

COMPUTING AT FERMILAB

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Batch-processing computation at Fermilab has been bumping up against the limit stops of saturation for some months now. The three CPU system currently installed is not capable of substantial further enhancement or expansion and our plans for the future are for large new equipment. In the FY 78 President's budget there is an item of \$12 M for this equipment. We shall discuss the status and possible parameters of this new equipment in this article.

The Laboratory acquired its first CDC 6600 in December 1973 on transfer from LBL. A second CDC 6600 was added in 1975 and a CDC 6400 was installed as a "front end" for the 6600's in 1976. Thus all the Fermilab computers were acquired used. We have slowly enhanced the peripheral equipment supporting these computers, but it is still very lean. In addition, Fermilab has a PDP 10 acquired in 1971 when the Princeton-Pennsylvania Accelerator closed. It was initially used as a fast turn-around computer, a role now taken over by the 6600's. Since then it has been enhanced and is now used as a time-sharing computer with some interactive capability. Also in 1971, a second PDP 10 was donated by the Digital Equipment Corporation to Universities Research Association. It is used in the Film Analysis Facility to operate the Fermilab automatic measuring machine, SAMM.

The major aim of the Fermilab computing facility is to provide fast turn-around service for experiments while they are running. Currently

most of our computing is of this variety; only 20% is post-run analysis by Fermilab physicists and all other kinds of computing use comparatively small amounts of time. We have always worked at a level very close to the saturation limit of our facilities and it will very likely become particularly acute in the next six months. We have imposed a new priority system and more stringent accounting rules. These measures give some help, but our computing needs are much larger than we can hope to meet with our present computers. There are no funds assigned for enhancing the currently installed equipment. Furthermore, there isn't any more space for new equipment in the "Antique Computing Museum" on the Seventh Floor West where our venerable equipment is located.

We are therefore looking toward a modern integrated system more appropriate to Fermilab's needs. Although the Fermilab computer is in the President's Fiscal Year 1978 budget, there are also many other computers in that budget and it is not certain that all will survive. If all goes well with our computer, it will be installed and available in October, 1978. By that time, our existing system will have had to turn away much of the load. Exactly how we proceed depends, among many other things, on whether there is a conversion problem. If the new system is not compatible with existing 6600 programs, we will have a conversion period of up to a year.

We are beginning to work seriously on the specification of the system. Almost for sure the new system will be required to have two or more Central Processing Units plus a front end. The total computing power will be comparable to that of eight 6600's--about four times our present power. This

will give Fermilab a computation system comparable in power to the present systems of CERN, LBL, SLAC, and BNL. It will also help our difficult space problem on the seventh and eighth floors, once the transition to the new equipment is accomplished.

We will go out for bids with essentially no preconditions or limitations on the manufacturers. The Request for Proposals will define a figure of merit, a point system for quantitative analysis of the cost/performance ratio of the proposed machines and bids will be judged on the basis of this figure of merit.

The manufacturer will be expected to provide for continuation of our BISON-NET system and for continuation of our Remote Job Entry Terminals. New features that will be included in the RFP is a "mass-store" device, with a storage capacity of approximately 10^{12} bits. Such devices, which are improvements over the early "chip-store" devices (one of the three ever manufactured is installed at LBL) are now available commercially. This mass-store device, accessible to either CPU, allows the system to access the equivalent of many tapes for each user without operator intervention.

Another feature that is being considered is a limited interactive ("chit-chat") front end to this major computing system. There will be limitations on the level of interaction allowed in order to maintain a high level of efficiency for the whole system. As a tradeoff, the full Laboratory data file will be available at all times to users of both the batch system and the interactive system. The more fully interactive PDP 10 system will continue to operate as a stand-alone facility until it is no longer needed.

We are very desirous of input from users to tell us features appear to be lacking in the system currently installed and what attributes they would like to have in the new system. We are also looking for benchmarks, copies and documentation of large programs we can use to test proposed systems. With this help, we hope to provide greatly improved computing here at Fermilab.