

The background features a gradient from red at the top to dark blue at the bottom, overlaid with a starry space pattern. On the left side, there are several technical diagrams, including circular gauges with numerical scales (140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260) and various circular arrows indicating motion or flow.

# **PPI DATA SEARCH AND USABILITY**

PDS DATA SERVICE WORKSHOP  
NOVEMBER 5, 2019

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# A USER-CENTERED APPROACH

## What users want:

- **Google** – Most users begin data searches from Google.
- **Search Services** – Users want services that make data search more accurate, and download more efficient.
- **Useable Data** – Users want data that are readily accessible using generally available data visualization and manipulation tools.

# GOOGLE SEARCH TESTING

- PPI conducted internal testing comparing the results from identical searches using a PPI text search and an identical search in Google.
  - PPI searches generally did fairly well, though some data sets were missing.
    - Reasonable variations in search terms (e.g. “mag” instead of “magnetometer” or “fgm”)
    - Minor spelling variations (e.g. “ion” vs. “ions”, “magnetic field” vs. “magnetic-field”, etc.)
  - Google searches were less consistently reliable.
    - Search results must be in the first screen/page to be considered successful.
    - Successful results depended very much on selecting the right search terms.
    - Search terms of high public interest often push PDS holdings far down in search results.
  - Hierarchical mission and target pages were more reliable in finding all available data.

# BETTER SUPPORT FOR WORD SEARCHES

- PDS metadata need to be better conditioned to support text search:
  - More consistent metadata
  - Accommodation for reasonable variations of search terms
  - Support for associating reasonable alternative search terms with the canonical terms used found in the metadata
  - Metadata support for terms which will move PDS data up in relevant Google searches

# NEW PPI WEB INTERFACE

The screenshot shows a web browser window displaying the PDS: Planetary Plasma Interactions website. The browser's address bar shows 'localhost:443/index.jsp'. The website header features the NASA logo and the title 'PDS: PLANETARY PLASMA INTERACTIONS'. A navigation menu includes links for HOME, OVERVIEW, DATA, DOCUMENTS, SOFTWARE, PERSONNEL, RELATED SITES, and ABOUT PDS. A search bar is present with the text 'ions' and a 'Go' button. Below the search bar are radio buttons for 'Bundles' and 'Collections', and three buttons for 'By Target', 'By Mission', and 'By Instrument'. There are also buttons for 'Help', 'Useful Info', and 'How are we doing?'. A list of links includes 'NASA's Research Opportunities in Space and Earth Sciences (2019)', 'Mission Proposer's Archive Guide (Version 4.0.0 September 21, 2016)', and 'Individual Proposer's Archive Guide (Last Revision: April 21, 2016)'. At the bottom, there are links for 'Other PDS Nodes' such as 'PDS Home', 'Atmospheres', 'Geosciences', 'Cartography and Imaging Sciences', 'NAIF - SPICE', 'Ring-Moon Systems', 'Small Bodies', and 'Management'. The footer contains the USA.gov logo, a link to 'Privacy / Copyright Freedom of Information Act', the NASA logo, and contact information for the Web Master: PDS-PPI Operator, Nasa Official: Meagan Thompson, and a last updated date of Nov 2019.

localhost:443/index.jsp

## PDS: PLANETARY PLASMA INTERACTIONS

- Nasa Portal
- Site Help
- Feedback

HOME OVERVIEW DATA DOCUMENTS SOFTWARE PERSONNEL RELATED SITES ABOUT PDS

The Planetary Plasma Interactions (PPI) Node of the Planetary Data System (PDS) archives and distributes digital data related to the study of the interaction between the solar wind and planetary winds with planetary magnetospheres, ionospheres and surfaces. The PPI Node is located at the [Department of Earth, Planetary, and Space Sciences at the University of California, Los Angeles \(UCLA\)](#).

### Find Data

ions

Bundles  Collections

- [NASA's Research Opportunities in Space and Earth Sciences \(2019\)](#)
- [Mission Proposer's Archive Guide \(Version 4.0.0 September 21, 2016\)](#)
- [Individual Proposer's Archive Guide \(Last Revision: April 21, 2016\)](#)

Other PDS Nodes: [PDS Home](#) [Atmospheres](#) [Geosciences](#) [Cartography and Imaging Sciences](#) [NAIF - SPICE](#) [Ring-Moon Systems](#) [Small Bodies](#) [Management](#)

[Privacy / Copyright Freedom of Information Act](#) Web Master: [PDS-PPI Operator](#)  
Nasa Official: Meagan Thompson  
Last Updated: Nov 2019

# PPI DATA SEARCH SERVICE CONCEPT

- Ring-Moon Systems OPUS-style search interface
- PPI-style results list (by bundle/data set)
- Geosciences ODE-style checkout

# OPUS-STYLE SEARCH INTERFACE

- OPUS (RMS)
  - Clean, intuitive interface
    - Well grouped, collapsible facet lists
  - Realtime selection criteria updates
  - Realtime product counts
- Add PPI-specific selection criteria
  - Primary Results

The screenshot displays the OPUS search interface in a web browser. The URL is [tools.pds-rings.seti.org/opus/#/cols=opusid,instrument,planet,target,time1,observationduration&widgets=planet,target&order=time1,opusid&view=search...](https://tools.pds-rings.seti.org/opus/#/cols=opusid,instrument,planet,target,time1,observationduration&widgets=planet,target&order=time1,opusid&view=search...). The interface features a top navigation bar with 'OPUS3', a search bar, and a 'Browse Results' button showing 1,524,696 results. Below the navigation bar, there are several constraint filters on the left side, including 'General Constraints', 'PDS Constraints', 'Image Constraints', 'Wavelength Constraints', and 'Surface Geometry Constraints'. The 'General Constraints' section is expanded, showing a list of filters such as 'Planet', 'Intended Target Name', 'Nominal Target Class', 'Mission', 'Instrument Host Name', 'Instrument Name', 'Observation Type', 'Observation Time', 'Observation Duration', 'Measurement Quantity', 'Right Ascension', and 'Declination'. The 'Planet' filter is selected, and the 'Intended Target Name' filter is also expanded, showing a list of planets and their corresponding counts: Venus 0, Earth 10, Mars 351, Jupiter 183932, Saturn 1299185, Uranus 9842, Neptune 11629, Pluto 10994, and Other 8753. The 'Intended Target Name' filter also includes a description: '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 Name under Surface Geometry Constraints in the left menu. To search for observations containing rings, use the Ring Geometry Constraints menu.' Below the description, there is a list of planets with expandable options: Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. At the bottom of the interface, there are buttons for 'Reset Search' and 'Reset Search and Metadata'. The footer of the page includes the text 'OPUS is a project of the PDS Ring-Moon Systems Node' and a 'Download Links History' link.

# PPI-STYLE SEARCH RESULTS

- PPI
  - Results listed by bundle
    - Add product counts/volume for each data set
    - Add checkbox to allow selection of multiple data sets

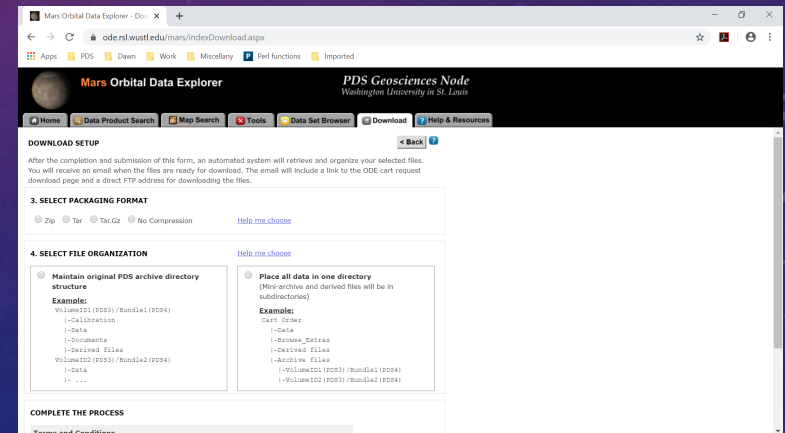
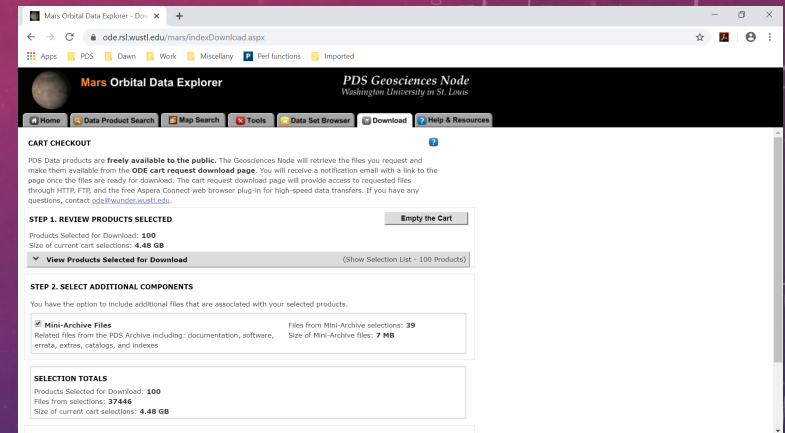
The screenshot shows a web browser window displaying the search results for the Planetary Plasma Interactions (PPI) data set. The page title is "PDS: PLANETARY PLASMA INTERACTIONS". The search results are listed by bundle, with 32 results found. The results are displayed in a table format, with each row representing a data collection. The table includes columns for the collection name, start date, stop date, and a brief description of the data. The results are sorted by mission, instrument, and target planet. The search results are displayed in a table format, with each row representing a data collection. The table includes columns for the collection name, start date, stop date, and a brief description of the data. The results are sorted by mission, instrument, and target planet.

Collection Name	Start Date	Stop Date	Description
MAVEN STATIC Calibrated Energy Flux: 32 Energy X 64 Mass Bins Data Collection	2014-10-13T00:00:04.316Z	2019-05-15T00:00:00.562Z	This collection contains files with time-ordered fully calibrated differential energy flux in 32 energy bin x 64 mass bin arrays, summed over look direction. Data are derived from APID d8.
MAVEN STATIC Calibrated Energy Flux: 64 Energy x 2 Mass Bins Data Collection	2014-10-13T00:00:20.315Z	2019-05-15T00:00:16.962Z	This collection contains files with time-ordered fully calibrated differential energy flux in 64 energy bin x 2 mass bin arrays, summed over look direction. Data are derived from APID d0.
MAVEN STATIC Event Rate: 12 Rate Channels Summed Over a Single Spin Data Collection	2014-10-13T00:00:36.315Z	2019-05-15T00:00:48.562Z	This collection contains files with time-ordered event rate data summed over a spin. Data are derived from APID d8.
MAVEN STATIC Housekeeping Data Collection	2014-10-13T00:00:53.92Z	2019-05-14T23:59:42.415Z	The collection contains time-ordered fully calibrated housekeeping data, derived from APID 2a. The 99 different housekeeping data include instrument voltages and currents, configuration bytes, table check sums, etc.
MAVEN STATIC Event Rate Selected Channel Data Collection	2014-10-13T00:00:52.315Z	2019-05-15T00:00:48.562Z	This collection contains files with time-ordered event rate data from a selected rate channel. Data are derived from APID da
MAVEN STATIC Raw Time-of-Flight Data Collection	2014-10-13T00:00:58.315Z	2019-05-15T00:00:02.963Z	This collection contains files with time-ordered time-of-flight (TOF) raw data. Data are derived from APID db.
Galileo Orbiter Jupiter PLS Fitted Parameters Data Collection	1995-12-07T15:21:07.109Z	2003-08-21T18:25:24.915Z	This collection contains all of the fitted parameters (both good and bad) for fitting an ion species to the Galileo PLS instrument.
MAVEN STATIC Fast Housekeeping Data Collection	2014-10-13T00:01:08.702Z	2019-05-01T12:31:01.405Z	This collection contains files with time-ordered fully calibrated fast housekeeping data. Data are derived from APID d7.
MAVEN STATIC Raw Event Data Collection	2014-10-13T00:01:46.97349Z	2019-05-14T23:05:21.394Z	This collection contains files with time-ordered raw event data. Data are derived from APID d5.
NGIMS Instrument data DRF Data Collection	2014-11-15T11:10:04.047Z	2019-05-20T23:59:55.359Z	This collection contains MAVEN NGIMS Instrument Data Return Files (DRFs).
MAVEN SWIA Calibrated Fine Survey 3D Data Collection	2014-03-19T14:19:47.895Z	2019-05-14T23:59:54.562Z	SWIA fine survey 3d files with time-ordered fully calibrated ion distributions in units of differential energy flux derived from the SWIA Fine distribution Survey telemetry, as well as a header of ancillary information needed to interpret the data.



# ODE STYLE CHECKOUT

- Orbital Data Explorer (GEO)
  - Option to include associated documentation
  - Option to maintain original multiple volume structures, or merge into single volume
  - Compression (or no compression) options
  - Warnings/time estimate for large downloads

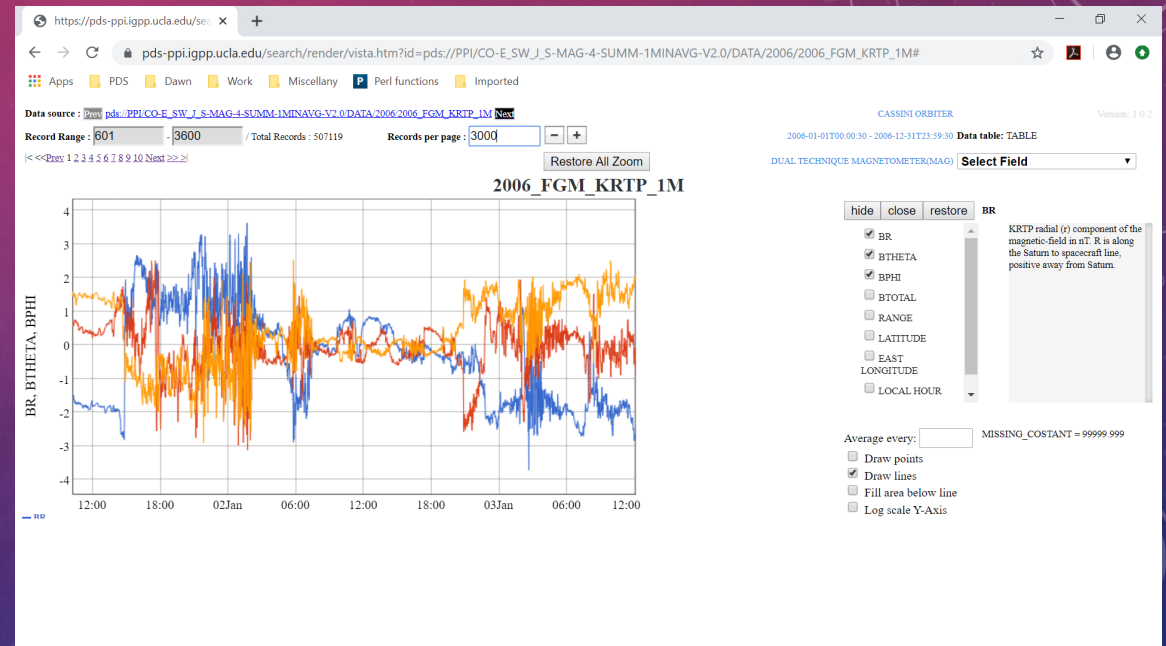


# PPI USER SUPPORT TOOLS

- PPI users are frequently looking for tools to support their research.
  - Web based visualization tools can help users to select data to download.
  - Analysis tools can support data users' research.

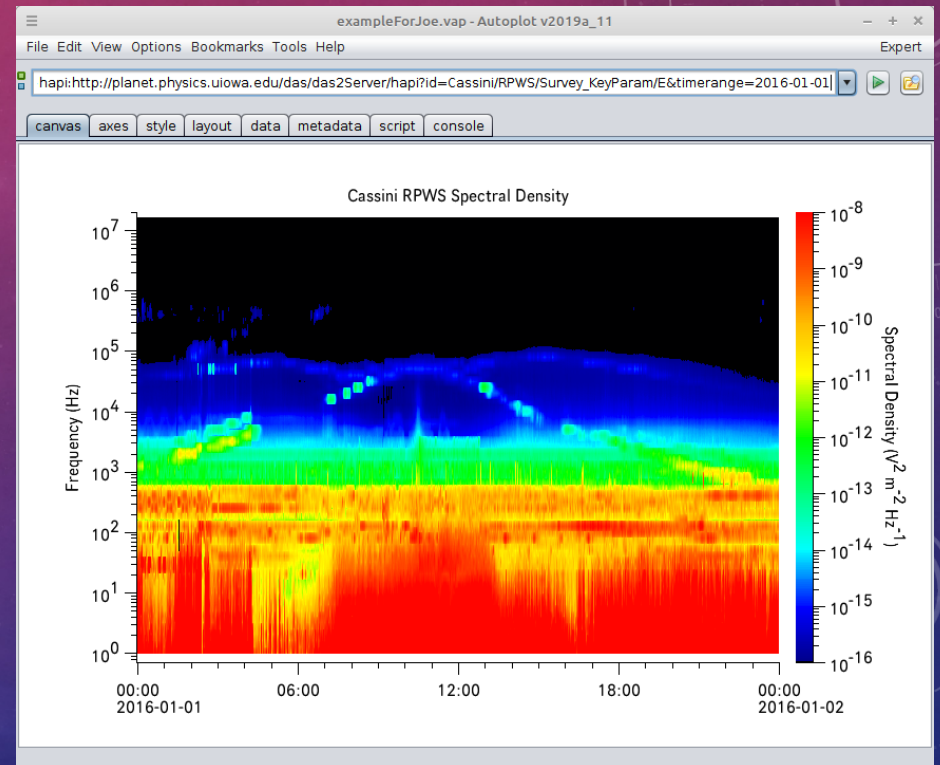
# VISTA

- Simple line plotter
- Supports: PDS labelled ASCII, binary, and delimited (CSV) tables



# AUTO PLOT

- Spectral image plotter
- Supports: ASCII tables, CDF, FITS, and other formats



# PPI VISUALIZATION SUPPORT

- PPI has been working to expand visualization support for its data holdings.
  - VISTA has been adapted to support previously unsupported data sets.
  - Autoplot config files will be added to enable visualization of appropriate data sets.
  - Metadata will be stored in the server to indicate the appropriate visualization tool for each data set.

# SUPPORT FOR PARTICLE DATA

- Many particle data sets are in formats not supported by any visualization or analysis tools.
  - Data are multi-dimensional arrays flattened into two-dimensional tables.
  - Flattening has been performed differently from data set to data set.
- PPI is exploring alternatives for improving tool support for these data sets:
  - Expanding PDS4 metadata to more accurately describe array flattening
  - Converting flattened arrays to CDF

# EXPANDING PDS4 METADATA

## Pros

- Relatively minor effort

## Cons

- May not solve the problem for all data sets.
- Existing tools would have to be adapted, or new tools developed to work with the expanded metadata.

# CONVERSION TO CDF

## Pros

- CDF supported by existing tools (IDL, MATLAB, Autoplot, etc.)
- SPARTA (developed by ESA for Rosetta) – tool to convert PDS3 labeled data to CDF

## Cons

- Major effort
- Converted data sets would have to be peer reviewed in order to become part of the permanent archive (could be maintained as a “contemporary format”).





# **BACKUP SLIDES**

# PPI DATA SEARCH DATABASE PARAMETERS

- LID
- Title
- Description
- start time/stop time
- Science\_Facets
- Investigation\_Area/name and type
- Observing\_System\_Component/name and type for spacecraft and instrument
- Target

# MULTI-DIMENSIONAL ARRAY FLATTENING

- “Road Kill” method
  - Each record contains the whole array: header followed all of the data rows arranged end-to-end.
    - In some cases ITEMS and/or CONTAINER objects have been used in an attempt to represent the multi-dimensional structure of these data.
- “Flat Stanley” method
  - Each record contains header information, followed by a single row of the array.
    - Header data (e.g. time stamps, etc.) are repeated.

# MULTI-DIMENSIONAL ARRAY FLATTENING

- “Off with its head!” method
  - The first record of the array contains either the header information by itself, or the header followed by a single data row. Subsequent records contain subsequent rows of data (without the header) through the end of the array.
    - This method only works by the creative use of PDS3 containers.
    - Data flattened using this method are often reformatted.
- “This is a what?!” method
  - Each record contains a header followed by a cell ID and data value for that cell.
    - Header data (e.g. time stamps, etc.) are repeated.