



Physics MRI Research Centre

UNIFIT
VERSION 1.24

User's Guide

Note: If an error occurs please quit UNIFIT and type:
`.reset`
in the IDL command line, and restart UNIFIT.

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Introduction

UNIFIT is designed to fit data to equations commonly encountered in MRI research. Currently UNIFIT can process 3D, 2D and 1D data, fitting equations for T_1 , T_2 and T_2^* experiments.

Running UNIFIT

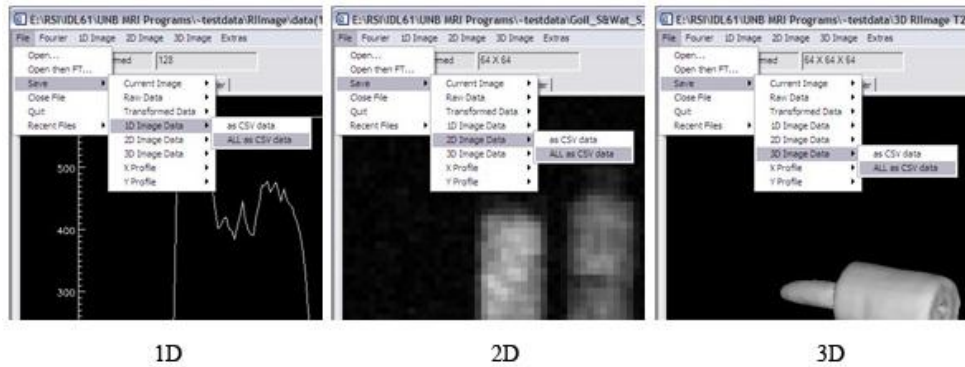
UNIFIT is started by typing “unifit” in the command line in IDL.

Data used in UNIFIT

1) UNIFIT can read files in DAT or csv (comma separated values) format. The user must first process the data in ACCISS and export the data as DAT or csv files for UNIFIT. The data should be in magnitude (or image) format, and not in complex format.

Various export formats are provided in ACCISS. The user needs to specify either “1D image Data” or “2D image Data”, and “as CSV data” for exporting a single image or “all as CSV data”^{*} for exporting all of a set of images.

^{*} The order of files is very important in UNIFIT. It processes the files in the order that they appear in the directory listing. With older operating systems, files might be sorted as: “data1 data10 data11 data12 data 2 data 3 data 4...”. When the user chooses “Transformed Data/as byte data” or “all as CSV data”, the files must be in the correct order, as the exported files will be named according their positions in the list. Although the user can adjust the order in UNIFIT, there is no such option in ACCISS. If the files not in order, rename the files, import them to ACCISS and process them again.



2) The user can also import generic data and times to perform a custom fitting. The data and time sets must be contained in two separate text files. Since this is neither 2D mapping nor 1D fitting data, the data set will simply be listed in the data list, and times in the time list. The user can apply the options outlined below and click the “custom button” on the fitting tab in the control panel.

Fitting process

Loading data and time files

Loading wizard: when UNIFIT is initialized, a dialog is generated to import data files. Choose one or more files and click OK. The current data file format should be “.dat” or “.csv”. A second dialog box is generated to import the time files. The current time file format should be “.txt”.

loading data file: if UNIFIT is already running, go to *file menu* and choose *load files* to choose one or more data files and click OK. Alternatively, go to *configure control tab*, click the *browse* button of *input path*, choose one or more files and click OK. The current data file format should be “.dat” or “.csv”.

loading time file: if UNIFIT is already running, go to file menu and choose *load Tau Table* to choose one or more time files and click OK. Alternatively, go to *configure control tab*, click the *browse* button of *time file*, choose one or more files and click OK. The current data file format should be “.txt”.

Specify equation

Equation wizard: When UNIFIT is initialized, a box is generated to select the equation for the fitting routine.

Equation select: if UNIFIT is already running, to select the equation see figure 12. It is important to save your results before changing the equation type, as this will alter the format of the output.

Use Filters

There are two filters for 2D fitting.

1. **Signal level filter:** is used to remove noisy pixels before the fitting procedure begins. Pixels whose intensity in the first image is below the threshold will be masked. Users may disable the filter [4.19], adjust the threshold level [4.8], display the filter [4.7], and choose the color of the mask [4.3].
2. **Error level filter:** is used to remove noisy pixels resulting from the fitting procedure. Pixels with statistical uncertainties greater than the threshold will be masked. Masked pixels will be designated in the ROI list [6.11] with the notation “<-----bad uncertainty”. Users may disable the filter [4.17], adjust the threshold level [4.9], display the filter [4.7], and choose the color of the mask [4.6].

3D fitting:

1. **Set threshold:** use the threshold slider [2.8] to adjust the surface threshold of a 3D object.
2. **Set angles:** an object can be rotated either with the mouse by clicking on the object in the 3D draw window [2.12] and dragging the object to rotate it, or with the sliders [2.5] as x angle sliders, [2.6] as y angle sliders and [2.7] as z angle sliders.
3. **Do the fitting:**
 - a) **Fit single slice:**
 - i. **Set slice:** to set the slice, either click on the mini 3D draw window [2.1] directly or use the z slice position slider [3.3] to set the position of the slice. A line showing the location of the slice will be plotted in the mini-draw window as [3.2].
 - ii. **Do the 2D fitting:** see “2D fitting” section.
 - b) **Fit slices in a range:**
 - i. **Set range:** enter the start and end slice positions in slice range boxes [3.7].
 - ii. **Preview the range:** two red lines will be plotted in mini 3D draw window [2.1] to present the range.
 - iii. **Set filters for each slice:** as signals on each slice are different, we need to specify the signal filter and error filter for each slice.
 1. **(Optional) load the filter setting:** If you have a saved filter setting file, you can load it. Each slice will be automatically configured.
 2. **Use the filter dialog:** see figure 13. A convenient way is to apply a general setting of both filters to all the slices [13.7]. And then check slices one by one by selecting the slice index to see how the signal filter works. If a certain slice is not well filtered, then adjust the settings and use [13.1] to apply the changes.

3. **(Optional) save the filter setting:** If you like to save the settings presented in the filter dialog, you can save the settings to a file for next use.
- iv. **Fit the slices in the range: after everything is ready, click fit slices button [3.6] to fit the slices.**

2D fitting

There are currently 6 options in the 2D fitting:

1. **Single pixel fit (default):** this is the default setting. When the user clicks on the 2D draw window, the data from that position in each image will be extracted and listed in [6.12]. A green cross will indicate the position selected. These data are fit to the equation specified by the user.
2. **Draw ROI and fit the average:** click [4.12] to specify a ROI. Data within the ROI in each image will be averaged and the average fit as single pixel fitting. ROI information will be listed in [6.11].
3. **Draw ROI and fit each pixel:** click [4.13] to specify a ROI. UNIFIT fits each pixel within the ROI. i.e. if there are 49 pixels in the ROI, the fitting routine will proceed 49 times for these 49 pixels. [4.11] displays the ROI and [4.16] sets the color of the mask. ROI information will be listed in [6.11].
4. **Average all pixels and fit the average:** click [4.14] to apply. This is similar to *Draw ROI and fit the average* except that the ROI is the entire image. The user does not specify any position or ROI.
5. **Pick all pixels and fit each pixel:** click [4.15] to apply. This is similar to *Draw ROI and fit each pixel* except that the ROI is the entire image. Unifit fits all pixels individually within the image. A ROI is not specified.

1D fitting

1. **Select the position of the data:** use [5.2] to set the position, or enter the position value in text box and click the set button [5.3] to apply.
2. **Single position fit:** click [5.4] to begin the fitting process. The fitted data set will be listed in [6.12].

Instant fitting

The purpose is

- 1) In general 3D, 2D, 1D fitting: to quickly fit the data set listed in [6.12] after modification is applied to the equation or the initial values. It's like a preview and test.

Only if a single pixel fit has just been processed, or a single data file (.txt) is imported, the data to be fit will be listed in [6.12]. If the time data is valid, clicking [7.2] initiates the customized fitting. The user can specify the initial values, change the equation, change the split line and perform the fit again. A quick fit based on the previous picked data set is performed, similar to [4.10] and [5.4] but based on the data listed in [6.12] and the times listed in [6.4].

2) In the simple fitting using data and time (or y and x) provided by user: see description of Figure 15.

View results

1. **Info lists:** for ROI fitting, the ROI information will be listed in [6.11] and time table will be listed in [6.4]. For a single fit, data will be listed in [6.12].
2. **Fitted curves:** the fitted curves will be plotted in the result draw window [7.8]. Comments (the result of the fitting) will be plotted along with the curve in [7.8]. Comments controller [8.2] adjusts the position of the comments. For a ROI fitting with more than one result, clicking on the ROI information listed in [6.11] or using the ROI points slider [7.5] displays results for that position.
3. **View the fitted params in 2D ROI or 3D range cases:** it's a tricky part. As there are many pixels fitted and for each pixel there are more than one fitted param should be present. The large amount of data must be sorted/separated by some way. I use params to sort the results. Like param A, you can see



in [8.1]. The 1st option button is for the fitted param A matrix and second option button is for its uncertainty matrix.

For a ROI fitting on 2D image/3D slice or for a 3D range fitting, the radio option buttons in [8.1] place the fitted parameter matrix in the data table [8.20]. The fitted parameter matrix is also plotted in the data view draw window [8.19] as 3D or 2D. Specific data can be viewed by selecting a position in the image and viewing the data table. [8.15] and [8.14] set the image brightness and contrast. Occasionally there are very large values which result in very bright pixels, in which case [8.13] / [9.3] can be used to modify them. [8.11] / [9.1] resets all data tables and draw options. See figure 08 and 09 for more details

Export results

Export options are covered in figure 10 applies these options. Exported files will be stored in the same folder as the imported data and time files.

Figure 1:
General overview

I separate the GUI into 3 parts: main draw area, mini draw area and the control panel. The main draw area is the entire left hand side; the mini draw area is on the top of the right hand side; the control panel area is the other half of right hand side. The menu bar is at the top of the interface.

In the main GUI areas:

- **Main tabs [1.8]:** images or curves are shown in the draw window. Data and related information are show in the data table or data list.
- **Mini tabs [1.2]:** there are 2 mini tabs to present the current contents in 3D and 2D draw widgets.
- **Control tabs [1.4]:** switches between different control panels.

Some shared GUI elements:

- **Menu bar [1.1]:** contains the common options of UNIFIT
- **Timer [1.6]:** Show the estimated time left and used. It's not very accurate as the number of the data to be processed is dynamic in many cases.
- **Multiple file slider [1.5]:** If more than one file is imported into UNIFIT, this slider will allow the user to select a particular file to review or process.
- **System message [1.7]:** shows any messages from UNIFIT such as notices or errors. The most important messages will appear in a pop-up message box.
- **Dialogs [1.3]:** the extra functions or utilities to help the process.

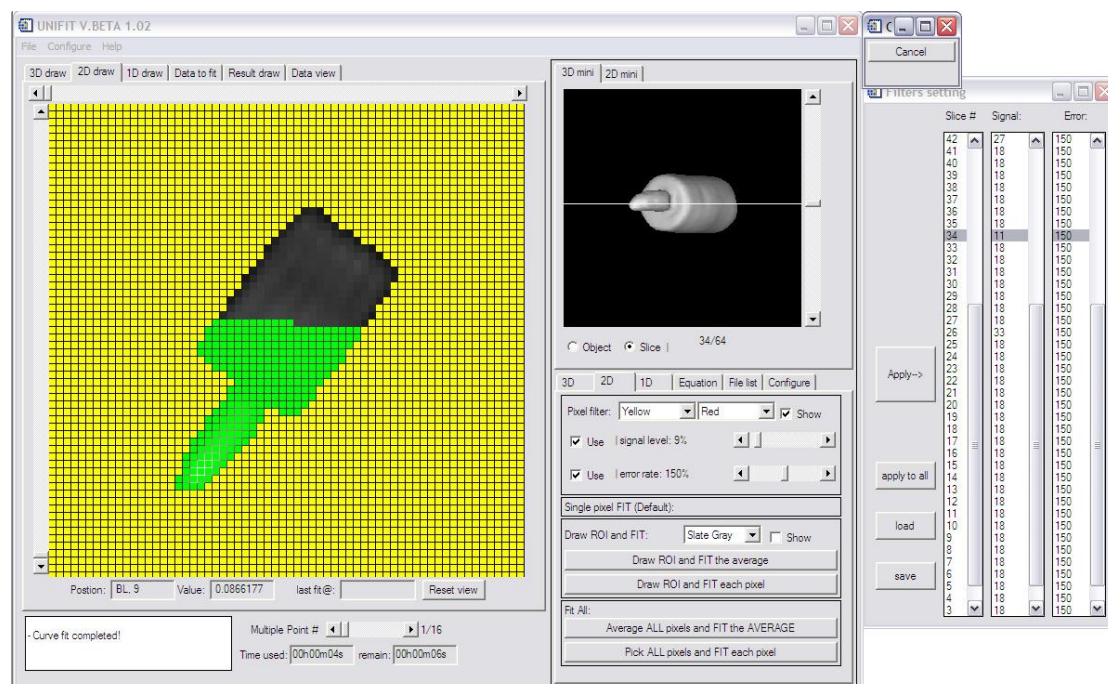


Figure 2: 3D draw & 3D angle control

In the 3D draw window area:

- **3D draw window [2.12]:** the window shows the 3D data as a 3D object.
- **Angle information bar [2.11]:** shows the x, y and z angles.
- **object / slice mode option button [2.10]:** When in the object mode, the 3D object will response to the mouse event on 3D draw window [2.12] and rotate; when in the slice mode, a slice will be picked up according to position where the cursor is clicked on 3D draw window [2.12].
- **Reset object position button [2.9]:** resets all the angle sliders to zero. This includes [2.1], [2.4], [2.5], [2.6] and [2.7].

In the 3D mini draw area:

- **Mini 3D draw window [2.1]:** same content as what plotted in 3D draw window [2.12]
- **Slice position on z axis slider [2.6]:** Use the slider to pick the slice position along the z axis. In [3.3], there are two sliders are same.
- **object / slice mode option button [2.4]:** When in the object mode, the 3D object will response to the mouse event on mini 3D draw window [2.1] and rotate; when in the slice mode, a slice will be picked up according to position where the cursor is clicked on mini 3D draw window [2.1].

In the 3D angle Control area:

- **X angle slider [2.5]:** rotates the 3D object around the x axis.
- **Y angle slider [2.6]:** rotates the 3D object around the y axis.
- **Z angle slider [2.7]:** rotates the 3D object around the z axis.
- **Thresh slider [2.8]:** The threshold slider controls how much of the image is displayed. Pixels with intensities higher than the threshold intensity appear in the image, while the remaining ones do not.

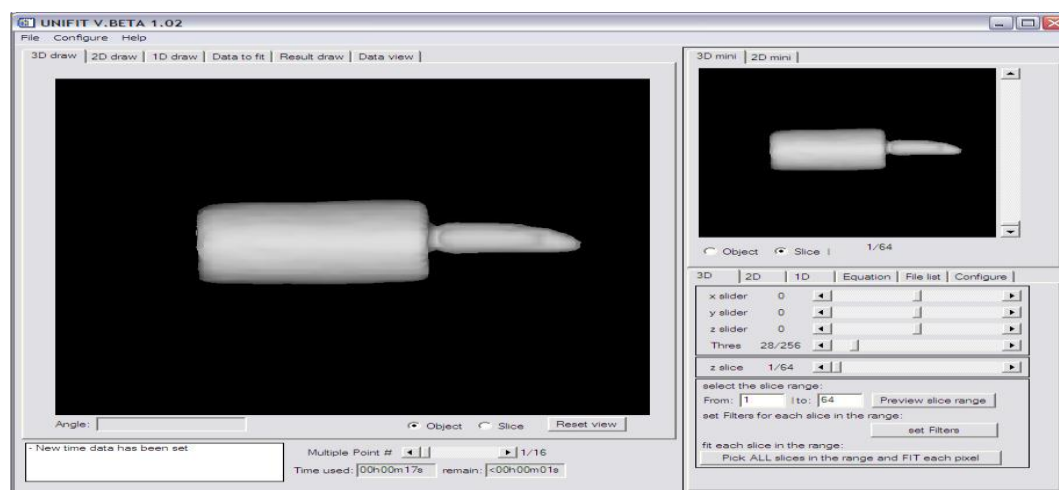


Figure 3: 3D slice controller

In the 3D draw window area:

The current slice is plotted as a 2D image in 2D draw window [4.24]. When multiple files are used, a slice will be picked from each file. User can view the slice of a certain file using the multi file slider [1.5].

In the 3D mini draw area:

- **Slice position on z axis slider [3.3]:** picks the slice position along the z axis.
- **Slice position line [3.2]:** if the user clicks on the mini 3D draw window [3.1] or uses the z slice position sliders [3.3], to set the slice, a white line is plotted on the mini 3D draw window [2.1] showing the current slice position.
- **Slice position label [3.1]:** shows the position where the current slice is picked

In the 3D slice control area:

- **Slice position on z axis [3.3]:** same as above.
- **Slice range boxes [3.6]:** if the user wants to fit the entire or part of the 3D object, he could specify a range where the slices should be picked. E.g, if we say from 10 to 20, then the slices between 10 and 20 including 10th and 20th slices will be picked and fitted.
- **Preview slice range button [3.4]:** after the user specified the beginning and the end positions, he could preview the range on the mini 3D draw window [2.1]. Two red lines will present the range.
- **Filter dialog button [3.5]:** call the filter dialog.
- **Fit slices button [3.6]:** click to fit the slices included in the range. After the fitting is finished, results will reform to a new 3D object and will be shown in data view window [8.19].

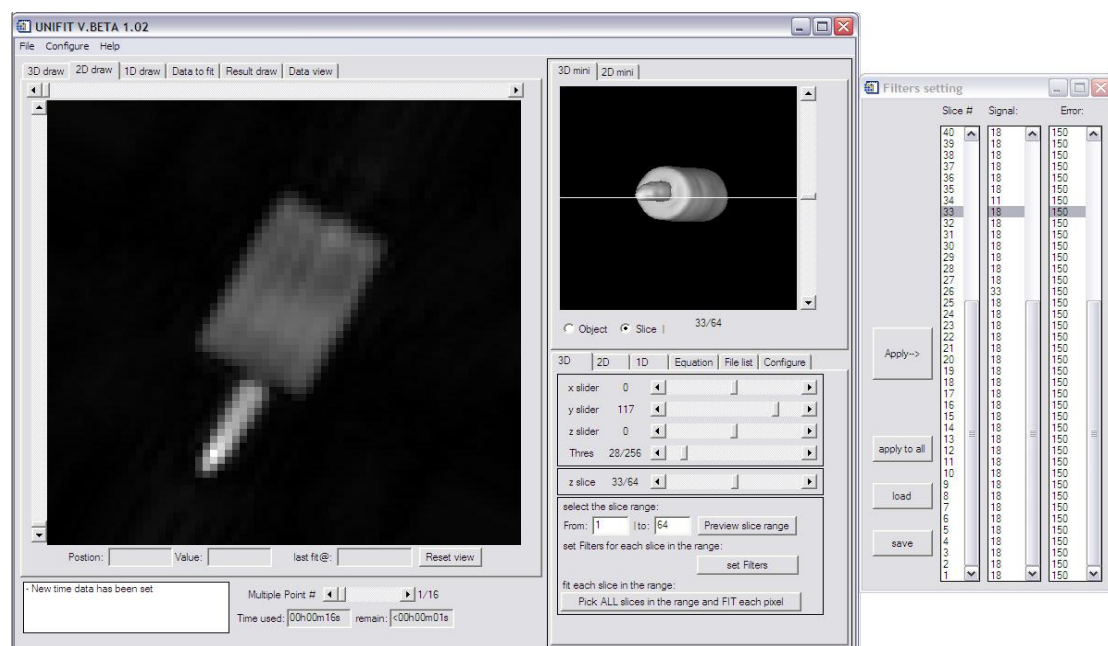


Figure 4: 2D draw window & 2D control panel

In the 2D draw window area:

- **2D draw window [4.24]:** the window shows the data as a 2D image.
- **Column slider [4.1]:** adjusts the position of the vertical profile.
- **Row slider [4.23]:** adjusts the position of the horizontal profile.
- **Position box [4.22]:** the cursor position in the 2D draw window.
- **Value box [4.21]:** the image intensity at the cursor position.
- **Previous fit position box [4.20]:** the pixel position of the previous fit.
- **Reset view button [4.19]:** resets the 2D view settings.

In the 2D mini draw area:

- **Mini 2D draw window [4.4]:** same content as what plotted in 2D draw window [4.24]
- **Continuous fitting button [4.2]:** If the button is checked, the user just move the cursor over the pixels and get the fitted curve instantly; otherwise, the user has to pick the mouse to tell the program the pixel is picked for fitting.
- **position box [4.5]:** the cursor position in the 2D mini draw window

In the 2D control panel area:

- **Signal filter color option [4.3]:** a droplist to select the color of the pixels excluded (masked) by the signal filter.
- **Error filter color option [4.6]:** a droplist to select the color of the pixels excluded (masked) by the error filter.
- **Check box to show filters [4.7]:** check this box to show both the signal and error filter masks. The masked pixels will be displayed with their respective filter colors.
- **Check box to use signal filter [4.18]:** check this box to enable the signal filter.
- **Signal filter slider [4.8]:** set the level of the signal filter. Pixels with signal levels below the specified level rate will be masked.
$$\text{Level} = [(\text{signal value of current pixel}) - (\text{the min signal value})] / [(\text{the max signal value}) - (\text{the min signal value})] * 100\%$$
- **Check box to use error filter [4.17]:** check this box to enable the error filter.
- **Error filter slider [4.9]:** set the rate of the error filter. Pixels with uncertainties from the fitting routine above the specified rate will be masked.
$$\text{Level} = (\text{current uncertainties}) / (\text{current fitted parameters}) * 100\%$$
- **ROI color [4.16]:** a droplist to select the color of the ROI.
- **Single pixel fit (default) [4.10]:** fits a single pixel to the specified equation. This is the default setting. Once the user clicks the image, the fitting will proceed.
- **Draw ROI and fit the average [4.12]:** allows the user to fit the average of all pixels within a user defined region of interest (ROI) to a specific equation.

- **Draw ROI and fit each pixel [4.13]:** allows the user to fit each pixel within a user defined region of interest (ROI) to a specific equation.
- **Average all pixels and fit the average [4.14]:** allows the user to fit the average of all pixels within the image to a specific equation.
- **Pick all pixels and fit each pixel [4.15]:** allows the user to fit each pixel within the image to a specific equation. Note that this may take considerable time to process.

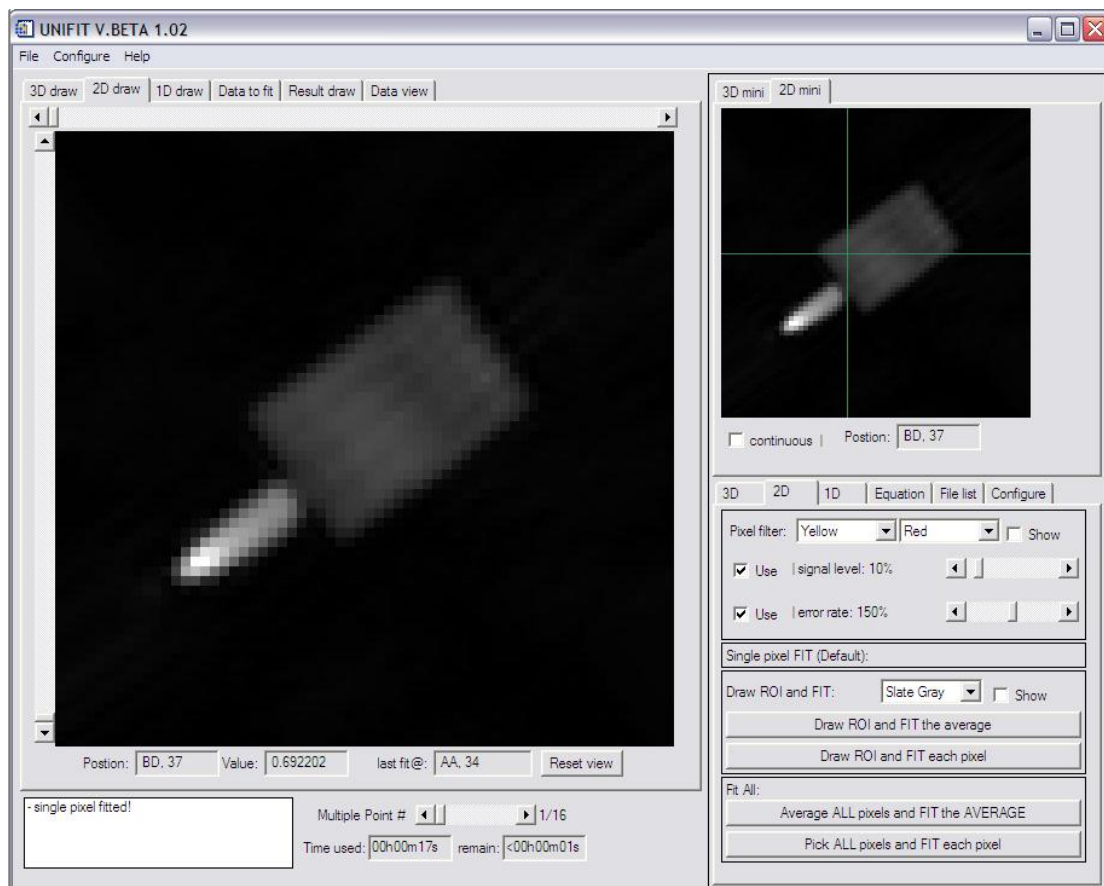


Figure 5:

1D Data & its Control

In the 1D data area:

- **1D draw window [5.7]:** The current data position for fitting is plotted as an orange star.
- **Value of selected pixel [5.5]:** the value of current selected pixel from the current selected file.

In the 1D control area:

- **Data line options [5.1]:** determines how the data are plotted. If “Show data line” is selected, the data will be plotted as a line. If “Hide data line” is selected, the data will be plotted as points.
- **Data position slider [5.2]:** the current data position for fitting.
- **Data position textbox and the apply button [5.3]:** allows for manual entry of the pixel to be fit. The value is only registered once the apply button is clicked.
- **Single position fit [5.4]:** performs the single pixel fit on the data at the selected position.

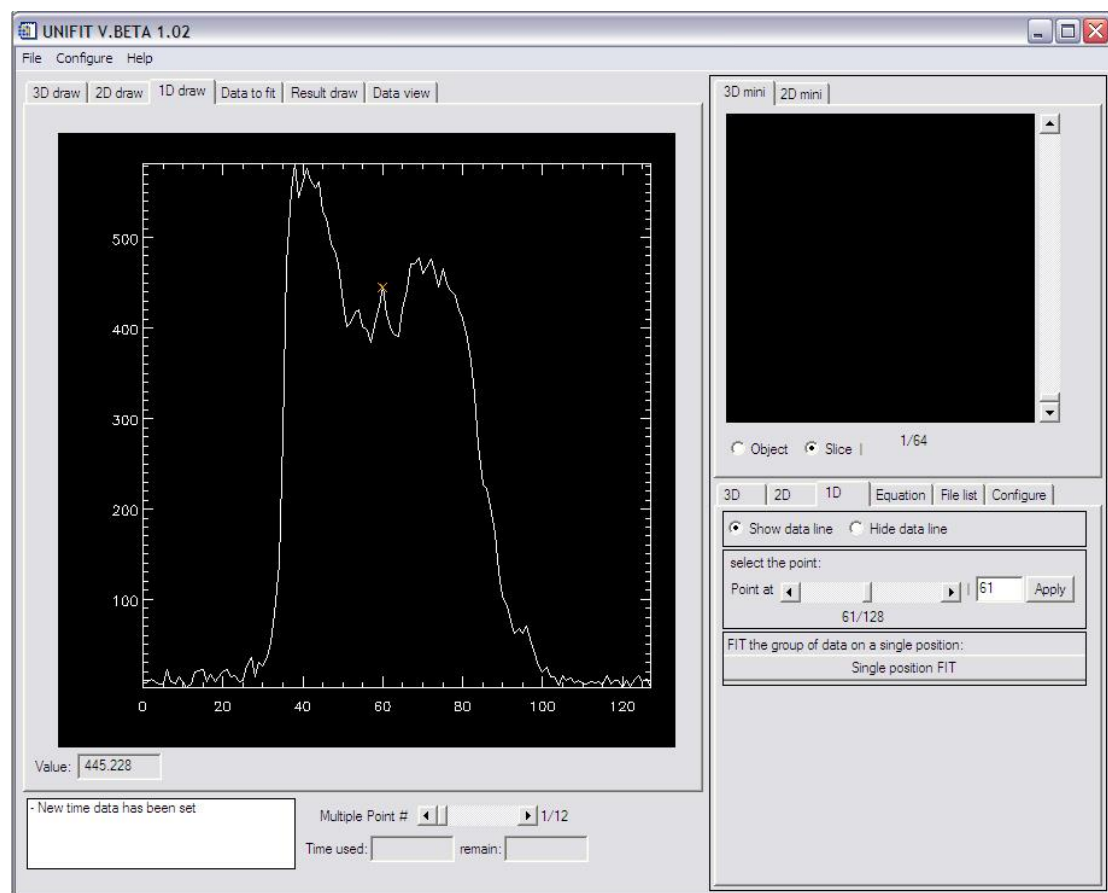


Figure 6: Data to fit & file list

In the lists area:

- **ROI list [6.11]:** If a ROI is applied and the fitting process is finished, the positions of each pixel in the ROI will be listed here. If any of these positions in the list are selected with the mouse, its fitted curve will be plotted and the output will be updated in result window [7.7]. Note that the pixels that are filtered by the signal filter will not be listed.
 - ◆ **Fitted pixels in ROI:** those pixels that are not filtered by the signal filter before the fitting, and by the error filter after the fitting, will be listed followed by a double line, “=====”. If any of these positions are selected with the mouse, its fitted curve will be plotted and the output will be updated in result window [7.7].
 - ◆ **Error filtered pixels in ROI:** those pixels that are not filtered by the signal filter before the fitting but are filtered by the error filter after the fitting will be listed followed by a double line “=====” and will be indicated with the notation “<----- bad uncertainty”.
- **Data list [6.12]:** contains the data to be fit. For a single fit, there is only one data set and a corresponding time set.
- **Time list [6.4]:** the table of time values for the fit.
- **Move selected data up/down [6.1] / [6.10]:** move the selected data up/ down in the data list
- **Move selected data and time up/down [6.2] / [6.9]:** move the selected data and time up/ down in both lists
- **Move selected time up/down [6.3] / [6.8]:** move the selected time up/ down in the time list

In the file list area:

- **Input file list [6.6]:** contains the imported file names. When any filename is selected, the content drawn in main windows [2.12], [4.24], [5.6] and mini windows will be replaced with the current file.
- **Move selected file up/down [6.5] / [6.7]:** move the selected file up/ down in the file list. The order of images or curves will be rearranged accordingly.

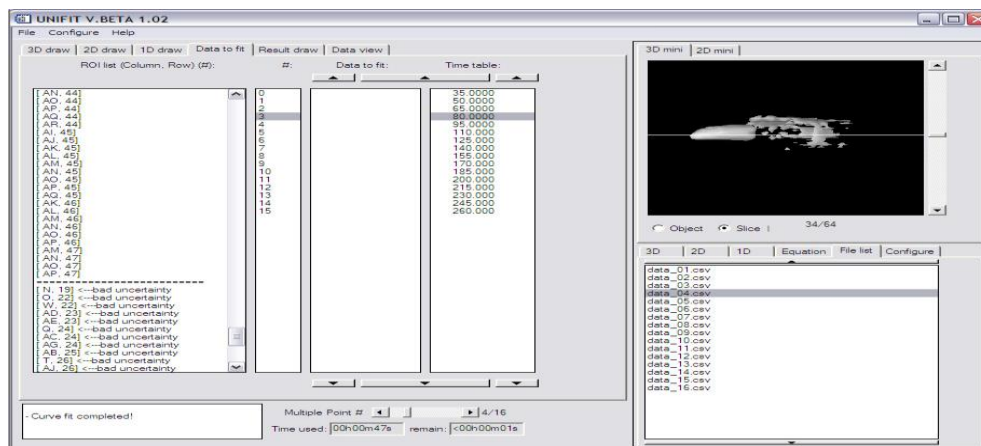


Figure 7: Result draw & Equation

Result draw plots the fitted curve and shows the related results.

In the result draw area:

- **Result draw window [7.8]:** the window to plot the original data and the fitted curves.
- **Comments [7.1]:** reports the results of the fitting process, including position information, the equation used and the fitted parameters in the Result draw window [7.8].
- **Data to fit [7.6]:** the original data are plotted as yellow star symbols.
- **Fitted curves [7.7]:** the curve of best fit is plotted in red.
- **Slider of position in ROI [7.5]:** similar to the “ROI list” on the set data tab. Appear only if a ROI is applied. The position numbers will be listed here. When a position is selected with the mouse, its fitted curve will be plotted and the output will be updated.

In the fit control area:

- **Instant fit [7.2]:** allows the user to tailor the fit to their data. The fit will be based on the data in the data [6.4] and time [6.12] lists.
- **Equation select:** see figure 12.
- **Use my initial values [7.3]:** before performing a fit of the data, UNIFIT determines the starting values of the various parameters. The user has the option of choosing a different set of initial values.
- **Current equation (as IDL codes) [7.4]:** the equation we see in the comments is the print version. The equation used/called behind the software is a different one. The params are presented by arrays. E.g. if we got 3 params to fit, then an array with 3 elements, A[0],A[1] and [2] will be used in the equation. Although the 3 params we see in the comments might be named as A, T2 and C. It's useful especially when we set our own equation. We can see how our equation is transferred or worked at background.

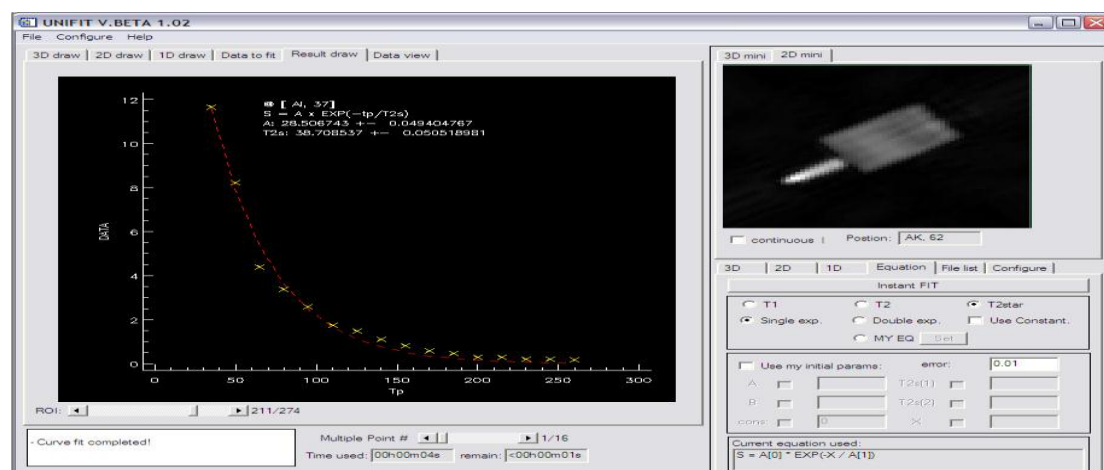
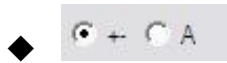


Figure 8:

Data/result view 2D & Configure panel

In the data view area (top):

- **File info area [8.21]:** shows the general file information.
- **Options of data to view [8.1]:** there are up to 11 options to set. *Image data* is always available, which is the original data or the image data (magnitude data). The remaining options will be available when an ROI fitting process is complete. The fitted parameters and their uncertainties for all equations will be stored in matrix form. One matrix stores one kind of parameter or uncertainty.



- ◆ The first option is the parameter A (here it is checked) and the second option is the uncertainty of A (here it is unchecked).
- **Data table [8.20]:** a table to view the data.

In the data/result view area (bottom) (2D)

- **Position of the currently selected pixel [8.18] [8.17]:** these two text boxes show the column and the row of the pixel selected by the user. Once the user clicks on the window [8.19], the corresponding data from that position in the table [8.5] will be displayed.
- **Value of the selected pixel [8.16]:** shows the value of the currently selected pixel. This is the same as the value of the data in that position [8.18] and [8.17] of the table [8.20].
- **Brightness slider [8.15]:** set the brightness level of the image in [8.8].
- **Contrast slider [8.14]:** set the contrast slider level of the image in [8.8].
- **Result filter slider [8.13]:** occasionally there will be erroneously large values in the data matrix, which distort the dynamic range of the data. This produces a few very bright pixels, while the remaining pixels blend into the background. I separate the results into 100 levels from the minimum to the maximum. Use the filter to get rid of those high level data and click the apply button [8.12] to apply the changes.
- **Apply filter button [8.12]:** Apply the changes and filter the high level data. Once filtered, a new 100 level will be separated.
- **Reset [8.11]:** reset the current result or uncertainty.

In the configure control:

- **Configure more button [8.4]:** call/close the configure more dialog. See figure 11.
- **Check box to show position info in Excel style [8.5]:** only useful for locating a pixel on 2D image. As each pixel on a 2D image is related to a data in a matrix, we can find the data in CSV file using excel. If we are using excel style, then the

column will be labeled by letters and row will be labeled by numbers; otherwise, both will be labeled by numbers which start from 0.

- **Comments position controllers [8.2]:** a label to show the current position of the comments. 4 buttons control the position. Changes will be applied when the plot is refreshed.
- **Check box to plot fitted curve in log mod [8.3]:** check this box to plot the data and results on a semi-log scale.
- **Check box to draw grid [8.6]:** check this box to draw grids in the result draw window [8.1].
- **Check box to reverse the color of result draw [8.8]:** If you hate the black background of the result plot, then why not reverse the color to white?
- **Check box to show the comments [8.7]:** If the comments are not needed to be shown up with the results, then uncheck the button.
- **Check boxes of export options [8.9]:** select the images or data the user wishes to save. For details, see the figure 10.
- **Export button [8.11]:** apply the checked options and save the images or data. The file names will contain the time that the file was saved.
- **Reset (in the export option area) [8.10]:** uncheck all of the checked boxes of [8.9].

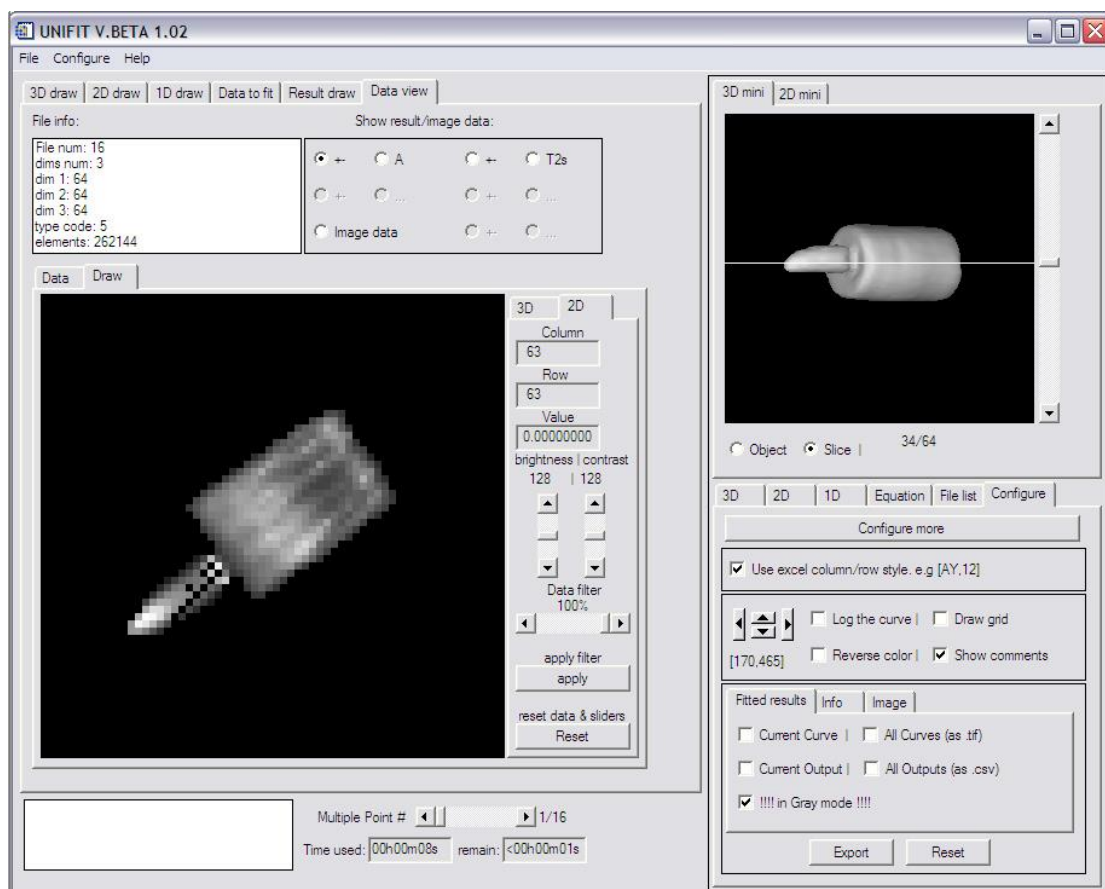


Figure 9: Data/result view 3D & Configure panel

In the data/result view area (bottom) (3D)

- **X angle slider [9.4]:** rotates the 3D results around the x axis.
- **Y angle slider [9.5]:** rotates the 3D results around the y axis.
- **Z angle slider [9.6]:** rotates the 3D results around the z axis.
- **Thresh slider [9.7]:** The threshold slider controls how much of the image is displayed. Pixels with intensities higher than the threshold intensity appear in the image, while the remaining ones do not.
- **Result filter slider [9.3]:** occasionally there will be erroneously large values in the data matrix, which distort the dynamic range of the data. This produces a few very bright pixels, while the remaining pixels blend into the background. I separate the results into 100 levels from the minimum to the maximum. Use the filter to get rid of those high level data and click the apply button [8.12] to apply the changes.
- **Apply filter button [9.2]:** Apply the changes and filter the high level data. Once filtered, a new 100 level will be separated.
- **Reset [9.1]:** reset the current result or uncertainty.

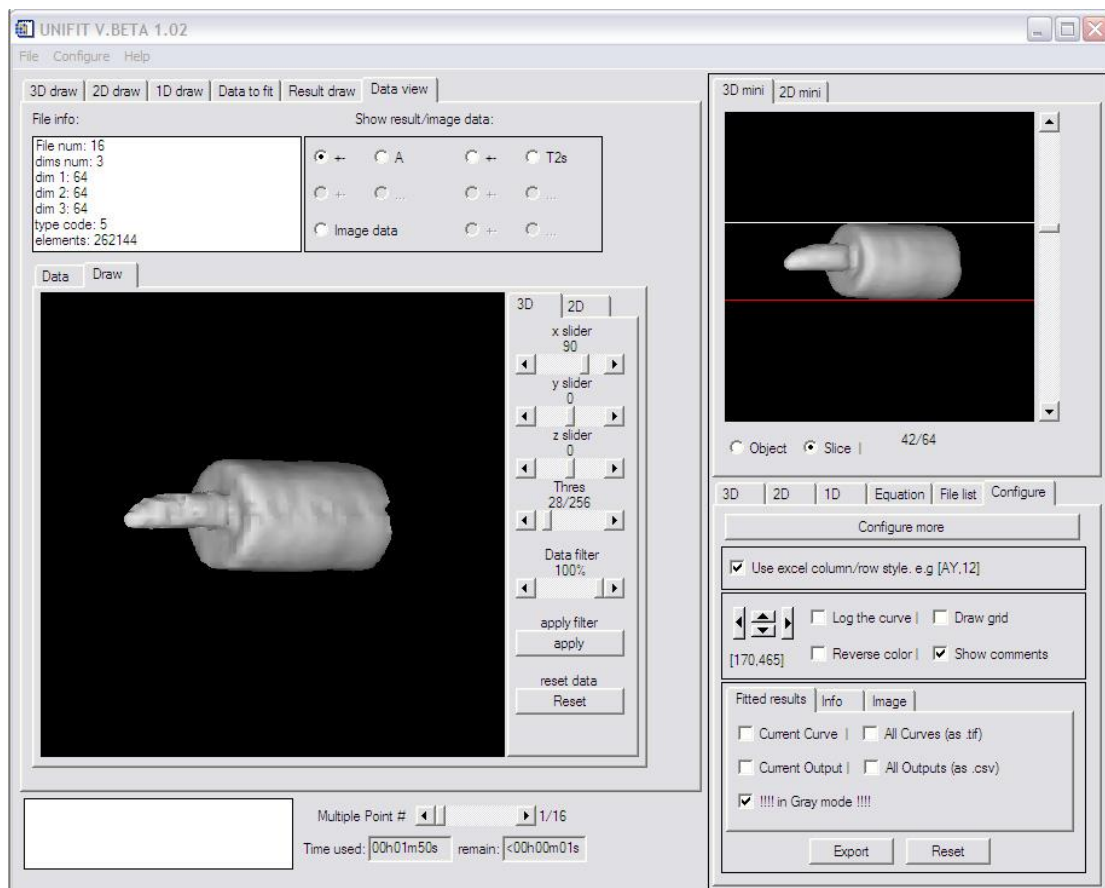


Figure 10:

Export panel

In the results subtab area:

- **Current curve (as .tif) [10.15]:** check to export the current image in the result draw window [7.8].
- **All curves (as .tif) [10.16]:** for an ROI fitting with more than one curve, check this box to export all of the fitted curves. Each curve, ordered from the first to last ROI position will be plotted and exported.
- **Current comments (as .txt) [10.14]:** saves the comments printed with the result in the result draw window [7.8].
- **All outputs (as .csv) [10.12]:** for an ROI fitting, the results will be exported as multiple matrices for each of the different parameters. For example, in the biexponential T_2^* case, there will be 5 matrices written into 5 separate files: one each for the spin density and T_2^* of the first component, the spin density and T_2^* of the second component, and the offset.
- **Curves in gray mode [10.13]:** check this to save all curves in grayscale format. The default condition is checked.

In the info subtab area:

- **ROI list [10.2]:** export the content listed in [6.11].
- **Data list [10.3]:** export the content listed in [6.12].
- **Time list [10.4]:** export the content listed in [6.4].
- **3D info [10.12]:** export the information about a 3D object's angles, etc. The related components are [2.5], [2.6], [2.7] and [2.8].
- **2D Filters info [10.5]:** export the information about the signal and error filters. The related components are [4.3], [4.6], [4.17], [4.18], [4.8] and [4.9].
- **equation info [10.6]:** the equation used for the fitting. Save the content presented in [7.4]

In the image subtab area:

- **Current 2D image [10.7]:** export the current image/slice in the 2D draw window [4.24].
- **All 2D images [10.8]:** all of the 2D images/slices will be exported. Each image/slice will be drawn and exported in order from the first to last file.
- **Current 1D image [10.11]:** export the current image in the 1D draw window [5.7].
- **Current DV images [10.9]:** export the images in the data view draw window [8.19]. The images from each point will be drawn separately and exported.
- **Images in gray mode [10.10]:** check this box to save all images in grayscale format. The default condition is checked.

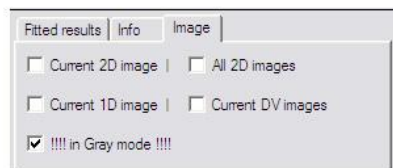
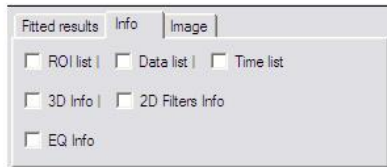
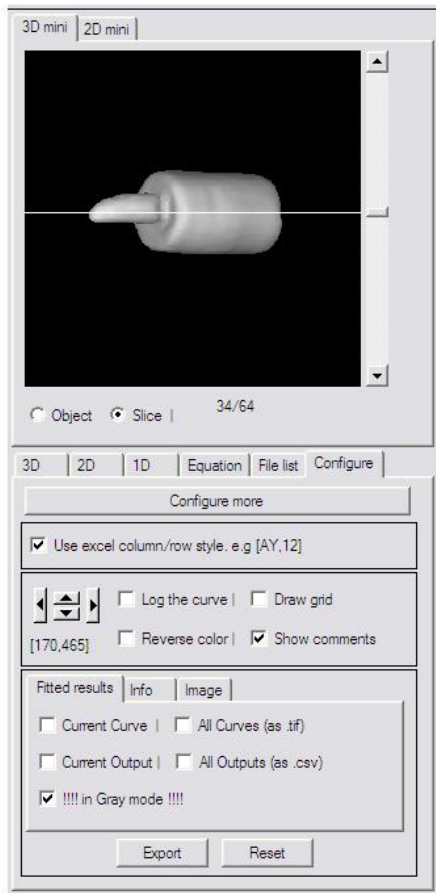


Figure 11: Configure more dialog

In configure control panel area:

- **call/close configure more dialog [11.9]:** call and close the dialog

In configure more dialog area:

- **Signal filter configure[11.1]:** the data will be separated into certain levels according to the minimum and maximum values. When local contrast is set, the minimum and maximum will be chosen from the current image; otherwise, they will be chosen from all the images.
- **Error filter configure[11.2]:** the value shown in the error filter slider label is the percentage. However the percentage value can be infinite big. The maximum I used is limited 300. If that's not enough, that change it.
- **time modifier [11.3]:** allows for simple mathematical manipulation of the data listed in the time table [6.4]. There are currently four operation options, +, -, * and /. E.g. entering 13 and clicking the + button will add 13 to all of the time points.
- **T1 configure [11.4]:** for a T_1 inversion recovery experiment. UNIFIT will find the position of the smallest value in the data set and invert all of the data before this position. The user can change the default setting by entering a new position.
- **Bi-exp initial fitting configure:** if desired, UNIFIT will separate the data and time sets into 2 parts for separate fitting (used only with biexponential fitting). The user can select the time position with the slider, or enter it's value in the textbox. The default position is the midpoint of the time list.
- **Axis style [11.6]:** the style of the axis used for plotting the data.
- **2D single pixel fitting configure [11.7]:** If the button is checked, a green cross will be plotted to specify the pixel which is picked from the 2D draw window to fit.
- **Debug mode configure [11.8]:** useful for the programmer to maintain or debug the program. If debug mode is turned off, the program will not be able to catch and handle the errors.

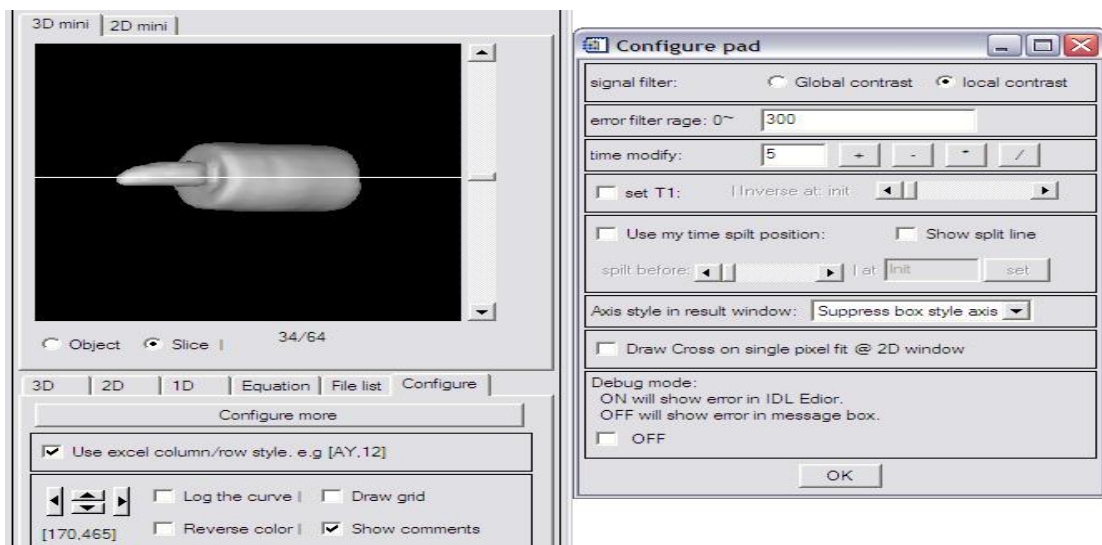


Figure 12:

Equation dialog

Notice:

1: To configure the 6 general equations we usually use:

- 1) T1 single exponential equation <-----> set both “T1” and “single exp”
- 2) T1 double exponential equation <-----> set both “T1” and “double exp”
- 3) T2 single exponential equation <-----> set both “T2” and “single exp”
- 4) T2 double exponential equation <-----> set both “T2” and “double exp”
- 4) Linear single exponential equation <---> set both “Linear” and “single exp”
- 6) Linear double exponential equation <---> set both “Linear” and “double exp”

Note that the T2* option has been replaced with the linear option because T2 and T2* do the exact same thing.

2: If you like to add a constant to the equation, check the “use constant” button. The option won’t work when user sets his own equation.

3: If you like to have you own equation, then set the “my eq”. At the same time, the option buttons for the general equations will be unchecked. To enter or modify your own equation, then click the set button, a dialog will pop up.

4: If you like to choose which params of the general equations to be fitted, you could lock or unlock the params by check the buttons before the params.

In equation control panel area:

- **call/close filter dialog [12.5]:** call or close the dialog.
- **initial value of the variable [12.6]:** If general equation is chosen, UNIFIT could provide the initial values automatically. user could use the initial values to do the fitting. If user wants to use his own initial values, then check the “use my initial params” and enter his values to the proper params. AND user also can choose which params of the general equations to be fitted by check the buttons before the params to lock or unlock the params.

In equation dialog area:

- **number of the variables [12.1]:** as the params to be fitted running at the background are in array format, the number of the params should be specified to create the proper array.
- **Error [12.2]:** errors used in the experiment to get the data.
- **Equation file location[12.4]:** in default, the equation will be saved into the file and be compiled after equation is configured. The compiled file will be called by the program to do the fitting.

- **Equation [12.4]:** the equation here should be written in IDL code format for the compile.

Equation FORMAT:

$S = a * \text{EXP}(-x/T2) + c$ where a, T2 and c are unknown params.

To translate the equation, we need a 3-element array to contain the params:

$$S = A[0] * \text{EXP}(-x/A[1]) + A[2]$$

- Where A[0] for 1st param a, A[1] for 2nd param T2 and A[3] for last one C.
- **Name of the variable to present [12.7]:** bind to param name to the certain element in the array. The names will be presented for the comments
- **Variable in the routine [12.8]:** the array in the running codes.
- **Initial value of the variable [12.6]:** If user uses his own equation, UNIFIT won't provide the auto-calculated initial values to start the fitting. User himself should provide some values.

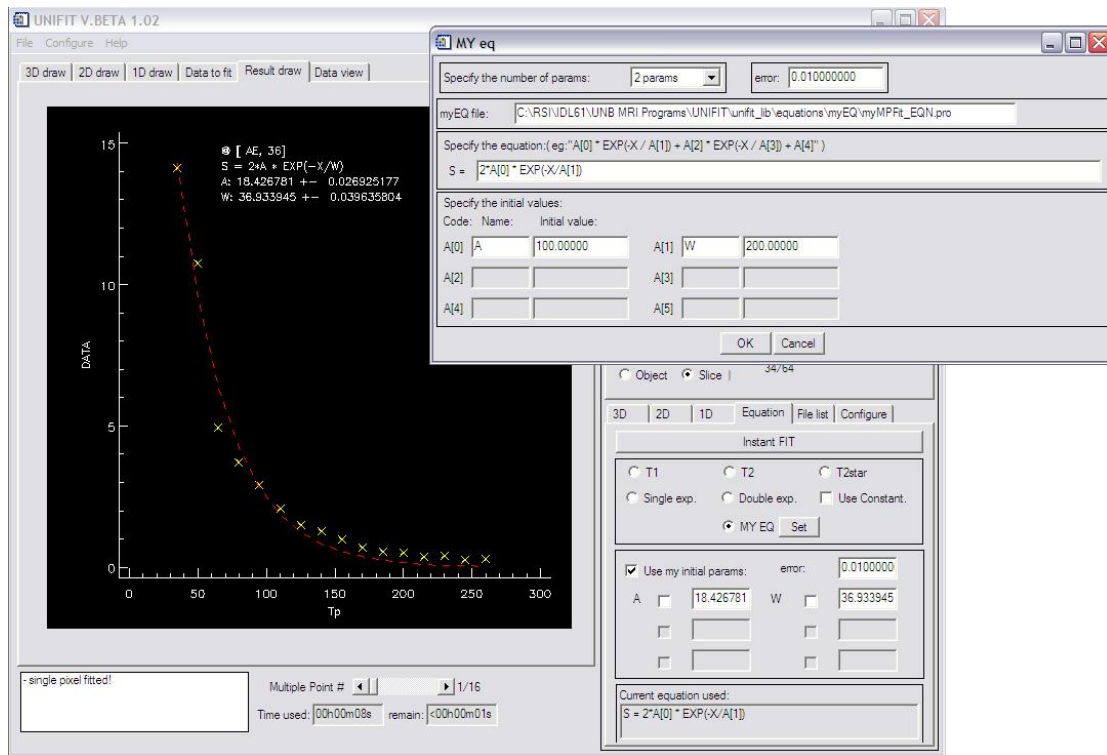


Figure 13: Filter dialog

In 3D control panel area:

- **call/close filter dialog [13.8]:** call / close the dialog.

In filter dialog area:

- **Slice index [13.2]:** show the number of the slices as index.
- **Signal filter setting on related slice [13.2]:** the signal filter setting for each slices.
- **Error filter setting on related slice [13.3]:** the error filter setting for each slices.
- **Apply filters setting of current slice button [13.4]:** apply the current signal and error filter settings from the 2D control panel to the current selected slice in the dialog.
- **Apply filters setting of current slice to all slices button [13.1]:** apply the current signal and error filter settings from the 2D control panel to all the slices in the dialog.
- **Load previous content to all lists button [13.6]:** load the filter settings from a saved file.
- **Save content in all lists button [13.5]:** save the filter settings to a file.

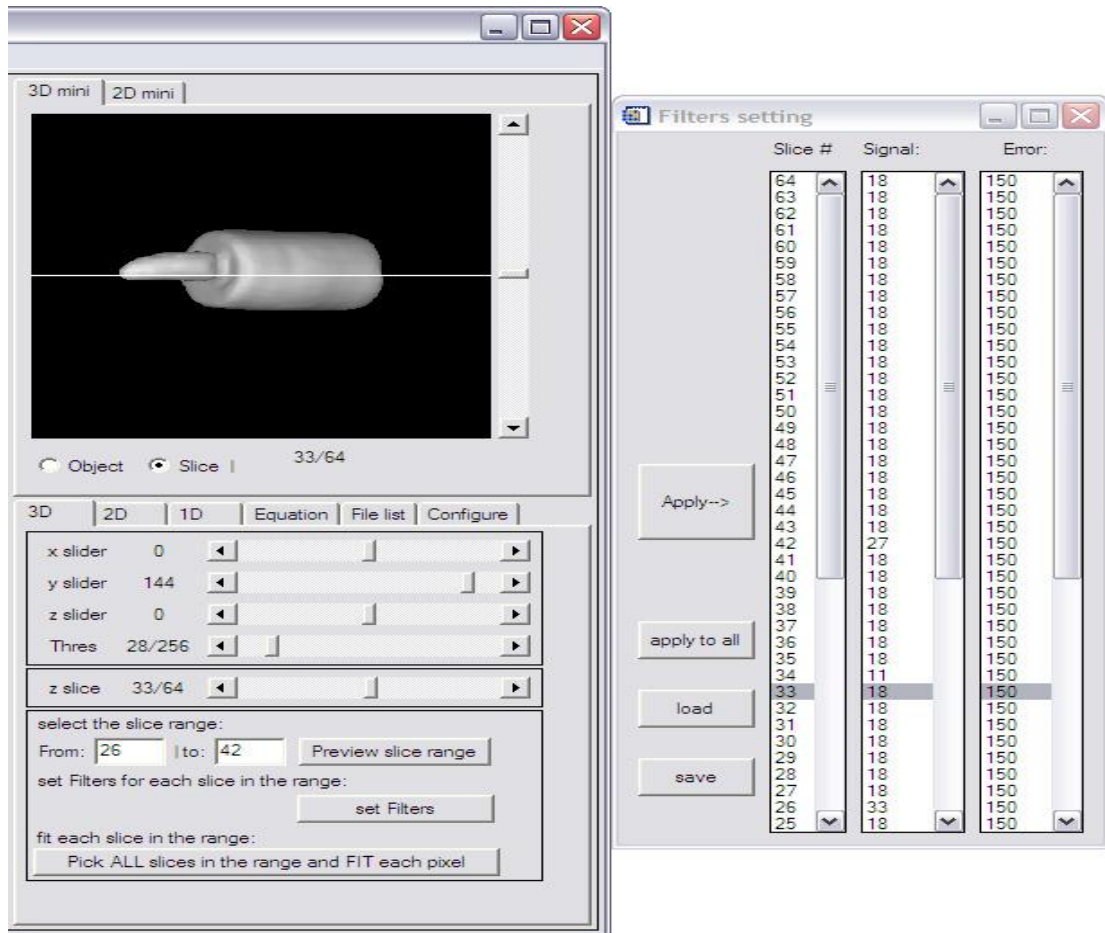


Figure 14:

ROI dialog

When doing a ROI fitting, a ROI dialog will pop up. After the ROI is selected properly, user can click the DONE button to apply the ROI. And the ROI dialog will disappear and the fitting begins.

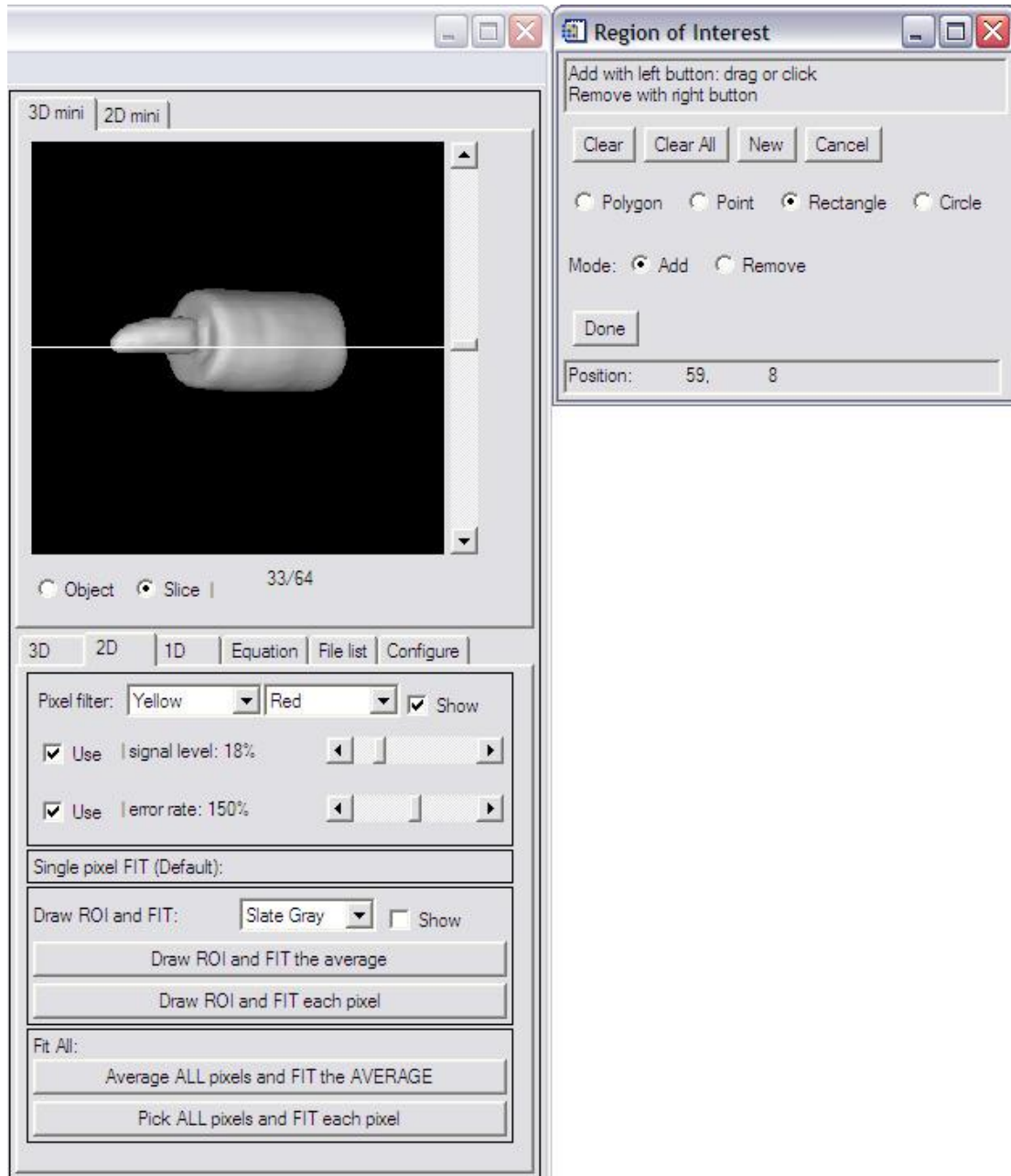


Figure 15:
Instant fitting

- Instant fitting can be used separately. Here is an example of the process steps:
- **Prepare the data:** we get two data sets:
 - $Y = [2,4,6,8,10,12,14,16]$
 - $X = [1,2,3,4,5,6,7,8]$
- And we want to fit the equation: $Y = A * X + B$.

Then we save the two data sets into two txt files (can be csv format as well).
 Notice the format (see the 3 valid file formats area):

- 1) The data in files can be stored in vertical or horizontal.
 - 2) The data in files can be separated by space or comma if stored in horizontal.
- **Load the data:** Then we call UNIFIT. Click “load instant fit data file” to load the data file (or y file”); click “load instant fit time file” to load the time file (or x file). The data loaded will be listed in [6.12] and [6.4].
 - **Choose equation / enter equation:**
 - 1) Use general equations: configure the 6 options buttons
 - 2) Use user’s own equation: choose “my eq” option and click [12.5] to set the equation. Details see description of Figure 12.
 - **Fit:** Click the instant fit button [7.2]
 - **Result:** result can be found in Result draw window [7.8]

