



Update on the East Asia ALMA Development Program – the first steps towards the implementation of the ALMA2030 Wideband Sensitivity Upgrade

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The ALMA (Atacama Large Millimeter/sub-millimeter Array) telescope has been producing ground-breaking science since 2011, but it is mostly based on technology from the 2000s. In order to keep ALMA competitive in the coming decade, timely updates are necessary in order to further improve the science output of the telescope. These updates are planned and executed through the ALMA Development Program based on the vision developed in collaboration between the Observatory and the Community in the ALMA Development Roadmap [1]. The highest priority is the increase of the IF bandwidth of the receivers by at least a factor x2 (goal x4) and the update of the related electronics, which is now known as the ALMA2030 Wideband Sensitivity Upgrade [2]. The ALMA Development Program is composed of Projects and Studies managed by the ALMA regions: East Asia, Europe and North America. In this contribution, we provide an update on the East Asia Development Program, which was last reported in [3].

The ALMA Band 1 (35-50 GHz) receiver construction project, led by ASIAA in collaboration with NAOJ, has been nearly completed and receivers are currently being integrated in the array in Chile. This new frequency band will be used for Open-Use scientific observations from Cycle 10, starting in October 2023. The corrugated horns installed in the final production cartridges have been fabricated in-house at NAOJ by all-metal 3D-printing and show similar performance to direct machined horns. This is to our knowledge the first time that 3D-printed components will be used for mm-wave observations.

The ALMA Band 2 (67-116 GHz) receiver project, led by ESO in collaboration with NAOJ, is approaching the end of the pre-production phase with the goal to build six pre-production cartridge receivers. NAOJ contributes the design and production of receiver optics, including warm lenses, corrugated horns and OMTs.

The ACA spectrometer project, led by KASI in collaboration with NAOJ, is also approaching completion. The new instrument, based on GPU technology, has been installed and commissioned at the high-site, and it is ready to provide improved processing capabilities for the Total Power array from Cycle 10.

The ALMA Board approved a new East Asia Project in November 2022, the ALMA2030 Data Transmission System (DTS). This is a project led by NAOJ in collaboration with NRAO, and in its Phase 1, it intends to design and prototype the new digital link between the antennas and the 2nd Generation Correlator, which will be built at the Operations Support Facility (OSF) at 3000 m. This DTS will be based on Ethernet standards and built using commercially available components as much as possible. It will address the goal to increase the IF bandwidth of receivers by a factor 4, and also the mid-term goal of increasing the maximum baseline length in the array.

In addition to these projects, NAOJ is doing fundamental research on wideband receivers, multibeam receivers, microfabrication techniques, microwave photonics, application of GPU technology to future correlators, and software. A brief update on recent advances in these studies will be provided in this contribution.

References

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