

Step 1: Select the Protocol from the GE Protocol Library

- **H.7 8HR Brain ASSET**

Step 2: Prepare and Position the Patient

- Patient entry is HEAD first
- Choose the appropriate coil (Head or 8-Channel Brain Coil).
- Pad the patient to reduce the likelihood of artifacts related to motion
- Ask the patient to un-clasp hands
- Landmark to the nasion

Step 3: Perform Localizer and ASSET CAL Series

- Select and scan both the 3-plane localizer series and ASSET calibration scan in the protocol

FYI- Be certain to include the entire brain anatomy in the ASSET calibration scan.

A Word About Diffusion Tensor Processing Outputs:

ADC: Apparent Diffusion Coefficient —

This output subtracts T2 “shine through” from the final image. Restricted diffusion is bright, and T2 is iso-intense. Characterizes the mobility of water molecules inside tissues

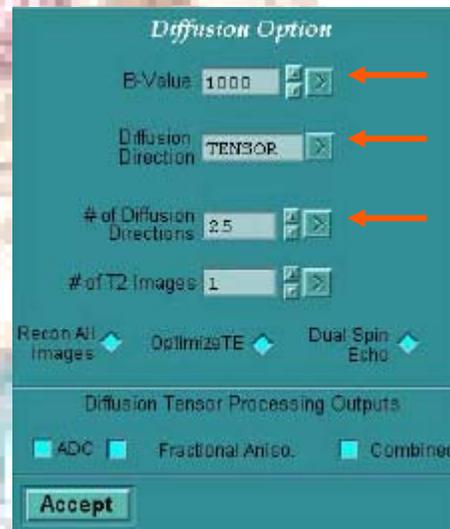
Fractional Anisotropy-

The output displays an “anisotropy” map that characterizes the lack of uniformity of the diffusion process along different orientations. This output is helpful in visualizing white matter tracks in the human brain.

Combined- The output displays an iso-tropic diffusion map. Restricted diffusion is bright, and T2 is bright. Characterizes the mobility of water molecules inside tissues.

Step 4: Perform DW-Tensor Imaging

- Select the “DW-TENSOR with ASSET” series from the RX Manager.
- Prescribe an Axial Graphic RX TENSOR series.
- Select the Diffusion Options Screen .Enter the B-Value and select “TENSOR” for your “Diffusion Direction”. (**Max B-Value is 3500s/mm²**)
- Enter the number of TENSOR directions –25. (**Maximum # of tensor directions is 55**)



- Select **Optimize TE** . This option will default “ON” to help ensure that the lowest TE possible is utilized based on the the gradient amplitude applied (B-Value).
- **Select Dual Spin Echo “ON”**. This option is a DTI helps reduce distortion related to eddy currents
- Select the **Diffusion Tensor Processing Outputs**
- Select **Save Series / Prepare to Scan / Scan IMPORTANT!** As “B-Value” increases, so does the diffusion weighting but at the expense of SNR! Select a B-Value that represents the best compromise between IQ and clinical benefit. A Typical value for Diffusion Tensor Imaging is 900-1000s/mm².

Diffusion Tensor Imaging: How it Works

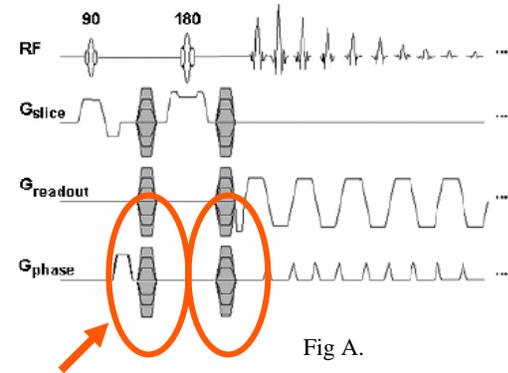
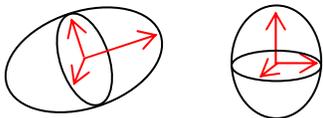


Fig A.

Diffusion gradients are applied before and after the 180 degree RF pulse. The example above illustrate the diffusion gradients applied in all three directions. Fig. A



TENSOR Isotropic DWI Fig B.

The Diffusion Tensor acquisition data provides information on the direction of diffusion within each imaging voxel which the current 3-axis diffusion product (Isotropic DWI) cannot resolve. Fig. B

Diffusion Tensor (DTI) is an imaging technique that produces image contrast proportional to the local diffusion coefficient of water **and it's directional dependence**. The DTI pulse sequence is an adaptation of the Diffusion Weighted (DW) single-shot Echo Planar Imaging (EPI) sequence for image acquisition. Like DW-EPI, DTI applies a pair of DW gradients, one placed before the 180° RF, the other immediately after. This pair of gradients is applied not only for the slice gradient axes, but the readout and the phase gradient axes as well. These six gradients provide the basis of the mathematical expression called **Diffusion Tensor**.

In order to calculate the Diffusion Tensor, at least six diffusion measurements must be performed with the diffusion gradients applied along different gradient axes. The true mathematical equation for Diffusion Tensor is shown below:

$$D = \begin{bmatrix} D_{xx} & D_{xy} & D_{xz} \\ D_{yx} & D_{yy} & D_{yz} \\ D_{zx} & D_{zy} & D_{zz} \end{bmatrix}$$

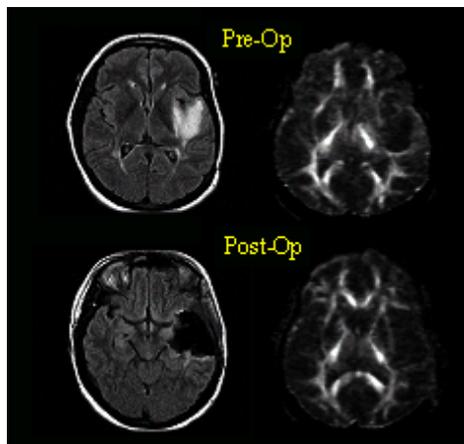


Fig D.

DTI creates a set of DW images, as well as T2 weighted images. Both are used to help fully characterize the diffusion tensor at each voxel. Based on information derived from the DTI acquisition, maps highlighting white matter tracts (Fractional Anisotropy Map) can be produced as illustrated in Fig C. Visualization of white matter tracks can be important clinically in pre-surgical planning. Fig. D

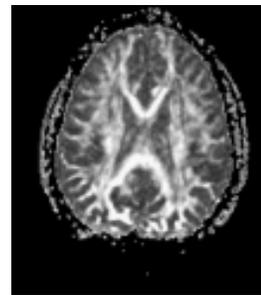


Fig C.

GE Healthcare Fig A.
Imagination at Work