

TOSHIBA

Leading Innovation >>>



Coupler fabrication for low-beta cavities

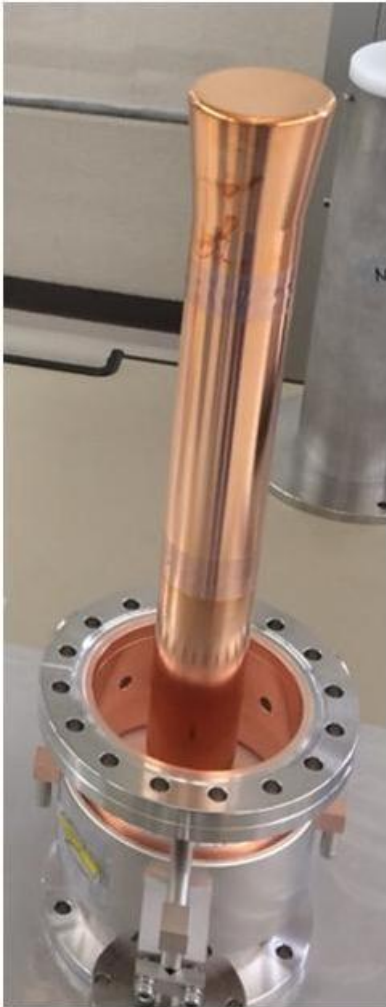
TTC Meeting at CEA-Saclay
6 July, 2016
Masao IRIKURA

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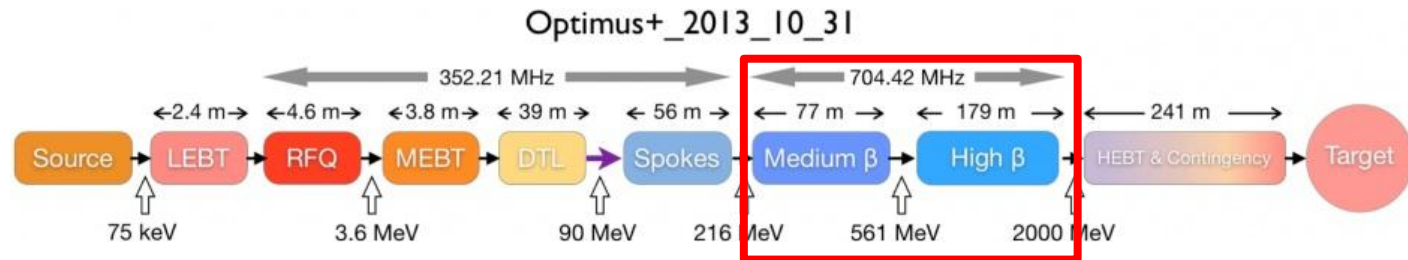
- 1. Recent delivered SC prototype couplers**
- 2. Equipments for mass production**
- 3. Technical improvement**
 1. Improvement of copper plating
 2. Improvement of brazing
- 4. Summary**

1. Recent delivered SC prototype couplers(1)

- ESS(CEA-Saclay)



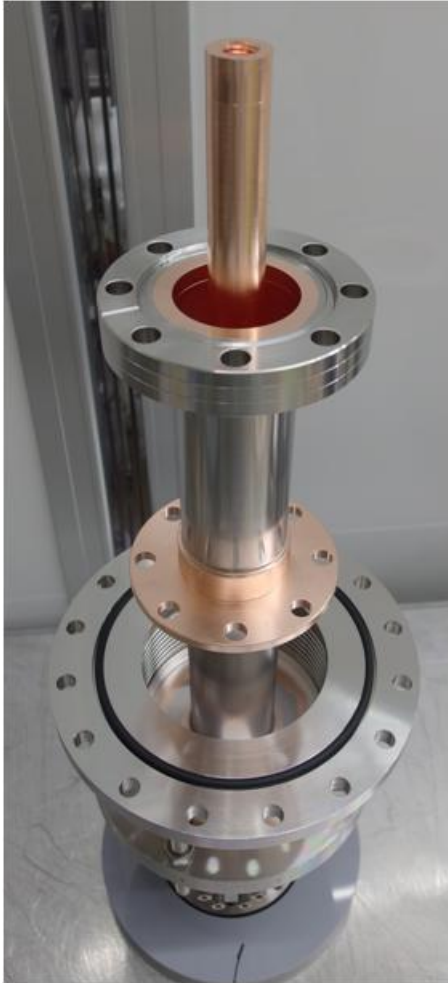
ESS Accelerator



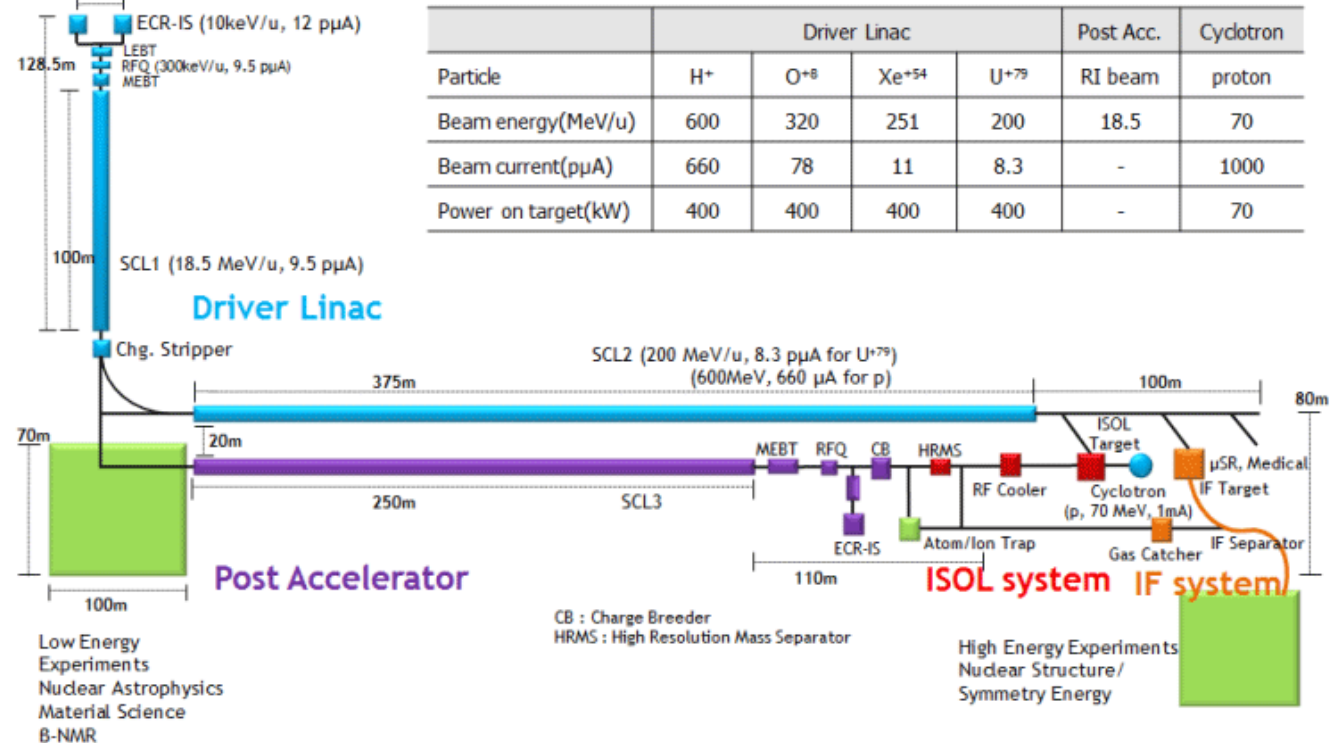
<https://europeanspallationsource.se/accelerator>

1. Recent delivered SC prototype couplers(2)

- RISP QWR



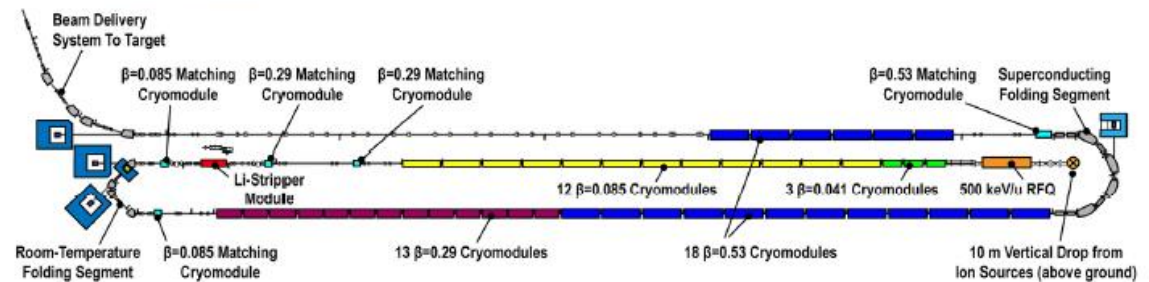
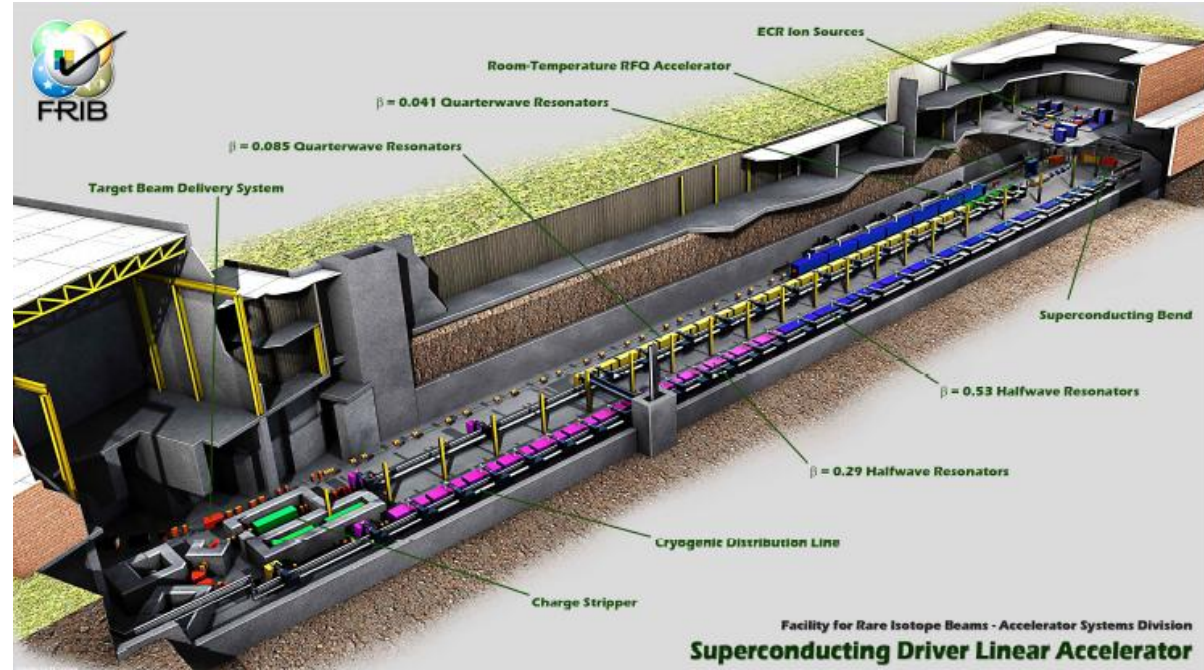
Rare Isotope Accelerator Conceptual Diagram



http://www.risp.re.kr/eng/orginfo/intro_project.do

1. Recent delivered SC prototype couplers(3)

- FRIB HWR



<http://epaper.kek.jp/SRF2011/papers/mopo009.pdf>

2. Equipments for coupler production(1)

Clean room for manufacturing couplers



2. Equipments for coupler production(2)



Ultra-pure water generator



Ultrasonic bath



Sink for rinsing



Leak detector and auxiliary vacuum system



Baking systems

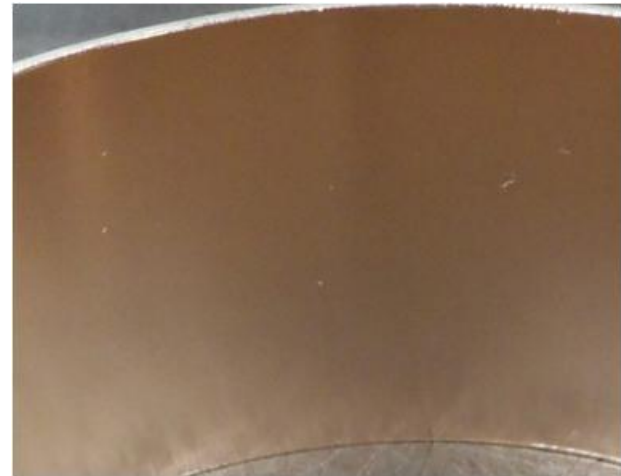
3. Technical improvement(1)

Improvement of copper plating

- Heating processes after copper plating sometimes gave many blisters on cylinder and bellows of outer conductors. Investigations was made with KEK and our subcontractor.
- The relation with plating solution became clear. The subcontractor is controlling a parameter.



Many large blisters on the inner surface after heating

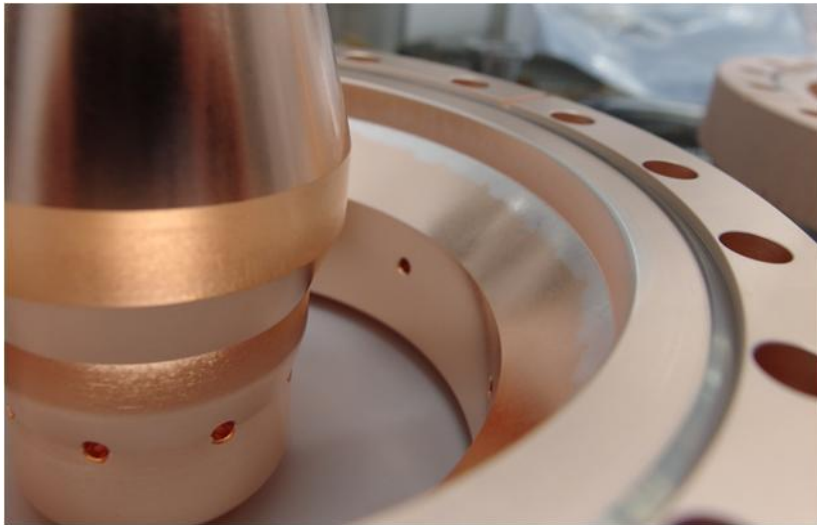


Normal surface after heating

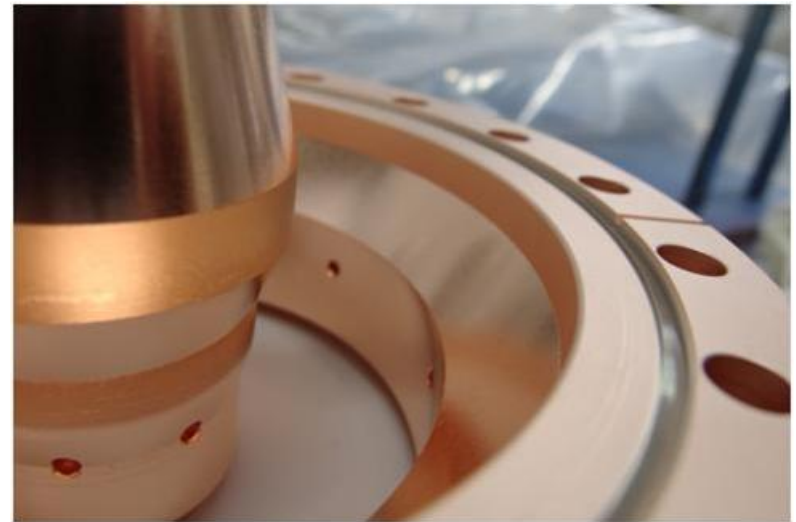
3. Technical improvement(2)

Improvement of brazing

- **Ag-Cu brazing alloy was sometimes found oozing through brazing joint on RF surface.**
- **We try to control the amount of the brazing alloy, but it's difficult to avoid because it is affected by variation in smoothness of copper part and copper plating, brazing temperature, content of brazing alloy and so on.**



Oozed brazing alloy



No oozing

Summary

- **TETD delivered prototype couplers for ESS(CEA-Saclay), IBS/RISP and MSU/FRIB in 2015 - 2016.**
- **TETD introduced a clean room and some equipments for coupler production.**
- **Some technical improvements was made in our prototype coupler production.**
 - Blisters on the copper plating after heating is found to be related to plating solution, and our subcontractor is controlling a parameter successfully.
 - Oozing of brazing alloy is unavoidable, but we keep on trying to avoid oozing it by controlling the amount of brazing alloy and other conditions.
- **TETD will start manufacturing FRIB HWR couplers in this summer.**

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