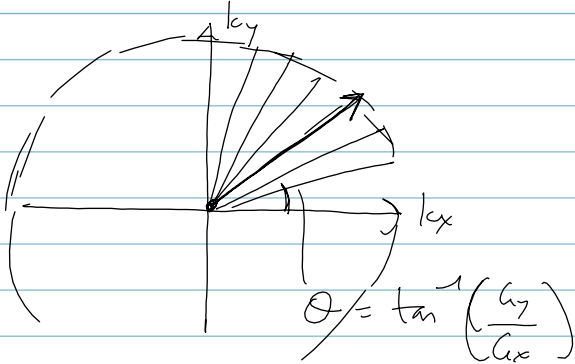
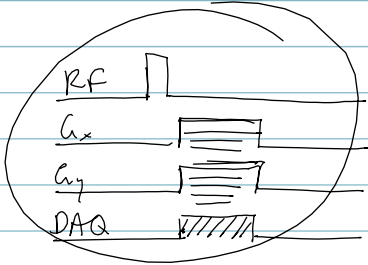


## 2D imaging

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

### ① Projection Reconstruction (PR)

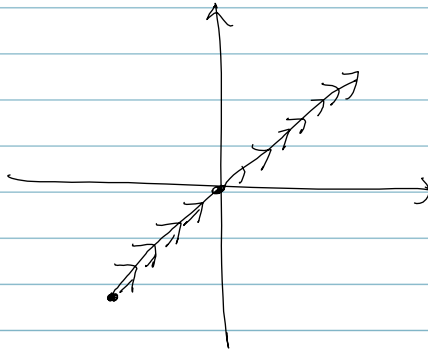
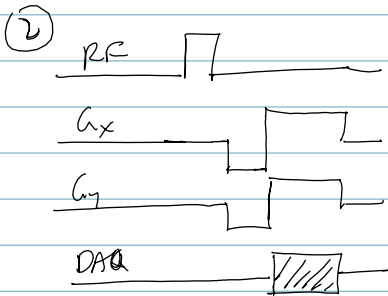


$$\checkmark \quad G_x = G \cos \theta$$

$$G_y = G \sin \theta$$

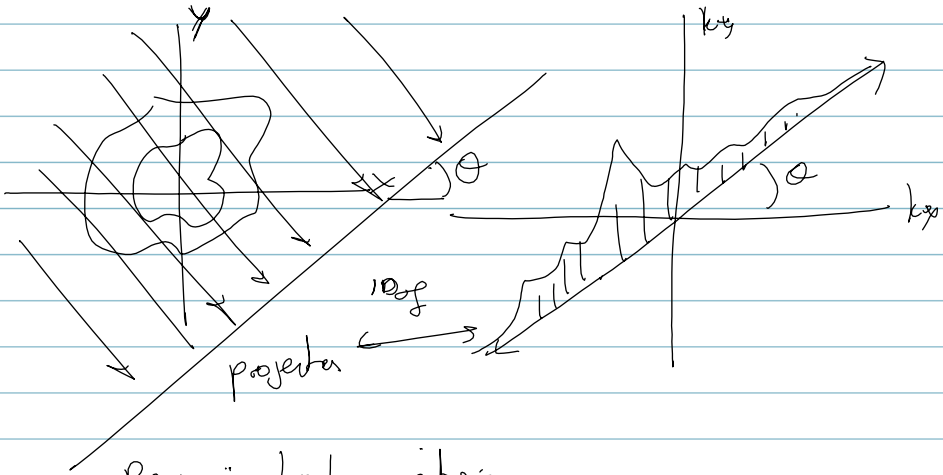
"single sided" 2D PR

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



"full spoke" 2D PR

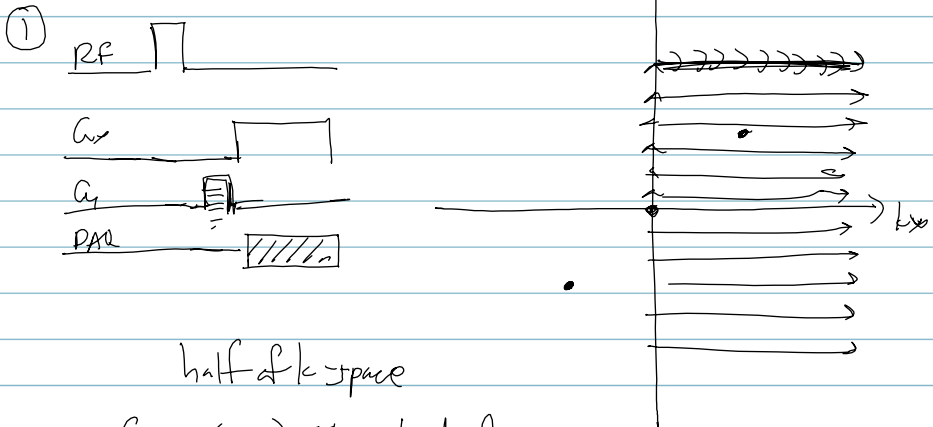
### Reflect on CST



Recall: back-projection,

interpolate k-space data &  $\mathcal{F}^{-1}$

### 2DFT imaging "spin warp"

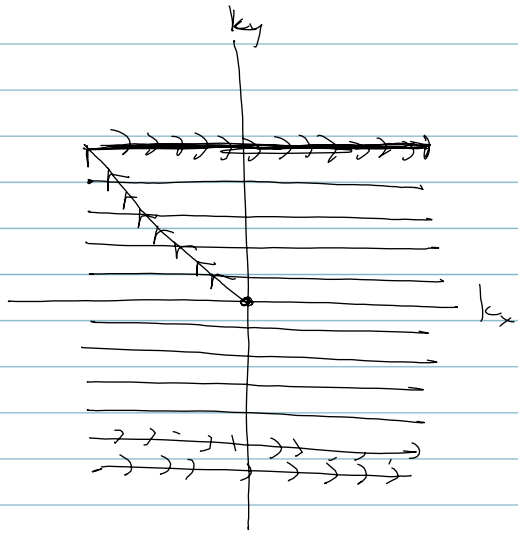
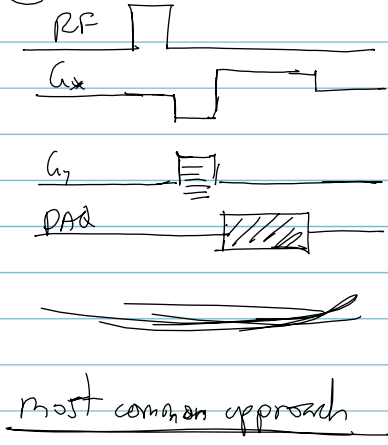


half of k-space

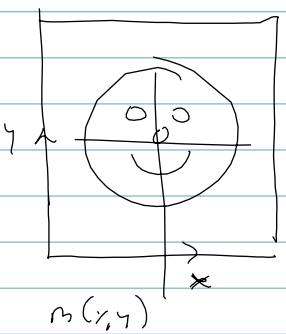
if  $m(x, y)$  is real valued

$M(k_x, k_y)$  is Hermitian symmetric

②

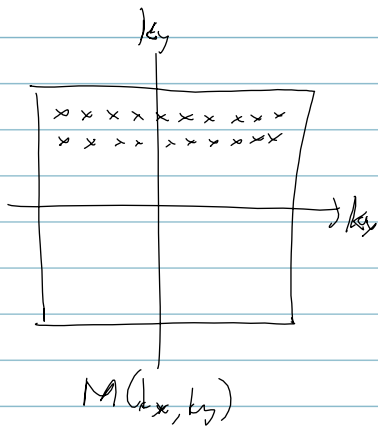


SAMPLING CONSIDERATIONS



complex valued

>



complex valued

$$\hat{M}(k_x, k_y) = M(k_x, k_y) \underbrace{S(k_x, k_y)}_{\text{Sampling function}}$$

sampled version

Sampling function

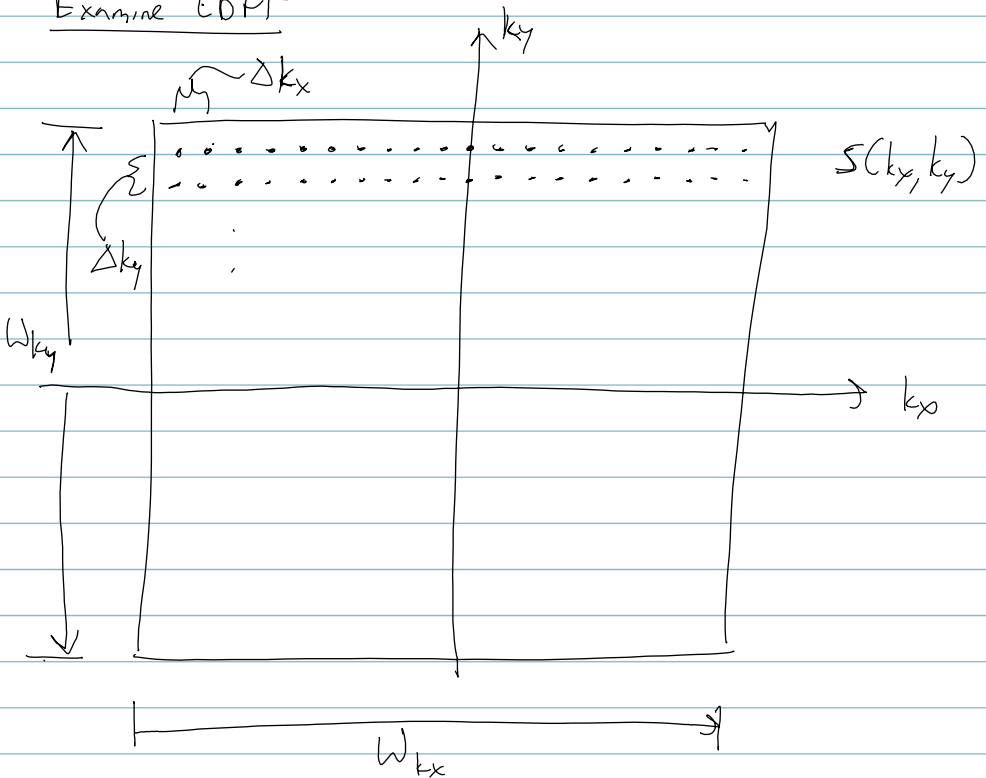
$$\sum_j \delta(k_x - k_{xj}, k_y - k_{yj})$$

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

↑  
true object

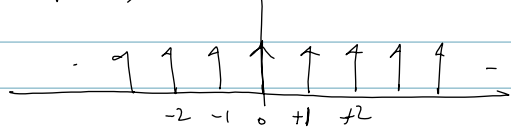
↑  
inverse FT of sampling function

Examine 2DFT



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

$\text{III}(x)$



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

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

$$= \underbrace{\prod \left( \frac{k_x}{\omega_{k_x}}, \frac{k_y}{\omega_{k_y}} \right)}_{\text{extent}} \cdot \frac{1}{\Delta k_x \Delta k_y} \underbrace{\text{III} \left( \frac{k_x}{\Delta k_x}, \frac{k_y}{\Delta k_y} \right)}_{\text{spacing}}$$

$\downarrow \text{inv FT}$

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

$$\underbrace{\text{III}(\Delta k_x, \Delta k_y)}_{\text{spacing}}$$

$$\hat{m} = m \text{ * } s$$

