



A high Resolution Imaging Camera concept for the Marco Polo mission

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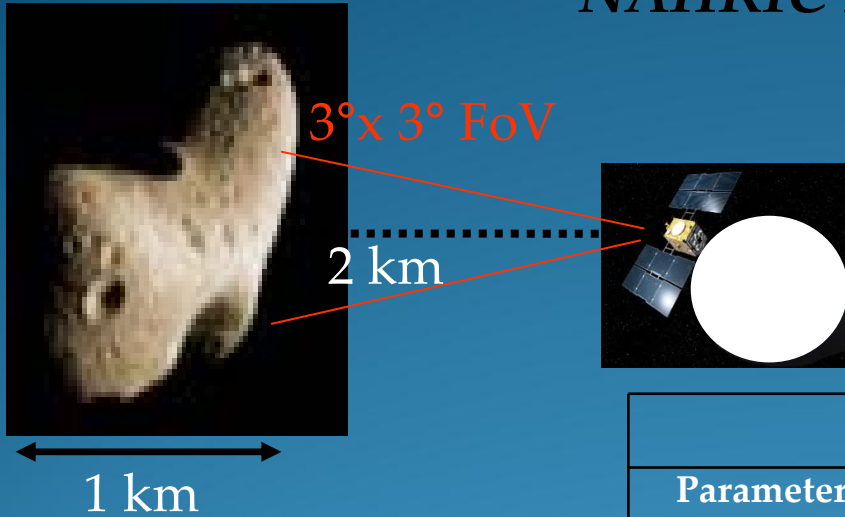
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Scientific and operational objectives

- To carefully analyse the morphology and topography of the NEO target surface;
- To identify landing site opportunities which are suitable for samples acquisition;
- To help (by broad-band filter images) exploration of mineralogical and chemical compositions.



NAHRIC Requirements



Geometric and Radiometric req.

Pointing req.

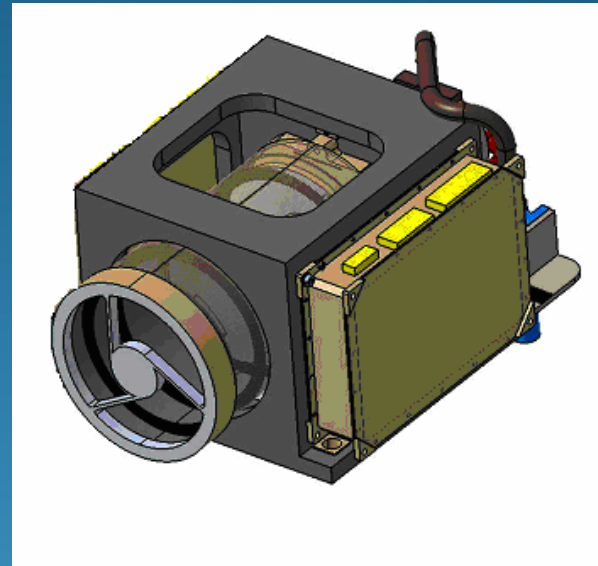
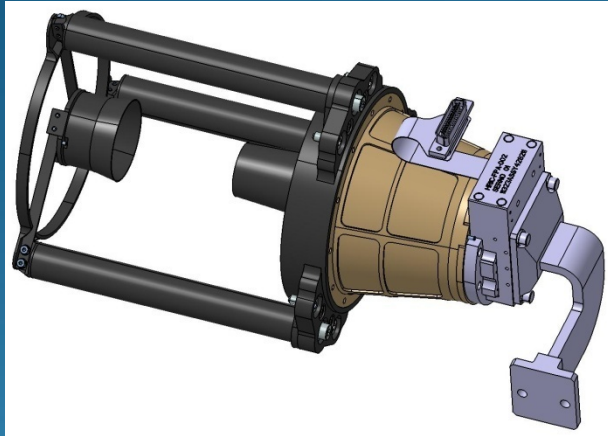
Main Scientific requirements	
Parameter	Value
Pixel scale	0.05 m pixel ⁻¹ at 2 km from NEO
Pixel IFOV	5.2"/pixel
Spectral range	400 ÷ 900 nm
Image quality	Diffraction limited at 400 nm
Field of view	3 deg
Filters	1 panchromatic (central λ = 650 nm; 500 nm bandwidth) 3 band-pass (λ = TBD nm; 40 nm bandwidth - TBC)
AME	5.2 arcsec (absolute accuracy)
RPE	1.5 arcsec/s (stability)

Optical design - Trade-off Analysis

- Optical design optimised wrt the stringent requirement on spatial resolution and considering mechanical and compactness constraints
- The optical design is integrated with filters, detector and mechanics
- Analysis of on-axis (heritage from HRIC SIMBIO-SYS) vs. off-axis solution

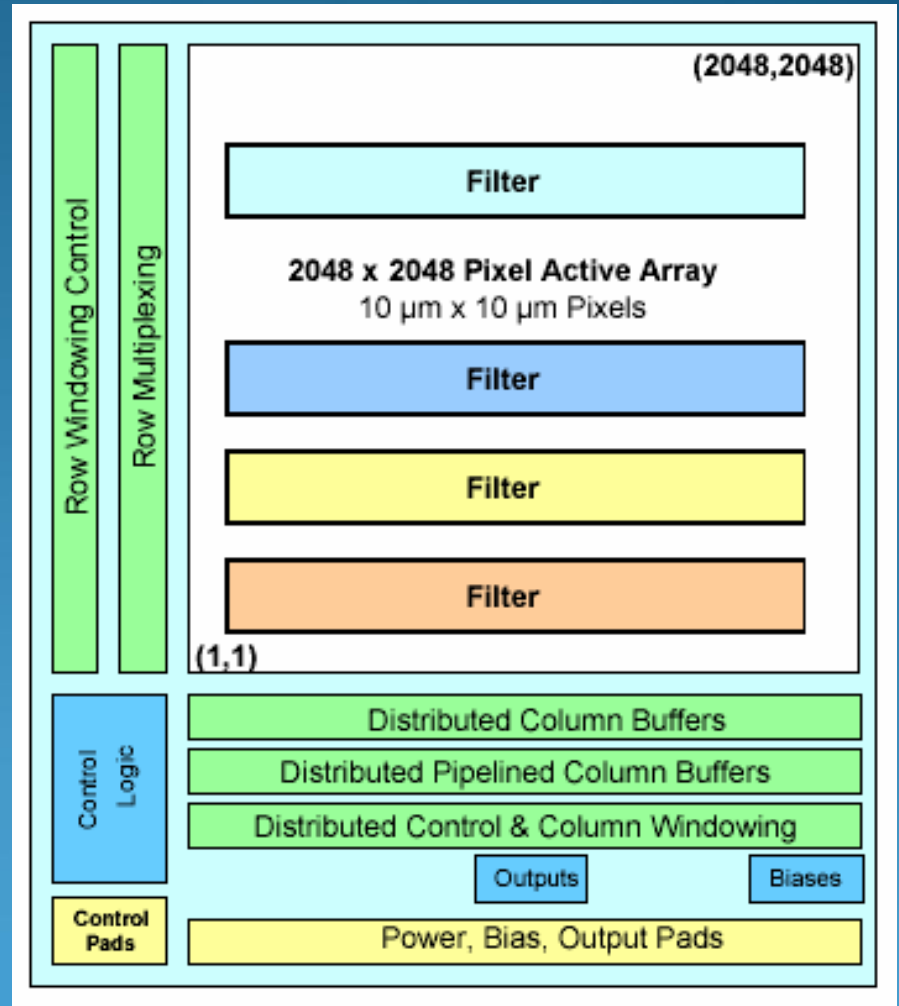
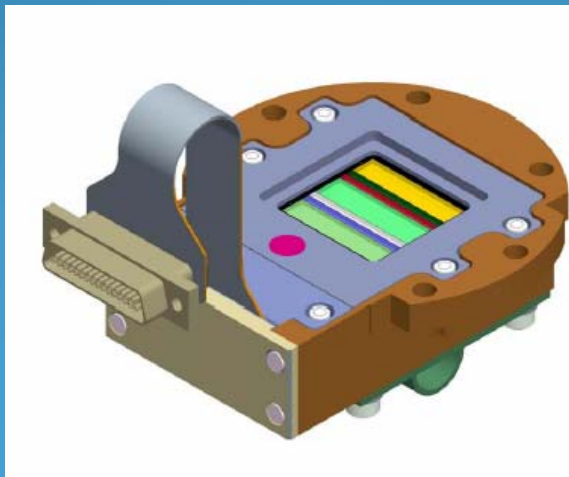
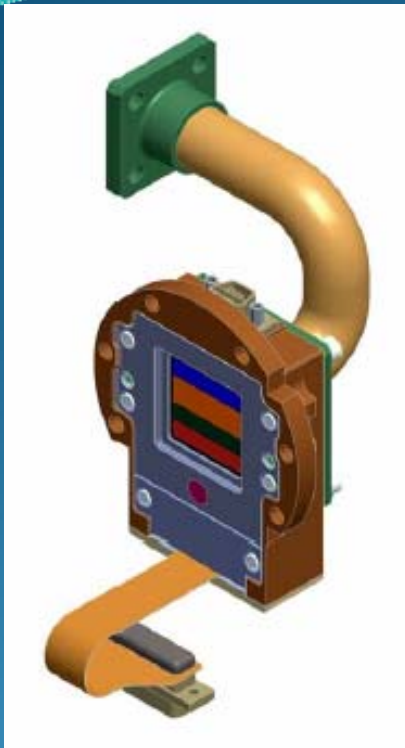
Main optical characteristics	
Parameter	Value
Optical configuration	Catadioptric: Ritchey-Chretien with dedicated corrector
Aperture size	50 mm
Obscuration	30%
F-number	8
Focal length	400 mm
Spectral range	400 ÷ 900 nm (diffraction limited at 400 nm)
Field of view	3 deg
Pixel IFOV	5.2"/pixel
Detector	Si-PIN 2048x2048
Pixel size	10 μm

Budgets

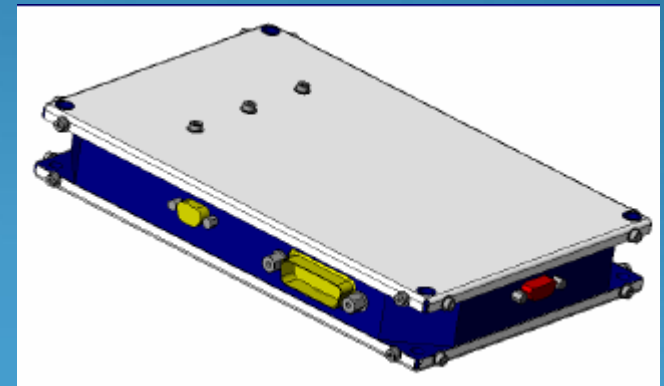
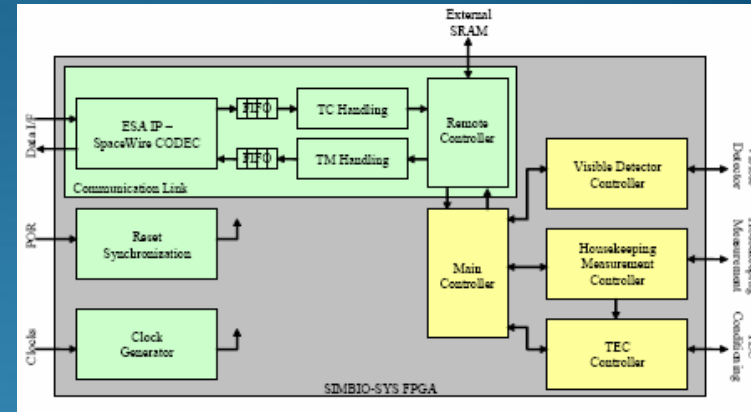
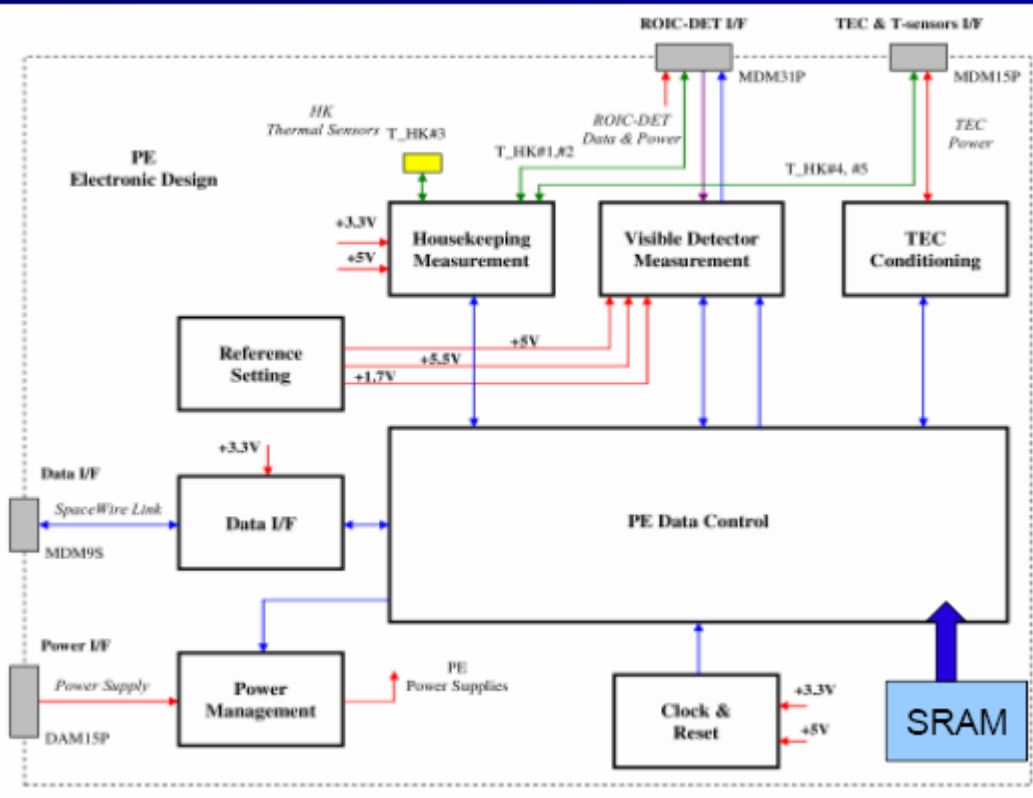


Parameter	Unit	Value	Note
Mass	kg	3.5 Kg	Including PE box, but except cabling between PE and Main Electronics
Dimensions	mm	H=120 mm W=80 mm L=280mm	Volume: $2.7 \cdot 10^6 \text{ mm}^3$
Total average power	W	7	Without ME and DC/DC converter which are assumed part of the S/C electronics

Sensor



Proximity Electronics



Conclusions

Optical design:

- simple, light and compact
- trade-off analysis

Operations:

- cover of the NEO surface
- high image quality (in terms of SNR)
- acceptable data rate

Management:

- Heritage from other on-going projects (sensor, PE, ME)
- Few dedicated (internal) resources