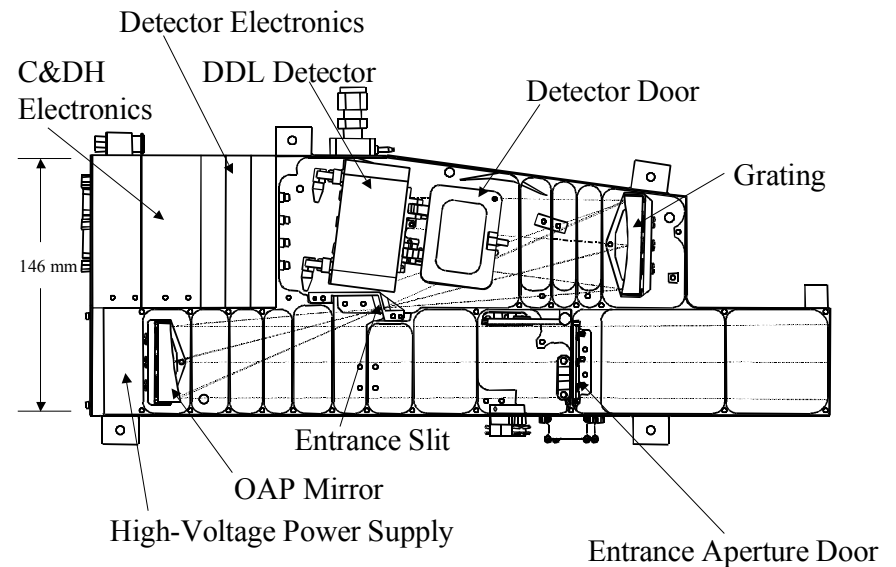
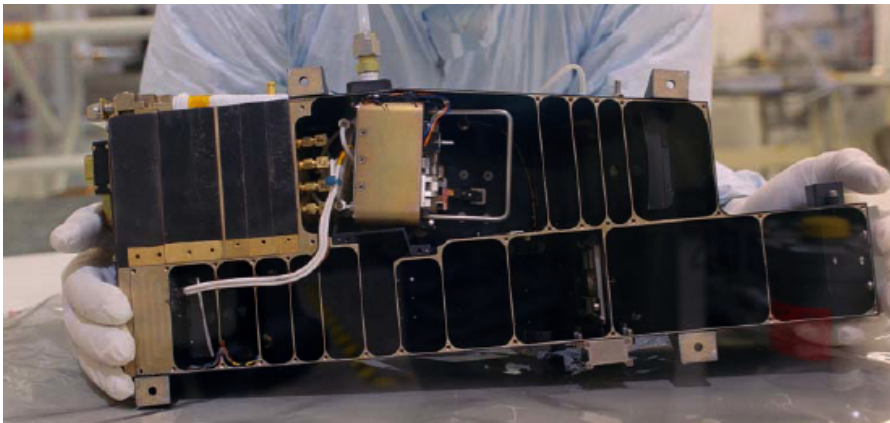


# Rosetta-Alice Update

Joel Parker & The R-Alice Team

2017 November 9

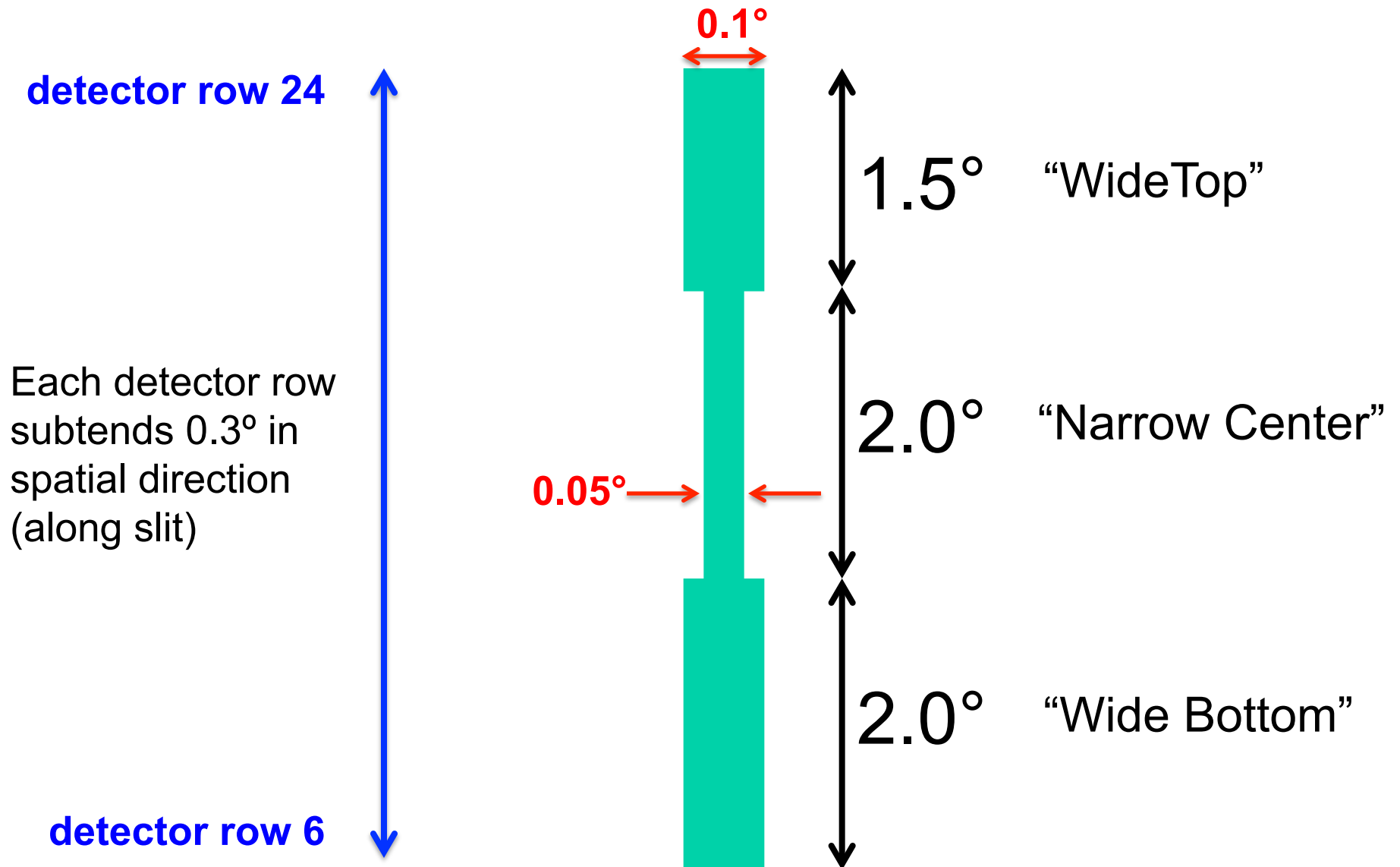
Rosetta SWT #48



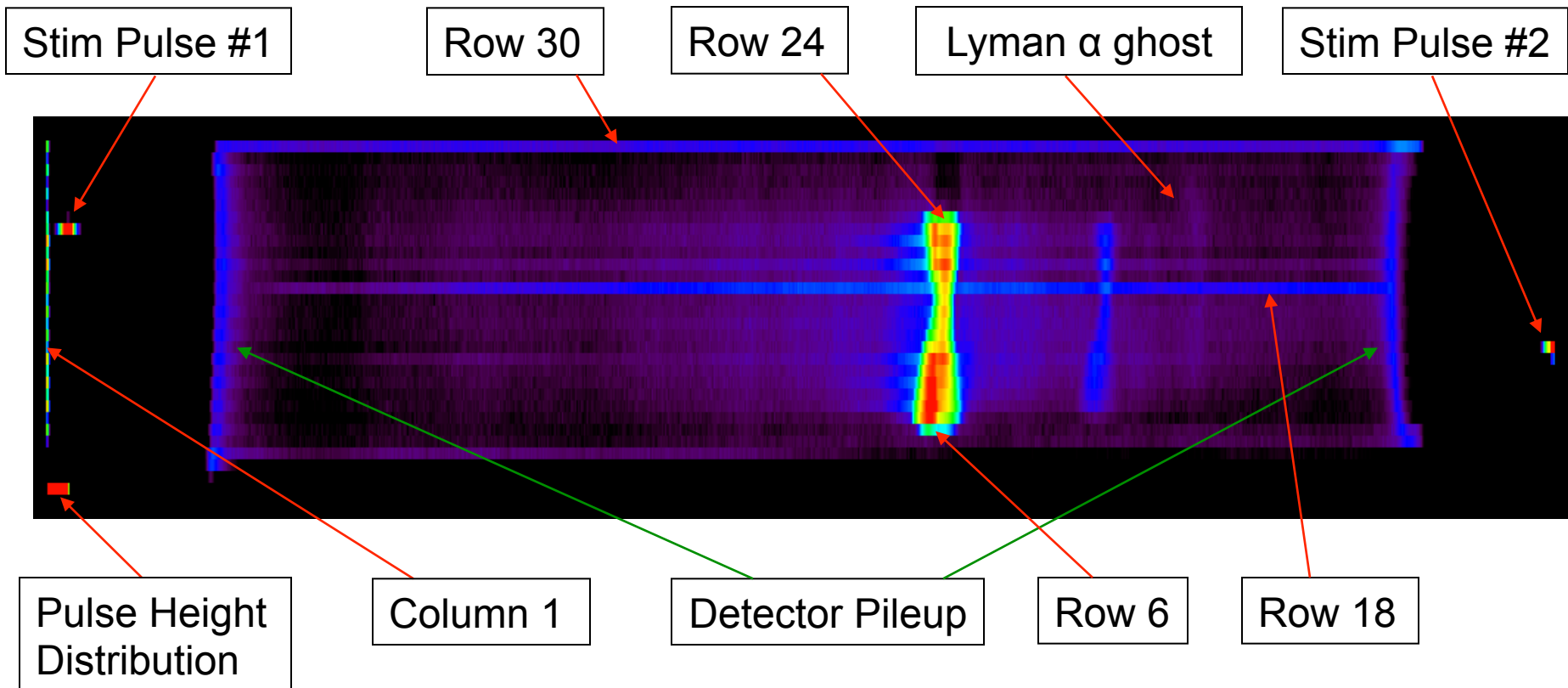
- 40 mm square aperture
- Off-axis paraboloidal primary mirror
- Toroidal holographic grating
- Effective wavelength range of 700-2050 Å
- Microchannel plate coated with CsI (700-1200Å) and KBr (1230-2050Å)
  - 30Å gap with no photocathode around Ly- $\alpha$  (1216 Å); ~10x less sensitive
- 2-D double-delay line (DDL) detector 1024 x 32 pixels

## The Alice “Dogbone” Slit

Project Status & Archive



## R-Alice Data and “Features”



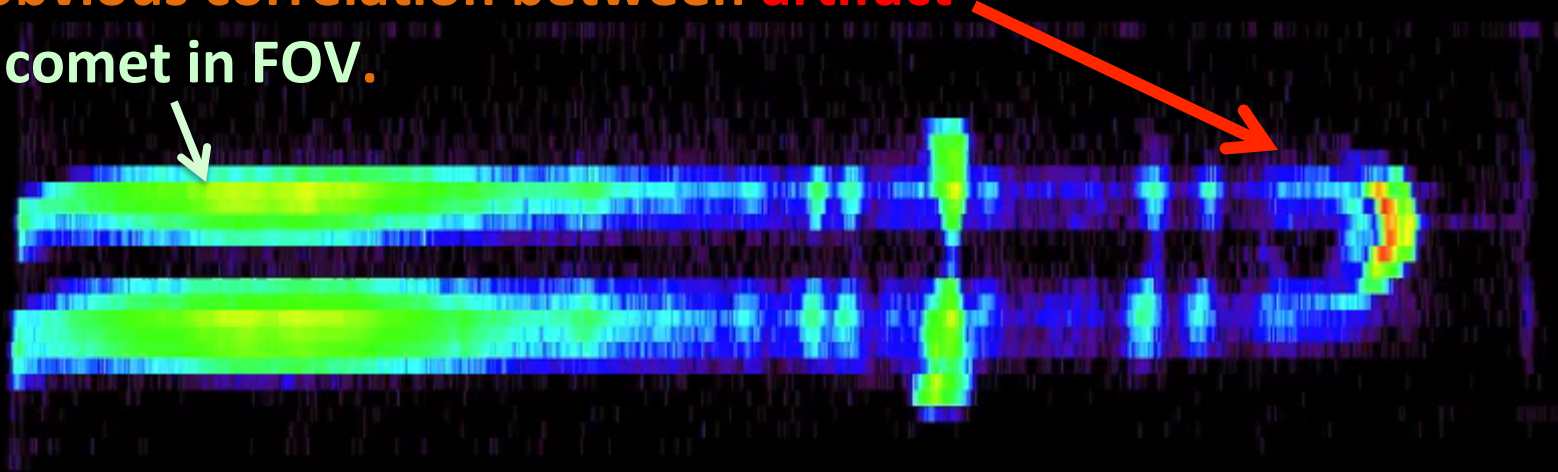
← Increasing Wavelength

Column & Row numbers  
listed with base index = 1

## “Chameleon” Artifact

This is a sequence of 10-minute observations, though we detect changes on timescales of seconds.

No obvious correlation between artifact and comet in FOV.



Artifact disappears when door is closed.  
Probably due to ions in Alice instrument (Noon et al. 2016)

- The active region of the Alice detector fills only the central part of the full 1024x32 pixel image
  - Approx. columns 100-930; rows 4-30 (base index=1)
- Lower column numbers = higher wavelength
- Column 1 contains spurious values
- Rows 18 and 30 have significantly elevated dark counts
- Odd-Even row effect due to effect of counts in one row appearing in a neighboring row
- “Stim pulses” located at each end of detector
  - Fiducial points added by the detector electronics
  - Used to remove linear wavelength shifts added by detector electronics (though STIM #2 partially falls off edge of image)

- The plate scale goes highly non-linear at the edges of the active region
  - A function of the detector electronics, not optics
  - Leads to the “detector pileup” artifacts
- Optical distortion (coma) causes the image of the slit to appear slightly curved
  - Low row numbers appear shifted to higher wavelength (lower column numbers)
- Chameleon obscures data at short wavelengths.

- Most commonly used mode
- Produces a 1024x32 pixel image of the detector
- Image values are the total number of counts detected at that pixel location during the exposure
- Information about timing of detected counts is not kept



- The X,Y location of each detected count is encoded as a 16-bit integer
  - 5 bits for spatial location (Y; 0-31)
  - 10 bits for spectral location (X; 0-1023)
- Encoded counts are stored sequentially in a 1-D array in memory.
- Special values (“time hacks”) of 65535 are inserted into data array at a pre-defined rate (fastest rate = 4 ms)
- When memory fills (32768 events), Alice stops exposure to transfer to Rosetta SSMM (~ 40s).

- Rarely used.
- Detector acts like a simple photometer.
- Records the total number of counts detected in a pre-defined sample period .
- No information about the location (spectral or spatial) of detected counts.

- ENG files (CODMAC processing level 2) – FITS format
  - Uncalibrated data
  - Extensions: data image, pulse height distribution, count rate during exposure
- SCI files (CODMAC processing level 3) – FITS format
  - Calibrated data
  - Extensions: data image, statistical uncertainty image, wavelength image, pulse height distribution, count rate during exposure
- LIN files (CODMAC processing level 4) – FITS format
  - Calibrated data re-sampled onto a common, linear wavelength scale
  - Extensions: data image, statistical uncertainty image, wavelength vector, pulse height distribution, count rate during exposure
- HKTM files (“eng” CODMAC processing level 2) – ASCII format
  - Text tables of Alice housekeeping telemetry
- “Postcards” (PSA quicklook images) of “LIN” data.

- Alice data are stored in FITS (Flexible Image Transport System) format
  - FITS is common in astronomical applications
  - Format defined by Hanisch et al., 2001, *A&A*, v. 376, p. 359
  - Binary format consisting of a primary data unit and an optional number of extension data units
    - data units contain a discrete piece of data like an array or table
    - data units that contain arrays are called “IMAGE” extensions
      - IMAGE extensions need not be 2-D; e.g. could be a 1-D vector
    - data units that contain tables are called “TABLE” extensions
      - Alice table data are stored as binary
  - Numerous FITS reader programs exist for almost any major programming language
    - FITS reader not required! Alice data are fully PDS-compliant, so any software designed to read PDS data should also be able to read Alice data

- Each data unit has an associated ASCII header
  - Similar in concept to a PDS label
  - Alice label files are derived from a subset of information in the FITS headers
  - FITS headers have a `KEYWORD = Value` format

```
SIMPLE =                               T / Written by IDL: Tue Apr 14 12:25:17 2009
BITPIX =                               -32 / Number of bits per data pixel
NAXIS  =                               2 / Number of data axes
NAXIS1 =                               1024 / histogram spectral axis size (1-1024)
NAXIS2 =                               32 / histogram spatial axis size (1-32)
EXTEND =                               T / Fits data may contain extensions
CTYPE1 = 'WAVE'                        / Vacuum Wavelength
CUNIT1 = 'Angstrom'                    / Wavelength units
CRVAL1 = 2278.52506797 / Reference wavelength (Angstroms)
CRPIX1 = 1.00000 / Reference pixel
CDELTA1 = -1.74635319922 / Linear dispersion (Angstrom/pixel)
CTYPE2 = 'ROWN'                        / Row number
CRVAL2 = 1.00000 / Reference row number
CRPIX2 = 1.00000 / Reference row
CDELTA2 = 1.00000 / Row increment
ORIGIN = 'SwRI' / Southwest Research Institute (R)
DATE    = '2008-10-06T10:11:10' / file creation/processing date/time
LIMA_VER= '0.16' / LIMA software version number
LIMA_DAT= '2007-02-26' / LIMA software version date
MISSION = 'Rosetta' / ESA comet exploration mission
INSTRUME= 'R-Alice' / Ultra-Violet Spectrometer
```

- Alice data files are of the form:  
`RA_<YYMMDDhhmmss>_<type>_<lev>.<ext>`
  - **<YYMMDDhhmmss>** is the UTC date and time of the start of the observation
  - **<type>** is one of the following 4-character values
    - HIS# Data taken in histogram mode
    - PIX# Data taken in pixel list mode
    - CNT# Data taken in count rate mode
    - HKTM Data taken are housekeeping/telemetry
    - # is a 1-character version number
  - **<lev>** is the level of data processing
    - ENG CODMAC level 2; uncalibrated (“raw”) data
    - SCI CODMAC level 3; calibrated data
    - LIN CODMAC level 4; calibrated and resampled data
  - **<ext>** is one of three values
    - FIT data are stored in FITS format
    - TAB HKTM data are stored as an ASCII table
    - LBL PDS label files

- Data set:  
PDS: RO-<target id>-ALICE-<level>-<phase>-V<#.#>
- Data Directories:  
DATA/<YYYY>/<MM>/
- Example:  
RO-C-CAL-ALICE-3-ESC1-V1.0/DATA/2015/02/RA\_150201002605\_HIS3\_SCI.FIT







- Search capabilities through PSA and PDS
- The Alice Logbook
  - Contains a chronological listing of Alice activities and exposures
  - Also contains meta data like intended target, exposure times, etc.
  - Organized by observing scenario
  - Located in the archive DOCUMENT directory



TABLE VIEW

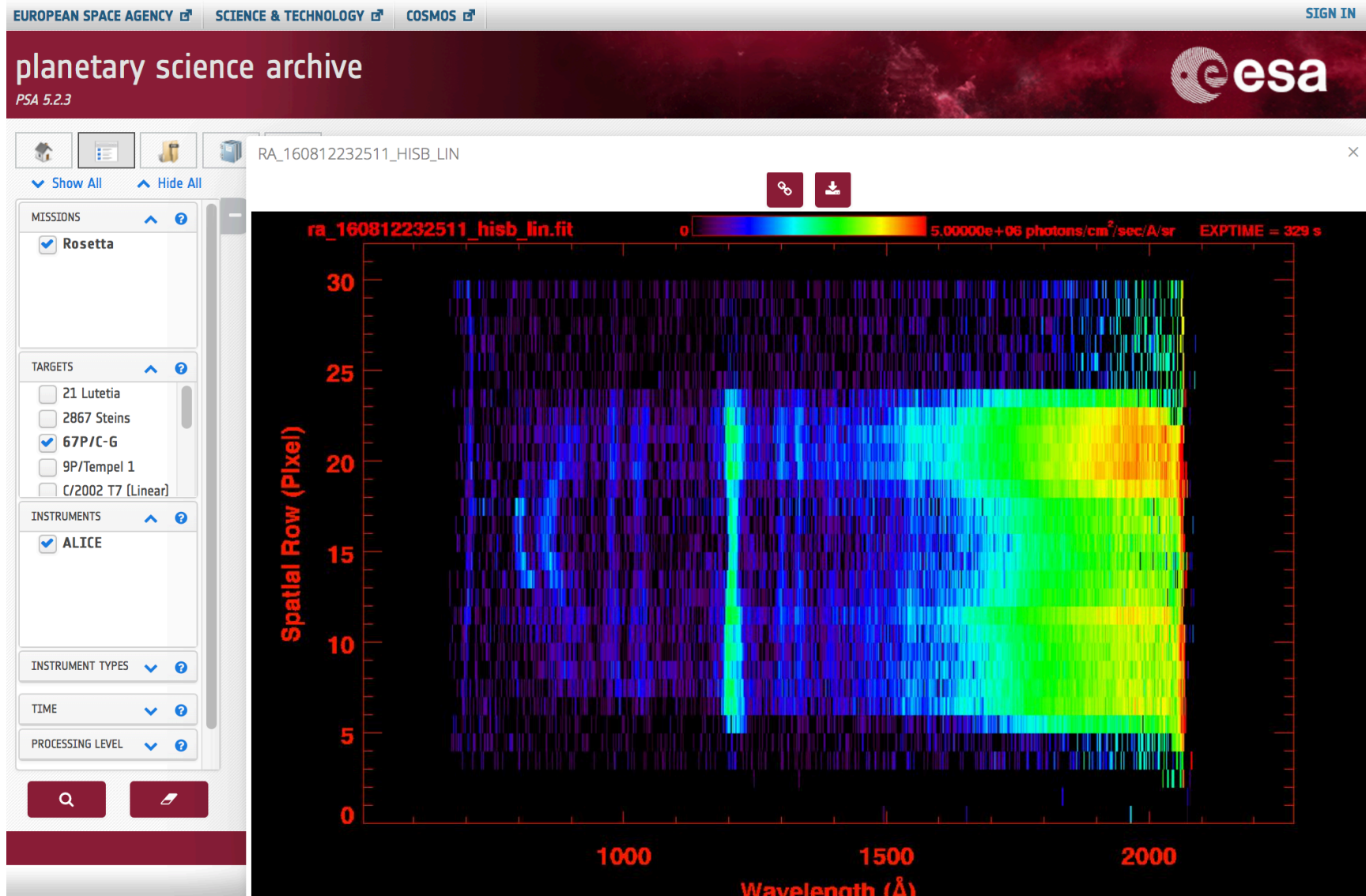
Number of selected products: 0

Filter by string in the current pag

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Items/page: 5000 Displaying 1 - 5000 of 258027



## NASA PDS: Small Bodies Node

NASA Portal   
Site Map

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TOOLS/SOFTWARE ▾

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- + [Data Release Schedule](#)
- + [Small Body Designation Formats](#)
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## Rosetta Mission

The Rosetta Mission is the third cornerstone mission in ESA's Horizon 2000 program. The purpose of the mission is to rendezvous with the comet 67P/Churyumov-Gerasimenko, gather information on the comet as the spacecraft orbits it, and to land a package of instruments on the surface of the comet.

Scientific objectives of the mission are to study the origin of comets, and the relationship between cometary and interstellar material.

The Rosetta spacecraft launched in March 2004 from Kourou, French Guiana. On its way to the comet it has flown by two asteroids, (2867) Steins on 5 September 2008 and (21) Lutetia on 10 July 2010. In May 2014 Rosetta will rendezvous with 67P/Churyumov-Gerasimenko and gather data on the comet for 18 months. The mission is scheduled to end in December 2015.

The SBN in cooperation with ESA will archive Earth-based observations of comet 67P/Churyumov-Gerasimenko.


See [Rosetta data](#)  at the [ESA Planetary Science Archive](#). 


This page only shows data sets that have been *archived* or were *CERTIFIED* by a *peer review* (are currently in *lien resolution*) or *certified by ESA PSA*. If you wish to see other Rosetta datasets that have been released but that are NOT CERTIFIED please see our [Rosetta Draft Data Set Area](#).

### Mission Websites


Here we list links to the primary mission website as well as pages about the mission on other sites such as the NSSDC, NASA portal, etc.

Mission: [Rosetta](#)  (ESA)

NSSDC: [Rosetta](#) 

NASA: [Rosetta](#) 

ESA: [Rosetta](#) 

Campaign: [67P/C-G Earth-based Observing Campaign](#) 

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## Rosetta-Orbiter ALICE Extension 3 67P Raw Data

**Status:** *LOCALLY ARCHIVED*

**Abstract:** This data set contains CODMAC Level 2 data acquired by the Rosetta Orbiter ALICE UV Spectrometer during the comet 67P/Churyumov-Gerasimenko Rosetta Extension 3 mission phase, which took place between 2016-07-01 and 2016-09-30.

RO-C/CAL-ALICE-2-EXT3-V1.0 [\[Errata\]](#)

[Browse](#)

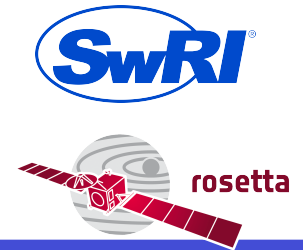
[Download \(86.6 MB\)](#)

**Citation to use when referencing this data set:** "Steffl, A. J., Kaufmann, D. E., Parker, J. Wm., and S. A. Stern, ROSETTA-ORBITER 67P/CAL ALICE 2 EXT3 V1.0, RO-C/CAL-ALICE-2-EXT3-V1.0, ESA Planetary Science Archive and NASA Planetary Data System, 2017."
































#### Useful links:

- [SBN Data Users: How to Approach a PDS Data Set](#)
- [Downloading large files](#)
- [Contact Us](#)

## Alice Datasets (PSA and PDS)



Project Status & Archive

RO-C-CAL-ALICE-3-ESC1-V1.0	
Name	
	AAREADME.TXT
▶ 	CALIB
▶ 	CATALOG
▼ 	DATA
▼ 	2014
▶ 	11
▶ 	12
▼ 	2015
▶ 	01
▶ 	02
▶ 	03
▼ 	DOCUMENT
	ALICE_DATA_TO_RAYLEIGHS.ASC
	ALICE_MANUAL_V2_1.DOC
	ALICE_MANUAL_V2_1.LBL
	ALICE_MANUAL_V2_1.PDF
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	CALIBRATION_COOKBOOK.PDF
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	EAICD_ALICE_V3.PDF
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	RALICE_CALSTAR_SPECTRA.PDF
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▶ 	INDEX
	VOLDESC.CAT

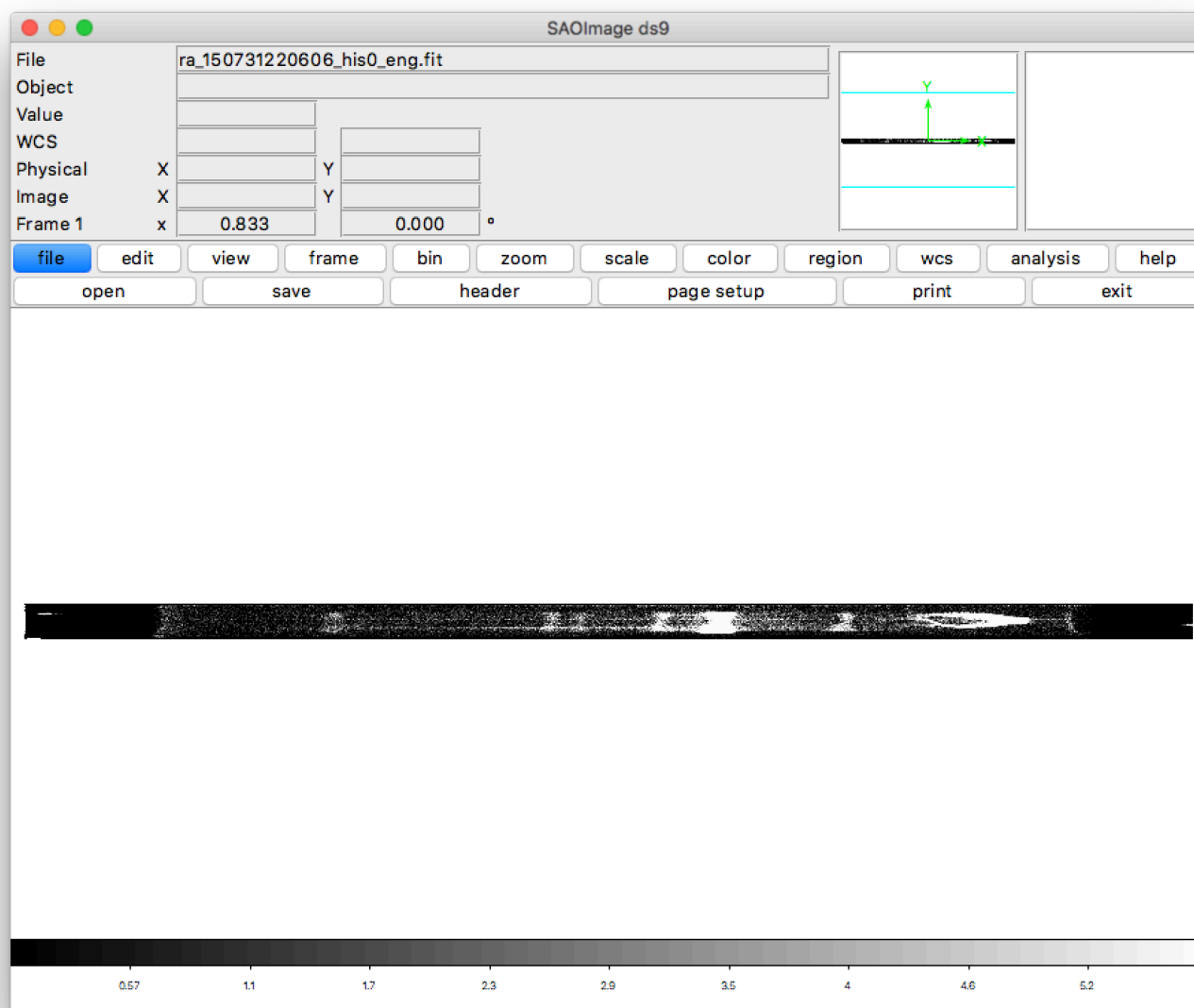


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 <a href="#">Parent Directory</a>		-	
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 <a href="#">ra_160801000023_hktm_eng.tab</a>	24-Mar-2017 18:06	49M	[Table file]
 <a href="#">ra_160801000314_his0_eng.fit</a>	23-Mar-2017 15:42	93K	[FITS file]
 <a href="#">ra_160801000314_his0_eng.lbl</a>	26-Apr-2017 13:21	13K	[PDS label]
 <a href="#">ra_160801001358_his0_eng.fit</a>	23-Mar-2017 15:42	93K	[FITS file]
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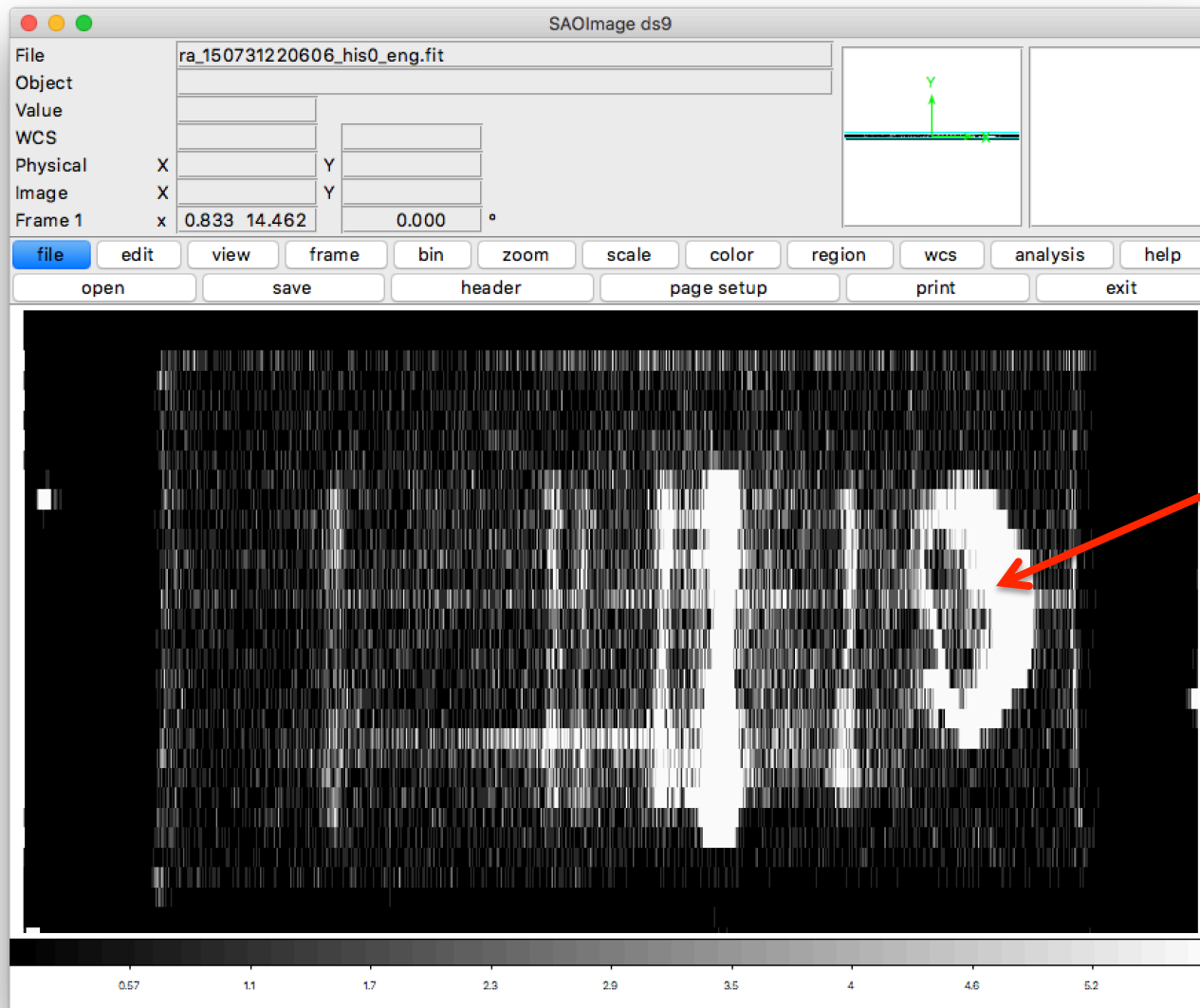
## Alice Level 2 (“ENG”) Image

Project Status & Archive



## Alice Level 2 (“ENG”) Image

Project Status & Archive

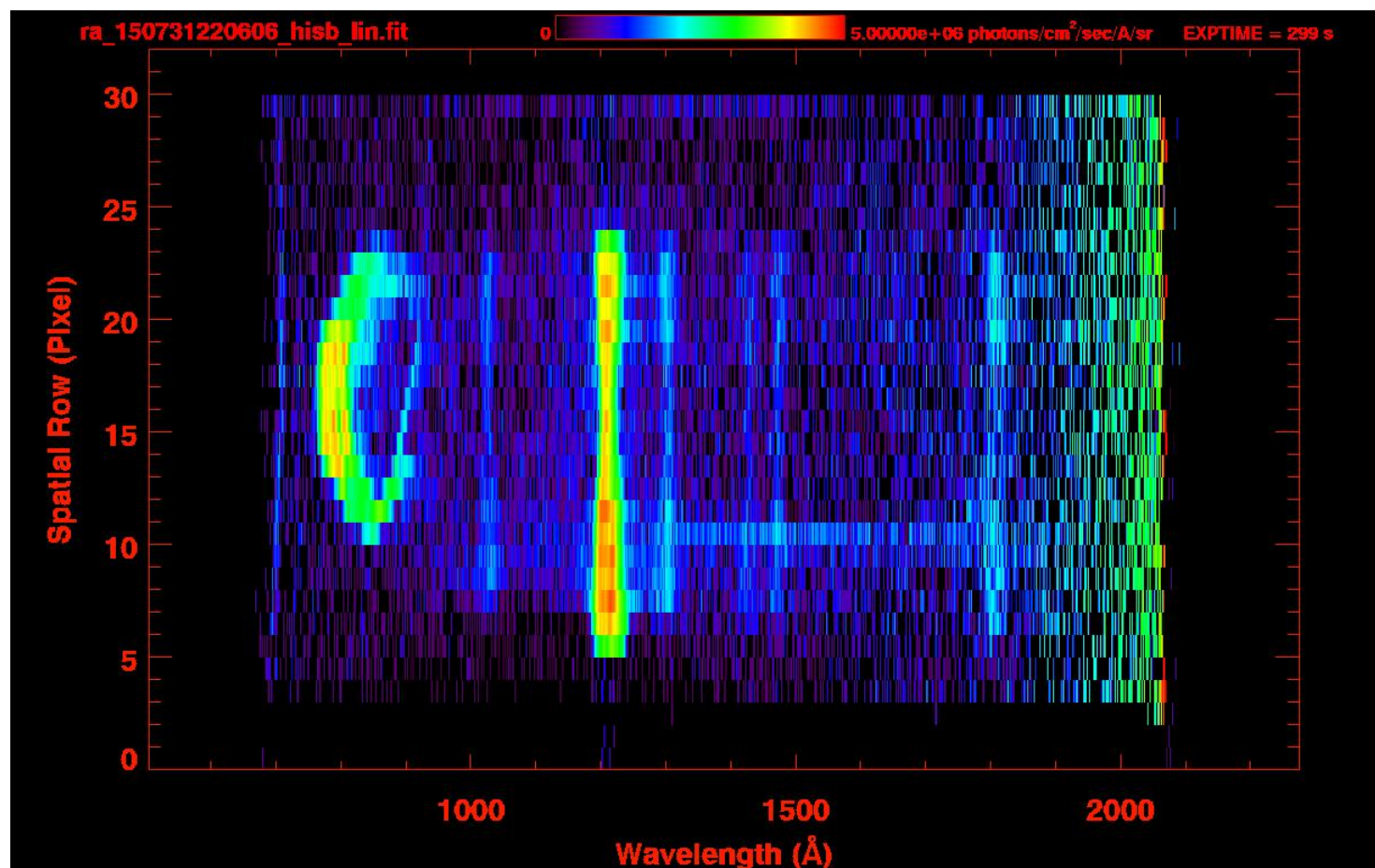


as scaled to  
aspect ratio  
of detector

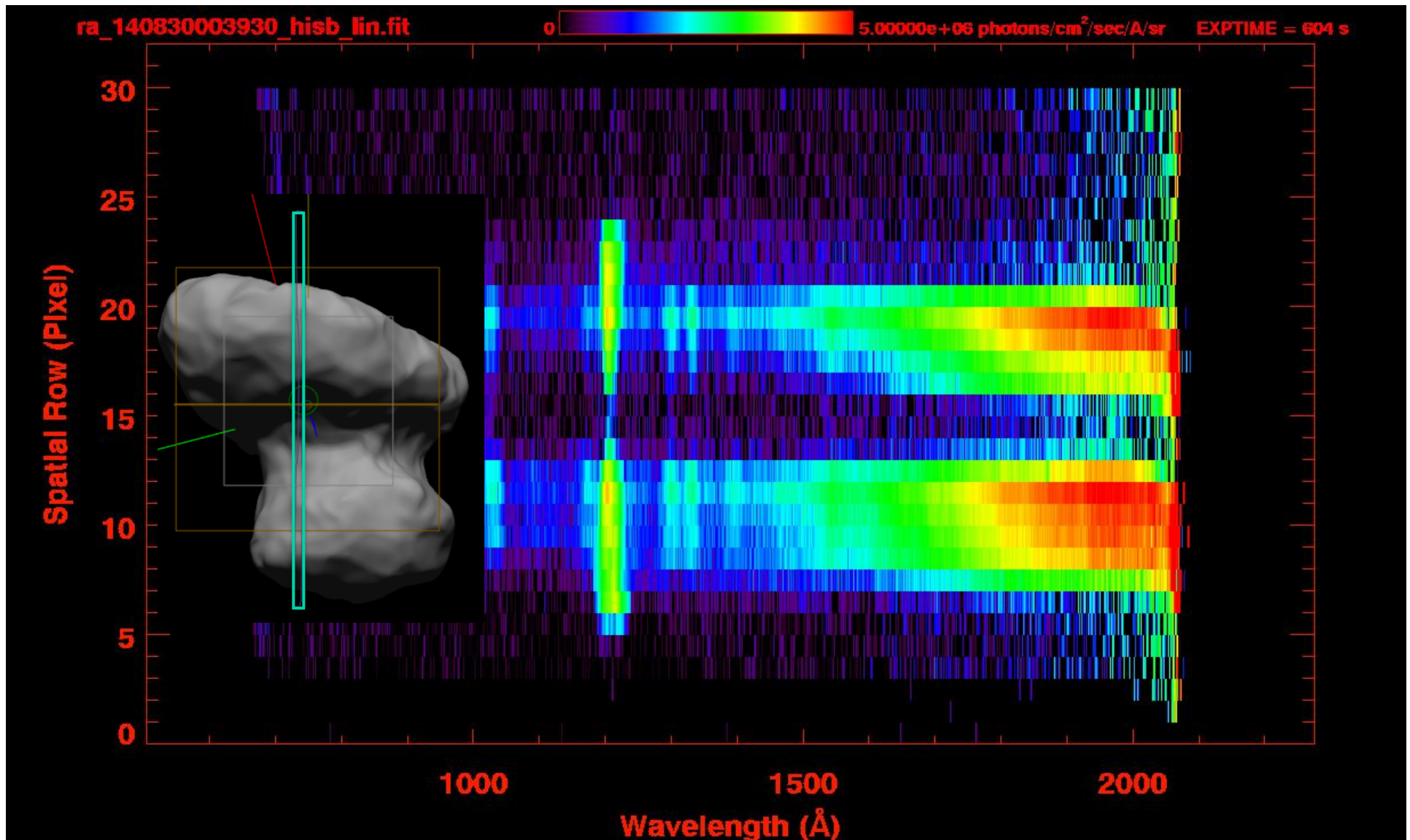
“Chameleon”



## Alice Level 3 (“LIN”) Image



## Appearance Of 67P in Alice Slit



- The documents in the archive DOCUMENT/ directory have tons of details for understanding and working with Alice data:
  - EAICD
  - User's Guide
  - Calibration Cookbook
  - Operations Paper
- If you have questions, contact the Alice team.