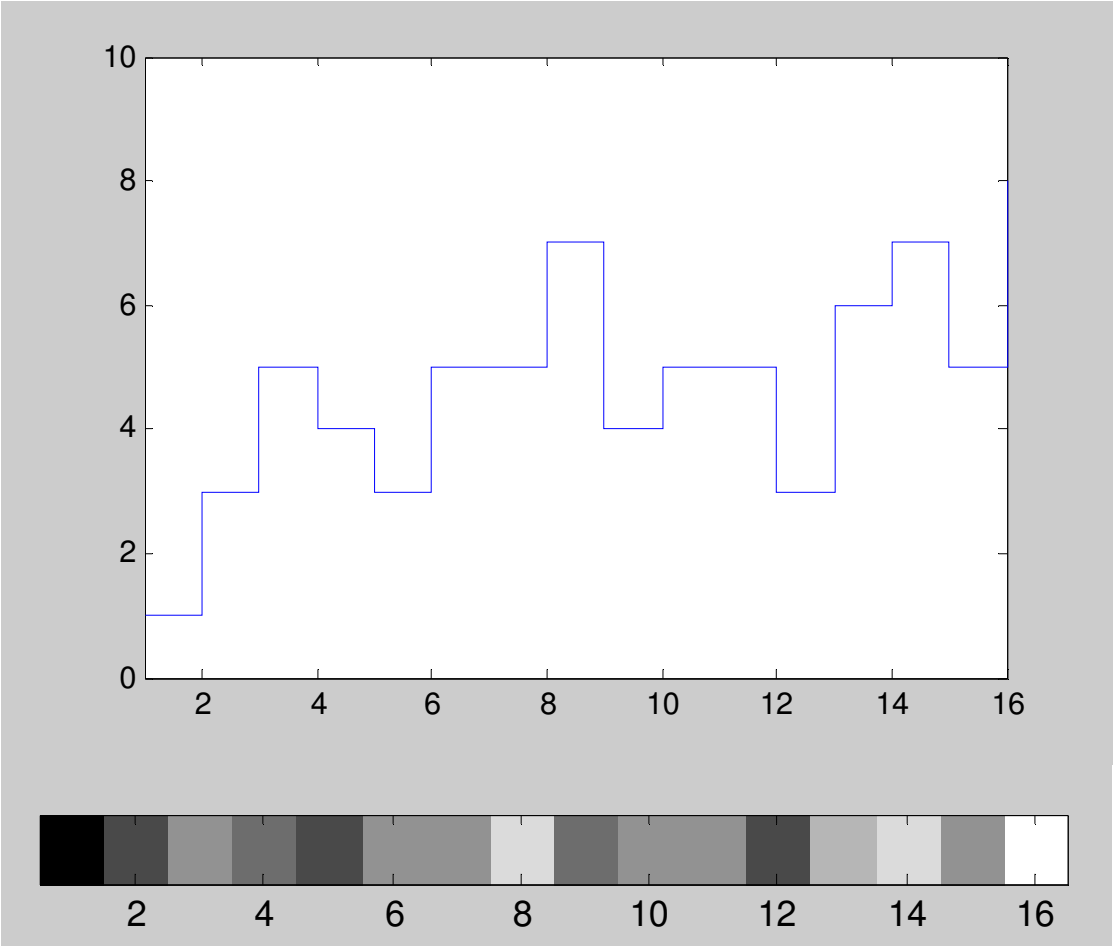
FYS-KJM 4740

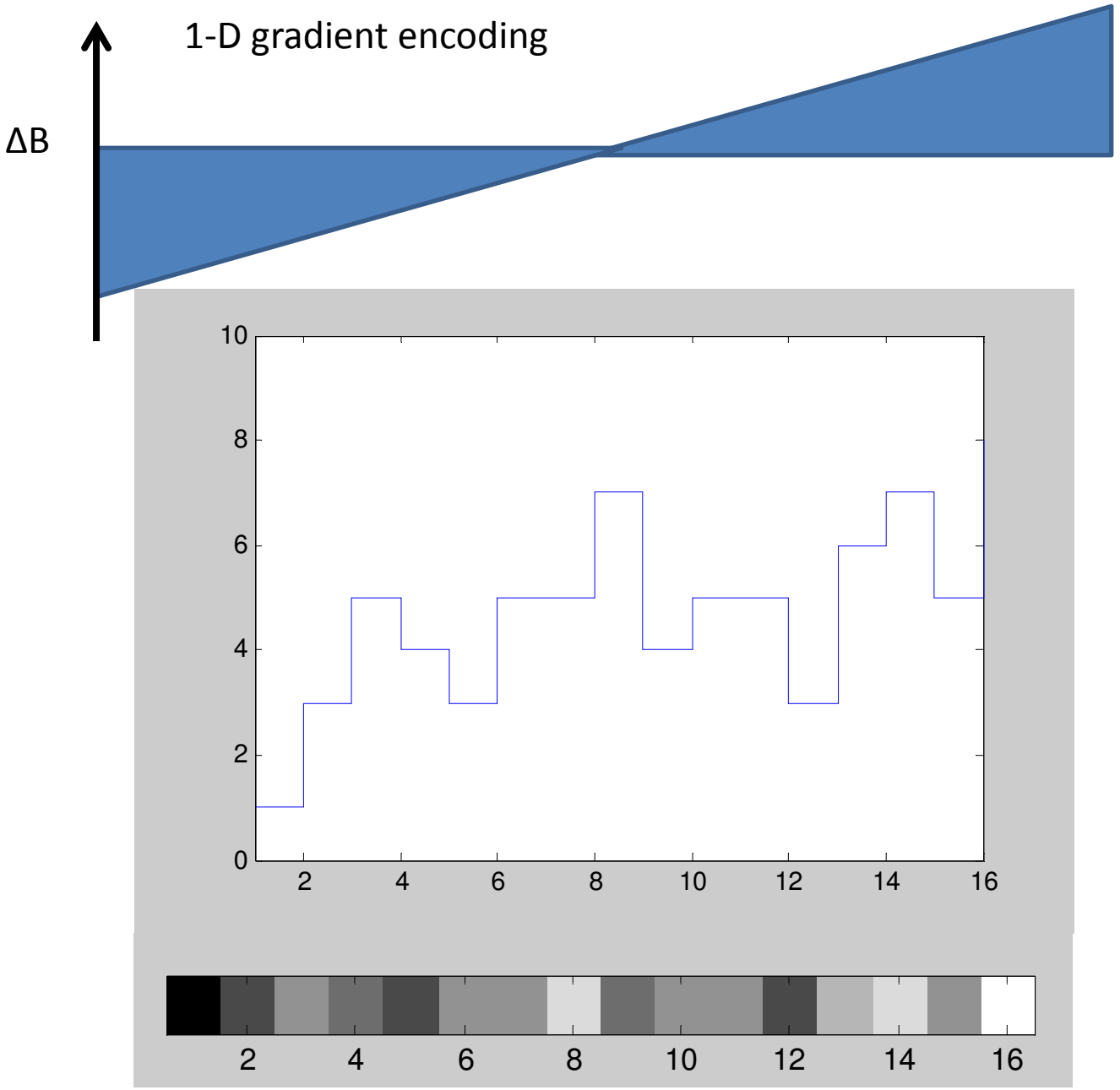
MR-teori og medisinsk diagnostikk

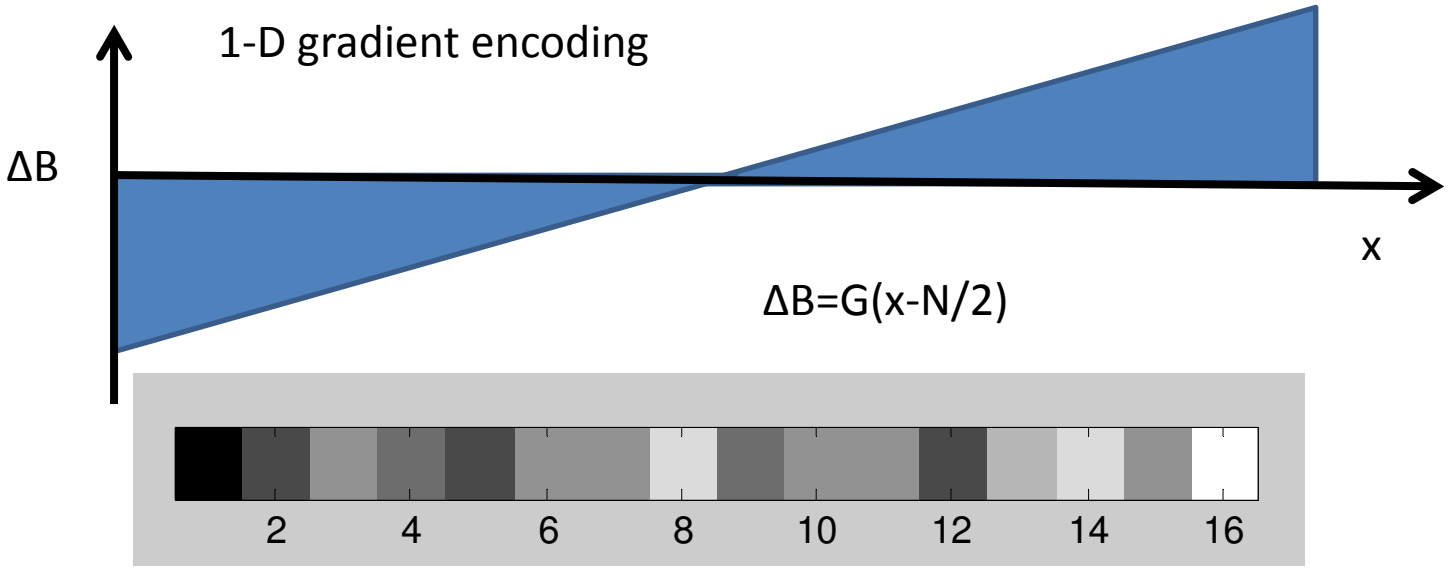
K-space vs image space
A 1-D sample

Atle Bjørnerud, Rikshospitalet
atle.bjornerud@fys.uio.no
975 39 499

Sample of 1-D proton density-vector(N=16):




1-D gradient encoding
ΔB
10
8
6
4
2
0
2
4
6
8
10
12
14
16
2
4
6
8
10
12
14
16



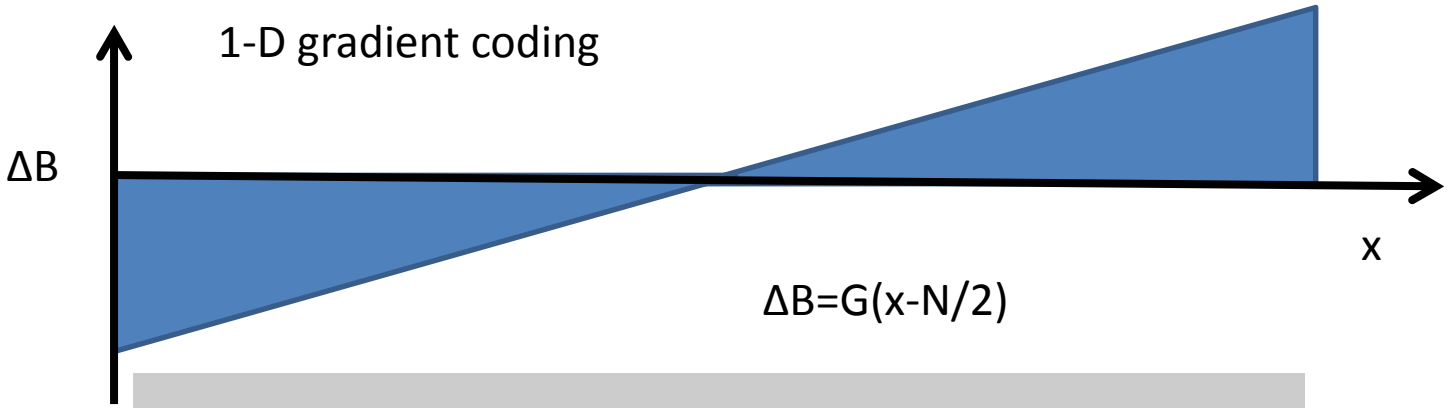
Magnetiserings-vector:

$$M_T(t) = \int_x \rho(x) \exp(-jk_x r) dr$$

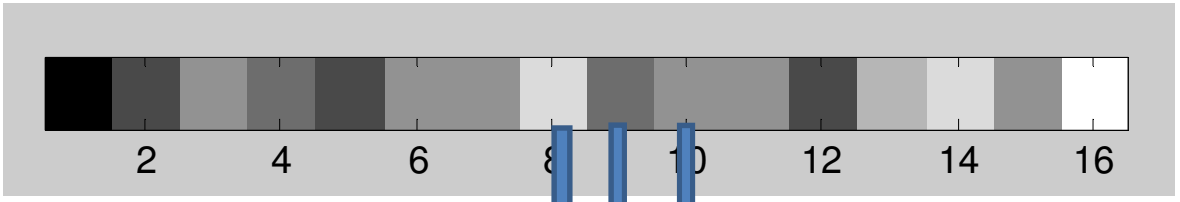
$$k_x = \gamma \cdot G_x \cdot T$$

In discrete form (N=16):

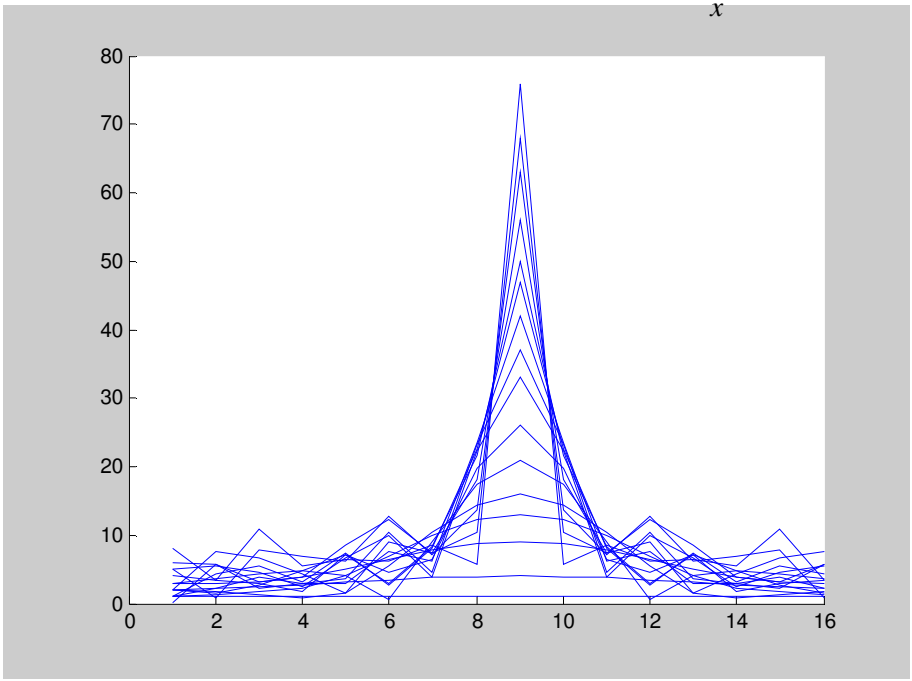
$$M_T(k_x) = \sum_x \rho(x) \exp(-j2\pi \cdot x \cdot k_x / N)$$



$\Delta B = G(x - N/2)$

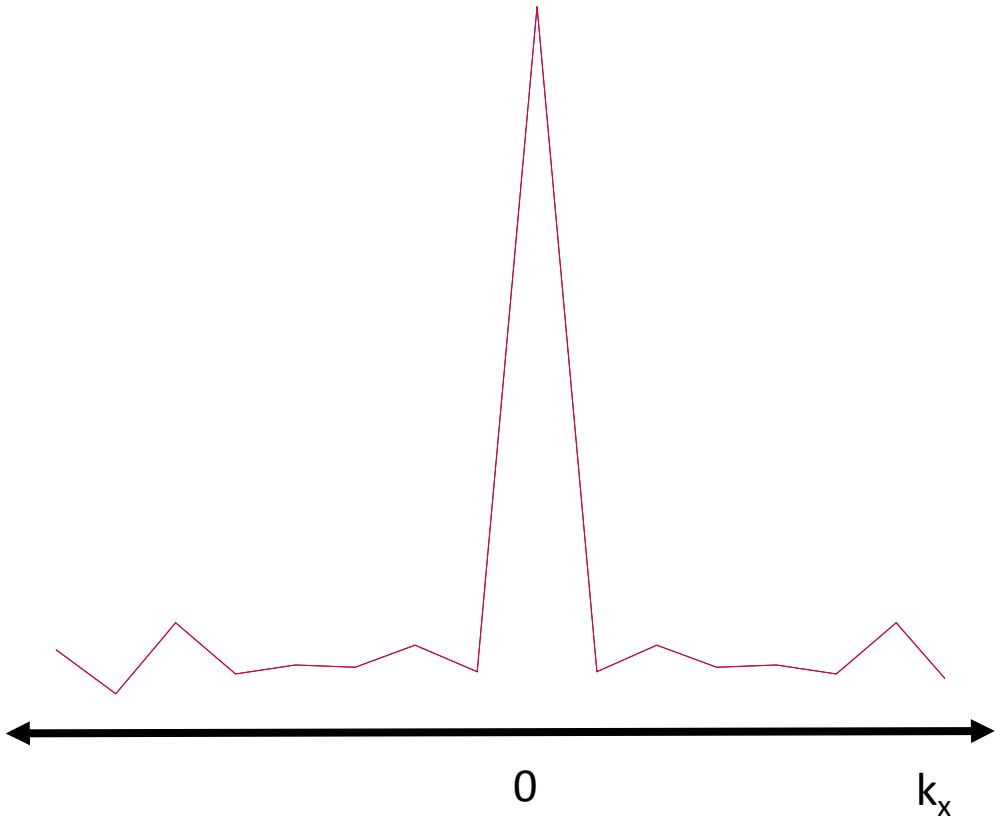


$$\sum_x \rho(x) \exp(-j2\pi \cdot x \cdot k_x / N)$$



$$M_T(k_x) = \sum_x \rho(x) \exp(-j2\pi \cdot x \cdot k_x / N)$$

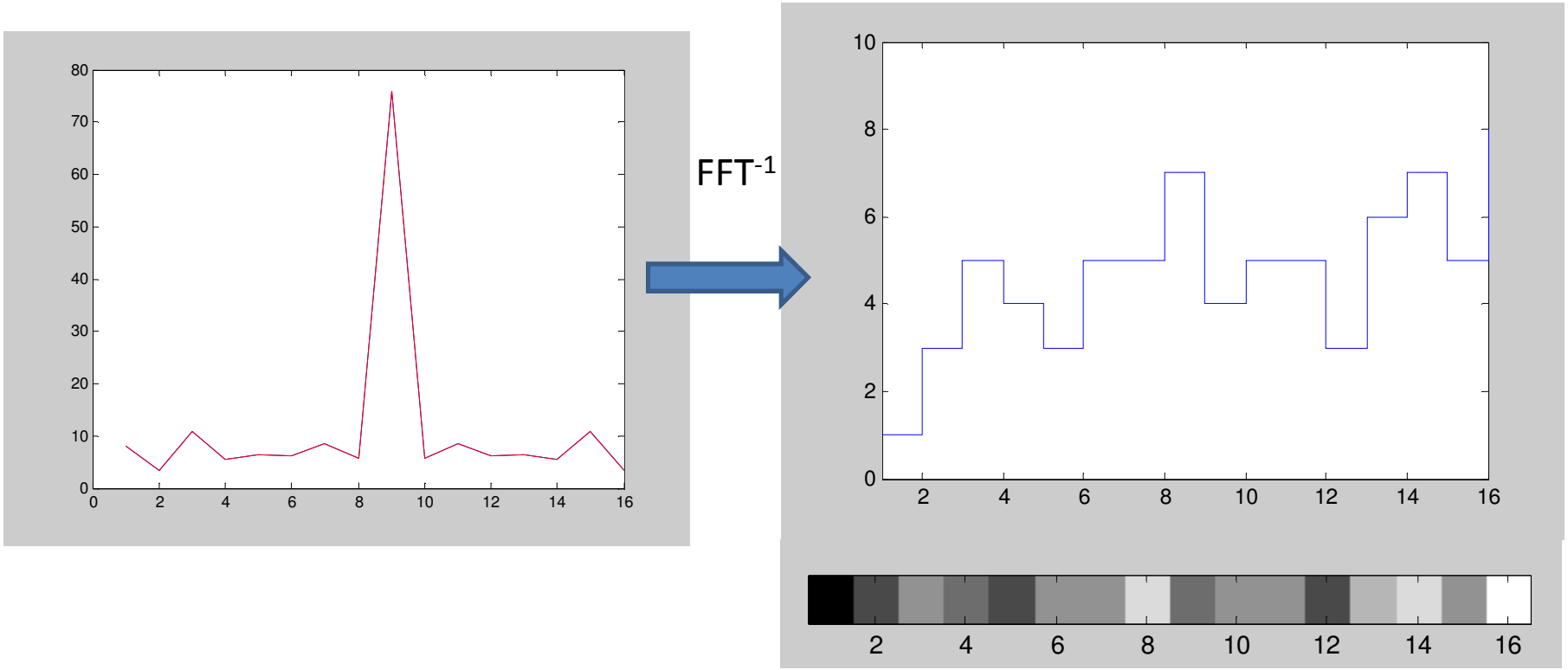
= 1 line in k-space (for one value of phase encoding)



See similarity with'echo -signal' (SE/GRE)

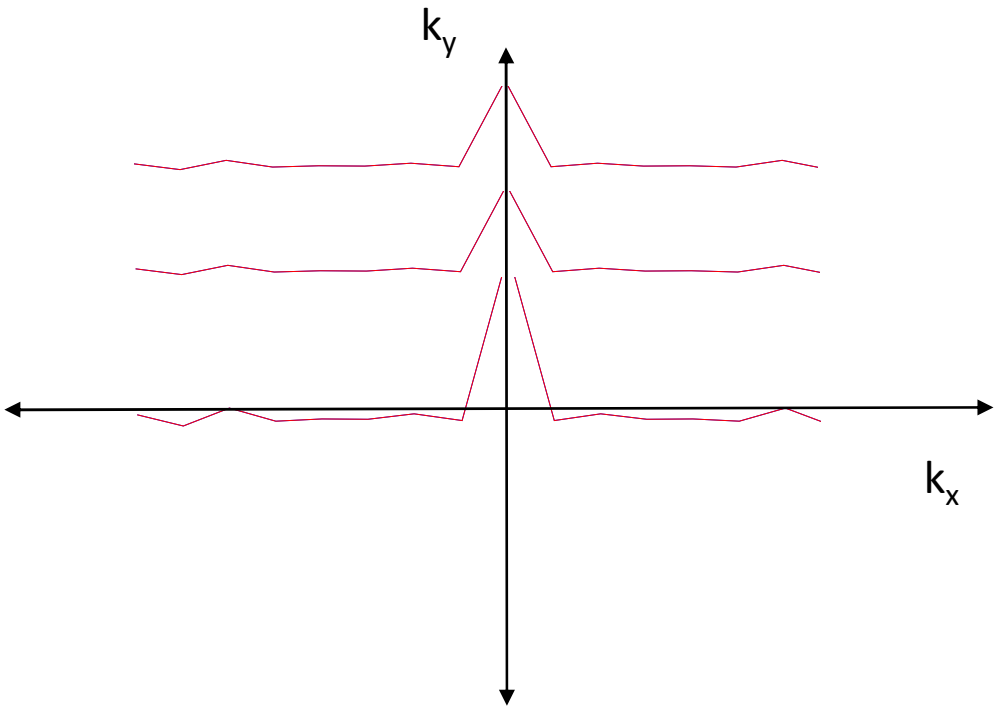
Proton density distribution along the x-axis is given by iFFT of
The magnetization vector, M_T

$$\rho(x) = \sum_{k_x} M_T(k_x) \exp(j2\pi \cdot x \cdot k_x / N)$$

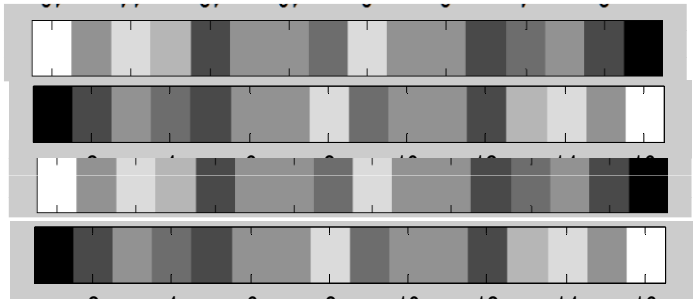


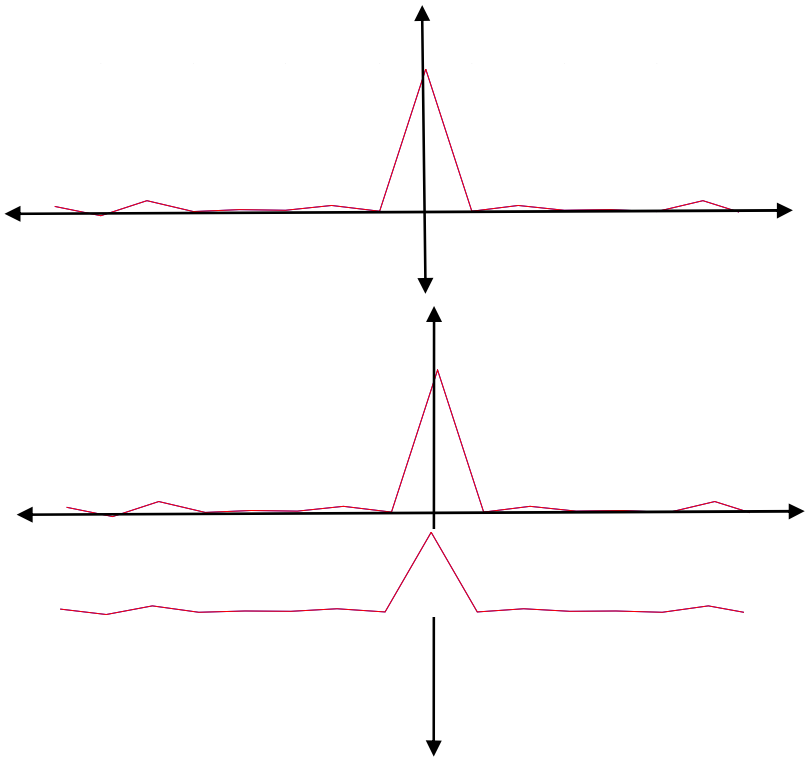
Expand to 2 dimensions:

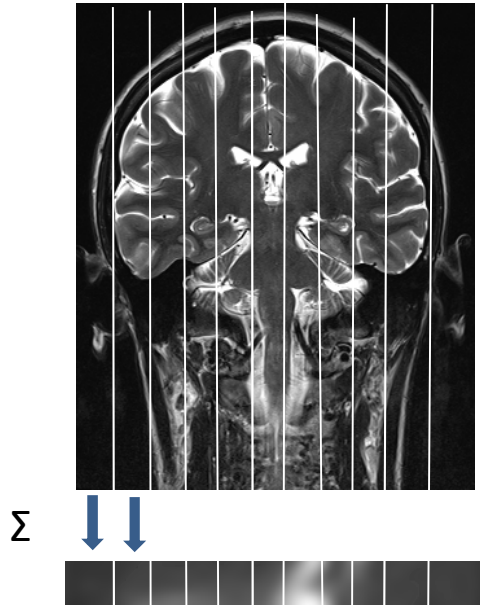
$$\rho(x,y) = \sum_{k_y}\sum_{k_x} M_T(k_x,k_y)\exp(j2\pi\cdot(x\cdot k_x + y\cdot k_y)/N)$$



ρ(x,y)






Σ