

Quickbird-2 Spatial Response Assessment using Urban Targets

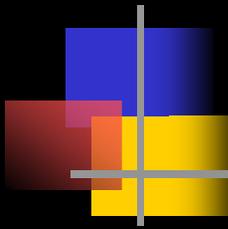
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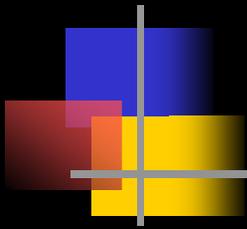
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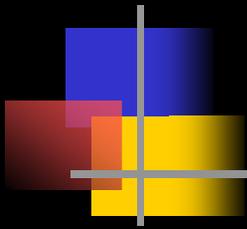
Topics

- Introduction
- Parking lot stripe analysis
- Edge analysis
- Stripe and edge analysis comparison
- MTFC and no MTFC data comparison
- Summary and conclusions



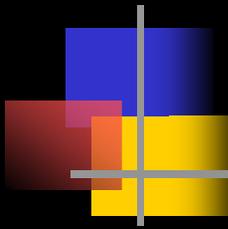
Introduction

- Targets of opportunity
 - Urban area is relatively target-rich
 - Parking lot stripes, roof and shadow edges
- Criteria for choosing targets
 - No temporal change
 - Uniform and high contrast
 - Large, multiple targets for better averaging



Introduction - data sets

Date	Type	GSD		Resampling Kernel
		In Track	Cross Track	
11/04/2002	Standard 2A	0.70 m	0.70m	Cubic
10/17/2002	Standard 2A	0.70 m	0.70 m	Cubic
11/04/2002	Basic 1B	0.62 m	0.61 m	Bilinear
11/04/2002	Standard 2A	0.60 m	0.60 m	MTFc



Topics

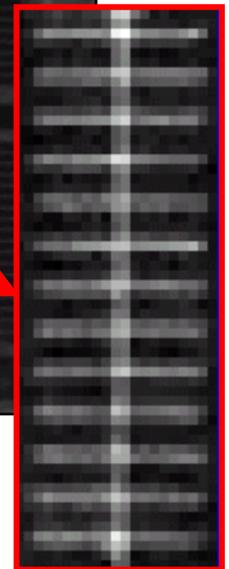
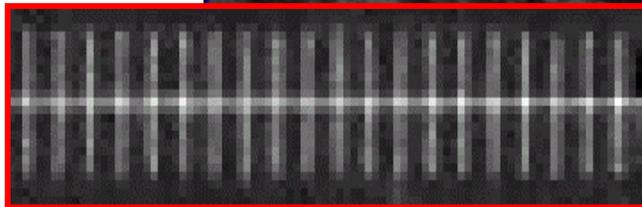
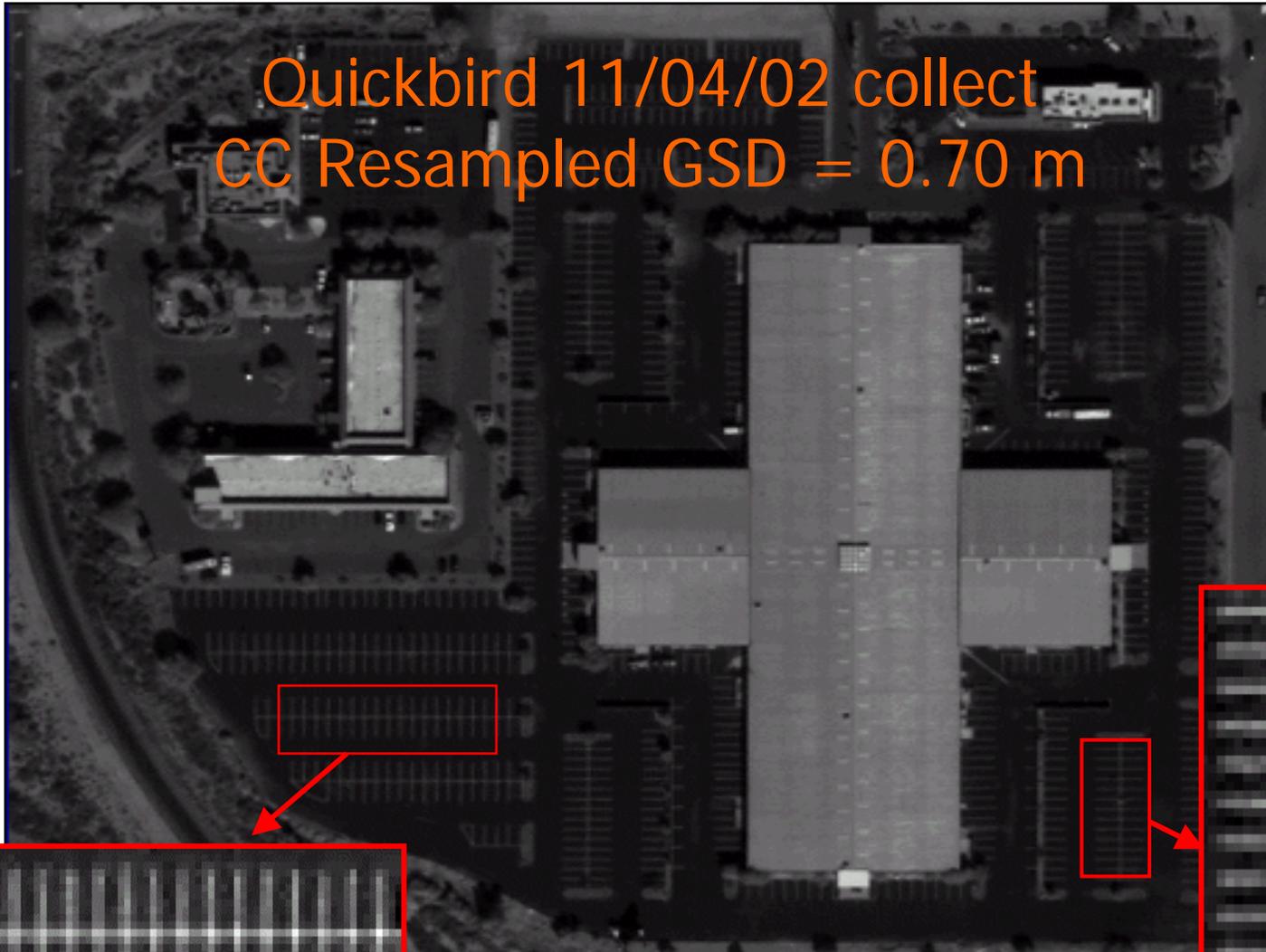
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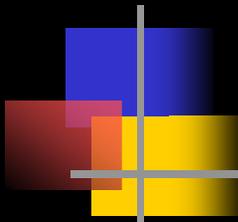
Parking lot stripe analysis



	Inches	Meters	Pixels
Width	4	0.102	0.145
Spacing	120	3.05	4.40
Length	240	6.10	8.80

Quickbird 11/04/02 collect
CC Resampled GSD = 0.70 m





Parking lot stripe analysis

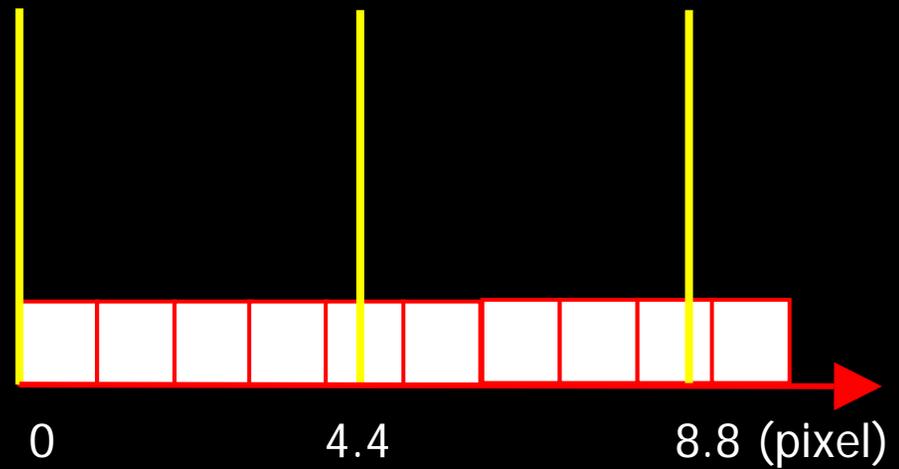
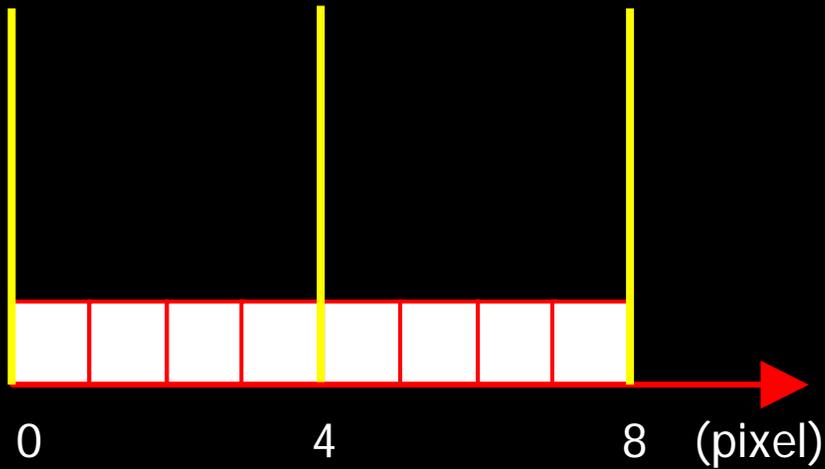
- Determine how many pixels between stripes
 - Slight difference between in- and cross-track
- Average profiles across stripes to reduce noise
- Interleave pixels from all the stripes
- Average and interpolate to get LSF
- Normalize area of LSF to 1 and FFT to get MTF

Parking lot stripe analysis

Pixel interleaving

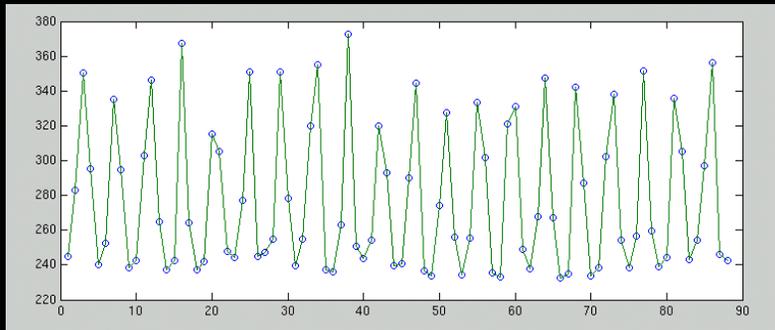
■ No Subpixel Effect

■ With Subpixel Effect

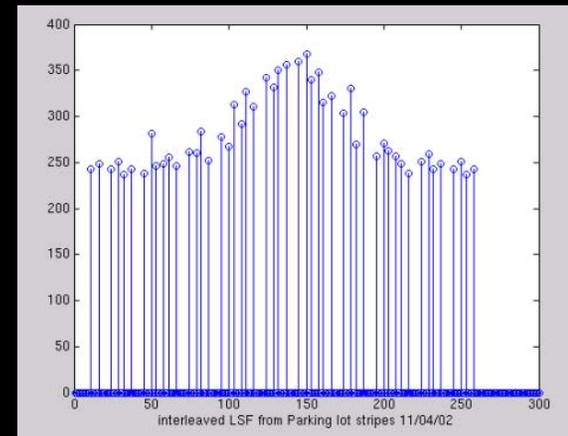
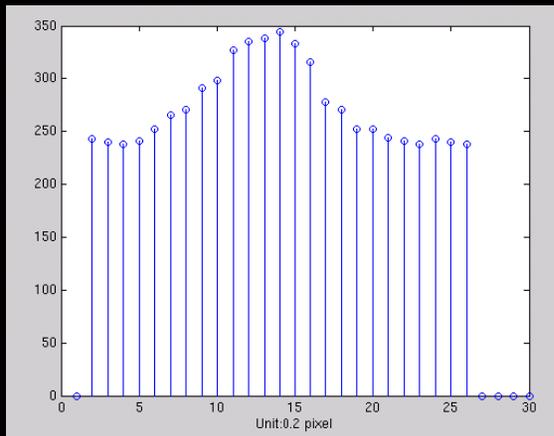
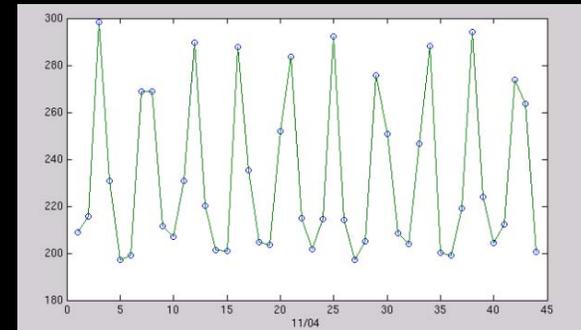


Parking lot stripe analysis

- Cross track averaged stripe profile and LSF



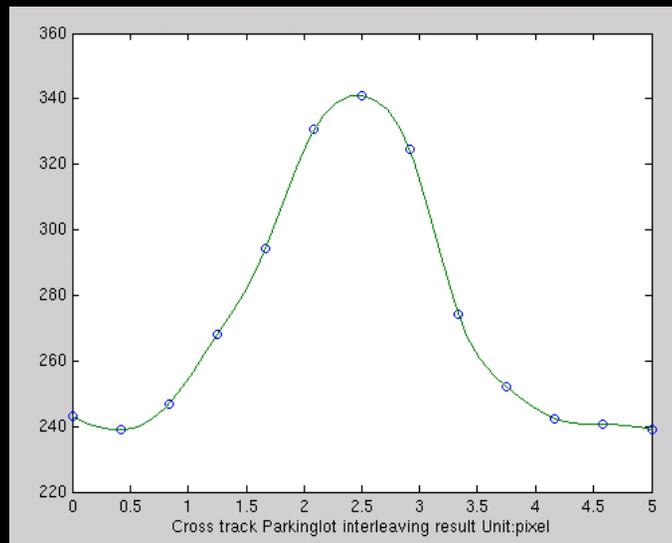
- In track averaged stripe profile and LSF



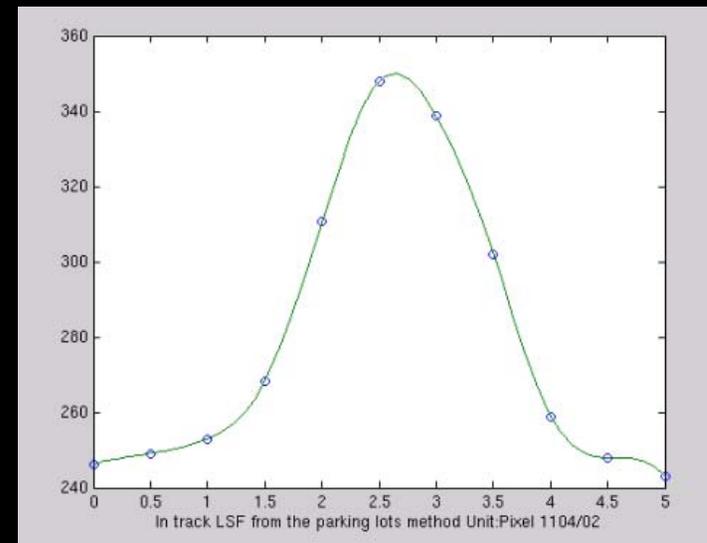
Parking lot stripe analysis

- Averaged and interpolated LSF

Cross track



In track



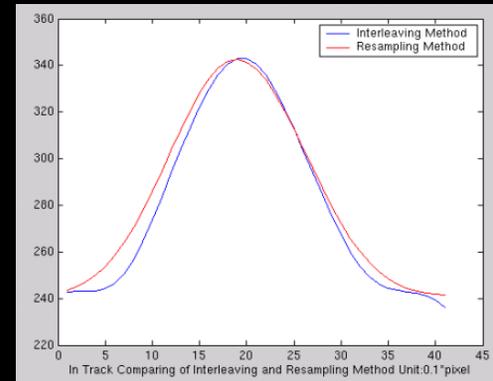
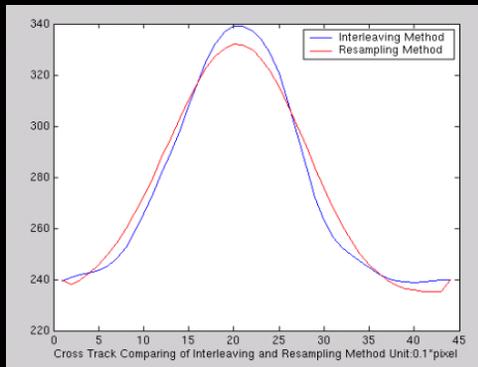
Parking lot stripe analysis

- Compare the results with resampling algorithm

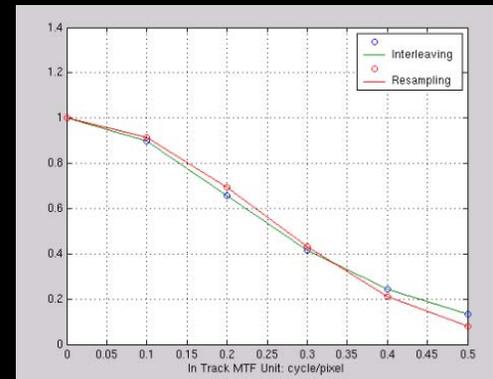
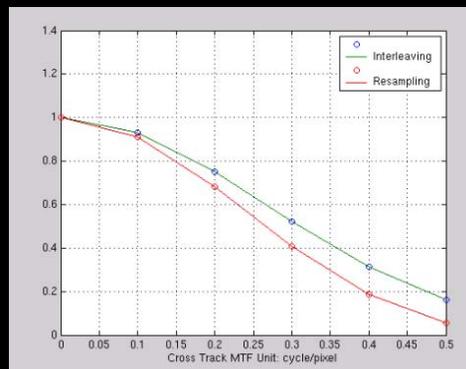
Cross track

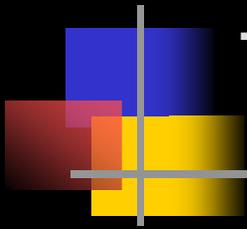
In track

LSF



MTF





Topics

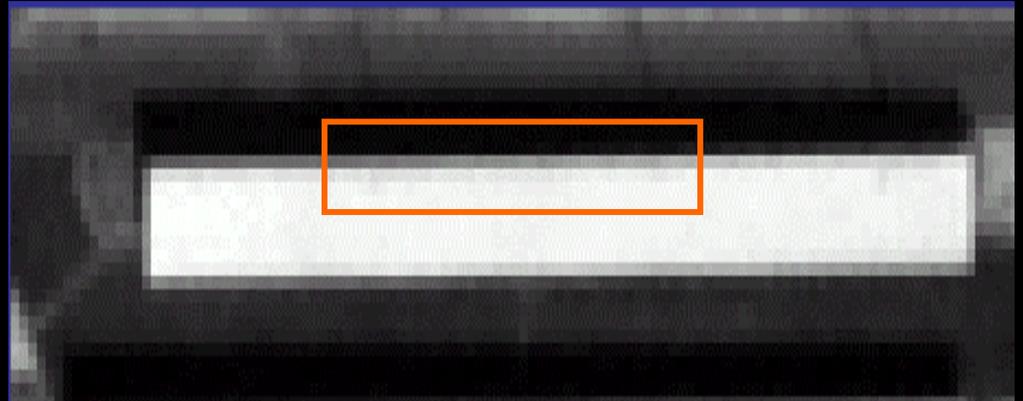
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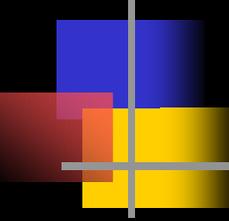
Edge Analysis

- Cross Track



In Track

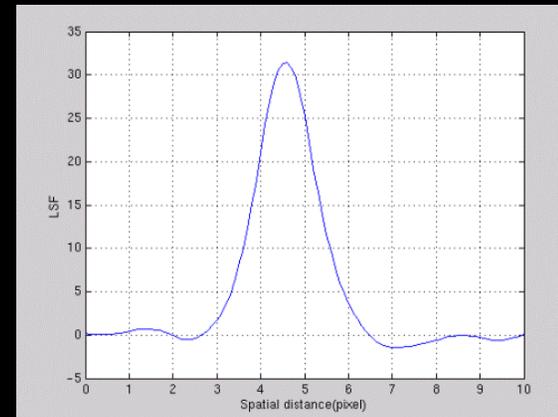
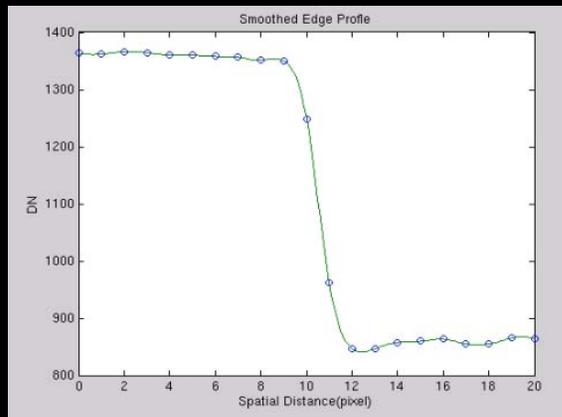
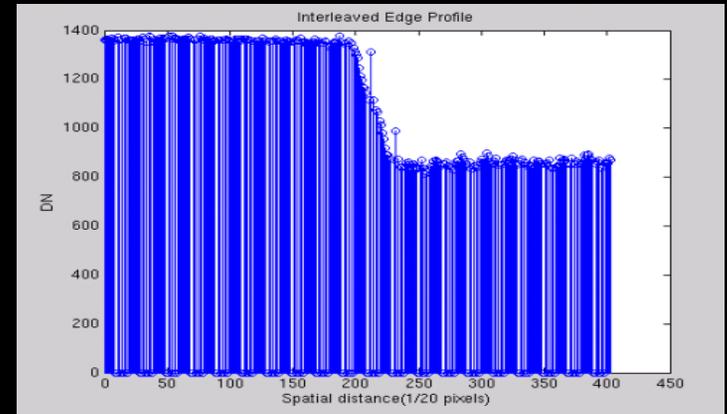
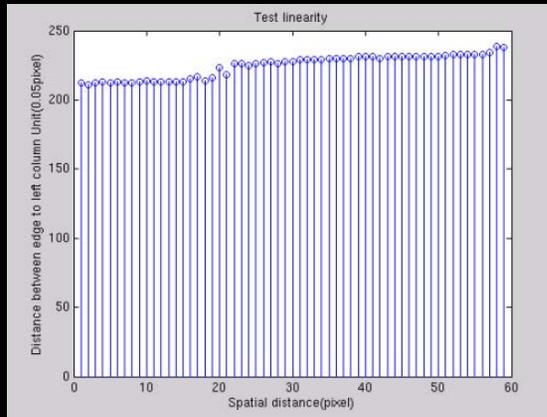




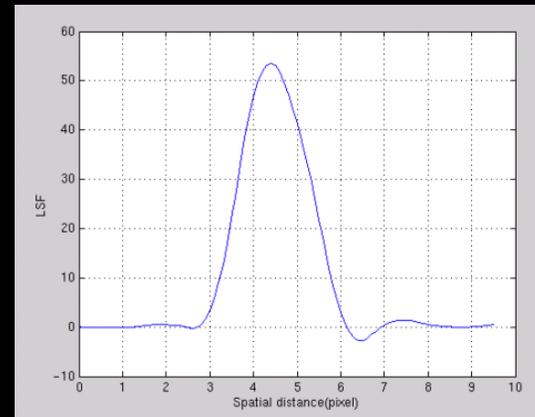
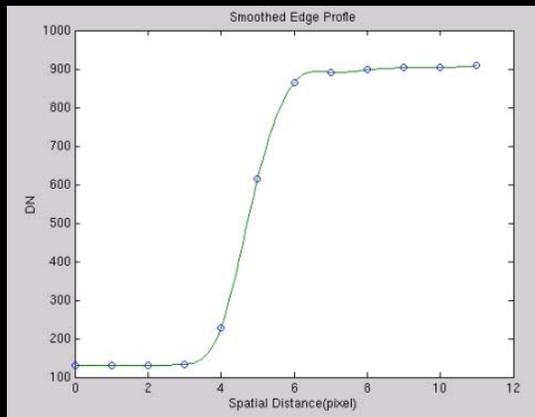
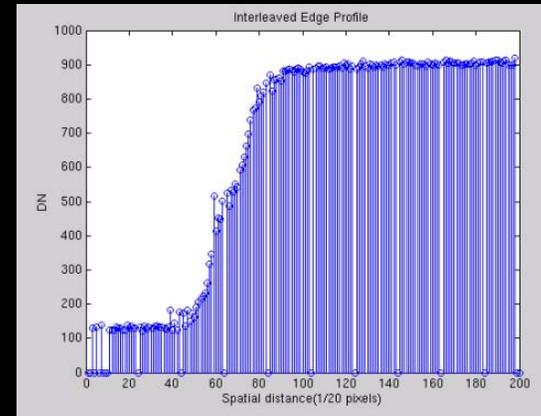
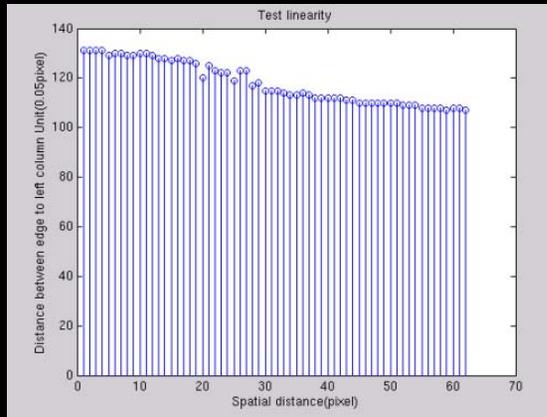
Edge Analysis -Algorithm

- Test for straightness of edge
- Extract and interpolate edge profiles
- Find location of maximum slope point and align edge profiles
- Average and interpolate to get ESF
- Differentiate to get LSF and FFT to get MTF

Edge Analysis – Cross track

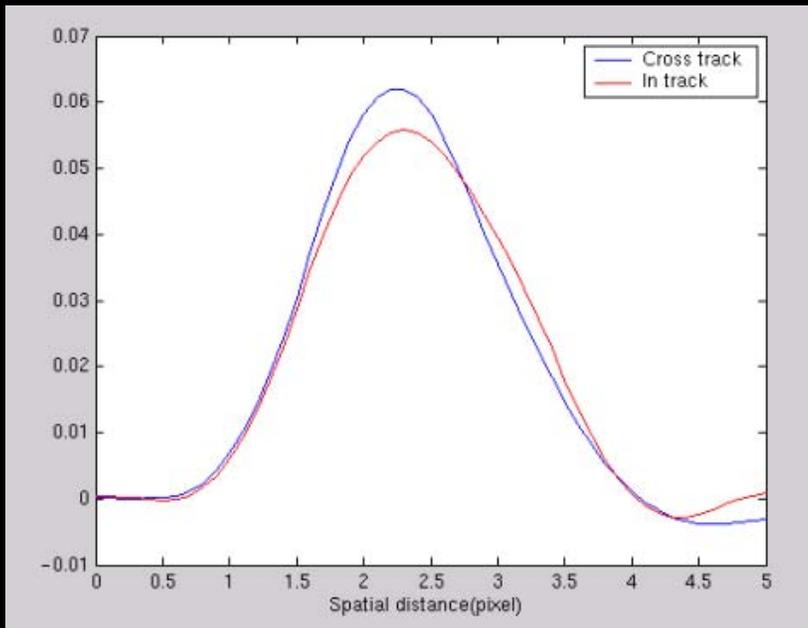


Edge Analysis – In track

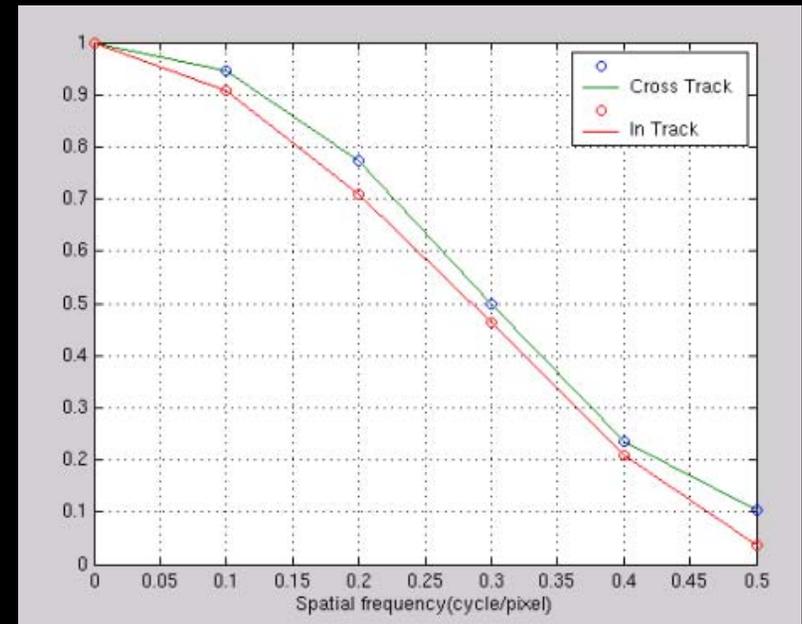


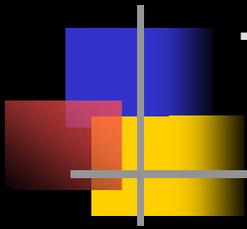
Edge Analysis

LSF



MTF





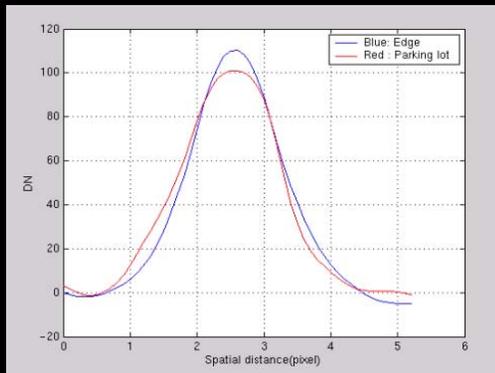
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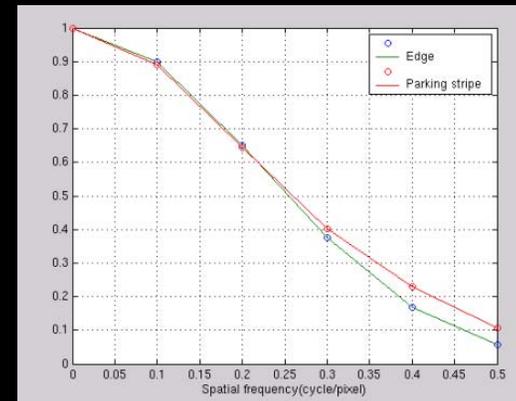
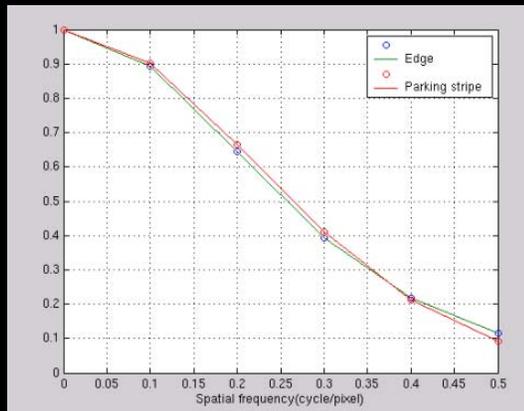
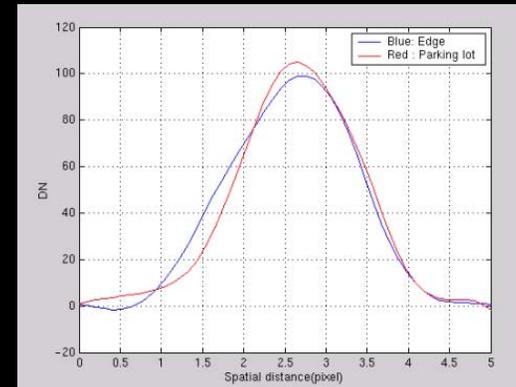
Stripe and edge analysis comparison

- Area of LSF Normalized to 1

cross-track

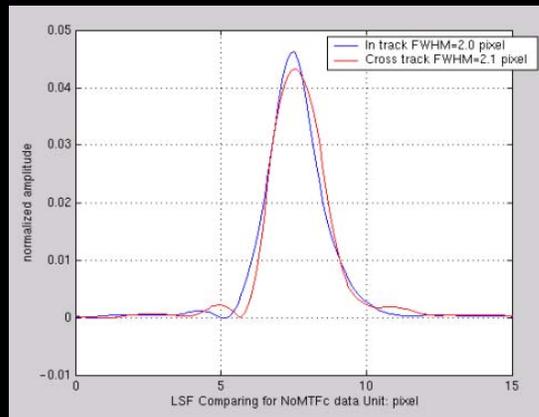


in-track

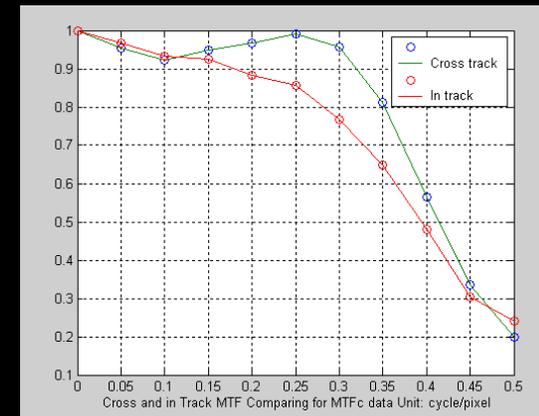
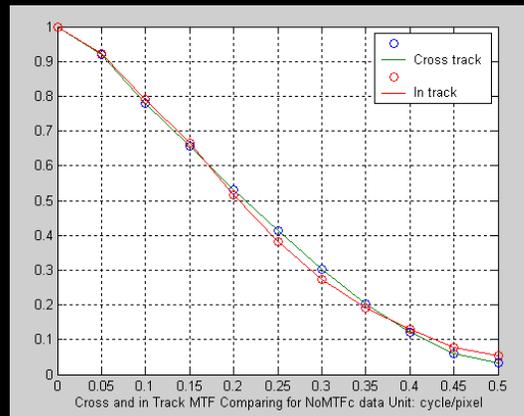
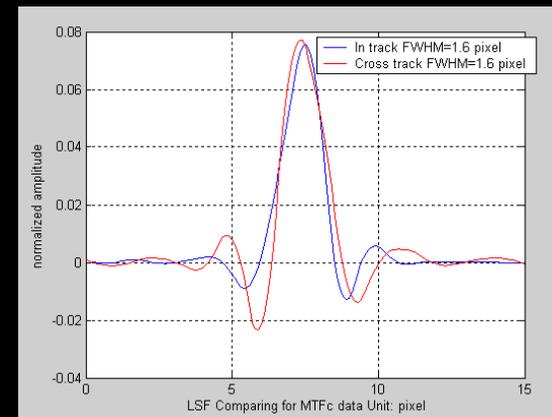


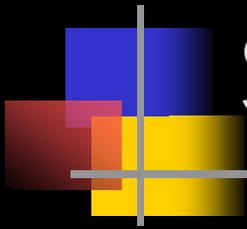
MTFc and No MTFc Comparison

No MTFc



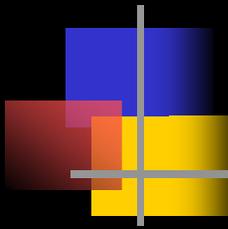
MTFc





Summary and Conclusions

- Results from parking lot stripes consistent with those from edges
- Parking lot stripes can be effective image quality targets
- Sensitive to image scale
 - Spacing must be non-integer multiple of pixel Ground Sample Distance (GSD)
- Cross-track MTFc correction greater than in-track correction



Acknowledgement

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*Radiometric and Spatial Characterization
of High-Spatial Resolution Sensors*

- DAIIers Jeff Smeaton and Tai Hong
Department of Electrical and Computer
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