OSIRIS

Optical, Spectroscopic, and Infrared Remote Imaging System

OSIRIS camera bad pixel list

RO-RIS-MPAE-TN-080

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Document Change Record

Iss./Rev.	Date / Author	Pages affected	Description
1 / -	29/06/2015 G. Kovacs	all	first release
1 / a	22/2/2017 G. Kovacs	Sec. 3	Section added
1 / b	21/02/2018 C. Güttler	Sect. 2 and 3	Adding NAC "scar" area to uncorrected bad pixel Harmonization of format
1 / c	24/10/2018 C. Güttler	Data: Sects. 2.2.3, 2.3.3, and 3 Text: all	- Added backtravel opening and black bottom line, to be treated as NO_CORR - Several clarifications in text

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1 General aspects

1.1 Scope

This document describes the current bad pixel list of the OSIRIS NAC and WAC. It also specifies their correction methods.

1.2 Introduction

The OSIRIS cameras are equipped with 2048x2048 backside illuminated CCDs. These devices may contain blemishes, which must be corrected during the image calibration process. These are generally referred to as *bad pixels* and are produced:

- during the manufacturing of the detector
- during integration of the camera system
- in-flight

Furthermore, temporary malfunction of the instrument may produce image artefacts, which are treated algorithmically similar to CCD blemishes and flagged in the QUALITY_MAP of the images. These are also listed in this document.

1.3 Applicable Documents

no.	document name	document number, Iss./Rev.
AD1	OSIRIS Experiment Data Record and Software Interface Specification (EDR/SIS)	RO-RIS-MPAE-ID-018
AD2	Rosetta-OSIRIS to Planetary Science Archive Interface Control Document	RO-RIS-MPAE-ID-015

1.4 Reference Documents

no.	document name	document number, Iss./Rev.
RD1	OSIRIS user manual	RO-RIS-MPAE-UM-004, D/s
RD2	OSIRIS Calibration Report	RO-RIS-MPAE-RP-147, D/b
RD3	OSIRIS Calibration Pipeline OsiCalliope	RO-RIS-MPAE-MA-007, 1/d
RD4	Shutter parameters for exposure time calculation	RO-RIS-MPAE-TN-073, 1/c

2 Bad pixel list

2.1 Correction method

The general concept is that bad pixels can be corrected by replacing their DN values by the median (or average) of the neighboring good ones. Lines, columns or areas can also be corrected by shifting their DN values to match the adjacent line or area. The implemented methods are called:

- *SHIFT_**X**_CORR* [**X** = *L* or *R*]
- *MEDIAN_CORR*
- *NO_CORR*

Note that the NO_CORR method does not result in any correction but the affected pixels are flagged in the QUALITY_MAP of the image.

Details on the correction methods can be found in [RD3].

2.2 NAC bad pixels

The current bad pixels list is applicable to all OSIRIS flight data.

2.2.1 Individual bad pixels and correction methods

No individual bad pixels are known or corrected.

2.2.2 Bad columns and correction methods

Column 995 is a bad column, with further effect on the neighboring columns (C994 and C996). The method first corrects columns 994 and 996 by shifting their values to match in average with C993 and C997. Column 995 is then corrected by replacing each of its pixels DN with the median of 6 neighboring column pixels.

The following correction is implemented:

    COLUMN = (994, 0, SHIFT_L_CORR, 128)
    COLUMN = (996, 0, SHIFT_L_CORR, 128)
    COLUMN = (995, 0, MEDIAN_CORR, 128)

2.2.3 Bad areas and methods

The NAC "blob" area is a rectangular area with effectively higher (dark) noise. This is marked in the image quality map, but currently not corrected.

The following is implemented in the database:

    AREA_R = (915, 970, 20, 20, NO_CORR, 128)

Moreover, the "scar" area is a V-shaped feature from a particle sticking on the CCD surface. The particle is scattering light and dimming the pixels below. The feature is mostly corrected by the high spatial frequency flat-fielding but should be treated with care in some cases and, in particular, for photometry. The feature is not corrected by the bad-pixel algorithm but marked in the quality map.

The following is implemented in the database:

    AREA_R = (1559, 645, 14, 24, NO_CORR, 128)

In the time frame of January and February 2015 (planning phase MTP012 and MTP013), about 70 NAC images were affected by a shutter mechanism malfunction. After the end of exposure, when both blades traveled back to the home position, there was a small gap between the blades and extra light could reach the CCD during readout. This *backtravel opening* shows as vertical stripes on the images, resembling a curtain. Details on the shutter operation can be found in [RD4]. Images affected by this cannot be corrected but are flagged in the QUIALITY_MAP.

The following is implemented in the database:

AREA_R = (0, 0, 2048, 2048, NO_CORR, 2)
Note: This is only applied for images that are affected by the NAC backtravel opening, which is flagged in the DATA_QUALITY_ID in the image header.

2.3 WAC bad pixels

The current bad pixels list is applicable to all OSIRIS flight data.

2.3.1 Individual bad pixels and correction methods

No individual bad pixels are known or corrected.

2.3.2 Bad columns and correction methods

The WAC has one bad cluster at column 119, for line 1664 and larger.

The following correction is implemented:

COLUMN = (119, 1664, MEDIAN_CORR, 128)

2.3.3 Bad areas and methods

During the end of the Rosetta mission, the WAC mechanical shutter was operated in the so called BALLISTIC_DUAL mode (details in in [RD4]). Due to an imperfect blade travel, this resulted in an opening of the two blades in the upper part of the full frame image (in Rosetta standard orientation), thus extra light. Images affected by this cannot be corrected but are flagged in the QUIALITY_MAP.

The following correction is implemented:

AREA_R = (0, 1536, 2048, 512, NO_CORR, 2)
Note: This is only applied for images that are affected by the WAC backtravel opening, which is flagged in the DATA_QUALITY_ID in the image header.

A total of 11 images in MTP029 and MTP032 are affected by an image artefact in the lower few lines (in Rosetta standard orientation). These pixels show sub-bias values and the number of affected lines are in the few tens. Images affected by this cannot be corrected but are flagged in the QUIALITY_MAP. The correction is currently implemented for the first 100 lines in CCD coordinates, while it was recognized for two images that this artefact can also be observed for windowed images. Further studies are ongoing.

The following correction is implemented:

AREA_R = (0, 0, 2048, 100, NO_CORR, 16)
Note: This is only applied for images that are affected by this artefact, which is flagged in the DATA_QUALITY_ID in the image header.

3 Calibration files used by OsiCalliope

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

- WAC_FM_BAD_PIXEL_V02.TXT
- NAC_FM_BAD_PIXEL_V03.TXT

Previous versions:

- WAC_FM_BAD_PIXEL_V01.TXT
- NAC_FM_BAD_PIXEL_V02.TXT
- NAC_FM_BAD_PIXEL_V01.TXT
- NAC_FM_ BAD_PIXEL_LIST.LBL
  (obsolete, same values as NAC_FM_BAD_PIXEL_V01.TXT)
- WAC_FM_ BAD_PIXEL_LIST.LBL
  (obsolete, same values as WAC_FM_BAD_PIXEL_V01.TXT)