



Rutherford Laboratory

Technical leaflet

C.12

ACCELERATOR RESEARCH

Development of Valveless Accelerators

A new type of accelerator for producing very intense beams of protons at energies up to 1000 MeV has recently been invented at this Laboratory. Based upon the revolutionary, but well established principles of the Separated Orbit Cyclotron, this new type of machine called the Super-SOC does not use any high power radio valves for exciting the acceleration cavities. Instead a contra-rotating beam of electrons is directed through the cavities and is arranged to feed energy to the cavities. This process is the converse to that used for accelerating the protons in the same cavities.

A preliminary design of such a machine has been made for an intermediate range of energies. The principal use for such a machine is likely to be in the generation of ultra-intense beams of neutrons, exceeding that obtainable from any reactor, which are produced by allowing the accelerated protons to impinge on a lead-bismuth target. Typically, nearly 100 megawatts of power would be required from such an accelerator and it is obviously necessary to produce this large quantity of power by an efficient process. The Super-SOC appears to be one way in which this could be achieved for preliminary investigation has shown that efficiencies in excess of 90% might be achievable.

In place of the high radio frequency valves which are normally used in an accelerator, the power is derived from the electron beam. This electron beam is in turn produced by acceleration in a large d.c. high voltage generator of about 4 million volts potential. The principle of the Super-SOC is illustrated in the diagram overleaf.

