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NOTES ON THE HIGH ENERGY ACCELERATOR PROGRAMME

The Symposium

The Symposium showed that physicists were interested in two of the various possible accelerators for the next stage of a high energy accelerator programme, namely an A.G. proton synchrotron for about 12 GeV and some form of high intensity proton accelerator for 2-3 GeV. The following views appeared to be very widely held:

1. The high intensity machine should be designed for nearer 3 than 2 GeV, and 2.5 GeV should be considered as the lowest energy at which to aim.

2. Whatever machine were built, there should be a long-term programme involving serious study of new types of accelerators, especially the F.F.A.G. system.

However, there was a divergence of views as to which of the two machines should be adopted for the immediate future. Moreover, the situation was complicated by the considerable uncertainty involved in the high intensity cyclotron-type machines. A 12 GeV proton synchrotron was the only machine offering reasonable assurance of success in the near future.

Manpower and time scales

1. 12 GeV A.G. proton synchrotron

If this project were to be adopted, there would be a premium on speed. It is therefore assumed that the design would exploit the work already done in Geneva to the maximum extent, and on this assumption the minimum manpower required would be the following:

	S.O. etc. (scientific & engineering)	E.O. etc. (Technical)	Asst.(Sci.) (Assistant)
	24	29	12
Present strength (Including attached staff)	19	17	9
Net new requirements	5	12	3

On the same assumption, it would be possible to order magnet blocks at the end of 1955, and to begin detailed design of building at the same time. Adopting similar time schedules to those envisaged by C.E.R.N., the machine could be completed by early 1960.

2. 2-3 GeV high intensity machine

A programme of theoretical and experimental study could be formulated at once, and would require the following minimum manpower:

S.O.	E.O.	Asst. (Sci.)
12	12	3

Additional effort would be required in the shape of strong computing facilities and workshop and drawing office services on a moderate scale. In the stage of detailed design and construction, the minimum manpower is more difficult to estimate, but the following figures are given as a guess:

	S.O.	E.O.	Asst.(Sci.)
Cyclotron type	12	14	7
Synchrotron type	18	21	12

In this stage, much stronger engineering services would be required.

The time scale is impossible to predict, but if the design studies were successfully completed in 2 years then a machine could probably be completed by the end of 1960.

Types of high energy machines

Three types are considered to be promising:

1. A cyclotron using spiral-ridge focussing, similar to that proposed by Anderson.

2. A new adaptation of the cyclotron recently proposed by Ridley at A.E.R.E. This appears to have several important advantages over the spiral-ridge machine; it would use constant frequency and azimuthally uniform magnet poles.

3. A reverse-field ("Mark I") synchrotron-type machine of the Kerst-Symon type, for 3 GeV.

All involve serious difficulties, but it is felt that one or other of the machines could probably be put into practical form after intensive design studies.

Role of the proton linear accelerator

This would be required as a 50 MeV injector if the 12 GeV machine were built. None of the high intensity machines would need it. However, the view has been expressed that the P.L.A. could be justified independently on the following grounds:

1. The study of heavy particle linear accelerators, on a practical scale remains an important field appropriate to the A.E.R.E. programme.

2. The 50 MeV proton beam, with small energy spread and good collimation, would be of considerable value as a nuclear tool.

Possibility of a two machine programme

Since opinions are divided as to which of two projects to adopt for the immediate future, but are agreed that each is attractive, it is important to consider both the practicability and the desirability of conducting both projects. It is believed that the necessary scientific staff, at honours graduate level, could be recruited and that university collaboration would be an effective help in this. Recruitment into the Experimental Officer class has been more difficult at Harwell, and an estimated net increase of 24 in this category would be required for the immediate double programme. University collaboration could be an effective help here; we are of the opinion that adequate members of pass-degree graduates, with sufficient practical aptitude to make good Experimental Officer material, could be made available.

All the manpower figures given are for scientific staff directly engaged on the project. The consequential problems in manpower and facilities (e.g. engineering, buildings and administrative services) are internal ones for the A.E.A. and will be urgently examined.

Each machine would eventually support about 50 research workers, and the U.K. share of the C.E.R.N. facilities might support a further 15-20. It is necessary to consider whether the country requires high energy research facilities on this scale, and also the likely attitude of the Treasury to expenditure on two machines at approximately the same time.

Role of the Universities

The question of the relations between the U.K.A.E.A. and the universities is under discussion elsewhere. It seems clear that all future high energy accelerators should be operated on behalf of some joint body representing the interests of the Authority and the Universities, no matter where each particular machine might be situated. Some of the manpower required for accelerator studies might properly be supplied by the universities; this would help to develop the large-scale collaboration which would ultimately be essential for the full use of the accelerators for research, and, as has already been stated, would also ease the manpower situation during the design study and constructional stages.