SPIRE Photometer Data Products

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on behalf of the SPIRE ICC,
HSC and NHSC

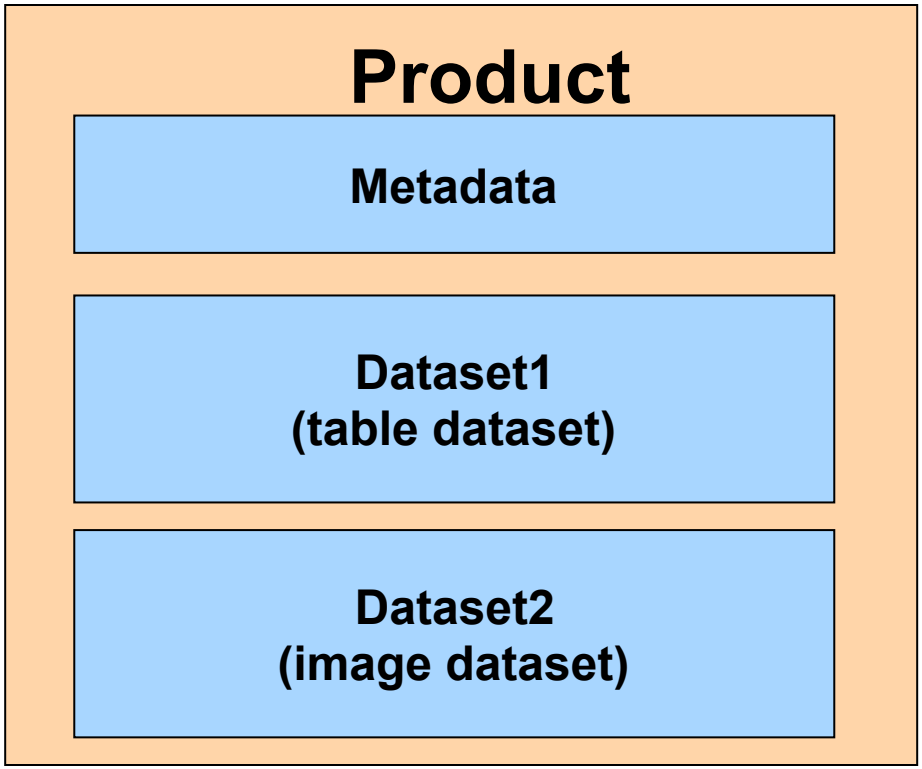
Guidelines

- I'll introduce SPIRE Photometer products & viewers
- Will concentrate on Level 1 (calibrated timelines) & Level 2 (maps) products.

Reference: "*SPIRE Data Reduction Guide*"
in HIPE (under "Help") or in:
http://herschel.esac.esa.int/hcss-doc-12.0/load/spire_drg/html/spire_drg.html

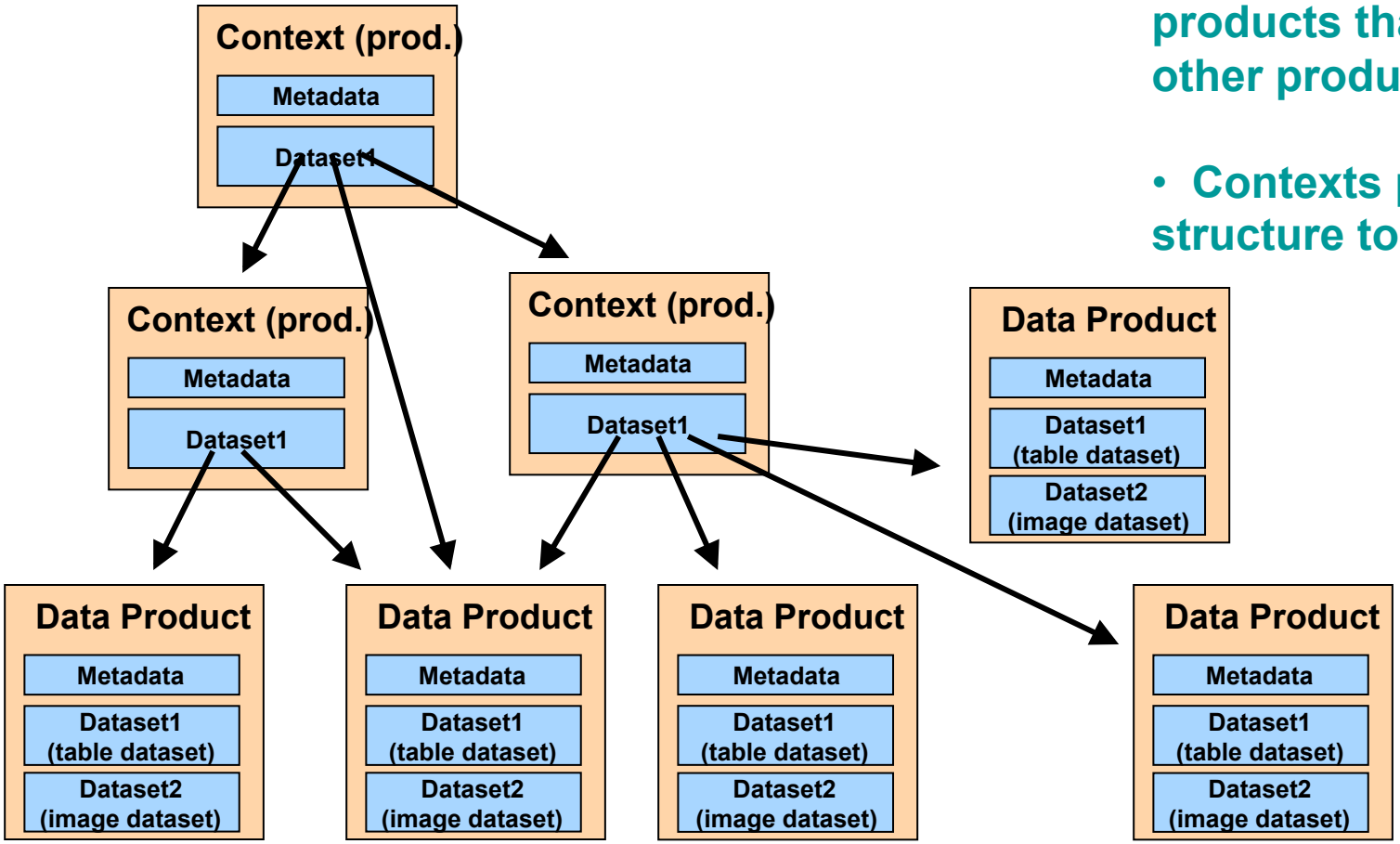
General HIPE Product Structure

- Products are containers for datasets that can be stored within the HCSS system.
- They can be exported from HCSS system as FITS files and used by other software.



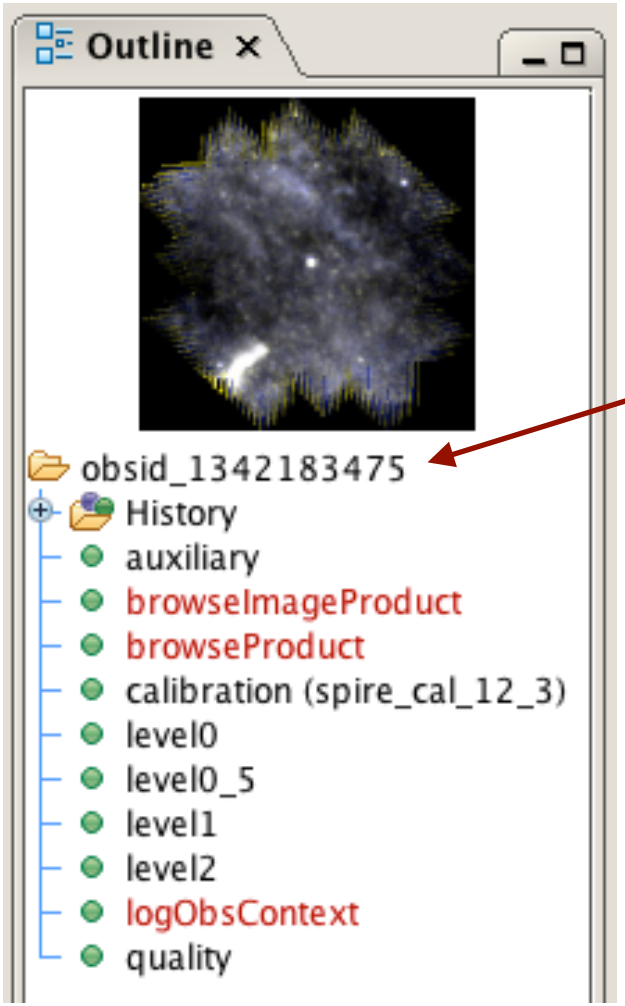
- **Products contain:**
  - Metadata,
  - Datasets
  - Processing history
- **Types of datasets include:**
  - Array dataset
  - Table dataset
  - Composite dataset
  - Spectrum1d
  - Spectrum2d
- **Generic Product Types:**
  - SimpleImage
  - SimpleCube
  - SpectralSimpleCube
  - Context

Contexts



- Contexts are products that point to other products.
- Contexts provide structure to the data.

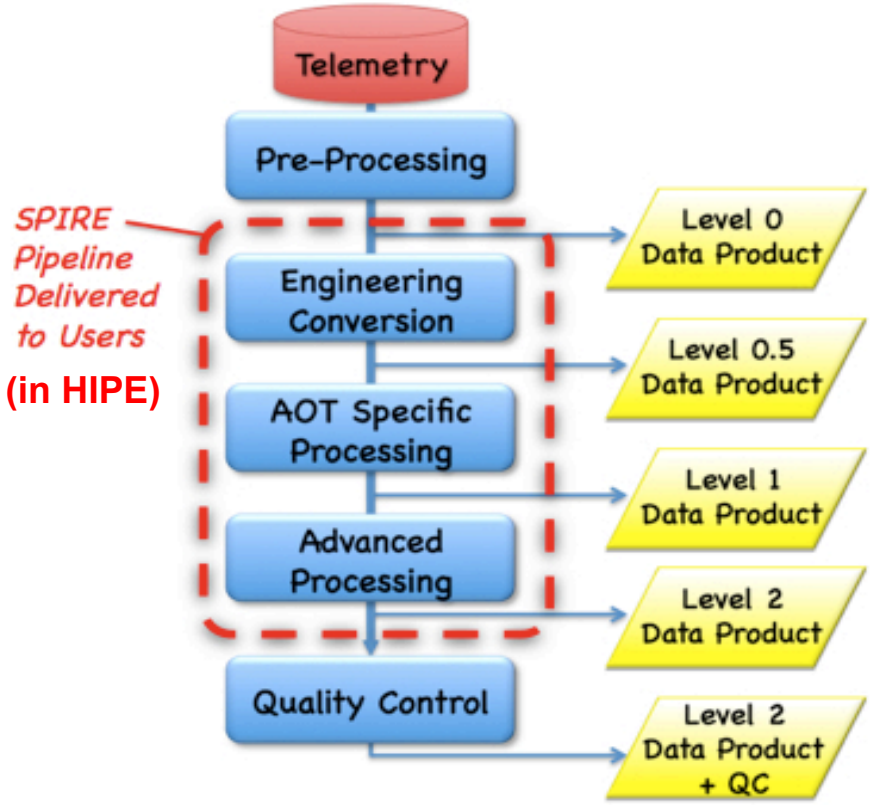
Observation Context



For a given observation, all data products are packed inside a single ***observation context***

HIPE: the best tool for viewing these data products

Data Products & Pipeline



Since HIPE 11 (only in archive data from HSA) →

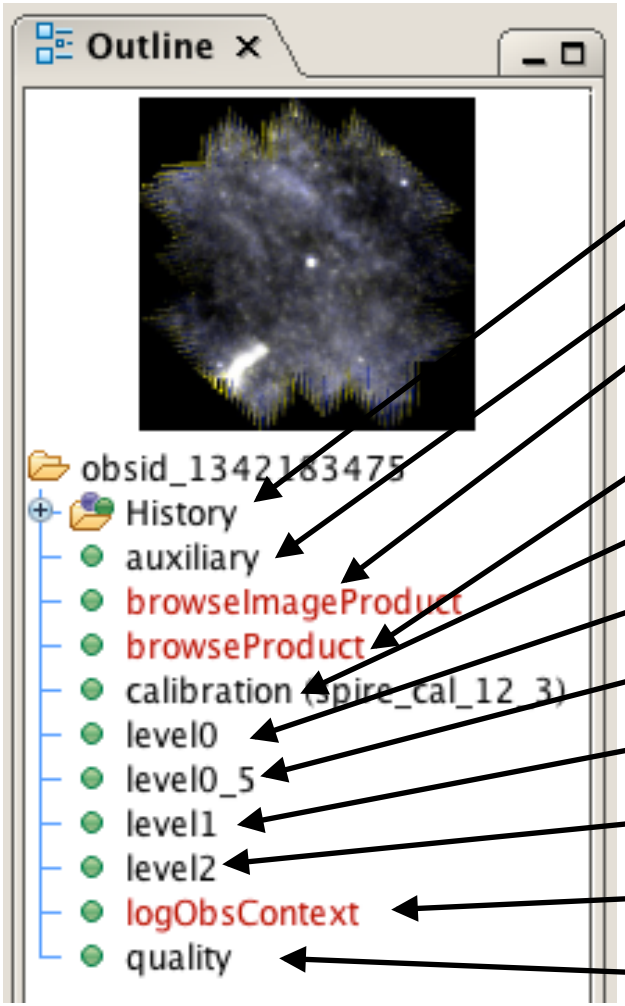
Level 2.5 Data Product

- **Maps of combined parallel observations with cross-scans**

Level 3 Data Product

- **Maps of overlap observations belonging to the same proposal**

Viewing Data Products with HIPE



Example: A large map mode observation

History of data reduction

Auxiliary data: Pointing, uplink info, etc…

Browse image product: Simple representation of final maps for a quicklook

Browse product: Another browse product

Calibration product: Cal. data used in processing

Level 0: Raw unprocessed data

Level 0.5: Data converted to engineering units

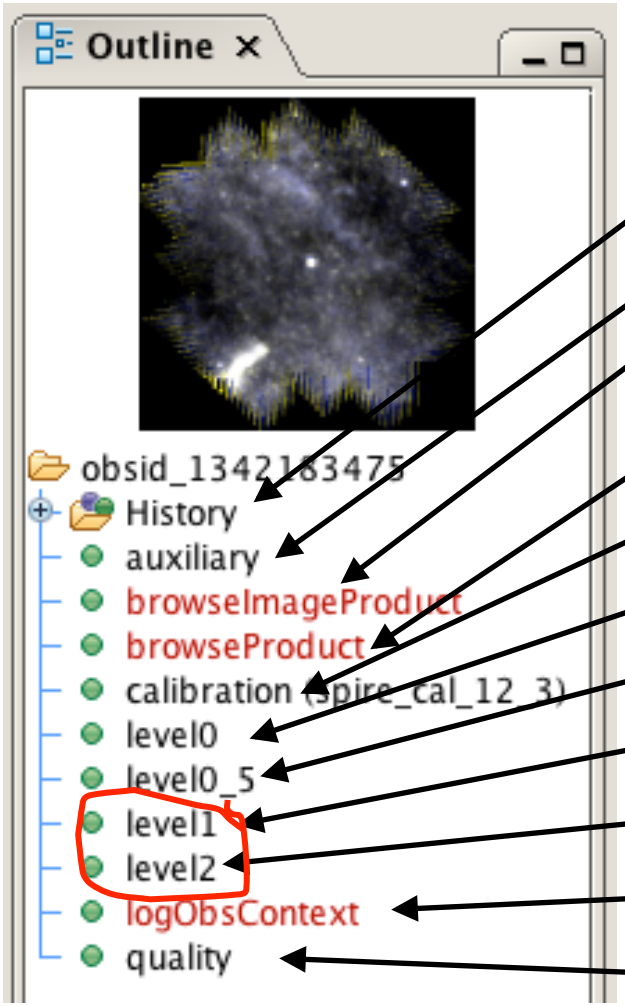
Level 1: Calibrated timelines [Jy/beam]

Level 2: Maps

Data reduction Log

Quality control: Tells whether things went O.K.

Viewing Data Products with HIPE



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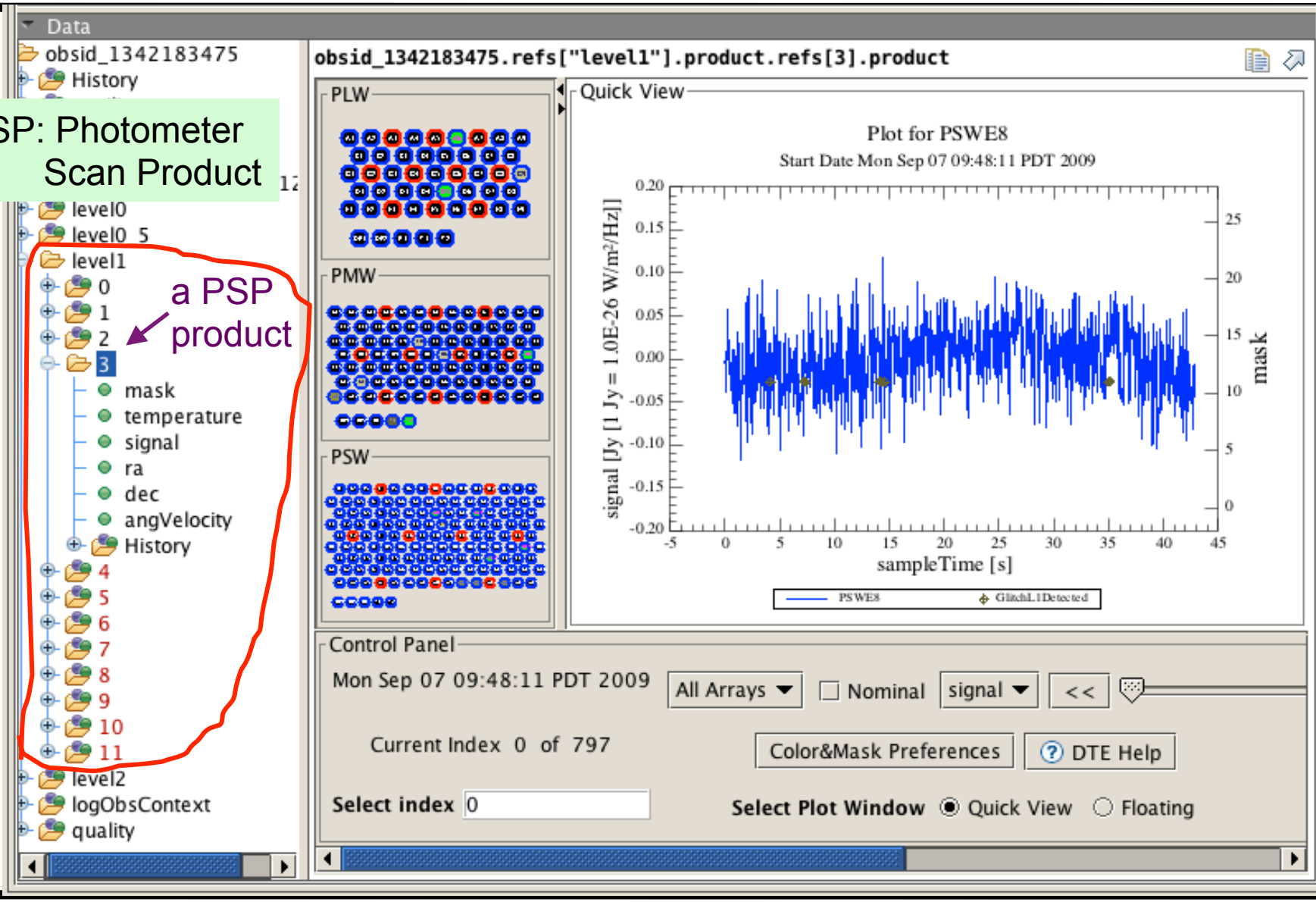
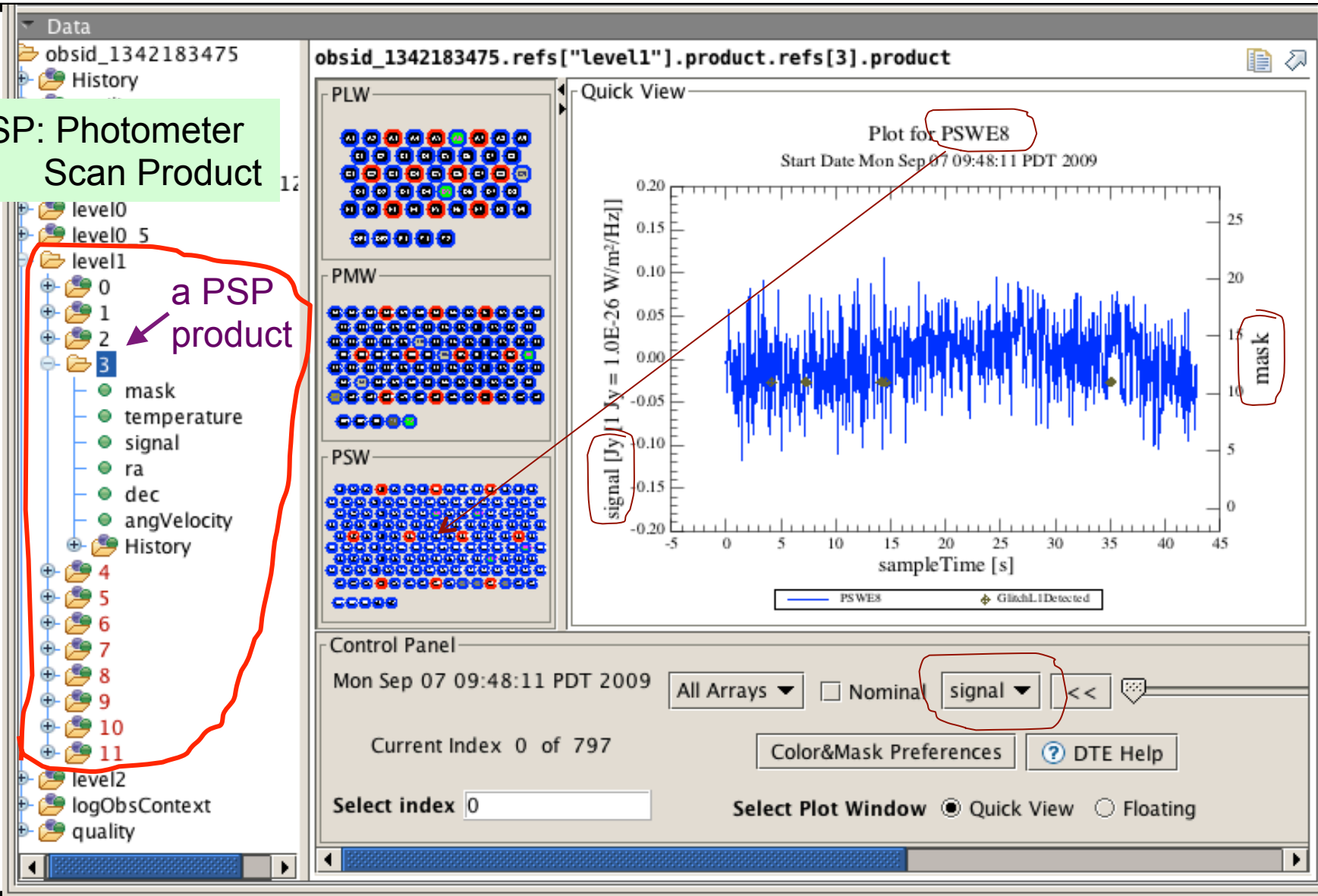
Level 1 Products: Timelines of Scans

PSP: Photometer Scan Product

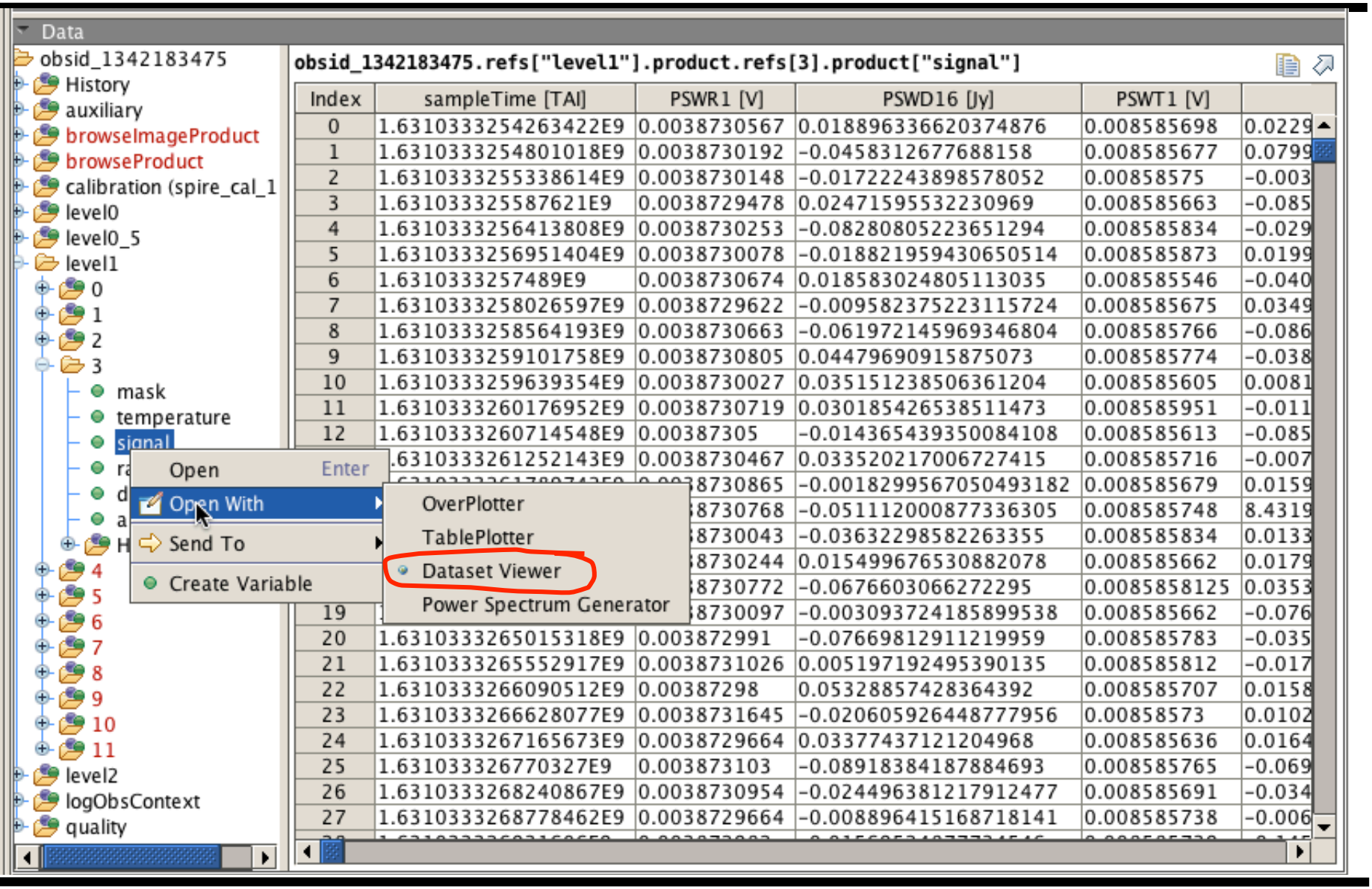


Level 1 Products: Timelines of Scans

PSP: Photometer Scan Product

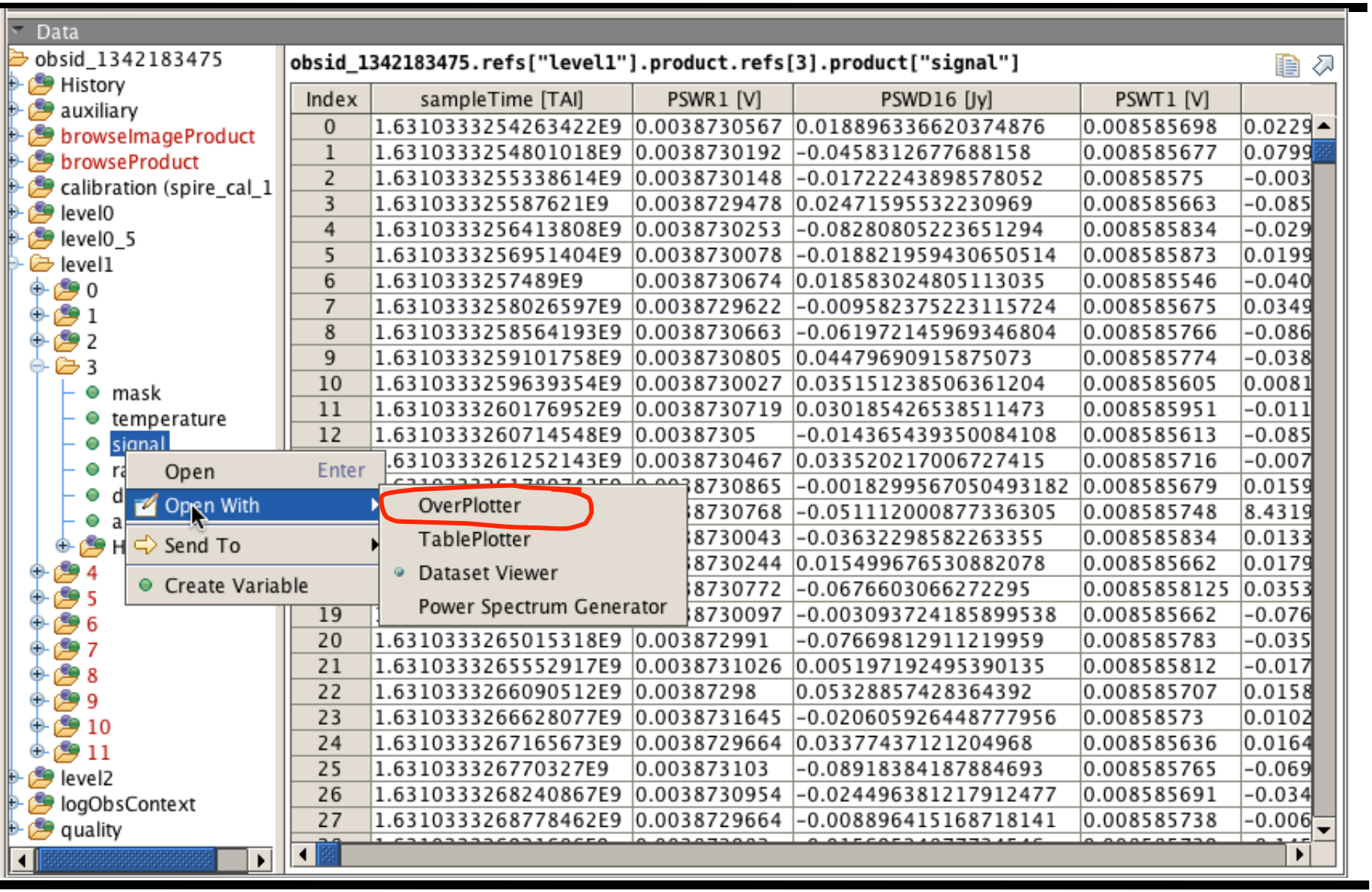


Level 1 Products: Dataset Viewer



Index	sampleTime [TAI]	PSWR1 [V]	PSWD16 [Jy]	PSWT1 [V]	
0	1.6310333254263422E9	0.0038730567	0.018896336620374876	0.008585698	0.0229
1	1.6310333254801018E9	0.0038730192	-0.0458312677688158	0.008585677	0.0799
2	1.6310333255338614E9	0.0038730148	-0.01722243898578052	0.00858575	-0.003
3	1.631033325587621E9	0.0038729478	0.02471595532230969	0.008585663	-0.085
4	1.6310333256413808E9	0.0038730253	-0.08280805223651294	0.008585834	-0.029
5	1.6310333256951404E9	0.0038730078	-0.018821959430650514	0.008585873	0.0199
6	1.631033257489E9	0.0038730674	0.018583024805113035	0.008585546	-0.040
7	1.6310333258026597E9	0.0038729622	-0.009582375223115724	0.008585675	0.0349
8	1.6310333258564193E9	0.0038730663	-0.061972145969346804	0.008585766	-0.086
9	1.6310333259101758E9	0.0038730805	0.04479690915875073	0.008585774	-0.038
10	1.6310333259639354E9	0.0038730027	0.035151238506361204	0.008585605	0.0081
11	1.6310333260176952E9	0.0038730719	0.030185426538511473	0.008585951	-0.011
12	1.6310333260714548E9	0.00387305	-0.014365439350084108	0.008585613	-0.085
	.6310333261252143E9	0.0038730467	0.033520217006727415	0.008585716	-0.007
		38730865	-0.0018299567050493182	0.008585679	0.0159
		8730768	-0.051112000877336305	0.008585748	8.4319
		8730043	-0.03632298582263355	0.008585834	0.0133
		8730244	0.015499676530882078	0.008585662	0.0179
		8730772	-0.0676603066272295	0.0085858125	0.0353
19		8730097	-0.003093724185899538	0.008585662	-0.076
20	1.6310333265015318E9	0.003872991	-0.07669812911219959	0.008585783	-0.035
21	1.6310333265552917E9	0.0038731026	0.005197192495390135	0.008585812	-0.017
22	1.6310333266090512E9	0.00387298	0.05328857428364392	0.008585707	0.0158
23	1.6310333266628077E9	0.0038731645	-0.020605926448777956	0.00858573	0.0102
24	1.6310333267165673E9	0.0038729664	0.03377437121204968	0.008585636	0.0164
25	1.631033326770327E9	0.003873103	-0.08918384187884693	0.008585765	-0.069
26	1.6310333268240867E9	0.0038730954	-0.024496381217912477	0.008585691	-0.034
27	1.6310333268778462E9	0.0038729664	-0.008896415168718141	0.008585738	-0.006

Level 1 Products: Dataset Viewer



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7	1.6310333258026597E9	0.0038729622	-0.009582375223115724	0.008585675	0.0349
8	1.6310333258564193E9	0.0038730663	-0.061972145969346804	0.008585766	-0.086
9	1.6310333259101758E9	0.0038730805	0.04479690915875073	0.008585774	-0.038
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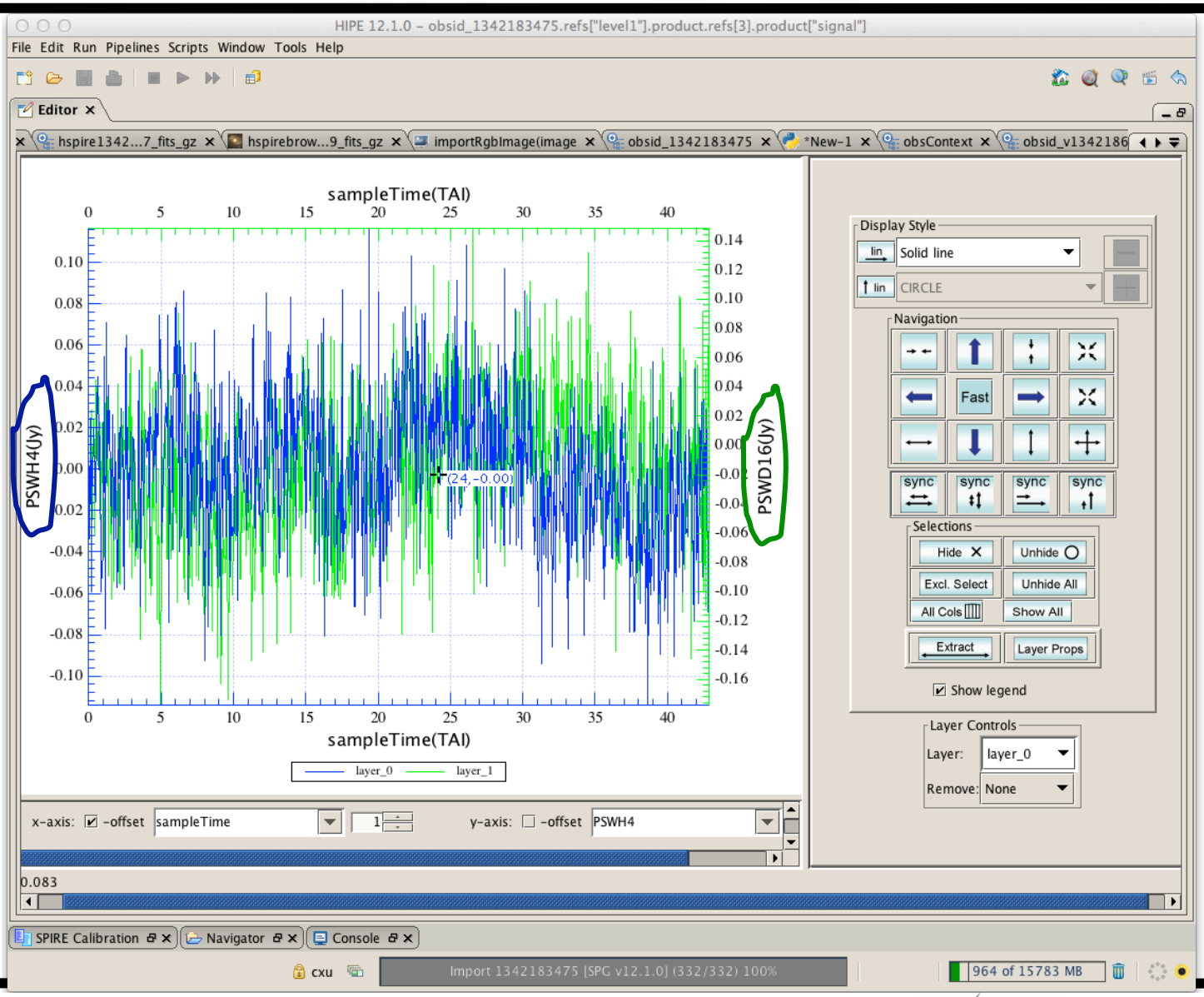
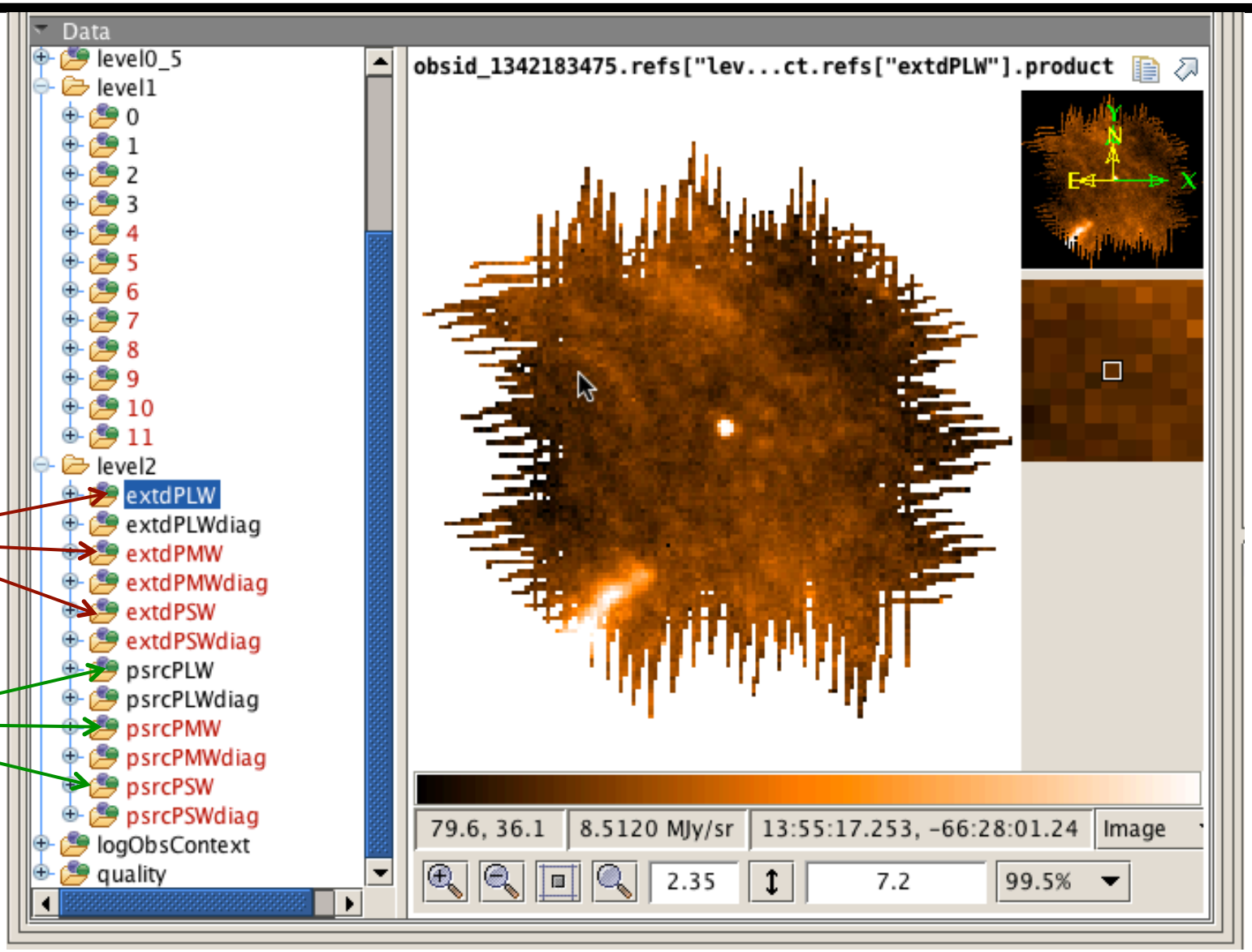
Level 1 Products: OverPlotter

OverPlotter:
Can compare timelines of different detectors.



Level 2: Mapping Products

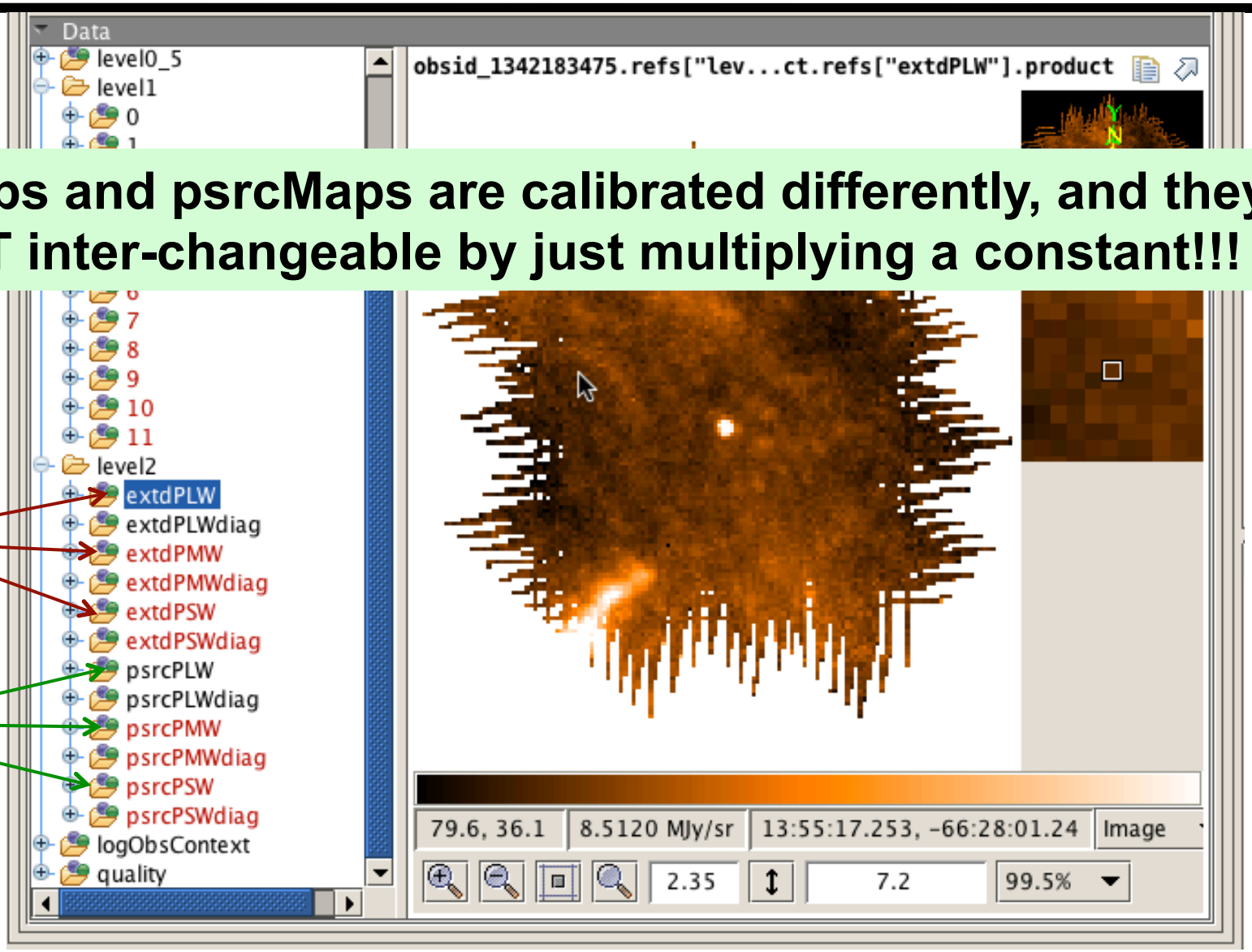


extended emission maps (MJy/sr)

point source maps (Jy/beam)

Level 2: Mapping Products

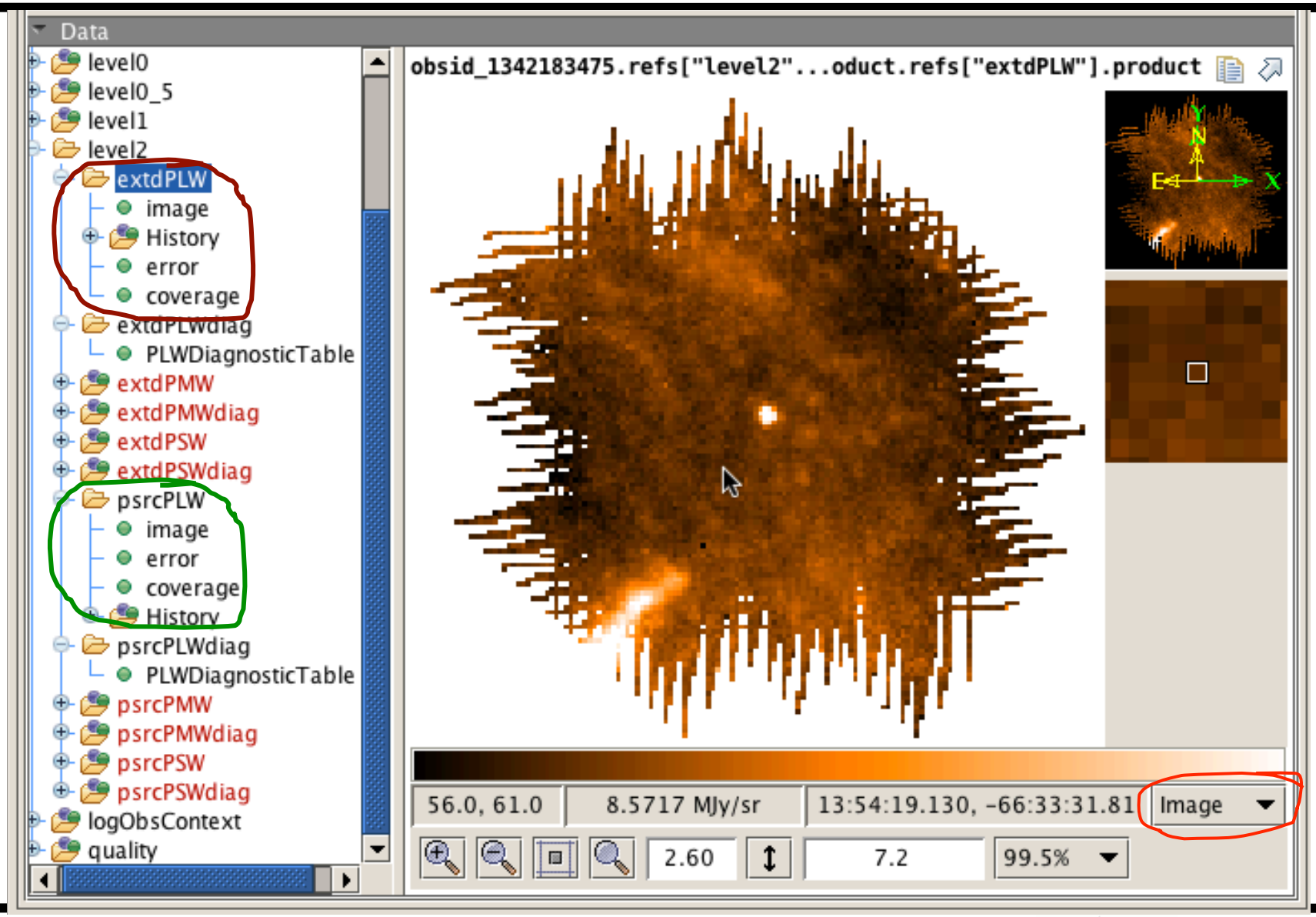
extdMaps and psrcMaps are calibrated differently, and they are NOT inter-changeable by just multiplying a constant!!!



extended emission maps (MJy/sr)

point source maps (Jy/beam)

Level 2: Mapping Products



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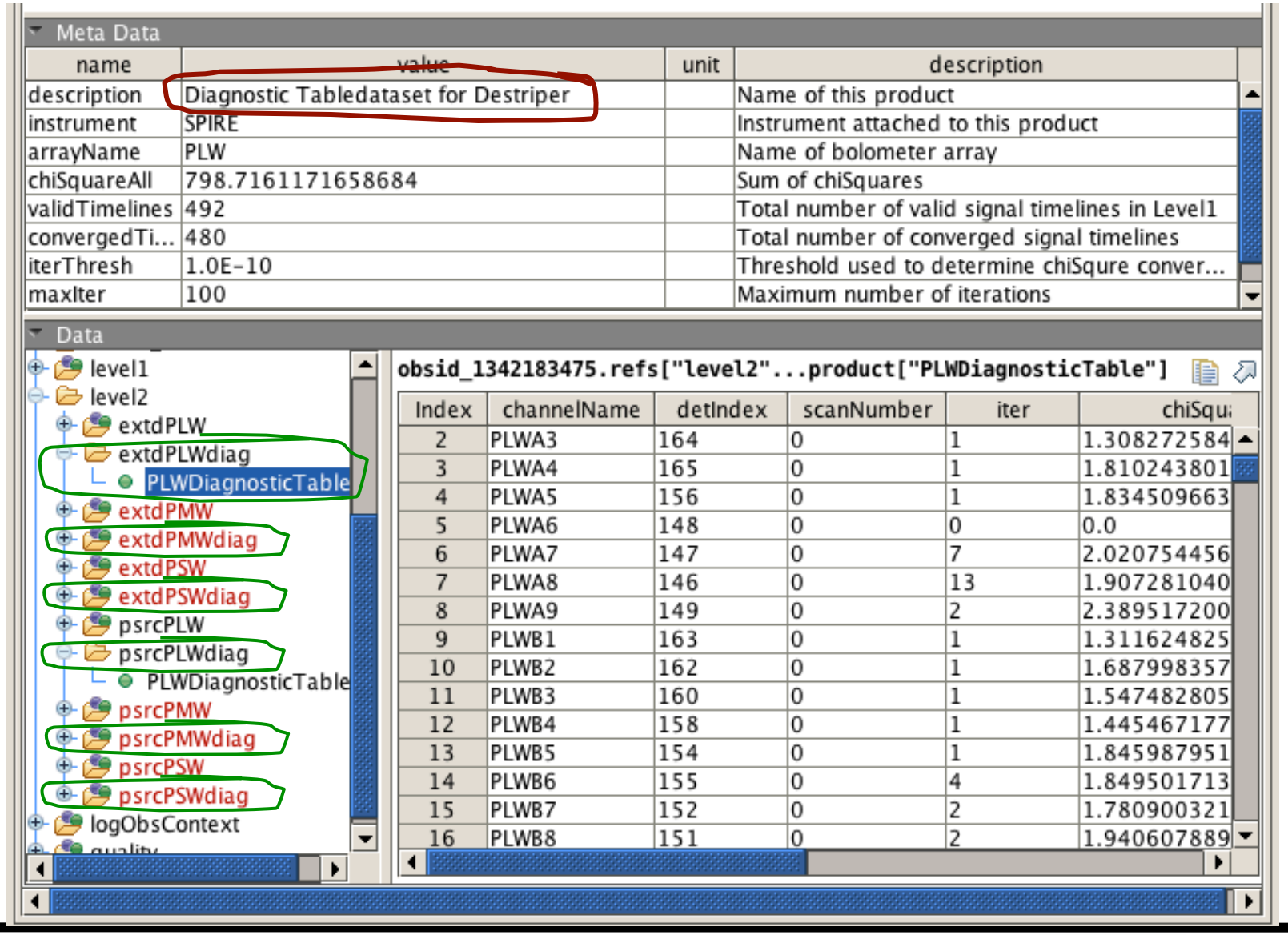


Meta Data

name	value	unit	description
description	Diagnostic Tabledataset for Destriper		Name of this product
instrument	SPIRE		Instrument attached to this product
arrayName	PLW		Name of bolometer array
chiSquareAll	798.7161171658684		Sum of chiSquares
validTimelines	492		Total number of valid signal timelines in Level1
convergedTi...	480		Total number of converged signal timelines
iterThresh	1.0E-10		Threshold used to determine chiSqure conver...
maxIter	100		Maximum number of iterations

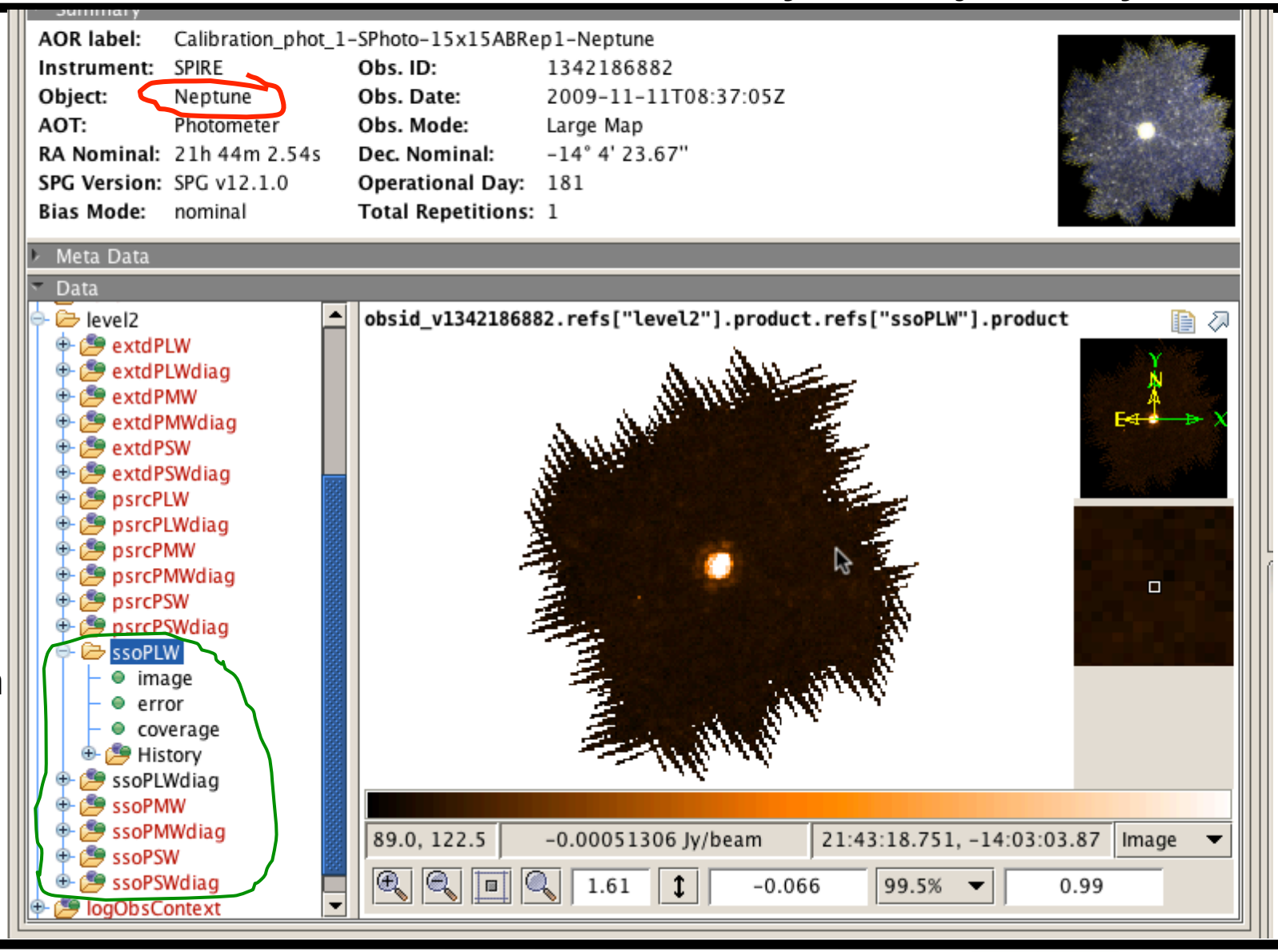
Data

obsid_1342183475.refs["level2"...product["PLWDiagnosticTable"]

Index	channelName	detIndex	scanNumber	iter	chiSqu
2	PLWA3	164	0	1	1.308272584
3	PLWA4	165	0	1	1.810243801
4	PLWA5	156	0	1	1.834509663
5	PLWA6	148	0	0	0.0
6	PLWA7	147	0	7	2.020754456
7	PLWA8	146	0	13	1.907281040
8	PLWA9	149	0	2	2.389517200
9	PLWB1	163	0	1	1.311624825
10	PLWB2	162	0	1	1.687998357
11	PLWB3	160	0	1	1.547482805
12	PLWB4	158	0	1	1.445467177
13	PLWB5	154	0	1	1.845987951
14	PLWB6	155	0	4	1.849501713
15	PLWB7	152	0	2	1.780900321
16	PLWB8	151	0	2	1.940607889

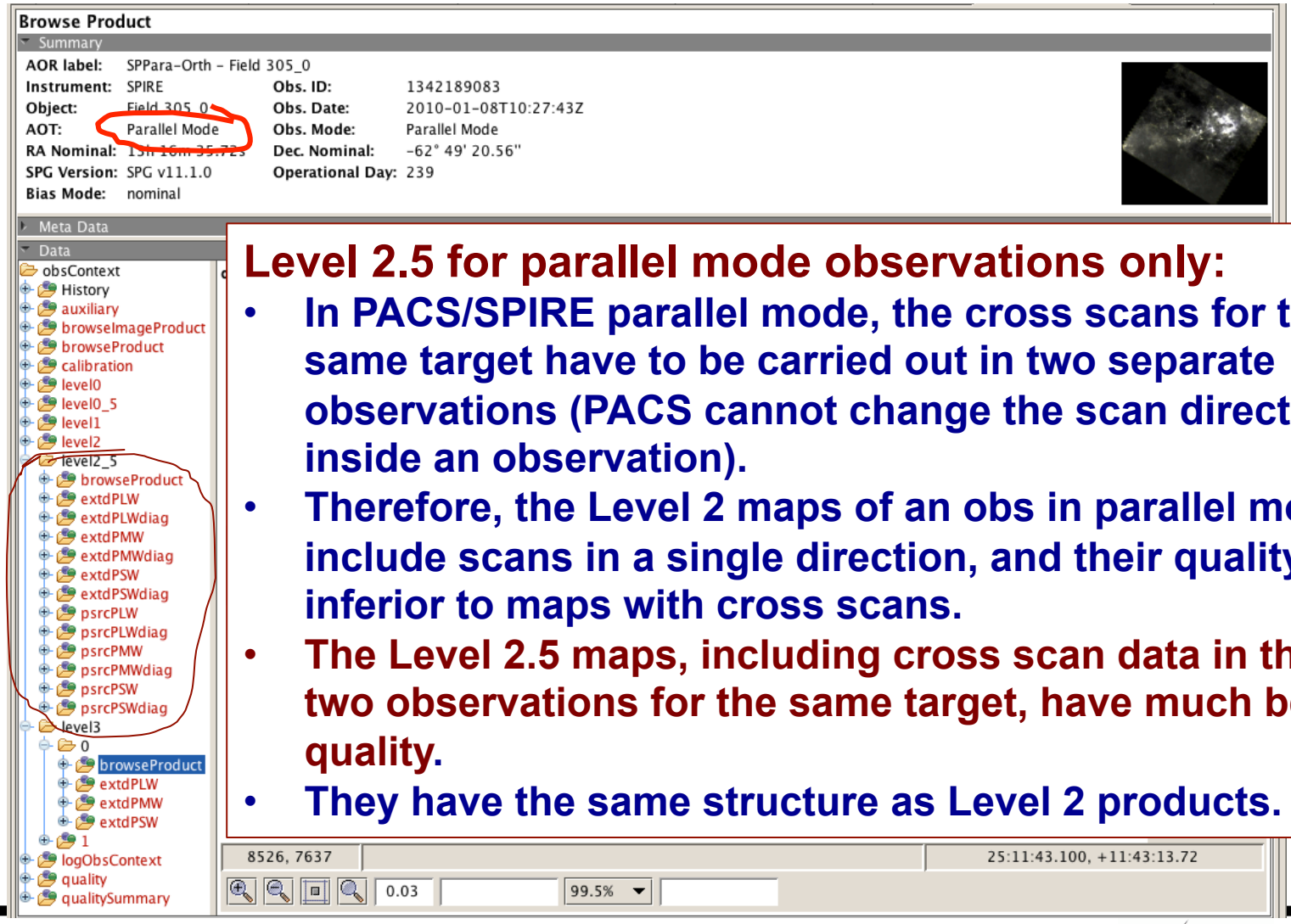
Level 2: ssoMaps for Solar System Objects Only

ssoMaps:
Including SSO motion correction



Level 2.5 Products:

Example: A parallel mode observation in a large survey (HiGal):

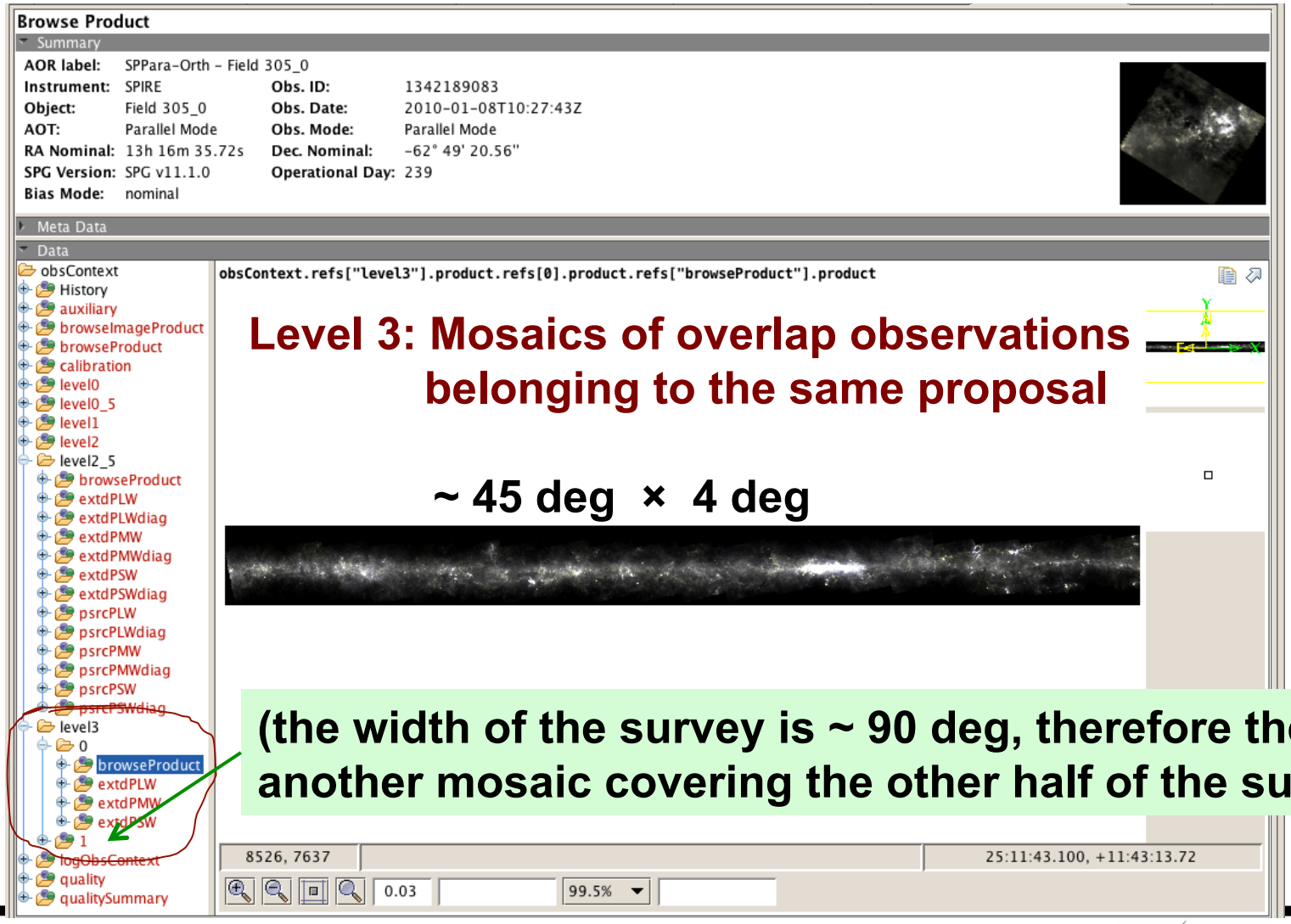


Level 2.5 for parallel mode observations only:

- In PACS/SPIRE parallel mode, the cross scans for the same target have to be carried out in two separate observations (PACS cannot change the scan direction inside an observation).
- Therefore, the Level 2 maps of an obs in parallel mode include scans in a single direction, and their quality is inferior to maps with cross scans.
- The Level 2.5 maps, including cross scan data in the two observations for the same target, have much better quality.
- They have the same structure as Level 2 products.

Level 3 Products:

Example: A parallel mode observation in a large survey (HiGal):



Summary

- For a given SPIRE Photometer observation, all data products are organized within a single ***Observation Context***.
- Major products are in the following ***Levels***:
  - Level 0: Raw data.
  - Level 0.5: Data converted to engineering units.
  - **Level 1: Calibrated scan timelines (in astrophysical units).**
  - **Level 2: Maps (and diagnostic tables).**
  - Level 2.5: Maps of *combined parallel observations* with cross-scans (with the same structures as the Level 2 products).
  - Level 3: Mosaics of overlap observations belonging to the same proposal.
- If you want to make a SPIRE Photometer map using your own mapmaker, all you need are the **Level 1 products (timelines of flux, RA, Dec, etc.).**
- **Level 2 products** include three different types of maps made by a naïve mapmaker (pipeline default):
  1. point source maps (psrcMaps: in Jy/beam).
  2. extended emission maps (extdMaps: in MJy/sr).
  3. ssoMaps (for solar system objects only, with sso motion correction).