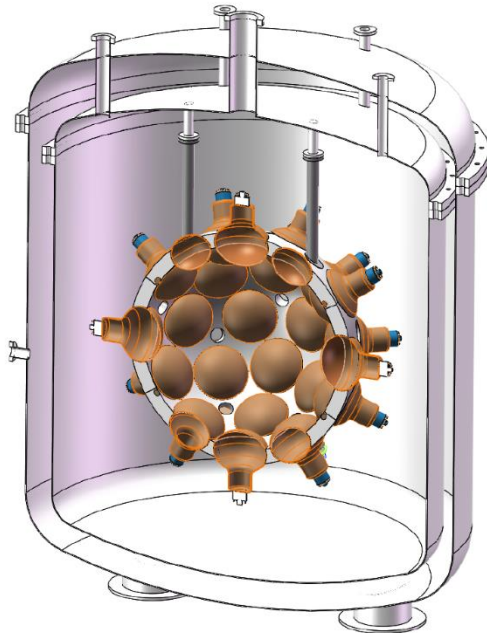




Design of Front End Electronics for Direct Dark Matter Detection based on LAr



- 60 channels
 - PMT
- PXIe chassis
 - NI PXIe-1085

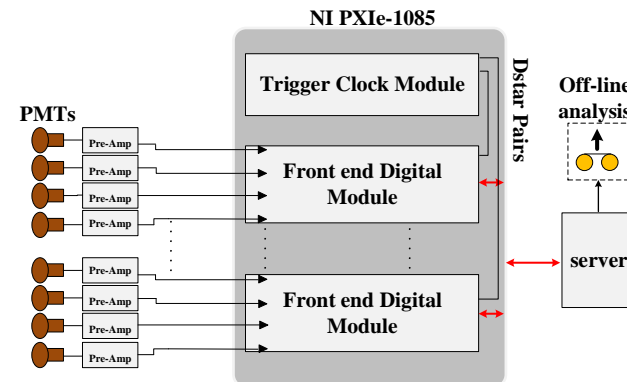


Fig. 1 Structure of liquid argon detector

Fig. 2 Basic structure of front end electronics

Prototype Front end Digital Module

- ADC : AD9680
 - 1GSps 14 bit
 - JESD204b interface
- FPGA : Xilinx Kintex-7

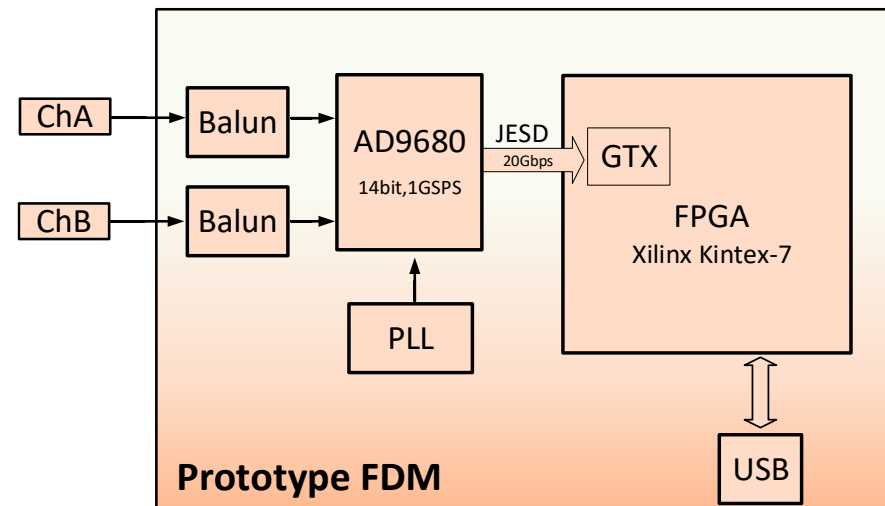


Fig. 3 Block diagram of prototype FDM



➤ $E_{\text{nob}} = 10.40$ bits
@ $F_{\text{in}} = 298$ MHz

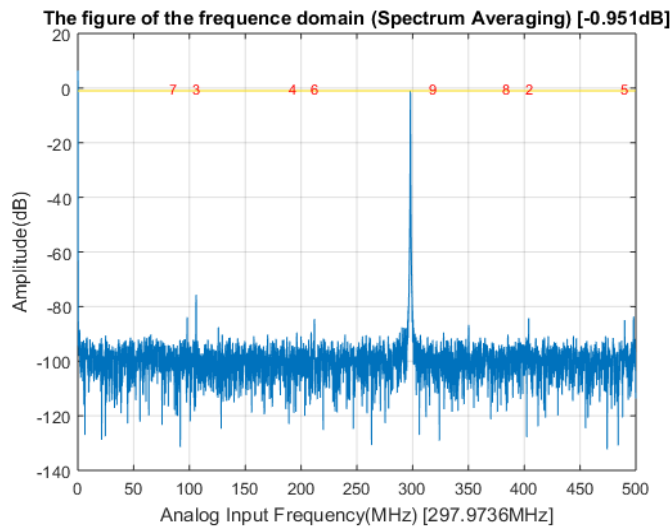


Fig. 4 Spectrum of sine wave

➤ Tests of LAr detector
with ^{22}Na gamma source

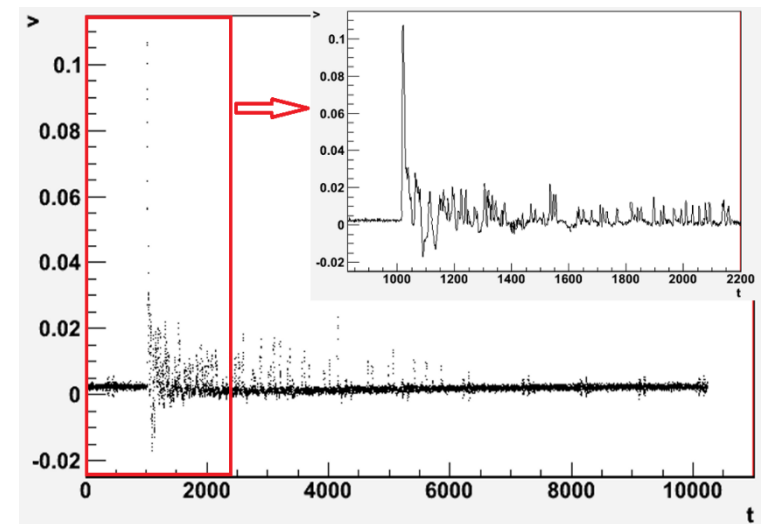


Fig. 5 Waveform of LAr detector



Poster



Design of Front End Electronics for Direct Dark Matter Detection based on LAr

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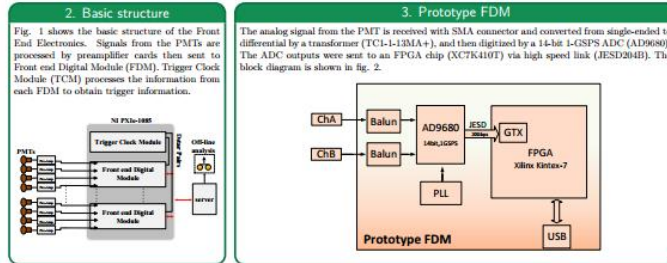
Introduction

1. Introduction

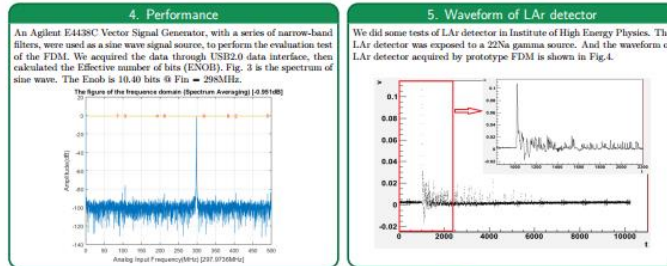
Weakly interacting massive particles (WIMPs) are a well-motivated galactic dark matter candidate. Numerous direct detection experiments are being developed to detect WIMPs. Liquid argon (LAr) detectors, with a high light yield of approximately 40 photons per keV, are attractive detectors for the direct detection of WIMPs.

The Front End Electronics is designed to simultaneously read out approximately 60 PMTs which combined with about 1-ton LAr. And these Front End Electronics has an input dynamic range from 5pC to 1nC, while also have high resolution that single photoelectron can be distinguished.

Prototype



Test Results



6. Next step

According to the test of prototype FDM, we had optimized the FDM shown in Fig. 5.

- Increase the number of channels from 2 to 4
- Replace the balun by amplifier
- Transmit the data by PXIe interface

We plan to use the PXI chassis (NI PXIe-1085) to receive data in the next step.

7. Conclusions

A prototype FDM are designed, and detailed tests of FDM have been done. This Front End Electronics can bring better performance in PSD to detect rare nuclear recoil events.