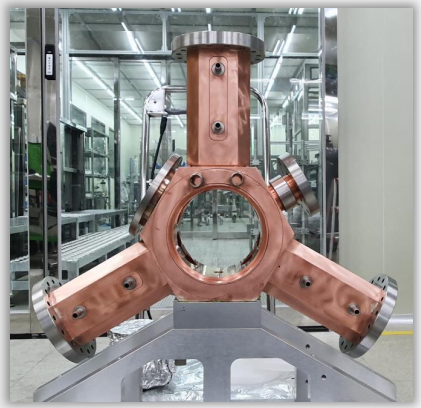
J. Ocampo on behalf of the ALBA RF group



ALBA 3rd Harmonic Cavity manufacturing and test collaboration

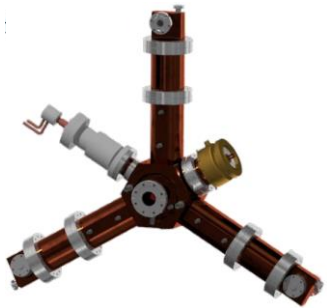
25th ESLS RF meeting Hamburg 8th/9th Nov. 2021

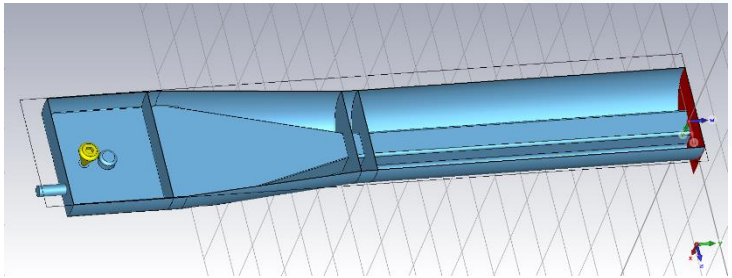
Contents

- Introduction
- Manufacturing status
- Test collaboration with DESY and HZB
- Conclusions

Introduction

- Scaled version of the 500 MHz EU HOM Damped cavity and optimized
- Replaced ferrite absorbers in dampers by transition to external load
- Prototype is currently doing the FAT





Cavity main parameters

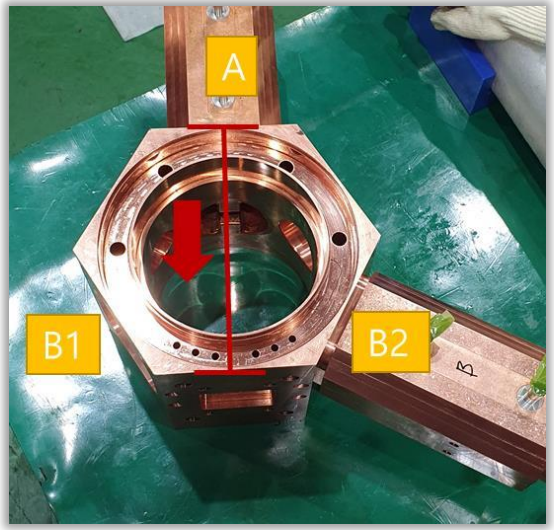
	Design value	Pre-FAT measurements
Central frequency	1499,8 MHz	1497,6 MHz
Tuning range	> 6 MHz	12 MHz
Voltage	215 kV	
Dissipated power	16 kW	
Q	14.000	12.700*
Shunt impedance	1,2 MΩ	
R/Q	86 Ω	

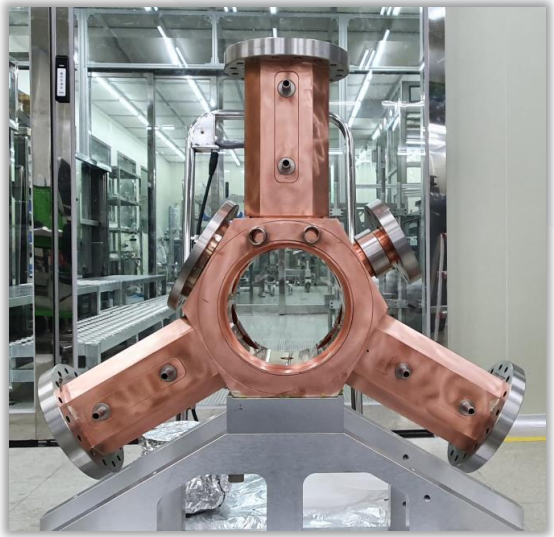
Manufacturing

- Manufacturing started in February 2020 by Vitzro Tech (South Korea)
- No significant delays due to Covid-19
- Also no possibilities of visiting the manufacturer during the whole project

Manufacturing difficulties

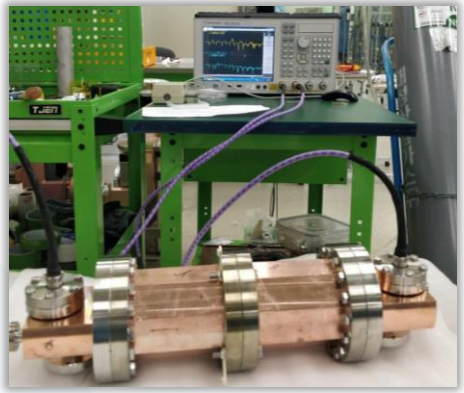
- Complicated body brazing had to be repeated
- Also, this part had to be baked 3 times to avoid vacuum leaks

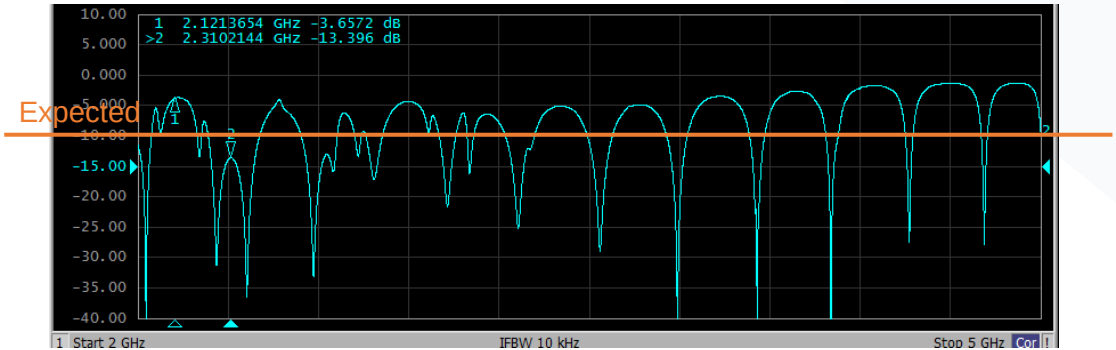




TransDamper performance

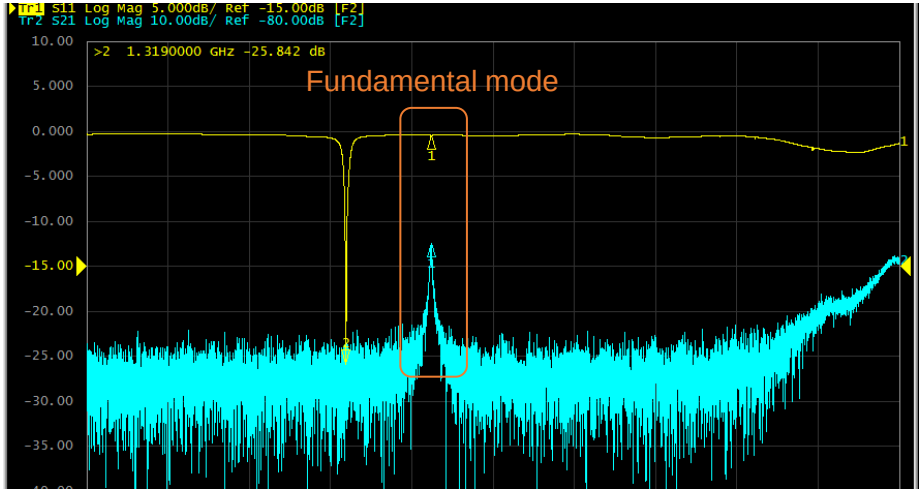
- TransDamper matching checked.
  - Expected -10dB, but measured -5dB up to 4GHz.
  - Optimization by adjusting antenna position/size possible
  - Effect on HOM damping to be measured in bead-pull
  - Ferrite design as alternative





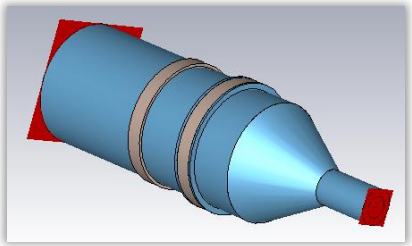
Input coupler on-the-fly redesign

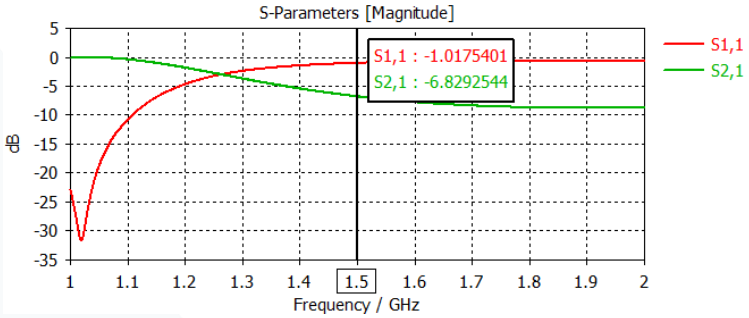
- First RF measurements showed little coupling to fundamental mode
- Rotating the coupling loop did not help significantly

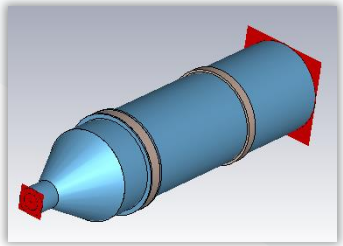


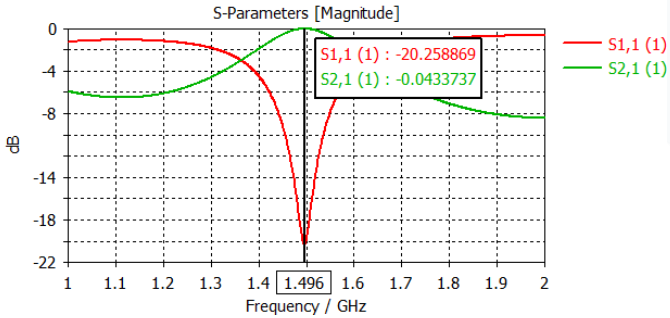
Coupler problem 1: low transmission at 1,5 GHz

- High reflection at 1,5GHz. Fixed without modifying already brazed parts



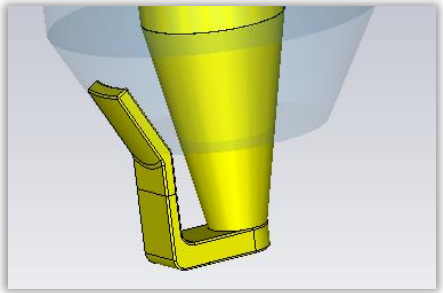


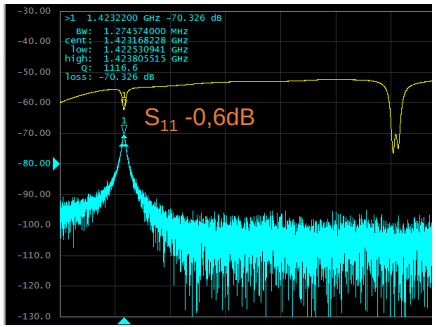




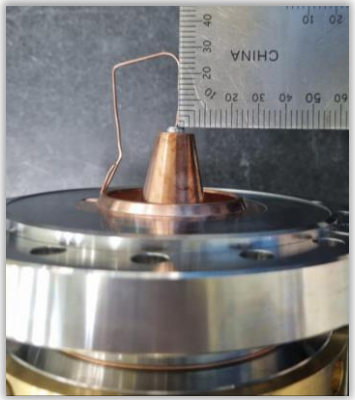
Coupler problem 2: low coupling (loop geometry)

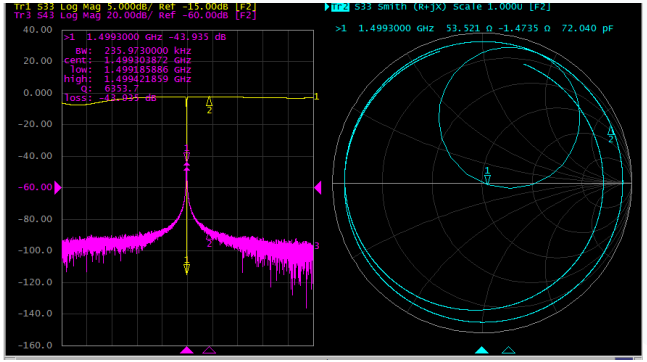
- After modifying coaxial line, still low coupling to fundamental mode:





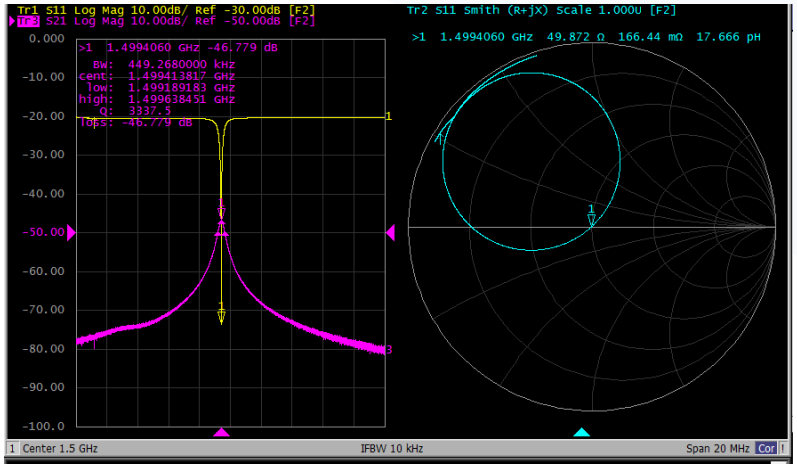
Wire test to find approximate geometry





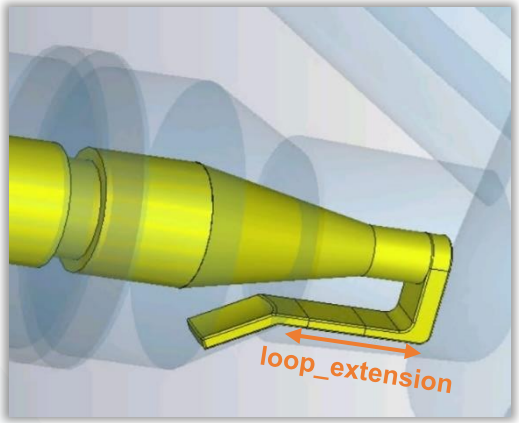
Coupler problem 2: low coupling (loop geometry)

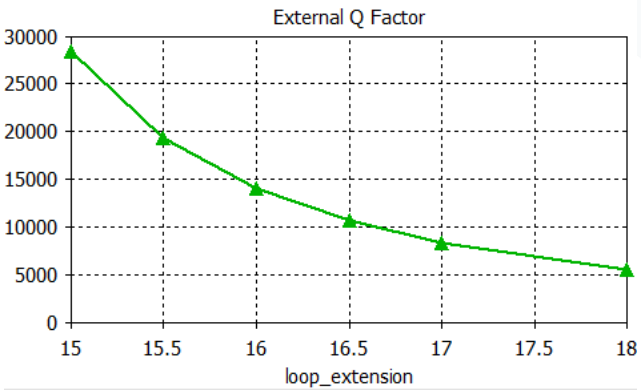
- Test second loop geometry based on wire test result:
  - Good coupling (-46,7 dB), but Q_0 degraded to ~7000



Coupler problem 2: low coupling (loop geometry)

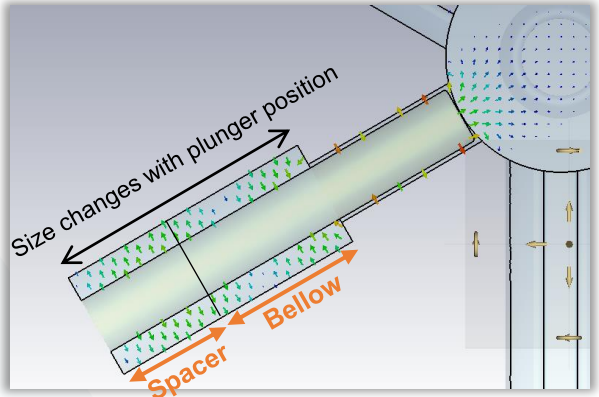
- Obtain optimal loop length during SAT:
  1. Manufacture and test optimum loop according to simulator
  2. If it does not work, test 2 loops with close dimensions
  3. Q_{ext} is vs loop length is easy to interpolate in this region



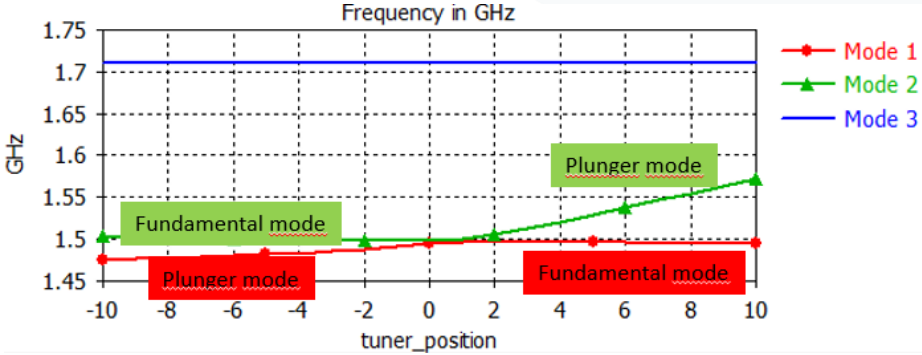


Plunger mode

- Around the central frequency, the quality factor suddenly drops
- Behaviour dependant on plunger position

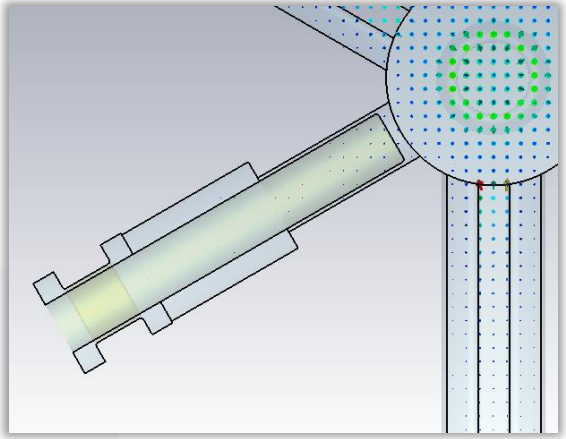


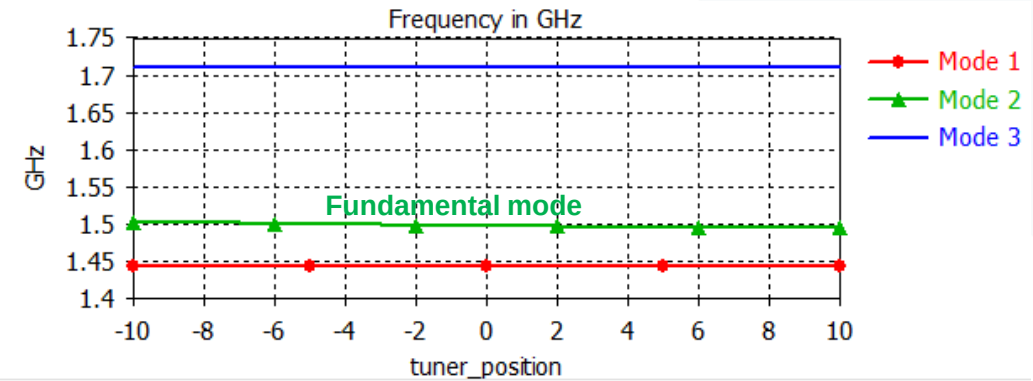
Resonant mode at 1.5GHz in plunger manipulator



Plunger mode

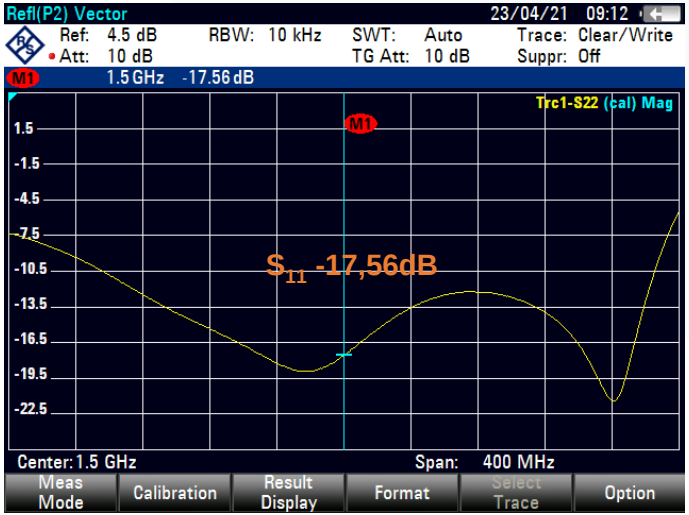
- Around the resonant frequency, the quality factor suddenly drops
- Behaviour dependant on plunger position
- Will fill the cavity to move away this mode





1,5 GHz WATRAX

- Designed a 1,5GHz WATRAX (WG to coax transition)
- Manufactured and measured by DESY



Picture and measurements courtesy of Fuchs, Heuck and Rüdiger Onken, DESY

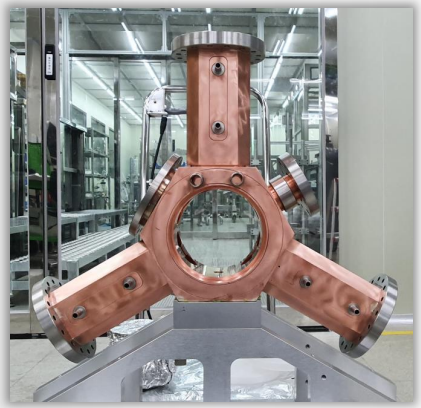
Test collaboration with DESY and HZB

- DESY, HZB and ALBA are collaborating on this project to:
  - Build the cavity prototype
  - Build WATRAX
  - Perform EM simulations of the cavity
  - Bead-pull measurement
  - Conditioning in HoBiCaT bunker
  - Installation in BESSY II on 2022 summer shutdown

Conclusions

- Cavity prototype doing FAT right now
- SAT foreseen before the end of this year
  - Coupler loop optimization to be done during SAT
  - Plunger mode suppressor to be tested during SAT
- Bead-pull, conditioning and beam tests in BESSY II foreseen during 2022 in collaboration with HZB and DESY
- TransDamper performance to be validated during bead-pull

ALBA SYNCHROTRON



Thank you for your attention!

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