

# SPIRE Spectrometer Data Products and Visualization Tools in HIPE

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## List of Topics

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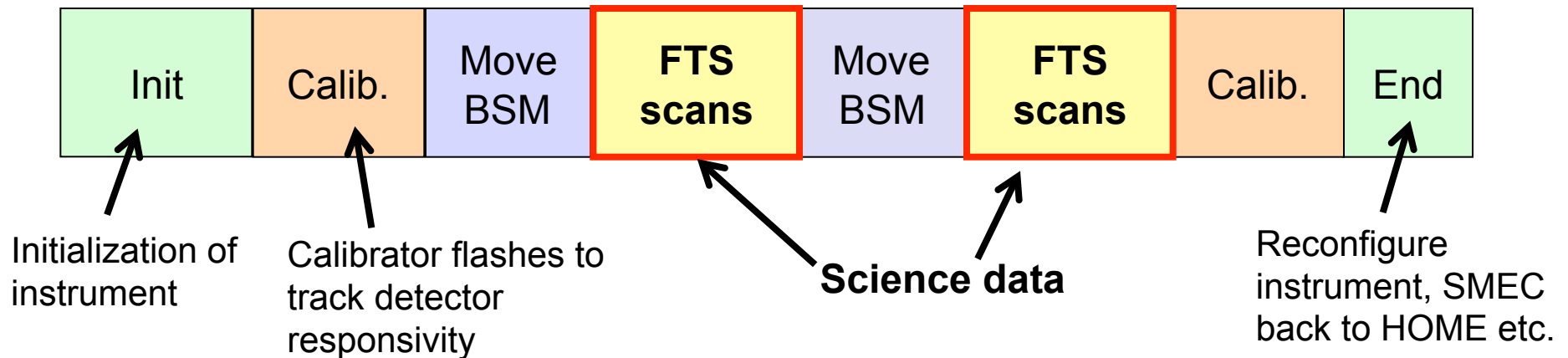
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- **SPIRE Spectrometer Pipeline Data Products**
- How to Graphically Investigate Spectrometer Data in HIPE

(No script is involved for this talk)

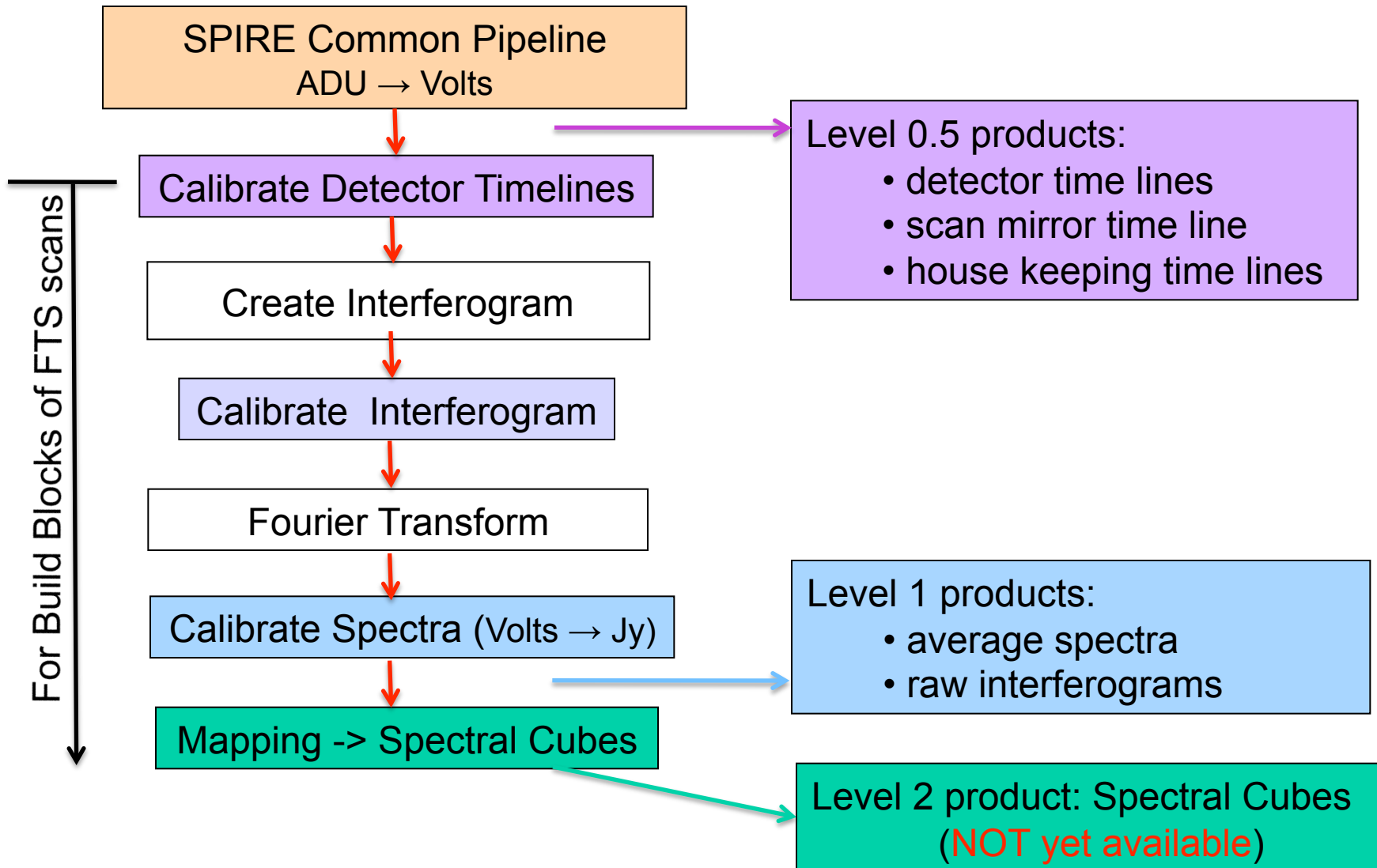
## Spectrometer Observation Sequence

- 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?

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- 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

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*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**

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## Level 1 Data

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- 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

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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 with the following output:

```
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.

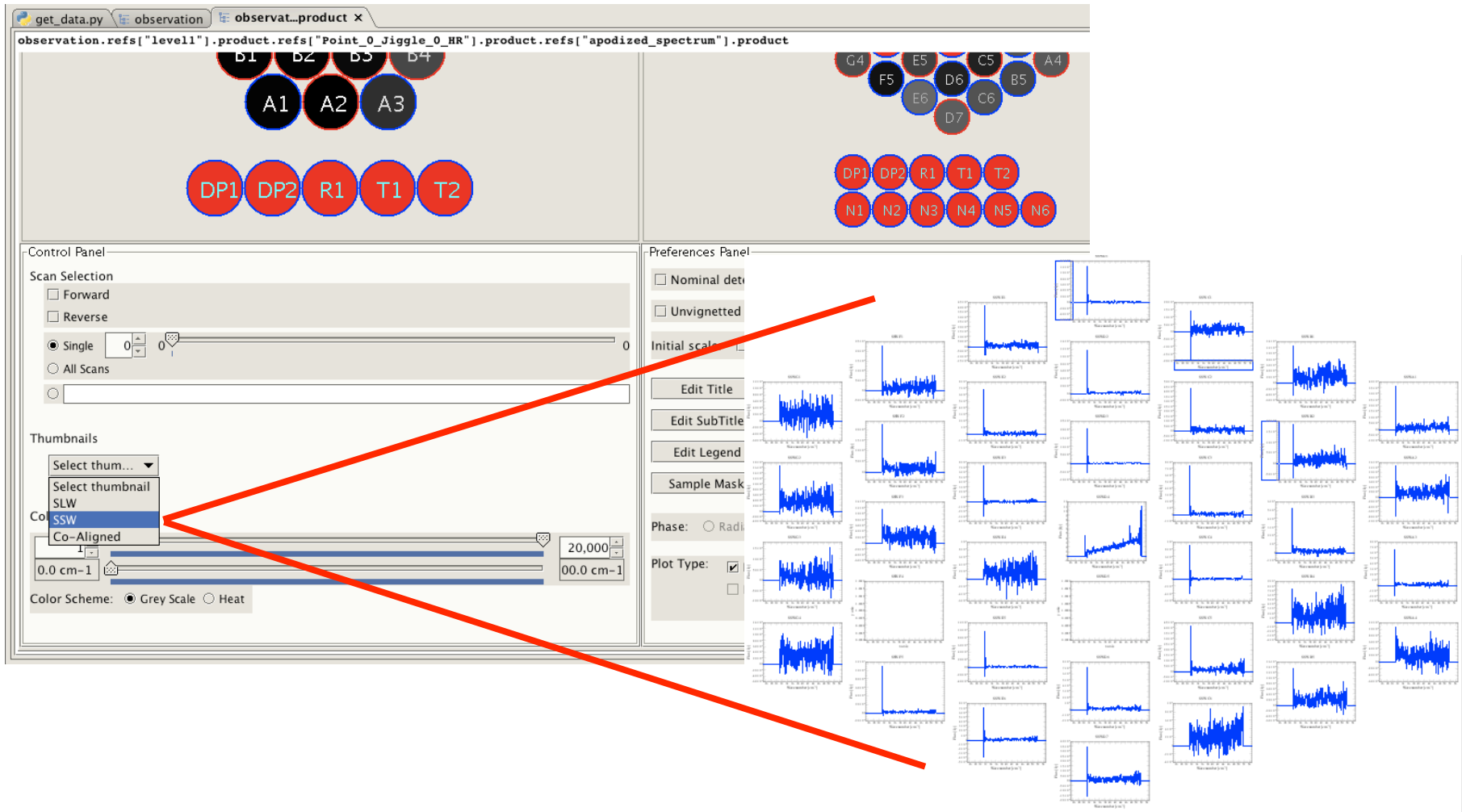
# Level 1 Product Visualization

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<sup>-1</sup>] on the x-axis (ranging from 26 to 52). The plot shows a noisy spectrum with a prominent peak around 48 cm<sup>-1</sup>. The plot title is "1342184122 - 2701524993 - 2009/Sep/21 03:20:57 UTC".
- 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 image shows a sequence of three software windows from the Herschel DP interface. The first window on the left shows a hierarchical data tree with 'level0\_5' selected. A context menu is open over it, with 'Product Viewer' highlighted. A red arrow points from this menu item to the second window. The second window, titled 'Voltages table', displays a table of data with columns for 'Index', 'sampleTime', and various detector parameters like 'SSWR1 [V]', 'SSWA4 [V]', etc. A second red arrow points from the 'Product Viewer' menu item in the first window to the third window. The third window is a visualization interface with two detector layout diagrams (SLW and SSW) and a plot titled 'Plot for SSWD4'. The plot shows 'voltage [V]' on the y-axis (ranging from 0.0055 to 0.0063) and 'sampleTime[s]' on the x-axis (ranging from -200 to 800). The plot shows a series of vertical spikes at regular intervals, indicating the sampling rate.

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