INTRODUCTORY TALK FOR THE 1968 PROTON LINAC CONFERENCE

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It was in 1936 that one of the world's most esteemed and most productive physicists published a paper proving that protons cannot be accelerated in a cyclotron to energies greater than 8 MeV.

I suspect that this paper had quite a lot to do with stimulating interest in the development of linear accelerators. For a while, there was great progress culminating in the Alvarez accelerator and the traveling wave electron linac. Then it was discovered how to accelerate charged particles to almost any energy in circular machines and the development of linear accelerator technology languished. True, linear accelerators have been the preferred vehicle for producing intense pulsed beams of low energy electrons and for producing pulsed beams for injection into the high energy accelerators; but significant changes in the linac art had to await the authorization of SLAC. Even so, the highest energy for proton linacs still does not exceed 100 MeV. These proton linacs all utilize drift-tube accelerating structures and all operate in the 2π mode. They probably cannot be pushed much beyond 200 MeV without serious economic penalties.

Within the past several years there have been developed linear accelerating structures which are very efficient and which permit extension of proton linac energies to well beyond 1 BeV; and even the drift-tube linac has been drastically improved. For very intense beams, where a good part of the rf power is transformed into beam power, these new structures provide an acceptable solution to the problem of high duty factor, high intensity linear accelerators.

On the horizon there now appear new possibilities for linear accelerators which may make them quite competitive with circular machines, even at high energies. I am hopeful that this conference will provide convincing evidence of very substantial progress in the development of superconducting linacs. This is a most exciting endeavor, the technology from which will certainly have many additional applications. Perhaps even more exciting, but somewhat further in the future, one sees the collective ion accelerators. These may well carry linacs to very high energy and at average currents not too different from those feasible with circular machines. We all look forward to hearing about developments in this area.

Even though many troublesome effects remain to be circumvented, these new principles offer great promise and they must be vigorously pursued by theory and experiment. In the meantime, the new ideas developed during the past several years should be exploited to their practicable limits.

One, I think, can safely predict that linear accelerators are destined to play an ever-important role in nuclear and particle physics and in practical applications of nuclear particles and electromagnet radiations. The limitation on their development is likely to be an economic rather than a technical one.

It is abundantly apparent that, in the USA, the honeymoon between accelerator builders and the national treasury is on the rocks. This notwithstanding the enormous contributions which accelerators have made to the intellectual and material abundance of our society. I would suggest that this state of affairs is mainly of our own making. We have taken it for granted that the worth of our endeavors is obvious to all. Well, it isn't.

I recently had occasion to talk to Congressman Tom Morris, who is on the JCAE, the House Appropriations Committee, and the Subcommittee for AEC Affairs of the House Appropriations Committee. He is one of the ablest men in Congress and understands the value of science to our society. He understands very well that important battles in the war on poverty are fought in the nation's scientific laboratories from which emerge the technologies on which are based new industries and new jobs. But I came away from my conversation with him convinced that an end to the Vietnam war will not change the funding picture for science; that it is up to us, to the community of engineers and scientists, to bring about an appropriate understanding by our citizens and by the Congress of the implications of science for our society. Otherwise, science will suffer; and, more importantly, so will our society.

I think it is up to us to devote some of our efforts to elucidating the benefits which science brings. I think accelerator builders, as well as accelerator users, have a duty to make understandable the value of what they are doing. We must do so seriously, and competently, and continuously. Actually this task can be fun. I urge those of you who haven't tried it to do so.