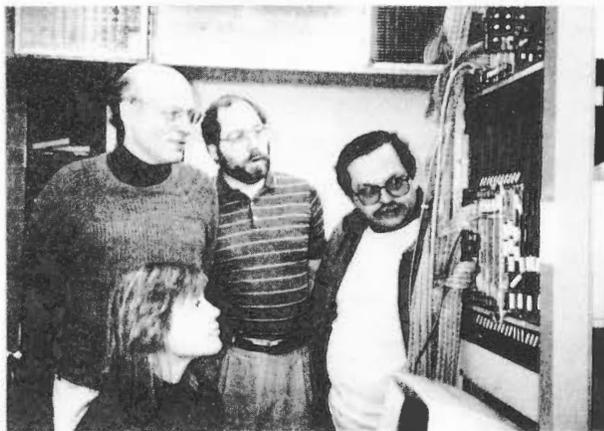


The ACP/R3000 Project

Computer R&D Department & LAFEX/CBPF Cooperate

by *Joe Biel and Roy Rubinstein*

For about a decade, Fermilab has had a program of assisting the growth of Latin American physics, and particularly (in keeping with the Laboratory's mission) of stimulating the growth of high energy physics in the region. Over that period, the Laboratory has helped in the formation of experimental high energy physics groups in Brazil, Colombia and Mexico, and assisted activities by individual physicists in Argentina and Ecuador. The largest



Tom Nash (Head, Computing Division), Joe Biel (Head, Computer R & D Department) and Alberto Santoro (Head, LAFEX/CBPF) observe as Carla De Barros (member of the LAFEX/CBPF group) demonstrates one of the ACP/R3000 modules.

est Latin American group is currently that led by Professor Alberto Santoro at Centro Brasileiro de Pesquisas Físicas (CBPF) in Rio de Janeiro, Brazil. This group, which now consists of about 40 people, has taken part in 3 Fermilab experiments (E691, E769 and E791). They have created a laboratory inside CBPF called Laboratório de Física Experimental de Altas Energias (LAFEX).

As a complement to its high energy physics program, the LAFEX/CBPF group has been active in using and developing the Fermilab Advanced Computer Program (ACP) system. For many years now, LAFEX/CBPF has been working closely with Fermilab's Computer Research and Development Department (and its predecessor, the Advanced Computer Program). The contribution

made by LAFEX/CBPF has grown over the years. At the beginning, the LAFEX/CBPF group successfully copied the ACP hardware and software developed at Fermilab and brought it to their institution in Brazil. More recently, its involvement has become more substantial. In particular, members of LAFEX/CBPF played key roles in designing and writing the Cooperative Processes Software (CPS) in use at Fermilab and elsewhere: this is a successor to the ACP software used on the ACP processor farms. The LAFEX/CBPF group's ACP system in Rio de Janeiro has been used by other institutions, universities, basic research institutes and other branches of physics in Brazil. It has enhanced the reputation of Fermilab there, and is an excellent example of technology transfer from high energy physics to other fields.

The system has proved to be very valuable to the Rio high energy physics community, and allows analysis to be performed there which otherwise could only take place in the United States. This is of obvious advantage to the physicists and students involved. In addition, several engineering and theoretical physics students from Rio area universities have written theses based on work using this system.

The Fermilab Computer R&D Department and the LAFEX/CBPF group are now cooperating on the completion of the ACP/3000 project. This project was started several years ago at Fermilab to provide an upgrade for the successful ACP multiprocessor system. A new computer module, called the ACP/R3000 with approximately twenty times the power of the original ACP module, has been designed and constructed. The module is based on the 25 MHz version of the R3000 microprocessor from MIPS Computer Systems, Incorporated. The R3000 microprocessor is a popular example of the new generation of Reduced Instruction Set Computer (RISC) chips. RISC chips have provided a great reduction in the price of doing computing. The LAFEX/CBPF group has already made important contributions to the porting of UNIX to the ACP/R3000 module. It has acquired the expertise needed to test and maintain a multiprocessor system constructed from ACP/R3000 modules, and is now in an excellent position to provide hardware and software support for a project involving the ACP/R3000 and UNIX.

The next step in the ACP/R3000 project is to construct a farm of the processors for use by physicists. It has been decided that a farm of 50 processors will be assigned to experiment E791 for its event reconstruction. Further, it has been decided that LAFEX/CBPF will take a leadership role in constructing and supporting this farm—a task for which it is very well qualified. LAFEX/CBPF will support not only the construction, testing and integration of the ACP/R3000 farm hardware, but will also complete the porting of UNIX to the ACP/R3000 and provide support for the Cooperative Processes Software on the farm. The Computer R&D Department will provide technical assistance for LAFEX/CBPF, but the latter has primary responsibility for making the project work.

The contribution to the farm construction and operation project by LAFEX/CBPF comes at a very critical time. The Computer R&D Department has, with the combined needs of the ACP/R3000 project and the ACPMAPS super computer project, found itself short handed. The additional skilled engineering talent provided by LAFEX/CBPF has made it possible to continue a strong effort on both projects to get them completed in a reasonable length of time. In exchange for taking on a greater degree of responsibility on the ACP/R3000 project, LAFEX/CBPF will get the exclusive use of the processor farm after its use by E791 has been completed. This will substantially increase the computing power available at LAFEX/CBPF and may even be the most powerful computer in Brazil for some classes of computations.

Already the collaboration between Fermilab and LAFEX/CBPF has helped the latter group make significant progress in high energy physics and its associated technologies, and has demonstrated that it is possible to work in this frontier field in a developing country such as Brazil. In addition, it is important to note the many interactions and friendships that have developed between the individuals who have taken part in this international collaboration. The new work on the ACP/R3000 project can only further such cooperation and international understanding.



Members of the LAFEX/CBPF group currently working at Fermilab are: (back row, l. to r.) Ignacio Bediaga, Isaias Costa, Alberto Reis, Roberto Valois, (front row, l. to r.) Carla De Barros, Carmen Silva, Marcelo Mendes and Sandra Amato.



Members of the LAFEX/CBPF group in Brazil are: (l. to r.) Marcelo Nicola, Helio Da Motta Filho, Moacyr Souza, Regio Gomes, Raquel Schulze, Joao Ramos T. Mello Neto, Miriam Gandelman, Jussara Miranda, Mariano Miranda, Alberto Santoro (head), Simone Franco, Jose Guilherme Lima, Eliane, Gilvan Alves, Mario Vaz, Cicero Marques, Amilton Machado, Bruno Schulze, Jose De A. Ricardo and Joao Dos Anjos.
