Choosing the Correct Chopper and Incident Energy

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October 2000

CHOP is a utility program to help choose the chopper and incident energy on MARI or HET. It can perform the following:

- Plot the flux at the sample position as a function of incident energy E_i
- Plot the incoherent line width (vanadium width) as a function of E_i
- Plot the resolution as a function of energy transfer at a given E_i and scattering angle ϕ.
- For a given E_i , ϕ and energy transfer ε, the separate contributions to the resolution from the moderator, chopper, sweep time etc. can be listed.

CHOP allows the results for different choppers, E_i and ϕ to be overlaid for a detailed comparison. The plots can be stored as Postscript files, and from within the program can be sent to a laser printer.

1.Basic Operation

1.1 Starting the Program and Setting Parameters

The program runs after CHOP is typed at the DCL prompt and the [RETURN] key is pressed.

In the description that follows:

- command lines can be entered as upper, lower or mixed case
- any command or keyword can be replaced by an unambiguous abbreviation. This can be as short as a single letter, with the exception of the EI and EPS keywords
- if prompted for a parameter value, pressing [RETURN] leaves the current value unchanged

Choosing the default instrument:

Upon entry, the program prompts the user for the instrument, either HET or MARI. The default instrument parameters and sample size are then chosen and the program proper is entered, indicated by the command prompt > .

At any stage the default instrument parameters and sample size can be reset by typing:

```
> HET
```

or

```
> MARI
```

Setting the chopper type and frequency:

To set the chopper as the 'B' chopper running at 600Hz (that is, 12 times the ISIS frequency) type:

```
> SET CHOPPER 12B
```

or

```
> SET CHOPPER B 600
```

It is assumed that the chopper comes from the suite belonging to the default instrument. If, however, it is desired to use the HET 'B' chopper when the instrument is MARI, type:

```
> SET CHOPPER 12B HET
```

or

```
> SET CHOPPER B 600 HET
```

If required arguments are missing (in this case the chopper type and frequency) the user will be prompted for them by the program.

As with all commands that follow, the case of the characters is unimportant and each argument on the line can abbreviated to its minimum unambiguous length - for instance in the above example it is sufficient to type:

```
> s c b 600 h
```

Setting the scattering angle:

The vanadium width depends on the scattering angle to the detector. The default value is zero, which will give the resolution at small scattering angles, but its value can be changed by typing:

```
> SET PHI <value_in_degrees>
```

Setting the secondary flight path:

The vanadium width depends strongly on L_2, the distance between the sample and the detector. On MARI all the detectors are at 4 m from the sample, but on HET they can be at either 4.0 m or 2.5 m. The default distance is set to 4 m. To change this type

```
> SET LENGTHS
```

and press [RETURN] until prompted for L_2 when the new value should be entered. More details about the SET LENGTHS command are given below.

1.2 Plotting the Flux at the Sample Position and/or Vanadium Width

Plotting the flux and vanadium width:

To plot both the flux at the sample position and the vanadium width on the same graph, type:

```
> PLOT CHOPPER
```

which plots between the default incident energies 0 and 1000meV. The units are neutrons / cm^2 / sec / 100mA on the left hand scale and the FWHH in meV on the right hand scale. To change the limits, numerical arguments should be provided in pairs:

```
> PLOT CHOPPER [ <ei_lo> <ei_hi> [ <flux_lo> <flux_hi>
                                  [ <van_lo <van_hi> ] ] ]
```

If the chopper type or frequency, the scattering angle or other parameters are changed, the resulting flux and vanadium widths can be overlaid by typing:

```
> PLOT OVER CHOPPER
```

To plot (over) just the flux:

Type:

```
> PLOT FLUX [<ei_lo> <ei_hi> [ <flux_lo> <flux_hi> ] ]

> PLOT OVER FLUX
```

To plot (over) just the vanadium width:

Type:

```
> PLOT VANADIUM [<ei_lo> <ei_hi> [ <van_lo> <van_hi> ] ]

> PLOT OVER VANADIUM
```

1.3 Plotting the Resolution as a Function of Energy Transfer

Setting the incident energy:

Before plotting the resolution as a function of energy transfer, the incident energy has to be fixed. This is done by typing:

```
> SET EI <value_in_meV>
```

The scattering angle is also used. To change it from the current value the SET PHI command introduced earlier is used:

```
> SET PHI <value_in_degrees>
```

The sample to detector distance should also be changed from the current value if required with

```
> SET LENGTHS
```

as described above.

Plotting the resolution:

This is achieved by typing:

```
> PLOT RESOLUTION
```

which chooses the default energy transfer range 0 - E_i, and plots the FWHH resolution in meV. The default limits can be changed by providing further arguments:

```
> PLOT RESOLUTION [<eps_lo> <eps_hi> [<res_lo> <res_hi> ] ]
```

If any of the chopper type or frequency, incident energy or other parameters are changed, the result can be overlaid by typing:

```
> PLOT OVER RESOLUTION
```

1.4 Displaying the Flux at a Given Incident Energy

To change the incident energy from the current value type:

```
> SET EI <value_in_meV>
```

Then print the flux by typing:

```
> DISPLAY FLUX
```

1.5 Displaying the Resolution at a Given Energy Transfer

In addition to the scattering angle and the incident energy the energy transfer must also be set:

```
> SET EPS <value_in_meV>
```

The current values of E_i and scattering angle can be changed using the SET EI and SET PHI commands above:

```
> SET PHI <value_in_degrees>
```

```
> SET EI <value_in_meV>
```

The energy resolution and the individual contributions arising from the moderator, chopper, sweep time, sample and detector can then be displayed by typing:

```
> DISPLAY RESOLUTION
```

1.6 Other Commands

Keep a hardcopy:

```
> KEEP [<file_name>]
```

where the file name is an optional parameter. If it not provided, then the output is stored in SYS$SCRATCH:CHOP.PS. If a file name is provided, the default directory is SYS$SCRATCH.

DCL command line / spawn a DCL process:

```
> JUMP [<command_line>]
```

If a DCL command line is provided, the command is executed and control returns immediately to CHOP. If a command line is not provided, a DCL process is spawned. To return to CHOP, log out in the normal fashion.

Leaving CHOP:

To return to the DCL prompt, type:

```
> EXIT
```

2. Advanced Operation

2.1 Alternative Chopper Parameters

Chopper parameters can be set explicitly with the SET CHOPPER command by using OTHER as a chopper type:

```
> SET CHOPPER <multiple_of_50Hz>O
```

or

```
> SET CHOPPER OTHER <frequency_in_Hz>
```

The program will prompt for the slit width (p), the absorbing slat width (d), chopper radius (R) and the slit radius of curvature (r), all in mm.

2.2 Changing Instrument and Sample Parameters

Spectrometer dimensions:

```
> SET LENGTHS [<instrument_name>]
```

will reset lengths in the instrument to the defaults for HET or MARI if the instrument name is given, or will prompt for new values if no instrument name is given. Normally the dimensions should not be changed, but the command is useful in the case of HET because it allows the user to set the sample - detector distance L_2 appropriate for the 4m or 2.5m detector banks in either the forward or backward angle banks (4.033 m, 2.512 m for the forward angle banks and 4.038 m, 2.496 m for the backward angle banks). The default value of L_2 is 4.033 m for HET.

Sample parameters:

```
> SET SAMPLE [<instrument_name>]
```

resets the sample to the default vanadium scatterer (plate on HET, hollow cylinder on MARI), or, if the instrument name is absent, allows the sample parameters to be changed. Usually the resolution is little affected by the sample unless it is very large or elongated. The sample contribution can be checked using the DISPLAY RESOLUTION command.

Moderator parameters:

```
> SET MODERATOR [<instrument_name>]
```

will reset the parameters to those for the ambient poisoned moderator (HET) or methane moderator (MARI). Omitting the instrument name allows these parameters to be changed from the defaults. However, the user should not normally need to change them.

Detector parameters:

```
> SET DETECTOR [<instrument_name>]
```

will reset the parameters to their default values or allow them to be changed, depending on whether or not the instrument name is provided. Again, the user should not normally need to change the parameters from the default values.

Resetting instrument default parameters:

The commands HET and MARI introduced earlier reset the default spectrometer dimensions, moderator parameters, detector parameters and default vanadium scatterer for HET and MARI respectively. The commands are equivalent to successively entering the four commands above.

To reset all the above except the sample parameters, type:

```
> SET INSTRUMENT <instrument_name>
```