

Polarimeter to Unify the Corona and Heliosphere

Status of the PUNCH SOC



Marcus Hughes
on behalf of the PUNCH SOC

PUNCH 7 Conference

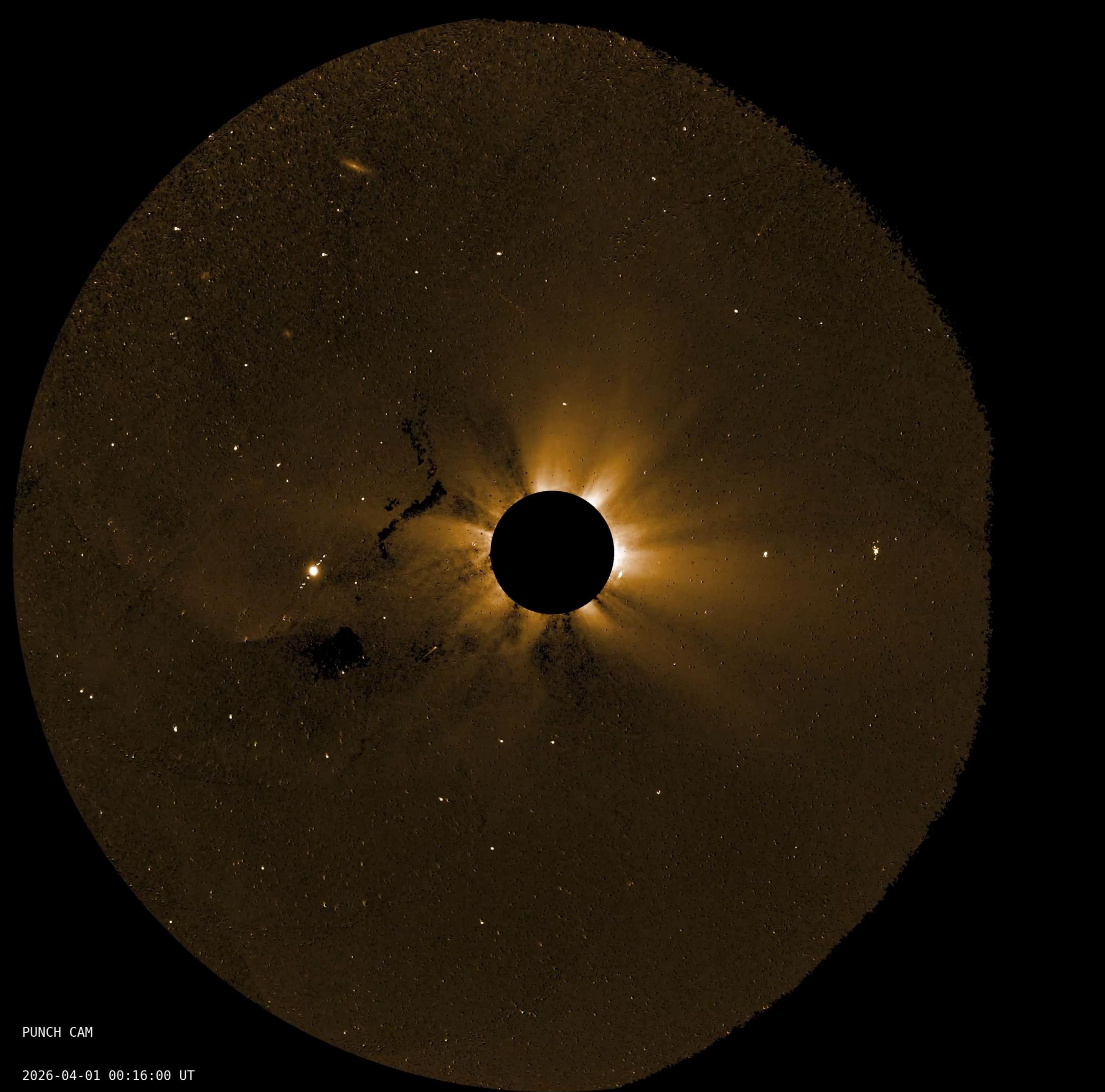
May 12 2026

Boulder, Colorado, USA



Overview

- . Data are flowing
- . The SOC is generating new v0k images from recent dates now
- . We have a plan to improve the data
 - . v0k polarization images are not aligned to the correct reference angle
 - . v0l will fix many items, discussed later
 - . v1a will be stable



PUNCH CAM

2026-04-01 00:16:00 UT



https://github.com/punch-mission

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PUNCH Mission

a NASA mission to study the solar wind

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📍 United States of America
🌐 <https://punch.space.swri.edu/>
✉️ punch_soc@swri.org

readme.md ✎

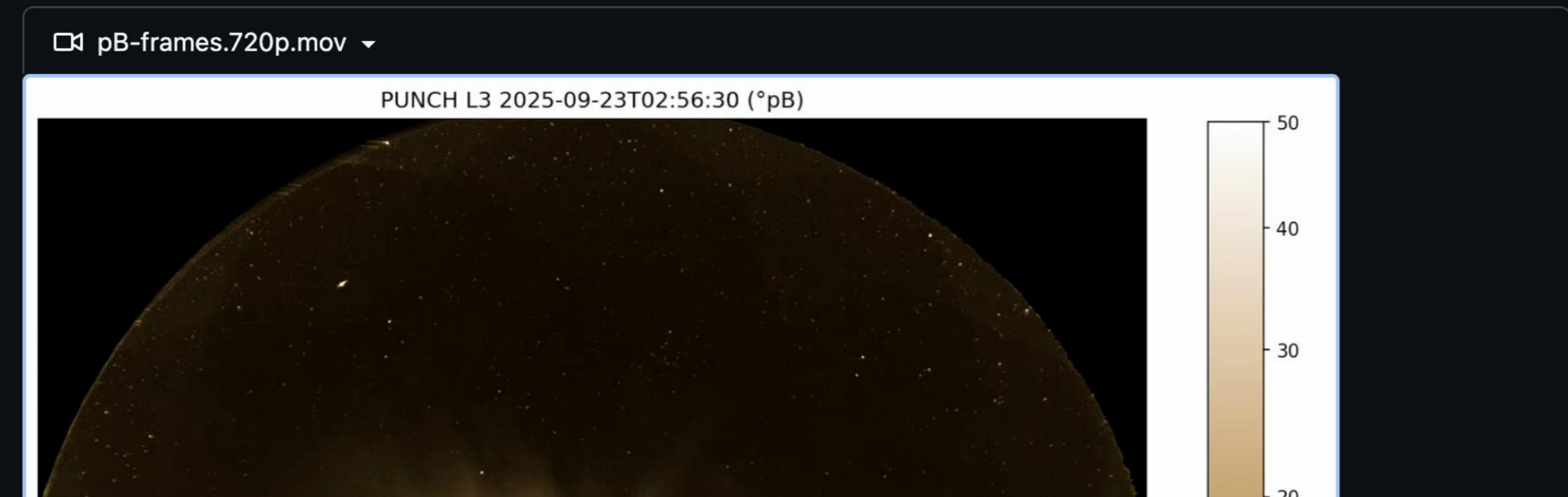
PUNCH Mission

[PUNCH](#) is a NASA Small Explorer (SMEX) mission to better understand how the mass and energy of the Sun's corona become the solar wind that fills the solar system. Four suitcase-sized satellites work together to produce images of the entire inner solar system around the clock.

- To learn more about PUNCH, check [the PUNCH website](#).
- To get started with PUNCH software, check [the punch-mission repo](#).
- To learn how to download data, check [this example](#).
- To ask questions, please log in to GitHub and [open a discussion](#).

💡 Tip

Community contributed PUNCH-related software is listed [at this link](#) Open an issue or pull request to contribute new tools.



👁️ View as: Public ▾

You are viewing the README and pinned repositories as a public user.

[Get started with tasks](#) that most successful organizations complete.

Top discussions this past month

Discussions are for sharing announcements, creating conversation in your community, answering questions, and more.

[Start a new discussion](#)

People



Invite someone

Top languages

- 🟠 Jupyter Notebook
- 🟡 Python
- 🔴 C++
- 🟢 IDL



How do I get help?

Open Issues for Problems

Ask Questions

Primary Documentation Website

GitHub repository page for **punchbowl** (Public).

Navigation: Code | Issues (97) | Pull requests (12) | Discussions | Actions | Projects | Wiki | Security and quality | Insights | Settings

Repository details: 18 Branches, 23 Tags, 4 Forks, 15 Stars

Recent activity:

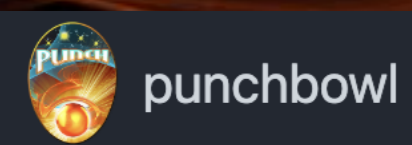
- jimbhughes Merge pull request #930 from punch-mission/L3_CAM_PAM_file... 501a07c · 2 days ago 2,729 Commits
- .github pre-commit updates 3 weeks ago
- changelog Merge pull request #930 from punch-mission/L3_CAM_PA... 2 days ago
- docs Update docs/data/data_versions.rst 4 days ago
- examples add more to the examples header 2 months ago
- punchbowl Set DB polarization for L3 *IM, *TM 2 days ago
- scripts Add script for creating Level 3 CAM and PAM file counts 2 days ago

Right sidebar (About):

- Calibration for the PUNCH mission
- punchbowl.readthedocs.io
- image nasa solar-physics
- nasa-data punch solar-wind
- Readme
- View license
- Cite this repository
- Activity
- Custom properties



We're updating documentation



Introduction Data Pipeline Examples FAQ More ▾

Search [K] [Dark Mode] [Refresh]

[Collapse Sidebar](#)

Section Navigation

- PUNCH data overview
- Accessing PUNCH Data
- PUNCH data structure
- Data Product Codes
- Metadata Description
- Data Versions

Home > Data

[Edit on GitHub](#)

Data

Welcome to PUNCH data!

Our latest version of data is 0k (learn more about [data versions](#)). We will begin providing browse data and movies soon.

PUNCH is still being calibrated, but you can take a look at the most up to date data through the [Get Data](#) page on our PUNCH website. The most commonly used data products are L3_PAM (polarized) and L3_CAM (clear) low-noise mosaics.

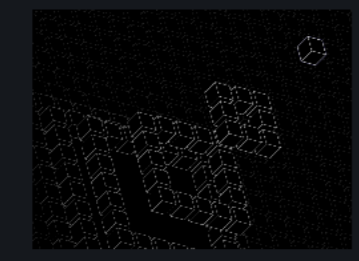
Note that from data level 1 and onward, all data is represented in units of Mean Solar Brightness (MSB).

For more information about how to download data, see this [data access](#) page.

For more information about data analysis tools, see the [example gallery](#).

For information on more data products, read this [data overview](#).

We'd love your contributed examples!



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What are the Data Products?

PUNCH_L3_CAM_20250830004829_v0k.fits

Product ID

Date of Observation

Version

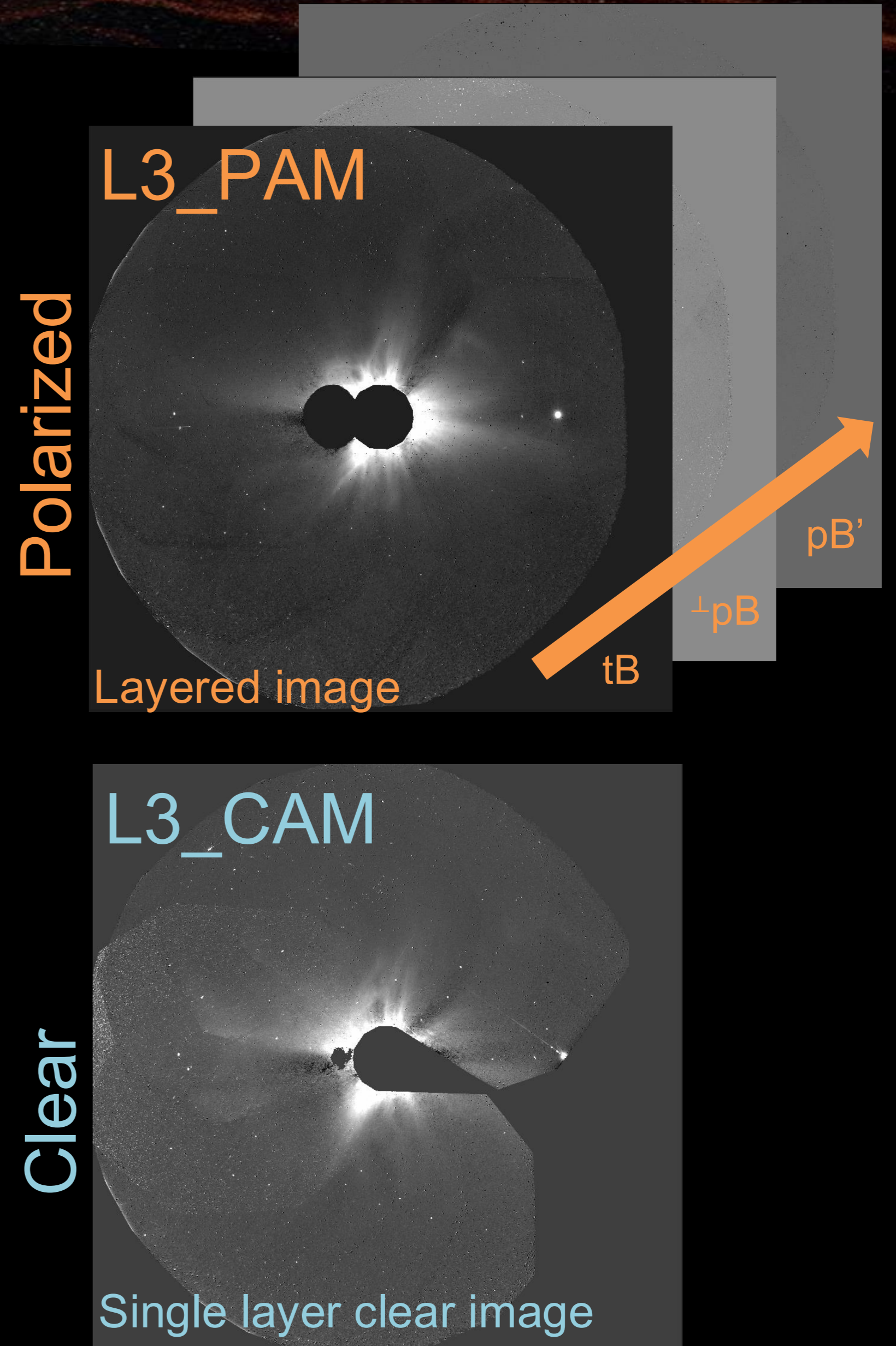
Data products are described by level and product code:

L3_PAM:

Level 3

Polarized A-grade mosaic

Full list of codes available in *punchbowl* documentation





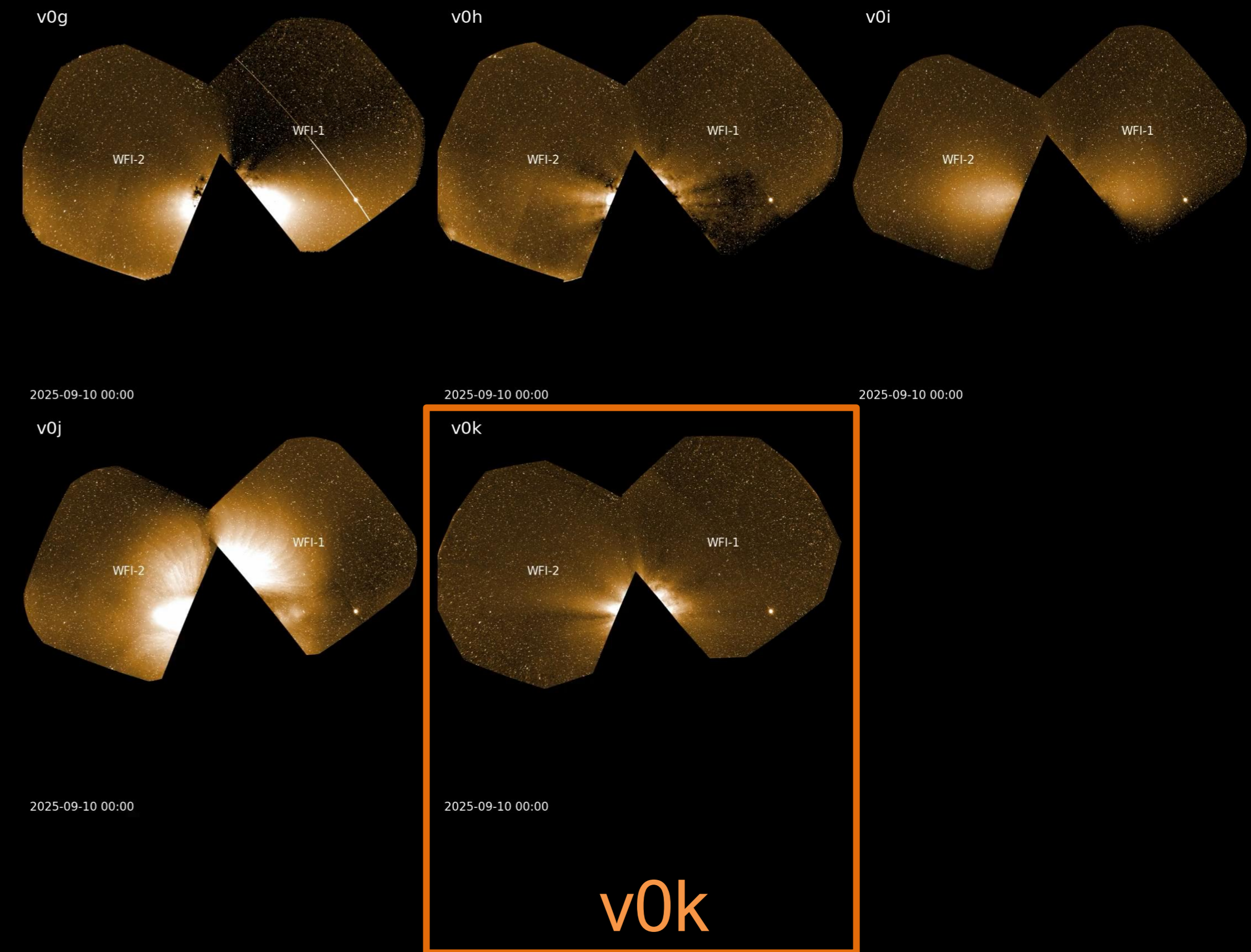
What are the product levels?

- **Level 0:** converts raw satellite data to FITS images
- **Level 1:** photometric image calibration
- **Level 2:** polarization resolution, image merging, quality marking
- **Level 3:** background subtraction
- **Level Q:** QuickPUNCH products for space weather
- **Level L:** QuickLook products, JPEG2000 images for preview



How does data versioning work?

- Scheme: A number followed by a letter, in lexicographic order: **0k**
 - "0" indicates it's still a beta version of the data
 - "k" indicates that a through j minor versions have already been created
- Version 1 will be fully processed for all products
- Data version notes are available in the *punchbowl* documentation





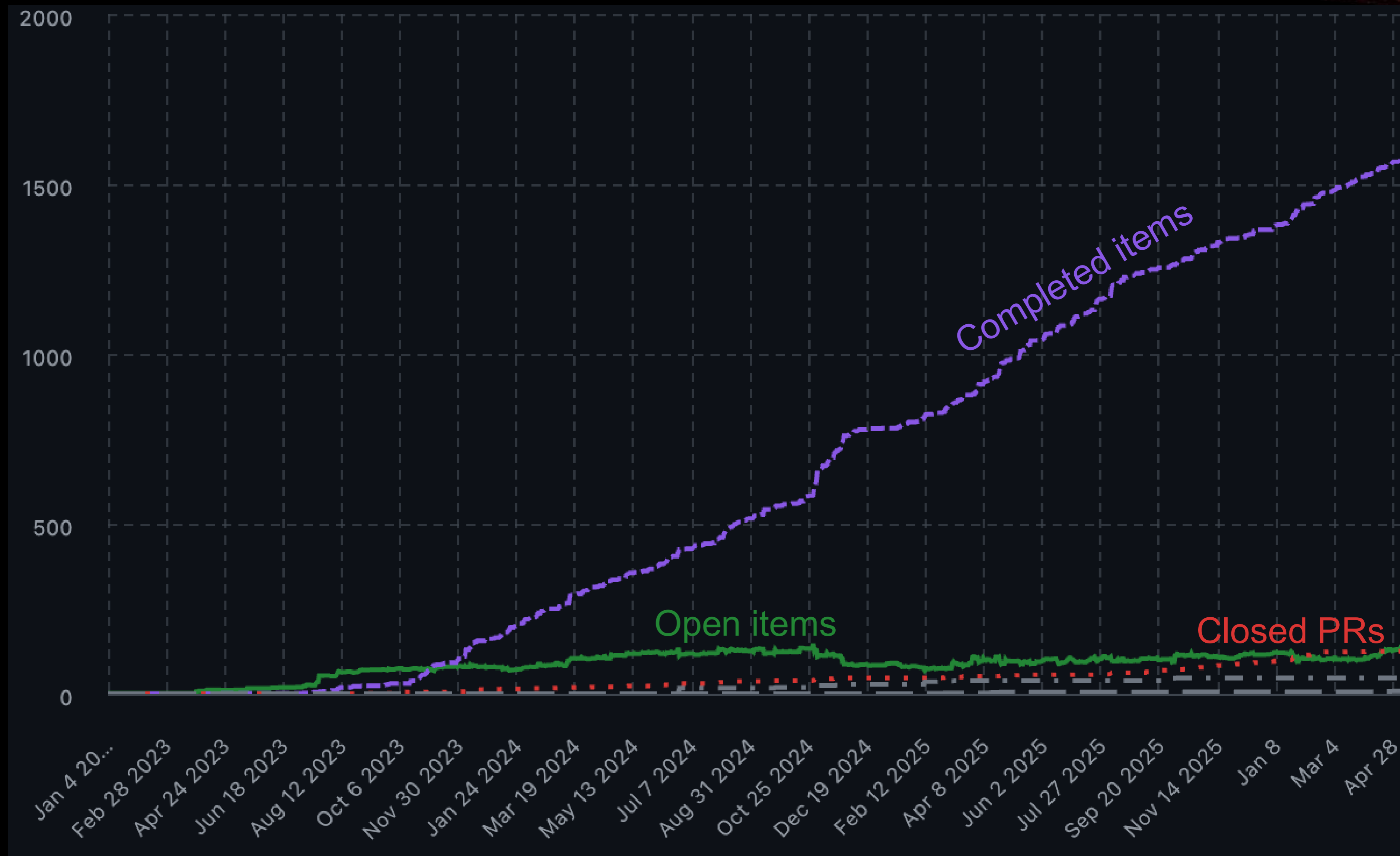
What's coming in future versions?

- . Improved starfield subtraction that will resolve black spot residuals and avoid flickering when switching between models
- . Fixed polarization reference angle which will correct a major challenge in current polarization images
- . Reprocessed and fully filled in L0 images will fill holes in downstream products
- . Reliable velocity maps
- . Improved inter-calibration and absolute calibration
- . Cleaned up catalog of what is available
- . Full Helioviewer.org and JHelioviewer integration
- . Many more items, all tracked in GitHub issues



Progress is incremental

- We need your feedback!
- We know many things to fix, but there are more items we may not be aware of that you see





Where do I get the images?

- All images are archived at the SDAC:
<https://umbra.nascom.nasa.gov/punch/>
- You can directly download images from that site
- We recommend searching with the Virtual Solar Observatory
 - This can be done either at
<https://sdac.virtualsolar.org/cgi/search> or
using SunPy's Fido API
- There is an example in the punchbowl documentation how to use SunPy

The screenshot shows the 'punchbowl' documentation website. The navigation bar includes 'Introduction', 'Data', 'Pipeline', 'Examples', 'Help', and 'More'. The left sidebar shows 'Section Navigation' with 'Querying PUNCH Data' highlighted. The main content area features a 'Note' box with a link to 'Go to the end' for downloading code or running it in a browser. Below this is the title 'Querying PUNCH Data' and a subtitle 'A notebook guide to querying and loading PUNCH data using SunPy.' The text explains that the notebook provides a guide on using tools to query PUNCH data from the VSO / SDAC using Python tools. A 'Load libraries' section contains a code block for importing 'Map', 'Fido', and 'attrs' from 'sunpy.map', 'sunpy.net', and 'sunpy.net' respectively. The 'Data querying' section explains that with a range of dates and a PUNCH instrument in mind, data can be queried. It mentions focusing on data from WFI-2 only. A final code block shows a query using the Fido tool with specific search attributes.

```
from sunpy.map import Map
from sunpy.net import Fido
from sunpy.net import attrs as a

time_range = a.Time('2025/06/01 00:00:00', '2025/06/01 00:02:00')
result = Fido.search(time_range, a.Instrument('WFI-2'))
result
```



Helioviewer

- Data are available in Helioviewer.org
- JHelioviewer integration is imminent
- IT at Goddard are working on it
- For now, you can drop JP2 images into JHelioviewer

The screenshot displays the Helioviewer.org interface. At the top, the site name 'Helioviewer.org' is visible along with navigation icons. The main area shows a large solar image with a blue circular overlay in the center. On the left, there is a 'Data Sources' panel with the following information:

Source	Observation Date
PUNCH	2025/09/18 16:48:00 UTC
LASCO C3	2025/09/18 16:54:08 UTC
AIA 304	2025/09/18 16:54:17 UTC
LASCO C2	2025/09/18 16:48:08 UTC
EUVI-A 195	2025/09/18 16:55:00 UTC

Each source entry includes an 'Opacity' slider and a 'Difference' dropdown menu. The right side of the interface features a 'Generate a Screenshot' panel with options for 'Full Viewport' and 'Select Area', and a 'Screenshot History' section showing a recent screenshot from 'AIA 304, LASCO C2/C3, EUV-A EUV' taken '3 days ago'. A 'Bar Scale' indicates a distance of 11,226,000 km. At the bottom, there are buttons for 'Image Timeline' and 'HEK Events Timeline'.



We have tools available to aid you!

- See the examples for Python tools
- We have plotting utilities for IDL too
- See the IDL repository on GitHub
- We're working to integrate into SSW

punchbowl

Introduction Data Pipeline Examples FAQ More ▾

🏠 > Examples > Plotting PUNCH data

[Collapse Sidebar](#)

Section Navigation

- Environment setup
- Plotting PUNCH data**
- Animating PUNCH data
- Querying PUNCH Data
- Creating PUNCH RGB maps
- Decoding square root encoded data
- Guide to QuickPUNCH Data
- Overplotting Parker Solar Probe and Solar Orbiter Trajectories on PUNCH Images
- Guide to PUNCH Data

Note

[Go to the end](#) to download the full example code or to run this example in your browser via Binder.

Plotting PUNCH data

How to plot PUNCH data using built-in plotting tools

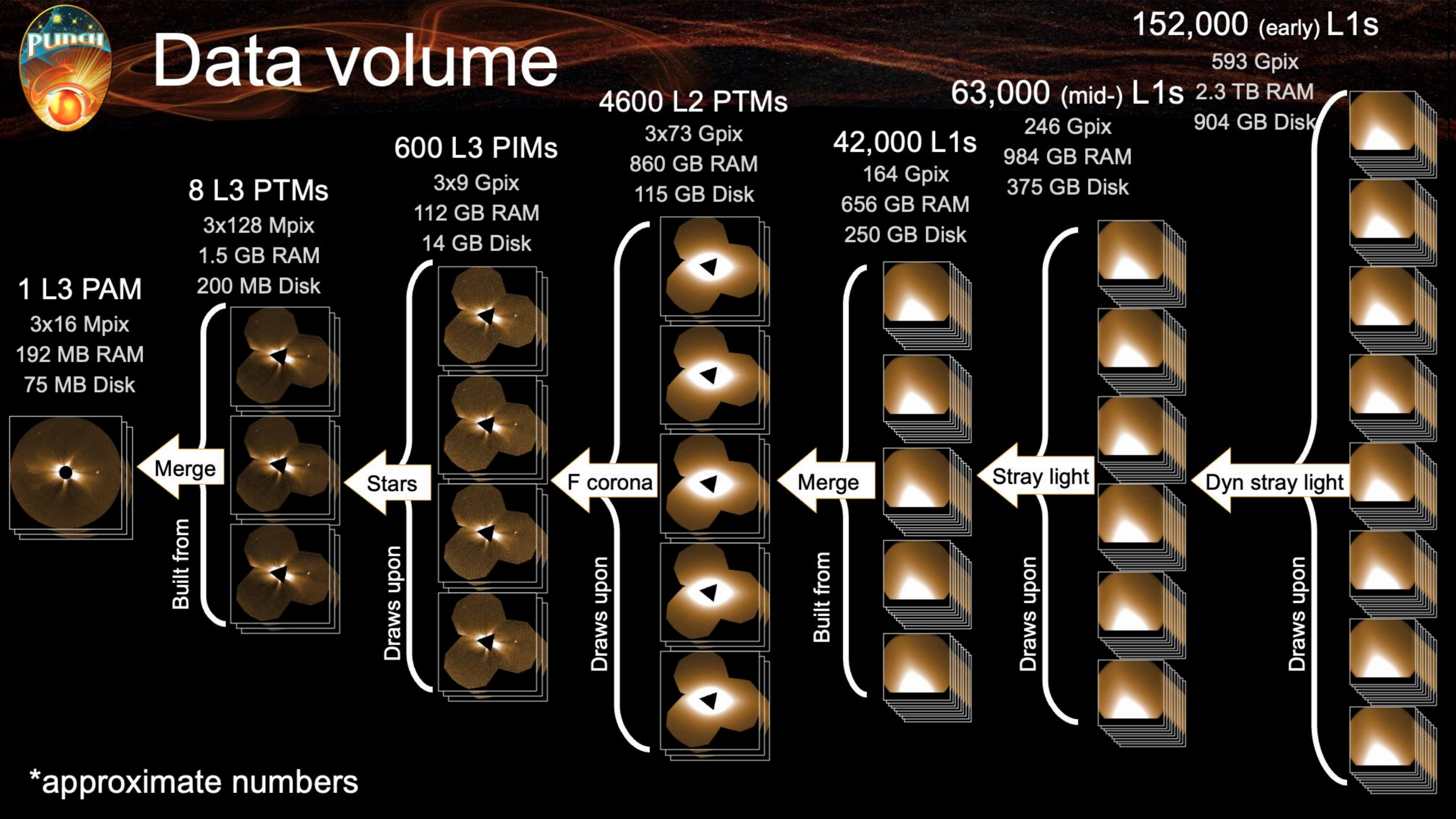
So you've downloaded a PUNCH FITS file, and you want to display it in Python in a simple way. We've encapsulated a flexible plotting function within the punchbowl repository that users can use and build on.

First we'll load a set of libraries. This is minimal, but will provide a sample file to use for plotting, and the plotting function itself.

```
from punchbowl.data.sample import PUNCH_CAM
from punchbowl.data.visualize import plot_punch
```



Data volume

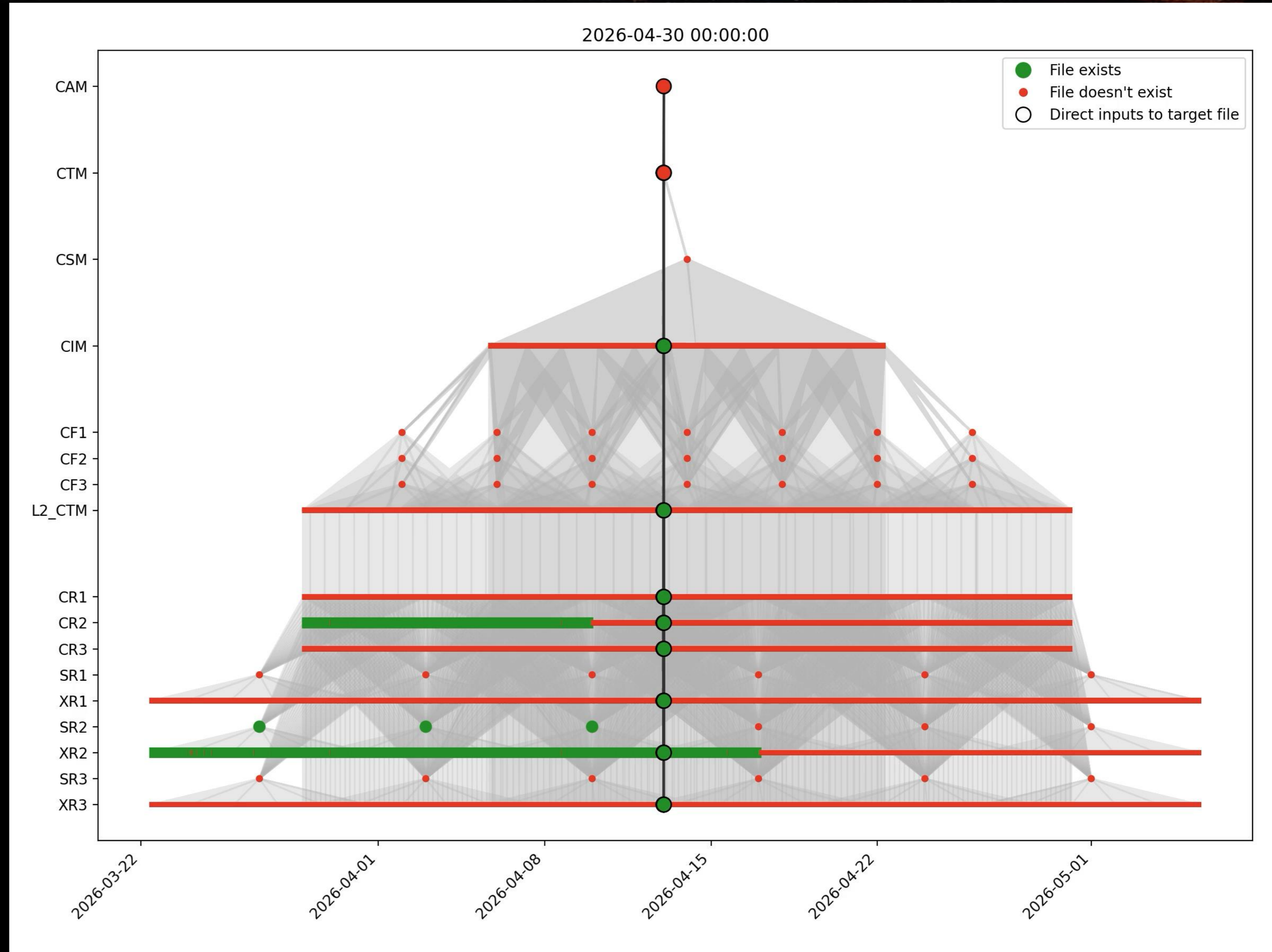


*approximate numbers



We're working on speeding up the pipeline

- This shows the pipeline running to make a specific L3_CAM product
- The hierarchy indicates all the required input files
- Dots turn green as they're made





How do I get help?

Open Issues for Problems

Ask Questions

Primary Documentation Website

Navigation: Code | Issues 43 | Pull requests 2 | Discussions | Actions | Projects | Security | Insights | Settings

Repository: **punchbowl** (Public) | Edit Pins | Unwatch 4 | Fork 2 | Starred 11

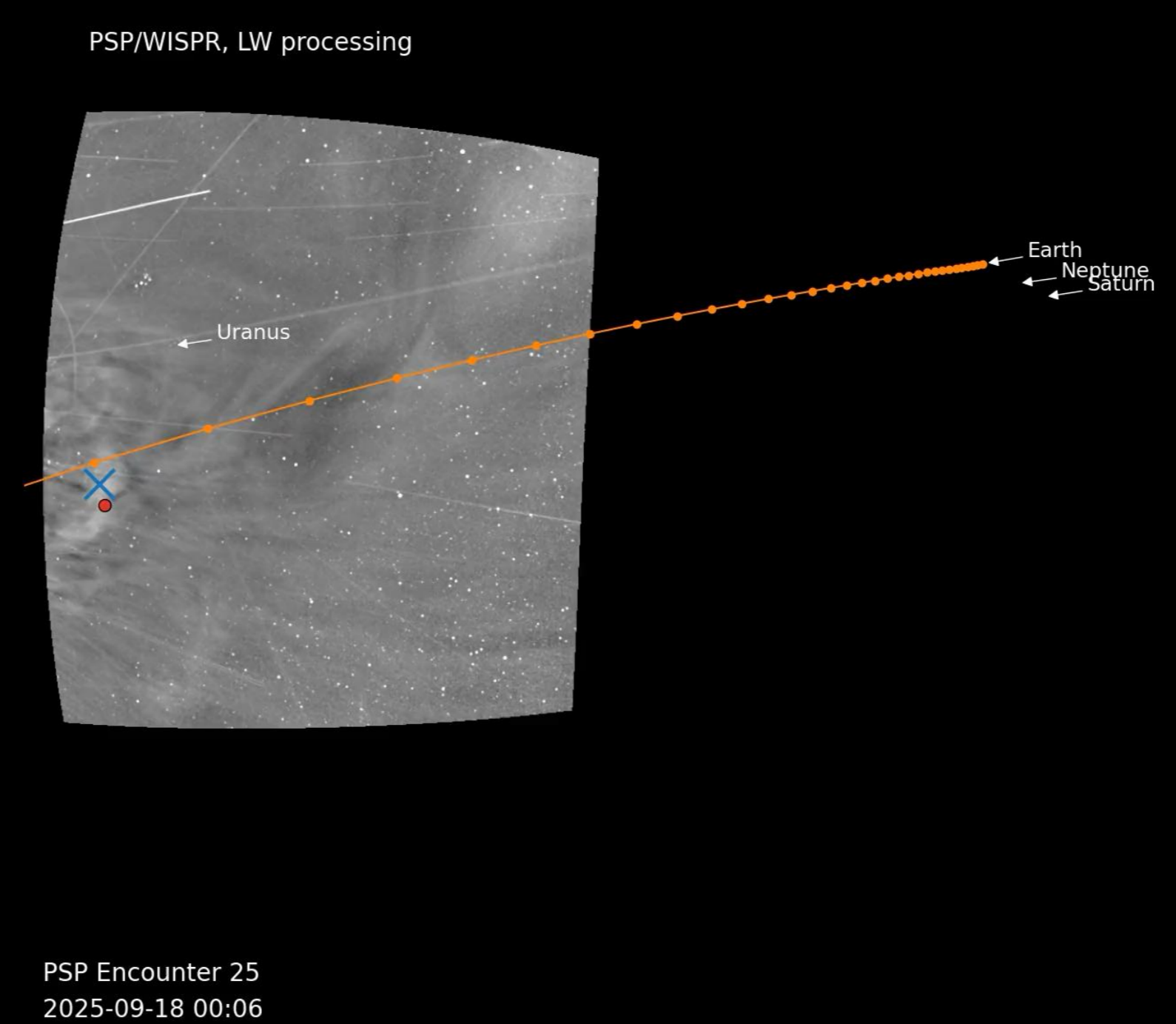
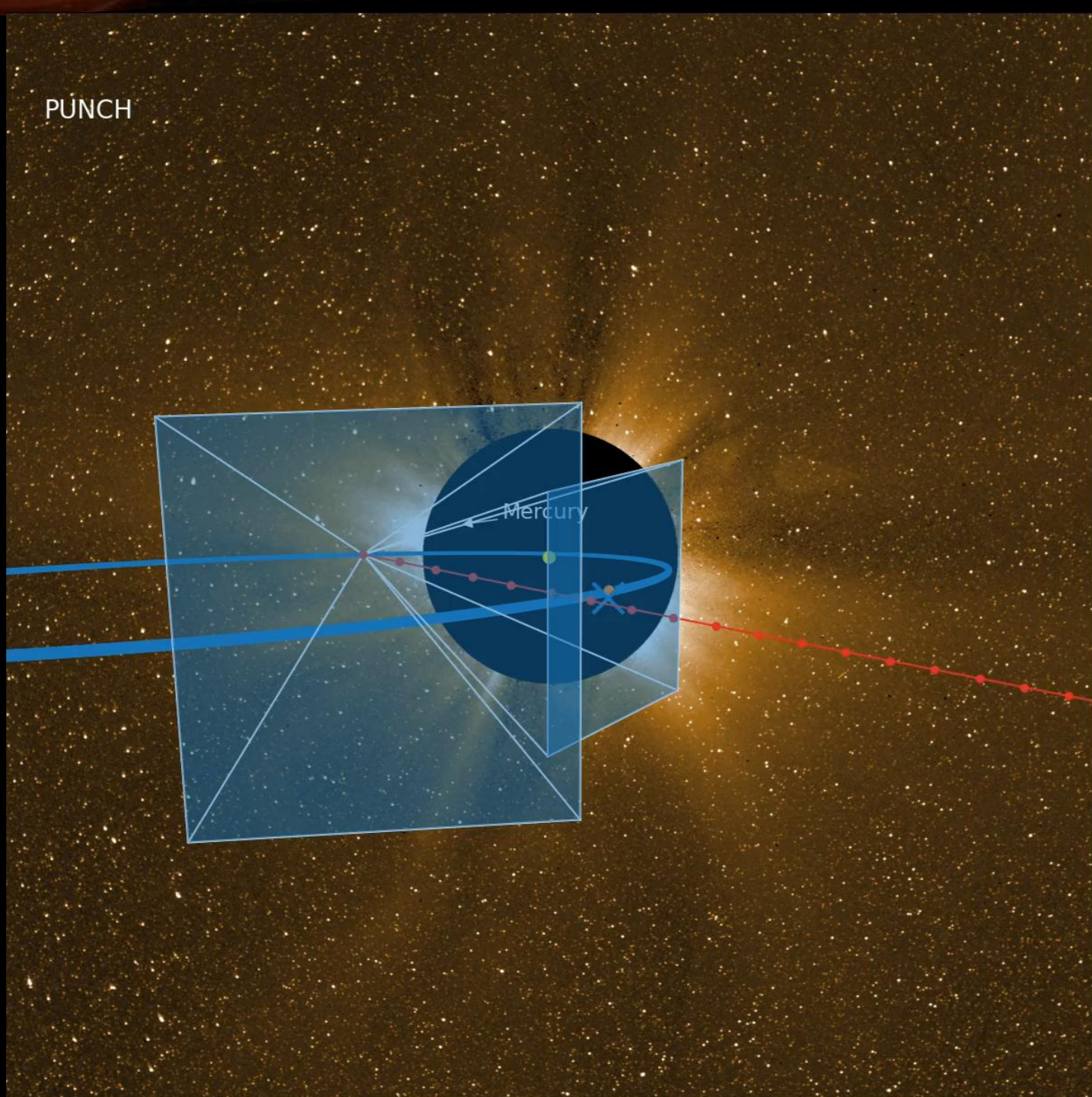
Branches: main | 8 Branches | 14 Tags | Go to file | Add file | Code

	jimbhughes Merge pull request #483 from punch-mission/develop	e3c9700 · yesterday	🕒 1,172 Commits
📁 .github	run on push to develop		last month
📁 docs	Merge pull request #464 from punch-mission/develop		2 weeks ago
📁 examples	Add square root decoding notebook (#425)		2 months ago
📁 punchbowl	Merge pull request #482 from punch-mission/post-qp-cl...		yesterday
📁 scripts	Added Polarization Conversion Functions to and from Cel...		3 months ago

About
Science processing code for the PUNCH mission
punchbowl.readthedocs.io/en/latest/
image | nasa | solar-physics | nasa-data | punch | solar-wind
Readme | View license | Cite this repository



PUNCH's future is bright!



The PUNCH SOC want to help!
Let's do great science together!

github.com/punch-mission
punch_soc@swri.org