Parkes Fast Radio Burst National Facility detection mode

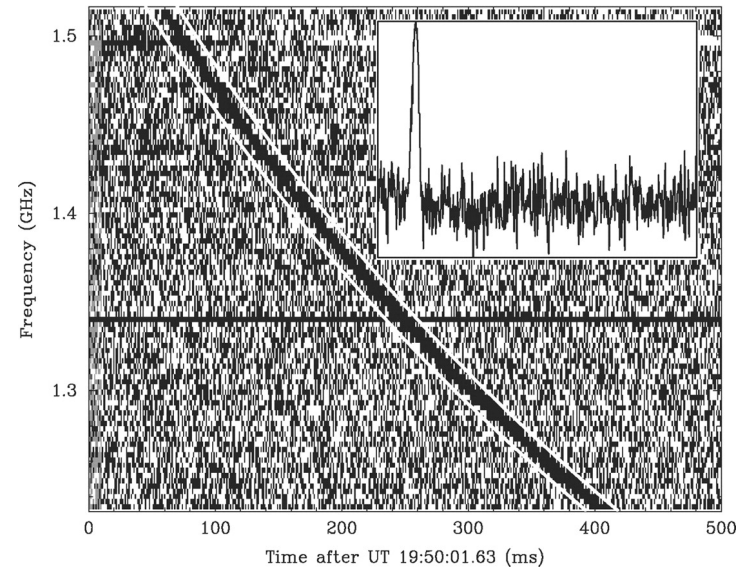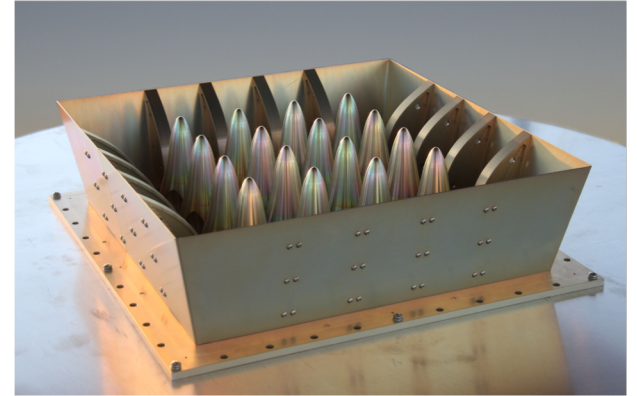## ATUC

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Overview

- Proposal Summary
- History & Context
- Proposal Details
  - Description
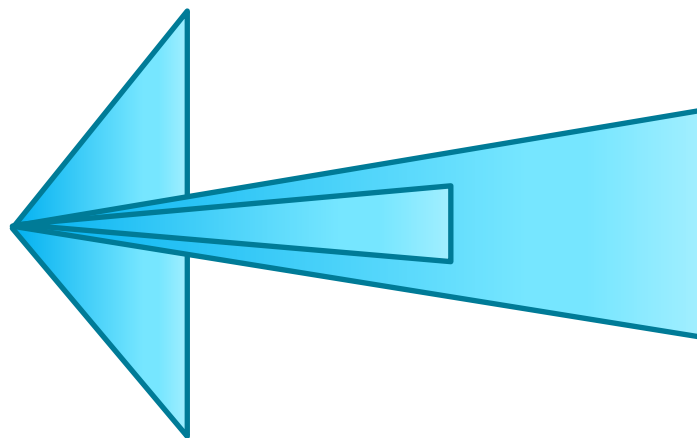 - Summary
  - Requirements
  - Discussion Points

Summary

We propose to operate the Parkes Fast Radio Burst (FRB) real-time detection system at all times that the Multi-beam receiver is on focus.
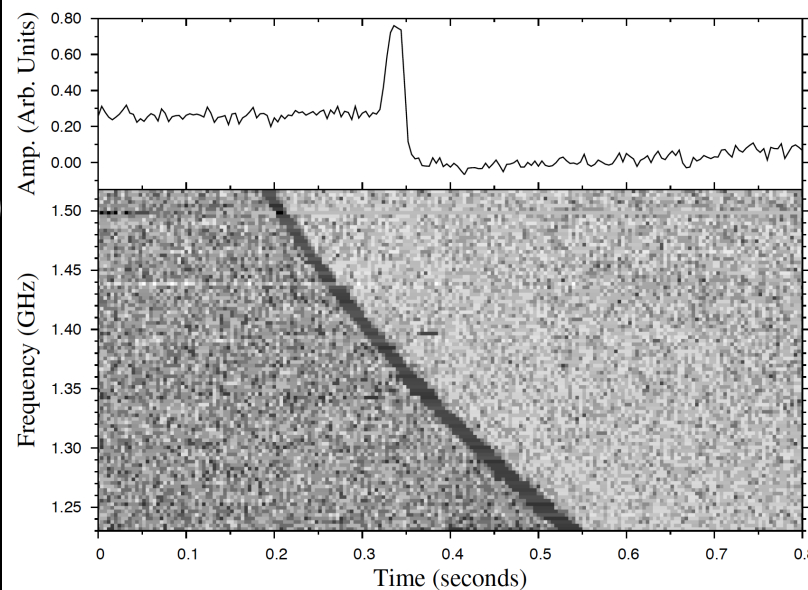
This includes:
- tracked observations
- wind stows
- slewing.

Maximises the FRB-discovery rate of Parkes (high gain) which is sensitive to the highest redshift FRBs for cosmological studies.

Complementary to ASKAP (less gain, much larger FOV)

WTF?!

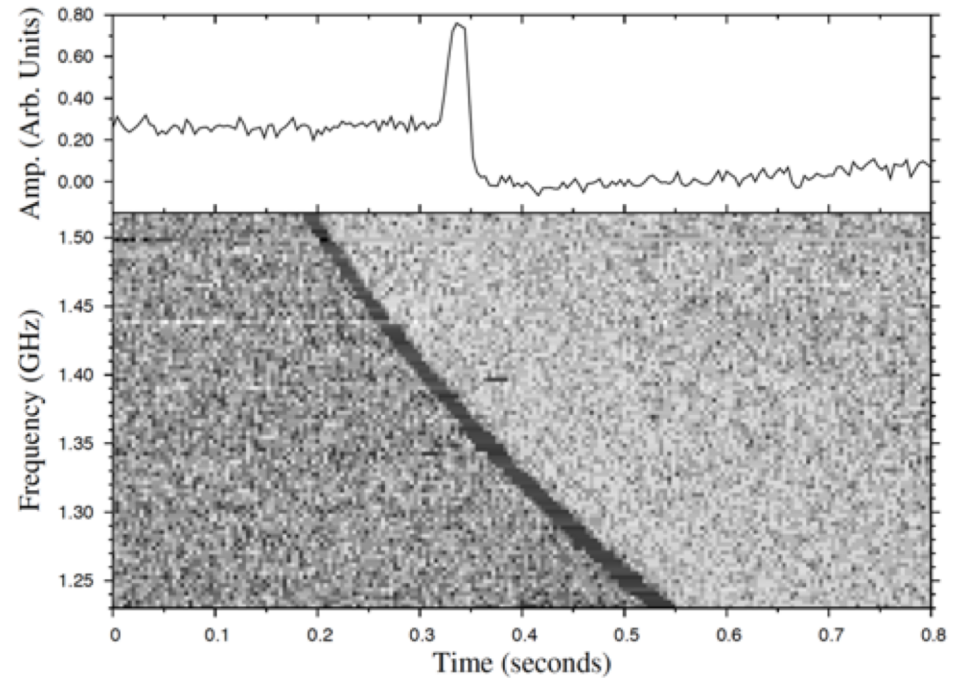de Selby & Keane, in prep.

History & Context
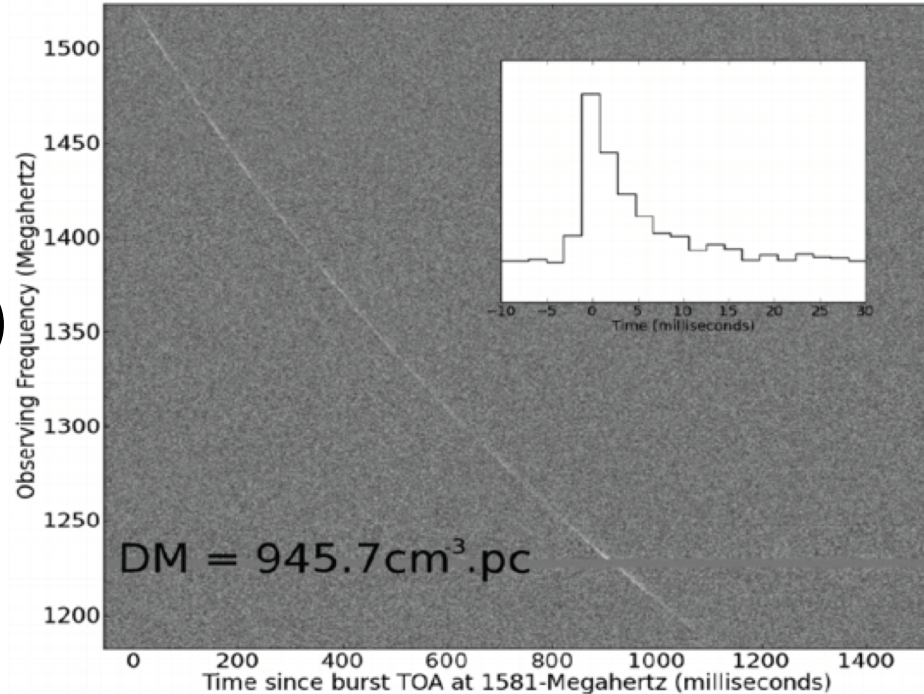

Lorimer et al. 2007, Science, 318, 777.

- FRB010724 discovered in archival search of SMC survey

- Dispersive delay 8.4x times the max MW contribution

- Cosmological!

- Nobody had looked for these before

History & Context

- FRB010621 found in PMPS
- HTRU High-lat survey (2008-2013)
- SUPERB (2014-today)

Keane et al. 2011, MNRAS, 415, 3065.

DM = 945.7cm^3.pc
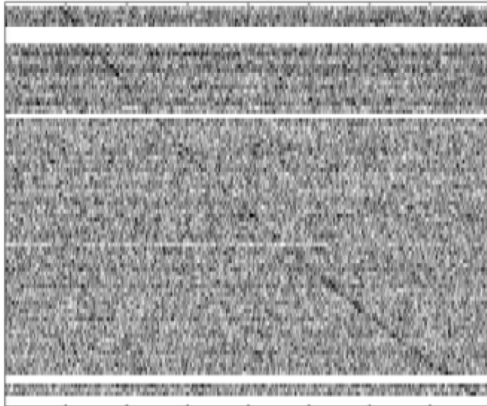
Thornton et al. 2013, Science, 341, 53.

- By 2017 HIPSR/BPSR/Heimdall system had become easy to use in parallel with MB observations
- PPTA and BL began doing that in OCT2017, and each have discovered FRBs doing that
- Recently FAST has begun also in APR2018

History & Context

- Parkes receiver development is building towards a cryogenically cooled Phased Array Feed (cryo-PAF)

- Envisaged that a continuously-running commensal FRB search, as proposed here, will be default mode of operation for the cryo-PAF.
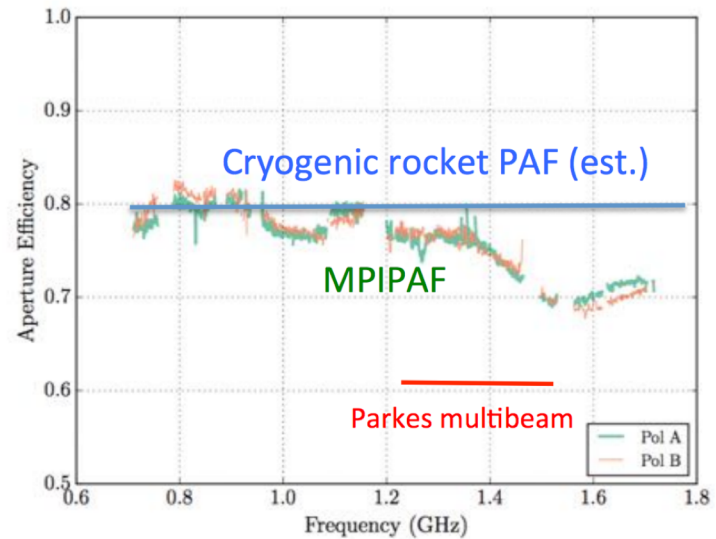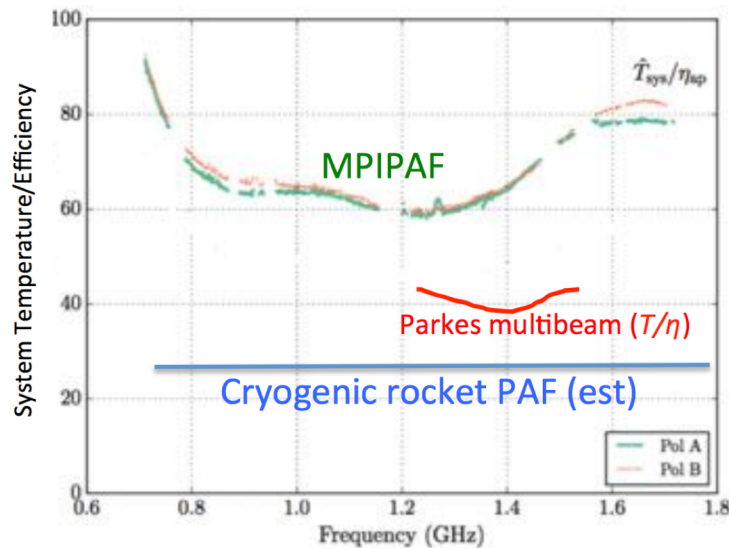
Proposal Details

- **Make it ATNF Parkes policy to run BPSR/HIPSR/Heimdall whenever the multi-beam is on focus**.

- FRB candidate events emailed to an exploder list consisting of national and international members experienced in FRB validation (membership will be open and inclusive, but subject to some initial training).

- Responsibility on the on-call member(s) of this FRB validation team to validate the detection (in case of a false +ive) and react accordingly, e.g. calibration observations ASAP, track for repeat bursts, triggering radio/multi-wavelength/multi-messenger follow-up, and coordinating a validated VOEvent + ATEL.

- Intention is validated FRB info distributed by VOEvent + ATEL in <1 hr and the data would be made publicly available within 24 hrs

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Proposal Details

- Essentially means that Parkes will search for FRBs using the Multi-beam for all the time that it can, maximising the scientific return. Number of FRBs scales linearly with Tobs.

- Counter-point is that future FRB-only detection proposals would effectively be excluded because they are not necessary*.

- Overall more FRB time, and data available to all provided through this scheme.

- Proposal can be easily extended to include ATCA.

* Excludes targeted regions not covered by other projects, the DM of repeats from (say) ASKAP/Molonglo FRBs.

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Summary Sequence

1. HIPSR/BPSR/Heimdall continually running

2. Detection made and event email sent to experienced users (the Parkes FRB Team, PFT)

3. Event validated by experienced users (PFT)

4. VOEvent generated

5. ATEL produced (target < 1 hr) and
   data made available (target < 24 hr)

6. Data (transient buffer, detection and cals) archived in DAP and accessible through system

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Requirements

- Automatically run BPSR when Multi-beam is on focus, or ask all observers to enable when observing.

- Enable BPSR to run during slewing as well, requiring acquisition of positional meta-data to reconstruct sky positions

- Set up a new FRB detection team, with an email exploder whose membership vet events and initiate follow-up activities.

- Set up software to publicly release (un-validated and, up to one hour later,) validated FRB VOEevent (not currently implemented).

- Enable a method to make data products available publicly ASAP.

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Requirements

- Further technical support for the BPSR software beyond the current single point of contact (A. Jameson, Swinburne): either in the form of training for existing ATNF personnel or the addition of appropriate skilled FTE.

- Single pointing durations need to be limited so as not to overwhelm the transient detection software (N x 1-hour pointings NOT 1 x N-hour pointing)

- A single project code that applies to the Heimdall/BPSR processed data to enable prompt archiving and data accessibility (e.g. 'PFRB')

- Estimate we need 1 FTE for 2 months for initial h/w and s/w set-up with ongoing maintenance support thereafter.

Queries (for ATUC and all Parkes Users)

- What acknowledgements are required for the FRBs and resultant publications – FRB data will be public within 24 hrs in the proposed model, but policies may be required around analysis/publications? Will a standard ATNF and FRB team acknowledgement suffice? Who 'owns' the FRBs?
We propose that the FRB is considered 'published by ATNF' at the point of issue of the ATEL and thence the data public.

- What method would be used for power level setting? (addressed in P737, existing system characterisation project) Will having all beams on for projects only requiring the central beam of the Multi-beam affect Tsys of the central beam?

- Could the data of single pulse detections from pulsars incidentally in the beams be recorded/utilised

- Allow projects to 'opt-out'?

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Thank you
Comments/Questions?

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