



The LHC ACS RF power couplers for testing  
magnetic SEY suppression

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Large Hadron Colider

Accelerating Cavities Superconducting

400 MHz 300 kW cw coupler



# LHC couplers (layout)

The LHC power coupler is a 400 MHz **mobile RF power coupler** with very high power requirements :

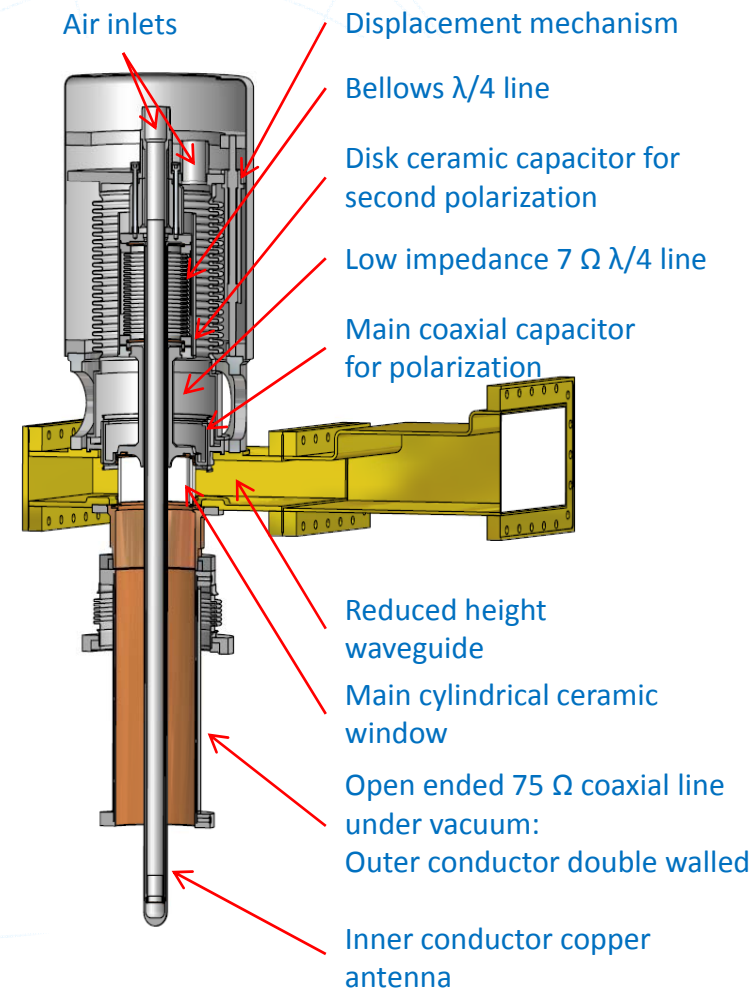
- Continuous : **250 kW**
- Pulsed : 300 kW fwd + 670 kW rev, including beam loading, i.e. **1.85 MW local peak power**.

## Challenge

- To design a **mobile RF power coupler without sliding contacts** for these very high power levels.

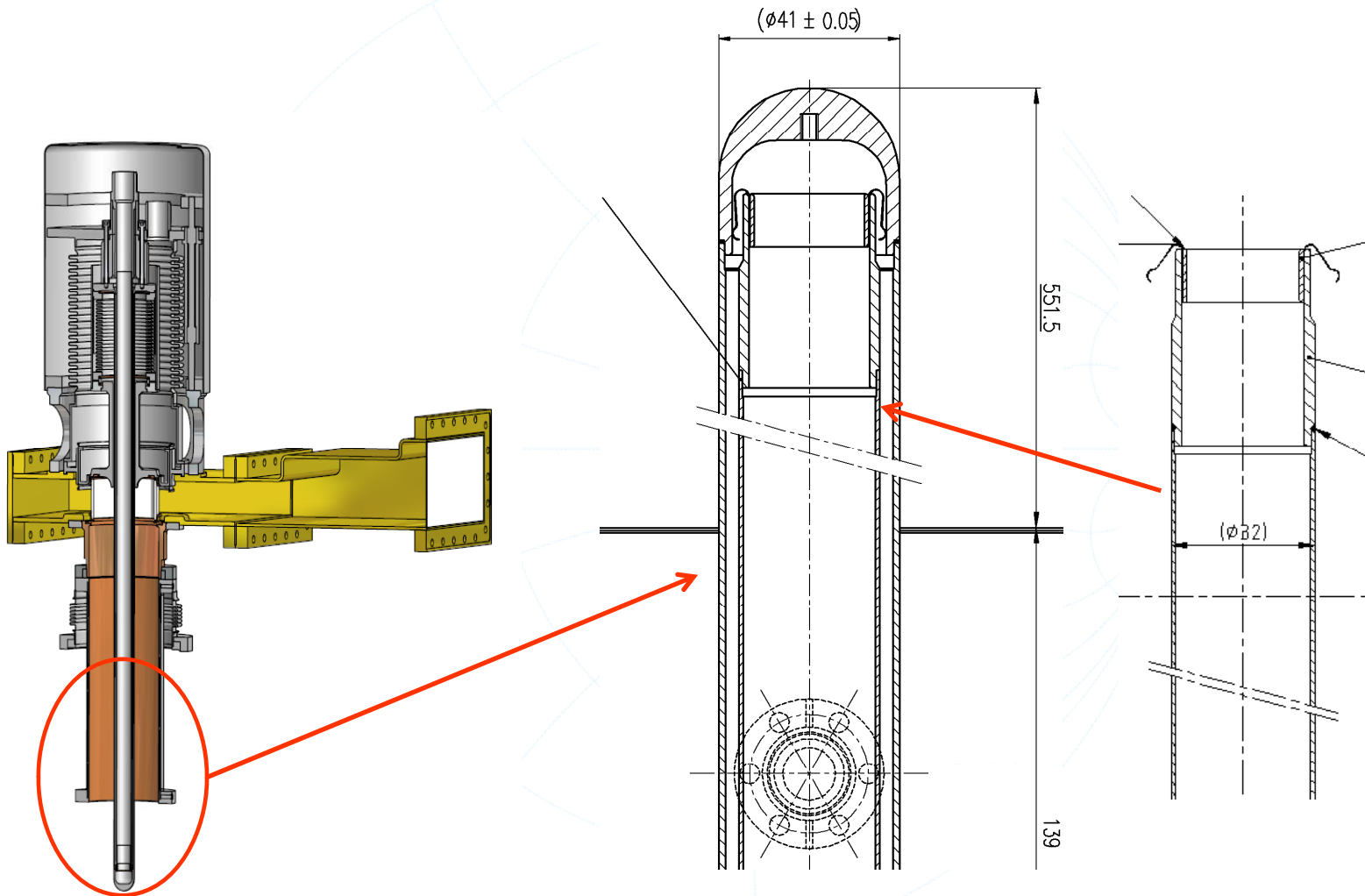
## Main design features

- A Cylindrical ceramic window with **solid copper rings brazed** to the ceramic ends, placed in the waveguide-to-coaxial transformer, provides vacuum integrity.
- To suppress multipactor during operation **two DC bias levels** are applied:
  - 2.6 kV, **to the low impedance  $7 \Omega$   $\lambda/4$  line transformer**, isolated from ground by a coaxial capacitor in the waveguide.
  - 2.6 kV + 400 V, **to the antenna**, isolated from the  $\lambda/4$  line transformer by a disk ceramic capacitor between  $\lambda/4$  line transformer and bellows.
- Air cooling is provided on the window and other critical elements of the coupler, such as the antenna.
- A **Vacuum gauge** is located **close to the window** and is used for coupler conditioning and interlock.





# LHC couplers (layout detail)



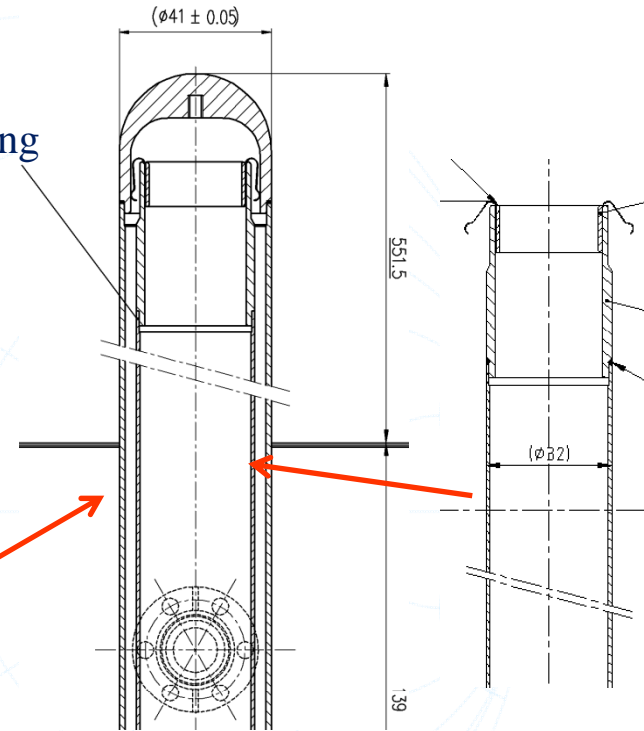
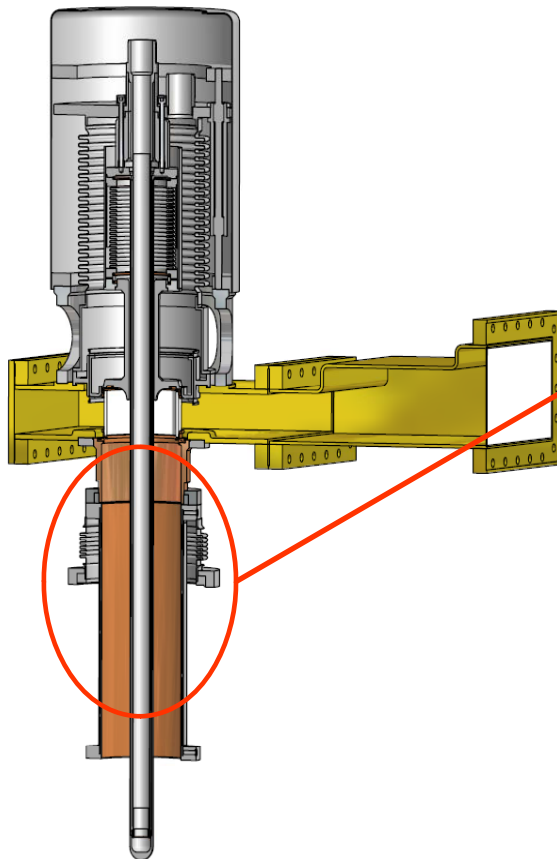
Copper antenna with inner air cooling cane

Note, that this coupler is like an anti-cryostat.. warm... and with air inside



# LHC couplers - where to install a double coil

First idea was to apply a nickel layer on the outer surface of this coupler, coated with 10 micron copper...but we need multipacting during the “running in phase“ thus we require a „switchable“ SEY.. we need the double coil inside



Copper antenna :

external diameter = 41 mm  
internal diameter = 38 mm

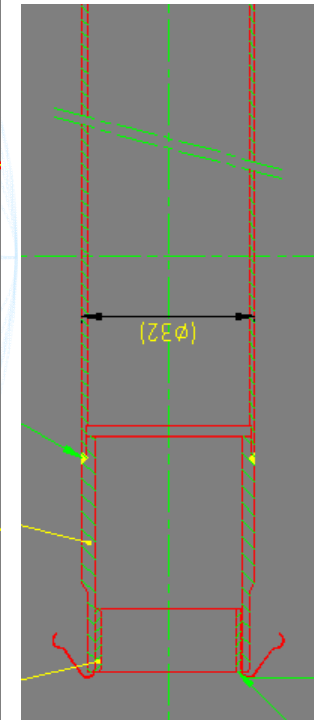
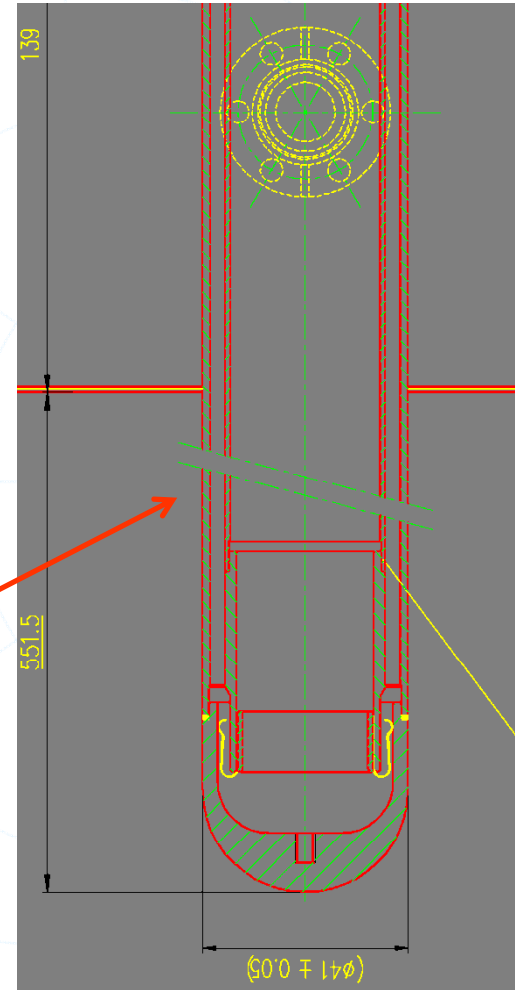
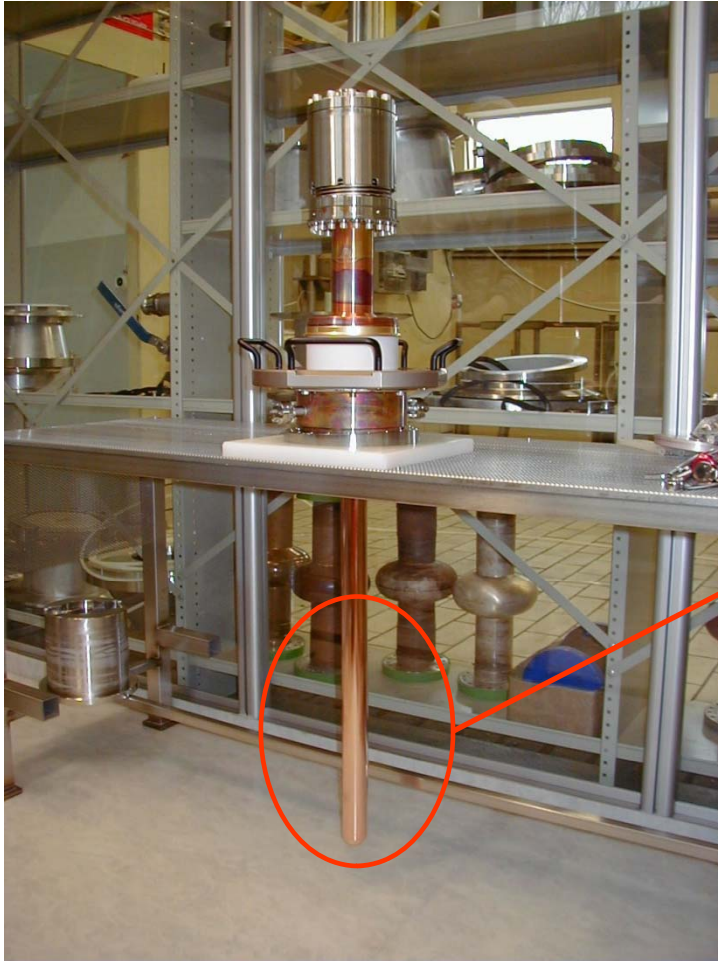
Inner air cooling cane

external diameter = 32 mm

Space for winding = 3 mm



# LHC couplers



Inner copper antenna with inner air cooling cane