Atomic energy

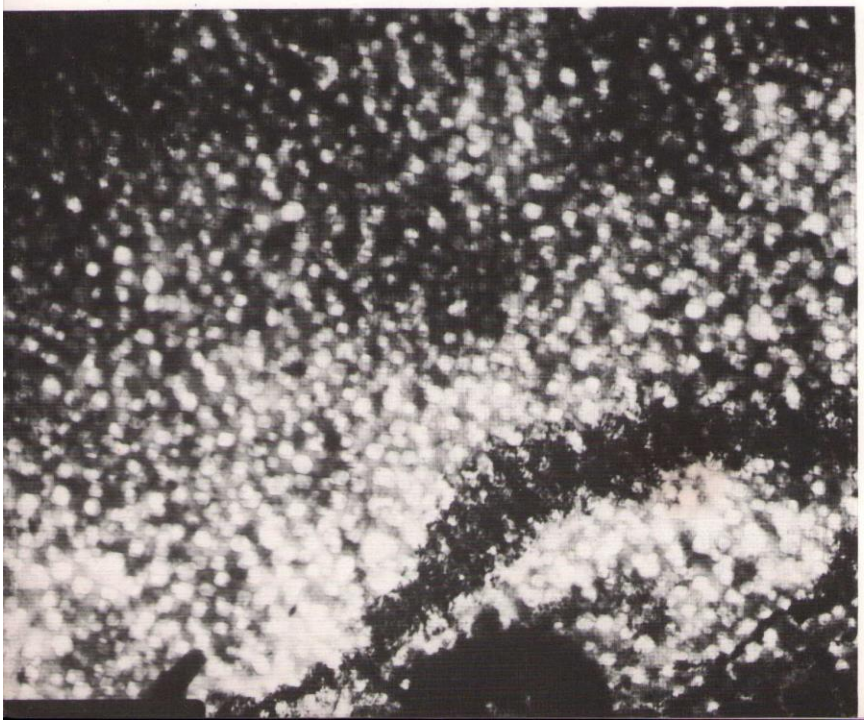
Particle accelerators have traditionally been associated with atomic energy research, and this is still a field of major importance in the use of the Harwell facilities. Beams of charged particles, neutrons and secondary radiations are used for the following major purposes:-

To carry out accelerated tests on the behaviour of nuclear materials under operational conditions. Some heavy-ion beams have linear energy transfer values approaching those of fission fragments. Many years of reactor irradiation can be simulated in a few hours, with little hazard from induced radioactivity.

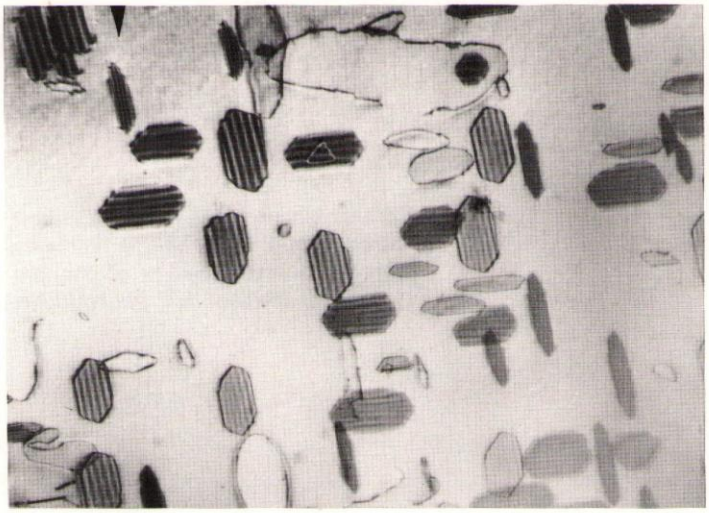
To study the influence of radiation on the course of chemical reactions relevant to reactor operation, e.g. radiolytic decomposition of water, CO_2 and other reactor coolants.

To obtain data on cross-sections for nuclear reactions. These are required for all aspects of the design and safety assessment of reactors and to estimate the composition of nuclear fuels to be processed. The fusion reactors of the future will require measurements of cross-sections for charged particles and neutrons for a wide variety of elements.

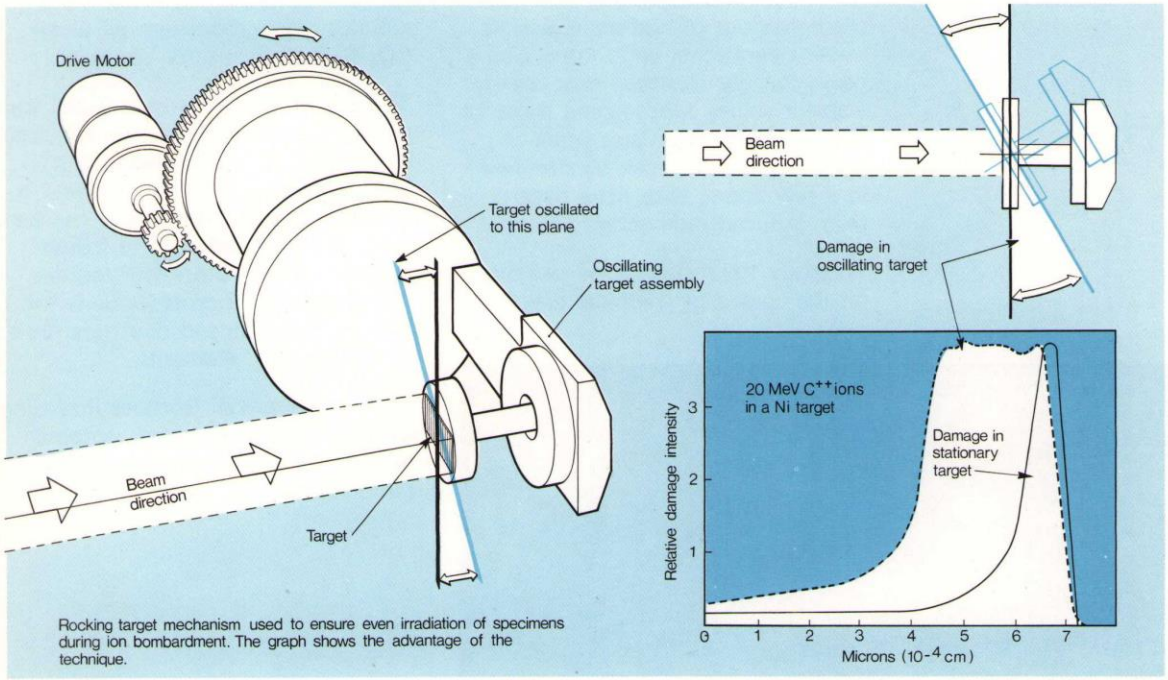
To prepare special isotopes including separated stable isotopes, isotopic target materials, and proton-rich radioisotopes.



Voids in 316 steel after bombardment with carbon ions to 200 displacements per atom at 525°C.



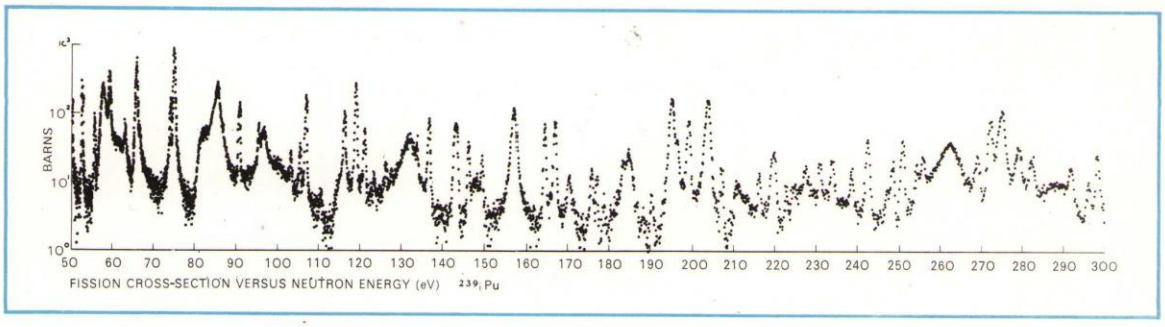
Interstitial dislocation loops in proton-irradiated copper at 100°C (x 16,000).

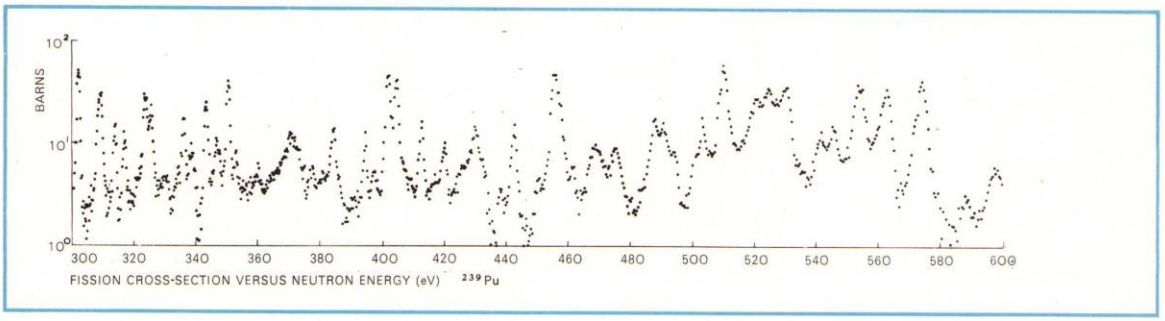


Rocking target mechanism used to ensure even irradiation of specimens during ion bombardment. The graph shows the advantage of the technique.

The solid curve of the graph in the rocking target mechanism illustration shows that the intensity of radiation damage along a track of a heavy ion is non-uniform and peaks to a maximum towards the end of its range.

The narrow width of this peak makes examinations of damage by electron microscopy very difficult. If however, the target is suitably oscillated during bombardment then the effective range of the particles is varied continuously and a region of uniform damage can be generated within the irradiated material. This is represented by the dotted curve. A simplified view of the technique used is shown.





Fission cross-section of ^{239}Pu.

For further information write or telephone to:
Miss J. Lincoln,
AERE Harwell, Oxfordshire,
OX11 0RA
Tel: Abingdon 4141 (STD 0235) ext. 2506

Harwell Design Studio 63/1974