



MISPA 3

CERES/EPC, Studies of realization of challenging signal processing applications

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Approved:

Checked:

Date:
2009-12-09

Confidentiality Class:
COMPANY UNCLASSIFIED

Document Number:
en

Revision:
PA1

Document Name:

MISPA3

- ▶ Two main parts

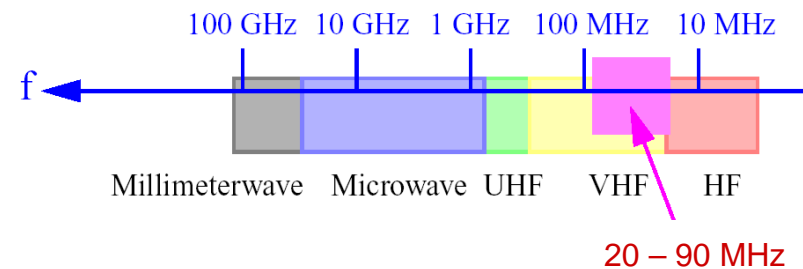
- ▶ WP1. Q1-Q2 2009
 - identify the requirements of image forming calculations
 - point out critical part to be studied further

- ▶ WP2. Q3 2009 - Q2 2010
 - define and evaluate various parallel computer architectures for the task
 - manycore, multicore, multiprocessor, ...

- ▶ Output: Solution for RT execution

A high-end Synthetic Aperture Radar (SAR) system

- ▶ Ultra-wideband system that operates in the low VHF-band
- ▶ Ultra-wideband: Resolution near wavelength limit
- ▶ VHF: efficient foliage penetration and biomass estimation



Radar data collection

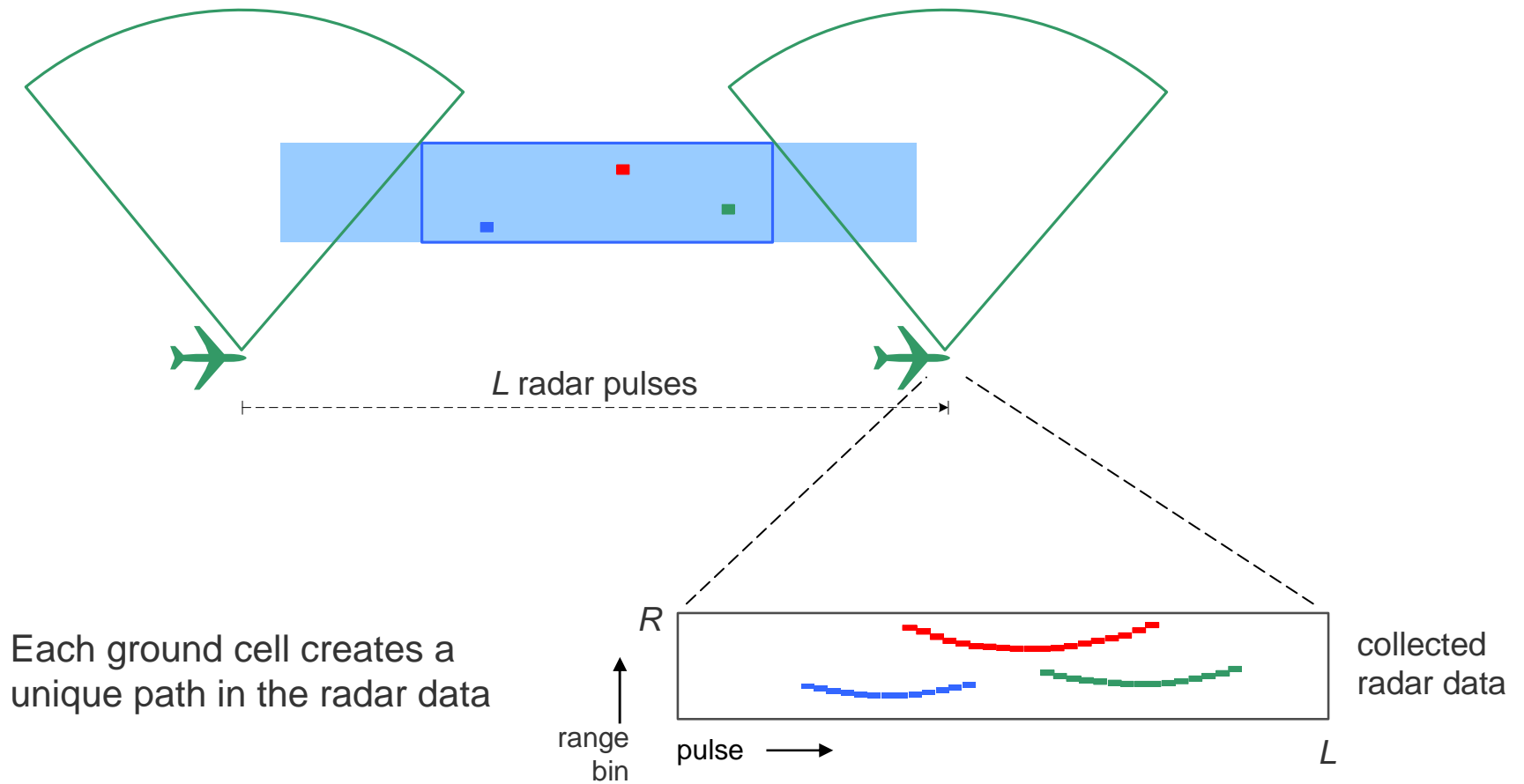
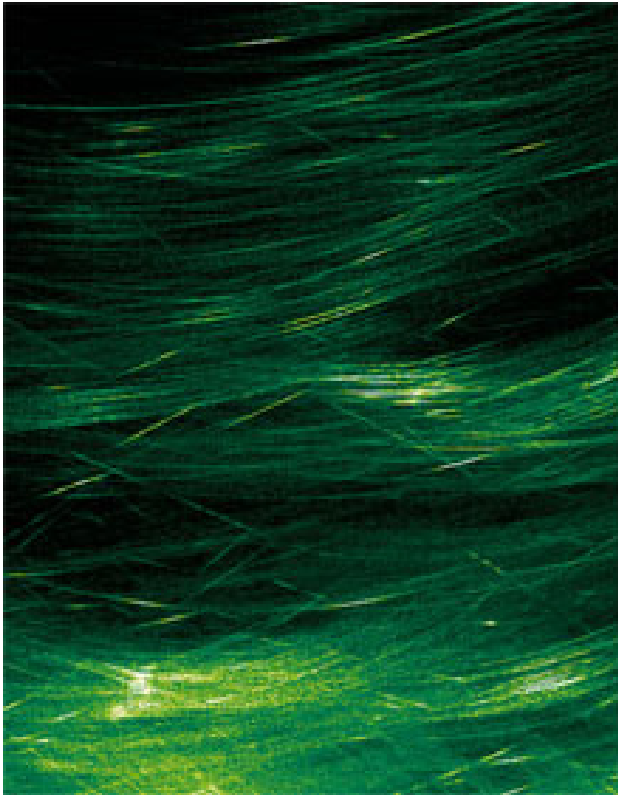


Image forming



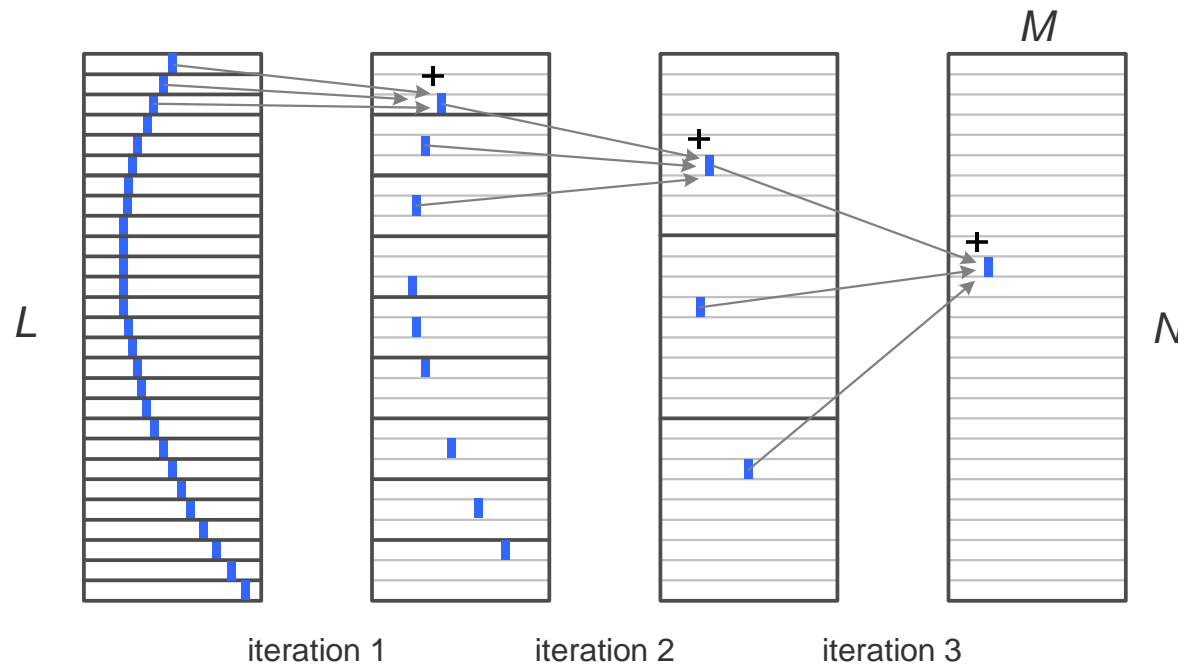
radar data



image

Fast factorized back-projection (FFBP) - a fast method

iterative subaperture merges



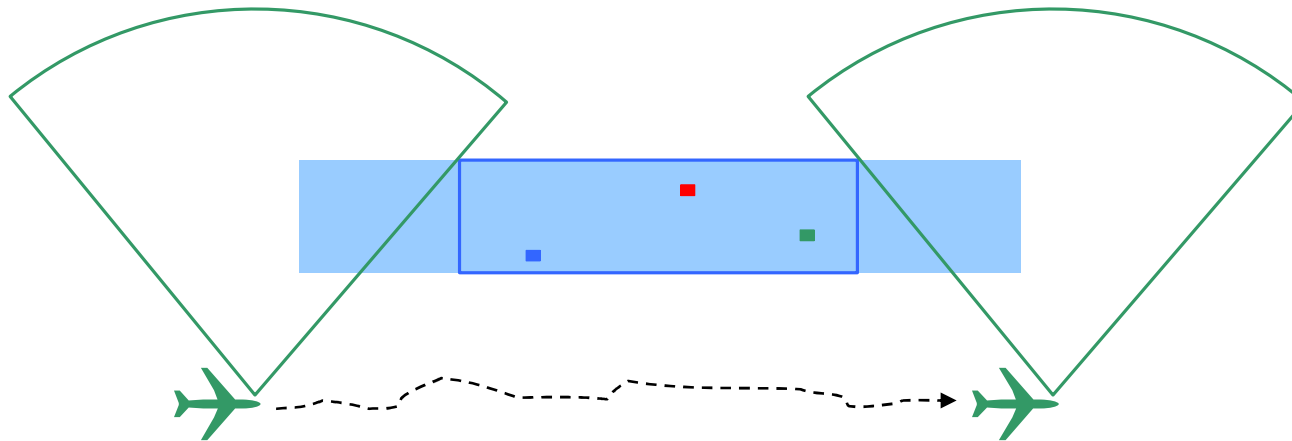
Ops: $\sim 3M \log_3 L$

$L=10^5 \Rightarrow$

3000x reduction
compared to GPB

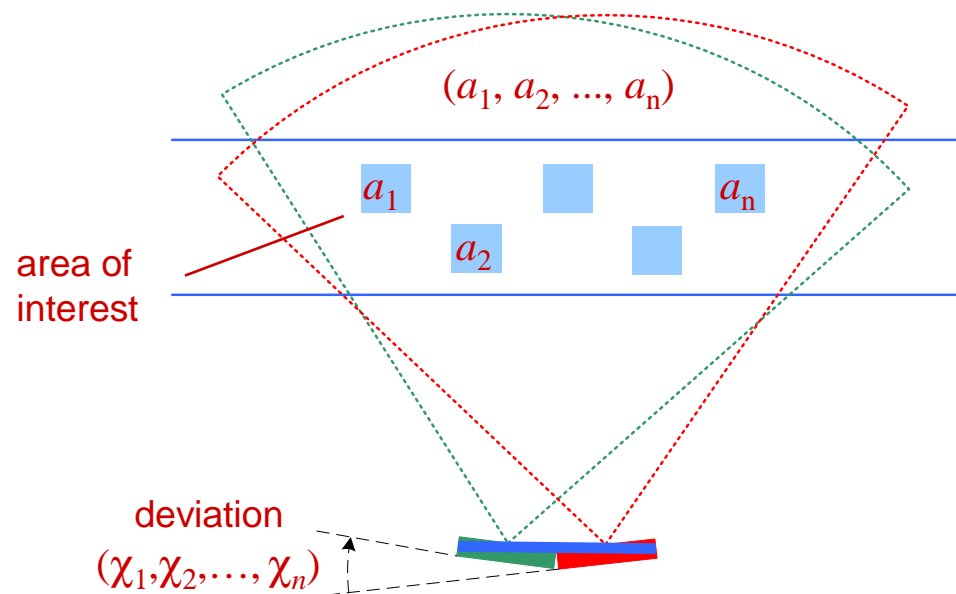
Non-linear flight path

- ▶ A non-linear flight path causes defocusing
- ▶ Autofocus can compensate for this



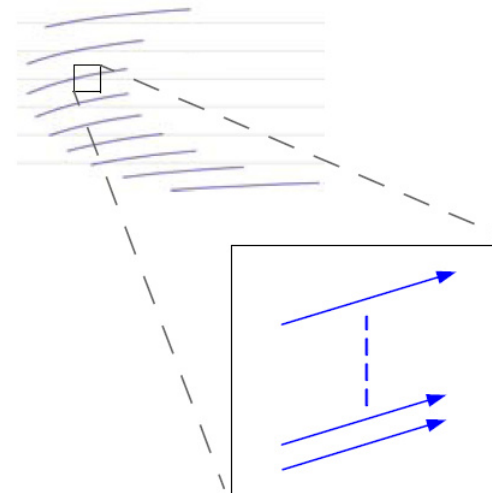
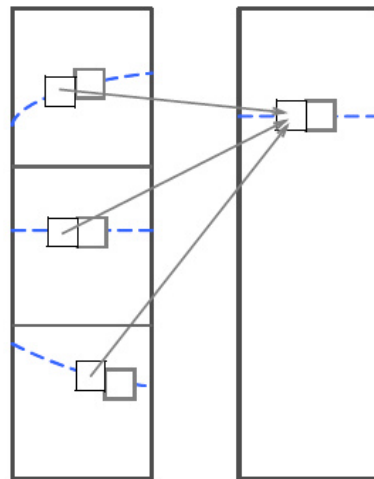
Autofocus

- ▶ Find the best compensation for the path deviation by iteratively matching the contributing images, testing different path parameters



Memory segmentation

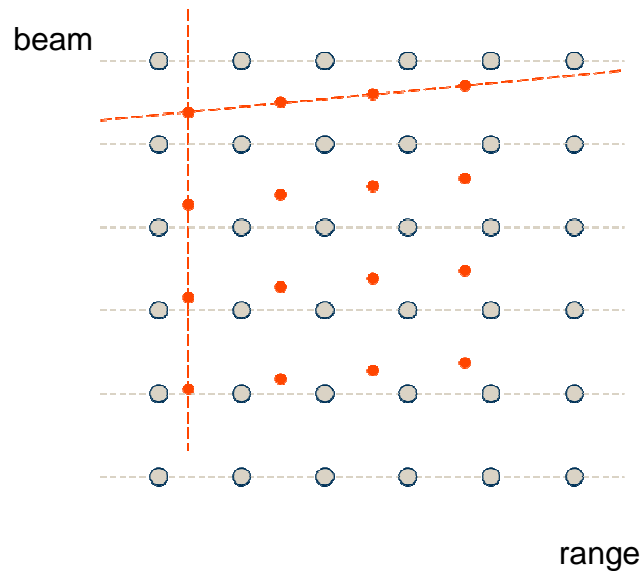
- ▶ Curved memory read paths in data set
- ▶ Path approximated to tilted lines within segments
- ▶ The segments could be rhomb shaped
 - a bundle of read paths



A segment

▶ Assumptions (from MISPA2):

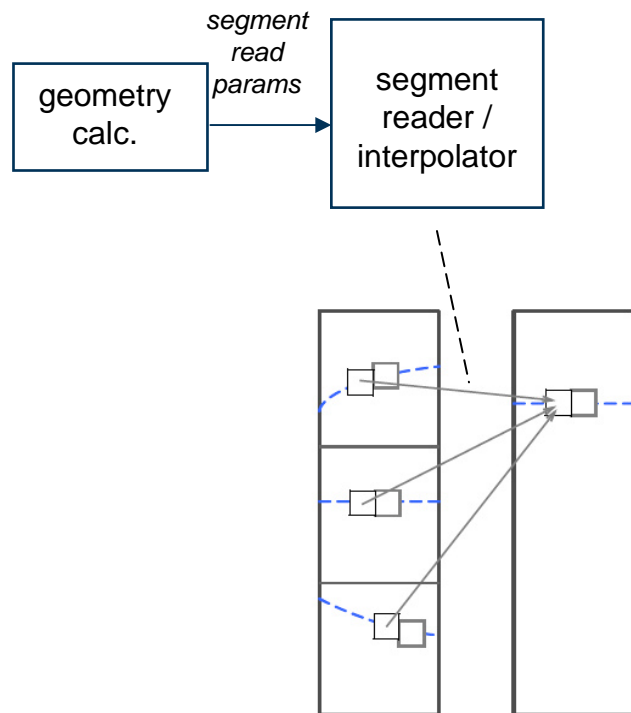
- interpolation points are equidistant in both range and beam direction
- points form a tilted line in the range direction
- points are aligned in the beam direction



▶ Segment characteristics

- “lower left” interpolation point
- “upper right” interpolation point
- interpolation point spacing in range
- interpolation point spacing in beam
- degree of tilt

Segment reader/interpolator



Used by both merger and autofocus
Gets parameters from Geo function

- ▶ Compute intensive
- ▶ High memory BW
- ▶ Tilted memory access (interpolation pattern)

Crucial for efficient real-time realization

Realization of segment reader/interpolator

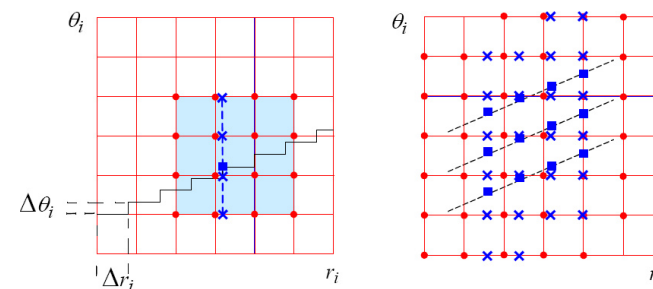
► FPGA realization

- FPGA:s are well suited for “data crunching” such as interpolation operations

► Manycore realization

- a manycore architecture could be a good choice for implementation

► Realization will be studied in WP2



Summary

- ▶ The **autofocus function** has been identified as a realization critical part in future SAR processing
 - performance-intensive image matching

- ▶ The future work of MISPA 3 will focus on this function
 - efficient parallelization and mapping on parallel processing architectures



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