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NEUTRONS FROM A LINEAR DEUTERIUM PINCH

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NEUTRONS FROM A LINEAR DEUTERIUM PINCH

by

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Preliminary results from measurements on the spatial distribution of neutrons from a linear deuterium pinch are consistent with a line source at the axis of the pinch tube, and inconsistent with production at the ends or walls of the tube.

The neutron detectors so far employed in these studies consist of plastic scintillators, long BF_3 counters and lithium iodide crystals, and some preliminary measurements with photographic emulsions have just been started. Most of these measurements have been non-directional, but some measurements have been made with plastic scintillators in lead and paraffin collimators, using both single pulse and integration type techniques.

The neutron yields from some of the linear pinch tubes of Anderson and Baker were measured with a long boron counter, calibrated with a Po-Be source, assuming isotropic production of neutrons. Under optimum conditions, average yields of $1 - 2 \times 10^7$ neutrons per burst have been observed with a quartz tube 18 in. in length and 3 in. in diameter, containing deuterium at 100 microns pressure.

The axial distribution of neutrons has been measured using two types of detectors:

(a) a plastic scintillator, embedded in a paraffin collimator, and
(b) an unshielded plastic scintillator, using the integrated pulse-height of the recoil protons produced by the neutrons in the scintillator.

Both these measurements were consistent with a uniform distribution, and definitely inconsistent with neutron production at the ends of the tube only.

The radial distribution has been measured by means of a plastic scintillator in a large paraffin and lead collimator. The results are consistent, within the rather poor angular resolution, with a line source of neutrons along the axis of the tube. Further studies are being made on this effect, but it is now certain that the neutrons do not come from the walls.

Photographic emulsion studies have been instigated in an attempt to get the spatial distribution of neutrons. They are also being used in an effort to rule out the acceleration of deuterons to high energies by direct electric field acceleration along the axis of the pinch tube: following a suggestion of Stirling Colgate, emulsions were placed above the discharge tube, in line with the axis, and then a second set was exposed with the voltage reversed. If the neutrons are produced by direct deuteron acceleration to energies of about 10 kilovolts or more, the ranges of the recoil protons should be measurably different for the two polarities. These films are being scanned.