Parkes Update

ATUC

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Overview

- NASA Voyager 2 tracking
- Receiver Development
 - Ultra wideband receiver low (UWL)
 - Ultra wideband receiver high (UWH)
 - Cryogenically cooled Phased Array Feed (cryo-PAF)
- Maintenance
- ATUC responses
 - Fast Radio Burst Mode update statistics on proposals
 - Documentation
 - Other items





NASA Voyager 2 tracking - completed!

- Voyager 2 tracking finished in February, having passed through heliosphere.
- Big team effort to support and coordinate, John Sarkissian, Jane Kaczmarek and Stacy Mader undertook the observations locally.
- Displaced projects accommodated in 2019 April Semester, mitigated impact with community and continued UWL development.
- 896.5 hrs allocation in 2018OCT, Breakthrough Listen 310hrs (~500 hrs to make up over coming semesters), FAST 329hrs (~120 hrs to make up), contract time ~45% for semester





The ultra-wide bandwidth low frequency receiver The 'UWL' – new front end, back end, control system









- 700MHz 4000 MHz
- ~20 K System Temperature
- Digitisation at focus
- GPU based backend
- Web interface control system
- Online Data Access ('DAP')



The ultra-wide bandwidth low frequency receiver **Science enabled**



J1559-4438 Pulse Profile across band

Telescope Operation System User Interface

- Undergoing rapid development
- Now Implemented:
 - TRACKING observing mode
 - CONTINUUM (Spectral-line) MEDUSA modes
 - Pulsar FOLD and SEARCH MEDUSA modes
 - FROG synoptic view and TPS monitoring
 - Medusa status/plots (no need to have separate web interface)
- Under development:
 - DRIFT, GRID and RASTER observing modes
 - Further pulsar community input for TCS -> TOS transition
 - Combined modes (FOLD/SEARCH) being discussed
 - VLBI "atsnap" style functionality
 - Automatic/dynamic scheduling (complex, needs community input)
- Expectation is all new projects will be using TOS/UI if observing mode(s) supported.







Ultra-Wideband High (UWH)

- Next step following/in conjunction with Cryo-PAF development
- UWL does job of 4 receivers previously, UWH (4-25) could cover 5 other receivers in fleet and negate need for receiver changes.
- Question of UWH or UWM (4-?) + UWH (?-25)
 - If split, how best to split?
- Science cases made Oct 2012 and Dec 2013 (available online), include:
 - Sensitive surveys of water and ammonia (argues for high freq. PAF?)
 - Maser astrometry through LBA flexible scheduling
 - Galactic centre multi-transition studies
 - VLBI in general
- Plus bistatic radar
- Question of what is still relevant today, what are the current drivers?



Cryogenically cooled Phased Array Feed The 'Cryo-PAF' - concept



- "MKIII" Cryogenically cooled 'Rocket' Phased **Array Feed**
- Prototype on dish testing (plus aperture tests) May 2016







- 700 MHz 2 GHz
- 3 x MB field of view (~4.5 deg @1.4 GHz)
 - sub-20 K Tsys

1.8





Cryogenically cooled Phased Array Feed The 'Cryo-PAF' - progress

- Electromagnetic design optimisation underway.
- Design of a two stage L-band (0.7-2.1GHz) prototype Low Noise Amplifier is complete and ready to be submitted to a foundry.
- cryo-cooler is being characterised with a test system.
- 4 Gigasample per sec Radio Frequency System on Chip prototype printed circuit board is being developed for digitisation at the PAF.
- A Structural-Thermal Module (STM) is in construction for the verification of the cryostat concept.
- Concept Design Review being held tomorrow with intention of completing the design work in Q1, 2020.
- Applied for Australian Research Council funding in 2020 (take 3)







Cryogenically cooled Phased Array Feed The 'Cryo-PAF' - science

Significant improvement in six key areas:

- 1. an improved receiver noise;
- 2. a wider field of view (3 x MB);
- 3. Nyquist sampling of the focal plane;
- 4. a wide front-end bandwidth;
- 5. greater aperture efficiency;
- 6. reduced baseline ripple.

Together = 10 to 30-fold increase in survey speed



Fast Radio Bursts – accurate fluence, low fluence sample Pulsars and Hydrogen – cost effective surveys, intensity mapping VLBI with ASKAP / zero spacing for ASKAP High-energy particles - entire moon limb view



Maintenance Updates

- Greasing improvements
- Telescope Azimuth Jacks being refurbished
- Azimuth gearbox leak fix underway
- Lower power on beam 2A of Multibeam being investigated
- Plus multibeam fridge in last week, offline until May maintenance week, maintenance week may need extending





Fast Radio Burst mode

- Offered option in OPAL submissions for 2019 APR semester
 - 37 proposals
 - 10 specified potential MB use
 - 8 opted in, 2 out
 - Essentially all of those 'in' are already using BPSR or preferring to observe with UWL
- Ability to implement mode fully has been limited with UWL commissioning priority (and has had low proposal pressure as above)
- Will continue to explore



Time after UT 19:50:01.63 (ms)



Contract Time

BREAKTHROUGH LISTEN

- First pass of Galactic plane survey completed, second pass started
- Now working with student on analysing pulsar data
- Detected commensal FRB
- Commensed UWL observations
- Potential work on flare stars
- ➤ Asteroid (514107) 2015 BZ₅₀₉ Price et al. 2019
- Fast Radio Burst with frequency-dependent polarization Price et al. 2019
- Wide-bandwidth digital instrumentation for the CSIRO Parkes 64-m telescope Price et al. 2018

~800hrs per semester, ~1000hrs in 2019APR, 2019OCT



National Astronomical Observatories of China Chinese Academy of Sciences

- To date, have confirmed 15 of FAST's 83 pulsar candidates (50 of which are visible from Parkes).
- 13 of the confirmed pulsars are now the subject of a long term timing and deep-study campaign.
- UWL used for 2 confirmations so far, primary receiver used for time
- Listing of projects and PIs now provided online for projects other than pulsar confirmations.

~400hrs per semester ~500 hrs in 2019 APR, 2019 OCT



Tracking Contract Time

	2017 APRS	2017 OCTS	2018 APRS	2018 OCTS	2019 APR
Contract	BL (1000hrs)	BL (850hrs)	BL+FAST (1220 hrs)	BL+FAST+NASA (1535hrs)	BL+FAST (1472hrs)
Other	(30 hrs UWL)	(40 hrs UWL)	(180 hrs UWL)	(213hrs UWL)	(87hrs UWL)
# Proposals	26 (3600hrs)	19 (3100hrs)	33 (3400hrs)	36 (2750hrs)	37 (2180hrs)
Cutoff grade	3.6	3.7	3.7	3.4	3.0
Projects 90- 100%	10	9	8	20*	21
Projects 40- 90%	5	3	7	7	8
Projects <40%	2	0	1	4	0
Projects 0%	9	7	17	5	2
Student PI success	33%	50%	50%	69%	100%



Documentation – webpages

- Jane Kaczmarek (+ science ops team) coordinating ongoing update of the Parkes Users Guide (PUG)
 - Work in progress currently, old/out of date material being removed
 - *Temporary* Google documents for observers currently to assist with UWL/TCS and UWL/TOS GUI usage – to be integrated with Users Guide for next semester
 - More new users has meant the documentation/information demand up
- UWL paper in preparation for submission
- Feedback on PORTAL welcome (link on login)
- Feedback on Users guide (https://www.cognitoforms.com/ATNF2/Park esUsersSurvey)
- Dedicated instance of OPAL for FAST projects set up, and now in use.



Interim draft UWL user guide

Please note this is a temporary user guide to assist observers using the UWL in the first few weeks of operation following commissioning (November/December 2018). Once the system is stable, this guide will be removed and the usual users guide will be updated to reflect the information. This guide currently has instructions for using TCS and TOS - the expectation is that TOS will replace TOS for UWL observing over the next the months.

Note that this guide assumes that you have had formal observer training and understand the use of the PORTAL, FROG and TCS, i.e. it is purely to assist with UWL observing .

pecifically you have issues with your observing then please remember to put in a Parkes fault report (email <u>parkes_support@csirc.au</u>) and/or contact a local staff member.

What you need to know about the UWL How to set up for UWL observations with Medusa and TCS

TOS/UI User Guide for UWL

Phase note this is a temporary user guide to assist observers using the Telescope Operating System User Interfect (TSUS) in the first few weeks of operation following commissioning (November/Desember 2018). Once the system is stable, this guide will be removed and the usual users guide will be updated to reflect the information. The expectation is that IOS will replace TGS for most modes of observing with the UVL observing over the next few months.

Note that this guide assumes that you have had formal observer training and understand the use of the PORTAL and FROG, i.e. it is purely to assist with UWL observing specifically.

Access to TOS/UI



Apollo 11 Anniversary

- Open Days on 20th and 21st July
- CASS and NASA staff involvement
- Telescope tours and 'The Dish' screening
- Will include PULSE@Parkes sessions
- Helpers & volunteers needed!



PULSE@Parkes (broadening reach & inclusivity)

- Public PULSE@Parkes run at Perth Astrofest
- Trundle Central and Aurora College Regional students @ Telescope
- NSW Dept. for Education Distance Education session in June
- Trialing remote students via CSIRO's Virtual Work Experience Program



Other Items

- 1PB of Parkes data now in the Data Access Portal
- 12m antenna at Parkes potentially available for some astronomy use
- Monitoring and alerting will migrate to Grafana web interface over time (from MONICA)
- Data rates can be very large with UWL
 - semi-automatic restrictions of data rates possible with TOS/UI, being investigated
- Telescope efficiency in relation to observer training/certification
 - with contract users with large teams, as well as new users with advent of UWL, further training and documentation required
 - potential revision of policies in relation to training certification, SOC/face-to-face compared with videocon
 - mixed use of portal bookings and general observer planning



Thank you

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