

Computational challenges of the AARTFAAC all-sky monitor

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Overview

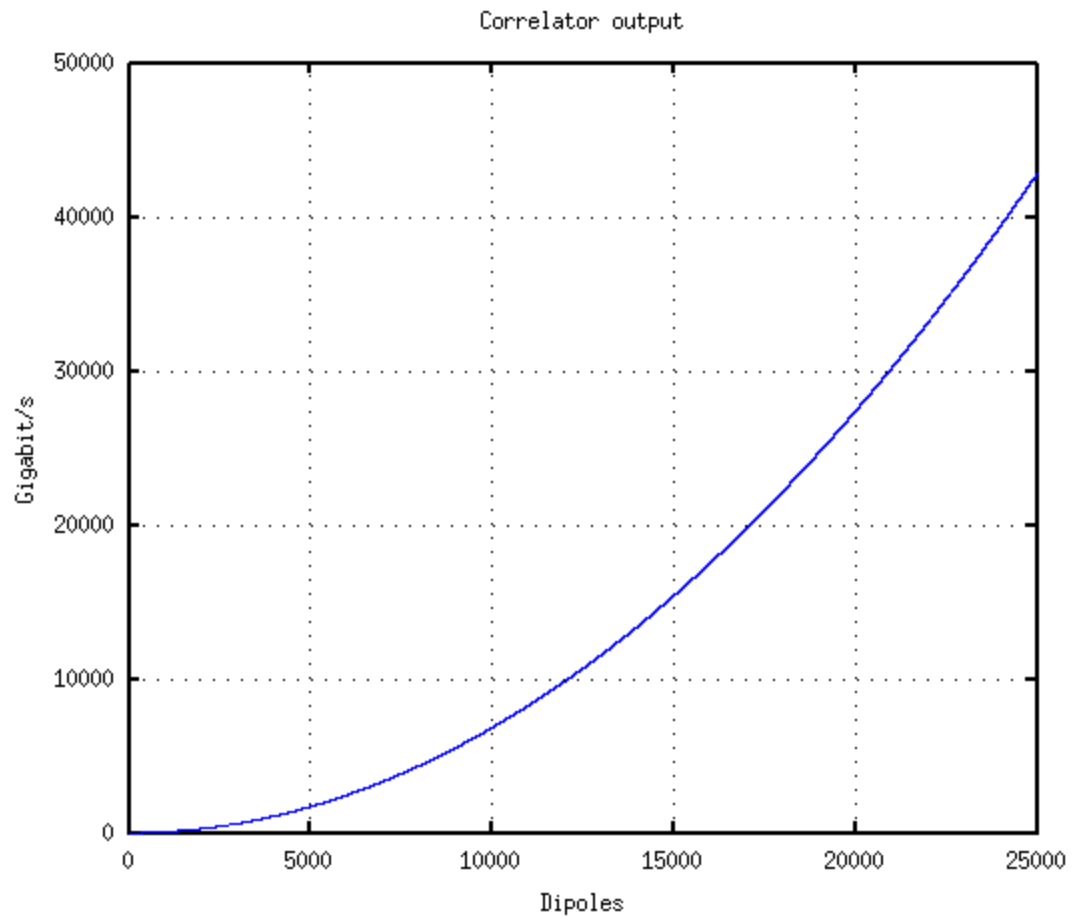
- Goal
- Problem specification
- Solution
- Computational challenges
- Pipeline design
- Computational hotspots
- Results
- Conclusion

Goal

- All sky monitor looking for transients
- Commensal to LOFAR
- Online 24/7
- Detect and respond in real-time
- Public alerts & minable lightcurve archives

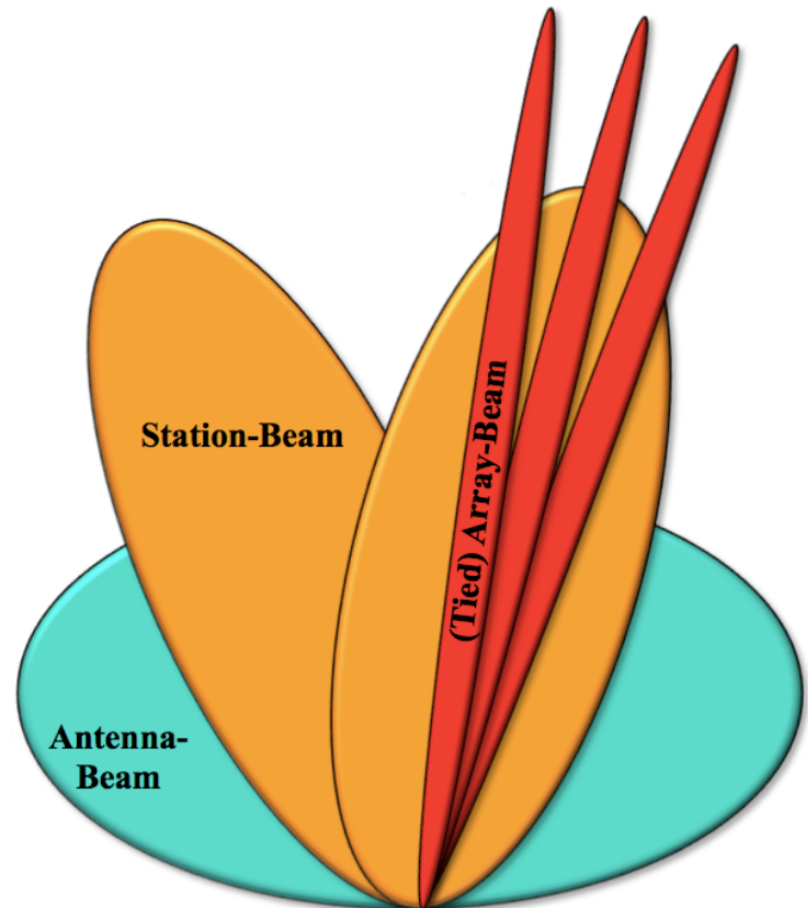


Ideally...



Reduce data

- Beamforming
 - lose all sky
- Reduce #dipoles
 - keep all sky

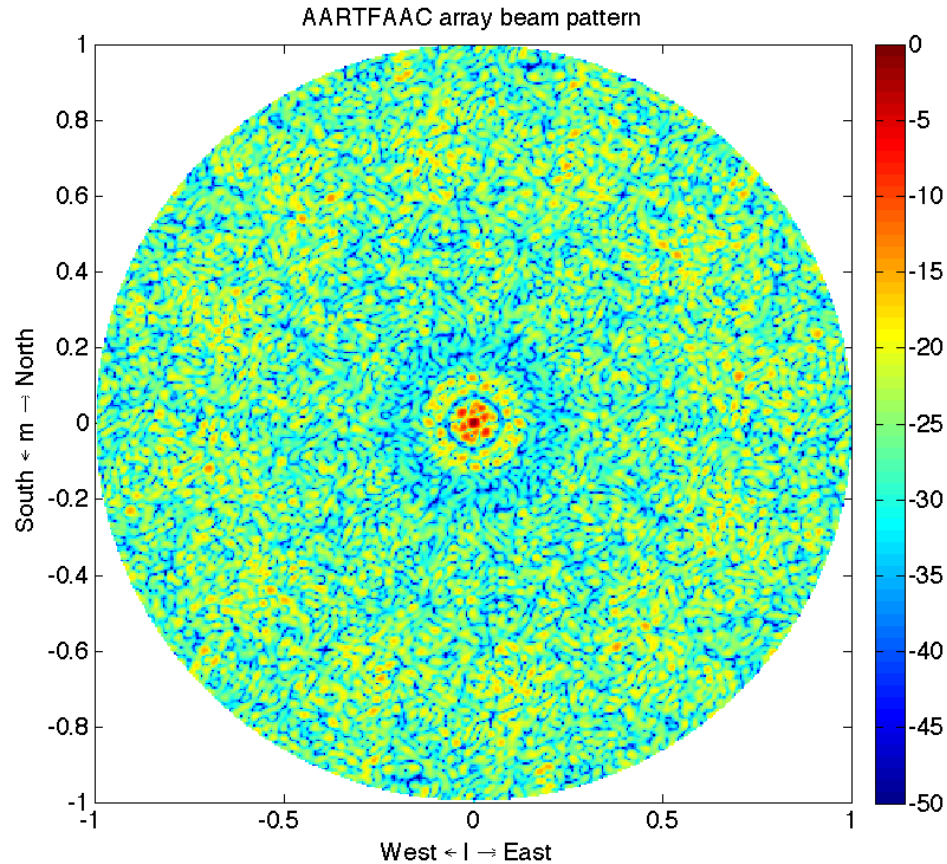
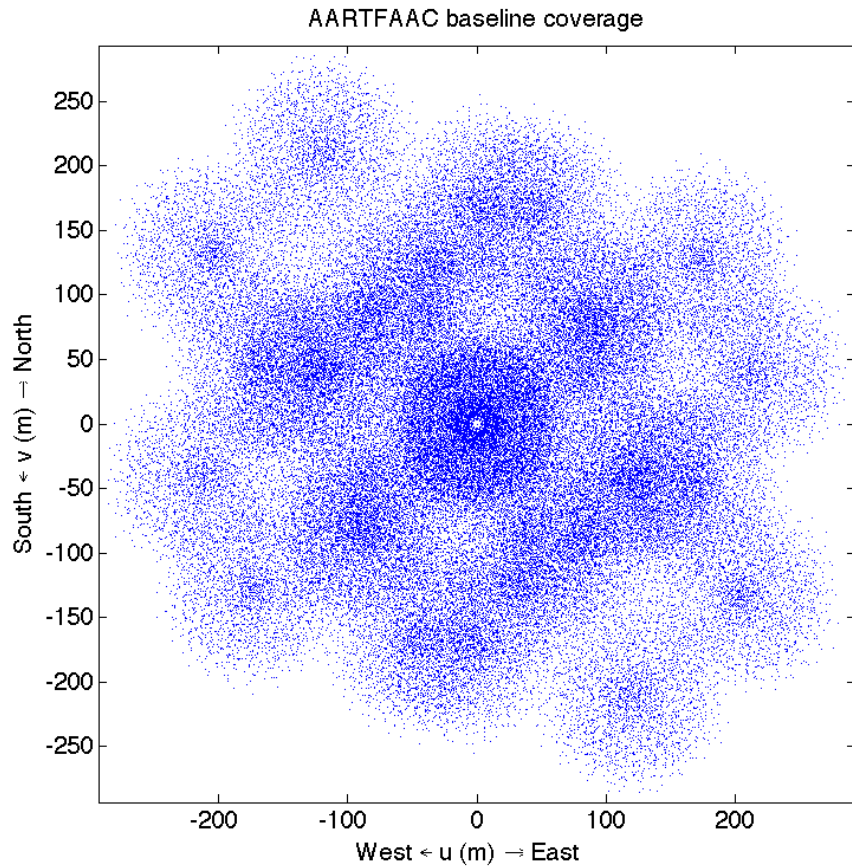


Enter AARTFAAC

- Superterp
- 6 Stations
- 288 usable ant.
- 300m diameter
- Dual polarisation
- All sky monitor
- Commensal



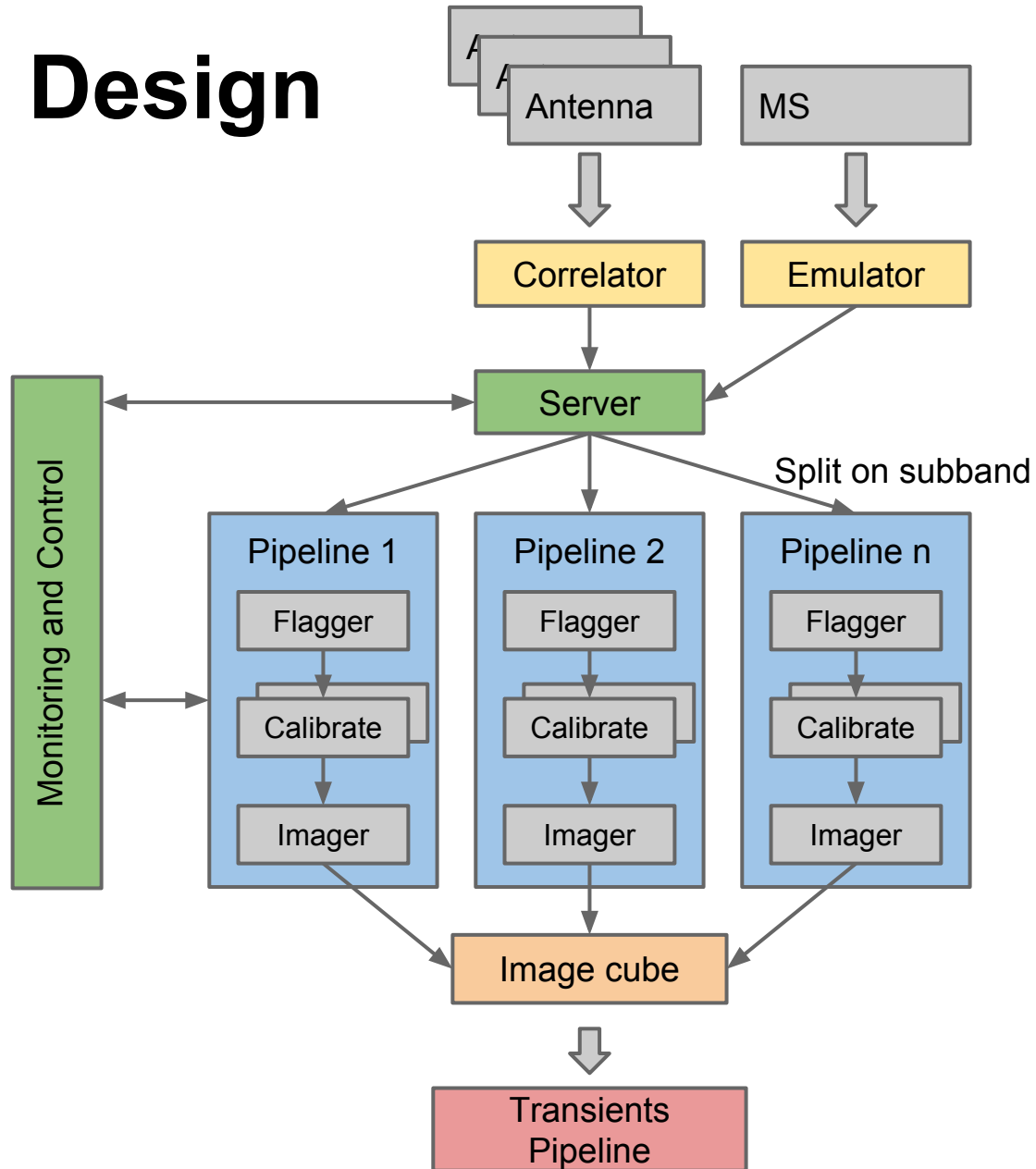
Coverage and Beam pattern



Computational Challenges

- Correlator: 12 Uniboards of FPGAs @ Astron (delayed)
- Temporary: GPU correlator derived from COBALT
- Visibilities: $(288 \times 289) / 2 = 41616$
- Bandwidth: up to 13.8 MHz
- Subband width: 12 kHz
- Dump time: At least every second
- Data rate: 6 Gb/s or 60 Gb/s
- Latency: ≤ 1 second

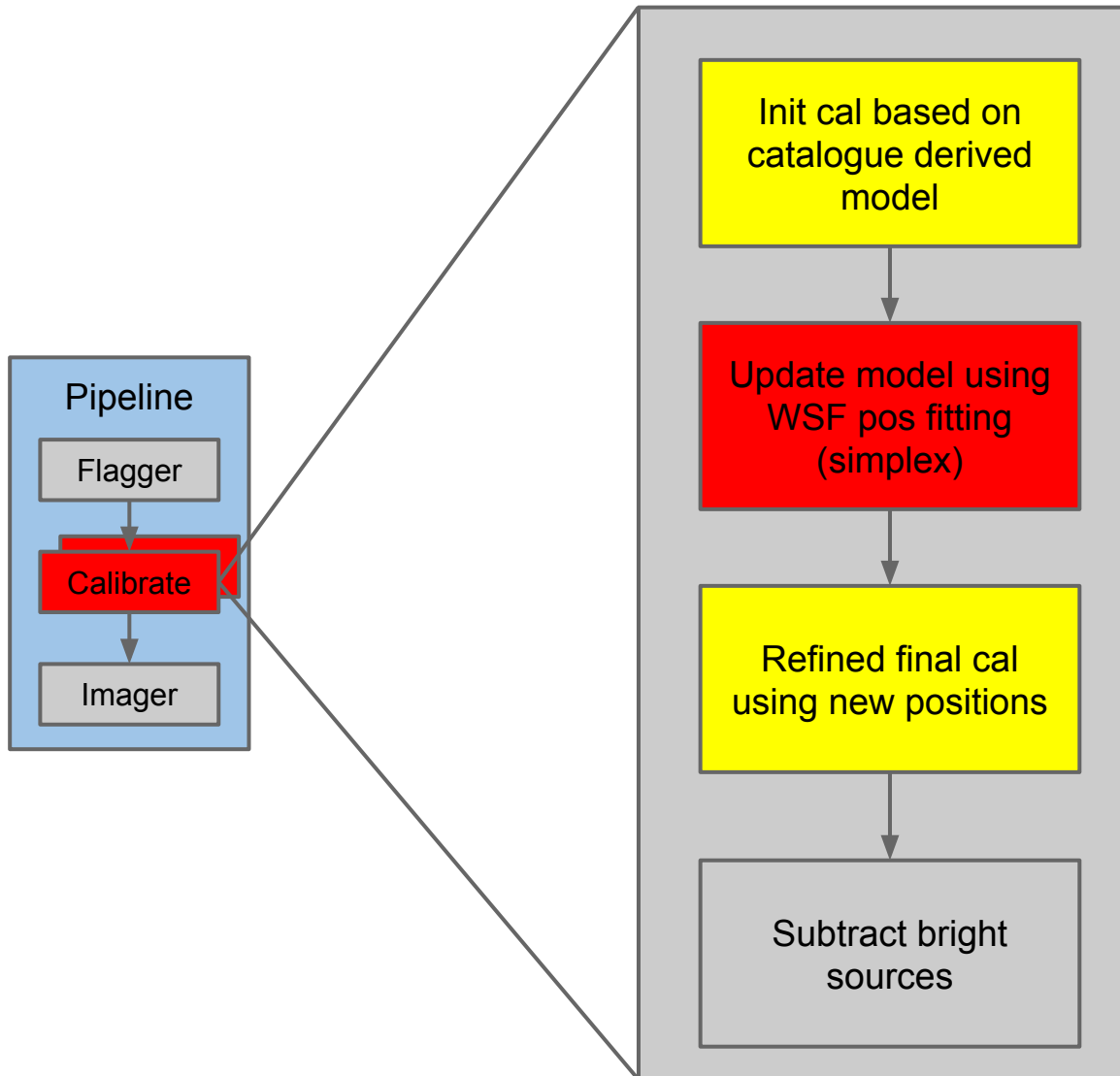
Pipeline Design



Performance Results

- Intel(R) Core(TM) i7-2600 CPU @ 3.40GHz
- 0.25s single channel on valid data per core
(std = 0.015s)
- Valid data being data with a calibration solution

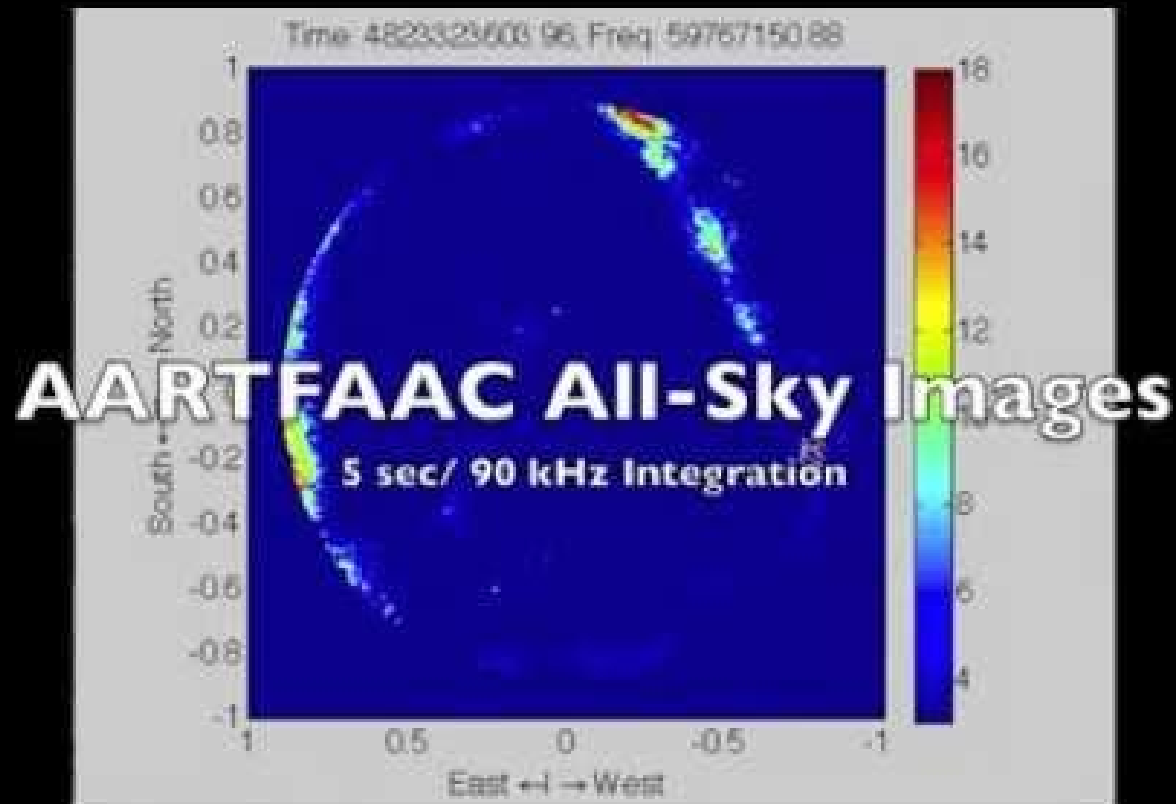
Computational Hotspot



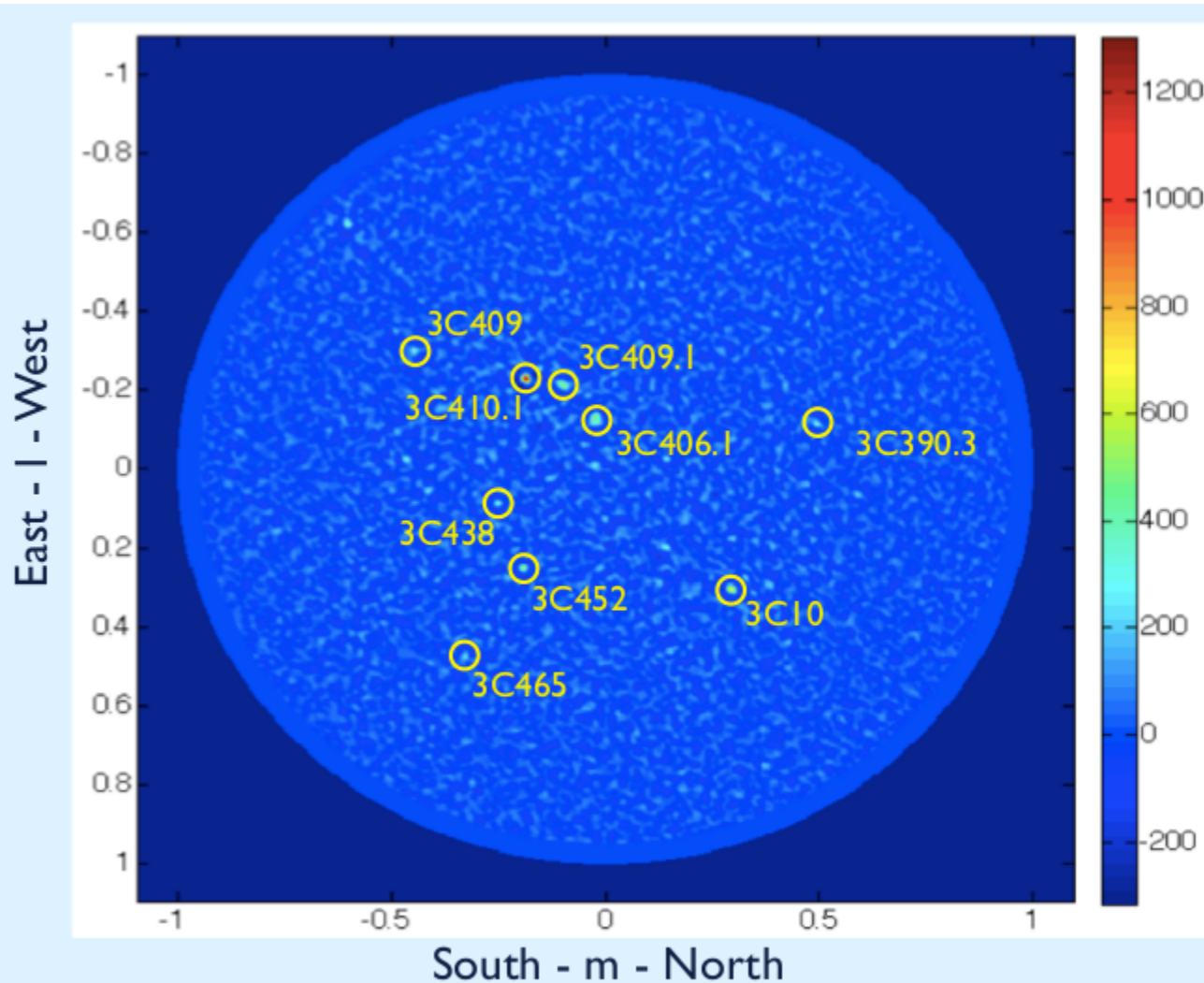
Performance Results

Calibration	
Initial calibration	9%
Nelder Mead Algorithm	77%
Final calibration	4%
Imaging	4%
Rest (flagging + restructuring)	6%

Promotion Video



Imaging Results



- 54 MHz
- 1s integration
- 120 kHz Bandwidth
- LBA_OUTER
- Cas A, Cyg A subtracted
- Noise ~ 17 Jy

Conclusions

- Image single channel in ~ 0.25 sec on current hardware
- Calibration shows computational hotspot
 - WSF can still be improved
 - Tracking calibration
- GPU Correlator online next month
- Uniboard correlator online 2014

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