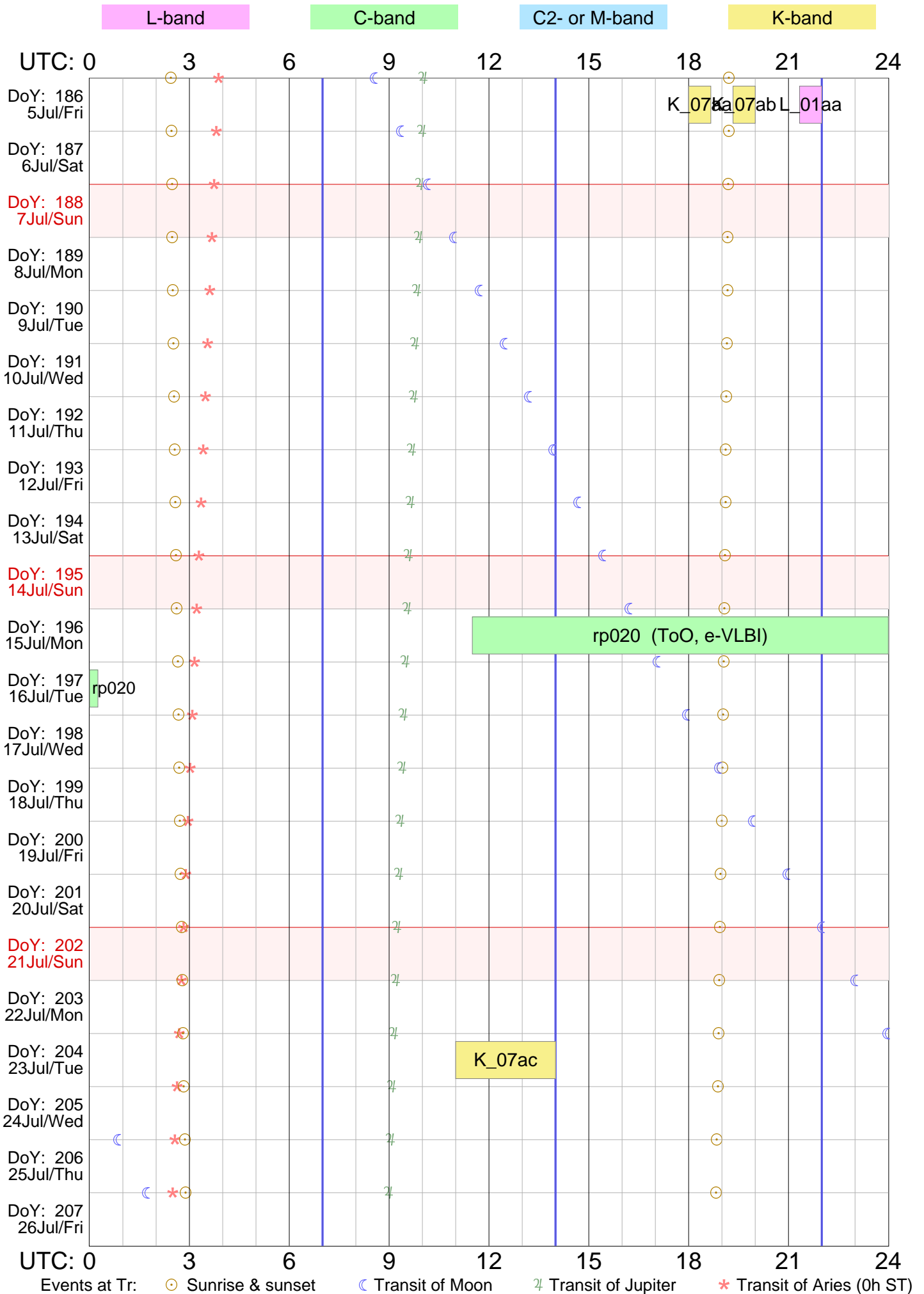


# Tr VLBI schedule for Jul 2013



# RadioAstron Experiments, July 2013

Użytkownik i hasło ftp dla logów i schedulów: `grt K0&th%`

`ftp://webinet.asc.rssi.ru`

Przykład dla log files: `cd GRT_log_files/2013_07/2013_07_23_raks07ac`

Przykład dla sched files: `cd schedule/grtsched/RAES/rk07ac`

Name	Band	DoY	D	M/WD	UT_Start	UT_Stop	Disk_space
rk07aa	K	186	5.	07/Pia	18 00	18 40	74 GB
rk07ab	K	186	5.	07/Pia	19 20	20 00	74 GB
rk01aa	L	186	5.	07/Pia	21 20	22 00	74 GB
rk07ac	K	204	23.	07/Wto	11 00	14 00	329 GB

Przed rk07aa na packu RadioAstrona (TR-00002/1600) jest ok. 800 GB wolnej przestrzeni.

**rk07aatr**

RADIOASTRON MASER OBSERVATIONS

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Observing mode: K-band, dual-pol

Schedule for TORUN                      (Code Tr )                                      Page    2

RadioAstron Maser observations

UP: D => Below limits; H => Below horizon mask; W => still slewing at end; blank => Up.  
 Early: Seconds between end of slew and start.    Dwell: On source seconds.  
 Disk: GBytes recorded to this point.  
 TPStart: Recording start time. Frequencies are LO sum (band edge).  
 SYNC: Time correlator is expected to sync up.

```
-----
Start UT  Source                Start / Stop                Early  Disk  TPStart
Stop UT   LST      EL    AZ    HA  UP   ParA Dwell  GBytes  SYNC
-----
```

--- Fri    5 Jul 2013    Day 186 ---

----- Please, make sure PCAL is OFF for U\_HER maser observations. -----

Next scan frequencies: 22228.00 22228.00 22228.00 22228.00  
 Next BBC frequencies:    728.00    728.00    728.00    728.00  
 Next scan bandwidths:    16.00    16.00    16.00    16.00

18 00 00	U_HER	14 09 49	46.8	129.1	-2.3	-29.5	0	0	18 00 00
18 09 30	---	14 19 21	47.9	132.0	-2.1	-28.1	570	18	18 00 01
18 10 00	U_HER	14 19 51	47.9	132.2	-2.1	-28.0	24	18	18 10 00
18 19 30	---	14 29 22	49.0	135.2	-2.0	-26.6	570	36	18 10 01
18 20 00	U_HER	14 29 53	49.0	135.4	-1.9	-26.5	24	36	18 20 00
18 29 30	---	14 39 24	50.0	138.5	-1.8	-24.9	570	55	18 20 01
18 30 00	U_HER	14 39 54	50.0	138.7	-1.8	-24.8	24	55	18 30 00
18 40 00	---	14 49 56	51.0	142.1	-1.6	-23.0	600	74	18 30 01

SETUP FILE INFORMATION:

==== Setup file: ra1cm2.set

Matching groups in /home/kirx/sched/catalogs/freq.dat:  
 tricm                      Values from Bob Campbell by email (23-04-2013)

Setup group:    3                      Station: TORUN                      Total bit rate:    256  
 Format: MKIV1:4                      Bits per sample: 2                      Sample rate: 32.000  
 Number of channels: 4                      DBE type:                      Speedup factor:    1.00

Disk used to record data.

1st LO= 21500.00 21500.00 21500.00 21500.00  
 Net SB=            L            L            U            U  
 IF SB =            U            U            U            U  
 Pol. =            RCP            LCP            RCP            LCP  
 BBC =            1            2            1            2  
 BBC SB=            L            L            U            U  
 IF =            C            A            C            A

The following frequency sets based on these setups were used.

```

Frequency Set:  5  Setup file default.  Used pcal sets:  1
LO sum=  22228.00  22228.00  22228.00  22228.00
BBC fr=   728.00   728.00   728.00   728.00
Bandwd=   16.00   16.00   16.00   16.00
Matching frequency sets:  5

```

The following pulse cal sets were used with this setup:

```

Pulse cal detection set:  1  PCAL = OFF
PCALXB1=  S1  S2  S3  S4  OFF  OFF  OFF  OFF
PCALXB2=  M1  M2  M3  M4  OFF  OFF  OFF  OFF
PCALFR1=   0   0   0   0   0   0   0   0
PCALFR2=   0   0   0   0   0   0   0   0

```

Track assignments are:

```

track1=  2, 18,  3, 19
barrel=roll_off

```

#### POSITIONS OF SOURCES USED IN RECORDING SCANS

Source	Source position (RA/Dec)		(Date)	Error (mas)
	(B1950)	(J2000)		
* U_HER	16 23 34.668708	* 16 25 47.471670	16 26 25.093421	0.00
	19 00 17.63232	* 18 53 32.85560	18 51 55.30582	0.00
* FAKERA	11 57 21.769299	* 12 00 00.000000	12 00 33.248918	0.00
	85 16 41.77889	* 85 00 00.00000	84 55 43.94605	0.00
	fake circumpolar target for the TS to look at			

#### EFFECT OF SOLAR CORONA

The solar corona can cause unstable phases for sources too close to the Sun. SCHED provides warnings at individual scans for distances less than 10 degrees. The distance from the Sun to each source in this schedule is:

Source	Sun distance (deg)
U_HER	124.0
FAKERA	66.1

Barry Clark estimates from predictions by Ketan Desai of IPM scattering sizes that the Sun will cause amplitude reductions on the longest VLBA baselines at a solar distance of  $60 \text{ deg } F^{-0.6}$  where  $F$  is in GHz.

For common VLBI bands, this is:

327 MHz	117. deg
610 MHz	81. deg
1.6 GHz	45. deg
2.3 GHz	36. deg
5.0 GHz	23. deg
8.4 GHz	17. deg
15.0 GHz	12. deg
22.0 GHz	9. deg
43.0 GHz	6. deg

RADIOASTRON MASER OBSERVATIONS

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Observing mode: K-band, dual-pol

Schedule for TORUN                      (Code Tr )                                      Page    2

RadioAstron Maser observations

UP: D => Below limits; H => Below horizon mask; W => still slewing at end; blank => Up.  
 Early: Seconds between end of slew and start.    Dwell: On source seconds.  
 Disk: GBytes recorded to this point.  
 TPStart: Recording start time. Frequencies are LO sum (band edge).  
 SYNC: Time correlator is expected to sync up.

```
-----
Start UT  Source                Start / Stop                Early  Disk  TPStart
Stop UT   LST      EL    AZ    HA  UP   ParA Dwell  GBytes  SYNC
-----
```

--- Fri    5 Jul 2013    Day 186 ---

----- Please, make sure PCAL is OFF for NML\_CYG maser observations. -----

Next scan frequencies: 22228.00 22228.00 22228.00 22228.00  
 Next BBC frequencies:    728.00    728.00    728.00    728.00  
 Next scan bandwidths:    16.00    16.00    16.00    16.00

19 20 00	NML_CYG	15 30 02	37.0	70.0	-5.3	-47.6	0	0	19 20 00
19 29 30	---	15 39 34	38.3	71.5	-5.1	-48.2	570	18	19 20 01
19 30 00	NML_CYG	15 40 04	38.4	71.6	-5.1	-48.2	24	18	19 30 00
19 39 30	---	15 49 36	39.8	73.2	-5.0	-48.8	570	36	19 30 01
19 40 00	NML_CYG	15 50 06	39.8	73.3	-4.9	-48.8	24	36	19 40 00
19 49 30	---	15 59 37	41.2	74.8	-4.8	-49.3	570	55	19 40 01
19 50 00	NML_CYG	16 00 07	41.3	74.9	-4.8	-49.4	24	55	19 50 00
20 00 00	---	16 10 09	42.7	76.6	-4.6	-49.9	600	74	19 50 01

SETUP FILE INFORMATION:

=====  
 ===== Setup file: ra1cm2.set

Matching groups in /home/kirx/sched/catalogs/freq.dat:  
 tricm                      Values from Bob Campbell by email (23-04-2013)

Setup group:    3                      Station: TORUN                      Total bit rate:    256  
 Format: MKIV1:4                      Bits per sample: 2                      Sample rate: 32.000  
 Number of channels: 4                      DBE type:                      Speedup factor:    1.00

Disk used to record data.

```
1st LO= 21500.00 21500.00 21500.00 21500.00
Net SB=            L            L            U            U
IF SB =            U            U            U            U
Pol.  =            RCP            LCP            RCP            LCP
BBC   =            1            2            1            2
BBC SB=            L            L            U            U
IF    =            C            A            C            A
```

The following frequency sets based on these setups were used.

```

Frequency Set:  5  Setup file default.  Used pcal sets:  1
LO sum=  22228.00  22228.00  22228.00  22228.00
BBC fr=   728.00   728.00   728.00   728.00
Bandwd=   16.00   16.00   16.00   16.00
Matching frequency sets:  5

```

The following pulse cal sets were used with this setup:

```

Pulse cal detection set:  1  PCAL = OFF
PCALXB1=  S1  S2  S3  S4  OFF  OFF  OFF  OFF
PCALXB2=  M1  M2  M3  M4  OFF  OFF  OFF  OFF
PCALFR1=   0   0   0   0   0   0   0   0
PCALFR2=   0   0   0   0   0   0   0   0

```

```

Track assignments are:
track1=  2, 18,  3, 19
barrel=roll_off

```

#### POSITIONS OF SOURCES USED IN RECORDING SCANS

Source	Source position (RA/Dec)		(Date)	Error (mas)
	(B1950)	(J2000)		
* NML_CYG	20 44 33.856231	* 20 46 25.543000	20 46 58.078200	0.00
	39 55 57.12927	* 40 06 59.42000	40 10 03.38350	0.00
* FAKERA	11 57 21.769299	* 12 00 00.000000	12 00 33.236606	0.00
	85 16 41.77889	* 85 00 00.00000	84 55 43.93729	0.00
	Fake circumpolar target for the TS to look at			

#### EFFECT OF SOLAR CORONA

The solar corona can cause unstable phases for sources too close to the Sun. SCHED provides warnings at individual scans for distances less than 10 degrees. The distance from the Sun to each source in this schedule is:

Source	Sun distance (deg)
NML_CYG	112.4
FAKERA	66.1

Barry Clark estimates from predictions by Ketan Desai of IPM scattering sizes that the Sun will cause amplitude reductions on the longest VLBA baselines at a solar distance of  $60 \text{deg } F^{-0.6}$  where  $F$  is in GHz.

For common VLBI bands, this is:

327 MHz	117. deg
610 MHz	81. deg
1.6 GHz	45. deg
2.3 GHz	36. deg
5.0 GHz	23. deg
8.4 GHz	17. deg
15.0 GHz	12. deg
22.0 GHz	9. deg
43.0 GHz	6. deg

**rk01aatr**

RADIOASTRON AGN SURVEY

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Observing mode: L-band, dual-pol

Schedule for TORUN                      (Code Tr )                                      Page    2

RadioAstron AGN Survey

UP: D => Below limits; H => Below horizon mask; W => still slewing at end; blank => Up.  
 Early: Seconds between end of slew and start.    Dwell: On source seconds.  
 Disk: GBytes recorded to this point.  
 TPStart: Recording start time. Frequencies are LO sum (band edge).  
 SYNC: Time correlator is expected to sync up.

```
-----
Start UT  Source                Start / Stop                Early  Disk  TPStart
Stop UT   LST      EL    AZ    HA  UP   ParA Dwell  GBytes  SYNC
-----
```

--- Fri    5 Jul 2013    Day 186 ---

----- L-band VLBI scans -----

Next scan frequencies: 1668.00 1668.00 1668.00 1668.00  
 Next BBC frequencies:  632.00  632.00  632.00  632.00  
 Next scan bandwidths:  16.00  16.00  16.00  16.00

21 20 00	2021+614	17 30 22	65.8	52.2	-2.9	-91.0	0	0	21 20 00
21 29 30	---	17 39 54	66.9	52.1	-2.7	-93.2	570	18	21 20 01
21 30 00	2021+614	17 40 24	67.0	52.1	-2.7	-93.3	24	18	21 30 00
21 39 30	---	17 49 55	68.1	51.9	-2.5	-95.6	570	36	21 30 01
21 40 00	2021+614	17 50 25	68.2	51.9	-2.5	-95.7	24	36	21 40 00
21 49 30	---	17 59 57	69.3	51.5	-2.4	-98.2	570	55	21 40 01
21 50 00	2021+614	18 00 27	69.4	51.5	-2.4	-98.3	24	55	21 50 00
22 00 00	---	18 10 29	70.5	50.9	-2.2	-101.0	600	74	21 50 01

SETUP FILE INFORMATION:

==== Setup file: ra18cm2.set

Matching groups in /home/kirx/sched/catalogs/freq.dat:  
 tr18cm                      E-mail Borkowski 12Mar98, preferred alternative

Setup group:    3                      Station: TORUN                      Total bit rate:    256  
 Format: MKIV1:4                      Bits per sample: 2                      Sample rate: 32.000  
 Number of channels: 4                      DBE type:                      Speedup factor:    1.00

Disk used to record data.

1st LO=	2300.00	2300.00	2300.00	2300.00
Net SB=	L	L	U	U
IF SB =	L	L	L	L
Pol. =	RCP	LCP	RCP	LCP
BBC =	1	2	1	2
BBC SB=	U	U	L	L
IF =	C	A	C	A

The following frequency sets based on these setups were used.

```

Frequency Set:  5  Setup file default.  Used pcal sets:  1
LO sum=    1668.00  1668.00  1668.00  1668.00
BBC fr=     632.00  632.00  632.00  632.00
Bandwd=     16.00   16.00   16.00   16.00
Matching frequency sets:  5

```

The following pulse cal sets were used with this setup:

```

Pulse cal detection set:  1  PCAL = 1MHZ
PCALXB1=  S1   S3   S1   S3   S1   S2   S3   S4
PCALXB2=  S2   S4   S2   S4   M1   M2   M3   M4
PCALFR1= 1000 1000 13000 13000   0   0   0   0
PCALFR2= 1000 1000 13000 13000   0   0   0   0

```

Track assignments are:

```

track1=  2, 18,  3, 19
barrel=roll_off

```

#### POSITIONS OF SOURCES USED IN RECORDING SCANS

Source	Source position (RA/Dec) (B1950)	(J2000)	(Date)	Error (mas)
* FAKERA	11 57 21.769299	* 12 00 00.000000	12 00 33.219660	0.00
	85 16 41.77889	* 85 00 00.000000	84 55 43.92513	0.00
	Fake circumpolar target for the TS to look at			
J2022+6136	20 21 13.300235	* 20 22 06.681753	20 22 24.410985	0.21
* 2021+614	61 27 18.15575	* 61 36 58.80476	61 39 39.16888	0.10

#### EFFECT OF SOLAR CORONA

The solar corona can cause unstable phases for sources too close to the Sun. SCHED provides warnings at individual scans for distances less than 10 degrees. The distance from the Sun to each source in this schedule is:

Source	Sun distance (deg)
FAKERA	66.1
2021+614	94.1

Barry Clark estimates from predictions by Ketan Desai of IPM scattering sizes that the Sun will cause amplitude reductions on the longest VLBA baselines at a solar distance of  $60 \text{deg } F^{-0.6}$  where  $F$  is in GHz.

For common VLBI bands, this is:

327 MHz	117. deg
610 MHz	81. deg
1.6 GHz	45. deg
2.3 GHz	36. deg
5.0 GHz	23. deg
8.4 GHz	17. deg
15.0 GHz	12. deg
22.0 GHz	9. deg
43.0 GHz	6. deg



**rk07actr**

**RADIOASTRON MASER OBSERVATIONS**

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Observing mode: K-band, dual-pol

Schedule for TORUN (Code Tr ) Page 2

RadioAstron Maser observations

UP: D => Below limits; H => Below horizon mask; W => still slewing at end; blank => Up.

Early: Seconds between end of slew and start. Dwell: On source seconds.

Disk: GBytes recorded to this point.

TPStart: Recording start time. Frequencies are LO sum (band edge).

SYNC: Time correlator is expected to sync up.

Start UT	Source	Start / Stop					Early	Disk	TPStart	
Stop UT		LST	EL	AZ	HA	UP	ParA	Dwell	GBytes	SYNC

--- Tue 23 Jul 2013 Day 204 ---

----- Please, make sure PCAL is OFF for CEP\_A maser observations. -----

Next scan frequencies:	22228.00	22228.00	22228.00	22228.00
Next BBC frequencies:	728.00	728.00	728.00	728.00
Next scan bandwidths:	16.00	16.00	16.00	16.00

11 00 00	CEP_A	08 19 38	29.3	-19.9	9.4		25.9	0	0	11 00 00
11 09 30	---	08 29 10	28.8	-18.7	9.5		24.3	570	18	11 00 01
11 10 00	CEP_A	08 29 40	28.8	-18.7	9.5		24.2	24	18	11 10 00
11 19 30	---	08 39 11	28.4	-17.5	9.7		22.7	570	36	11 10 01
11 20 00	CEP_A	08 39 42	28.3	-17.4	9.7		22.6	24	36	11 20 00
11 29 30	---	08 49 13	27.9	-16.3	9.9		21.1	570	55	11 20 01
11 30 00	CEP_A	08 49 43	27.9	-16.2	9.9		21.0	24	55	11 30 00
11 39 30	---	08 59 15	27.5	-15.0	10.0		19.4	570	73	11 30 01
11 40 00	CEP_A	08 59 45	27.5	-15.0	10.0		19.3	24	73	11 40 00
11 50 00	---	09 09 46	27.1	-13.7	10.2		17.7	600	92	11 40 01

----- Ground-only fringe-finder scan to set clocks. -----

11 53 00	J2302+6405	09 12 47	29.2	-13.4	10.2		18.6	158	92	11 53 00
11 56 00	=2300+638	09 15 47	29.1	-13.0	10.2		18.1	180	98	11 53 01

----- Please, make sure PCAL is OFF for CEP\_A maser observations. -----

12 00 00	CEP_A	09 19 48	26.8	-12.4	10.4		16.1	218	98	12 00 00
12 09 30	---	09 29 20	26.5	-11.2	10.5		14.5	570	116	12 00 01
12 10 00	CEP_A	09 29 50	26.5	-11.2	10.5		14.4	24	116	12 10 00
12 19 30	---	09 39 21	26.2	-10.0	10.7		12.8	570	134	12 10 01
12 20 00	CEP_A	09 39 51	26.2	-9.9	10.7		12.8	24	134	12 20 00
12 29 30	---	09 49 23	26.0	-8.7	10.9		11.2	570	153	12 20 01

Schedule for TORUN (Code Tr )

Page 3

RadioAstron Maser observations

UP: D =&gt; Below limits; H =&gt; Below horizon mask; W =&gt; still slewing at end; blank =&gt; Up.

Early: Seconds between end of slew and start. Dwell: On source seconds.

Disk: GBytes recorded to this point.

TPStart: Recording start time. Frequencies are LO sum (band edge).

SYNC: Time correlator is expected to sync up.

```

-----
Start UT  Source          Start / Stop          Early  Disk  TPStart
Stop UT          LST      EL  AZ  HA  UP  ParA  Dwell  GBytes  SYNC
-----
--- Tue 23 Jul 2013  Day 204 ---

12 30 00  CEP_A          09 49 53  26.0 -8.6 10.9      11.1  24    153  12 30 00
12 39 30  ---          09 59 25  25.8 -7.4 11.0      9.5   570   171  12 30 01

12 40 00  CEP_A          09 59 55  25.7 -7.3 11.1      9.4   24    171  12 40 00
12 49 30  ---          10 09 26  25.6 -6.1 11.2      7.9   570   189  12 40 01

12 50 00  CEP_A          10 09 56  25.6 -6.1 11.2      7.8   24    189  12 50 00
13 00 00  ---          10 19 58  25.4 -4.8 11.4      6.1   600   208  12 50 01

13 10 00  CEP_A          10 30 00  25.3 -3.5 11.6      4.5   594   208  13 10 00
13 19 30  ---          10 39 31  25.2 -2.2 11.7      2.9   570   227  13 10 01

13 20 00  CEP_A          10 40 01  25.2 -2.2 11.7      2.8   24    227  13 20 00
13 29 30  ---          10 49 33  25.2 -1.0 11.9      1.2   570   245  13 20 01

13 30 00  CEP_A          10 50 03  25.2 -0.9 11.9      1.1   24    245  13 30 00
13 39 30  ---          10 59 34  25.2  0.3-12.0  -0.4   570   263  13 30 01

13 40 00  CEP_A          11 00 05  25.2  0.4-11.9  -0.5   24    263  13 40 00
13 49 30  ---          11 09 36  25.2  1.6-11.8  -2.1   570   281  13 40 01

13 50 00  CEP_A          11 10 06  25.2  1.7-11.8  -2.2   24    281  13 50 00
14 00 00  ---          11 20 08  25.3  3.0-11.6  -3.9   600   300  13 50 01

```

## SETUP FILE INFORMATION:

NOTE: If DOPPLER, FREQ, or BW were used, see the individual scans for the final BBC settings.

==== Setup file: ra1cm2.set

Matching groups in /home/kirx/sched/catalogs/freq.dat:

tr1cm Values from Bob Campbell by email (23-04-2013)

```

Setup group: 3          Station: TORUN          Total bit rate: 256
Format: MKIV1:4        Bits per sample: 2          Sample rate: 32.000
Number of channels: 4  DBE type:          Speedup factor: 1.00

```

Disk used to record data.

```

1st LO= 21500.00 21500.00 21500.00 21500.00
Net SB=      L      L      U      U
IF SB =      U      U      U      U
Pol.  =      RCP      LCP      RCP      LCP
BBC   =      1      2      1      2
BBC SB=      L      L      U      U
IF    =      C      A      C      A

```

The following frequency sets based on these setups were used.

```

Frequency Set:  5  Setup file default.  Used pcal sets:  1
LO sum=  22228.00  22228.00  22228.00  22228.00
BBC fr=   728.00   728.00   728.00   728.00
Bandwd=   16.00   16.00   16.00   16.00
Matching frequency sets:  5

```

The following pulse cal sets were used with this setup:

```

Pulse cal detection set:  1  PCAL = OFF
PCALXB1=  S1  S2  S3  S4  OFF  OFF  OFF  OFF
PCALXB2=  M1  M2  M3  M4  OFF  OFF  OFF  OFF
PCALFR1=   0   0   0   0   0   0   0   0
PCALFR2=   0   0   0   0   0   0   0   0

```

Track assignments are:

```

track1=  2, 18,  3, 19
barrel=roll_off

```

#### POSITIONS OF SOURCES USED IN RECORDING SCANS

Source	Source position (RA/Dec)		(Date)	Error (mas)
	(B1950)	(J2000)		
* CEP_A	22 54 19.036554	* 22 56 17.977900	22 56 53.791757	0.00
	61 45 47.22200	* 62 01 49.44210	62 06 07.32226	0.00
* FAKERA	11 57 21.769299	* 12 00 00.000000	12 00 29.724376	0.00
	85 16 41.77889	* 85 00 00.00000	84 55 40.65456	0.00
	Fake circumpolar target for the TS to look at			
* J2302+6405	23 00 41.944884	* 23 02 41.314959	23 03 17.435953	0.32
2300+638	63 49 43.23608	* 64 05 52.84882	64 10 11.83939	0.18

#### EFFECT OF SOLAR CORONA

The solar corona can cause unstable phases for sources too close to the Sun. SCHED provides warnings at individual scans for distances less than 10 degrees. The distance from the Sun to each source in this schedule is:

Source	Sun distance (deg)
CEP_A	91.7
FAKERA	67.3
J2302+6405	89.6

Barry Clark estimates from predictions by Ketan Desai of IPM scattering sizes that the Sun will cause amplitude reductions on the longest VLBA baselines at a solar distance of  $60 \text{ deg } F^{(-0.6)}$  where  $F$  is in GHz.

For common VLBI bands, this is:

327 MHz	117. deg
610 MHz	81. deg
1.6 GHz	45. deg
2.3 GHz	36. deg
5.0 GHz	23. deg
8.4 GHz	17. deg
15.0 GHz	12. deg
22.0 GHz	9. deg
43.0 GHz	6. deg

# RadioAstron Mission

[http://www.asc.rssi.ru/radioastron/description/intro\\_eng.htm](http://www.asc.rssi.ru/radioastron/description/intro_eng.htm)

RadioAstron project is an international collaborative mission to launch a free flying satellite carrying a 10-meter radio telescope in high apogee orbit around the Earth. The aim of the mission is to use the space telescope to conduct interferometer observations in conjunction with the global ground radio telescope network in order to obtain images, coordinates, motions and evolution of angular structure of different radio emitting objects in the Universe with the extraordinary high angular resolution.

The orbit of RadioAstron satellite will have apogee radius in the range up to 350 000 km. The spacecraft's operational lifetime will be no less than five years. Space-ground Very Long Baseline Interferometer (VLBI) measurements with this orbit will provide morphological and coordinate information on galactic and extragalactic radio sources with fringe size up to 8 micro arc second at the shortest wavelength 1.35 cm.

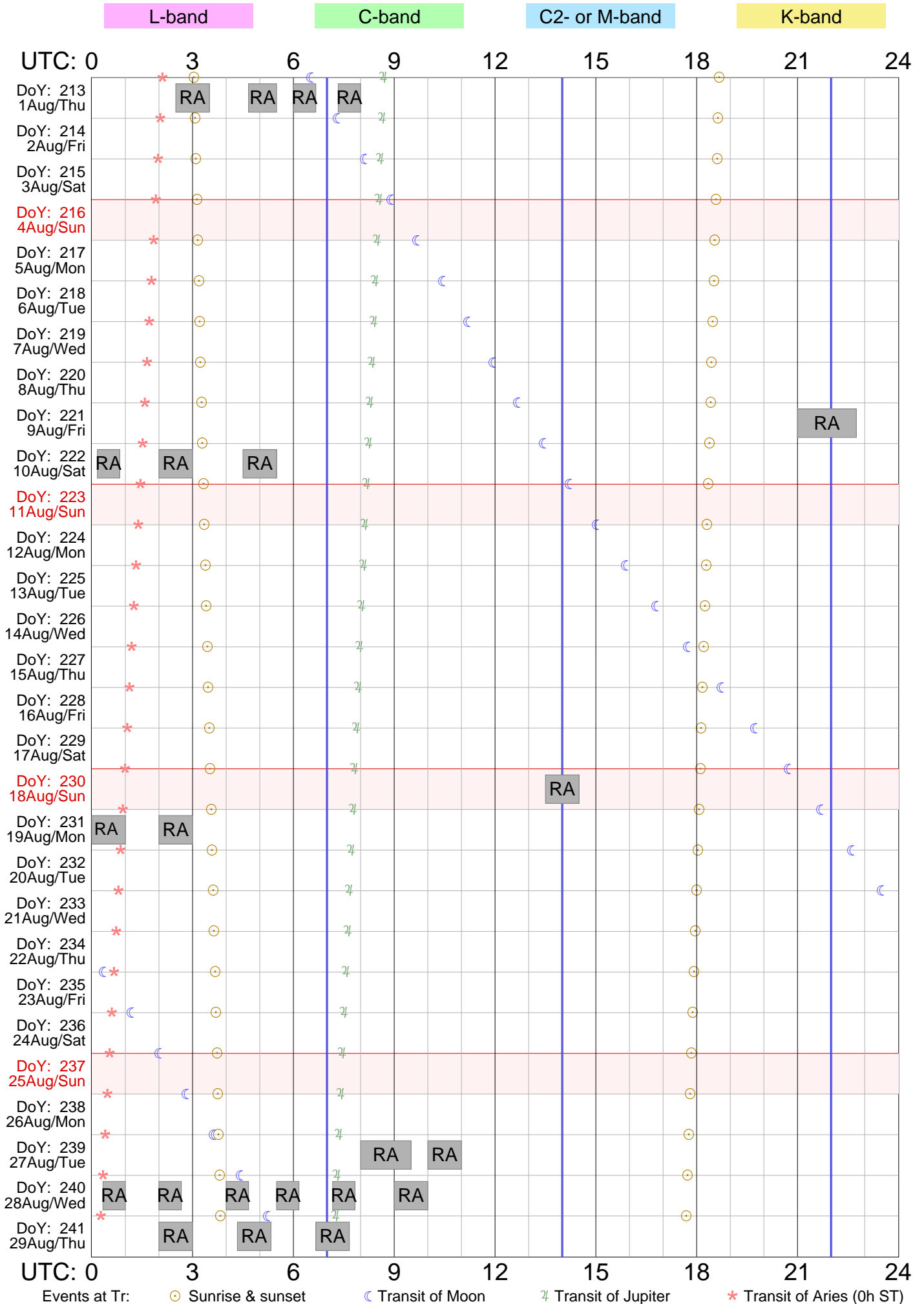
The RadioAstron program, initiated by Astro Space Center (ASC) of Lebedev Physical Institute of Russian Academy of Sciences (RAS) in collaboration with other institutions of RAS and Federal Space Agency (FSA), has expanded into a broad international collaboration: scientists from over 20 countries are constructing the instruments, planning the mission profile, and assuring ground radio telescopes support for RadioAstron. Russia will provide the satellite, most of the on-board hardware, interferometer integration and all kinds of the tests. General designer of satellite and SRT construction is Lavochkin Association (LA) of the RosKosmos.

Several other countries contribute to the on-board scientific payload. The 92-cm receiver is being built in India - National Center for Radio Astrophysics (NCRA) and Russia (Nizhny Novgorod, OAO KB "Gorizont"), the 18-cm receiver in Australia (CSIRO - Commonwealth Scientific and Industrial Research Organization), the 6-cm receiver by Russia, the 1.35-cm receiver by Finland (HUT - Helsinki University of Technology) and upgraded in USA (National Radio Astronomy Observatory- NRAO) and Russia (Moscow Institute of Radioengineering and Electronics - IRE), rubidium on-board frequency standard was built by the European Space Agency (ESA) at Neuchatel observatory in Switzerland. H-maser on-board frequency standard is being developed in Russia (Nizhny Novgorod, ZAO "Vremya-CH"). Russian (ASC) recording system on 6-system HDD and tapes will be able to accept a digital data stream at a maximum data rate of 128 Mbit/s. The correlator will be able to process the data from up to 5 interferometer stations (including the space element) at a maximum data rate of 128 Mbit/s. European Space Agency (ESA) participated in testing of the space radio telescope antenna. On board operating spacecraft system and command communication centers at Bear Lake (near Moscow) and near Ussuriisk (Eastern Russia), and also a tracking station at Pushchino are under preparation.

Main scientific goal of the mission is the study of various astronomical objects with unprecedented angular resolution up to few millionth of an arcsecond. The resolution achieved with RadioAstron will allow us in principle to study the following phenomena and problems:

- central engine of AGN and physical processes near super massive black holes providing an acceleration of cosmic rays — size, velocity and shape of emitting region in the core, spectrum, polarization and variability of emitting components;
- cosmological models, dark matter and dark energy - by studying dependence of above mentioned AGN's parameters with redshift, and by observing gravitational lensing;
- structure and dynamics of star and planets forming regions in our Galaxy and in AGN — by studying maser and Mega maser radio emission;
- neutron (quark?) stars and black holes in our Galaxy, their structure and dynamics — by VLBI and measurements of visibility scintillations, proper motions and parallaxes;
- structure and distribution of interstellar and interplanetary plasma — by fringe visibility scintillations of pulsars;
- building of high accuracy astronomical reference system of coordinates;
- building of high accuracy model of the Earth gravity field.

# Tentative RA schedule for Aug 2013



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