



# JUNO Padova

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# Padova activities

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## Hardware

- supervision and shifts for the installation of the large PMT electronics in JUNO
- BEC firmware and data taking/analysis for the Legnaro setup in view of the OSIRIS data taking

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## Data Analysis

- data production for the reactor physics group
- sensitivity/analysis of the  $\theta_{12}$  and  $\Delta m_{12}$  solar parameters
- sensitivity/analysis of the  $\Delta m_{31}$  for the atmospheric oscillation parameter
- global fit for the oscillated data
- reconstruction algorithms using ML inspired techniques

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  - reconstruction algorithms using ML inspired techniques
- all activities covered in specific talks by Padova group members

# Electronics installation in JUNO



Last year	3-21	3-22	3-23	3-24	3-25	3-26
	2:30pm-9:00pm	7:30am-5:00pm	7:30am-5:00pm	8:30am-5:00pm	(no crown block)	
20 CD UWB	10 CD UWB	14 CD UWB	6CD+2 Spmt+1 Veto UWB	16 cd UWB		1spmt+1veto+ moving Ladders

JUNO electronics being installes: 312 CD, 10 Veto, and 10 sPMT electronics boxes installed.  
All test results on installed boxes are ok.

## Validation and integration tests of the JUNO 20-inch PMTs readout electronics

- corresponding author: Katharina von Sturm
- arXiv: <https://arxiv.org/abs/2212.08454>
- submitted: December 16, 2022
- referees' review: [The paper is interesting and generally in good shape. The manuscript requires a relatively minor revision before it can be reconsidered for publication.](#)
- reply to journal under preparation

### Validation and integration tests of the JUNO 20-inch PMTs readout electronics

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#### **Abstract**

The Jiangmen Underground Neutrino Observatory (JUNO) is a large neutrino detector currently under construction in China. JUNO will be able to study the neutrino mass ordering and to perform leading measurements detecting terrestrial and astrophysical neutrinos in a wide energy range, spanning from 200 keV to several GeV. Given the ambitious physics goals of JUNO, the electronic system has to meet specific tight requirements, and a thorough characterization is required. The present paper describes the tests performed on the readout modules to measure their performances.

*Keywords:* electronics, photomultiplier, large scale neutrino experiment

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## Mass testing of the JUNO experiment 20-inch PMTs readout electronics

- corresponding author: [Beatrice Jelmini](#)
- arXiv: <https://arxiv.org/abs/2301.04379>
- submitted: January 11, 2023
- referees' review: [The paper is interesting, matches the scope of NIM and is already in a good shape. I conclude that your manuscript requires a rather minor revision before it can be reconsidered for publication.](#)
- reply submitted, waiting for Journal response

### Mass testing of the JUNO experiment 20-inch PMTs readout electronics

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#### Abstract

The Jiangmen Underground Neutrino Observatory (JUNO) is a multi-purpose, large size, liquid scintillator experiment under construction in China. JUNO will perform leading measurements detecting neutrinos from different sources (reactor, terrestrial and astrophysical neutrinos) covering a wide energy range (from 200 keV to several GeV). This paper focuses on the design and development of a test protocol for the 20-inch PMT underwater readout electronics, performed in parallel to the mass production line. In a time period of about ten months, a total number of 6950 electronic boards were tested with an acceptance yield of 99.1%.

*Keywords:* Read-Out electronics, photomultiplier, liquid scintillator, large scale neutrino experiment

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## Implementation and performances of the IPbus protocol for the JUNO Large-PMT readout electronics

- corresponding author: [Andrea Serafini](#)
- arXiv: <https://arxiv.org/abs/2302.10133>
- submitted: February 20, 2023
- referees' review: [paper still under review](#)

### Implementation and performances of the IPbus protocol for the JUNO Large-PMT readout electronics

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#### Abstract

The Jiangmen Underground Neutrino Observatory (JUNO) is a large neutrino detector currently under construction in China. Thanks to the tight requirements on its optical and radio-purity properties, it will be able to perform leading measurements detecting terrestrial and astrophysical neutrinos in a wide energy range from tens of keV to hundreds of MeV. A key requirement for the success of the experiment is an unprecedented 3% energy resolution, guaranteed by its large active mass (20 kton) and the use of more than 20,000 20-inch photo-multiplier tubes (PMTs) acquired by high-speed, high-resolution sampling electronics located very close to the PMTs. As the Front-End and Read-Out electronics is expected to continuously run underwater for 30 years, a reliable readout acquisition system capable of handling the timestamped data stream coming from the Large-PMTs and permitting to simultaneously monitor and operate remotely the inaccessible electronics had to be developed. In this contribution, the firmware and hardware implementation of the IPbus based readout protocol will be presented, together with the performances measured on final modules during the mass production of the electronics.

*Keywords:* electronics, photomultiplier, large scale neutrino experiment

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