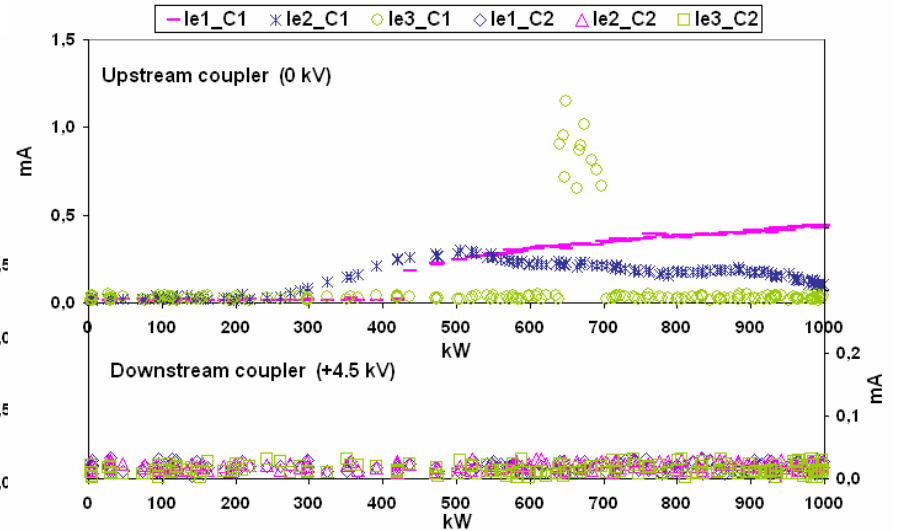
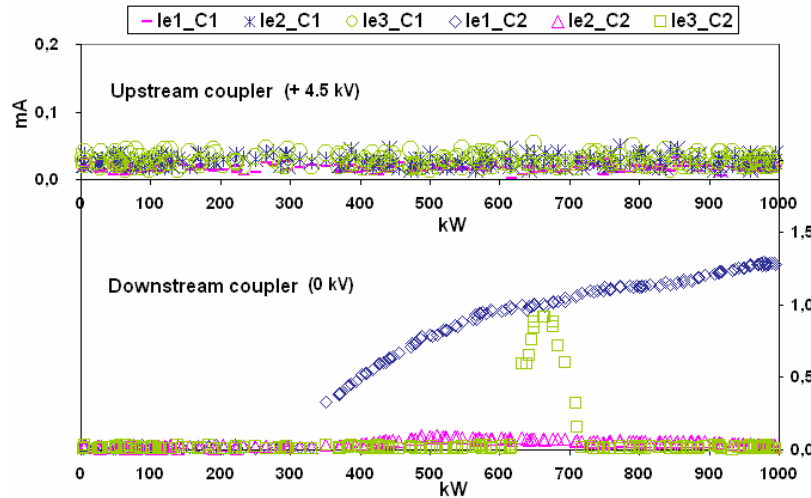
DC bias

$V = + 4.5 \text{ kV}$

DC Bias was applied to already conditioned couplers (to test a controlled process)

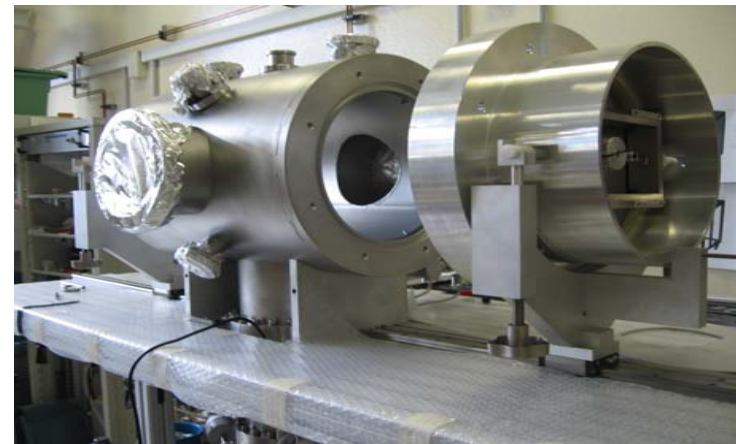
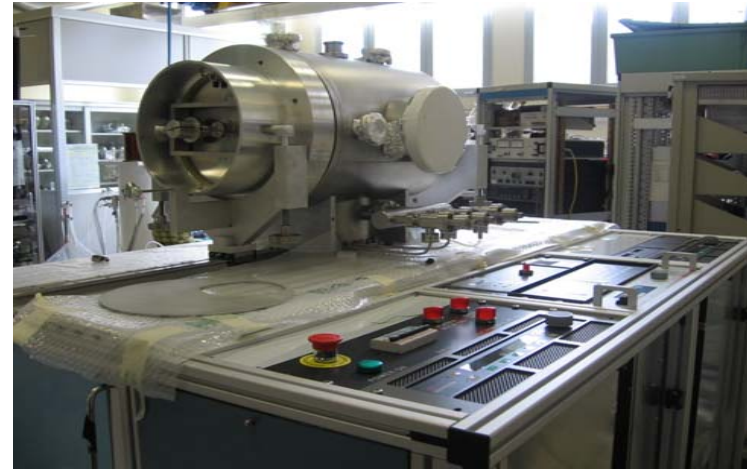


We found a controlled bias level to suppress e- activity with conditioned couplers. Unfortunately we are stopped with the station but there is already an experiment planned (in collaboration with DESY) to acquire e- Signal on the antenna. In the same framework we will study the application of the bias to non conditioned couplers.



2]TiN Bench

Design and manufacturing of TiN sputtering machine in collaboration with Ferrara Ricerche Association (Italy)



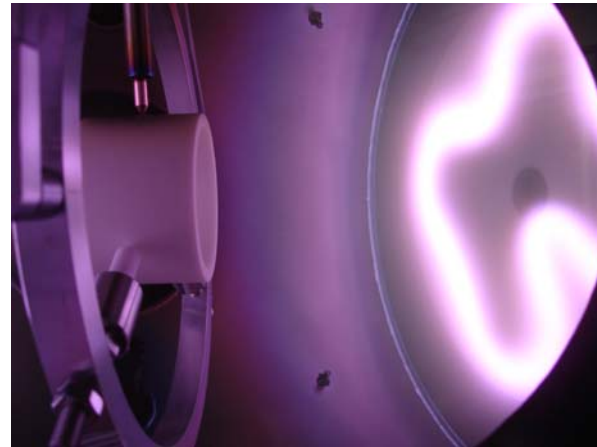
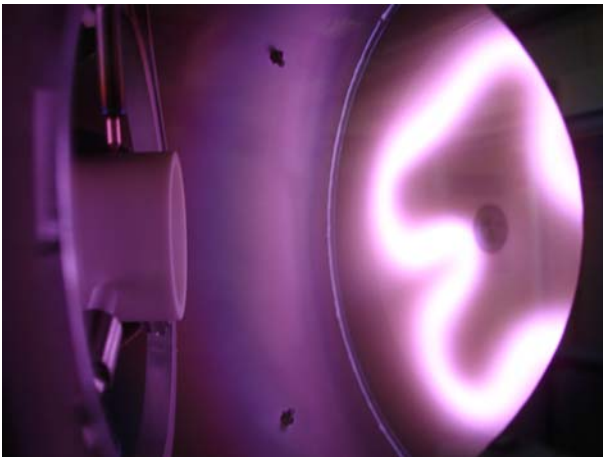
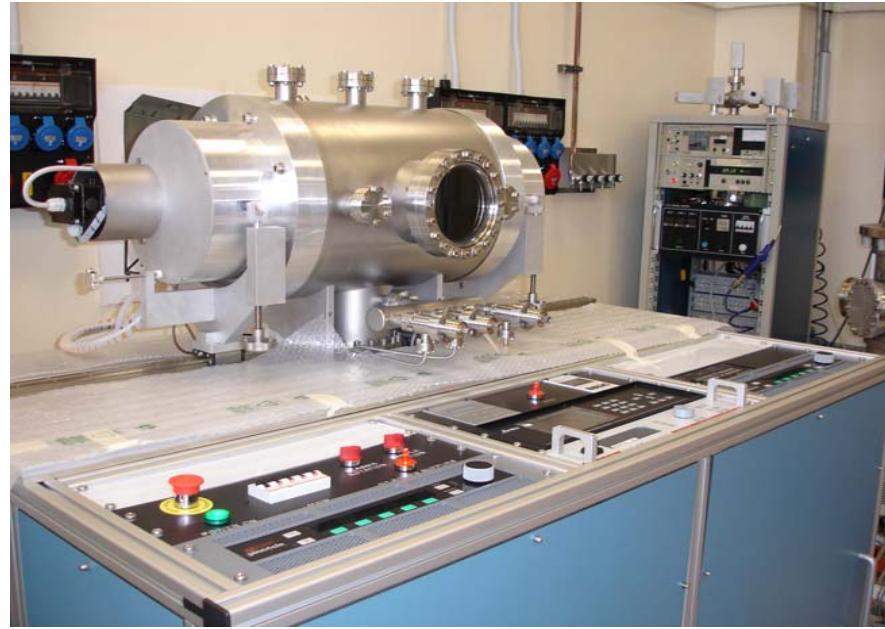
First tests (in Italy) using several
TTF-III coupler ceramics
(beginning of September 2007)

Reception of the machine on the
following week

20/09/2007

Alessandro Variola, LAL-ORSAY
2007 JRA SRF
Warsaw meeting

TiN bench is ready. We need further tests before reception



20/09/2007

Alessandro Variola, LAL-ORSAY
2007 JRA SRF
Warsaw meeting

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Fitting out of a local for sputtering bench



- ✓ Partitions and ceiling installation
- ✓ Electrical and computer work
- ✓ Plumbing
- ✓ Ground painting

20/09/2007

Alessandro Variola, LAL-ORSAY
2007 JRA SRF
Warsaw meeting

TiN Bench experimental hall is ready



20/09/2007

Alessandro Variola, LAL-ORSAY
2007 JRA SRF
Warsaw meeting

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Study of TiN coating- Ceramic disk sample

TiN_x thick layer deposition (800 nm) on ceramic disk



Coating parameters
optimization



TiN stoichiometry
(Samples analyzed by XRD)

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



tg δ measurements and multipacting tests.

stoichiometric TiN deposit and optimization of layer thickness



Deposition on cylindrical ceramic
windows (internal and external
surfaces)



TTF-III coupler window type

Risks

- Proto ready to be tested but they are the results of different compromises.
- Need of "external" diagnostics for TiN coatings samples
- The team is strongly suffering from a lot of departures. LAL is doing his best to find valuable and competent substitutes as soon as possible

Conclusions

- TTF 5 TW60 see partial conclusions. In budget.
- Bias on antenna successfully tested. Waiting for measurements as a pick-up
- TTF 3 statistics at low cond. time ok
- TiN bench ready for coating and samples will be analyzed. (delayed but in budget)

Thanks to all the participants and to the colleagues that provided the slides.

P.Lepercq, H.Jenhani, W Kaabi, M. Lacroix, A.Thiebault