



# Observing Strategies and the art of Science Proposal Writing

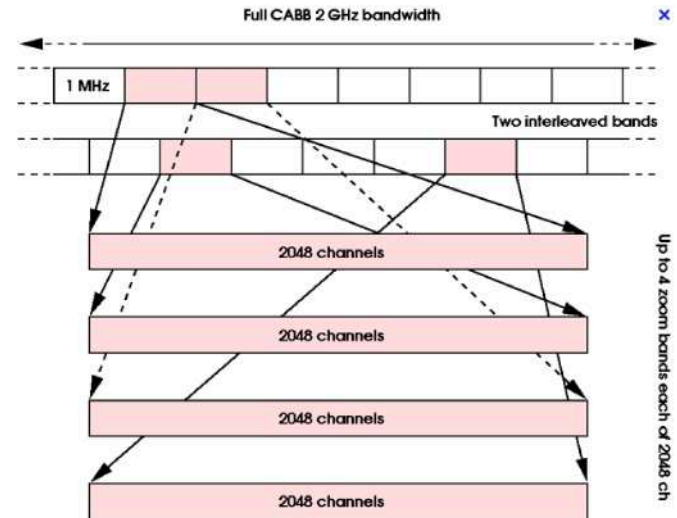
Shari Breen | University of Sydney Research Fellow  
CASS Radio School, Narrabri, September 2017



THE UNIVERSITY OF  
**SYDNEY**

# Outline

- Why is a good observing strategy important?
- Things to think about
  - What, when, for how long, frequency, array, overheads, CABB mode?
- Observing
  - The simple cm case
  - Slightly less simple cases
  - The mm case
  - Spectral lines
- Turning your plan into a winning proposal



# The importance of a good strategy

- Starts taking shape at the proposal stage
- Good telescopes are generally oversubscribed (ATCA usually by 2 – 3 times)
- Need to have a good plan to get good data that meets your science goals
- Make sure you are familiar with the current status of the instrument

The screenshot shows the ATNF website with a blue header containing the CSIRO logo and the text "Australia Telescope National Facility". A search bar is located on the right. Below the header is a navigation menu with links: "ATNF Home", "About ATNF", "Facilities", "Science & Technology", "Online Resources", and "Outreach".

The main content area is titled "ATNF Online Proposal Applications & Links". It includes a welcome message: "Welcome to OPAL, the Australia Telescope National Facility online proposal system." A yellow banner states: "The ATNF is not currently accepting telescope proposals. Please be aware that any proposals you construct are not guaranteed to be valid for the next proposal round." Below this, it says: "To submit and view your proposals, you must have a registered OPAL account." and "OPAL proposals generally require three components:"

1. A cover sheet created with the cover sheet editor.
2. An observations table created with the observations table editor.
3. A scientific justification in PDF format (<10 megabytes and not more than three pages in total — see the science case requirements) created by any tool you wish to use. This is not required for projects that have pre-graded project status.

It also provides links: "See the full information on ATNF Telescope Applications." and "In particular please read the web information on the current status of the ATNF telescopes." At the bottom, it says: "OPAL supports Firefox and Internet Explorer. More about OPAL."

On the left side, there is a sidebar titled "OPAL links" with the following links: "OPAL Users Guide", "Cover sheet editor", "Source list editor", "Observations table editor", "Search proposals", "Preview a proposal", "Contact us", "Register", "Log in or reset password", and "ATOA".

On the right side, there is a circular diagram illustrating the OPAL process flow:

- Prepare files (Cover sheet, Observations table, Science case)
- Preview proposal
- Submit proposal to OPAL
- OPAL Access (List submissions, Download proposals)

```
graph TD; A[Prepare files<br/>Cover sheet<br/>Observations table<br/>Science case] --> B[Preview proposal]; B --> C[Submit proposal to OPAL]; C --> D[OPAL Access<br/>List submissions<br/>Download proposals]; D --> A;
```



# Lots of resources

- Talk to postdocs, other ATCA users, ATNF “friend”, DAs etc and <http://www.narrabri.atnf.csiro.au/observing/>
- The ATCA users guide: [http://www.narrabri.atnf.csiro.au/observing/users\\_guide/html/atug.html](http://www.narrabri.atnf.csiro.au/observing/users_guide/html/atug.html)
- The ATCA forum: <https://atcaforum.atnf.csiro.au/>
- ATCA current issues: <https://www.narrabri.atnf.csiro.au/observing/CurrentIssues.html>
- CABB: <https://www.narrabri.atnf.csiro.au/observing/CABB.html>
- OPAL: <http://opal.atnf.csiro.au/>

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### ATCA Users Guide

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## 1. About this Guide

This manual describes how to apply for observing time, make a schedule file, and carry out an observation with the Australia Telescope Compact Array (ATCA).

This manual is a reference guide: you do not need to read all of it to use the ATCA. Chapter 1 describes the telescope and what you need to know before proposing to use it. Chapter 2 can be read after getting observing time on the ATCA. It describes how to prepare for your observations. Chapter 3 deals with the online software and all the details of how to actually do your observations. Chapter 4 goes into detail about what to do with your data after it has been collected. The appendices provide additional details above and beyond what will usually be required for routine observing.

**The ATCA Forum**  
A place to discuss the intricacies of the Australia Telescope Compact Array

Board index

TOPICS	POSTS	LAST POST
<b>Information</b> Information about the ATCA Forum, this forum system, and a place to experiment with posting if you want to. Moderator: Mark Wieringa	7	10 by Mark Wieringa 12 Wed Jan 11, 2017 9:01 am
<b>DATA REDUCTION</b>		
<b>Calibration</b> Got a calibration problem? Discuss it here. Moderator: Mark Wieringa	54	207 by wu616 14 Fri Jul 14, 2017 3:33 pm
<b>Imaging</b> Got an image problem? Let us help! Moderator: Mark Wieringa	28	117 by ryanmcg 12 Tue Sep 26, 2017 5:22 pm
<b>MIRIAD</b> Is MIRIAD being a pain? Let us know your experience. Moderator: Mark Wieringa	150	606 by Mark Wieringa 12 Thu Jun 15, 2017 2:30 pm
<b>CASA</b> Want to use CASA with CABB data? We can help each other! Moderator: Mark Wieringa	2	14 by anykindall 12 Thu Sep 03, 2013 2:52 pm
<b>Other Tools</b> Do you use (or want to use) other tools to reduce ATCA data? Moderator: Mark Wieringa	9	45 by acornet 12 Tue Jan 17, 2017 4:43 pm

**Australia Telescope National Facility**

### ATCA Current Issues

Unless you have been trained to do this:

**Do Not Reprogram the Correlator while in Zoom Configurations**

See [here](#) for information.

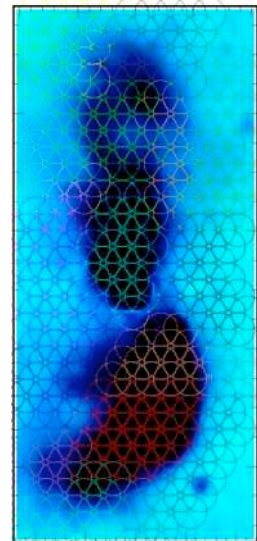
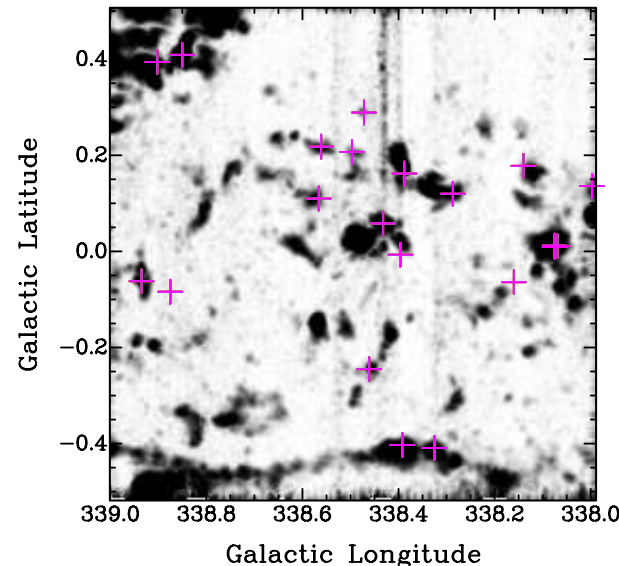
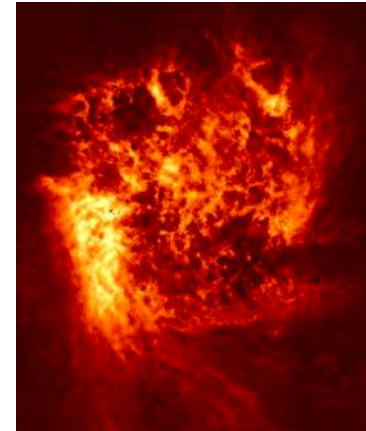
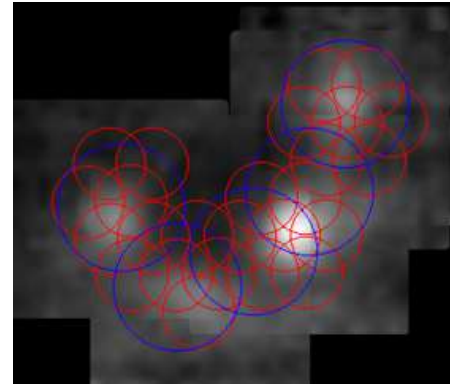
**mm Cryo Sensor Not Working**

The second 20K temperature sensor on the antenna 2, mm cryo system is not working and is calling a alarm in the

# Things to think about – 1) What?

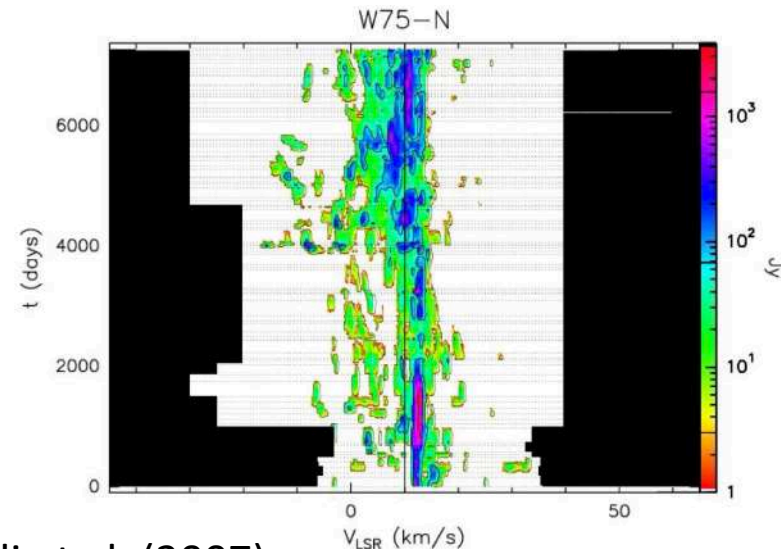
- Strategy dependent on science/object!
  - Complicated extended structure? → might need multiple array configs and single dish data
  - Point source? → a handful of short cuts over several hours might be enough
  - Know where your object is and just need a flux measurement or spectrum? → 1 short observation might be enough
- Shadowing?
- Confusion?
- Location? Dec 0?
- Mosaic? (primary beam  $\lambda/D$ )
- Continuum and/or spectral line?

Kim et al.

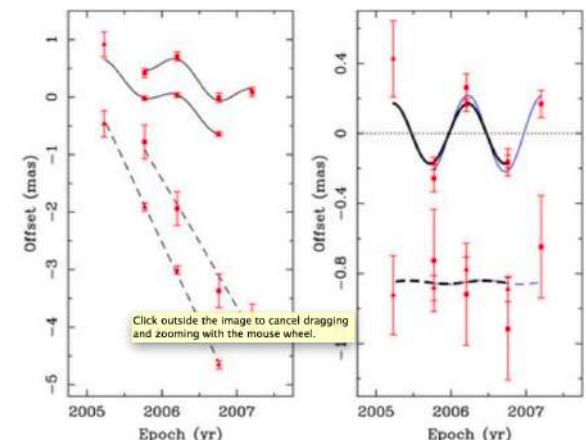


# Things to think about – 2) When?

- Variable source?
  - observe when it is expected to be bright
  - Or track the flux with observations spread over multiple epochs
- Coordination with other telescopes?
- Weather?
  - Atmosphere generally more stable during winter and at night → better mm observing
  - Generally less interference at night at the lower frequencies too (man made and solar)
  - Thunderstorms during afternoon in summer



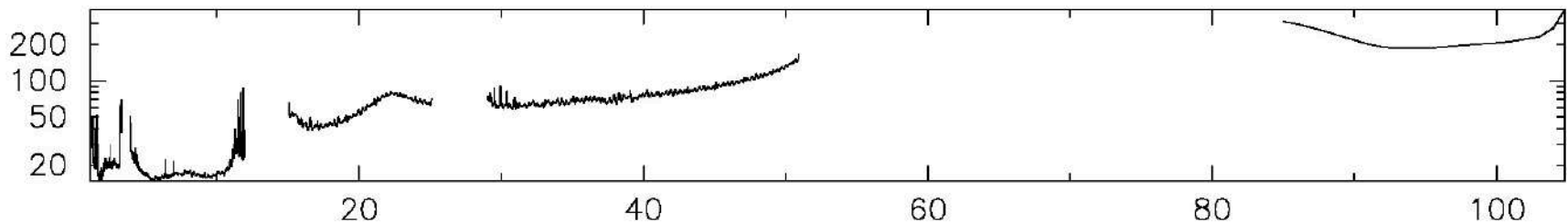
Felli et al. (2007)



Sanna et al. (2009)

# Things to think about – 3) Frequency?

- Usually driven by science
  - Lines?
  - Remember to consider how the telescope performs at different frequencies
  - Spread the 2 IFs as far apart as possible, or continuous coverage?
  - Take the receiver limitations into consideration (e.g. the 13cm receiver works between 1.1 and 3.1 GHz)
  - ‘Standard’ continuum frequencies



Band	IF1 (MHz)	IF2 (MHz)
16cm	2100	2100
4cm	5500	9000
15mm	<del>17000</del> 16700	<del>17000</del> 21200
7mm (LSB)	33000	35000
7mm (USB)	43000	45000
3mm	93000	95000

# Things to think about – 4) For how long?

- Mostly dictated by required sensitivity
  - Effective BW and spectral resolution
- UV coverage (e.g. bright spectral lines)
  - Short integrations across a range of hour angles increases overheads BUT may be the most efficient use of time to cover many sources

## Parameters

Continuum centre frequency:	<input type="text"/>	MHz	✖
Specific zoom frequency:	<input type="text"/>	MHz	
Maximum baseline and configuration:	<input type="text" value="Please select..."/>		✖
Include CA06?:	<input type="text" value="Yes"/>		✔
Number of 4cm receivers:	<input type="text" value="1"/>		✔
CABB frequency resolution:	<input type="text" value="Please select..."/>		✖
Zoom channels to concatenate:	<input type="text" value="1"/>		✔
Source Declination:	<input type="text" value="-30"/>	degrees	✔
Integration Time:	<input type="text" value="720"/>	minutes	✔
Elevation Limit:	<input type="text" value="12"/>	degrees	✔
Hour-angle Limit:	<input type="text" value="6"/>	hours	✔
Line Rest Frequency:	<input type="text"/>	GHz	
	<input type="text"/>	<input type="button" value="Set"/>	
Image Weighting Scheme:	<input type="text" value="Natural"/>		✔
Smoothing filter width:	<input type="text" value="1"/>		✔
Discard self-generated birdies?:	<input type="text" value="No"/>		✔
Discard known RFI frequency bands?:	<input type="text" value="No"/>		✔
Number of edge channels to discard:	<input type="text" value="0"/>		✔
<input type="button" value="Calculate Sensitivity"/>			
<input type="button" value="Reset to Defaults"/>		<input type="button" value="Save as Defaults"/>	

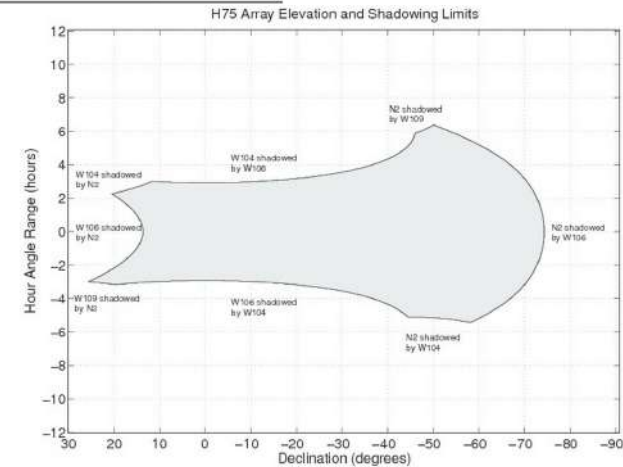


# Things to think about – 5) Array?

- Dictated by:
  - the resolution required
  - uv-coverage requirements (specific arrays work well together – 6A, 6C, 1.5B, 1.5D)
  - What's offered
  - Where your source is – shadowing?

Semester	2010APRS	2010OCTS	2011APRS	2011OCTS	2012APRS
Array					
6A	*	*	*	*	*
6B			*		
6C	*			*	
6D		*			*
1.5A		*		*	
1.5B		*			*
1.5C			*		
1.5D	*			*	
750A		*			*
750B			*		
750C	*			*	
750D		*		*	
EW367		*			
EW352	*	*			
H214	*	*			
H168	*				
H75	*				

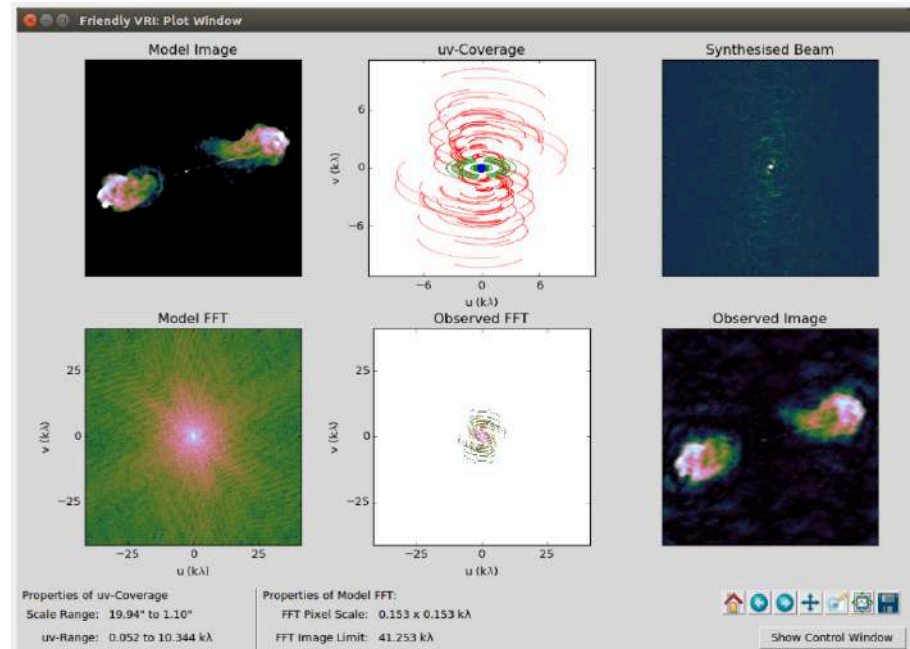
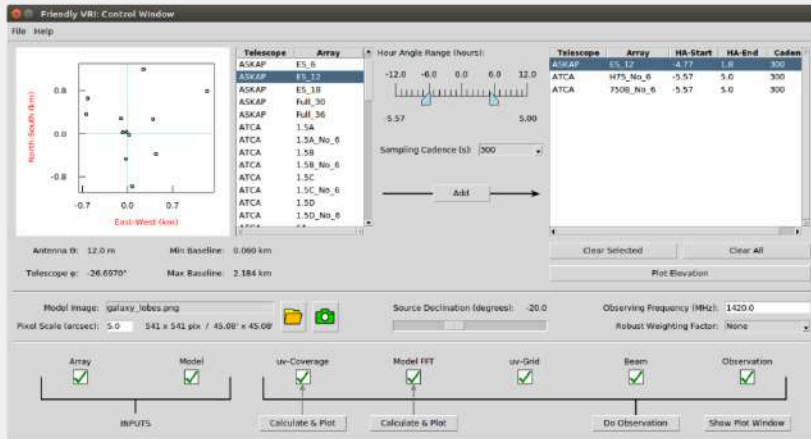
Table 1.3: Array configurations



# Virtual interferometer

## The Friendly Virtual Radio Interferometer

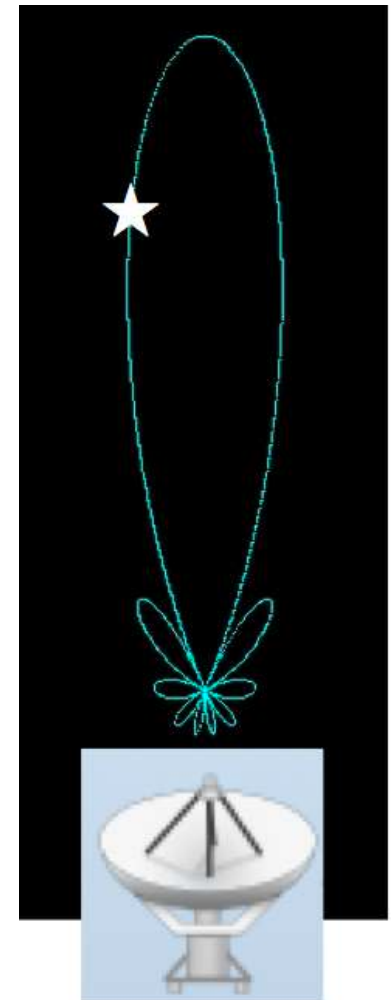
The Friendly Virtual Radio Interferometer (VRI) is designed to simulate astronomical observations using linked arrays of radio antennas in a technique called *earth rotation aperture synthesis*. As the successor to the original [Java-based VRI](#), it focuses on simulating the effect of combining different antenna layouts.



<https://crpurcell.github.io/friendlyVRI/>

# Things to think about – 6) Calibration and other overheads?

- Primary (flux density) calibration
  - 1934-638 at most frequencies (Uranus/Mars at 3mm)
- Bandpass calibration
  - 1934-638 strong enough at most cm wavelengths
  - 1253-055 or 1921-293 often used at higher frequencies
- Phase calibration (~2min every 40min)
  - Unresolved, strongish source within about 10 degrees of target
- Pointing calibration
  - Carried out every hour at all mm frequencies on a source within ~20 degrees of target
- Other overheads
  - Set up, slewing,.....



# Cycle time

<http://www.narrabri.atnf.csiro.au/calibrators/calcycle.html>



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### Calibrator cycle time calculator

The following calculator determines the calibrator cycle time (the amount of time between successive visits to the calibrator) given observer parameters and parameters describing the phase stability. This assumes that self-calibration is not going to be used.

Observing frequency:	90000	MHz
Max baseline length of interest:	214m	÷
Seeing monitor rms phase:	400	microns
Phase screen speed:	1	m/s
Kolmogorov exponent:	0.83	

CALCULATE

### Explanation of input parameters

The calculation of the recommended calibre

- Observing frequency and maximum ba
- Seeing monitor phase stability: this giv
- Phase screen speed: This gives the pa
- Kolmogorov exponent  $\beta/2$ : The phase :

For more information, see Thompson, Mor.

Original: Bob Sault (22-Nov-2004)

Modified: Bob Sault (26-Nov-2004), Phil E

## Calibrator cycle time calculator

The following table gives an estimate of the resultant image dynamic range (assuming it is limited by phase errors), the percentage amplitude decorrelation in the resultant image, and the rms uncorrected phase in the visibility data. These are given as a function of the time interval between successive visits to the phase calibrator.

This calculation assumes a frequency of 90000 MHz, maximum baseline of 214 m, rms seeing monitor phase of 400  $\mu\text{m}$ , phase screen speed of 1 m/s and Kolmogorov power law of 0.83.

The dynamic range assumes 5 hours observing on-source and 10 baselines. The dynamic range estimate varies as the inverse square root of these quantities.

$t_{\text{cycle}}$	Dynamic Range	Decorrelation	RMS Phase
20 sec	1343	0%	6°
30 sec	780	1%	8°
1 min	304	3%	14°
2 min	113	9%	25°
3 min	60	17%	35°

Calibrator cycle times longer than 3 min do not degrade the results further.

**Note:** The above calculation assumes that phase errors are dominated by the atmosphere. It does not include the effect of

- errors in the assumed geometry of the array;
- errors in deducing the phase from a calibrator (the calibrator phase may be in error because it is measured at a slightly different time, at a different position, and because of sensitivity limits), and
- uncorrected instrumental drifts.

All of these may be significant.



# Things to think about – 7) CABB mode?

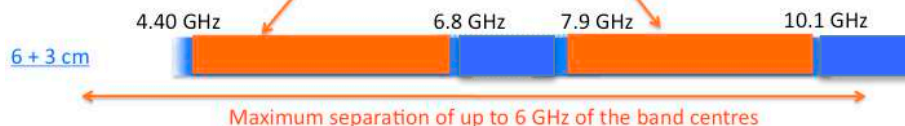
- Two x 2 GHz wide IFs (2048 x 1 MHz channels)
- Where you can put them depends on the frequency and your science



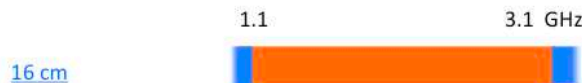
## CABB in the cm bands

8 GHz CABB range over which two 2-GHz bands can be positioned

2 x 2-GHz bandwidth with full Stokes. Either 2048 x 1MHz channels or 32 x 64MHz channels.



Note: It is possible to observe at 6 and 3 cm simultaneously by placing 1 frequency setting (IF) in each receiver band. It is also possible to place 2 IFs in the 6-cm band

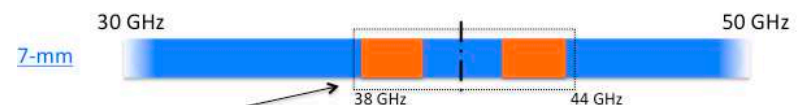


Effective observing bandwidth is 2.0 GHz (with some reduction due to RFI)

## CABB in the mm bands

8 GHz CABB range over which two 2-GHz bands can be positioned

2 x 2-GHz bandwidth with full Stokes. Either 2048 x 1MHz channels or 32 x 64 MHz

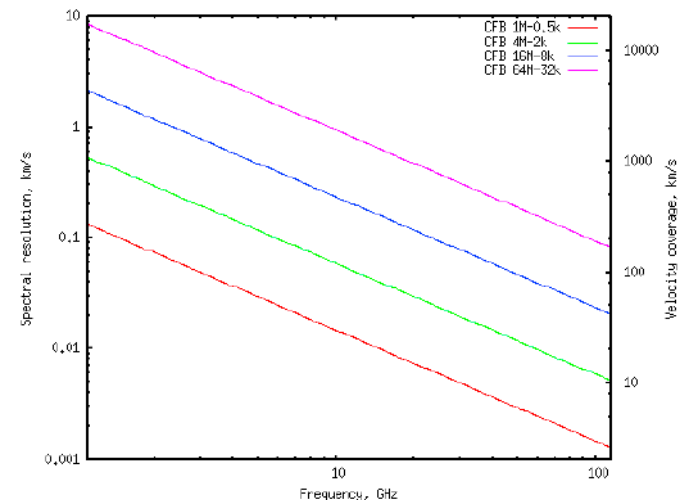
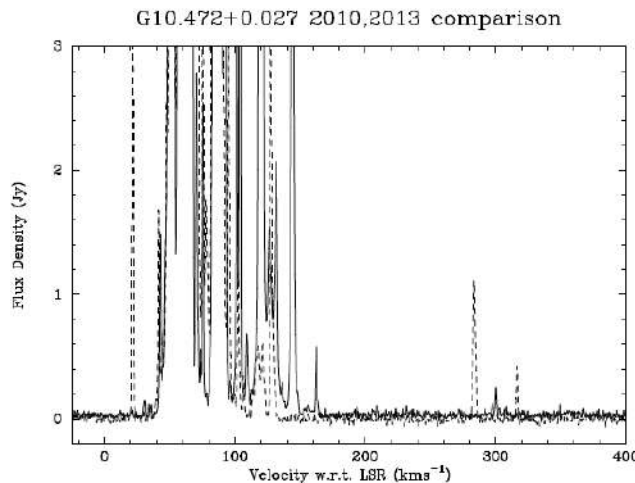
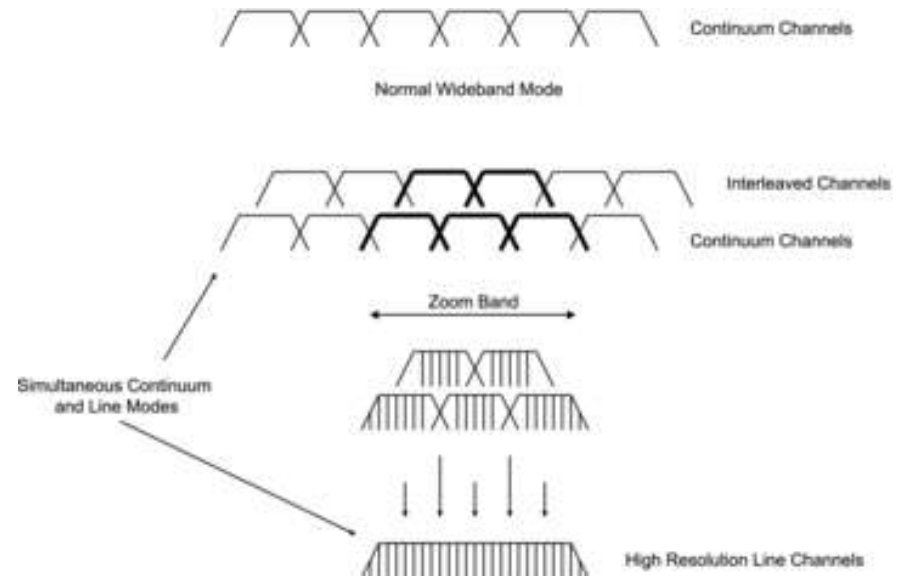


Note: For the 7-mm system both 2GHz band centres must be either greater than 41 GHz (the point at which the conversion changes from lower side-band to upper side-band) or both less than 41 GHz.



# Things to think about – 7) CABB mode?

- Optional zoom windows (currently 32 x 1 MHz zooms, or 32 x 64 MHz zooms each with 2048 channels or a hybrid mode)
- Concatenate zoom windows for more velocity coverage
- What mode depends on velocity res/coverage needed



# Schedule files <https://www.narrabri.atnf.csiro.au/observing/sched/cabb/>

## CABB Scheduler - c3145g300.sch

**Sched** **Listing**

File Edit Tools

1. j1147-6753  
2. g300\_b01  
3. j1147-6753  
4. g300\_b02  
5. j1147-6753  
6. g300\_b03  
7. j1147-6753  
8. g300\_b04  
9. j1147-6753  
10. g300\_b05  
11. j1147-6753  
12. g300\_b06  
13. j1147-6753  
14. g300\_b07  
15. j1147-6753  
16. g300\_b08  
17. j1147-6753  
18. g300\_b09  
19. j1147-6753  
20. g300\_b10  
21. j1147-6753  
22. g300\_b11  
23. j1147-6753  
24. g300\_b12  
25. j1147-6753  
26. g300\_b13  
27. j1147-6753  
28. g300\_b14  
29. j1147-6753  
30. g300\_b15  
31. j1147-6753  
32. g300\_b16

Scan Parameters

Source j1147-6753  
RA (hms) 11:47:33.401  
Dec (dms) -67:53:41.766  
Epoch J2000  
CalCode  
ScanLength 00:04:00  
ScanType Point  
Pointing Update  
Observer sb,mv  
Project C3145  
Time 14:00:00  
TimeCode LST  
Date 27/05/2017

Freq1 43195MHz  
Freq2 48610MHz

New Scan Search Cal  
Delete Pick Source

Data rate = 13.33GB/h, or 4GB every 18m

## CABB Scheduler - c3145g300.sch

Sched Listing													
#	Source	Cal	RA	Dec	Epoch	Time(LST)	ScanLength	Az	El	Drive	ScanType	Pointing	Freq-1 Freq-2
1	j1147-6753		11:47:33.401	-67:53:41.766	J2000	14:00:00	00:04:00	197:35:42.6	47:41:36.5	00:03:30	Point	Update	43195 48610
2	g300_b01		12:22:54.374	-65:42:32.786	J2000	14:04:01	01:05:06	196:06:40.8	51:20:52.3	00:00:14	Otfmos	Offset	43195 48610
3	j1147-6753		11:47:33.401	-67:53:41.766	J2000	15:09:17	00:04:00	202:58:00.0	42:26:57.1	00:00:15	Point	Update	43195 48610
4	g300_b02		12:23:21.953	-65:42:51.579	J2000	15:13:18	01:05:06	203:27:48.2	46:14:43.0	00:00:15	Otfmos	Offset	43195 48610
5	j1147-6753		11:47:33.401	-67:53:41.766	J2000	16:18:35	00:04:00	205:25:55.0	36:15:59.7	00:00:14	Point	Update	43195 48610
6	g300_b03		12:23:49.543	-65:43:10.069	J2000	16:22:35	01:05:06	207:19:56.7	39:48:37.0	00:00:14	Otfmos	Offset	43195 48610
7	j1147-6753		11:47:33.401	-67:53:41.766	J2000	17:27:52	00:04:00	205:28:08.1	29:47:51.7	00:00:12	Point	Update	43195 48610
8	g300_b04		12:24:17.143	-65:43:28.254	J2000	17:31:53	01:05:06	208:18:23.6	32:49:43.1	00:00:12	Otfmos	Offset	43195 48610
9	j1147-6753		11:47:33.401	-67:53:41.766	J2000	18:37:09	00:04:00	203:32:58.4	23:33:35.4	00:00:10	Point	Update	43195 48610
10	g300_b05		12:24:44.754	-65:43:46.135	J2000	18:41:10	01:05:06	207:00:33.2	25:53:45.4	00:00:10	Otfmos	Offset	43195 48610
11	j1147-6753		11:47:33.401	-67:53:41.766	J2000	19:46:27	00:04:00	200:02:57.2	17:58:43.5	00:00:11	Point	Update	43195 48610
12	g300_b06		12:25:12.376	-65:44:03.712	J2000	19:50:27	01:05:06	203:54:23.6	19:28:55.4	00:00:11	Otfmos	Offset	43195 48610
13	j1147-6753		11:47:33.401	-67:53:41.766	J2000	20:55:44	00:04:00	195:16:51.6	13:25:08.7	00:00:11	Point	Update	43195 48610
14	g300_b07		12:25:40.007	-65:44:20.984	J2000	20:59:45	01:05:06	199:20:28.3	13:59:10.2	00:00:11	Otfmos	Offset	43195 48610
15	j1147-6753		11:47:33.401	-67:53:41.766	J2000	22:05:01	00:04:00	189:33:17.3	10:11:16.4	00:00:00	Point	Update	43195 48610
16	g300_b08		12:26:07.649	-65:44:37.952	J2000	22:05:01	01:05:06	193:58:24.5	9:57:50.3	00:00:00	Otfmos	Offset	43195 48610
17	j1147-6753		11:47:33.401	-67:53:41.766	J2000	22:05:01	00:04:00	189:33:17.3	10:11:16.4	00:00:00	Point	Update	43195 48610
18	g300_b09		12:26:35.301	-65:44:54.615	J2000	22:05:01	01:05:06	194:00:44.7	9:59:31.5	00:00:00	Otfmos	Offset	43195 48610





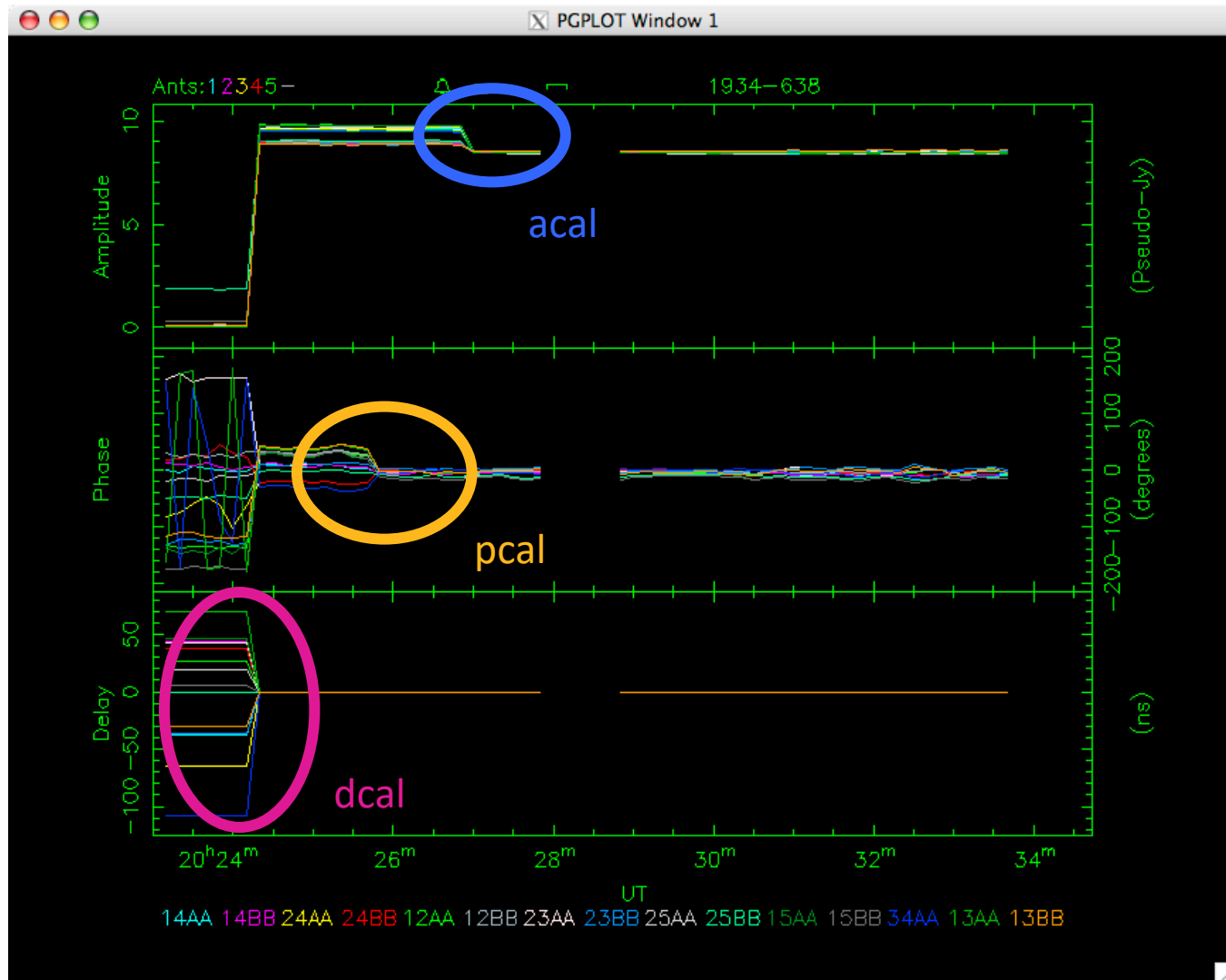


# Observing – the simple cm case

- If you are prepared the actual observing is not hard
- A simple cm continuum observation of a single source may go something like
  - Observe 1934-638
    - Do initial array calibration (delays, phases, amplitudes; dcal, pcal, acal)
    - Close junk file
    - Track 1934-638 for primary and bandpass calibration (~10min)
  - Go to target schedule which contains
    - Phase calibrator (~2min)
    - Target (~20 – 40 min)
    - Loop through target schedule until the end (start 1/99 or 1-2/99)



# Calibrating the array



# The less simple cases

- Lower frequencies ( $\sim 2.1$  GHz)
  - Second IF is redundant
  - Lots of interference  $\rightarrow$  need to choose channel range for calibration carefully (set “tvchan”)
  - More chance of confusion
- Higher frequencies
  - 1934-638 gets too weak for setup and bandpass  $\rightarrow$  use a stronger source (e.g. 0537-441, 1253-055, 1921-293)
  - Observe 1934-638 or a planet at 3mm for primary calibration
  - fewer calibrators

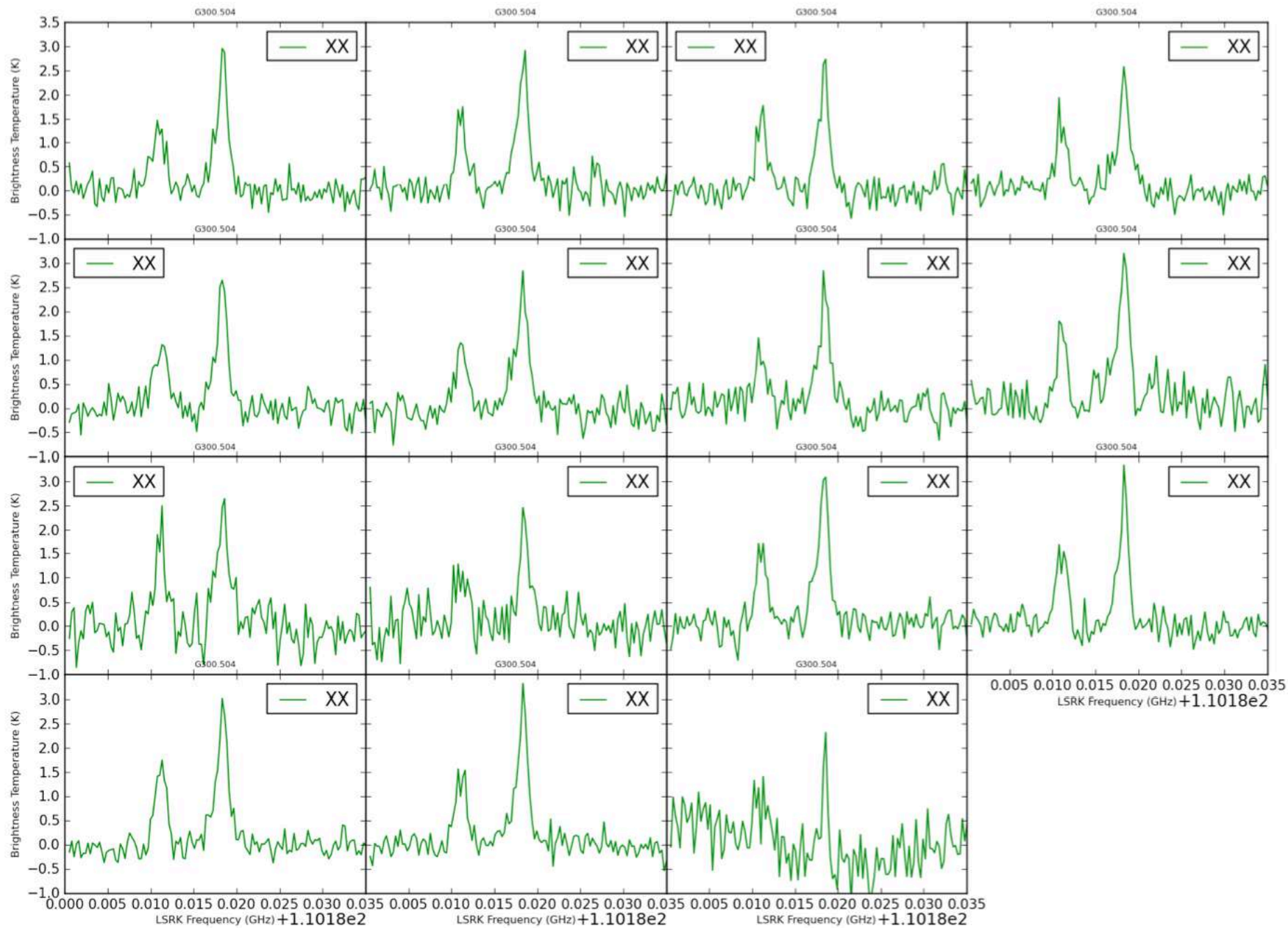


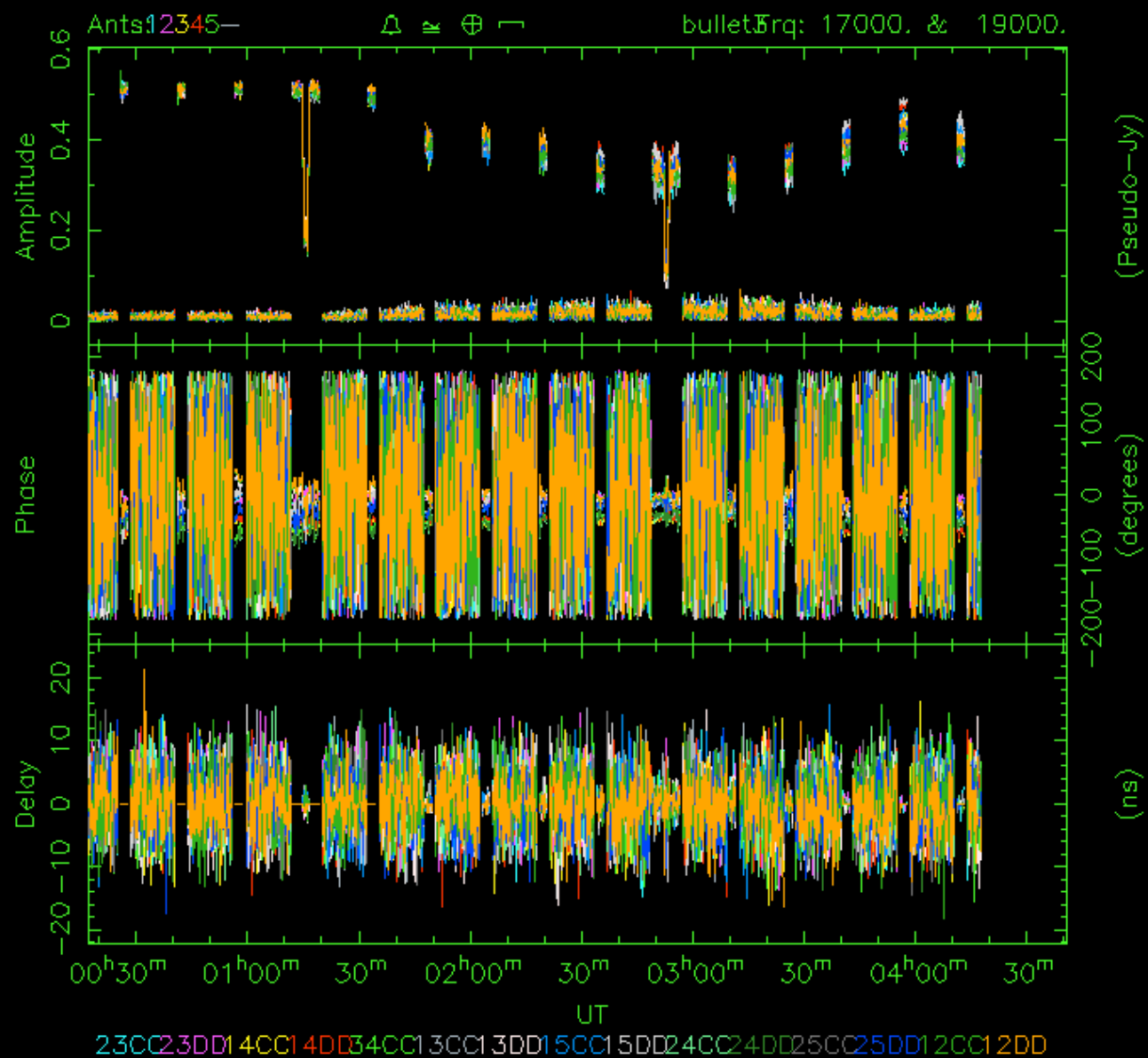
# mm observing – the least simple case

- Everything becomes more difficult at mm frequencies
  - Atmospheric opacity increases  $T_{\text{sys}}$  and attenuates signal
  - Not as many bright calibrator sources
  - Instrument stability is more difficult to maintain
  - Antenna accuracy becomes important
  - The FOV is smaller
- To overcome some of these difficulties we usually only observe during the winter months (60-65 % chance of suitable 3mm weather) or during the night (especially at 12 or 7mm).





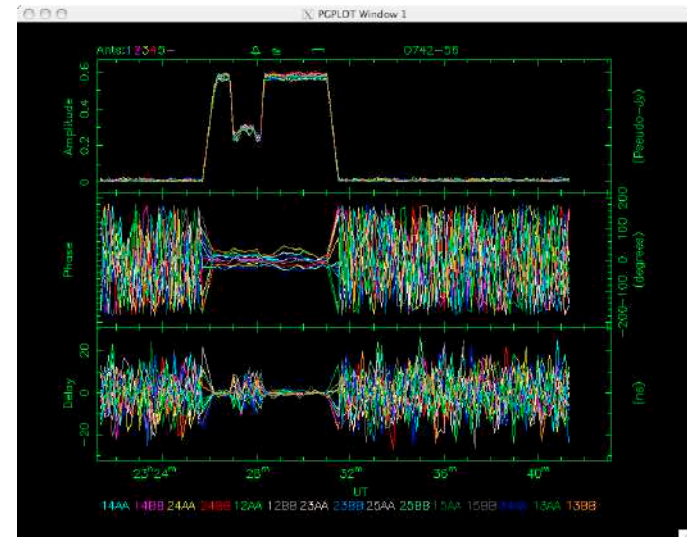




# Observing at mm frequencies

- Observe a strong calibrator (e.g. 0537-441, 1253-055 or 1921-295)

- Calibrate delays (dcal)
- Do a pointing (can choose specs)
- Calibrate phase (pcal)
- Calibrate amplitudes (acal or paddle at 3mm)



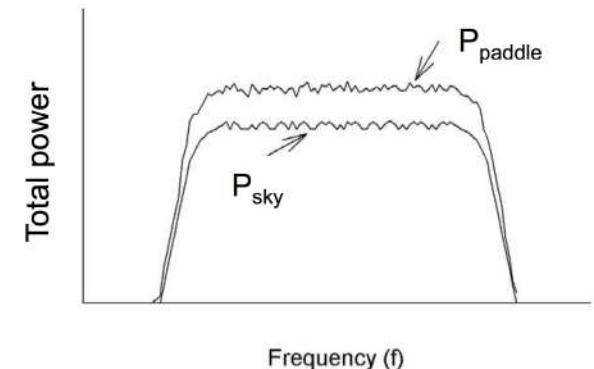
- Observe either 1934-638 (at 12 or 7mm) or a planet (at 3mm) for primary calibration
  - Pointing first (1934-638 or source nearby planet)
- Target observations
  - Include a pointing once an hour (ideally on a strong source within ~20 degrees)

# Paddle scans

- Measure  $T_{\text{sys}}$  and correct for the atmosphere at 3mm
- Place an ambient load in front of receiver horn for 30 sec
- Gives  $T_{\text{sys}}$  corrected for the current atmospheric conditions

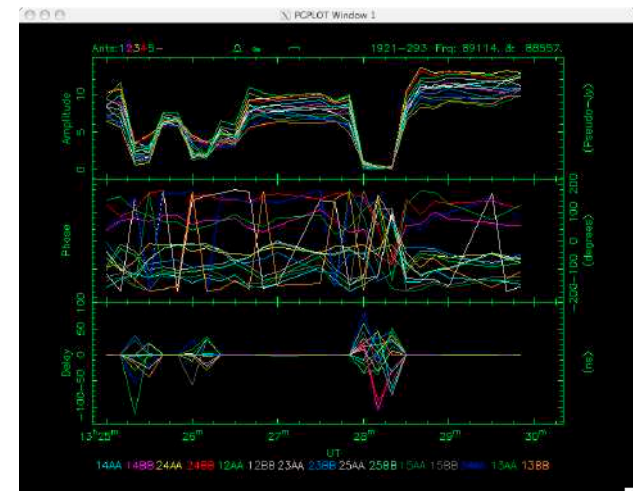
$$T_{\text{sys}}^{\text{eff}} = (300 \text{ K}) \frac{P_{\text{sky}}}{P_{\text{paddle}} - P_{\text{sky}}}$$

- Every ~15 mins (often every second phase cal) and before primary and bandpass calibrators



## CABB Scheduler - c2639-sio.sch

#	Source	Cal	RA	Dec	Epoch	Time(LST)	ScanLength	Az	El	Drive	ScanType	Pointing	Freq-1	Freq-2
1	x1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:00:00	00:01:30	98:11:44.5	12:08:12.0	00:03:54	Point	Update	85908	87400
2	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:01:30	00:01:30	98:00:57.2	12:27:29.0	00:00:00	Paddle	Offset	85908	87400
3	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:03:00	00:01:30	97:50:10.0	12:46:46.4	00:00:00	Dwell	Offset	85908	87400
4	g025+02_86		17:46:02.704	-28:44:09.110	J2000	12:04:31	00:12:00	113:33:09.5	17:30:32.4	00:00:34	Mosaic	Offset	85908	87400
5	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:16:33	00:01:30	96:13:05.9	15:40:44.6	00:00:34	Paddle	Offset	85908	87400
6	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:18:03	00:01:30	96:02:18.0	16:00:06.6	00:00:00	Dwell	Offset	85908	87400
7	g025+02_86		17:46:02.704	-28:44:09.110	J2000	12:19:33	00:12:00	112:05:16.7	20:30:03.9	00:00:34	Mosaic	Offset	85908	87400
8	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:31:35	00:01:30	94:24:48.8	18:54:40.1	00:00:35	Paddle	Offset	85908	87400
9	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:33:05	00:01:30	94:13:56.1	19:14:05.4	00:00:00	Dwell	Offset	85908	87400
10	g025+02_86		17:46:02.704	-28:44:09.110	J2000	12:34:36	00:12:00	110:40:05.0	23:31:26.1	00:00:35	Mosaic	Offset	85908	87400
11	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:46:38	00:01:30	92:35:22.0	22:09:04.0	00:00:35	Paddle	Offset	85908	87400
12	1730-130	C	17:33:02.706	-13:04:49.548	J2000	12:48:08	00:01:30	92:24:19.6	22:28:31.5	00:00:00	Dwell	Offset	85908	87400
13	g025+02_86		17:46:02.704	-28:44:09.110	J2000	12:49:38	00:12:00	109:17:17.2	26:34:29.0	00:00:35	Mosaic	Offset	85908	87400





# Summary and further information

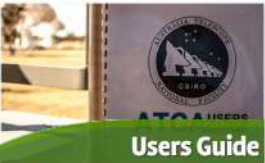

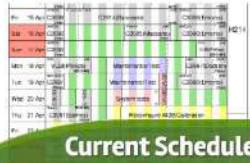

- Have a plan and make sure it is a good one!
- Different science goals require different strategies so think carefully about what is required
- See ATCA webpage for further information and links to other resources:

<http://www.narrabri.atnf.csiro.au/observing/>

### ATCA Observing Information

Recent News – Also see the [Current Issues](#) page

- 19 July 2017
  - Updated news on [direct flights from Sydney to Narrabri and Brisbane to Narrabri](#)
- 5 June 2017
  - The user feedback survey link was fixed.
- 1 June 2017
  - The users guide has been updated to include information on how the rapid response mode works and how to use it.
- 15 May 2017
  - The link to the old Java-based Virtual Radio Interferometer was replaced by one to the new [Friendly Virtual Radio Interferometer](#). Huge thanks to Cormac Purcell and Roy Truelove for developing this excellent and useful tool.

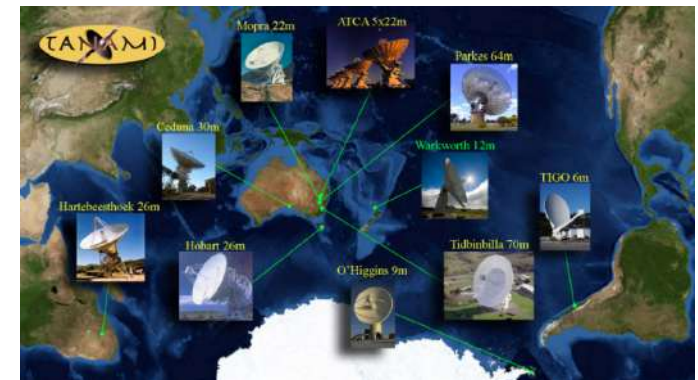


# Turning your plan into a compelling proposal



# A little about the process

- There are two proposal rounds a year (15 Dec and 15 Jun for the APRS and OCTS, respectively)
- The ATNF receives ~150 proposals a semester
- The TAC is made up of 9 members and ~12 readers and they proposals from Parkes, ATCA, Tid and the LBA
- Each proposal is reviewed by two TAC members and two readers
  - Each gives a grade and comments
  - Grades are finalised during the TAC meeting (held around a month after the proposal deadline)
  - Grades given to the scheduler (Jamie for ATCA, Jimi for Parkes)
- On the ATCA ~35% proposals get most of their time, ~15% get some and ~50% get none



Dense Gas Across the Milky Way - The ‘Full-Strength’ MALT45

Name
G336-G343

Total time for eem

**Summary:** We will build on Australia’s rich tradition of spectral line legacy surveys (e.g. [5, 6, 18, 30, 10]) and deliver a dense gas survey of the Galactic plane to address a wide range of astrophysical challenges. This survey will provide an essential dataset on the large-scale gas distribution and the clearest picture of Galactic structure to date: the distribution of the densest gas will be uncovered, and, combined with data from a number of other surveys will allow us to trace the cycle of material through the interstellar medium (ISM) and into stars. We already know the warm dust, cold dust, diffuse atomic and moderately dense molecular gas content of the Galaxy, and the dense gas provided by this legacy survey will **complete the picture**. Understanding our own Galaxy will provide the astrophysical template that allows us to interpret future sensitive, high resolution surveys of external galaxies with Atacama Large Millimetre Array (ALMA) and the Square Kilometre Array (SKA).

Understanding our own Galaxy is of the utmost importance to many branches of astronomy and astrophysics: “Our Galaxy, the Milky Way, is a benchmark for understanding disk galaxies....Galactic studies will continue to play a fundamental role far into the future because there are measurements that can only be made in the near field and much of contemporary astrophysics depends on such observations” [29]. Crucially, in order to understand galaxies we must solve one of the most fundamental mysteries of our Universe - one of the six ‘big questions’ posed in the 2016 Decadal Plan for Australian Astronomy: How do stars and planetary systems form? This project will directly address this fundamental question. Specifically, we will:

- Characterise the dense gas structure of our Galaxy through sensitive CS observations, allowing us to detect molecular clouds out to the far side of the Galaxy.
- Gain a new census of high-mass star forming regions (through CS, SiO, methanol masers and radio continuum observations) and directly test theoretical predictions of high-mass star formation and their precursors, feeding directly into future ALMA work on high-mass star formation.
- Produce an essential dataset that will underpin the Galactic plane survey in TeV ( $10^{12}$  eV) gamma-rays by the forthcoming multi-national Cherenkov Telescope Array (CTA) facility.

1 Background

*Star formation and the structure of our Galaxy*

High-mass stars ( $> 8 M_{\odot}$ ), have shaped galaxies throughout the Universe. In spite of the important role that they play, little is known about how they form. This is because they are intrinsically rare (about one in a million), form very quickly ( $< 100,000$  yrs) and in clusters, confusing contributions from individual stars. Their powerful stellar winds can halt the formation of the next generation of stars, or trigger star formation in adjacent clouds, then, during their time on the main sequence, they may inject as much momentum and energy into the Galaxy as a supernova explosion. Finally, they will explode as supernovae, enriching the ISM with heavy elements. Understanding how high-mass stars form is one of the most important topics in modern astrophysics.

Peak flux (mJy)

# Some advice

- Know your audience, know the rules
  - Write to astronomers but not an expert in your field
  - STICK to the rules. 3 pages means 3 pages.
- Make it clear what the key question/problem you are going to address and how you will achieve it
  - Don't wait to explain this!
  - What observations are you planning (demonstrate in the technical justification that your plan is good!)? How will they address the problem?
- Think about the people reading the proposal
  - Make it concise
  - Use clear language – please avoid acronyms and jargon
  - Make it enjoyable to read – story, background, motivation, what the important question is and how you will answer it. Why is it important? Why are the observations critical to help address the big question?
- Use figures
  - Make sure that they are relevant and support your proposal





# Most annoying things from the last proposal round

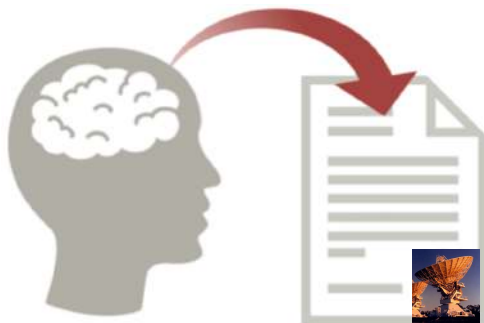
- Figures – relevance, axis labels!!!! Please make it so I can read them.

- SNR, SNRs, SN, CSM, ER, ALMA, ATCA, MWA, GLEAM, ICRAR, CAASTRO, NRAO, ESO, CSIRO, LMC, MCs, CABB, RMS, HI, SINGG, HIPASS, WISE,
- GALEX, DECam, CTIO, SFE, HST, ISM, SNe, SFR, VLA, HII, ASKAP, GASKAP, RFI, MC, GMC, SMC, UV, CNM, WNM, MW, ANU, CFB, FWHM, LST, WIMP,
- dSphs, CDM, GBT, EMU, SKA, UFDs, DM, ATOA, CABB, PNe, PN, AGB, IRAS, RMS, BW, IR, AGN, YSO, CMZ, WALLABY, PAF, ASKAPsoft, ACES, SUMSS, ASKAP-12, IMAGINE, BGC, HICAT, JVLA, IRAM, SMA, SDC, NANTEN, SEST, MAGMA, SUPERBx, FRB, SUPERB, GMRT, IGM, GLIMPSE, DM, HESS, LIGO,
- NSW, TDE, CHIME, MeerKAT, PPTA, CASS, ANDS, CGI, HIPSR, CGM, CSE, LBA, MM1, CM2, HartRAO.....

- In resubmitting address the TACs previous comments. If you don't it will piss the person off from the beginning. Do it! Even if the TAC was wrong!

# Do

- Ask for help and read successful proposals – writing good proposals is a skill that takes time to learn
- Give yourself enough time
- Put your work into broader scientific context and emphasise how the proposed observations address a problem
- Justify technical requirements!
- Make it enjoyable to read
- Use dot points to summarise main points (added benefit that they stand out and draw the reader's eye)
- Highlight progress in ongoing projects
- Write for a general astronomy audience



# Don't

- Make extra work for the people reading your proposal
- Ignore the TACs comments from previous rounds – explicitly address them
- Add figures unless they are relevant, you explain them and you can READ THE AXIS LABELS
- Use many acronyms
- Wait to deliver the punch line
- Ignore the rules (3 pages means 3 pages!)
- Assume that the TAC readers know why your science is important
- Just say you need a 6D array and a sensitivity of 40 mJy – justify!!!

