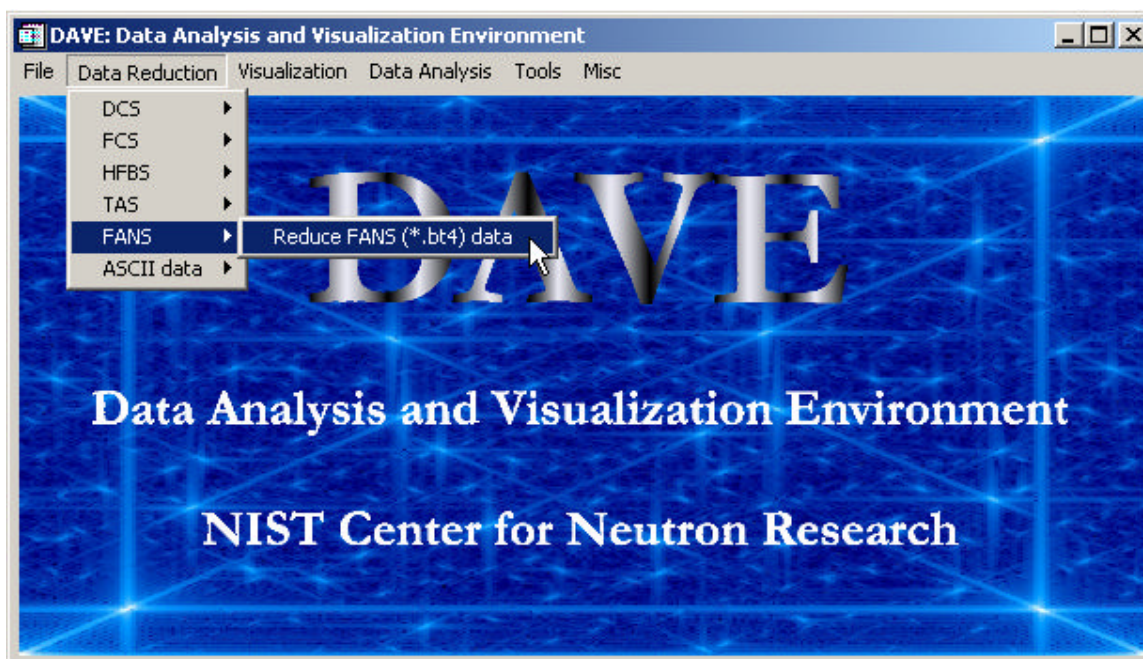


# FANS DATA REDUCTION

## Manual

NIST Center for Neutron Research



The FANS Data Reduction software was developed as a part of the Data Analysis and Visualization Environment (DAVE) package by the NIST Center for High Resolution Neutron Scattering. Through user friendly menus, sample files collected at the Filter Analyzer Neutron Spectrometer (FANS) are binned, displayed and analyzed to generate a reduced vibration spectrum (.DAVE file) that can be further analyzed by other subroutines within DAVE such as the Peak Analysis (PAN), or saved as a five-column text file.

The FANS Data Reduction software is able to merge a number of different scan files generating a continuous spectrum. Files can be added or viewed separately, in units of energy or wavenumbers; and detectors can be masked in order to exclude poor statistics.

FANS Data Reduction is also built to facilitate background subtraction. A *Fast-background* (measurement of the background due to neutrons of energy greater than the filter analyzer's cut-off limit) can be reduced from the data. It is sometimes necessary to take into account sample independent background, and this can also be read as a background scan. Since the background file must have a one-to-one correspondence in energy steps with the sample file, a direct point-by-point subtraction is performed.

## Getting Started

The first step in analyzing FANS data is to load the sample file(s), fast-background file(s), and/or background file(s) using the pull down menu “File” for each appropriate choice.

Once the files are loaded, the configuration options should be change to suite the user’s needs. Either if the sample scan is composed of a single file, or if there are a series of files that, together, compose the complete sample scan; the user should configure the options. Refer to section 1.1.2 **“Settings”** for details on each option.

The next step is to enable the **“Sample”** button in the **“Display”** box (section 1.3.1.1). The main plot window will display the sample scan file in detector number versus neutron counts. Sliding the “Energy Transfer Cut” slider (section 1.3.2.2) will show a different plot of the respective energy transfer cut for the sample scan. The individual detector counts, at each energy scanned, for the sample file(s) should be checked for intensities lower or higher than expected and masked if necessary. The masking must be applied before the fast-background fit. For more details on detector masking see section 1.3.1.1 **“Sample”**.

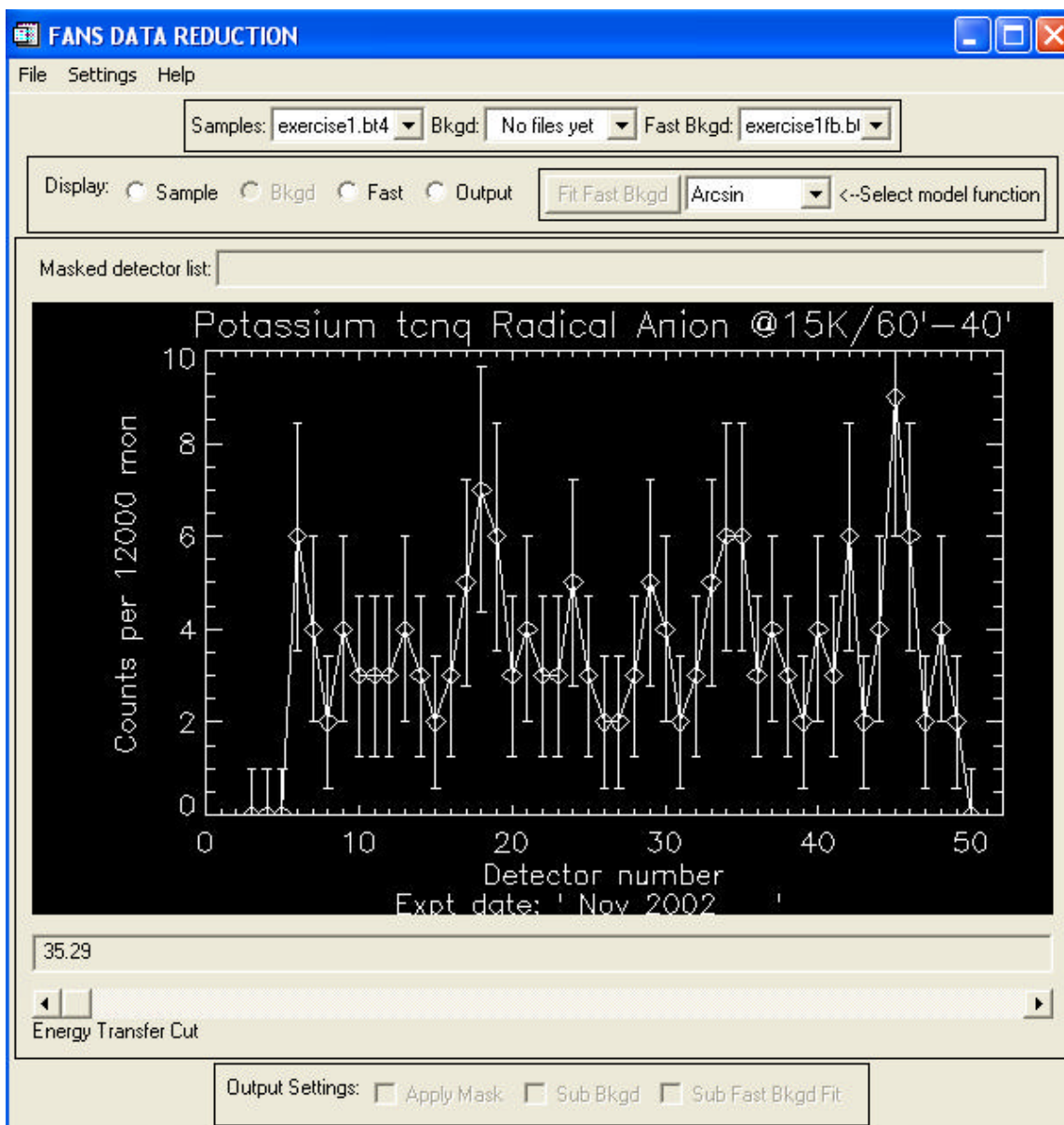
Now the “fast background” scan must be fit (see section 1.3.1.5) with one of the fit functions available in order to allow for the fast background subtraction. It is important to remember that the fast background fit must be done after the detector masking procedure to ensure proper analysis of the data.

Finally, with the **“Output”** button enabled, the sample scan is plotted in energy transfer (or wave numbers) versus neutron counts. At this point no subtractions have been executed. In order for the detector masking to take effect, and the background (or fast-background) to be subtracted; the buttons labeled **Apply Mask**, **“Sub Bkgd”**, and **“Sub Fast Bkgd Fit”** must be toggled in respective order.

The reduced data is now ready to be saved in DAVE, or ASCII format; and be analyzed by other subroutines within DAVE such as the Peak Analysis (PAN), or saved as a five-column text file.

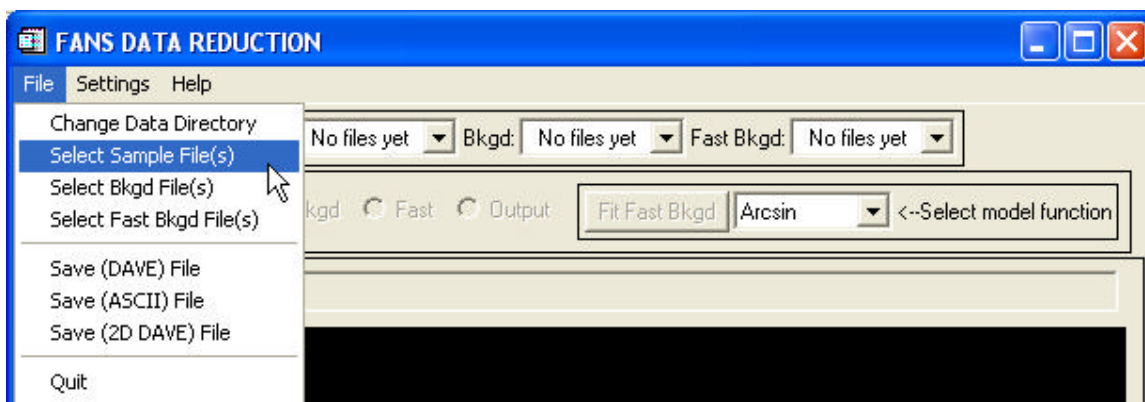
## Main Window

As indicated in the screenshot below, the main interface of the program consists of a main window for displaying the currently selected data and numerous controls that define the data reduction and the data display options. Usage of the program is straight forward, as described in section 2. Moreover, a full description of all available features is given in the remainder of this section.

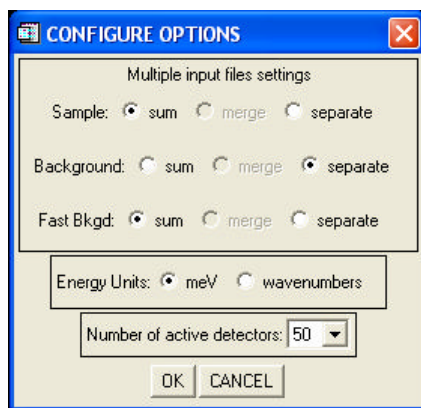


## Menus Description

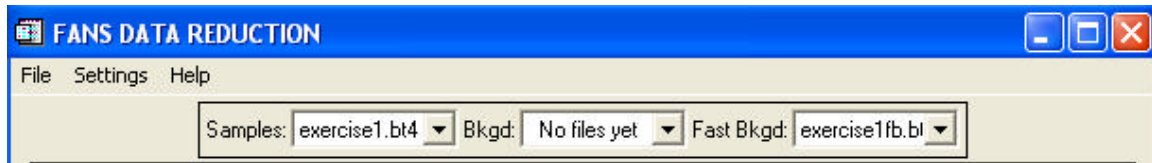
- **File** Controls the input and output of files within FANS Data Reduction software. One can change the default data directory; load sample, background, and fast-background files (i.e. .bt4 files); or save reduced files in the DAVE format, or ASCII files. The output files can be read directly into PAN for peak fit analysis, or into the data browser for visualization or plotting.



- **Settings** Configures various options that affect data reduction. The multiple input file settings allow for several files to be added together generating a continuous spectrum. In essence, a scan that was separated into several different files (or multiple copies on the same energy scan range) will be automatically adjusted for overlapping points, as well as appropriately accounting for counting statistics. The energy units setting allow for the spectrum to be displayed and saved in units of meV or wavenumbers. Finally, the number of active detectors can be set. However, currently the number of detectors is fixed at 50.

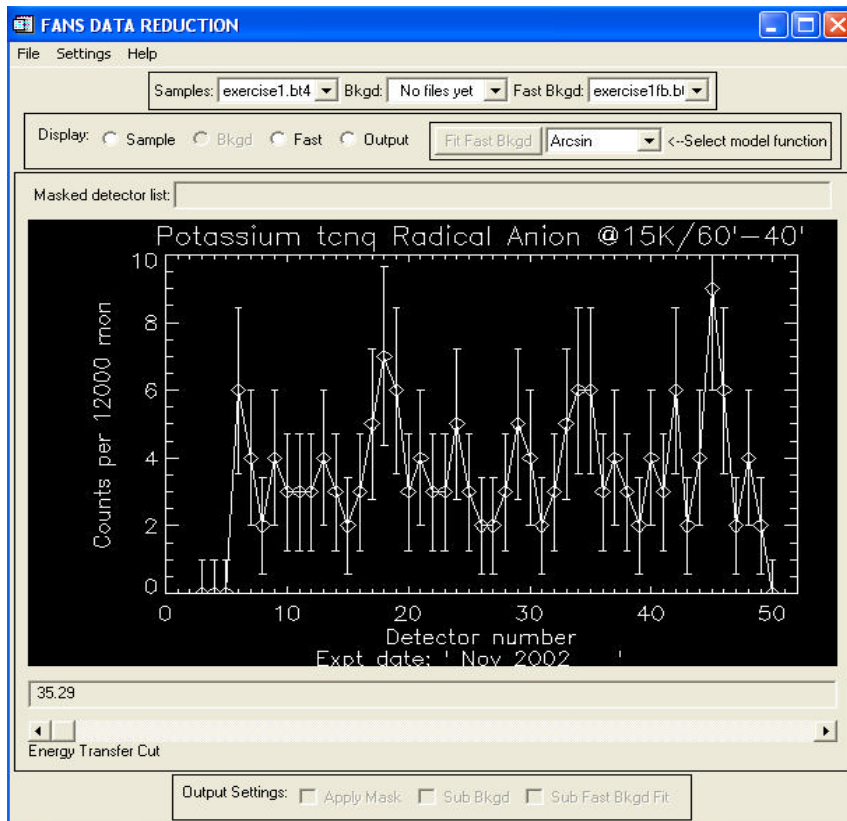


## File Name Display



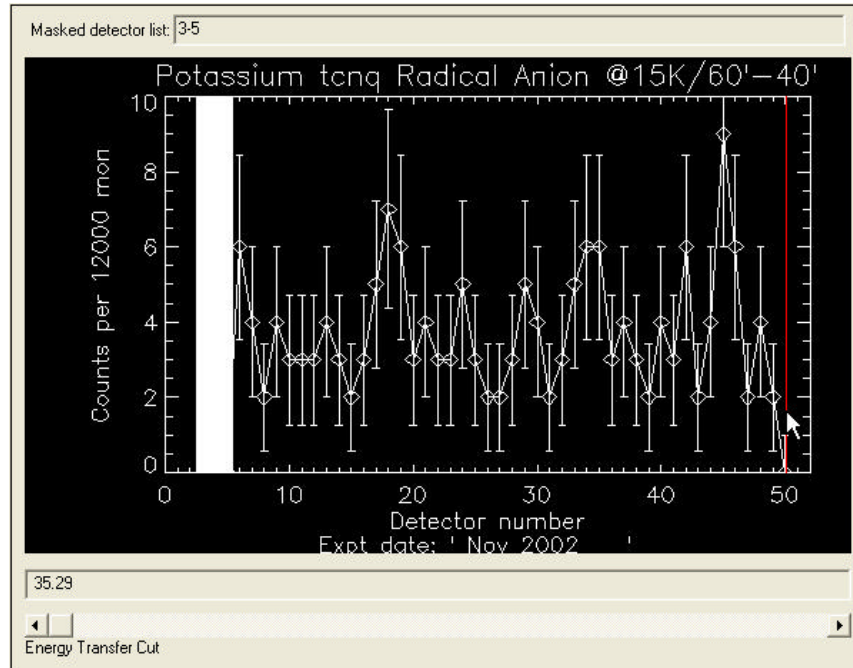
When the multiple input file setting is set to “separate”(see 2.1.2), each file will be individually displayed in the “*Samples*” pull-down menu. The same is true for both the “*Bkgd*” and “*Fast Bkgd*” pull-down menus. However, when the multiple input file setting is set to “sum”, all the listed files are added together to generate a continuous scan.

## Screen Display



## Display Settings:

- **Sample**



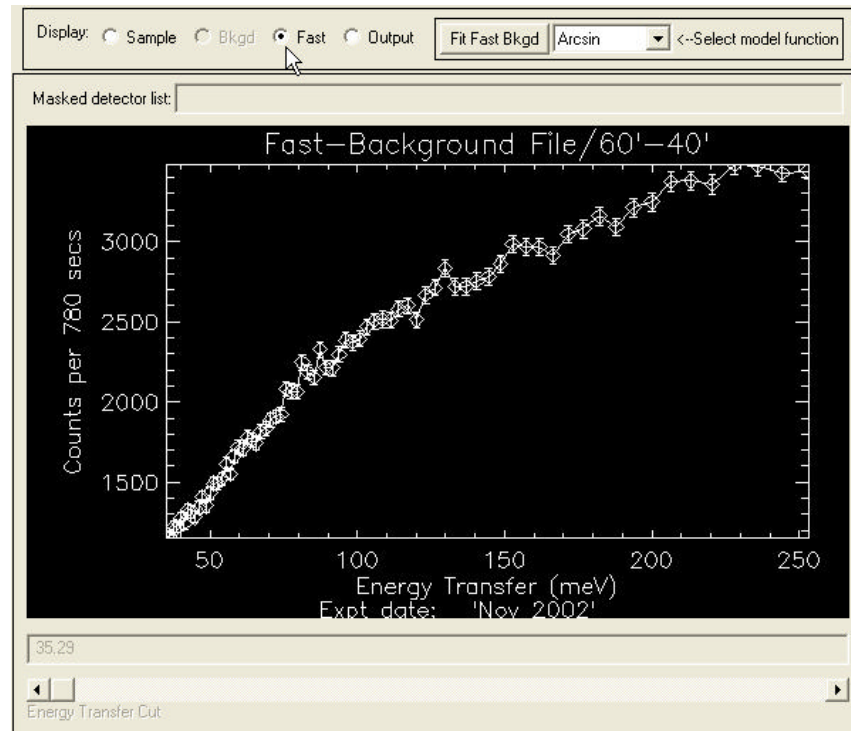
Displays the sample file in individual detector counts for each energy steps. Here the user is able to “mask” (opt to discard) any individual detector or series of detectors. While the file is displayed in individual detector counts for each energy step, the plot display window allows for the masking of individual detectors by simply clicking on the desired detector to be masked. One or more detectors can be masked; however, it is important to note that a detector masked at a specific energy transfer cut will cause the same detector to be excluded from all of the energy transfer cut slices when the “Apply Mask” button is enabled (see 1.3.3.1 below).

- **Bkgd**

Displays the sample independent background (if it was loaded). The background file must have a one-to-one correspondence in energy steps with the sample file so that a direct point-by-point subtraction can be performed. The plot will be similar to the “Sample” plot in which neutron counts are plotted as a function of detector numbers. If any detector was masked in the sample scan, it will be displayed here as masked also.



- **Fast**



Displays the fast-background file plotted in monitor counts as a function of energy transfer. The fast background fit will also be displayed in the same plot once the “Fit Fast Bkgd” virtual button is activated. See 1.3.1.5 for more details.

- **Output**

Displays the output data, calculated according to the current “output settings”. See 1.3.3 below

- **Fit Fast Bkgd**

Here a fit function is applied to the fast-background scan. There are currently 4 choices for fast-background fitting functions. These are: Arcsin, Linear, Quadratic, and Cubic. The user has the flexibility to choose a function that better fits the fast background.

## Plot Window

The plot window is a user interactive window that, according to the display settings (see also 1.3.1 above) will allow for different functions to be executed. The main plot window is composed of:

- **Masked detector list:**

Here a list of all of the masked detectors is displayed and updated automatically upon each detector masking.

- **Plot display:**

There are a number of different plots that will be displayed within this window: The plot of detector number versus neutron counts will appear when the “Sample” display button is enabled, the background plot when the “Bkgd” button is enabled, and finally the “fast background” plot (in energy transfer versus monitor counts) will appear when the “Fast” button is enabled. The Energy Transfer Cut slider, directly below the plot area, enables a view of the individual detector count for each energy step only when the “Sample” button is enabled.

## Output Settings

Here the detector masking, background, and/or fast-background subtractions will be applied to the sample scan once each box is checked. The user should note that the background subtractions must be applied AFTER the appropriate detector masking (if necessary), or the fast background fit is executed.

- **Apply Mask**

Enabling this button will cause the program to exclude all (if any) detectors masking as listed in the “masked detector list”. The detectors masked previously (see 1.3.1.1 above) will only be excluded from the calculations when the “Apply Mask” button is enabled.

- **Sub Bkgd**

If a sample independent background was loaded (see 1.3.1.2 above), it will be subtracted from the sample scan once this button is enabled. Moreover, the sample independent background will be subtracted only if there is a one-to-one correspondence in energy transfer between the sample scan and the sample independent background.

- **Sub Fast Bkgd Fit**

This should be the last step in the data reduction. The fast background is subtracted from the sample scan once a fit function is applied to the fast-background scan (see 1.3.1.5 above), and this button is enabled. Make sure to refit the fast background before enabling this subtraction if any detector was masked.