35 Ton Electronics

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- Big dividing line is with the availability of the cold ADC
  - Warm ADC
    - One channel per wire ~2000 chsannels
    - Analog ground system similar to microboone
    - Electronics similar to microboone
    - Software and read out likely to be similar to microboone
- No electronics and software development for LBNE!
- Only advantage is APAs and HV design

With Cold ADC

- Two Phases
  - Bare 16 channels chip without multiplexor
  - With 8 to 1 mux

- My preference is to start with bare ADC
  - Allows some delay for BNL to produce the mux
  - More direct observation of ADC
  - Rate at surface detector may require changes in the mux scheme

Possible Scenario

- Assume that cold ADC is not available at the start of tests
- Instrument only a small portion of one APA
  - Channel count is 1/16 of total
  - Cable and penetration is then the same as with the 16 channel cold ADC
    - this gives 128 total channels
  - Is this enough for a test?
    - could probably double this

Scenario II

- Un instrumented channels would be AC or DC coupled to ground
- When cold ADC becomes available, cryostat is emptied and new boards are installed and connected to existing cable plant
- External electronics is also redone.

Scenario III

- Second year would have the cold ADC
- This probably meets the schedule of the photon detector
- Possibly integrate both ADC and photon detector into readout

Scenario IV

- If multiplexor is available, go to one cable per ADC (not all channels of mux are used)
- readout would be modified to use the multiplexed scheme
  - Allows test of entire readout chain for LBNE
- Likely to be 2 to 3 year program

Details for Warm ADC

- Best solution is to use Microboone electronics and readout
  - Engineering costs for a separate ADC system are large and the time scale might deliver it after the cold ADC is available
- Use cold discriminator and driver from BNL
- Use the Nevis ADC and readout system
  - Likely need some modification for our use

Warm ADC

- Mount 1 rack on top of cryostat
- Adopt limited version of microboone grounding scheme
  - copper ground shield under floor
  - single faraday shielded transformers etc.
- Fiber optic readout to control room off cryostat
- Software?

Readout with ADC

- APAs are ~40% of full size
- 2560 channels in full size APA so 40% is 1024 channels
- 16 channels per ADC gives 64 readout wires
  - Fits directly into a 64 channel DCM from NOvA
  - 2 DCM's required for 35 ton system

DCM

- DCM has download, clock and readout for each channel
  - May not fit ADC requirements exactly
  - Might require a small adapter board with an FPGA on it
    - Mount this outside the cryostat

Software

- Set time slice to > max drift time
  - Modify software to send slice and slice -1 to same computer in farm

    Get entire track no matter when it arrived
  - Get entire track no matter when it arrived
- Farm node receiving software should be very similar to NOvA
- NOvA people seem willing to help on this
- Need to be able to pay for them