

SAMPLE ENVIRONMENT EQUIPMENT FOR THE SNS

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GENERAL DESIGN PHILOSOPHY - STANDARDIZATION

It is intended to operate the neutron scattering instruments with the minimum of support personnel. Hence the sample environment equipment must be designed with the following requirements:

1. Reliability

Equipment is being designed to be fundamentally as simple as possible to aid reliability and minimise maintenance.

2. Interchangeability and standardisation

All instruments have been provided with a standard services panel to provide both single and three phase mains voltage, 50 Hz, socket outlets; cooling water flow and return with flow meter and trip level; bottled gas (Helium and Nitrogen) outlets; compressed air at 5 Bar; Helium recovery lines; and Helium lines from the compressors for the closed cycle refrigerators.

In addition there are standard sockets to the computer control interfaces in instrument cabins.

A single standard electronic control unit is available to measure and control temperatures in the range 1K to 2000K through the computer terminals in the instrument cabins.

The ILL design of "maxi orange cryostat" has been adopted as the SNS standard for almost all instruments. Closed cycle refrigerators will be used wherever possible down to temperatures of approximately 20K.

Instruments are equipped with a standard flange configuration of 400 mm diameter for entry of sample environment equipment. The distance of this flange from the neutron beam has also been unified at 300 mm to aid interchangeability of sample environment equipment.

3. Remote operation and automated sample changing

These are longer term aims but sample changers with remote control have already been developed for both ambient and low temperature sample environments.

SAMPLE ENVIRONMENT EQUIPMENT

A limited range of equipment has been designed and manufactured for use on the instruments: this is briefly listed below. Not included in the list is a range of sample cans and holders, which are intended to be provided as a central facility to users.

More sophisticated equipment is also being considered; a goniometer is being manufactured, a furnace for 3 samples at temperatures up to 1500K or 2000K is in design and magnets producing several Tesla have been requested. Table 1 summarises the equipment provided and its scheduled availability. Figure 1 shows a view of the carousel type sample changer; a version of this is to be used down to 90K.

Temperature

(a) Orange cryostat

These liquid helium cryostats, of ILL design, are suited to measurements from 1.7K to 80K. On the SNS, most will accept samples 100 mm diameter, 100 mm in length. They are provided with Rh/Fe resistance thermometers.

(b) Sorption cryostat

An Oxford Instruments sorption-pumped ^3He cryostat is available, with a base temperature 0.3K. The nominal sample size is 15 mm diameter and 50 mm length.

(c) Cryofridge cryostats

Seven Leybold-Heraeus closed cycle refrigerators (CCRs) are available, suitable for sample temperatures 20 - 300K. Three CCRs have been incorporated into cryostats for use on LAD, HET and TFXA. Another CCR is in a cryostat suitable for all standard instruments. All are provided with Rh/Fe resistance thermometers.

(d) Dilution refrigerator

A dilution refrigerator based on the design of Neumaier will give 25mK.

(e) Ambient temperature

A circulating water/glycol bath suitable for use from -40°C to 80°C is available. It is fitted with Pt thermometers, on a sample changer for the LOQ spectrometer.

(f) Furnaces

Suitable for temperatures ~ 100°C to 1400°C. Design to be fixed.

Sample changers

(a) Sample changer for LOQ spectrometer

An ambient temperature sample changer is being constructed in collaboration with Liverpool Polytechnic, primarily designed for use on LOQ in conjunction with the ambient temperature bath. The translation table of the device will have 60 cm movement across the neutron beam enabling up to 15 samples to be mounted. Both temperature control and sample translations will be controlled via the Falcon/CAMAC crate controller.

(b) Sample changer for LAD

A ten position sample changer, of a carousel design, is available. It is suitable for ambient temperature samples nominally 20 mm diameter and 50 mm long.

(c) Other instruments

A carousel design, capable of accommodating 10 samples, has been successfully tested; a cryogenic version is being developed.

Pressure

(a) 2 kbar unit

This is a single-stage unit utilising light oil as the pressurising medium, capable of 2 kbar. The system is only suitable for ambient temperature use.

(b) 5 kbar unit

This is a two-stage compressed helium system operating up to 5 kbar; a specially adapted cryostat operating down to 4.2K is available.

(c) Static loaded cell

This is a statically-loaded and locked cell utilising opposed pistons. Pressures up to 30 kbar can be generated; the cell is designed for use with a 100 mm bore helium cryostat.

Table 1

SAMPLE ENVIRONMENT EQUIPMENT

The following sample environment equipment will be available for scheduled use; all of this equipment is suitable for instruments which accept standard apparatus, unless otherwise stated.

	Available March 1985	Additional 1986-87	Comments
<u>(1) Temperature</u>			
(a) Orange cryostats	4	-	
(b) Sorption cryostat	-	1	
(c) Cryofridge cryostats (CCRs)	4	3	including LAD
(d) Dilution refrigerator	-	1	
(e) Ambient	1	2	LOQ initially
(f) Furnaces	-	3	
<u>(2) Sample Changers</u>			
(a) Sample changer for LOQ	1	-	LOQ
(b) Sample changer for LAD	1	-	LAD
(c) Other instruments	-	3	
<u>(3) Pressure</u>			
(a) 2 kbar Unit	1	1	
(b) 5 kbar Unit	1	-	
(c) Static loaded cell (McWhan) max 30 kbar	1	1	
<u>(4) Magnetic Field</u>			
Full requirement not yet defined	-	1	
<u>(5) Control</u>			
(a) Microprocessors (Falcon Units)	2	4	
(b) Temperature controllers	1	7	

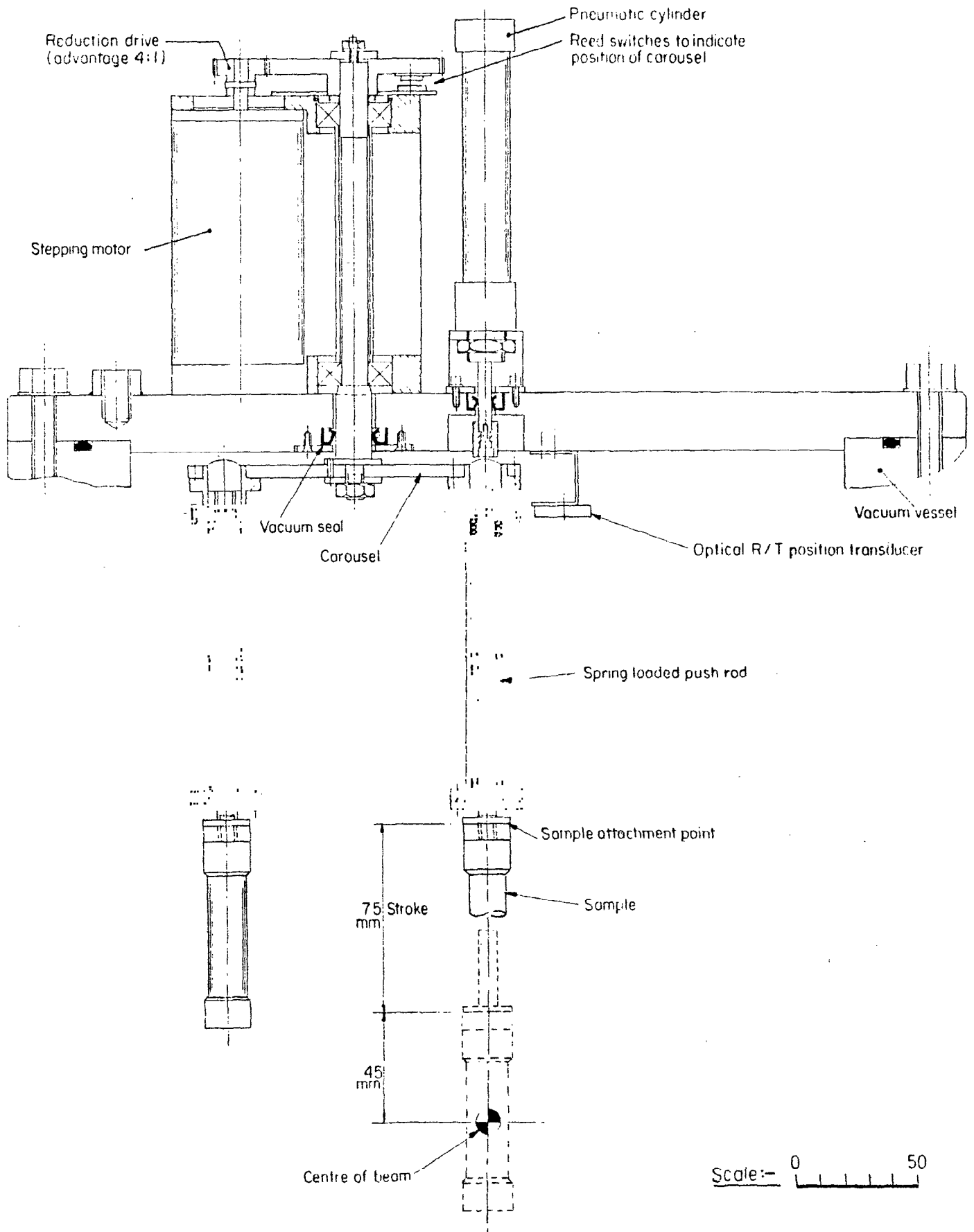


Fig 1 Sample Changer.