

# LArIAT Front End Electronics Update

October 14, 2014

Carl Bromberg, Andrew Cudd, Dean Shooltz

# Overview of LArIAT Front End Electronics (MSU supplies the components in blue)

Feed-through/  
backplane card  
and custom card file

DAQ  
computer

USB

ASIC master control  
Text-based interface  
CPP class written (Andrew Cudd)

Fiber optics

Receiver/  
Driver  
Cards  
(10) \* 48 ch

Long cables from T962

Differential  
To  
Single  
Ended  
Cards

Short cables

CAEN  
Digitizers

## Cryostat

480 channel TPC

(10) 48 channel ASIC cards

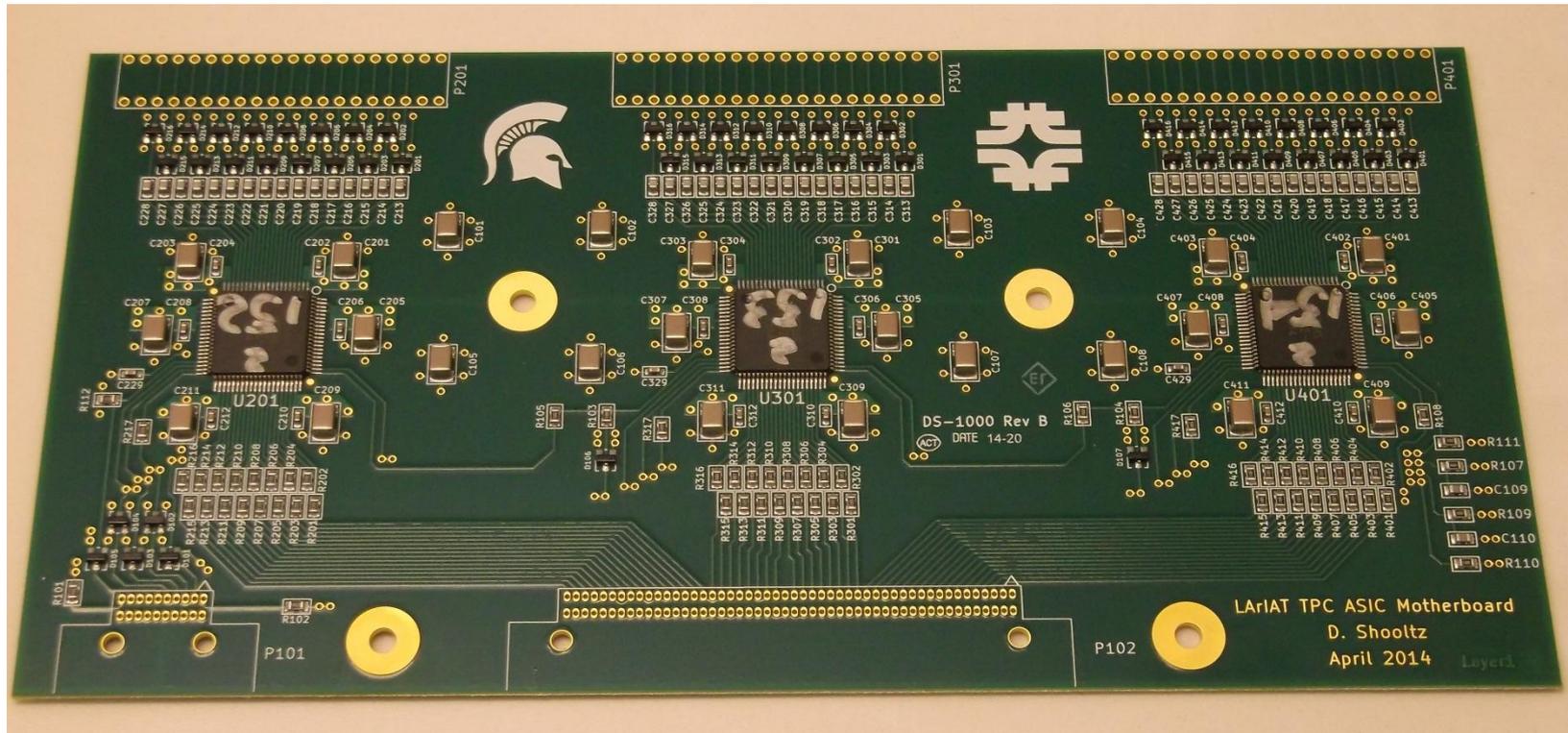
(30) ASIC preamps from  
Brookhaven N.L.

ASIC and  
Warm  
Receiver  
Power  
Supplies

# ASIC Motherboards

Cards are manufactured, assembled, tested, installed on TPC  
14 cards were produced. We need 10 for LArIAT TPC.

Very nice workmanship (Advanced Circuits, same company used for TPC wire frames)  
Testing at Lab 6: 10 of 11 cards tested good. One card had one bad ASIC.

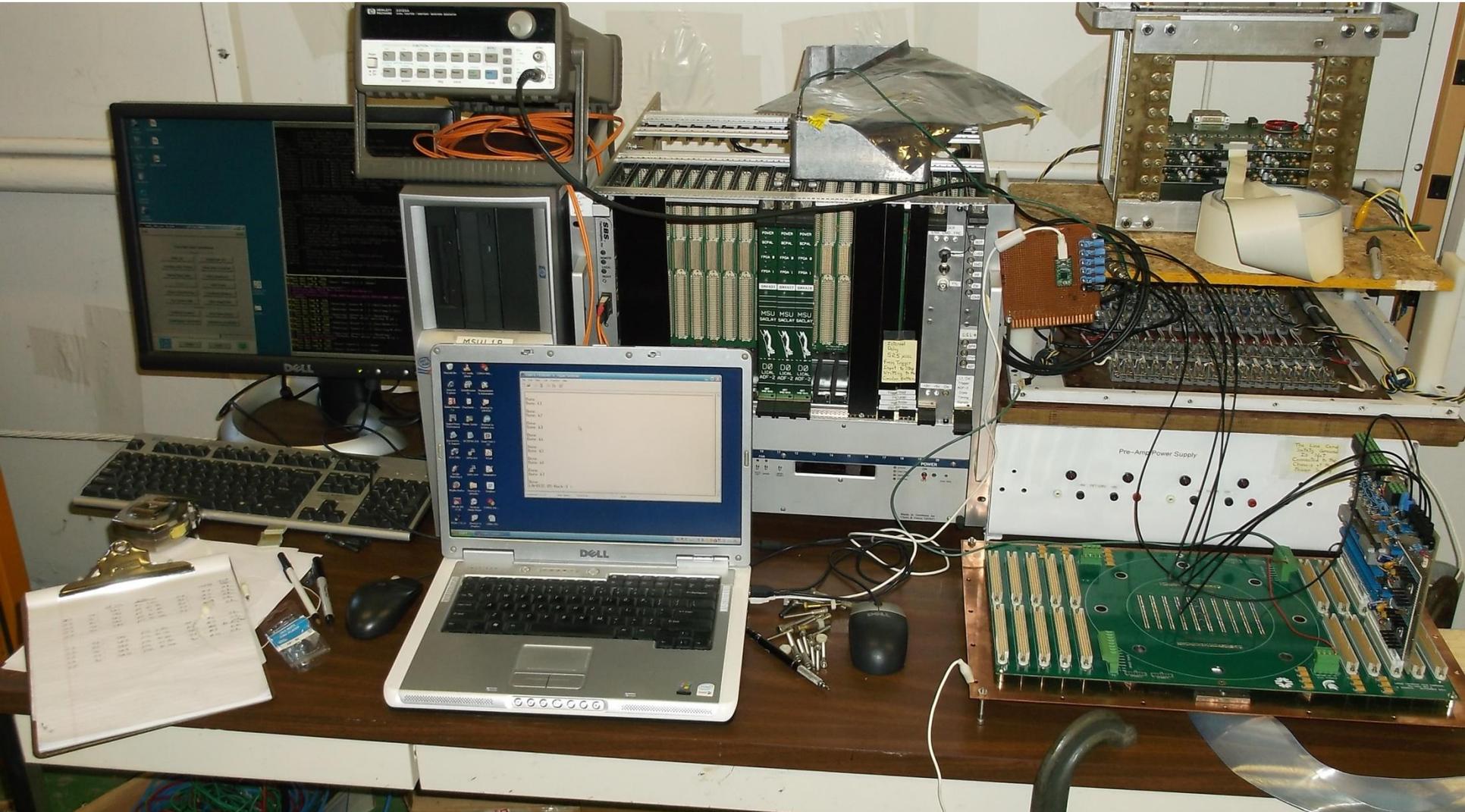


## ASIC Card Testing

Signal chain from ASIC cards to warm side of feed through were tested.

All ASIC cards were tested in liquid nitrogen.

One card had one bad ASIC- this card was replaced. (1 of 30 ASICs was bad)



## ASIC Card Testing

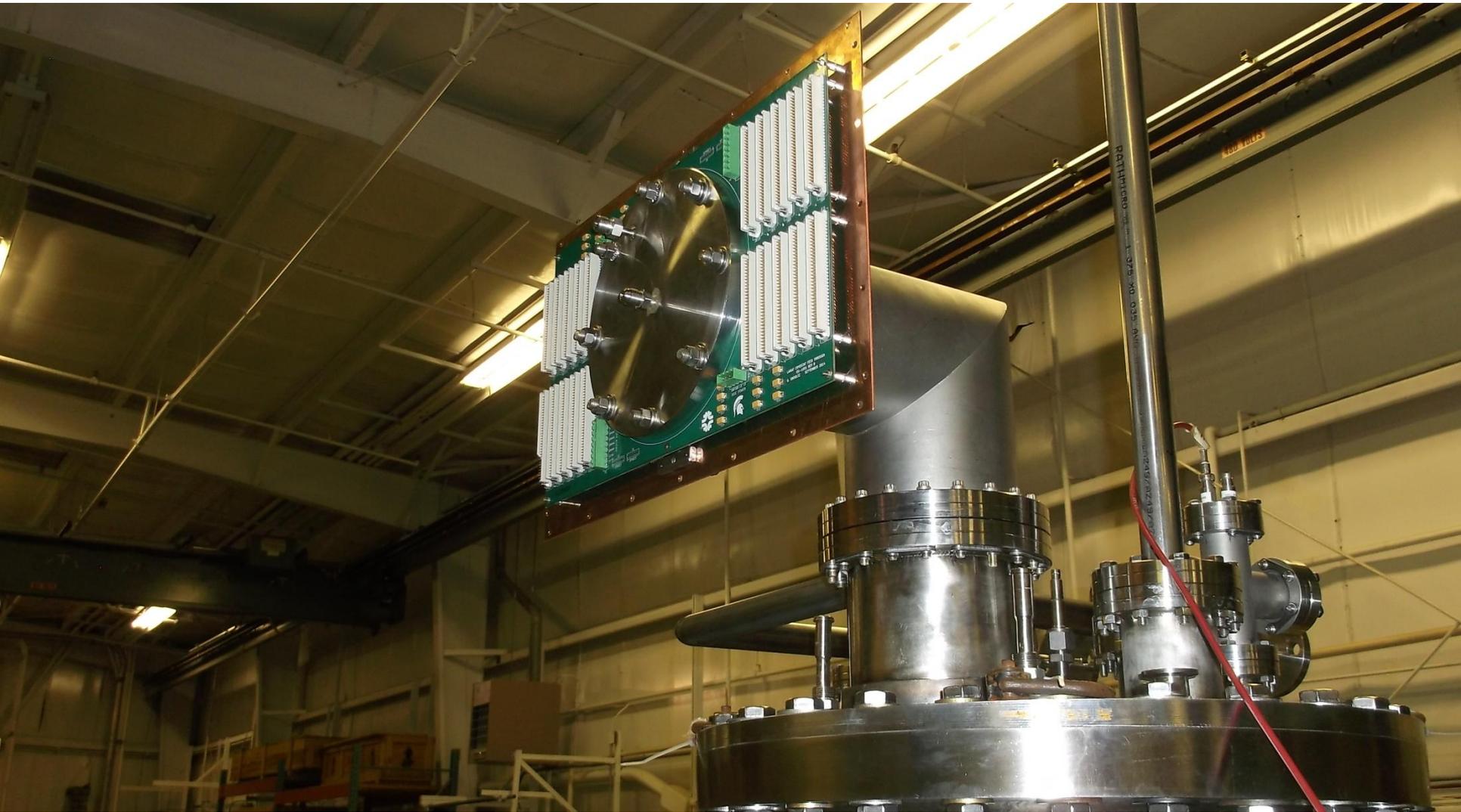
View including LN2 dewars.

Five cards per dewar, with all cards connected to feed through.



## Cryostat feedthrough/backplane

Order of operations: We installed the FEP ribbon cables on the feed through, then installed the elbow, fed the cables into the dewar from the top, and finally installed the elbow/backplane assembly onto the top of the dewar.



LArIAT TPC feed-through.

## Cryostat feedthrough/backplane

Aluminum adapters bridge between the feed through copper back plate and the back side of the feed through flange.



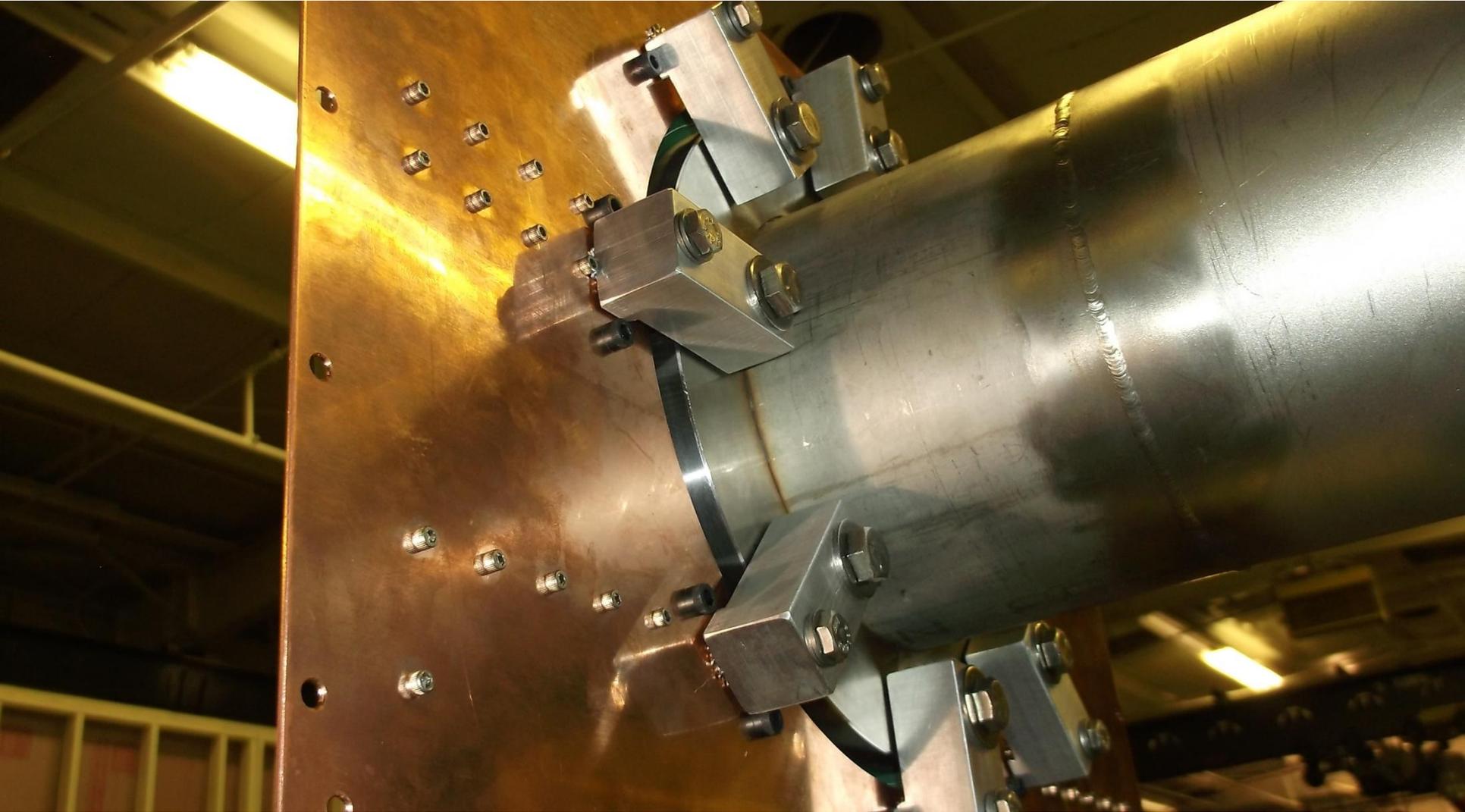
LArIAT TPC feed-through.

## Cryostat feedthrough/backplane

Detail of the adapter connections.

3/8" external-tooth lack washers are under each of the eight adapters.

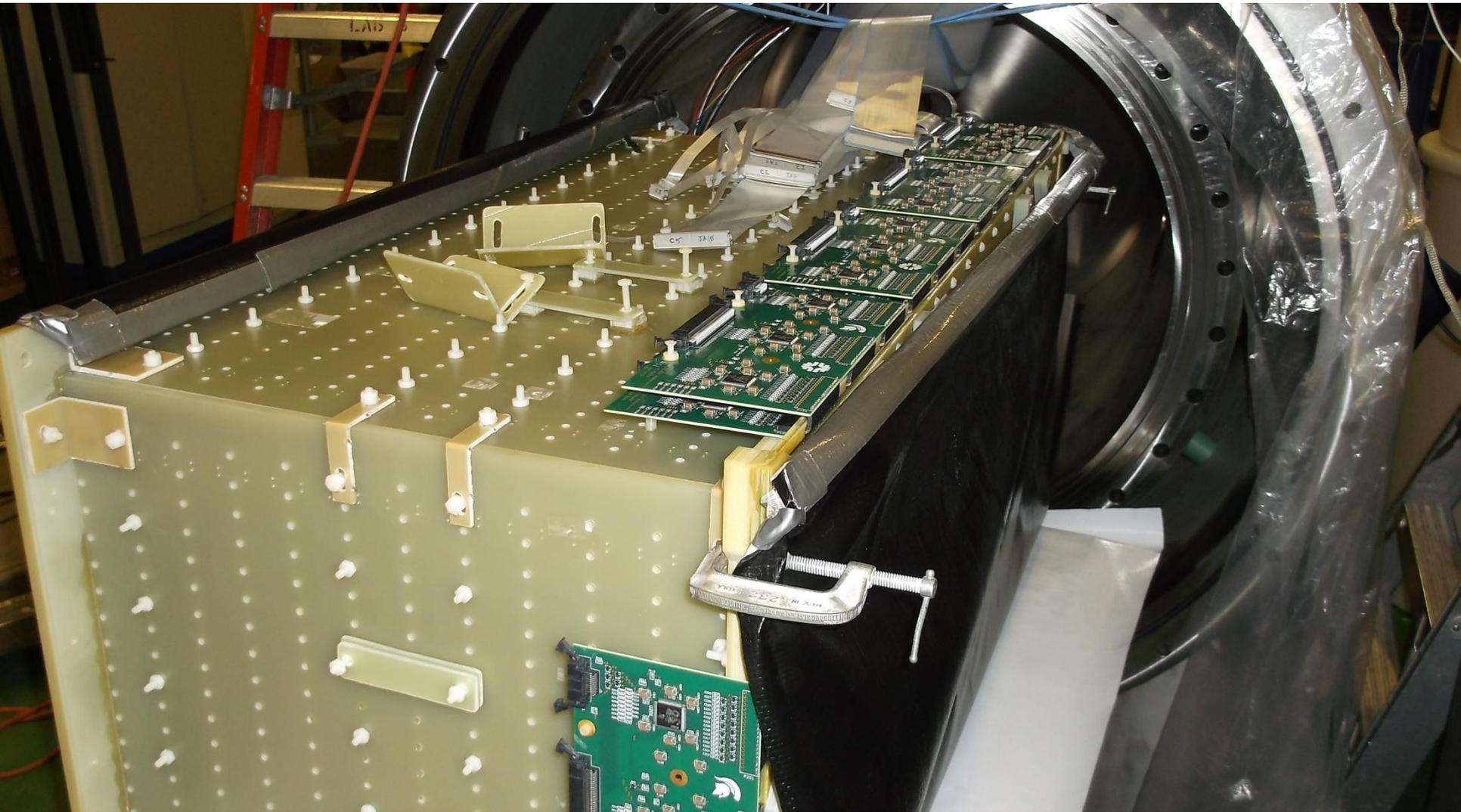
These washers make a ground connection between the copper plate and the feed through flange.



LArIAT TPC feed-through.

## ASIC Card Installation

Ten cards installed and tested in-situ through ribbon cables and feed through. Installation went well, no surprises.

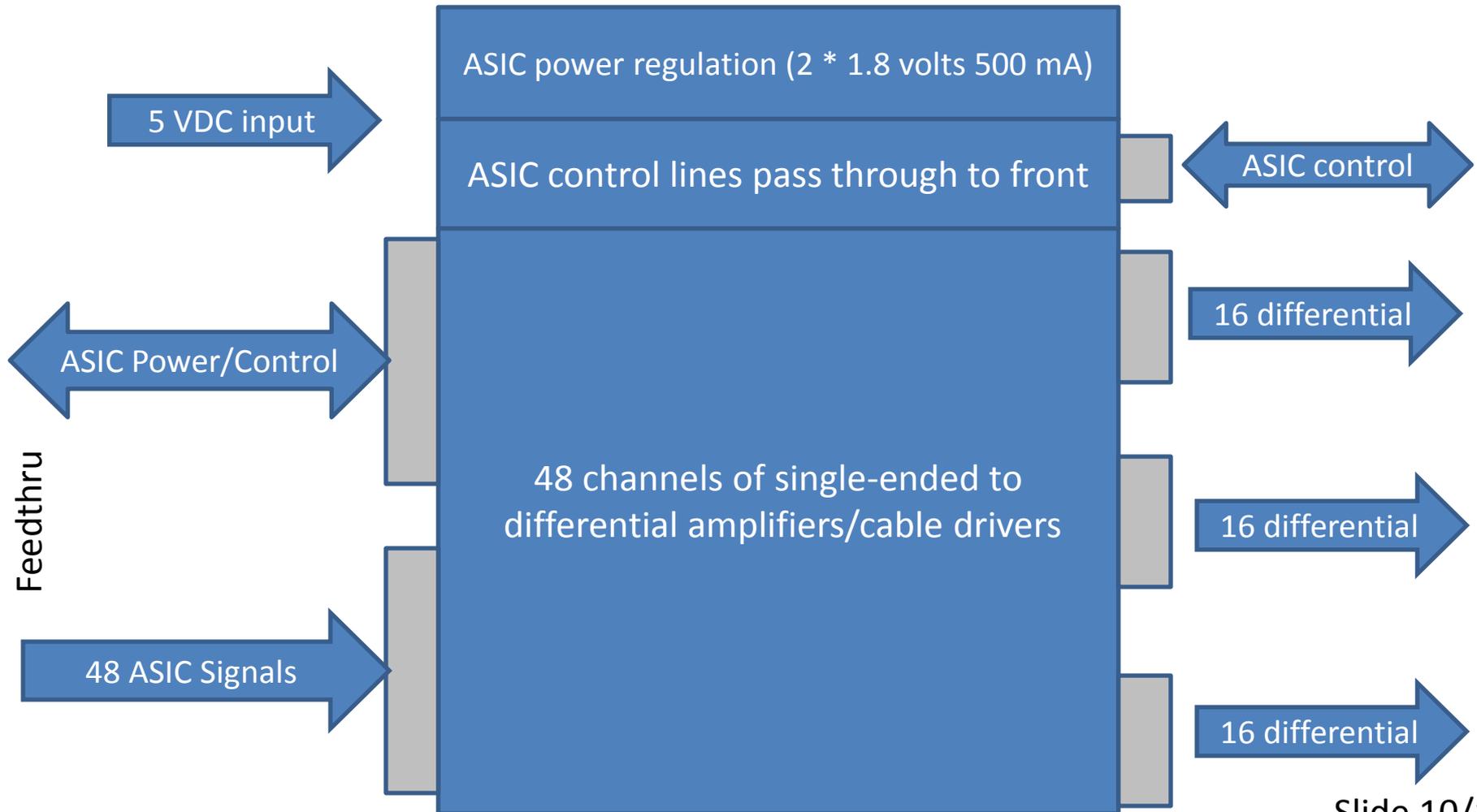


## Still To Do: Warm receiver/Driver card

Each warm receiver card supplies power and control signals to one 48 channel ASIC motherboard.

The ASIC control lines are routed to the front panel.

From the front panel the ASIC control lines are daisy chained and then connected to inexpensive fiber optic links.



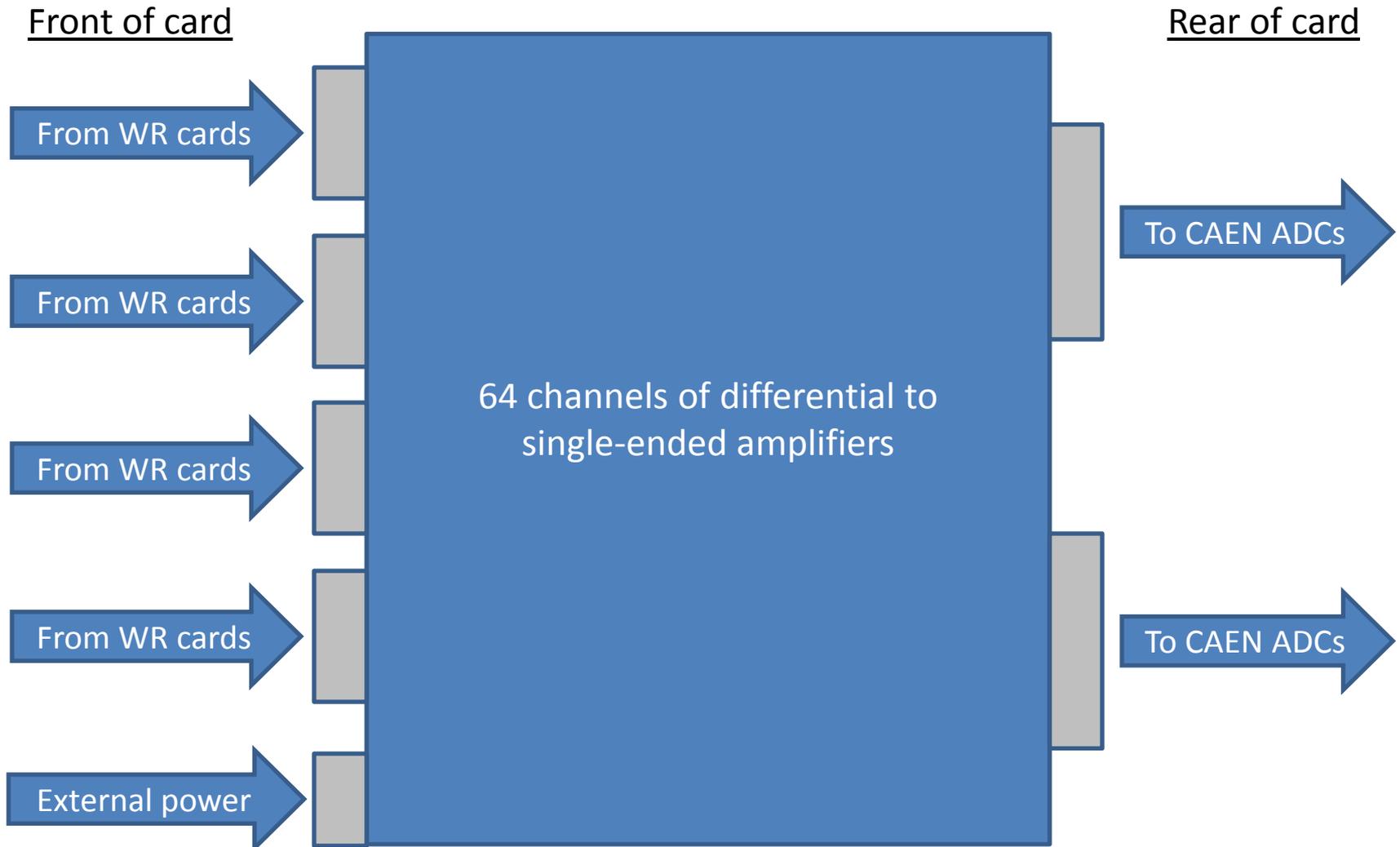
## Still To Do: D2S (differential to single-ended) card

Card supplies a simple function- no major design challenges.

Cards will reside next to CAEN ADCs in VME crate.

Cards will be supplied from private 5 volt power supplies.

Outputs to CAEN units will be on ~30 cm ribbon cables (rear of D2S to front of CAEN)



# Tentative Schedule

## ASIC motherboards

Done, tested, installed.

## Feed-through / backplane card

Manufactured, tested, installed.

## Warm receiver cards (ASIC signals & power)

PCB layout ongoing.

PCB manufacture (expect 2 weeks turnaround).

Populate prototype channels and test (expect 1 week).

## ASIC Control System

Andrew Cudd's ASIC control firmware worked well during testing.

C++ classes written, about ready for integration with DAQ (with Bill Badgett).

## D2S cards

Signal exit to CAEN at rear (front panel area constraints for VME 6U sized cards).

PCB layout (2 weeks).

PCB manufacture (expect 2 weeks turnaround).

Populate prototype channels and test (1 week).

## Cabling

Long signal cables from ArgoNeuT: 29 of 30 are in hand, one is still at FNAL.

Cables from D2S to CAEN:

The CAEN digitizers have a hard-to-find input connector. Need to special order.

Currently waiting for delivery from CAEN/ERNI.

These cables will be modified- the D2S side will have a more standard connector.