LETTERS

How physics and technology interact

In PHYSICS TODAY for August, 1969, Henry Barschall[1] describes the development of time-of-flight neutron spectrometry as follows:

"The flight times for fast neutrons were too short for the detectors and the available electronics until about 1950. Then organic scintillators and advances in electronics made possible the measurement of flight times with an accuracy of nanoseconds. Multichannel analyzers and, later, computers allowed efficient collection of time information."

Several points should be noted for the record. It would be surprising if new methods of experimental physics were a spontaneous by-product of technology, as Barschall has implied. And it would also be surprising if experimental physics did not contribute to technology as well as receive from it. The history of time-of-flight neutron spectrometry illustrates both these points. It also illustrates again

the advantage of *hindsight over foresight*. Thus, in 1952, Barschall wrote discouragingly as follows[2] of the difficulties confronting the development of time-of-flight neutron scattering spectrometry:

"With the usually available accelerated-particle sources the counting rates to be expected in such time-of-flight measurements are small enough to have discouraged the exploration of this method."

Anticipation of counting-rate problems may have discouraged some workers, although calculations gave no ground for such concern. But in my judgment the critical problem to be solved in scattering was shielding a low-biased detector against background effects due to the neutron source. A successful solution to this problem could not have been predicted on the basis of technological developments or of physical or technical information available at the time success was achieved.

The feasibility of the pulsed-beam time-of-flight method was in fact demonstrated in 1953 for neutron-emission spectrometry and in 1955 for neutron-scattering spectrometry, by pulsing the "usually available accelerated particle sources".[3] The keys to success in scattering were an empirically developed geometry and shielding arrangement, and an effective system of time analysis and sorting devised specifically for the purpose of these measurements.

In my experience the critical limitation on the quality of the results obtainable with the pulsed-beam time-of-flight method as applied to scattering is still the background arising from the purely physical problems of neutron shielding and neutron multiple scattering.

Mainstream technology contributed vitally to the feasibility of time-of-flight spectrometry, but present-day systems are also the *results of major technical developments specifically motivated by the needs of neutron spectrometry*: time-to-pulse-height converters, antislewing circuits, pulse-shape discrimination techniques, and effective methods of ion chopping and ion bunching. These are the results of a decade and a half of development at many laboratories—national, industrial and university. They have grown out of the intensive and successful applications of the systems at their several stages of development, and have themselves contributed substantially to the mainstream of technological development.

Time-of-flight spectrometry is now a well-established part of experimental nuclear physics by means of which a vast mass of neutron data of scientific

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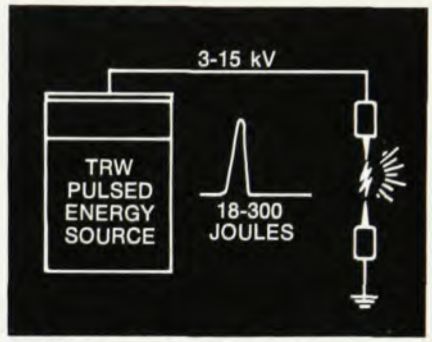

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and technological importance has been accumulated. This development was the result of a difficult, deliberate, protracted and costly effort—or at least so it seemed to one who was involved.

References

1. H. H. Barschall, PHYSICS TODAY **22**, no. 8, 56 (1969).
2. H. H. Barschall, Revs. Mod. Phys. **24**, 129 (1952).
3. For a partial account see L. Cranberg, PHYSICS TODAY **20**, no. 8, 39 (1967).

LAWRENCE CRANBERG
University of Virginia

Foreign subscription rates

The much discussed "Let them eat freedom" editorial in your June issue was annoying but hardly surprising. The spectacle of an organization that, instead of defending its members, tries to persuade them to acquiesce in policies inimical to their interest is indicative of a managerial elite defending its own self-interest and by now is all too familiar. However, the editorial by itself will probably not cause any great harm as it was not directly connected with any action by the American Institute of Physics. (I notice that you still feel no compunction about printing the statement ". . . such a time as now, when so many more scientists and engineers are required in our ever increasingly complex world" on page 77 of the November PHYSICS TODAY).

The differential subscriptions charge for foreign subscribers announced in your November issue is much more sinister. This action, coupled with your vindictive statement that it is being taken in retribution for foreign authors failing to meet the ill-conceived publication charge, can only serve to weaken one of the most important features of the physics profession — its international character. The first reaction of many foreign scientists and their institutions to the publication charges was simply to publish their findings in journals that do not make such a charge. Thus international cooperation in the profession was already weakened to some extent. Now you follow the page charge with a blatantly xenophobic action. Perhaps, the AIP does not consider the impairment of international cooperation in physics to be as detrimental to the well being of the profession as some others do. I was surprised to find that the AIP statement of purpose (PHYSICS TODAY masthead) contains no commitment to international cooperation and communication.

As the arguments of those more eloquent than myself were unsuccessful in having the page charges removed, I hold no hope that this decision will be reconsidered. When one examines the ballot for AIP officers that has just been sent out, the reason that policies so harmful to the profession can be instituted becomes clear. We are told of the fine academic work and impressive research accomplishments of the various candidates, but are not given any further information as to their views on the function of AIP and the American Physical Society, on the relationship of the physics community to society, on the educational reforms that are being initiated at various locations throughout the country or on any of the other issues being debated so vigorously among physicists today. In the absence of any debate between the candidates the elections are a farce, a mere popularity contest, and the "democratically" elected officers are free to pursue policies of their own choosing independent of, and often contrary to, the wishes of the members.

ROBERT GOLUB
The University of Sussex

REPLY FOR AIP: Golub's letter questions a number of AIP and member-society policies. In this letter I will clarify the AIP policy on foreign subscription prices. Before doing so, I will give a brief introductory background.

Publication of primary journals requires a substantial income to cover expenses. We require about $5 million per year to publish the following AIP journals: *Journal of Chemical Physics, Journal of Applied Physics, Physics of Fluids, Applied Physics Letters* and *Review of Scientific Instruments.*

For the last 30 years, the AIP method of collecting the publishing income in physics in the US has been according to the page-charge plan, in which the author's institution contributes to the composition and editing expenses and the subscriber pays for the printing and mailing expenses. This method has resulted in the lowest subscription prices for primary journals of any private publisher anywhere and in rel-

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