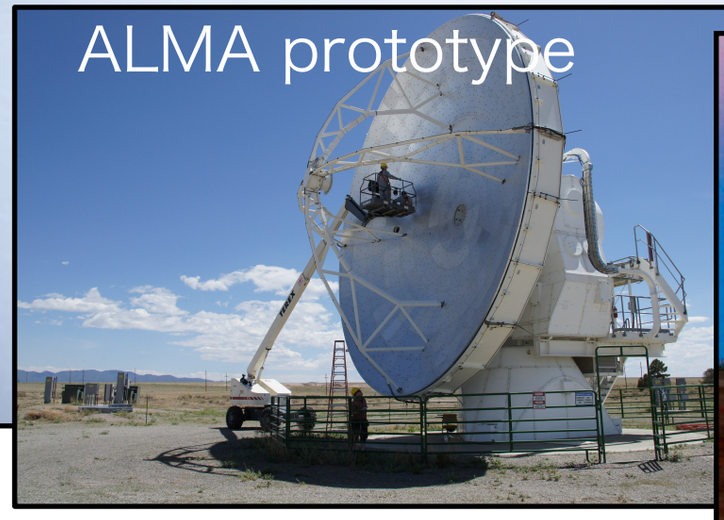
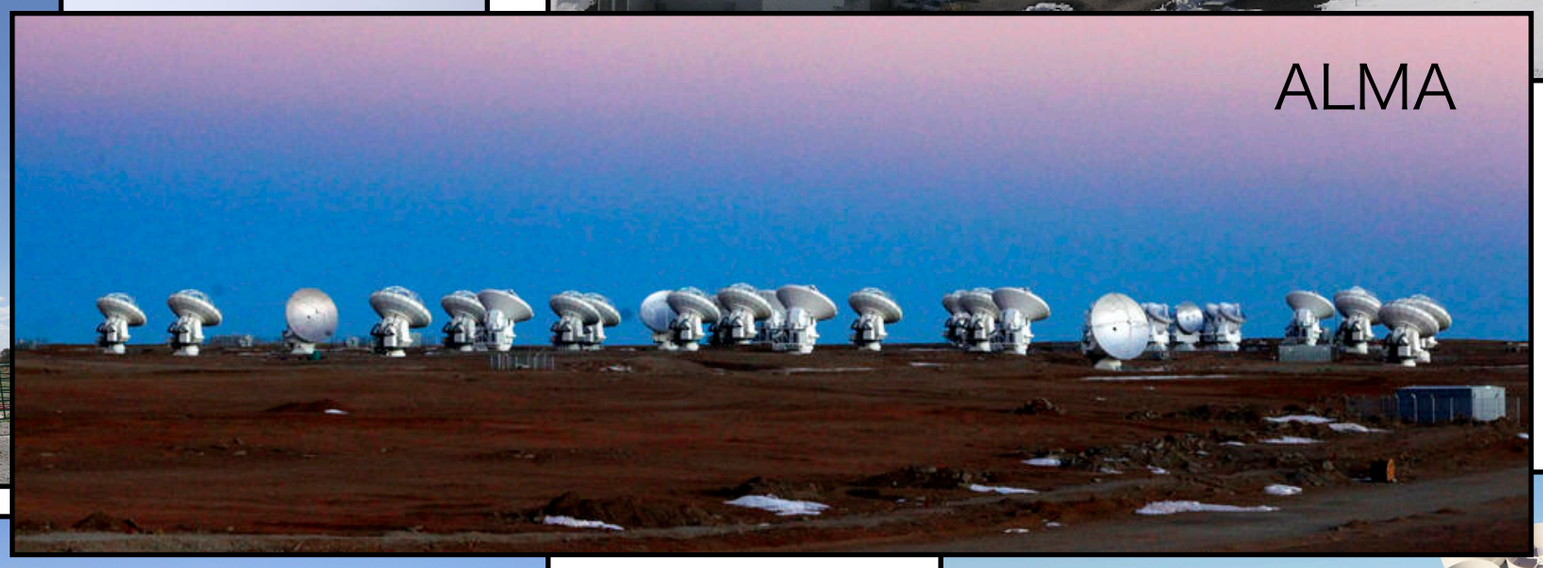
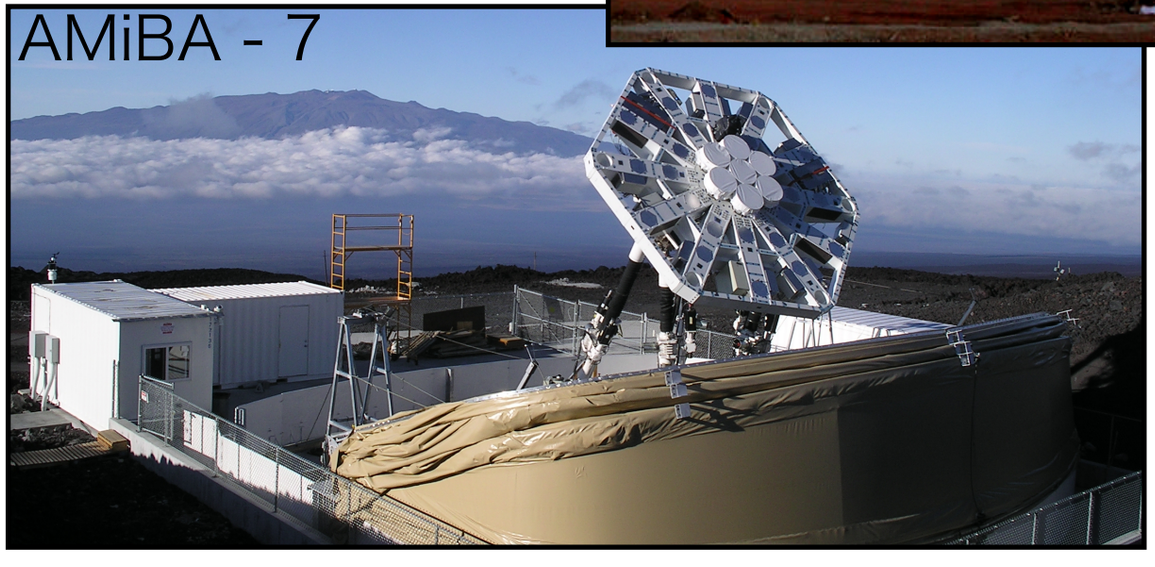
ALMA-Taiwan Activities

Patrick Koch (ASIAA) for ALMA-T

Greenland







9th EAMA @ NCU, Taiwan; October 14, 2013

How to gain access and contribute ?

ALMA-Taiwan 2-path strategy:

- through Japan
- through NA

on-island:

- ASIAA + universities
- industrial partners

Projects Overview

East-Asia

FEIC

ALS
LORTM

Band 1

Junction Development
Band 10 / Band 11/ THz

ARC

Science

FEIC / THz / Nutator

North-America

FESV

Nutator

GLT

Front-End Integration Center (FEIC) - completed

Taiwan's 1st major contribution to ALMA through ALMA-Japan starting from early 2009 to March 2013

assembly, integration and testing of
receiver bands for 26 (out of 69) front ends (FEs)

FEIC in Taichung, Taiwan

receiver cartridge

FEIC - milestones

* 17 FEs delivered for ALMA-Japan collaboration, January 2012
* 5 and 4 FEs delivered for ALMA-NA and ALMA-E, December 2012
* 1 testing line installed and commissioned at OSF, March 2013

last FE # 17 for ALMA-J, December 2011

very last FE #26 shipped out on December 7, 2012

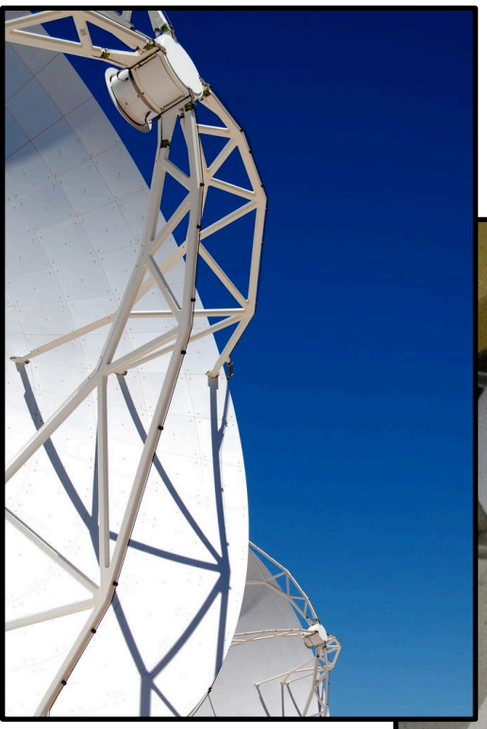
Front-End Service Vehicle - completed

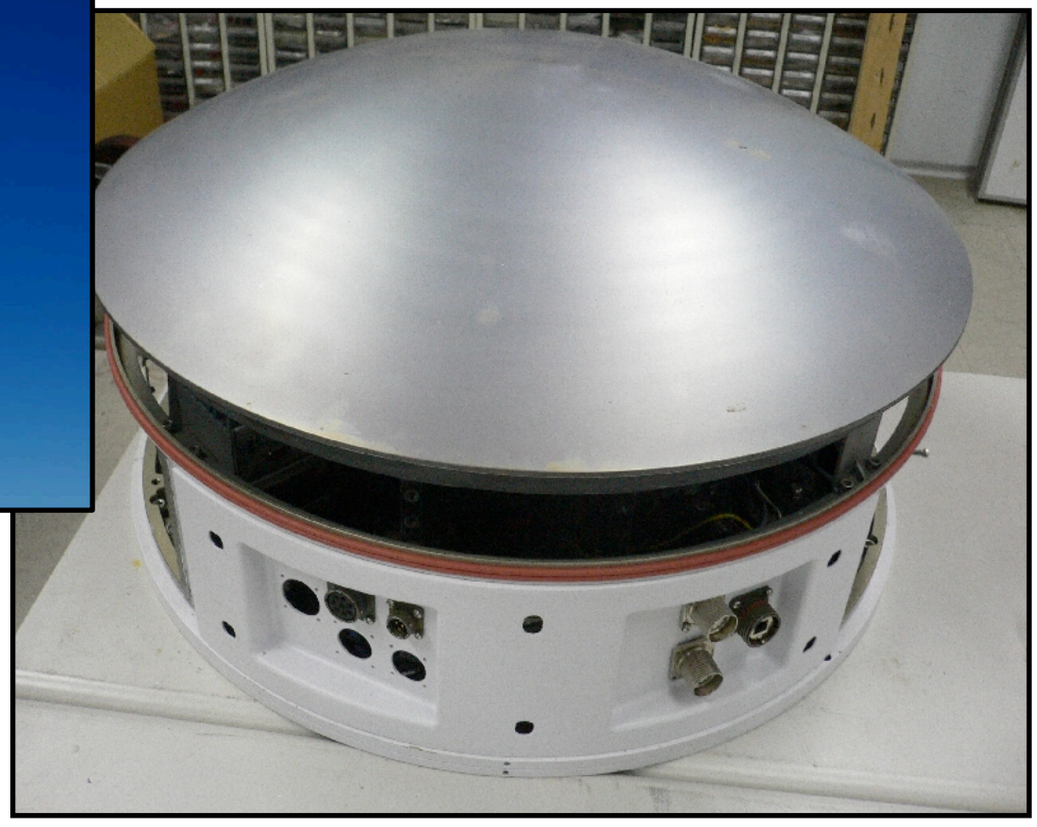
1: at OSF in August 2011
2: at OSF in December 2011

梅花

藍鵲

Nutator Development

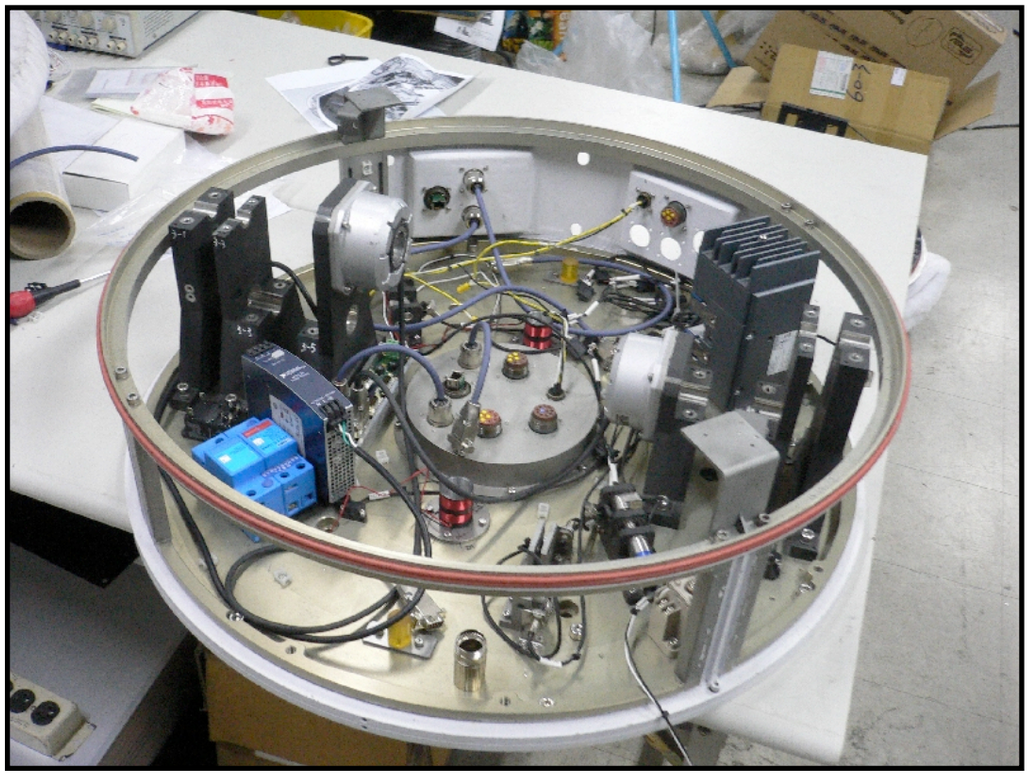




- contract awarded by ALMA-NA to Cotech (Taiwan)

- based on prototype, 5 CFRP nutators are manufactured (prototype: aluminum)

- ASIAA providing technical support; lead: NRAO



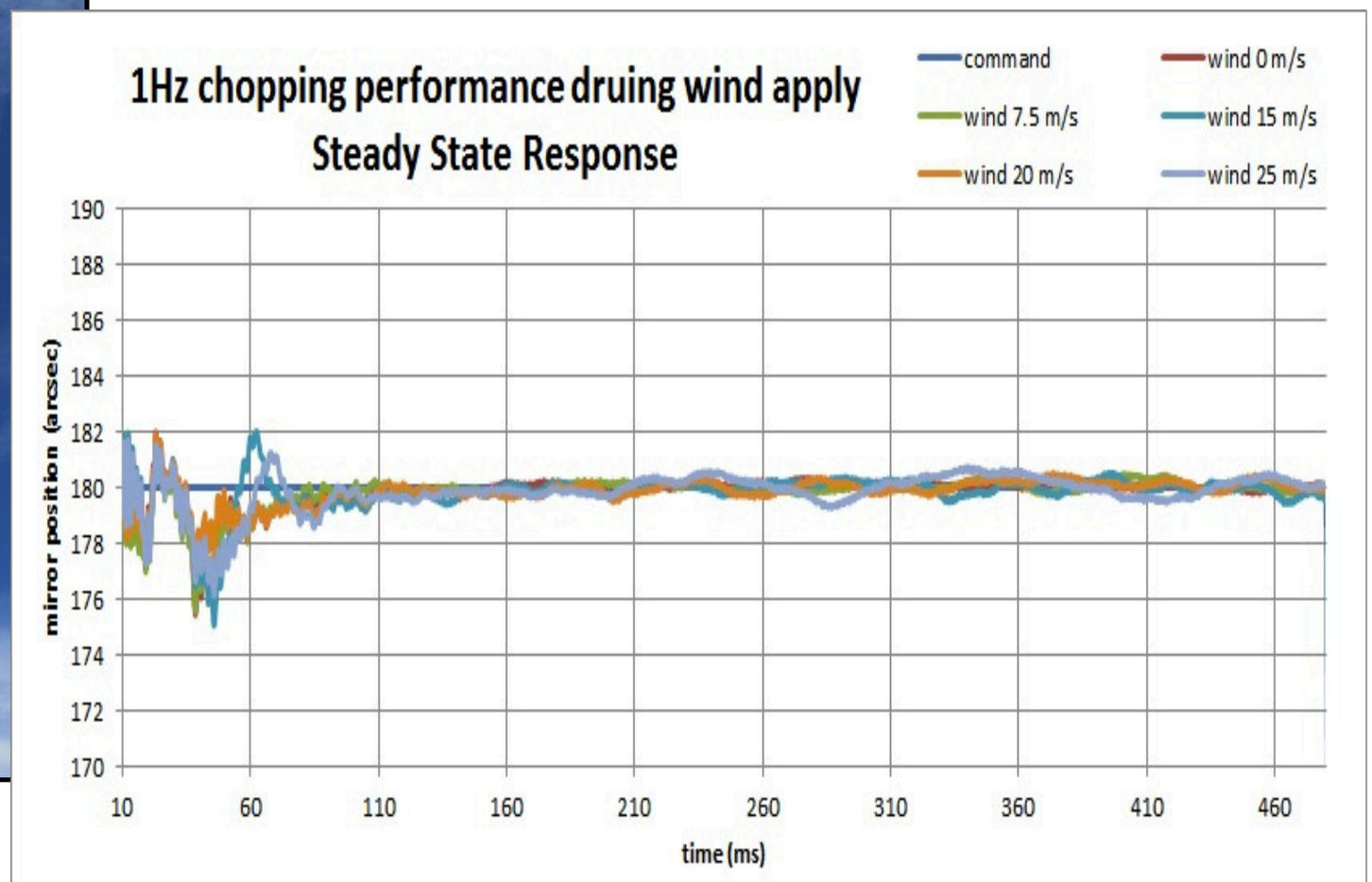
most stringent technical specifications:

* chopping range up to 18 arcmin, frequency up to 10 Hz
* settling time within 10ms
* rms pointing error < 1.3"
* residual torque < 20 Nmm

Nutator Development - just completed as per October 2013

* successful SAT at OSF in Chile of unit #1 in January 2013
* 2 more units passed FAT in Taichung, Taiwan in April/May 2013
* SAT of additional 4 units in September / October 2013 - remaining issue: surface coating

installation during SAT at OSF
of unit #1 in January 2013



key problem at beginning:

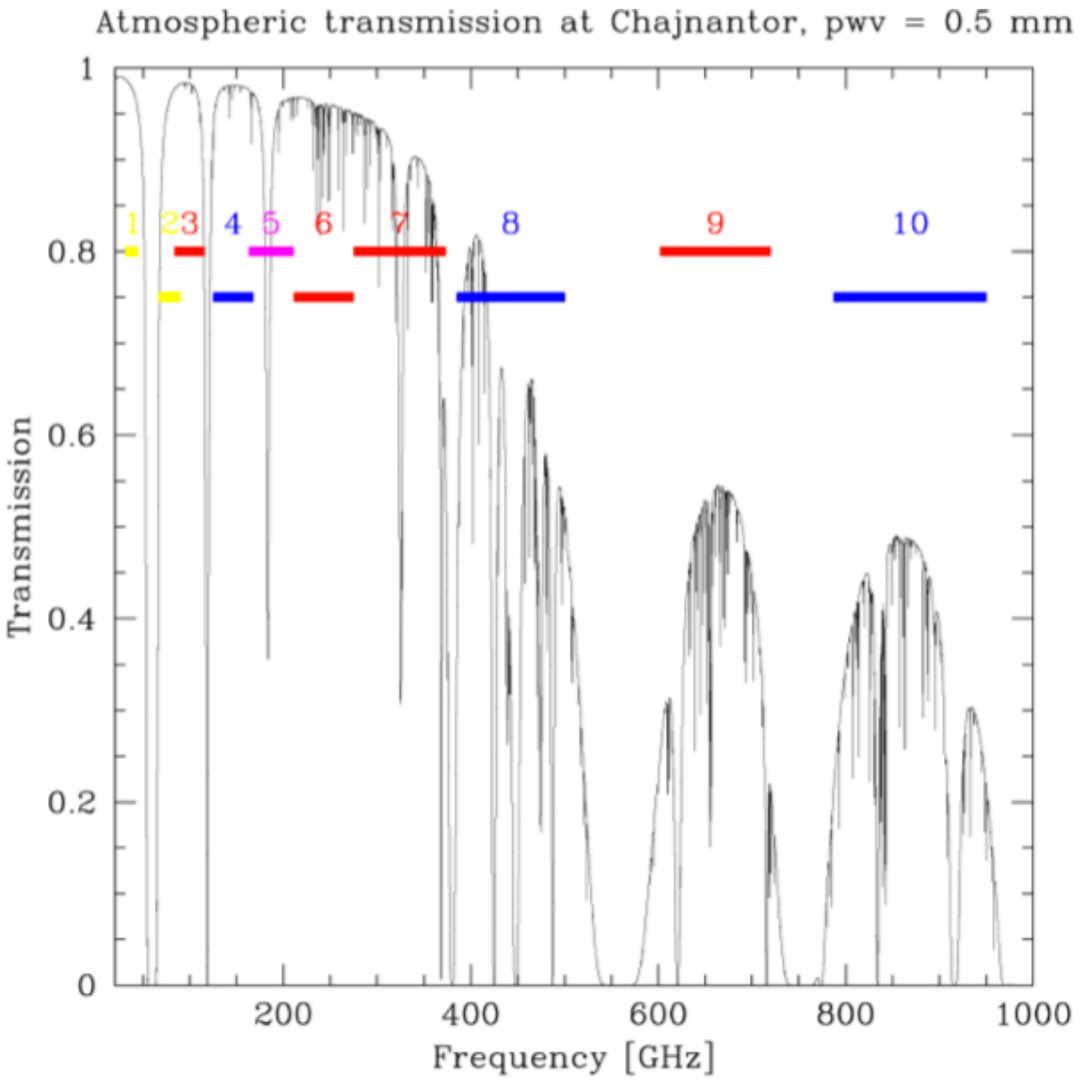
dead time in position switching,
mirror deformation, oscillations
--> re-work of mirror

Major New Initiative in EA: Band 1

- Band 1: one of the remaining receiver bands
- goal: access to lowest frequency band;
  35 - 50 (52) GHz

- current status:
  * Band 1 consortium: ASIAA (PI institute)
    NAOJ, Univ. of Chile, NRAO, HIA
  * approval to build prototype from
    ALMA Board and ADSC
  * key component down-selection: Jan 2013
  * **ASIAA to lead integration / testing / manufacturing (Band-1 receiver group)**

- target timeline:
  * prototype: end 2014
  * production of 73 cartridges: 2015 - 2018



Band-1 Science: 35-50 (52) GHz

main science drivers:

(1) ***study of the evolution of grains in protoplanetary disks***
(2) ***detection of molecular line emission from high-redshift galaxies***
(CO transition lines for redshifts z ~ 1-10)

additionally:

- molecular tracers of star formation: focus on large grains
- anomalous emission from very small grains
- Sunyaev-Zel'dovich (SZ) effect: cluster substructures
- pulsars and radio supernovae
- methanol and SiO masers
- probing magnetic fields with the Zeeman effect

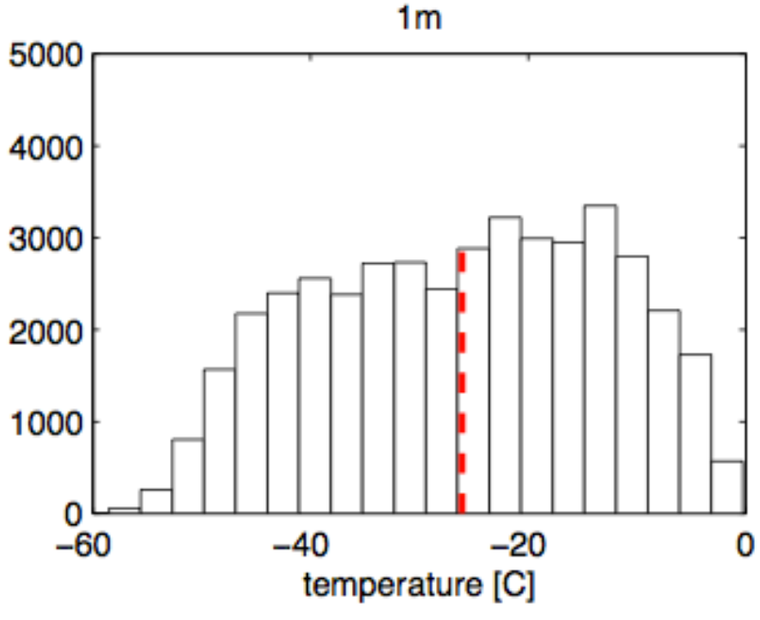
detailed ALMA Band-1 science cases just posted on arXiv

Major New Initiative:
The GreenLand Telescope (GLT)

immediate challenges:
(1) different environment
(2) moving logistics

Greenland Summit Station @ 3200m

different weather conditions !



primary: -50 deg C
secondary: -55 deg C
survival: -73 deg C

target date: 2015 /2016: first light from Thule (sea level)

GLT Science

talk by Makoto Inoue, Wednesday

(1) (sub-)millimeter VLBI (~10 % time)

black-hole shadow imaging / AGNs
[direct probe of GR in strong regime]

(2) single-dish operation

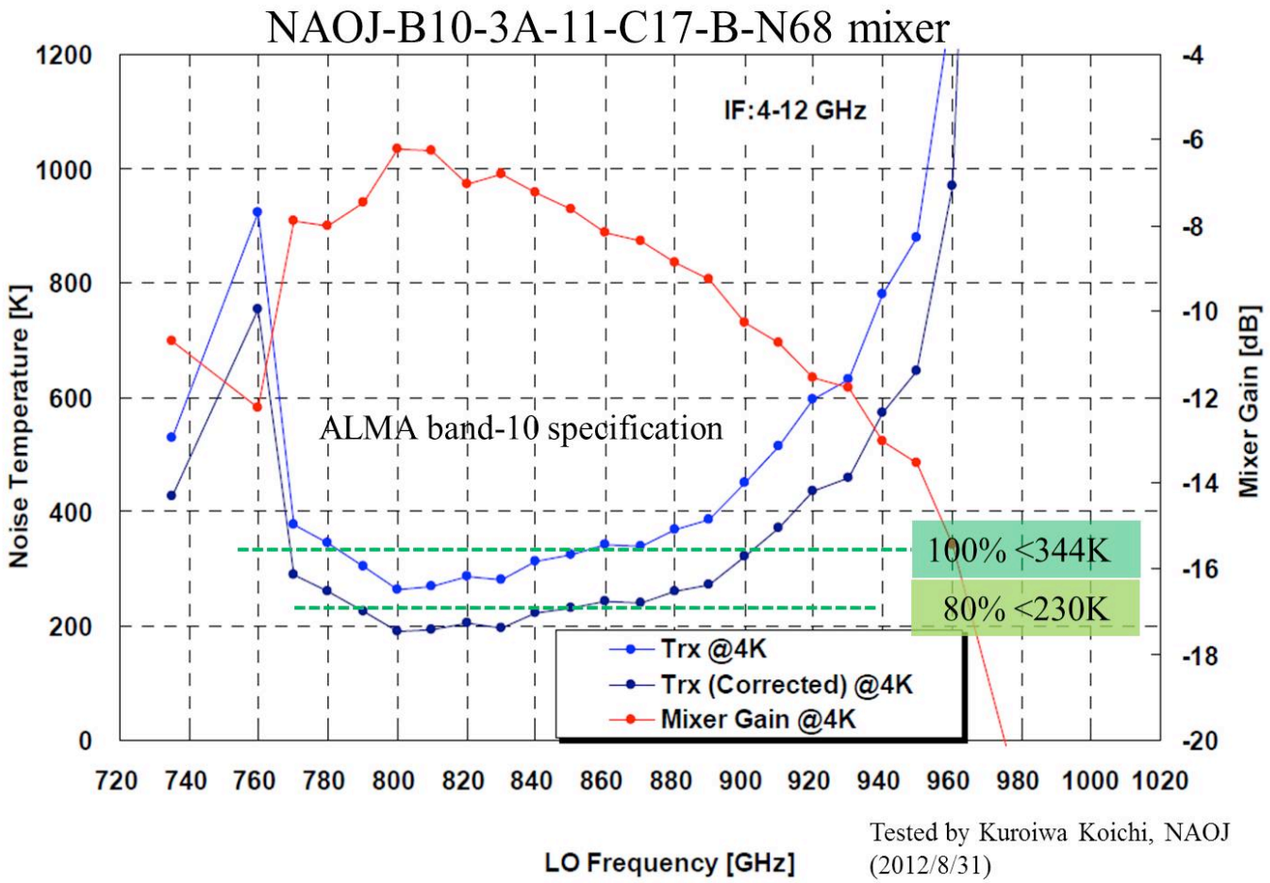
- THz science (windows around 1.3 THz and 1.5 THz
- lower frequency bands

ALMA synergy: (1) array phase-up

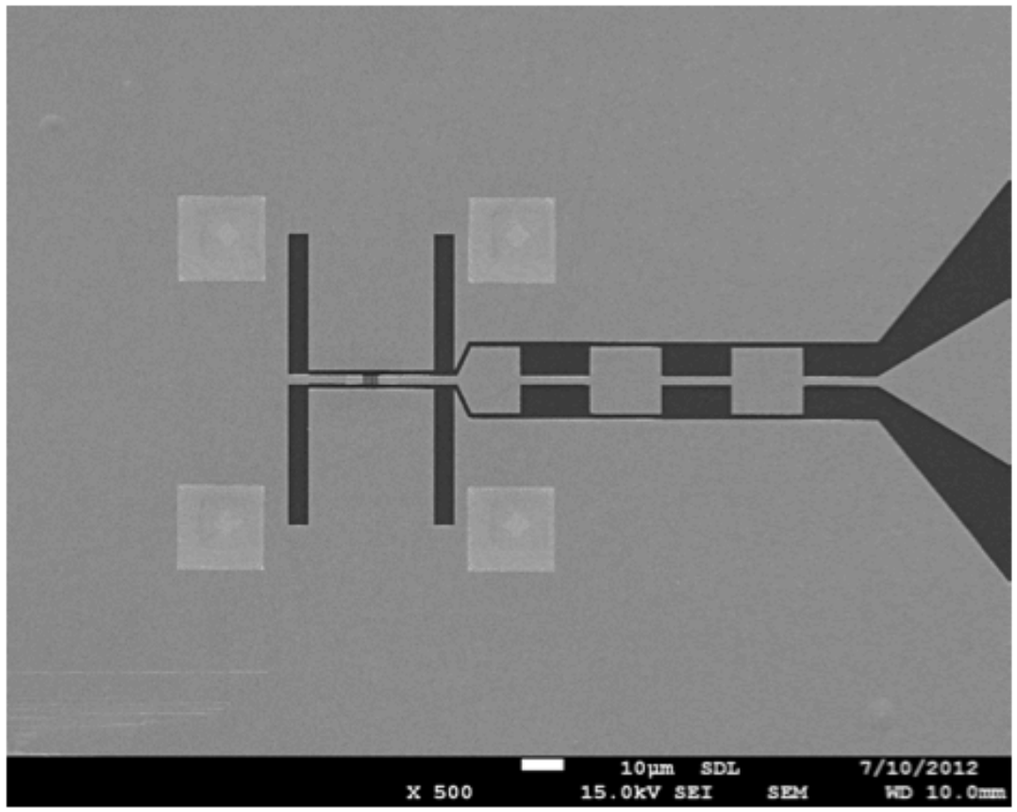
(2) Band 10 / 11 and single dish THz science

Continuous Efforts: Band 10 / THz Development

device fabrication for radio telescope



Receiver noise temperature of ALMA band-10 mixer, NAOJ-B10-3A-11-C17-B-N68, tested by NAOJ team



Scanning Electron Microscope (SEM) image of HEB mixer for 1.4THz.

Towards Science - more Initiatives and Activities

* contributions to telescope commissioning:

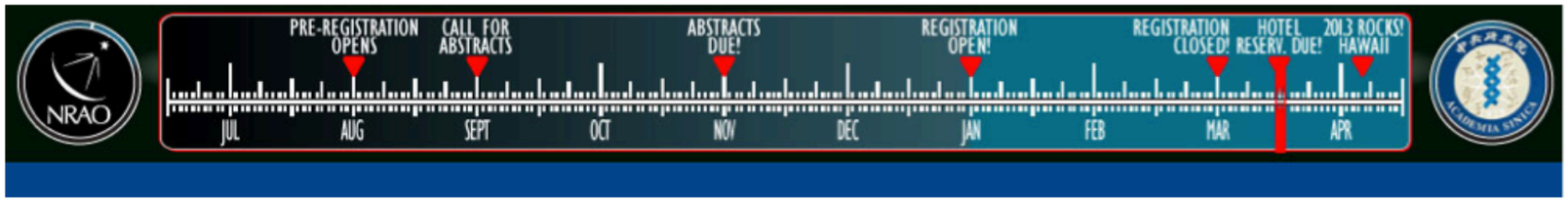
  - long-baseline testing
  - polarization

* Taiwan ARC @ ASIAA (Taipei) : local community support

  - working with Japan for user support core functions
  - working with NA for enhanced functions
  - organizing workshops / tutorials on-island in Taiwan, together with universities in Taiwan

ARC - Active Promotion of ALMA Science

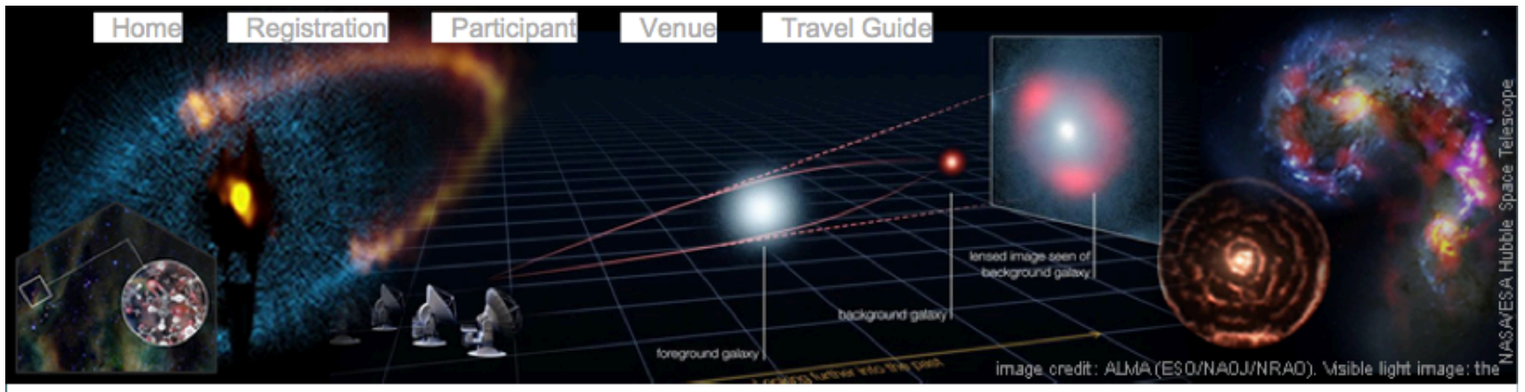
1- NA-Taiwan Science Workshop 2013, April 8-12 @ Hawaii



Transformational Science with ALMA: From Dust to Rocks to Planets
Formation and Evolution of Planetary Systems

April 8–12, 2013 at the Hilton Waikoloa Village, The Big Island of Hawaii

2 - East-Asian ALMA Science Workshop 2013, September 2-4 @ ASIAA



Registration Deadline: Aug 8, 2013

East-Asian ALMA Science Workshop 2013
Time: September 2-4, 2013
Place: ASIAA, Taipei, Taiwan

~100 participants, ~50 % from outside Taiwan
next workshop in Korea in summer 2014

ALMA-Taiwan Proposals / Science

	total number of proposals submitted	total number of proposals accepted	number of Taiwanese proposals submitted	number of Taiwanese proposals accepted
cycle 0	919	112 (550 h)	45	8 (33.7 hours)
cycle 1	1133	196 (880 h)	56	14 (47.2 hours)

cycle 0: first Taiwan 1st-author paper published (Wang et al. 2012)
cycle 1: overall proposal success rate ~ 1/6
Taiwan: 1/4
cycle 2: deadline December 5, 2013