CSPEC Guide System Design Description for TG3

	Name	**Role/Title**
Owner	Pascale Deen Joseph Guyon Le Bouffy Luis Laoiza	CSPEC Lead Scientist CSPEC Lead Engineer CSPEC Guide Engineer
Reviewer	G. Laszlo	Neutron Instruments Lead Engineer
Approver	S. Kennedy	NSS Project Leader

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1. SCOPE

- This document contains the Technical Design Description of the CSPEC guide and the housing system.
- Verification of the fulfilment of high and low-level requirements.
- As part of the TG3 documentation this document and those referenced herein shall provide information to a level of detail sufficient to perform the components detailed design of the system.

2. ISSUING ORGANISATION

CSPEC Instrument team, TUM.

3. CONTEXT

The purpose and scope of the document is the following:

- Verification of the CSPEC optics system to deliver the CSPEC high level optics requirements.
- Overview of the interfaces: vacuum, ICS, handling.
- Overview of design considerations: materials, installation, handling and transport, maintenance, survey, ES&H.

The aim of this document is to provide an overview of typical guide, vacuum housing and support solutions throughout the CSPEC instrument. A complete overview of the CSPEC components are given in Figure 1. However, since the bunker region is the most complex, this is the region that the CSPEC team have focussed on in this document.

It should be noted that currently no detailed shielding calculations have been performed and therefore the addition of in-bunker collimators and a T0 chopper is not yet considered in detail. These will be implemented, if necessary, according to MCMP calculations. Space has nevertheless been envisaged.

4. HIGH LEVEL REQUIREMENTS AND SOLUTIONS

4.1. Beam Transport and Conditioning System (BTCS)

Initial function statement: The beam transport system transports a beam of neutrons from the moderator surface to the sample. The size, divergence and wavelength spectrum of the beam are tailored to the needs of the experiment. An overview of the BTCS parameters are provided after the functional requirements.

Functional requirements

1. **Beam size**
    1.1. The BTS shall transport from the moderator to the sample a beam of neutrons with maximum size (full width half maximum) of 4 ± 0.1 cm x 2 ± 0.1 cm (height x width) and minimum size of 1 ± 0.1 cm x 1 ± 0.1 cm (height x width).
    1.2. **Rationale**: Matching the beam size to the sample size maximises the signal to noise.
    1.3. **Verification**: Measurement of the beam intensity profile at sample.
2. **Beam flux variation**
    2.1. The BTS shall transport to the sample a beam of neutrons whose flux does not vary by 20% across the sample area for unfocussed beams (4 ± 0.1 cm x 2 ± 0.1 cm (height x width))
    2.2. **Rationale**: It is necessary that the flux profile is uniform across the sample for adequate data analysis.
    2.3. **Verification**: Measurement of the beam intensity profile at sample
3. **Beam divergence**
    3.1. The BTS shall transport from the moderator to the sample a beam of neutrons optimised for a divergence of +/-1^{o} at 3 Å, greater if possible for higher wavelengths.
    3.2. **Rationale**: Time of Flight spectroscopy is a very flux intensive technique, but rarely Q-limited technique.
    3.3. **Verification**: Measurement of the beam divergence at sample.
4. **Beam divergence profile**
    4.1. The BTS shall transport from the moderator to the sample a beam of neutrons with a smooth beam divergence.
    4.2. **Rationale**: It is import to provide a smooth angular distribution of flux to determine correctly the S(**Q**,ω) from a single crystal sample. A discrete divergence profile will result in discrete S(**Q**,ω) features that impair the scientific results.
    4.3. **Verification**: Measurement of the beam divergence at sample.
5. **Useful wavelength range**
    5.1. The BTS shall transport from the moderator to the sample a beam of neutrons with a bandwidth that can be freely chosen within the wavelength range 2 ± 0.1 Å and 20.0 ± 0.1 Å.
    5.2. **Rationale**: The dynamic scales, and thus the science, observable depends on the wavelength range accessible.
    5.3. **Verification**: Measurement of the neutron spectrum at detector using an incident monochromated beam on a coherent elastic scatterer.
6. **Line-of-sight avoidance**
    6.1. The guide must be out of line of sight to avoid high background levels derived from the fast neutron pulse on the target. A guide that is curved out of line of sight will limit the path of the fast neutron pulse to the sample position.
    6.2. **Rationale**: The signal to noise at the sample is required to be at least 10^5 , a signal from the prompt pulse will significantly degrade this value.
    6.3. **Verification**: Measurement of the dose rate in the experimental cave as a function of time of flight.
7. **Instrument shutter**

7.1. When the experimental or optical cave is not *interlocked* the BTS in conjunction with the instrument shutters shall block radiation from the target to a level required by safety regulations.
7.2. **Rationale**: The user must be able to change a sample at the sample position.
7.3. **Verification**: Measurement of the dose rate in the experimental cave.

8. Brilliance transfer

8.1. The BTS should transport from the moderator to the sample a beam of neutrons with 70% *brilliance transfer (BT)* within the divergence range for λ > 6 Å. The BT is defined as the number of neutrons transported from the moderator to the sample for the sample area defined (4x2 cm^2 (height x width) for unfocussed nose and 1x1 cm^2 (height x width) for focussed nose) with a divergence range of +/-1°.
8.2. **Rationale**: Increasing the BT results in a higher flux.
8.3. **Verification**: Measurement of the flux at sample vs. flux at guide entrance.

9. Wavelength selection

9.1. The BTS should transport from the moderator to the sample a beam of neutrons where the total *flux* outside the selected wavelength band does not decrease the signal to noise from the scientific requirements.
9.2. **Rationale**: The neutrons outside the used wavelength band add to the background.
9.3. **Verification**: Measurement of the neutron spectrum at sample

10. Beamstop

10.1. The BTS shall absorb the neutrons not scattered by the sample
10.2. **Rationale**: The neutrons not scattered by the sample contribute to background and should not be incident on the detectors.
10.3. **Verification**: Measurement with and without sample.

11. Provision for Polarisation analysis

11.1. Provision will be made for polarisation of the incident neutron beam and for polarisation analysis. This will include providing space for a polarising guide, a flipper and an analyser
11.2. **Rationale**: Scientifically, polarisation analysis provides a new dimension to the information that neutron scattering yields. However the area around the polarising and analysing equipment needs to be a highly uniform or a low magnetic field environment to ensure the neutrons are not depolarised.
Verification: Measure magnetic permeability of materials.

4.2. Brief guide overview

The details of the CSPEC guide have been reviewed in the document Guide_CSPEC_OverviewJune2017.pdf. The CSPEC guide is shown below, Figure 2. The beam and divergence profile are shown in Figure 5 and 6 and show conformity to the high level requirements. The exact details of each guide piece, corresponding vacuum housing and gaps for monitors and choppers are given in the document 20180504-CSPEC-nl-specs.xls and the CSPEC beamline components-Model.pdf of which an overview is provided in Figure 1. An example of a manufacturing drawing for the guide pieces is shown in the Appendix, section 7.

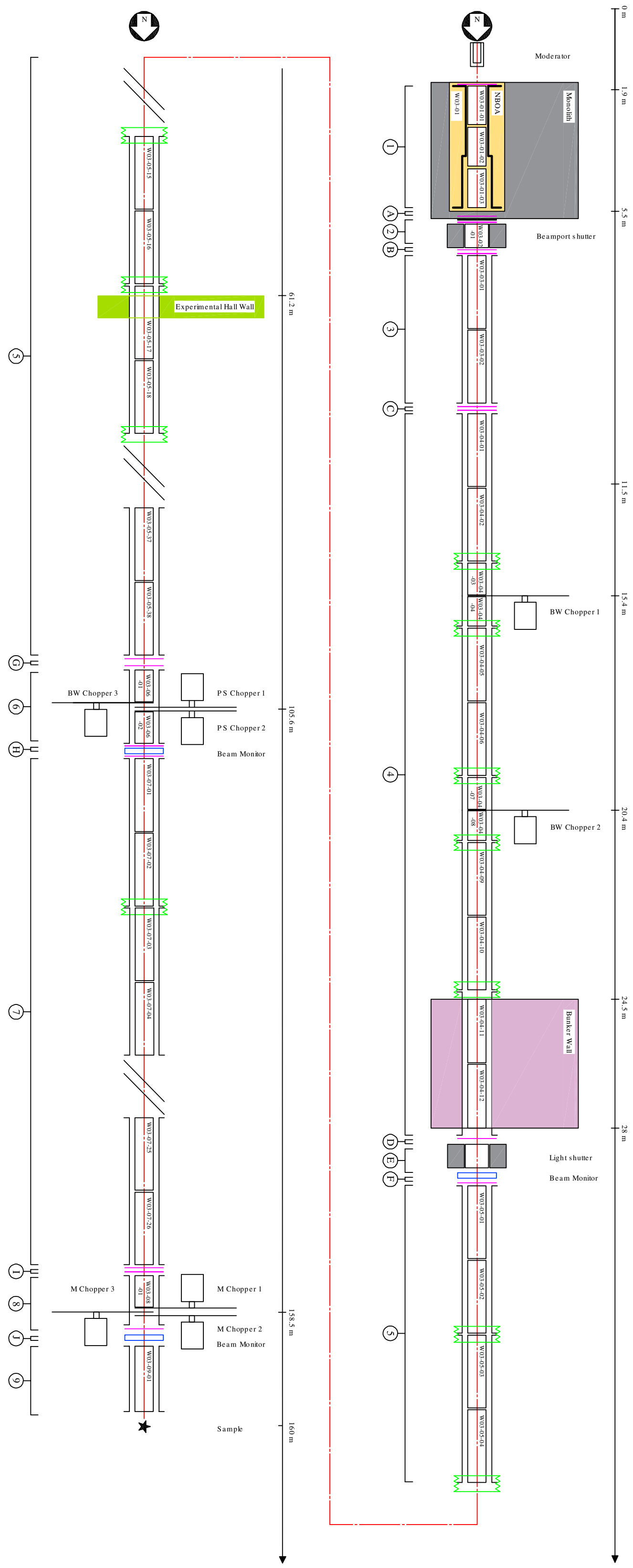

Figure 1: Overview of the CSPEC components. Image will be submitted separately as an A3 print-out for clarity.

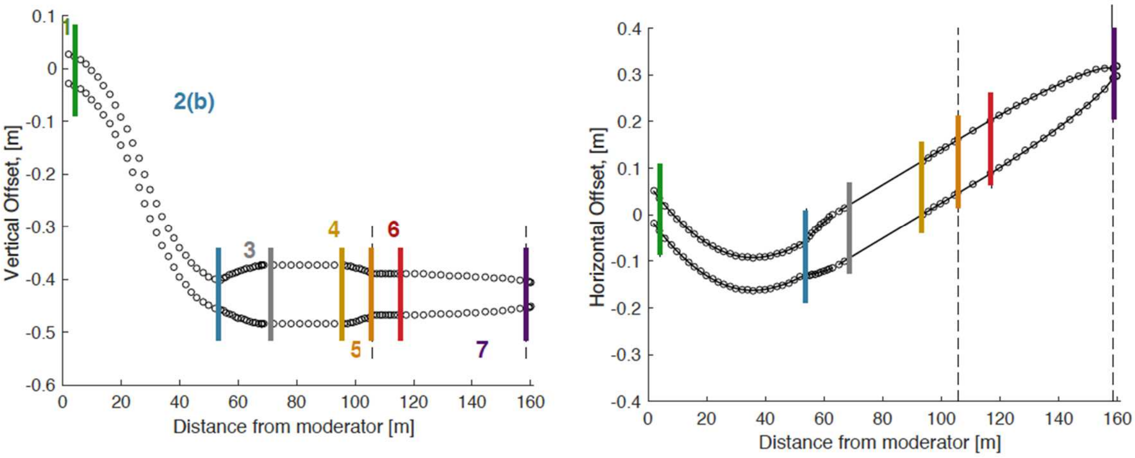

Figure 2: Overview of the CSPEC guide. (left) Vertical offset and (right) Horizontal offset. McStas coordinates.

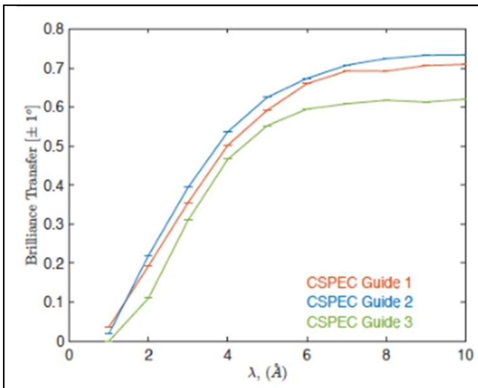

Figure 3: Wavelength dependence of the brilliance transfer (+/-1°) for a range of guides studied: guides 1, 2 and 3. Guide 2 is the final option.

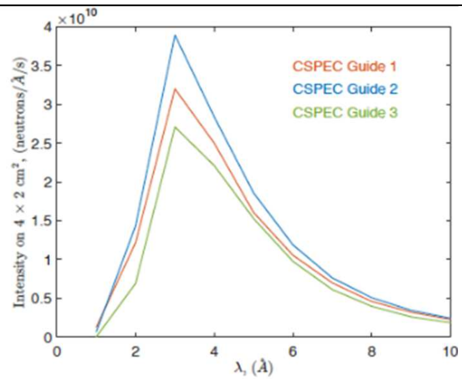

Figure 4: Intensity across the required sample area (4_ 2 cm^2) for a range of guides studied: guides 1, 2 and 3. Guide 2 is the final option.

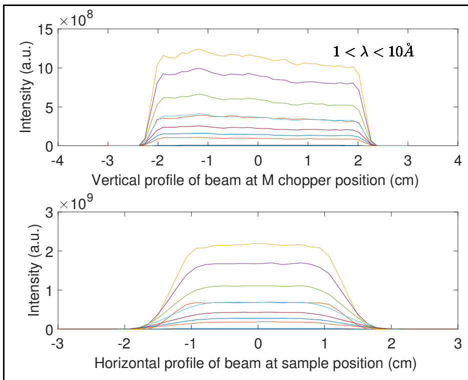

Figure 5: Beam profiles for a range of incident wavelengths, wavelength band λ-0.5 < λ < λ+0.5 at the sample position.

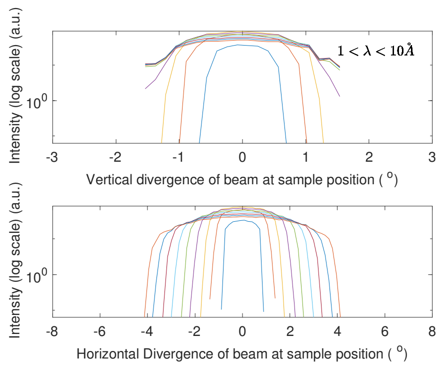

Figure 6: Divergence profiles ((log scale)) for a range of incident wavelengths,

	wavelength band λ-0.5 < λ < λ+0.5, at the sample position.

5. GENERAL SYSTEM LAYOUT (IN BUNKER)

A summary of the main components in the bunker, along with nominal positions and quick component details are found in Figure 7 and Table 1. A more detailed overview of the components are provided in sections 5.1.1 and beyond.

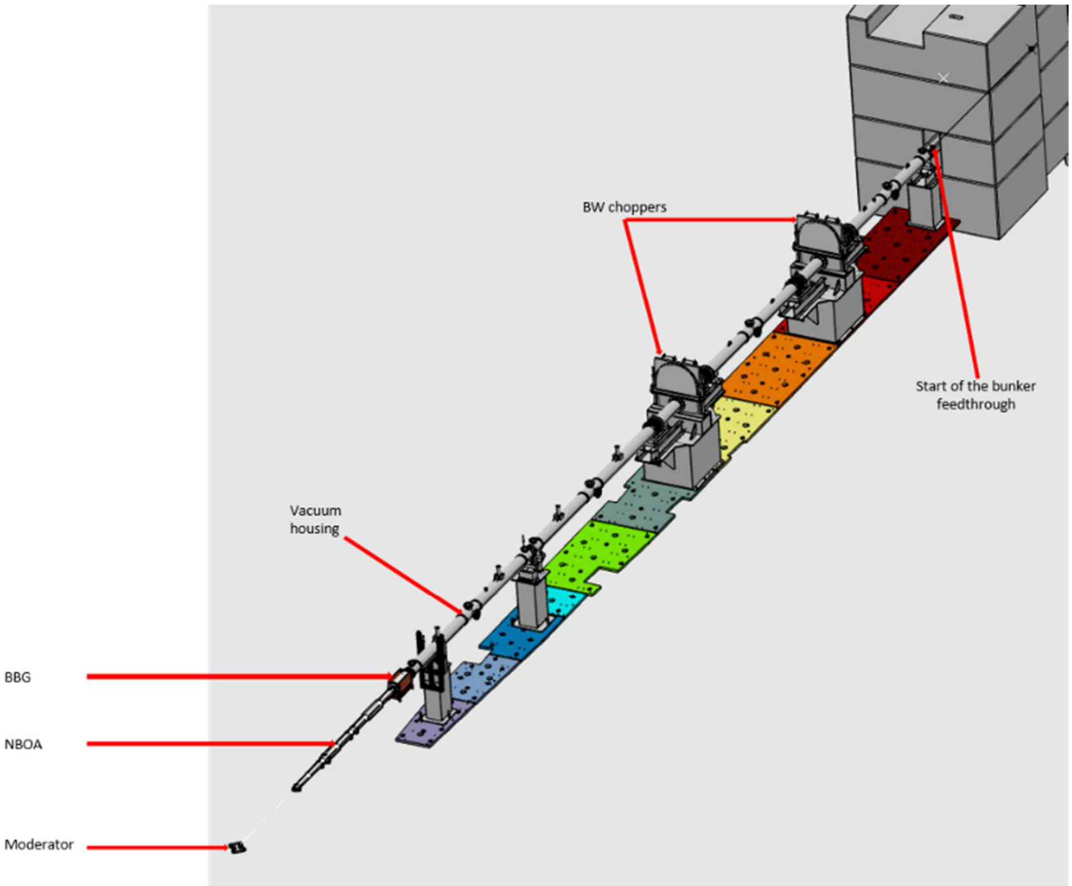

Figure 7. General overview in the bunker.

Nr	Component Name	ISCS (mm), approx length	Notes, *interface references*
1.	Monolith Insert	(1879.94,-0.005,0.0) :(5359,94,1.11,-2.78) (~3.48m)	*ESS-098382 - Monolith interface* *Guide substrate: Cu*

Nr	Component Name	ISCS (mm), approx length	Notes, *interface references*
2.	Gamma Shutter Insert (BBG)	(5359,94,1.11,-2.78) :(5877.94,1.52,-3.82) (~0.518m)	ID150mm *ESS-0217889 – Product1577401 –Shutter interface* Argon filled Guide substrate: Cu
3.	Vacuum housing 1	(5877.94,1.52,-3.82) :(10240.63,7.72,-19.31) (~4.266m)	ID200mm *Product1576716* *Guide substrate: Na float*
4.	Vacuum housing 2 and bellow	(10242.63,7.72,-19.32) :(14605,18.68,-46.71) (4.364m)	ID200mm *Product1576694* *Guide substrate: Na float*
5.	BW chopper vacuum housing	(14607.25,18.68,-46.72) :(15407,21.21,-53.04) (~0.80m)	ID200mm *Product1576603* *Guide substrate: Na float*
6.	BW chopper 1	(15407.58,21.21,53.04): (15434.08,21.30,-53.25) (~0.027m)	Bandwidth chopper 1, 700mm diameter, 14Hz, *Product1576680*
7.	BW chopper vacuum housing	(15434.08,21.30,-53.25) :(16234.04,23.99,-59.98) (0.80m)	ID200mm *Guide substrate: Na float*
8.	Vacuum housing 3 and bellows	(16236.04,23.99,-60.00) (19641.06,37.24,-93.11) (~3.405m)	ID200mm *Product1576547* *Guide substrate: Na float*
9.	Bandwidth chopper vacuum housing	(19643.06,37.25,-93.13) (20443.30,40.78,-101.96) (~0.8m)	ID200mm *Product1576603* *Guide substrate: Na float*
10.	BW chopper 2	(20443.30,40.78,-101.96) :(20469.80,40.90.-102.26) (~0.027m)	Bandwidth chopper 2, 700mm diameter, 14Hz, *Product1576605*
11.	Bandwidth chopper vacuum housing	(20469.80,40.90.-102.26) :(21269,44.60,-111.50) (~0.8m)	ID200mm *Guide substrate: Na float*

Nr	Component Name	ISCS (mm), approx length	Notes, *interface references*
12.	Vacuum housing 4	(21271.74,44.61,-111.53) :(23972.48,58.28,-145.70) (~2.7m)	ID200mm *Guide substrate: Na float*
13.	Bunker Wall Insert	(23974.48,58.29,-145.73) :(27874.99,81.24,-203.13) (~3.9m)	Details to be defined from ESS. *Guide substrate: Cu.*

5.1. Description of components in the bunker.

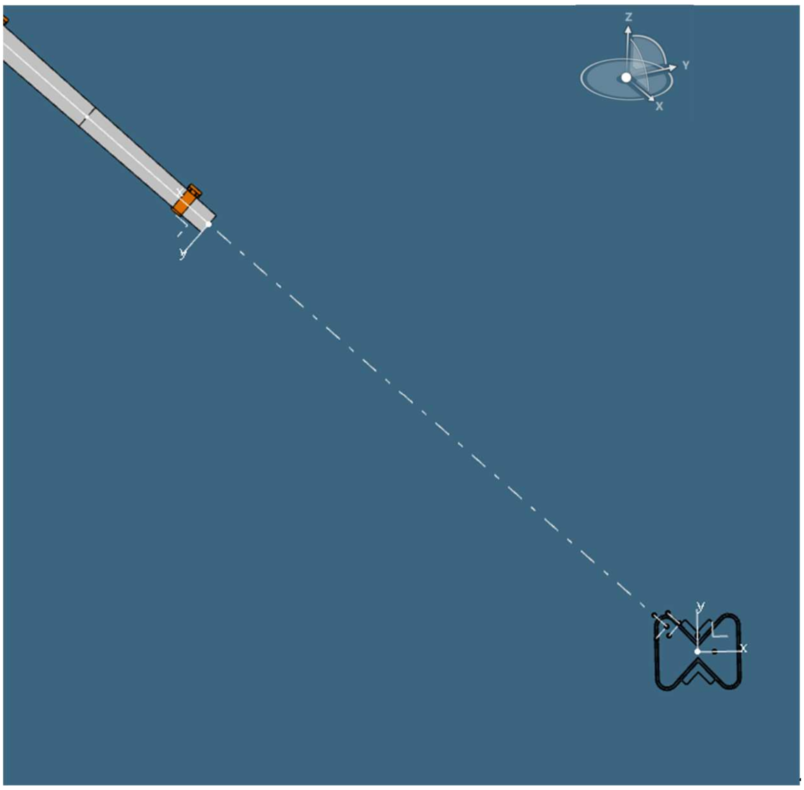

Figure 8: CSPEC view on the moderator.

The CSPEC guide is rotated, with respect to the original instrument axis, to view the cold moderator. Figure 8 shows the view of the CSPEC guide and the center of the cold moderator in the West sector.

The main components that will be outlined in this document are shown in Figure 9.

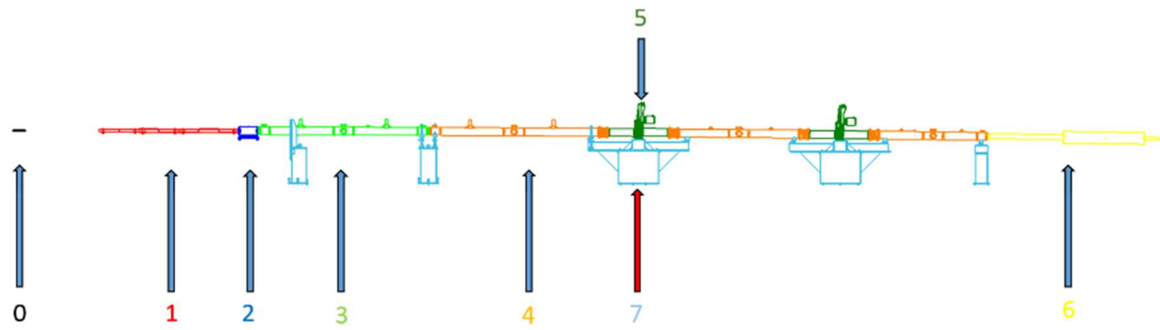

Figure 9: Schematic view of the components in the bunker.

0: Moderator (black)
1: Neutron beam optical assembly (NBOA) (red)
2: Bridge beam guide (BBG) (dark blue)
3: First vacuum housing (light green)
4: Second, third and fourth vacuum housing (orange)
5: BW choppers vacuum housing (dark green)
6: Bunker feedthrough (yellow)
7: Guide supports (light blue)

5.1.1. Monolith Insert

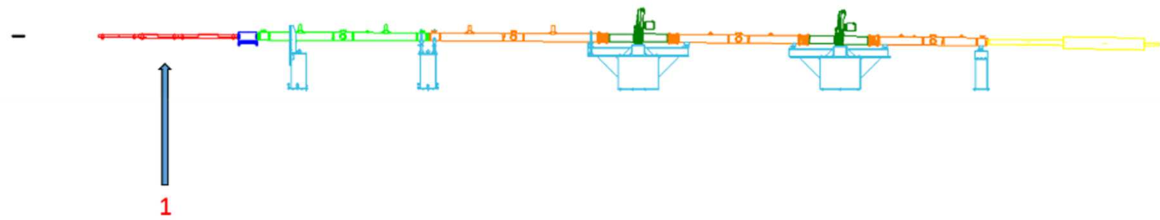

Figure 10: Schematic view of the components in the bunker, NBOA highlighted.

The neutron beam extraction system is responsible for ensuring the efficient extraction of neutrons from the facility's moderators and their transport through the target monolith shielding out into the instrument buildings. Optical components commence at ~1.9m from the moderator axis and terminate before the monolith neutron beam window at radius 5.5m. The material used for the guide substrate in the monolith is high purity copper (C10100). The CSPEC team are in the process of finalising the tender documents for the NBOA guide.

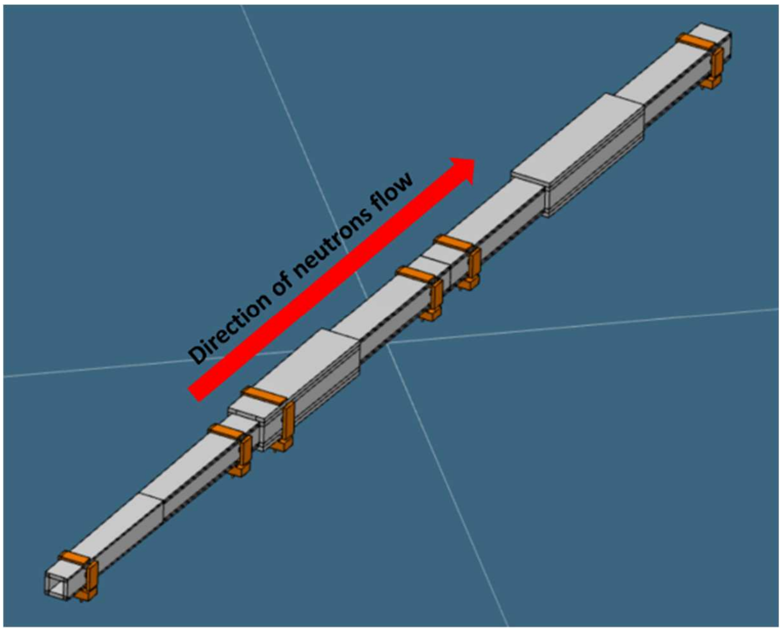

Figure 11: CAD view of the NBOA with the alignment system.

5.1.2. Bridge Beam Guide (BBG) of CSPEC

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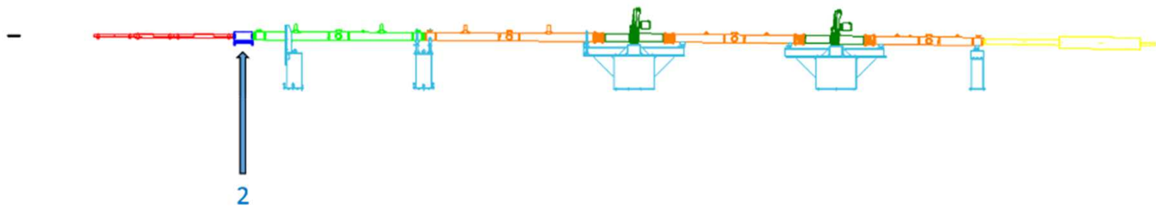
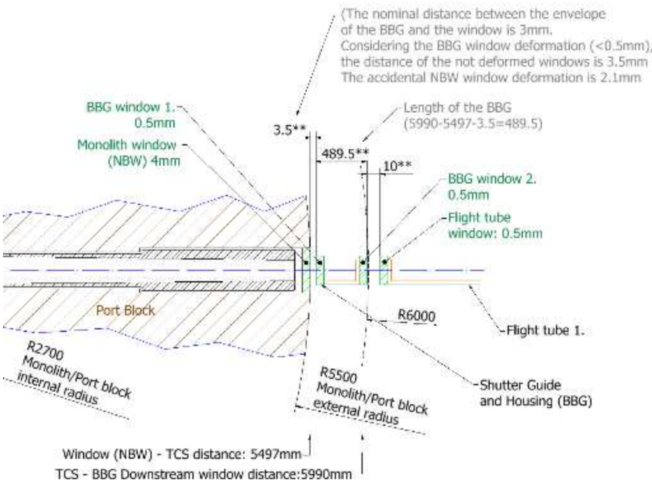


Figure 12: Schematic view of the components in the bunker, BBG highlighted.

The BBG assembly is located downstream the Monolith Insert, before the first vacuum housing (Figure 13). It is mounted in the copper collar of the Light Shutter structure (figure 14).



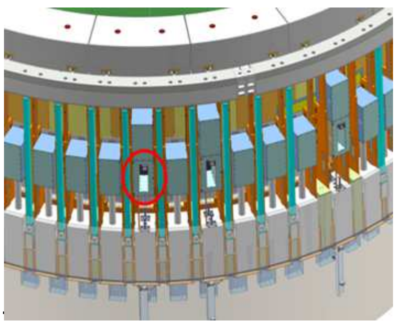
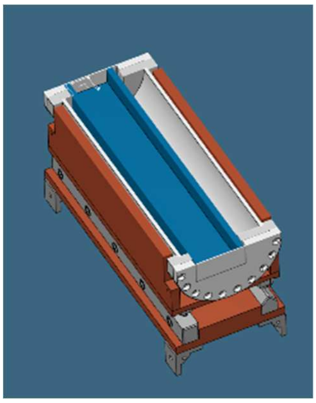
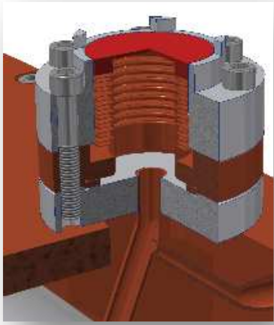
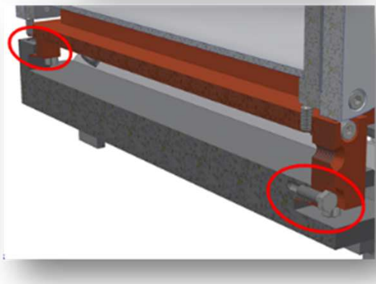


Figure 13: Location of the BBG assembly. Figure 14: Location of the BBG assembly within the light shutter.







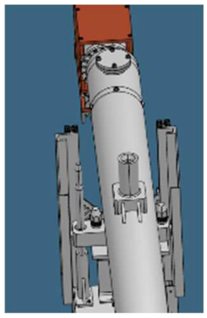


Figure 15 (left): Cut view of the BBG assembly **Middle:(top) Pressure Indicator, (bottom) vertical locking with spring plates.** **(right) Current misalignment of the CSPEC guide with BBG (target).**

The CSPEC BBG, Figure 15, contains the optics with neutron beam windows. It is filled with Argon gas at 0.2 bar over-pressure. The tube is permanently sealed, with no refill of the argon possible. The length of the optic guide is 482mm with a gap of 2.25mm between the guide and the front and back window of the BBG. It should be noted that the BBG is currently misaligned with our guide, see Figure 9 (right). This is since the CSPEC guide is rotated to view the cold moderator while the BBG remains aligned to the instrument axis, positioned at the point between the cold and thermal moderator. Target holds responsibility for the BBG and this misalignment should be addressed shortly.

5.1.3. Vacuum housing 1

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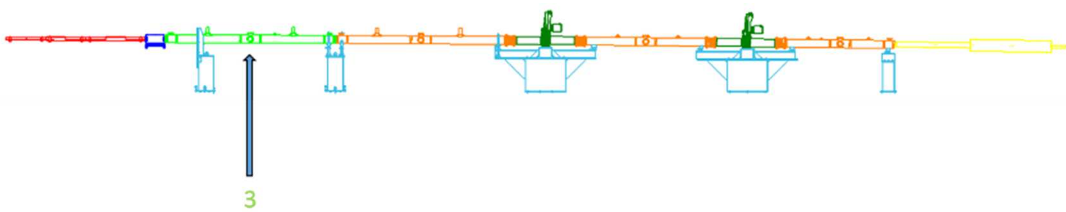


Figure 16: Schematic view of the components in the bunker, first vacuum housing highlighted.

The first vacuum housing is located after the BBG, Figure 16. This guide section doesn't require maintenance but is located in the region between 6m and 11.5m from the moderator, in the "limited remote handling" region. Although the extraction will be remote handled, the re-installation of the components in this section will be performed after a long shutdown and staff can be in the vicinity.

This guide piece is isolated from the other guide pieces by windows on either side of the vacuum housing section. The 0.5 mm windows on either side of the housing will be aluminium (Al2024), after studies at ISIS showed that this Aluminium supports high stresses for windows. Remote handling of this guide piece will be possible using the two remote handling points in which an extraction screw can be inserted (~ 1.5 m in length) to fasten the vacuum housing and enable extraction. Alignment features to ensure ease of extraction are attached to the nearest housing, see section 5.1.4: Supports for vacuum housing. The second vacuum housing is separated from the first vacuum housing by a 5mm gap to enable remote handling. A specific DN50 vacuum port is required to evacuate this volume to 10^{-2} mbar. Further material details are found in Figure 20. Three types of aluminium are presented in Figure 20 to show the range of materials under consideration. A final decision will be made once cost values are available.

Figures 21 and 22 show the mechanism envisaged for guide alignment. The alignment of the guides will be performed using laser tracking devices. Access for the lasers is available via a flange, 3 for each 4 m vacuum housing, one centrally and one at each side of the vacuum housing. A fiducial marker is placed permanently on the surface of the guide for use as a point of reference. Experience at TUM provides confidence that alignment precision of 50 micrometers are easily achieved using this mechanism.

Nevertheless, there is considerable concern regarding the alignment of guide pieces within the bunker. The CSPEC team understand that the bunker roof will be put in place after the final alignment of the guide thereby resulting in a possible misalignment of the guide. We suggest a side entrance to the bunker so that the guide can be installed with the complete bunker load in place.

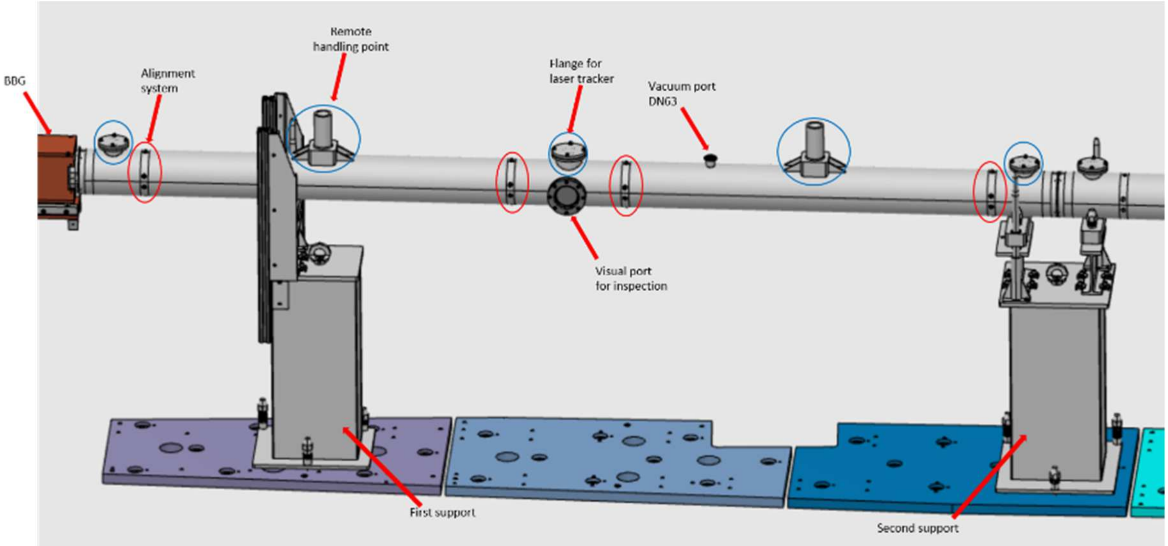


Figure 17. CAD view of the first vacuum housing.

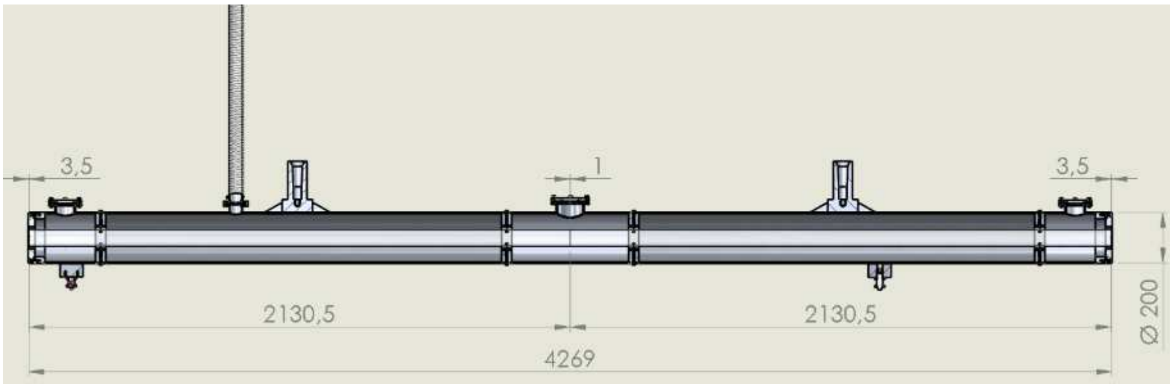


Figure 18. Neutron guide within the vacuum housing.

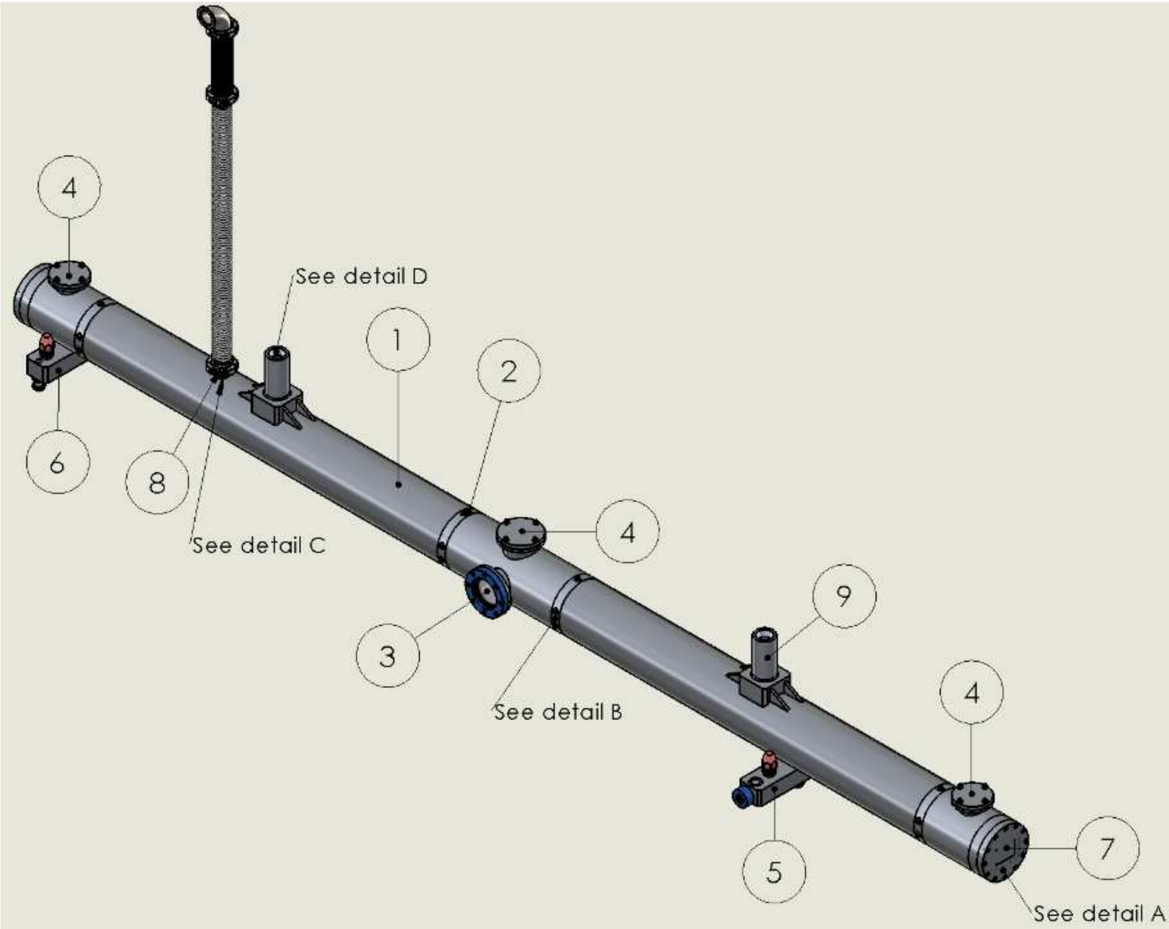


Figure 19: Overview of first vacuum housing with remote access detail.

No.	PART	MATERIAL	QTY
1	Ø 200 mm pipe, THK= 5 mm	EN AW 6060 / 5754 / 6082	1
2	Adjustment flange	EN AW 6060 / 5754 / 6082	4
3	Viewport	Anodised aluminium (Flange) with borosilicate glass (5 mm)	1
4	Access flange for Laser Tracker	EN AW 6060 / 5754 / 6082	3
5	Load attachment plate	EN AW 6060 / 5754 /6082	1
6	Load attachment plate	EN AW 6060 / 5754 / 6082	1
7	0,5 mm window	EN AW 2024 - T3	2
8	Vacuum flange DN50 ISO - KF	EN AW 6060 / 5754 / 6082	1
9	Remote handling- Connection bar	EN AW 6060 / 5754 / 6082	2

Figure 20: Materials information for first vacuum housing.

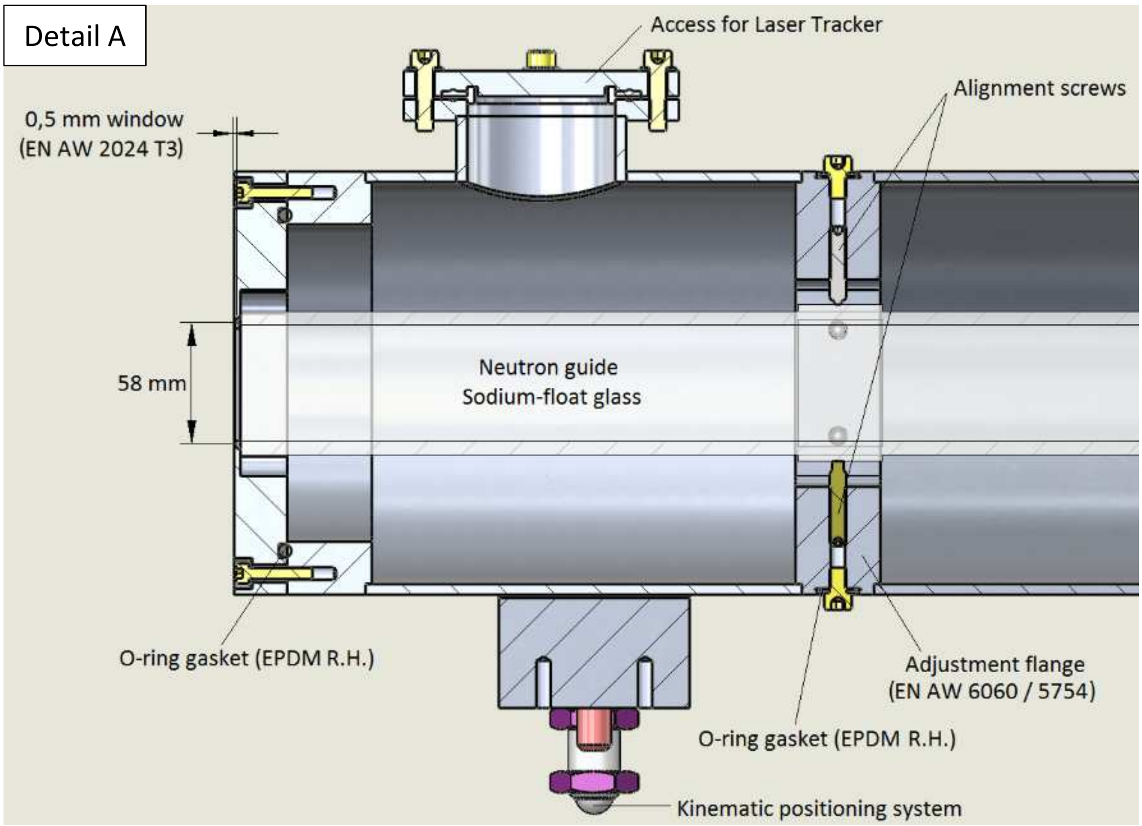


Figure 21: A cut view of vacuum housing 1 showing the neutron guide, adjustment flanges, kinematic positioning system and access for laser tracking.

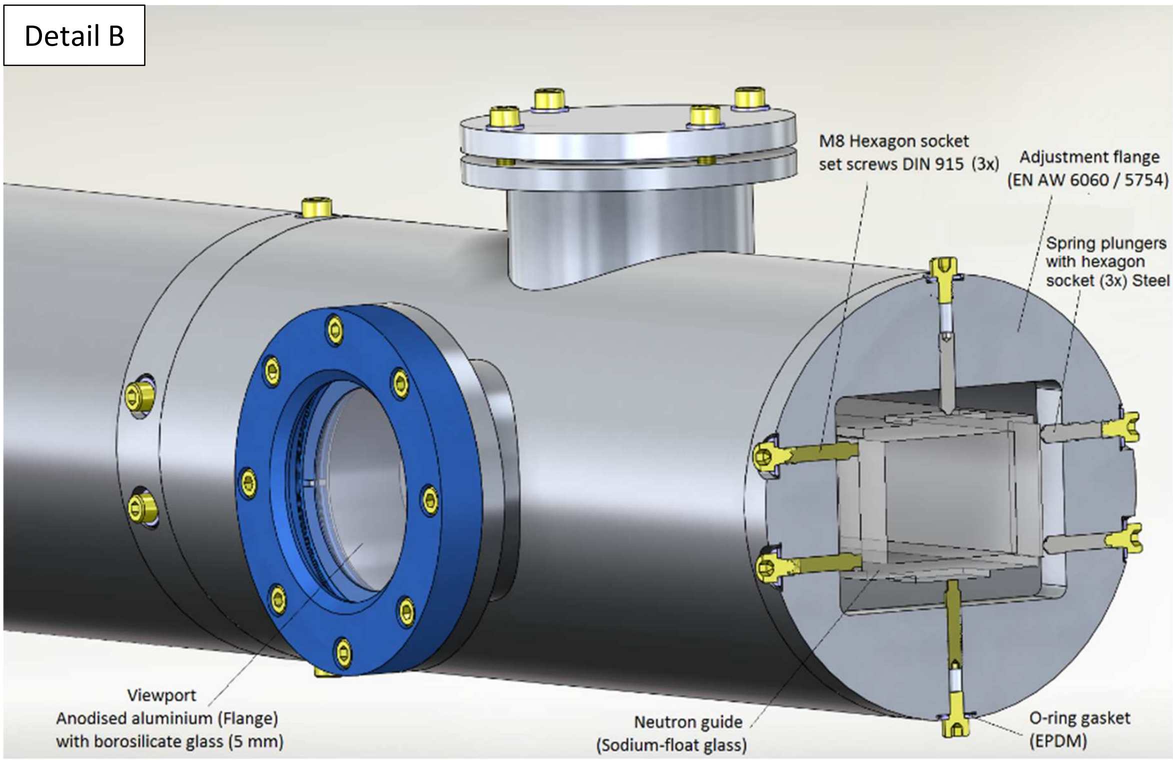


Figure 22: Further details of the adjustment system for the guide.

Figure 23: Details C and D.

5.1.4. Supports for vacuum housing.

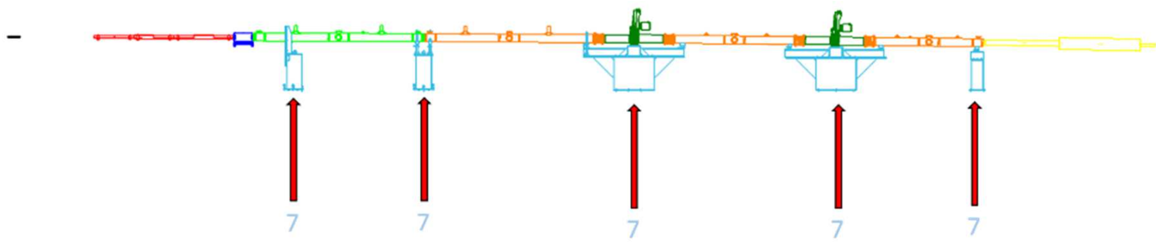


Figure 24: Schematic view of the components in the bunker, supports highlighted

Five guide supports are required inside the bunker. Their locations are showed in the schematic, Figure 24. The first one is positioned as close as possible to the beginning of the first vacuum housing after the bridge beam guide and supports the first 4m section of the vacuum housing. It is located in the remote handling zone of the bunker and as such this support is designed to be removed remotely. This support will only be removed if the NBOA has to be changed.

Three self-catching bolts are implemented on the base of the guide support. The self-catching bolts will be unbolted remotely. They are designed in accordance with the recommendation from the remote handling group.

A second constraint for this first support is the presence of two instruments nearby. Figure 27 shows the footprint of the three instruments, BIFROST, CSPEC and BEER. Specific attention was given to the footprint of our guide support and to the footprint of the chopper support of BIFROST. Indeed, a clash was first spotted in this region, and our guide support needed to be moved further from the light shutter. That is the reason why there a significant offset between the light shutter and the guide support.

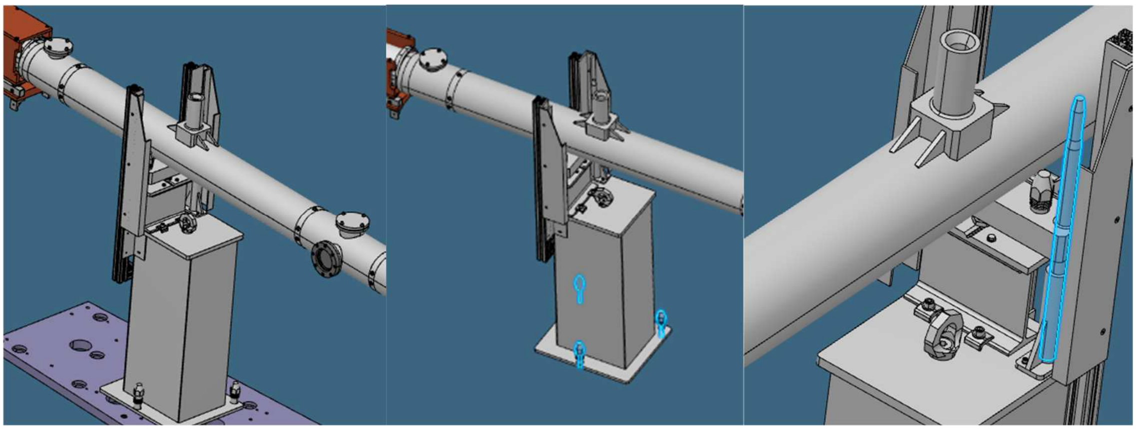


Figure 25: CAD view of the first guide support in the remote handling region. Figure 25 CAD view of the first support with the self-catching bolt in blue. Figure 26 CAD view of the guiding rod for the extraction of the first vacuum housing

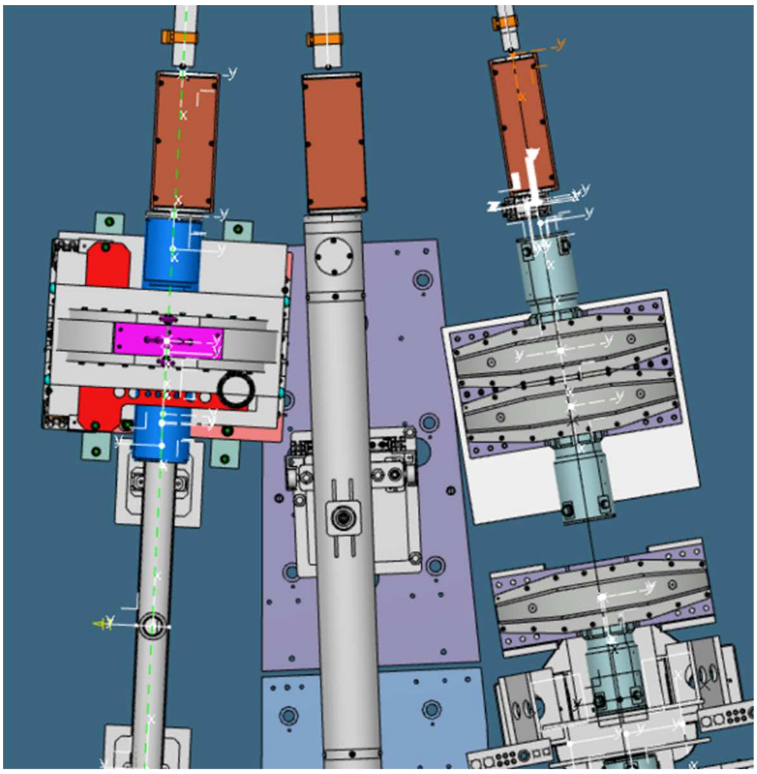


Figure 27: CAD view of BIFROST, CSPEC and BEER (from left to right) in the remote handling region.

For the repositioning of the chopper support a three balls handling system has been implemented below the support. The first baseplate was changed to accommodate this specific requirement. Further details of the support system are provided in Figures 28-30.

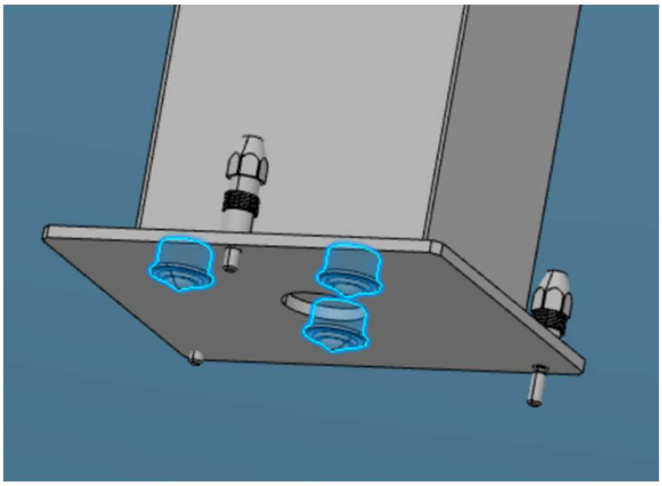
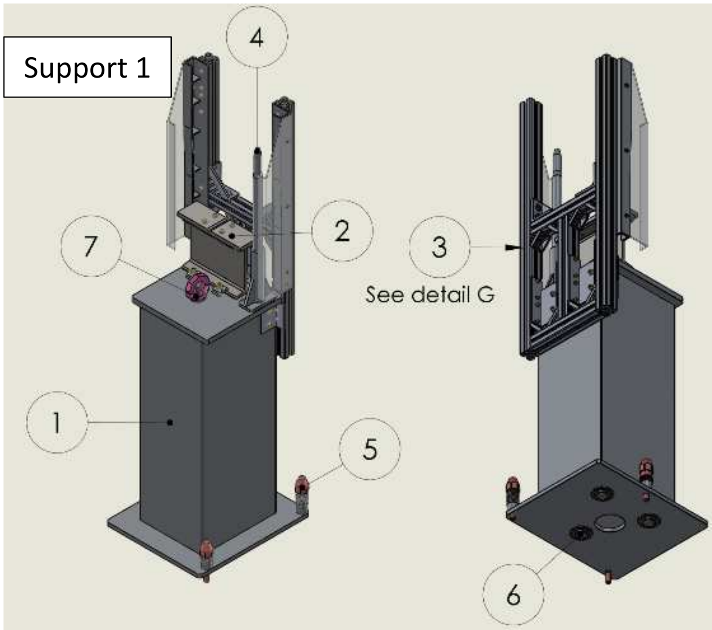


Figure 28: CAD view of the three-ball handling system below the guide support.



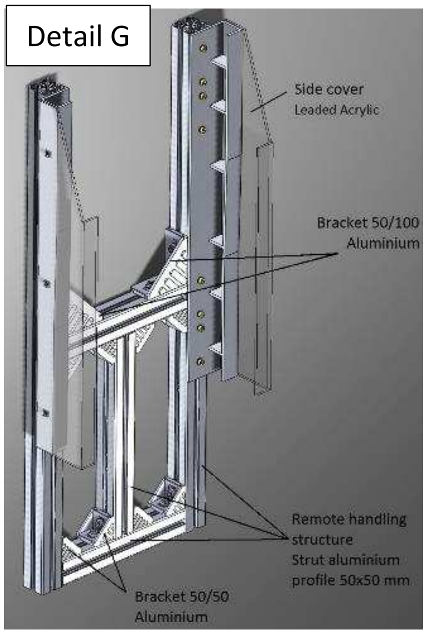


Figure 29: Overview of support 1. Figure 30: Detail G.

No.	PART	MATERIAL	QTY
1	Supporting structure filled with concrete	EN AW 6082 / 6060	1
2	I-Beam with kinematic base plate	EN AW 6061-T6 / Steel	1
3	Remote handling structure	Strut aluminium profile 50x50 mm with 10 mm slot	1
4	Guiding rod	EN AW 6082	1
5	Self-catching Fastener	Steel	3
6	Ball caster	Steel	3
7	Lifting eye	Steel	1

Figure 31: Material overview for support 1.

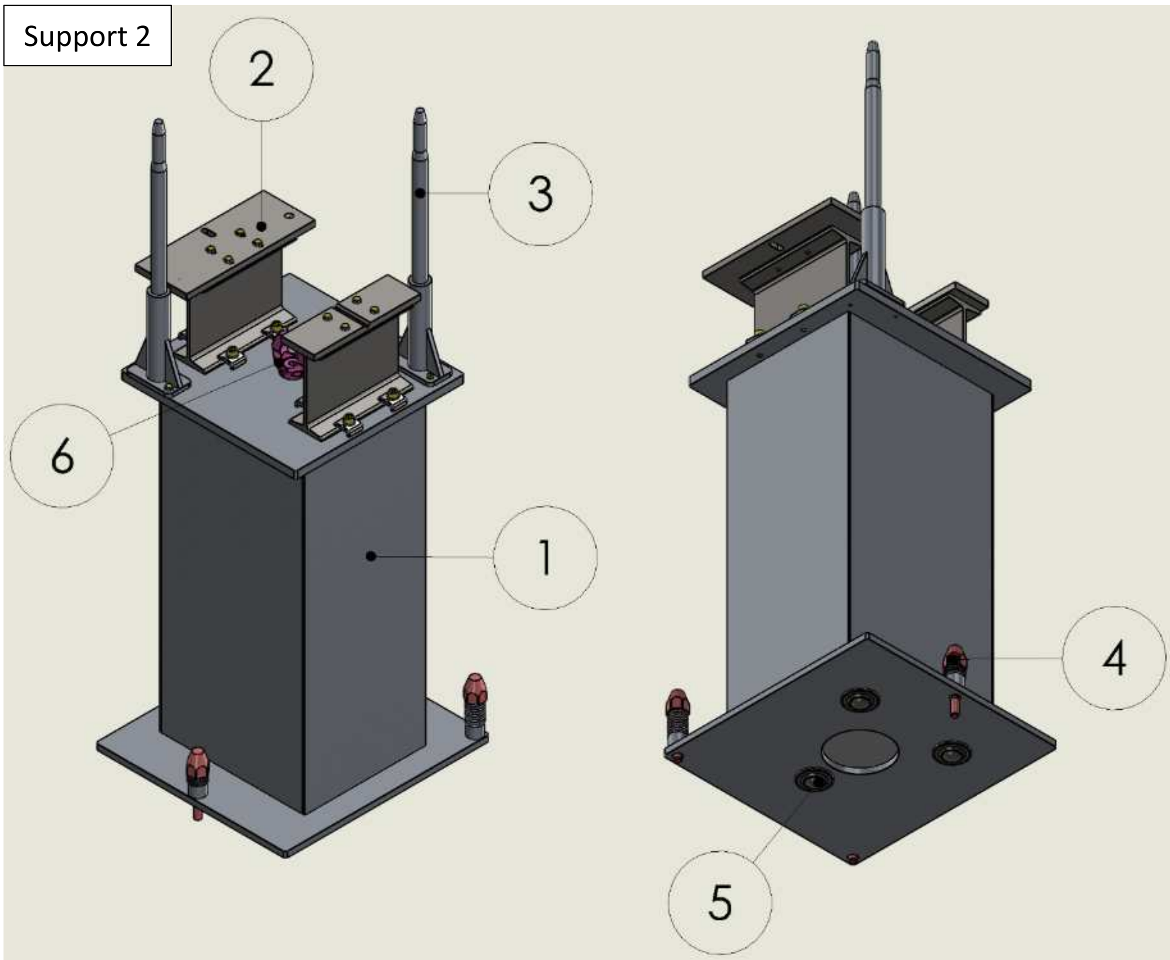


Figure 32: Overview of support 2.

No.	PART	MATERIAL	QTY
1	Supporting structure filled with concrete	EN AW 6082 / 6060	1
2	I-Beam with kinematic base plate	EN AW 6061 T6 / Steel	2
3	Guiding rod	EN AW 6082	2
4	Self-catching Fastener	Steel	3
5	Ball caster	Steel	3
6	Lifting eye	Steel	1

Figure 33: Material overview for support 2.

5.1.5. Vacuum housing 2.

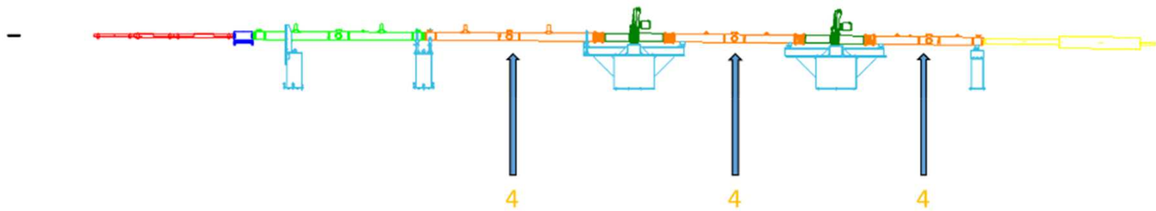


Figure 34: Schematic view of the components in the bunker, second, third and fourth vacuum housing highlighted.

The characteristics of vacuum housing 2 (materials, flanges, windows etc.) are similar to vacuum housing number 1. The junction between this second vacuum housing and the vacuum housing of the chopper is made with a DN200 titanium bellow. The technical drawing of this bellow can be found in section 5.1.6.

The connection between the second vacuum housing and the vacuum housing of the chopper is located at 14.600 m from the moderator. Therefore, remote access in not necessary and a physical disconnection of the bellow is feasible.

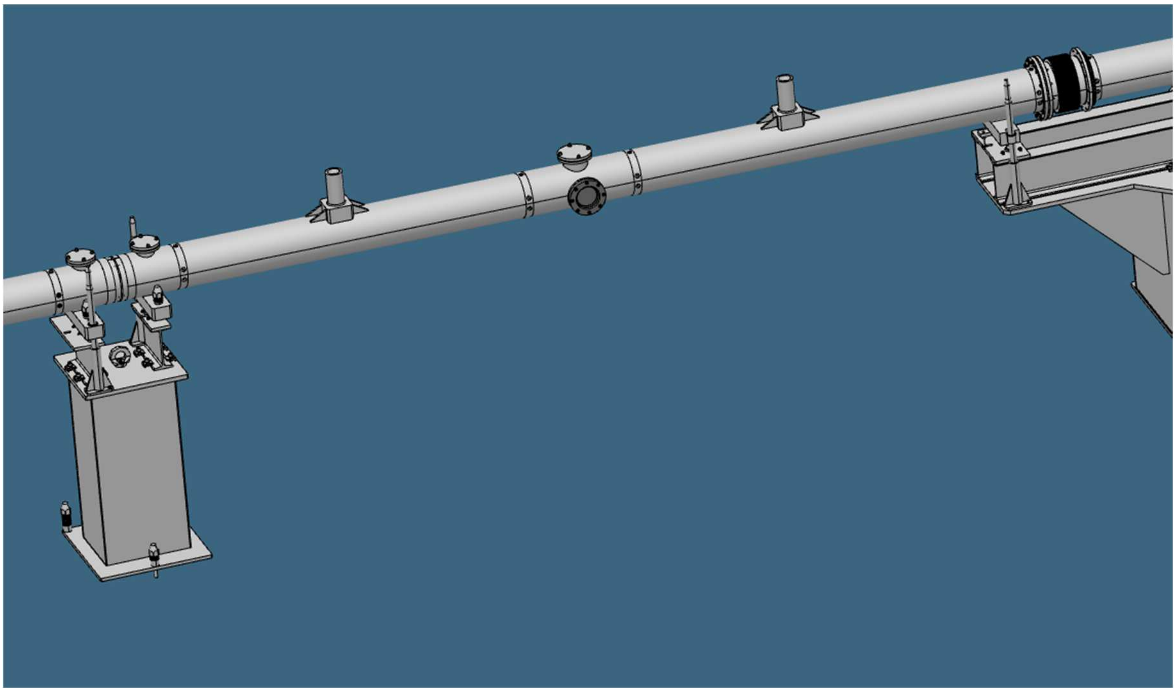


Figure 35: CAD view of the second vacuum housing connected to the support.

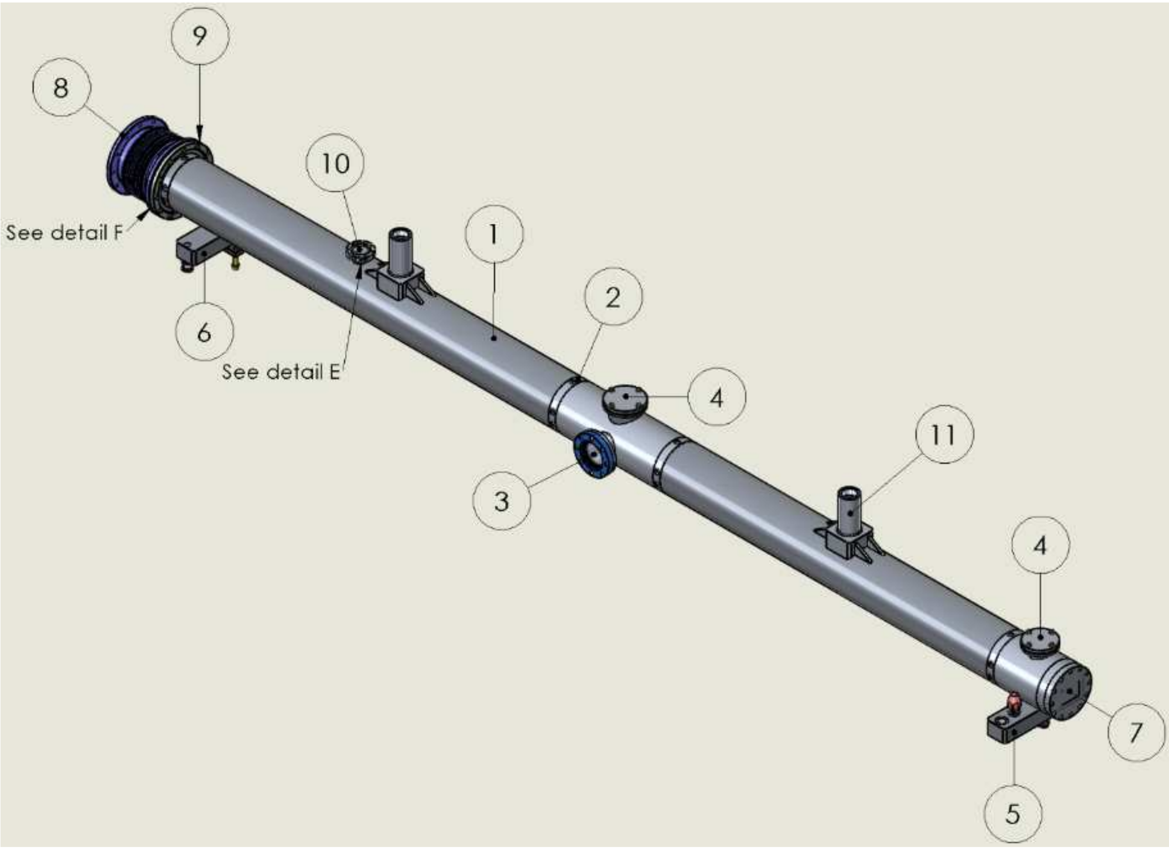


Figure 36: Overview of the second vacuum housing connected to the support.

No.	PART	MATERIAL	QTY
1	Ø 200 mm pipe, THK= 5 mm	EN AW 6060 / 5754 / 6082	1
2	Adjustment flange	EN AW 6060 / 5754 / 6082	4
3	Viewport	Anodised aluminium (Flange) with borosilicate glass (5 mm)	1
4	Access flange for Laser Tracker	EN AW 6060 / 5754 / 6082	2
5	Load attachment plate	EN AW 6060 / 5754 / 6082	1
6	Load attachment plate	EN AW 6060 / 5754 / 6082	1
7	0,5 mm window	EN AW 2024 - T3	1
8	Diaphragm bellow	Titanium grade 2	1
9	Connection flanges: DN 200 ISO K and sollar flange	EN AW 6060 / 5754 / 6082	1
10	Vacuum flange DN50 ISO- KF	EN AW 6060 / 5754 / 6082	1
11	Remote handling- Connection bar	EN AW 6060 / 5754 / 6082	2

Figure 37: Materials employed in the second vacuum housing.

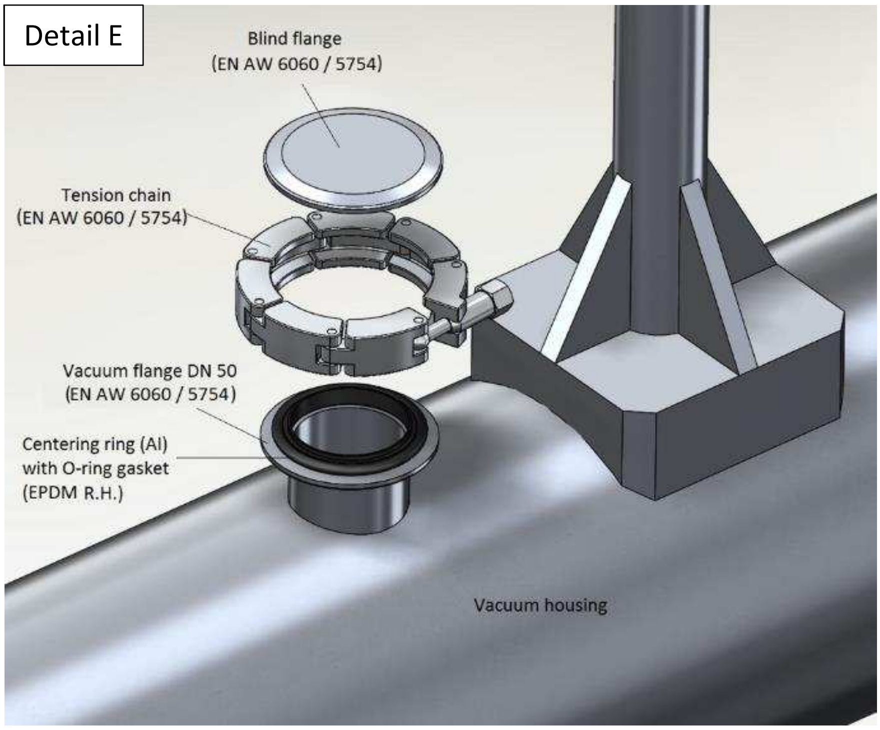


Figure 38: Detail E in vacuum housing 2.

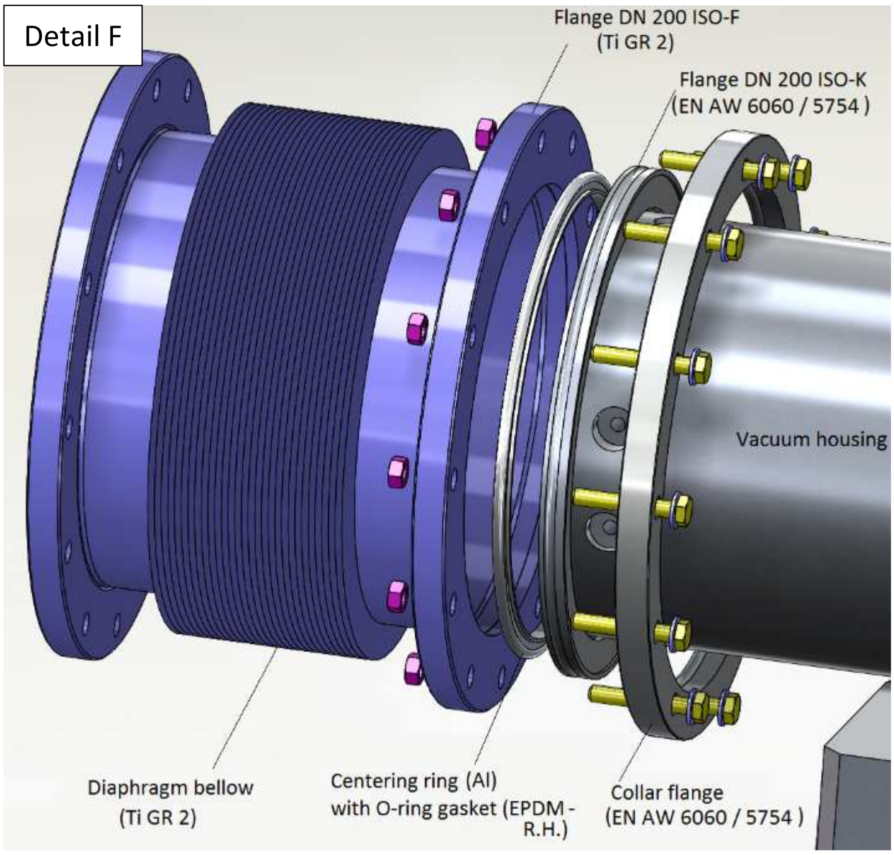


Figure 39: Detail F in vacuum housing 2.

5.1.6. Bellows

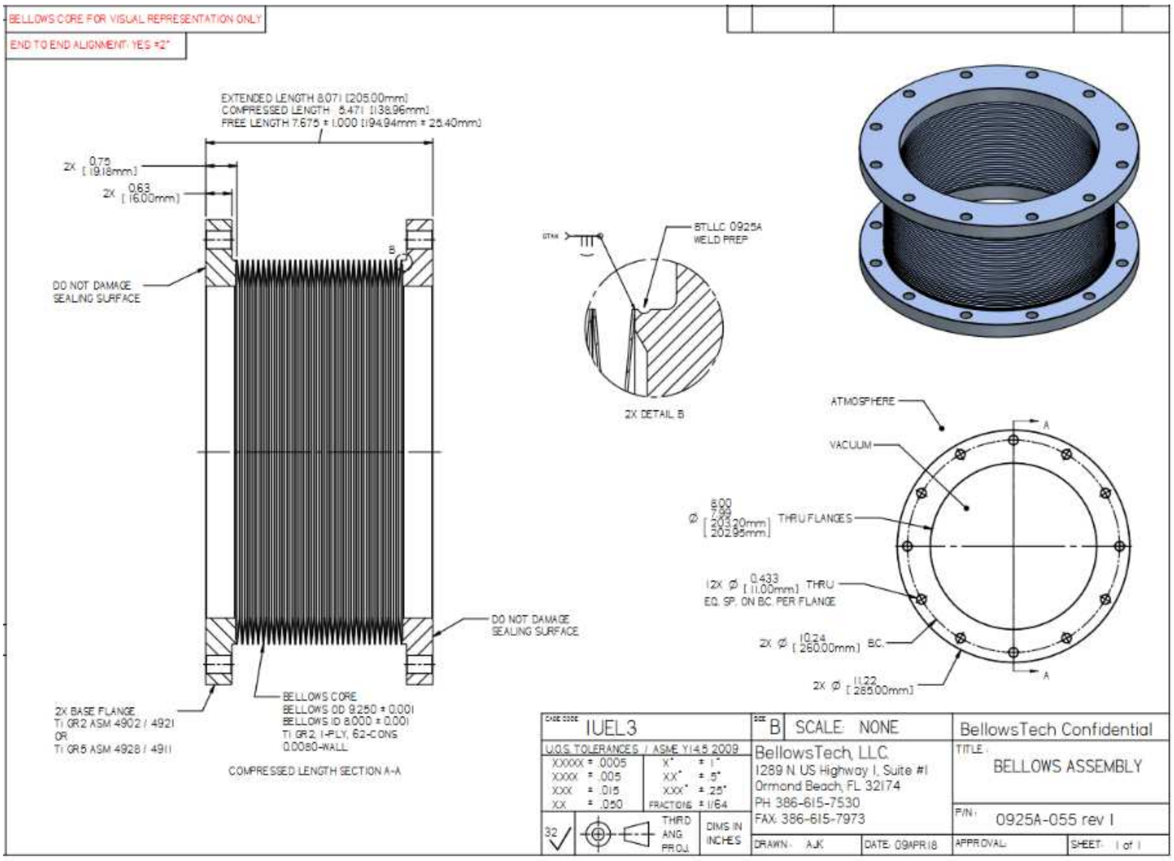


Figure 40: Manufacturing drawing of the Ti bellows.

MATERIAL:	Titanium Grade 2 (Ti GR2 ASM 4902)
FREE LENGTH:	194,94 mm
EXTENDED LENGTH:	205,00 mm
COMPRESSED LENGTH:	138,96 mm
LATERAL OFFSET BELLOWS CORE:	10,16 mm
ANGULAR OFFSET BELLOWS CORE:	5,0 °
LEAK RATE:	1 X 10^{-9} std cc He/SEC
FLANGES:	DN 200 ISO-F (Ti GR2 ASM 49029)

Figure 41: Further details for the Ti bellows.

5.1.7. Vacuum housing 3.

Figure 42: Overview of the third vacuum housing connected to the support.

No.	PART	MATERIAL	QTY
1	Ø200 mm pipe, THK= 5 mm	EN AW 6060 / 5754 / 6082	1
2	Adjustment flange	EN AW 6060 / 5754 / 6082	4
3	Viewport	Anodised aluminium (Flange) with borosilicate glass (5 mm)	1
4	Access flange for Laser Tracker	EN AW 6060 / 5754 / 6082	1
5	Load attachment plate	EN AW 6060 / 5754 / 6082	1
6	Load attachment plate	EN AW 6060 / 5754 / 6082	1
7	Diaphragm bellow	Titanium grade 2	2
8	Connection flanges: DN 200 ISO K and collar flange	EN AW 6060 / 5754 / 6082	1
9	Vacuum flange DN50 ISO-KF	EN AW 6060 / 5754 / 6082	1
10	Lifting eye	EN AW 6060 / 5754 / 6082	2

Figure 43: Materials employed in the third vacuum housing.

5.1.8. Vacuum housing 4.

Figure 44: Overview of the fourth vacuum housing.

No.	PART	MATERIAL	QTY
1	Ø200 mm pipe, THK= 5 mm	EN AW 6060 / 5754 / 6082	1
2	Adjustment flange	EN AW 6060 / 5754 / 6082	4
3	Viewport	Anodised aluminium (Flange) with borosilicate glass (5 mm)	1
4	Access flange for Laser Tracker	EN AW 6060 / 5754 / 6082	1
5	Load attachment plate	EN AW 6060 / 5754 / 6082	1
6	Load attachment plate	EN AW 6060 / 5754 / 6082	1
7	Diaphragm bellow	Titanium grade 2	2
8	Connection flanges: DN 200 ISO K and collar flange	EN AW 6060 / 5754 / 6082	1
9	Vacuum flange DN50 ISO - KF	EN AW 6060 / 5754 / 6082	1
10	Lifting eye	EN AW 6060 / 5754 / 6082	2

Figure 45: Materials employed in the fourth vacuum housing.

5.1.9. Regions around the BW choppers.

The guide pieces around the BW choppers are envisaged to provide a 0.8 m guide section that provides ample space for the alignment procedure. BW2 sits very close to the dilation joint in the bunker. The chopper housing spans 2 baseplates but is attached to one only so that free movement is possible, see Figure 48.

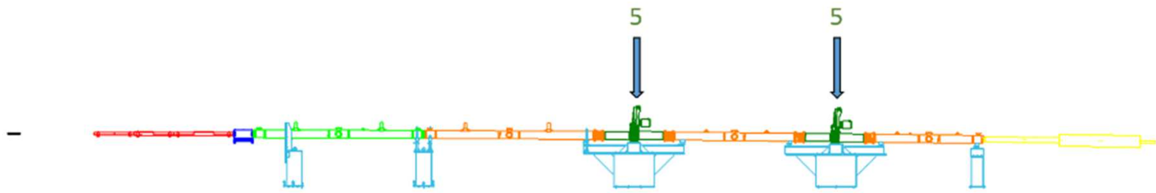


Figure 46: Schematic view of the components in the bunker, BW choppers vacuum housing highlighted.

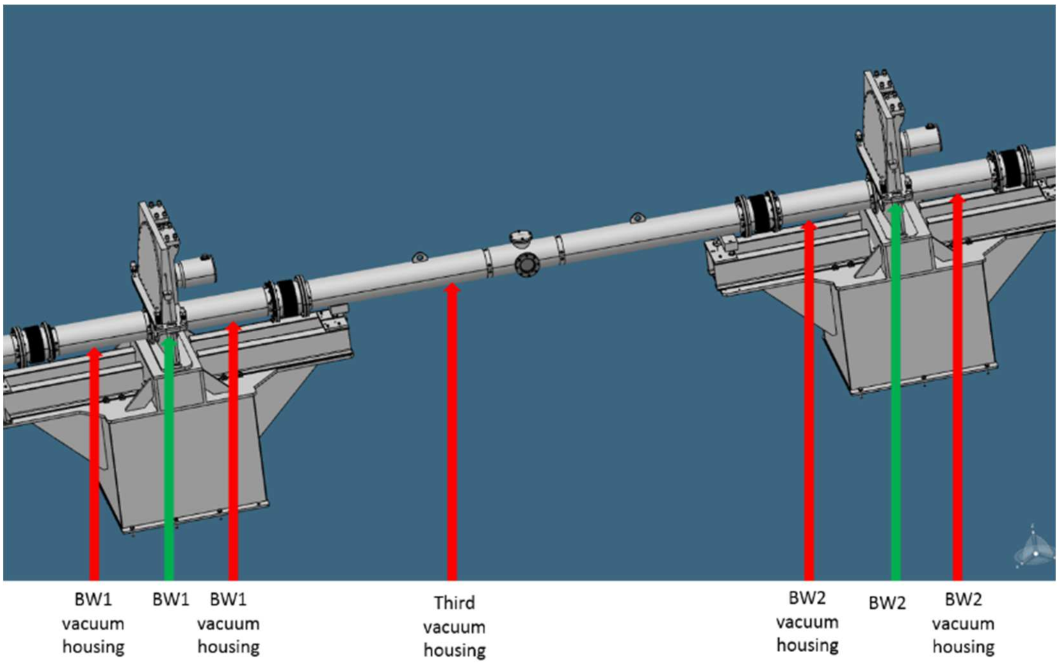


Figure 47: CAD view of the third vacuum housing and the chopper vacuum housings.

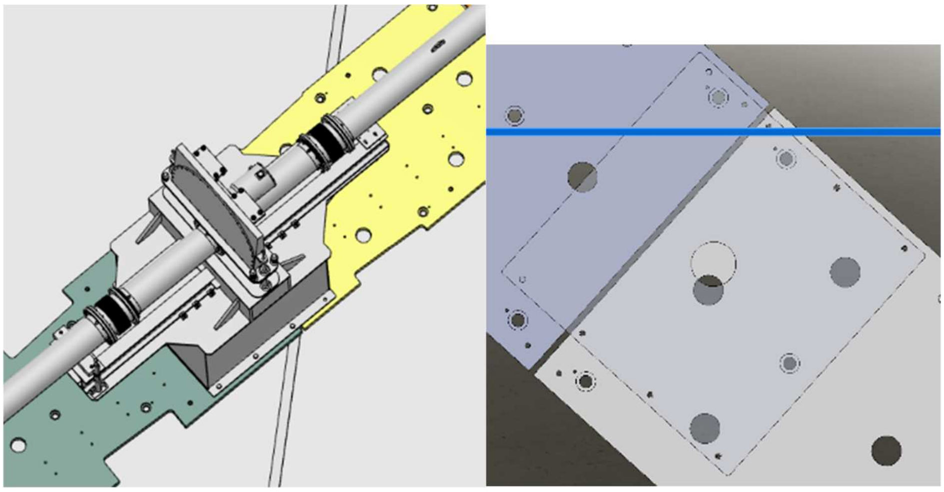


Figure 48: CAD view of the chopper support attached to the green baseplate. (Right) Dilatation joint under the main chopper support.

5.1.10. Bunker Wall Insert

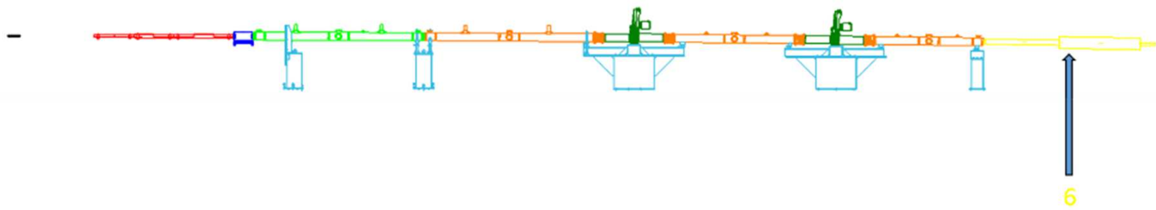


Figure 49: Schematic view of the components in the bunker, with the bunker feedthrough highlighted.

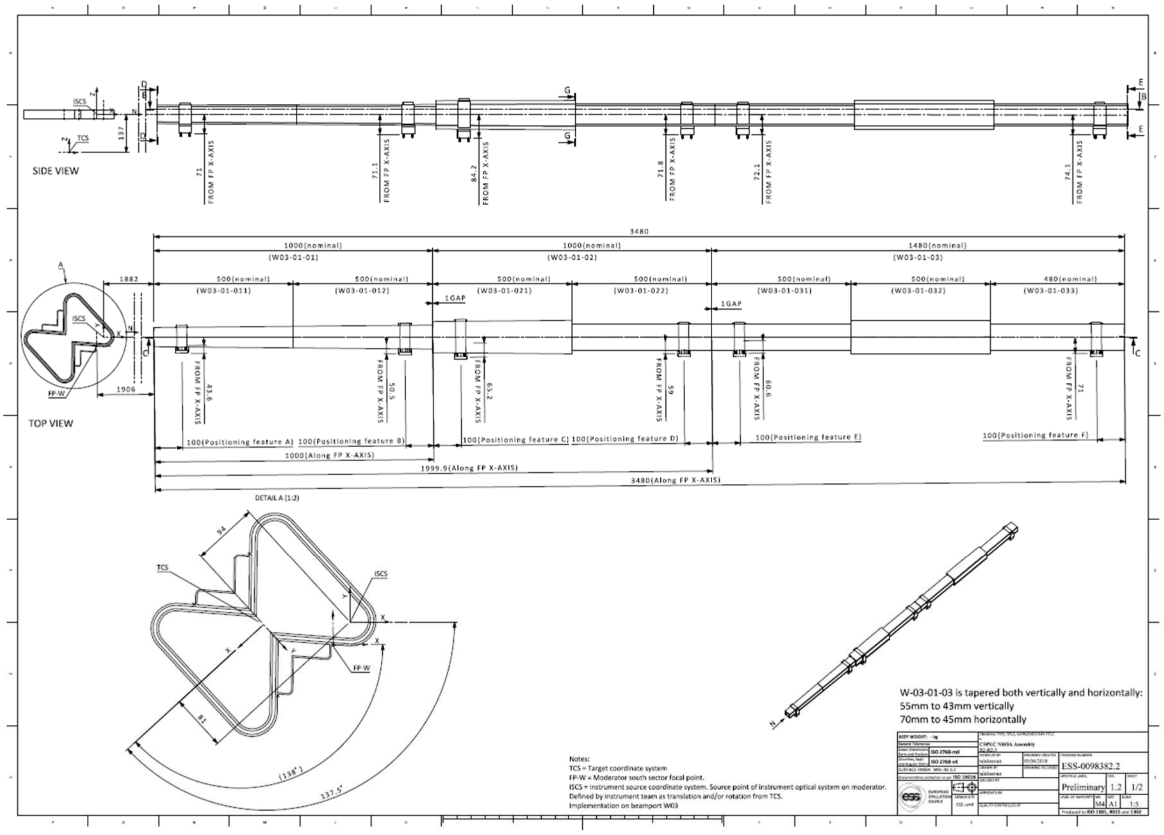
The guide substrate in the bunker feedthrough is Cu. The exact details of the shimming plates around the bunker feedthrough, nor are the exact details of the bunker known. The CSPEC team leave enough freedom around the bunker wall to accommodate changes that can be implemented when more information is available.

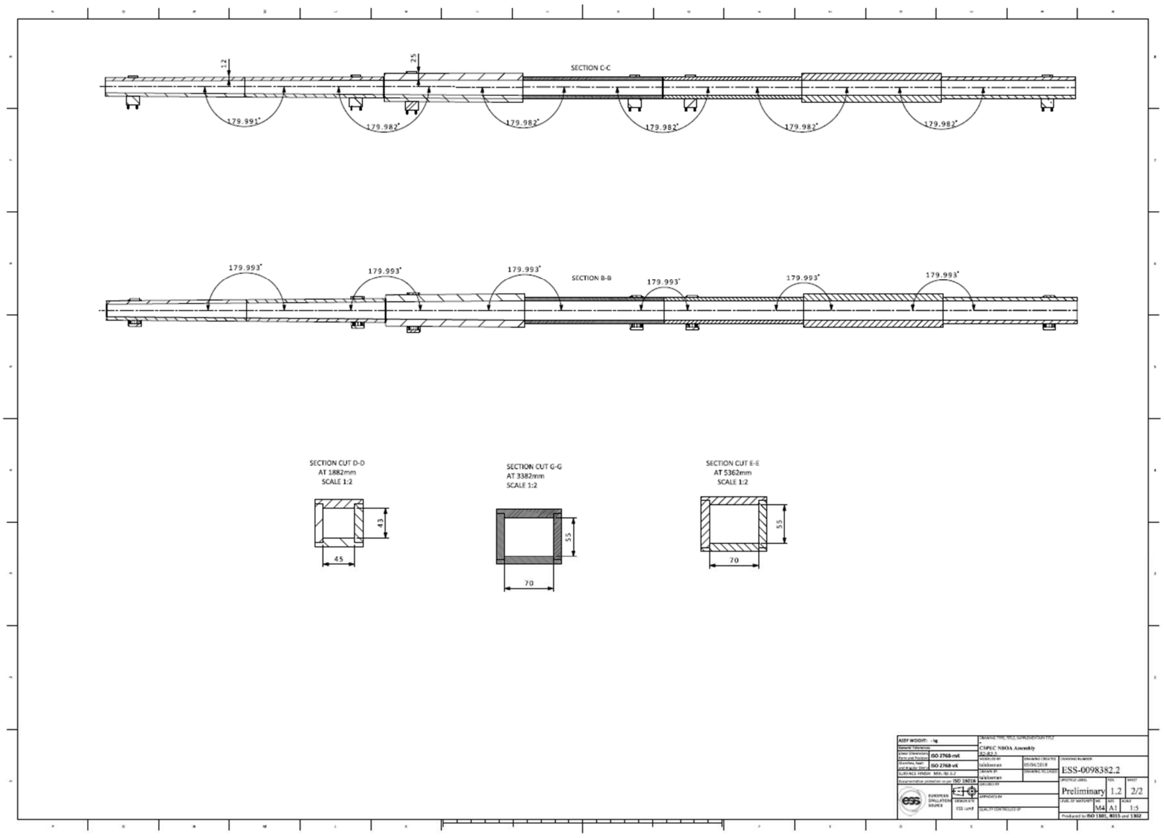
6. THE COMPLETE GUIDE.

The main CSPEC components in the bunker have been presented in sections 1-5. However, the aim of the mini-TG3 is to start development of the entire CSPEC guide. Figure 2 provides an overview of the entire CSPEC guide which is furthermore outlined in more detail in the document 20180504-CSPEC-nl-specs.xlsx. An example of a manufacturing drawing of guide piece W03-06 -22 is shown in the Annexe, section 7. The guide vacuum housing will be developed according to vacuum housing sections 3 and 4. Uncertainty remains around the bunker wall, the instrument shutter, the monitor widths and the precise details of the chopper housing. These uncertainties are mitigated by producing guide pieces adjacent to these regions, at a later date. In particular, guide pieces around the chopper will be finalised after chopper manufacturing drawings are produced.

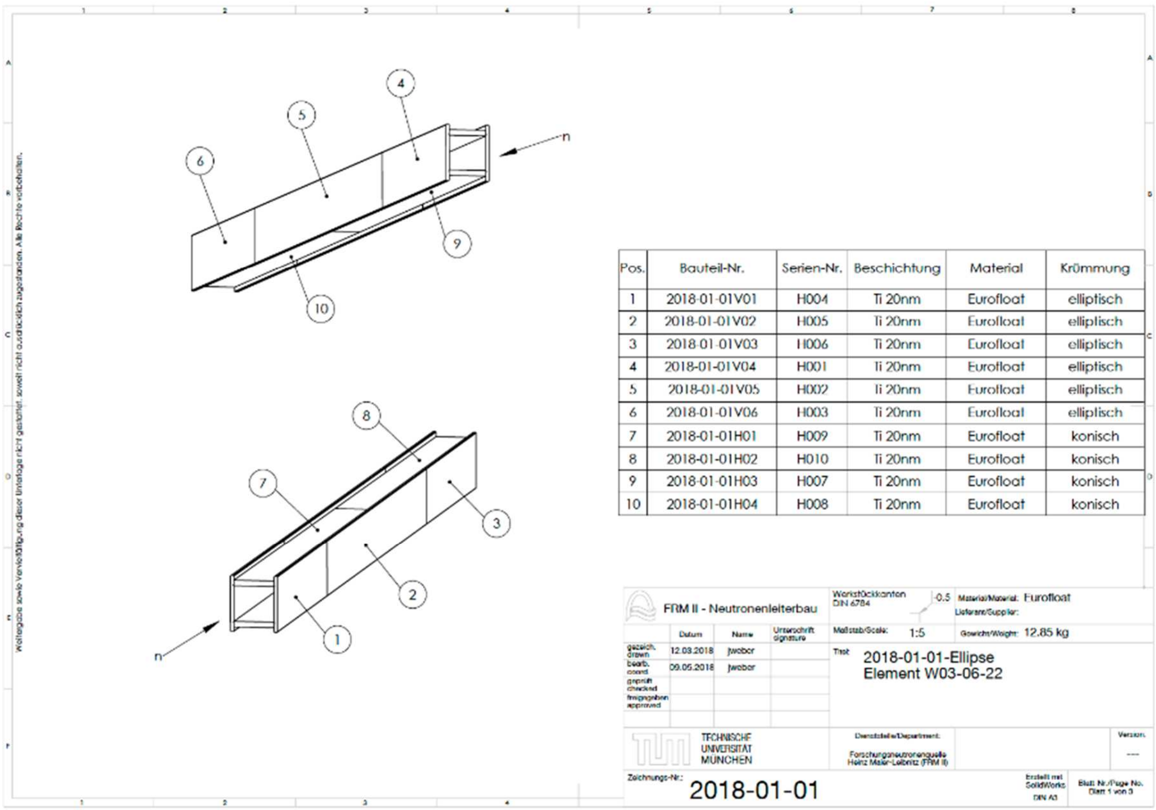
7. ANNEXE

7.1. NBOA CSPEC/ESS design.





NBOA technical drawings



Pos.	Bauteil-Nr.	Serien-Nr.	Beschichtung	Material	Krümmung
1	2018-01-01V01	H004	Ti 20nm	Eurofloat	elliptisch
2	2018-01-01V02	H005	Ti 20nm	Eurofloat	elliptisch
3	2018-01-01V03	H006	Ti 20nm	Eurofloat	elliptisch
4	2018-01-01V04	H001	Ti 20nm	Eurofloat	elliptisch
5	2018-01-01V05	H002	Ti 20nm	Eurofloat	elliptisch
6	2018-01-01V06	H003	Ti 20nm	Eurofloat	elliptisch
7	2018-01-01H01	H009	Ti 20nm	Eurofloat	konisch
8	2018-01-01H02	H010	Ti 20nm	Eurofloat	konisch
9	2018-01-01H03	H007	Ti 20nm	Eurofloat	konisch
10	2018-01-01H04	H008	Ti 20nm	Eurofloat	konisch

Manufacturing drawing of guide piece W03-06-22.

8. GLOSSARY

Term	Definition

9. REFERENCES

[1] ESS-0178279 - Monolith interface.pdf

[2]

DOCUMENT REVISION HISTORY

Revision	Reason for and description of change	Author	Date
1	First issue	P. Deen	06-05-2018