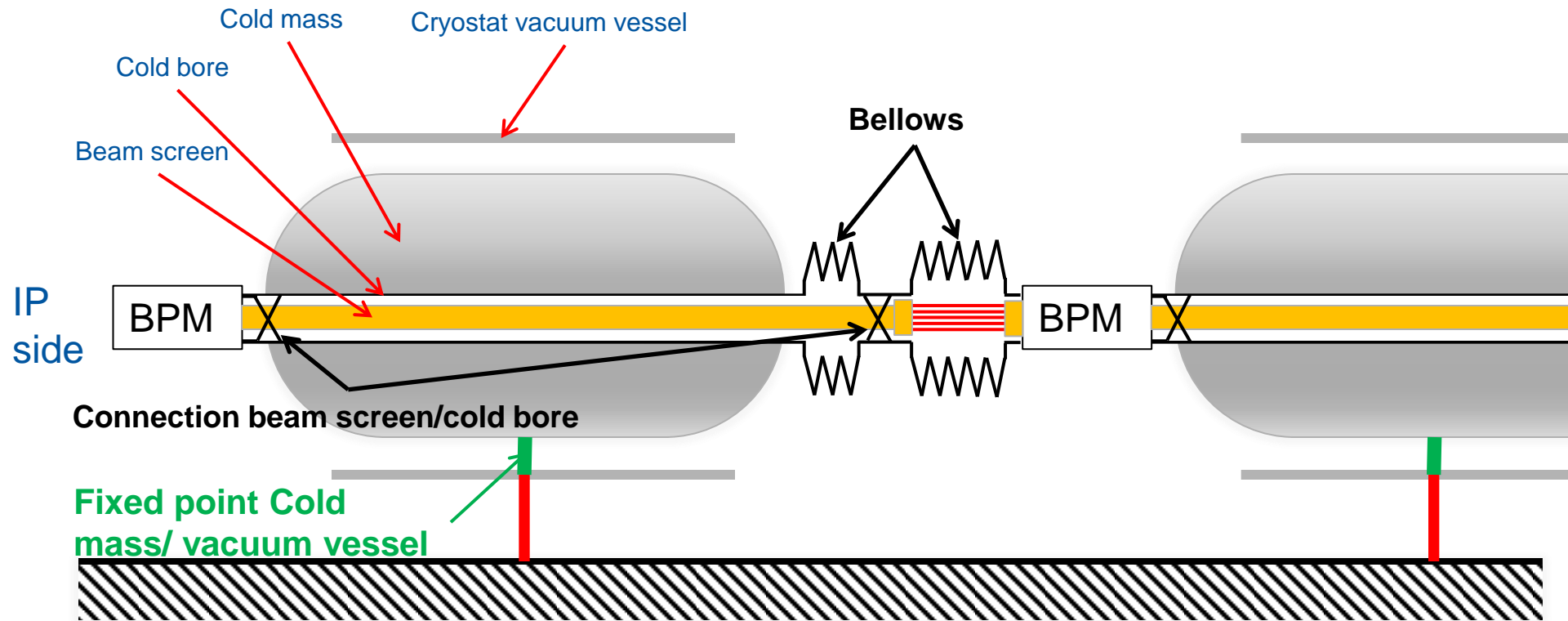# Beam Line Interconnection: snapshot of present design principles for vacuum components

C. Garion
CERN/TE/VSC

Outline:

- Layout principle

- Compensation system requirements

- Bellows/ RF finger geometrical parameters

- Conceptual design

- Next steps

Layout principle

- Fixed point of the beam screen on the IP side (Minimise the distance IP/Q1)
- Bellows between beam screen and cold bore on the other side
- Shielded bellows between the two magnets (PIM)

Compensation system requirements

The thermal expansion coefficients of the cold masses and the beam screen tube have been assumed equal to those measured during the string II operation. [B. Calcagno, EDMS 434135].

The stroke, in mm, of the compensation system has been evaluated for different cooling/warm-up scenarii, validated on string II:

	Beam screen bellows	PIM
Nominal conditions	5.2	27.5
Cool down	21.6	-10.8
Warm-up	-19.6	31.7
Exceptional 1	30.7	0.05
Exceptional 2	-19.6	20.8
Design value for the bellows	-19.6/21.6	-10.8/31.7

Bellows parameters

Beam screen bellows.
The axial stroke is specified to -19.6/21.6 mm. A transversal offset of +/- 0.5 mm is assumed.
→ The following bellows parameters are proposed:
- Internal diameter: 258 mm,
- Convolution height: 12 mm, convolution length: 68 mm, number of convolutions: 9
- 1 ply, 0.15 mm thick

PIM bellows.
The axial stroke is specified to -10.8/31.7 mm. A transversal offset of +/- 2 mm is assumed.
→ The following bellows parameters are proposed:
- Internal diameter: 160 mm,
- Convolution height: 10 mm, convolution length: 76.5 mm, number of convolutions: 15
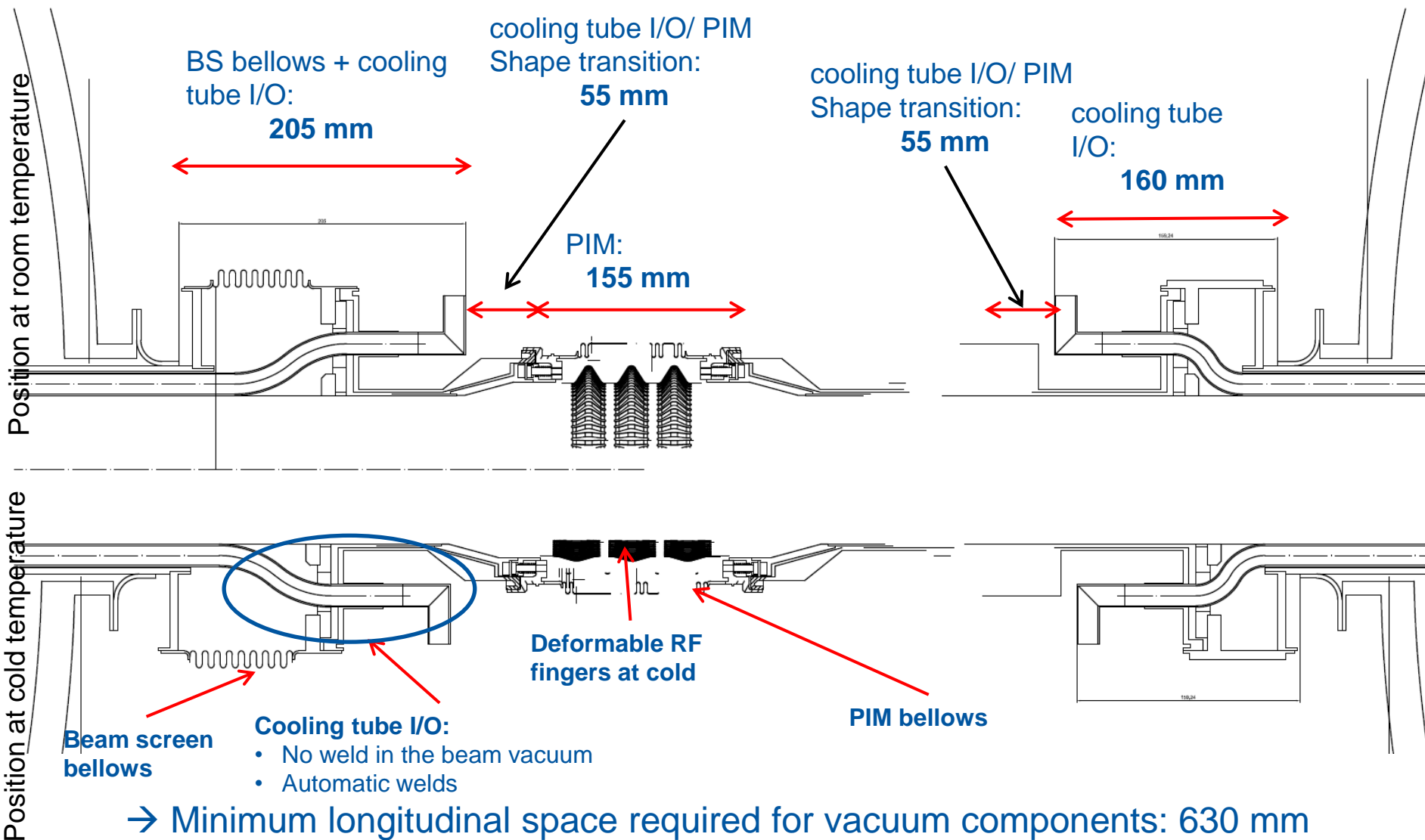- 1 ply, 0.15 mm thick

RF finger parameters

The concept of deformable fingers is considered.
The operation conditions are defined by an extension (w.r.t. to installation position) of 27.5 mm, corresponding to an angle of 15°.
→ 3 convolutions

Conceptual design

Position at room temperature

BS bellows + cooling tube I/O:
205 mm

cooling tube I/O/ PIM
Shape transition:
55 mm

PIM:
155 mm

cooling tube I/O/ PIM
Shape transition:
55 mm

cooling tube I/O:
160 mm

Position at cold temperature

Deformable RF fingers at cold

PIM bellows

Beam screen bellows

Cooling tube I/O:
• No weld in the beam vacuum
• Automatic welds

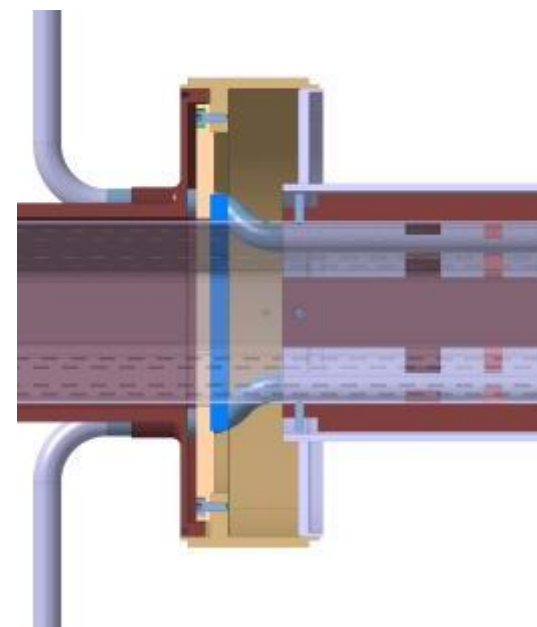→ Minimum longitudinal space required for vacuum components: 630 mm

Next steps

- 3D model of beam vacuum interconnections and, in parallel, continue the design of components
- Design, with BE/BI, the interfaces with BPM to optimize the longitudinal space
- Fix the interconnection length (Q2 2015)
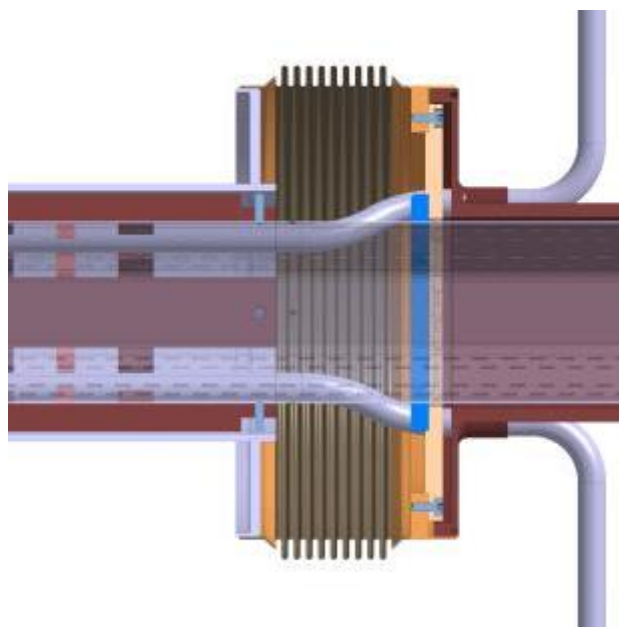
Preliminary 3D model of the sliding point

Preliminary 3D model of the fixe point

And then, prototyping of beam screen extremities and vacuum interconnections.