

SPIRE Spectrometer Data Products and Visualization Tools in HIPE

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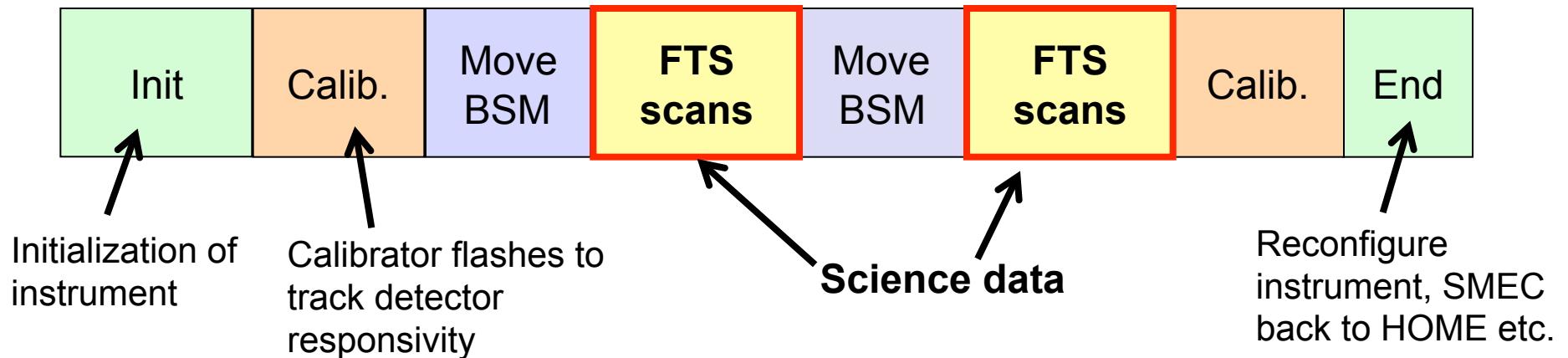
List of Topics

- **SPIRE Spectrometer Pipeline Data Products**
- How to Graphically Investigate Spectrometer Data in HIPE

(No script is involved for this talk)

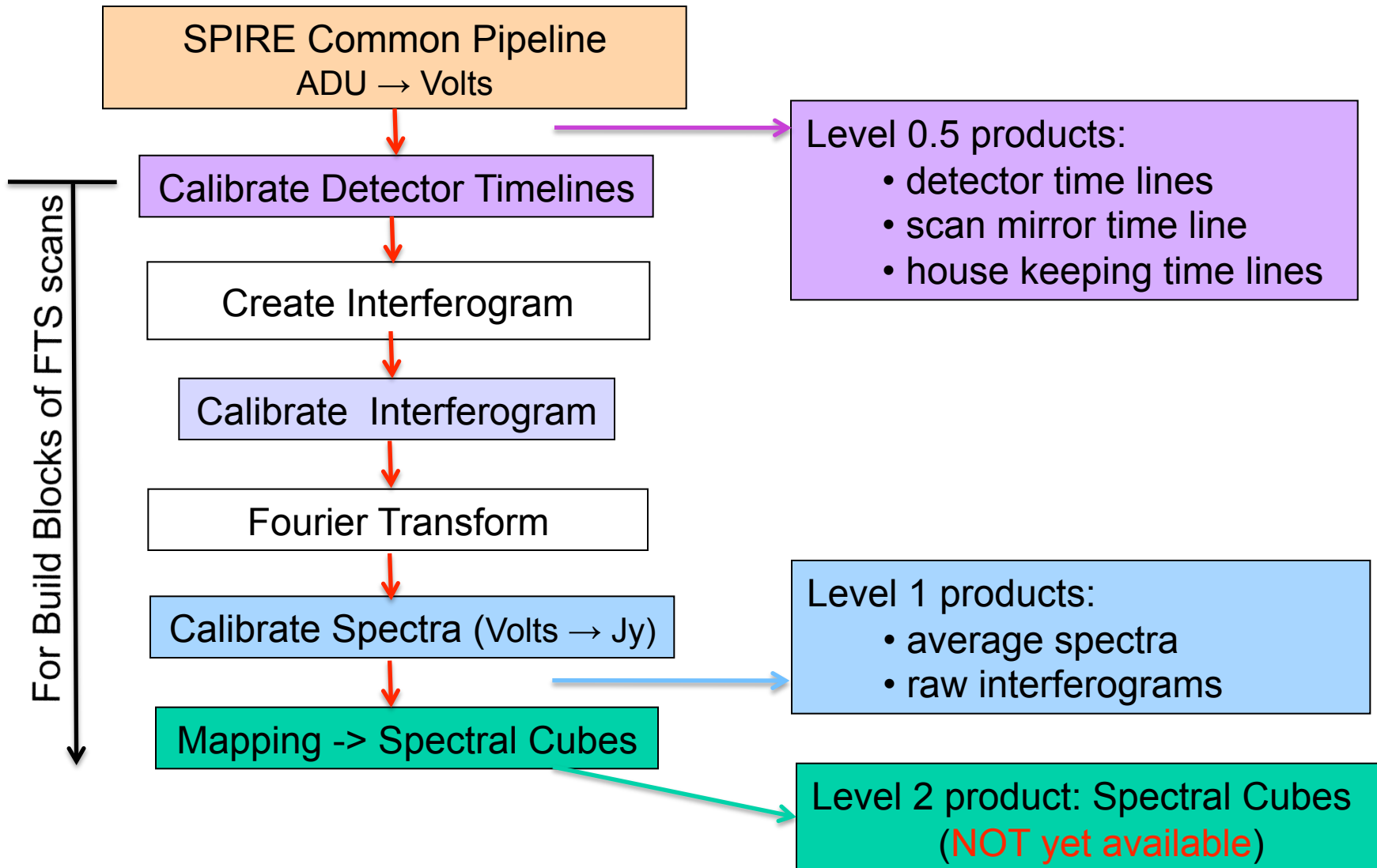
Spectrometer Observation Sequence

- A SPIRE observation is divided into *Building Blocks*:



- Each **basic instrument operation** is contained in a separate **building block**
- Pipeline processing is per building block (to Level 1).

Spectrometer Pipeline Products



What Data do You Get?

- When your observation is done, you download the data from Herschel Science Archive (HSA) to a "local pool" on your computer containing one **Observation Context**.
- An **Observation Context** contains all the data:
 - Auxiliary (pointing) data
 - Calibration data
 - Level 0 (raw) data
 - **Level 0.5** ← **Engineering data for all building blocks**
 - **Level 1** ← **Fully calibrated, average spectra**
 - Level 2 (for maps; to be implemented)

Level 0.5 Data

Observation Context:

Level-0.5 Context:

Building Block Context:

Detector timeline: SDT (~80 Hz sampling)
Housekeeping timeline: NHKT (1 Hz)
SMEC position timeline: SMECT (~240 Hz)

Building Block Context:

Detector data timeline: SDT
Housekeeping timeline: NHKT
SMEC position timeline: SMECT

.....

Level 1 Data

- For each set of science scans (= **one building block**), Level 1 context lists the following three products:
 - (1) An average spectrum with no apodization.
 - (2) An average spectrum with a default apodization (to depress the side lobes of bright lines).
 - (3) Raw interferograms of individual scans.

Data Visualization in HIPE

Graphic Tools Available in HIPE for Quick Look at

- Level 1 – Average spectra (& interferograms)
- Level 0.5 – Various detector time lines.

Load an Observation Context into HIPE

The image shows the HIPE 2.0 interface with the following components:

- Editor:** A Python script named `get_data.py` with the following content:

```
1 # Load the data
2 # - NGC 5315: High resolution, 5 repetitions: obsid=0x5000182e
3
4 # open a local pool storage:
5 storage = ProductStorage("demo-spire-spec-0x5000182e")
6
7 # Query it for an observation context:
8 obsid=0x5000182e
9 results = storage.select(Query(ObservationContext,"obsid="+str(obsid)+"L"))
10
11 # Select the first observation context in the results:
12 observation = results[0].product
13
14
```
- Console:** Shows the execution of the script and an error message:

```
HIPE>
HIPE> storage = ProductStorage("demo-spire-spec-0x5000182e")
HIPE> obsid=0x5000182e
HIPE> results = storage.select(Query(ObservationContext,"obsid="+str(obsid)+"L"))
java.util.NoSuchElementException: Requesting access to non existing item:
urn:demo-spire-spec-0x5000182e:herschel.ia.obs.ObservationContext:2
HIPE> observation = results[0].product
HIPE>
HIPE>
```
- Variables Window:** Lists variables: `C`, `observation`, `obsid`, `resolution`, `results`, and `storage`. The `observation` variable is selected, and a context menu is open with the following options:
 - Open (Enter)
 - Open With (Product Viewer)
 - Send to (Context Viewer)
 - Delete (Delete)
 - Help Selection (F1)

Annotations include a red circle around the `observation` variable and a red arrow pointing to it from the text "Appears in 'Variables' window". A red box highlights the context menu and the Variables window.

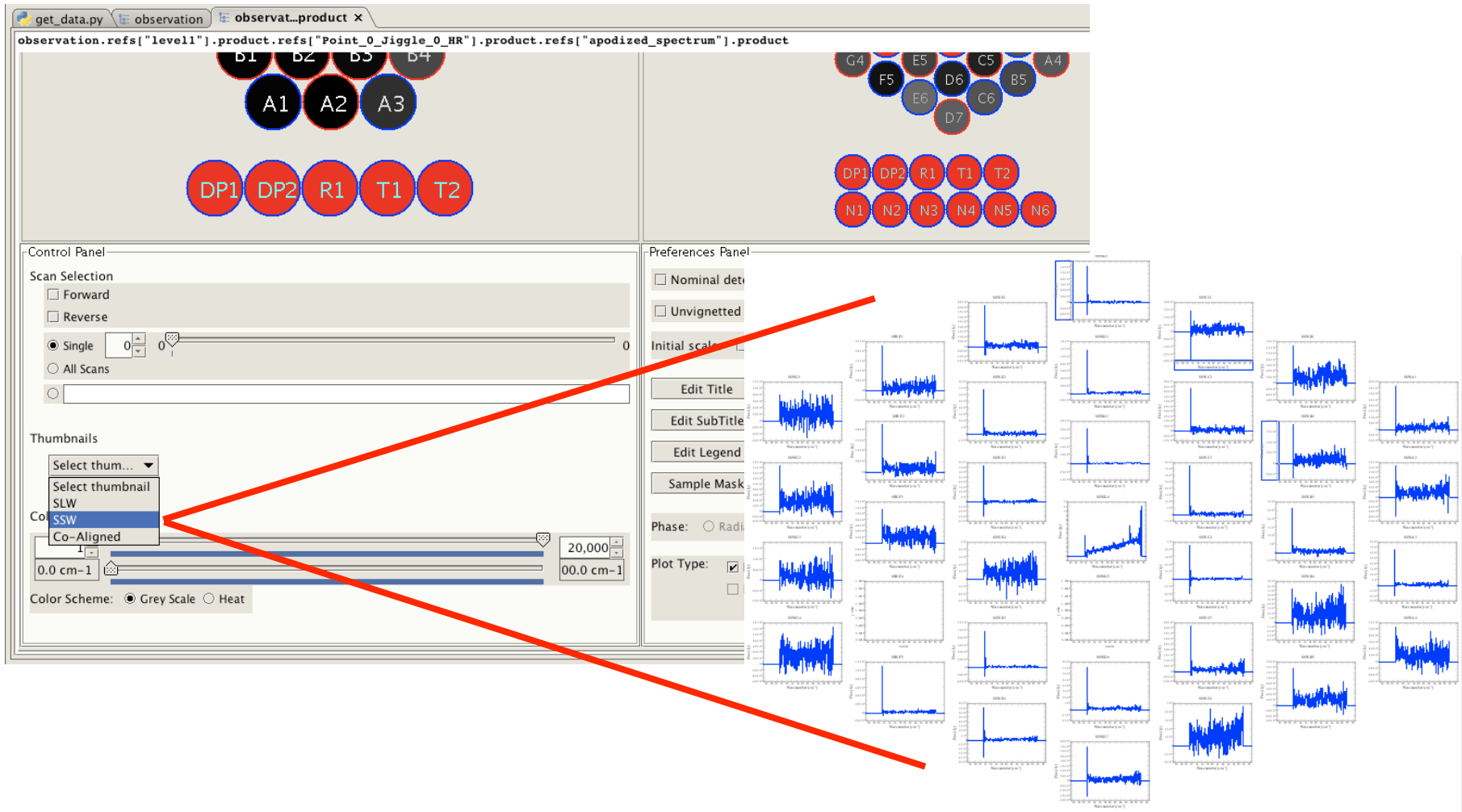
Level 1 Product Visualization

The image displays a software interface for visualizing Level 1 products from the Herschel mission. It consists of three main windows:

- Spectrometer Detector Spectrum:** A table showing metadata for the product. The table has columns for name, value, unit, and description.
- Herschel PlotXY:** A plot showing Flux [Jy] on the y-axis (ranging from -10 to 80) versus Wavenumber [cm⁻¹] on the x-axis (ranging from 26 to 52). The plot shows a noisy spectrum with a prominent peak around 48 cm⁻¹. The plot is titled "1342184122 - 2701524993 - 2009/Sep/21 03:20:57 UTC" and the legend indicates "SSWD4 - 0".
- Product Viewer:** A window showing a detector array layout. The array is a 5x5 grid of detectors labeled A1 through E5. The layout is shown in a top-down view with a red arrow pointing to the 'Product Viewer' option in the 'Open With' menu.

name	value	unit	description
type	SDS		Product Type Identification
creator	SpecOptCrossCorrectionTask \$R...		Generator of this product
creationDate	2009-11-28T20:01:54Z		Creation date of this product
description	Spectrometer Detector Spectrum		Name of this product
instrument	SPIRE		Instrument attached to this product
modelName	FLIGHT		Model name attached to this product
startDate	2009-09-07T15:41:32Z		Start date of this product
endDate	2009-09-07T15:52:51Z		End date of this product

Level 1 Product Visualization



Look into Individual Level 0.5 Building Blocks

The screenshot displays the Herschel DP software interface. On the left, a data tree shows a hierarchy from 'Data' to 'level0_5'. A context menu is open over the 'level0_5' folder, with 'Product Viewer' selected. An orange arrow points from this menu to the 'Product Viewer' window in the top right. Another orange arrow points from the 'Product Viewer' window to the 'Detector Timeline Viewer' window in the bottom right.

The 'Product Viewer' window shows a 'Voltages table' with the following data:

Index	sampleTi...	SSWR1 [V]	SSWA4 [V]	SSWA3 [V]	SSWA2 [V]	SSWA1 [V]	SSWDP1...	S
0	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
1	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
2	1.631029...	0.005188...	0.006490...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
3	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
4	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
5	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
6	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
7	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
8	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
9	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4
10	1.631029...	0.005188...	0.006489...	0.006160...	0.006447...	0.006421...	0.005924...	0.4

The 'Detector Timeline Viewer' window shows a detector layout with two views: 'SLW' and 'SSW'. The 'SLW' view shows a circular arrangement of detectors labeled E1-E3, D1-D3, C1-C5, B1-B4, A1-A3, DP1-DP2, R1, T1, and T2. The 'SSW' view shows a similar arrangement with labels E1-E6, D1-D7, F1-F5, G1-G4, C1-C6, B1-B4, A1-A4, DP1-DP2, R1, T1, T2, N1-N6. A 'Quick View' plot for 'SSWD4' shows a graph of 'voltage [V]' vs 'sampleTime[s]' with a value of approximately 0.0059 V. The plot title is 'Plot for SSWD4' and the start date is 'Mon Sep 07 08:41:32 PDT 2009'.