

OUTER PLANETS UNIFIED SEARCH (OPUS) CURRENT STATUS



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- ∅ OPUS is the web-based search tool of the Ring-Moon Systems Node
<https://opus.pds-rings.seti.org>
- ∅ The Ring-Moon Systems Node, based in Mountain View (CA), is one of the six science data nodes of NASA's Planetary Data System
- ∅ OPUS is the result of over 25 years of development. OPUS3 was released in May 2019 after years of work by 3 developers (Robert French, Debra Stopp , Yu-Jen Chang)
- ∅ Our goal is to make it easy to **search**, **discover**, and **explore** the available data, and then to **select** and **download** products
- ∅ Three things are necessary for a successful PDS user search experience:
 - ❑ High-quality metadata
 - ❑ A fast and flexible search engine
 - ❑ A powerful but easy-to-use interface



*Nodes of NASA's Planetary Data System
(Project Office based at Goddard Space Flight Center)*

*Blue (upper) = Science data node
Grey (lower) = Support node (JPL)*

Total number of results with current search

OPUS3 Search Browse Results **1,624,532** Cart 2 Detail Recent Announcements

General Constraints

- Planet
- Intended Target Name
- Nominal Target Class
- Mission
- Instrument Host Name
- Instrument Name
- Observation Type
- Observation Time
- Observation Duration
- Measurement Quantity
- Right Ascension
- Declination

PDS Constraints

Image Constraints

Wavelength Constraints

- Wavelength
- Wavelength Resolution
- Wavenumber
- Wavenumber Resolution
- Spectral Information Flag
- Spectrum Size
- Polarization Type

Occultation/Reflectance Profiles Constraints

Surface Geometry Constraints

Ring Geometry Constraints

Reset Search Reset Search and Metadata

Wavelength [Wavelength] microns

Min: 0.0402 Max: 130629 N/A: 56

Min: Wavelength or Color Max: any + (OR)

PDS4 Wavelength Ranges

	Min	Max
Ultraviolet	0.01	0.4
Visible	0.39	0.7
Near Infrared	0.65	5
Infrared	0.75	300
Far Infrared	30	300

CRC Wavelength Ranges

- New Horizons MVIC 1897
- Ground-based 12

Observation Type [General]

- Image 576510
- Spectrum 1153
- Spectral Image 274
- Spectral Cube 962113
- Time Series 58711
- Spectral Time Series 24950
- Occultation Profile 819
- Reflectance Profile 2

Intended Target Name [General]

The Intended Target Name represents the observer's intentions and is valid for all missions and instruments. To search for ANY body in the field of view (but only for some instruments), select Surface Geometry Target Selector under Surface Geometry Constraints in the left menu. To search for observations containing rings, use the Ring Geometry Constraints menu.

- Venus 353

OPUS is a project of the PDS Ring-Moon Systems Node

- ∅ Sidebar (universal fields applicable to all data sets)
- ∅ Defaults to commonly used parameters
- ∅ Toggle down menus group other parameters by type
- ∅ String searches give suggestions based on partial completion

Note: number of results if each option is selected is given by green value

HETEROGENEOUS OBSERVATIONS

Seamless cross-mission, cross-instrument search (both spacecraft and ground-based remote sensing observations)

The screenshot displays the OPUS3 search interface. At the top, the navigation bar includes 'OPUS3', a search field, a 'Browse Results' button with '16,553' results, a 'Cart' icon with '0' items, a 'Detail' icon, a 'New!' badge, and 'Recent Announcements'. On the right, there is a 'Help' dropdown. Below the navigation bar, there are options for 'View Table', 'Select Metadata', and 'Download CSV (all results)'. A filter for 'Observation #' is set to '1'. Below the filters, there are two dropdown menus for 'Observation Start Time' and 'OPUS ID'. The main area is a grid of observation thumbnails. Three blue boxes with white text label specific thumbnails: 'Voyager ISS' (top row, 4th column), 'Cassini ISS' (middle row, 8th column), and 'Cassini VIMS' (middle row, 2nd column). The thumbnails show various images, including grayscale and color (yellow, white, black) patterns. At the bottom, there is a footer with 'OPUS is a project of the PDS Ring-Moon Systems Node' and a Twitter icon, and 'Download Links History' on the right.

Toggle between **Gallery view** (this slide) or **Table view** (slide 7)

- ∅ Scrollbar supports infinite scroll in both directions
- ∅ Slider allows coarse positioning
- ∅ Current sort order is displayed and ascending/descending order can be toggled
- ∅ “Hamburger” menu provides quick access to cart and download features
- ∅ Can ctrl/cmd+click to add an item to the cart; shift+click to start or end range

OPUS3 Search Browse Results 443,177 Cart 96 Detail New! Recent Announcements Questions/Feedback Help

View Table Select Metadata Download CSV (all results) Observation # 142,902

Observation Start Time OPUS ID

#142902: co-iss-w1550421859
Click to enlarge (slideshow mode)
Ctrl+click to toggle cart
Shift+click to start/end range
co-iss-w1550421859

- Add to cart
- Start add range to cart here
- Show detail
- Download CSV of selected metadata
- Download CSV of all metadata
- Download zipped data archive
- Download zipped URL archive

https://tools.pds-rings.seti.org/opus/# OPUS is a project of the PDS Ring-Moon Systems Node Download History

- ∅ You can add/remove from the cart, move left/right using mouse or arrow keys, and access the hamburger menu
- ∅ Clicking on image brings up the full-size preview

OPUS3 Search Browse Results 443,177 Cart 96 Detail **New!** Recent Announcements Questions/Feedback Help

OPUS ID:
co-iss-w1550421859

Instrument Name:
Cassini ISS

Intended Target Name:
Saturn Rings

Observation Start Time:
2007-02-17T16:11:10.505

Greater Size in Pixels:
512

Lesser Size in Pixels:
512

Wavelength (Min) (microns):
0.4919

Wavelength (Max) (microns):
0.7779

Observed Ring Radius (Min) [Ring] (km):
66436.785000

Observed Ring Radius (Max) [Ring] (km):
163078.747000

OPUS is a project of the [PDS Ring-Moon Systems Node](#) [Download History](#)

View Gallery Select Metadata Download CSV (all results)

Observation #

142,902

Observation Start Time OPUS ID

	OPUS ID	Instrument Name	Intended Target Name	Observation Start Time	Greater Size in Pixels	Lesser Size in Pixels	Wavelength (Min) (microns)	Wavelength (Max) (microns)	Observed Ring Radius (Min) [Ring] (km)	Observed Ring Radius (Max) [Ring] (km)
	co-iss-w1550421859	Cassini ISS	Saturn Rings	2007-02-17T16:11:10.505	512	512	0.4919	0.7779	66436.785000	163078.747000
	co-iss-w1550422628	Cassini ISS	Saturn Rings	2007-02-17T16:23:59.416	1024	1024	0.4919	0.7779	65644.153000	155738.306000
	co-iss-w1550423401	Cassini ISS	Saturn Rings	2007-02-17T16:36:52.496	512	512	0.4919	0.7779	65817.617000	147135.954000
	co-iss-w1550424174	Cassini ISS	Saturn Rings	2007-02-17T16:49:45.491	512	512	0.4919	0.7779	66147.889000	137604.985000
	co-iss-w1550424946	Cassini ISS	Saturn Rings	2007-02-17T17:02:37.401	1024	1024	0.4919	0.7779	65697.323000	127140.629000
	co-iss-w1550425719	Cassini ISS	Saturn Rings	2007-02-17T17:15:30.396	1024	1024	0.4919	0.7779	65677.922000	115882.714000
	co-iss-w1550426492	Cassini ISS	Saturn Rings	2007-02-17T17:28:23.391	1024	1024	0.4919	0.7779	68649.417000	111144.858000
	co-iss-w1550427135	Cassini ISS	Saturn Rings	2007-02-17T17:39:06.387	1024	1024	0.4919	0.7779	79011.558000	126506.605000
	co-iss-w1550428459	Cassini ISS	Saturn Rings	2007-02-17T18:01:10.379	1024	1024	0.4919	0.7779	79117.707000	165637.398000
	co-iss-w1550429228	Cassini ISS	Saturn Rings	2007-02-17T18:13:59.344	1024	1024	0.4919	0.7779	94252.122000	165677.095000
	co-iss-w1550430001	Cassini ISS	Saturn Rings	2007-02-17T18:26:52.339	1024	1024	0.4919	0.7779	108436.964000	163836.423000
	co-iss-w1550430774	Cassini ISS	Saturn Rings	2007-02-17T18:39:45.334	1024	1024	0.4919	0.7779	90528.221000	134850.218000
	co-iss-w1550431546	Cassini ISS	Saturn Rings	2007-02-17T18:52:37.329	1024	1024	0.4919	0.7779	71633.957000	128745.232000
	co-iss-w1550432319	Cassini ISS	Saturn Rings	2007-02-17T19:05:30.444	512	512	0.4919	0.7779	71072.445000	140523.045000
	co-iss-w1550433092	Cassini ISS	Saturn Rings	2007-02-17T19:18:23.439	512	512	0.4919	0.7779	72767.458000	151257.371000
	co-iss-w1550433865	Cassini ISS	Saturn Rings	2007-02-17T19:31:16.435	512	512	0.4919	0.7779	71182.418000	160747.728000

OTHER FEATURES

OPUS provides its own preview images



Cassini
UVIS HDAC

Cassini
UVIS HSP

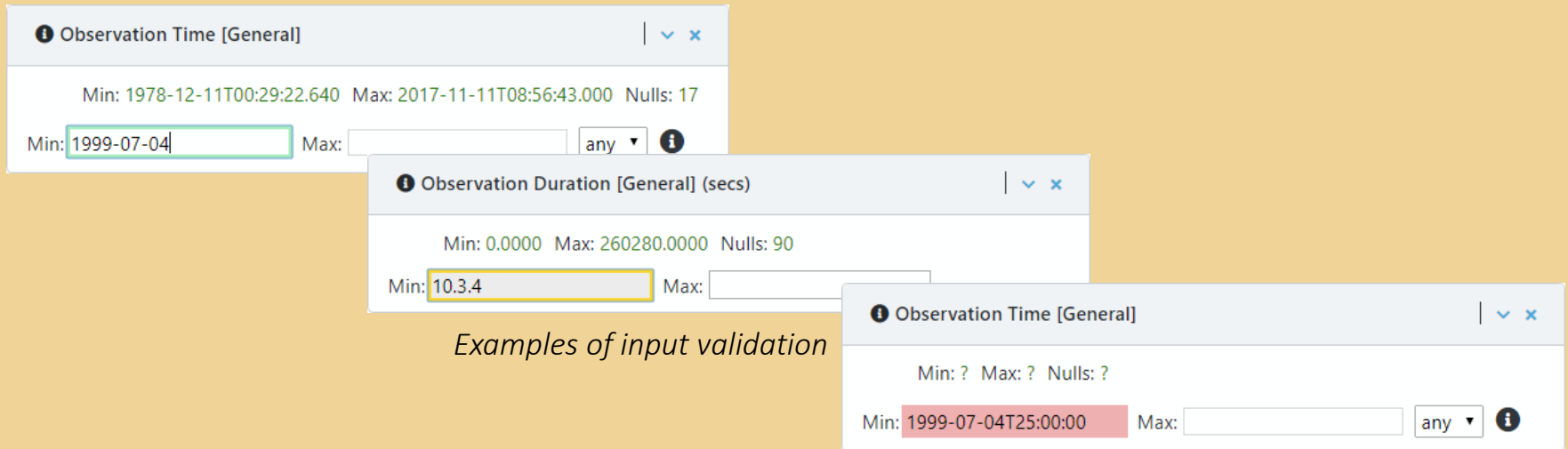
Cassini
UVIS EUV



Cassini ISS Different Filters

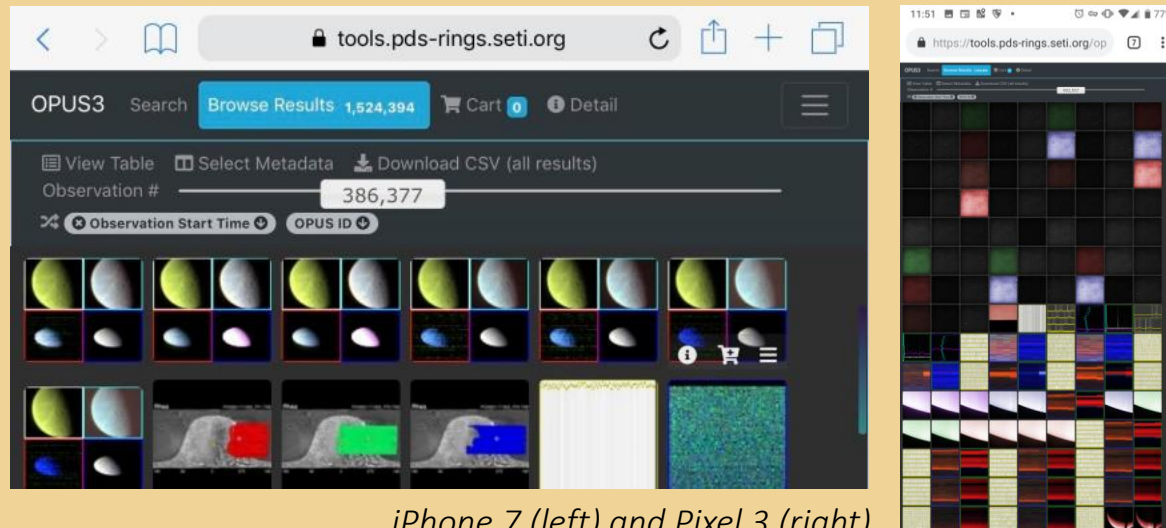
A screenshot of the OPUS interface. At the top right is a blue 'Help' button with a question mark icon. Below it is a navigation menu with the following items: 'About', 'Getting Started', 'Tutorial Videos', 'FAQ', 'Interpreting Preview Images' (highlighted with a left-pointing arrow), 'Recent Announcements', 'Data Volumes', 'API Guide', 'Welcome Message', 'Citing OPUS', and 'Contact Us'. To the left of the menu is a dropdown menu with three items: 'Cassini CIRS', 'Cassini UVIS', and 'Cassini VIMS'. Below the dropdown menu is a vertical bar with a blue gradient. At the bottom left of the screenshot, there is a text box with the number '560' and 'WFPC2 0'.

- ∅ Users are given feedback as they type, preventing illegal values



Examples of input validation

- ∅ Responsive design supports many browser sizes, including mobile support



iPhone 7 (left) and Pixel 3 (right)

- ∅ Easy-to-access downloads of data for this observation (w/o adding to cart)
- ∅ Full list of older versions and ability to download that data



Example from title slide



OPUS provides QR codes encoding the full current URL, refer to *How to Cite OPUS* slide

PV2023

OPUS3 Search Browse Results 3 Cart 3 Detail 1 Recent Announcements

Observation Detail

OPUS ID: co-iss-w1506059076  [SHARE](#)

PDS Products

Download zipped [data archive](#) or [URL archive](#) for this observation (all products, current version only).

Click on any "Index" type to see the entry for this observation in that table.

Version: Current

- 📄 Raw Image: [W1506059076_1.IMG](#) [W1506059076_1.LBL](#) [prefix3.fmt](#) [tlmtab.fmt](#)
- 📄 Calibrated Image: [W1506059076_1_CALIB.IMG](#) [W1506059076_1_CALIB.LBL](#)
- 📄 Extra Preview (thumbnail): [W1506059076_1.IMG_small](#)
- 📄 Extra Preview (medium): [W1506059076_1.IMG.jpeg](#)
- 📄 Extra Preview (full): [W1506059076_1.IMG.png](#)
- 📄 Documentation: [VICAR-File-Format.pdf](#) [ISS-Users-Guide.pdf](#) [ISS-Users-Guide.docx](#) [Data-Product-SIS.txt](#) [Data-Product-SIS.pdf](#) [Cassini-ISS-Final-Report.pdf](#) [Calibration-Theoretical-Basis.pdf](#) [Calibration-Plan.pdf](#) [CISSCAL-Users-Guide.pdf](#) [Archive-SIS.txt](#) [Archive-SIS.pdf](#)
- 📄 RMS Node Augmented Index: [COISS_2015_index.tab](#) [COISS_2015_index.lbl](#)
- 📄 Target Body Inventory: [COISS_2015_inventory.csv](#) [COISS_2015_inventory.lbl](#)
- 📄 Planet Geometry Index: [COISS_2015_saturn_summary.tab](#) [COISS_2015_saturn_summary.lbl](#)
- 📄 Moon Geometry Index: [COISS_2015_moon_summary.tab](#) [COISS_2015_moon_summary.lbl](#)
- 📄 Ring Geometry Index: [COISS_2015_ring_summary.tab](#) [COISS_2015_ring_summary.lbl](#)
- 📄 Browse Image (thumbnail): [W1506059076_1_thumb.jpg](#)
- 📄 Browse Image (small): [W1506059076_1_small.jpg](#)
- 📄 Browse Image (medium): [W1506059076_1_med.jpg](#)
- 📄 Browse Image (full): [W1506059076_1_full.png](#)

Version: 2





- 📄 Calibrated Image: [W1506059076_1_CALIB.IMG](#) [W1506059076_1_CALIB.LBL](#)

Version: 1

- 📄 Calibrated Image: [W1506059076_1_CALIB.IMG](#) [W1506059076_1_CALIB.LBL](#)

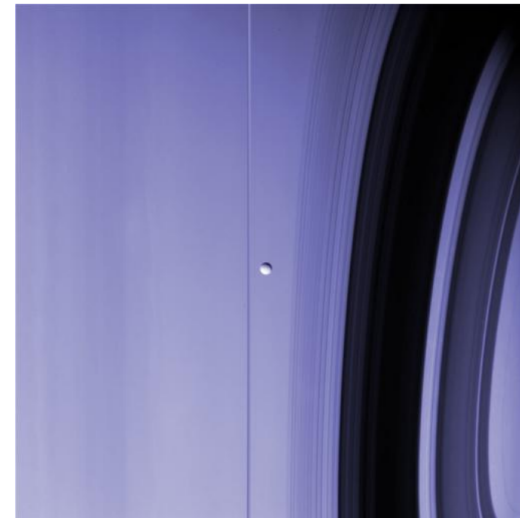
Selected Metadata

[Download CSV of selected metadata](#)

- 📄 OPUS ID: [co-iss-w1506059076](#) 
- 📄 Instrument Name: [Cassini ISS](#) 
- 📄 Planet: [Saturn](#) 
- 📄 Intended Target Name(s): [Dione](#) 
- 📄 Observation Start Time (YMDhms): 2005-09-22T05:16:11.149
- 📄 Observation Duration (secs): 0.15

All OPUS Metadata for this Observation

Download all metadata [as JSON](#)



Link to pull up geometric metadata index in Viewmaster¹ showing data from this observation


¹Viewmaster is another tool provided by RMS Node

OPUS3 [Search](#) [Browse Results 3](#) [Cart 3](#) [Detail 1](#) [Recent Announcements](#)






Observation Detail

OPUS ID: [co-iss-w1506059076](#) [SHARE](#)

PDS Products

RMS Viewmaster 

[Volumes](#) | [Calibrated](#) | [Previews](#) | [Diagrams](#) | [Metadata](#) | [Documents](#)

-  [metadata/](#)
-  [COISS_2xxx/](#)
-  [COISS_2015/](#) [\[tar.gz\]](#) [\[MD5.txt\]](#)
-  [COISS_2015_saturn_summary.tab](#)
-  [W1506059042](#)


Supplemental metadata curated by the RMS Node

RMS-curated ISS Saturn image metadata collection, v1.2

RMS-curated ISS image metadata 2005-08-20 to 2005-09-30 (SC clock 1503245364-1506814111)

Index of observed geometry on Saturn

Selected row of index



Jump in this page to: [\[Top | Directory 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Related files | Documentation | Product label \]](#)

This directory in: [\[Volumes | Calibrated | Previews | Metadata | WGET access \]](#) **Versions:** [\[Previous | Next | Latest \]](#)



metadata/COISS_2xxx/COISS_2015/COISS_2015_saturn_summary.tab	...
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TARGET_NAME	= "SATURN"
MINIMUM_PLANETOCENTRIC_LATITUDE	= -33.583
MAXIMUM_PLANETOCENTRIC_LATITUDE	= 43.247
MINIMUM_PLANETOGRAPHIC_LATITUDE	= -39.215
MAXIMUM_PLANETOGRAPHIC_LATITUDE	= 49.138
MINIMUM_IAU_LONGITUDE	= 81.329
MAXIMUM_IAU_LONGITUDE	= 199.552
MINIMUM_LOCAL_HOUR_ANGLE	= 98.268
MAXIMUM_LOCAL_HOUR_ANGLE	= 223.243
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All OPUS metadata for this Observation













Download all metadata [as JSON](#)

[Questions / Feedback](#)

Click on magnifying glass to create a new OPUS tab with a search of that field on the displayed value

OPUS3 Browse Results **2,318**  Cart **0**  Detail Recent Announcements

General Constraints ▾

-  Planet
-  Intended Target Name
-  Nominal Target Class
-  Mission
-  Instrument Host Name
-  Instrument Name
-  Observation Type
-  Observation Time
-  Observation Duration
-  Measurement Quantity
-  Right Ascension
-  Declination

PDS Constraints ▶

Image Constraints ▶

Wavelength Constraints ▶


Occultation/Reflectance Profiles Constraints ▶

Surface Geometry Constraints ▶




Ring Geometry Constraints ▶

Cassini Mission Constraints ▶

Cassini ISS Constraints ▶

























































































































































































































































































 Volume ID [PDS] ▾ ×

matches ▾ + (OR)

OPUS3 Browse Results **2,318**  Cart **3**  Detail  Recent Announcements

View Table Select Metadata Download CSV (all results) Observation #

Sort by Observation Start Time + OPUS ID ▾

-  Expo
 -  Great
 -  Lesse
 -  Inten
 -  Image
- Wavel
-  Wave
 -  Wave
 -  Wave
 -  Wave

SHOPPING CART (DOWNLOAD)

OPUS3 Search Browse Results **2,318** **Cart 14** Detail Recent Announcements Help

Download Data

Total Size (before zip): 77M Total Files: 72

[Data Archive](#) [URL Archive](#) [Metadata CSV](#)

Download Options

Flat file structure File format: **zip**

Select which product types to include in downloads:

Select all current version product types Deselect all product types

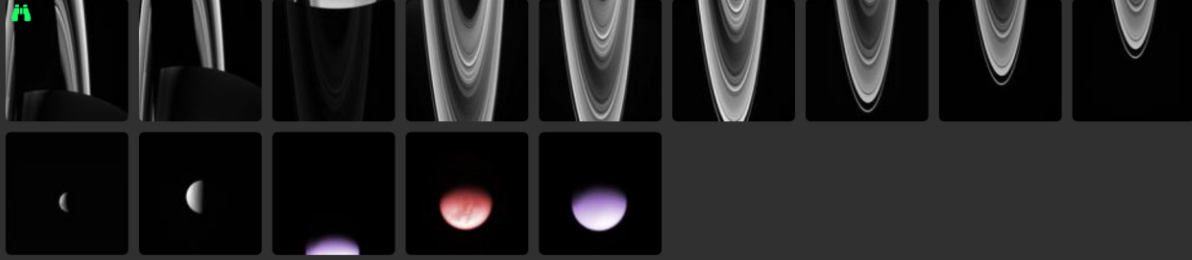
Show previous versions

Product Type	# Obs	# Files	Size
✓ x Cassini ISS-Specific Products			
<input checked="" type="checkbox"/> Raw Image	14	30	19M
<input checked="" type="checkbox"/> Calibrated Image	14	28	56M
<input type="checkbox"/> Extra Preview (thumbnail)	14	14	8K
<input type="checkbox"/> Extra Preview (medium)	14	14	56K
<input type="checkbox"/> Extra Preview (full)	14	14	3M
<input type="checkbox"/> Documentation	14	11	22M
✓ x Metadata Products			
<input type="checkbox"/> RMS Node Augmented Index	14	2	6M
<input type="checkbox"/> Target Body Inventory	14	2	214K
<input type="checkbox"/> Planet Geometry Index	14	2	951K
<input type="checkbox"/> Moon Geometry Index	7	2	1M
<input type="checkbox"/> Ring Geometry Index	14	2	1M
✓ x Browse Products			
<input type="checkbox"/> Browse Image (thumbnail)	14	14	17K
<input type="checkbox"/> Browse Image (small)	14	14	60K
<input type="checkbox"/> Browse Image (medium)	14	14	174K

View Table **Select Metadata** Observation # -

Sort by **Observation Start Time** + OPUS ID

Empty Cart Empty Recycle Bin Restore Recycle Bin to Cart



Download Archive Links

- <https://opus.pds-rings.seti.org/downloads/pdsrms-2023-04-25T07-44-35-005539-data-f.zip>
- <https://opus.pds-rings.seti.org/downloads/pdsrms-2023-04-25T07-44-10-052603-url-d.zip>

[How to Cite OPUS](#) Clear All

OPUS is a project of the [PDS Ring-Moon Systems Node](#)

[Download Links History](#)

Select Metadata

Available Metadata Fields

Click on a field name to include (or exclude) it from the Selected Metadata list. To show Surface Geometry Constraints, select a Surface Geometry Target Name on the Search tab.

Ring Geometry Constraints ▶

Cassini Mission Constraints ▶

Cassini ISS Constraints ▾

- Camera
- Filter
- Shutter Mode
- Shutter State
- Compression Type
- Data Conversion Type
- Gain Mode
- Instrument Mode
- Missing Lines
- Image Number
- Target Description
- Image Observation Type

Selected Metadata Fields

These fields will be shown in the Table View, Slideshow, and Detail tab and will be included in downloaded CSV files and archives. Fields can be reordered with drag-and-drop.

<input type="checkbox"/> OPUS ID	<input type="checkbox"/>
<input type="checkbox"/> Observation Start Time	<input type="checkbox"/>
<input type="checkbox"/> Observation Duration	<input type="checkbox"/>
<input type="checkbox"/> Observation Name [Cassini]	<input type="checkbox"/>
<input type="checkbox"/> Filter [Cassini ISS]	<input type="checkbox"/>
<input type="checkbox"/> Compression Type [Cassini ISS]	<input type="checkbox"/>
<input type="checkbox"/> Missing Lines [Cassini ISS]	<input type="checkbox"/>
<input type="checkbox"/> Target Description [Cassini ISS]	<input type="checkbox"/>

Reset to Default

Save Changes

Discard Changes

About OPUS



Welcome to OPUS3, the 10th anniversary version of OPUS released May, 2019. OPUS3 has a new look-and-feel and new functionality. Please see the [FAQ section](#) or [our blog](#) for details.

[View in new browser tab](#)

OPUS (Outer Planets Unified Search), a web-based data search tool for NASA outer planet missions, is a project of the [Ring-Moon Systems Node](#) of NASA's [Planetary Data System \(PDS\)](#). The PDS is a carefully-curated permanent archive of data from and supporting NASA missions, which are freely available to researchers and the general public. The [Ring-Moon Systems Node](#), one of six Discipline Nodes, specializes in imaging, spectral, and occultation data related to the outer planets, rings, and moons of our solar system. It is hosted at [The SETI Institute](#) in Mountain View, California.

OPUS supports user-friendly searching on metadata normally associated with observations, such as the mission, instrument, intended target, observation time, and PDS volume name, as well as metadata specific to each supported mission and instrument.

In addition, OPUS excels at multi-mission and multi-instrument searches by providing search parameters that are more generic in nature; these are computed by the Ring-Moon Systems Node and uniquely available in OPUS. Among these are:

Getting Started



The Cart

The cart allows you to collect observations for future downloading. As described above, you can add or remove individual observations, or ranges of observations, from the **Browse Results** tab. The number of observations in the cart will be displayed next to the **Cart** tab.

The **Cart** tab allows you to view and navigate through your cart in the same way the **Browse** tab allows you to view and navigate through your total result set. In addition, the **Download Options** pane on the left shows the estimated total download size of your cart as well as which data products will be included in a download. The individual products can be selected or removed to reduce the file size.

Three basic methods of download are provided:

1. A **Metadata CSV** is a comma-separated value (CSV) text file containing one row per observation. The rows contain all of the metadata fields selected using the **Select Metadata** option. On the **Cart** tab, the **Metadata CSV** option will include all of the observations in your cart. On the **Browse** tab, the **Download CSV (all results)** option will include *all* of the observations in your result set (which may be a lot!). The **☰** menu may also be used to create a metadata CSV file for a single observation.

Frequently Asked Questions (FAQ)



General Questions

[View in new browser tab](#)

1. What is OPUS?
2. What's new in OPUS3?
3. Where are all the pretty pictures?

Using Search

1. What do Any, All, and Only mean?
2. How do I find all observations containing a particular body?
3. How do I search for observations that contain two particular bodies in the same observation?
4. How do I search for images that were taken using a particular color filter?
5. How do I search for a series of observations that were designed to be a movie?

About OPUS gives an overview of OPUS and its capabilities plus supported missions and instruments

Getting Started is a brief but thorough overview of how to use OPUS. **Please read this!**

FAQ gives answers to frequently asked questions. Suggestions for new questions are welcome.

Descriptive tooltips

Observation Time

Observation Duration

The time range during which an observation was performed. For compound observations such as spectral cubes or time series, or instruments with multiple detectors like Cassini VIMS, this is the range covered by the entire observation, and may be much longer than the times of the individual component observations. Although many formats are supported, the standard is YYYY-MM-DD[Thh:mm:ss.sss]. Both the start and stop time are available as a range, and the search can be made more specific using the any/all/only modifiers. See Help/FAQ for more information.

OPUS demo (time permitting, or ask me about it later!)

Thanks, any questions?

∅ OPUS is open source:

<https://github.com/SETI/pds-opus>

∅ Join our announcement mailing list:

opus-users-request@list.seti.org

∅ Mastodon: <https://astrodon.social/@PDSRMS>

∅ Contact me: mmace@seti.org

or any member of the RMS team: *<first initial/s><surname>@seti.org*

Title slide image source: <https://photojournal.jpl.nasa.gov/catalog/PIA07771>

https://opus.pds-rings.seti.org/#/COISScamera=Wide+Angle&duration1=0&duration2=0.5&unit-duration=seconds&instrument=Cassini+ISS&target=Dione&time1=2005-09-22T00:00:00.000&time2=2005-09-22T23:59:59.000&qtype-time=any&unit-time=ymdhms&cols=opusid,instrument,planet,target,time1,observationduration&widgets=duration,COISScamera,time,instrument,observationtype,target&order=time1,opusid&view=browse&browse=gallery&cart_browse=data&startobs=1&cart_startobs=1&detail=