Development of Total Power GPU Spectrometer for ALMA Wideband Sensitivity Upgrade

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The ALMA observatory is currently carrying out the Wideband Sensitivity Upgrade (WSU) program with the aim of broadening the Intermediate Frequency (IF) bandwidth by at least a factor of two. As part of this program, the spectrometer team formed by Korea Astronomy and Space Science Institute (KASI) and National Astronomical Observatory of Japan (NAOJ) is developing a new spectrometer called Total Power GPU Spectrometer (TPGS).

This spectrometer has been designed to receive digitized IF signals from four antennas in the ALMA Total Power Array. The data rate from one antenna is 240 Gbps (6 bit x 40 G samples per second) per polarization per sideband. The team has developed prototype code to receive this large amount of data using 400 GbE network cards and Data Plane Development Kit (DPDK). The team has also made the baseline design of the digital signal processing chain based on Polyphase Filter Bank, developed prototype GPU code of some digital signal processing elements, and made the preliminary software design. As a result, the team passed Preliminary Design Review (PDR) in January 2026. This presentation provides the latest status of this new spectrometer development.