

# MOP038: Fabrication and Testing of TRASCO RFQ

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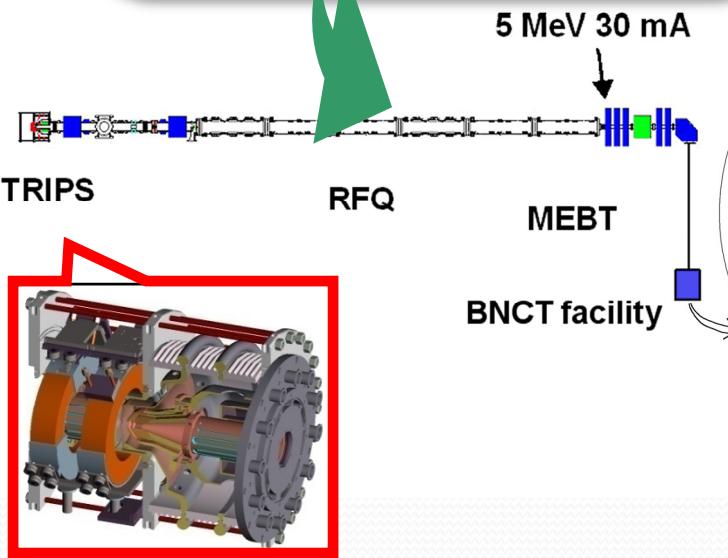
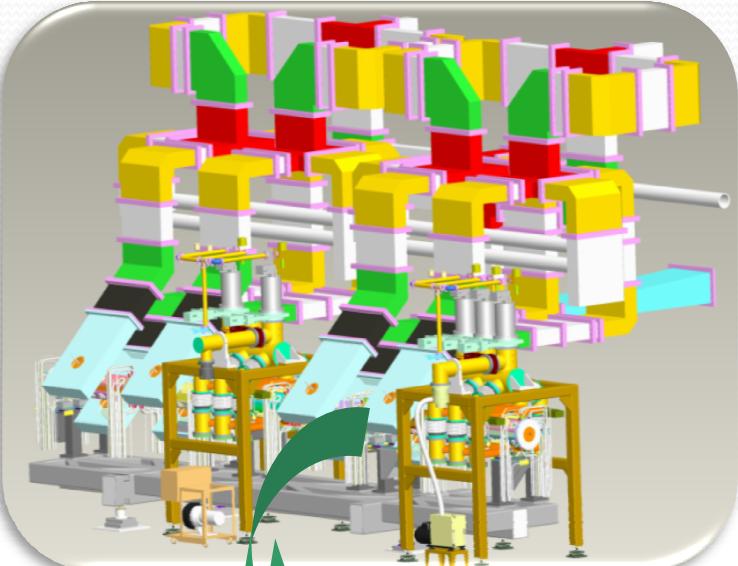
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# Outline

- The TRASCO-BNCT project
- RFQ: mechanical fabrication and brazing
- RF Measurements on the 1st segment

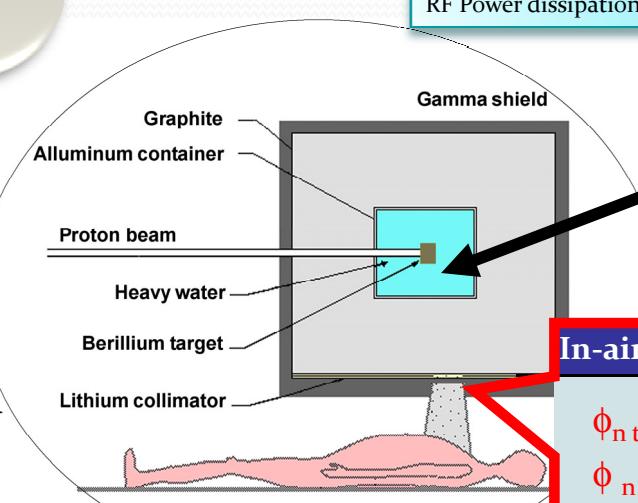
# The TRASCO-BNCT project: the irradiation facility concept



**TRASCO RFO main specifications**

Parameter	Value	Unit
Energy In/Out	0.08/5	MeV
Frequency	352.2	MHz
Proton Current (CW)	30	mA
Emit. t. rms.n. in/out	0.20/0.21	mm-mrad
Emit. l. rms.	0.19	MeV-deg
RFQ length	7.13	m (8.4 $\lambda$ )
Intervane Voltage	68	KV (1.8 Kil.)
Transmission (Waterbag)	98.5	%
Q (70% of SF result)	7000	
Beam Loading	0.148	MW
RF Power dissipation	0.847	MW

**150 kW neutron converter**

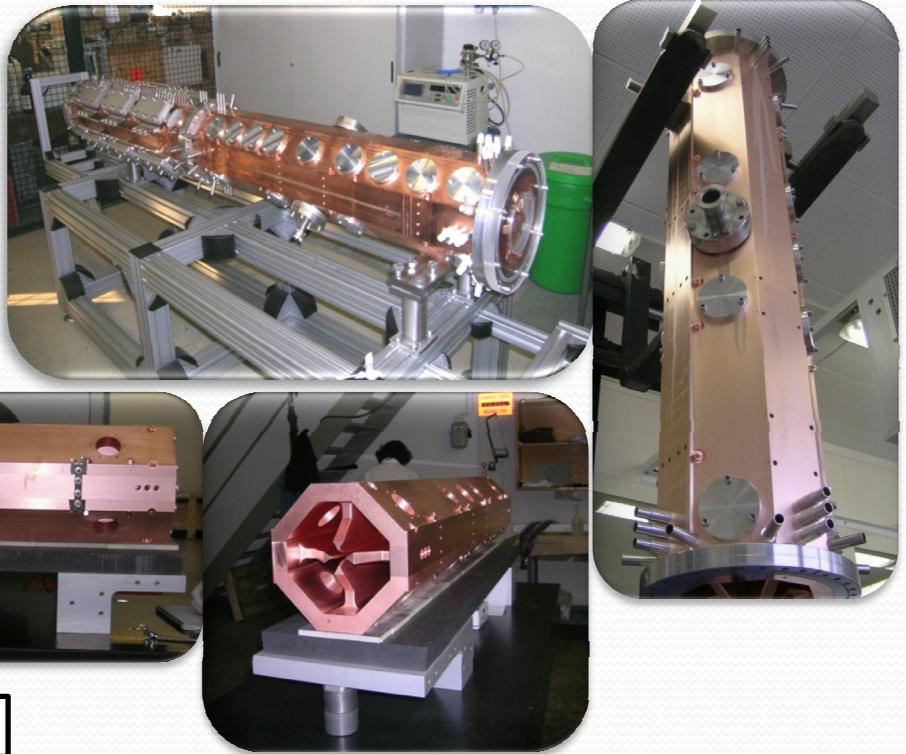


**In-air beam port quality requirements**

- $\phi_{n\text{ th}} (\leq 0.4 \text{ eV}) \geq 10^9 [\text{cm}^{-2} \text{s}^{-1}]$
- $\phi_{n\text{ th}} / \phi_{n\text{ total}} \geq 0.90$
- $D_{n\text{ epi+fast}} / \phi_{n\text{ th}} \leq 2 \cdot 10^{-13} [\text{Gy cm}^2]$
- $D_\gamma / \phi_{n\text{ th}} \leq 2 \cdot 10^{-13} [\text{Gy cm}^2]$

# RFQ: mechanical fabrication and brazing

- Machining complete for all the modules since 2006.
- First electro-magnetic segment (RFQ1+RFQ2): complete.
- RFQ3: vacuum leak after 2° brazing (nickelization problem).
- RFQ4: currently under 2° brazing.
- RFQ5: ready for 2° brazing.
- RFQ6: currently under 1° brazing.



## Fabrication problem for the first two modules

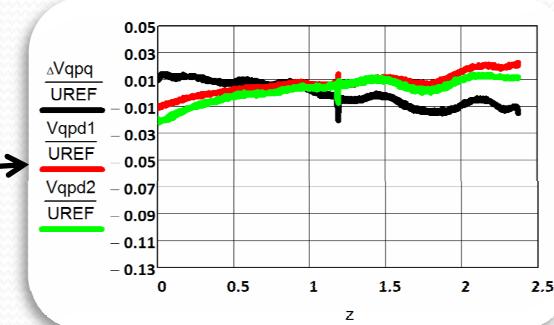
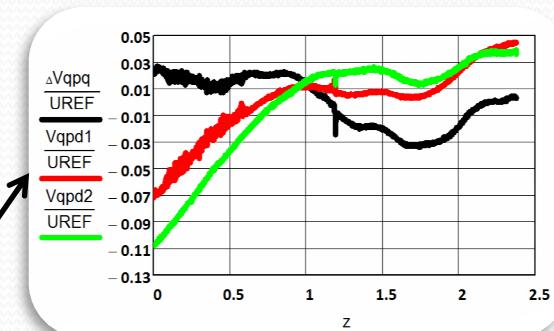
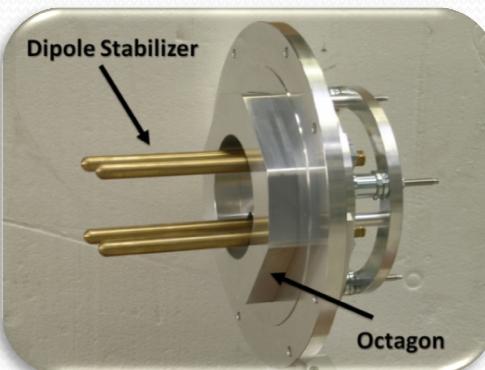
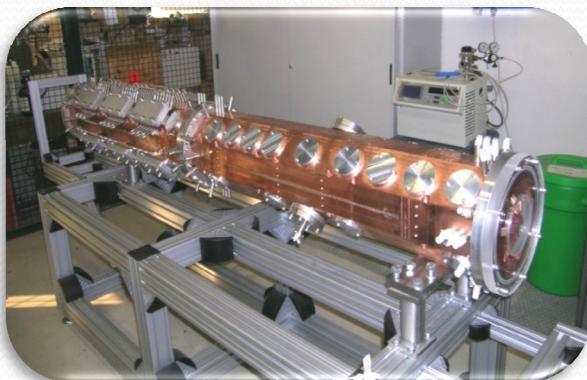
- RFQ1:
  - Leak on vacuum flanges after 1° brazing
  - Remarkable longitudinal bending (200 microns)
- RFQ2:
  - Remarkable longitudinal bending (200 microns)
  - Remarkable displacement in one transversal direction.

## Solutions

- SS collars for the vacuum flanges brazed in the vertical brazing. Vacuum flanges tig welded on the collar.
- Full annealing at 600 °C before finishing.
- Eight additional holes for tuners were machined on RFQ2 to recover the frequency.

# RF Measurements on the 1<sup>st</sup> segment

- In order to allow a complete RF characterization, the segment was prepared on low and high energy sides with two aluminum Tunable End Cells equipped with variable dipole stabilizing rods (DSR).
- The RF measurements were performed in steps:
  - the optimum length and transverse position of DSRs that guaranteed the maximum dipole-free region (about  $\pm 7$  MHz) around the operating mode were determined
  - the boundary conditions for the TE<sub>210</sub> mode were tuned by inserting the octagon in the RFQ volume
  - the bead pull measurements and the tuning operations, based on an on-purpose developed algorithms making use of the RFQ modal expansion, were performed



Perturbative quadrupole (black) and dipole (red and green) components before tuning and...  
...after tuning

# THANKS