HIFI Data Inspection

NHSC DP workshop

26-30 August 2013

UNIVERSITY OF WATERLOO

uwaterloo.ca

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astro.uwaterloo.ca/HIFI/

CSA ASC

Documentation and Tour of the data

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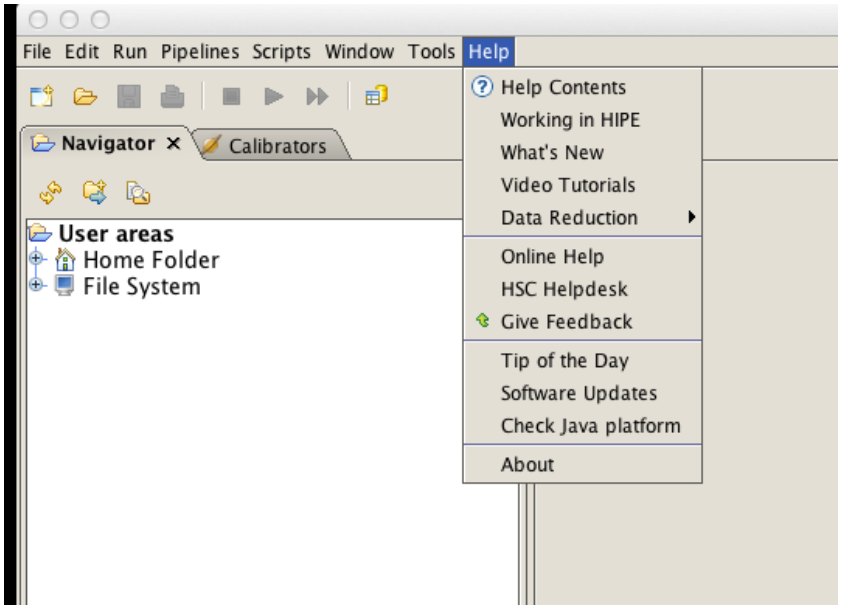
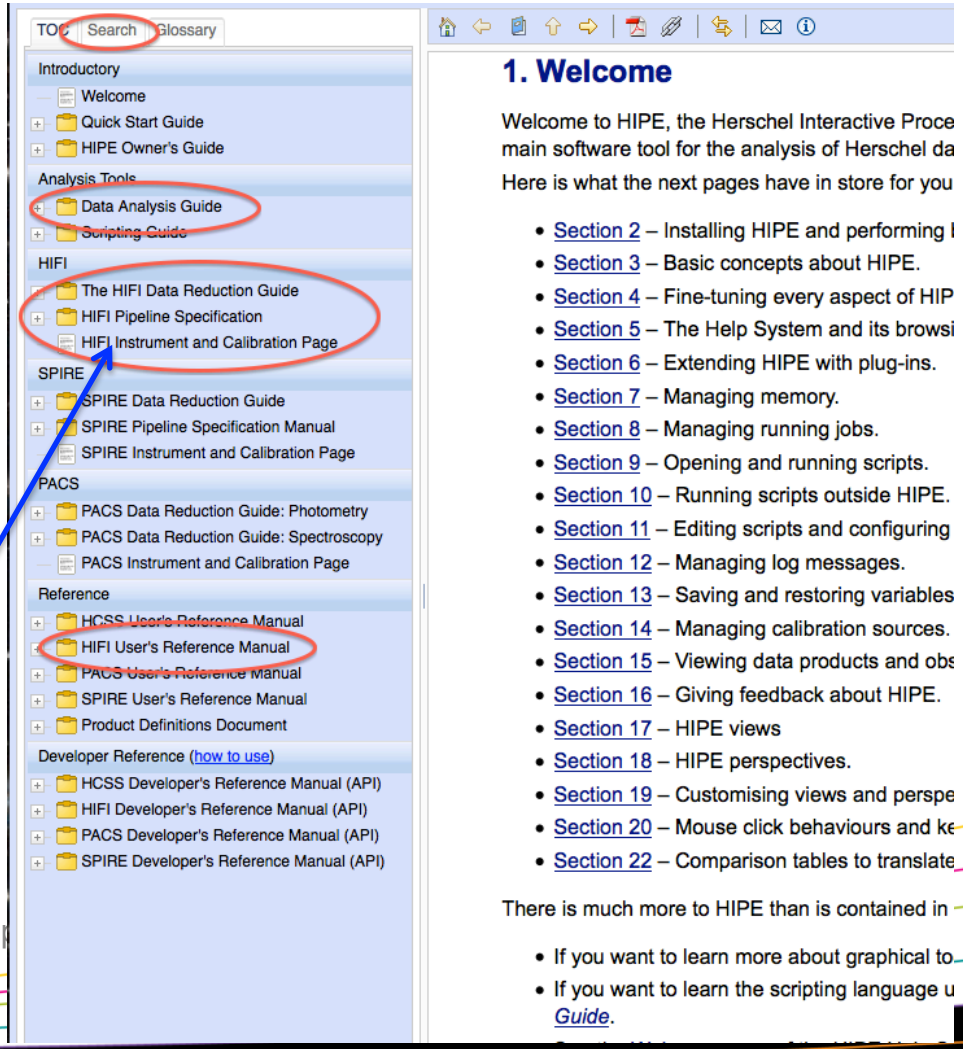
DOCUMENTATION

Access through HIPE

Or via http://herschel.esac.esa.int/hcss-doc-11.0/index.jsp#hifi_um:hifi-um



HIFI Instrument and Calibration www:
Known Issues, What's New in HIPE,
Calibration information…



TOUR OF THE DATA

- **Opening the Observation Context**
  - Tour of the various products
- **Common Issues**
  - Baseline offsets and slopes
  - Standing Waves
  - Spurs
  - Emission in the off position

- ❑ **HIFI Data Reduction Guide**
- ❑ **Data Analysis Guide**

ObservationContext

Recall

Various layers of science data, auxiliary data, and other information in a tree-like structure

Products: are like directories (and subdirectories)
Datasets: are the files in the directories

obs = getObservation("1342190183", poolName="1342190183")

(or from the Navigator window)

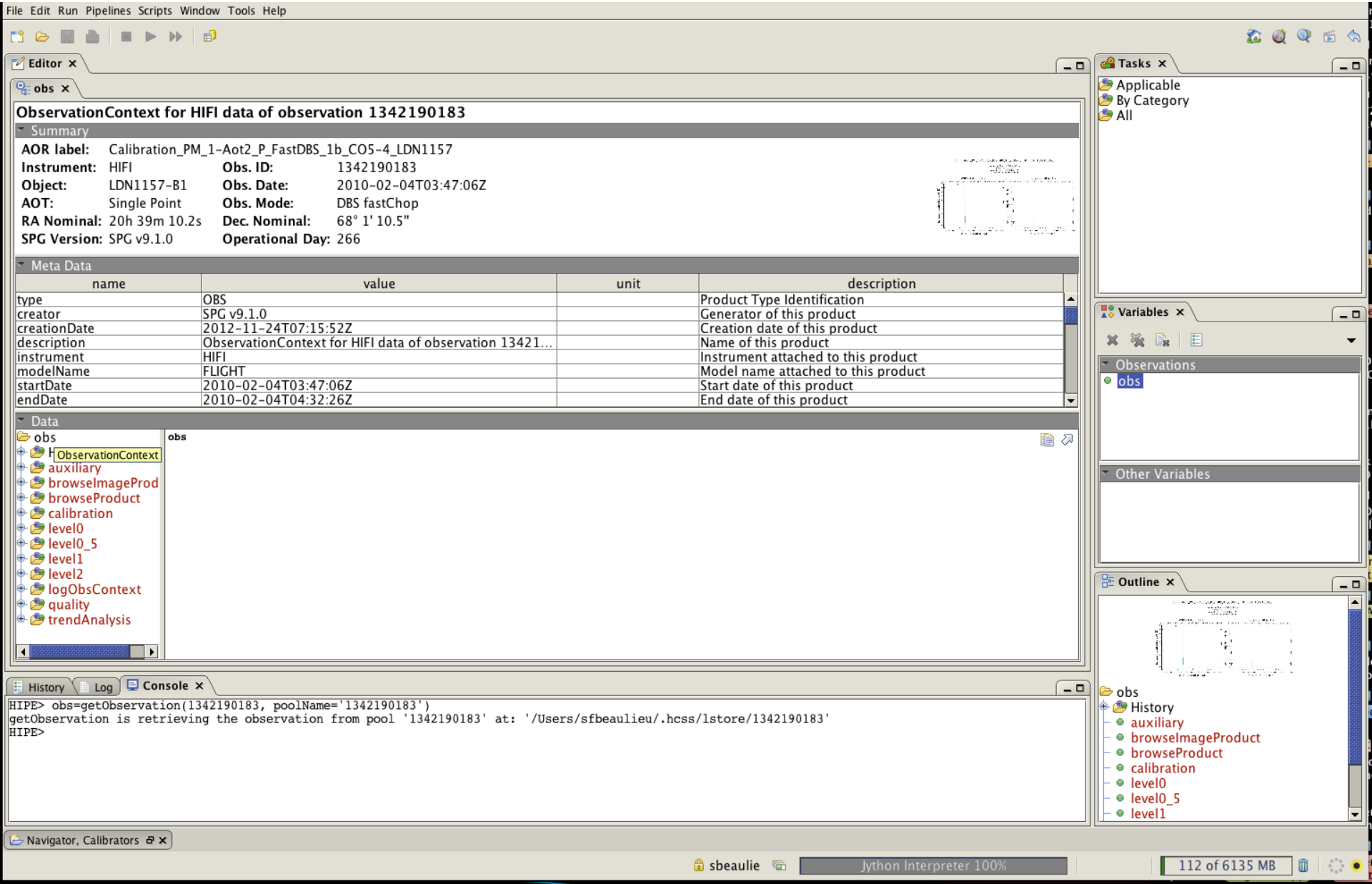
Then, select a product (double left-click)

HIPE GUI broken up into sections (with a menu (top bar))

- **Summary**
- **Meta data**
- **Dataset display tool**

Select your product called “obs” (double left-click)

Recall



The browse products: a quick look at the data

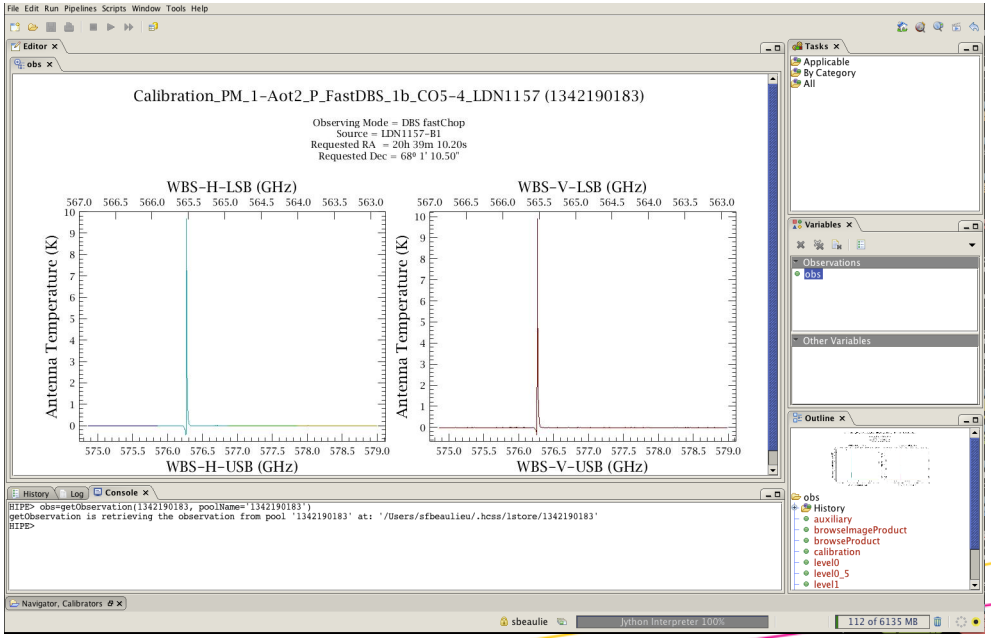
Automated extraction from the results of the standard pipeline.

Mapping Mode: - a sets of map-averaged Level 2 spectra + the integrated maps, for each subband

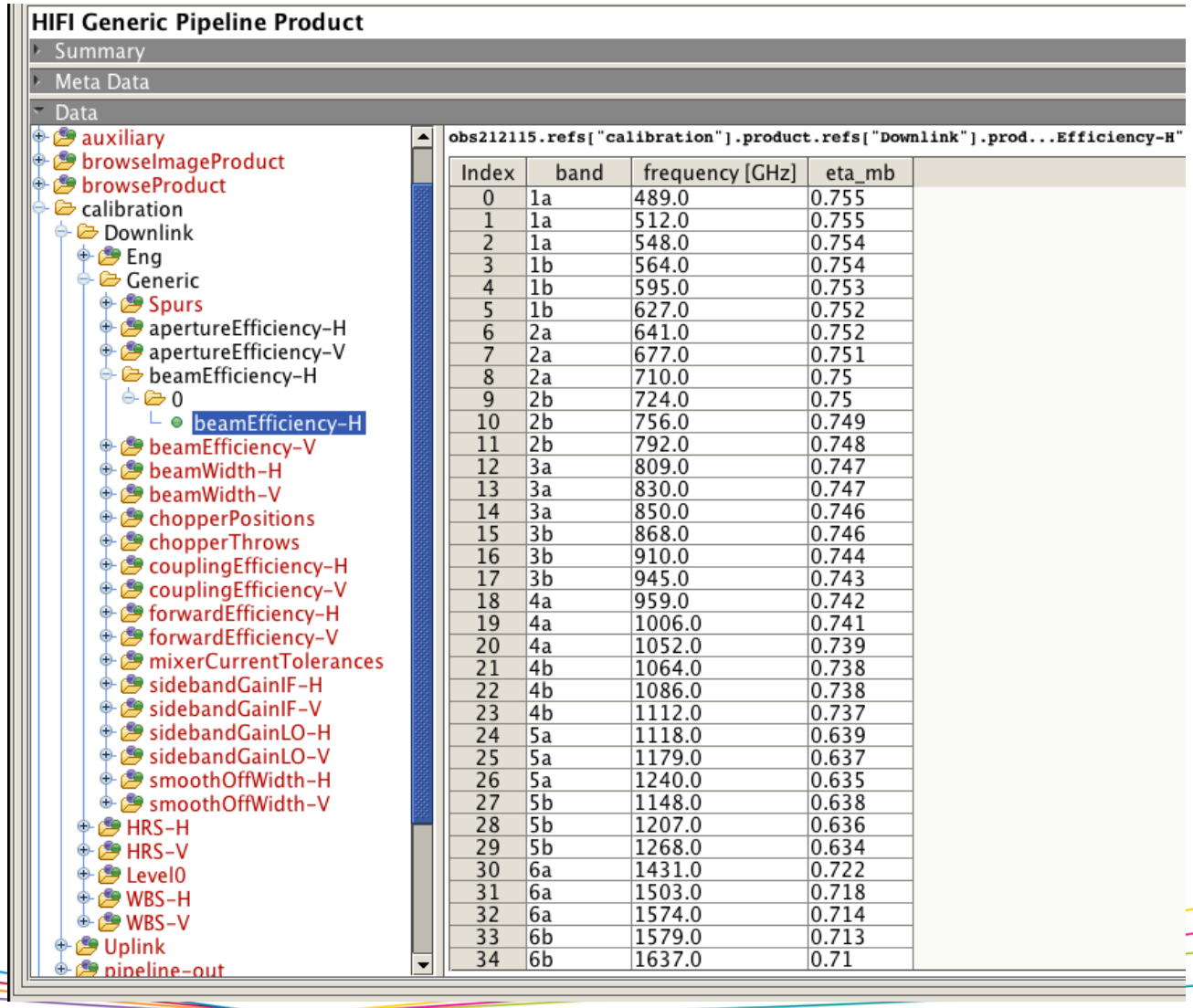
SScan: a single sideband solution after deconvolution of the Level 2 WBS spectra

Point Mode: 2 plots (H- and V-pol) of unstitched Level 2 WBS spectra

Note: Intensity scale is T_A (not in T_{MB})



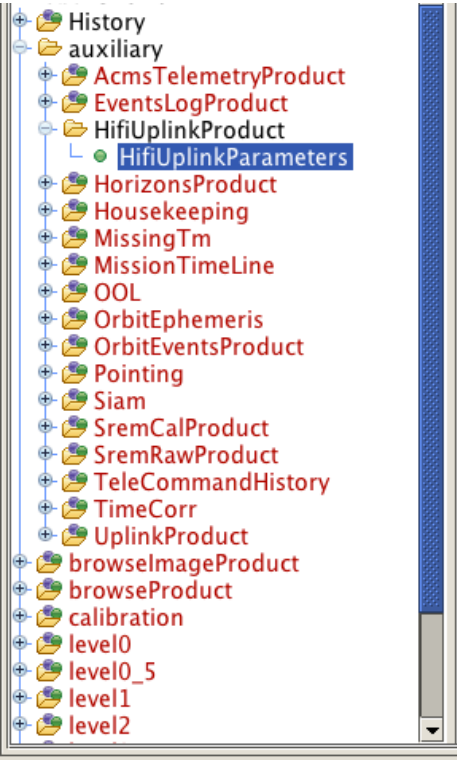
CalibrationContext: - the data passed to the pipeline for calibration (*Downlink*)
- the calibration files created by the pipeline (*Pipeline-out*)
- the information about how the data was carried out (*Uplink*)



Index	band	frequency [GHz]	eta_mb
0	1a	489.0	0.755
1	1a	512.0	0.755
2	1a	548.0	0.754
3	1b	564.0	0.754
4	1b	595.0	0.753
5	1b	627.0	0.752
6	2a	641.0	0.752
7	2a	677.0	0.751
8	2a	710.0	0.75
9	2b	724.0	0.75
10	2b	756.0	0.749
11	2b	792.0	0.748
12	3a	809.0	0.747
13	3a	830.0	0.747
14	3a	850.0	0.746
15	3b	868.0	0.746
16	3b	910.0	0.744
17	3b	945.0	0.743
18	4a	959.0	0.742
19	4a	1006.0	0.741
20	4a	1052.0	0.739
21	4b	1064.0	0.738
22	4b	1086.0	0.738
23	4b	1112.0	0.737
24	5a	1118.0	0.639
25	5a	1179.0	0.637
26	5a	1240.0	0.635
27	5b	1148.0	0.638
28	5b	1207.0	0.636
29	5b	1268.0	0.634
30	6a	1431.0	0.722
31	6a	1503.0	0.718
32	6a	1574.0	0.714
33	6b	1579.0	0.713
34	6b	1637.0	0.71

HifiUpLinkParameters Table

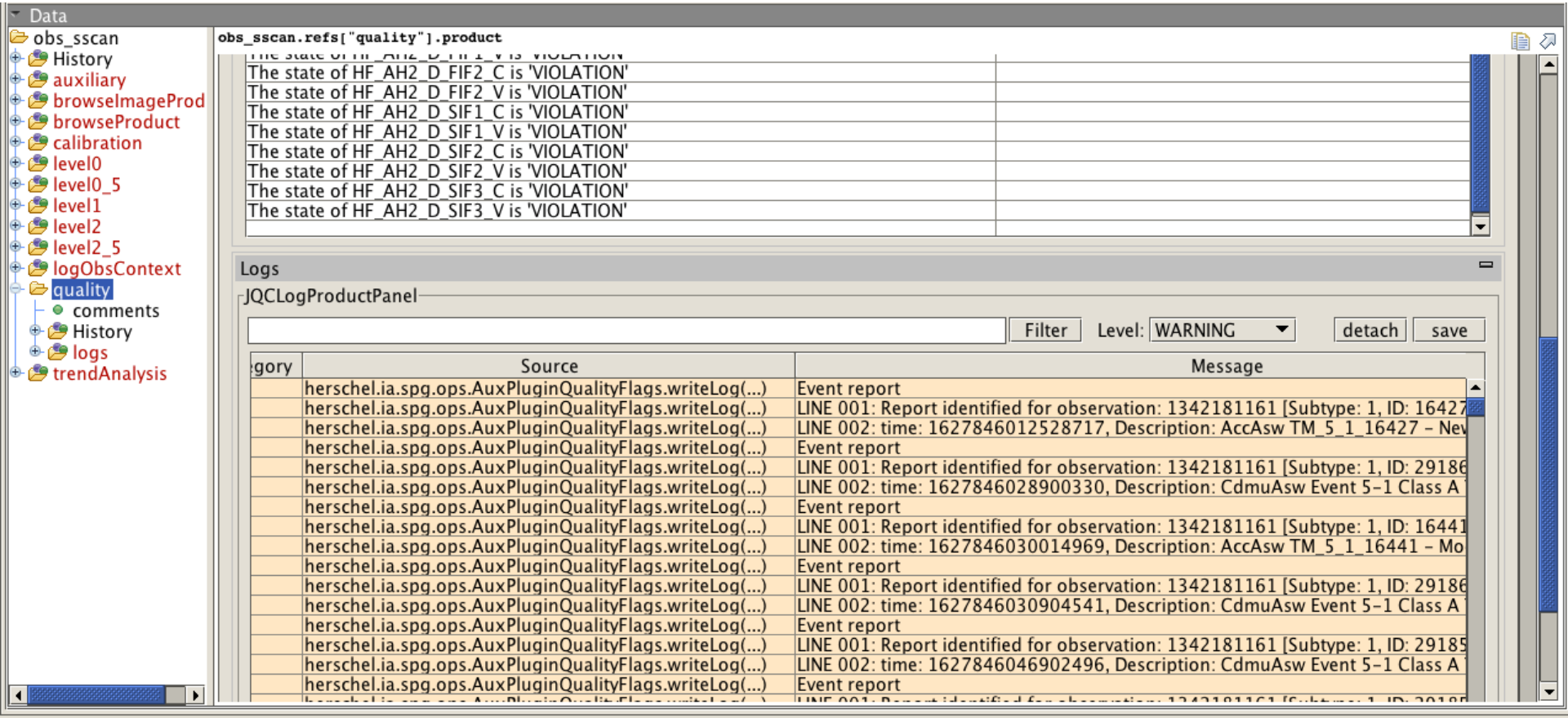
Provide information on how the observation was carried out
You will also find information on e.g. the predicted noise, goal RMS etc…



Index	name	value	unit	type	description
0	dbsChopFrequency	0.25	Hz	java.lang.Double	Chop frequency
1	dbsChopPhase	2.0	s	java.lang.Double	Chop phase length
2	hrsParMode	none		java.lang.String	HRS in parallel
3	loSettings	107		java.lang.Long	Number LO settings
4	loRangeStart	487.55359999999996	GHz	java.lang.Double	Actual LO range start
5	loRangeEnd	553.4390999999999	GHz	java.lang.Double	Actual LO range end
6	scanNoiseRefFrequency	520.49635	GHz	java.lang.Double	Noise reference frequency in scan rang
7	noiseDSBMin	0.074	K	java.lang.Double	Predicted DSB Noise at minimum bandv
8	noiseDSBMax	0.03	K	java.lang.Double	Predicted DSB Noise at maximum band
9	noiseSSBMin	0.026	K	java.lang.Double	Predicted Deconvolved SSB Noise at mi
10	noiseSSBMax	0.011	K	java.lang.Double	Predicted Deconvolved SSB Noise at ma
11	noiseMinWidth	1.617	MHz	java.lang.Double	Minimum bandwidth for noise predicti
12	noiseMaxWidth	10.517	MHz	java.lang.Double	Maximum bandwidth for noise predicti
13	tmbReference	123.0	K	java.lang.Double	Temperature (main beam) at noise refe
14	noiseRefFrequency	520.0	GHz	java.lang.Double	Noise reference frequency
15	observingTime	5459	s	java.lang.Long	Observing time
16	offTime	365.9	s	java.lang.Double	Off source time
17	overheadTime	4727.1	s	java.lang.Double	Overhead
18	totTimeEfficiency	13.4	%	java.lang.Double	Total time efficiency
19	totNoiseEfficiency	3.1	%	java.lang.Double	Total noise efficiency
20	driftNoiseContrib	6.08	%	java.lang.Double	Drift noise contribution
21	dbsContinuum	false		java.lang.Boolean	DBS continuum timing
22	goalNoise	0.02	K	java.lang.Double	Goal rms basline noise
23	fastChop	false		java.lang.Boolean	DBS fast chop
24	oneGHzReference	true		java.lang.Boolean	One GHz noise estimation bandwidth
25	doingTime	false		java.lang.Boolean	Time estimation is based on observing

Quality Reports: quality flags, logs, and control report history

You should worry about “SEVERE”



Level 2.5

You will find this level in two of the three observing modes:

Mapping mode – in the form of data cubes called *cubesContexts*

SScan (Spectral Scan) – in the form of a deconvolution Context called *myDecon*

Point mode do not have a Level 2.5

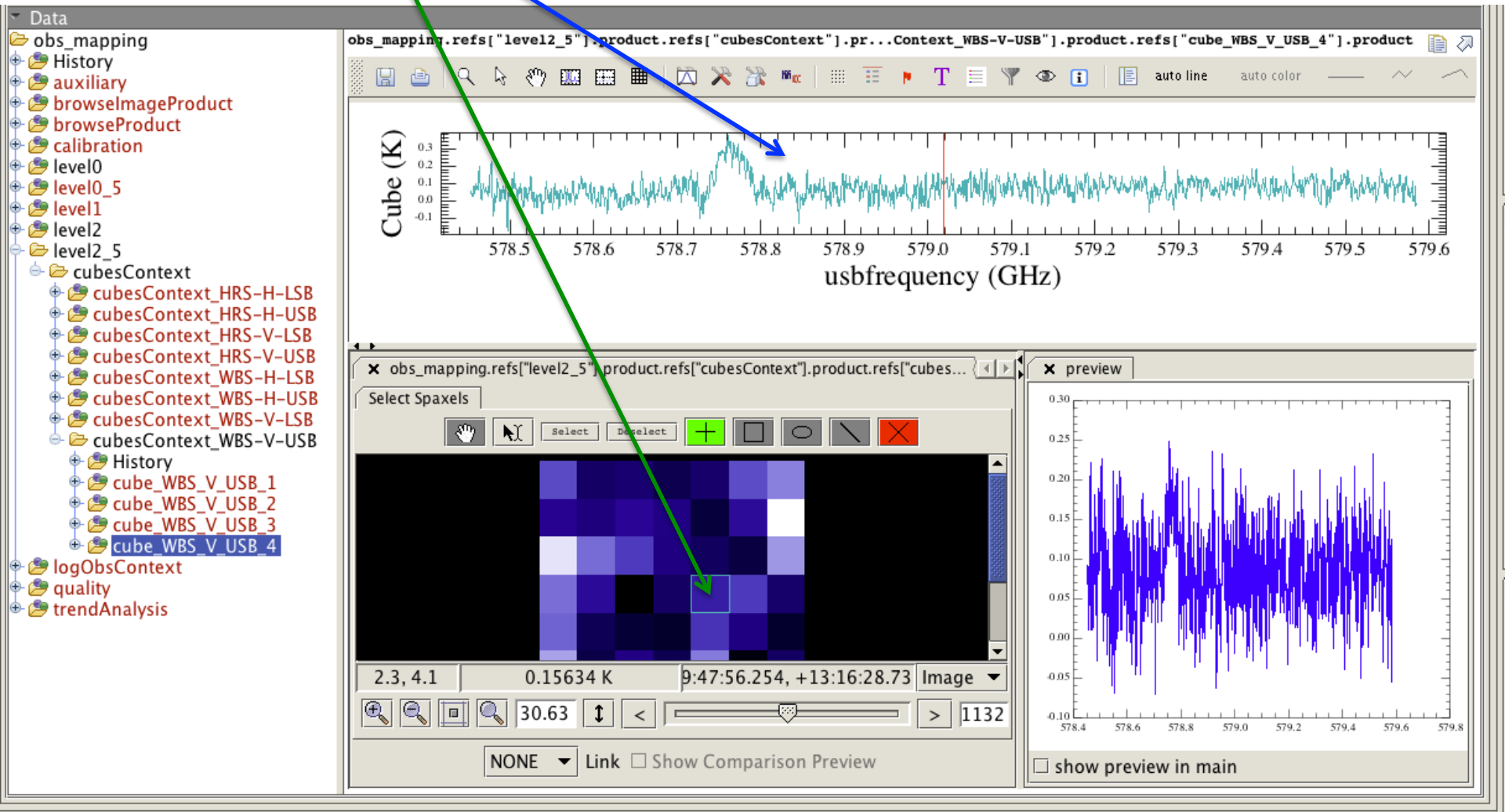
Note that corrections such as standing waves and baseline drifts are not performed through the pipeline. These must be preformed at the Level 2 by you, and then, you must perform **doGridding** (for Mapping Mode) and **doDeconvolution** (for SScan) to obtain your corrected cubesContext and myDecon Context. (*demo of doGridding and doDeconvolution later today*)

Level 2: science data calibrated but…

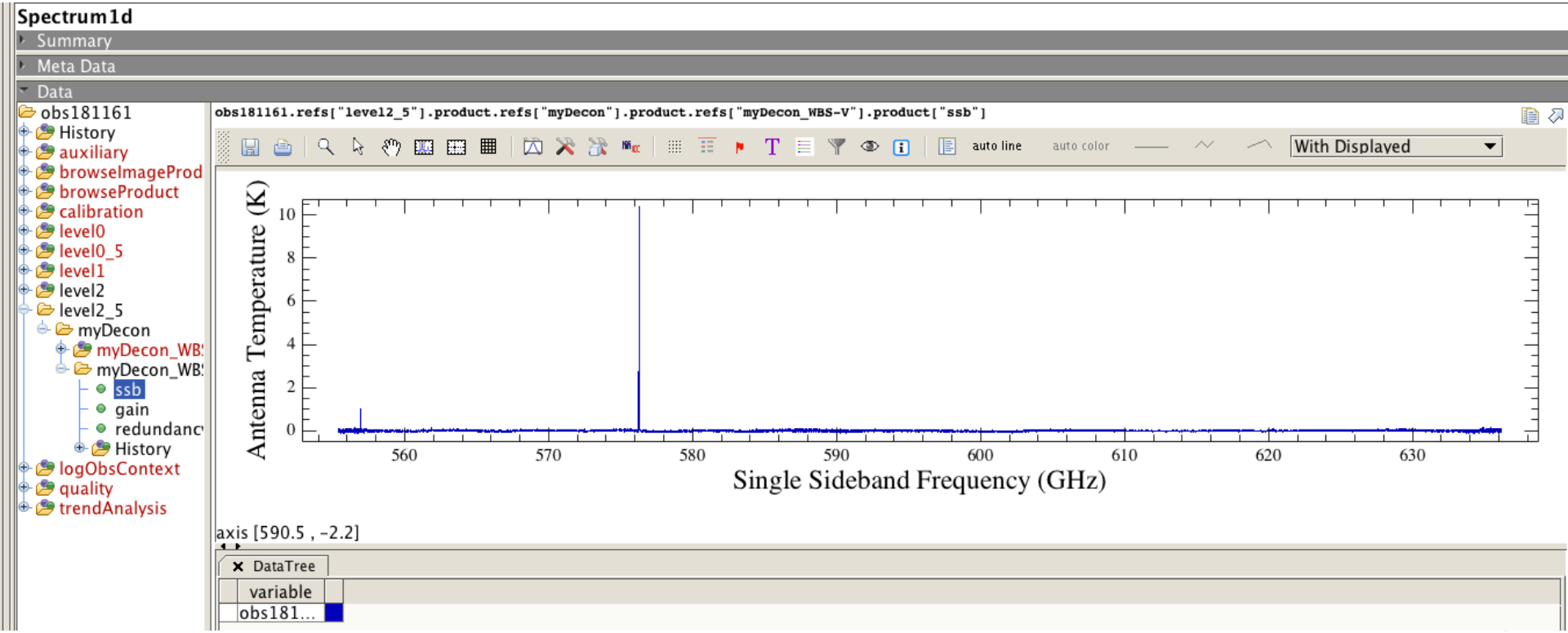
Must perform flagging, if needed, removal of standing waves, baseline fit (for drifts)… (*demo later today*)

Level 2.5: Mapping mode

Spectrum from a selected spaxel

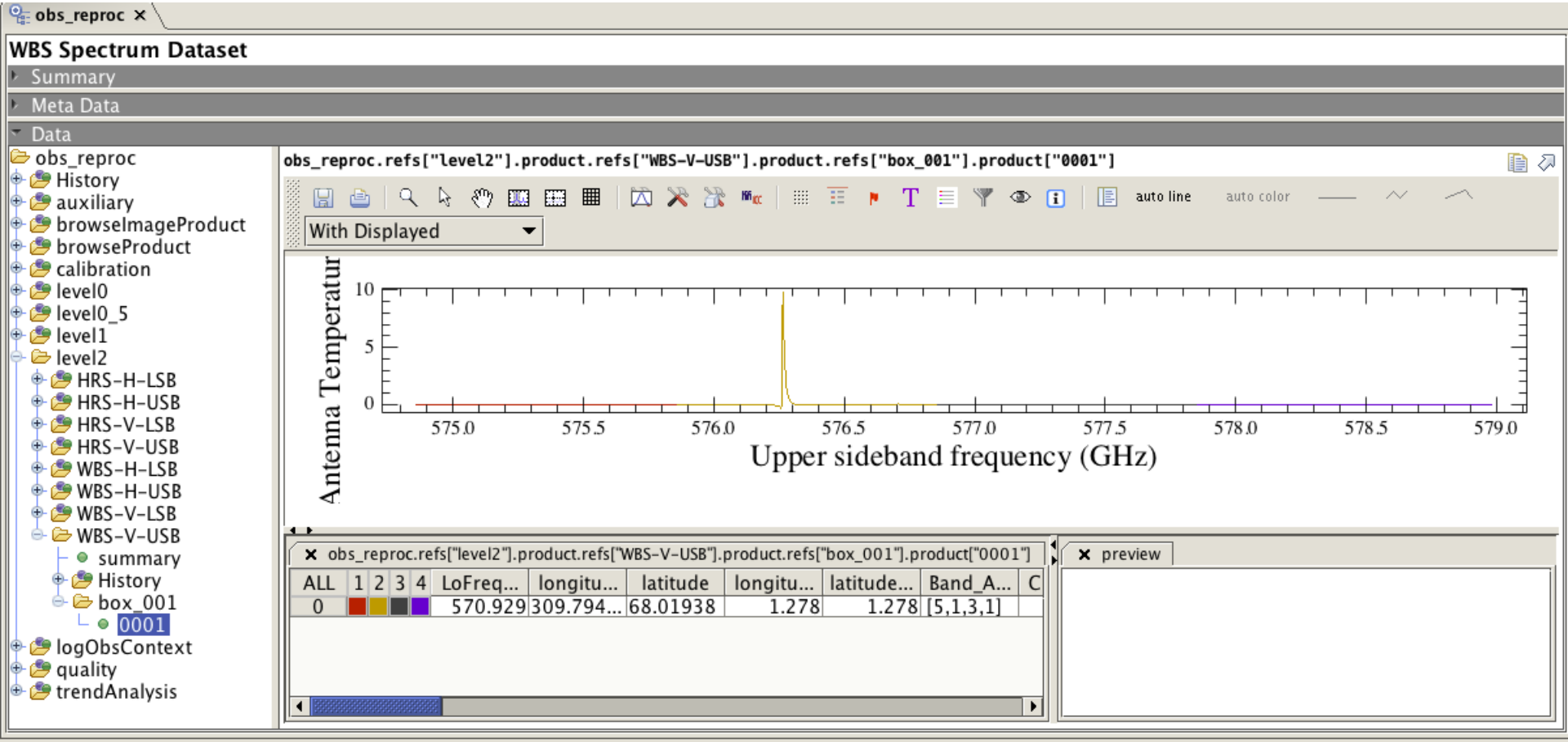


Level 2.5: Spectral Scan (SScan) deconvolution solution



Level 2: science data calibrated but…

flagging, if needed, removal of standing waves, baseline fit (for drifts)…
(demo later today)



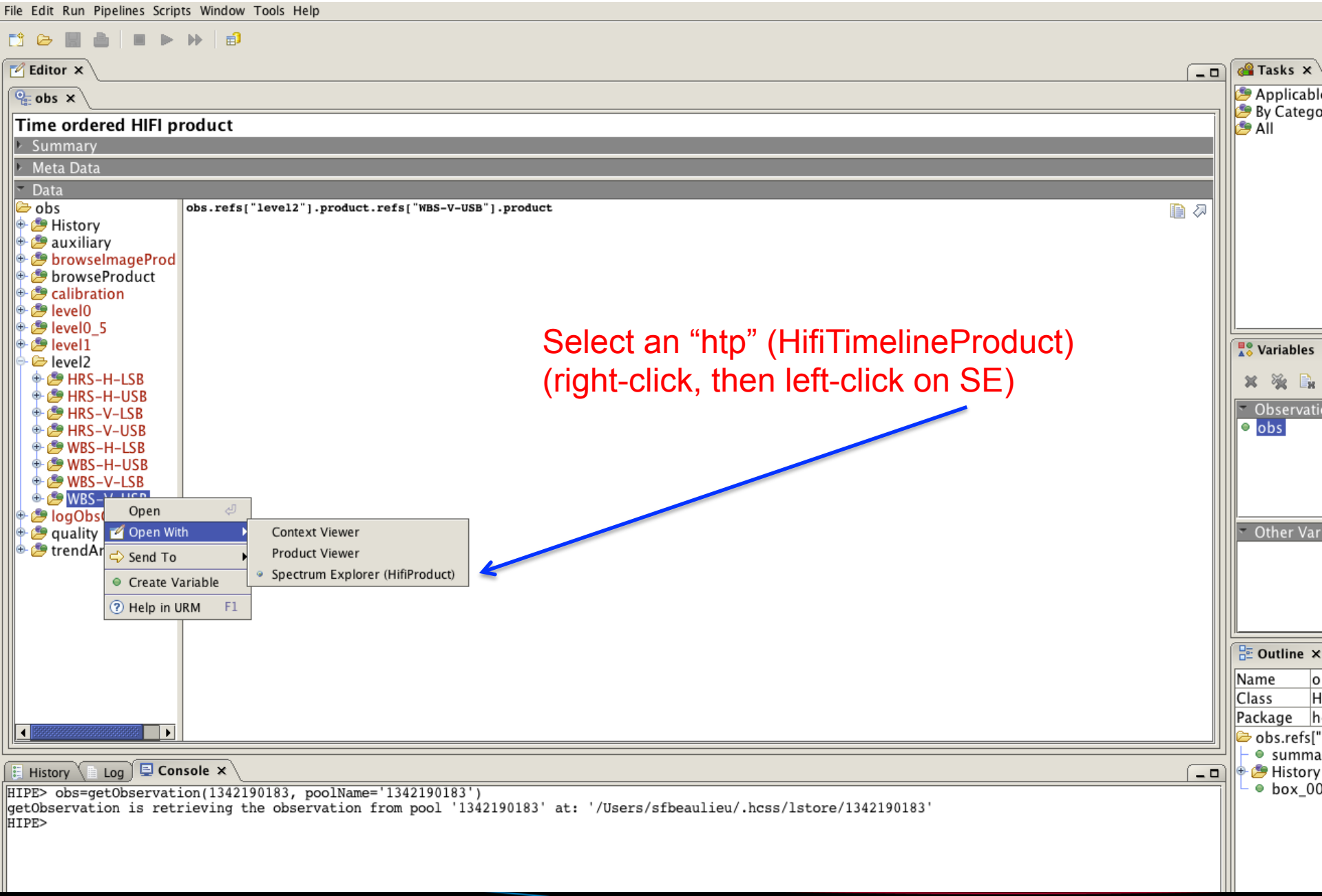
Saving products into Variables:

Recall

left-click to select an htp
right-click to open the menu
select “Create variable” with left-click

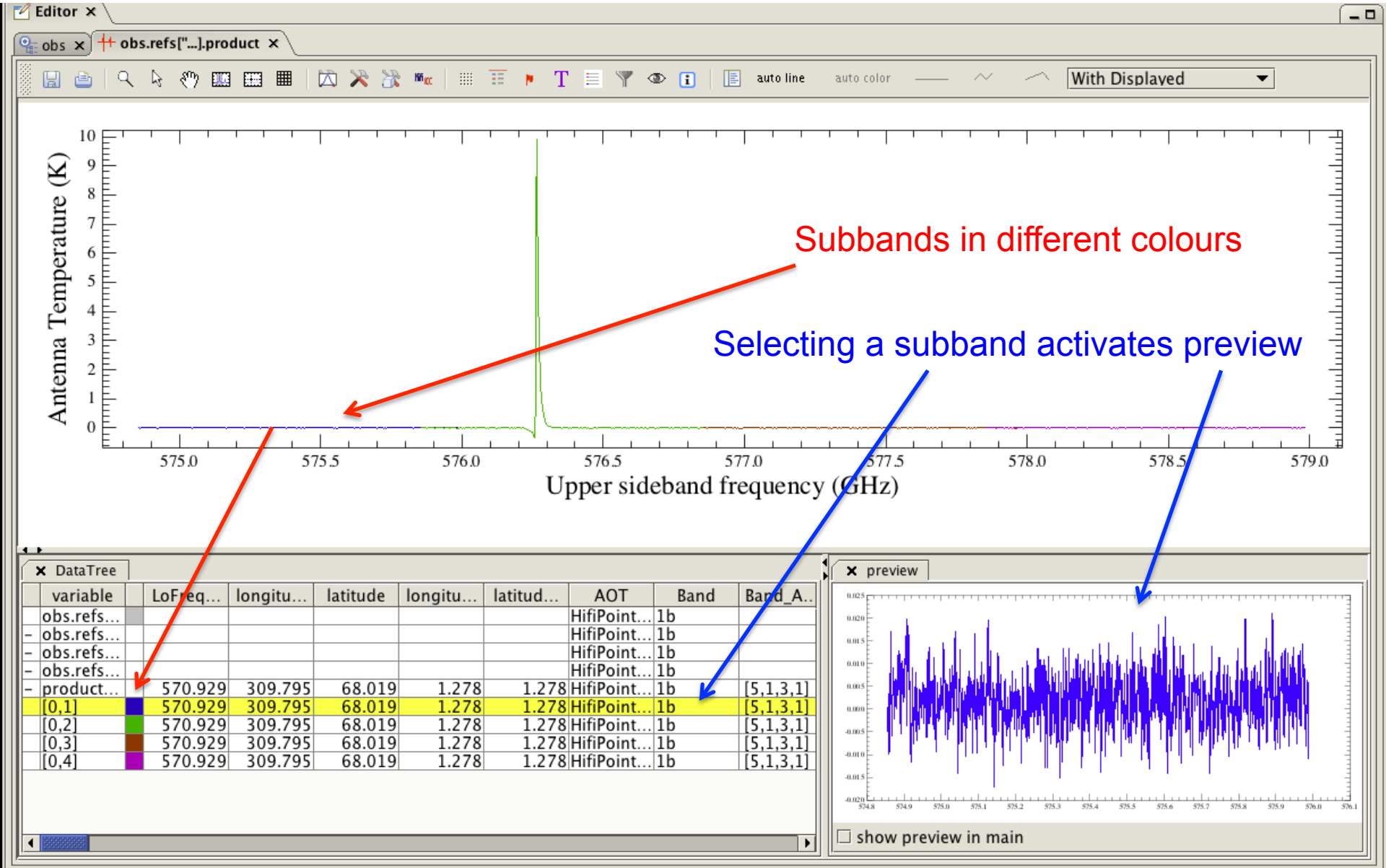
Level 2: opening a htp with **Spectrum Explorer**

Recall



Looking at your data with SpectrumExplorer

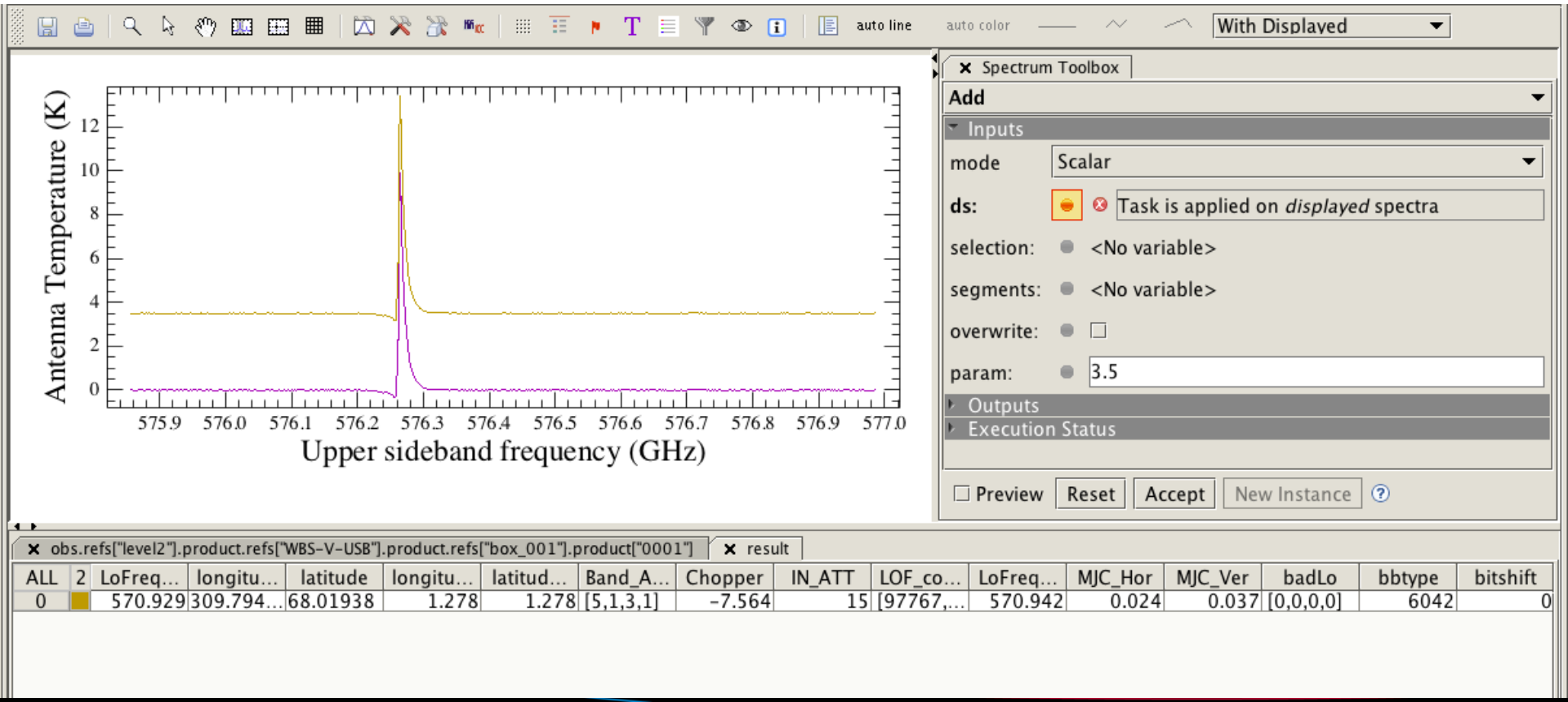
Recall



variable	LoFreq...	longitu...	latitude	longitu...	latitud...	AOT	Band	Band_A...
obs.refs...						HifiPoint...	1b	
obs.refs...						HifiPoint...	1b	
obs.refs...						HifiPoint...	1b	
obs.refs...						HifiPoint...	1b	
product...	570.929	309.795	68.019	1.278	1.278	HifiPoint...	1b	[5,1,3,1]
[0,1]	570.929	309.795	68.019	1.278	1.278	HifiPoint...	1b	[5,1,3,1]
[0,2]	570.929	309.795	68.019	1.278	1.278	HifiPoint...	1b	[5,1,3,1]
[0,3]	570.929	309.795	68.019	1.278	1.278	HifiPoint...	1b	[5,1,3,1]
[0,4]	570.929	309.795	68.019	1.278	1.278	HifiPoint...	1b	[5,1,3,1]

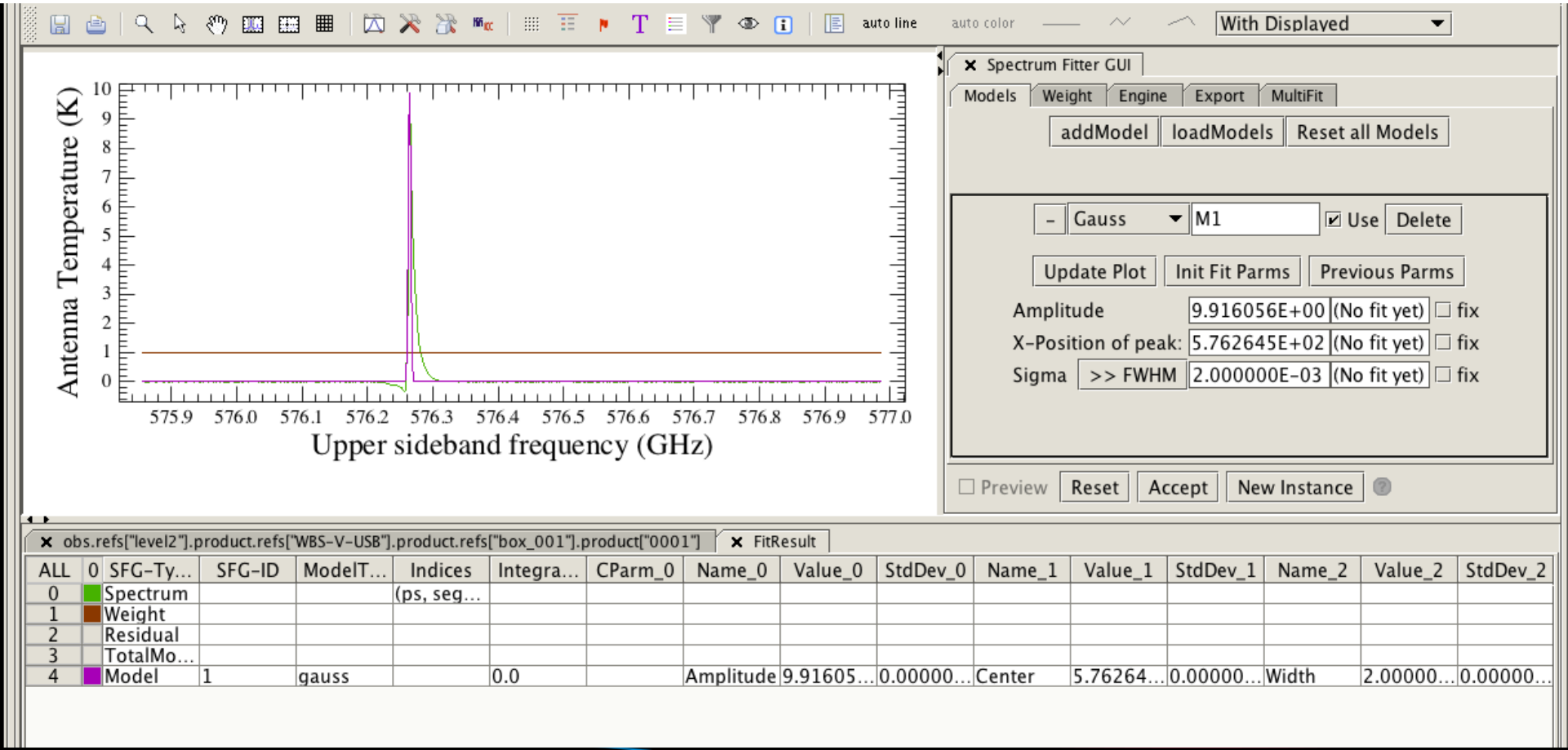
Looking at your data with SpectrumExplorer

using the **Spectrum Toolbox**: adding a scalar



Looking at your data with SpectrumExplorer

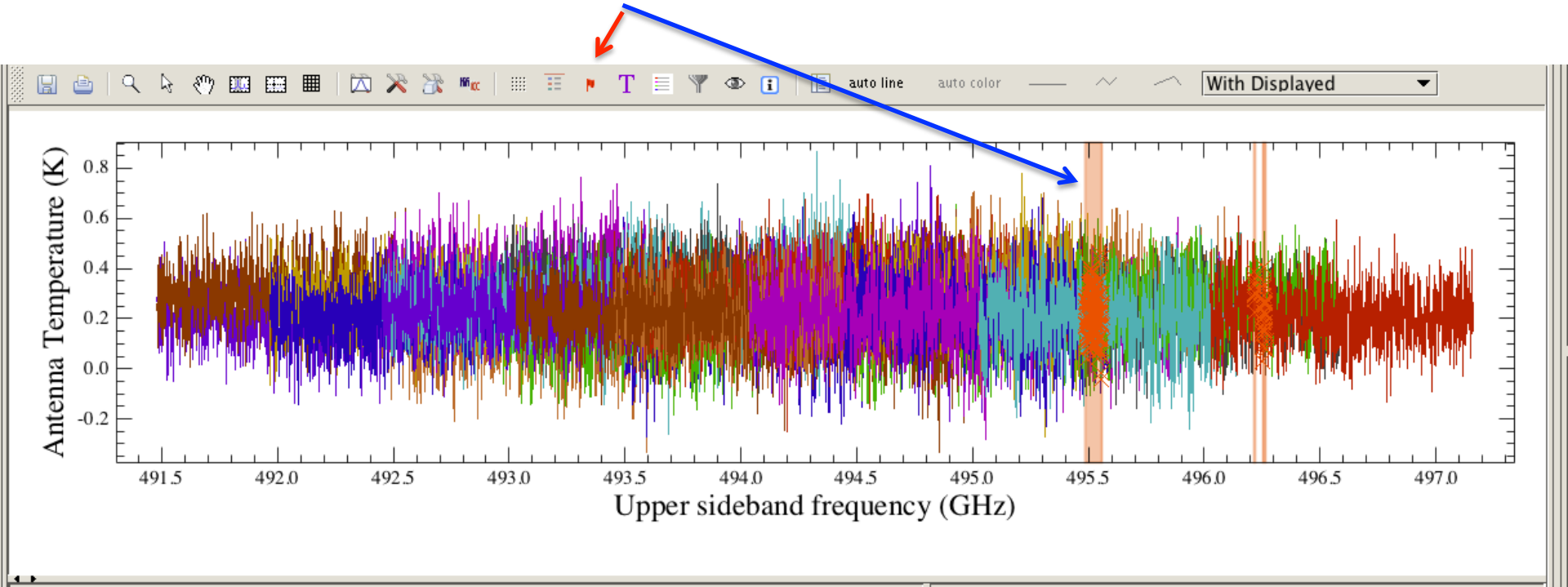
using the **Spectrum Fitter**: modeling profiles



ALL	0	SFG-Ty...	SFG-ID	ModelT...	Indices	Integra...	CParm_0	Name_0	Value_0	StdDev_0	Name_1	Value_1	StdDev_1	Name_2	Value_2	StdDev_2
0		Spectrum			(ps, seg...											
1		Weight														
2		Residual														
3		TotalMo...														
4		Model	1	gauss		0.0		Amplitude	9.91605...	0.00000...	Center	5.76264...	0.00000...	Width	2.00000...	0.00000...

Looking at your data with SpectrumExplorer

Quick look at flags



DataTree

	variable		LoFreq...	longitu...	latitude	longitu...	latitud...	AOT	Band	Band_A
	[0,1]		488.527	161.266	-59.684	0.54	0.54	HifiSSca...	1a	[6,2,4,(
	[0,2]		488.527	161.266	-59.684	0.54	0.54	HifiSSca...	1a	[6,2,4,(
	[0,3]		488.527	161.266	-59.684	0.54	0.54	HifiSSca...	1a	[6,2,4,(
	[0,4]		488.527	161.266	-59.684	0.54	0.54	HifiSSca...	1a	[6,2,4,(
-	obs_ssc...							HifiSSca...	1a	
-	product...		489.105	161.265	-59.684	0.6	0.6	HifiSSca...	1a	[6,2,4,(
	[0,1]		489.105	161.265	-59.684	0.6	0.6	HifiSSca...	1a	[6,2,4,(
	[0,2]		489.105	161.265	-59.684	0.6	0.6	HifiSSca...	1a	[6,2,4,(
	[0,3]		489.105	161.265	-59.684	0.6	0.6	HifiSSca...	1a	[6,2,4,(
	[0,4]		489.105	161.265	-59.684	0.6	0.6	HifiSSca...	1a	[6,2,4,(
-	obs_ssc...							HifiSSca...	1a	

preview

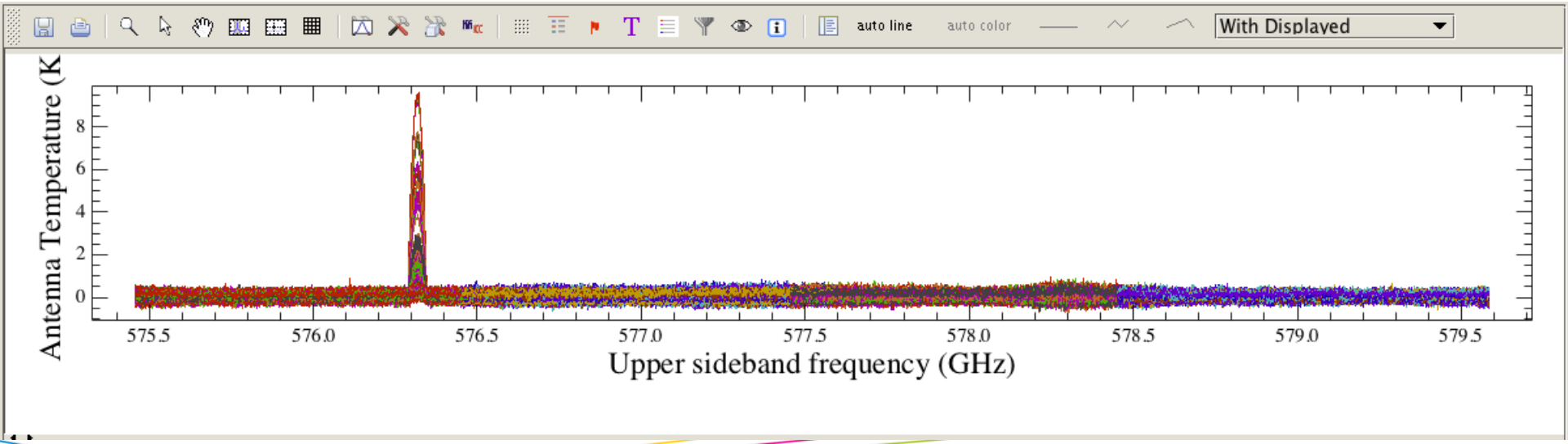
History Log Console

The importance of looking at your data

Baseline drift

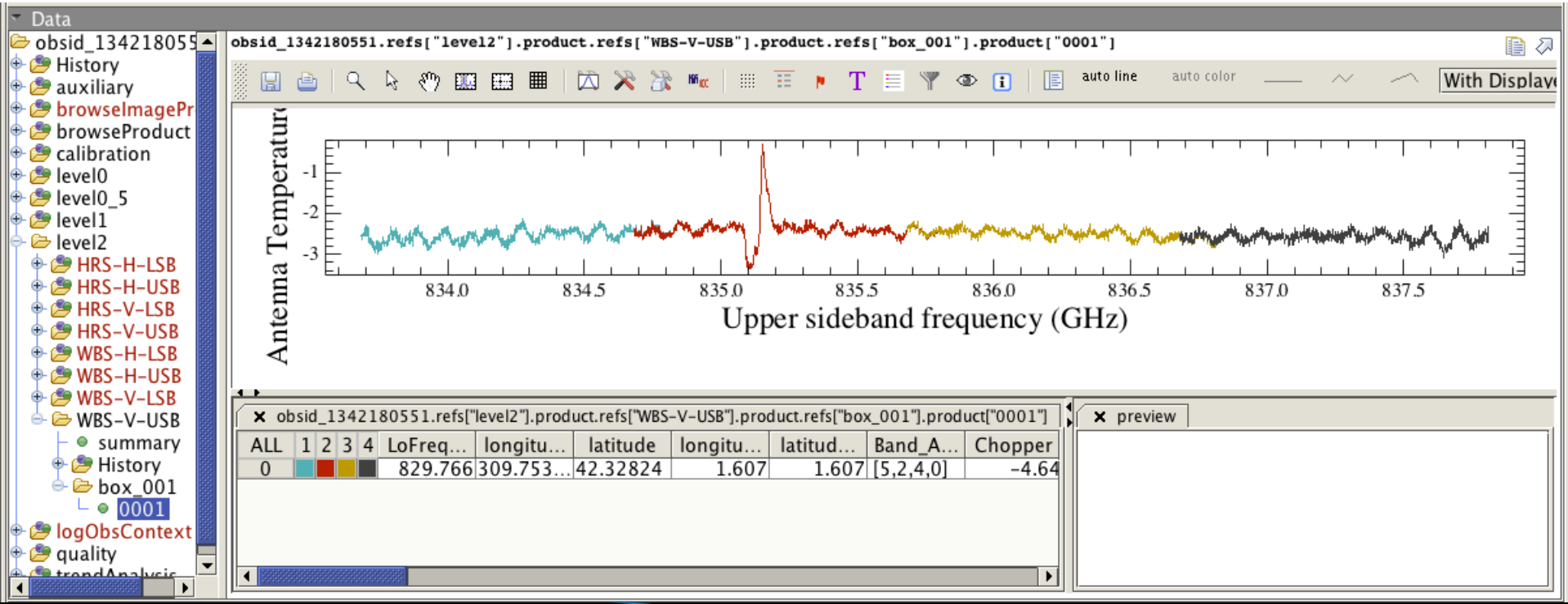
left-over of instrument instabilities: offset, slope, curve, and/or ripple

can be corrected using **FitBaseline** task

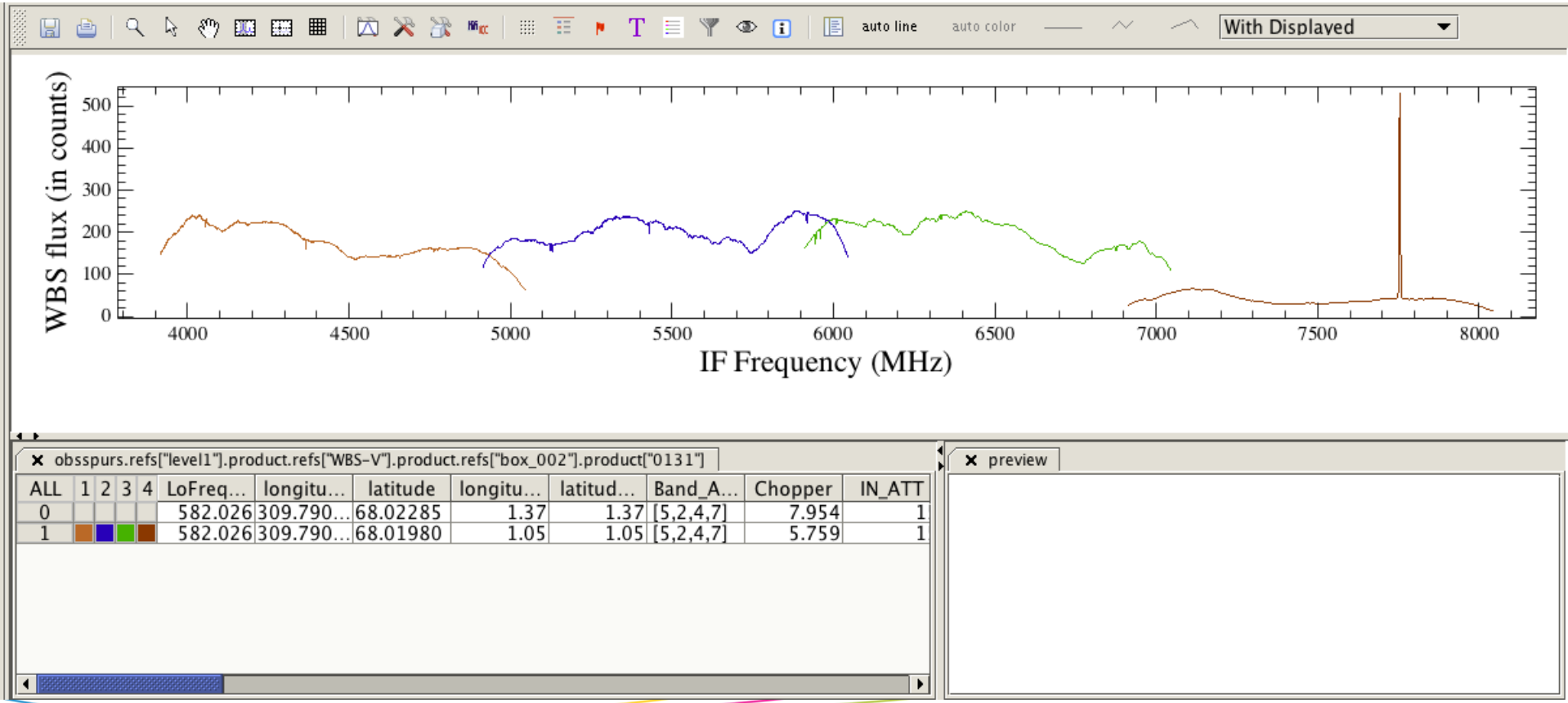


Standing waves: periodic signals present in all bands

A very nice example of standing waves: can be corrected using the task **FitHifiFringe**



Spurs: - features that are gaussian in shape and narrow
- they can look like astronomical lines
- automatic detection in calibration – check spurs table in Trend Analysis

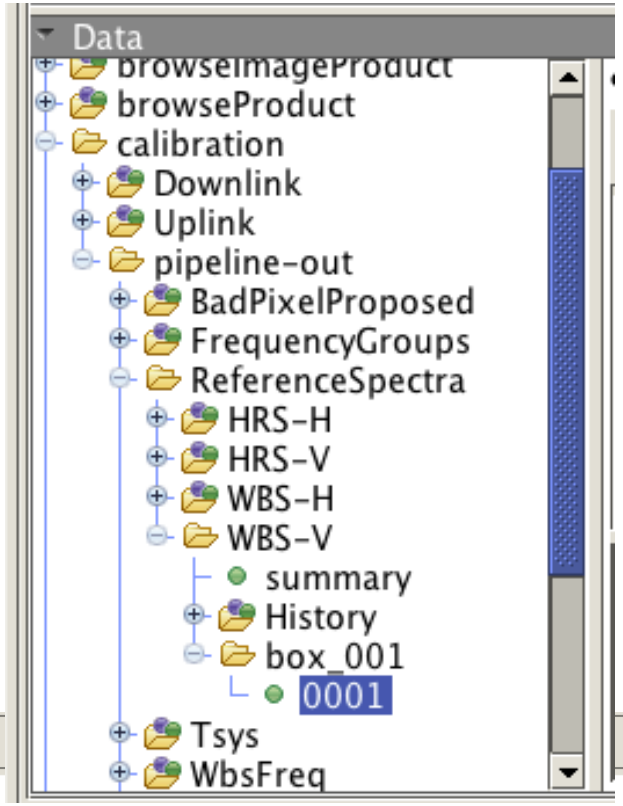


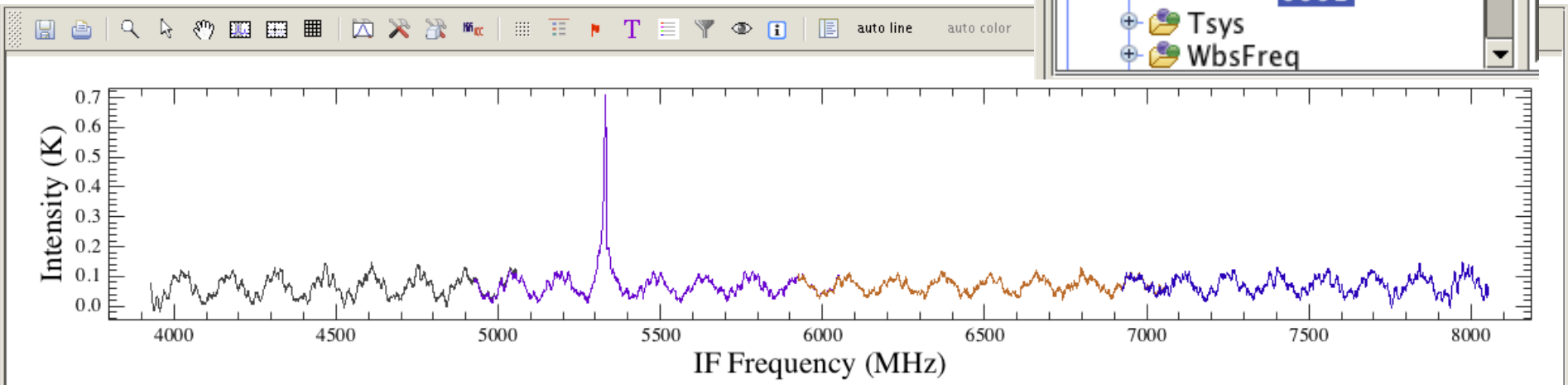
ALL	1	2	3	4	LoFreq...	longitu...	latitude	longitu...	latitud...	Band_A...	Chopper	IN_ATT
0					582.026	309.790...	68.02285	1.37	1.37	[5,2,4,7]	7.954	1
1					582.026	309.790...	68.01980	1.05	1.05	[5,2,4,7]	5.759	1

How to examine your reference spectra

Emission in the off position: in principle, the reference position should be devoided of any emission but for, e.g. extended sources, emission can still be present

Some discussion in the *HIFI Data Reduction Guide* Cookbook on Mapping Mode to correct for emission In chop positions.





obs_reproc.refs["calibration"].product.refs["pipeline-out"].product.refs["ReferenceSpectra"].product.refs["WBS-V"].product.refs["box_001"].product["0001"]

ALL	1	2	3	4	LoFreq...	longitu...	latitude	longitu...	latitud...	Band_A...	Chopper	IN_ATT	LOF_co...	LoFreq...	MJC_Hor
0					570.929	309.794...	68.01942	1.087	1.087	[5,1,3,1]	-2.41	15	[97767,...	570.942	0.024

preview

Demo…