HEL collector

Giorgia Gobbi, Antti Kolehmainen, Diego Perini

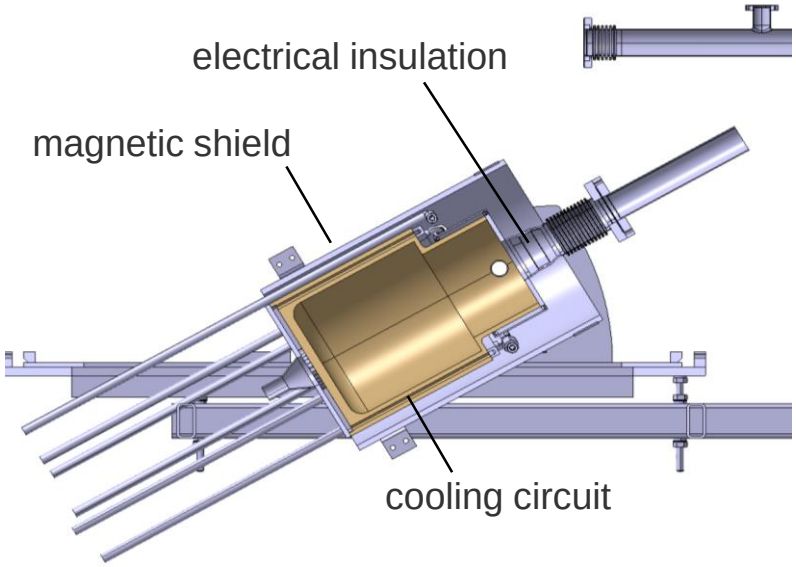
01/07/2019

Specifications

- Collector: used to collect electron cloud and dissipate its energy
- Material: CuCr1Zr
- Dimensions: 340xØ350 mm
- Active cooling via circulating water
- Power to absorb: **75 kW maximum value**

  →**Magnetic shield**

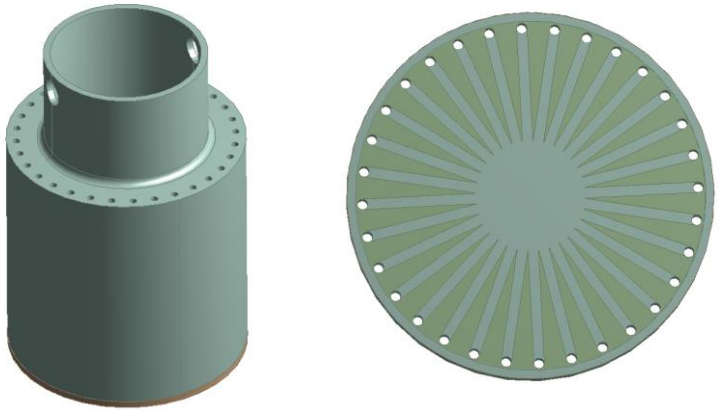
  →**Electrical insulation**



33 channels in parallel Ø = 10 mm

Restrictions:

- Cu max temperature **< 90°C** for UHV compatibility
- Initial flow speed max 1.0 m/s
- Size limitations



Cooling circuits - Lapland Design

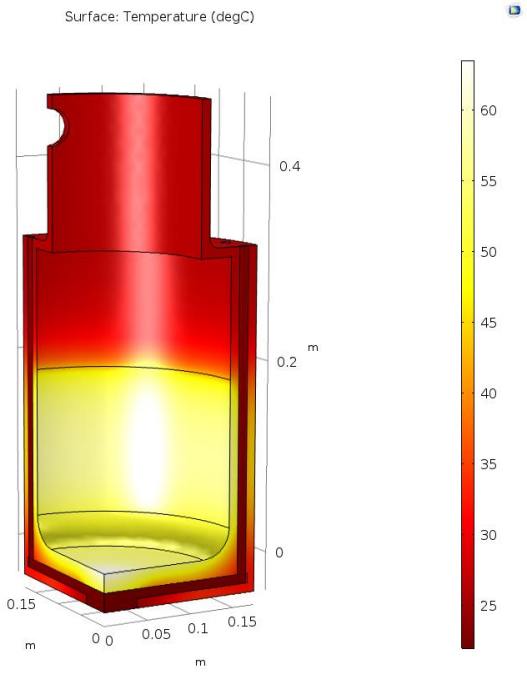
CuCr1Zr - Results

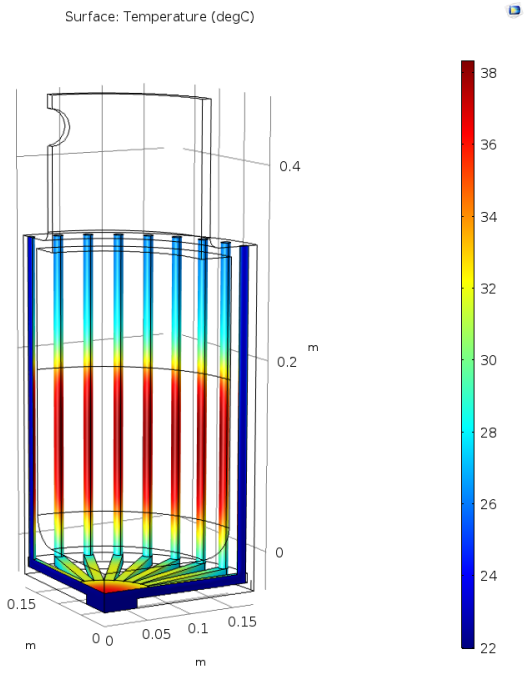
Load: 50 kW
V_{in} water = 1.0 m/s
Material: CuCr1Zr → **$T_{softening}$ = 450 - 500 ºC**

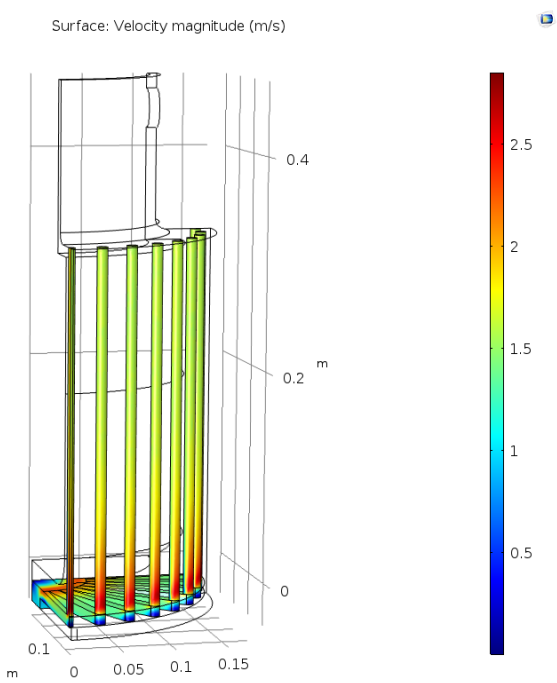
T_{max} Cu = 63 ºC

ΔT water = 16 ºC

v_{max} water = 2.7 m/s







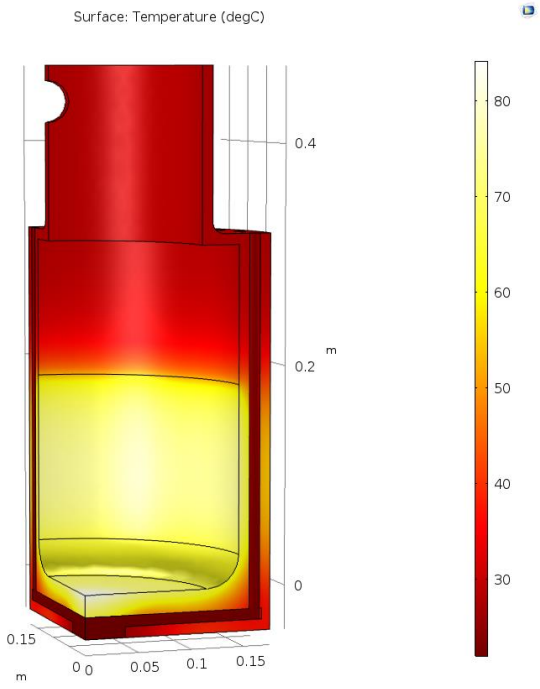
CuCr1Zr - Results (1.5*Load)

Load: 75 kW

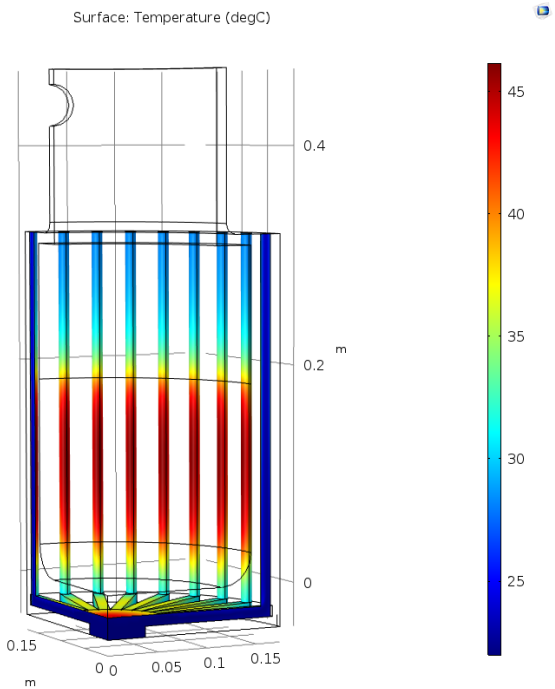
V_{in} water = 1.0 m/s

Material: CuCr1Zr → **$T_{softening}$ = 450 - 500 ºC**

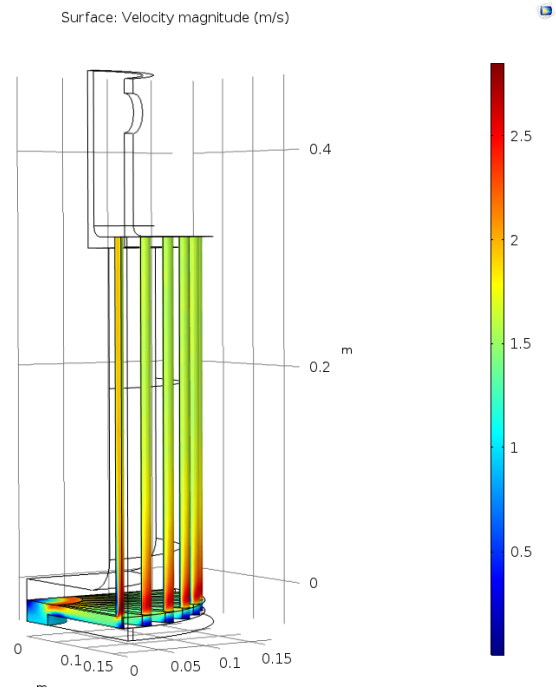
T_{max} Cu = 83 ºC



ΔT water = 24 ºC

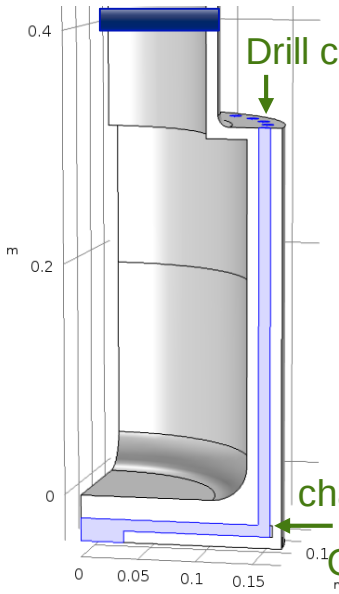


v_{max} water = 2.7 m/s



Manufacturing and plan

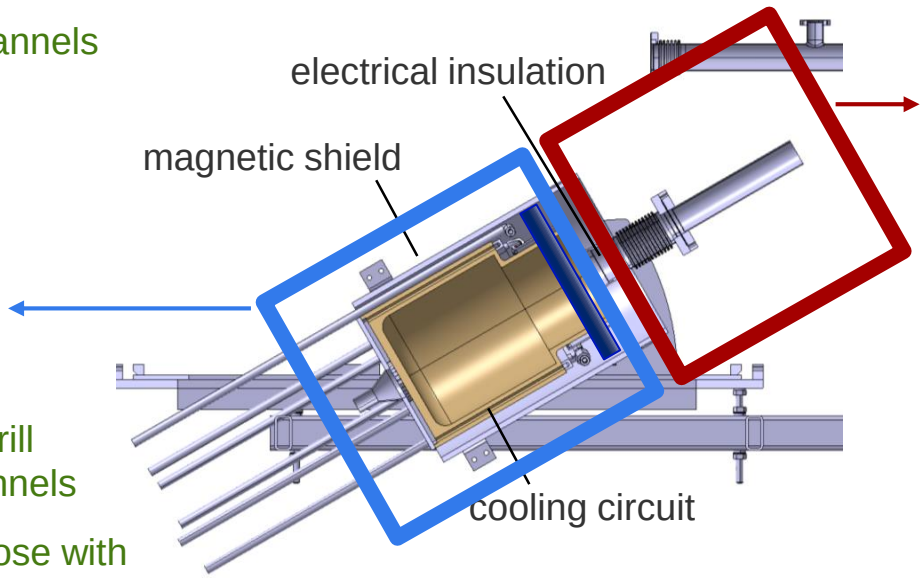
Flange SS brazed on CuCr1Zr



Drill channels

Drill channels

Close with mechanical joint



To be defined based on BINP beam dynamics simulations. It should include:

- Electrodes
- Resistive coil / permanent magnet

Drawings → 2 months
Pieces manufactured → 5 months

→ Inputs from BINP and BE/BI needed as soon as possible

Conclusions

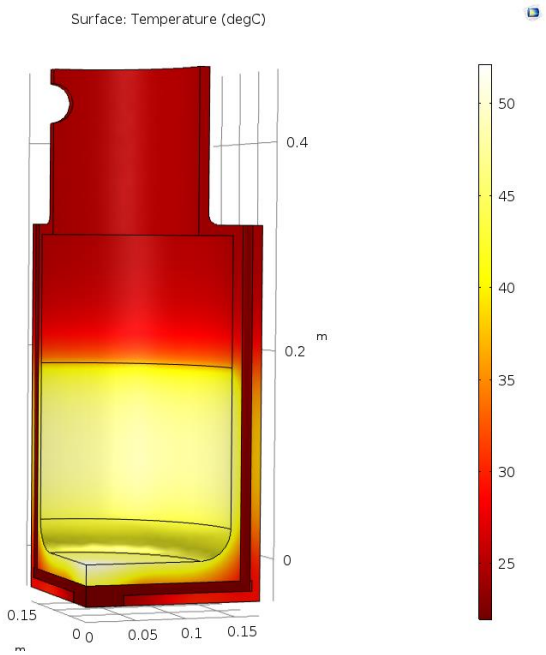
- Collector simulations performed starting from previous outcome of particle trajectory
- Recommend to use **CuCr1Zr** for higher softening temperature
- With **50 kW** and an initial water velocity of **1 m/s collector presents no issues**
- Tested also at **75 kW** and **no issues** from a **structural point** of view were detected →**T to be checked** with vacuum colleagues
- Manufacturing feasibility checked with the EN-MME workshop
- **Waiting from inputs to start with the manufacturing**

Thanks for your attention

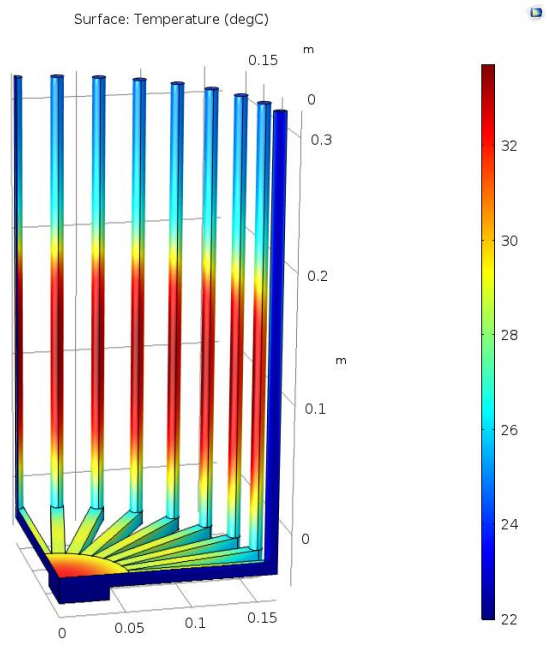
Copper – Results

COMSOL: Coupling heat transfer – turbulent flow analysis
Load: 50 kW
Material: Copper
V_{in} water = 1.5 m/s

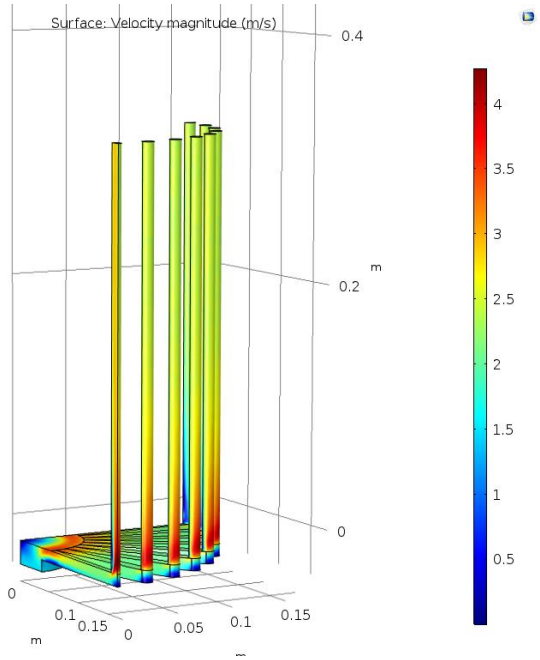
T_{max} Cu = 52 ºC



ΔT water = 12 ºC



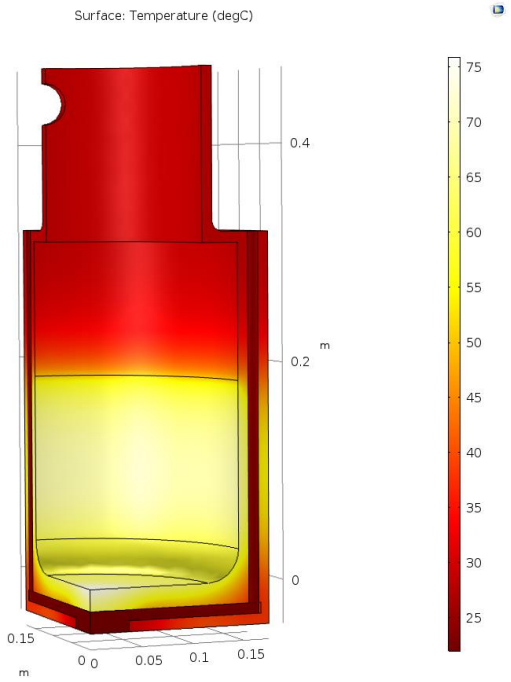
v_{max} water = 4 m/s



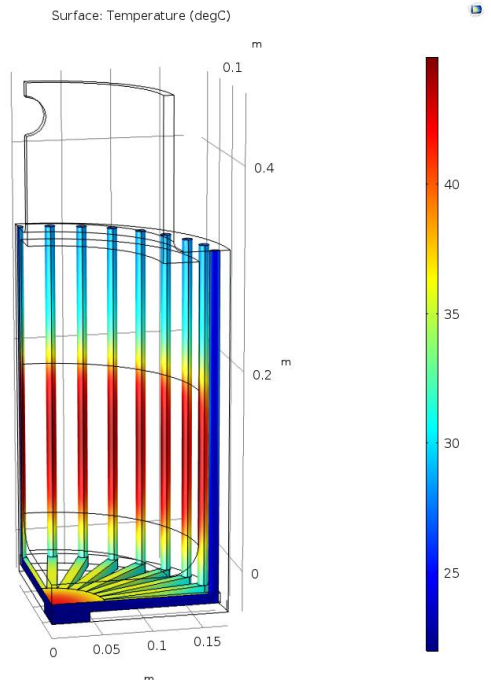
Copper - Results (1.5*Load)

COMSOL: Coupling heat transfer – turbulent flow analysis
Load: 75 kW
Material: Copper
V_{in} water = 1.0 m/s

T_{max} Cu = 75 ºC



ΔT water = 23 ºC



v_{max} water = 2.7 m/s