Near Real-Time Processing System: Handling SAR Images

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Earth Observation Showcase – Emerging Applications Powered by Innovative Technologies
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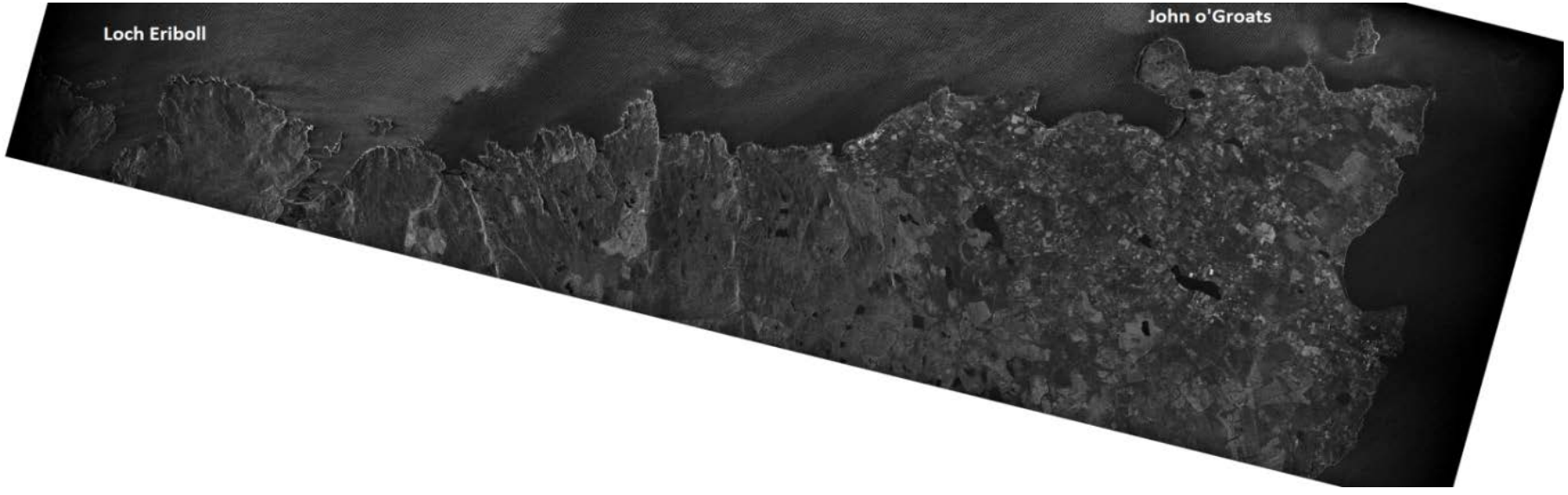
Introduction

- NSTP2 Fast Track Project
- KO March 2015 FR Sep 2016
- Airbus Defence and Space, Satellite Applications Catapult
- Objectives
  - prototype modern SAR SLC slant-range focussing algorithm
  - map onto hardware accelerator – FPGA/multi-core/GPU
  - demonstration system integrated within CEMS
- Aim is to specify a system for near real-time processing and dissemination of SAR imagery
- Inform technology development roadmap for space/airborne/ground segment



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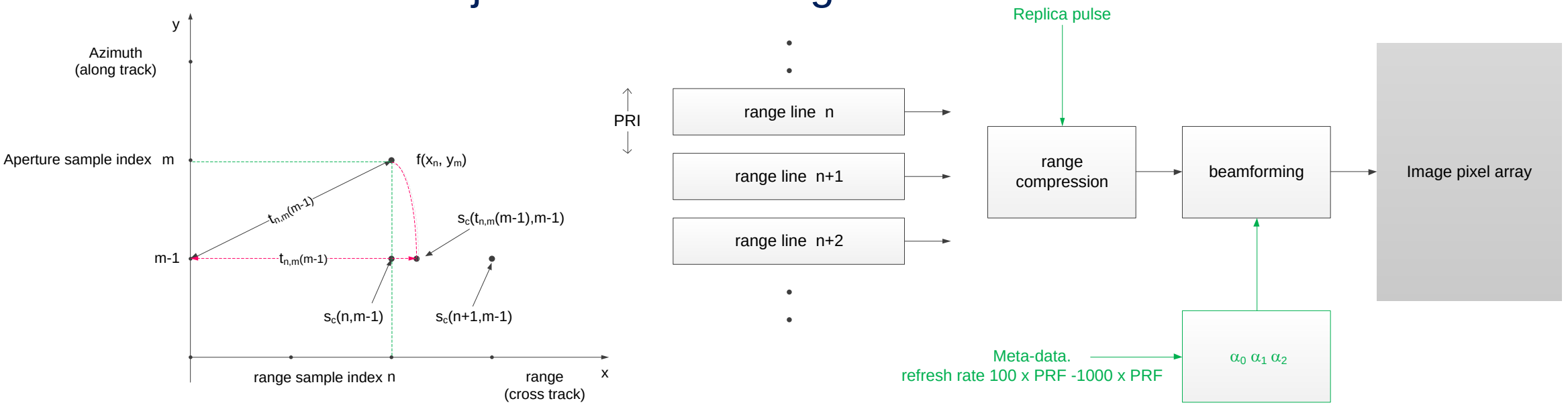
Time Domain Back Projection Processing Flow



- Range lines generated serially by receiver front end at rate = PRF = PRI^{-1}
- May be processed directly as they are received or stored in level 0 memory for subsequent processing
- ‘Range compression’ is simple matched filtering of the range line to focus the radar return in range
- ‘Beamforming’ is the process of calculating the contributions of the focussed range return from the current aperture position to every pixel in the image space
- Range lines may be processed serially or in parallel – no ‘memory’ between successive lines
- Architecture has been investigated that allows for reduced data-bandwidth to remove data transfer bottlenecks in the system.
- Constructed S1 Image used only on-board available data and used no ‘memory’ or calculated parameters that required information from previous/future range lines to keep the whole process contained per Range Line for efficient processing.

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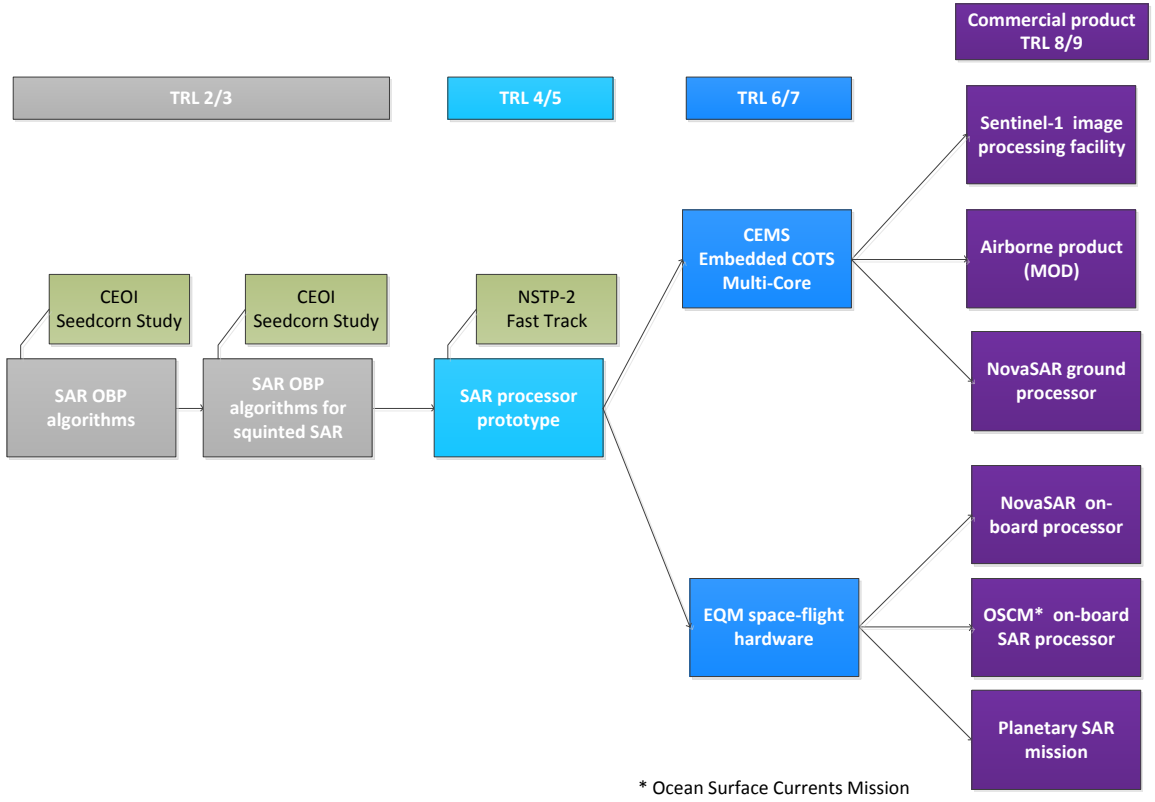
New work

- Mapping the algorithm to a GPU
  - Offers different ‘Speed-up’ Architecture as GPU’s offer best speed up during matrix element-element operations.
  - Vs FPGA which offers a parallelism of compressing multiple echo lines simultaneously.
  - Matlab simulations show a significant speed up is possible (done with a basic end GPU).
  - Currently implementing in C++ to allow running on increased performance GPUs available at Airbus DS.

SATOR: Airbus is also currently working for DSTL to develop SAR technology/hardware/techniques for small or limited platforms. Capability to use GPU acceleration as a 1st implementation demonstration upon completion of previous RnD work.



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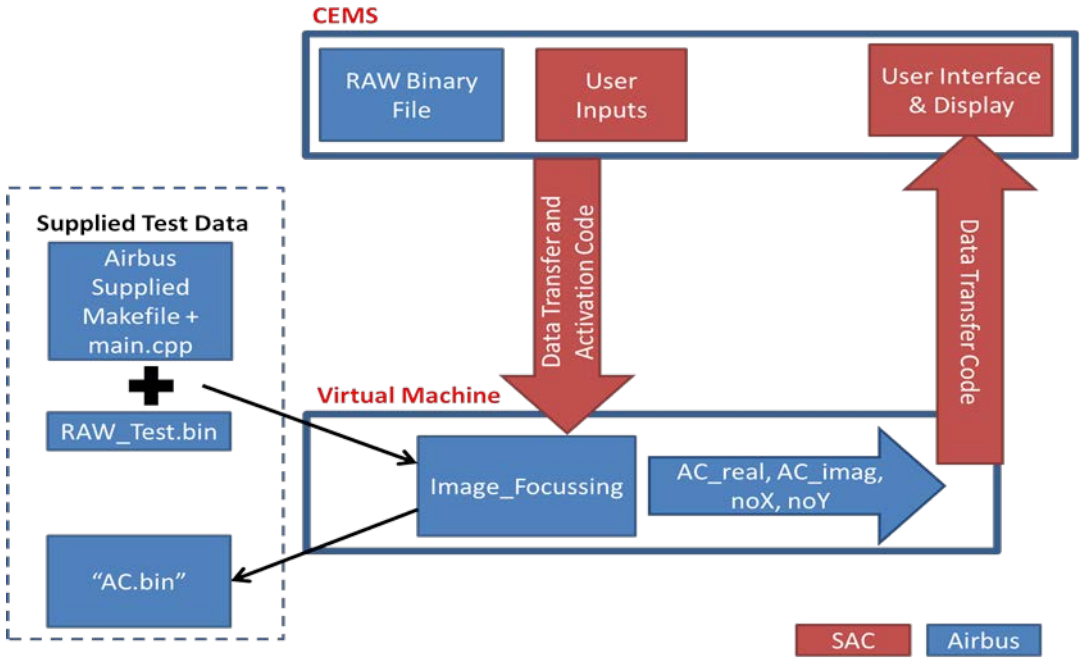
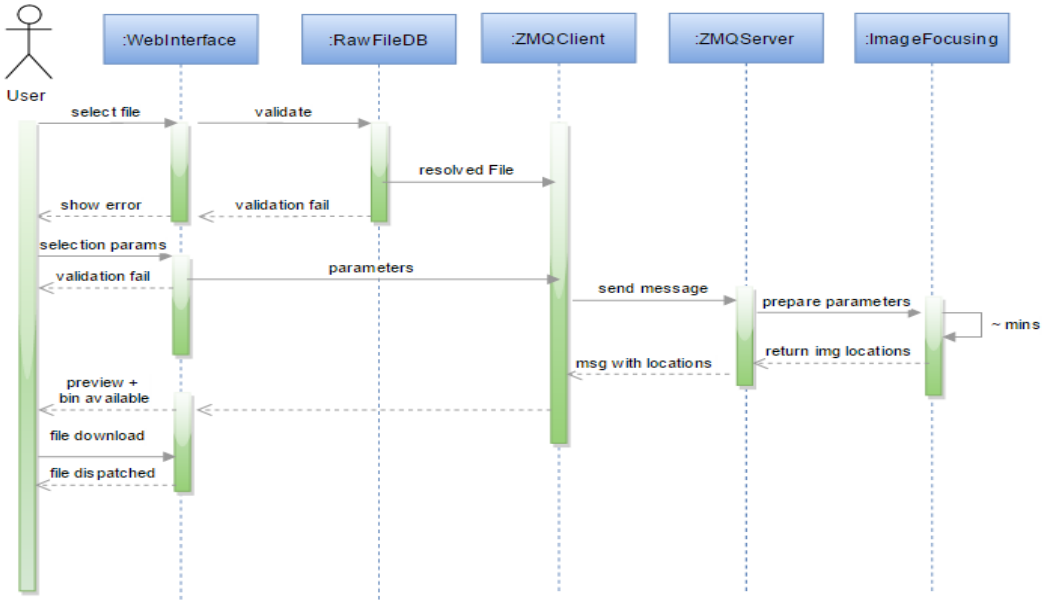
NSTP2-FPGA Application

Application **objectives**:

- UI
- Ability to:
  - select SAR image to process
  - Input parameters
  - interact with Image Focusing algorithm
- Final products available for the user for view and download





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