

LESSONS LEARNED FROM CURRENT INTENSITY MAPPING EXPERIMENTS

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OPPORTUNITIES AND CHALLENGES IN INTENSITY MAPPING MARCH 21-24 2016



LESSONS

Precision Instrumentation

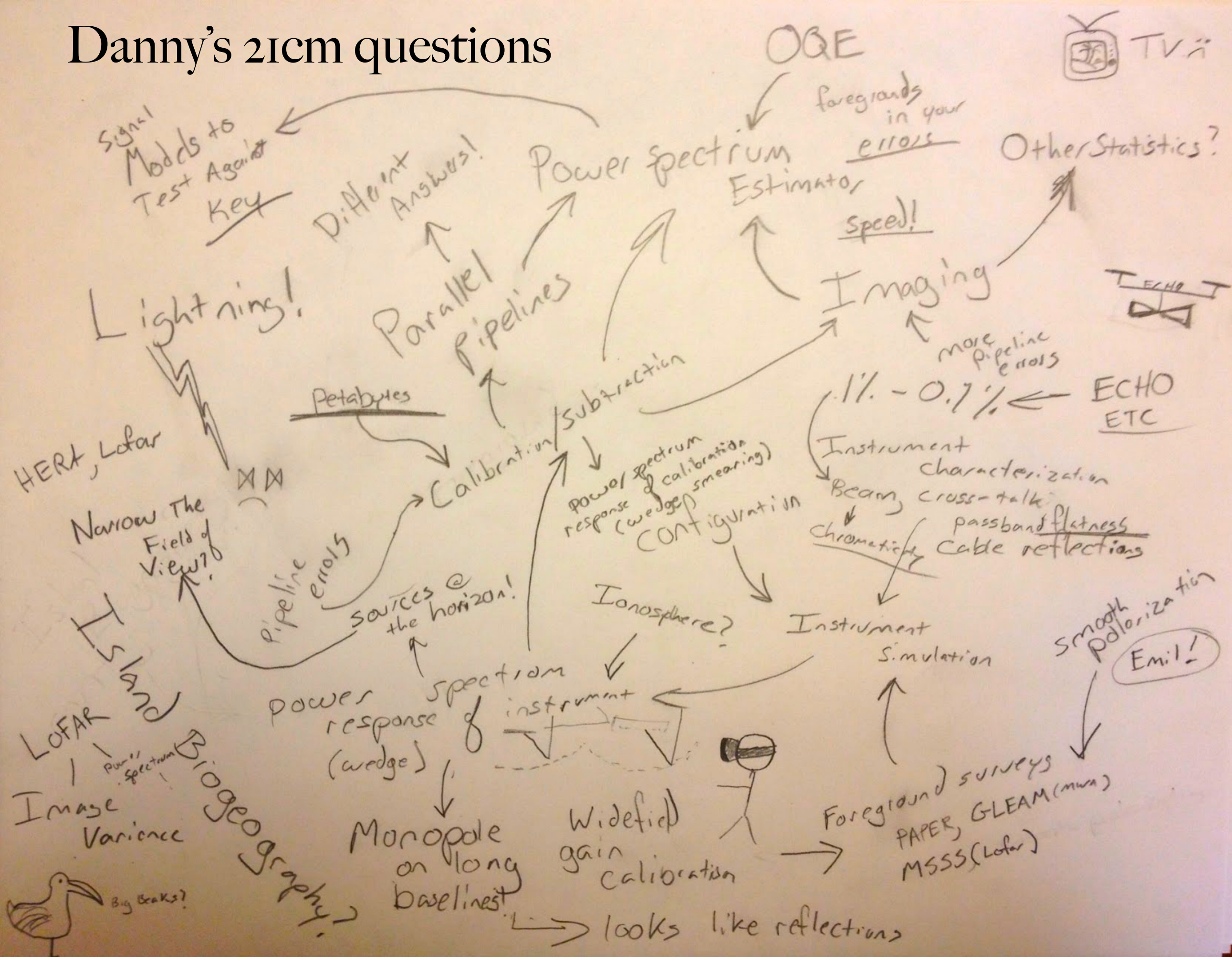
Good input models



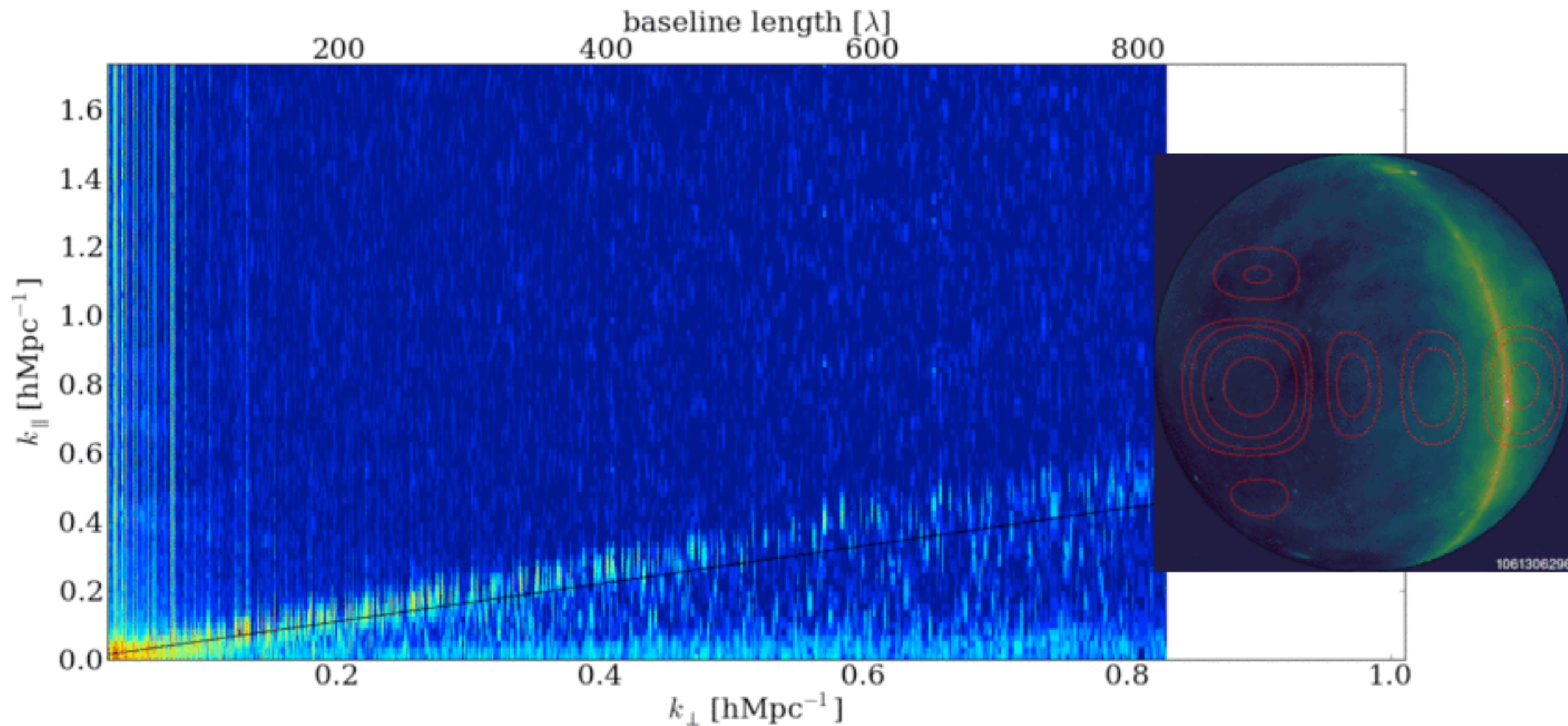
21CM LESSONS 2016

- power spectrum response of instrument (wedge)
- accurate instrument simulation
- polarization contamination, polarization of smooth structure
- OQE (MWA and PAPER)
- redundant calibration (PAPER, HERA, MWA2)
- reflections, delays, beam chromaticity
- configuration (imaging vs redundancy)
- having models to test against (21cmfast/cmmc)
- difficulty of calibrating drift scans
- Comparing results (parallel pipelines vs island barrier genetic isolation)

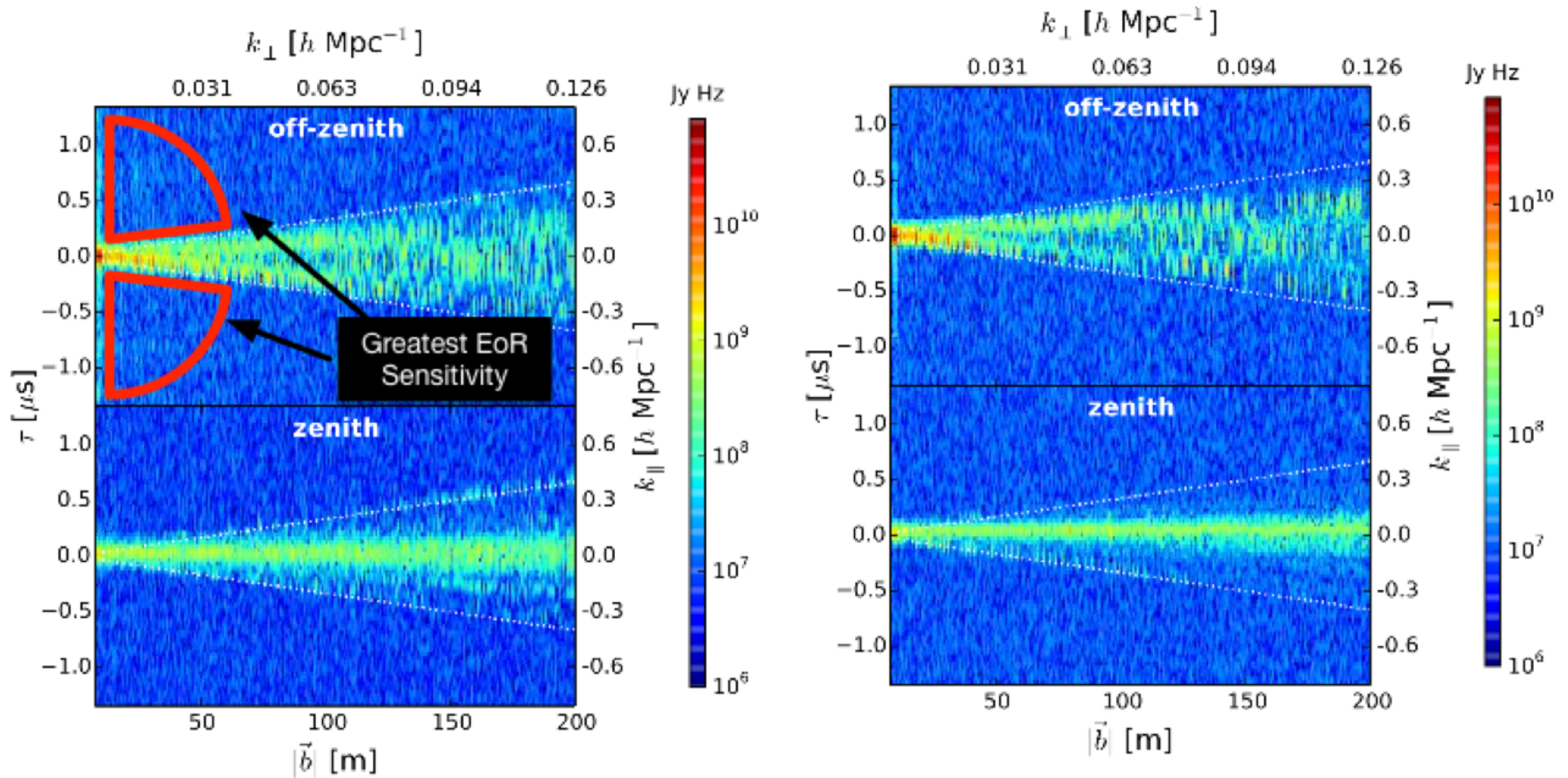
Danny's 21cm questions



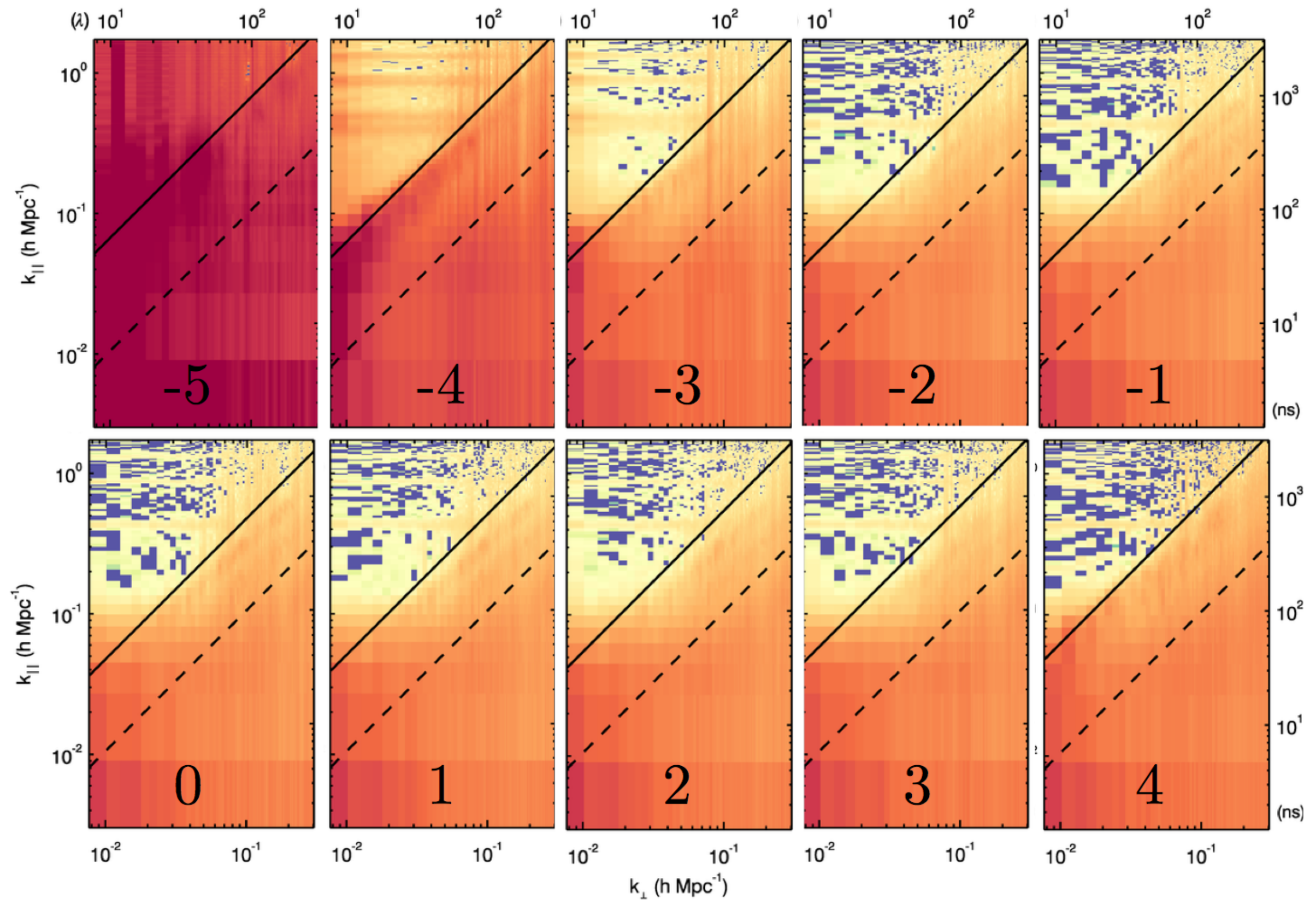
3D POWER SPECTRUM RESPONSE OF WIDE FIELD OF VIEW INSTRUMENTS



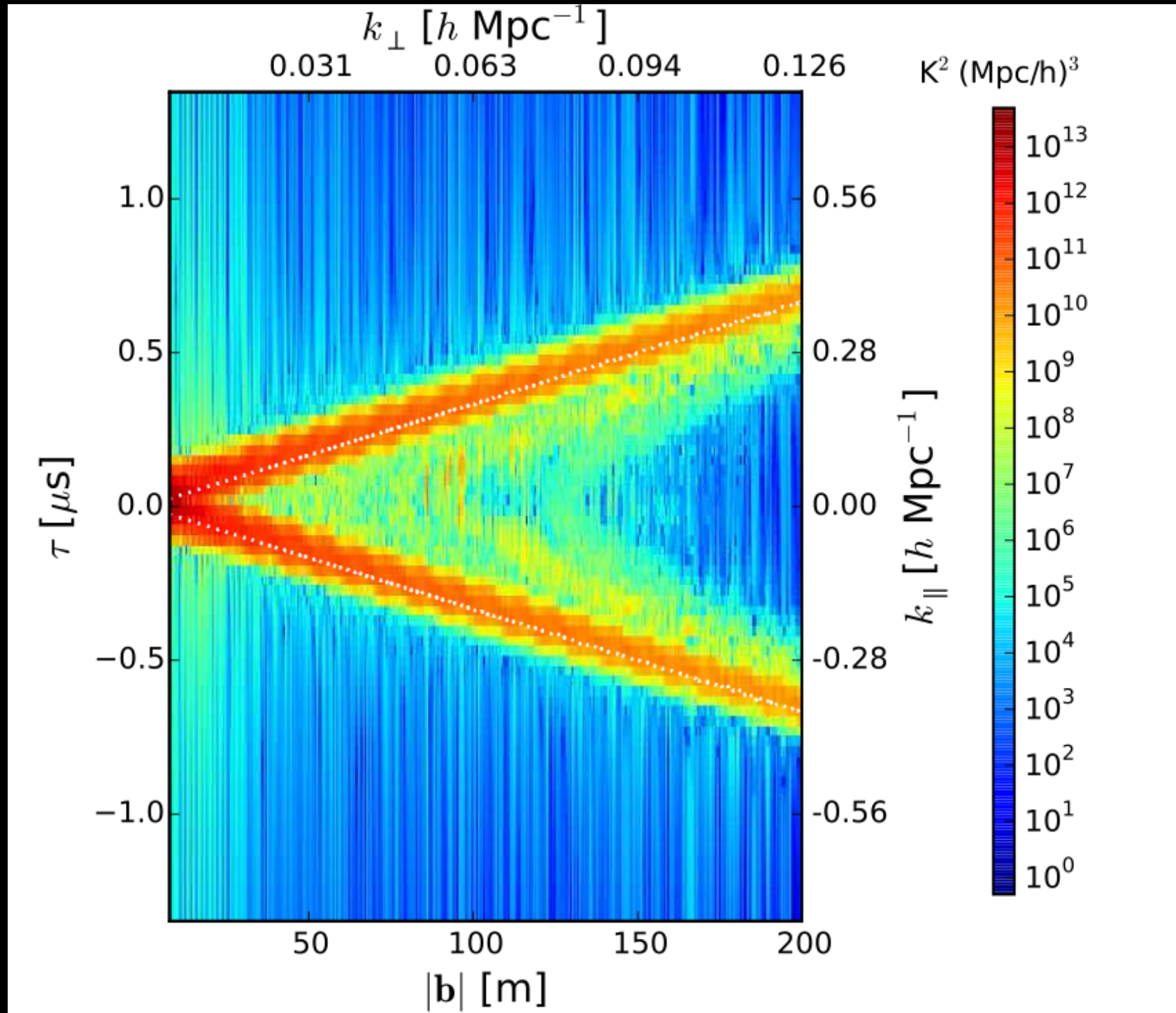
Widefield Foreground simulation



arxiv:1502.07596 Thyagarajan et al 2015a,b
 arXiv:1506.06150



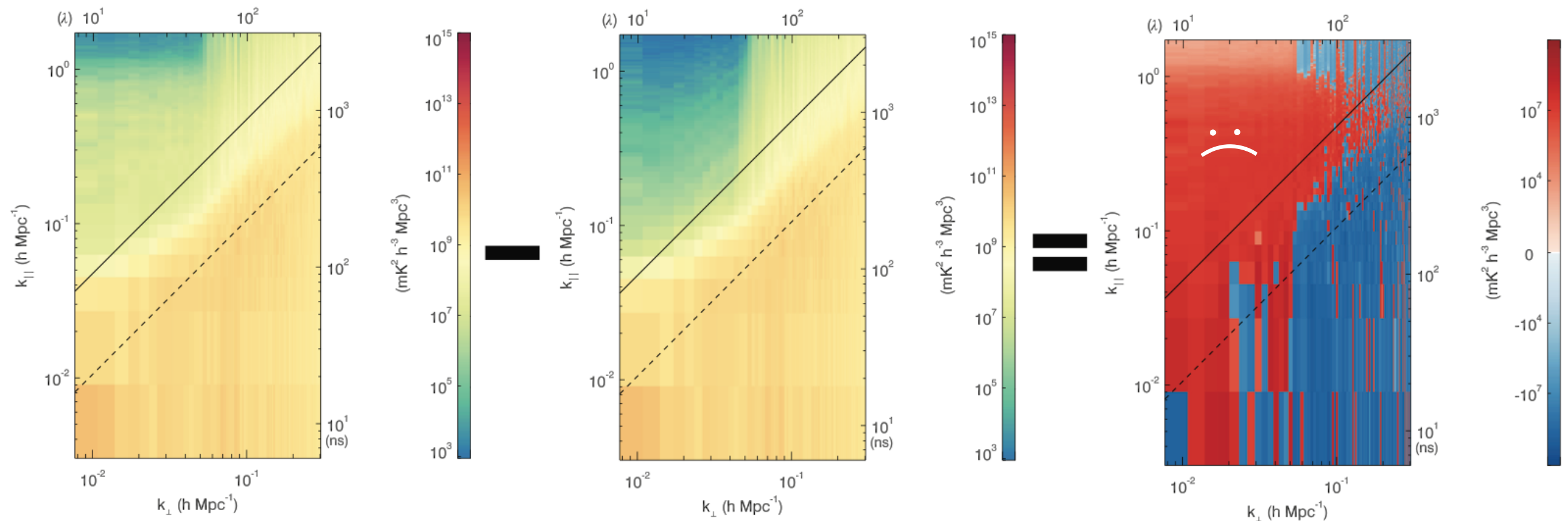
ACCURATE INSTRUMENT SIMULATION



arxiv:1502.07596 Thyagarajan et al 2015a,b
arXiv:1506.06150

CALIBRATION

Incomplete catalogs: cal residuals couple sideways

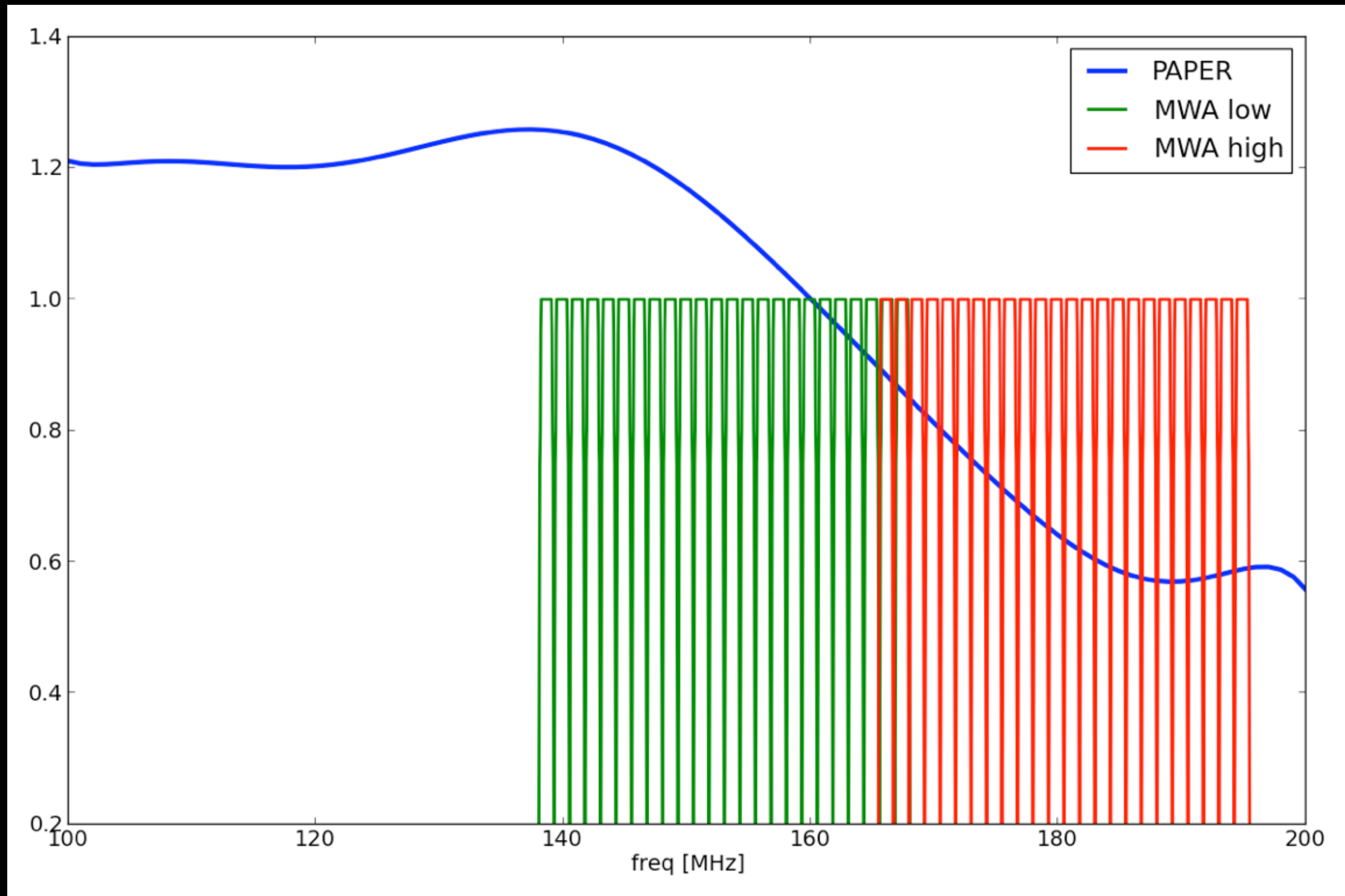


Per-Channel
Cal

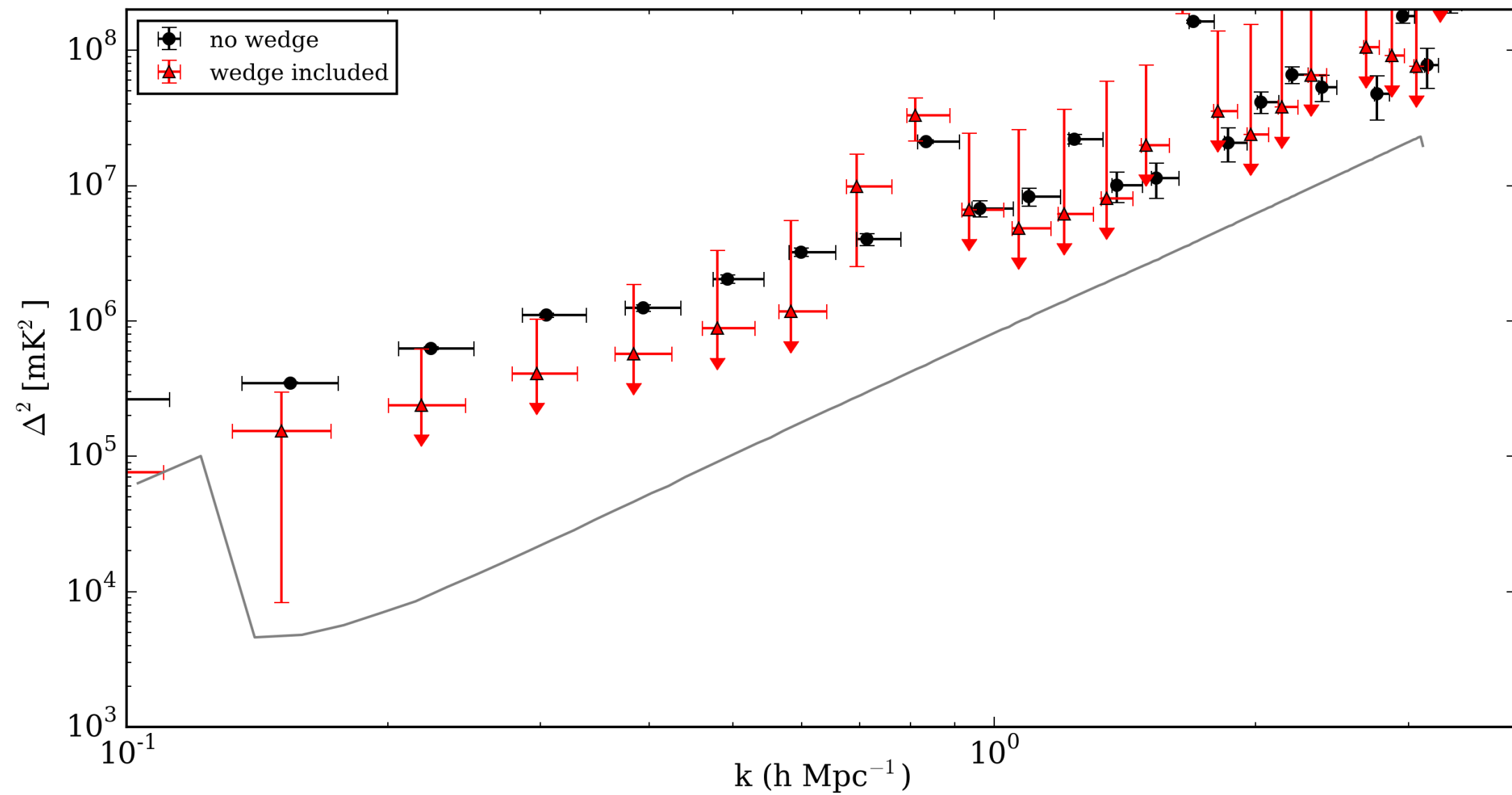
No Cal

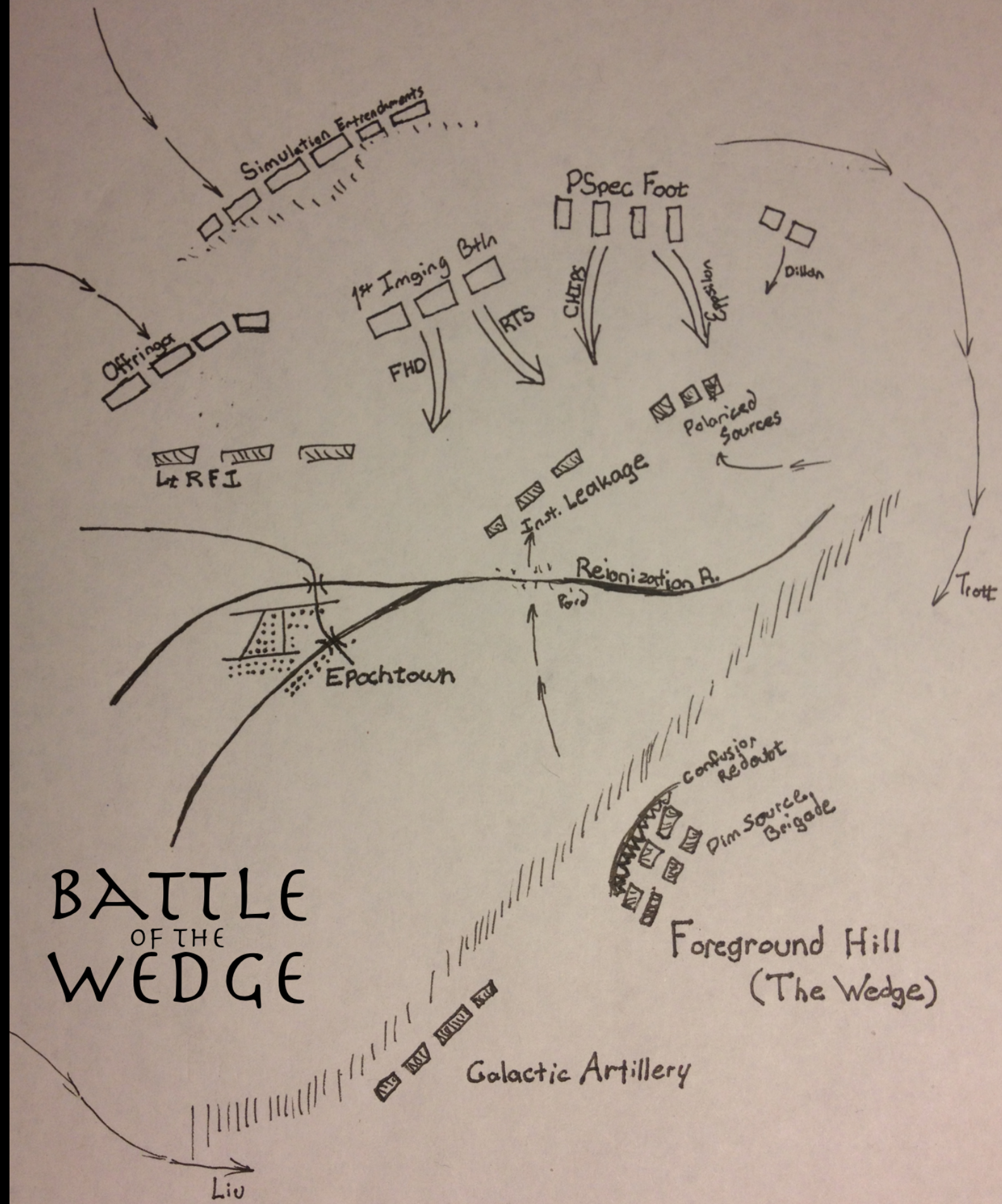
Barry et al (in prep)

PASSBAND IS KEY



OQE: OBVIOUS QUADRATIC ESTIMATORS





BATTLE OF THE WEDGE

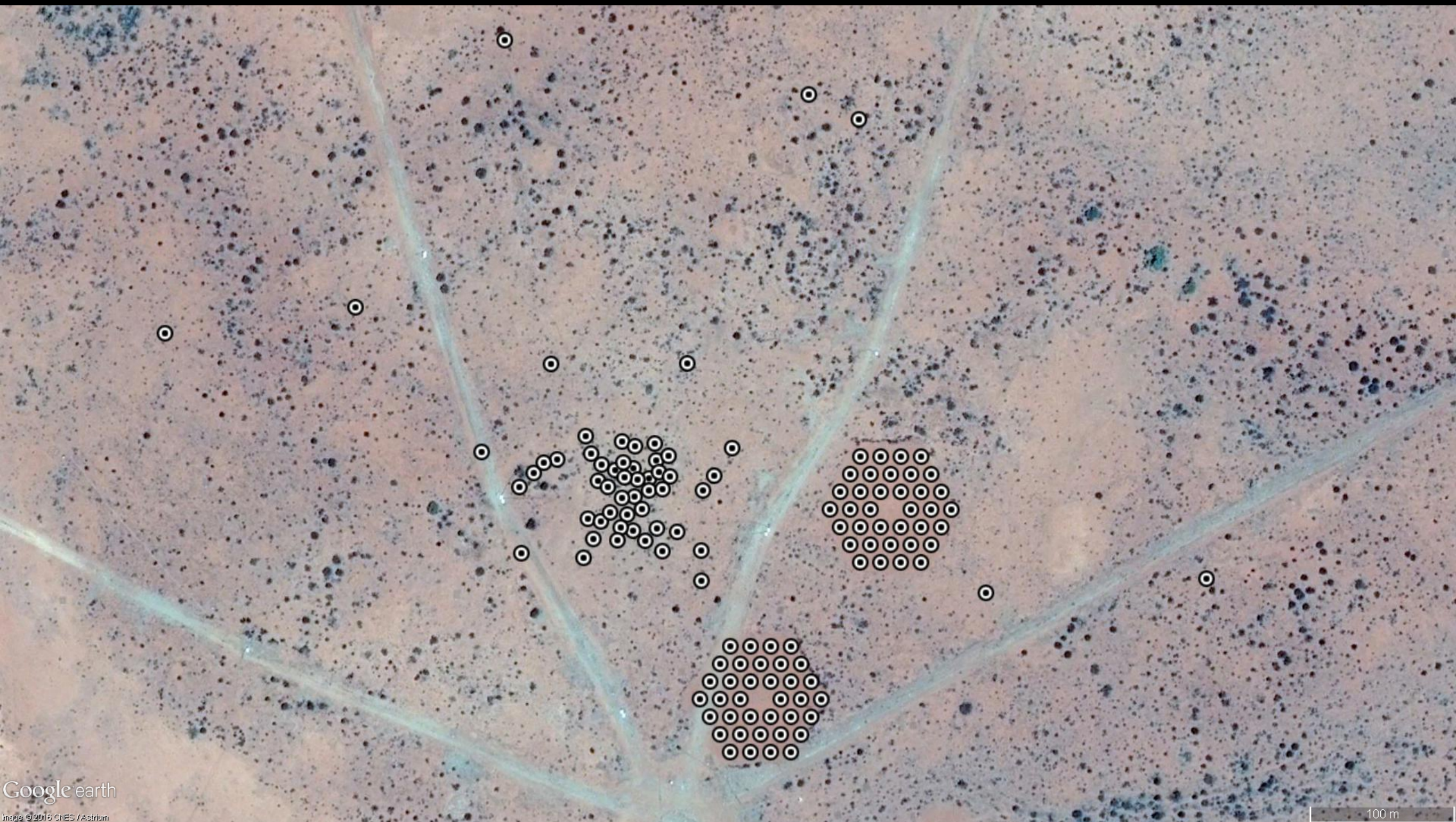
REDUNDANT CALIBRATION: CALIBRATION WITH NO CATALOG





HERA

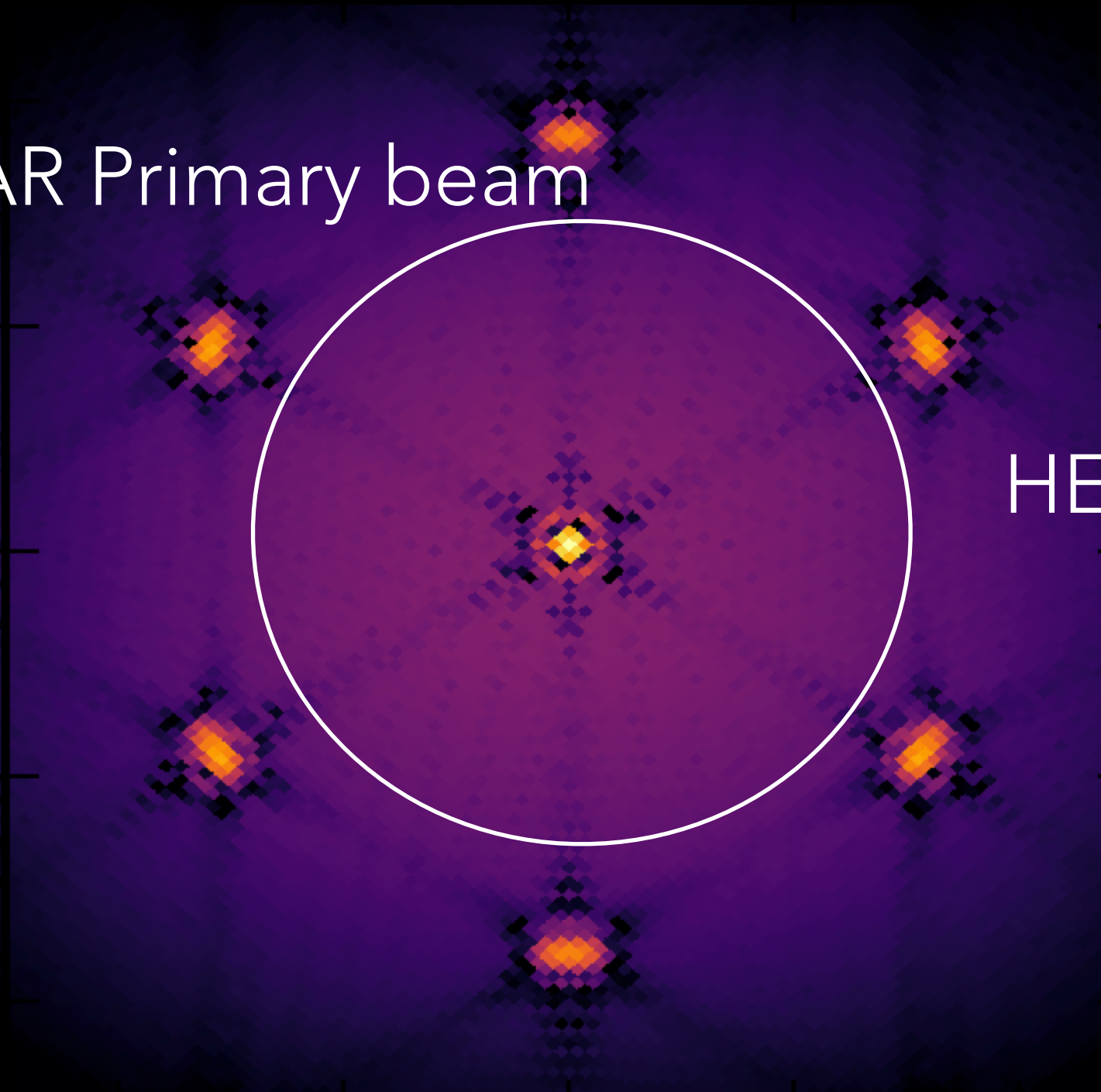
MWA REDUNDANCY



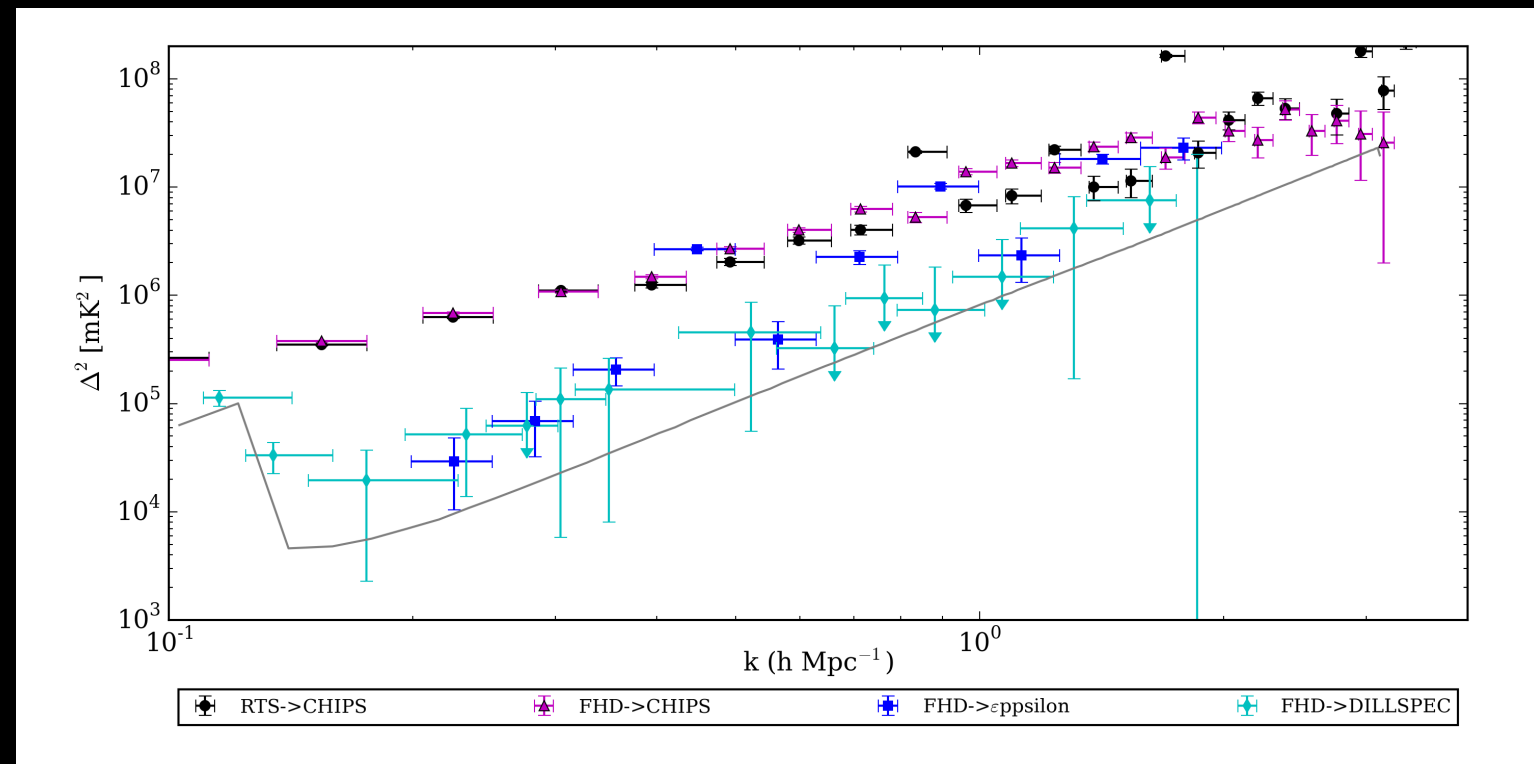
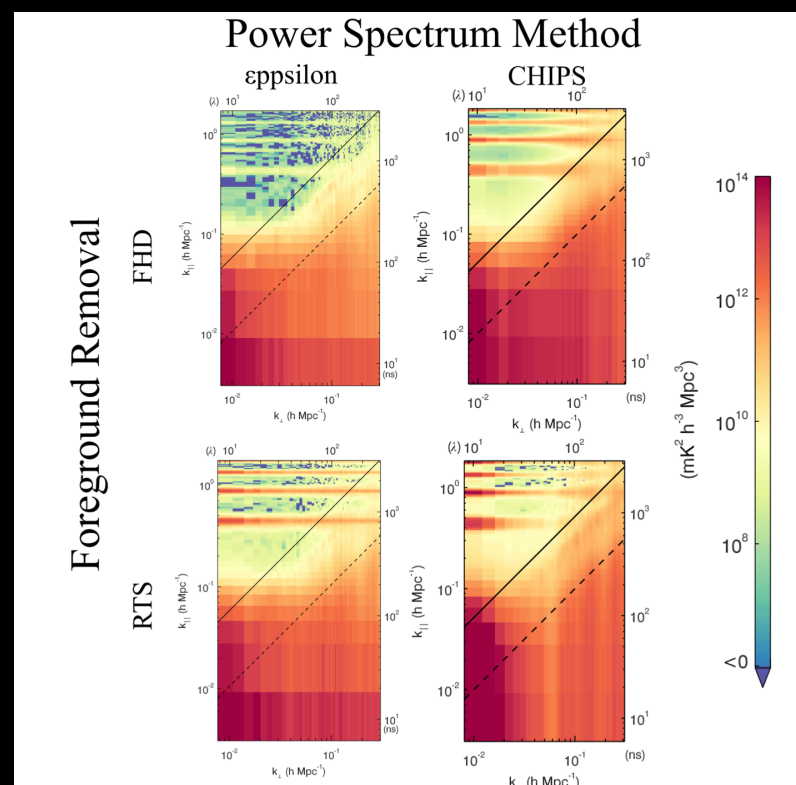
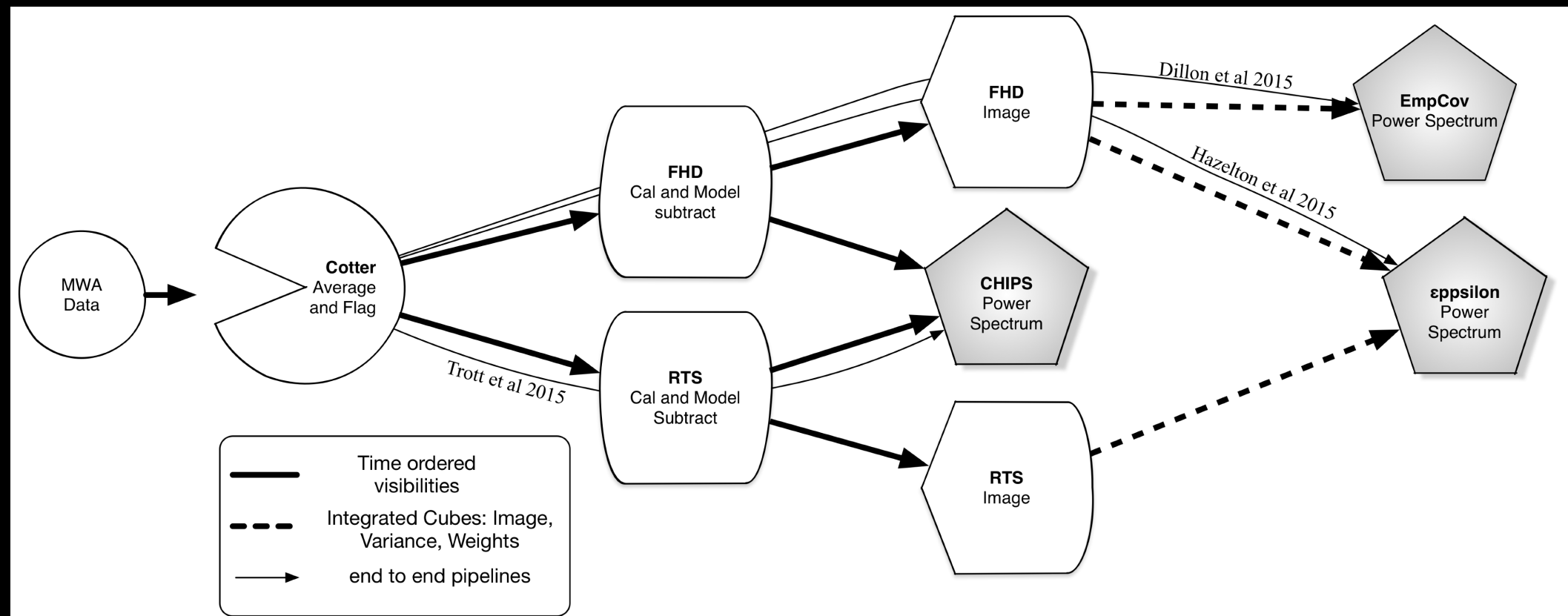
HEAR Primary beam

HERA PSF

Dillon et al 2016

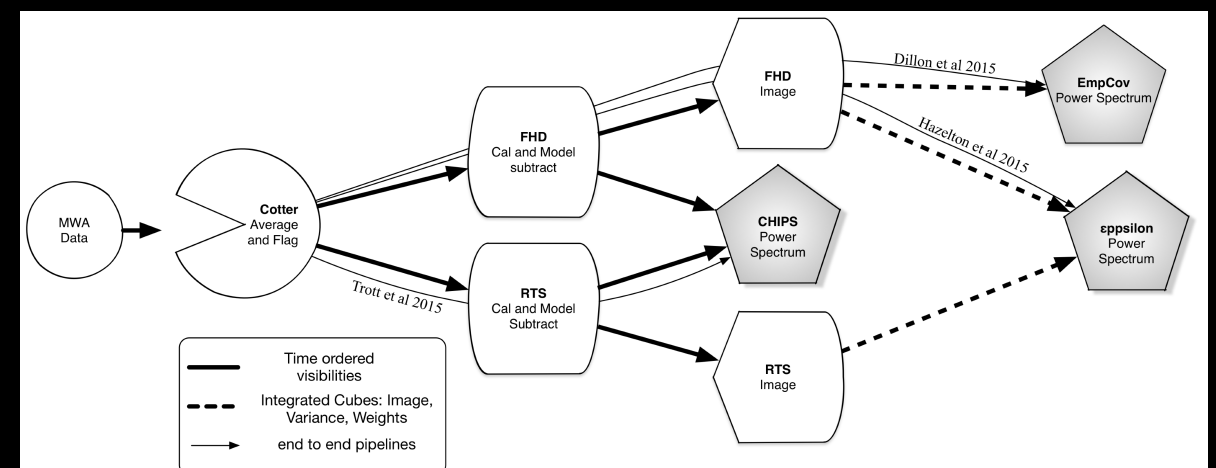
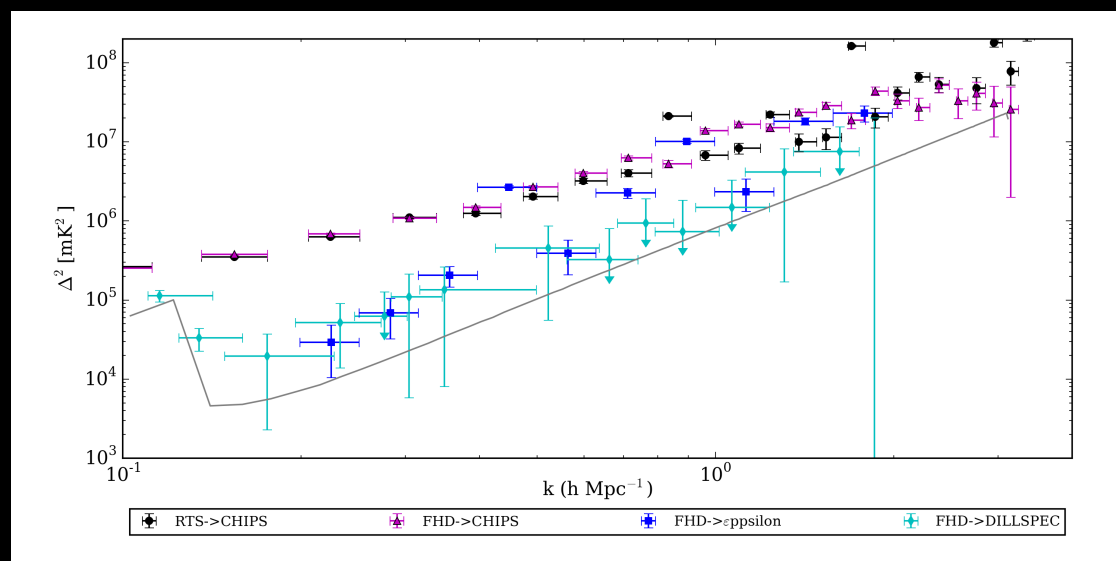
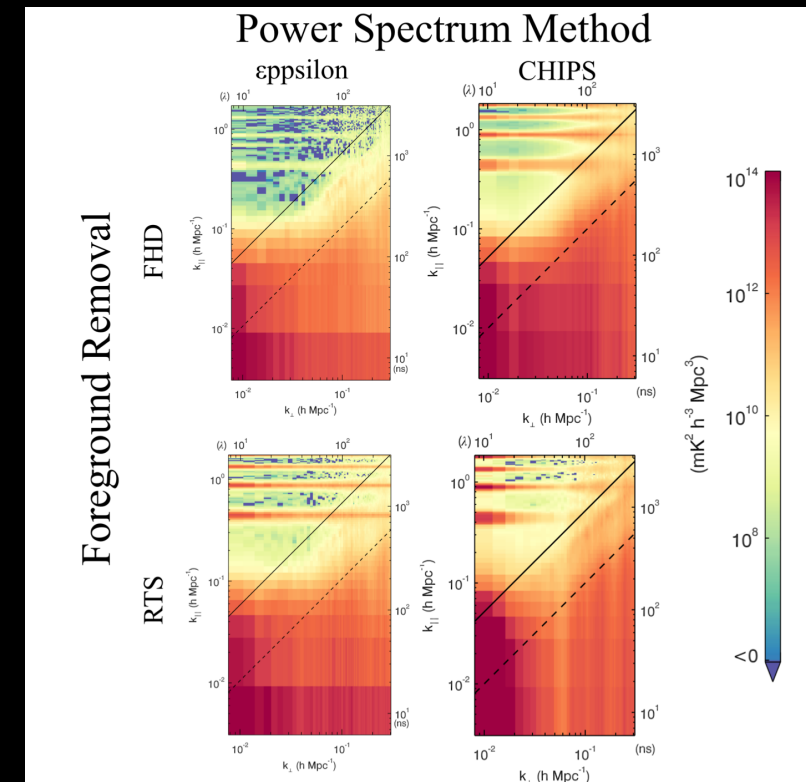


BUILDING NEW PIPELINES: A DANGEROUS NECESSITY



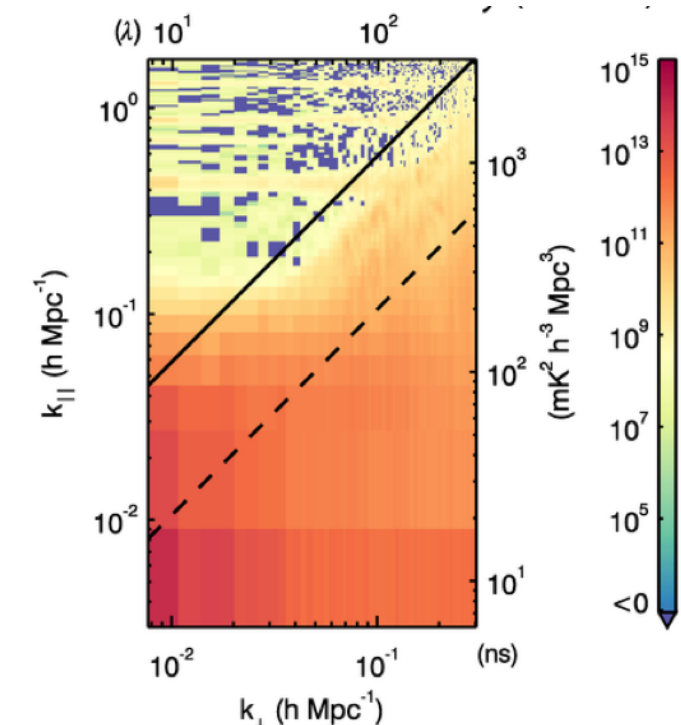
BUILDING NEW PIPELINES: A DANGEROUS NECESSITY

- Things we found:
Calibration model, systematic identification, signal loss, algorithmic tuning, data interchange standards



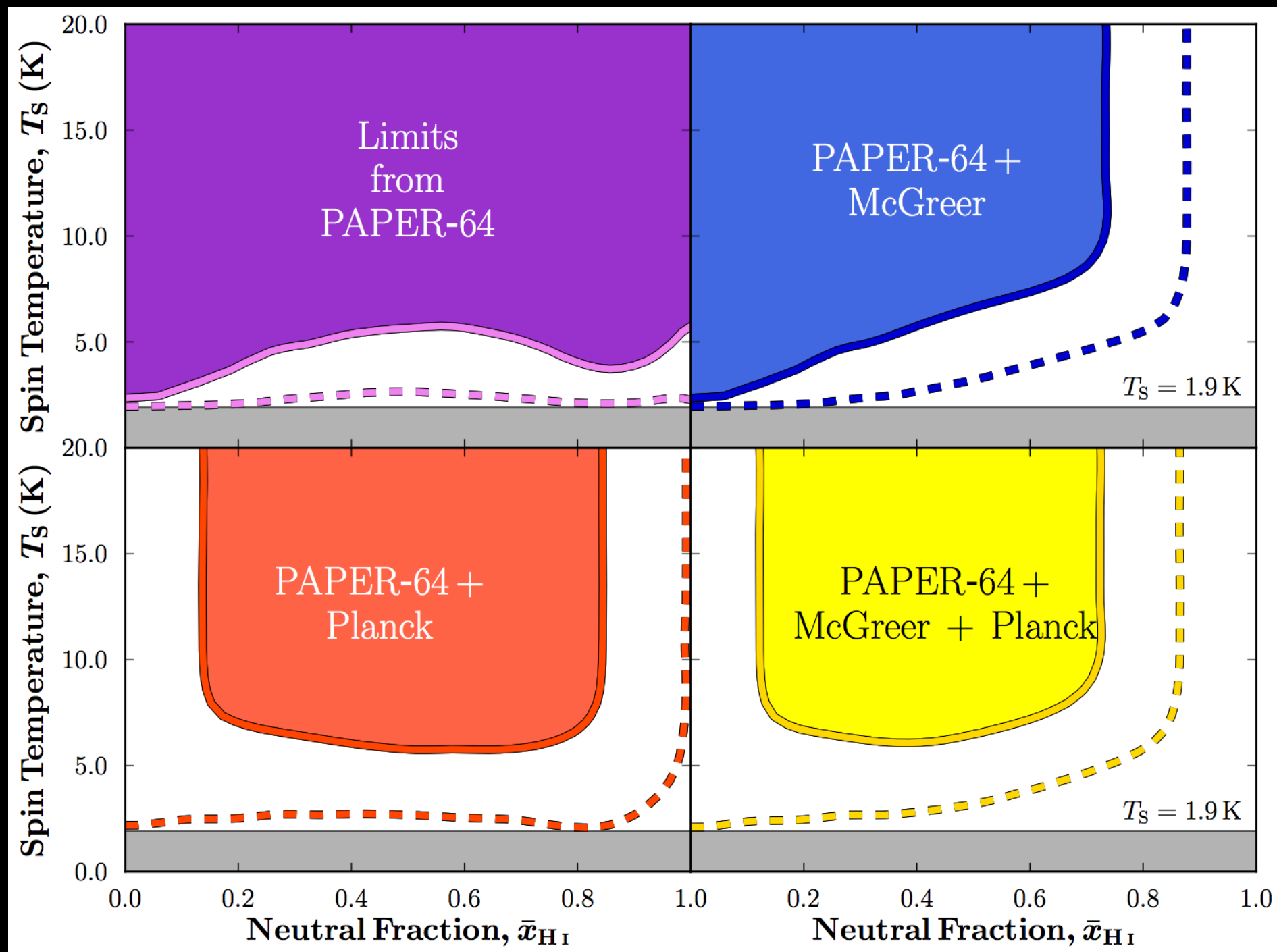
Foreground Lessons

- Avoidance is easiest but least sensitive
- Source subtraction is best but is also the hardest
- Sources at the horizon are the first hurdle
- the galaxy is probably showing up on long baselines
- averaging baselines without care can lead to spectral issues
- modeling of covariance can put foregrounds into errors instead of a bias

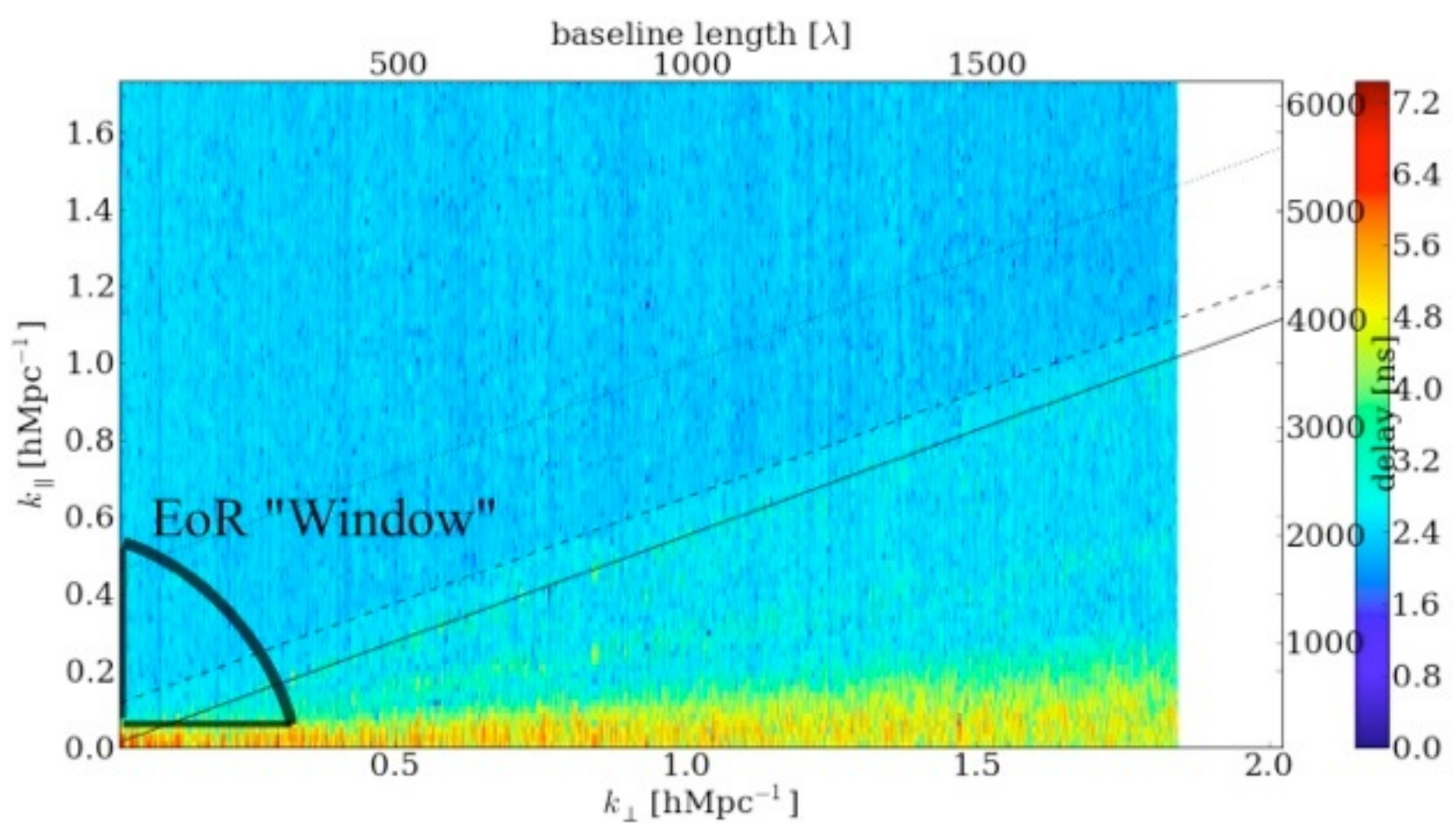
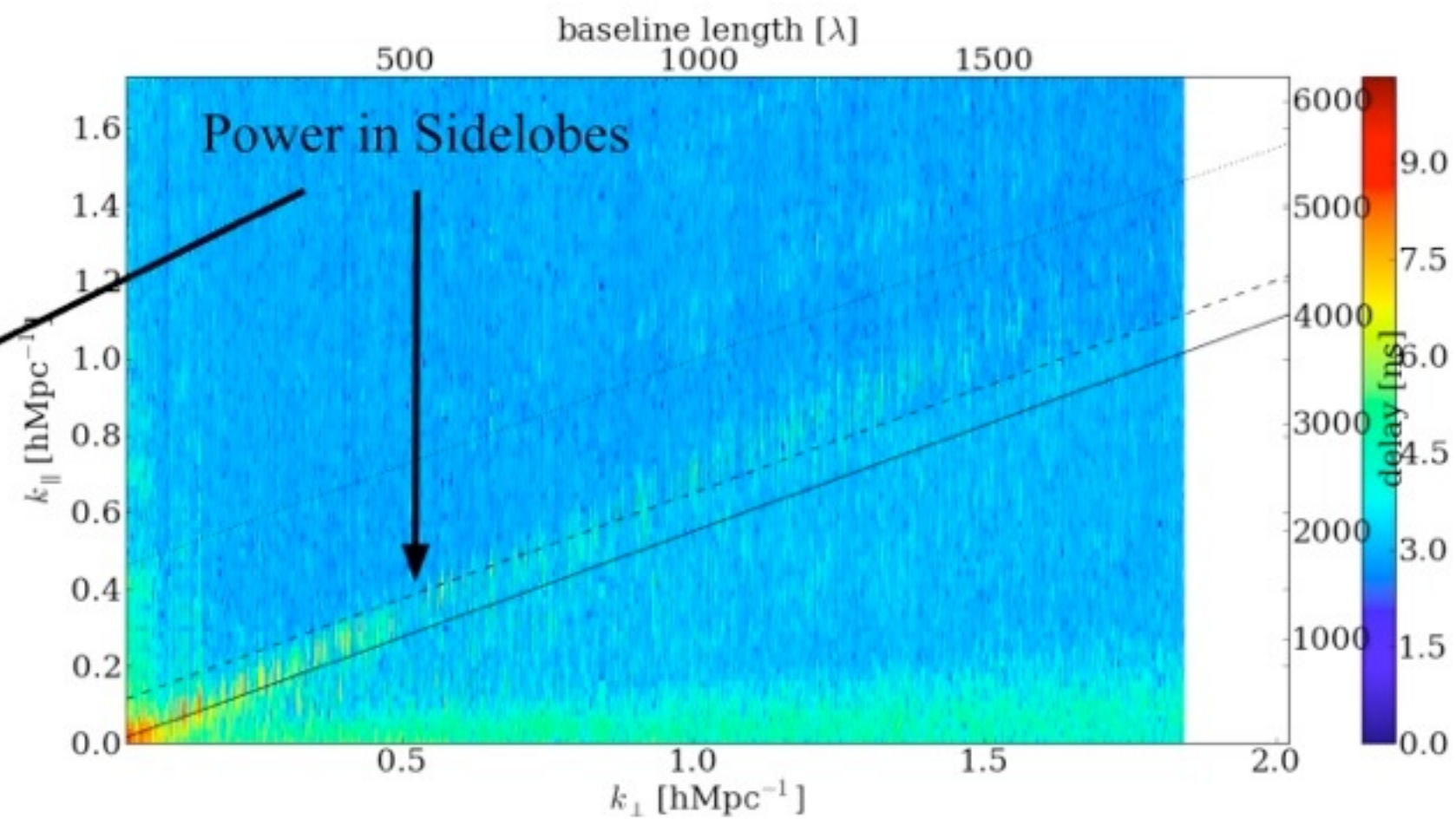
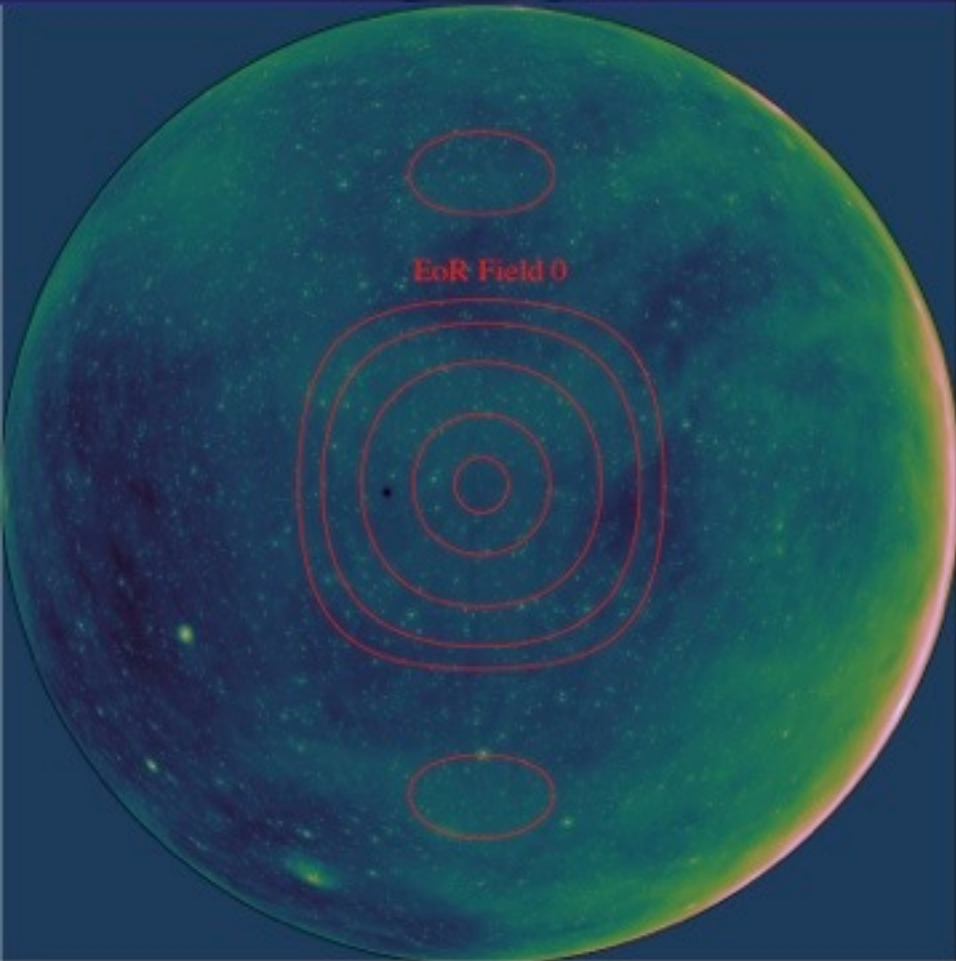
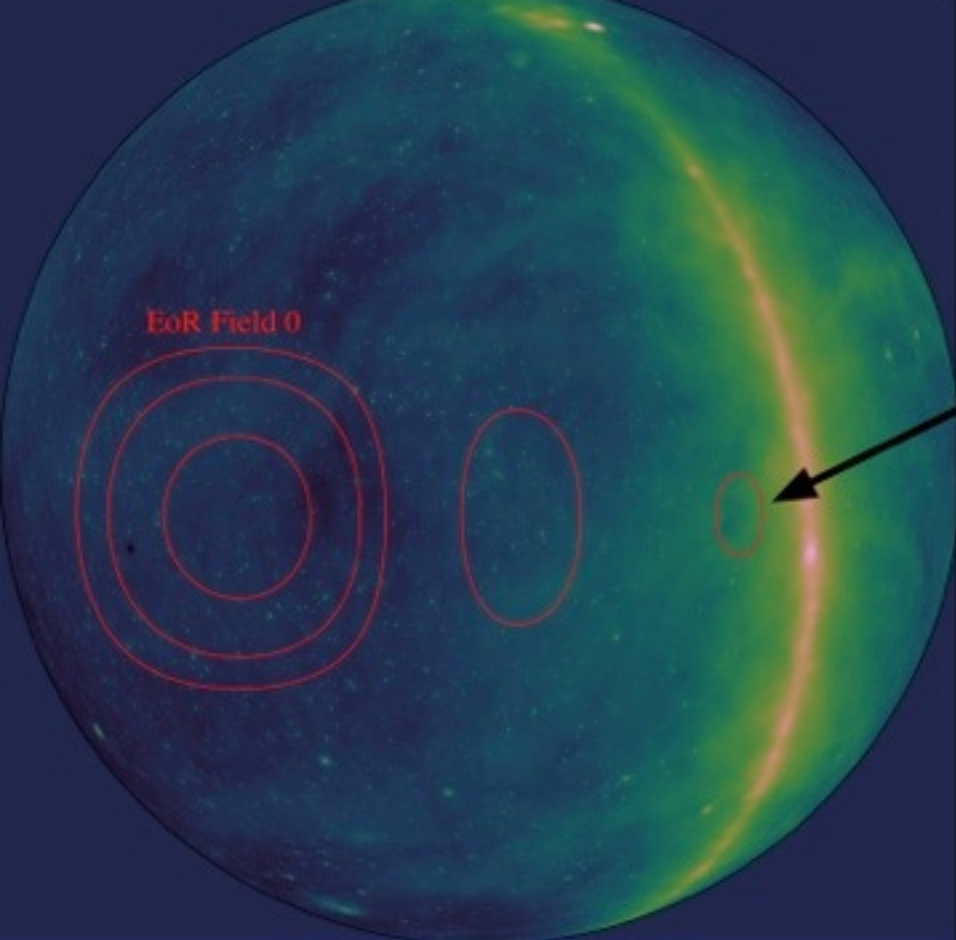


HAVING MODELS TO TEST AGAINST

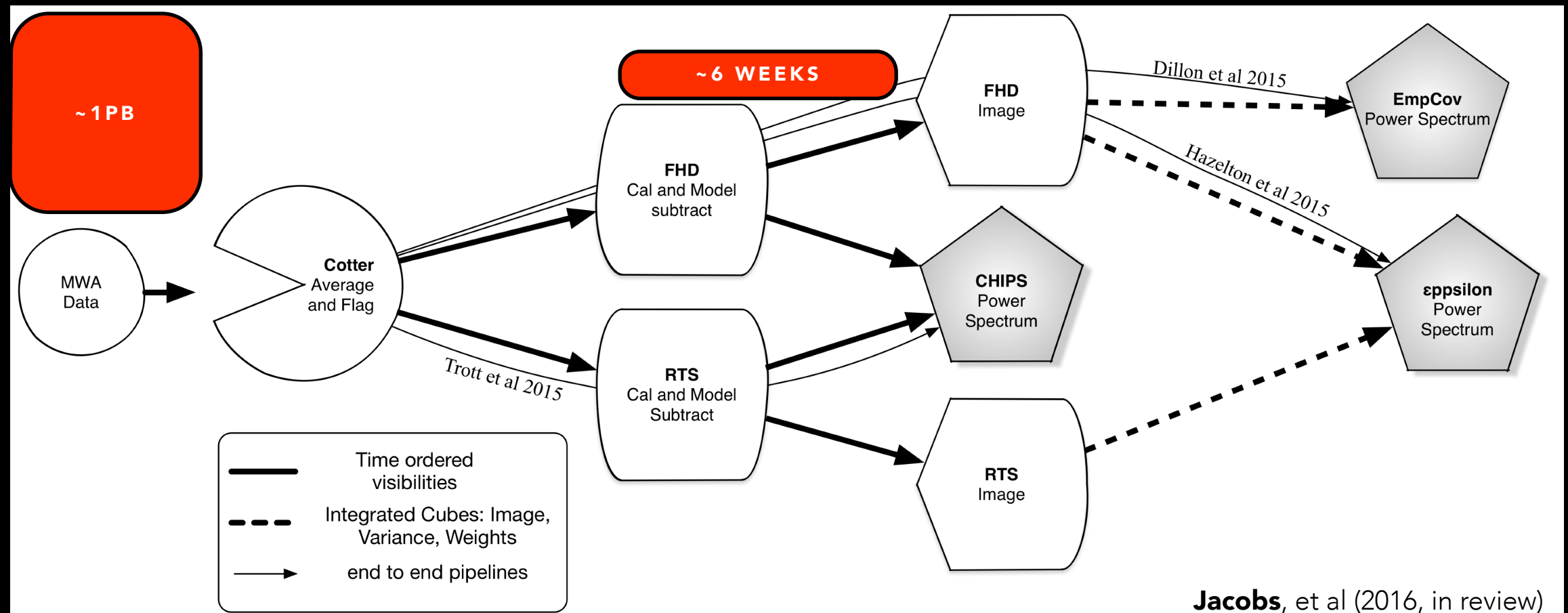
21cmFAST



Greig et al 2015



COMPARE PIPELINES

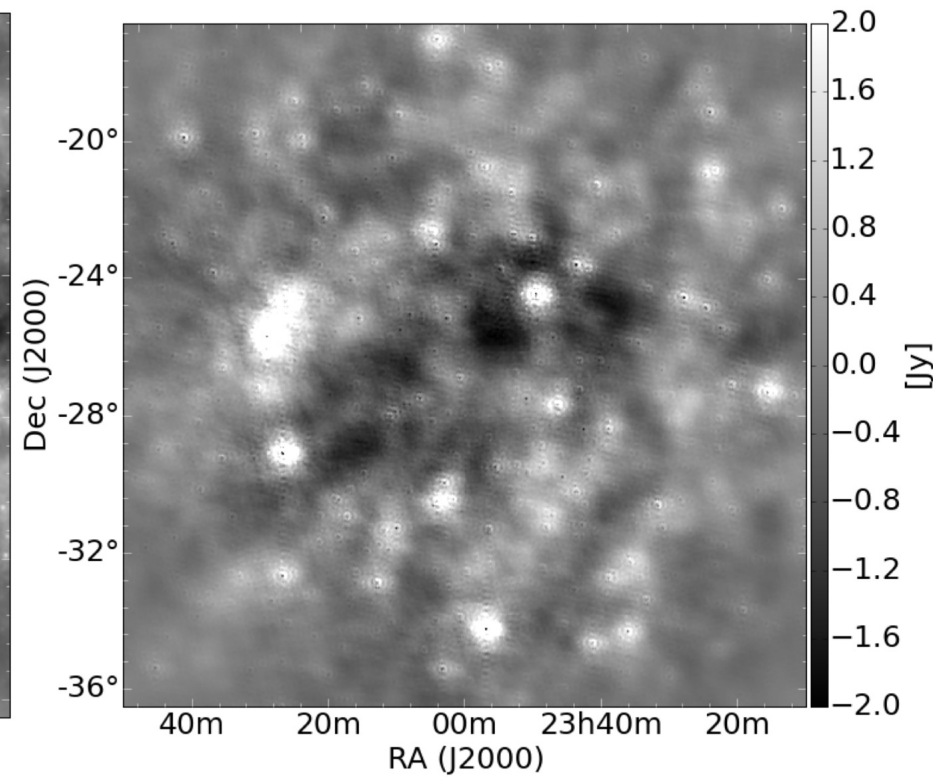
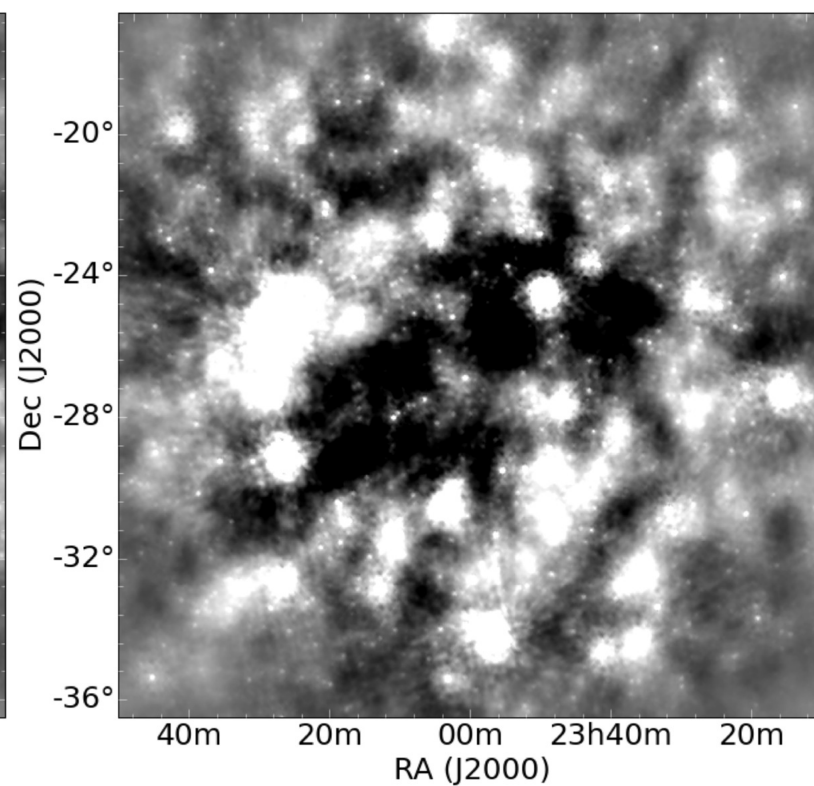
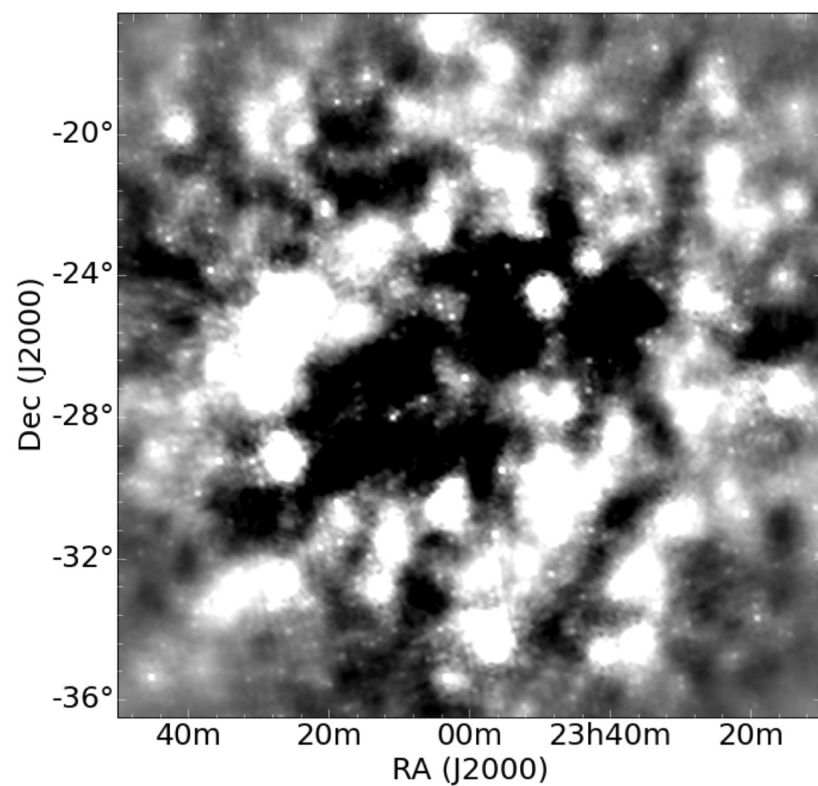


Sky

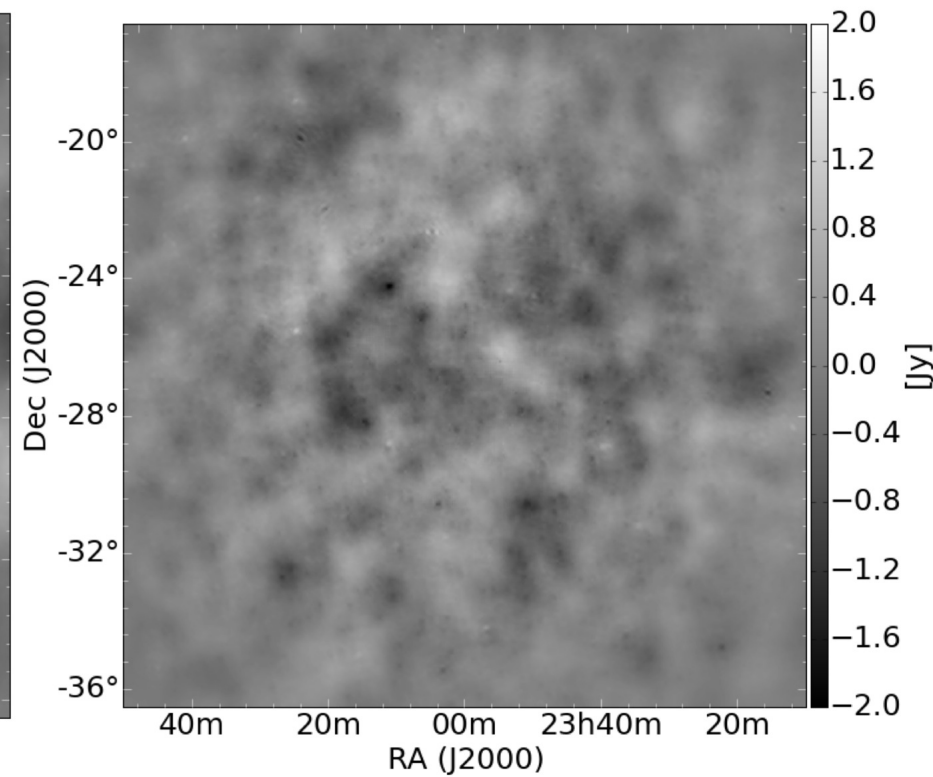
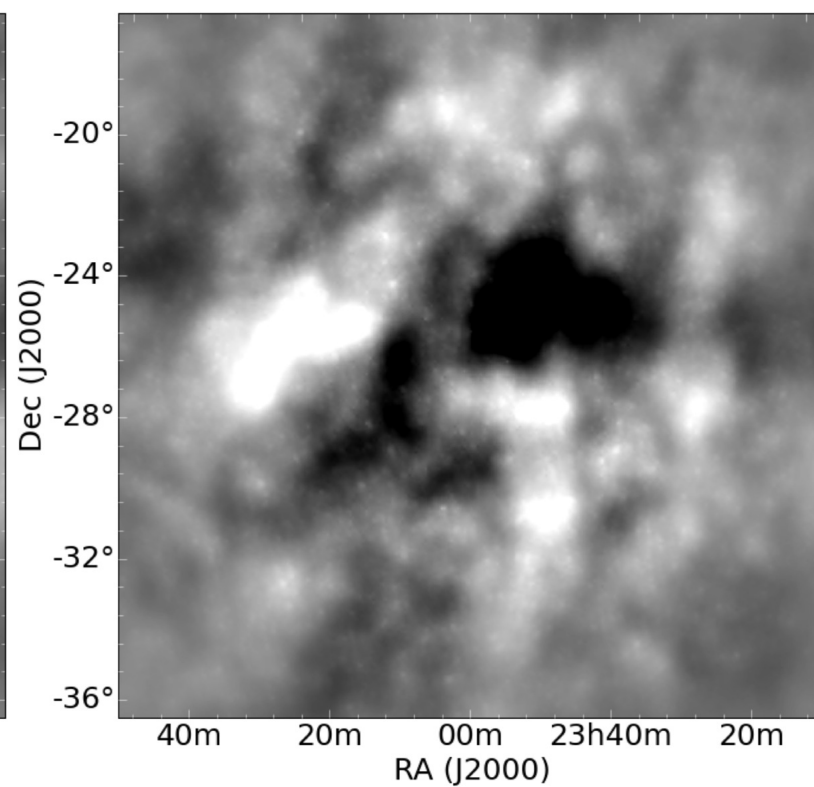
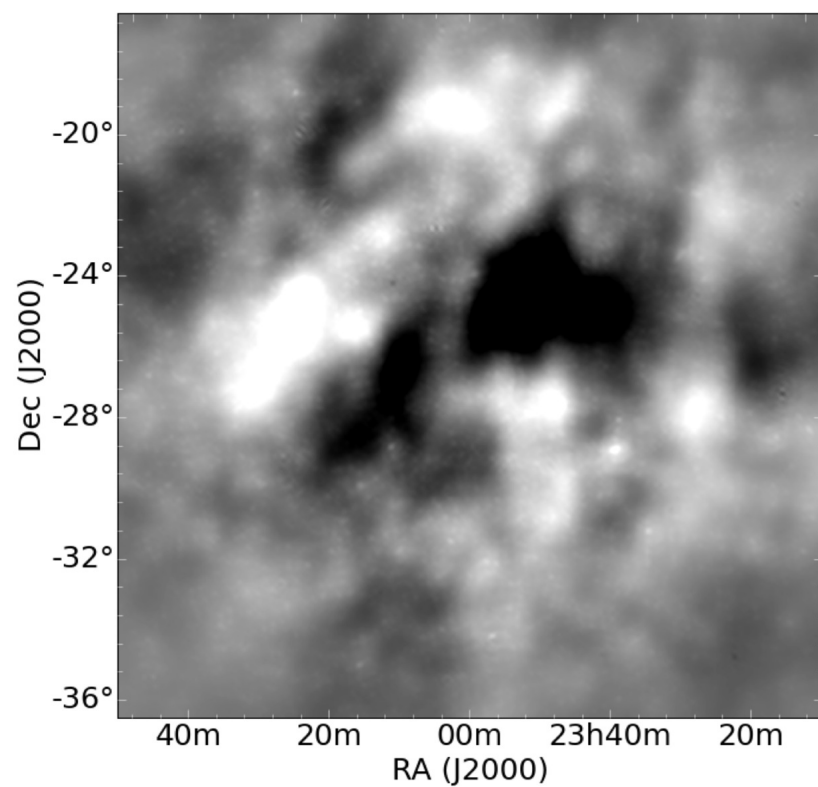
FHD

RTS

FHD-RTS

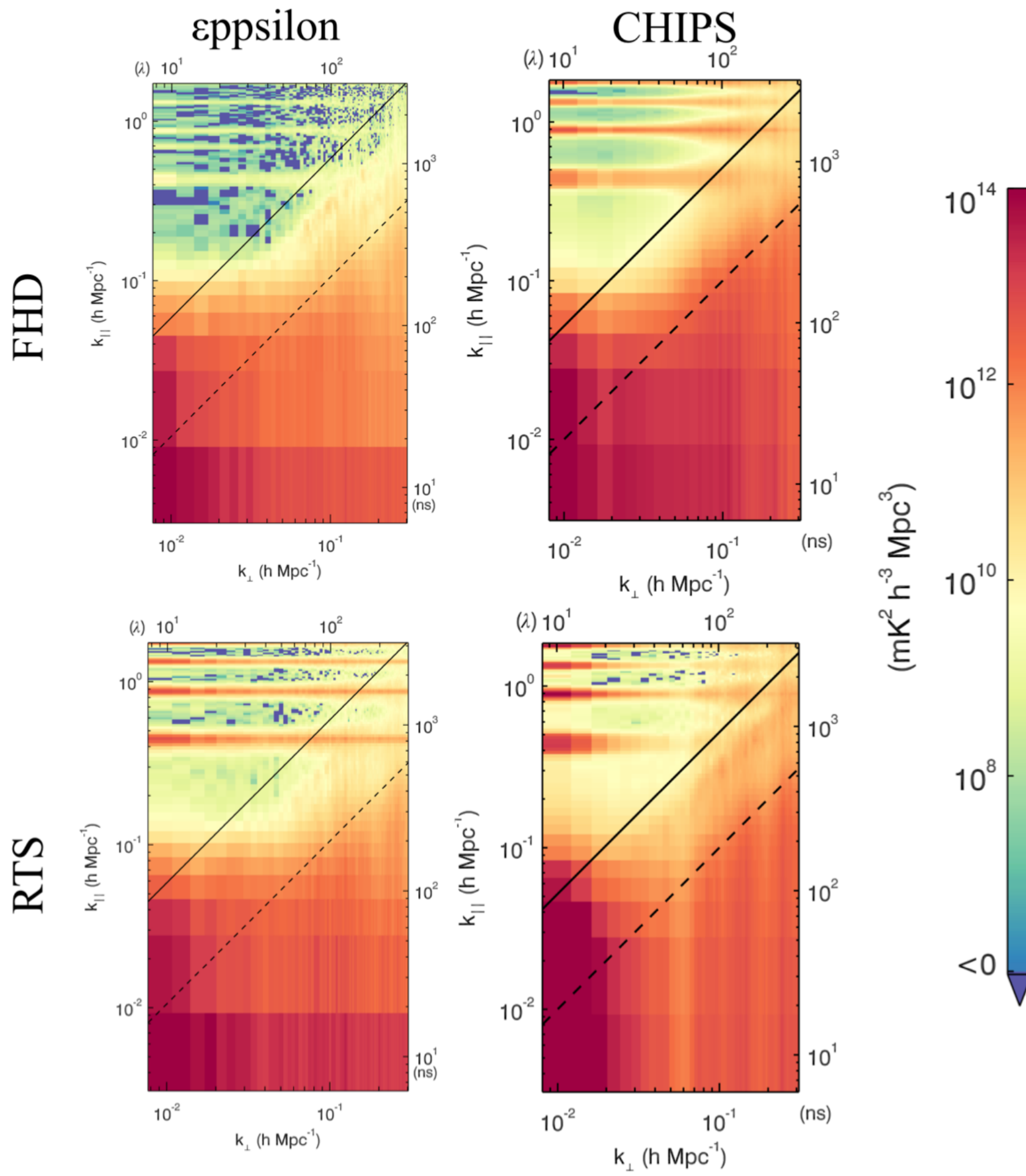


Sky – Foreground model



Foreground Removal

Power Spectrum Method



COMPARE PIPELINES

