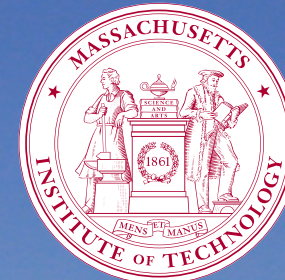




CAL POLY POMONA



SCUOLA
NORMALE
SUPERIORE



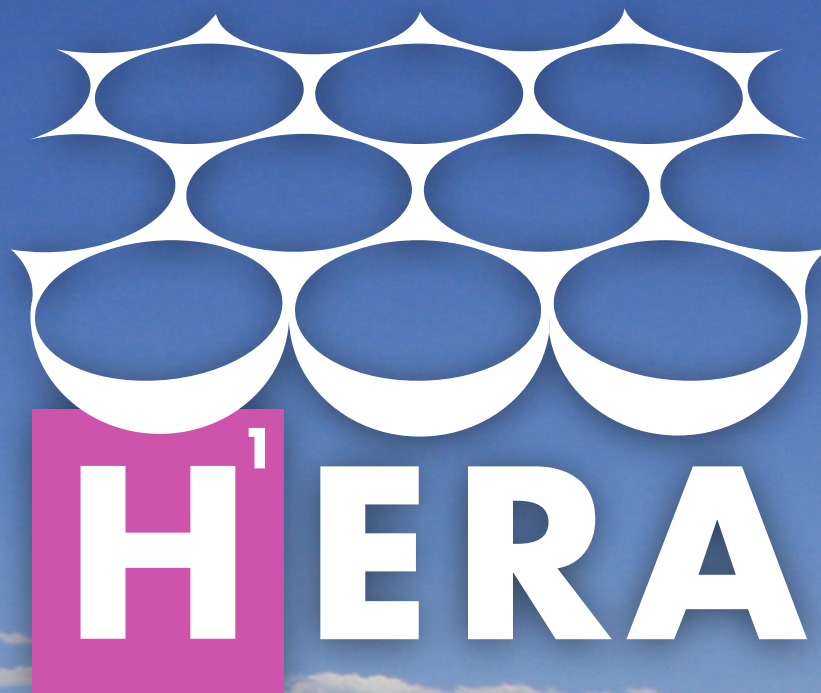
UNIVERSITY OF
CAMBRIDGE



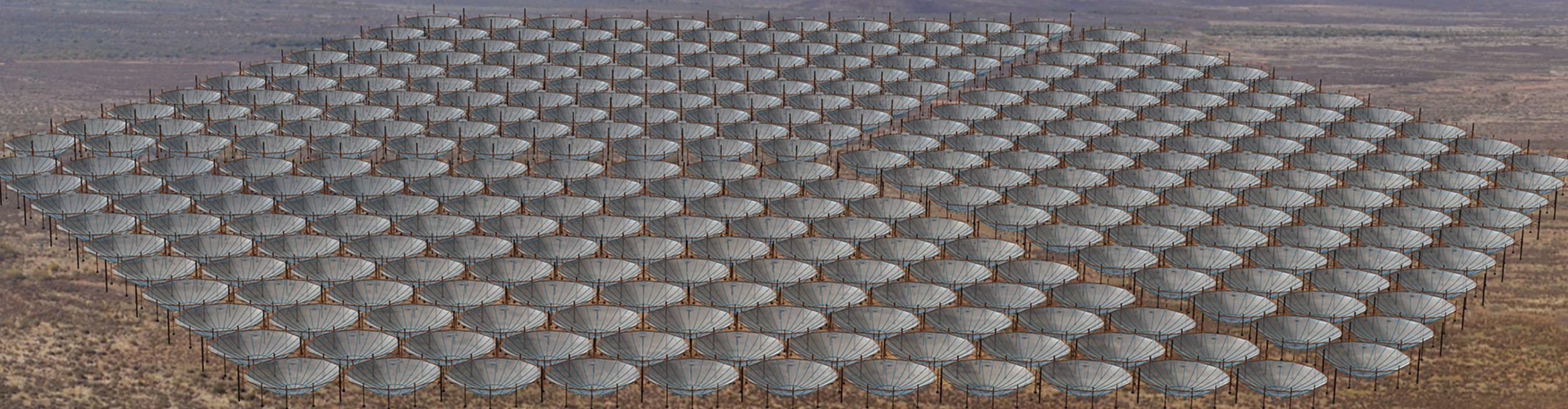
Penn
UNIVERSITY of PENNSYLVANIA



BROWN



The Hydrogen Epoch of Reionization Array



HYDROGEN EPOCH OF REIONIZATION ARRAY (HERA)

Location: Karoo Desert, South Africa

Science: High sensitivity on
Reionization and late Dark Ages

Design: 350 14m fixed dishes

Goal: High SNR Power spectra and
first images

Stretch Goal: redshifts 13 to 20

Supported by the NSF Mid-Scale program, construction under way.



HYDROGEN EPOCH OF REIONIZATION ARRAY (HERA)

Builds on Lessons learned.

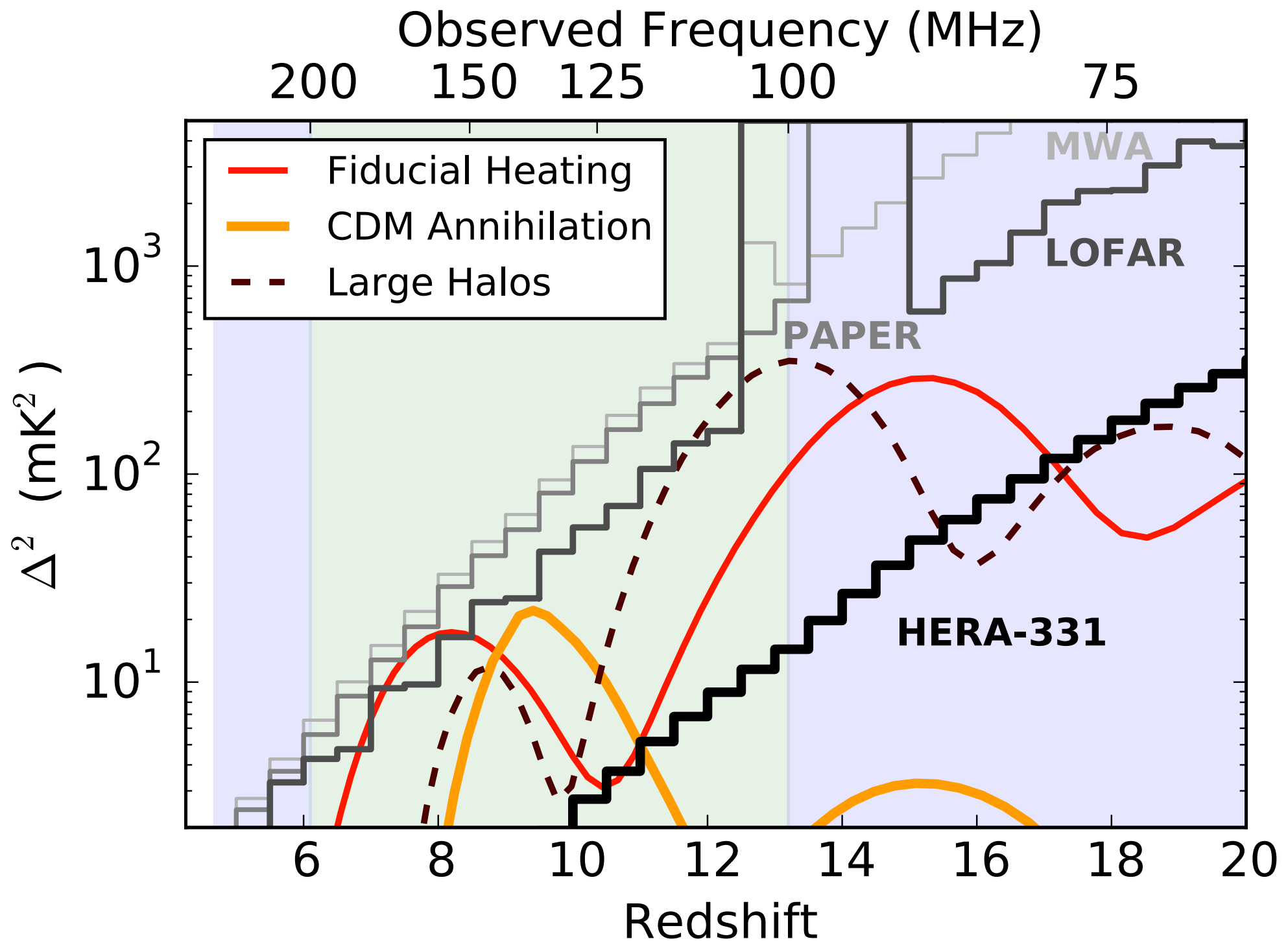
- 1) Builds on MWA and PAPER
- 2) Redundancy
- 3) Reflection Control
- 4) More Collecting Area
- 5) Various Instrumental Improvements
- 6) Enable Many Analysis Approaches



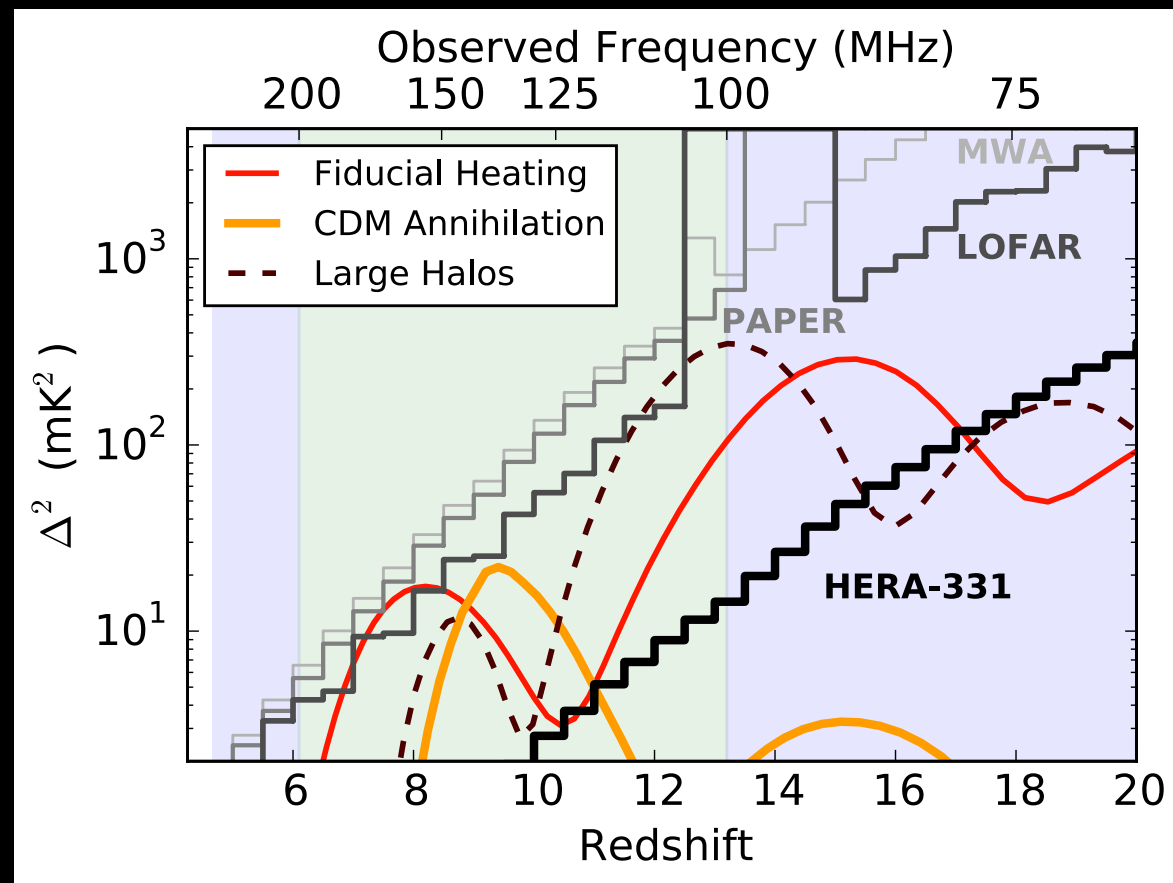
HERA SCIENCE GOALS

1. Measure reionization 21cm emission at high significance
2. Constrain global parameters of First Astrophysics
3. Direct measurement of CMB optical depth (τ)
4. First true survey images suitable for cross-comparison

1. Detect and characterize reionization 21cm emission at high significance



1. Detect and characterize reionization 21cm emission at high significance



Instrument	SNR
PAPER 128	1.56
MWA 128	0.66
LOFAR	0.70
HERA 37	5.67
HERA 331	38.75
MWA 256 ^a	2.40
SKA1 Low ^b	21.23

Pober, HERA memo #4

2. Constrain global parameters of First Astrophysics

Over what distance?

Depends on the kinds of ionizing sources.

R_{mfp}

How many UV photons?

This tracks the properties of the galaxies.

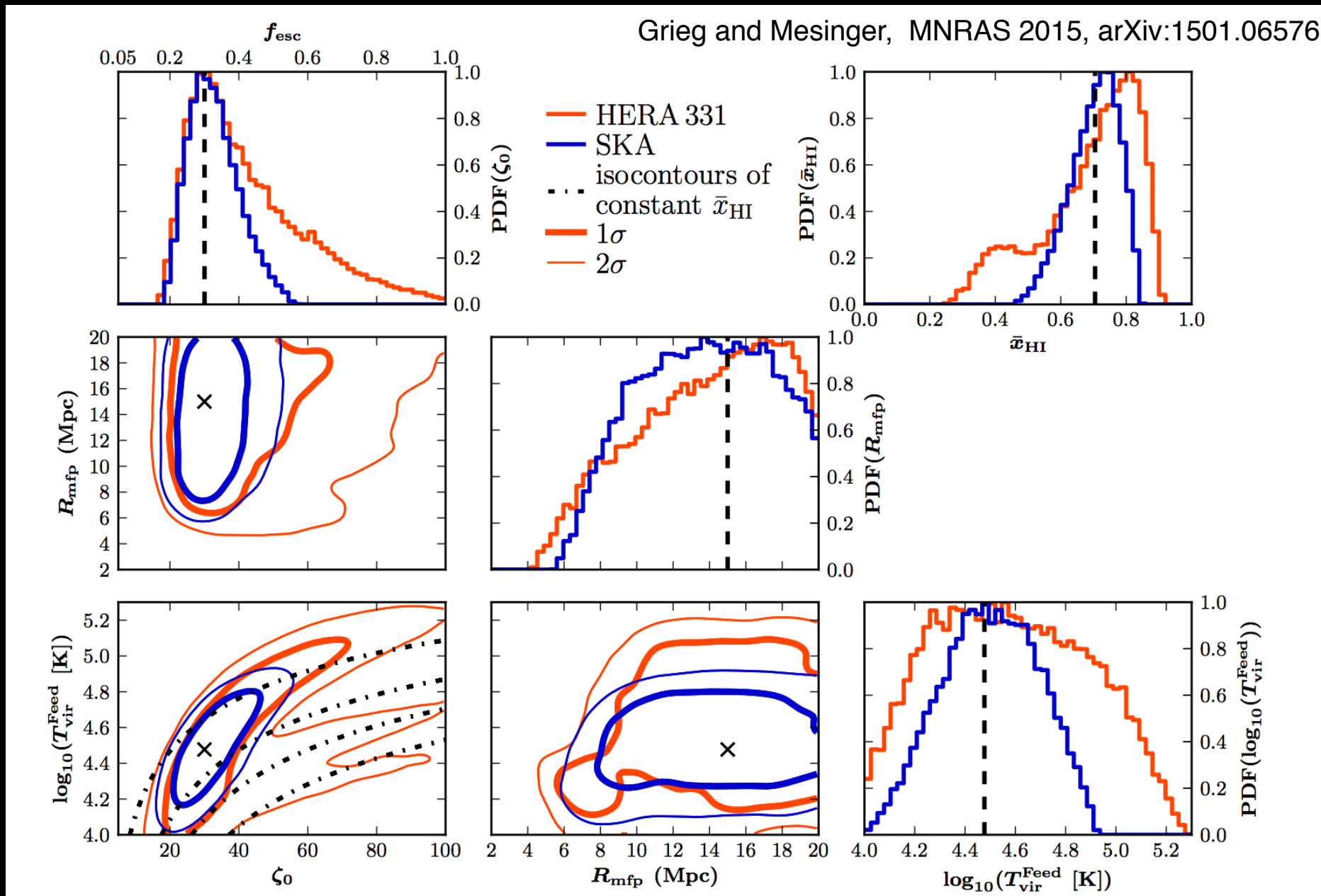
T_{vir}

Which halos ?

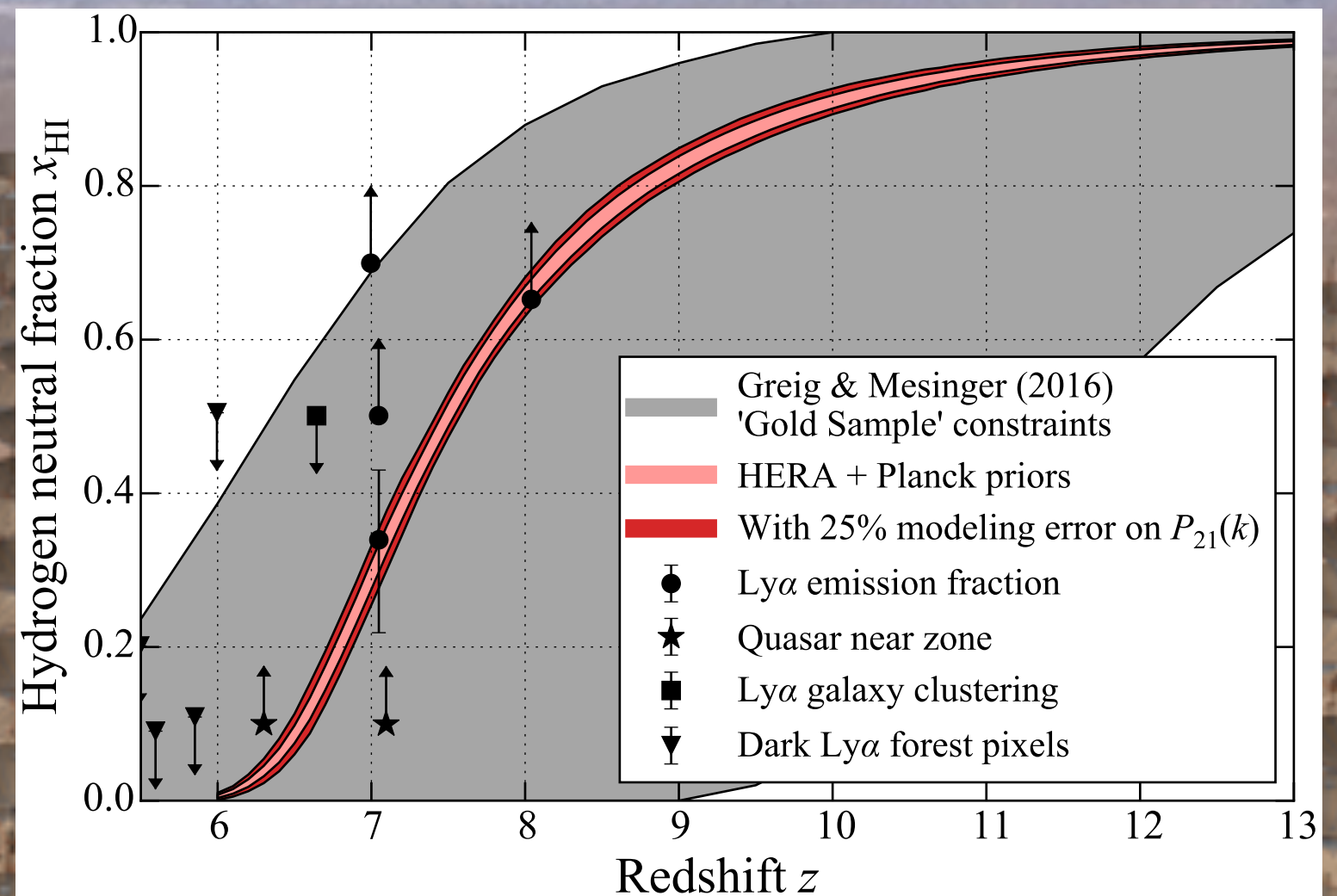
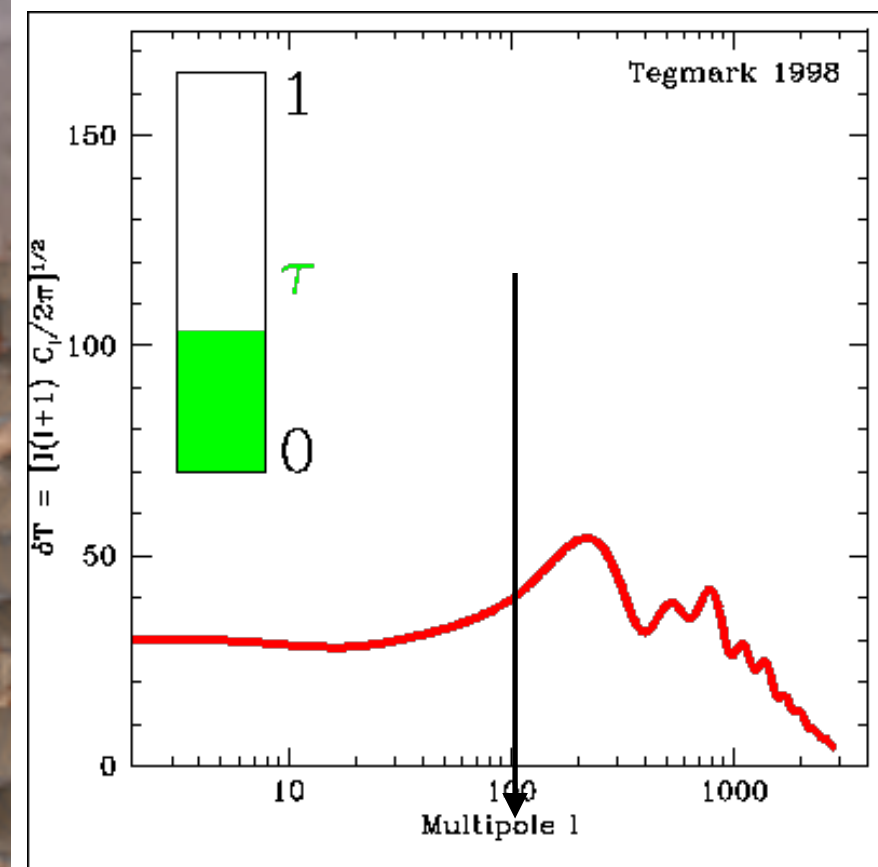
This tracks the **Timing**

ζ

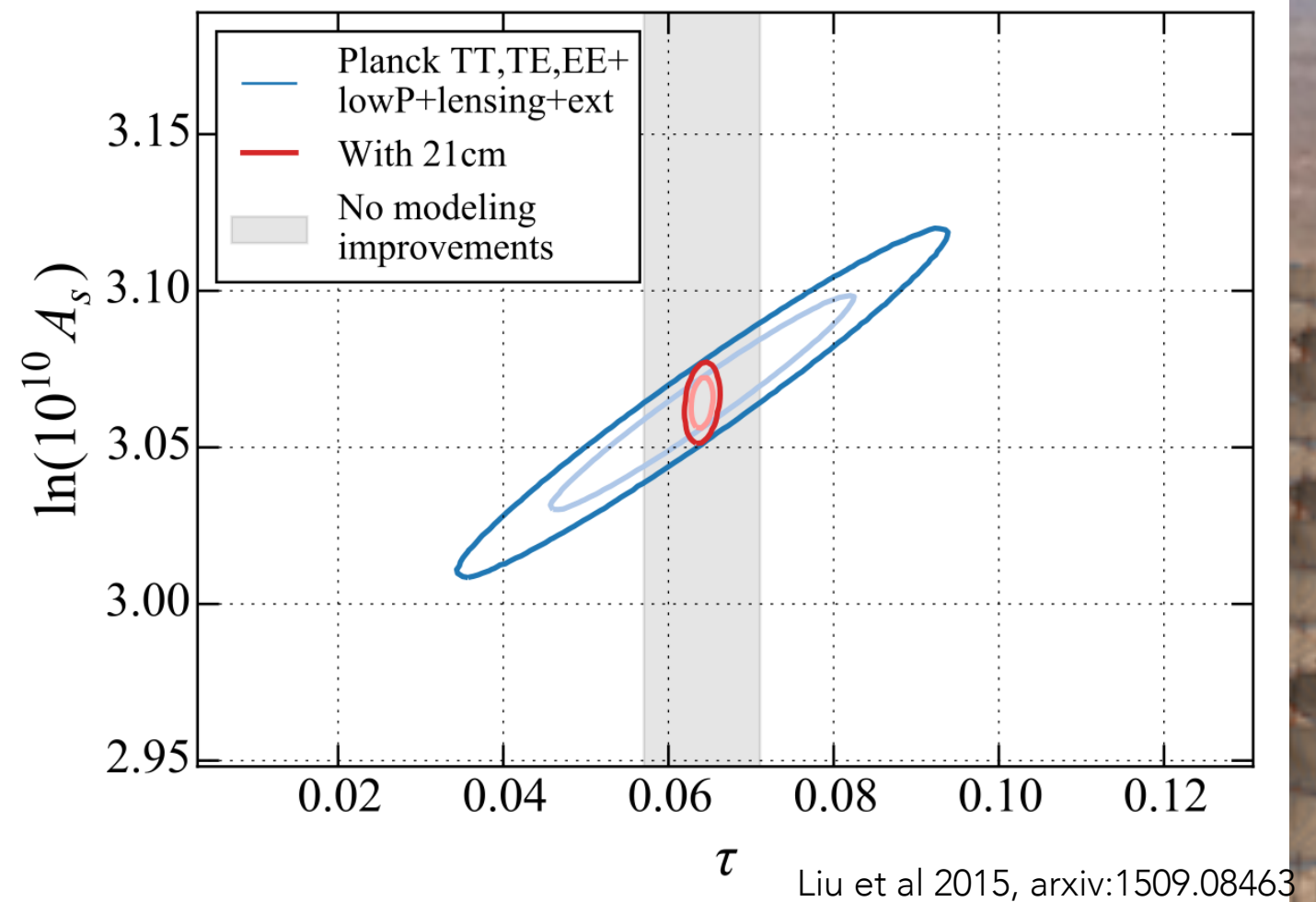
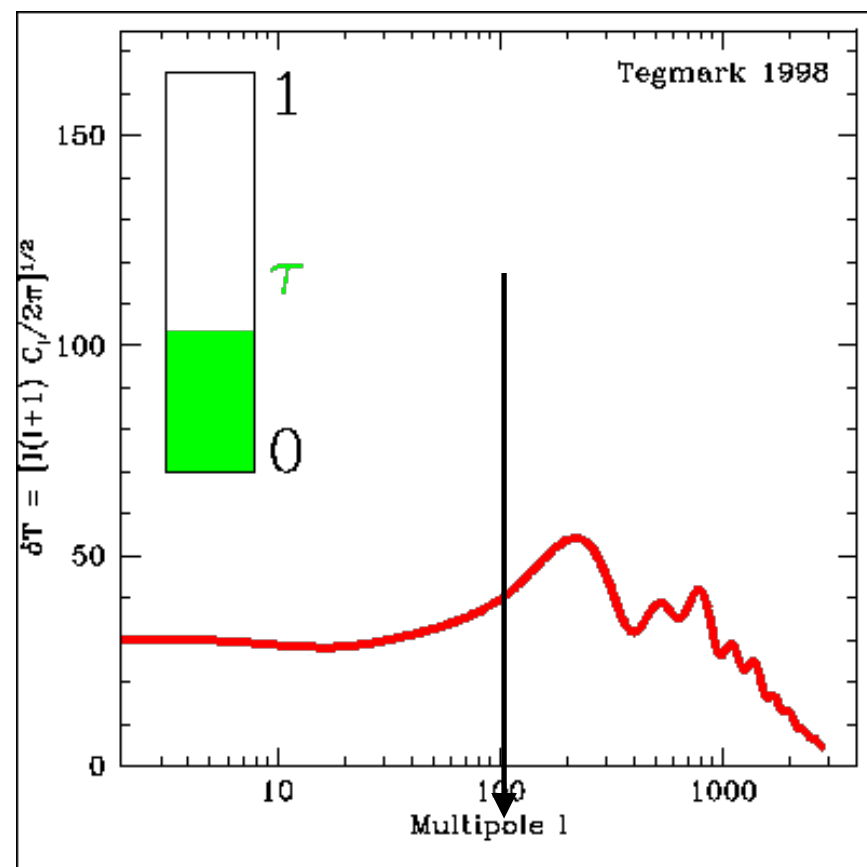
2. Constrain global parameters of First Astrophysics

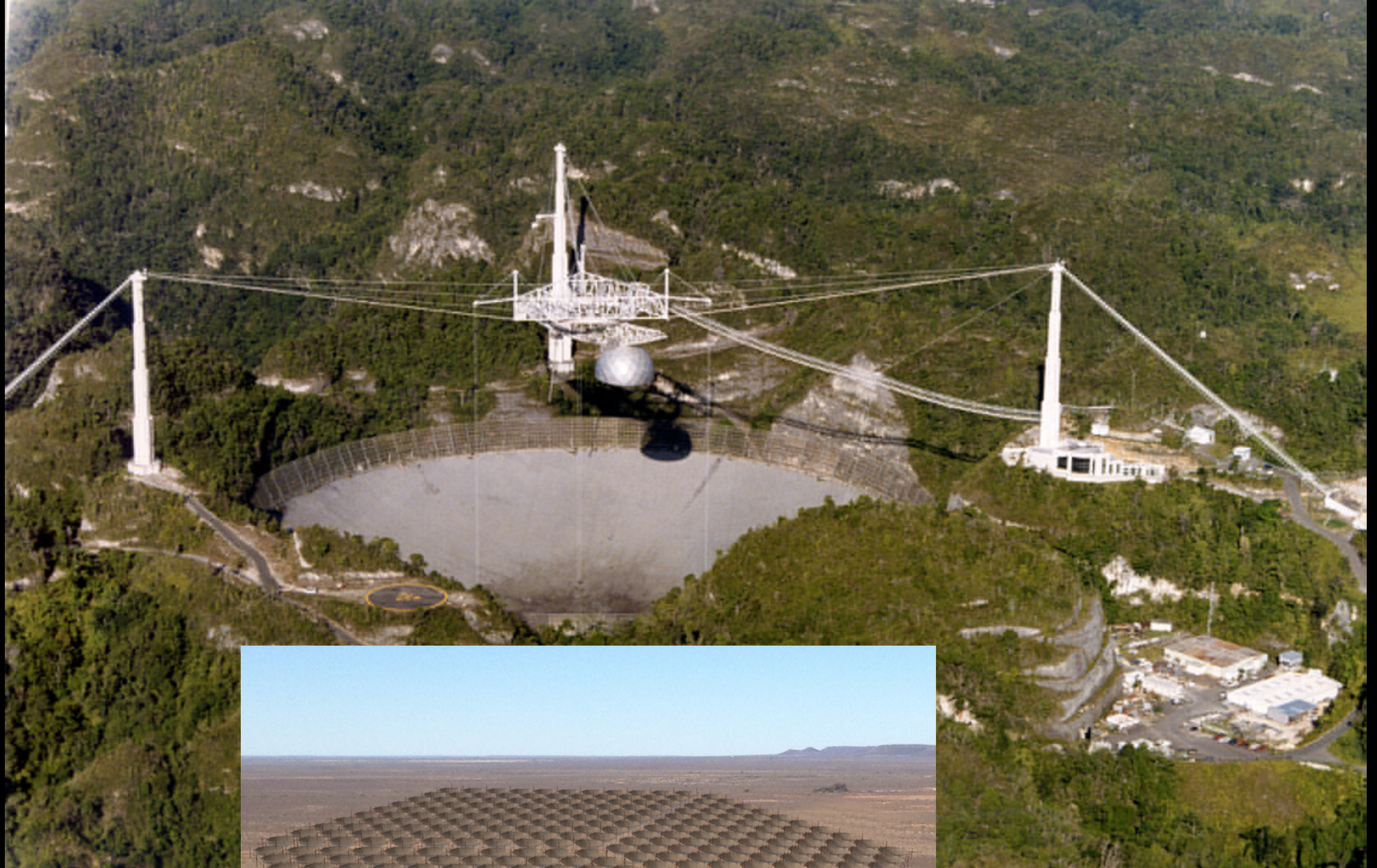


3 Direct measurement of CMB optical depth (τ)



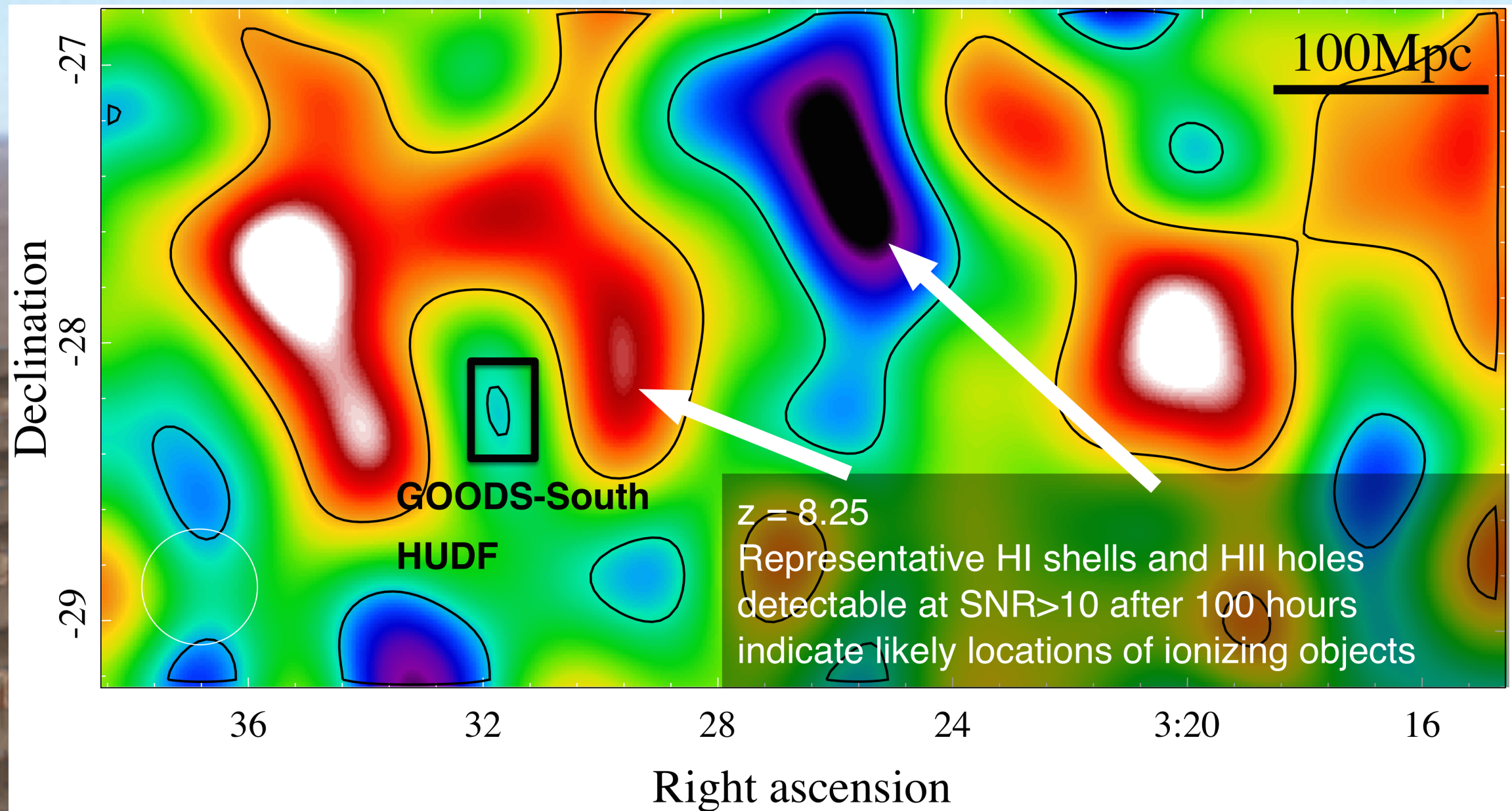
3. Direct measurement of CMB optical depth (τ)



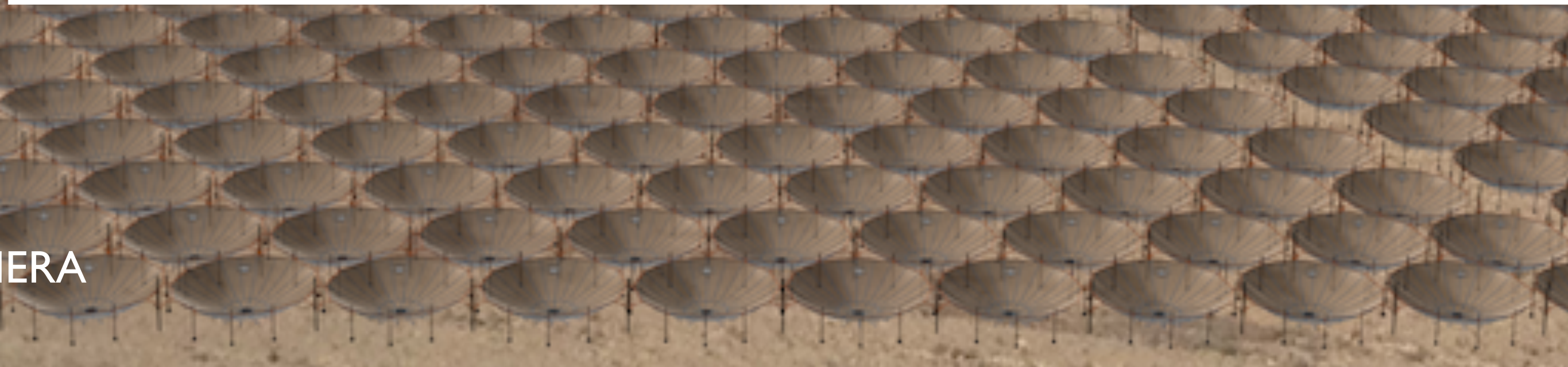
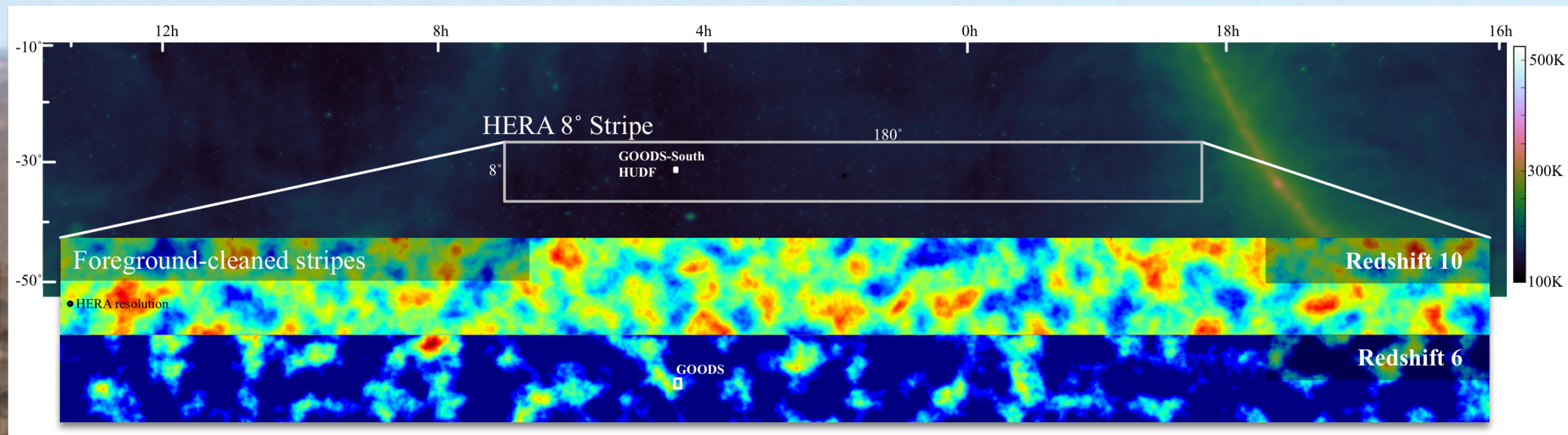


HERA

4. First true survey images suitable for cross-comparison



4. First true survey images suitable for cross-comparison

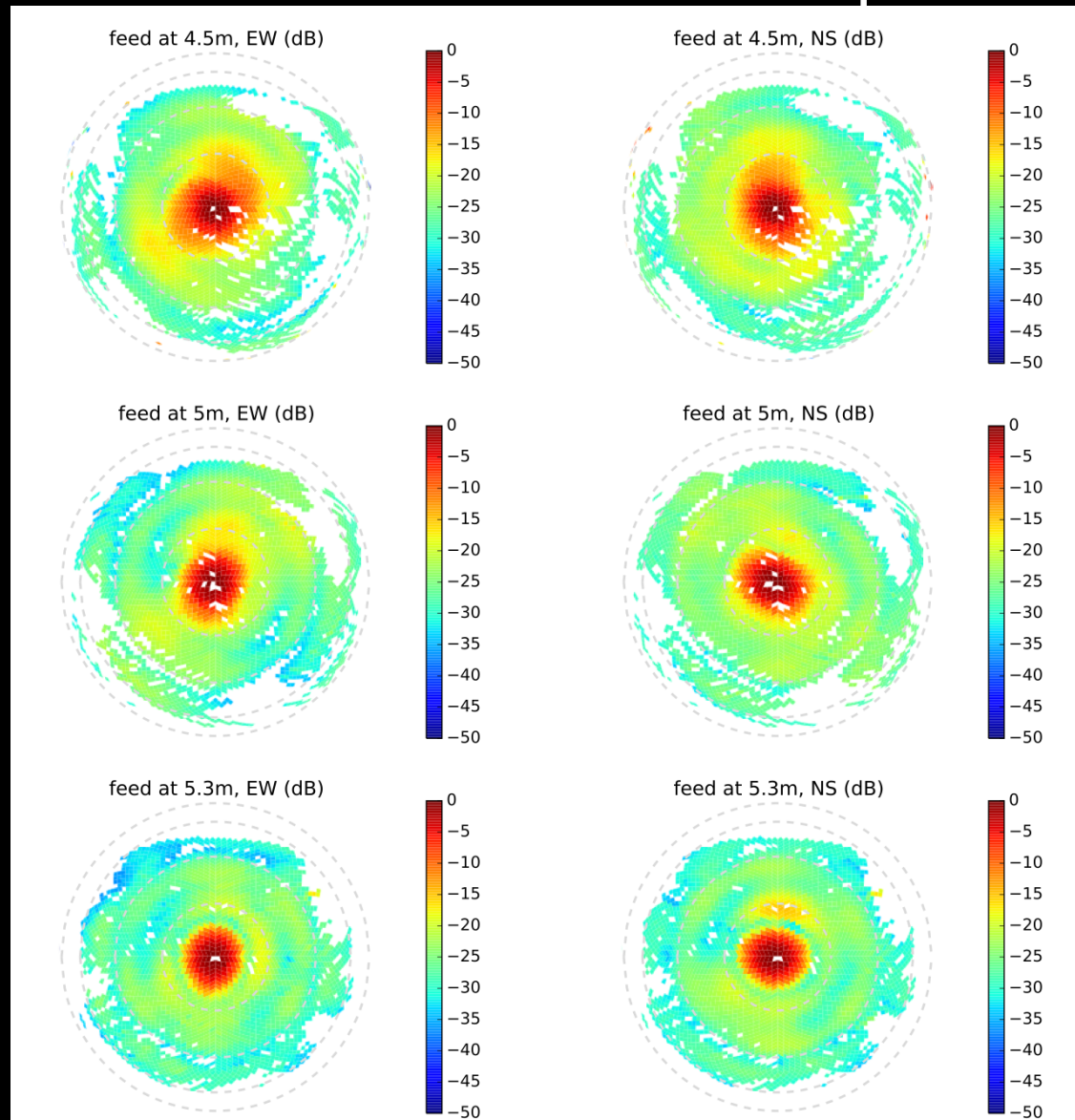


DISH CHARACTERIZATION



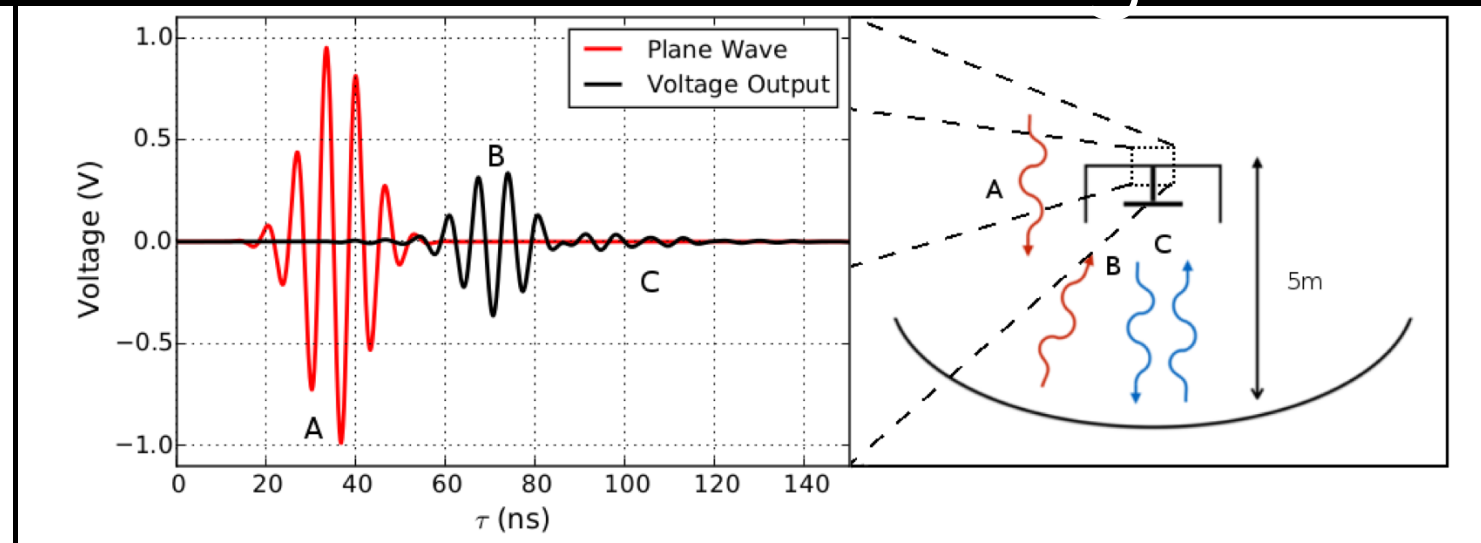
HERA DISH CHARACTERIZATION

Orbcomm Dish Maps



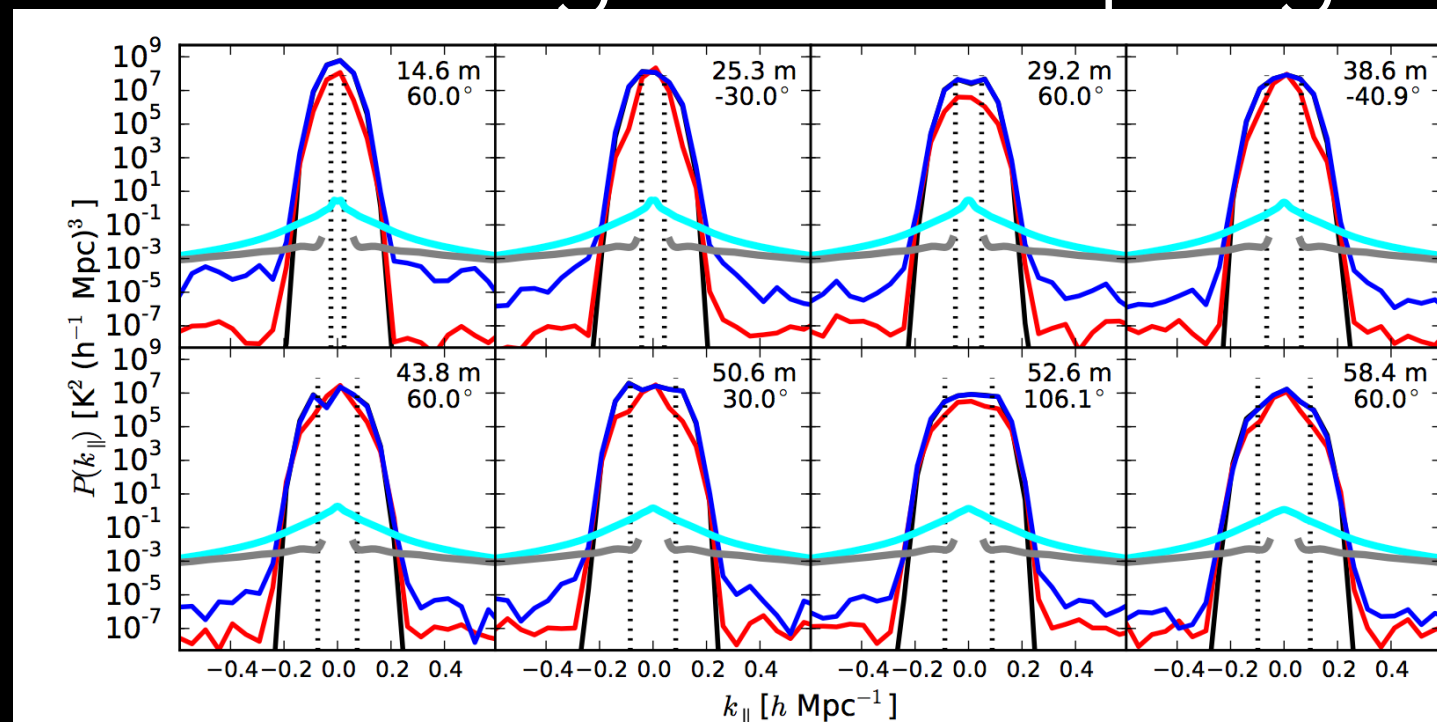
Neben et al 2016
<http://arxiv.org/abs/1602.03887>

Time Domain Modeling

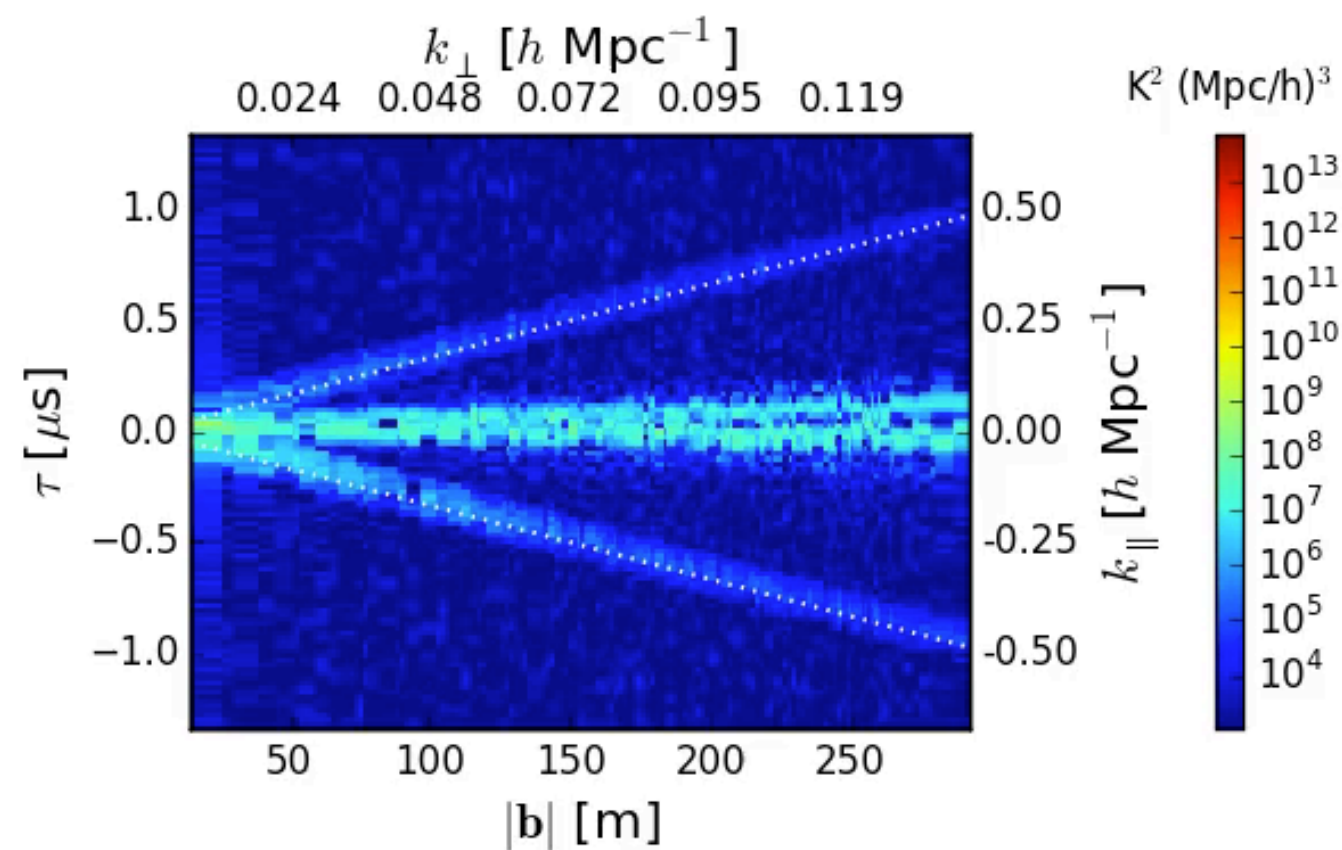
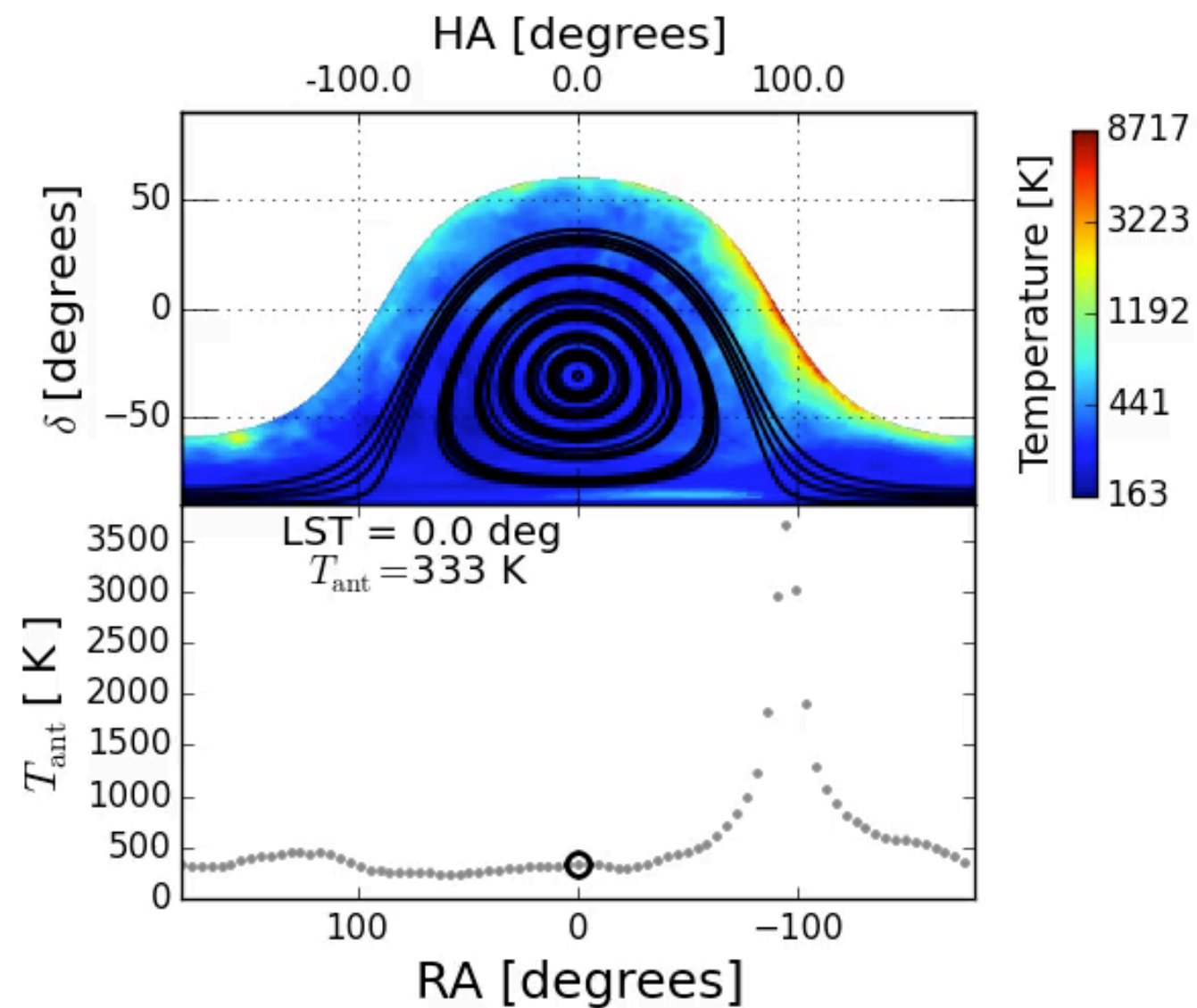


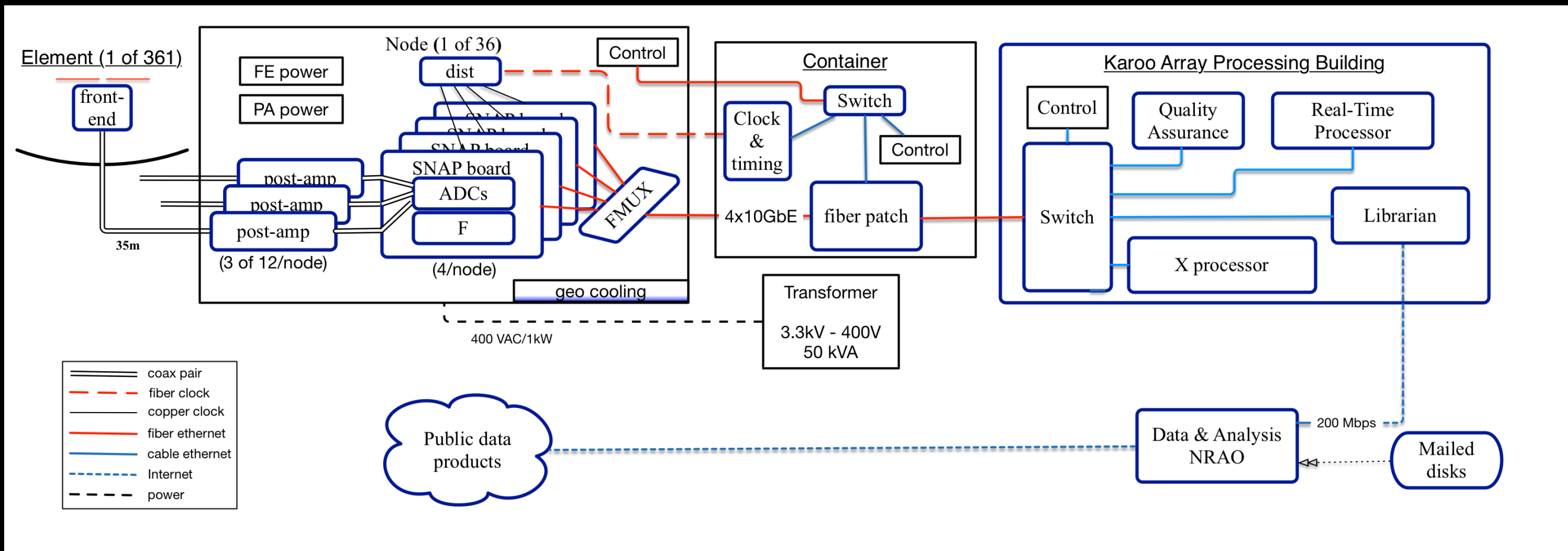
Ewall-Wice et al 2016
<http://arxiv.org/abs/1602.06277>

Beam-Foreground coupling

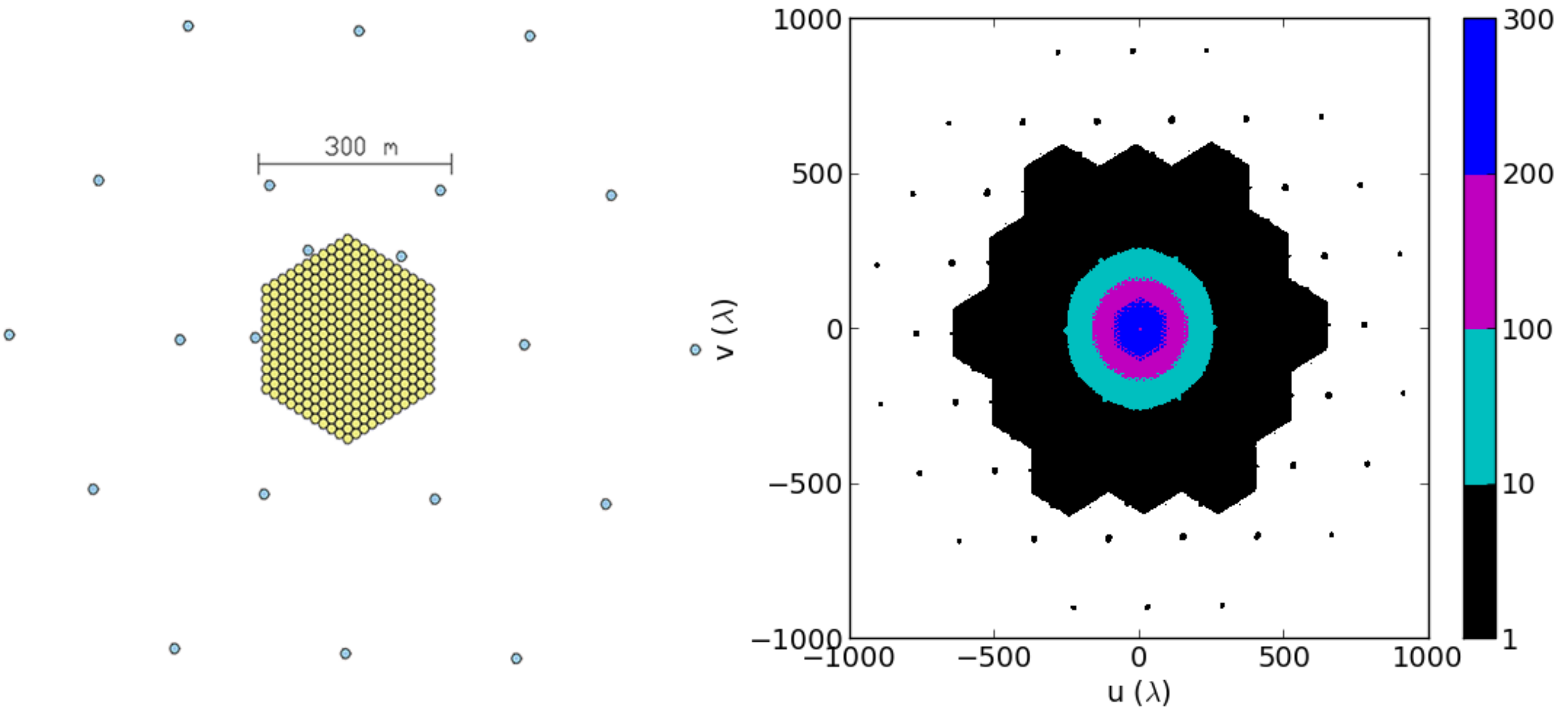


Thyagarajan et al 2016





HERA uv coverage



SKA CORE

MEERKAT CORE

PAPER

HERA

KAT7

OFFICES

HYRAX

KAROO ARRAY
PROCESSING BUILDING

QUARTERS

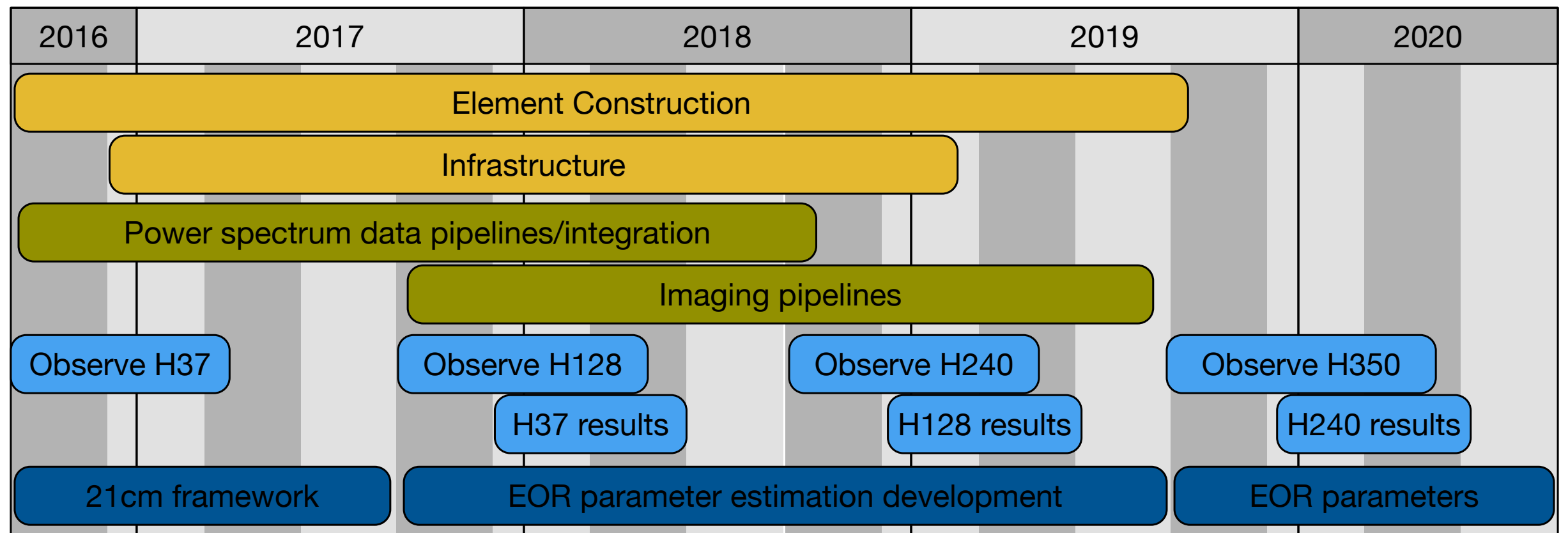
1km







March 3 2016





HERA 19 Site crew, March 2016



11/02/2016



18/02/2016



08/03/2016



HERA Group, Irvine 2015