



CHILES

COSMOS HI LARGE EXTRAGALACTIC SURVEY

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Columbia University

A pathfinder to the SKA and its pathfinders



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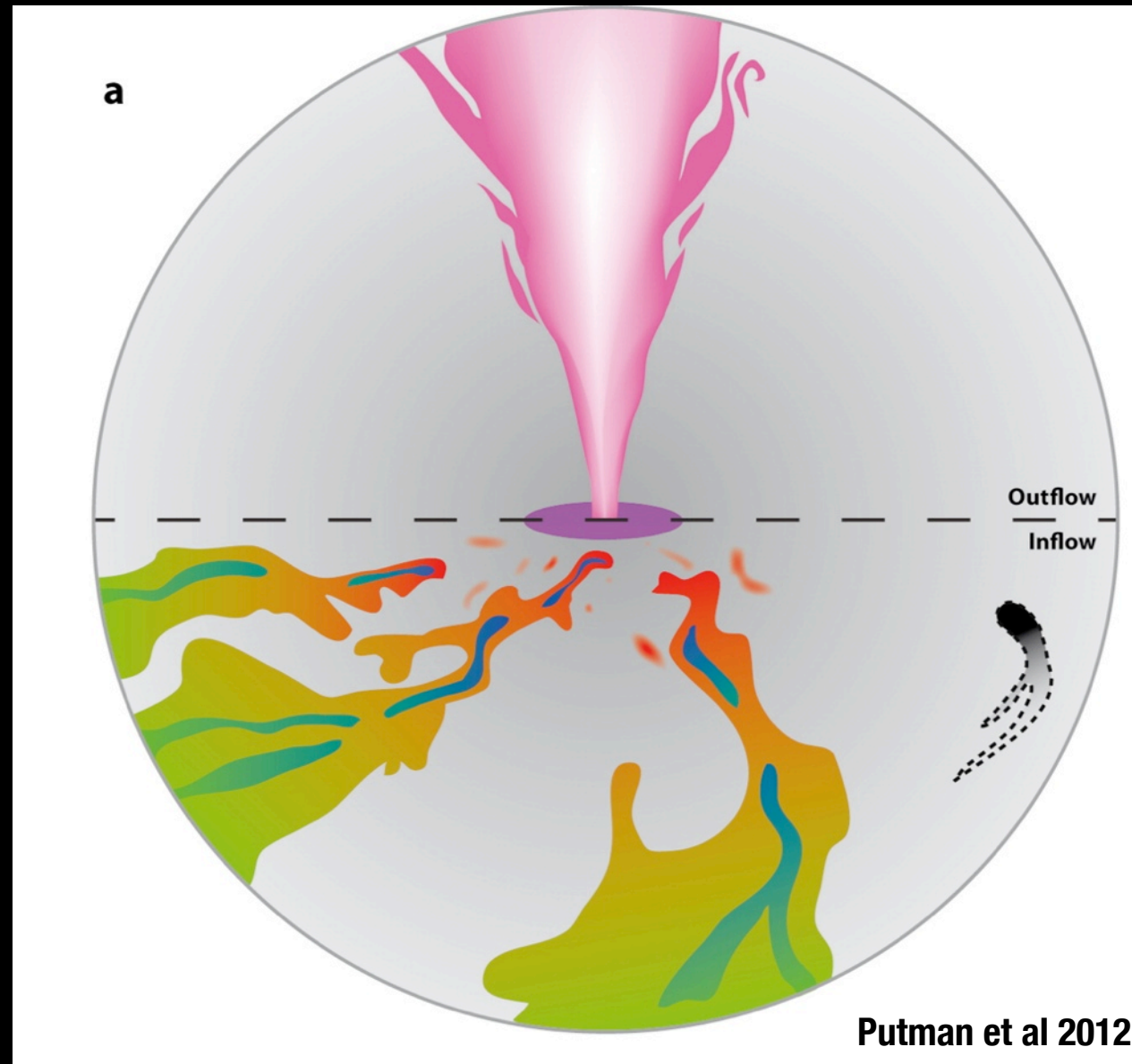
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UWA/ICRAR

Attila Popping
Martin Meyer
Andreas Wicenec

+ CHILES CON POL
(commensal survey led by Chris Hales)

Key questions:

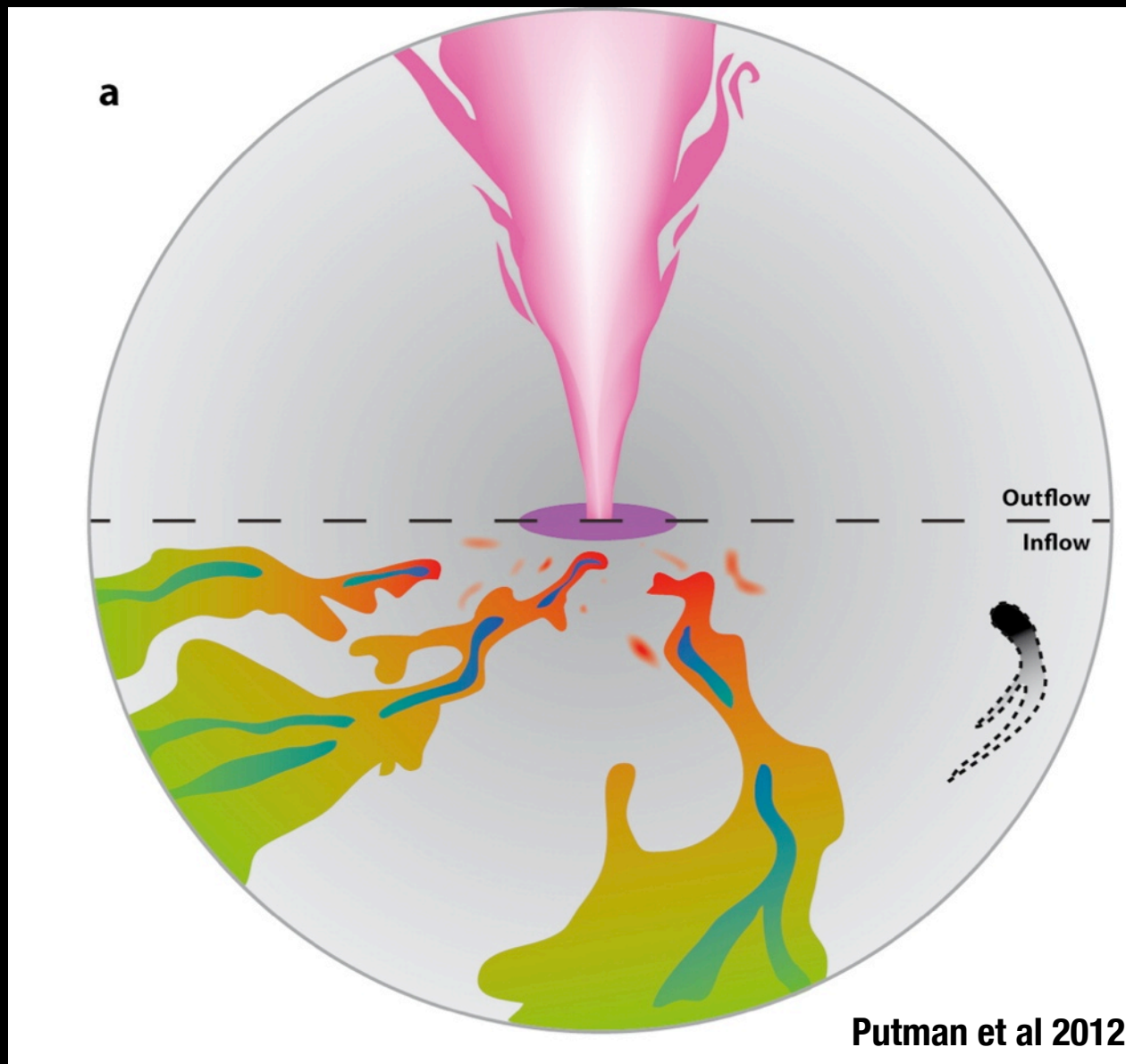


How do galaxies lose their gas?

How do galaxies accrete their gas?

What is the relationship between SFR and gas?

Key questions:



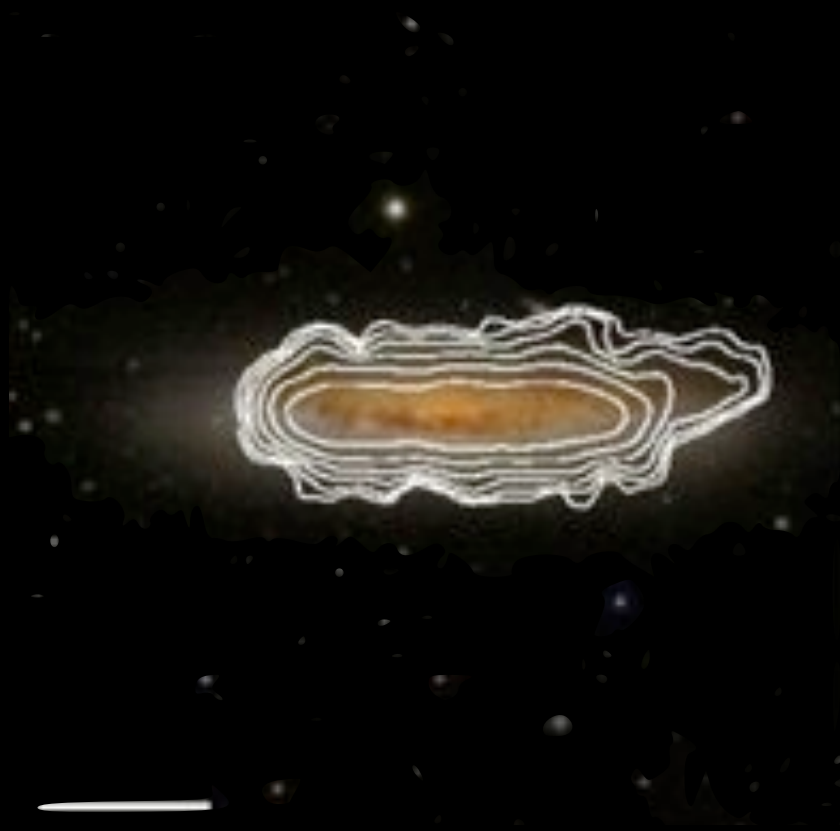
How do galaxies lose their gas?

How do galaxies accrete their gas?

What is the relationship between SFR and gas?

How does it change as a function of environment and across cosmic time?

HI Imaging in the Nearby Universe



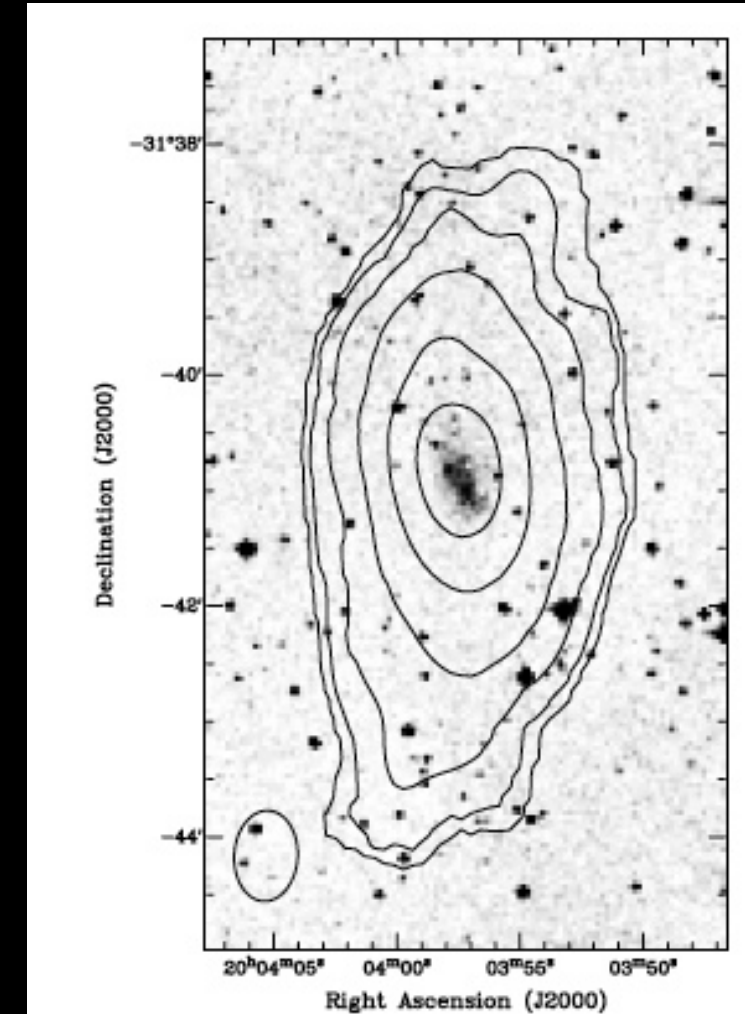
NGC 4402 (Chung et al. 2009)

- Galaxies in clusters: galaxies lose their gas due to interactions with the ICM

HI Imaging in the Nearby Universe



NGC 4402 (Chung et al. 2009)

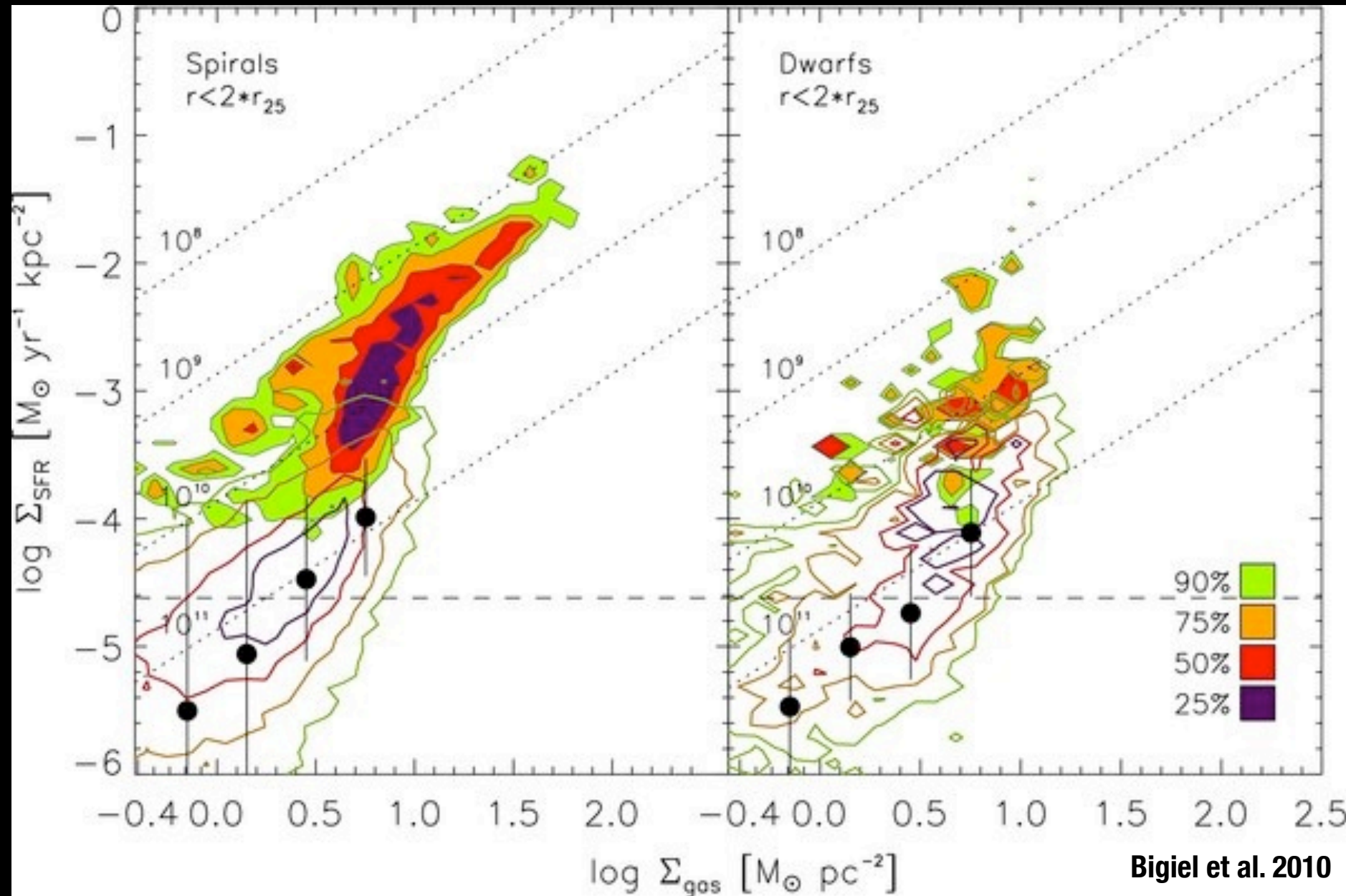


KK 246 (Kreckel et al. 2010)

- Galaxies in clusters: galaxies lose their gas due to interactions with the ICM

- Galaxies in voids: evidence for on-going accretion

Studies of SFR & Gas at $z \sim 0$



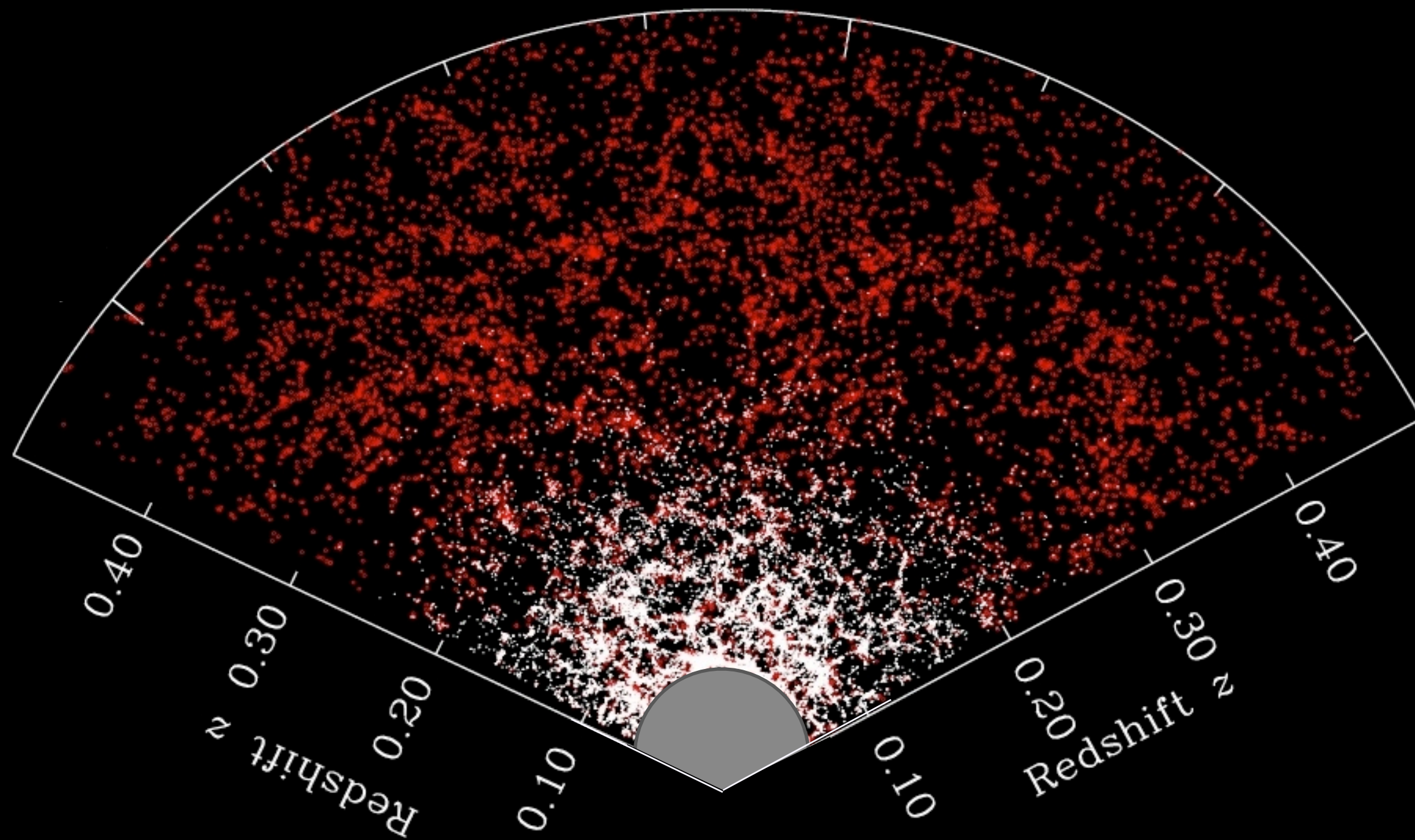
Filled contours: Inside r_{25}

ISM dominated by molecular gas

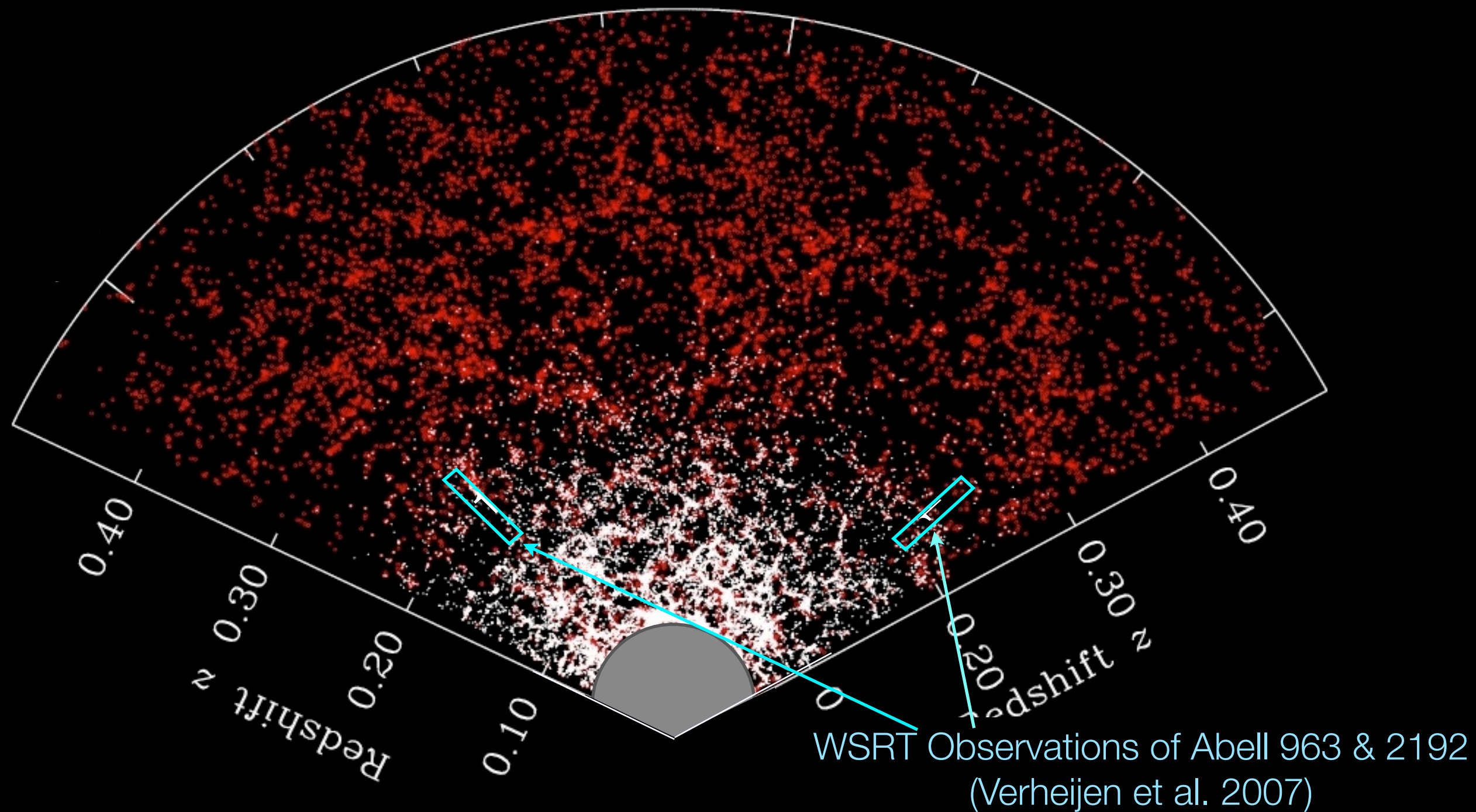
Empty contours: Outside r_{25}

ISM dominated by HI

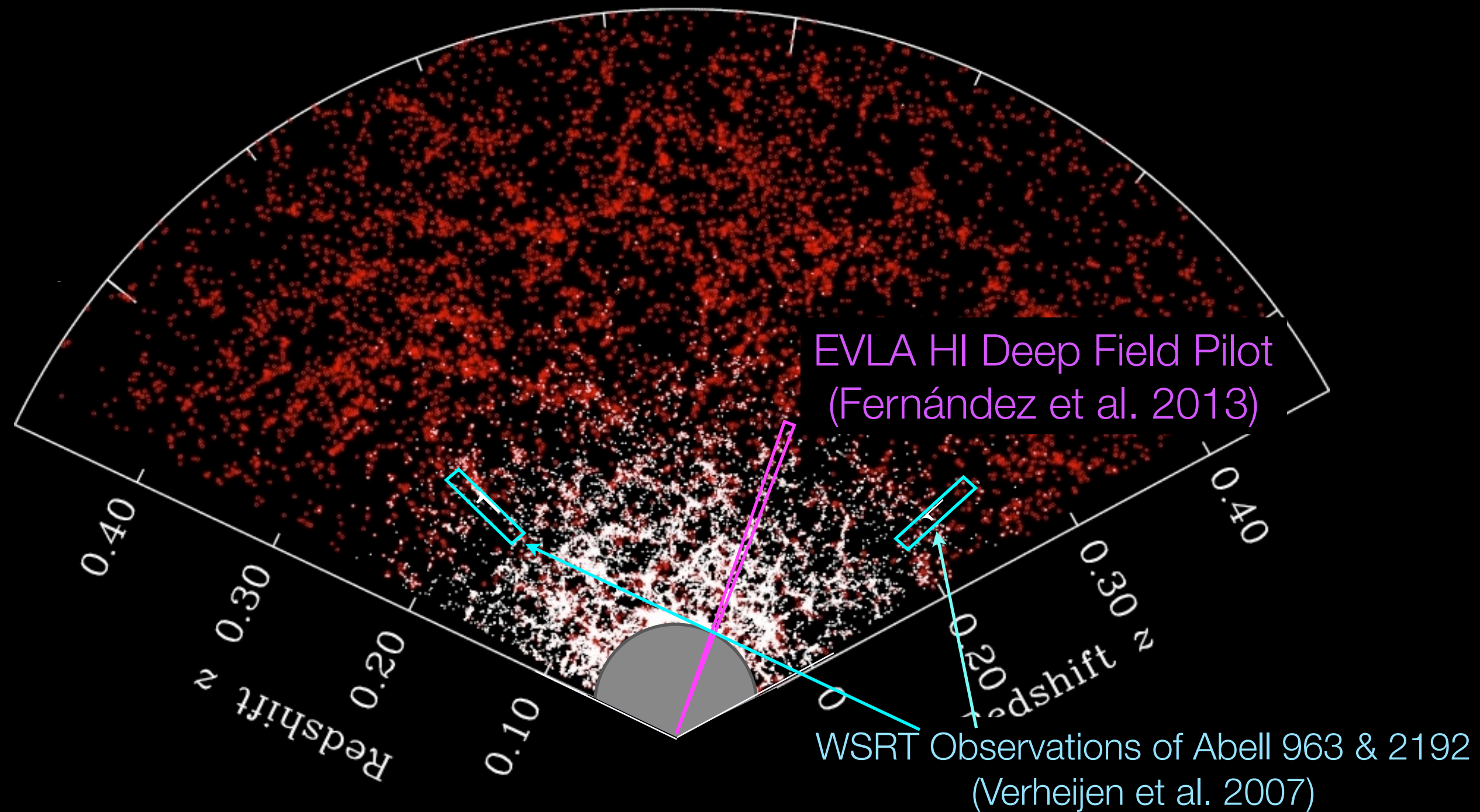
Blind HI surveys



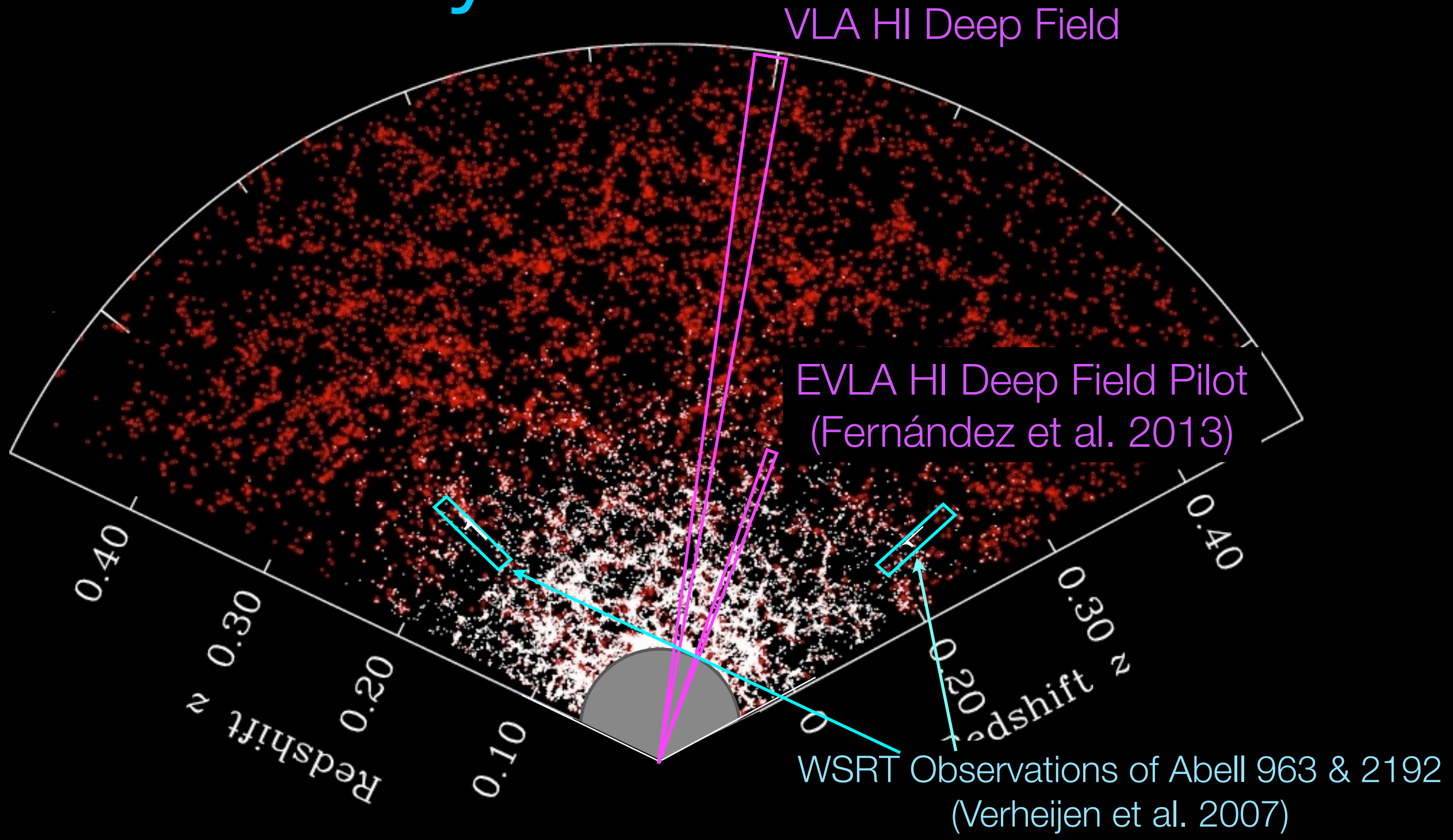
Blind HI surveys



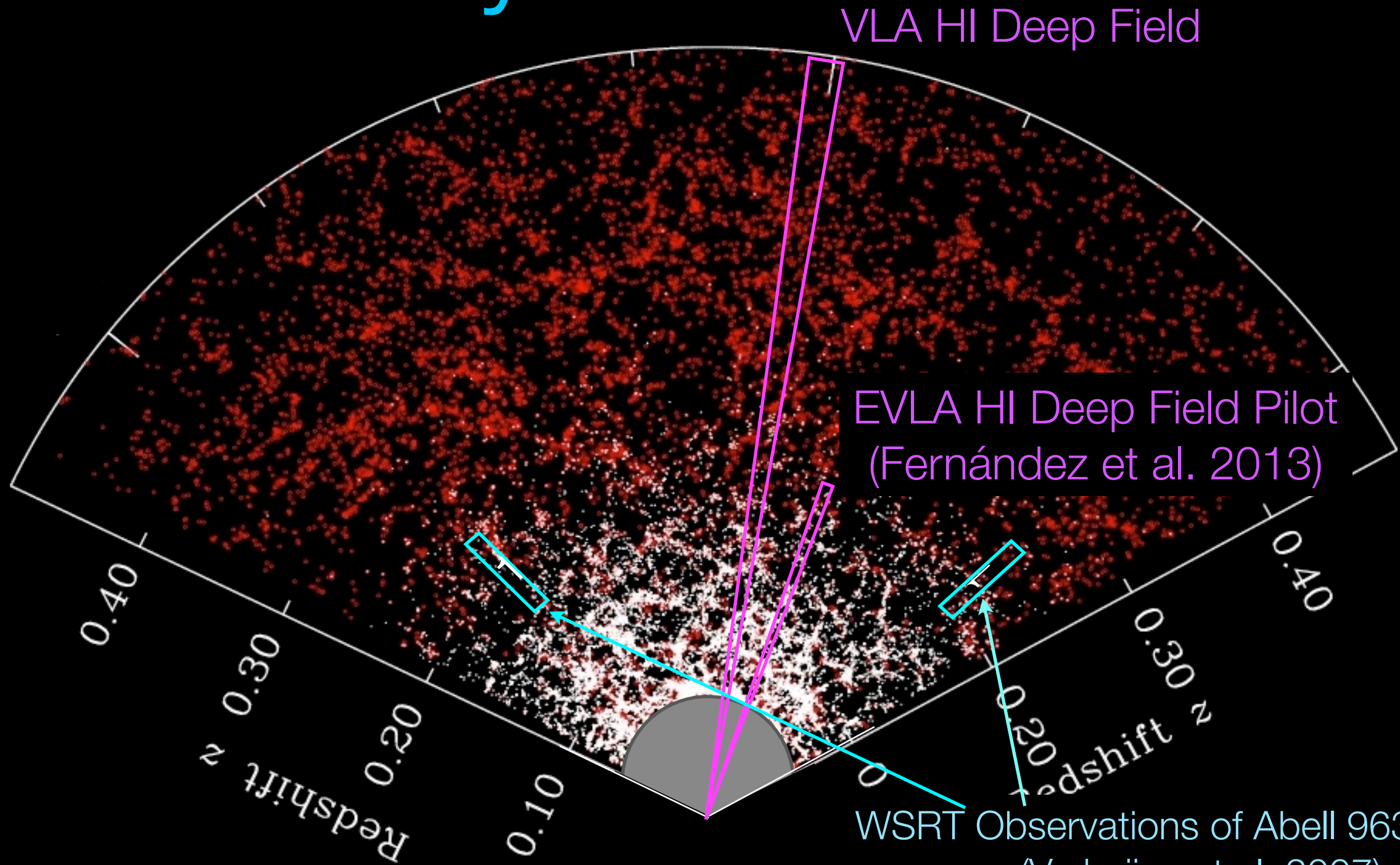
Blind HI surveys



Blind HI surveys



Blind HI surveys



VLA HI Deep Field

EVLA HI Deep Field Pilot
(Fernández et al. 2013)

WSRT Observations of Abell 963 & 2192
(Verheijen et al. 2007)

+ MeerKat, ASKAP & SKA

An Upgraded VLA

	OLD	PILOT	NOW
Bandwidth (MHz)	6.25	240	480
Channels	31	16384	30720
Velocity resolution (km/s)	40	3.5	3.5
Instantaneous z coverage	$0 < z < 0.004$	$0 < z < 0.193$	$0 < z < 0.5$

CHILES Science Drivers

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3. How does the cosmic HI gas density evolve with time?

- Our survey will help constrain Ω_{HI} in the interval $0 < z < 0.5$

Commensal Observing



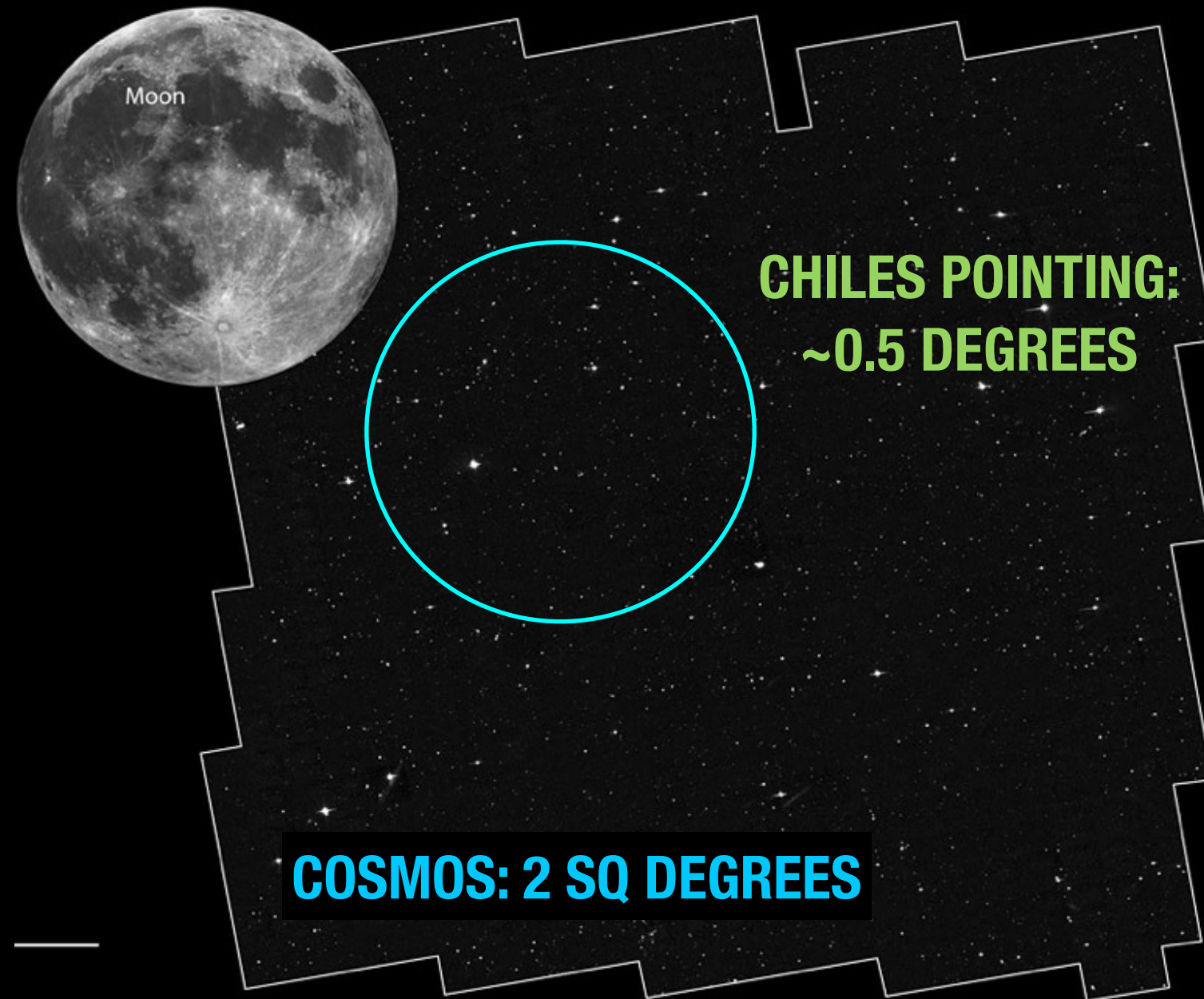
CHILES
CONTINUUM
POLARIZATION

- Survey led by Chris Hales
- Full polarization continuum image
 - Noise: 400 nano-Jy/beam
- Science goals: galaxy evolution, transients, weak lensing and cosmic magnetism

Observation Setup

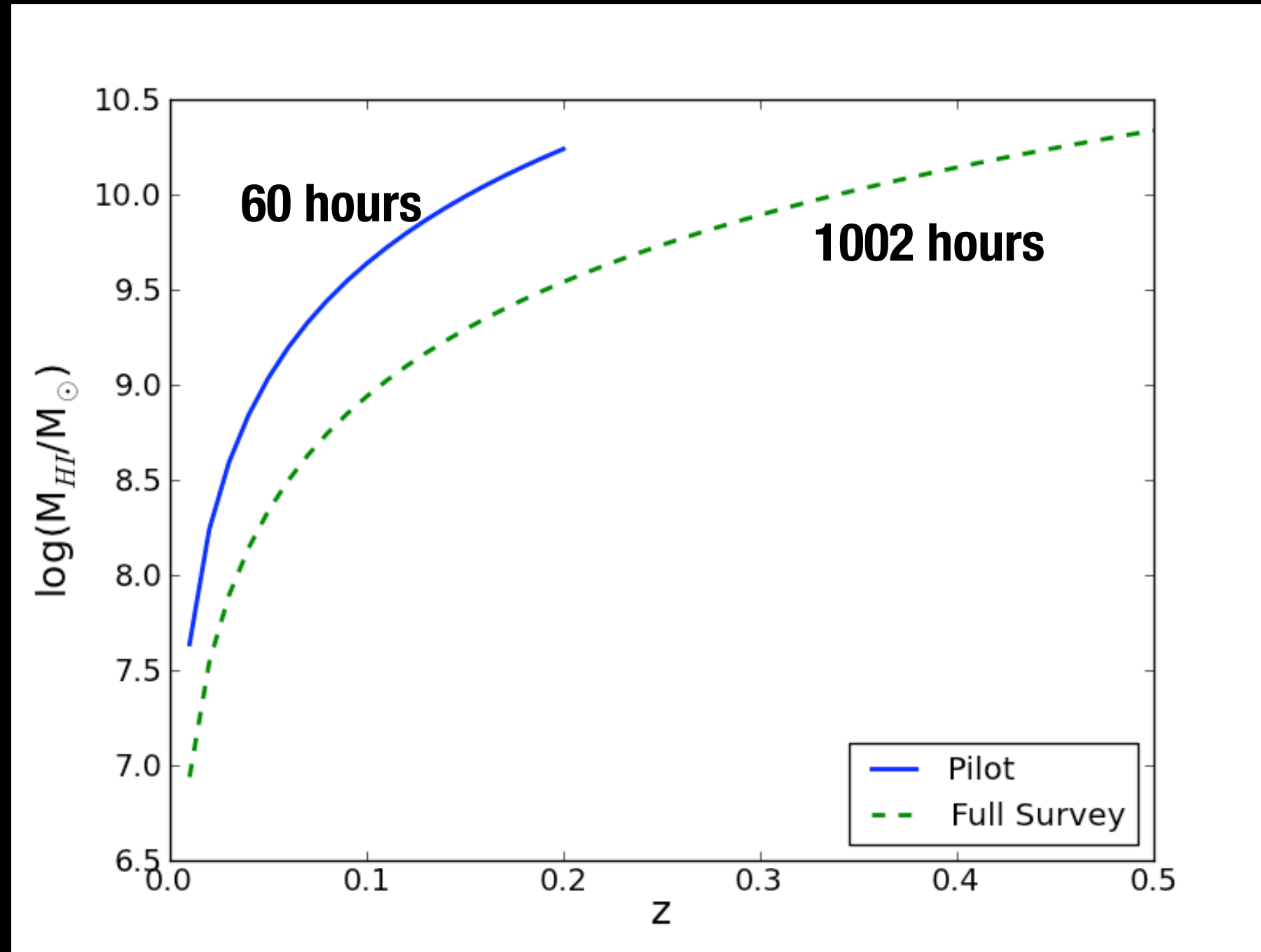
- B array observations (5" resolution)
 - Spatial: 0.68-29 kpc
- 1002 hours of requested time scheduled over 3 B-arrays
 - Observations started Fall 2013
- Correlator setup:
 - Frequency dithering: 3 frequencies settings (941-1420 MHz)
 - 30,720 channels each of ~3.5 km/s

Target: COSMOS Field



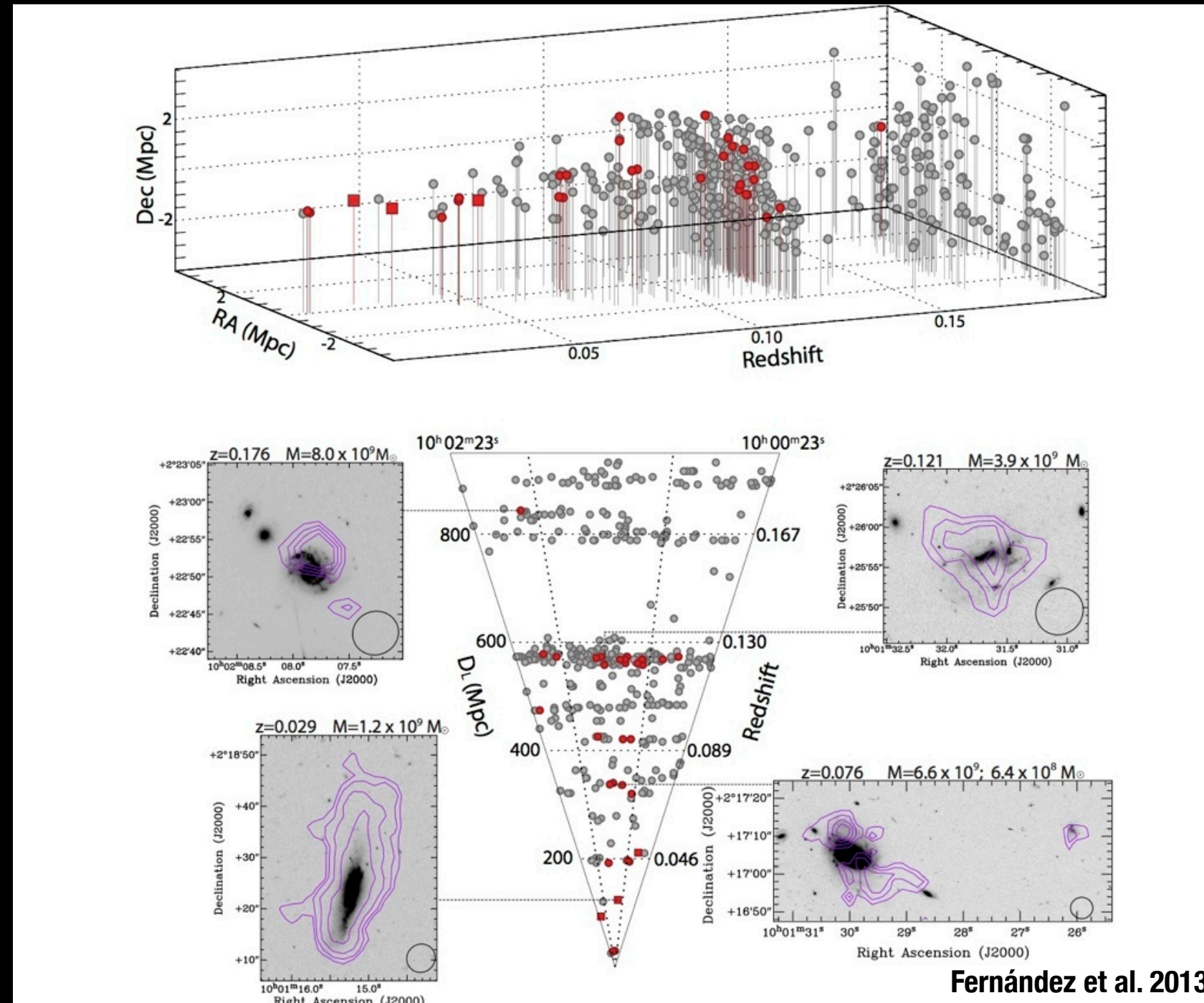
1. Deep multiwavelength data
2. No strong radio continuum sources

HI Deep Field



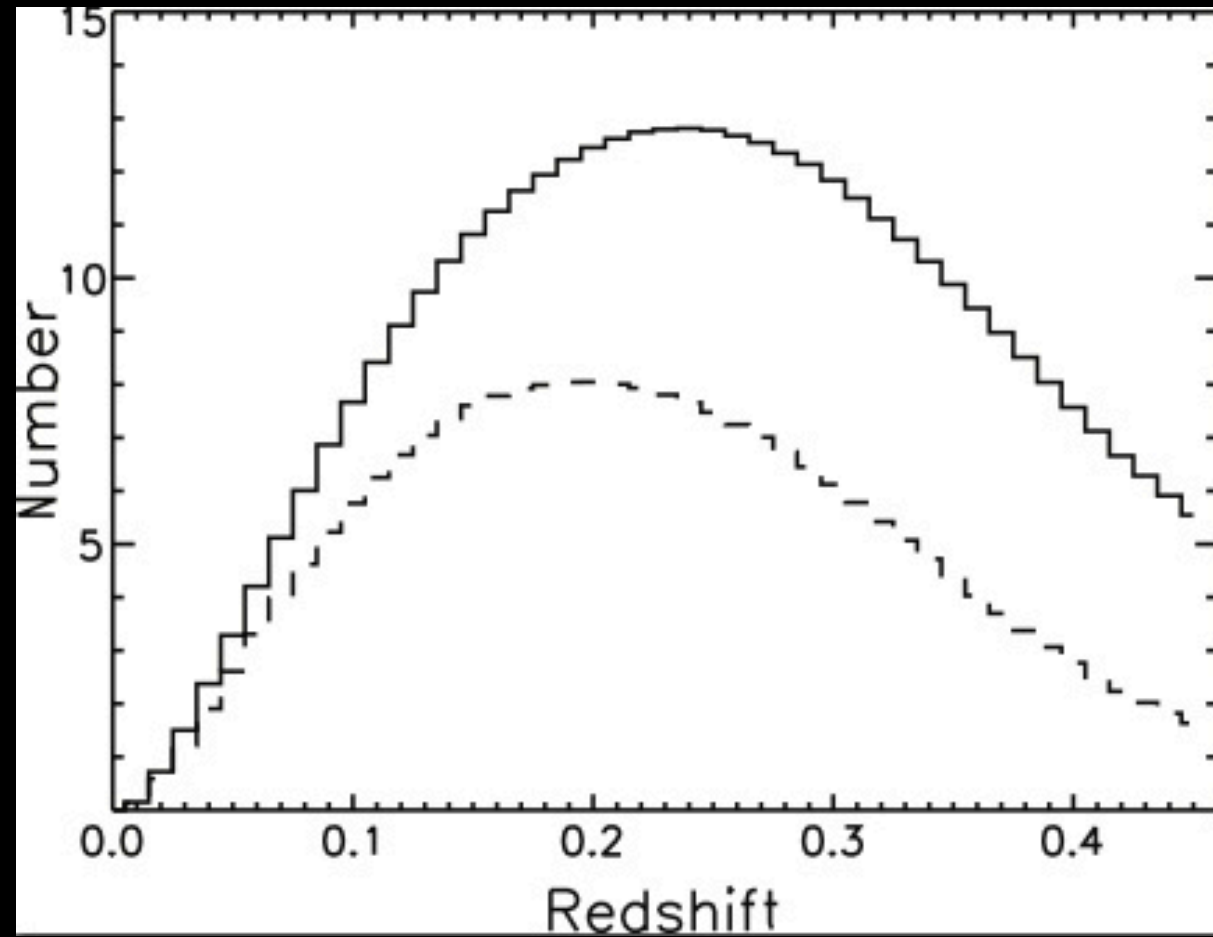
Survey design: detect $3 \times 10^{10} M_{\odot}$

A Pilot for CHILES: $z < 0.2$

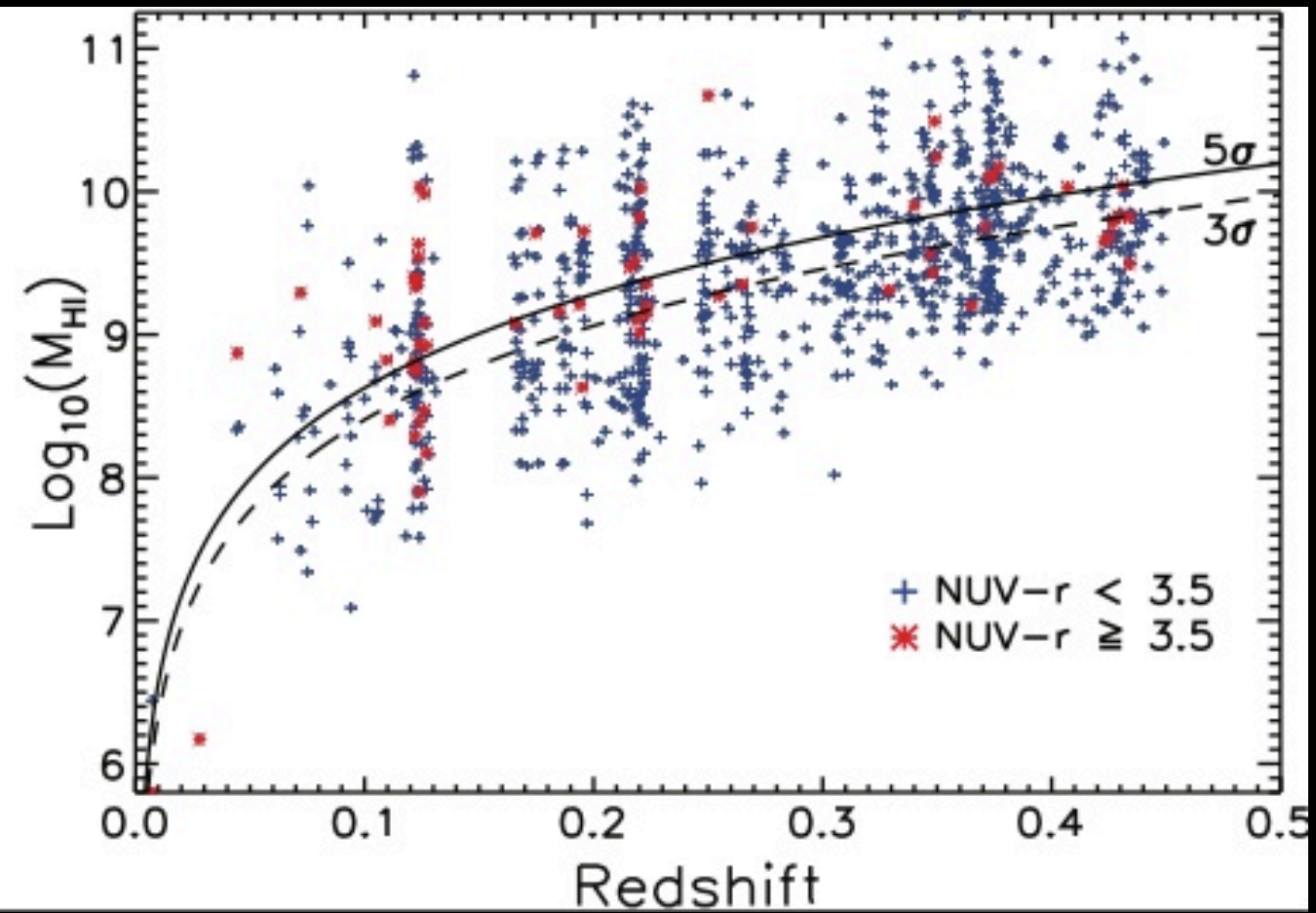


33 HI detections in different environments across cosmic time

Full Survey: HI Predictions



HIMF



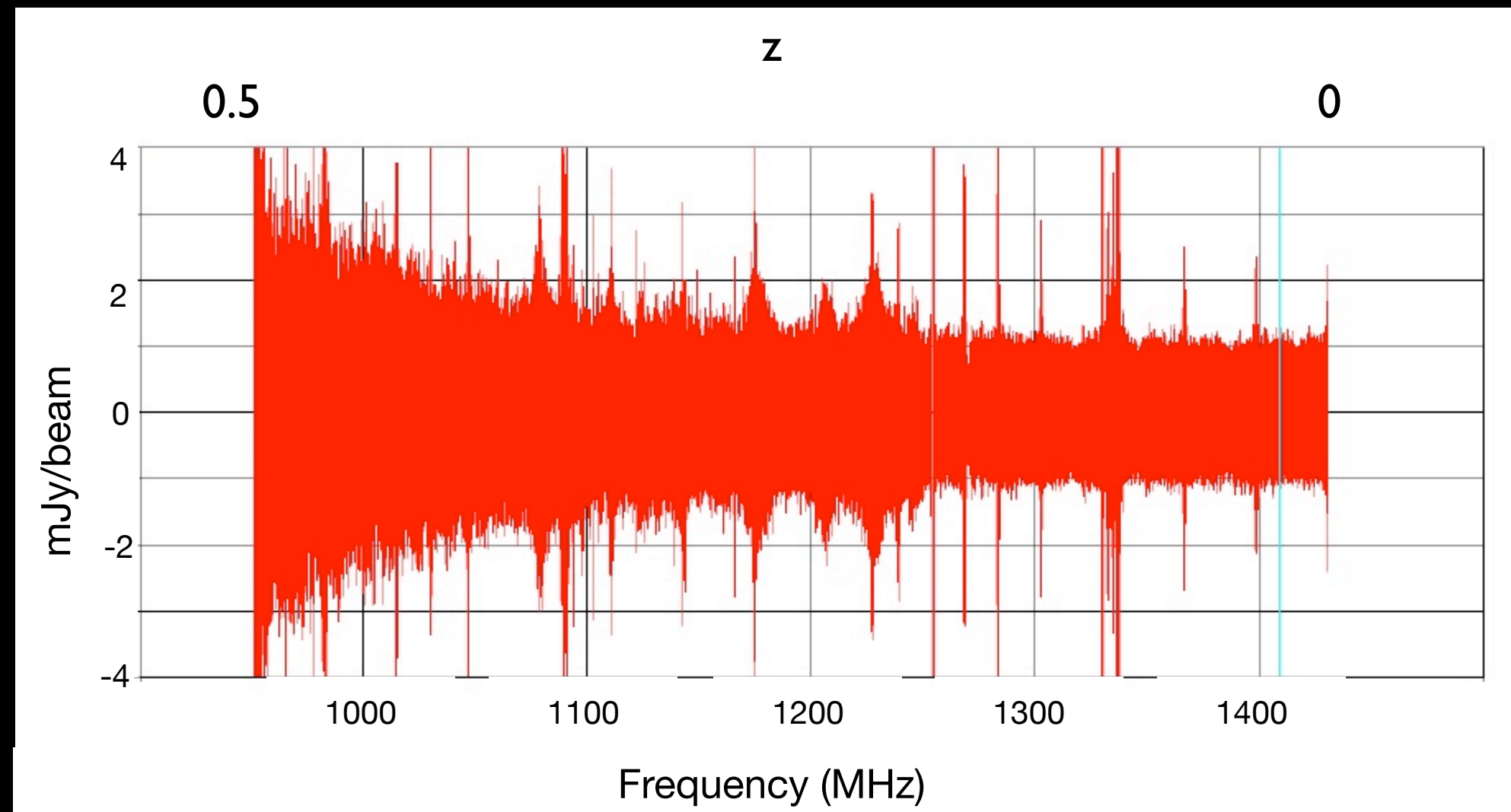
Photometric

~ 300 5σ detections

Full Survey

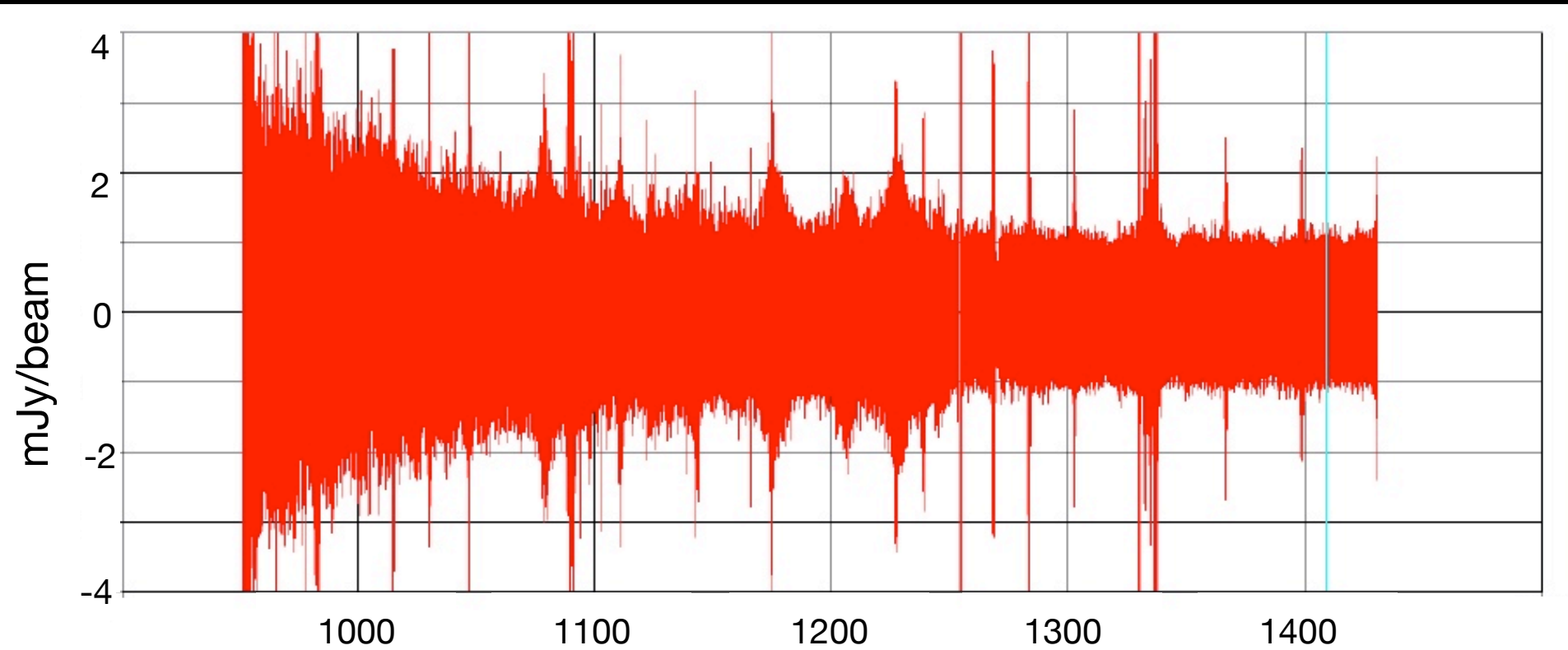
- 178/1002 hours done
- Data reduction is mostly done
 - modified the NRAO pipeline for our observations
 - 1.5 TB per 6 hours, pipeline runs for 60 hours
- uv gridder: new imaging task developed
 - 2 TB (compared to 100 TB)
 - testing phase
- Expect to make cube of the first 178 hours in September

Spectrum: 950~1420 MHz

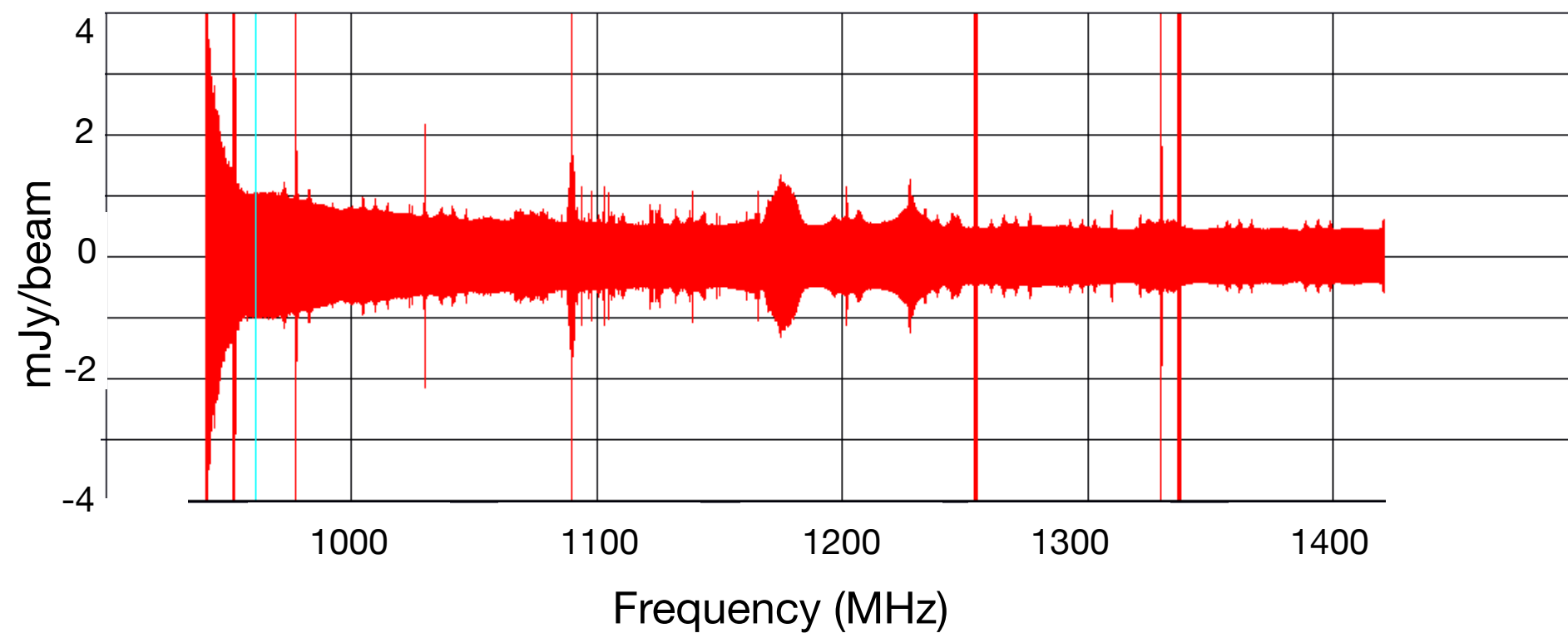


First HI cube covering the entire $0 < z < 0.5$ range

Frequency dithering

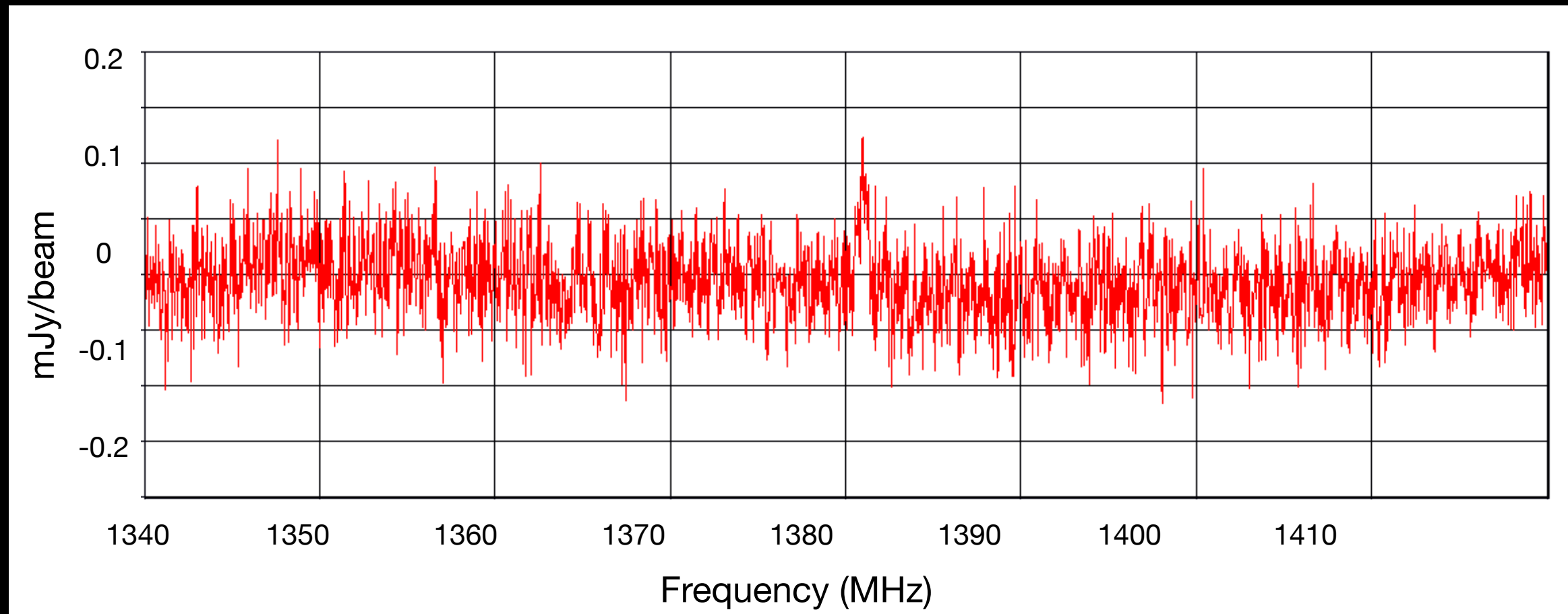


6-hour run



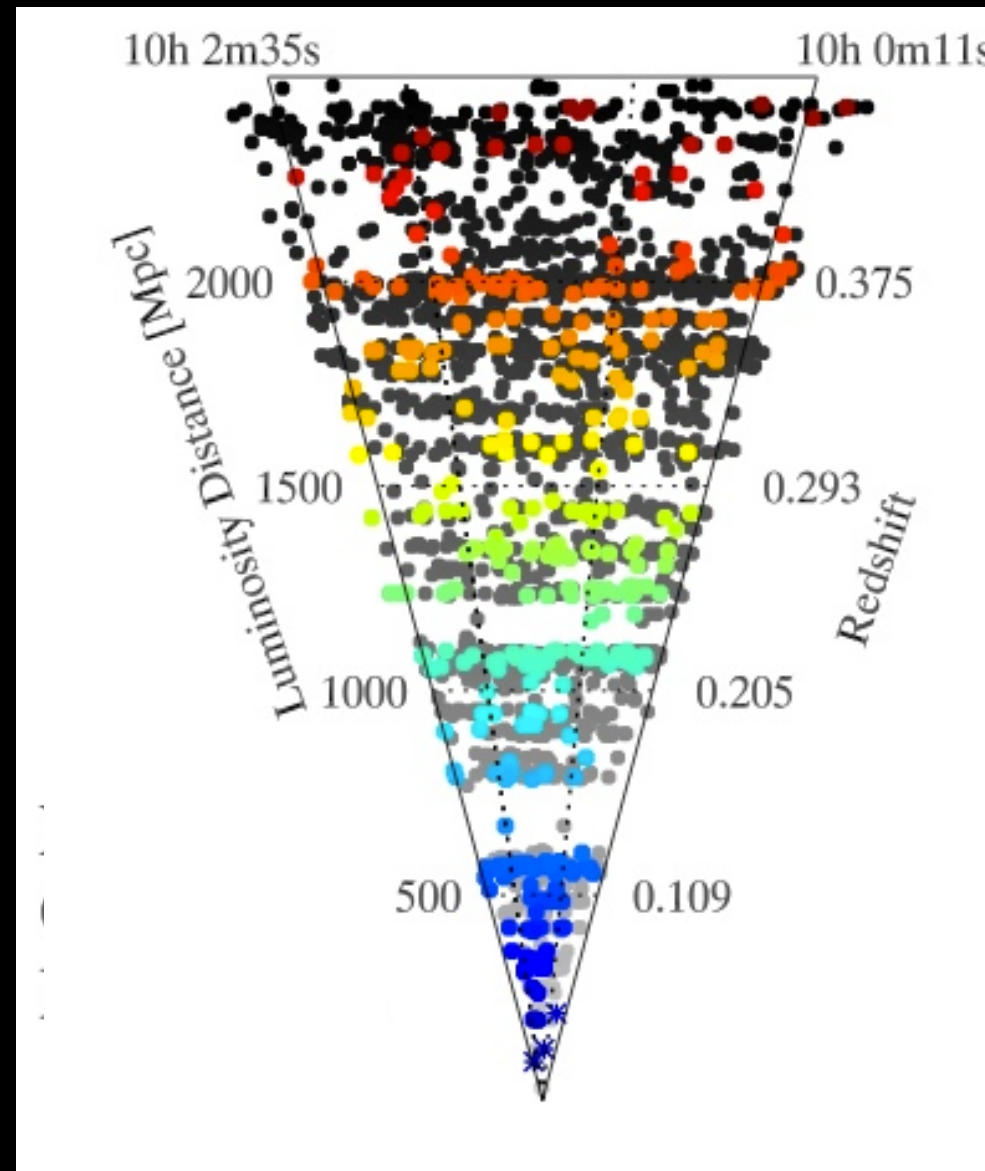
3 frequency settings
combined (18 hours)

Verification



Brightest detection in the pilot

In a few years...



To Do:

1. Observe 1002 hours to get HI images of these galaxies
2. Pointed observations with ALMA for a subset of these in different environments and z