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Portable calibration node for LHAASO KM2A detector array

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About 6000 detectors will be deployed in 1.2KM² area at 4400m a.s.l in LHAASO experiment and are synchronized to 500ps precision benefit from White Rabbit technology.

To guarantee the connection and verify the synchronization performance after installation, a PCN (portable calibration node) is designed which acts as a standard white rabbit node, always connects to the most top White rabbit switch and provides the recovered clock/pps as reference signals. The node circuit is sealed inside a water and vibration tolerant container and connected to WR network through a armored Optic Electric Composite Cable for both power and communication purpose thus the PCN can be dragged to any required detector location while maintain the link.

The PPS from the PCN is loop back together with the PPS from the detector to the PCN to measure the offset by a 30ps resolution FPGA based TDC. The results are histogrammed inside the FPGA and displayed on a local LCD by a LM32 soft-core, which also provides a serial port for configuration and data transmission. The white rabbit PTP core, the TDC and soft-core shares the same FPGA chip which make the node very compact and cost saving. The helper PLL used by the White rabbit technology is also acts as a calibration source for the TDC to build the lookup table of the delay chain.

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