LAST TIME

TALKED ABOUT $\Gamma_2$ DECAY.

TWO EFFECTS:

(a) SIGNAL LOSS BY $e^{-\frac{\Gamma_2}{T_2}}$

(b) DEPHASING BY $e^{-\frac{k_d}{T_2}}$

(BLURRING IN READOUT)

TALKED ABOUT OFF RESONANCE SOURCES:

(1) MAIN MAGNET NOT A BIG DEAL

(2) MAGNETIC SUSCEPTIBILITY

(3) CHEMICAL SHIFT

1) INHOMOGENEITY IN A VOLUME LEADS TO DEPHASING AND SIGNAL LOSS.

\[
\begin{align*}
S(t) &= \int_{\text{Voxel}} m_y(r_0) e^{i \omega_e (t^2)} e^{-\frac{t}{T_2^*}} d\mathbf{r} \\
&= \left[ \int_{\text{Voxel}} m_y(r_0) d\mathbf{r} \right] e^{-\frac{t}{T_2^*}} \\
&= \frac{1}{T_2^*} + \frac{\gamma}{T_2'}
\end{align*}
\]
Gradients act as $E_x$ source.

$E_x$ source

No signal

Capillaries
During readout

\[ k_2(b) = \frac{6}{\pi} \delta_x (b-TE) \]

And

\[ b = \frac{k_2}{\frac{6}{\pi} \delta_x} + TE \]

The inverse magnetization is

\[ m_{xy}(r, t) = m_{xy}(r, 0) e^{-i\omega (r^2) t - \frac{t}{T_2}} e^{-i\pi k_2(b) t} \]

Neglecting \( T_1 \) and substituting for \( b \).
Off-resonance (not in spin-warp (DWFT)) modest spatial distortions (few-pixels) relatively benign artifact reduced with large $\gamma$

Chemical Shift

$$\frac{\omega_f}{\omega_H} = \frac{\omega_w}{\omega_H} - 200 \text{ Hz} \quad \text{in } 15T$$

Fat image is displaced from water

In practice, fat/water shift limited to 1 voxel limit and length.

$\text{in } 15T$

$$\frac{1}{T_2 (\text{water})} = 9.1 \text{ ms} \text{ and time}$$

Typical: 8 ms.