



Testbeam/Lab DAQ for DCDB readout

S. Furletov

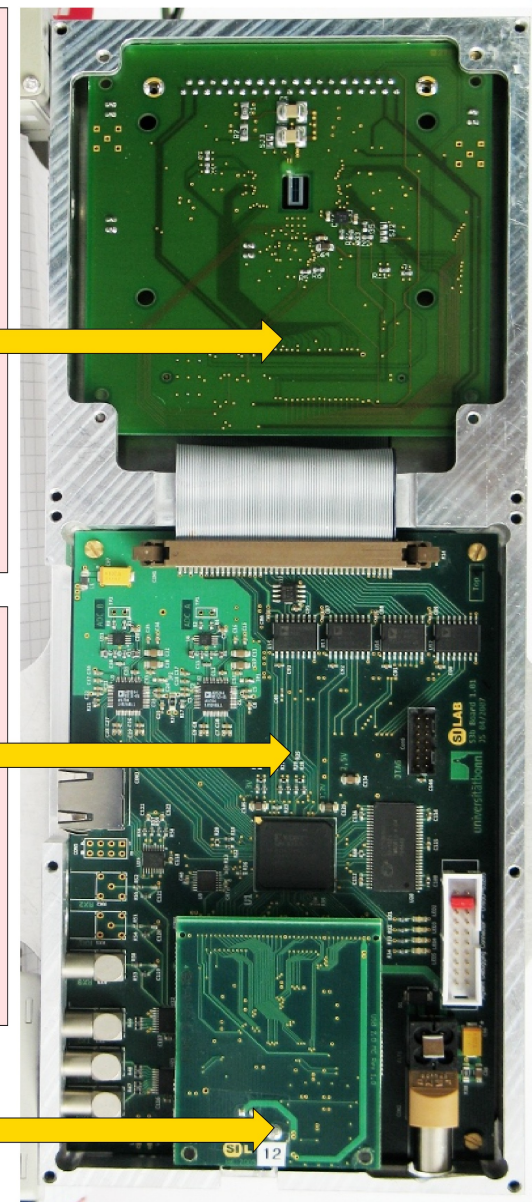
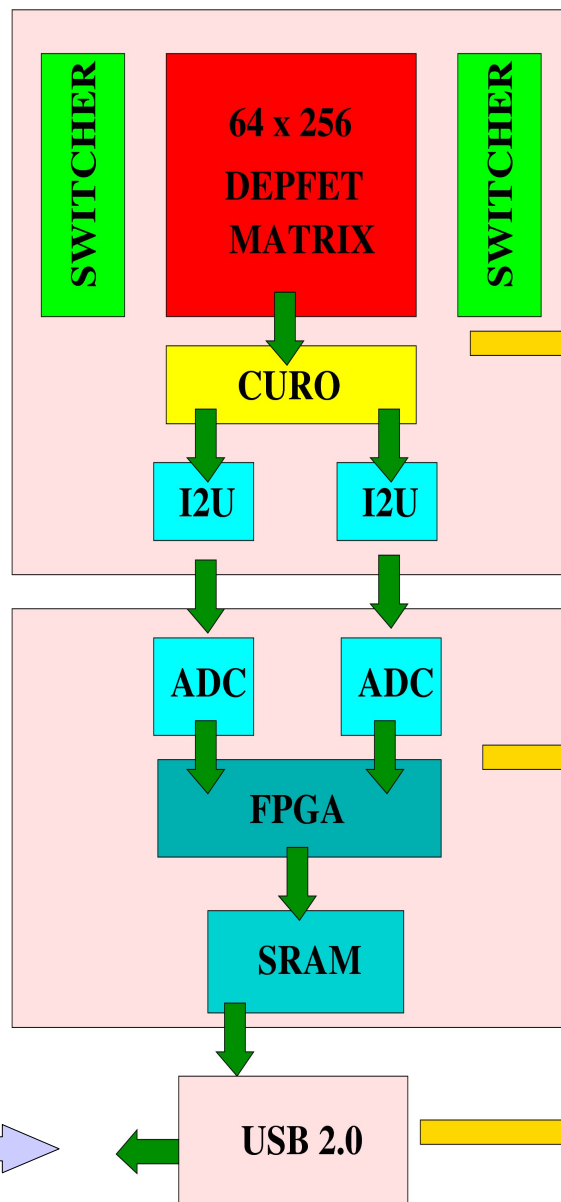
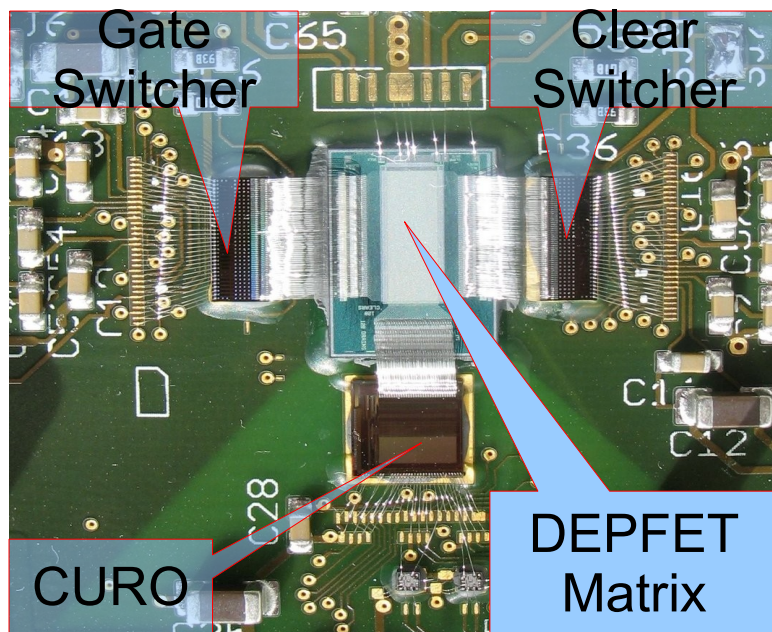
University of Bonn

4th International Workshop on DEPFET Detectors and Applications
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- *S3B data acquisition system (DAQ)*
- *DCDB + Manuel's FPGA readout*
- *DCDB + DHP readout*
- *Conclusion*

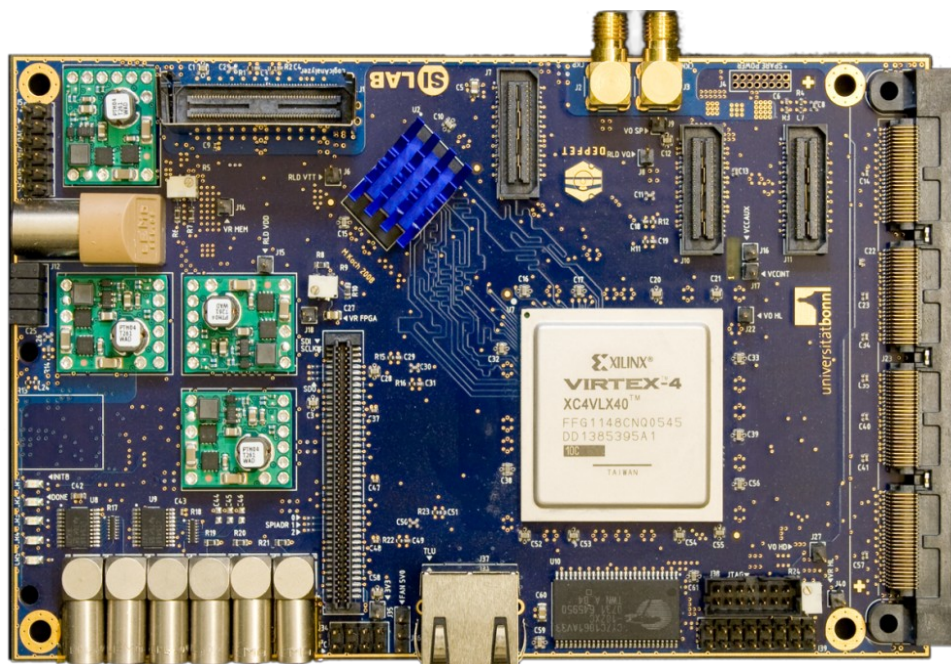
- *Data acquisition is developing for 3 new readout systems:*
 - 1) CURO readout based on S3B readout board
 - 2) DCDB readout based on Manuel's FPGA board (Virtex 4)
 - 3) DCDB + DHP readout based on ML-505 evaluation board
- *DEPFET telescope DAQ is based on S3B system*
- *New R/O boards should be integrated in DEPFET telescope DAQ*
 - Change data format
 - Upgrade S3B DQM for new matrices
- *S3B DAQ is integrated into EUDET telescope DAQ*
 - Upgrade offline software

S3B (CURO) readout system



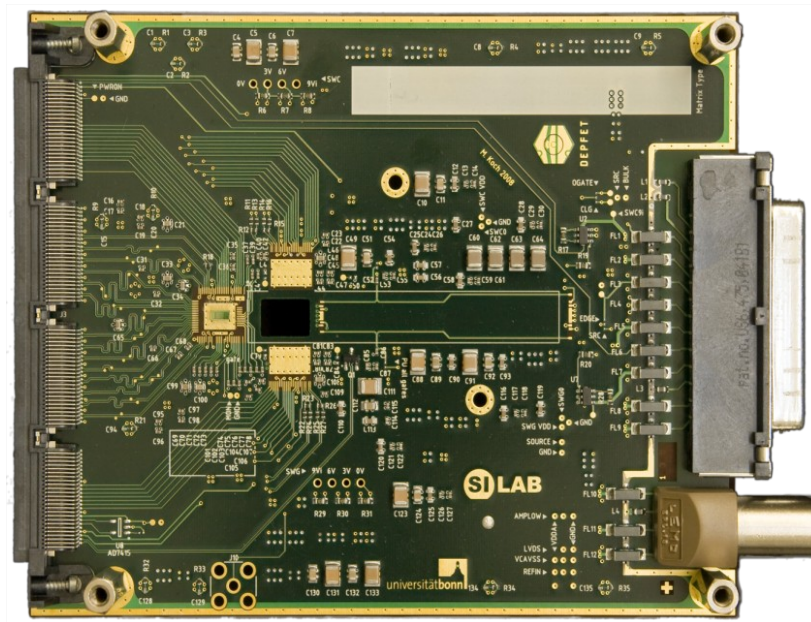
• *FPGA-based readout board*

- XILINX Virtex 4 LX40-1148
- 288Mbit RLDRAM
- >32 LVDS inputs up to 1Gb/s
- DEPFET DAQ / EUDET TLU / Test beam
- Data rate (burst) ~15Gbit/s
- USB 2.0 PC-connection



• *DCD2 / DEPFET Hybrid*

- intensive Tests of new generation of DEPFET ASICS (DCD2/Switcher3)
- DEPFET Sensor Integration
 - ✓ small 128x128 matrix
 - ✓ large 256x1024 matrix
- low-noise / high-speed design



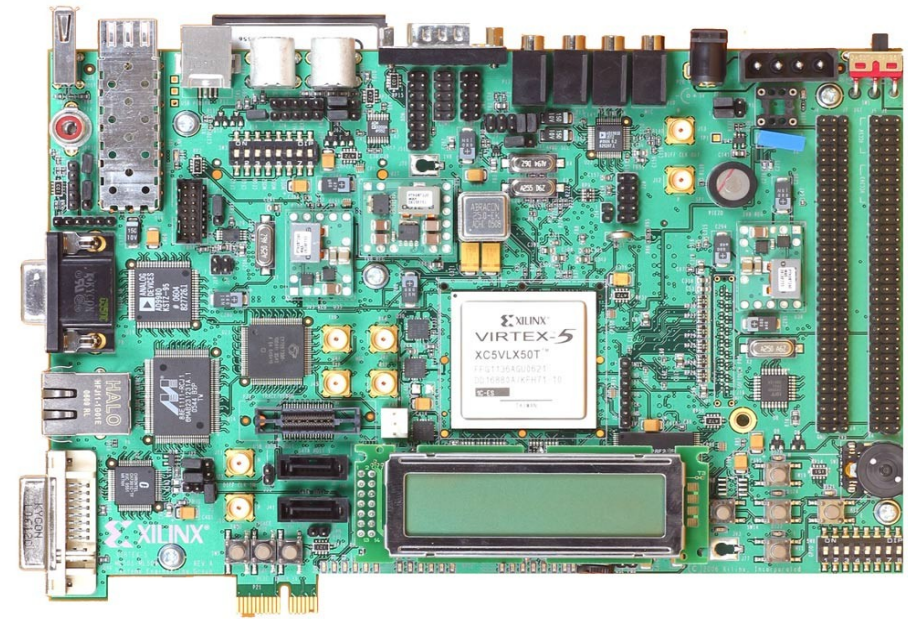
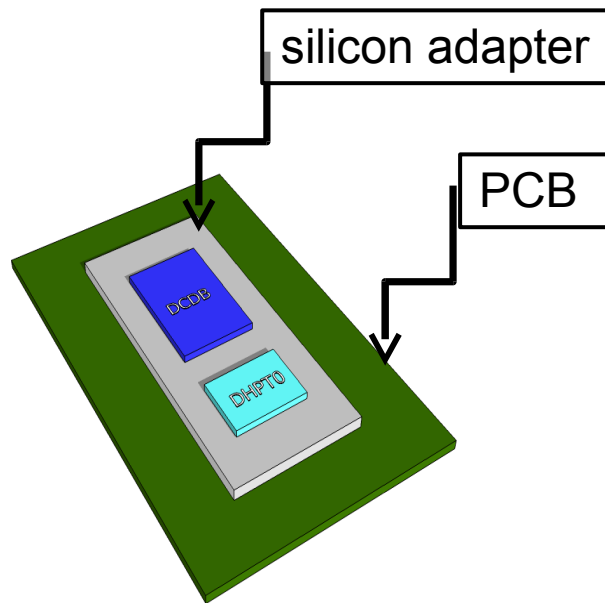
- *development of an DHP 0.1 test system*

- based on commercial evaluation board (ML-505)
- basis for PXD6 matrix r/o with DHP

- *Xilinx ML505 (Virtex®-5 LXT)*

- *PC communication:*

- PCI Express x1 (2.5Gb/s)
- 1Gb/s Ethernet



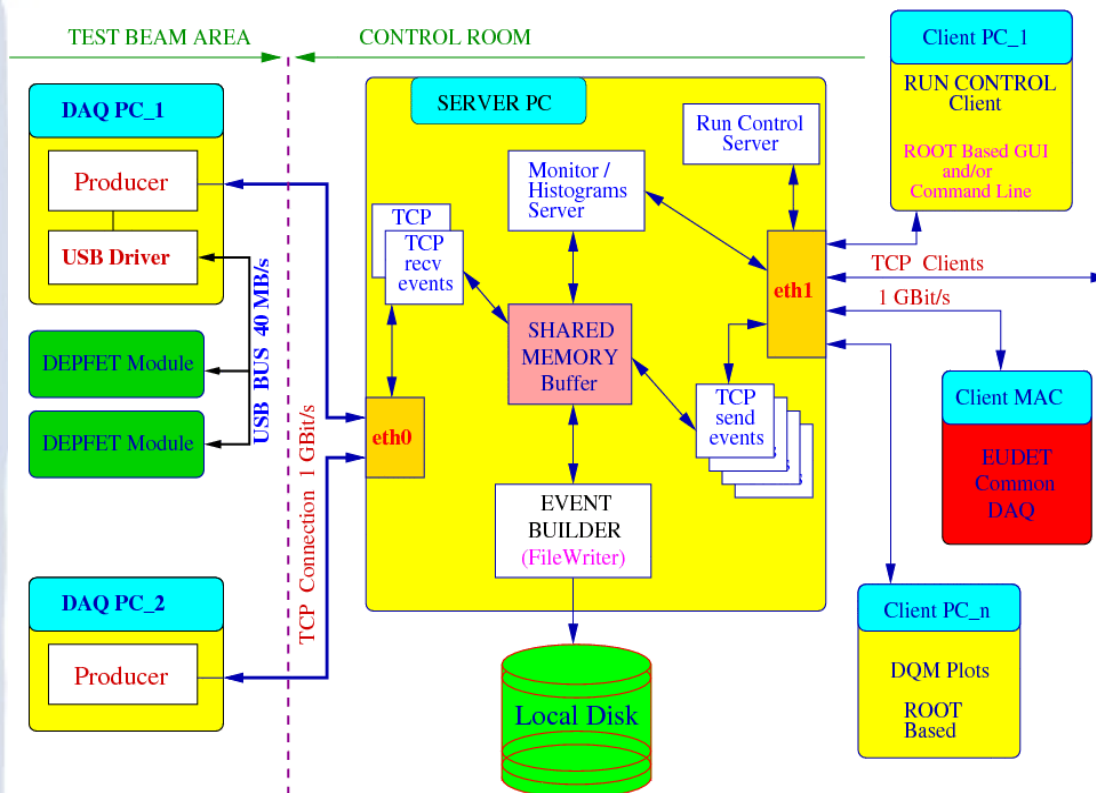
- DAQ is based on Linux network distributed client/server architecture which allows :

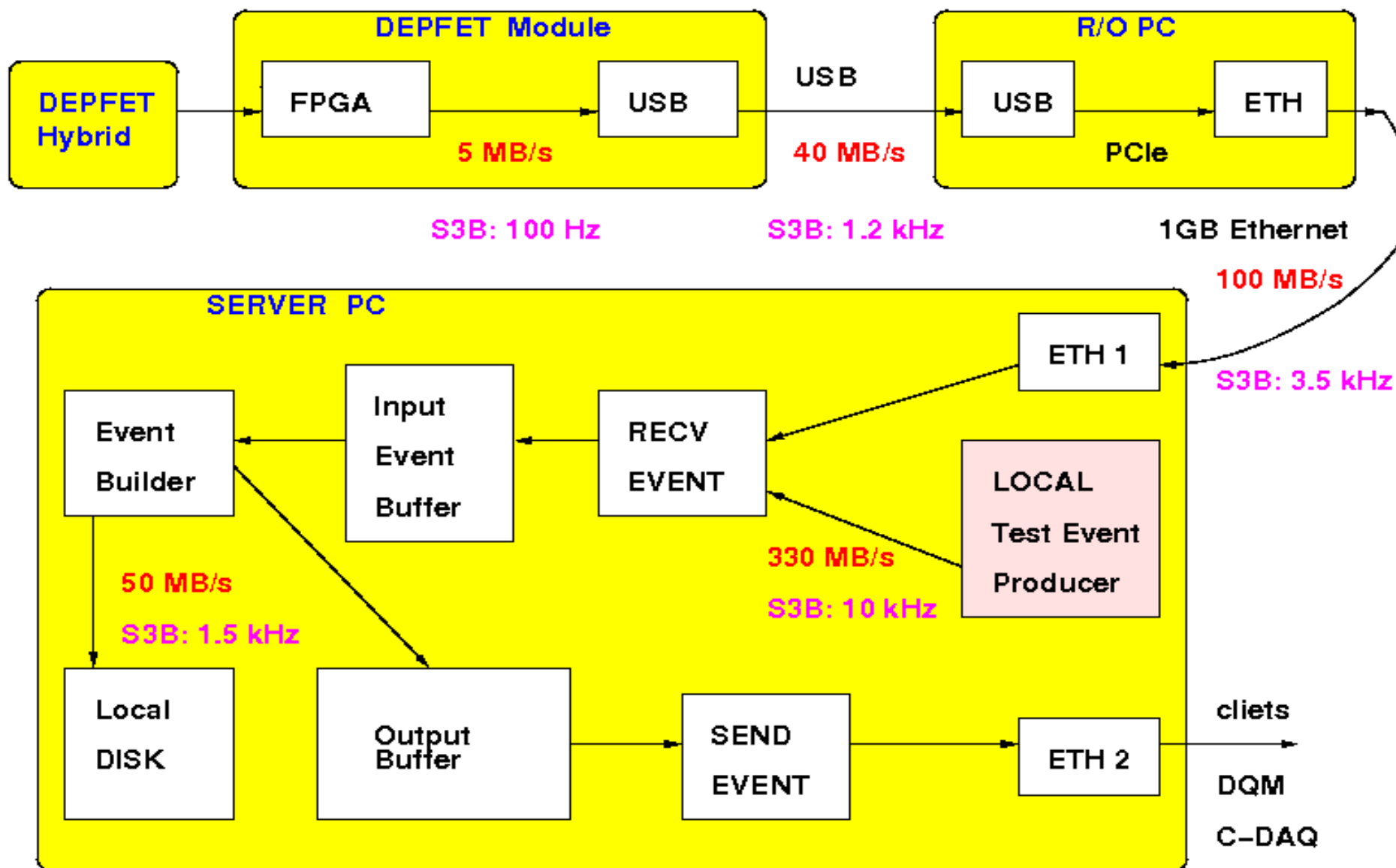
- ➔ share resources and tasks
- ➔ easy scale the system
- ➔ remote control and monitoring
- ➔ easy integration of other detectors

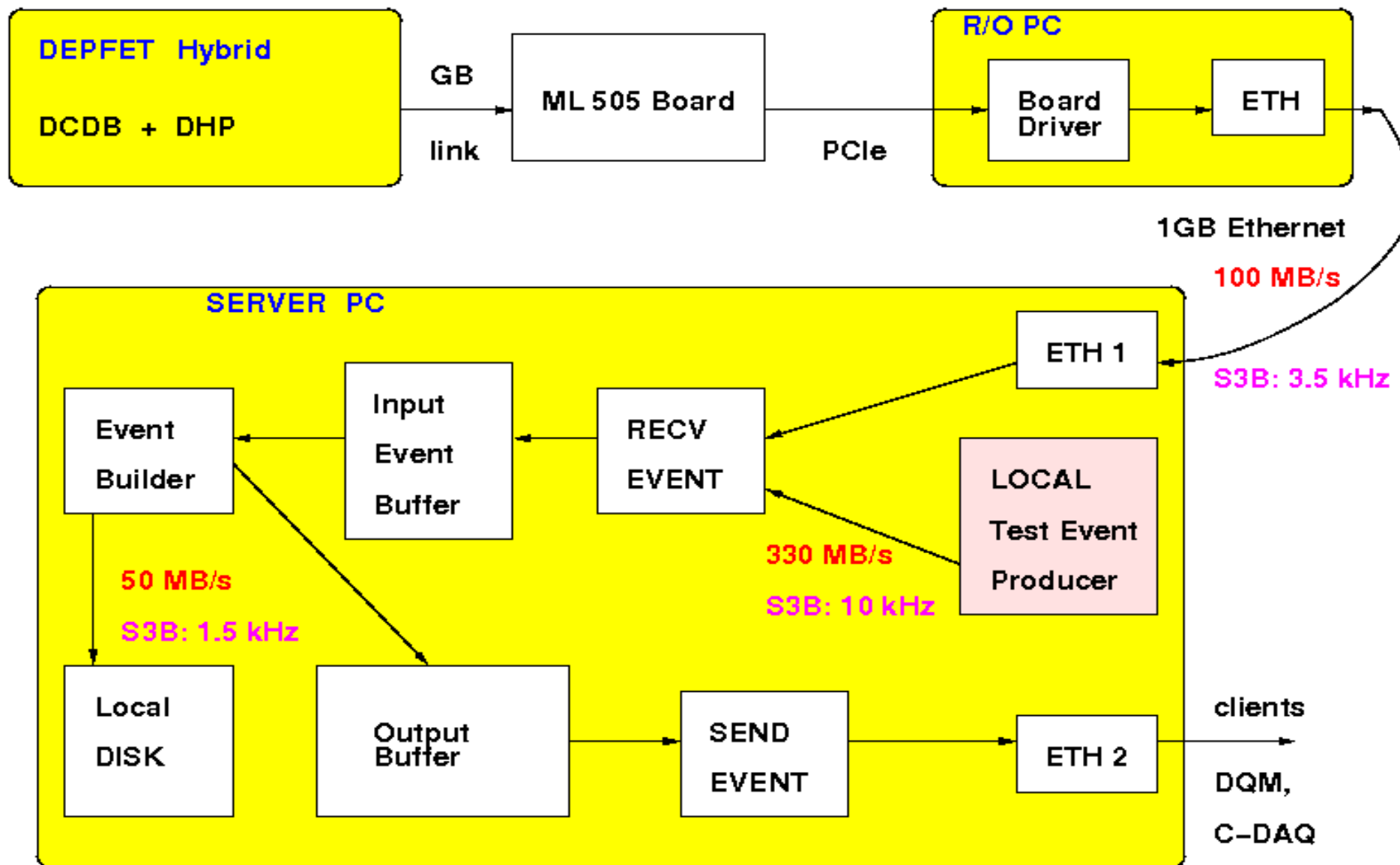
- DAQ uses USB 2.0 for data transfer from DEPFET R/O board to PC and TCP/IP to send data to Event Builder .

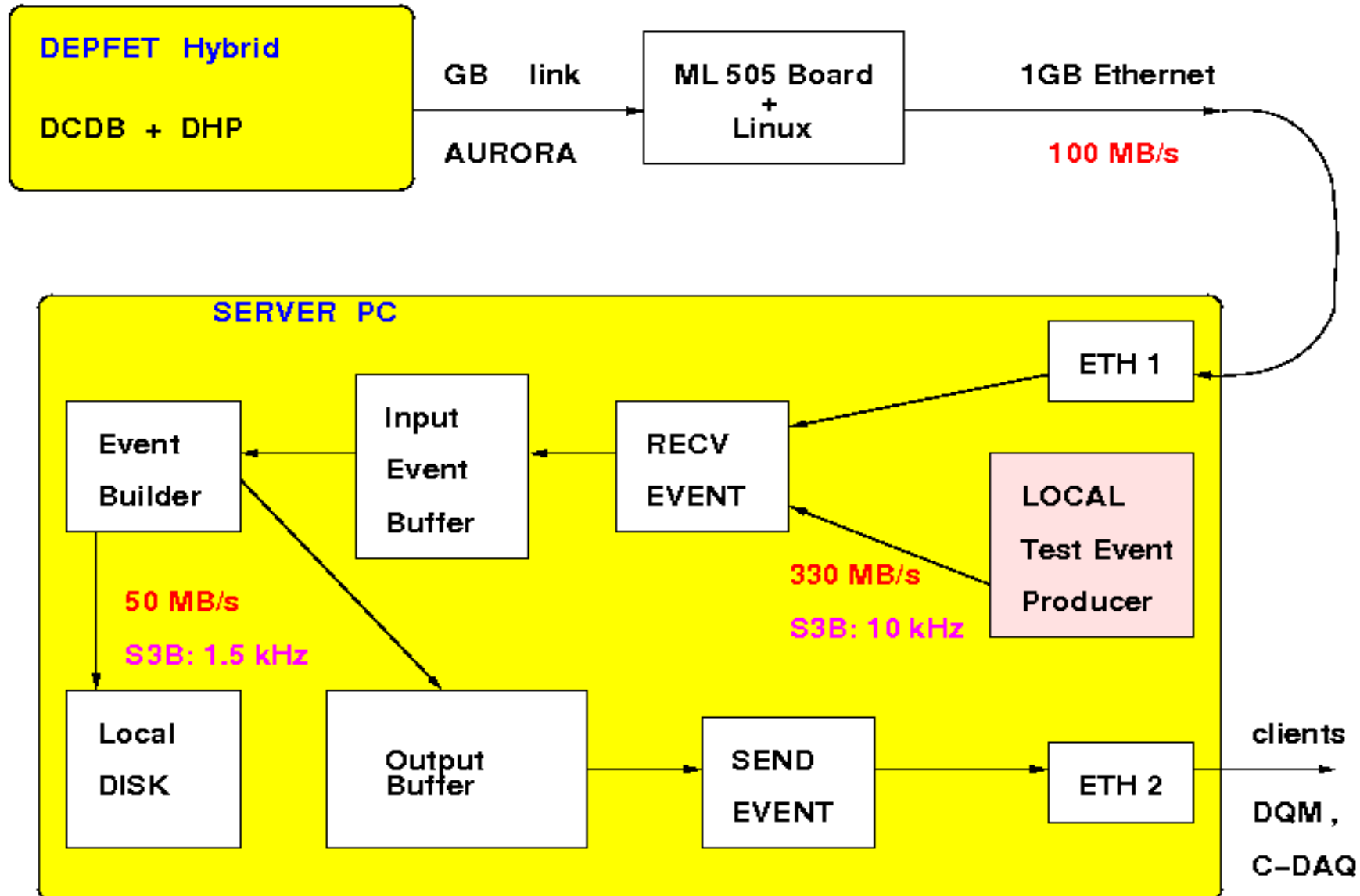
- The DAQ components are:

- ➔ a LINUX based USB driver for the DEPFET DAQ board
- ➔ a USB readout client transferring data to an event builder via network;
- ➔ an Event Builder assembling complete events and storing in a shared memory buffer;
- ➔ an event server send complete event to consumers (file writer, DQM, upper level DAQ, histogram server);
- ➔ online Data Quality Monitoring (DQM) package based on ROOT.



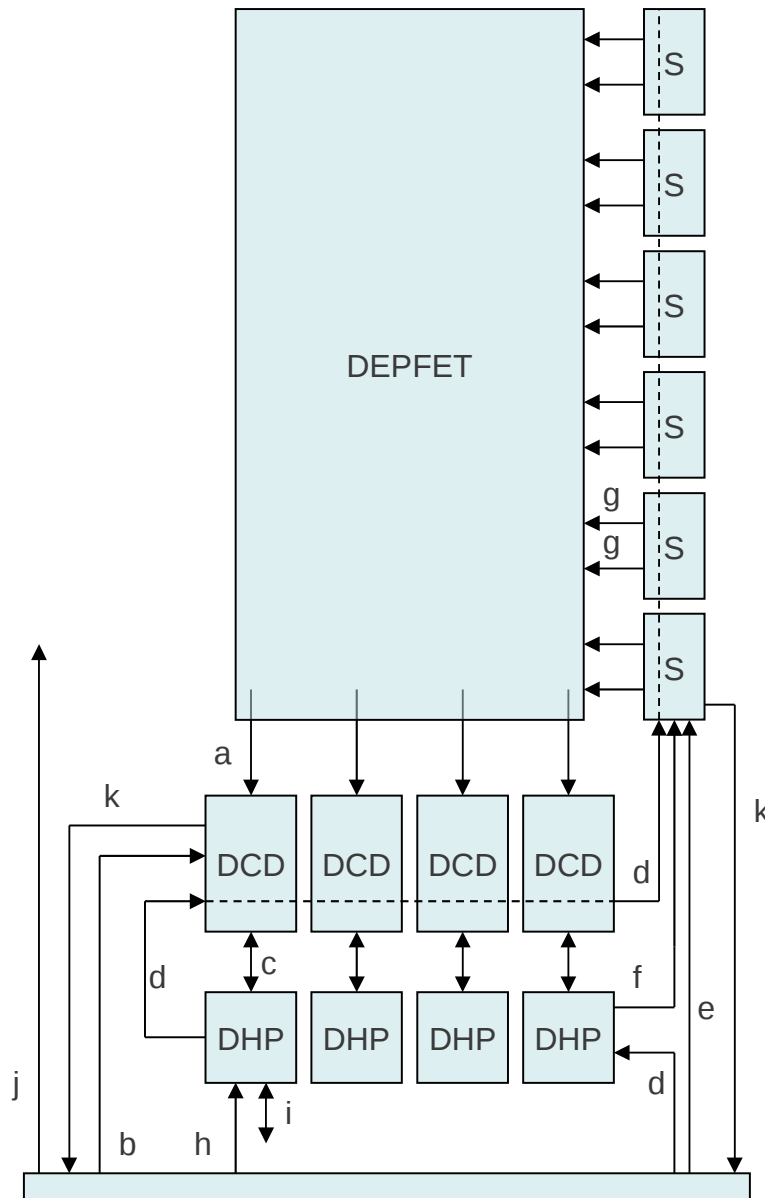




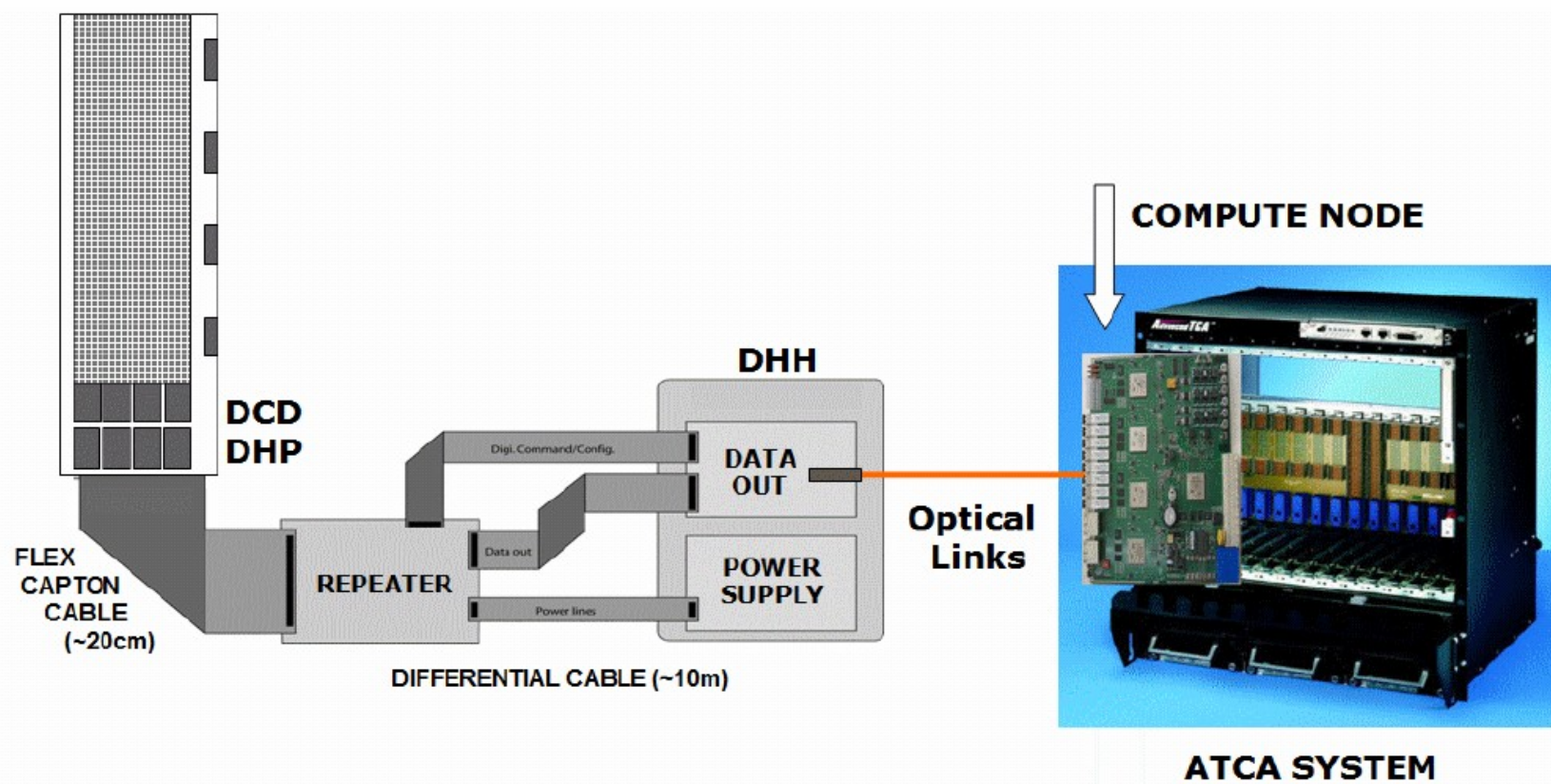


- *PXD6 CURO based readout (S3B) is important for comparison with previous measurements*
 - ➔ it also require minimum modifications
- *DCDB + Manuel's FPGA board :*
 - ➔ DCDB readout and USB interface - Heidelberg
 - ➔ DHP functions and DAQ - Bonn
- *Work on DHP readout with ML-505 board is just started*
 - ➔ 2 operating system - Solaris and Linux are tested.

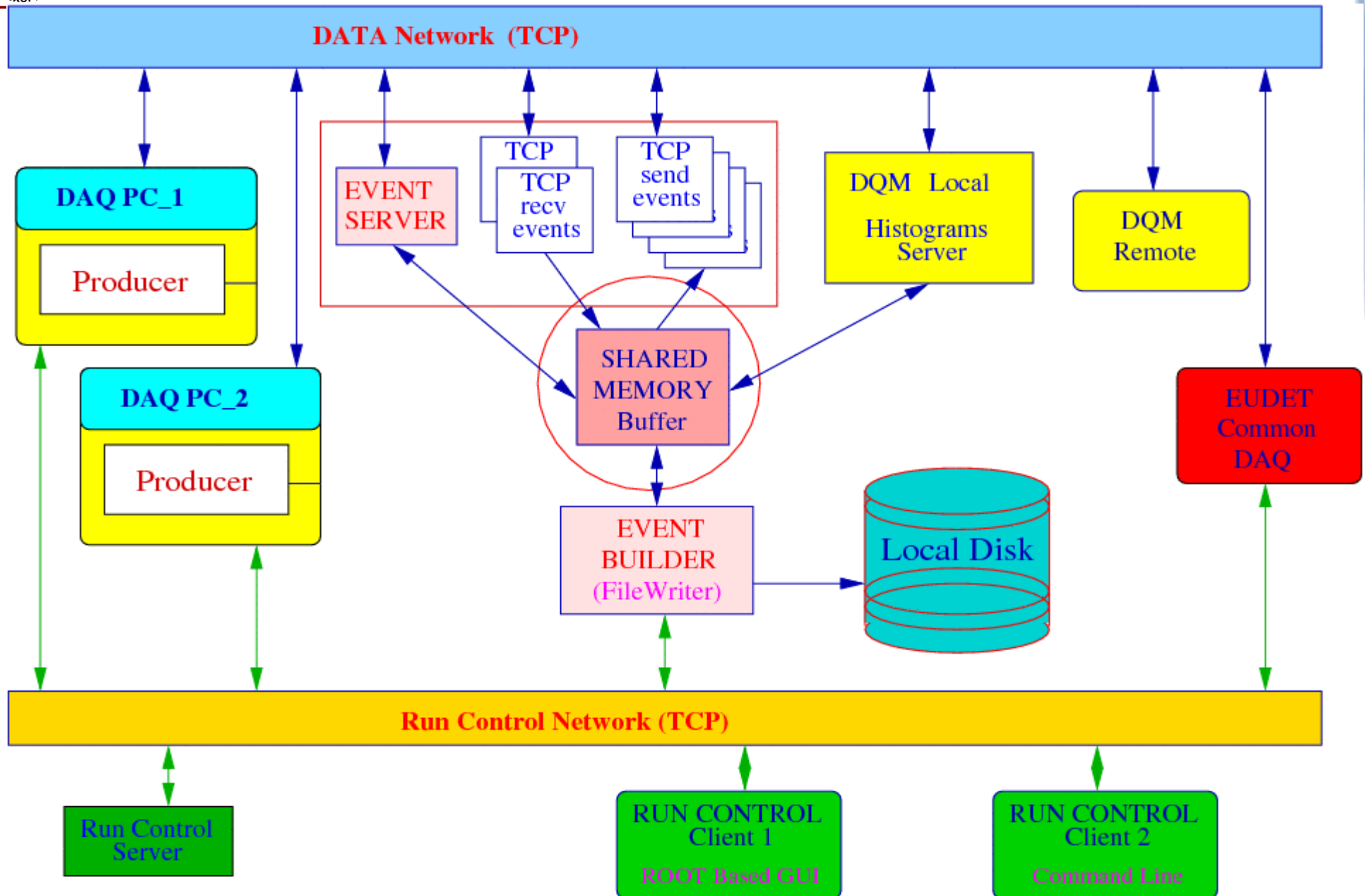
Backup Slides



- a A(0:255)
- b analog AVDD, AGND, AmpLow, RefIn (+4xrefCurr)
digital DVDD, DGND
- c DCD->DHP DO(0:63), RefOut
DHP->DCD DI(0:15)
DCD->DHP CLK, SYNC_RES, STR
SYNCHR(0:1)
- d JTAG5x
- e HV AHI, ALO, BHI, BLO, SUB, Ref?
LV VDDD3.3, GNDD, VDDJTAG1.8
- f CLK, SERIN, SEROUT STRGATE, STRCLR
- g CLR(0:31), GATE(0:31)
- h VDDDC_DHP, GNDD_DHP, VDDGB_DHP, VDD1.8_DHP,
- i IO DHP
- j S, CG, PC, GU, HV
- k Monitor_DCD, MonA_SW, MonB_SW

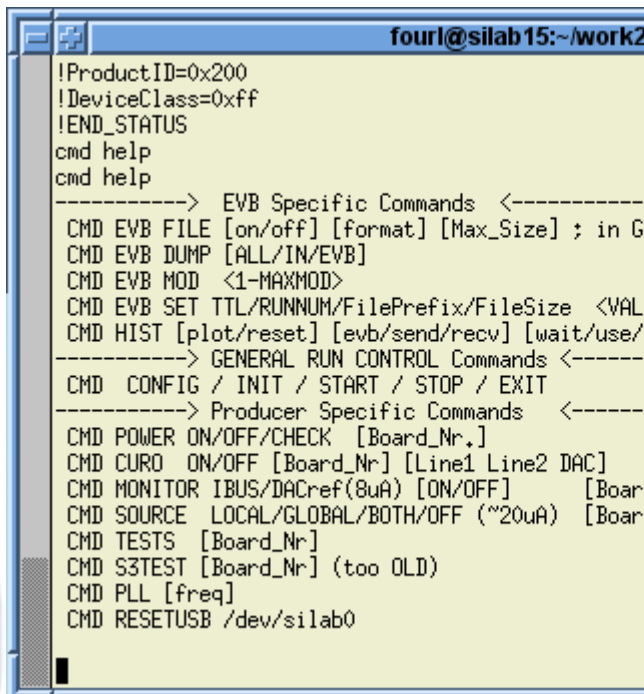


Network DAQ, logic view



• Run control server can accept commands from different clients:

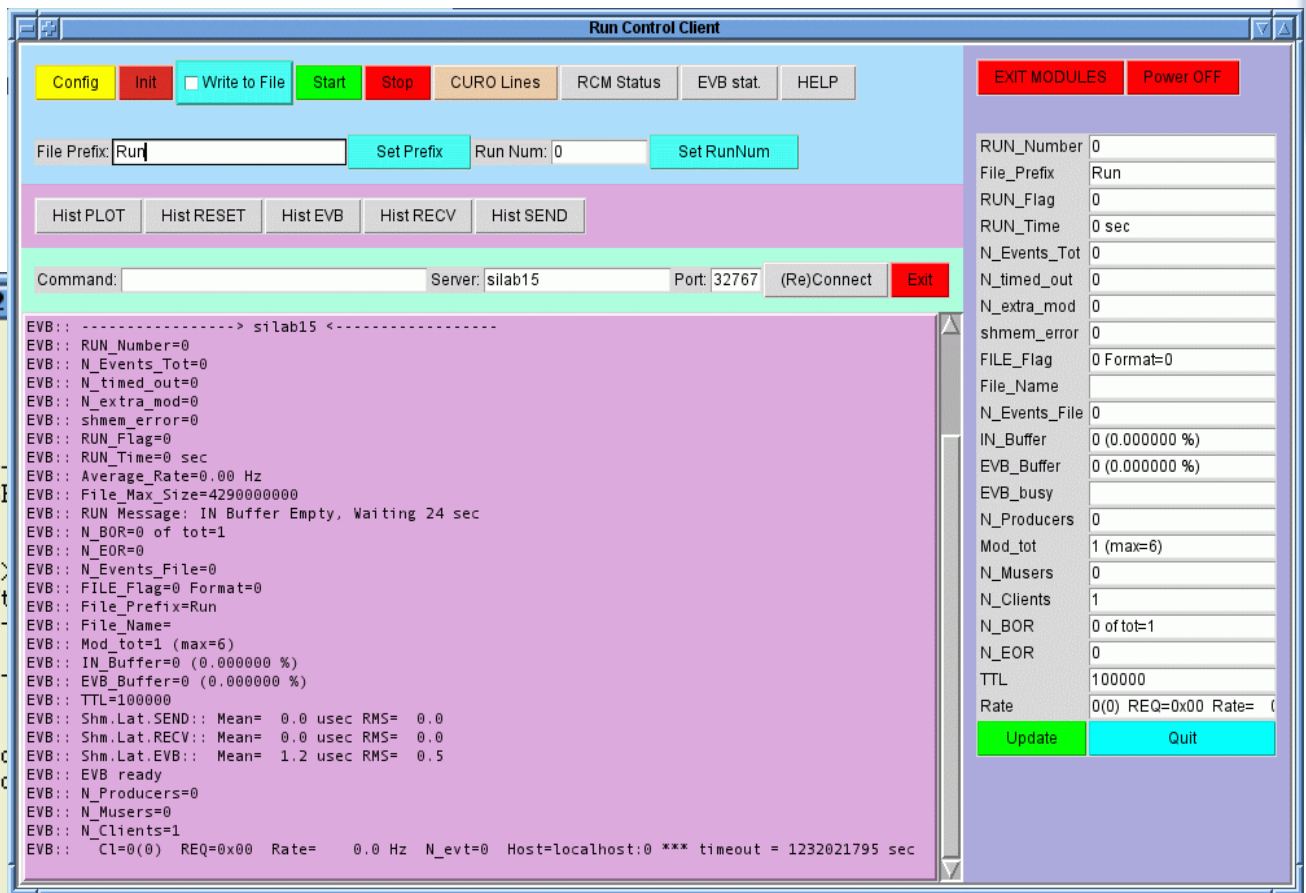
- ➔ Command line interface via Telnet
- ➔ TCL/TK or Root GUI
- ➔ Another program with TCP connection to Run Control



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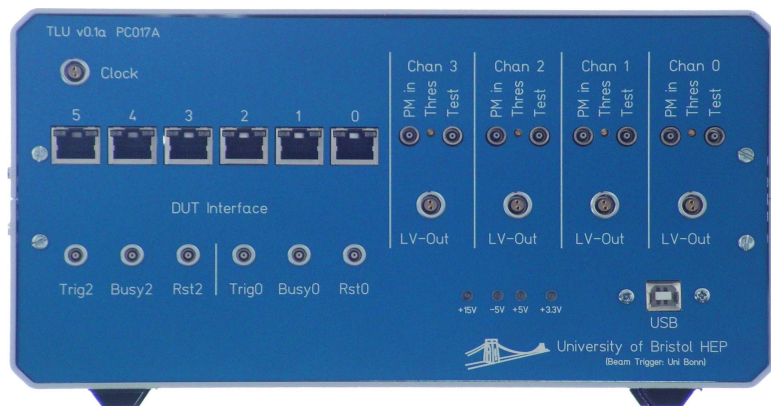
fourl@silab15:~/work2
!ProductID=0x200
!DeviceClass=0xff
!END_STATUS
cmd help
cmd help

-----> EVB Specific Commands <-----
CMD EVB FILE [on/off] [format] [Max_Size] ; in G
CMD EVB DUMP [ALL/IN/EVB]
CMD EVB MOD <1-MAXMOD>
CMD EVB SET TTL/RUNNUM/FilePrefix/FileSize <VAL>
CMD HIST [plot/reset] [evb/send/recv] [wait/use/t
-----> GENERAL RUN CONTROL Commands <-----
CMD CONFIG / INIT / START / STOP / EXIT
-----> Producer Specific Commands <-----
CMD POWER ON/OFF/CHECK [Board_Nr.]
CMD Curo ON/OFF [Board_Nr] [Line1 Line2 DAC]
CMD MONITOR IBUS/DACref(8uA) [ON/OFF] [Board
CMD SOURCE LOCAL/GLOBAL/BOTH/OFF ("20uA) [Board
CMD TESTS [Board_Nr]
CMD S3TEST [Board_Nr] (too OLD)
CMD PLL [freq]
CMD RESETUSB /dev/silab0
        
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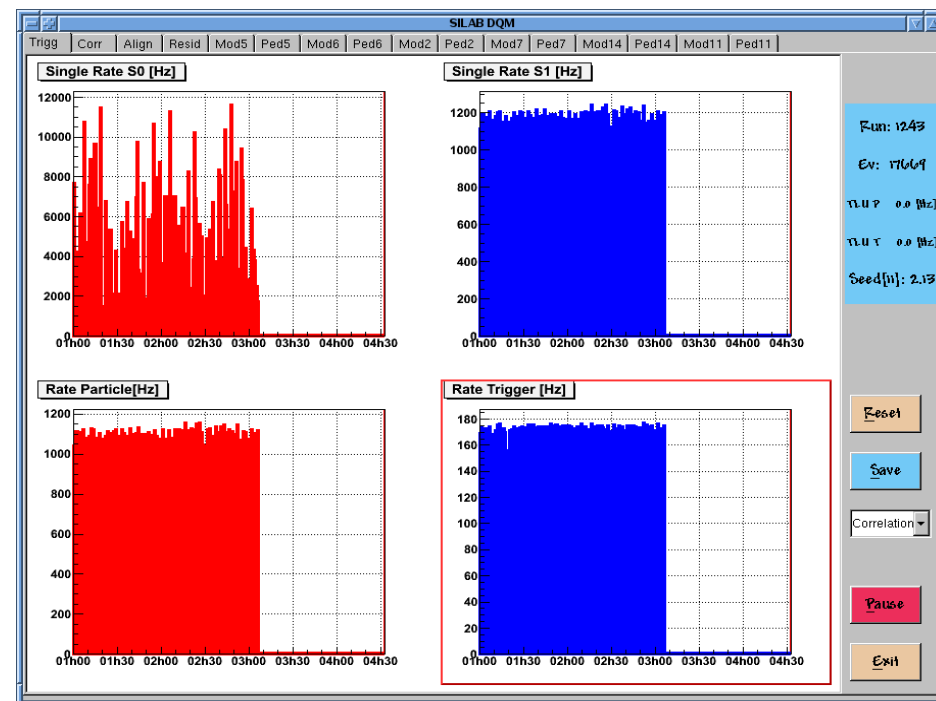
The Run Control Client GUI features a top toolbar with buttons: Config, Init, Write to File, Start, Stop, Curo Lines, RCM Status, EVB stat, and HELP. Below this is a section for File Prefix (Run) and Run Num (0), with Set Prefix and Set RunNum buttons. A central Command input field is connected to a Server (silab15) on Port 32767, with (Re)Connect and Exit buttons. The main display area shows a detailed status report from the server, including EVB parameters like RUN_Number, RUN_Time, and various buffer/producer statistics. On the right, a table lists these parameters with their current values. At the bottom right of the GUI are Update and Quit buttons.

RUN_Number	0
File_Prefix	Run
RUN_Flag	0
RUN_Time	0 sec
N_Events_Tot	0
N_timed_out	0
N_extra_mod	0
shmerror	0
FILE_Flag	0 Format=0
File_Name	
N_Events_File	0
IN_Buffer	0 (0.000000 %)
EVB_Buffer	0 (0.000000 %)
EVB_busy	
N_Producers	0
Mod_tot	1 (max=6)
N_Musers	0
N_Clients	1
N_BOR	0 of tot=1
N_EOR	0
TTL	100000
Rate	0(0) REQ=0x00 Rate= (

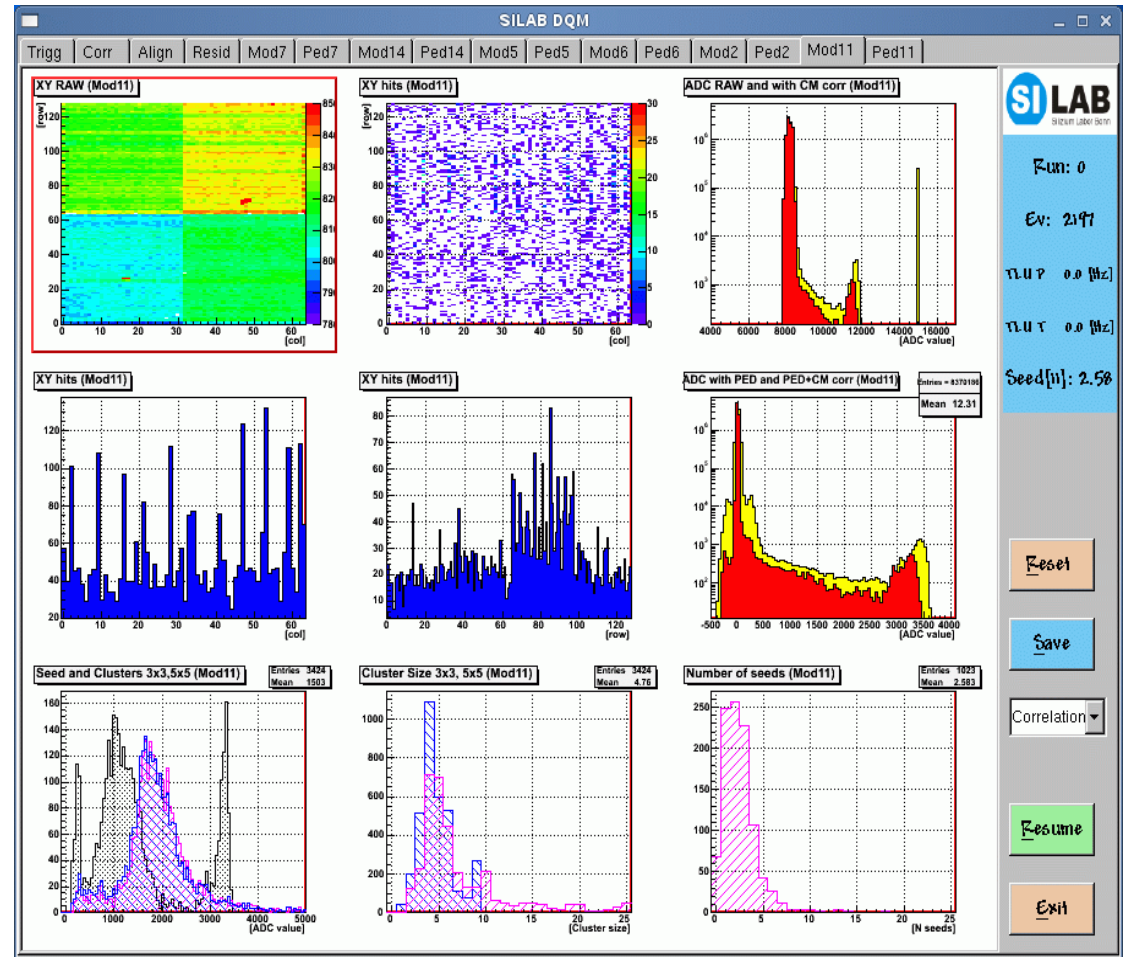


- A dedicated Trigger Logic Unit (TLU) accepts signals from the scintillators or external trigger and generates a signal to trigger the system.
- Each trigger carries a unique number and time stamp.

- H6 line with 120 GeV pions
- Coincidence rate of 2 scintillators is about 1000 Hz
- DAQ with slow readout sequence (readout full matrix 64x128) accepts 180-220 Hz depending on number of readout PCs.
- Data volume rate for 6 modules is about 20 GB / hour
- One disk of 500GB is filled in 1-2 days
- Hot swapping RAID system allows to change the disks without stopping taking data



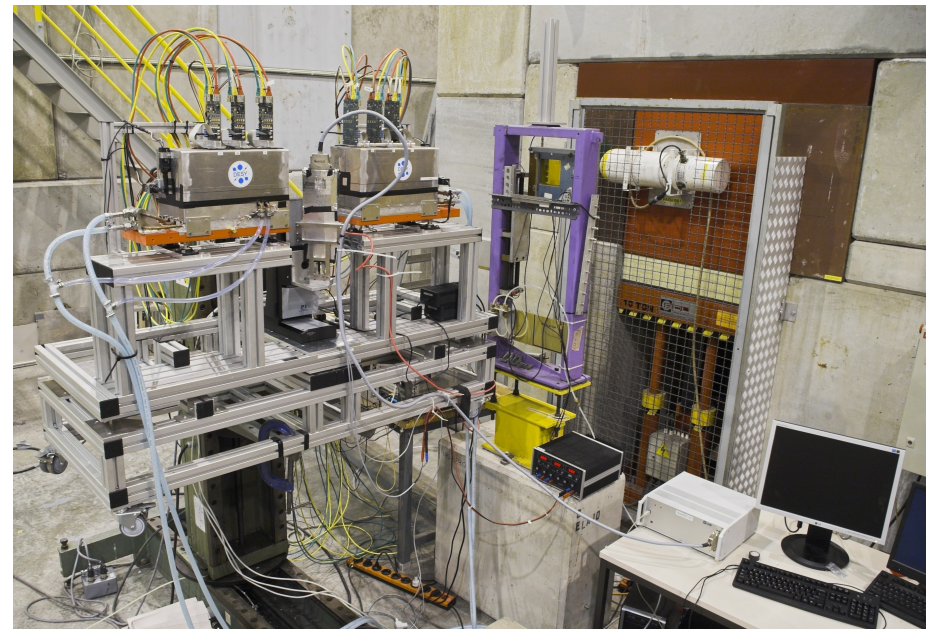
- *Network Data Acquisition system allows to run powerful Data Quality Monitor on dedicated PC in real time*
- *DQM is based on ROOT :*
 - includes various data access methods : file, shared memory, network
 - online data processing – pedestal and common mode calculation, cluster reconstruction and simple tracking.
 - can also act as network histogram server
- *advanced DQM functionality allows to find most of DAQ and DEPFET matrix problems during the run*
- *WEB interface for remote DQM*



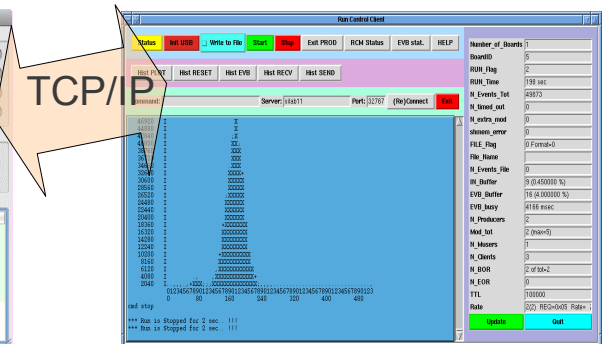
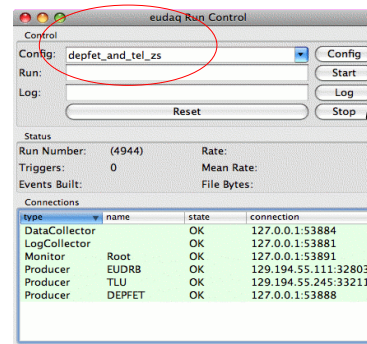
EUDET project is a program to develop the infrastructure, to facilitate the experimentation and to enable the analysis of data using shared equipment and common tools.

JRA1- test beam infrastructure (EUDET Telescope)

- 6 EUDET Modules MAPS - Monolithic active pixel sensors :
 - 7.7x7.7 mm²,
 - 256x256 pixels
 - pitch 30x30 μm²
- MVME6100 PowerPC computer with general purpose acquisition boards (EUDRB) inside the VME64x crate connected to 1GB ethernet HUB
- EUDET DAQ server on MAC PC , 1GB Ethernet
- Trigger Logic Unit (TLU)
- DEPFET DUT with Readout PC
- About 2 million events collected



DEPFET DUT is steered by the EUDET DAQ software



EUDET Run Control DEPFET Run Control