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Introduction of µTCA DAQ system and parallel reading in CANDLES experiment

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Neutrino-less Double Beta Decay ($0\nu\beta\beta$) is an important tool to study absolute neutrino mass and nature of neutrino (Majorana or Dirac particle). Moreover, this phenomenon signals the violation of lepton number conservation, and it has not been observed so far. CANDLES experiment aims to obtain the $0\nu\beta\beta$ from ^{48}Ca. This measurement is a big challenge due to the extremely rare decay rate of ^{48}Ca. To obtain $0\nu\beta\beta$, it is needed to reduce background as much as possible. Series of alpha and beta decays originated from radioactive impurities can remain as background in the energy region of $0\nu\beta\beta$. Because they are sequential decays, we can remove them by tagging preceding and following events. This tagging method requires minimized dead-time of DAQ system. A new µTCA DAQ system was introduced with SpaceWire-to-GigabitEthernet (SpW-GbE) network for data readout and FADCs equipping 8 event buffers. Event buffers, which act as de-randomizer, help reduce dead-time. SpW-GbE has high latency (about 100 µsec) due to long turnaround time, but GbE has high throughput. Thus, for minimization of dead-time, we developed our DAQ system with 4 "module-parallel"reading threads (modules are read in parallel). As a result, the read-time is reduced by 4 times: 40msec down to 10msec. With improved performance, it is expected to achieve higher background suppression for CANDLES experiment. Moreover, for energy calibration, "event-parallel"reading process (events are read in parallel) is also introduced to reduce measurement time. With 2 "event-parallel"reading processes, the data rate is increased 2 times.

Minioral

Yes

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