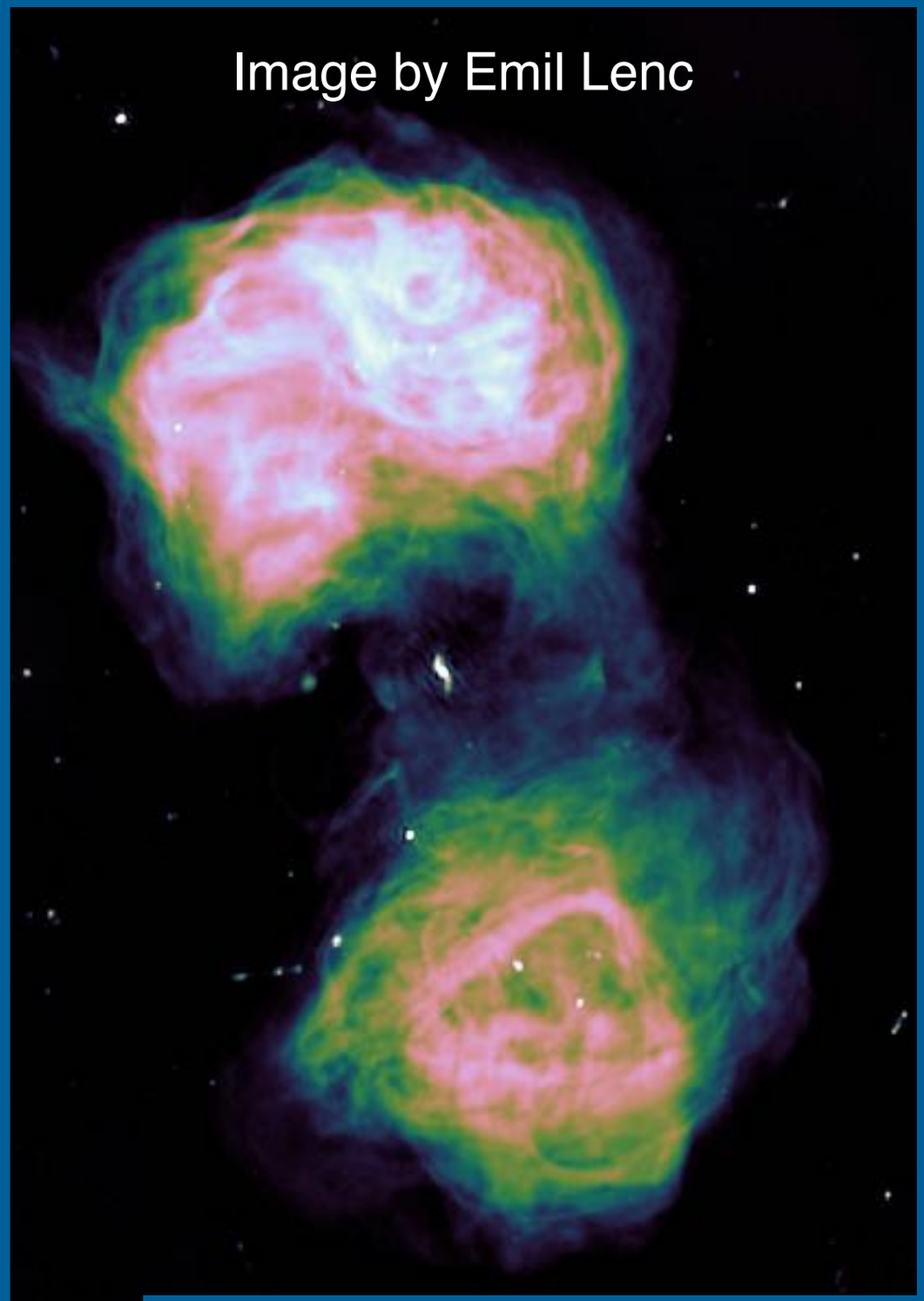
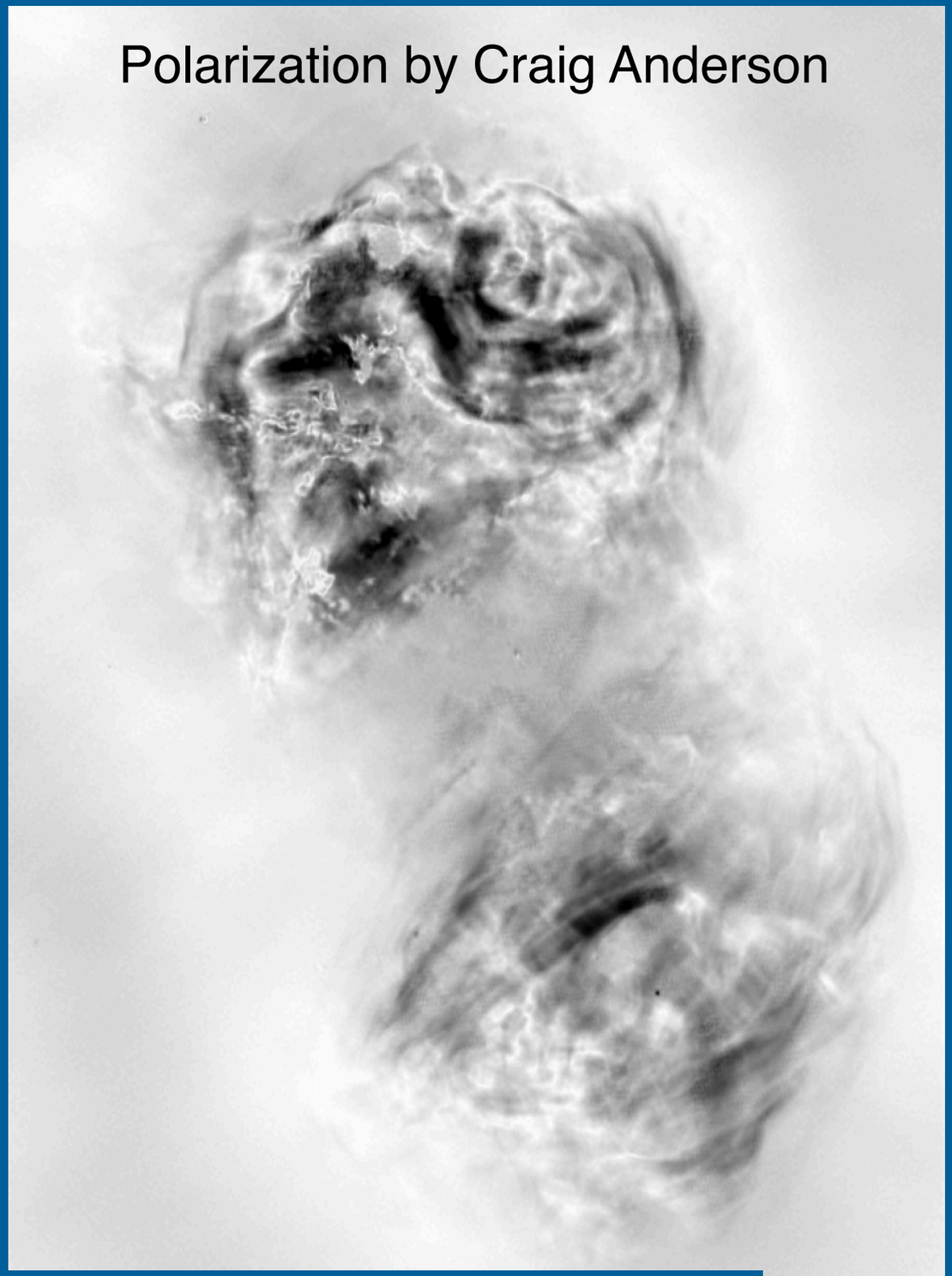




Rapid ASKAP Continuum Survey - RACS

POSSUM workshop 27 May 2019

Project objectives

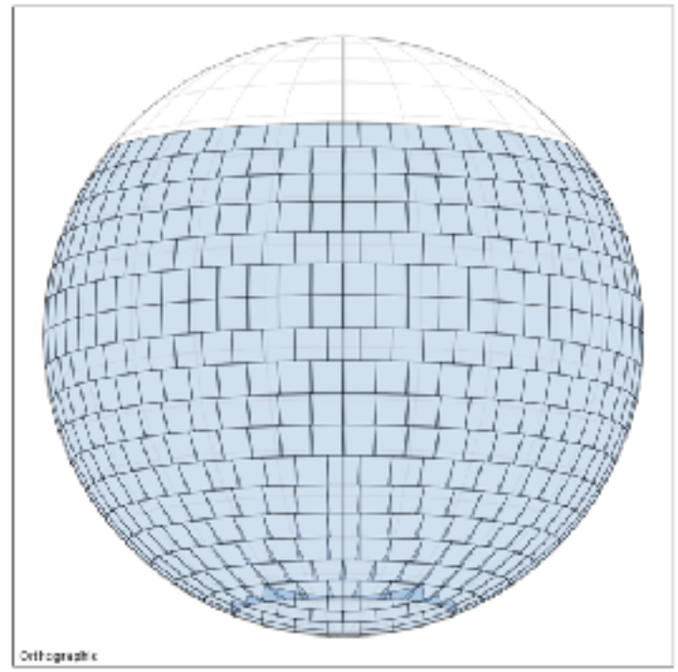
- ASKAP calibration
  - Provide data for the ASKAP Global Sky Model (GSM)

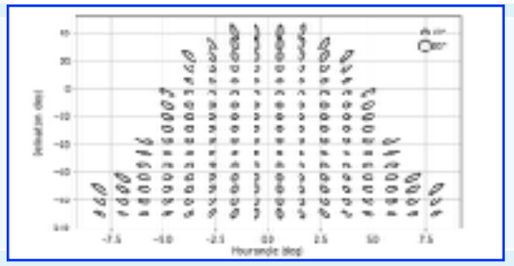
- Generate survey products for scientists
  - Transients (VAST)
  - Polarisation

- ASKAP survey “shake-down”

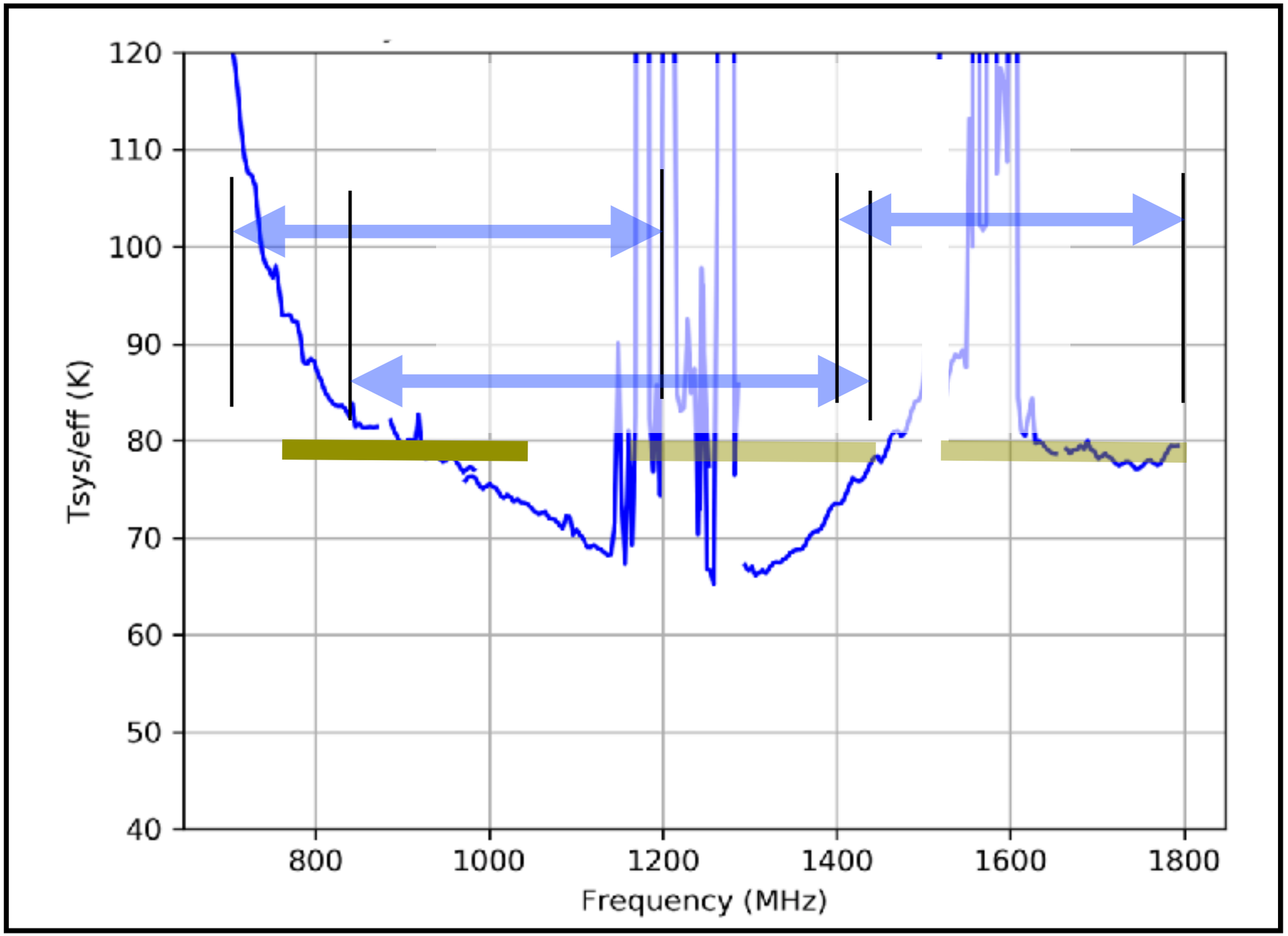
Survey configuration and parameters

Sky coverage	-90 < δ < +40
Tile positions	Use current tiling scheme
Footprint	square_6x6 1.0 - 1.05 degree pitch
HA/elev limits	To control synthesized beam, shape
Integration time	15 minutes
Frequencies	744 - 1032 MHz; 1300 - 1440 MHz





Frequency coverage



Radio sky surveys

	Frequency	Res'n	Sky coverage	Sensitivity	Polarization	N
RACS	744 - 1032 MHz (700 - 1800 MHz)	15"	-90 < δ < +40	~200 μJy/ beam	I,Q,U,V	> 2 × 10^6
SUMSS	843±1.5 MHz	45"	-90 < δ -30	1 - 2 mJy/ beam	Right Circ	2 × 10^5
NVSS	1.3649, 1.4351 GHz (Δf = 2 × 42	45"	-40 < δ < +90	450 μJy/ beam	I,Q,U	2 × 10^6
FIRST	1.3649, 1.4351 GHz (Δf = 2 × 42	5"	Gal Poles 10575 sq deg	150 μJy/ beam	R,L	1 × 10^6
VLASS	2-4 GHz	2.5"	-40 < δ < +90	120 μJy/ beam (69 μJy/	I,Q,U	~ 5 × 10^6

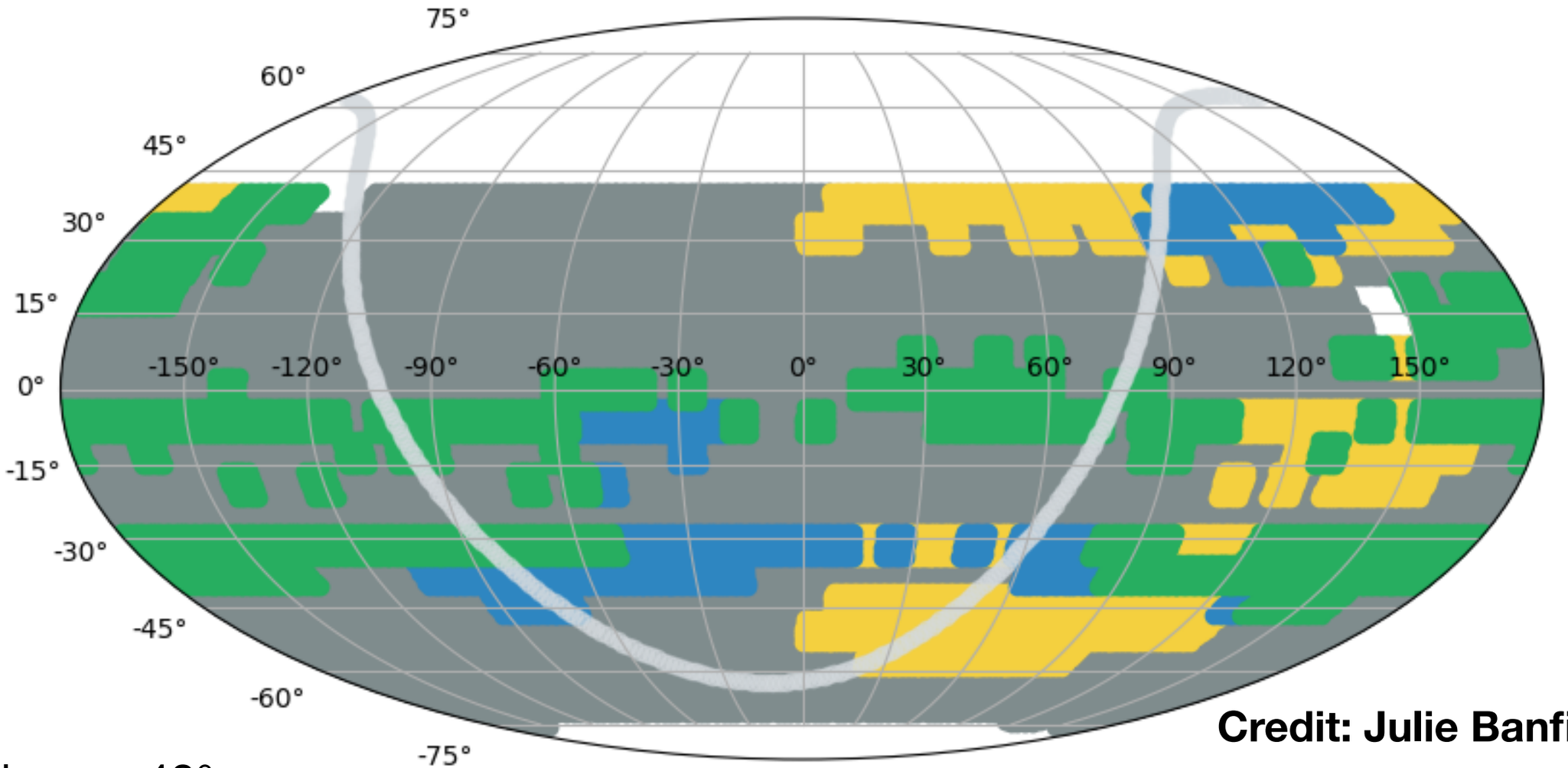
Progress to date

- Julie BAnfield's table
  - https://docs.google.com/spreadsheets/d/1DSjXx_vjC4VjtayEobmQJn7yAhrPEfVdGV3XH924G4o/edit?ts=5cc699cd#gid=1244421999

Science ready images noted by STATE=IMAGED will be placed in --> /group/askap/jbanfield/RACS/IMAGES/

	SRC	FIELD_NAME	SBID	STATE	RA_HMS	DEC_DMS	RA_DEG	DEC_DEG	OBS_FREQ	FOOTPRINT	PITCH	ROTATION	DURATION	POL_MODE	POL_AXIS	SB_TIME	SB_STAR
774	134	RACS_test4_1.05_2018-50A	8646	OBSERVED	20:18:28	-50:05:45	304.616383	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	13120	
775	176	RACS_test4_1.05_2112-43A	8646	OBSERVED	21:12:33	-43:52:21	318.139533	-43.872603	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	13120	
776	136	RACS_test4_1.05_2132-50A	8646	OBSERVED	21:32:18	-50:05:45	323.076921	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	13120	
777	145	RACS_test4_1.05_0304-50A	8673	OBSERVED	3:04:37	-50:05:45	46.153846	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
778	108	RACS_test4_1.05_0310-56A	8673	OBSERVED	3:10:35	-56:18:23	47.647058	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
779	109	RACS_test4_1.05_0352-56A	8673	OBSERVED	3:52:56	-56:18:23	58.235292	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
780	110	RACS_test4_1.05_0436-56A	8673	OBSERVED	4:35:18	-56:18:23	68.823529	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
781	111	RACS_test4_1.05_0517-56A	8673	OBSERVED	5:17:39	-56:18:23	79.411762	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
782	79	RACS_test4_1.05_0547-62A	8673	OBSERVED	5:47:35	-62:29:55	86.896550	-62.498628	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
783	80	RACS_test4_1.05_0637-62A	8673	OBSERVED	6:37:14	-62:29:55	99.310342	-62.498628	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
784	81	RACS_test4_1.05_0726-62A	8673	OBSERVED	7:26:54	-62:29:55	111.724138	-62.498628	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
785	82	RACS_test4_1.05_0816-62A	8673	OBSERVED	8:16:33	-62:29:55	124.137929	-62.498628	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
786	84	RACS_test4_1.05_0955-62A	8673	OBSERVED	9:55:52	-62:29:55	148.965517	-62.498628	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
787	119	RACS_test4_1.05_1056-56A	8673	OBSERVED	10:56:28	-56:18:23	164.117646	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
788	120	RACS_test4_1.05_1136-56A	8673	OBSERVED	11:36:49	-56:18:23	174.705879	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
789	160	RACS_test4_1.05_1216-43A	8673	OBSERVED	12:16:45	-43:52:21	184.186046	-43.872603	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
790	121	RACS_test4_1.05_1218-50A	8673	OBSERVED	12:18:28	-50:05:45	184.615383	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
791	87	RACS_test4_1.05_1221-56A	8673	OBSERVED	12:21:11	-56:18:23	185.294117	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
792	122	RACS_test4_1.05_1255-50A	8673	OBSERVED	12:55:23	-50:05:45	193.846150	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
793	162	RACS_test4_1.05_1323-43A	8673	OBSERVED	13:23:43	-43:52:21	200.930229	-43.872603	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
794	123	RACS_test4_1.05_1332-50A	8673	OBSERVED	13:32:18	-50:05:45	203.076921	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
795	89	RACS_test4_1.05_1345-56A	8673	OBSERVED	13:45:53	-56:18:23	206.470588	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
796	124	RACS_test4_1.05_1409-50A	8673	OBSERVED	14:09:14	-50:05:45	212.307692	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
797	90	RACS_test4_1.05_1428-56A	8673	OBSERVED	14:28:14	-56:18:23	217.058821	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
798	125	RACS_test4_1.05_1446-50A	8673	OBSERVED	14:46:09	-50:05:45	221.536450	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
799	91	RACS_test4_1.05_1510-56A	8673	OBSERVED	15:10:35	-56:18:23	227.647050	-56.306294	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	
800	126	RACS_test4_1.05_1523-50A	8673	OBSERVED	15:23:05	-50:05:45	230.769229	-50.095908	864.5	square_6x6	1.05	45.00	900.00	pa_fixed	-45.000	22302	

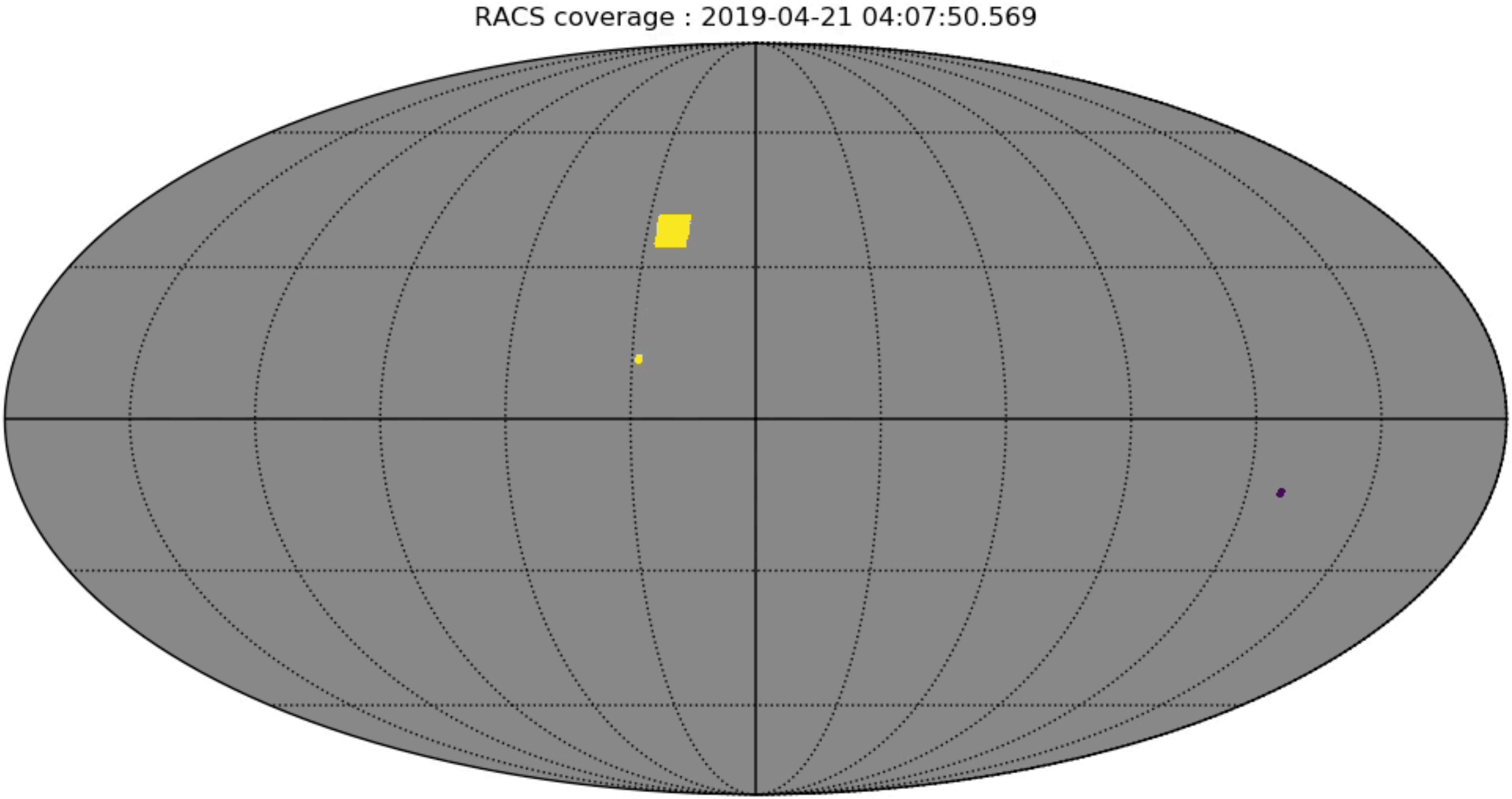
RACS Test 4 - Summary



Credit: Julie Banfield

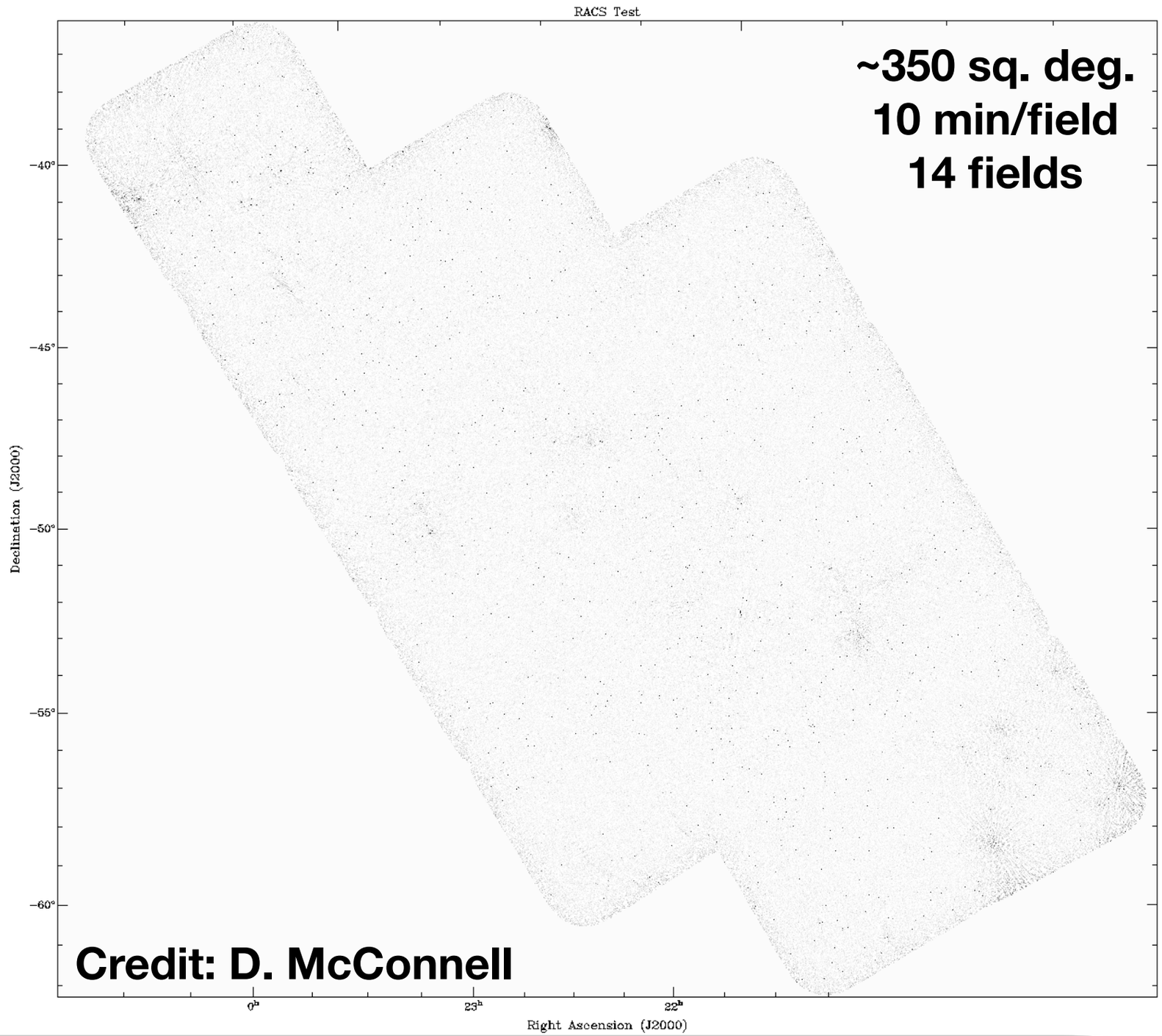
Declination < +40°
15 min/field (not interleaved)
220 hours observing (over 18 days)
888 MHz; ~10” resolution
~200 uJy sensitivity
Imaging: ~48 fields/day (~1.7 real-time)

Observed **Calibrated**
Processing **Imaged**

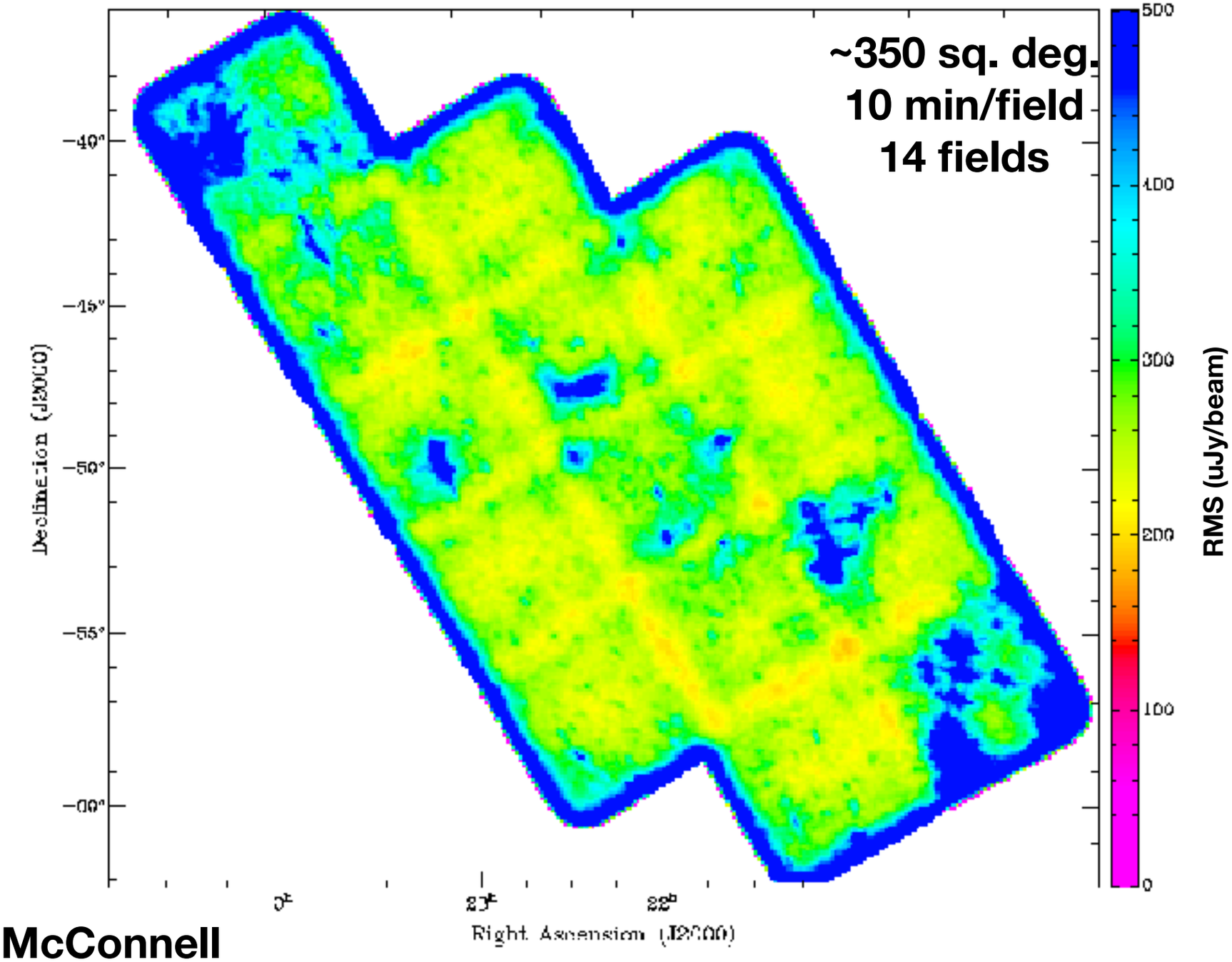


Credit: Emil Lenc

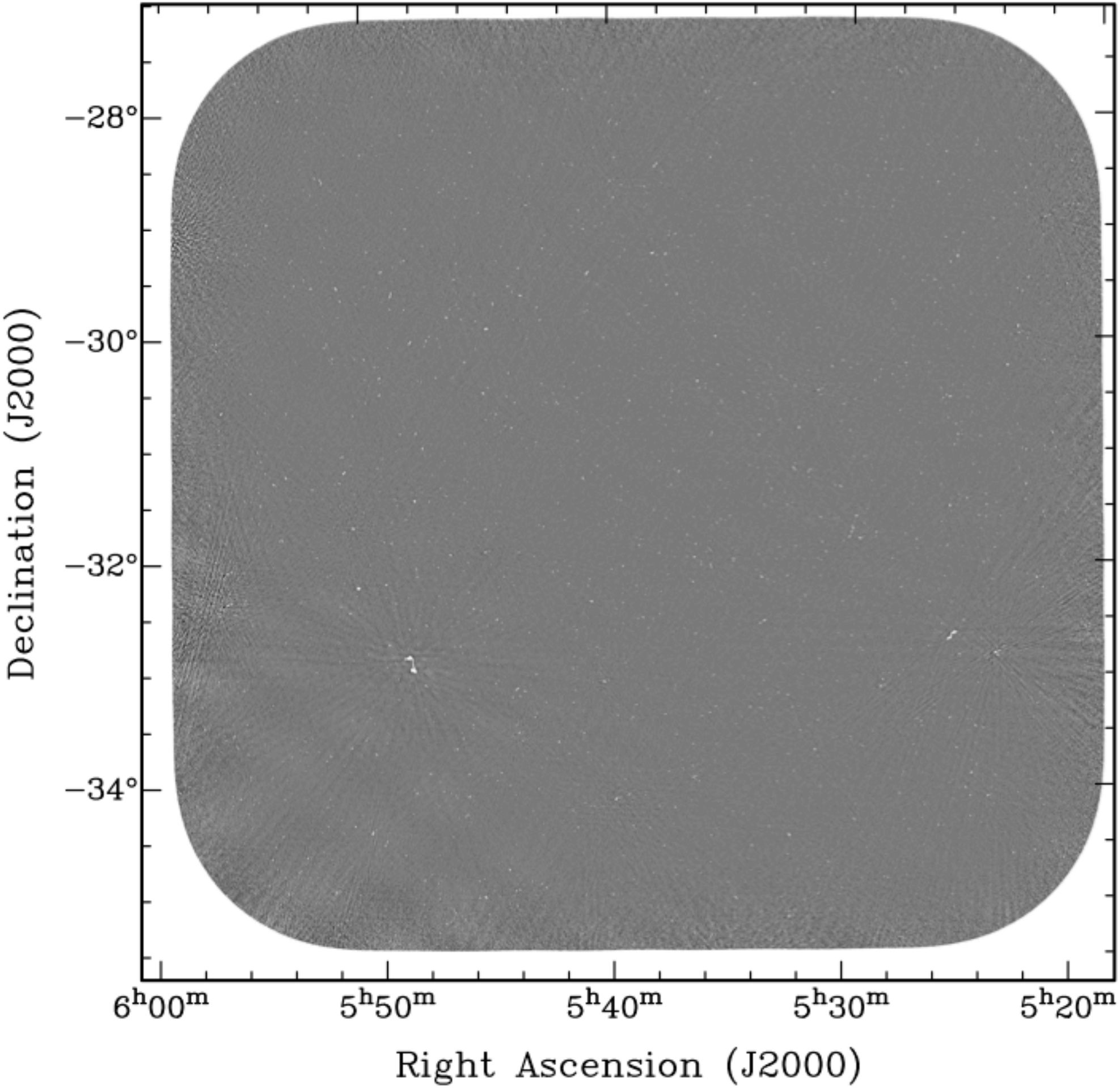
RACS epoch 1(?)

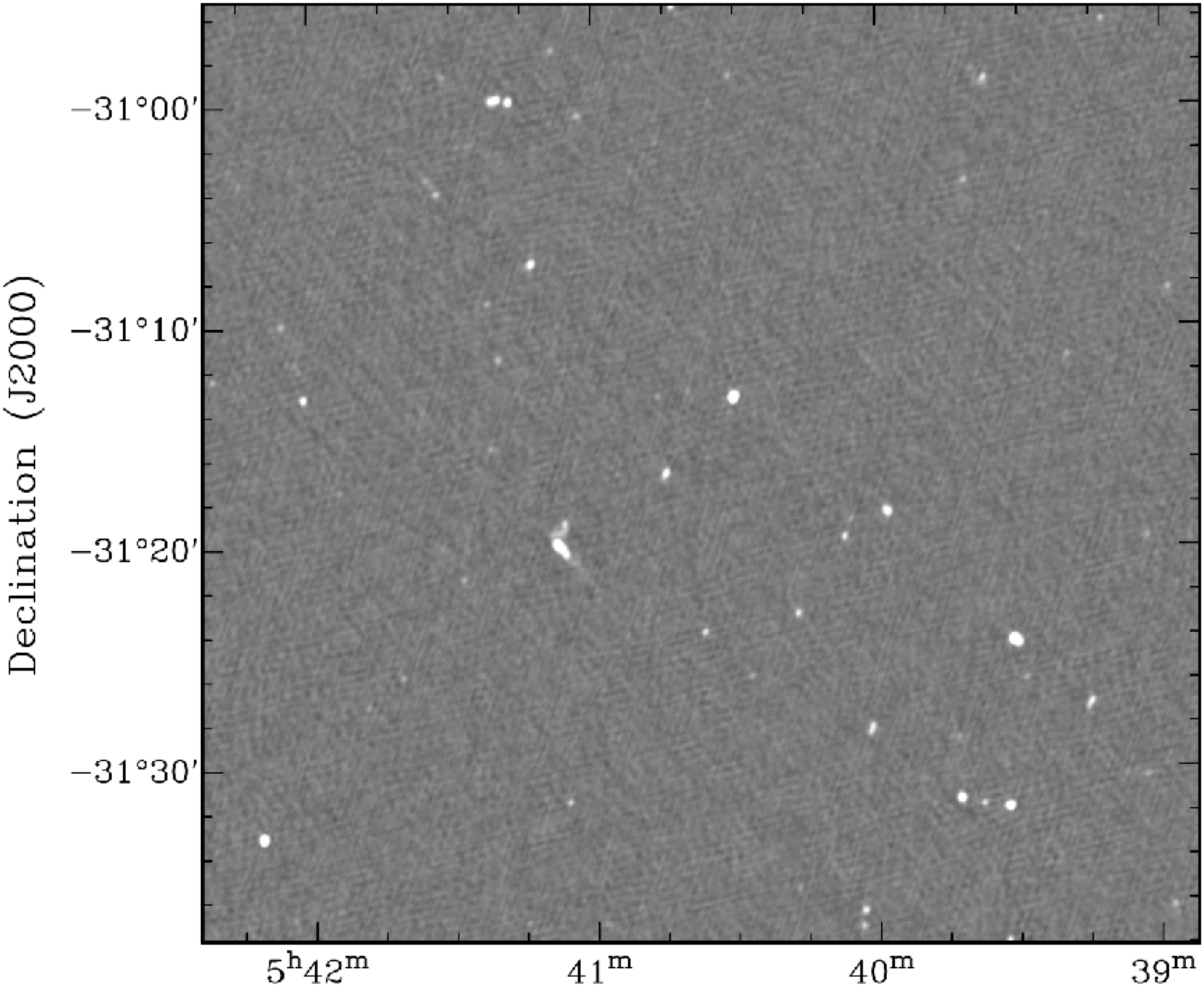

RACS Test
~350 sq. deg.
10 min/field
14 fields
Credit: D. McConnell
−40°
−45°
−50°
−55°
−60°
Declination (J2000)
0h
23h
22h
Right Ascension (J2000)

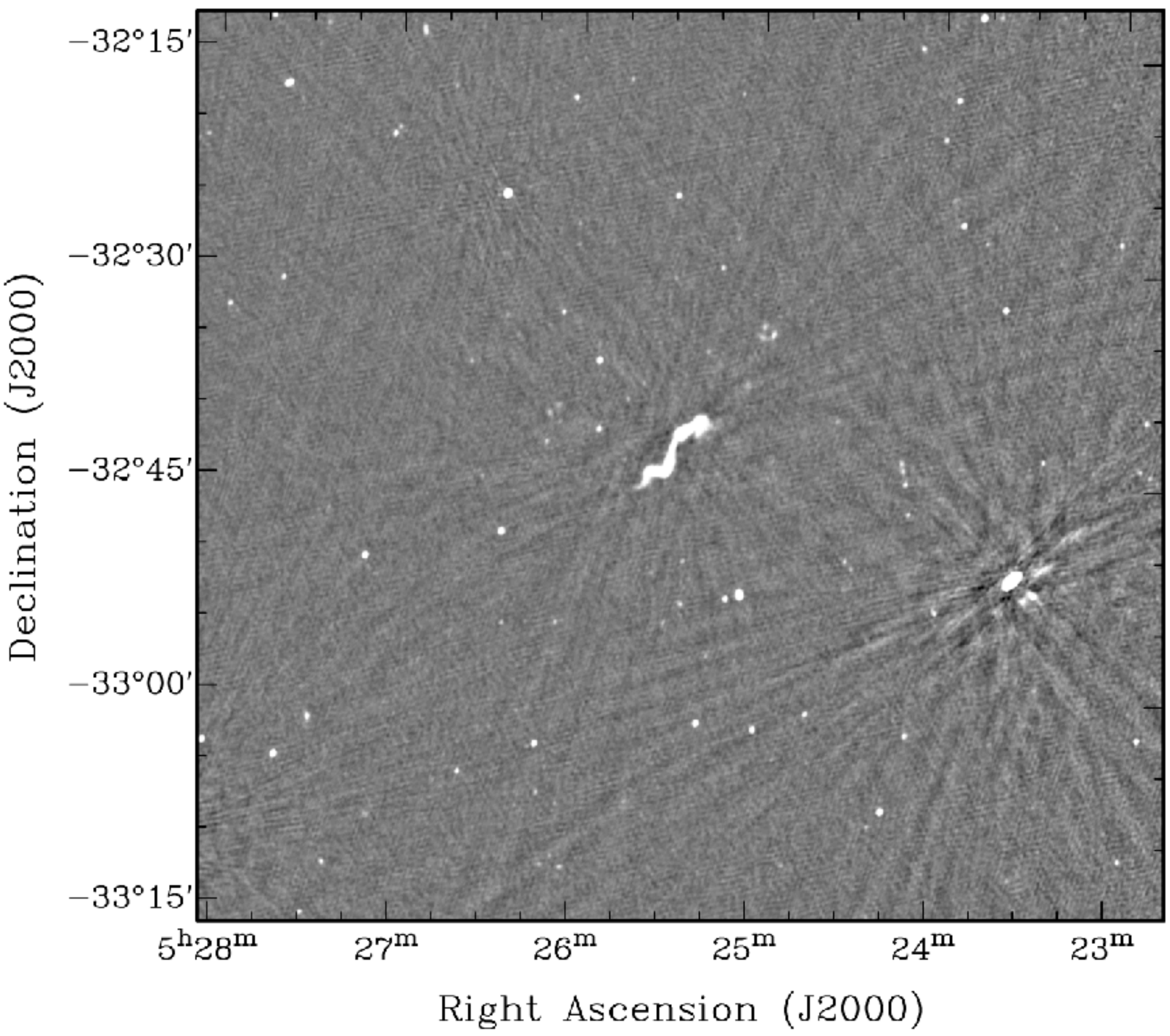
RACS epoch 1(?)

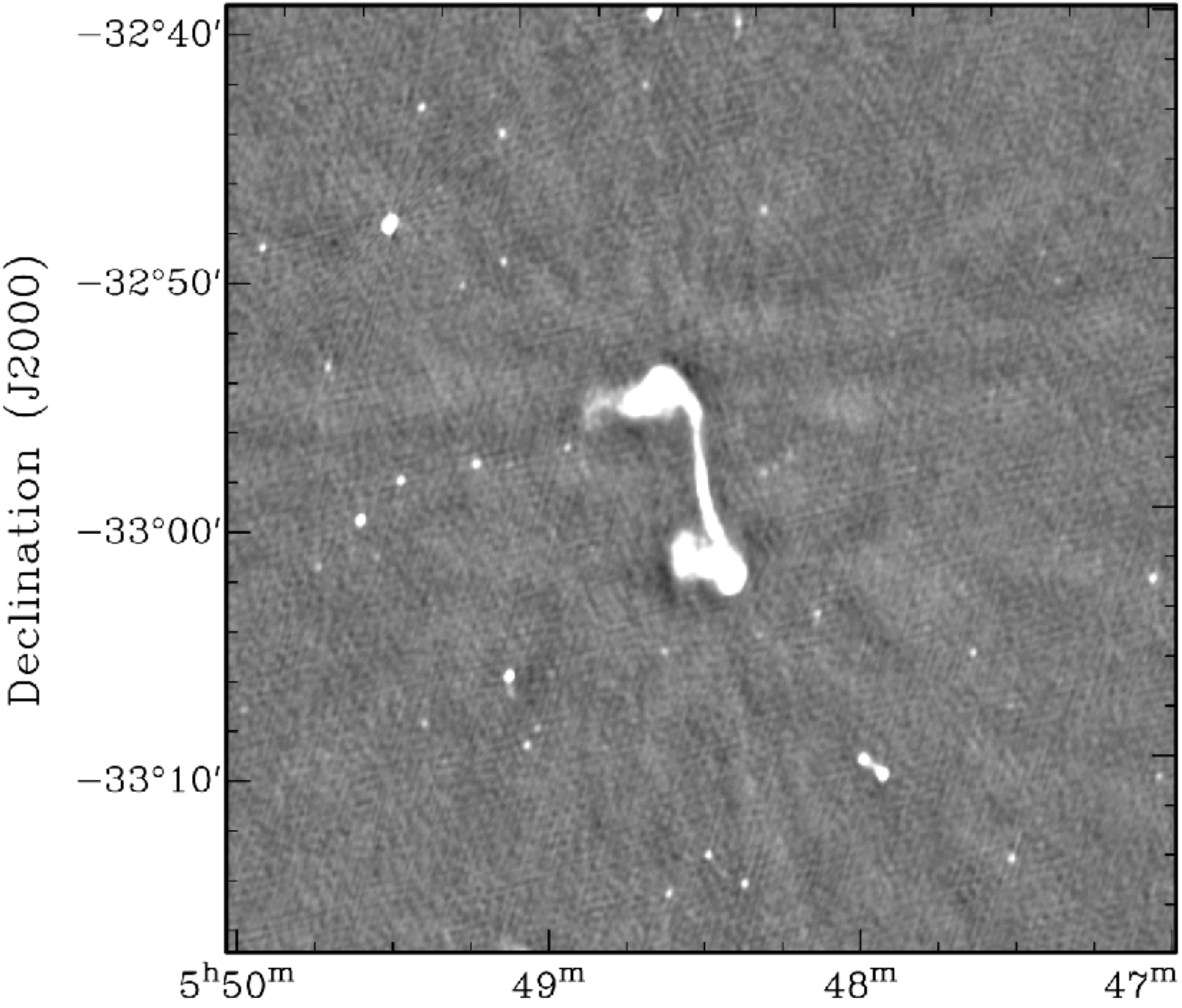


Credit: D. McConnell


−28°
−30°
−32°
−34°
Declination (J2000)
6h00m
5h50m
5h40m
5h30m
5h20m
Right Ascension (J2000)


−31°00′
−31°10′
−31°20′
−31°30′
Declination (J2000)
5h42m
41m
40m
39m
Right Ascension (J2000)


−32°15′
−32°30′
−32°45′
−33°00′
−33°15′
Declination (J2000)
5h28m
27m
26m
25m
24m
23m
Right Ascension (J2000)


−32°40′
−32°50′
−33°00′
−33°10′
Declination (J2000)
5h50m
49m
48m
47m
Right Ascension (J2000)

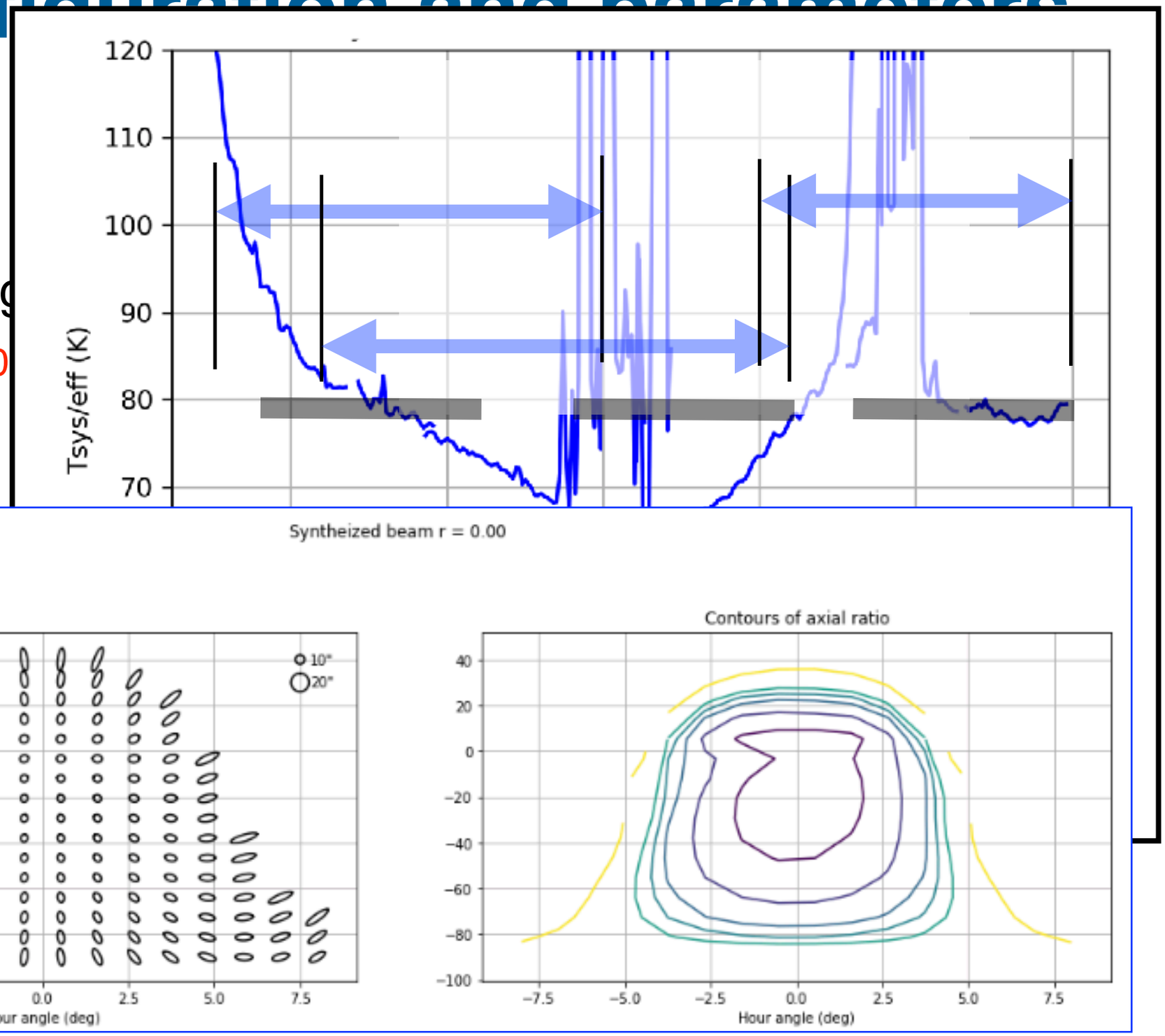
Discussion & questions

Data processing

- calibration
  - standard procedure with 1934-638
- imaging params
  - image & cell size - 5000 X 2.5”
  - weighting (robustness value) - r = 0.0
- self-cal strategy
  - one cycle, phase only, τ = 60s
- astrometry
  - bootstrap from fields containing astrometric standards
- polarisation
  - standard X-Y phase cal
  - off-axis procedure tbd
- mosaicing
  - into 36-beam tiles; + groups of tiles ???

Survey configuration and parameters

- sky coverage
  - -90 < δ < +40
- frequency coverag
  - 744 - 1032 MHz; 130
- integration time
  - 15 min
-



Expected performance

- resolution
- image noise
- uniformity of image noise
- possibly galactic latitude effects
- source detection limit (vs frequency?)
- astrometry
- flux accuracy
- polarimetric performance

RACS planning

- Welcome
- Project personnel
- Project objectives
- Survey configuration and parameters
- Data processing
- Data products
- Data release
- Expected performance
- What’s missing?

Data release

1. Survey parameters - sky coverage, frequency coverage, integration time.
2. Observing configuration - footprint, whether frequency-dependent, tile positions, HA/elevation limits
3. Data processing sequence - calibration, imaging params (robustness, etc) self-cal strategy, astrometry, polarisation, mosaicing
4. Expected performance - resolution, image noise, uniformity of image noise, possibly galactic latitude effects, source detection limit (vs frequency?), astrometry, flux accuracy, polarimetric performance, …
5. Data products - catalogues (what quantities), images (tiles?, all-sky?, recomposed into differently sized tiles, ???)
6. Data release - presumably CASDA;
7. Timing - observations, data release
8. Process for generating the Global Sky Model;

>> What's needed to gather information for the above:
>> 1. current trials of reducing RACS first pass
>> 2. achieved performance from first pass
>> 3. outcomes of polarisation analysis from POSSUM busy week
>> 4. I think that in addition to this full pass at 746 - 1032 MHz, we could use a small test (~a dozen tiles) at all the other parts of the band; these will compromise the 288MHz bandwidth because of RFI.
>> 5. A meeting - soonish - to turn the above into plan for the plan; I expect I have overlooked some stuff.