Current Status of AMiBA : Array for Microwave Background Anisotropy

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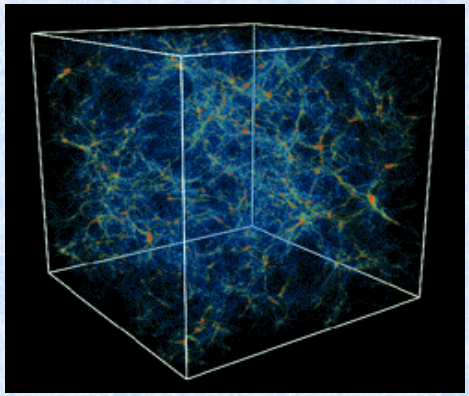
CosPA – Cosmology, Particle, Astrophysics

- 1. **AMiBA:** (AS/NTU/ATNF)
  90-GHz interferometer - CMB Secondary Anisotropy and Polarization
- 2. **CP violation + High Energy Neutrinos**: (NTU)
- 3. **Theory:** (NTU/AS)

  String Cosmology; Particle Physics implications of CMB and BBN data;
  Non-equilibrium phase transition; Quintessence; CMB polarization
- 4. **OIR Telescope Access:** (AS/NTU/NCU/NTHU)
  CFHT (4-m) via construction of WIRCAM; OIR complement to AMiBA
- 5. **National Infra-structure:** (NCU/NTHU/AS/NTU)
  Jade Mountain Lu-lin Observatory



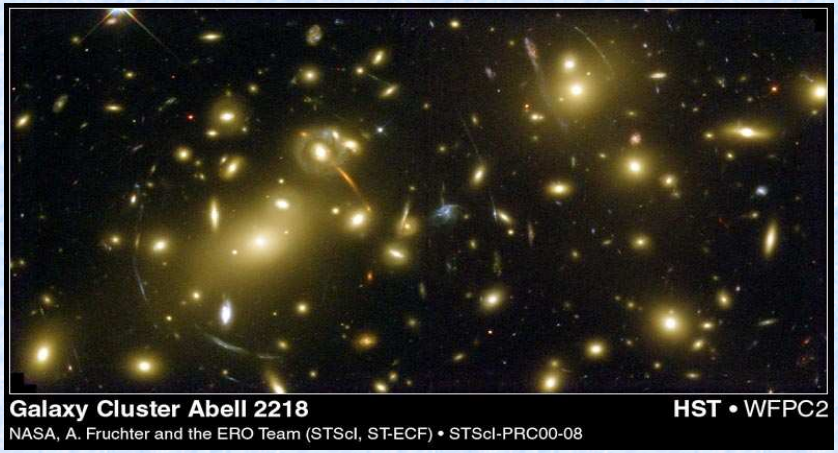
Outline

- Project Description
- 7-Element AMiBA Status:
  - Site Development
  - Mount and Platform
  - Receiver
  - Correlator
- Summary & Future Plan

AMiBA Science Goals

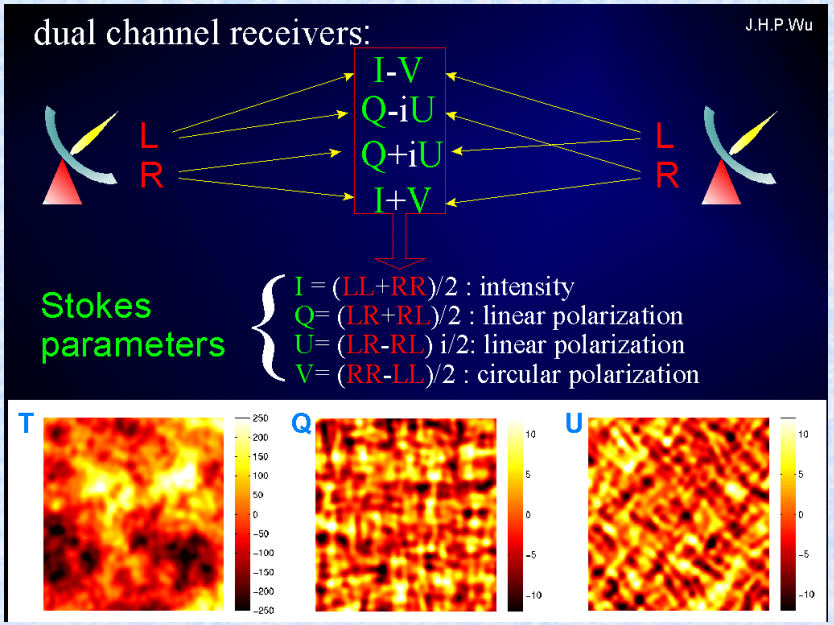
High z Cluster Survey via SZE

- Distance independence of SZE
- Structure Formation History: Ω_b, Ω_m, σ_8
- Cluster and Galaxy Evolution



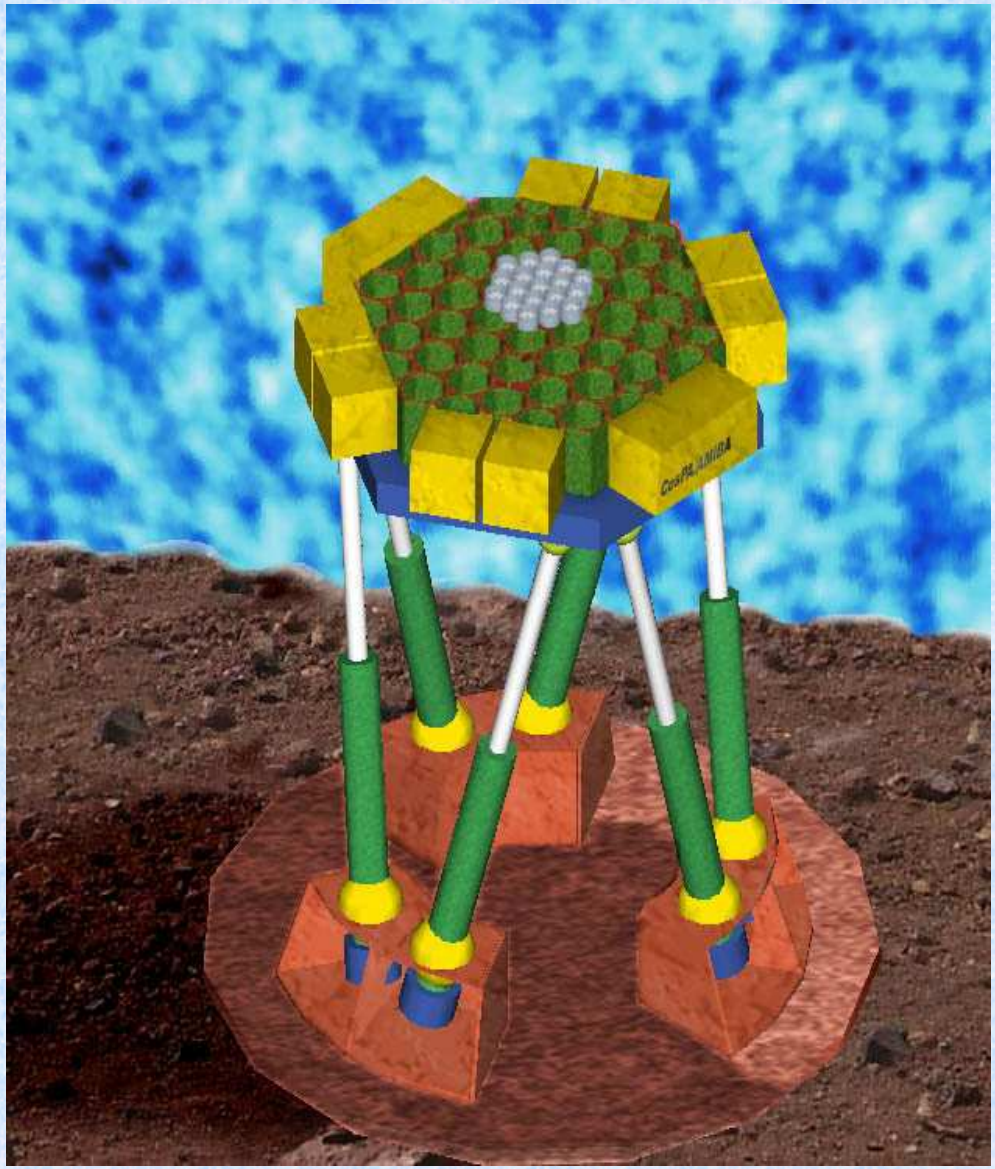
Polarization of CMB

- Unambiguous time signature of CMB
- Cleaner imprint of initial perturbations
- Degeneracy-breaking of cosmological parameters
- Determination of Epoch of Re-ionization



AMiBA Specifications

- Up to 19-element (0.6/1.2m)
- Platform mounted (6m)
- Dual-channel 85 - 105 GHz HEMTs at 20K
- Full polarization capabilities
- 2’ - 20’ resolution
- $\Delta T = 10\ \mu K$ in 1 hour
- Site: Mauna Loa



AMiBA Personnel

- ASIAA Hawaii:
  Ming-Tang Chen, Philippe Raffin, Derek Kubo, Ferdinand Patt, Kevin O'Connell, Debbie Kenui, Debbie Hansen

- ASIAA Taipei:
  Sun Kwok, Chao-Te Li, Homin Jiang, Joshua Chang, Ted Huang, Johnson Han, Tashun Wei, West Ho, Steven Teng, Mark Chen, Patrick Kock, Pierre Martin-Cocher, Eugene Huang, Jackie Wang, Esther Lin, Celia Chen, Paul Shaw
  J. Lim, K. Umetsu, H. Nishioka, G. C. Liu

- NTUPHYS: *Tzihong Chieuh, Kyle Lin, J. H. Wu*

**In 2004, technical – 12 person-year, Hilo administration – 1 person-year, Taipei administration – 4 person-year*

Collaborators

- NTU - EE, T. H. Chu -- IF/LO
- NTU - EE, H. Wang & Jet Propulsion Laboratory/TRW -- MMIC development
- National Radio Astronomy Observatory -- OMT
- Australia Telescope National Facility, M. Kesteven & W. Wilson -- Correlator, Observing software
- Carnegie-Mellon University - Physics, J. Peterson
- Major Contractors: Vertex, CMA, ALONG

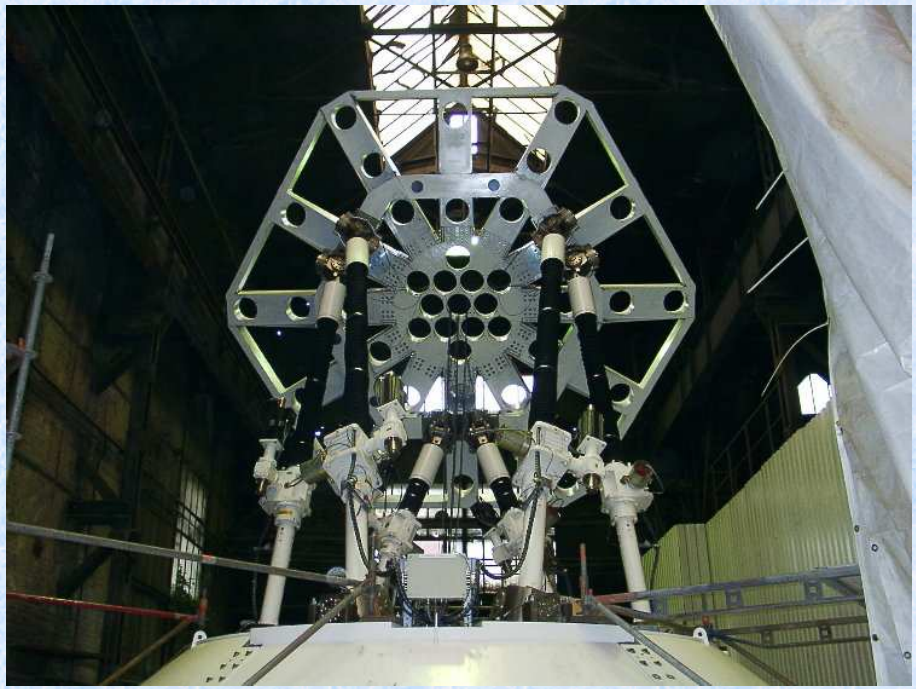
Mauna Loa – AMiBA Site

NOAA (National Oceanic Atmospheric Administration) Mauna Loa Observatory

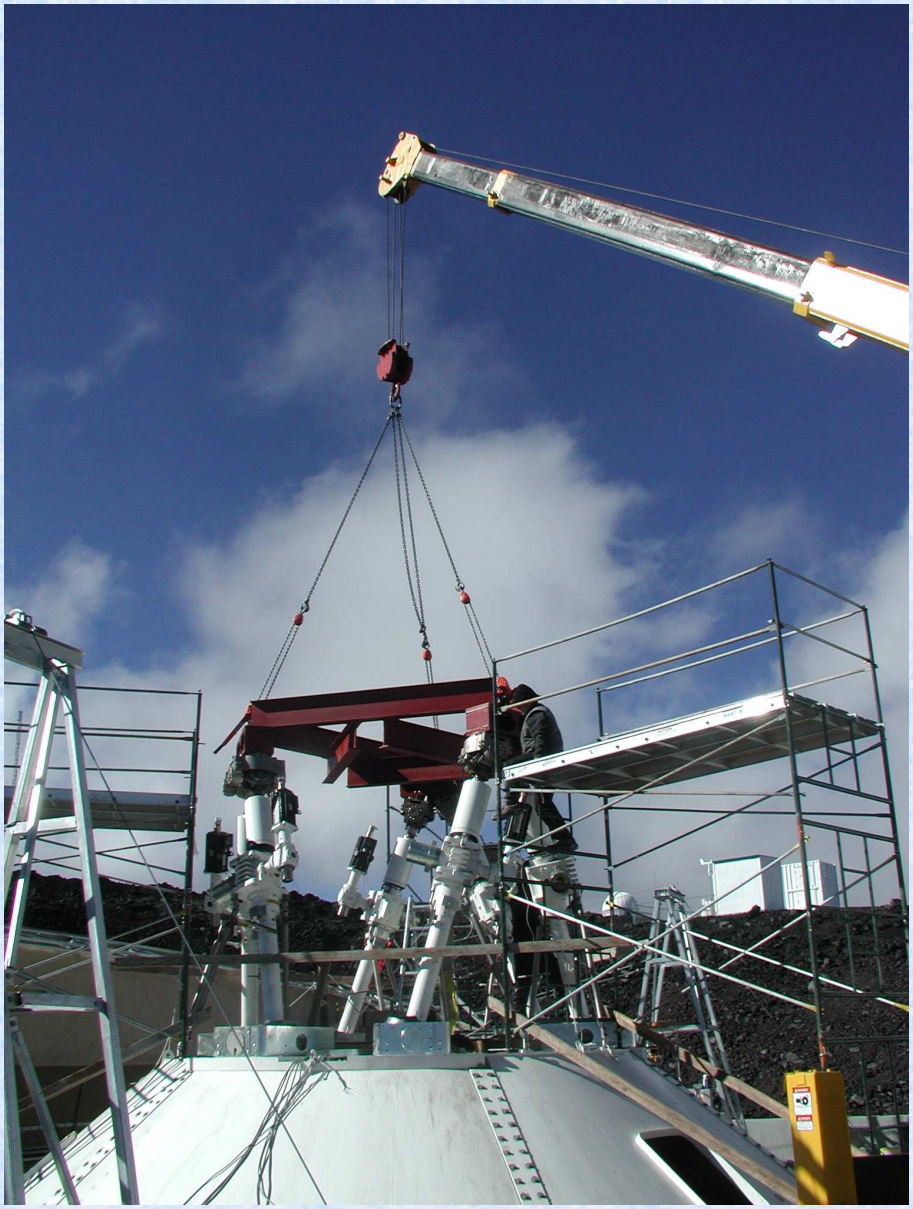
Site Construction

Enclosure Construction

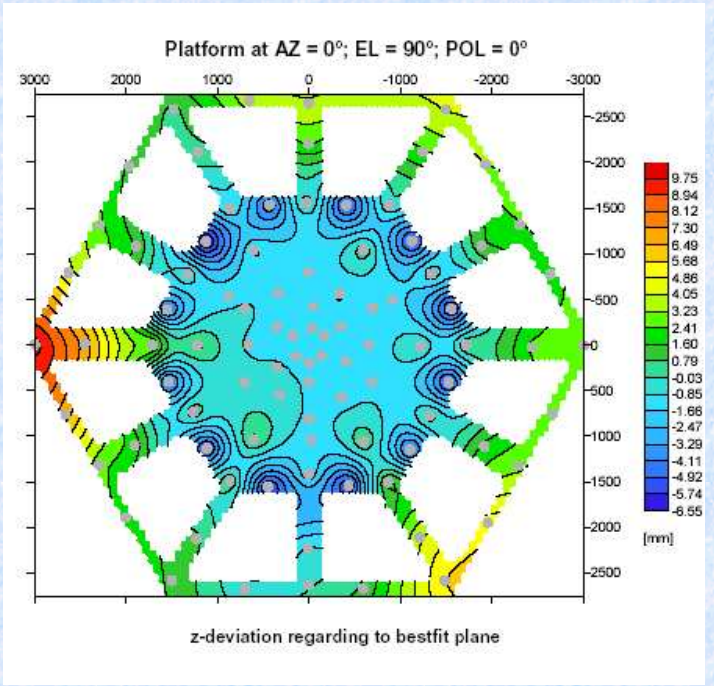
Work in Duisburg



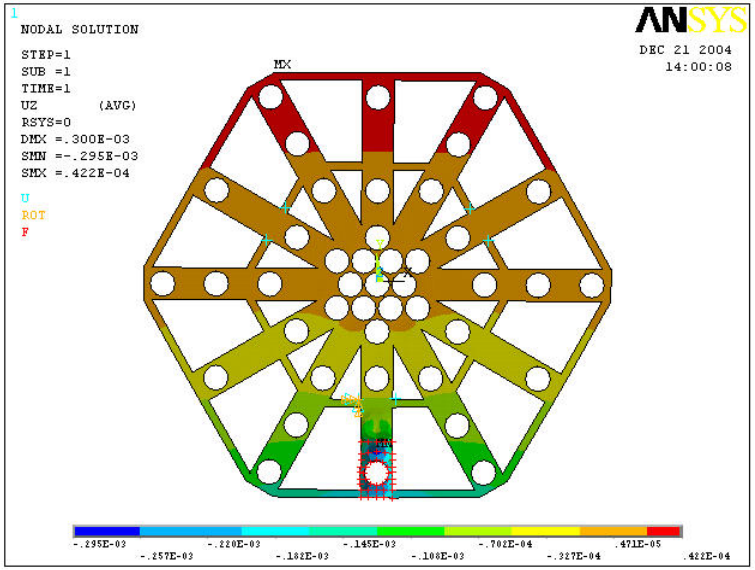
Work in Hawaii

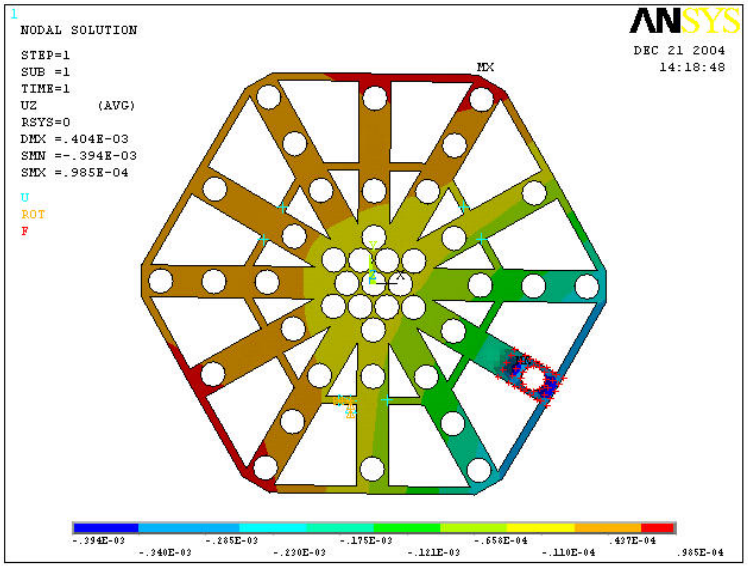


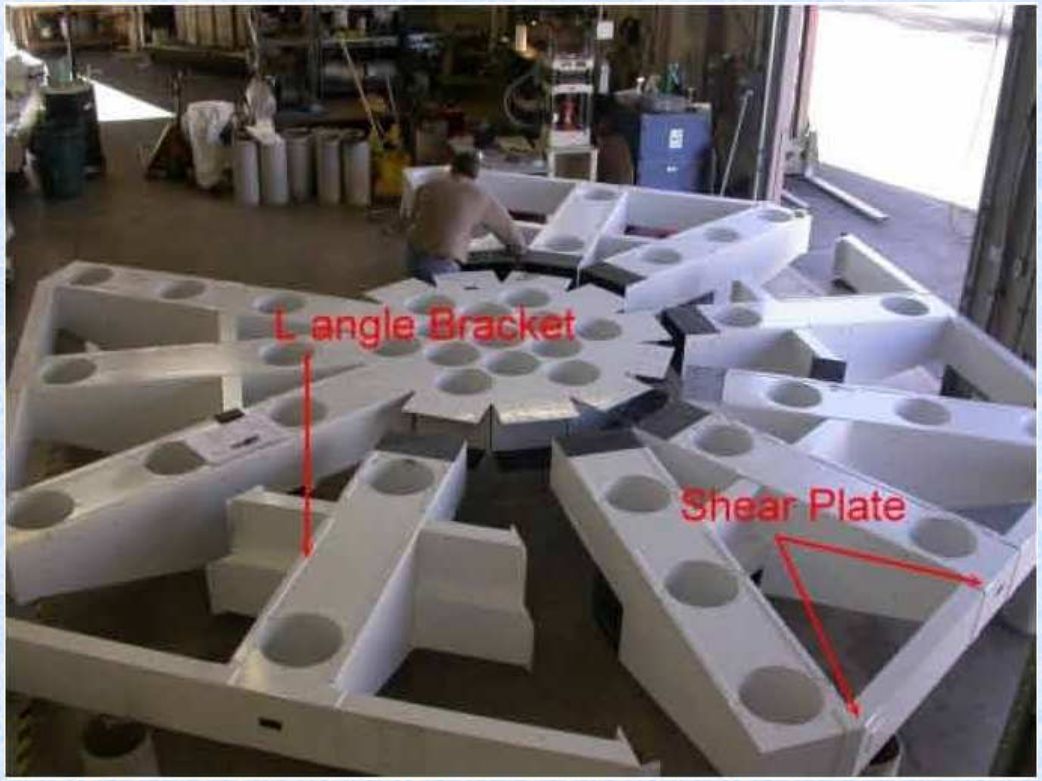
AMiBA Platform on Hexapod



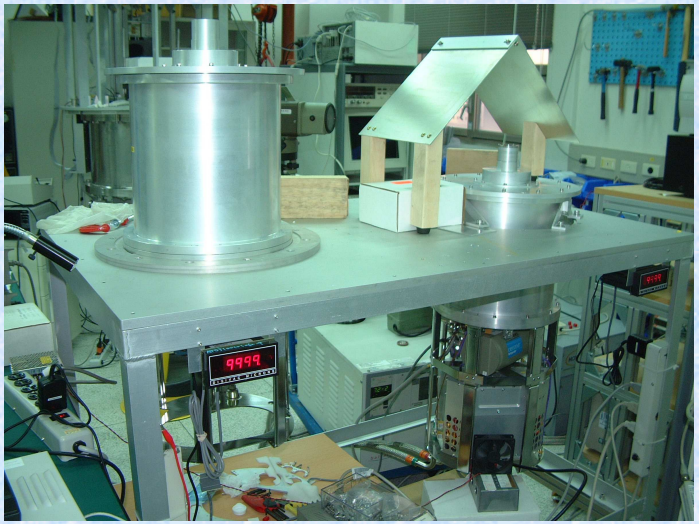
Platform FEA & Reinforcement

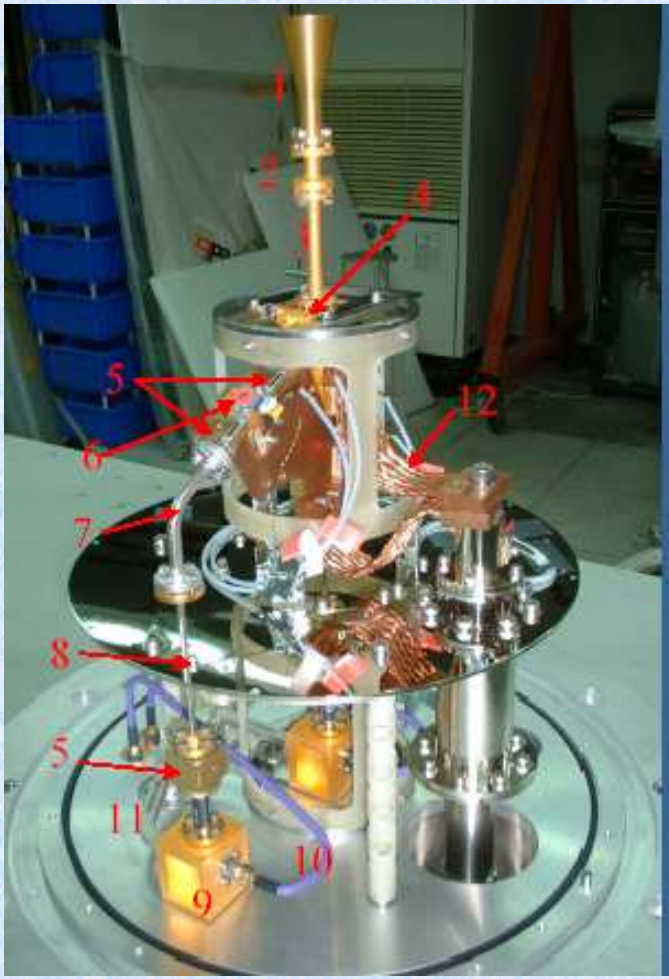






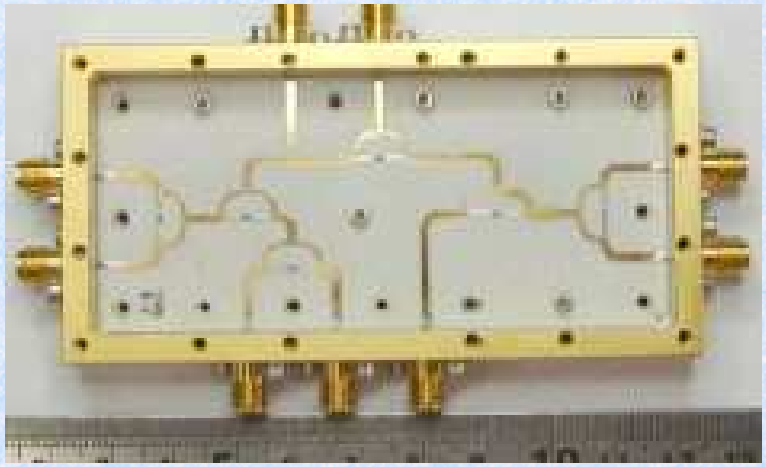
W-band Dual Polarization Receiver

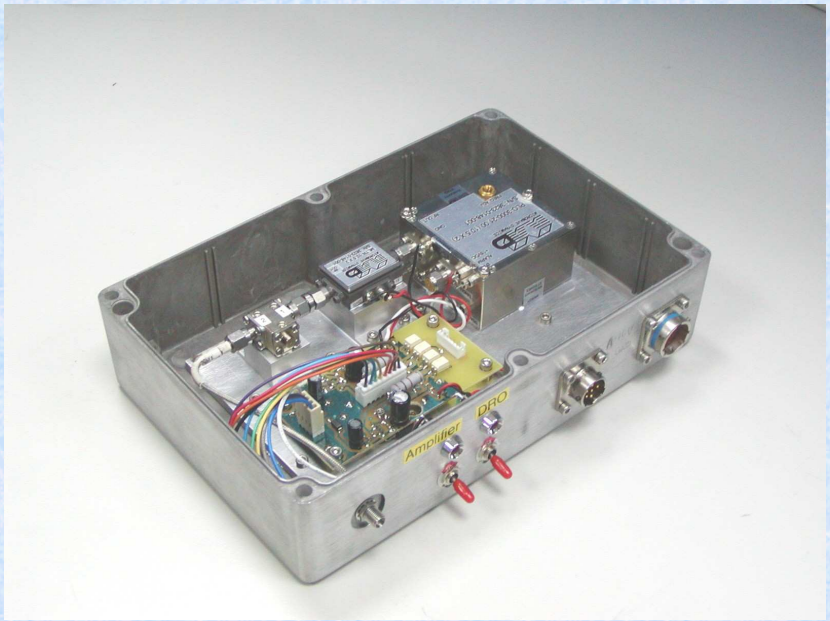


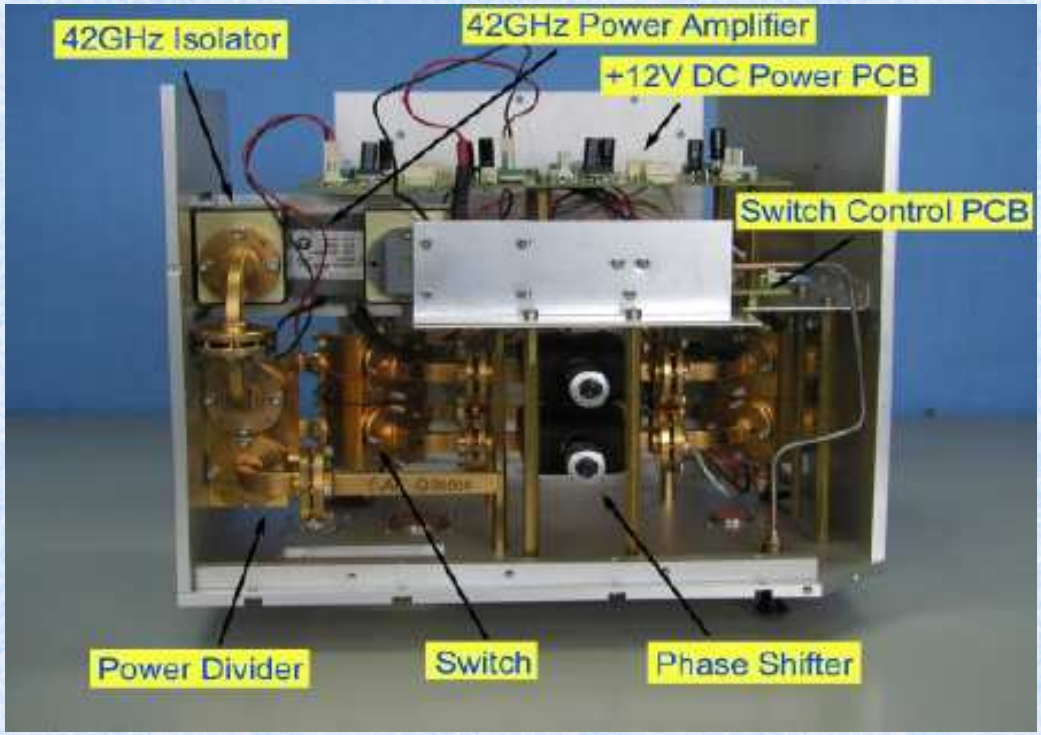


1. Feed Horn
2. Round to Square W/G
3. Section for Noise Coupler + Phase Shifter
4. OMT & Holder
5. Isolator
6. Low-Noise Amplifier
7. WR10 65 degree H-Bend W/G
8. 3" Thin-wall stainless W/G
9. Sub-Harmonic Mixer
10. Coaxial IF output Cable
11. WR22 Main-arm LO input W/G
12. Heat Strap

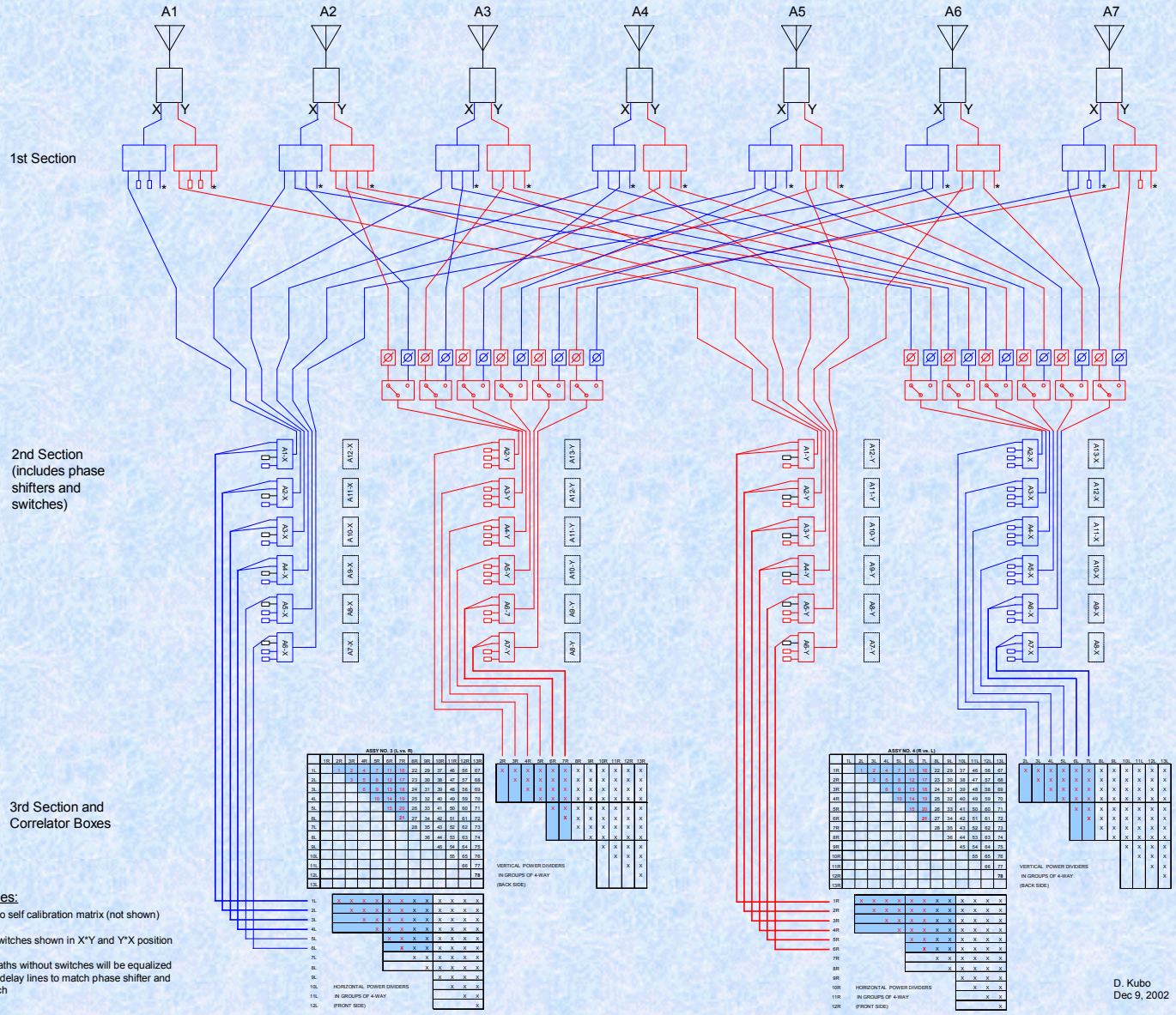
LO Unit




Amplifier
DRO


42GHz Isolator
42GHz Power Amplifier
+12V DC Power PCB
Switch Control PCB
Power Divider
Switch
Phase Shifter

7-Element Correlation



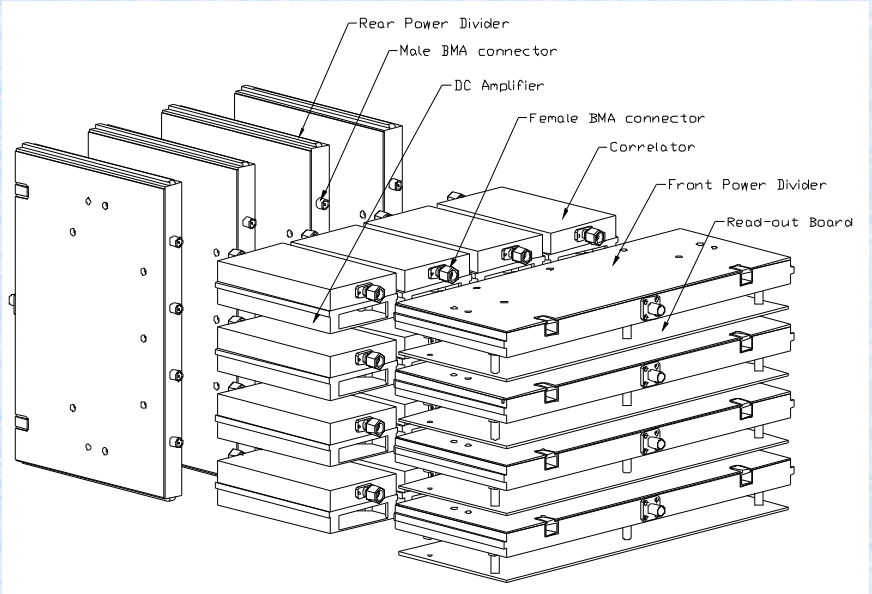
Notes:

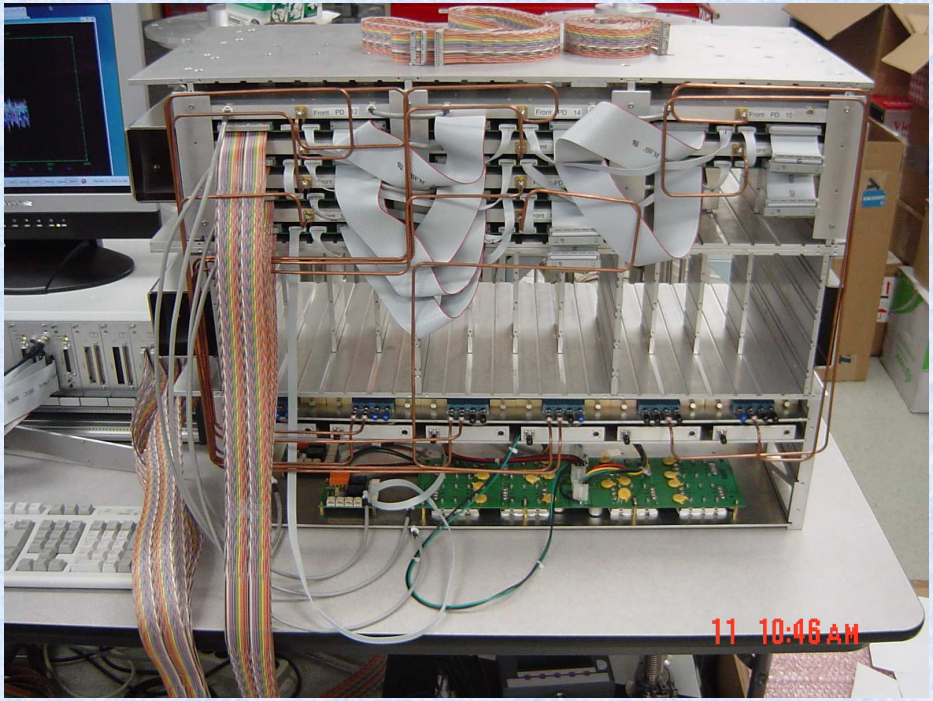
* = to self calibration matrix (not shown)

1) Switches shown in X*Y and Y*X position

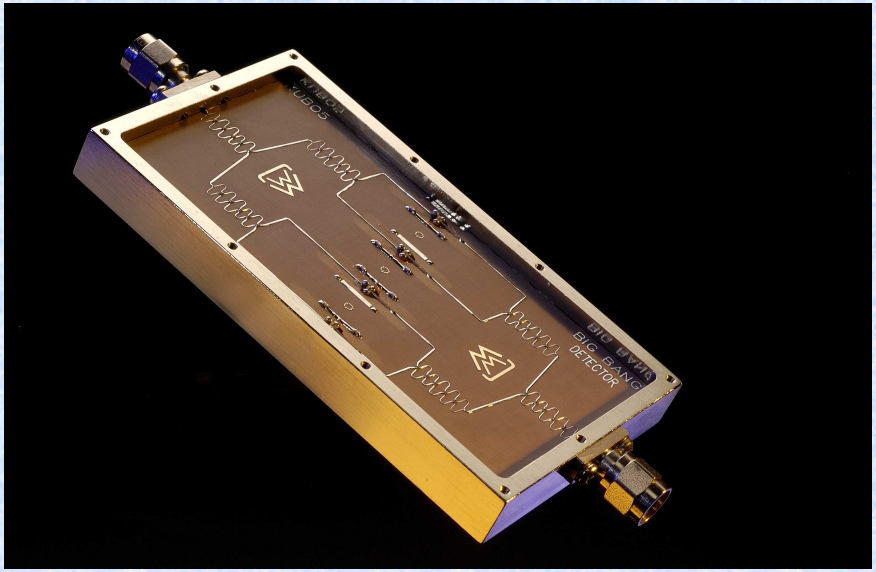
2) Paths without switches will be equalized with delay lines to match phase shifter and switch

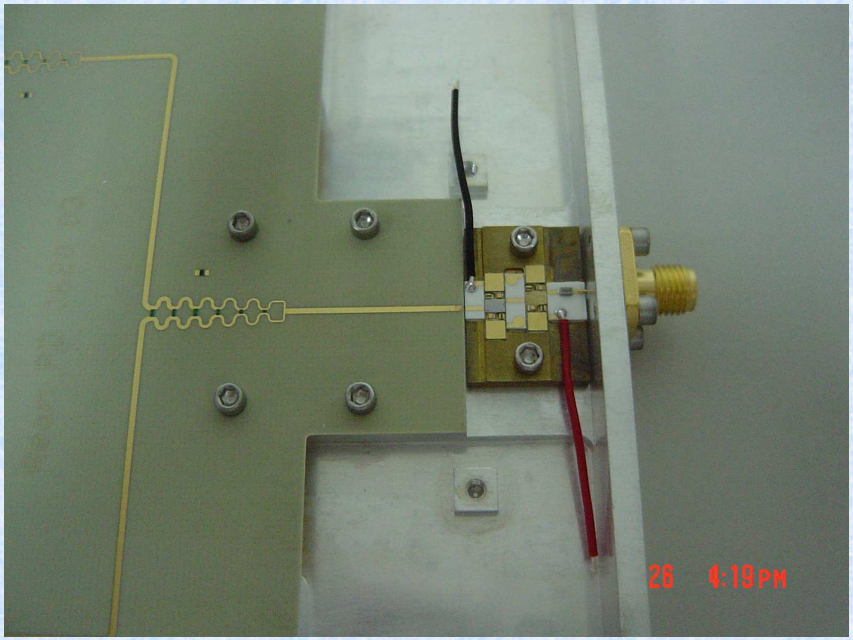
Correlator IF Distribution

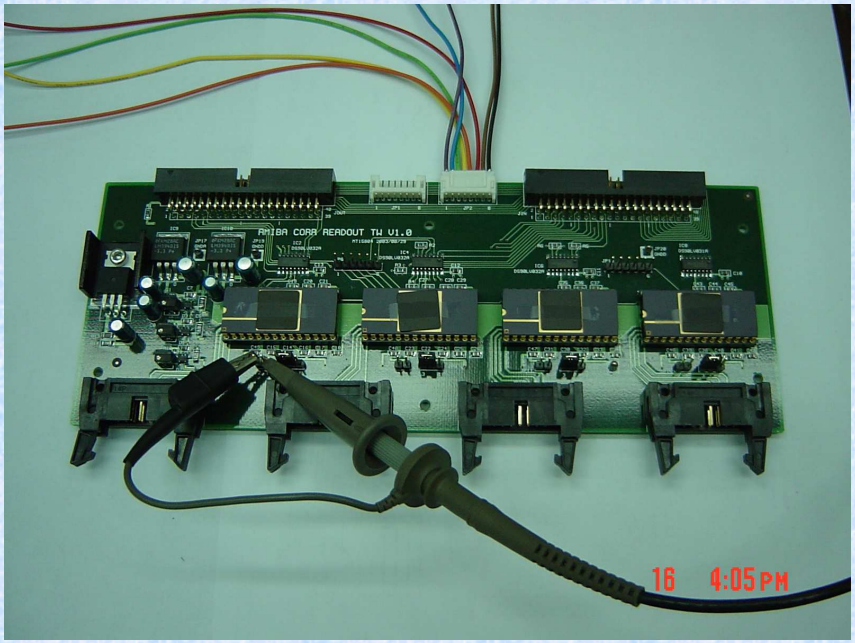




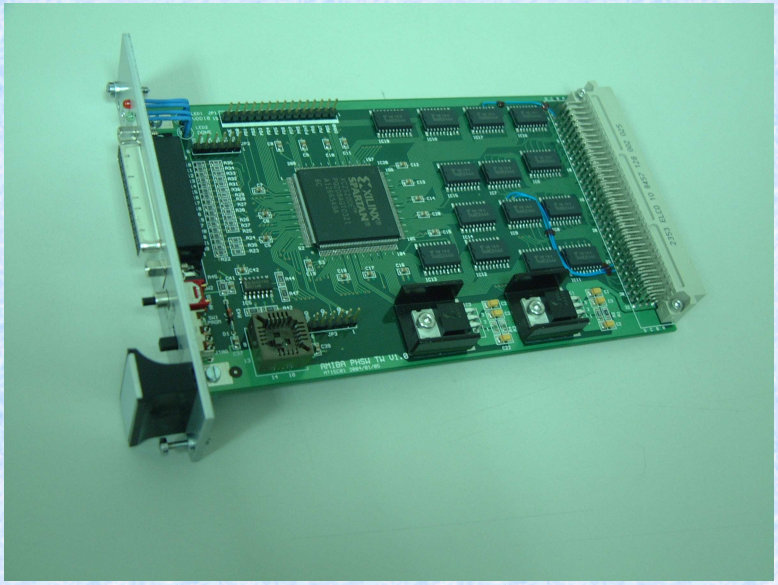
4-Lag Correlator→
Readout Circuit
4-Way Power Divider↓

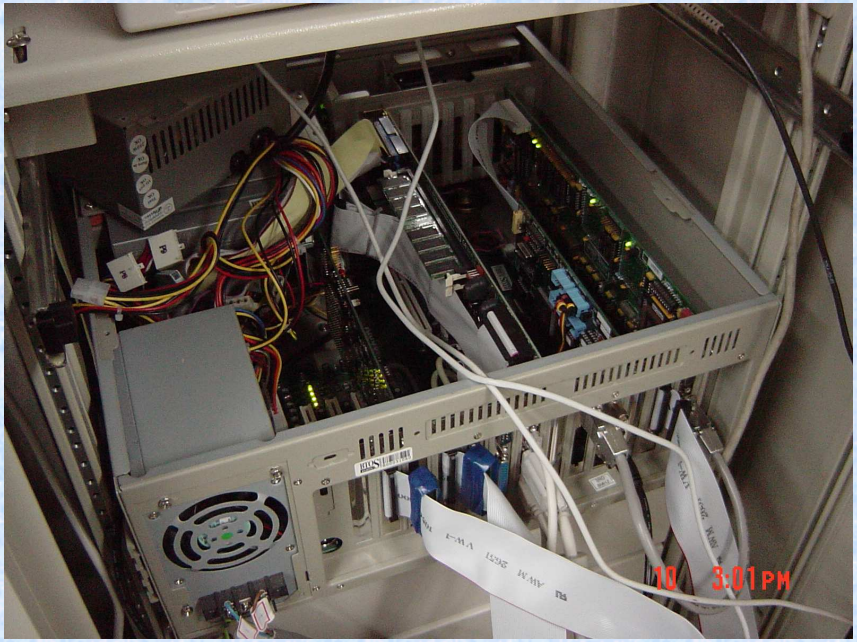


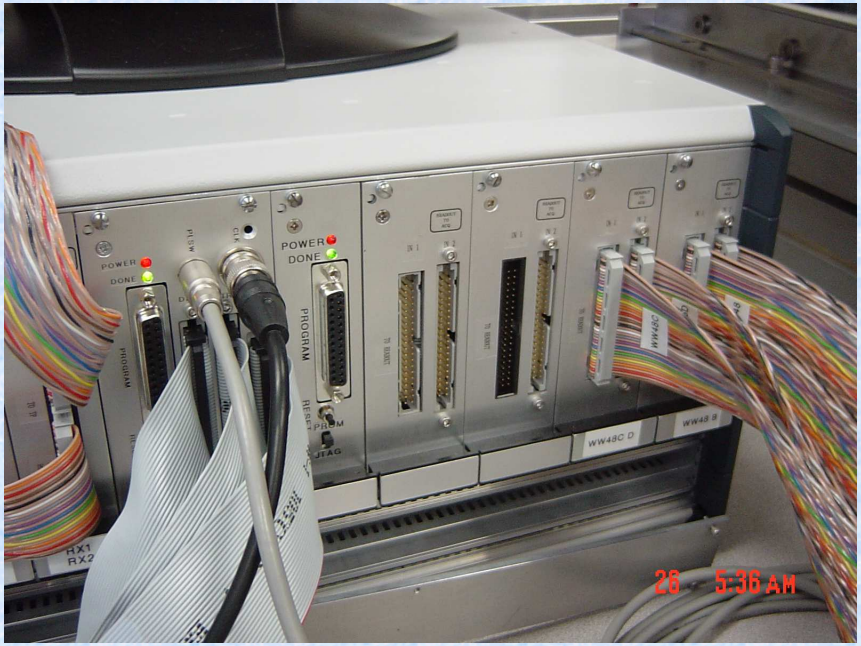




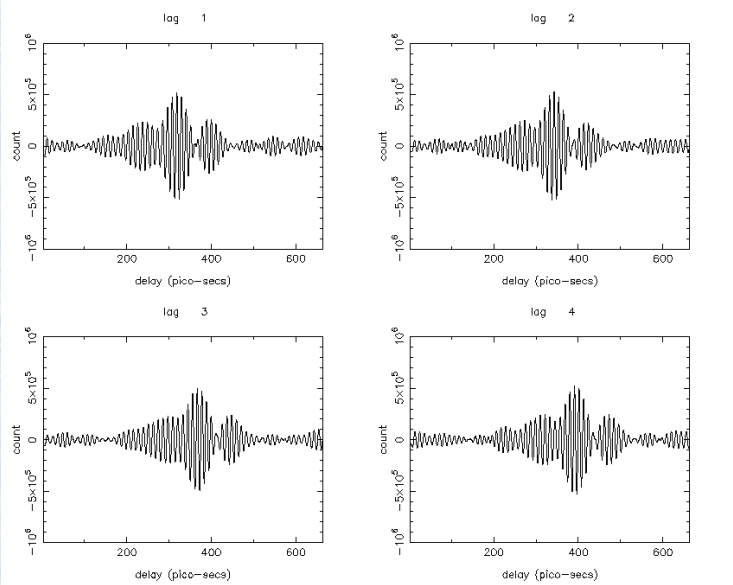
Data Acquisition →
Correlator Computer↓

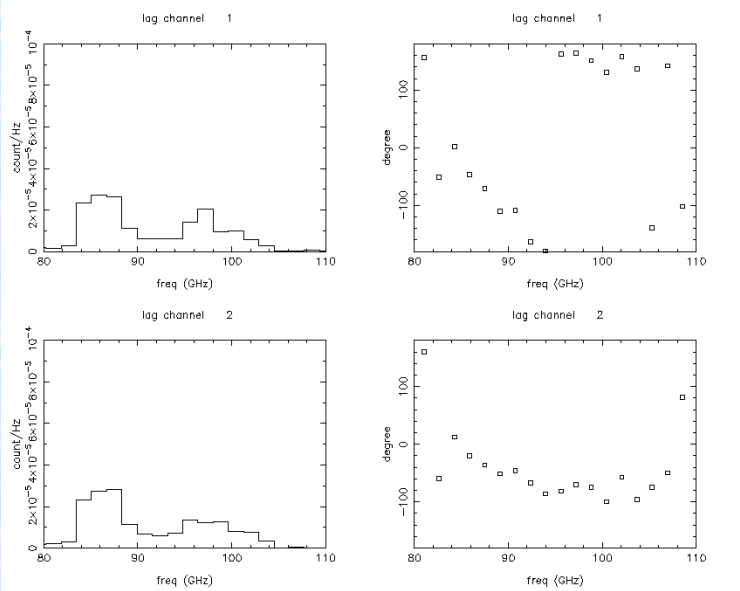


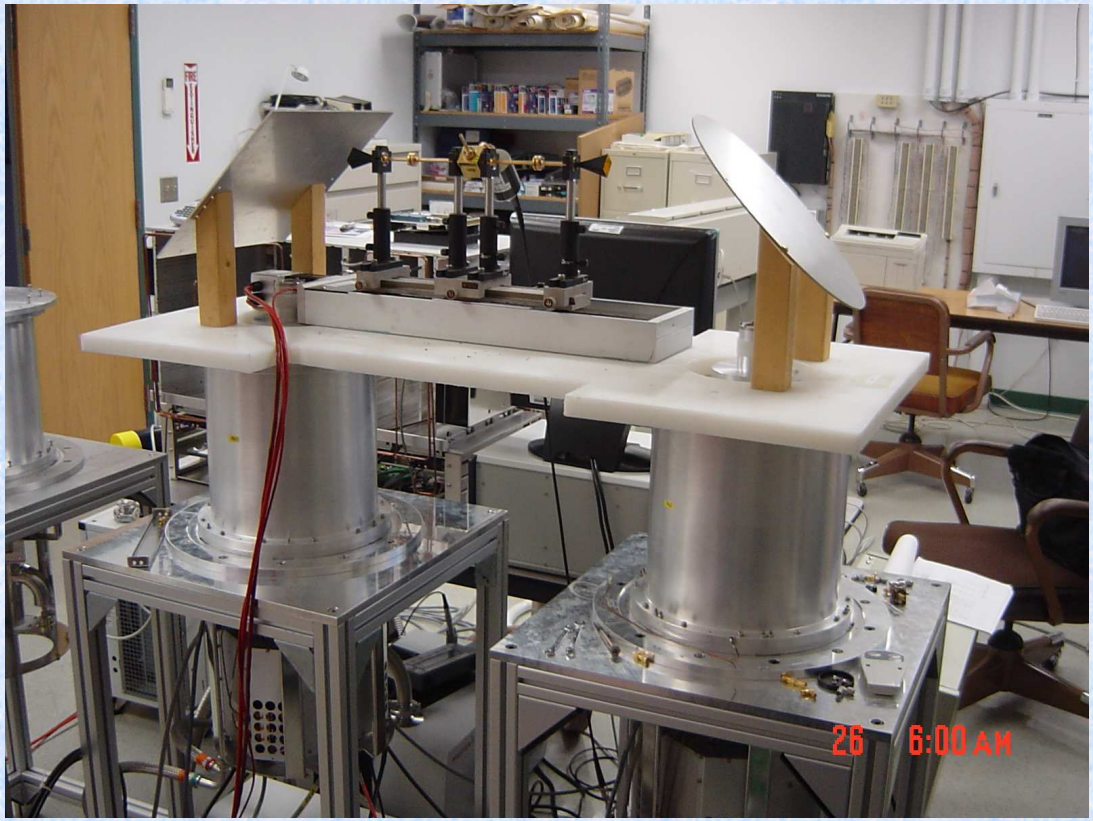




Receiver / Correlator Integration







Summary & Future Plan

- Establishing Experimental Cosmology
- Enhancing Collaboration with University
- Strengthen Technical Capabilities

- Telescope integration / Commissioning
- Pointing & Calibration
- Scientific Observation