First astronomy results from PAFs

Paolo Serra
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- **Serra et al. 2015**, MNRAS, 452, 2680, *ASKAP HI imaging of the galaxy group IC 1459*
- **Allison et al. 2015**, MNRAS, 453, 1249, *Discovery of HI gas in a young radio galaxy at z = 0.44 using the Australian Square Kilometre Array Pathfinder*
- **Hobbs et al. 2016**, MNRAS, 456, 3948, *A pilot ASKAP survey of radio transient events in the region around the intermittent pulsar PSR J1107-5907*
- **Heywood et al. 2016**, MNRAS, 457, 4160-4178, *Wide-field broadband radio imaging with phased array feeds: a pilot multi-epoch continuum survey with ASKAP-BETA*
- **Abbott et al. 2016**, ApJL, 826, 13, *Localization and Broadband Follow-up of the Gravitational-wave Transient GW150914*
- **Harvey-Smith et al. 2016**, MNRAS, 460, 218, *High-velocity OH megamasers in IRAS 20100-4156: Evidence for a Supermassive Black Hole*

ASKAP commissioning and early science

Dave McConnell, James Allison, Keith Bannister, Martin Bell, Aaron Chippendale, Phil Edwards, Lisa Harvey-Smith, Sarah Hegarty, Ian Heywood, Aidan Hotan, Balt Indermuehle, Karen Lee-Waddell, Emil Lenc, Josh Marvil, Chris Phillips, Attila Popping, Pietro Procopio, Wasim Raja, John Reynolds, Bob Sault, Paolo Serra, Maxim Voronkov, Robin Wark, Matthew Whiting

Boolardy Engineering Test Array

Balayi

Wilara

Bundara

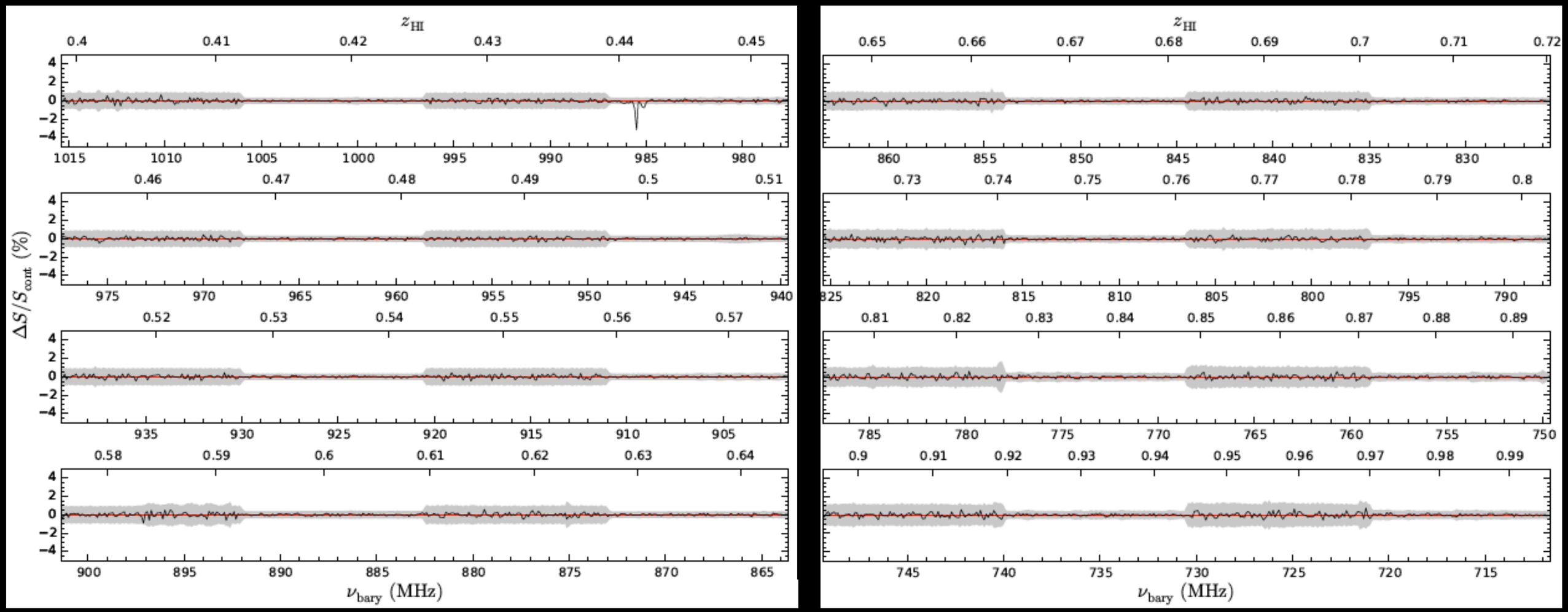
Biyarli

Jirdilungu

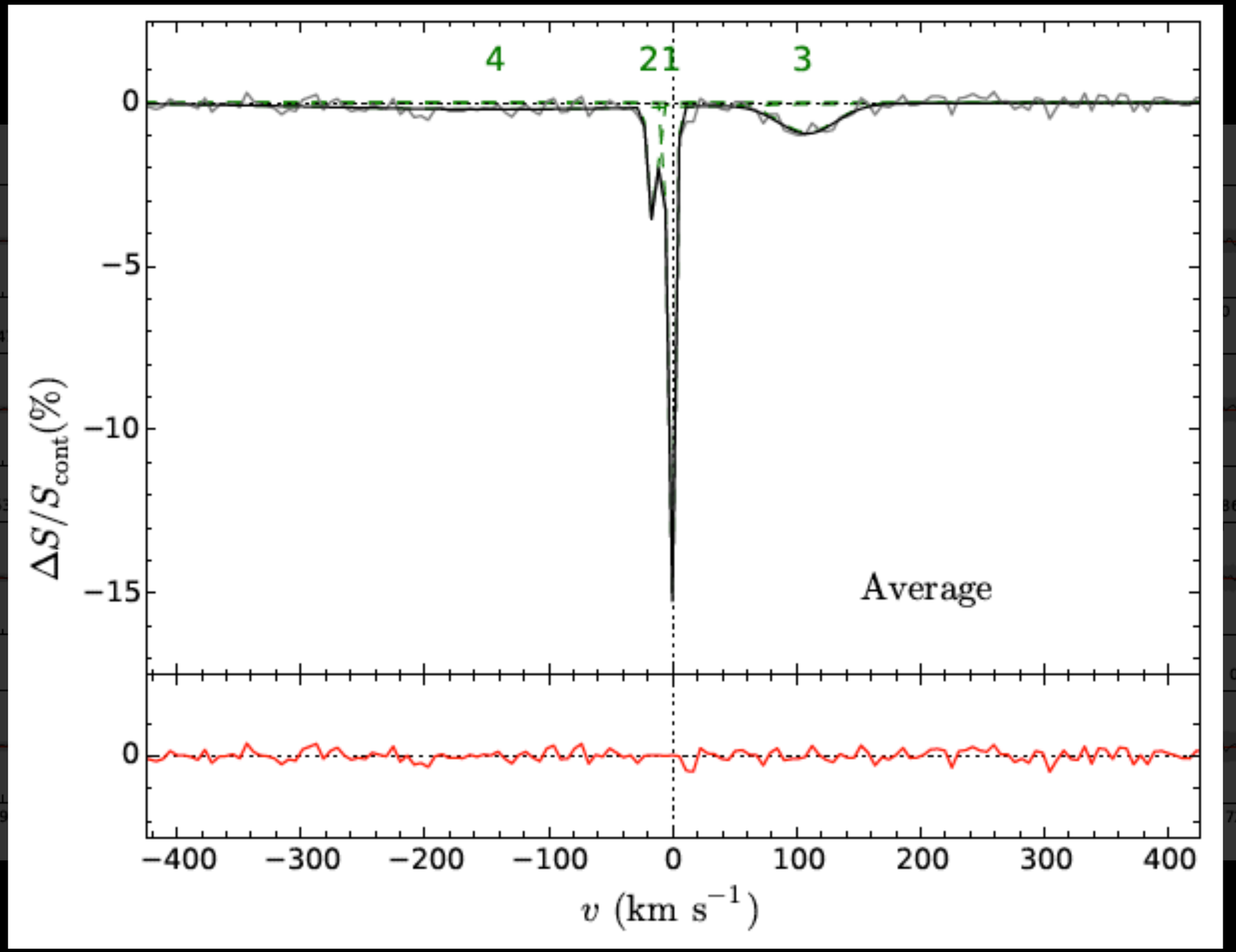
Birri-birri

Hotan et al. (2014)

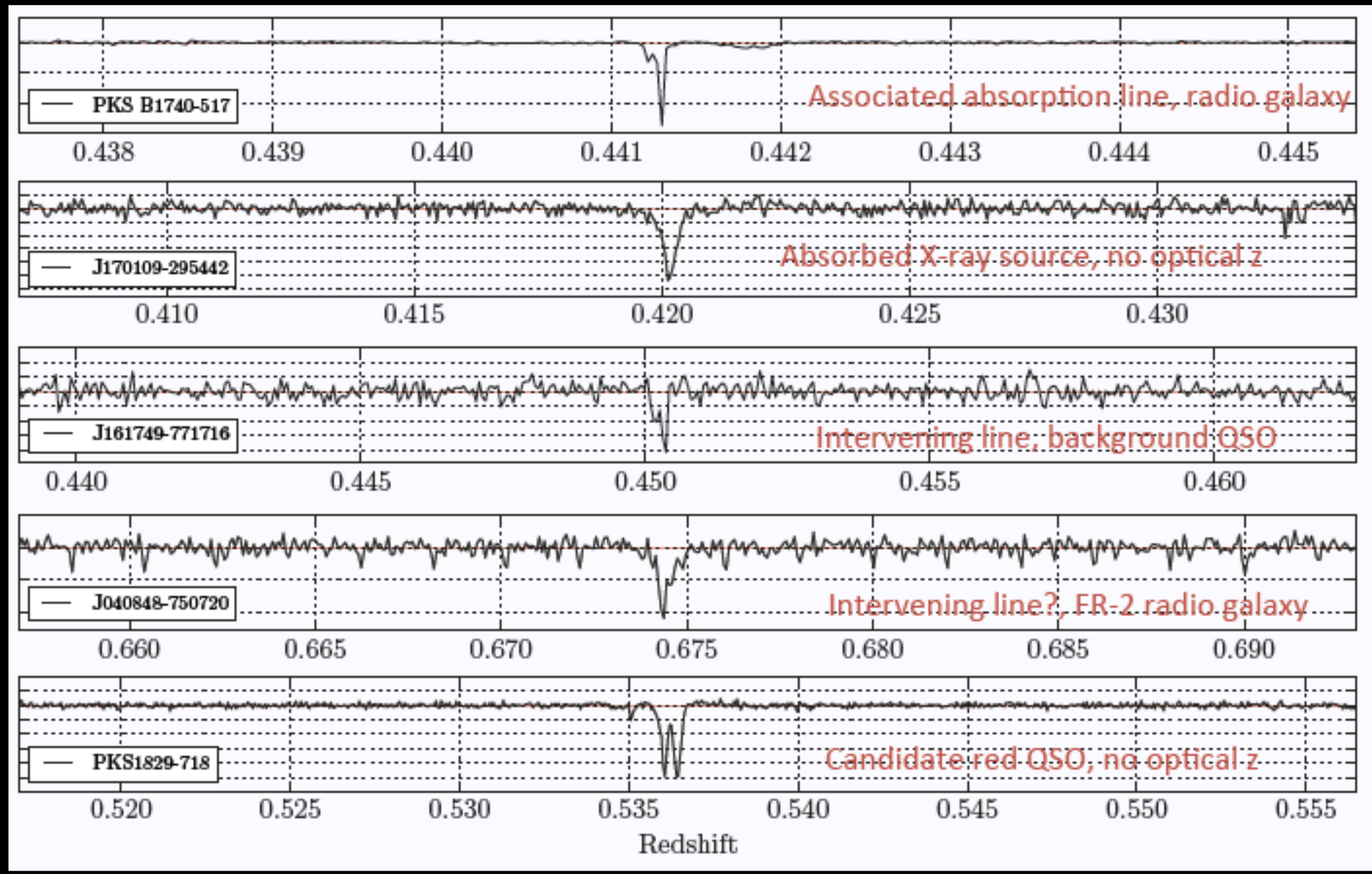
- 6 x 12 m antennas with Mk.1 PAF
- b_{min} = 37 m, b_{max} = 916 m
- 9 beams
- freq range: 700 - 1800 MHz
- 304 MHz instantaneous bandwidth
- 16,416 x 18.5 kHz channels



Allison et al. (2015)



Allison et al. (2015)

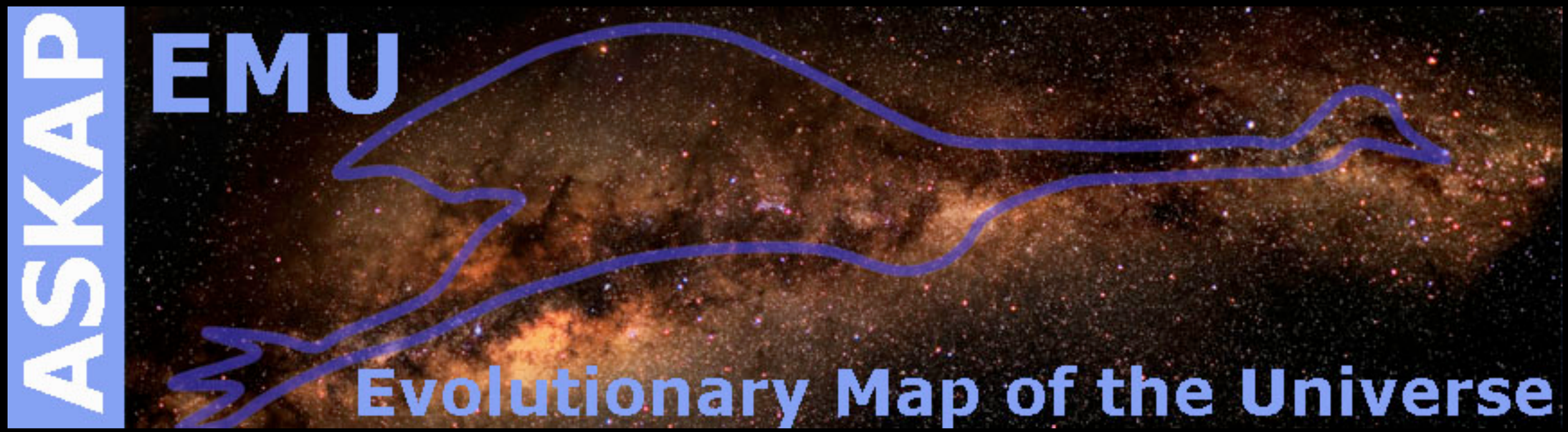


ASKAP-FLASH
First Large Absorption Survey in HI

Sadler (PI), Allison, Glowacki,
Mahoney, Moss & FLASH team
150,000 spectra at z = 0.4 - 1.0

150 deg^2 in 12 h at 700-1000 MHz
3,700 detections
1,000 spectral indices

Heywood et al. (2016)



PI Norris

- 75% of the sky at 1100-1400 MHz
- 10 μJy rms at 10” resolution
  (40× NVSS sensitivity at 5× the resolution)
- 70 million detections
  (2.5 million over the entire history of radio astronomy so far)

ASKAP HI imaging of the galaxy group IC 1459 (Serra et al. 2015)

ESO 406-G42

ESO 406-G40

IC 5273

IC 5269C

IC 5270

NGC 7421

NGC 7418A

IC 5264

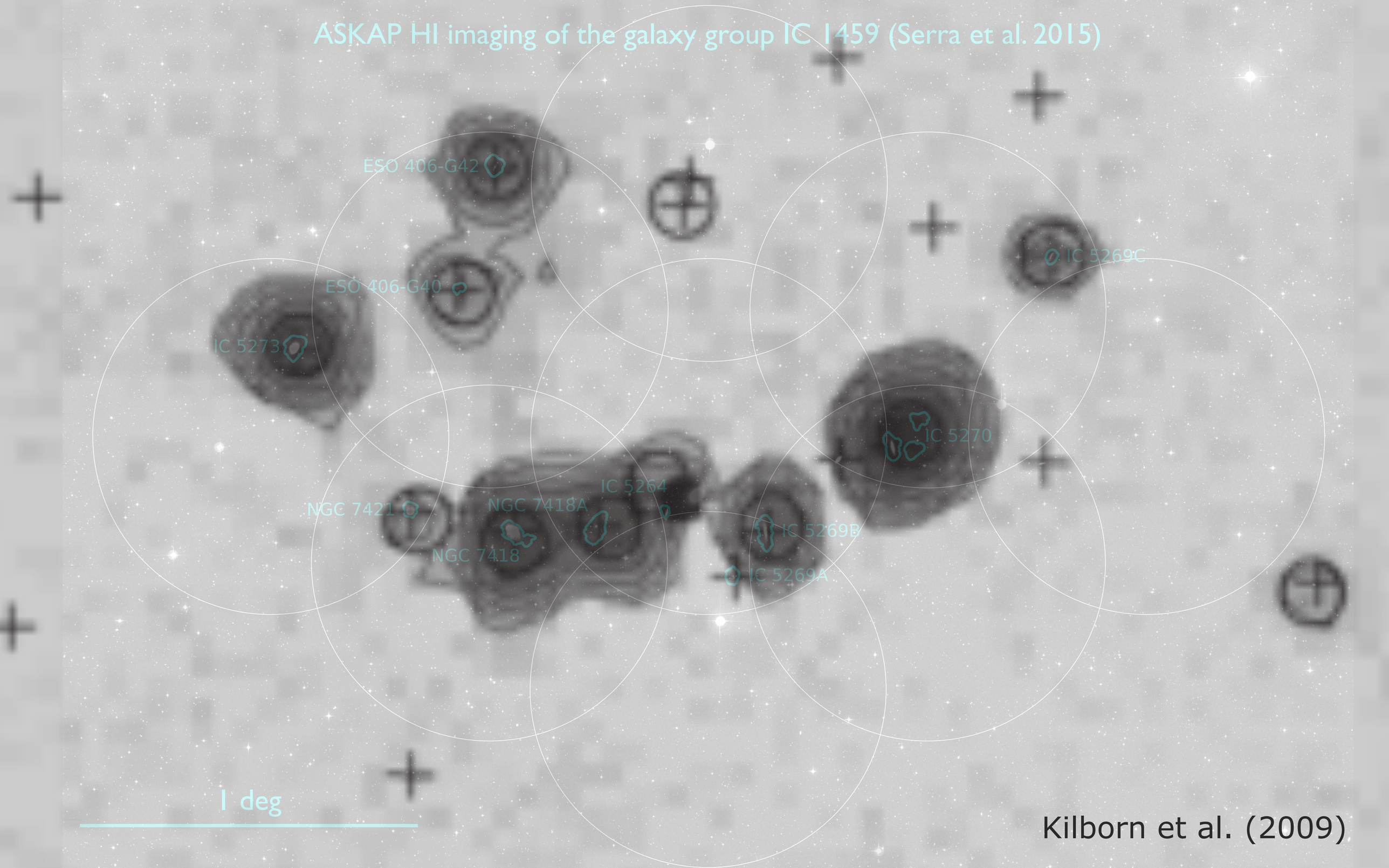
NGC 7418

IC 5269B

IC 5269A

1 deg

ASKAP HI imaging of the galaxy group IC 1459 (Serra et al. 2015)

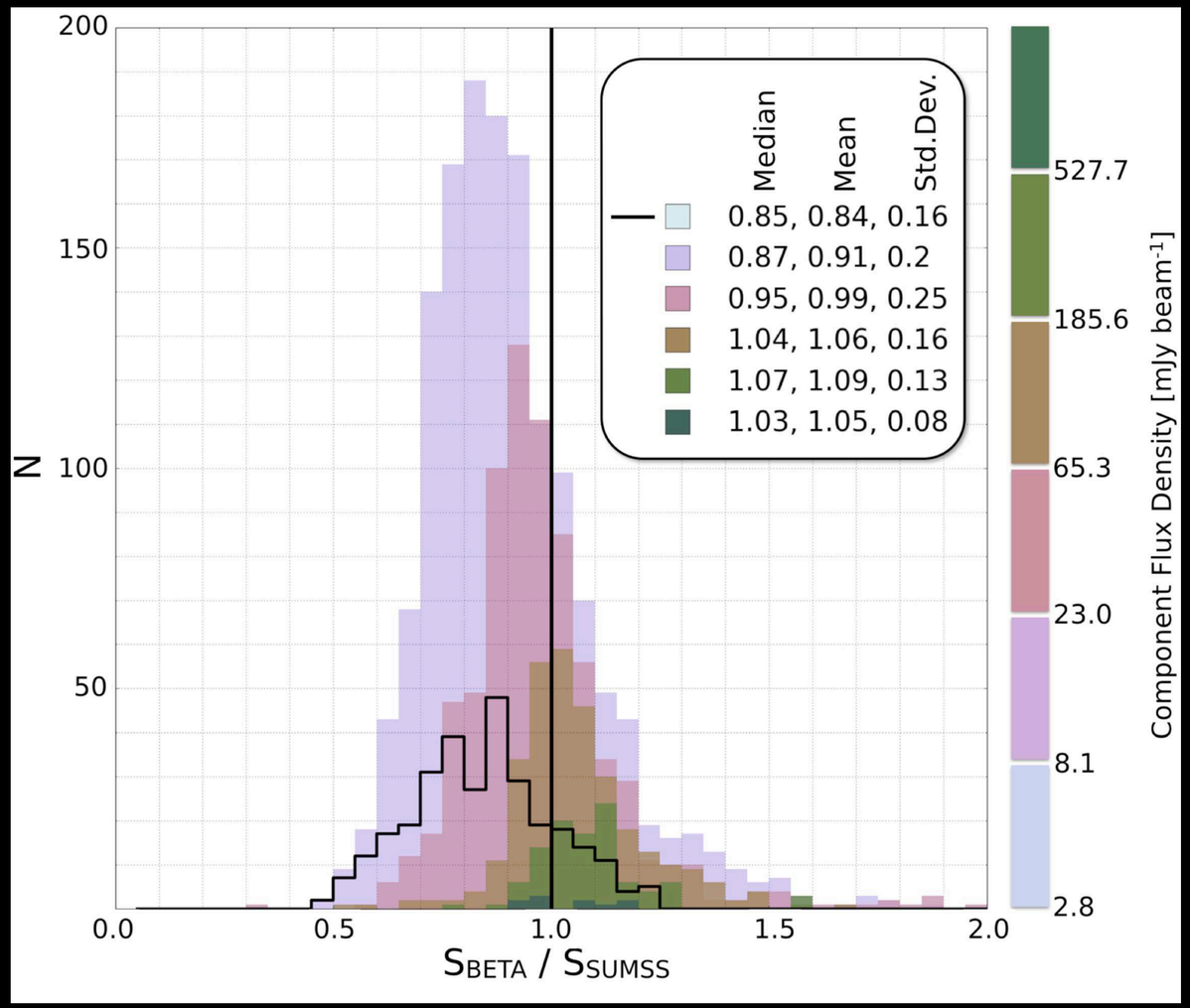


Kilborn et al. (2009)

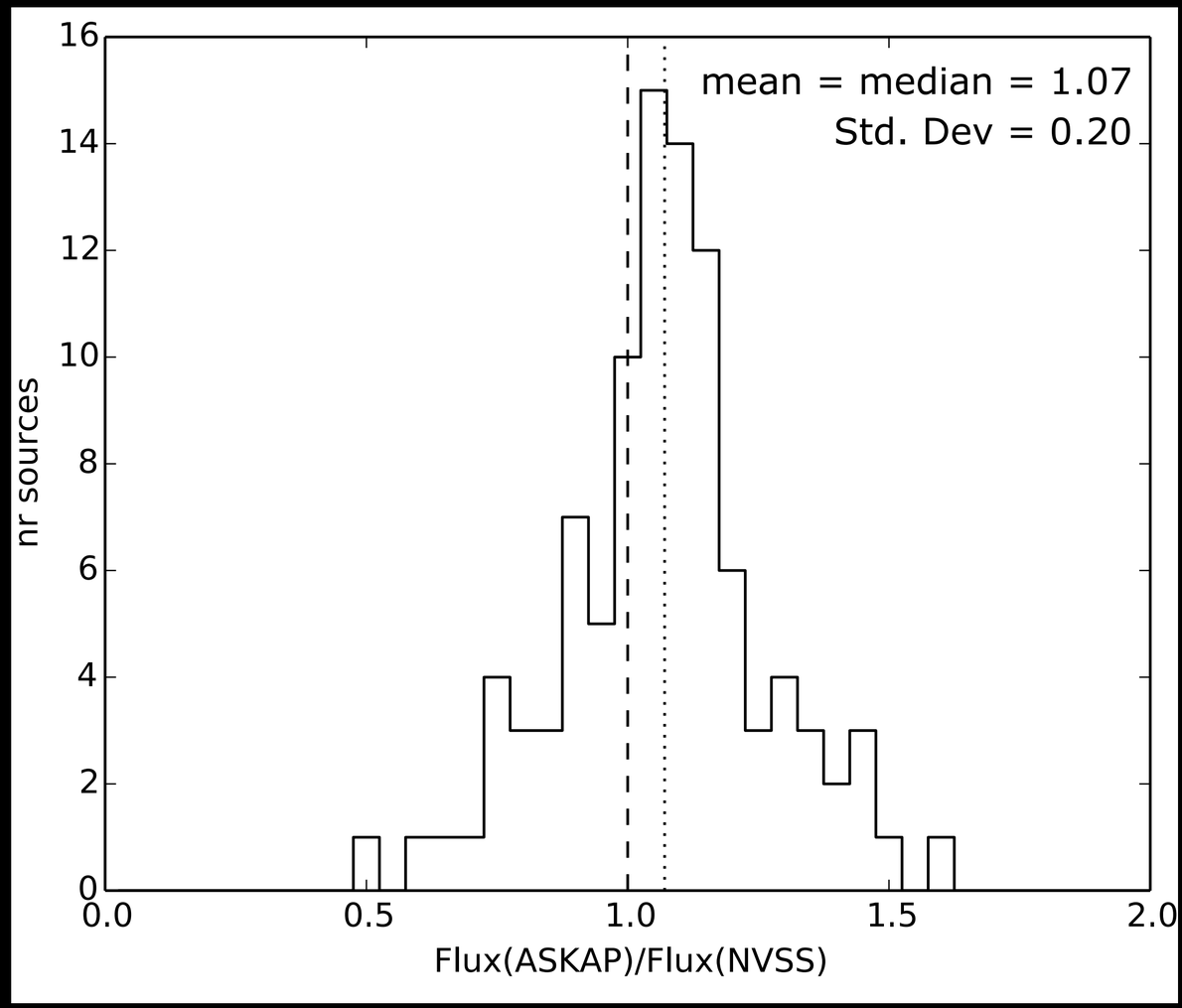
	WALLABY	*HIPASS*
area	3π (~1,000 fields)	3π
resolution	0.5 arcmin, 4 km/s	15 arcmin, 18 km/s
noise (20 km/s)	0.7 mJy/beam	13 mJy/beam
nr detections	500,000	5,000
redshift range	0 - 0.26	0 - 0.04

WALLABY PIs: Koribalsky & Staveley-Smith

How well do we know our beams?



Heywood et al. (2016)



Serra et al. (2015)

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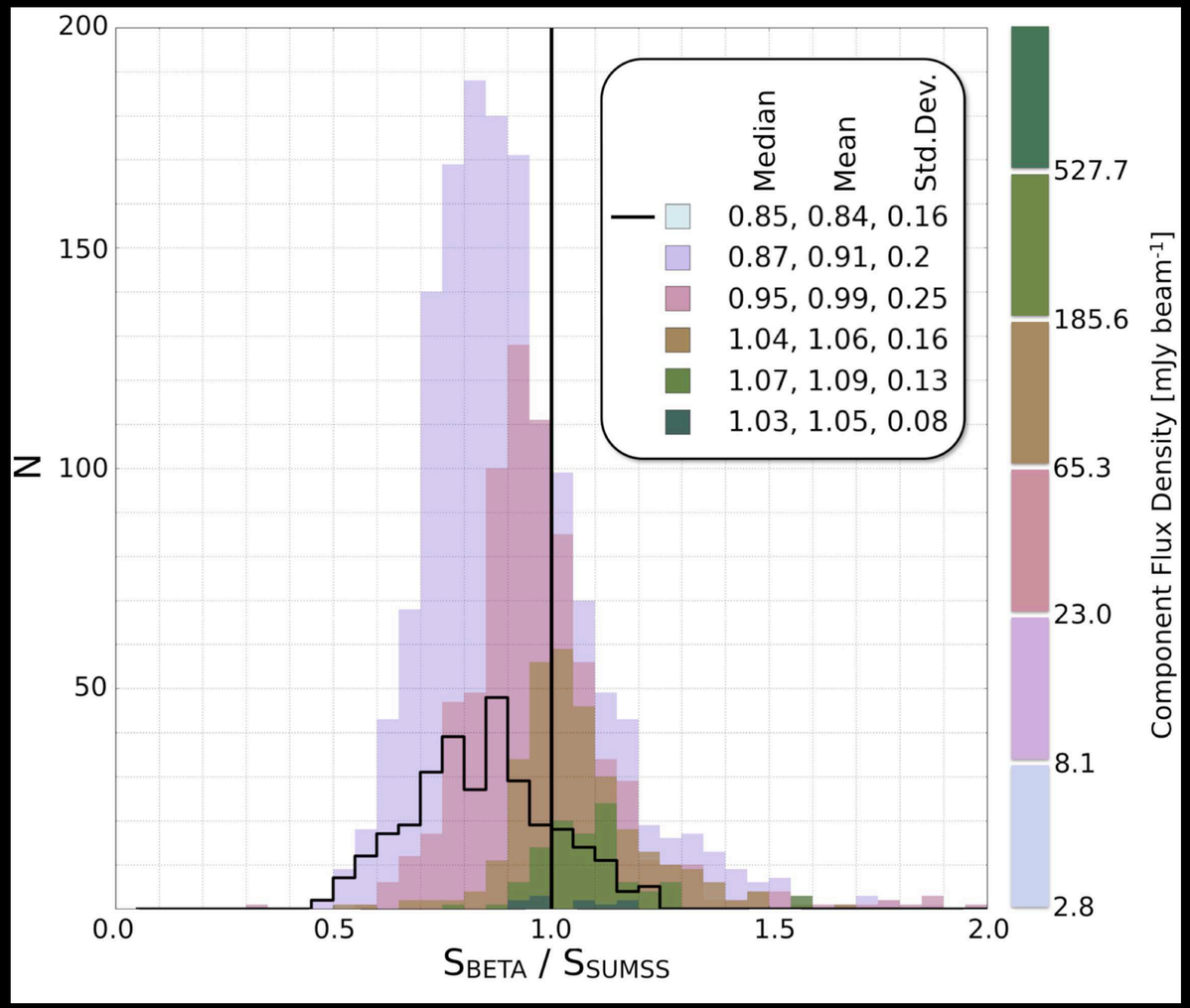
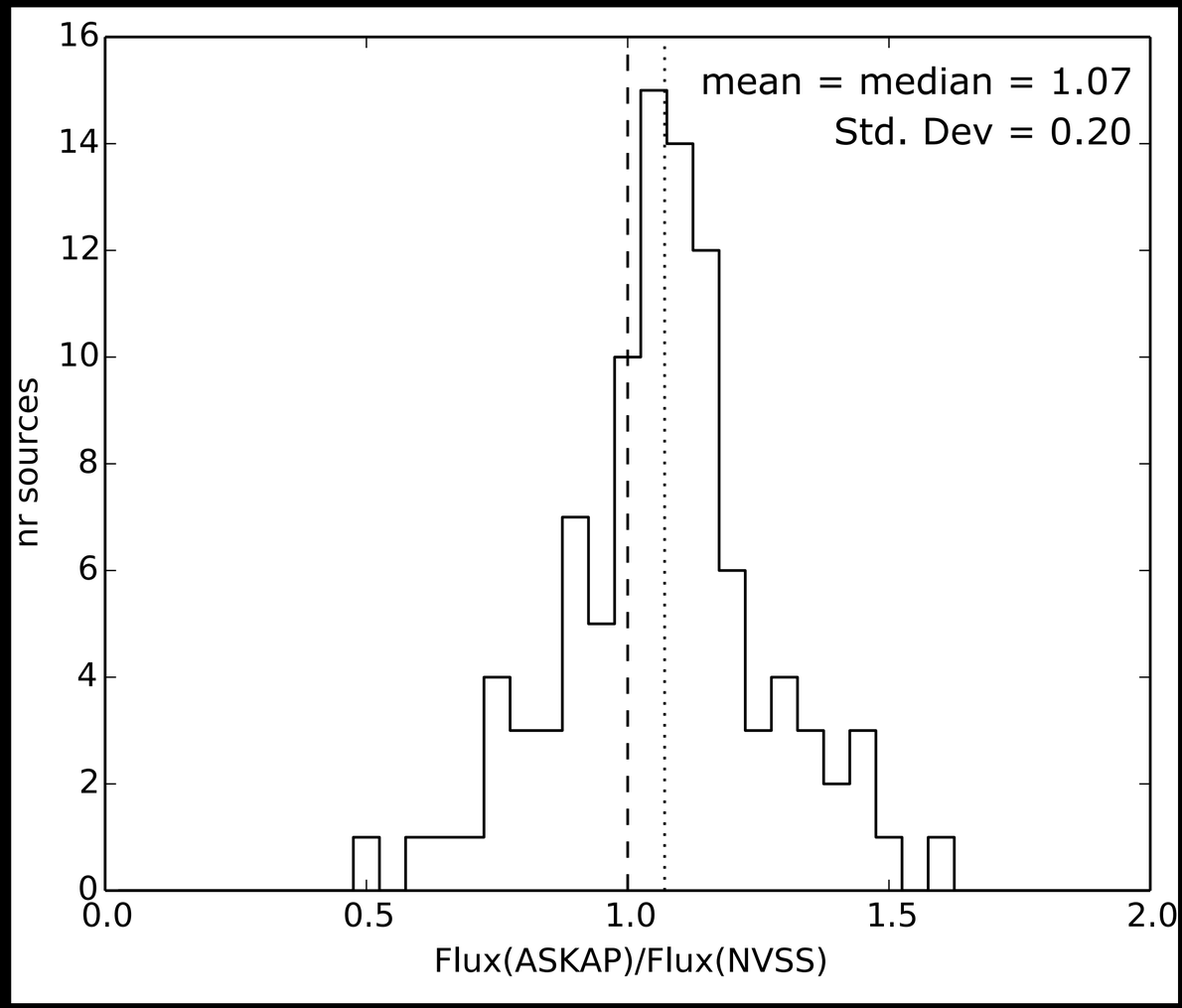


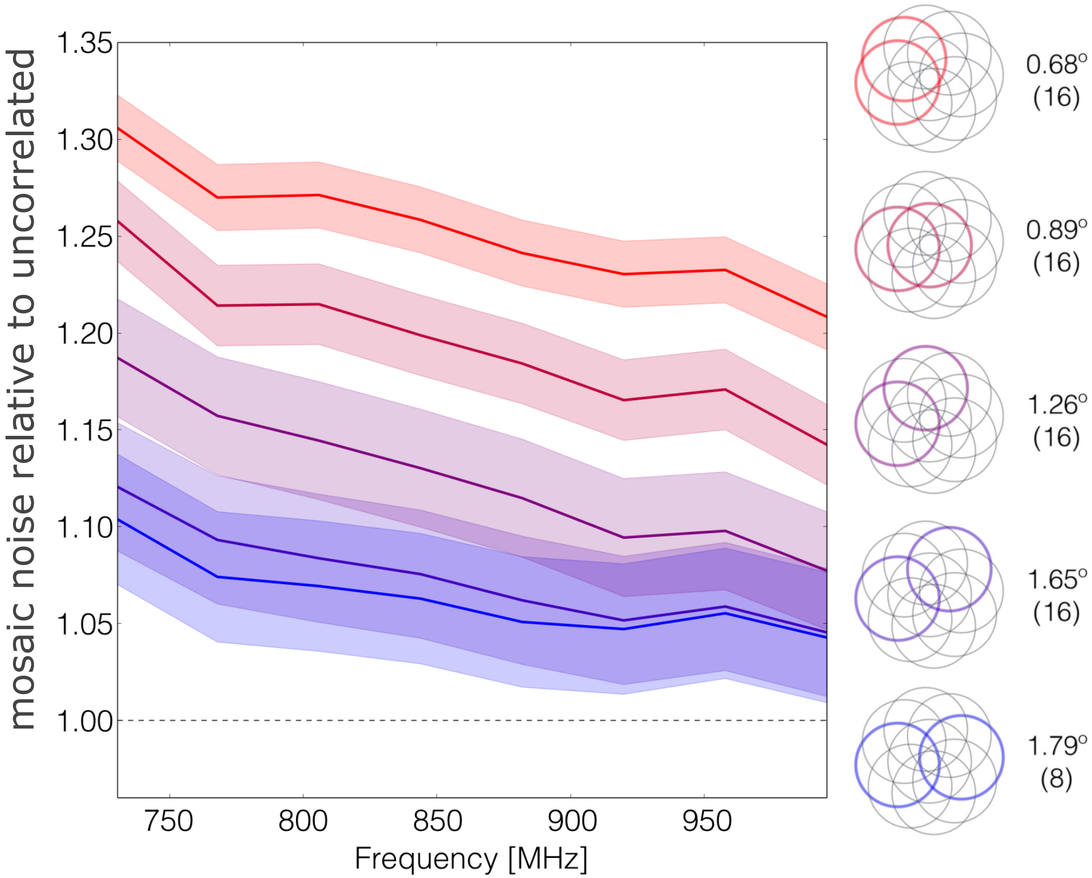
Heywood et al. (2016)

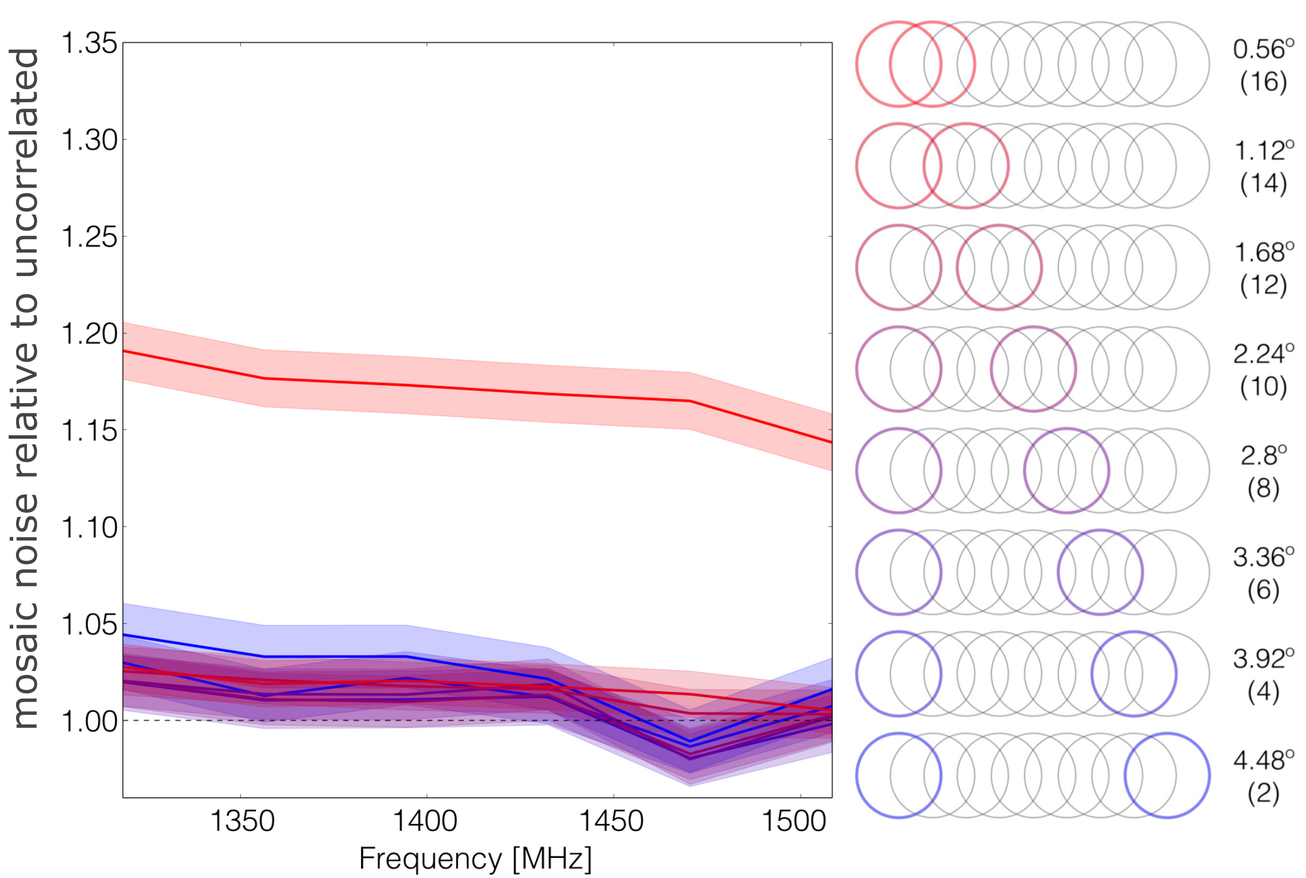


Serra et al. (2015)

Need well known (e.g., shape constrained) and stable (on-dish radiator) beams

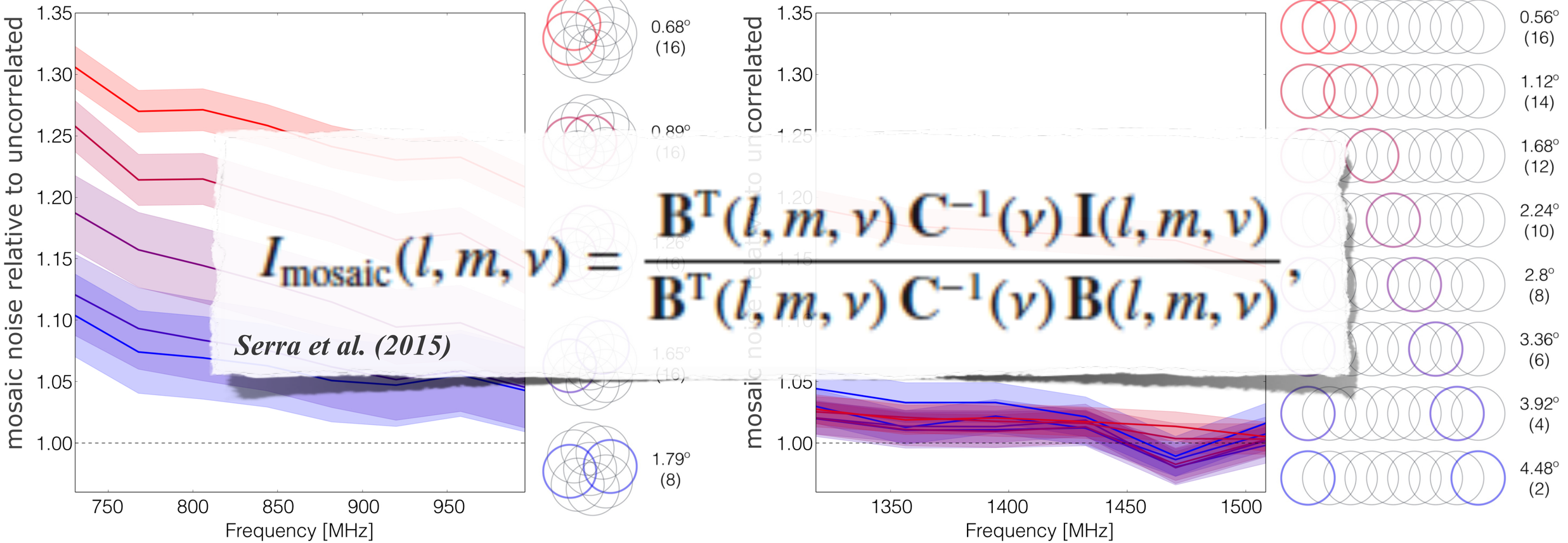
Noise correlation





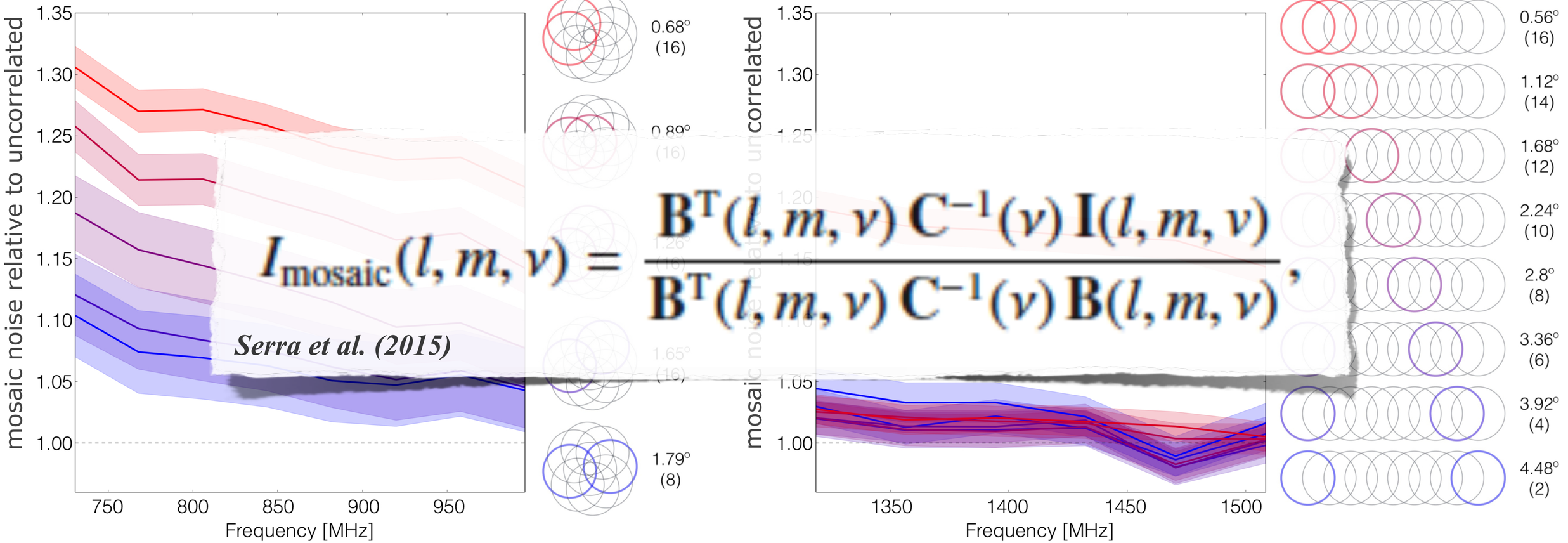
Ian Heywood

Noise correlation



Ian Heywood

Noise correlation



Ian Heywood

*Need to know **C** as a function of frequency*

Bandpass calibration

BETA: 15 min on B1934-638 per beam
For ASKAP’s 36 beams this would be 9 h

Significant change compared to single-pixel feeds:
cannot bandpass calibrate before/after every 12-h track

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Need to characterise bandpass stability: stable enough for long enough?

- Six refereed astronomy papers from ASKAP/BETA in 2015/2016
  Radio continuum imaging
  Spectral line emission and absorption imaging
  Variable radio sky

- Many lessons/questions from ASKAP/BETA (McConnell et al. 2016, PASA)
  Beam shape, stability, correlation
  Calibration strategies
  RFI mitigation

- ASKAP-12 now taking data: expect heaps of new exciting science!