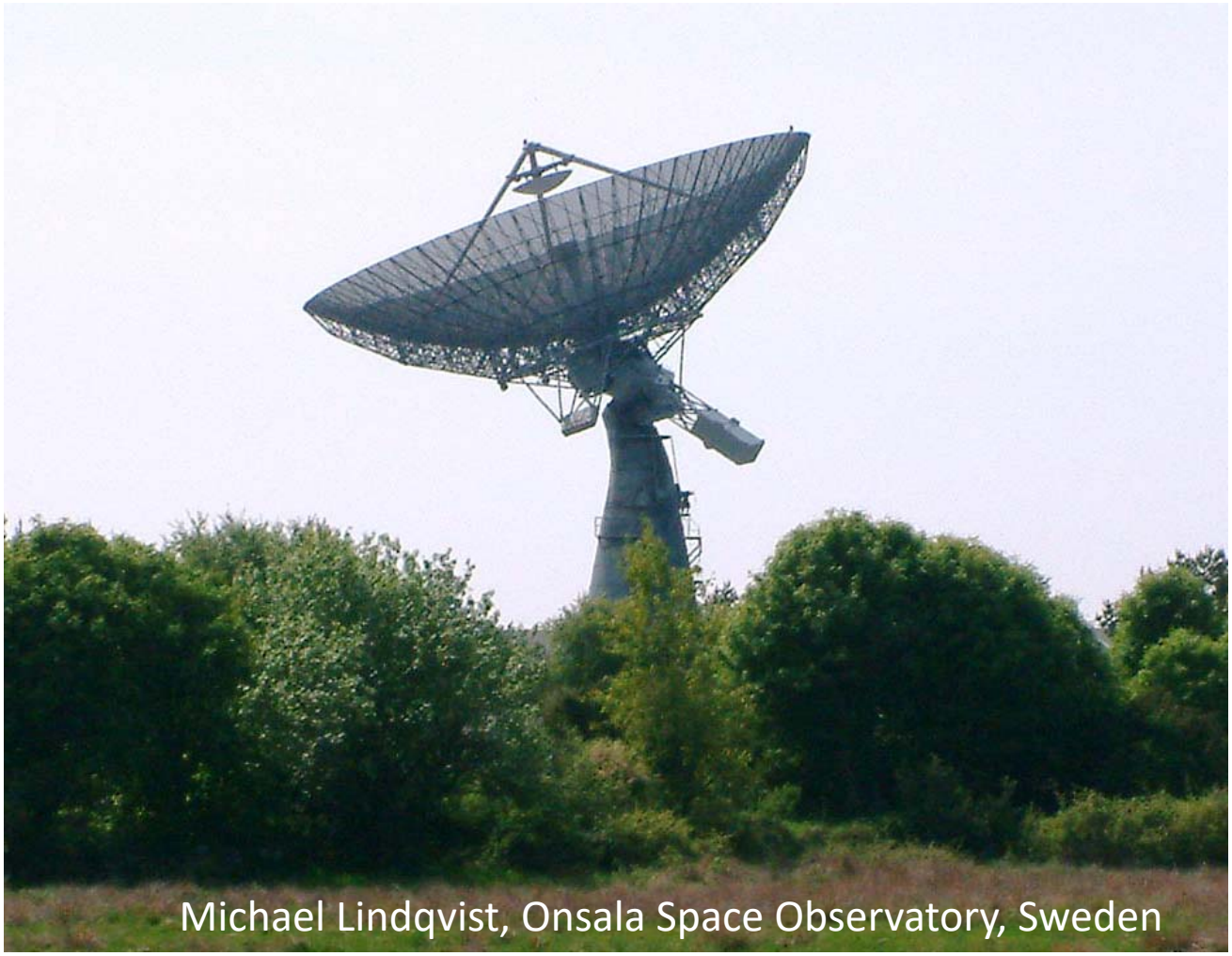
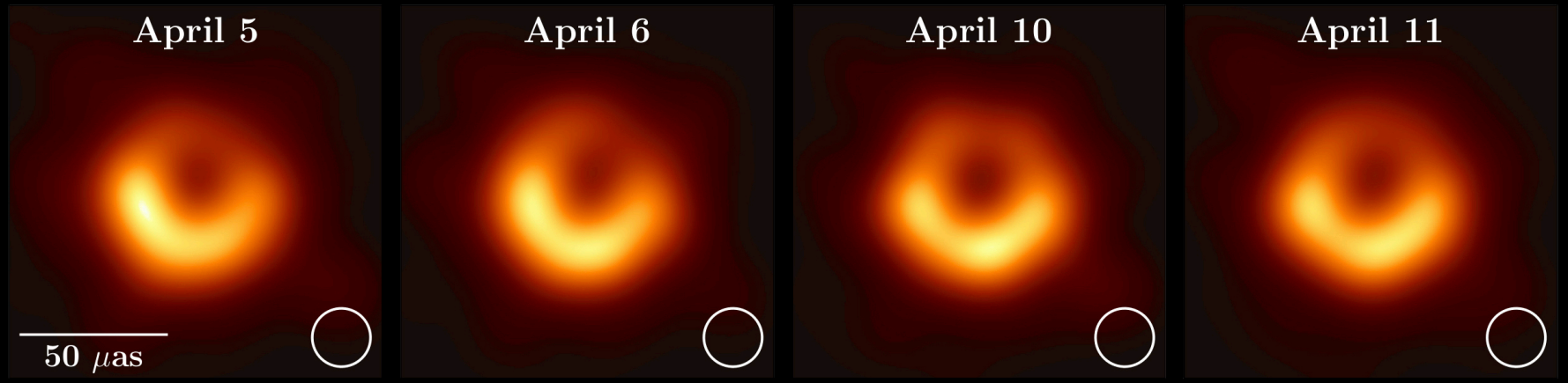
Antenna Gain Calibration



Why is calibration important?



How can we deliver better calibrated data to the user?

The answer to this question is very simple but it is not so easy to realize: we need to determine T_{cal}(K) and the combination of DPFU (Degrees per Flux Unit) and the gain curve (G).

- fivept (Ed H. class)
- onoff
- gnplt

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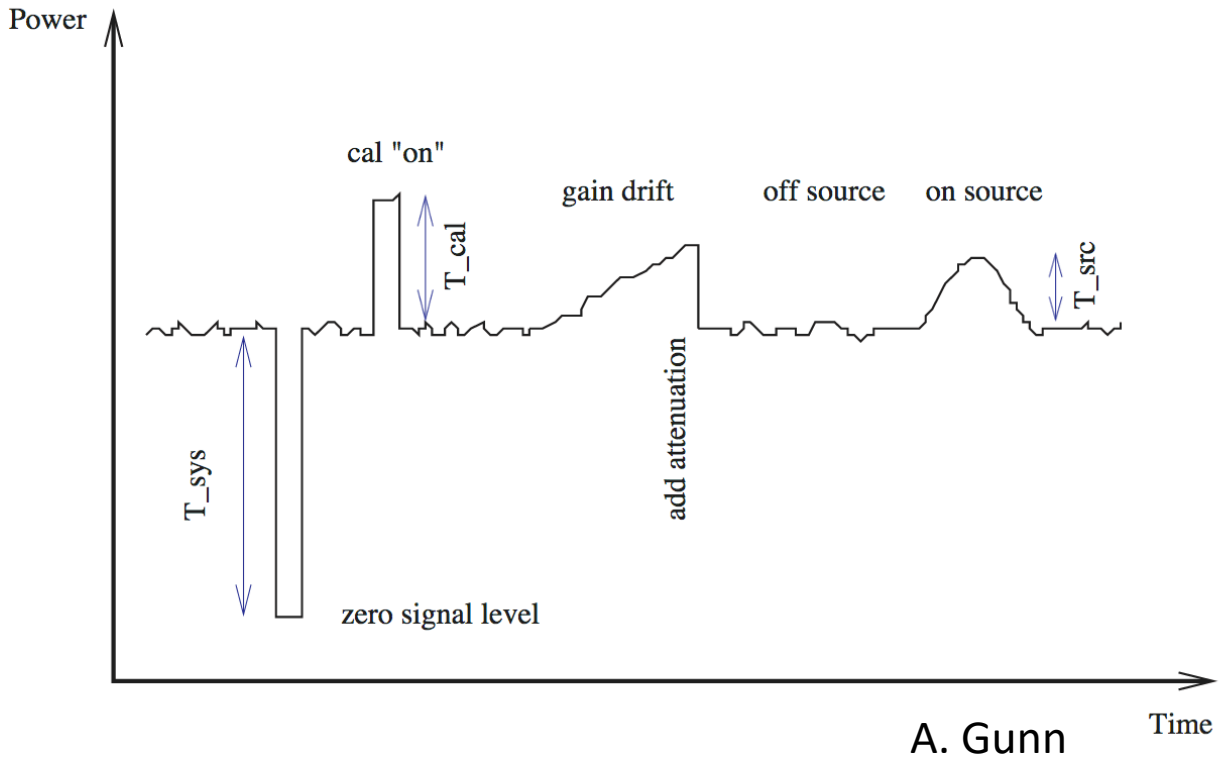


Important files

- flux.ctl /usr2/control
- pointc.ctl /usr2/control
- *.rxg /usr2/control/rxg_files
- *.prc /usr2/proc
- *.log /usr2/log

ONOFF

- **Power on source [ONSO]**
- **Power on source with noise diode on [ONSC]**
- **Power off source with noise diode on [OFFC]**
- **Power off source with noise diode off [OFFS]**
- **Power off source with no signal for “zero” [ZERO]**

2011.067.07:43:29.45#onoff#	source	Az	El	De	I	P	Center	Comp	Tsys	SEFD	Tcal(j)	Tcal(r)
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	1u	1	l	4941.00	0.9850	57.62	736.3	193.744	1.05
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	2u	2	r	4941.00	0.9878	169.9	844.2	77.882	0.41
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	3u	1	l	4943.00	0.9938	57.61	729.9	193.649	1.04
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	4u	2	r	4943.00	0.9845	167.7	840.6	79.017	0.41
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	5u	1	l	4945.00	0.9851	57.66	729.9	193.592	1.04
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	6u	2	r	4945.00	0.9877	168.0	837.7	79.321	0.41
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	7u	1	l	4947.00	0.9833	57.81	727.6	190.954	1.03
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	8u	2	r	4947.00	0.9865	171.5	837.2	79.032	0.40
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	9u	1	l	4949.00	0.9959	58.03	718.5	187.139	1.02
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	au	2	r	4949.00	0.9907	172.8	839.8	78.740	0.40
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	bu	1	l	4953.00	0.9867	58.17	712.0	179.502	1.00
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	cu	2	r	4953.09	0.9939	171.5	834.4	77.979	0.40
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	du	1	l	4955.00	0.9900	58.04	713.0	175.949	1.01
2011.067.07:43:29.45#onoff#VAL	cygnusa	161.7	72.8	eu	2	r	4955.00	0.9920	173.7	837.8	76.844	0.40
2011.067.07:43:29.45#onoff#	source	Az	El	De	I	P	Center	Comp	Tsys	SEFD	Tcal(j)	Tcal(r)

SEFD is the "system equivalent flux density" (Jy), defined as the flux density of a radio source that doubles the system temperature. SEFD = Tsys/G

$$\mathrm{Comp} = \frac{\mathrm{ONSC} - \mathrm{ONSO}}{\mathrm{OFFC} - \mathrm{OFFS}}$$

$$\mathrm{SEFD} = \mathrm{S} \times \frac{\mathrm{OFFS} - \mathrm{ZERO}}{\mathrm{ONSO} - \mathrm{OFFS}}$$

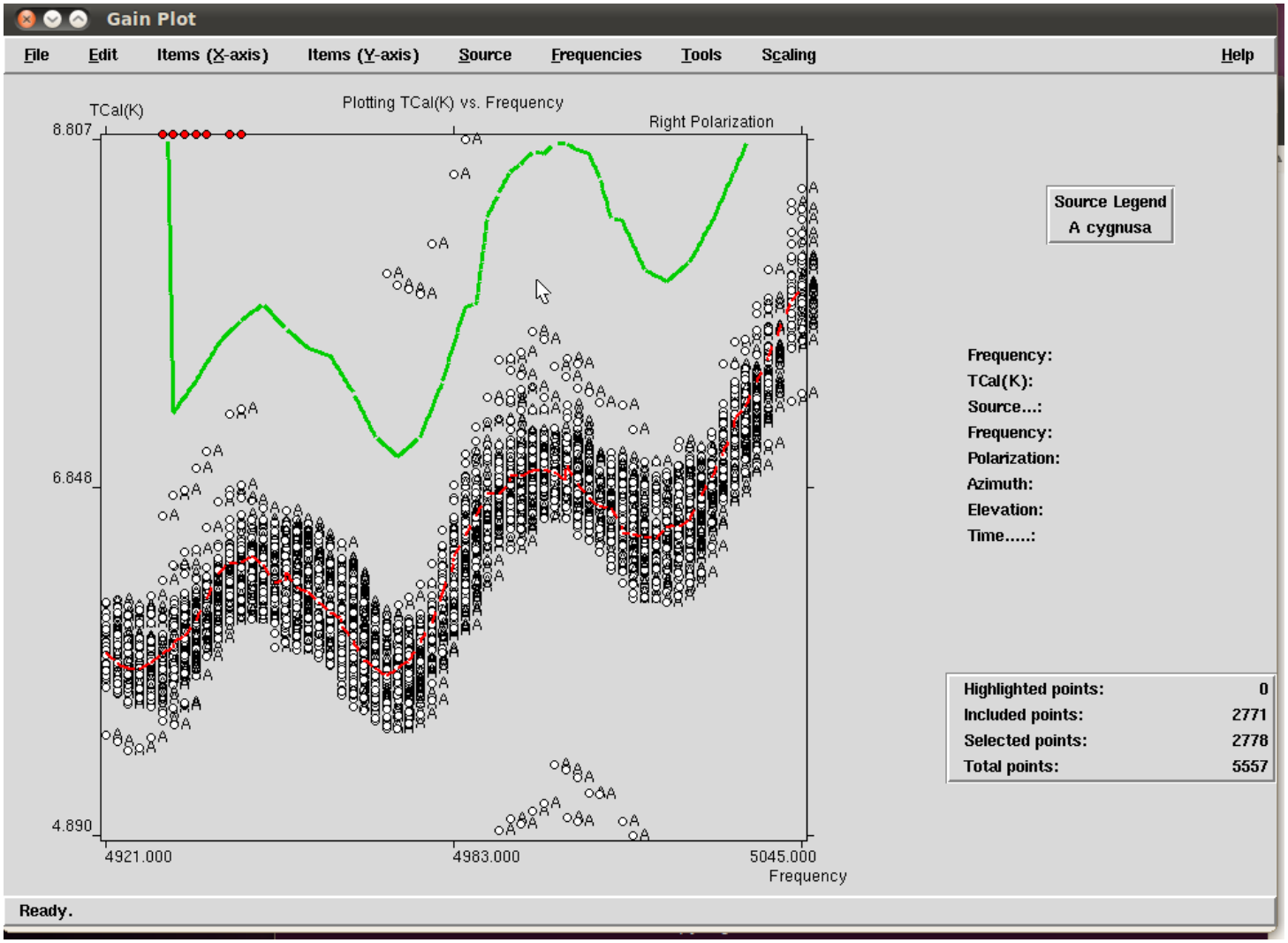
$$\mathrm{T_{sys}} = \mathrm{T_{cal}} \times \frac{\mathrm{OFFS} - \mathrm{ZERO}}{\mathrm{OFFC} - \mathrm{OFFS}}$$

$$\mathrm{T_{cal}(Jy)} = \mathrm{S} \times \frac{\mathrm{OFFC} - \mathrm{OFFS}}{\mathrm{ONSO} - \mathrm{OFFS}}$$

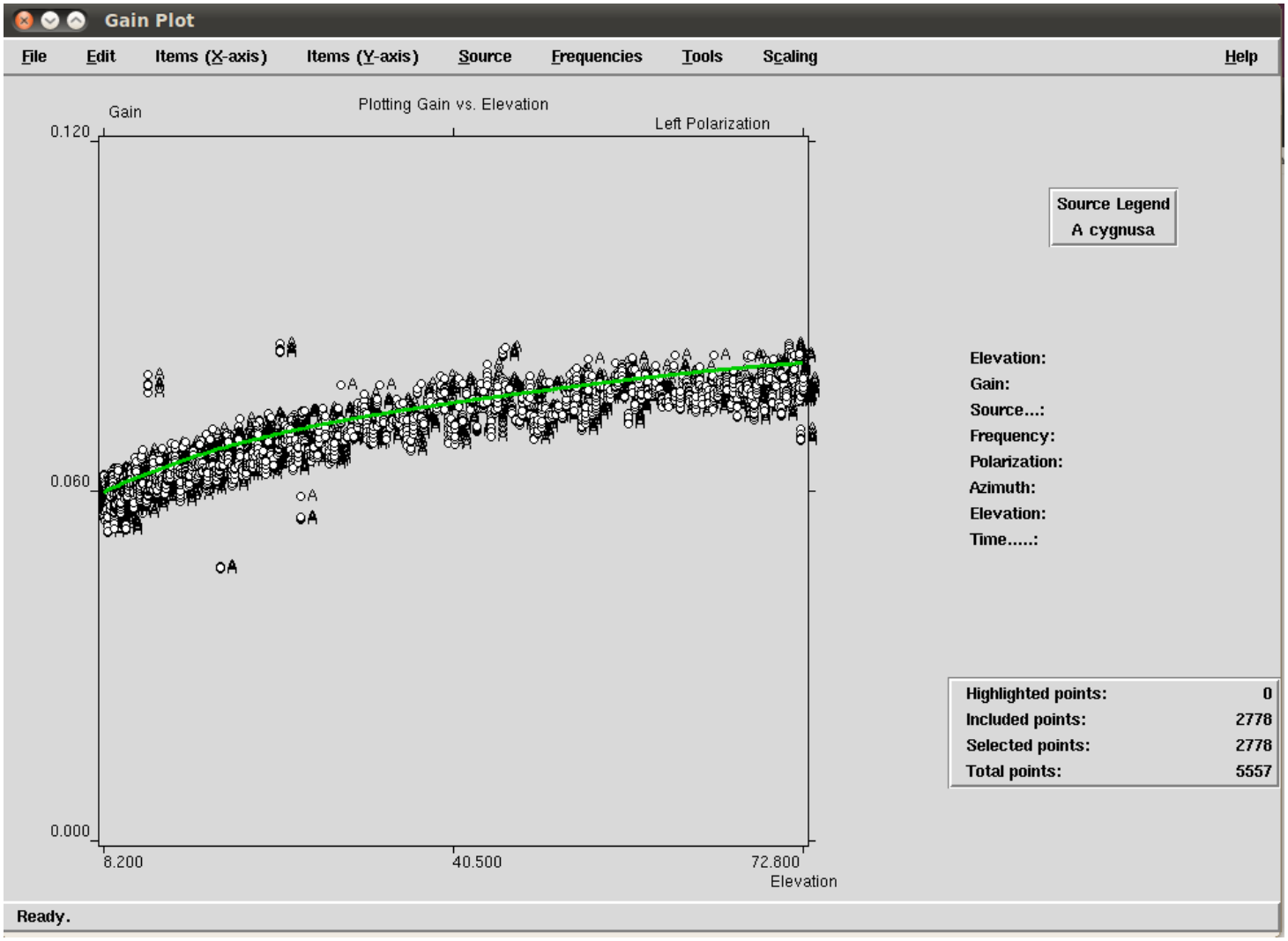
$$\mathrm{T_{cal}(K)} = \mathrm{DPFU} \times \mathrm{gain(el)} \times \mathrm{T_{cal}(Jy)}$$

$$\mathrm{T_{cal}(r)} = \mathrm{T_{cal}(K)} / \mathrm{T_{cal,rxg}(K)}$$

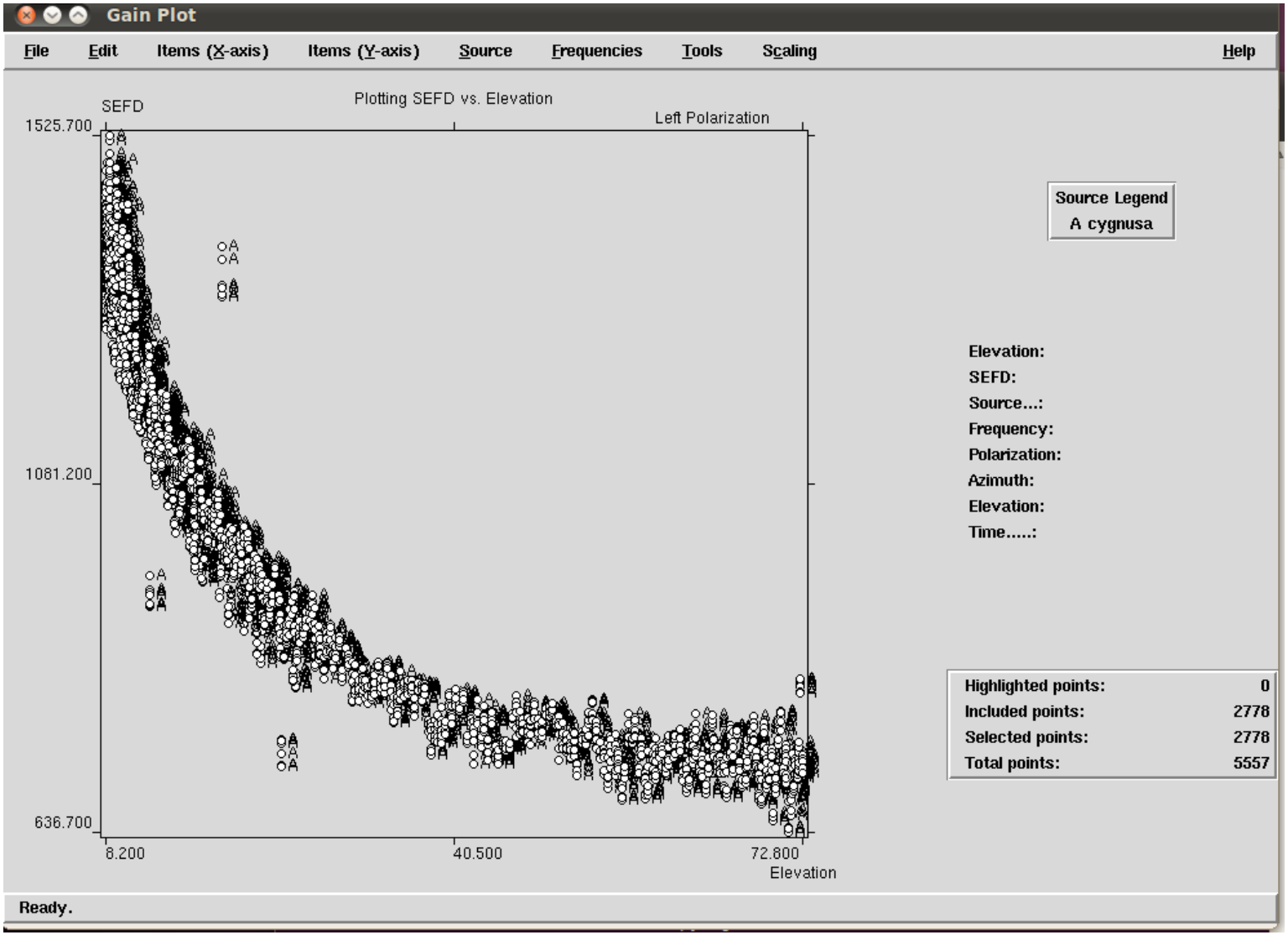
GNPLT


Gain Plot
File
Edit
Items (X-axis)
Items (Y-axis)
Source
Frequencies
Tools
Scaling
Help
Plotting TCal(K) vs. Frequency
Right Polarization
TCal(K)
8.807
6.848
4.890
4921.000
4983.000
5045.000
Frequency
Source Legend
A cygnusa
Frequency:
TCal(K):
Source...:
Frequency:
Polarization:
Azimuth:
Elevation:
Time.....:
Highlighted points: 0
Included points: 2771
Selected points: 2778
Total points: 5557
Ready.

GNPLT


Gain Plot
File
Edit
Items (X-axis)
Items (Y-axis)
Source
Frequencies
Tools
Scaling
Help
Plotting Gain vs. Elevation
Gain
Left Polarization
0.120
0.060
0.000
8.200
40.500
72.800
Elevation
Source Legend
A cygnusa
Elevation:
Gain:
Source...:
Frequency:
Polarization:
Azimuth:
Elevation:
Time.....:
Highlighted points: 0
Included points: 2778
Selected points: 2778
Total points: 5557
Ready.

GNPLT


Gain Plot
File
Edit
Items (X-axis)
Items (Y-axis)
Source
Frequencies
Tools
Scaling
Help
Plotting SEFD vs. Elevation
SEFD
Left Polarization
1525.700
1081.200
636.700
8.200
40.500
72.800
Elevation
Source Legend
A cygnusa
Elevation:
SEFD:
Source...:
Frequency:
Polarization:
Azimuth:
Elevation:
Time.....:
Highlighted points: 0
Included points: 2778
Selected points: 2778
Total points: 5557
Ready.

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| PART 2  5 cm  |
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N19M2  Jb2 Wb1 Ef Mc Nt On85 T6 -- Tr Ys Hh -- -- -- Ir Sr -- -- -- -- -- -- --- EVN     4.15  0.35 Eu 154 1400(03/06)-1700(03/06) -
EB073  Jb2 Wb1 Ef Mc Nt On85 T6 -- Tr Ys Hh -- -- -- Ir Sr -- -- -- -- -- -- --- EVN    13.82  1.15 Eu 154 2030(03/06)-0630(04/06) -
CL19M2 Jb2 Wb1 Ef Mc Nt On85 T6 -- Tr Ys Hh -- -- -- Ir Sr -- -- -- -- -- -- --- ---     0.00  0.00 Eu 155 1400(04/06)-1800(04/06) -
EO016A Jb2 Wb1 Ef Mc Nt On85 T6 -- Tr Ys Hh -- -- -- Ir Sr -- -- -- -- -- -- --- EVN    11.06  0.92 Eu 155 2000(04/06)-0400(05/06) -

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| PART 3  6 cm  |
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N19C2  Jb2 Wb1 Ef Mc Nt On85 T6 Ur Tr Ys Hh Sv Zc Bd Ir --(Ar)--(Km)-- -- -- --- EVN    11.75  0.69 Eu 156 1300(05/06)-1600(05/06)  512 Mbps
EM137  Jb2 Wb1 Ef Mc Nt On85 T6 Ur Tr Ys Hh Sv Zc Bd Ir --(Ar)--(Km)-- -- -- --- EVN   179.25 11.06 Eu 156 1700(05/06)-0500(06/06) -
                                                                                            2.30 Ar 157 0230(06/06)-0500(06/06) Ar
CL19C2 Jb2 Wb1 Ef Mc Nt On85 T6 Ur Tr Ys Hh Sv Zc Bd Ir --(Ar)--(Km)-- -- -- --- ---     0.00  0.00 Eu 157 1000(06/06)-1400(06/06) 6cm FS CAL
EG103B Jb2 Wb1 Ef Mc Nt On85 T6 Ur Tr Ys Hh Sv Zc Bd Ir -- -- --(Km)-- -- -- MER EVN    73.73  4.61 Eu 157 1630(06/06)-0230(07/06) -
EK038C Jb2 Wb1 Ef Mc Nt On85 T6 Ur Tr Ys Hh Sv Zc Bd Ir -- -- -- -- -- -- -- --- EVN    27.65  1.84 Eu 158 1600(07/06)-2000(07/06) re-observation
EL056B Jb2 Wb1 Ef Mc Nt On85 T6 Ur Tr Ys Hh Sv Zc Bd -- -- -- -- -- -- -- -- --- EVN    77.41  5.53 Eu 159 0130(08/06)-0730(08/06) re-observation
EK038D Jb2 Wb1 Ef Mc Nt On85 T6 Ur Tr Ys Hh Sv Zc Bd Ir -- -- -- -- -- -- -- --- EVN    27.65  1.84 Eu 160 0200(09/06)-0600(09/06) re-observation
EK040B Jb2 Wb1 Ef Mc Nt On85 -- -- Tr Ys -- -- -- -- Ir -- -- -- -- -- -- -- MER EVN    62.21  6.91 Eu 160 2100(09/06)-0430(10/06) -

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| PART 4  1.3cm   |
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N19K2  Jb2 --- Ef Mc Nt On60 T6 Ur Tr Ys Hh Sv Zc Bd -- Sr -- Mh -- Kt Ky Ku --- EVN    24.88  1.38 Eu 161 1300(10/06)-1600(10/06)  1024 Mbps
EP113E Jb2 --- Ef Mc Nt On60 T6 Ur Tr Ys -- Sv Zc Bd -- Sr -- Mh -- Kt Ky Ku --- EVN    47.00  0.00 Eu 161 1700(10/06)-2000(10/06) 3rd epoch
EB064E Jb2 --- Ef Mc Nt On60 -- Ur Tr Ys Hh Sv Zc Bd -- Sr -- Mh -- -- -- -- --- EVN    38.71  0.00 Eu 162 0200(11/06)-0800(11/06) 3rd epoch
CL19K2 Jb2 --- Ef Mc Nt On60 T6 Ur Tr Ys Hh Sv Zc Bd -- Sr -- Mh -- Kt Ky Ku --- ---     0.00  0.00 Eu 162 0900(11/06)-1300(11/06) 1.3cm FS CAL
EB064F Jb2 --- Ef Mc Nt On60 T6 Ur Tr Ys Hh Sv Zc Bd -- Sr -- Mh -- Kt Ky Ku --- EVN    49.77  2.76 Eu 162 2200(11/06)-0400(12/06) 3rd epoch
```

- onoff
- gnplt

→ • rxg-file (Tcal(K), DPFU, gaincurve) → log-file+rxg-file

→ antabfs → antab-file to the user

Feedback from JIVE

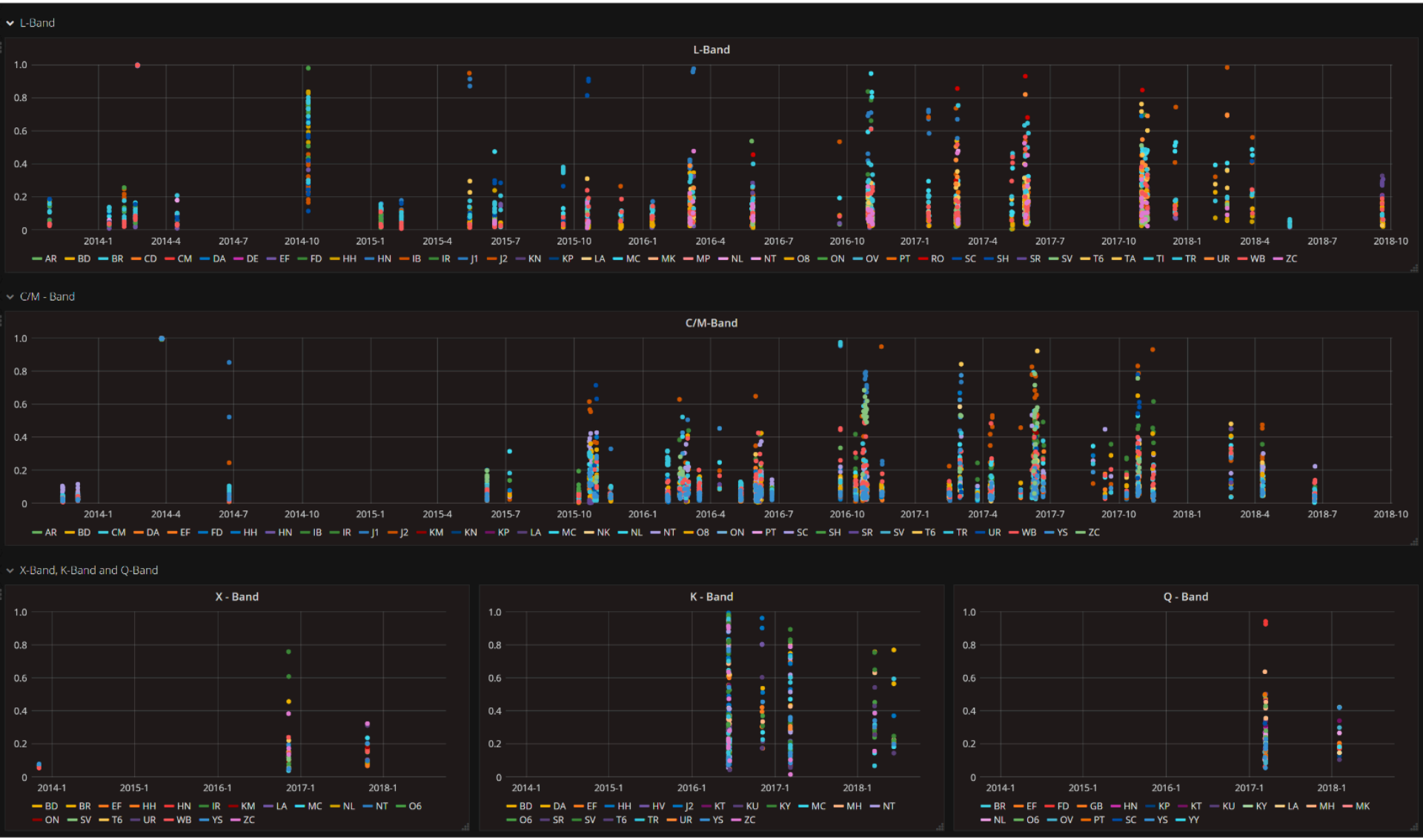
Session 3 2017 Oct

- The following table gives the **median absolute error** in the antenna gain amplitude. This number will be approximately half the error in the SEFD and is the same that you see in AIPS gain plots. The number in brackets after each entry is the number of experiments that were used.

Feedback from JIVE

	21cm	18cm	6cm
BD	0.21 (1)	0.06 (10)	0.11 (5)
EF	0.12 (2)	0.12 (13)	0.07 (18)
HH		0.11 (6)	0.07 (13)
IR		0.46 (2)	0.36 (14)
J2	0.33 (2)	0.16 (11)	0.06 (13)
MC		0.47 (13)	0.24 (14)
NT			0.16 (11)
O8	0.16 (2)	0.20 (11)	0.28 (9)
RO		0.84 (1)	
SV	0.37 (2)	0.07 (10)	0.09 (6)
T6		0.23 (9)	0.11 (12)
TR		0.28 (12)	0.07 (14)
UR	0.21 (2)	0.37 (11)	0.54 (7)
WB	0.29 (2)	0.18 (12)	0.18 (18)
YS			0.06 (18)
ZC	0.25 (2)	0.10 (10)	0.25 (5)

Feedback from JIVE



Feedback from JIVE

Antabfs and feedback name and shame