Good work!

CH-314 Structural Analysis
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Jigsaw 3D

1. [Keeler Section 4.8] In a simple pulse-acquire experiment to determine a pulse length, an operator observed a positive signal for pulse lengths of 5 and 10 µs. As the pulse was lengthened further the intensity decreased, went through a null at 20.5 µs and then became negative.

   a. Explain what is happening in this experiment.

   At the beginning the spin was in the z direction, therefore, no signal was emitted
   When applying a pulse with the lengths of 5 µs and 10 µs the spin isn't on the z axes anymore and a positive signal is shown.
   However, when a pulse of lengths 20.5 µs is applied, the spin turns 180° which means that it is on the z axis causing no signal to be emitted.

   b. Use the data to determine the RF field strength in Hz and in rad·s^{-1}.

   $$\omega_1 = \frac{\pi}{t_{180}} = \frac{\pi}{20{,}5\cdot 10^{-6}} = 153248{,}4 \text{ rad}\cdot\text{s}^{-1} \qquad f = \frac{\omega}{2\pi} = 24390{,}2 \text{ Hz}$$

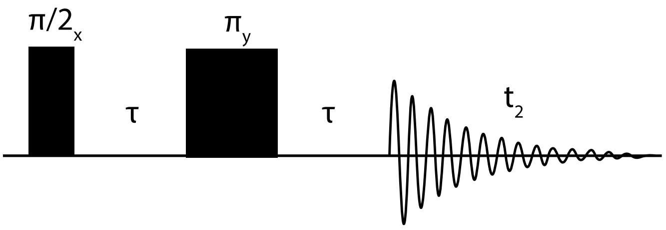
   c. Find the length of a 90° pulse.

   $$\frac{20.5}{2} = 10{,}25$$

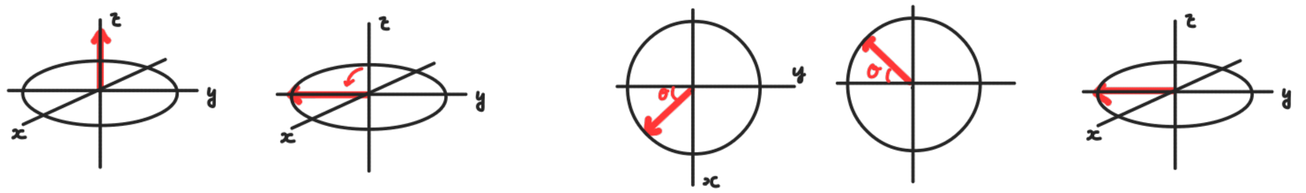
   d. At what pulse length will the next null be observed?

   $$2 \cdot 20{,}5 = 41 \mu s$$

2. [Keeler Section 4.9] The spin echo sequence is shown below. *See also: Jigsaw 3A.2*

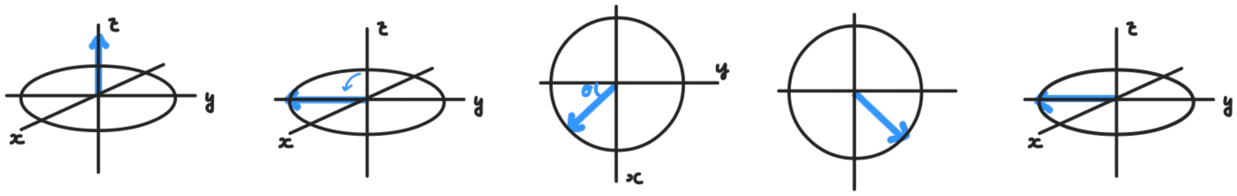


   a. Use vector diagrams to show what happens during the spin echo sequence.



   b. In what way does the result differ from a spin echo in which the 180° pulse is about the x-axis? Without drawing up further detailed diagrams, state what the effect of applying the refocusing pulse about the x-axis would be.

(“without drawing up further diagrams”)



Not quite….in your example, the spin rotates about 45° CCW during the second τ period. After the πx pulse, it would then rotate another 45° CCW during τ, ending up on the +y-axis (as opposed to the -y-axis with a πy pulse)

Excellent!