Cartovel

User's Guide

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Acknowledgements

The data processing portion of Cartovel's code was written by Konstantin Romanenko, and many of the data loading procedures were written by Ben Newling. My thanks go out to both of them for their code, hard work, and all the help and support they gave me while making this program. My thanks also go out to Bruce Balcom, and Olusegun Adegbite for their ideas and support.

The current version of Cartovel is 1.5, and was updated by Thierry Pelletier in the April of 2016.

Introduction

Scope

The jAIMS program is not in very good condition and has become very hard to work with. It would take more time than it is worth to repair jAIMS, so Cartovel was created. Cartovel wraps around Konstantin's velocity mapping procedures, and make them more accessible to everyone else in the lab. Cartovel performs velocity maps on 3D and 2D data.

Functionality Summary

Cartovel was created to be as simple as possible, so that we could avoid the problems encountered with jAIMS. Cartovel can currently do the following:

-Read files in text, RIImage, RIDat, NTNMR(tnt), IDL byte data(dat), and MatLab files(mat).

-Display the Magnitude, Real, Imaginary, and phase parts of the q-space in slices of 3D data (2D images), or 2D images.

-Perform a velocity map of 2D and 3D data.

-Display the Peak, Mean, and Phase Velocity of the velocity map data.

-Display the propagators and phase at points in the velocity map data.

-Display x and y profiles of both the q-space and velocity map data.

-Export images for use in publications.

Running Cartovel

Cartovel was developed under MathWorks MatLab R2011b. To run Cartovel you must have MatLab version R2011b, a versions of MatLab newer than R2011b, or the MCR installed on your computer.

How to run Cartovel with MatLab R2011b or newer:

1. Start Matlab
2. Change the current folder to the folder that contains Cartovel. The folder is most likely called Cartovel, and should be inside the UNB MRI Programs folder.
3. Type Cartovel in the command line.

How to run Cartovel with the MCR:

This is the only way for people to run MatLab programs without a MatLab license. The MCR, MatLab Compiler Runtime, is required to run MatLab executable files, and is supplied for free by MathWorks. The MCR can be downloaded here http://www.mathworks.com/products/compiler/mcr, and is available on Windows(both 32 and 64 bit), Linux, and Mac. There is a small trick to getting the Cartovel exe working. The exe must be made on a computer running the same operating system as the

computer that will be running the exe. In other words if you want Cartovel to work on your 32bit Windows computer then the exe must be made on a 32bit Windows computer, and if you want it to work on your Mac you need to have an exe that was made on a Mac etc.

How to use Cartovel

After name pending is running, the first thing you need to do is open a file. Once a file has been opened it can be velocity mapped, and the results can then be viewed.

The Cartovel Interface

This section describes the functionality of Cartovel's 2 main graphics windows and two minor graphics windows.

The Cartovel Graphical Display Window

This is the opening window of Cartovel, and is the window containing most of Cartovel's functionality. This window has two modes. The mode it starts in is q-space view, and the other mode is velocity view. While in q-space view mode you can look at 2D Magnitude, Real, Imaginary, and Phase slices of the loaded data. While in velocity view mode you can look at 2D peak, mean, and phase velocities of the velocity mapped data. You can switch between these 2D slices with the four buttons at the bottom of the window that are labeled accordingly. The slices appear on the display area that dominates the window.

There are two more buttons on the bottom of the window. The 'Pick Propagator/Phase' button is only active while Cartovel is in velocity view mode, and allows you to look at a Propagator or Phase at a particular point of the velocity data. Instead of clicking the button you can just click on the display area. You will be given a propagator while looking at mean and peak, and you will be given phase while looking at the phase. The other button 'Pick x and y profiles' gives you x and y profiles across the velocity data or the q-space data. While in q-space view mode clicking on the display gives an x and y profile.
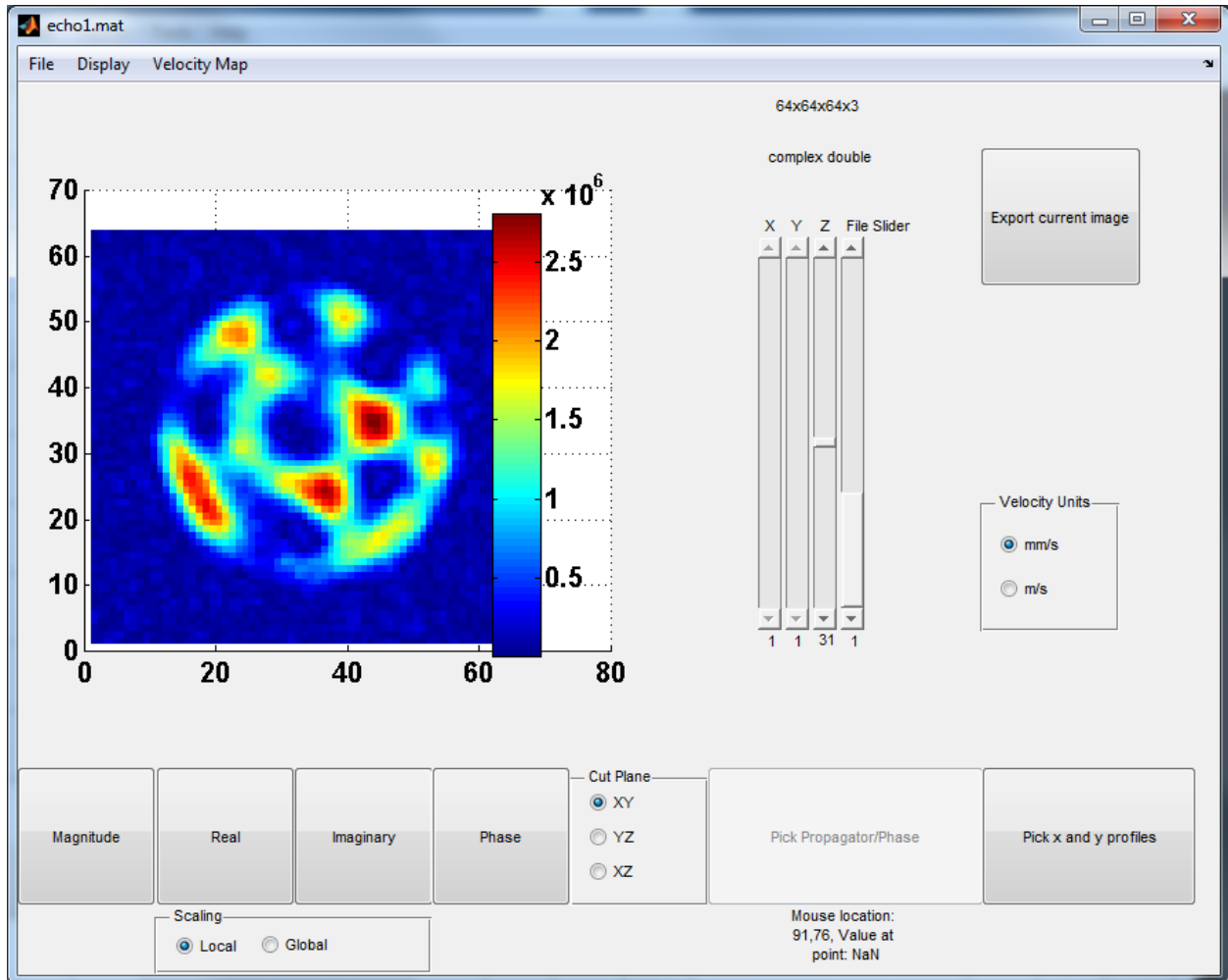
There is one final button in the top right corner of this window 'Export current image'. This button creates a new figure containing the same image being displayed in the display. This new figure lets you save the image, and change the appearance of the image.

There are four sliders to the right of the display. These sliders are labeled 'X','Y','Z', and 'File Slider'. These sliders are used to cycle through different slices of data. The 'File Slider' is only used with the q-space data, and the 'X','Y', and 'Z' sliders only work with 3D data.

There are three sets of radio buttons on this window. In the bottom left is the first called 'Scaling'. The 'Scaling' radio buttons are used to change between local and global scaling of the displayed image. Choosing the local option causes the colour scale maximum and minimum values to be the maximum and minimum values of the current image. Choosing the global option causes the colour scale maximum and minimum values to be the maximum and minimum values of all the images of that type. The 'Cut Plane' radio buttons control which direction slices are made into the 3D data. In 2D data they do nothing. The 'Velocity Units' control the units of the colour bar when viewing velocity data.

There are two text displays on this window. One is above the sliders. This one gives information on the dimensions of the loaded data, and tells if it is complex data or not. The second text display is below the 'Pick Propagator/Phase' button. This one gives the location of the mouse and the value of the data at that location. It displays 'NaN' for the value of the location if the location is outside of the data.

There are three dropdown menus at the top of the window. Under 'File' you will find 'load' and 'exit' buttons. Under display you will find 'View Velocity' and 'View q-space'. Under 'Velocity Map' you will find 'Velocity Map'.

The Cartovel Velocity Map Options Window

This window is for setting the parameters used in velocity mapping. Before using Cartovel the user is expected to do a Zero flow correction on their data. It is also necessary for the user's data to be isotropic (square or cube).

There are eleven input boxes for setting the parameters. Two of these 'Number of q-points to fit' and 'Image Matrix Size' are set by Cartovel, and are determined by the number of files loaded and the dimensions of those files. The following is a description of the parameters:

- 'Number of q-points to fit': The number of experimental q-points.
- 'ZeroBin': The index of zero gradient
- Mask Level: The threshold level for the data
- Image Matrix Size: Image resolution in one dimension
- Zero-filling for q-space: Used in the propagators. There will only be a number of points equal to the number of files loaded, so we zero-fill to make the image look smoother.
- Number of points to fit with power: The number of unwrapped-phase points to be fit the polynomial power (Order of polynomial fit).
- Order of polynomial fit: The power of the polynomial to fit the phase data
- Gamma: The gyromagnetic ratio (default H1)
- Maximum flow encoding gradient: Self-explanatory
- Small Delta and Effective Big Delta: Those performing these experiments should know what they are, and if not ask Konstantin or Ben.
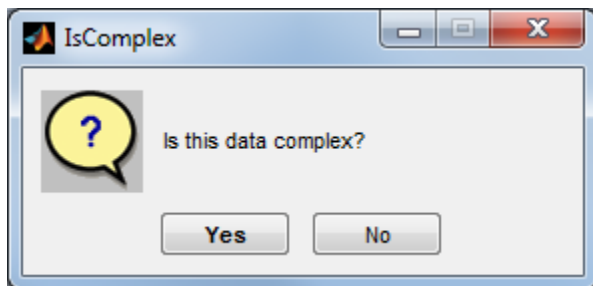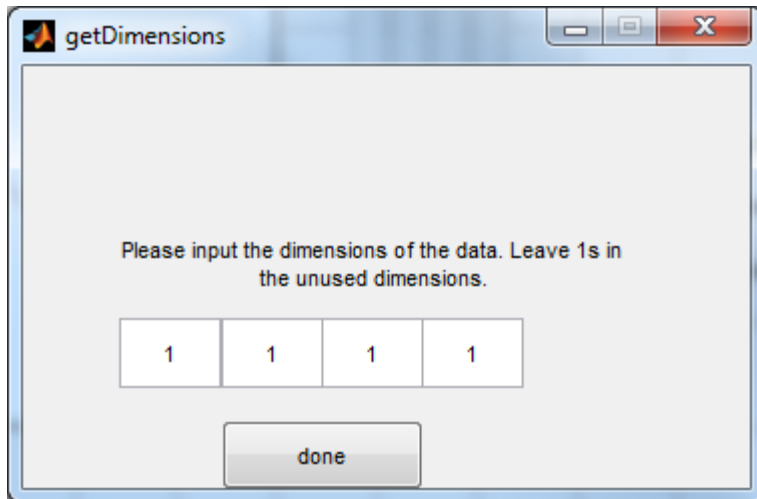
There are two buttons on this window. The 'Cancel' button just closes the window. The 'Calculate Velocity Map' button begins the velocity mapping procedure. After the velocity map procedure is finished hit the 'Cancel' button or the x button in the top right corner.
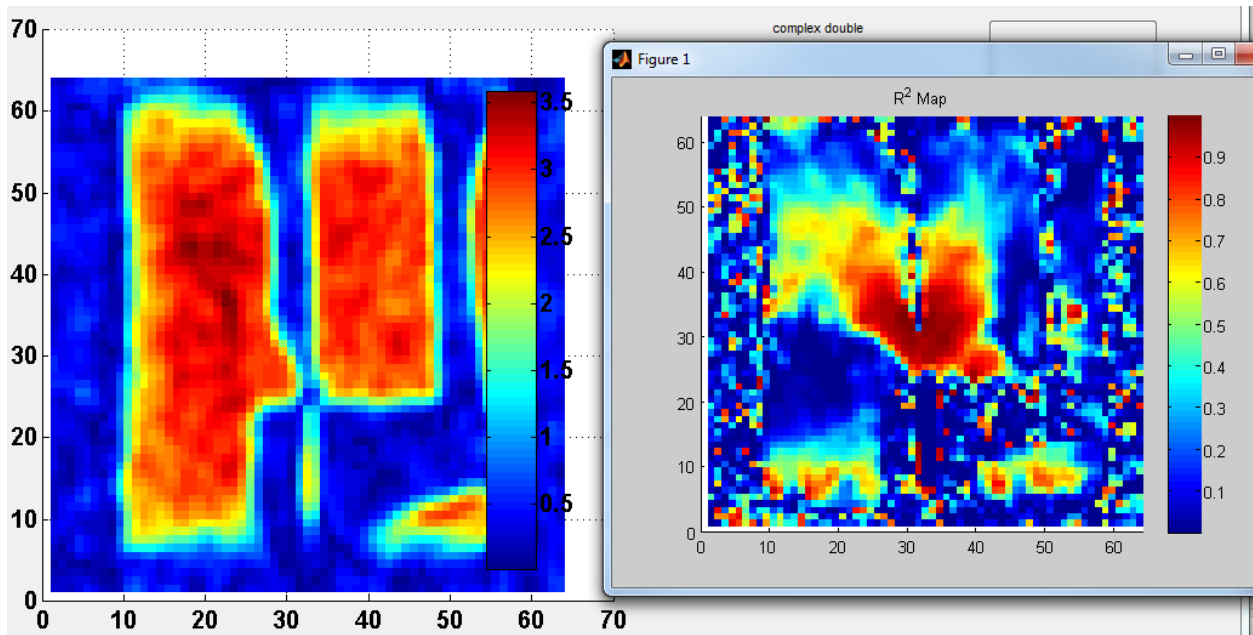
The Cartovel Minor Graphics Windows

These two windows are only used when text files are loaded, and they are used to get additional information about the text files from the user. The first is getDimensions where the user needs to input the dimensions of their data, and the second is isComplex where the user needs to answer the question 'is this data complex?'

The Cartovel R Squared Maps

This feature was added in May, 2016. After the velocity maps have been generated, the R Squared Maps then generate a matrix of correlation coefficients that corresponds to the matrix of velocity values. Displaying the R Squared Maps generates the map in a new window allowing the user to compare the correlation coefficients to the Velocity Maps.

Miscellaneous notes

- The top of the main graphics window (the title bar) contains the name of the loaded file/files. If loading of the data fails or if the user clicks cancel when loading the title bar changes to 'loading failed'.
- When a velocity map is done on a set of data a series of files are saved into the location of the loaded files. These new files contain all of the velocity map data. If velocity map data exists in the directory of the loaded files it is not necessary to do another velocity map. Cartovel will automatically load those files if you switch to velocity view mode.