Invitation to Quote

Invitation to Quote (ITQ) on behalf of UK Research and Innovation (UKRI) - Science and Technology Facilities Council (STFC)

Subject: SANDALS Slit System

Sourcing Reference Number: RE20558

UK Shared Business Services Ltd (UK SBS)
www.uksbs.co.uk

Version 4.0

UKSBS
Shared Business Services

Table of Contents

Section 1 – About UK Shared Business Services

Putting the business into shared services

UK Shared Business Services Ltd (UK SBS) brings a commercial attitude to the public sector; helping our Contracting Authorities improve efficiency, generate savings and modernise.

It is our vision to become the leading service provider for the Contracting Authorities of shared business services in the UK public sector, continuously reducing cost and improving quality of business services for Government and the public sector.

Our broad range of expert services is shared by our Contracting Authorities. This allows Contracting Authorities the freedom to focus resources on core activities; innovating and transforming their own organisations.

Core services include Procurement, Finance, Grants Admissions, Human Resources, Payroll, ISS, and Property Asset Management all underpinned by our Service Delivery and Contact Centre teams.

UK SBS is a people rather than task focused business. It's what makes us different to the traditional transactional shared services centre. What is more, being a not-for-profit organisation owned by the Department for Business, Energy & Industrial Strategy (BEIS), UK SBS' goals are aligned with the public sector and delivering best value for the UK taxpayer.

UK Shared Business Services Ltd changed its name from RCUK Shared Services Centre Ltd in March 2013.

Our Customers

Growing from a foundation of supporting the Research Councils, 2012/13 saw Business, Energy and Industrial Strategy (BEIS) transition their procurement to UK SBS and Crown Commercial Services (CCS – previously Government Procurement Service) agree a Memorandum of Understanding with UK SBS to deliver two major procurement categories (construction and research) across Government.

UK SBS currently manages £700m expenditure for its Contracting Authorities.
Our Contracting Authorities who have access to our services and Contracts are detailed here.

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At UK Shared Business Services (UK SBS) we recognise and understand that your privacy is extremely important, and we want you to know exactly what kind of information we collect about you and how we use it.

This privacy notice link below details what you can expect from UK SBS when we collect your personal information.

- We will keep your data safe and private.
- We will not sell your data to anyone.

- We will only share your data with those you give us permission to share with and only for legitimate service delivery reasons.

https://www.uksbs.co.uk/use/pages/privacy.aspx

For details on how the Contracting Authority protect and process your personal data please follow the link below:

https://www.ukri.org/privacy-notice/

Section 2 – About the Contracting Authority

UK Research and Innovation

Operating across the whole of the UK and with a combined budget of more than £6 billion, UK Research and Innovation represents the largest reform of the research and innovation funding landscape in the last 50 years.

As an independent non-departmental public body UK Research and Innovation brings together the seven Research Councils (AHRC, BBSRC, EPSRC, ESRC, MRC, NERC, STFC) plus Innovate UK and a new organisation, Research England.

UK Research and Innovation ensures the UK maintains its world-leading position in research and innovation. This is done by creating the best environment for research and innovation to flourish.

For more information, please visit: www.ukri.org

Section 3 - Working with the Contracting Authority.

In this section you will find details of your Procurement contact point and the timescales relating to this opportunity.

Section 3 – Contact details		
3.1.	Contracting Authority Name and address	UK Research and Innovation Polaris House Swindon SN2 1FL
3.2.	Buyer name	Tim Johnston
3.3.	Buyer contact details	Research.Tenders@uksbs.co.uk
3.4.	Estimated value of the Opportunity Maximum value of the Opportunity	£90,000.00 excluding VAT £120,000.00 excluding VAT
3.5.	Process for the submission of clarifications and Bids	**All correspondence shall be submitted within the Messaging Centre of the e-sourcing. Guidance Notes to support the use of Delta eSourcing is available here.** **Please note submission of a Bid to any email address including the Buyer will result in the Bid not being considered.**

Section 3 - Timescales		
3.6.	Date of Issue of Contract Advert on Contracts Finder	Wednesday, 18 November 2020 Location: Contracts Finder
3.7.	Latest date / time ITQ clarification questions shall be received through Delta eSourcing messaging system	Wednesday, 02 December 2020 14:00
3.8.	Latest date / time ITQ clarification answers should be sent to all Bidders by the Buyer through Delta eSourcing Portal	Thursday, 03 December 2020 14:00
3.9.	Latest date and time ITQ Bid shall be submitted through Delta eSourcing	Wednesday, 09 December 2020 14:00
3.10.	Anticipated notification date of successful and unsuccessful Bids	Wednesday, 23 December 2020 14:00
3.11.	Anticipated Contract Award date	Wednesday, 06 January 2021
3.12.	Anticipated Contract Start date	Wednesday, 13 January 2021
3.13.	Anticipated Contract End date	Wednesday, 28 July 2021
3.14.	Bid Validity Period	60 Days

Section 4 – Specification

Contents

1 Introduction

1.1 Introduction to the Project

1.1.1 ISIS Neutron and Muon Source

ISIS Neutron and Muon Source is a world-leading centre for research located at the Rutherford Appleton Laboratory near Oxford. Our suite of neutron and muon instruments give unique insights into the properties of materials on the atomic scale.

1.1.2 SANDALS overview

SANDALS is a diffractometer specially built for investigating the structure of liquids and amorphous materials.

The Small Angle Neutron Diffractometer for Amorphous and Liquid Samples (SANDALS) is located on the north side of ISIS Target Station 1 and views the liquid methane moderator, making use of neutrons with wavelengths ranging from 0.05 – 4.95 Å. The instrument is optimized for investigating the structure of liquids and amorphous materials formed from light element components, and the delivered wavelength band-pass combined with the detector angle coverage delivers in a practical operating Q-range of 0.1 Å-1 ≤ Q ≤ 50 Å-1. This delivers sub-Angstrom distance resolution (~0.1 Å) for pair distribution studies of liquids and disordered materials out to a length scale of 30 Å.

1.1.3 The science

Understanding the physical, chemical, biological, and materials science properties of liquids and amorphous materials requires a detailed understanding of the interatomic and intermolecular correlations that define these structurally disordered systems. To address this challenge, materials characterisation techniques that do not depend on regular periodic placement of the atomic and molecular components are necessary. SANDALS has been designed to accurately measure total scattering structure factors that allow us to derive atomic pair distribution functions that can characterise disordered atomic and molecular networks. A particular strength of the instrument is

its ability to study hydrogenous materials using the techniques of first and second order difference hydrogen-deuterium isotopic substitution. These methods allow unprecedented levels of information to be extracted from many aqueous and organic systems that would otherwise defy comprehensive atomically resolved characterisation by radiation scattering methods. This capability makes the instrument a particularly potent international resource that delivers significant impact in many fields of modern technological importance, e.g. chemical synthesis, biochemical interactions, and advanced materials development etc.

1.1.4 Slits

Slits are used to cut the neutron beam down to different sizes to meet the requirements of each experiment. Slits consist of four neutron-absorbing blades; two horizontal and two vertical, as seen in Figure 1-1. These blades can be moved with a motion controller to precisely define the neutron beam size.

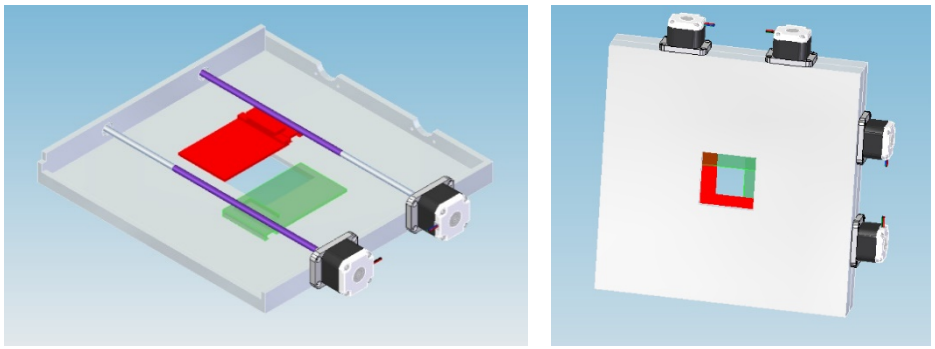

Figure 1-1 - A CAD mock-up of a slit assembly: inside (left) and outside (right)

SANDALS will require three vacuum slit assemblies between the neutron source and the sample, Figure 1-2.

To reduce neutron scatter between the target and the sample, the neutrons travel along an evacuated series of assemblies. The vacuum is 10^{-3} mbar and is considered rough. The slit housings will maintain the integrity of the vacuum for the neutrons to pass through.

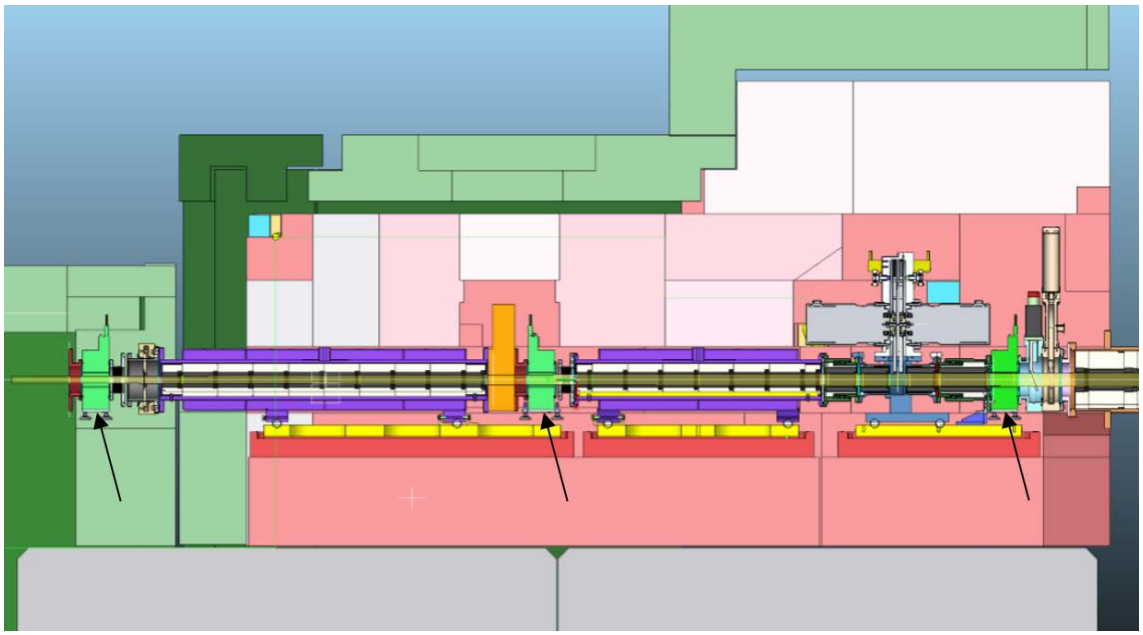

Figure 1-2 - The three slit assemblies (indicated with arrows) are located in the front end shielding

1.1.5 Use case

Good scattering and diffraction measurements require the delivery of well-collimated beams of radiation to the sample position. To facilitate the delivery of variable collimation along the 11m primary radiation flight path of the instrument, the opening of each slit will need to be continuously variable from a closed position up to fully open (either 30x30mm or 60x60mm). This variability is required to allow the instrument performance (in terms of delivered neutron flux and resolution) to be tuned to the requirements posed by the different sizes of sample and sample environment, and associated sample properties, that vary from experiment to experiment. As SANDALS operates via the use of a wide range of neutron wavelengths (0.05 – 4.95 Å), the slits need to be capable of stopping and cleanly shaping beams of epithermal neutrons with energies up to 50eV.

The desired beam sizes at the sample position will lie within the range 3 – 30 mm and steps in beam sizes between experiments are of the order of a few mm. In a diffraction experiment, we keep the slits fixed throughout the whole batch of measurements since we perform a series of background and calibration runs that have to apply to all our sample measurements equally. We thus need to keep everything fixed for the full duration of a set of measurements (up to 14 days). The typical experiment on SANDALS will last around 4 – 5 days and the slits would usually only be moved between experiments. However, several adjustments are required at the beginning of an experiment to find the best settings. Therefore, it should be assumed that each slit would on average be moved twice per week over a period of 30 years. At the other extreme, we do experience periods of several months without the requirement to move the slits. For such times, the slits must stably hold their position; the desired stability should be available over periods of up to six months, regardless of potential power cuts during that time.

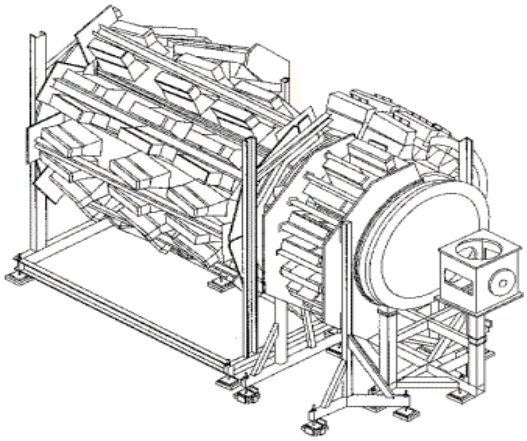

Figure 1-3 - A 3D CAD model of the SANDALS detector banks and vacuum vessel

As slit movements are very unlikely to be the rate-limiting factor on SANDALS, their speed is not particularly critical. A minute or two would be acceptable for the slit blades to move into their specified positions.

Repeatability and accuracy of position and angle are crucial for our experiments. Over a lifetime of 30 years, it is essential that the blades maintain parallelism – when they are closed, they should be closed. We cannot afford to see some slight triangular opening due to misalignment. Also, the unit needs to be installed level. Considering the beam sizes used on SANDALS, the precision of their angular installation is important. When we are setting our aperture sizes we need to be confident that we do not clip material that surrounds the sample in complex sample environments. These materials could be as close as 1 mm from the edge of the beam and the positioning accuracy is required to be at least an order of magnitude greater, as a safety margin.

1.2 Subject of this Technical Specification

The requirement is for the design, supply of material, manufacture, assembly, testing, and delivery of 3 YZ vacuum slit assemblies to STFC, RAL.

2 Scope

Included within the scope of work is:

- the design of the equipment that is to be supplied;
- all sourcing, manufacturing, and assembly activities associated with the supply of the equipment (unless stated otherwise in Section 2.3);
- the delivery of the slits to STFC, RAL, and all packaging and handling activities associated with this delivery;
- defining, implementing, and documenting the results of the quality control and assurance plan;
- the documentation listed in Section 2.2; and
- the activities and deliverables needed for the approval steps listed in Section 3.4.

2.1 Equipment

Included within the scope of the supply are:

- three vacuum slit assemblies;
- transparent covers for the vacuum faces of each slit, to allow visual inspection during testing whilst stopping dirt ingress and unnecessary damage to the vacuum faces;
- a full set of cables required to operate the slits, these cables shall be up to 50m long, *(optional)*; and
- A full set of neutron-absorbing blades, *(optional).*

2.2 Documentation

The contract shall include the supply of the following documentation, all of which should be clearly presented in English and submitted in PDF format unless otherwise stated:

1. Preliminary Design Review (PDR) documentation and minutes
2. Critical Design Review (CDR) documentation and minutes
3. Final Design Review (FDR) documentation and minutes
4. Factory Acceptance Test Procedures
5. Factory Acceptance Test Reports
6. Survey report describing blade positions in XYZ in relation to the external datum of the slit (negative XY, negative ZX, negative YZ planes, see Figure 4-1)
7. Full support documentation of equipment supplied, including installation, operation, and maintenance manuals
8. Programme of work
9. A full set of technical drawings for all equipment supplied (all dimensions to be metric)
10. A complete 3D CAD model of the assembly (STEP format)
11. A list of recommended spare items and costs
12. Safety report
13. Hazard ID documenting residual risks
14. Quality Assurance Plan (including calculations and validation processes)
15. Quality Assurance report
16. Declaration of Incorporation; in accordance with the Machinery Directive 2006/42/EC

2.2.1 Manuals

A detailed technical file and user manual are required. Installation, operation, and maintenance manuals shall be supplied (as electronic and hard copy versions) as part of this Contract. The manuals shall include and/or detail:

1. Installation manual
2. Operation manual
3. Detailed assembly and disassembly instructions
4. Routine maintenance requirements – including a detailed description of tasks, the conditions under which it shall be performed, and the estimated time to complete the task
5. Fault diagnosis instructions
6. Relevant mechanical and electrical drawings
7. Residual risks

2.2.2 Programme of work

Shall include:

1. The total duration of the Contract
2. Details of the design, procurement, manufacturing, assembly, testing, and delivery of the systems
3. The milestones listed in Section 3.4
4. List of the significant work packages to be undertaken by the Supplier, and by any sub-contractors, together with their names

2.3 Items Supplied by STFC

2.3.1 Outline test document

ISIS will include this.

2.3.2 Electrical pinouts

ISIS will provide details of how the slits should be wired. The Supplier should collaborate with ISIS to design and confirm a solution that performs well.

2.3.3 Neutron-absorbing blades

The neutron blades required for each slit will either be provided by ISIS or may be quoted for separately by the Supplier. The Supplier must collaborate with ISIS to determine the YZ dimensions of each blade and any additional mechanical features required.

3 Contract Execution

3.1 Responsibility for Design, Components, and Performance

The Supplier shall be responsible for the correct performance of all items supplied, irrespective of whether they have been chosen by the Supplier or suggested by STFC. STFC's approval of the design and STFC’s component selection does not release the Supplier from their responsibilities in meeting the Technical Specification.

STFC assumes responsibility for the performance of items and sub-systems supplied by STFC.

3.2 Contract Engineer

The Supplier shall assign an engineer to be responsible for the technical execution of the Contract and its follow-up throughout the duration of the Contract.

3.3 Progress Report

The Supplier shall supply, within two weeks of notification of the Contract, a written programme detailing the manufacturing and testing schedules. The programme shall include preliminary dates for inspections and tests.

A written progress report shall be sent to STFC every month via email until completion of the Contract.

3.4 Design Approvals

The following program details the hold points along the design process. For the preliminary, critical, and final design reviews, STFC will deliver the review verdicts within 10 working days.

1. Preliminary Design Review (HOLD POINT)
2. Critical Design Review (HOLD POINT)
3. Final Design Review (HOLD POINT)
4. Manufacture of Final Design
5. Pre-factory Acceptance Test (HOLD POINT)
6. Factory Acceptance Test (HOLD POINT)
7. Site Acceptance Test (HOLD POINT) (FULL PAYMENT RELEASED)

3.4.1 Preliminary Design Review

Review of the conceptual design. This review shall be deemed satisfactory before significant commitment to detailed engineering analysis or the generation of full 3D models.

Objectives:

1. Confirm the requirements and specification, technically as well as time
2. Present the outline concept design or designs – with a clear preferred option, if multiple designs are presented
3. Review and agree the technical viability of the chosen conceptual design and its suitability to advance to the engineering design phase
4. Review and agree the expected timescale
5. Review the risk profile and agree its acceptability
6. Review how the slits will be tested at the Pre-factory Acceptance Test

3.4.2 Critical Design Review

Review of the engineering design. This review should take place when engineering calculations and 3D modelling (or general assembly drawings) have been completed, but before significant commitment is made to the detailed design.

Objectives:

1. Reconfirm that the design satisfies the project requirements and specification
2. Review and agree the technical viability of the engineering design and its suitability to advance to the detailed design phase (the expectation is that there will be no significant changes)
3. Review the risk profile and agree its acceptability
4. Initiate purchase of long lead time items, as appropriate

3.4.3 Final Design Review

Review of the detailed design. This review should take place when the 2D detailed drawings have been completed but before committing to significant procurement.

Objectives:

1. Reconfirm that the design satisfies the project requirements and specification
2. Review any changes to the design since the CDR
3. Review and agree the technical viability of the design and its suitability to advance to the procurement phase

3.4.4 Manufacture of final design

Following a successful final design review, the technical documentation will be developed so that the system components can be procured and assembled.

3.4.5 Pre-factory Acceptance Tests

These tests will be performed at the Supplier's site and the results sent to STFC. Once STFC are satisfied with these results, the Factory Acceptance Test will be organised.

The 1st part of the test will be to run the axes back and forth a desired amount of times to simulate running the slits for a number of months on the beamline. This shall involve driving axes 100 times from one limit switch to the other. This shall be done to help the slits bed in. Once this is completed, accuracy and repeatability tests shall be performed.

The control system used for this test does not need to be the ISIS standard Beckhoff system. The supplier can choose the control system to be used for this test.

3.4.6 Factory Acceptance Tests

These tests shall be performed at the Supplier's site. STFC will witness these tests. This will be a repeat of the Pre-factory Acceptance Test, although the test may be shortened with STFC-approval. For this test, the Supplier can choose the control system to be used to perform the tests. Once STFC are happy with results of the Factory Acceptance Test, shipping to the UK can be organised.

The Supplier shall perform part of the Factory Acceptance Tests with the slits under vacuum (10^{-3} mbar).

3.4.7 Site Acceptance Tests

These tests will be carried out at STFC's RAL site, these will be similar to the Factory Acceptance Tests. These will verify that the specification is still met by the slits and that they have not suffered any damage during transport.

The slits will be tested under vacuum to check suitability for the required vacuum. A shortened version of the Factory Acceptance Test will be performed to check that the slits will operate in vacuum.

Once the tests are completed satisfactorily, full payment will be released. These tests will be performed within 4 weeks of STFC taking delivery of the slits.

3.5 Factory Access

STFC and its representatives shall have free access during normal working hours to the manufacturing or assembly sites, including any subcontractor's premises, during the Contract period.

This access may need to be provided remotely by video conferencing, such as Zoom.

3.6 Tests to be Carried Out at the Supplier's Premises

STFC reserves the right to be present, or to be represented by an organization of its choice, to witness any tests carried out at the Supplier's or subcontractors' premises. The Supplier shall give at least 10 working days' notice of the proposed date of any such tests.

3.7 Testing

When the slits are tested, each blade shall be measured simultaneously by the encoder and two external measurement devices.

4 Technical Requirements

The requirement is for three fully assembled vacuum slits for defining the beam aperture. Each slit will consist of four independently controlled axes of motion (consisting of two Y and two Z axes) mounted within a vacuum-tight structure (once mated with the vacuum assembly on the front and back faces). Each axis will position a neutron-absorbing blade in order to define the aperture.

4.1 Coordinate System and Naming Conventions

The following diagrams detail the coordinate system and naming conventions used.

The neutron beam travels along the X-axis, from the neutron source or target to the sample, Figure 4-1. The Z-axis is vertical.

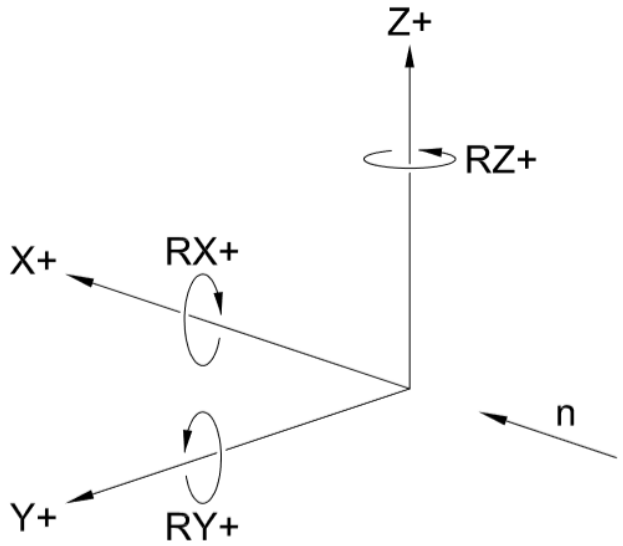

Figure 4-4 - The motion coordinate system: specifying the axis naming convention, and the positive directions and rotations, with the neutron beam entering from the right

An individual blade is sometimes most easily referred to by the side of the beam it acts on. Figure 4-3 shows how this is achieved used the compass naming convention with the beam heading into the page. The blades can then be described as North, South, East, and West, Figure 4-4. 'Into' and 'out of' the page are defined in Figure 4-2.

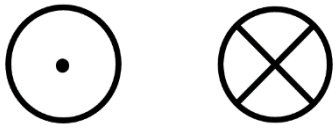

Figure 4-5 - The beam coming out of (left) and into (right) the page

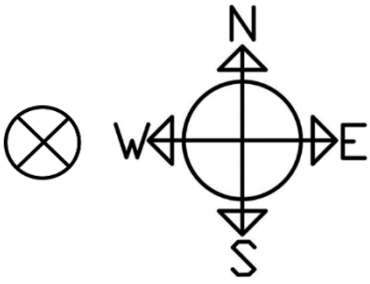

Figure 4-6 - The compass naming convention for blades

The North and South blades define the slit apertures in the Z axis, or the beam's 'height', and the axes are defined as Z2 and Z1 respectively. The East and West blades define the slit apertures in the Y axis, or the beam's 'width', and the axes are defined as Y1 and Y2 respectively.

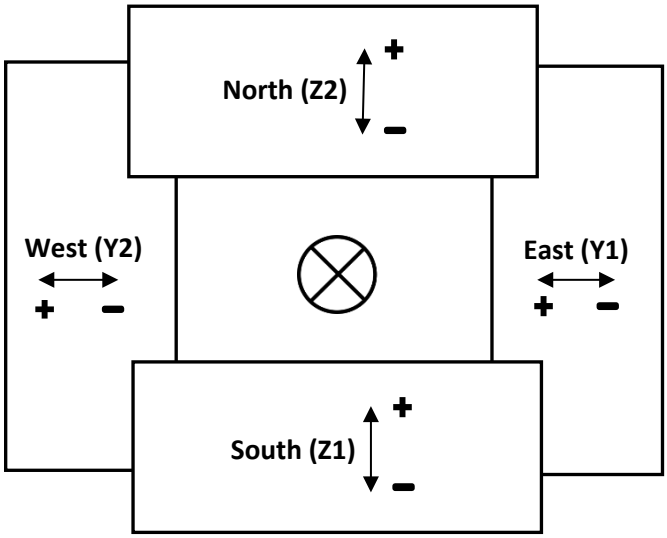

Figure 4-7 - Blade naming convention

4.2 Space Envelope

There is a different space envelope associated with each slit, see Table 4-1. Combined with Figure 4-5, the space available for each is defined from the centre of the beam.

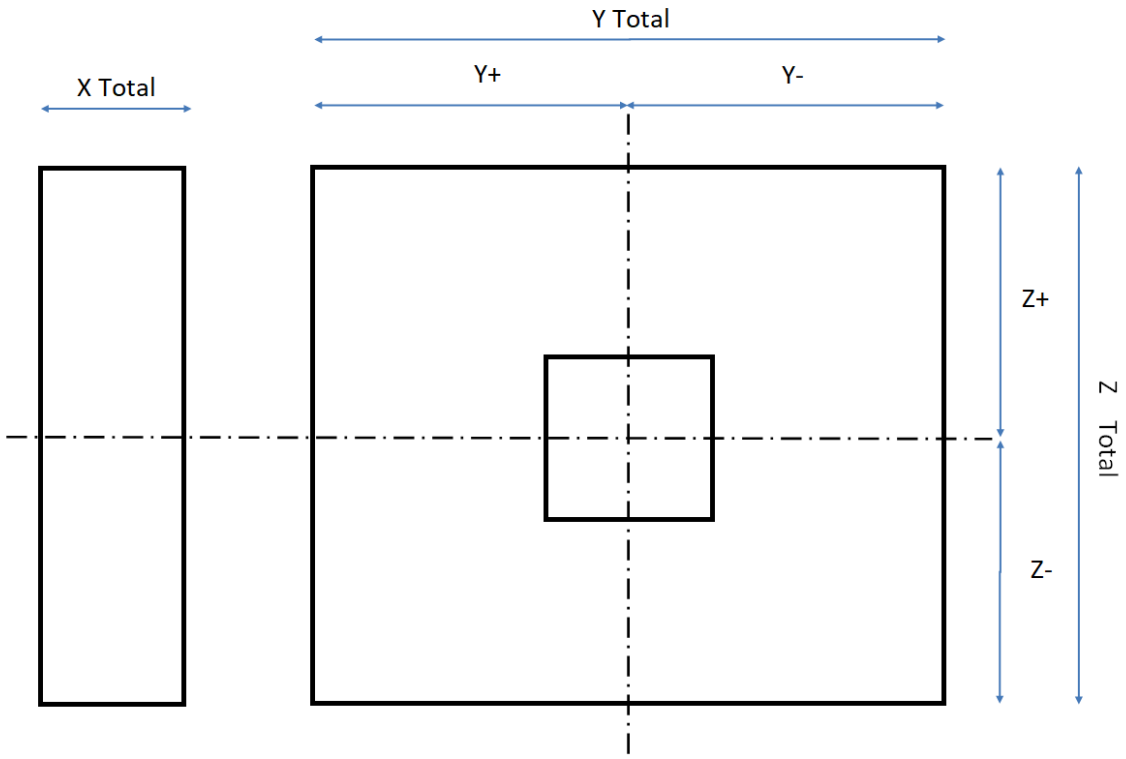

Figure 4-8 – The space envelopes dimensioned from the origin or the centre of the beam

There are mechanical interfaces on the front, back, and bottom of the slit and these are defined in Section 4.5.1. These are both of the external YZ planes and the bottom XY plane.

	Slit 1	Slit 2	Slit 3
X (mm)	122	122	122
Y (mm)	-275, +275	-150, +150	-210, +387
Z (mm)	-134, +750	-134, +450	-134, +215
Electrical Interface	XY-plane, Z+	XY-plane, Z+	XZ-plane, Y+
Total (X) x (Y) x (Z)	122x550x884	122x300x584	122x597x349

Table 4-1 - Space envelopes

The electrical interfaces, defined in Section 4.5.2, shall be situated on the external planes specified in Table 4-1. The location of the fixed sockets on each slit must allow for the cables to be plugged in and complete one full 90 degree bend in the YZ plane within the space envelope, Figure 4-6. It should be assumed that two of the cables each have a fixed bend radius of ~100mm and will be terminated into plugs that are each 75mm long. The other two cables will have smaller connectors and cables that are more flexible.

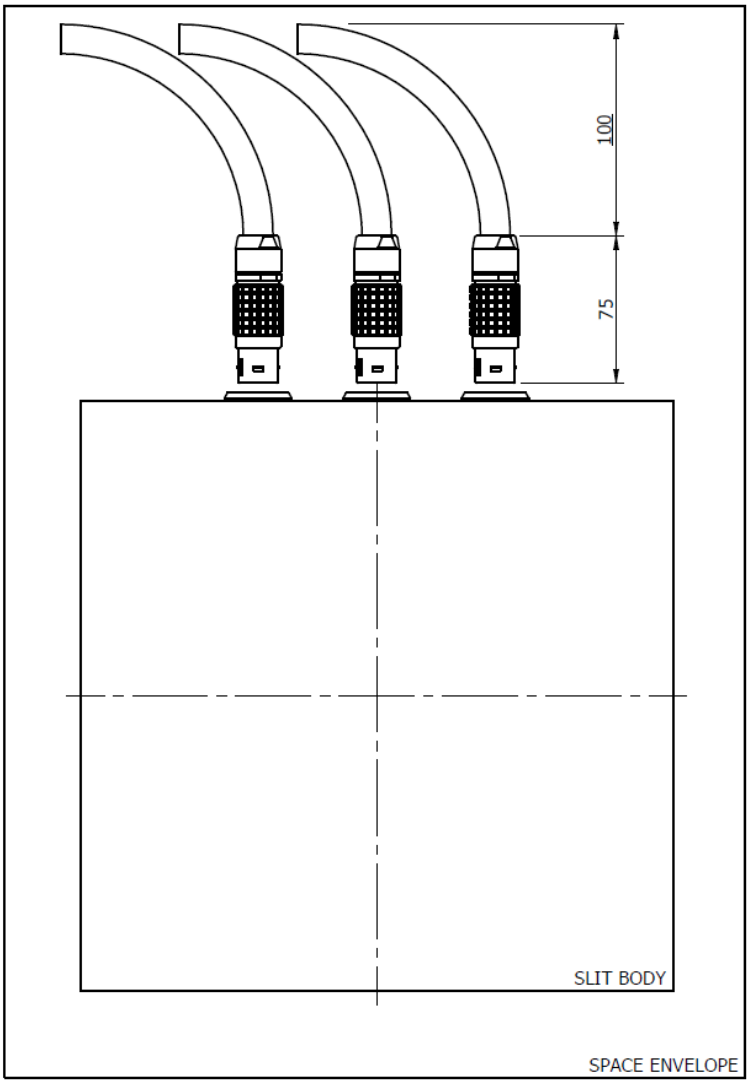

Figure 4-9 - Accommodating Cables within the Space Envelope

4.3 Apertures and Blades

4.3.1 Aperture dimensions

The three slits do not all have the same aperture and their maximum sizes are detailed in Table 4-2. Each slit shall also be able to be block the beam completely. To ensure a completely closed aperture, each blade must be able to translate to 5mm past the beam centre, Figure 4-7. For example, the North/Z2 blade on slit 1 must be able to travel from -5mm to +30mm.

	Slit 1	Slit 2	Slit 3
Y (mm)	60	30	30
Z (mm)	60	30	30
Travel (mm)	35	20	20

Table 4-2 - Slit apertures

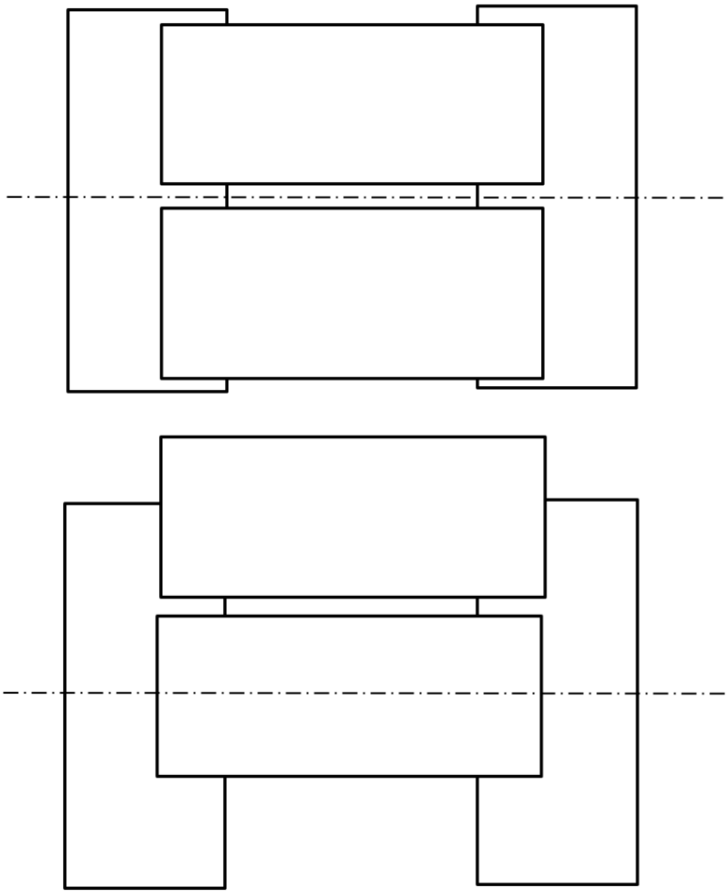

Figure 4-10 - Blades passing over the beam centre

4.3.2 Blade order and separation

The North and South blades should be closer to the sample than their orthogonal pair, East and West.

It is preferred that each blade should be able to overlap its partner, to close the beam entirely, without clashing. The gap between a blade pair (for example, North and South) should be kept to a minimum (less than 1mm), see Figure 4-8. The gap between the two pairs should be no more than 10mm (back of one pair to the front of the other). It is anticipated that these gaps may be even smaller, due to the thick blades and the limited Z-dimension of the space envelopes.

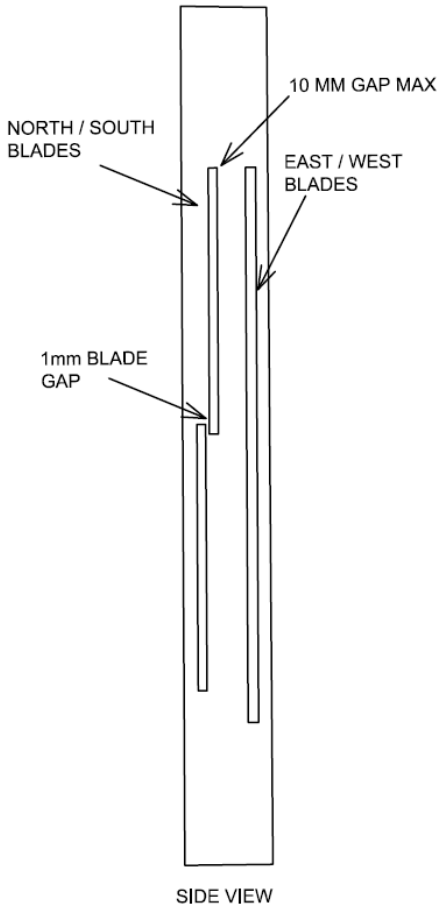

Figure 4-11 - Gaps between blades

The design shall ensure that the blades are unable to clash with each other or any other surface. If the blades must act on the same plane, anti-clash limit switches or some other mechanism will be required to prevent clashes occurring. A design utilising anti-clash limit switches would require different connectors to those specified in Section 4.5.2.

4.3.3 Blades

To ensure there are never any shine paths around the blades, a border providing 5mm of overlap outside the maximum aperture will be required at all times, Figure 4-9. This includes when the blades are at the 5mm over-travel position which, together with the aperture sizes, allows us to define a minimum blade size, Table 4-3. In addition to the minimum, the Supplier will require additional material to interface with the blade carrier mechanism.

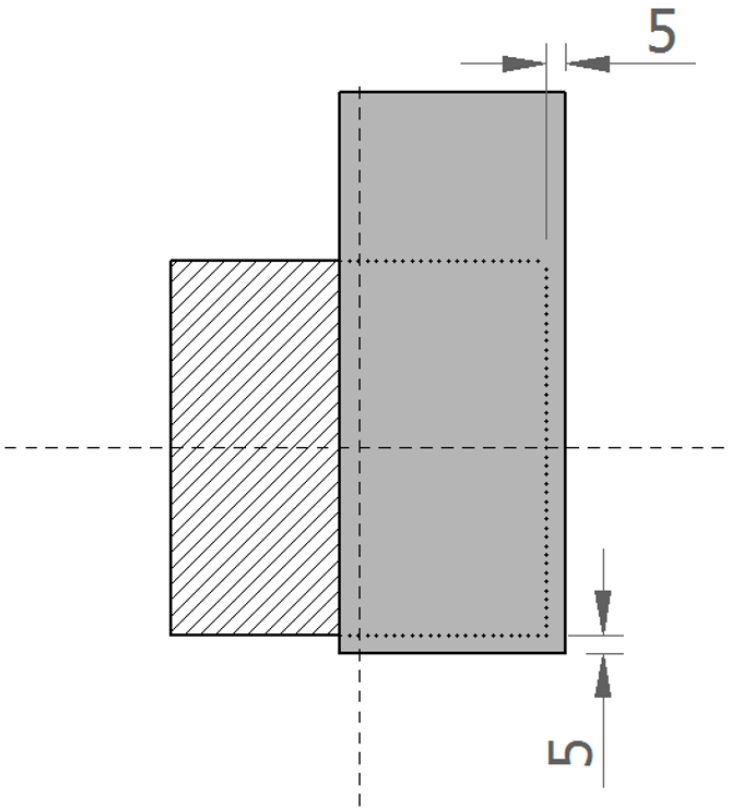

Figure 4-12 - Maintaining a border around the maximum aperture

The Supplier is responsible for ensuring that the design of the blade carrier mechanism is such that only the blade material pass into the active area (within the maximum beam aperture) at any position within the required range of motion.

The Supplier shall design a mechanism for aligning the blades to the base of the slit assembly to within the given tolerance. The blade aligning mechanism shall also allow ISIS staff to realign these the blades with the base in the future.

	Slit 1	Slit 2	Slit 3
Minimum YZ dimensions (mm)	40 x 70	25 x 40	25 x 40
X dimension and material(s)	10mm Nimonic alloy 10mm Sintered B4C	20mm Sintered B4C	20mm Sintered B4C
Estimated blade mass	300-600g	50-100g	50-100g
All dimensions +-0.1mm. Nimonic alloy density taken as 8.2g/cm^3 Sintered B4C density taken as 2.5g/cm^3			
The long edge that defines the slit opening is to have a flatness form tolerance:			0.05mm

Table 4-3 - Blade details

Motion Requirements

4.3.4 Motion overview

The following specification points, in Table 4-4, apply to all axes except where stated otherwise.

Motor type	Stepper
Speed	0.5mm/s
Local positional accuracy	+/- 50µm
Positional repeatability	+/- 5µm
Resolution of motion	2µm
Blade pair parallelism or orthogonality to the datum face	100µm
Parallelism within a blade pair	100µm
Travel range per blade	Slit 1 = 35mm Slit 2 = 20mm Slit 3 = 20mm
Travel restrictions	Limit switch at each end of all axes, which can be overrun Adjustable hard stop at each end of all axes, if limit switches fail
Position feedback	Slit 1 = Resolver Slit 2 = Resolver Slit 3 = Absolute linear encoder
Power-off condition	Self-supporting mechanism capable of maintaining blade position without a brake

Table 4-4 - Motion overview

4.3.5 Motor type

Each axis will be driven by a stepper motor:

- Each motor shall also be fitted with a PT100
- The stepper motor drive will provide 5A, 48VDC max
- Torque and speed performance shall be achievable whilst microstepping

4.3.6 Speed

Speed to be the nominated value or faster.

4.3.7 Local positional accuracy

The accuracy is local and taken from the zero position at the centre of the slit aperture. This will be tested in multiple positions along the travel and measured at two points on the blade surface, Figure 4-10. These two positions on the blade surface shall be within 5mm of the extremes of the maximum aperture for that slit.

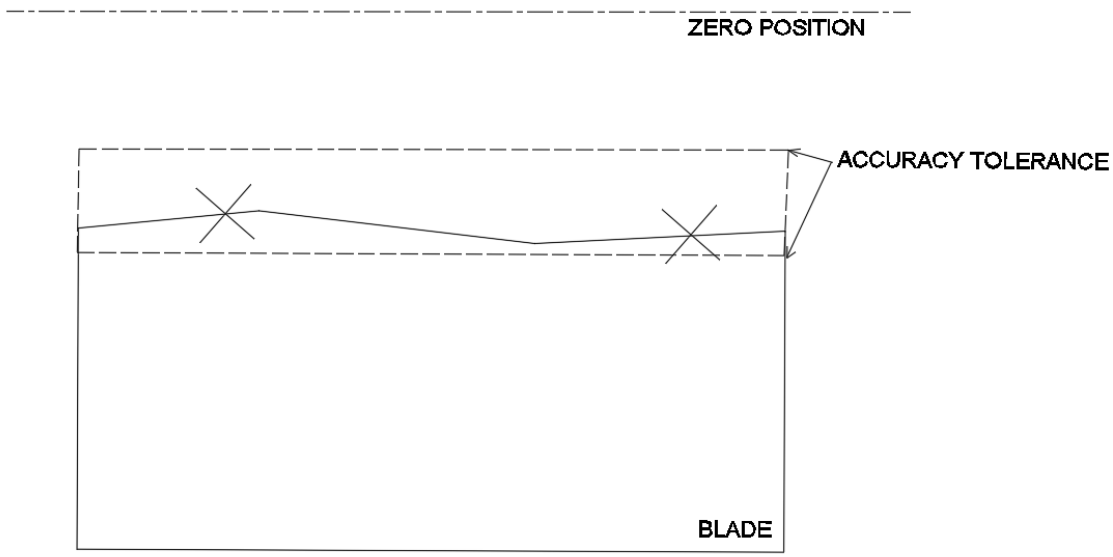

Figure 4-13 – Measuring that the positional accuracy of the blade (solid line) at two points (crosses) is within the tolerance window (dashed line)

4.3.8 Positional repeatability

The blade shall move to the same position, within the nominated value, on at least 10 consecutive occasions as measured at a minimum of two positions, as in Section 4.4.4.

4.3.9 Resolution of motion

The resolution is the distance travelled by the blade from the movement of a single full motor step; microstepping will be not considered. The travel shall be either the same or smaller than the nominated value.

It must be possible to read this move on the encoder.

4.3.10 Blade pair parallelism or orthogonality to the datum face

To make sure that all the slits are parallel, it is important that the North and South blades are parallel throughout their whole travel to a known datum, Figure 4-11. This datum face shall be the bottom mounting face of the slit housing and is to be set horizontal with respect to the ground.

For the East and West blades they shall be orthogonal to this datum to within the nominated tolerance.

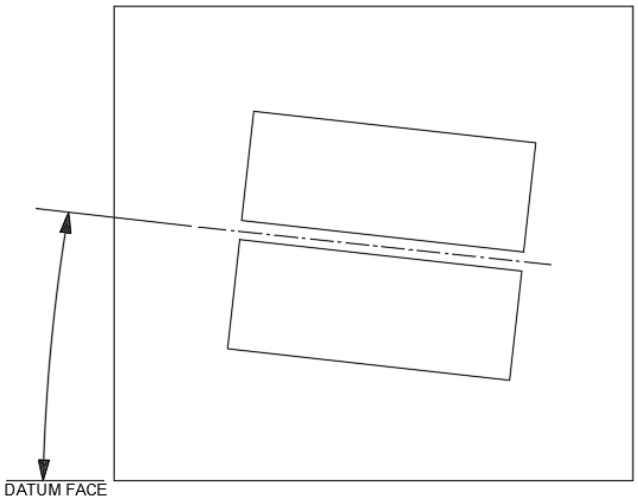

Figure 4-14 - Blade gap orientation relative to the datum face

4.3.11 Parallelism within a blade pair

The slit blades shall remain parallel to each other across the motion to within the nominated value.

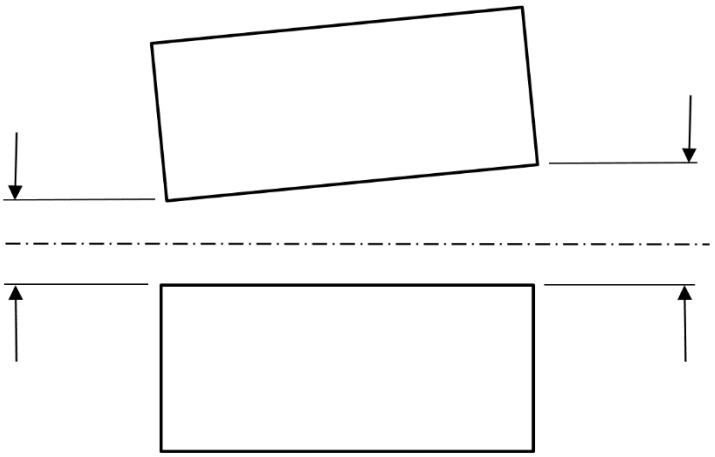

Figure 4-15 - Blade parallelism

4.3.12 Travel range per blade

As detailed in Section 4.3.1, there are different aperture requirements, and therefore travel ranges per blade, for each slit.

4.3.13 Travel restrictions

The travel shall be restricted at each end of each axis using a limit switch, which is actuated by a ramped cam and triggered side on, Figure 4-13. The stage must be able to overrun the switch, in case the switch malfunctions, and then hit an adjustable hard stop.

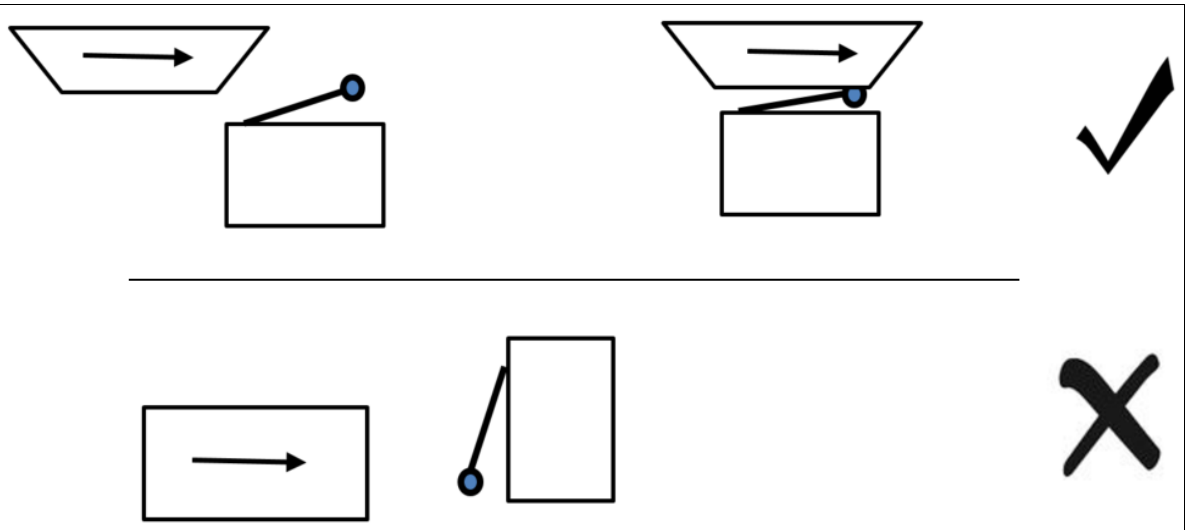

Figure 4-16 - Limit switches correctly (above) and incorrectly (below) orientated

4.3.14 Position feedback

The position feedback for slits 1 and 2 will be a resolver attached to either the rear shaft of the motor or directly onto the axis screw.

The position feedback for slit 3 shall be an absolute linear encoder meeting the specification in Table 4-5, and attached as close to the moving blade as possible. The encoder resolution should be smaller than the resolution of motion.

Technology	Supply voltage	Interface
Optical or Magnetic	5, 9, or 24VDC	BISS-C, EnDat 2.2, SSI

Table 4-5 - Absolute encoder specification

4.3.15 Power-off conditions

The axes shall not be able to move when they are powered off. This should be achieved by producing a system with a low enough drive efficiency. Lead screws may provide adequate friction to hold their position when unpowered, whereas a ball screw may fall if the load is larger than the detent torque of the stepper motor. It is acceptable to use a ball screw with a gearbox, if it produces enough friction to hold the load.

4.4 Critical Interfaces

4.4.1 Mechanical interfaces

The slits performance in parallelism will be measured from the base of the slits, this surface shall be machined to a suitable tolerance to achieve these accuracies. The slits will then be mounted to a base plate.

Each slit shall be fitted front and back with an O-ring seal, with a DN160 ISO-K centering ring and secured with 8x M10 claw clamps on a 200PCD, see Figure 4-14. The diagram also details two location features, which will be required on the front and back of each slit.

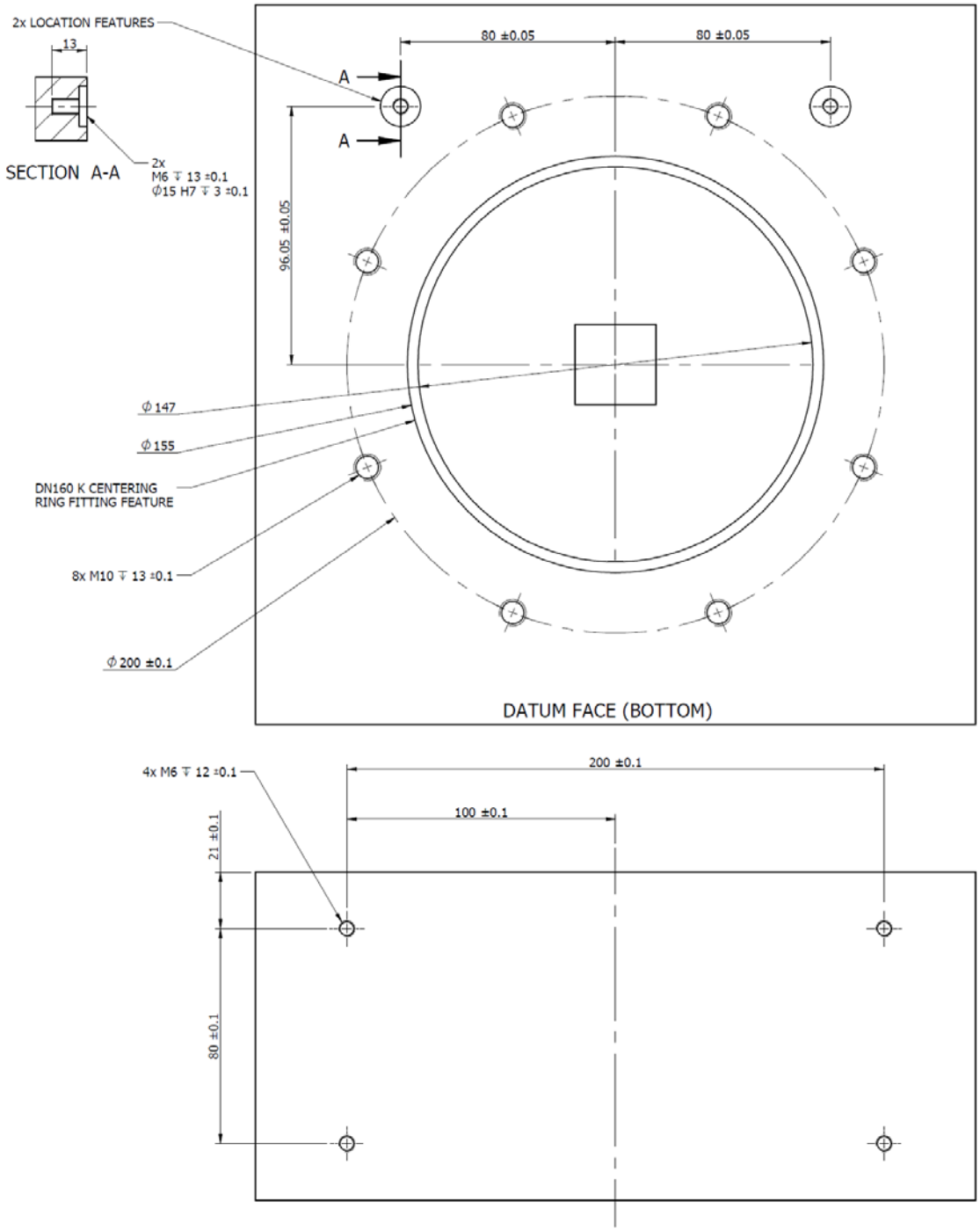

Figure 4-17 - Mechanical interfaces including vacuum and location features (above) and base (below)

4.4.2 Electrical interfaces

The control system will connect to the electrical devices (motors, Pt100s, feedback, and switches) in the slit assemblies using four cables per slit. The cables will be permanently installed in the rack, without connectors. At each slit there will be an electrical break, consisting of fixed sockets and free plugs, for ease of installation and maintenance.

The connectors used in the electrical break should be selected from the LEMO B series. It is strongly recommended that they are chosen from the proposal in Table 4-6. The switches and

Pt100 connectors will be size 2B, whilst the motor and feedback connectors will be size 4B. The exact selection (EGJ or HGJ fixed sockets) will depend on whether the Supplier's design has all of the electrical devices in vacuum or some in and some out of vacuum.

The table includes recommended cables for each device type from Helukabel. Alternatives with a higher specification may also be proposed to STFC by the Supplier.

The final digit of the part number for free sockets (for devices in air) relate to crimp size and will be dictated by the wiring of the devices selected by the Supplier. Internal wiring sizes should be agreed with STFC.

In the UK, all of these components have lead times of 4-12 weeks, at the time of writing.

The cables may be required to be up to 50m in length.

	Cable	Free Plug	Fixed Socket (for devices in air)	Fixed Socket (for devices in vacuum)
Motor	(8 x 2 x 0.5) Part # 19125 ⌀13.4mm	FGJ.4B.316.CYMD13Z GMA.4B.013.DS	EGJ.4B.316.CY# GCA.4S.255.LT	HGJ.4B.316.CLAPV GCA.4S.255.LT
Pt100	(4 x 2 x 0.25) Part # 21036 ⌀7.4mm	FGJ.2B.308.CYMD82Z GMA.2B.070.DR	EGJ.2B.308.CY# GCA.2S.255.LT	HGJ.2B.308.CLAPV GCA.2S.255.LT
Feedback (Slit 1 & 2)	10 x (2 x 0.25) Part # 21329 ⌀11.7mm	FGJ.4B.340.CYMD12Z GMA.4B.010.DV	EGJ.4B.340.CY# GCA.4S.255.LT	HGJ.4B.340.CLAPV GCA.4S.255.LT
Feedback (Slit 3)	(20 x 2 x 0.25) Part # 21047 ⌀14.5mm	FGJ.4B.340.CYMD15Z GMA.4B.013.DV	EGJ.4B.340.CY# GCA.4S.255.LT	HGJ.4B.340.CLAPV GCA.4S.255.LT
Switches	(6 x 2 x 0.25) Part # 21038 ⌀8.9mm	FGJ.2B.312.CYMD92Z GMA.2B.070.DJ	EGJ.2B.312.CY# GCA.2S.255.LT	HGJ.2B.312.CLAPV GCA.2S.255.LT

Table 4-6 - Electrical interface components

4.5 Materials

The bulk material of the slit housing, and any large parts within it, should be made from aluminium alloys. Stainless steels are permitted for fasteners and small fittings only. Bronzes are permitted for use within the motion mechanics.

4.6 Safety

The slits should be designed in way to keep risks to personnel to a minimum.

The slits will form their own vacuum containment when in operational use, which will likely provide an element of protection, but personnel will also need to interact with the slits during commissioning and maintenance.

Lower torque motors should be used where possible.

The assembly should be free of sharp edges.

All electrical contacts should be suitably insulated to avoid electric shock or short circuit.

During an emergency stop situation power may be removed from motors. Removal of power to the motors should not cause any other hazardous situation due to stored energy etc.

4.7 Operational Conditions

4.7.1 Lifespan and duty cycle

The SANDALS beamline will be in use for 30 years. The slits shall be in operation for this time.

ISIS has 200 operational days through the year and the slits will be driven 10 times during an operational week. For the purpose of this specification, it should be assumed that each axis will complete 285 moves a year and roughly 8500 moves in its lifetime.

All axes must be driven from one limit switch to the other 100 times during the pre-factory tests.

4.7.2 Environmental conditions

4.7.2.1 Vacuum environment

All three slit assemblies will act as their own vacuum chamber enclosures when interfaced with the wider front end vacuum assembly. They shall not introduce additional vacuum windows that the neutron beam must pass through.

The vacuum will be $1x10^{-3}$ mbar.

The slit housings should achieve a leak rate of less than $1x10^{-5}$ mbar*l/s.

All items shall be cleaned for vacuum and all trapped volumes are to be vented. All equipment to be used within vacuum shall have a proven ability to perform well within a similar vacuum range. Evidence will be required for any equipment without a vacuum rating. Lubricants, greases, and outgassing materials should be kept to a minimum.

The slit vacuum faces must be provided with simple covers to keep them clean and free of scratches during testing and commissioning. The material selected should be readily recyclable and clearly engraved with its material.

4.7.2.2 Radiation environment

The slits will operate within a moderate neutron and gamma radiation environment. Such radiation; can damage parts and materials, thereby limiting the reliability of a system; and can cause materials to activate, which can create a hazard during maintenance and other work. The materials and parts specified have been selected to appropriately limit this risk. The materials selected by the Supplier as a part of the detailed design will be reviewed by STFC with regard to this risk.

4.7.2.3 Operational temperature

The slit assemblies shall meet specification at temperatures of 20°C ± 2°C but will be operated at a wider range.

5 Quality Assurance

The system components and completed assembly must be inspected and validated to verify compliance to the specification. The Supplier will be responsible for defining, implementing, and documenting the results of the quality control and assurance plan. The Supplier must provide a detailed quality control and assurance plan at the CDR. The completeness of which shall form part of the review approval criteria. The plan submitted at CDR must demonstrate how the quality control and quality assurance steps planned and taken will ensure compliance to each specification clause.

All characteristics listed in Table 4-4 must be ensured as part of the quality control process.

In accordance with the Machinery Directive 2006/42/EC, a complete Hazard Identification & risk assessment, including residual risks, must be generated. These documents must be submitted as part of the documentation scope and will be reviewed at the design reviews.

6 Delivery and Commissioning

6.1 Provisional Delivery Schedule

Supplier may adapt the intermediate steps in the provisional schedule below to suit their programme of work. Schedule below assumes contract commences on 13/01/21.

Final design documentation submitted for Final Design Review no later than:	30/03/21	11 weeks
Final design approval given no later than:	21/04/21	13 weeks
Successful Factory Acceptance Test completed no later than:	14/07/21	26 weeks
Successful delivery to RAL site no later than:	28/07/21	28 weeks

Installation is due to commence from 18 weeks and the tender delivery weighting reflects this. The dates above reflect the possible float in the plan but earlier delivery is preferred.

6.2 Items delivered

The items shall be delivered to STFC's RAL site within 28 weeks of the Contract being placed.

6.3 Acceptance and Guarantee

Provisional acceptance will be given by STFC only after all items have been delivered in accordance with the conditions of the Contract including documentation referred to in this Technical Specification, all tests specified have been successfully completed, and all test or other certificates have been supplied to STFC.

The Supplier shall offer a minimum warranty period of 24 month.

Terms and Conditions

Bidders are to note that any requested modifications to the Contracting Authority Terms and Conditions on the grounds of statutory and legal matters only, shall be raised as a formal clarification during the permitted clarification period.

Section 5 – Evaluation model

The evaluation model below shall be used for this ITQ, which will be determined to two decimal places.

Where a question is 'for information only' it will not be scored.

The evaluation and if required team may comprise staff from UK SBS and the Contracting Authority and any specific external stakeholders the Contracting Authority deems required.

After evaluation and if required moderation scores will be finalised by performing a calculation to identify (at question level) the mean average of all evaluators (Example – a question is scored by three evaluators and judged as scoring 5, 5 and 6. These scores will be added together and divided by the number of evaluators to produce the final score of 5.33 (5+5+6 =16÷3 = 5.33)

Pass / Fail criteria		
Questionnaire	**Q No.**	**Question subject**
Commercial	SEL1.2	Employment breaches/ Equality
Commercial	SEL1.3	Compliance to Section 54 of the Modern Slavery Act
Commercial	FOI1.1	Freedom of Information
Commercial	AW1.1	Form of Bid
Commercial	AW1.3	Certificate of Bona Fide Bid
Commercial	AW3.1	Validation check
Commercial	AW4.1	Compliance to the Contract Terms
Commercial	AW4.2	Changes to the Contract Terms
Price	AW5.1	Maximum budget
Quality	AW6.1	Compliance to the Specification
Quality	AW6.2	Variable Bids
Quality	PROJ1.3	Delivery Schedule
-	-	Invitation to Quote – received on time within e-sourcing tool
	In the event of a Bidder failing to meet the requirements of a Mandatory pass / fail criteria, the Contracting Authority reserves the right to disqualify the Bidder and not consider evaluation of any of the Award stage scoring methodology or Mandatory pass / fail criteria.	

Scoring criteria

Evaluation Justification Statement

In consideration of this particular requirement the Contracting Authority has decided to evaluate Potential Providers by adopting the weightings/scoring mechanism detailed within this ITQ. The Contracting Authority considers these weightings to be in line with existing best practice for a requirement of this type.

Questionnaire	Q No.	Question subject	Maximum Marks
Price	AW5.2	Price	30%
Quality	PROJ1.1	Supply of Cables	5%
Quality	PROJ1.4	Delivery Date	15%
Quality	PROJ1.5	Demonstrate capability to meet the requirements	40%
Quality	PROJ1.6	Specification confirmation calculations	10%

Evaluation of criteria

Non-Price elements

Each question will be judged on a score from 0 to 100, which shall be subjected to a multiplier to reflect the percentage of the evaluation criteria allocated to that question.

Where an evaluation criterion is worth 20% then the 0-100 score achieved will be multiplied by 20**%**.
Example if a Bidder scores 60 from the available 100 points this will equate to 12% by using the following calculation:
Score = {weighting percentage} x {bidder's score} = 20% x 60 = 12

The same logic will be applied to groups of questions which equate to a single evaluation criterion.

The 0-100 score shall be based on (unless otherwise stated within the question):

0	The Question is not answered, or the response is completely unacceptable.
10	Extremely poor response – they have completely missed the point of the question.
20	Very poor response and not wholly acceptable. Requires major revision to the response to make it acceptable. Only partially answers the requirement, with major deficiencies and little relevant detail proposed.
40	Poor response only partially satisfying the selection question requirements with deficiencies apparent. Some useful evidence provided but response falls well short of expectations. Low probability of being a capable supplier.
60	Response is acceptable but remains basic and could have been expanded upon. Response is sufficient but does not inspire.

80	Good response which describes their capabilities in detail which provides high levels of assurance consistent with a quality provider. The response includes a full description of techniques and measurements currently employed.
100	Response is exceptional and clearly demonstrates they are capable of meeting the requirement. No significant weaknesses noted. The response is compelling in its description of techniques and measurements currently employed, providing full assurance consistent with a quality provider.

All questions will be scored based on the above mechanism. Please be aware that there may be multiple evaluators. If so, their individual scores will be averaged (mean) to determine your final score as follows:

Example
Evaluator 1 scored your bid as 60
Evaluator 2 scored your bid as 60
Evaluator 3 scored your bid as 40
Evaluator 4 scored your bid as 40
Your final score will (60+60+40+40) ÷ 4 = 50

Price elements will be judged on the following criteria.

The lowest price for a response which meets the pass criteria shall score 100.
All other bids shall be scored on a pro rata basis in relation to the lowest price. The score is then subject to a multiplier to reflect the percentage value of the price criterion.

For example - Bid 1 £100,000 scores 100.
Bid 2 £120,000 differential of £20,000 or 20% remove 20% from price scores 80
Bid 3 £150,000 differential £50,000 remove 50% from price scores 50.
Bid 4 £175,000 differential £75,000 remove 75% from price scores 25.
Bid 5 £200,000 differential £100,000 remove 100% from price scores 0.
Bid 6 £300,000 differential £200,000 remove 100% from price scores 0.
Where the scoring criterion is worth 50% then the 0-100 score achieved will be multiplied by 50.

In the example if a supplier scores 80 from the available 100 points this will equate to 40% by using the following calculation: Score/Total Points multiplied by 50 (80/100 x 50 = 40)

The lowest score possible is 0 even if the price submitted is more than 100% greater than the lowest price.

Section 6 – Evaluation questionnaire

Bidders should note that the evaluation questionnaire is located within the **e-sourcing questionnaire.**

Guidance on completion of the questionnaire is available at http://www.uksbs.co.uk/services/procure/Pages/supplier.aspx

PLEASE NOTE THE QUESTIONS ARE NOT NUMBERED SEQUENTIALLY

Section 7 – General Information

What makes a good bid – some simple do's ☺

DO:

7.1 Do comply with Procurement document instructions. Failure to do so may lead to disqualification.

7.2 Do provide the Bid on time, and in the required format. Remember that the date/time given for a response is the last date that it can be accepted; we are legally bound to disqualify late submissions. Responses received after the date indicated in the ITQ shall not be considered by the Contracting Authority, unless the Bidder can justify that the reason for the delay, is solely attributable to the Contracting Authority

7.3 Do ensure you have read all the training materials to utilise e-sourcing tool prior to responding to this Bid. If you send your Bid by email or post it will be rejected.

7.4 Do use Microsoft Word, PowerPoint Excel 97-03 or compatible formats, or PDF unless agreed in writing by the Buyer. If you use another file format without our written permission, we may reject your Bid.

7.5 Do ensure you utilise the Delta eSourcing messaging system to raise any clarifications to our ITQ. You should note that we will release the answer to the question to all Bidders and where we suspect the question contains confidential information, we may modify the content of the question to protect the anonymity of the Bidder or their proposed solution

7.6 Do answer the question, it is not enough simply to cross-reference to a 'policy', web page or another part of your Bid, the evaluation team have limited time to assess bids and if they can't find the answer, they can't score it.

7.7 Do consider who the Contracting Authority is and what they want – a generic answer does not necessarily meet every Contracting Authority's needs.

7.8 Do reference your documents correctly, specifically where supporting documentation is requested e.g. referencing the question/s they apply to.

7.9 Do provide clear, concise and ideally generic contact details; telephone numbers, e-mails and fax details.

7.10 Do complete all questions in the questionnaire or we may reject your Bid.

7.11 Do ensure that the Response and any documents accompanying it are in the English Language, the Contracting Authority reserve the right to disqualify any full or part responses that are not in English.

7.12 Do check and recheck your Bid before dispatch.

What makes a good bid – some simple do not's ☹

DO NOT

7.13 Do not cut and paste from a previous document and forget to change the previous details such as the previous buyer's name.

7.14 Do not attach 'glossy' brochures that have not been requested, they will not be read unless we have asked for them. Only send what has been requested and only send supplementary information if we have offered the opportunity so to do.

7.15 Do not share the Procurement documents, they are confidential and should not be shared with anyone without the Buyers written permission.

7.16 Do not seek to influence the procurement process by requesting meetings or contacting UK SBS or the Contracting Authority to discuss your Bid. If your Bid requires clarification the Buyer will contact you. All information secured outside of formal Buyer communications shall have no Legal standing or worth and should not be relied upon.

7.17 Do not contact any UK SBS staff or the Contracting Authority staff without the Buyers written permission or we may reject your Bid.

7.18 Do not collude to fix or adjust the price or withdraw your Bid with another Party as we will reject your Bid.

7.19 Do not offer UK SBS or the Contracting Authority staff any inducement or we will reject your Bid.

7.20 Do not seek changes to the Bid after responses have been submitted and the deadline for Bids to be submitted has passed.

7.21 Do not cross reference answers to external websites or other parts of your Bid, the cross references and website links will not be considered.

7.22 Do not exceed word counts, the additional words will not be considered.

7.23 Do not make your Bid conditional on acceptance of your own Terms of Contract, as your Bid will be rejected.

7.24 Do not unless explicitly requested by the Contracting Authority either in the procurement documents or via a formal clarification from the Contracting Authority send your response by any way other than via e-sourcing tool. Responses received by any other method than requested will not be considered for the opportunity.

Some additional guidance notes

7.25 All enquiries with respect to access to the e-sourcing tool and problems with functionality within the tool must be submitted to Delta eSourcing, Telephone 0845 270 7050

7.26 Bidders will be specifically advised where attachments are permissible to support a question response within the e-sourcing tool. Where they are not permissible any attachments submitted will not be considered as part of the evaluation process.

7.27 Question numbering is not sequential and all questions which require submission are included in the Section 6 Evaluation Questionnaire.

7.28 Any Contract offered may not guarantee any volume of work or any exclusivity of supply.

7.29 We do not guarantee to award any Contract as a result of this procurement

7.30 All documents issued or received in relation to this procurement shall be the property of the Contracting Authority / UKSBS.

7.31 We can amend any part of the procurement documents at any time prior to the latest date / time Bids shall be submitted through the Delta eSourcing Portal.

7.32 If you are a Consortium you must provide details of the Consortiums structure.

7.33 Bidders will be expected to comply with the Freedom of Information Act 2000, or your Bid will be rejected.

7.34 Bidders should note the Government's transparency agenda requires your Bid and any Contract entered into to be published on a designated, publicly searchable web site. By submitting a response to this ITQ Bidders are agreeing that their Bid and Contract may be made public

7.35 Your bid will be valid for 60 days or your Bid will be rejected.

7.36 Bidders may only amend the contract terms during the clarification period only, only if you can demonstrate there is a legal or statutory reason why you cannot accept them. If you request changes to the Contract terms without such grounds and the Contracting Authority fail to accept your legal or statutory reason is reasonably justified, we may reject your Bid.

7.37 We will let you know the outcome of your Bid evaluation and where requested will provide a written debrief of the relative strengths and weaknesses of your Bid.

7.38 If you fail mandatory pass / fail criteria we will reject your Bid.

7.39 Bidders are required to use IE8, IE9, Chrome or Firefox in order to access the functionality of the Delta eSourcing Portal.

7.40 Bidders should note that if they are successful with their proposal the Contracting Authority reserves the right to ask additional compliancy checks prior to the award of

any Contract. In the event of a Bidder failing to meet one of the compliancy checks the Contracting Authority may decline to proceed with the award of the Contract to the successful Bidder.

7.41 All timescales are set using a 24-hour clock and are based on British Summer Time or Greenwich Mean Time, depending on which applies at the point when Date and Time Bids shall be submitted through the Delta eSourcing Portal.

7.42 All Central Government Departments and their Executive Agencies and Non-Departmental Public Bodies are subject to control and reporting within Government. In particular, they report to the Cabinet Office and HM Treasury for all expenditure. Further, the Cabinet Office has a cross-Government role delivering overall Government policy on public procurement - including ensuring value for money and related aspects of good procurement practice.

For these purposes, the Contracting Authority may disclose within Government any of the Bidders documentation/information (including any that the Bidder considers to be confidential and/or commercially sensitive such as specific bid information) submitted by the Bidder to the Contracting Authority during this Procurement. The information will not be disclosed outside Government. Bidders taking part in this ITQ consent to these terms as part of the competition process.

7.43 The Government introduced its new Government Security Classifications (GSC) classification scheme on the 2nd April 2014 to replace the current Government Protective Marking System (GPMS). A key aspect of this is the reduction in the number of security classifications used. All Bidders are encouraged to make themselves aware of the changes and identify any potential impacts in their Bid, as the protective marking and applicable protection of any material passed to, or generated by, you during the procurement process or pursuant to any Contract awarded to you as a result of this tender process will be subject to the new GSC. The link below to the Gov.uk website provides information on the new GSC:

https://www.gov.uk/government/publications/government-security-classifications

The Contracting Authority reserves the right to amend any security related term or condition of the draft contract accompanying this ITQ to reflect any changes introduced by the GSC. In particular where this ITQ is accompanied by any instructions on safeguarding classified information (e.g. a Security Aspects Letter) as a result of any changes stemming from the new GSC, whether in respect of the applicable protective marking scheme, specific protective markings given, the aspects to which any protective marking applies or otherwise. This may relate to the instructions on safeguarding classified information (e.g. a Security Aspects Letter) as they apply to the procurement as they apply to the procurement process and/or any contracts awarded to you as a result of the procurement process.

USEFUL INFORMATION LINKS

- Contracts Finder
- Equalities Act introduction
- Bribery Act introduction
- Freedom of information Act