Rutherford Laboratory

Press Release

NIMROD REACHES DESIGN INTENSITY

The proton synchrotron NIMROD, at the Rutherford High Energy Laboratory, Chilton, Berkshire, accelerated bursts of a million million protons for the first time on 23rd September, 1964. This beam intensity was the figure chosen for the accelerator performance when the project was decided upon in 1957. At the pulse repetition rate of NIMROD, the intensity is equivalent to about 5 x 10" protons per second which compares favourably with accelerators at other high energy physics research centres.

NIMROD achieved its design energy of seven thousand million electron volts in August 1963 when bursts of 10,000 million protons were accelerated. Over the past twelve months the intensity has been steadily raised as the various factors contributing to the performance of the machine have been optimised. The enhanced intensity of NIMROD will increase the efficiency of the machine in supplying high energy beams of particles for experiments.

In February of this year NIMROD provided its first beams for experiments and from then until August, 845 hours of machine operation have been used for high energy physics with an average intensity of several hundred thousand million protons per pulse. Five experimental teams collected data on particle interactions at the machine using pi-mesons, neutron and proton beams.

In the second period of operation, now underway, experiments will begin using an 80 centimetre hydrogen bubble chamber recently moved from the Saclay Laboratory in France to be used at NIMROD for approximately twelve months. More intense beams in the accelerator will be particularly advantageous for bubble chamber work.

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Background Information

The Rutherford High Energy Laboratory is the first Laboratory of the National Institute for Research in Nuclear Science which was founded in 1957 to pursue nuclear science and to provide facilities on a national scale for the use of Universities and other bodies interested in nuclear science. The Laboratory has two proton accelerators of which the proton synchrotron, NIMROD is the larger. Over a hundred University scientists are involved in NIMROD's experimental programme.

In NIMROD, a beam of protons at an energy of 15 million electron volts is injected into a large magnet ring 155 feet in diameter. Each time the beam orbits the ring, it passes a radio-frequency accelerating cavity and its energy is increased by an alternating voltage. To keep the beam in the ring, the magnetic field has to be increased in step with the increase in energy. Further improvements to the injection process, the radio-frequency system and the detailed shape of the magnetic field have all contributed to minimise the number of protons lost from the beam during acceleration.

When the beam has reached full energy of seven thousand million electron volts it is allowed to collide with a target, such as a block of metal, in the magnet ring. The violence of the collision with the nuclei in the target produces a spray of nuclear and sub-nuclear particles. A particular type of particle can be sifted out from the spray by magnetic and electrostatic fields and channeled down a 'beam line' to experimental equipment.

The experiments are designed to investigate the behaviour of fundamental particles when they interact with one another. In any one experiment a large number of events, involving the particular interaction being studied, need to be recorded to assemble sufficient information to draw statistical conclusions. Therefore the more particles in the beam from the accelerator, the more interactions will be recorded at each machine pulse and the less time any one experiment will be using NIMROD. Also with more intense accelerated beams several experiments can be fed with particles at each machine pulse.