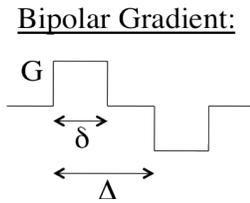


Bioengineering 278: Magnetic Resonance Imaging Laboratory
 Winter 2013
 Lab 6

For this lab you will use the diffusion features in spec. A feature we call variable diffusion ramps the diffusion gradient amplitude from 0 to a_g[xyz]d across reps, allowing for a sampling of the b value curve in one run. For all experiments, use the T/R birdcage head coil, spin echo spiral, and a single axial slice with slice thickness 5mm. For the bipolar gradient shown on the right, $b = \gamma^2 G^2 \delta^2 (\Delta - \delta/3)$. Relevant CV's are:



dif	1	Switch for diffusion weighting
pw_gd	???	δ is pw_gd + 400us
a_gxd	0 or 4	Amplitude of X diffusion grad in G/cm
a_gyd	0 or 4	Amplitude of Y diffusion grad in G/cm
a_gzd	0 or 4	Amplitude of Z diffusion grad in G/cm
		Assume $\Delta = \delta + 5.5\text{ms}$
vdif	1	Stepped diffusion per rep with linear ramp of gradient amplitude across reps
vdif_ramp	10	Number of b values
reps	10	Number of image (1 per value of diffusion weighting)
dda	2	Dummy scans

- Measure diffusion anisotropy in a phantom.** An appropriate phantom will be provided. Use variable diffusion in X, Y, Z, and calculate values of pw_gd to give a bmax of approximately 1000s/mm².

 - Single shot.** Collect one diffusion weighted run with diffusion weighting in each [XYZ] direction, opxres=64 and nl=1. Calculate maps of: Dxx, Dyy, Dzz, Trace, and Anisotropy (Var(Dnn)) for both single shot and two shot data. Provide absolute scales for these maps. (4 points)
 - Four shot.** Repeat 1a with opxres=256 and nl=16. (4 points)
 - Is anisotropy higher or lower with higher resolution? Why? Hint: Think about the spatial scale of the anisotropy relative to the voxel volume. (2 points)
- Measure diffusion and motion in brain.** Use a human subject, and variable diffusion in X, Y, Z. Again use a bmax of approximately 1000s/mm².

 - Repeat part 1a. (2 points)
 - Repeat part 1b. (2 points)
 - Calculate the VENC for each of your 10 b values. Use the b=0 image, and choose one b>0 image to calculate an image of the Z component of the velocity of the brain from the data of part 2a. (4 points)
 - As the b value increases what do you notice about the qualitative image quality for nl=1 vs nl=16? What do you think accounts for these differences? (2 points)