NTU-Array:
Secondary CMB Anisotropy

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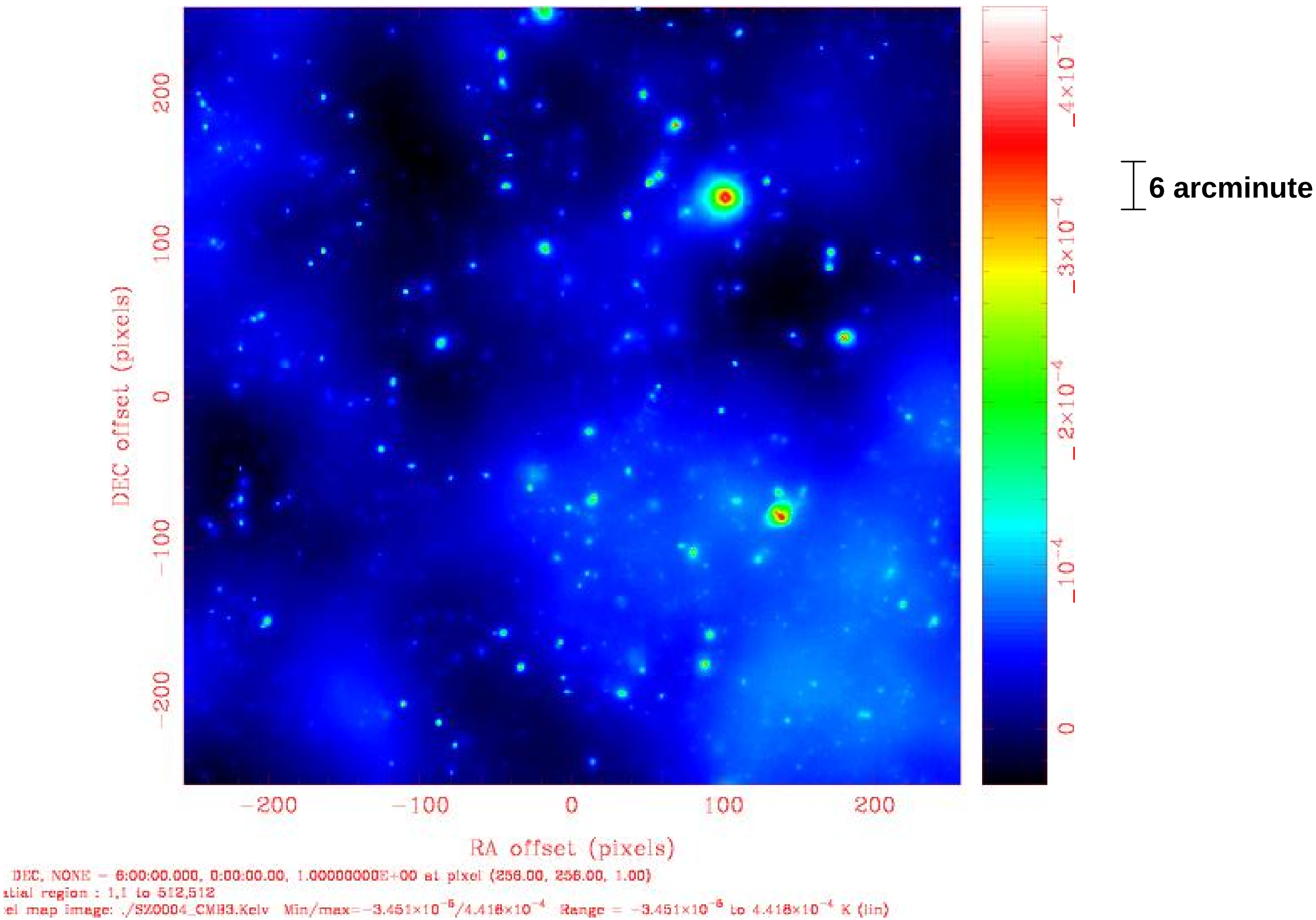
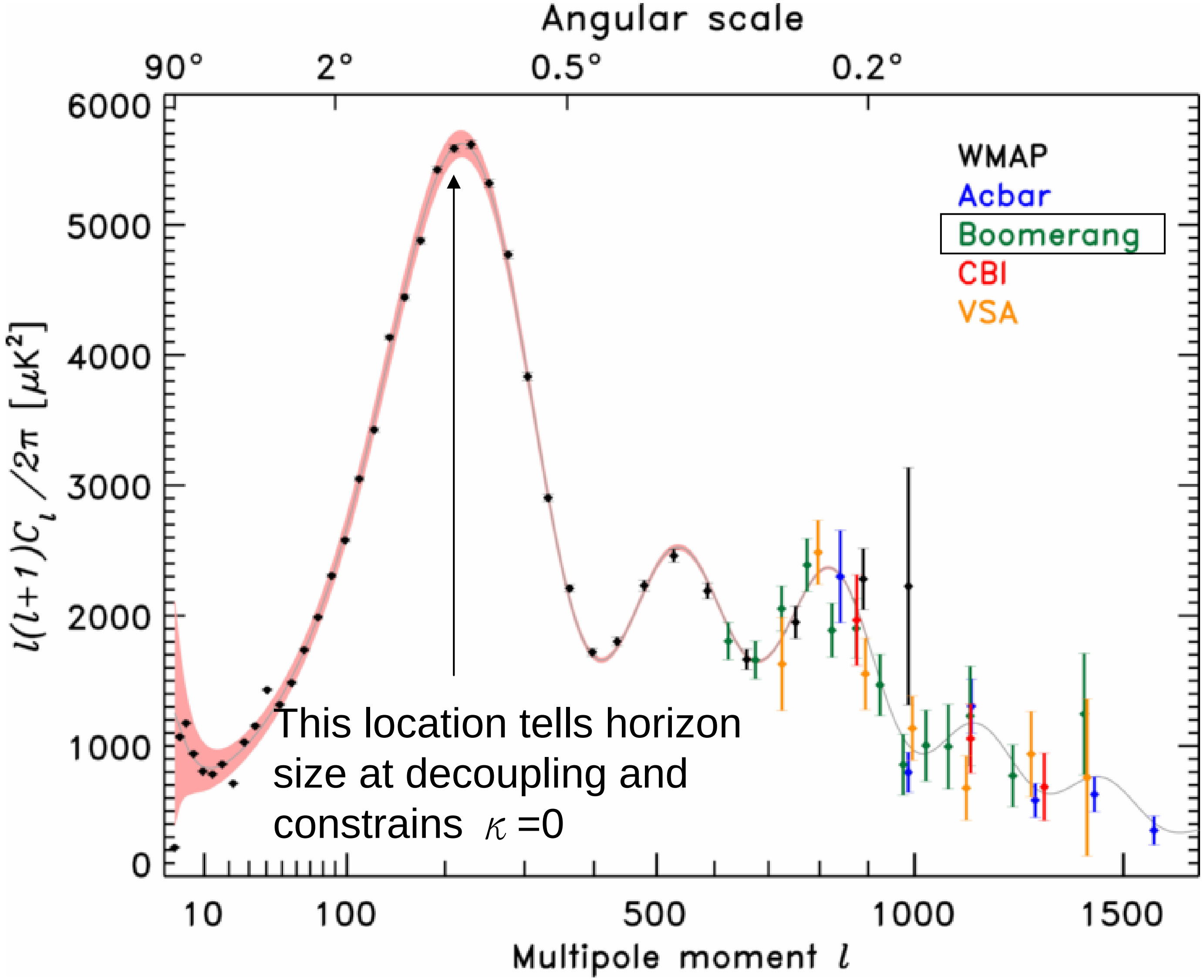
Simulated CMB sky of 1°x1° - DC

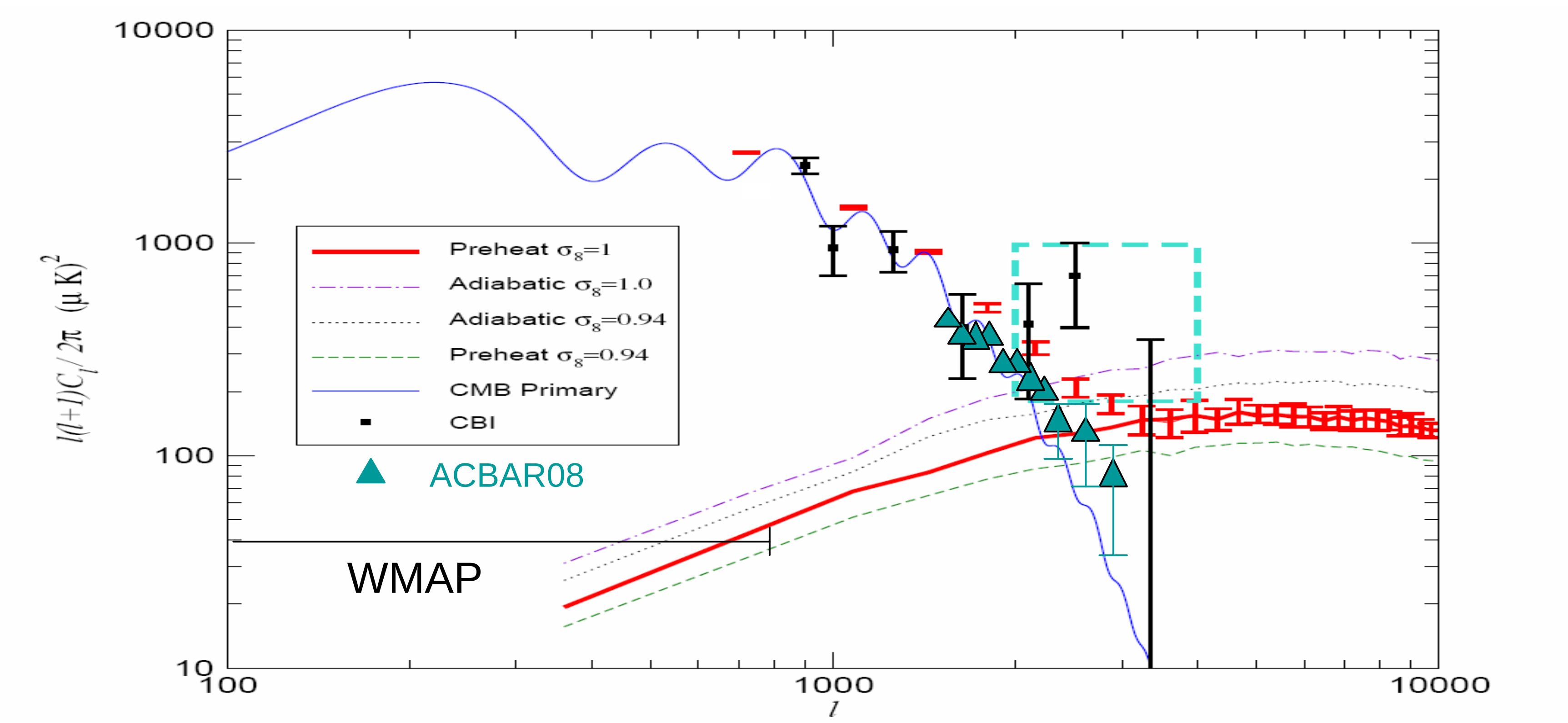


CMB Primary Anisotropy

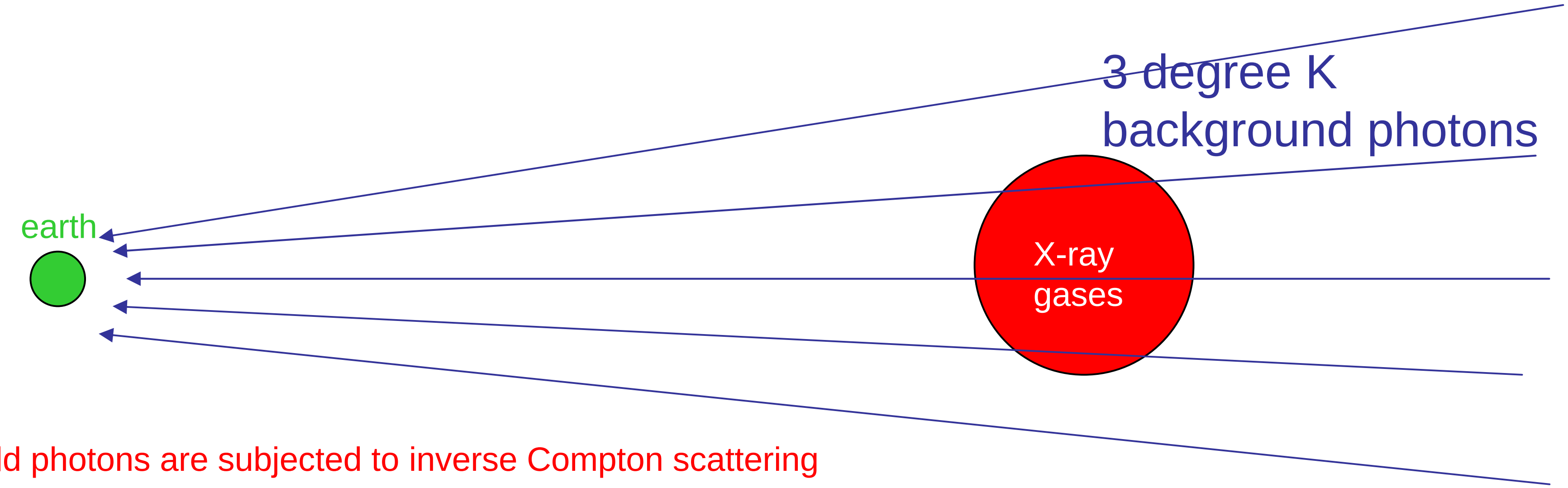


Secondary Power Spectrum

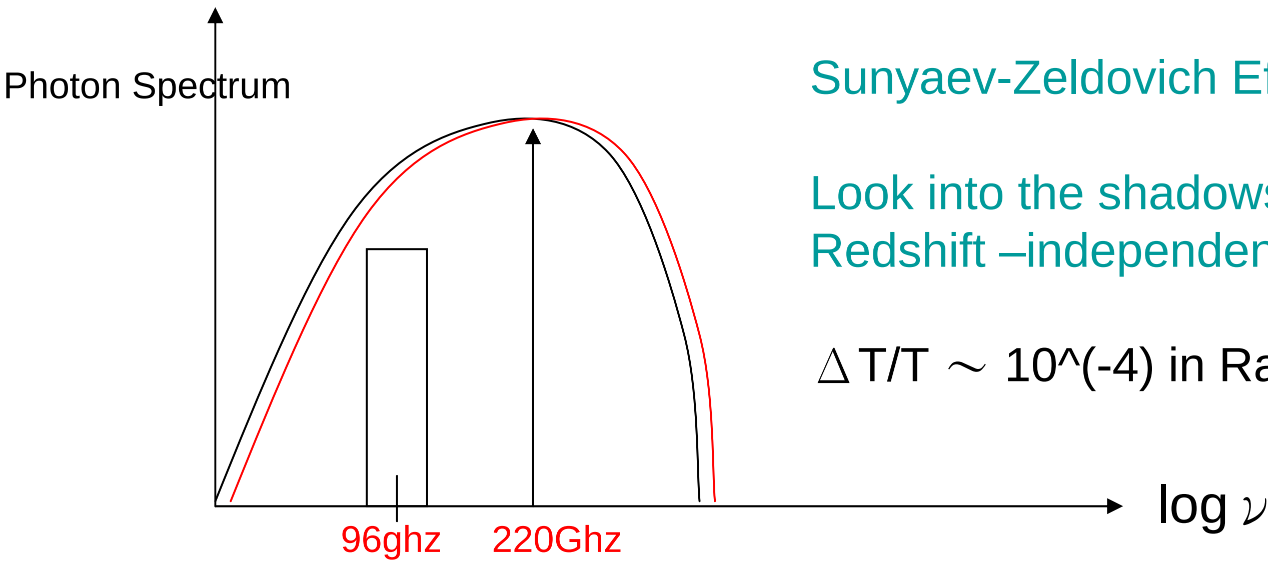
[red error bar symbol] : samples variance of 40 sq.deg. for a $\sigma_8 = 1$ universe



Secondary CMB Anisotropy



Cold photons are subjected to inverse Compton scattering

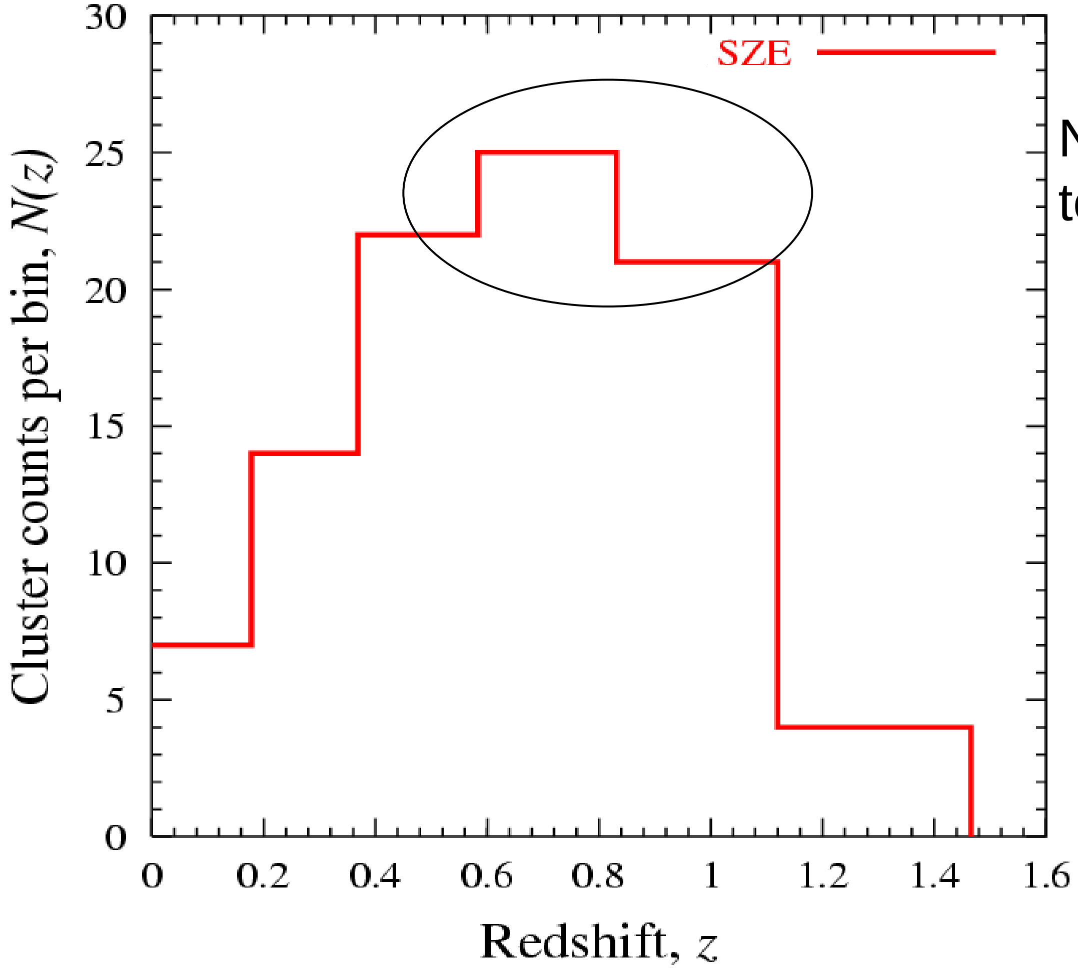


Sunyaev-Zeldovich Effect:

Look into the shadows of galaxy clusters
Redshift –independent effect

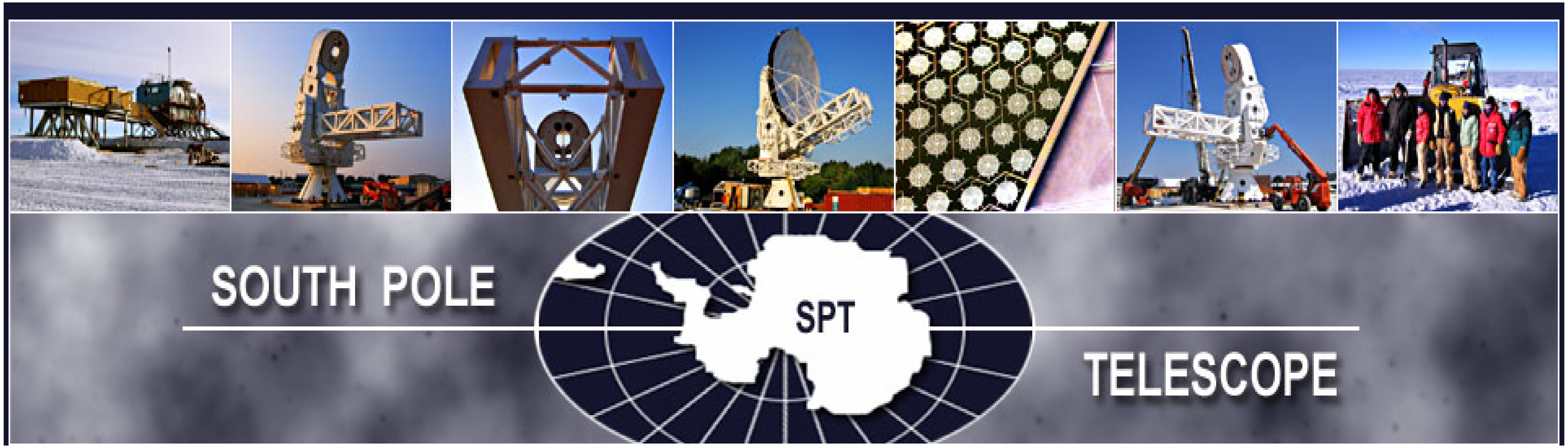
ΔT/T $\sim$ 10^(-4) in Rayleigh-Jeans Tail

Medium Depth Galaxy Cluster Survey for 10mJ Flux Limit & 10°x10°



Need optical follow-up to determine z

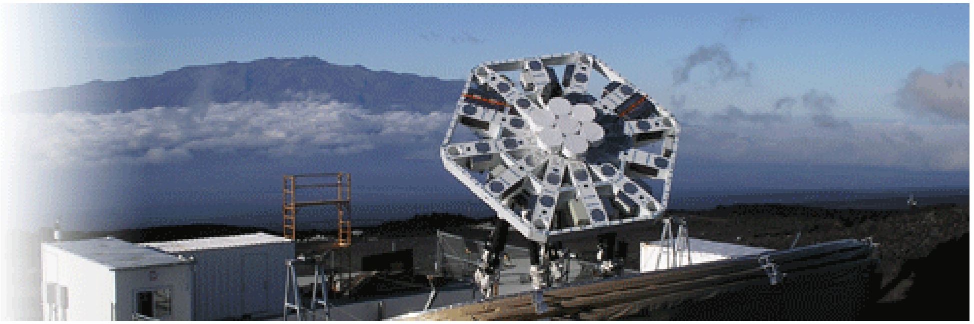
Most powerful SZ telescope to probe Evolution of Dark Energy Λ



1'-resolution, 1000-pixel Bolometer Array
led by Chicago, Caltech, Berkeley

But can only cover 5% of the sky

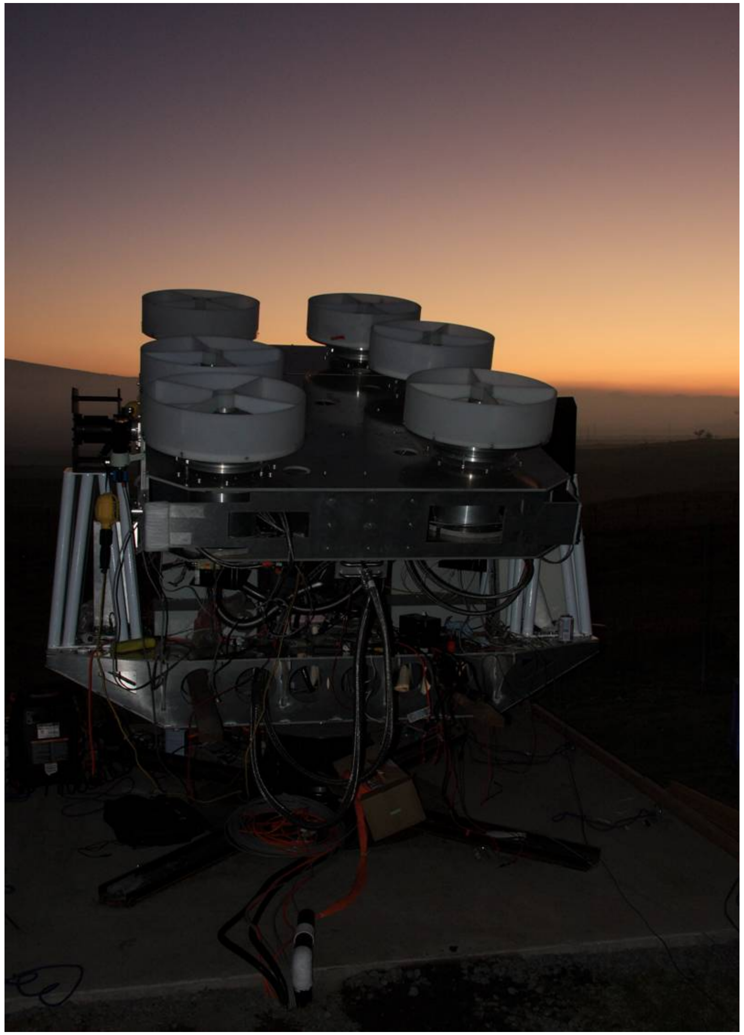
Interferometer SZ Telescopes



AMiBA (90Ghz): Hawaii island, currently upgraded to longer baselines

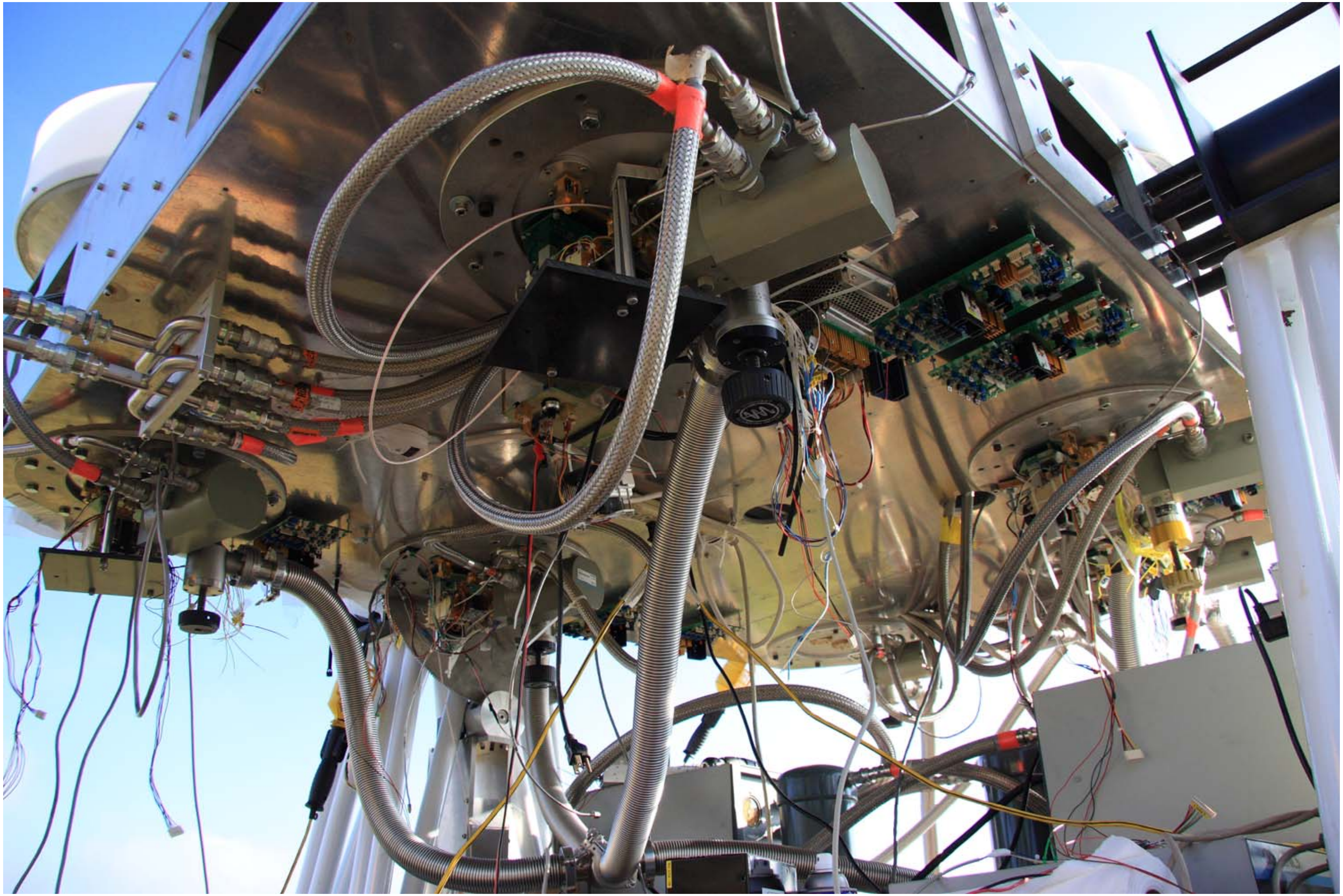
SZA (30Ghz): Bishop, CA
Student project of U Chicago

NTU-Array (78-113Ghz) project beginning in 2006



Hawaii Island

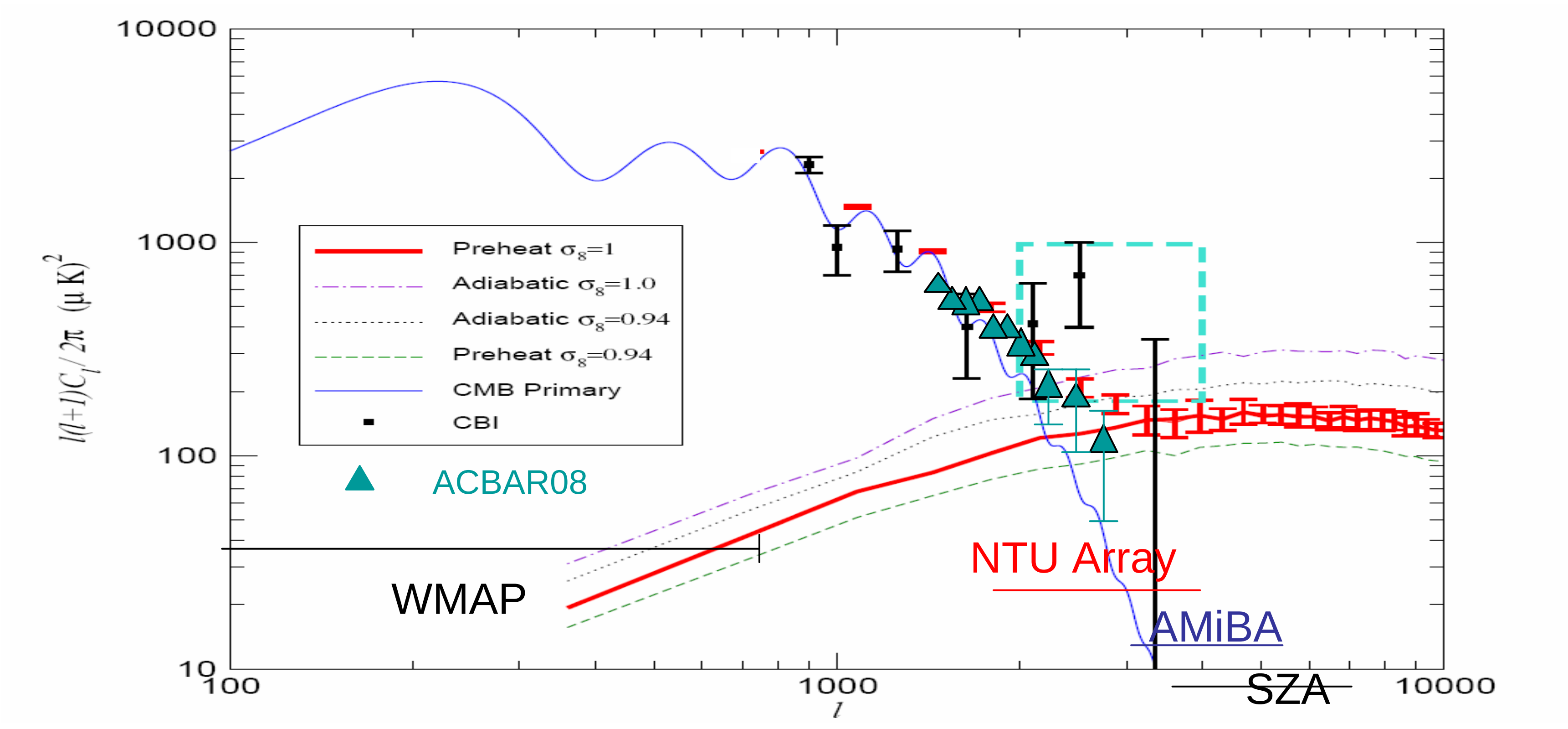
$T_{sys} = 90K + T_{sky}$



Comparison with other telescopes

The only telescope to probe the cross-over

NTU Array --- $> 3\sigma$ detection in 300 hr observation



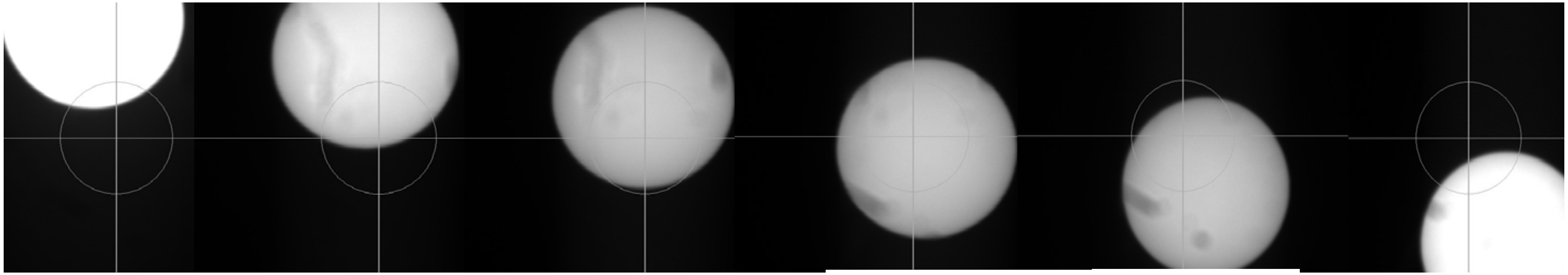
6-Receiver Prototype Specs:

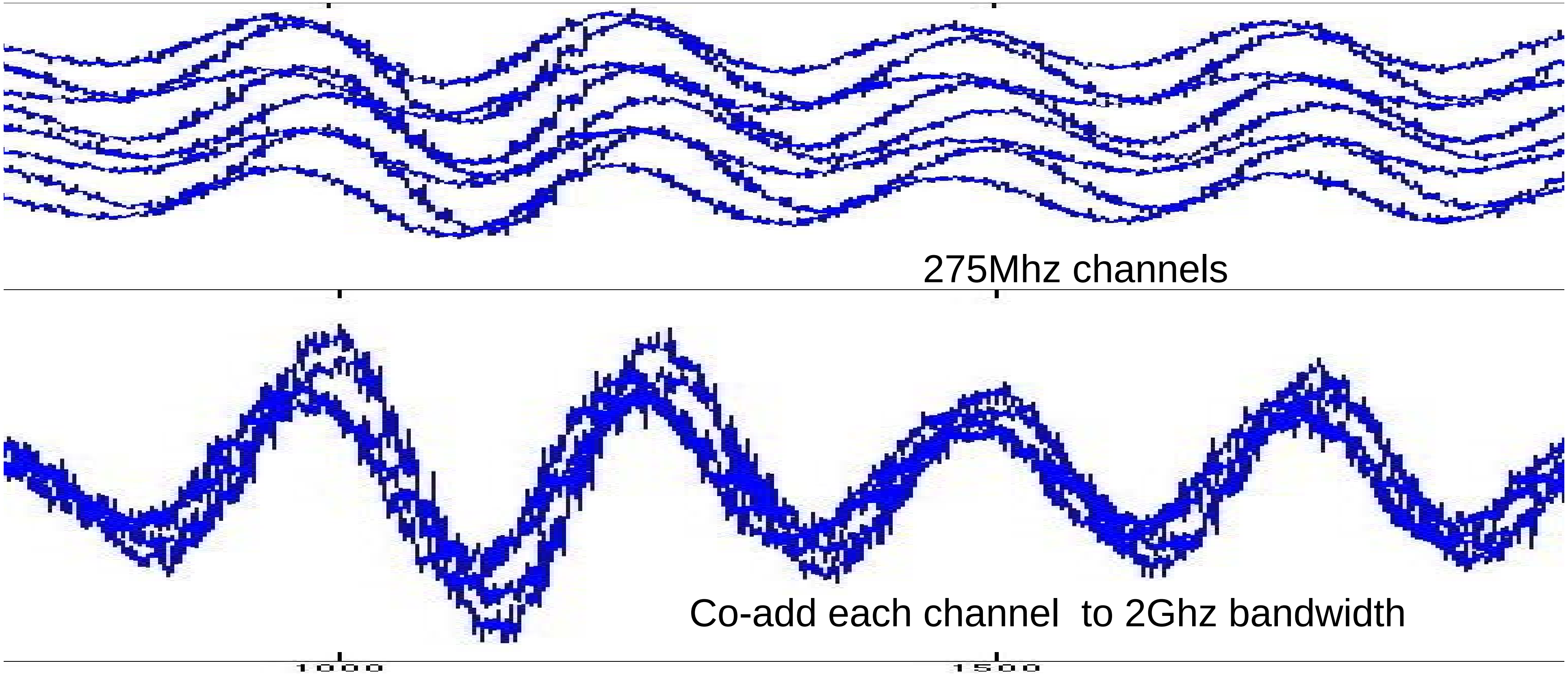
- 78Ghz – 113Ghz instantaneous bandwidth
- 275Mhz frequency resolution
- Angular resolution = 5’ (longest baseline=2.5m)
- 6 receivers
- Dual polarization (currently single polarization)
- 18GS/sec, 1-bit digital correlator (currently 1-bit, 9GS/sec)

Black: installed

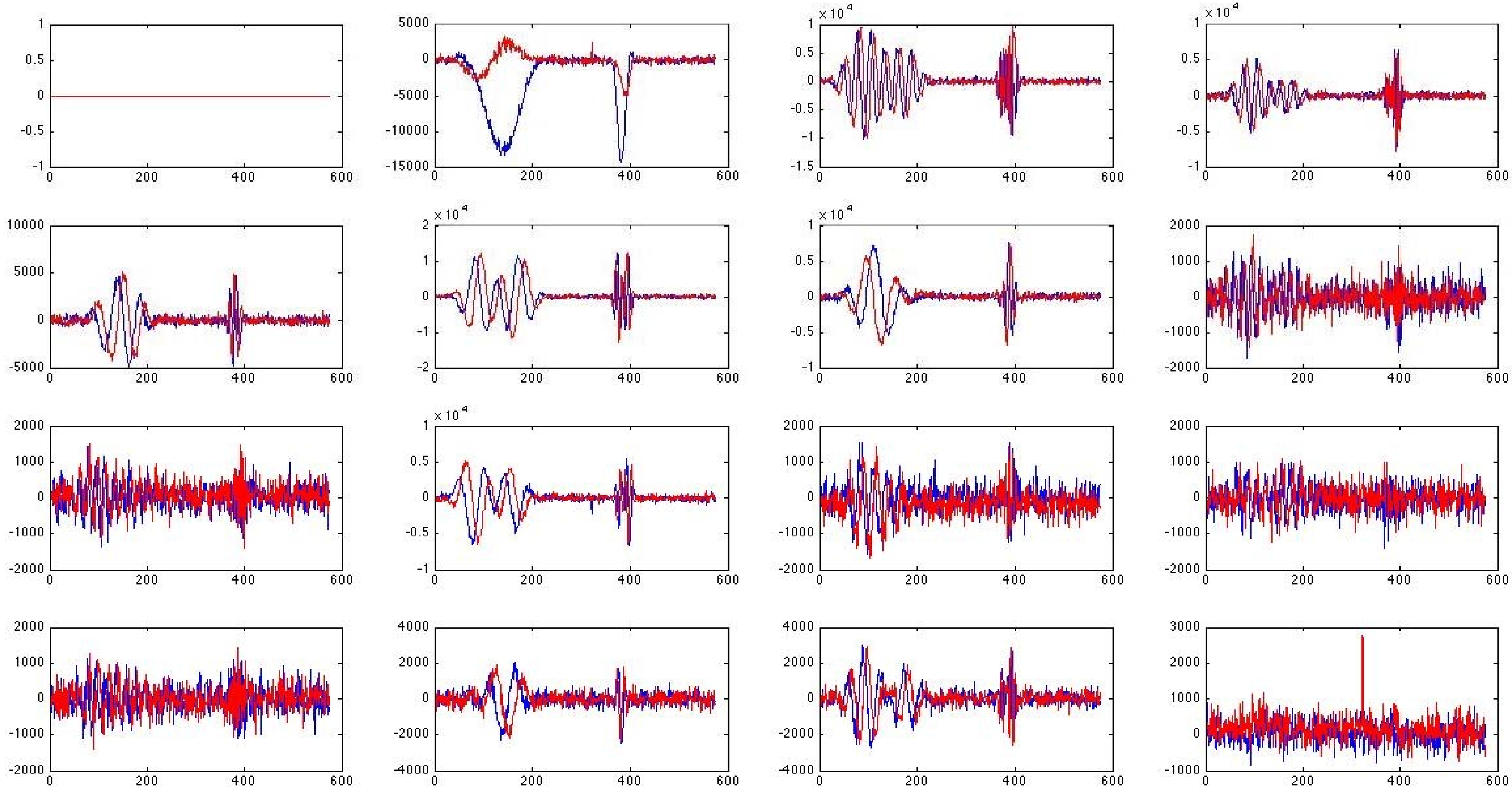
Red: to be installed in early 2009

First Light : Moon Observation (May 2008)



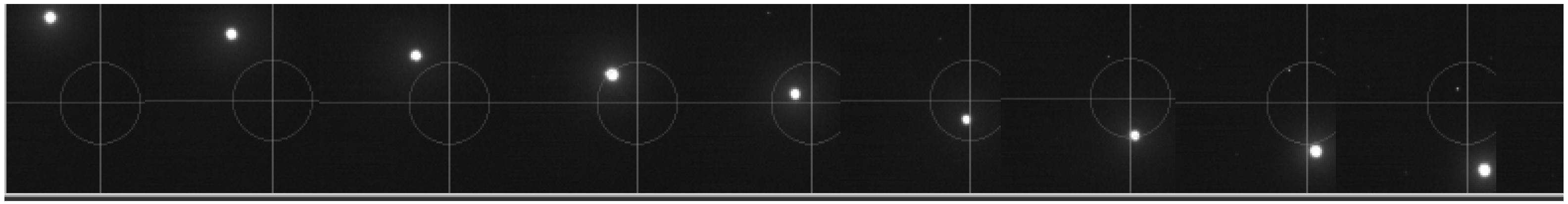


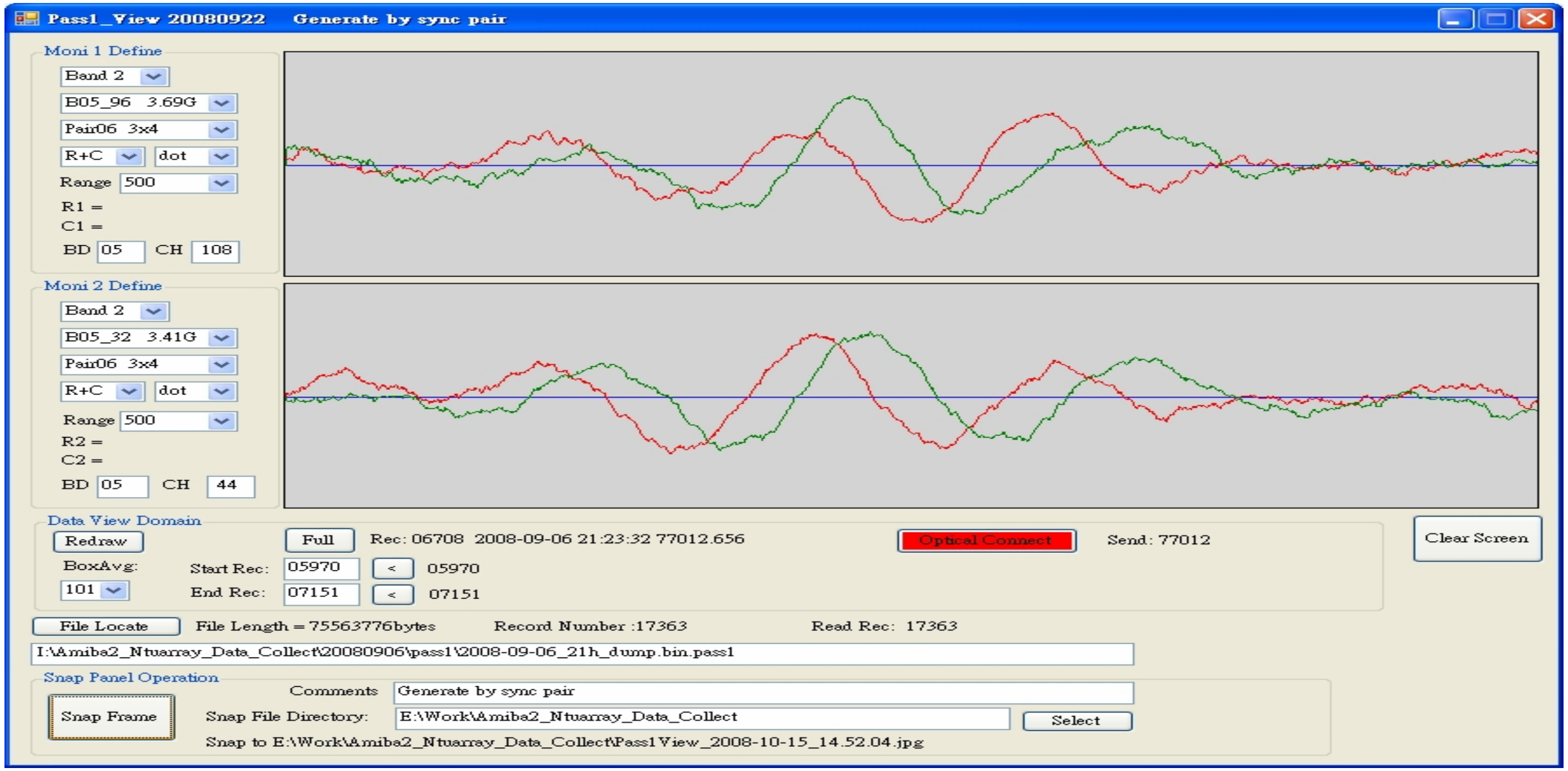
Moon Fringes of 15 baselines for one 275Mhz channel



Verification of 6-receiver Digital Correlator

Jupiter Observation (Sep/08)

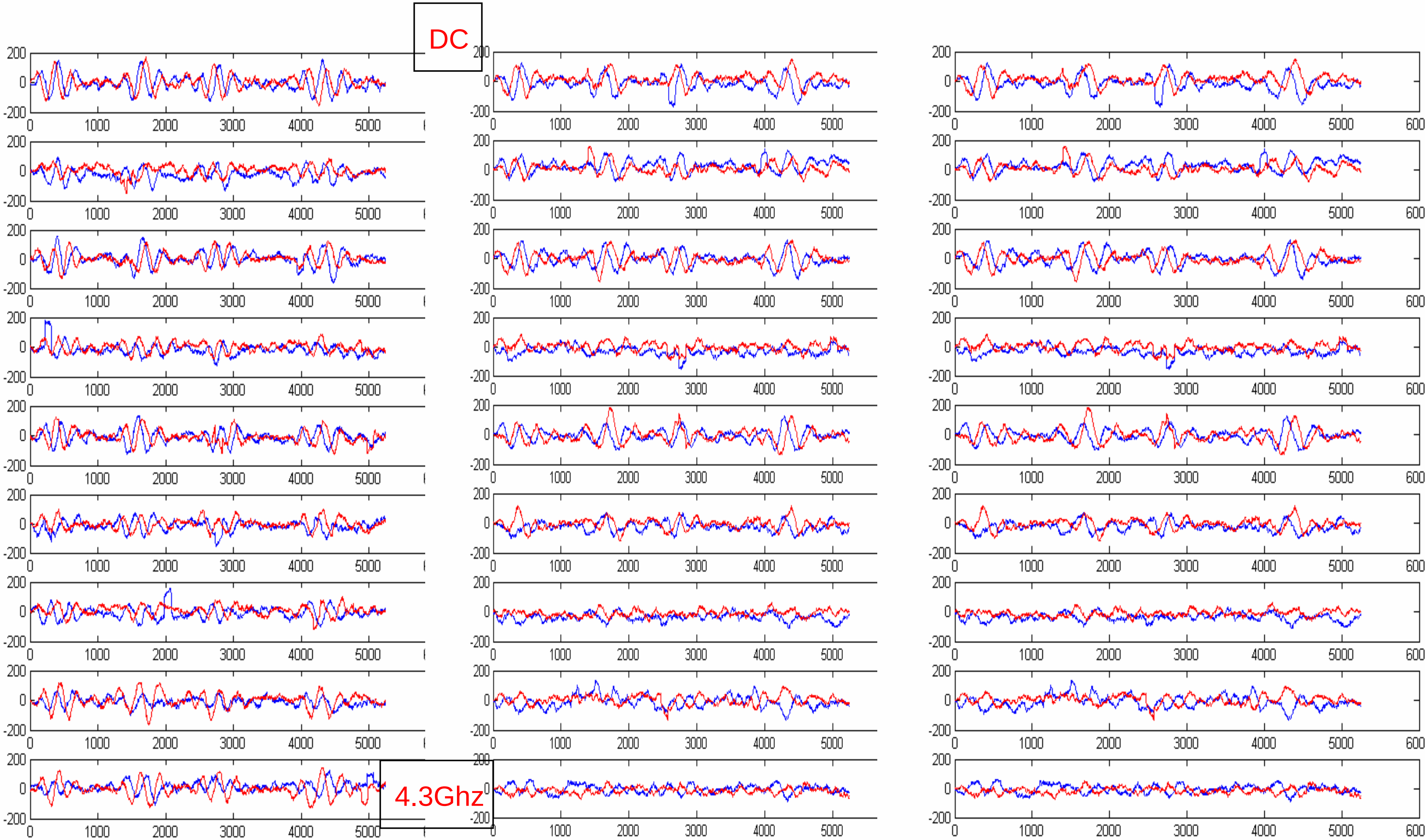




Fringes of two adjacent channels of 275Mhz

Verify the system temperature = 90°K + 40°K

Jupiter Fringes of Other Receiver Pairs



3x4 pair

3x6 pair

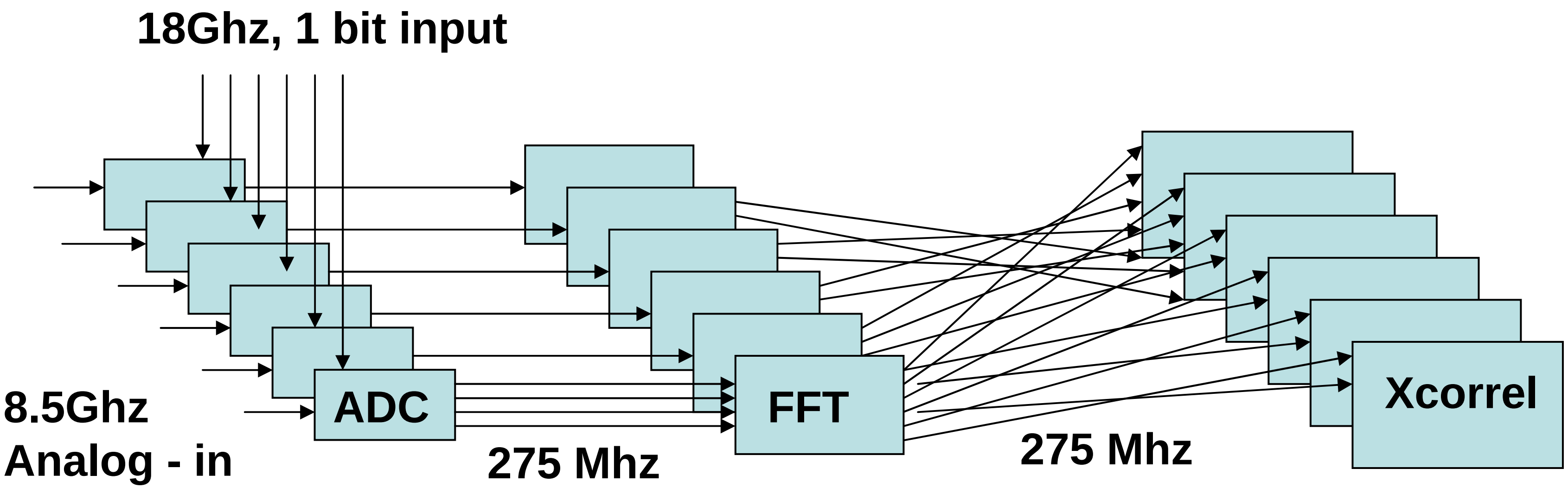
5x6 pair

Correlator to Upgrade in early 2009

World Fastest Digital Correlator

EVLA correlator: 4Ghz, 2-bit input (Aug/2008)

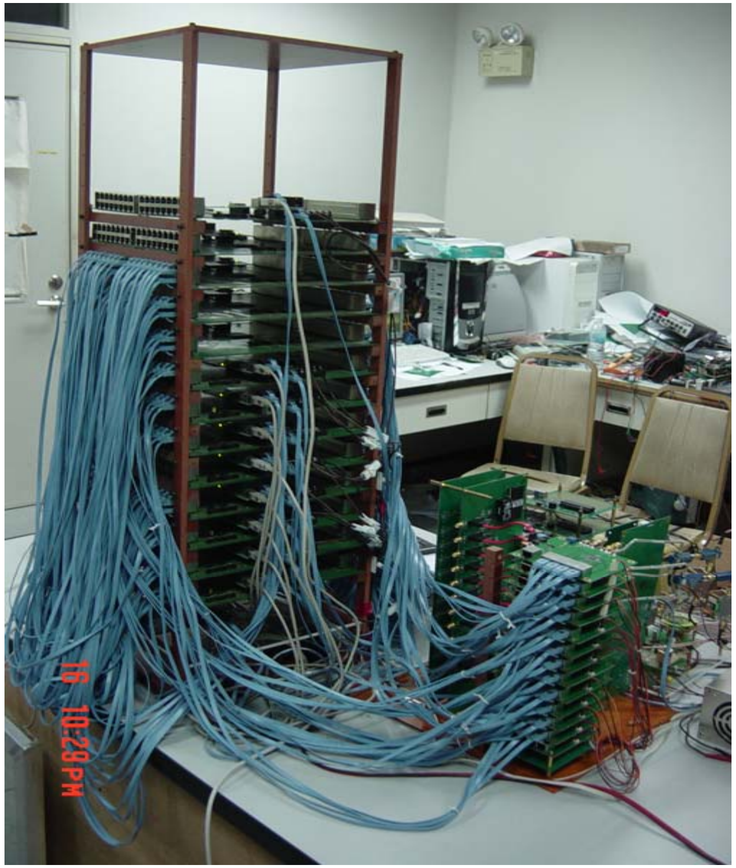
ALMA correlator: 4Ghz, 3-bit input (?/ 2010)

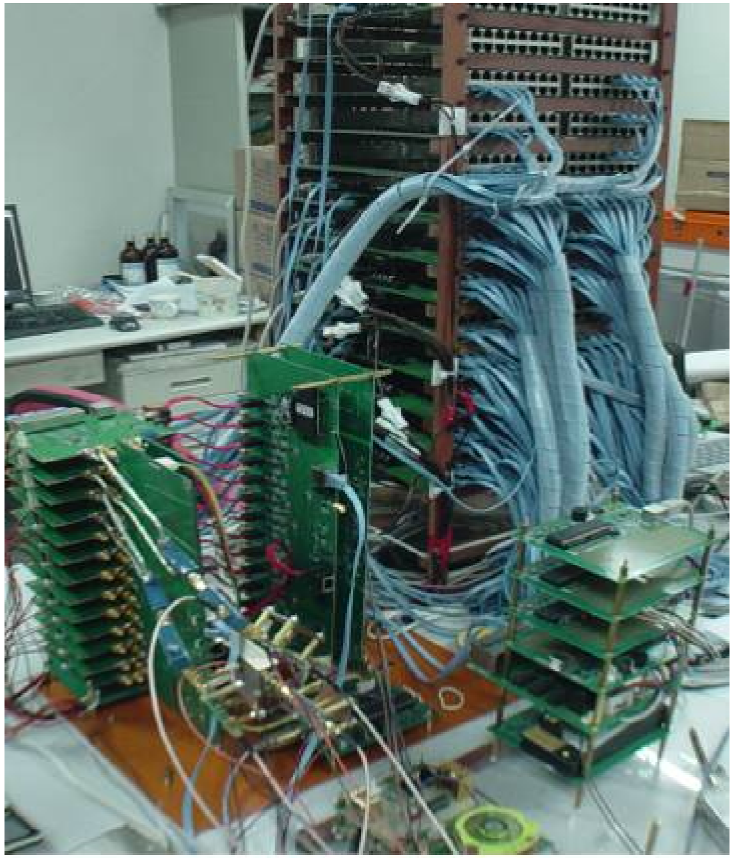


Digital Correlator for One Band of 8.7Ghz

NTU Array has 4 bands of a total 35Ghz bandwidth

Digital Correlator of 1-bit 18Ghz sampling 100W





Compared with **ExVLA correlator: 2-bit, 4GS/sec (now)**

ALMA correlator: 3-bit, 4GS/sec (2010)

Lab test of 18Ghz 1-bit correlator

CMB interferometry telescopes

- An intrinsically low-resolution telescope
- No need of stable atmosphere
- Only need a dry site for observation, since water vapor is an effective microwave absorber
- To move to Nevada in early 2009

Conclusion

- To spend 1 years to probe l=1700 – 4000, expected 3 to 5 σ measurement for l=4000
- Widest bandwidth microwave telescope
- World fastest digital correlator
- Observing site in Nevada beginning in Spring 2009