



ASKAP commissioning

presentation to ATUC

Dave McConnell

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www.csiro.au



Telescope status

BETA: 5 antennas still operating



ASKAP:

- 6 PAFs installed, on antennas 2, 4, 5, 12, 13, 14
- 48MHz of processing bandwidth installed and in use
- Fringes detected with all 6 antennas over this bandwidth

- 2nd 6 PAFs to be completed by end December
- 2nd 6 PAFs to be installed Jan-Feb
- Bandwidth up to 300MHz ~ end Feb

ASKAP Commissioning

Context

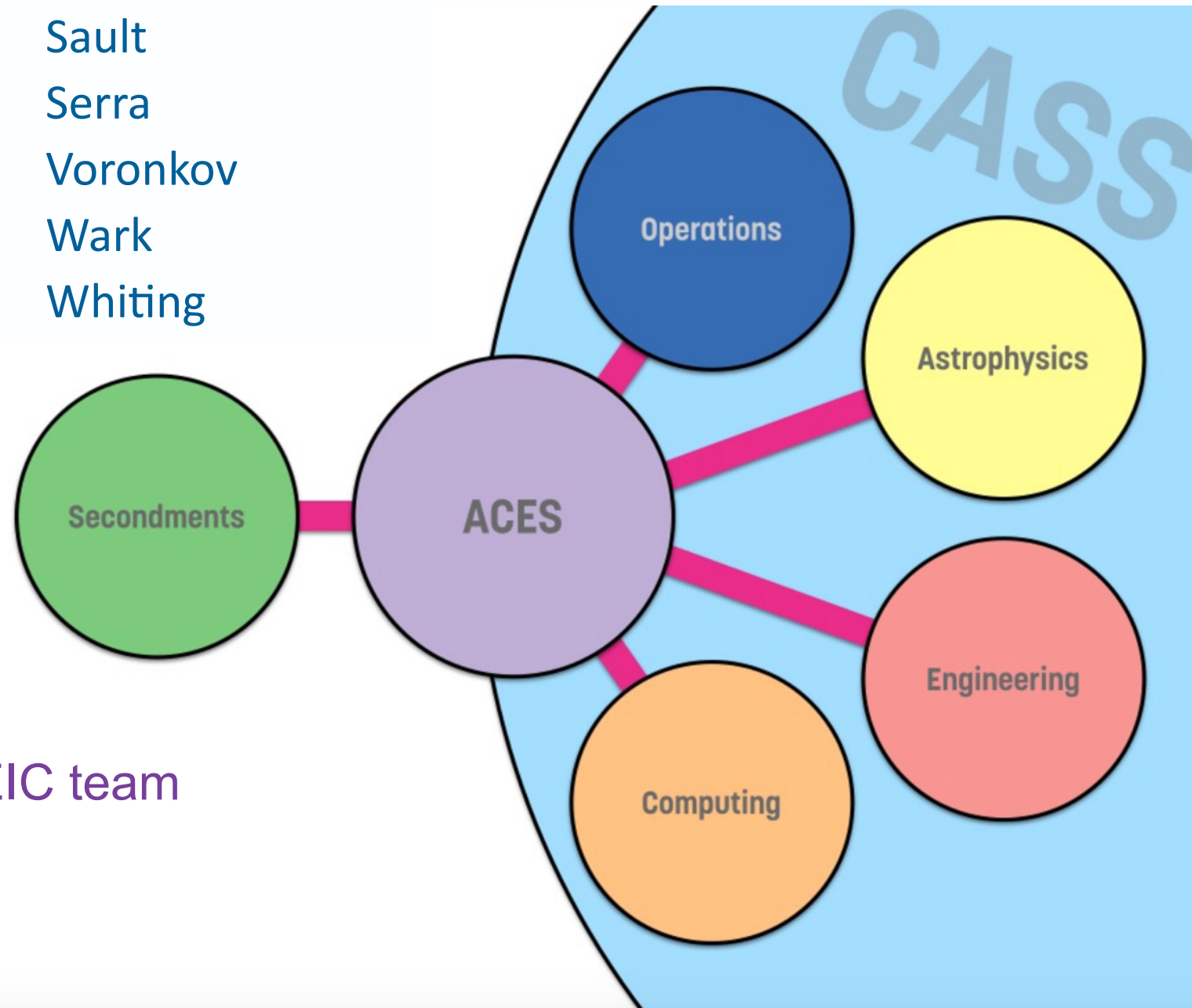
- Construction
 - Assembly, Integration & Verification (AIV = SEIC System Scientist)
 - Commissioning & Early Science (ACES)
 - Science
-
- Commissioning will, in the long term, merge into “Science operations”

ACES ASKAP Commissioning & Early Science

Allison
Bannister
Bell
Chippendale
Edwards
Harvey-Smith
Hegarty
Heywood

Hotan
Indermuehle
Kimball
Mader
Marvil
McConnell
Phillips
Popping

Raja
Reynolds
Sarkissian
Sault
Serra
Voronkov
Wark
Whiting

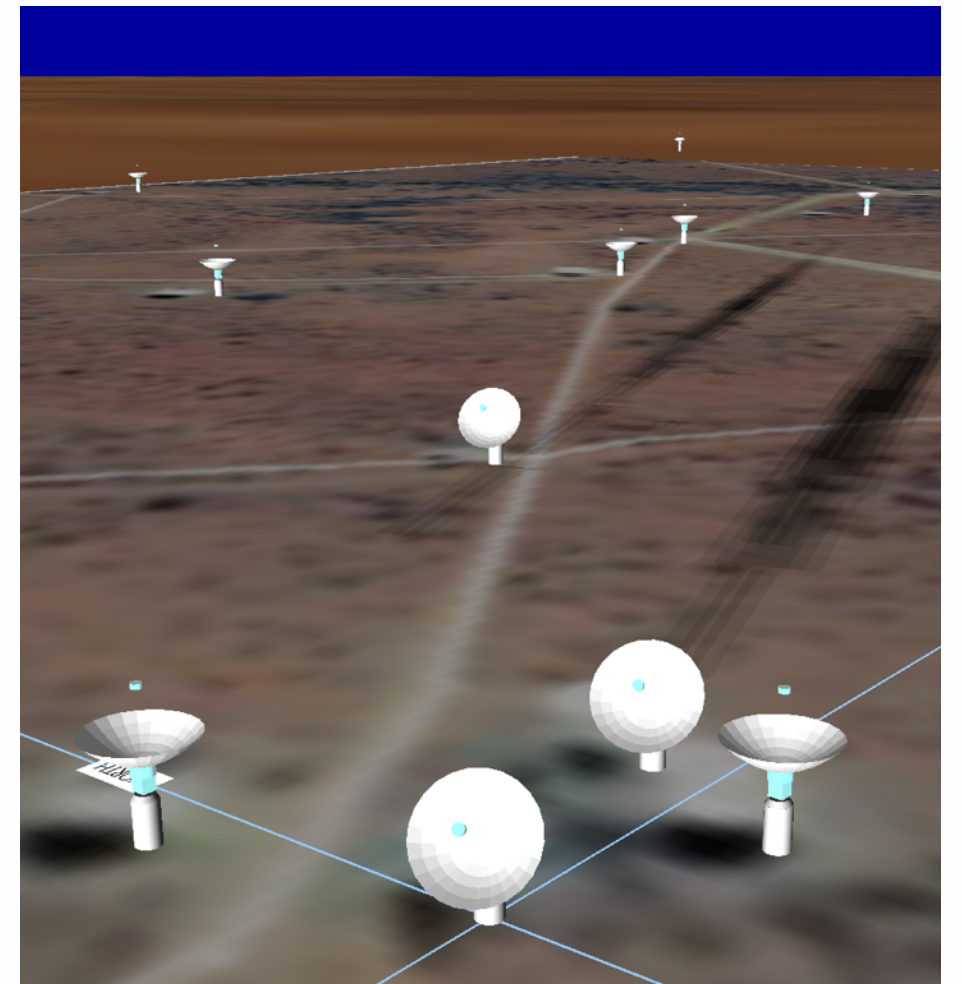


Overlaps with John Reynold's SEIC team

The utility of BETA

BETA has provided a test bed to:

- Test the functionality of all the major components of ASKAP
- Inform some design and implementation revisions for ASKAP (ADE)
- Develop methods, procedures and scripts for many aspects of operation
- Learn how to use the PAFs
 - beamforming and measurement
 - performance measurement:
 - Management of beam placement, sky coverage techniques.
- Gain experience with various observation types:
 - continue imaging
 - spectral imaging : emission and absorption
 - polarimetry



BETA results

Results I - Beams

Maximum SNR beamforming

- Holographic measurement
- Size and position determination

Beam stability

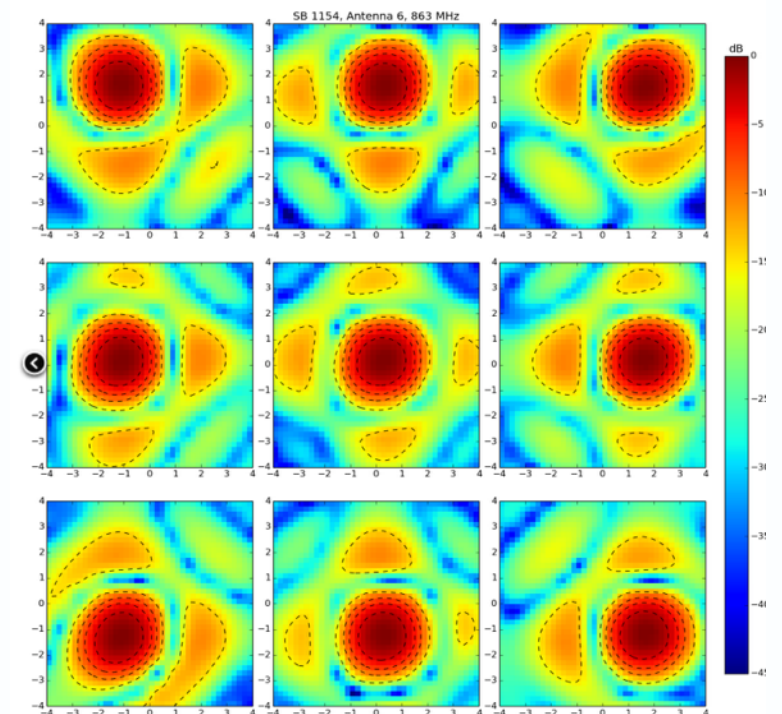
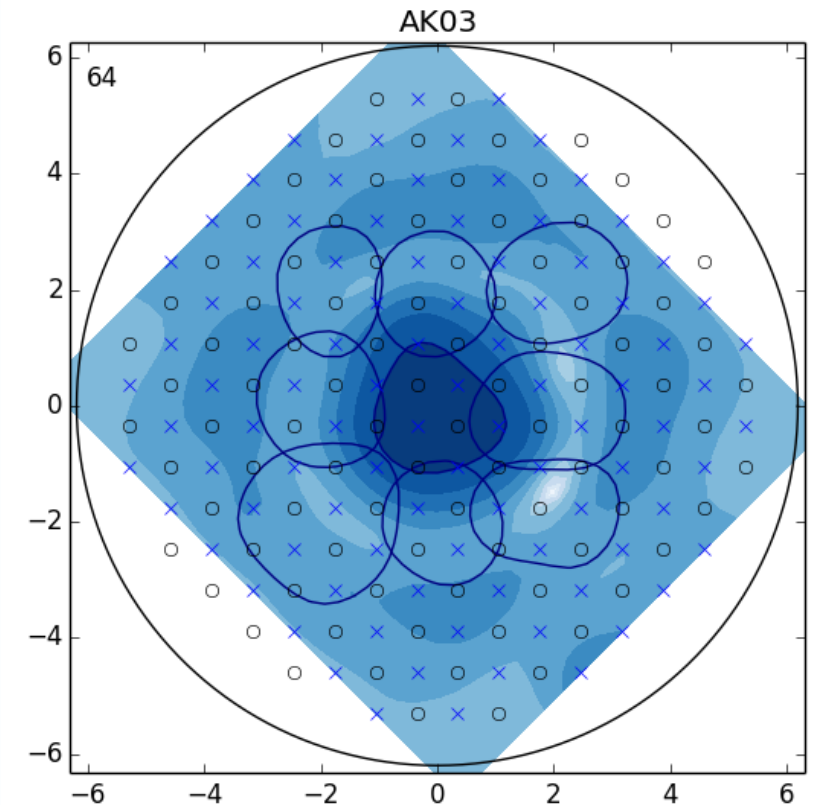
- Understanding of sources of “beam decay”
- Relating PAF element gain to beam stability

Uses for PAF “single port” beams

- delay calibration
- characterising PAF element reception patterns
- antenna pointing calibration

Shape-constrained beam forming

- successful demonstration using subset of elements
- more R&D necessary



Credit Aidan Hotan

Results II - Sensitivity

System Equiv. Flux Density (SEFD)

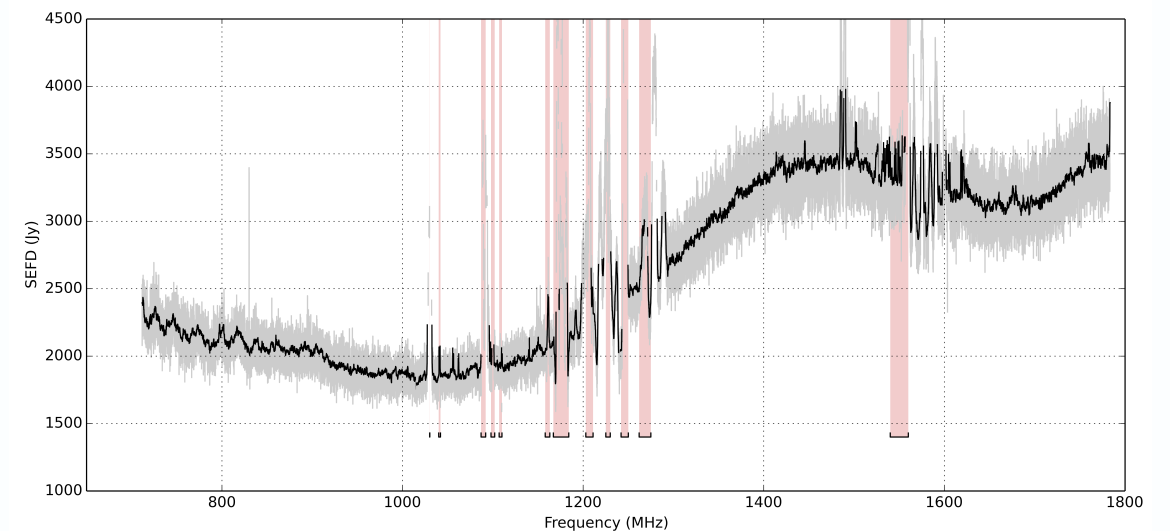
- Scale the observed noise against B1934-638
- Used as a diagnostic of beam quality
- Agrees with “aperture array” measures

T_{sys} and efficiency measures

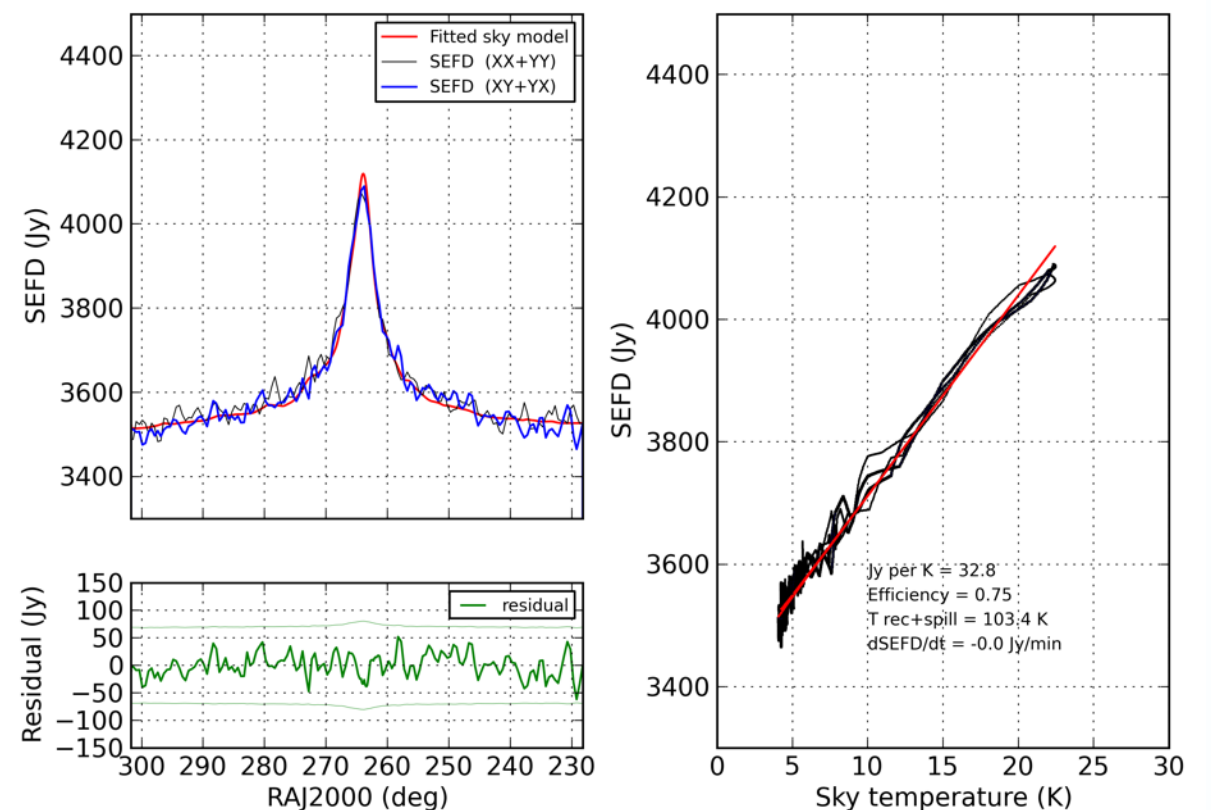
- Use Galactic noise as temperature reference
- Method developed using drift scan
- Aperture efficiency $\sim 70-75\%$
- Increasing agreement between various measures and modelling by Stuart Hay

From images

- Spectral images reach thermal limit
- Continuum images dominated by “sidelobe



AK03 1394.0 MHz



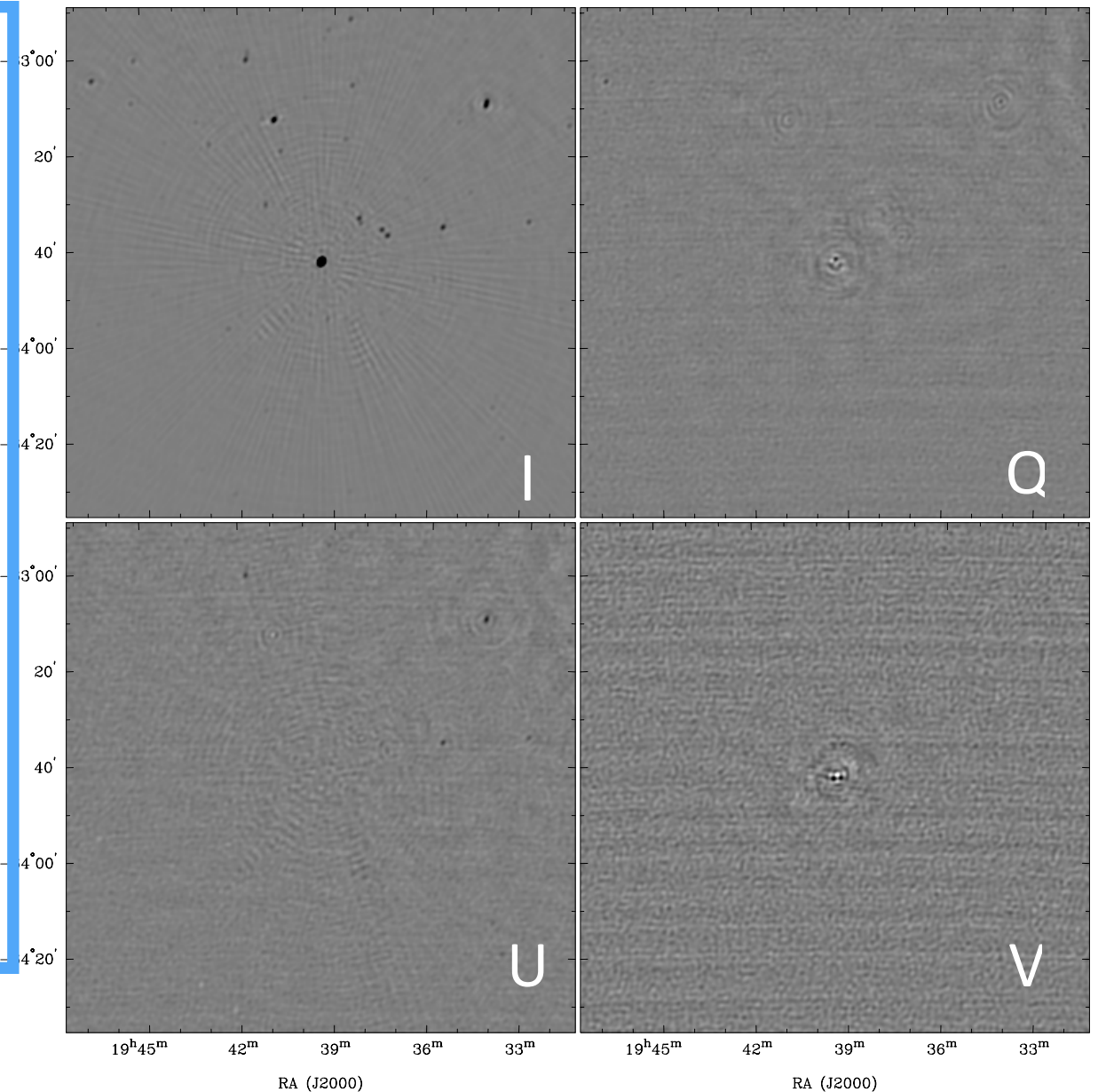
Results III - Polarization

BETA not fully suitable for polarimetry

- Detailed X and Y beam shapes not known in general
- No built-in XY phase measurement
- BUT ...

BETA is polarimetrically pure on-axis

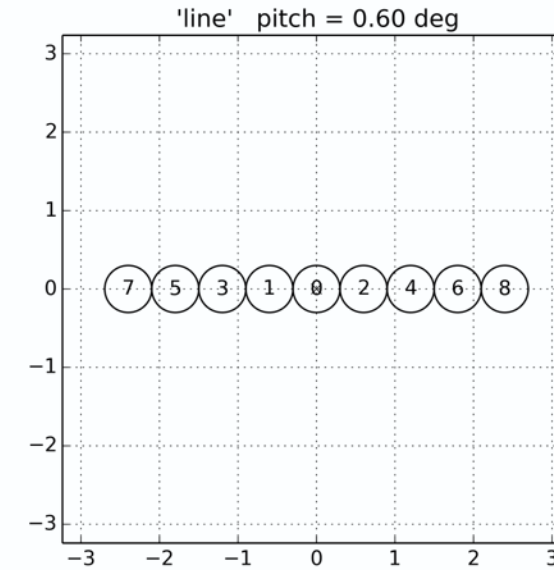
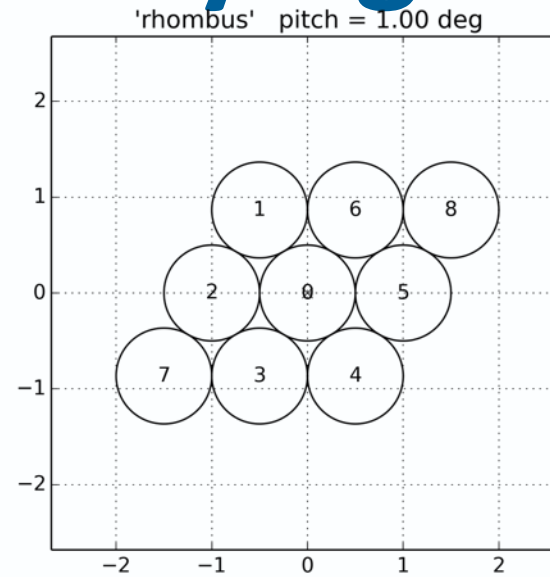
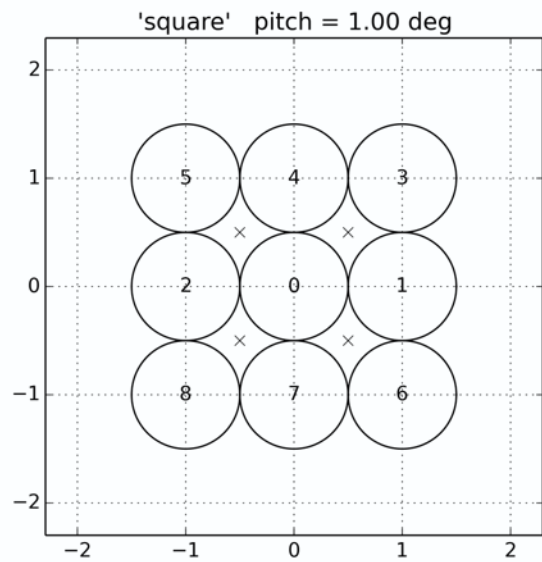
- XY phase measured using roll axis
- Leakages indistinguishable from zero, and stable, apart from roll-axis misalignments



OCE Postdoc opportunity !

Credit Bob Sault

Results IV - Surveying the Sky



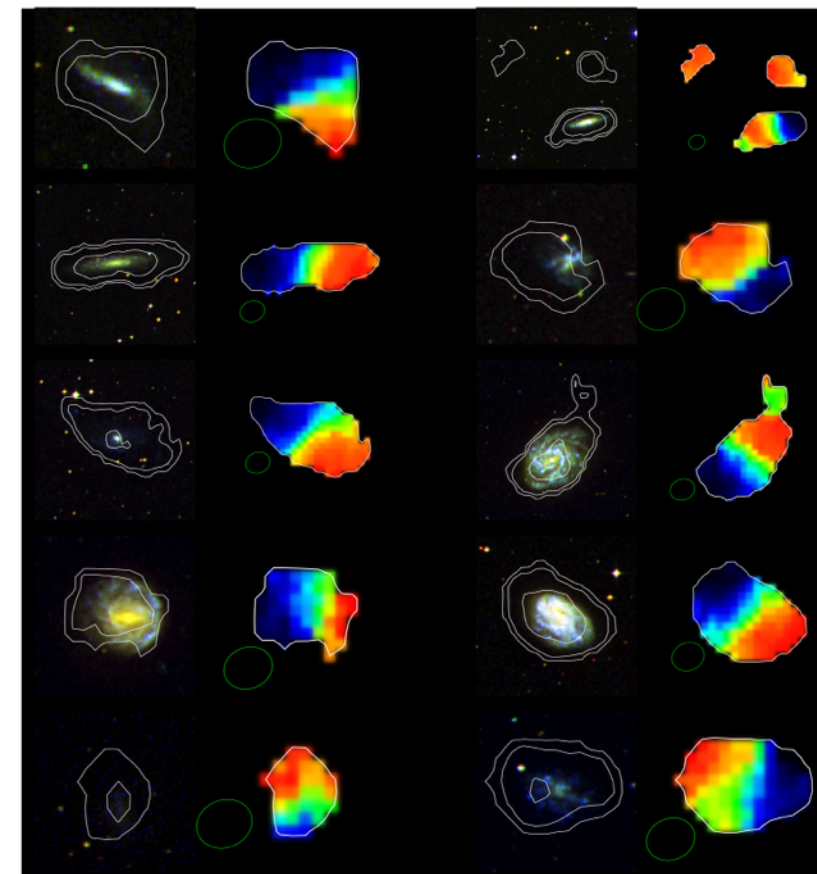
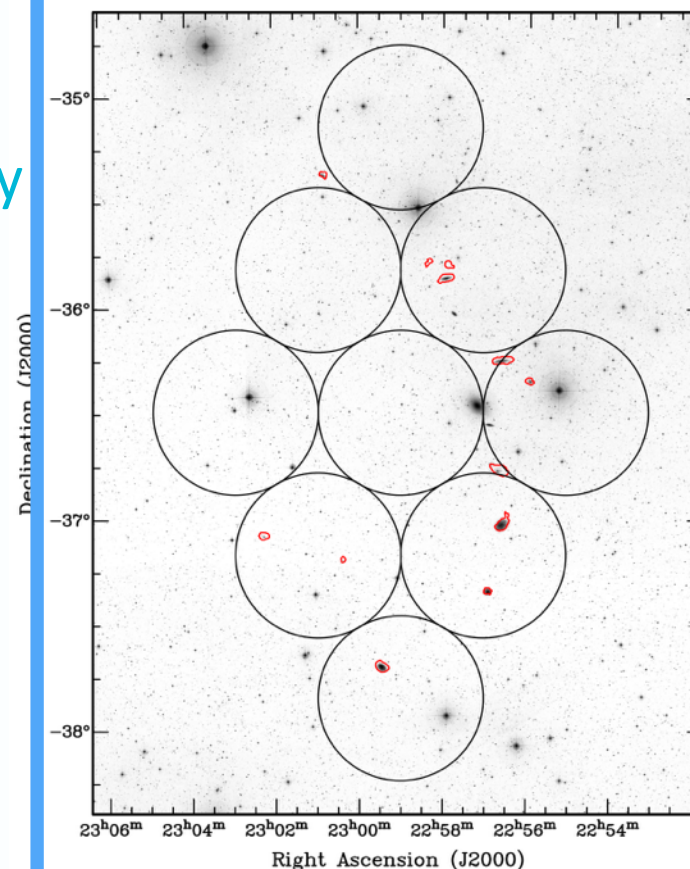
Arranging beams

- Patterns called “footprints”
- Strive for uniform sensitivity
- Avoid correlated noise
- Use “Interleaving”

Arranging footprints

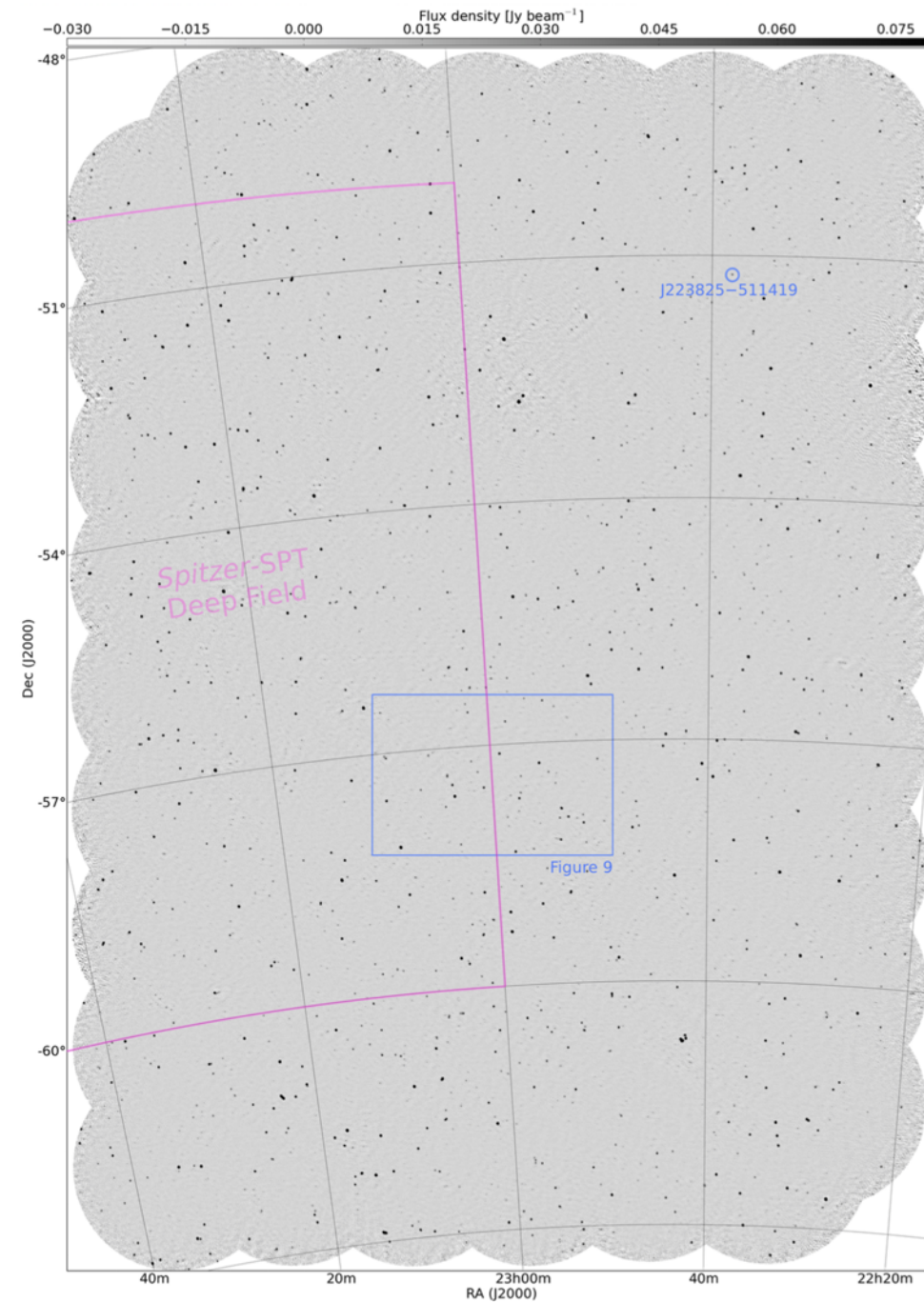
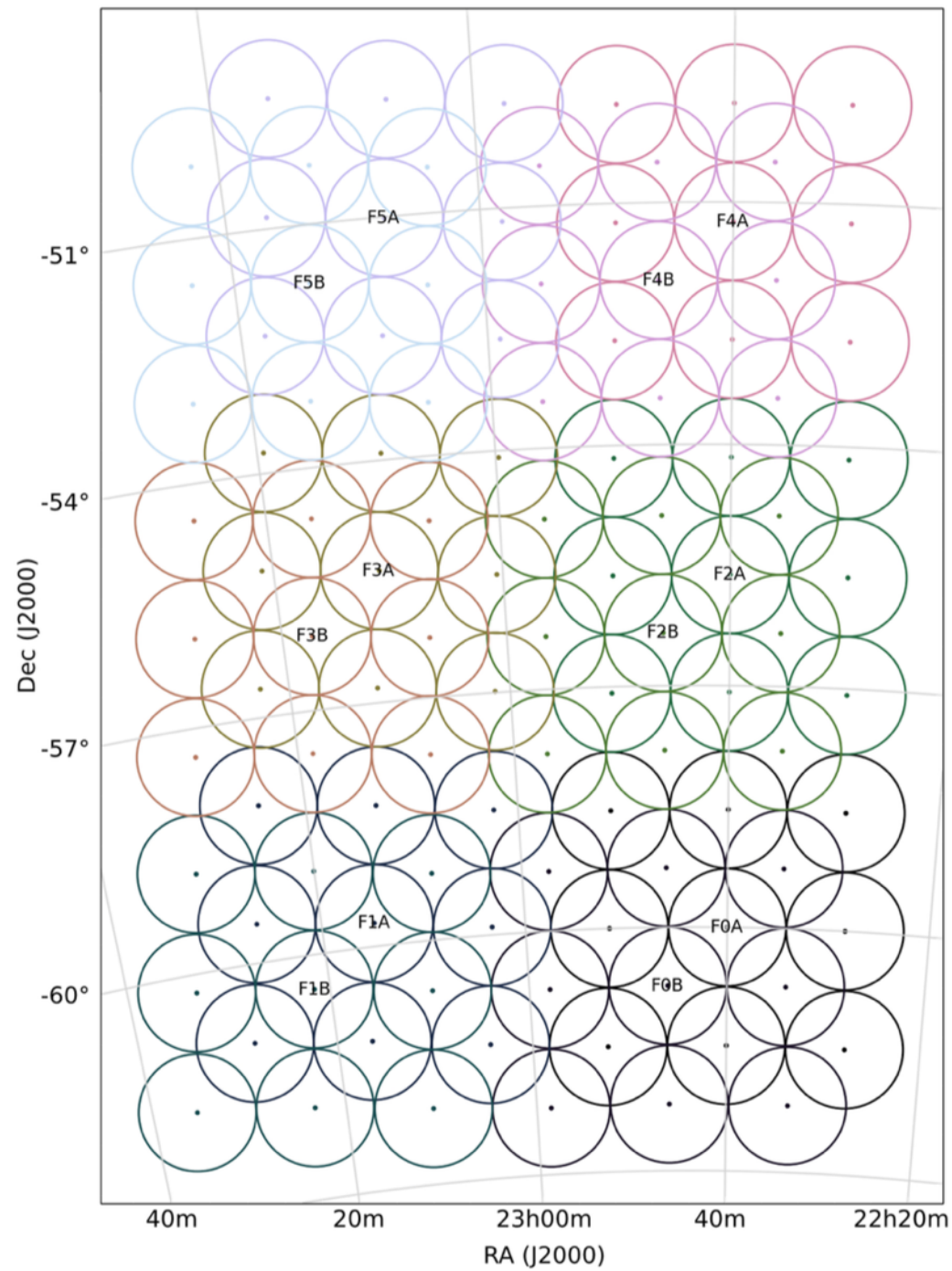
- called “Tiling”
- aim for “seamless” surveys
- not possible for whole sphere

Imaging of HI in the galaxy group IC 1459



Credit Paolo Serra

Results IV - Surveying the Sky



Credit Ian Heywood

ACES Technical Memos & Papers

ACES memo series (ASKAP Commissioning & Early Science)

This series of *ASKAP Memoranda* presents material arising from ASKAP Commissioning & Early Science (ACES) activities.

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▪ <http://www.atnf.csiro.au/projects/askap/ACES-memos>

Title	Author 1	Date	Link
001 Beam geometry in ASKAP	Reynolds, J.E.	2014-06-24	4.4 MB pdf
002 Initial characterisation of BETA polarimetric response	Sault, R.J.	2014-09-22	372 kB pdf
003 The ASKAP Roll Axis—Preliminary study of its benefits to calibration and imaging	Heywood, I.	2014-09-22	2.2 MB pdf
004 Delay calibration of the Phased Array Feed using observations of the South Celestial Pole	Bannister, K.	2014-09-29	1.4 MB pdf
005 ASKAP antenna aperture efficiency estimation	McConnell, D.	2015-06-03	2.2 MB pdf
006 The outer six antennas and the WALLABY and EMU survey times for a 30 PAF ASKAP array	Heywood, I.	2015-05-07	1.2 MB pdf
007 Widefield polarimetric considerations for ASKAP	Sault, R.J.	2015-05-05	714 kB pdf
008 Optimisation of the 2-km core of ASKAP-30	Westmeier, T.	2015-05-12	844 kB pdf

[BETA description](#)

Hotan et al., PASA, 2014

[HI emission](#)

Serra et al., MNRAS, 2015

[HI absorption](#)

Allison et al., MNRAS, 2015

[Pilot multi-epoch continuum survey](#)

Heywood et al., MNRAS [submitted]

[Intermittent pulsar observations](#)

Hobbs et al., MNRAS [submitted]

BETA shortcomings

No built-in gain calibration

Restricted to 9 beams (dual pol)

Has not implemented “per beam” phase tracking

Suffers from some self-generated RFI

BETA has poor radiometric performance above 1.1 GHz

ASKAP commissioning

(from the recently rewritten “ASKAP Commissioning plan”)

Beam forming

Go to 36 beams; continue R&D for advanced beam forming methods

On Dish Calibration system

Develop (from scratch) methods using ODC for gain stabilisation, XY phase measure, PAF diagnostics, etc etc

Calibration strategy

Continue R&D into optimal calibration methods: bandpass, gain vs time, self-cal with and without sky models

Polarimetry

Extend methods to true wide-field polarimetry: use ODC, better beams, ionospheric data.

High spectral resolution

High spectral resolution capability will be introduced soon: develop methods for cal'n transfer from wide to narrow channel data

ASKAPsoft

Continue program of comparisons between ASKAPsoft and “ACES pipelines”

Software upgrades

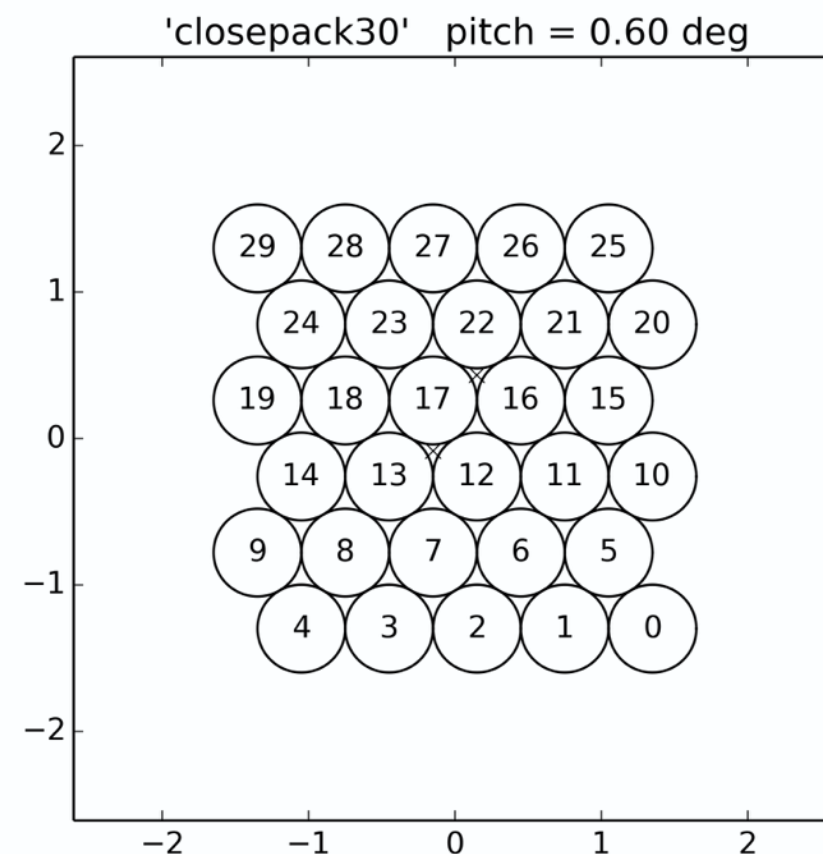
Software developed for BETA needs adapting to ASKAP.

Array calibration and characterisation operations

Delays, pointing, sensitivity, beam forming and measuring, ...

Training and documentation

The training of ASKAP operational support staff and the preparation of operational documentation falls in the scope of this plan.



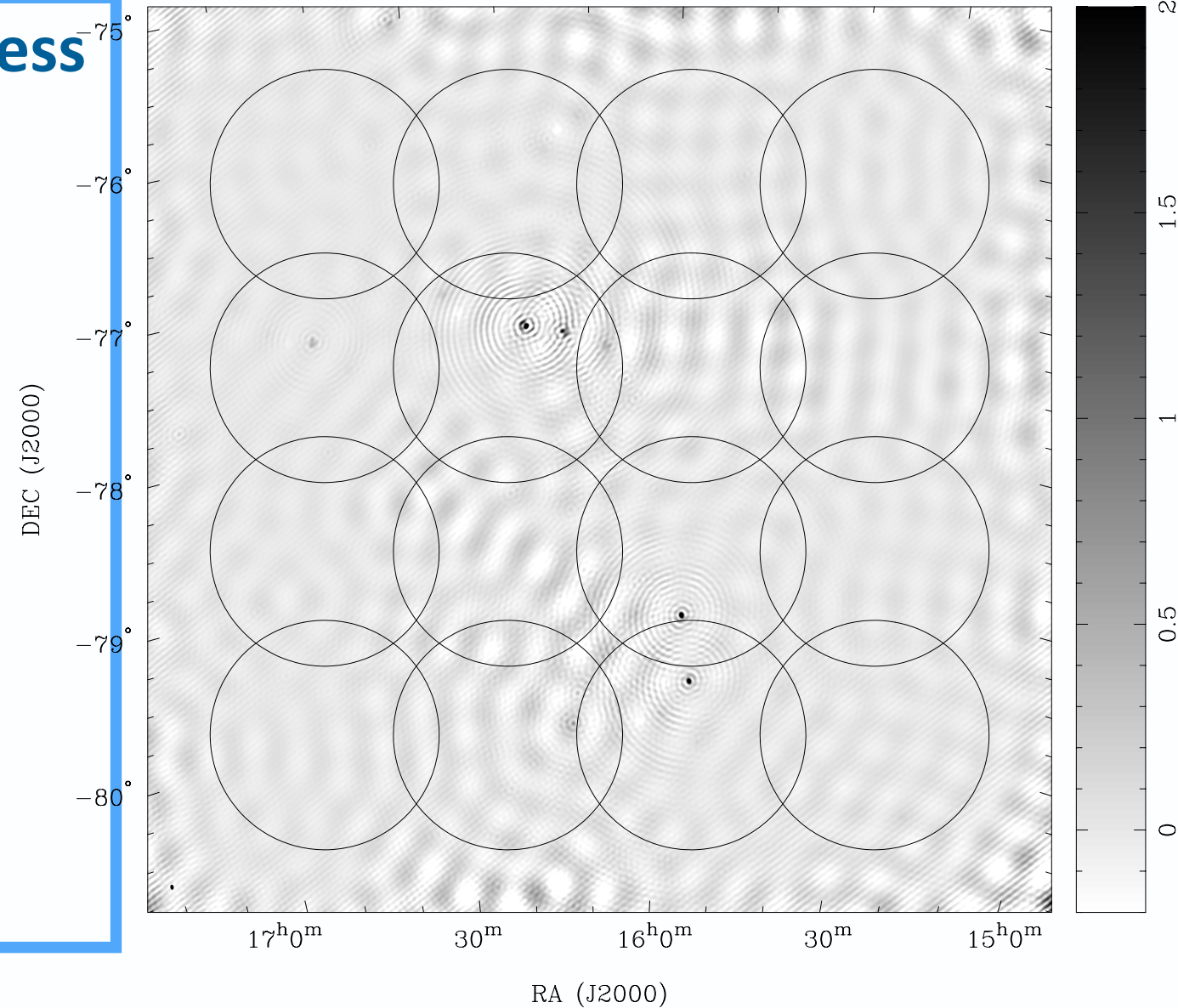
Current status

Commissioning (AIV) session in progress

- 1st 6 antennas, 48MHz bandwidth
- Developing use of up to 36 beams
- Data ingest to Pawsey
- Aim for “ACES-ready” system in December

On-Dish-Calibration

- prototype on AK29
- Basic functionality proven
- Production has begun
- 2nd pre-production unit to go on AK14

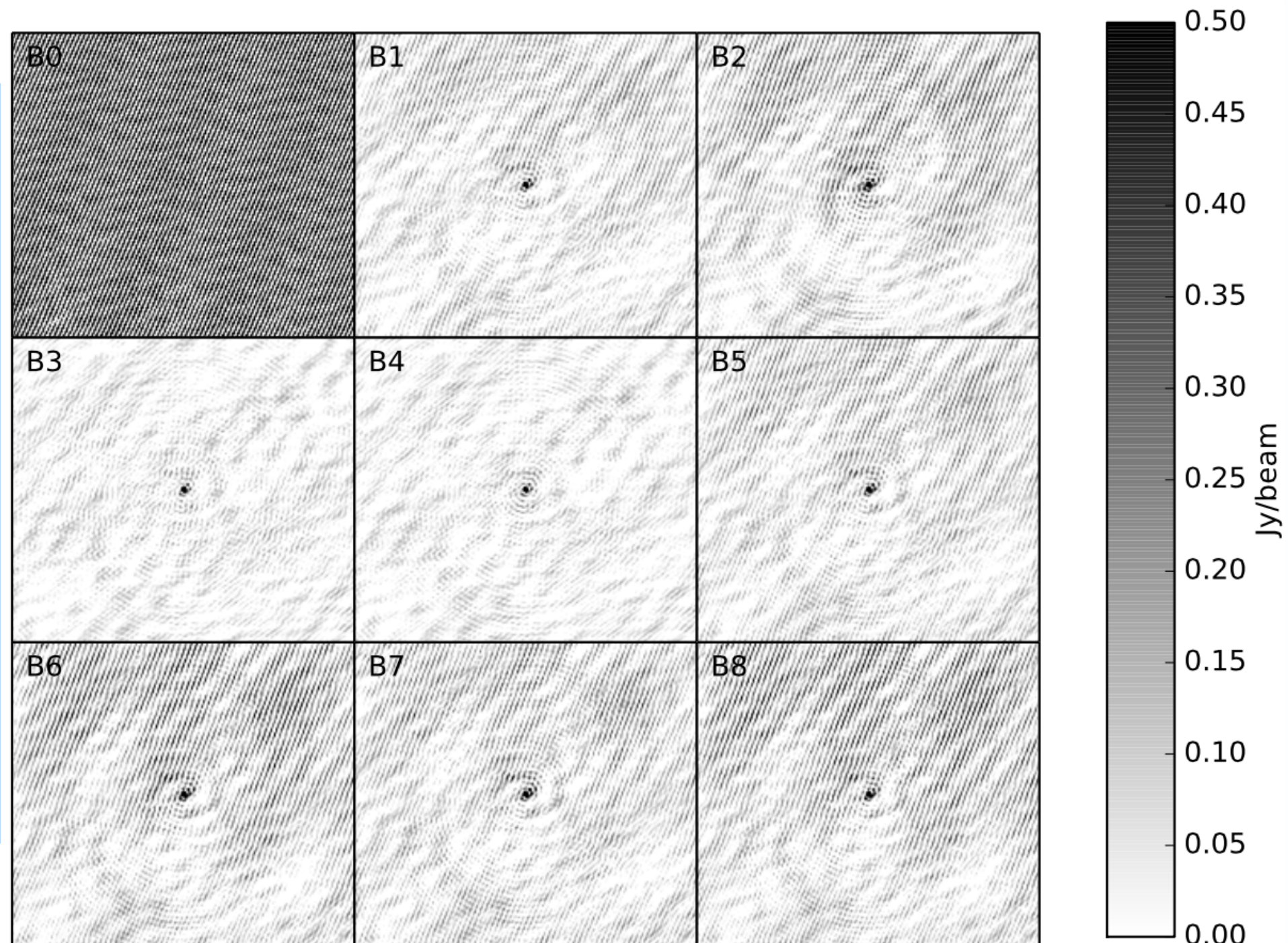


Credit Max Voronkov

STOP PRESS

RFI mitigation

- Point at B1934-638
- Tune to known interferer (GPS)
- Adapt beam weights using “projection” algorithms
- Steers null towards interferer
- Update weights every 8 seconds



Credit Keith Bannister

A fledgling telescope?

AK25 to replace AK27!



Credit Vanessa Moss

Credit Vanessa Moss