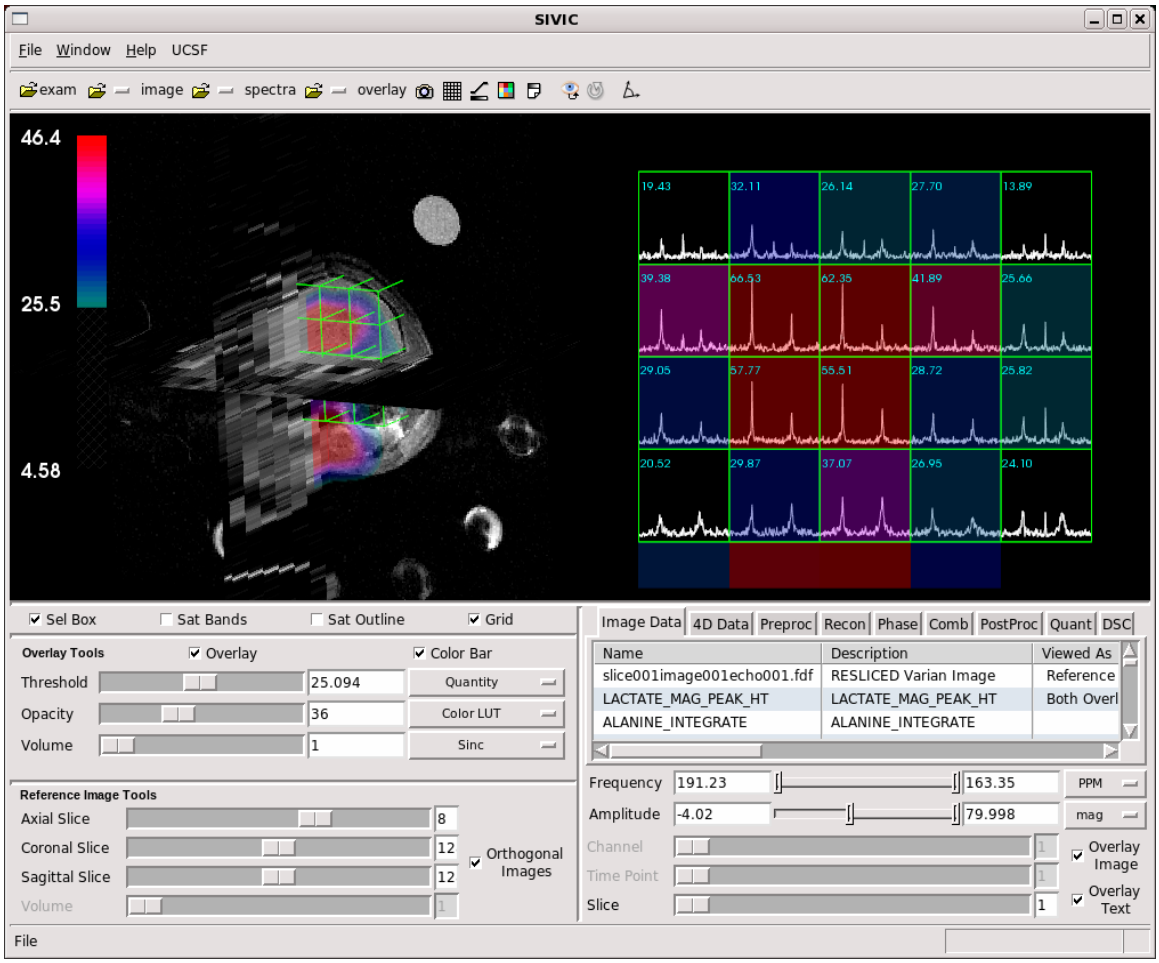
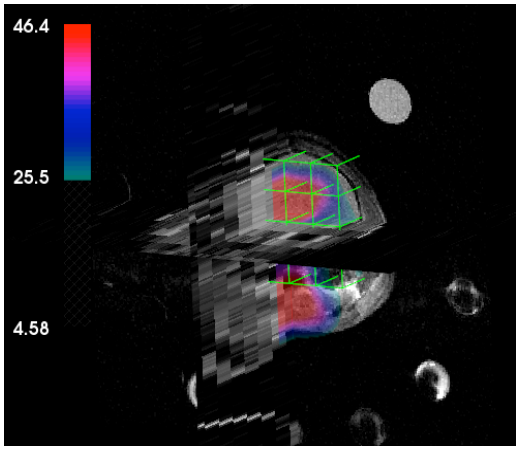
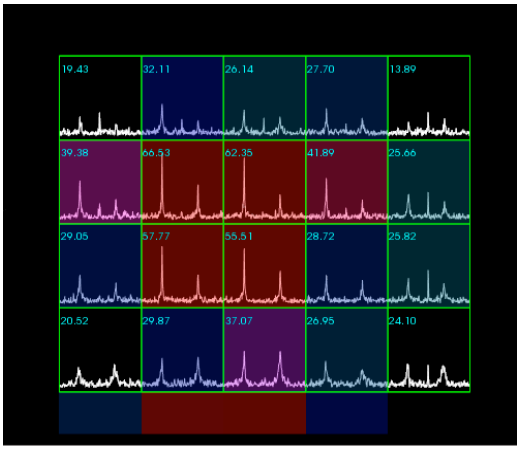
# SIVIC GUI Overview




## SIVIC GUI Layout Overview

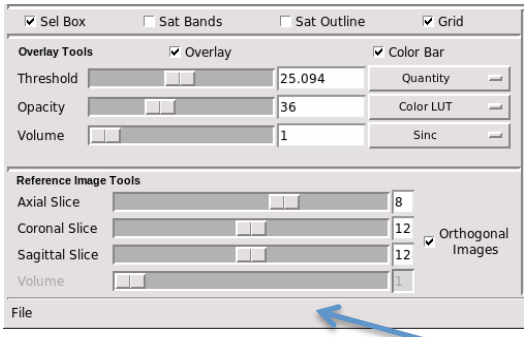

***At the top of the SIVIC GUI is a row of buttons called the "Toolbar". It is a quick interface for loading datasets, controlling how the mouse manipulates the two "Views" (see below), and has some quick tools for resetting the state of those Views.***

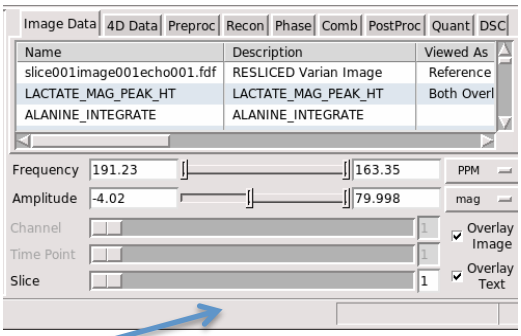



***On the left is the "Image View". This View is used for displaying reference anatomical images with a 3D wire grid (shown here in green) that visualizes the spatial locations of the 4D traces in the "Trace View". Additional image volumes of quantified or reference data can be display as color overlays.***

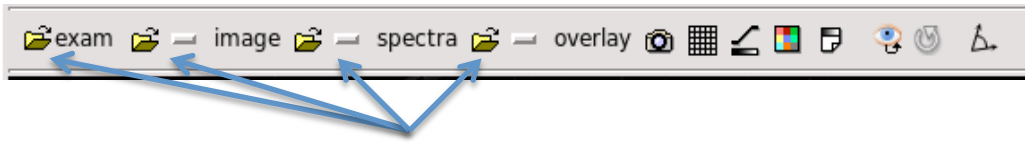
***On the right is the "Trace View". This View is used for displaying the 4$^{th}$ dimension of 4D datasets. For example the 4$^{th}$ dimension for spectroscopic datasets is frequency, and for dynamic imaging it is time. Color overlays of quantified metrics can be displayed along with the actual value in each voxel shown here in blue.***



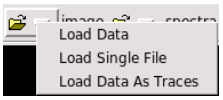

***Directly below each of the two Views are controls used for manipulating the state of its respective View. Almost all of the controls have tooltips that can be activated by hovering over the control in question.***

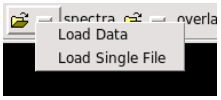
## SIVIC Data Loading



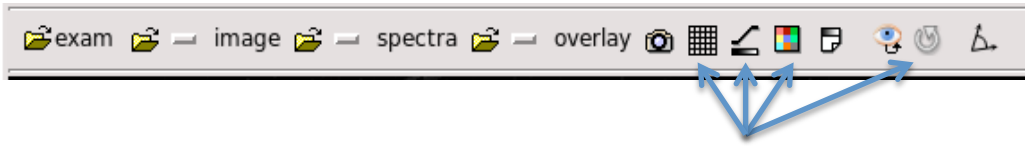

***The toolbar has four data loading buttons indicated by a folder icon. From left to right the options are:***

1. "exam" opens three file browsers consecutively. The first is used to select a reference image, the second so for 4D data, and the third for an overlay.
2. "image" gives you a drop-down menu to select from three options:
   a. "Load Data" Loads a reference image in grey-scale.
   b. "Load Single File" Loads a single file of a reference dataset.
   c. "Load As Traces" Loads a dynamic dataset in the Trace View.
3. "spectra" gives you a drop-down menu to select from two options:
   a. "Load Data" Loads 4D data into the Trace View.
   b. "Load Single File" Loads a single file of a dataset as 4D traces.
4. "overlay" gives you the same options as spectra, but data is loaded as a color overlay. If the dataset has the same dimensionality as any loaded 4D dataset then it is overlayed in both views, otherwise it only appears in the Image View.




## SIVIC Mouse Interactions




***This toolbar has four buttons for determining how the mouse interacts with the Views.***

 The "voxel selection" interactor is used to select voxels on either the Image View or the Trace View. It provides the following interactions:

| | Left Button | Middle Button | Right Button |
|---|---|---|---|
| Click | Select Single Voxel | | |
| Drag | Selects Multiple Voxels | Translate Image/Trace Grid | Zoom View |

 The "window/level" interactor is used to adjust the contrast of the grey-scale reference image. It provides the following interactions:

| | Left Button | Middle Button | Right Button |
|---|---|---|---|
| Drag Left/Right | Adjusts Window | Translate Image/Trace Grid | Zoom View |
| Drag Up/Down | Adjusts Level | Translate Image/Trace Grid | Zoom View |

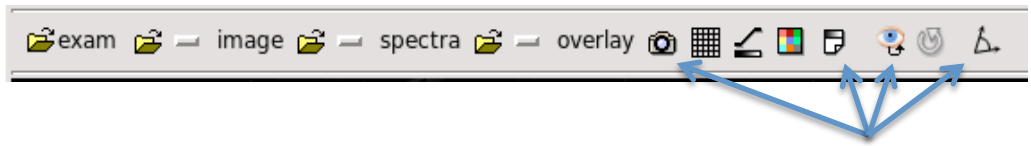
 The “color window/level” interactor is used to adjust the color mapping of the color overlay image. It provides the following interactions:

| | Left Button | Middle Button | Right Button |
|---|---|---|---|
| Drag Left/Right | Adjusts Window | Translate Image/Trace Grid | Zoom View |
| Drag Up/Down | Adjusts Level | Translate Image/Trace Grid | Zoom View |

 The “3D” interactor is used to rotate the Image View in 3D allowing for a more detailed spatial visualization of the displayed data:

| | Left Button | Middle Button | Right Button |
|---|---|---|---|
| Drag | Rotate Scene in 3D | Translate Image/Trace Grid | Zoom View |

## SIVIC Toolbar Extras

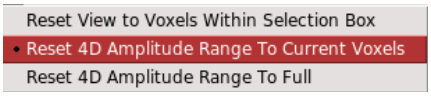



***In addition to the data loading and mouse interactions the toolbar has four extra buttons used to perform common actions quickly.***

 The screenshot button is used for taking screen captures of the current scene. Screen captures can be exported as DICOM Secondary Captures for easy integration into imaging workflows as well as common image formats such as tiff, jpeg and png.

 The reset window level button is used to reset the window/level of the reference grey-scale image back to its default state.

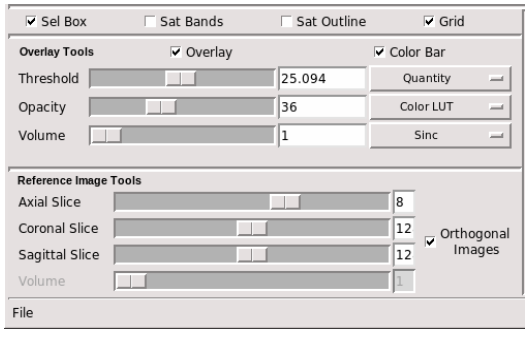
 The reset view button is used to reset the visible range of the 4D traces. It provides a drop-down menu with three options:




1. “Reset View to Voxels Within Selection Box” reset the visible voxels to only those within the selection box.
2. “Reset 4D Amplitude Range to Current Voxels” resets the amplitude range of the traces using the maximum and the minimum of the data in the current voxels to determine the range.
3. “Reset 4D Amplitude Range to Full” resets the amplitude range of the traces using the all of the data the data in the entire current volume.

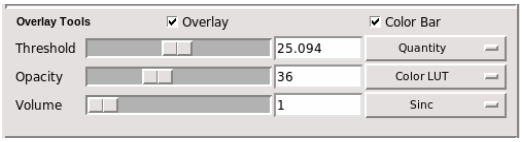
 The orientation button is used to toggle the orientation in which the data is displayed in both Views between axial, coronal, and sagittal.

## SIVIC Sliders, Buttons and Drop-Downs (Oh My!)



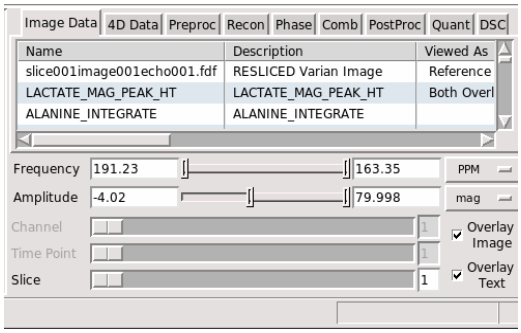

***As stated above the bottom left panel is used to control the Image View. It has three sections:***


1. The four check boxes in the top section are used to toggle the visibility of objects in the Image View. This includes the selection box, the saturation bands, and the wire grid representation the spatial locations of the trace voxels.

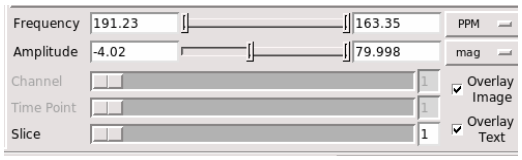



2. The "Overlay Tools" section is used for controlling the color overlays.
   - The top two check boxes toggle the visibility of the overlay and the associated color bar showing the mapping of colors to intensity values.
   - The "Threshold" slider controls the minimum visible intensity of the overlay-- pixels below this threshold are transparent. You can toggle the definition of the threshold between "Quantity" and "Percent" using the drop-down to the right of the slider.
   - The "Opacity" slider adjusts the opacity of the overlay. To the right of the "Opacity" slider is a drop-down to select the color look up table, which defines how values are mapped to colors.
   - The "Volume" slider controls the volume within the dataset to display. For example with a dynamic dataset you can use this to control the visible time point.


3. The “Reference Image Tools” section is used for manipulating the visible slices of the reference image. Orthogonal image slices are only visible in 3D mode and can only be manipulated when in that mode. Use the “3D” mouse interactor to put the scene in 3D mode. Clicking on the “voxel selection” interactor will return the Image View to 2D.



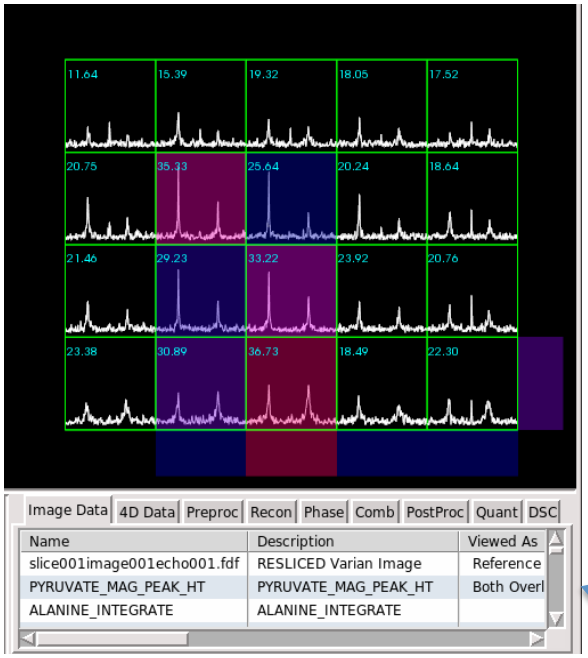

***The controls below the Trace View are used to manipulate the trace data. The top section of this panel contains tabs that will be described below.***




There are two sets of sliders that are used to control the Trace View.

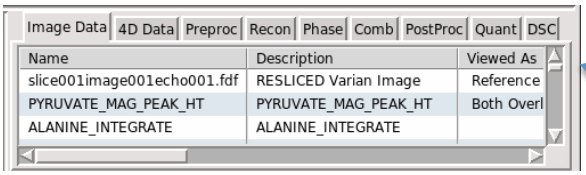
- The top slider is used to adjust the visible range of the traces in the x-axis. The drop-down to the right controls the units used to adjust this range. This drop-down includes PPM, Hz and Pts for points. The units available depend on the loaded data.
- The “Amplitude” slider is used to adjust the visible range of the traces in the y-axis. To the right of that slider is a drop-down menu that lets the user toggle between real, imaginary, and magnitude data when complex data is loaded.
- The “Channel” slider is used to change the visible channel.
- The “Time Point” slider is used to change the visible time point.
- The “Slice” slider is used to change the visible slice.

## SIVIC Trace View Tabs

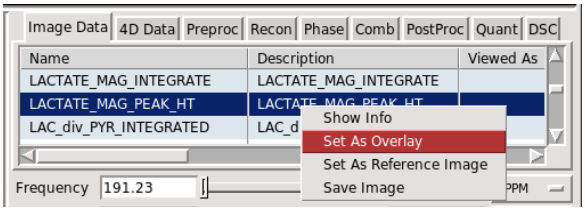



***Below the Trace View the top panel contains a tabbed area that is used to manage loaded data in SIVIC and provides controls to perform processing on 4D datasets. Currently SIVIC has 9 Trace View control tabs.***

1. "Image Data" tab:



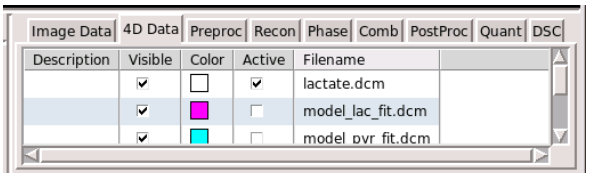

The "Image Data" tab is used for viewing the image datasets currently loaded. There are four columns to this tab. The first displays the name of the dataset. The second is the series description. The third shows if and how each dataset is currently being displayed in SIVIC, be it as a reference image, as an overlay in the Image View, an overlay in the Trace View, or an overlay in both views. The fourth column displays the full-path filename.




By right clicking on a row in the Image Data tab a menu is displayed with four or five options.

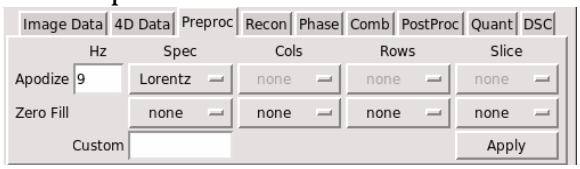
- "Show Info" displays the DICOM header representation of the data.
- "Set As Overlay" sets the image as an overlay.
- "Set As Reference Image" sets the image as the grey-scale reference image.
- "Set As Dynamic Traces" sets the data as dynamic traces in the Trace View. This option is only available for dynamic datasets.
- "Save Image" lets you export the data.

2. "4D Data" tab:



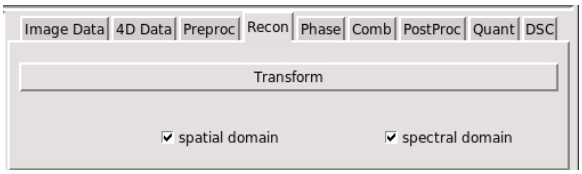

The "4D Data" tab displays all loaded 4D data. Examples of 4D data include dynamic and spectroscopic data. This is data that can be loaded as traces in the Trace View. There are four columns in this tab. The first displays the description of the data. The second has check boxes that allow you to toggle the visibility of the trace. The third sets the "Active" trace. Any processing that manipulates the trace data, for example phasing, will ONLY apply to the active dataset. Currently only one dataset can be active at time. The fourth column simply has the filename.

3. "Preproc" tab:



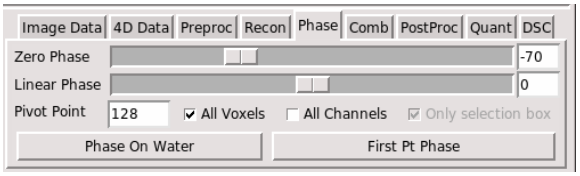

This tab is used exclusively for pre-processing spectroscopic data. It permits both apodization and zero-filling. To pre-process data first use the "4D Data" tab to set the data you wish to apply the processing to as "Active". Data can be apodized by selecting a window shape using the drop down box below the "Spec" column. The FWHH can be adjusted using the text box and is set in Hz. To zero fill data you can select one of the options in the drop-down menus for each dimension, which include doubling, extending to the next power of two, or using the custom text box in the "Spec" column to set desired length. Once you have selected the operations click the "Apply" button and the data will refresh in the visualization to reflect the changes.

4. “Recon” tab:



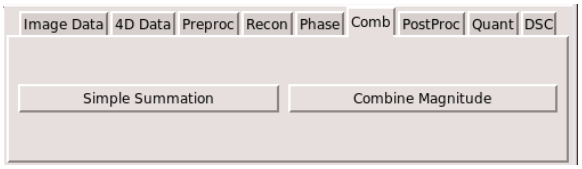

The recon tab is used exclusively to reconstruct spectroscopic data data. Both spectral and spatial FFT’s can be applied. Applies only to “Active” data. Click “Transform” to apply.

5. “Phase” tab:



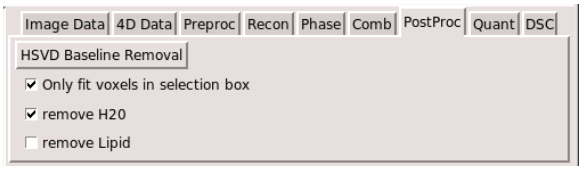

The phase tab is used exclusively for phasing spectroscopic data. The top slider sets the zero-order phase. The second slider sets the first-order or linear phase. This is applied about the pivot point, which can be modified using the text box. The units of the pivot point is always points. The three check boxes determine whether the phasing applies to all voxels or visible voxels, all channels or only the visible channel, and the final check box sets the phase for all voxels within the selection box. At the bottom of the tab there are two buttons to apply automatic phasing algorithms. The first, “Phase On Water”, phases data using the water peak. The second, “First Pt Phase”, applies a first point phase algorithm.

6. “Comb” tab:



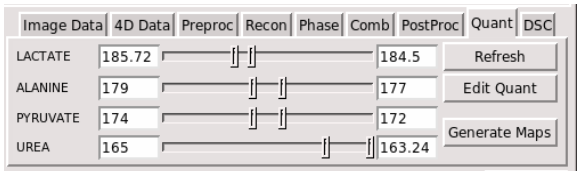

The “Comb” tab is used for combining multi-channel data. Currently SIVIC supports combining by simple summation and combining using magnitude data.

7. “PostProc” tab:



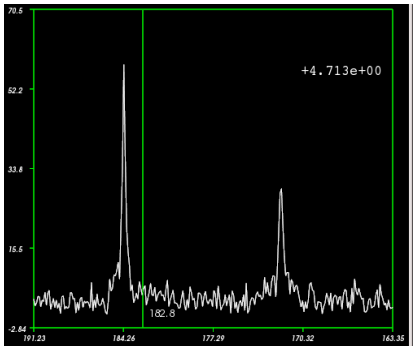

The “PostProc” tab is used exclusively for removing lipid or water from spectroscopic data using HSVD baseline removal.

8. “Quant” tab:



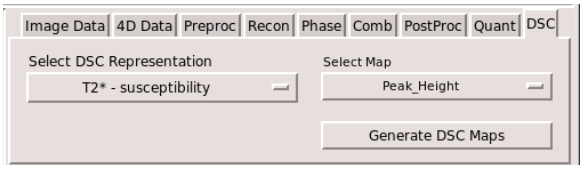

The “Quant” tab is used for quantifying spectroscopic data. Sliders are used to define the maximum and minimum range used for quantification. The metabolites quantified and their default ranges are configurable using an xml file found in the user’s home directory under the name “.SIVICQuantrc.xml”. Defaults for different target isotopes and anatomies are defined in this file. This file can be edited by clicking the “Edit Quant” button. Additionally the types of maps that can be generated are configurable and include:

- Peak Height
- Magnitude Peak Height
- Integrated Area
- Magnitude Integrated Area
- Z-scores
- Ratios of other maps




Selecting a single voxel in SIVIC displays a vertical line over the trace as the mouse is moved. The intensity of the trace at that point is displayed in the top right of the plot and the exact frequency is displayed at the base of the vertical line.

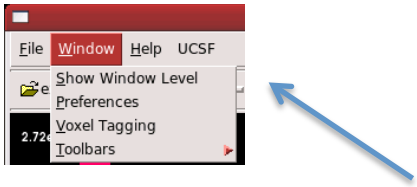
9. “DSC” tab:




The DSC tab is used for basic quantification of dynamic susceptibility contrast imaging. It has two drop down menus:

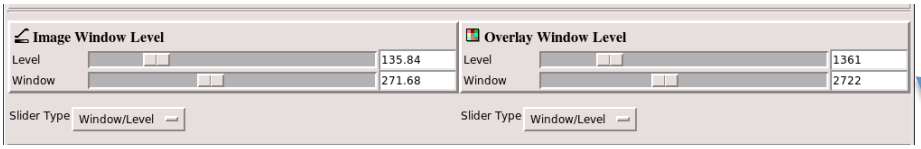
- “Select DSC Representations” lets you view the data is T2* susceptibility or delta R2* (relative gadolinium concentration).
- “Select Map” lets you load the peak height, normalized peak height or percent recovery maps as an overlay.

# SIVIC Window Menu



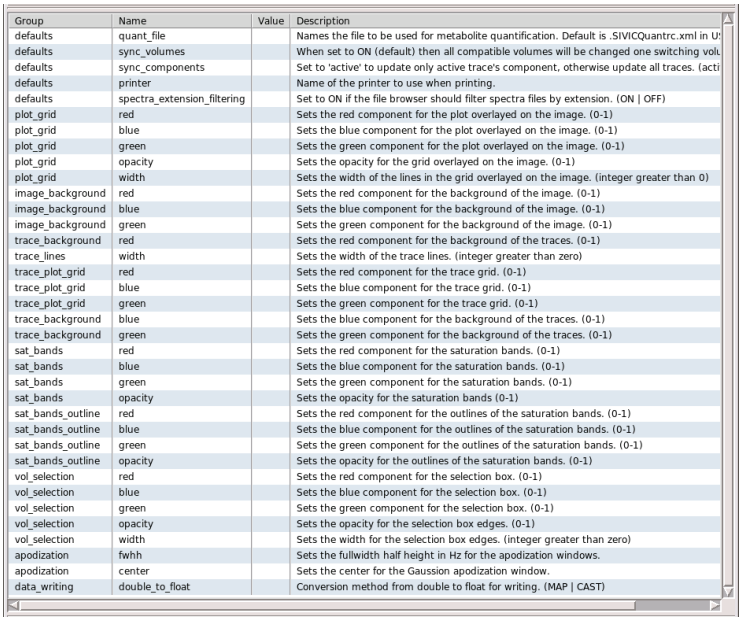

***The SIVIC "Window" Menu contains four options.***

1. "Show Window Level" brings up a window containing sliders for precisely manipulating the Window/Level ranges of the grey-scale reference image as well as the color overlay.




The "Slider Type" is a drop-down menu that allows the user to toggle between adjusting the contrast using window/level parameters or max/min parameters.

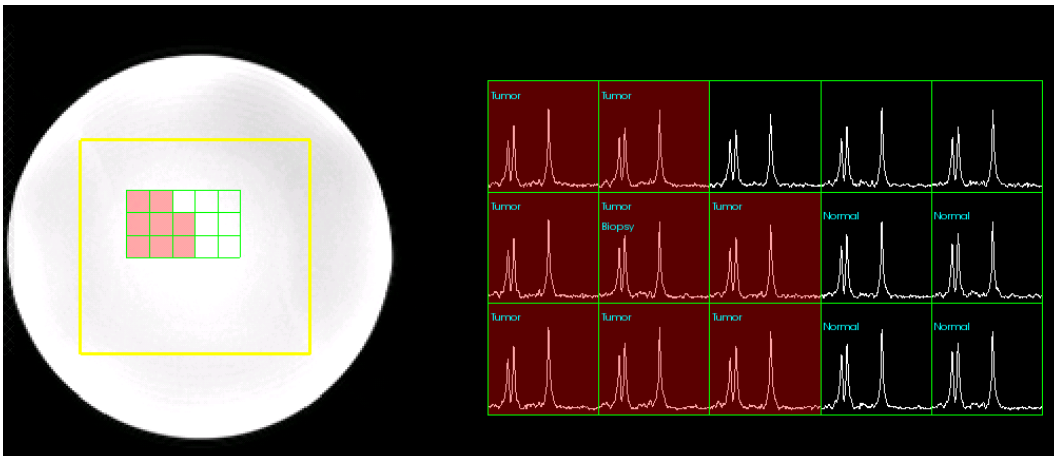
2. "Preferences" displays a window that allows the user to set preferences.



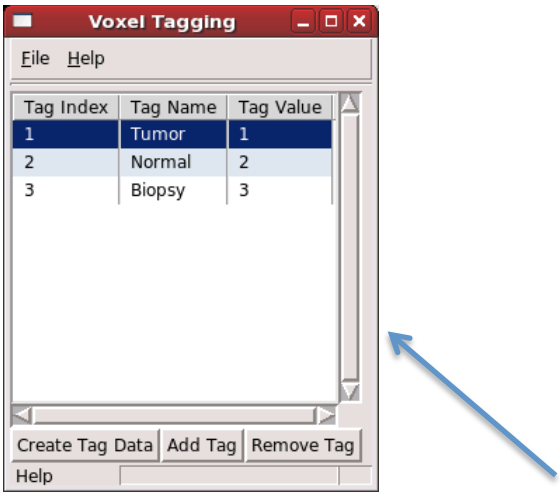
| Group | Name | Value | Description |
|---|---|---|---|
| defaults | quant_file | | Names the file to be used for metabolite quantification. Default is .SIVICQuantrc.xml in U |
| defaults | sync_volumes | | When set to ON (default) then all compatible volumes will be changed one switching volu |
| defaults | sync_components | | Set to 'active' to update only active trace's component, otherwise update all traces. (acti |
| defaults | printer | | Name of the printer to use when printing. |
| defaults | spectra_extension_filtering | | Set to ON if the file browser should filter spectra files by extension. (ON \| OFF) |
| plot_grid | red | | Sets the red component for the plot overlayed on the image. (0-1) |
| plot_grid | blue | | Sets the blue component for the plot overlayed on the image. (0-1) |
| plot_grid | green | | Sets the green component for the plot overlayed on the image. (0-1) |
| plot_grid | opacity | | Sets the opacity for the grid overlayed on the image. (0-1) |
| plot_grid | width | | Sets the width of the lines in the grid overlayed on the image. (integer greater than 0) |
| image_background | red | | Sets the red component for the background of the image. (0-1) |
| image_background | blue | | Sets the blue component for the background of the image. (0-1) |
| image_background | green | | Sets the green component for the background of the image. (0-1) |
| trace_background | red | | Sets the red component for the background of the traces. (0-1) |
| trace_lines | width | | Sets the width of the trace lines. (integer greater than zero) |
| trace_plot_grid | red | | Sets the red component for the trace grid. (0-1) |
| trace_plot_grid | blue | | Sets the blue component for the trace grid. (0-1) |
| trace_plot_grid | green | | Sets the green component for the trace grid. (0-1) |
| trace_background | blue | | Sets the blue component for the background of the traces. (0-1) |
| trace_background | green | | Sets the green component for the background of the traces. (0-1) |
| sat_bands | red | | Sets the red component for the saturation bands. (0-1) |
| sat_bands | blue | | Sets the blue component for the saturation bands. (0-1) |
| sat_bands | green | | Sets the green component for the saturation bands. (0-1) |
| sat_bands | opacity | | Sets the opacity for the saturation bands (0-1) |
| sat_bands_outline | red | | Sets the red component for the outlines of the saturation bands. (0-1) |
| sat_bands_outline | blue | | Sets the blue component for the outlines of the saturation bands. (0-1) |
| sat_bands_outline | green | | Sets the green component for the outlines of the saturation bands. (0-1) |
| sat_bands_outline | opacity | | Sets the opacity for the outlines of the saturation bands. (0-1) |
| vol_selection | red | | Sets the red component for the selection box. (0-1) |
| vol_selection | blue | | Sets the blue component for the selection box. (0-1) |
| vol_selection | green | | Sets the green component for the selection box. (0-1) |
| vol_selection | opacity | | Sets the opacity for the selection box edges. (0-1) |
| vol_selection | width | | Sets the width for the selection box edges. (integer greater than zero) |
| apodization | fwhh | | Sets the fullwidth half height in Hz for the apodization windows. |
| apodization | center | | Sets the center for the Gaussion apodization window. |
| data_writing | double_to_float | | Conversion method from double to float for writing. (MAP \| CAST) |

The preferences window contains four columns, the first column is the group of the preference, the second is the name of the preference, the third is where the user enters the value of the preference, and the fourth is a description. At the end of the description is a list of possible values where applicable. Colors are set using RGB values ranging from 0-1 representing the relative value of the primary color in the final combined color.

3. “Voxel Tagging” displays a window for generating and modifying voxel tag data.




Voxel tagging in SIVIC is a process used to “tag” voxels within a 4D dataset using a value and a short text string. Voxel tags are stored as multi-volumetric DICOM MR Image data object. Each tag is stored in a different volume with an intensity that is set by the user. The text strings are stored in a DICOM private tag. Voxel tag data can be exported as any data type supported by SIVIC, but the text strings are only stored in the data itself if DICOM data is used.

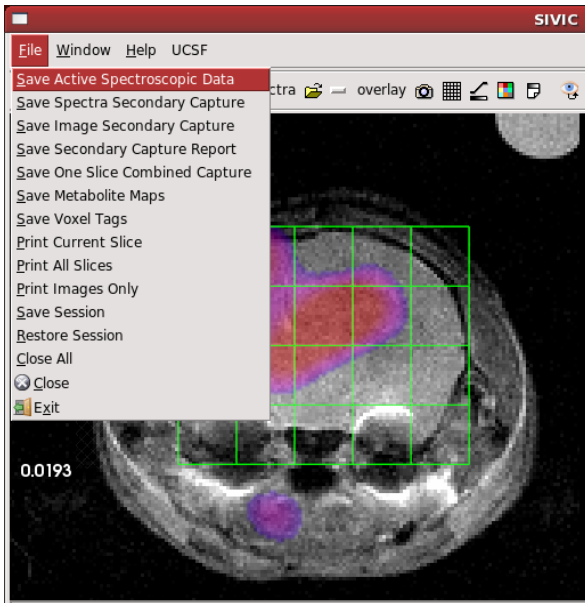



To start voxel tagging, click the “Create Tag Data” button in the Voxel Tagging window. A default tag called “ROI” with a value set to 1 is generated by default. Tag names and values can be edited in the table. Tags can be added and removed using the buttons at the bottom of the window. To tag a voxel highlight the row of the tag you wish to mark the voxel as and then left click in the Image or Trace View.

A detailed tutorial on voxel tagging can be found on the SIVIC website: http://sourceforge.net/apps/trac/sivic/wiki/voxel_tagging_tutorial

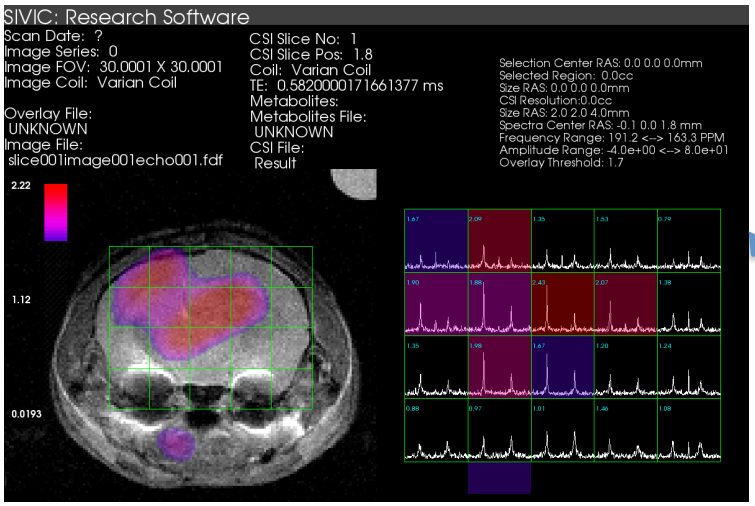
4. “Toolbars” lets you toggle the visibility of the toolbars.

## SIVIC File Menu




***The "File" menu gives the user options for exporting/printing data as well as for saving and restoring sessions. Currently there are 15 options in the "File" menu.***

1. "Save Active Spectroscopic Data" saves the currently "Active" spectroscopic data. This is used to save reconstructed data.
2. "Save Spectra Secondary Capture" takes a screen capture of the Trace View.
3. "Save Image Secondary Capture" takes a screen capture of the Image View.




4. "Save Secondary Capture Report" iterates through all slices of the data and takes a screen capture of both views and overlays the result with text annotations about the dataset.

5. “Save One Slice Combined Capture” takes a screen capture of both views for the current slice only.
6. “Save Metabolite Maps” is used to save the metabolite maps generated by the “Quant” tab.
7. “Save Voxel Tags” saves any tagging data generated by the user.
8. “Print Current Slice” prints screen captures of both views for the current slice. The printer name is set in the preferences window.
9. “Print All Slices” prints screen captures of both views for all slices.
10. “Print Images Only” prints a screen capture of images within the 4D grid.
11. “Save Session” saves the filenames of the currently viewed image, overlay, and trace data into the configuration file.
12. “Restore Sessions” loads the data from the last saved session.
13. “Close All” closes all data currently loaded.
14. “Close” closes SIVIC.
15. “Exit” exits SIVIC.

## SIVIC Help

For help please visit the SIVIC website:
http://sourceforge.net/p/sivic/sivicwiki/Home/