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KM3NeT: Real-time Opto-electronic Readout System

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The purpose of this paper is to demonstrate that current optical communications technologies could be used to implement a real-time data transfer system for KM3NeT. We propose a solution based on Passive Optical Network principles (PONs) employing wavelength division multiplexing. A key feature of the design is that it does not employ remote light sources; instead a shore-based centralized array of lasers is shared by all of the telescope's Optical Modules (OMs). Data (up to 10Gb/s) is transferred onto the optical carriers by means of high reliability, ultra-low electrical drive power, Reflection-mode Electro-Absorption Modulators (REAMs). In this way the electro-optic design of each OM is identical and they can be fitted in any position. (Each OM's space-wavelength address is only set once it has been connected to the system.) This modular approach offers maximum flexibility for growth both in terms of telescope size and capacity. An example design will be described that can support up to10,000 OMs each serving 32 (or more) Photo-Multiplier Tubes (PMTs). We will describe how real-time readout and synchronisation is achieved and the details of the optical system design. The main advantage of this approach is that it minimises the amount of remote electronics, hence power consumption, and consequently maximises the telescope reliability and serviceability. The paradigm for the system is to consider KM3NeT as a giant photo-sensor that is readout on the shore.

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