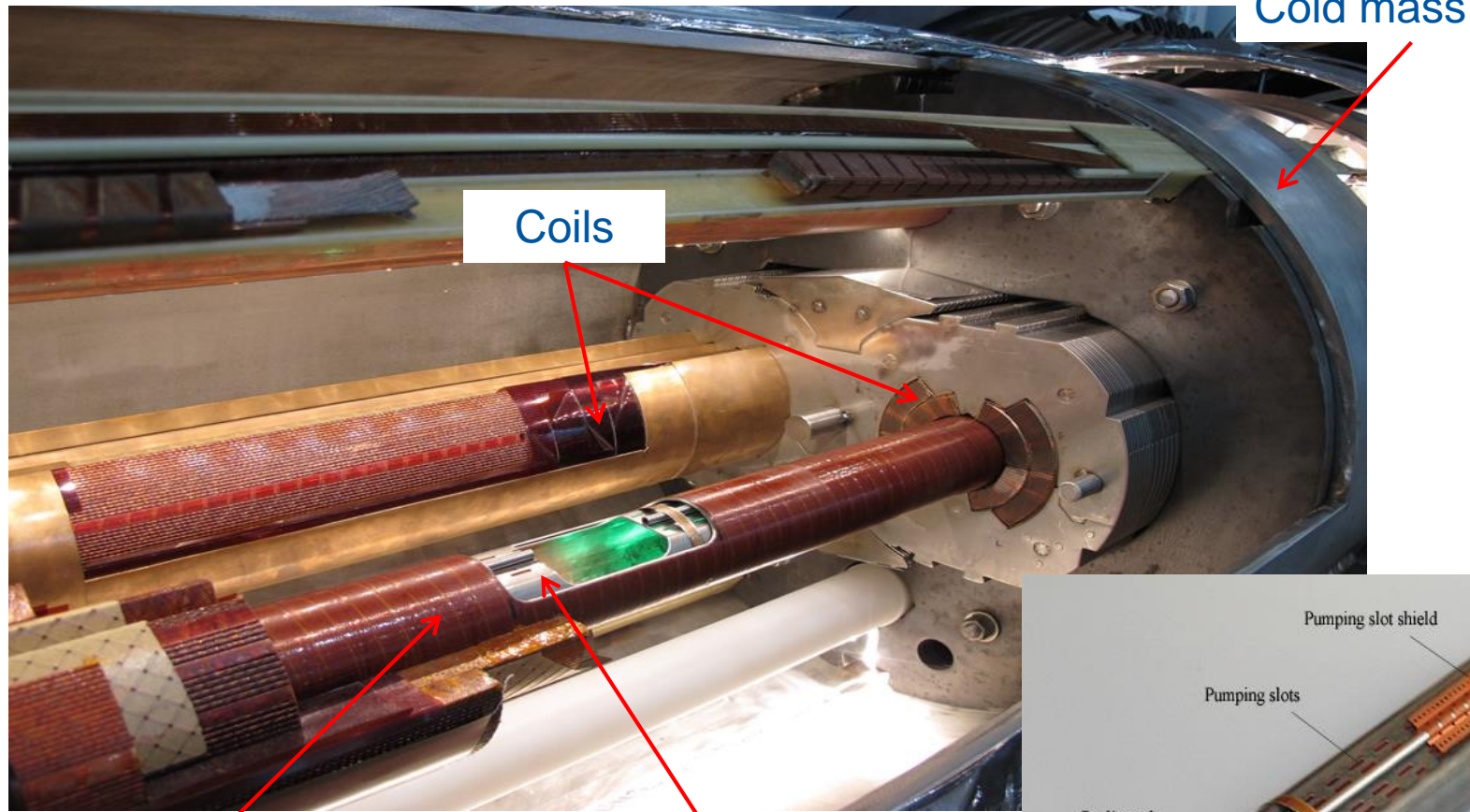




Cold vacuum system

- FCC beam screen
 - Beam screen functions and concept
 - Beam screen prototype manufacturing
 - Status
- New deformable RF finger module
- LHC cold/warm transition

LHC beam screen and cold bore



Cold bore: separation
UHV/ superfluid helium

Beam
screen



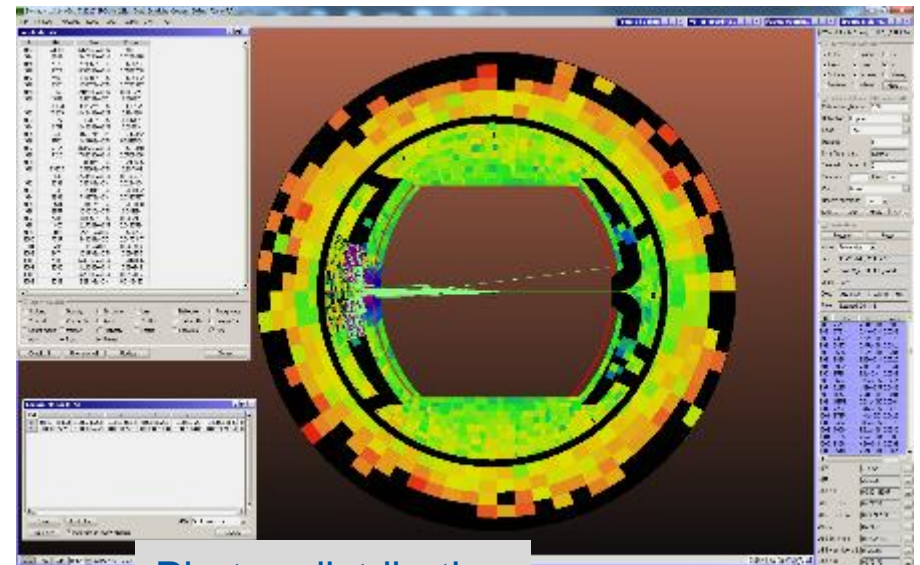
Synchrotron radiation/beam screen

Handling of high synchrotron radiation load of protons @ 50 TeV:

- **~30 W/m/beam (@16 T)** (LHC <0.2W/m)
- **5 MW total in arcs**

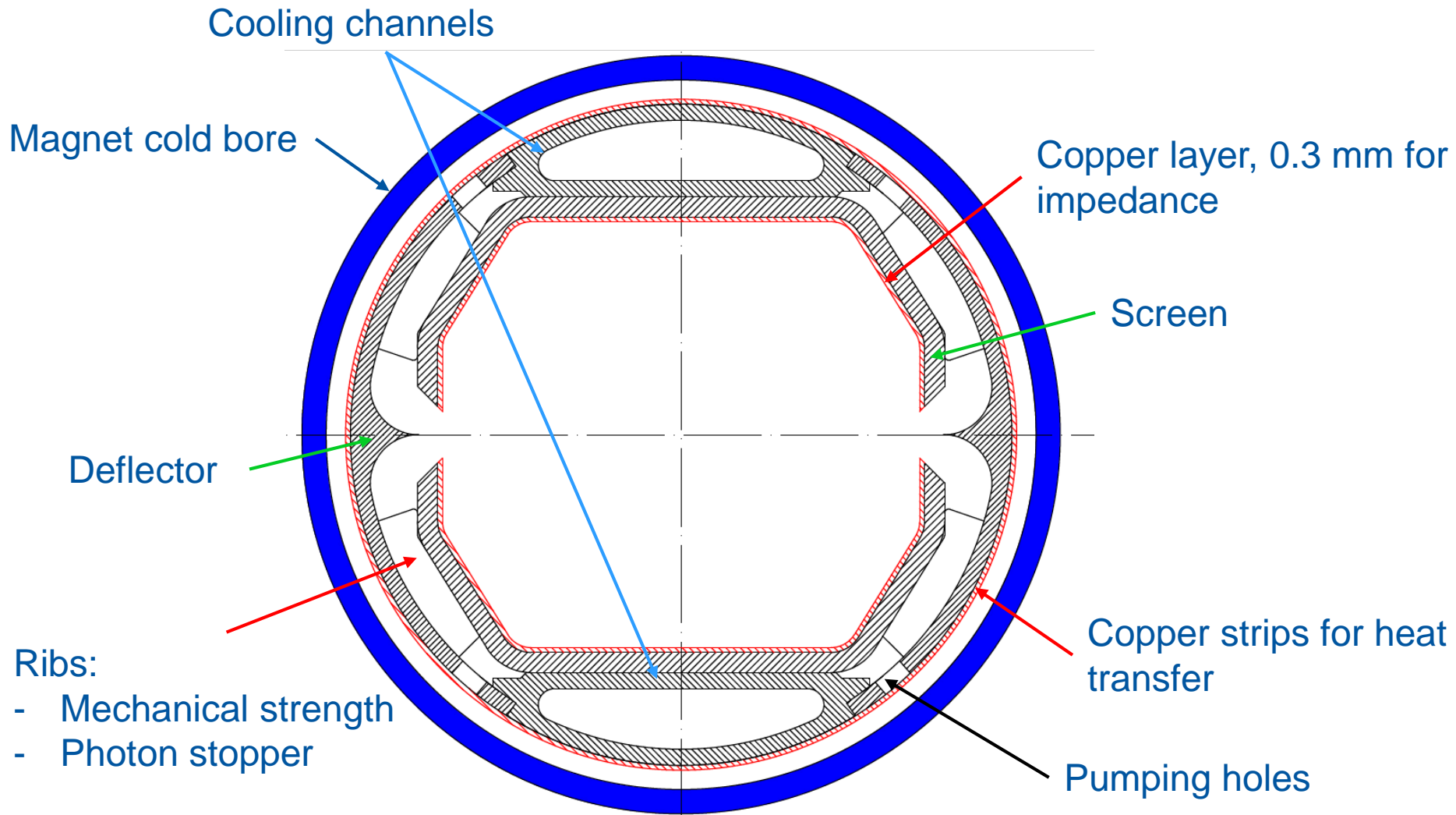
New beam screen with ante-chamber

- absorption of synchrotron radiation at 50 K to reduce cryogenic power
- avoids photo-electrons, helps vacuum



Photon distribution

Beam screen concept



Design – Main dimensions

Cold bore diameter: 44/47 mm

Beam screen wall:

- 1.25 mm P506 (high-Mn high-N st. steel)
- 0.3 mm copper

Nominal aperture:

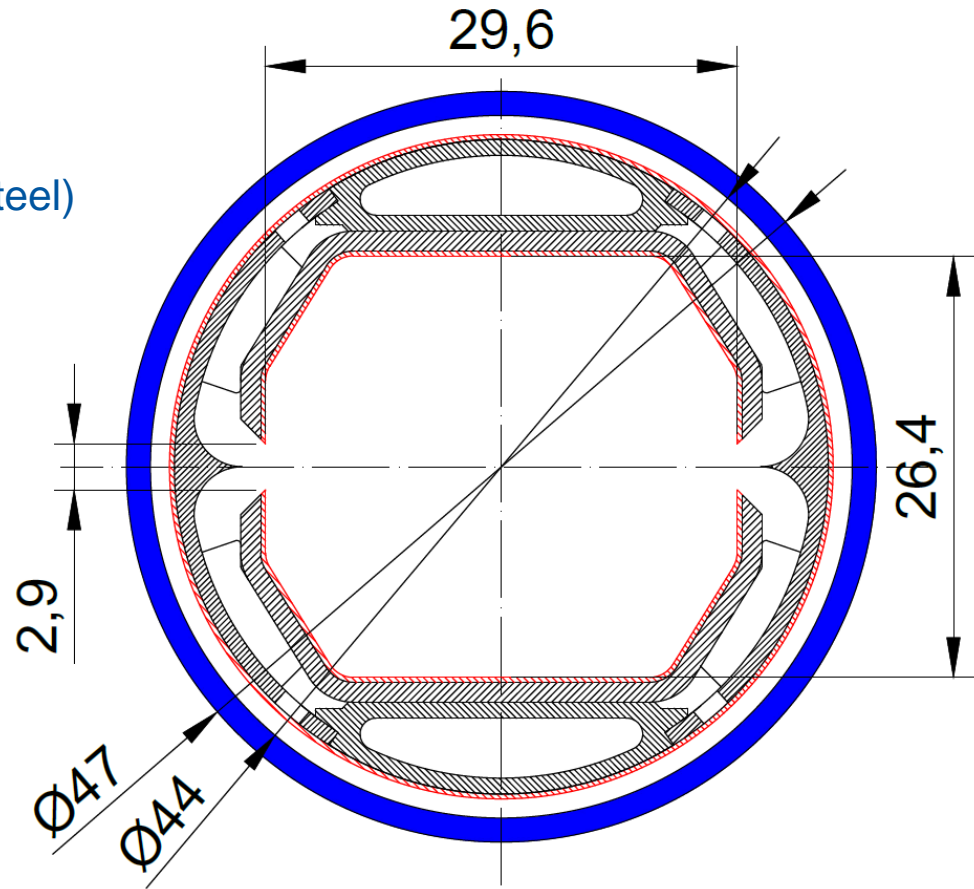
- H:~ 29.6 mm
- V:~26.4 mm

Slit height: ~ 3/5 mm

Cooling channel:

- Thickness 1 mm
- Internal 53.58 mm²
- Hydraulic diameter: 5.61 mm

Copper for heat transfer: 0.3 mm



Prototypes

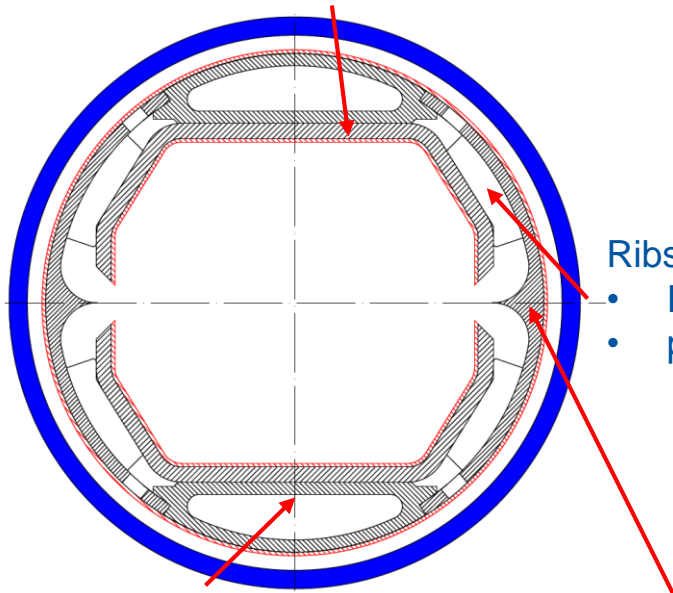
Series vs first prototypes

Sub-component manufacturing:

Series

Beam screen wall:

- P506, 1.25 mm
- copper colamination, 0.3 mm



Ribs:

- P506
- punching

Cooling channel:

- P506 stainless steel
- Extruded

Reflector:

- P506 stainless steel
- Extruded + finishing

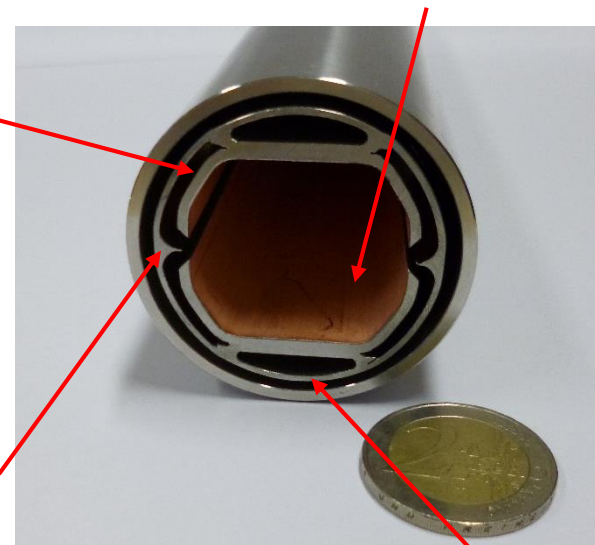
1st prototype

Beam screen wall:

- 304L, 1.5 mm
- copper electrodeposition, 0.05 mm

Ribs:

- 304L
- Laser cutting



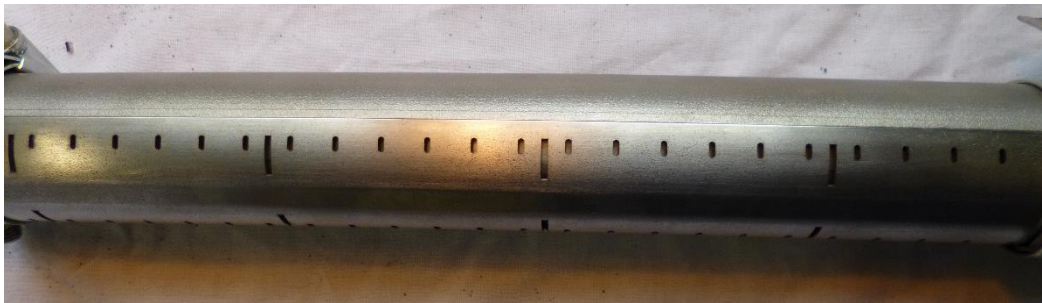
Reflector:

- 304,
- Machined + forming + finishing

Cooling channel:

- 316L,
- 3D printed + machined

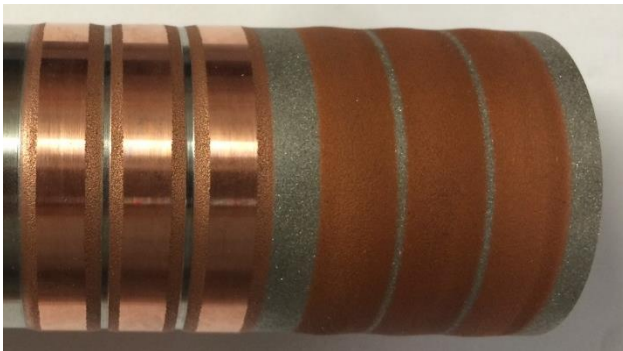
Short (30 cm) prototype manufacturing



Assembly and welding



30 cm long prototypes

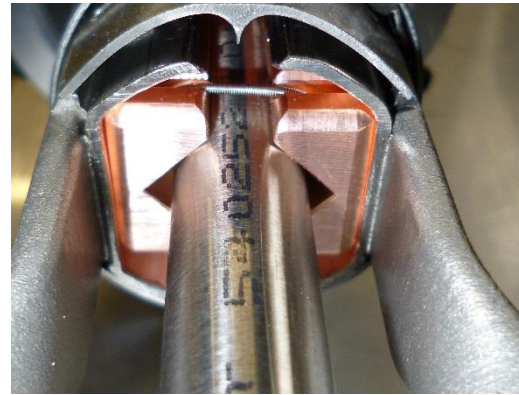


Cold sprayed copper (0.3 mm)



Status

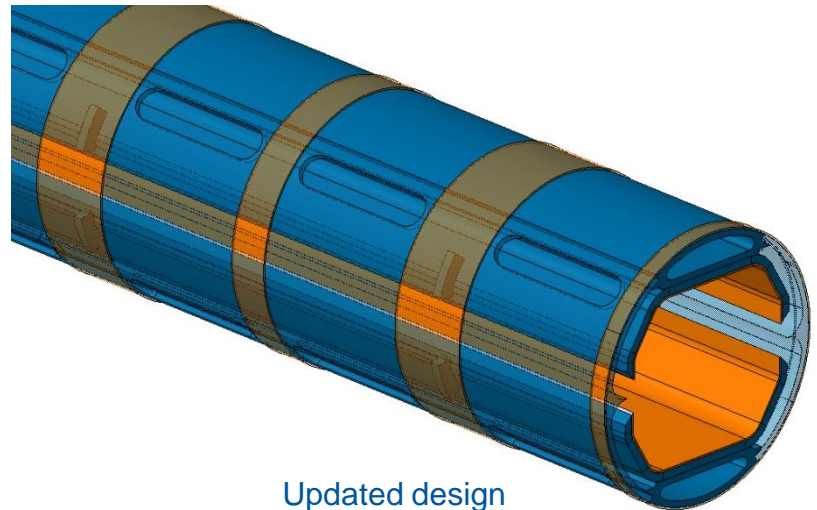
First 2m long prototype being manufactured and to be tested at ANKA.



2 m long prototype

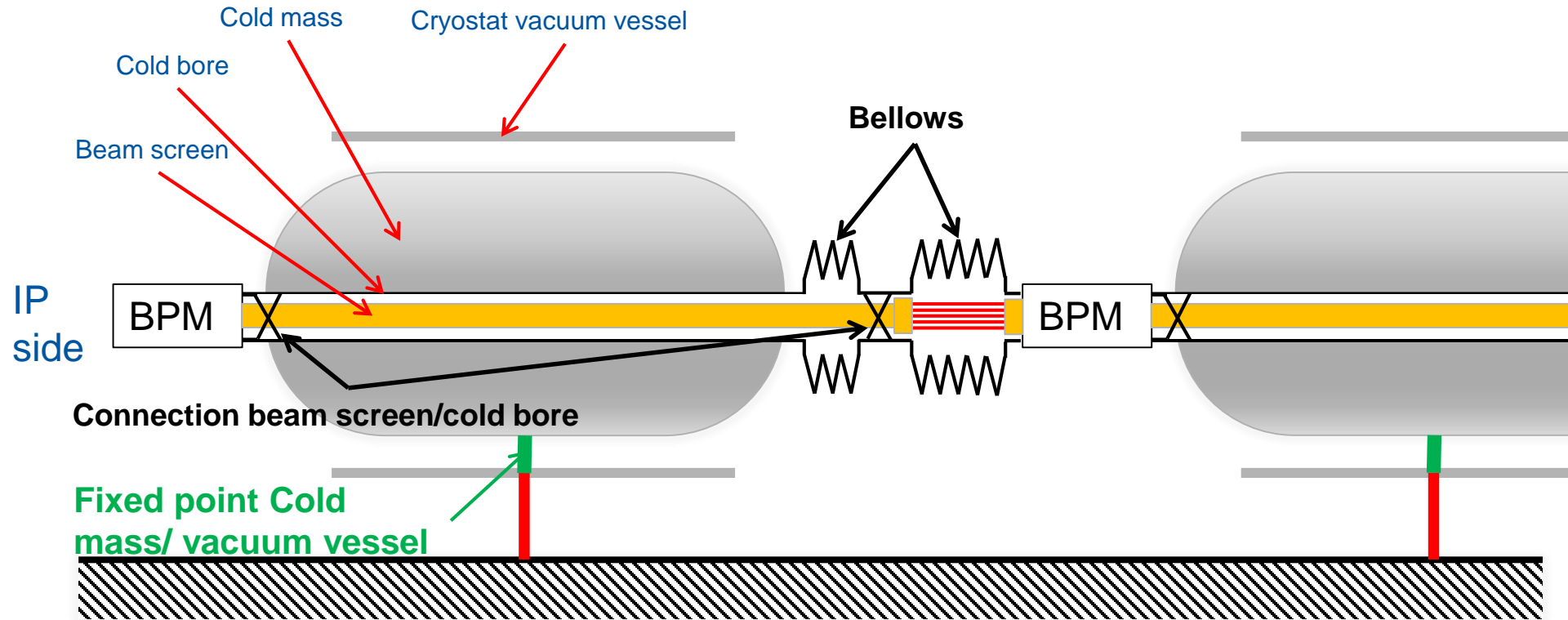
Next steps:

- New prototypes with updated design
- Beam screen interconnection



Updated design

HL-LHC cold vacuum system layout principle

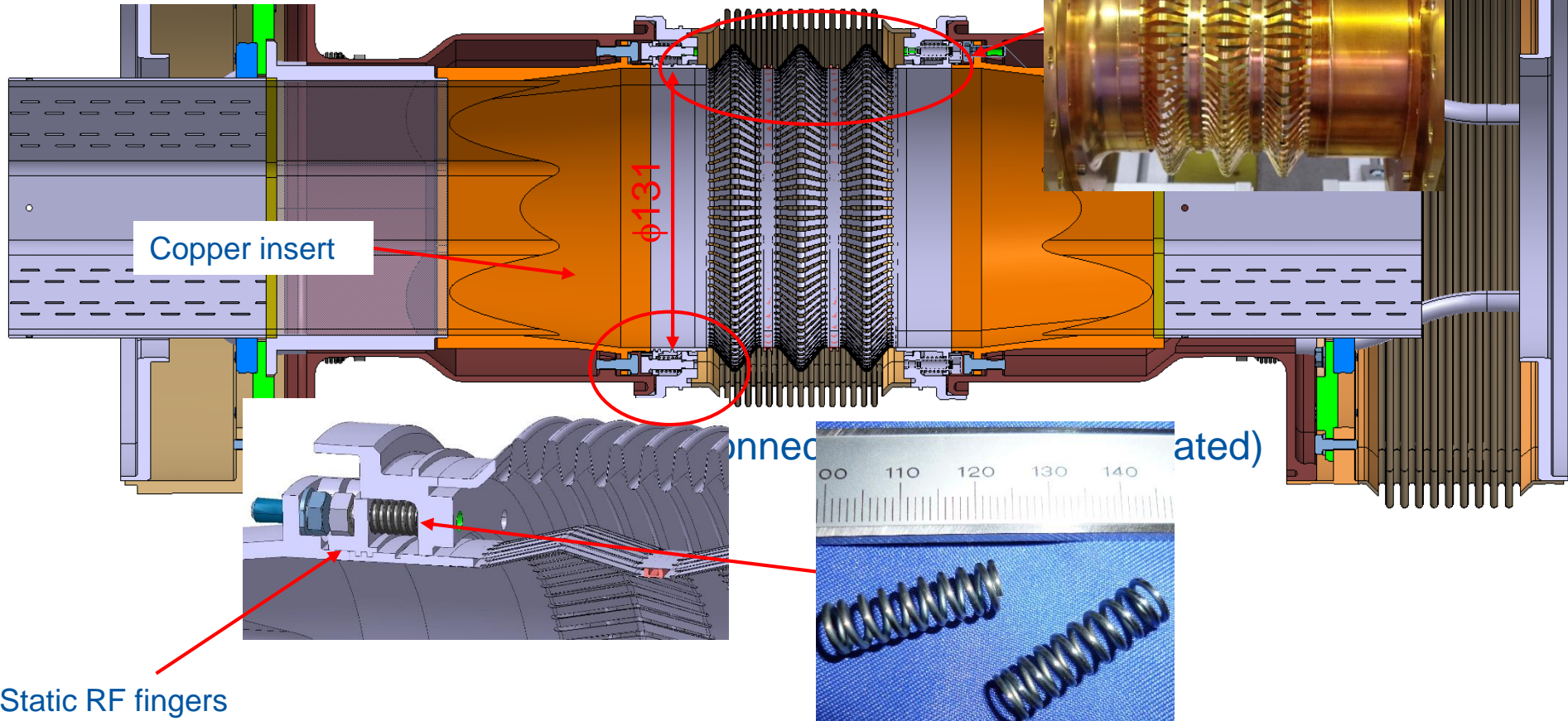


- Fixed point of the beam screen on the IP side
- Bellows between beam screen and cold bore on the other side
- Shielded bellows between the two magnets (PIM)

RF finger design in triplet area

Copper Beryllium deformable RF fingers:

- Compact and robust design
- C17410
- 0.1 mm thick, 3 mm width, gap: 1.4 mm

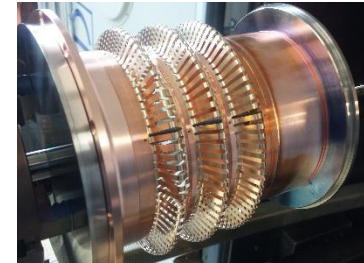


Titanium spring (total prestress: ~370 N)

Status

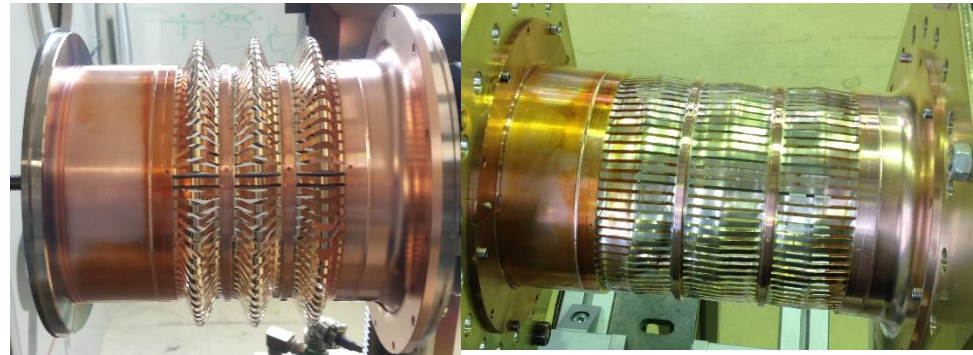
First prototypes have been manufactured.

Mechanical and RF tests have been successfully carried out.



Prototype assembly

→ Plug-in modules with deformable RF fingers are now the baseline for the HL-LHC interconnections in the triplet areas.

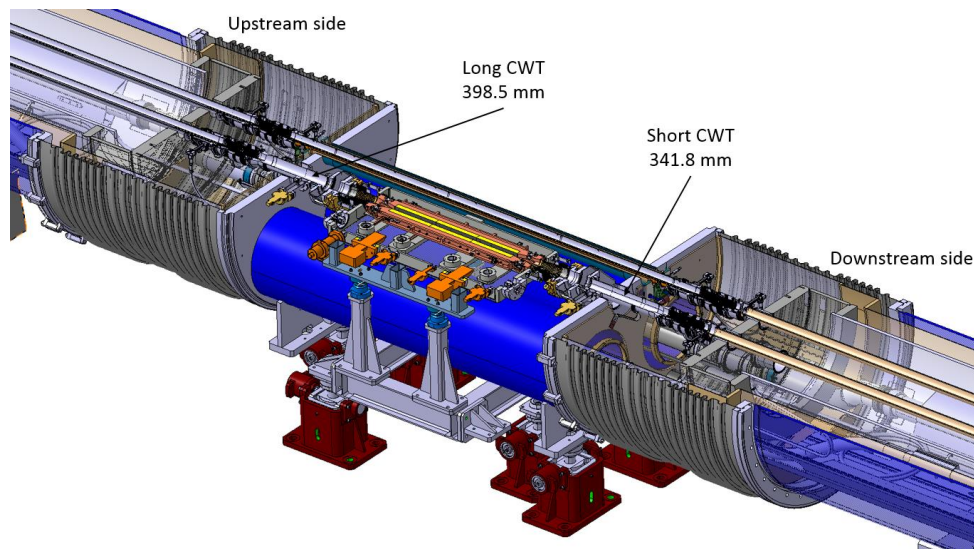


Prototype for RF measurements

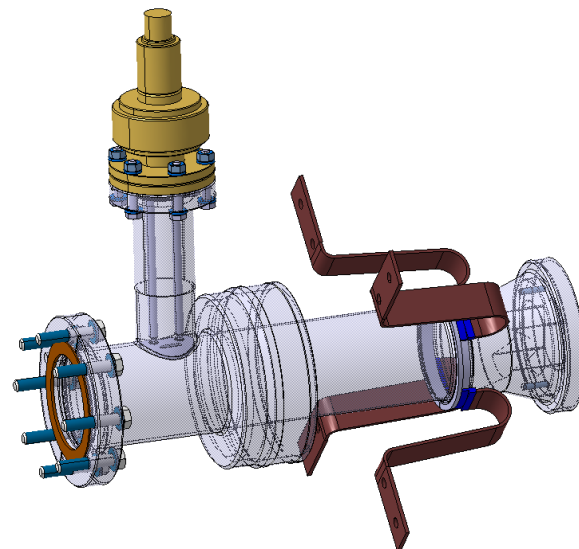
The design is being updated.

New prototypes will have to be produced and tested before the series production.

Cold/Warm transition for the collimator by-pass



Vacuum system for the collimator by-pass



New C/W transition with vacuum port integrated

The design is being completed (2D detailed drawings ongoing).

Manufacturing of two pre-series units (straight after) and then the series.



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