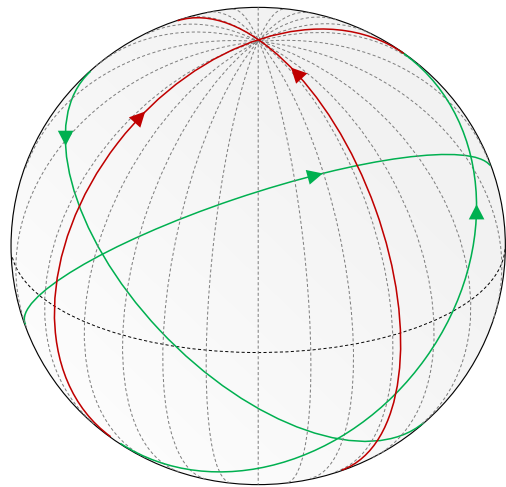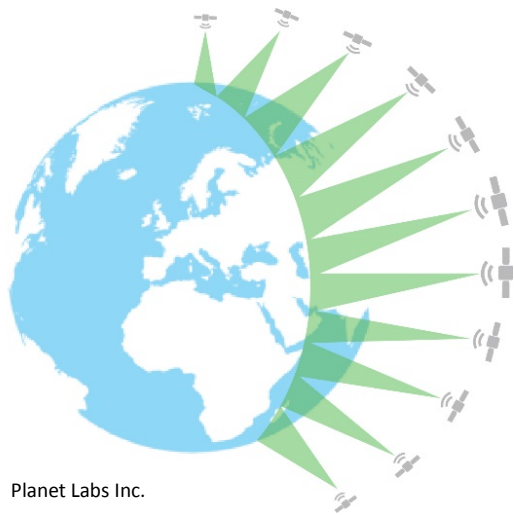# Scanning Compressive Sensing for Earth Observation

CMSIN Project Lead: Dr Daniel Oi

Computational Nonlinear & Quantum Optics

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Concept

Planet Labs Inc.


- (Hyper) Multi-Spectral Imaging, increased target and event discrimination, e.g. Maritime, Security, Agriculture, Disasters

- Constellation of small, inexpensive nanosats to provide persistent coverage with low latency and high revisit capability

- Complementary to fewer, larger, more capable and expensive satellites but with less coverage
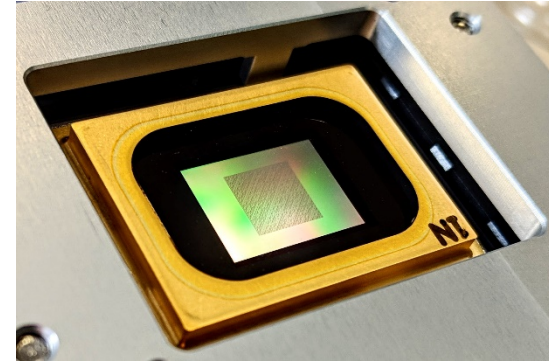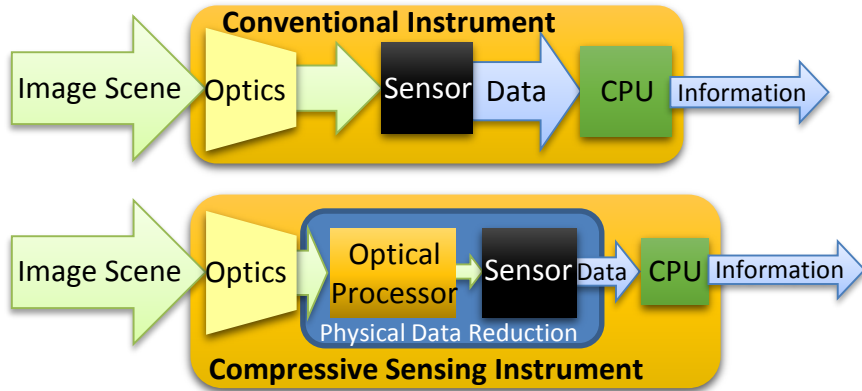
Constellation Design and Utility
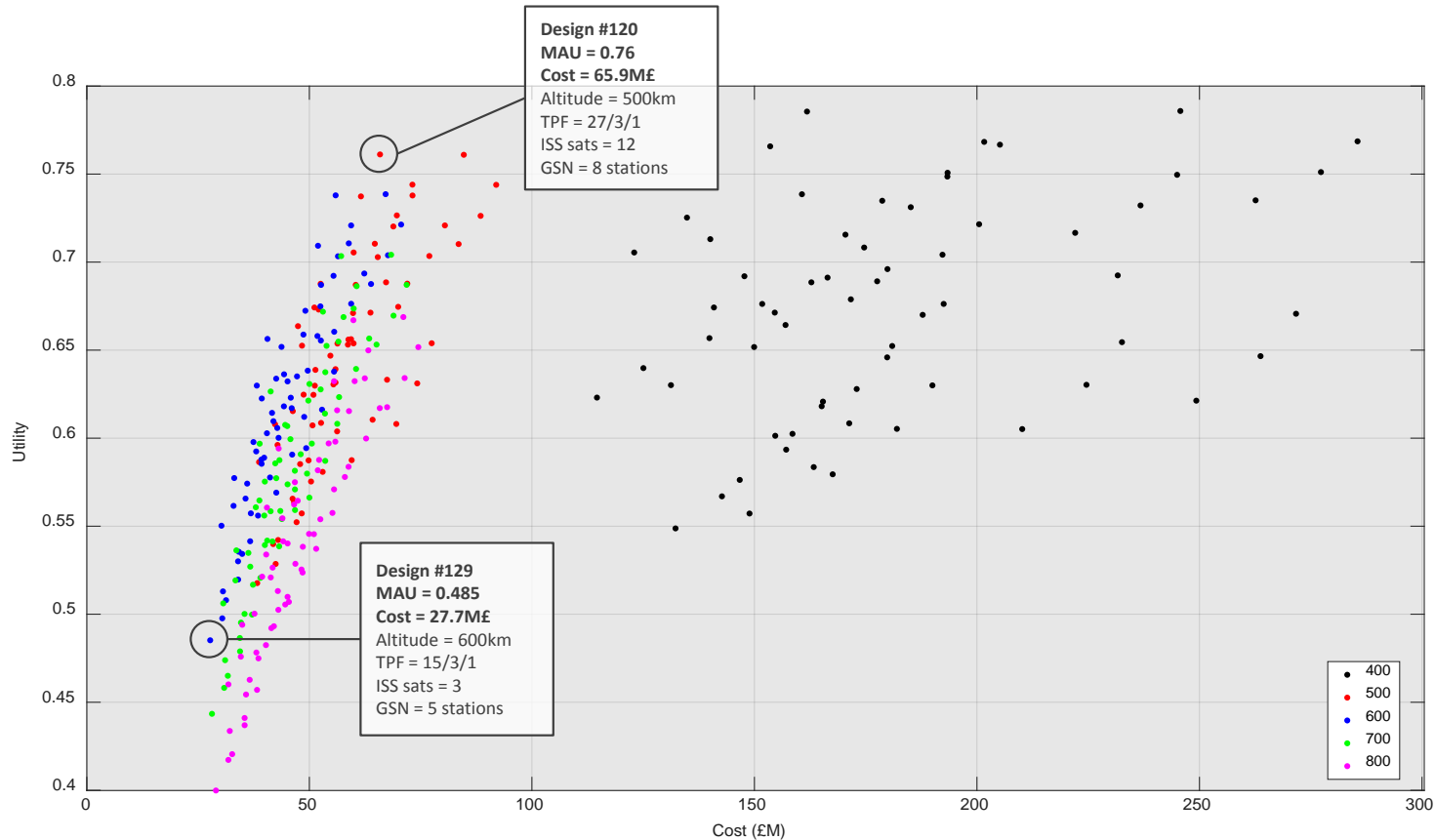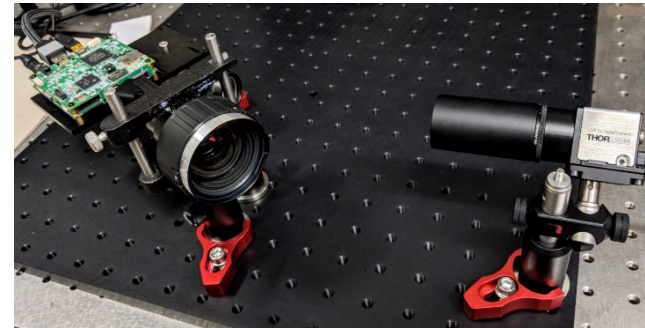

Utility function of:
- Spatial Resolution
- Temporal Resolution
- Data Latency

Compressive Sensing

- Data Deluge problem under CubeSat SWaP constraints

- Compressive Sensing "Single Pixel Camera" (SPC)

Conventional Instrument

Image Scene → Optics → Sensor → Data → CPU → Information

Image Scene → Optics → Optical Processor → Sensor → Data → CPU → Information

Physical Data Reduction

Compressive Sensing Instrument

Digital Light Processing DMD Chip

Single Pixel Camera

- Conventional SPC not suited for EO from LEO [1]

- New type of scanning SPC required

[1] J. E. Fowler, Compressive pushbroom and whiskbroom sensing for hyperspectral remote-sensing imaging, ICIP IEEE (2014).

Compact MSI for Nanosats

- Scanning SPC, shared aperture Vis/SWIR

- Flexible, in-flight programmable sensing modalities

  - Scalable data acquisition rate

  - Intra-scene multiresolution

  - Real-time adaptive target recognition

  - Low-power monitoring mode + wake-up
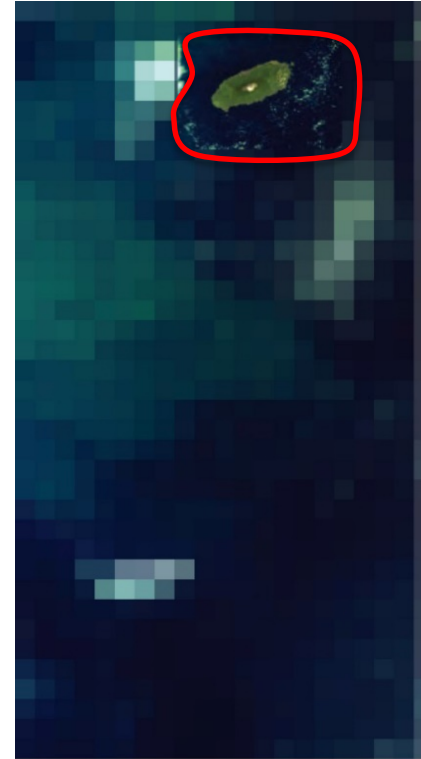
- Potential SNR Improvement in SWIR

CMSIN   Conventional

Simulated Results

Status

- IPR Protection in Progress (NDAs can be arranged)

- Proof-of-principle experiment complete

- Demonstration prototype in development

- Aerial trials planned for 2019

- Looking for partners/collaborations

  - Applications Development

  - Commercialisation

  - IOD Opportunities

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