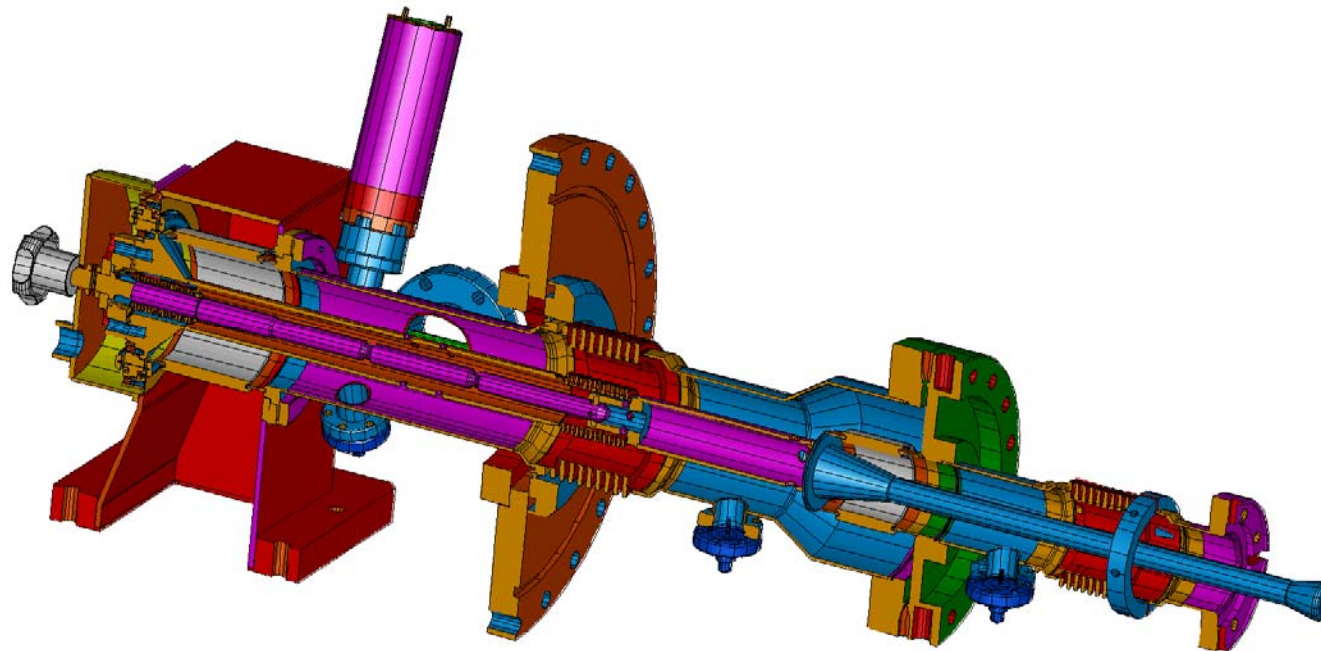




LAL & Power Couplers



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- WHAT WE DO

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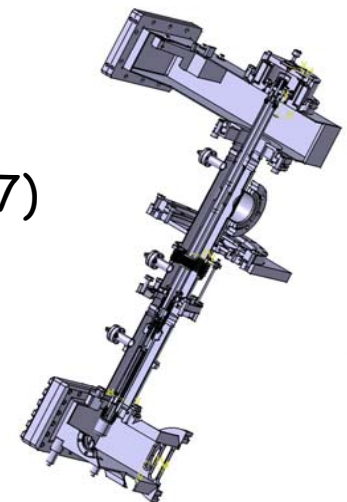
Different activities

- Manufacture of 30 TTF-III Couplers in Industry for VUV-FEL. Reception, cleaning and assembly. Pre-conditioning at room temperature. (2006)
- Design, construction and test of new proto-type power couplers: TTFV, TW60. => Cost & Conditioning time (2006-2007)
- Industrialisation studies of the Coupler for the European X-Ray Free Electron Laser (1000 couplers !!!). (2006-2008)
Prototypes are expected from the industries (ACCEL, Toshiba, E2V) for validation of the process (2008)
- 30 new couplers in the DESY-LAL cooperation agreement framework (2007-2009).

-
- Design and construction/acquisition of TiN coating bench (2007)
 - Conditioning studies ~ 10 couplers (2006-2007)
 - Associated studies (surfaces, vacuum, mechanics..etc)

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- WHAT WE HAVE

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Coupler Lab Infra-structure



Class 10 clean room

1 shared building !
27 m² class 1000
13 m² class 10
External laminar flow class 100

Ultra sonic bath => up to 8kW @ 40 kHz
Ultra-pure Water => 200 litres /day @ 18 MΩ cm
Diagnostics: Particle counter & resistive-meter



Vacuum furnace

Vacuum furnace => 400° @ 10⁻⁶ mbar



Ultra-pure water production

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UPGRADE FORESEEN

- In the framework of the next 30 couplers conditioning (DESY-LAL) we will double the UP water production to allow a continuous flow resistivity measurement.
- We will acquire a special baking jacket to speed up the process.
- In the WP7 framework we are working to acquire a TiN coating bench for the TTF-type ceramics. We plan to get an in-house know-how on the magnetron-sputtering technique.



Conditioning Facility

- Modulator and klystron (THALES TH 2104C) , RF source of 5 MW peak power rating
- Rep. Rate up to 10 Hz
- Variable pulse width from 20 μ sec. to 1300 μ sec. (max 2 msec)
- Computer controlled acquisition procedure



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For the coupler reception:

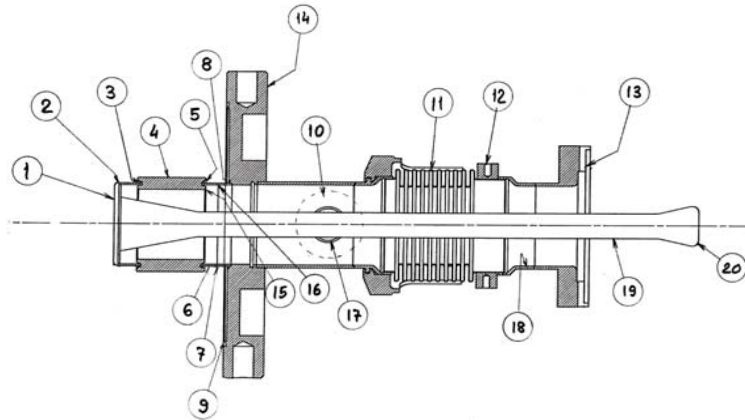
- Non-destructive examination by endoscopy @ LAL
- Visualisation and acquisition by CCD camera
- Storage of the reception datas in a database

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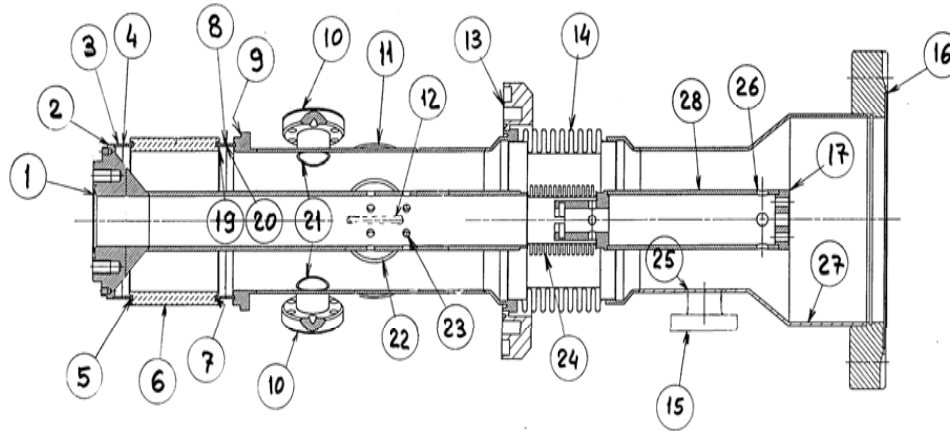
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Example: Points of visual inspection



Cold assembly



Warm assembly

Observations → EXCEL files → data base



- HOW WE PROCEED

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Coupler preparation

- Ultra-sonic cleaning using ultra-pure water ($\rho = 18 \text{ M}\Omega\cdot\text{cm}$) with 1% Tickopur solution.
- Rinsing with UP water.
- Drying in class 10 clean room area
- Baking to 400 °C in vacuum oven during 4 hours.
- Assembly of cold coupler parts to WG test box in Class 10 clean room.
- Assembly of warm parts.
- Leak test in the clean room
- Connection of couplers to high power source under mobile laminar flow (class 100)
- In situ baking (130 degrees)



Conditioning procedure

- Pulse length 20 ms, ramp power to 1.0 MW in 0.2 dB steps
 - Pulse length 50 ms, ramp power to 1.0 MW in 0.2 dB steps
 - Pulse length 100 ms, ramp power to 1.0 MW in 0.2 dB steps
 - Pulse length 200 ms, ramp power to 1.0 MW in 0.2 dB steps
 - Pulse length 400 ms, ramp power to 1.0 MW in 0.2 dB steps
 - Pulse length 800 ms, ramp power to 0.5 MW in 0.2 dB steps
 - Pulse length 1300 ms, ramp power to 0.5 MW in 0.2 dB steps
 - Sweep power @ 1.3 ms, 50 to 500 kW.
- **Interlocks**
 - e- pick-ups, photo-multiplier, vacuum, ceramic temperature
 - Wave-guide sparks - stop operation!



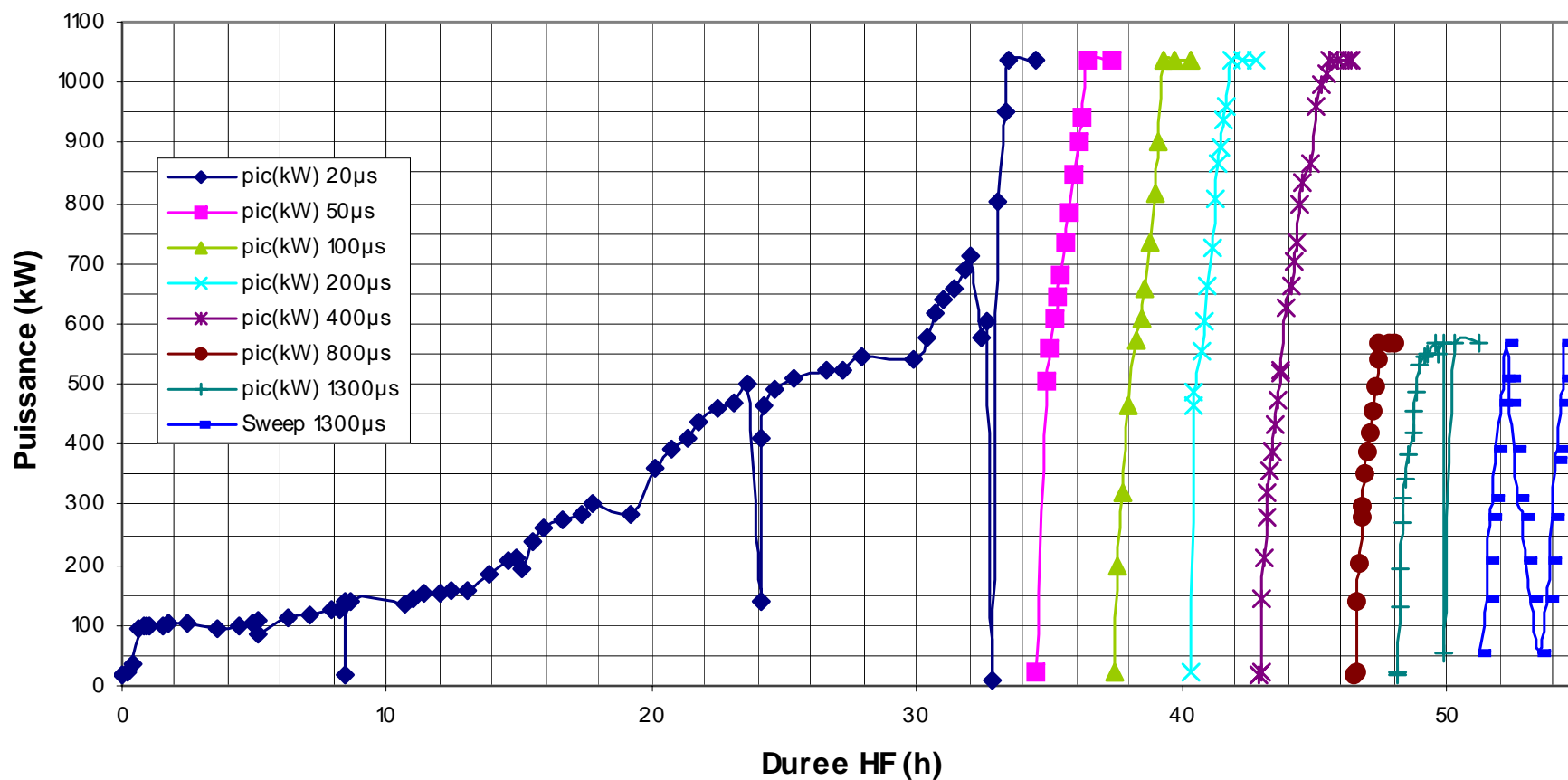
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EXAMPLE

Evolution de la puissance au cours du conditionnement

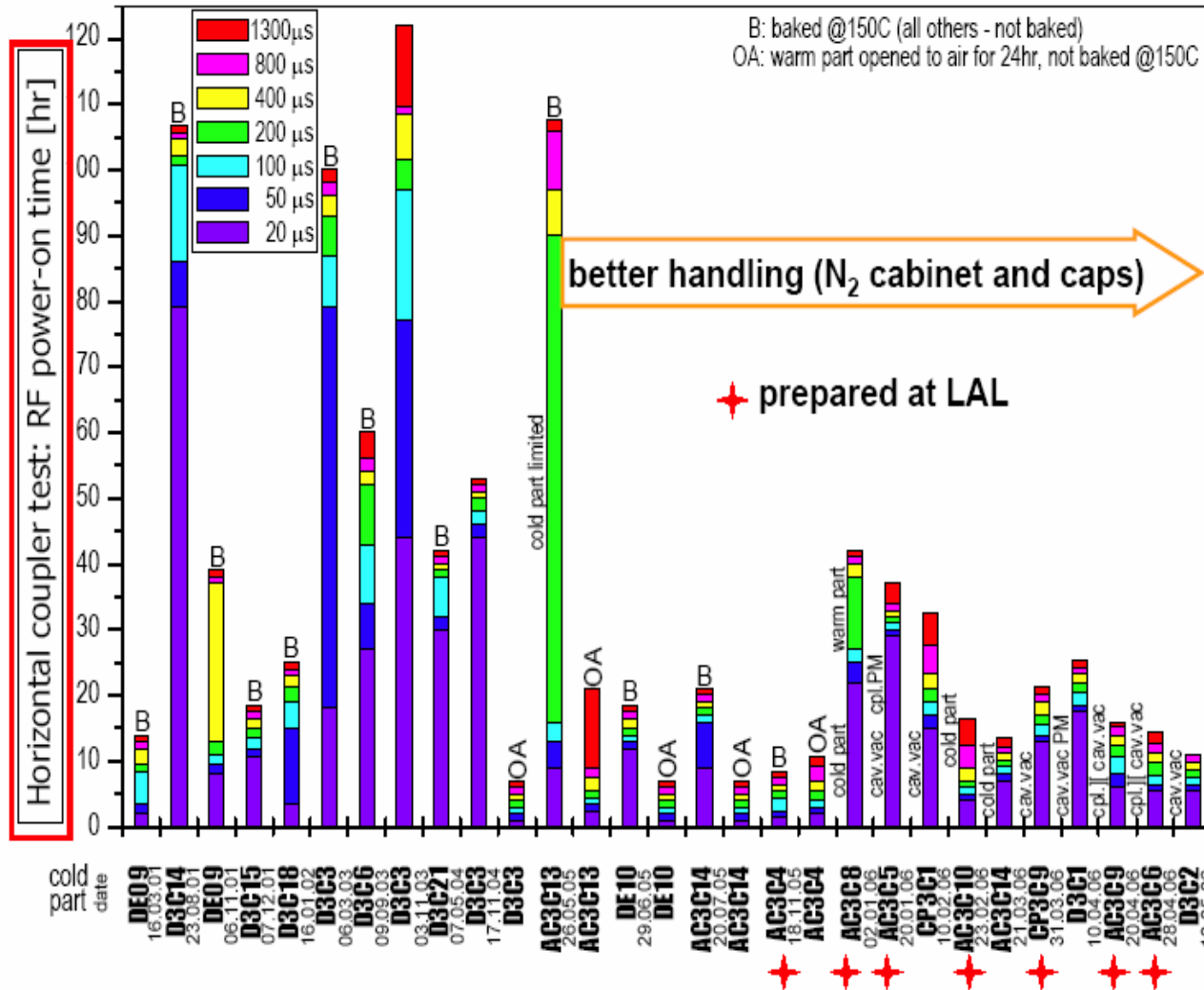


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Results



More:
 The couplers have been tested on CHECHIA attaining $\sim 35 \text{ Mv/m}$ With a Q of $\sim 10^{10}$

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Rate

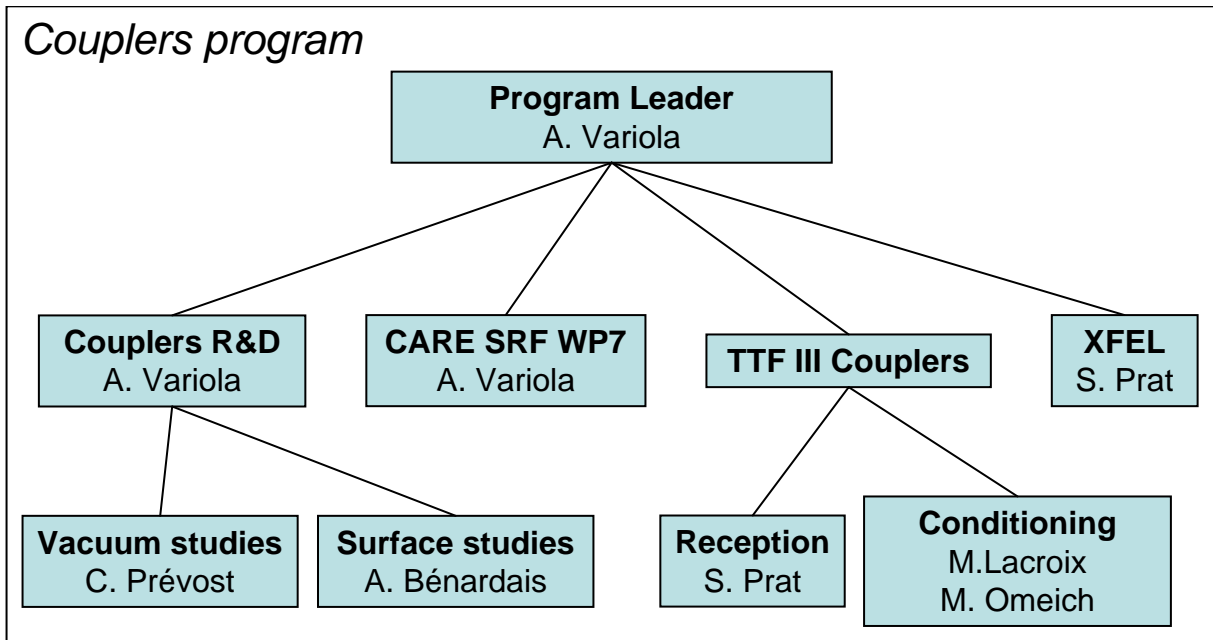
- In continuous mode we can overlap, up to a certain degree of freedom, the preparation of a new coupler with the conditioning phase.
- This allows us to provide one pair every three weeks.
- So actually, taking into account the stops due to the cooling water and the holidays, we are working on a basis of one pair per month (twelve pairs in a year)
- All modification of this schedule requires the re-evaluation of the whole procedure, starting from assembling in the clean room.



- WHO WE ARE

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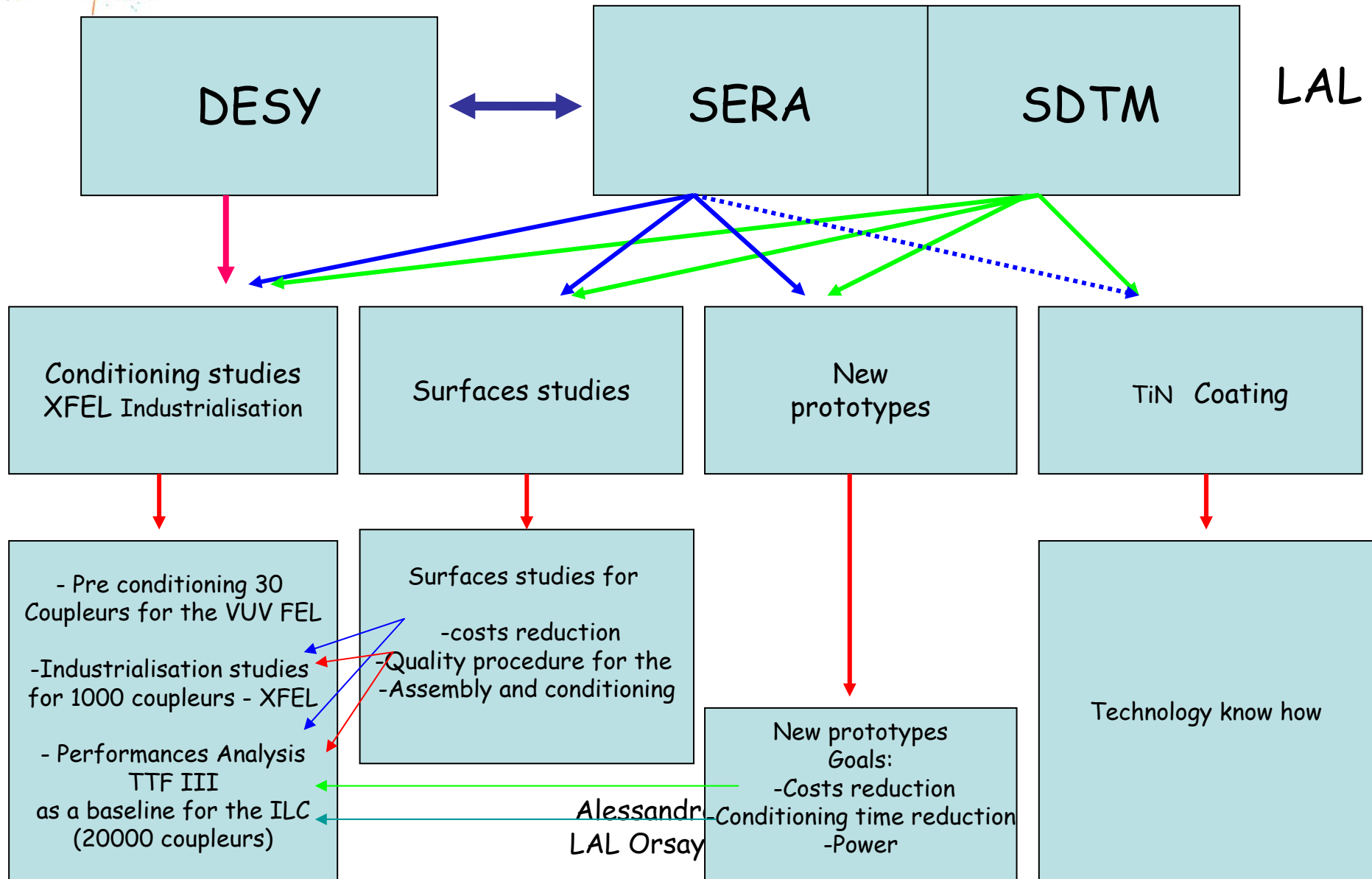
A. Variola	SERA	Coordination	IR
M. Omeich	SERA	Power source	IR
J. Vieira	SERA	Power source	AI
T. Chabaud	SERA	Power source	AI
F. Cordillot	SERA	Power source	AI
P. Lepercq	SERA	RF & Thermal Simulation	IR
S. Cavalier	SERA	RF & Thermal Simulation	IR
A. Benardais	SDTM	Coating, brazing and surfaces	IR
M. Lacroix	SDTM	Mech. Ing	IR
S. Prat	SDTM	Mech. Ing	IR
A. Thiebault	SDTM	Assembling	AI
F. Barjot	SDTM	Assembling	TCN
M. Herry	SDTM	Assembling	TCS
R. Panvier	SDTM	Tech design	I
A. Gonnin	SDTM	Tech design	CDD
O. Dalifard	SDTM	Control	AI
C. Prevost	SDTM	Vacuum	IR
B. Mercier	SDTM	Vacuum	IE
H. Jehnani	SERA	Data analysis	THESARD

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Collaboration Scheme





FUTURE

- We have a full R&D program up to the beginning / middle 2009 (depending on XFEL prototype couplers arrival).
- This program is strictly connected to the ILC that is our priority
- For any new perspective we will take into account this priority