TESTOBSERVATIONS WITH THE NEW 14.7 GHZ RECEIVER SYSTEM 28./29.12.95

All maps were observed with an integration time of 0.5 s per pixel and a pixelsize of 15".

1) Calculations from point source measurements

8 point sources were mapped as calibration maps with a mapsize of 8′ x 8′ and 1 beam pattern on the source 3C84 with a mapsize of 12′ x 12′.

a) Gainfactors referenced to channel 1, calculated with 9 observations of four different point sources.

SCAN	SOURCE	CHAN 1	CHAN 2	CHAN 3	CHAN 4
0968	NGC7027	1.000	1.068	0.983	0.903
0970	NGC7027	1.000	1.060	0.963	0.872
0971	NGC7027	1.000	1.062	0.955	0.881
0986	3C138	1.000	1.086	1.006	0.913
0991	3C138	1.000	1.049	0.985	0.886
0995	3C138	1.000	1.051	0.969	0.900
0999	3C84	1.000	1.087	0.990	0.909
1002	3C84	1.000	1.071	0.981	0.893
1006	3C286	1.000	1.095	0.981	0.891
mean value		1.000	1.070	0.979	0.894
error		–	0.005	0.005	0.004

The deviations from the calculated mean value are lower than 3 % in all channels, so that we can say that the gain factors are quite stable.

b) omegaB [sr] calculated with 7 observations of four point sources.

SCAN	SOURCE	omegaB [1e-8 sr]
0968	NGC7027	7.8269
0986	3C138	7.4046
0991	3C138	7.5848
0995	3C138	7.7408
0999	3C84	7.9222
1002	3C84	7.8501
1006	3C286	7.6861
mean value		7.717
error		0.021

All these observations have been made at elevation angles in the range from 38 to 55 degrees, so that we can neglect any effect of dependence on elevation.

c) Calculation of TB/S

TB/S = lambda^2/(omegaB * 2 * k)
lambda : wavelength
k : Boltzmann constant

with
lambda = 2 cm
omegaB = 7.717e-8 sr +/- 0.021e-8 sr
k = 1.3806e-16 erg/K

we get : TB/S = 1.877 +/- 0.007 (TB[K],S[Jy])

d) Factor to calibrate the flux in mJy/beam calculated wit 7 observations of 3 pointsources.

The following sources were used for the calibration :

NGC7027 : 6.16 Jy
3C286 : 3.44 Jy
3C138 : 1.62 Jy

SCAN	SOURCE	FITVALUE	CALIBRATIONFACTOR
0968	NGC7027	197936	0.0311
0970	NGC7027	203192	0.0303
0971	NGC7027	200090	0.0308
0986	3C138	52420	0.0309
0991	3C138	52837	0.0307
0995	3C138	54562	0.0297
1006	3C286	112684	0.0306
		mean value	0.0306
		error	0.0005

With TB/S = 1.877 we get a calibrationfactor of 0.0574 +/- 0.0011 to calibrate the flux in mK.

e) The beam pattern observed on the source 3C84

Figure 1 shows the beam pattern observed around the source 3C84 at an elevation angle of 38 degrees. The flux of the source is about 24.1 +/- 0.5 Jy. The first side lobes are at 2 to 3 % of the peakflux and the other structures are lower than 1 %.

2) Noise estimation.

A small area in the sky around the star Betelgeuse with an expected flux of 8 mJy at 14.7 GHz with a size of 10′ x 10′ was mapped seven times. The maps of the different feed were taken as independent couverages to get a good noise estimation for each feed.

After combining the different maps of each feed we get :
CH 1 : rms = 4.6 mJy => rms = 12.1 mJy per couverage
CH 2 : rms = 6.7 mJy => rms = 17.8 mJy per couverage
CH 3 : rms = 3.4 mJy => rms = 8.9 mJy per couverage
CH 4 : rms = 4.3 mJy => rms = 11.3 mJy per couverage

After combining all 28 maps we get a noise of 2.85 mJy on the final map which leads to a mean value for the noise of 15.1 mJy per couverage.

Theoretically we would expect for the rms noise :

rms = Tsys / etaB * sqrt(t * BW)

with Tsys : System temperature (about 100 K)
t : integration time per point (0.5 s)
BW : bandwidth (1 GHz)
TB/S : 1.877
etaB : main - beam - efficiency = 0.67 (67 %)

we get rms = 3.55 mJy per couverage which is significantly lower than the observed values.
Especially feed number two has a noise nearly as twice as high as the others. Several spikes are on all maps of this feed.

Figure 2 shows the final map of Betelgeuse. The flux of the central source is about 11 +/- 2 mJy.

3) Maps of extended sources.

Observations of two supernova remnants were made with a mapsize of 16' x 16'. The results are on figure 3 (Tycho's SNR) and figure 4 (3C58).

The fluxes of the sources are :

Tycho : 11.0 +/- 0.6 Jy (expected : 10.9 Jy)
3C58 : 26.2 +/- 0.9 Jy (expected : 25.2 Jy)

4) results :

a) Calculated parameters :

gainfactors :

CH1 : 1.000
CH2 : 1.070 +/- 0.005
CH3 : 0.979 +/- 0.005
CH4 : 0.894 +/- 0.004

omegaB : 7.717e-8 +/- 0.021e-8 sr

TB/S : 1.877 +/- 0.007

calibration factors :

0.0304 +/- 0.0003 (mJy/beam)
0.0574 +/- 0.0011 (mK)

b) Problems :

- significantly higher noise than the theoretical one in all feed
- feed 2 has about twice the noise of the others and many spikes on all maps
- sense of the "Drehstand" rotation is wrong

Distribution :

Wielebinski, Zins, W. Reich, P. Reich, Lochner, Koch, Fuerst, Beck, Altenhoff, Kothes

Figures :

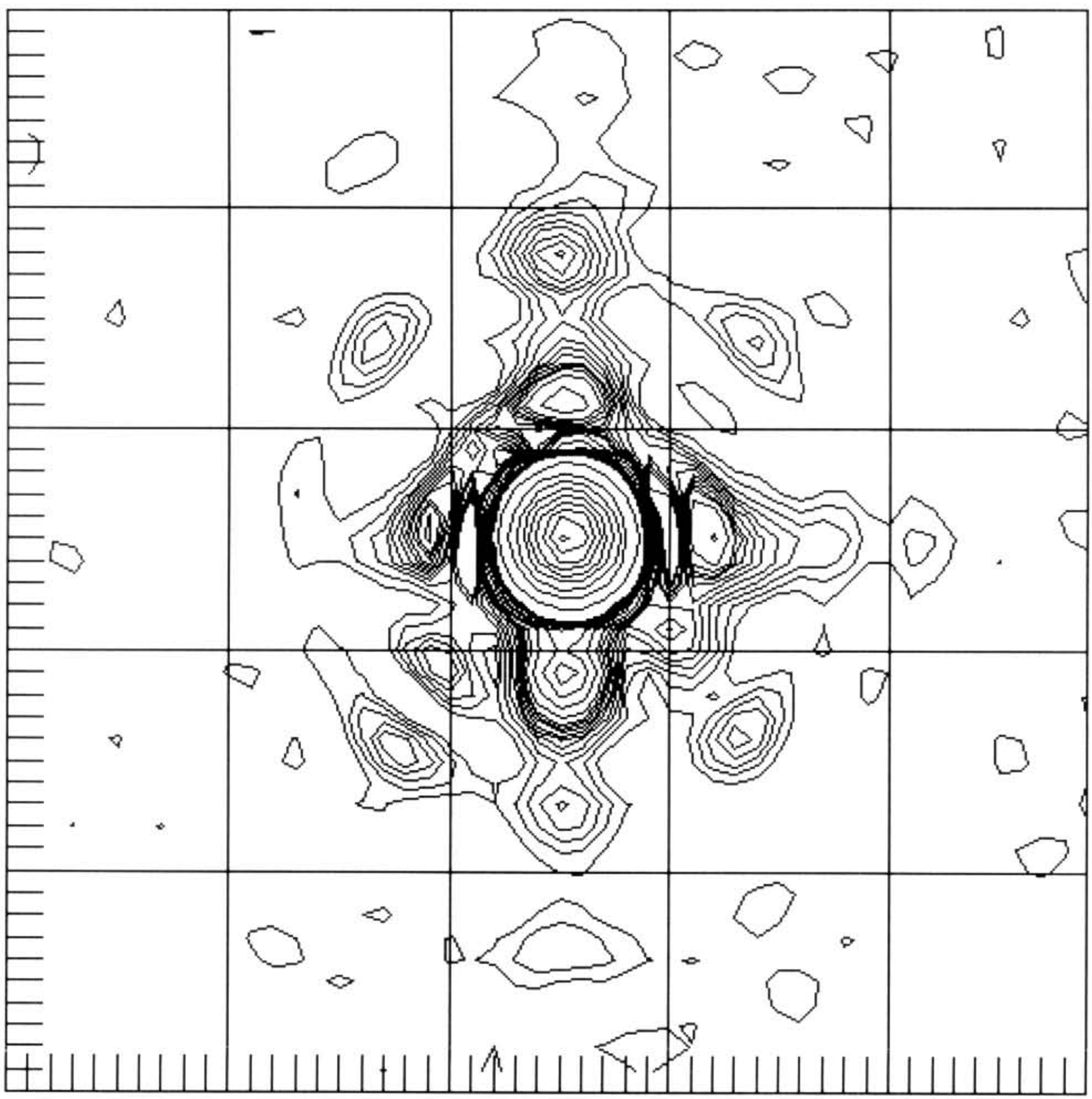
figure 1 : mean beam pattern for all feed observed with the source 3C84 with an integrated flux of 24.1 Jy.
the contours are :
50 mJy + n* 50 mJy for outer structures
600 mJy + n* 200 mJy for first sidelobes
5000 mJy + n*5000 mJy for the main lobe
(n : 0...9)
the zero contour is shown dashed.

figure 2 : final map of Betelgeuse after combining all 7 couverages. smoothed to 1.5' resolution
The contours are : 2 mJy + n*2 mJy, n : 0...6
the zero contour is shown dashed

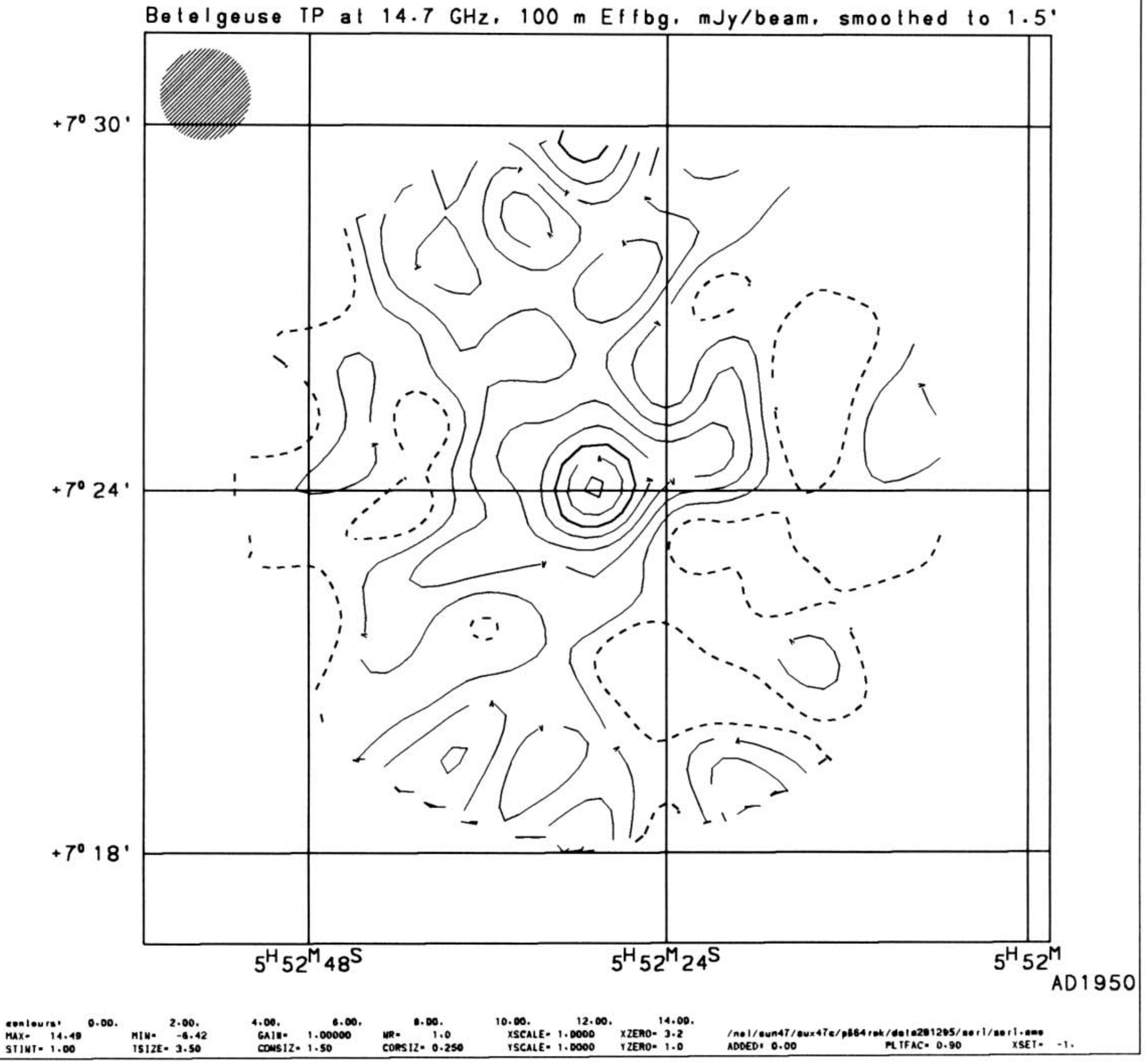
figure 3 : Tycho's supernova remnant.
the contours are : 30 mJy + n*30 mJy, n : 0...9
the zero contour is shown dashed

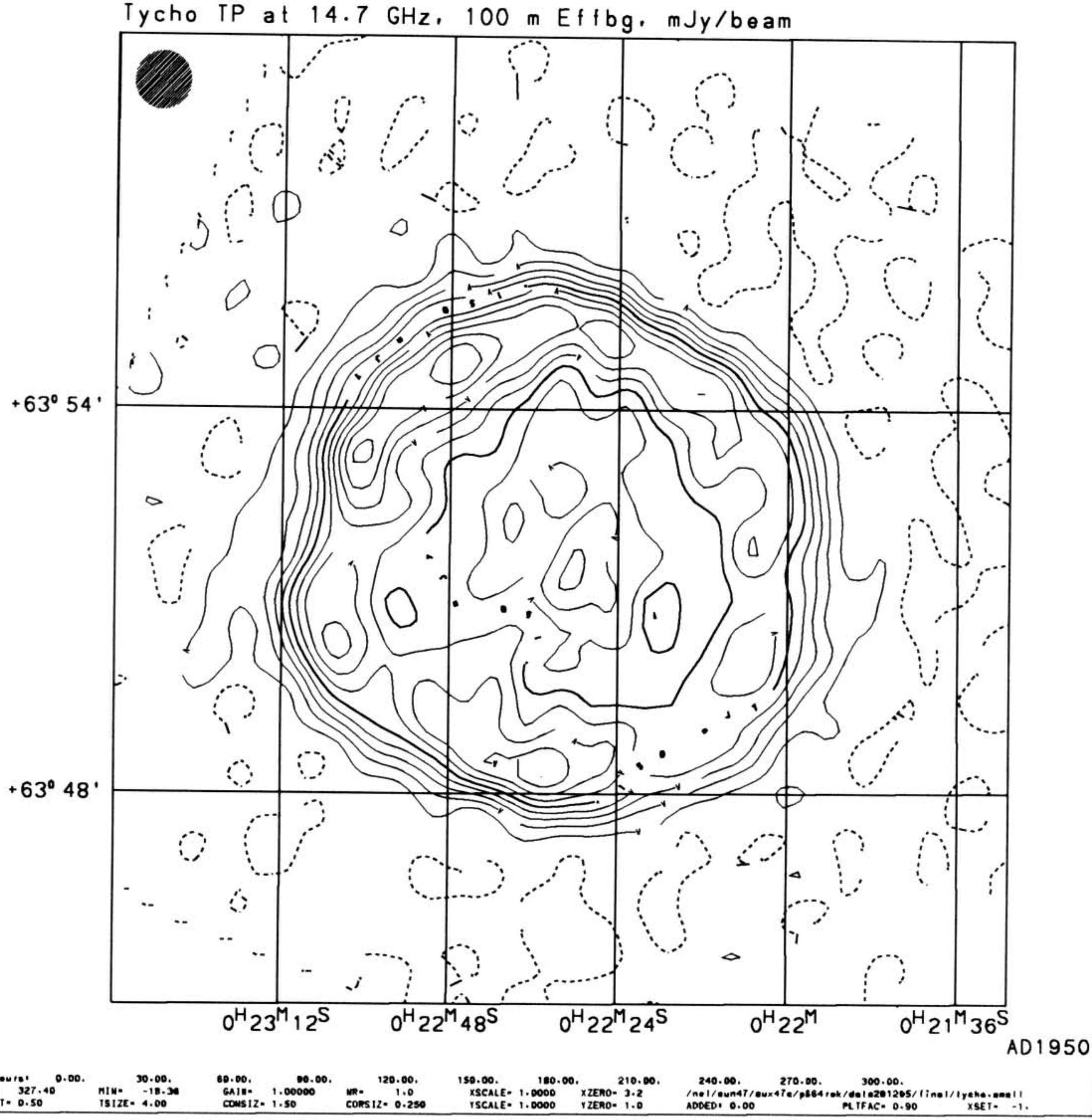
figure 4 : the supernova remnant 3C58
the contours are : 20 mJy, 50 mJy and
100 mJy + n*100 mJy, n : 0...14
the zero contour is shown dashed

3C84 1002 14700MH 14700.MHz = 1=
COL/ROW= 49/ 49 L= -0.100/ 0.100 B= -0.100/ 0.10
MAX/MIN= 45889./ -392. mr1002.add
NCTR, ZERO, HEIGHT = 10 50.0 50.0
NCTR, ZERO, HEIGHT = 10 600.0 200.0
NCTR, ZERO, HEIGHT = 10 5000.0 5000.0



Jan 11 14:38:25 1996 by p664rok


Betelgeuse TP at 14.7 GHz, 100 m Effbg, mJy/beam, smoothed to 1.5'
+7° 30'
+7° 24'
+7° 18'
5H52M48S
5H52M24S
5H52M
AD1950
contours: 0.00, 2.00, 4.00, 6.00, 8.00, 10.00, 12.00, 14.00,
MAX= 14.49 MIN= -6.42 GAIN= 1.00000 NR= 1.0 XSCALE= 1.0000 XZERO= 3.2
STINT= 1.00 TSIZE= 3.50 CONSIZ= 1.50 CORSIZ= 0.250 YSCALE= 1.0000 YZERO= 1.0
ADDED: 0.00 PLTFAC= 0.90 XSET= -1.



Tycho TP at 14.7 GHz, 100 m Effbg, mJy/beam
+63° 54'
+63° 48'
0H23M12S
0H22M48S
0H22M24S
0H22M
0H21M36S
AD1950
contours: 0.00. 30.00. 60.00. 90.00. 120.00. 150.00. 180.00. 210.00. 240.00. 270.00. 300.00.
MAX= 327.40 MIN= -18.36 GAIN= 1.00000 NR= 1.0 XSCALE= 1.0000 XZERO= 3.2
STINT= 0.50 TSIZE= 4.00 CONSIZ= 1.50 CORSIZ= 0.250 YSCALE= 1.0000 YZERO= 1.0 ADDED: 0.00 PLTFAC= 0.90 XSET= -1.

3C58 TP at 14.7 GHz, 100 m Effbg, mJy/beam