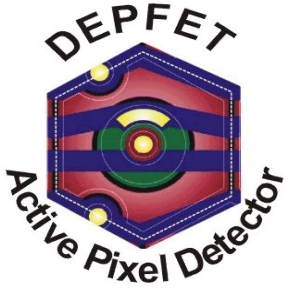

Testbeam/Lab DAQ for DCDB readout

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University of Bonn

4th International Workshop on DEPFET Detectors and Applications
Ringberg Castle, 4 May 2010

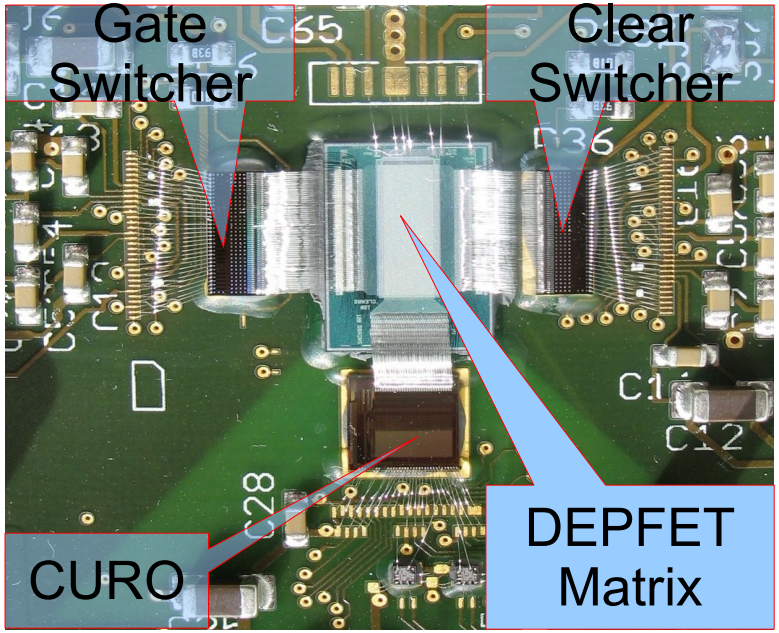
Outline

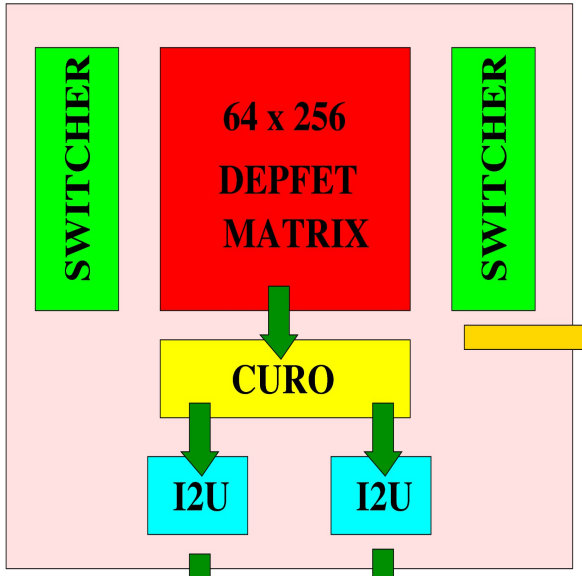
- *S3B data acquisition system (DAQ)*
- *DCDB + Manuel's FPGA readout*
- *DCDB + DHP readout*
- *Conclusion*

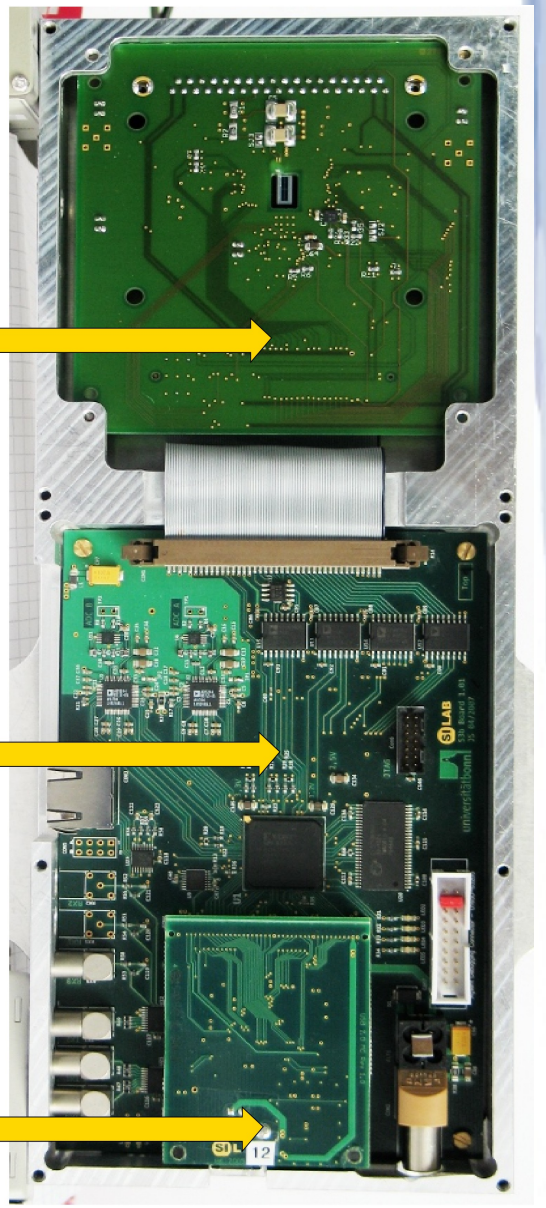
PXD 6 test systems

- *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



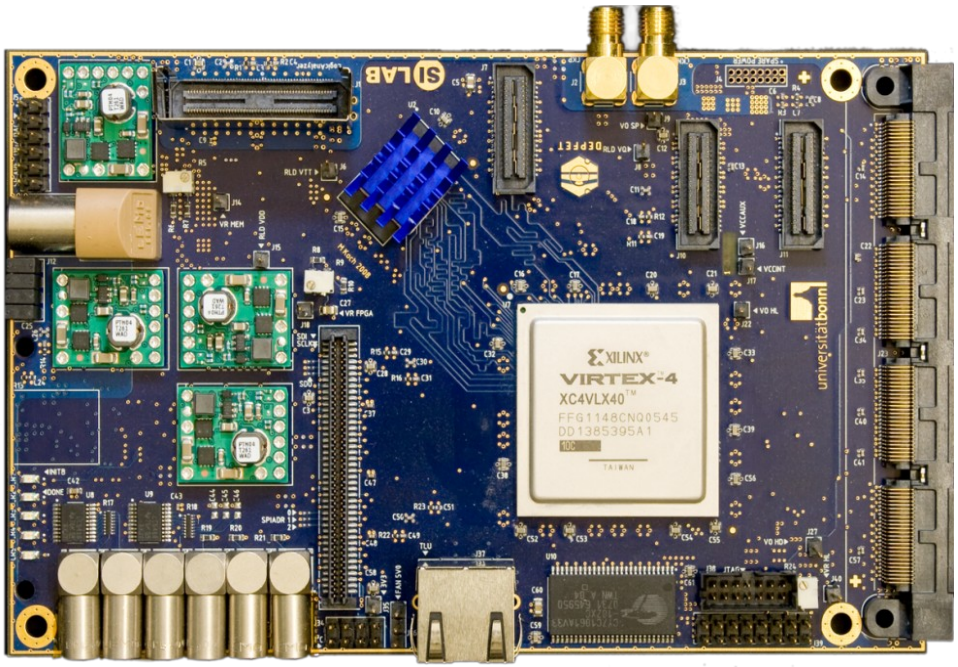


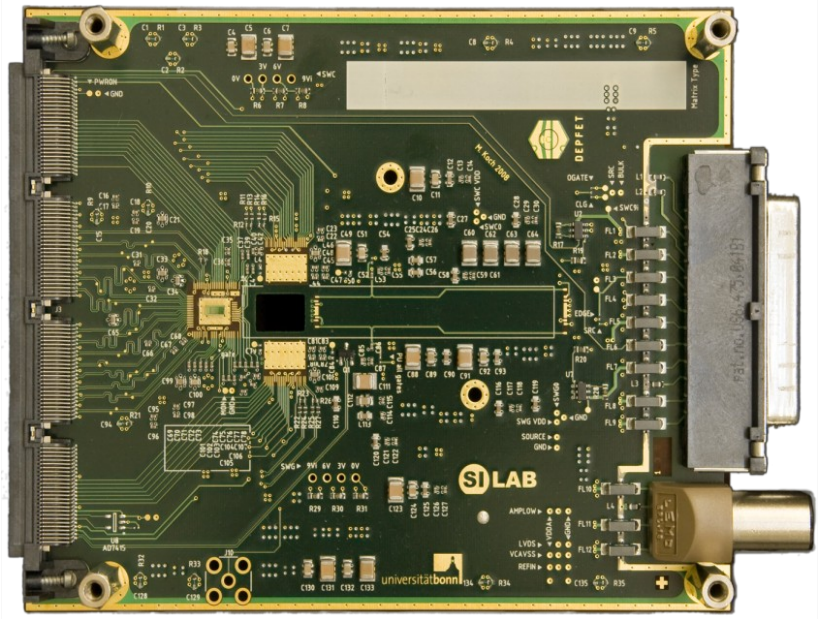


Data Acquisition System

DCD2 test system

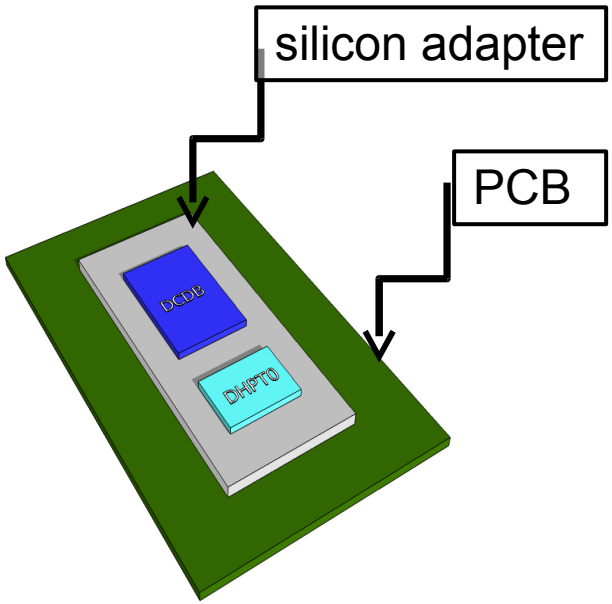
- *FPGA-based readout board*
  - XILINX Virtex 4 LX40-1148
  - 288Mbit RLDRAM
  - >32 LVDS inputs up to 1Gb/s
  - DEPFET DAQ / EUDET TLU / Test beam
  - Data rate (burst) ~15Gbit/s
  - USB 2.0 PC-connection
- *DCD2 / DEPFET Hybrid*
  - intensive Tests of new generation of DEPFET ASICS (DCD2/Switcher3)
  - DEPFET Sensor Integration
    - small 128x128 matrix
    - large 256x1024 matrix
  - low-noise / high-speed design

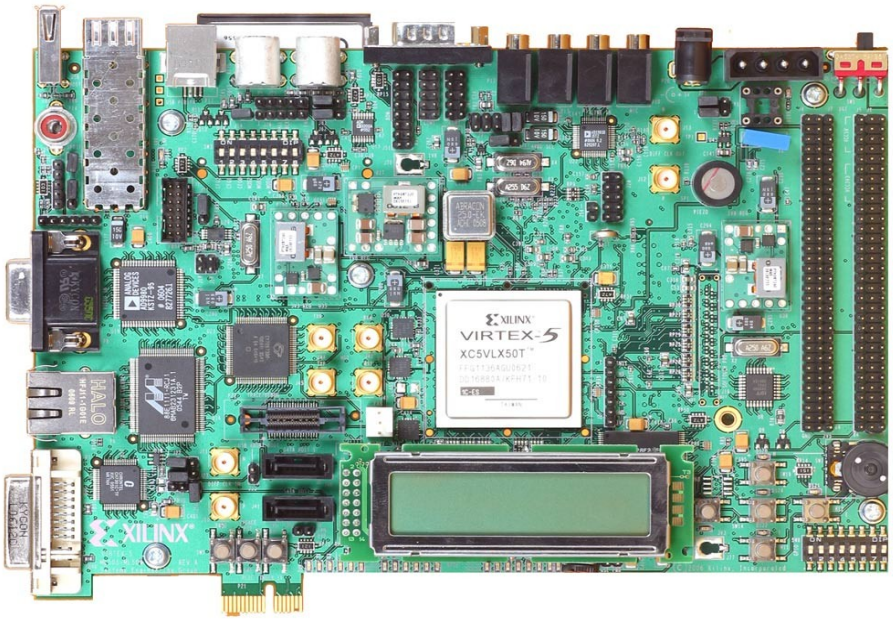




DHP test system

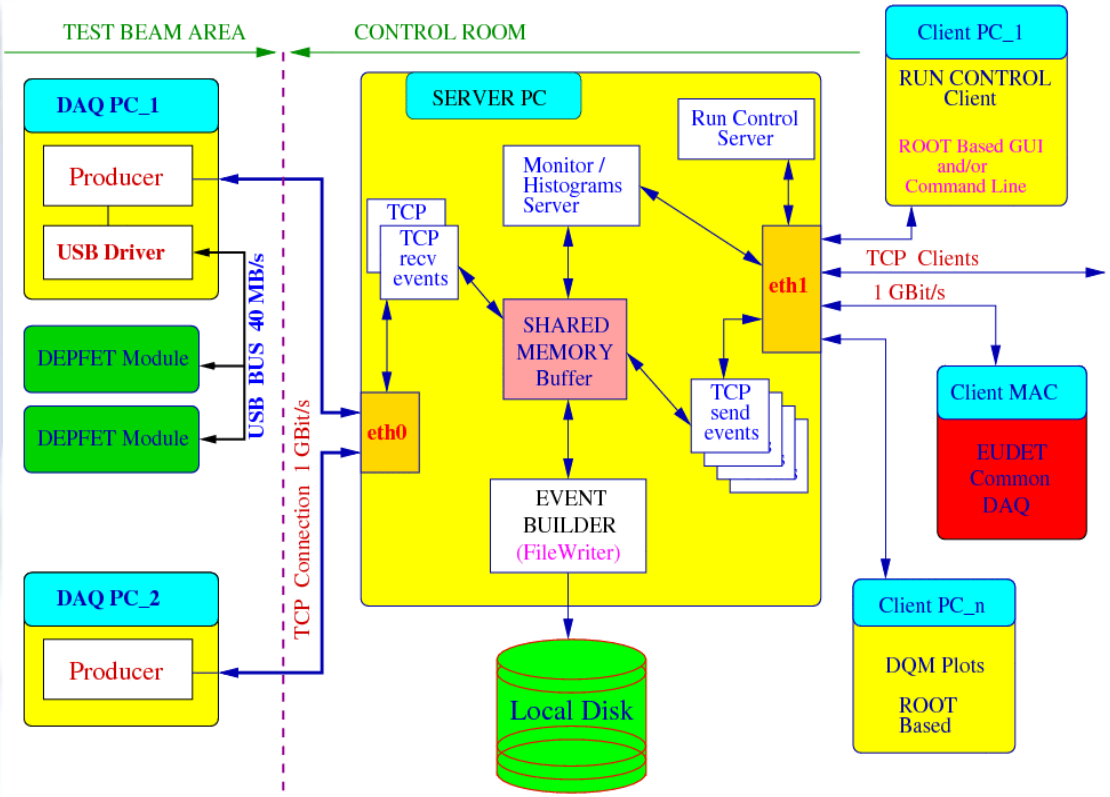
- *development of an DHP 0.1 test system*
  - based on commercial evaluation board (ML-505)
  - basis for PXD6 matrix r/o with DHP
- *Xilinx ML505 (Virtex®-5 LXT)*
- *PC communication:*
  - PCI Express x1 (2.5Gb/s)
  - 1Gb/s Ethernet





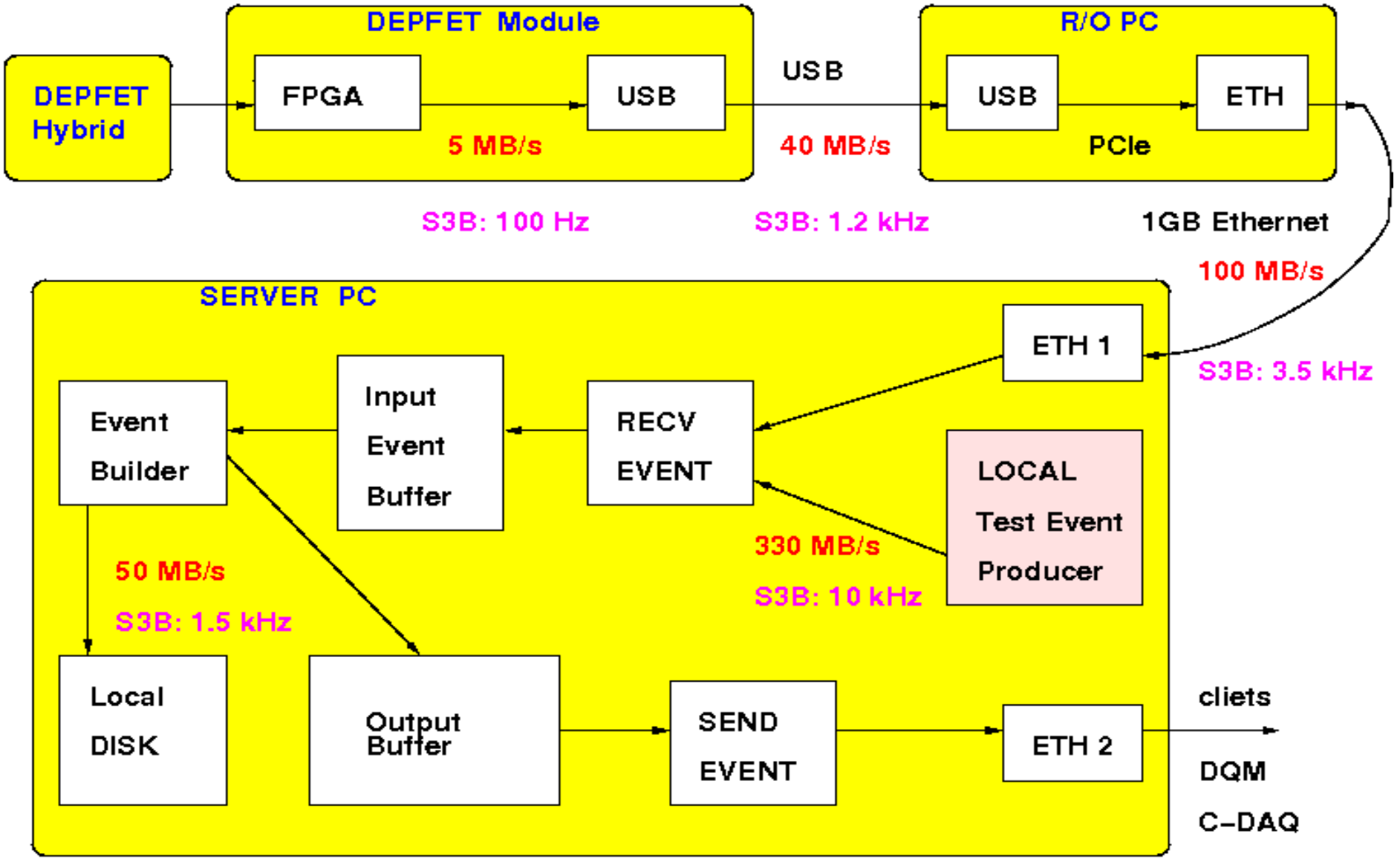
S3B network DAQ system

- *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

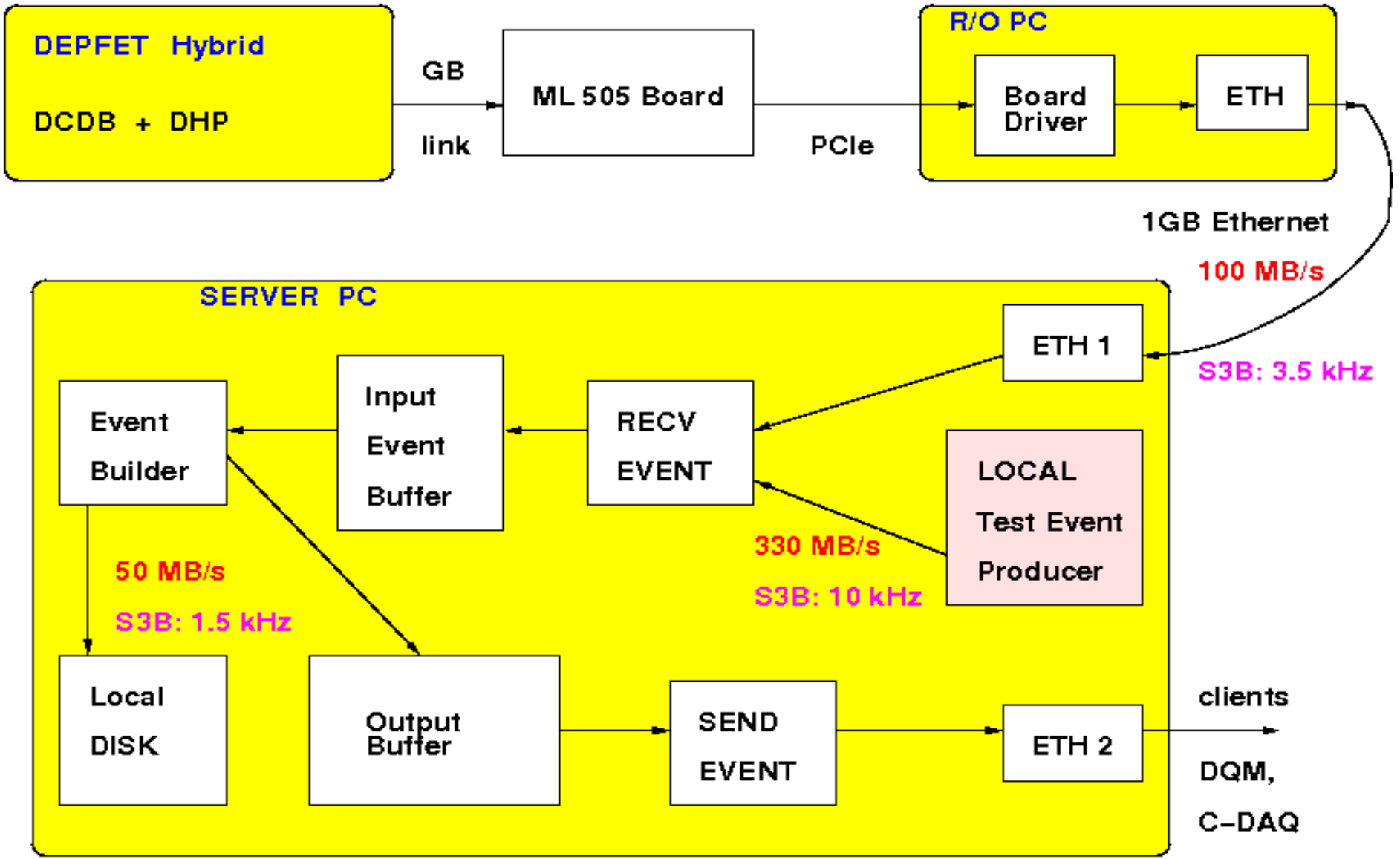


- *DAQ uses USB 2.0 for data transfer from DEPFET R/O board to PC and TCP/IP to send data to Event Builder .*
- *The DAQ components are:*
  - a LINUX based USB driver for the DEPFET DAQ board
  - a USB readout client transferring data to an event builder via network;
  - an Event Builder assembling complete 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.

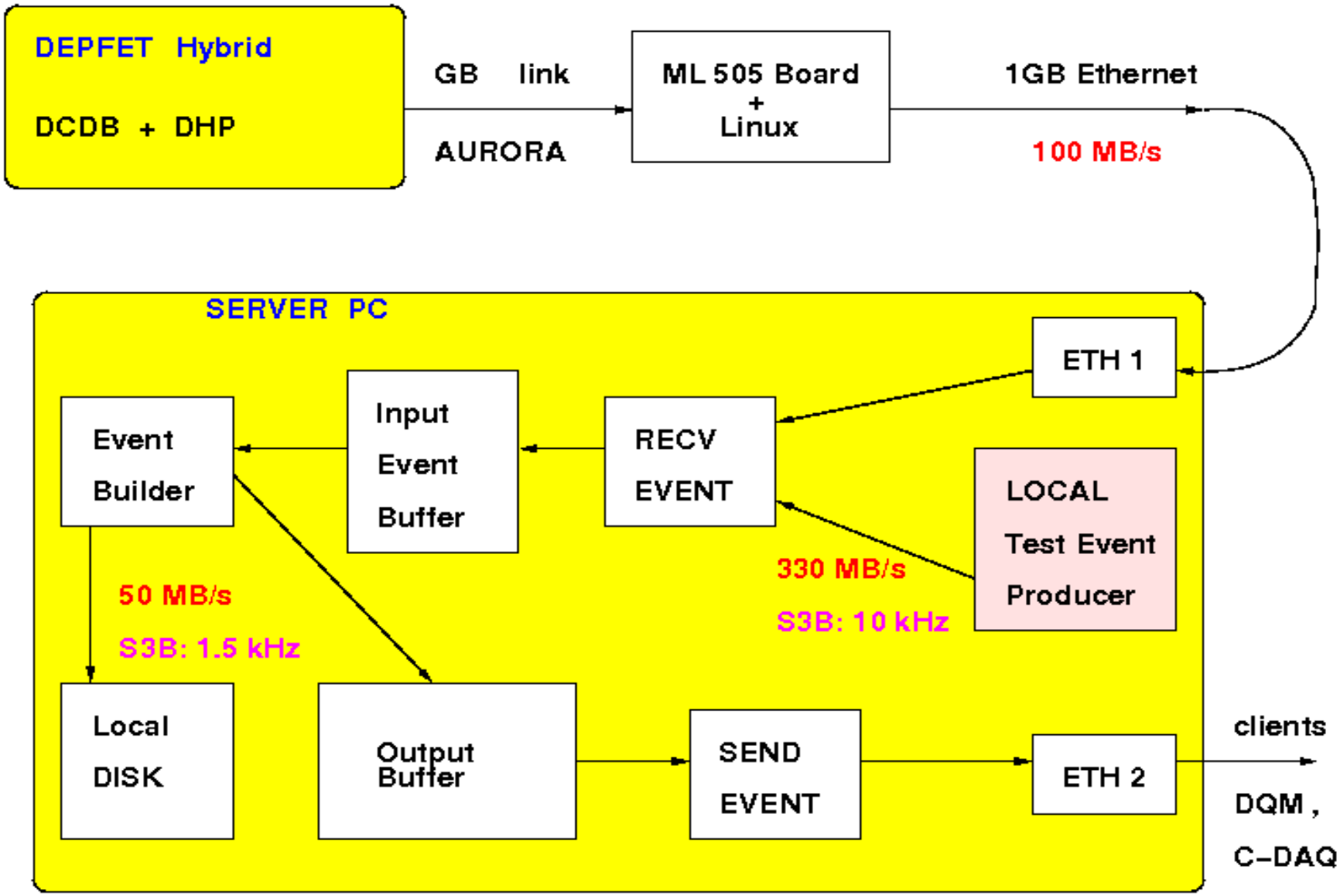
DCDB + Manuel's board



DCDB + DHP r/o , PCIe version



DCDB + DHP r/o , ETH version

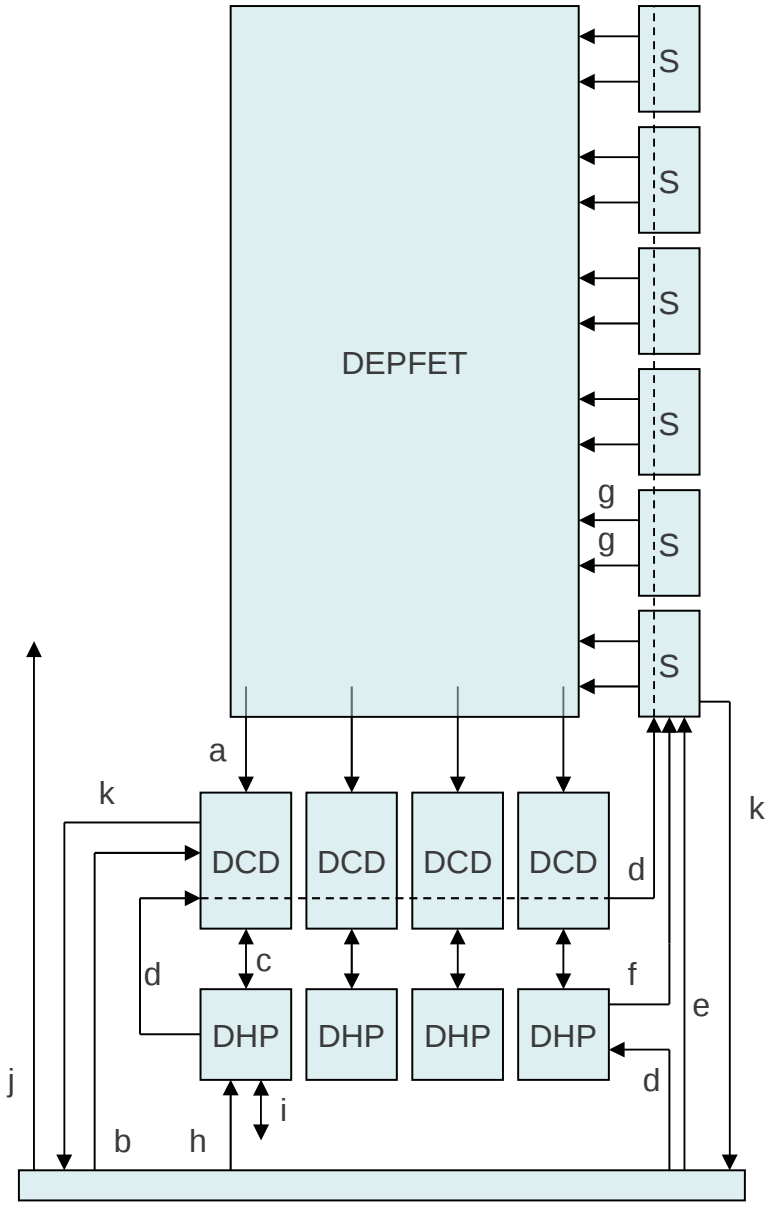


Outlook

- *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

Readout of DEPFET



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)

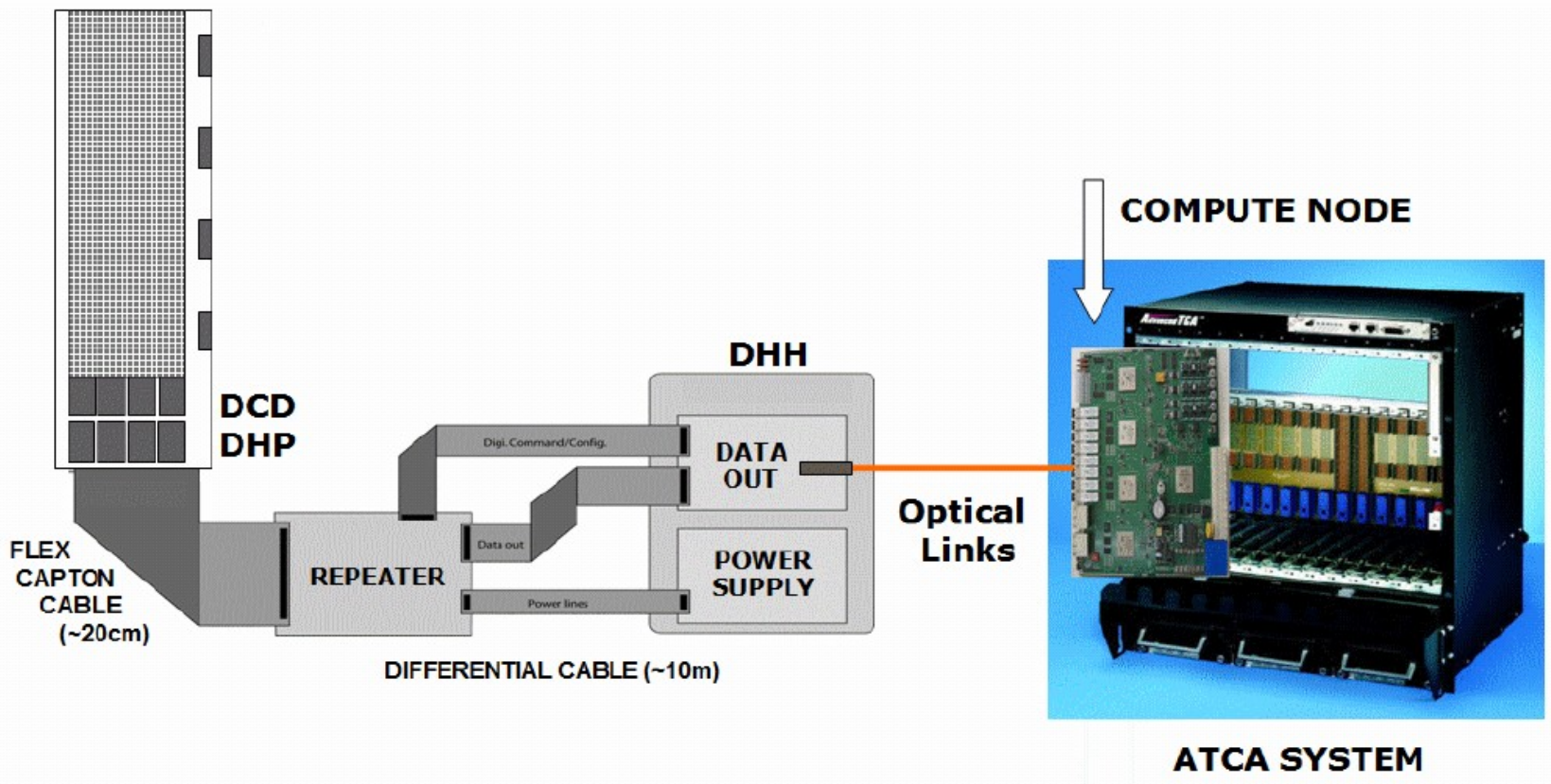
h VDDDC_DHP, GNDD_DHP, VDDGB_DHP, VDD1.8_DHP,

i IO DHP

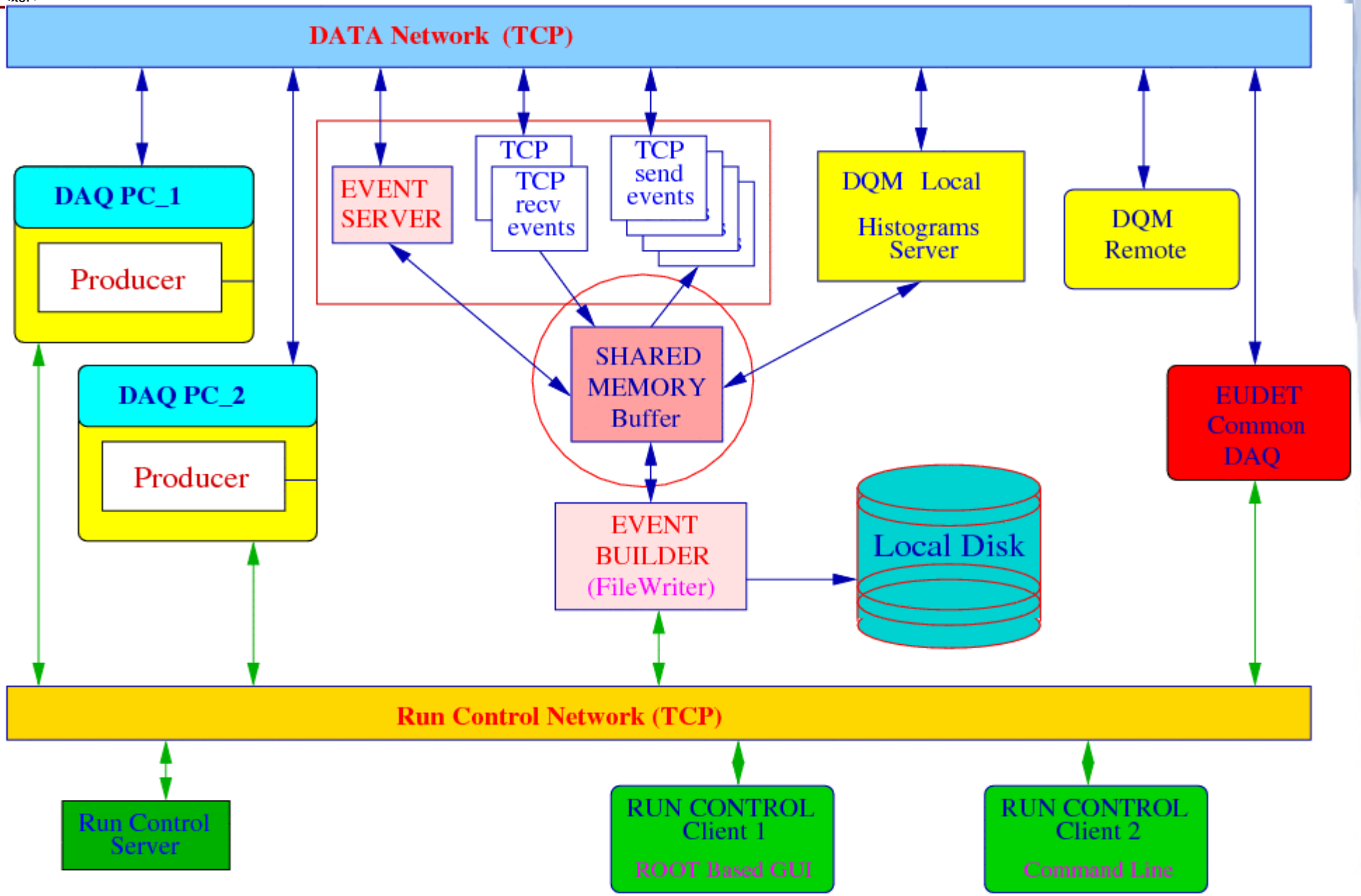
j S, CG, PC, GU, HV

k Monitor_DCD, MonA_SW, MonB_SW

PXD readout system

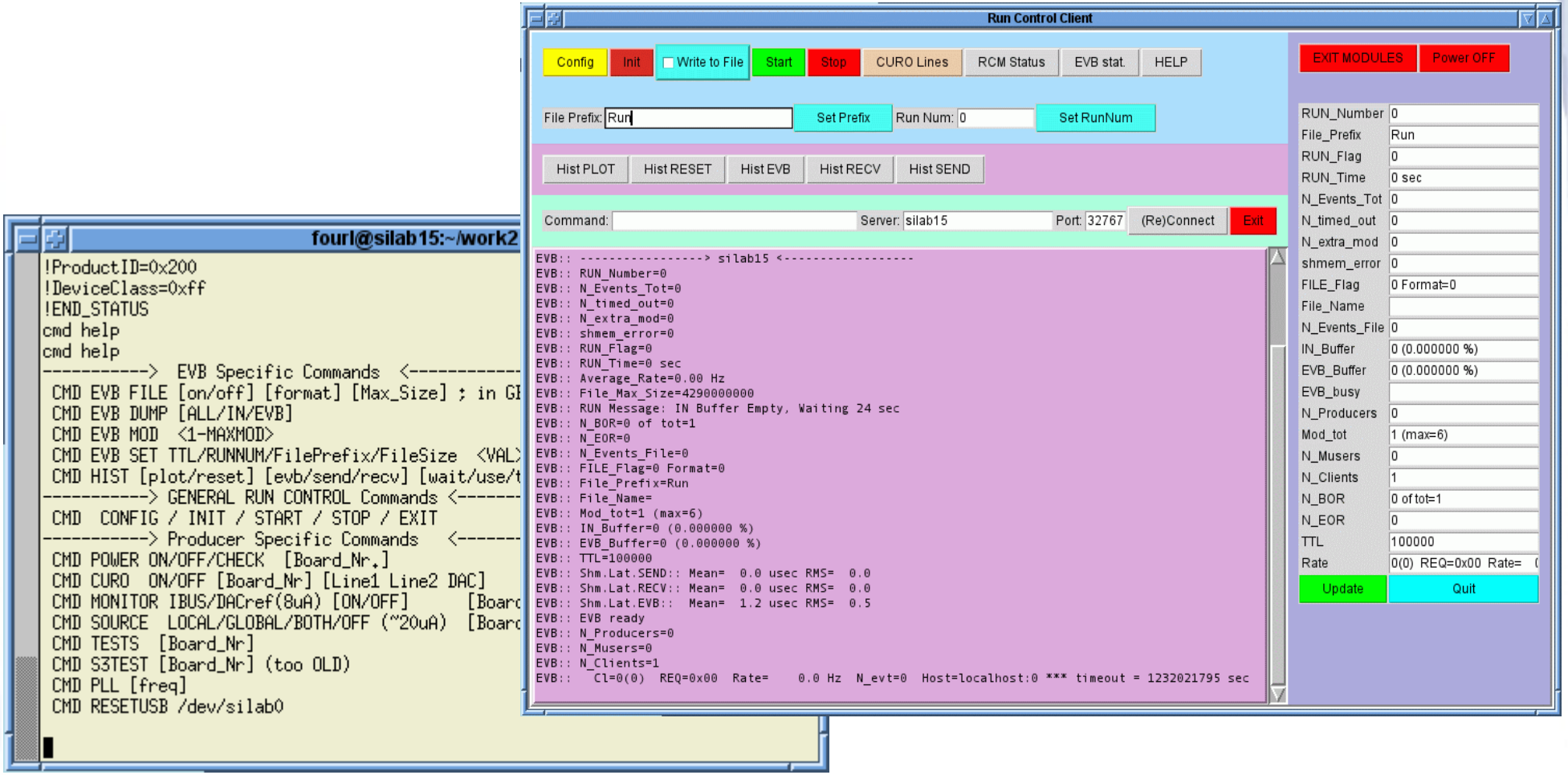


Network DAQ, logic view

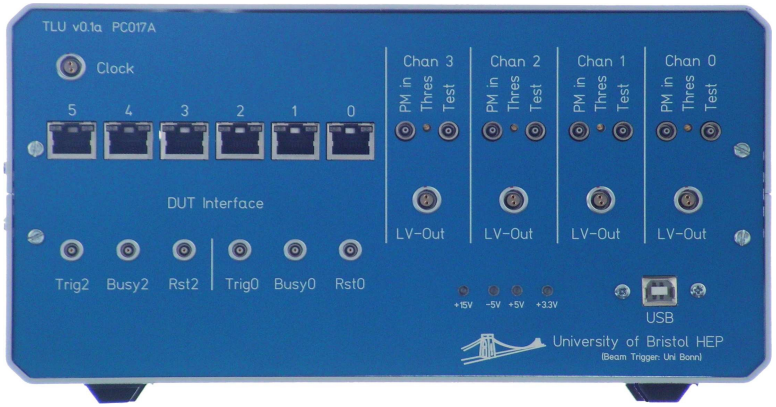


RUN Control

- *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

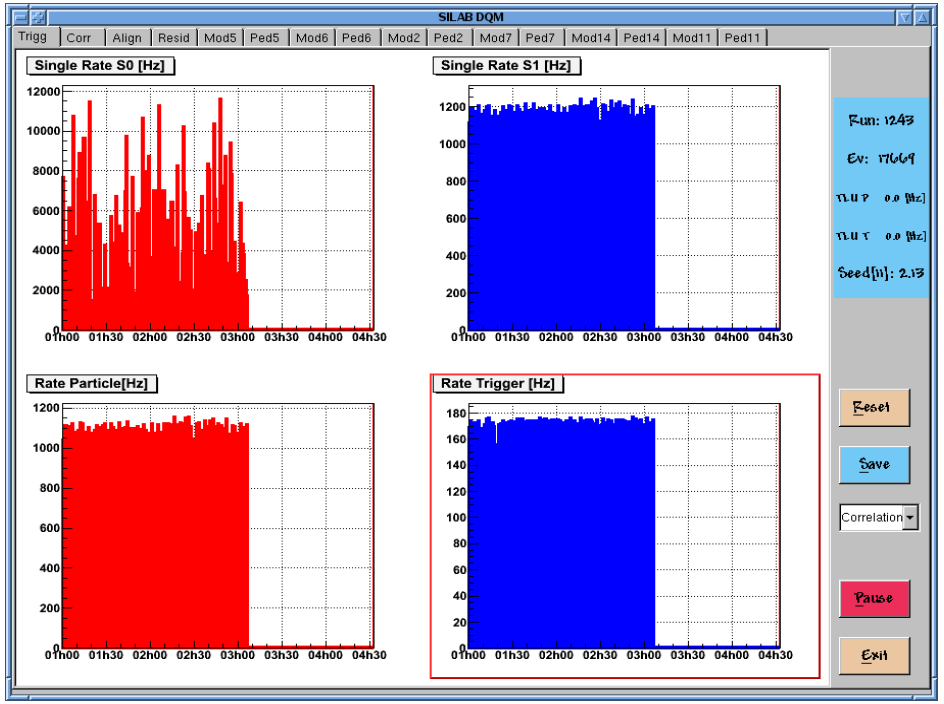


Trigger and Event Rate



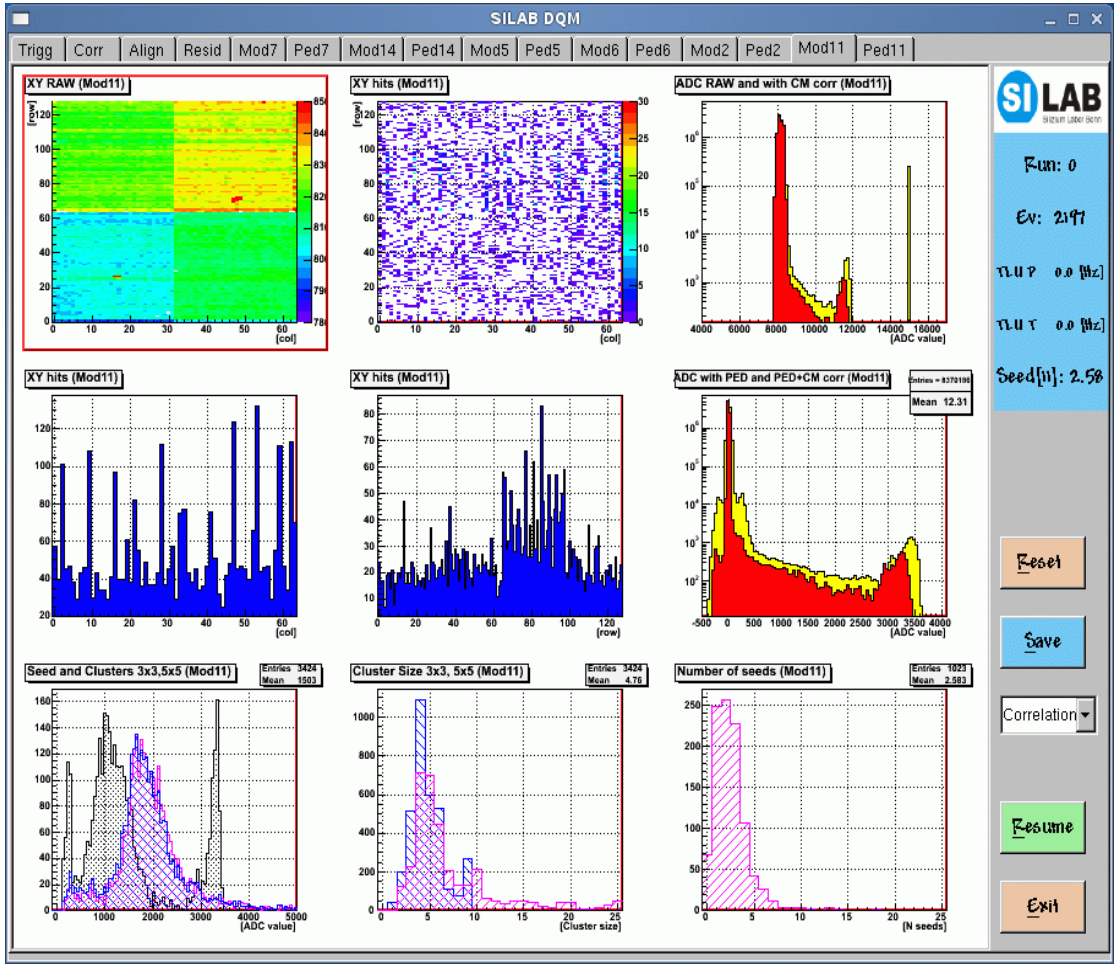
- *A dedicated Trigger Logic Unit (TLU) accepts signals from the scintillators or external trigger and generates a signal to trigger the system.*
- *Each trigger carries a unique number and time stamp.*

- *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*



Data Quality Monitor

- *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*

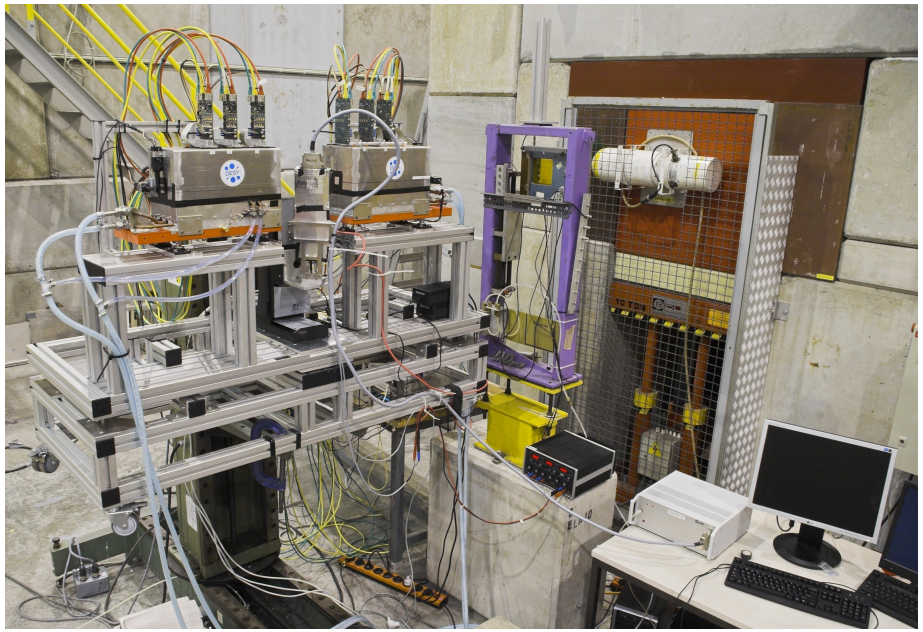


DEPFET with EUDET Telescope

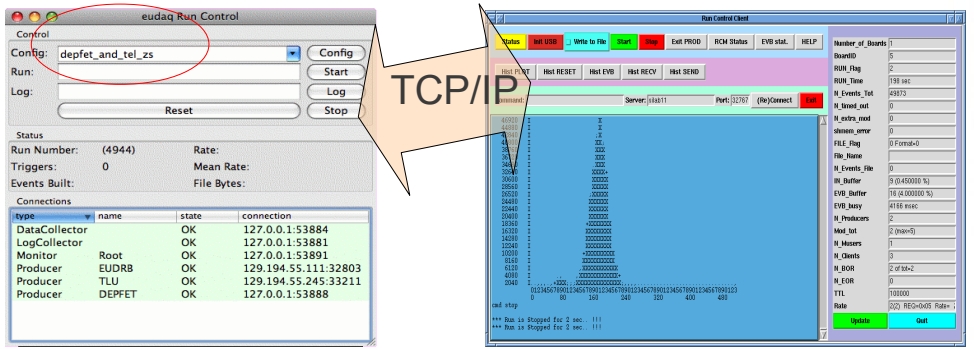
EUDET project is a program to develop the infrastructure, to facilitate the experimentation and to enable the analysis of data using shared equipment and common tools.

JRA1- test beam infrastructure (EUDET Telescope)

- *6 EUDET Modules MAPS - Monolithic active pixel sensors :*
  - 7.7x7.7 mm^2,
  - 256x256 pixels
  - pitch 30x30 μm^2
- *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 Contro