

SETI

Breakthrough Listen technosignature searches with ALPACA

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Breakthrough Listen has deployed a receiver / detector backend (MacMahon et al. 2018) to the GBO which has been in operation since the beginning of 2016, and represents the most capable digital spectrometer currently in operation anywhere in the world. Listen's purchase of 20% of the available time on GBT has enabled the team to undertake the most comprehensive, sensitive, and intensive search for extraterrestrial intelligence in history. To date, Listen has primarily used the single pixel receivers at L, S, C, and X-band, to perform technosignature searches of thousands of individual stars (e.g., Price et al. 2020).

The single pixel feeds have also been used for surveys of the Galactic center and some of the Galactic plane (Gajjar et al. 2021), but are not optimal for this purpose, or for planned surveys of nearby galaxies, globular clusters, and other extended objects (Lacki et al. 2021). The 40 beams provided by ALPACA on the GBT would enable a dramatic increase in survey speed across a range of usable frequencies (avoiding bright RFI in the band) that is not much less than the usable band delivered by the current L-band feed. This will enable Listen to undertake a northern-hemisphere counterpart to the current Breakthrough Listen Galactic plane survey at Parkes, with an order of magnitude improvement in survey speed compared to the use of the current single-pixel receiver, and with better rejection of RFI.

The use of ALPACA for Breakthrough Listen surveys will not add to proposal pressure on the telescope, since it will primarily be used during Listen's purchased time. In fact, the availability of spare 100 GbE ports on the ALPACA switch can potentially allow commensal use of the telescope, reducing proposal pressure via, for example, simultaneous technosignature and pulsar searches of the Galactic center and plane, or of globular clusters.

The Breakthrough Listen backend is also made available by the Listen team for up to 50 hours of shared risk observing each semester. To date, guest users have primarily undertaken studies of pulsars and FRBs, but the flexibility of the DSP hardware (allowing voltage capture, as well as total power spectrograms with easily-configurable frequency and time resolution), combined with the field of view of ALPACA, make this an attractive combination for all kinds of surveys.