First catalog of IPS sources detected at the MEXART

remote sensing of the inner heliosphere / May 5-8 / Aberystwyth

Mexican Array Radio Telescope

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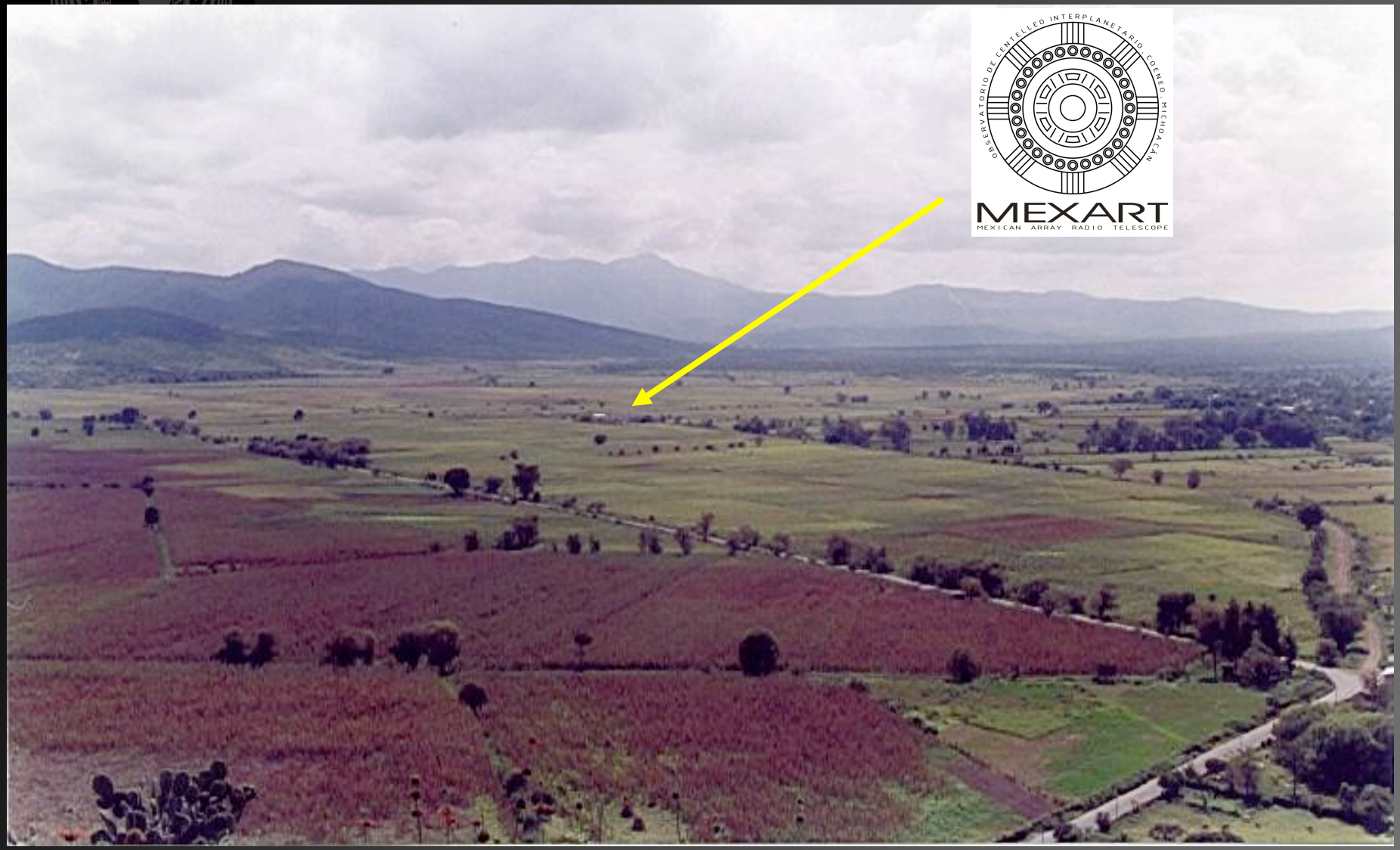
360 km north-west from Mexico City
19°48' north and 101°41' west, 1964 m above sea level
29 ° geomagnetic latitude

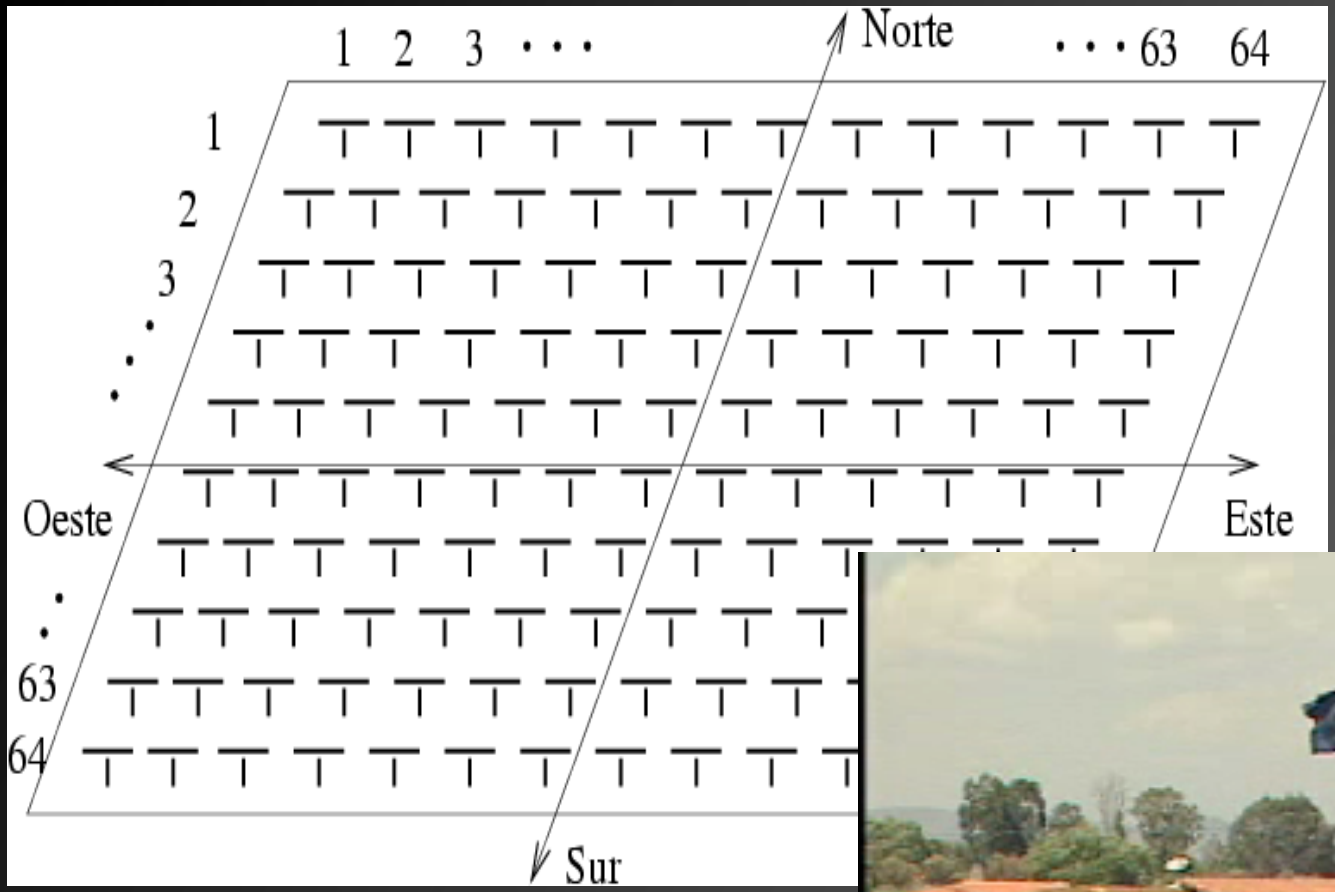
-6 hours 46 minutes GMT



MEXART TECHNICAL CHARACTERISTICS

operation frequency	139.65 MHz
elongation angle from the Sun	20 degrees
band width	1.5 MHz.
basic element	full wavelength dipole
number of elements	4096
number of East-West rows	64, each row has 64 full wavelength dipoles
expected sensitivity	2.5 K/Jy
physical area	9,600 square meters (70m x 138m)

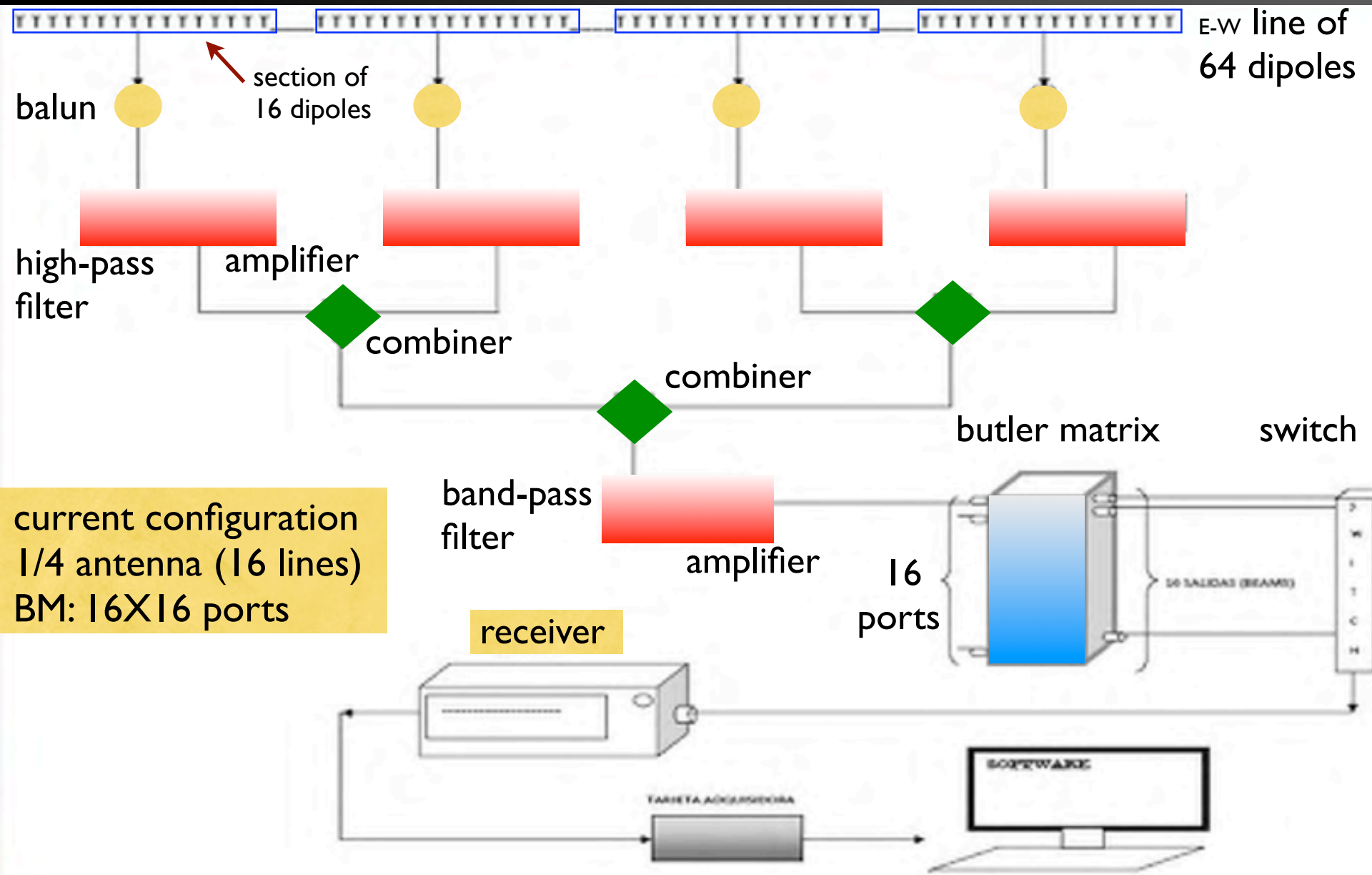
plane array of 64x64 elements



64 E-W lines of
64 dipoles

current configuration
antenna:16 lines of 64 dipoles

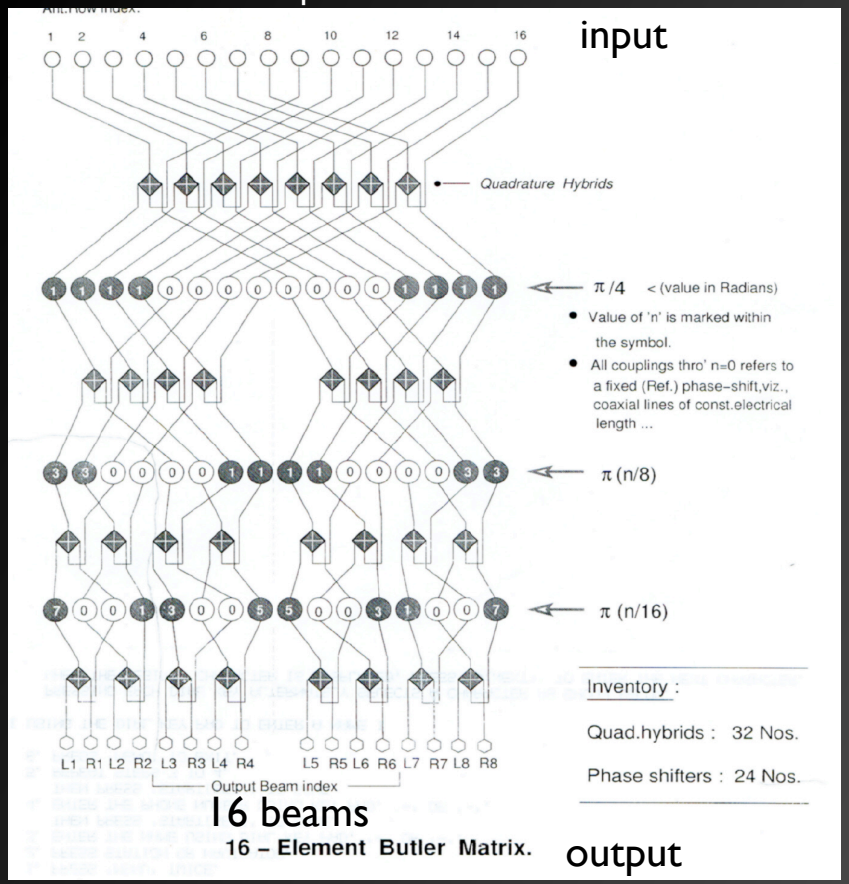
geofisica UNAM

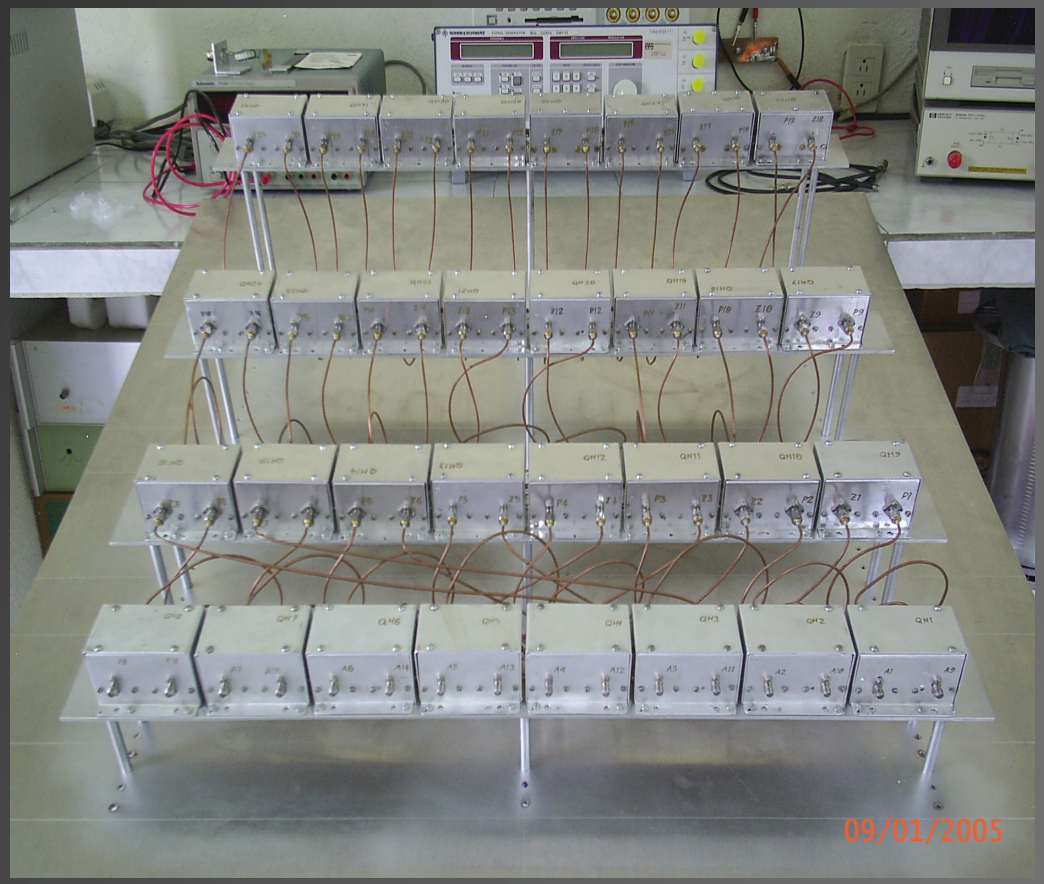


current configuration
1/4 antenna (16 lines)
BM: 16X16 ports

Butler Matrix 16x16 (designed at NCRA-India)

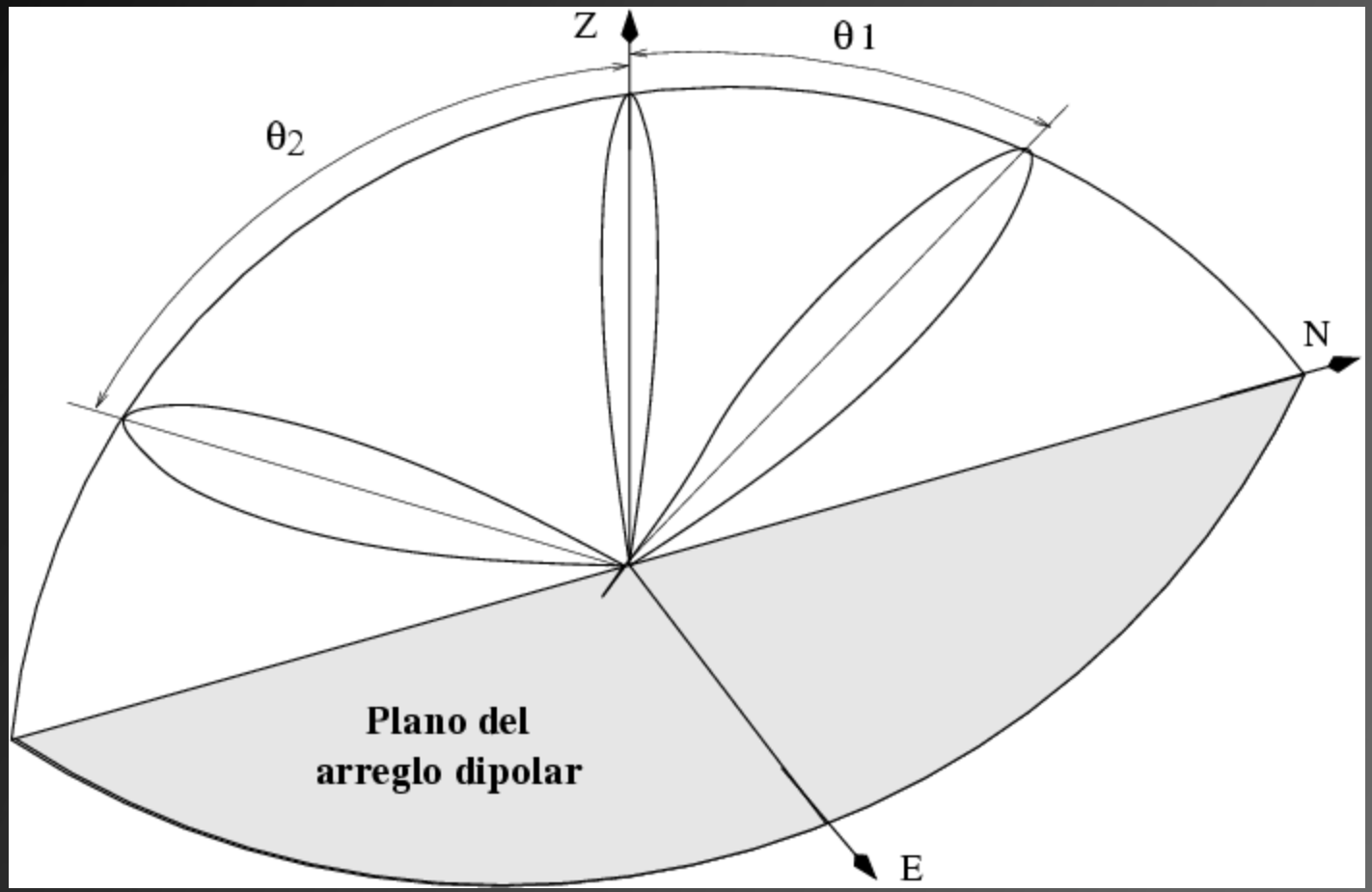
16 lines of 64 dipoles each



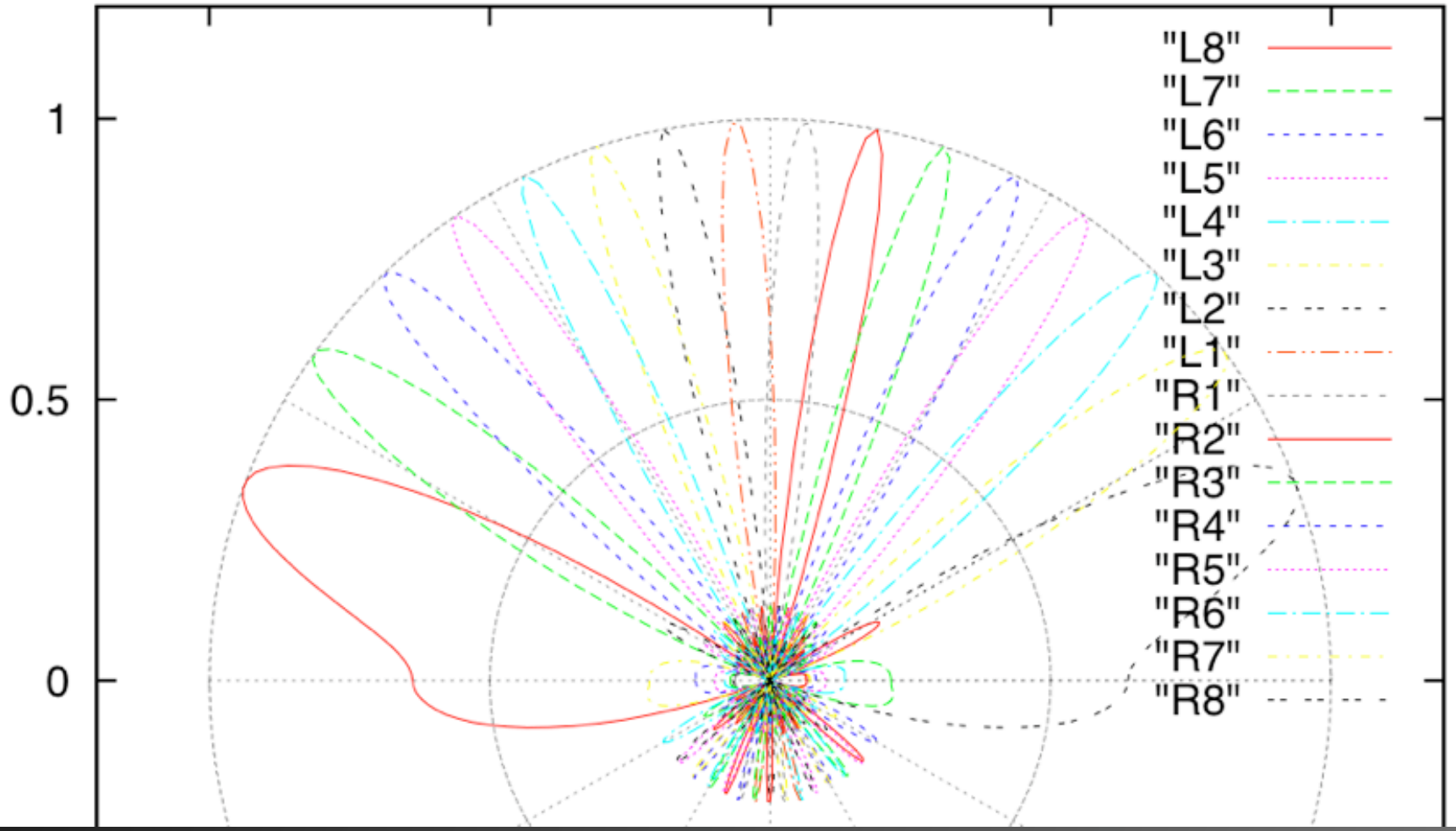


this BM requires 16 lines of the antenna (1/4 total area)

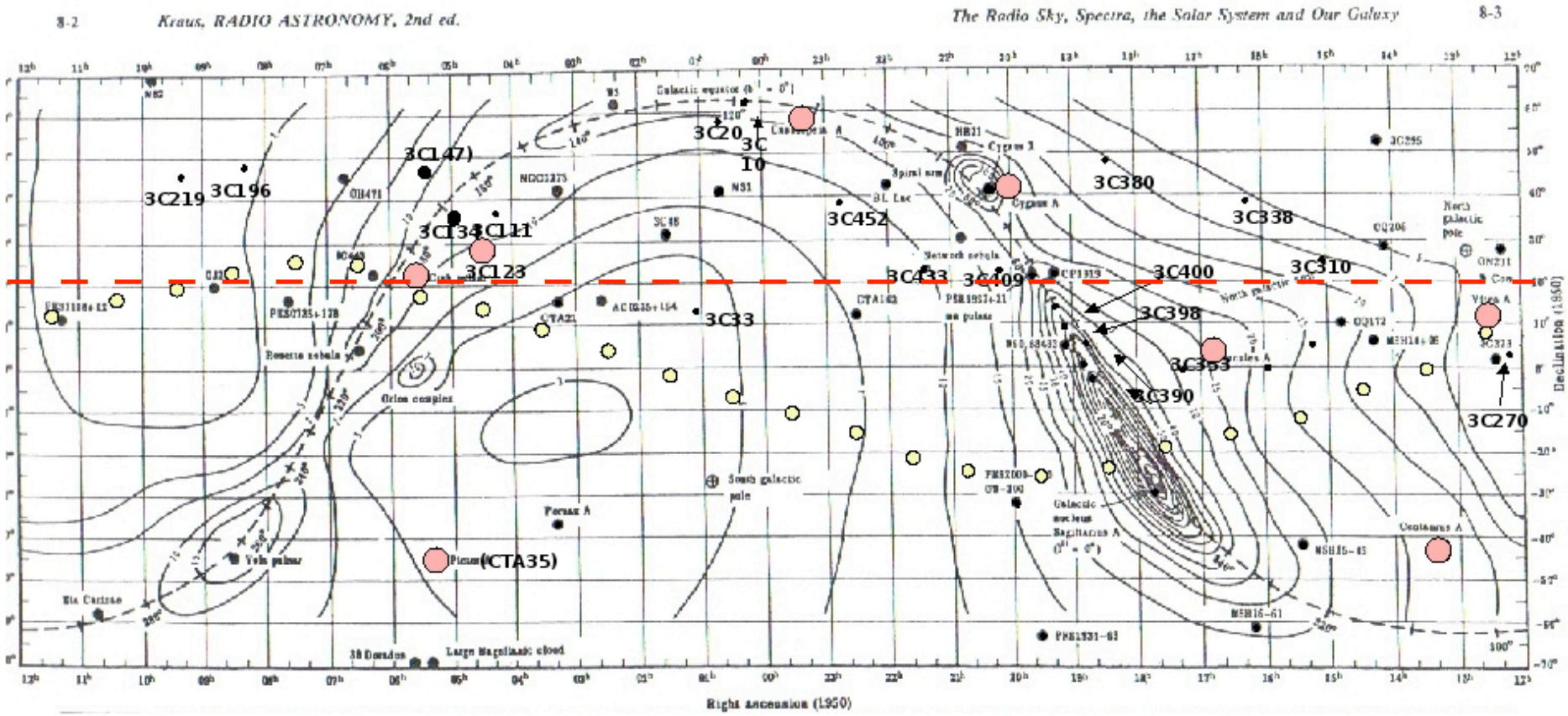
LATITUDINAL BEAM FORMATION



theoretical beam pattern

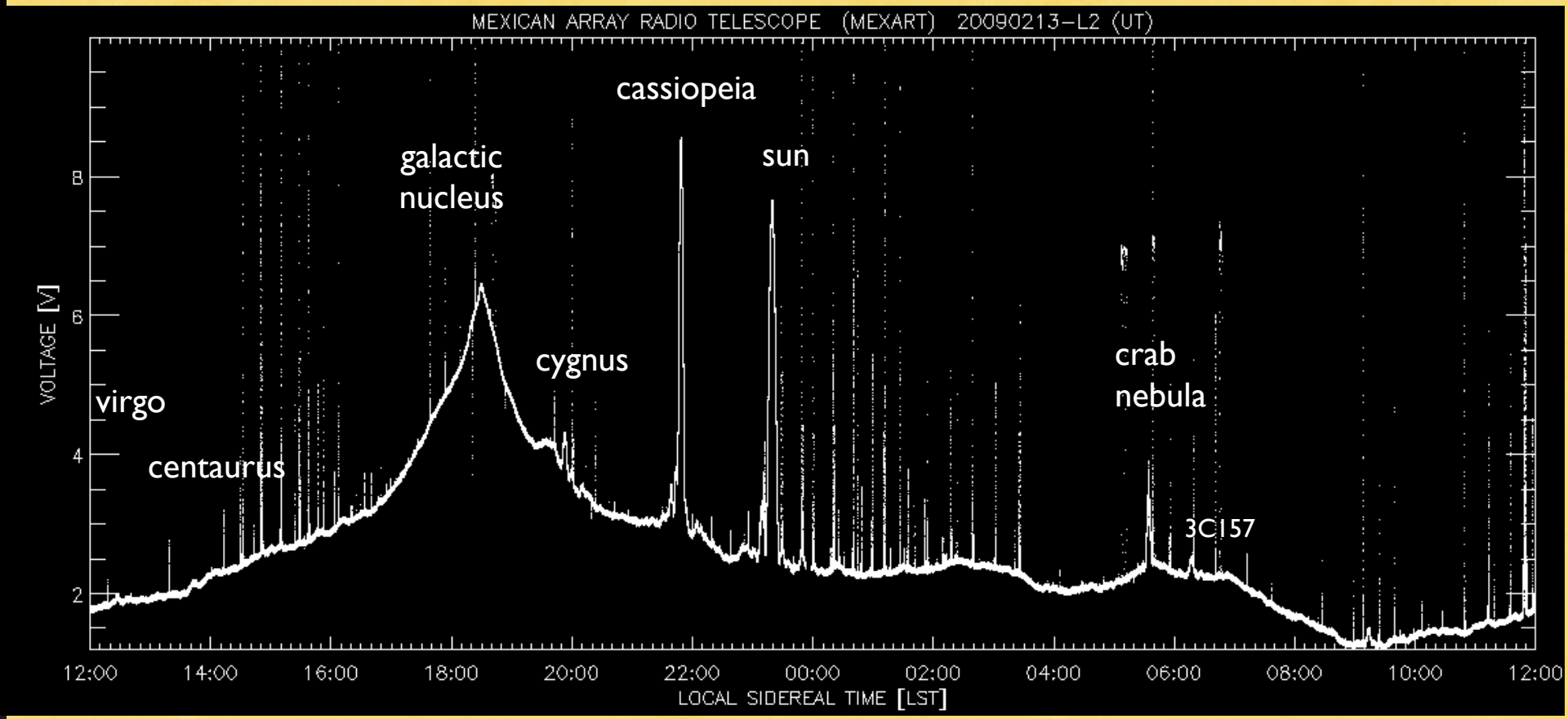


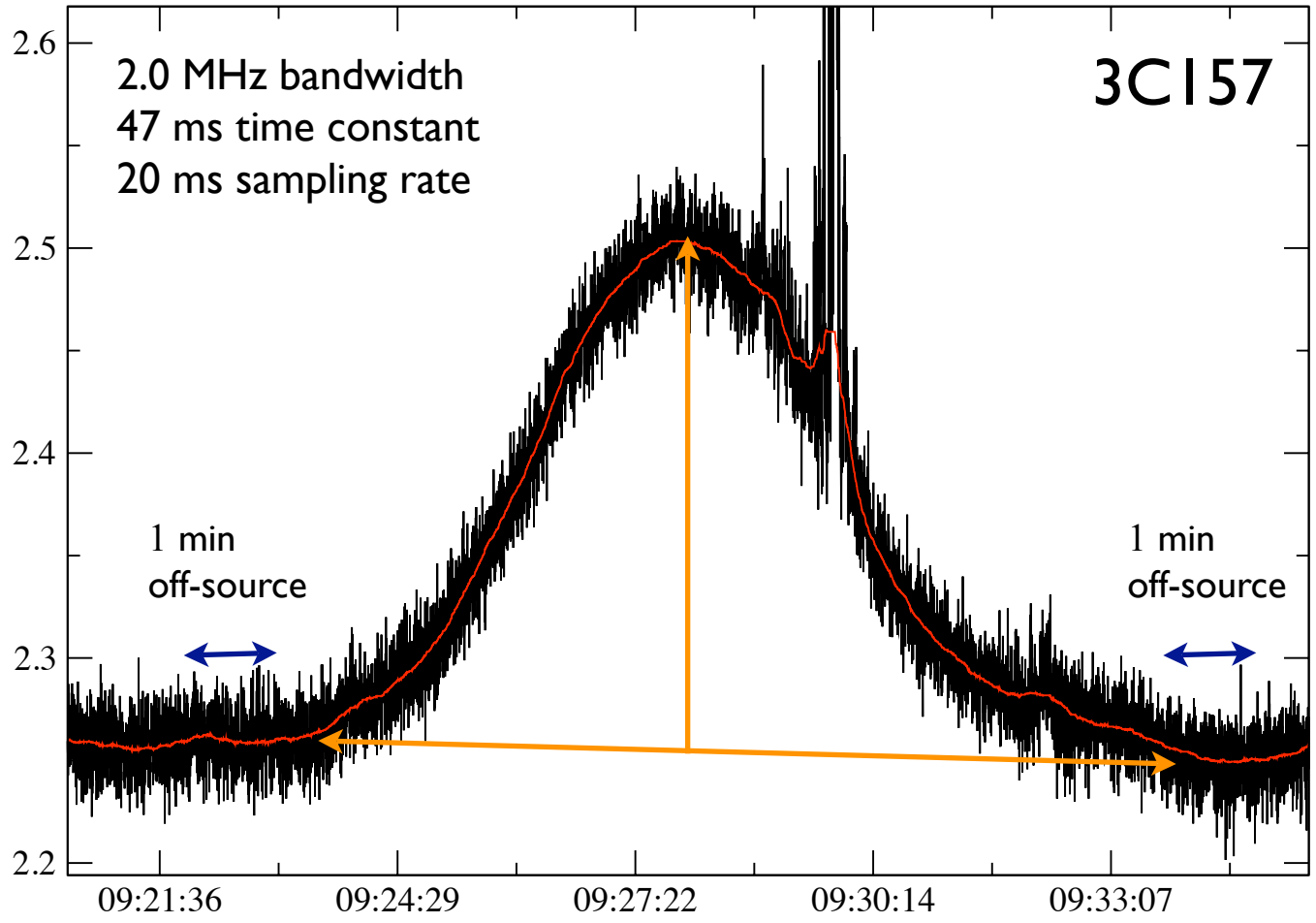
solar transit and the Galaxy background along the year

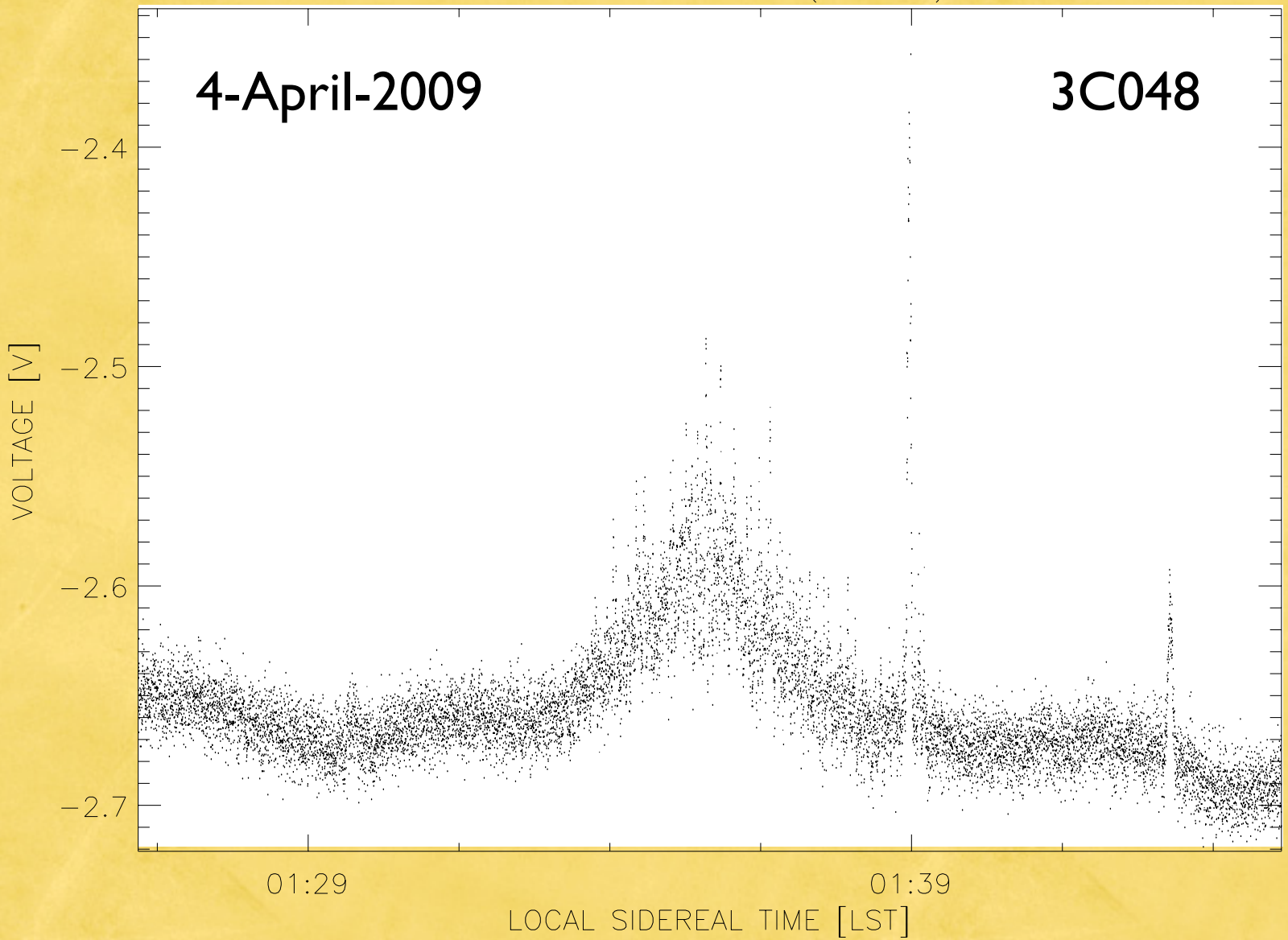


● solar transit – – MEXART latitude ● strong radio sources

Galactic transit @ 140 MHz / beam L2 / 2009-02-13

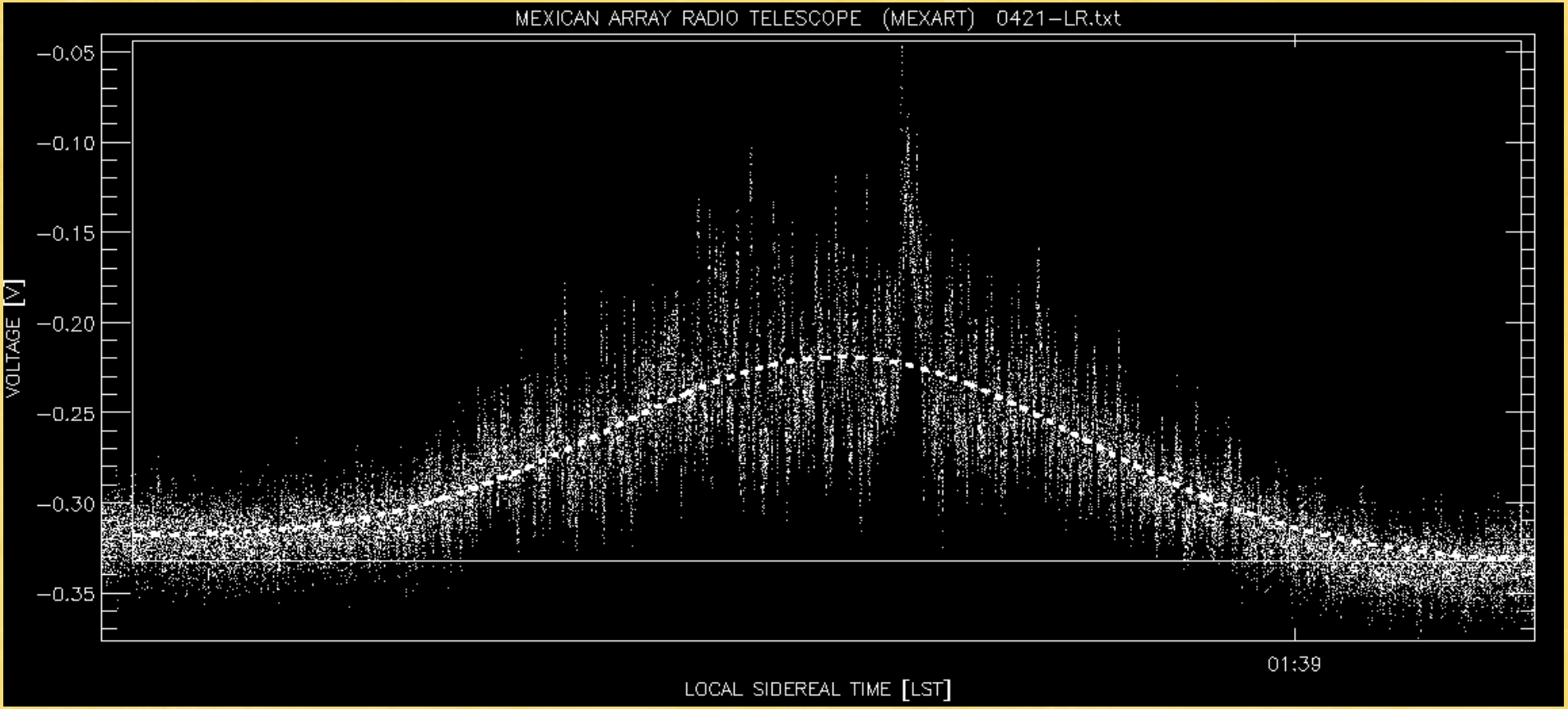



2.0 MHz bandwidth
47 ms time constant
20 ms sampling rate
3C157
1 min
off-source
1 min
off-source
2.6
2.5
2.4
2.3
2.2
09:21:36
09:24:29
09:27:22
09:30:14
09:33:07

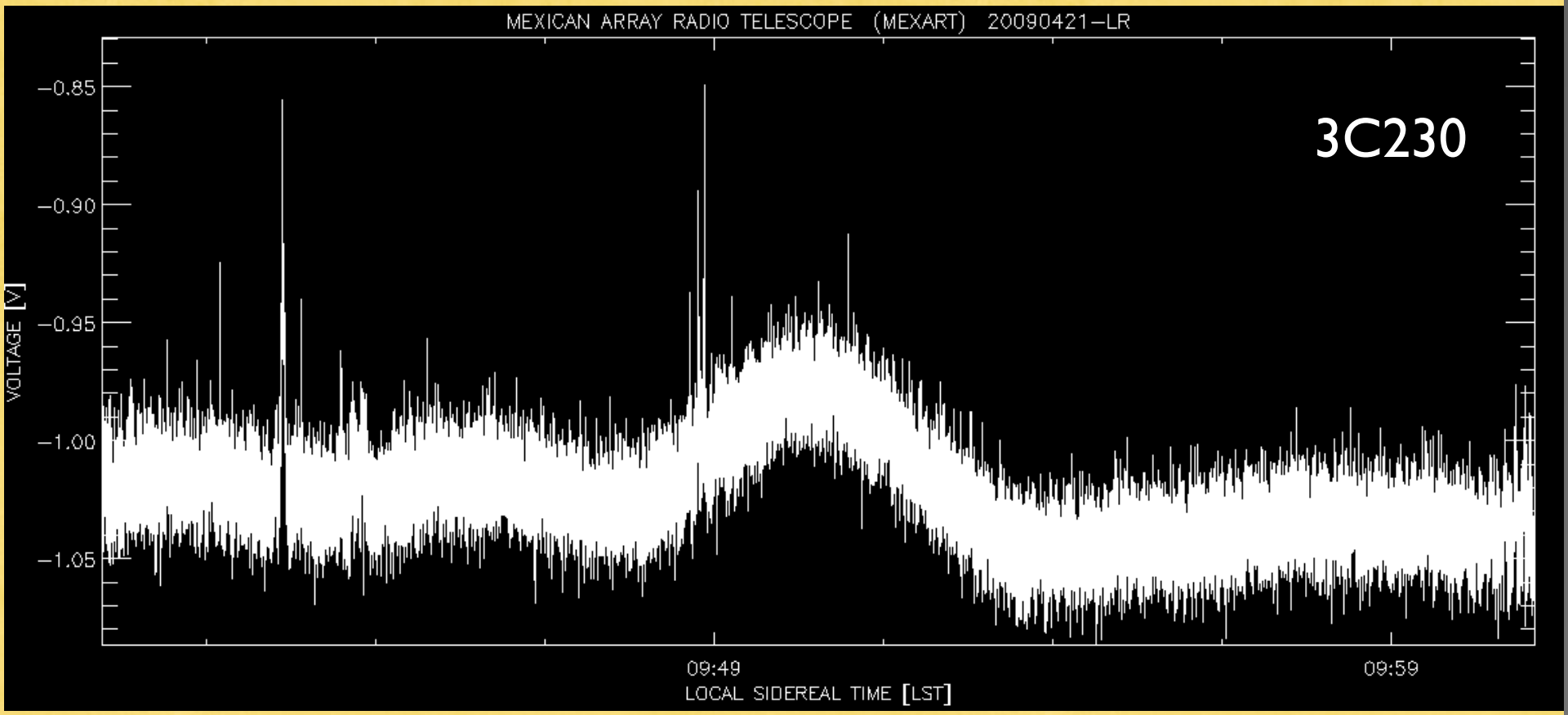

MEXICAN ARRAY RADIO TELESCOPE (MEXART) 0404−LR.txt
4-April-2009
3C048
−2.4
−2.5
−2.6
−2.7
VOLTAGE [V]
01:29
01:39
LOCAL SIDEREAL TIME [LST]

21-April-2009

3C048



	3C048					
day	rms off source	rms	m	amplitude σ	ε	
5	0.0094	0.0255	0.3596	7.5425	28.46	**
6	0.0099	0.0191	0.4360	4.4242	27.86	**
7	0.0111	0.0252	0.4488	5.0585	27.26	
8	0.0116	0.0262	0.4971	4.5431	26.68	
21	0.0117	0.0331	0.3476	8.1367	22.46	*
22	0.0118	0.0335	0.5887	4.8220	22.41	*
23	0.0118	0.0410	0.4535	7.6610	22.41	*
24	0.0118	0.0342	0.6031	4.8050	22.46	*
25	0.0115	0.0260	0.3385	6.6782	22.53	*


MEXICAN ARRAY RADIO TELESCOPE (MEXART) 20090421-LR
3C230
-0.85
-0.90
-0.95
-1.00
-1.05
VOLTAGE [V]
09:49
09:59
LOCAL SIDEREAL TIME [LST]

3C230

day	rms off source		rms		m	amplitude σ	ε (deg)	
5	0.0088		0.0026		0.0512	5.7613	131.96	**
6	0.0085	----		----		5.6470	130.95	
7	0.0108		0.0036		0.0674	4.9444	129.93	
8	0.0110	----		----		5.9900	128.92	
9	0.0119		0.0000		0.0000	5.0588	127.91	
10	0.0108		0.0029		0.0504	5.3240	126.91	
21	0.0114		0.0000		0.0000	5.2719	115.88	*
22	0.0114		0.0072		0.1174	5.3771	114.88	*
24	0.0113		0.0060		0.0946	5.6106	112.89	*

source	R.A.	DEC	SIGMAS	BEAM	CATALOG
3C017	0:38:20	-2º07'41"	4.00	R5	O
3C033	1:08:53	13º20'14"	4.90	R8	O
3C048	1:37:41	33º9'35"	4.29	L5	O,S,C
3C084 (PERSEO A)	3:19:48	41º30'42"	8.16	R3	O,S
FORNAX A	3:22:41	-37º12'30"	23.50	L5	O
3C098	3:58:54	10º26'03"	4.00	R3	O
3C111	4:18:21	38º01'36"	4.06	L3	O
3C123	4:37:04	29º40'14"	15.47	L5	*
3C134	5:04:42	38º06'11"	8.73	R4	O
PICTOR A	5:19:49	-45º46'44"	13.60	L5	O
3C157	6:16:37	22º31'54"	19.01	L2	*
3C161	6:27:10	-5º53'05"	4.00	L2	O,S,C
3C180	7:27:04	-2º04'42"	4.71	R5	O
3C196	8:13:36	48º13'03"	7.65	L8	O,S,C
3C219	9:21:08	45º38'57"	5.88	L8	O
3C230	9:51:58	-00º01'22"	5.26	R5	O,S,C
3C283	13:11:40	-22º17'04"	4.89	L7	O,S
3C295	14:11:20	52º12'09"	4.46	R7	C
3C298	14:19:08	06º28'35"	5.26	L3	O,S,C
3C310	15:04:57	26º00'59"	4.46	R1	O
1602+014	16:04:45	01º17'51"	5.20	R5	O
3C348 (HÉRCULES A)	16:51:08	4º59'33"	16.18	L4	O
3C409	20:14:27	23º34'53"	12.03	R1	O
3C452	22:45:48	39º41'16"	5.41	R6	O

summary

- The MEXART is a 64x64 full wavelength dipole array operating at 140 MHZ having 9,600m2 of physical area (-6 hours 46 minutes GMT)
- At the moment the MEXART is operating with a 16x16 Matrix Butler employing 1/4 of the antenna (16 lines)
- We report the first full-sky scans where we identified 138 radio sources from which 24 out of them appear in the ORT, STEL or Cambridge IPS catalogs (the sources were detected with gains >= 4 sigmas)
- We perform the first analysis to obtain the *m* values associated with the sources

IPS workshop MEXART targets

- a standard methodology for single station data to obtain g values & velocities / error estimates
- cross-correlation of the IPS stations data sets to perform blind tests on the g & velocity values
- common radio sources to inter calibrate the data reductions?
- METADATA and IPS data files format
- plot formats to present the data
- To pursue an IPS virtual observatory unifying all the observations and create the global network

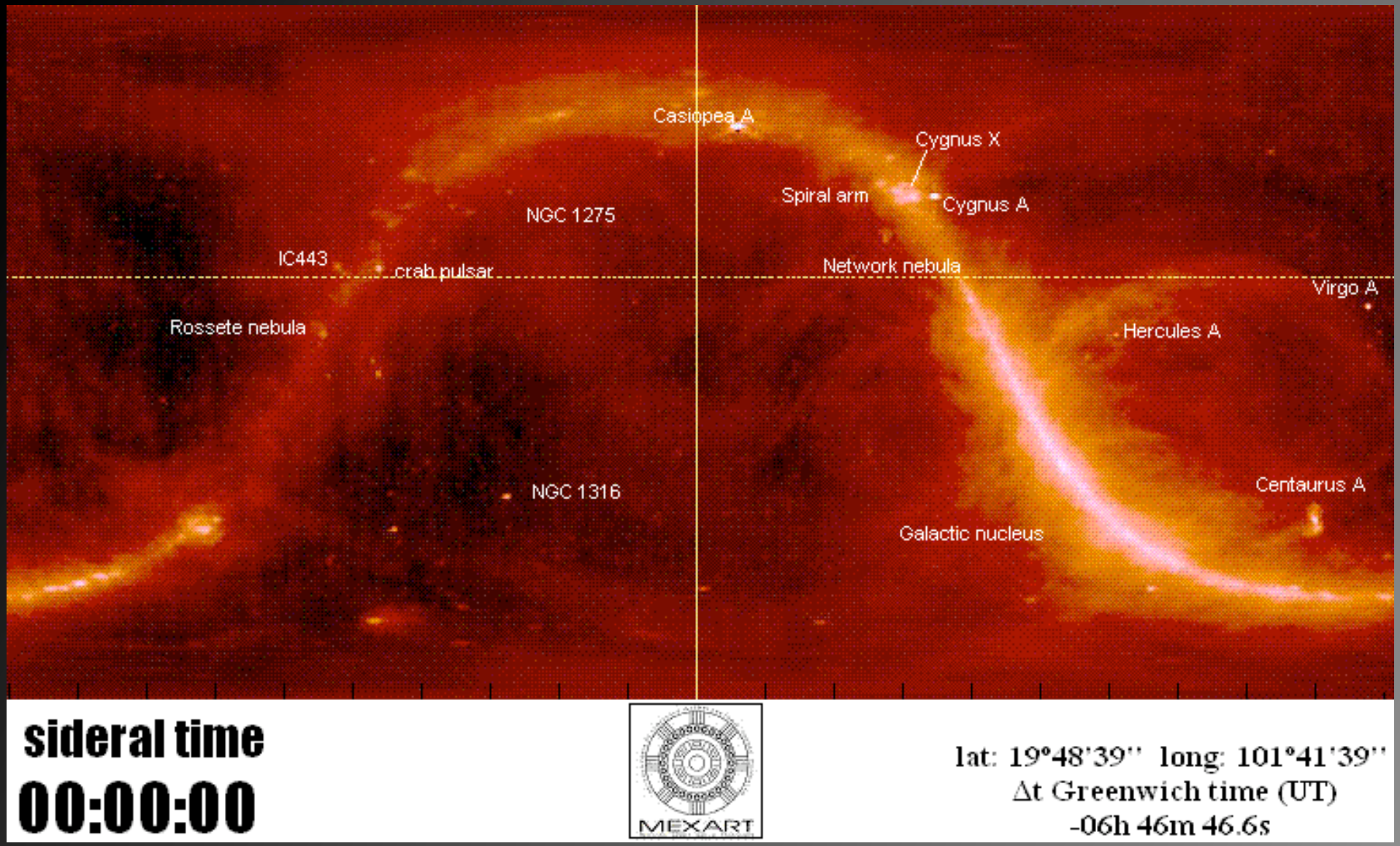
Expected Sensitivity @ Different Array Configurations

Configuration	Sensitivity K/Jy	ΔSrms, Jy B=4MHz	Δ Srms, Jy B=2MHz
1 section (16 dipoles)	0.0051	465	660
1 row (64 dipoles)	0.0204	116	165
2 rows (128 dipoles)	0.0408	58.2	82.5
4 rows (256 dipoles)	0.0817	29.1	41.3
16 rows (1024 dipoles)	0.3267	7.27	10.3
full array (4096 dipoles)	1.3066	1.82	2.58

$T_{r\text{-}c}$=275K, $T_{r\text{-}o}$=360K

T_{sys}= 540 K

T_{sky}(hr)=200K,



sideral time

00:00:00

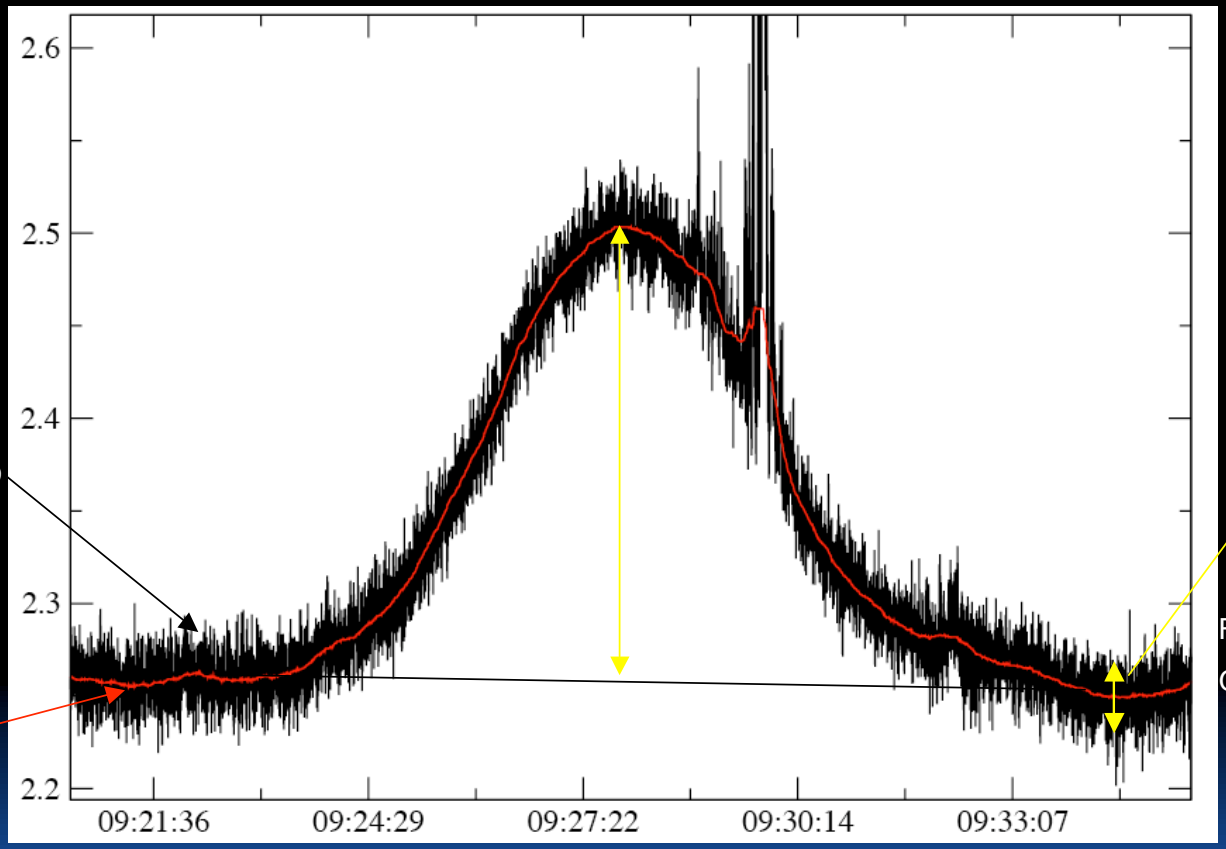
MEXART

lat: 19°48'39'' long: 101°41'39''

Δt Greenwich time (UT)

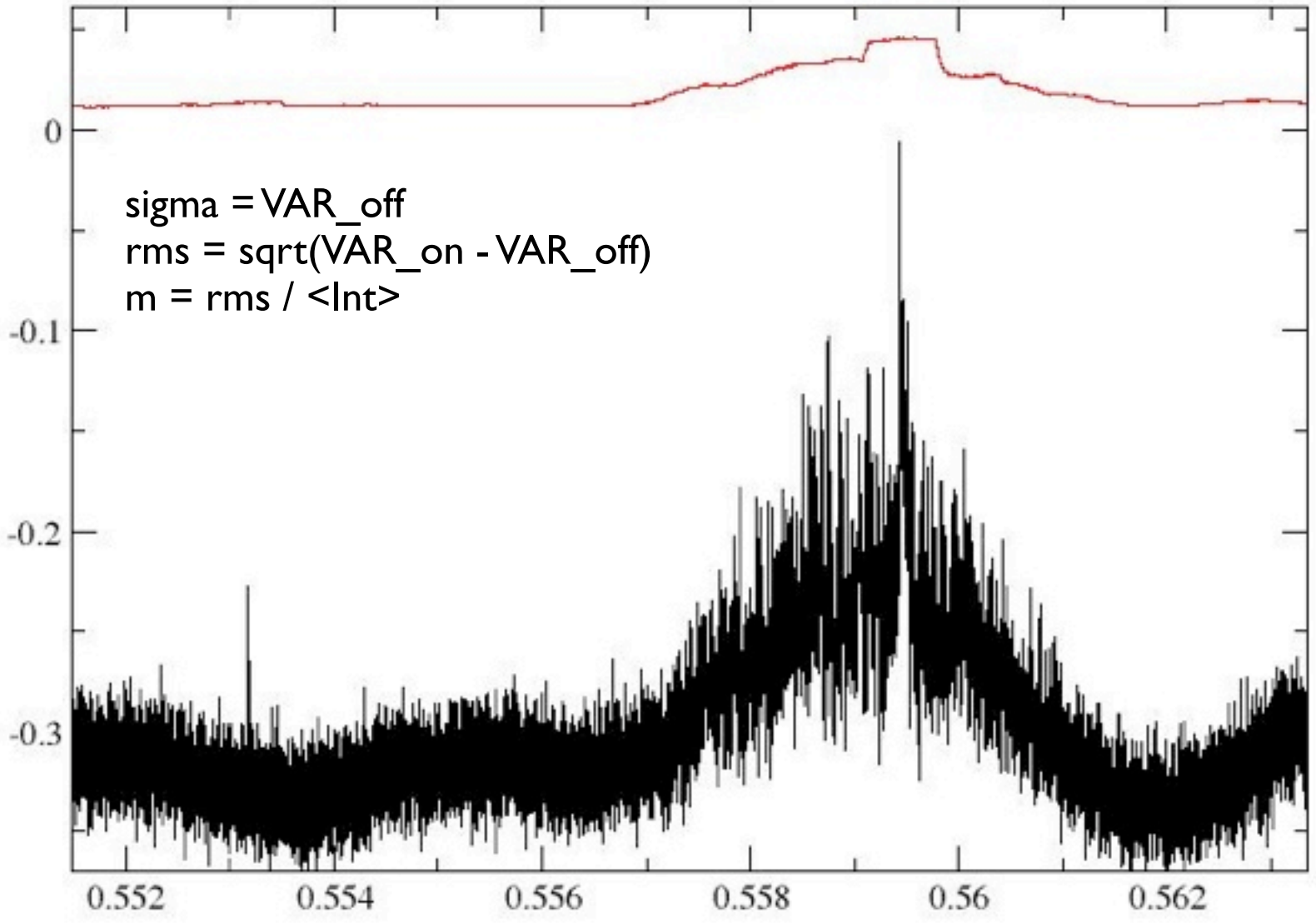
-06h 46m 46.6s

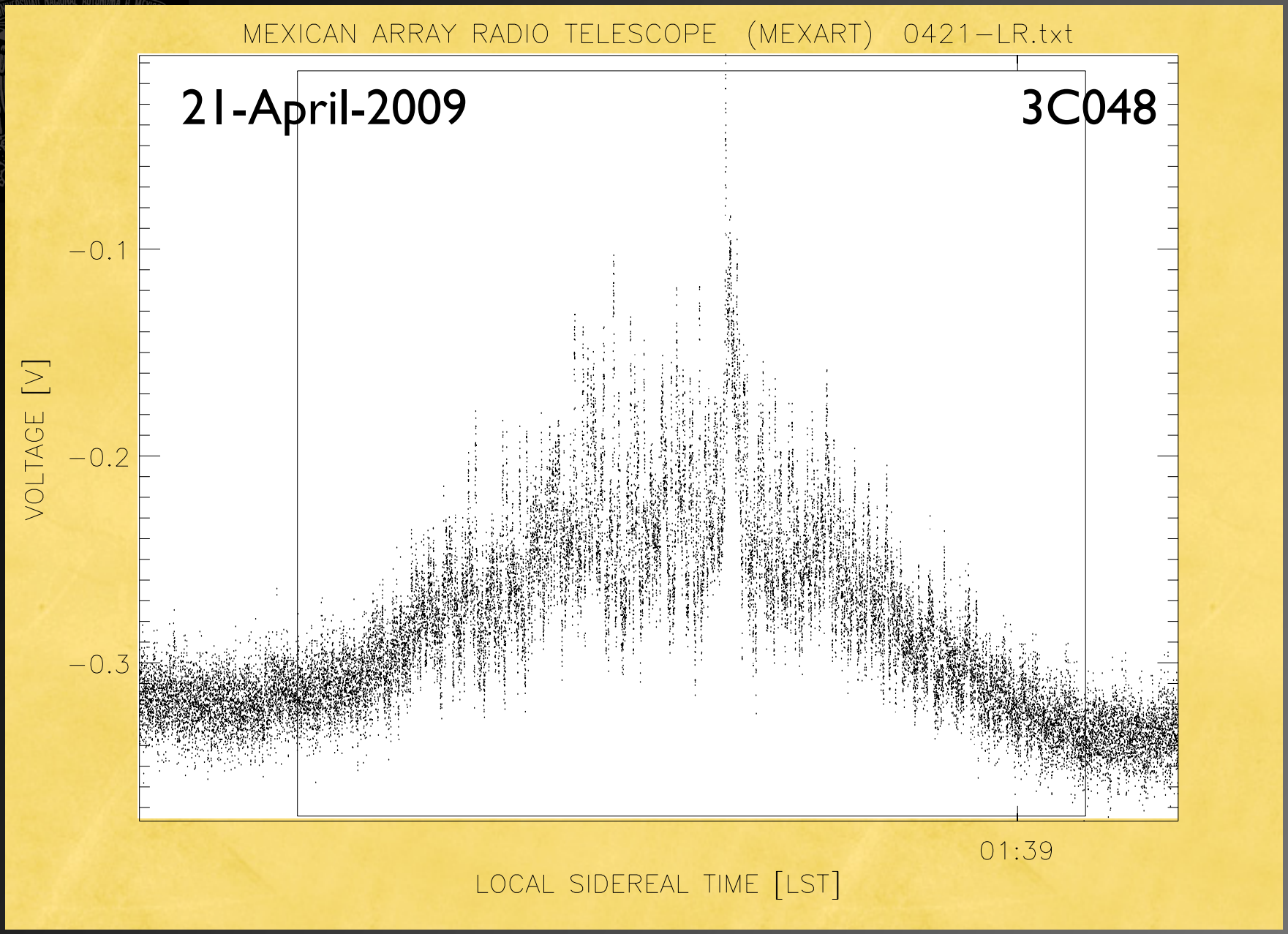
METODOLOGÍA DE OBSERVACIONES



Al hacer una ampliación de una región en la gráfica de un haz, se pueden observar los tránsitos de fuentes caracterizados por una forma gaussiana con un ancho de 4 minutos en promedio. Una forma de medir su gancia es calculando el promedio del ruido del receptor (cielo frío) durante un minuto antes y después del tránsito y restarselo al máximo del promedio obtenido. Otra manera es medir el número de sigmas que tiene de ganancia cada fuente.

3C048


sigma = VAR_off
rms = sqrt(VAR_on - VAR_off)
m = rms / <Int>
0
-0.1
-0.2
-0.3
0.552
0.554
0.556
0.558
0.56
0.562


MEXICAN ARRAY RADIO TELESCOPE (MEXART) 0421−LR.txt
21-April-2009
3C048
−0.1
−0.2
−0.3
VOLTAGE [V]
01:39
LOCAL SIDEREAL TIME [LST]

3C048

day	rms off source	rms	m	amplitude σ	ε (deg)
5	0.0094	0.0255	0.3596	7.5425	28.46 **
6	0.0099	0.0191	0.4360	4.4242	27.86 **
7	0.0111	0.0252	0.4488	5.0585	27.26
8	0.0116	0.0262	0.4971	4.5431	26.68
21	0.0117	0.0331	0.3476	8.1367	22.46 *
22	0.0118	0.0335	0.5887	4.8220	22.41 *
23	0.0118	0.0410	0.4535	7.6610	22.41 *
24	0.0118	0.0342	0.6031	4.8050	22.46 *
25	0.0115	0.0260	0.3385	6.6782	22.53 *

3C161

day	rms off source	rms	m	amplitude σ	ε (deg)
5	0.0116	0.0037	0.0802	3.9741	81.70 **
6	0.0112	0.0043	0.0942	4.0714	80.00
7	0.0111	0.0059	0.1250	4.2252	79.03
8	0.0113	0.0037	0.0783	4.1769	78.92
9	0.0113	0.0064	0.1355	4.1327	78.00
10	0.0117 ----	----		3.5300	77.09
21	0.0115 -----	----		3.9069	67.21 *
23	0.0118	0.0015	0.0335	3.7881	65.46 *
24	0.0116	0.0057	0.1258	3.9051	64.59 *
25	0.0119	0.0021	0.0483	3.6470	63.73 *