Long-term (TP-) stability and noise of individual HBA dipoles

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CS-1 meeting, 14 nov 2007

Conversion AIPS++ and Exloo antenna nomenclature

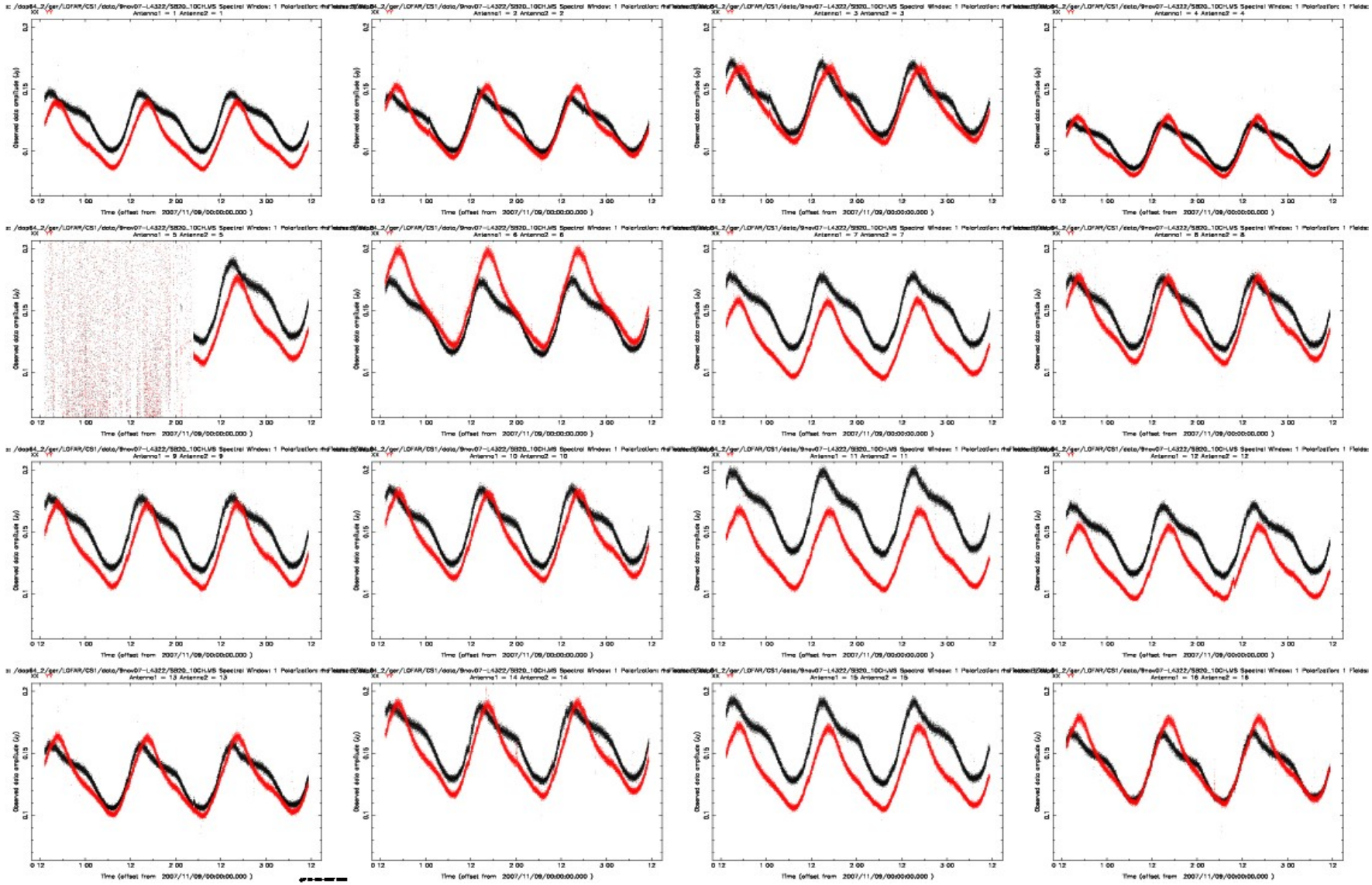
Wrong !

These refer to LBA positions

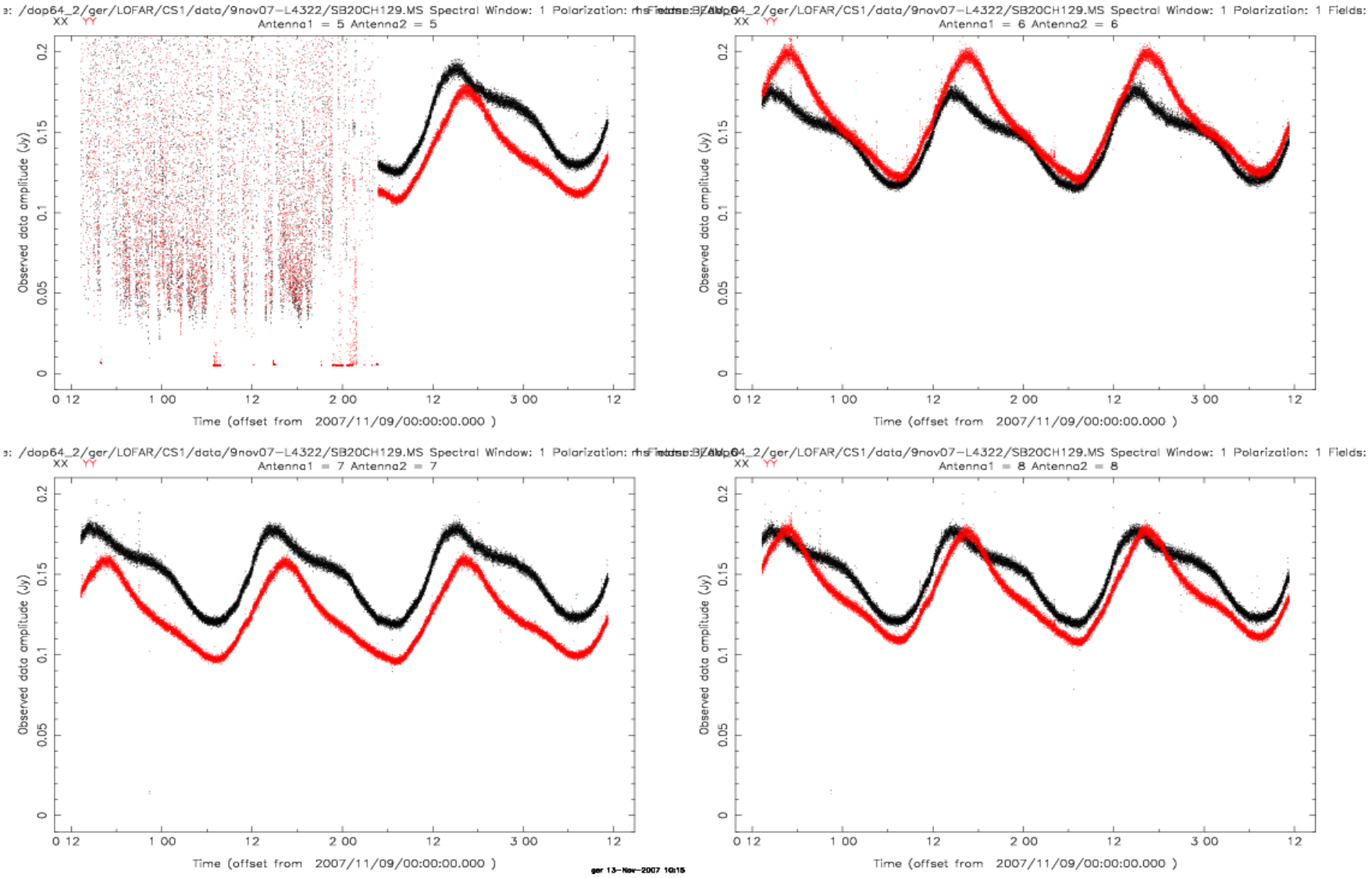
L4322-HBA

ID	Name	Station	Diam.	Long.	Lat.
1	CS010_HBA0LOFAR		150.0m	+006.52.07.3	+52.43.37.8
2	CS010_HBA1LOFAR		150.0m	+006.52.08.8	+52.43.38.4
3	CS010_HBA2LOFAR		150.0m	+006.52.07.0	+52.43.37.7
4	CS010_HBA3LOFAR		150.0m	+006.52.08.2	+52.43.38.1
5	CS001_HBA0LOFAR		150.0m	+006.52.01.5	+52.43.32.0
6	CS001_HBA1LOFAR		150.0m	+006.52.02.3	+52.43.33.0
7	CS001_HBA2LOFAR		150.0m	+006.52.03.8	+52.43.32.5
8	CS001_HBA3LOFAR		150.0m	+006.52.03.0	+52.43.31.6
9	CS008_HBA0LOFAR		150.0m	+006.52.05.0	+52.43.43.3
10	CS008_HBA1LOFAR		150.0m	+006.52.05.8	+52.43.44.2
11	CS008_HBA2LOFAR		150.0m	+006.52.10.7	+52.43.42.9
12	CS008_HBA3LOFAR		150.0m	+006.52.09.9	+52.43.42.0
13	CS016_HBA0LOFAR		150.0m	+006.52.23.6	+52.43.37.7
14	CS016_HBA1LOFAR		150.0m	+006.52.24.4	+52.43.38.6
15	CS016_HBA2LOFAR		150.0m	+006.52.25.9	+52.43.38.2
16	CS016_HBA3LOFAR		150.0m	+006.52.25.1	+52.43.37.2

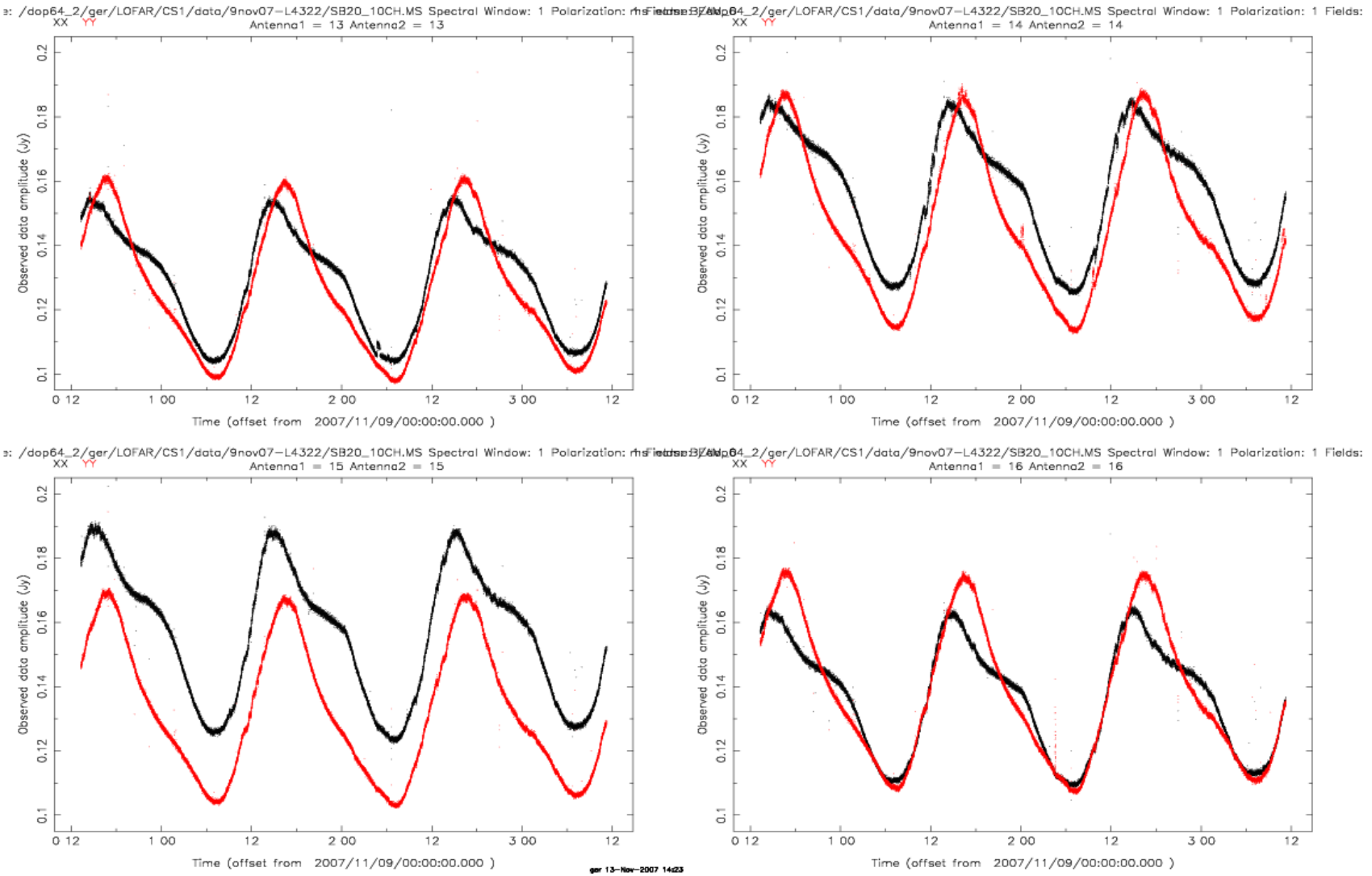
70h HBA observation, 155 MHz , SB20 (9-12 Nov 2007, L4322)



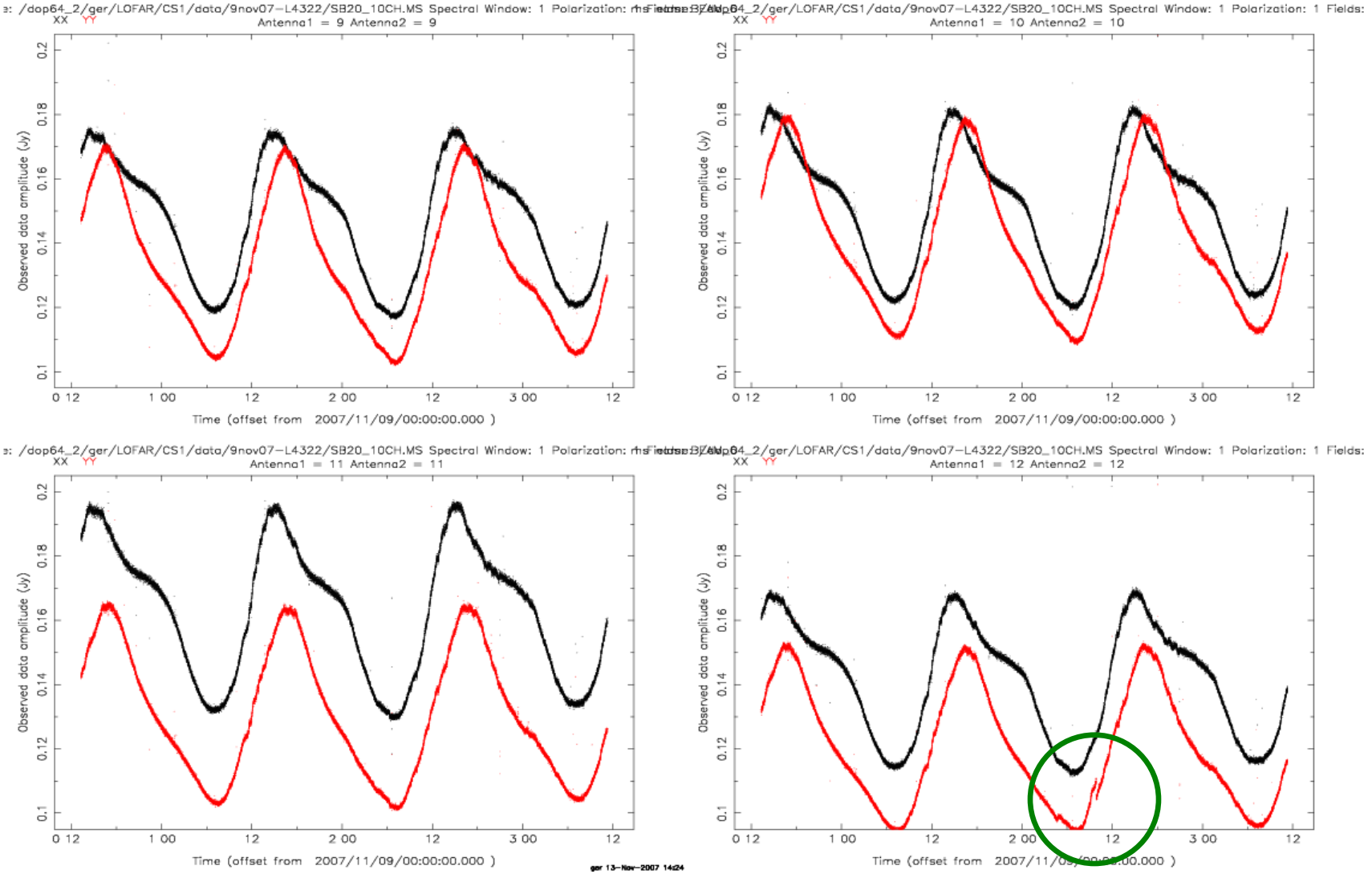
CS001


/dop64_2/ger/LOFAR/CS1/data/9nov07-L4322/SB20CH129.MS Spectral Window: 1 Polarization: 1 Fields:
XX YY
Antenna1 = 5 Antenna2 = 5
Antenna1 = 6 Antenna2 = 6
Antenna1 = 7 Antenna2 = 7
Antenna1 = 8 Antenna2 = 8
Observed data amplitude (Jy)
Time (offset from 2007/11/09/00:00:00.000)
0 12
1 00
2 00
3 00
ger 13-Nov-2007 10:15

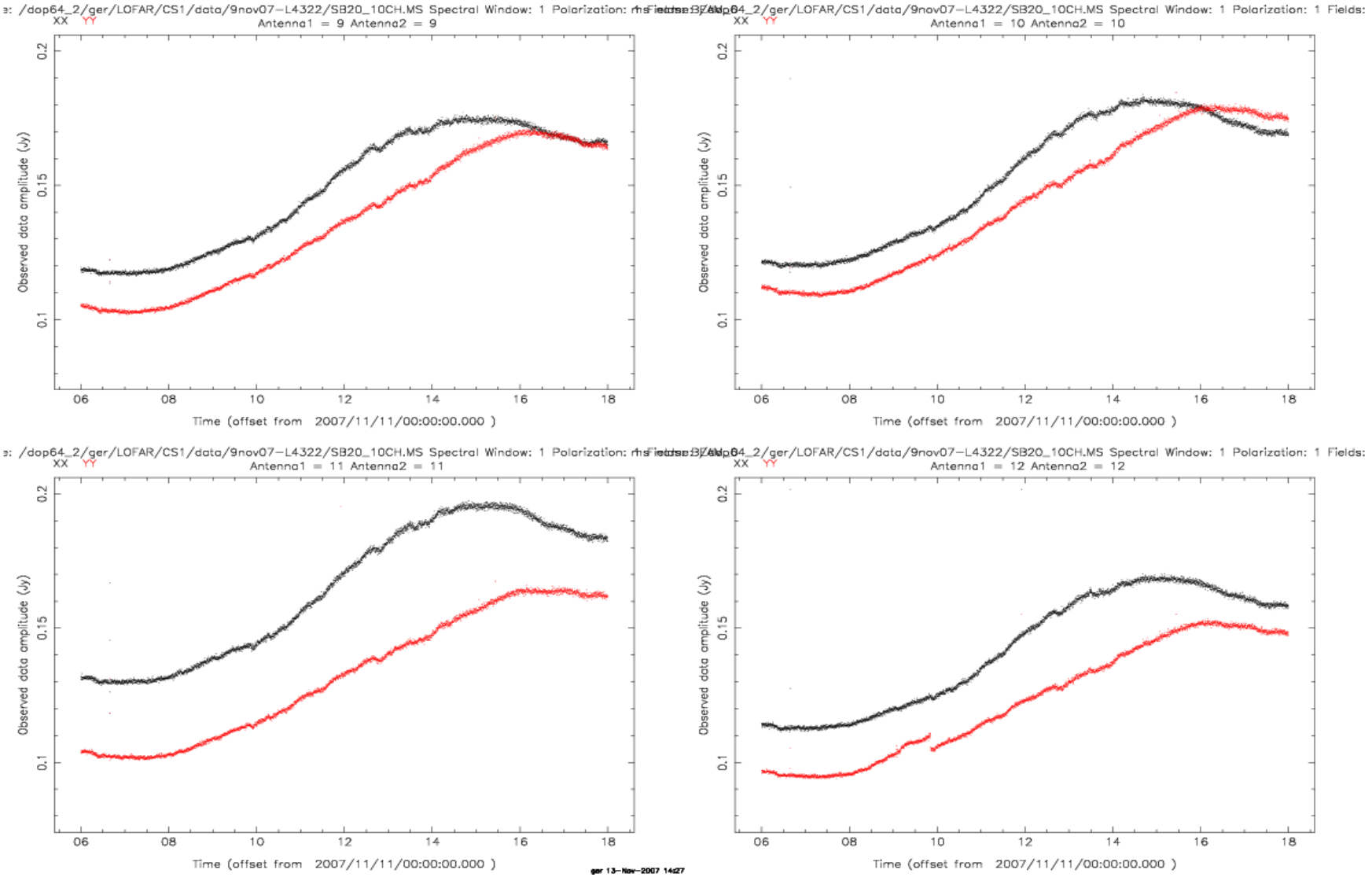
CS016


/dop64_2/ger/LOFAR/CS1/data/9nov07-L4322/SB20_10CH.MS Spectral Window: 1 Polarization: 1 Fields: 3
XX YY
Antenna1 = 13 Antenna2 = 13
Antenna1 = 14 Antenna2 = 14
Antenna1 = 15 Antenna2 = 15
Antenna1 = 16 Antenna2 = 16
Observed data amplitude (Jy)
0.1
0.12
0.14
0.16
0.18
0.2
0 12
1 00
12
2 00
12
3 00
12
Time (offset from 2007/11/09/00:00:00.000)
ger 13-Nov-2007 14:23

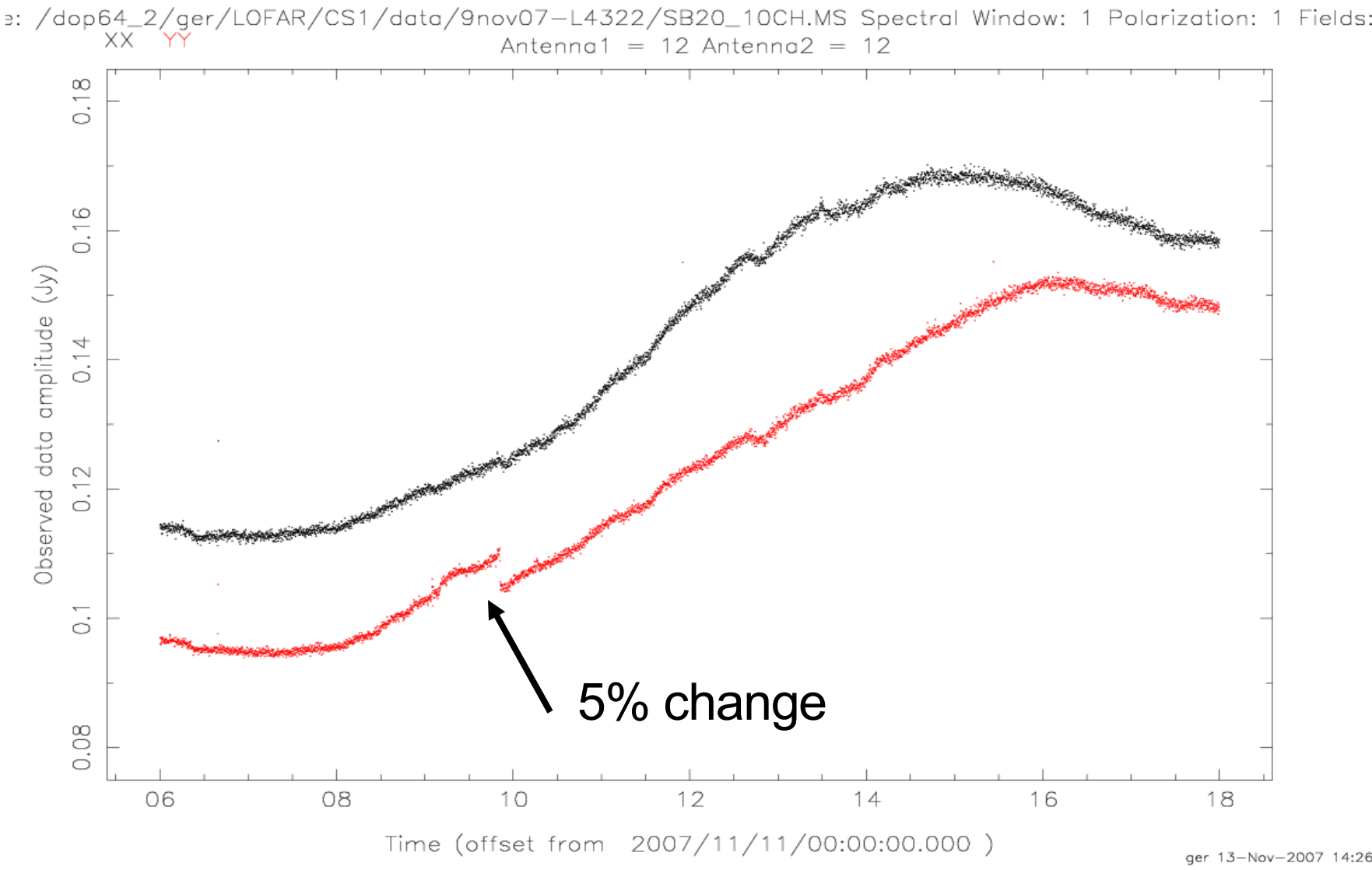
CS008


/dop64_2/ger/LOFAR/CS1/data/9nov07-L4322/SB20_10CH.MS Spectral Window: 1 Polarization: 1 Fields:
XX YY
Antenna1 = 9 Antenna2 = 9
Antenna1 = 10 Antenna2 = 10
Antenna1 = 11 Antenna2 = 11
Antenna1 = 12 Antenna2 = 12
Observed data amplitude (Jy)
Time (offset from 2007/11/09/00:00:00.000)
ger 13-Nov-2007 14:24

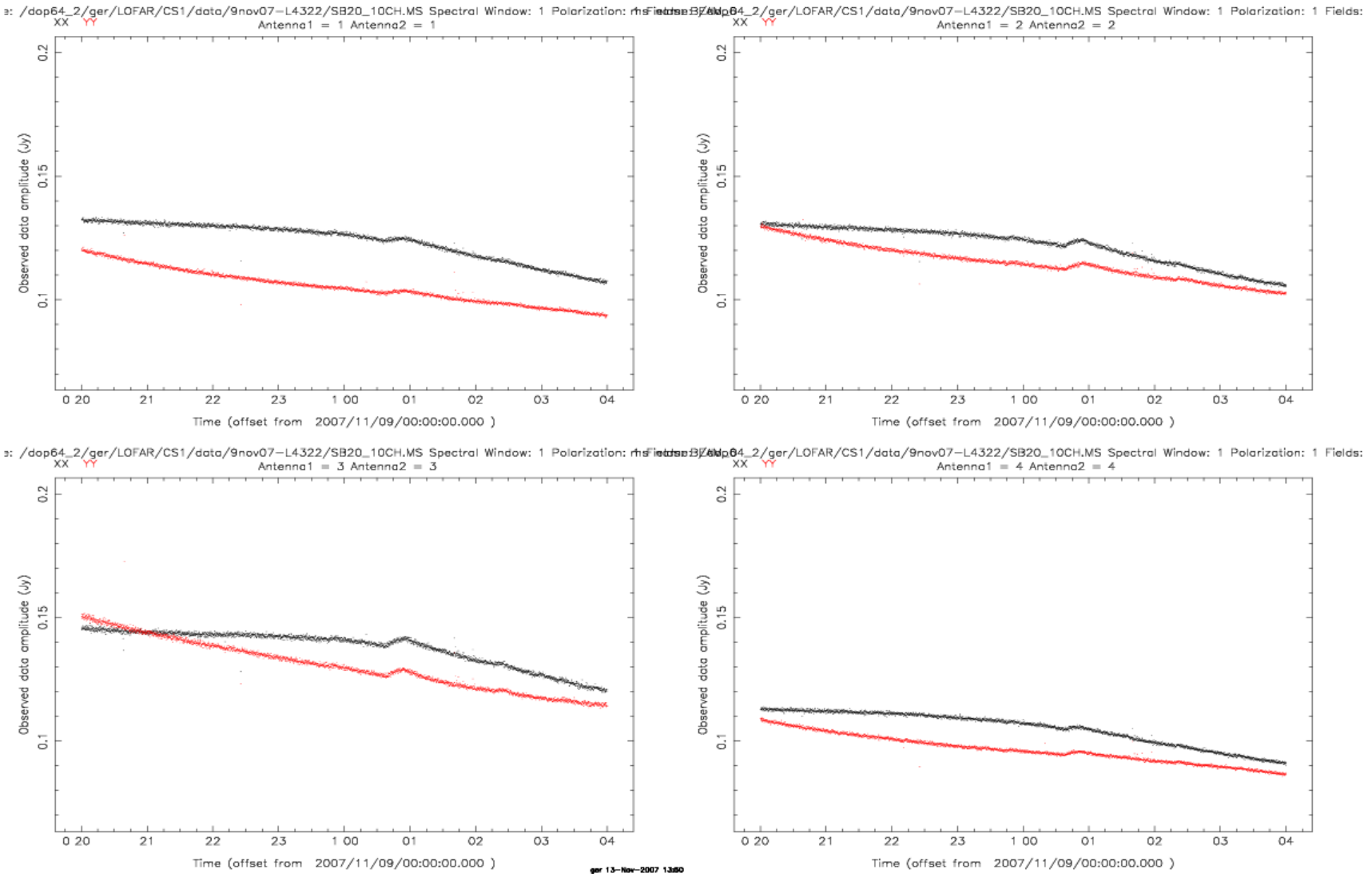
CS008, blowup



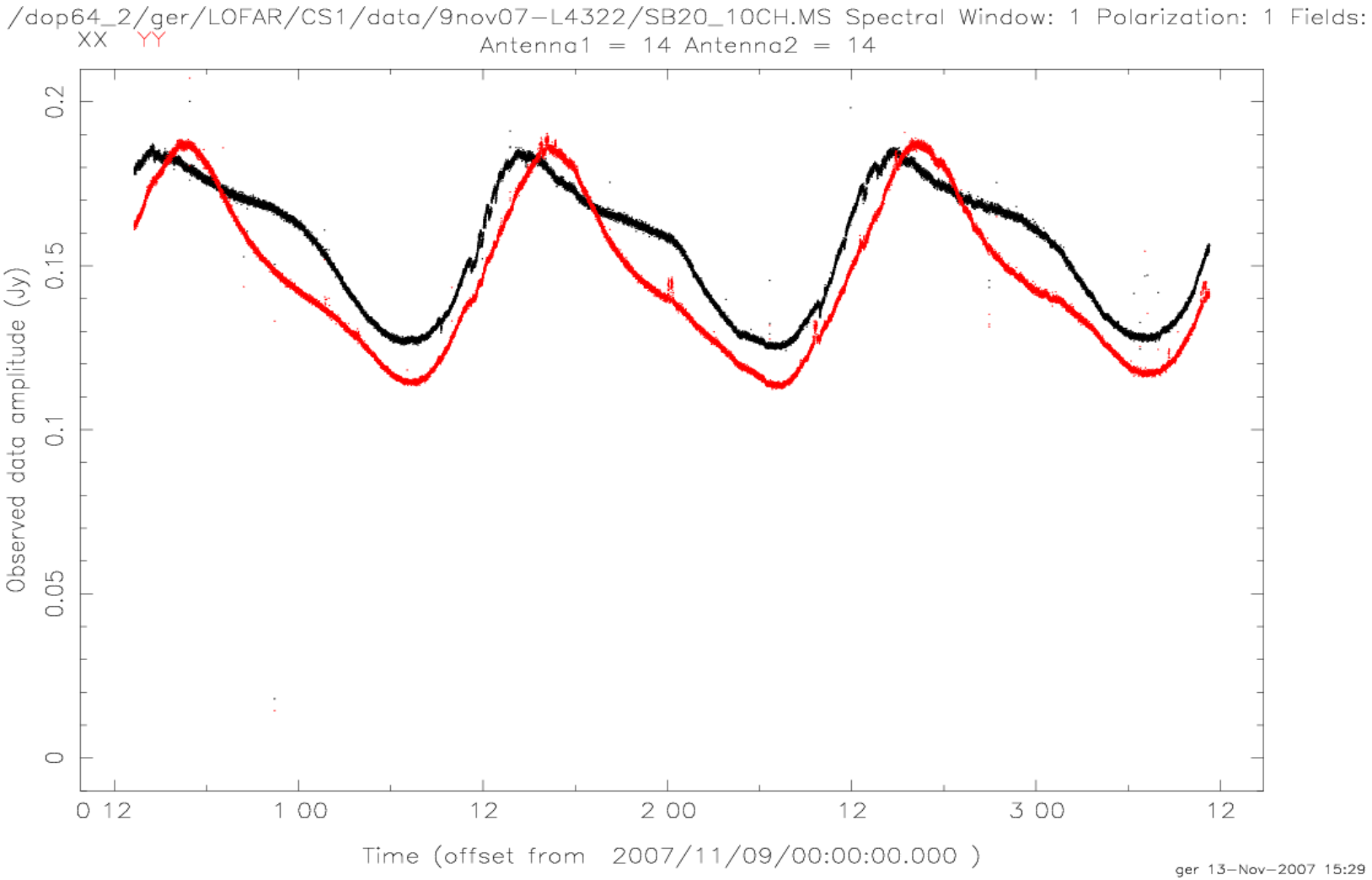
CS008, ANT12, blowup



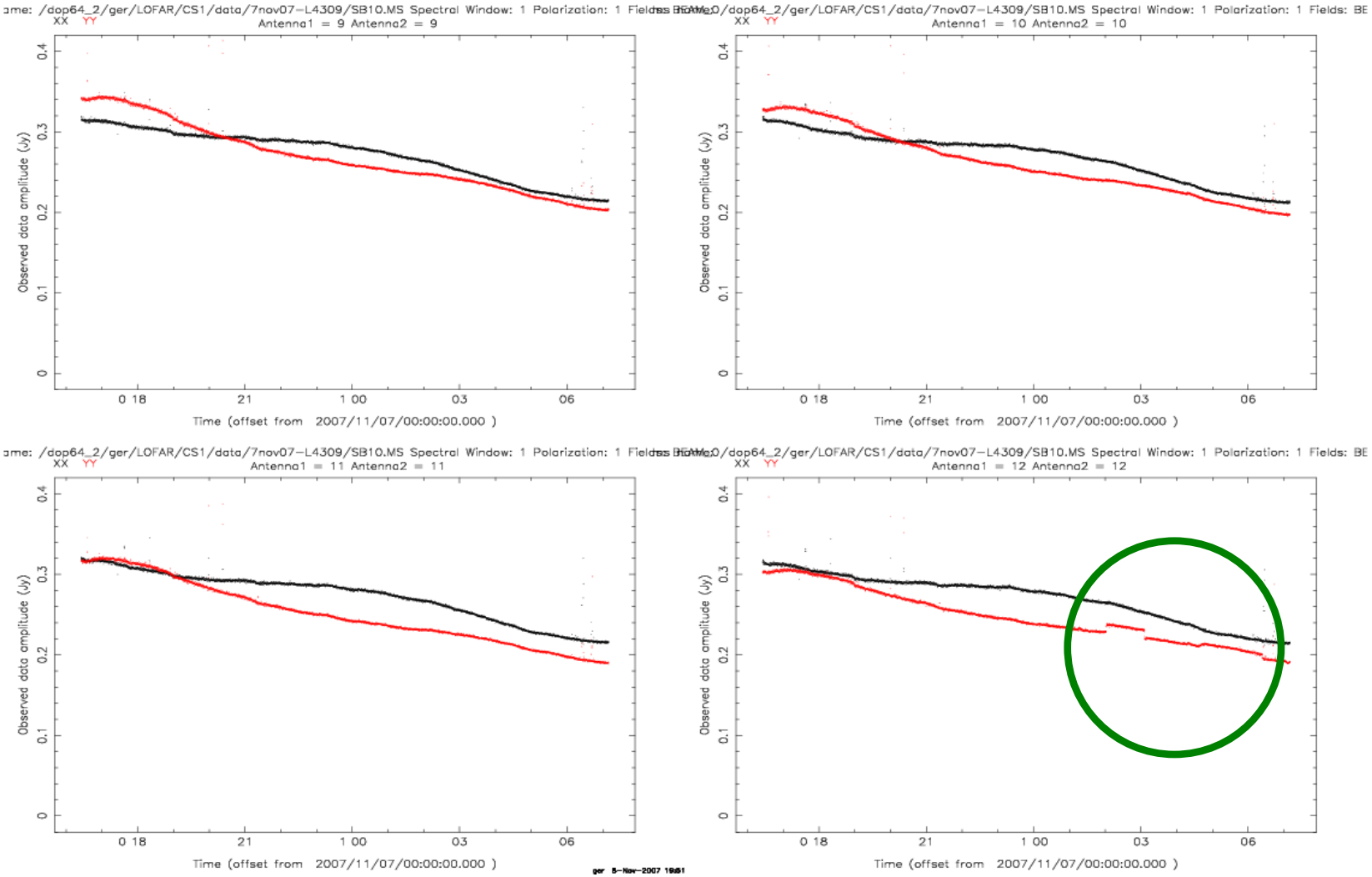
CS010, blowup



CS016 ANT14


e: /dop64_2/ger/LOFAR/CS1/data/9nov07-L4322/SB20_10CH.MS Spectral Window: 1 Polarization: 1 Fields:
XX YY
Antenna1 = 14 Antenna2 = 14
Observed data amplitude (Jy)
0
0.05
0.1
0.15
0.2
0 12
1 00
12
2 00
12
3 00
12
Time (offset from 2007/11/09/00:00:00.000)
ger 13-Nov-2007 15:29

7/8 November 2007, L4309 CS008



S/N in HBA fringes at 155 MHz
L4320, 8/9 nov2007

Expected peak amplitude at LST~21h due to CasA+CygA is about 18,000 Jy

(assuming dipole beam gain ~ 0.9 and 20,200 Jy total flux (RJN))

Observed S/N in 1 - 10 - 25 - 100 ch is about 2.5 - 8 - 12.5 - 25

$\Rightarrow$ noise in 1ch ~ 7200 Jy.

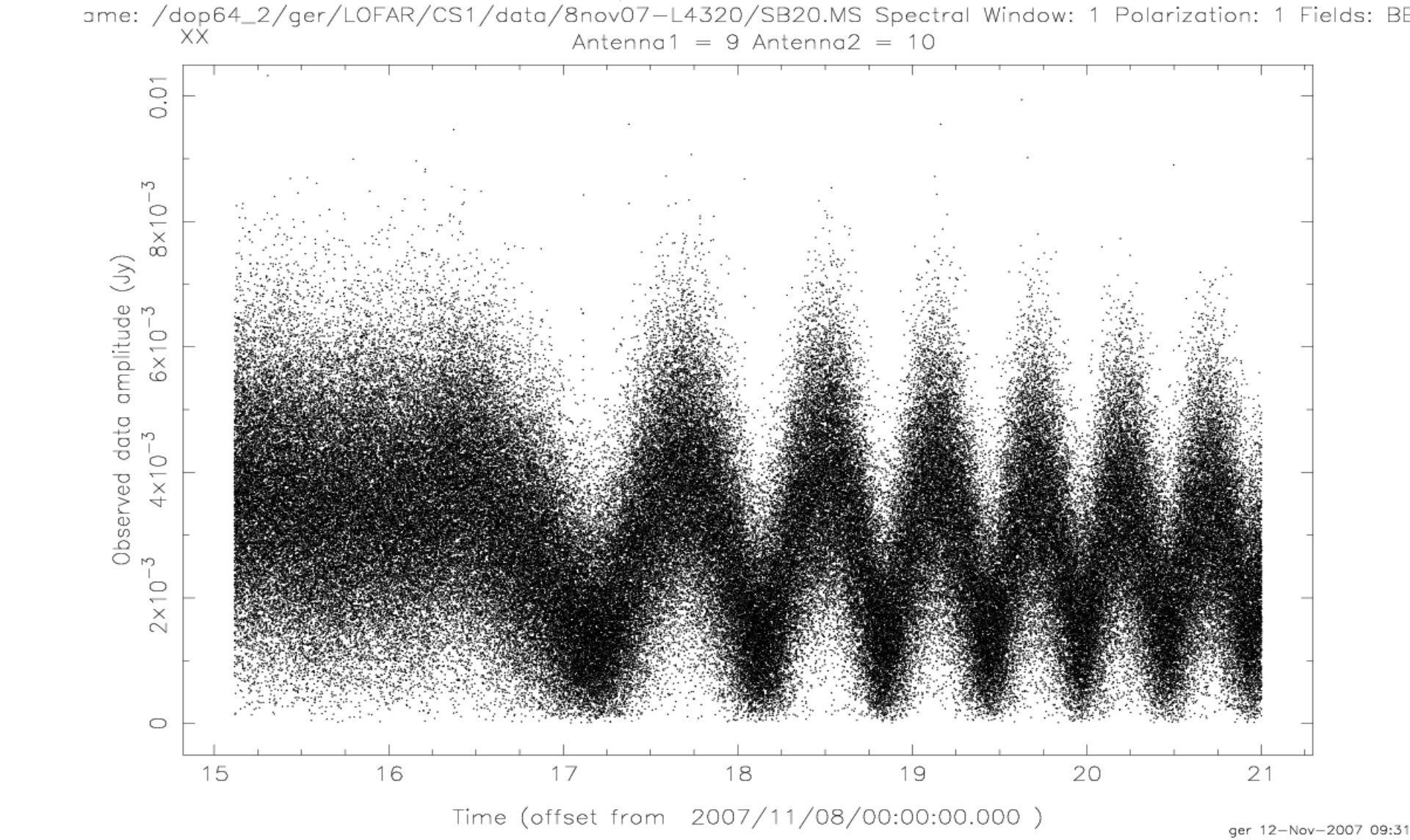
B=780 Hz, t=10s $\Rightarrow$ SEFD = 7200 Jy x SQRT(B.t) ~ 640,000 Jy

Isolated dipole has $A_{eff} \sim 1/3\ \lambda^2 \sim 1.25\ m^2$

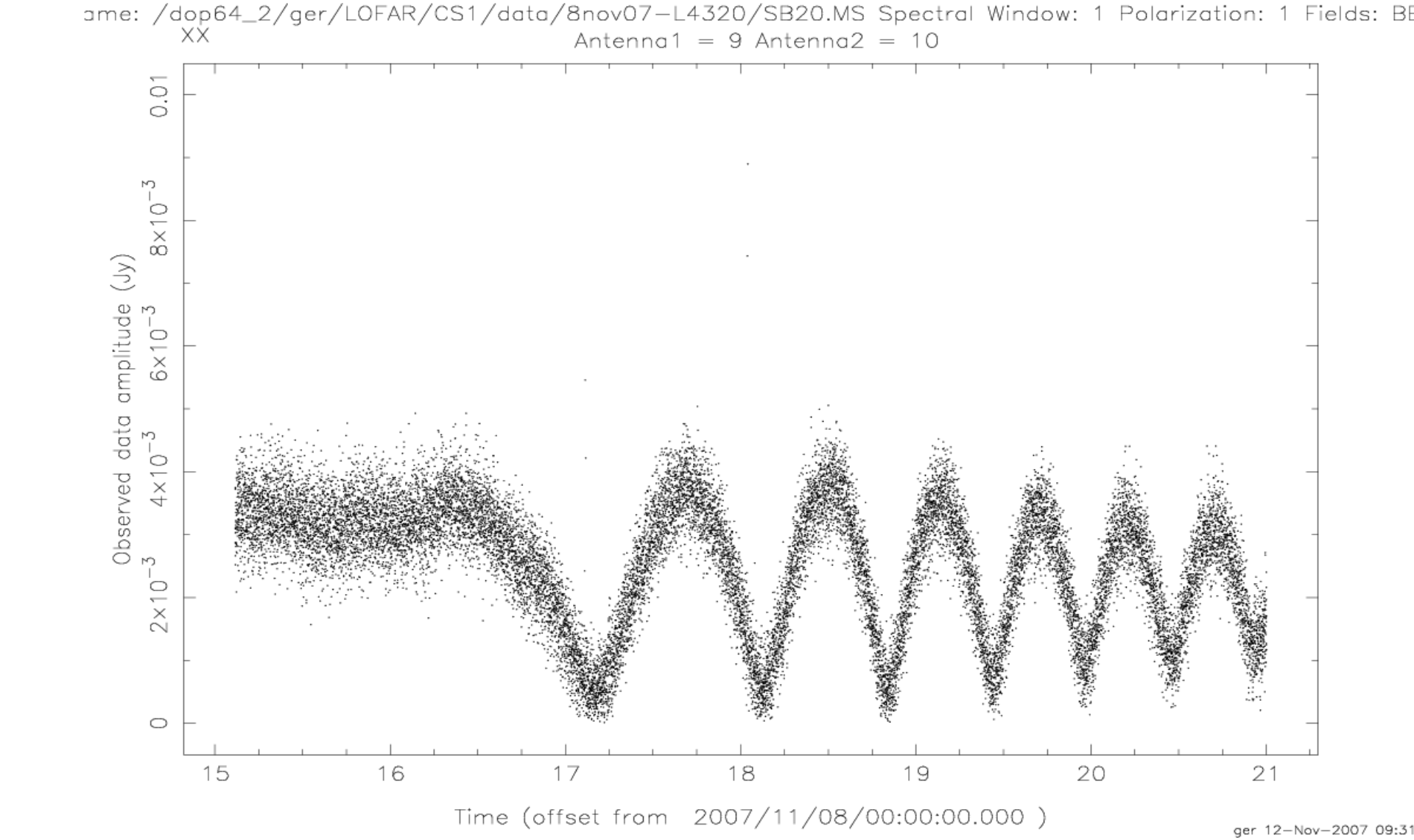
From SEFD = 2760 T_{sys}/A_{eff} we then deduce that $T_{sys} \sim 290$ K

This is significantly lower (better !) than expected

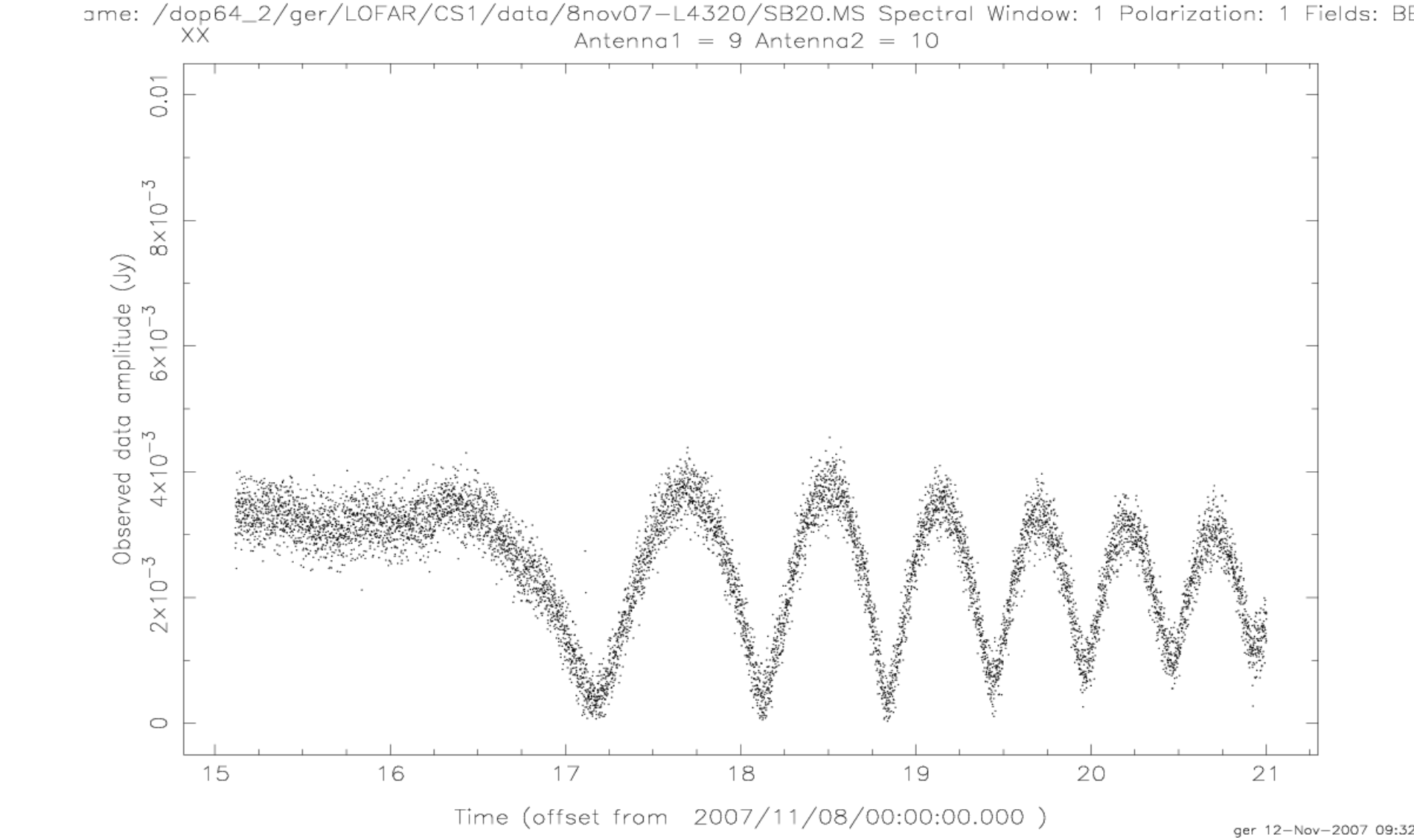
S/N in fringes at 155 MHz <1ch-10ch-25ch-100ch>
L4320, 8/9 nov2007



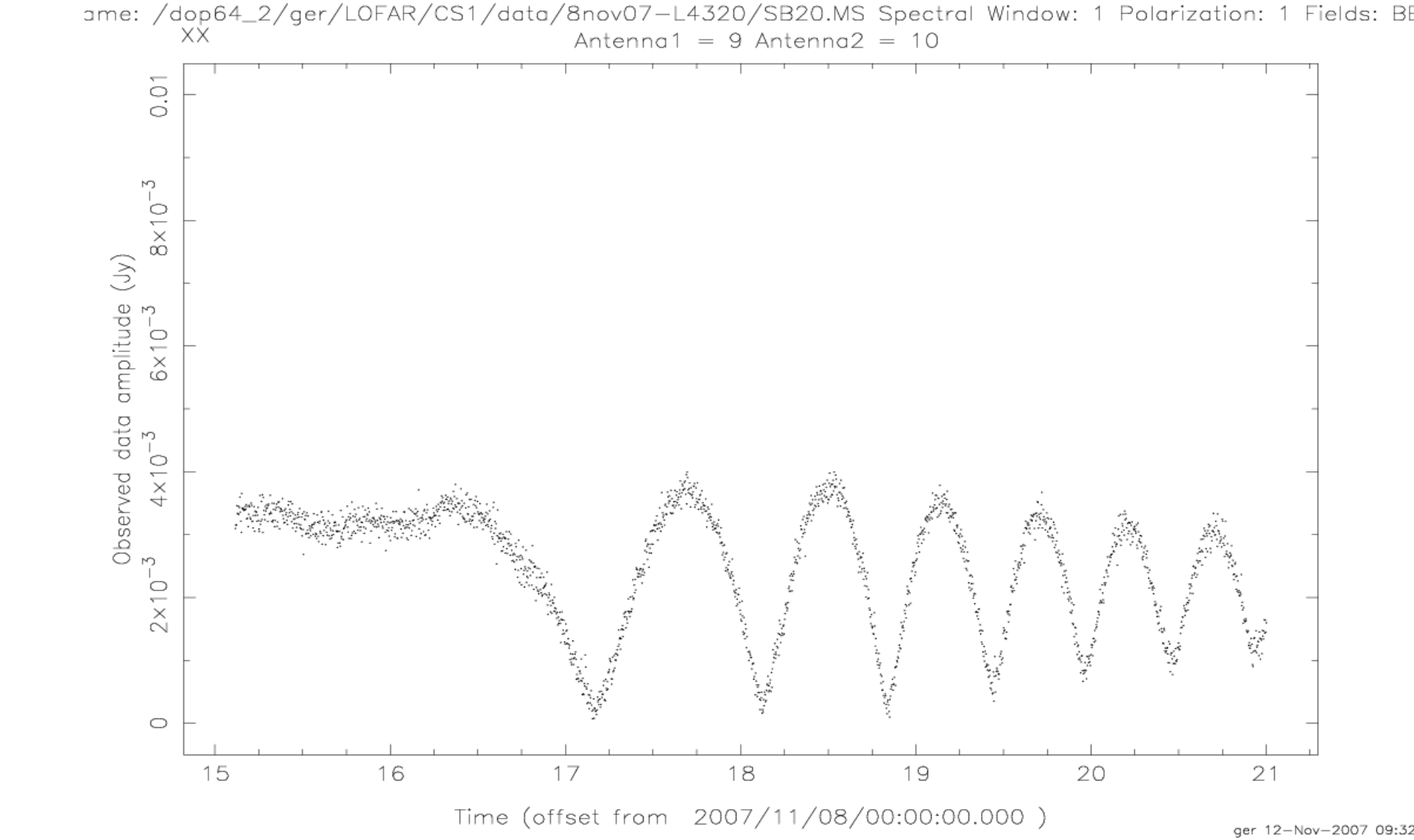
S/N in fringes at 155 MHz <1ch-10ch-25ch-100ch>
L4320, 8/9 nov2007



S/N in fringes at 155 MHz <1ch-10ch-25ch-100ch>
L4320, 8/9 nov2007



S/N in fringes at 155 MHz <1ch-10ch-25ch-100ch>
L4320, 8/9 nov2007



Some preliminary conclusions on HBA dipoles:

- S/N in fringes good (at 155 MHz) hence good A_{eff}/T_{sys}.

Still to be investigated at other frequencies, also above 200 MHz and then to be compared with tiles.

2) Long term stability of HBA in TP seems good.

3) Short term jumps, drops and drifts at ~ 5% level still need investigation