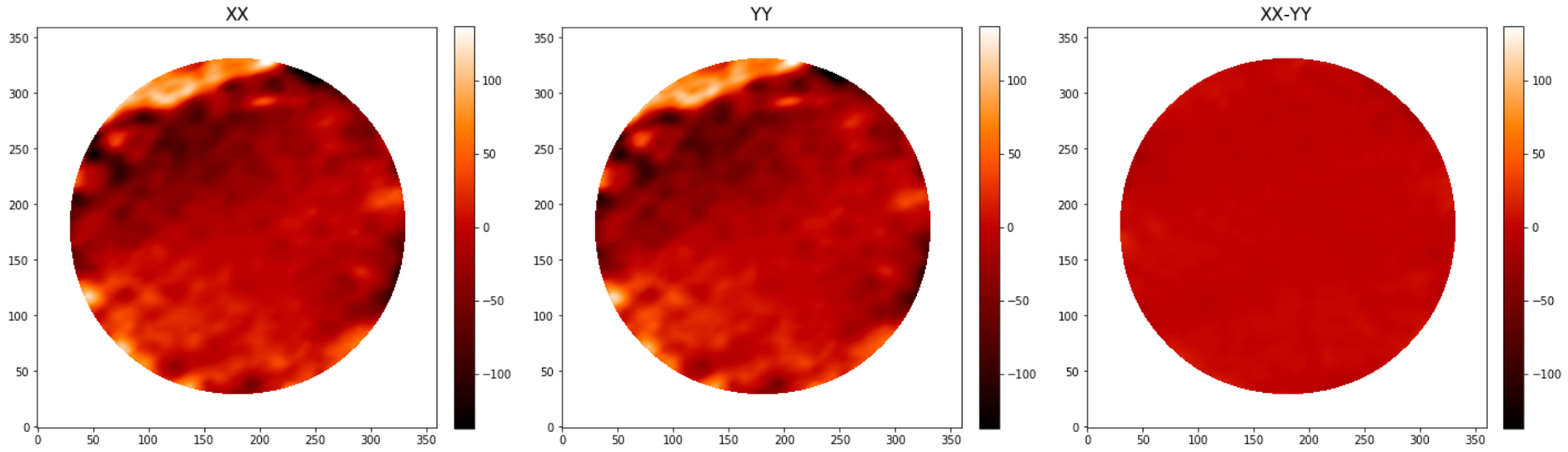
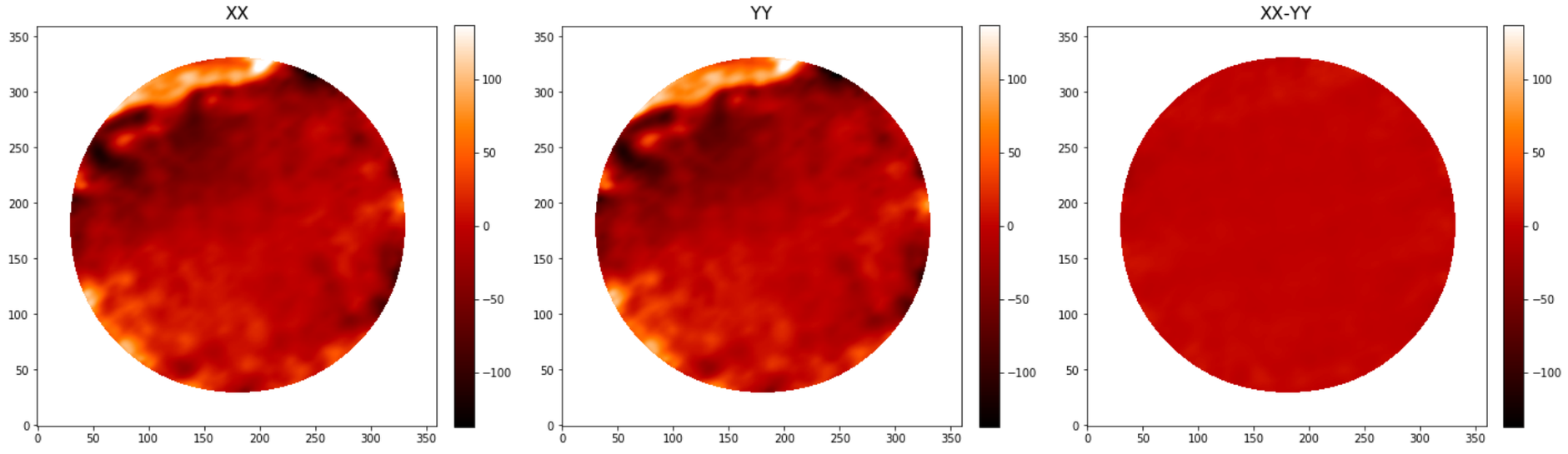
XX - YY asymmetry

Dataset ID: 7
2017.1.01138.S

Scan 2



Scan 3



Conclusion for this dataset: No asymmetry

Team C: Large variation of the antenna temperature

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2020/03/05 1st International Workshop on Solar Imaging with ALMA@RoCS/UiO, Norway

From my presentation on 1st day

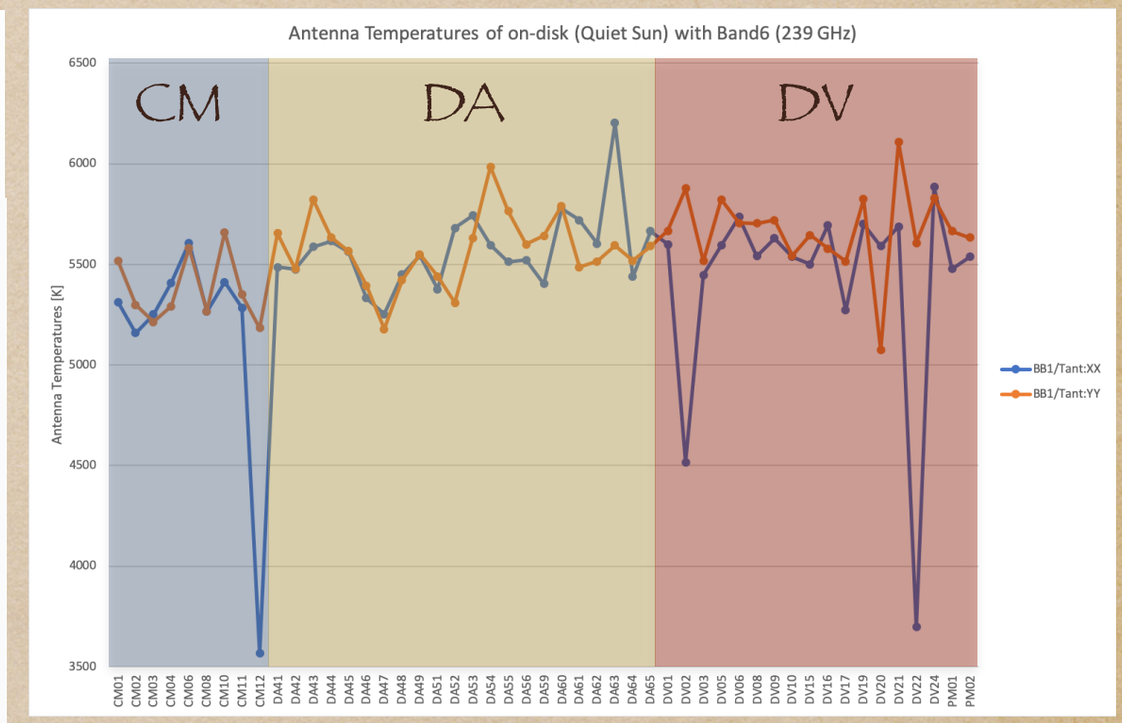
2. Large variation of T_{ant} in a sub-scan.

- T_{ant}: output power from the receiver caused by a target.
  - The value is derived using the data of the SQLD and the following formula, because the dynamic range of the corrleator is not enough for the calculation.

$$T_{\rm ant} = \frac{P_{\rm sky} - P_{\rm zero}}{P_{\rm off} - P_{\rm zero}} \frac{P_{\rm sun} - P_{\rm off}}{P_{\rm hot} - P_{\rm cold}} (T_{\rm hot} - T_{\rm cold})$$

- a cold-load observation $P_{\rm cold}$ (also known as the ambient load), in which an absorber at the temperature of the thermally controlled receiver cabin (nominally 15 – 18° C) fills the beam path;
- a hot-load observation $P_{\rm hot}$, in which an absorber heated to about 85° C fills the beam path;
- a sky observation $P_{\rm sky}$, offset from the Sun (typically by two degrees) and at the same elevation. The attenuation levels of the attenuators in the IF chain are the same as that for the measurement of $P_{\rm cold}$ and $P_{\rm hot}$;
- an off observation $P_{\rm off}$, which is the same as the $P_{\rm sky}$, except the attenuation levels are set to the values optimized for the Sun;
- a Sun observation $P_{\rm sun}$, which is at the attenuation levels of the target (Sun);
- a zero level measurement $P_{\rm zero}$, which reports the levels in the detectors when no power is being supplied.

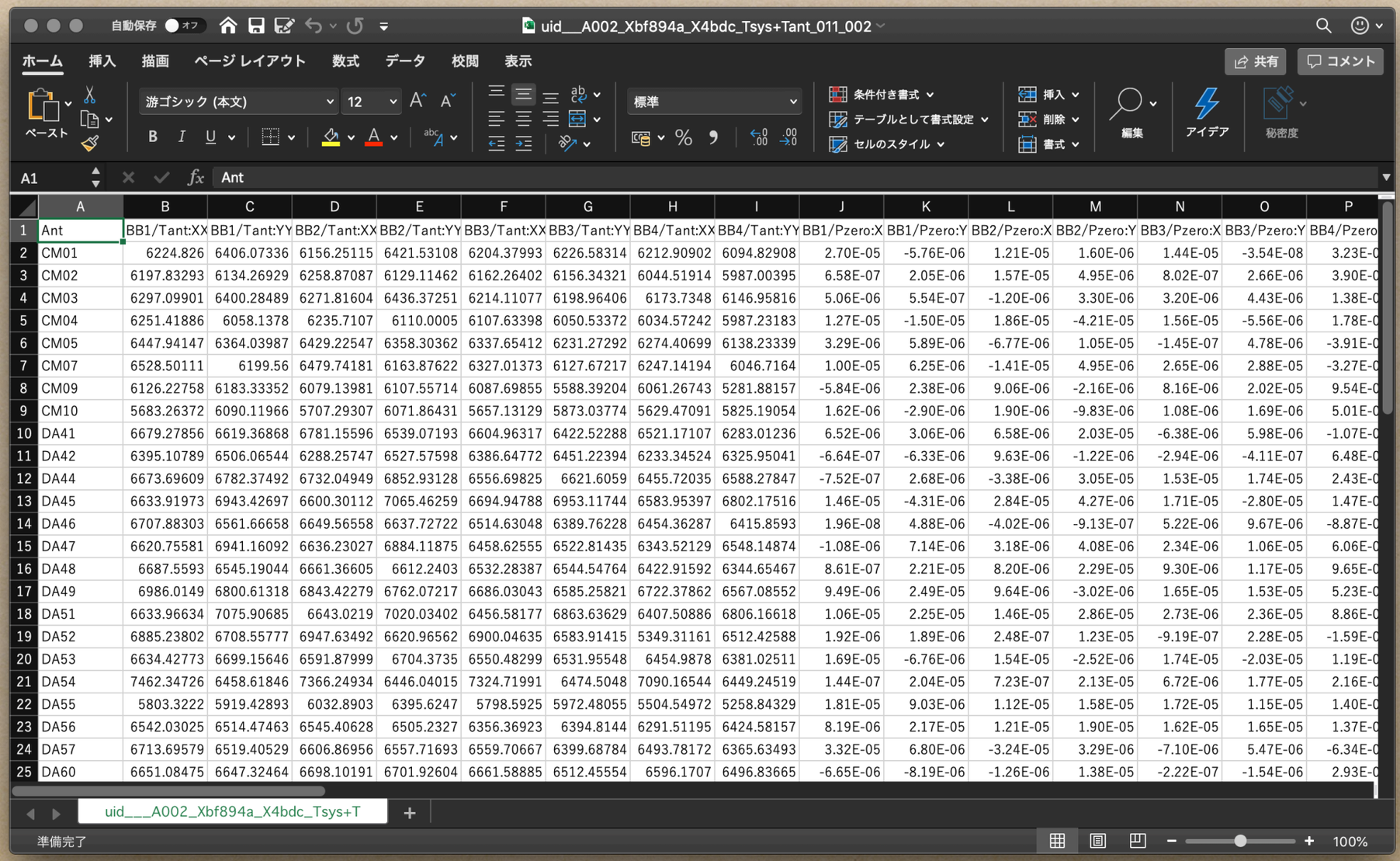
Shimojo et al. (2017)



What is caused the large variation?

Data of SQLD and T_ant

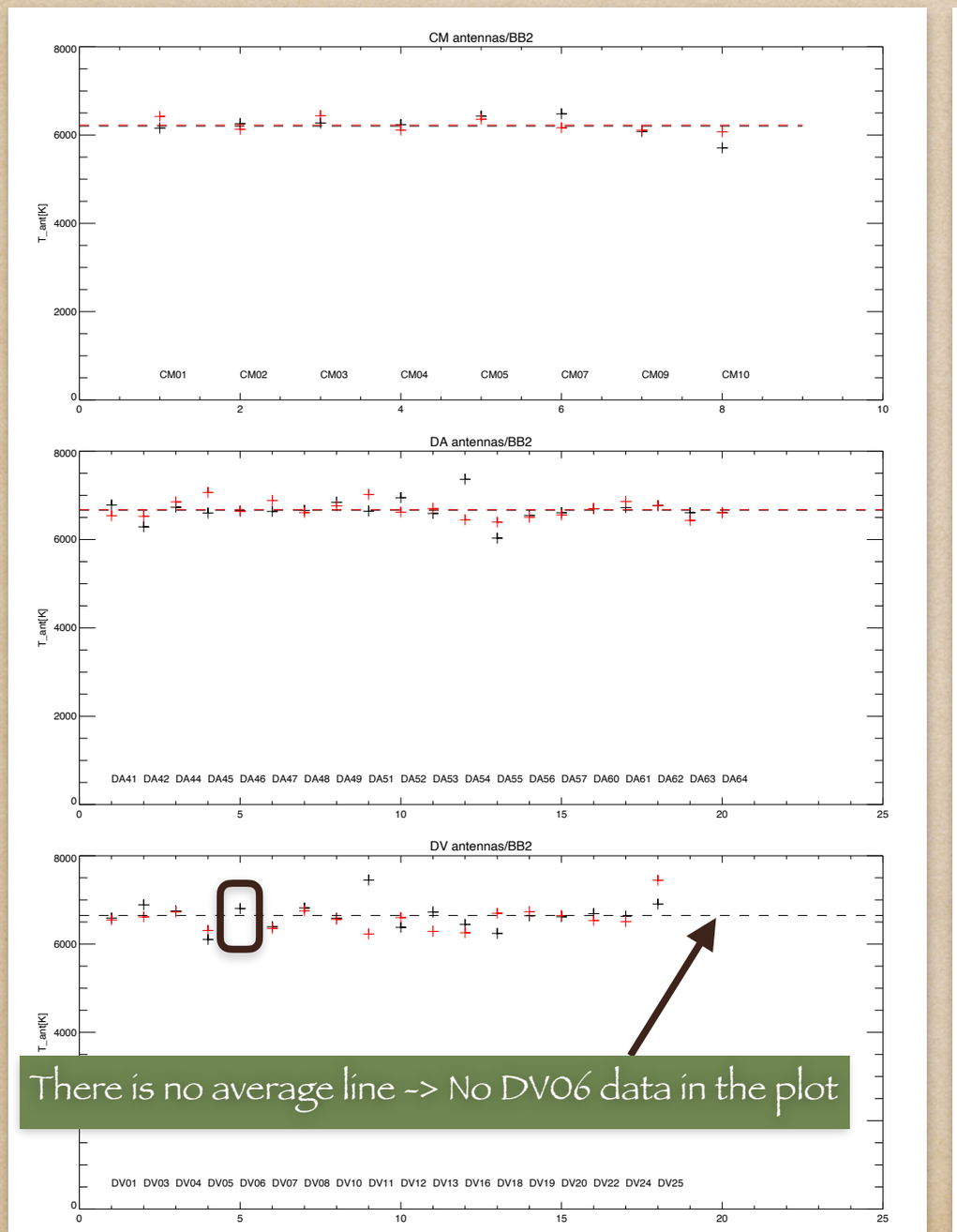
- The standard calibration in the QA2 process creates the CSV files that recorded T_ant and the outputs from SQLD for estimating T_ant.

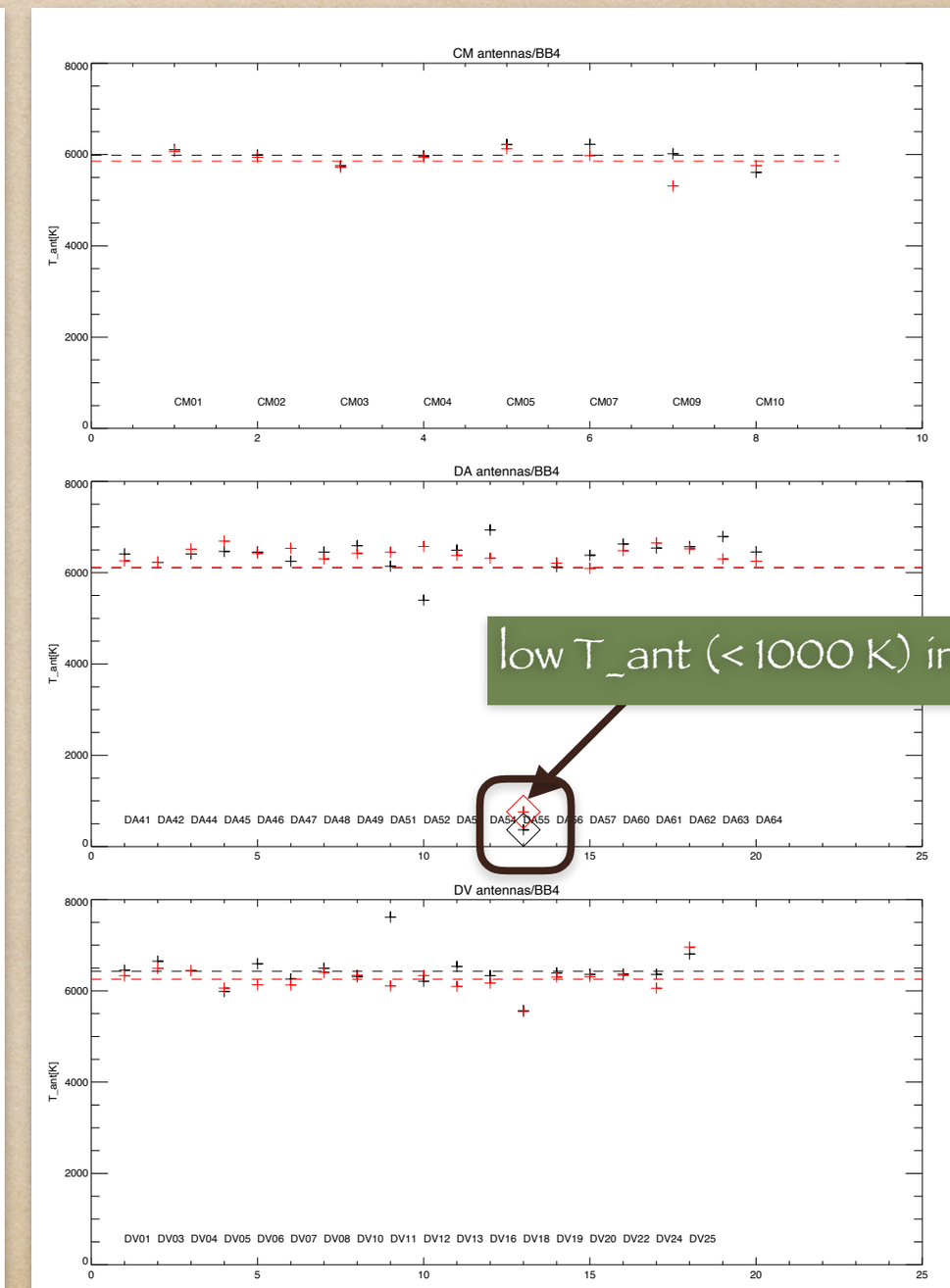


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Ant	BB1/Tant:XX	BB1/Tant:YY	BB2/Tant:XX	BB2/Tant:YY	BB3/Tant:XX	BB3/Tant:YY	BB4/Tant:XX	BB4/Tant:YY	BB1/Pzero:X	BB1/Pzero:Y	BB2/Pzero:X	BB2/Pzero:Y	BB3/Pzero:X	BB3/Pzero:Y	BB4/Pzero
2	CM01	6224.826	6406.07336	6156.25115	6421.53108	6204.37993	6226.58314	6212.90902	6094.82908	2.70E-05	-5.76E-06	1.21E-05	1.60E-06	1.44E-05	-3.54E-08	3.23E-0
3	CM02	6197.83293	6134.26929	6258.87087	6129.11462	6162.26402	6156.34321	6044.51914	5987.00395	6.58E-07	2.05E-06	1.57E-05	4.95E-06	8.02E-07	2.66E-06	3.90E-0
4	CM03	6297.09901	6400.28489	6271.81604	6436.37251	6214.11077	6198.96406	6173.7348	6146.95816	5.06E-06	5.54E-07	-1.20E-06	3.30E-06	3.20E-06	4.43E-06	1.38E-0
5	CM04	6251.41886	6058.1378	6235.7107	6110.0005	6107.63398	6050.53372	6034.57242	5987.23183	1.27E-05	-1.50E-05	1.86E-05	-4.21E-05	1.56E-05	-5.56E-06	1.78E-0
6	CM05	6447.94147	6364.03987	6429.22547	6358.30362	6337.65412	6231.27292	6274.40699	6138.23339	3.29E-06	5.89E-06	-6.77E-06	1.05E-05	-1.45E-07	4.78E-06	-3.91E-0
7	CM07	6528.50111	6199.56	6479.74181	6163.87622	6327.01373	6127.67217	6247.14194	6046.7164	1.00E-05	6.25E-06	-1.41E-05	4.95E-06	2.65E-06	2.88E-05	-3.27E-0
8	CM09	6126.22758	6183.33352	6079.13981	6107.55714	6087.69855	5588.39204	6061.26743	5281.88157	-5.84E-06	2.38E-06	9.06E-06	-2.16E-06	8.16E-06	2.02E-05	9.54E-0
9	CM10	5683.26372	6090.11966	5707.29307	6071.86431	5657.13129	5873.03774	5629.47091	5825.19054	1.62E-06	-2.90E-06	1.90E-06	-9.83E-06	1.08E-06	1.69E-06	5.01E-0
10	DA41	6679.27856	6619.36868	6781.15596	6539.07193	6604.96317	6422.52288	6521.17107	6283.01236	6.52E-06	3.06E-06	6.58E-06	2.03E-05	-6.38E-06	5.98E-06	-1.07E-0
11	DA42	6395.10789	6506.06544	6288.25747	6527.57598	6386.64772	6451.22394	6233.34524	6325.95041	-6.64E-07	-6.33E-06	9.63E-06	-1.22E-06	-2.94E-06	-4.11E-07	6.48E-0
12	DA44	6673.69609	6782.37492	6732.04949	6852.93128	6556.69825	6621.6059	6455.72035	6588.27847	-7.52E-07	2.68E-06	-3.38E-06	3.05E-05	1.53E-05	1.74E-05	2.43E-0
13	DA45	6633.91973	6943.42697	6600.30112	7065.46259	6694.94788	6953.11744	6583.95397	6802.17516	1.46E-05	-4.31E-06	2.84E-05	4.27E-06	1.71E-05	-2.80E-05	1.47E-0
14	DA46	6707.88303	6561.66658	6649.56558	6637.72722	6514.63048	6389.76228	6454.36287	6415.8593	1.96E-08	4.88E-06	-4.02E-06	-9.13E-07	5.22E-06	9.67E-06	-8.87E-0
15	DA47	6620.75581	6941.16092	6636.23027	6884.11875	6458.62555	6522.81435	6343.52129	6548.14874	-1.08E-06	7.14E-06	3.18E-06	4.08E-06	2.34E-06	1.06E-05	6.06E-0
16	DA48	6687.5593	6545.19044	6661.36605	6612.2403	6532.28387	6544.54764	6422.91592	6344.65467	8.61E-07	2.21E-05	8.20E-06	2.29E-05	9.30E-06	1.17E-05	9.65E-0
17	DA49	6986.0149	6800.61318	6843.42279	6762.07217	6686.03043	6585.25821	6722.37862	6567.08552	9.49E-06	2.49E-05	9.64E-06	-3.02E-06	1.65E-05	1.53E-05	5.23E-0
18	DA51	6633.96634	7075.90685	6643.0219	7020.03402	6456.58177	6863.63629	6407.50886	6806.16618	1.06E-05	2.25E-05	1.46E-05	2.86E-05	2.73E-06	2.36E-05	8.86E-0
19	DA52	6885.23802	6708.55777	6947.63492	6620.96562	6900.04635	6583.91415	5349.31161	6512.42588	1.92E-06	1.89E-06	2.48E-07	1.23E-05	-9.19E-07	2.28E-05	-1.59E-0
20	DA53	6634.42773	6699.15646	6591.87999	6704.3735	6550.48299	6531.95548	6454.9878	6381.02511	1.69E-05	-6.76E-06	1.54E-05	-2.52E-06	1.74E-05	-2.03E-05	1.19E-0
21	DA54	7462.34726	6458.61846	7366.24934	6446.04015	7324.71991	6474.5048	7090.16544	6449.24519	1.44E-07	2.04E-05	7.23E-07	2.13E-05	6.72E-06	1.77E-05	2.16E-0
22	DA55	5803.3222	5919.42893	6032.8903	6395.6247	5798.5925	5972.48055	5504.54972	5258.84329	1.81E-05	9.03E-06	1.12E-05	1.58E-05	1.72E-05	1.15E-05	1.40E-0
23	DA56	6542.03025	6514.47463	6545.40628	6505.2327	6356.36923	6394.8144	6291.51195	6424.58157	8.19E-06	2.17E-05	1.21E-05	1.90E-05	1.62E-05	1.65E-05	1.37E-0
24	DA57	6713.69579	6519.40529	6606.86956	6557.71693	6559.70667	6399.68784	6493.78172	6365.63493	3.32E-05	6.80E-06	-3.24E-05	3.29E-06	-7.10E-06	5.47E-06	-6.34E-0
25	DA60	6651.08475	6647.32464	6698.10191	6701.92604	6661.58885	6512.45554	6596.1707	6496.83665	-6.65E-06	-8.19E-06	-1.26E-06	1.38E-05	-2.22E-07	-1.54E-06	2.93E-0

Data#1a: uid://A002/Xbf894a/X4bdc

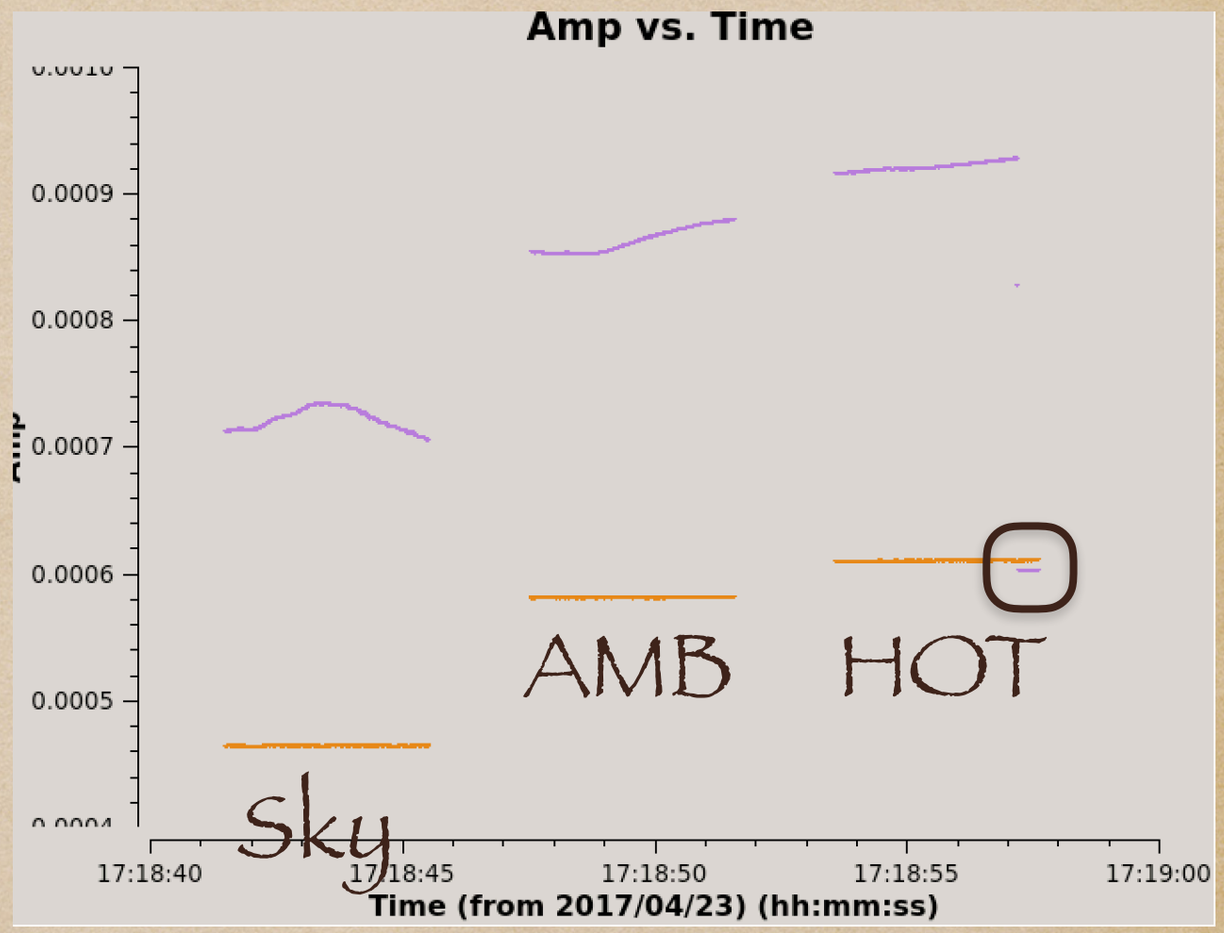
Visualization of the data





The investigation of DV06

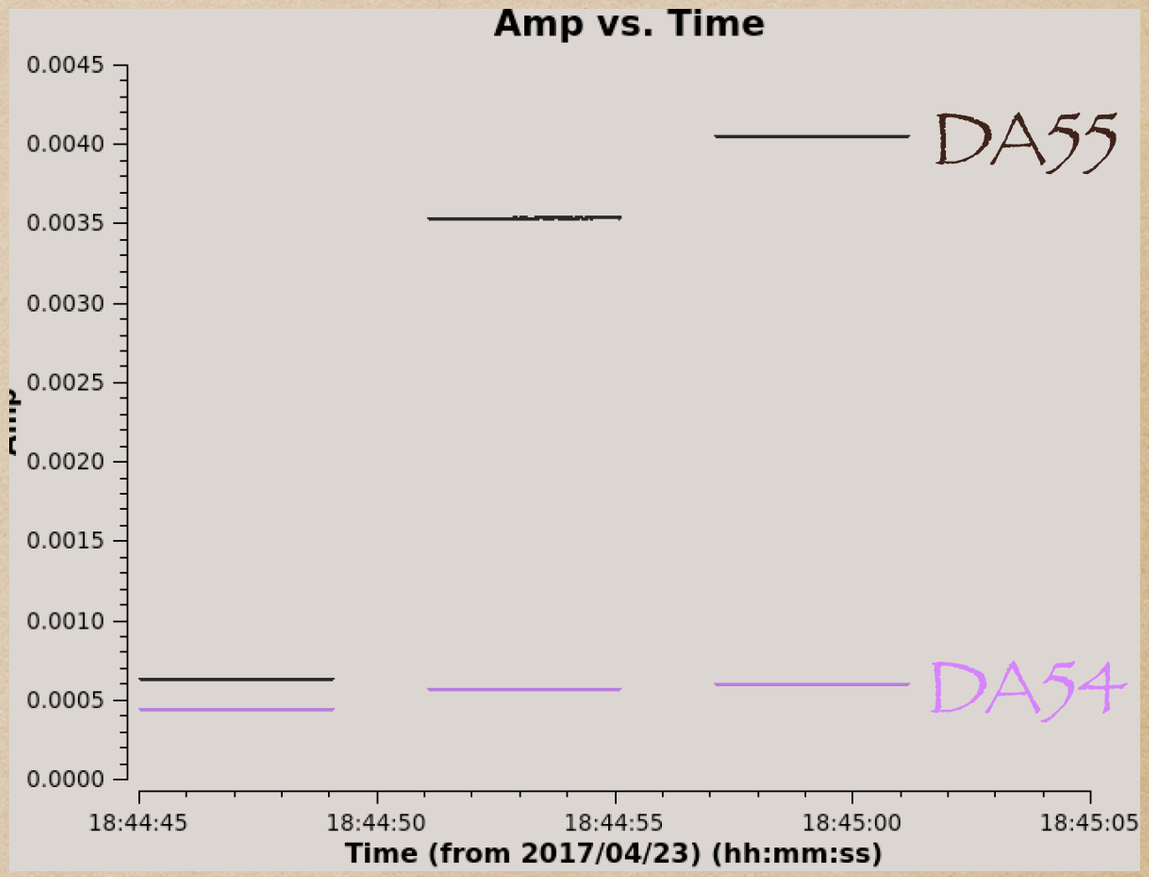
- T_ant: -163722.89 K!! (Negative!!)
- SQLD output
  - Hot: 0.00088534
    - T_hot: 357.7 K
  - Amb:0.00088808
    - T_amb: 291.85 K
  - P_hot is smaller than P_amb!
  - Therefor, the T_ant is negative value.
- It is caused by the unstably of the receiver.



Time variation of the SQLD output of DV06 during the ATM calibration

The investigation of DA55

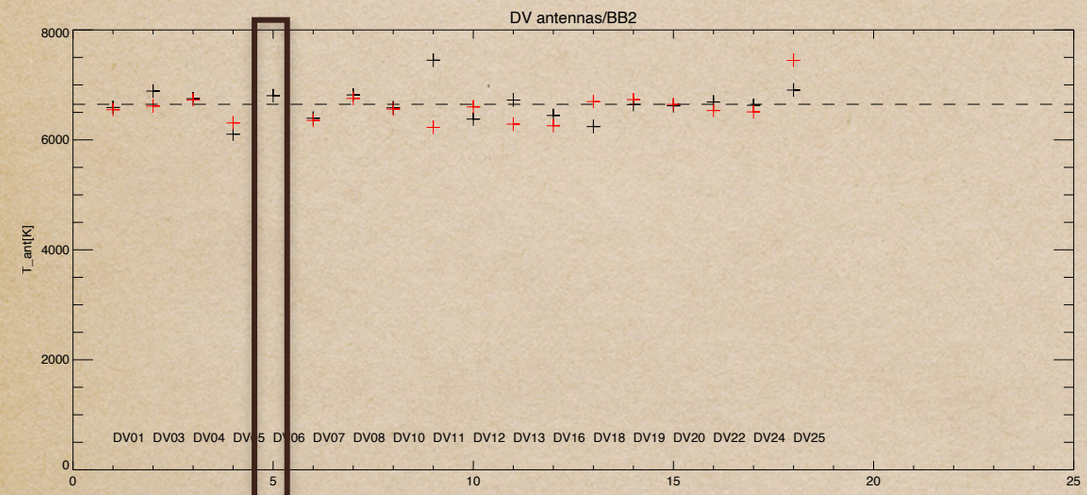
- T_ant: 366.5K!! (Too small)
- SQLD output
  - Hot:0.00325844
  - Amb:0.00302868
  - Difference: 0.00023
    - Usual difference: 0.00003
- P_hot and P_amb and the difference of them are too large.
- Therefor, the T_ant is small.



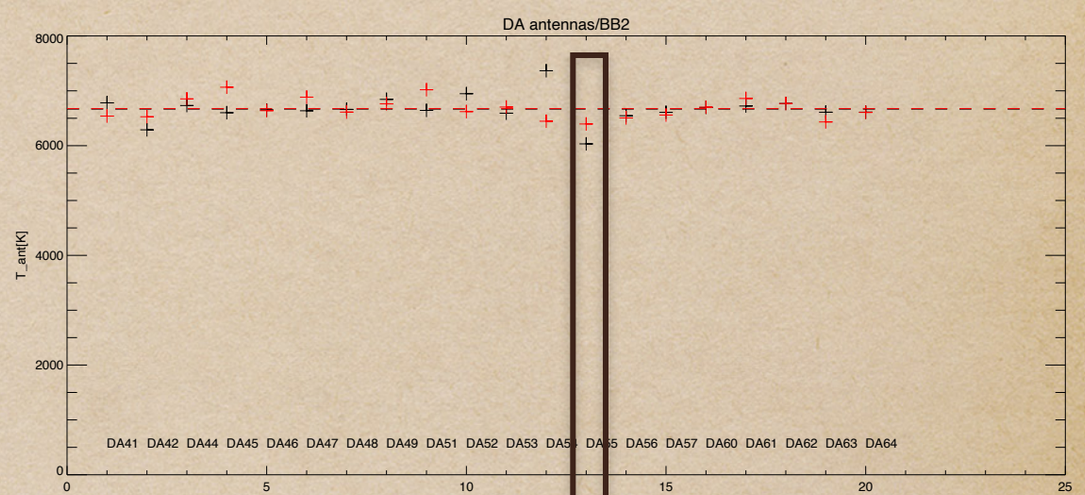
Time variation of the SQLD output of DA54&55 during the ATM calibration (SPW2:XX)

The anomalies vary in one Execution block (one observation).

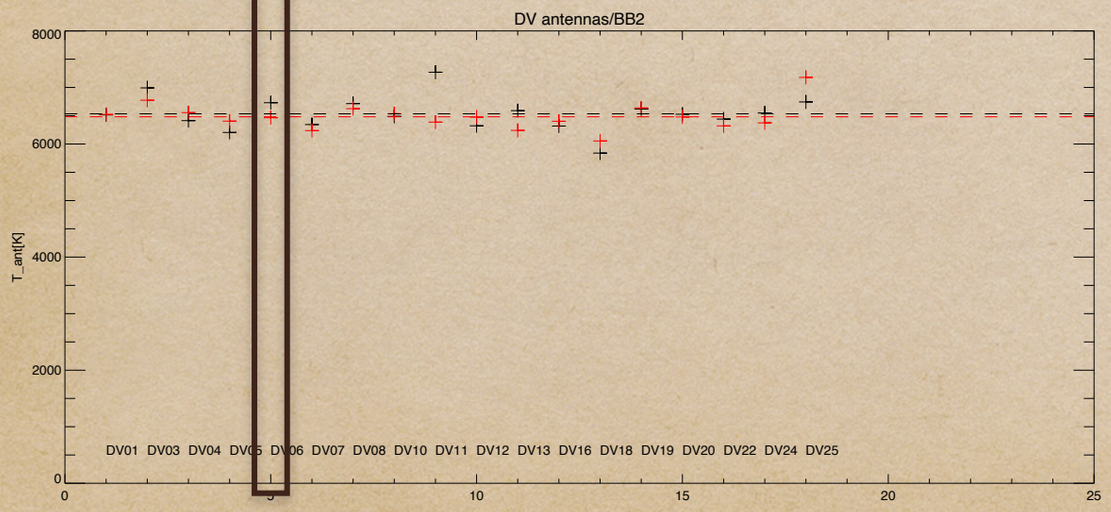
DV06: Scan#11 subscan#02



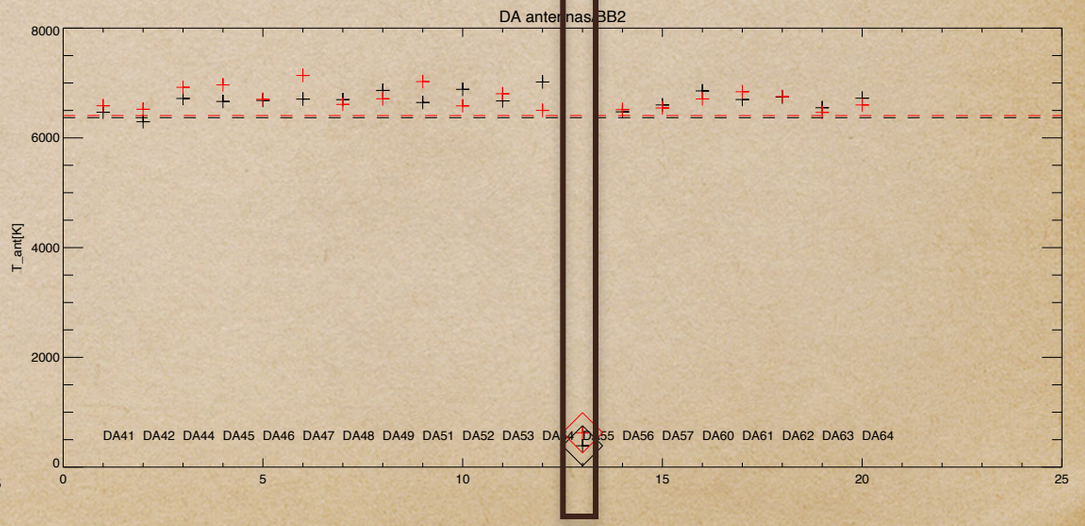
DV55: Scan#11 subscan#02



DV06: Scan#29 subscan#02



DV55: Scan#20 subscan#03



Summary

- The antennas that have the T_ant anomaly were flagged in QA2 process. Hence, there is no influences for your science.
- In most case, the large variations are caused by the unstableness of the receiver (not bug of the software).
- To confirm the issue, we need to investigate the data obtained in Cycle 5 and later.