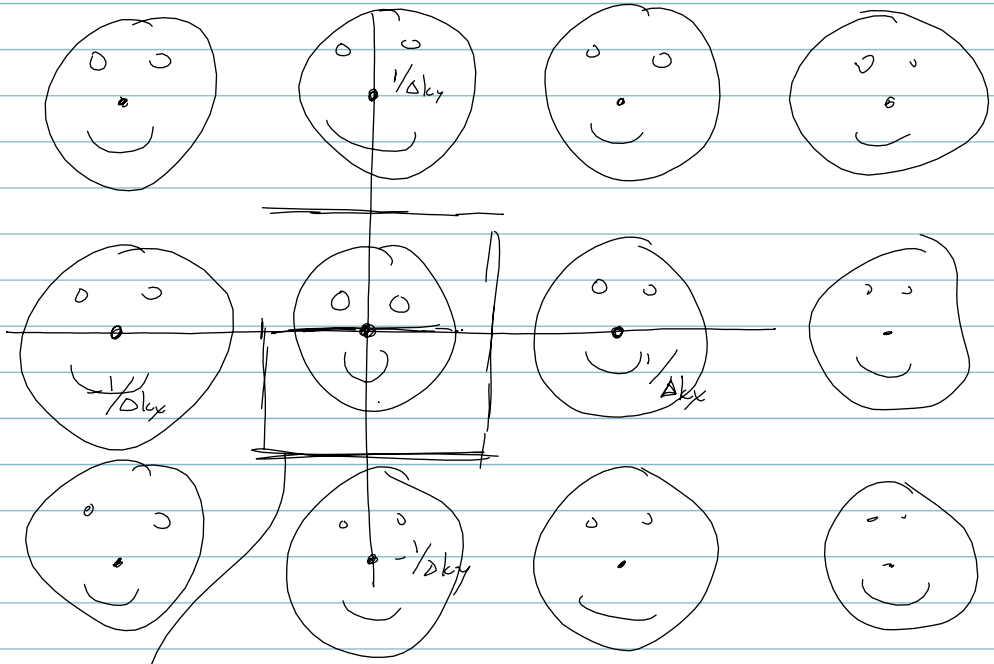
Effects of Sampling in k-space

(1) Replication

$m(x,y) \ast\ast \text{III}(\Delta k_x x, \Delta k_y y)$



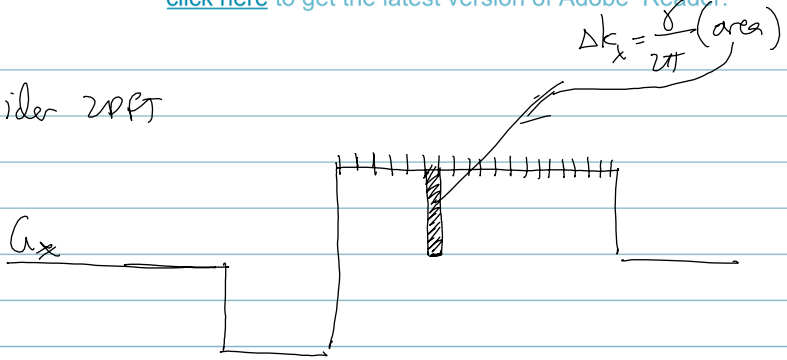
unaliased field of view

to avoid aliasing

$FOV_x = \frac{1}{\Delta k_x} > \text{width}_x$

$FOV_y = \frac{1}{\Delta k_y} > \text{height}_y$

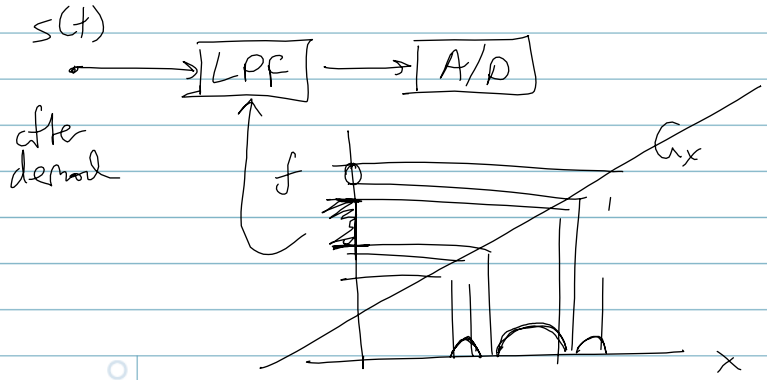
consider 2PFT



Δk_x

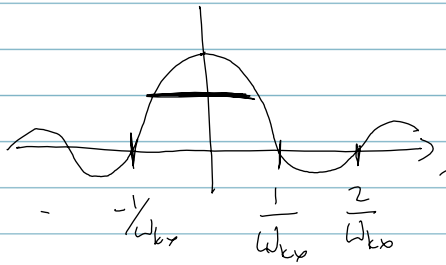
Δk_y

Analysis aliasing in the x direction



② Blurring

$$m(x,y) ** \text{sinc}(W_{kx} x)\,\text{sinc}(W_{ky} y)$$



Impacts spatial resolution

convolution

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

spatial resolution

$$\delta_x \triangleq \frac{1}{W_{kx}} \qquad \delta_y \triangleq \frac{1}{W_{ky}}$$

Limits to Resolution

T_2 decay, gradient 4 G/cm

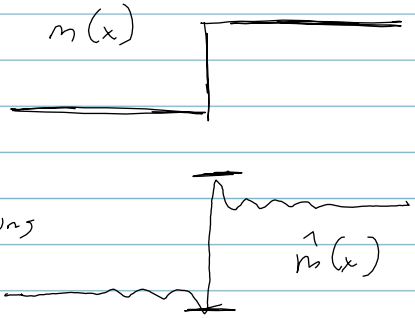
↑ limit readout time

Fundamental limits: 1) SNR ∝ voxel size

2) diffusion of spins

truncation artifacts

* sinc

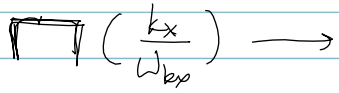


Gibbs ringing

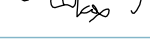
avoid

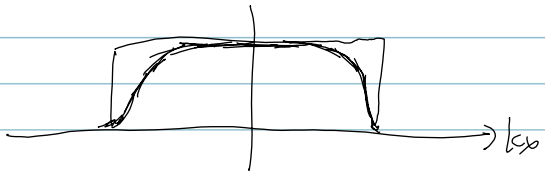
1) improve resolution

2) apply a window



hamming
hanning
kaiser bessel





tradeoff

wase spatial resolution