The Current Status of ALMA (slideshow version)

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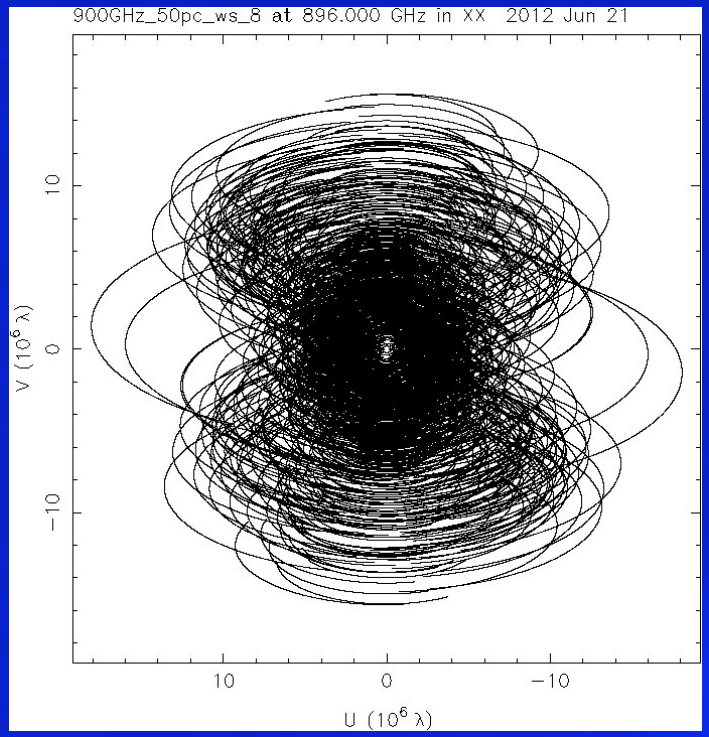
What do we want?



CASA beam and u,v coverage simulations soon to be online for proposal planning

- High Fidelity Imaging
- Precise Imaging at 0.1" Resolution
- Routine Sub-mJy Continuum Sensitivity
- Routine mK Spectral Sensitivity
- Wideband Frequency Coverage
- Wide Field Imaging Mosaicing
- Submillimeter Receiver System
- Full Polarization Capability
- System Flexibility

How do we get it?

Technical Specifications

- 54 12-m antennas, 12 7-m antennas, at 5000m site
- Surface accuracy ±25 μm, 0.6" reference pointing in 9m/s wind, 2" absolute pointing all-sky.
- Array configurations between 150m to ~15-18km.
- 10 bands in 31-950 GHz + 183 GHz WVR.
- 8 GHz BW, dual polarization.
- Interferometry, mosaicing & total-power observing.
- Correlator: 4096 channels/IF (multi-IF), full Stokes.
- Data rate: 6Mb/s average; peak 64 Mb/s.
- All data archived (raw + images), pipeline processing.

During full operations, the estimated flow of int/SD data into archive ~100 Tb per year.

Project lifecycle: online proposal tool, script generator, dynamic scheduling, raw data available plus a reference image with pipeline processing history, calibration data…

ALMA Sites

- **Array Operations Site – AOS** – 5000m – Antennas, correlator, some (oxygenated) office space

- **Operations Support Facility – OSF** – 3000m – Array operation, equipment maintenance, living quarters

- **ALMA Test Facility – ATF** – Socorro, VLA site – prototype antennas, software development

- **Santiago Central Offices – SCO** – Administration, scientific support. Will be located near ESO, currently Las Condes (also JAO - Joint ALMA Observatory)

- **ALMA Regional Centers – ARCs + ARC nodes** – interfaces to astronomy community

Approximate Schedule

- First fringes ATF: Q2 2007
- First fringes Chile: Q1 2009
- AOS, OSF facilities: Complete
  Start move in (w/ furniture and power) end 2008
- Antennas: 11 now on site in assembly,
  First 2 acceptance by AIV: Q4 2008
- Front Ends: #1 delivered, install Oct 2008
  #2 - end 2008
- Correlator: 1st quadrant being installed at AOS
  ACA correlator installed at AOS
  New 2-antenna correlator installed at OSF

- Call for Early Science: 2010
- Early Science: 2010-11
- Full Operations: ~2012

Receivers / Front Ends

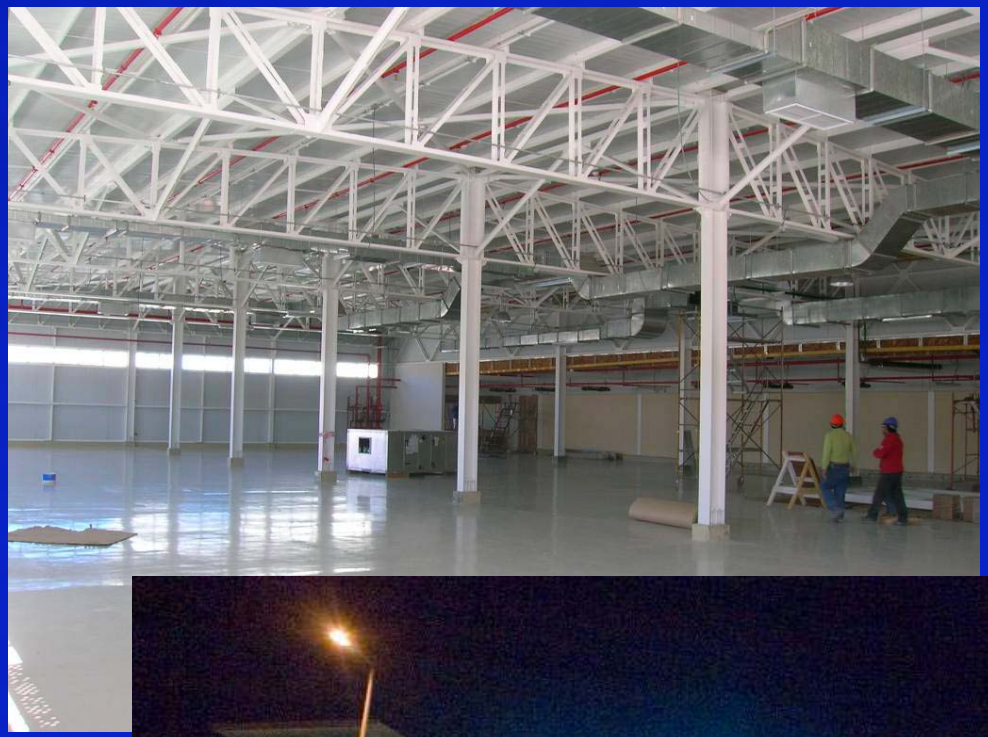
ALMA Band	Frequency Range	Receiver noise temperature		Mixing scheme	Receiver technology
		T_{Rx} over 80% of the RF band	T_{Rx} at any RF frequency		
1	31.3 – 45 GHz	17 K	28 K	USB	HEMT
2	67 – 90 GHz	30 K	50 K	LSB	HEMT
3	84 – 116 GHz	37 K	62 K	2SB	SIS
4	125 – 169 GHz	51 K	85 K	2SB	SIS
5	163 - 211 GHz	65 K	108 K	2SB	SIS
6	211 – 275 GHz	83 K	138 K	2SB	SIS
7	275 – 373 GHz	147 K	221 K	2SB	SIS
8	385 – 500 GHz	98 K	147 K	DSB	SIS
9	602 – 720 GHz	175 K	263 K	DSB	SIS
10	787 – 950 GHz	230 K	345 K	DSB	SIS

Initially for CSV, Bands 3 and 6 on all antennas, plus Band 7 or 9

Operations Support Facility (OSF): Technical Facilities 3000m

Contractor's Camp
holds ~440 persons

OSF Warehouse and Offices



ALMA Camp - OSF

Scientist dorms

Bunkhouse dorms

AIV Lab

Offices and cantina

Medical center

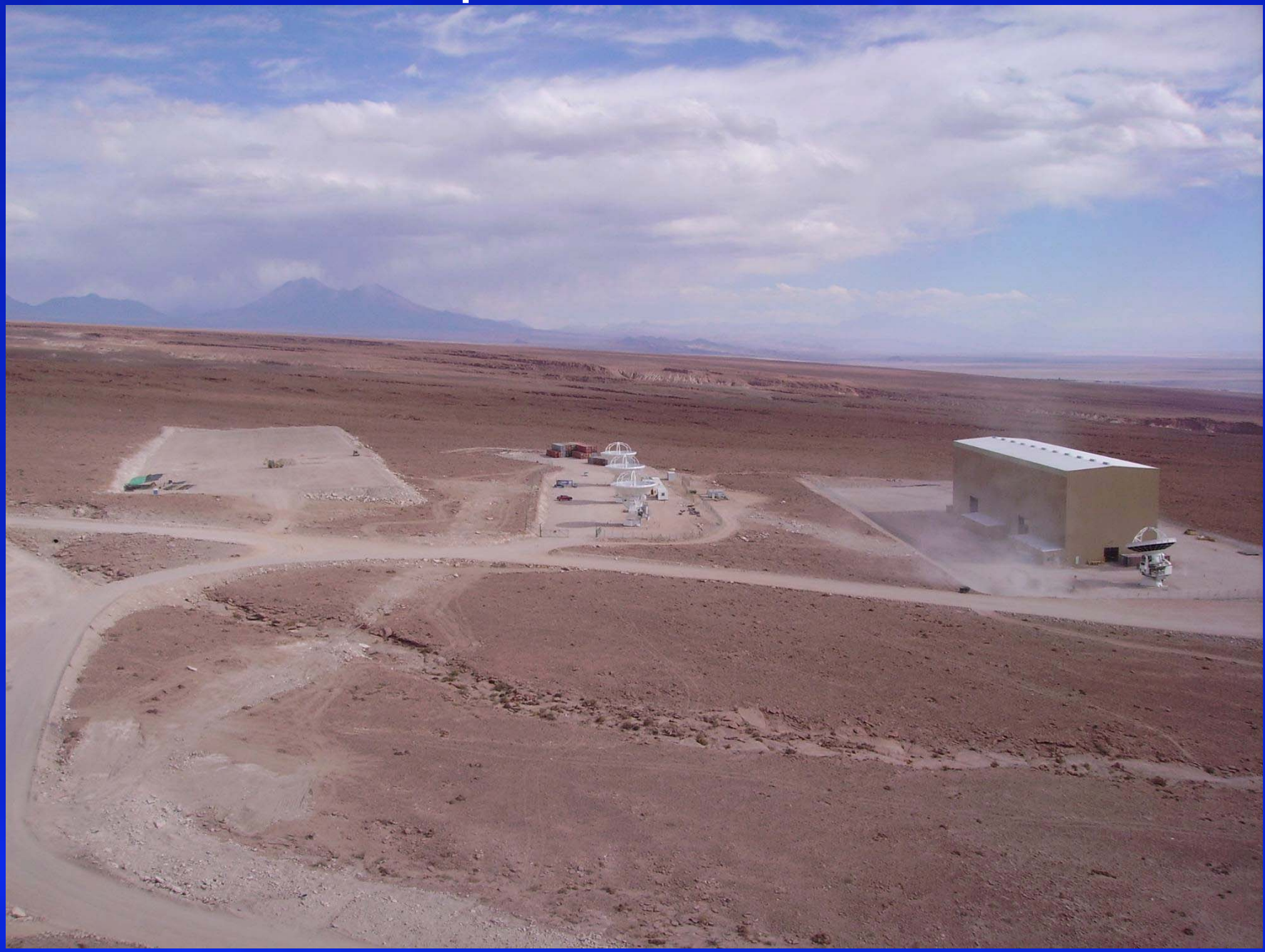
Tennis court

Inset:
Scientist dorms

First Front End Installation at OSF lab in Chile, April 2008

First FE / Second BE being tested at OSF

Vendor camps - with dust devil



Vertex #1 - Fully assembled and being tested

Vertex #2, straight off the truck, Sept 2007 now assembled and outside being tested

Assembly of Vertex #2 and 3 - late 2007

Four Complete Mitsubishi 12m Antennas (March 2008)

Back End racks being lifted into MELCO #2 receiver cabin

AEM #1

- CFRP cabin
- Stiff yoke
- Direct drives

Drive tests complete
Stiffer Az bearing support being added

ALMA
ATACAMA LARGE MILLIMETER ARRAY

Transporter being unloaded in Chile - February 2008

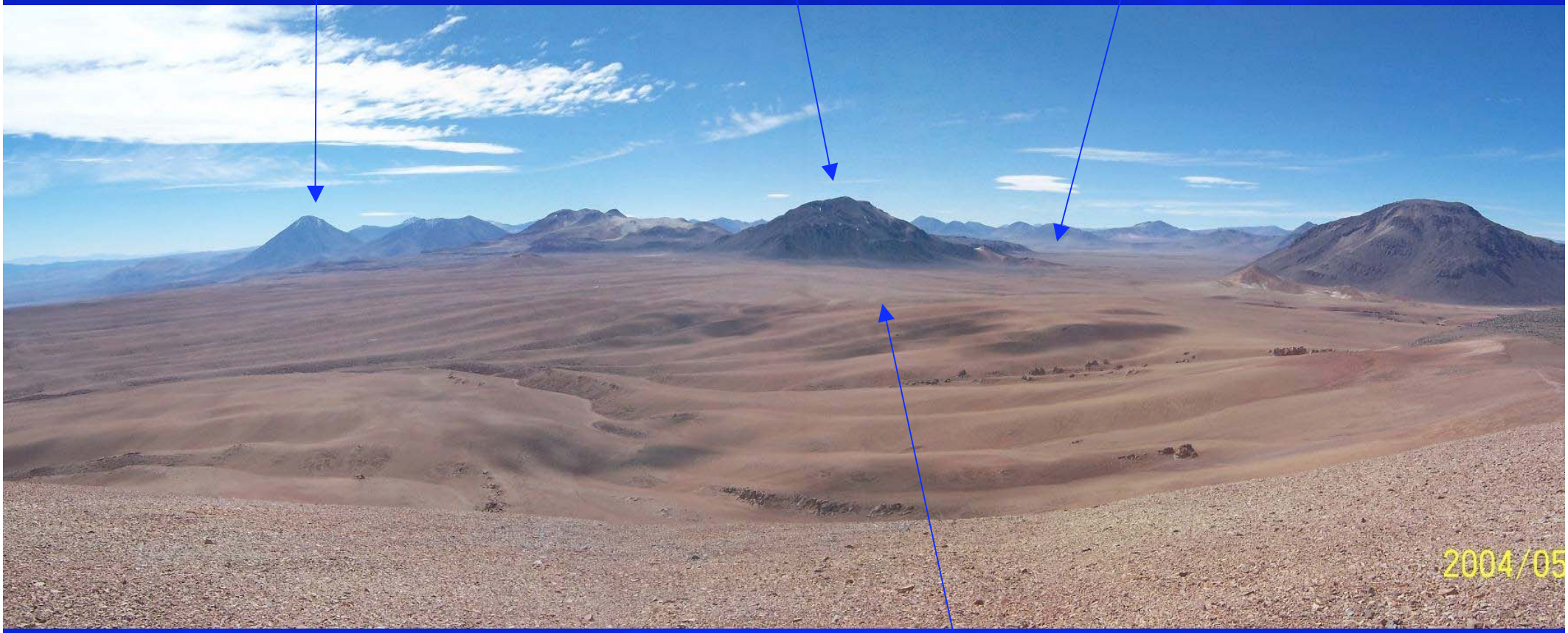
On the road to the OSF

September 27, 2008

First Transporter Outing - OSF to AOS
April 2008

First Move - Vertex#2 from Hangar to outside pad for testing

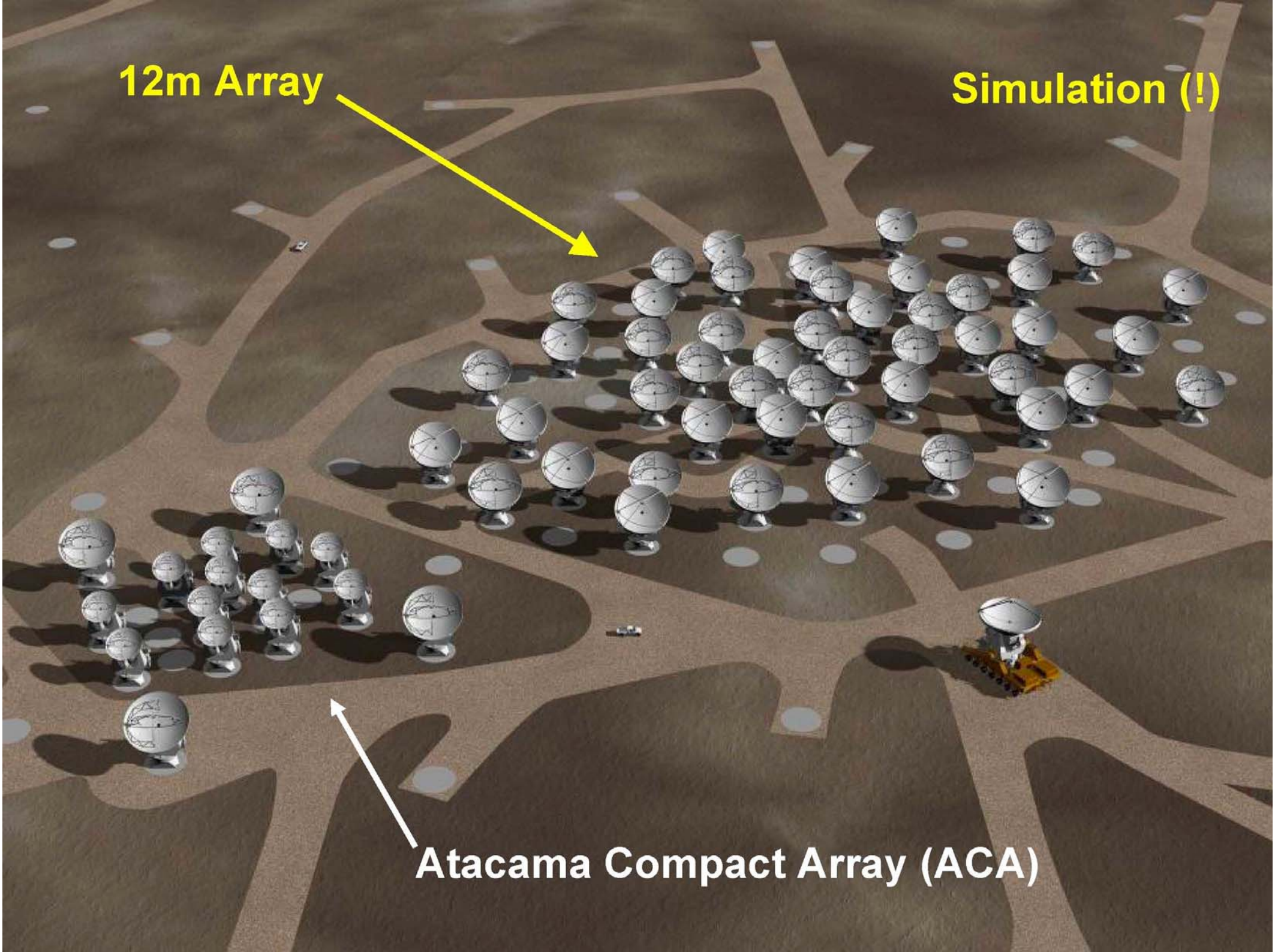
Chajnantor Plateau – looking north



AOS Technical Building

AOS Technical Building - completed 2008

Simulation of Extended Configuration


12m Array
Simulation (!)
Atacama Compact Array (ACA)

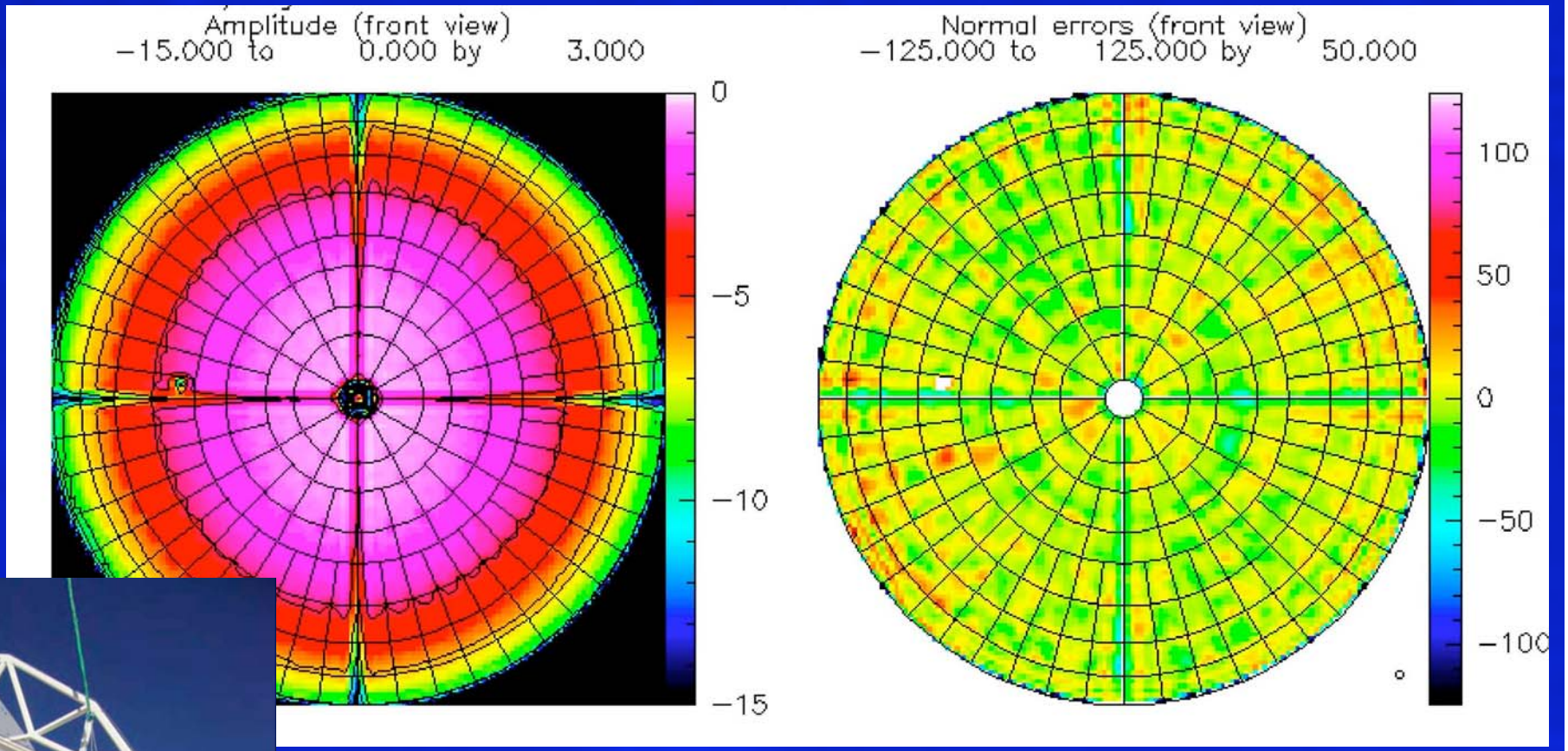
Central Cluster

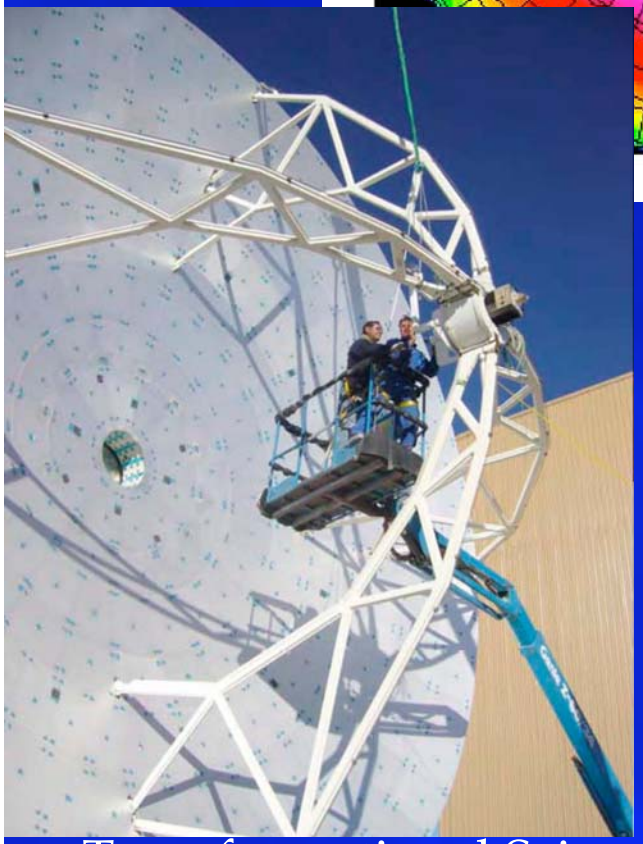
grading underway

Foundation being kept warm while it cures

Correlator First Quadrant at AOS

Correlator first quadrant being installed

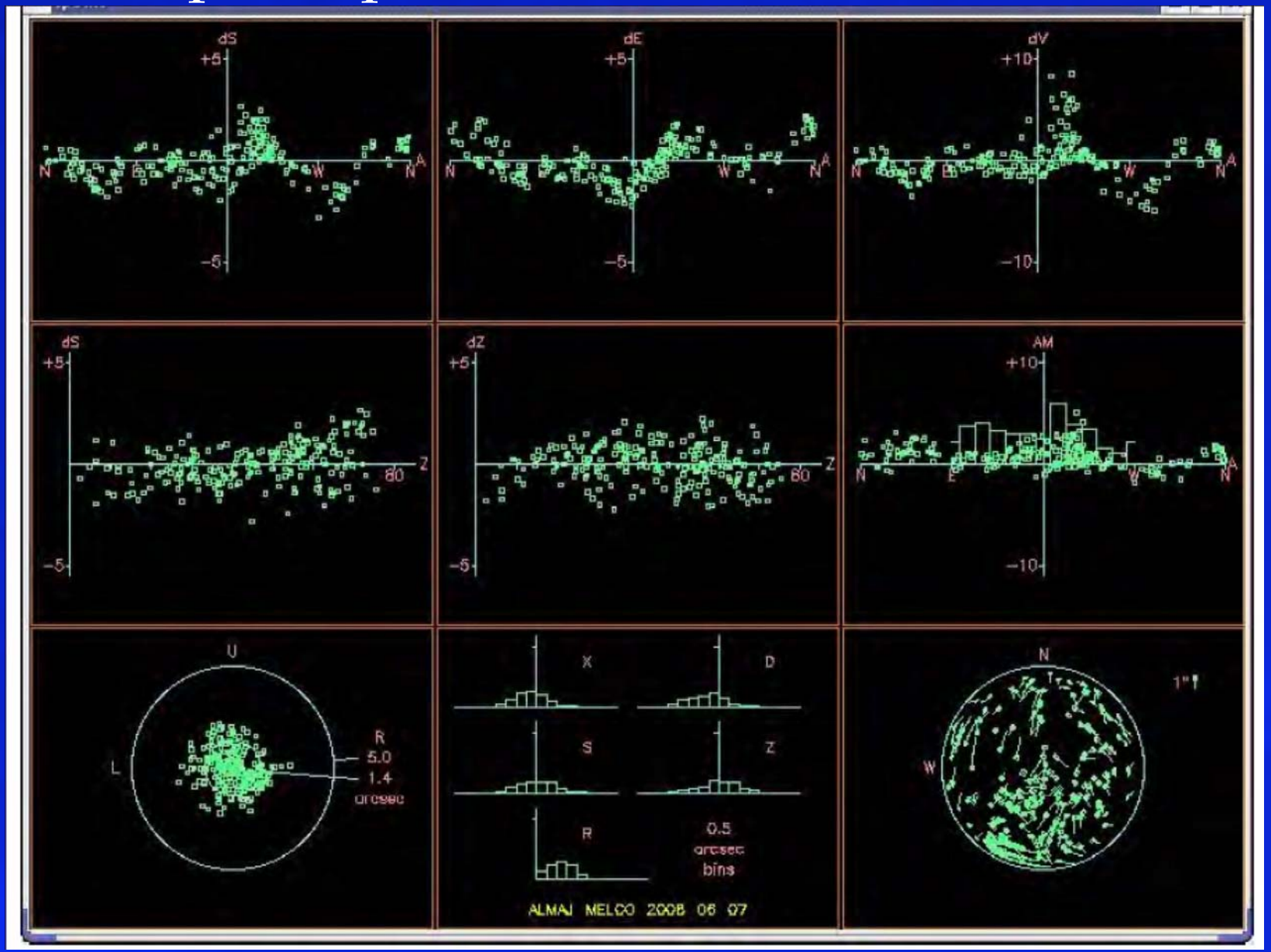




Preliminary Holography Results:

Done on both MElCo and Vertex antennas -
Now Preparing for Antenna Acceptance by ALMA

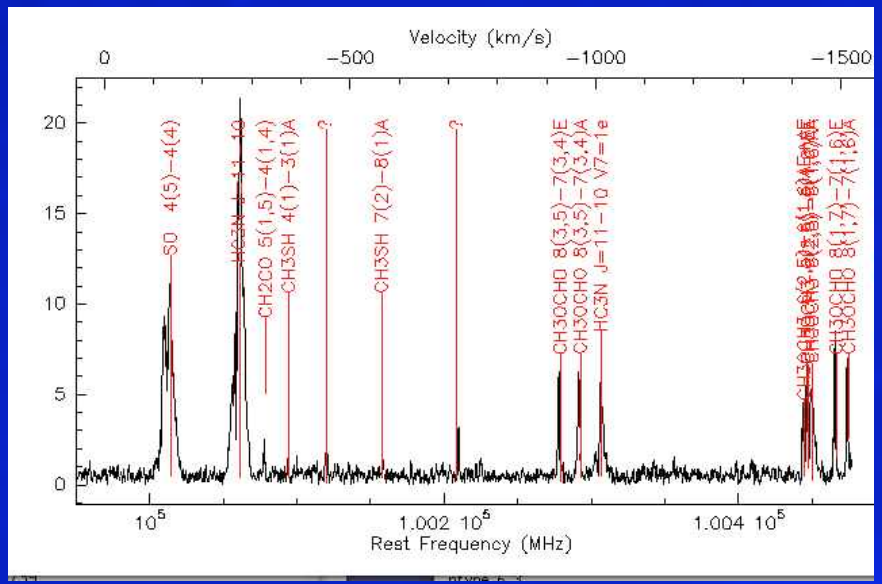
Data taken using prototype optical pointing telescope on production antenna-- rms~1.4 asec

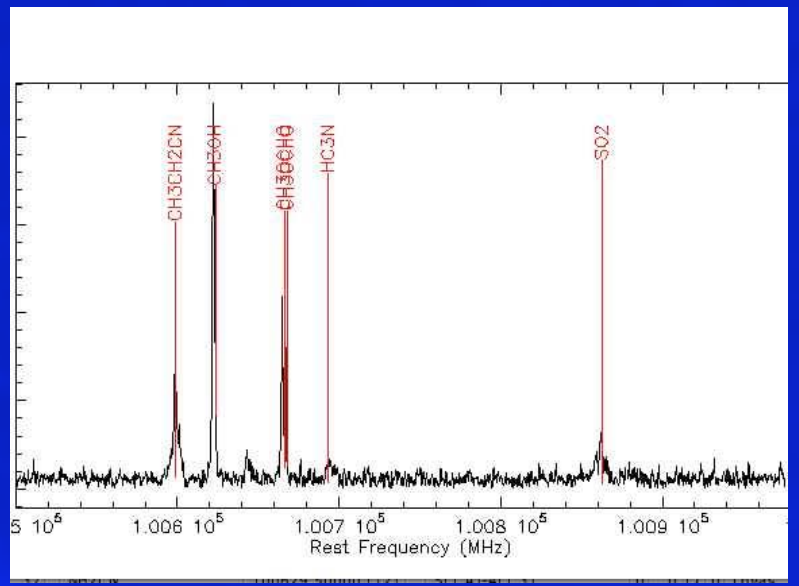


Prototype Antennas at ATF (2006)

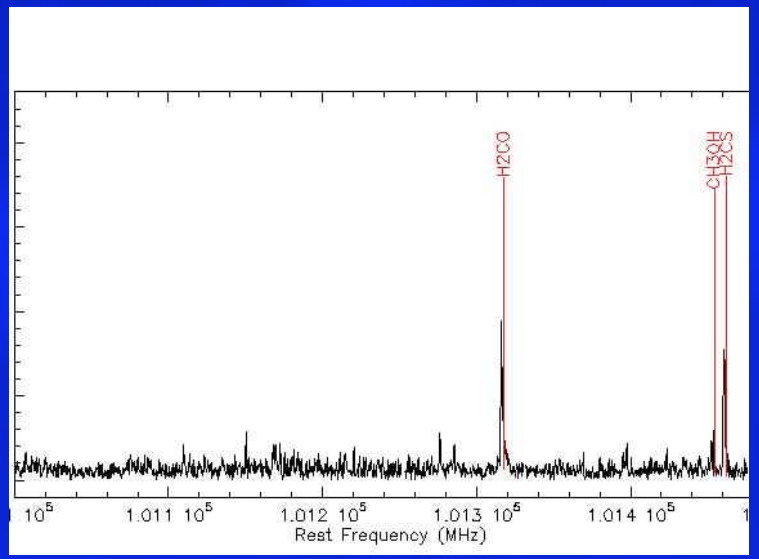
12-m, Carbon Fiber Support Structure

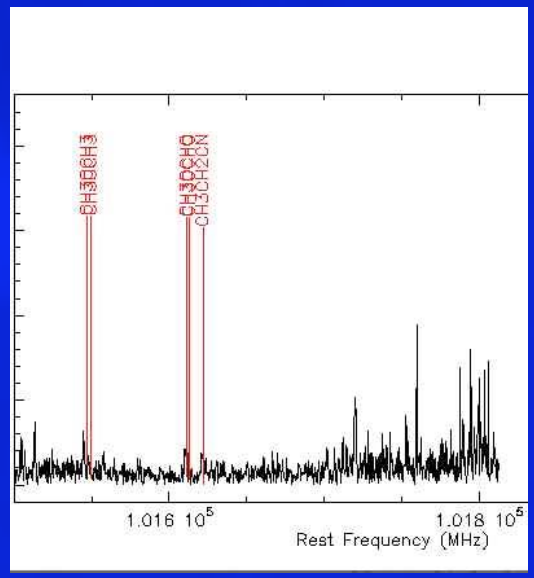
Interferometric spectrum: Orion - 101 GHz, April 2008



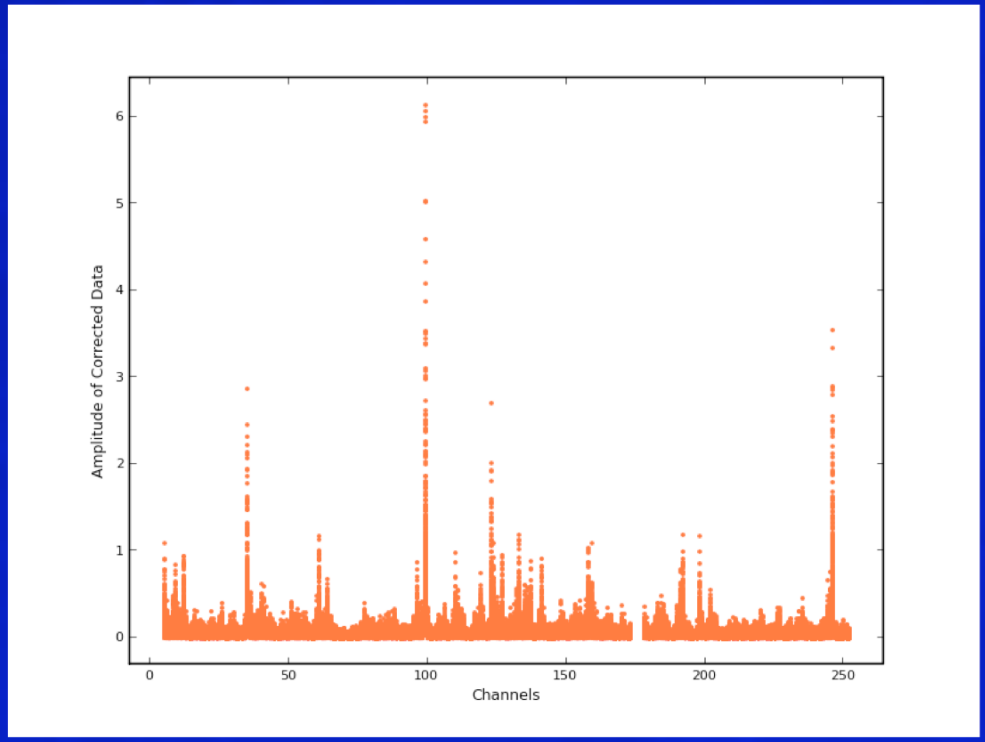


Taken at ATF, not using production receivers, but verifying software for control, tuning, correlator and data reduction





(Thanks to Hunter, Indebetouw, Wootten, etc)

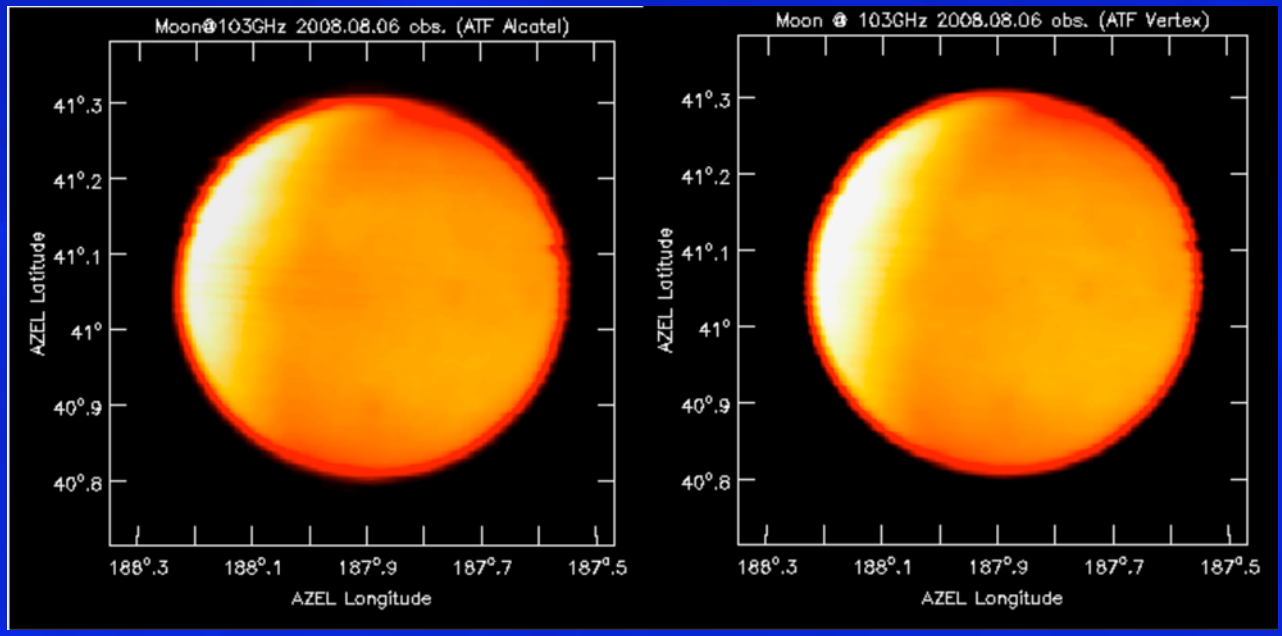


Most recent:
Sgr B2 Spectrum
97.9 GHz

(Thanks to de Gregorio, Fomalont, Remijan, Biggs, CASA and Control s/w people)

Raster on Moon with Total Power detectors

Taken at ATF, not using production receivers, but verifying software for control, tuning, correlator and data reduction



Where you come in…

Current job advertisements:

Charlottesville	CV4896	NAASC Postdoc - CASA
Charlottesville	CV4888	NAASC Postdoc - Splatalogue
Charlottesville	CV4870	ALMA FEIC Technical Leader
Charlottesville	CV4853	NAASC Scientist - CSV Liaison
Charlottesville	CV3682	Scientist - CASA Developer
Socorro, NM	SO3391	CASA Group Supervisor
Santiago, Chile	CL4845	Commissioning Scientists

Visitor's program:

- Some support (typically at least travel and lodging) for people who can take leave or sabbatical from their home institutions to participate in CSV.
- Beginning mid 2009.
- Stays of 3 months to 1 year recommended
- NO "own" data during this period
- Check alma.cl web page soon for more info, or contact me at apeck@alma.cl

For more info:

www.alma.cl

Or email apeck@alma.cl

The Atacama Large Millimeter Array (ALMA) is an international astronomy facility. ALMA is a partnership between Europe, North America and Japan, in cooperation with the Republic of Chile. ALMA is funded in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC), in Europe by the European Southern Observatory (ESO) and Spain. ALMA construction and operations are led on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI), on behalf of Europe by ESO, and on behalf of Japan by the National Astronomical Observatory of Japan.

ALMA Median Sensitivity

(1 minute; 75% Quartile opacities λ>1mm, 25% λ <1mm)

Frequency (GHz)	Continuum (mJy)	Line 1 km s^{-1} (mJy)	Line 25 km s^{-1} (mJy)
35	0.02	5.1	1.03
110	0.027	4.4	0.89
140	0.039	5.1	1.01
230	0.071	7.2	1.44
345	0.12	10	1.99
675	0.85	51	10.2
850	1.26	66	13.3