430 linefeed gain after the extension

phil perillat
18 july 1999

1.0 Summary

The 430 Mhz linefeed was extended by 13 inches during the month of june 1999. The center frequency, gain, system temperature, SEFD, and pointing were measured using on/off pairs and cross scans with the long range receiver. The center frequency, sefd,gain, and tsys are reported here. The pointing results are in 4*30 linefeed pointing after the extension*. The gain and frequency results using polarization A are:

1. The center frequency of the feed ranges from 430 .7 to 431.5 Mhz with the platform at 1256.32 feet (figure 2).
2. The frequency change versus zenith angle is .5 Mhz or 2.5 inches radially (using 5 inches/Mhz). This is probably caused by the rails curving upward.
3. The frequency drops by .8 Mhz at 18 degrees za.
4. The system temperature using the 98.9 K cal for pol A and the 65 K cal for pol B is:
   $Tsys(za) = .1142 \times za^2 + .2472 \times za + 89.8$ K PolA (see fig 6)
   $Tsys(za) = .1096 \times za^2 + .1299 \times za + 79.2$ K PolB
5. The system equivalent flux density (figure 4) is:
   $SEFD(za) = 0.7739 \times za^3 + 0.04295 \times za^2 - 0.3008 \times za + 5.83$ Jy/Tsys
6. The gain (K/Jy) versus zenith angle (figure 5) is:
   $Gain(za) = -.011248 \times za^2 - .2446 \times \mathrm{za} + 18.84$ K/Jy

2.0 Center frequency of feed.

The center frequency of the feed was measured by doing on off pairs on the continuum source J1859+129 (8 Jy at 365 Mhz). A 12.5 Mhz bandwidth was centered at 430 Mhz. The dome was set at 9 degrees. The pointing had not yet been updated (it was off by up to 1 arc minute) so the telescope gain was not computed. This source had also been measured on 22 nov 1997 during the day.

TABLE 1. J1859+129 specs

date	dome za	time	temperature	avg platform height
26jun99	9	midnight	74.5 F	1256.32 ‘
22nov97	10	14:00	82.6 F	1256.17 ‘

Figure 1 overplots the on/off-1 for the source J1859+129. Zenith angle increases going from the top to bottom. You can see the bandpass move to the right as you go to higher zenith angle until the bottom most strips (both at 18 degrees za) where it jumps back to 430 Mhz

Figure 2 shows the center frequency of each on/off pair versus zenith angle for J1859+129 (rise to set). A gaussian fit was done to each strip to find the center frequency. You can see the dip in frequency at 18 degrees zenith angle.

Figure 3 shows the same source measure on 22 nov 97. The platform was 1.8 inches lower and the dome was 1 degree higher in za. For these setting the center frequency was 432.7 Mhz.

3.0 Tsys, gain, SEFD.

The telescope gain, system temperature, and pointing were checked on 27,28 jun99 using total power cross scans. The strips in azimuth and zenith angle were 30 arcminutes on 27jun99 and 40 arcminutes on 28jun99 (these are great circle lengths, the beam width is about 10 arcminutes). A 2 Mhz filter was used at 430 Mhz, the signal was detected with a .2 second time constant, and then sampled at 10 Hz. The cal was fired once at the beginning of the evening to get the conversion from D/A counts to Kelvins.

The sources used are listed in Table 2.

TABLE 2. source fluxes for gain, and pointing.

Source	430 Flux Jy	date	figure symbol
J1540+147	2.67	27jun99	open triangle
J1859+129	8.56	27jun99	open box
J2251+188	5.90	27jun99	*
J1831+291	5.42	28jun99	o
J2148+069	3.58	28jun99	filled triangle
J0020+156	8.27	28jun99	filled box

The “good enough for government work” 430 fluxes (thanks to chris salter) come from the 365 Mhz Texas fluxes (adjusted to the Baars et al. flux density scale) and the NVSS 1400 Mhz fluxes (assuming a power law spectrum.. chris also notes that J2148+069 is a low frequency variable with a 7% rms variation)

A linear baseline was subtracted from each strip and then a gaussian fit was made to the interference free portion of the strip.

3.1 Tsys.

Figure 6 shows the system temperature vs zenith angle.The baseline fit was evaluated at the center of the gaussian and then scaled by the cal value. A global fit of Tsys vs za was then done for all the data (excluding J1859+129) and a second order polynomial fit gave:

$$Tsys(za) = .1142 \times za^2 + .2472 \times za + 89.8 \text{ K} .$$

These system temperatures are probably a bit high (a few %) since the 1st sidelobe is close to where the baseline values were taken. The system temperature for J1859+129 was double the normal value even though it appears as a normal point source at lband (either there is 430Mhz continuum or the cal was left on (about 98 K)).

3.2 Gain.

Figure 5 shows the telescope gain vs zenith angle.
The gain was computed taking the (gaussian height)/(baseline at center of gaussian) , converting Tsys units to Kelvins from the tsys(za) in section3.1, and then dividing by the fluxes from table 2. A second order polynomial was fit using all the sources (J1859+129 had a normal gain which means that it was the system temperature that was screwed up . probably the cal was left on). The fit gave: $Gain(za) = -.011248 \times za^2 - .2446 \times \mathrm{za} + 18.84$ K/Jy

3.3 SEFD.

Figure 4 shows the system equivalent flux density vs zenith angle.
The SEFD was computed taking (source flux)/(gaussian height/(baseline at center of gaussian)) for all the sources (excluding J1859+129). A 3rd order polynomial fit gave:

$$SEFD(za) = 0.7739 \times za^3 + 0.04295 \times za^2 - 0.3008 \times za + 5.83 \text{ Jy/Tsys}$$

FIGURE 1: Bandpass of feed tracking J1859+129 rise to set.

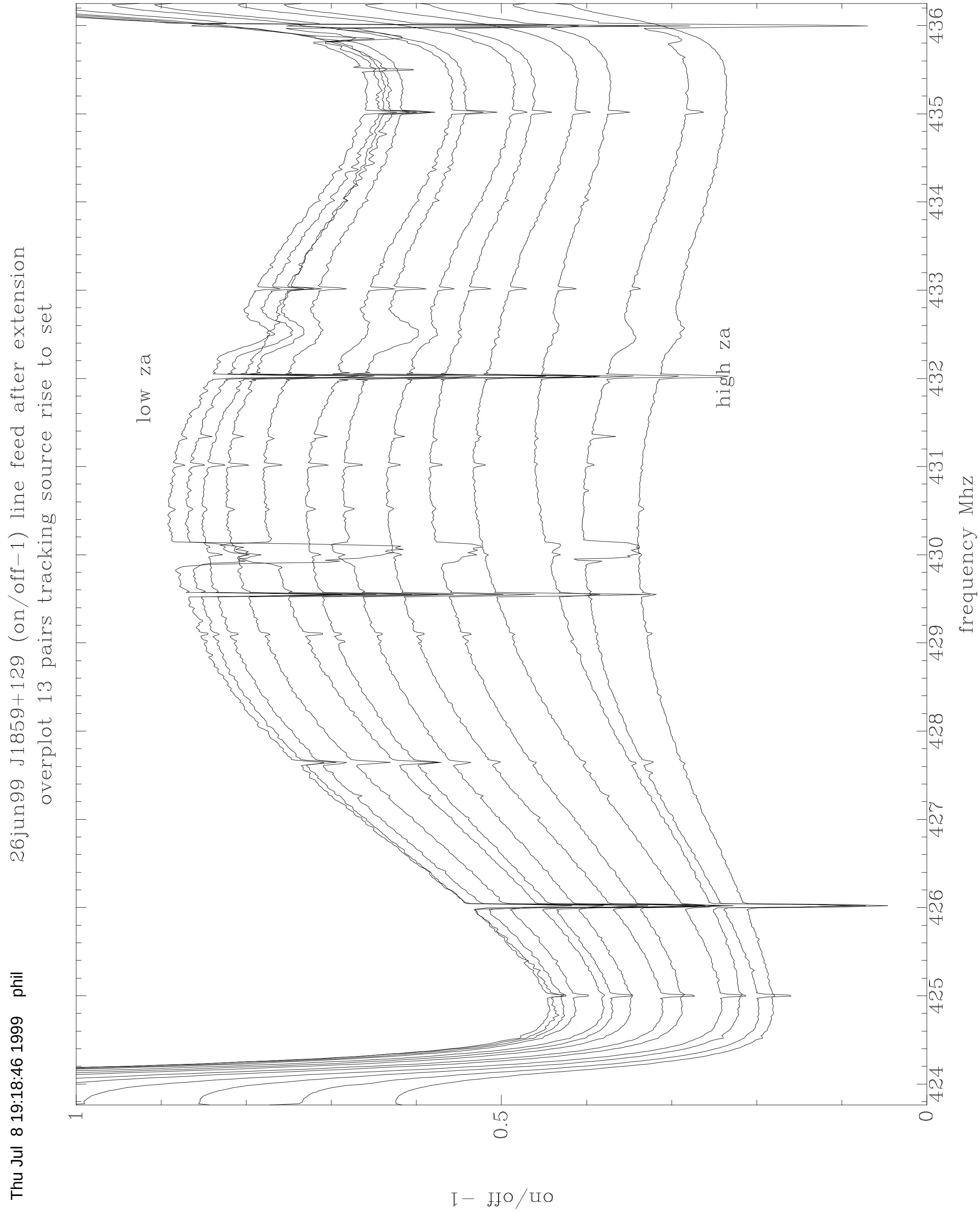

FIGURE 2: Center frequency of feed vs zenith angle.

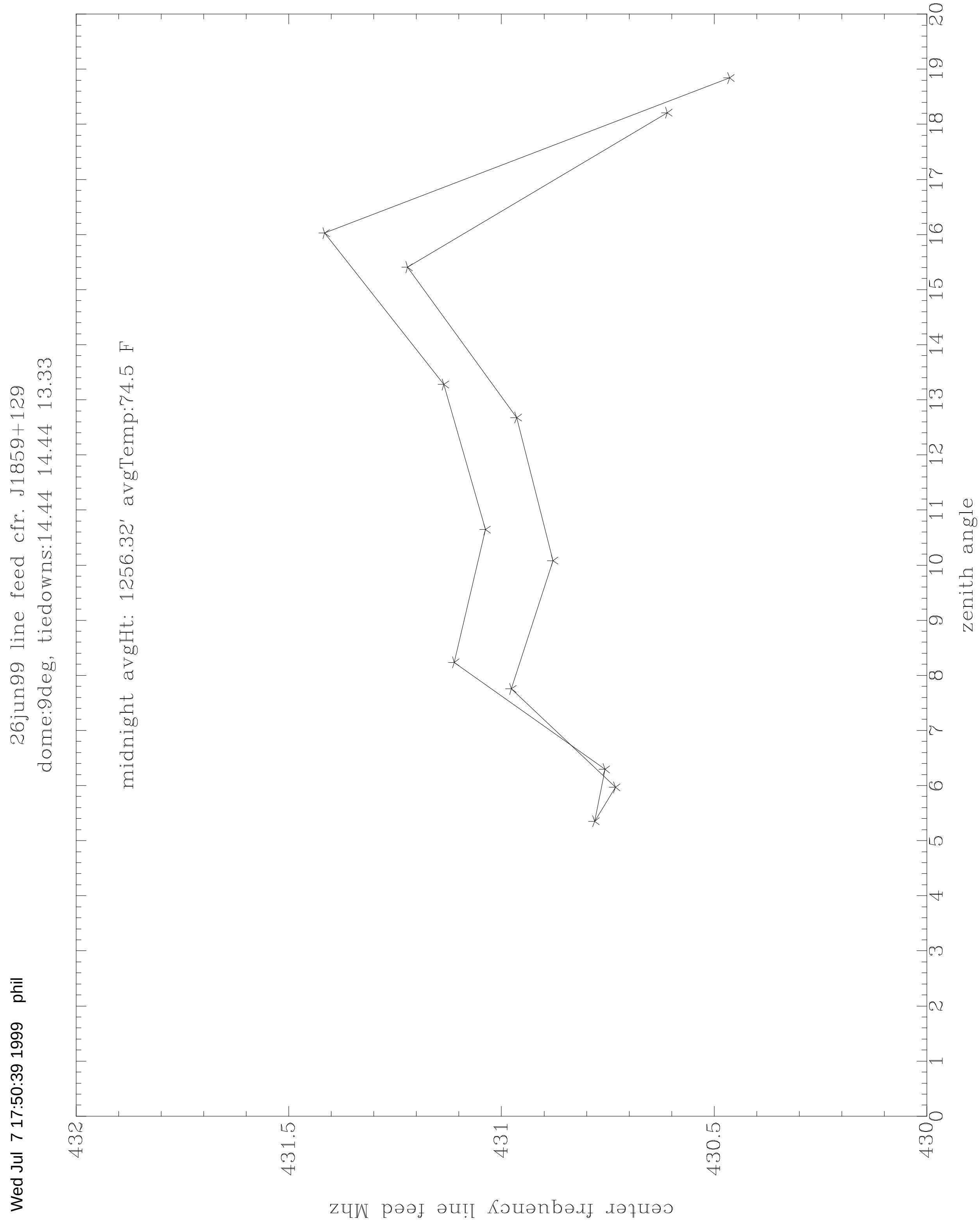

FIGURE 3:Center frequency of feed nov 1997.

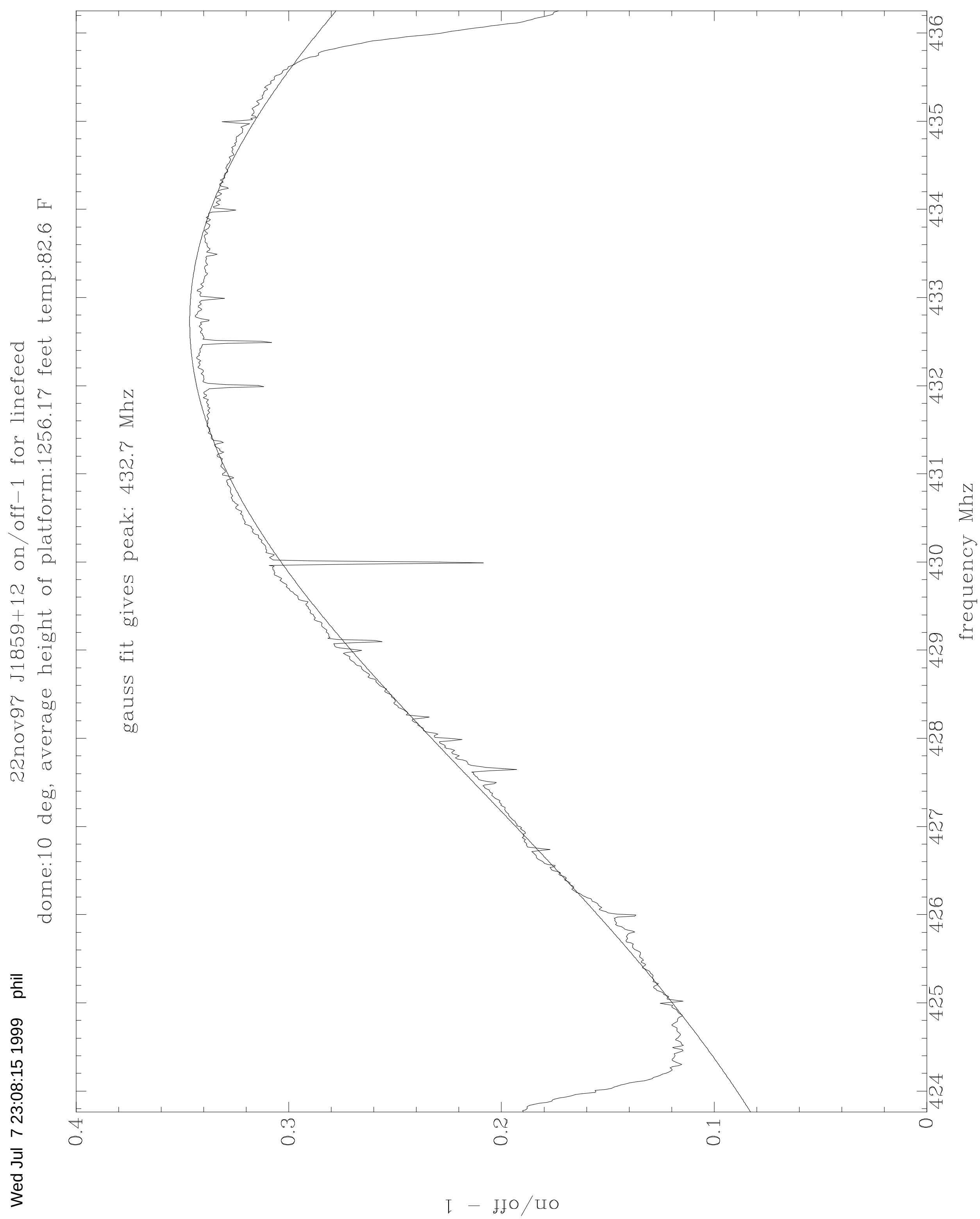

FIGURE 4:SEFD (system equivalent flux density Jy/Tsys) vs zenith angle.

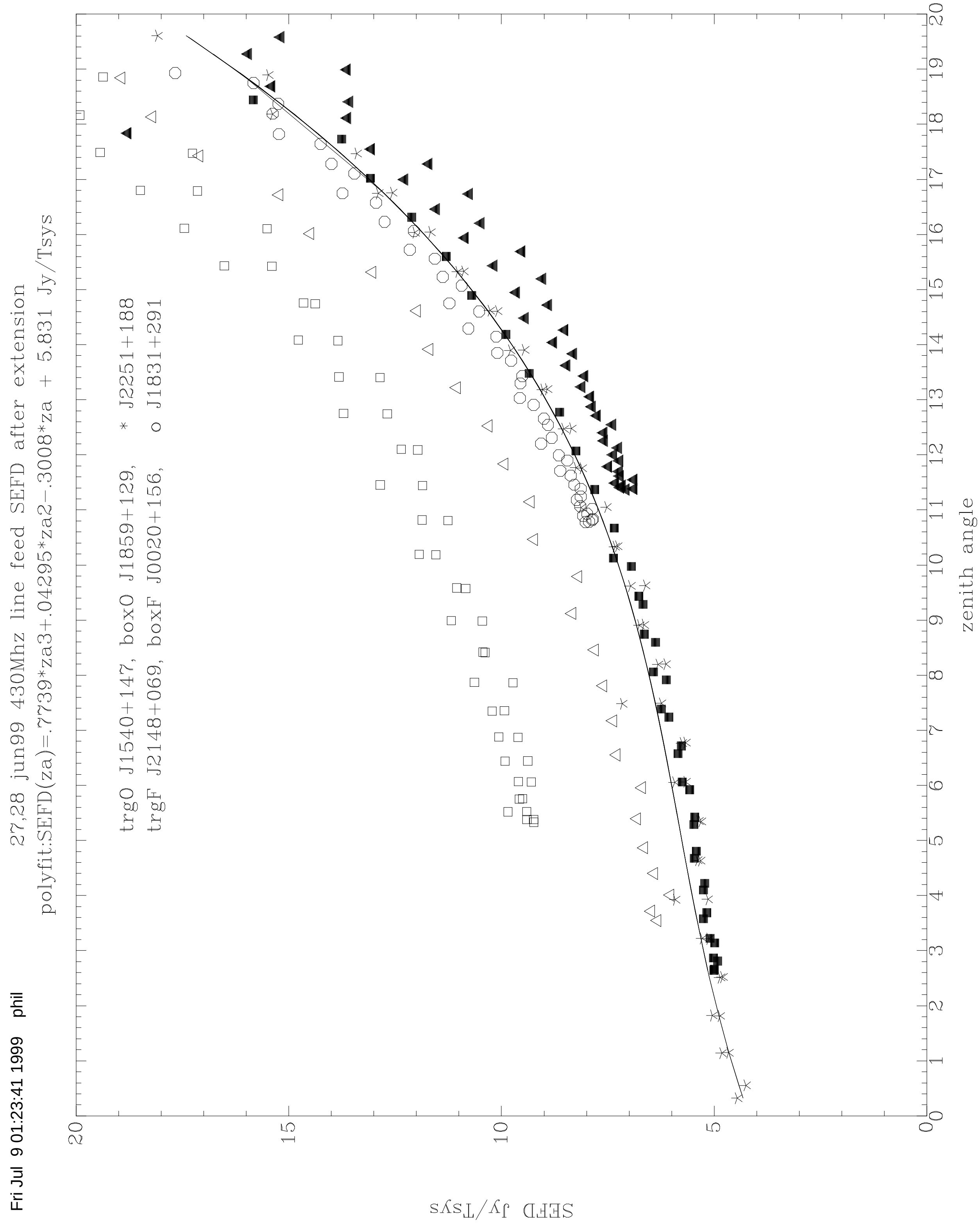

FIGURE 5: gain vs zenith angle

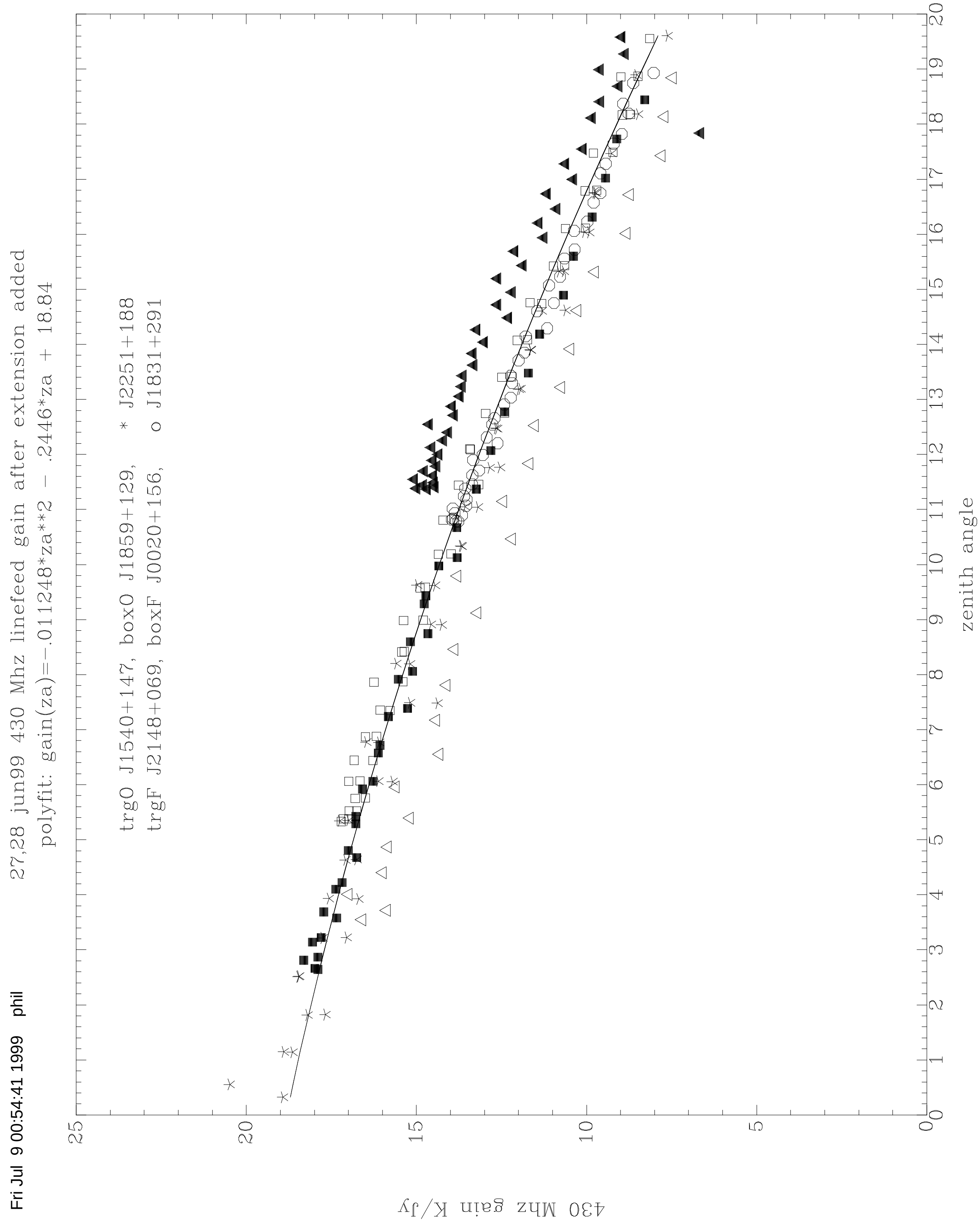

FIGURE 6: system temperature vs za.