Searching for Slow and Fast Transients with the VLA Low Band Ionospheric and Transient Experiment (VLITE)

Emil Polisensky[(1)], Namir Kassim[(1)], Wendy Peters[(1)], Scott Hyman[(2, 6)], Paul Ray[(3)], Julia Deneva[(4)], Fernando Cardoso[(5)], Tracy Clarke[(1)], Simona Giacintucci[(6)], Joseph Helmboldt[(1)], Tony Mroczkowski[(4)], Emily Cleland[(7)]
(1) Naval Research Laboratory, Remote Sensing Division, Washington, DC 20375 USA
(2) Sweet Briar College, Department of Engineering and Physics, Sweet Briar, VA 24595 USA
(3) Naval Research Laboratory, Space Sciences Division, Washington, DC 20375 USA
(4) National Research Council Postdoc, Washington, DC 20375 USA
(5) West Virginia University, Morgantown, WV 26506 USA
(6) Computational Physics Inc, Springfield, VA 22151 USA
(7) Thomas Jefferson High School for Science and Technology, Alexandria, VA 22312 USA

NRL and NRAO have broadened the low frequency capabilities of the VLA through the VLA Low Band Ionospheric and Transient Experiment (VLITE). VLITE is a new commensal observing system that harvests data from the VLA's prime focus in parallel with normal Cassegrain focus observing on a subset of 10 VLA antennas. VLITE provides over 3000 "free" observing hours per year in a large field-of-view (~5 deg^2) using 64 MHz bandwidth centered on 352 MHz. By operating in parallel, VLITE offers invaluable low frequency data to targeted observations of transient sources detected at higher frequencies. VLITE additionally offers great potential for blind searches of rarer radio-selected transients by maximizing the product of the field-of-view and observing time. We present our approach and describe our results for slow (> 1min) and fast (< 1min) timescale transient searches in the first year of VLITE science operations.

VLITE visibility data from its DiFX correlator is processed daily through an automated Obit-based imaging pipeline that offers minute timescale resolution and mJy sensitivity. The LOFAR Transient Pipeline (TraP) software is used to search for slow transients in the products of the imaging pipeline. We describe our experience using the TraP software and optimization of the free parameters for VLITE data to reduce the number of spurious detections requiring human follow-up.

We also present the latest developments of our GPU-based pipeline, operating upstream of the correlator, for fast transient searches. This system operates in real time upstream and independent of the main VLITE signal path. It taps the raw voltage data stream into a ring buffer that is searched for dispersed pulses in the time domain using GPUs. Triggers in multiple antennas will cause the memory buffer to be written to disk for further offline processing and imaging. A key advantage is the VLA's sub-arcminute angular resolution to provide an accurate position for fast transient candidates.