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THE ELECTRONICS READOUT SYSTEM OF THE JUNO EXPERIMENT

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The Jiangmen Underground Neutrino Observatory (JUNO) is a neutrino medium baseline experiment in construction in China, with the main goal to determine the neutrino mass hierarchy and to measure several neutrino mass and mixing parameters with a precision at the sub-percent level. The JUNO detector consists of 20 ktons of liquid scintillator contained in a 35 m diameter acrylic sphere, instrumented by more than 18000 20-inch photomultiplier tubes (PMTs), and about 25600 3-inch small PMTs. The required energy resolution to discriminate between the normal and inverted neutrino mass hierarchies at a 3-4 sigma CL for about 6 years of data taking is 3% at an energy of 1 MeV. This puts strong constraints on the detector component quality.

The JUNO electronics system can be separated into mainly two parts: the front-end electronics system performing analog signal processing (the underwater electronics), and after 100 meters Ethernet cables, the back-end electronics system, sitting outside water, consisting of the DAQ and the trigger. For the front-end part, the electronics are located very close to the PMTs in order to minimize the length of cables and maximize the signal to noise ratio. The incoming analog signals from the PMTs are digitized in the Global Control Unit (GCU), contained in a water-tight box. Each underwater box is connected to three PMTs. The GCU is a custom Field Programmable Gate Array (FPGA) board with 3 ADU and 3 HV units. The digital signal and trigger informations are forwarded to the dry electronics by means of 100 m CAT5 Ethernet cable. For the back-end electronics part, back-end cards (BEC) are used as concentrators to collect and compensate the incoming trigger request signals and an FPGA mezzanine card handles all trigger request signals. The signals from the various BECs are sent to 21 RMU (Reorganise&Multiplex Unit) cards, and their sum is forwarded to the CTU (Central Trigger Unit). The main challenge of the whole electronics system is the very strict criteria on reliability: a maximum of 0.5% failure over 6 years for the PMT full readout chain.

The overall picture of the main parts of the JUNO detector, as well as its electronics readout system will be presented in this talk.

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