

NATIONAL RADIO ASTRONOMY OBSERVATORY
ALMA Development Cycle 7 Studies

Cycle 7 NRAO ALMA Development Study Proposal – ALMA CLOA Improvements and Upgrades

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ABSTRACT

As delivered, the ALMA Photonic LO currently operates within its original specifications. However, as we anticipate future directions for ALMA science, such as the longer baselines articulated in the ALMA ASAC 2030 Roadmap and ALMA Development Roadmap reports, enhanced capabilities are envisioned that the existing specifications were not designed to support (for example, the current maximum AOS-to-antenna pad distance where all specifications are met is 15 km). The analysis and testing conducted under this study will help provide a roadmap for ALMA scientists to proactively plan and budget for technical enhancements that will be required to support future science goals. This longer term groundwork will be carried out by the lead experts that designed, built, tested, and delivered both versions of the current ALMA Central LO Article, and who are therefore fully versed in the ALMA requirements and interfaces.

The areas that we have targeted for enhanced performance in this study are motivated by the following goals:

- To provide a clear roadmap towards the scientific goals made possible by extending ALMA to longer baselines, by pro-actively investigating the changes necessary to the Central LO, in order for it to support longer distances to the antennas with adequate phase stability, to allow for higher resolution imaging.
- To improve array visibility and coherence, especially for Bands 8-10 to get maximum value from the limited observing hours in these bands.
- To improve antenna-to-antenna phase stability by improvement to the Central LO photonic line length correction, providing better visibility which will also have higher impact on the shorter wavelength bands.
- To increase the dynamic range and resolution of the ALMA active phase correction, thereby lengthening the amount of time that ALMA can maintain exceptional phase stability before recalibrating.
- To present budgetary figures linked to the various options, as well as the timelines that will be required to implement and deploy the upgrades.

The study would ultimately provide a pathway for the ALMA Photonic LO to evolve.