

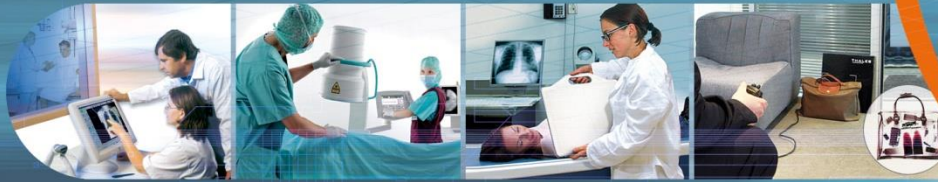


Radio Frequency & Microwave sources



Microwave & Imaging Sub-Systems

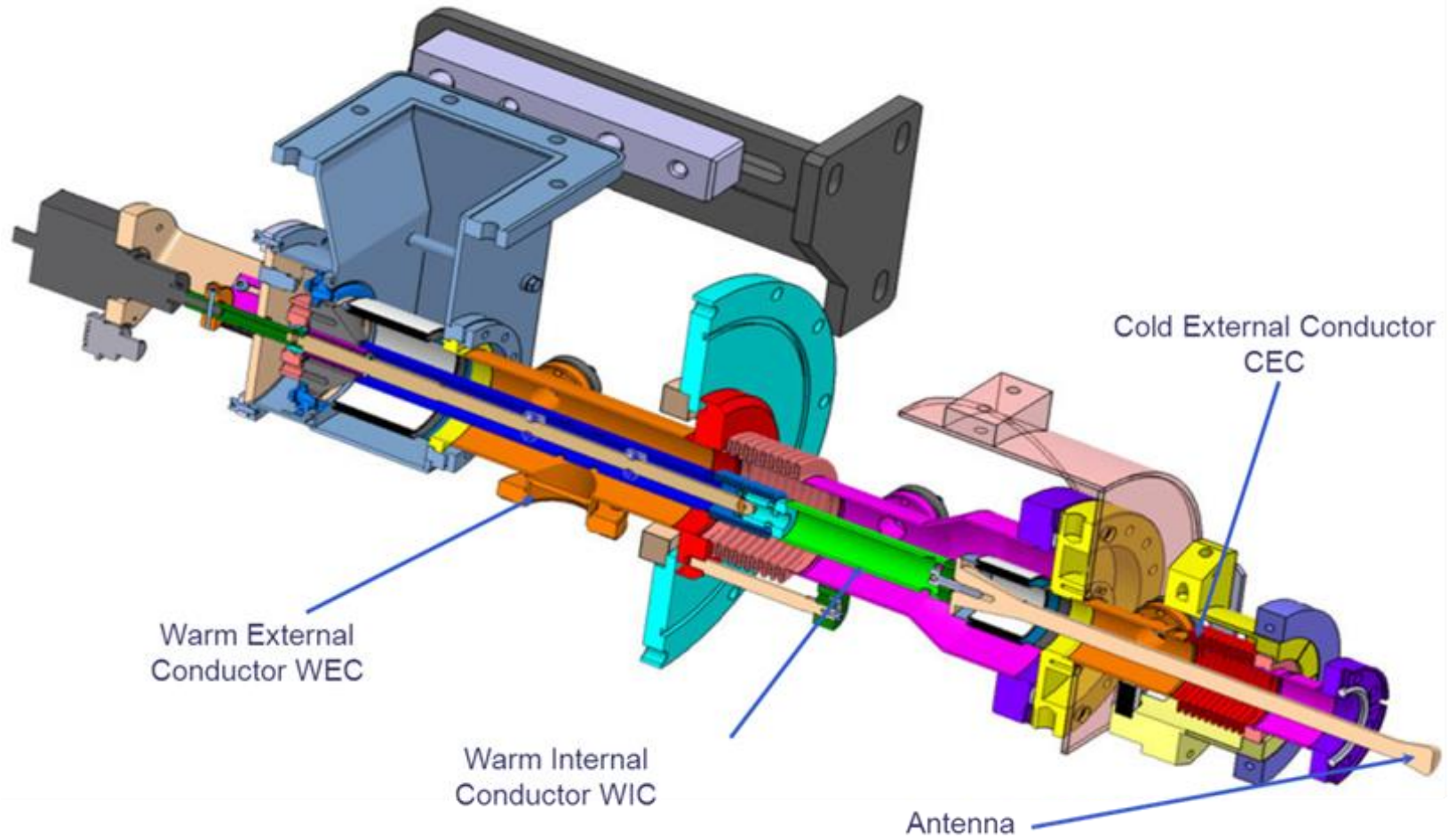
Large Instruments



Radiology



**LCWS 13 November 12<sup>th</sup>**  
**Coupler fabrication**  
**C.Lievin, S.Sierra**



Couplers November 12th 2013



## Design:

**Design must be done with a complete collaboration of manufacturer(s)**

**Each manufacturer could have his own process managed and could implement for fabrication without changing the final coupler.**

**Sufficient mock ups must be realized with production tools before starting full production.**



## Manufacturing

**A maximum of task should be non-operator dependent and accept batches, example:**

- **Brazing versus welding**

**Never forget that the final yield of production is the result of each individual sub-assemblies:**

**if each sub-assemblies is realized with a 85% yield, for 4 individual sub-assemblies that mean a final yield of 52% (which means that ONE coupler is rejected for each coupler manufactured**



## Controls

**How to avoid too much steps of controls without having lacks?**

**How to implement measurable criteria on each inspection?**

## Tests and RF conditioning

**How realistic is it to have a complete automatic conditioning of couplers without human control?**



## Design questions:

**Capacitor implementation mandatory?**

**Double window mandatory?**

**Tunable coupler?**

**Could bellows be on the warm parts of the coupler?**

**Losses higher or other material than copper for coating ?**

**TiN coating on ceramic :**

**what could be the influence if ceramic is brased?**

**Other material than TiN for coating ceramics:**

**Ti, TiOx, Cr2o3...**



## Process difficulties

**Copper coating specification:**

**RRR 30-80**

**Thickness including bellows**

**10 or 30  $\mu\text{m}$   $\pm$  20%**

**Controls: visual control difficulties**

**Not “real objective criteria” for : controls difficulties in conclusion of defects**

**example:**





## Process difficulties

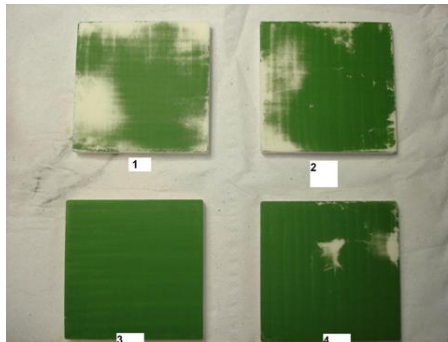
**Cleanliness of individual pieces before coating not always obvious to obtain (contamination) example:**

**Even with more than three hydrogen treatment in furnaces some pieces remain non coatable.**

**Discrepancies between treatments example :**

**US power in bath could have significant impacts**

**picture of CR2O3 coating with various power (factor 2 max)  
copper coating and TiN coating adherences are also dependent on power**







## **Mass production of coupler Is a tricky task**

**At RI and TED we demonstrate that we are able of a production rate of 8 per week but:**

- **It is not an easy task**
- **It is not finished**
- **It is not yet stabilized**



**I want to thanks all people working on this project among them specially:**

**C Lievin, E. Lavanchy, G. Garcin, C. Bourat any many other from TED**

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**For all the supports and exchanges we had and I hope we will have on the XFEL project**