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BLADE: ALLEN TELESCOPE ARRAY GPU ACCELERATED REAL-TIME BEAMFORMER

**Abstract**

The Allen Telescope Array (ATA) is a radio interferometer composed of 42 antennas optimized for the Search for Extraterrestrial Intelligence (SETI). The array is made up of 6.1-meter diameter offset Gregorian telescope elements distributed randomly with a maximum baseline of 300 meters. The recently upgraded cryo-cooled log-periodic antenna feed (known as Antonio Feed) is sensitive to a wide and continuous range of frequencies ranging from 900 MHz to 12 GHz.

Breakthrough Listen Accelerated DSP Engine (BLADE) is a C++20 GPU-based computer software developed in-house to process data produced by the array. It is being used in production at the Allen Telescope Array to combine signals received by individual antennas steering the sensitivity towards a target, a technique known as "beamforming". Moreover, BLADE is also capable to post-channelize the beam-formed data into high-resolution (1.0 Hz/bin) spectrogram in real-time for SETI search. Currently, a twenty-antenna multi-beam observation routine at the Allen Telescope Array produces a 60 GHz of complex 8-bit integer stream of aggregated data that is processed (beamformed and channelized) in real-time by BLADE. Compute kernels are written in CUDA and leverage the power of NVIDIA GPUs.

In this talk, we are going to discuss how a software-defined telescope that processes observational data in real-time can enable new scientific capabilities. As well as how the modular architecture of BLADE can handle the required data throughput at the same time as being easily extensible.