MSU Cold Electronics R&D for LBNE

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FNAL Support for MSU LArTPC Electronics R&D

Dan Edmunds and Philippe Laurens built and maintain the D0 calorimeter trigger system for Run-II with continuing FNAL support.

Their ADF2 card (32 channels, 100 MHz ADC, 64k FPGA) running at 5-10 MHz, is nearly ideal for readout of an LArTPC front-end.

With PPD support via Stephen Pordes, D0 ADF2 spares and surplus preamps, CLEAN Argon, we broke new ground in the U.S., LArTPC: 3-view x 30-hit tracks.

With Neutrino Dept. support via Gina Rameika, we built new front-ends for the ArgoNeuT (T962) collaboration LArTP, which is breaking more new ground.

With LBNE R&D support via Bruce Baller, we are designing and building a cold electronics readout system for an LArTPC.

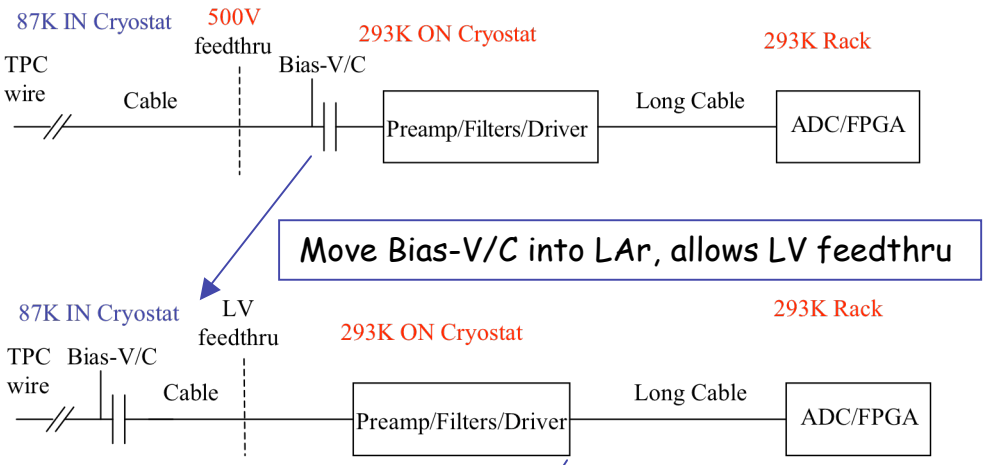
We'd like to express our thanks to those who backed this exciting and rewarding R&D program over the last 4 years.

Development of LArTPC electronics at MSU

Initial steps

Readout for 3 pl. x 32 wires/plane
(5 mm pitch) TPC in Bo Cryostat
1st 3D tracks with US built electronics
FFT DSP developed

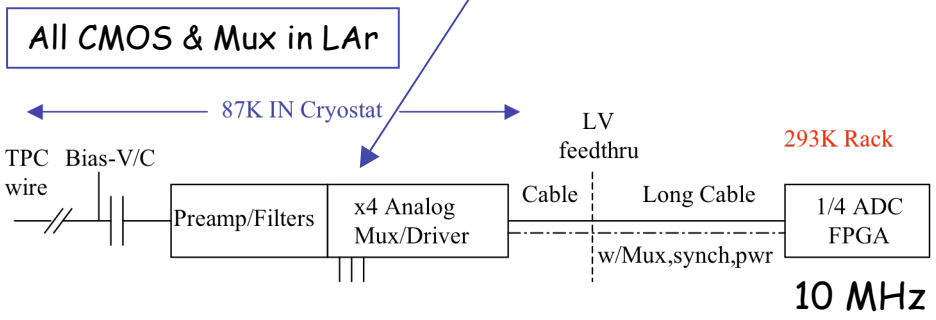
New Readout for 2 pl. x 240 wires/plane
(4 mm pitch) TPC in ArgoNeuT Cryostat
1st LArTPC neutrino events in the US,
now analyzing for physics



Full run-based DAQ to computer, with pedestal & noise diagnostics

FY10

New Readout for 3 pl. x 48 wires/plane
(4 mm pitch) TPC in Bo Cryostat
1st cold Mux'd readout of an LArTPC



In large systems, multiplexing is essential to reduce per channel costs.
Need Synch. of ADC and Mux ADC rates/channel & FPGA size go up by Mux factor !

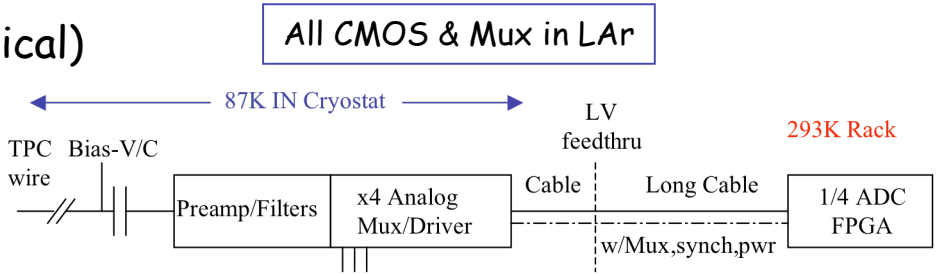
LArTPC cold electronics for other projects?

FY11+ planning

Collaborate to move ADC into LAr, use digital multiplexing -- probably w/ASIC
Commercial FPGA/CPU, firmware hit finding & trigger

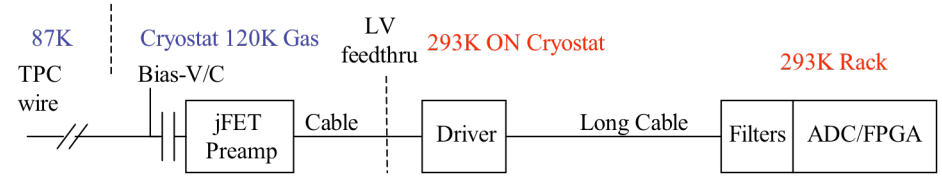
LAr Purity Demonstrator (LAPD), 30 Tons
Perhaps extend Bo TPC to 2.5 meter (vertical)
Drift (4 mm pitch) 3 pl. x 48 wires/plane

Instrumented TPC in kTon membrane cryostat prototype for LBNE



Will this make sense in 2012?

CD-1 MicroBooNE Electronics



Bias-V in Ar gas?

Cool jFET

Driver needed

Analog filtering in racks

No Multiplexing