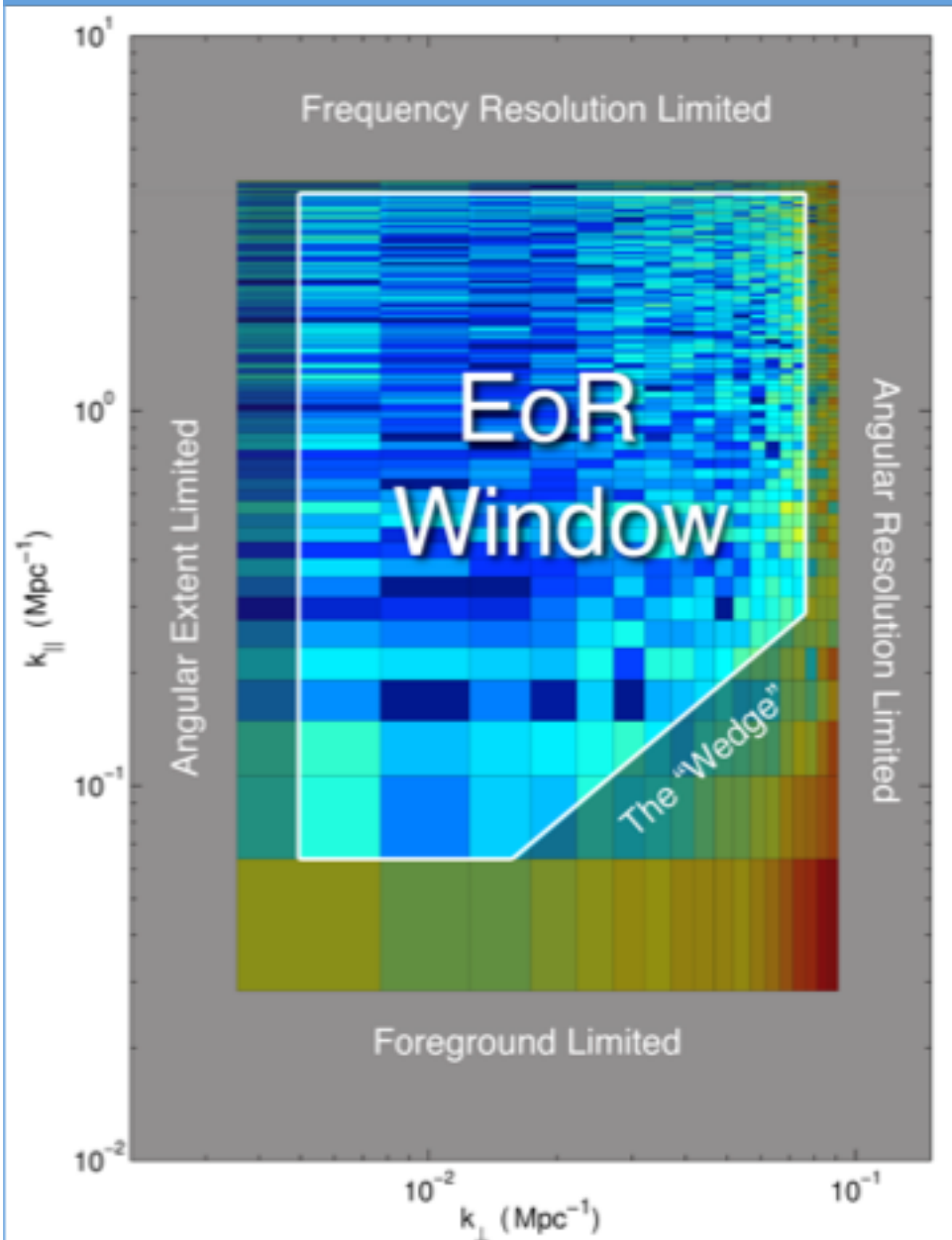


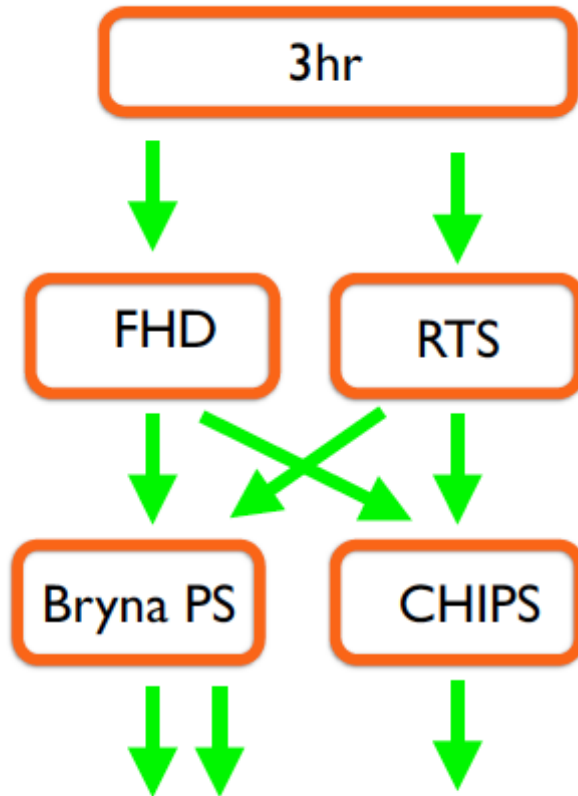


MWA Extension: a raft of opportunities

Rachel Webster
University of
Melbourne



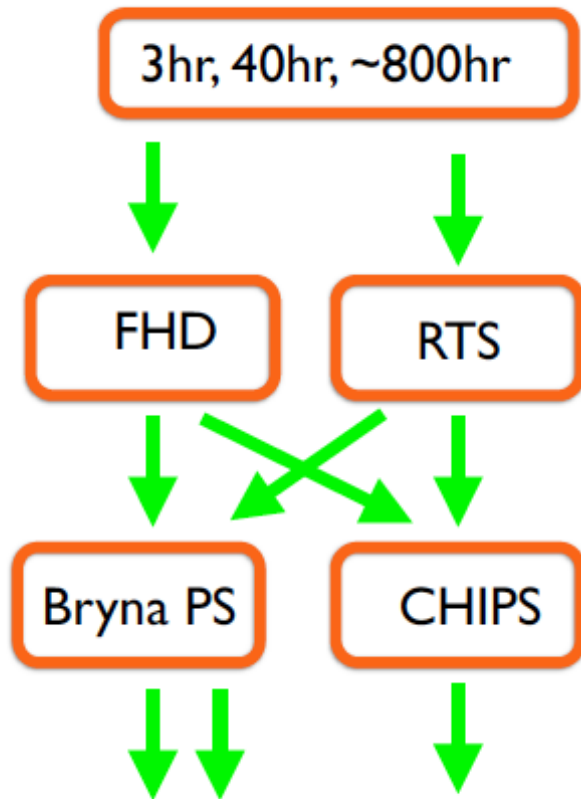
EoR Collaboration: status



Pipelines

- strategy: end-to-end pipeline
- diagnostic: k_{\perp}/k_{\parallel}
- cross-checking → robust diagnoses
- jack-knife tests
- → Jacobs et al 2015

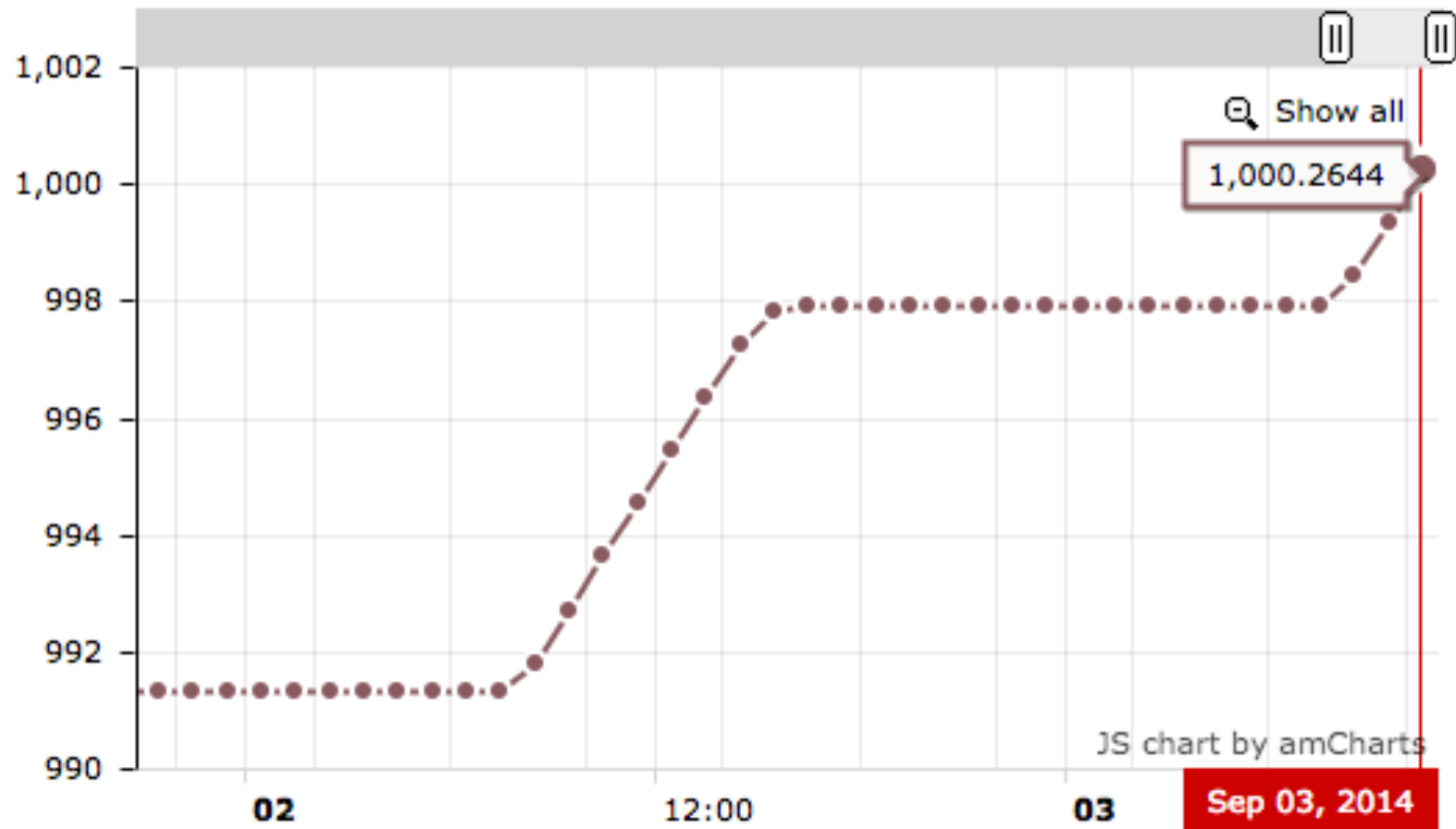
EoR Collaboration: status



Pipelines

- strategy: end-to-end pipeline
- diagnostic: k_{\perp}/k_{\parallel}
- cross-checking → robust diagnoses
- jack-knife tests
- → Jacobs et al 2015

Hours of EoR Observing

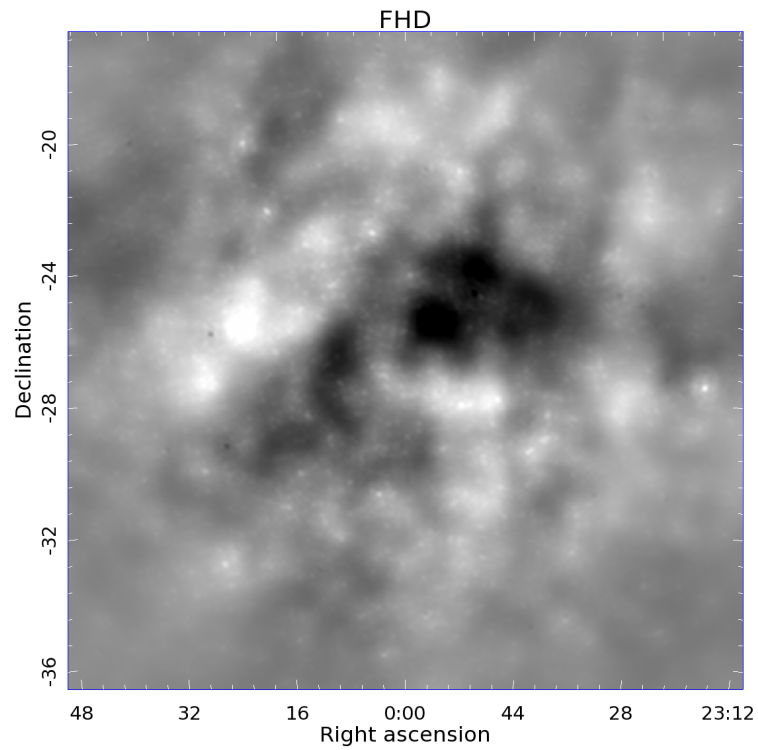


1227 hours to October 13 from Adam Beardsley

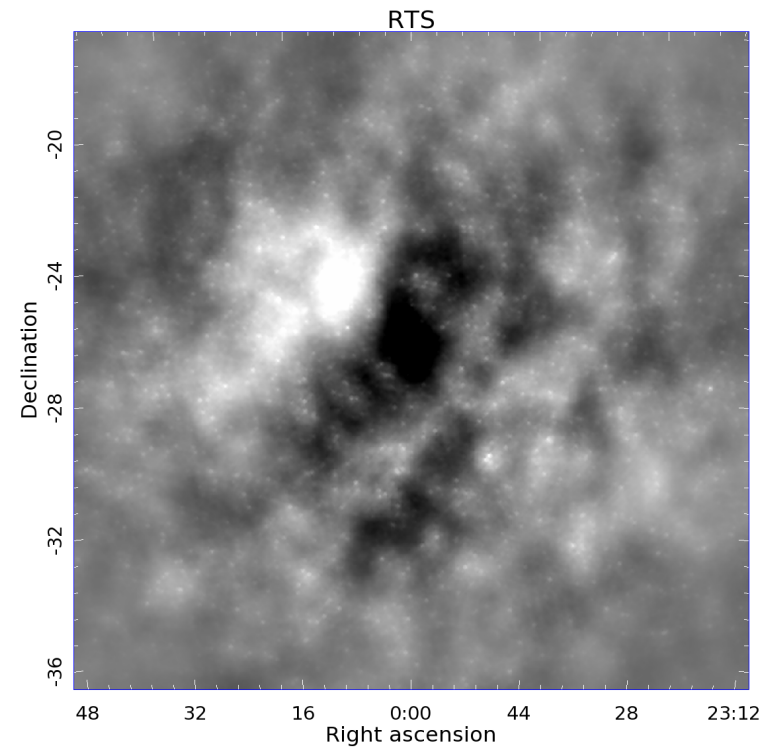
- 600 hours in a single field will provide interesting limits
- We have 346 hours in our deepest field at a redshift of 7.6
- Results that will be shown are our 3 hour 'Golden set'
- We have agreed not to show our 40 hour data set publically at this time though we have processed this data several times

Comparison of foreground analyses

Washington

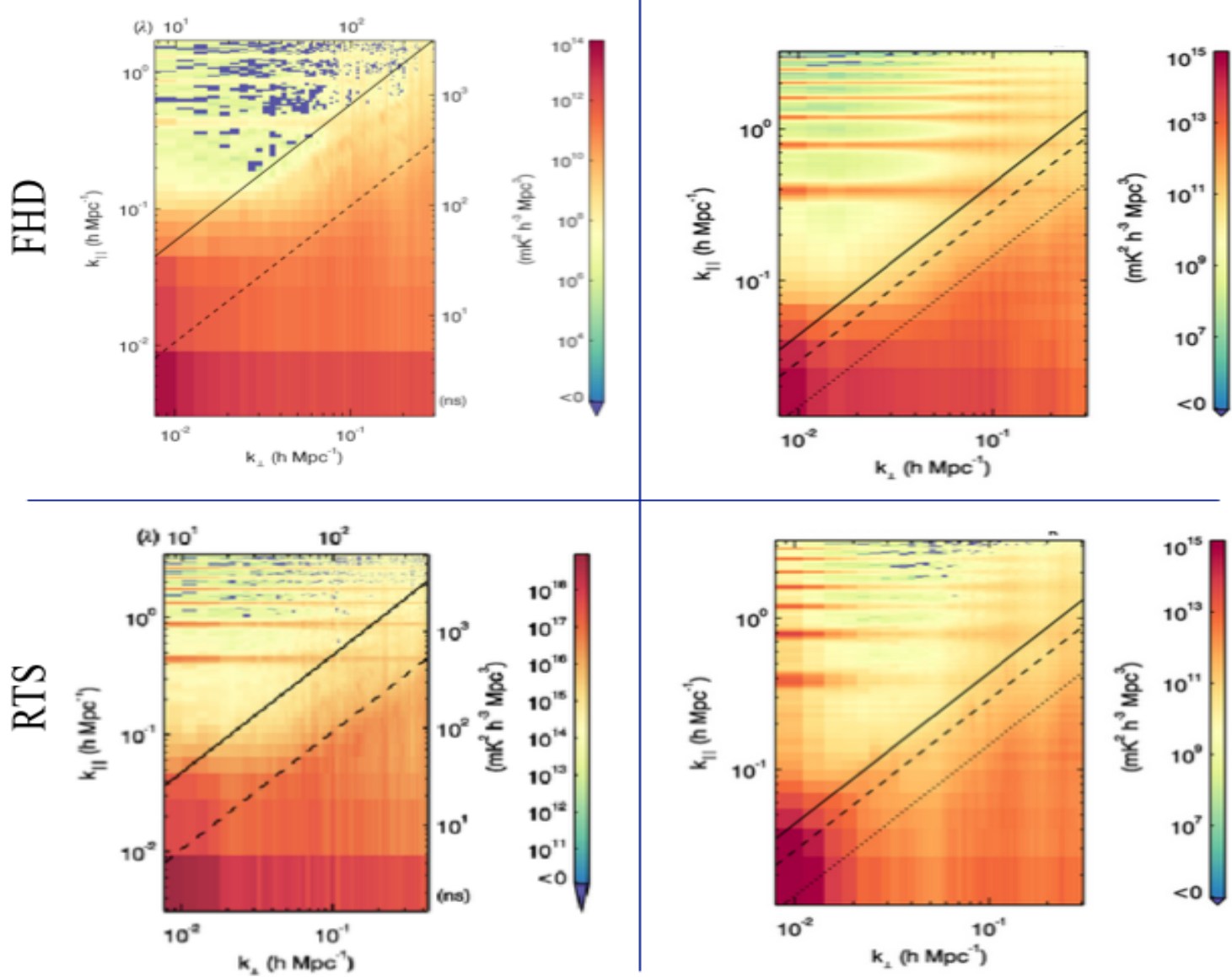


Australian



Foreground Removal

Power Spectrum Method



Will systematics beat us?

- Foregrounds:
 - point sources
 - extended sources
 - smooth galactic emission and polarisation
- Instrumental:
 - RFI
 - coarse band edges
 - cable reflections
- Algorithms:
 - still learning and exploring

Will systematics beat us?

- Foregrounds:
 - point sources ✓
 - extended sources ✓
 - smooth galactic emission ✓ and polarisation ~
- Instrumental:
 - RFI ✓
 - coarse band edges ~
 - cable reflections ~
- Algorithms:

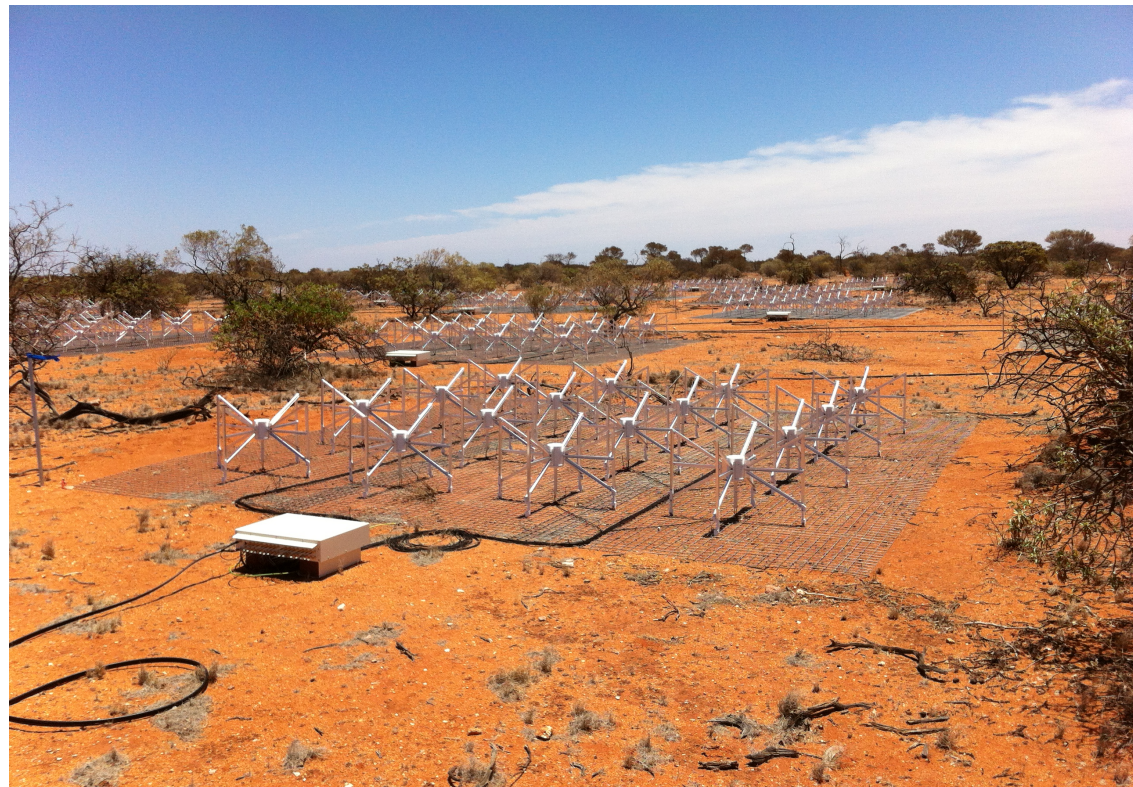
Limiting factors
unknown at this time

MWA_{ext} Options

- Potential improvements in the MWA
 - more tiles
 - new digital systems
 - new software pipeline
- New EoR experiment – MWA-EoR2
 - issues

More tiles

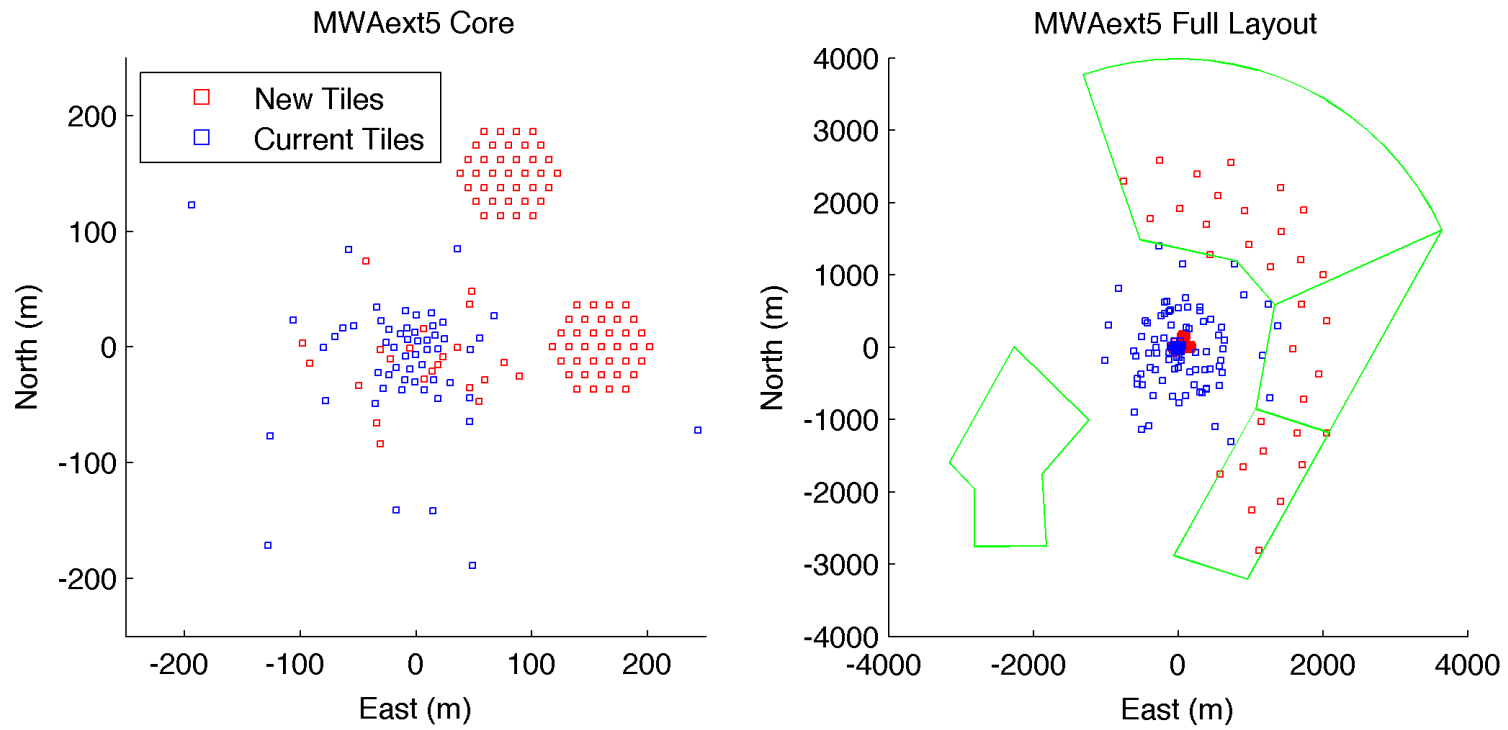
- Layout
- Sensitivity → Cath's talk
- Potential funding
 - LIEF (~\$1-1.5m)
 - International partners?



Some of Beardsley's thinking

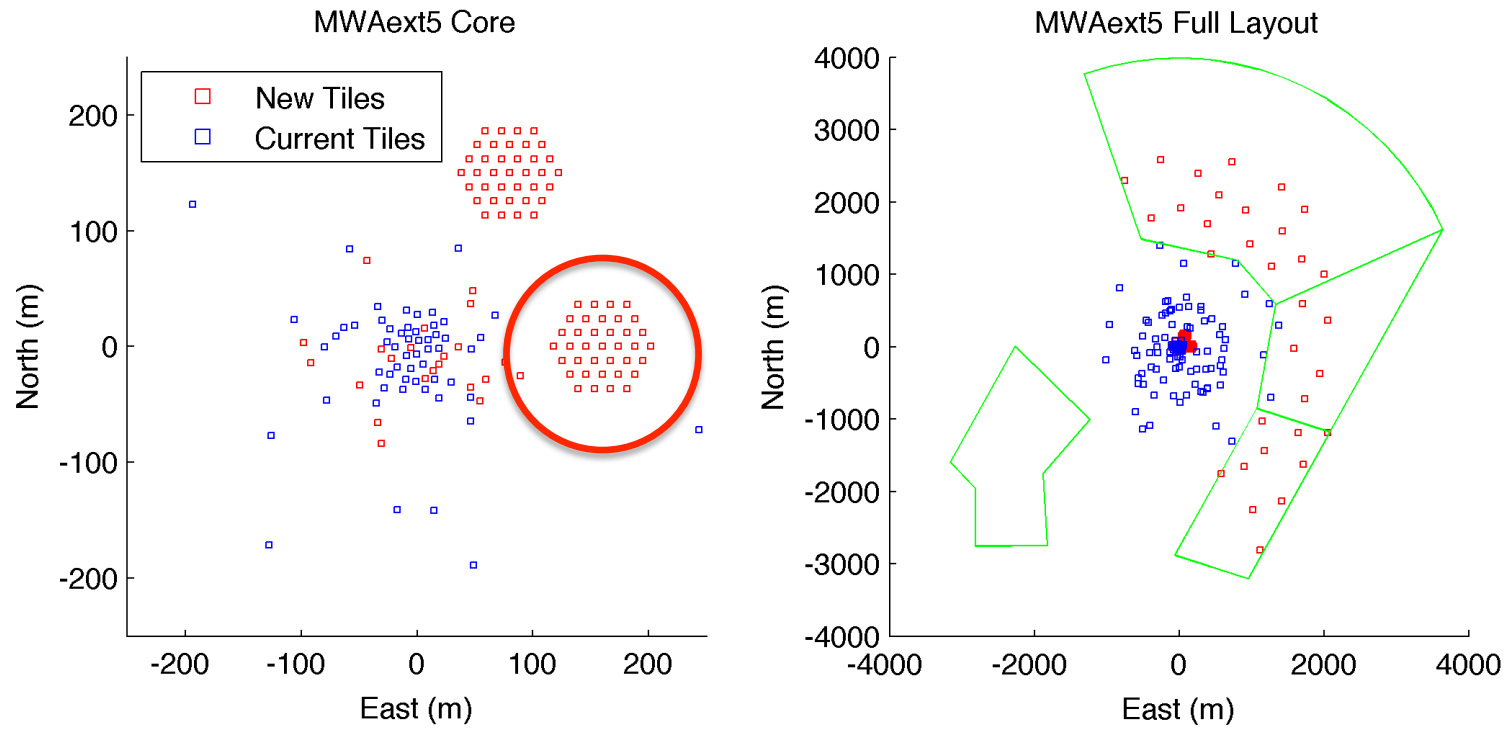
- EoR specific!
- Elements: longer baselines, concentrated core, redundancy
- → hybrid array
- Could just fill in the core, but...
- Receivers are all outside the current core so it is easier to put things outside
- Limits to the west, so had to extend to the east

Beardsley option

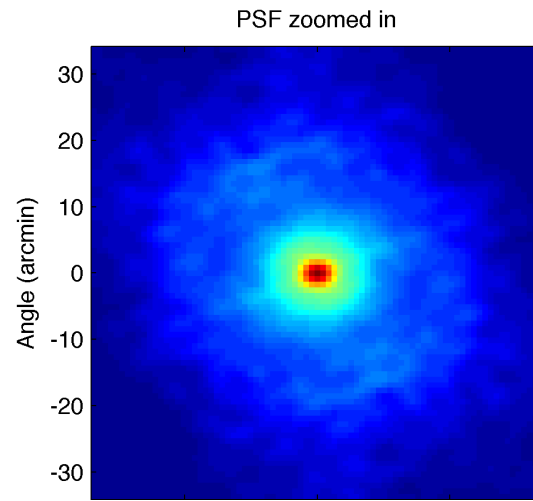
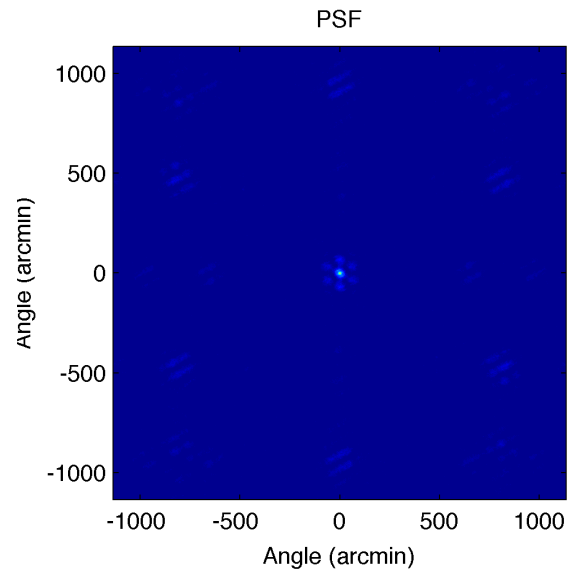


* Redundant arrays

Beardsley option

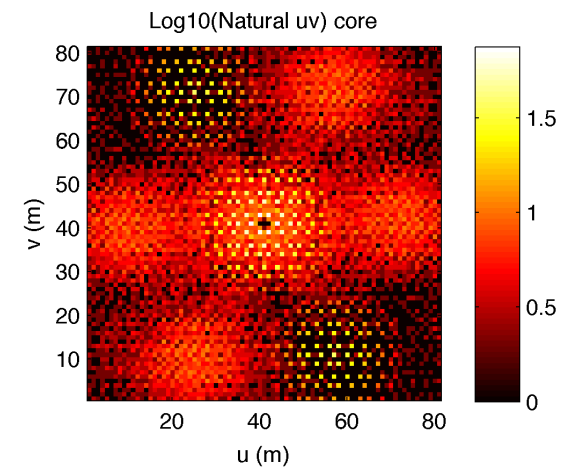
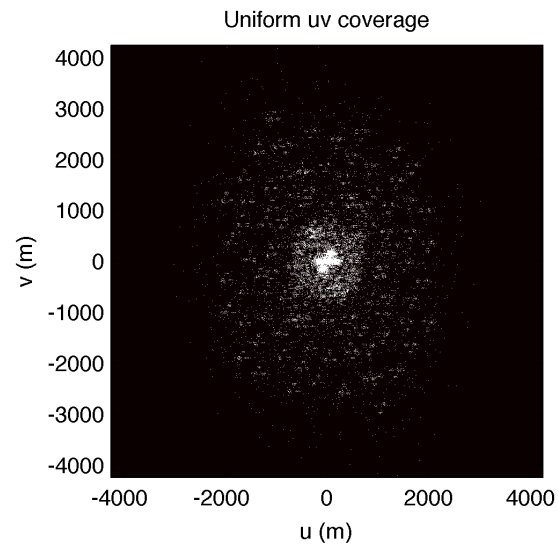


* Redundant arrays



PSF

UV coverage

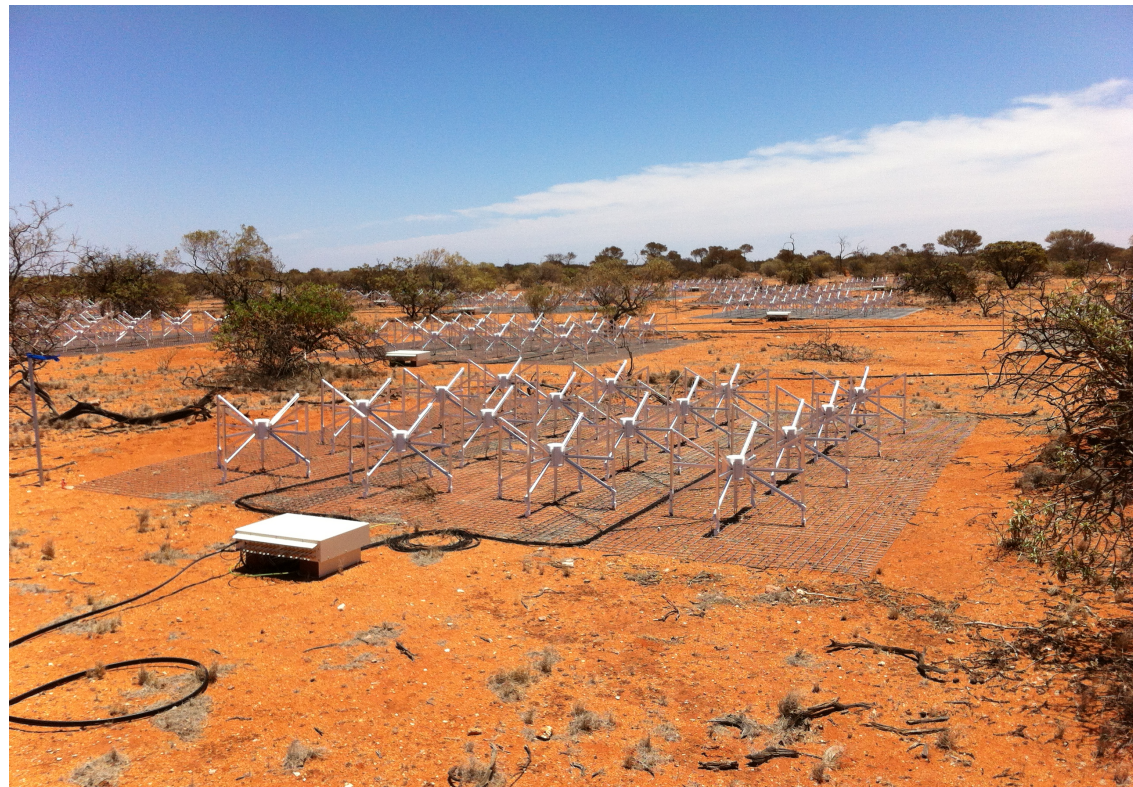


Redundant Arrays

- USA EoR groups are committed to exploring redundant arrays - HERA
- Increased signal, but can the systematics be removed?
- US funding cycle is delayed, and yet to be secured
- Can MWA_{ext} explore the advantages/ otherwise of redundant array?

More tiles

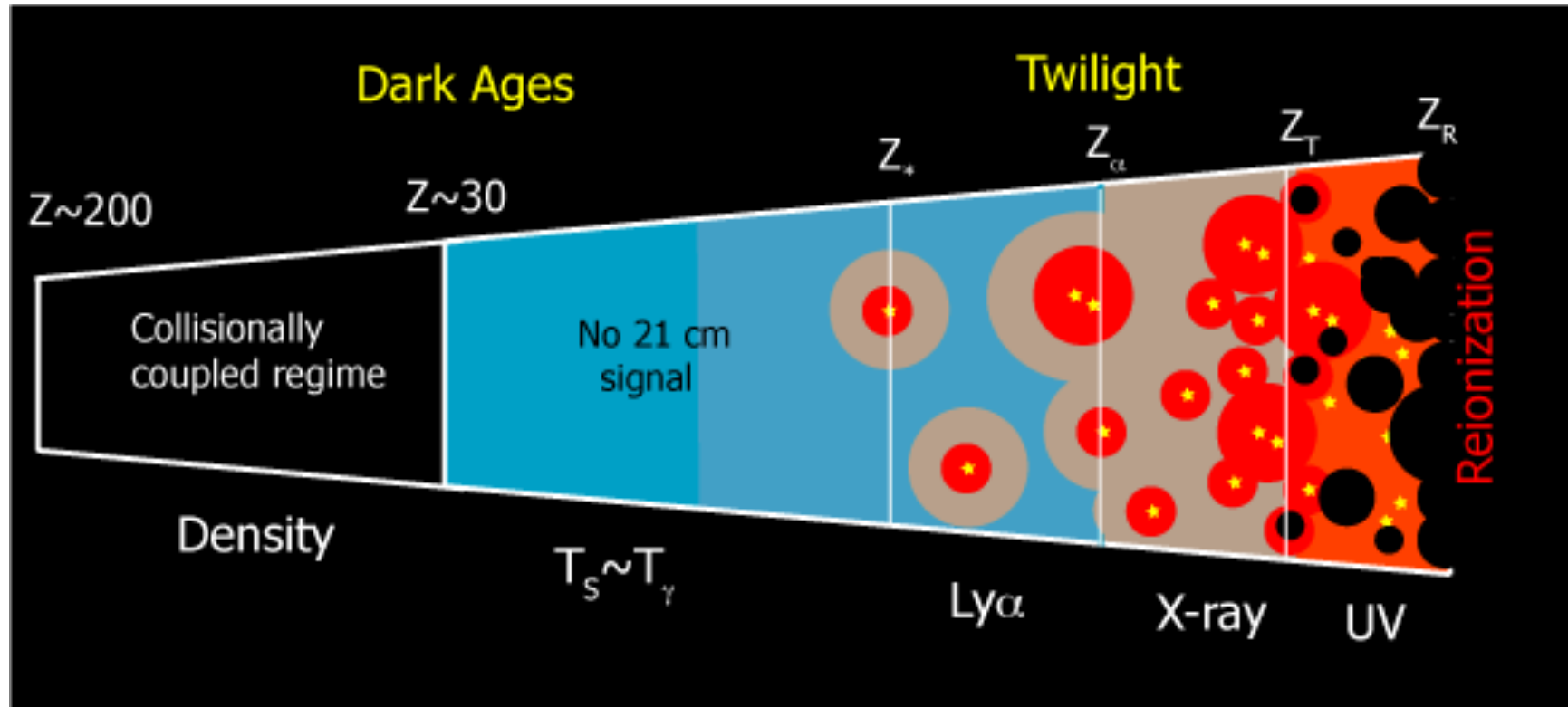
- Layout
- Sensitivity → Cath's talk
- Potential funding
 - LIEF (~\$1-1.5m)
 - International partners?



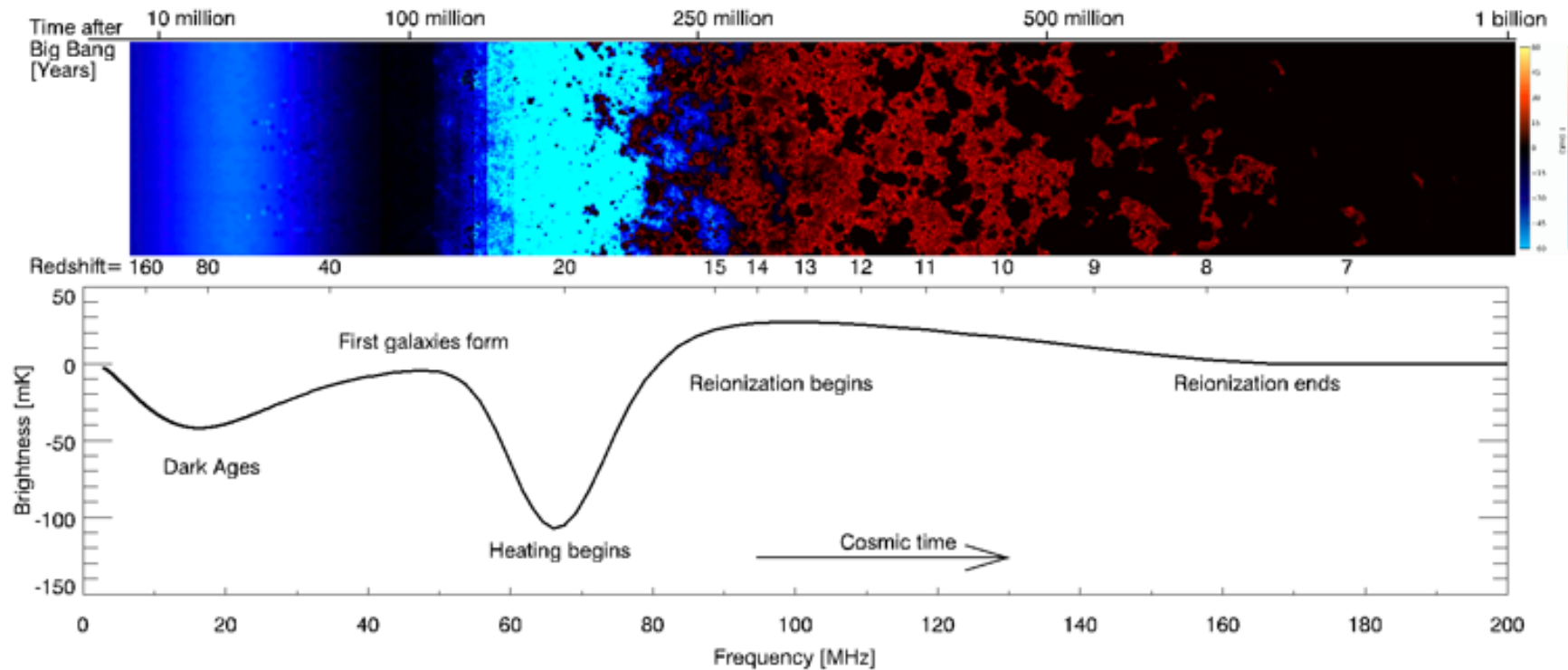
Digital data path

- Why? The science drivers
- Estimated costs
- Funding – International partners?

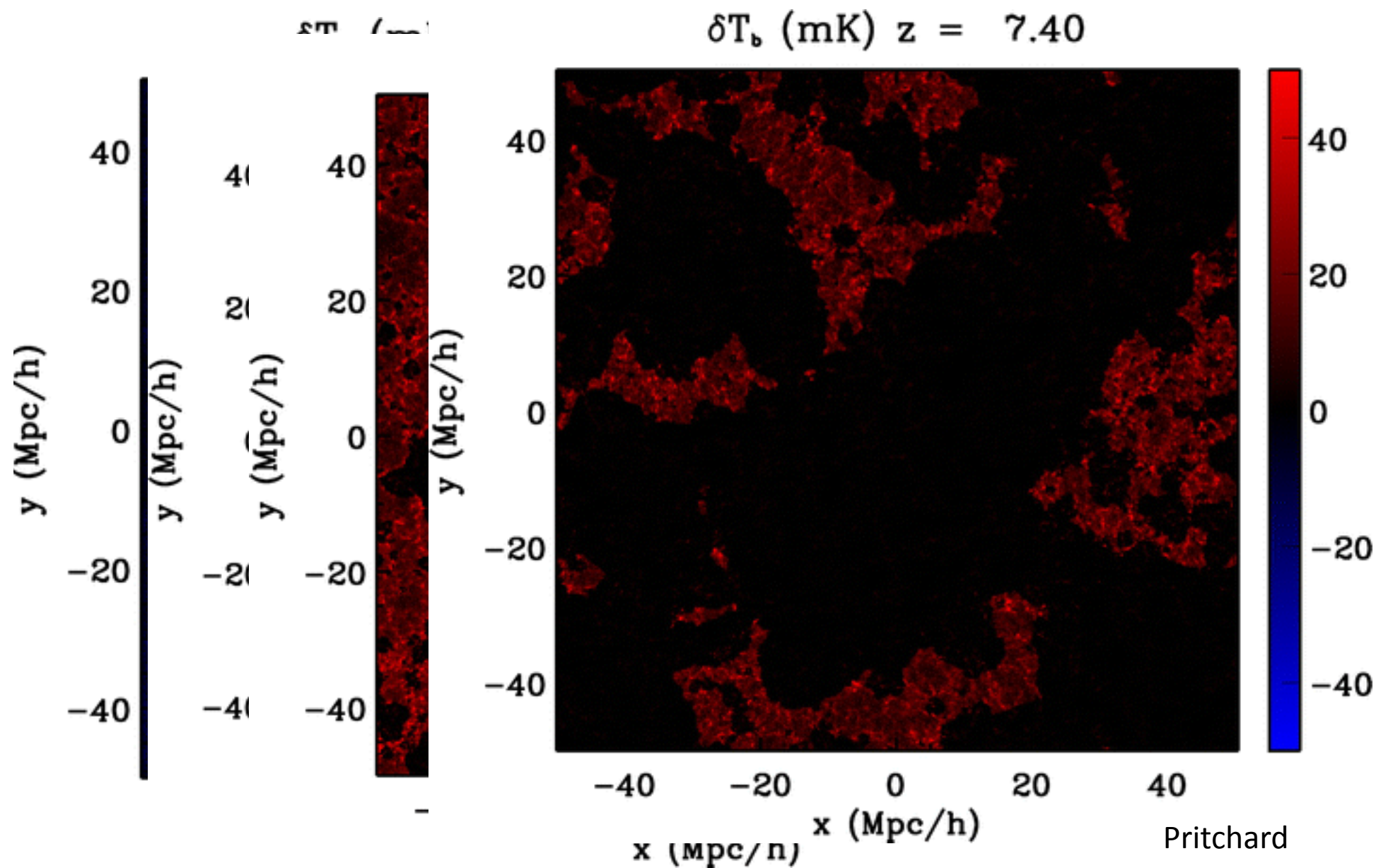
X-ray heating provides a stronger signal, but the foregrounds increase



21cm signal – absorption then emission



Fluctuations – note the scale changes



Digital data path

- Why? EoR science drivers
 - X-ray heating signature
 - 50-250Mhz, wide bandpass – foreground removal
 - smooth bandpass
- Estimated cost
 - could be a staged upgrade
 - ~\$4m
- Funding – International partners?
 - US likely to be a minor partner
 - new partners need cash

New software pipeline

- See Bart's talk → tomorrow
- Introductory comments
 - RTS designed for a different array/computer
 - Better understanding of data/science options
 - Need a fast automated pipeline
 - Need to develop hardware in parallel
- Funding: ~10 FTEs – CAASTRO2?

New EoR Experiment

- A suitably upgraded extension will provide the opportunity for enhanced EoR measurement
- Requires a new EoR Collaboration 2017-2023
- New international partners?
- Australian-led
- Pre-cursor to SKA₁-low EoR experiment
- Advise the development and design of that experiment

Final Comments

- Major ^{Australian} scientific opportunity – MWA-EoR₂
- Three potential upgrade components
- Funding de-coupled
- → develop all cases – science and funding
- (guesstimate: digital upgrade will have greatest impact on EoR)

