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MULTI-STAGE ADAPTIVE FILTERING OF COSMIC RAY SIGNAL DATA - APPLICATION AND CONFIGURATION FOR ULTRA-HIGH-ENERGY COSMIC RAY STUDY AT PIERRE AUGER OBSERVATORY

Abstract

The universe's radiation fields stand as one of the primary sources of information about the environment present and developing, as well as current and possible risks to mission planning and exploration. Ultra-High-Energy Cosmic Rays have been observed to reach energies as high as $3 \cdot 10^{20}$eV, without known point of origin. Study of such powerful rays is ongoing, with a view of increasing the knowledge base about the structure of space. Pierre Auger Observatory employs hybrid detectors in order to detect the way of magnetic-field-undeviated neutrinos, though notably, radio detection of very-high-energy cosmic rays is susceptible to RFI beacon signals generated by broadcast and communication stations and solar power farms. Elimination or, at the very least, significant suppression of those is crucial for proper detection and analysis of weak signature radio signals of cosmic rays. The subject of this paper is a comparison of applied, tested and considered filters as well as presenting the viability of, as of present, experimentally best Least-Mean-Squares (LMS) 32-stage adaptive filter with amplification and tests of its optimal configuration for desired application in denoising signal data.