Press release

JUNO Completed Liquid Filling and Begins Data Taking

26/08/2026

The Jiangmen Underground Neutrino Observatory (JUNO) has successfully completed filling its 20,000-tons liquid scintillator detector and begun data taking on August 26. After more than a decade of preparation and construction, JUNO is the first of a new generation of very large neutrino experiments to reach this stage. Initial trial operation and data taking show that key performance indicators met or exceeded design expectations, enabling JUNO to tackle one of this decade's major open questions in particle physics: the ordering of neutrino masses—whether the third mass state (ν_3) is heavier than the second (ν_2).

Prof. WANG Yifang, a researcher at the Institute of High Energy Physics (IHEP) of the Chinese Academy of Sciences and JUNO spokesperson, said: "Completing the filling of the JUNO detector and starting data taking marks a historic milestone. For the first time, we have in operation a detector of this scale and precision dedicated to neutrinos. JUNO will allow us to answer fundamental questions about the nature of matter and the universe."

Located 700 meters underground near Jiangmen city in the Guangdong Province, China, JUNO detects antineutrinos produced 53 kilometers away by the Taishan and Yangjiang nuclear power plants and measures their energy spectrum with record precision. Unlike other approaches, JUNO's determination of the mass ordering is independent of matter effects in the Earth and largely free of parameter degeneracies. JUNO will also deliver order-of-magnitude improvements in the precision of several neutrino-oscillation parameters and enable cutting-edge studies of neutrinos from the Sun, supernovae, the atmosphere, and the Earth. It will also open new windows to explore unknown physics, including searches for sterile neutrinos and proton decay.

Proposed in 2008 and approved by the Chinese Academy of Sciences and Guangdong Province in 2013, JUNO began underground construction in 2015. Detector installation started in December 2021 and was completed in December 2024, followed by a phased filling campaign. Within 45 days, the team filled 60,000 tons of ultra-pure water, keeping the liquid-level difference between the inner and outer acrylic spheres within centimeters and maintaining a flow-rate uncertainty below 0.5%, safeguarding structural integrity. Over the next six months, 20,000 tons of liquid scintillator were filled into the 35.4-meter-diameter acrylic sphere while displacing the water. Throughout, stringent requirements on ultra-high purity, optical transparency, and extremely low radioactivity were achieved. In parallel, the collaboration conducted detector debugging, commissioning, and optimization, enabling a seamless transition to full operations at the completion of filling.

At the heart of JUNO is a central liquid-scintillator detector with an unprecedentedly large effective mass of 20,000 tons, housed at the center of a 44-meter-deep water pool. A 41.1-meter-diameter stainless steel truss supports the 35.4-meter acrylic sphere, the scintillator, 20,000 20-inch photomultiplier tubes (PMTs), 25,600 3-inch PMTs, front-end electronics, cabling, anti-magnetic compensation coils, and optical panels. All PMTs operate simultaneously to capture scintillation light from neutrino interactions and convert it to electrical signals.

Prof. MA Xiaoyan, JUNO Chief Engineer, remarked: “Building JUNO has been a journey of extraordinary challenges. It demanded not only new ideas and technologies, but also years of careful planning, testing, and perseverance. Meeting the stringent requirements of purity, stability, and safety called for the dedication of hundreds of engineers and technicians. Their teamwork and integrity turned a bold design into a functioning detector, ready now to open a new window on the neutrino world.”

JUNO is hosted by the IHEP and involves more than 700 researchers from 74 institutions across 17 countries and regions. “The landmark achievement that we announce today is also a result of the fruitful international cooperation ensured by many research groups outside China, bringing to JUNO their expertise from previous liquid scintillator set-ups. The worldwide liquid scintillator community has pushed the technology to its ultimate frontier, opening the path towards the ambitious physics goals of the experiment”, commented Prof. Gioacchino Ranucci, Deputy spokesperson of JUNO and a Professor at the University of Milano and INFN-Milano.

JUNO is designed for a scientific lifetime of up to 30 years, with a credible upgrade path toward a world-leading search for neutrinoless double-beta decay. Such an upgrade would probe the absolute neutrino mass scale and test whether neutrinos are Majorana particles, addressing fundamental questions spanning particle physics, astrophysics, and cosmology, and profoundly shaping our understanding of the universe.

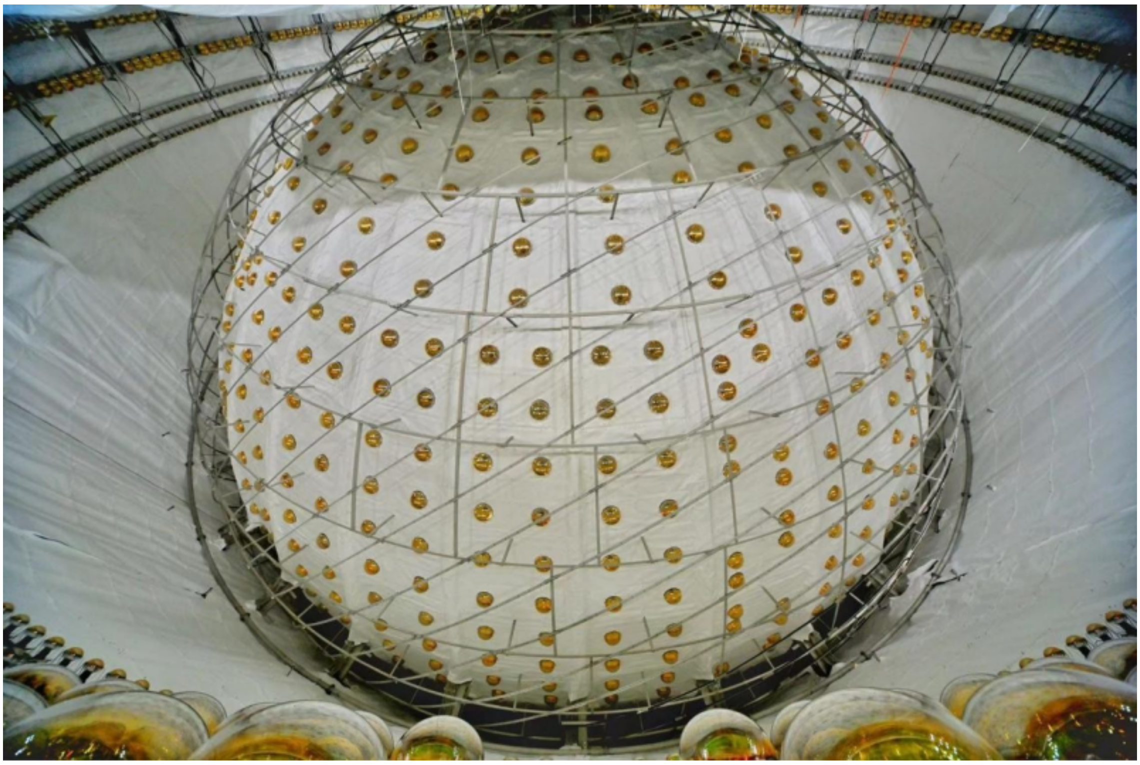

Fig.1 The JUNO detector seen from outside. (Credit: JUNO Collaboration)

Fig.2 The central acrylic sphere and PMTs. (Credit: JUNO Collaboration)

Fig.3 Top tracker above the water pool. (Credit: JUNO Collaboration)

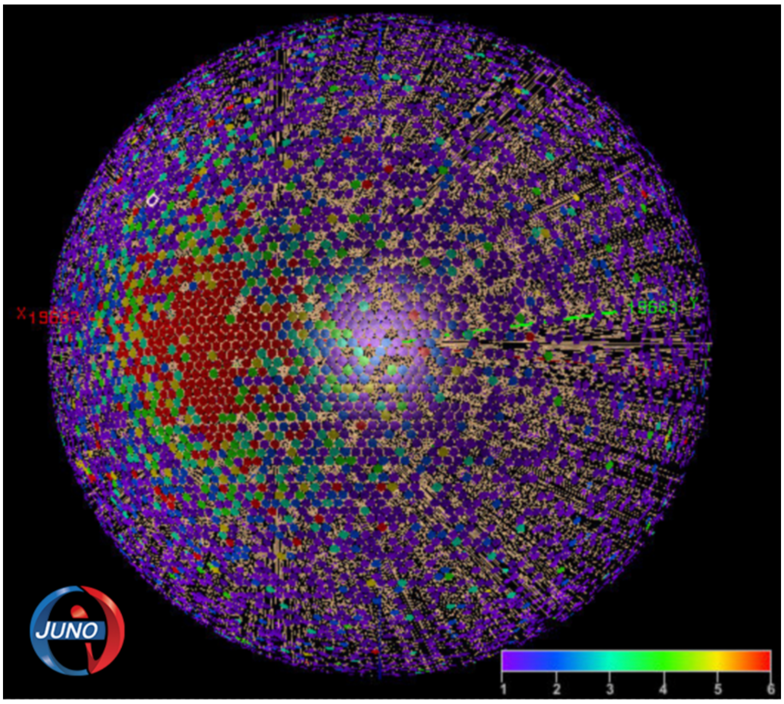

Fig.4 Prompt signal of a reactor neutrino event detected on August 24, with energy of ~5.7MeV. (Credit: JUNO Collaboration)

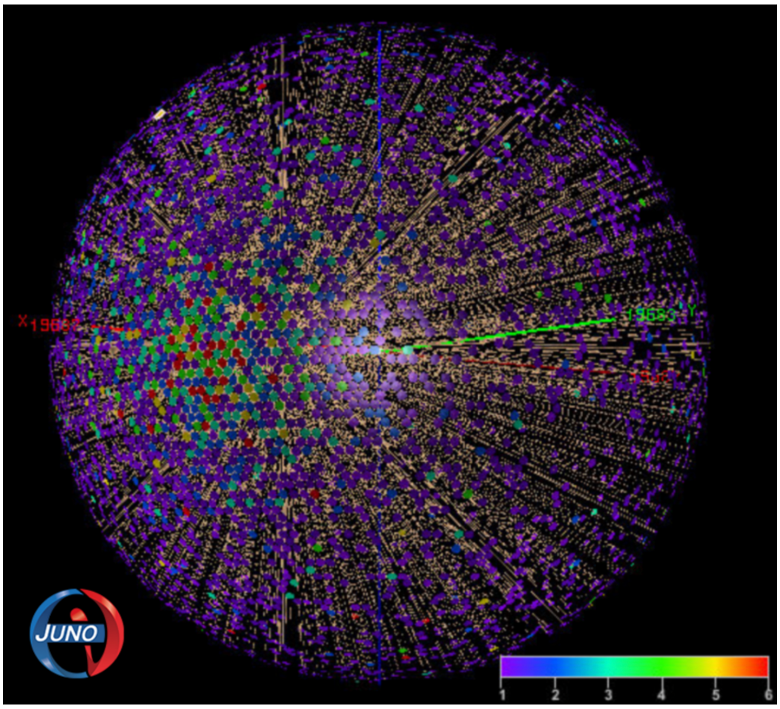

Fig. 5 Delayed signal of a reactor neutrino event detected on August 24, with energy of ~2.2MeV. (Credit: JUNO Collaboration)