IMPSTAR 2.1

User's Guide

Last Update July 2006 by Biao Wang

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Introduction

IMPSTAR (IMage Processing, STatistics And ROI) is a program that allows users to perform image analysis.

At first, many researchers at the MRI Centre used two IDL programs by David Axelson called II.pro and II_zoom.pro as image analysis tools, which are the basis for Impstar. Impstar 1.0 was written by James Rioux in 2003. The current version is Impstar 2.1, which was written by Biao Wang in 2005.

This document outlines the basic functionality of Impstar and all the menu commands and dialog boxes available to the user. For more information on how IMPSTAR itself operates, please consult the IDL source code on one of the data analysis computers in Room 110.

Functionality Summary

IMPSTAR is meant to provide various image statistics and analysis functions. It can currently do the following:

- Read DAT (BYTE format) and Bruker files generated by other programs such as Acciss
- Define ROI by various methods
- Display ROI in one of three modes
- Edit ROI point by point
- View or export ROI portion of an image
- Calculate integral over ROI
- Convert to any image conveniently
- View real, imaginary, magnitude and phase angle data channels selectively
- Display an image either in brightened mode or normal mode
- Perform image calculation using image calculator
- Smooth image
- Select color table
- Reset color table
- Print histograms or contour maps
- Save image, histogram or statistics data

Running IMPSTAR 2.1

IMPSTAR is developed under Research Systems Inc.'s IDL 6.3 Integration Developing Environment (IDE). Normally, IDL 6.3 needs to be installed with a valid license first and then you can run IMPSTAR at the IDL command line. The detail information on how to run IMPSTAR on Windows and Mac computers is described below.

How to run IDL (and IMPSTAR) on Windows:

1. Start IDL 6.3 by double clicking IDL 6.3 icon on the desktop.
2. If you want to run IMPSTAR, simply enter the command "impstar" at the IDL command line. Note that each MRI program should have a main program name which can be entered in the command input window in a similar way, for example, "acciss", "fitting", and "unisort".

How to run IDL (and IMPSTAR) on MAC OS X:

1. Start X11 (typically by clicking a button on the application toolbar or by running the program called X11 in the Applications folder). The X11 program is an emulator made by Apple to allow you to run graphical UNIX programs on Mac OS X.
2. Select the option "Application -> IDLDE from the menu bar of X11 at the top of the screen to start IDL 6.3.
3. If you want to run IMPSTAR, simply enter the command "acciss" at the IDL command line. Note that each MRI program should have a main program name which can be entered in the command input window in a similar way, for example, "acciss", "fitting", and "unisort".

IDL Virtual Machine

In order to run IMPSTAR and other MRI programs on a computer without IDL, you will need to include a runtime version of IDL with a runtime or embedded license in your application distribution. The IDL Virtual Machine™ (IDL VM™) is a free IDL runtime environment available with the release of IDL 6.3 CD, which can also be downloaded from the RSI web site. You can use the IDL Virtual Machine to open the .sav file which is a stand-alone IDL application that can be run on any Windows, UNIX or Mac OS X computer containing the IDL Virtual Machine or a licensed copy of IDL. Therefore, in order to run IMPSTAR without IDL installed, please use the IDL Virtual Machine to open the IMPSTAR.sav file.

The Interface of IMPSTAR

This section describes the functionality of each of IMPSTAR's four graphics windows. The user can switch between the histogram window and the contour map windows by clicking the tabs at the top of the window.

The Main Window
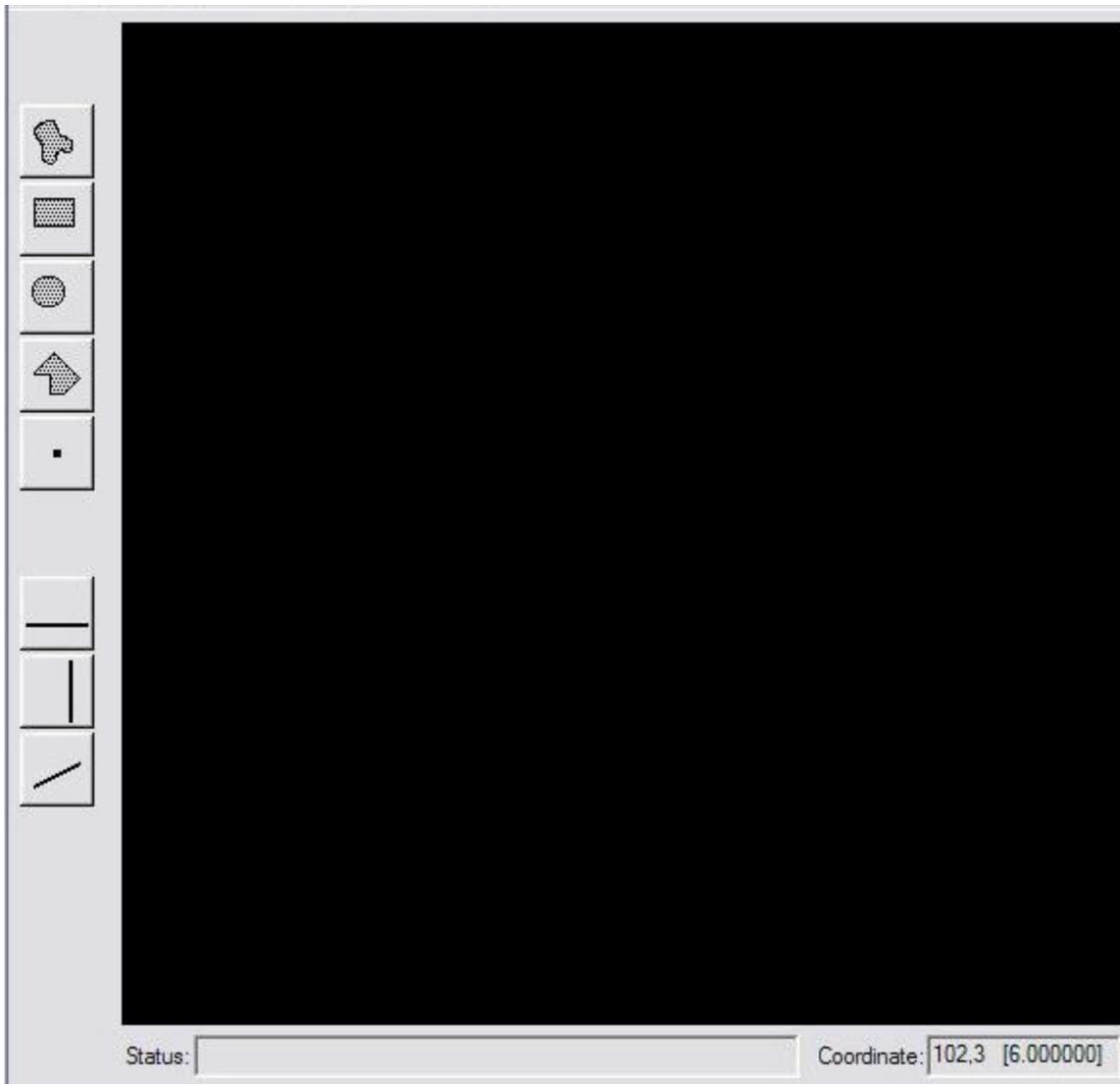
This window is used for displaying current image or associated profiles.

The title bar above the main window displays the version information and the name of the current file.

There are eight buttons at the left side of the main window. The first four buttons are used to define ROI of current image. The next one is used to edit ROI point by point. The last three buttons are used to extract a profile from the image along different directions. There are hints if you move the cursor over these buttons.

There are two non-editable textboxes below the main window. One is used to display system status. Aonthser is used to display the coordinates of the current point and its associated intensity.

The Histogram Window
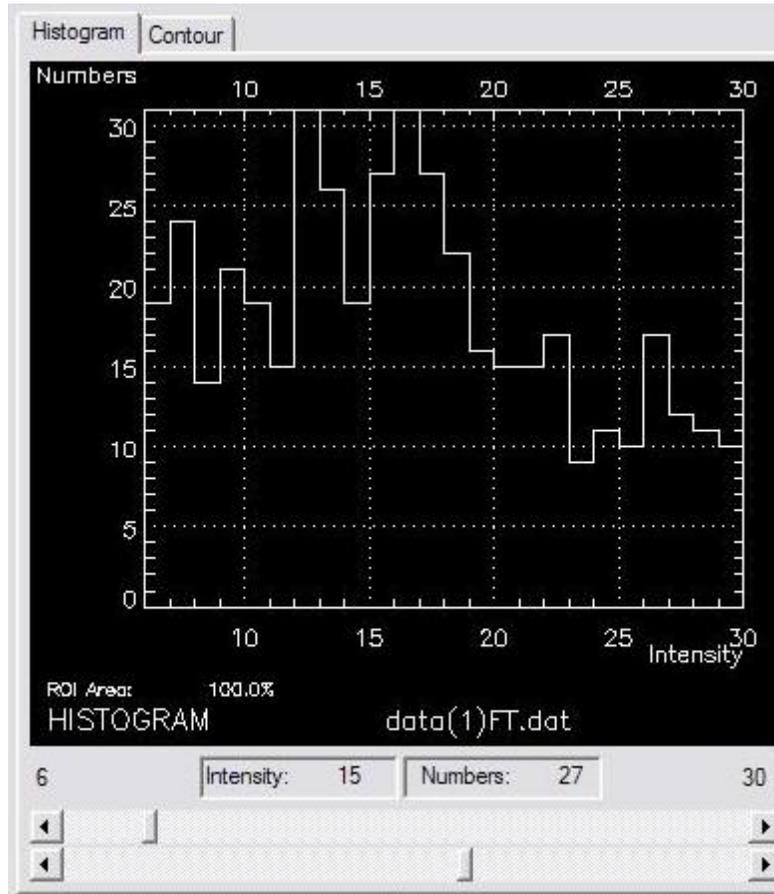
This window displays the associated histogram of the current image.

There are two non-editable textboxes below this window. One is for intensity value; another is for corresponding number of points. When you move cursor within the histogram window using mouse, the current intensity that the cursor stands for is displayed in the intensity textbox, and the corresponding number of points that have this intensity value is displayed in the number textbox. This will help to analyze the histogram.

There are also two sliders below these two textboxes, which are used to define the scope of the histogram, i.e., the maximum and minimum values to be considered.

The Contour Map Window

CONTOURMAP   data(1)FT.dat
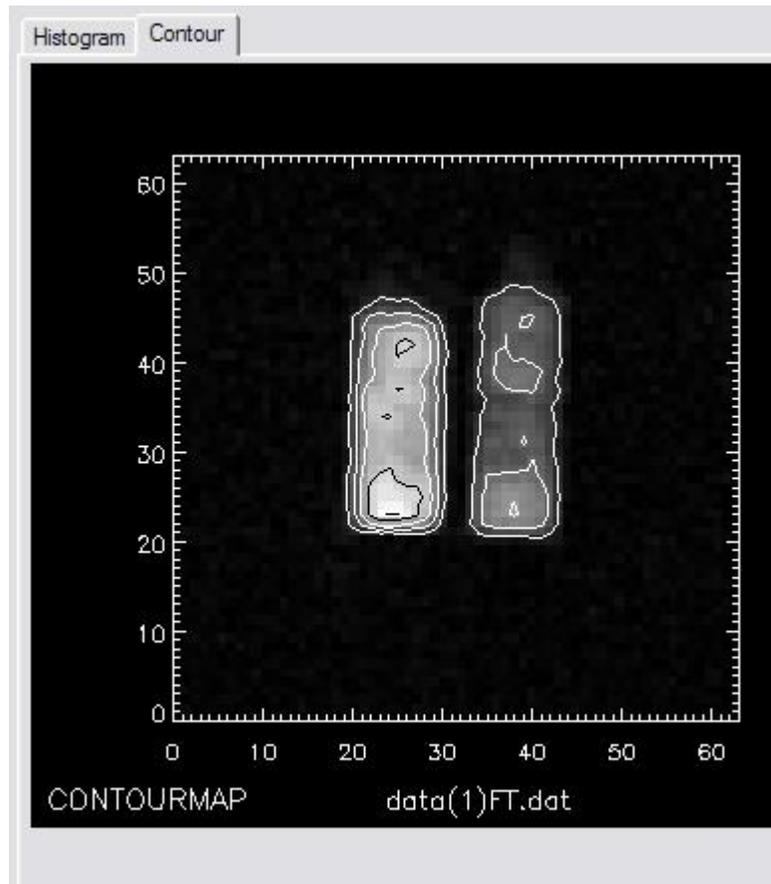
Thils window displays the associaated contour map of the current image.

The Stat Window

Area	4096	Area (%)	100.0
Min	0.0195035	Max	50.1042
Mean	4.29486	Median	1.37189
Variance	68.3838	Std.dev.	8.26945

Integral over ROI: 17591.8

This window displays the statistics data of the current image

There is a non-editable textbox below the stat window, which is used to display the summary of intensities of all the points within ROI.

The Menu Commands

This section provides a brief overview of the functions performed by the menu commands available in IMPSTAR 2.1. More information on the details of these commands may be found in other sections of this User's Guide.

File Menu

Open
Load files of DAT, Bruker, CSV, JPEG or TIFF format into the program. Select the files to be loaded using the File Selection Dialog. Please change "File of type" to *.* if you want to open a Bruker file so that it will be listed. On most operating systems, you can use the *Ctrl* and/or *Shift* keys to select multiple files. The image of the current file will then be displayed in the main window. The file name of the current image is displayed in the bar above the main window. You click on the *__Images__* menu to select another file as current file. Note that only 2D data is supported by IMPSTAR 2.1.
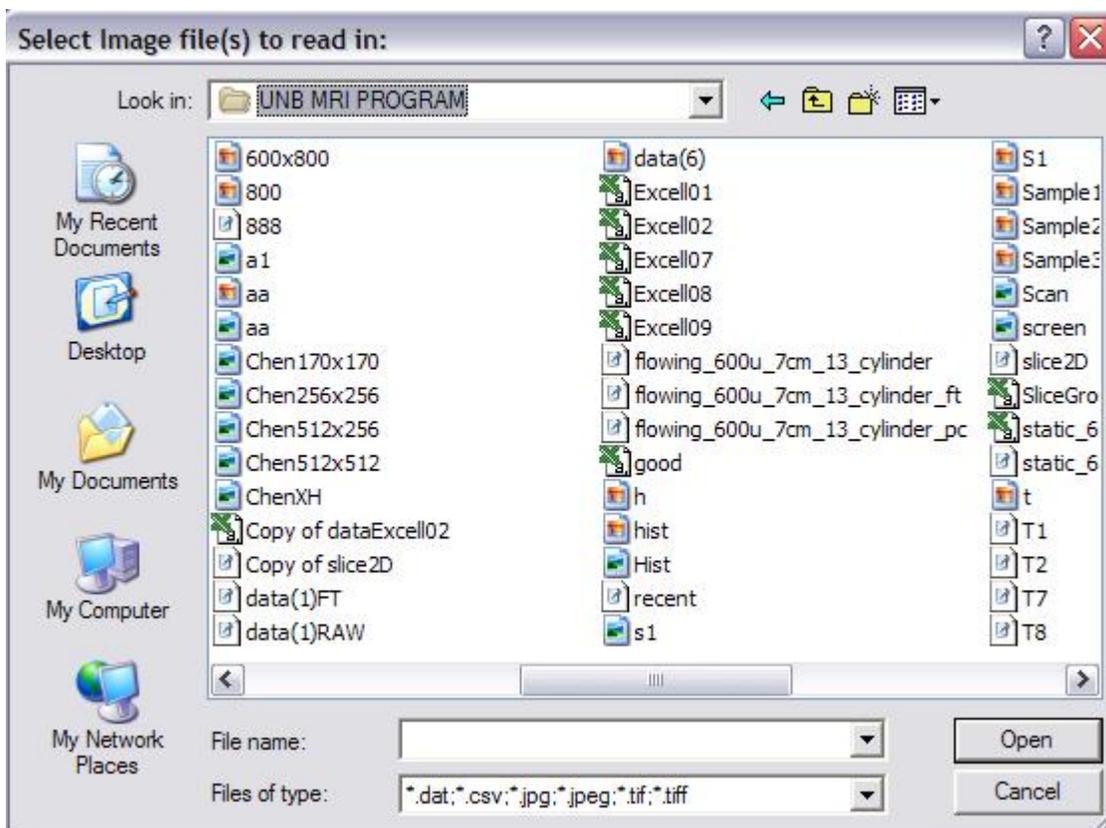

Figure 1-1 File Selection Dialog for reading file

Save
This sub-menu contains commands to save current image, current ROI, histogram, statistics data and integral values. If you click on <u>Current Image…</u> menu item, File Selection Dialog will pop up. Please select a file to be overwritten or input a new file name. The current file will then be saved in DAT format. Note that DAT format is the default file format for IMPSTAR 2.1 and it can be handled by all other IDL programs in MRI Center.
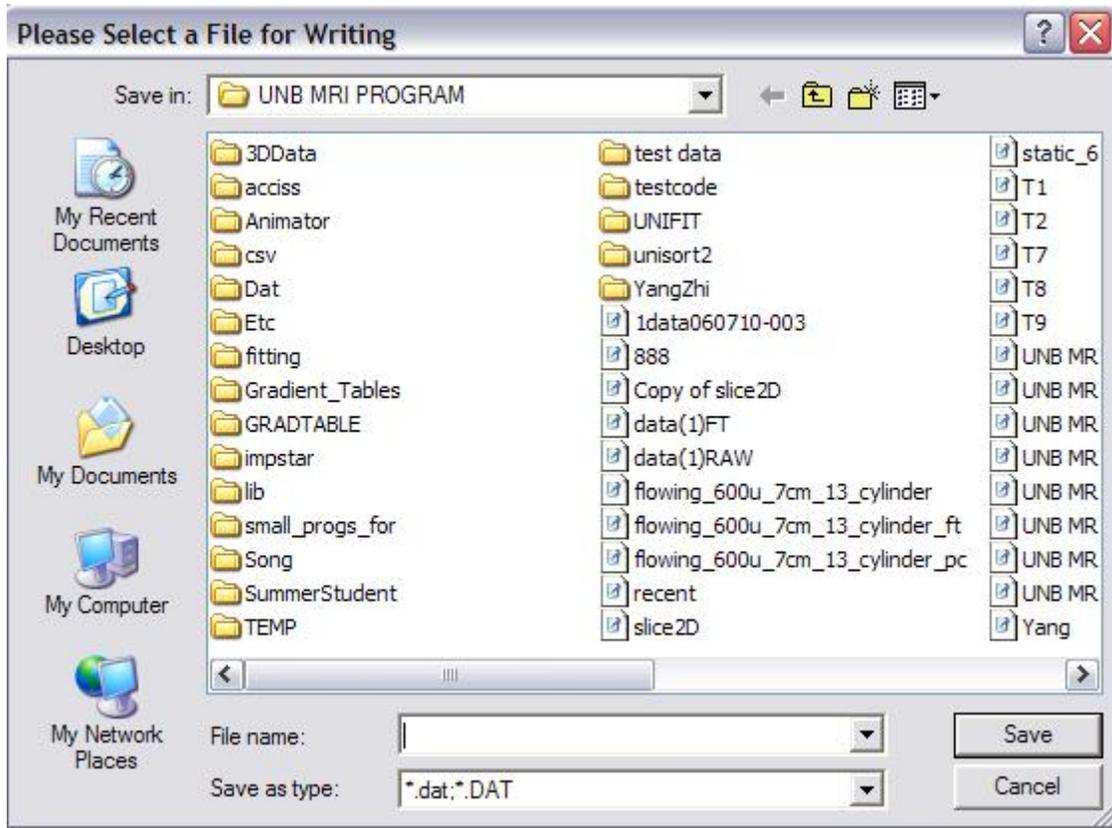
Figure 1-2 File Selection Dialog for writing file

Similarly, you can also save the ROI portion of the image in DAT format. You can save the histogram of the current image as TIFF or JPEG format by selecting appropriate menu item. File Selection Dialog will be available to select a file to be overwritten or input a new file name.

You can also save the statistics data as TEXT format. After clicking on Statistics… menu item, a File Selection Dialog will be available to select a file to be overwritten or input a new file name.

The integral values of all the loaded files can be saved into a text file. After clicking on Integrations menu item, a File Selection Dialog will be available to select a file to be overwritten or input a new file name.

Print
Print the histogram or contour map of all loaded files depending on which is currently displayed. Print Dialog will pop up with default layout. You can select the number of columns to change the layout. The default scale factor is 1. Click on Invert button to perform black-white inversion. Click on Print to print out the histograms or contour maps.

Figure 1-3 Print Dialog

Close
Close the current file, refresh all graphics windows, and clear all the variables associated with that file. Another loaded file will be set as the current file, if any.

Quit
Exit IMPSTAR and returns to the IDL IDE environment.

Edit Menu

Undo
Undo the last change. This is available while smoothing image.

Redo

Redo the last change. This is available while smoothing image.

Restore Original
Restore the original image. This is available while smoothing image.

Smooth Image…
Smooth current image using one of the three smooth algorithms: average smooth, median smooth and noise filter. Smooth Options Dialog will pop up. Select one of the three smooth algorithms as smoothing type. Input strength with valid value that is between 1 and 100. Input box size with valid value that is between 2 and 30. Click on <u>Smooth</u> to begin smoothing. Click on <u>Cancel</u> to cancel the operation and close Smooth Options Dialog.
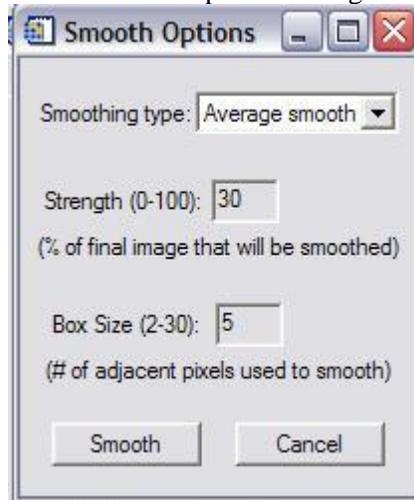

Figure 2-1 Smooth Options Dialog

Color Tables…
XLOADCT Dialog will pop up. This is a predefined dialog provided by IDL. It displays the current Direct Graphics color table and shows a list of available predefined color tables. Clicking on the name of a color table causes that color table to become IDL's current color table. Click <u>Done</u> to apply the selected color table. The Stretch Bottom slider in the XLOADCT Dialog increases the range of the lowest color index. For example, if black was the color of the lowest index and you increased the bottom stretch by 50 percent, the lower half of the color table would become all black. The remaining part of the color table will contain a scaled version of all the previous color ranges. The Stretch Top slider in the XLOADCT Dialog increases the range of the highest color index. For example, if white was the color of the highest index and you increased the top stretch by 50 percent, the higher half of the color table would become all white. The remaining part of the color table will contain a scaled version of all the previous color ranges. You can change the contrast within the color table using the Gamma Correction slider in the XLOADCT Dialog. A value of 1.0 indicates a linear ramp (no gamma correction). Values other than 1.0 indicate a logarithmic ramp. Higher values of gamma give more contrast. Values less than 1.0 yield lower contrast.
XLOADCT Dialog also contains two other sections: Options and Function. The Options section allows you to change what the sliders represent and how they are used. When the Gang option is selected, the sliders become dependent upon each other. When either the Stretch Bottom or Stretch Top sliders are moved, the other ones reset to their default values (0 or 100, respectively). With the Chop option, you can chop off the top of the color table (the range of the Stretch Top is now black instead of the color at the original highest index). With the Intensity option, you can change the slider to control the intensity instead of the index location. The Stretch Bottom slider will darken the color table and the Stretch Top slider will brighten the color table.
 The Function section allows you to place control points which you can use to change the color table with respect to the other colors in that table. The color table function is shown as a straight line increasing from the lowest index (0) to the highest index (255). The x-axis ranges from 0 to 255 and the y-axis ranges from 0 to 255. Moving a control point in the x-direction has the same effects as the previous sliders. Moving a control point in the y-direction changes the color of that index to another color within the color table. For example, if a control point is red at an index of 128 and the color table is

green at an index of 92, when the control point is moved in the y-direction to an index of 92, the color at that x-location will become green.
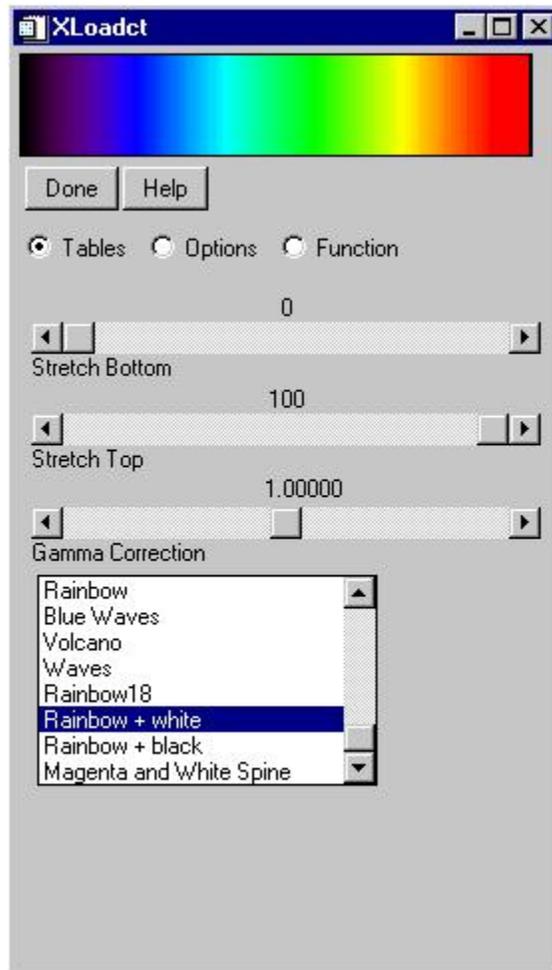

Figure 2-2 XLOADCT Dialog

ResetColorTables
Reset current color table to the default value. This is useful if you want to restore the default color table after selecting a color table.

View Menu

Channel
View real, imaginary, magnitude and phase angle data channels selectively if current file is DAT format.

Brighten
Brighten current image in the main window.

Restore
Restore the brightness of current image in the main window.

Global
Display current image according to the global scale of all the loaded images. This is implemented by finding the brightest and dimmest points in the entire dataset of all loaded images and scales every image accordingly. This is useful when a number of different images have to be compared at the same scale factor, but if one image is significantly brighter than the rest (or even has one extremely bright pixel), all the other images could appear very dark.

ROI Menu

Import…
Import an external ROI definition file as ROI of current image. You can select an external ROI definition file with the File Selection Dialog. The default extension name of ROI definition file is roi.
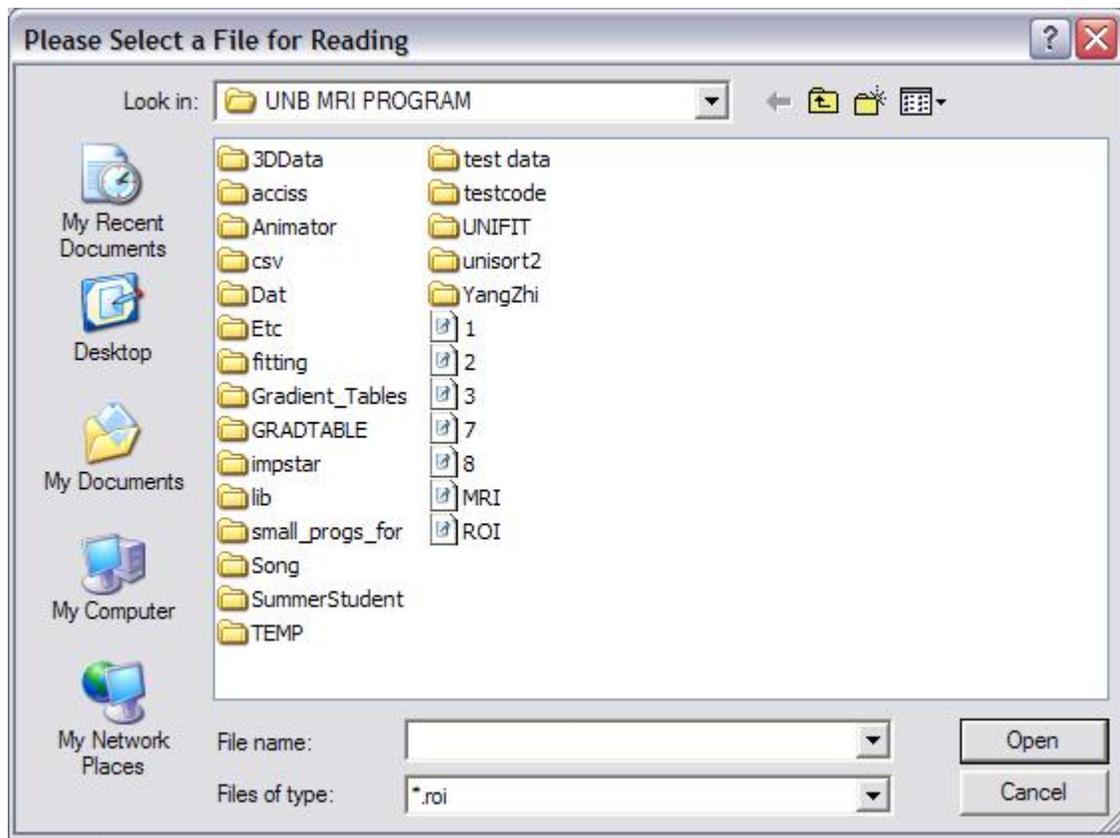

Figure 4-1 File Selection Dialog for importing ROI definition file

Export…
Save ROI of current image as an external ROI definition file. File Selection Dialog will be available to select a file to be overwritten or input a new file name. The default extension name of ROI definition file is roi.
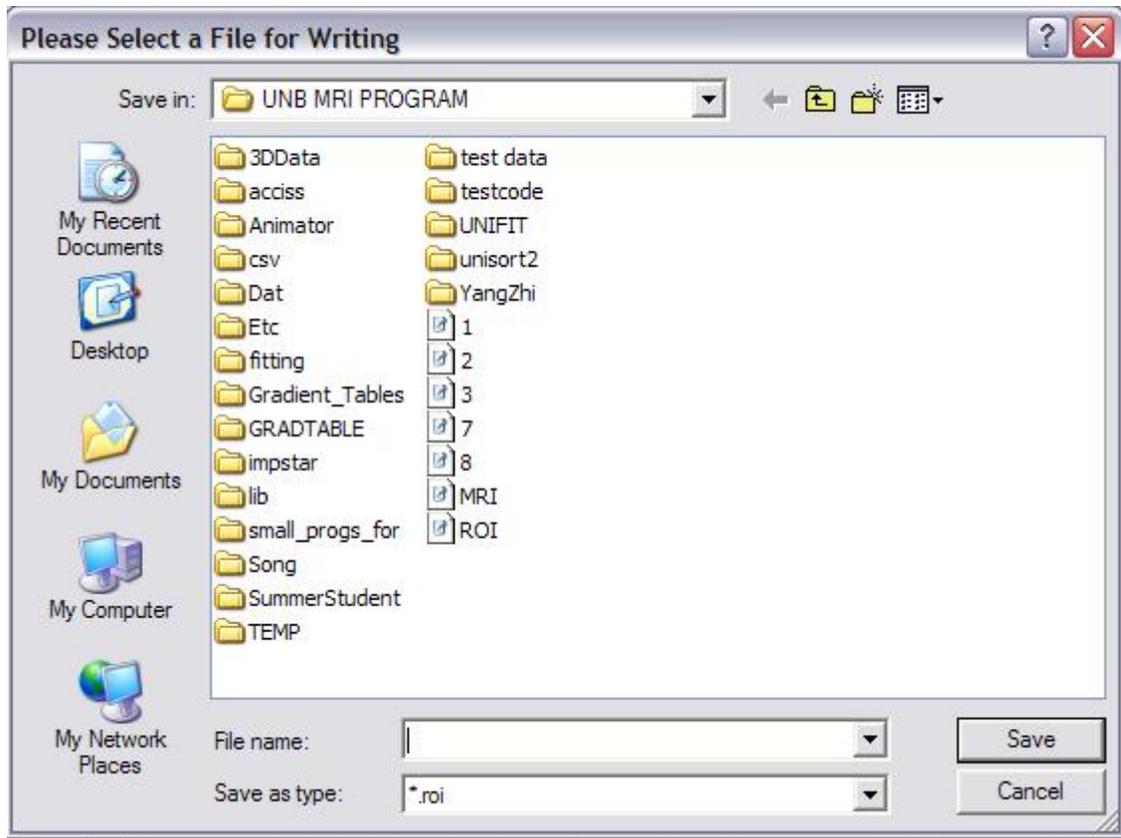
Figure 4-2 File Selection Dialog for exporting ROI definition file

Display
Select one of the three ROI display modes: Fill, Outline and Hide. The default ROI display mode is ***Fill*** mode.
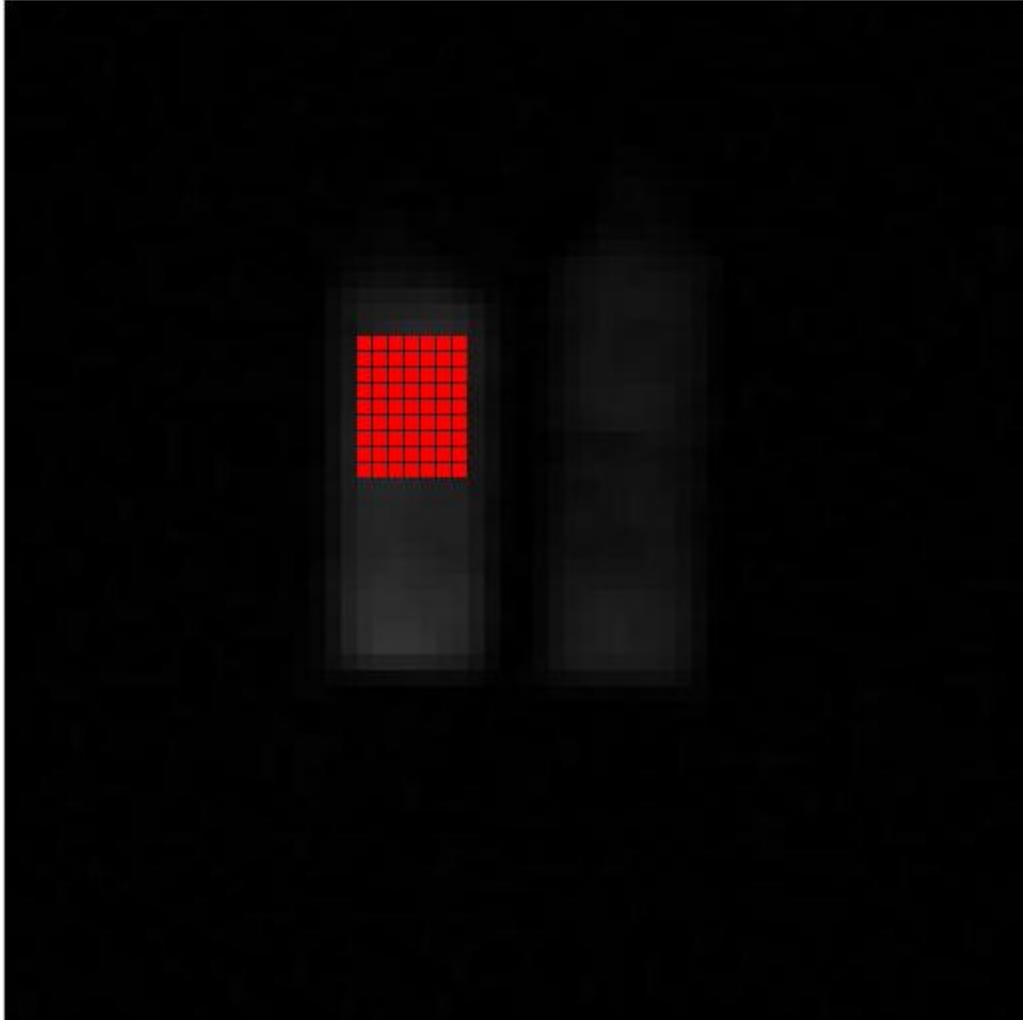
Figure 4-3 ROI display mode: _**Fill**_
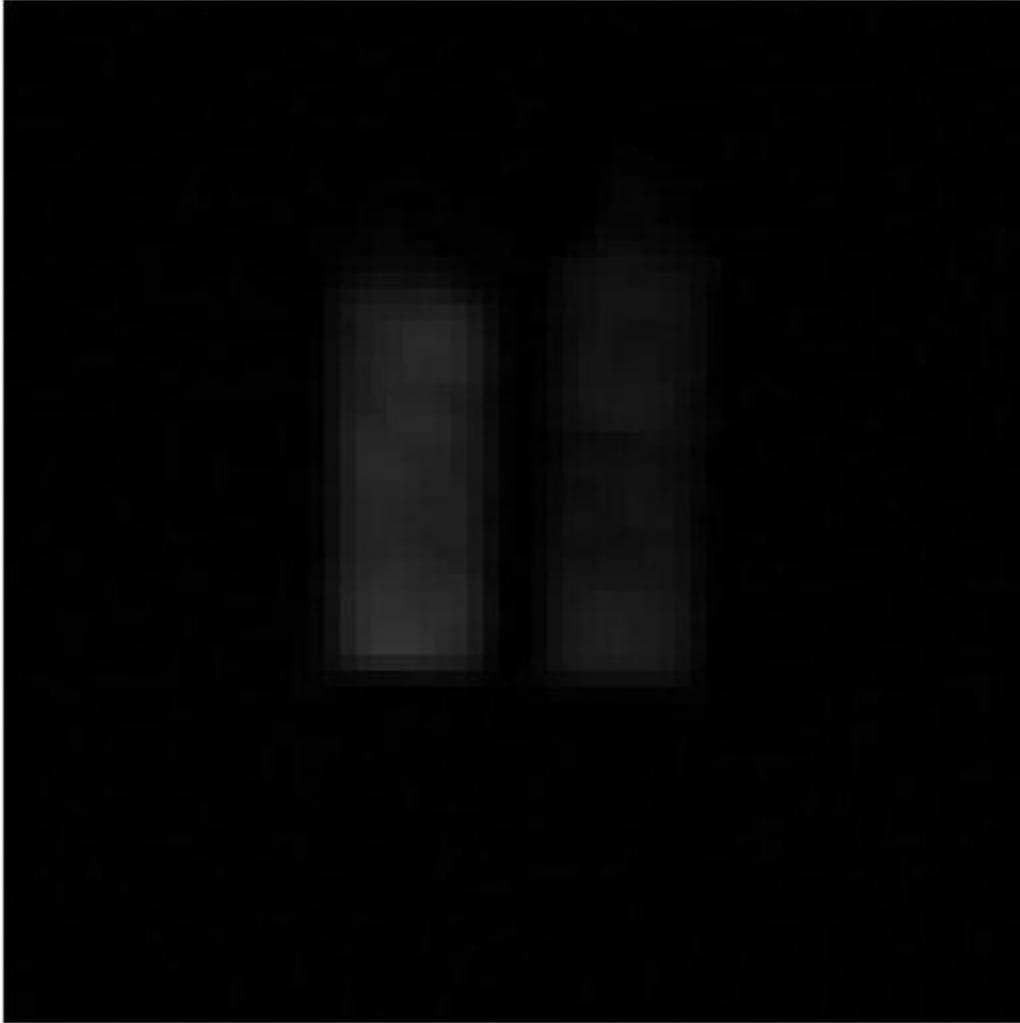
Figure 4-4 ROI display mode: ***Outline***

Figure 4-5 ROI display mode: ***Hide***

View ROI Only
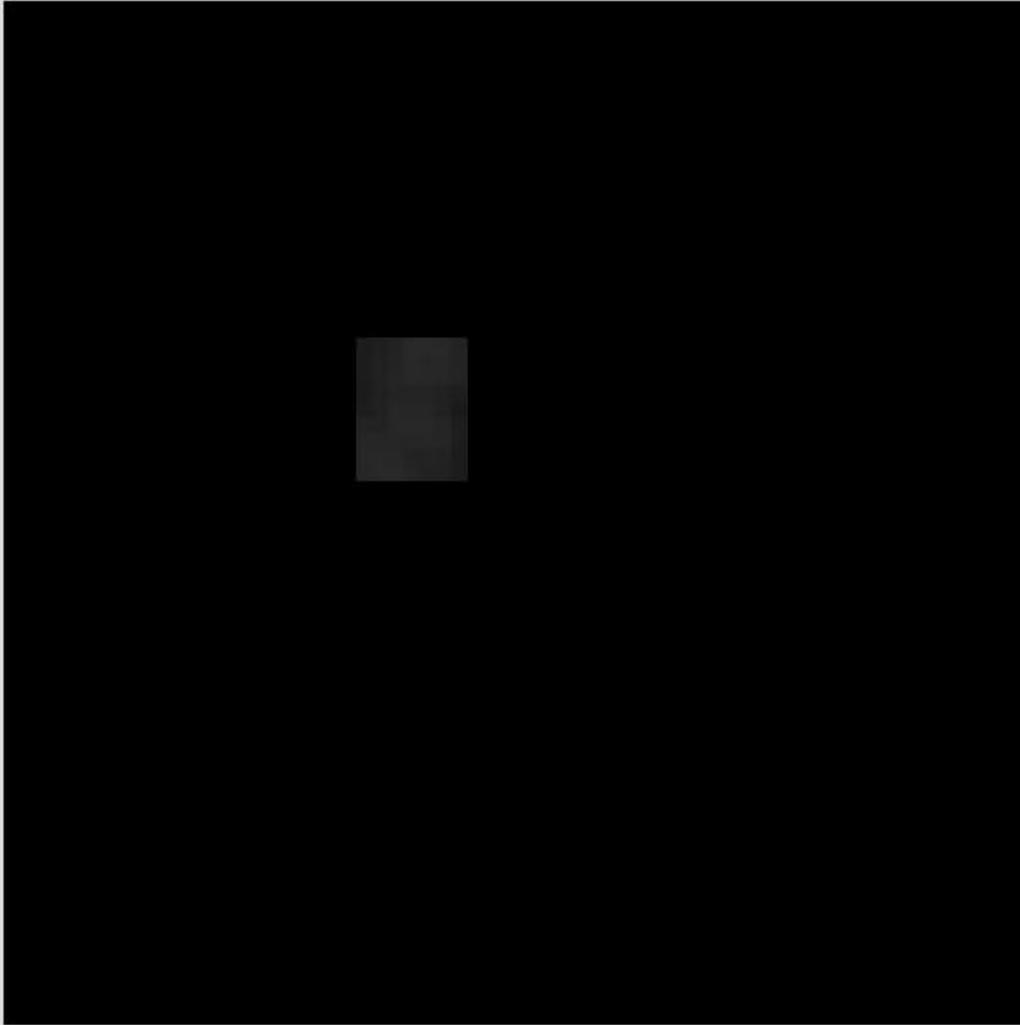Only ROI portion of the image is displayed.

Figure 4-6 View ROI portion only

__Invert ROI__
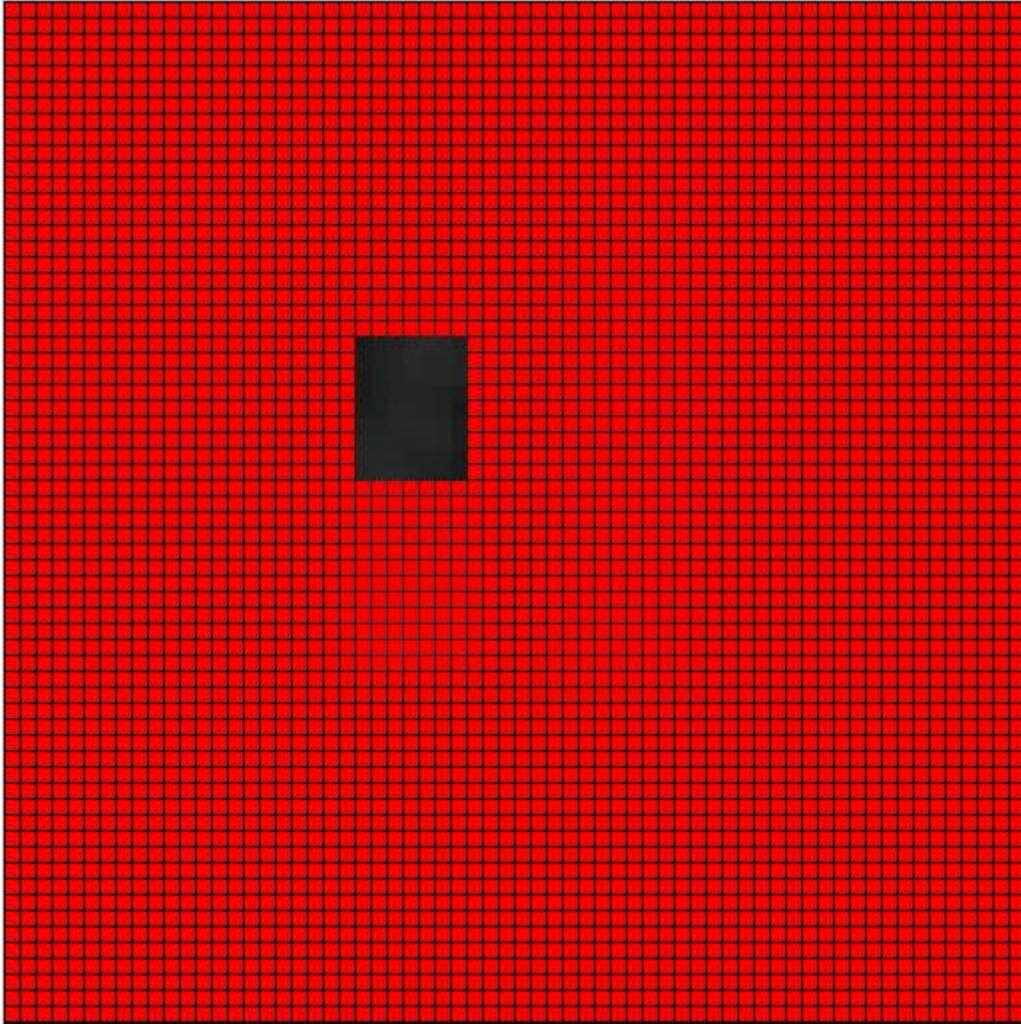Clear current ROI and convert the rest portion of current image as ROI.

Figure 4-7 Invert ROI

Clear ROI
Clear current ROI and the whole image is regard as ROI.

Apply ROI to All
Apply ROI of current image to all loaded files.

Images Menu
Select a file as current file from a list of loaded files and refresh all the graphical windows.

ImageCalc Menu
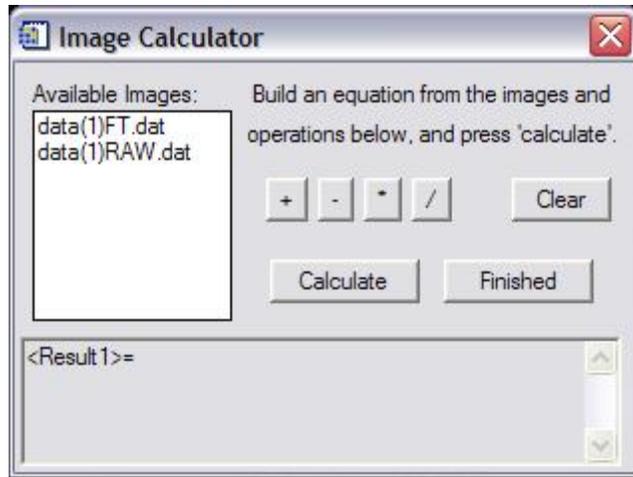Perform image calculation with Image Calculator Dialog.

Figure 4-8 Image Calculator Dialog

Help Menu

Contents…
Display this user manual in a pop-up window.

About Impstar…
Display version information in a pop-up window.