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The JUNO Large PMT Readout Electronics

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One of the many challenges neutrino physics is facing is it's mass hierarchy determination. The Jiangmen Underground Neutrino Observatory (JUNO) is determined on answering to this question by detecting reactor neutrinos generated from nuclear power plants at a medium baseline, around 50 km, featuring an unprecedent energy resolution of 3% @ 1 MeV thanks to a 20 kton of LAB liquid scintillator detector surrounded by 18'000 20 inches Photo Multiplier Tubes (PMT), all immersed in a water pool about 600 m underground.

To achieve such demanding requirements the data readout electronics foresees an energy resolution of 0.1 photoelectron and a timing resolution and synchronization of 16 ns (up to 1 ns through offline analysis). These features are made possible thanks to the Global Control unit (GCU): a custom board that will be placed underwater and contained in a water-tight box together with three High Voltage Units (HVU). Each box will be connected to three PMTs.

The core of the GCU board is a Field Programmable Gate Array (FPGA) which guarantees the capability of data storage and transfer, data analyzing and several peripherals controlling, as well as functioning as an interface to three Analog to Digital Units (ADU), that continuously digitize the PMT signal analogue stream. The digital signal and trigger informations are forwarded to the dry electronics by means of 100 m Ethernet cable.

The front-end inaccessibility after installation highlights the importance to design high reliability hardware and to adopt strategies for recovering from stalling situations due to bugged or corrupted firmware.

The proposed talk introduces a detailed overview of the JUNO Large PMT readout electronics, its main functionalities and the requirements needed.

Collaboration name

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