

Testing of the Triggering Interferometric Sum Correlator and the Tunable Universal Filtering Frontend

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The Antarctic Impulsive Transient Antenna (ANITA) is a balloon-borne radio experiment that is a collaboration between multiple universities, including Ohio State University and is designed to detect ultra-high energy (UHE) neutrinos and cosmic rays. The fourth iteration of ANITA is currently flying and was launched on December 2, 2016 in Antarctica. ANITA 4 will fly for twenty to forty-five days at heights that range from thirty-five to forty kilometers. After ascending to these altitudes, ANITA 4 observes the ice below it for radio pulses that are a result of neutrino interactions with the ice.

During the summer, two of the main components of the ANITA 4 data acquisition system were worked on at Ohio State University (OSU). These components were the Triggering Interferometric Sum Correlator (TISC) and the Tunable Universal Filtering Frontend (TUFF). The TISC was designed to make the ANITA 4 triggering system more efficient and enable it to observe more frequent, low-energy events. The TUFF was designed to block out certain continuous wave frequencies. Eighteen TUFFs, four per quadrant of ANITA and two extra, were assembled and then the hardware problems were debugged and fixed for both circuit boards. Different software was required for each board to help calibrate the various components while also ensuring that they communicated correctly with the rest of ANITA 4. The boards were also tested in environments similar to those where ANITA 4 is currently flying. While testing the TISC, it was found that some of the components, namely the Field Programmable Gate Arrays, did not work correctly. This problem caused specific bits of data to be inverted or locked into state. This in turn made the TISC not perform correctly and made it unusable for ANITA 4. The TUFF was assembled and modified based on subsequent tests and is currently onboard ANITA 4. The TUFF should allow ANITA 4 to obtain more extensive data about cosmic rays and UHE neutrino interactions during its flight.