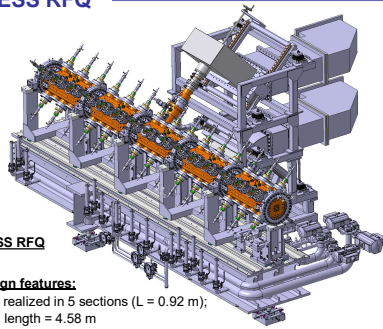


P Hamel, O. Piquet, A.-C. Chauveau, D. Chirpaz-Cerbat, M. Desmons, A. Dubois, A.C. France, A. Gaget, Y. Le Noa, L. Napoly, M. Oublaïd, G. Perreu, B. Pottin, N. Misiara, IRFU, CEA, University Paris-Saclay, France

ESS RFQ



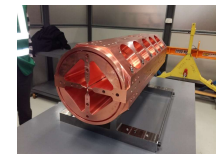
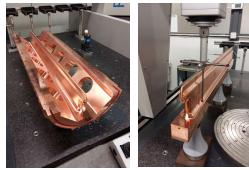
ESS RFQ

Design features:
RFQ realized in 5 sections (L = 0.92 m);
total length = 4.58 m
CuC2 copper and stainless steel flanges
36 vacuum ports
60 adjustable slug tuners 80 mm dia.
8 end-tuning rods (4 per end plate)
8 10mm-diameter cooling channels per section (variable length)
2 power coupling loops (in Section3) for 1.6MW maximum power
20 pickups for voltage profile reconstruction

RFQ construction flow

RF machining at Mecachrome

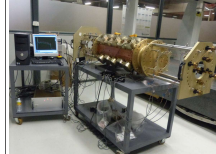
Vane machining with $\pm 20\mu\text{m}$ tolerance



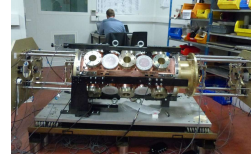
Vane assembly with $\pm 30\mu\text{m}$ tolerance

Beadpull measurement

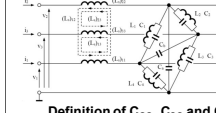
Check the machining and the assembly of the 4 vanes according to RF design



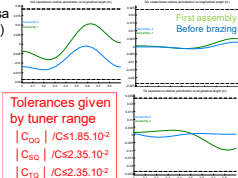
Beadpull before brazing to check the final assembly



Electrical parameters of RFQ vs. abscissa (Transmission Line model (TLM) of RFQ)



Definition of C_{00} , C_{S0} and C_{T0} parameters



Brazing



Brazing at 850°C

RFQ construction flow

Leak test after brazing

Defined by the CEA (and ESS) RFQ Helium Leak Testing Procedure :

1. First check by helium spraying of the different interfaces (welding and brazing part, seals, ...)
2. Global (or Partial) leak testing using a bag

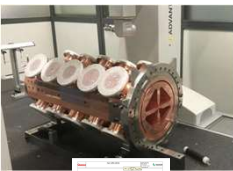
→ The leak should be less than 1.10^{-10} mbar.l.s⁻¹



Final machining

Tridimensional measurements of the section after brazing

→ Final machining of the section (end faces and locating)



→ Definition of the beam axis and interfaces with the next section

Section validation (Site acceptance Test) At CEA Saclay

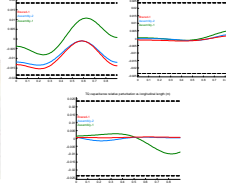
Vacuum leak test



RF validation



Hydraulic tests of the cooling channels and cooling plates



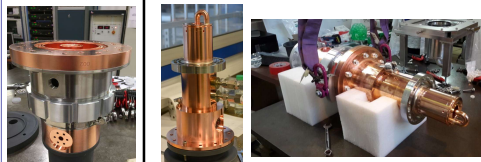
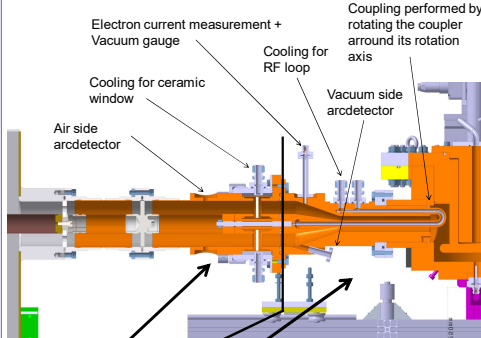
Status of RFQ fabrication

	Section 1	Section 2	Section 3	Section 4	Section 5
First beadpull after machining	10/10/2018	04/12/2018	11/02/2019	24/06/2019	16/04/2019
brazing	23/10/2018	05/02/2019	11/03/2019	09/07/2019	30/04/2019
3D measurement	OK	OK	OK	OK	OK
final machining	OK	OK	OK	OK	OK
final leak test	8.10^{-10} mbar.l.s ⁻¹	1.10^{-10} mbar.l.s ⁻¹	$1.3.10^{-10}$ mbar.l.s ⁻¹	2.10^{-10} mbar.l.s ⁻¹	3.10^{-10} mbar.l.s ⁻¹
final beadpull	OK	OK	OK	OK	OK
Status	Delivered at ESS	Delivered at ESS	Delivered at ESS	Delivered at ESS	Delivered at ESS

April 2019:
3 sections installed at CEA/Saclay on the RFQ support to validate the tools and assembly procedure



RFQ coupler

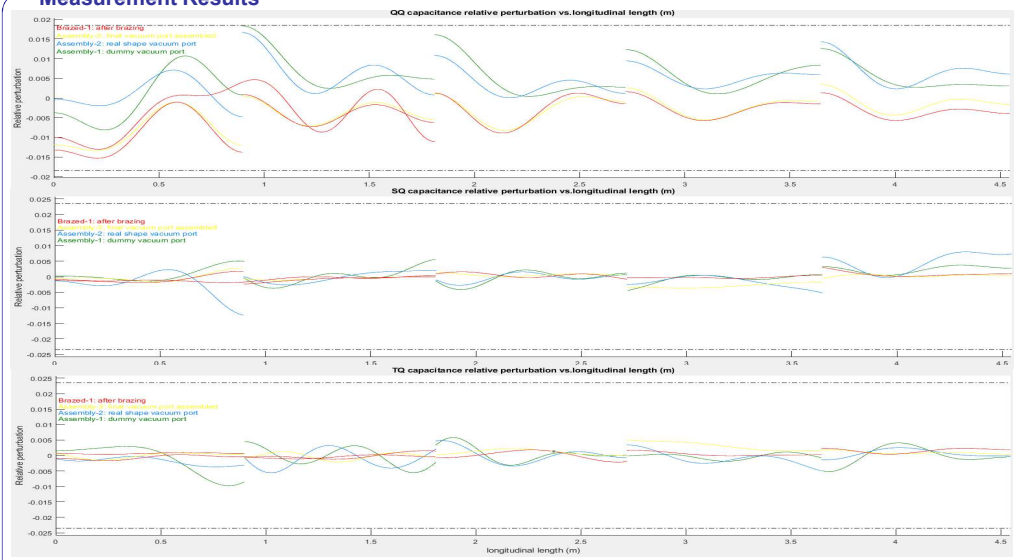


RF windows

RF Loop

Assembled coupler

Measurement Results



All the capacitance relative errors are well within the specification bounds. This validate the design process.

ESS installation



Conclusion

All sections delivered and installed at ESS
3 Power couplers qualified at CEA/Saclay and delivered at ESS
60 RFQ tunable tuners assembled and ready for tuning
RFQ cooling skid delivered at ESS

Next step:

- RFQ tuning in November 2019
- Conditioning scheduled in Mars 2020