Copy to Dr. Pickavance

Phys Committee
working party
(7/3/60 JL

29th February, 1960.

Sir J. D. Cockcroft, F.R.S.,
31 Sedley Taylor Road,
CAMBRIDGE.

Dear Sir John,

As promised in my last letter Pickavance, Mullett, Walkinshaw and myself had a talk on Friday last to try to clarify in our minds what we might hope to achieve at the Accelerator Working party meetings. You may be interested in a summary of the conclusions we reached.

We started by assuming that at the end of the meetings we may hope to be in the position to make specific recommendations to the Governing Board of the National Institute, concerning a second National laboratory. We would hope that we could get as far as settling a possible site, making an estimate of the total cost of the project and over what period this money would be spent. (Such a National Laboratory complete with machine, buildings and equipment would be in the region of £20 million.) The two most likely sites are, of course, (a) Risley, to cover Liverpool and Manchester and (b) Glasgow who have been very active with proposals for a multi-GeV electron linear accelerator. As you will later see this could be a serious contender.

We then wrote down a list of the more practicable high energy accelerators and divided this list, which is attached, into three parts consisting of

(a) those accelerators which could be built from existing knowledge,

(b) those accelerators which could be built following some development work, and

(c) those accelerators which could not be built until a great deal of basic investigation had been completed.

We then attempted to narrow the field. Two facts should now be considered. The first is that until research on the C.E.R.N. proton synchrotron showed the need it would be inadvisable to go to energies greater than 25 GeV. The second is that there is clear need, as ever, for higher intensities of pions, muons, kaons, in fact, of all secondary beams. As we already have the 50 MeV linear accelerator at the Rutherford Laboratory one possible way of catering for the need for high intensity pion beams with energies up to a few hundred MeV would be by extending this machine. This would enable us to eliminate the various cyclotrons from our list. This does not necessarily mean that the cyclotrons are not good machines to build but rather that we have a start with the P.L.A. and it would therefore be sensible to pursue this line. (Incidentally, there is considerable world interest in Proton Linear Accelerators at present. Both Yale, U.S.A. and Zurich have written to us asking for all the information we have on them.)

Assuming medium energy pion physics is catered for by a P.L.A. and that we should not go to proton energies higher than 25 GeV at present we are left with the following possible accelerators that could be started without several years of basic investigations.

(a) Electron linear accelerator.

(b) Electron synchrotron.

(c) A/G Proton synchrotron of energy 25 GeV or less:- probably less and with high repetition rate.

/(d)

(d) Few GeV Proton Linear Accelerator.

The first three are very good possibilities and a decision should depend to a large extent on the preference of the people who intend using the machine.

There is another line of thought which may be profitable to pursue. If we were to build a second large and ambitious machine at this stage it would be difficult to avoid placing it in a National Laboratory near Risley as there it could serve the greater number of Universities. Until one knows more about 25 GeV physics and until more basic investigations are completed on storage rings and other advanced ideas perhaps the time is not ripe for another National project on this scale. If Liverpool - Manchester were to be happy with a 5-6 GeV electron synchrotron or some other project costing about £5 million, it may be possible to satisfy the immediate needs of Glasgow with the 100 MeV linear accelerator and satisfy future needs by extending it to higher energies. Low energy pion physics could be satisfied by extending the P.L.A. This would then not commit the U.K. to an overwhelmingly ambitious project and in 3 years time, say, one may be in a position to propose a second National Laboratory with a revolutionary and no doubt expensive accelerator.

I have not yet eliminated the few GeV proton linear accelerator. Because of its complexity and because of the success of the A.G. proton synchrotron this is not a very promising machine for immediate construction. In any case it would be wise to gain experience with smaller linear accelerators first.

Such were our thoughts and I trust you will find them useful.

There is also the question of the preparation of papers for the main meeting. We thought it may be useful to ask Hine to write a short note on the performance of the proton synchrotron and possible future developments.

Mullett and Walkinshaw would be willing to write a short note to enlarge, essentially, the considerations which went into compiling the attached table of possible accelerators and I could give my current views on the extension of the P.L.A. Some progress has been made since I spoke at the Physics Committee meeting on this and the picture is rather more favourable.

In conclusion, Dr. Pickavance has mentioned to me that at the meeting on the 7th March in the morning you may wish to spend a few minutes clarifying the relation of the Dee 100 MeV electron accelerator and the Wilkinson Electrostatic Generator to the main programme so that it can be reported to the D.S.I.R. meeting in the afternoon.

Yours sincerely,

G. H. Stafford.

	Can be built with existing knowledge	Requires development work	Requires basic investigations
Electron linear accelerator (multi-GeV)	YES		
Electron synchrotron ($\sim$ 6 GeV)	YES		
A/G Proton synchrotron (25 GeV)	YES		
A/G Proton synchrotron ($<$25 GeV) 30-50 pulses for record repetition rate.		YES	
A/G Proton synchrotron ($>$25 GeV)		YES	
Proton synchrotron (Spiral Ridge)			YES
Proton synchrotron (Storage rings)			YES
Cyclotron, C.W. $\sim$400 MeV.		YES	
Cyclotron, Spiral ridge, P.M. $\sim$ 800 MeV		YES	
Cyclotron, C.W. 800 MeV.			YES
Proton Linear Accelerator 150 MeV	YES		
Proton Linear Accelerator 600 MeV		YES	
Proton Linear Accelerator $>$600 MeV		YES	