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HKROC: an integrated front-end ASIC to readout photomultiplier tubes for large neutrino experiments

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The HKROC ASIC was originally designed to readout the photomultiplier tubes for the Hyper-Kamiokande experiment. HKROC is an innovative ASIC capable of readout a large number of channels satisfying stringent requirements in terms of noise, speed and dynamic range.

Each HKROC channel features a low-noise preamplifier and shapers, a 10-bit successive approximation Analog-to-Digital Converter (SAR-ADC) for the charge measurement (up to 2500 pC) and a Time-to-Digital Converter (TDC) for the Time-of-Arrival (ToA) measurement with 25 ps binning. HKROC is auto-triggered and includes all necessary ancillary services as bandgap circuit, PLL (Phase-locked loop) and threshold DACs (Digital to Analog Converters).

The key feature of HKROC is its "waveform digitization" capability: it dynamically opens acquisition windows for internal digitization. It enables new possibilities in terms of double pulse triggering with a low dead time (below 50 ns) and in terms of triggering rate with its adaptive readout to cope with supernovae events.

The presentation will describe the ASIC architecture and the experimental results of the second HKROC prototype received in December 2022.

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