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by

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Sir John Cockcroft.

Discussions are in progress between the A.E.A., the Vice-Chancellors of the Universities, the U.G.C., and the Treasury regarding the creation of a National Institute for nuclear physics. Meanwhile it is a matter of the greatest urgency to settle the location for the first large particle accelerator to be built for this Institute. Since the Authority are to be asked to create and operate the Institute the Executive are asked to consider the question of location and agree to invite the various bodies interested to approve of the construction of the next large particle accelerator at A.E.R.E.

In my paper to the Executive AEX 156 on the second site for the Research Group, I said that its provision would allow Harwell to be used to house at least the first large machine necessary to equip an Institute for Nuclear Science.

It is now widely recognised that some such National Institute is necessary and the Authority is likely to be asked to take the major part in its creation. The large particle accelerators which it is proposed shall be the major items of equipment in this Institute take many years to design and build. It is a matter of the greatest urgency to decide now upon the location of the next big accelerator if it is to be built within the next five years. The case for putting it at Harwell is a very strong one.

The machine proposed, upon which an intensive design study is being carried out, is a 6.5 BeV proton synchrotron. It will have an estimate yield at least a factor 100 greater than that at present available from a machine of similar energy now in operation at Berkeley, U.S.A. A large group is working on this design at A.E.R.E. at the present time. It is anticipated that detailed cost estimates will be completed by the end of 1956. Allowing time for their scrutiny and subsequent approval by the Authority it should be possible to start the first constructional work. i.e. building foundations etc., by April 1957. But this can only be done on a site already developed such as that at A.E.R.E. Speed is vital, for this is a highly competitive field of research which is progressing very rapidly. Already much time has been lost in this country.

A move to any new site would have the following consequences.

(1) At least a year would be consumed in deciding upon a site which is suitable for a new establishment especially when it is also imperative that extensive soil mechanics is required to prove a new site for accelerator construction.

(2) Since the site is most unlikely to have the ideal natural advantages of the Harwell site for accelerator foundations and shielding, both time scale and cost must be increased appreciably to overcome the disadvantages.

(3) Much additional building will be required to replace the headquarters building which we have at present. Wastage of scientific effort will be involved in moving and re-equipping, with further additions to the time scale.

(4) Many additional personnel will be required to provide services at present provided by the establishment. The prime advantage of this communal system which makes a large scale of effort readily available for short periods would be lost.

(5) Disruption of the accelerator group is bound to occur if it is moved from Harwell. This disruption should be avoided at all cost. The group has been laboriously built up over the last three years and is now a competent, efficient and balanced accelerator team. Such manpower is in extremely short supply both in Europe and in the U.S.A. In the U.S.A. it is recognised that even their existing programmes are seriously →

threatened by this problem.
This group has been built from and around the ashes of British accelera-

tor groups which were allowed to disintegrate in the past. We see no hope for the future of high energy physics in this country if anything like this occurs again.
Contributing factors to the dispersion of previous groups have been changes of location and lack of continuity of experience and maintenance of interest in building and operating machines.

(6) Other equipment at Harwell which could be made directly available, would be lost to the Institute. This includes the proton linear accelerator now under construction and the existing synchrocyclotron. Similarly, the cross-stimulation of research work in allied fields would be lost, and this would hurt Harwell as well as the Institute.

RECOMMENDATIONS.

1. The A.E.X. are asked to recognise the urgency of fixing the location for the next high energy particle accelerator to be built in Britain.
2. They are asked to recognise the advantages to be gained by locating at Harwell.
3. They are asked to agree that the bodies interested in the next machine shall be invited to accept its location at Harwell.

APPENDIX

TIME SCALE AND COORDINATION

The scale and diversity of effort required to design and build this machine and the coordination thereof prescribes a time scale of four to five years assuming the most advantageous circumstances. The essential features of an installation are:-

1. Linear Accelerator Injector.

The attainment of at least a factor of 100 over the present current of the Bevatron depends entirely upon a major advance in linear accelerator performance. The specification requires a current during the pulse of at least 2-3 milliamperes and a pulse length of at least 2-3 milliseconds. It will be necessary to build a new 10 MeV injector accelerator.

2. Magnet, R.F. acceleration, vacuum system, magnet power supplies.

A great deal of work is proceeding.

3. Engineering.

Engineering studies for the injector, magnets, machine layout and foundations, shielding and many other features are under way. Much of this work has to be carried out at a very early stage.

4. Building.

The first priority is a permanent headquarters for the accelerator group with all those laboratory and engineering services and installations which allow basic design features to be settled at the correct time. Such a headquarters already exists at A.E.R.E.

The second priority is to lay down the concrete foundations for the ring and to provide overflow space from the headquarters building for the assembly of injector parts, large magnet models and R.F. accelerating cavities. Before this can be done a complete design study of the ring building has to be made, with special reference to the natural features of the site in conjunction with the design, construction, shielding and operating of the accelerator. No architectural work proper is of any value unless tied to such a plan.

With these large orbital machines extreme stability of the foundations is all important. The load to be considered is not only the magnet (about 6,000 tons) →

but also the shielding, which can be several times the weight of the magnet. The rock-chalk subsoil found on the Harwell site at a depth of 3 feet is uniquely suitable ...