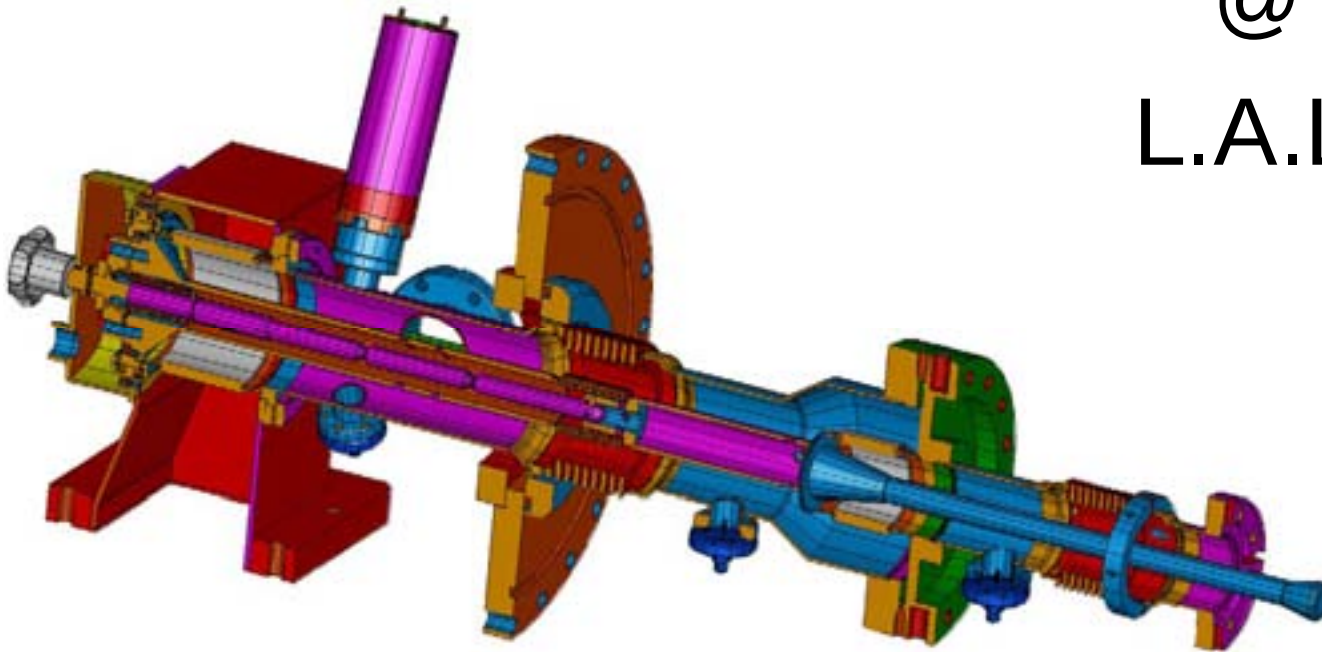


# Power Coupler Program @ L.A.L.



# Different activities

- Manufacture of 30 TTF-III Couplers in Industry for VUV-FEL. Pre-conditioning at room temperature.
  - Design, construction and test of new proto-type power couplers: TTFV, TW60. => Cost & Conditioning time
  - Industrialisation studies of the Coupler for the European X-Ray Free Electron Laser (1000 couplers !!!).
- 

- Design and construction/acquisition of TiN coating bench.
- Conditioning studies ~ 10 couplers
- Associated studies (surfaces, vacuum, mechanics..etc)

- Manufacture of 30 TTF-III Couplers in Industry for VUV/FEL - Installation.  
This experimental set-up will be used for all the other activities

Class 10 clean room



Klystron/modulator



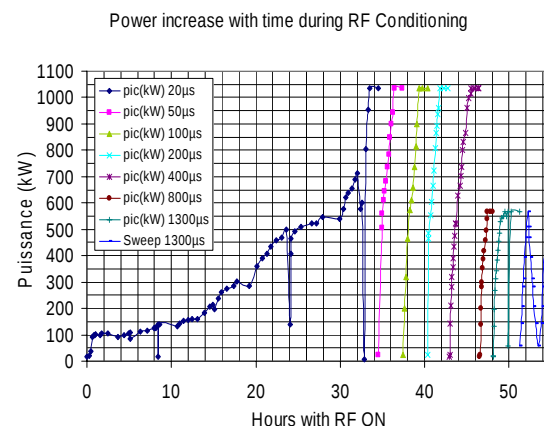
Vacuum furnace



Ultra-pure water production



Reception, cleaning, mounting  
Conditioning and tests => Diagnostics

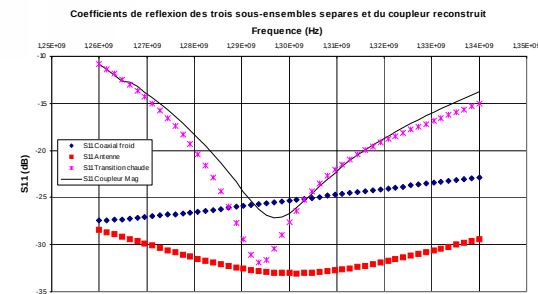
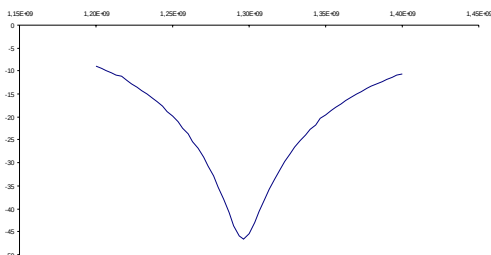


10/01/2006

Alessandro Variola, LAL - ORSAY  
2005 ALCPG & ILC Snowmass Workshop

# Design, construction and test of new proto-type power couplers (TTFV , TW60) - Funded through CARE .

Study, simulations & design. Setting up the call for tenders and evaluation of offers.



10/01/2006

Alessandro Variola, LAL - ORSAY  
2005 ALCPG & ILC Snowmass Workshop

# Industrialisation studies of the Coupler for the European X-Ray Free Electron Laser (see T. Garvey Talk)

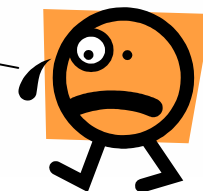
- Thermal studies, tolerances, simulations.
- Setting up the call for tenders and evaluation of offers.
- Define the procedure for quality control and final decision

## Principle of "Definition contract for industrialisation studies"

- Essentially intellectual work:
  - Define all manufacturing processes
  - Risk analysis (process, logistics)
  - Determine cost in series and justify
- Produce validation models and 2 prototypes

## Particularities

- several contracts will be awarded on the same subject: **3 contracts are financed**
- 2 teams will be selected after final evaluation
- contracts for manufacturing 2 series of 532 XFEL couplers will be awarded without new call for tenders
- the 2 contracts may be awarded to a single company



# Status & Results

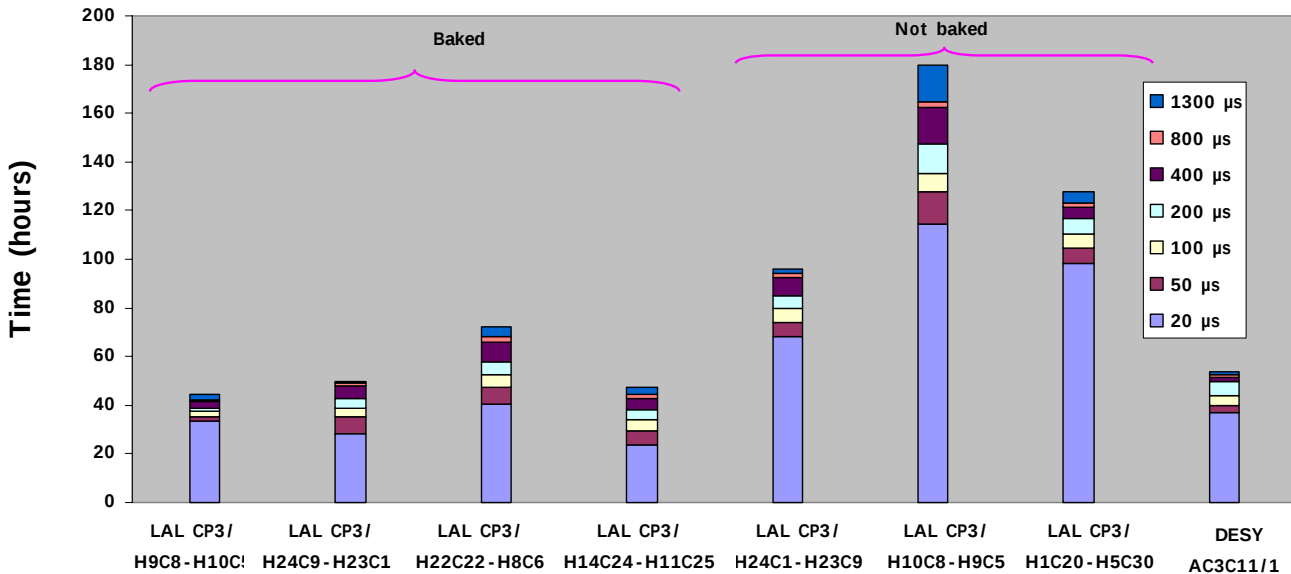
- Conditioning:

- Agreement & collaboration with DESY for the quality procedure (very extensive documentation)
- Communication : Web site => reports, conditioning advancement, internal notes, measurements, minutes
- Improvement of the technical equipment and of quality assurance for the assembly procedure: 1) Water resistivity measurement on the outgoing flow 2) New particle counter 3) Increased ultra pure water reservoir 4) Continuous RGA spectrum acquisition 5) Modified vacuum system to assure a delivery of the cold part under sealed vacuum 6) Box and supports for delivery to DESY
- Start of the conditioning of the VUV-FEL couplers in “continuous mode” testing both with and without “in situ baking”. Different measurements started (memory effect)
- First results produced and data analysis ongoing(see next page...)

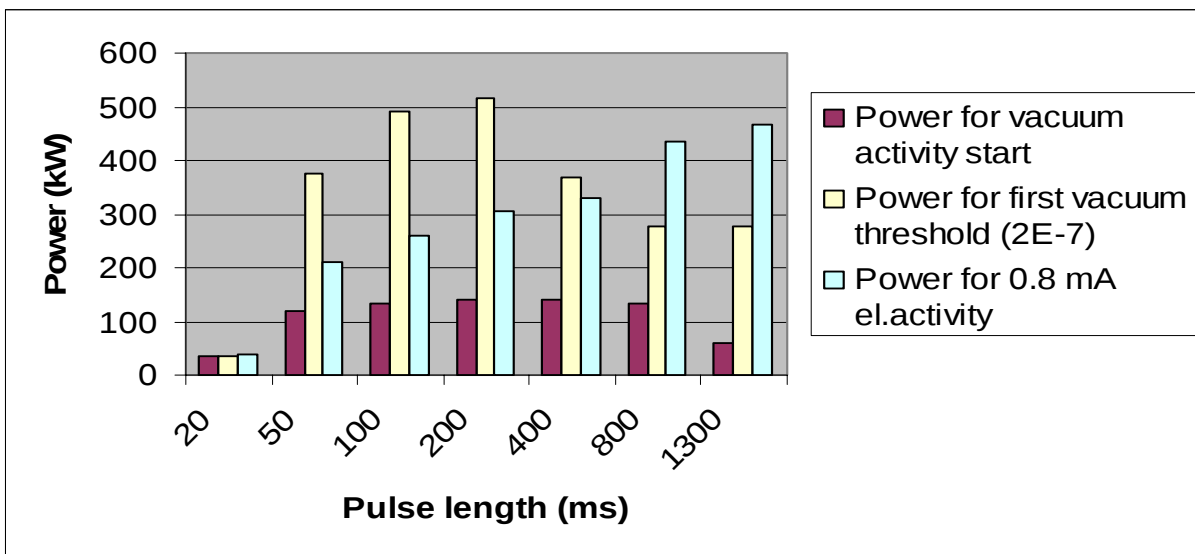
# First results

- 7 pairs already conditioned (1 pair / ~ 3 weeks)
- 1) Without in situ baking: conditioning time = ~ 134 h av. ( 94 @ 20  $\mu$ s)
- 2) With “in situ” baking: conditioning time = ~ 53 h av. ( 31 @ 20  $\mu$ s)  
but ~ 4 days for baking @ 130 degrees T
- Oven pre-baking @ 130 degrees. No visible effect. New test changing the gasket (silver plated annealed copper) and baking in oven at much higher T. If still no effect => directly to “in situ” baking.
- Almost no interlocks events with the present conditioning procedure.  
Next steps: increase ramp speed (modifying thresholds, shorten waiting time @ fixed power) or rep. rate
- With in situ baking the “RF on” time can be reduced at ~ 50 h  
RF = 

•(Av=6 pairs)



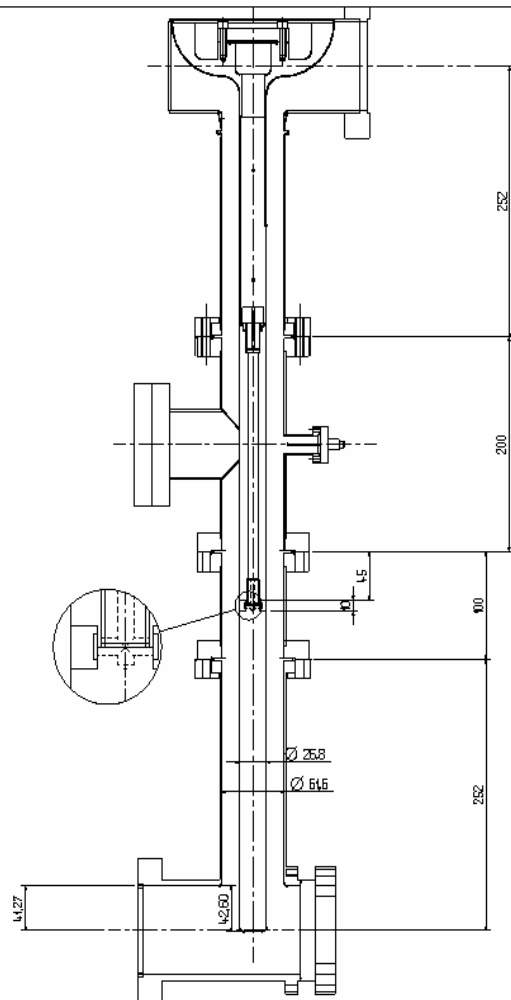
### Couplers



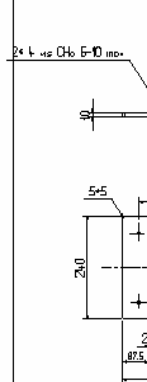
# 10 “spare” couplers for different measurements

- Some ideas for Conditioning Studies :
  - Memory effect (Couplers stored, first exp. performed) => Effect of different environments on re-conditioning times ( vacuum, N<sub>2</sub>,....)
  - DC bias sweep to provoke multipactor
  - Argon discharge cleaning
  - Ceramics coated with Zr-Va-Ti
  - Fully TiN coated coupler  
(Couplers ready to be coated - TiN @ DESY)
  - Establish maximum limits for interlock thresholds @ rep. rate
  - Effect of assembly of warm part in class 10 clean room
  - Central antenna as an e<sup>-</sup> pick-up
  - And other ideas are being discussed.....

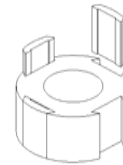
## TEST - Coupler (NEG, Surface analysis etc)



|                |       |
|----------------|-------|
| MATIERE:       | Cu Cl |
| ECHANTILLON PO |       |

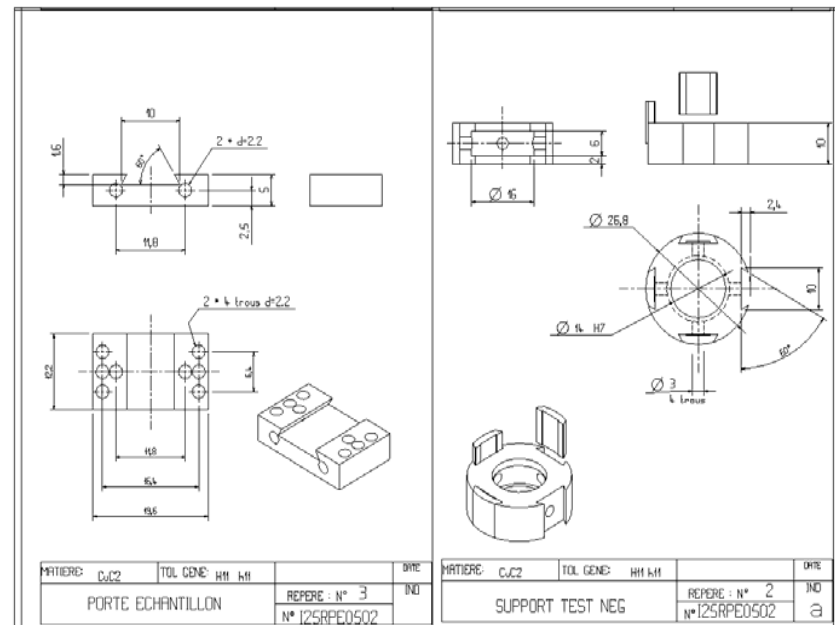


|          |     |
|----------|-----|
| MATIERE: | FUG |
|----------|-----|



Ai rencontré l'atelier  
peuvent faire un essai par découpe  
par fil electro érosion

- Adhesion
- Oxidation
- Quality of coating

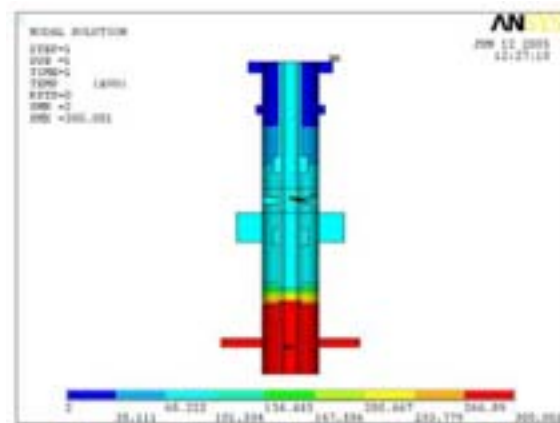
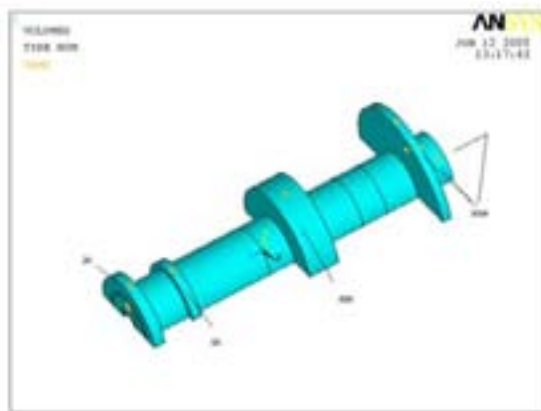
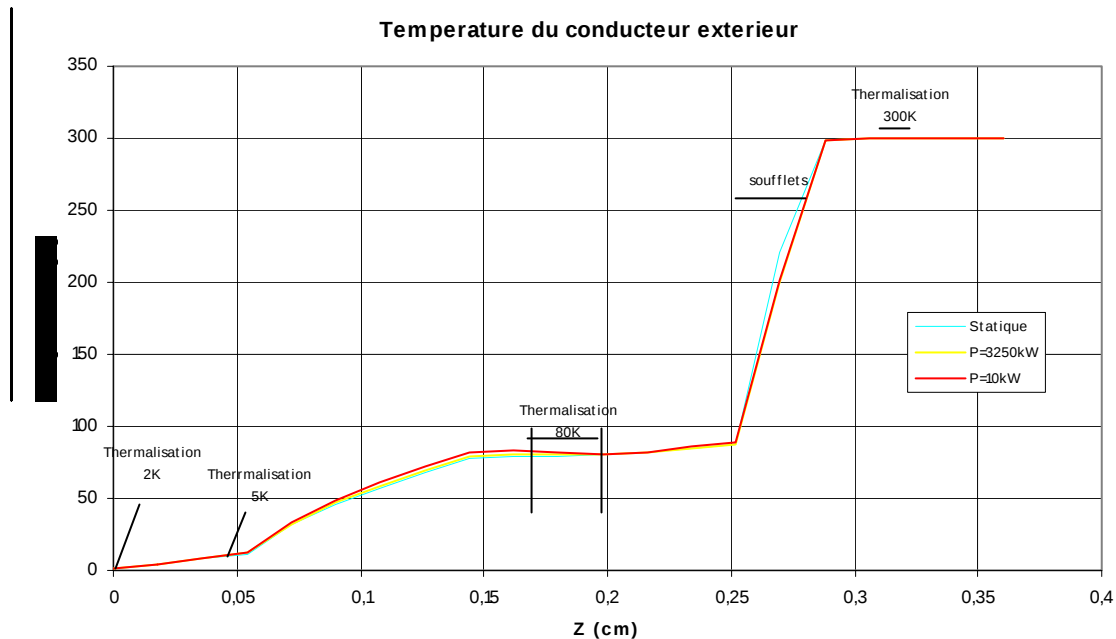


# • New Prototypes

- TTF V call for tender published  
Industries proposals analyzed  
Assignment of the contract to ACCEL
- TW60 call for tender published  
Industries proposals analyzed  
Assignment of the contract to ACCEL

One year for delivery....we hope to receive, test and validate the models before summer 2006. In the meanwhile thermal & multipacting studies and simulations will be carried out

# Thermal studies-ANSYS (P.Lepercq)



# XFEL industrialisation

- We obtain funding for a third contract
- The call for tender has been published
- A procedure for the contract following has been established
- A final decision for the composition of the committee that will evaluate the contractors is foreseen soon.

# Others....

- TiN team in place. Offers received from different industries, process=>sputtering
- Ideas for conditioning measurements evaluated and some project already started (**memory effect**)
- On going Data Analysis
- Surface activity proposed (**Samples mechanics in construction**)
- NEG (**Test Coupler in construction**)

# Conclusions & Outlook

- The power coupler activity is a priority in the accelerator activity of LAL.
- We have progressed in the definitions of the quality procedures and started the conditioning of the VUV FEL couplers. We have improved some technical aspects to increase the quality assurance. First results are being analyzed.
- TTF V & TW60 => Assigned
- TTF III – XFEL industrialization : 3 contracts, call for tender already published and proposals received.

# HFSS-ANSYS

