EUROPEAN SPALLATION SOURCE

SSS Mechanical Interface Reference Document

Malcolm Guthrie
High Pressure Scientist

www.europeanspallationsource.se
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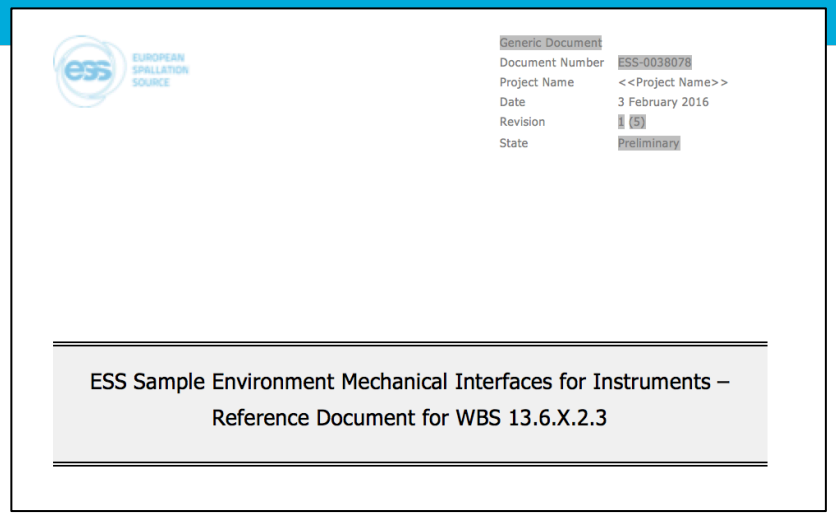
Goals

- Allow rapid, accurate, repeatable installation of sample-environment equipment (SEE).
- Maximise potential for sharing SEE between instruments
  - widest scientific scope for users
  - redundancy in case of equipment failures

This requires standards

Mechanical Interfaces Handbook



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State Preliminary

ESS Sample Environment Mechanical Interfaces for Instruments – Reference Document for WBS 13.6.X.2.3

ESS-0038078
available on CHESS and CONFLUENCE:

https://ess-ics.atlassian.net/wiki/display/SA/Feedback+here+from+instrument+teams

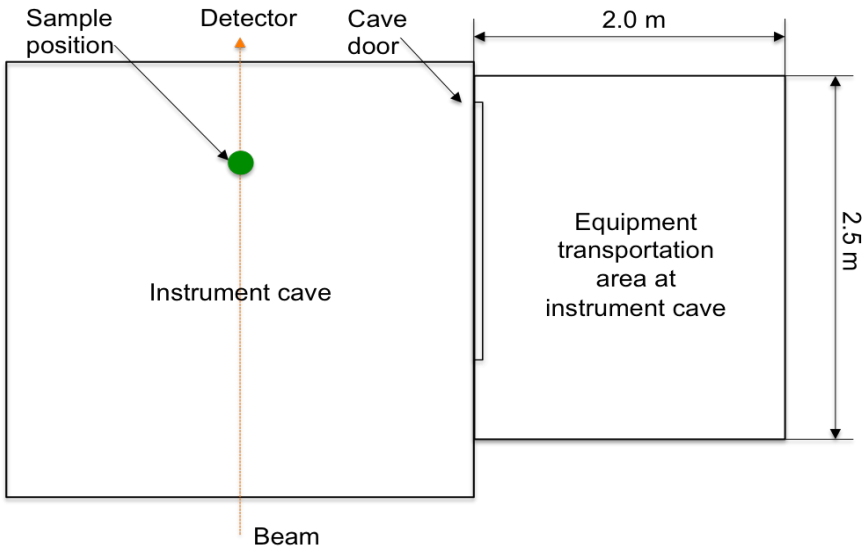
Requirements for:

1) Space
2) Mechanical positioning
3) Magnetic considerations

Focus here on general concepts

Space – general requirements

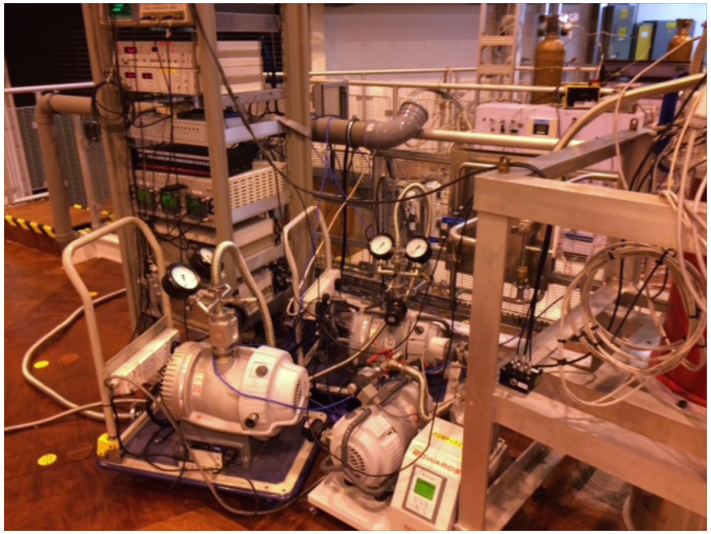
- Access

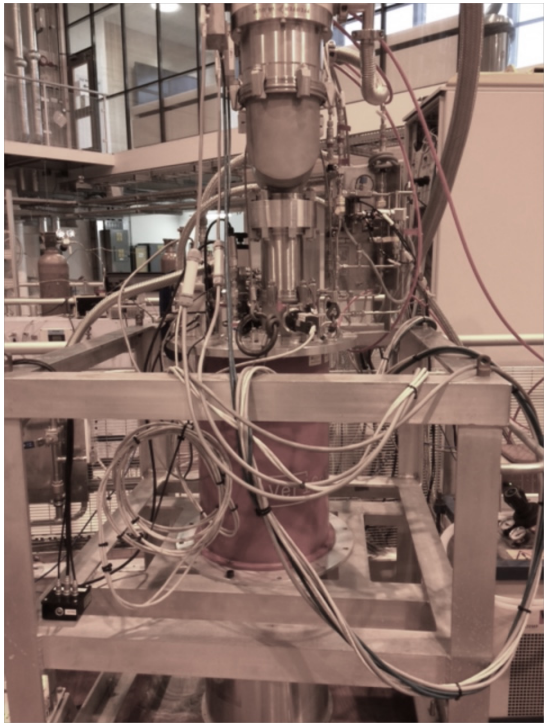


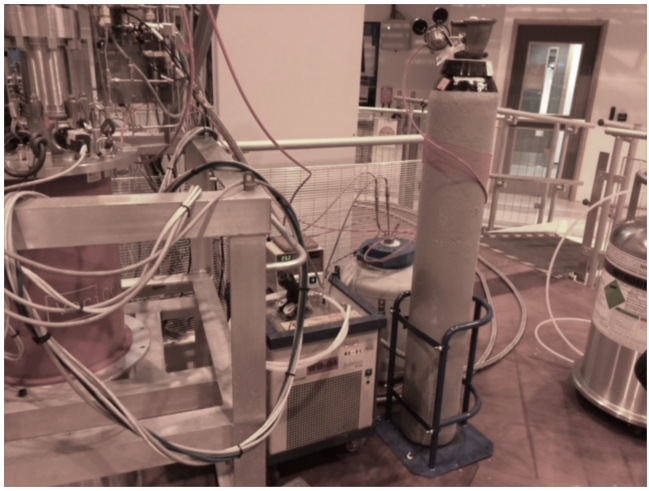
Need a clear area of **2.0 x 2.5m** adjacent to instrument entrance (may be on the roof for a top-loader).

Space – general requirements

- Space for ancillary equipment



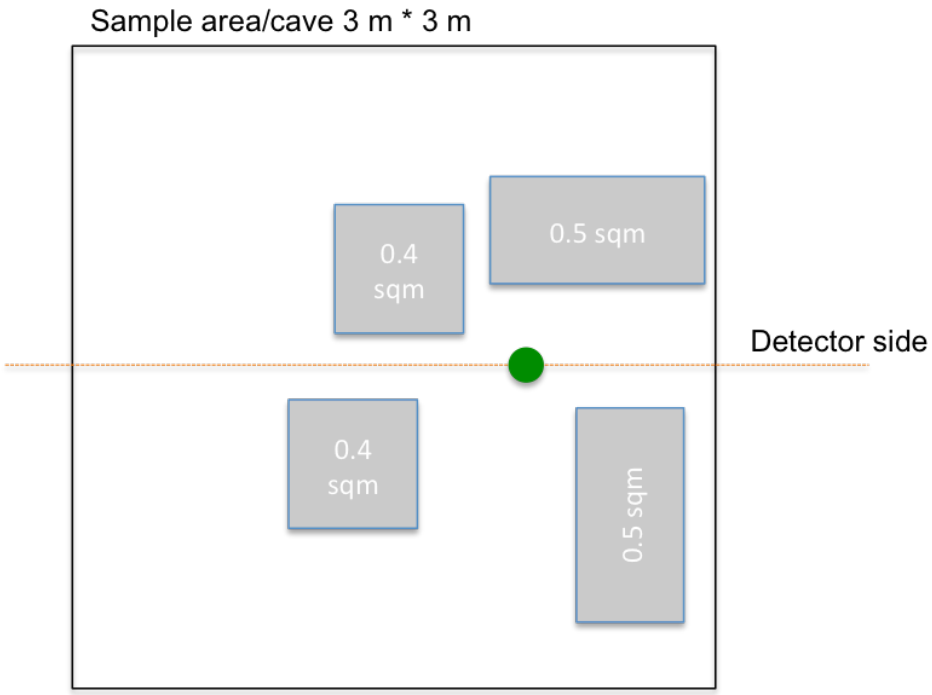




Example: dilution fridge being tested at ISIS

Space – general requirements

- Space for ancillary equipment



4 areas required:

- 2 x 0.5m^2
- 2 x 0.4m^2

75% shall be free floor area

Space – general requirements

- Space for ancillary equipment: LOKI example

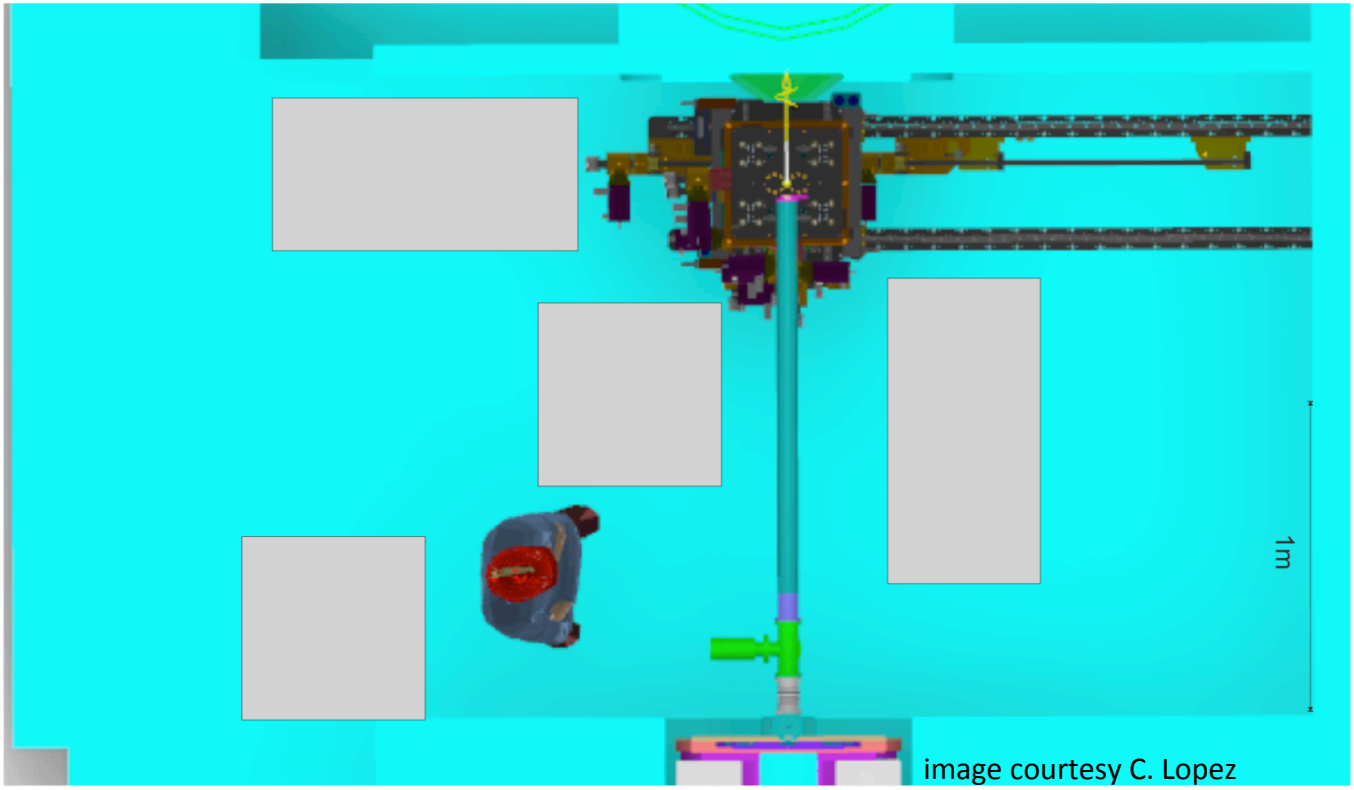
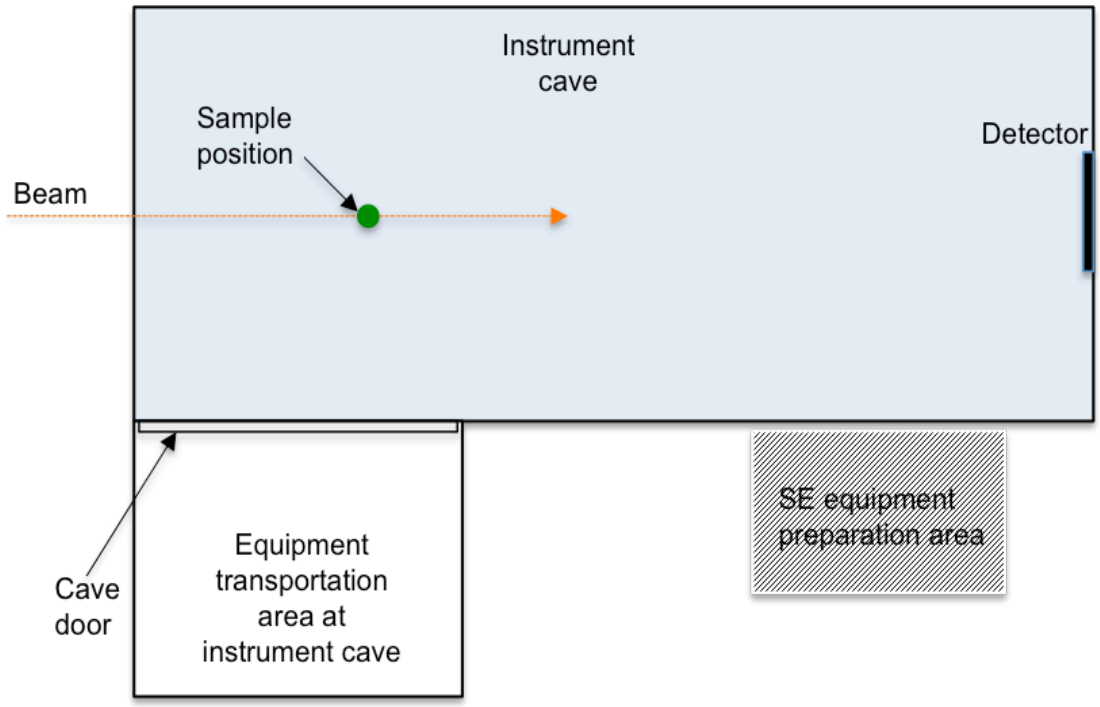


image courtesy C. Lopez

Space – general requirements

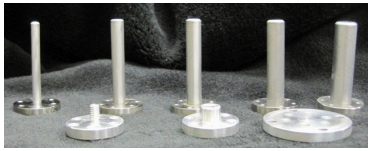
- Preparation area

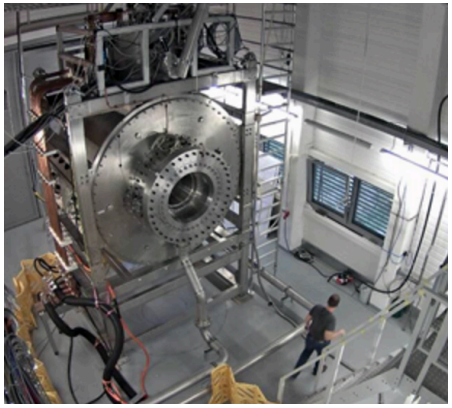


2m x 3m made available *at or within 20m* of instrument

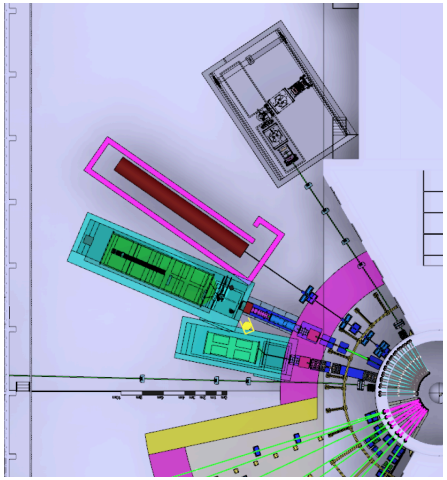
Space – instrument specific

- Sample environment comes in all different shapes and sizes

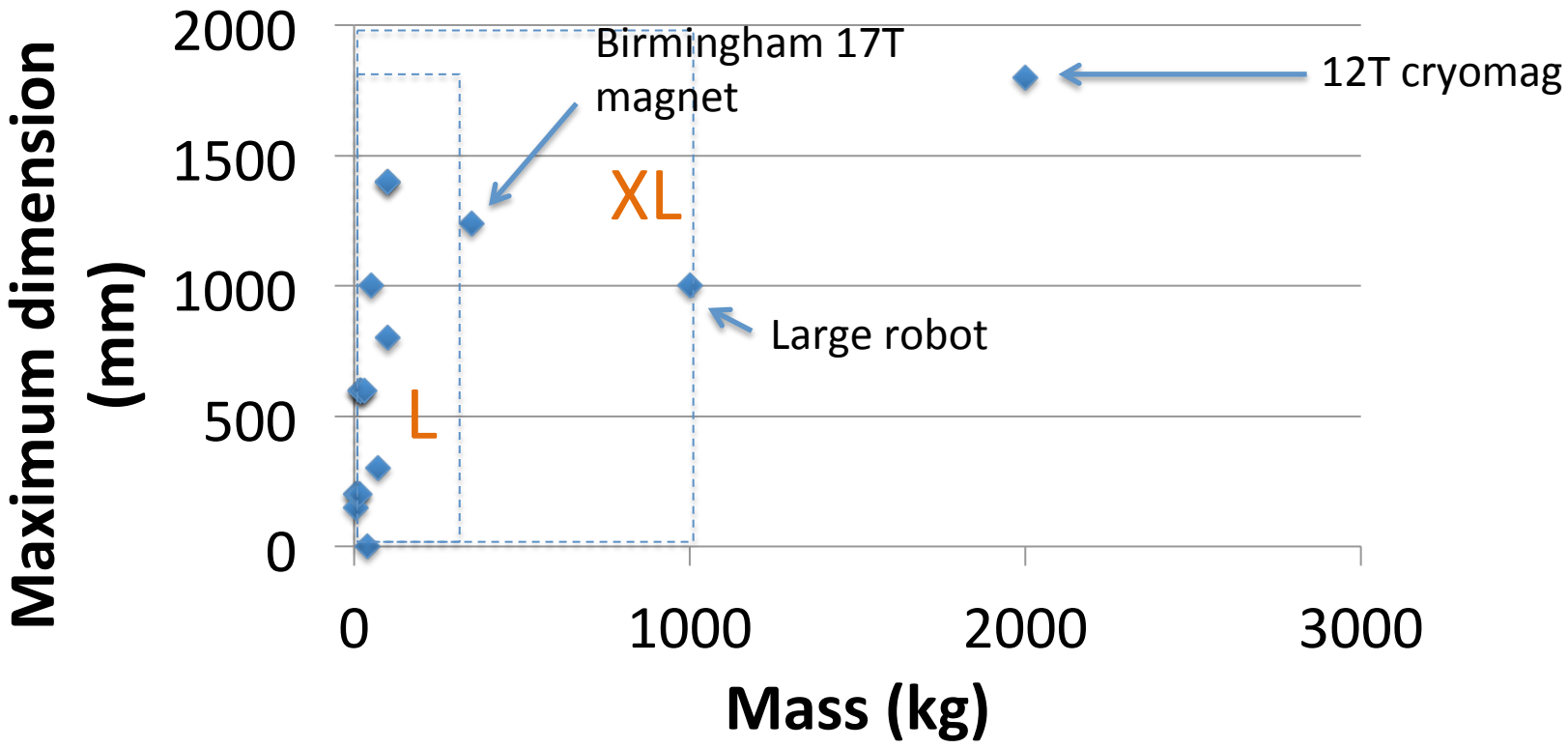




- As do instruments…



Space – instrument specific



- Define two compliance standards: L and XL

Space – instrument specific

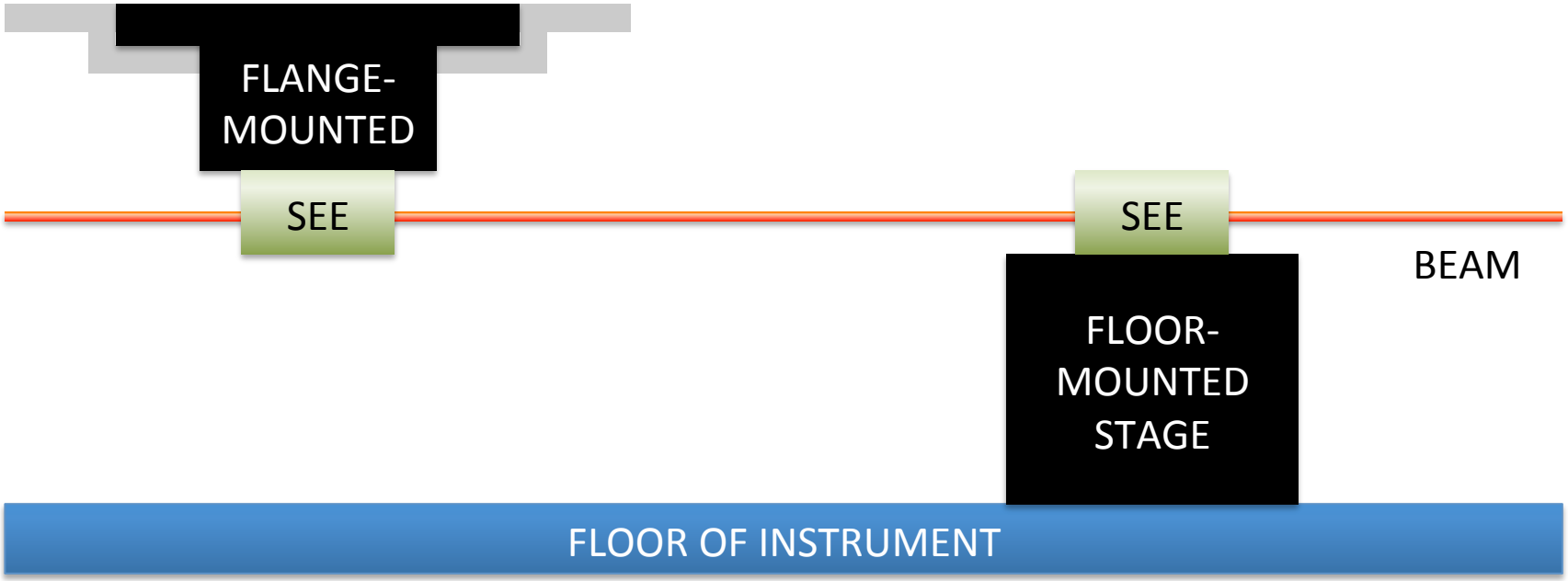
Appendix A lists compliance standard for each item of SEE

Equipment	Weight (kg)	Shape	COG	Max tilt (Degrees)	Width (X)/ Diameter (mm)	Length (Y) (mm)	Height (mm)	XL /L	Required Peripherals/comments
General									
Rotating sample holders	< 20							L	
Rheometer	20							L	
Langmuir Trough	< 20		Below half height					L	
Robot	30-1000 kg	Spherical						XL	Size dependent on reach required.
Linear sample changer	< 50	Rectangular box	Half height		500	1000	400	L	Z table, cooler
Temperature/Fields/Temp									
Pulsed Tube Refrigerator (PTR)	40	Cylinder	Top heavy	No restrictions but performance changes	150	150	600	L	2*Vacuum pumps, compressor

Space – instrument specific

Also considered two mounting scenarios*:

“Top-Down” “Bottom-up”



(* not mutually exclusive)

Space – instrument specific

There this gives 4 possible configurations:

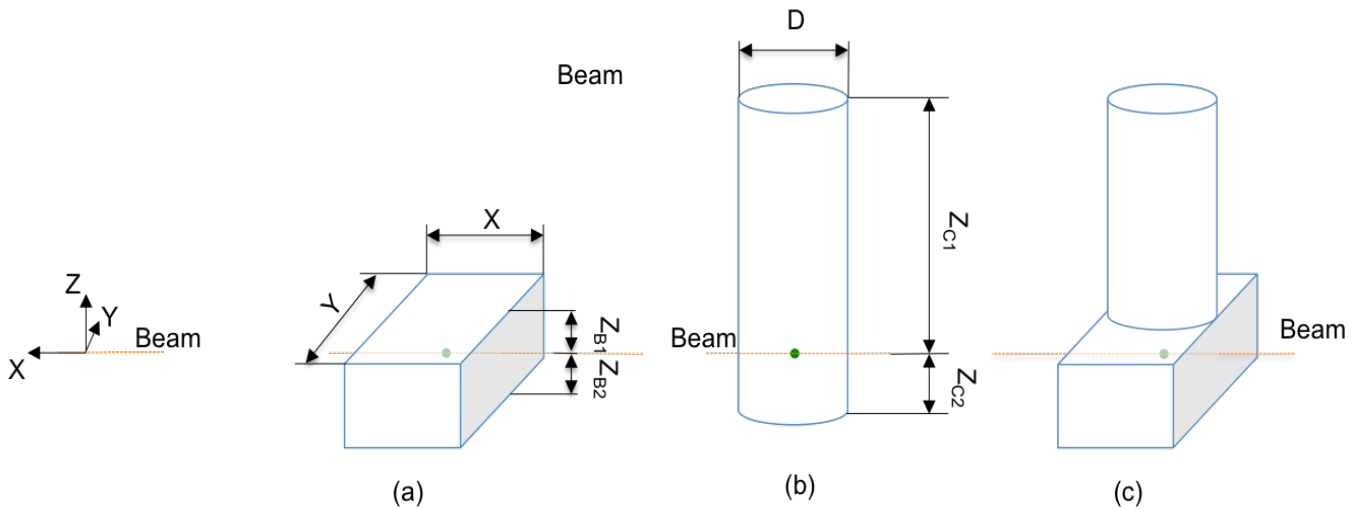
Bottom up - L

Bottom up - XL

Top down- L

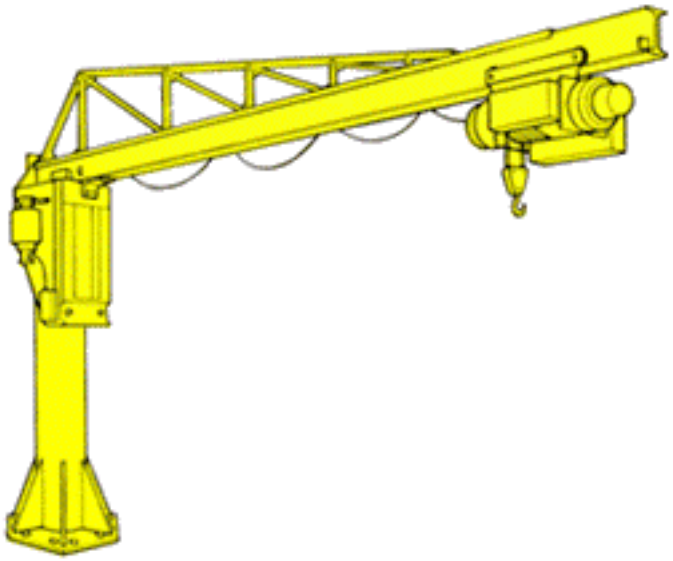
Top down- XL

Determines requirements for minimum sample space



Mechanical positioning

- Cranes



Availability of a crane is required to transport SEE to sample position.

Requirement for dedicated instrument cranes*.

Capacity dictated by chosen compliance standard:

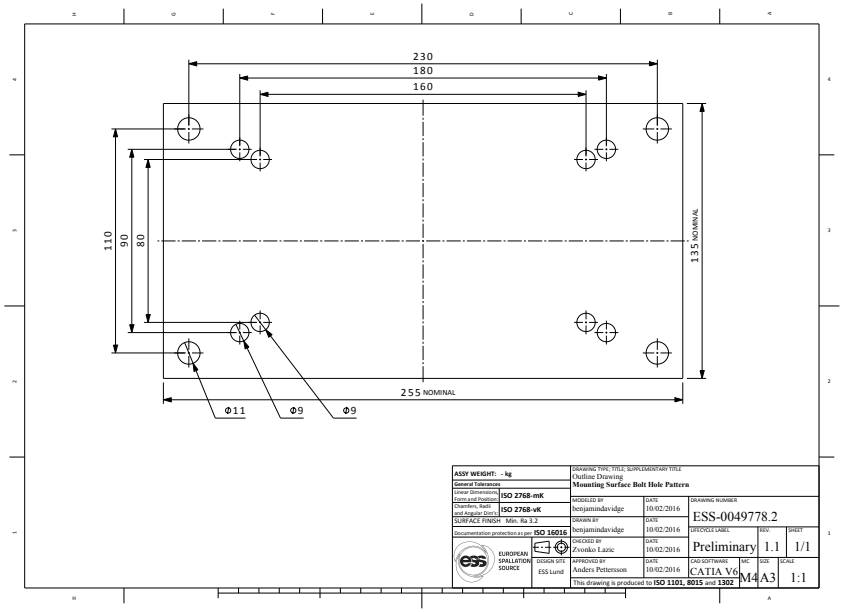
> 300 kg (L)
> 1000 kg (XL)

(*short instruments may be able to share a crane)

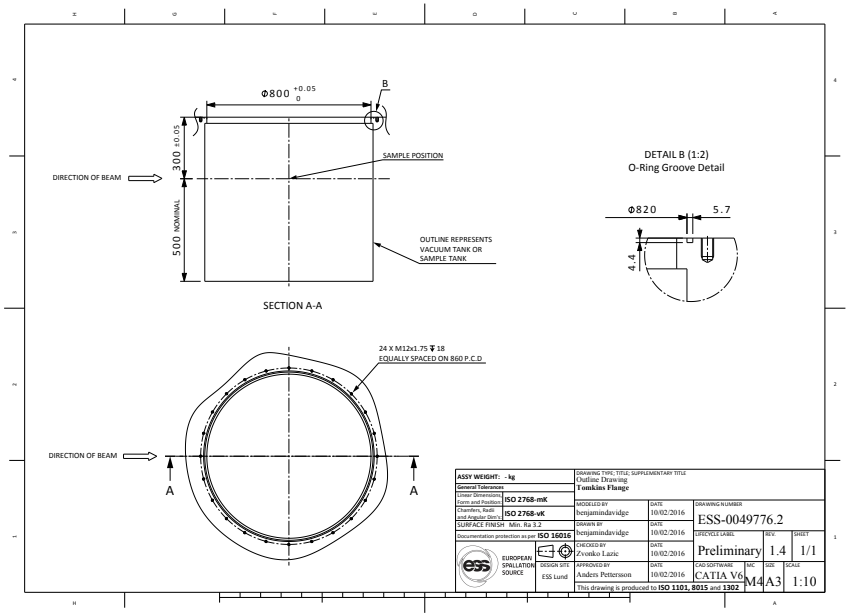
Mechanical positioning

Mechanical mounting

- Conceptual design for mounting systems for BU & TD instruments:



"Bottom up"



"Top down"

- Pursuing kinematic design allowing calibrated offline alignment of SEE
- Requirements on mount-beam distance.
- Load capacity also specified: 300kg (L), 1000 kg (XL).

Magnetic considerations

Special requirements for instruments using magnetic SEE

- Requirements depend on four service levels of instrumentation:

Level	Description
0	Spin echo
1	Electromagnet
2	<10T cryomagnet
3	>10T

- Distinct requirements for each service level described in Appendix C
- For level 2 and above **no magnetic material within 2m of sample position**

Magnetic considerations

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Appendix C

Reason	Power law* B^m/r^n	Approx. range (for level 3) Scale as $B^{m/n}$	Affected item	Effect	Mitigating action	Require for service level (0-3)
Magnetic forces (unsaturated, dipole approx.)	B^2/r^7	0-1m	Cryomagnet, nearby objects	Quench, damage, injury, death	No magnetic material allowed <1m from magnet Force test in position on first use and after any modification.	2
	B^2/r^7	1-2m	Moveable magnetic objects	Pulled towards cryomagnet (see <1m)	Remove or fix in position	2
	B^2/r^7	> 2m	Moveable magnetic objects	Equilibrium positions disturbed	Remove or fix in position	2
	B^2/r^7	<5m	Reed switches (including pacemakers!!!)	Erroneous readings, malfunction	Use alternative, distance, warning signs	2
Magnetic forces (permanent magnets / saturated ferro-magnets)	$\frac{B}{r^4}$	0-1m	Motors, encoders, magnetic bearings	Failure, damage	Move further away	2
	$\frac{B}{r^4}$	1-5m	Motors, encoders, magnetic bearings	Potential malfunction, failure, damage	Test for resilience, shield, move away	2

- Exact requirements are still being refined
- Please consider implications for your instruments and give feedback
- Requirements formalised by end of March.