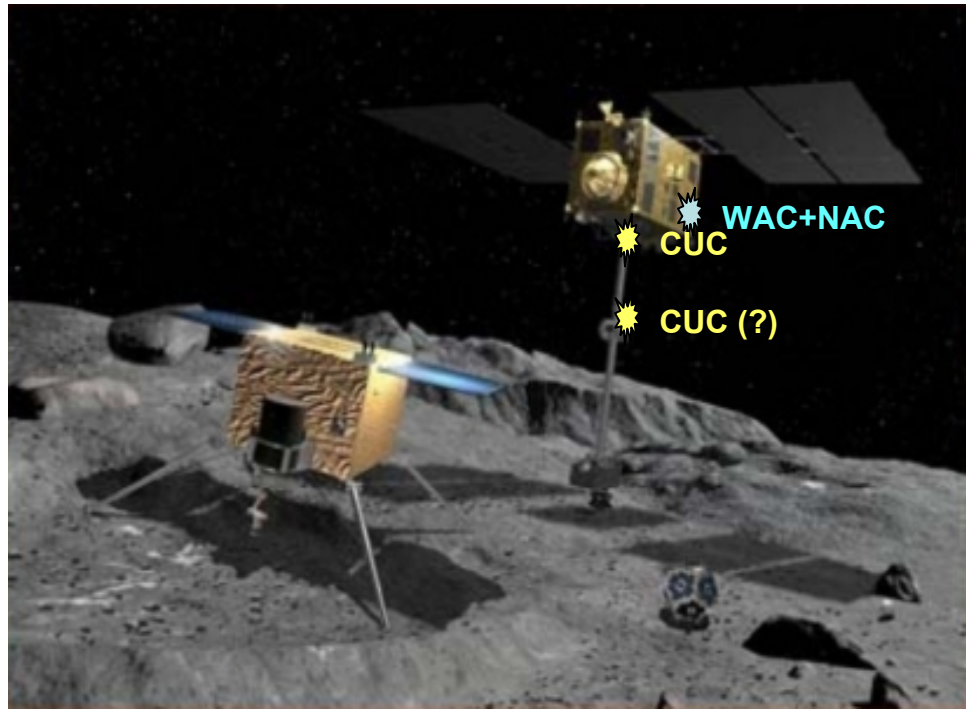
MPCS

The
***M*arco**
***P*olo**
***C*amera**
***S*ystem**

The MPCS Study Team

MarcoPolo Cameras

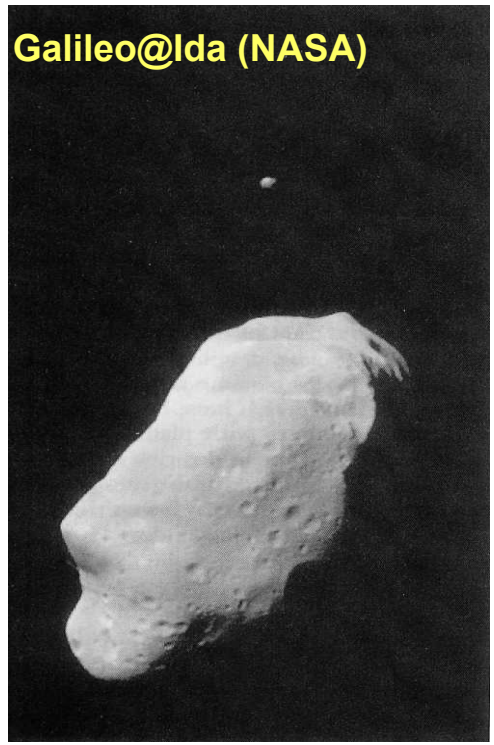
- **Wide Angle Camera WAC**
- **Narrow Angle Camera NAC**
- **Close-up Camera CUC**
  - **WAC+NAC from orbit**
  - **NAC @ 100m distance**
  - **CUC @ surface**

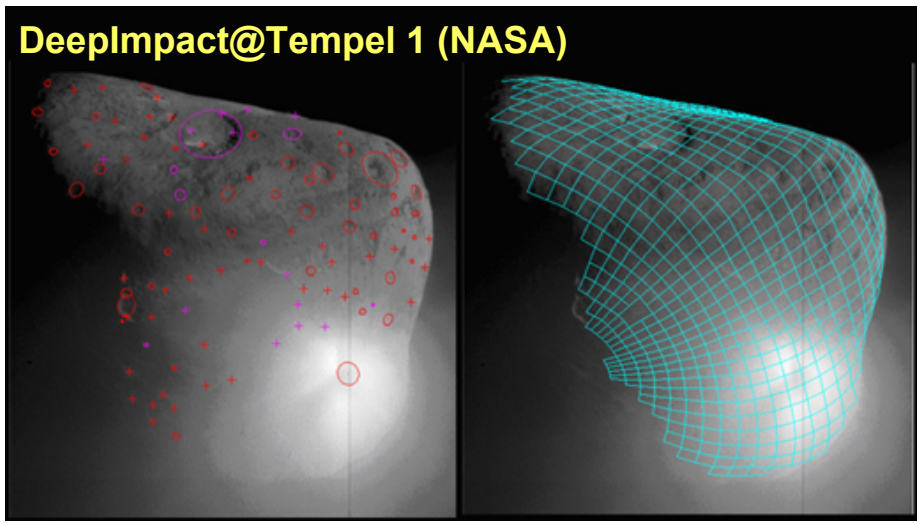


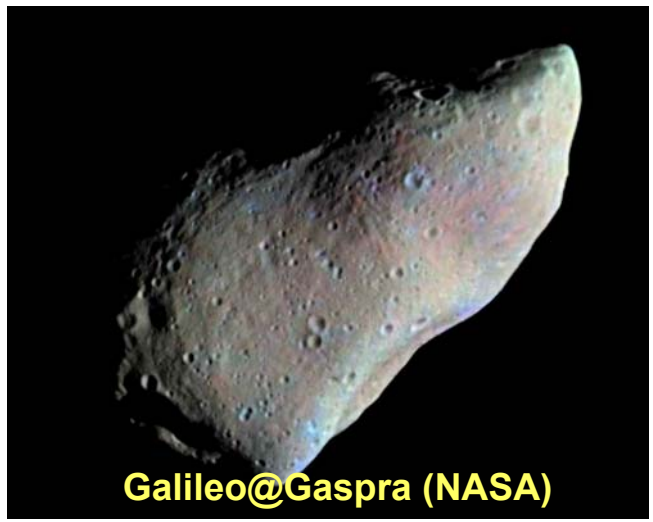
Requirements	Wavelength Range	Spatial Resolution	MPCS Camera
Global Charakterisation	400-1000 nm 1 & 3 filters	dm	WAC, NAC
Local Charakterisation	400-1000 nm 4 filters	mm	NAC
Sample Context	400-1000 nm illumination	100 µm	CUC

MPCS Science

- physical parameters of NEA: size, shape, volume, morphology
- rotation motion: moment of inertia, excited rotation, YORP
- NEA environment: companions
- surface age and processes: craters

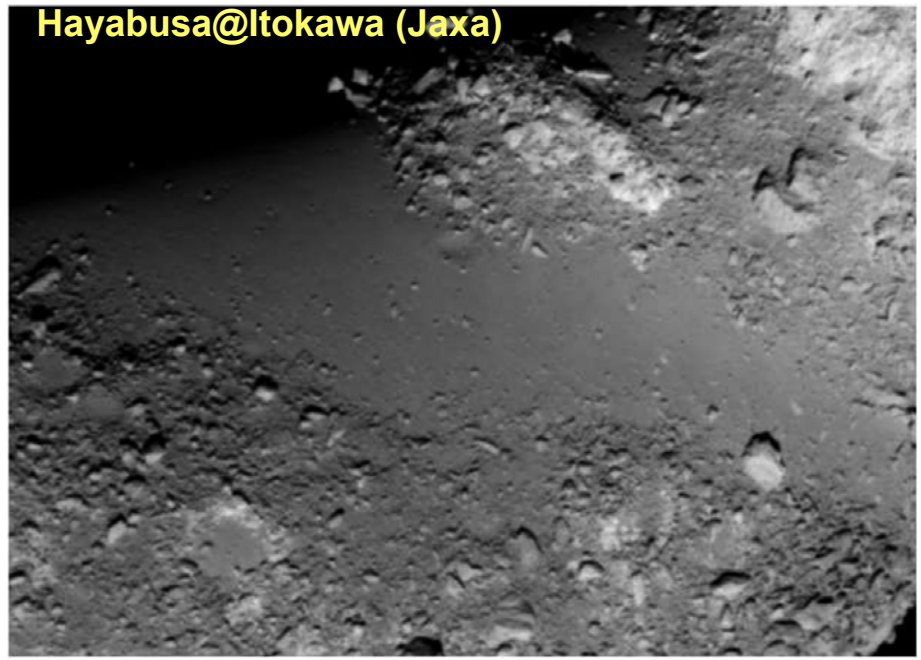


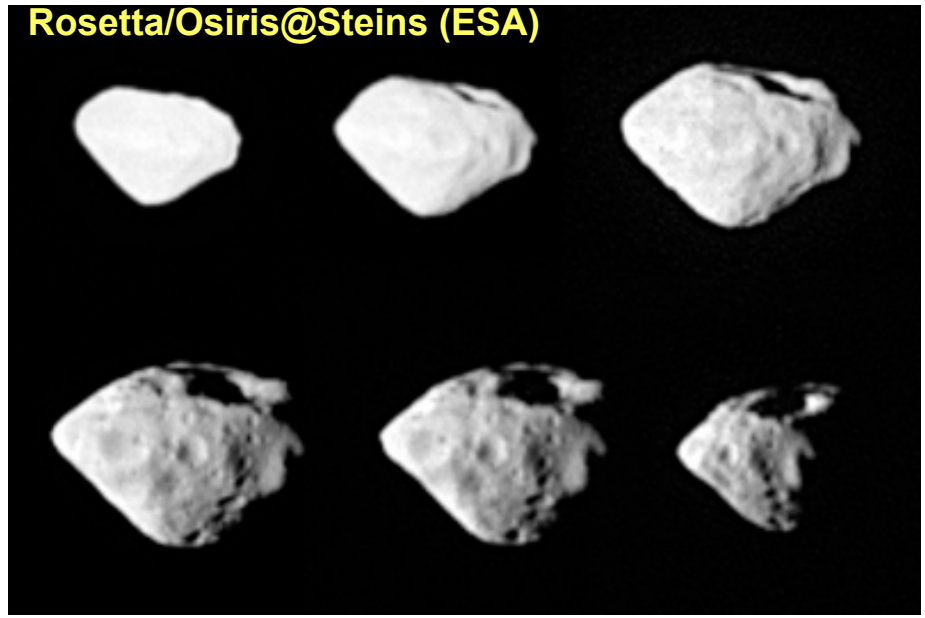




MPCS Science

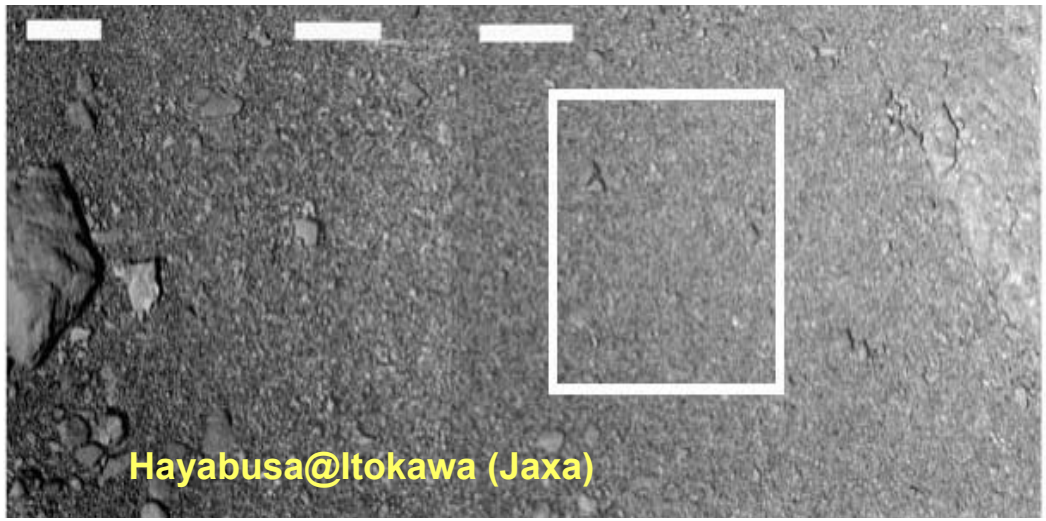
- surface geology: landforms and their origin, body structure
- surface composition: mineralogy, organics, water alterated material
- terrain of landing sites: 3D models, surface structure





MPCS Science

- surface constitution: regolith, space weathering, light scattering
- sampling site structure: regolith microstructure, grain properties



Other Useful Tasks

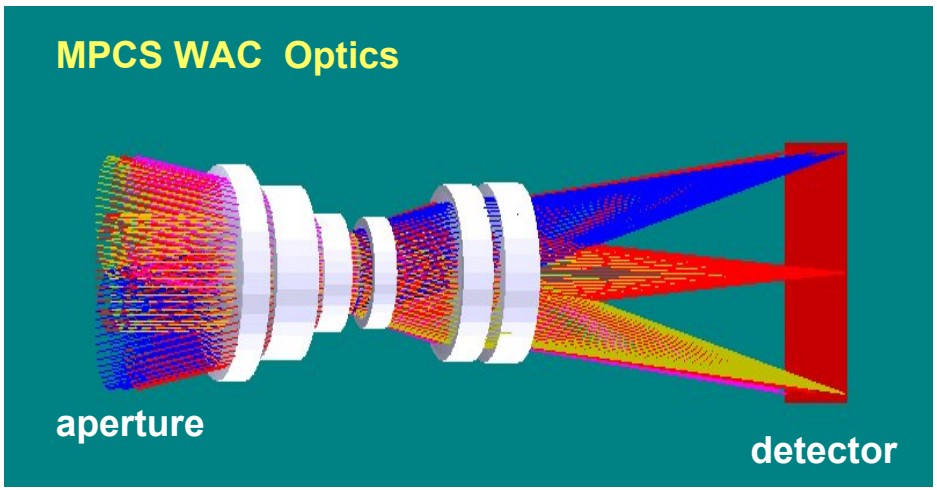
- navigation
- PR*opaganda*

The MPCS Detector(s)

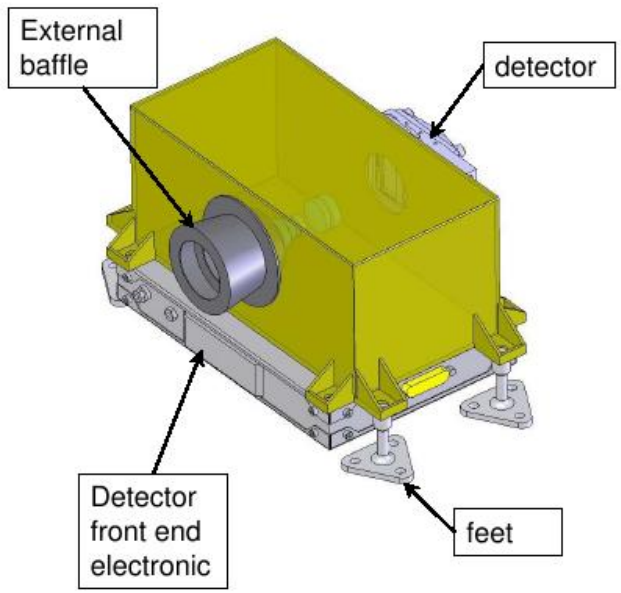
- same APS-type used for all three cameras

The MPCS WAC (1 Unit)

Type	Lens optics		Double Gauss
Aperture & Focal Length	10 & 65	mm	
F ratio	6.5		**Diff. limit @ 650nm**
Field of View	18 x 18	deg	
Wavelength Range	400-950	nm	
Pixel Scale	31.6	arcsec	75 cm/pix @ 5km
Filters	1		panchromatic

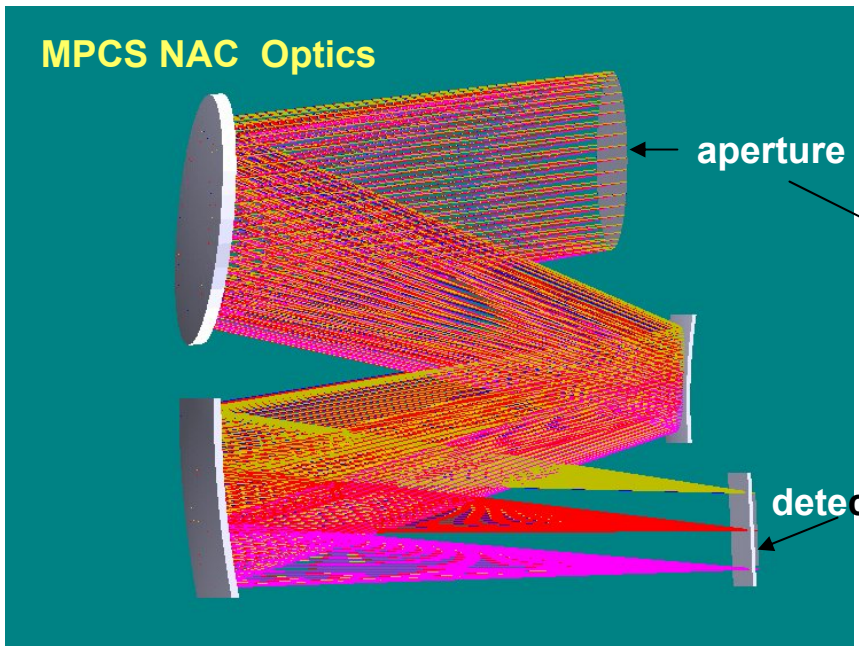


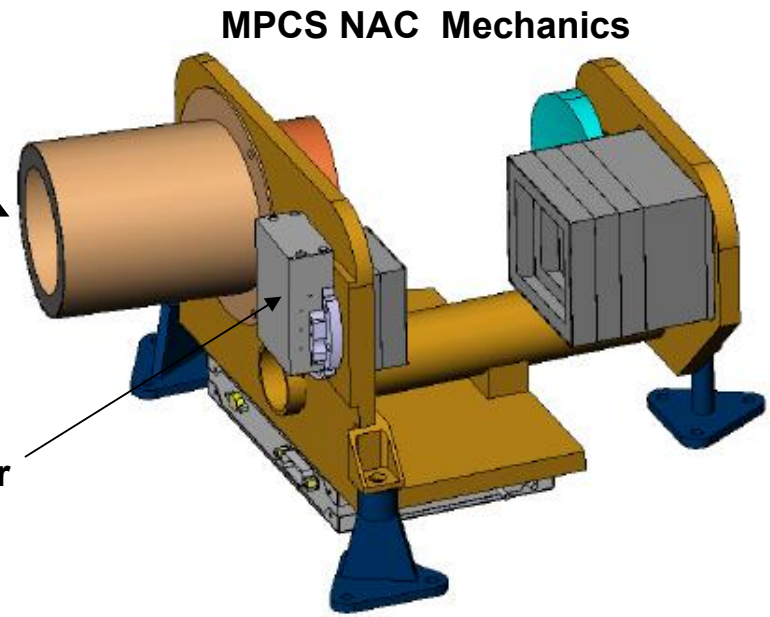
MPCS WAC Mechanics



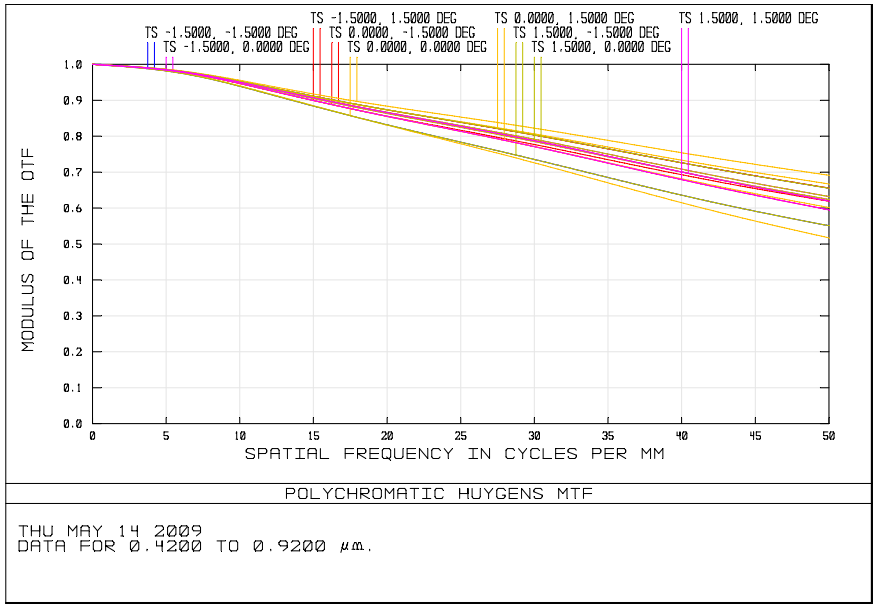
The MPCS NAC (1 Unit)

Type	Mirror optics		TMA (aspheric)
Aperture & Focal Length	50 & 400	mm	
F ratio	8		**Diff. limit @ 650nm**
Field of View	2.95 x 2.95	deg	
Wavelength Range	400-950	nm	
Pixel Scale	5.2	arcsec	2.5 cm/pix @ 1km
Filters	>4		8 filters, polarimetry

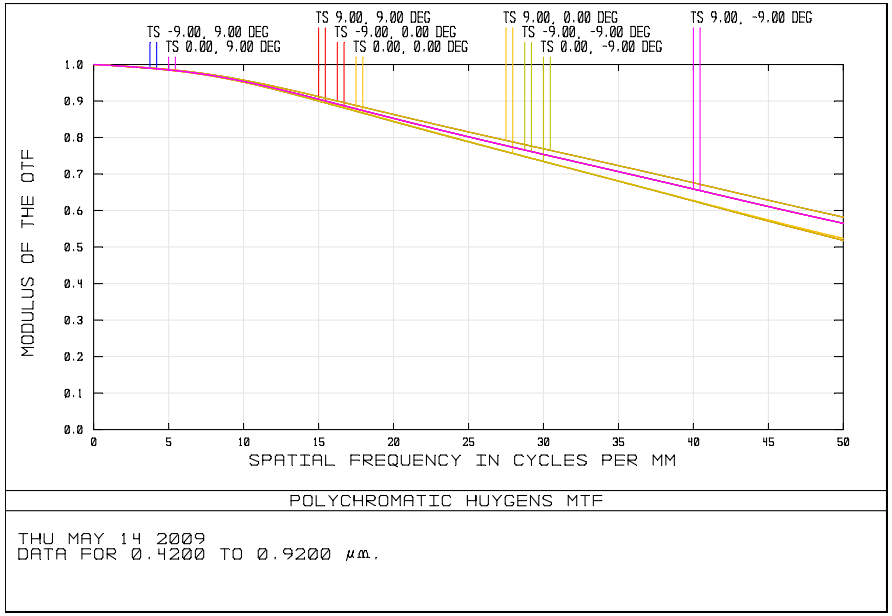




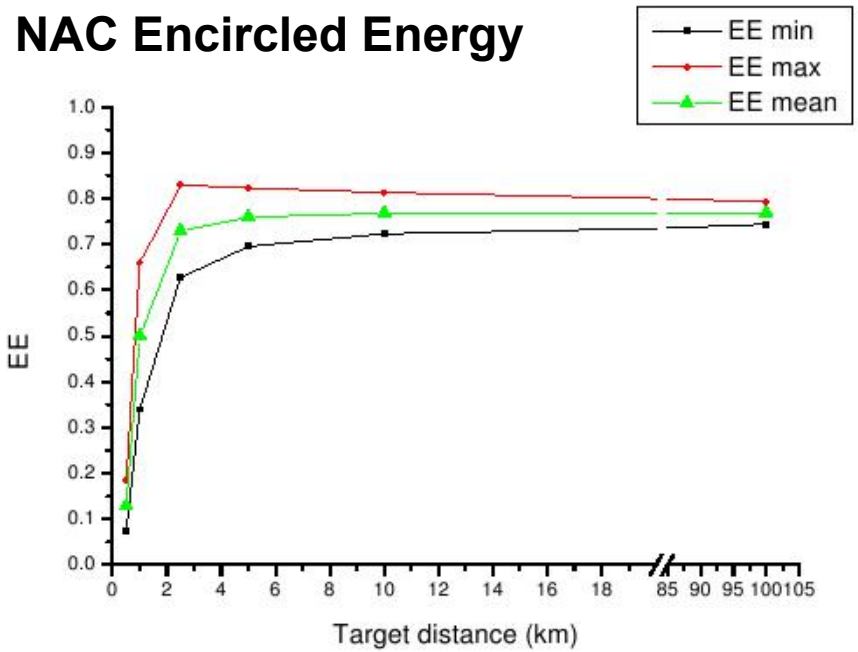
MPCS-NAC MTF



MPCS-WAC MTF



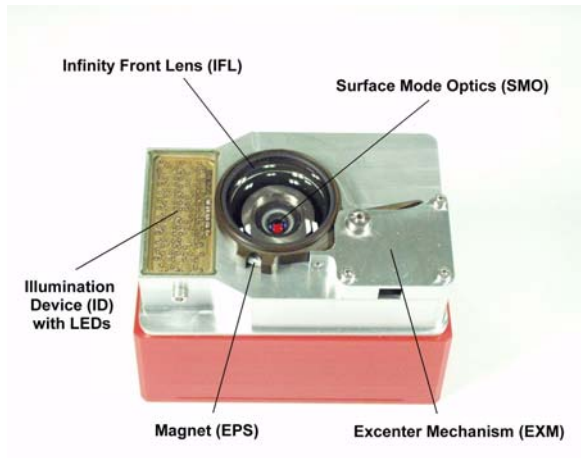
NAC Encircled Energy



The MPCS CUC

Type	Lens optics		
Aperture & Focal Length	10 & 100	mm	
F ratio	10		
Field of View	10 x 10	cm	Size of sampling field
Wavelength Range	400-950	nm	
Pixel Scale	50	µm	@ 0.5m distance
Filters	0		Illumination with > 4 LEDs

PANCAM HRC for ExoMars (DLR)

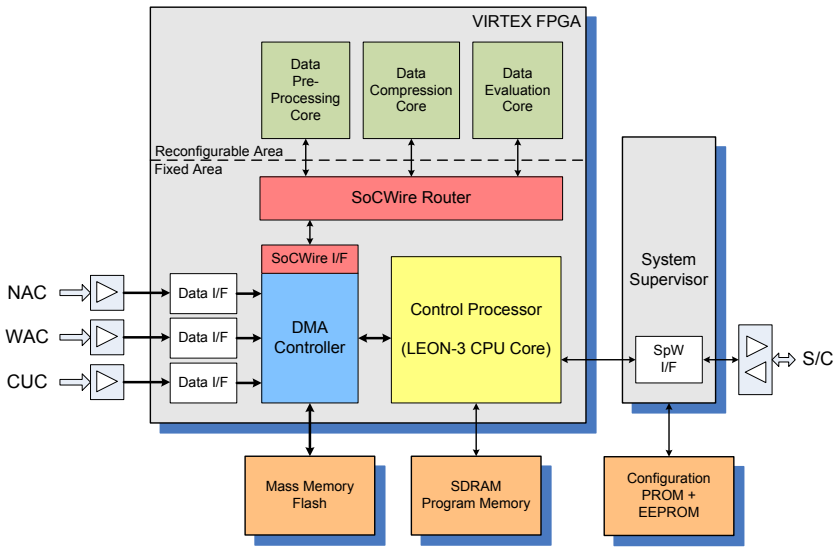


ROLIS for Rosetta (DLR)

PCU & CDPU (1 unit)

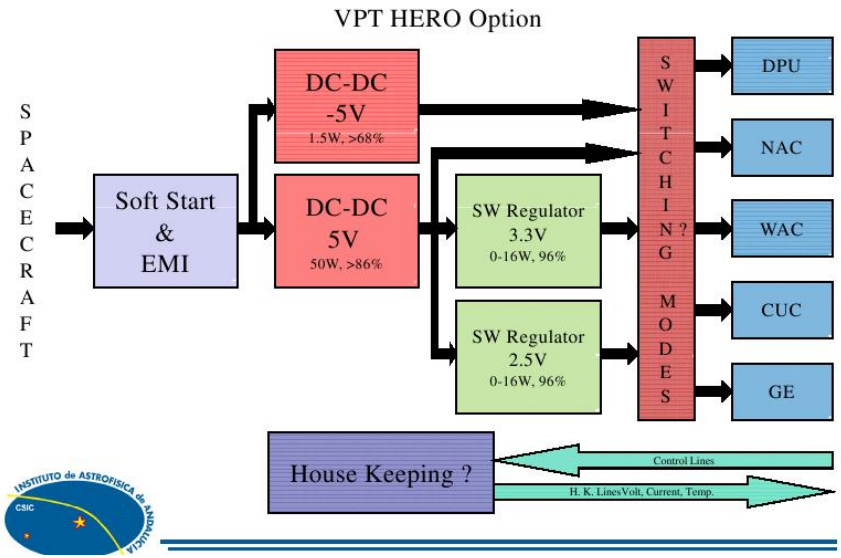
CDPU

- All 3 cameras in parallel
- System-on-Chip (SoC) Design (Xilinx Virtex FPGA)
- Non-Volatile Mass Memory (8000 img.)
- In-Flight Reconfigurability
- Built-in redundancy(cold stand-by)



PCU

- All 3 cameras in parallel
- Built-in redundancy



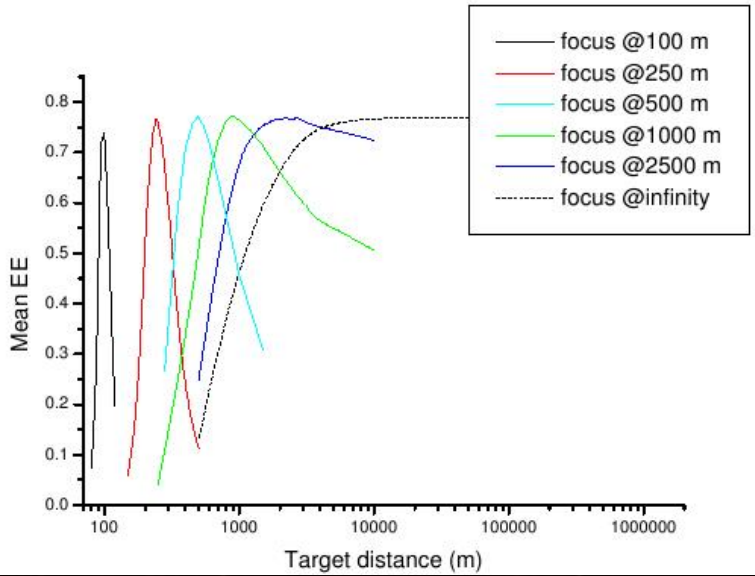
Special Aspects

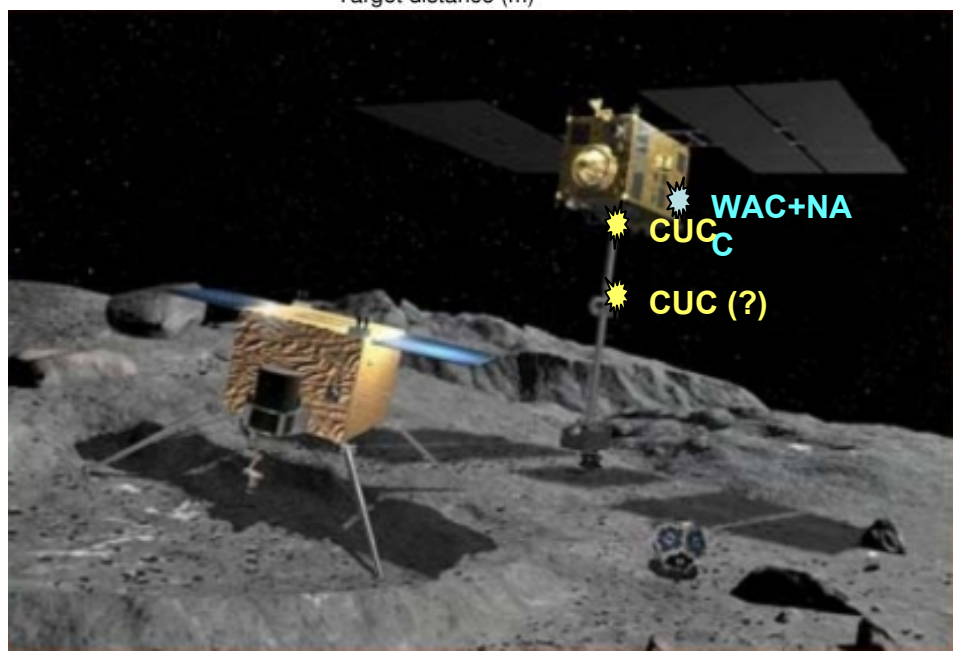
- **Camera re-focusing**
  - for NAC to deliver sharp images @ 100m above surface
  - for CUC to image uneven surface levels of sampling site

  automatic & autonomous procedure

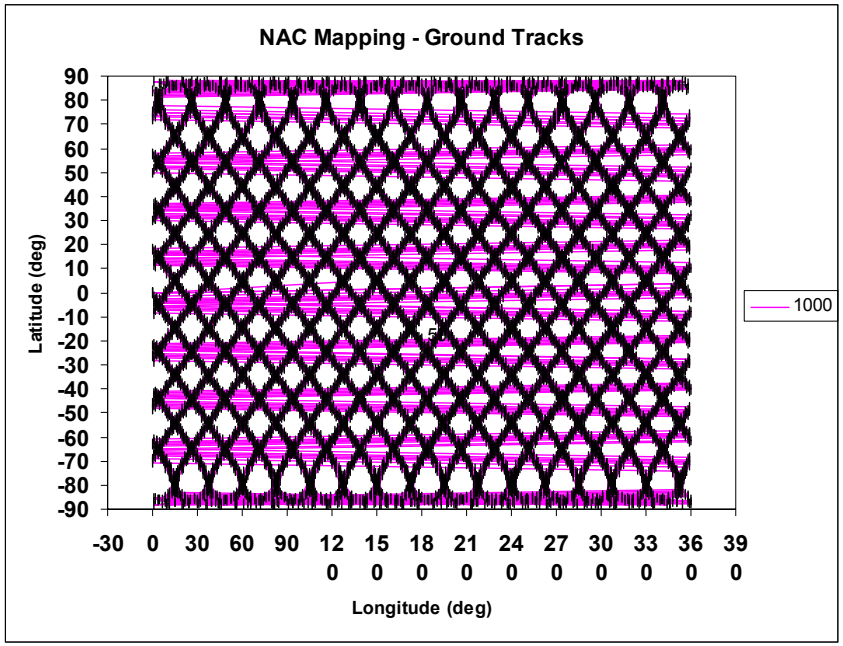
  three locations in optical path (one is sufficient)

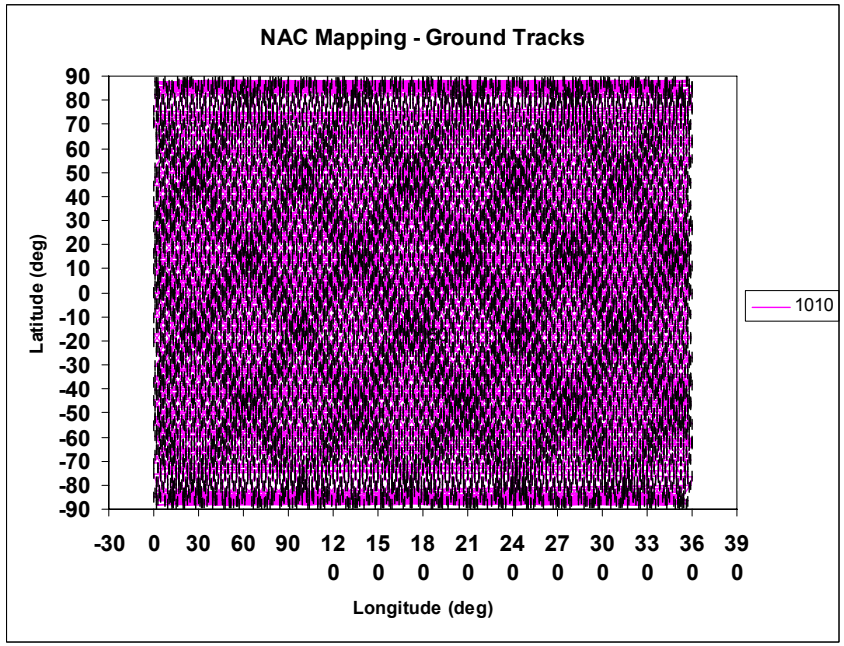
  various mechanics options for re-focusing
- **Camera filters**
  - NAC > 4 filters, maybe polarimetry
  - CUC with LED illumination of surface, positioning unit?
- **Mapping strategy**
  - fixed location advantageous
  - orbiting mapping less fuel





Mapping Strategy





The MPCS Study Team

MPS Katlenburg-Lindau

H.Boehnhardt A.Nathues
H. Perplies G. Tomasch

IAA Granada

L. Lara J. Castro-Marin
M. Herranz J.L. Ramos
J. Rodrigo-Campos

Univ. Politecnica Madrid

I. Perez-Grande G. Alonso
A. Sanz-Andres

Science Team (add.)

A.M. Barucci O. Hainaut
J. Licandro K. Muinonen

INAF&Univ. Padova/Rome

G. Cremonese M. Capria
V. daDeppo S. Debei
M. Lazzarin S. Marchi
S. Magrin F. Mazari
G. Naletto M. Zaccariotto

IDA Univ. Braunschweig

H. Michalik B. Fiethe
B. Osterloh

DLR Berlin-Adlershof

S. Mottola T. Behnke
H. Michaelis N. Schmitz
J. Oberst