Updates on stability

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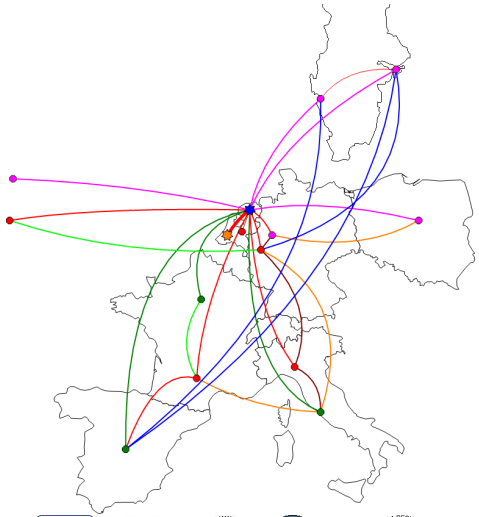

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Status as of last colocation

- **Tests from long-term integrations in cycle 32**
  - 7 LO bands only
  - Band 3a analysis affected by real astronomical line
- **HSPOT predictions typically met**
  - Large uncertainty in observations aiming at large binning widths
  - Often affected by insufficient statistics
  - Second-order Allan time irrelevant for any individual observation → count only as overall average
- **Drift is dominated by systematic effects**
  - Thermal history of the instrument and the SVM has most impact
  - Could only be treated by scheduling constraints

New measurements

- **Long-term integrations in four more LO bands**
  - Now 3 HEB bands covered
  - More complete statistics

Table 1: HSPOT predictions for the stability measurements at the different goal resolutions

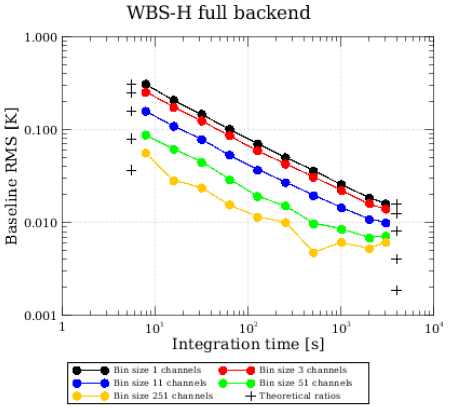
obsid	band	LO [GHz]	reference bandwidth	noise RMS [mK][1] 1.6 MHz	2.7 MHz	7.3 MHz	30.0 MHz	144 MHz
1342213707	2a	643	1 GHz	6.0	4.7	2.9	1.5	0.72
			4 GHz	6.1	4.7	3.0	1.7	1.1
1342213728	2b	758	1 GHz	7.2	5.6	3.5	1.8	1.1
			4 GHz	7.3	5.7	3.8	2.6	2.6
1342214300	3a	814	1 GHz	7.4	5.7	3.6	2.0	1.3
			4 GHz	7.7	6.1	4.1	2.8	2.3
1342214322	3b	928	1 GHz	8.0	6.2	3.8	2.0	1.1
			4 GHz	8.1	6.3	4.1	2.4	1.8
1342213345	4a	995	1 GHz	13.0	10.1	6.2	3.2	1.8
			4 GHz	14.8	12.3	9.5	8.0	7.7
1342214383	5a	1145	1 GHz	35.4	27.3	16.9	8.7	4.4
			4 GHz	35.9	30.0	17.8	10.1	6.6
1342215849	5a	1177	1 GHz	40.0	30.9	19.1	9.8	5.0
			4 GHz	40.6	31.6	20.1	11.5	7.4
1342214400	6a	1457	1 GHz	78.5	61.4	39.8	24.9	20.3
			4 GHz	85.6	70.2	52.2	41.7	38.6
1342214451	6b	1667	1 GHz	53.3	41.3	25.6	13.4	7.4
			4 GHz	55.3	43.6	28.7	17.9	12.9
1342218415	7a	1720	1 GHz	54.4	42.3	26.8	15.3	10.2
			4 GHz	56.9	45.3	30.9	20.9	16.5

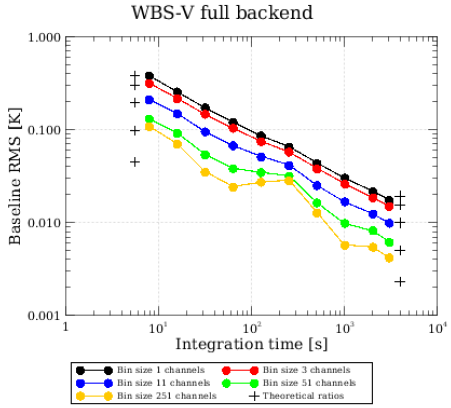
- **Stability measurements around 1834GHz**
  - Make sure that new LO multiplier settings do not degrade stability

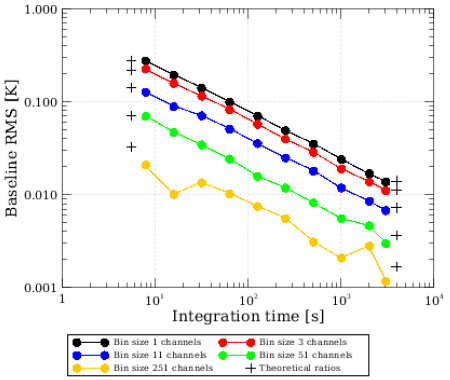
Results

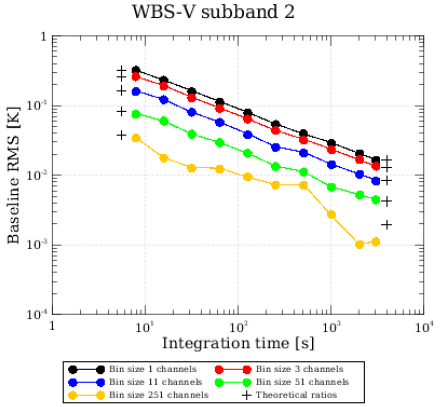
5a 1145GHz

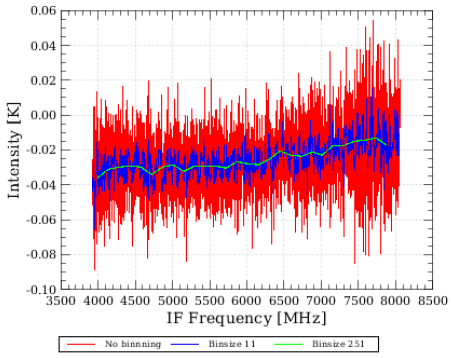
1342214383

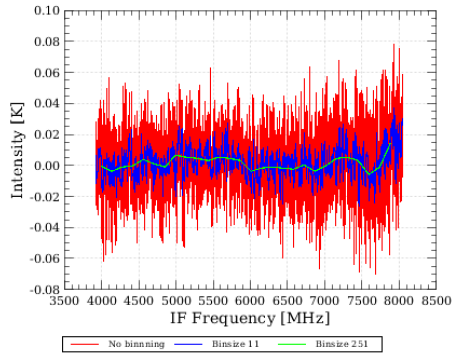






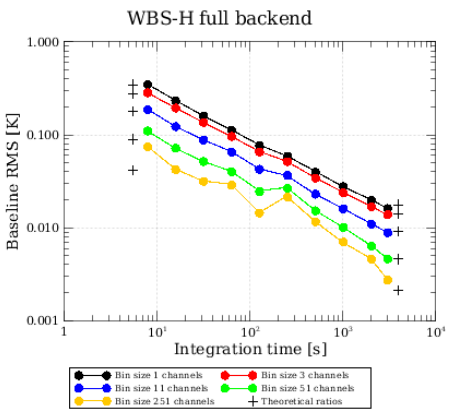


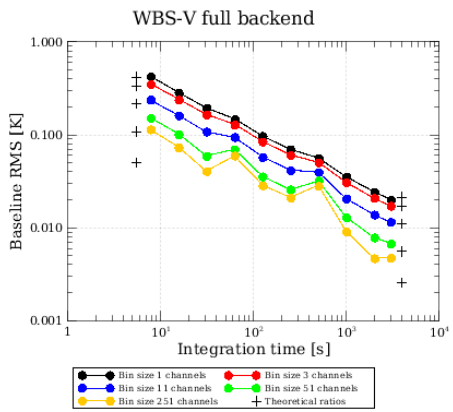


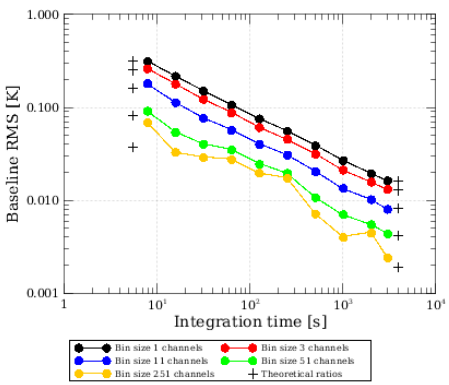


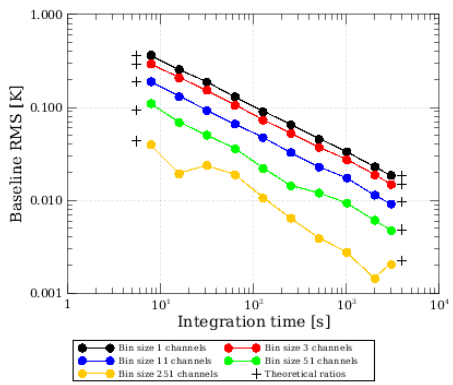
5a 1177GHz

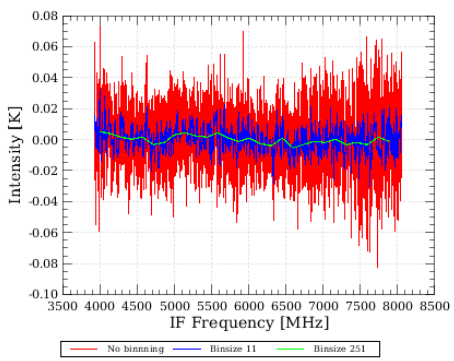
1342215849

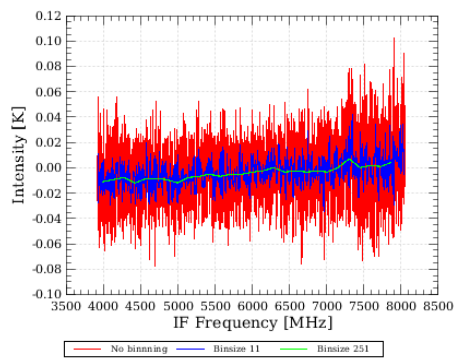








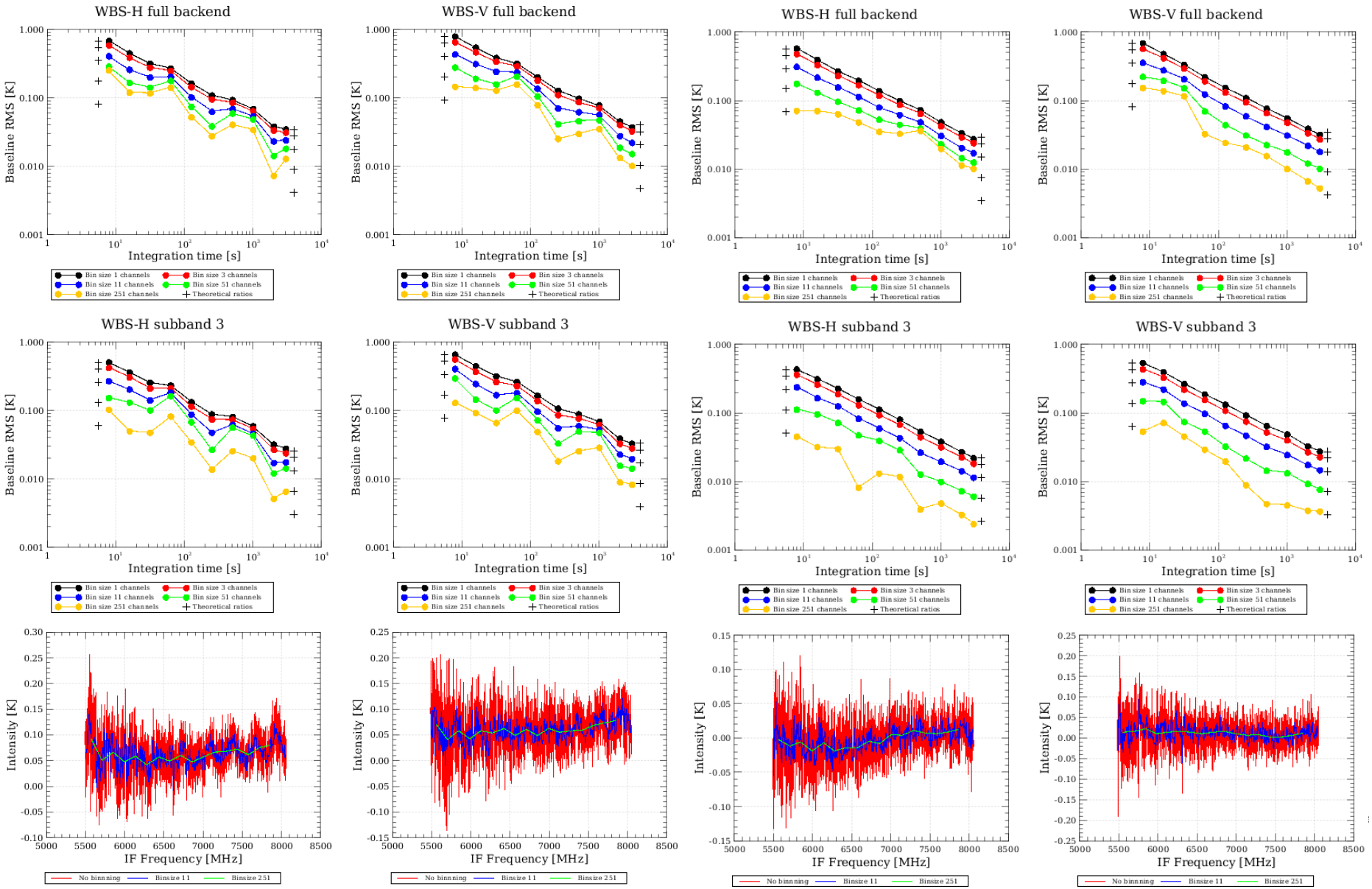




Results

6a 6b

1342214400 1342214451



Results

- **Very good stability in 5a confirmed**
  - Excellent reproducibility of result at somewhat higher frequency
- **Good stability in band 6b**
  - Radiometric behaviour up to binning widths of 30MHz
  - Erratic scaling for larger widths as usual
- **Bad stability in 6a**
  - In agreement with HSPOT predictions
  - Two thermal “events” visible in spectra
  - Possibly correctable by mixer-matching technique

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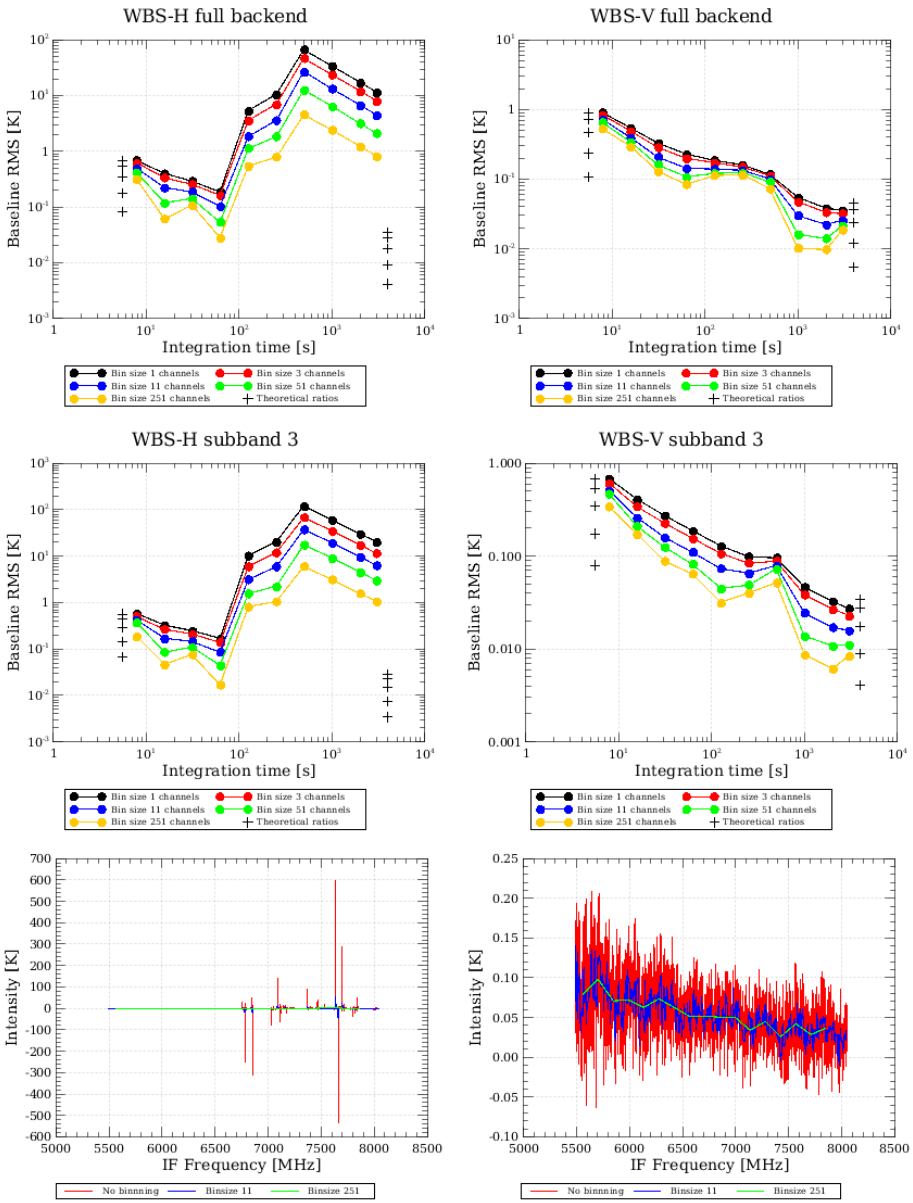
Results

7a

1342218415

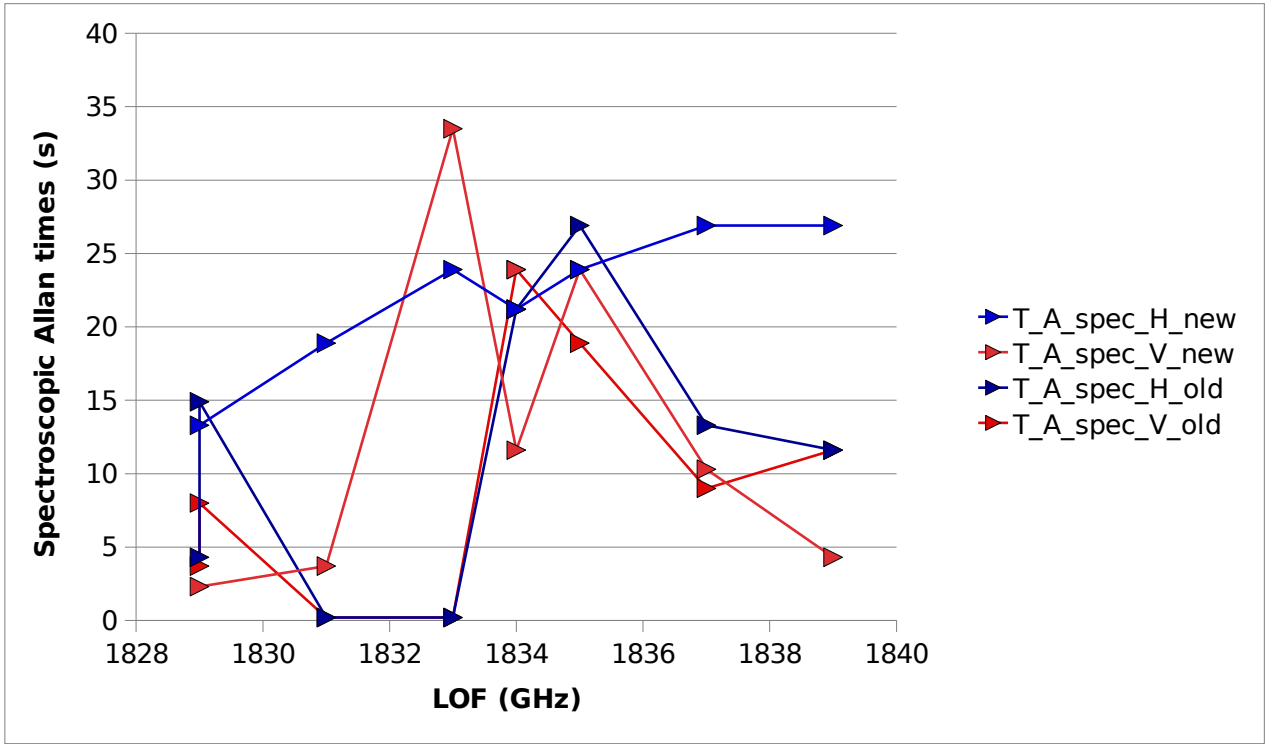


- **Very bad stability in 7a-H**
  - Instable "spur" showing up after 80s
  - Moving across IF
  - Polarization unusable
- **"Normal" HEB stability for V**
  - Thermal event visible
  - All binnings affected
  - Typical SW pattern

→ **Measurement should be repeated/verified**

1834 GHz

- **New multiplier settings applied to kill spur**
  - First measurements had indicated that stability is deteriorated
- **Systematic fast stability measurements performed**
  - One HRS subband only



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1834 GHz results

- **Within the uncertainties the new settings are as good as the old settings**
  - The C043 (new settings) stabilities are generally comparable to or better than C046 (old settings).
- **The extremely bad stability in C046 at 1831GHz & 1833GHz is consistent with a moving spur.**
  - Hit of HRS subband by chance.
  - The disappearance of the effect in the new settings proves that the purification works and helps the stability.
- **Thermal history plays a big role**
  - The repeat of the 1829 GHz test in C046 shows the strong effect.
  - An important clue may be hidden in 134226042. There we find a sudden onset of total-power spikes at t=280s with a strong impact on the stability parameters.

→ **New multiplier settings released in CUS.**

Summary and Outlook

- **Still very low number statistics**
  - More tests in DTCPs should still improve instrument knowledge.
  - Focus on open points, like FSW.
  - Band 7a test needs repetition.
  - Bands 1, 4b, 7b still not covered.
- **HSPOT predictions typically met**
  - Large uncertainty in observations aiming at large binning widths
  - Broad-line observations need to ask for large goal resolution and 4GHz reference bandwidth
  - Drift is dominated by systematic effects
  - Thermal history of the instrument and the SVM has most impact
    - Correlation of visible instability events with HK history may give further clues.