24/6

Rutherford Laboratory

Press Release

FRENCH BUBBLE CHAMBER COMES TO THE RUTHERFORD LABORATORY

A hydrogen bubble chamber from the Centre d'Etudes Nucleaires et Saclay, France, arrives in England on 25th June. The chamber is being transferred to the Rutherford High Energy Laboratory at Chilton in Berkshire where it will be used in high energy physics experiments with the 7 GeV proton synchrotron, 'Nimrod'. The Laboratory was formally opened and Nimrod inaugurated by the Secretary of State for Education and Science in April 1964.

The chamber has previously been used with the accelerator at Saclay, a 3 GeV proton synchrotron called 'Saturne'. 180 litres (11000 cubic inches) of liquid hydrogen are contained in the chamber. A beam of high energy particles from an accelerator passes through 82 centimetres (32 inches) of the liquid when it is directed at the chamber and produces interactions with the protons which are the nuclei of the hydrogen atoms. These interactions are revealed by tracks of minute bubbles which are photographed and investigated by the scientists.

Two types of particle beam from Nimrod, a K meson beam and a pi meson beam are at present planned to be used with the French chamber.

A large liquid hydrogen bubble chamber (the 1.5 metre, i.e. 59 inches, British National Hydrogen Bubble Chamber) was built in England, and was sent to CERN - the European Centre for Nuclear Research in Switzerland, which is owned and operated by several European countries, including the U.K., to be used with a particle accelerator several times larger than Nimrod. In August 1963, Nimrod became operational and a programme of research work was begun at the Rutherford Laboratory. It was desirable to have a hydrogen bubble chamber without curtailing the programme of the British chamber at CERN. Discussions with French physicists at the "Laboratoire de ~~Particules~~ Physique Corpusculaire à Haute Energies" of the C.E.A. (French Atomic Energy Commission), Saclay, Paris, indicated the possibility of bringing their large hydrogen bubble chamber to Nimrod. It was just finishing a valuable programme of work with Saturne.

A team of research scientists from France will collaborate with British scientists in the bubble chamber experiments and the chamber is expected to remain at the Rutherford Laboratory for about eighteen months.

The exchange of major items of nuclear physics equipment between European accelerator centres is an indication of the international nature of nuclear physics research.

Rutherford Laboratory Press Release N/1/64
Issued at the request of the Dept. of Education & Science

Rutherford Laboratory
Chilton, Didcot, Berks.
Tel.: Abingdon 1900

Background Information

The Rutherford 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 for the use of Universities and other bodies interested in nuclear science. About 150 scientists from British Universities are involved in the current experimental programmes of the accelerators at the Laboratory. The experiments are directed towards obtaining detailed knowledge of the properties of fundamental particles, which are the units from which all matter is constructed, and the laws which describe their behaviour. This knowledge is of basic importance to the scientist in his attempt to understand the laws of nature. During the past few years it has been found that many strange phenomena occur when high energy particles collide, or 'interact', with other particles. A whole family of new particles has been discovered, many of which 'decay' into smaller units in a very short time.

Nimrod accelerates protons to an energy of seven thousand million electron volts and when they have reached their full energy, they bombard a target, such as a block of tungsten. The collision with the nuclei of the target produces a spray of nuclear and sub-nuclear particles (such as K mesons or pi mesons). A particular type of particle can be separated out by magnetic fields and channeled down a 'beam line' to experimental equipment where interactions can be investigated.

One type of experimental equipment is the bubble chamber, which enables the scientist to 'see' particle interactions. A volume of liquid, such as hydrogen, is kept at low temperature and under sufficiently high pressure that it is held on the point of vapourising. It has been found that the liquid vapourises more easily in the presence of charged particles. As a beam of charged particles from an accelerator passes through, the pressure on the chamber is suddenly released and the liquid vapourises along the tracks of the charged particles. The tracks are therefore picked out by a line of tiny bubbles and a photograph of the chamber at this instant provides a permanent record of the particle's passage.

When incoming particles collide with the nuclei of the liquid in the chamber, interactions which are of interest to the scientists may take place. The products of the interactions are either charged particles, or are neutral particles which may decay into charged particles before they escape from the chamber, and they too can be seen as bubble tracks on the photograph. Applying a strong magnetic field across the chamber causes a charged particle to follow a curved path and by measuring the curvature, the scientist obtains information on the particle's charge and momentum.

A knowledge of the incident particle and the target nucleus in the chamber together with measurements on the bubble chamber photographs enable the scientist to deduce the products of the collision and in this way, build up a full picture of the interaction that took place.