Xavier Janssen - Université Libre de Bruxelles

On behalf of the LC-TPC Collaboration

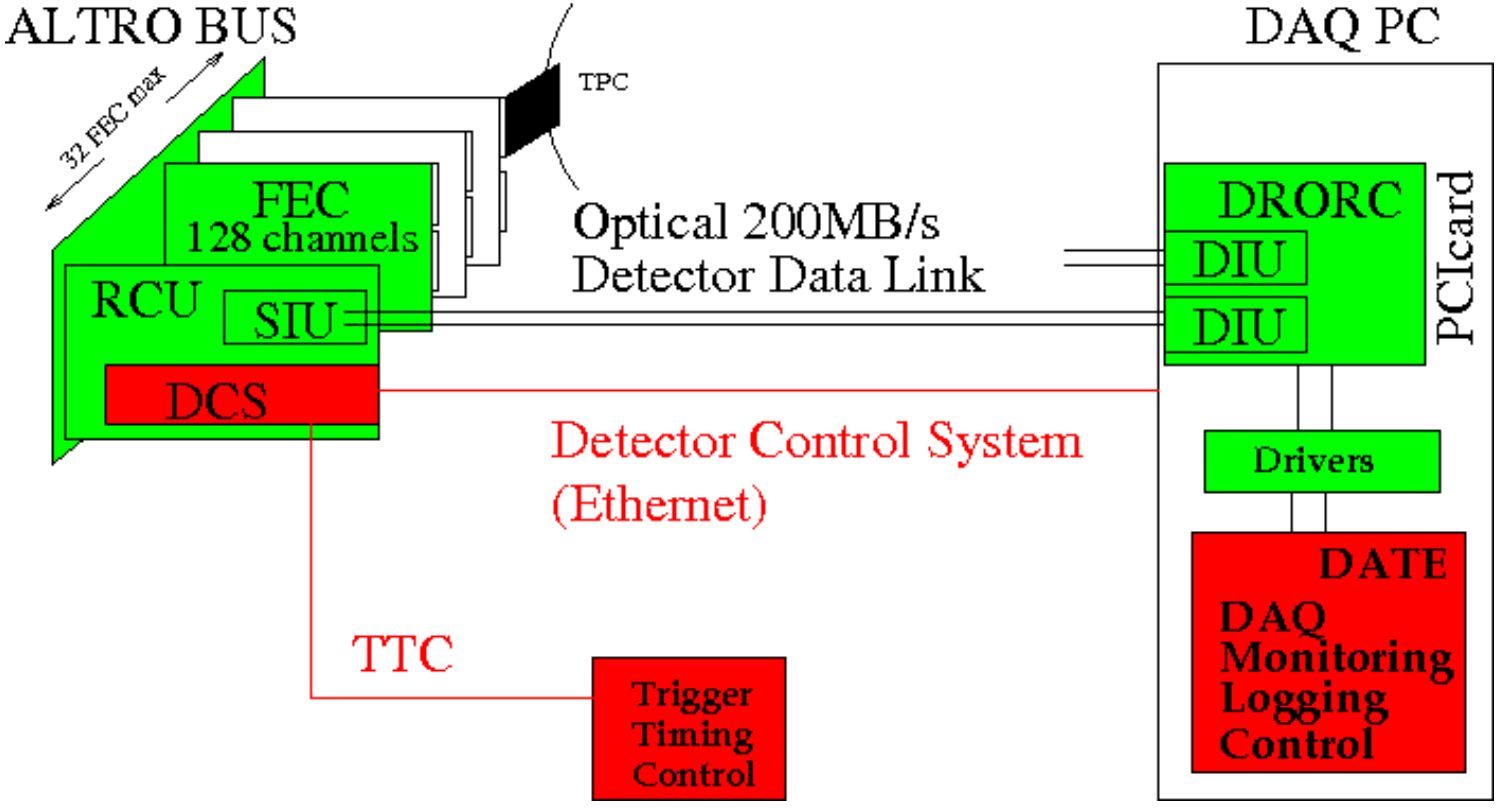
LC-TPC read-out

IIHE (Brussels University), CERN, Lund University,
Bonn University, CEA Saclay

ILC-ECFA 2008, Warsaw, Poland, 9th-12th June, 2008

ALTRO r/o: ALICE TPC r/o overview

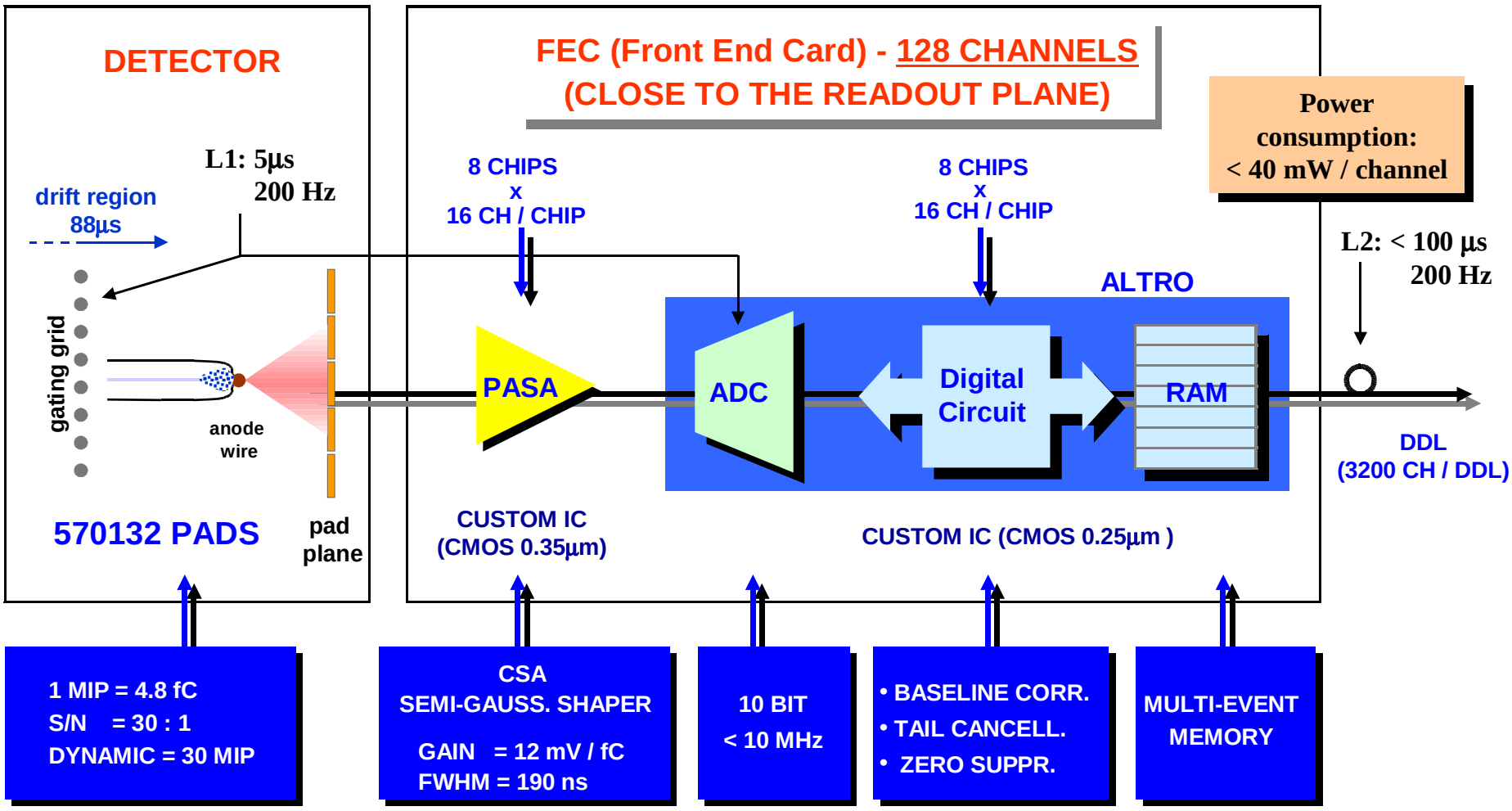
Original ALICE design:



Will not be used for LC-TPC:

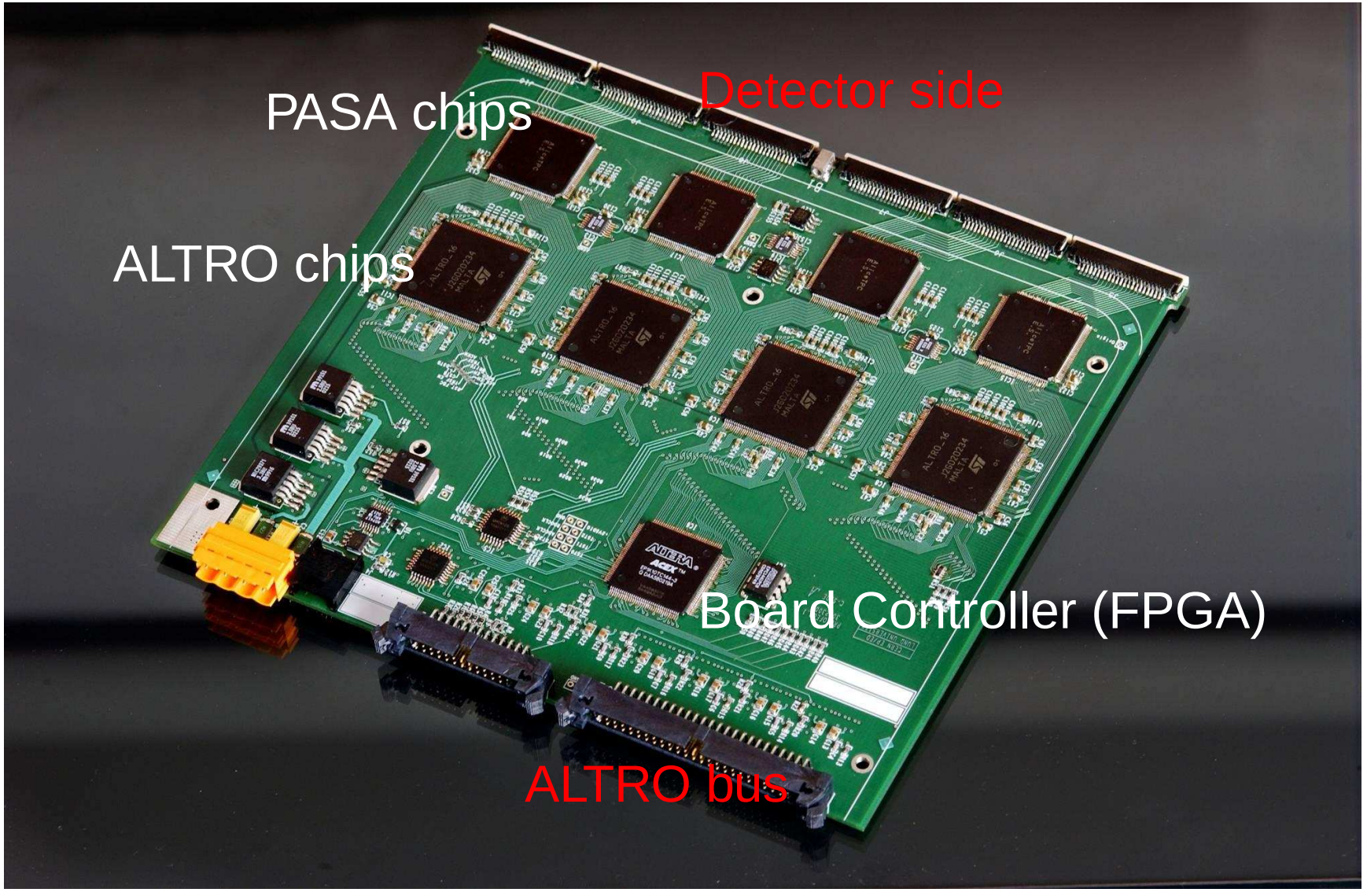
- TTC: LHC specific trigger electronics
- DATE r/o software (beyond drivers level)
- DCS

ALTRO r/o: ALICE Front End Card (1)



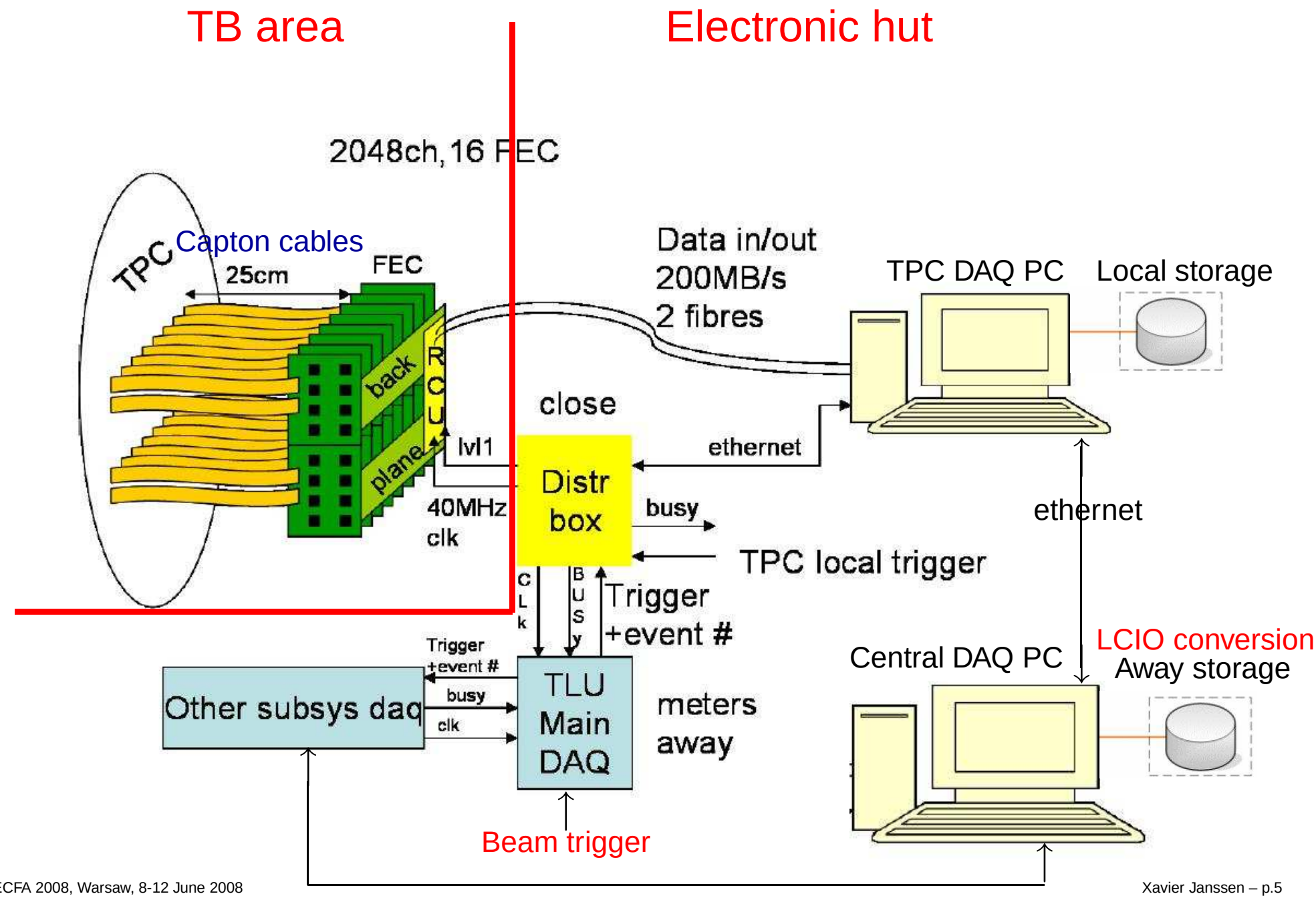
ALTRO r/o: ALICE Front End Card (2)

128 channels ALICE FEC:

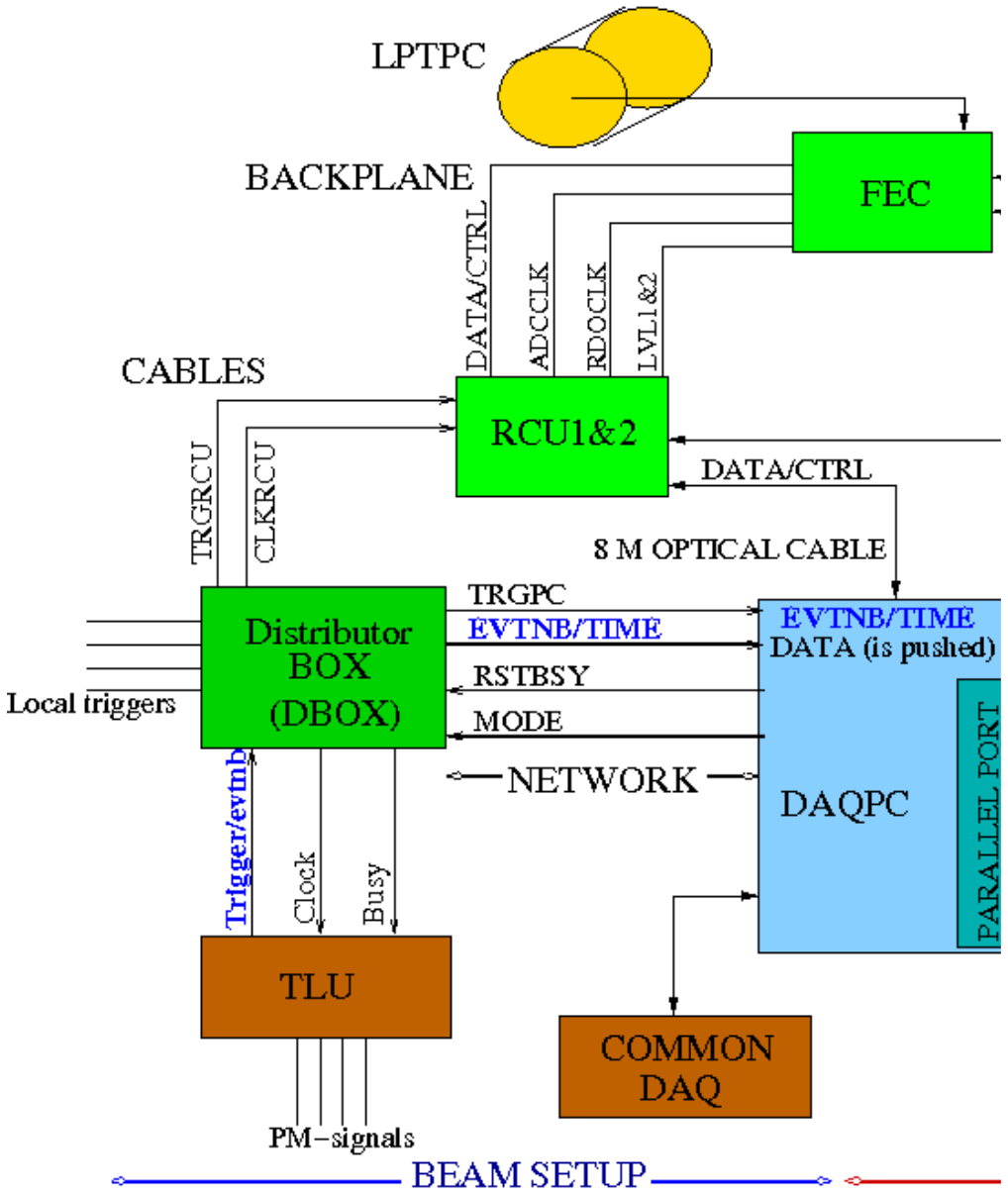


+ 4 PASA chips on rear side

ALTRO r/o: LC-TPC DAQ overview



ALTRO r/o: LC-TPC r/o electronic



Modifications vs ALICE:

- 25 cm capton cables between TPC endplate and FEC's
- New programmable Amplifiers
  $\longrightarrow$ FEC modifications
- Trigger source: EUDET TLU
  $\longrightarrow$ DBOX: interface to TLU
- New DAQ software

EUDET 2000 channels needs:

- 1 RCU (available)
- 16 modified FECs (1 prototype)
- TLU (avail.), DBOX (ongoing)

$\longrightarrow$ 10000 channels later

ALTRO r/o: New Amplifiers

16 channels Programmable Charge Amplifier - PCA16 (CERN)

- 1.5 V Supply, power consumption < 8 mW / channel
- programmable features:

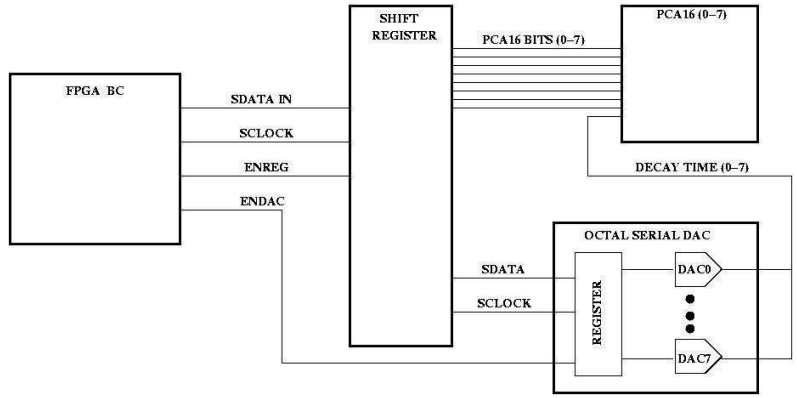
- Signal polarity
- Peaking time (30 ns - 120 ns)
- Decay time (continously programmable)
- Power down (wake-up = 1 ms)
- Gain in 4 steps (12 -27 mV/fC)

→ Final version was delivered at end of 2007

→ 200 purchased for EUDET test beams (test next week @ Lund)

PCA16 control:

- FEC modified to add a DAC and a shift register (Lund)
- Reprogram FEC's FPGA to control them (Brussels)



→ Tested sucessfully with 1st prototype of modified FEC

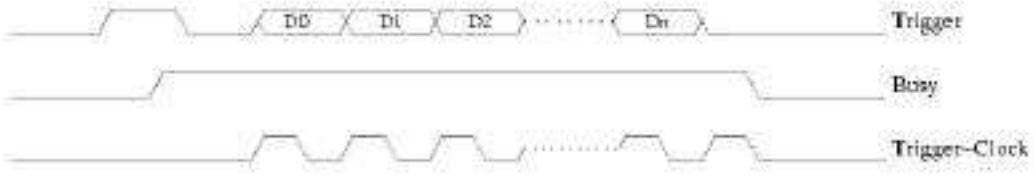
EUDET Trigger Logic Unit

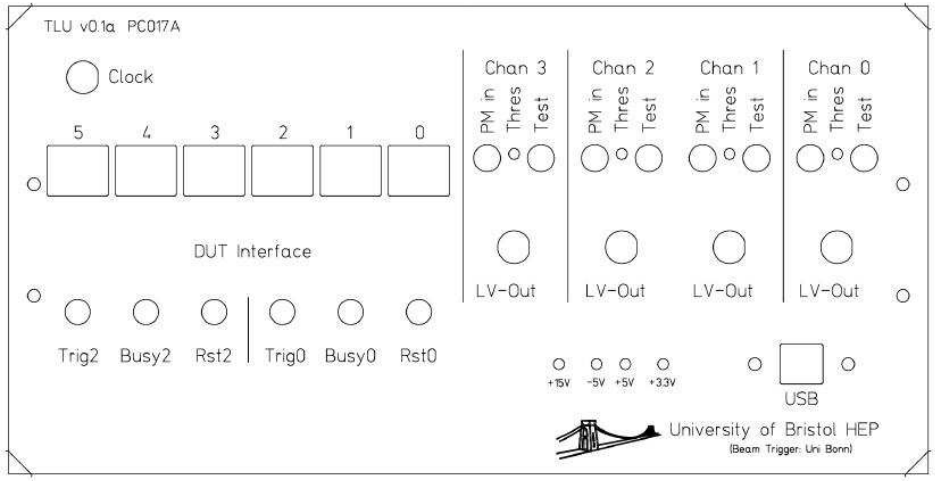
TLU inputs:

- 4 comparators with level between $\pm$800 mV (LEMO connectots)
  - $\rightarrow$ Cosmic trigger will send NIM signal to TLU
  - $\rightarrow$ beam trigger
- BUSY signal from TPC (+ other detectors: Si) in LVDS format
  - $\rightarrow$ None of r/o electronic provide such a signal (see later)
- Reset (LVDS): allow synchronisation of timestamps

TLU outputs:

- Trigger signal (LVDS)
- Event number (LVDS) pulled out by a data clock (LVDS)





ALTRO r/o: Distributor Box (Brussels)

- ALTRO needs a 3.3 V Trigger signal and a clock
- ALTRO do not provide BUSY $\longrightarrow$ Fixed timeout or ethernet
- Synchronisation (timestamp/event#) via special trigger count

Use commercial ALTERA Cyclone 3 board + few custom electronic board for LVDS (TLU) interface

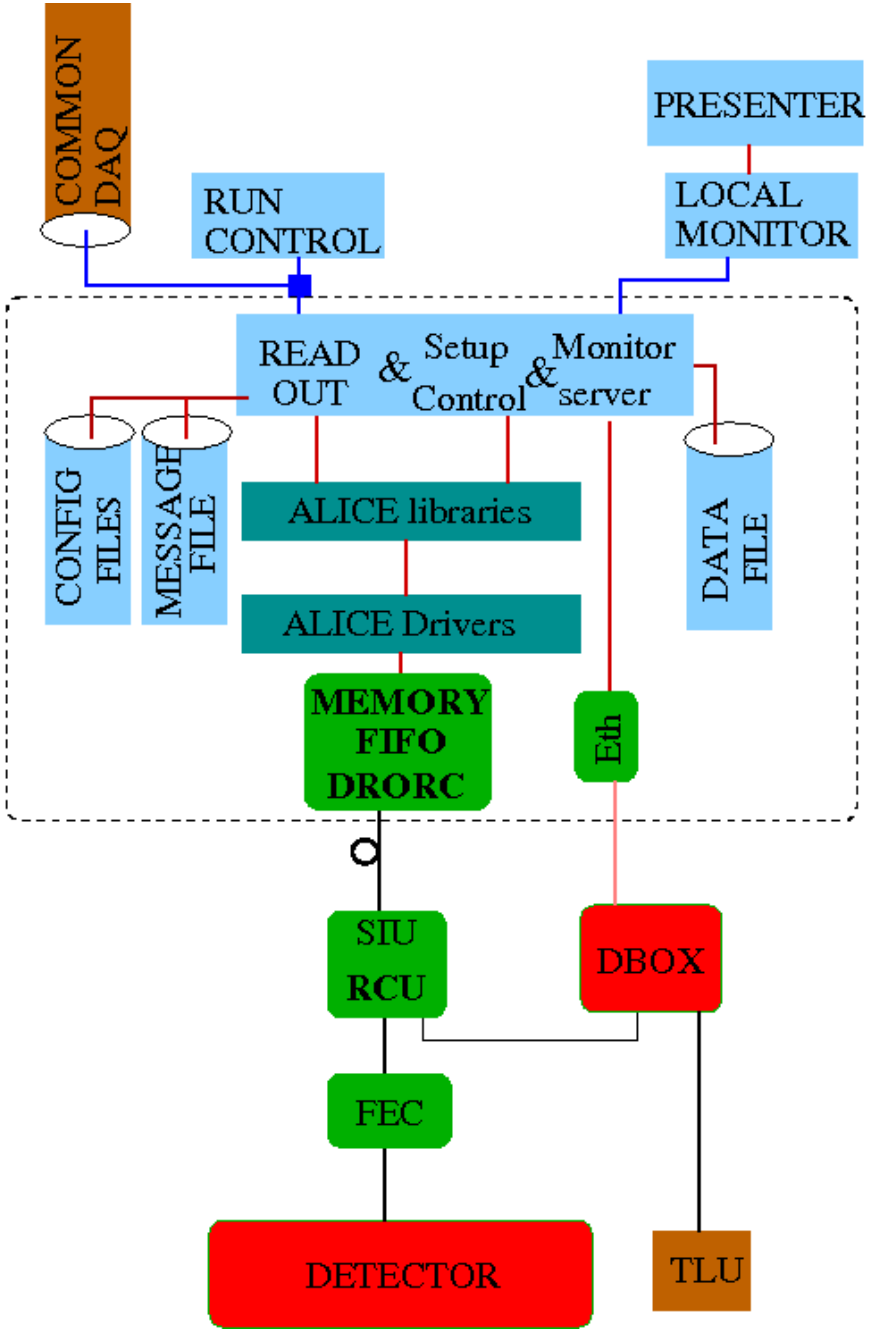
Distributor box should:

- Translate trigger level
- Get event# from TLU
- Tag event with time

$\longrightarrow$ Send event # + time to DAQ computer

- Assert BUSY for a fixed time: waiting for DAC pc end of r/o
- provide soft trig / reset
- provide common clock

ALTRO r/o: DAQ Software



Local Readout Software (Lund)

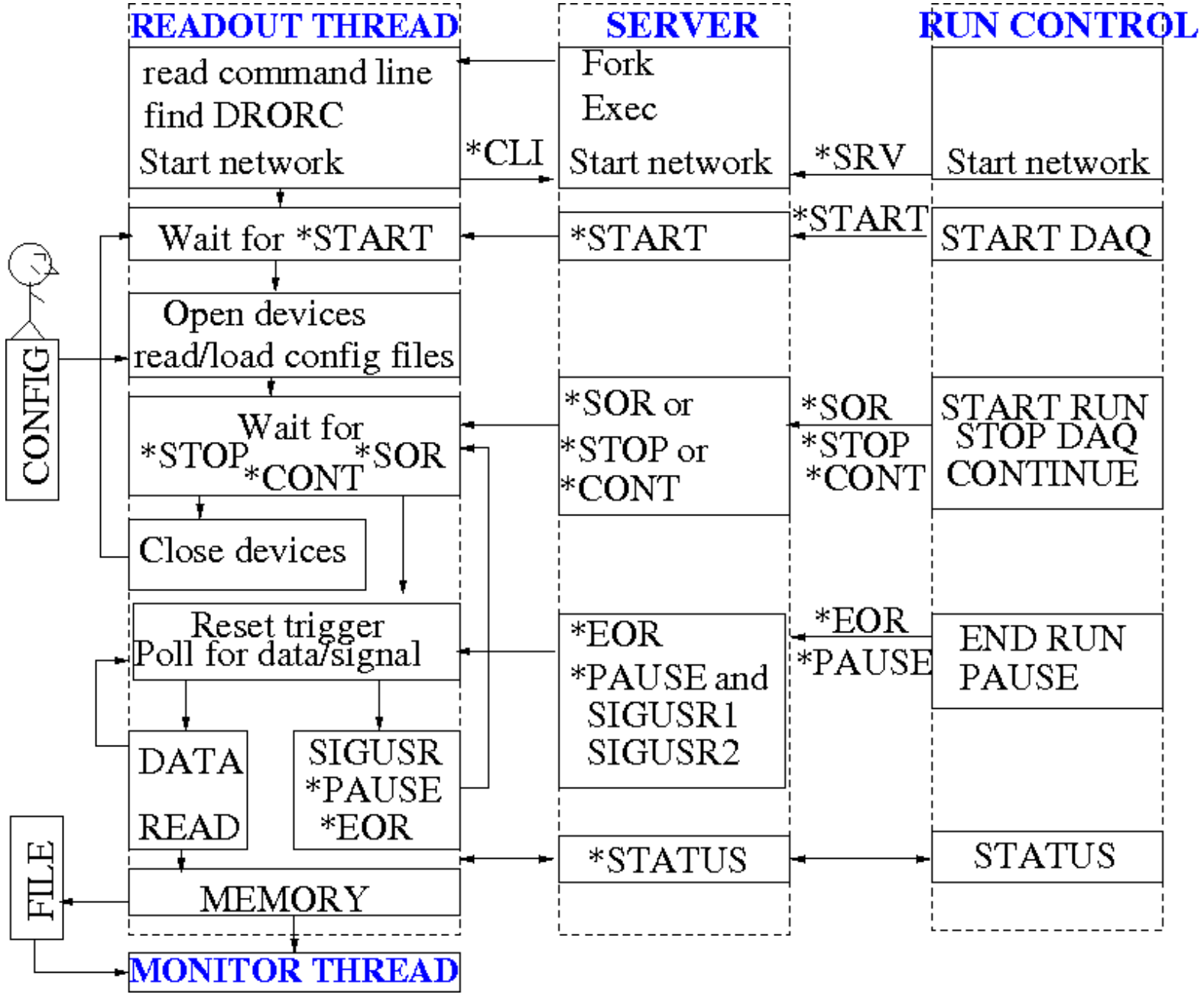
- Use ALICE drivers and librairies
- Direct memory access for RCU
- Configuration: ASCII files
- Local data: binary files
- TCP/IP server for data transfer
- TCP/IP server for run control
- Local monitor (TCP/IP): Histos
- Message files: ASCII files
- DBOX interface: TCP/IP server

Common DAQ (Bonn)

- TCP/IP connection to local DAQ
- Should ensure LCIO conversion

Slow control: not yet implemented

ALTRO r/o: DAQ Software

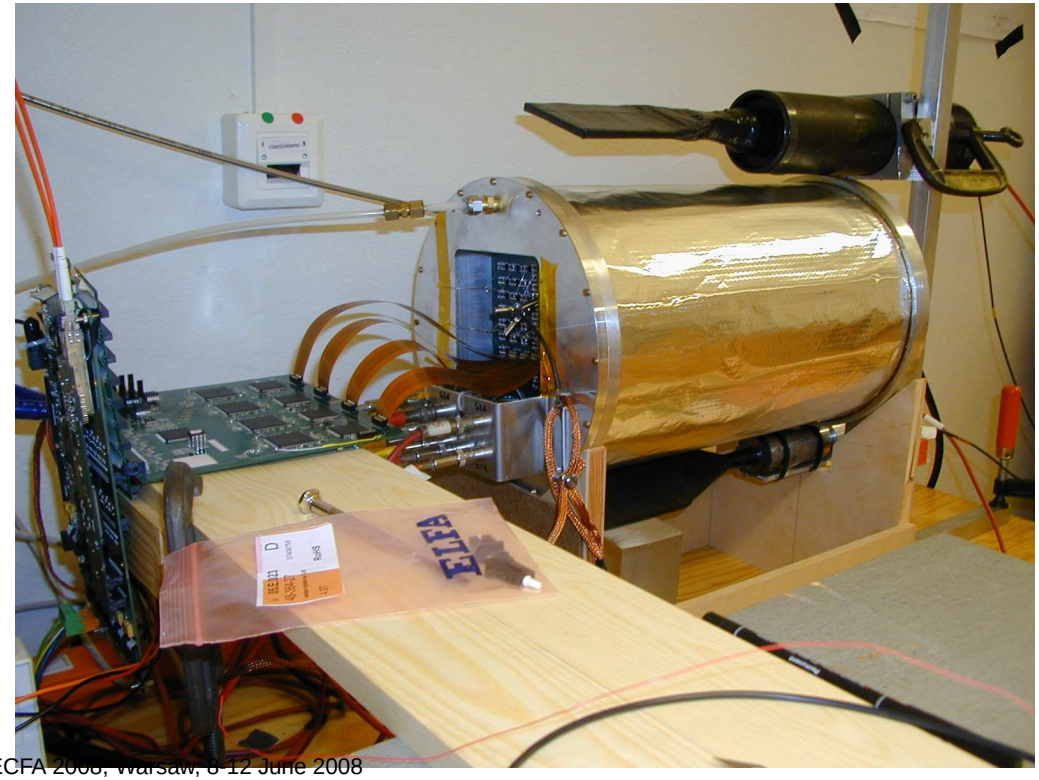


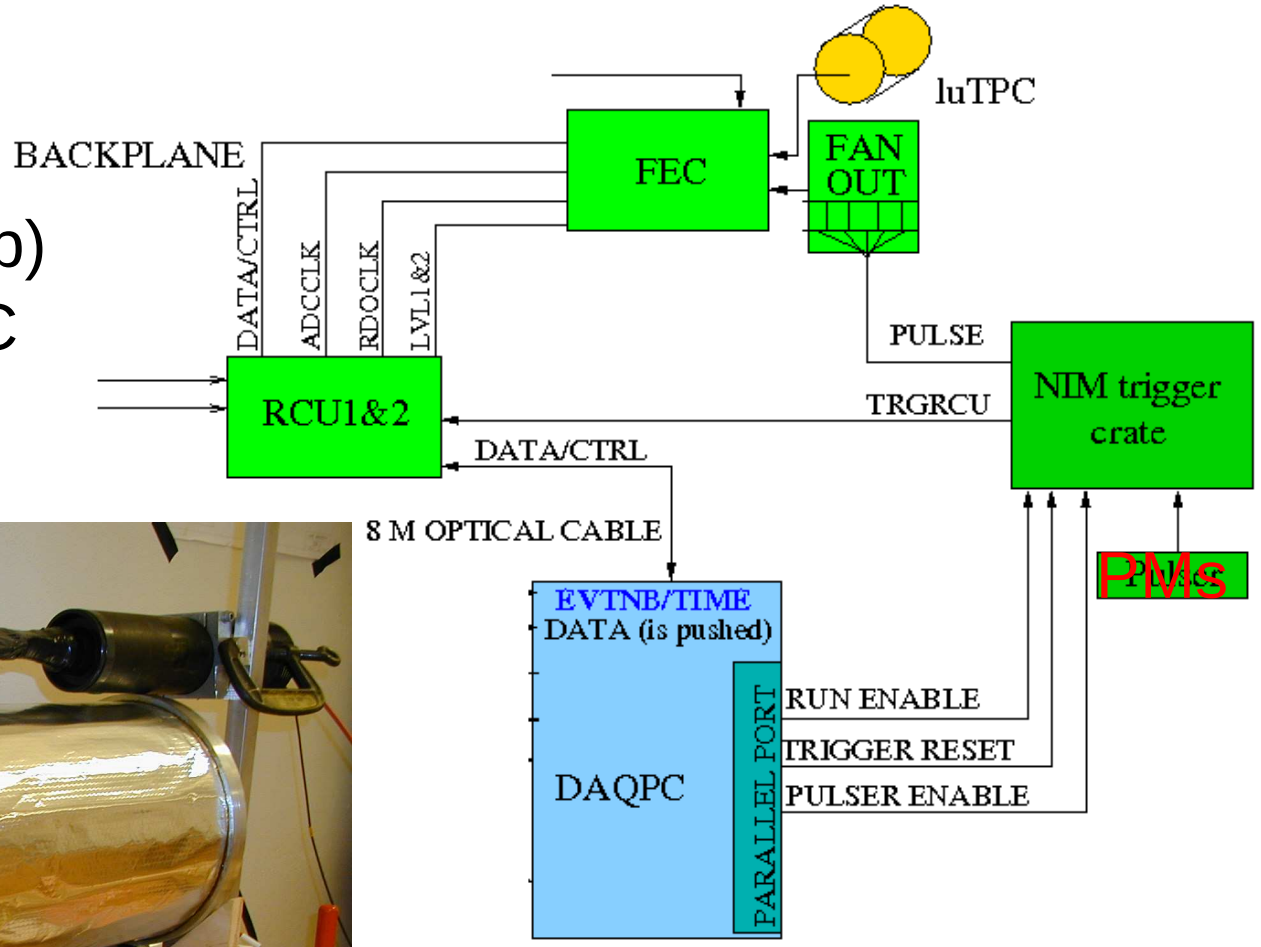
ALTRO r/o: Cosmics with Lund TPC

LuTPC:

- GEM detector
- 1x6 mm pads
- 2 rows (1mm side up) connected to 1 FEC

→ Test DAQ in real life

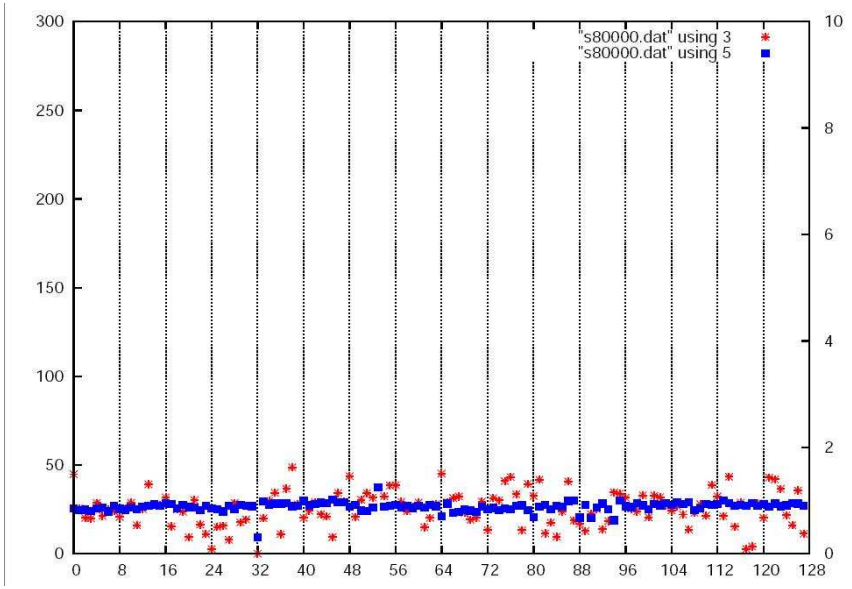




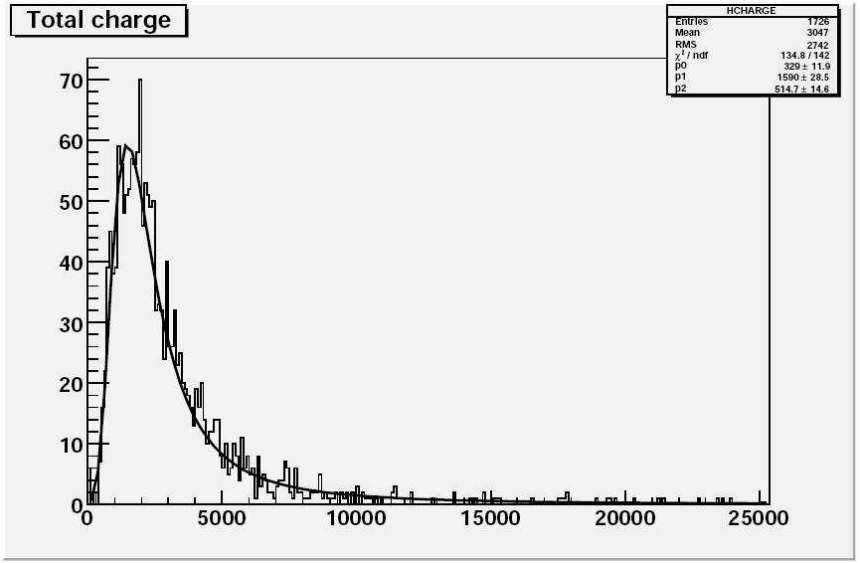
TEST SETUP

ALTRO r/o: Cosmics with Lund TPC

Pedestals:



Total charge vs time:



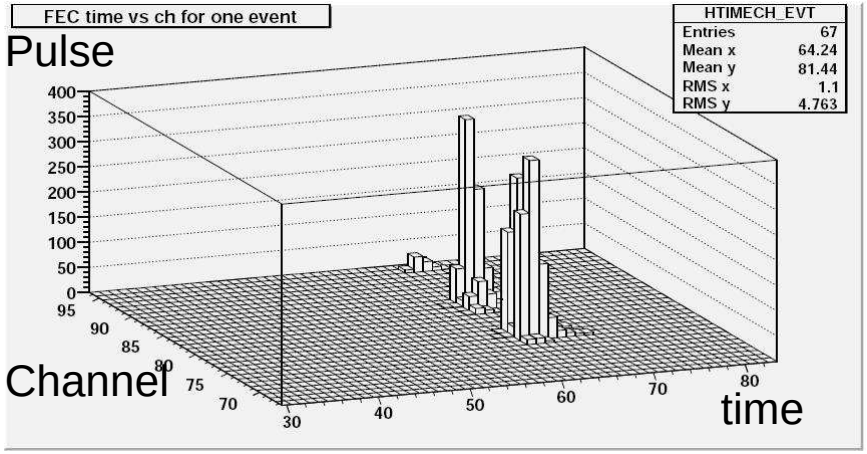
Pedestal run:

Low noise after FEC modification

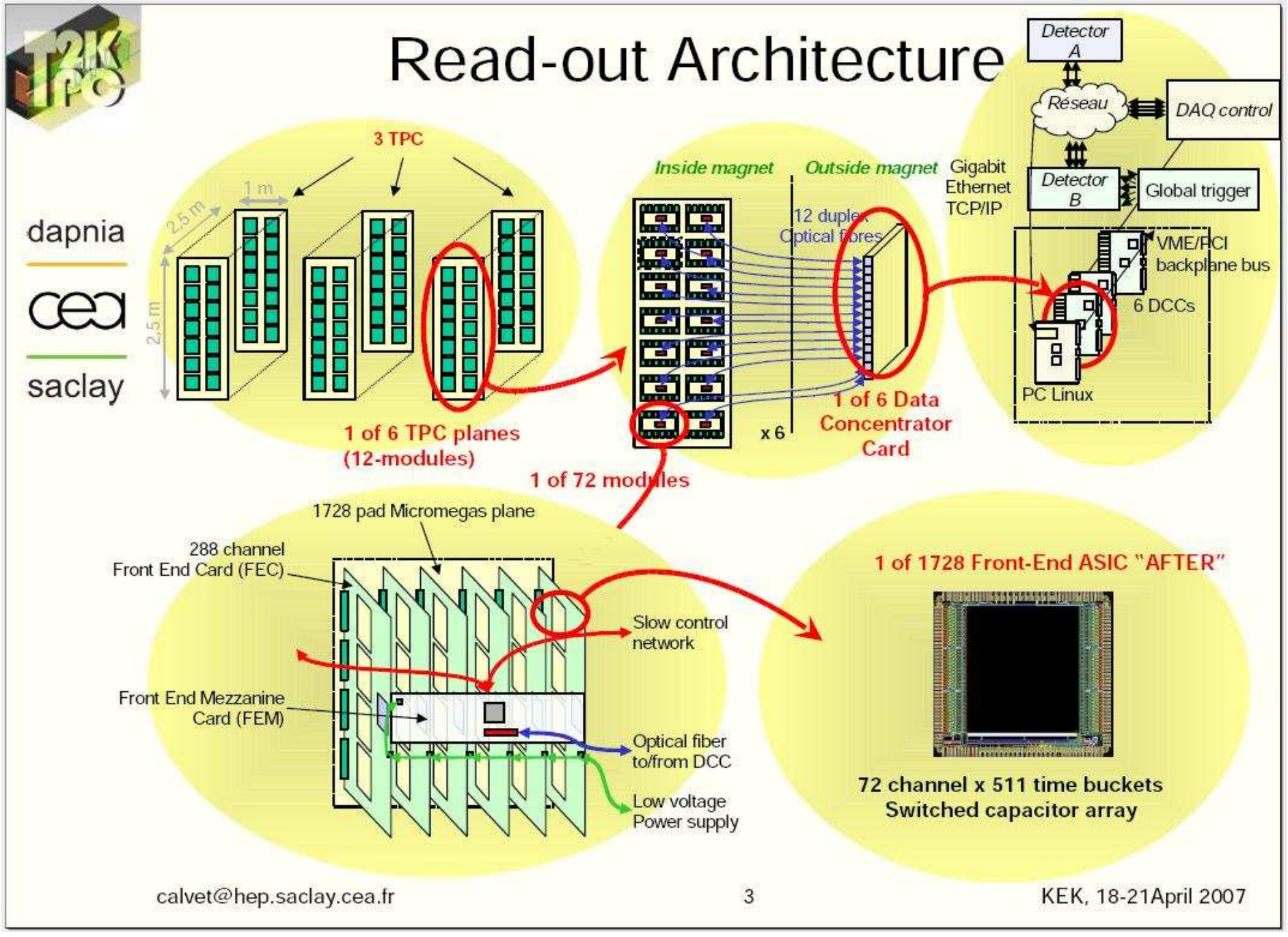
Cosmic run:

DAQ seems to work

Single event:



AFTER r/o: T2K TPC Electronic (CEA-Saclay)



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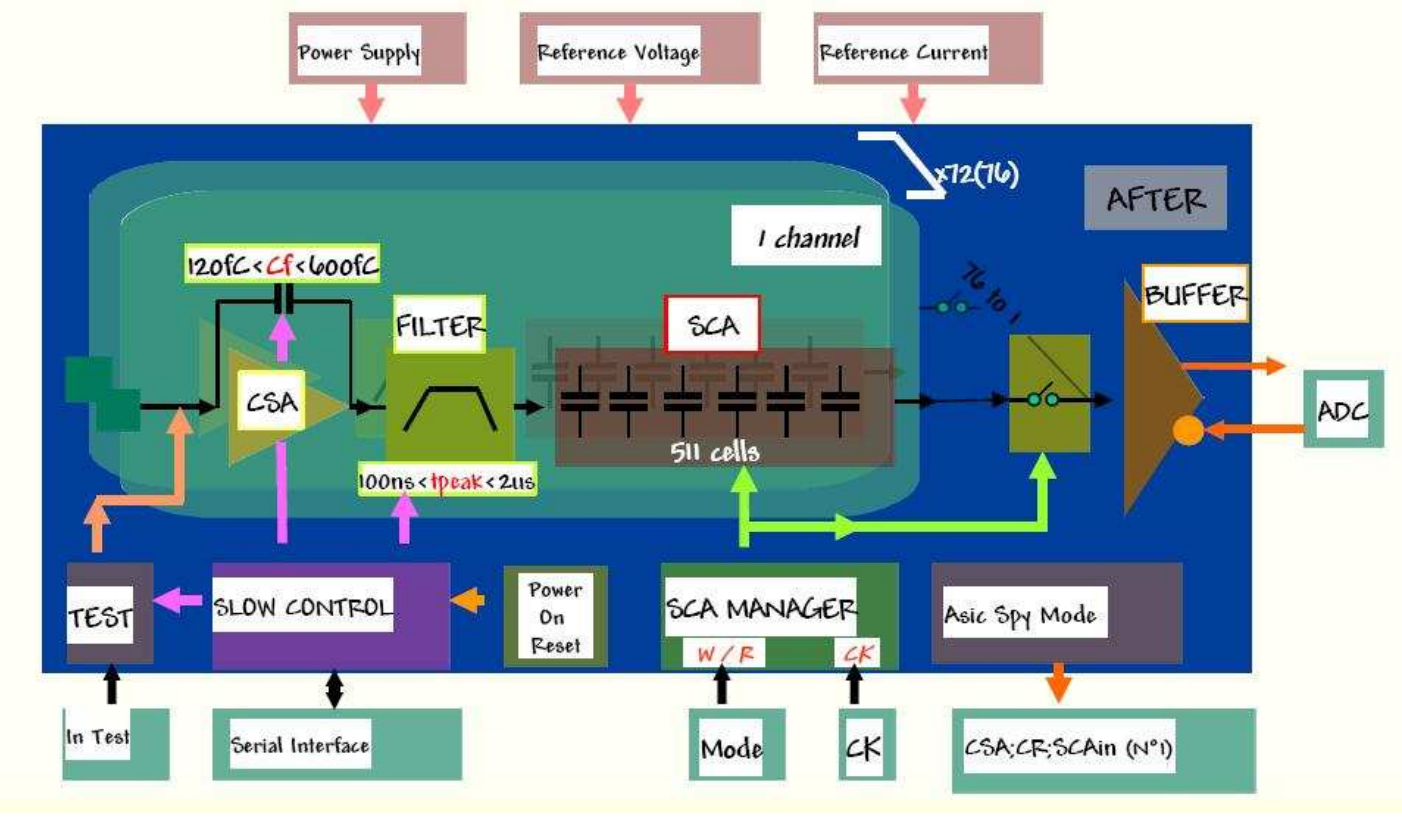
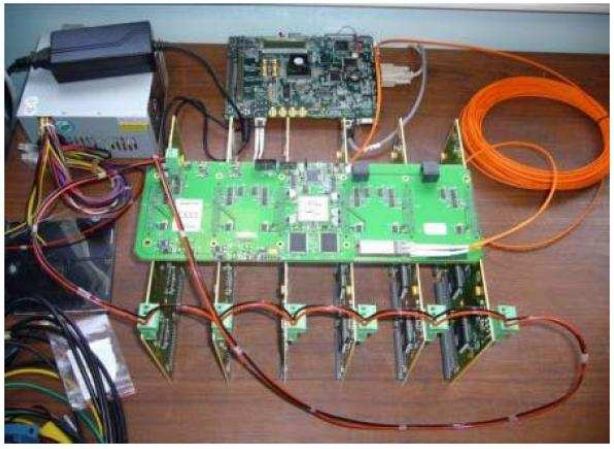


AFTER ASICS:

- 72 Analog channels
- 2 input polarities
- 4 gains: 120, 240, 360 and 600 fC
- 16 peaking times: from 100 ns to 2 ps
- 511 analog memory cells / channel



- Analog pipe-line + offline ADC/zero-suppress
- 1 crate tested for LCTPC (1738 channels)
- Mechanic suuport and shielding being build

→ Will be used with Micromegas panels

SUMMARY

ALTRO r/o electronic:

- First DAQ prototype tested sucesfully with cosmics
- Second FEC prototype to be submitted next week(s)
- Trigger Distributor Work being developped
- Goal is to deliver (at least) a 2000 channels r/o by octobre

  $\rightarrow$ Use for GEM detectors and mixed Si/GEM detectors

AFTER r/o electronic:

- T2K r/o tested sucessfully, mechanic (+shielding) being build
- Work needed to integrate DAQ software in common DAQ

Not discused in this talk !:

- r/o electronic for Si-endplate, TDC r/o, ...
- Advanced en-plate: r/o directly on endplate detector PCB