



# Issues with Photometer Data & How to Resolve them with HIPE Tools

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on behalf of the SPIRE ICC



# Known Issues

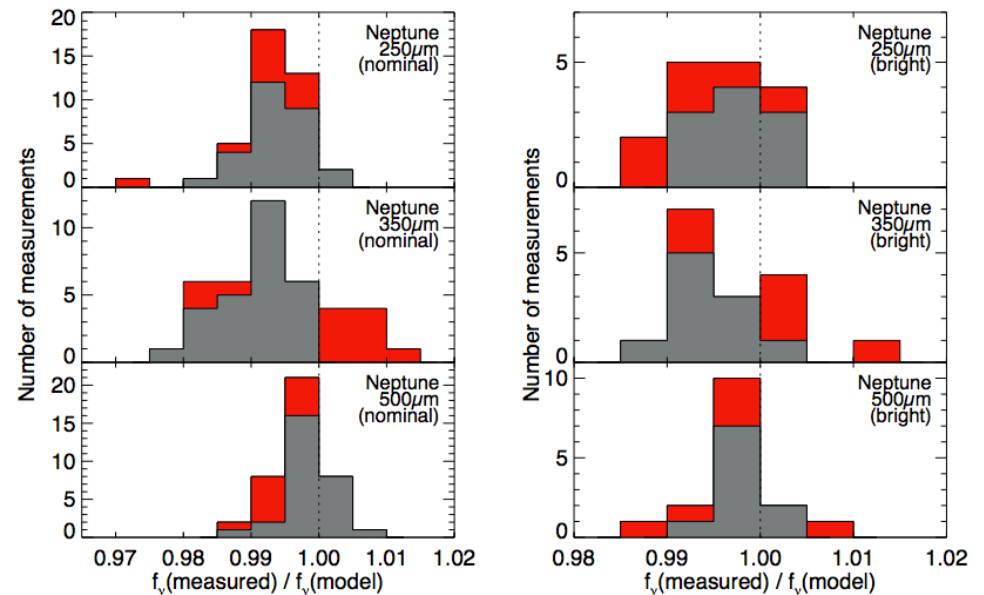
- New Flux Calibration in HIPE 11
- “Cooler Burps”
- Glitches
- Missed Thermistor Signal Jumps

**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](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:  $\sim 1 - 2 \%$ .
  - 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  $\sim 4\%$  ([Bendo et al. 2013 in press. arXiv:1306.1217](#))



## Reprocess with new calibration

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

The screenshot shows the HSA Science Archive v4.3.1 interface. The 'Shopping Basket' tab is active, and the 'On Demand Reprocessing' option is selected. A table lists one observation: 1342202246, Alpha Cet, with RA 03h 02m 17.92s and DEC +04d 05' 52.25". The 'Submit Request' button is highlighted.

Observation	Target Name	RA	DEC
1342202246	Alpha Cet	03h 02m 17.92s	+04d 05' 52.25"



- Option 2: Reprocess using 'user pipeline' and new cal file (cal\_11)

The screenshot shows the HIPE 11.0.1 interface. The 'Pipelines' menu is open, listing various user pipelines. The 'Editor' window shows a script for a photometer pipeline. Red circles highlight the 'SPIRE' menu item and the user input fields in the script. An arrow points to the text 'The only mandatory user inputs'.

```
52 #####
53 # (A) Specify the name of the observation
54 # (B) the name of the data pool
55 # (C) specify the name of the output directory
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
66 includeTurnaround = False
67 applyExtendedEmissionGains = False
68 useBaselineSubtraction = False
69 useDestriper = True
70 coolerBurpDetection = False
71 #####
72 ## Load in an observation context from your data pool into HIPE:
73 #obs=getObservation(myObsid,useHsa=True,instrument="SPIRE") # from the H
74 obs=getObservation(myObsid,poolName=myDataPool,instrument="SPIRE") # from a pool
75
76 print
77 print "Processing observation %i (0x%X)"%(myObsid, myObsid)
78
79 #####
80 # Calibration Context and Calibration Files
81 # read the latest calibration tree relevant to HCSS v11 from the local disc:
82
83 cal = spireCal(pool="spire_cal_11_0")
84
```

The only mandatory user inputs



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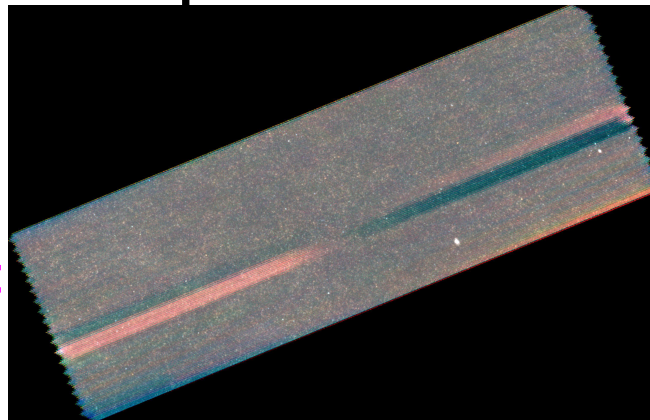
# “Cooler Burp”



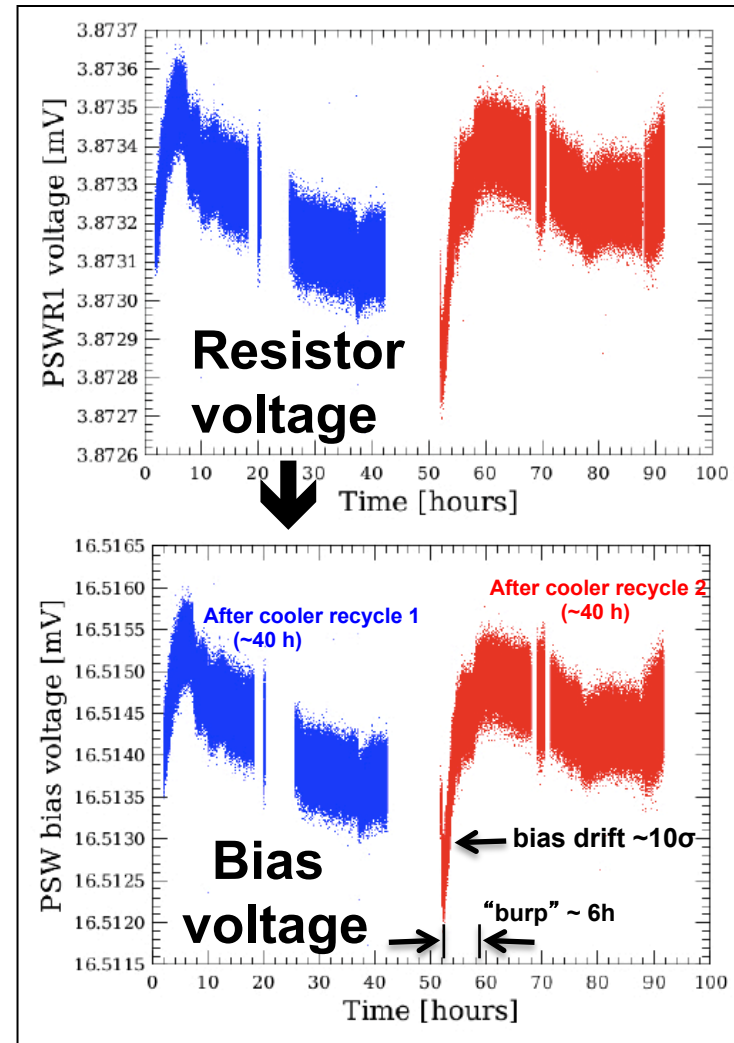
- Every time when SPIRE is switched on after a cooler recycle, the first ~6 h sees rapid drifts of the temperature and of the bias voltage.
- It causes abnormal drifts in detector timelines, which in turn cause stripes in maps observed during the “cooler burp” period.

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.





## User pipeline

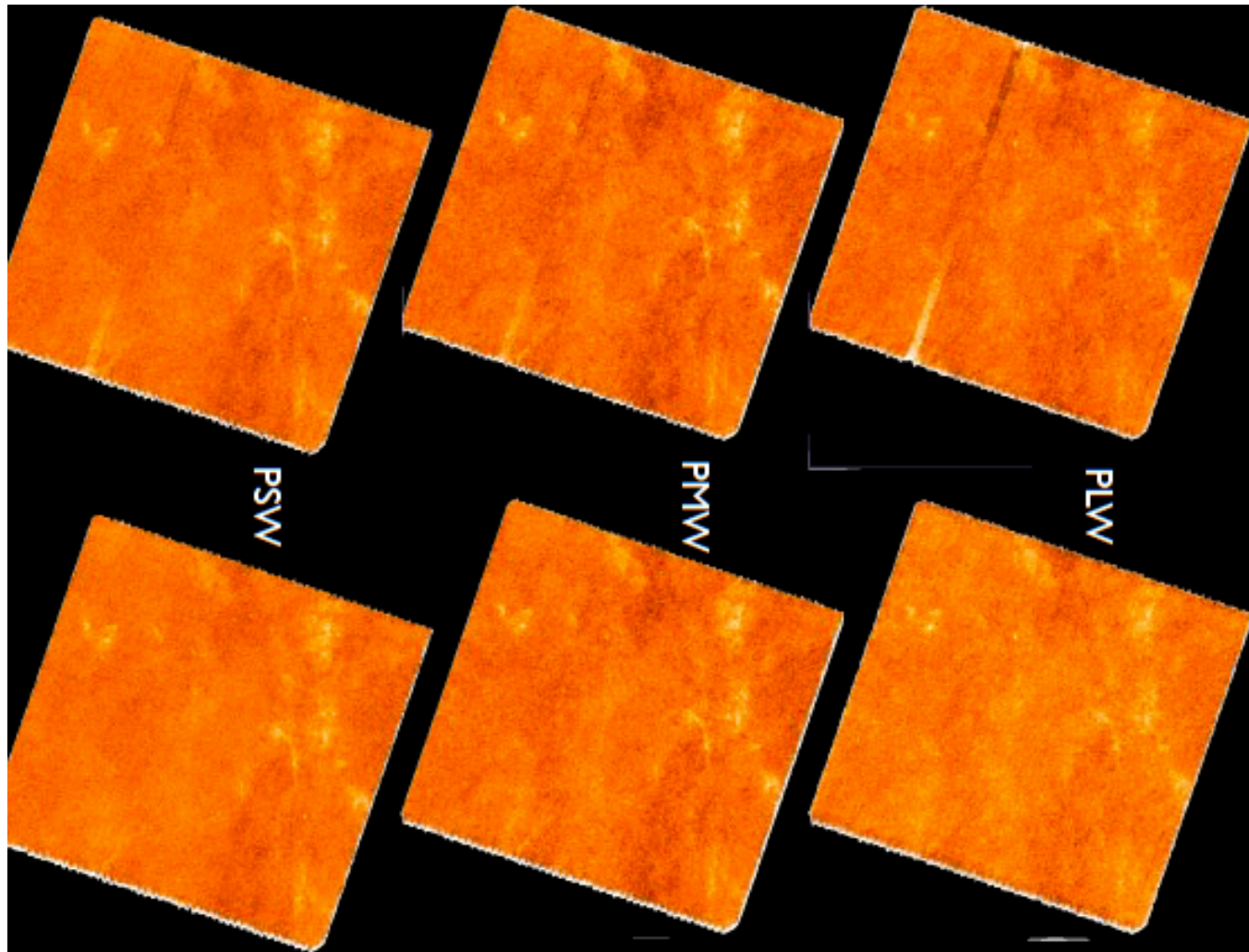
```
Editor x
*Photomete...peline.py x
50 #####
51 ### User Selectable Options ###
52 #####
53 # (A) Specific OBSID in the form of an integer or hexadecimal (0x) number:
54 # (B) the name of the data Pool in your Local Store:
55 # (C) Specify the output directory for writing the maps FITS files:
56 #
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
```





An example for results of the Cooler-Burp correction:

before correction →



after correction →



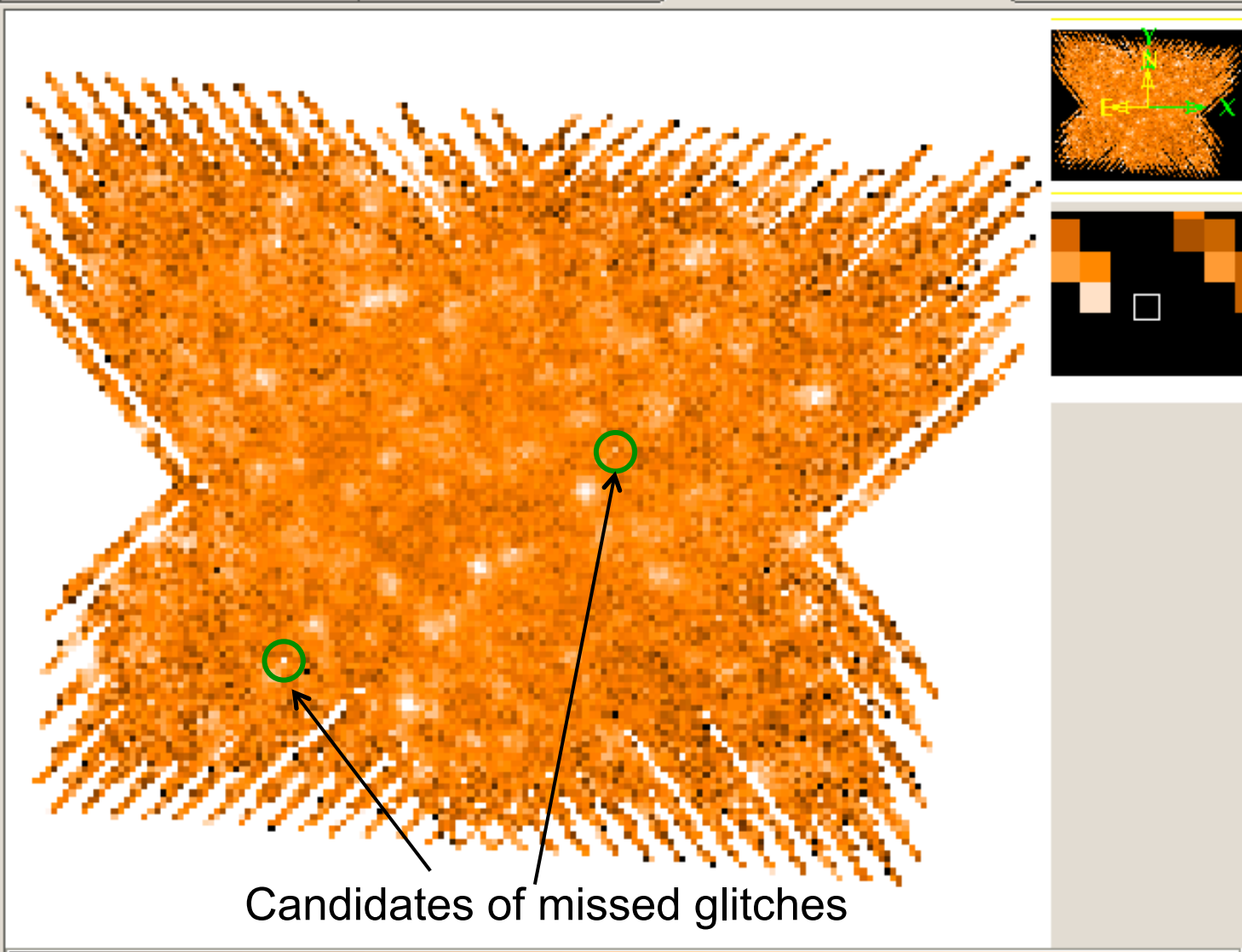
# Known Issues

- New Flux Calibration in HIPE 11
- “Cooler Burps”
- **Glitches**
- Missed Thermistor Signal Jumps

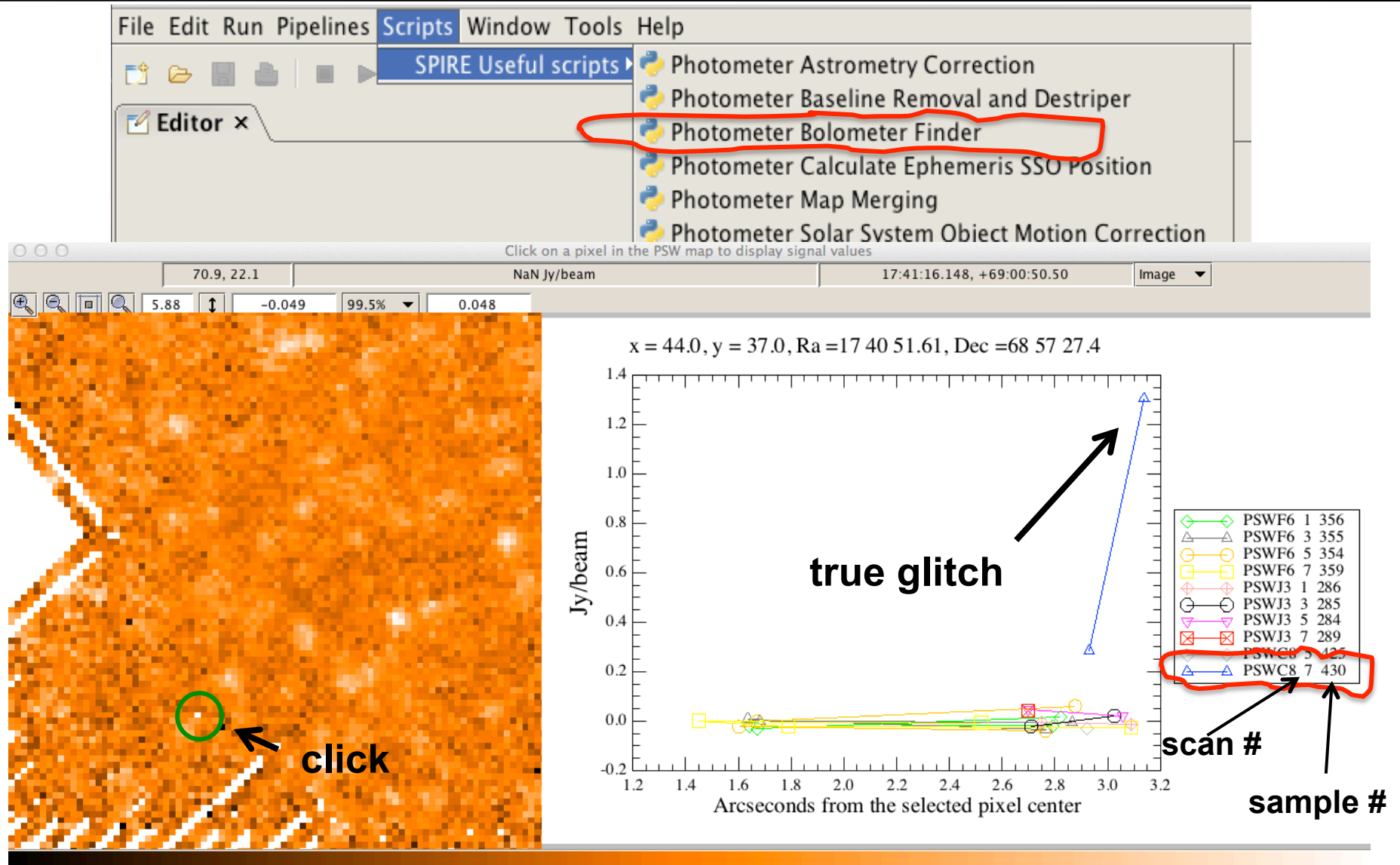
# Glitches



- 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”





right-click on ‘obs’

**Browse Product**

Summary

AOR label: Calibration\_cycle29\_1-SPhoto-SmallIM-Rep4-DarkSky - 0001  
Instrument: SPIRE      Obs. ID: 1342211401  
Object: Dark Sky      Obs. Date: 2010-12-22T11:03:02Z  
AOT: Photometer      Obs. Mode: Small Map  
RA Nominal: 17h 40m 12s      Dec. Nominal: 69° 0' 0"  
SPG Version: SPG v10.3.0      Operational Day: 587

Meta Data

Data

- obs
  - History
  - auxiliary
  - browseImageProduct
  - browseProduct
  - calibration
  - level0
  - level0\_5
  - level1
  - level2
  - logObsContext
  - quality

obs.refs["browseProduct"].product

Observations

- signalJumpDetector
- simpleFitsReader
- simpleFitsWriter
- smooth
- smoothBaseline

Product Viewer  
Context Viewer  
Level0\_5 SpireMaskEditor  
**Level1 SpireMaskEditor**  
Observation Viewer

sourceFitting  
sourceFlux  
sourceSubtractor  
specApplyBrightGain  
specApplyPcalGain  
specExtendedFluxConversion  
specNonLinearityCorrection  
specOptCrossCorrection  
specPointFluxConversion  
SpectrumFitterGUI  
spiaCalCopyHsa  
spiaCopyHsa  
spiaLevel05  
spiaLevel1

# Mask glitches with “Mask Editor”



OBSID: Context: BBID: a1030008(SpireBbScanLine) 7 Number of samples:

Spire Mask Bits

<input type="radio"/>	0	0	Master
<input type="radio"/>	0	1	InvalidTime
<input type="radio"/>	0	2	AdcLatch
<input type="radio"/>	0	3	Truncated
<input type="radio"/>	0	4	UncorrectedTruncation
<input type="radio"/>	N/A	5	TBD
<input type="radio"/>	N/A	6	TBD
<input type="radio"/>	0	7	Dead
<input type="radio"/>	0	8	Noisy
<input type="radio"/>	0	9	NotChoppedToSky
<input type="radio"/>	0	10	VoltageOol
<input checked="" type="radio"/>	3	11	GlitchL1Detected
<input type="radio"/>	0	12	GlitchL1NotRemoved
<input type="radio"/>	0	13	GlitchL2Detected
<input type="radio"/>	0	14	GlitchL2NotRemoved
<input type="radio"/>	0	15	Slow
<input type="radio"/>	0	16	VoltageBelowK3
<input type="radio"/>	0	17	NoRespData
<input type="radio"/>	0	18	TsignalHdv
<input type="radio"/>	0	19	BsmChopOol
<input type="radio"/>	0	20	BsmJiggOol
<input type="radio"/>	0	21	JumpThermistorsDarksSignal
<input type="radio"/>	0	22	NoThermistorAvailable
<input type="radio"/>	0	23	NonNominalVelocity
<input type="radio"/>	0	24	NoDarkChannelAvailable
<input type="radio"/>	N/A	25	TBD
<input type="radio"/>	N/A	26	TBD
<input type="radio"/>	N/A	27	TBD
<input type="radio"/>	N/A	28	TBD
<input type="radio"/>	N/A	29	TBD
<input type="radio"/>	N/A	30	TBD
<input type="radio"/>	N/A	31	TBD

Mask Bit Operation

Show/Edit

Set All

Unset All

Invert All

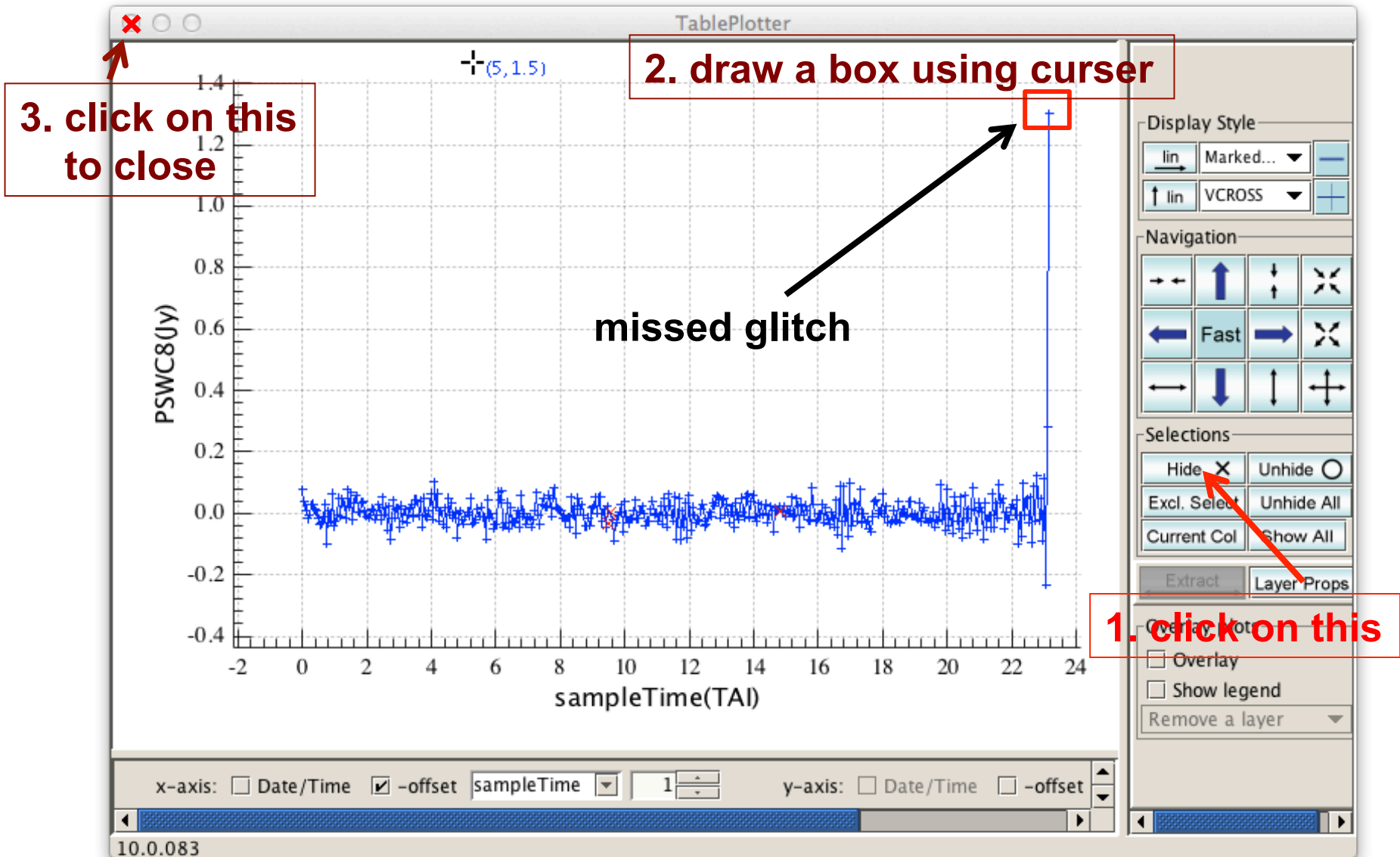
Cancel

Save

Exit

Selectors

Channel: PSWC8 108 Sample: 0th 0



# Mask glitches with “Mask Editor”



OBSID: Context: BBID: a1030008(SpireBbScanLine) 7 Number of samples:

Spire Mask Bits

<input type="radio"/>	0	0	Master	<input type="radio"/>	0	16	VoltageBelowK3
<input type="radio"/>	0	1	InvalidTime	<input type="radio"/>	0	17	NoRespData
<input type="radio"/>	0	2	AdcLatch	<input type="radio"/>	0	18	TsignalHdv
<input type="radio"/>	0	3	Truncated	<input type="radio"/>	0	19	BsmChopOol
<input type="radio"/>	0	4	UncorrectedTruncation	<input type="radio"/>	0	20	BsmJiggOol
<input type="radio"/>	N/A	5	TBD	<input type="radio"/>	0	21	JumpThermistorsDarksSignal
<input type="radio"/>	N/A	6	TBD	<input type="radio"/>	0	22	NoThermistorAvailable
<input type="radio"/>	0	7	Dead	<input type="radio"/>	0	23	NonNominalVelocity
<input type="radio"/>	0	8	Noisy	<input type="radio"/>	0	24	NoDarkChannelAvailable
<input type="radio"/>	0	9	NotChoppedToSky	<input type="radio"/>	N/A	25	TBD
<input type="radio"/>	0	10	VoltageOol	<input type="radio"/>	N/A	26	TBD
<input checked="" type="radio"/>	4	11	GlitchL1Detected	<input type="radio"/>	N/A	27	TBD
<input type="radio"/>	0	12	GlitchL1NotRemoved	<input type="radio"/>	N/A	28	TBD
<input type="radio"/>	0	13	GlitchL2Detected	<input type="radio"/>	N/A	29	TBD
<input type="radio"/>	0	14	GlitchL2NotRemoved	<input type="radio"/>	N/A	30	TBD
<input type="radio"/>	0	15	Slow	<input type="radio"/>	N/A	31	TBD

Mask Bit Operatio

Show/Edit

Set All

Unset All

Invert All

Cancel

Save

Exit

Selectors

Channel: PSWC8 108 Sample: 0th 0

1 more glitch count

click on this to save



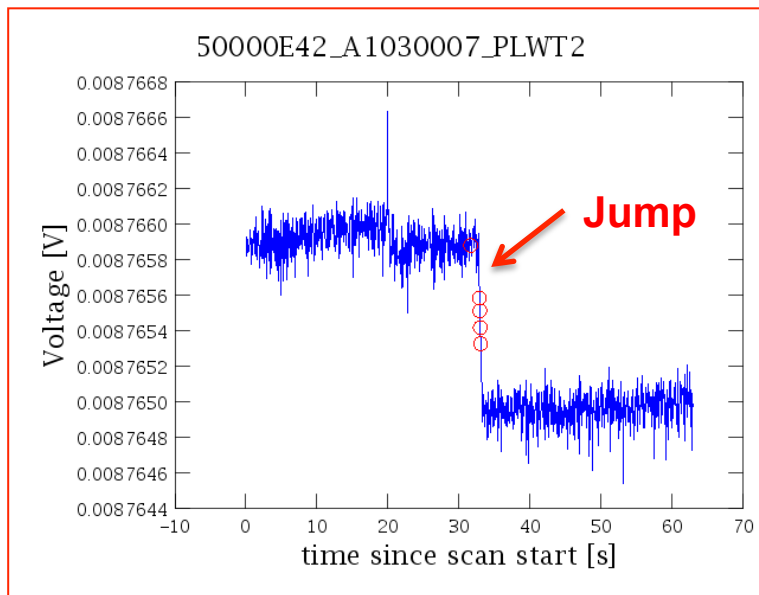


# Known Issues

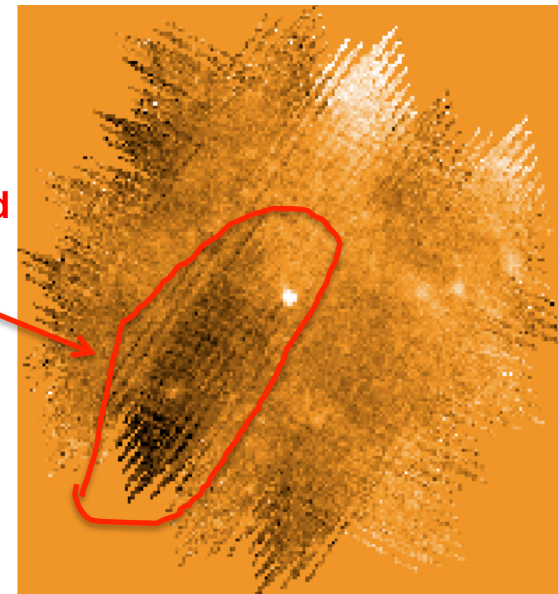
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- Sudden spontaneous jump in a thermistor timeline.
- The average frequency is  $\sim 1/\text{day}$ .
- Effect: The pipeline uses thermistor timelines in the correction for detector signal drift due to temperature drift. A thermistor “jump” affects this correction, introducing artificial stripes in the final map.



Stripe caused by the jump



- The automatic thermistor jump detector in the pipeline has a failure rate of  $\sim 3\%$ .
- 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”.