On the shoulders of Dawn & Rosetta: Operation of the Asteroid Framing Camera (AFC)

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Dawn-FC and Rosetta/OSIRIS

Dawn Framing Camera
Operated on NASA Dawn
Spacecraft from Sep 2007
to Nov 2018

OSIRIS Narrow Angle (top) and
Wide Angle (bottom) Camera
Operated on ESA Rosetta
Spacecraft from
Mar 2004 to Sep 2016
### Dawn Framing Camera

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focal Length</td>
<td>150 mm</td>
</tr>
<tr>
<td>F-Number</td>
<td>7.5</td>
</tr>
<tr>
<td>Encircled Energy</td>
<td>&gt;80% inside a pixel of 14 μm sq.</td>
</tr>
<tr>
<td>BFL</td>
<td>19 mm</td>
</tr>
<tr>
<td>Focal Shift</td>
<td>&lt;20 μm wrt. channel 4</td>
</tr>
<tr>
<td>Field of View</td>
<td>5.5° × 5.5°</td>
</tr>
<tr>
<td>IFOV</td>
<td>93.7 μrad</td>
</tr>
<tr>
<td>Field Curvature</td>
<td>&lt;10 μm</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>Spectral Range</td>
<td>400–1050 nm</td>
</tr>
<tr>
<td>Spectral Transmission</td>
<td>&gt;75%</td>
</tr>
</tbody>
</table>

Sierks et al. (2011)

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Dawn-FC Planning Scheme

- High Level Observation Plan
- Time Ordered Listing (TOL)
  - Sequence Name
  - Start time, Cadence, Repetitions
- Command Snippets
  - Short command sequences, used for one “station”
  - One to a few images (e.g. colour stack)
- Damocles
  - Input: TOL & Command Snippets
  - Output: integrated commanding file

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Rosetta/OSIRIS Planning Scheme

• Initially derived from Dawn

• Difference:
  • Pointing considered a valuable resource
    PTRM determines timeline (OSIRIS metadata)

• Developments:
  • Complex memory model (compression)
  • Dynamic change of exposure times
    (surface: phase angle; coma: activity level, gas species, etc.)
Static vs. Dynamic Pointing

Static pointing:

Dynamic pointing (ellipse):

Dynamic pointing (two ellipses):
Static vs. Dynamic Pointing

The so called illuminatedPoint might not be illuminated.
Static vs. Dynamic Pointing

SHAP5: nucleus mapping in 2014

SHAP8: nucleus mapping in 2016
Additional OSIRIS Metadata

• Introduced metadata in pointing file
• Event timing intimately linked to pointing
• If pointing changes, timing remains synchronized
Compression Planning

*lossless compression*
(ratio depends on content)

*lossy compression*
(known ratio; easy to plan)

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Instrument MMB and Spacecraft SSMM

Optimisation of instrument MMB and spacecraft SSM: Interaction between MPS Damocles and ESA MAPPS.
Coverage Studies

Identified lack of coverage (and corrected for delivery)

Rosetta/OSIRIS SHAP8

Dawn-FC Occator; XM2 orbits

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Hera / Didymos image simulation
• Spice kernels from Marc Costa
• Fixed nadir attitude kernel
• Morpheus image simulator
• 2022-08-01 to 2022-08-04
• Image rate synchronized with rotation