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The eVS User-Guide

J Mayers and A C Evans

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COUNCIL FOR THE CENTRAL LABORATORY OF THE RESEARCH COUNCILS

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1. INTRODUCTION

This document is designed to help you with the practical aspects of running your experiment on eVS. There are separate manuals [1, 2] giving a detailed account of the analysis procedures, including theory and details of computer routines. Reports already exist on the sample environment equipment and on the GENIE data display package[3], which are used on all ISIS instruments. Copies of these manuals can be obtained from your local contact, although copies are kept in the instrument cabin. A PUNCH manual [4], which describes many of the commands used for computer control of sample environment equipment, can also be found in the cabin. This manual contains information on the Instrument Control Program (ICP) and sample environment controls via CAMAC.

Before you start your experiment please make sure that:

- You have registered with the University Liason Office (ULS) in R3 or in the main control room (MCR) if you arrive outside working hours. If you are a new user, you will be issued with safety instructions which you should read. You should also have viewed the ISIS safety video, which can be seen in room 2.9/10 R3.
- You have picked up a film badge from the Health Physics Office opposite the MCR and a swipe card from the MCR.
- You have picked up and read the sample record sheet from the Data Aquisition Centre (DAC) and that you understand the sample handling instructions. This sheet must be displayed on the instrument during the experiment. This is a legal requirement.
- ISIS conforms to COSSH regulations. Any chemical process or procedure that involves chemical must be assessed beforehand by ISIS safety personnel

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[1] User Guide to eVS data analysis routines.
[2] eVS Analysis Routines for Fitting Time of Flight Data.
[3] Punch Genie Manual Version 2.3, W.I.F. David et al Ruherford Appleton Laboratory Report RAL-86-102
[4] PUNCH user guide.

2. DESCRIPTION OF INSTRUMENT

eVS (electron-Volt Spectrometer) is used to measures atomic momentum distributions in a wide range of samples, e.g. hydrogen bonds[4] quantum liquids and solids such as helium, hydrogen and neon,[5,6,7,8] catalysts such as molybdenum sulphide,[9] and amorphous materials[10,11]. Some other recent eVS publications, which give an idea of the type of experiments which can be performed on eVS are listed below.

1. "Neutron Compton scattering: a new probe of condensed matter." J Mayers, A C Evans, D L Timms and M J Cooper, Z Nat **48A** 425, (1993)
2. "The kinetic energy of lithium 7 above and below the martensitic transformation." A C Evans, J Mayers and D N Timms, J Phys Condens Matt **6** 4197 (1994).
3. "Momentum Distributions in Fluids Determined by Neutron Compton Scattering. J. Mayers and A C Evans, Nuovo Cimento 16D 737 (1994)
4. " A Neutron Scattering Study of the Impulse Approximation in Zirconium Hydride", A.C. Evans, J. Mayers and D.N. Timms, Phys Rev B **53** 3023 (1995)

The technique of using high energy neutrons to measure atomic momentum distributions is known as "Deep Inelastic Neutron Scattering"(DINS) or " Neutron Compton Scattering (NCS). The former name originates from the older technique of "Deep Inelastic Scattering', which is used to measure momenta of nuclear constituents by scattering of high energy electrons and the latter name from measurement of electron momentum distributions by Compton scattering. All three techniques rely upon the validity of the Impulse Approximation (IA) for interpretation of data. When the IA is valid, kinetic energy and momentum is conserved in collisions between single atoms and neutrons and the momentum of the atom is simply related to the energy and momentum change of the neutron.

Consider a scattering event in which a neutron loses momentum $\vec{q}$ and energy ω scattering from an atom of mass M. If the momentum of the atom is $\vec{p}$ before the collision, then from conservation of momentum it is $\vec{p}+\vec{q}$ after the collision and to conserve kinetic energy the equation

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4 "Neutron Compton Scattering Study of Proton Transfer in N-Methylacetamide." F Fillaux,M. H. Baron, J Mayers and J. Tomkinson, Chem Phys Lett **240** 114 (1995)

5 " Measurement of the Proton Wavefunction in Molecular Hydrogen by Neutron Compton Scattering." , J Mayers, Phys Rev Lett **71** 1553, (1993)

6 "Quantum and Classical Behaviour of Single Particle Dynamics in Dense Liquid ^{4}He" C. Andreani, A. Filabozzi, M. Nardone, F.P.Ricci and J. Mayers. Phys Rev B **50** 12744 (1994).

7 " Concentration Dependence of the Kinetic Energy in ^{3}He-^{4}He mixtures." R.T.Azuah,W.G.Stirling, J. Mayers, I.F.Bailey and P.E.Sokol, Phys Rev B **51** 6780 (1995).

8 " The momentum distribution of ^{4}He across the melting transition", U. Bafile, M. Zoppi, F. Barocchi, R. Magli and J Mayers, Phys Rev Lett **75** 1957 (1995).

9 P Mitchell

10 "Neutron Compton Scattering from Amorphous Hydrogenated Carbon "J Mayers, T M Burke and R J Newport, J Phys Cond Matt, **6**, 641 (1994).

11 "Deep Inelastic Scattering as a Tool for the Measurement of Glassy Dynamics.", F.J. Berjemo, F.J.Mompean, J. Mayers and A.C. Evans.Phys Lett **A189**, 333 (1994).

$$\omega = \frac{(\vec{p}+\vec{q})^2}{2M} - \frac{p^2}{2M} \qquad (1.1)$$

must be satisfied. Rearrangement of this equation gives

$$y = \vec{p}.\hat{\vec{q}} = \frac{M}{q}\left(\omega - \frac{q^2}{2M}\right) \qquad (1.2)$$

where $\hat{\vec{q}} = \vec{q}/|\vec{q}|$ is the unit vector along the direction of $\vec{q}$ and y is the component of atomic momentum along the direction of $\vec{q}$. In other words, from a measurement of the neutron $\vec{q}$ and ω we can determine the component of the atomic momentum along the direction of $\vec{q}$. (In the literature on neutron Compton scattering, for historical reasons, this component is generally denoted by the letter y as indicated in equation 1.2). In an experiment we measure a large number of such events and by recording the direction of $\hat{\vec{q}}$ and the value of y for each event we build up a distribution $J(\hat{\vec{q}},y)$ (the 'directional Compton profile') which is proportional to the probability that an atom has momentum component y along the direction of $\hat{\vec{q}}$.

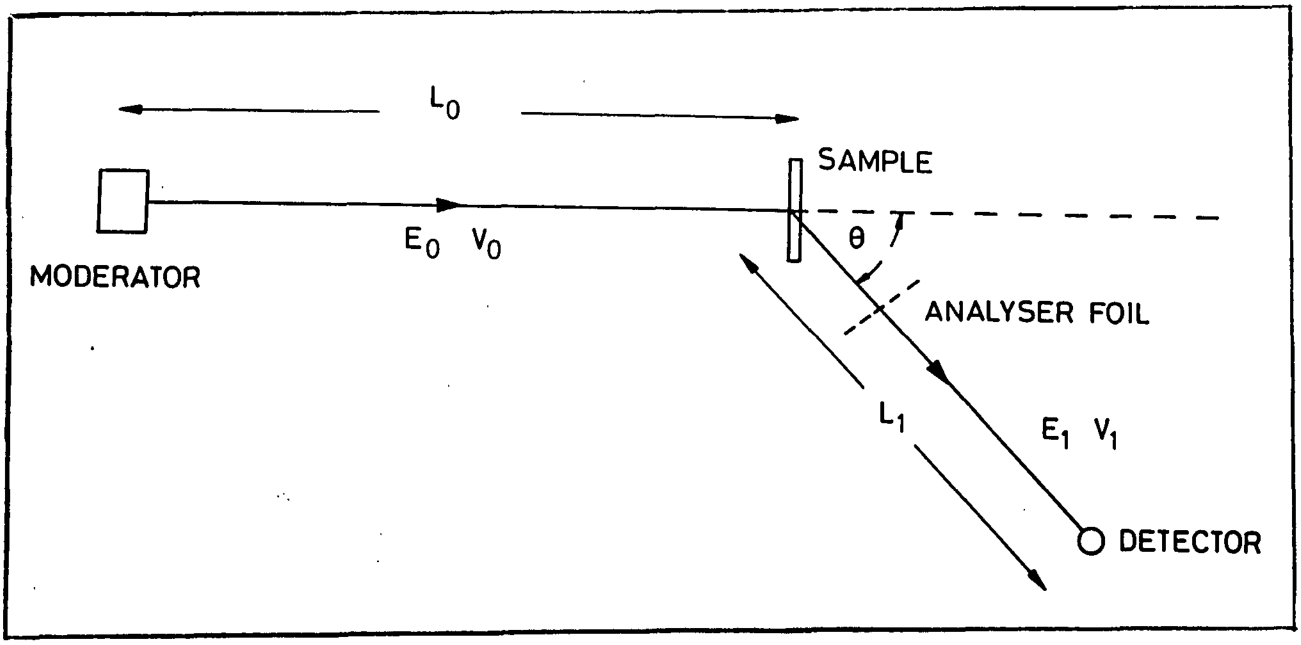

Figure 1 Schematic diagram of the eVS spectrometer. The incident flight path of the neutrons is L_0, that of the scattered neutrons L_1 and the scattering angle is θ. The final neutron energy E_1 is defined by an analyser foil, which can be either gold or uranium.

A schematic diagram of the eVS spectrometer is shown in figure 1. eVS is an " inverse geometry " inelastic spectrometer, i.e. only neutrons scattered with an energy within a narrow range are detected. The energy and momentum transfer in the experiment are measured using time of flight techniques. A filter difference method [13] is used to isolate the scattering of neutrons with energy E_1. The filter is a thin foil which absorbs neutrons strongly over a narrow band of energy centred at E_1. Two time of flight spectra are taken, one with the foil between the sample and detectors and the second

[13] P.A. Seeger, A.D. Taylor and R. M. Brugger Nucl. Inst. Meth. **A240** 98 (1985)

with the foil removed. The difference between these spectra is due to neutrons absorbed in the foil and is effectively the time of flight spectrum for neutrons scattered with energy E_1. If E_1 is known, the momentum transfer $\vec{q}$ and energy transfer ω can be determined from a measurement of the neutron time of flight t as follows. The velocity v_1 of the scattered neutrons can be calculated from $E_1 = mv_1^2/2$ where m is the neutron mass and the velocity v_0 of the incident neutron is determined from a measurement of the neutron time of flight via the equation

$$t = \frac{L_0}{v_0} + \frac{L_1}{v_1} + t_0 \tag{1.3}$$

where L_0 is the distance from source to sample and L_1 that from sample to detector. t_0 is an electronic time delay constant.
The energy transfer is

$$\omega = m\left(v_0^2 - v_1^2\right)/2 \tag{1.4}$$

and the momentum transfer

$$q = m\left(v_1^2 + v_0^2 + 2v_0v_1\cos\theta\right)^{1/2} \tag{1.5}$$

where θ is the scattering angle.

At present two different resonance foils are used on eVS to analyse the scattered neutron energy. A gold foil provides energy analysis at 4900 meV with a Lorentzian resolution function of half width at half maximum of 136 meV. This foil is used when high count rates are required or when the distribution being measured is relatively broad (e.g. for hydrogen measurements). If heavier masses are studied then a uranium foil is generally preferred. This has a count rate lower by a factor ~10, but provides significantly better resolution. The U foil provides a Gaussian resolution function centred at 6671 meV, with a standard deviation of 63 meV.

eVS has four mobile detector banks of Li glass scintillation detectors, which can be placed at forward or backward scattering angles. (see figure 2) Depending on the experiment to be performed, a decision needs to be made about the optimum detector positions. This should be discussed with your local contact. A calibration is made at the beginning of your experiment to determine the values of the instrument parameters L_0 L_1, t_0, θ and E_1 and also the uncertainty in these parameters, due to e.g. finite sample and detector size, width of the energy range over which neutrons are detected etc. The uncertainty in these parameters determines the instrument resolution function. The calibration procedure is described in a separate report[14]. Typically a calibration takes about 12 hours

Fig. 2 shows the inside of the eVS blockhouse. Below is a brief description of salient points.

1) Moveable analyser foils - these are mounted on a cylindrical frame that goes around the sample tank. They are be put in or out of the scattered beam by the operation of computer-controlled pneumatic pistons. One complete cycle is performed every ten

[14] eVS istrument calibration procedure.

minutes, i.e. 5 minutes with foil in and 5 minutes with foil out. This is to avoid effects due to long-term changes in the relative efficiency of the detectors.

Figure 2 Inside the eVS blockhouse

2) 4 modules of 8 lithium-glass scintillation detectors.

3) Sample tank with standard "Tomkinson flange". Most SE equipment complies to this standard.

4) White warning button. This must be pressed before the blockhouse door can be shut (see section 3)

3. ACCESS TO THE INSTRUMENT. THE INTERLOCK SYSTEM

There are two ways of accessing the neutron beam line, both of which are interlocked to make it impossible for you to inadvertently get your body in the neutron beam. The most usual way of access for users is via the instrument gate, (Figure 3) which is located on top of the eVS beam line. If you are **not** running your sample at room temperature and pressure, e.g. if you are using a cryostat, then you will almost certainly access the beam line via this route. The other method of access to the beam line is via the inside of the instrument blockhouse, through a door at ground level (see Figure 4). If you are running samples at room temperature and pressure, you will need to enter the blockhouse to change samples.

Figure 3 The instrument gate on top of the eVS beamline.

Procedure for Opening the Instrument Shutter

(1) If you are on top of the beam line.

(a) Close the instrument gate and remove the 'S' key

(b) Replace the 'S' key in the grey box below the shutter control (Fig 5)

(c) Remove the master key which has a red tag attached to it. (The master key can only be removed if all the 'S' keys are in position. If any 'S' keys are absent this almost certainly means that the blockhouse is still open and another 'S' key must be removed from the blockhouse door.

(d) Insert the master key into the green box

(e) Press the 'OPEN' button above the grey box.

Figure 4 The door to the eVS blockhouse

(2) If you are inside the blockhouse

(a) Press the white button on the yellow stanchion to the right of the sample tank (Figure 2). This will sound a warning note (to alert anyone who may be inside the blockhouse)

(b) Close the blockhouse door (see Fig 4).

(c) Remove the interlock key from the blockhouse door

(d) Go on to the top of the beam line and insert this 'S' key into the grey box below the shutter control buttons.

(e) Remove the master control key and insert into the green box

(f) Press the 'OPEN' button above the grey box.

Figure 5. Interlock key press and shutter control on top of eVS beamline.

Note: *You only have control of the shutter if the Master key is in its Green-box. You will not be able to open the shutter if the interlock sequence has not been completed.*

Procedure for gaining access to the beam line

In order to gain access to the neutron beam for sample changing, the procedure above is essentially reversed.
(a) Press the shutter close button, either on top of the beam line or in the eVS cabin.
(b) Wait until the beam on light goes off and the green 'closed' light on the box with the shutter control buttons lights up
(c) Remove the master key from the green box. The master key can only be removed when the shutter is fully closed.
(d) Insert the master key in its slot in the grey box and remove the 'S' key
To access the gate on top of the beam line
(e) Insert the 'S' key in the gate, slide the bolt fully back and open the gate
To access the inside of the blockhouse
(e) Insert the 'S' key in the blockhouse door slot, slide back the bolt and open the door.

4. SAMPLE HANDLING

Before you start your experiment, you will need a **sample assessment sheet**. This will have been prepared before you arrive and can be found in a grey filing cabinet located in the Data Acquisition Cabin (DAC) on the north side of the hall. It details the hazards (activation/chemical) associated with your sample. It is a legal requirement to have this displayed in the window provided by the access port on the top of the blockhouse.There are several sample preparation areas in the experimental hall: one by eVS on ground level, one next to LAD on the south side and two by the IRIS cabin on the north side of the hall. **Please take the time to fill in the 'experiment in progress' chit available in these areas and place it by any chemicals or equipment that you leave there.**

4a. Loading a Sample

For experiments at ambient temperature, where the sample will not be affected by contact with air or by being placed in a vacuum, the sample is generally placed inside an aluminium sachet and is then fastened to an open Al frame. The frame is then attached to the eVS "candlestick" holder which can be adjusted so that the sample is at the correct height in the beam. It is important to get the sample properly centred in the beam. Note that the beam size at the sample position is 30mm in diameter (umbra), with a penumbra of 50 mm diameter. The correct height for the candlestick is shown in Figure 6. It is preferable to contain the sample in a sachet of aluminium foil, rather than in an Al holder, as this will minimise the scattering from the container and make data analysis and subtraction of the container signal from the sample signal easier.

For samples which degrade on contact with air, it will be necessary to place the sample in a sealed can. This can be done in a glovebox. One may be found on the north side of the experimental hall by the IRIS cabin. Contact John Wright (ext. 5768 or bleep 251) for bookings before you come to do your experiment. It may be necessary to first contain the sample inside a foil holder and then seal the foil+sample inside an ISIS can. Otherwise the sample may fall to the bottom of the can.

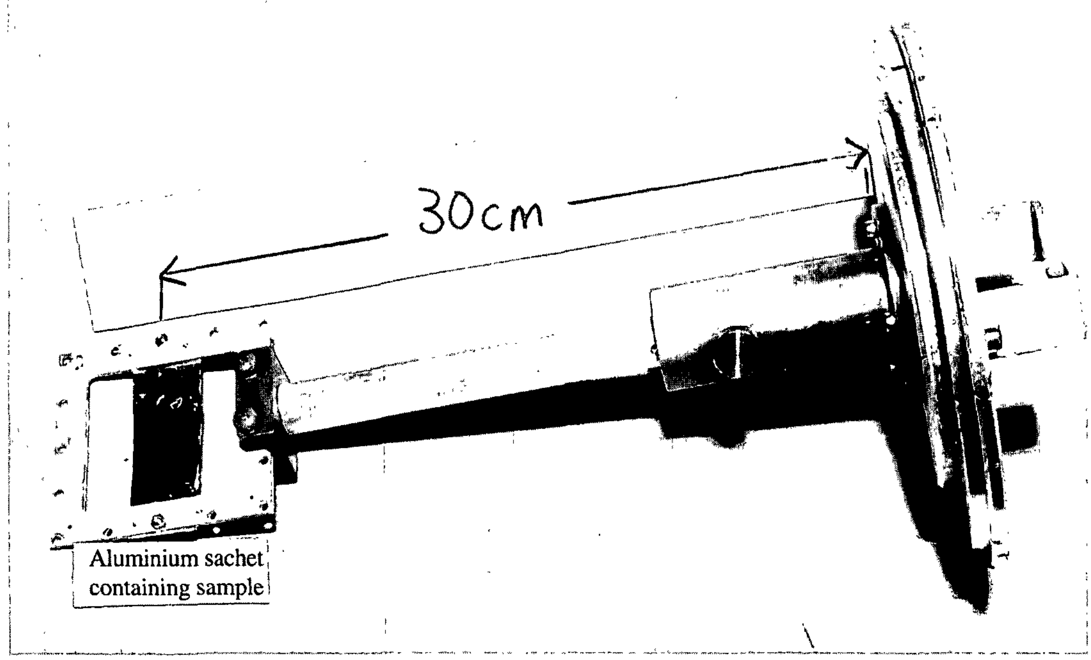

Figure 6 The eVS " candlestick" holder for mounting samples at room temperature. The distance to the beam centre is shown.

To load samples mounted on the "candlestick" holder at room temperature you will need to enter the instrument blockhouse. **Make sure before you do this that the run is ended and that the command file running the foil cycler has stopped.(see section 5)** Otherwise the pressure driven foil changer may move while you are changing sample, with a possible risk of injury. Also ensure that you do not touch the detectors as (a) They have an HT voltage and (b) you could change their position and destroy the validity of the instrument calibration. If you are loading samples into an orange cryostat, see appendix 1 for details of how to load samples.

The sample tank is evacuated by means of a pump located outside the blockhouse at ground level between the POLARIS and eVS beamlines. The pump is operated by closing the small valve A, (see Fig. 7) ensuring the large valve B is open. Press the green button (C). To switch off the pump for the removal of a sample hit the red power off button and open the small valve A. **It is essential to remember to evacuate the sample tank before starting a run.** Otherwise background scattering from air will make analysis of your data impossible. It takes two or three minutes to evacuate the line.

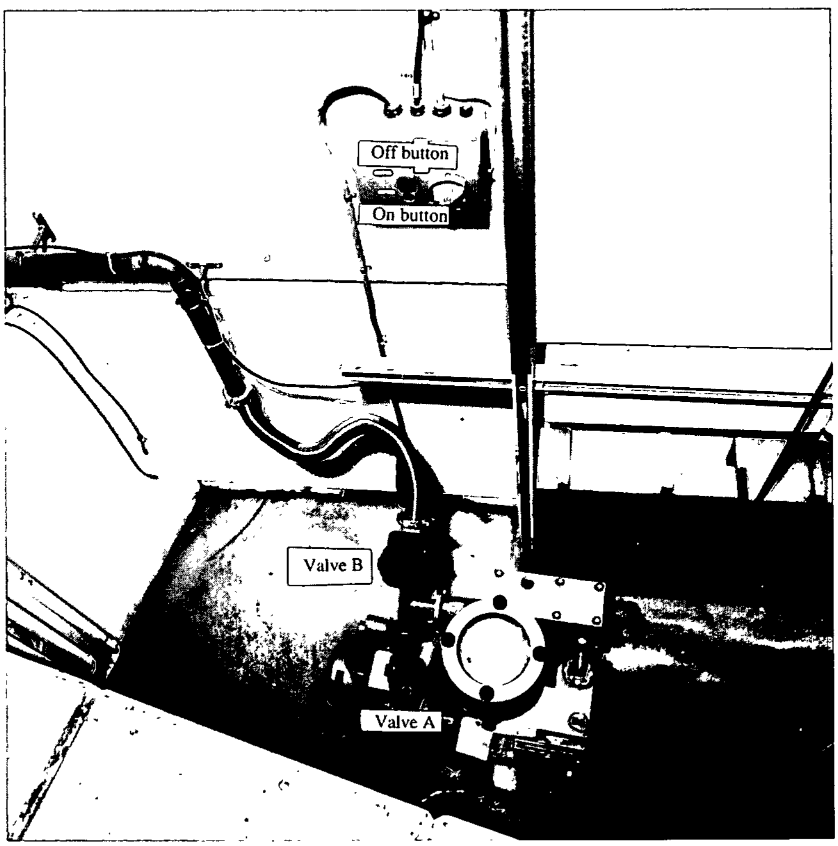

Figure 7 The rotary pump used to evacuate the beamline and sample tank.

Most experiments on eVS are performed either at ambient temperature and pressure or at low temperatures. Low temperature experiments are generally performed in a standard orange cryostat, although a closed cycle refrigerator is also available. For measurements of liquids and solids at high pressures, specially designed centre-sticks are required. All high pressure equipment brought from outside requires clearance by a RAL engineer. If you wish to bring your own pressure equipment please contact Colin Uden (ext. 6606) well in advance of your experiment. All pressure systems must be tested and approved before the start of the experiment.

4b. Removing a Sample from the Beam

If the sample is to be removed directly from the sample tank (i.e. for room temperature measurements), air must be let into the sample tank before the 'candlestick' holder can be removed. to do this open valve A on the pump (Figure 7) and press the red stop button. If you are removing a sample from a cryostat, consult appendix 1 for instructions on how to do this.

NEVER HANDLE AN ACTIVE SAMPLE WITH BARE HANDS. USE GLOVES OR TWEEZERS.

After removing the sample from the beam, monitor it with both γ and β monitors (Figure 8). If the radiation is,

- Greater than 75 μSv/hr (γ or β). The ISIS duty officer must be informed to supervise the removal of the sample. Any operation concerning the sample must be supervised by the ISIS duty officer (Ext 6789)

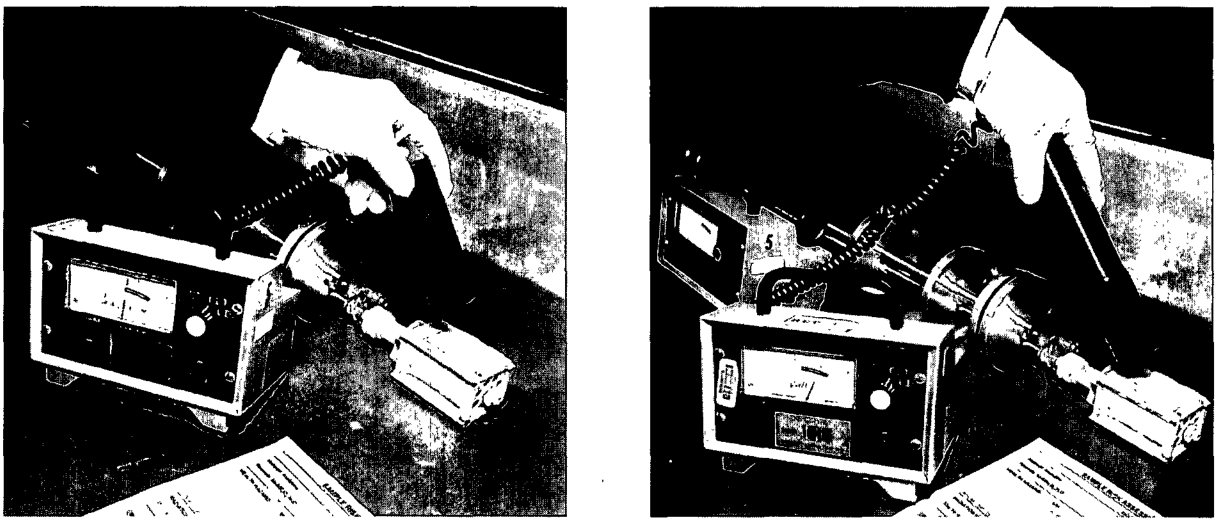

Figure 8 Monitoring samples after removal from the beam. The left picture shows β and the right γ radiation monitoring.

- Greater than 10 μSv/hr. The sample can be removed and stored in the active sample cabinet. However any operation that requires the sample to be opened must be done in an active glovebox.

- Less than 10 μSv/hr. The sample can be handled normally, using good laboratory practice.

- If you wish to transfer active loose powders between sample holders or if a sachet bursts accidentally, phone the duty officer for instructions and help.

After completion of the experiment the sample can and sample should be placed in the active sample cupboard in a sealed plastic bag, with a record of the numbers of the runs and a copy of the sample record sheet. Sealed plastic bags can be found in the active sample cupboard.

- If it is necessary to transport an irradiated sample off-site, documentation must be obtained from the health physics office. Do not take the sample to them- they will come down to the instrument. Preparing the documentation will take some time, so ask for this well in advance of departure.

- If you have any safety concerns ask you local contact, or ring the MCR (ext 5789)

5. OPERATING THE INSTRUMENT COMPUTER

To start a run:

Type: **foil.** On eVS this command is the equivalent of the command 'BEGIN' on other instruments. It will automatically start the instrument counting, begin a command file which provides computer control of the foil cycler and store the data collected with 'foil in' and 'foil out' in separate areas of memory. For more sophisticated procedures, such as making a series of measurements at different temperatures a customised command file can be written. For assistance with this, speak to your local contact.

To end a run:

1. To end a run press the **<ctrl>** and **y** keys simultaneously to exit from the command file and then type '**end**'. The dashboard should change from **'RUNNING'** to 'SETUP'. **Write the time, Run No, total number of microamps and any other details of the run which are relevant in the Instrument Log Book.**

Other useful commands.
(n.b. > denotes a command in Genie, $ denotes a command outside Genie)

$ c	*Re-enter Genie after (inadvertent) ctrl y in Genie.*
$ Change title """" arbitrary sample """ "	
	Changes title of run in status display.
$ Dev	*Tells you how much disc space is available*
> Ex	*Exit Genie*
$ Head 3457	*Lists details of run 3457*
$ Genie	*Enter the Genie data display package*
$ Isisnews current	*Gives current status of ISIS beam.*
> j/p	*Exit Genie temporarily while retaining workspace data.*
$ log	*Re-enter Genie after >j/p*
$ PPS	*Prints postscript file 'file.ps' in LAD cabin*
$ sh def	*Shows current directory*
$ user	*Sets directory to user area*

You should process your data in the user area of the eVS disk and then transfer any files you wish to keep to your own computer account, which will be set up for you by the ISIS computer section. Any files left in the user area will be deleted periodically.

It is strongly recommended that you read Appendix 2, which gives some hints on avoiding lost beamtime.

6. COMPUTER MONITORING OF TEMPERATURES

Resistance Thermometers.

Rh/Fe resistance thermometers are available for temperatures from 4.2 K to room temperature. Each sensor has a 4 digit identifying code, which can be read from a tag attached to either cryostat or centre stick and for which there exists a characteristic calibration curve. This number should be entered into the computer by use of the command e.g. ' CSET TEMP/DEVSPec=1139'. Thermometers and heaters are connected to the 'Eurotherm' temperature controller located in the eVS cabin. CAMAC commands are sent to the ICP (Instrument Control Program) from one of the terminals. A full explanation of these commands is given in the PuNCH manual. Refer to RAL-87-049 (ISIS Sample Environment Control System) and to RAL-92-041 (Use of Cryogenic Liquids on ISIS Instruments) for more details.

Commands for setting up computer monitoring of temperature.
There are generally two temperature sensors which are connected to blocks 'TEMP' and 'TEMP1'. To set up monitiring of TEMP, the following commands are used. (To set up TEMP1, replace TEMP by TEMP1 in the following commands.) More detailed information on these commands can be found in the PUNCH manual in the cabin.

CSET TEMP/DEVSPEC=????. The four Figure number of the temperature sensor will be entered into the computer.

CSET TEMP/LOG . This will start computer logging of the temperature

CSET TEMP/DISP- A display of the temperature with 'raw' mV reading and conversion to temperature either in C or K will be displayed in the status display box.

CSET TEMP/NOCTRL. Switches off run control option. There is an option to only collect data when the temperature is between set limits.(CSET TEMP/CTRL) It is recommended that this feature is not used however, since it can often lead to **no** data being collected for long periods. If you are worried about instabilities, it is suggested that a series of short runs are performed. You can then check the value of the temperature by plotting the temperature log file, as described below.

Another useful command for moinitoring the status of the temperature logging and control is

CSHOW TEMP/FU This will display the current status of temperature logging.

In order to display a plot of the current temperature type **>TPLOT1** in Genie. The program will ask for
(1) A workspace number. Data from the temperature log file will be loaded into the workspace you specify.
(2) SE block name. This will usually be either TEMP or TEMP1
(3) LOG COLUMN. Press return here
A plot of the temperature log in the current run will be displayed.

In order to display the temperature log plot of a previous run, type **>TPLOT**. The program will ask for
(1) A workspace number. Data from the temperature log file will be loaded into the workspace you specify.
(2) The run number.
(3) SE block name. This will usually be either TEMP or TEMP1
(4) LOG COLUMN. Press return here
A plot of the temperature log in the specified run will be displayed.

APPENDIX 1: Operation of the Orange Cryostat (OC)

The orange cryostat has a base temperature of 1.5K when attached to a roots pump, and 4.2 K otherwise. If you are planning to run below 4.2 K you should state this clearly in your proposal or mention it to the local contact, before the experiment begins so that a roots pump can be reserved. Filling of He is done by ISIS technicians and they should check this each day. Nevertheless check it occasionally yourself. It is full when the display reads 500 mm. Contact the number displayed in the Cabin if you need to have the cryostat refilled..

Installing the cryostat in the beam

The local contact will load the cryostat into the sample tank for you. The operation of the cranes in R55 requires a permit and this should not be attempted without one. During silent hours, personnel in the Main Control Room (MCR) will help if your local contact is not available. The sample tank should be pumped out (the pump is located outside the blockhouse on the ground level) once the cryostat is in place. The helium return line should be connected. This allows the monitoring of the He flow rate via a gas flow meter (with red float) mounted just by the eVS pit. The He level monitor and the line from the liquid N2 dewar also be connected. . Attach a pump to the line with the blue plastic valve.

Inserting the centerstick

Assume blanking plate is in place.

1. Turn the blue plastic valve (V1) down to fill sample volume with He gas.

CAUTION

If the cryostat has been left at base temperature for a long period there may be rapid boil off of condensed ^{4}He liquid. This will be indicated immediately by a loud hissing sound as the gas is released at a relief valve. If this happens, wait for it to die down. When there is no more hissing with the blue valve in the down position the 4He liquid has boiled off. **Failure to ensure this can lead to serious damage to the cryostat and the end of your experiment!**

2. Remove blanking flange.

3. Place centrestick in cryostat with steady motion and seal the top plate by screwing down the fixing screws.

4. Open D to pump out the sample volume. Purge the volume twice to expel any air or moisture.

5. Flow rate is controlled by the micrometer-type ‘warm’ valve. The ‘cold’ valve (knurled copper knob) should be open about half a turn.

6. Finally, the sample volume should be pumped out to about 10 mbar to leave sufficient exchange gas so that thermal equilibrium can be reached in a fairly short time. You will need a pressure gauge fitted to the pump for this. Set the temperature to the required value. Once this has been reached, be sure to reduce the flow rate to 3-4 litres per minute.

APENDIX 2 Some hints on avoiding lost time

Common causes of lost beam time on eVS are listed below. An awareness of these could save you losing some of your beam time.

1. **Disk space.** There is limited disk space. Before submitting jobs or starting a new run, check the available free blocks on evs$dua0 (type **$ dev**). If this is below 20000 blocks you will need to delete some of your analysed files or some old raw files from the data directory evs$dua0:[evsmgr.data].

2. **Run lengths.** In case of some failure of SE equipment it is wise to make shorter runs (say 6-12 hours) so that if there is a problem you reduce the amount of beam time lost. The other option is to open a new dec window and type **$ updt** which will save the contents of the DAE every 6 hours to a file suffixed .SAV (as opposed to .RAW).

3 **Orange Cryostats** sometimes run out of helium. Make a point of checking the level of helium regularly. Do not leave the flow rate at maximum overnight.

4 **Sample tank.** Check that the sample tank is pumped out before starting a run.

5. **Exchange gas.** Check that you leave sufficient exchange gas in the sample volume of the Orange Cryostat after changing the sample, otherwise your sample may take a long time to reach an equilibrium temperature.

APPENDIX 3 USEFUL INFORMATION AND TELEPHONE NUMBERS.

Useful Phone Numbers

In the event of any problems with the instrument, computing or sample environment your first point of contact should be your local contact who's number will be displayed in the instrument cabin.

The home numbers can be used in case of problems in the evening, but please not after 11 p.m., except for dire emergencies. The Main Control Room is manned at all hours and they can also be contacted if you have a problem. If you have queries about accomodation, claims or transport, contact the university liason office (ext 5592) inside working hours.

To dial a RAL extension from outside RAL	01235 55+extension number
To make an external call from an RAL phone	9 + normal number

Other useful numbers

Emergency fire or ambulance	2222

Main Control Room	6789
University Liason Office	5592

Eating and Drinking

R22 Restaurant Opening Hours

	Mon-Fri	Sat-Sun
Breakfast	7:30-8:30	8:00-9:00
Lunch	11:45-13:45	12:00-13:00
Dinner	17:15-19:15	18:00-19:00

R1 Coffee Lounge	9:00-11:30, 11:45-15:45
R22 Coffee Lounge	11:30-13:45

Pubs

Blewbury	Red Lion
Chilton	Rose and Crown
West Hagbourne	Horse and Harrow
East Hendred	Plough
	Wheatsheaf
East Illsley	Crown and Horns
	Swan
Steventon	Cherry Tree
Wantage	Lamb
	Swan
West Hendred	Hare
West Illesley	Harrow