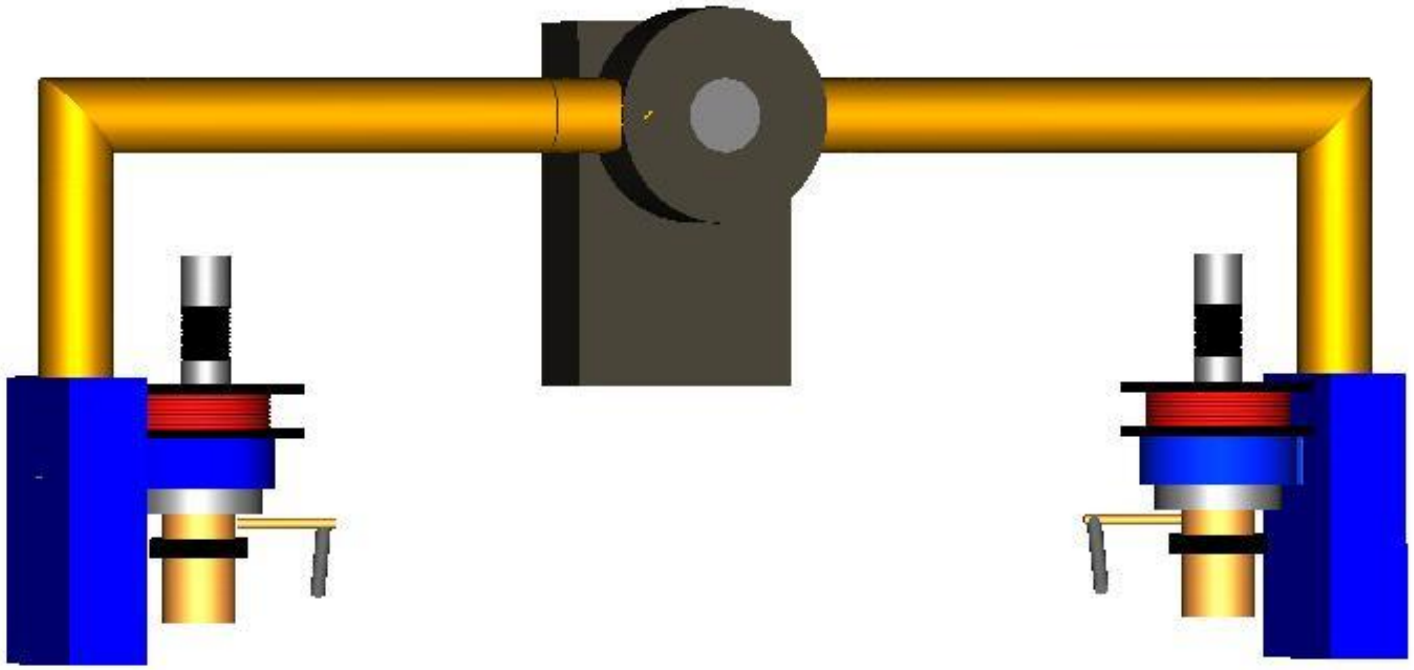
SIMULATIONS OF CACO AND IOTs

Beatriz Bravo

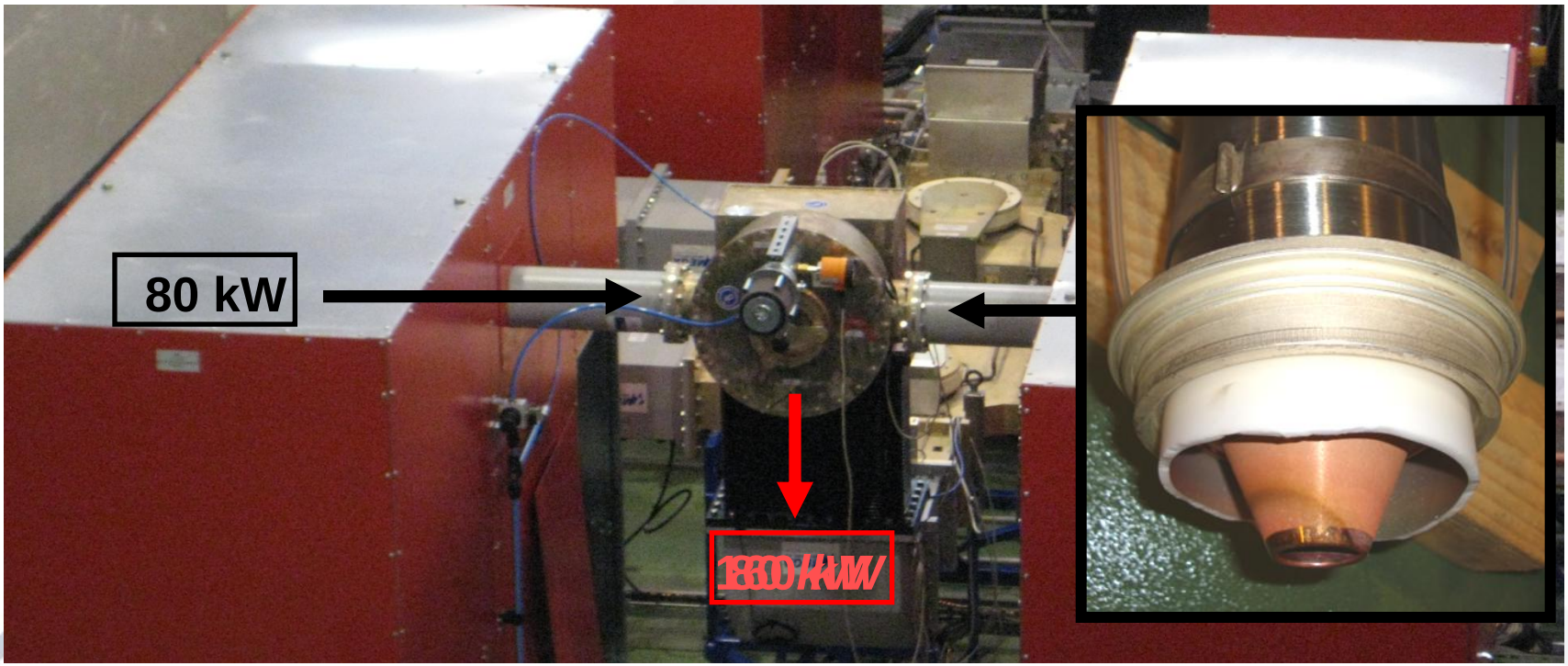


Overview

- Introduction
- How does the asymmetrical mode work?
- Proposal of a solution
- Conclusions

Introduction

- At Alba there are 6 cavities in the storage ring. Each one is fed by two IOT.
- During the CWRF at Alba the asymmetrical mode was used for the first time.

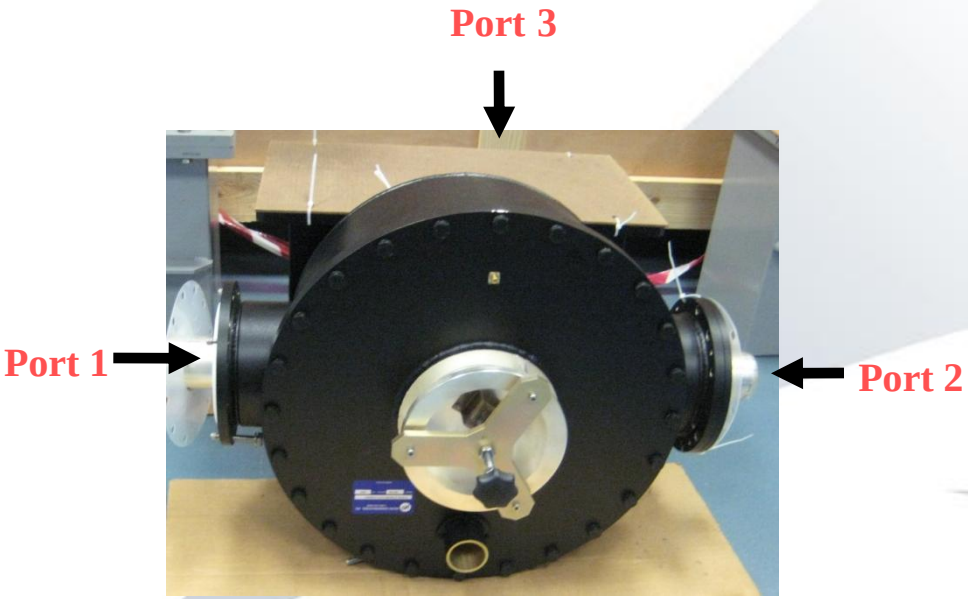


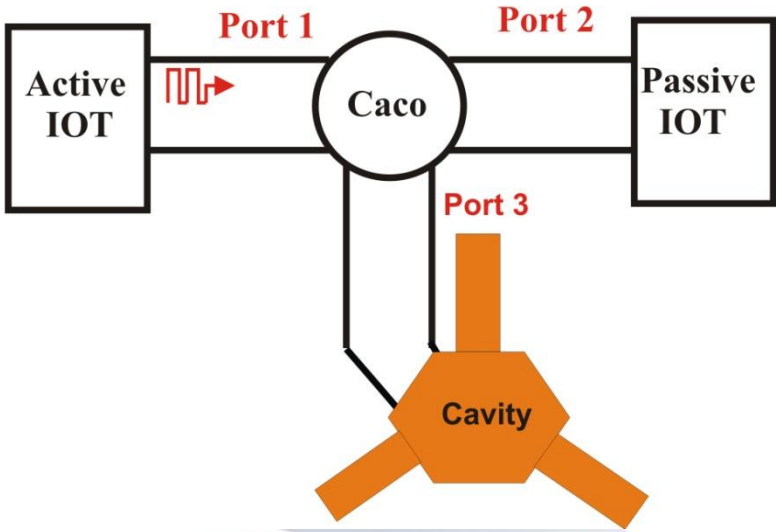
How does the asymetrical mode work?

- This project has been developed by:

  Francis Perez, Paco Sánchez, Borut Baricevic, Michel Langlois

- Caco is an electromagnetic resonator and is formed out of three ports.

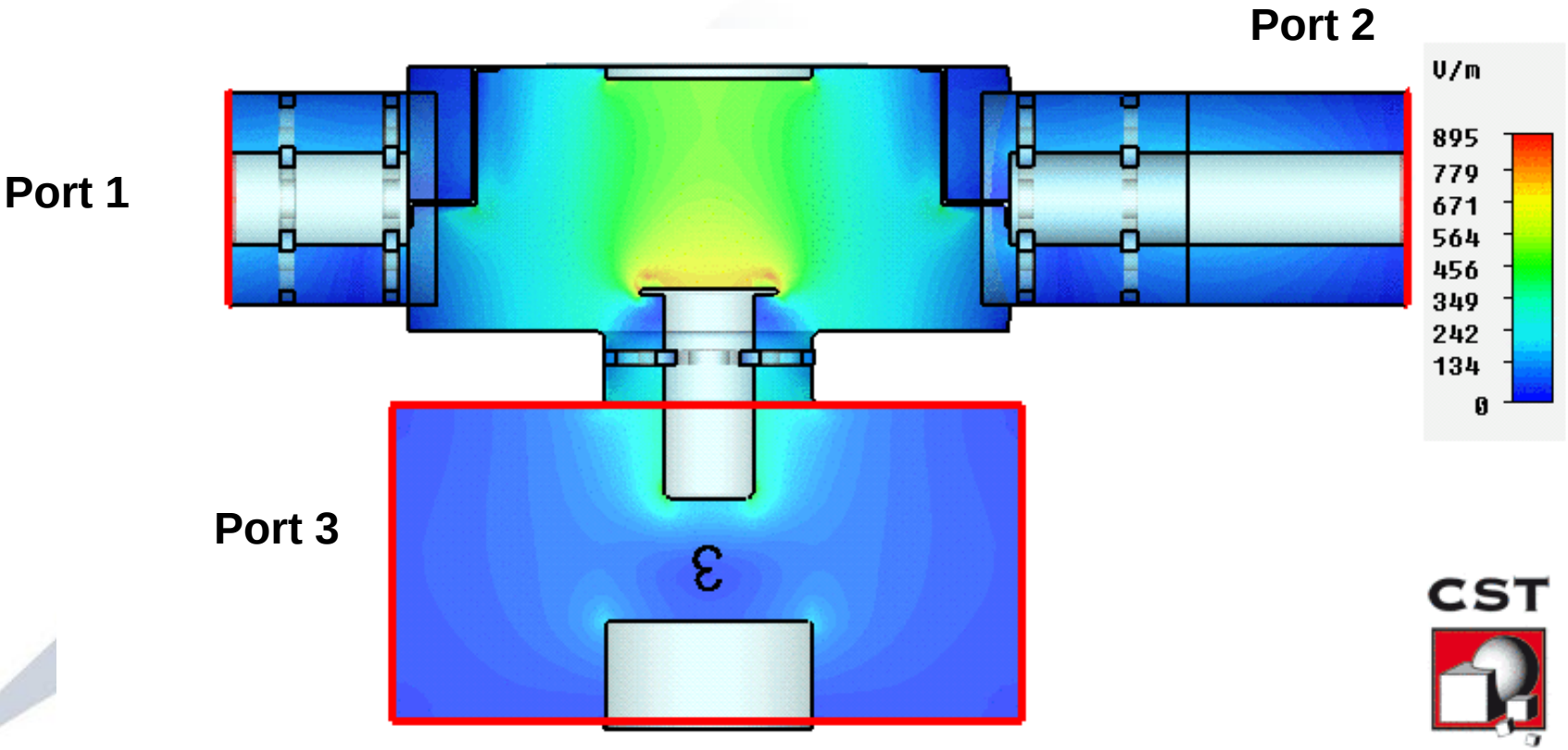




How does the asymetrical mode work?

- Caco is fed by the left arm.

- The standing wave pattern in the resonator is coupled to port 2 and port 3. **Half** of the incident power leaves port 3.

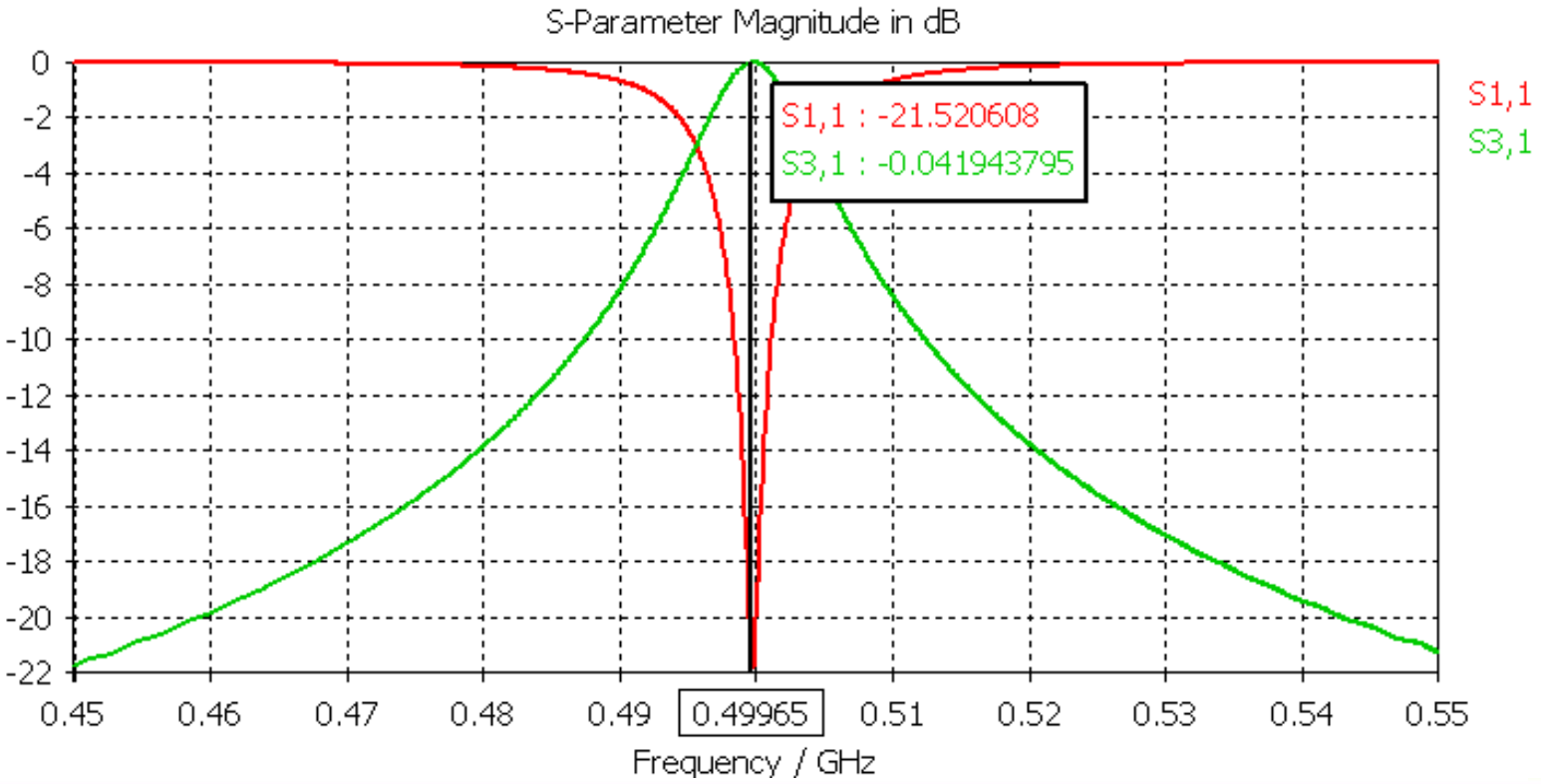


How does the asymetrical mode work?

All the incident power does not travel to port 3

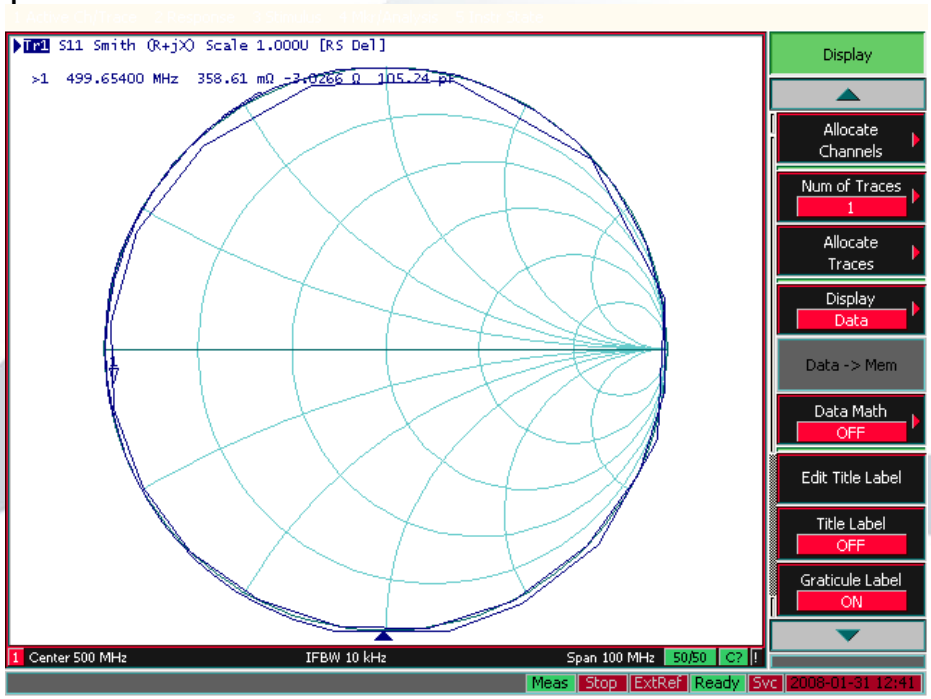
The cavity receives less power than it needs

Solution
Short circuit Port 2



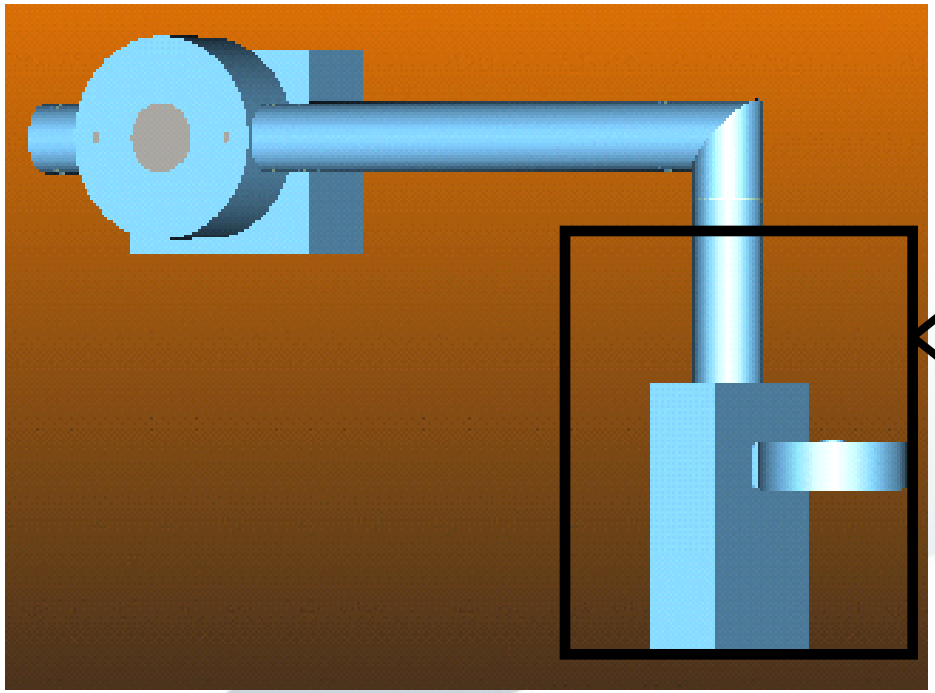
How does the asymetrical mode works?

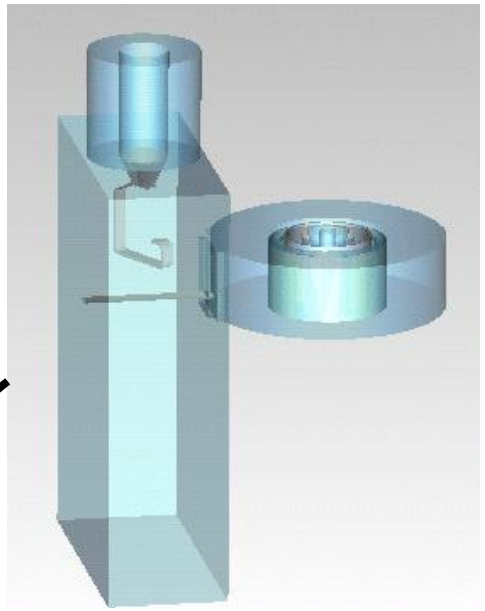
- IOT without beam
  - It was characterized by a NVA.
  - It was found equivalent to a short circuit.
  - All the incident power is delivered to the port 3
  - At real operation at Alba:
    - It was no detected power flow in the passive arm
    - The power delivered to the Port 3 was the same than the incident power.

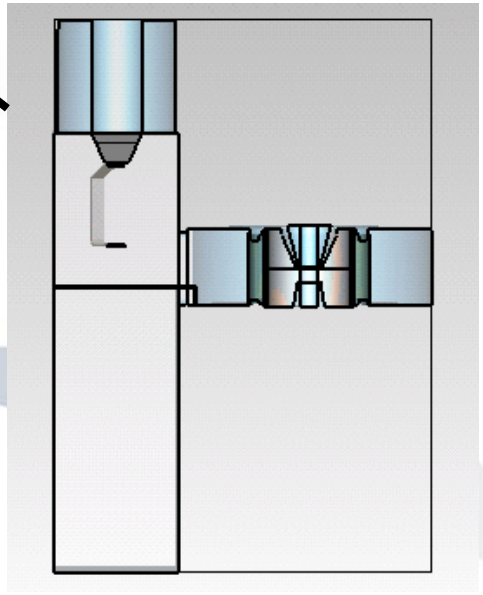


How does the asymetrical mode work?

- Simulation of IOT and Caco

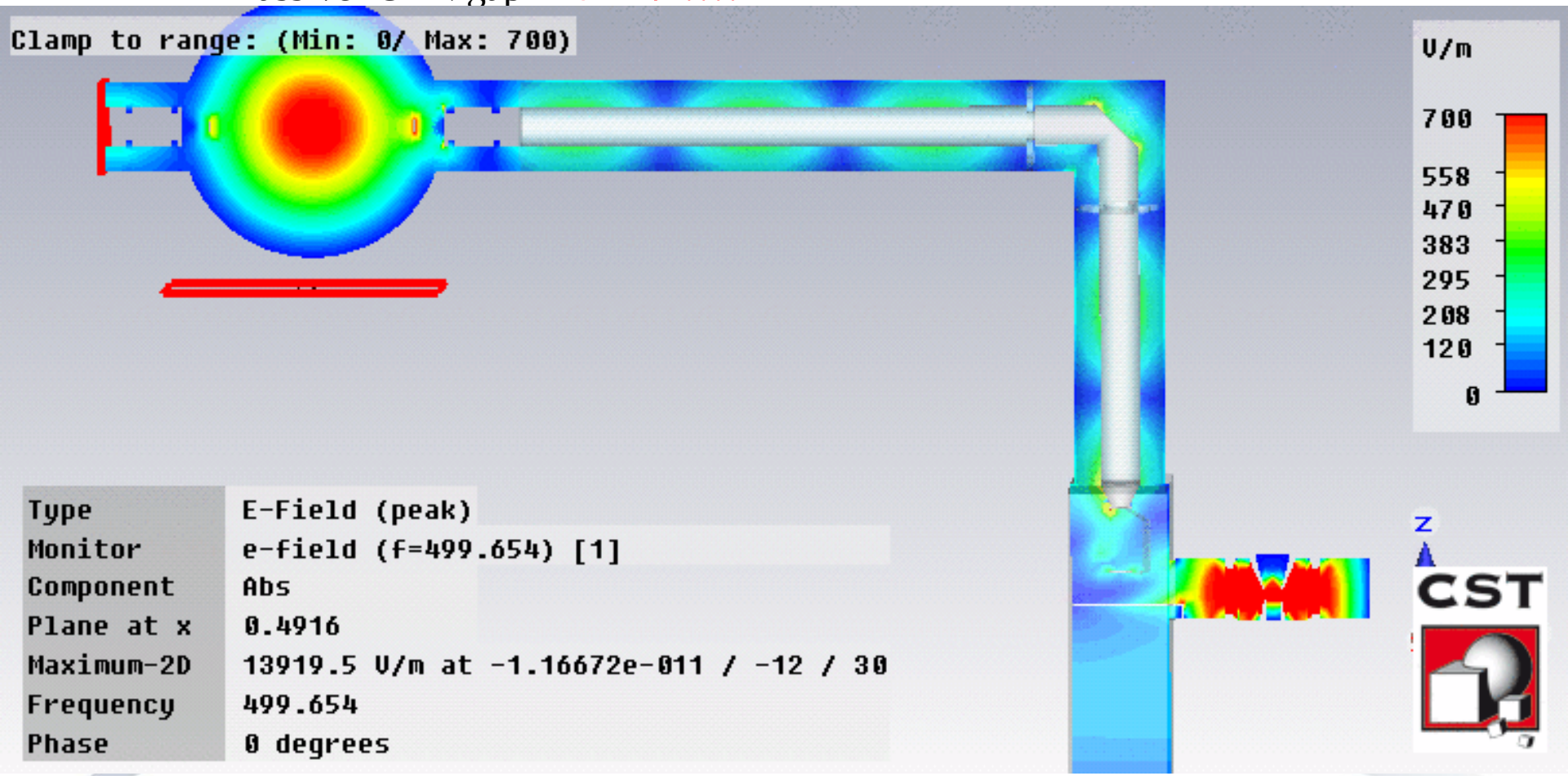






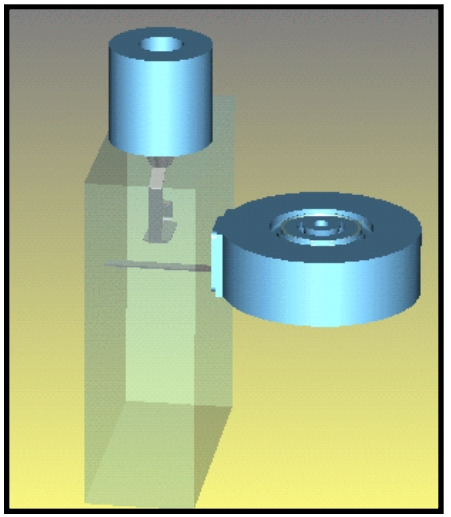
How does the asymetrical mode work?

- Simulation of IOT and Caco
  - Passive IOT Vgap = **64kV !!!!**



Proposal of a solution

❑ Looking for a solution

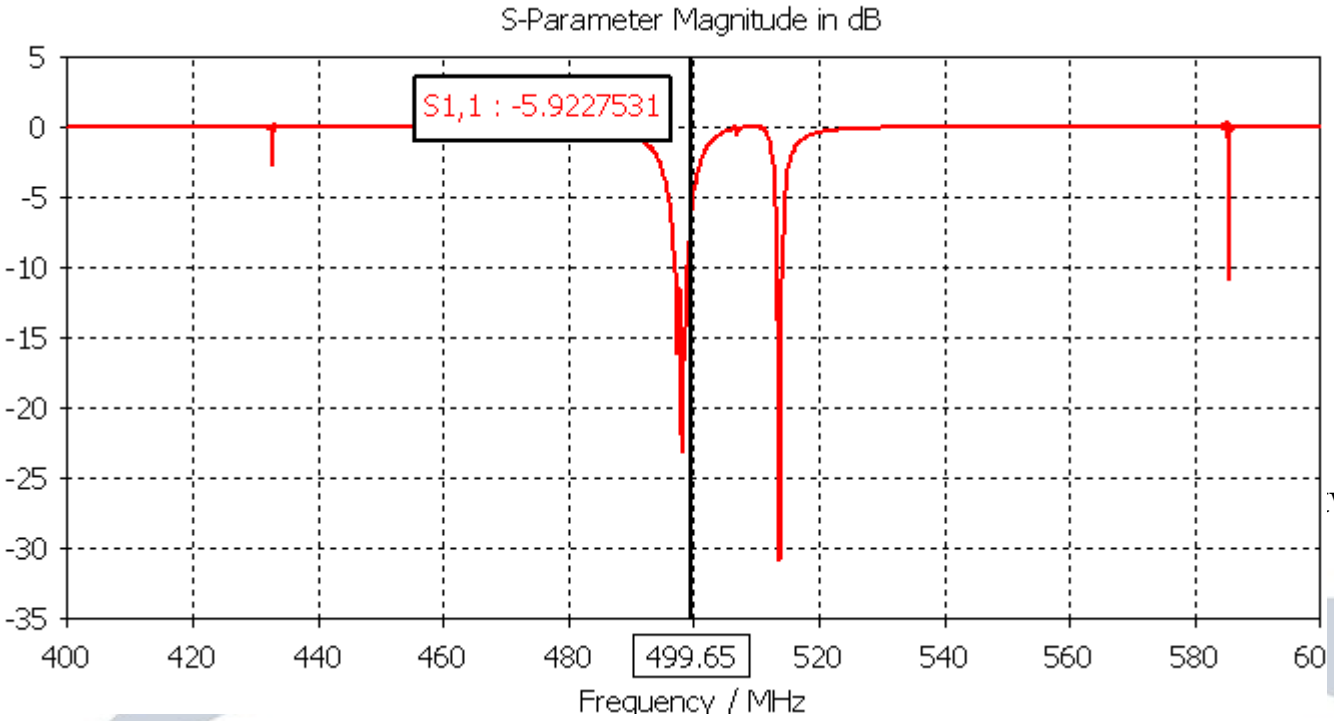


- ~~Position of the IOT loop parallel to the broad wall of the secundary cavity~~

  Real operation at Alba : high reflection in the active IOT

  Simulations: the resonant frequency changes

  => Tuning Caco and IOT

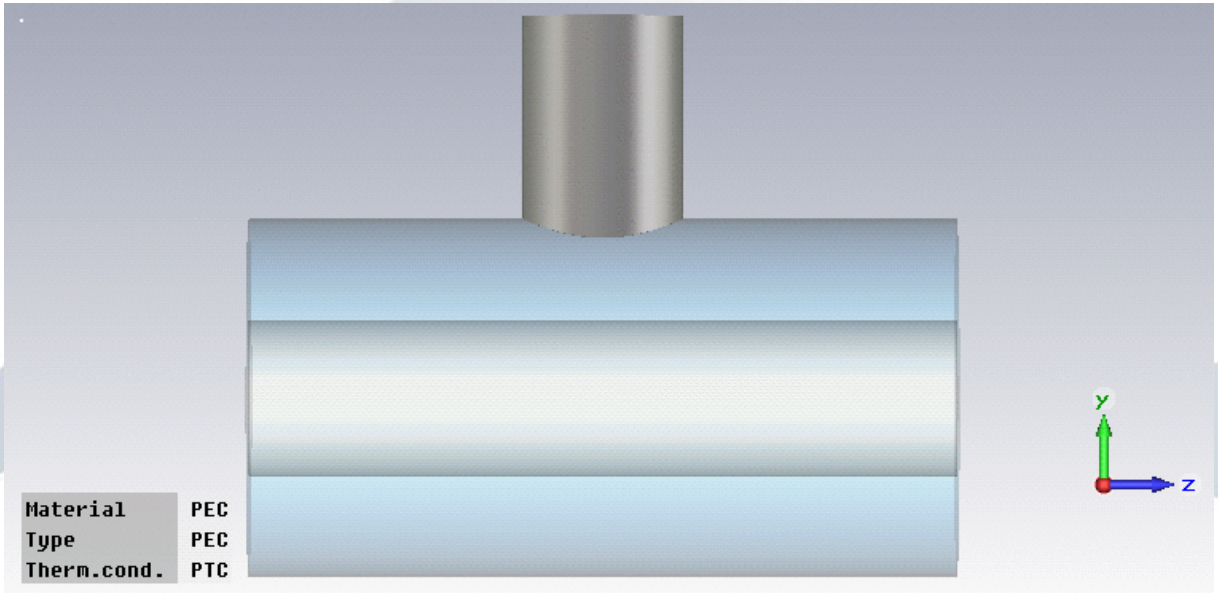


wo active IOTs)

Proposal of a solution

Stub tuner

- Stub tuners introduce simultaneous adjustment of both phase and amplitude of the reflection coefficients.
- The vertical position of the stub in the coaxial controls the amplitude of the reflection and the horizontal position the phase.
- High reflections in a coaxial waveguide are created by positioning the RF probe close to the central conductor.

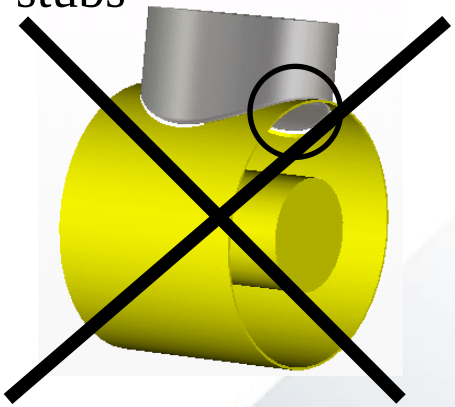


Proposal of a solution

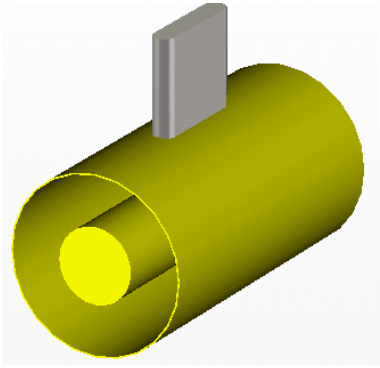
❑ Design of the stub tuner

- Shape of the stubs

Circular



Rectangular



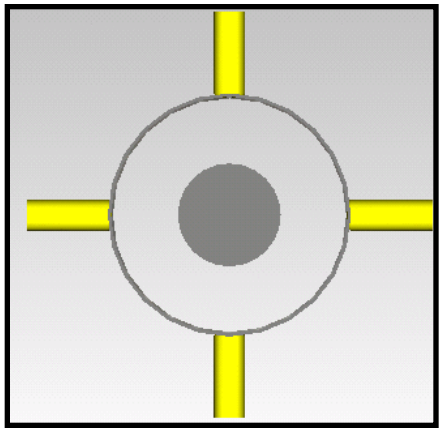
- Length and width of each stub
- Number of stubs
- Position of the stub along the coaxial w.g
- Distance between the stubs.

Optimized for the best performance in symmetrical and asymmetrical mode.

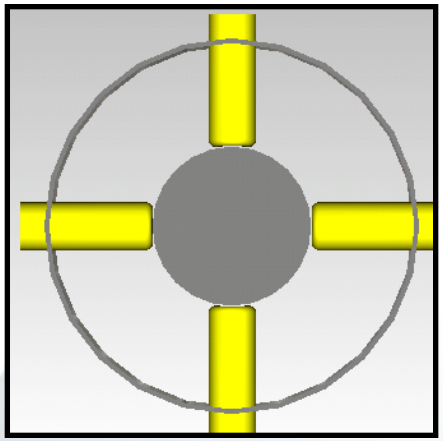
Proposal of a solution

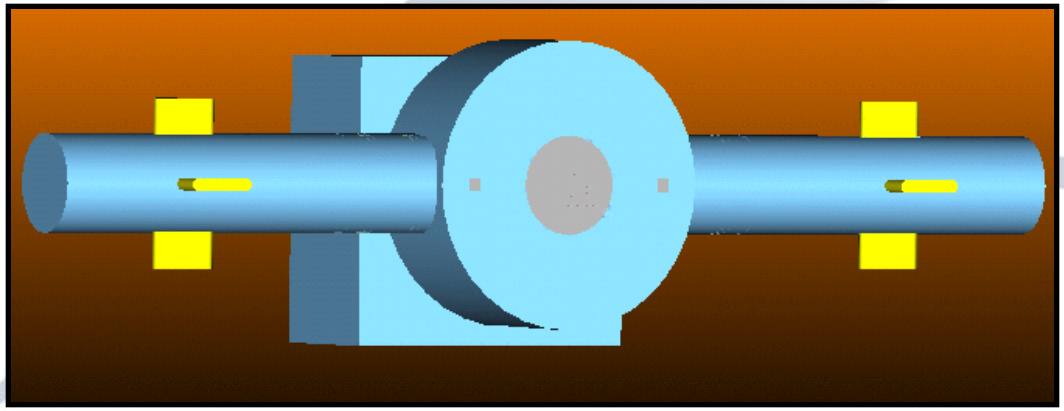
❑ Final design and results

Symmetrical mode



Asymmetrical mode

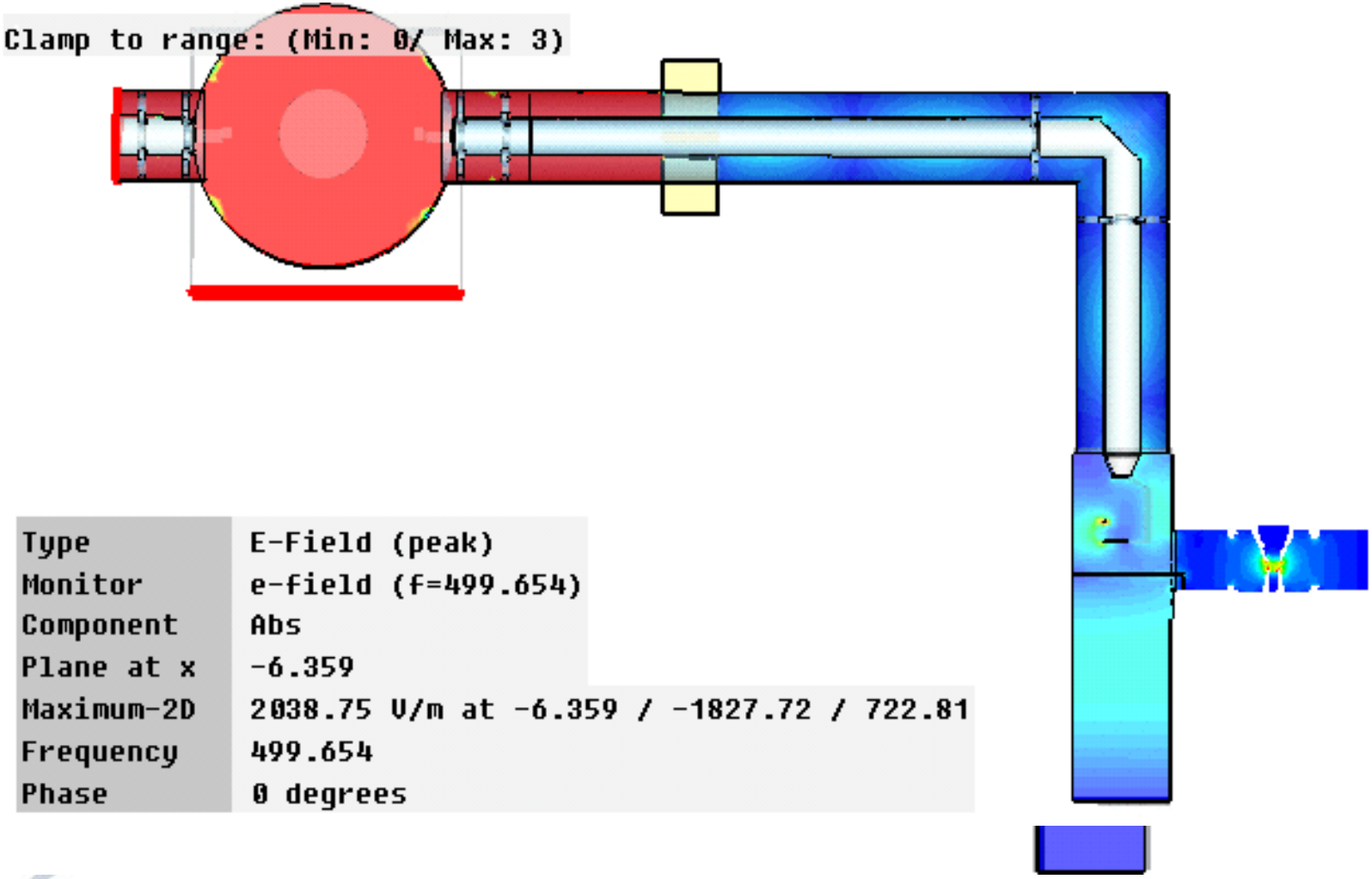




Number stubs	4
Distance between the stubs	90 degrees
Position respects Caco	236 mm away
Length	100 mm
Width	20 mm
|S21|	-53 dB
Power loss	10 W
Efield max around the stubs (scaled for 80000 RMS)	14000 V/m

Proposal of a solution

- Final design and results
  - Passive IOT Vgap = **125 V**



Conclusions

- In the asymmetrical mode: A standing wave is formed between the passive IOT and Caco. **Consequence:** the gap of the passive IOT sees Vgap = 64kV
- A method is proposed for using stubs tuner to solve this problem. The Vgap is reduced from 64kV to 125 V.
- A prototype will be built and tested. The results in the next RF meeting.

Acknowledgement

- **Michel langlois** for helping us to understand why the ceramic of the passive IOT broke

- **RF group**: **Francis, Paco, Angela** for taking time for consultation and discussions despite the eventful months around the commissioning.

- **Filip Mares** for his support in the mechanical design of the stubs.

Thank you very much for your attention