

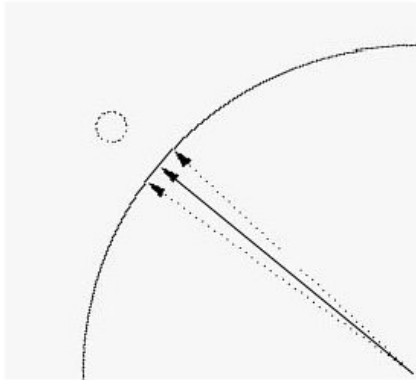
Some results from 2D
fitting of multiband GMRT
primary beams

By

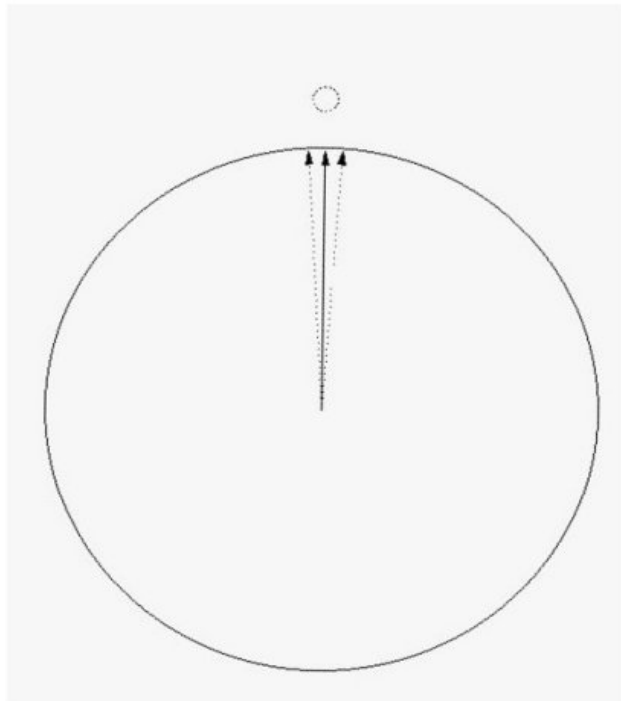
Santaji N Katore

NCRA, 11Sep2015

1D scans

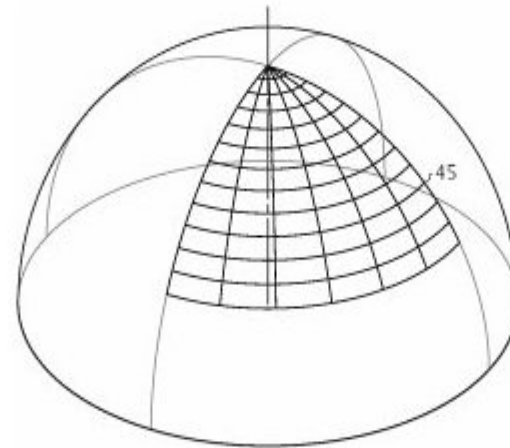


Elevation axis scan



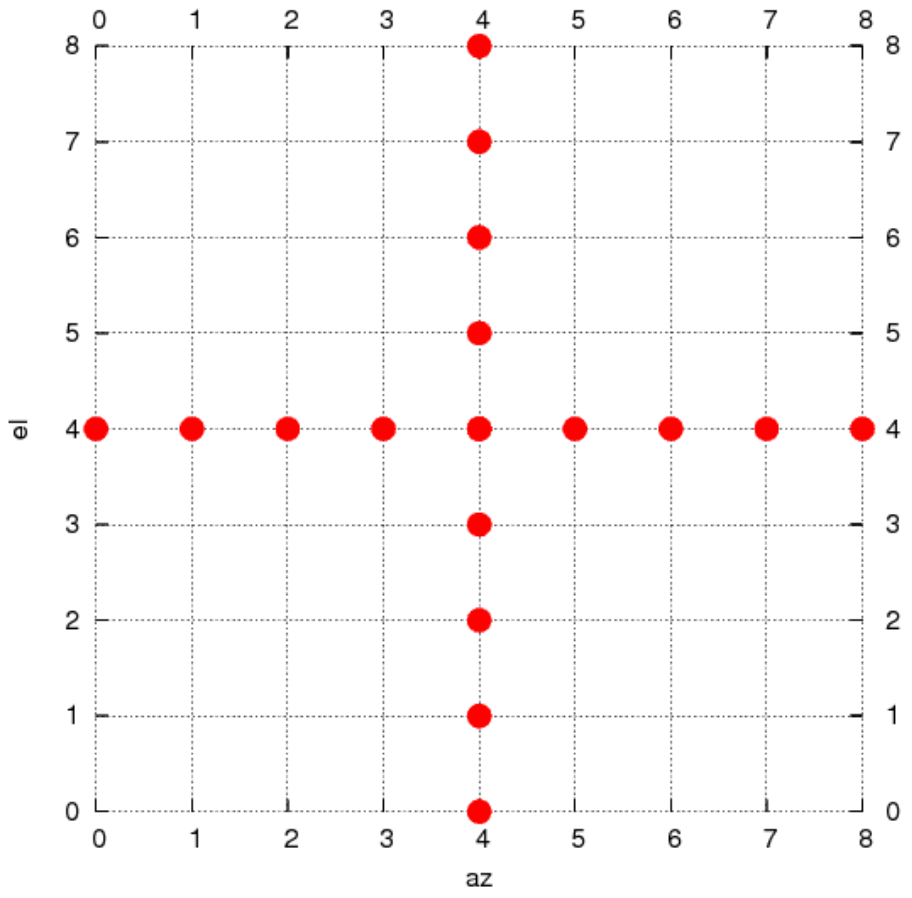
Azimuth axis scan

2D scan (az and el)



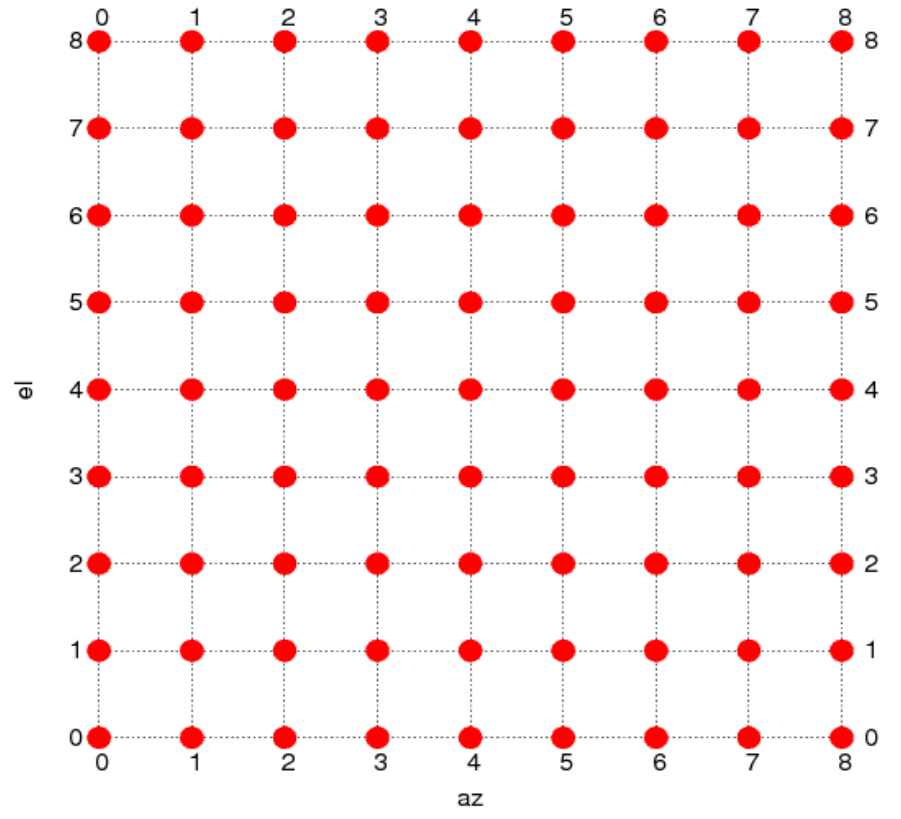
Grid pointing with self/cross mode, two axis

GRID FORMATION



← 1D grid (9 pts)

2D grid (9x9 pts) →



Grid pointing procedure

MTXPNTG(azsp,elasp,azpnt,elpnt,src,time,trk)

Where,

azsp = azimuth grid spacing.

elasp = elevation grid spacing.

azpnt = no. of grid points in AZ axis.

elpnt = no. of grid points in EL axis.

src = source name.

time = record time on each grid point.

trk = telescope track IN/OUT.

e.g MTXPNTG(3,3,9,9,'3C48',10,1),

1D Gaussian function

$$f(x) = a \exp\left(-\frac{(x-b)^2}{2c^2}\right)$$

$$f(x) = a * \exp(-((x-b)**2)/(2*c*c))$$

Where a=amplitude(peak),

b=offset,

c=sigma,

Beam width(FWHM) = 2.35482 * c

2D Gaussian function

$$f(x, y) = A \exp\left(-\left(\frac{(x-x_o)^2}{2\sigma_x^2} + \frac{(y-y_o)^2}{2\sigma_y^2}\right)\right).$$

$$f(x,y) = a * \exp (-(((x-b1)**2)/(c1**2) + ((y-b2)**2)/(c2**2))/2)$$

Where a=amplitude(peak)

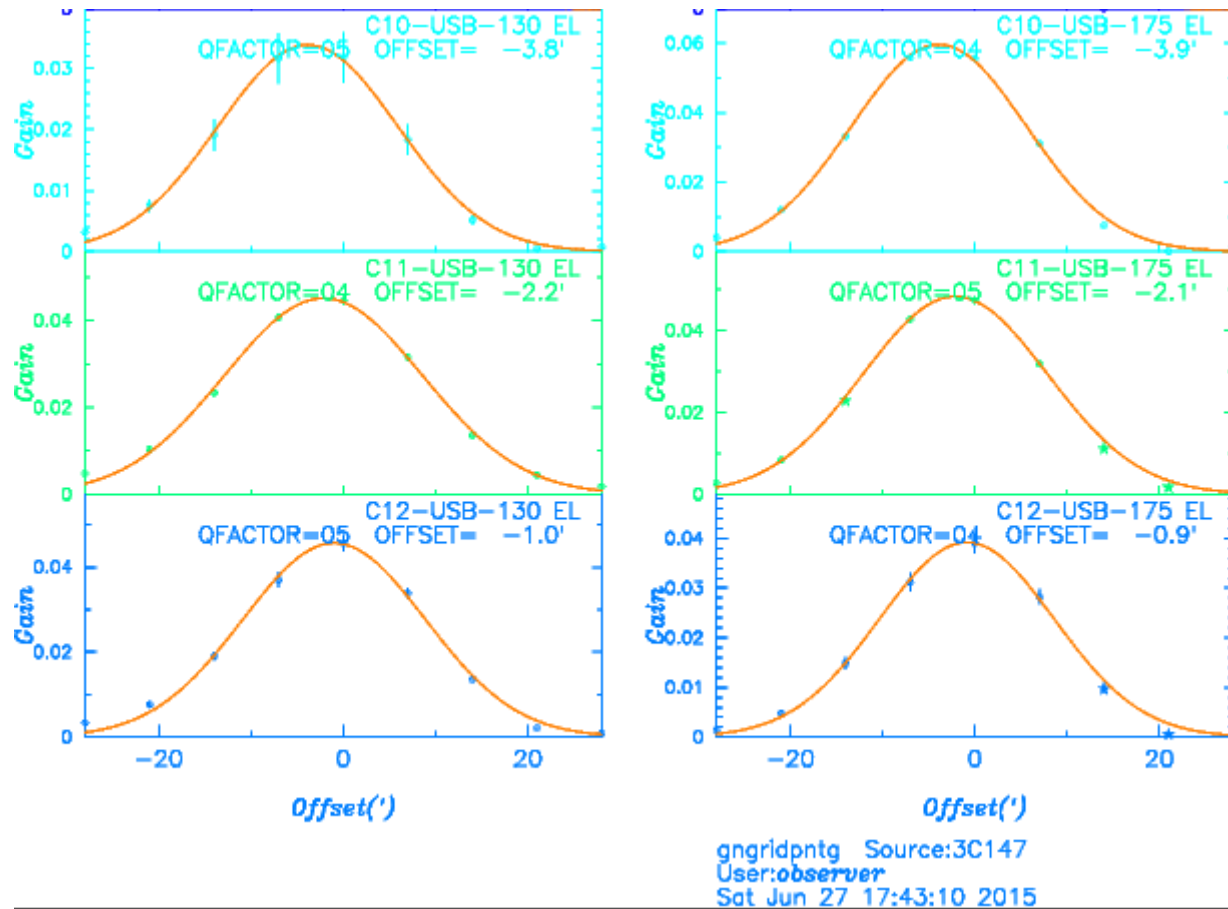
b1,b2=offsets(az,el),

c1,c2=sigma(az,el),

Beam width(FWHM)= 2.35482 * c1(az),

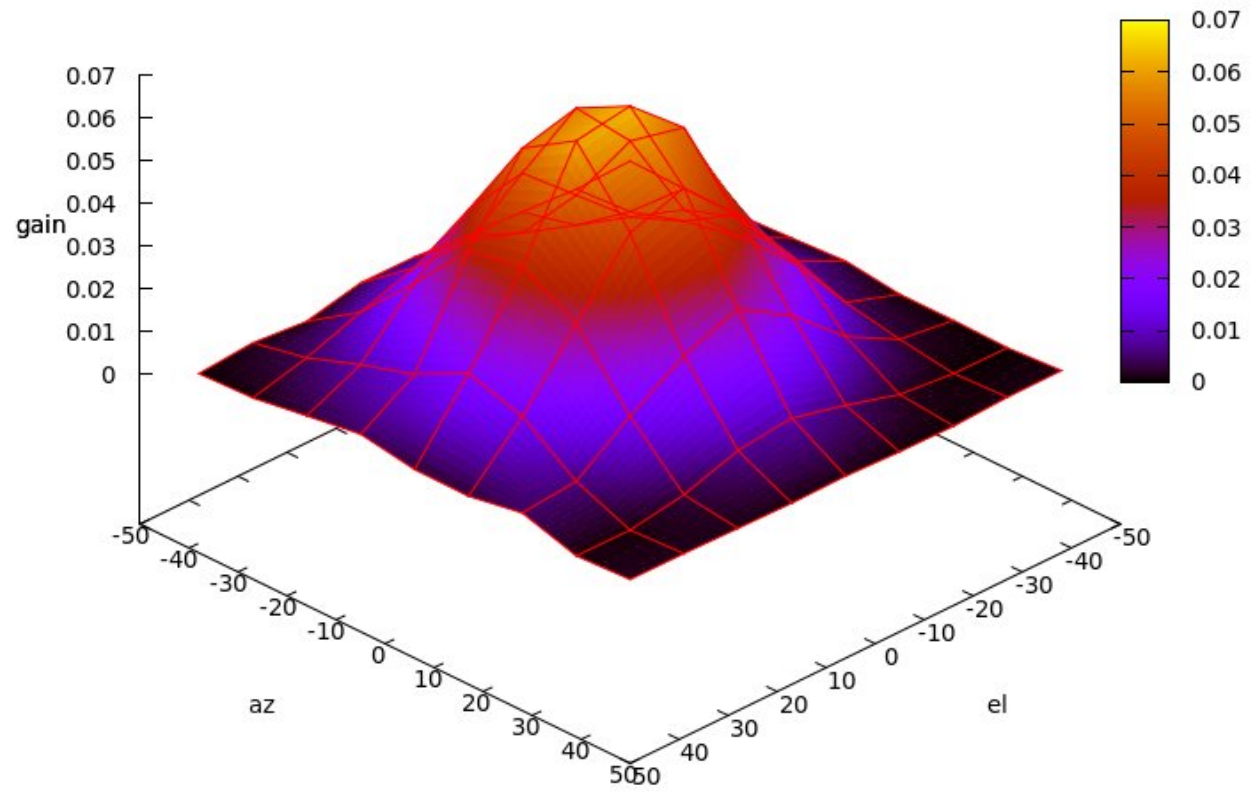
Beam width(FWHM)= 2.35482 * c2(el)

1D beam data + Gaussian f(x) at 1390 MHz.

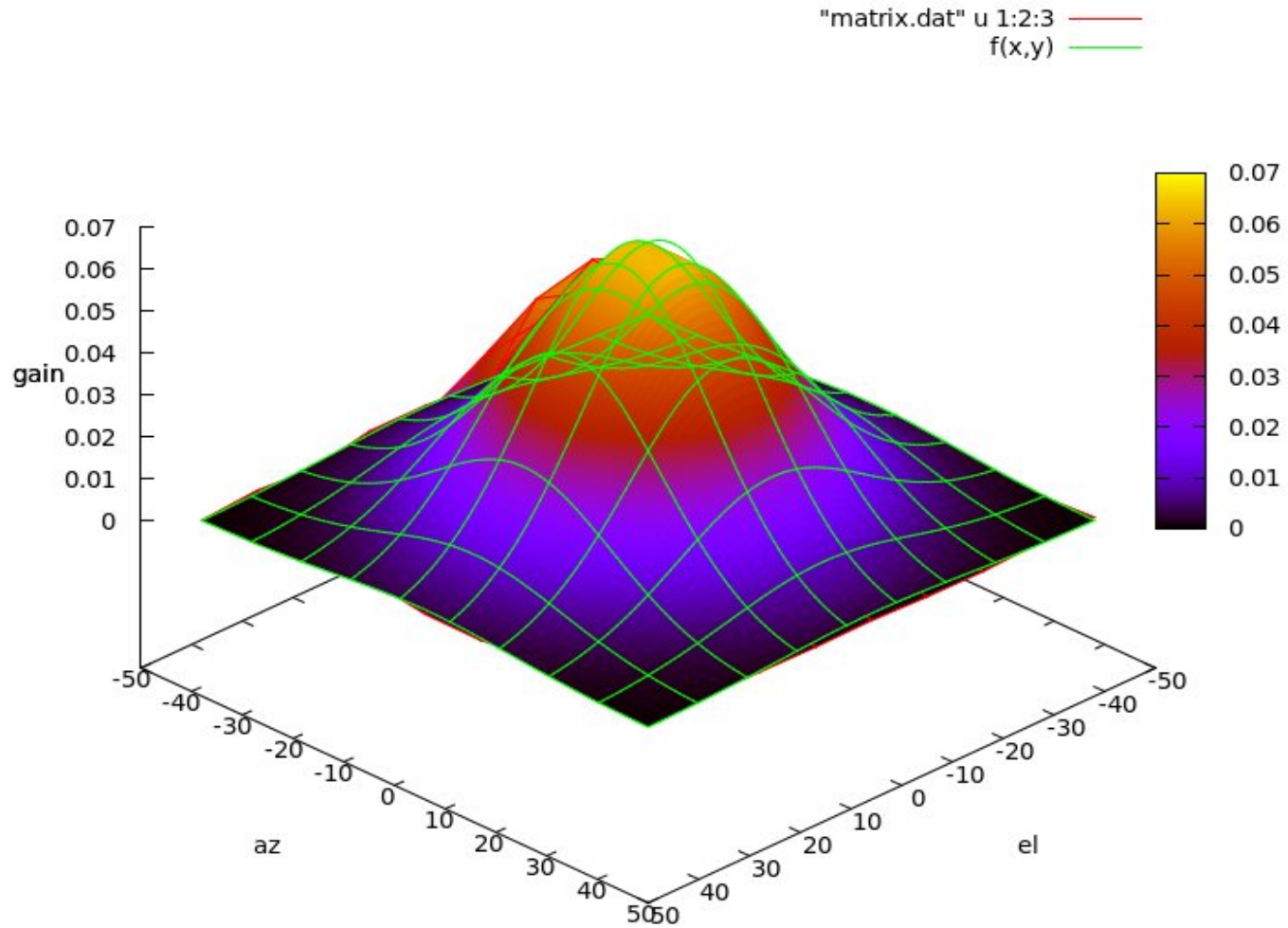


2D beam in to 3D graph (C00 @ 610 MHz)

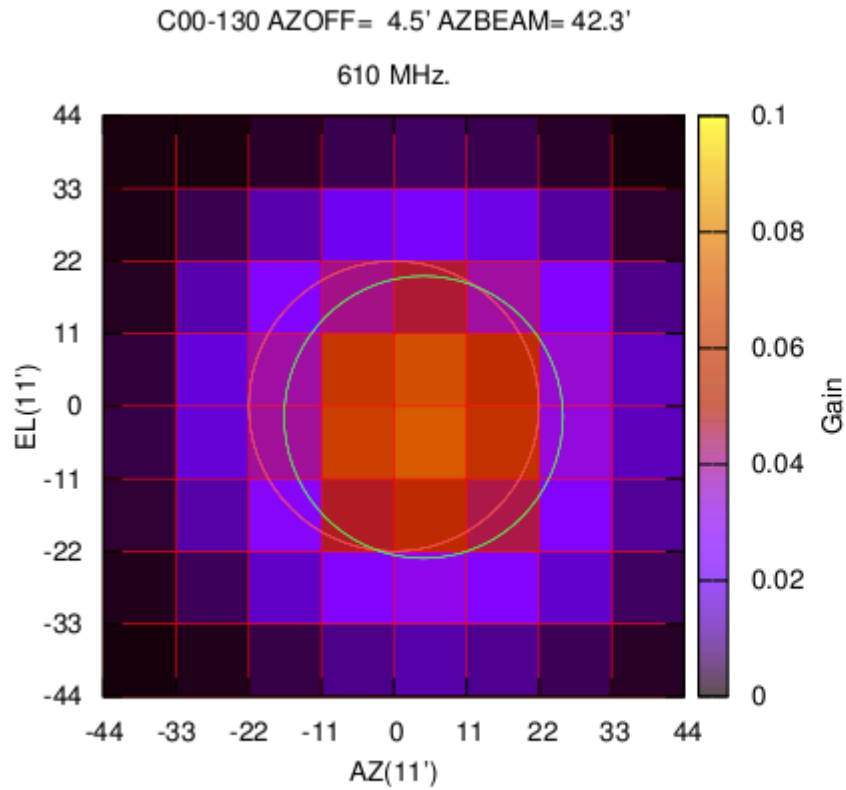
"matrix.dat" u 1:2:3



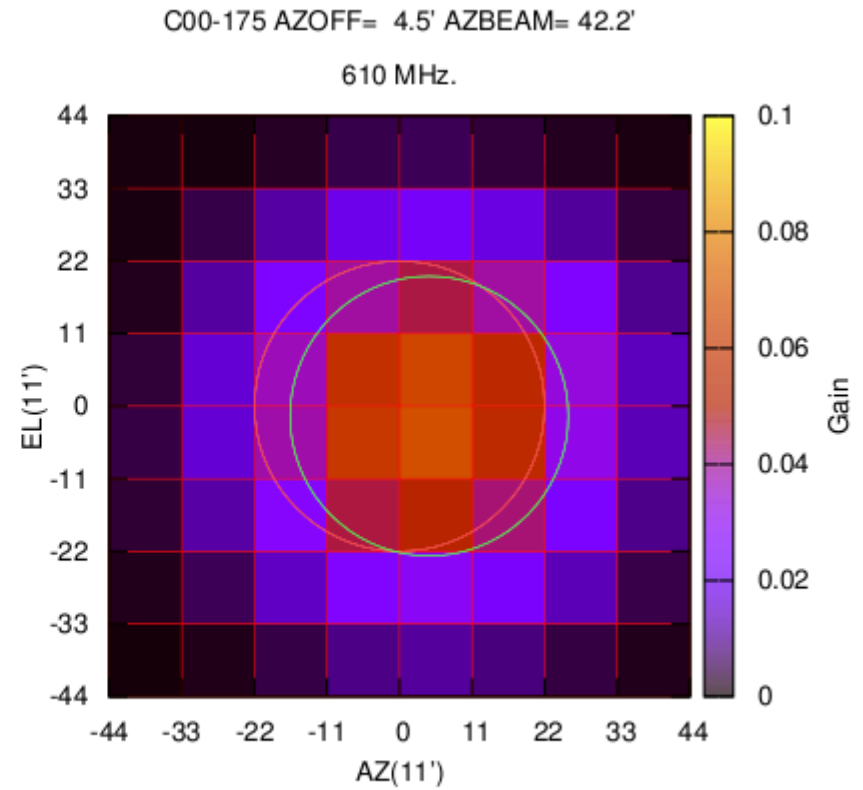
2D beam + Gaussian $f(x,y)$ in to 3D graph (C00 @ 610 MHz)



2D beam data plotting in gray-color 2D graph without interpolation

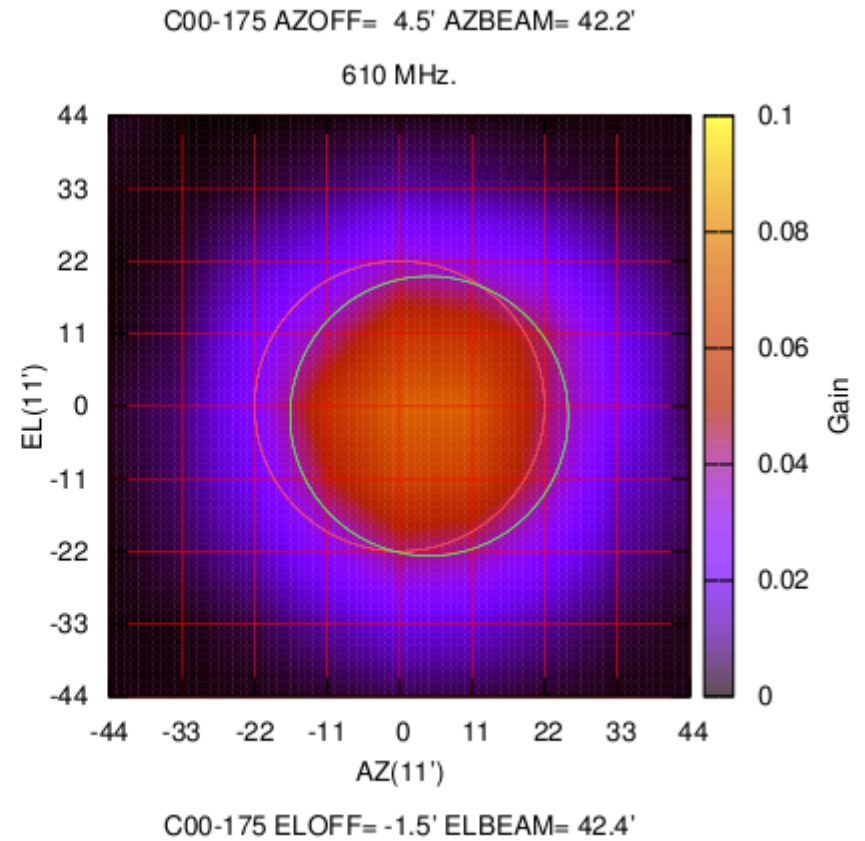
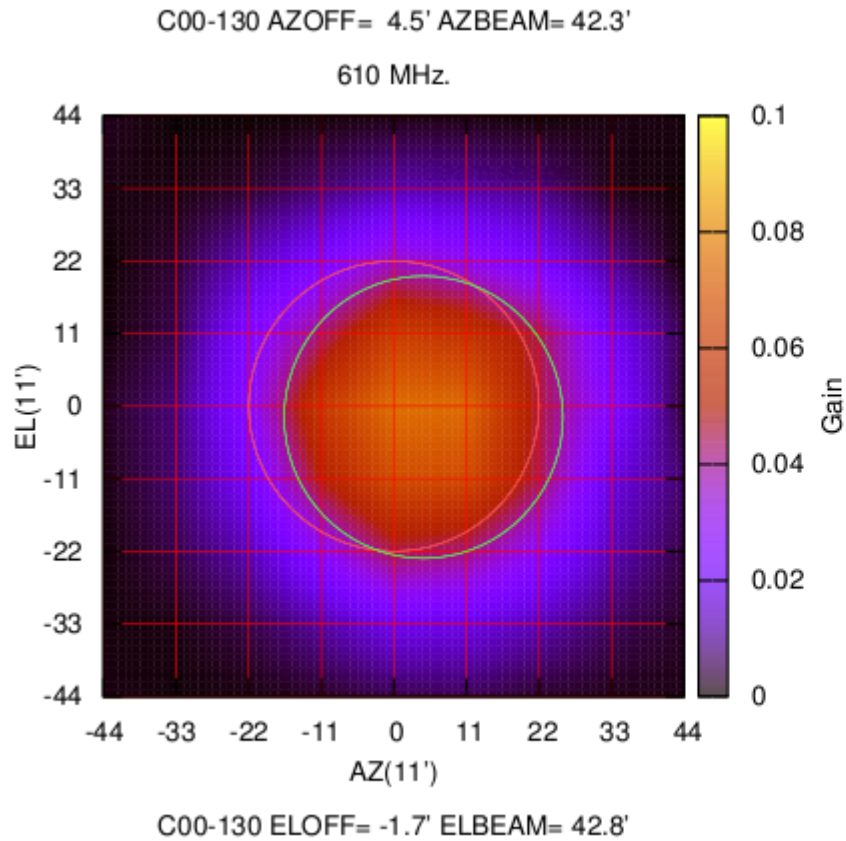


C00-130 ELOFF= -1.7' ELBEAM= 42.8'



C00-175 ELOFF= -1.5' ELBEAM= 42.4'

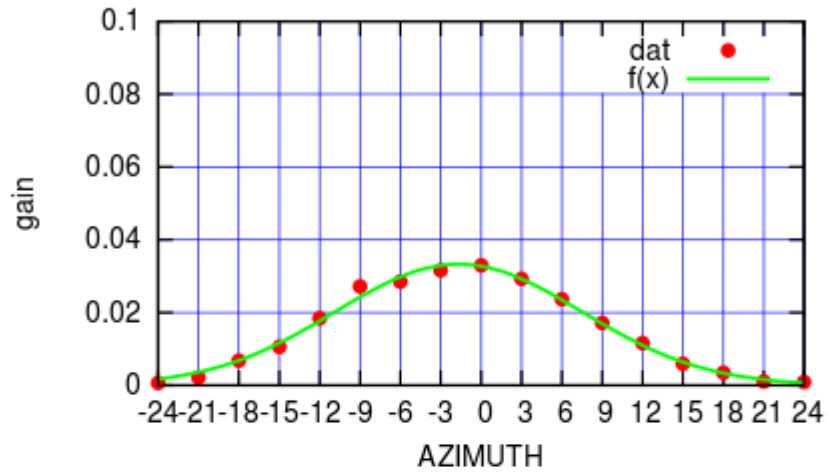
2D beam data plotting in gray-color 2D graph with interpolation



1D results @ 1390 MHz.

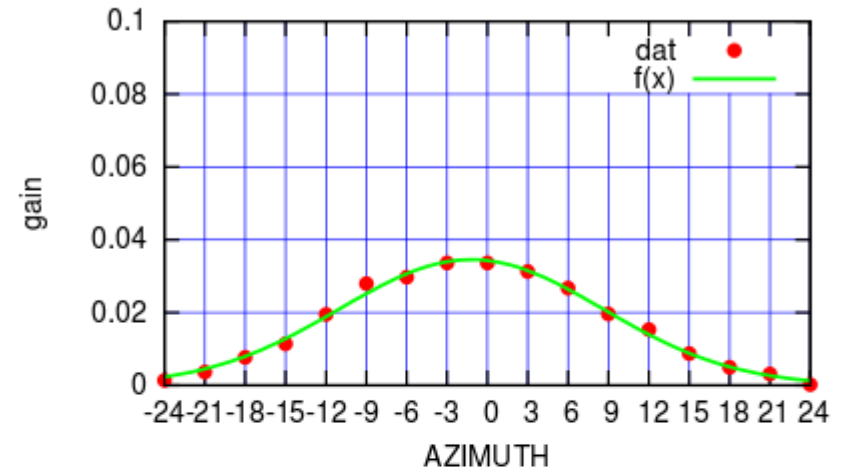
C02-130 AZOFF= -1.7' AZBEAM= 21.6'

1390 MHz.



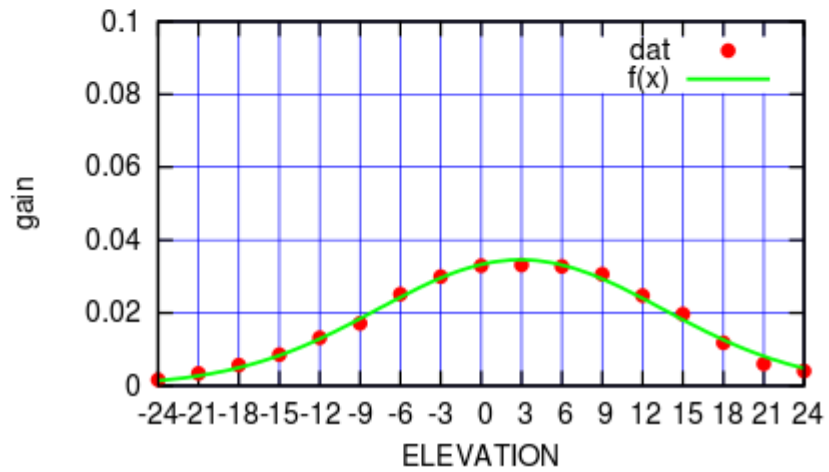
C02-175 AZOFF= -1.2' AZBEAM= 23.1'

1390 MHz.



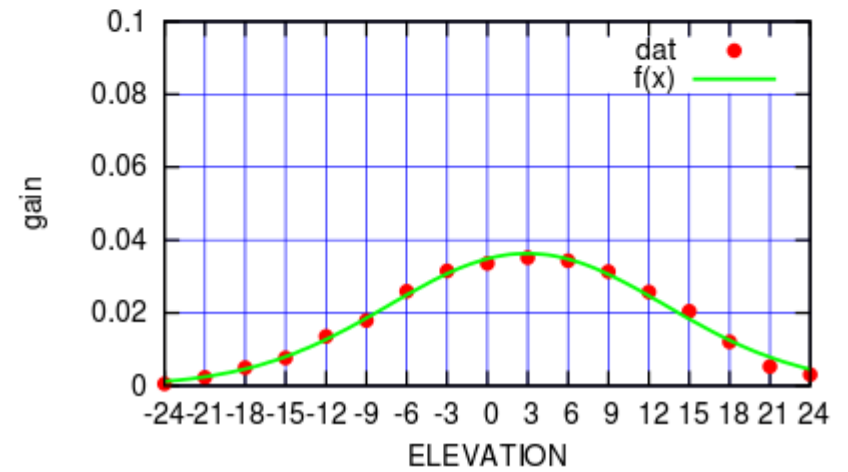
C02-130 ELOFF= 2.9' ELBEAM= 25.0'

1390 MHz.



C02-175 ELOFF= 2.9' ELBEAM= 24.3'

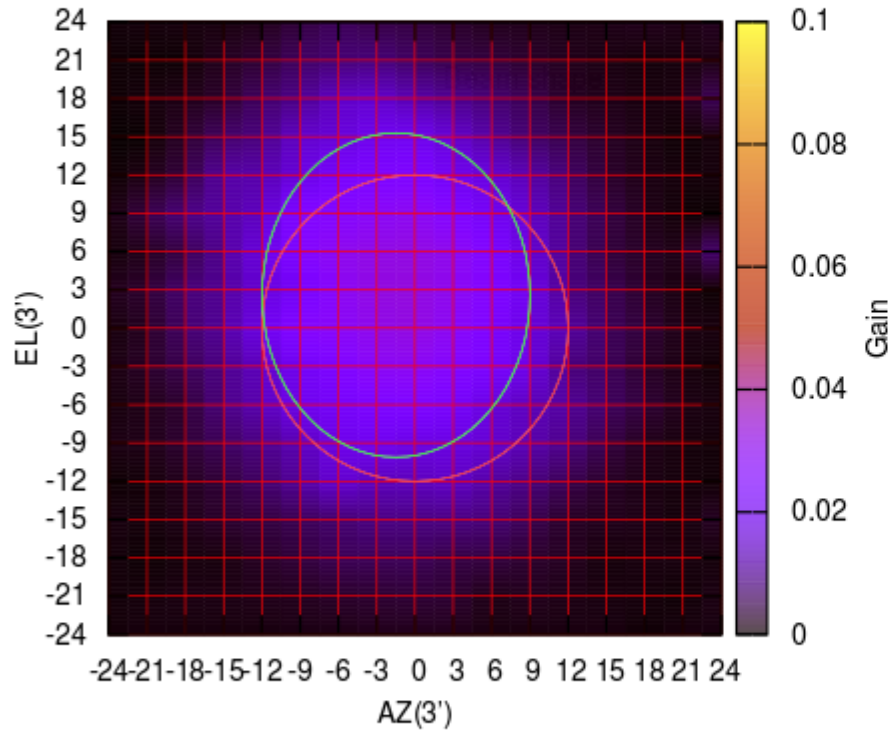
1390 MHz.



2D beam results at 1390 MHz.

C02-130 AZOFF= -1.5' AZBEAM= 21.0'

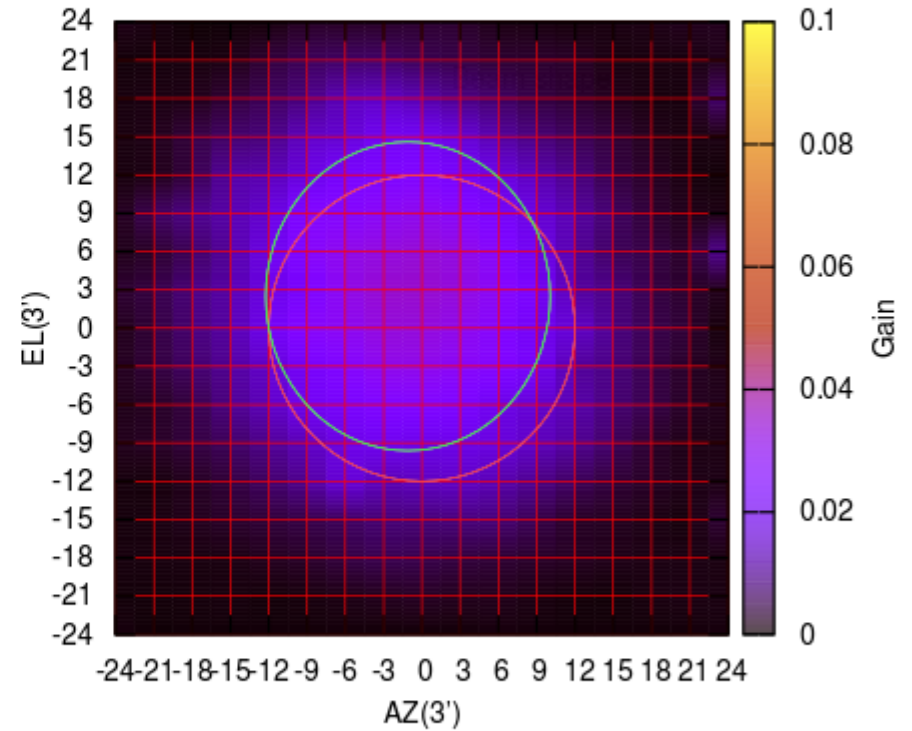
1390 MHz.



C02-130 ELOFF= 2.6' ELBEAM= 25.4'

C02-175 AZOFF= -1.1' AZBEAM= 22.3'

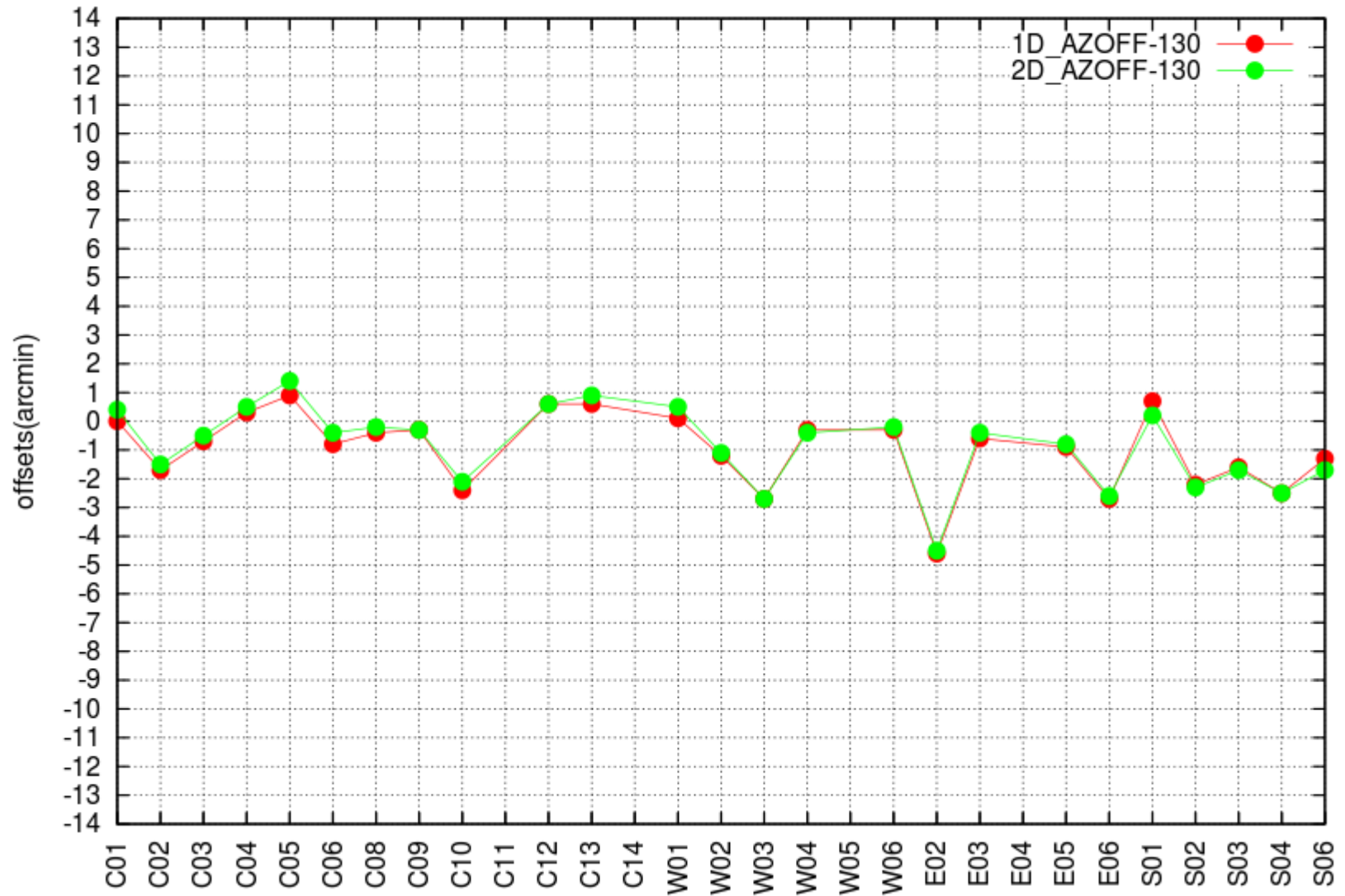
1390 MHz.



C02-175 ELOFF= 2.5' ELBEAM= 24.2'

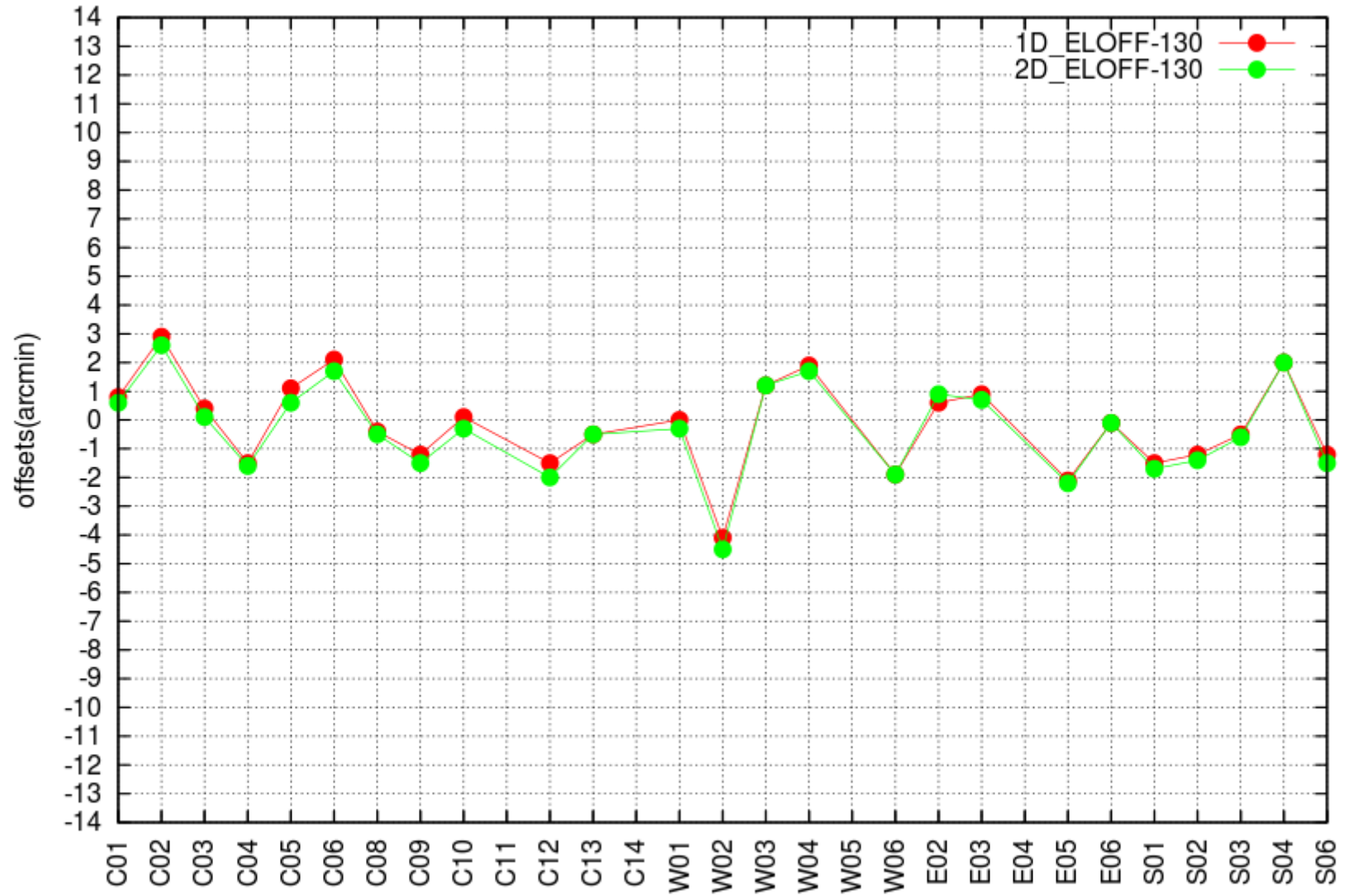
Comparison between 1D and 2D fit

1390 MHz. 17 points



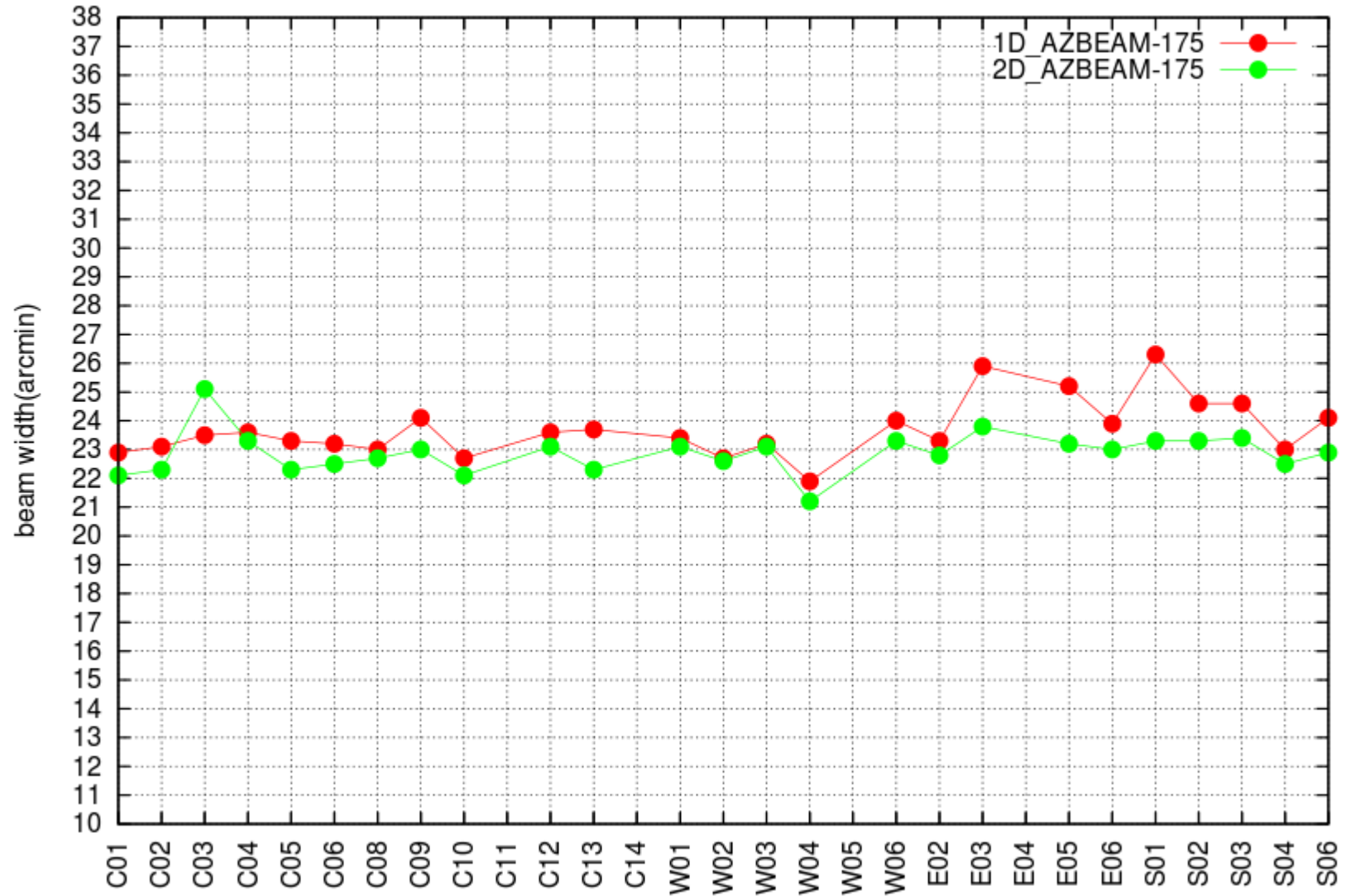
Comparison between 1D and 2D fit

1390 MHz. 17 points



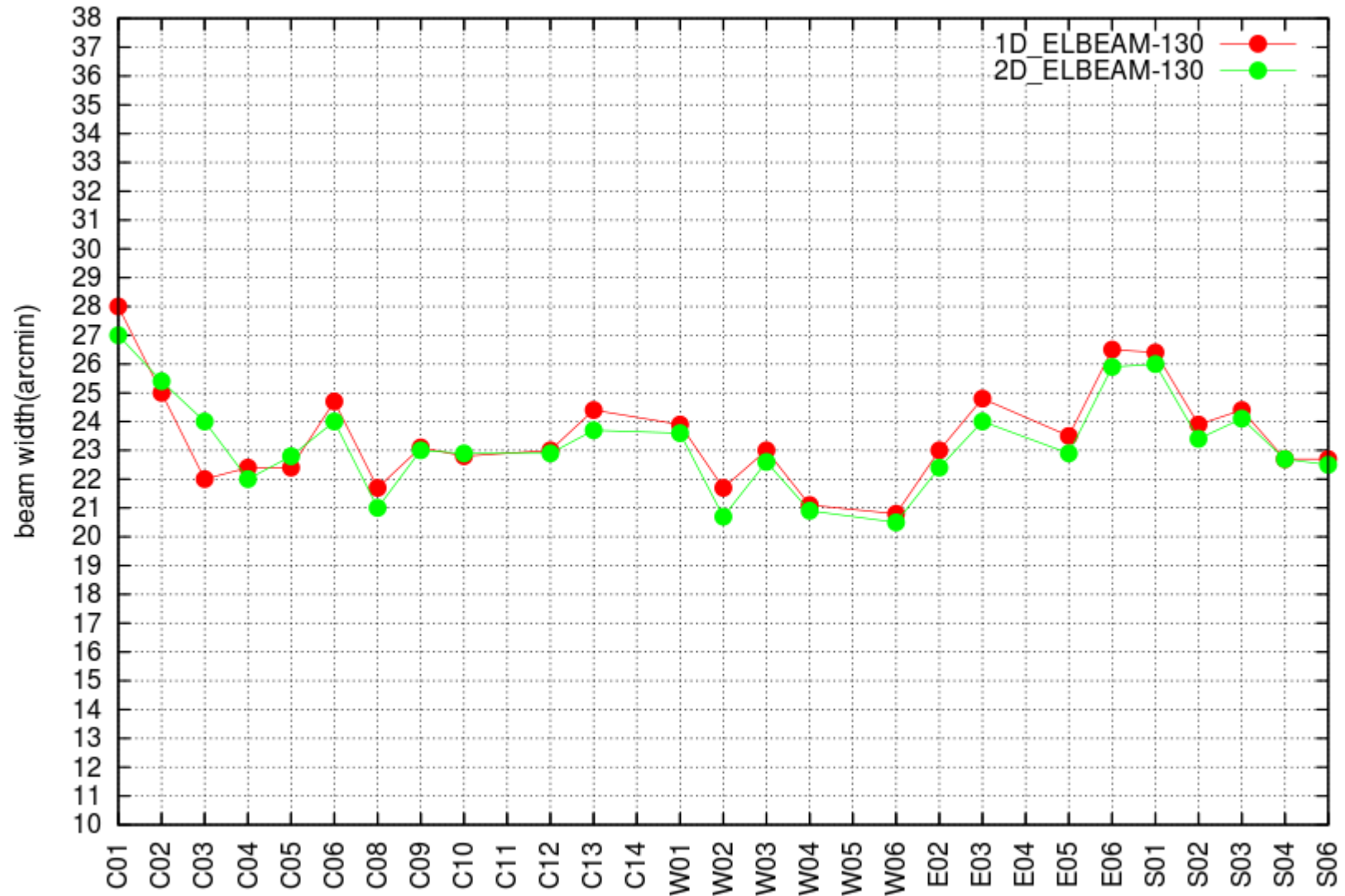
Comparison between 1D and 2D fit

1390 MHz. 17 points



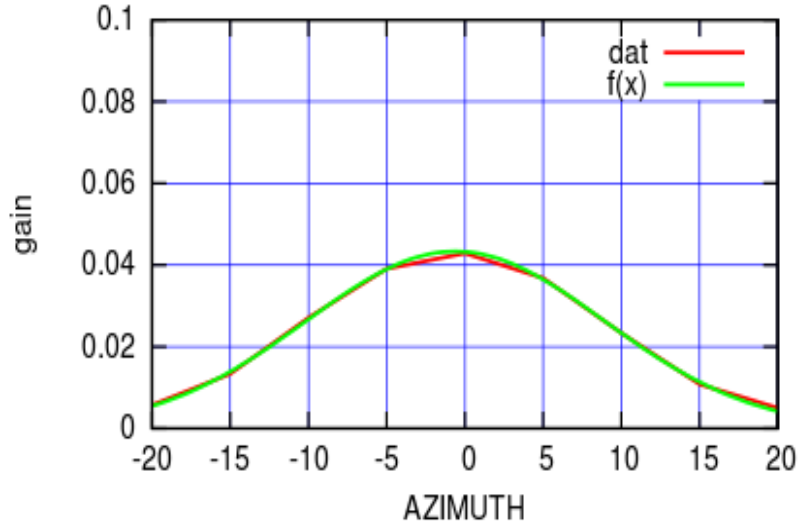
Comparison between 1D and 2D fit

1390 MHz. 17 points



C00-130 AZOFF= -0.6' AZBEAM= 22.5'

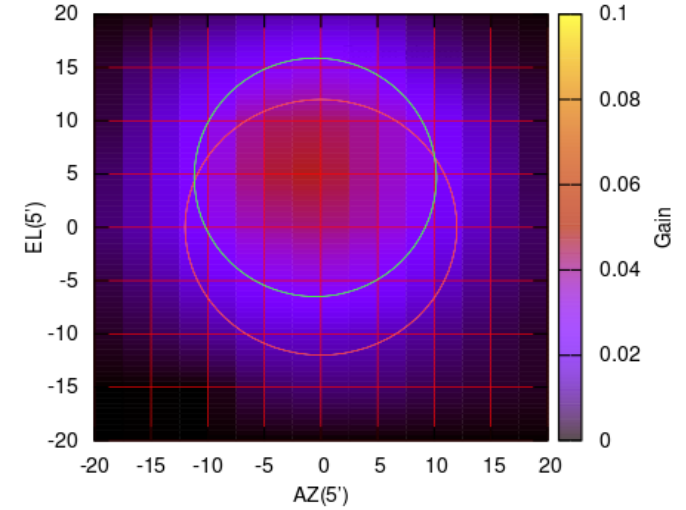
1390 MHz.



9x9

C00-130 AZOFF= -0.5' AZBEAM= 21.4'

1390 MHz.

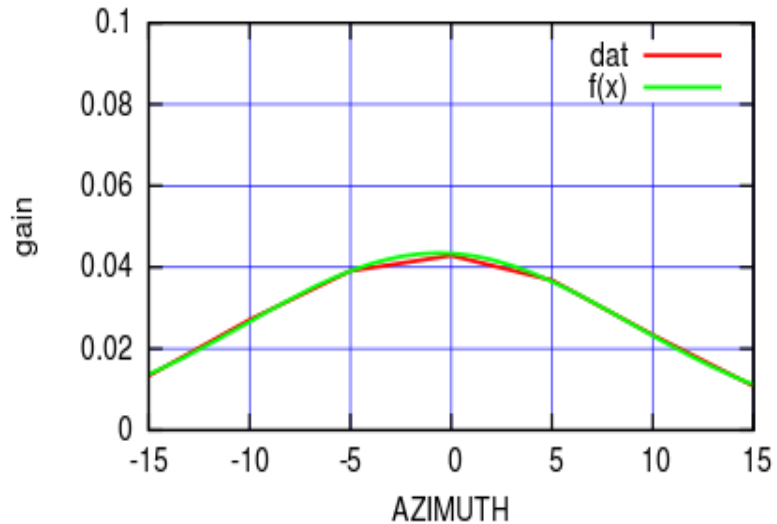


C00-130 ELOFF= 4.7' ELBEAM= 22.4'

Comparison between no of grid points on offsets and beam widths

C00-130 AZOFF= -0.6' AZBEAM= 22.3'

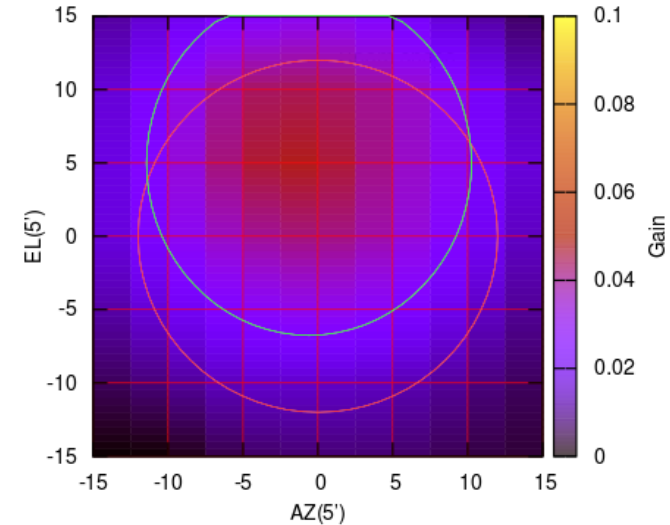
1390 MHz.



7x7

C00-130 AZOFF= -0.6' AZBEAM= 21.7'

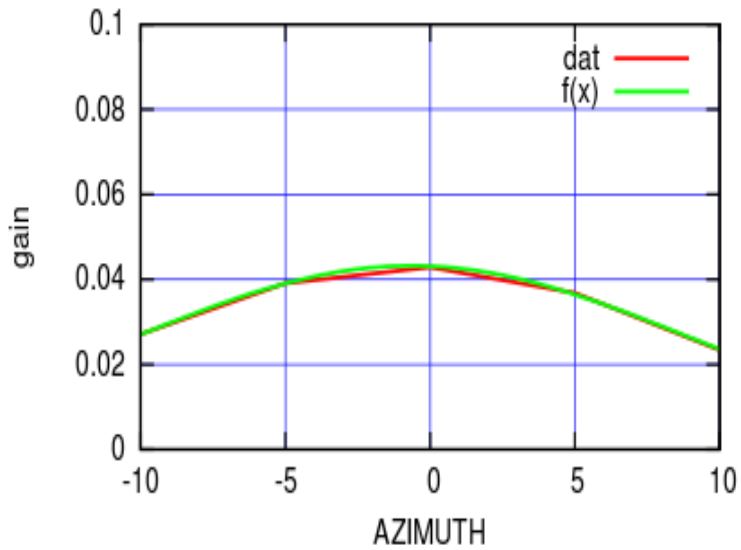
1390 MHz.



C00-130 ELOFF= 5.0' ELBEAM= 23.5'

C00-130 AZOFF= -0.6' AZBEAM= 22.8'

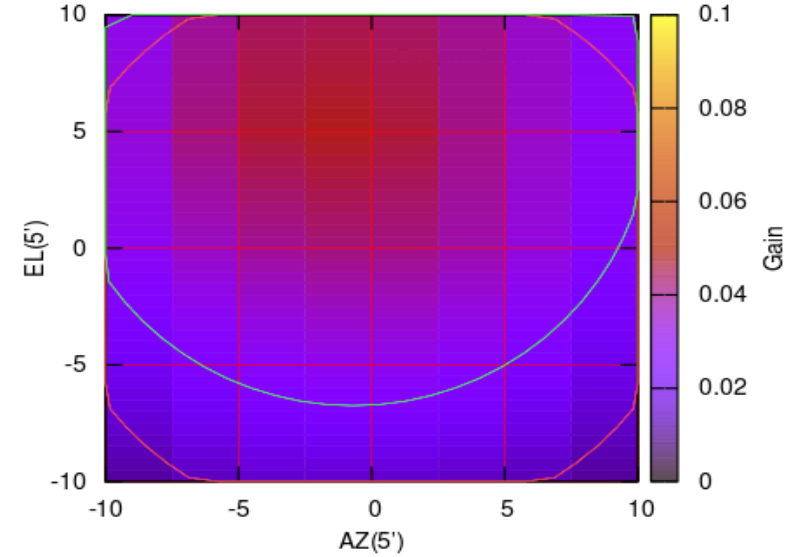
1390 MHz.



5X5

C00-130 AZOFF= -0.7' AZBEAM= 22.4'

1390 MHz.

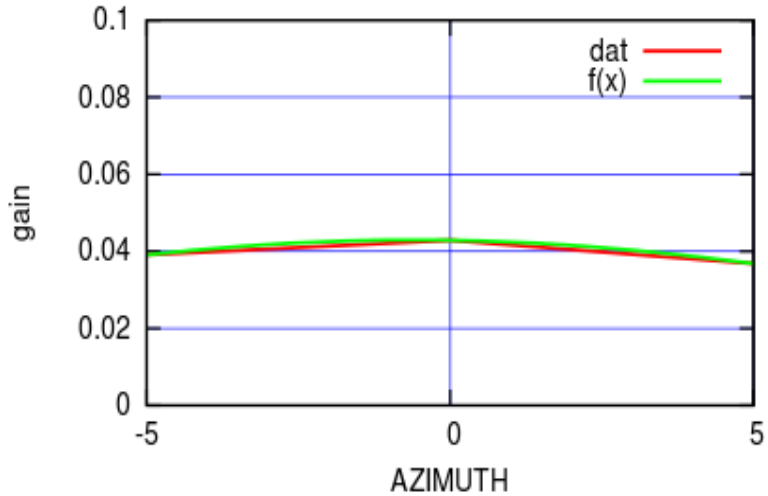


C00-130 ELOFF= 5.7' ELBEAM= 24.9'

Comparison between no of grid points on offsets and beam widths

C00-130 AZOFF= -0.6' AZBEAM= 23.8'

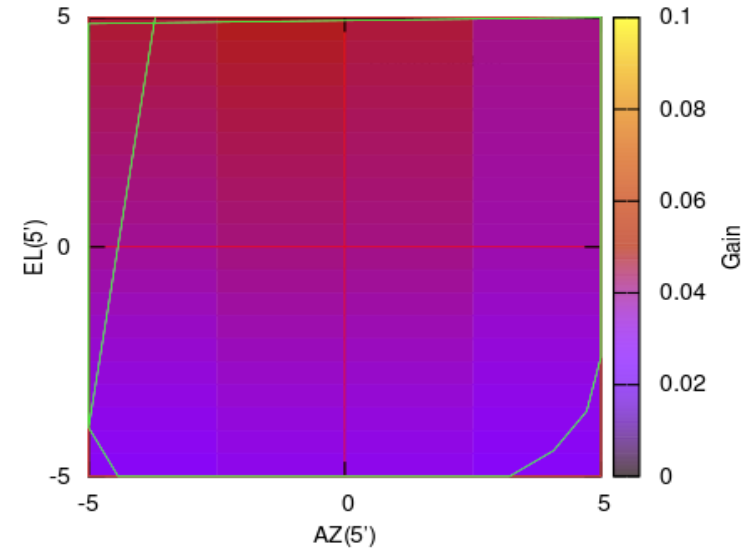
1390 MHz.



3X3

C00-130 AZOFF= -0.9' AZBEAM= 22.0'

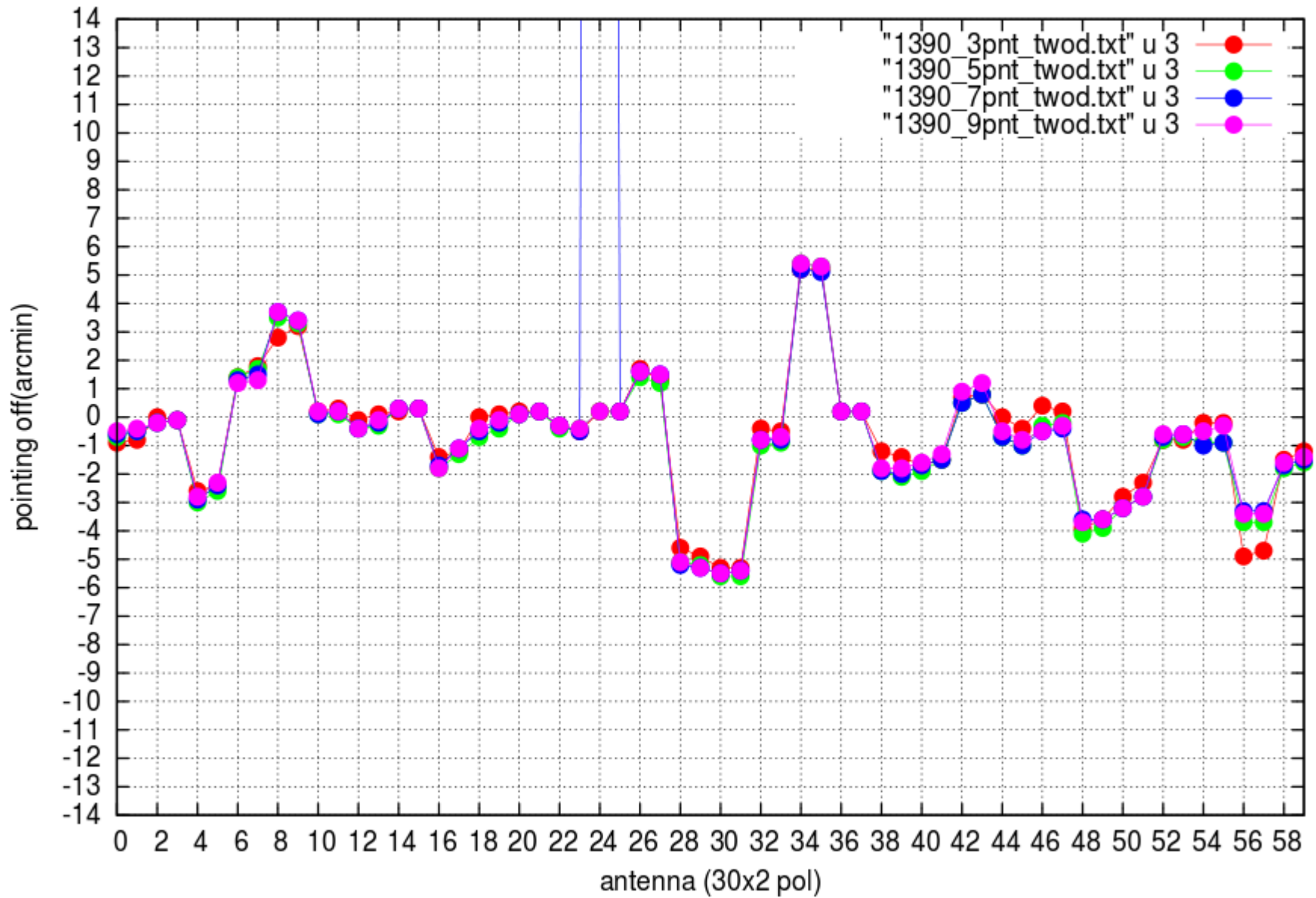
1390 MHz.



C00-130 ELOFF= 5.6' ELBEAM= 26.7'

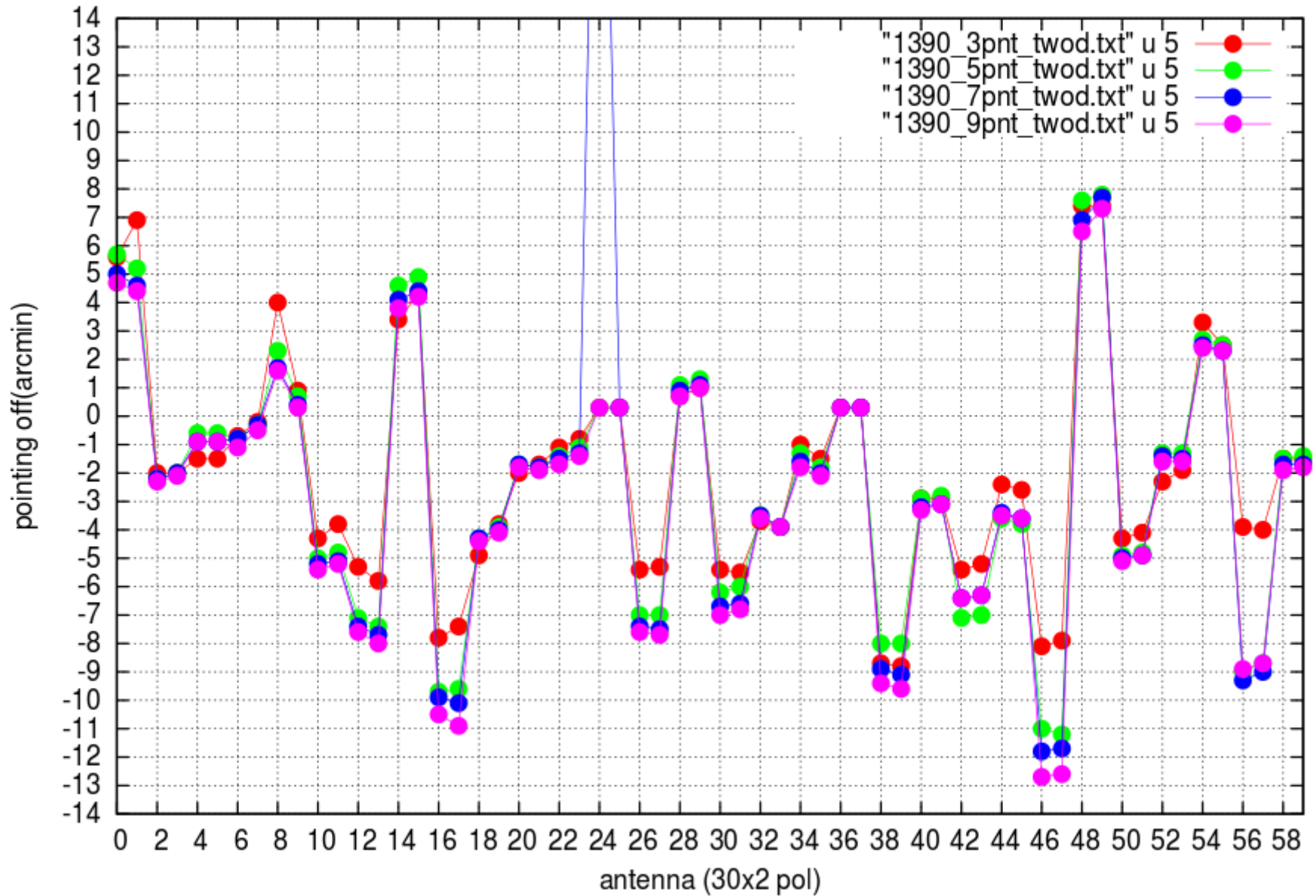
Comparison between no of grid points on offsets and beam widths

AZ pointing offsets at 3, 5, 7 and 9 grid point 2D fit



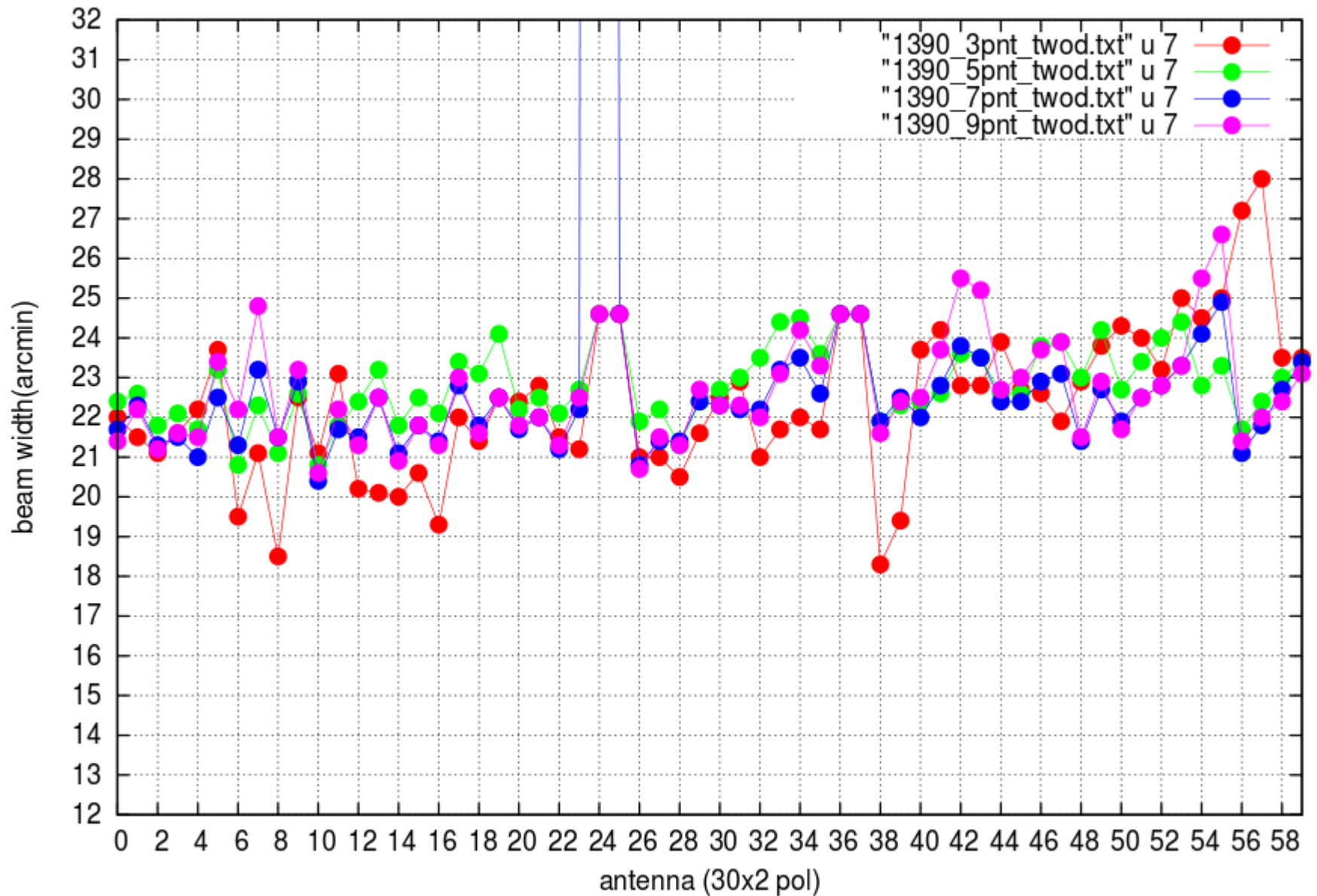
Comparison between no of grid points on offsets and beam widths

EL pointing offsets at 3, 5, 7 and 9 grid point 2D fit



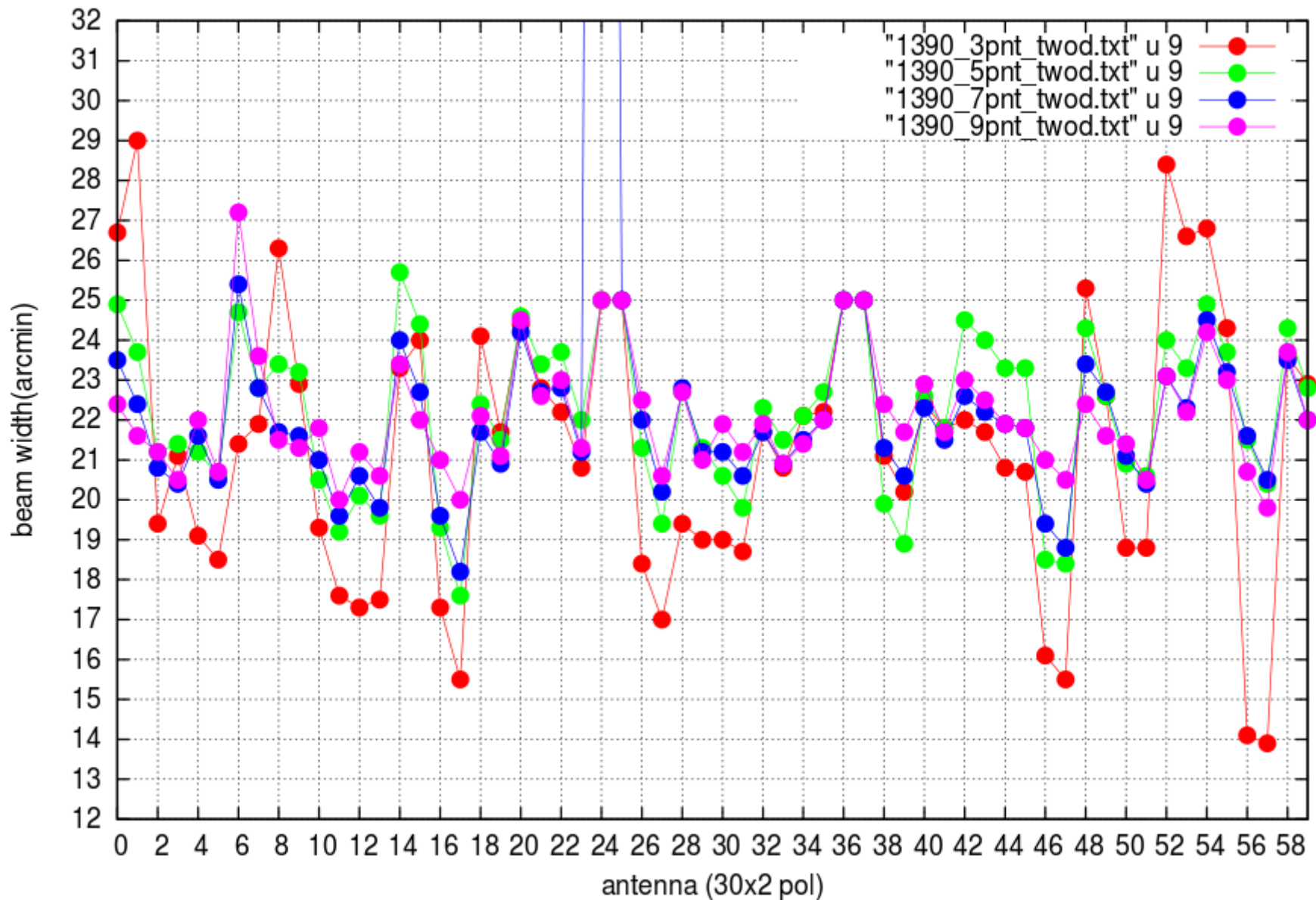
Comparison between no of grid points on offsets and beam widths

AZ beam widths at 3, 5, 7 and 9 grid point 2D fit



Comparison between no of grid points on offsets and beam widths

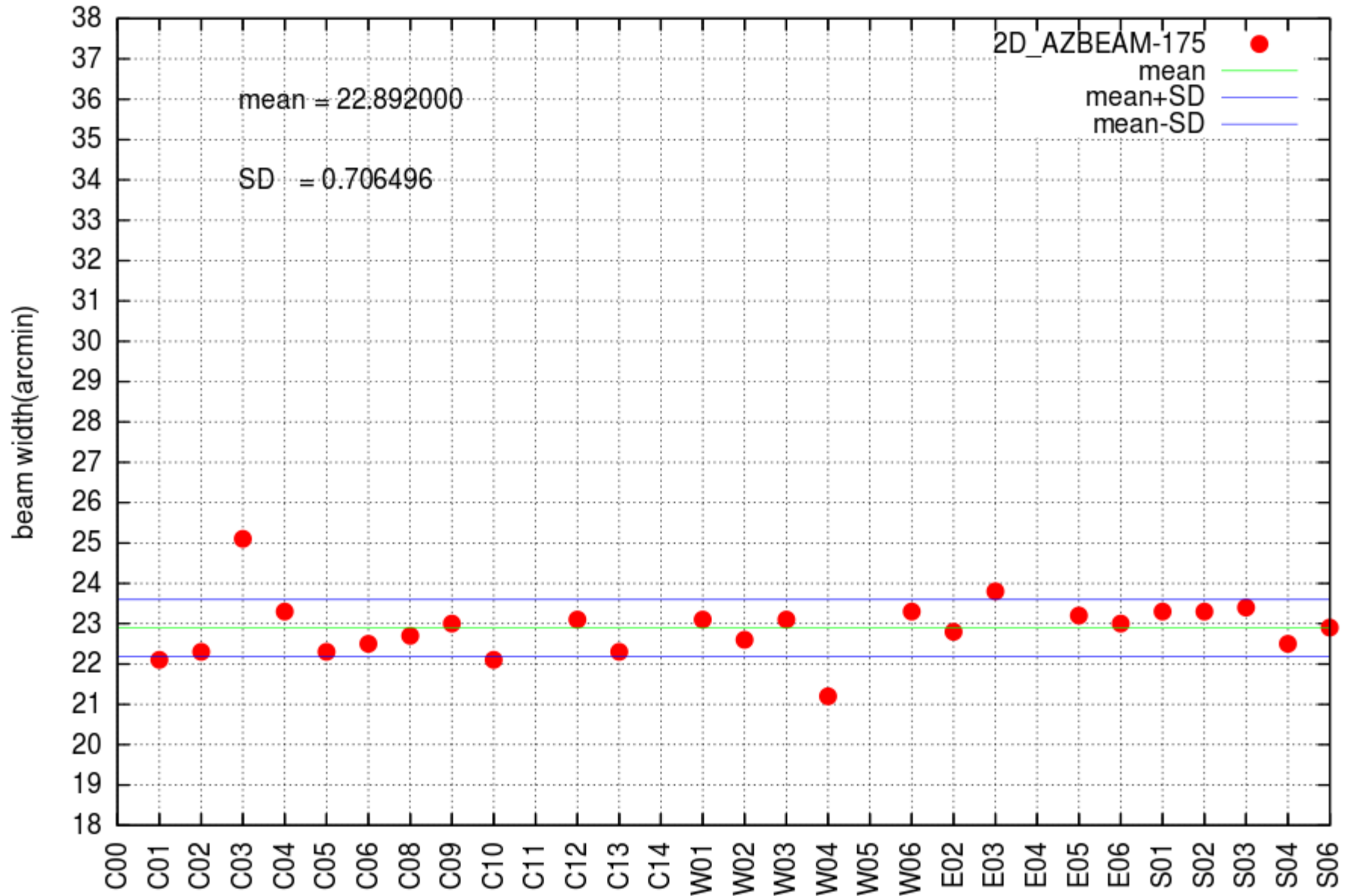
EL beam widths at 3, 5, 7 and 9 grid point 2D fit



2D grid pointing can be used for regular pointing procedure

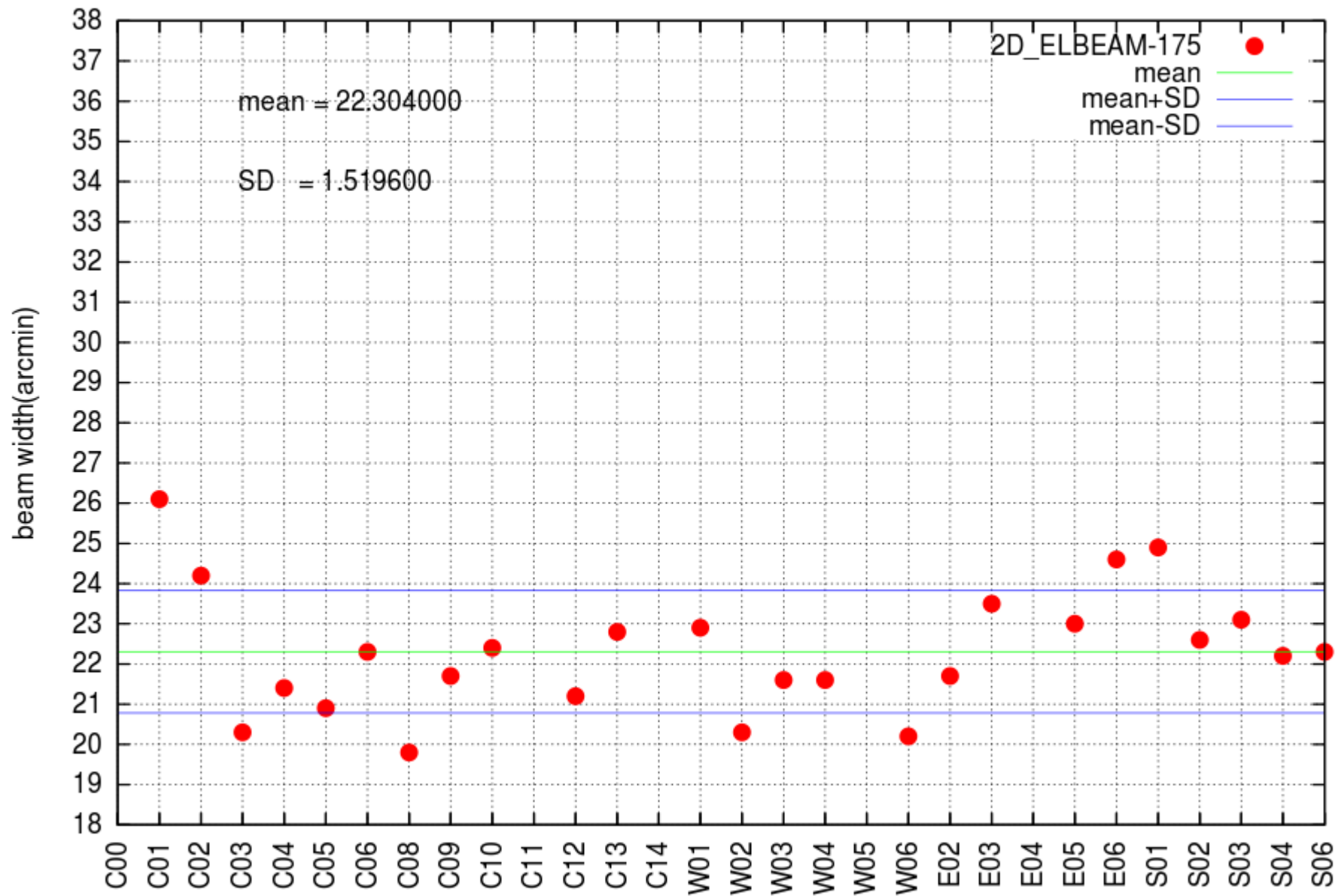
Comparison between AZ and EL on beam widths

1390 MHz. 17 points



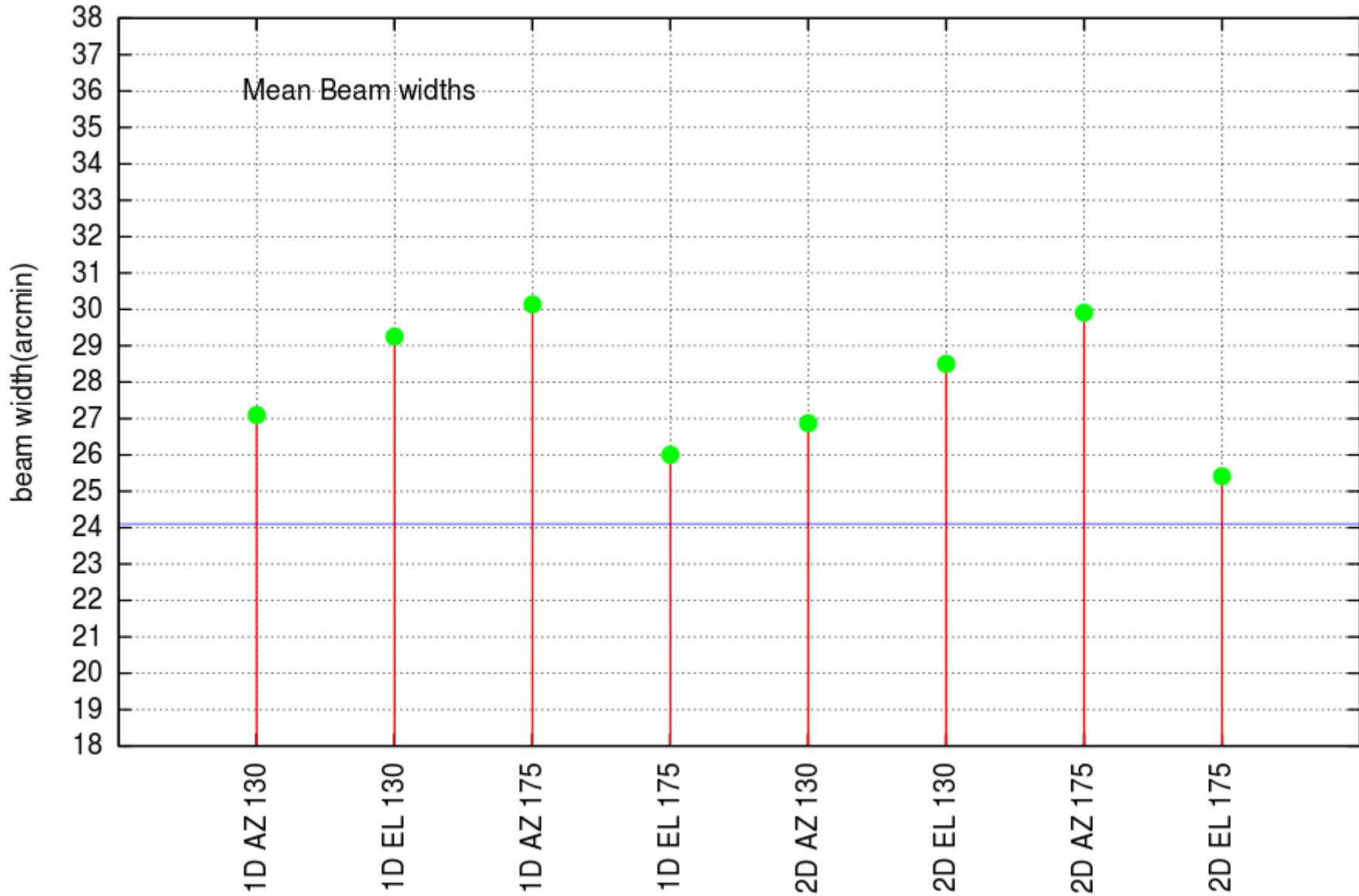
Comparison between AZ and EL on beam widths

1390 MHz. 17 points

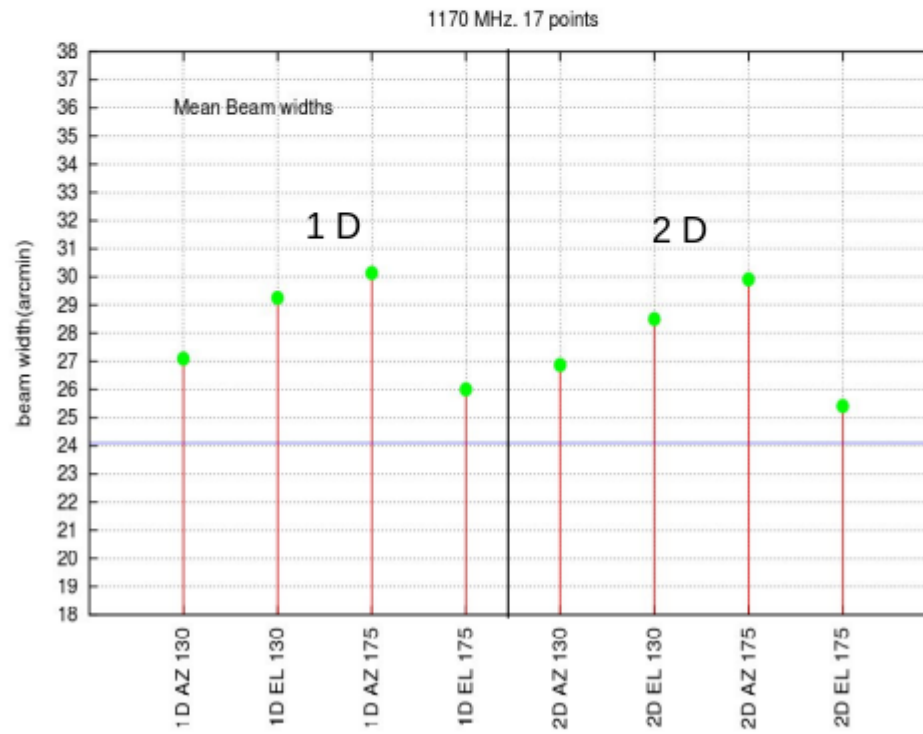
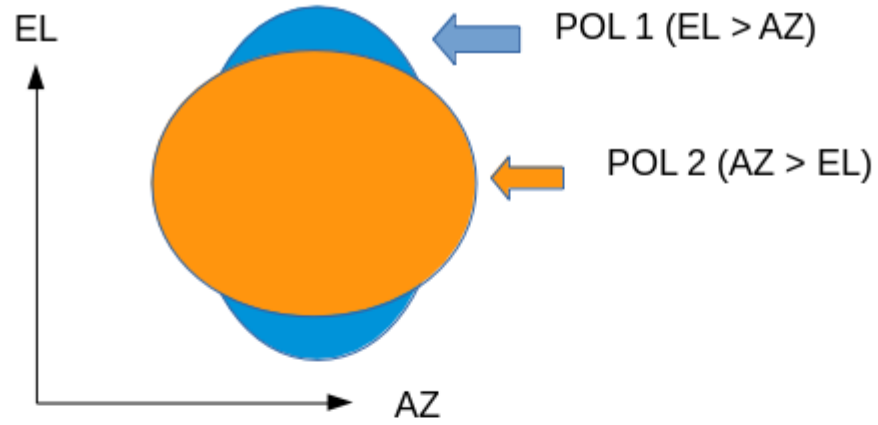


Comparison between AZ,EL,Pol_1 and Pol_2 (beam width)

1170 MHz. 17 points

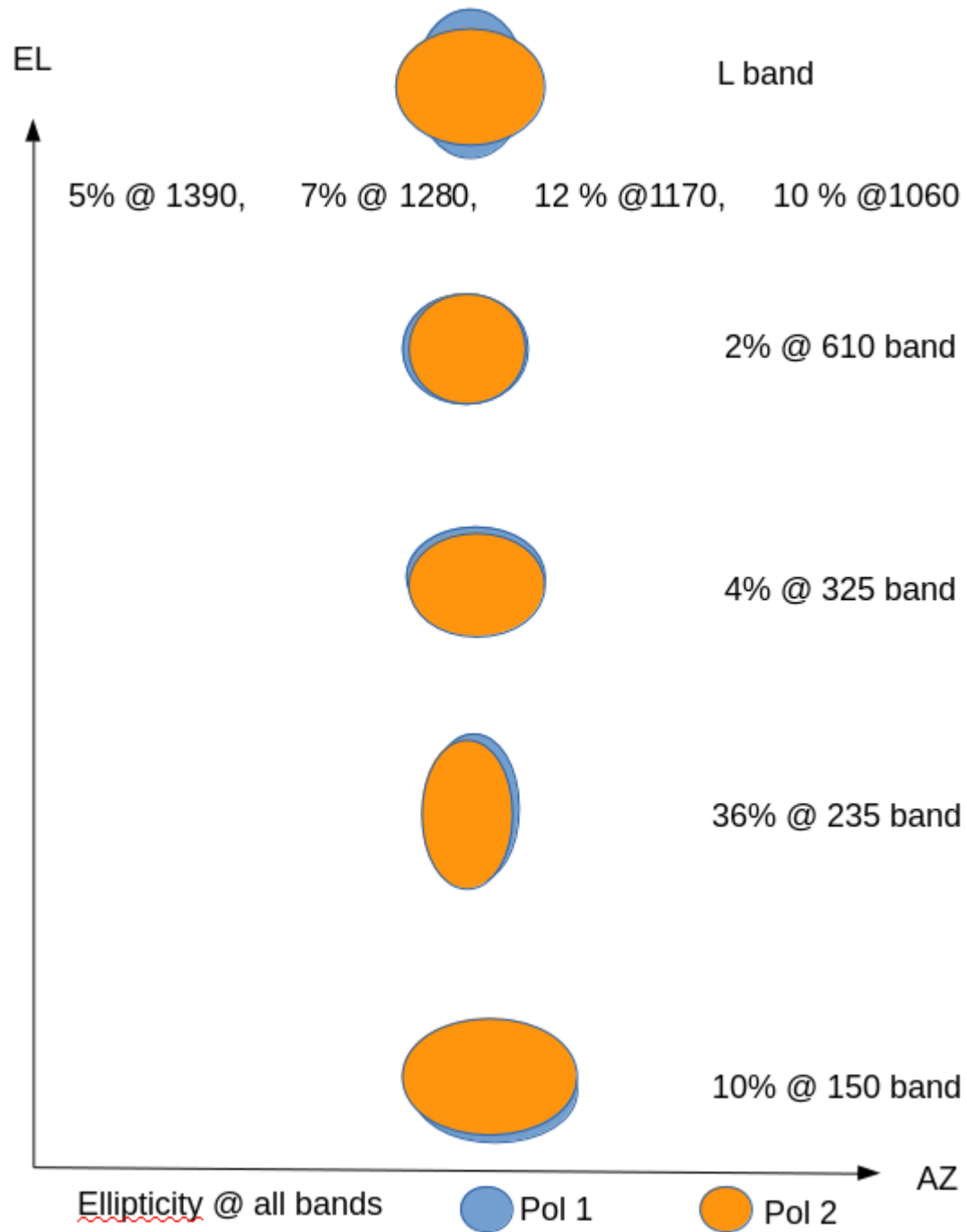


Beam @ 1170 MHz.

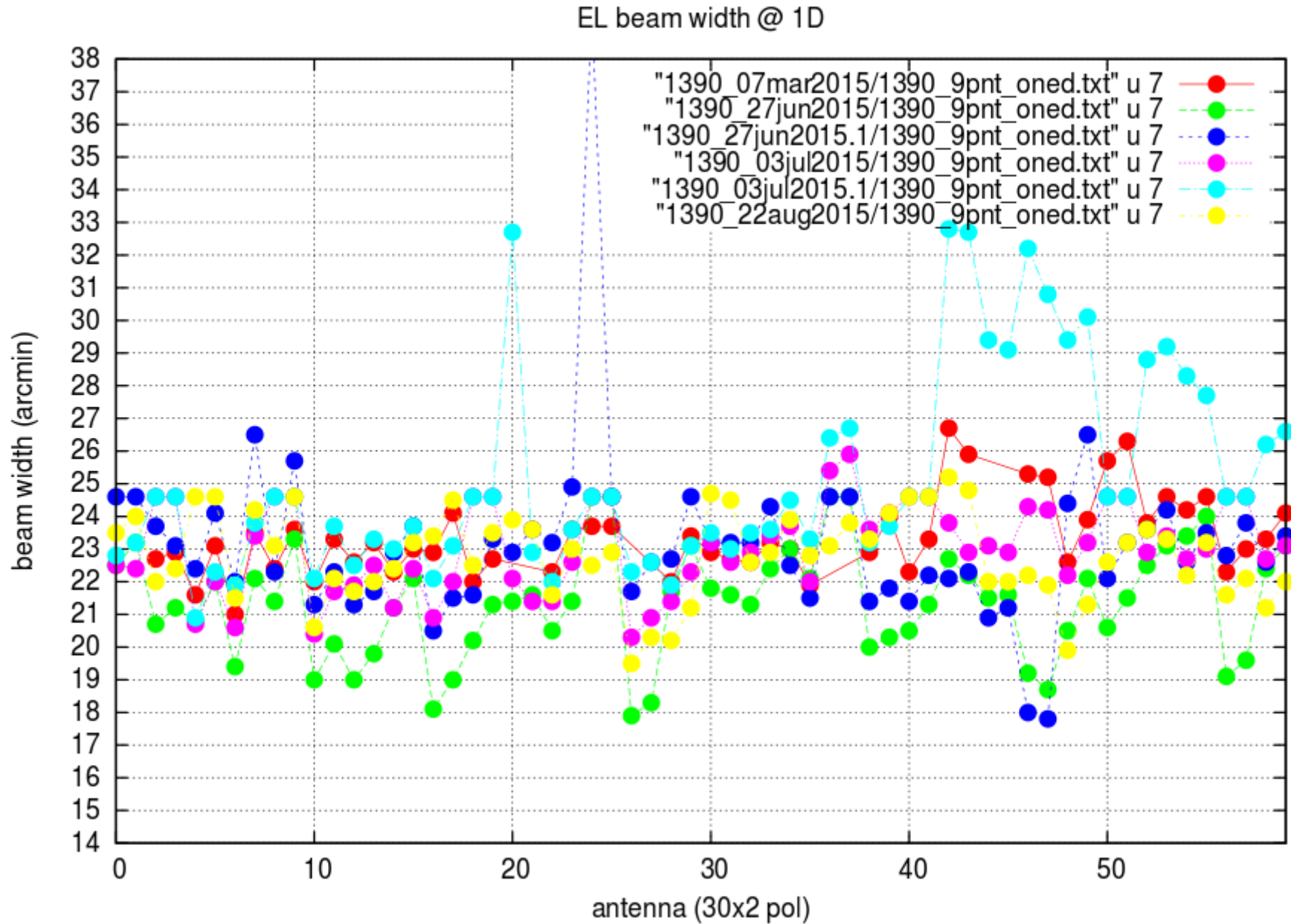


BAND	BEAM WIDTH EXPECTED	Observed 1D beam width (SD)				Observed 2D beam width (SD)			
		130 pol		175 pol		130 pol		175 pol	
		AZ	EL	AZ	EL	AZ	EL	AZ	EL
1390	20	23	23.5	23.7	22.6	22.2	23.2	23	22.3
		1.2	1.6	0.9	1.6	0.7	1.6	0.7	1.5
1280	21.5	24	25	25	23.5	23.7	24.7	25	23.3
		0.7	1.5	0.5	1.3	0.6	1.7	0.7	1.4
1170	24	27	29	30	26	27	28.5	30	25.4
		0.8	1.4	0.7	1.3	0.8	1.4	0.7	1.3
1060	26.3	28	31	31	28	29	30	32	28
		0.8	2	0.8	2.5	0.6	2	1	2.4
610	44	43	43.5	43.3	43.5	43.5	42.6	43.6	42.6
		1.7	1	1.7	0.9	1	1.1	1	1
325	86	83	82	84	82	87	84	87	84
		4.2	2.9	4.5	3.1	2.4	3.5	2.3	3.2
235	122	82	110	83	111	81	110	78	110
		1.9	3.7	2.6	3.8	2.2	4	2.6	4.2
150	186	212	177	214	185	190	177	195	181
		24	10	23	12	11	7	11	10

GMRT
PRIMARY
BEAMS



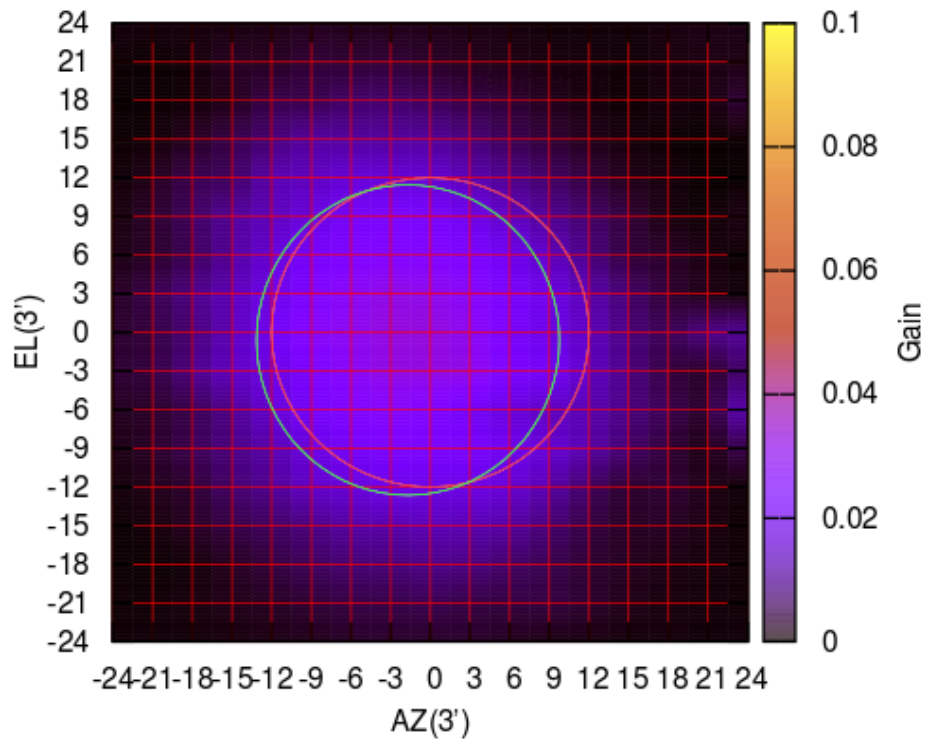
Beam width @ various time stamps (1390 MHz)



1390 MHz.

S03-130 AZOFF= -1.7' AZBEAM= 22.9'

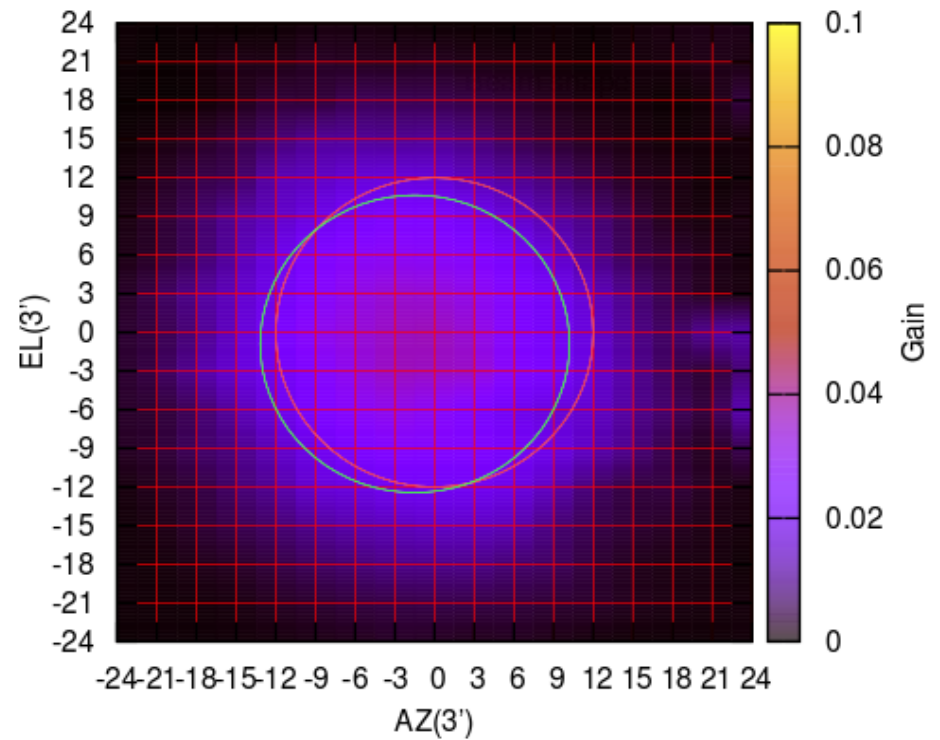
1390 MHz.



S03-130 ELOFF= -0.6' ELBEAM= 24.1'

S03-175 AZOFF= -1.5' AZBEAM= 23.4'

1390 MHz.

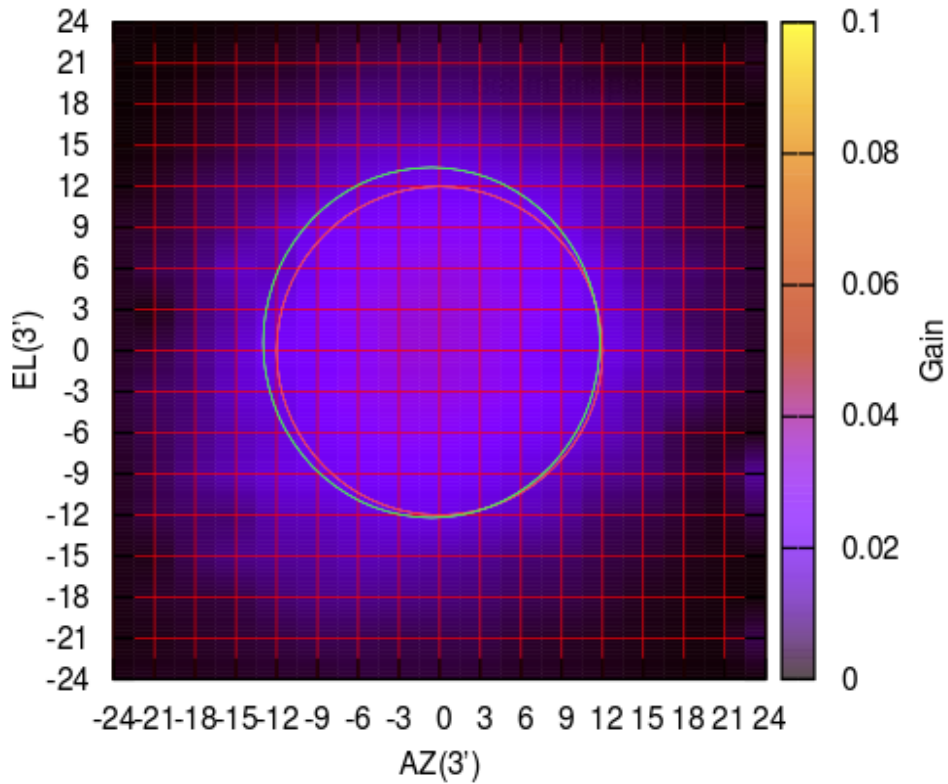


S03-175 ELOFF= -0.9' ELBEAM= 23.1'

1280 MHz.

S03-130 AZOFF= -0.6' AZBEAM= 24.8'

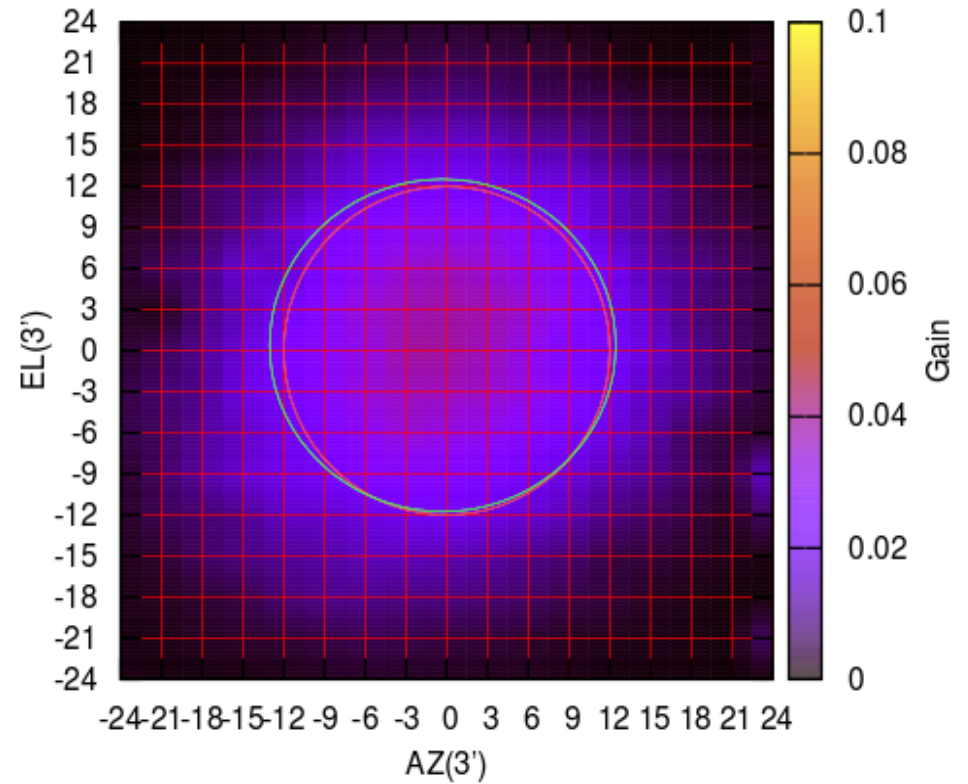
1280 MHz.



S03-130 ELOFF= 0.6' ELBEAM= 25.6'

S03-175 AZOFF= -0.3' AZBEAM= 25.5'

1280 MHz.

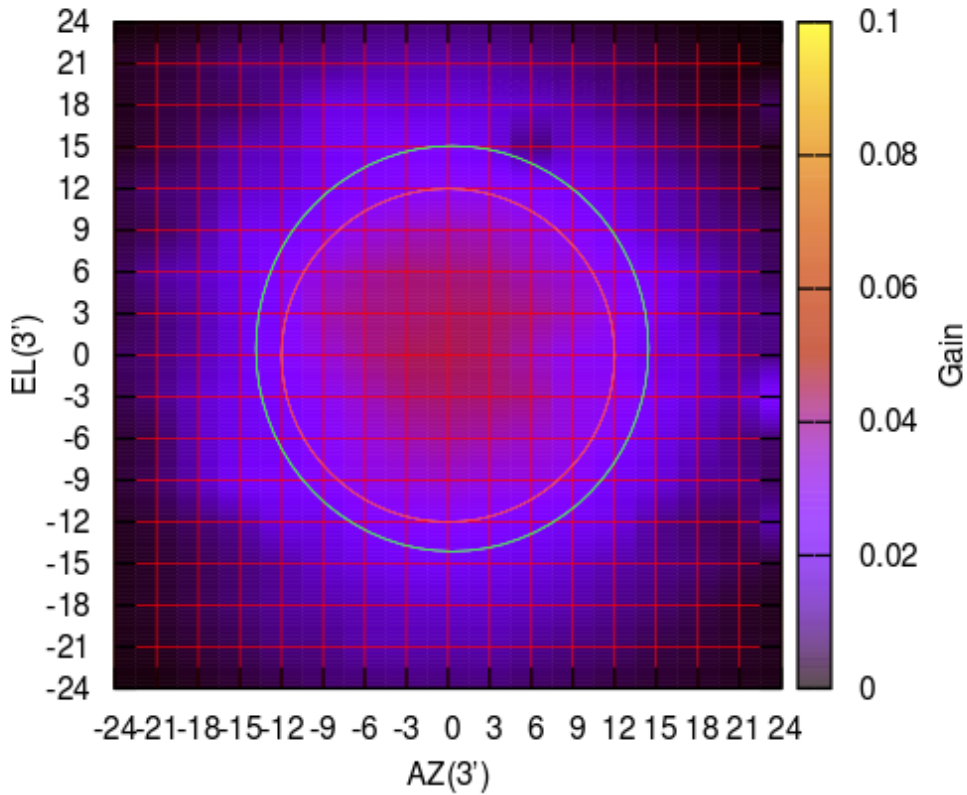


S03-175 ELOFF= 0.4' ELBEAM= 24.3'

1170 MHz.

S03-130 AZOFF= 0.3' AZBEAM= 28.3'

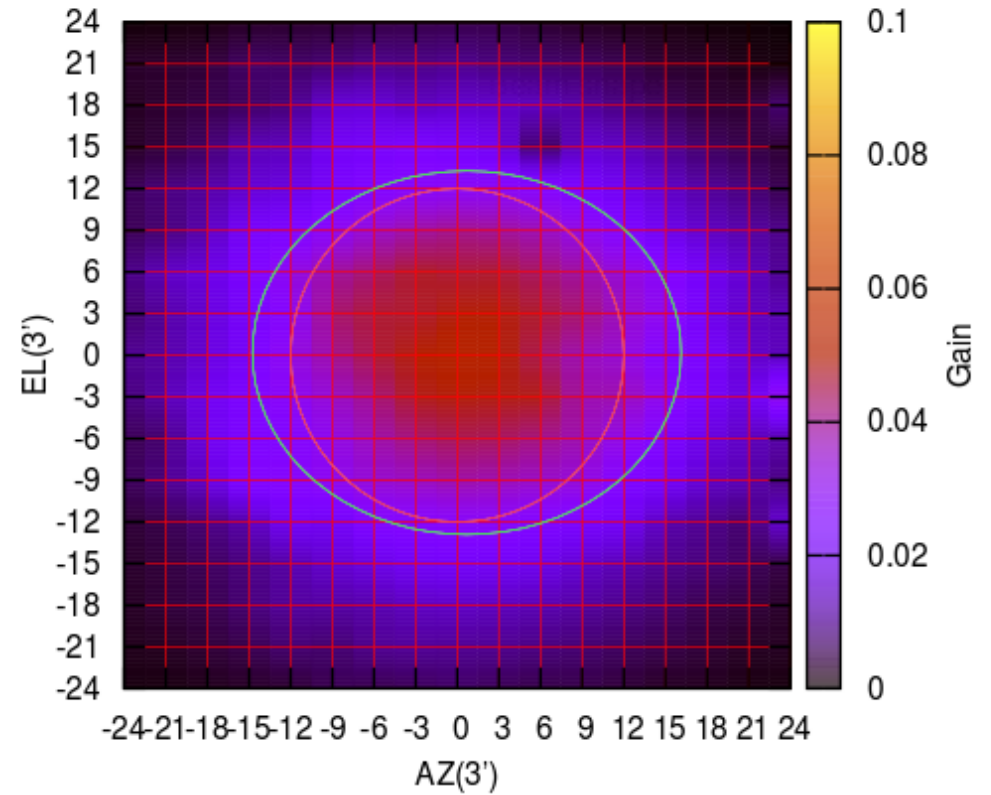
1170 MHz.



S03-130 ELOFF= 0.5' ELBEAM= 29.2'

S03-175 AZOFF= 0.7' AZBEAM= 30.9'

1170 MHz.

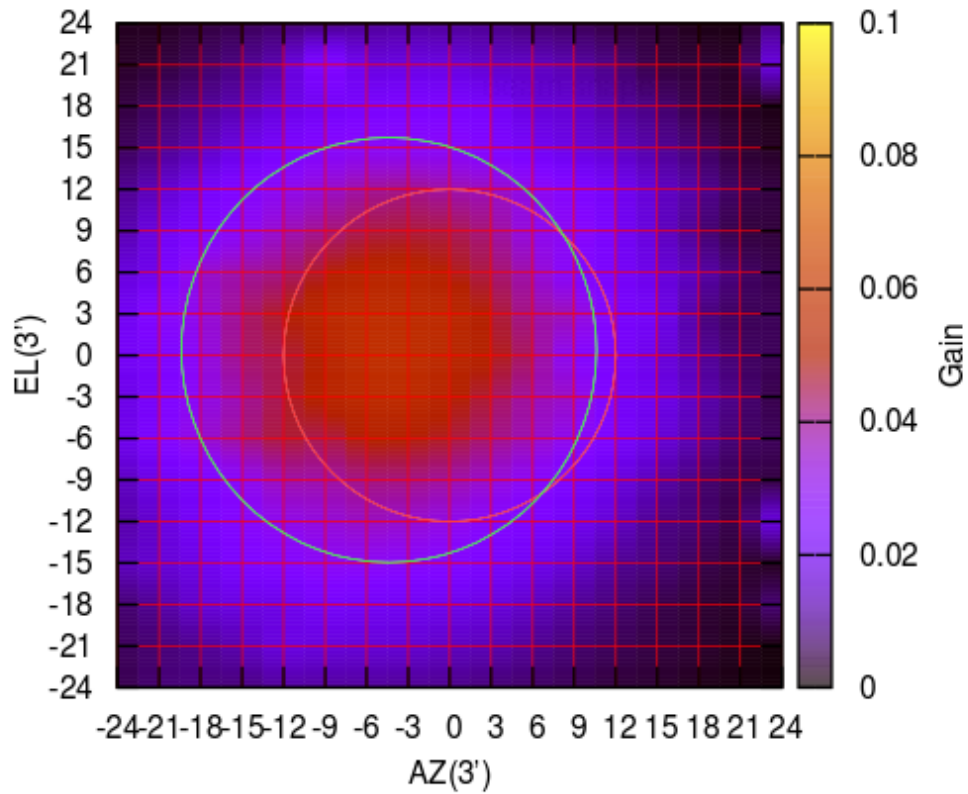


S03-175 ELOFF= 0.2' ELBEAM= 26.2'

1060 MHz.

S03-130 AZOFF= -4.4' AZBEAM= 30.0'

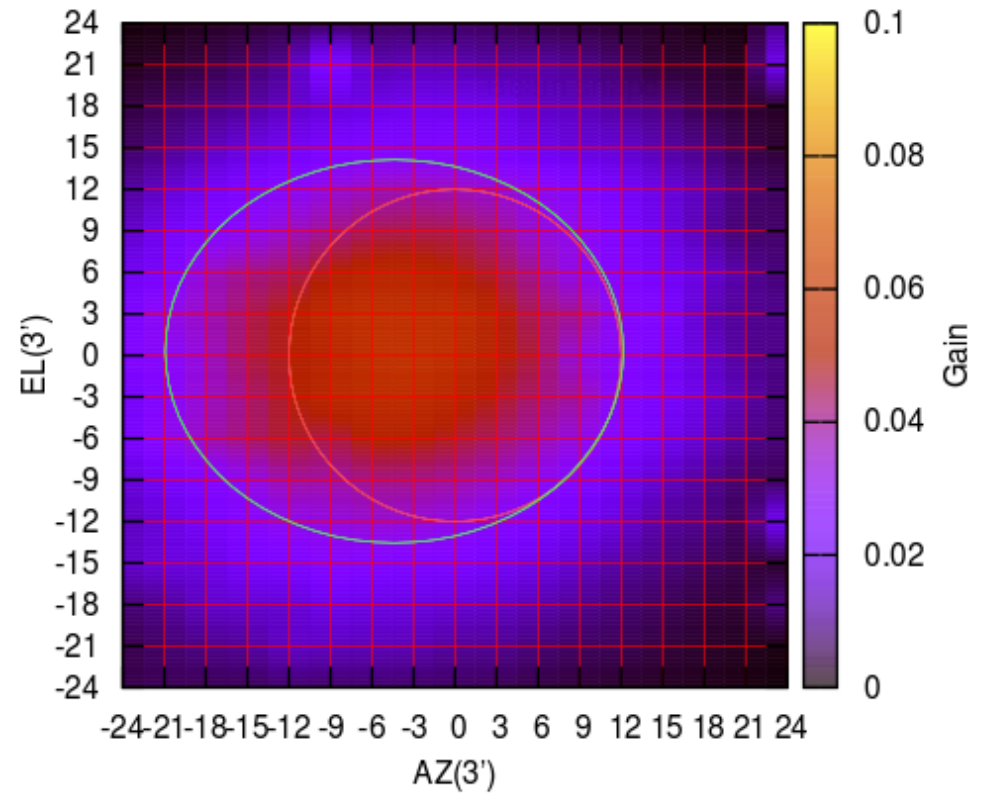
1060 MHz.



S03-130 ELOFF= 0.4' ELBEAM= 30.7'

S03-175 AZOFF= -4.4' AZBEAM= 33.1'

1060 MHz.

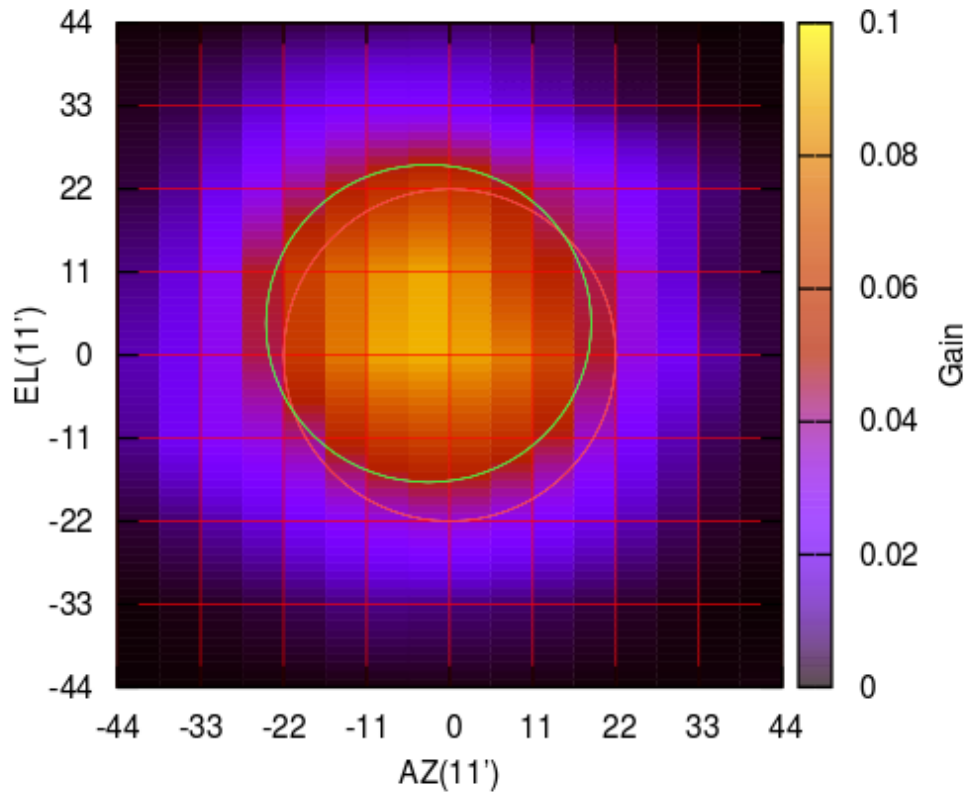


S03-175 ELOFF= 0.3' ELBEAM= 27.7'

610 MHz.

S03-130 AZOFF= -2.8' AZBEAM= 43.1'

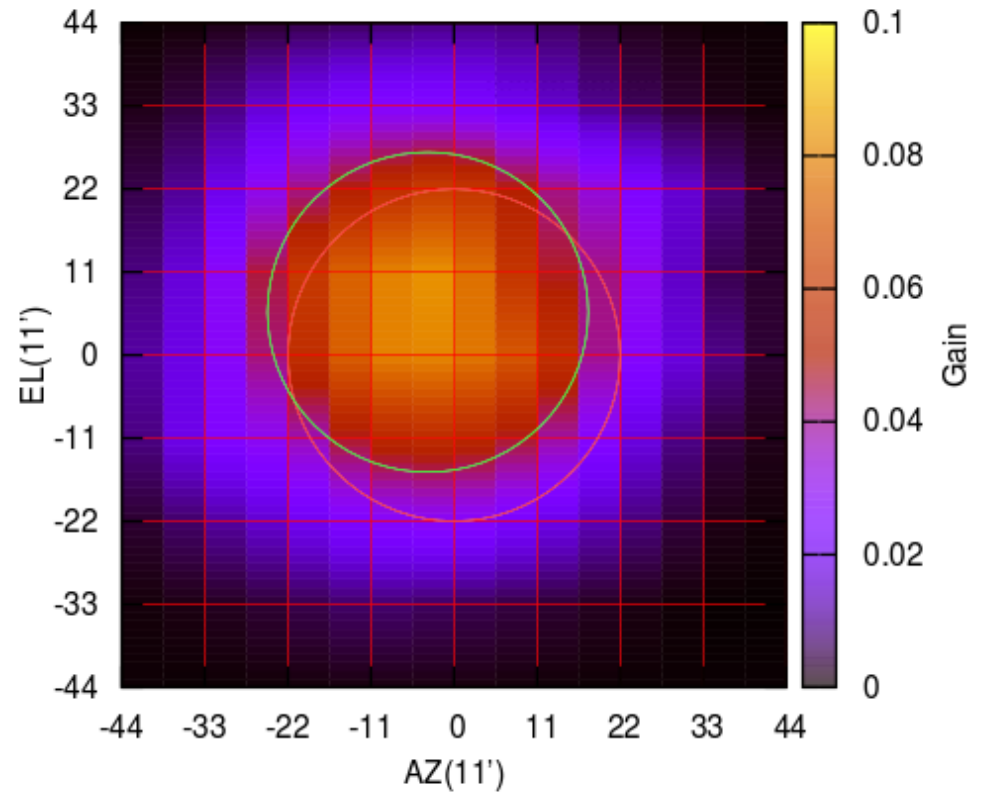
610 MHz.



S03-130 ELOFF= 4.2' ELBEAM= 42.1'

S03-175 AZOFF= -3.5' AZBEAM= 42.5'

610 MHz.

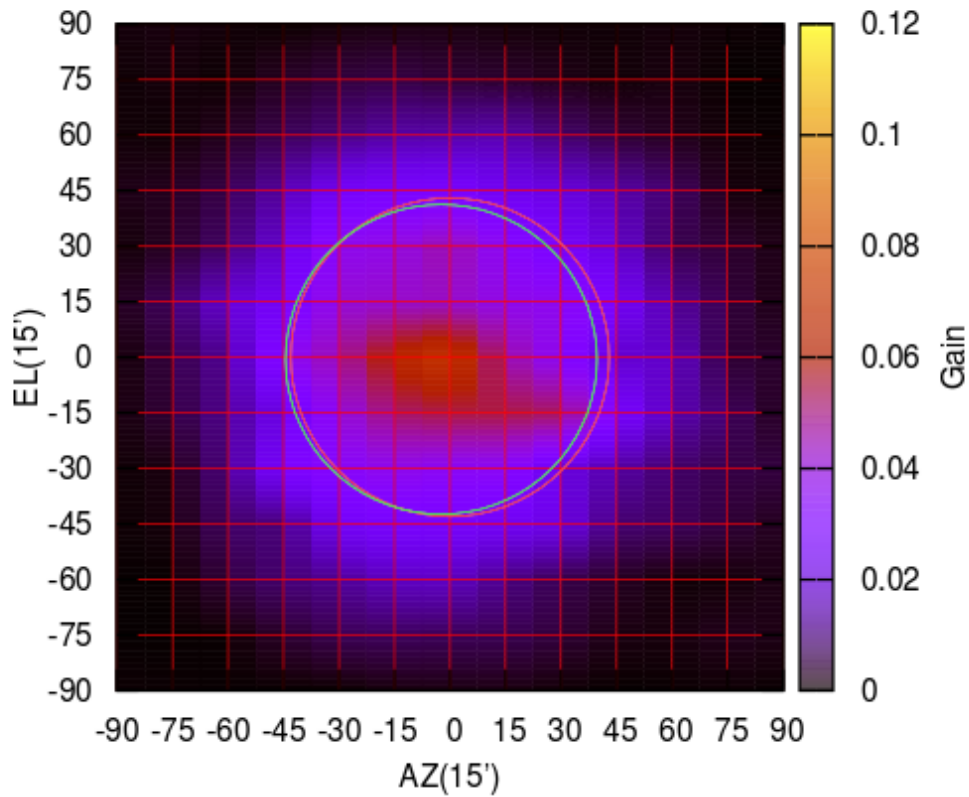


S03-175 ELOFF= 5.7' ELBEAM= 42.4'

325 MHz.

S03-130 AZOFF= -2.4' AZBEAM= 84.2'

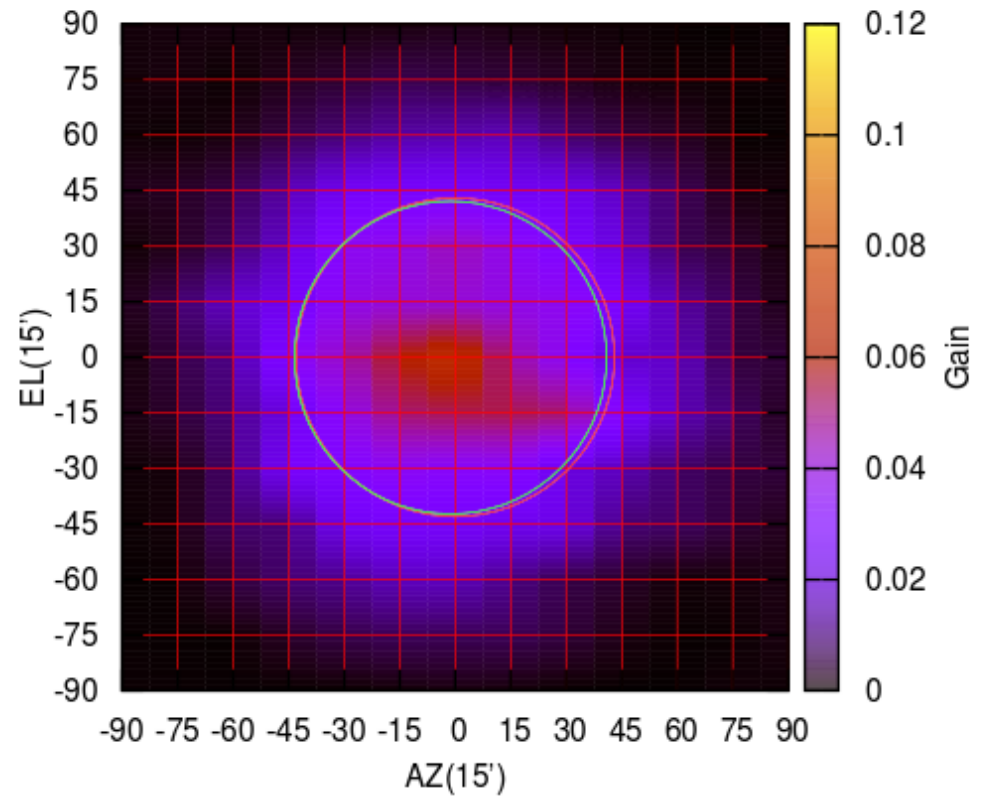
325 MHz.



S03-130 ELOFF= -0.6' ELBEAM= 83.7'

S03-175 AZOFF= -1.3' AZBEAM= 84.4'

325 MHz.

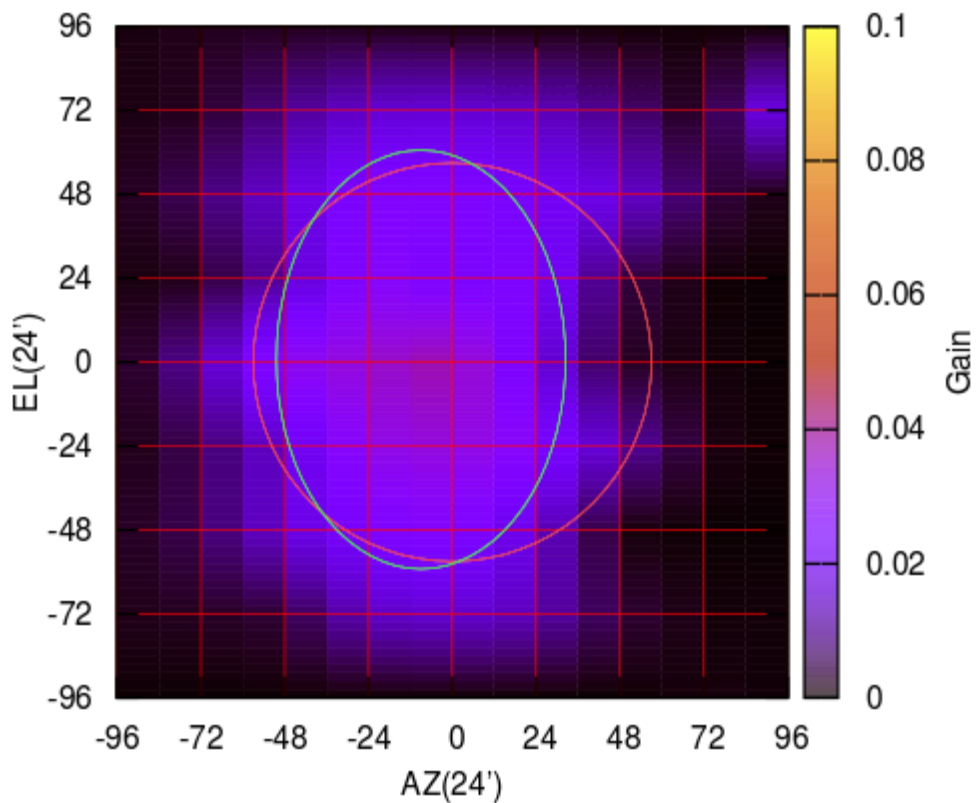


S03-175 ELOFF= -0.1' ELBEAM= 84.5'

235 MHz.

S03-130 AZOFF= -9.0' AZBEAM= 82.9'

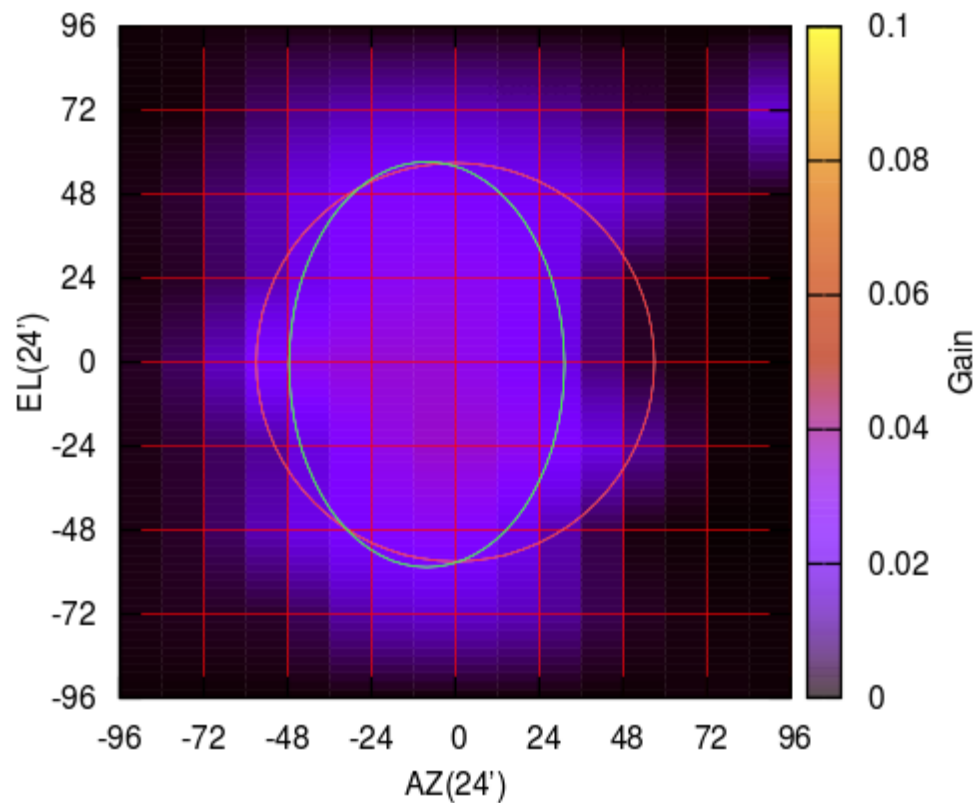
235 MHz.



S03-130 ELOFF= 0.8' ELBEAM=119.8'

S03-175 AZOFF= -8.2' AZBEAM= 78.9'

235 MHz.

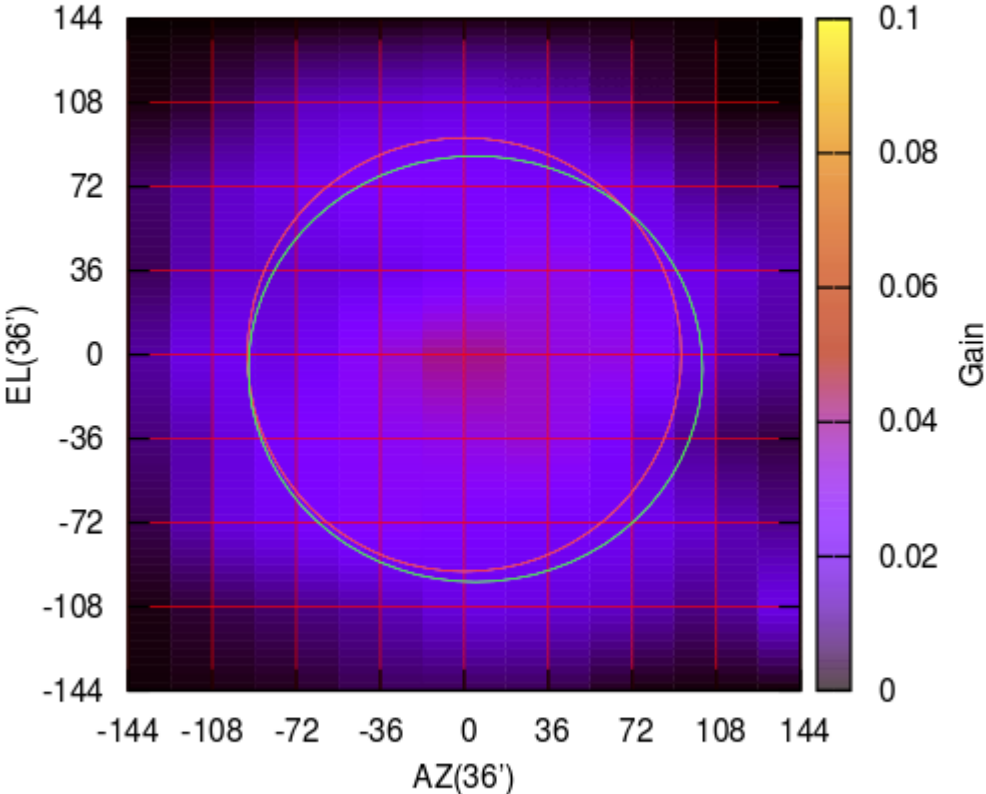


S03-175 ELOFF= -0.7' ELBEAM=116.0'

150 MHz.

S03-130 AZOFF= 4.8' AZBEAM=194.7'

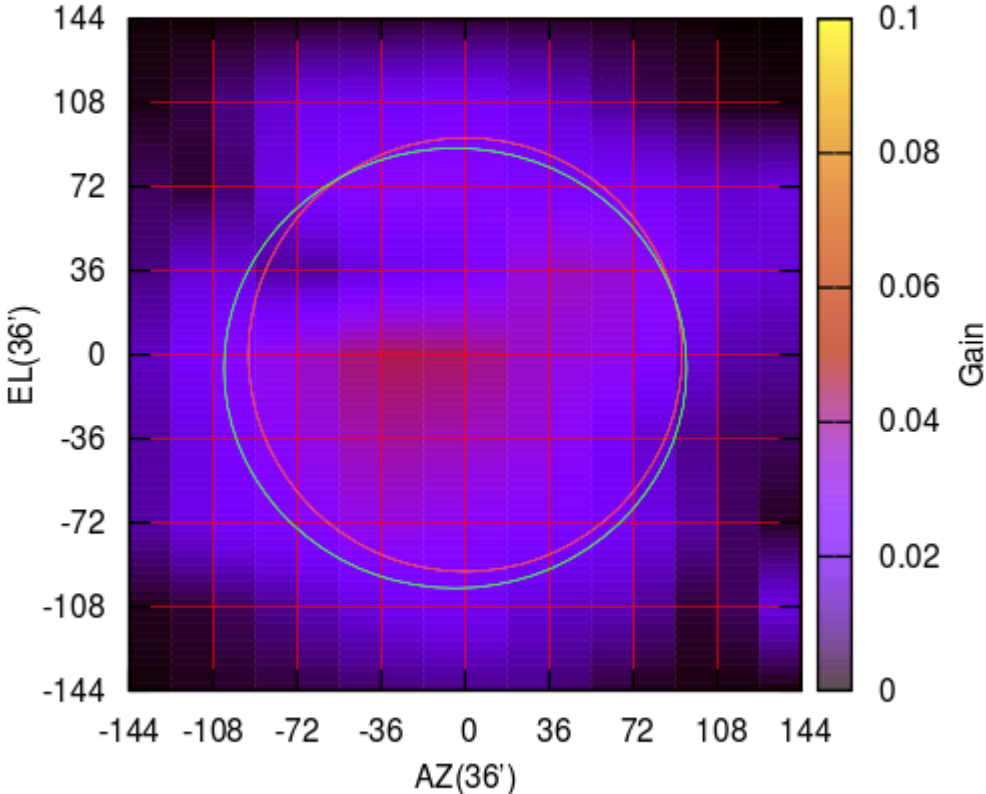
150 MHz.



S03-130 ELOFF= -6.2' ELBEAM=182.6'

S03-175 AZOFF= -4.3' AZBEAM=198.3'

150 MHz.



S03-175 ELOFF= -5.9' ELBEAM=188.7'

Thank you