Measuring T1, T2 and T2*

Manual Reference: T2 analysis, a step-by-step example in Manual O10_ISATool.pdf (10.2.3)

Tools for T1/T2 Measurement

If you want a quantitative measure of T1 or T2 from your image, there are two tools that will help you:

1. The **ISA tool** will allow you to calculate a value of a relaxation time averaged over an ROI that you can select. Use this if you are interested in the relaxation parameter values of a specific part of your image or to compare T1 or T2 values from different parts of an image.
2. A **parametric image** can give you a quick view of how the T1 or T2 values differ across an image. The image intensity of a parametric image is proportional to the relaxation time you are interested in (T1 or T2).

What Kind of Data Do I Need?

You need to have collected an image sequence from an experiment like MSME-T2 map, MGE-T2-star map or RARE T1-T2 map. The data is in the form of a series of images with different TE and/or TR values.

How to Use the ISA Tool

Launch the ISA tool from the Image Display and Processing Window. Processing -> Image Sequence Analysis. The tool is relatively intuitive. You can find instructions in the manual. Open the manual by clicking on the "?" button in the System Control window. Find ISA Tool in the index. It should be in section 10.3.3.2 for PV5.1.

How to Calculate a Parametric Image

1. Select your data set
2. Move a data set into the Image Display and Processing window by dragging it with the middle mouse button. You can select the appropriate data file either from the Scan Control window or from the Data Manager Window. To open the data manager window go to the System Control window and click the Tools menu.
3. Your data set must be a series of images with varying delay times like those produced by a RARE T1 and T2 map protocol or RAREvtr.
4. Be sure that the view port with your data series is currently selected (a purple, dashed line frames the current view port).

Start the ISA Tool

1. In Image Display and Processing select "Image Sequence Analysis."
2. Select the appropriate type of fit from "Available fitting methods" in the window that pops up.
3. Select the appropriate fitting method from the "Available fitting methods" window that pops up.
4. In the ISA Tool window, click Images-> Calculate parameter images - All slices
5. Repeat for other relaxation parameters you want to calculate

Interpreting the Data from the ISA Tool

Open your image using the data manager tool. You may have to refresh the data manager by clicking on File-> Rescan Disk in the Data Manager window.

Parametric images are output as sets of images in the proc subdirectory of your data directory. Each additional fit will be in a directory under proc. For instance, proc/1, proc/2, proc/3, etc.

Why are There Multiple Images of Each Slice?

The images reflect the same quantities and are in the same order as the parameters in the ISA output table of the ISA tool.

As a **concrete example**, for a T2 fit the output of the ISA tool will be 5 images for each slice. The intensity of those images is proportional to:

1. Signal intensity of the original image
2. Standard deviation of signal intensity of the original image
3. T2 best fit values calculated by fitting each pixel across the series of images
4. Standard deviation of T2 value
5. Standard deviation of the fit

The intensity values in the parametric images are NOT equal to the parameter values, but they are proportional to the parameter (T1/T2/T2*) values. In other words, the values of each image pixel is not the relaxation time you are trying to measure, but the relative intensities of the image will tell you the relative values of the T1, T2 or T2* parameters.

If you want measured values of the parameters, use either the cross-hairs icon or the statistics window of the ROI tool which will show you both the intensity values and the parameter values.