DATA ACQUISITION SYSTEM FOR THE FOCAL PLANE POLARIMETER

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A fast data acquisition (DAQ) system [1] was developed for experiments using the Focal Plane Polarimeter [2] at the Research Center for Nuclear Physics (RCNP). An upgraded system, called Phase-II, has been used in many experiments. The system was designed according to the following schemes.

- Use modules to digitize data which provide fast data conversion and readout.
- Store event data in buffer memories with no software overhead.
- Apply parallel data readout to each separated counter system.
- Assign double buffers to each separated counter system. The overheads for swapping buffers are reduced by using hardware logics.

The overview of the system is shown in Fig. 1. Data from LeCroy FERA/FERET, LeCroy 3377, and LeCroy PCOS-III systems are transfered to buffer memory modules in a VME system, which is equipped with a Motorola 68040 CPU and an operating system of OS/9. The data transfer is performed by hardware logics without any software overhead. Up to five separated counter systems can connect to the system. It is limited by the number of buffer memories. Standard trigger circuits based on field programmable gate arrays (FPGA's) [3] manage the data transfer. The buffer memory modules are switched to another set of modules when any one of the buffers becomes full, and the stored data are transfered to a SUN SPARC/20 work station "mari", with VMIC reflective memories via a fiber-optic link. The work station transfers data to a DEC/4100 alpha server by TCP/IP connections on FDDI. The server store data on hard disks. Two DEC/4100 alpha servers, "kasuga" and "senri", are assigned for on-line use. The data are also distributed to analyzers via TCP/IP.

Typical dead time per event is about 30 micro seconds. It is limited by the time of data conversions and data transfers to the buffer memories in the front system. The maximum data transfer rate is about 1 MByte per second. It is limited by the performance of the front VME system to transfer data on buffer memories by the reflective memory modules. Almost full performance of the system was actually used in an experiment to measure polarization transfer observables in proton elastic scattering at zero degrees [4]. The rate of events from the second level trigger system was 6 kHz, which corresponded to a data transfer of 1 MByte per second. The live time ratio was 80%.

The system has been used as a standard DAQ system for many experiments using the spectrometer Grand Raiden.

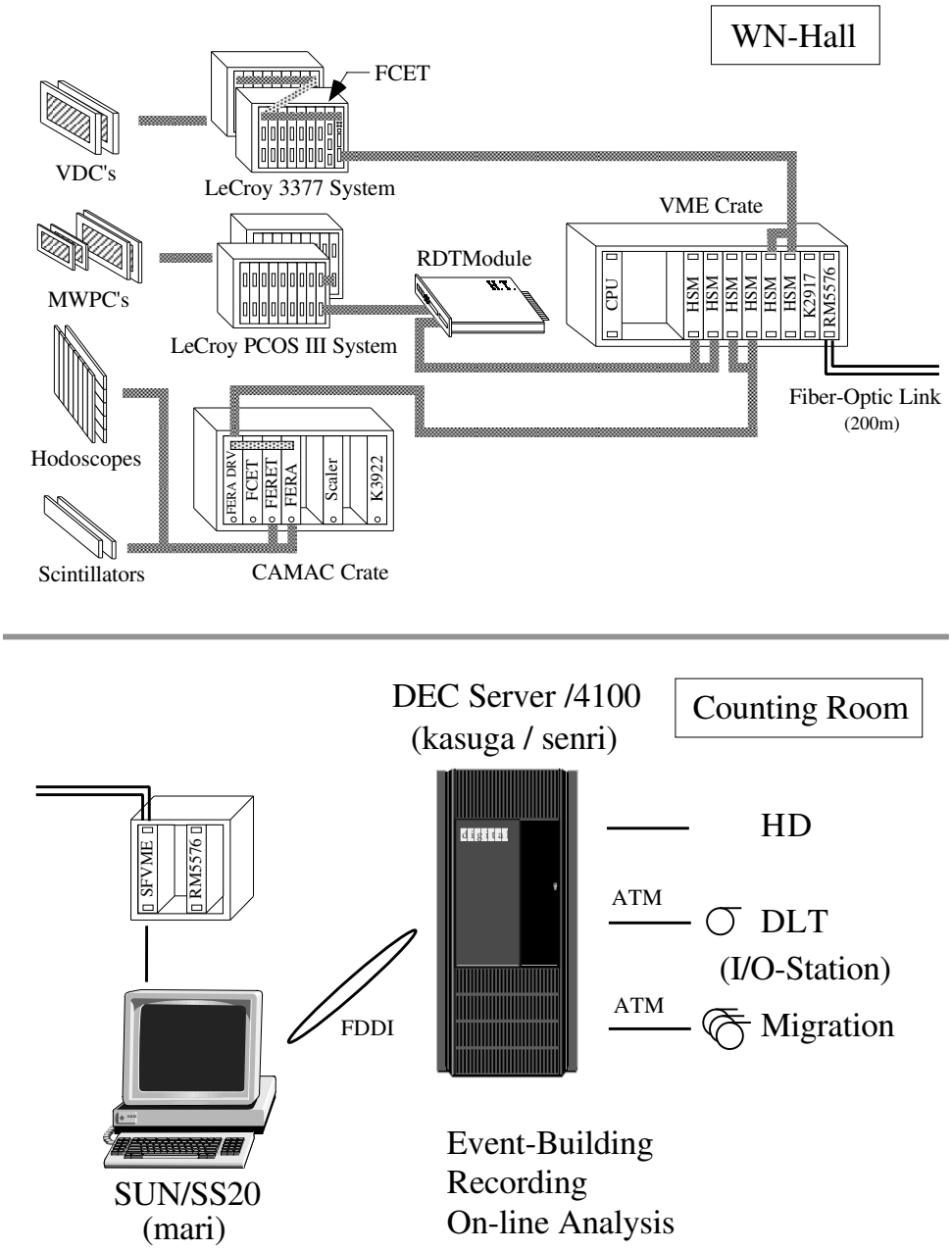

Figure 1: Overview of the data acquisition system.

References

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[3] H. Yoshida *et al.*, RCNP Annual Report 1996.

[4] A. Tamii *et al.*, RCNP Annual Report 1997.