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The GFU Program at Icecube. Current Developments and Future Perspectives

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The IceCube Neutrino Observatory is a unique astrophysical instrument located in the South Pole that operates continuously, detecting high-energy neutrinos from the entire sky. Among its core scientific capabilities is the real-time alert system, which enables rapid follow-up observations across the electromagnetic spectrum. Through the Gamma-ray Follow-Up (GFU) program, IceCube identifies significant neutrino events and issues alerts to partner observatories, helping to localize potential astrophysical sources.

GFU works on two main modes: The **Source List** mode, which focuses the search on the location of known sources of high energy emission; and the **All-sky** mode, which searches for exceptional neutrino emissions from any point in the sky. In recent work, we have focused on improving the quality and accessibility of these alerts. Moving towards alerts that are more robust and available for different kinds of multi-messenger observatories.

As part of this effort, we have worked on updating the probability density functions (PDFs) that underpin the reconstruction of events, using improved simulation to aid the accuracy in certain regions of the parameter space. Additionally, we are searching to develop a reliable method to report the angular uncertainty of “all-sky” alerts, so as to better localize emissions that might be interesting to follow-up campaigns.

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