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The JUNO-TAO detector is a unique tool for studying and monitoring nuclear reactors

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JUNO-TAO is a liquid scintillator antineutrino spectrometer being built as a satellite experiment within the Jiangmen Underground Neutrino Observatory (JUNO). The JUNO-TAO detector will be placed about 30 m from one of the twins EPR reactors of the Taishan nuclear power plant (Taishan, Guangdong Province, China). In the 90s of the 20th century, it was experimentally proved that antineutrino spectrometers based on liquid scintillators are capable to monitor the power of a nuclear reactor and the isotopic composition of a fuel. These capabilities provide a complementary way of nuclear power plant reactor monitoring with respect to the standard methods. Moreover, such capability offers a promising safeguard tool for independent verification of the declared reactor power. The development of such monitoring tool is supported by the International Atomic Energy Agency (IAEA).

Ten square meters of SiPM photons sensors with more than 50% photon detection efficiency will observe the spherical volume of liquid scintillator with 4500 photoelectrons per MeV light output in the TAO detector. SiPMs dark current rate is suppressed by 3 orders of magnitude due to operation at minus 50 degrees Celsius. The detector will capture about 2000 reactor antineutrinos within the fiducial volume per day. It is designed to be well shielded from cosmogenic and ambient backgrounds to have the background-to-signal ratio better than 10%. Unprecedented energy resolution of TAO-detector is expected due to symmetrical construction, low temperature scintillator and cooled photo sensors together with comprehensive active and passive shielding. These features open a way for precise reactor antineutrino spectrum measurement which making TAO-detector a promising tool to contribute greatly to applied antineutrino physics and open a possibility for industrial tool development.

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