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THE MODIFICATION OF THE SPECTRUM OF D-D NEUTRONS BY PASSAGE THROUGH 5" OF TUBALLOY

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ABSTRACT

The spectrum of D-D neutrons after they have been degraded by passing through five inches of tuballoy is measured by the methods of L A-17 and L A-48. Although the spectrum has two maxima, the average energy of the neutrons is comparable with that of the fission spectrum.

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THE MODIFICATION OF THE SPECTRUM OF D-D NEUTRONS
BY PASSAGE THROUGH 5" OF TUBALLOY

In connection with an investigation of the boron polonium neutron spectrum (see L A Report 48) it was necessary to take a calibration measurement on the D-D source in building Z. Since, in view of the necessity of obtaining artificial sources having a spectrum similar to that of the fission neutrons, it was felt that a D-D spectrum degraded by the interposition of tuballoy might offer a reasonable resemblance, data were taken of the recoil distribution after a large block of tuballoy 5" thick had been placed between source and ionization chamber.

The method and the equipment used and also the procedure for obtaining the neutron spectrum from the measured recoil spectrum are described in detail in L A Reports 17 and 48. A block of tuballoy 7" x 7" x 5" was placed 4" away from the target. The center of the ionization chamber was located at 6 3/4" off the farther side of the tuballoy block. With this arrangement measurements of the recoil distribution were taken the same way as for the bare D-D source in L A Report 48. The results of both measurements together with the spectra calculated from the recoil distribution are given in Figs. 1 and 2.

The total number of neutrons observed between .7 and 2.0 Mev, with and without tuballoy interposed between source and chamber but with the same primary neutron flux in each case, was determined in the following way. The D-D source was equipped with a monitor for recording the protons of the D-D reaction, thus measuring the primary neutron flux. For a certain bias

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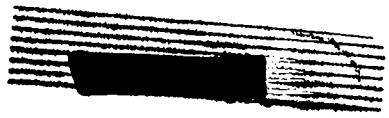
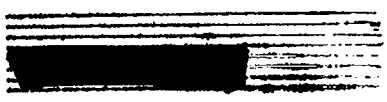


setting the total number of recoils above the corresponding energy was then determined for the same number of monitor counts with and without the tuballoy interposed. Then the energy value of the bias setting was determined and the two recoil-curves plotted in such a way as to give the required ratio of the integrals above this energy. The neutron spectra calculated from this recoil distribution have thus the same relative scale. By integrating the spectra one finds that the ratio of the total number of neutrons between .7 MV and 3.0 MV of the bare source to those from the tuballoy-shielded source is 3.67. The two spectra with their respective ordinate scales are given in Fig. 3.

From these results it may be seen that without excessive loss in intensity a fairly reasonable imitation of the fission spectrum may be obtained by shielding the D-D source with a sufficient amount of tuballoy. Although it is apparent that with the present arrangement still quite a few primary neutrons appear it should be possible to remedy this situation by using more tuballoy and surrounding the source completely. It may be noticed that the primary neutrons show a much larger spread with the shielding, than without. Most probably this is due to elastic scattering of high and low energy primaries emitted at considerable angles off the 90° direction. Since Since the tuballoy shield subtends an angle of $\pm 40^\circ$ the primary neutrons hitting the tuballoy have an energy (at .1 MV bombarding voltage) of $2.5 \begin{cases} +.26 \\ -.22 \end{cases}$ Mev.



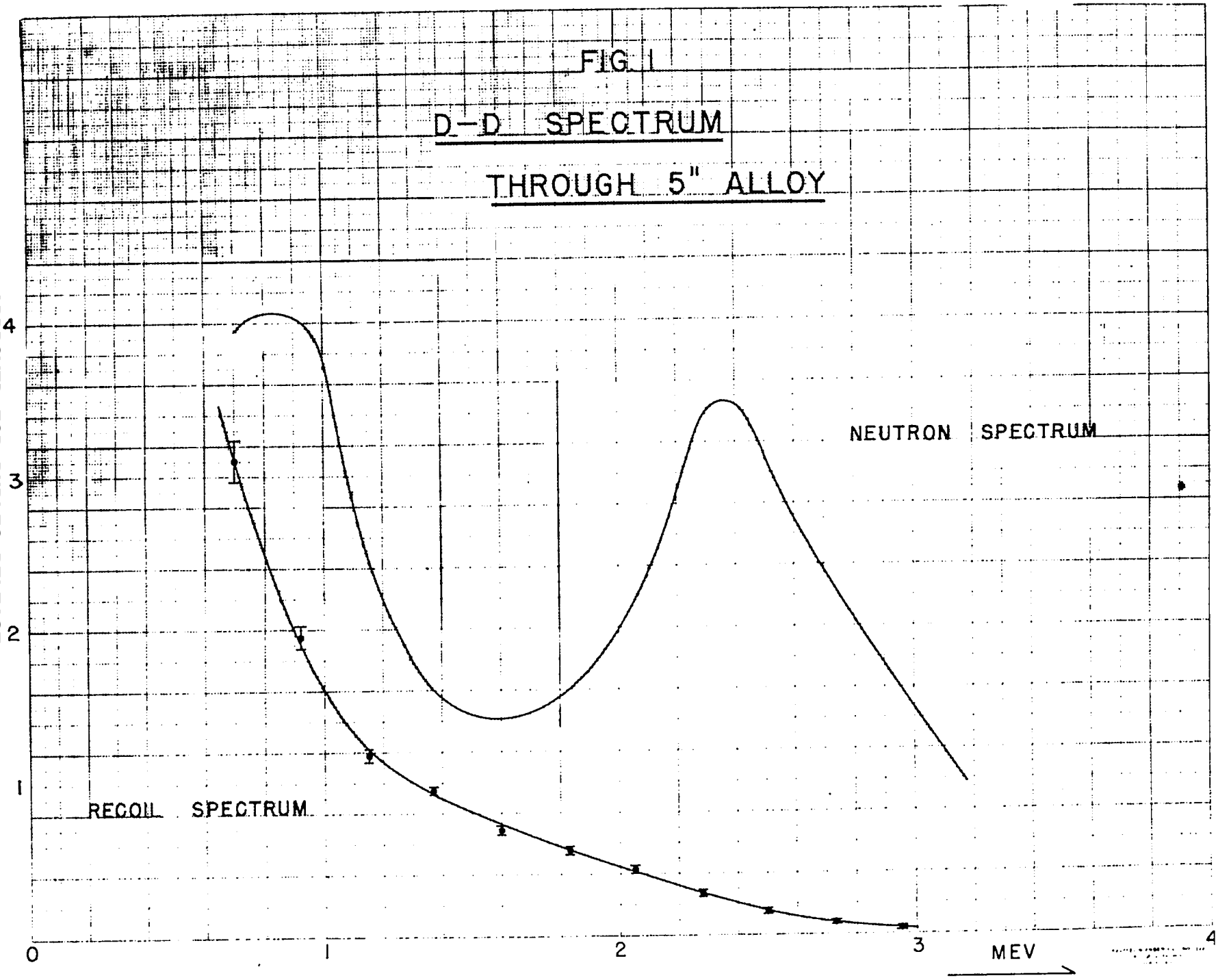


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FIG. 2

D–D CALIBRATION

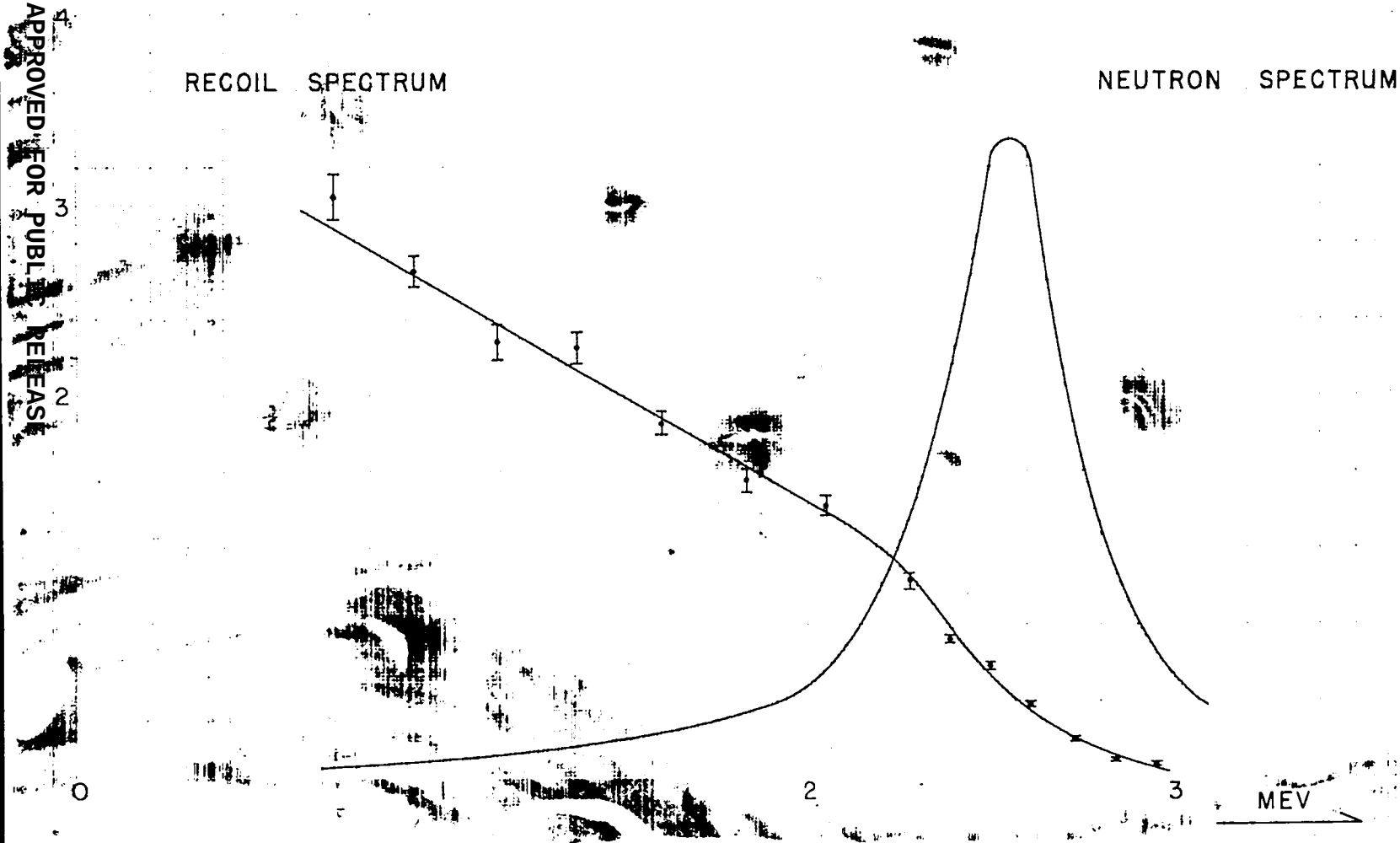

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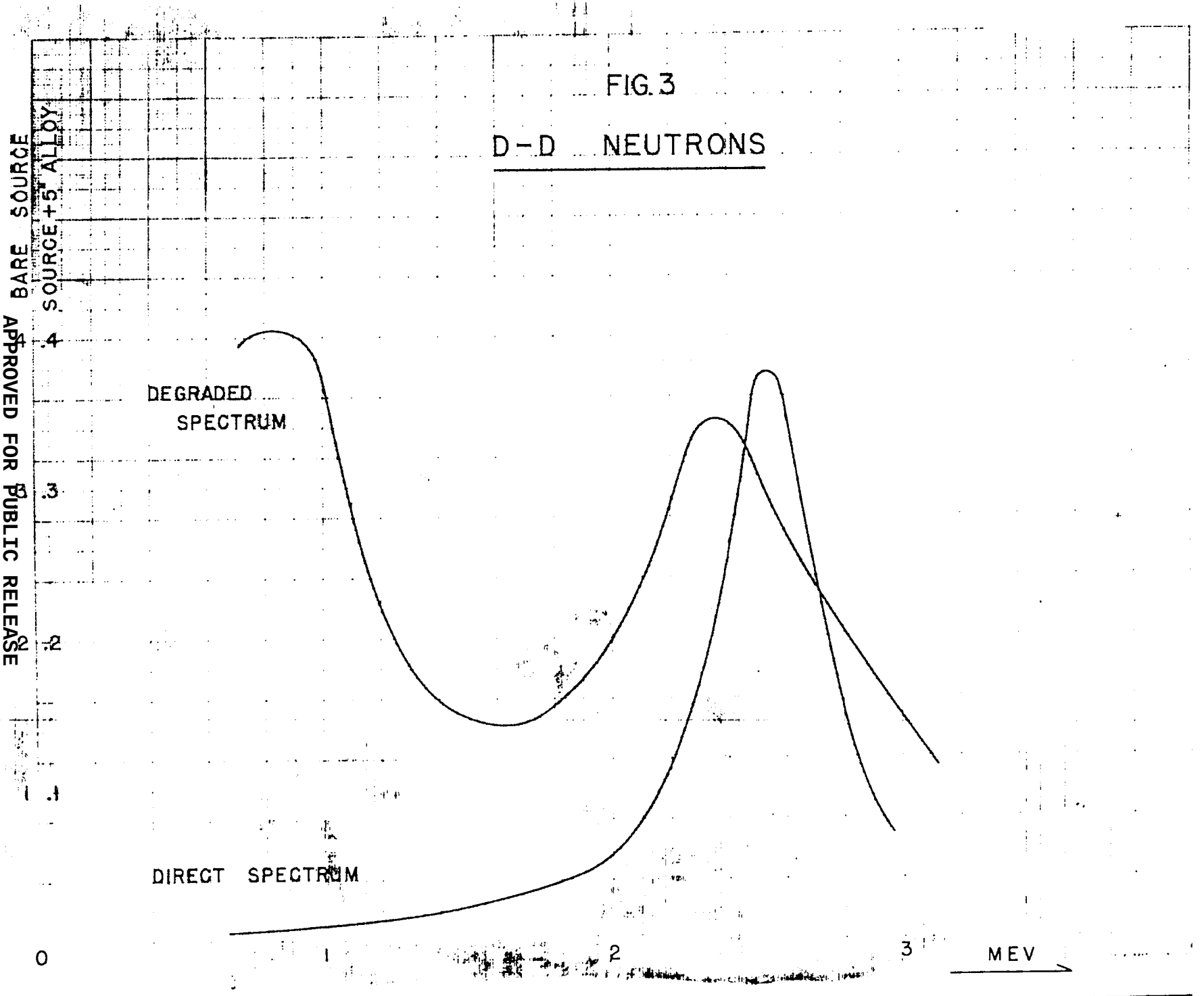
FIG. 3

D-D NEUTRONS



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