

Design Review of Tunnel Transfer Line

Michał Stanclik, PhD

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Presentation plan

- 1 TTL Overview
- 2 Bayonet can design
 - Vacuum vessel
 - Thermal shield
 - Process pipes
 - Process pipes supports
- 3 Coupler design
- 4 Turnaround Can design
- 5 Interconnections
- 6 Summary

Intermediate Transfer Line Overview

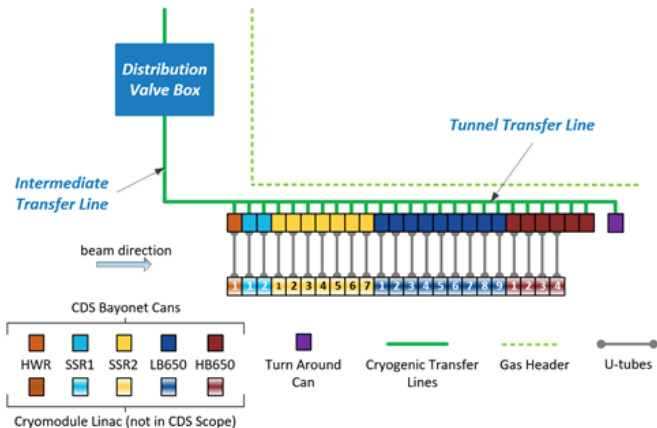


Figure 1: View on Tntermediate Transfer Line

Intermediate Transfer Line Overview

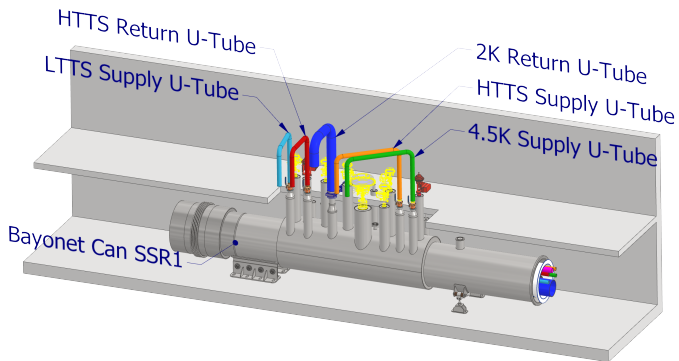


Figure 2: View on Bayonet Can SSR1

Intermediate Transfer Line Overview

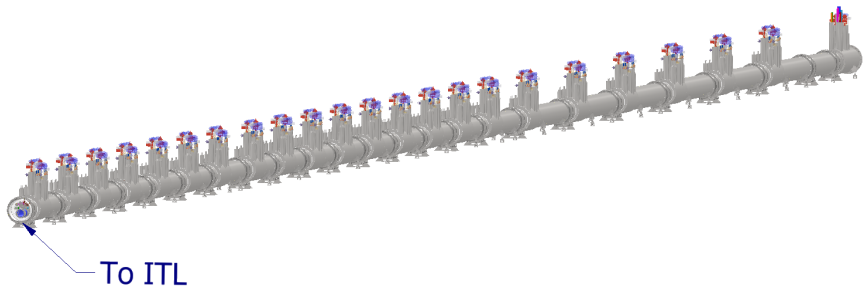


Figure 3: View on Tntermediate Transfer Line

TTL operating parameters

Table 1: Process pipes operating parameters

Pipe description	Size	OPmax, bar a	PS, bar a	Tn, K	Do, mm
2 K Return	10"	0.0313	4.1	3.8	273
4.5K Supply	2"	4.0	20	4.5	60.3
LTTS Return	2"	4.0	20	9	60.3
HTTS Supply	2"	18	20	40	60.3
HTTS Return	2"	18	20	80	60.3
Cool Down Return	3"	18	20	10/300	88.9
Vacuum Shield - ITL	28"	0/1.5*	0/1.5*	300	711

where:

OP_{max} - maximum operating pressure,

PS - design pressure,

T_n - operating temperature,

D_o - outer pipe diameter,

Pipes layout

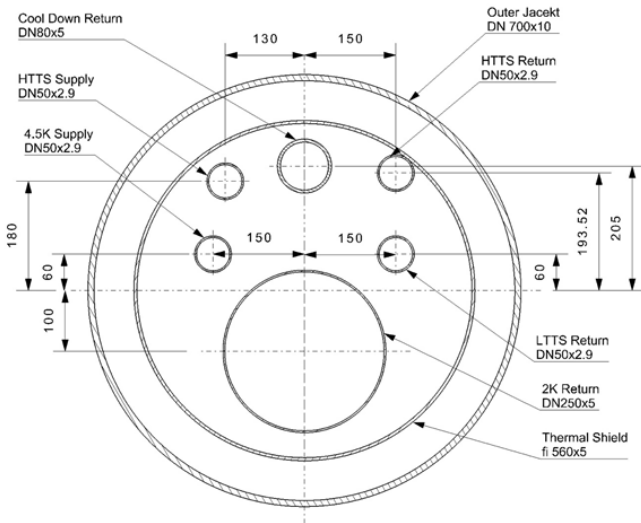


Figure 4: TTL process pipes layout

Bayonet can design

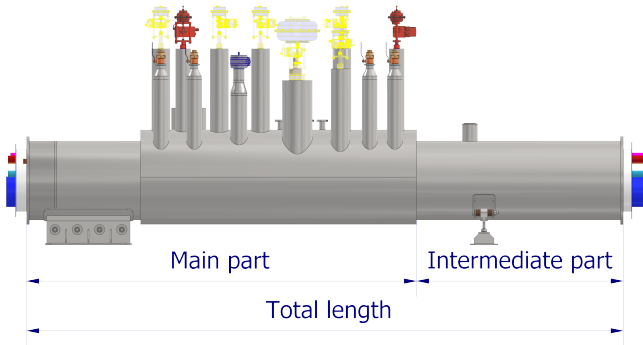


Figure 5: Bayonet can design

Bayonet cans layouts

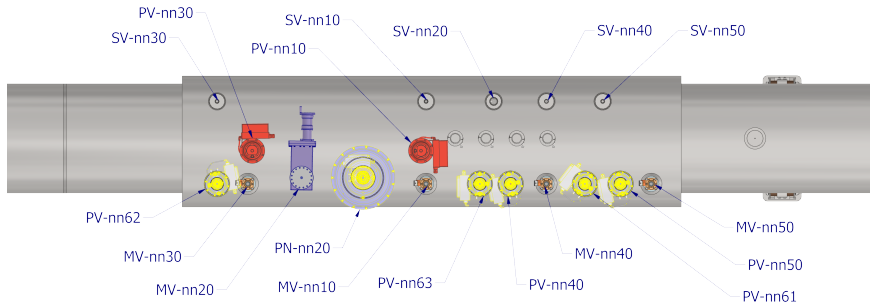


Figure 6: I Layout of valves and bayonets (Only in BC HWR)

Bayonet cans layouts

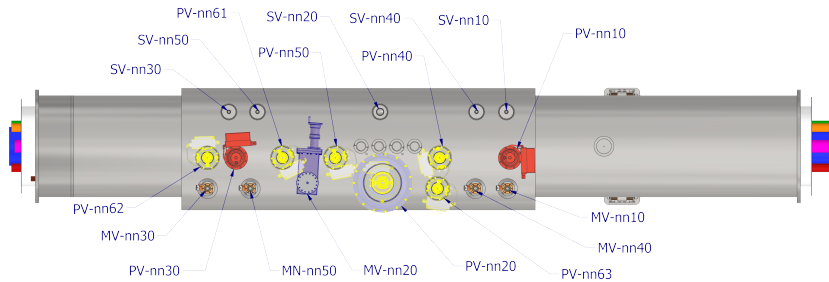


Figure 7: II Layout of valves and bayonets (in BC 2-10)

Bayonet cans layouts

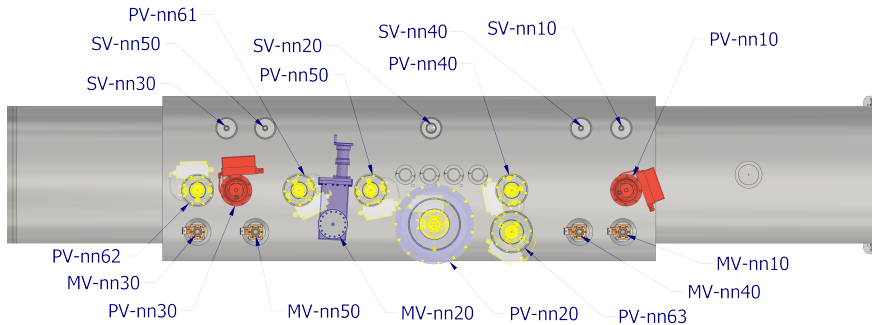


Figure 8: III Layout of valves and bayonets (in BC 11-25)

Bayonet cans design combinations

Table 2: Design details of individual bayonet cans

No	Type	Position (Fig. 1)	Qty	Layout (Fig. 6, 7, 8)	Total length, mm	Qty of ISS	Qty of ESS
1	HWR	1	1	I	6434	1	1
2	SSR1 L1	2	1	II	5356	1	1
3	SSR1 L2	3	1	II	5954	1	1
4	SSR2 L1	4-9	6	II	6058	1	1
5	SSR2 L2	10	1	II	7291	2	2
6	LB650 L1	11-18	7	III	6023	1	1
7	LB650 L1 VB	16	1	III	6023	1	1
8	LB650 L2	19	1	III	8074	2	2
9	HB650	20-25	6	III	10420	3	2

where:

ISS - internal sliding support,

ESS - external sliding support.

Each bayonet consists of the following elements

- vacuum vessel
- thermal shield
- process pipes
- process pipes internal supports

Bayonet can design - vacuum vessel

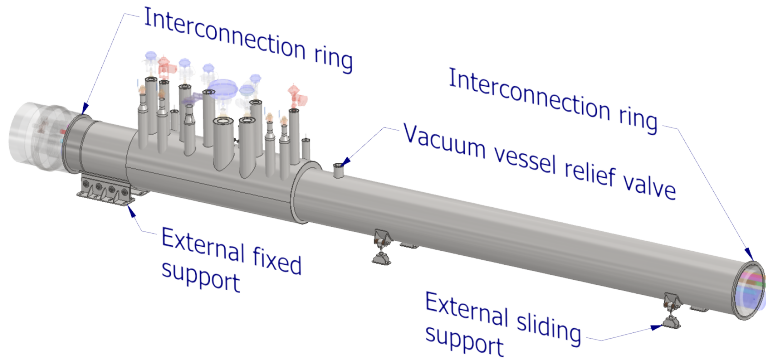
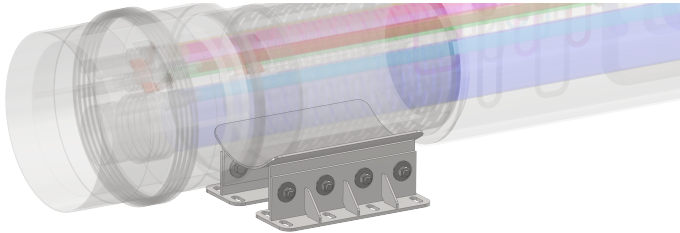
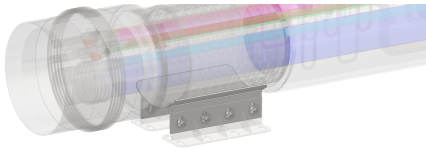


Figure 9: View on the vacuum vessel of LB650 Bayonet Can

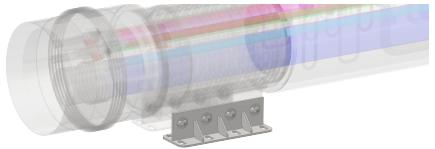
Bayonet can design - vacuum vessel supports



(a) View of fixed support



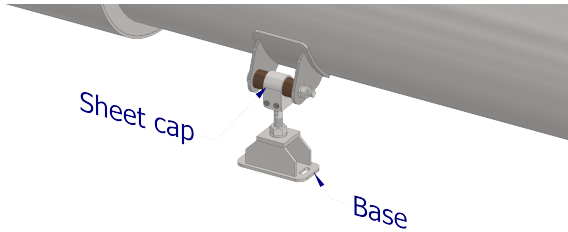
(b) View on the upper part of fixed support



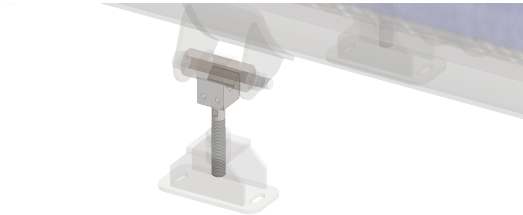
(c) View on the bottom part of fixed support

Figure 10: Design of vacuum vessel external fix support

Bayonet can design - vacuum vessel supports



(a) Design of sliding support



(b) view on the V shape groove in sliding socket

Figure 11: View on vacuum vessel sliding support

Bayonet can design - thermal shield

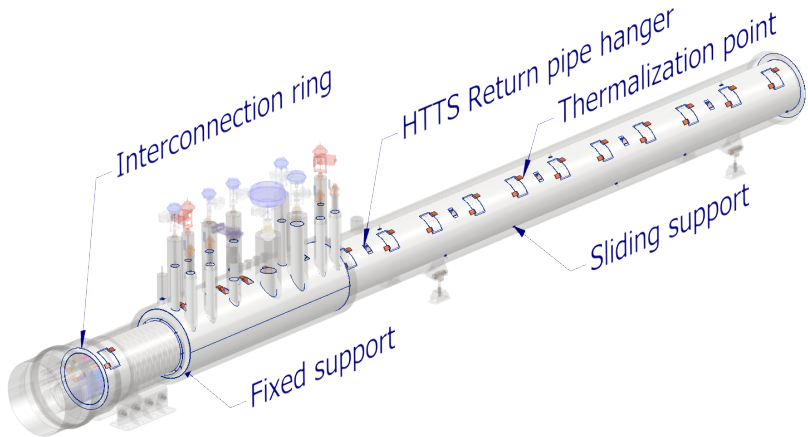


Figure 12: View on the thermal shield of Bayonet Can HB650

Bayonet can design - thermal shield

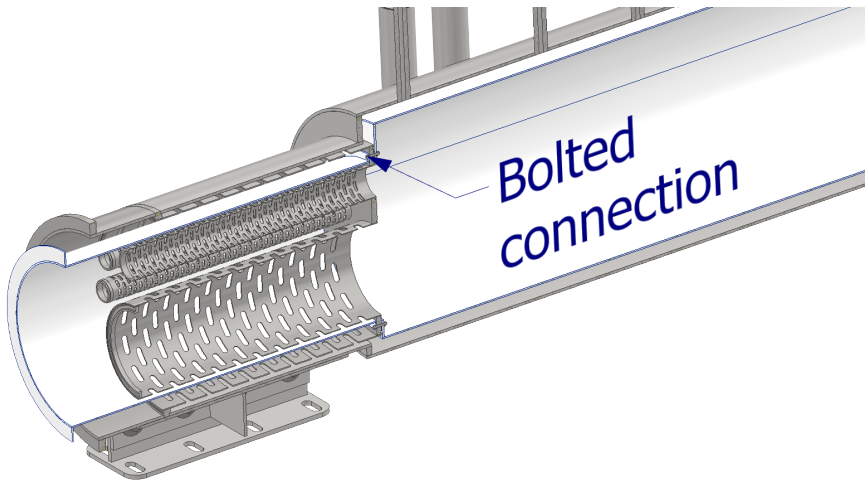


Figure 13: View on the thermal shield fix support

Bayonet can design - thermal shield



Figure 14: Scheme of thermal shield support system

Bayonet can design - thermal shield

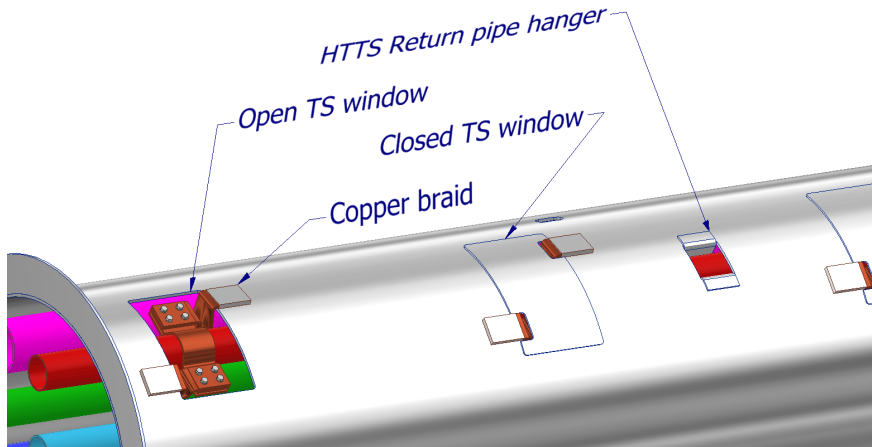


Figure 15: View on the thermal shield thermalization

Bayonet can design - process pipes

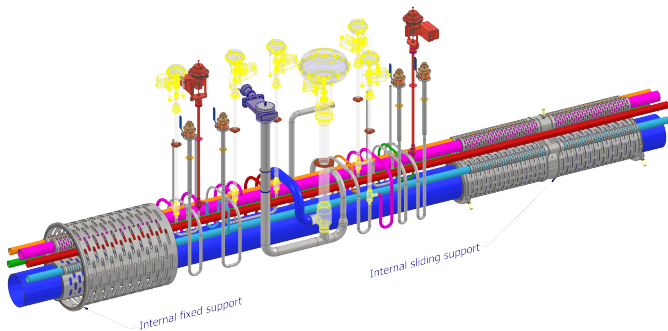


Figure 16: Process pipes with support system in bayonet can SSR1

Bayonet can design - process pipes supports

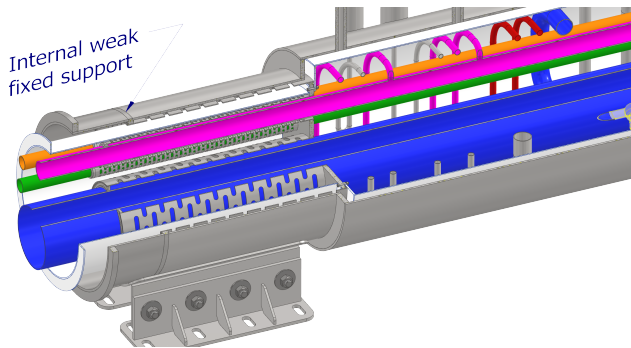


Figure 17: Process pipes weak fixed support

Bayonet can design - process pipes supports

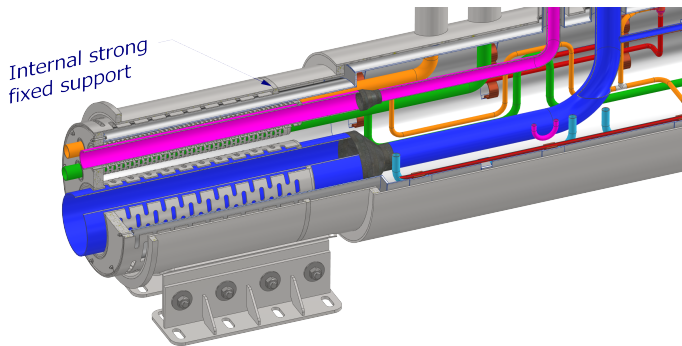


Figure 18: Process pipes strong fixed support

Bayonet can design - process pipes supports

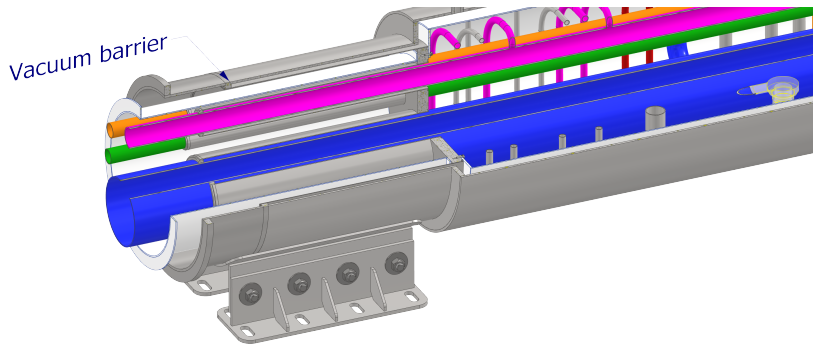


Figure 19: Vacuum barrier

Bayonet can design - process pipes supports

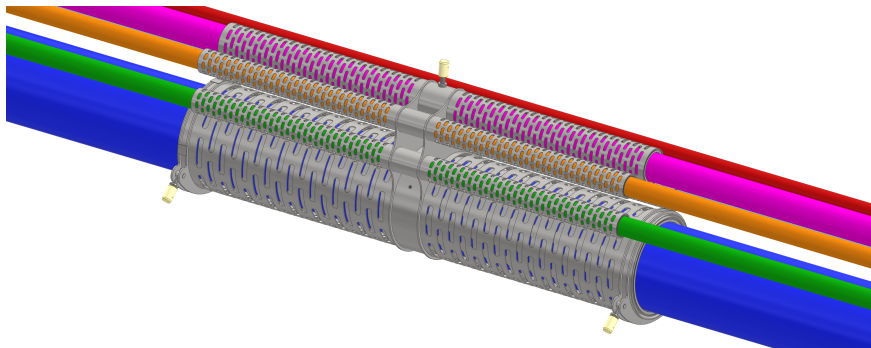


Figure 20: Process pipes sliding support

Bayonet can design - process pipes supports

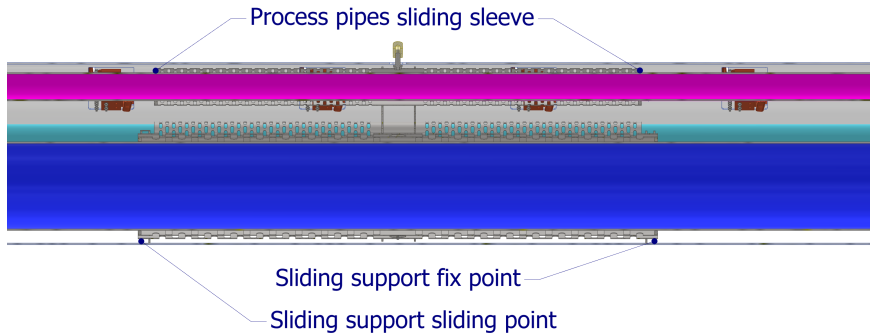


Figure 21: Process pipes sliding support

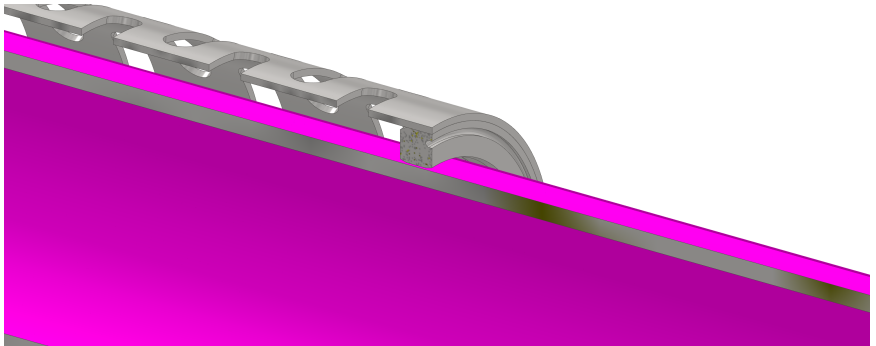


Figure 22: Sliding sleeve in sliding support

Bayonet can design - process pipes supports

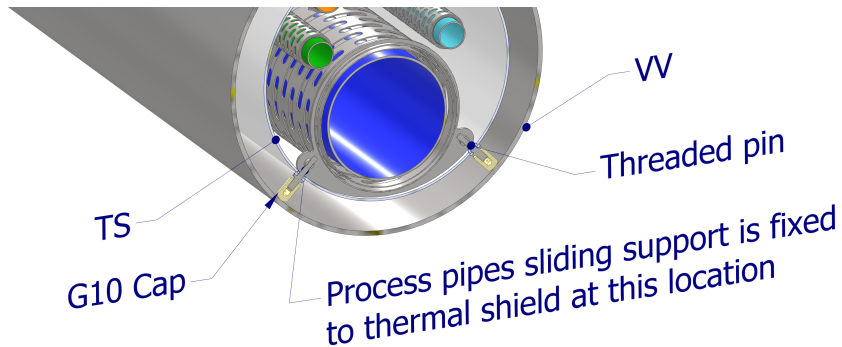


Figure 23: Process pipes sliding support connection with thermal shield

Bayonet can design - process pipes supports

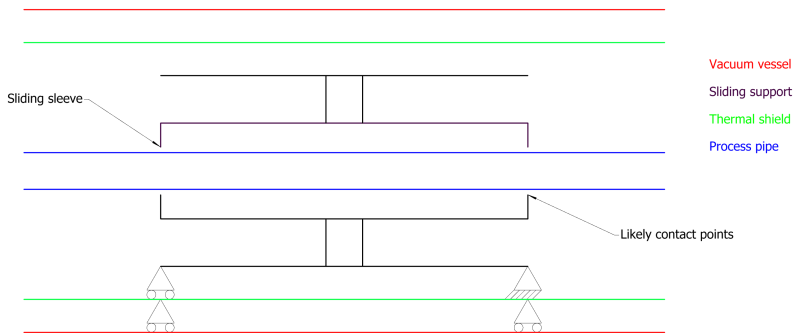


Figure 24: Process pipes sliding support scheme



Figure 25: View on the Coupler design

Coupler consists of the following elements

- vacuum vessel
- thermal shield
- process pipes

Coupler design - vacuum vessel

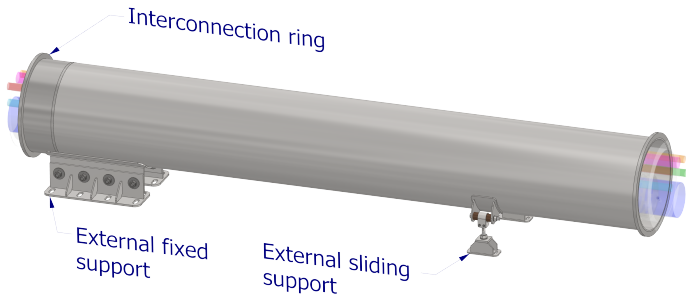


Figure 26: View on the Coupler vacuum vessel

Coupler design - thermal shield

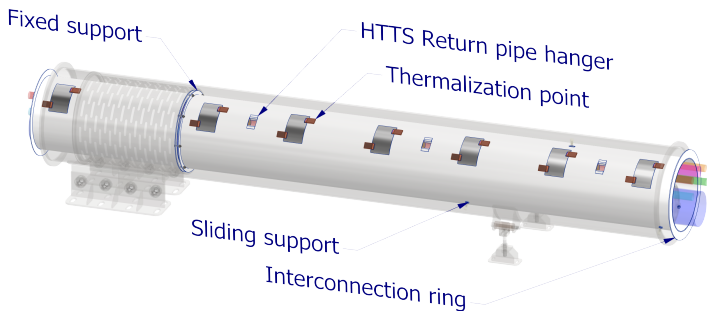


Figure 27: View on the Coupler thermal shield

Coupler design - process pipes

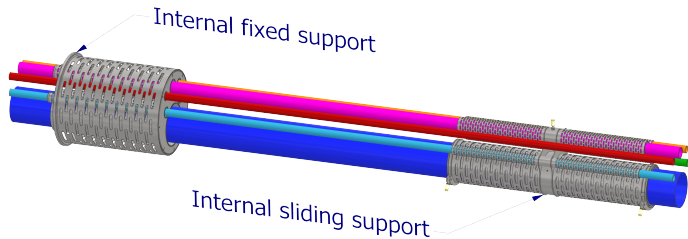


Figure 28: View on the Coupler process pipes

Turnaround Can design

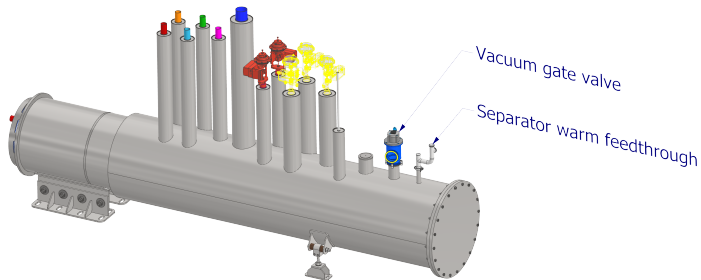


Figure 29: View on the turnaround can design

Turnaround can consists of the following elements

- vacuum vessel
- thermal shield
- process pipes

Turnaround Can design - thermal shield

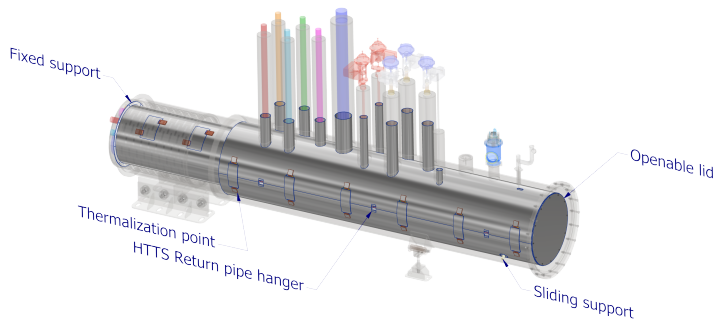


Figure 30: View on the turnarounds can design - thermal shield

Turnaround Can design - thermal shield

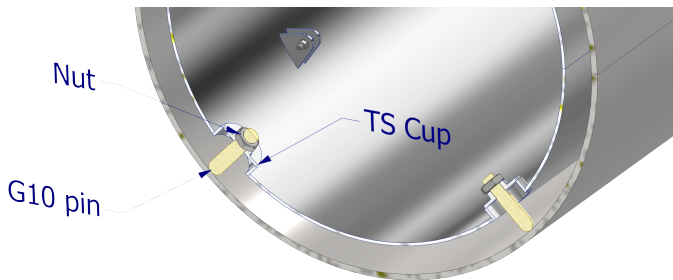


Figure 31: View on the turnaround can design - thermal shield

Turnaround Can design - thermal shield

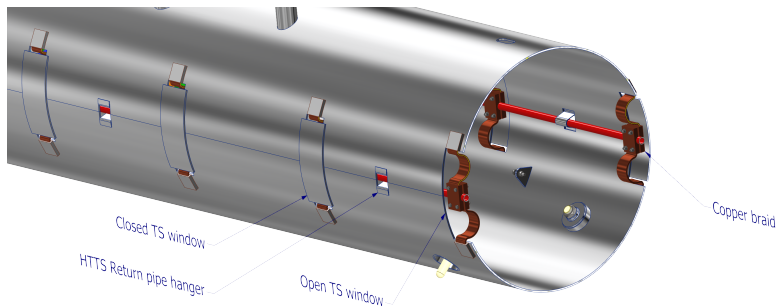


Figure 32: View on the turnaround can design - thermal shield

Turnaround Can design - process pipes

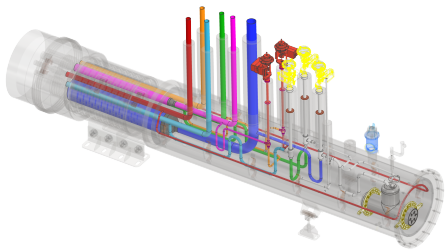


Figure 33: View on the turnaround can design - process pipes

Turnaround Can design - separator

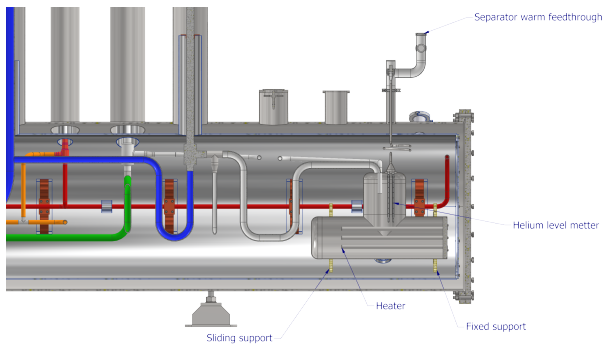


Figure 34: View on the turnarounds can design - separator

Turnaround Can design - separator

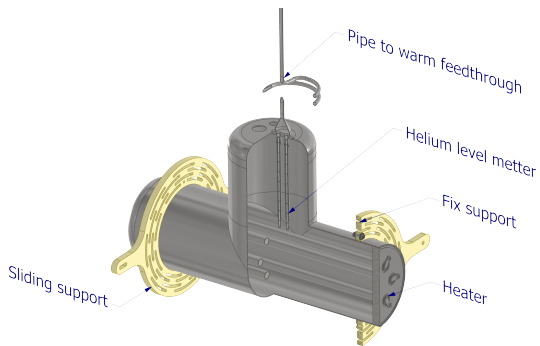


Figure 35: View on the turnaround can design - separator

Interconnections

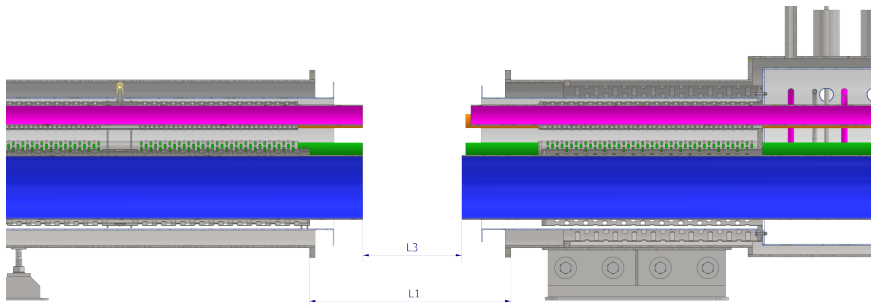


Figure 36: Interconnection assembly sequence - step I

Interconnections

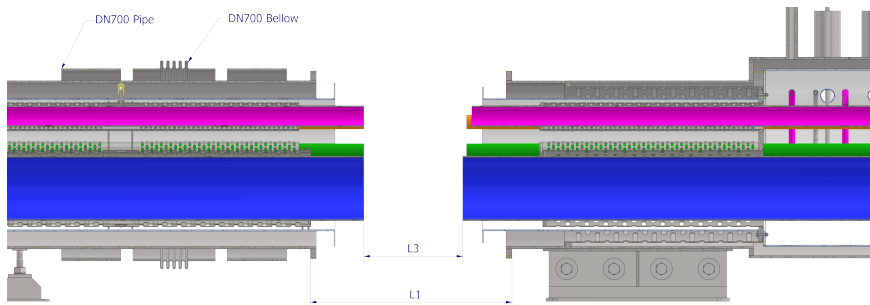


Figure 37: Interconnection assembly sequence - step II

Interconnections

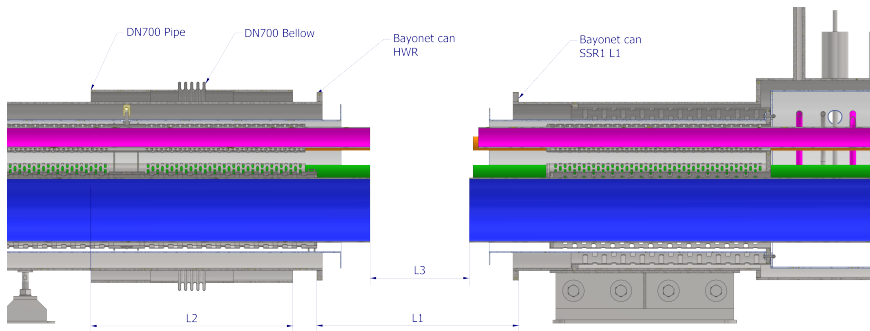


Figure 38: Interconnection assembly sequence - step III

Interconnections

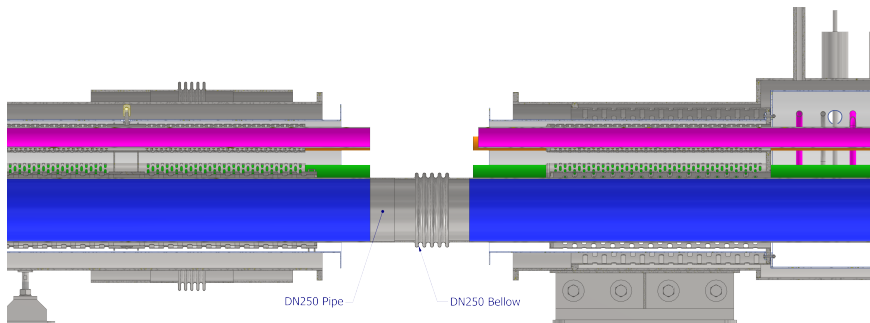


Figure 39: Interconnection assembly sequence - step IV

Interconnections

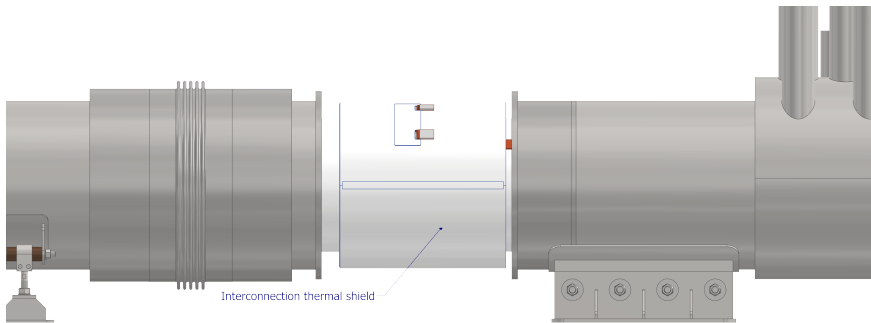


Figure 40: Interconnection assembly sequence - step V

Interconnections

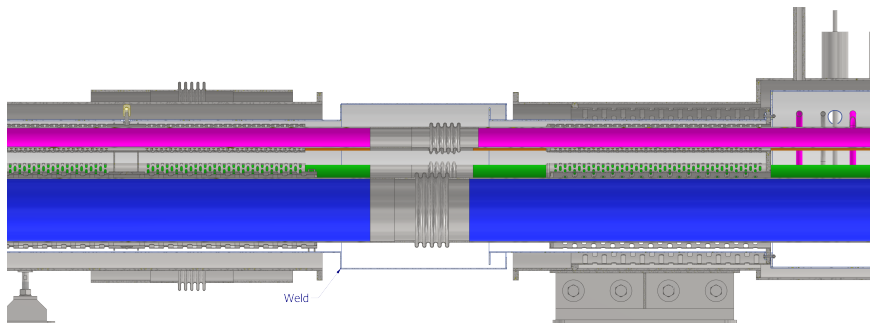


Figure 41: Interconnection assembly sequence - step VI

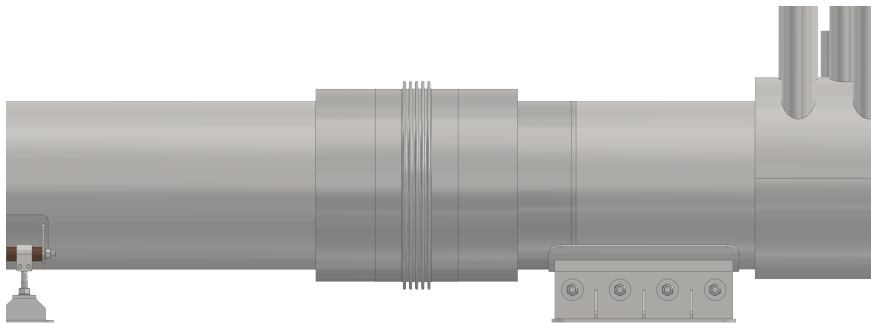


Figure 42: Interconnection assembly sequence - step VII

The scope of the TTL project done by WUST includes:

- Design in acc. to
 - EN 13458-2:2002 Cryogenic vessels, static vacuum insulated vessels. Part 2 design, fabrication, inspection and testing
 - EN 13480-3:2012 Metallic industrial piping. Part 3: Design and calculations
- Conceptual 3D model,
- FEM calculations