# Tomographic measurement

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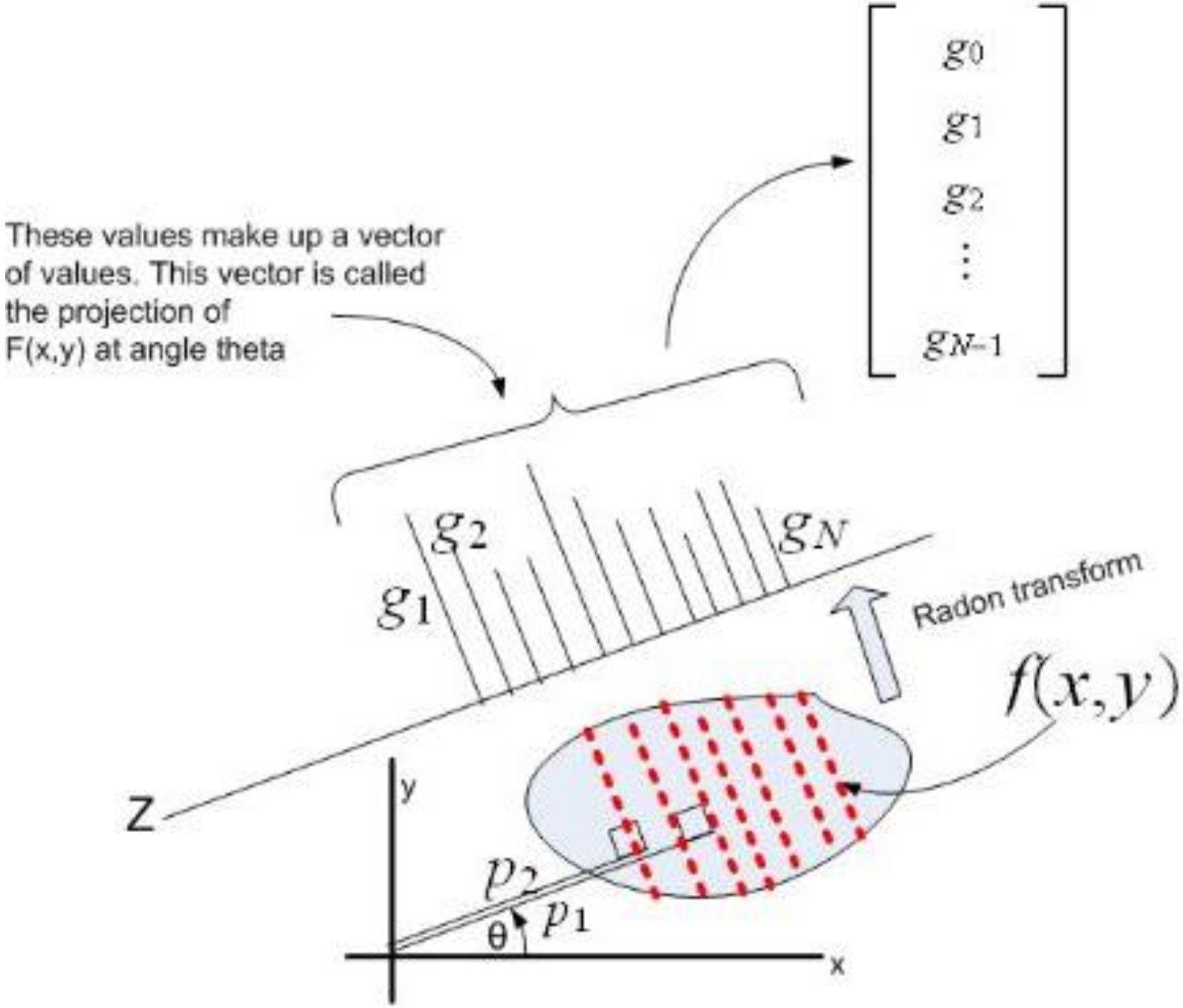
# Quick Review

Back filtered projection method

- Projection (Radon transformation) is needed.
- Projection needs to cover the angle from 0 to pi.



# From thesis by D. Stratakis (2008)

- Tomographic phase space reconstruction of space charge dominated beam has been demonstrated.
- http://drum.lib.umd.edu/handle/1903/8121

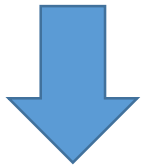
- Main idea: tomographic phase space reconstruction can be done by profile from **YAG screen** with **Transportation matrix**

# Procedure summary

- X,Y profile at YAG screen f(x,y)
- Line integral over dy (dx) => f(x)
- Scaling factor, s, and angle, Θ, by transportation matrix
- Get Radon transformation by scaling f(y)
- Having it filtered
- Integrating filtered projection over angle Θ.

$$s = \sqrt{M_{11}^2 + M_{12}^2},$$

$$\tan\theta = \frac{M_{12}}{M_{11}}.$$



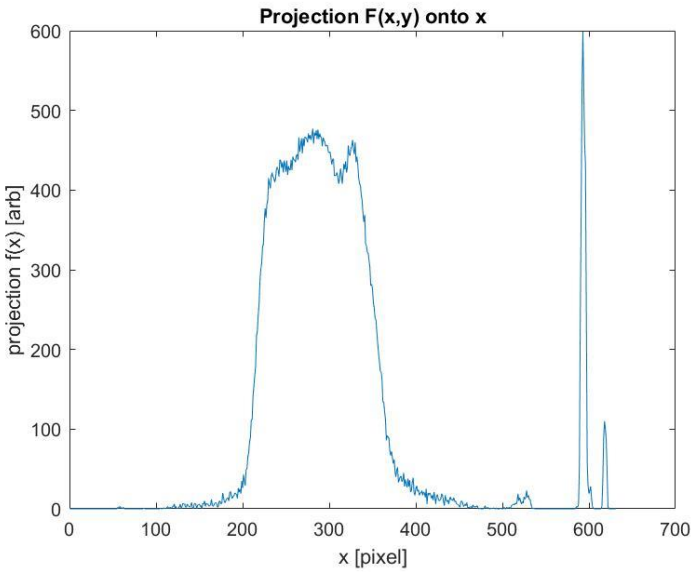
These can be done by matlab
Code ‘’iradon’’

# 1. X,Y profile at YAG1

- at 4.2m from cathode

# 2. Line integral over dy (dx) => f(x)

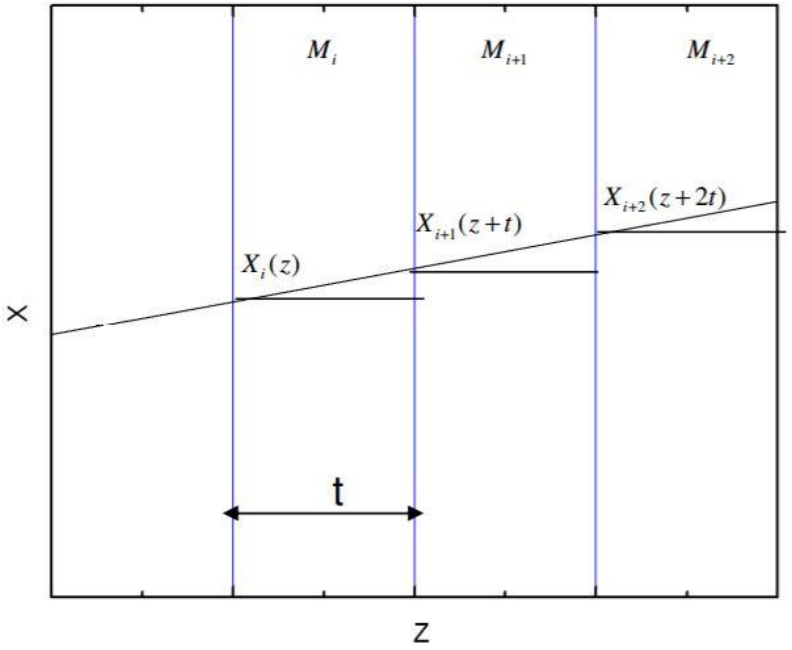
- Projection onto x

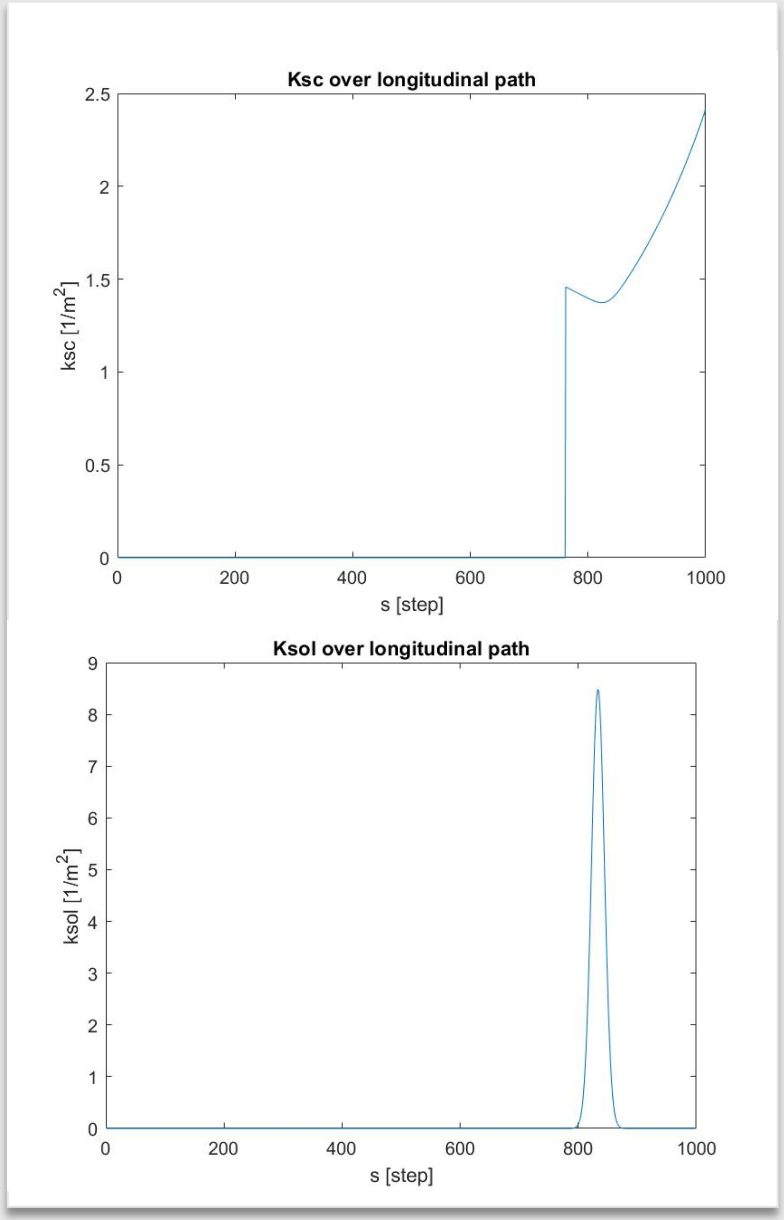


# 3.Transportation matrix

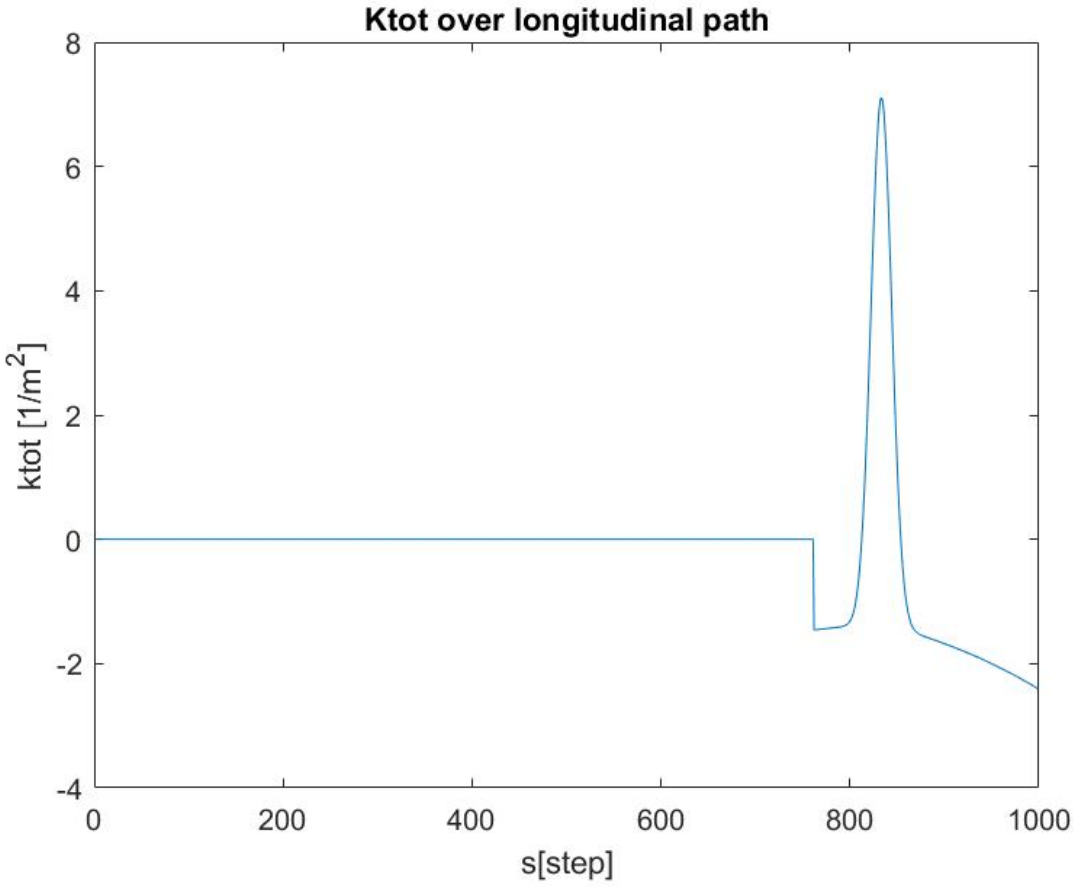
- Assuming radially uniform dist beam (500 pC, 1.3 MeV, 3.3 cm bunch length)
- k = ksol – ksc
- K = perveance ~ 3.5E-05 = qlam/(2pi eps m v^2 gam^3)
- Using Astra(any other code) to get envelope each step to calculate differential matrix
- 4.2 m, 1000 steps

$$\kappa_x = \kappa_{x0} - \frac{2K}{X(X+Y)},$$



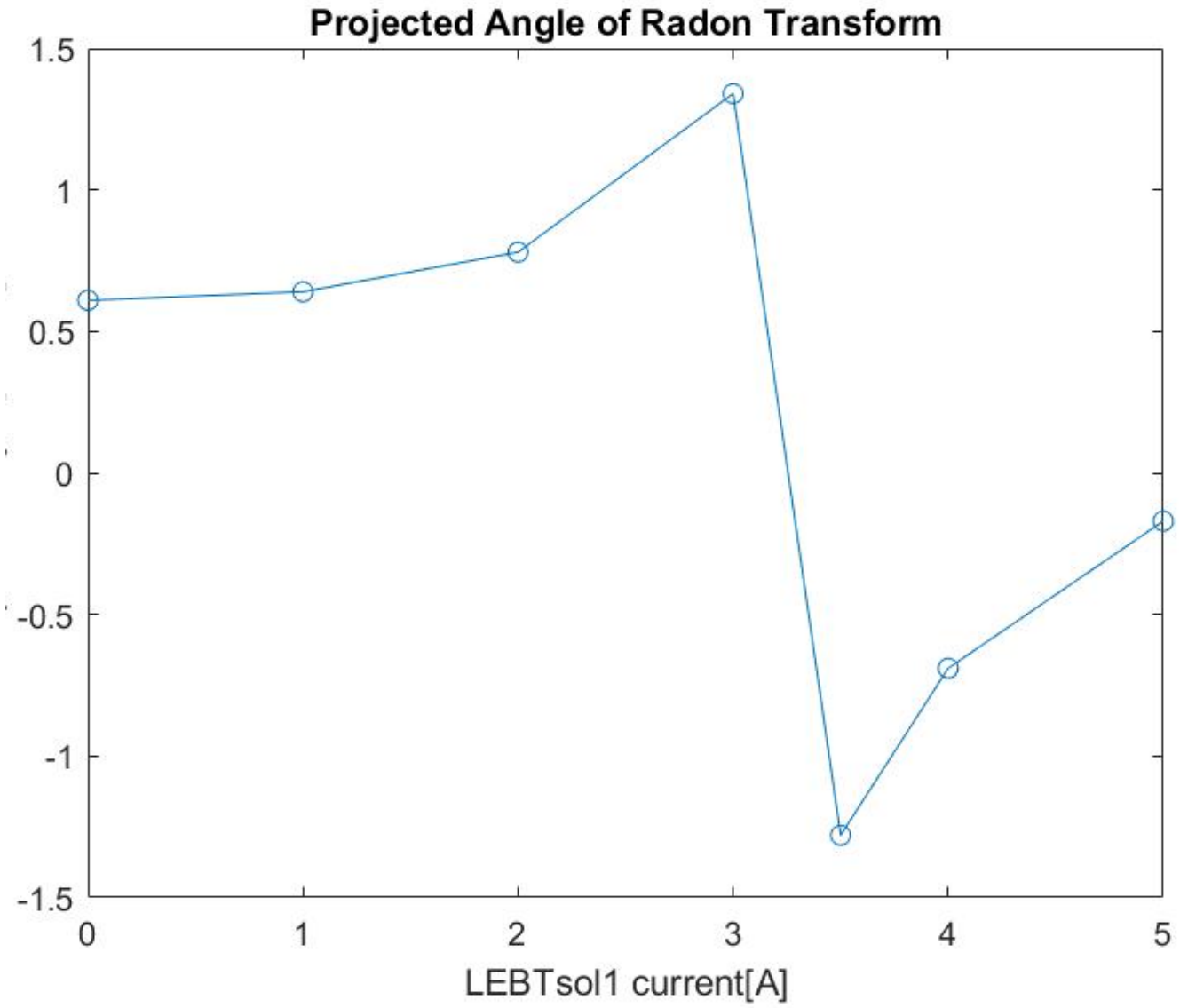



# ktot = ksol – ksc (LEBT1 2A)



# 4. Projection angle Θ

- Need to cover pi radian with fine separation
- By scanning 0 to 5[A] of LEBT1 solenoid, angle can be covered nearly pi.



# Summary

- It would be interesting to compare the reconstructed phase space with simulated phase space.
- Angle looks being covered enough to conduct the tomography
- A lot of profile is necessary (80 profiles in Diktis’s thesis)