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ASTE Status Report

Shin’ichiro Asayama and ASTE team

Atacama Submillimeter Telescope Experiment (ASTE)

- 10-m sub-mm telescope located at Pampla La Bola within Chajnantor area
- **Specifications of telescope:**
  - Surface accuracy: 19um
  - Pointing accuracy: 2” rms
  - Scientific Observing Time: 2,200h/year
- **Infrastructure:**
  - Diesel generators x 2 (max 150kw – 220V)
  - Fuel tanks (15,000 L x 2, consumption 300L/d)
  - Satellite Network (1Mbps)
  - Weather Station, web cameras, etc
- **The prime objectives of ASTE operations:**
  - to strength the proposals for the ALMA
  - to provide advanced science capabilities for the East Asian astronomers

Science Operation Policy

- NAOJ Chile Observatory TAC: 90%
  - Detailed operation plan discussed at JSAC.
  - 2 semesters of call for proposals provided East Asian community (JP, TW, KR) from 2014.
  - Guaranteed Time Observation (GTO)

    The ASTE consortium contributes to developments of instrumentation on ASTE, commissioning and science verification, and science operations. In return for doing these contributions, members of the ASTE consortium can apply for GTO.
  - Open Use Observations & GTO proposals are evaluated by same referees.
  - Observers remotely conduct their observations from Mitaka, SPdA facility, and their institutes (for experts).
- Chilean Time (CT) evaluated by CNTAC: 10%

ASTE Instrumentation

Receivers

Receiver	Type	Freq. [GHz]	HPBW [arcsec]	Npix	Npol
DASH345	Heterodyne	324-372	22	1	2
Band8	Heterodyne	385-500	17	1	2

Spectrometer

Spectrometer	Type	Quantization	BW [MHz]	Nchan	Δf [MHz]
MAC	XF	2-bit	512	1024	0.5
			128		0.125
WHSF	FX	3-bit	4096	4096*	1.0
			2048		0.5

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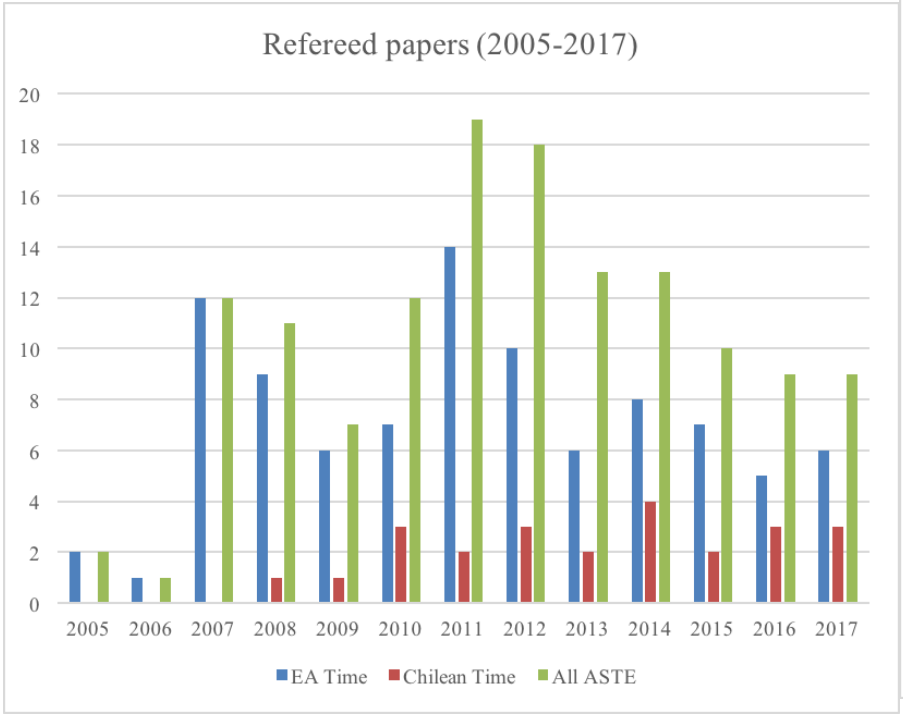
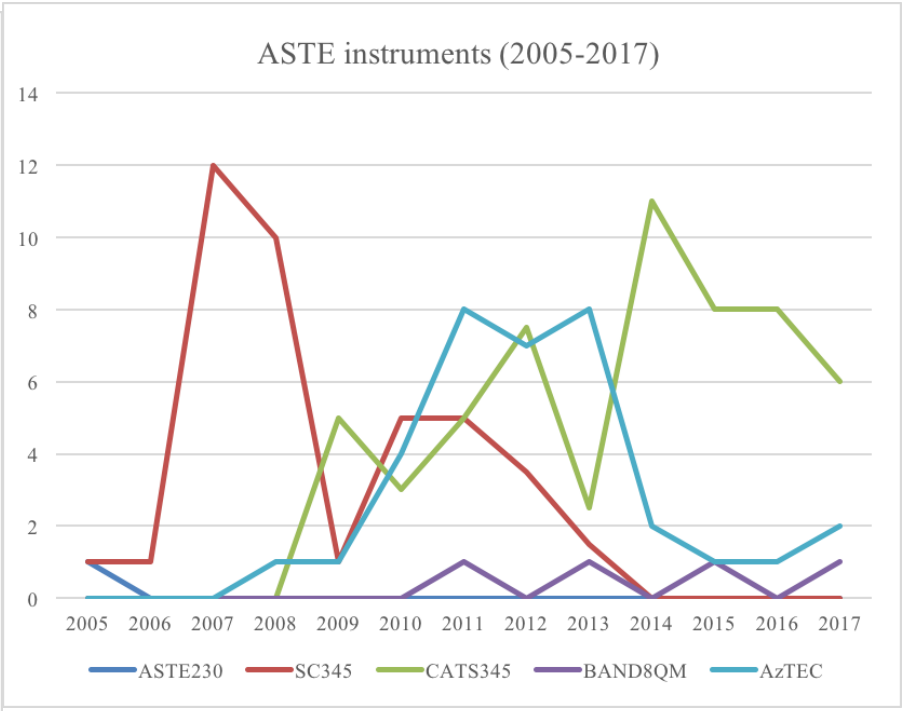
ASTE Science Operation – Status

ASTE Science Operation - Status

Trends in the number of publications.

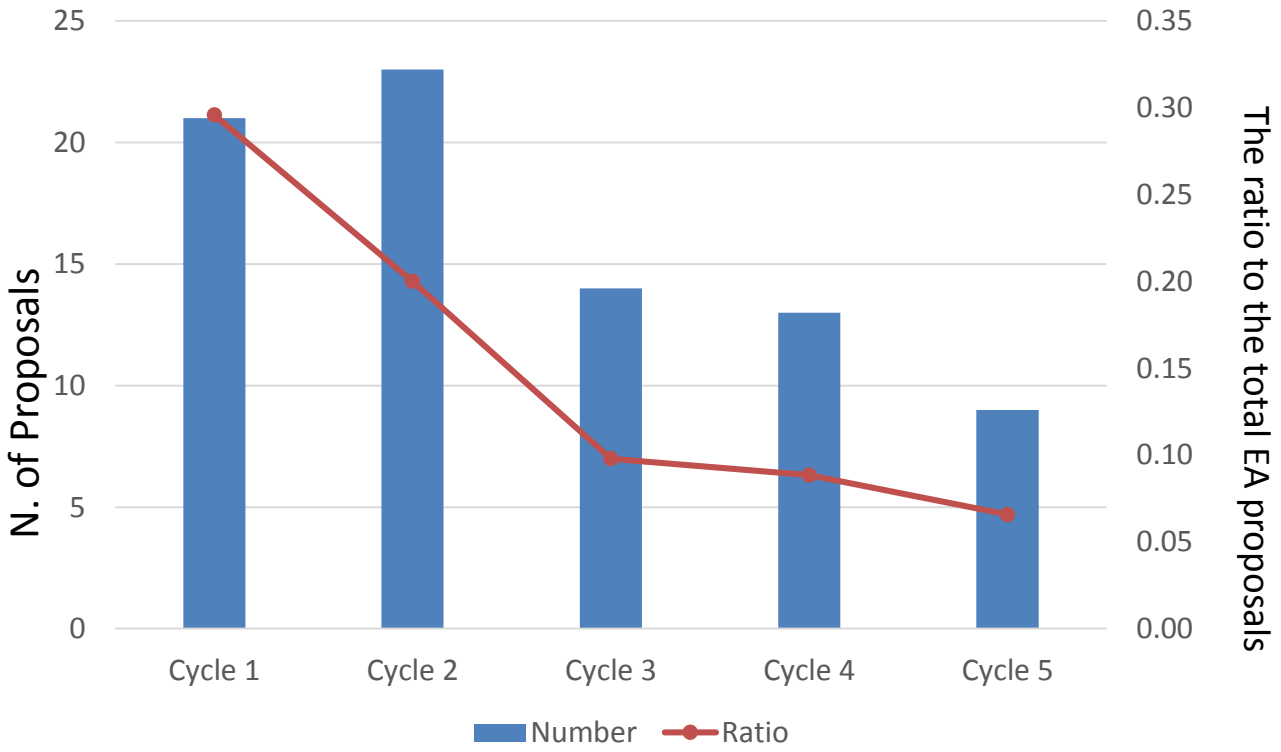
- Publication of CATS345 is the highest. Publication of AzTEC sporadic.
- The number of Band 8QM data is still not enough.
  - Need further promotion (Demo science data released in Nov 2017.)





ASTE Science Operation - Status

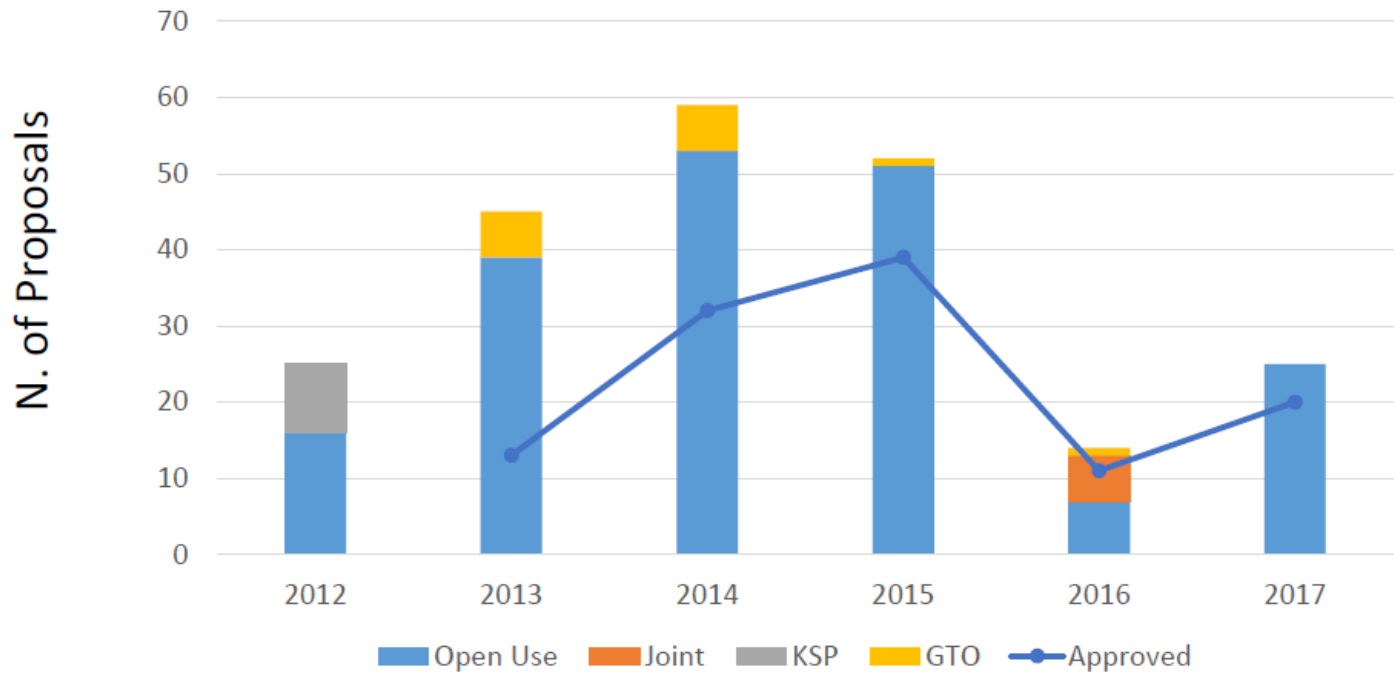
Accepted (ABC-rank) ALMA proposals in EA that used ASTE



ASTE Science Operation - Status

Trend of the Total open use time and the Number of Proposals.

	2012	2013	2014	2015	2016	2017
Total time [h]	360	630	2020	2152	900	1000



FY 2017

	Applied	Accepted
Open Use	25	20
Chile	5 (by Chile TAC)	

ASTE Science Operation - Status

2017 Open Use ： 2017 Jun – Sep (available time ~ 800 hours)

- Receivers : 345 GHz and 492 GHz heterodyne receivers.
- Spectrometers : MAC (BW[MHz]: 512/128)/WHSF (BW[MHz]: 4096/2048)

	East Asian Time				Chilean Time
	Total	345GHz	492GHz	Both (345GHz/492GHz)	
# submitted	25	11	9	5	
Requested time [h]	905	329	413	163	
# accepted	20	9	7	4	5
Accepted time [h]	693	278	279	136	122
Oversubscription (in #)	1.3	1.2	1.3	1.3	

ASTE Science Operation - Status

44% Execution (=359 hours of 815 hours) due to several issues.

- Snowstorm: Lost~1.5 month of our 4 month schedule.
  - ✓ Not enough commissioning time for the new 3 cartridge cryostats
  - ✓ No Chilean time observation
- Power Generator problem
  - ✓ Due to low temperature, ASTE power generator stopped because of fuel pipe plugging with paraffin deposition on August 18th.
- MAC Spectrometer trouble
  - ✓ The digitizer of the MAC Spectrometer system was ran down in July 2017. Most of high resolution observations were not able to be executed.

<u>Toward 2018</u>

- 456 hours observation will be carried over to 2018.
- We gave up the recovery for the MAC spectrometer system because it is too old (~20 years old).WHFS high resolution mode will be offered in 2018.

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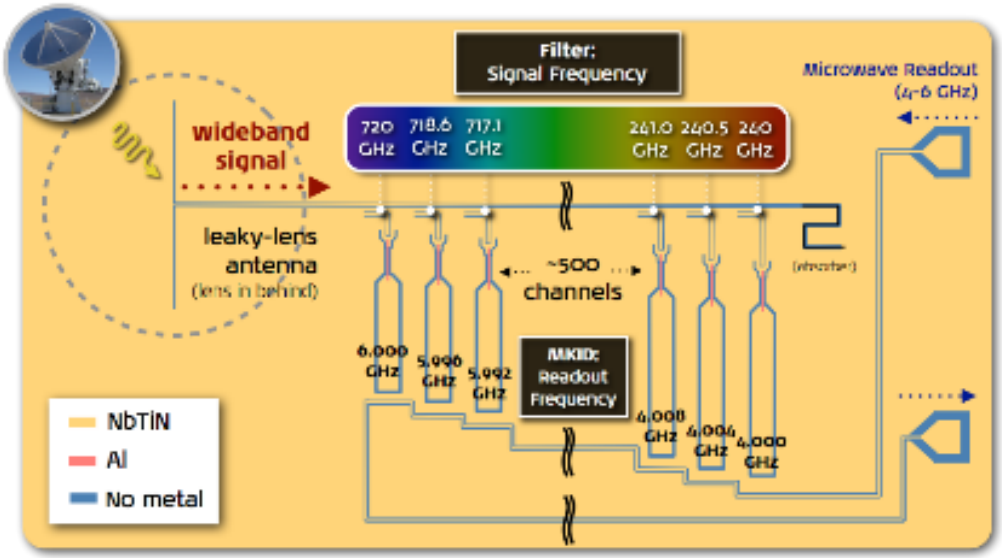
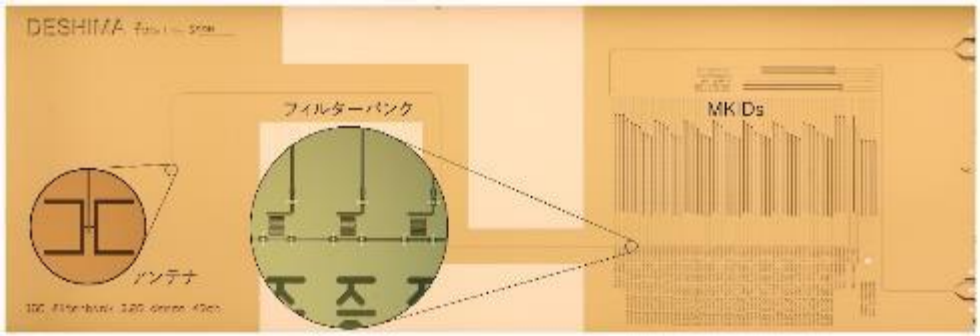
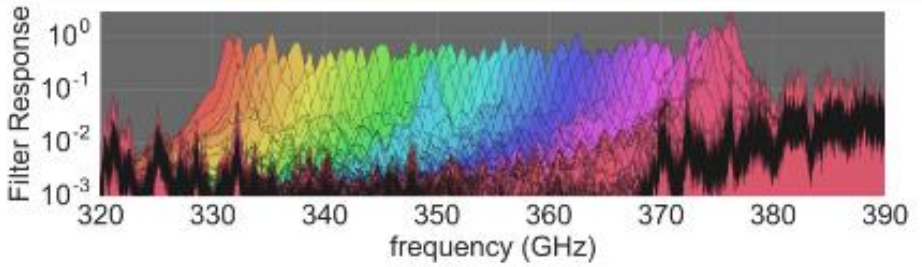
DESHIMA Commissioning Report

DESHIMA Commissioning on ASTE

- DESHIMA (Deep Spectroscopic High-redshift Mapper
  - An on-chip filterbank spectrometer with kinetic inductance detectors (KIDs).
- DESHIMA on the 10 m ASTE telescope.
  - Phase-1: 330-370 GHz band with 49 spectral channels (prototype).
  - Phase-2: target band 240-720 GHz and 2 spatial pixels).







Filter-bank chip (design: 49ch, F/dF = 350, 326-368 GHz)

Aim of the 2017 Campaign

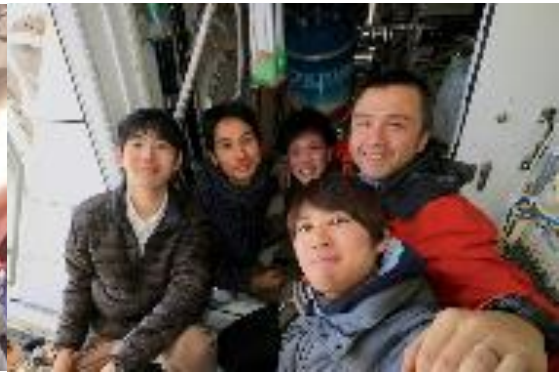
- **Baseline goal**
  - Test end-to-end operation of the DESHIMA system on ASTE, and confirm that we understand everything consistently between the lab and on ASTE.
    - Interface checks
    - Characterization of KIDs on ASTE
  - Identify problems that can be found only by an actual installation, and not in the lab.
  - In practical terms:
    - Full success: we are able to see continuum emission from a planet, we understand the response, and the cryostat can stay in Chile
    - Success: we are able to learn new lessons by operating KIDs in the ASTE cabin, either with or without signal from the sky.
    - Failure: we learn only problems that we could have addressed and solved in the lab.
- **Bonus goal**
  - Detection of an astronomical line signal using an on-chip filterbank.
  - If successful, this will be the first-light for a filterbank technology by any group.

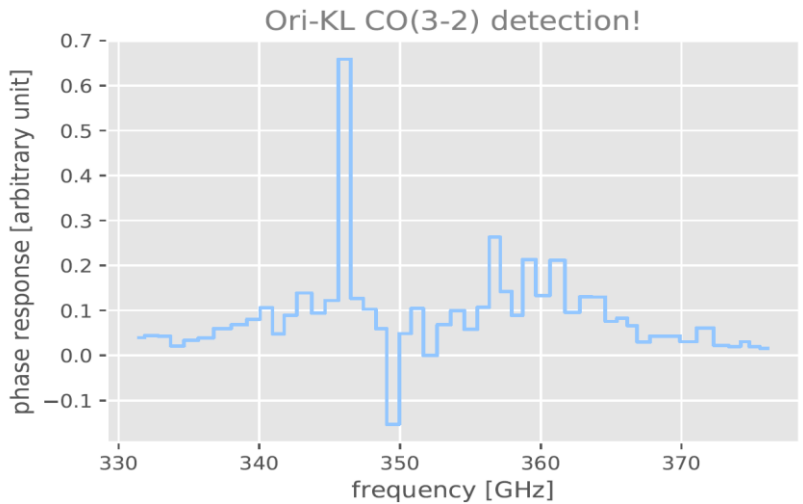
First light of DESHIMA on ASTE: on-chip filterbank spectrometer

Installed on ASTE since Oct 2017, DESHIMA has detected multiple astronomical sources in both continuum and line emission.

This is the first actual operation of an on-chip filterbank spectrometer on a telescope.

Details to be presented by next presentation





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ASTE Current Issues

ASTE Current Issues

- MAC Spectrometer trouble
  - The digitizer of the MAC Spectrometer system was ran down in July 2017. We gave up the recovery for the MAC spectrometer system because it is too old (~20 years old).WHFS high resolution mode will be offered in 2018.
- AZ Problem
  - During DESHIMA commissioning session, ASTE has gotten stuck/locked on Nov 26th.
  - There is an issue on AZ mechanism. The root cause of this issue is under investigation by MELCO

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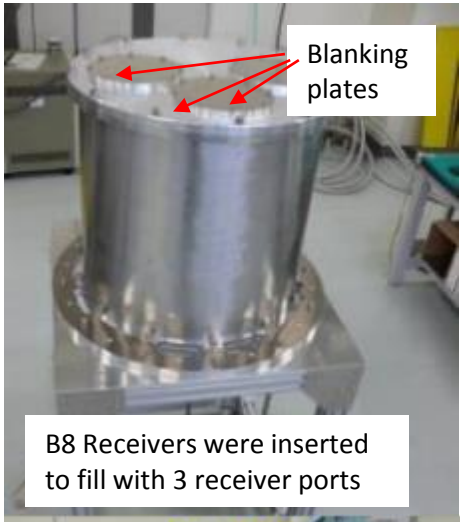
Mid-term Operation Plan

Medium-term Operation Plan

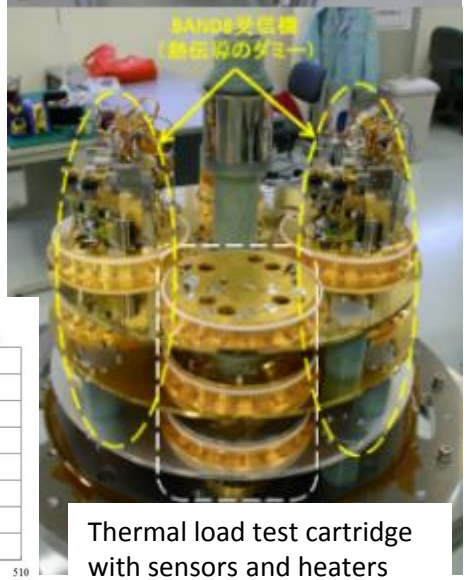
- Steady-state science operations with *ASTE future instruments*
- To maximize observing time for EA and Chilean community.
- To enhance synergy with ALMA and other telescopes including NRO 45m.
- ASTE Development Project to be extendable to ALMA.

Spectroscopic Observations

- New 3-cartridge cryostat
  - Operate 3 cartridge-type receivers simultaneously.
- Cartridge-type receivers
  - New 345GHz-band/ASTE BAND8
  - 0.9/1.3THz-RX **(**The University of Tokyo**)**
  - 230GHz-RX (The University of Electro-Communications)
  - 1-beam/4-beam BAND7+8 developed by KASI
- GPU Spectrometer developed by KASI

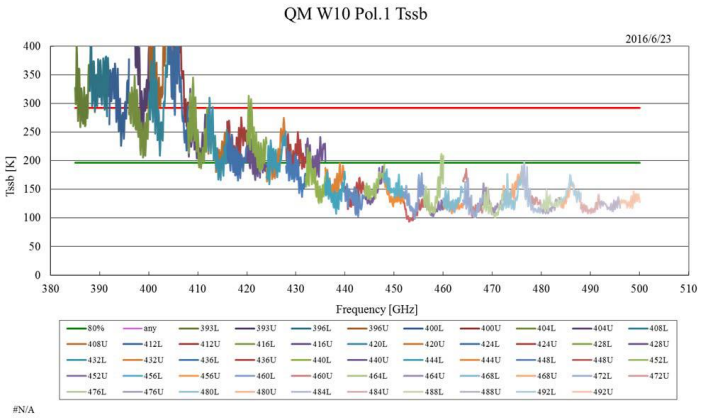


B8 Receivers were inserted to fill with 3 receiver ports

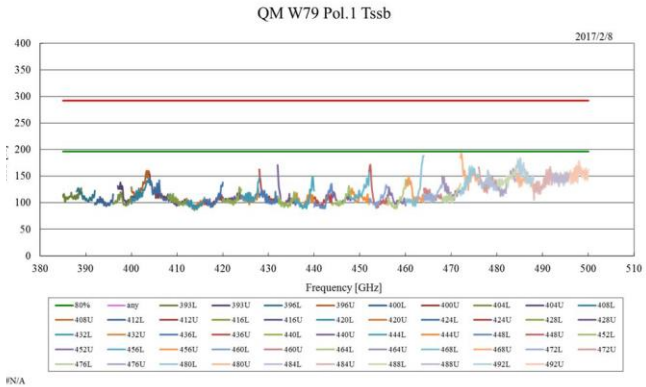


Thermal load test cartridge with sensors and heaters

Last year (2016/6/23)



Updated mixer (2017/2/8)



ASTE Summary

- The NAOJ Chile Observatory has established steady-state science operations of ASTE at 345 GHz and 450 GHz
- The mid-term operation plan of ASTE future instruments has been developed, with a long term vision that is connected to ALMA development and upgrades.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