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NAOJ
National Astronomical Observatory of Japan

# ASTE Status Report

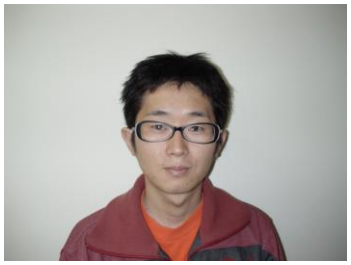
Shin’ichiro Asayama and ASTE team

# Atacama Submillimeter Telescope Experiment (ASTE)

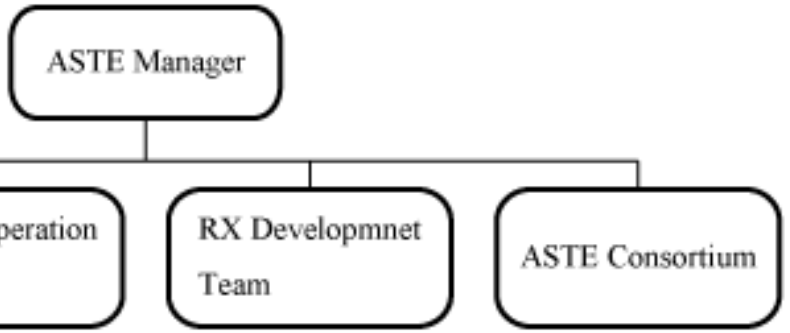
- 10-m sub-mm telescope located at Pampla La Bola within Chajnantor area
- **Specifications of telescope:**
  - Surface accuracy: 19um
  - Pointing accuracy: 2” rms
  - Scientific Observing Time: 2,200h/year
- **Infrastructure:**
  - Diesel generators x 2 (max 150kw – 220V)
  - Fuel tanks (15,000 L x 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

# ASTE Organization

Takeshi Okuda
(JAO Sr Instrument Engineer
from April,2016)



Shin'ichiro Asayama




Masumi Yamada

Daisuke Iono

Yasunori Fujii

The University of Chile,
and many Japanese Universities:
The University of Tokyo,
Hokkaido University,
Nagoya University,
Keio University,
Osaka Prefecture University,
Ibaraki University,
The University of Electro-Communications, and
Joetsu University of Education.

# 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

| Receiver | Type | Freq. [GHz] | HPBW [arcsec] | Npix | Npol | Status |
|---|---|---|---|---|---|---|
| CATS345 | Heterodyne | 324-372 | 22 | 1 | 1 | Decommission in 2014 |
| DASH345 | Heterodyne | 324-372 | 22 | 1 | 2 | Open from 2015 |
| Band8 | Heterodyne | 385-500 | 17 | 1 | 2 | Open from 2015 |
| ASTECAM | TES Bolometer | 270 | 28 | 169 | - | Commissioning from March 2016 |
| | | 350 | 22 | 271 | - | |

| Spectrometer | Type | Quantization | Bandwidth [MHz] | Nchan | Δf [MHz] | Status |
|---|---|---|---|---|---|---|
| MAC | XF | 2-bit | 512 | 1024 | 0.5 | Open |
| | | | 128 | | 0.125 | |
| WHSF | FX | 3-bit | 4096 | 4096* | 1.0 | Open from 2014b |
| | | | 2048 | | 0.5 | |

# Problems

Data acquisition from the WHSF spectrometer had a 1 second delay from the timing

- The effect is negligible for Position Switched observation mode (as the integration time is reduced by 1 second)
- The effect can be seen as a shift in source position for OTF mode, and can be noticeable for fast scan patterns.

The problem is currently fixed, but this problem affects all data taken using WHSF, during the period 2007 to September 27, 2016.

The correct data (with no shift) have been generated by “re-merging” the dataset
The collected data have been delivered to the PIs.

We apologize for any inconvenience that this have caused.

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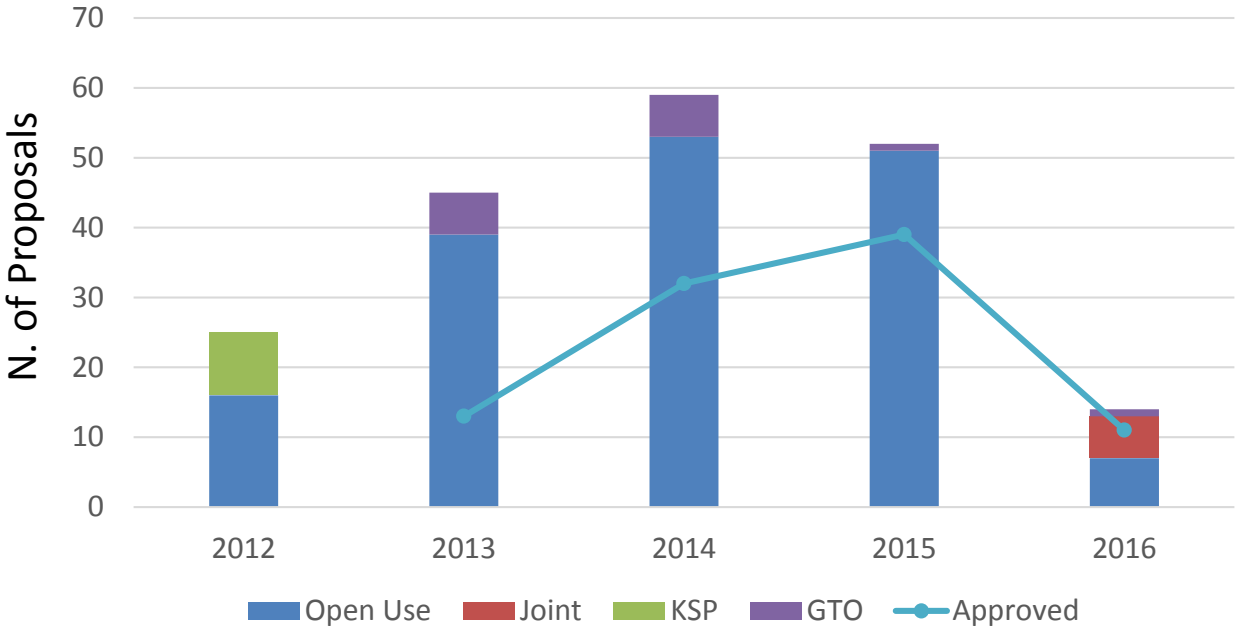
# ASTE Science Operation – Status

# ASTE Science Operation - Status

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

| | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| Total time [h] | 360 | 630 | 2020 | 2152 | 900 |



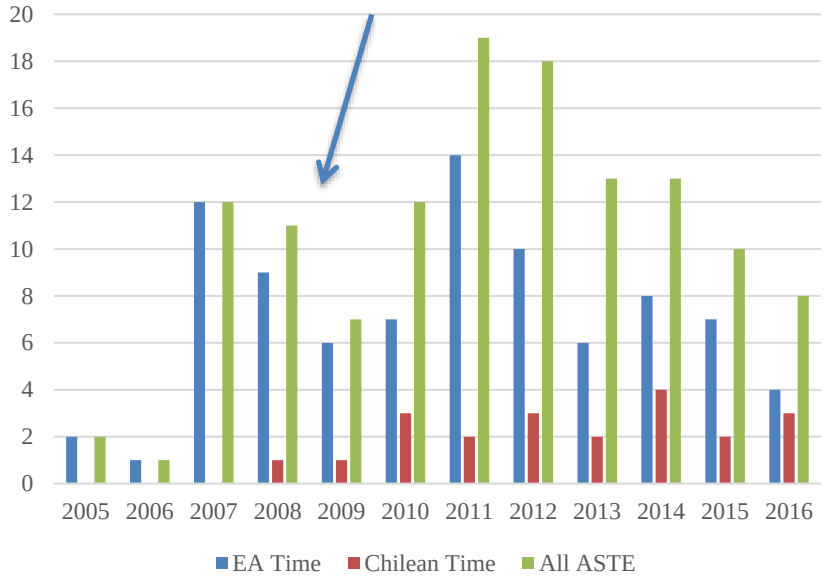

FY 2016

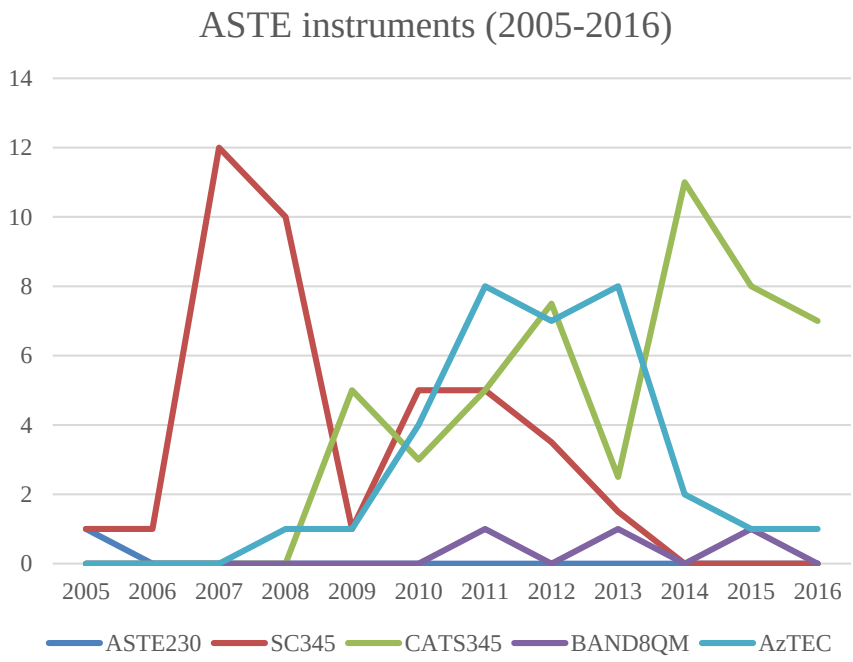
| | Applied | Accepted |
|---|---|---|
| Open Use | 7 | 6 |
| Joint | 6 | 4 |
| GTO | 1 | 1 |
| Chile | 3 (by Chile TAC) | |

# ASTE Science Operation - Status

Trends in the number of publications.

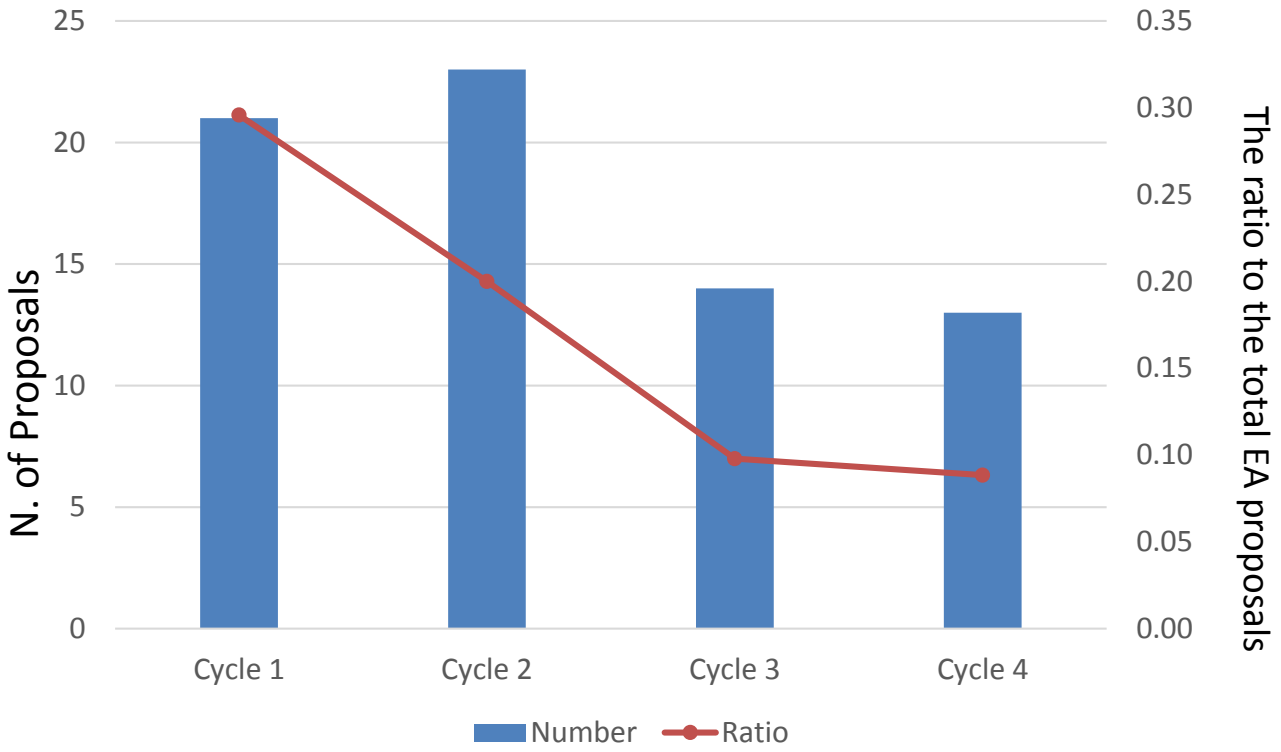
- Publication of CATS345, AzTEC data ongoing.
- The number of Band 8QM data is still not enough.
  - Need further promotion.



# ASTE Science Operation - Status

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



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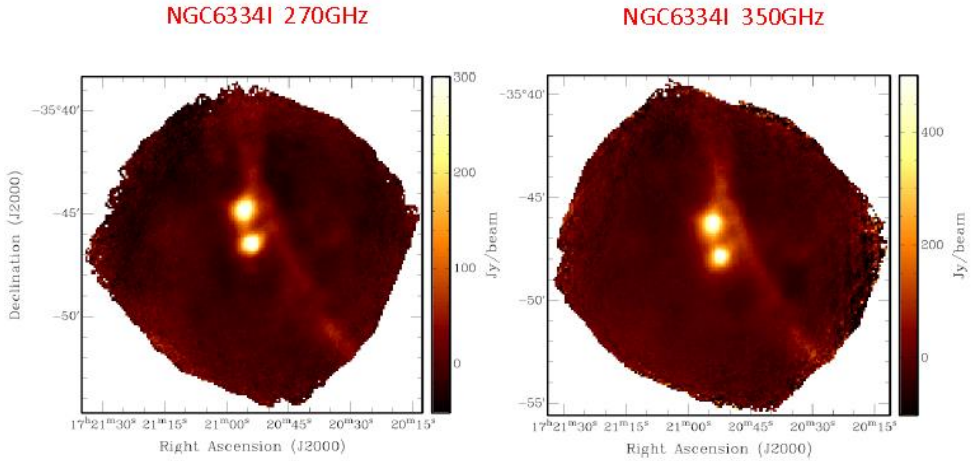
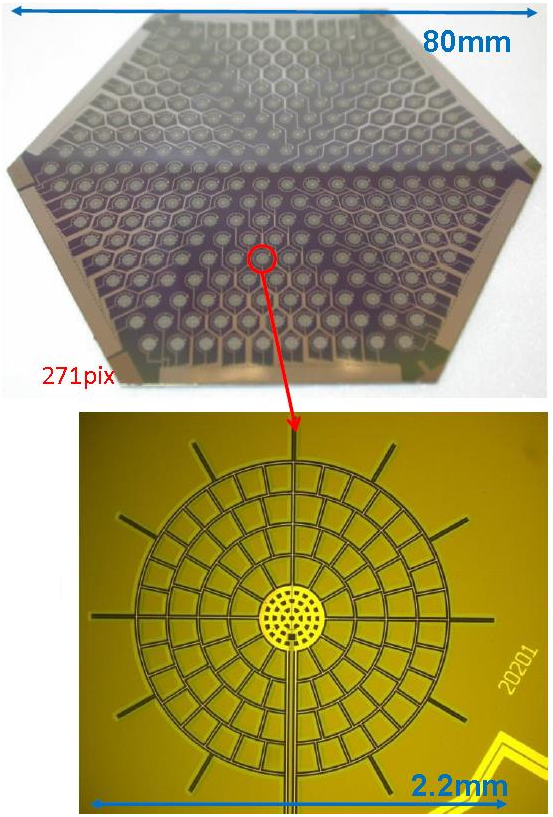
# ASTE Science Operation – 2016 Report

# ASTE Science Operation - 2016 Report

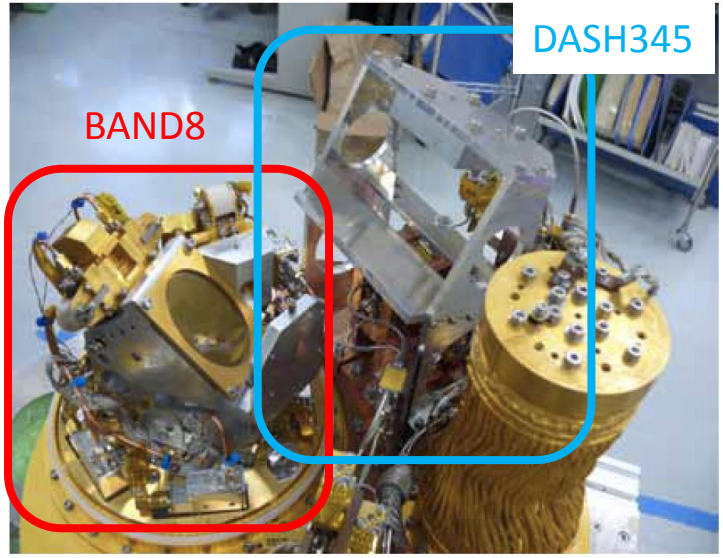
- Science operation
  - **<u>ASTECAM CSV (Mar – Jul)</u>**
    - CSV plan reviewed by JSAC.



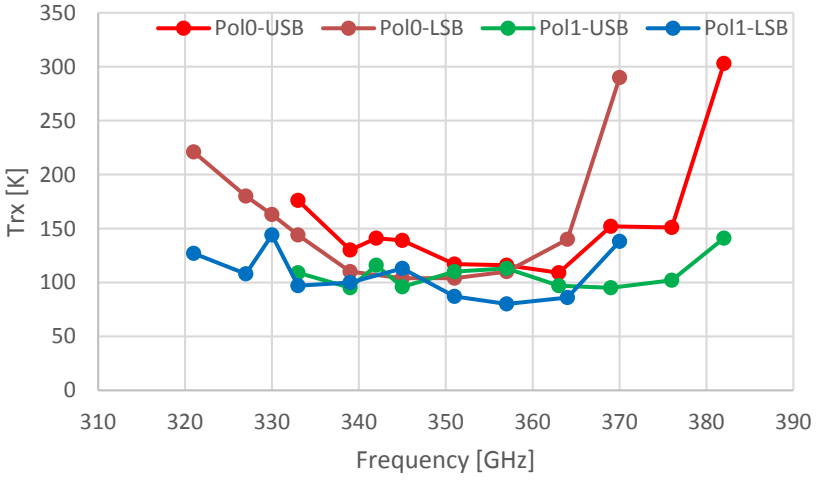




  - **<u>Open use observations with DASH345/BAND8 (Sep - Dec)</u>**
    - Total time: *<u>720 hours</u>* for open use

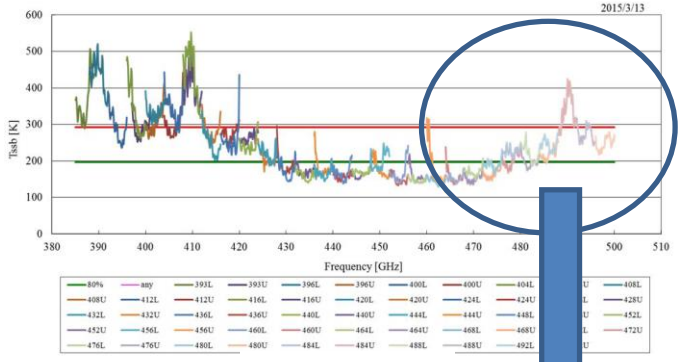
# ASTE Science Operation - 2016 Report



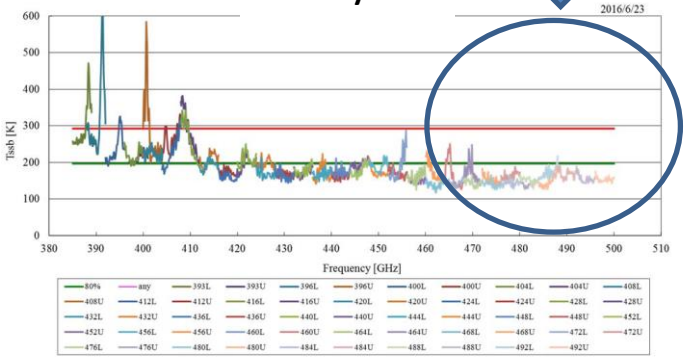

- DASH345
  - 1-pix 345GHz-band RX (2-pol/2SB)
    - Tsys (DASH345) < Tsys(CATS345)
- ASTE BAND8
  - Fixed and upgraded BAND8 QM
  - Operated by ALMA FEMC (NRAO)




Last year




This year



# ASTE Science Operation - 2016 Report

2016 Open Use ：2016 Sep – Dec (available time ~ 900 hours)

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

| | Total Time (except Chilean time) | Details | | | |
|---|---|---|---|---|---|
| | | Open Use (492GHz time shown in parentheses) | Joint | GTO | Chile |
| # submitted | 14 | 7 (3) | 6 | 1 | |
| Request time [h] | 428 | 262 (117) | 121 | 45 | |
| # accepted | 11 | 6 (3) | 4 | 1 | 3 |
| Accepted time [h] | 376 | 241 (117) | 90 | 45 | 90 |
| Oversubscription | 1.3 | 1.3 (1.0) | 1.5 | 1.0 | |

Note: One polarization observation was offered at 492 GHz receiver due to a malfunction of one of the receiver.

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# Medium-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.

# ASTE Development and Upgrades

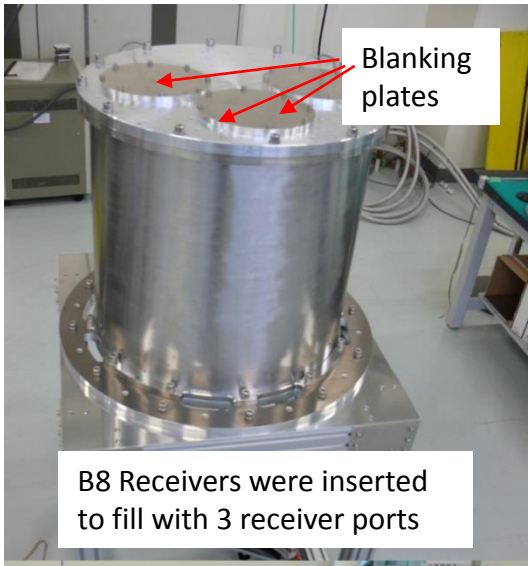
- To connect ALMA future developments with a long term vision.

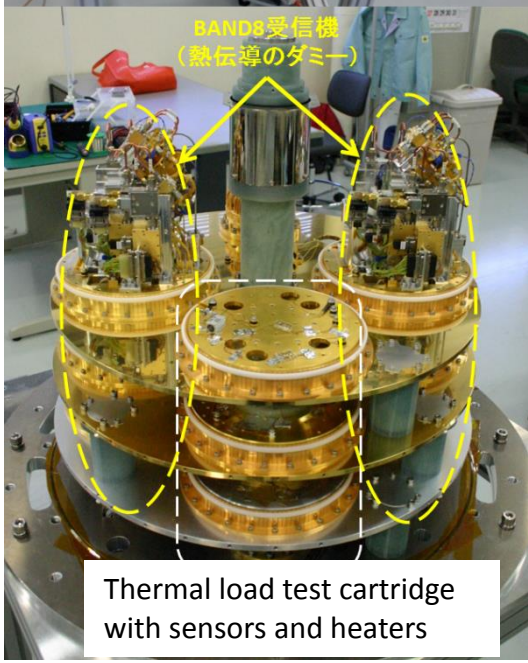
| ASTE | ALMA |
|---|---|
| 0.9/1.3 THz receiver | BAND11 |
| Multi-beam receiver (4-beam BAND7+8) | Multi-beam receiver for TP array |
| GPU Spectrometer | Spectrometer for TP array |

- To supplement ALMA
  - ASTECAM, Polarimeter on ASTECAM
  - DESHIMA

# Spectroscopic Observations

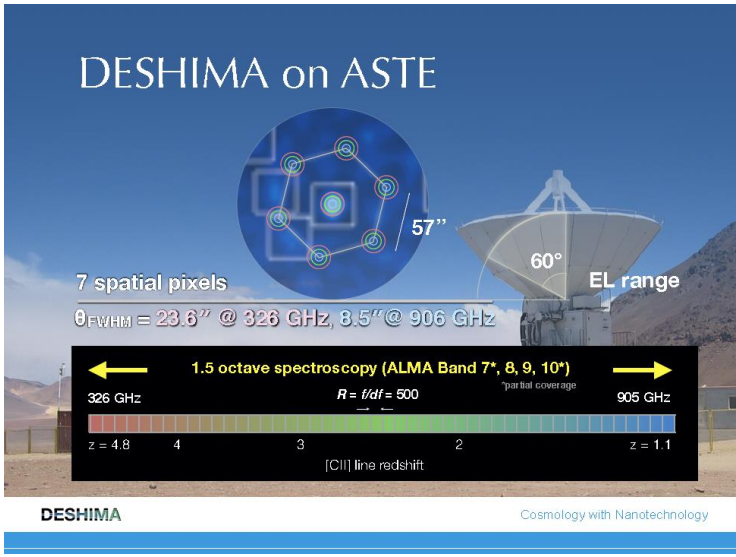
- New 3-cartridge cryostat
  - Operate 3 cartridge-type receivers simultaneously.
  - Developed by NAOJ ATC
  - Operated on ASTE from 2017
- Cartridge-type receivers
  - New 345GHz-band (modified DASH345)
  - ASTE BAND8
  - 0.9/1.3THz-RX **(**The University of Tokyo**)**
  - 230GHz-RX (The University of Electro-Communications)
  - 1-beam/4-beam BAND7+8 developed by KASI
- GPU Spectrometer developed by KASI

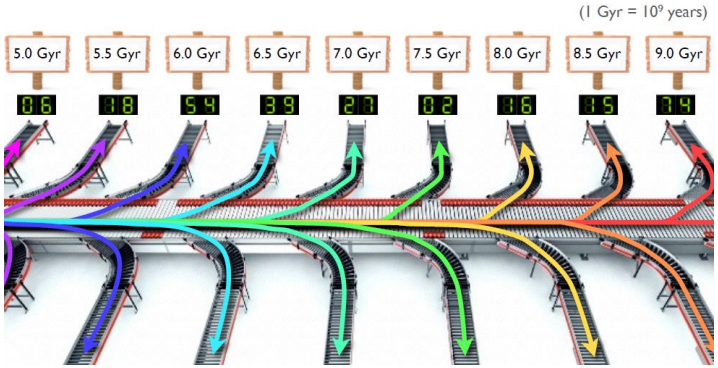


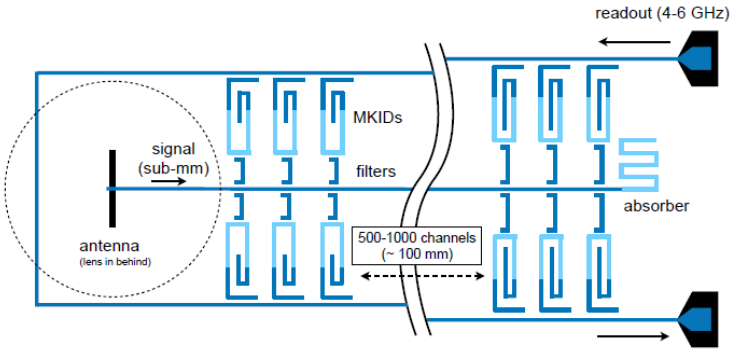



# Continuum Observations

- ASTECAM for open use in 2018.
  - Under discussion.
- Polarimeter on ASTECAM (*A-Pol*)
- DESHIMA
  - On-chip imaging spectrograph based on superconducting resonators
  - developed by TU Delft
  - operated with ASTECAM
  - 326-905 GHz w/ R=500
  - Mapping Submm Universe



# Operation schedule 2016-19

| | Mar | Apr. | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | ASTECAM(270GHz/350GHz) | | | | | DASH345 | | | | | | |
| | | | | | | BAND8 | | | | | | |
| 2017 | | | New 345GHz-RX | | | | | DESHIMA | | | | |
| | | | BAND8 | | | | | | | | | |
| 2018 | *ASTECAM | | | | | | | | | | | |
| | +DESHIMA/A-Pol | | | | | | | | | | | |
| 2019 | *4-beam BAND7+8 (Science Operations) | | | | | | | | | | | |
| | 345 GHz-RX (backup) | | | | | | | | | | | |
| 2020 | (TBD) | | | | | | | | | | | |

| Year | Open Use | Commissioning |
|---|---|---|
| 2016 | DASH345/BAND8 | ASTECAM |
| 2017 | 345GHz/BAND8 | BAND7+8 |
| 2018 | *ASTECAM | Full-DESHIMA/A-Pol |
| 2019 | *4-beam BAN7+8/345GHz | TBD |

*To be subjected to reviews and be decided for open use

# Summary

- The NAOJ Chile Observatory has steadily established the steady-state science operations of ASTE with the current capabilities and is planning the operations to maximize observing time and to save the resources.
- The medium-term operation plan with ASTE future instruments has been developed.
- ASTE Development and Upgrades to be connect ALMA future developments with a long term vision.