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Statistical Tools for Neutrino Signal Search

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Neutrinos are vital messengers for understanding the most extreme astrophysical processes, capable of traveling across cosmic distances without deflection. The Askaryan Radio Array (ARA), deployed at the South Pole, searches for these elusive particles by detecting radio pulses generated when neutrinos interact with Antarctic ice. However, identifying these rare signals is particularly challenging due to the overwhelming presence of background noise.

To isolate potential neutrino events, ARA employs a suite of signal characterization techniques, including signal-to-noise ratio (SNR), root power ratio (RPR), correlation, impulsivity, and more. These statistical tools help distinguish neutrino-like signals from both thermal noise and anthropogenic interference.

In this presentation, we will explore how different analysis variables are calculated and implemented in the search for neutrino signals.

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