



ADDRESSING FOREGROUNDS AND SYSTEMATICS FOR IMAGING THE 21CM REIONIZATION SIGNAL















Parsons et al. (2012b) arXiv:1204.4749









	Collecting	Foreground	Foreground
Instrument	Area (m^2)	Avoidance	Subtraction
PAPER	512	0.78σ	3.07σ
MWA Phase 1	2,752	0.53σ	2.66σ
LOFAR NL Core	35,762	0.91σ	8.19σ
HERA-61	9,390	4.66σ	19.08σ
HERA-350	53,878	${f 23.38}\sigma$	89.29σ
SKA1 Low	$492,\!352$	23.80σ	96.92 σ

Cross-correlations of E-W PAPER visibilities (by baseline length) 13-unit 14-unit 15-unit 12-unit 16-unit

	5
	6
	201
2	C.
	1







16-unit































Short baselines have very little overlap

- not good for calibration/foreground removal
- good for delay-spectrum foreground isolation

Mid-length baselines have some overlap

- good for calibrating passband
- deviations from redundancy inform beam modeling

 $g_i(\nu) = g_j(\nu)$ from standard redundant calibration.

 $\beta(\nu_i) V_{\text{true}}(\hat{\theta}) = \beta(\nu_j) V_{\text{true}}(\hat{\theta}) \rightarrow \text{redundant bandpass cal}$

 $\beta(\nu_i) A_i(\nu_i, \hat{\theta}) V_{\text{true}}(\nu_i, \hat{\theta}) = \beta(\nu_j) A_j(\nu_j, \hat{\theta}) V_{\text{true}}(\nu_j, \hat{\theta}) \rightarrow$



Mid-length baselines have some overlap

- good for calibrating passband
- deviations from redundancy inform beam modeling
- not dense enough for direct frequency transform

Long baselines have tons of overlap

- good for calibration (sky/beam don't evolve much)
- dense enough for direct frequency transform



Josh Dillon (NSF AAPF Fellow, UC Berkeley)

 $g_i(\nu) = g_j(\nu)$ from standard redundant calibration.

$$\begin{split} & \beta(\nu_i) \ V_{\text{true}}(\hat{\theta}) = \beta(\nu_j) \ V_{\text{true}}(\hat{\theta}) \to \text{redundant bandpass calibration.} \\ & \beta(\nu_i) \ A_i(\nu_i, \hat{\theta}) \ V_{\text{true}}(\nu_i, \hat{\theta}) = \beta(\nu_j) \ A_j(\nu_j, \hat{\theta}) \ V_{\text{true}}(\nu_j, \hat{\theta}) \to \text{chromaticity of a baseline the size of a dish.} \end{split}$$



18961 antennas?With a fracture, maybe only 6320.With cleverness, maybe even as low as several hundred