

# Medical Image Processing for Diagnostic Applications

## Fan Beam – Super Short Scan

Online Course – Unit 40

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Pattern Recognition Lab (CS 5)



# Topics

## Super Short Scan

## Summary

Take Home Messages

Further Readings

# Less than a short scan?

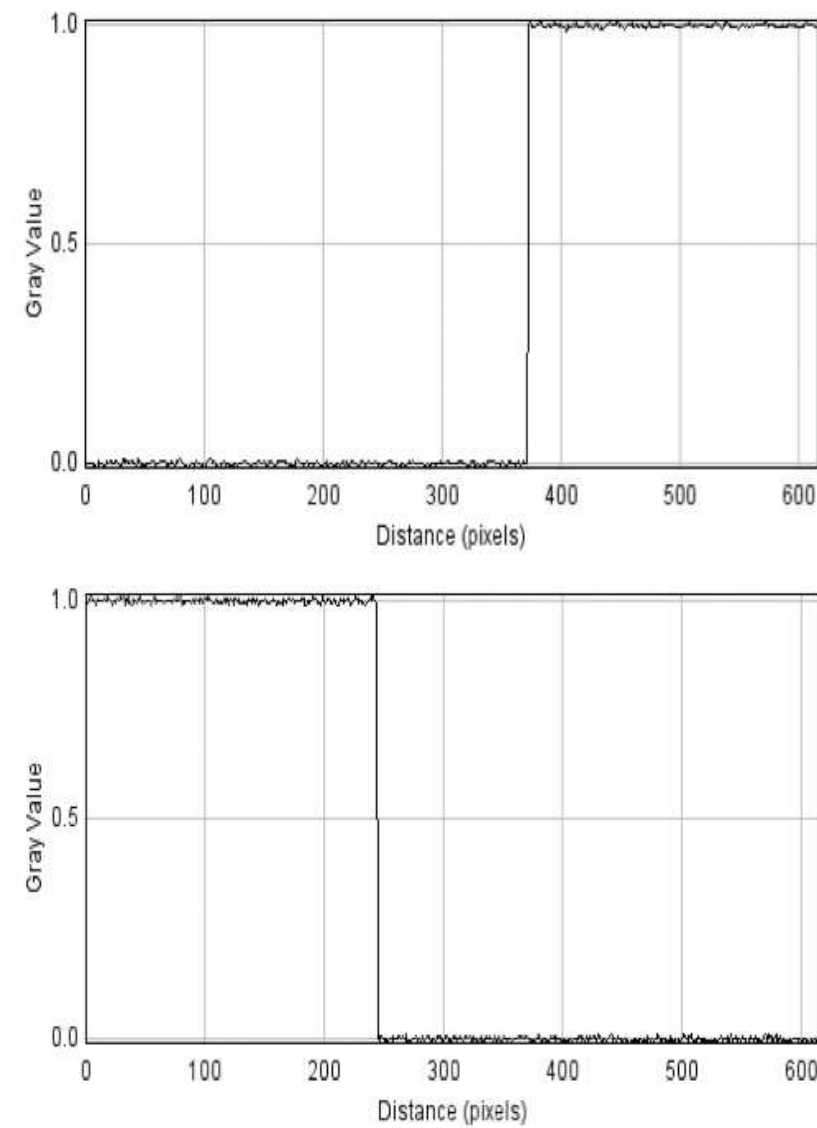


Figure 1: Weight profile

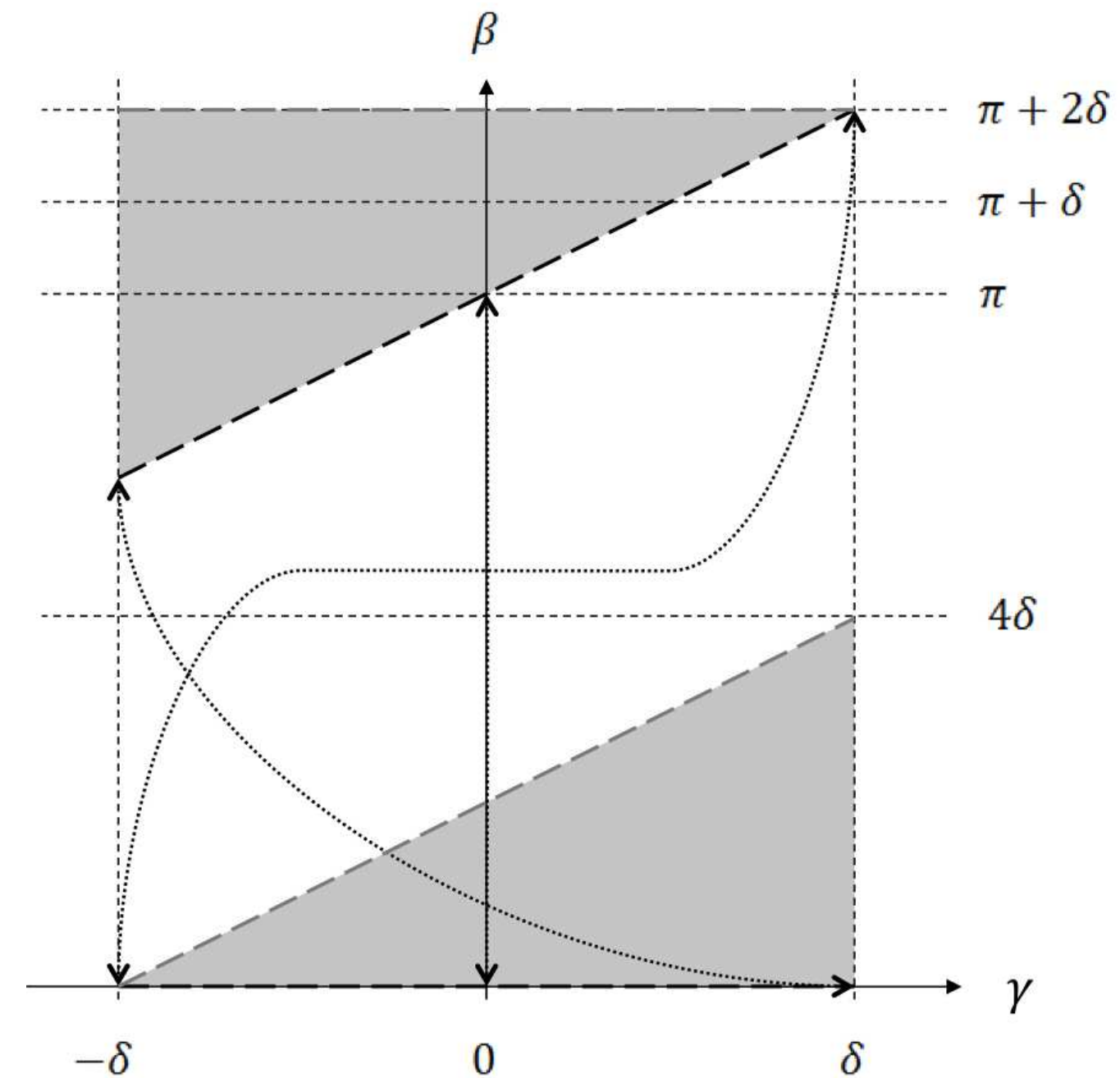


Figure 2: Redundant areas and ranges

# Less than a short scan?

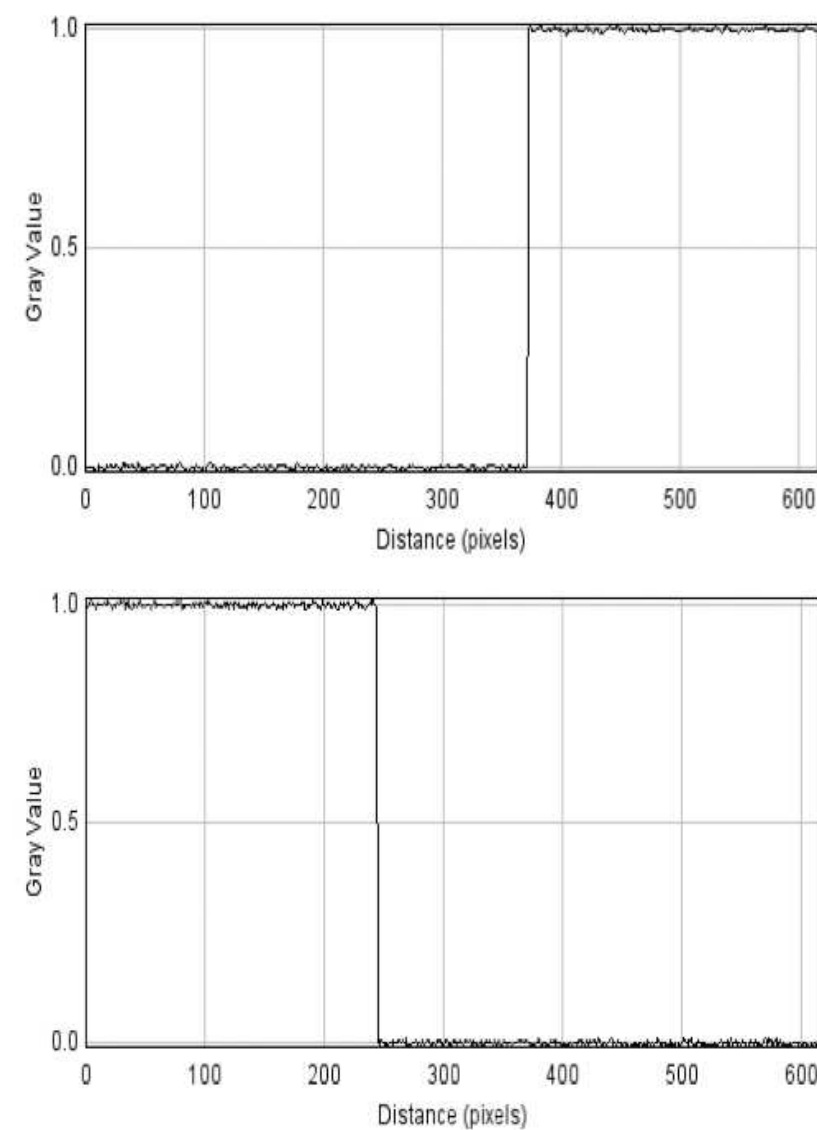


Figure 1: Weight profile

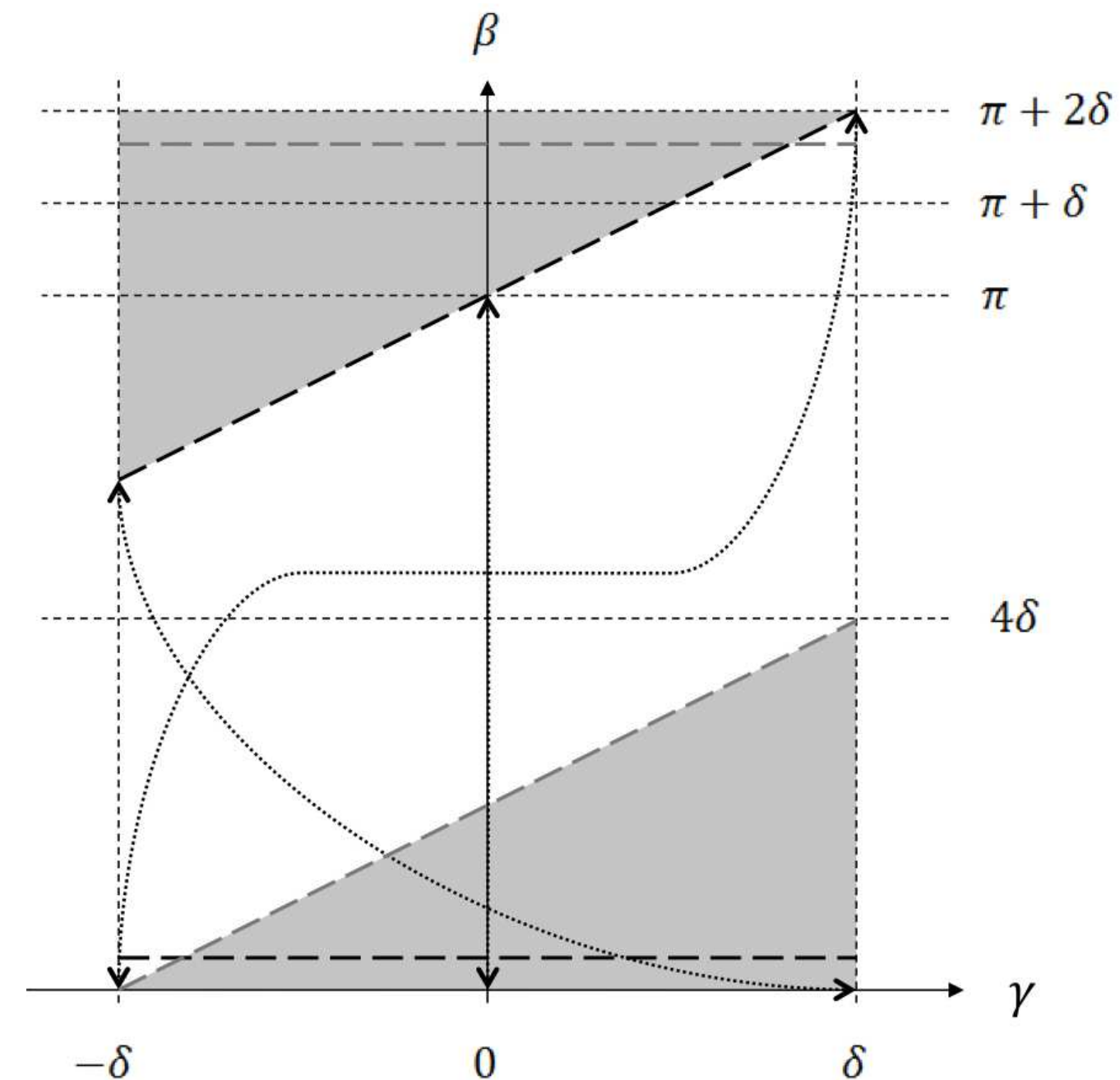


Figure 2: Redundant areas and ranges

## Less than a short scan?

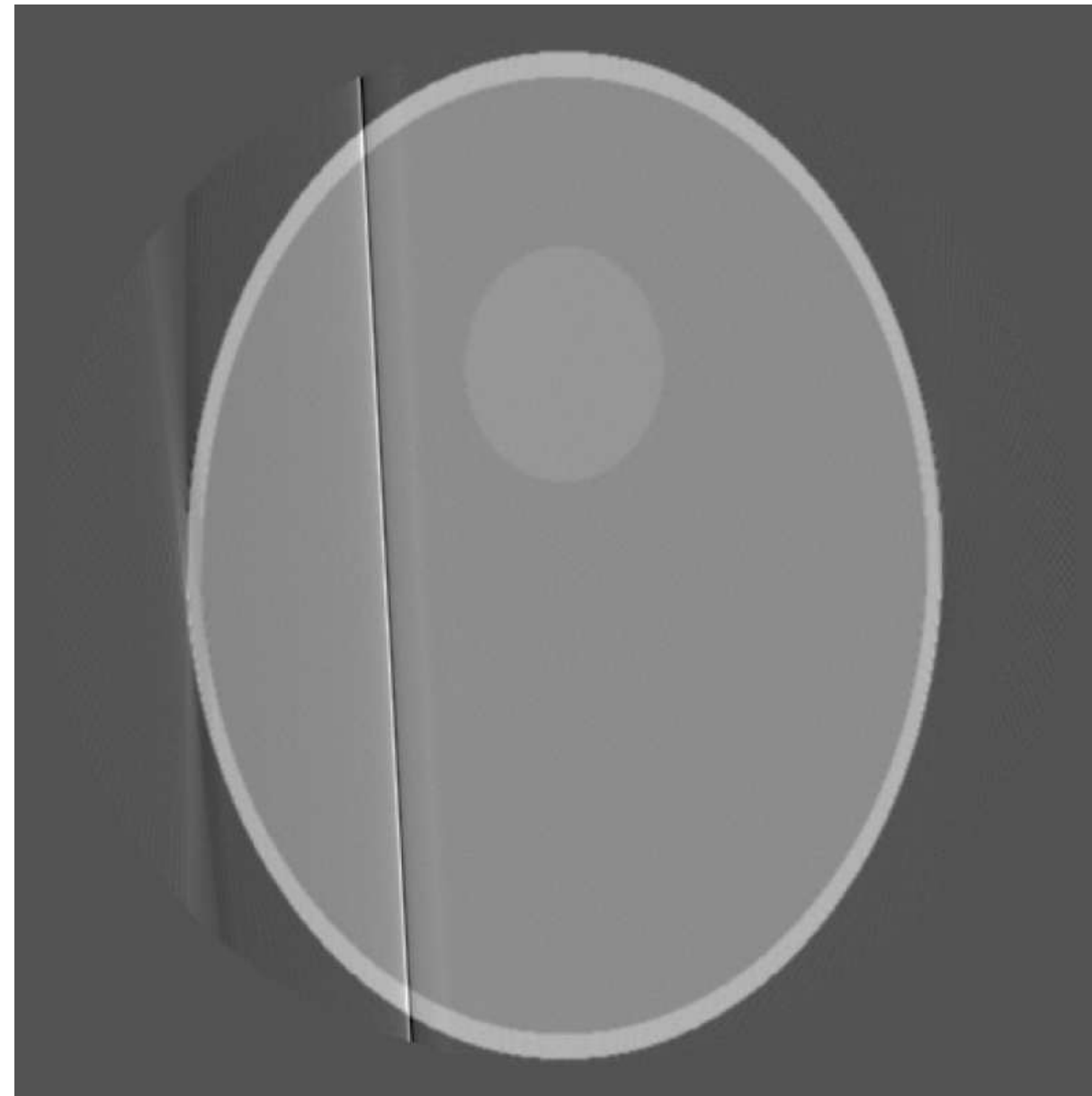


Figure 3: Super short scan reconstruction showing an artifact



## Less than a short scan?

- Apply Parker weight  $w_{\text{Parker}}(t, \beta)$  in reconstruction formula:

$$f(r, \varphi) = \frac{1}{2} \int_0^{2\pi} \frac{1}{U^2} \int_{-\infty}^{\infty} \frac{D}{\sqrt{D^2 + t^2}} (w_{\text{Parker}}(t, \beta) g(t, \beta)) h(t' - t) dt d\beta,$$

(cf. Unit 38).

- It is not possible to pull  $w_{\text{Parker}}(t, \beta)$  after the convolution without introducing artifacts.
- There is a solution that can solve this problem, but it is not covered in this course.
- This reconstruction method is known as ***super short scan***.

# Topics

Super Short Scan

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Further Readings

# Take Home Messages

- A super short scan with a lesser angular sampling range than required from theory can be feasible in practice.
- Parker weights are also important if a super short scan is acquired.



## Further Readings

Helpful reads for the current unit:

Frédéric Noo et al. “Image Reconstruction from Fan-Beam Projections on Less Than a Short Scan”. In: *Physics in Medicine and Biology* 47.14 (July 2002), pp. 2525–2546. DOI: 10.1088/0031-9155/47/14/311

Dennis L. Parker. “Optimal Short Scan Convolution Reconstruction for Fan Beam CT”. In: *Medical Physics* 9.2 (Mar. 1982), pp. 254–257. DOI: 10.1118/1.595078

Gengsheng Lawrence Zeng. *Medical Image Reconstruction – A Conceptual Tutorial*. Springer-Verlag Berlin Heidelberg, 2010. DOI: 10.1007/978-3-642-05368-9