LPTPC DAQ

29 September 2010

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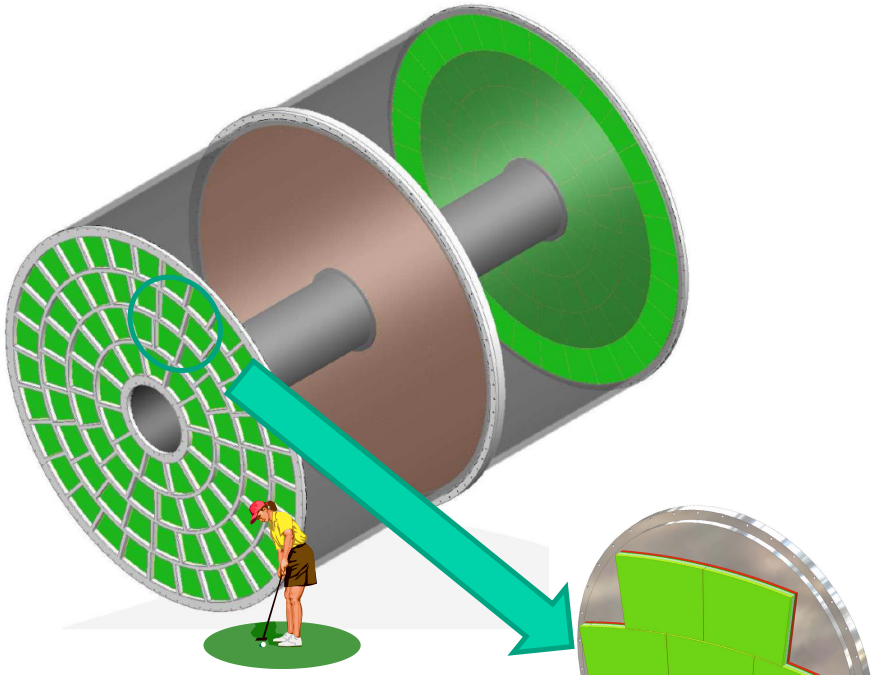
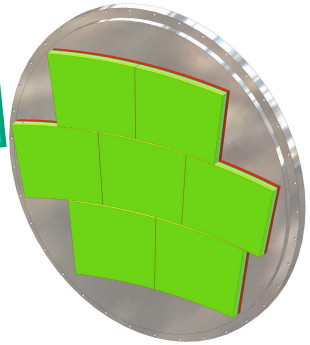
ILC-TPC

Continuous 3D tracking in a large gaseous volume with O(100) space points.



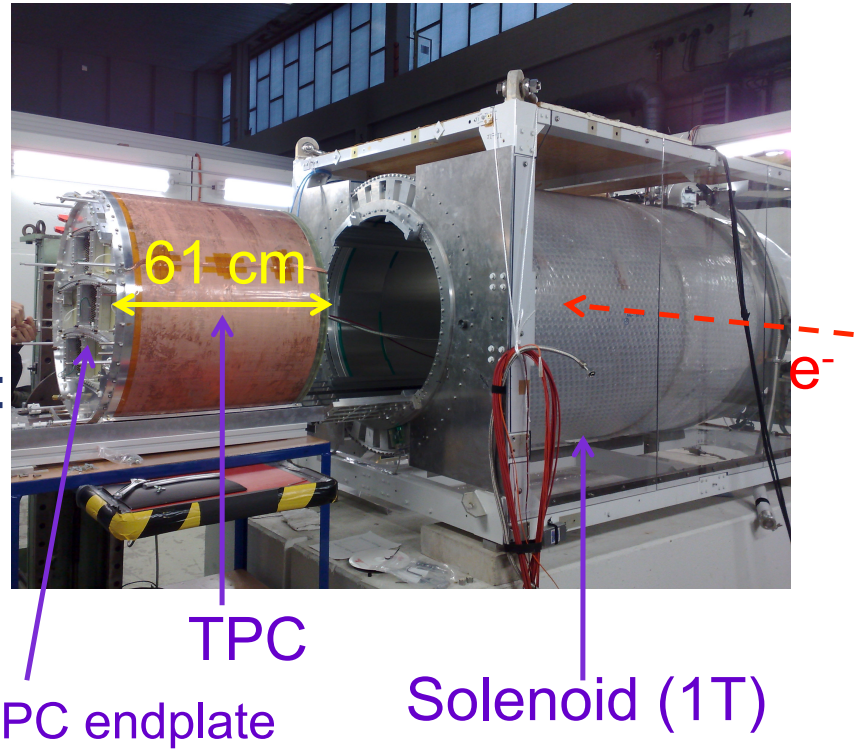
ILC-TPC (ILD concept)



Large prototype being tested at DESY

LPTPC @ DESY

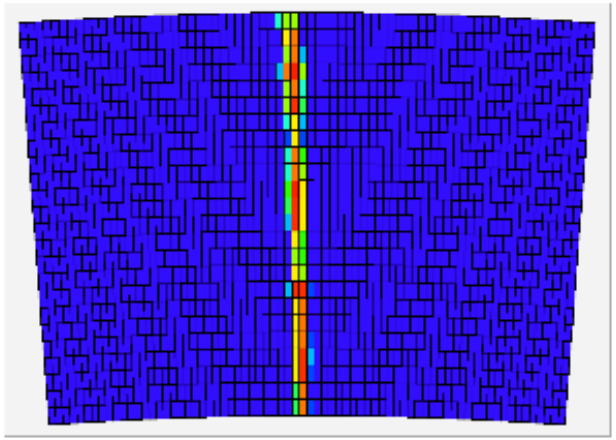
- Since end of 2008, LCTPC collaboration is testing a large TPC prototype (LPTPC) with 6 GeV e^- beam in DESY
- TPC endplate allows to easily accommodate different Micro Pattern Gas Detector (MPGD)
- 3 MPGD technologies are tested:
  - **MICROMEGAS + PADs**
  - **Double GEM + PADs**
  - **Triple GEM + CMOS Timepix chip**
- 3 ReadOut Electronics are tested:
  - **MICROMEGAS + T2K AFTER**
  - **Double GEM + ALTRO (ALICE)**
  - **Triple GEM + CMOS Timepix chip**

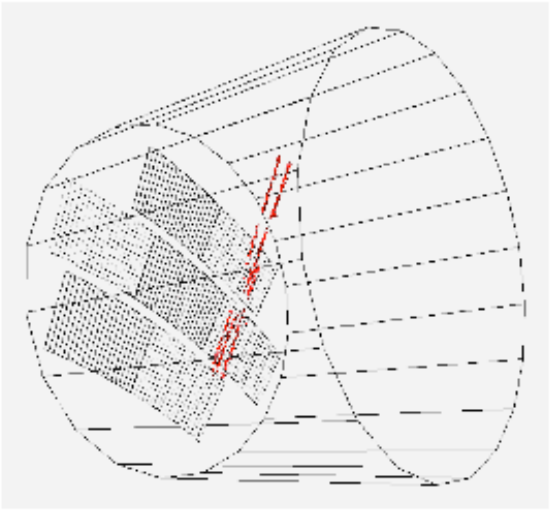


- In this talk I will mainly report on the latest TB (sept. 2010) with GEM
  - **+ a word on MICROMEGAS DAQ**

Test beam campaign

- Since end of 2008, many successful test beams in DESY with LPTPC
  - **Both GEMs and MICROMEGAS are running nicely**
  - **As well as their DAQ**





- However
  - **Different DAQ systems for the different detectors**
  - **In ILD, space will be limited for TPC electronics (10 cm)**
    - → need redesign of FE electronics and DAQ interface (sALTRO and AFTER)

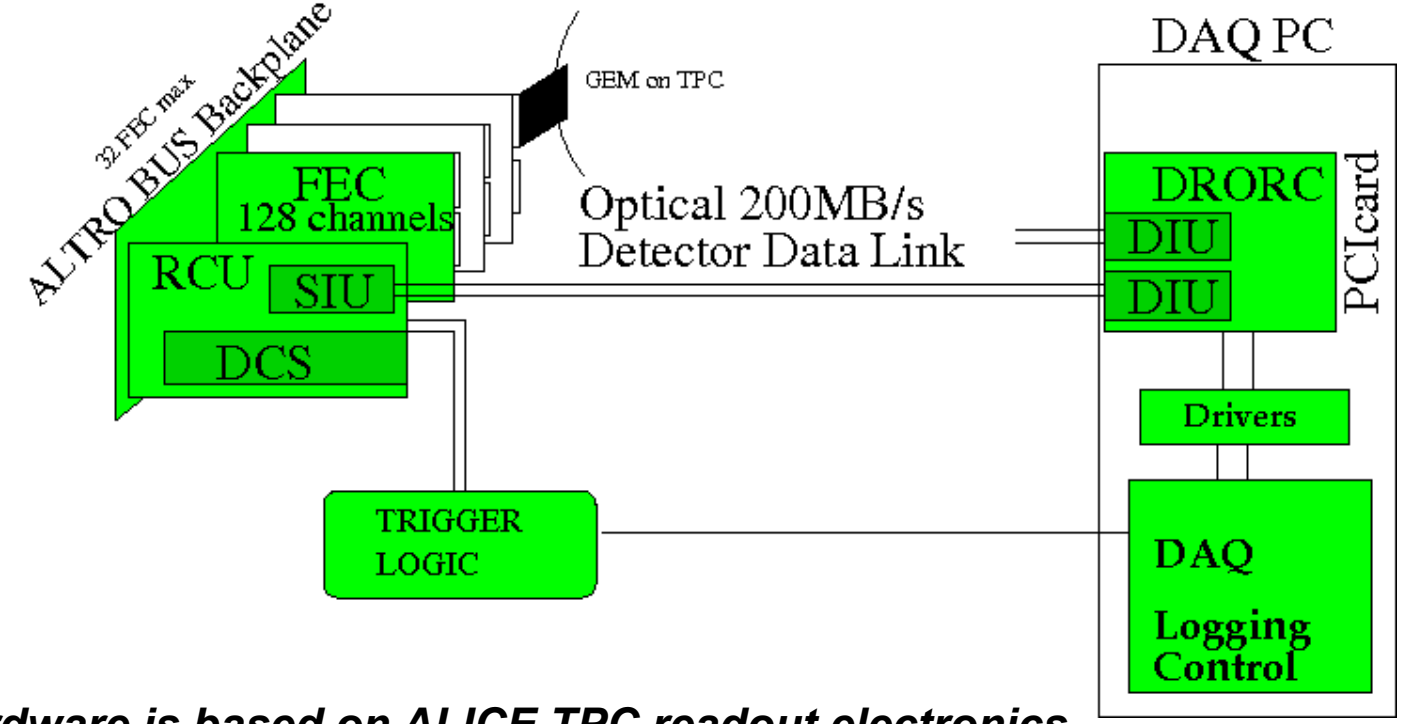
LPTPC ALTRO DAQ

Readout of GEM

A status report

29 September 2010

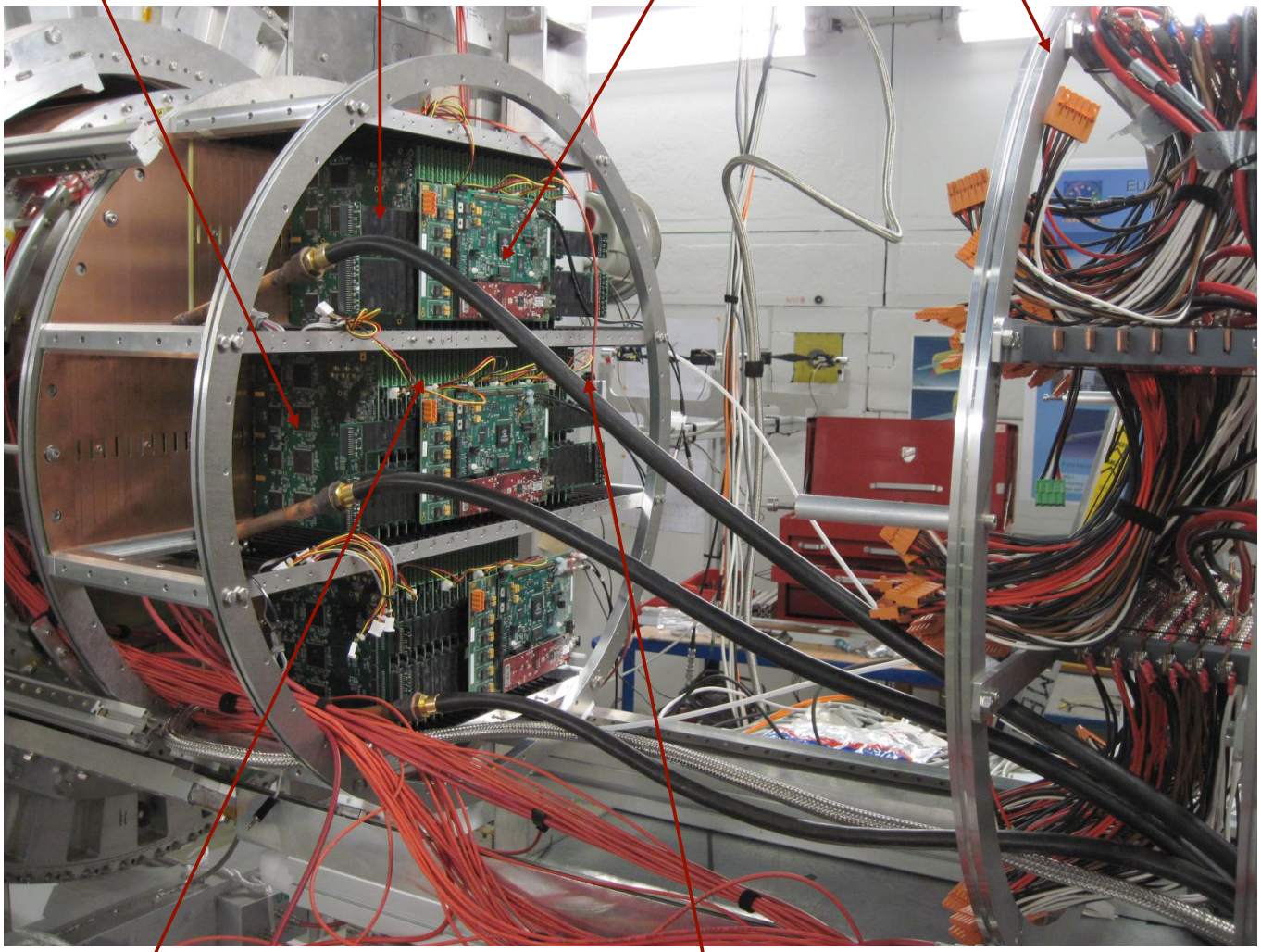
Ulf Mjörnmark, Lund University



Hardware is based on ALICE TPC readout electronics

modified Front End Cards (FEC) with 8*16 ch ALTRO chips (128 ch/FEC):
Preamplifier 16 ch PASA → 16 ch PCA16 with programmable gain,shaping
Added hardware to program PCA16 settings
Modified board controller firmware for downloading PCA16 settings
Other input connectors to use kapton cables between GEM and FEC

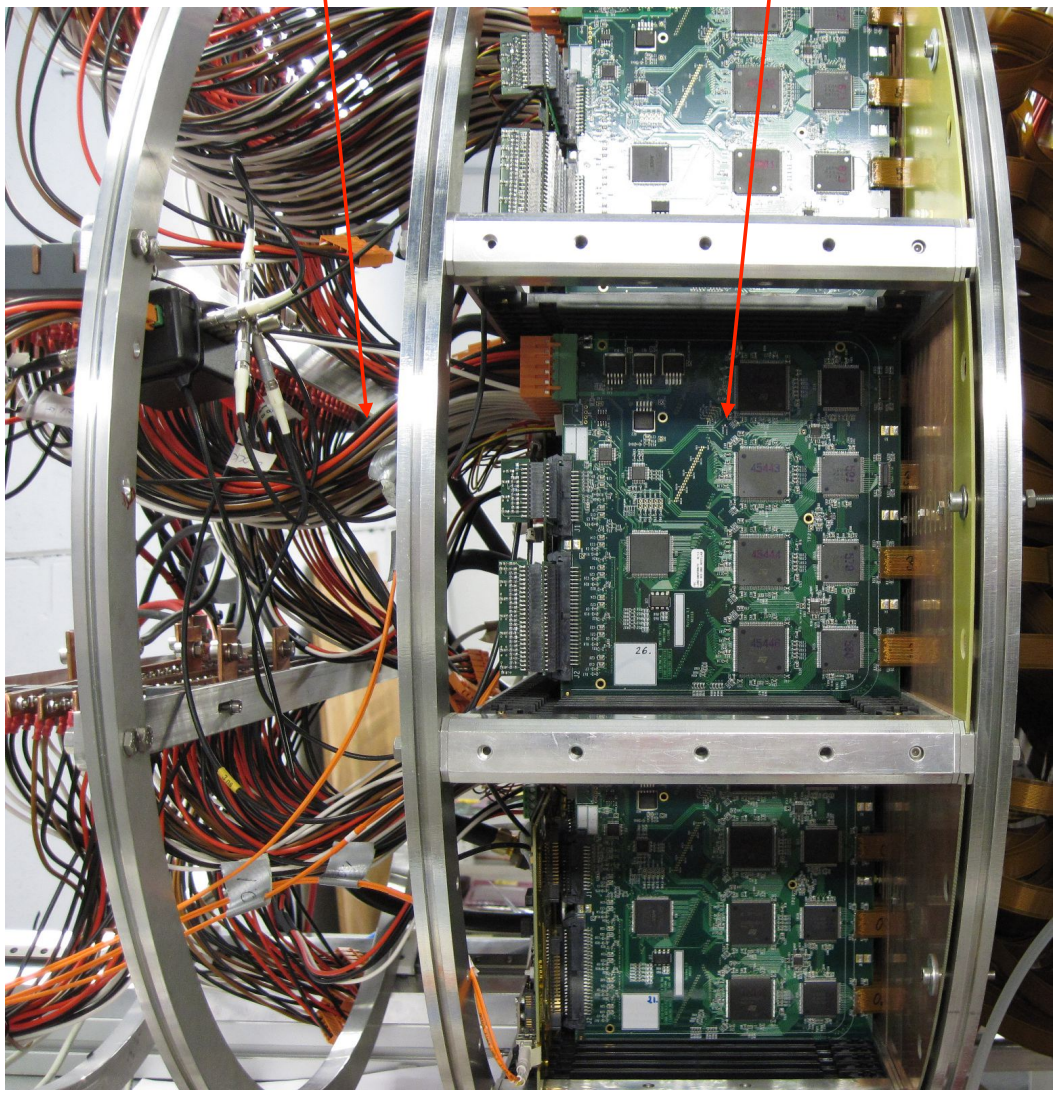
Modified ALTRO BUS backplane to allow 32 FECs instead of 26
Modified Readout Control Units (RCU) to handle external trigger and clocks
Standard Data Receiver (DRORC)

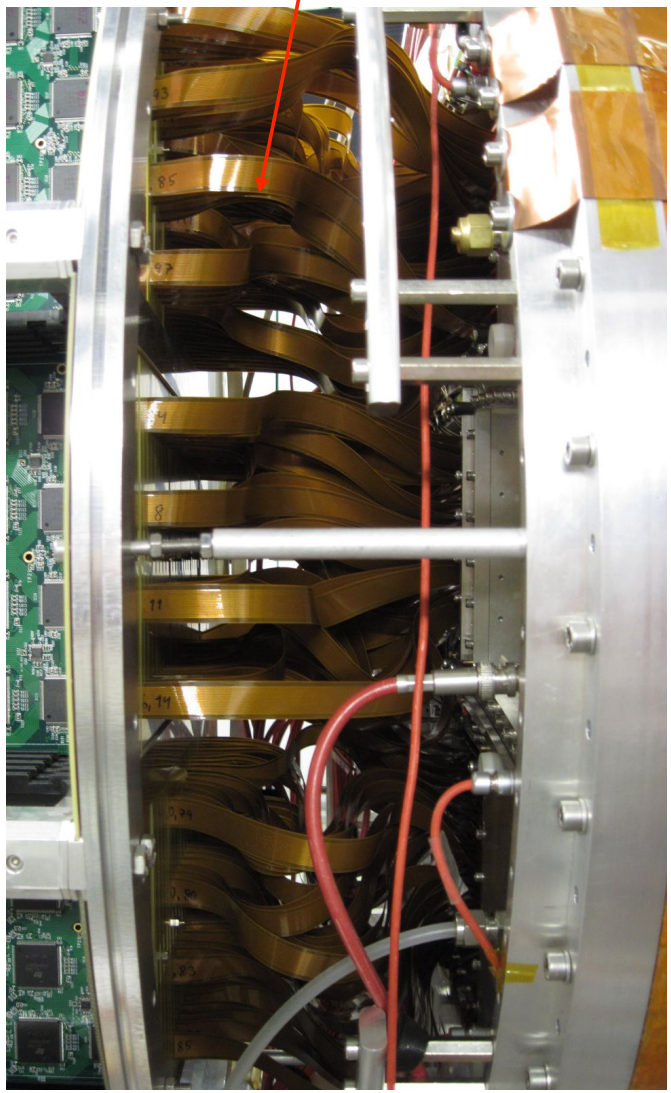

FEC
Backplanes
RCU
Low Voltage
Temperatures sensors
Cooling – compressed air

Low Voltage

FEC

Kapton cables





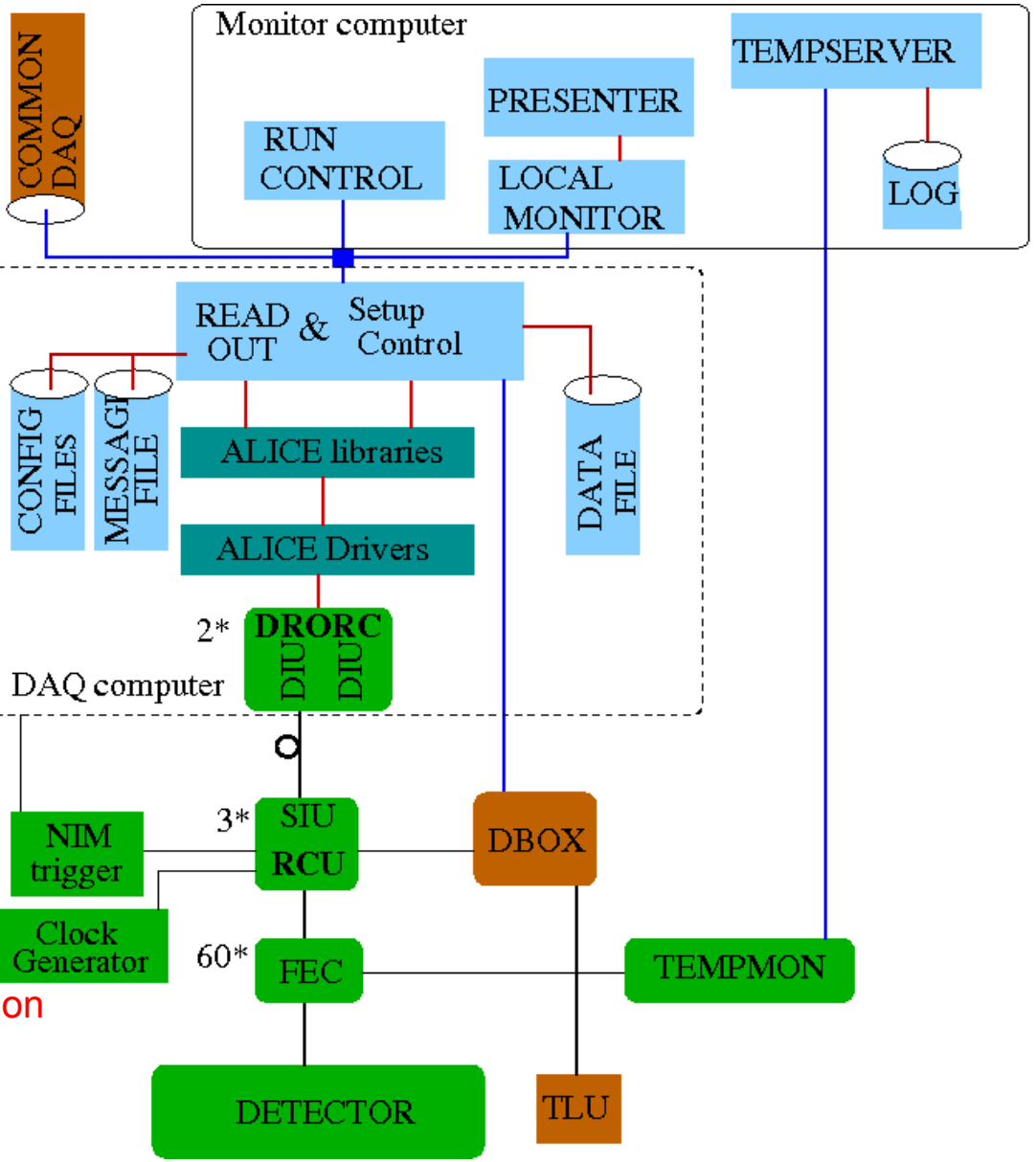
User interface:
Local run control (JAVA)
Local monitoring (C++/ROOT)
Temperature monitoring
No common DAQ interface

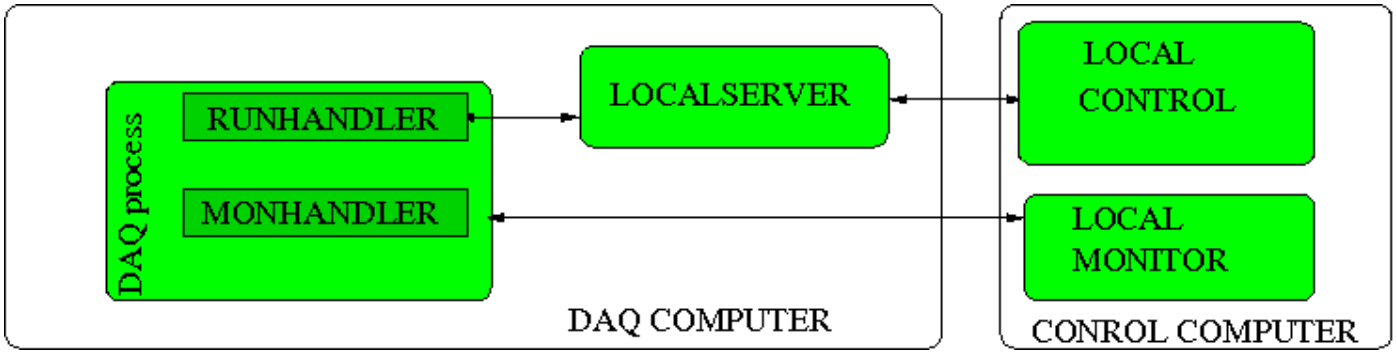
DAQ software (C):
readout, logging, configure

ALICE software used:
libraries
drivers

ALICE hardware:
DRORC
RCU
FEC

Trigger:
NIM system
DBOX-TLU trigger & clock distribution
DBOX-TLU for common running
not fully tested and used





Messages are sent between local control and localserver over network as simple text strings:
*<command> <parameters> e.g.:

*START	configure DRORC/data memory/RCU/ALTRO
*SOR, *EOR	start of run, end of run
*PCA	configure PCA16
*STOP	close DRORC/data memory
*POW	power on/off FECs, download lookup tables (takes long time)

Localserver communicates with DAQ runhandler using sockets or UNIX signals depending on run state (should have be done differently today).

Local monitor communicates with a thread (monhandler) in the DAQ process

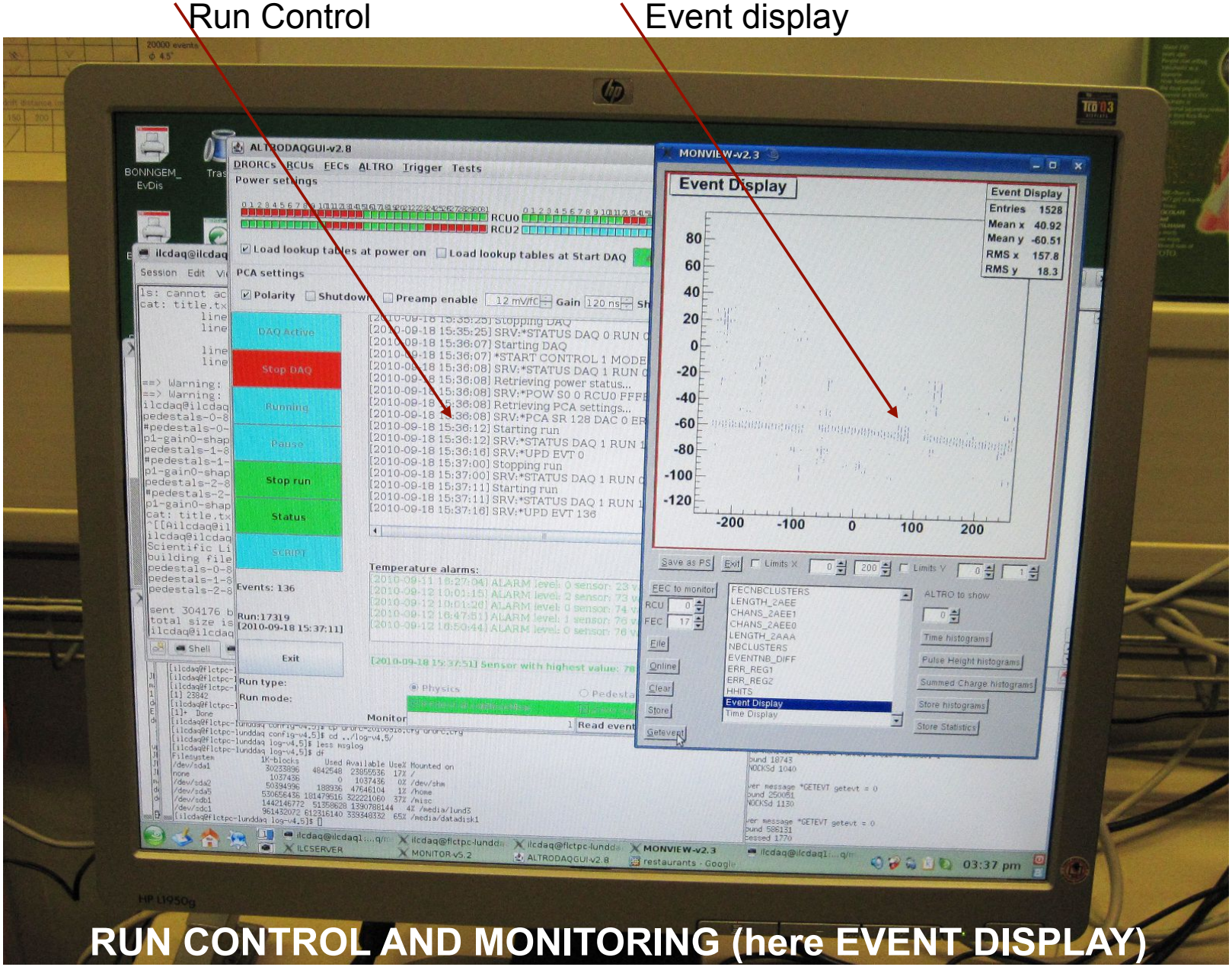
*GETEVT	request an event, event is sent as raw binary data over the network

TRIGGER SYSTEM

NIM electronics and using the parallel port on DAQ computer to enable/reset trigger.
External clock generator for the RCUs
One trigger mode:
1 - Data driven readout (DAQ process waits for data from DRORCs)

DBOX – TLU intended to be used for common running
D(istributor)BOX recieves trigger from TLU, distributes trigger and clocks to the RCUs
Two trigger modes:
1 - Data driven readout (DAQ process waits for data from DRORCs)
2 - Network trigger from DBOX to DAQ process

DAQ process send an acknowledge through the network to the DBOX when finished
Problem: acknowledge is sometimes sent but not received.
There has not yet been any combined running, so DBOX – TLU has not been the standard trigger system used.



RUN CONTROL AND MONITORING (here EVENT DISPLAY)

EXPERIENCE WITH READOUT SYSTEM

Operated reliable when taking data in test beams at DESY:
February – March 2009
July 2009
September 2009
September 2010

In September 2010 did the system consist of:
7680 channels (60 Front End cards)
3 RCUs
2 DRORCs

The system is designed to handle 10000 channels.

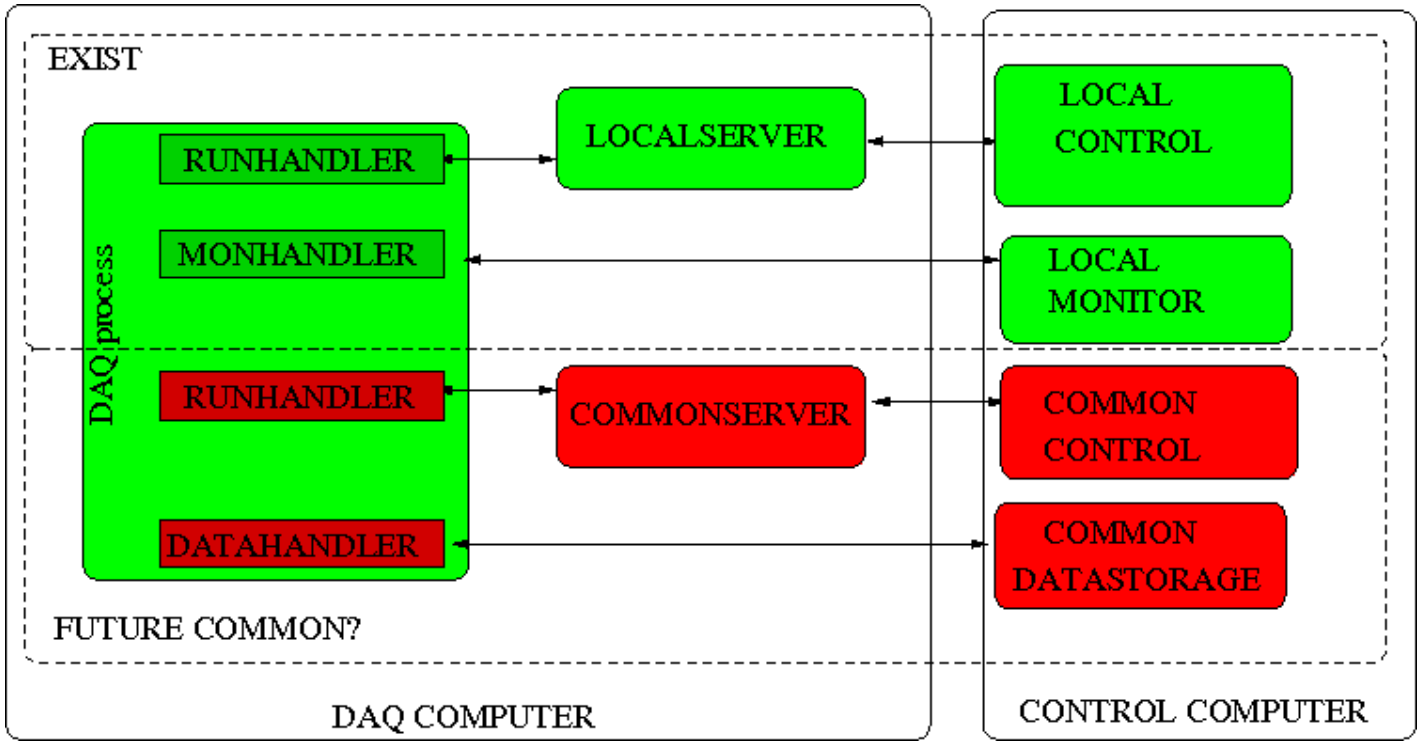
Improvements have been done during this time.

Used in Japan with 1 RCU + GEM + small TPC.

Used in Lund for system tests.

Some improvements in run control planned.

FUTURE?

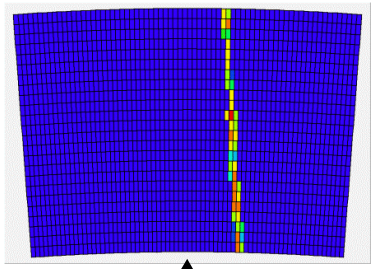


DBOX – TLU trigger? fully implemented if any combined running

Some work was done to integrate DAQ process with EUDAQ, but lack of time/manpower and problem with ALICE C-code interrupted it.

Control? implement a commonserver that can communicate with the DAQ process one one side, as the localserver do, and with a common control on the other side.
Event data transfer? Currently as local storage and sending raw binary data over network.

MICROMEGAS DAQ



DAQ:
- Maximum rate: 14 Hz (Zero Suppression mode)
- Triggered by beam (no TLU)
- Easy to use (GUI)

T2K electronics
1728 channels

Optical fibre

Back-end electronic (ML405)

TCP/IP via ethenet

PC
T2K DAQ
on Linux

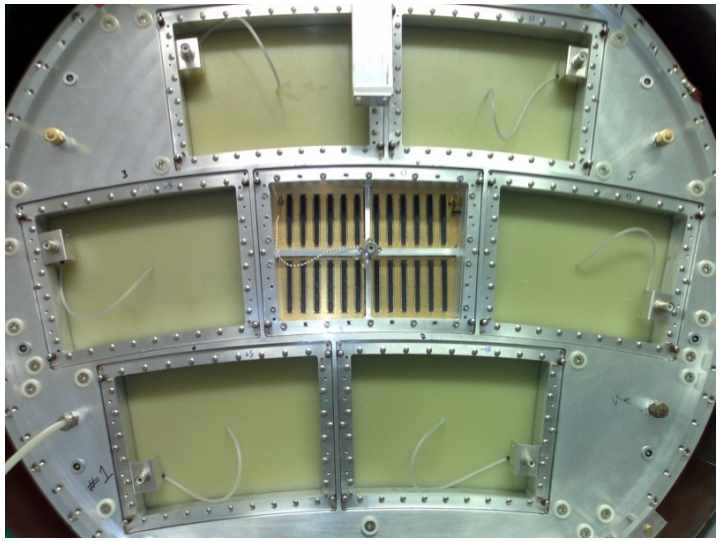
1-hour automatic rsync backup

500 Go — ILC_DATA_01
500 Go — ILC_BCKP_01
500 Go — ILC_DATA_02
500 Go — ILC_BCKP_02
1 To — Saclay

Grid

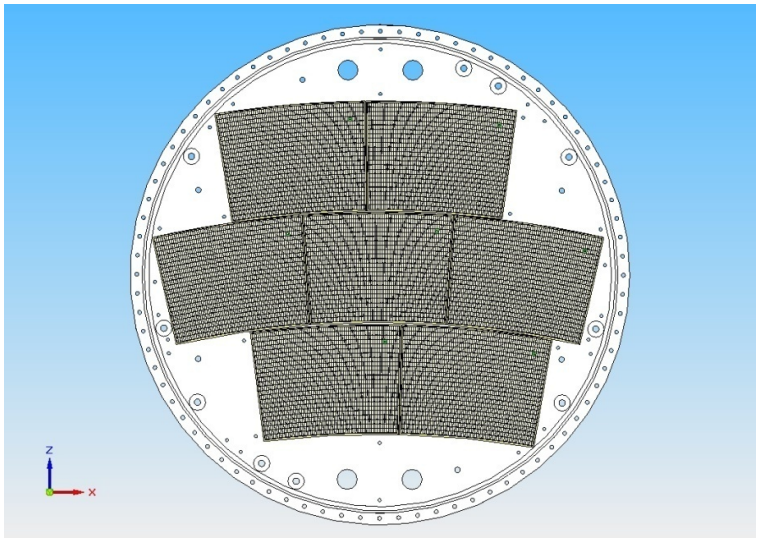
NativeToLCIO (Yun-Ha Shin)
Transfert done by K. Dehmelt

MICROMEGAS Future Plan

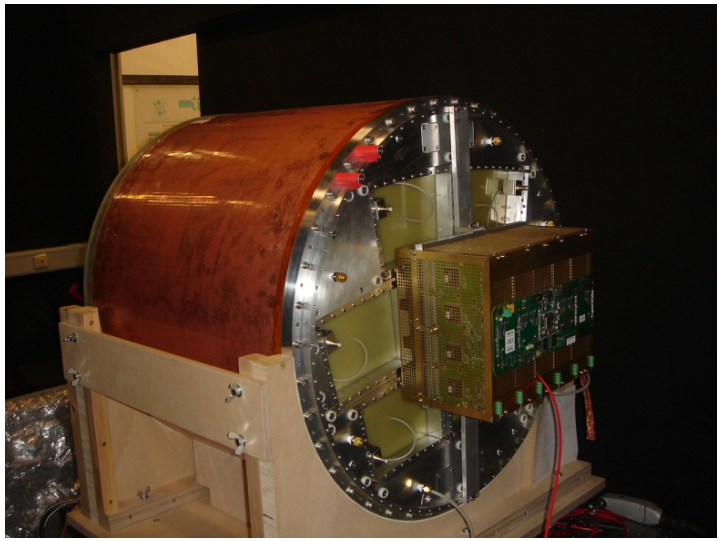


So far with one detector module (1728ch)

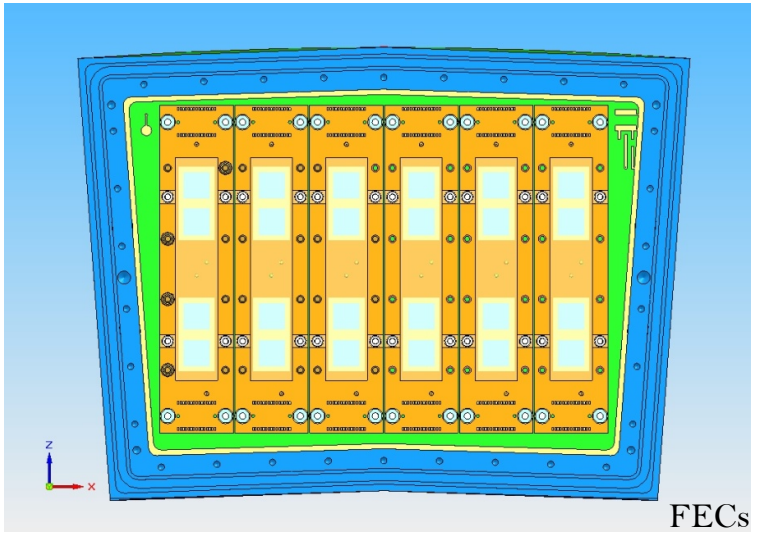
Resistive technology choice



with 7 detector modules.

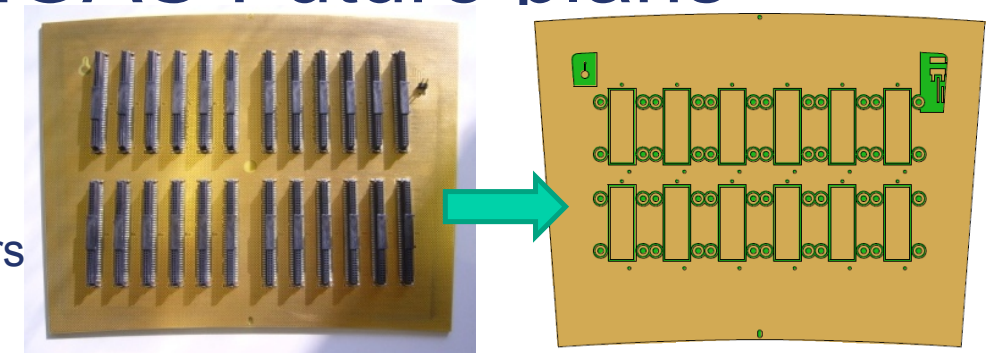


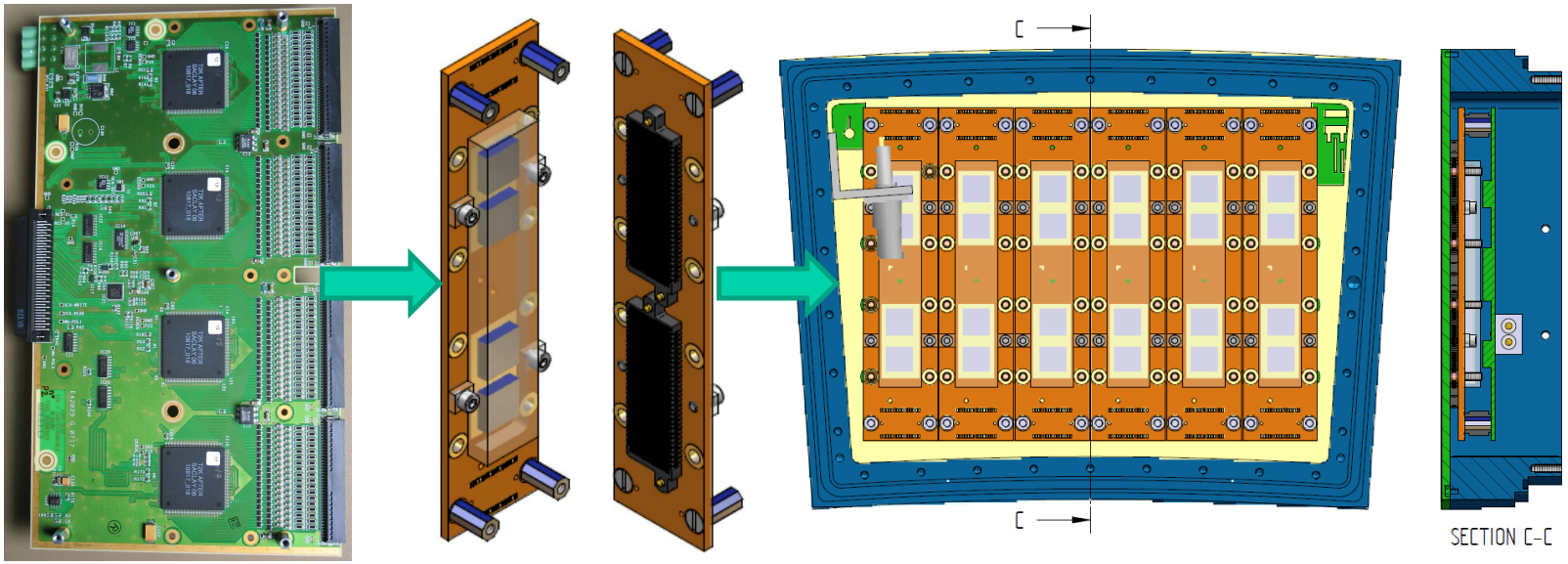
Reduce the electronics



MICROMEGAS Future plans

- This requires:
  - **New PCB routing**
    - keep pad layout
    - Use flat 300 point connectors
  - **New FEC**
    - Remove part of the protection (Resistive foil protects)
    - Remove packaging (silicon is 7x7mm instead of 20x20 for the packaging
    - transfer power regulation and ADC to the mezzanine module card.





- In addition: new Front End Mezzanine card and Back-end Module
- New System will be compatible with TLU

Summary Current TPC DAQs

- The LPTPC test beams have been very successful
  - Many data are being analyzed, more test beam coming with more channels
- BUT:
  - Each electronics (ALTRO, AFTER, Timepix and Si envelope) has its own DAQ system :
    - **Each system is working stand alone**
    - **Each system has local online monitoring tools**
    - **Most systems have local reconstruction and analysis**
    - **All have a converter to LCIO**
    - **Analysis in Marlin has started on all systems**
- For TPC alone tests, each system is working fine

  + already one successful combined test MICROMEGAS+Si envelope
- However :
  - **Except Timepix, other systems are not using EUDAQ**
  - **So far, only ALTRO can use TLU (with an extra distributor board)**
    - One of the problem : TLU uses LVDS signal while ALTRO/AFTER use LVTTL

For future combined test beams, both items have to be improved