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# **OSIRIS**

**Optical, Spectroscopic, and Infrared Remote Imaging System**

## **OSIRIS camera distortion correction parameters**

RO-RIS-MPAE-TN-081

Issue: 1

Revision: a

29/06/2015

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## Approval Sheet

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Prepared by: G. Kovacs (signature/date)

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Approved by: H. Sierks (signature/date)



## Document Change Record

Iss./Rev.	Date	Pages affected	Description
D / -	11/05/2015	all	first draft
1 / -	29/06/2015	all	first issue
1 / a	22/2/2017	Sec. 3	Section added
			Inserted Table of Content, List of Tables



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## 1 General aspects

### 1.1 Scope

This document describes the method and parameters for correcting the OSIRIS NAC and WAC camera distortion.

### 1.2 Introduction

The Osiris NAC utilizes a three mirror anastigmat; the WAC utilizes a two mirror anastigmat optical system. Both cameras have high transmission over the UV-VIS-NIR spectral bands, and a chromatic aberration free, near diffraction limited performance. However, the asymmetric optical setup introduces a relatively high image distortion. This effect can be effectively corrected by resampling the image according to the calculated or measured two dimensional distortion function.

### 1.3 Reference Documents

no.	document name	document number, Iss./Rev.
RD1	OSIRIS user manual	RO-RIS-MPAE-UM-004, D/-
RD2	OSIRIS Calibration Pipeline OsiCalliope	RO-RIS-MPAE-MA-007, 1/-



## 2 Distortion correction

### 2.1 Correction method

The camera distortion is measured (or calculated) over the full field of view and the values are fitted to a two dimensional, third order polynomial. The image is corrected by resampling the original pixels based on this polynomial. The undistorted pixel positions ( $X_u, Y_u$ ) are calculated as follows:

$$X_u = \sum_{i,j} kx_{i,j} \cdot X_0^i \cdot Y_0^j$$

$$Y_u = \sum_{i,j} ky_{i,j} \cdot X_0^i \cdot Y_0^j$$

They are expressed as function of the original coordinates ( $X_0, Y_0$ ).  $kx$  and  $ky$  are the coefficients for the distortion removal listed in Table 1.

### 2.2 Correction parameters

The distortion correction parameters were derived during the ground calibration and the first in-flight calibration sequences. The current NAC parameters were obtained by fitting the original PDS float image format on 2014-10-20. The fitting error was less than 0.1 pixels over the full field of view.

index		NAC		WAC	
i	j	kx	ky	kx	ky
0	0	-9.09076000E+00	4.61801000E+00	7.78487000E+01	-1.97971000E+01
0	1	9.06443000E-04	9.97063000E-01	-4.17323000E-02	1.01229000E+00
0	2	-5.26902000E-07	-5.93490000E-07	2.22691000E-05	1.41482000E-05
0	3	-3.32516000E-12	1.99967000E-10	-1.21773000E-17	-5.03314000E-09
1	0	1.01413000E+00	3.21866000E-03	9.10810000E-01	-1.03768000E-02
1	1	-2.39320000E-07	-3.38901000E-06	7.76574000E-06	1.08393000E-05
1	2	1.19823000E-10	1.88602000E-12	-4.14394000E-09	3.76481000E-10
1	3	-2.01772000E-16	-1.95971000E-17	4.93332000E-20	-1.33931000E-13
2	0	-4.71201000E-06	-6.41550000E-08	3.32148000E-05	4.87161000E-06
2	1	8.98608000E-12	1.16434000E-10	8.75255000E-10	-5.06338000E-09
2	2	-7.17827000E-16	-1.12755000E-16	-4.67052000E-13	-2.17359000E-13
2	3	2.23917000E-19	3.01745000E-20	-4.67452000E-23	7.73245000E-17
3	0	2.91214000E-10	-1.06652000E-11	-4.88078000E-09	-1.77868000E-11
3	1	-1.94627000E-16	-4.15382000E-17	-1.39050000E-13	1.73440000E-14
3	2	2.20615000E-19	3.98303000E-20	7.41997000E-17	2.62340000E-18
3	3	-6.87882000E-23	-1.09102000E-23	1.40179000E-26	-9.33268000E-22

**Table 1:** Coefficients for geometric distortion removal.



### 3 Calibration files used by OsiCalliope

The calibration files used by OsiCalliope to calibrate OSIRIS images are:

- NAC\_FM\_DISTORTION\_V01.TXT
- WAC\_FM\_DISTORTION\_V01.TXT

Previous versions:

- NAC\_FM\_DISTORTION.LBL (obsolete, same values as NAC\_FM\_DISTORTION\_V01.TXT)
- WAC\_FM\_DISTORTION.LBL (obsolete, same values as WAC\_FM\_DISTORTION\_V01.TXT)