

Determining Maximum Pulsed-Field Gradient Strength

Begin by loading the doped water sample. Tune and shim the probe. Record a one-dimensional proton NMR experiment with $nt=1$. Adjust the resonance of interest using the following commands:

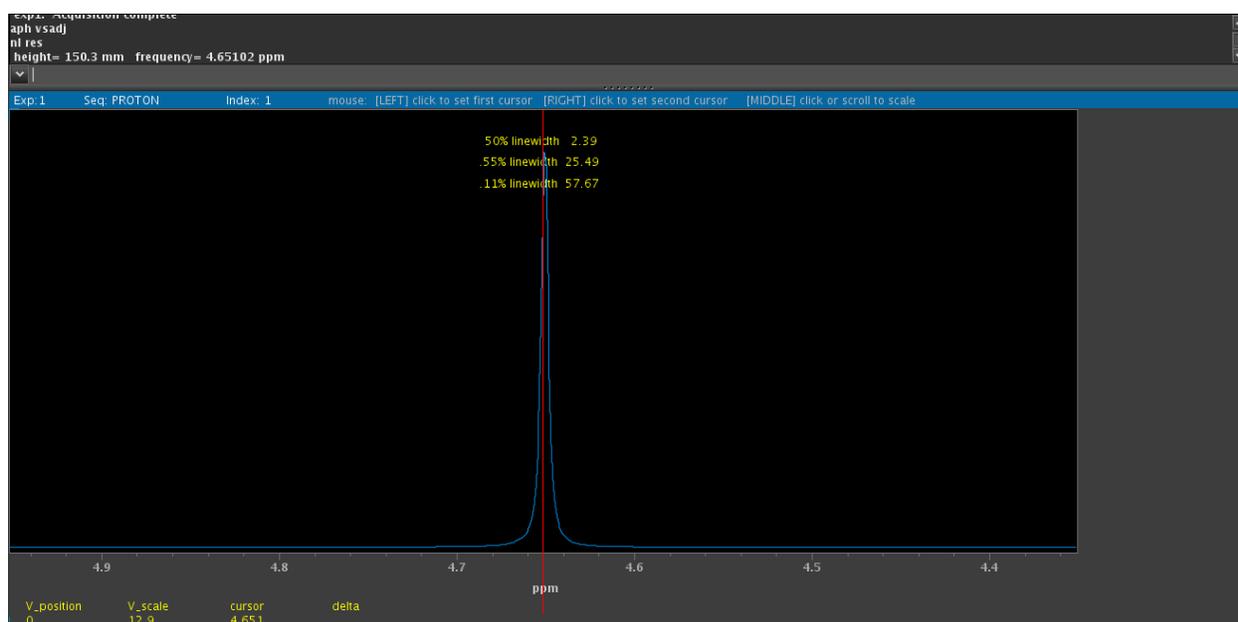
vsadj to adjust vertical scaling automatically
f full to ensure all data is visible within in the display
aph to automatically 'phase' the spectrum

You may also want to zoom in on the area containing the peak by clicking the cursor icon , setting each cursor on the left and right side of the resonance, and then clicking the 'zoom in' icon, , to zoom in on the selected area.

To determine the width of the resonance at half height, set the cursor in the center of the peak then type the following commands:

nl res

The full width of the resonance at half of its full height will then be displayed next to '50% linewidth' as shown in the image below. Before proceeding on to the next task, the water resonance should be symmetrical, and have a width no greater than 4 Hz.



The maximum strength of pulsed-field gradient is determined by on an evaluation of the width of a gradient echo profile. To set up the profiling experiment, type:

profile

The initial value of $gzlvl1$ will be set at 4000, however when finding maximum gradient strength it is important to record information at multiple values of $gzlvl1$. Typically, values obtained from $gzlvl1=2000, -2000, 4000, -4000, 8000,$ and -8000 , are sufficient to establish that the gradient pulses remain linear over the normal operating range.

Set the gzlvl1 value by typing:

gzlvl1=8000 (or any of the above values)

The spectral width will be set by default to $sw=100000$, which is large enough for gzlvl1 values of ± 2000 and ± 4000 , but not ± 8000 . When conducting a gradient strength measurement for $gzlvl1= \pm 8000$, the spectral width will need to be adjusted to 200000 Hz by typing:

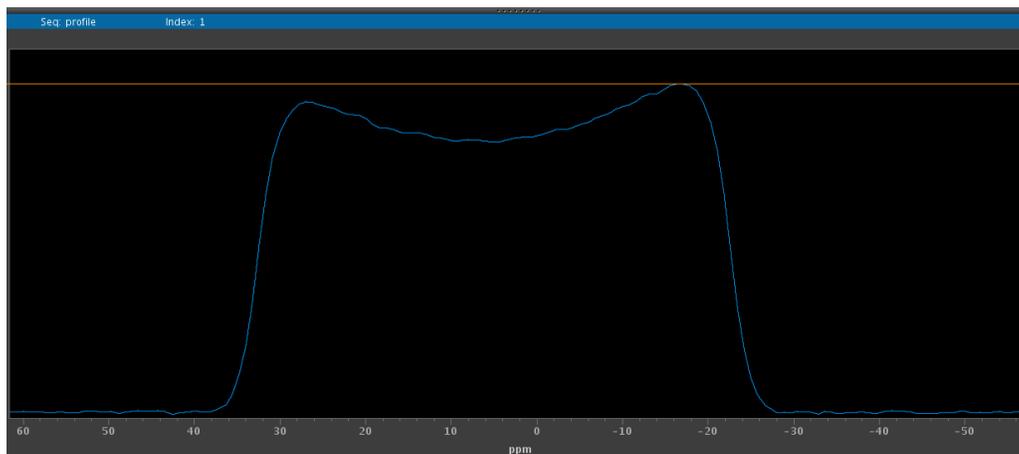
sw=200000

Start the experiment by typing:

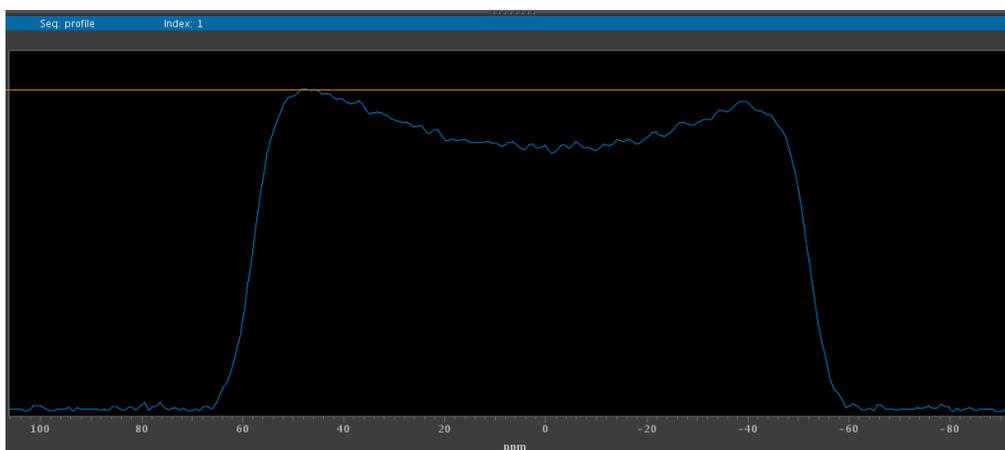
ga

A broad resonance like the one shown below will appear. Zoom in on the area using the same commands provided to zoom in on the single proton peak above. Fully expanding the viewing area by zooming in is important in order to minimize error in the width measurement. Click the threshold icon  and the horizontal threshold line will appear on the display. Move the threshold line to the topmost point on the spectrum by clicking and dragging the line.

The image below shows the threshold line at the top most point when $gzlvl1=-2000$. At $gzlvl1$ values of ± 2000 the resonance is fairly smooth, so the the threshold line can be easily placed.



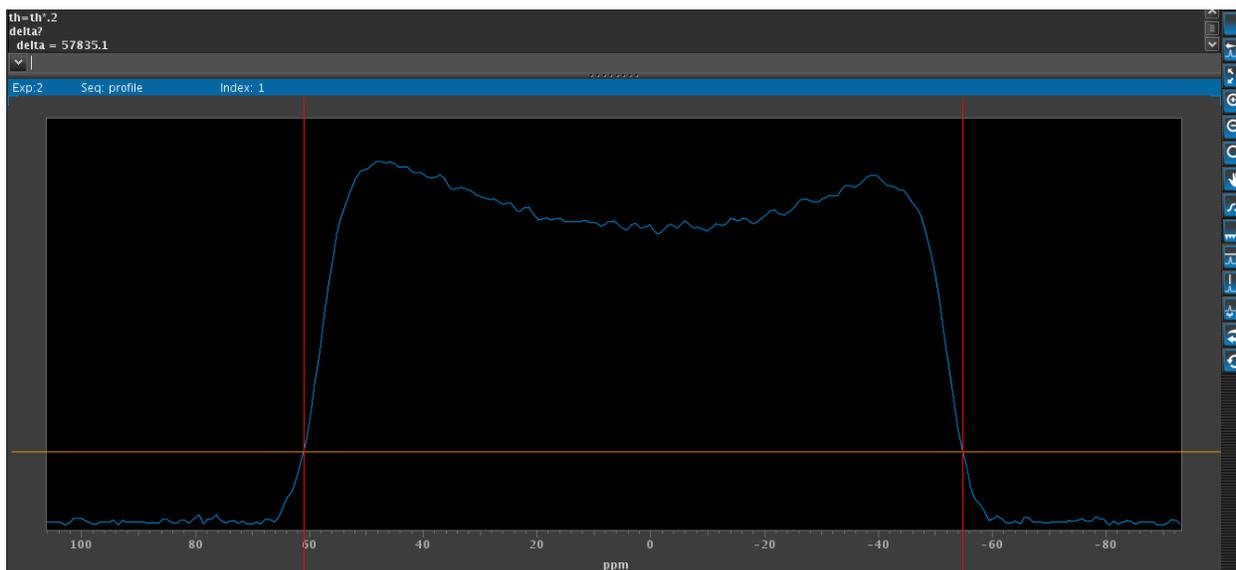
This image (below) shows the threshold line at the topmost point when $gzlvl1=8000$. At higher $gzlvl1$ values, the visible spectral noise increases. This can make setting the maximal height of the resonance more challenging. Set the threshold line by making a best estimate of the true maximal height.



With the threshold line in place, type the following command:

th=th*0.2 to move the threshold line to 20% of the full height

Then, click the cursor icon . Two red vertical lines will appear on the display. Use the left mouse button to click and drag the left cursor line, and the right mouse button to move the right cursor line. Place both cursors at the point of intersection between the resonance and the threshold line as shown in the below image.



Now type:

delta?

Then, record the delta value along with the set gzlvl1 value. To execute the 'setgcal' macro type:

setgcal

The macro will prompt you to input the values required to calculate gcal in the following order:

What is the size of the object (cm)? **1.6**
What is the freq. spread (Hz)? **delta value**
What is the gradient value (dac#s)? **gzlvl1 value**
Set this value (y/n)? **n**
Set into text (y/n)? **n**

The macro calculates the value of the maximal gradient strength in units of Gauss per cm per DAC unit in a value named gcal; record the value of gcal.

To obtain this value in units of Gauss per cm per DAC (G/cm/DAC) multiply the gcal value by 32767, which is the maximum DAC value) to convert to Gauss. Type:

r1=(gcal value)*32767
r1?

Record the value of r1, which is the maximal pulsed-field gradient strength in Gauss/cm.