

The making of a Venus movie with Venus Express public images

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The ESA Science web portal posted a Venus Express movie on 21 January 2013, "A DAY IN THE LIFE OF VENUS EXPRESS". The movie was based on images snapped by the Venus Monitoring Camera (VMC) over a period of 18 hours during one of the spacecraft's 24-hour orbits around the planet on 7–8 January 2012.

http://spaceinvideos.esa.int/Videos/2013/01/A_day_in_the_life_of_Venus_Express

http://www.esa.int/Our_Activities/Space_Science/A_day_in_the_life_of_Venus_Express

It was compiled using only public data from the Venus Express data archive in the ESA's Planetary Science Archive (PSA).

<http://archives.esac.esa.int/psa>

The authors explain here the steps they took to create the movie. These can be used by anyone to create similar products.

1. Obtain the original VMC images from the PSA
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Do it yourself! There is a lot of data to be analysed from the public VEX Data Archive. Here it is a list of similar observations (the so-called "VEX Terminator Observations") that you can try:

Orbit	Date	DOY
1529	2010-06-28	10-179
1530	2010-06-29	10-180
1531	2010-06-30	10-181
1532	2010-07-01	10-182
1533	2010-07-02	10-183
1534	2010-07-03	10-184
1541	2010-07-10	10-190
1542	2010-07-11	10-191
1749	2011-02-03	11-034
1751	2011-02-05	11-036
1752	2011-02-06	11-037
1755	2011-02-09	11-040
1870	2011-06-04	11-154
1871	2011-06-05	11-155
2088	2012-01-08	12-008
2316	2012-08-23	12-236
2317	2012-08-24	12-237

A particularly high number of images were obtained throughout a long proportion of these 24-hour orbits, so they are particularly good for making movie sequences.

1. Obtain the original VMC images from the PSA

Venus Express images are publicly available through the ESA PSA web portal:

<http://archives.esac.esa.int/psa>

There you can browse all the publicly available data from ESA's Solar System missions (currently Giotto, Huygens, Mars Express, Rosetta, SMART-1 and Venus Express). From the main page, click on the green *Advanced Search* button. This will open the PSA search interface. Select the Venus Express mission panel and then enter your search criteria.

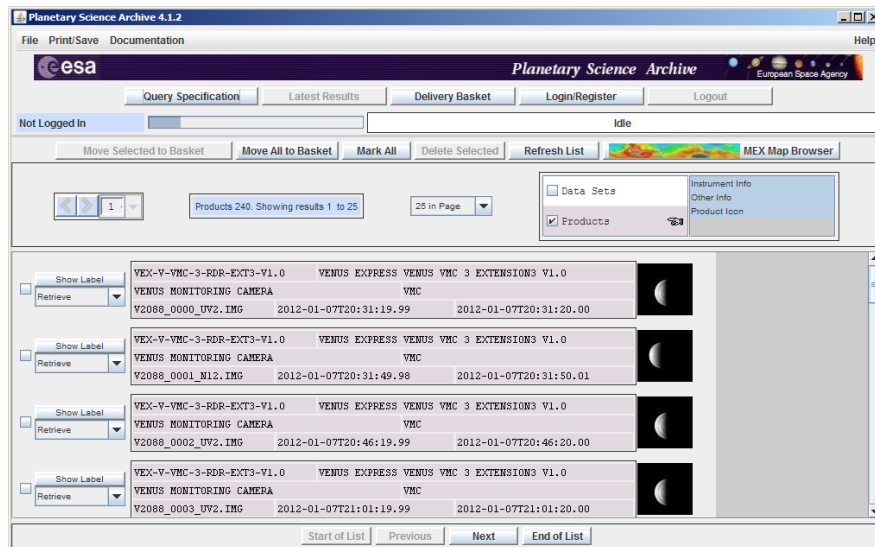
To download images, you will need to be logged into a personal PSA account. If you do not already have an account, you can click on the *Login/Register* button at the top of the page. After the brief registration process, you can return to the home page to continue the selection and download process.

In this case we selected the images in orbits 2088-2089, with the VEX_VMC_UV detector. Distinctive bright-dark patterns on the Venus cloud tops are best observed in the UV, due to an unknown chemical absorber.

The screenshot shows the Planetary Science Archive 4.1.2 Advanced Search interface. The window title is "Planetary Science Archive 4.1.2". The interface includes a navigation bar with "Query Specification", "Latest Results", "Delivery Basket", "Login/Register", and "Logout". Below this, there is a "Query Specification" section with buttons for "Execute Query", "MEX Map Browser", "Cancel Query", and "View/Edit SQL". The main search area is divided into several sections: "Results Display", "Products", "Sort Criteria", "Product Start Time", and "Sort Order". A list of mission panels is shown, with "Venus Express" selected and expanded. The "Venus Express" panel contains search criteria for "Instrument" (VMC), "Mission Phase" (Any), "Science Case Id" (Any), "Orbit Number" (2088-2089), "Spacecraft Altitude", "Sub-Spacecraft Longitude", and "Sub-Spacecraft Latitude". There are also buttons for "Any", "ASPERA4", "MAG", "SPICAV", "SPICAV-SOIR", "SPICE", "VRA", "VIRTIS", and "VMC". A "Product Id" field and a "Maximum Resolution" field are also present. The "SMART-1" panel is also visible at the bottom.

PSA Advanced Search interface query window

Select in *Results Display* whether you would like results to be displayed as data sets (data with all complementary documentation and information) or data products (just data). Click on *Execute Query*, and you will get a list of the available images, with thumbnails that display the selected content.



PSA Advanced Search interface snapshot with the selected image list

Mark the images that you want to download (or all images) and move them to the *Basket*. You will need to be logged into the PSA, so you will need to be logged into your personal PSA account. Go to the *Delivery Basket* and *Submit the Request*. Select your data packaging option (zip or tar) and confirm. You will receive an email with an FTP link to the compressed data package you have selected. You can then download this file to your local machine.

2. Convert to a format that can be read by your processing software

All PSA data are compatible with [NASA's Planetary Data System](http://pds.nasa.gov) (PDS) standards and therefore VMC images downloaded from the PSA are PDS formatted (with extension .IMG). In order to convert these PDS images into a more common image format (PNG, JPEG) you can use one of the following simple utilities:

- IMG2PNG (<http://www.mmedia.is/bjj/utills/img2png/>)
- PDS2JPG (<http://pds.nasa.gov/tools/pds2jpeg.shtml>)

For the VMC Terminator movie, we chose ReadPDS, a set of IDL procedures developed by the Small Bodies Node of NASA's PDS that allow for reading of most common PDS products, including images.

http://pds-smallbodies.astro.umd.edu/tools/tools_readPDS.shtml

By putting together a short IDL function, you can easily read the data in and save the result in JPEG format.

3. Images selection

The number of images from the PSA archive in the period of interest was 158, but images were not equally spaced in time. Although the video can just show all images, we opted to create a sequence with a regular time interval between images, so that the end user has a notion of natural time passage during a day in the life of Venus Express. This is important because the Venus Express orbit is highly elliptical: the spacecraft flies very slowly around the apocenter, and much faster in the pericenter passage.

By analysing the image creation time in the image header, the user can understand when the images are taken. We chose a 15min interval; therefore only 71 out of 158 images were selected. The list of all images used is contained below in the ANNEX.

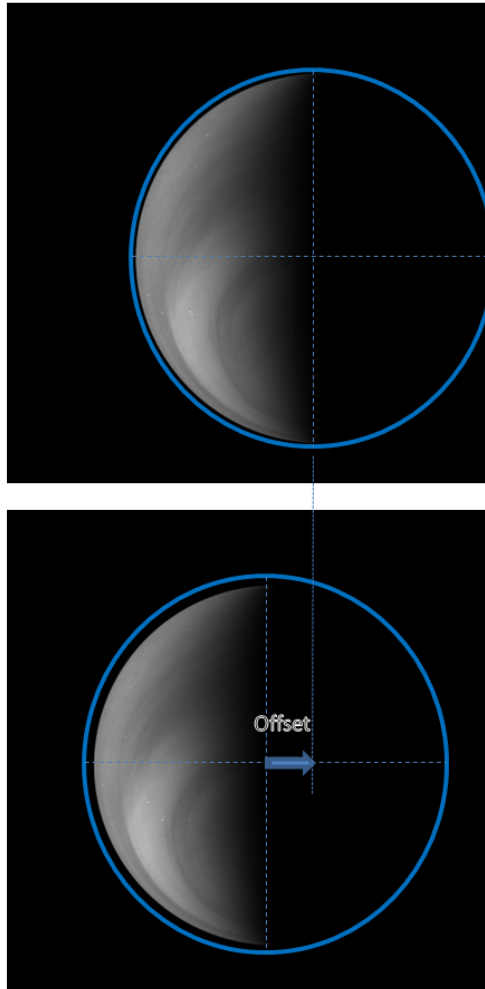
4. Rough image levels stretching

Pixel brightnesses in the original images are given as 16-bit integers. This scale, however, is optimised for radiometric accuracy rather than for display. In this step we simply rescale, or 'stretch', the pixel brightnesses to the 0 to 1 scale. The type of stretching done will depend on what the images will be used for. In our case, the min-max linear stretch is good enough for now, and was done using a simple IDL routine.

5. Centering images

The attitude of the spacecraft during the acquisition of the images had some offsets (<10deg) with respect to a pure NADIR pointing, due to operational constraints and decisions from the VMC team.

The images therefore have to be centered to get a smooth image transition for the movie.



Example of horizontal image offset for two consecutive images (V2088_0204_UV2.IMG.JPG and V2088_0206_UV2.IMG.JPG)

Detailed spacecraft pointing information is available in the SPICE (Spacecraft Pointing) information, also contained in the Planetary Science Archive. A simplified set of geometry data are also given in the header file for each image. However, for the present purpose we simply performed the geometric correction manually, by creating a Matlab routine that allows the user to drag the image position (for an even simpler approach but less precise approach, one could perform this manual correction in Microsoft Powerpoint). By comparing previous/next positions of images, smooth transitions are achieved. This was repeated for all the images of the sequence, and the resulting center offsets were saved for each image.

At this point one should have a clear understanding of the final look: output image size, aspect ratio, pixel resolution, Venus disk center position, etc. For example we wanted to create a 16:9 image of 1280x720 pixels. Therefore, in the Matlab routine the original images were automatically padded with black pixels to achieve the final image size (1280x720) and account for the calculated center offsets.

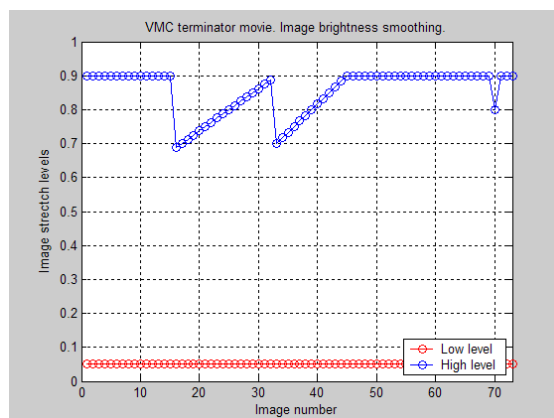
6. Smooth image levels stretching

The VMC team commands the instrument exposure time based upon several criteria. For example, the VEX-Venus distance, as images get brighter with increasing Venus albedo. The VMC goal is to achieve a reasonable brightness in the image, with good feature contrast but no pixel saturation. VMC takes groups of images with similar exposure times over certain periods of the orbit. Therefore there are, for certain images, some steps in brightness. In a first approach, this can be ignored. A more refined movie will take these changes in brightness into account.



Example of brightness step between image 16 (V2088_0023_UV2.IMG) and 17 (V2088_0024_UV2.IMG).

In our case we are compensating for this effect. We use simple linear stretching with the following values.



Example of smooth brightness stretching.

This pattern provides a good result to the eye.

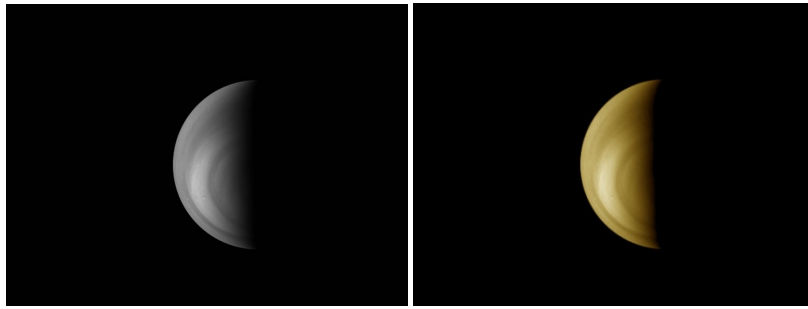
Note: small saturation is applied in both high/low pixel values to highlight the bright/dark features

7. Making it colour

The original VMC images are UV monochromatic. We added a false colouring to the image for aesthetic purposes. We have chosen a gamma adjustment of [0.6,0.8,1.8] in the R G B space that gives a yellowish hue to the images. The hue was chosen to match (roughly) the colour scale used in a recent ESA VMC UV image release:

http://spaceinimages.esa.int/Images/2012/10/Venus_cloud_tops2

The user might want to play with the image colour adjustment for other effects.

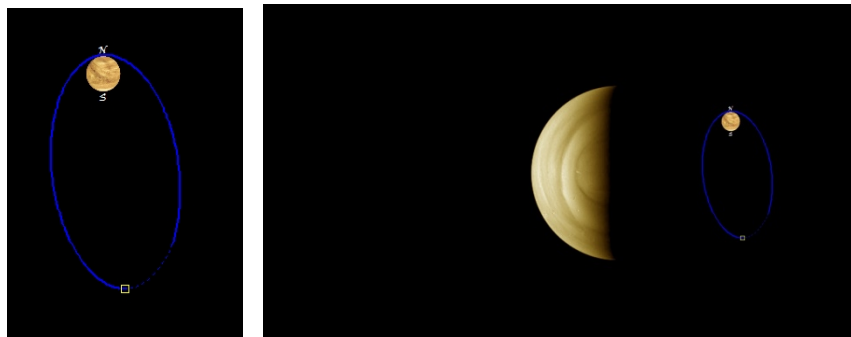


Example of image colouring

8. Adding the orbit position graph

The spacecraft orbital position (latitude, longitude and altitude) is found in the image header. Please see the ANNEX for an example. This data is used to make a plot of the orbit and mark the exact position in the orbit where the image was taken. The lat-long-alt data is transformed into a x-y plot projected into a Venus dayside camera view (the orbital plane in Orb 2088 was over the Venus terminator).

Then the orbit panel is placed to the right of the Venus image.



Example of orbital plot and insertion into Venus image

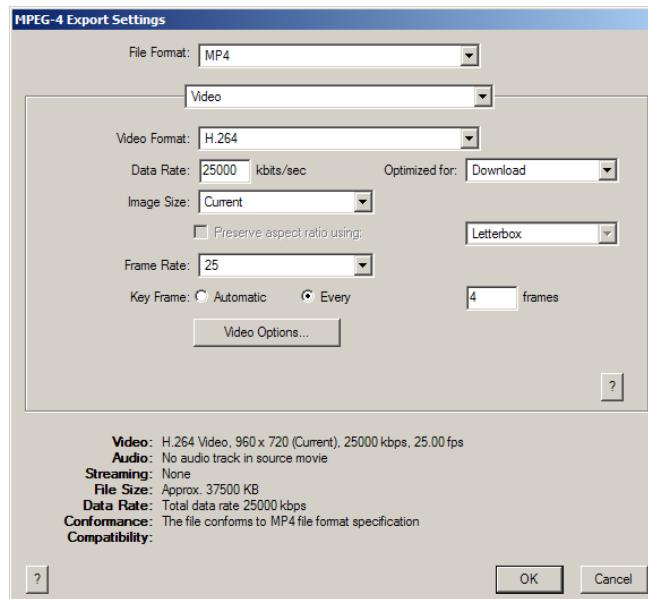
9. Final image output formatting

For the final output, we chose 1280x720 pixels so that the images/video could be displayed in HD format for the ESA web pages. All images are produced accordingly, and saved into a JPG format.

10. Video sequence creation

The processed JPG images are sequenced into a movie with a video editor. In our case we used QuickTime Pro. We opted to use 6 images per second, so that the final video is ~12 seconds long. For

the encoding, we used MP4 format, at 25Mbps, 25 frames per second, 1280x720 pixels. The output video size was about 3MB.



Video editing, MP4 output format window

ANNEX. Images auxiliary information

Note: For the final movie sequence, we intended to have, on average, an equal time interval between successive images. However, the time interval between acquisitions varied from 15 minutes down to 0.5 minutes. By selecting on those images with a 'Y' marked in the final column, the average time interval between successive images in the final movie is 15 minutes.

Image number	Image filename	Image time	Image delta time	Selected	Altitude [km]	Latitude [deg]	Longitude [deg]
1	V2088_0000_UV2.IMG	20:31:20	--		66490.7	-83.513	147.642
2	V2088_0002_UV2.IMG	20:46:20	00:15:00	Y	66415.7	-84.111	147.733
3	V2088_0003_UV2.IMG	21:01:20	00:15:00	Y	66298.5	-84.71	147.841
4	V2088_0005_UV2.IMG	21:16:20	00:15:00	Y	66139.1	-85.312	147.973
5	V2088_0006_UV2.IMG	21:31:20	00:15:00	Y	65937.3	-85.916	148.14
6	V2088_0008_UV2.IMG	21:46:20	00:15:00	Y	65692.8	-86.525	148.362
7	V2088_0009_UV2.IMG	22:01:20	00:15:00	Y	65405.5	-87.138	148.673
8	V2088_0011_UV2.IMG	22:16:20	00:15:00	Y	65075	-87.755	149.151
9	V2088_0012_UV2.IMG	22:31:20	00:15:00	Y	64700.9	-88.379	149.991
10	V2088_0014_UV2.IMG	22:46:20	00:15:00	Y	64282.8	-89.009	151.895
11	V2088_0015_UV2.IMG	23:01:20	00:15:00	Y	63820.2	-89.642	160.608
12	V2088_0017_UV2.IMG	23:16:20	00:15:00	Y	63312.7	-89.688	311.495
13	V2088_0018_UV2.IMG	23:31:20	00:15:00	Y	62759.6	-89.037	322.095
14	V2088_0020_UV2.IMG	23:46:20	00:15:00	Y	62160.2	-88.37	324.159
15	V2088_0021_UV2.IMG	00:01:20	00:15:00	Y	61513.9	-87.688	325.044
16	V2088_0023_UV2.IMG	00:16:20	00:15:00	Y	60819.8	-86.993	325.54
17	V2088_0024_UV2.IMG	00:31:20	00:15:00	Y	60076.9	-86.283	325.861
18	V2088_0026_UV2.IMG	00:46:20	00:15:00	Y	59284.5	-85.556	326.088
19	V2088_0027_UV2.IMG	01:01:20	00:15:00	Y	58441.2	-84.811	326.259
20	V2088_0029_UV2.IMG	01:16:20	00:15:00	Y	57546.1	-84.045	326.394
21	V2088_0030_UV2.IMG	01:31:20	00:15:00	Y	56597.6	-83.256	326.504
22	V2088_0032_UV2.IMG	01:46:20	00:15:00	Y	55594.5	-82.443	326.596
23	V2088_0033_UV2.IMG	02:01:20	00:15:00	Y	54535.1	-81.602	326.676
24	V2088_0035_UV2.IMG	02:16:20	00:15:00	Y	53417.7	-80.73	326.745
25	V2088_0036_UV2.IMG	02:31:20	00:15:00	Y	52240.3	-79.824	326.807
26	V2088_0038_UV2.IMG	02:46:20	00:15:00	Y	51000.8	-78.879	326.863
27	V2088_0039_UV2.IMG	03:01:20	00:15:00	Y	49696.8	-77.892	326.914
28	V2088_0041_UV2.IMG	03:16:20	00:15:00	Y	48325.6	-76.856	326.962
29	V2088_0042_UV2.IMG	03:31:20	00:15:00	Y	46884.4	-75.765	327.006
30	V2088_0044_UV2.IMG	03:41:20	00:10:00	Y	45882.9	-75.004	327.033
31	V2088_0045_UV2.IMG	03:51:20	00:10:00		44847.8	-74.211	327.06
32	V2088_0047_UV2.IMG	04:01:20	00:10:00	Y	43777.7	-73.386	327.086
33	V2088_0048_UV2.IMG	04:11:20	00:10:00	Y	42671.4	-72.524	327.111
34	V2088_0050_UV2.IMG	04:21:20	00:10:00		41527.6	-71.621	327.135
35	V2088_0051_UV2.IMG	04:31:20	00:10:00	Y	40344.6	-70.673	327.159

36	V2088_0053_UV2.IMG	04:41:20	00:10:00	Y	39120.7	-69.674	327.181
37	V2088_0054_UV2.IMG	04:51:20	00:10:00		37854.2	-68.619	327.204
38	V2088_0056_UV2.IMG	05:01:20	00:10:00	Y	36542.9	-67.5	327.226
39	V2088_0057_UV2.IMG	05:11:20	00:10:00	Y	35184.6	-66.308	327.247
40	V2088_0059_UV2.IMG	05:21:20	00:10:00		33776.8	-65.035	327.269
41	V2088_0060_UV2.IMG	05:31:20	00:10:00	Y	32316.6	-63.666	327.29
42	V2088_0062_UV2.IMG	05:41:20	00:10:00	Y	30800.7	-62.187	327.31
43	V2088_0063_UV2.IMG	05:51:20	00:10:00		29225.7	-60.578	327.331
44	V2088_0065_UV2.IMG	06:01:20	00:10:00	Y	27587.3	-58.816	327.351
45	V2088_0066_UV2.IMG	06:11:20	00:10:00		25881	-56.87	327.371
46	V2088_0068_UV2.IMG	06:16:20	00:05:00	Y	25000.7	-55.816	327.382
47	V2088_0069_UV2.IMG	06:21:20	00:05:00		24101.3	-54.699	327.392
48	V2088_0071_UV2.IMG	06:26:20	00:05:00		23182	-53.514	327.402
49	V2088_0072_UV2.IMG	06:31:20	00:05:00	Y	22242	-52.25	327.412
50	V2088_0074_UV2.IMG	06:36:20	00:05:00		21280.3	-50.899	327.422
51	V2088_0075_UV2.IMG	06:41:20	00:05:00		20296	-49.449	327.433
52	V2088_0077_UV2.IMG	06:46:20	00:05:00	Y	19288	-47.884	327.443
53	V2088_0078_UV2.IMG	06:51:20	00:05:00		18255	-46.189	327.453
54	V2088_0080_UV2.IMG	06:56:20	00:05:00		17196.1	-44.341	327.464
55	V2088_0081_UV2.IMG	07:01:20	00:05:00	Y	16109.7	-42.315	327.475
56	V2088_0083_UV2.IMG	07:06:20	00:05:00		14994.8	-40.078	327.486
57	V2088_0084_UV2.IMG	07:11:20	00:05:00		13849.8	-37.588	327.497
58	V2088_0086_UV2.IMG	07:14:20	00:03:00	Y	13148	-35.95	327.504
59	V2088_0087_UV2.IMG	07:17:20	00:03:00		12434.6	-34.187	327.511
60	V2088_0089_UV2.IMG	07:20:20	00:03:00		11709.6	-32.282	327.518
61	V2088_0090_UV2.IMG	07:23:20	00:03:00		10972.8	-30.214	327.525
62	V2088_0092_UV2.IMG	07:26:20	00:03:00		10224.2	-27.958	327.532
63	V2088_0093_UV2.IMG	07:29:20	00:03:00	Y	9463.81	-25.483	327.54
64	V2088_0095_UV2.IMG	07:32:20	00:03:00		8692.04	-22.753	327.548
65	V2088_0096_UV2.IMG	07:35:20	00:03:00		7909.48	-19.719	327.556
66	V2088_0098_UV2.IMG	07:38:20	00:03:00		7117.25	-16.325	327.565
67	V2088_0099_UV2.IMG	07:41:20	00:03:00		6317.1	-12.495	327.574
68	V2088_0101_UV2.IMG	07:44:20	00:03:00	Y	5511.84	-8.136	327.583
69	V2088_0102_UV2.IMG	07:47:20	00:03:00		4705.75	-3.127	327.594
70	V2088_0104_UV2.IMG	07:50:20	00:03:00		3905.37	2.685	327.606
71	V2088_0105_UV2.IMG	07:52:20	00:02:00		3379.69	7.101	327.614
72	V2088_0107_UV2.IMG	07:54:20	00:02:00		2864.95	12.03	327.624
73	V2088_0108_UV2.IMG	07:56:20	00:02:00		2366.48	17.549	327.634
74	V2088_0110_UV2.IMG	07:57:50	00:01:30		2007.38	22.124	327.644
75	V2088_0111_UV2.IMG	07:59:20	00:01:30		1664.82	27.113	327.654
76	V2088_0113_UV2.IMG	08:00:50	00:01:30	Y	1343	32.547	327.666
77	V2088_0114_UV2.IMG	08:02:20	00:01:30		1046.75	38.451	327.681
78	V2088_0116_UV2.IMG	08:03:50	00:01:30		781.49	44.837	327.699
79	V2088_0117_UV2.IMG	08:04:50	00:01:00		624.729	49.359	327.714
80	V2088_0119_UV2.IMG	08:06:20	00:01:30		424.102	56.518	327.745
81	V2088_0120_UV2.IMG	08:06:50	00:00:30		367.287	58.996	327.758

82	V2088_0121_UV2.IMG	08:07:20	00:00:30		315.84	61.517	327.774
83	V2088_0122_UV2.IMG	08:07:50	00:00:30		269.947	64.075	327.792
84	V2088_0123_UV2.IMG	08:08:20	00:00:30		229.779	66.669	327.815
85	V2088_0124_UV2.IMG	08:08:50	00:00:30		195.493	69.293	327.843
86	V2088_0125_UV2.IMG	08:09:20	00:00:30		167.223	71.943	327.879
87	V2088_0126_UV2.IMG	08:09:50	00:00:30		145.086	74.615	327.927
88	V2088_0127_UV2.IMG	08:10:20	00:00:30		129.172	77.303	327.995
89	V2088_0128_UV2.IMG	08:10:50	00:00:30		119.549	80.001	328.099
90	V2088_0129_UV2.IMG	08:11:20	00:00:30		116.256	82.706	328.279
91	V2088_0130_UV2.IMG	08:11:50	00:00:30		119.308	85.41	328.669
92	V2088_0131_UV2.IMG	08:12:20	00:00:30		128.693	88.108	330.166
93	V2088_0132_UV2.IMG	08:12:50	00:00:30		144.37	89.198	141.622
94	V2088_0133_UV2.IMG	08:13:20	00:00:30		166.273	86.529	146.242
95	V2088_0134_UV2.IMG	08:13:50	00:00:30		194.311	83.878	146.843
96	V2088_0135_UV2.IMG	08:14:20	00:00:30		228.371	81.254	147.081
97	V2088_0136_UV2.IMG	08:14:50	00:00:30		268.317	78.659	147.208
98	V2088_0137_UV2.IMG	08:15:20	00:00:30		313.993	76.1	147.288
99	V2088_0138_UV2.IMG	08:16:20	00:01:00	Y	421.838	71.099	147.383
100	V2088_0140_UV2.IMG	08:17:20	00:01:00		550.377	66.275	147.438
101	V2088_0141_UV2.IMG	08:18:20	00:01:00		697.932	61.648	147.475
102	V2088_0143_UV2.IMG	08:19:50	00:01:30		951.084	55.098	147.511
103	V2088_0144_UV2.IMG	08:21:20	00:01:30		1237.19	49.029	147.536
104	V2088_0146_UV2.IMG	08:22:50	00:01:30		1550.67	43.437	147.555
105	V2088_0147_UV2.IMG	08:24:20	00:01:30		1886.48	38.299	147.57
106	V2088_0149_UV2.IMG	08:25:50	00:01:30		2240.21	33.586	147.582
107	V2088_0150_UV2.IMG	08:27:20	00:01:30		2608.08	29.263	147.592
108	V2088_0152_UV2.IMG	08:29:20	00:02:00		3115.16	24.046	147.604
109	V2088_0153_UV2.IMG	08:31:20	00:02:00	Y	3635.72	19.379	147.613
110	V2088_0155_UV2.IMG	08:34:20	00:03:00		4431.91	13.253	147.626
111	V2088_0156_UV2.IMG	08:37:20	00:03:00		5236.75	7.992	147.637
112	V2088_0158_UV2.IMG	08:40:20	00:03:00		6042.69	3.429	147.647
113	V2088_0159_UV2.IMG	08:43:20	00:03:00		6844.77	-0.568	147.656
114	V2088_0161_UV2.IMG	08:46:20	00:03:00	Y	7639.77	-4.1	147.664
115	V2088_0162_UV2.IMG	08:49:20	00:03:00		8425.61	-7.249	147.672
116	V2088_0164_UV2.IMG	08:52:20	00:03:00		9200.99	-10.076	147.679
117	V2088_0165_UV2.IMG	08:55:20	00:03:00		9965.15	-12.633	147.686
118	V2088_0167_UV2.IMG	08:58:20	00:03:00		10717.7	-14.959	147.693
119	V2088_0168_UV2.IMG	09:01:20	00:03:00	Y	11458.4	-17.087	147.699
120	V2088_0170_UV2.IMG	09:04:20	00:03:00		12187.3	-19.045	147.706
121	V2088_0171_UV2.IMG	09:07:20	00:03:00		12904.4	-20.854	147.712
122	V2088_0173_UV2.IMG	09:10:20	00:03:00		13610.1	-22.532	147.717
123	V2088_0174_UV2.IMG	09:15:20	00:05:00	Y	14761.1	-25.08	147.727
124	V2088_0176_UV2.IMG	09:20:20	00:05:00		15881.9	-27.364	147.737
125	V2088_0177_UV2.IMG	09:25:20	00:05:00		16973.9	-29.43	147.746
126	V2088_0179_UV2.IMG	09:30:20	00:05:00	Y	18038.2	-31.312	147.754
127	V2088_0180_UV2.IMG	09:35:20	00:05:00		19076.2	-33.036	147.763

128	V2088_0182_UV2.IMG	09:40:20	00:05:00		20089.2	-34.626	147.772
129	V2088_0183_UV2.IMG	09:45:20	00:05:00	Y	21078.1	-36.098	147.78
130	V2088_0185_UV2.IMG	09:50:20	00:05:00		22044.3	-37.468	147.788
131	V2088_0186_UV2.IMG	09:55:20	00:05:00		22988.5	-38.749	147.797
132	V2088_0188_UV2.IMG	10:00:20	00:05:00	Y	23911.9	-39.949	147.805
133	V2088_0189_UV2.IMG	10:05:20	00:05:00		24815.2	-41.079	147.813
134	V2088_0191_UV2.IMG	10:10:20	00:05:00	Y	25699.3	-42.145	147.821
135	V2088_0192_UV2.IMG	10:20:20	00:10:00		27412.8	-44.112	147.836
136	V2088_0194_UV2.IMG	10:30:20	00:10:00	Y	29057.8	-45.891	147.852
137	V2088_0195_UV2.IMG	10:40:20	00:10:00	Y	30639	-47.514	147.867
138	V2088_0197_UV2.IMG	10:50:20	00:10:00		32160.7	-49.006	147.883
139	V2088_0198_UV2.IMG	11:00:20	00:10:00	Y	33626.4	-50.385	147.898
140	V2088_0200_UV2.IMG	11:10:20	00:10:00	Y	35039.4	-51.668	147.913
141	V2088_0201_UV2.IMG	11:20:20	00:10:00		36402.6	-52.867	147.928
142	V2088_0203_UV2.IMG	11:30:20	00:10:00	Y	37718.5	-53.993	147.943
143	V2088_0204_UV2.IMG	11:40:20	00:10:00	Y	38989.5	-55.055	147.958
144	V2088_0206_UV2.IMG	11:50:20	00:10:00		40217.6	-56.059	147.973
145	V2088_0207_UV2.IMG	12:00:20	00:10:00	Y	41404.7	-57.012	147.988
146	V2088_0209_UV2.IMG	12:10:20	00:10:00	Y	42552.6	-57.919	148.003
147	V2088_0210_UV2.IMG	12:20:20	00:10:00		43662.6	-58.785	148.017
148	V2088_0212_UV2.IMG	12:30:20	00:10:00	Y	44736.4	-59.614	148.032
149	V2088_0213_UV2.IMG	12:40:20	00:10:00	Y	45775.1	-60.41	148.047
150	V2088_0215_UV2.IMG	12:50:20	00:10:00		46779.9	-61.174	148.062
151	V2088_0216_UV2.IMG	13:00:20	00:10:00	Y	47752	-61.911	148.077
152	V2088_0218_UV2.IMG	13:10:20	00:10:00	Y	48692.4	-62.621	148.092
153	V2088_0219_UV2.IMG	13:25:20	00:15:00	Y	50045.6	-63.644	148.115
154	V2088_0221_UV2.IMG	13:40:20	00:15:00	Y	51332.3	-64.62	148.138
155	V2088_0222_UV2.IMG	13:55:20	00:15:00	Y	52555.2	-65.553	148.161
156	V2088_0224_UV2.IMG	14:10:20	00:15:00	Y	53716.6	-66.45	148.185
157	V2088_0225_UV2.IMG	14:25:20	00:15:00	Y	54818.5	-67.313	148.208
158	V2088_0227_UV2.IMG	14:40:20	00:15:00	Y	55863	-68.147	148.232