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The KM3NeT alert system for online multi-messenger astronomy

The KM3NeT neutrino telescope, under deployment in the Mediterranean Sea, consists of two detectors: KM3NeT/ARCA and KM3NeT/ORCA. Despite sharing the same hardware, their geometries are optimized for different neutrino energy ranges: ARCA targets high-energy neutrinos above the TeV scale, while ORCA focuses on the GeV-TeV range. Additionally, both are sensitive to MeV neutrinos from supernova bursts. Currently, 16% of the detector is operational, with full completion expected by the end of this decade. Its design provides a large field of view and high duty cycle, enabling it to address diverse physics goals, including the search for astrophysical neutrino sources or the detection of very high-energy neutrinos.

Multi-messenger astronomy combines observations from neutrinos, photons, charged particles, and gravitational waves to study transient astrophysical phenomena. Coincident detections improve the likelihood of identifying new sources, emphasizing the importance of real-time data sharing and follow-ups across observatories worldwide. KM3NeT's broad energy sensitivity and real-time analysis capabilities make it a key player in this global effort.

In this contribution, the alert system, developed by KM3NeT to share significant detections with the multi-messenger astronomy community, will be presented. The system continuously monitors the data, searching for significant events through various pipelines and issuing alerts when such events are detected. The implemented pipelines, the adopted analysis strategies, and the structure of the alert messages, as well as highlight the role and future potential of this system will be reviewed in detail.

Collaboration(s)

KM3NeT Collaboration

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