ASKAP commissioning

Presentation to ATUC

CSIRO Astronomy & Space Science

Dave McConnell
ASKAP Commissioning & Early Science
14 November 2016

PAF assembly line, Marsfield

ASKAP is complicated

- 36 antennas
- 36 PAFs
- 188 sensing elements per PAF
- 36 × 36 × 2 × 300 = 777600 beam formers

- Data from PAFs : 100 terabits / sec
- Visibility data to disk : 2.3 gigabytes /sec

- > 500,000 monitor points

ASKAP status

PAFs functioning on 12 antennas

36 beams in routine use

48 MHz bandwidth (Aug - Oct)

144 MHz (recently)

10 s integration cycles to limit data rate

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HI Early Science began 7 October

Recent commissioning

Single-port holography

Antenna pointing

Astrometry tests

PAF field-of-view measurements

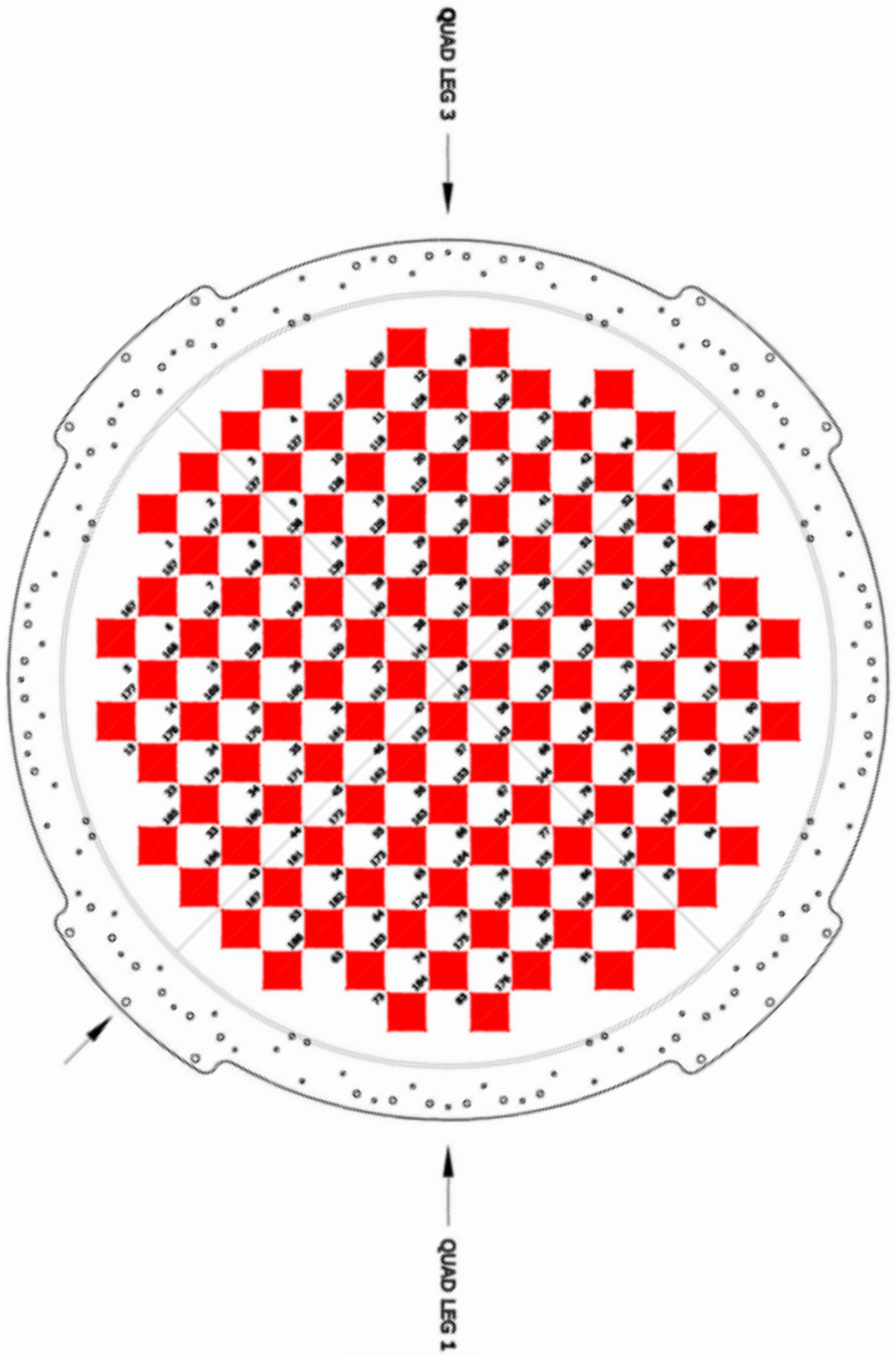
CRAFT mode developments

ASKAP PAF to Parkes PAF coherence

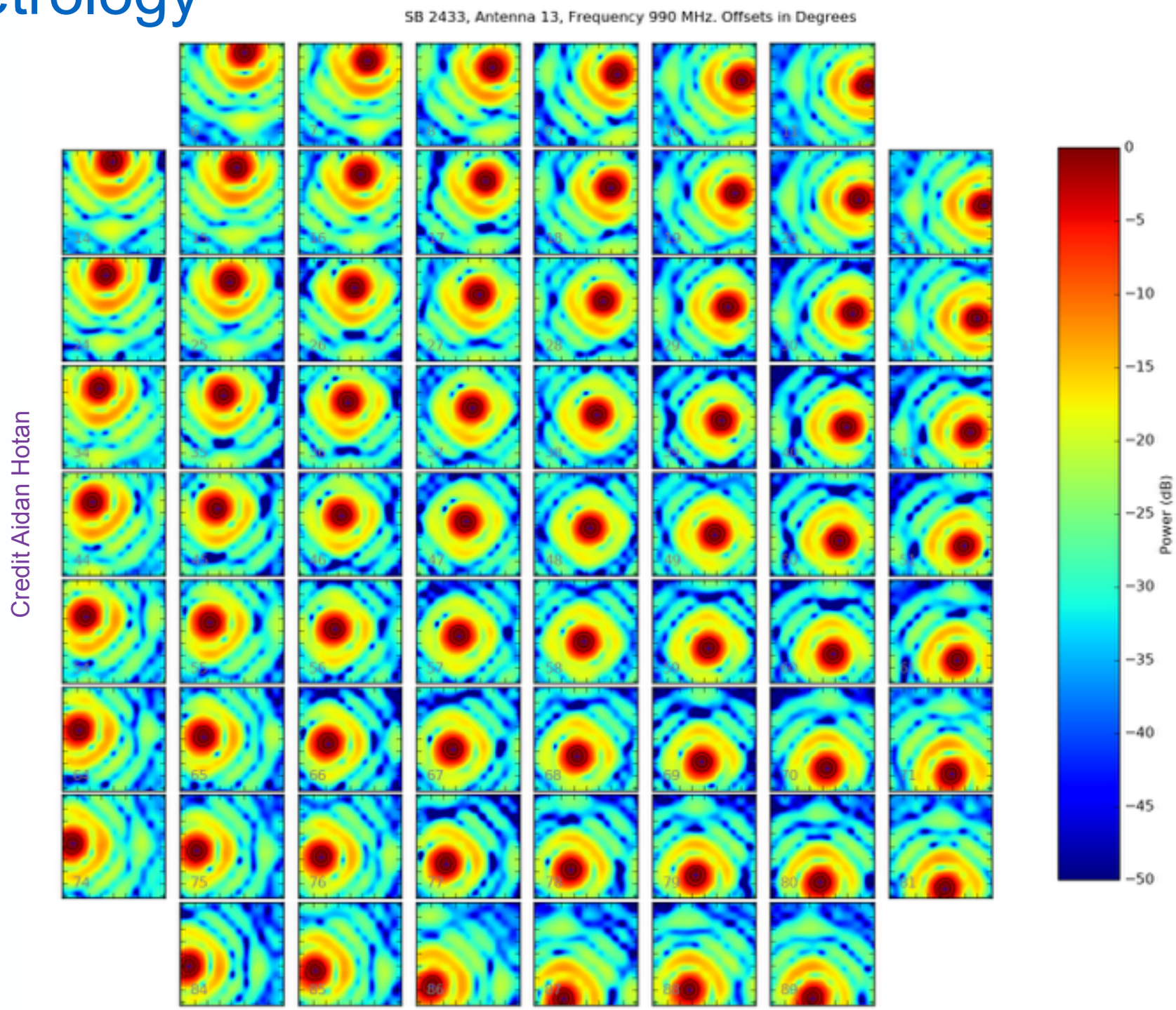
Characterising “single-port” patterns

Necessary for beam-shape control

Means of roll axis calibration



Beam metrology



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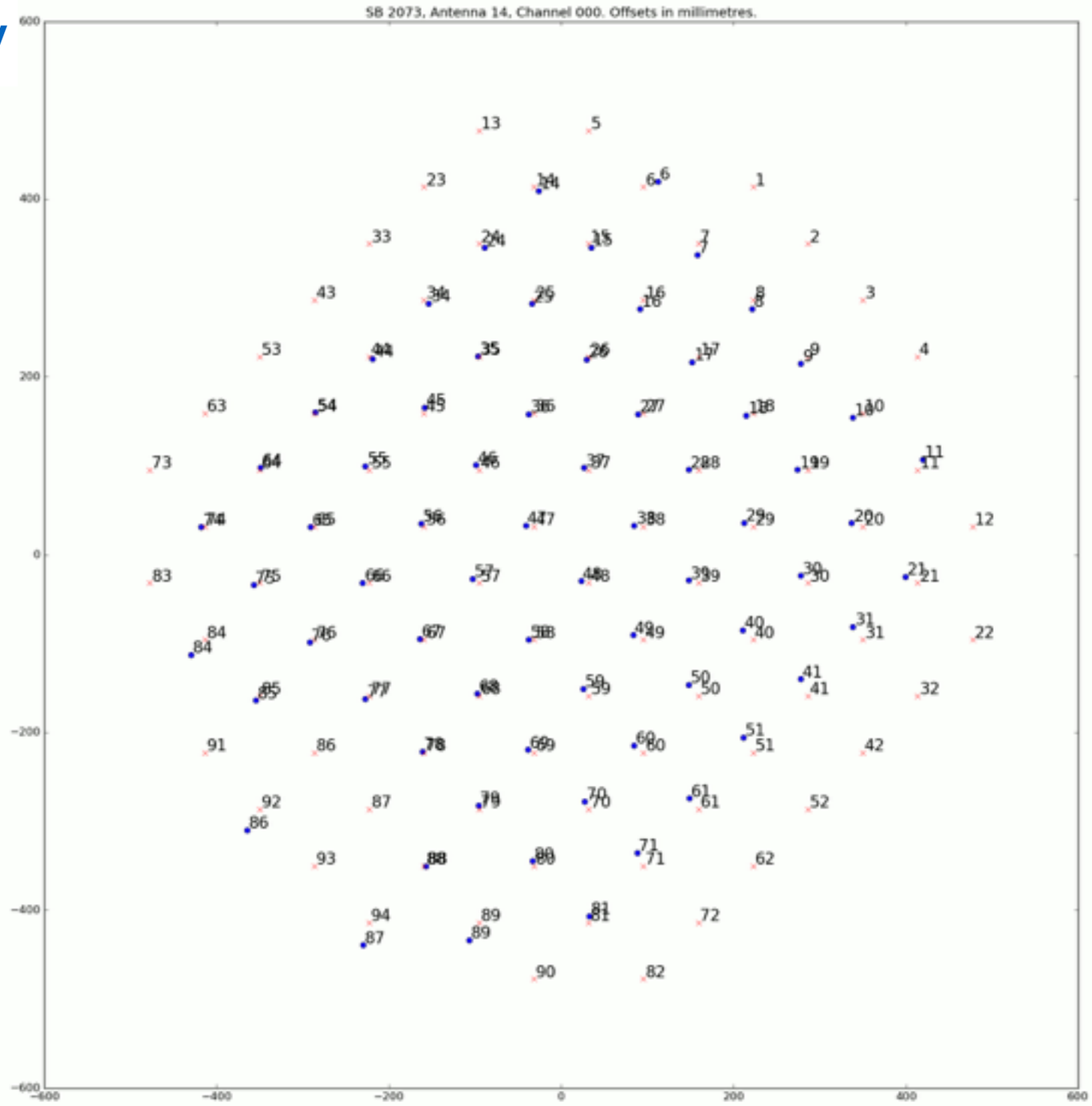

Credit Aidan Hotan

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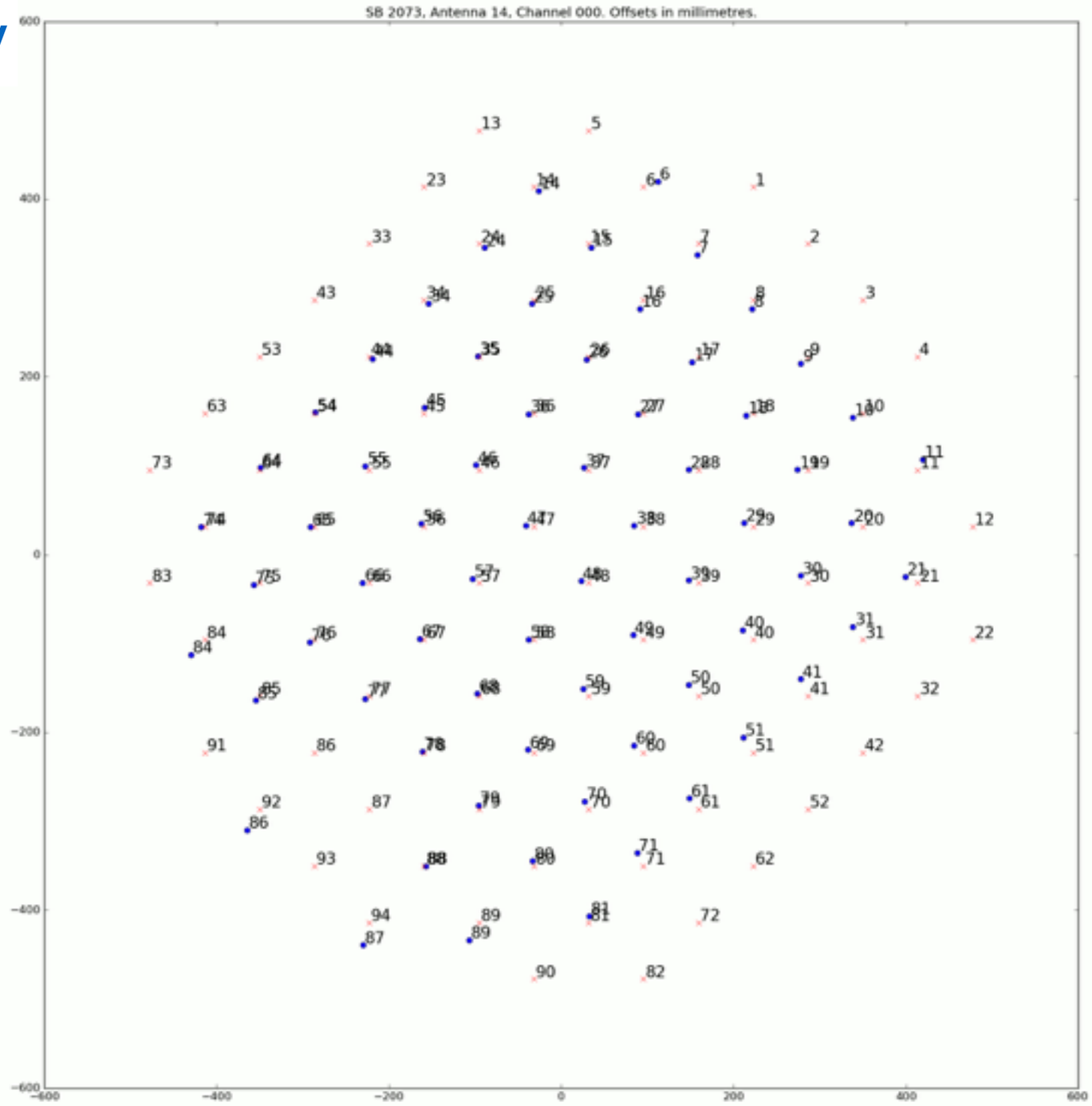
Beam metrology



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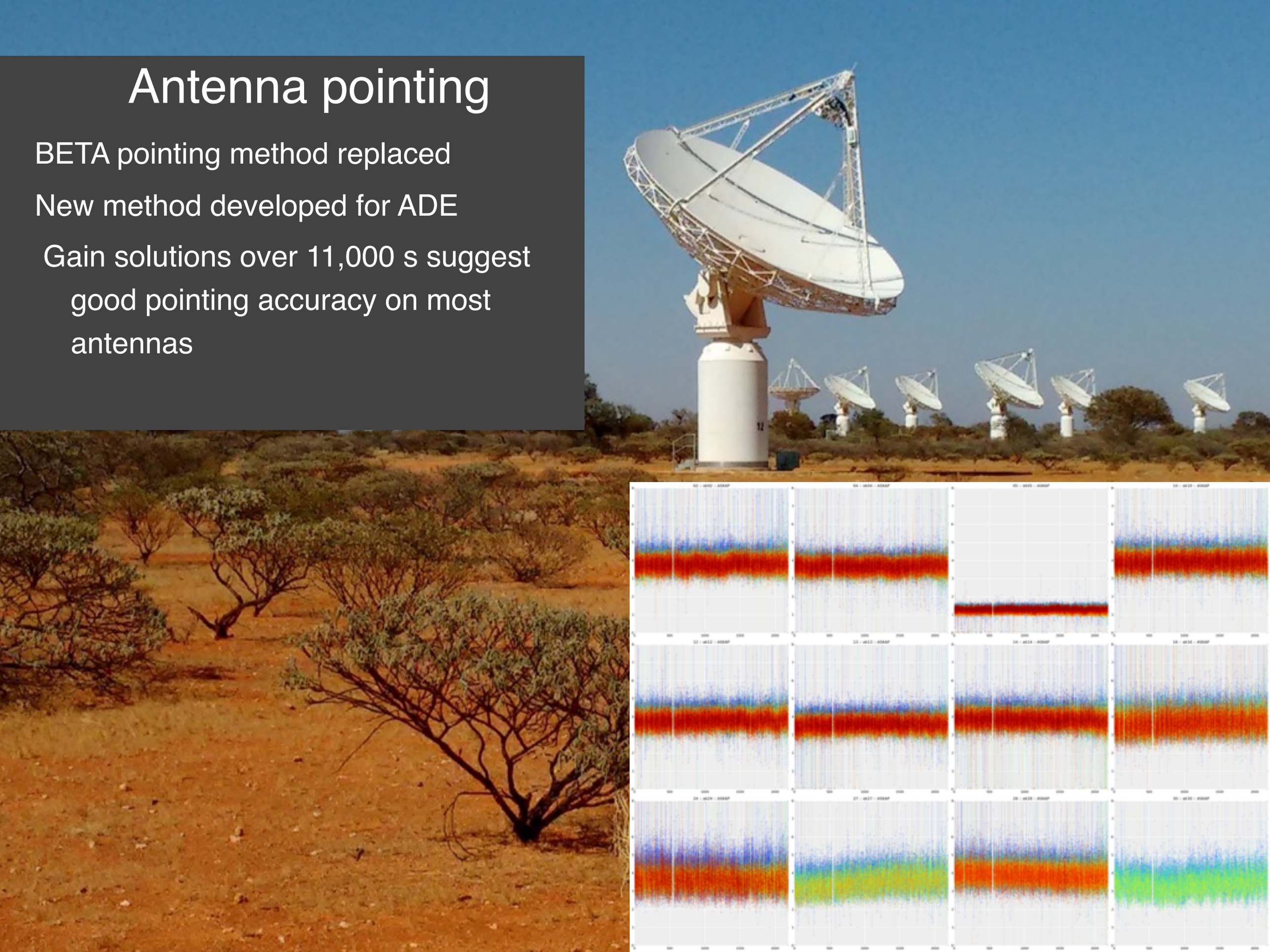
Antenna pointing

BETA pointing method replaced

New method developed for ADE

Gain solutions over 11,000 s suggest good pointing accuracy on most antennas



Astrometric Tests

- Verification of positional accuracy in ASKAP-12 data
- Two methods:

  (i) Cross-matching components in ASKAP LMC mosaic with deeper, higher resolution ATCA data (such that ASKAP systematics dominate)

  (ii) Checking measured positions of known calibrators, of which there are 3 in the LMC field

- Essential for understanding what form the minimum viable sky model might take

Astrometric Tests

- Main results so far:

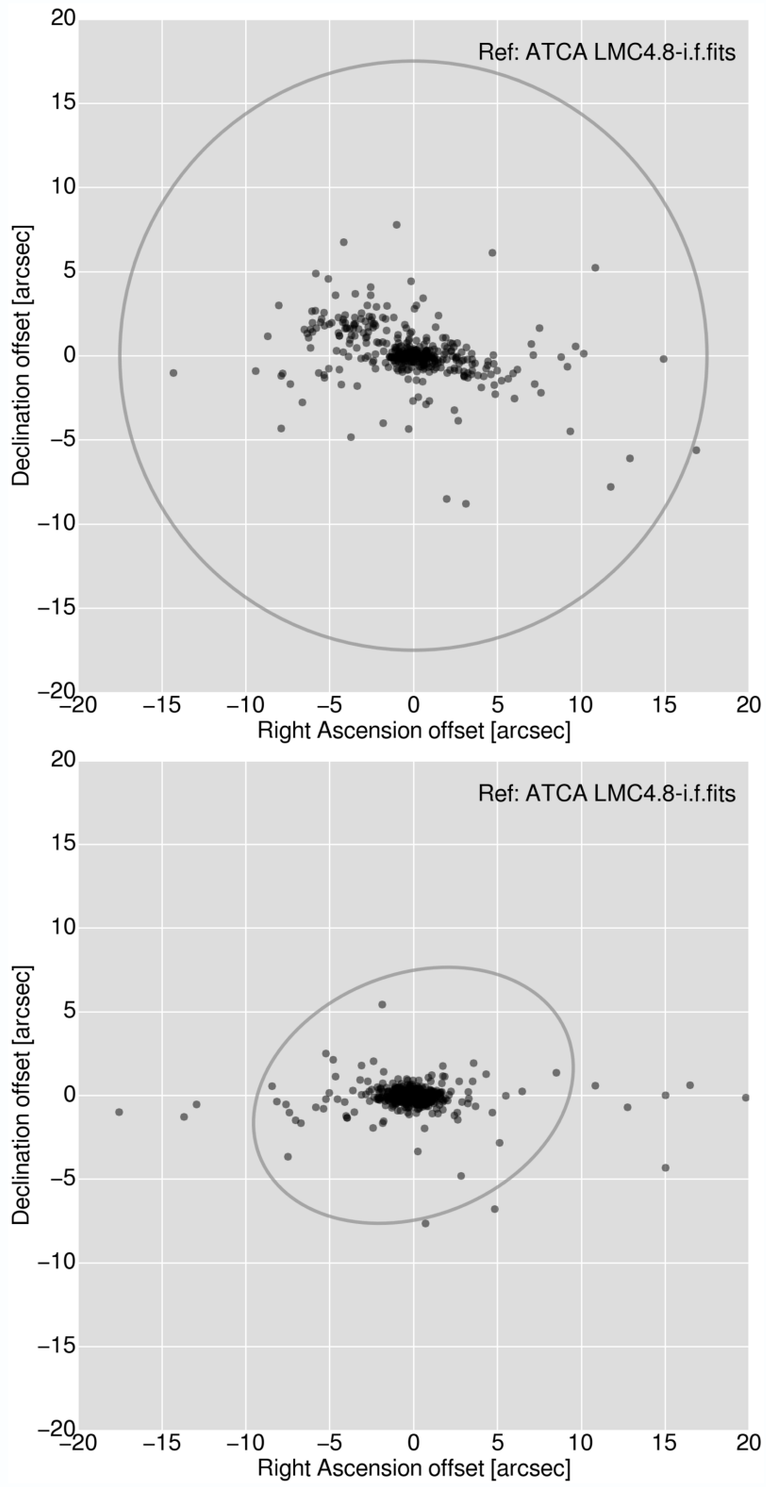
  (i) No evidence for systematic offsets -- cloud of points is centred on (0,0)

  (ii) Statistical scatter is as expected from SNR considerations

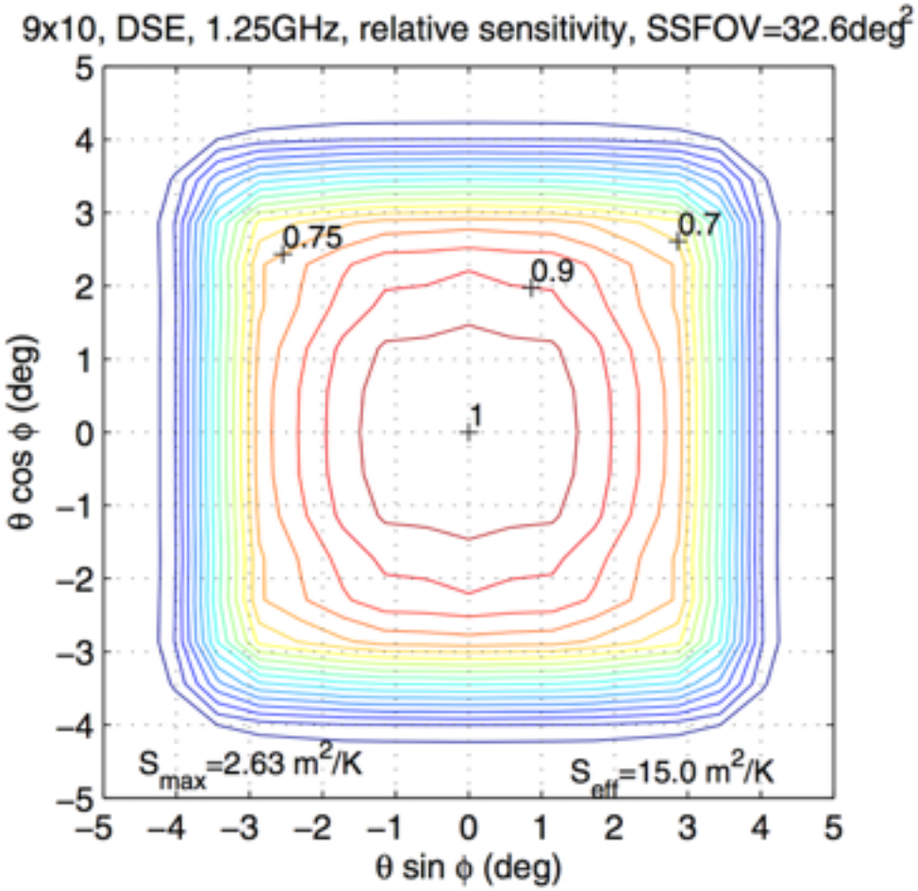
  (iii) Still some features to understand – errant points in plots are probably spurious (no self-cal was performed, and the catalogue was not pruned for artefacts)

  (iv) Calibrator exercise suggests no beam to beam astrometry variation, but more observations are needed to form a denser grid of measurements

Credit Ian Heywood

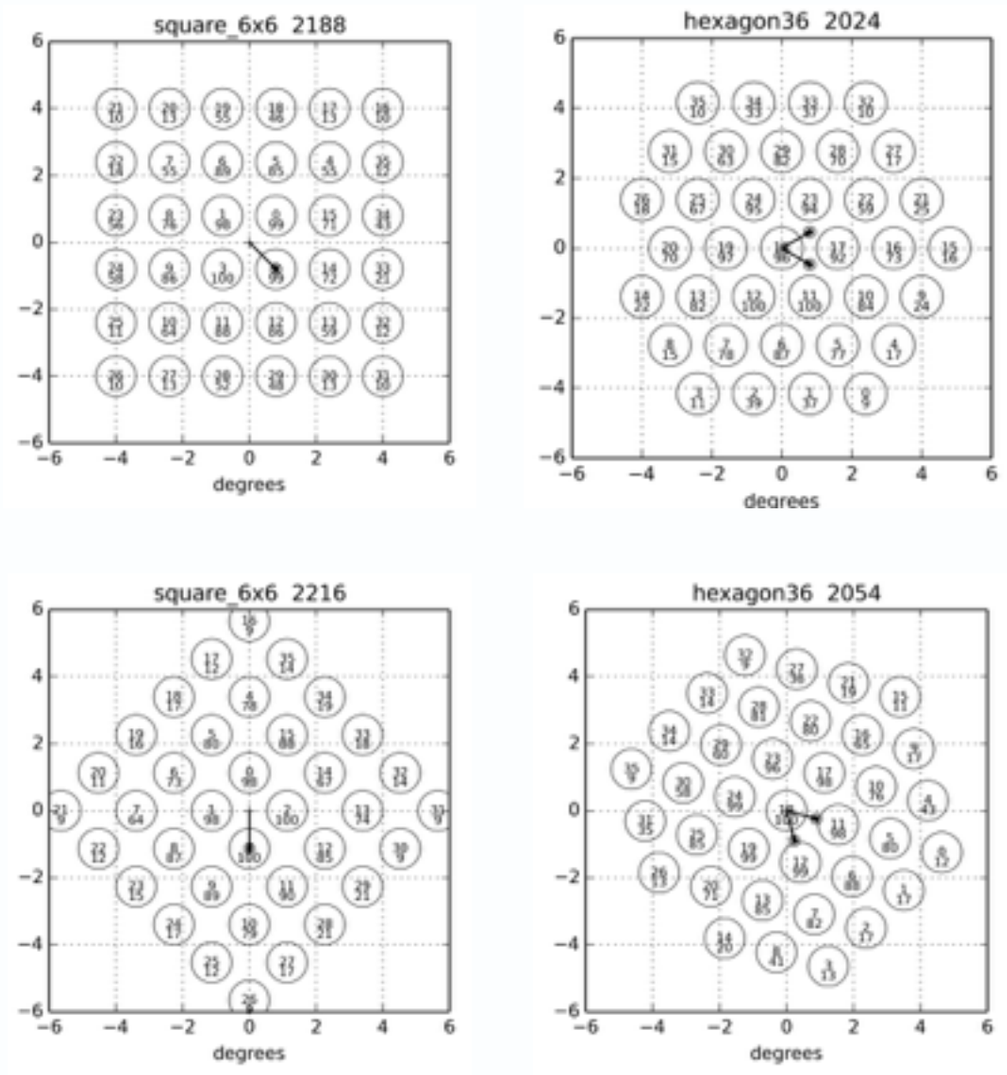


PAF Field-of-view



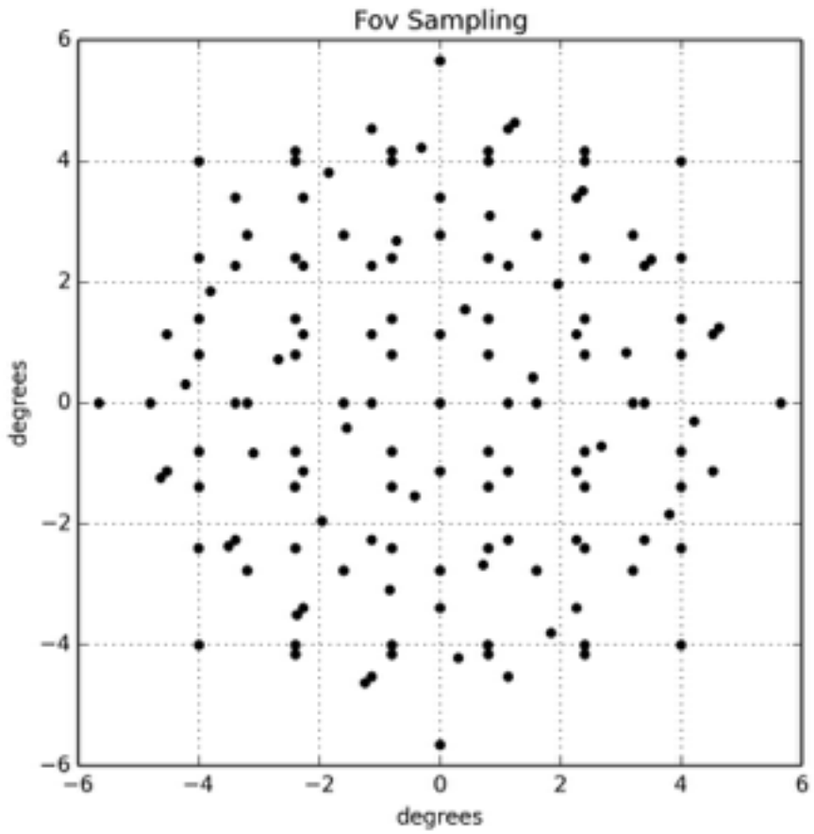
Predicted field of view of 9 x 10 chequerboard phased array on ASKAP dish, at 1.25 GHz

Bunton, J. D., & Hay, S. G. 2010, Electromagnetics in Advanced Applications (ICEAA), 728



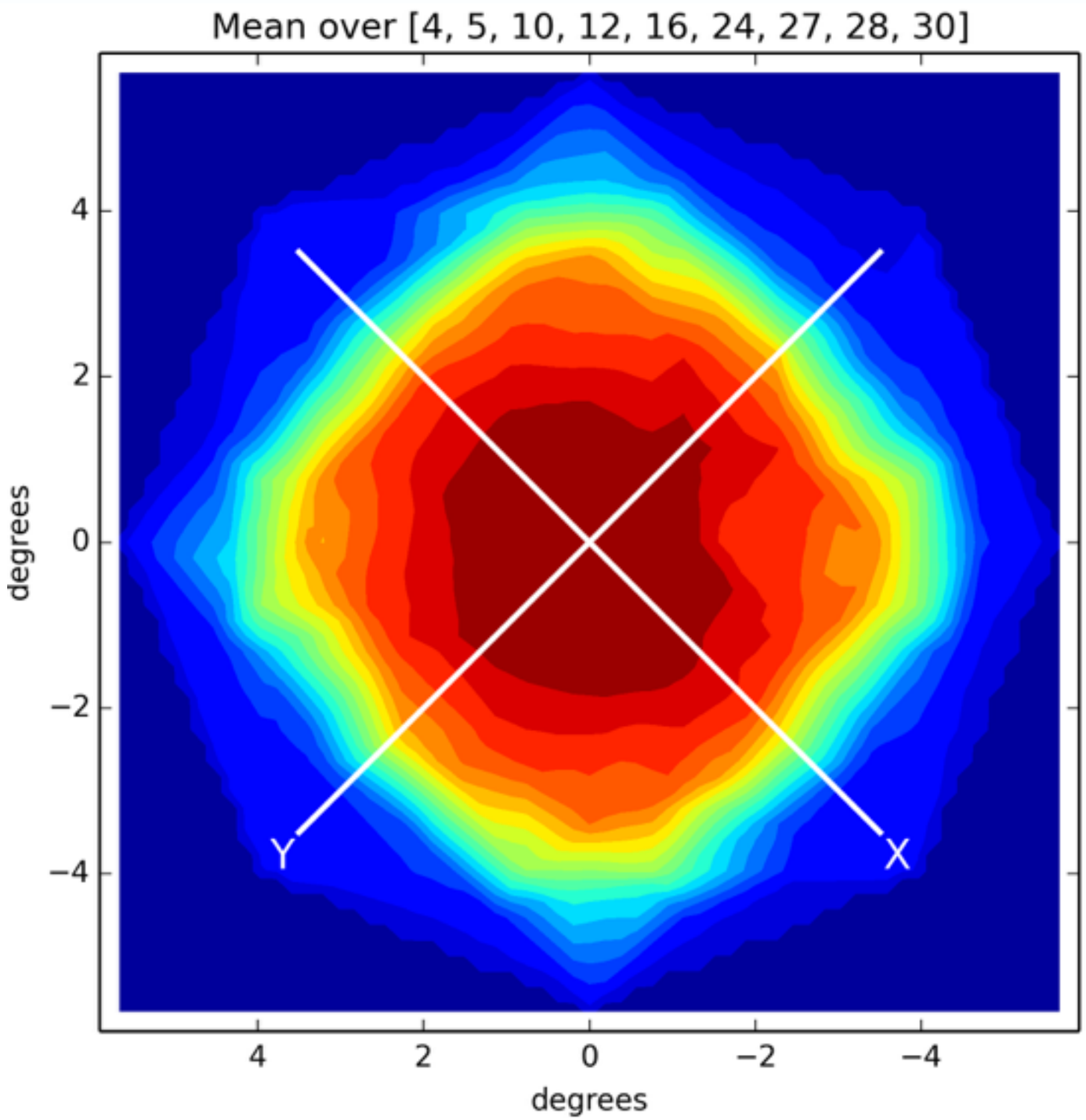
Measure relative sensitivity in each beam of each footprint

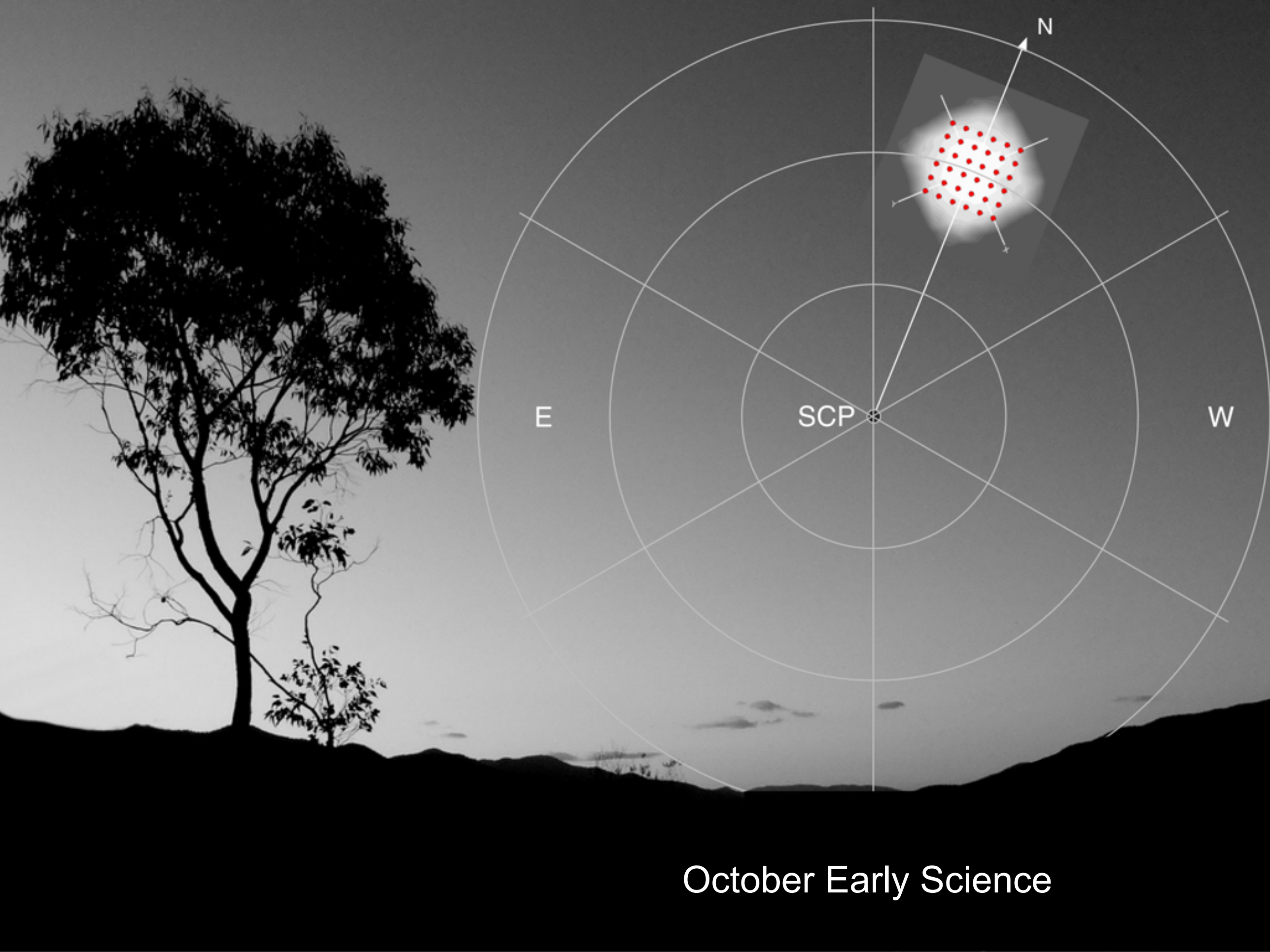
PAF Field-of-view



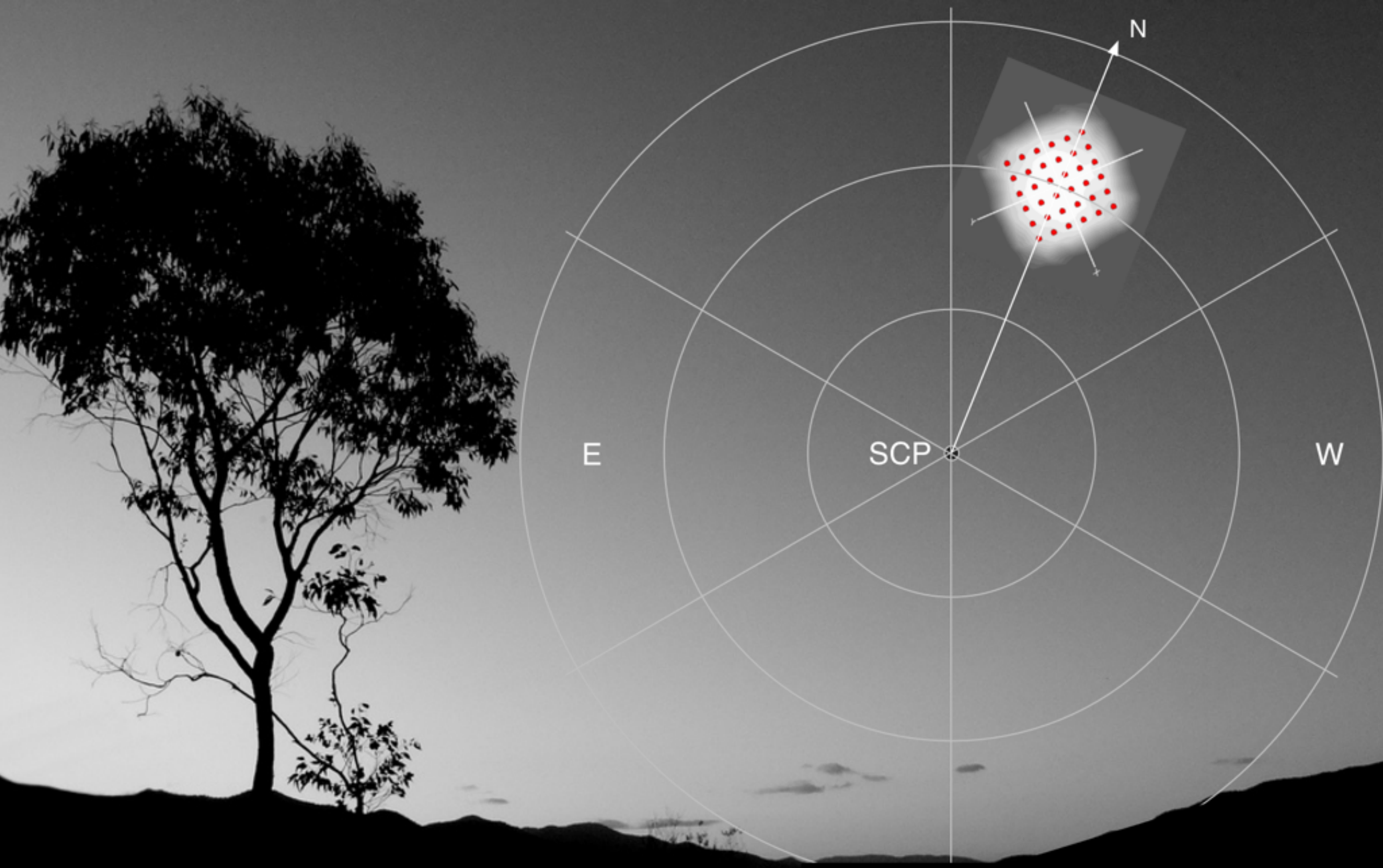
Equivalent FoV

32.8 sq deg

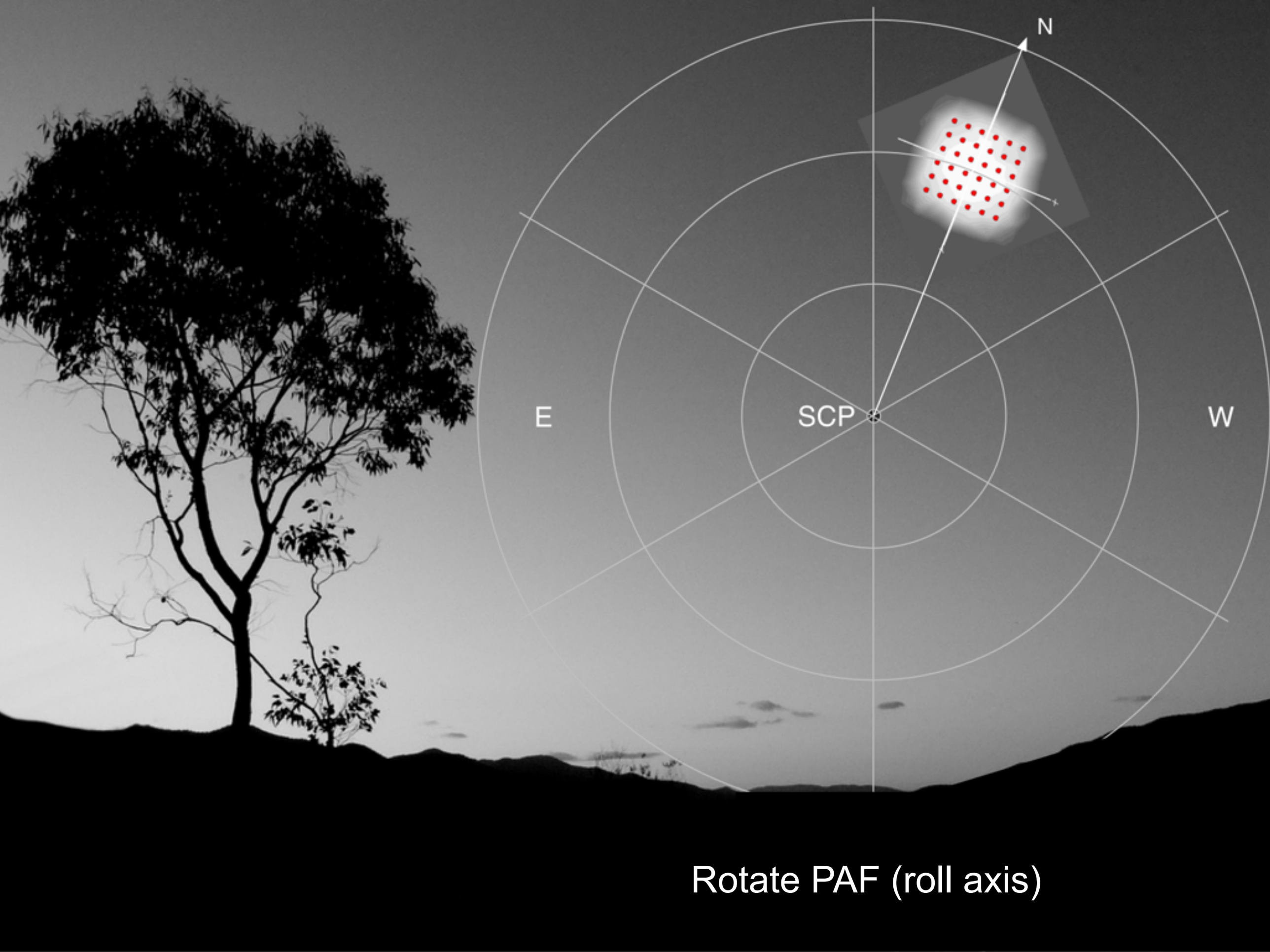




October Early Science



Rotate footprint



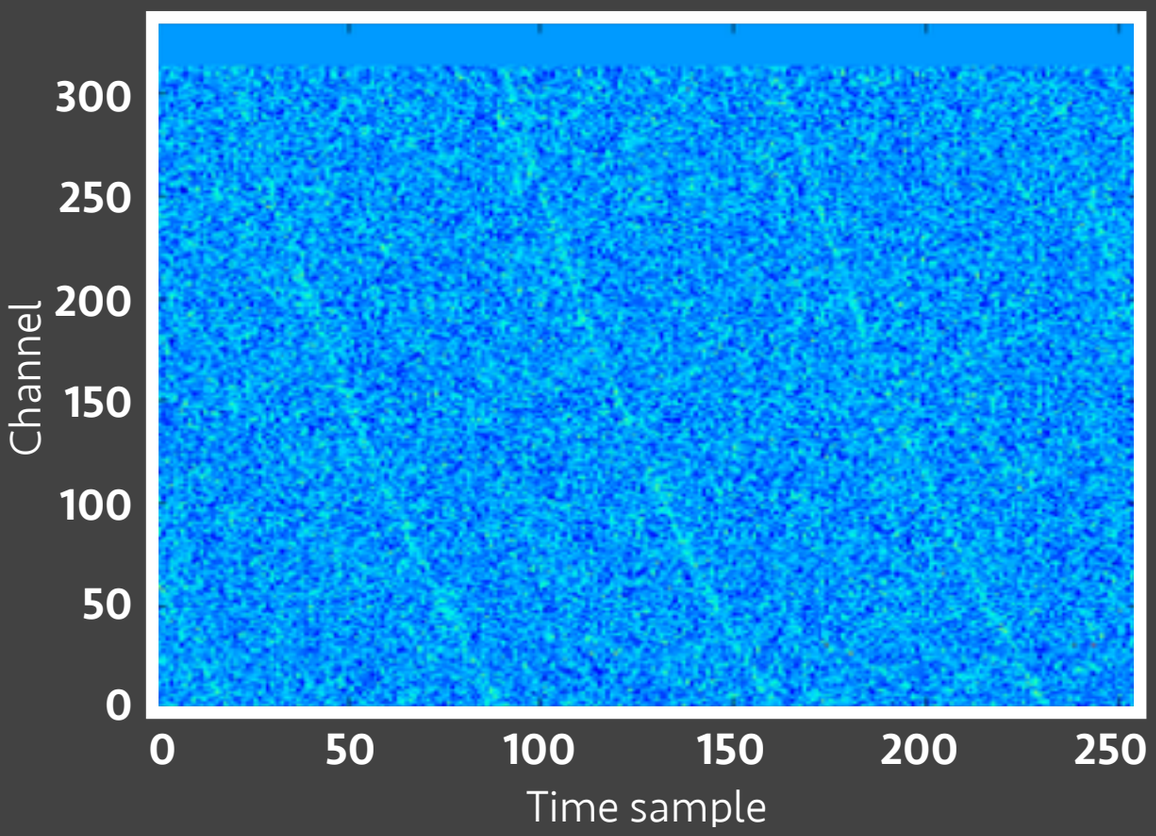
Rotate PAF (roll axis)

High-time resolution

Voltage data capture from beamformers

Vela pulsar - period 89.3 ms

SIngle antenna, one beam



credit Keith Bannister

What's next?

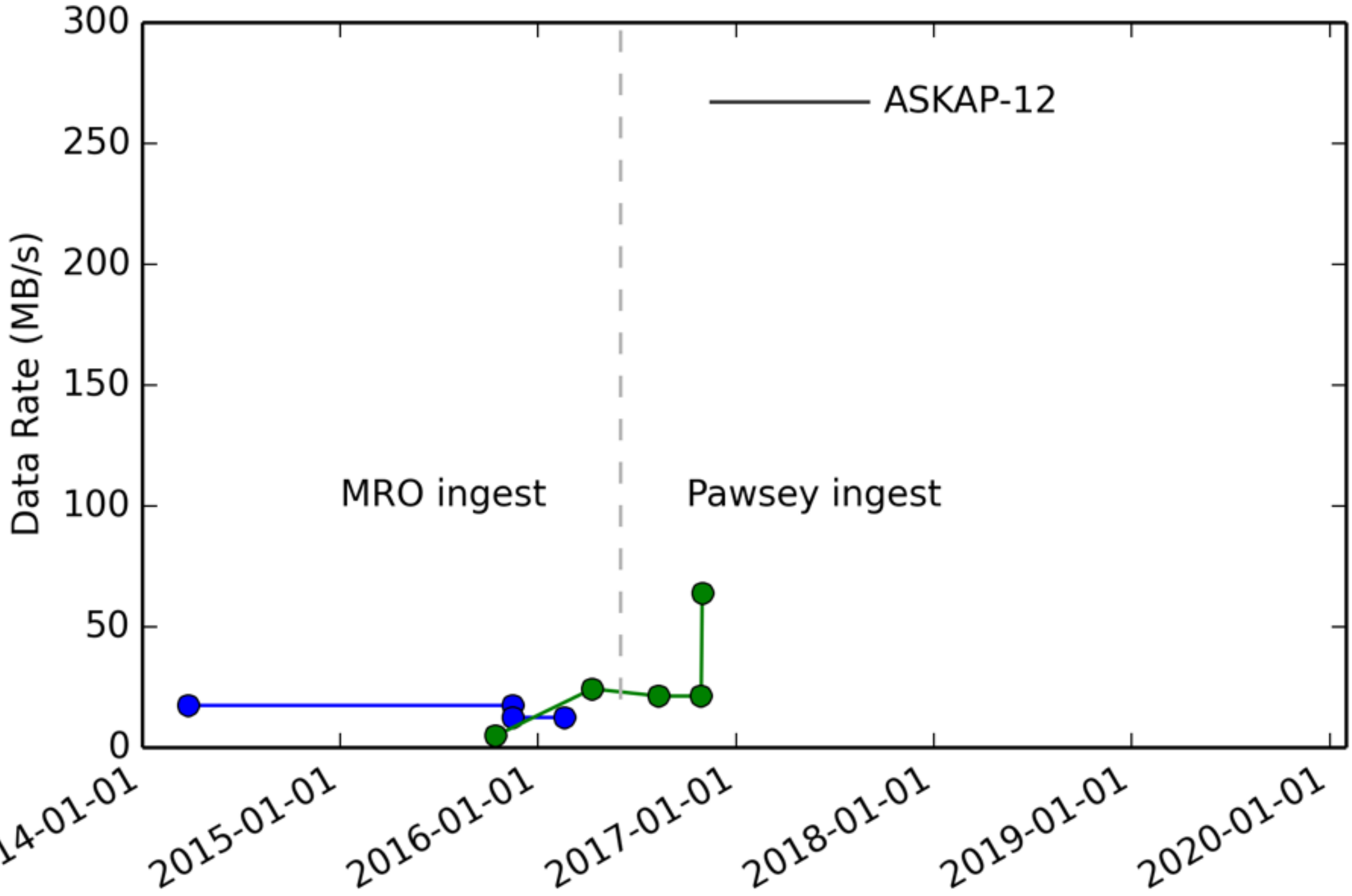
Immediate commissioning tasks:

- Extending bandwidth (scaling problem)
- Tuning over the whole ASKAP band
- Full delay and phase tracking
- Commissioning high-time resolution (CRAFT) modes
- Commissioning high-frequency resolution (zoom) modes

Commissioning in the longer term:

- On-Dish-Calibrators
- Beam shape control
- work towards the full calibration scheme using ODC and Sky Model

Data rates and the scaling problem



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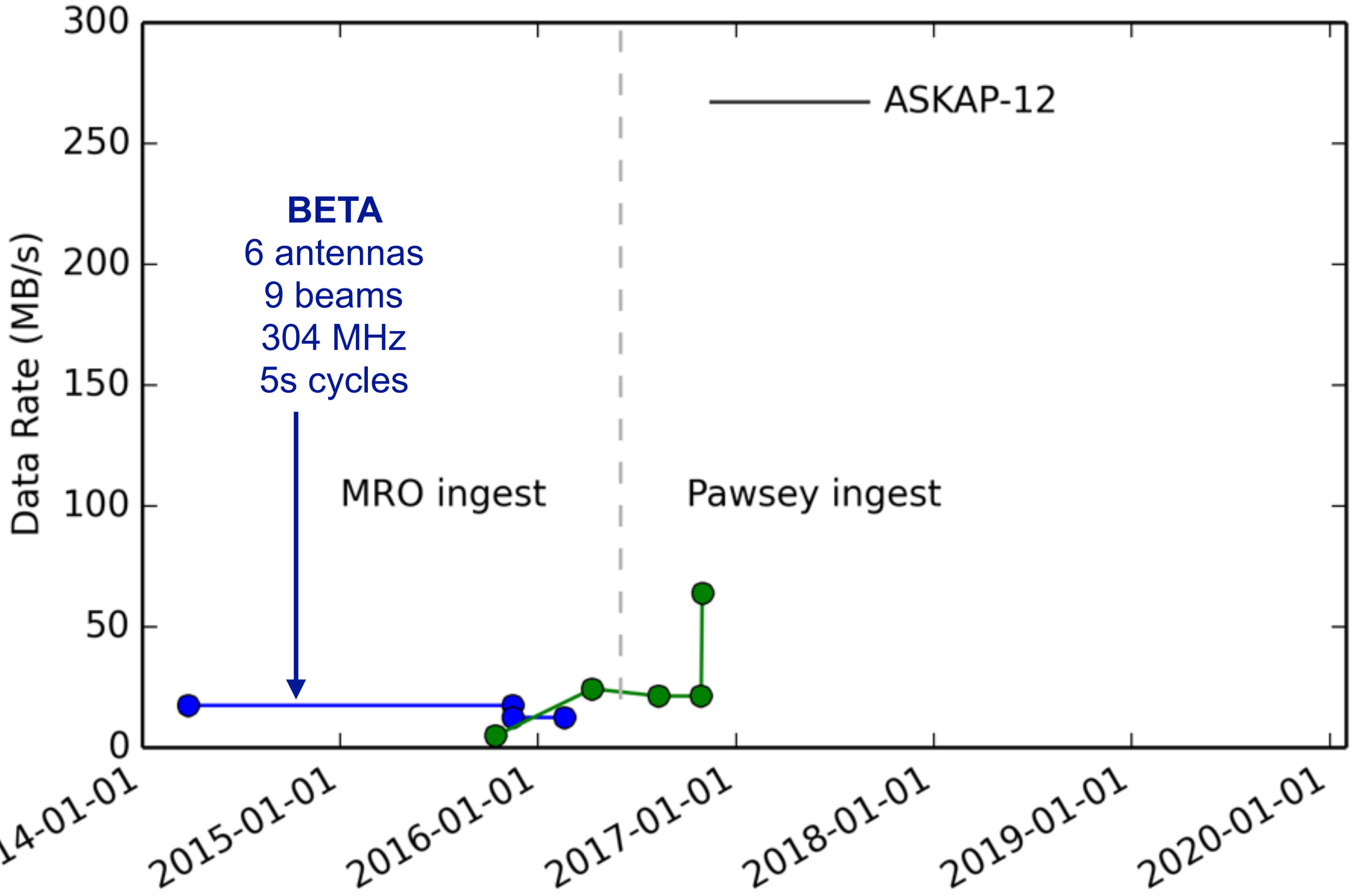

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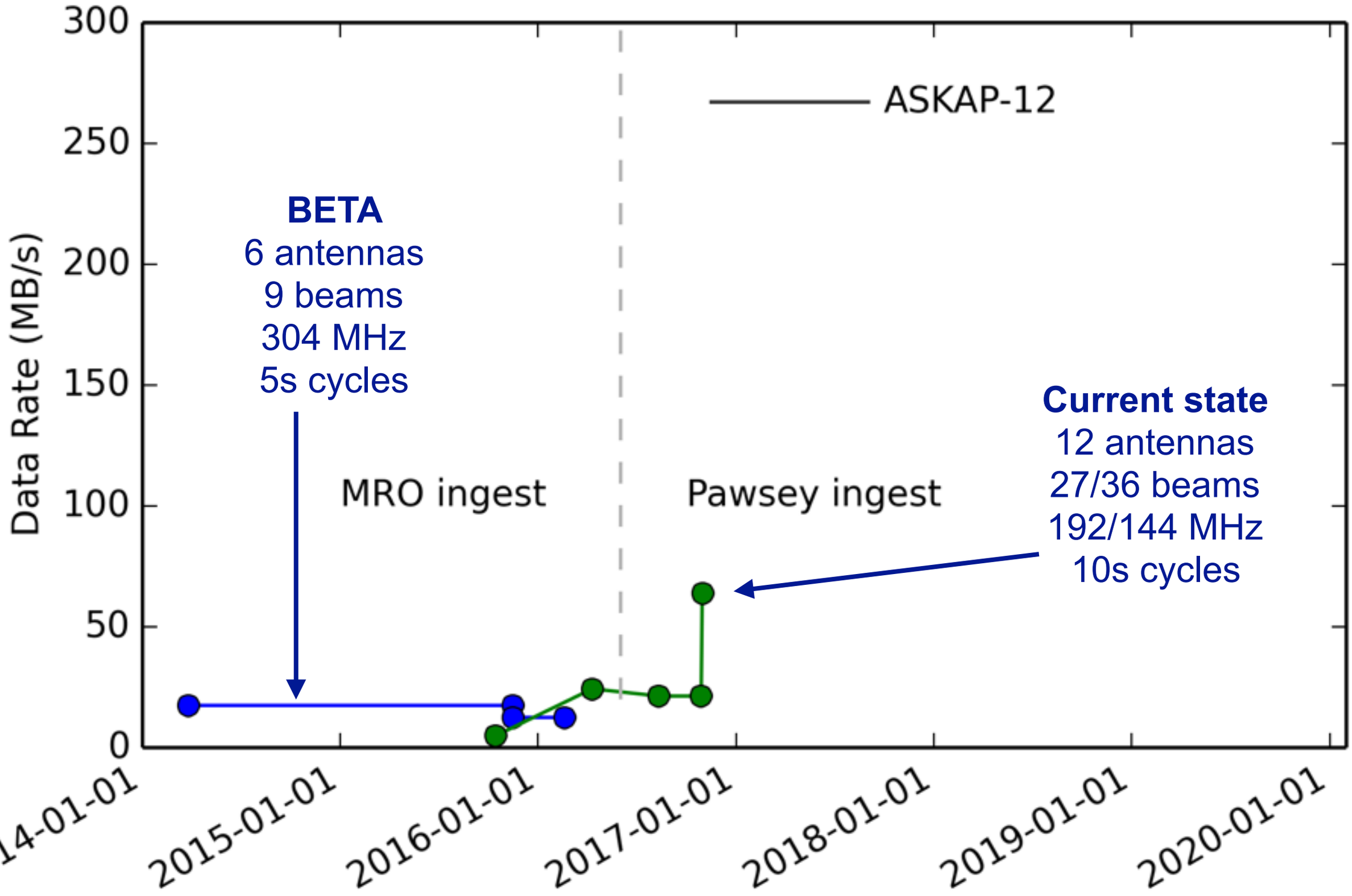

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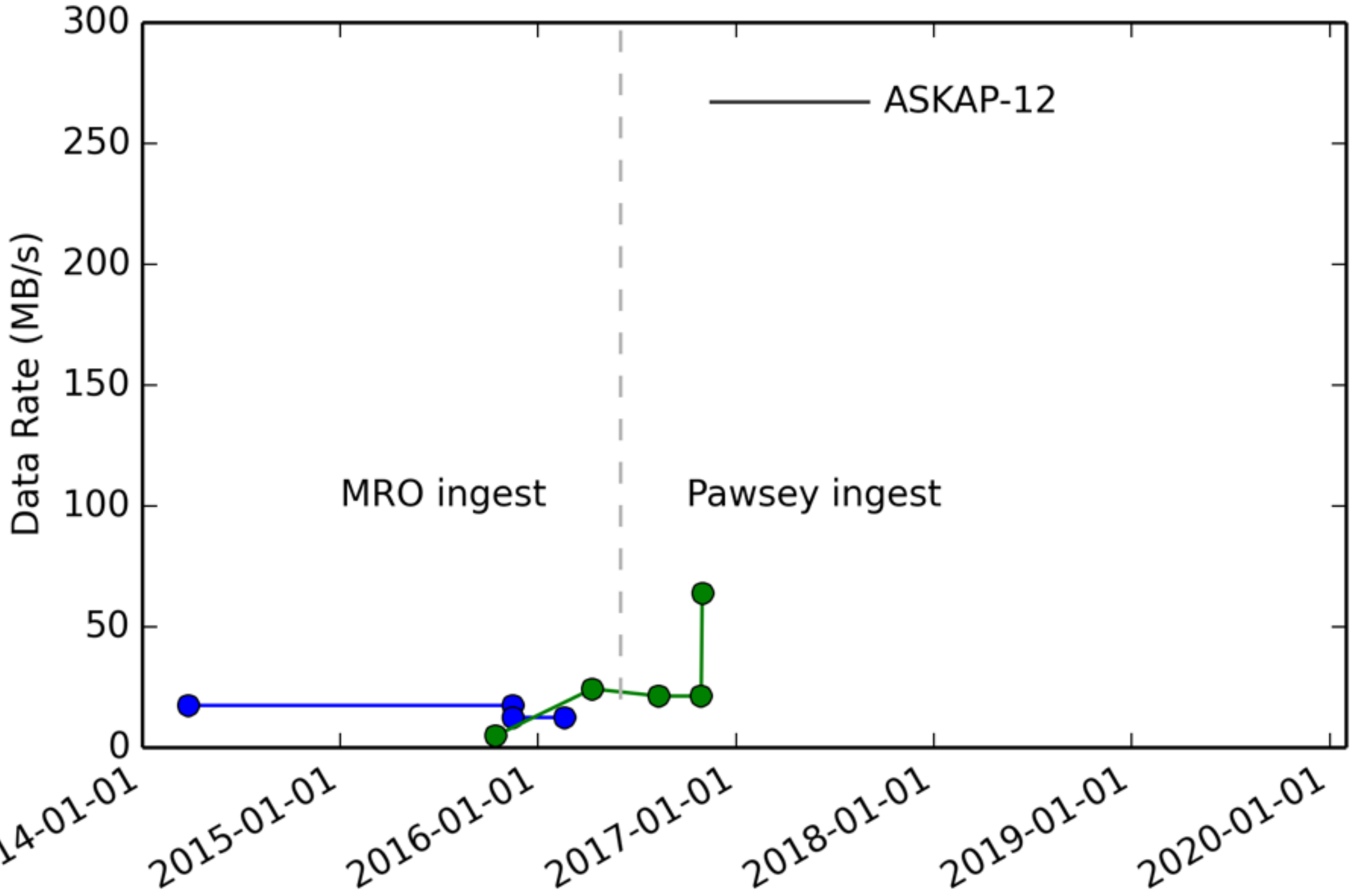

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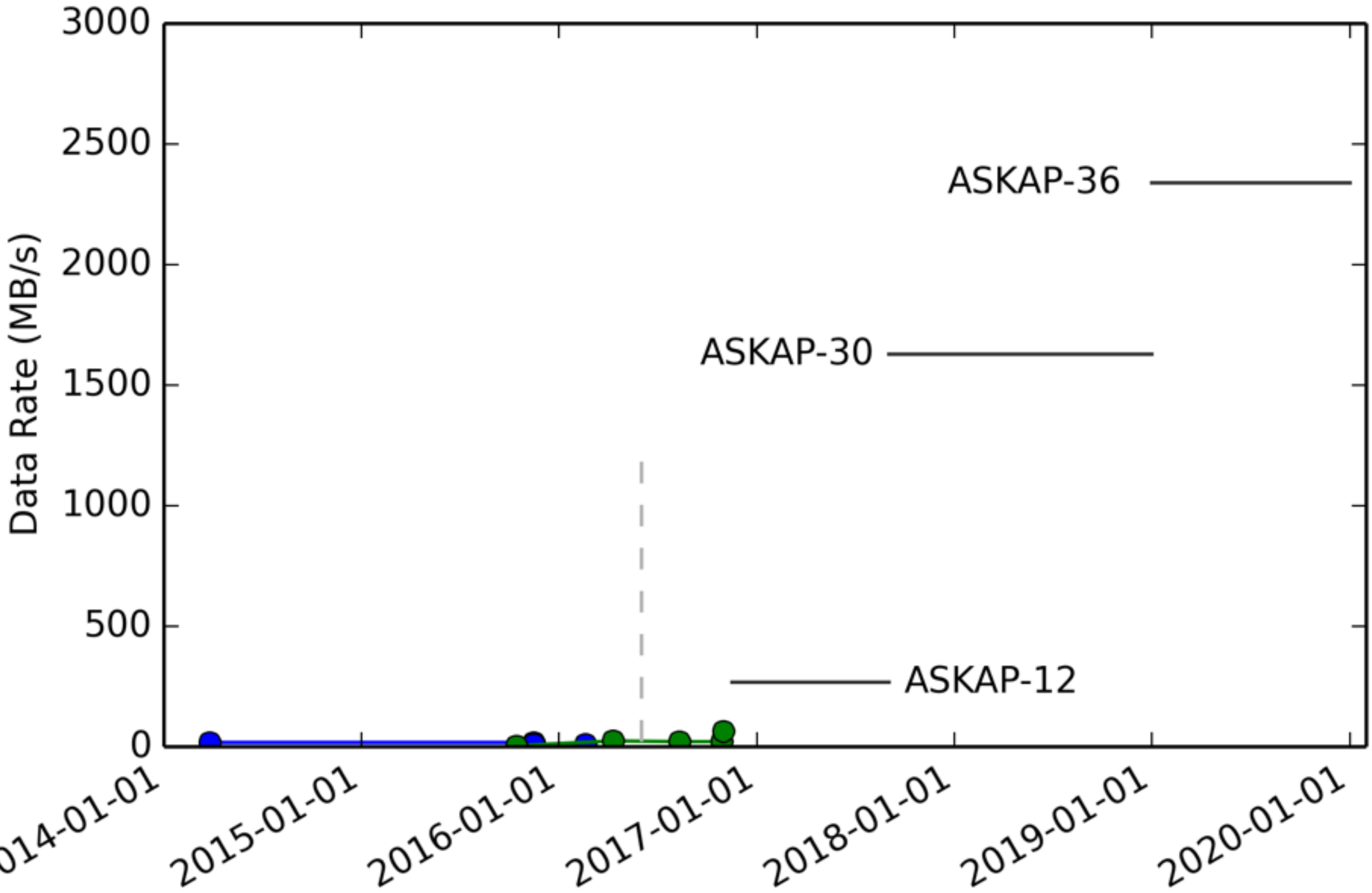
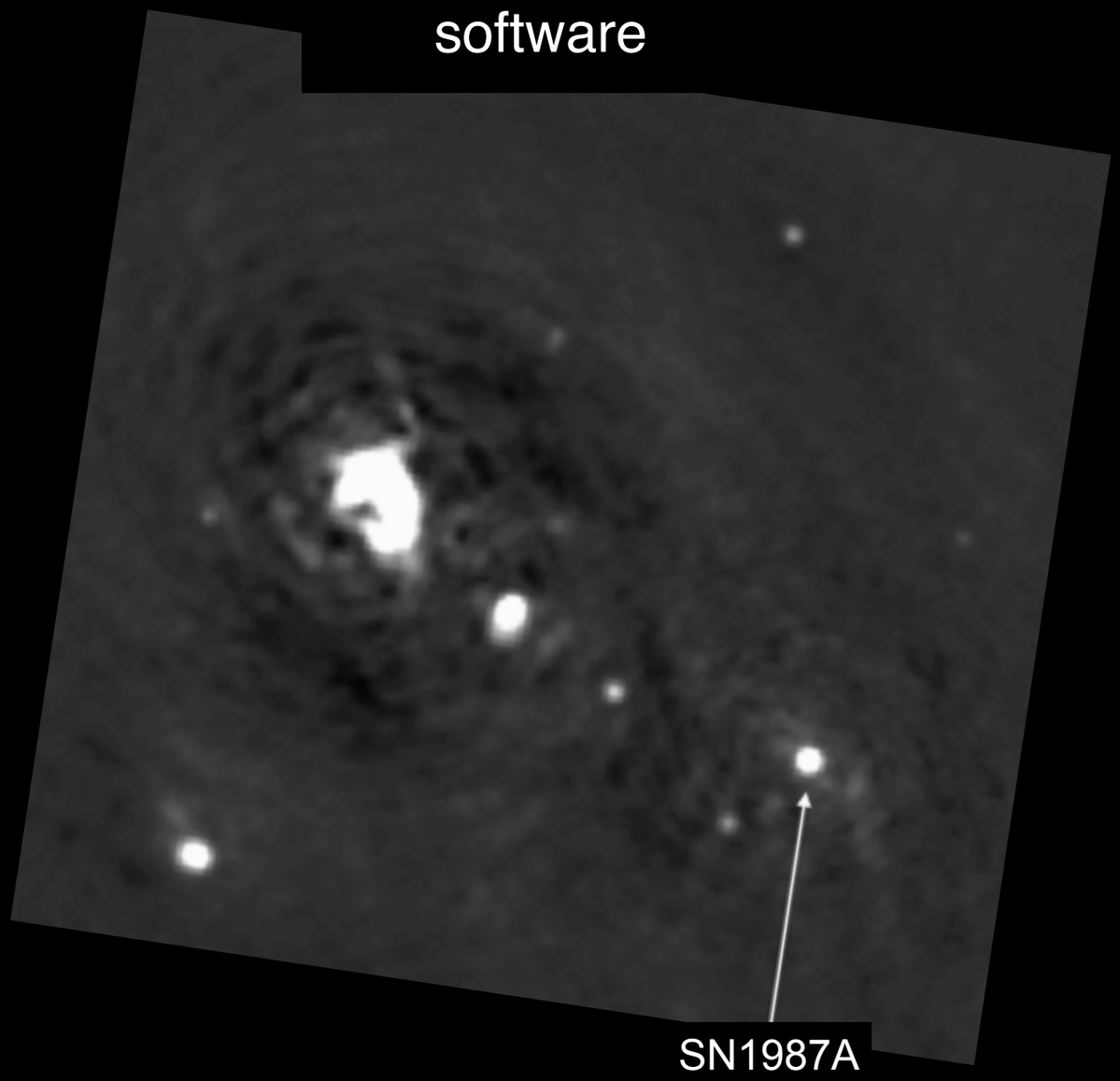
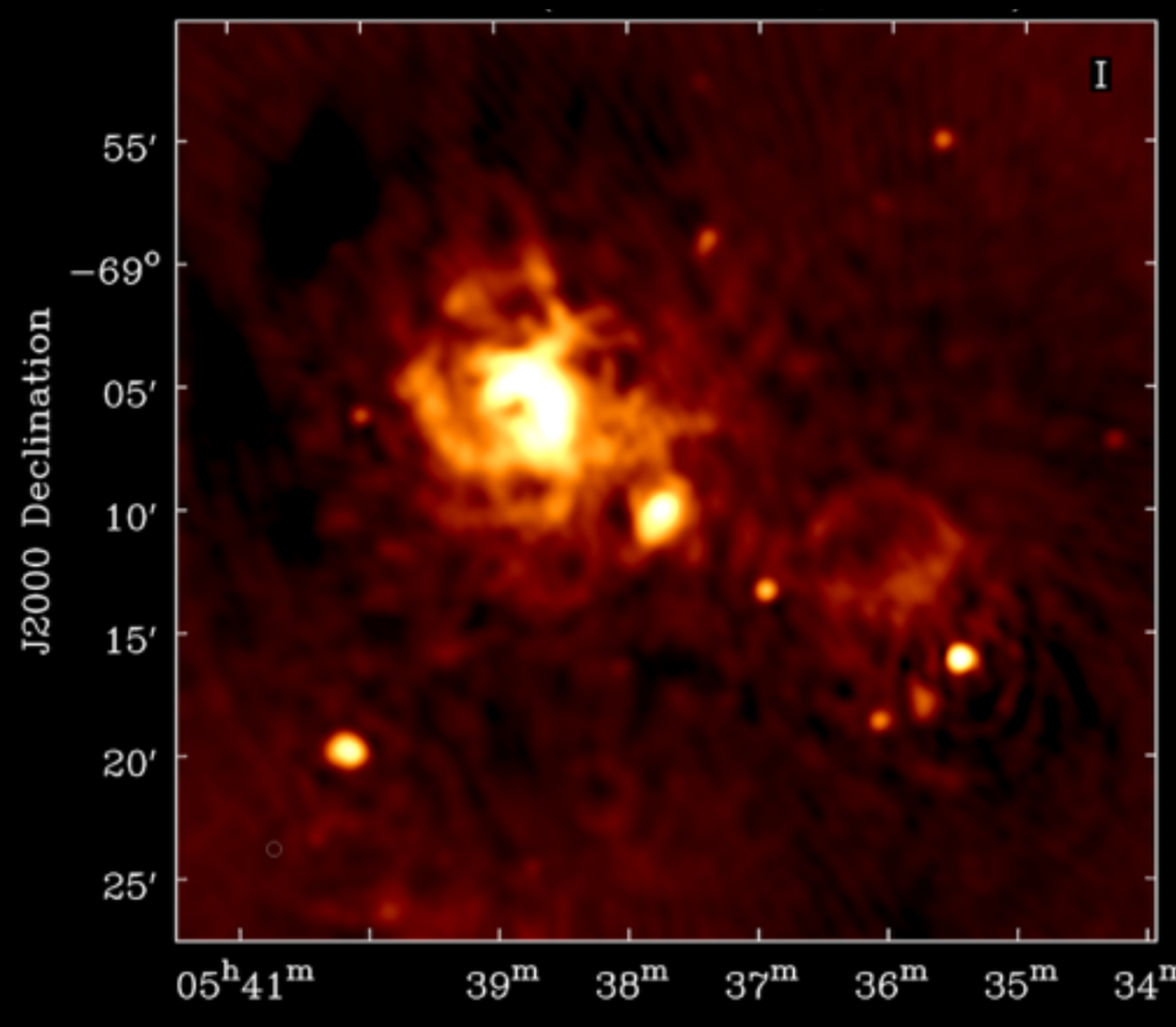


Imaging software

The LMC and 30 Doradus is one of several test fields. Work continues on both pipeline parameters and the underlying software



August 2016 1400MHz
11 Antennas 48 MHz
Short spacings omitted



Images by Wasim Raja

October 2016 963MHz
12 Antennas 192 MHz
All baselines used

Community busy weeks

Introduce SST members to ASKAP data and processing facilities

Three held this year : Sydney (2); Perth (1)

Next one in Canberra 29Nov-1Dec

- focus on polarimetry and high-res spectral

Early Science field of NGC 7232 in continuum

Credit Ian Heywood

We acknowledge the Wajarri Yamatji people as the traditional owners of the observatory site.