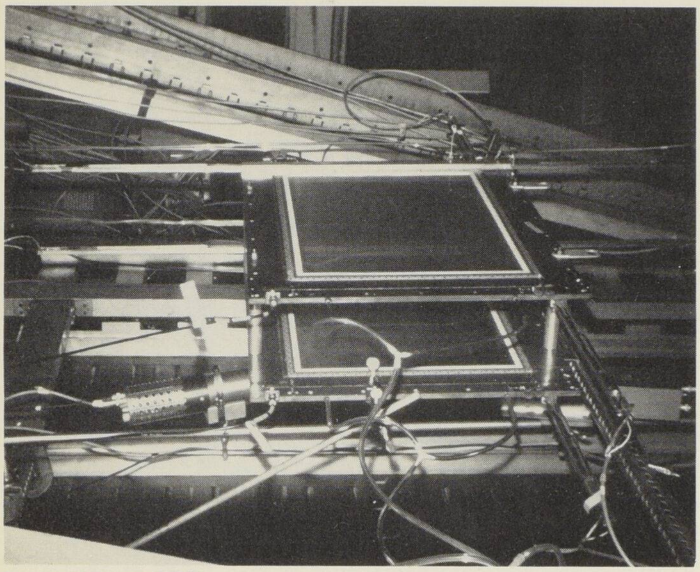
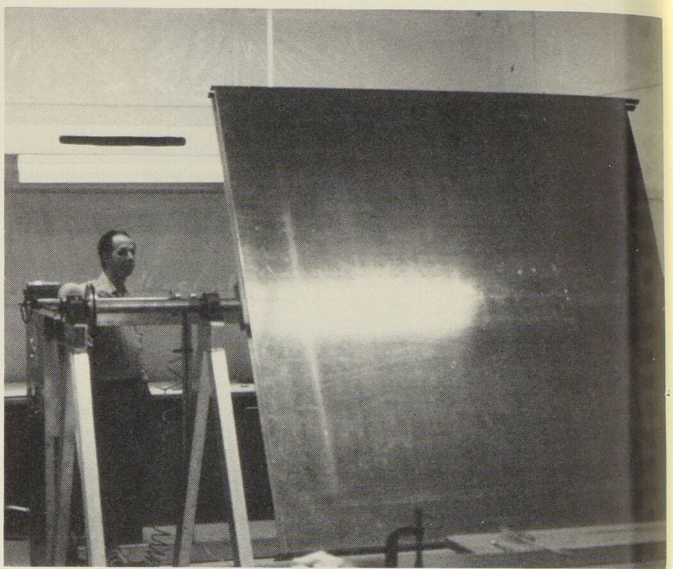


Division of Physics, NRC

Spark chambers being installed at Brookhaven.

Chambres à étincelles en cours d'installation à Brookhaven.



Division de physique, CNRC

Stage in the production of a wire grid electrode for the spark chambers.

Étape de la production d'une électrode à grille métallique pour les chambres à étincelles.

An important feature of the data acquisition and analysis system is its rapidity of operation. The presence of particles, and the directions in which they move, are detected by spark chambers whose electrodes are in the form of wire grids. These grids are connected to the computer system, so the system as well as responding to the presence of a particle detects the point at which it passes through the grid, and thus allows the particle's trajectory to be calculated. "All this," points out Mr. Hincks, "is accomplished at very high speed — for example, in the course of our work at Brookhaven we managed to record 20 million events. Now a lot of that is useless material — the computer has to sort it out and reject it; on the other hand, if we had limited ourselves to photographing particle tracks in a bubble chamber and tried to record even a fraction of that number of events, we never would have finished."

One of the highlights of the NRC-Carleton team's work has been an extensive program carried out in cooperation with physicists at the University of Chicago. This work was aimed at critically testing the quantum electrodynamics (QED) theory, the most successful of the modern "basic" theories, that describes electromagnetic interactions at very small distances. Using the Chicago cyclotron, the NRC-Carleton-Chicago group carried out their first experiment to test the theory in 1971. To everyone's surprise, the results were in serious disagreement with the predictions of the theory, this considerable discrepancy being confirmed by independent measurements completed by physicists in Europe. During the following four years, a large number of theoretical papers appeared. Some corrected errors in earlier work, some refined the calculations and others offered novel explanations for the discrepancy. This had the effect of narrowing, but not completely closing, the gap between theory and experiment so new experimental work seemed warranted.

This was initiated by the NRC-Carleton-Chicago team in the fall of 1974, using a cyclotron at the Space Radiation Effects Laboratory, Newport News, Virginia (the Chicago cyclotron had been shut down and dismantled in the interim) and the work was completed by late 1975. All results seem to be in excellent agreement with the revised QED calculations and so add to the stature of the theory and at the same time increase the demand for still better experiments. As Mr. Hincks points out, "the project led to the observation of several nuclear effects for the first time, and more significantly, it has provided a critical test of QED, one of our most fundamental and successful physical theories. It will also yield a better value for the mass of one of the most important elementary particles — the pion. It is an excellent example of highly sophisticated physics being performed by a Canadian group at very modest cost."

Is there, though, a rationale for indulging in this kind of research? After all, even the most devoted high energy physicist would be hard put to suggest a practical application for his work. As the song puts it, "it don't plant 'taters, it don't pick cotton", and certainly the study of particle interactions brings us no closer to the proverbial better mousetrap. However, there are surely two arguments for supporting this kind of work. The first is cooperation. Of all the fields of scientific endeavor there are not many that achieve such a high degree of international cooperation, transcending national and ideological boundaries. The second is that research in high energy physics offers the prospect of giving us an understanding of the nature of our universe, and the search for understanding is a duty which no civilization can afford to neglect. □

David Mosey