TIPP 2011 - 2nd International Conference on Technology and Instrumentation in Particle Physics



Contribution ID: 308

Type: Oral Presentation

The cryogenic performances of specific optical and electrical components for a liquid argon time projection chamber

Saturday 11 June 2011 14:50 (20 minutes)

A Liquid Argon Time Projection Chamber (LArTPC) has been proposed as a potential far site detector of long baseline neutrino experiment (LBNE). A cold front-end electronics scheme, in which preamplifiers, shapers, analog to digital converters, digital memories, data multiplexers, and cable drivers operates in liquid argon is under development. In this paper we present the cryogenic performance study of specific optical and electrical components for a LArTPC.

The data rate out of a LArTPC highly depends on where the LArTPC is located. The data rate of a LArTPC at 800 feet underground is low enough to be handled electrically. We have tested an LVDS driver with 20-meter CAT5E twisted-pair cables. The electrical link works up to 1 gigabit per second at liquid nitrogen temperature (77 K), exceeding the data rate requirement

If the LArTPC is not located in deep underground, the data rate will be so high that we have to use optical data links. A 16:1 serializer Application Specific Integrated Circuit (ASIC) fabricated in a commercial 0.25-micrometer Silicon-on-Sapphire CMOS technology, three types of laser diodes, and multimode and single mode optical fibers and optical connectors have been tested. All components continue to function at 77 K.

The multiplexer and the digital memory can be implemented in a field programmable gate array (FPGA). Two FPGAs have been tested and both function properly at 77 K.

A variety of commercial resistors and capacitors, which are necessary component in printed circuit boards, have been tested at 77 K. Resistance of almost all types resistors except carbon composition and capacitance of tantalum electrolytic capacitors, C0G/NP0 ceramic capacitors, specific types of film capacitors, and mica capacitors changes little.

Author: Dr LIU, Tiankuan (Department of Physics-Southern Methodist University (SMU))

Co-author: Dr LIU, Chonghan (SMU)

Presenter: Dr LIU, Tiankuan (Department of Physics-Southern Methodist University (SMU))

Session Classification: Front-end Electronics

Track Classification: Front-end Electronics