Diffusion Tensor Imaging on Agilent system

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**Overview:** Water thermal mobility, i.e. diffusion, is a three dimensional process. Diffusion Tensor Imaging (DTI) acquires diffusion weighted images (DWI) at various gradient directions allowing for the 3D diffusion to be quantified. Here you will find basic instructions on how to acquire and quantify DTI data.

**MRI Sequence:** semsdw\_dual has 7 DWI, 6 with gradient directions and 1 without (b0). You must specify a single bvalue appropriate for your experiment. Ex. A b value of 1000 is commonly used for brain.

**Gradient Scheme:** The gradient scheme used by Agilent for 6 gradient directions is [[0 0 0];[1 1 0];[1 0 1];[0 1 1];[-1 1 0];[-1 0 1];[0 -1 1]];. This is very important since how you calculate your diffusion tensor will be dependent on the order of the diffusion weighted images.

**Relevant Matlab Programs:**

1. CMI Program: for loading and saving DW images to workspace
2. DTI\_analysis: main DTI program that generates ADC, FA, and orientation maps
   1. In here you will have to specify gradient scheme and b value. Currently hardcoded to Agilent 6 gradient scheme and bvalue=1000;
3. DT\_invariant: used to calculate eigenvalues.
4. DT\_eigenvalue: calculate eigenvalues, ADC, and FA
5. DT\_eigenvector: calculate eigenvectors

**Method:**

1. Load DTI data (\*.fdf) using the CMI program written by BAHoff.
2. Save data to workspace using the following in line code:
   1. >>data=cmiObj0.img.mat;
3. At prompt: >>DTI\_analysis(data);
4. The following data will be saved:
   1. To Workspace: Evector, FA and orien1
   2. As FLD:
      1. DTI\_proc.fld->ADCe6 and FAe3
      2. DT\_orien.fld->Orien1e3 % this is a RGB map and will need imshow in Matlab to visualize or appropriate visualization software. (ex. figure(99);imshow(squeeze(orien1(:,:,8,:));)

Need to reshape data into 4D:

>> d=size(orien1);

>> corien = reshape(orien1,[d(1:2),25,3]);

>> size(corien)

ans =

256 256 25 3

>> max(corien(:))

ans =

1.1560

>> figure,imshow(squeeze(corien(:,:,8,:)))