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A REPORT ON RECENT DEVELOPMENTS IN COMPUTING, PROCESSOR, AND SOFTWARE RESEARCH FOR HIGH-ENERGY PHYSICS

A Symposium Held in Guanajuato, Mexico, May 8-11, 1984

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The bottleneck of computing is a critical problem for most existing and pending high-energy physics experiments. Many groups recognize that finding highly cost effective, yet user-friendly solutions to the computing problem will be a contribution to physics of the highest importance.

Work is going on in many laboratories to meet this need. This work was discussed at "Recent Developments in Computing, Processor, and Software Research for High-Energy Physics," a four-day international symposium held in Guanajuato, Mexico, May 8-11, 1984. The symposium was the third in a series of meetings exploring activities in leading-edge computing technology in both processor and software research and their effects on high-energy physics. Topics covered included fixed-target on- and off-line reconstruction processors, lattice-gauge and general theoretical processors and computing; multiprocessor projects, e^+e^- colliders on- and off-line reconstruction processors, state of the art in university computer science and industry; software research, accelerator processors, and on and off-line reconstruction processors for proton-antiproton colliders.

The major emphasis at Guanajuato was on large projects, including the CERN/SLAC 3081/E emulator effort; the Fermilab Advanced Computer Program multi-microprocessor project; the LBL Midas Project; the Nevis Data Driven Processor; and the CERN UA1 multiprocessor upgrade. With the exception of the Nevis processor, all of these high priority efforts are focusing on multiprocessor environments with well-supported Fortran. The projects differ in the number of nodes, ranging from fewer higher performance processors in the 3081/E approach to hundreds of microprocessors with at least 1/2 Vax power each in the Fermilab ACP project. With reasonable confidence, one can expect that next summer there will be available computation for special purposes with the power of 50 Vax 11/780s for about the cost of one commercial system.

Many reports were given at the Symposium on low-level triggering systems for fixed-target and colliding-beam experiments. Though sophisticated and powerful, these systems did not show any tendency toward a uniformity of approach like that developing in the FORTRAN multiprocessors for high-level triggers and off-line computing.

Theorists and accelerator builders are also feeling the computing crunch and are interested in developing their own computers. At Cal Tech and Columbia, grids of microprocessors

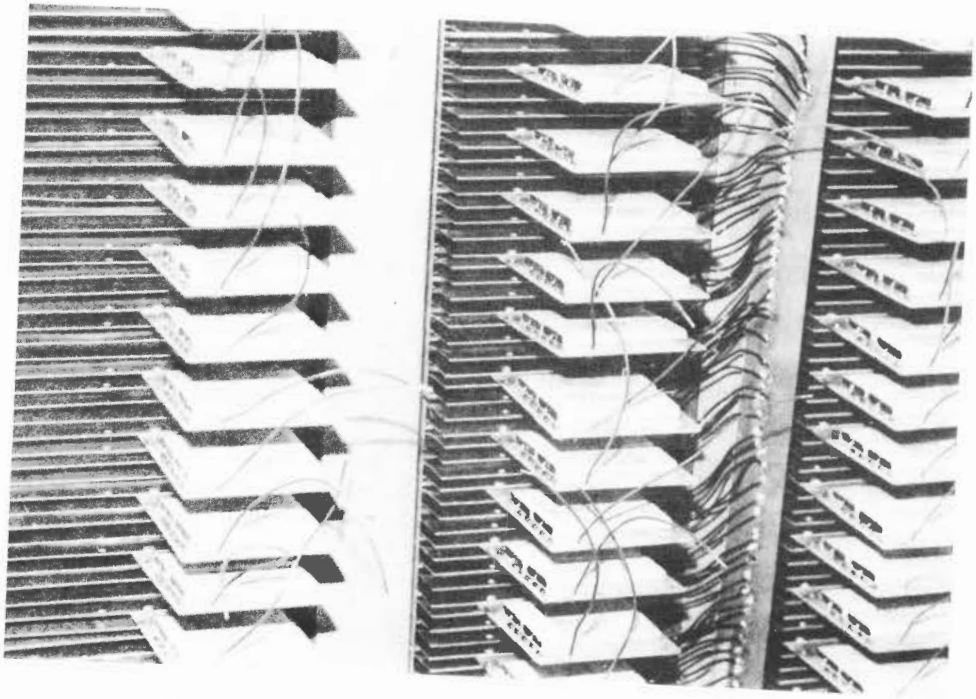
have been successfully assembled to attack the lattice gauge calculation. At Carnegie Mellon, even a QED calculation is being treated in this manner. At DESY, a multiprocessor system has been constructed for simulation of the HERA proton ring. This appears to be a forerunner of much future work on processors for accelerator calculations.

Many representatives of industry were present and were involved, along with a few stalwart physicist allies, in an intensive debate on the merits of commercial turn-key systems versus physicist-designed efforts. Industry is certainly feeling the pressure from the highly cost-effective multiprocessor-emulator efforts. The issue for industry is to what extent the activities in high-energy physics foreshadow a potential market outside this field.

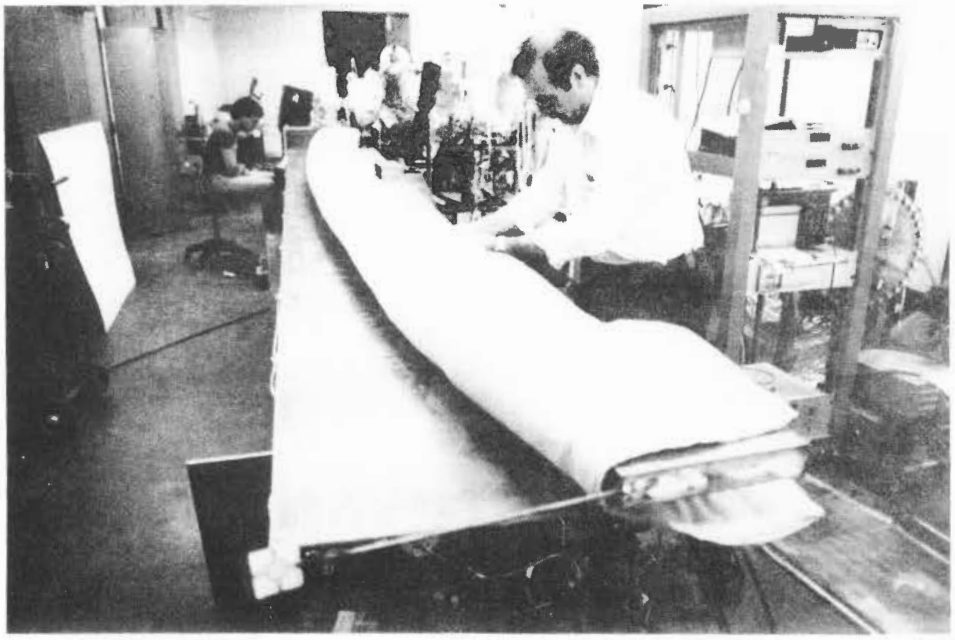
Finally, serious research in software aimed at improving physicist productivity was visible for the first time at such a conference. By far the most ambitious such activity is Cornell's Gibb's Project which is trying to develop a higher level than FORTRAN language environment. The idea is for physicists to write down their problems, mathematics and algorithms, in a readable book-like format using standard scientific notation and have this compiled automatically to FORTRAN.

The intensity of efforts in computing research for high-energy physics throughout the world was clearly felt at Guanajuato and the NIKHEF representative volunteered Amsterdam as a site for another meeting in a year.

Estudiantinas serenade attendees in the calles of Guanajuato during a traditional "callejoneada" at the Symposium on Recent Developments in Computing, Processor, and Software Research for High-Energy Physics, Guanajuato, Mexico, May 8-11, 1984.
(Photograph by Tom Nash)



Liquid Argon-Uranium Calorimeter for E-740.
(Photograph by Fermilab Photo Unit)



John Satti wrapping a prototype Accumulator vacuum-chamber section for brakeout tests.

(Photograph by Fermilab Photo Unit)