Instituto Tecnológico y de Estudios Superiores de Monterrey

MRI activity

BI2009B Procesamiento de imágenes médicas para el diagnóstico (Gpo 201)

Equipo #4

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RF effect

- Open the simulator:

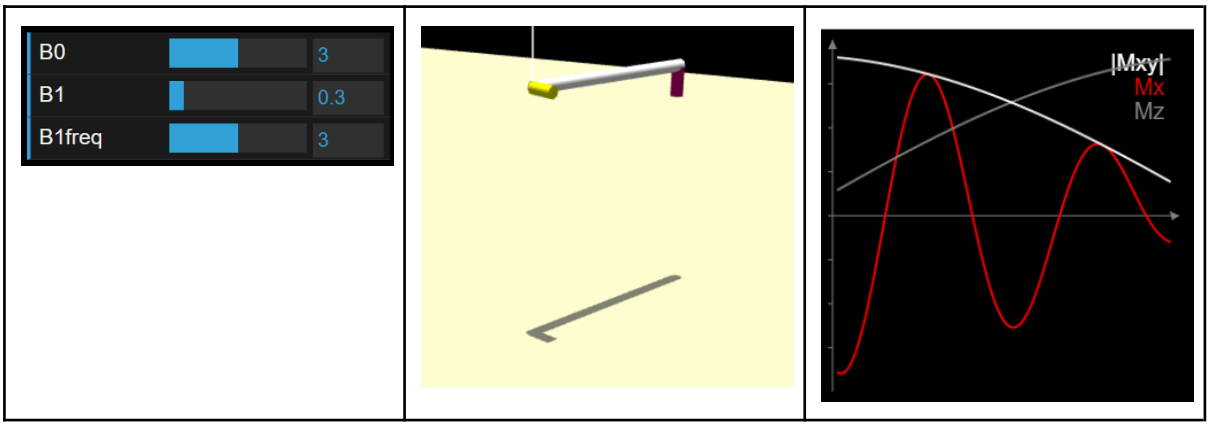
https://www.drcmr.dk/BlochSimulator/

- You start by looking at the magnetization of a sample represented with a gray bar. To begin with the activity, be sure to apply the respective conditions and fame.

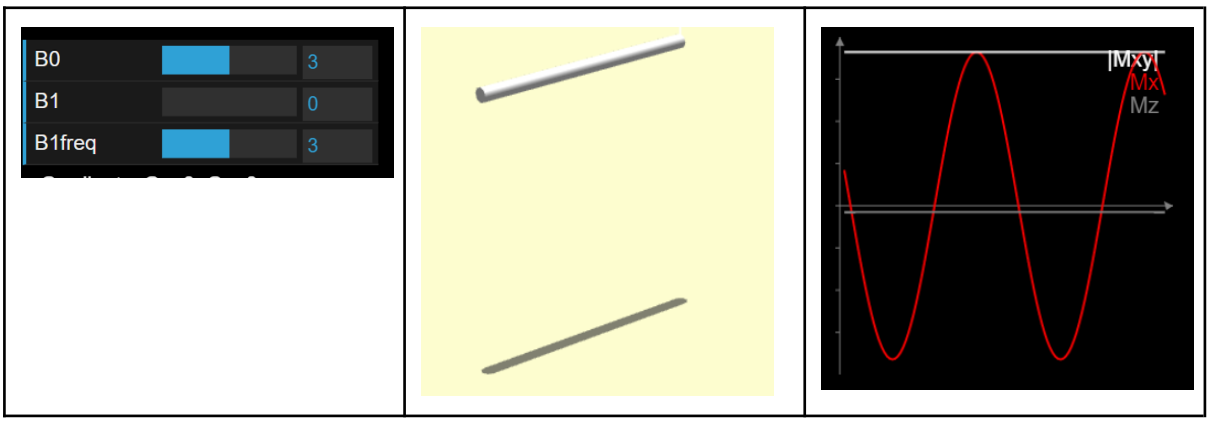
The effect is not too strong because the frequency of B1 is not the resonant frequency. Change the value of B1freq until the torque points towards only one direction. Once you find the appropriate frequency, register it for your report.

B1freq = 3

Click on Field and be sure B0 is on 3T, let B1freq in any value. Then put B1 in 0.3 and look at the effect on the magnetization (gray bar).



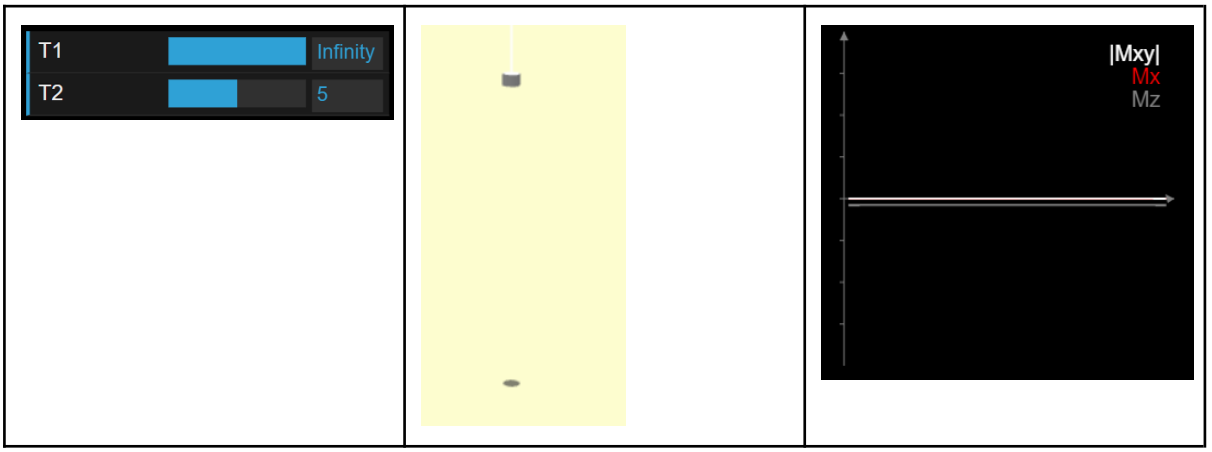
Once you have a strong signal (the length of the shadow in large) turn off B1.



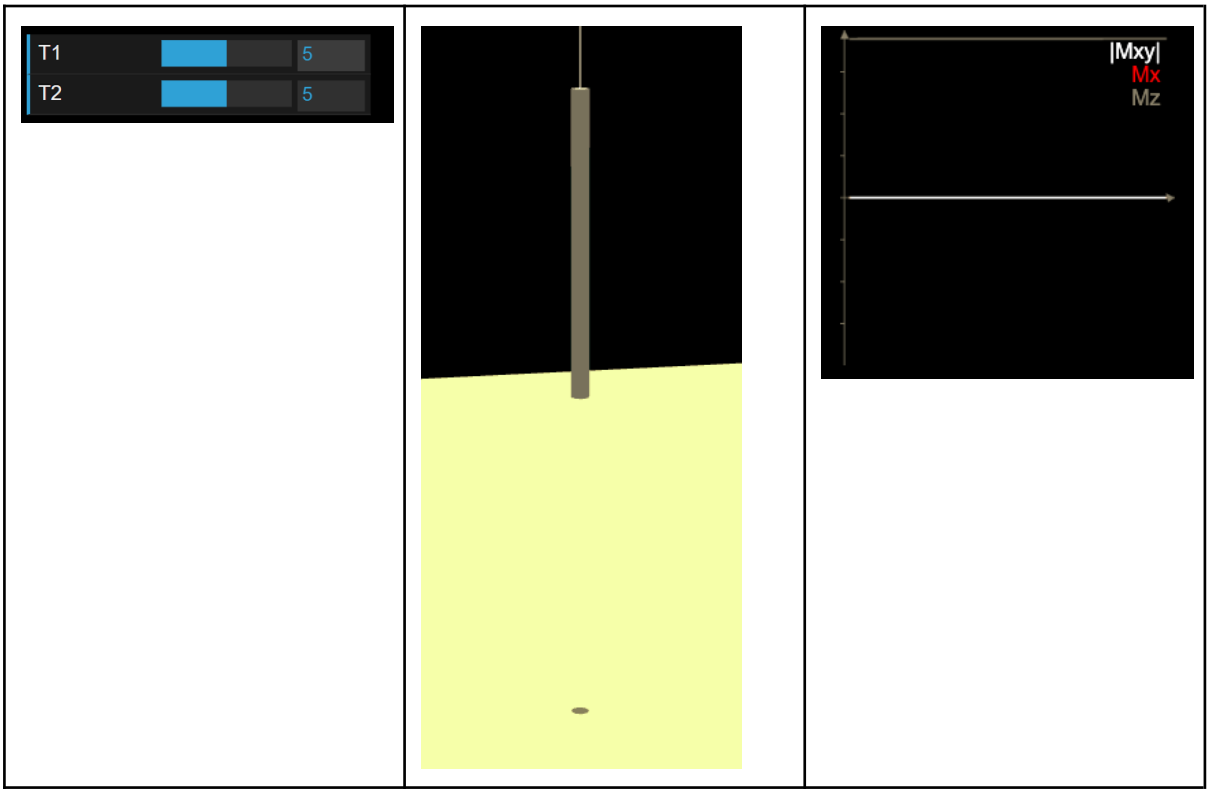
Until now, you explored the effect that the transversal field has on magnetization. Now you should return it to equilibrium. For doing so, you need to change the relaxation times.

First look at the effect of the T2 relaxation time.

Click on Relaxation and change T2 to 5 seconds.



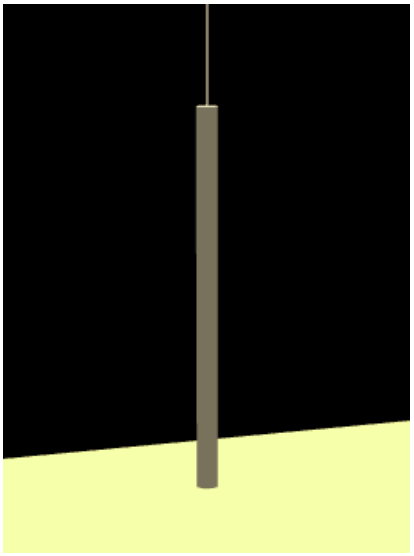
Now change T1 to 5 seconds.
Observe how it returns to the equilibrium state.



T2 efecto transversal
T1 efecto longitudinal

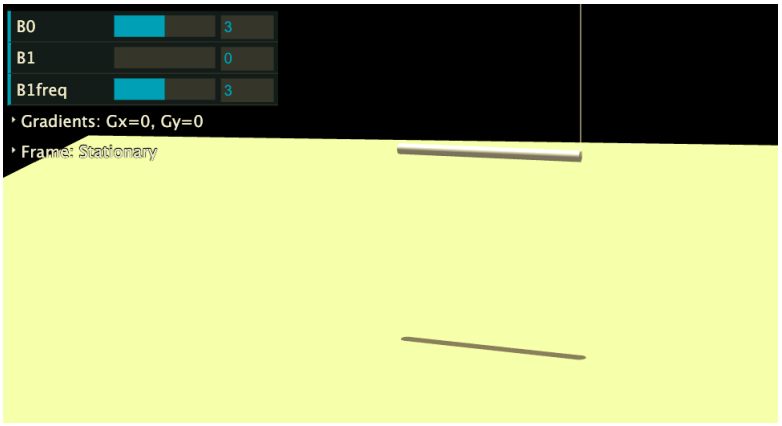
Complete process

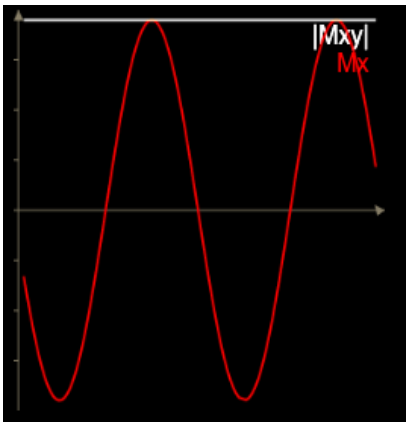
Start in the equilibrium



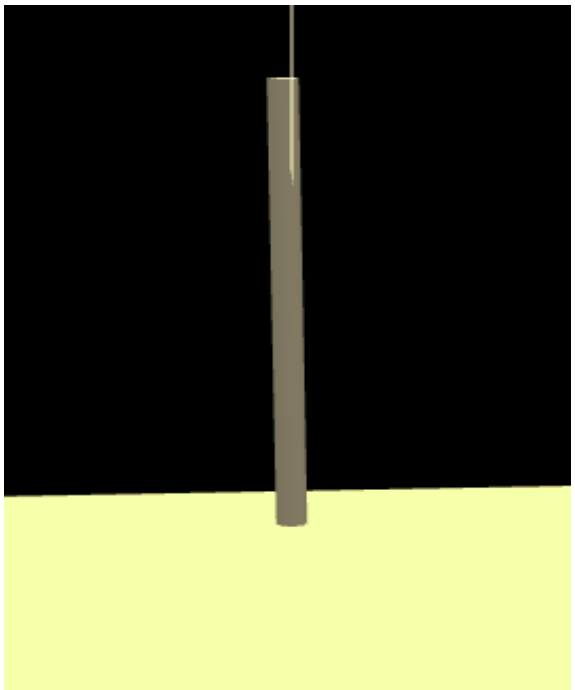
Turn on B1 and set the resonant frequency

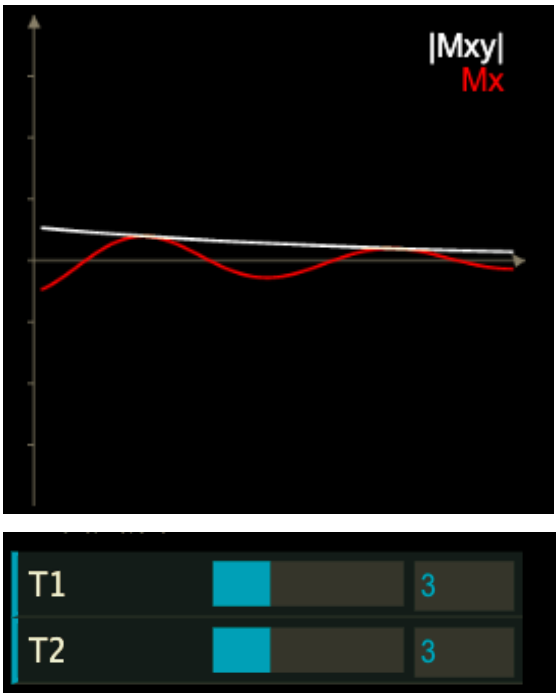
When you obtain a strong signal, turn off B1

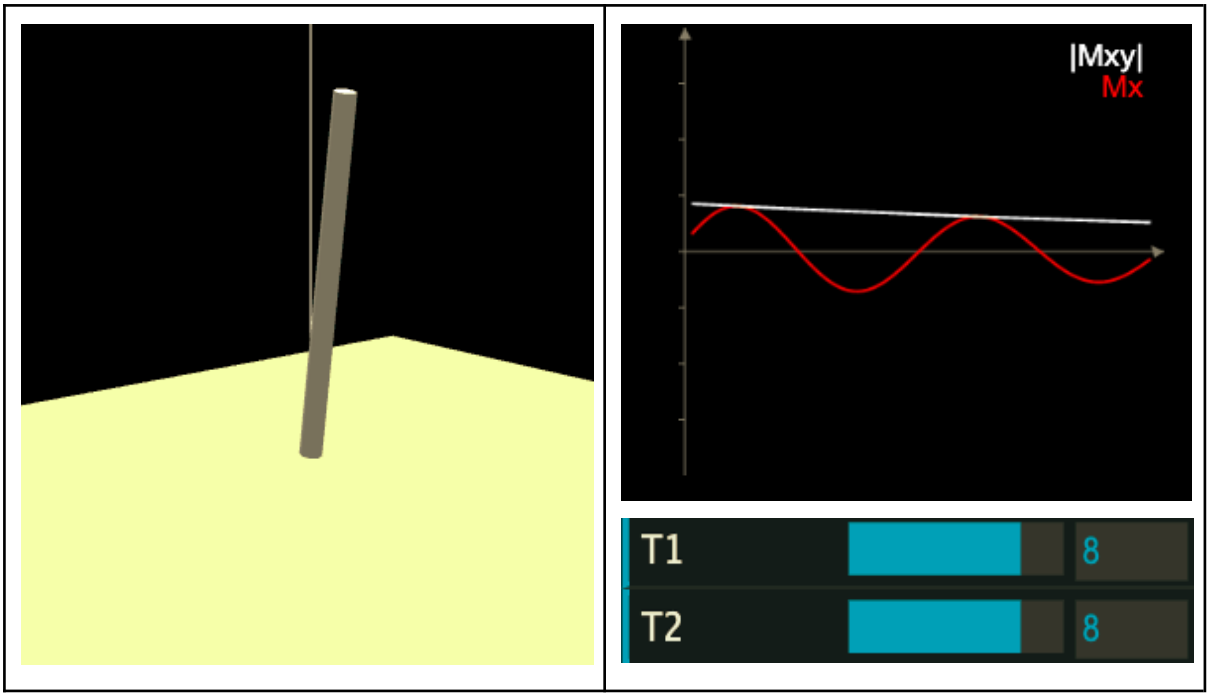




Use different relaxation times and observe the effect when changing the frames of reference from Stationary to B0 and again to Stationary as many times as you need to understand the process (at least once).





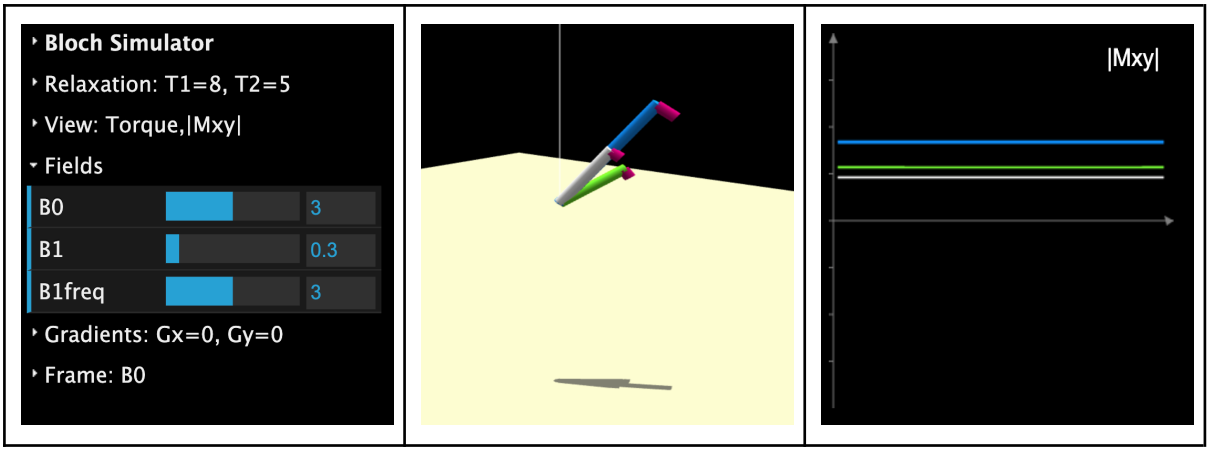


Al cambiar los tiempos de relajación se observa como con un tiempo de 8 la magnetización tarda más en llegar al equilibrio, mientras que con un tiempo de 3, esto es más rápido.

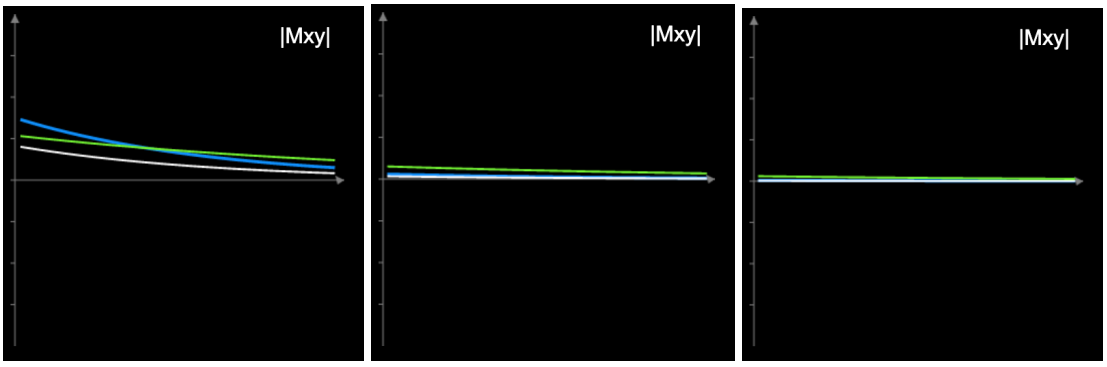
Different Tissues

Change the mode to Mixed matter. You are going to see the magnetizations corresponding to samples of different tissues with different colors. At the beginning all of them are together so you can't differentiate them.
Now repeat the process that you previously learned and observe how the magnetizations of the different tissues respond differently (Take evidence with ss). Explain in your report the differences (signal's strength and time) between the magnetizations referring to them by colors:

Las señales tienen diferentes intensidades, siendo el tejido azul el que presenta mayor magnetización y el verde el de menor magnetización



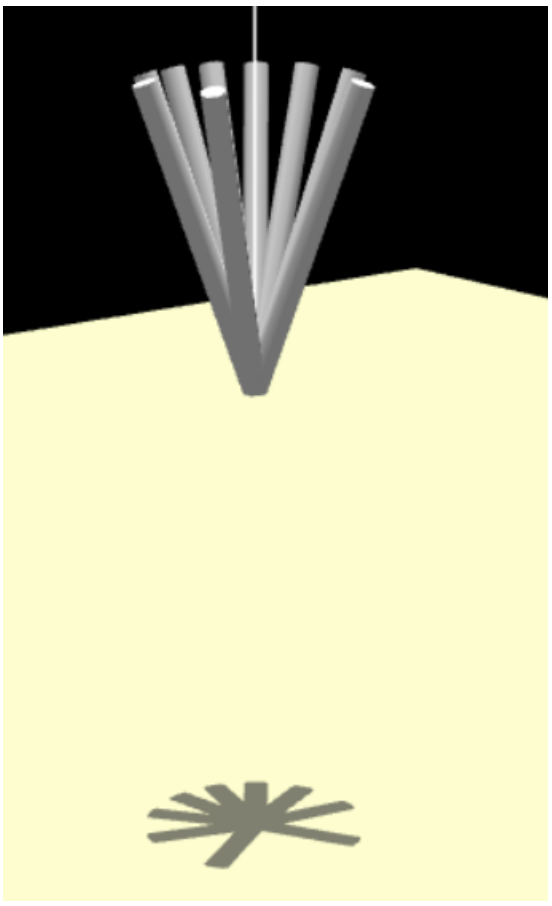
Cuando se apaga B1, el tiempo que tardan los tejidos en regresar al equilibrio es distinto. Se observa que la señal del azul, cuya magnetización es más fuerte,decae más rápido que las otras dos.



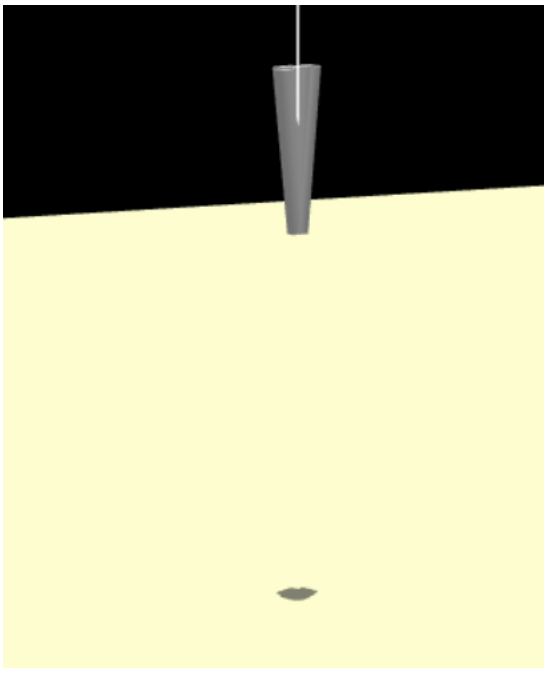
Spin Echo

- Now you are going to explore spin-echo and with it the dephasing effect.

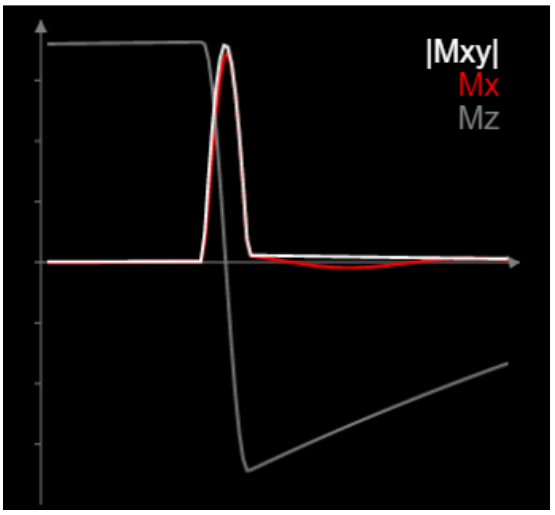
- Start with the specifications of the image. Note that Inhomogeneity mode was chosen. The commands in the bottom allow you to apply a quick pulse of 90° in the x-direction and 180° in the y-direction.



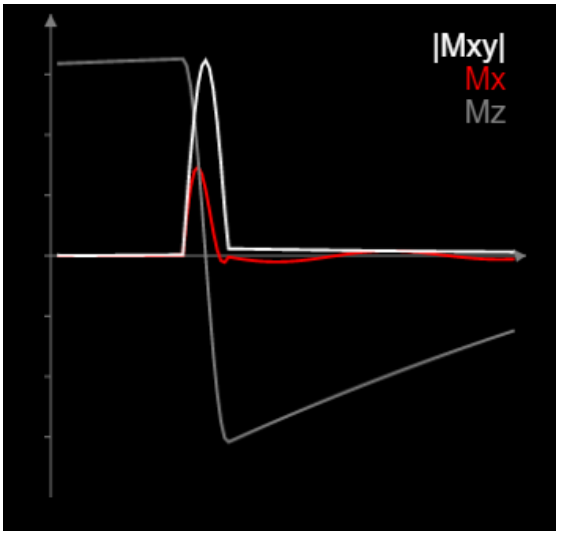
- After the magnetizations are dephased and they start to return to the equilibrium state apply a 180°y pulse.



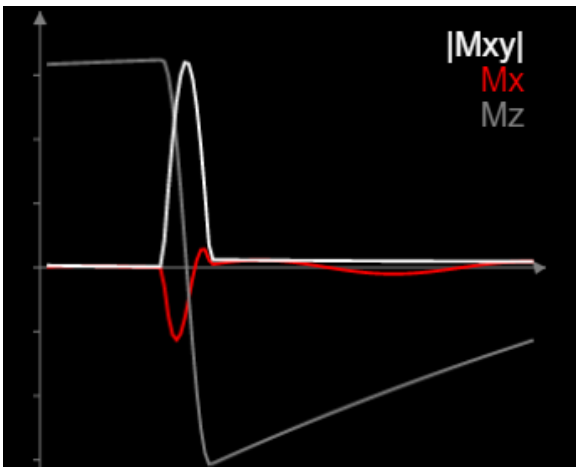
Cambio de 90° en x a 180° en y en B0 frame



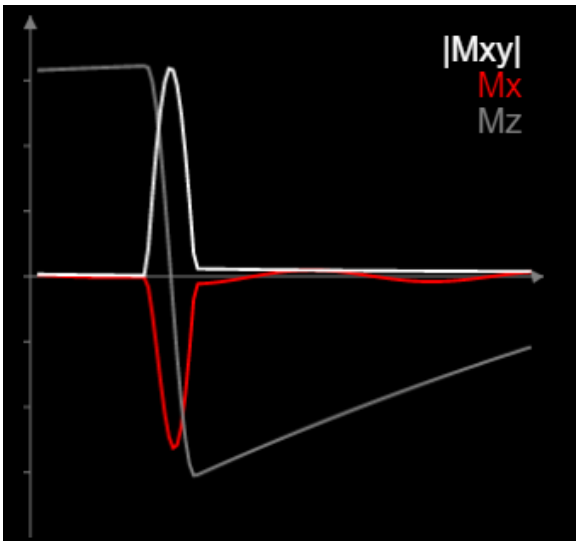
Cambio de 180° en x a 90° en y en B0 frame



De 90° a 180° en frame stationary



De 90° a 180° en frame B1



En las imágenes anteriores se observaron los ecos producidos al cambiar los pulsos de 90° en x a 180° y, y viceversa.

En la siguiente tabla podemos notar distintos ecos al usar distintas especificaciones como lo son cambios en B0,B1,T1,T2.

Ecos al usar distintas especificaciones (B0,B1,T1,T2)