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FISSION CROSS SECTIONS OF 02, 23, 25, 28, 49, B^{10} AND Li^{6}

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ABSTRACT

New data are presented on $\sigma_f(02)$, $\sigma_f(23)$, $\sigma_f(28)$, and $\sigma_f(49)$ for neutron energies of 3.4, 4.8, and 5.85 Mev. A collection is made of data on the above cross sections and $\sigma_f(25)$, $\sigma(B^{10})$, and $\sigma(Li^6)$ for neutron energies from 20 Kev to 5.85 Mev.

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FISSION CROSS SECTIONS OF 02, 23, 25, 28, 49, B^{10} and Li^{6}.

The electrostatic generator group has recently made extensive measurements on the fission cross section of 25 as a function of neutron energy from 20 Kev to 5.85 Mev. Some of this work has been reported[1] and other detailed reports are in preparation[2]. It is the purpose of this report to describe measurements on the cross section for fission of 02, 23, 28, and 49 for neutrons of energies 3.4, 4.8, and 5.85 Mev and to present a collection of our present knowledge of the fission cross sections of 02, 23, 25, 28, 49, B^{10} and Li^{6} over the energy region from 20 Kev to 5.85 Mev.

All of these data depend on determinations[1,2] of $\sigma_f(25)$ as a function of neutron energy. Other fission cross sections were then determined by a comparison method which involved the simultaneous irradiation of the isotope in question and a sample of 25. This comparison method has been described in detail by Bailey and Blair.[3]

Employing this method we have recently investigated the relative fission cross sections of thorium 02, uranium 23 and 28, and plutonium 49 for neutrons of energies 3.4, 4.8, and 5.85 Mev. These neutrons were produced by the D(d,n) reaction using deuterons accelerated by the "long" electrostatic generator impinging on a deuterium gas target in a manner described by Taschek.[2] The geometry and target

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1) J. H. Williams, LA-150.
   R. F. Taschek and C. M. Turner, LA-445.
   C. L. Bailey, LA-447.

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2) R. F. Taschek, forthcoming report.
   D. H. Frisch, forthcoming report.

3) Bailey and Blair, LA-90.

thickness of this experiment was such that the uncertainty in energy of the neutrons irradiating the foils in the comparison chamber were not significantly different from the conditions under which Taschek[2)] determined $\sigma_f(25)$ at these same energies. Since the comparison data is transformed to the final values of the fission cross section of a given isotope by multiplying the measured ratio of fission cross sections by $\sigma_f(25)$ this similarity of geometry is desirable.

The results of these observations are shown in the following table:

Energy in Mev	3.4	4.8	5.85
$\sigma_f(02)/\sigma_f(25)$	0.13	0.13	0.13
$\sigma_f(23)/\sigma_f(25)$	1.40	1.37	1.36
$\sigma_f(28)/\sigma_f(25)$	0.44	0.49	0.52
$\sigma_f(49)/\sigma_f(25)$	1.51	1.49	1.49

A collection of the more recent values of $\sigma_f(25)$ is shown in Fig. 1. These data form the basis of most of the other data presented in this report since other cross sections are in general determined by comparison methods.

The form of $\sigma_f(02)$ as a function of energy is uncertain in the interval between 2 Mev and 3.5 Mev where no data are available. The existing information is plotted in Fig. 2.

Fig. 3 shows the local information on $\sigma_f(23)$. The earlier measurements by Klema[4)] are corrected to account for a change in the accepted value for the half-life of 23. It is interesting to note that $\sigma_f(23)$ does not appear to reach a constant value at large neutron energies as does 25 and 49.

4) E. Klema, LA-188.

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A large amount of independent data on $\sigma_f(28)$ is presented in Fig. 4. The latest measurements at high energy described earlier in this report indicate a rising cross section with increasing neutron energy which was not apparent from earlier measurements.

Fig. 5 shows on an expanded scale the values of $\sigma_f(49)$. It seems reasonably certain that $\sigma_f(49)$ is constant to within 5 percent from 100 Kev to 6 Mev.

Earlier measurements[5] on boron and lithium have been corrected for our improved knowledge of $\sigma_f(25)$ below 200 Kev. The new curves are shown in Figs. 6 and 7.

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5) C. L. Bailey and A. O. Hanson, LA-46.
J. H. Williams, LA-150.

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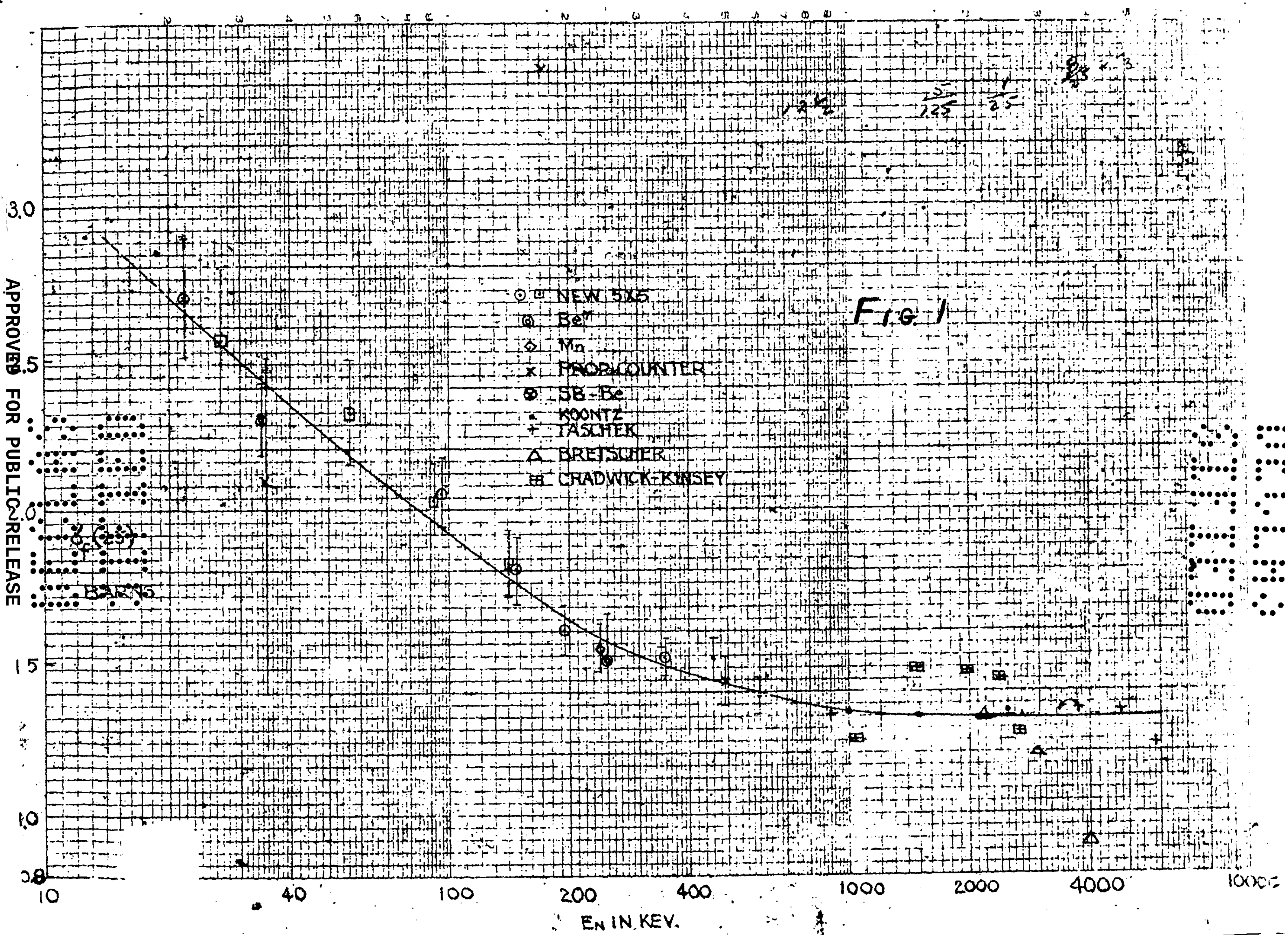


NEW 5X5
Be
Mn
PROP. COUNTER
SB-Be
KOONTZ
TASCHEK
BRETSCHER
CHADWICK-KINSEY
FIG. 1
BARNS
3.0
1.5
1.0
0.8
10
40
100
200
400
1000
2000
4000
10000
EN IN KEV.

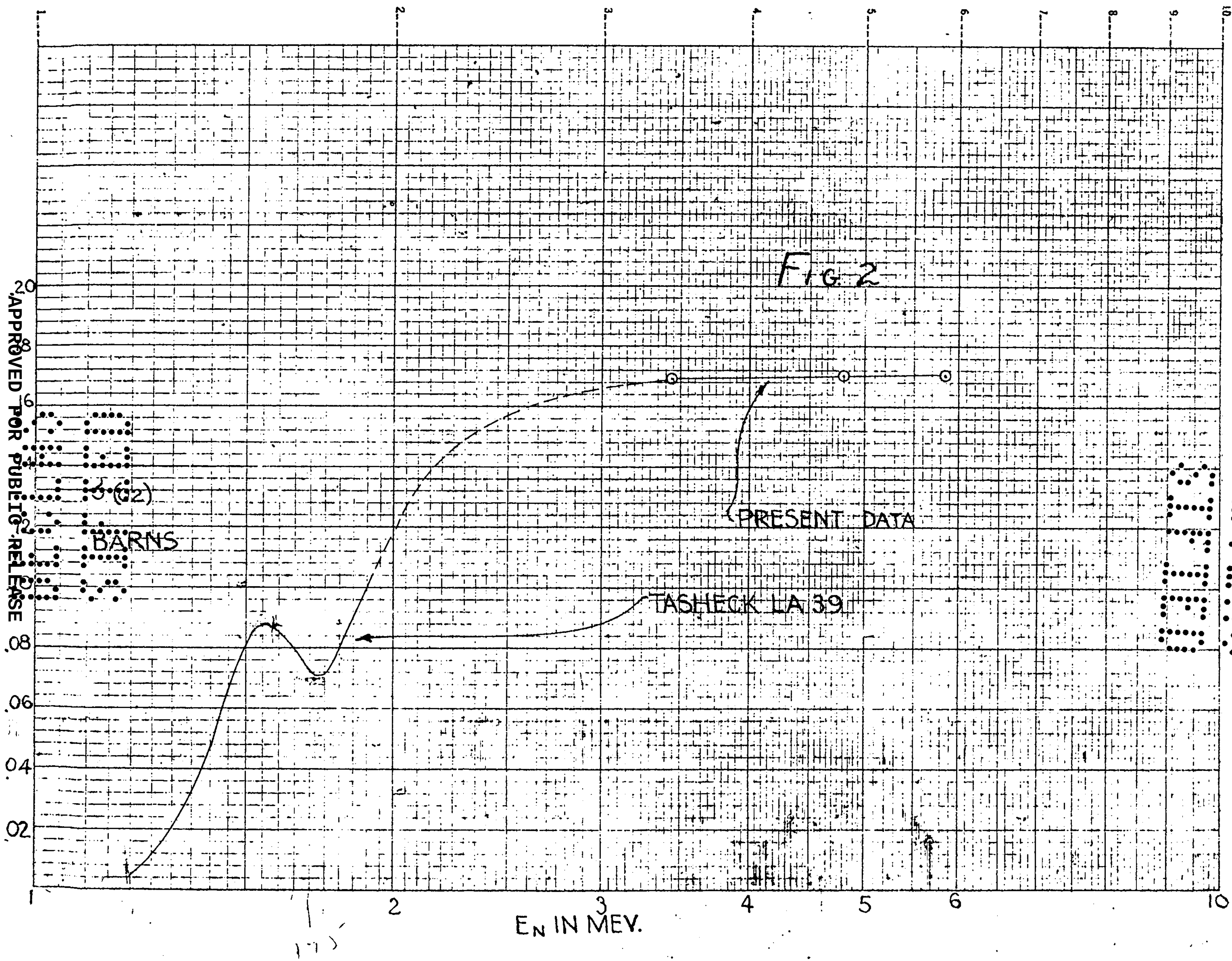
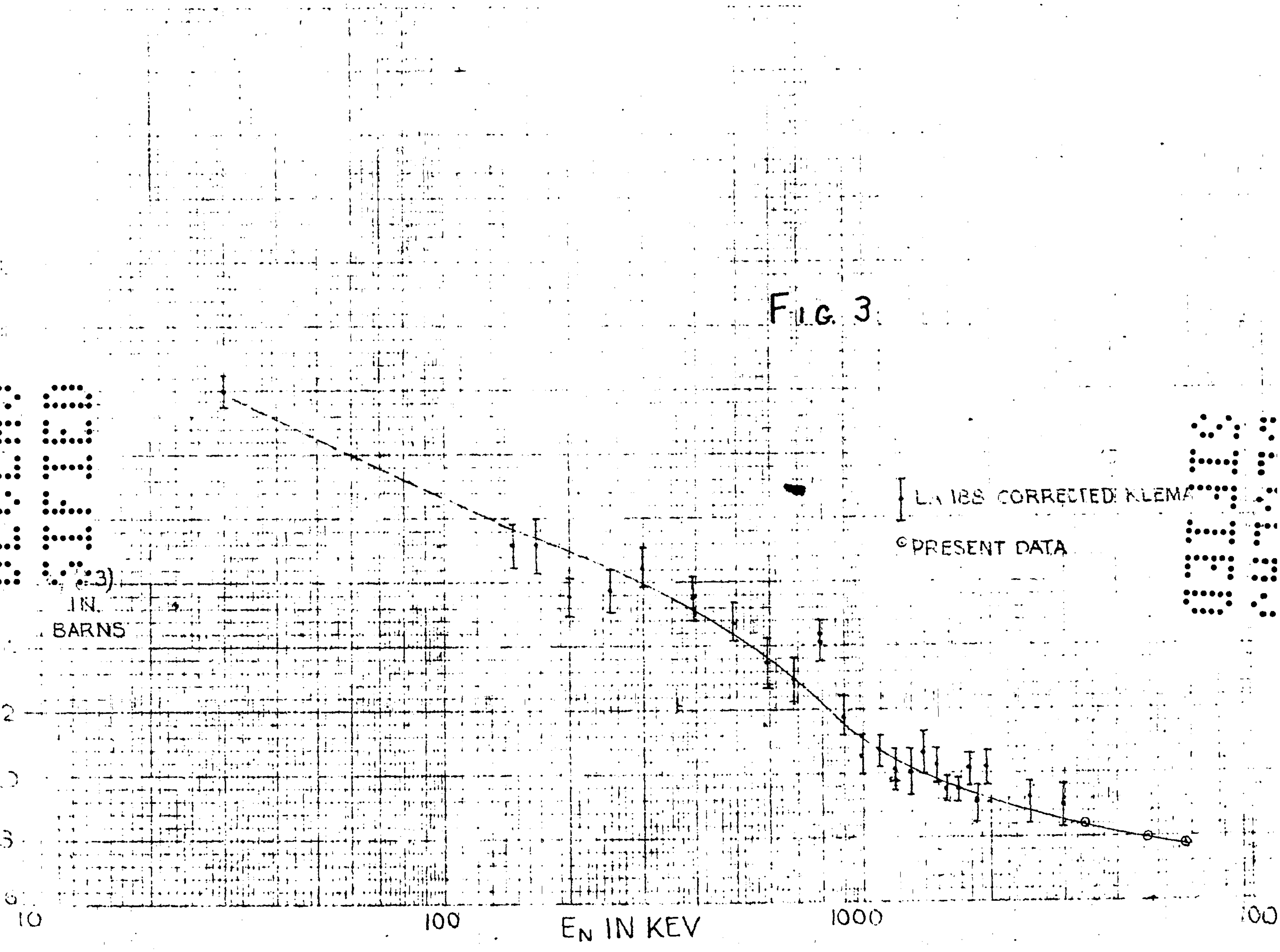


Fig 2
PRESENT DATA
TASHECK LA 39
BARNS
.20
.18
.16
.14
.12
.10
.08
.06
.04
.02
1
2
3
4
5
6
10
EN IN MEV.



IN BARNS
LA 1BS CORRECTED KLEMA
PRESENT DATA
10
100
1000
E_N IN KEV

FIG. 3

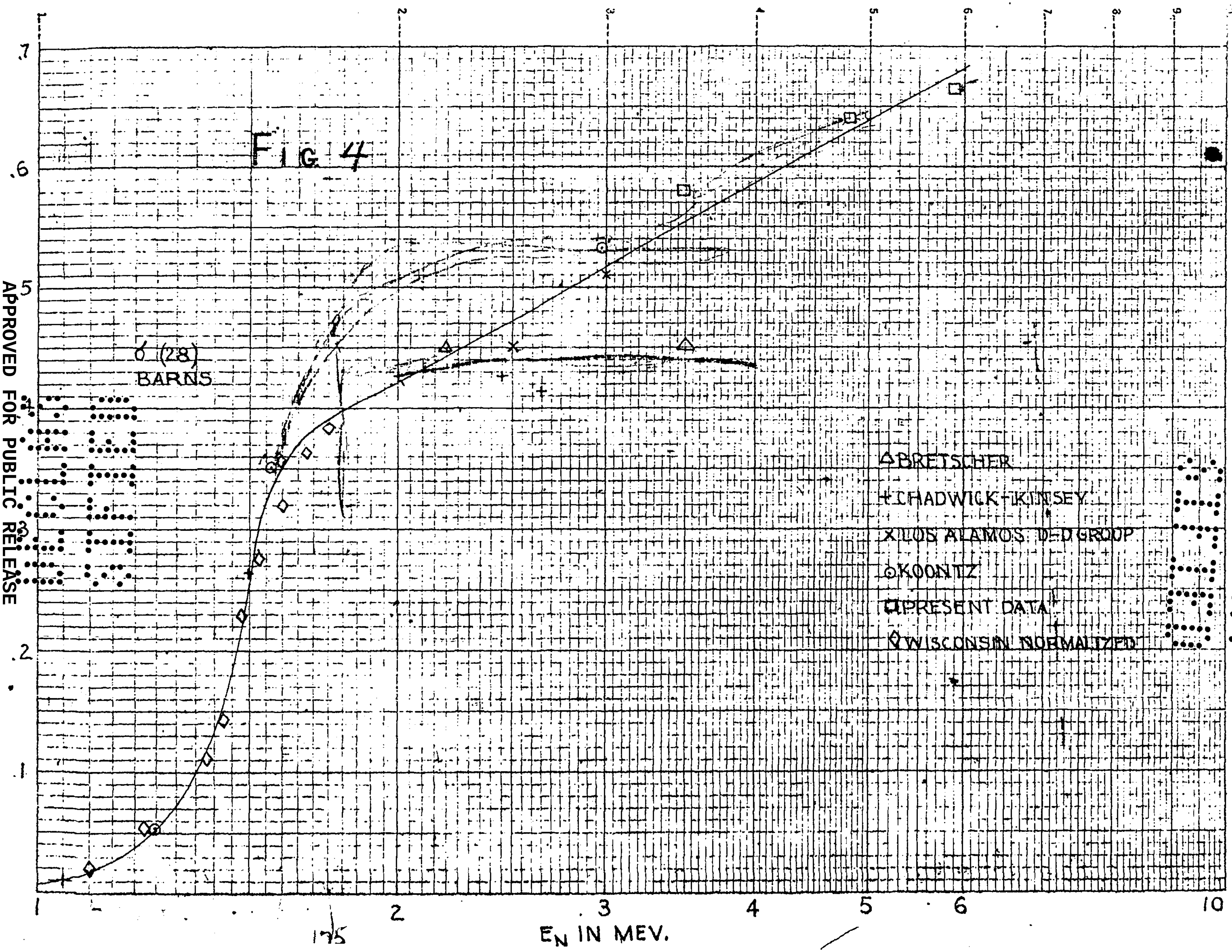


FIG 4
σ (28)
BARNS
BRETSCHER
CHADWICK-KINSEY
LOS ALAMOS D-D GROUP
KOONTZ
PRESENT DATA
WISCONSIN NORMALIZED
.7
.6
.5
.4
.3
.2
.1
1
2
3
4
5
6
10
E_N IN MEV.

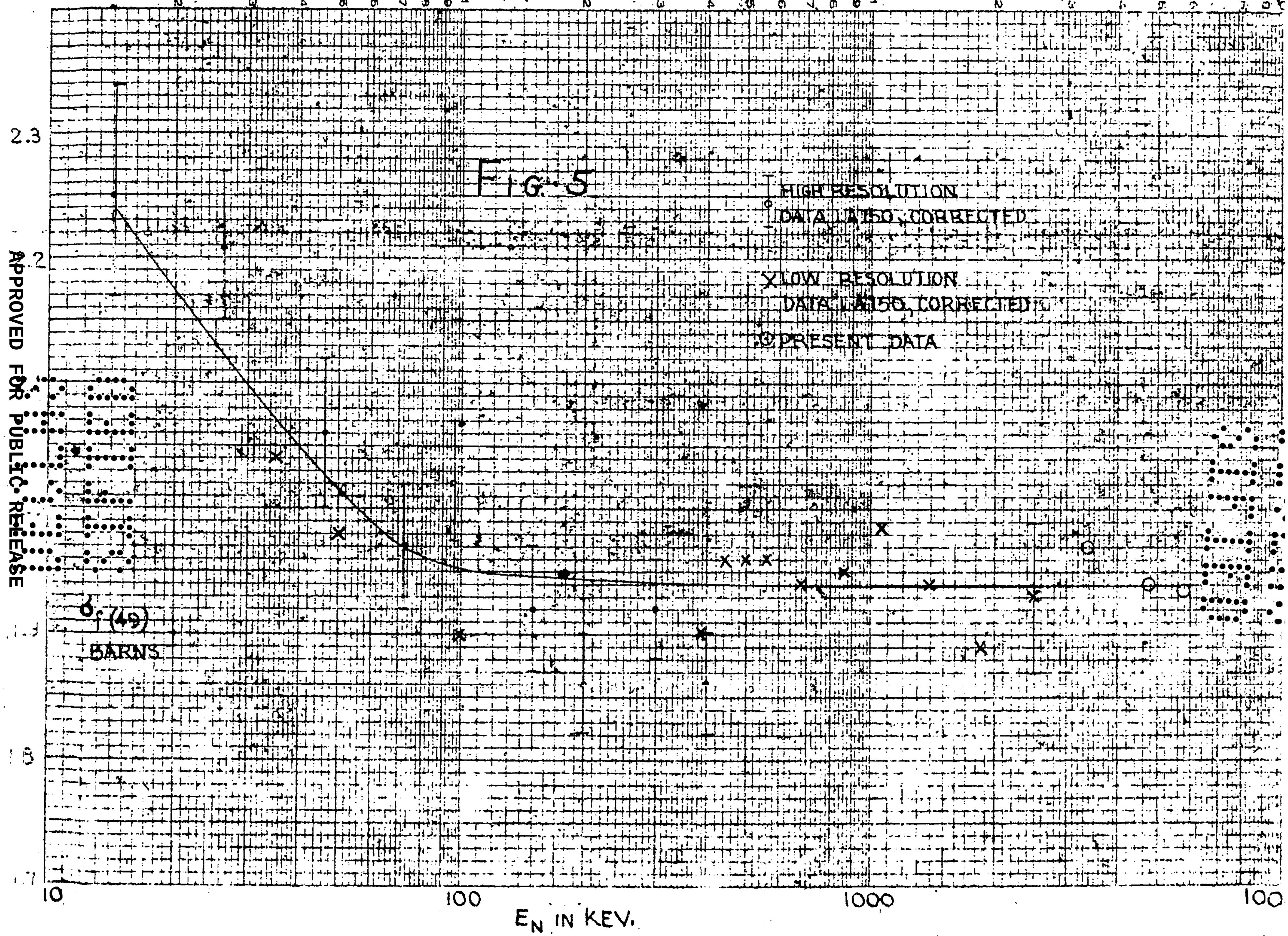


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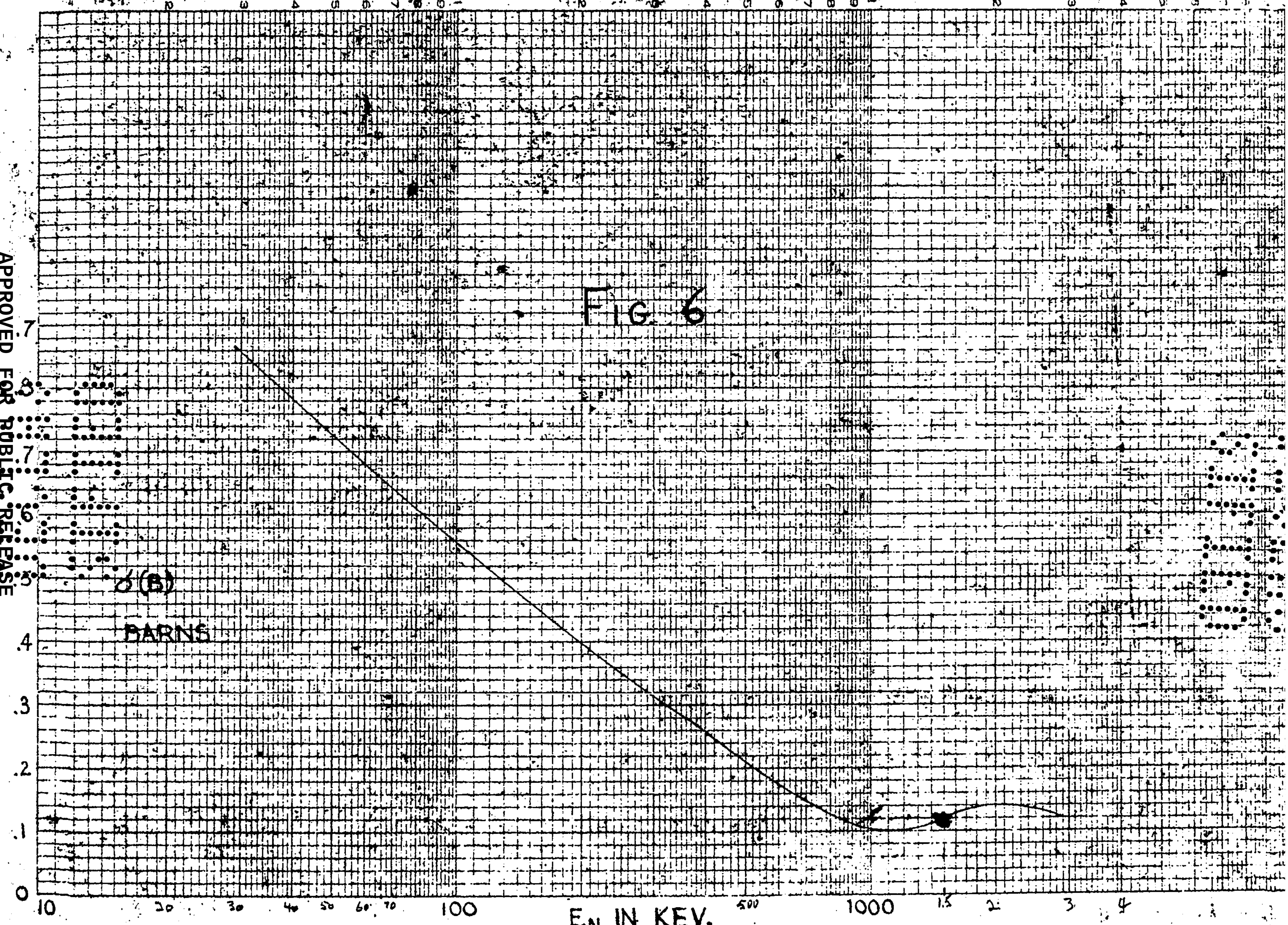
FIG. 6



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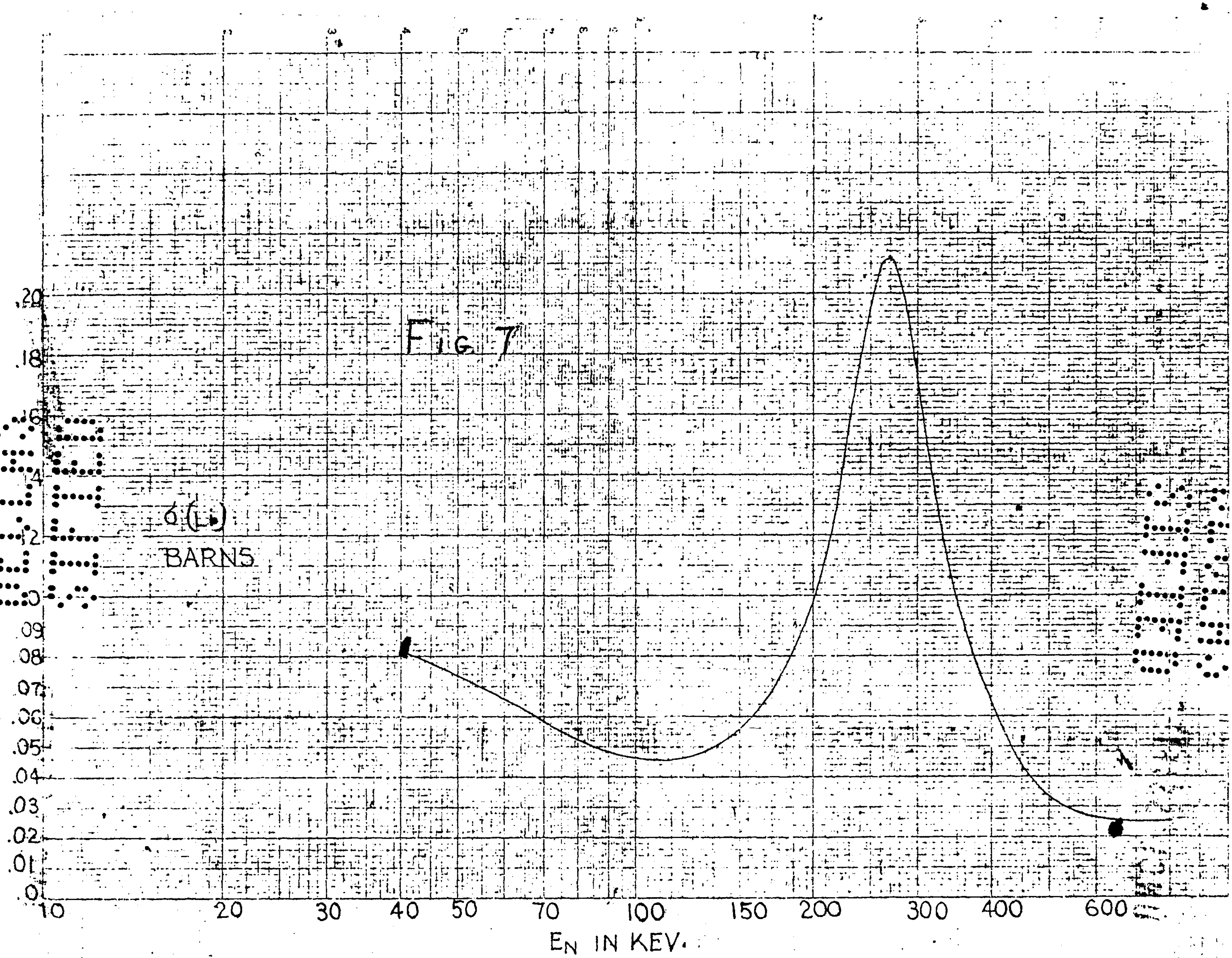

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