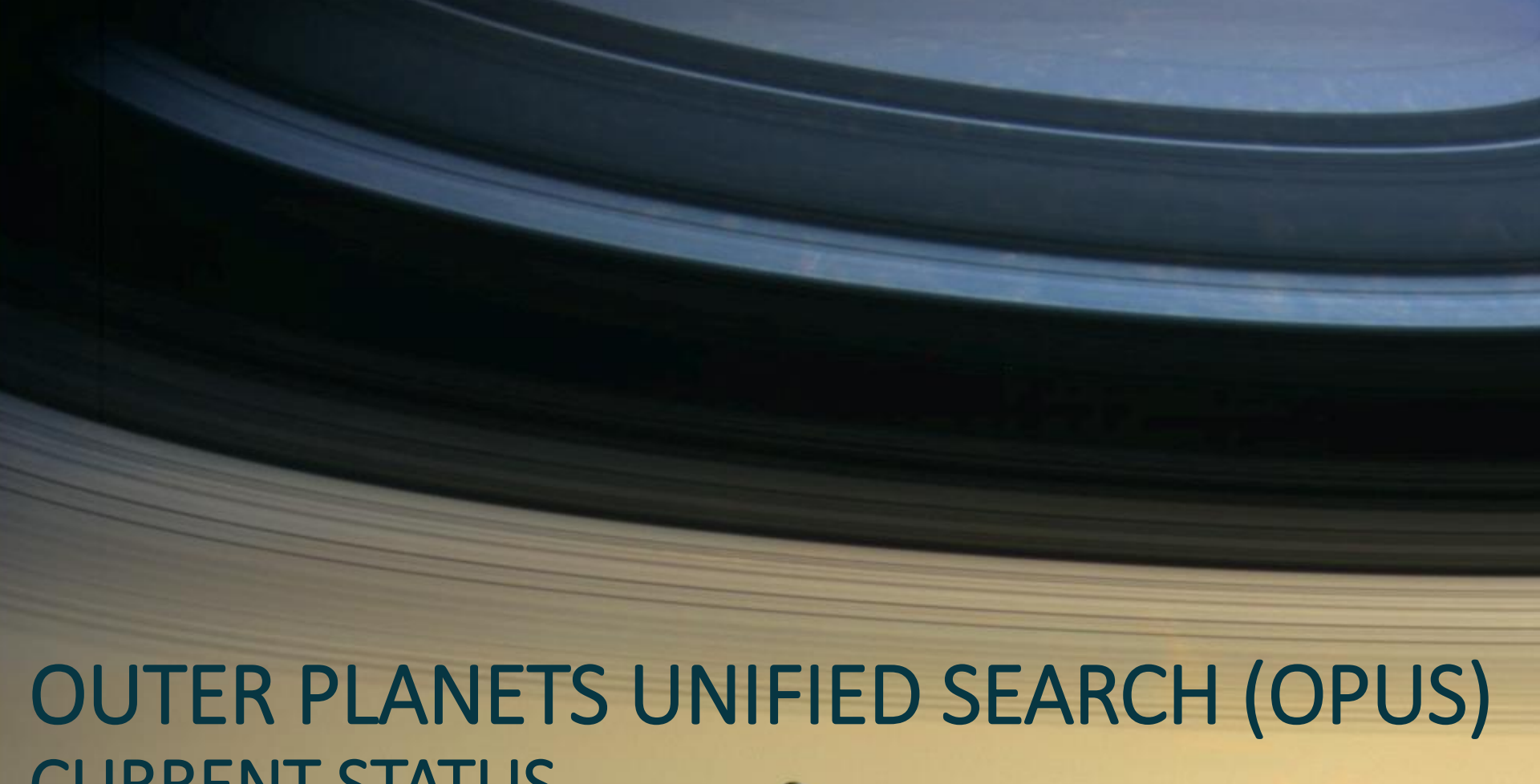

OUTER PLANETS UNIFIED SEARCH (OPUS)
CURRENT STATUS

Mia J. T. Mace, Robert S. French, Debra J. Stopp , Yu-Jen Chang, Matthew S. Tiscareno, Mark R. Showalter, Mitchell K. Gordon, Joseph N. Spitale.

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SETI INSTITUTE

BACKGROUND

- 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)

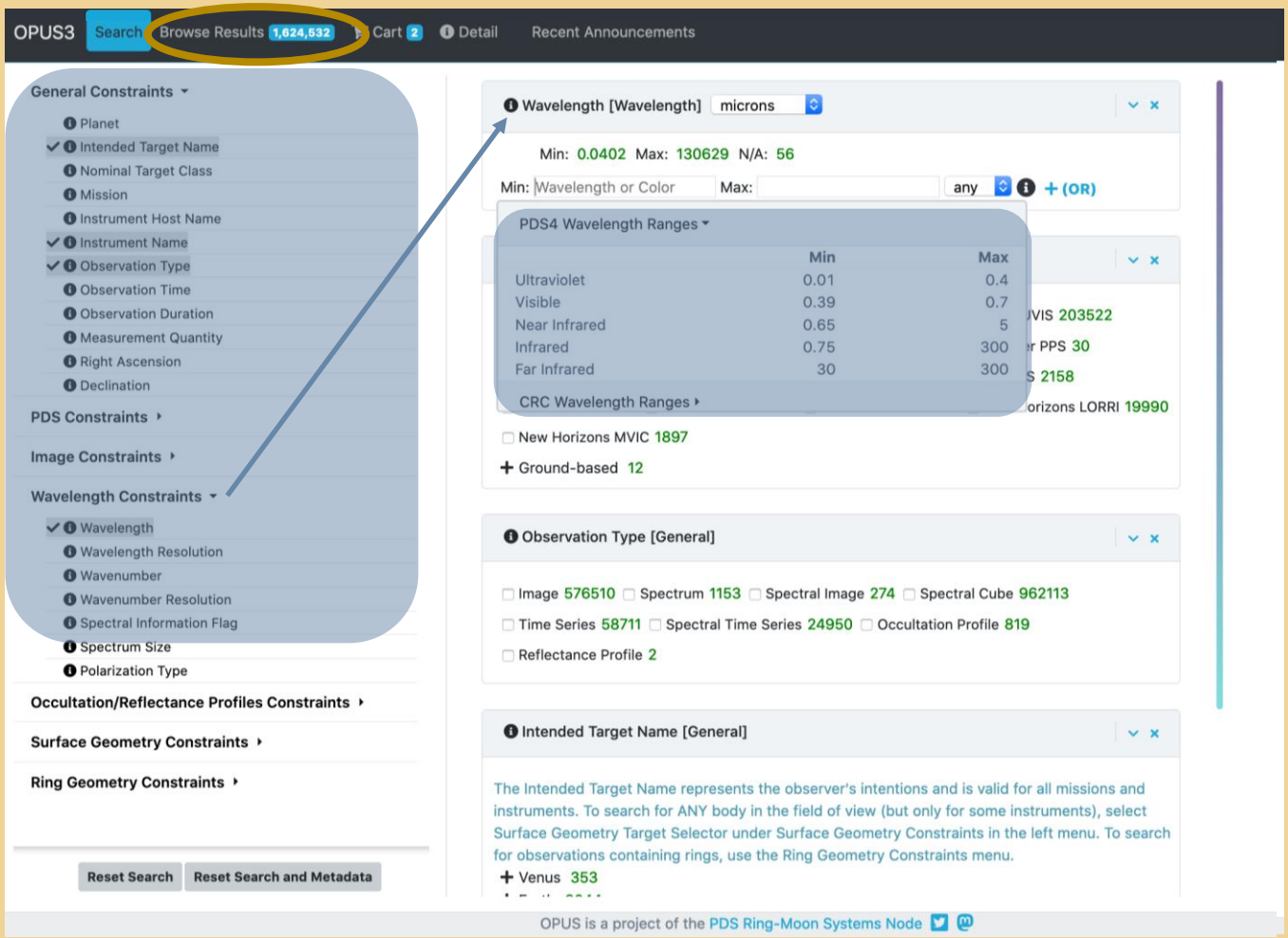
- Our goal is to make it easy to ***search***, ***discover***, and ***explore*** the available data, and then to ***select*** and ***download*** products

- 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

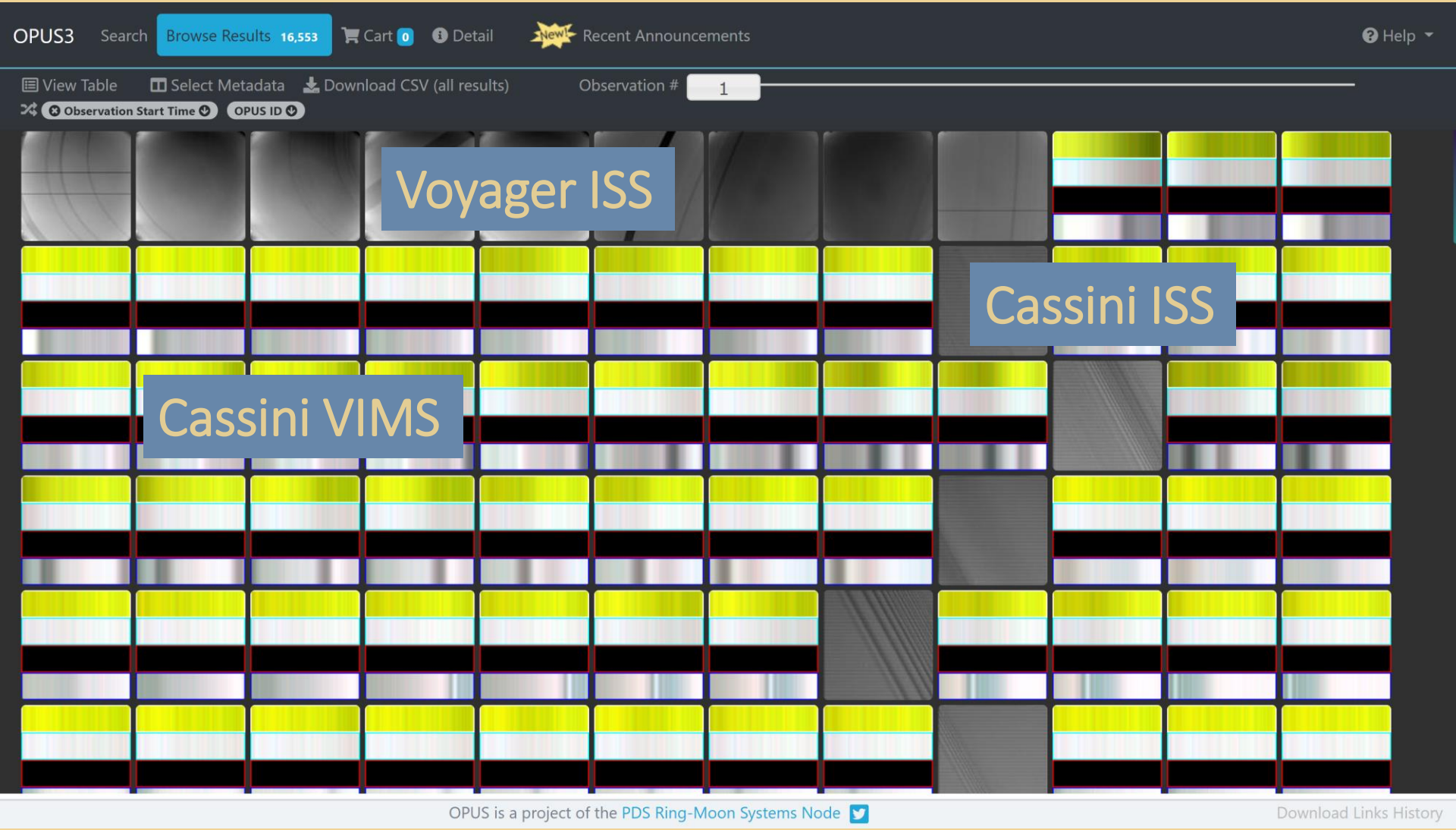


- Sidebar (universal fields applicable to all data sets)
- Defaults to commonly used parameters
- Toggle down menus group other parameters by type
- String searches give suggestions based on partial completion

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

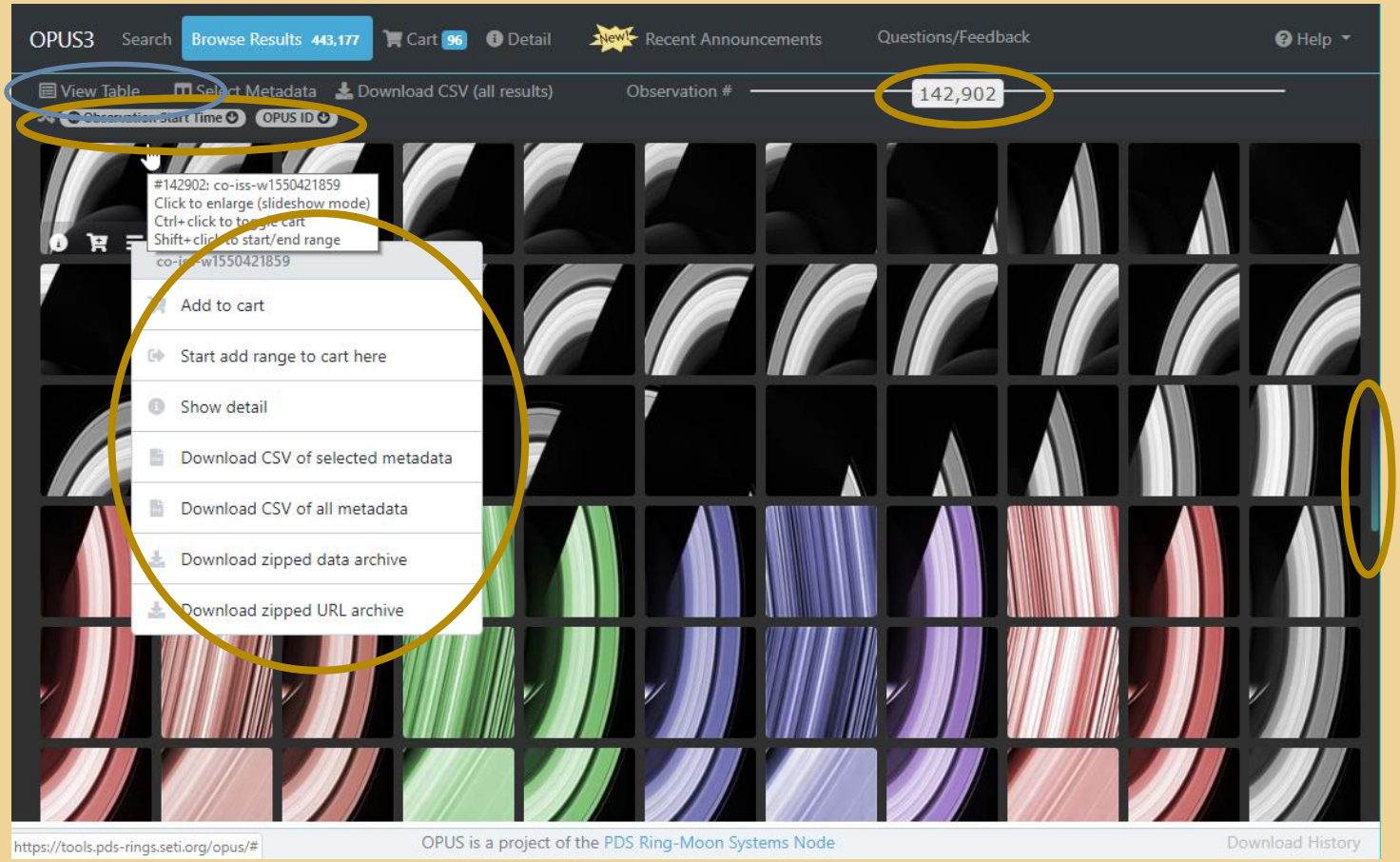
HETEROGENEOUS OBSERVATIONS

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



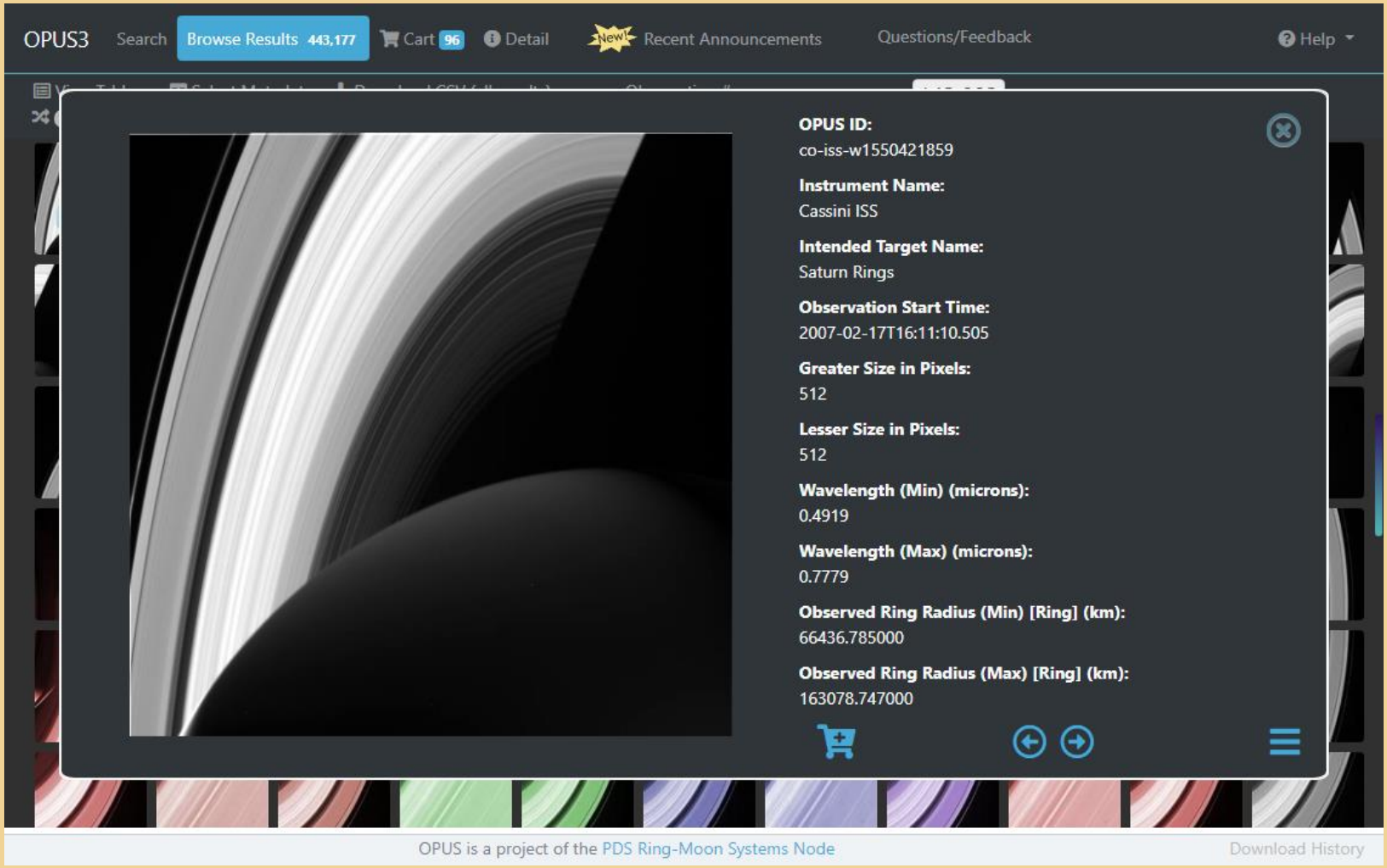
Toggle between **Gallery view** (this slide) or Table view (slide 7)

- 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

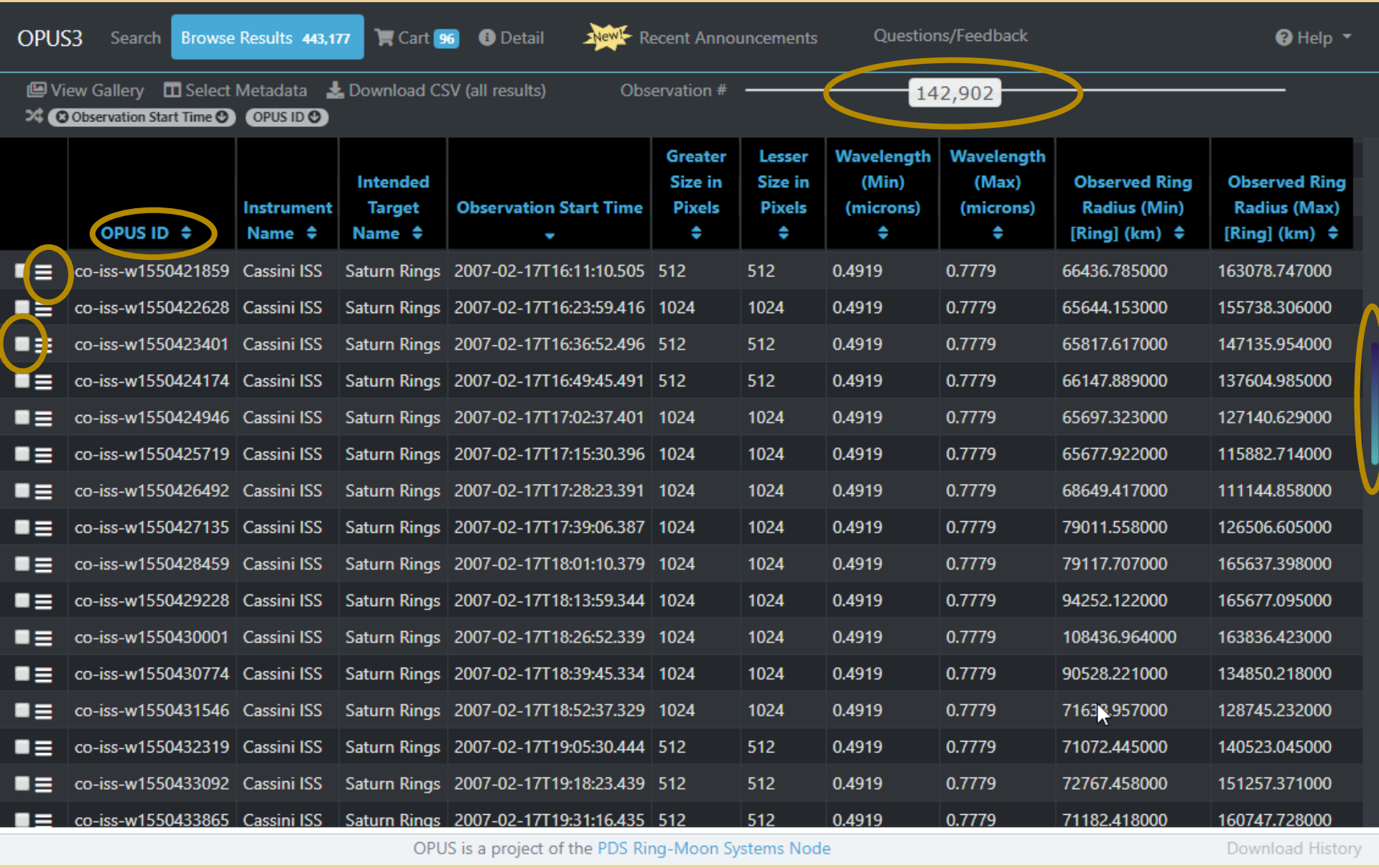


BROWSE (SLIDESHOW)

- 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



BROWSE (TABLE)



OTHER FEATURES

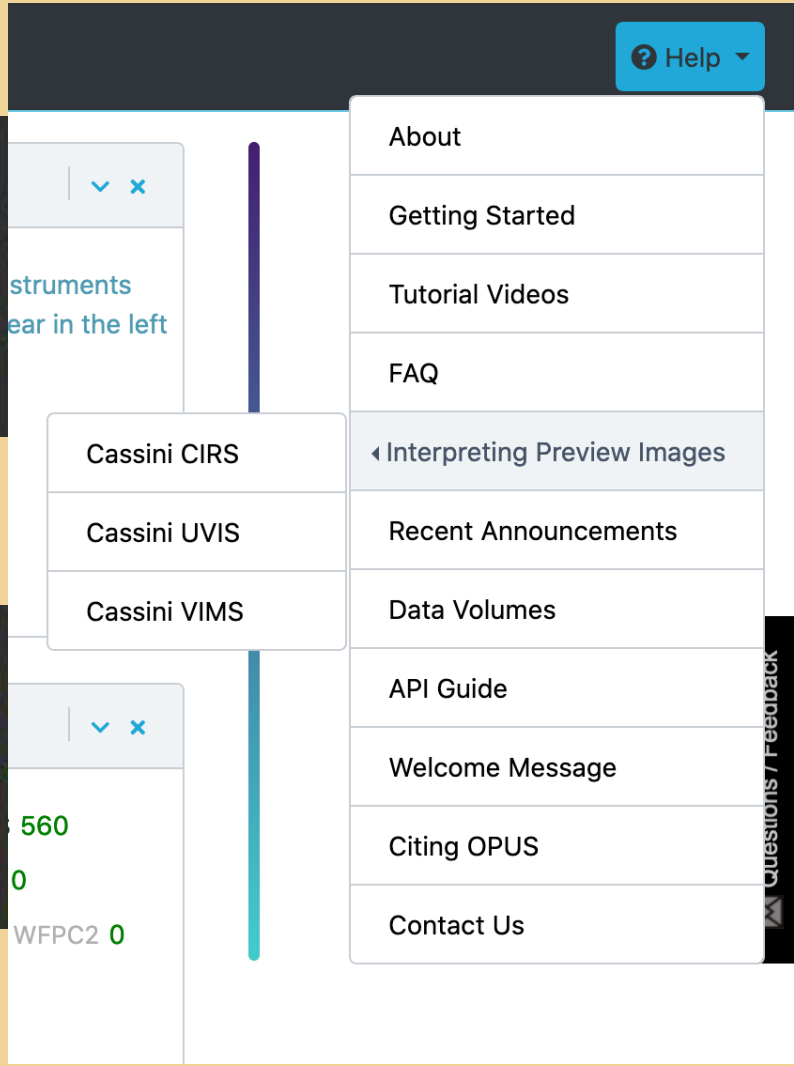
OPUS provides its own preview images

Cassini
UVIS HDAC

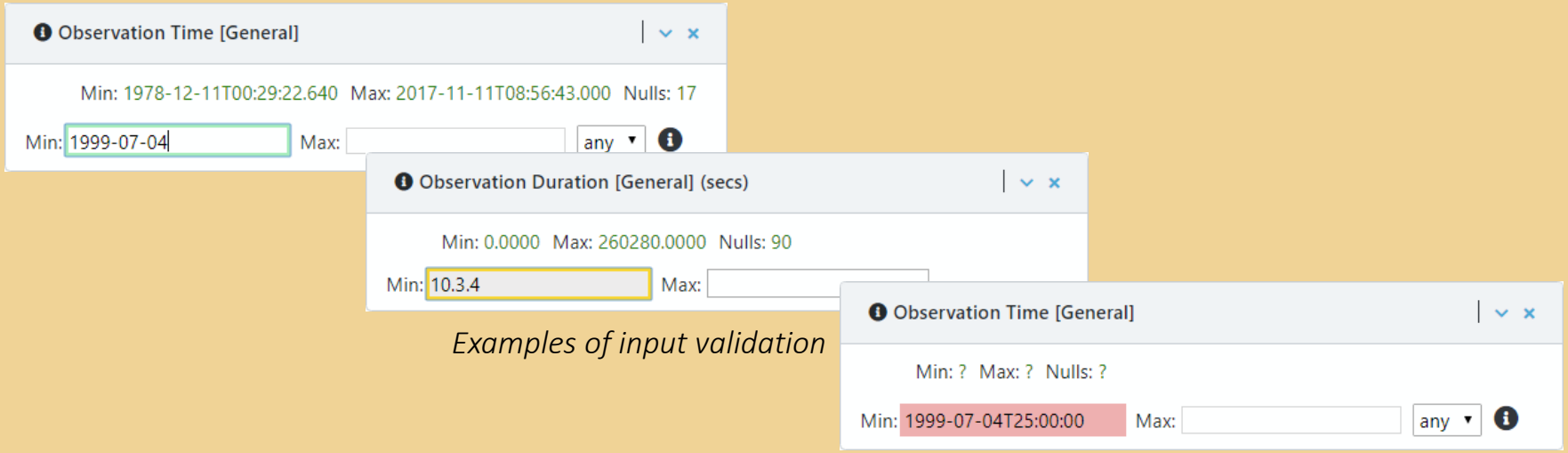
Cassini
UVIS HSP

Cassini
UVIS EUV

Cassini ISS Different Filters

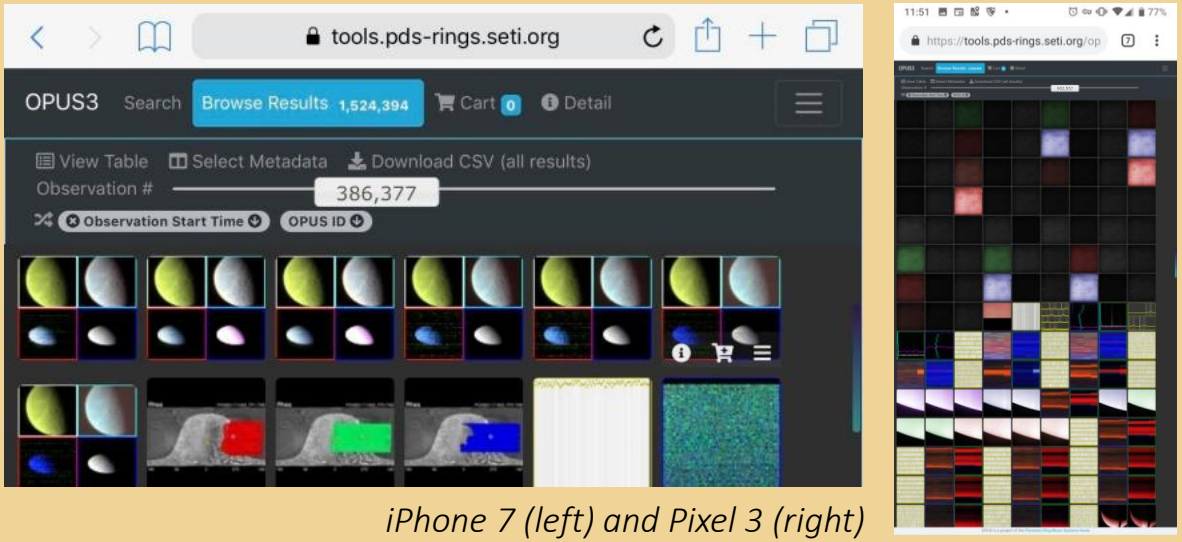


- Users are given feedback as they type, preventing illegal values



Examples of input validation

- Responsive design supports many browser sizes, including mobile support



iPhone 7 (left) and Pixel 3 (right)

DETAIL ⓘ

- 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

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OPUS3 Search Browse Results 3 Cart 3 Detail 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.jpeg_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

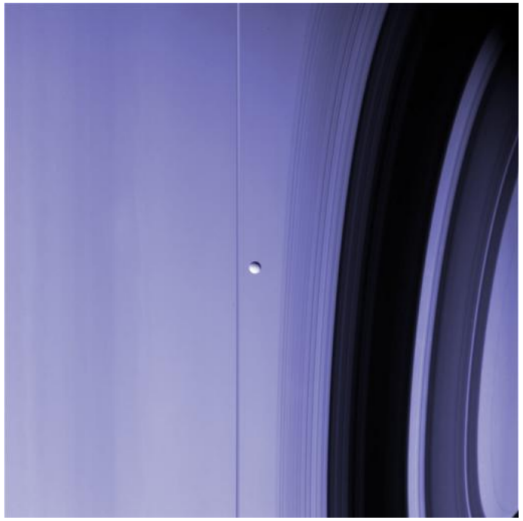
Selected Metadata

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

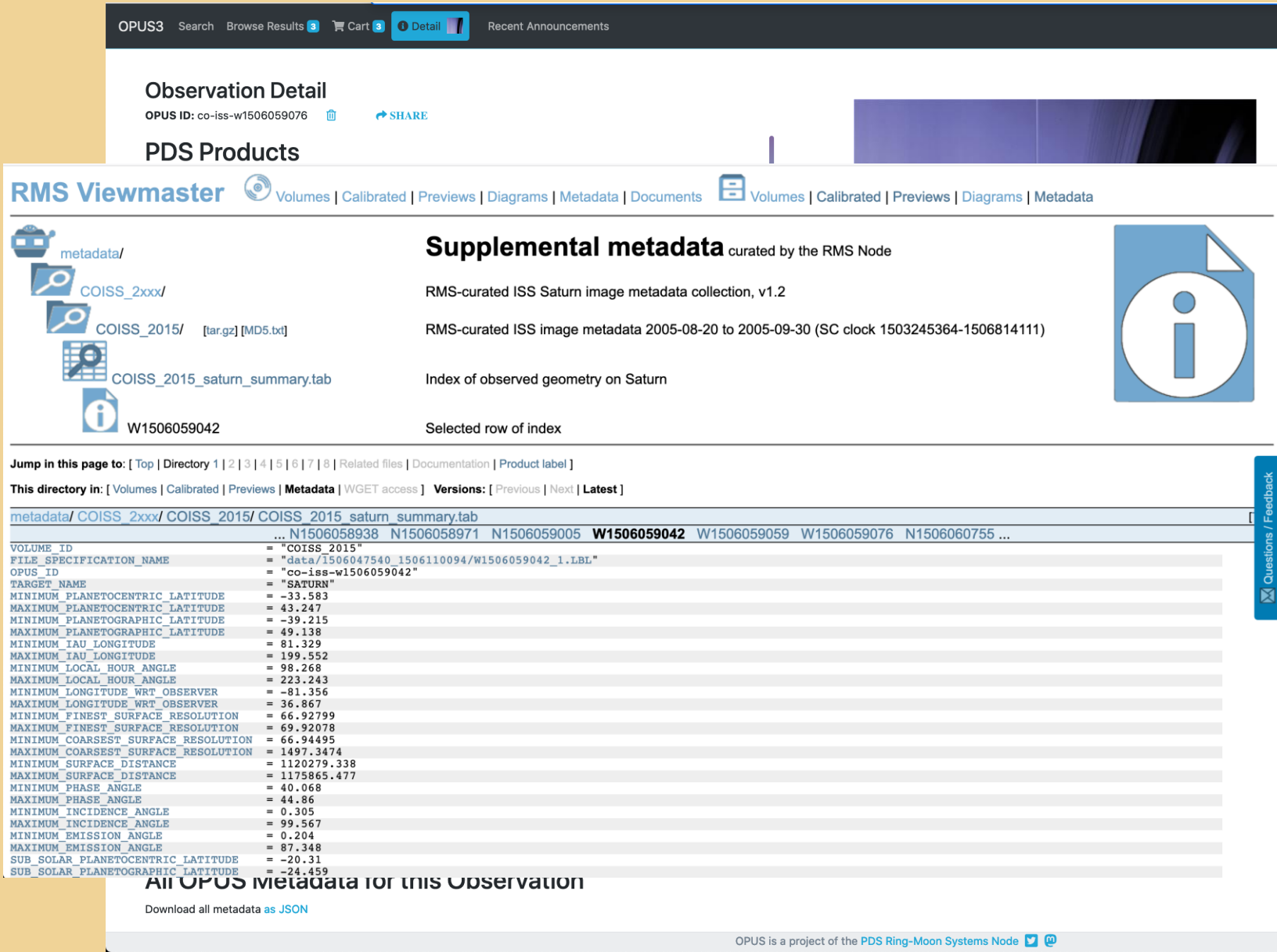
Download all metadata as JSON



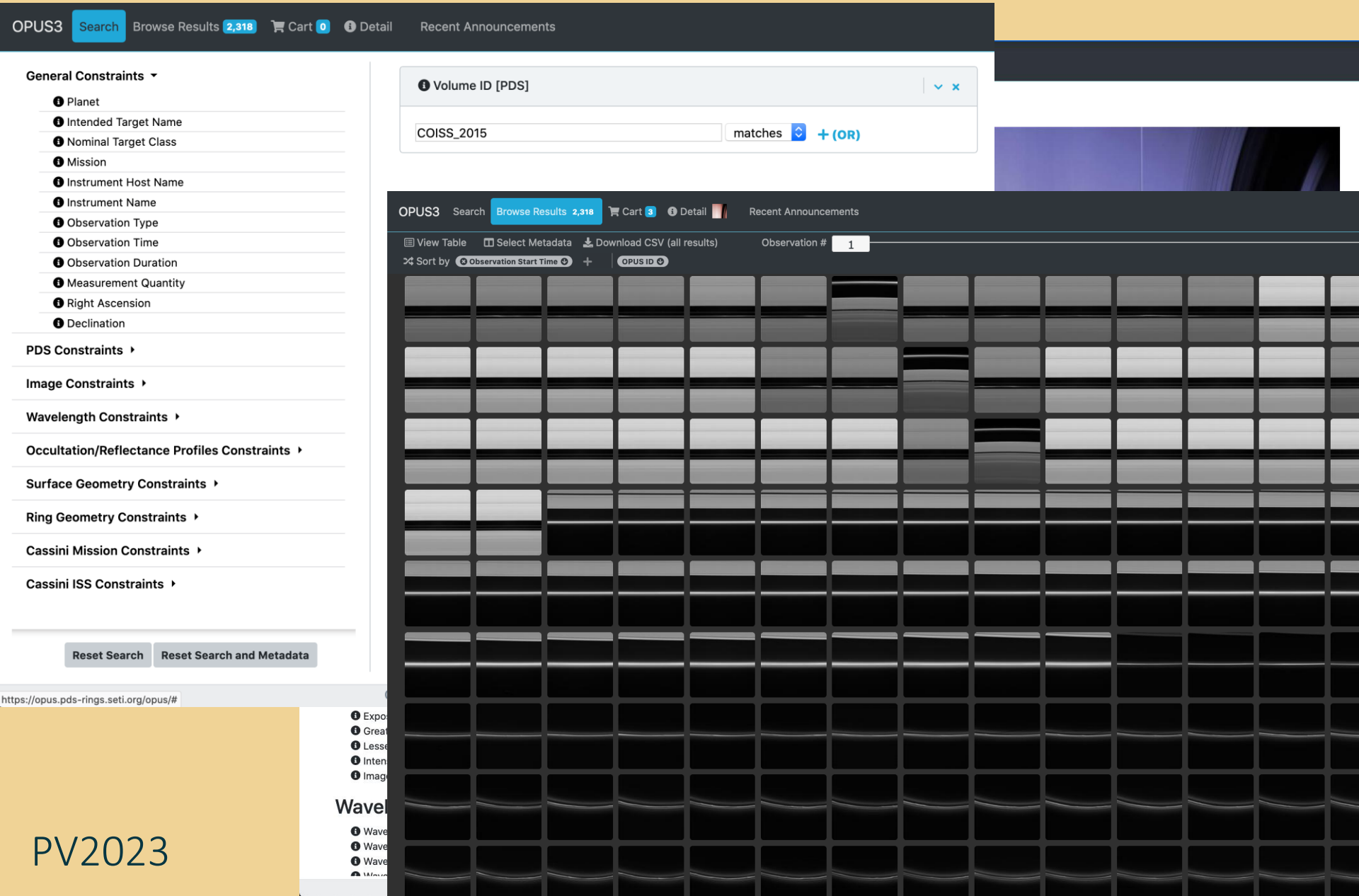
OPUS is a project of the PDS Ring-Moon Systems Node

⌀ Link to pull up geometric metadata index in Viewmaster[1] showing data from this observation

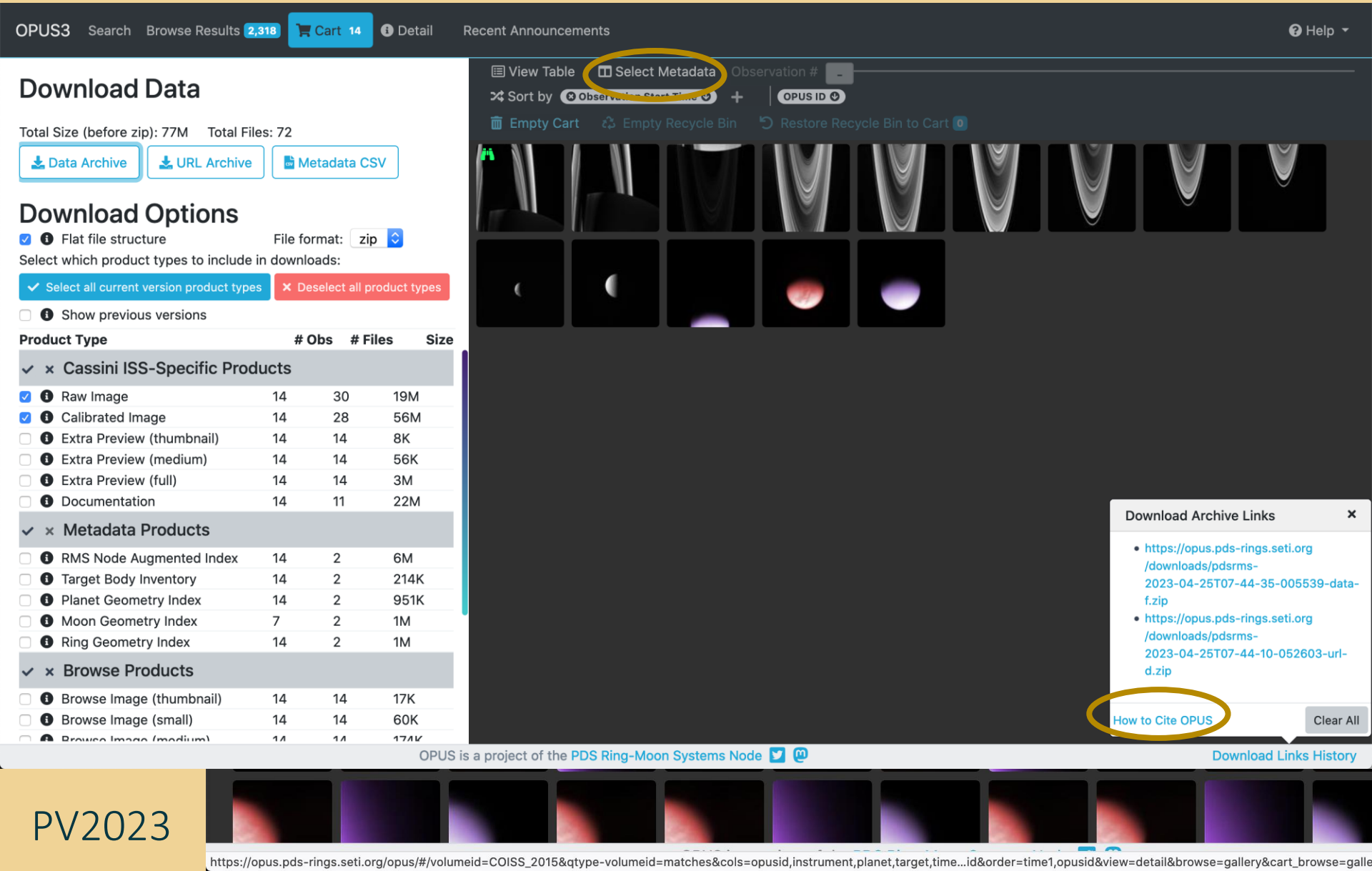
[1]Viewmaster is another tool provided by RMS Node



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



SHOPPING CART (DOWNLOAD)



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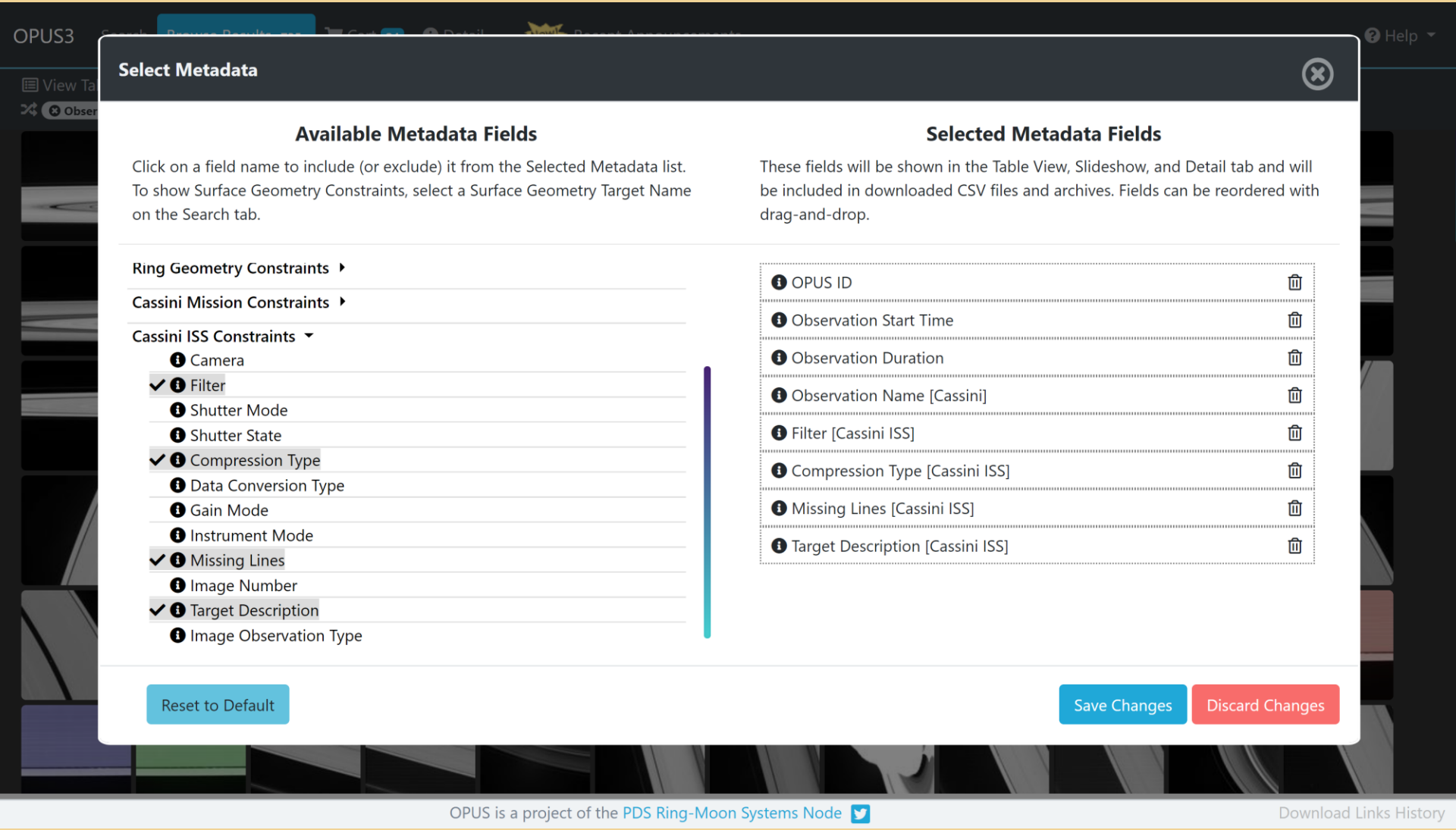
SELECTING METADATA



In addition, you may wish to use one of the following QR codes in your presentation or poster. These codes allow sor
a URL representing your data set. To save one of these QR codes to your computer, right-click on the image and sele

This QR code should be used to cite OPUS as a whole. Note: This does not include ar

(This encodes the URL **`https://pds-rings.seti.org/search/`**)

This QR code represents your current search parameters. Someone scanning this QR code
running, but not see your selection of metadata fields, sort order, etc.

(This encodes the URL **`https://opus.pds-rings.seti.org/#/volumeid=CO`**
`s`)

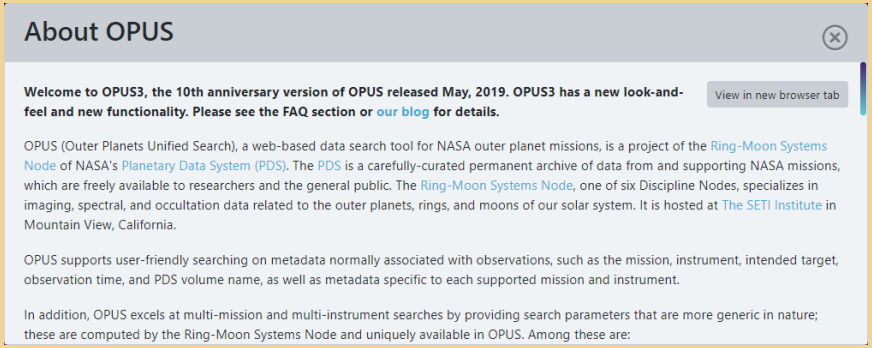
This QR code represents your complete current state. It includes search terms, sort order, me
(**Search**, **Browse Results**, **Cart**, or **Detail**), and which specific observations you are looking a
exactly what you were seeing before showing this Help panel (with the exception of minor cha

(This encodes your full current URL.)

Help

- About
- Getting Started
- Tutorial Videos
- FAQ
- Interpreting Preview Images
- Recent Announcements
- Data Volumes
- API Guide
- Welcome Message
- Citing OPUS
- Contact Us

OPUS DOCUMENTATION



About OPUS

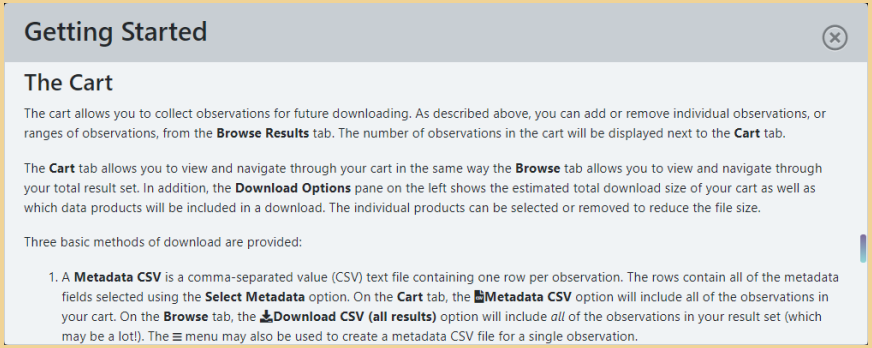
Welcome to OPUS3, the 10th anniversary version of OPUS released May, 2019. OPUS3 has a new look-and-feel and new functionality. Please see the FAQ section or our blog for details.

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

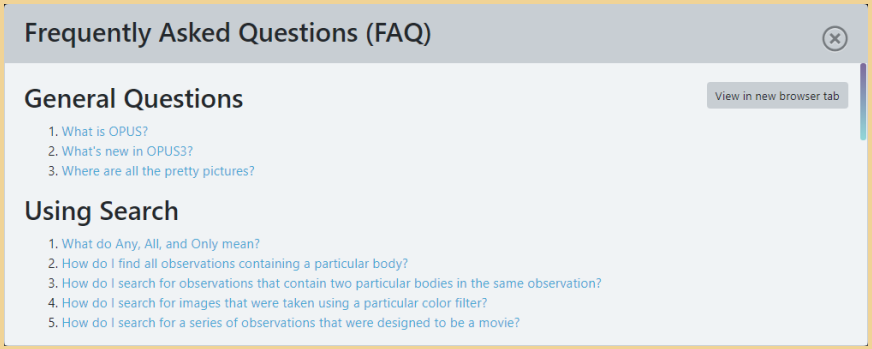
The Cart

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)

View in new browser tab

General Questions

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

Using Search

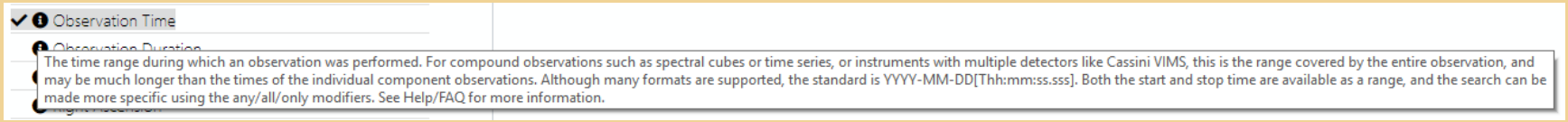
1. What do Any, All, and Only mean?
2. How do I find all observations containing a particular body?
3. How do I search for observations that contain two particular bodies in the same observation?
4. How do I search for images that were taken using a particular color filter?
5. How do I search for a series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



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=