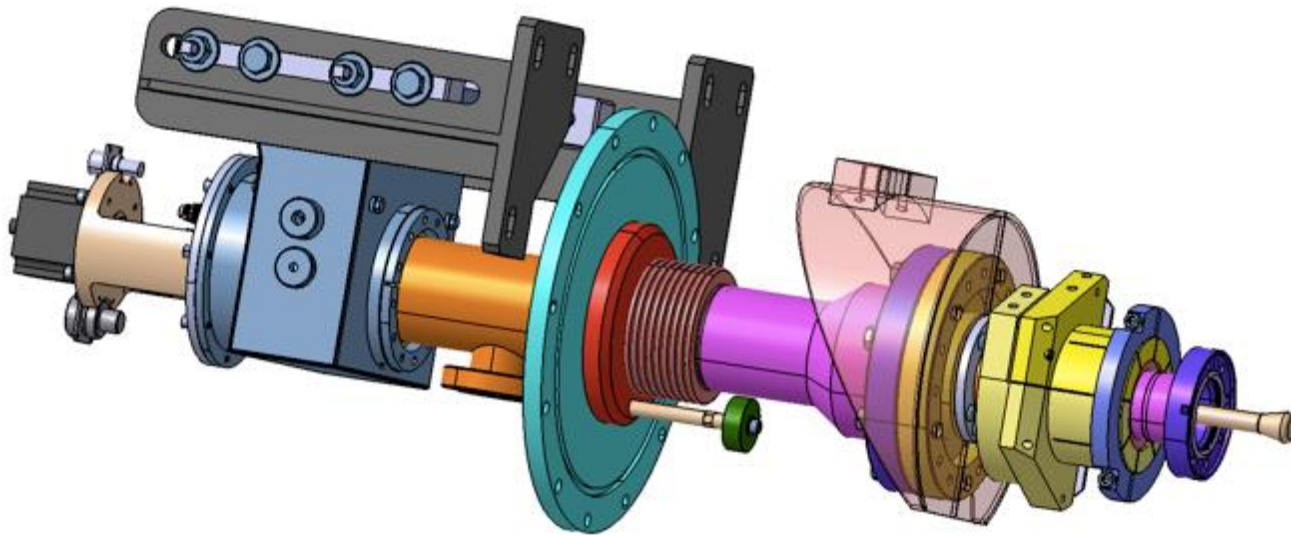


Status and REX of XFEL couplers production

CERN, June 23rd 2015



Walid KAABI- LAL/Orsay

Outlines:



- Introduction
- Production monitoring and quality control at companies
- Couplers preparation and RF conditioning at LAL
- Status of the XFEL couplers production
- REX of the coupler production

Introduction:

Linac composed of 100 Cryomodules, equipped with 8 couplers each → 800 Couplers needed



Introduction:



4

XFEL couplers are produced by 2 suppliers at 3 production sites:

- **Consortium Thales-RI** (Thonon les bains-France and Koln-Germany): **670** units.
- **CPI** (Beverly-Massachusetts-USA): **150** units.

Supported by DESY, LAL-Orsay has in charge:

- The **production monitoring** and the **quality control** at Thales-RI sites.
- The **RF conditioning** of all the couplers at Orsay and the weekly **delivery of 8 couplers/week** to IRFU-CEA.

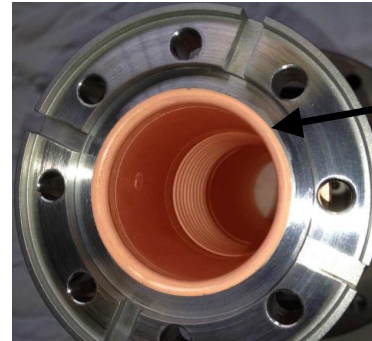
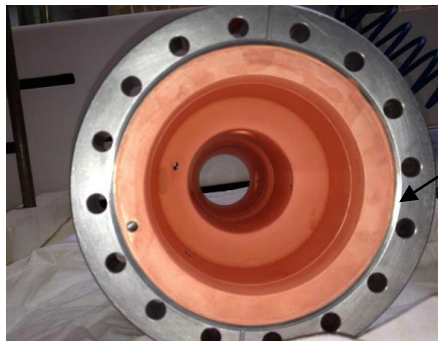


At Thales site:

- 1st step: parts assemblies by brazing:



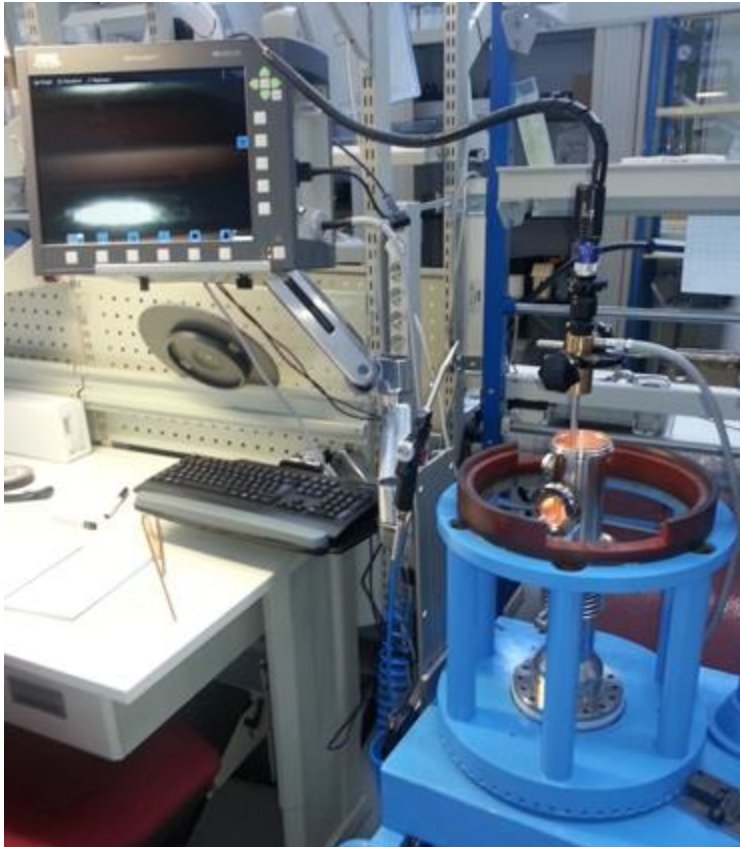
- 2nd step: RF Surfaces copper plating of the assembled parts:



Production monitoring and quality control at companies:



Weekly inspection meetings organized at Thales-Thonon to control parts copper plating quality



Warm part

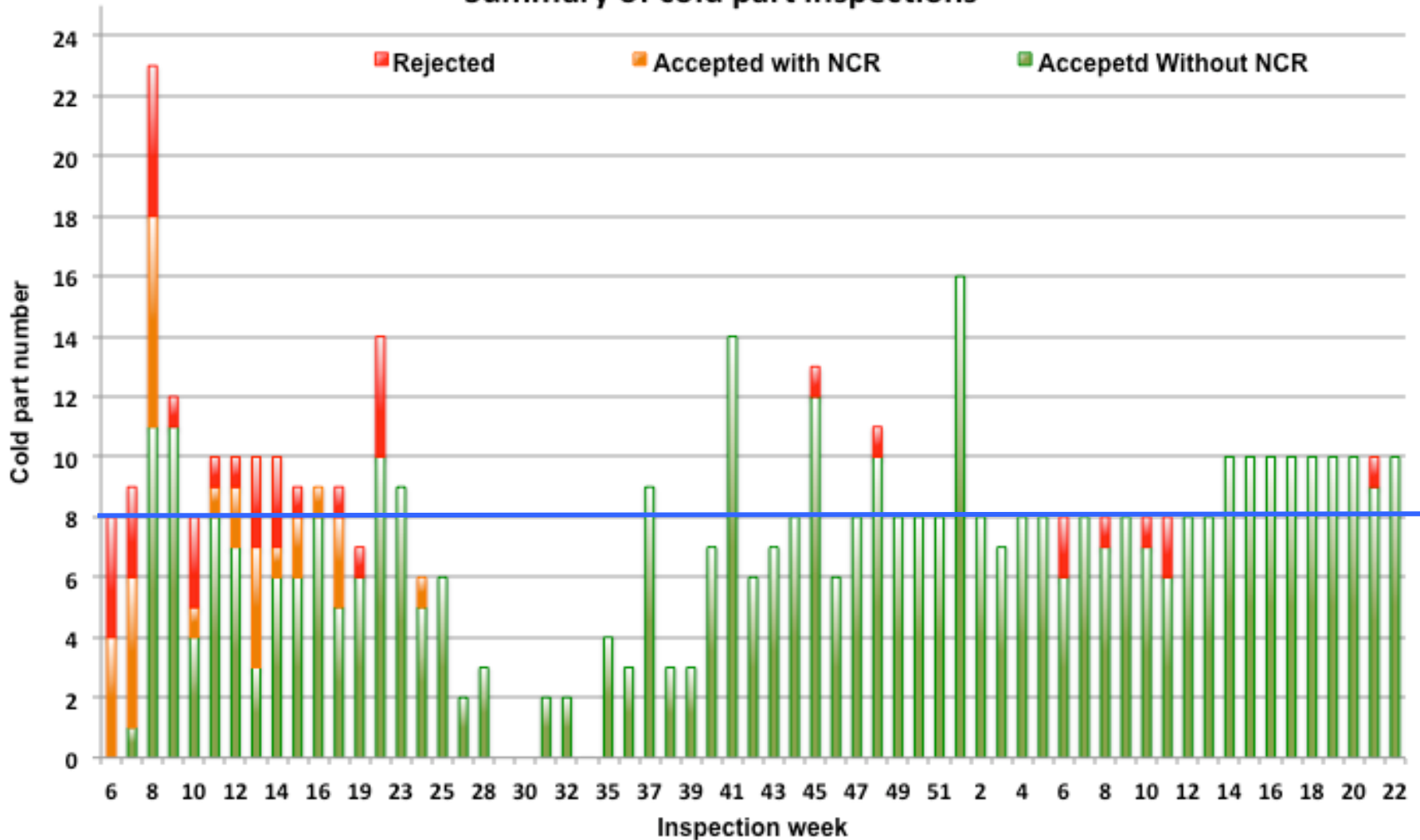
Cold part



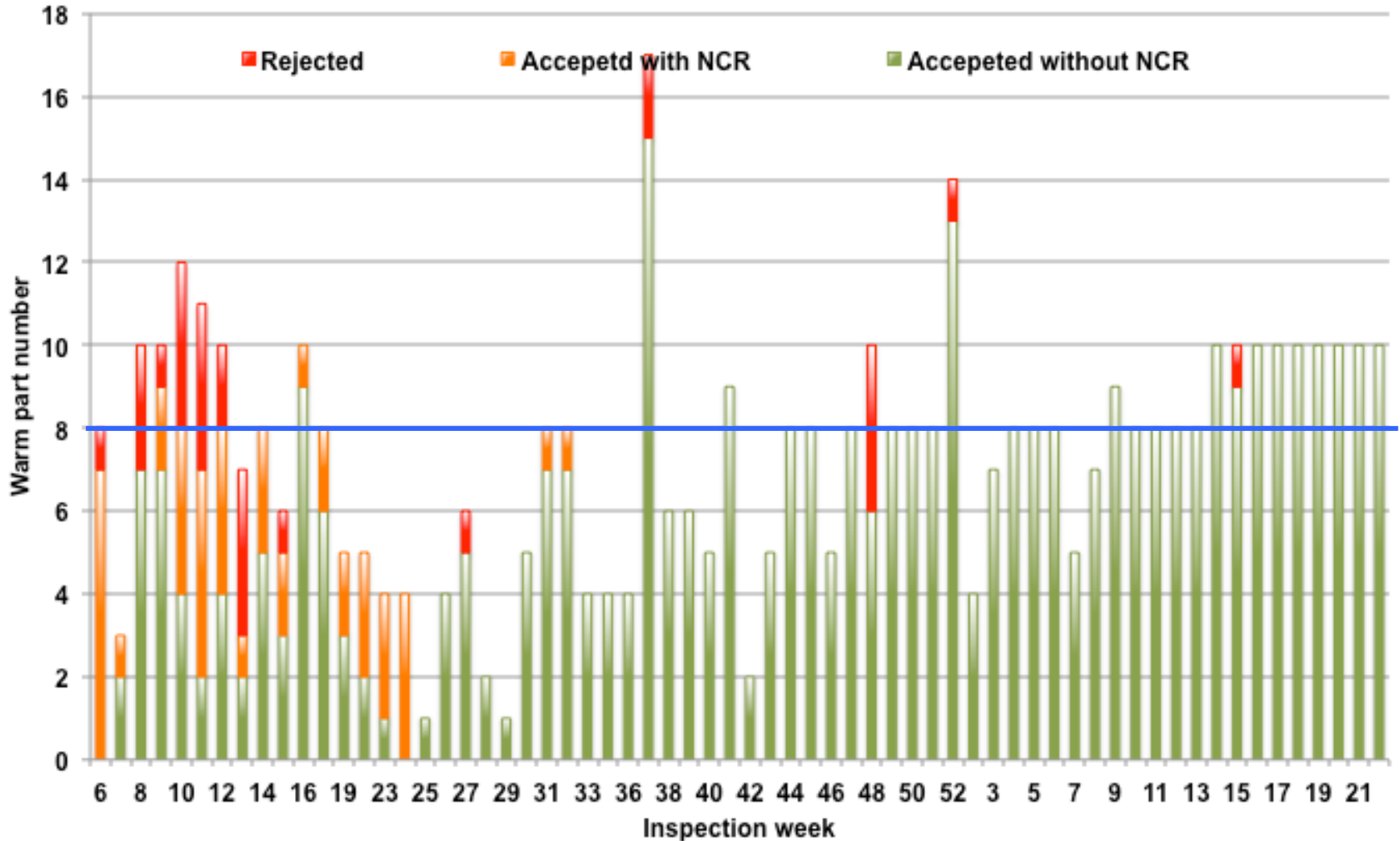
Production monitoring and quality control at companies:



Summary of cold part inspections



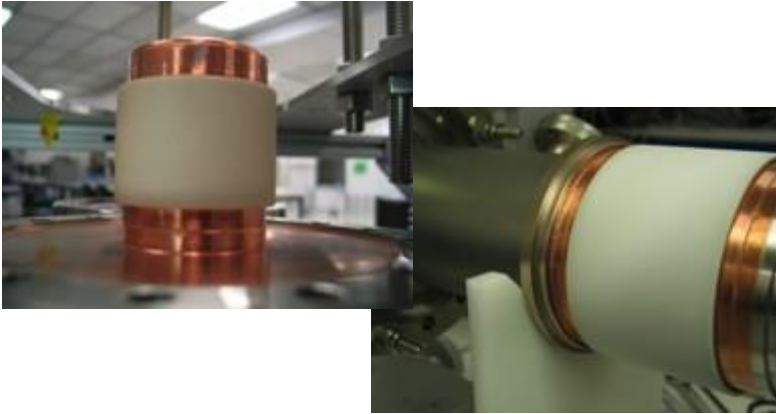
Summary of warm part inspections



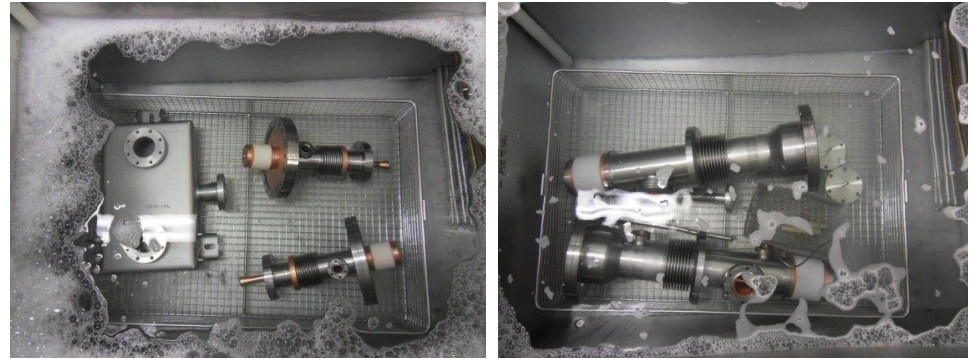
Production monitoring and quality control at companies:



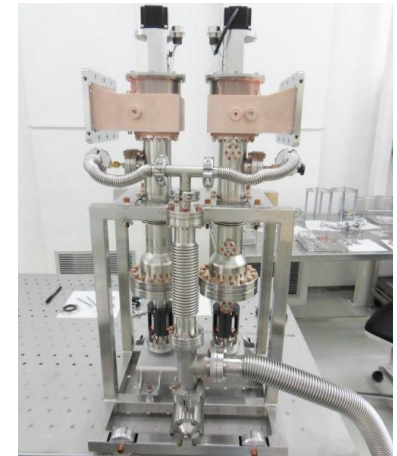
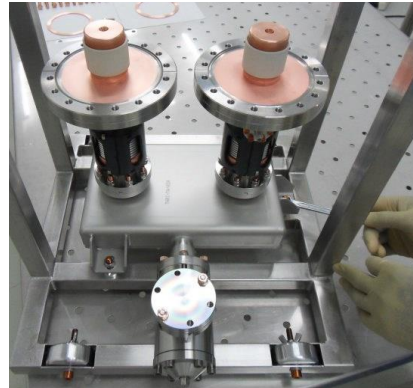
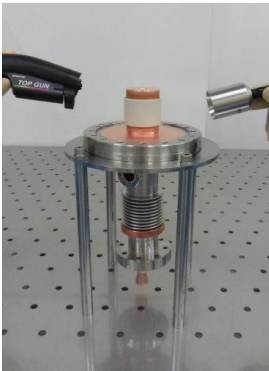
At RI site:



- TiN coating on ceramics
- ceramics EB welding of cold & warm parts



US degreasing of parts



particle counting

coupler pair clean room assembly,
leak and actuator displacement test

Couplers preparation and RF conditioning at LAL:



Leak test after reception



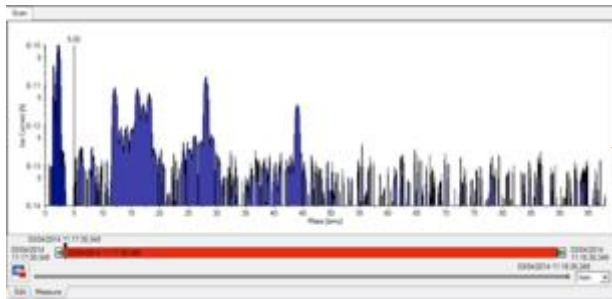
75h baking cycle at 150° C



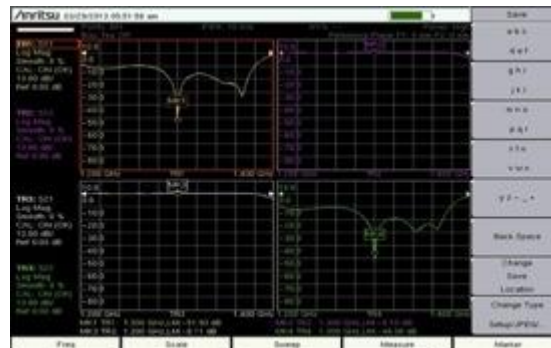
WGBs assembly



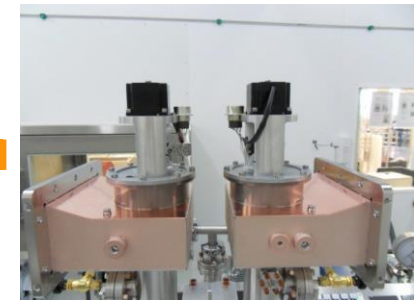
Capacitors assembly



RGA spectrum recording



Antenna tuning



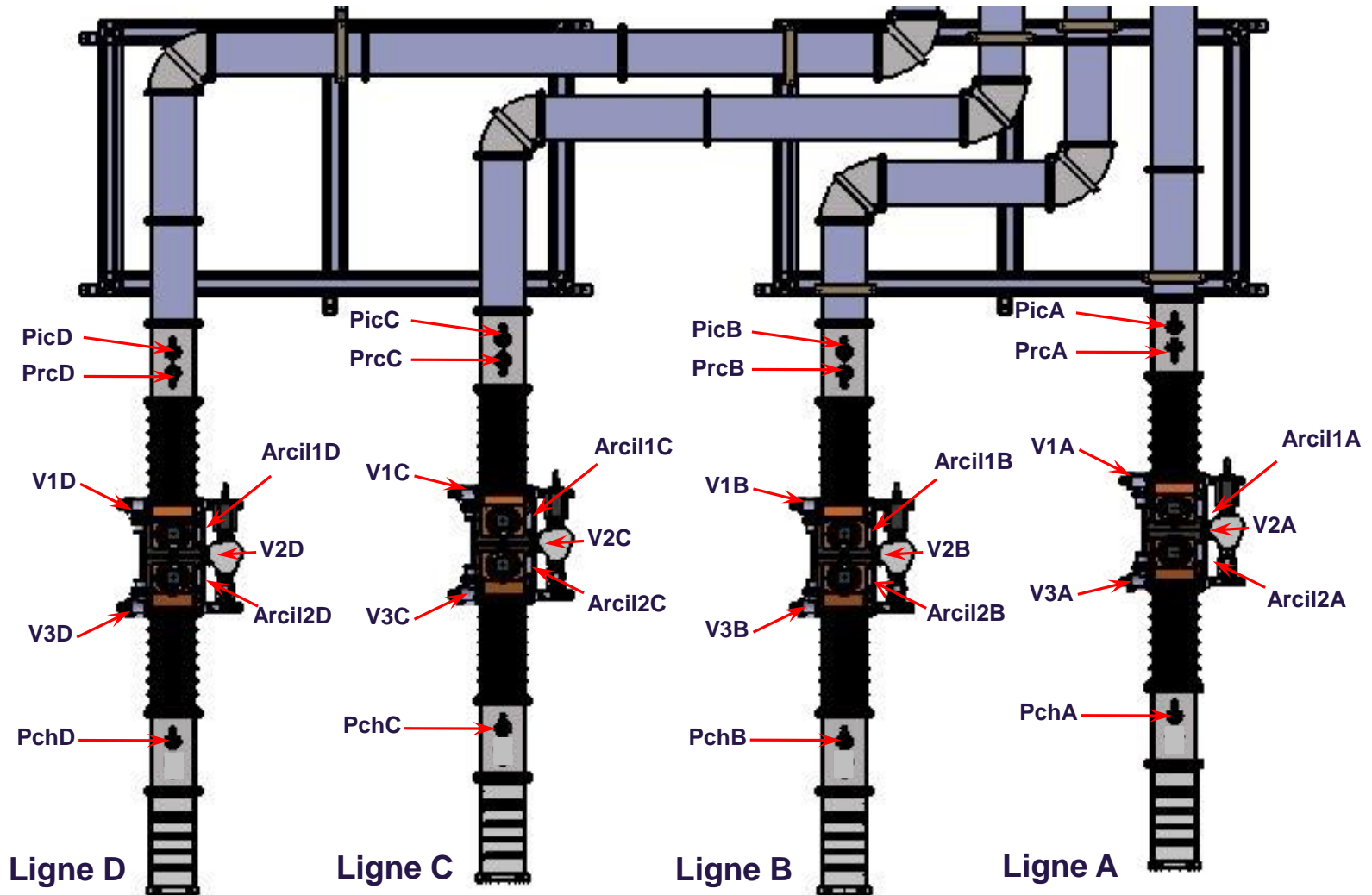
Actuators assembly

Couplers preparation and RF conditioning at LAL:

Optimized RF process, equipment, tools and man-power at LAL allow to process up to 14 couplers/week.



Couplers preparation and RF conditioning at LAL:



Couplers preparation and RF conditioning at LAL:



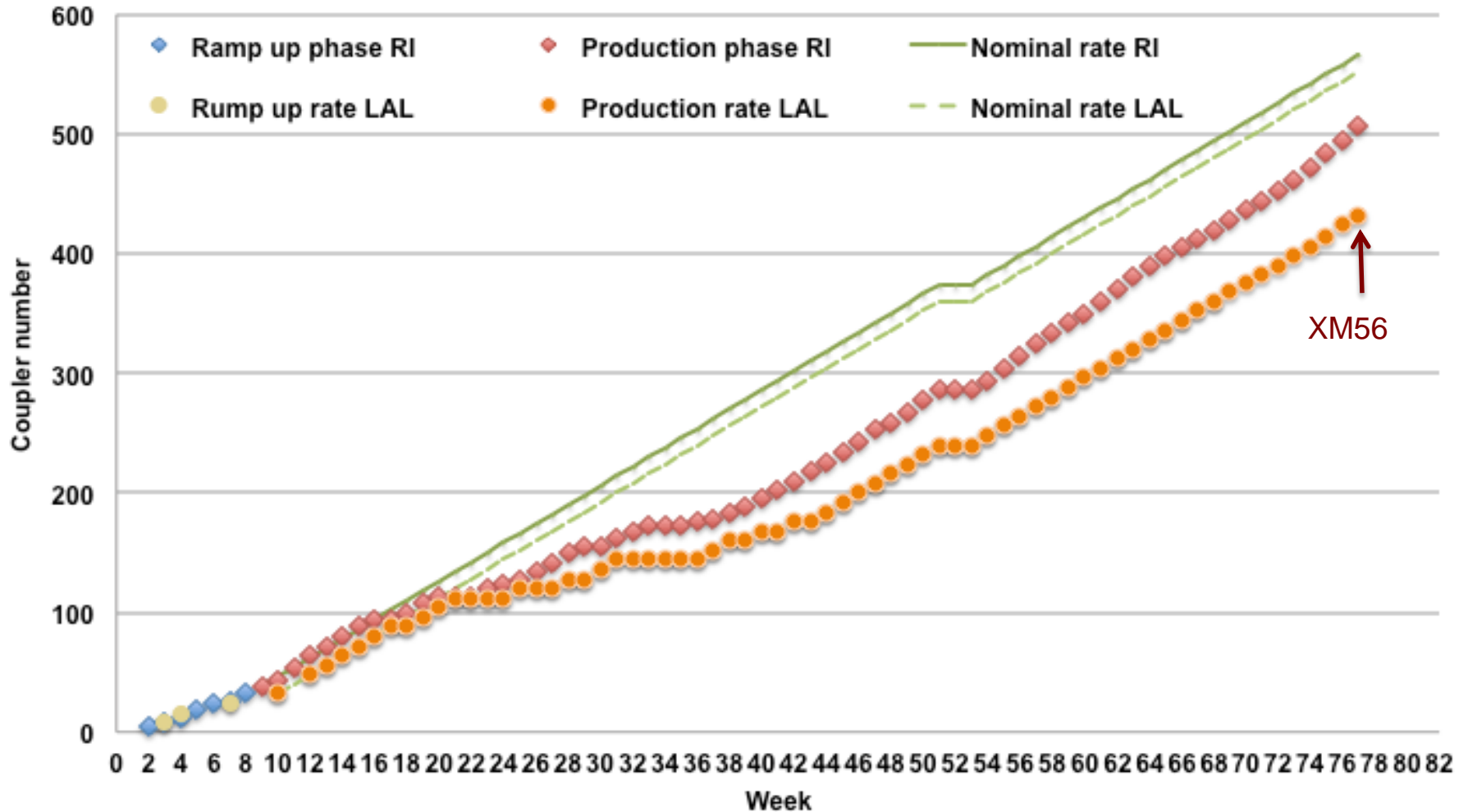
13



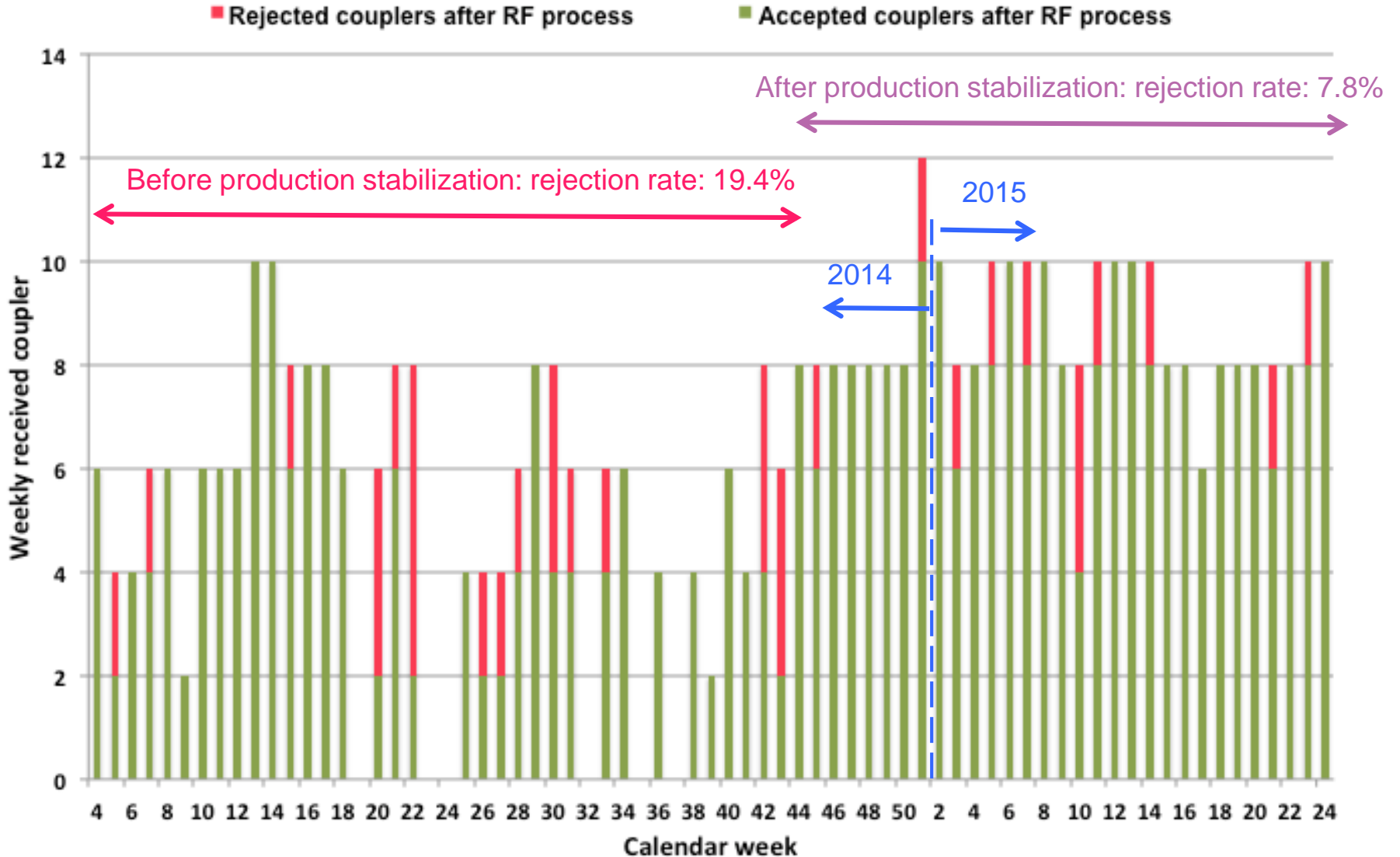
Status of coupler production:



Deliveries (2014-2015): Global view



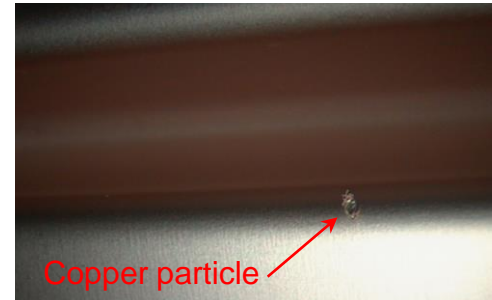
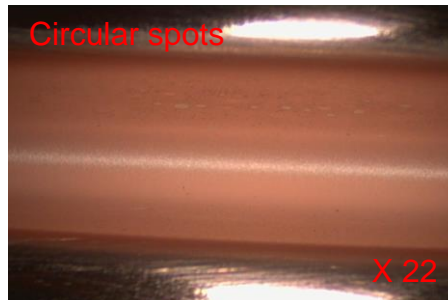
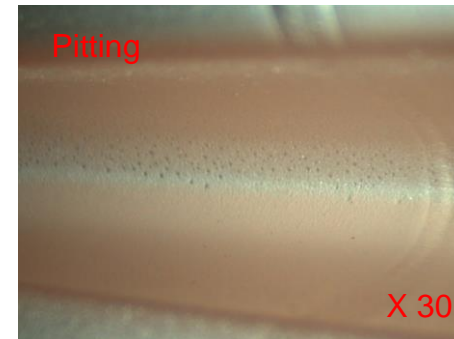
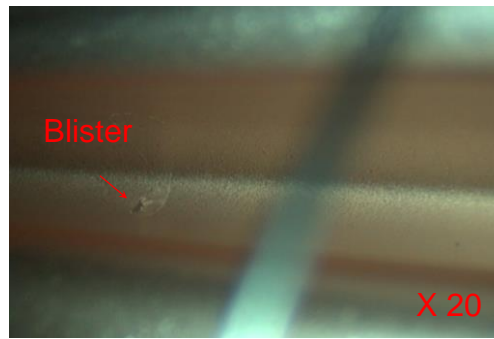
Status of coupler production:



REX of the coupler production:

Main reasons of coupler rejection at the final inspection:

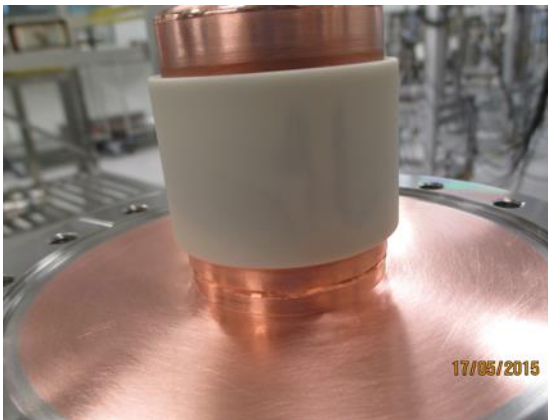
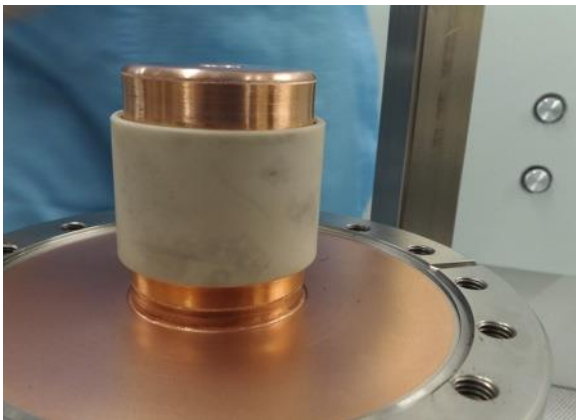
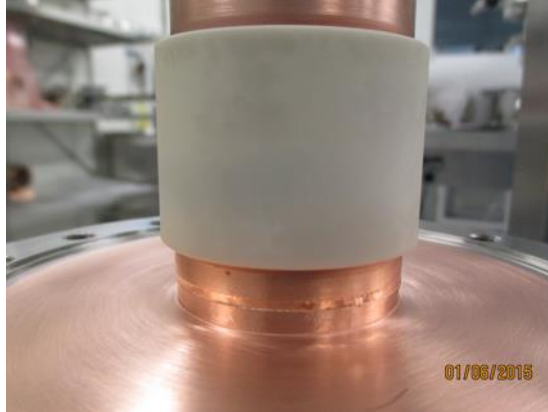
- **Copper plating defects** (mainly during ramp up phase and before production stabilization):



→ **Solved**: process improvement, setting acceptance criteria (defects classification by types, dimensions and number. Agreement in corrective actions and tests.

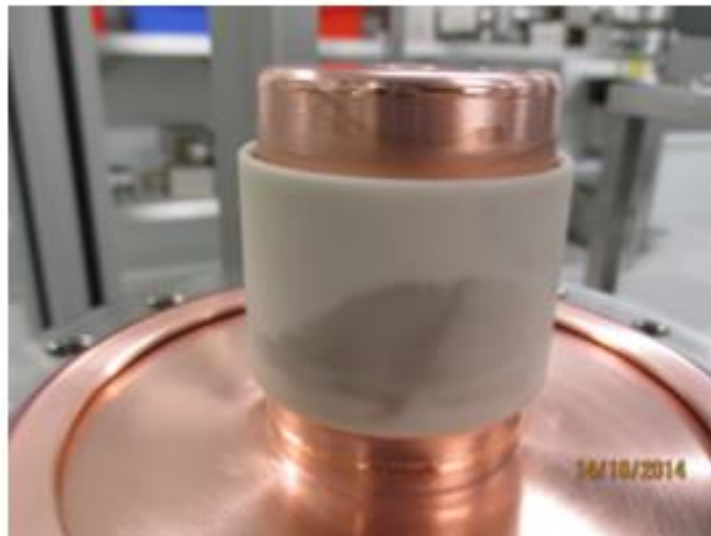
REX of the coupler production:

- Dark stain in the cold ceramics

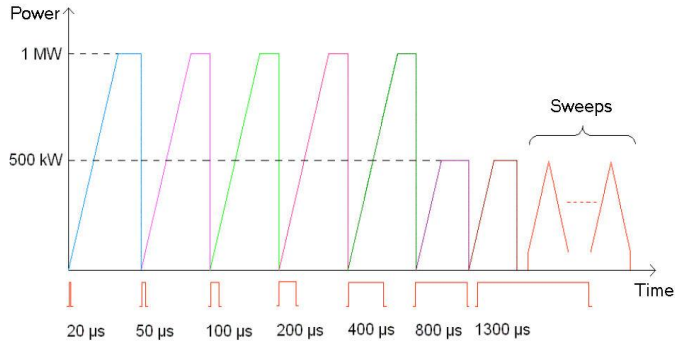


→ **Not yet solved**, investigations are on going.

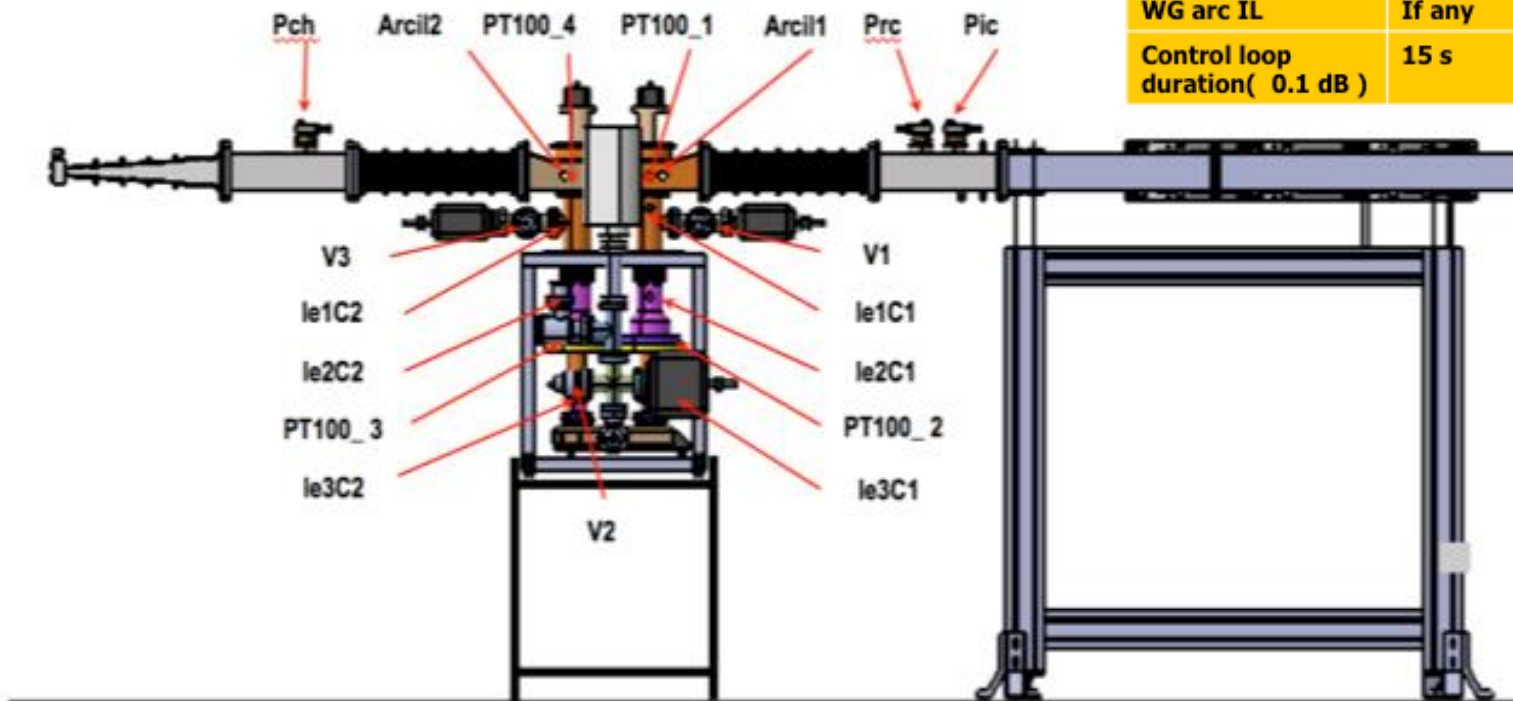
REX of the coupler production:



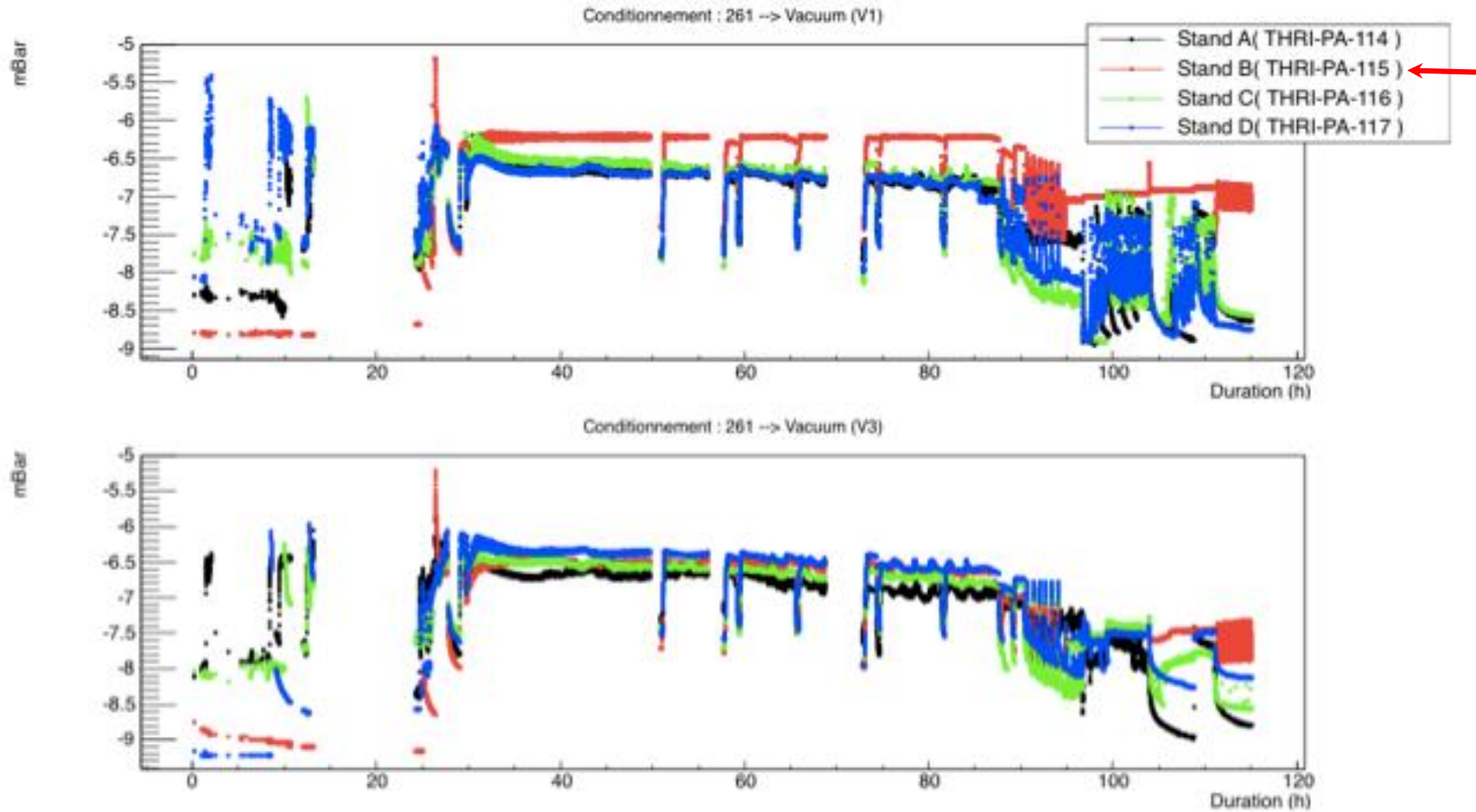
CP 331_Pair 115
Upstream coupler



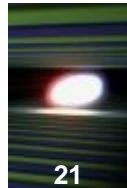
Vacuum	1 st threshold (0.1 dB): SV1	$6 \cdot 10^{-7}$ mbar
	2 nd threshold (0.4 dB): SV2	$2 \cdot 10^{-6}$ mbar
	Interlock: IL	$5 \cdot 10^{-6}$ mbar
e- current IL	8 mA	
Light IL	none	
Ceramic Temperature IL	60°C	
WG arc IL	If any	
Control loop duration(0.1 dB)	15 s	



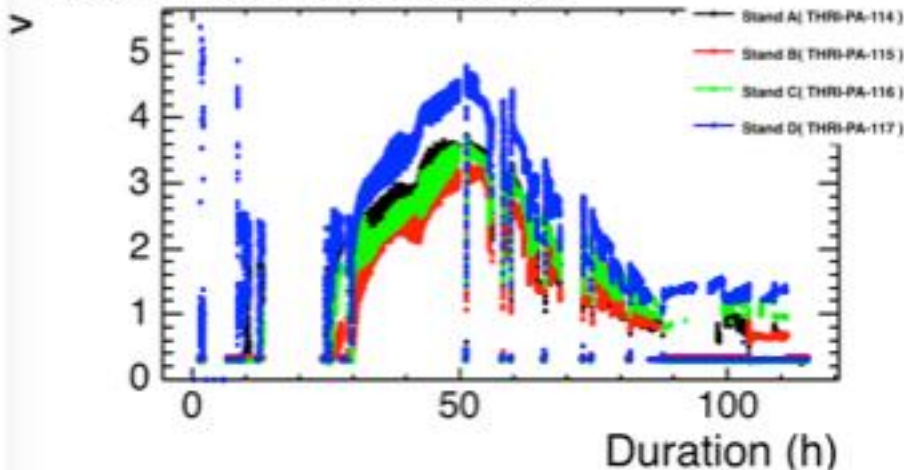
REX of the coupler production:



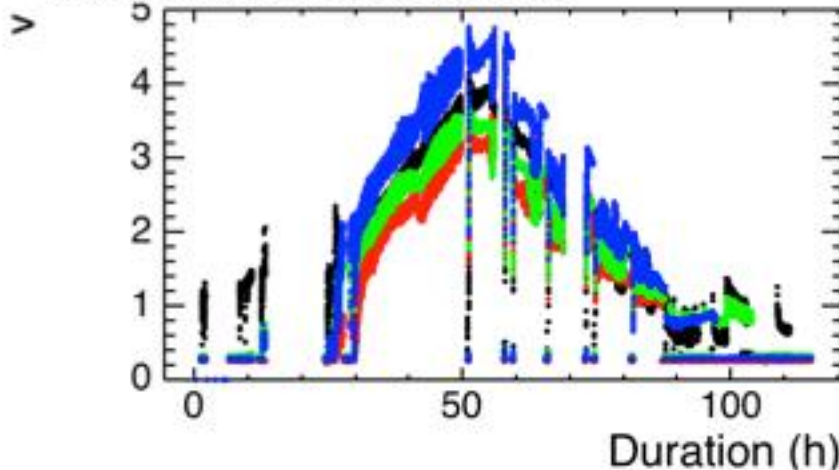
REX of the coupler production:



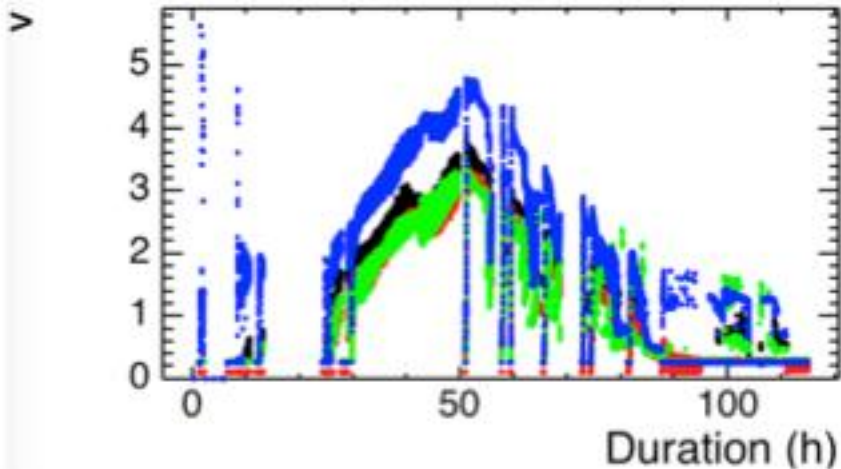
Conditionnement : 261 → Pickup (le1C1), All steps



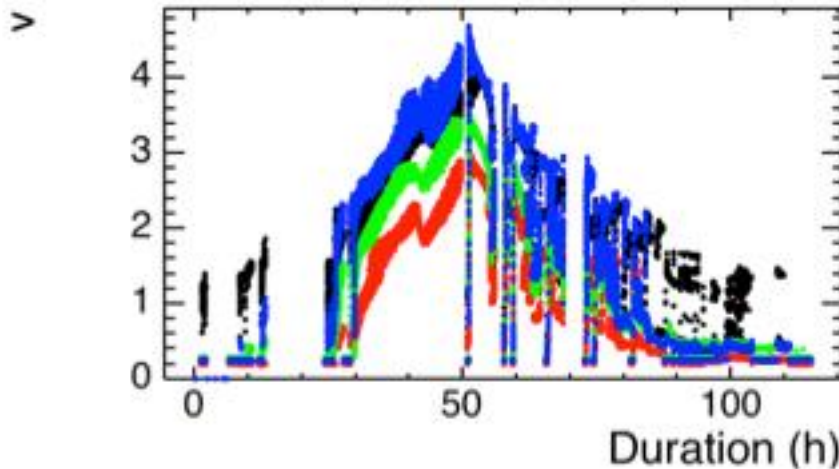
Conditionnement : 261 → Pickup (le1C2), All steps



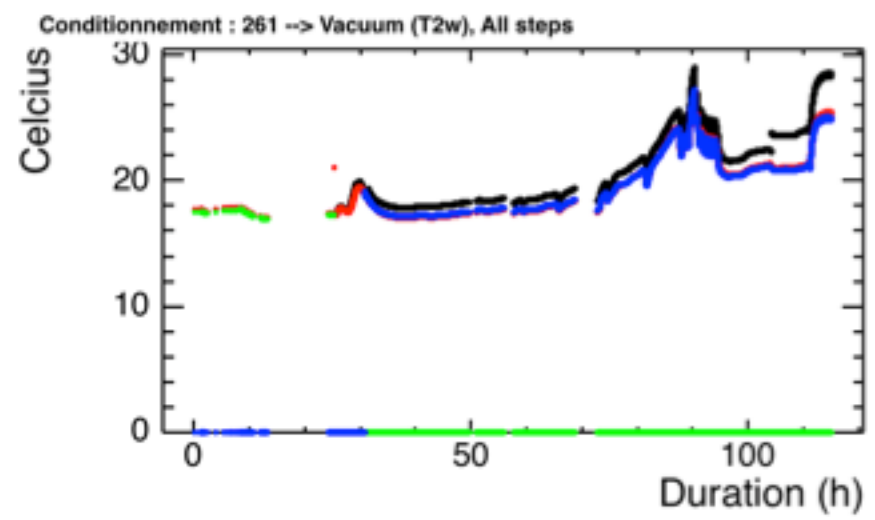
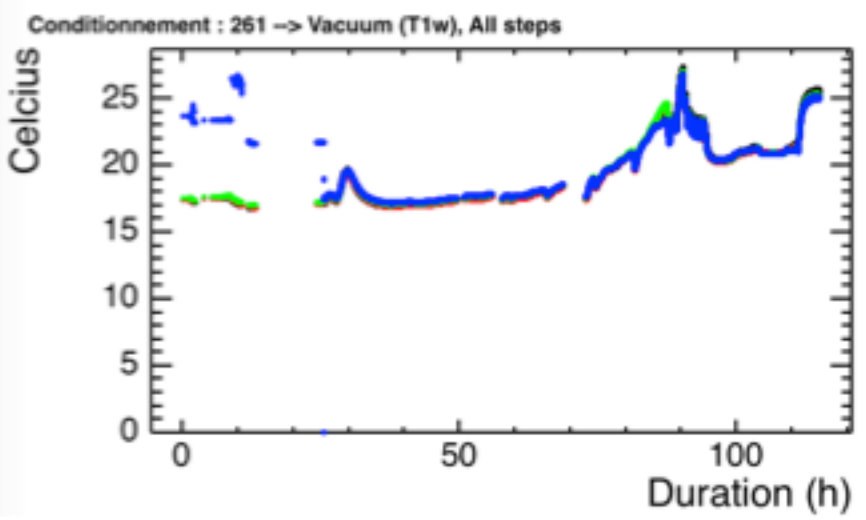
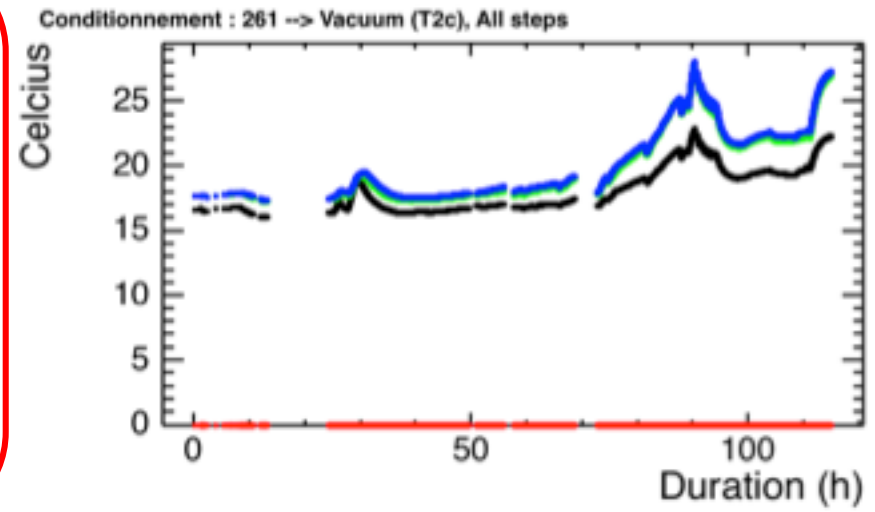
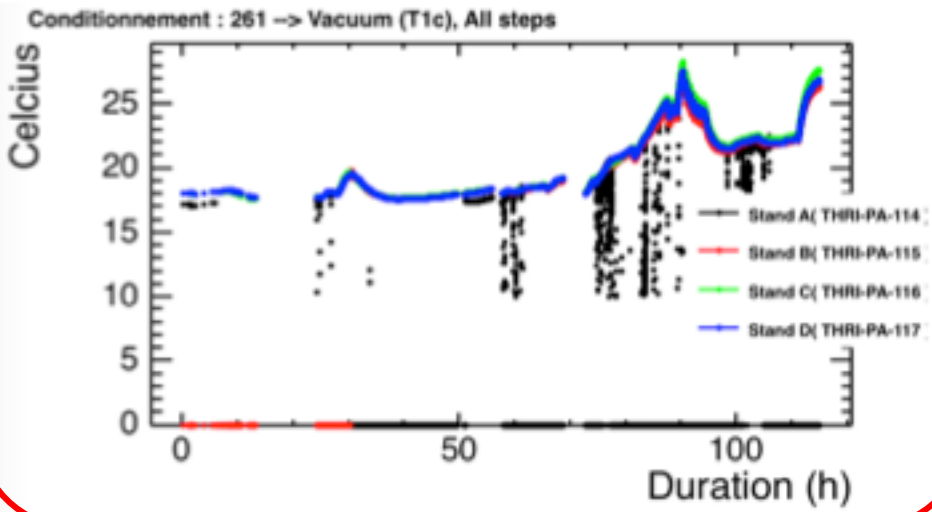
Conditionnement : 261 → Pickup (le2C1), All steps



Conditionnement : 261 → Pickup (le2C2), All steps



REX of the coupler production:



REX of the coupler production:

- The copper coating is the critical process: Important to set a common classification of the defects & acceptance criteria.
- Finishing treatment after copper coating (Brushing Vs. glass bead blasting): No problem with Mo wool brushing (Thales production). Investigation are on going with CPI production to see the impact of glass bead blasting treatment on the high outgassing observed during conditioning.
- Mass production may need adjustment in tolerances and specifications (at least during the ramp up phase).
- The cleaning and assembly process must be carefully controlled. RF conditioning time is highly impacted.
- Increasing the baking temperature by only 20°C (from 130 to 150°C) allow to reduce by nearly 55% the conditioning time (from 63h to 35h).

Thank you for your attention