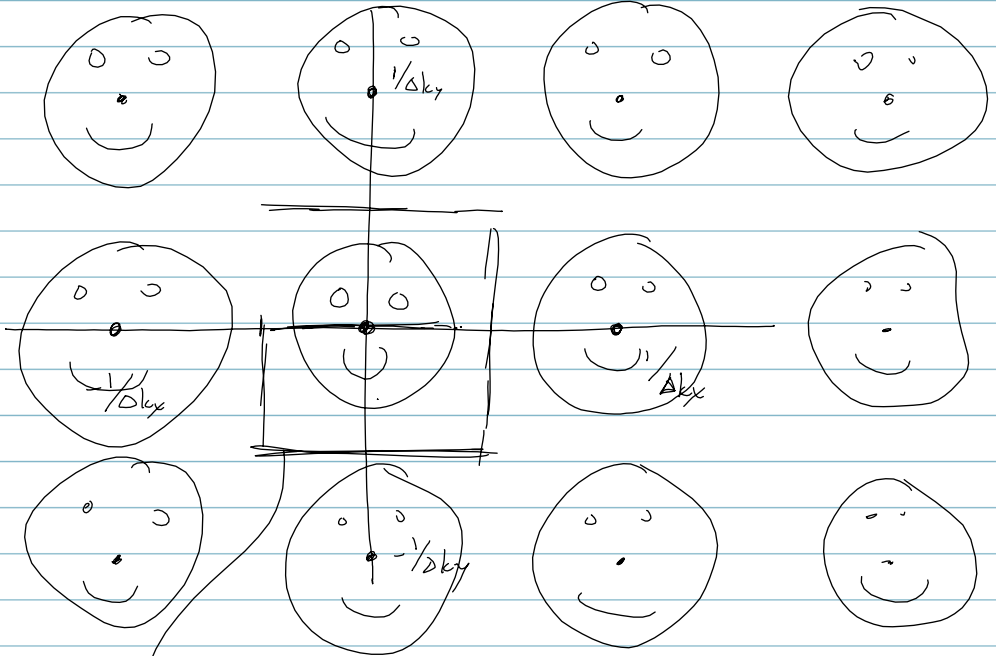


Effects of Sampling in k-space

① Replication

$$m(x,y) ** \sum \sum (\Delta k_x, \Delta k_y)$$



unaliased field of view

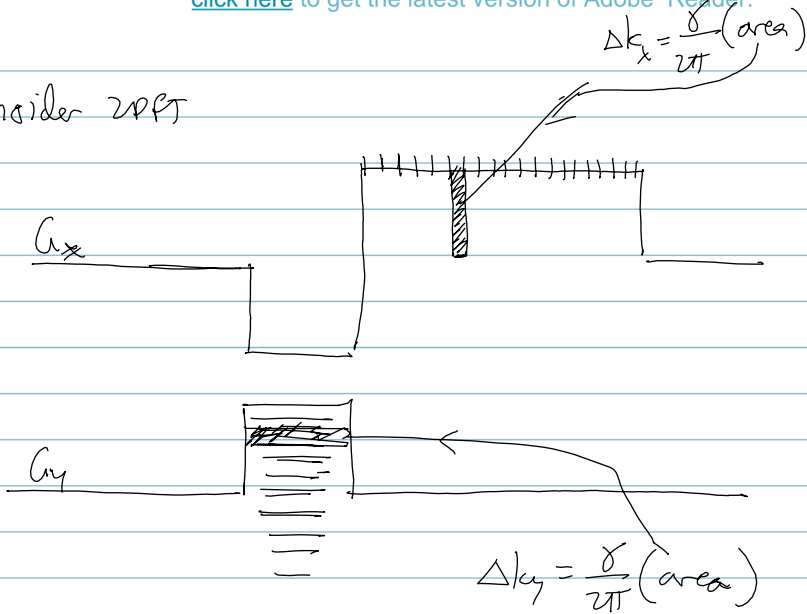
$$FOV_x = \frac{1}{\Delta k_x}$$

to avoid aliasing
→ width_x

$$FOV_y = \frac{1}{\Delta k_y}$$

> height_y

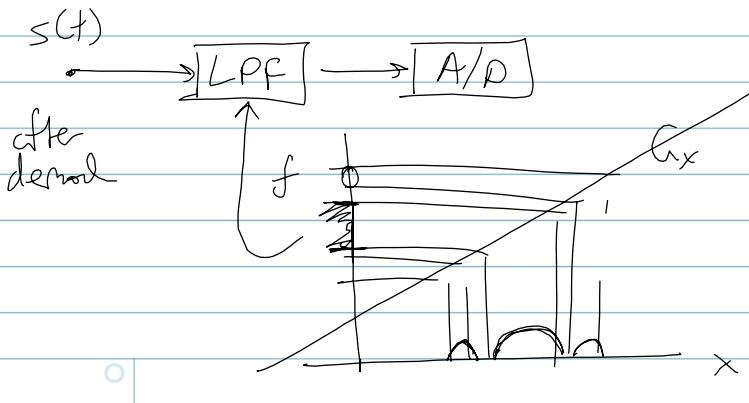
consider ZFFT



$$\Delta k_x$$

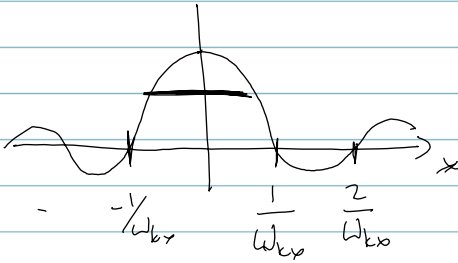
$$\Delta k_y$$

Avoiding aliasing in the x direction



② Blurring

$$m(x,y) \star \underbrace{\text{sinc}(\omega_{kx} x)}_{\text{main lobe}} \underbrace{\text{sinc}(\omega_{ky} y)}_{\text{main lobe}}$$



impacts spatial resolution

"convolution"

$$\text{main lobe width} \approx \frac{1}{\omega_{kx}}, \frac{1}{\omega_{ky}}$$

spatial resolution

$$\delta_x \triangleq \frac{1}{\omega_{kx}} \quad \delta_y \triangleq \frac{1}{\omega_{ky}}$$

Limits to Resolution

T_2 decay, gradient $\neq G/cm$

↑
limit-resolution time

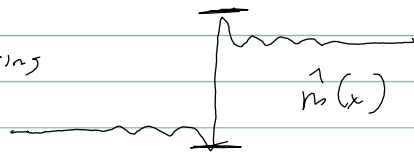
- Fundamental limits:
- 1) $SNR \propto \text{voxel size}$
 - 2) diffusion of spins

Truncation artifacts

* sinc




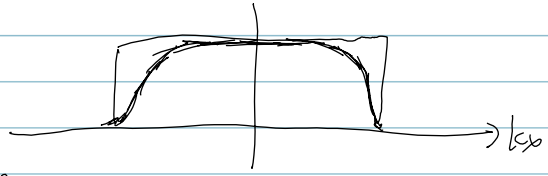
Gibbs ringing



avoid

- 1) improve resolution
- 2) apply a window

 $\left(\frac{kx}{W_{kx}} \right) \rightarrow$ hamming
hanning
kaiser bessel $\left(\frac{x}{W_{kx}} \right)$



tradeoff
lose spatial resolution