

Dr. J.C.W. Hobbs

PROPOSAL FOR A 7.0 GeV ACCELERATOR (Amended)

1. The accelerator programme was discussed at a meeting in December, 1955, attended by representatives of A.E.R.E. and the Physics Departments of the Universities. The consensus of opinion was that the immediate stage of the accelerator programme would best be met by a machine with a nominal proton energy of 6 GeV, and with an intensity at least $2 \cdot 10^{11}$ particles per second (i.e. about 100 times the present yield of the Bevatron). Two machines of this type were discussed:

1. A double-magnet synchrotron.
2. A spiral ridge synchrotron.

Both appeared to offer a good chance of fulfilling the requirements.

2. Progress of the accelerator studies since that time have confirmed the belief of the Accelerator Group that a machine of this type would be the right choice for early construction. Long term studies of more advanced types of accelerator, of fixed field type, have continued and have indicated that such machines are very promising for a later stage of the accelerator programme, but that they really do belong to the later stage because of the many fundamental problems which must still be solved. This view is also held in the U.S. laboratories. These studies will be continued.

3. We have abandoned the double-magnet machine on account of mechanical complexity, and now propose an accelerator having the following characteristics, for detailed design and construction in the immediate future:

Proton energy (kinetic)	7.0 GeV
Type	Spiral ridge synchrotron*
Peak magnetic field	14,000 gauss
Machine radius	61.6 feet
Number of magnet sectors	8
Length of straight sections	12.5 feet
Number of ridges	24*
Radial aperture	36 inches
Vertical aperture (mean)	5 inches*
Steel weight	6,000 tons
Peak stored energy	$2 \cdot 10^7$ joules*
Residual gas pressure	1 mm
Vacuum chamber	Stainless steel, enclosing pole tips.
Power supply	Alternator-ignitron set.
Injection energy	10 MeV - 13 MeV
Type of injector	Linear Accelerator (Single tank, 100 Mc/s or 133 Mc/s, 40' long).
Injected current	2 m.a. peak
Injection time	1 millise.
No. of protons accelerated to full energy per pulse.	10^{12}
Repetition rate	30 p.p.m.
Mean current	$5 \cdot 10^{11}$ /sec. <i>4/sec.</i>

*Computations indicate that the spiral ridge machine will be satisfactory.

The machine specified above could also accommodate constant gradient poles with a gap of 9 inches. All other parameters would be the same, except:

Peak stored energy 3.5×10^7 joules.

4- Long term future

Some system using colliding beams must inevitably be built sooner or later. Very high intensity will be needed, and fixed field machines appear to hold out the best hopes of this; we are therefore continuing to study fixed field machines with the aid of electron models, model magnets, and computing machines. Other long-term work will be concerned with the use of intense magnetic guide fields inside electron beams, as proposed in the U.S.S.R.

T. G. Pickavance

A.E.R.E., Harwell.
18th September, 1956.