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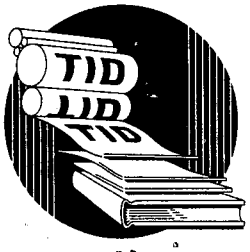

Technical Information Division, ORE, Oak Ridge, Tennessee

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Preliminary results concerning the γ-ray spectrum resulting from the capture of π^- mesons in hydrogen have been reported in a previous letter.* The purpose of this note is to present more conclusive data and to indicate the resultant mass values for the neutral meson. A more detailed report is in preparation.

The apparatus and geometrical arrangement used is similar to the instrumentation previously reported.* The principal improvement is the use of a 32-channel pair spectrometer (Fig. 1). Two sets of spectra are shown: one (Fig. 2) taken with the center of the spectrometer set at 100 Mev and one (Fig. 3) with the center set at 70 Mev. Figure 2 clearly shows that both processes discussed previously coexist, namely:

$$\pi^- + p \rightarrow n + \gamma \qquad (1)$$

$$\pi^- + p \rightarrow n + \pi^0 \qquad (2)$$
$$\qquad\qquad\quad \lfloor\!\rightarrow 2\gamma$$

Figure 3 permits a fairly accurate determination of the π^0 mass. We obtain from Fig. 3 and the kinematics pertaining to Eq. 2:

$$M_{\pi^-} - M_{\pi^0} = 10.6 \pm 2.0 \text{ electron masses.}$$

Figure 2 permits an estimate of the branching ratio between processes (1) and (2). The result is

$$\frac{\Gamma\pi^0}{\Gamma\gamma} = 0.96 \pm 0.20$$

and the available momentum space for the π^0 is $p/M_{\pi^0}c = 0.23 \pm 0.03$.

The authors are greatly indebted to Dr. Herbert F. York for cooperation during the early parts of the experiment.

*W. K. H. Panofsky, Lee Aamodt, and H. F. York, Phys. Rev., 78: 825 (1950).

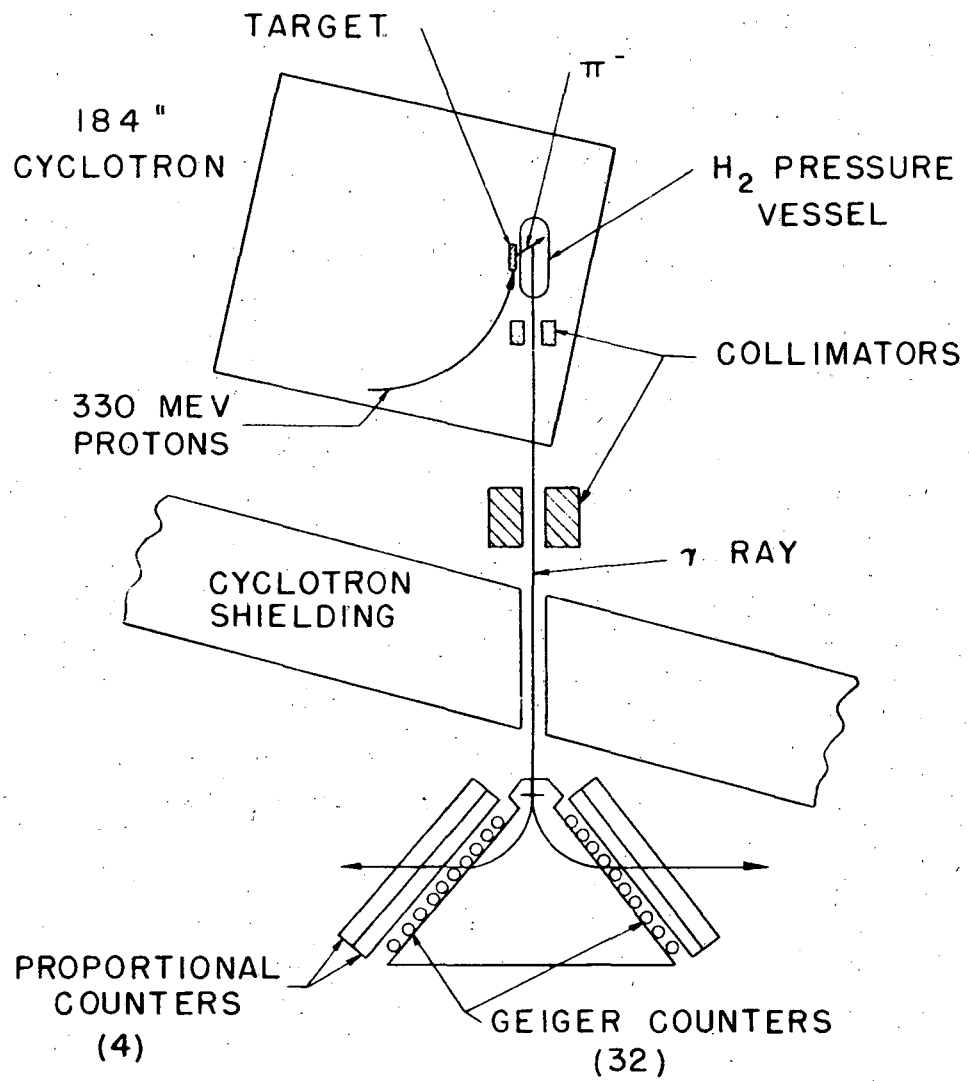

Fig. 1—Geometrical layout (not to scale) of components of the π^- absorption experiment. π^- mesons from the primary target struck by 330-Mev protons are absorbed in the H_2 pressure vessel. The resultant gamma rays are collimated and analyzed in a 90° pair spectrometer.

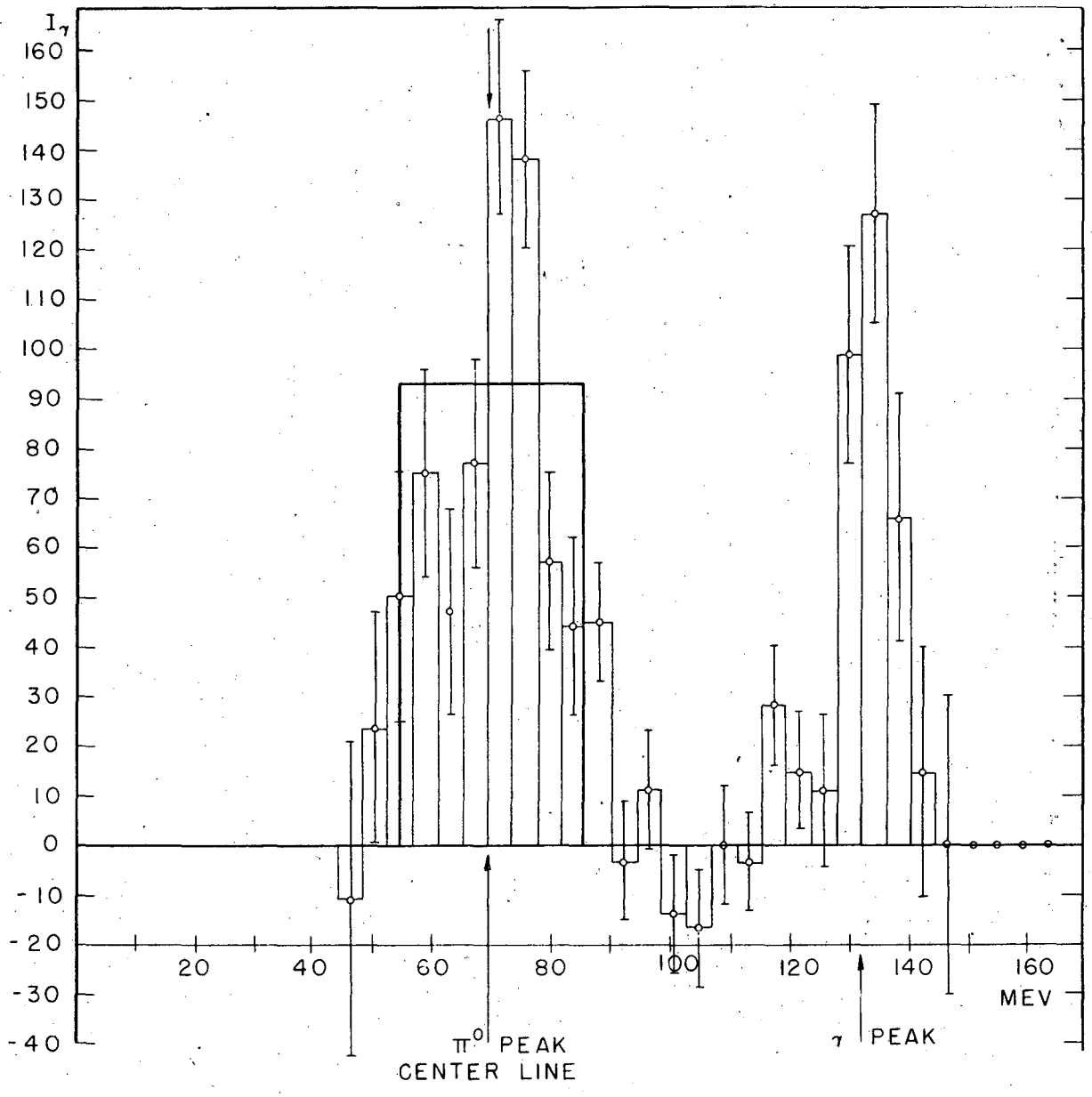

Fig. 2—Gamma-ray spectrum from the absorption of π^- mesons in H_2 with center of spectrometer set near a gamma-ray energy of 100 Mev. The center line of the π^0 peak and the γ peak as computed from a π^- rest energy of 141 Mev are marked. Also the theoretical π^0 spectrum (rectangular contour) is shown to correspond in area to the observed constant and in width to the curve of Fig. 3.

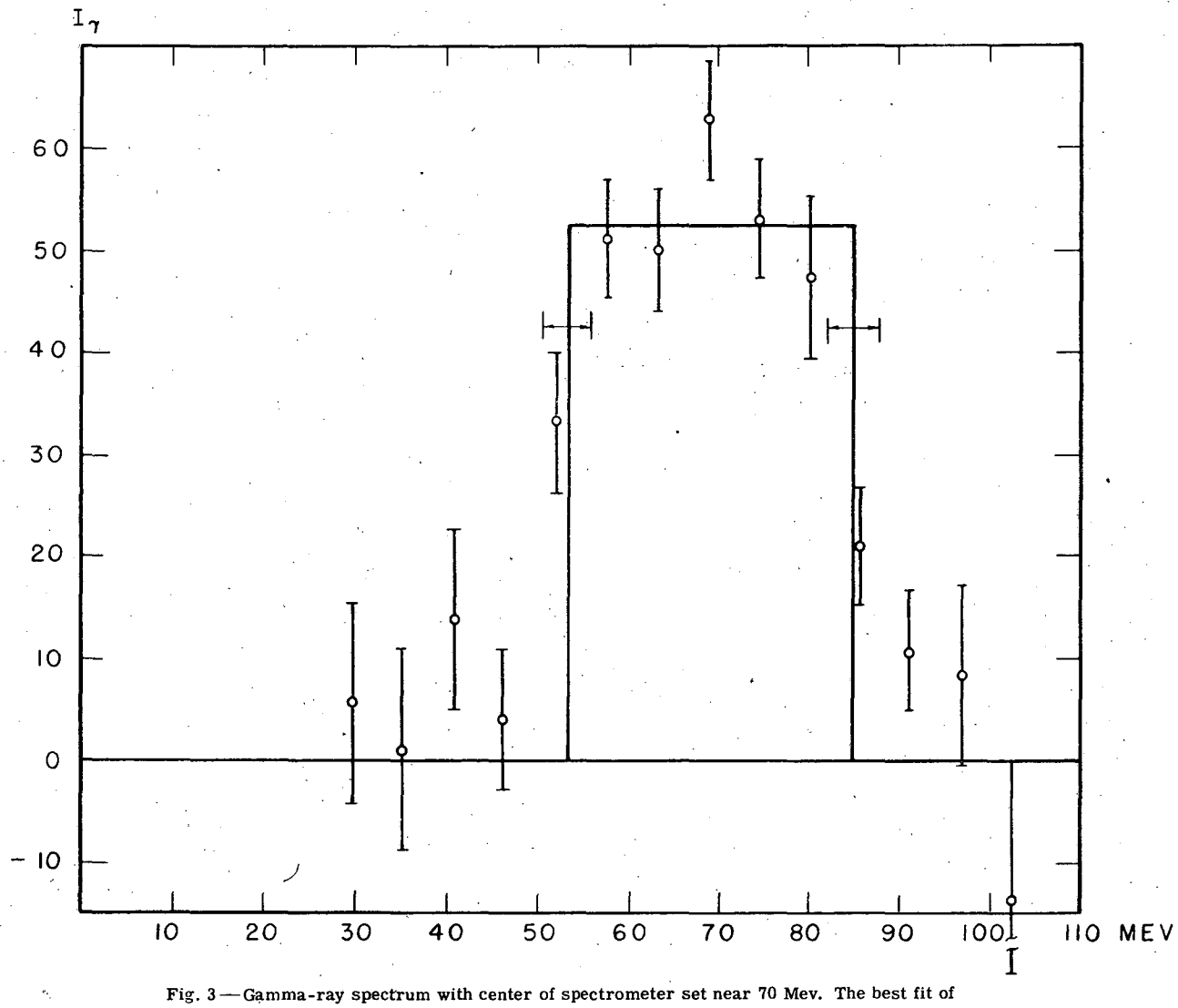

Fig. 3 — Gamma-ray spectrum with center of spectrometer set near 70 Mev. The best fit of rectangular contour is shown and the estimate of the probable error of the lower and upper limit of the spectrum is indicated.

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