Issues with Photometer Data

& How to Resolve them with HIPE Tools

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on behalf of the SPIRE ICC

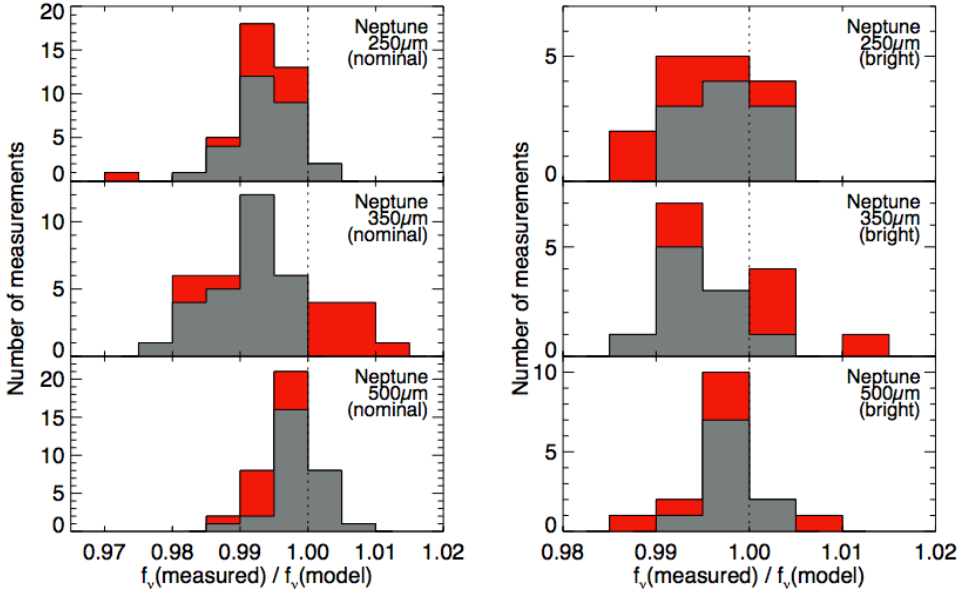
Known Issues

- New Flux Calibration in HIPE 11
- "Cooler Burps"
- Glitches
- Missed Thermistor Signal Jumps

Reference: *"SPIRE Data Reduction Guide"*
in HIPE (under "Help") or in:
http://herschel.esac.esa.int/hcss-doc-11.0/load/spire_drg/html/spire_drg.html

New Flux Calibration in HIPE 11

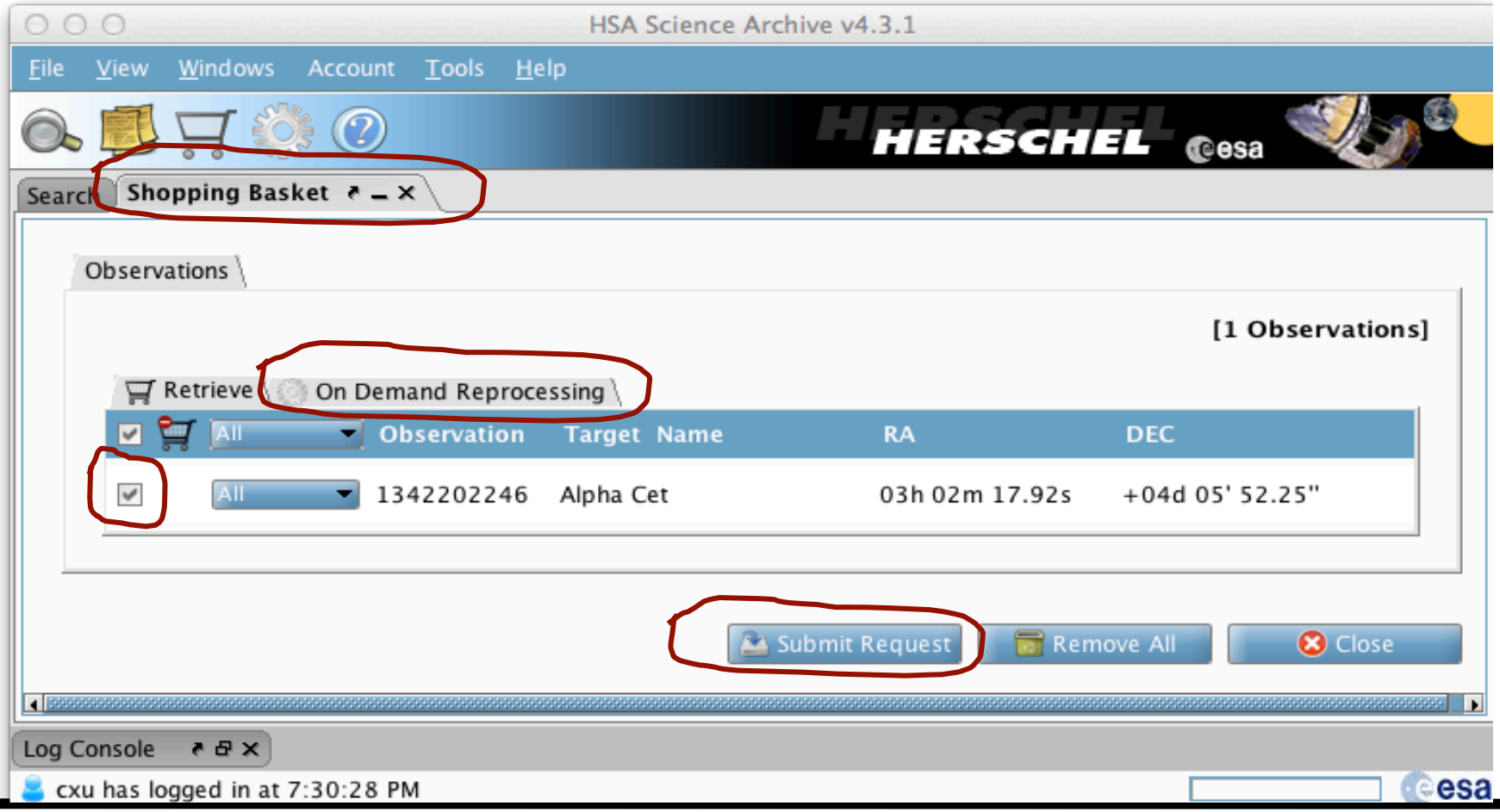
- Nominal mode
  - Re-calibrated using the new ESA4 Neptune model by R. Moreno.
- Bright mode
  - Previous calibrations were based on theoretical bolometer models.
  - New empirical calibration of linearity and flux using ESA4 Neptune model.
- Changes: ~ 1 – 2 %.
  - If HIPE version of your data is earlier than 11.0, you may want to reprocess them with the new calibration.



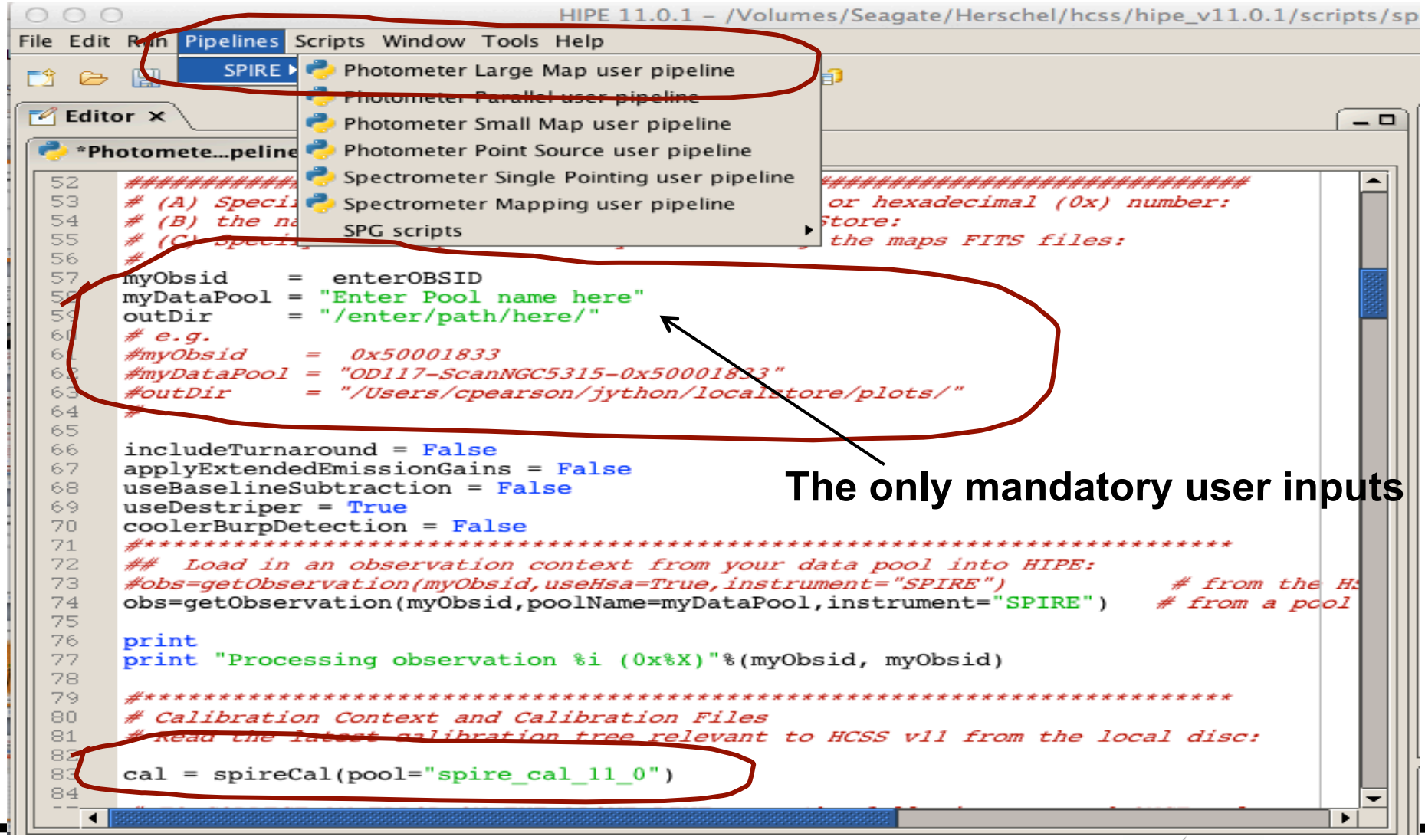
- Neptune model based on Moreno 1998.
- Instrumental uncertainties 1.5%, absolute flux uncertainty ~4% (Bendo et al. 2013 in press. arXiv:1306.1217)

Reprocess with new calibration

- **Option 1: HSA On-demand Reprocessing (latest calibration):**



- **Option 2: Reprocess using 'user pipeline' and new cal file (cal_11)**



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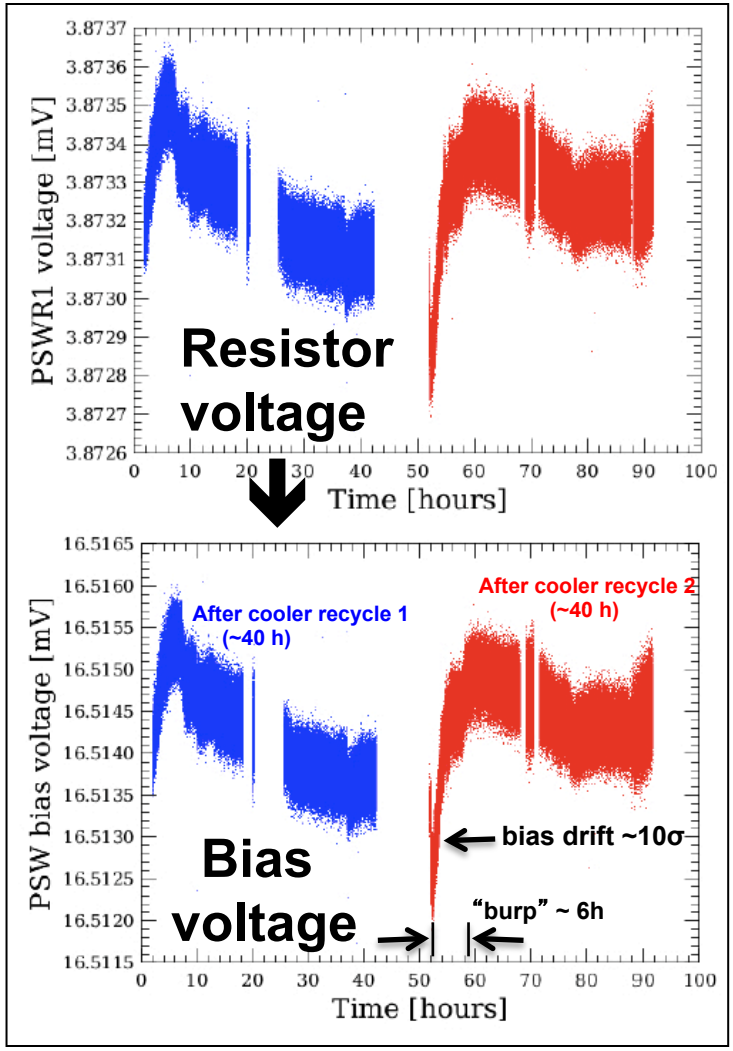
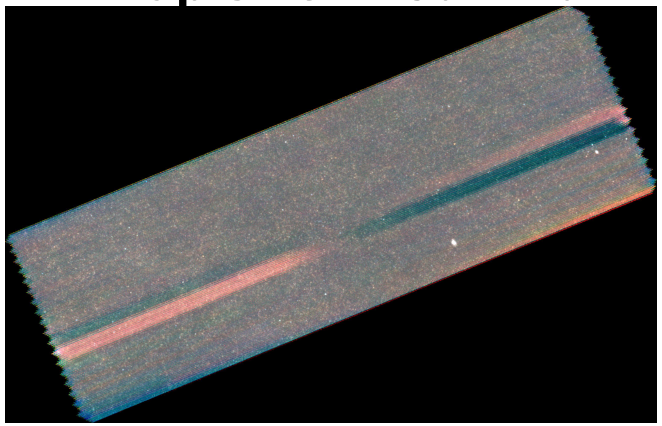
"Cooler Burp"

- Every time when SPIRE is switched on after a cooler recycle, the first ~6 h sees rapid drifts of the temperature and of the bias voltage.
- It causes abnormal drifts in detector timelines, which in turn cause stripes in maps observed during the "cooler burp" period.



Map size: ~ 8d x 2d

An example of stripes caused by cooler burp:



- Still uncorrected in the standard (SPG) pipeline of HIPE 11, but can be corrected using 'user pipeline' scripts.

Reprocess with Cooler-Burp correction

User pipeline

Editor ×

*Photomete...peline.py ×

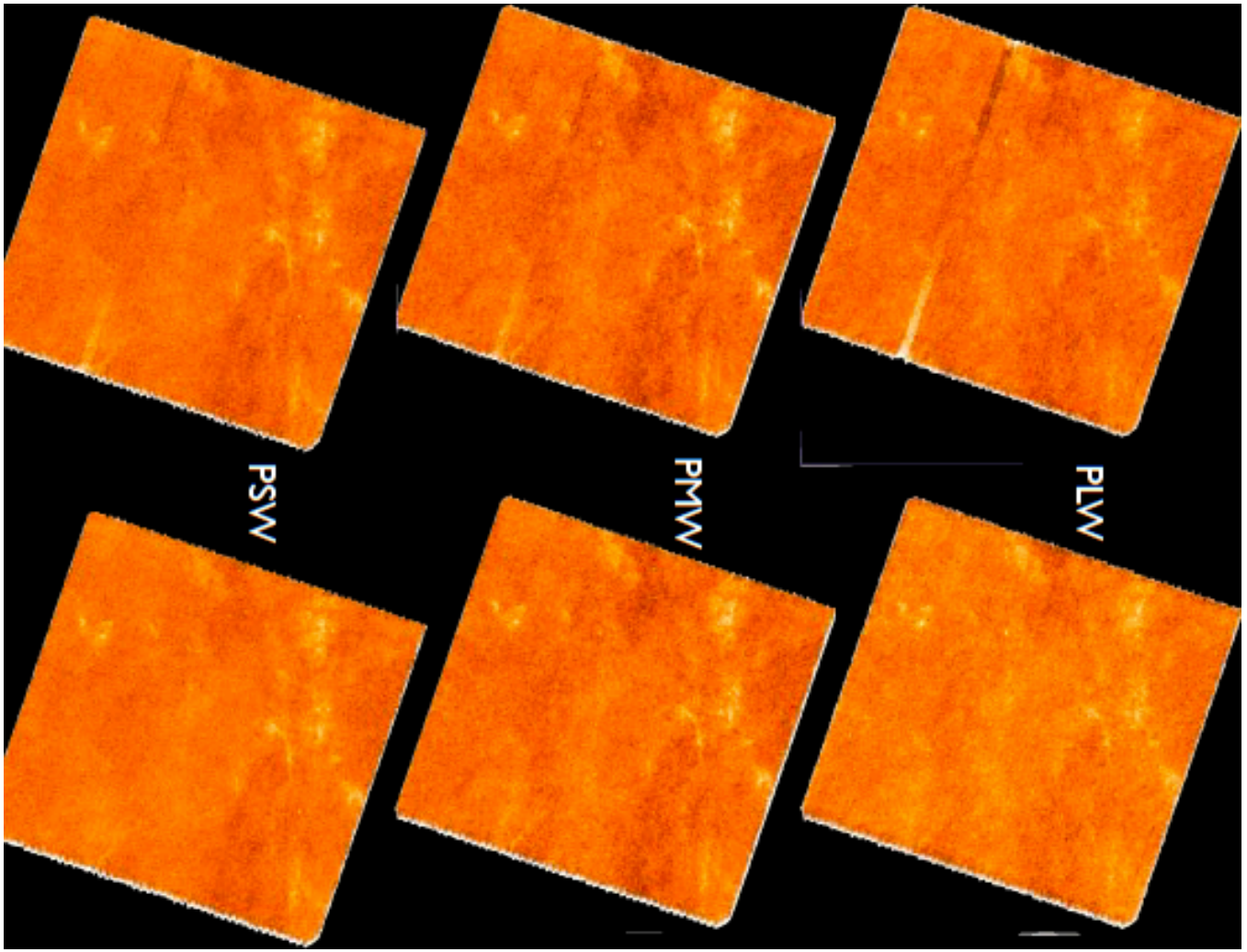
```
50  ##############################################################################
51  ###                        User Selectable Options                         ###
52  ##############################################################################
53  # (A) Specific OBSID in the form of an integer or hexadecimal (0x) number:
54  # (B) the name of the data Pool in your Local Store:
55  # (C) Specify the output directory for writing the maps FITS files:
56  #
57  myObsid     =  enterOBSID
58  myDataPool = "Enter Pool name here"
59  outDir      = "/enter/path/here/"
60  # e.g.
61  #myObsid     =  0x50001833
62  #myDataPool = "OD117-ScanNGC5315-0x50001833"
63  #outDir      = "/Users/cpearson/jython/localstore/plots/"
64  #
65  # Additional Options
66  # (D) includeTurnaround: Include the scan line turnarounds in the pocessing and
67  # (E) applyExtendedEmissionGain: Apply the relative gains for each bolometer fo
68  # (F) baselineSubtraction: Subtract a baseline from each scan to avoid stripes
69  # (G) destriper: Determine and remove baselines to achive an optimum fit betwee
70  #  **   At least one of the options G or H must be True.
71  # (H) coolerBurpDetection: Search and correct cooler burp recalculating the Tem
72  includeTurnaround = False
73  applyExtendedEmissionGains = False
74  useBaselineSubtraction = False
75  useDestriper = True
76  coolerBurpDetection = True
77  ##############################################################################
78
```

Reprocess with Cooler-Burp correction

An example for results of the Cooler-Burp correction:

before correction →

after correction →



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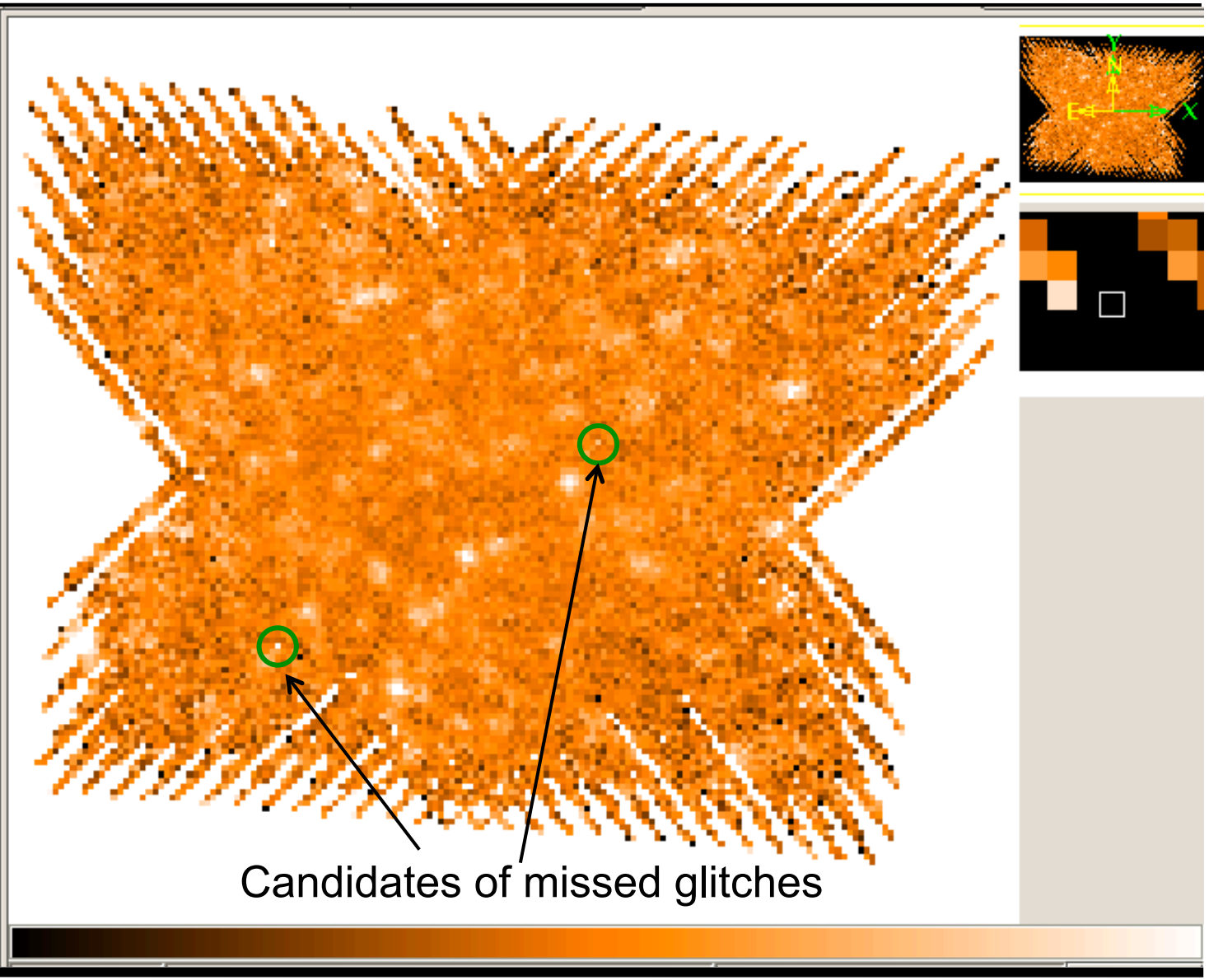
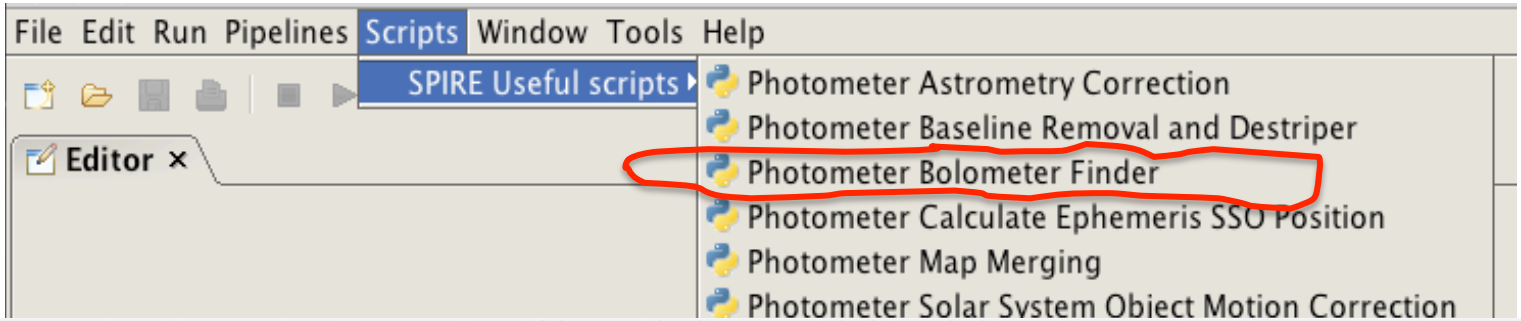
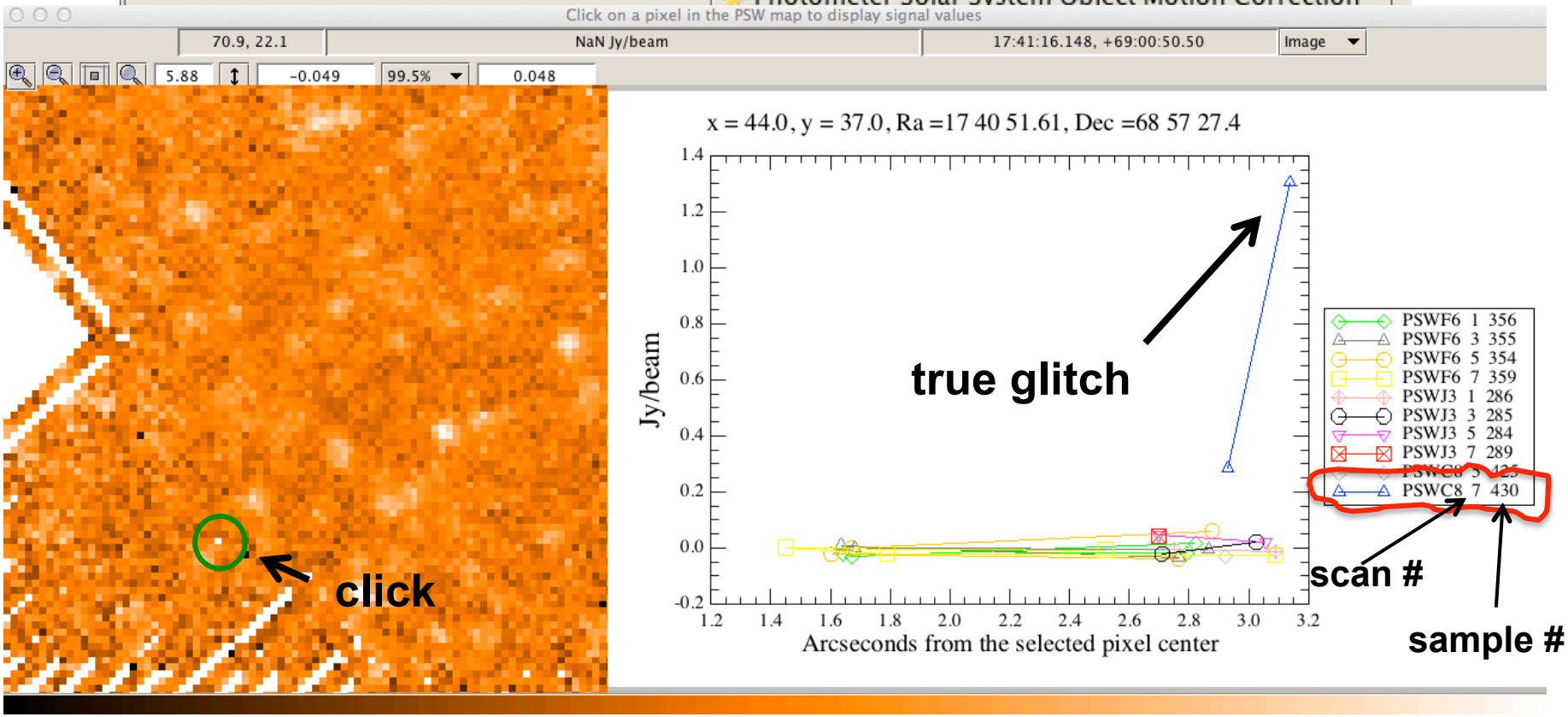
Glitches

- Glitches are mostly due to cosmic-rays
- Most of them are removed by the deglitchers in the pipeline.
- However, few of them may be missed and cause artifacts in final maps.
- Using HIPE tools, you can find where in the time-lines the glitches are & mask them.



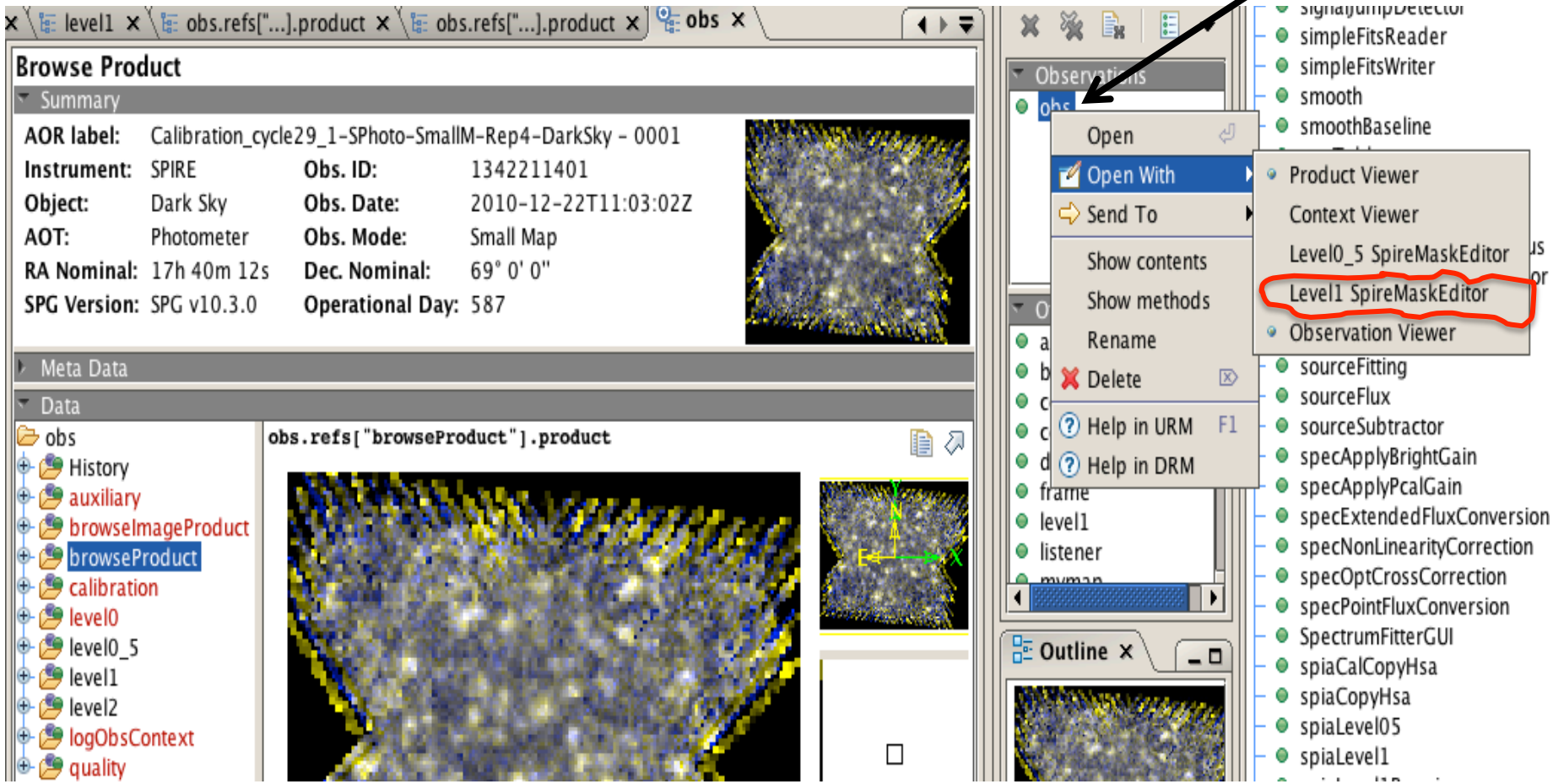
Allocate glitches with "Bolometer Finder"



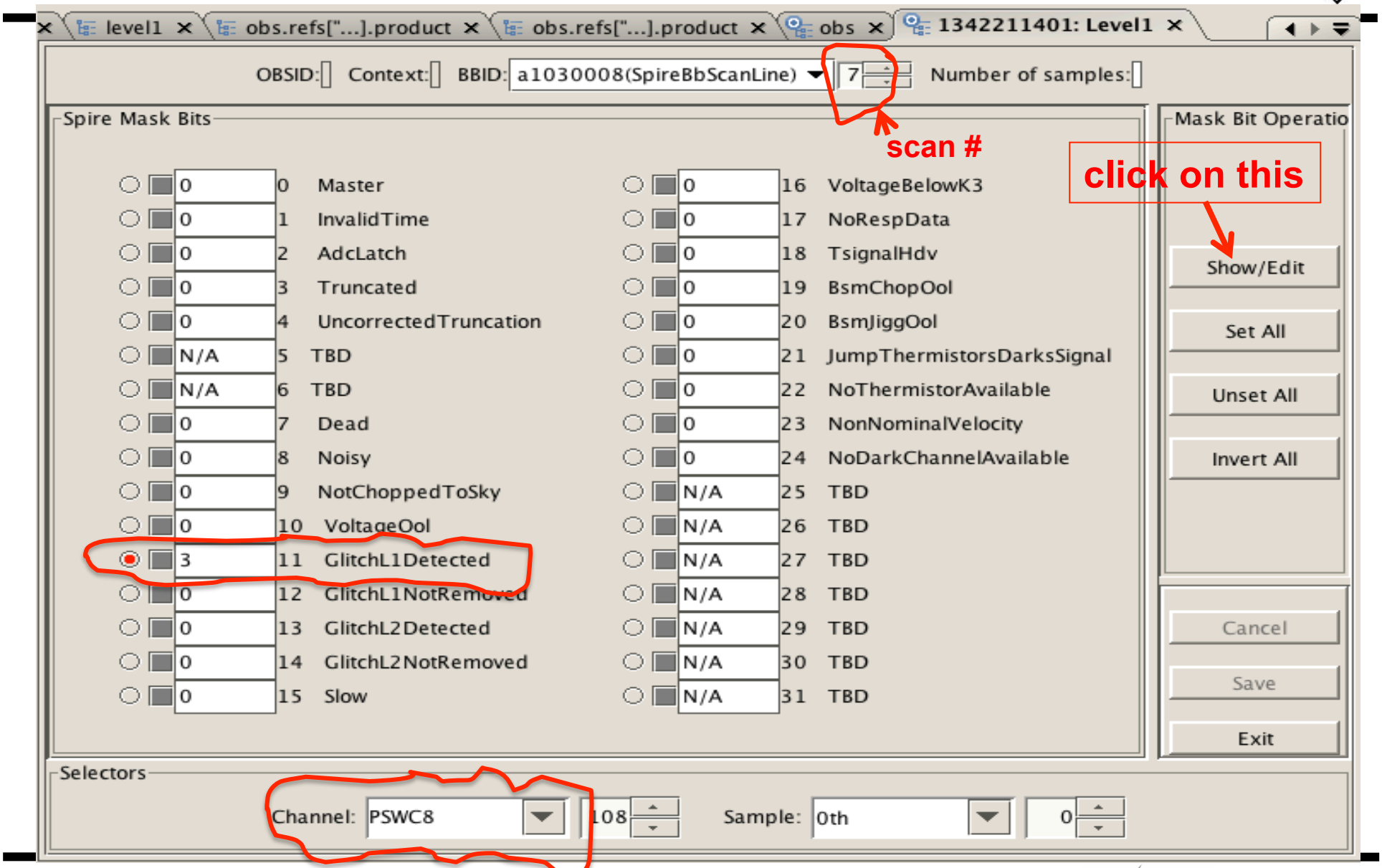


Mask glitches with "Mask Editor"

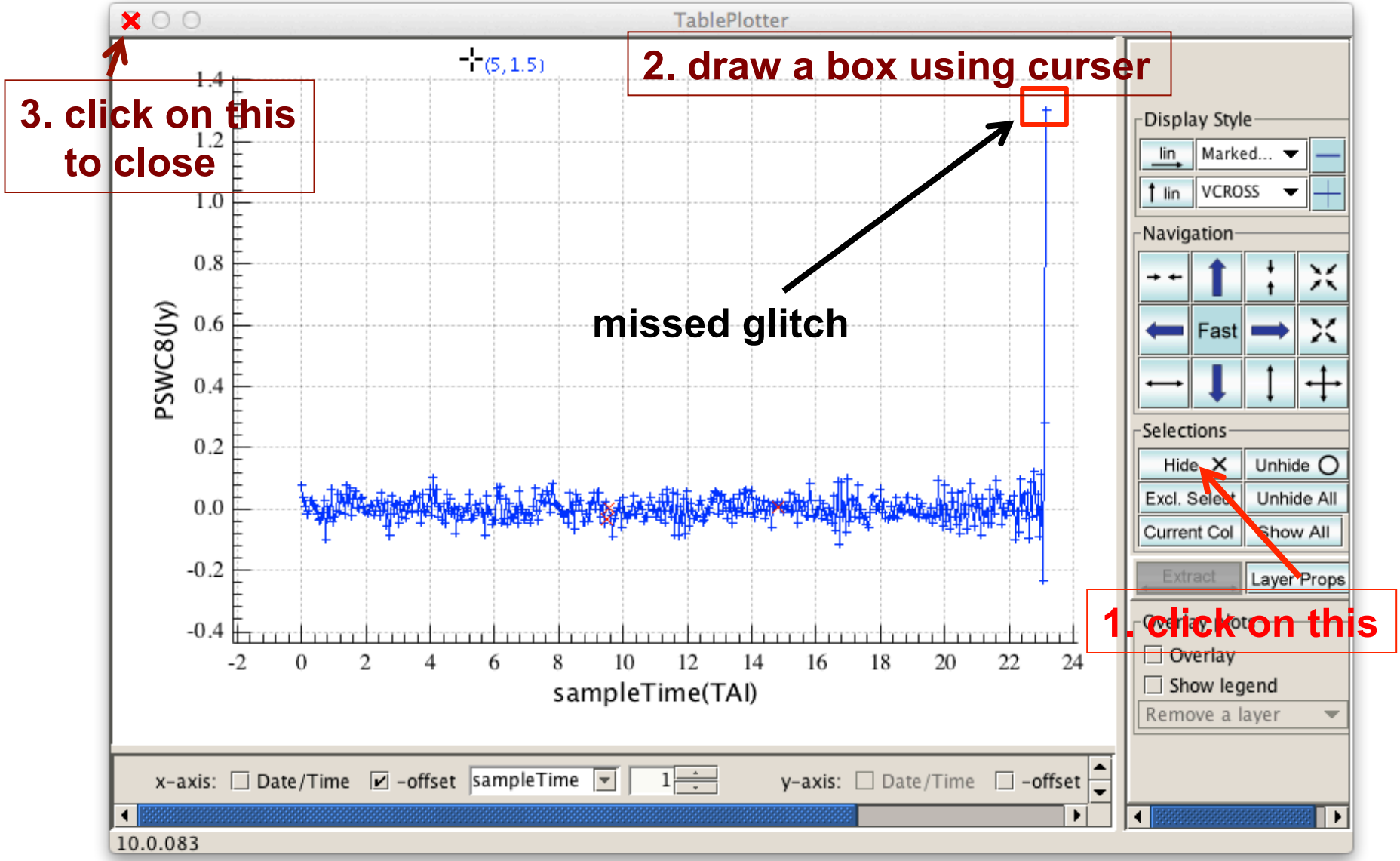
right-click on 'obs'



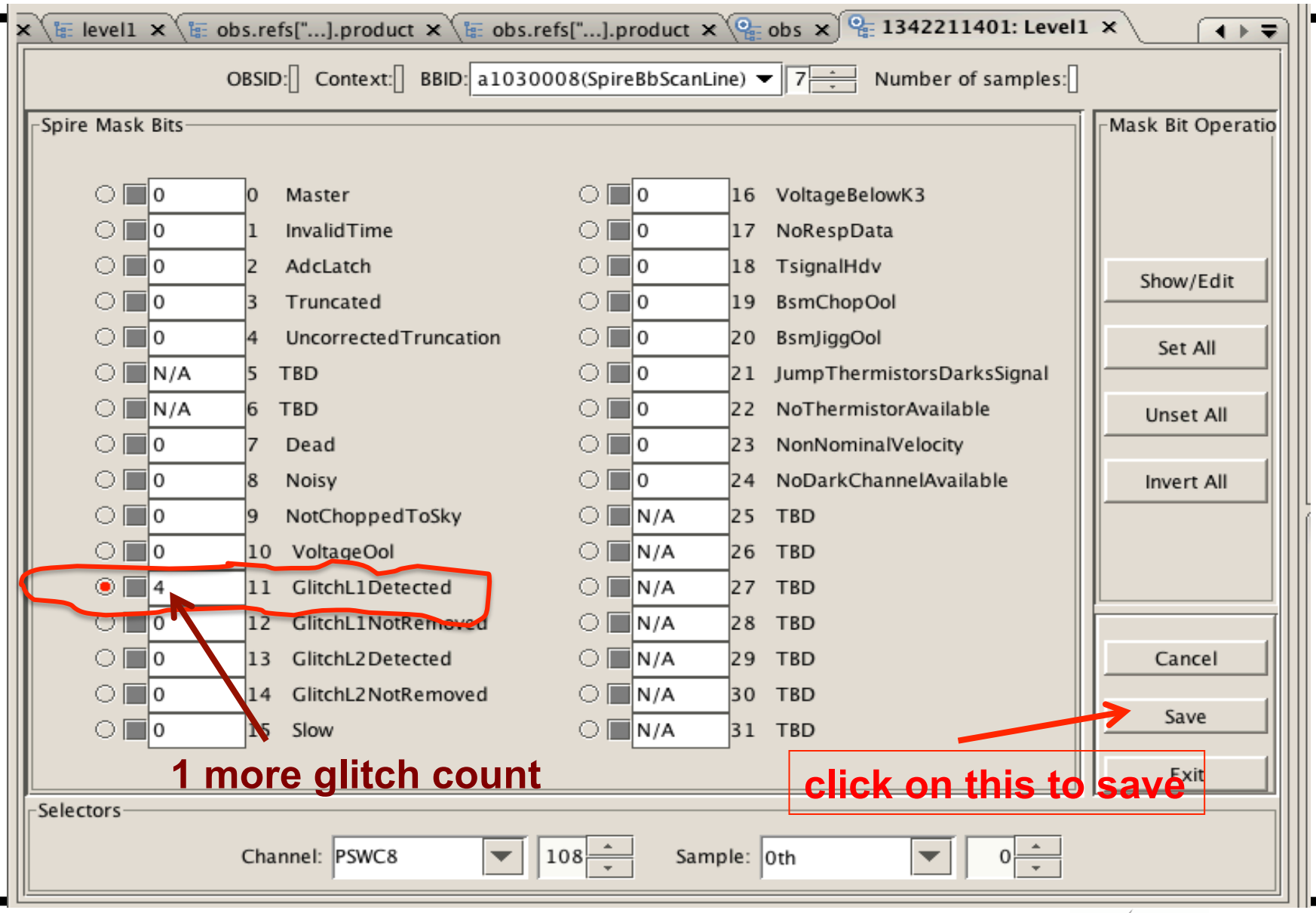
Mask glitches with "Mask Editor"



Mask glitches with "Mask Editor"



Mask glitches with "Mask Editor"



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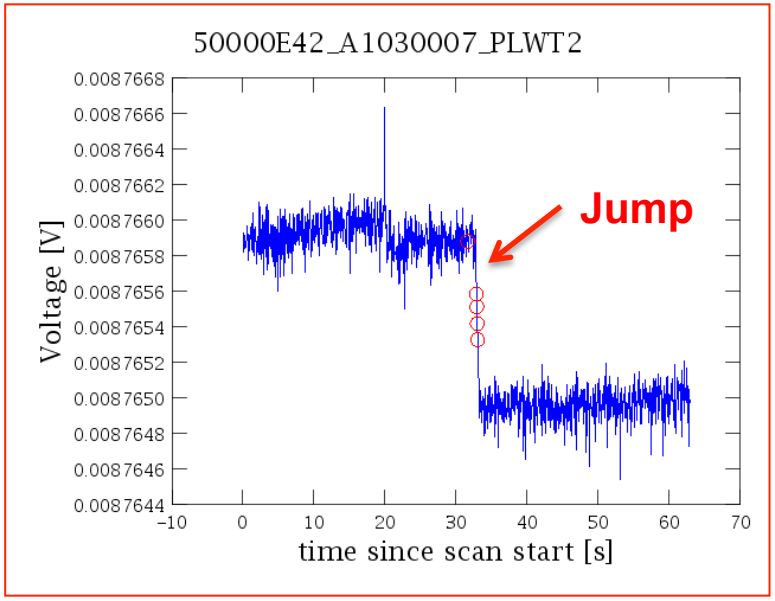
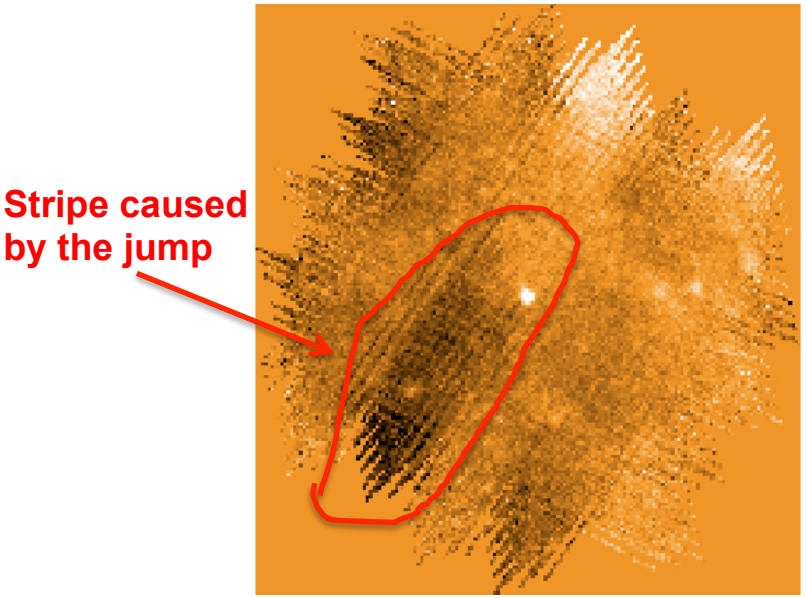
Thermistor Signal Jump

- Sudden spontaneous jump in a thermistor timeline.
- The average frequency is ~ 1/day.
- Effect: The pipeline uses thermistor timelines in the correction for detector signal drift due to temperature drift. A thermistor "jump" affects this correction, introducing artificial stripes in the final map.





- The automatic thermistor jump detector in the pipeline has a failure rate of ~ 3%.
- If you see a broad stripe such as that in the example, you need to reprocess the data (mask the affected thermistor manually using Mask Editor).

Summary

- The new flux calibration implemented in HIPE 11 causes ~ 1-2 % changes in the flux measurements obtained using SPIRE Photometer arrays. Currently, the HIPE version of SPIRE data downloaded from HSA is v10.3. In order to get the data with the new calibration, one can either do On-Demand Reprocessing using HSA, or reprocess the data using one of the User Pipeline scripts found in HIPE 11 and the new SPIRE calibration tree "spire_cal_11" (both HIPE 11 and "spire_cal_11" are provided in this workshop).
- "Cooler Burp" effect is arguably *the* most serious issue that has remained uncorrected in SPIRE Photometer data produced by current (HIPE 11) Standard Pipeline. It can be corrected using User Pipelines. It shall be corrected automatically in HIPE 12 Standard Pipeline according to the plan.
- The glitches missed by the pipeline degltichers can be identified and masked interactively using HIPE tools "Bolometer Finder" & "Mask Editor".
- Map stripes caused by thermistor signal jumps that missed by the Thermistor Jump Detector in the standard pipeline can be corrected by reprocessing the data using User Pipelines with the affected thermistor masked using "Mask Editor".