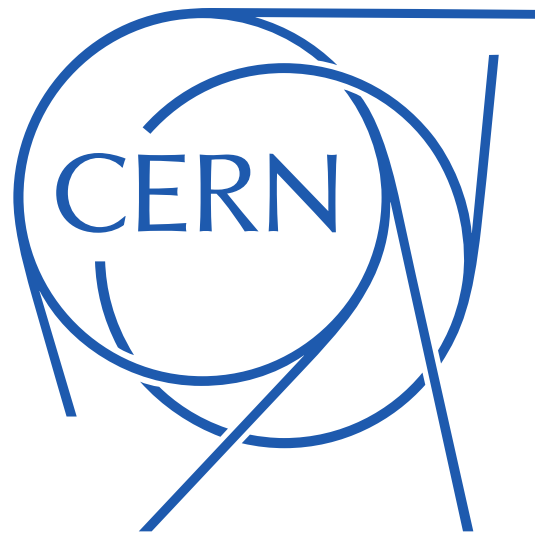


# Chemical & Electropolishing facility for niobium (HL-LHC) and copper (FCC) substrates



TTC 2020  
CERN 4-7 February 2020



Workshop at B. 118

# Motivations

## BCP of RFD & DQW complex geometries

### Advantages of horizontal polishing

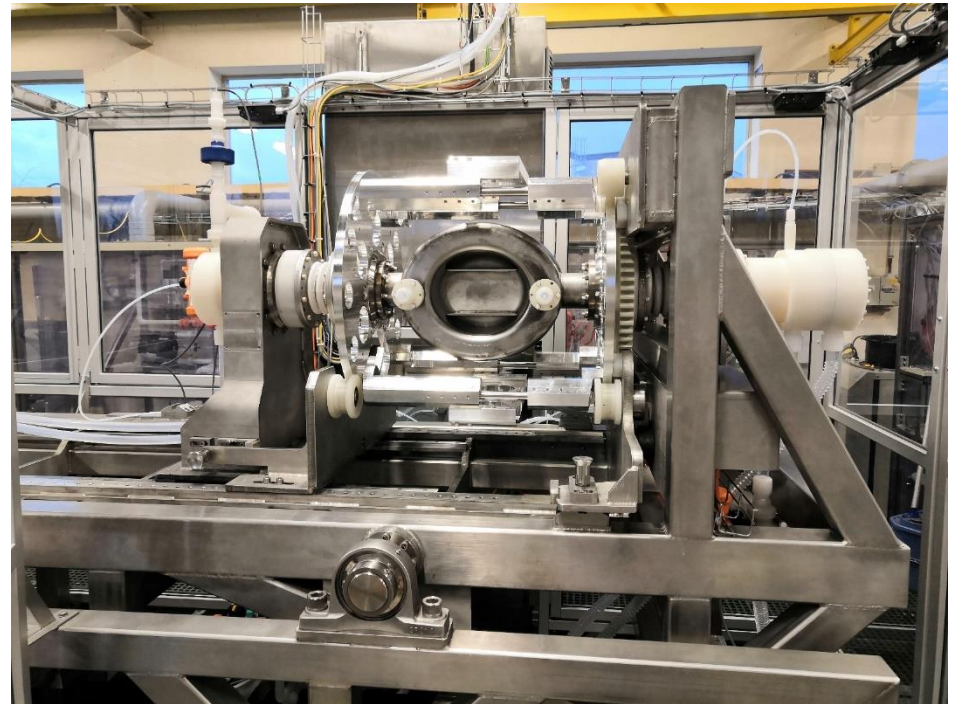
- Flushing of produced gas
- Less defects (bubbles)
- Increased homogeneity

Drawback → complexity and cost  
(316L SS, PVDF, FKM, ...)

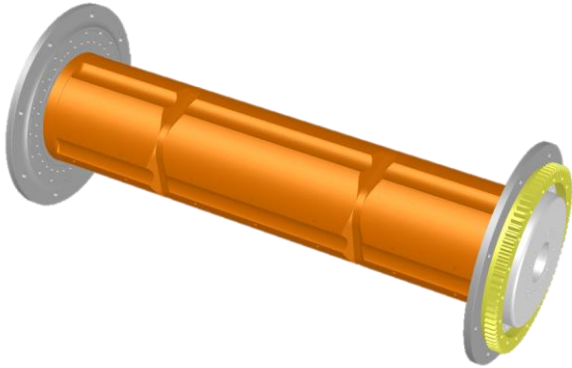
### Advantages of vertical polishing

- Transposable to an industrialised process

## Electropolishing of 400MHz cavities



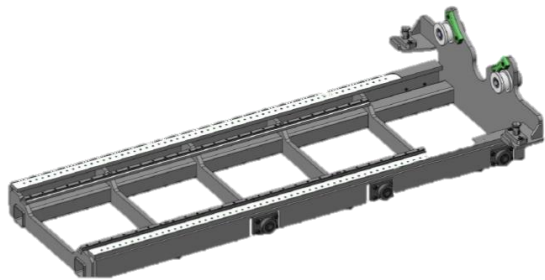
# Machine overview



WoW cavity with interfaces

## Size limitations

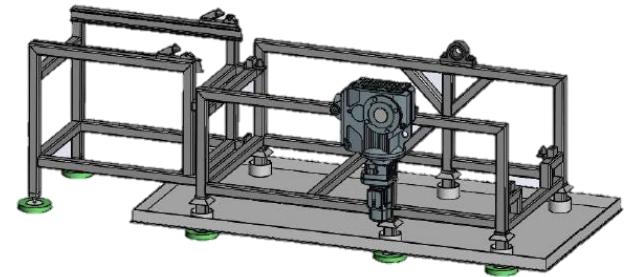
Length	Diameter	Weight (empty)
1.5 m	1 m	300 kg



Cart



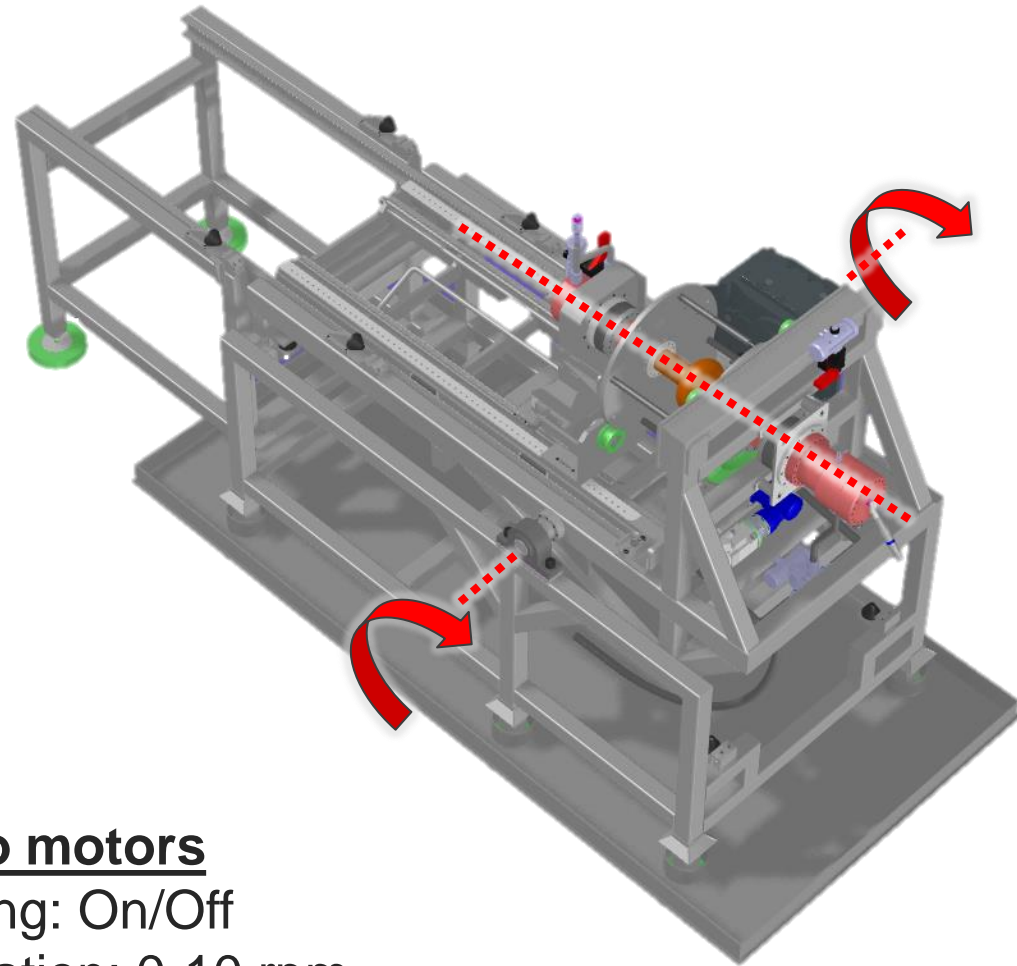
Tilting frame



Fixed frame



# Motion

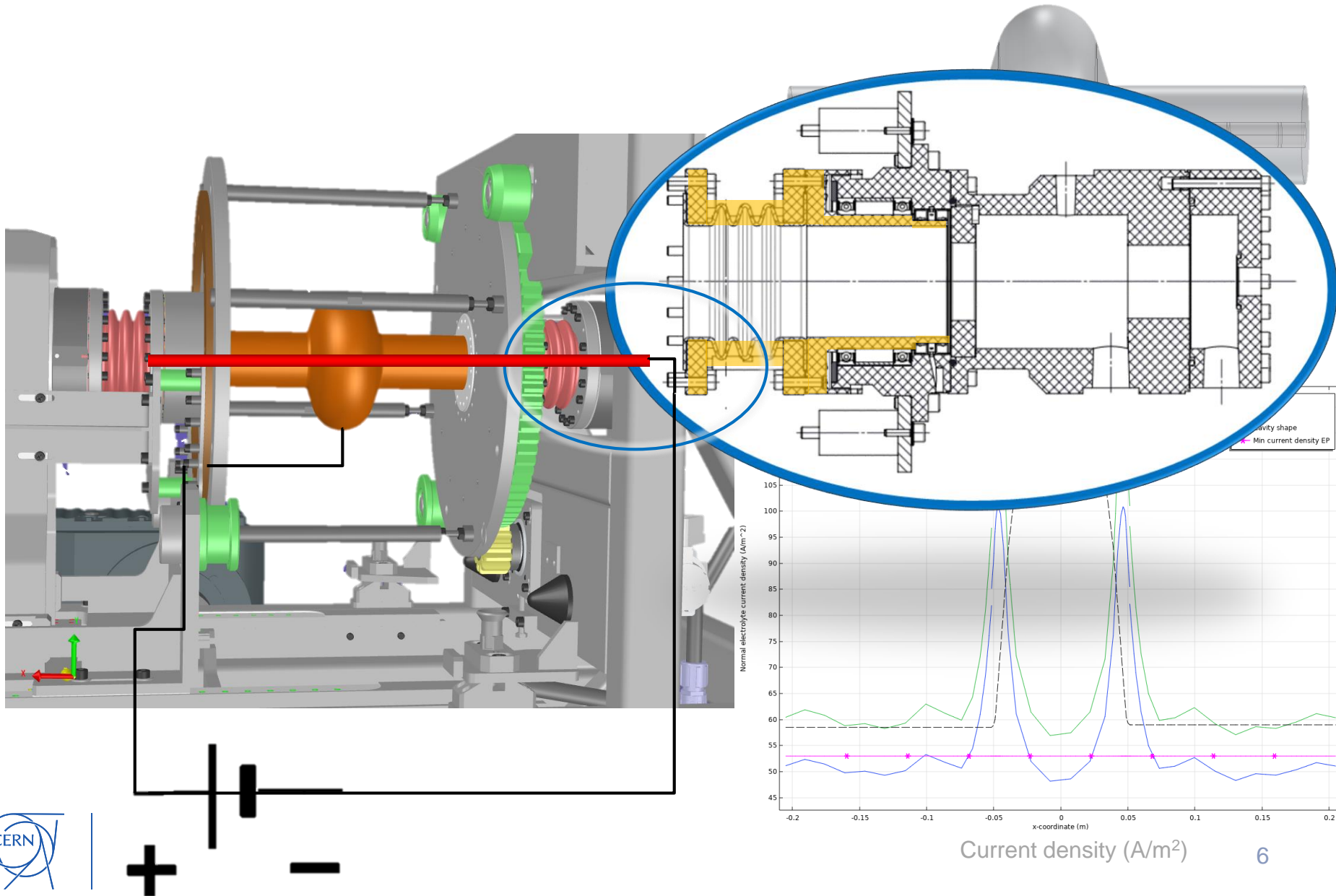


## Two motors

Tilting: On/Off

Rotation: 0-10 rpm

# Transmission



# Chemical assemblies

**Niobium**

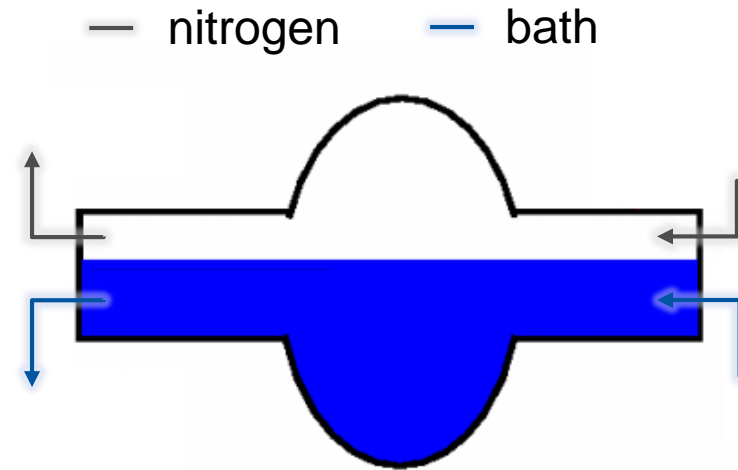
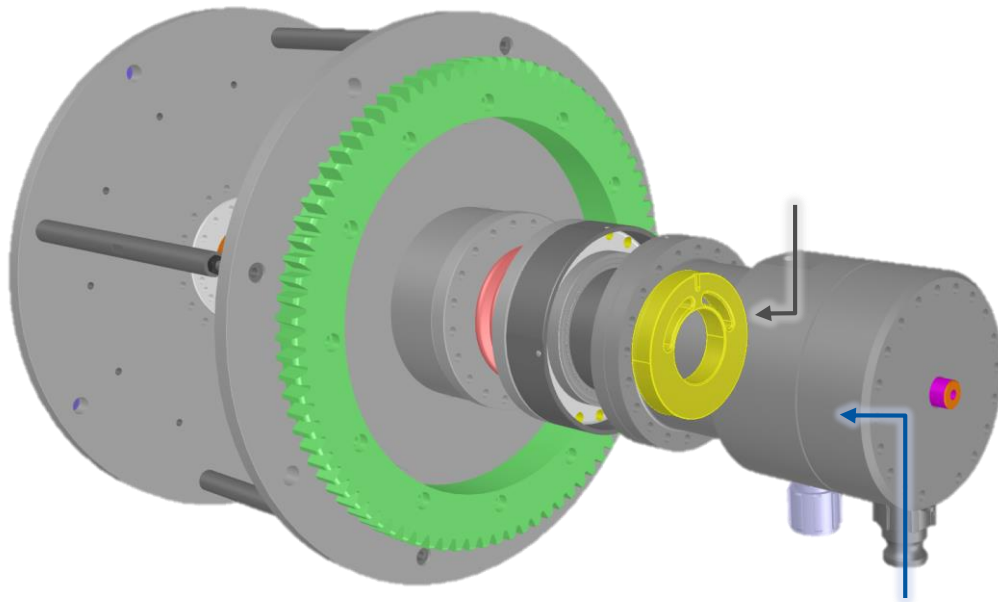


**Copper**





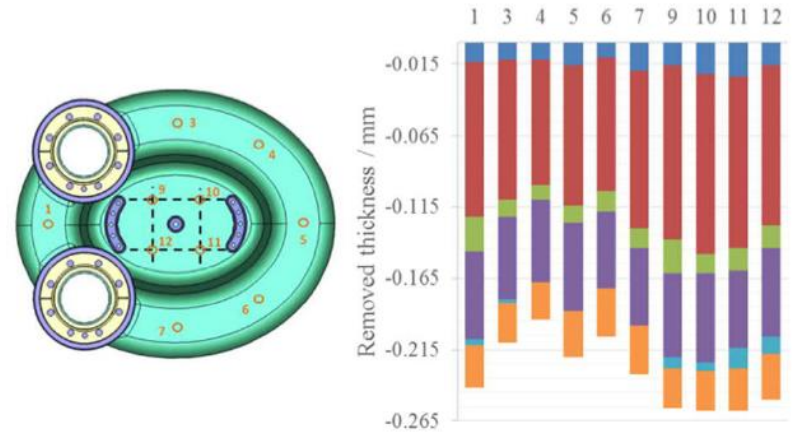
# Nitrogen venting



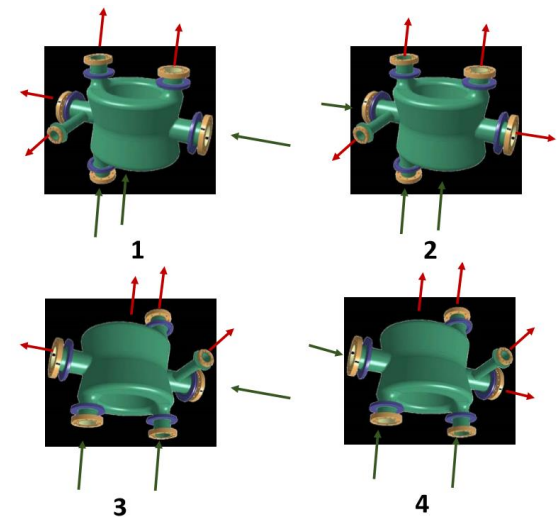
- Inert atmosphere: average  $H_2$  concentration 0.1% (LFL 4%)
- Reduced contact time of hydrogen with substrate



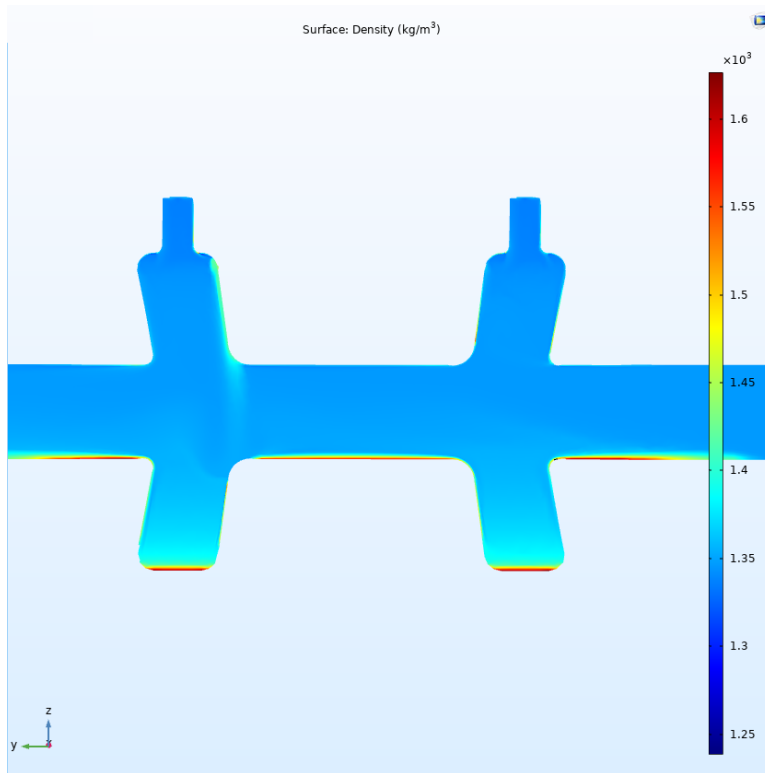
# Previous setup



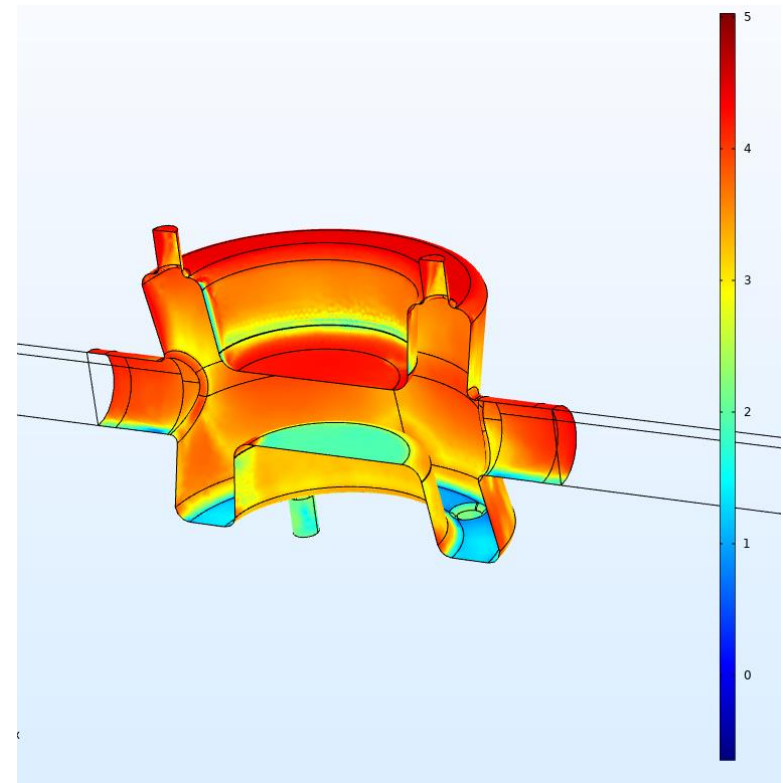
■ After LightBCP\_P4   
 ■ After LightBCP\_P1   
 ■ After BCP 4\_P3  
■ After BCP 3\_P2   
 ■ After BCP 2\_P4   
 ■ After BCP 1\_P1



# Previous setup - simulation



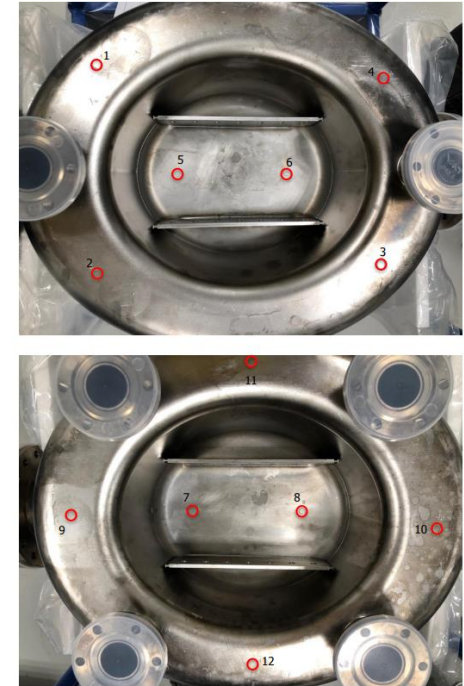
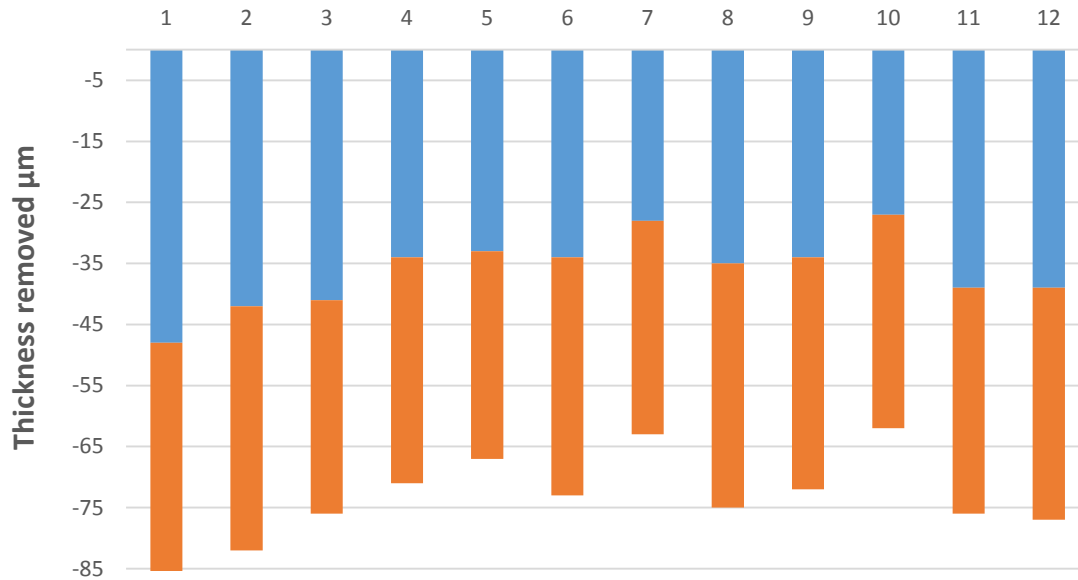
Bath density



Etching rate (ratio)

↳ Preponderance of natural convection

# PoP DQW results



After BCP1		After BCP2	
Average	-36	Average	-37
Max	-48	Max	-40
Min	-27	Min	-34

Average thickness removed from weight :  
58 µm

↳ Precision : ± 5 µm

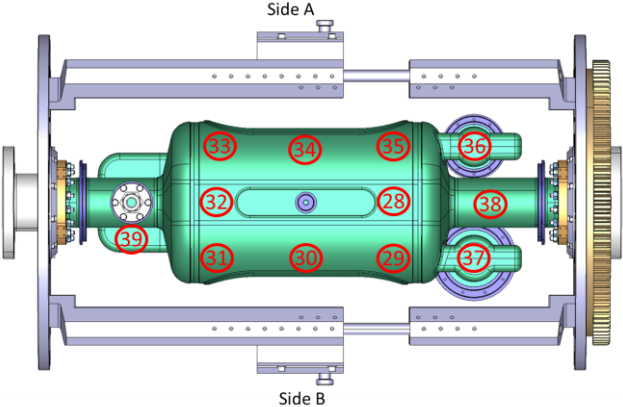
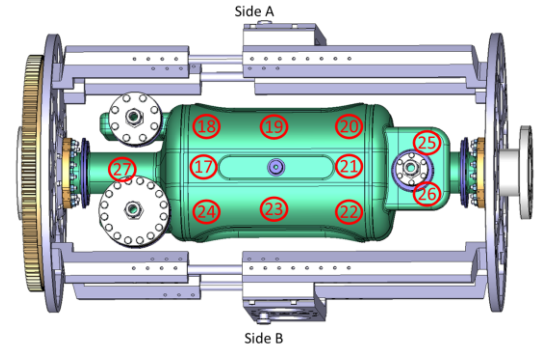
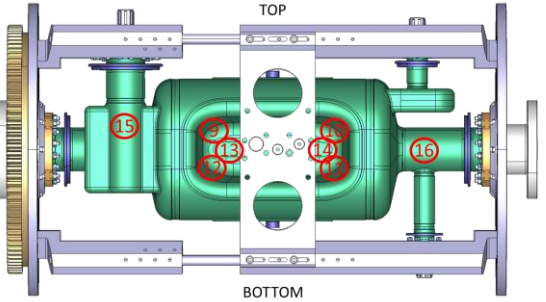
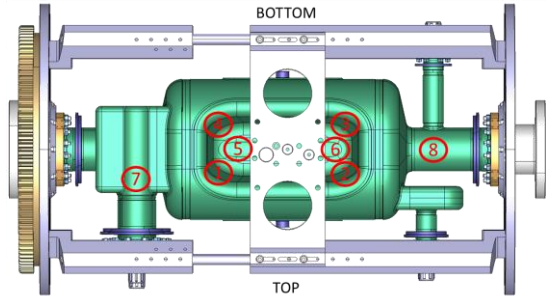
The probe changed after the reference measurement

Ti 10.5°C  
50 min

T 14.2°C  
60 Min



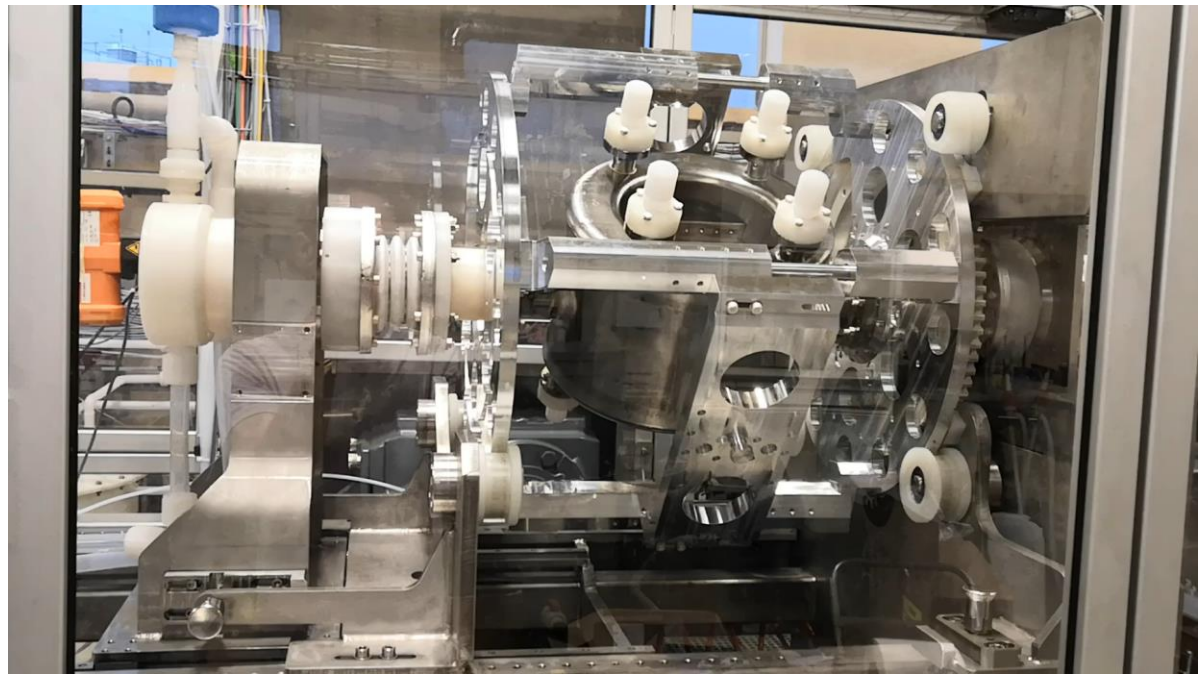
# RFD results



Average thickness removed : 87  $\mu\text{m}$

# Next steps

- BCP on RFD cavities (3 bulk, 2 light)
- Consolidation of our model
- EP on 1,3GHz single cell copper cavity
- EP on 400 MHz



**Thank you for your attention!**