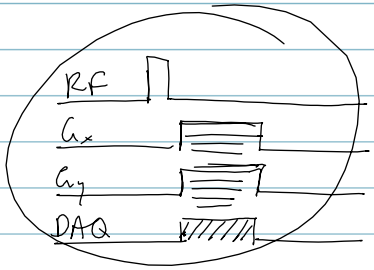
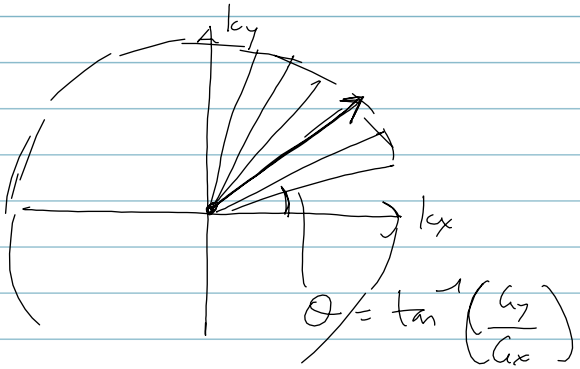
2D imaging

design $G_x(t)$, $G_y(t)$ to adequately cover k-space

① Projection Reconstruction (PR)





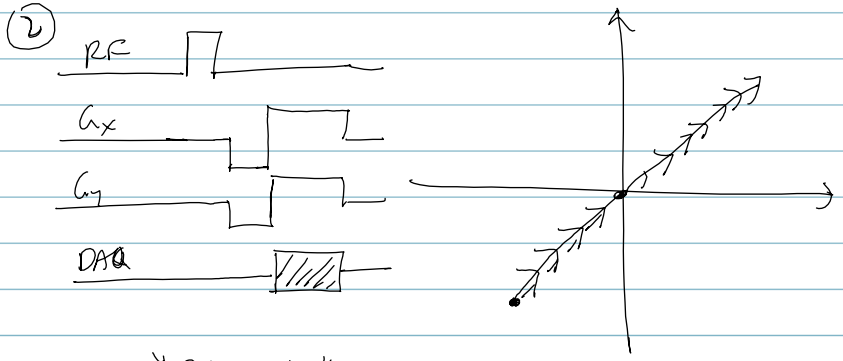
$G_x = G\cos\theta$

$G_y = G\sin\theta$

keep $\sqrt{G_x^2 + G_y^2}$ constant $= G$

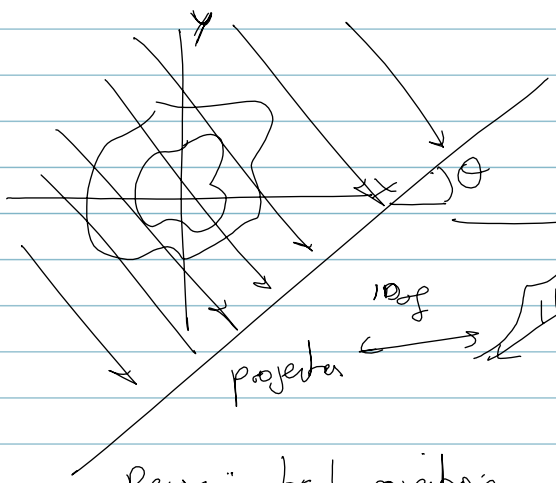
"single sided" 2D PR

②

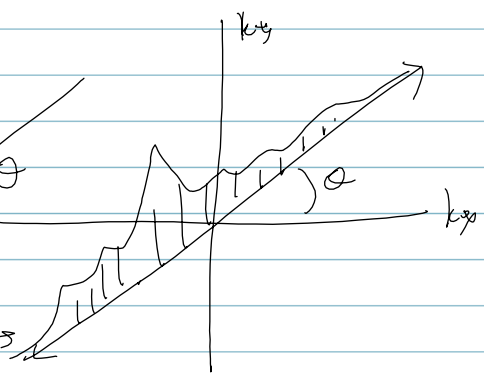


"full spoke" 2DPR

Reflection CST

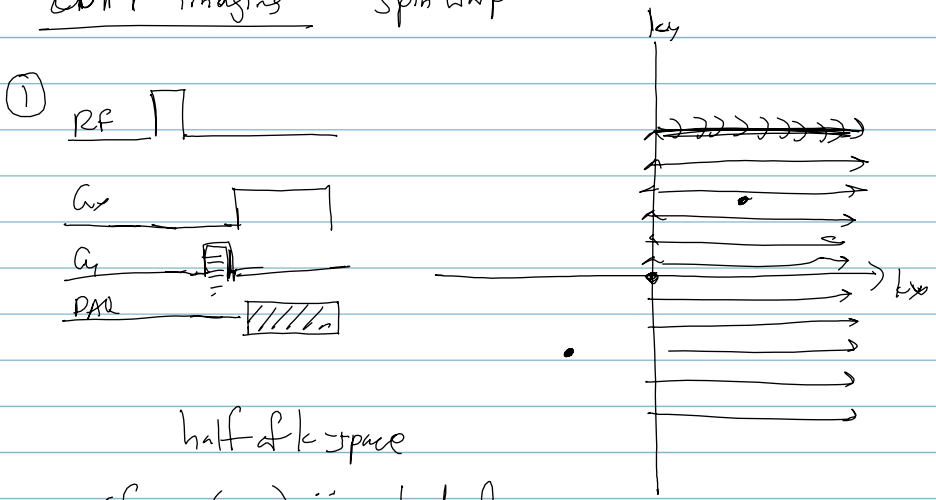


k-space



Recon: backprojection,
interpolate k-space data & FFT^{-1}

2DFT imaging "spin warp"

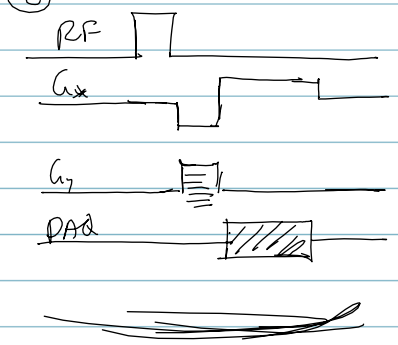


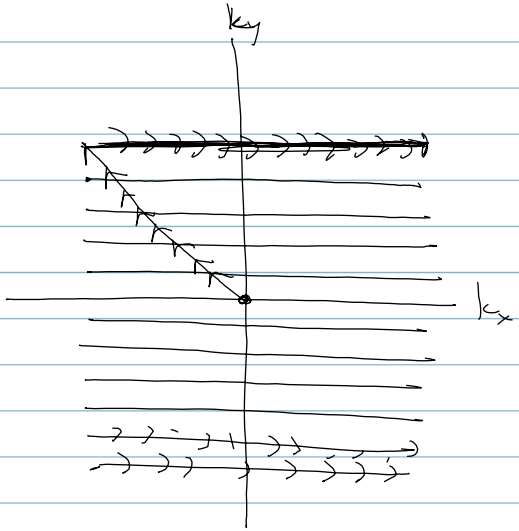
half of k-space

if $m(x,y)$ is real valued

$M(k_x,k_y)$ is Hermitian symmetric

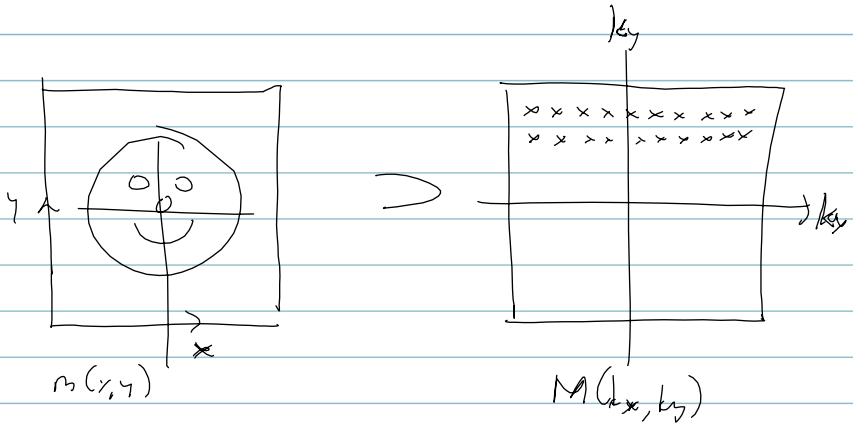
(2)





most common approach

SAMPLING CONSIDERATIONS



$m(x,y)$ $\quad\Rightarrow\quad$ $M(k_x, k_y)$

complex valued $\qquad$ complex valued

$$\hat{M}(k_x, k_y) = M(k_x, k_y)\, S(k_x, k_y)$$

sampled version

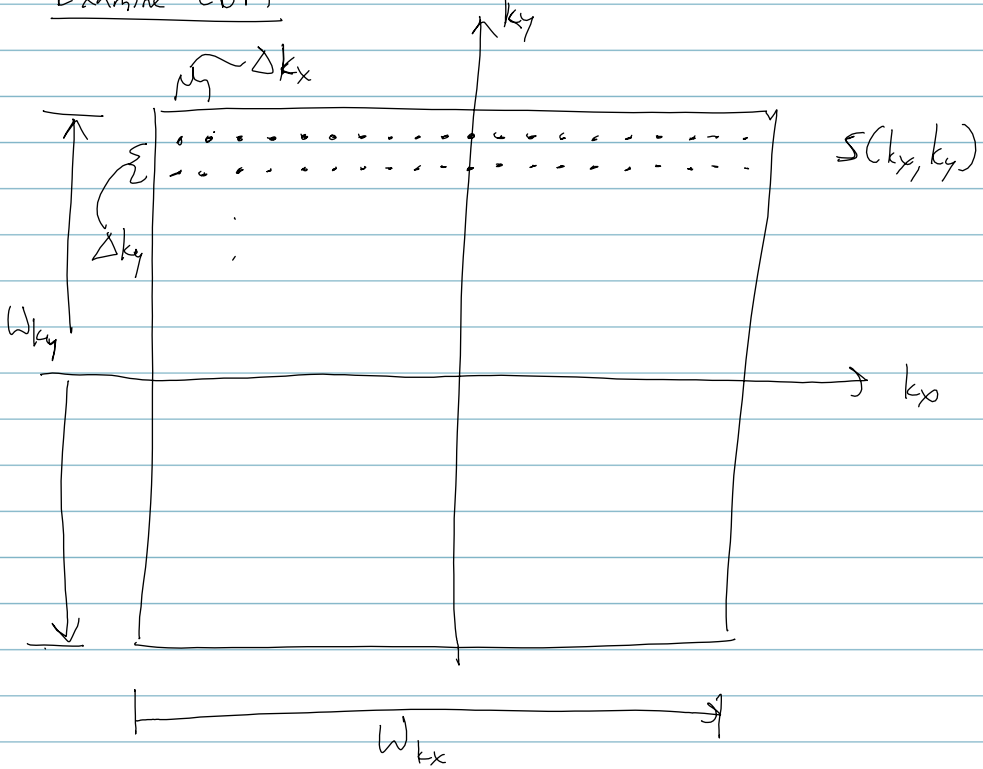
sampling function

$$\sum_j \delta(k_x - k_{xj}, k_y - k_{yj})$$

$$\hat{m}(x, y) = m(x, y) ** s(x, y)$$

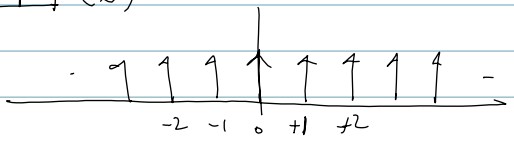
↑ true object ↑ inverse FT of sampling function

Examine 1DFT



"shah", "comb", "bed of nails"

$\text{Ш}(x)$



$$\stackrel{\Delta}{=} \sum_{k=-\infty}^{\infty} \delta(x-k)$$

$$S(k_x, k_y) = \left(\Pi\left(\frac{k_x}{\omega_{k_x}}\right) \frac{1}{\Delta k_x} \text{Ш}\left(\frac{k_x}{\Delta k_x}\right) \right) \cdot \left(\Pi\left(\frac{k_y}{\omega_{k_y}}\right) \frac{1}{\Delta k_y} \text{Ш}\left(\frac{k_y}{\Delta k_y}\right) \right)$$

$$= {}^{2}\Pi\left(\frac{k_x}{\omega_{k_{x0}}}, \frac{k_y}{\omega_{k_{y0}}}\right) \cdot \frac{1}{\Delta k_x \Delta k_y} \, {}^{2}\text{Ш}\left(\frac{k_{x0}}{\Delta k_x}, \frac{k_y}{\Delta k_y}\right)$$

extent — spacing

↓ 2nd FT

$$s(x,y) = \omega_{k_x} \omega_{k_y} \, \text{sinc}(\omega_{k_x} x) \, \text{sinc}(\omega_{k_y} y)$$

extent

$$\cdot\!\cdot\!\cdot \; \text{Ш}(\Delta k_x x, \Delta k_y y)$$

spacing

$\hat{m} = m \cdot\!\cdot\!\cdot s$