BIGCAT Update + Science Commissioning plans

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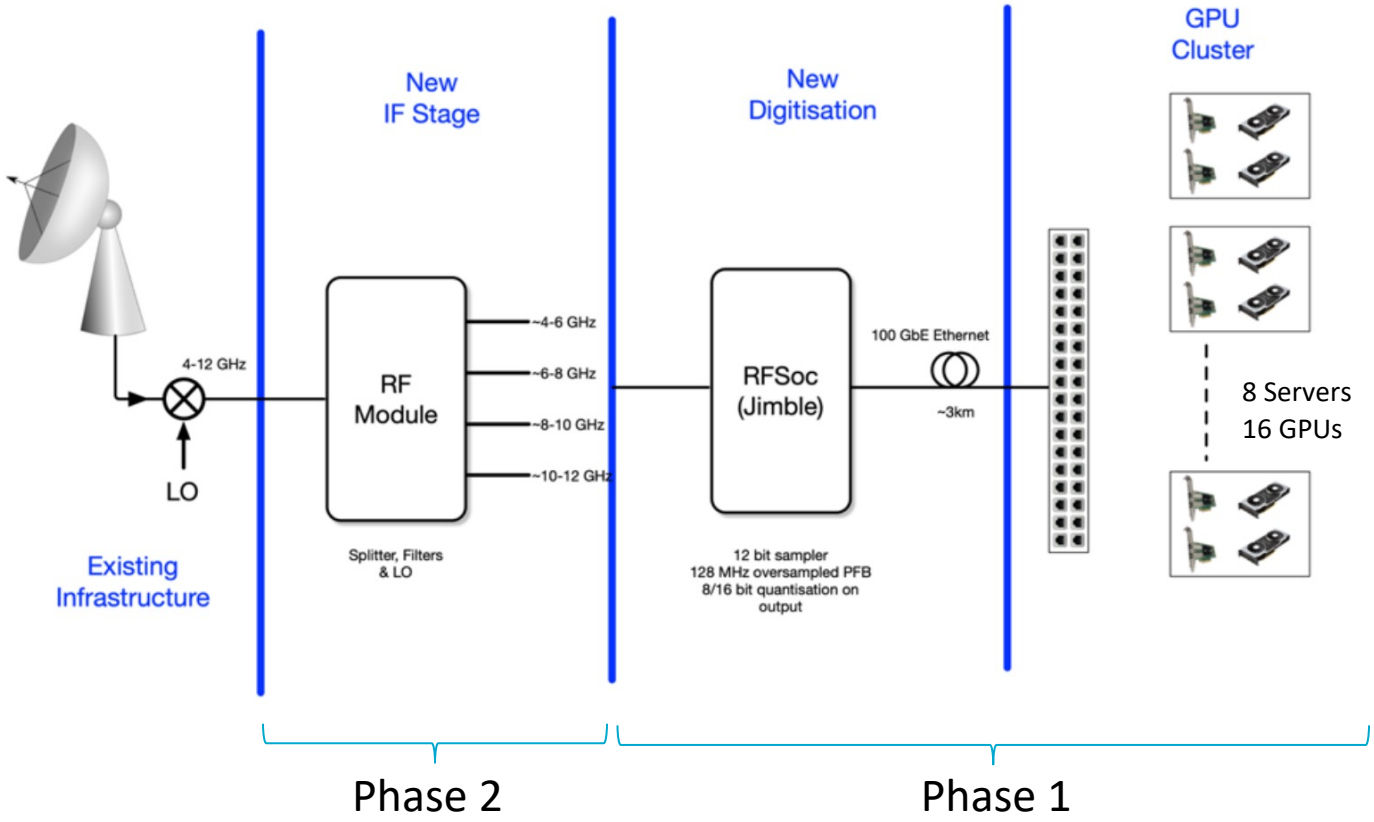
BIGCAT Overview

- BIGCAT: Broadband Integrated GPU Correlator for ATca
  - Replacement of CABB digitisers and correlator with a hybrid FPGA+GPU backend
- Key aspects of BIGCAT:
  - Double instantaneous bandwidth to ~8 GHz
  - Spectral resolution of at least 0.6 kHz
  - Improved reliability
  - More flexibility:
    - Many more options wrt. frequency resolution and integration times
    - Ability to change quickly between different observing modes
  - More adaptable to automated observing (e.g. rapid ToO follow-up)
  - Retain standard CABB features (e.g. mosaicing)

BIGCAT Overview



BIGCAT Overview

- What will change (from observer's view):
  - 4 x 2 GHz IFs
  - No CACOR
  - No re-booting blocks (no prog!)
  - New CAOBS
  - New Scheduler
  - New file format (RPFITS -> ASDM)
  - New archive (ATOA transitioning to CASDA)

- What won't change:
  - Antennas
  - Receivers

Archiving BIGCAT data

- BIGCAT files will use ASDM data format (ALMA Science Data Model)
  - MS filesystem (CASA compatible)
  - *atlod* in miriad will be updated to read in ASDM files

- Data will be archived in CASDA (see Minh's talk later today)
  - Estimating 0.5PB per year to archive
  - Max data rate of 100 Mbytes/sec
    - This will equate to some limit on spectral line modes available (e.g. high spectral resolution will require trade-off in bandwidth)
  - Observations will be identified with a SBID
  - Users will have the ability to extract and download portions of the data (e.g. a single IF/subband).
    - This functionality will not be available immediately

CSIRO

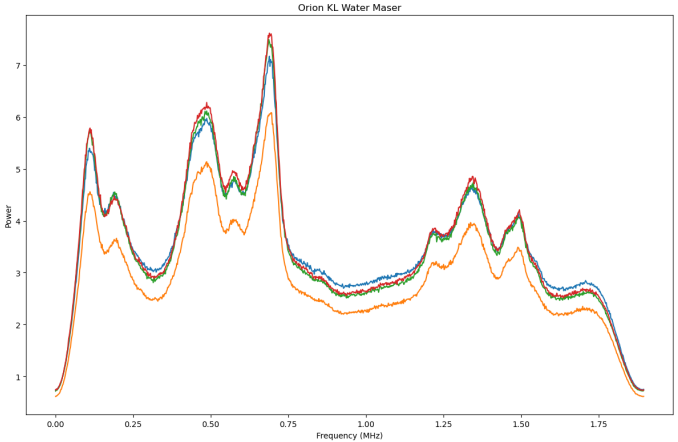
Recent updates

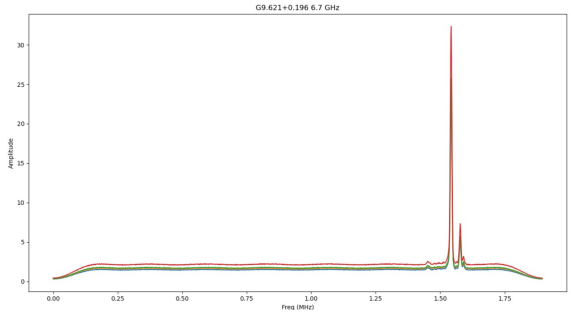
- Servers installed @ Marsfield
- First jimble installed and tested at ATCA (Dec. 2023)
- RF testing currently underway on-site (this week)
- BIGCAT scheduler almost complete
  - Web-based + built-in simulator
  - Currently being testing within commissioning team
- New staff hired to work on BIGCAT
  - Ian Morrison (GPU software engineer)
  - Stefan Osłowski (software engineer)
  - Chandra Murugeshan (commissioning scientist)

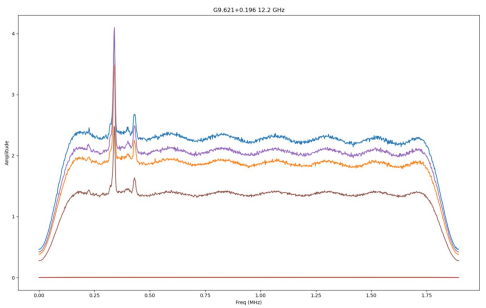

Photo: Chris Phillips

Recent updates – as of this morning

- Prototype RF hardware and one Jimble installed on 2 antenna in 1.5 days. Much faster than predicted.
- Observed 12.2 GHz Optus satellite and can clearly see signal
  - first time 12.2 GHz has worked on ATCA
  - Cross correlated the signal on 2 antenna.
- Observed the 22 GHz masers from Orion-KL (autocorrelations)
- Observed 6.7 + 12.2 GHz masers simultaneously (autocorrelations)

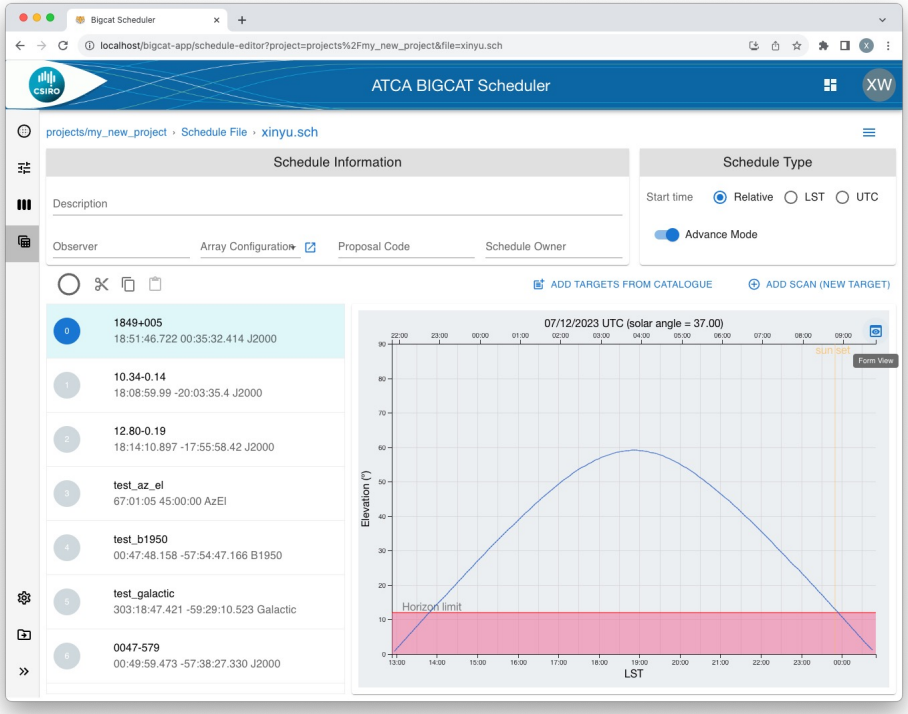






Credit: Chris Phillips

Recent updates – BIGCAT scheduler



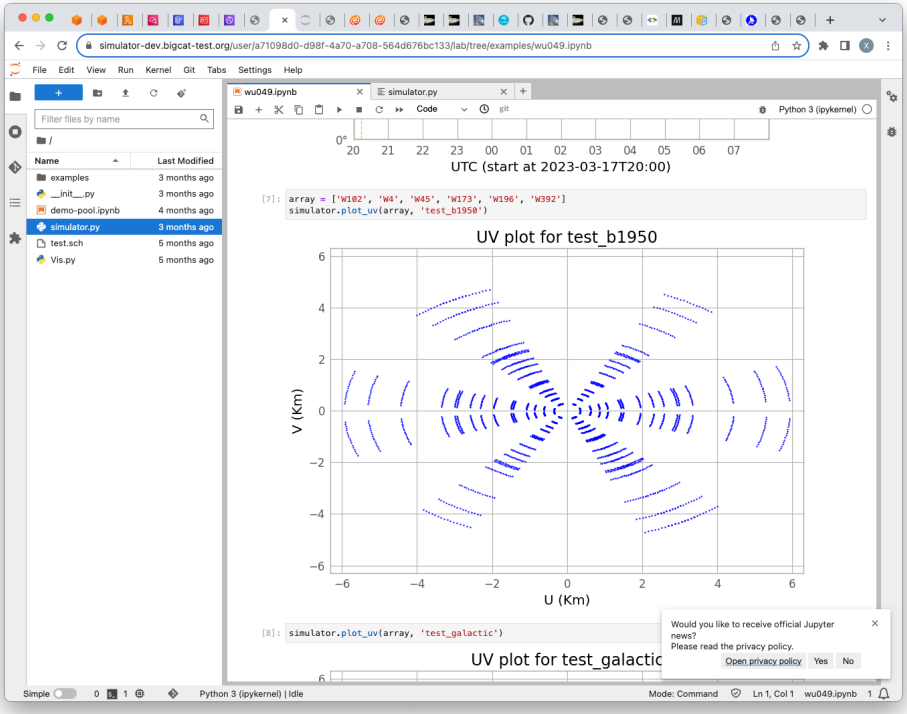
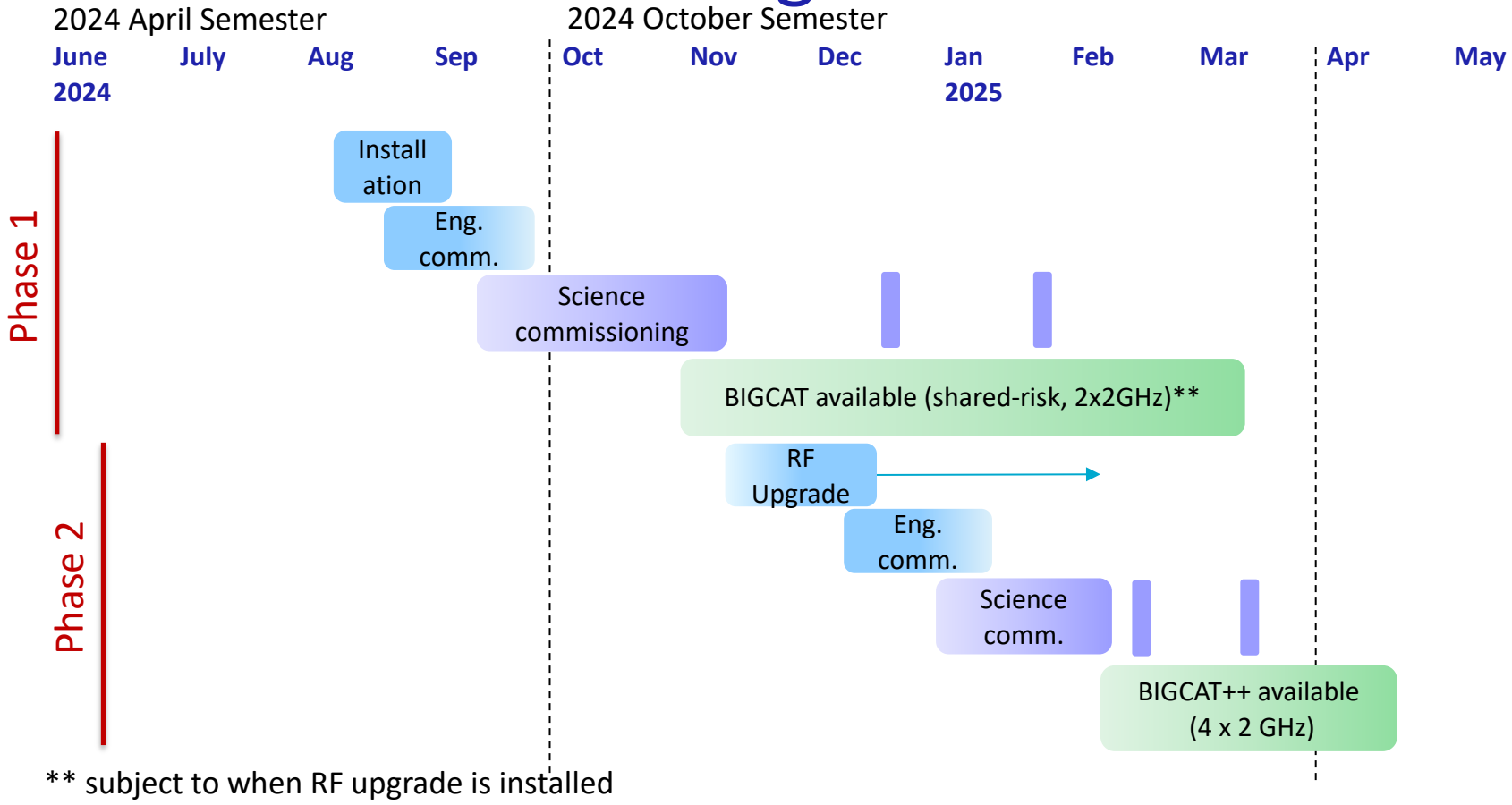


Image credit: Xinyu Wu

BIGCAT commissioning timeline

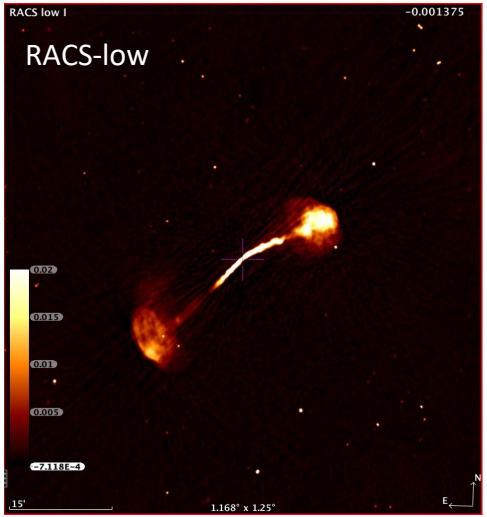


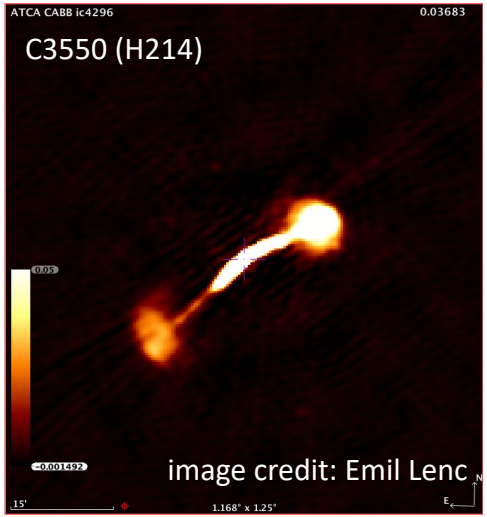
** subject to when RF upgrade is installed

Commissioning targets

Commissioning team has defined several ATCA verification fields – observed with CABB (proposal code C3550)

Target	Receiver/corr	Array	Functionality tested
IC4296	16cm, cont.	H214, 6D	Cont. imaging – extended emission
HIPASS J0732-77 ESO 245-G005	16cm + zooms 16cm + zooms	H214 6D	cm spectral line, diffuse emission cm spectral line + high resolution imaging
Various masers	12mm, 7mm + zooms	H214	mm spectral line, high spectral resolution
PSR J0742-2822	4cm, cont.	any	polarimetry
eCDFS	4cm, cont.	6D	Mosaicking mode
1934-638	all	any	Long track of 1934
Phase ref. pair	16cm, vlbi	any	VLBI/tied-array mode





BIGCAT observing modes

- Observing modes tested during initial science commissioning period:
  - Continuum + polarization
  - mosaicking
  - High spectral resolution mode
  - Basic VLBI mode (needs Parkes time during commissioning)
  - Automated rapid-response mode

- Additional modes to be commissioned once ATCA available to users:
  - 8 GHz bandwidth
  - Pulsar binning
  - Advanced VLBI
  - SSA/spacecraft tracking
  - Sub-arrays

Join the commissioning team

Everyone welcome!

email me: elizabeth.mahony@csiro.au

Responsibilities	Rewards
• Carry out observations of commissioning fields • Process data quickly • Prompt feedback of any issues • Contribute to documentation + tutorials	• Select commissioning targets • Be one of the first BIGCAT users • Become an expert BIGCAT user