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Supernova Early Warning in the Daya Bay Reactor Neutrino Experiment

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Providing an early warning of a galactic supernova using neutrino signals is of importance in studying both supernova dynamics and neutrino physics. The Daya Bay Reactor Neutrino Experiment, with the unique feature of multiple liquid scintillator detectors separated in space, is sensitive to the full energy spectrum of supernova burst electron-antineutrinos. By utilizing 8 Antineutrino Detectors (ADs) in three separate experimental halls, we obtain a more powerful and prompt rejection to muon spallation backgrounds than single-detector experiments. A dedicated supernova online trigger system has been installed to detect a coincidence of neutrinos via inverse-beta-decay (IBD) signals within a 10-second window, thus providing a robust early warning of a supernova occurrence within the Milky Way. In addition, more than half a year tests of the communication with the Supernova Early Warning System (SNEWS, an international organization) show that the promptness (about 10s delay) and robustness of the supernova online trigger system in Daya Bay perform perfectly. As a result, a golden trigger threshold, i.e. with a false alarm rate < 1/year, can be set as low as 6 candidates among the 8 detectors, leading to a 100% detection probability for all 1987A type supernova bursts at the distance to the Milky Way center and a 95% detection probability to those at the edge of the Milky Way. The schematic view, trigger methodology, unique features and the supernova explosion detection probability of the supernova online trigger system in Daya Bay will be presented in this poster.

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