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Aix-en -Provence, France

Contribution to the Benchmark Testing of JEF-2.2 Library

Decay heat calculations for U235 and Pu239 isotopes

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In the frame of the Benchmark testing task of JEF 2.2 decay data, we present decay heat calculations concerning two fissile systems : 235U and 239Pu. The decay heat calculations were carried out by using the PEPIN code.

1. Processing of JEF2.2 Library.

PEPIN code works from a DOP input library. The DOP library has been built from JEF 2.2 (january 1993 version) by THEMIS/NJOY nuclear data processing system. This library contains actually 762 fission products from 71Cu to 170 Tm. The number of gamma rays which are considered is 21661.

2. Decay heat calculation results.

Five kinds of decay heat calculations have been carried out and compared with experiments :

a/. Thermal fission/pulse :
- beta, gamma and total residual heat for U235 and Pu239
- JEF 2.2, CEA699 (our previous library cf. reference [1])
- Dickens experiment (Oak Ridge, [2])
- Akyama experiment (Tokyo 1979-1984)
- cooling time : 10^5 seconds

b/. Thermal fission/irradiation 10^{13} seconds:
- beta, gamma and total residual heat for U235 and Pu 239
- JEF 2.2, CEA699
- Dickens experiment [2]
- cooling time : 10^5 seconds

c/. Thermal fission/irradiation 2.10^4 seconds, thermal flux $3.\ 10^{13}$ n/cm2.s-1:
- total residual heat for U235
- JEF 2.2, CEA699
- Yarnell & Bendt experiment (Los Alamos, [3])
- cooling time : 10^5 seconds

d/. Thermal fission/pulse:
- U235
- gamma spectrum
- JEF 2.2, CEA699
- Dickens experiment [2]
- cooling time : 10^3 seconds

/. Thermal fission/irradiation 1 second, Pu 239 :
- gamma spectrum
- JEF 2.2
- ORNL experiment [5]
- ENDF/BVI, ENDF/BV calculations [5]
- cooling time : 2.2 seconds

Comparisons show improvement of calculation results due to utilization of the JEF 2.2 library We note also, in the case (e), the good agreement obtained between our spectra results and values (calculation and experiment) from reference [5].

[1] J. BLACHOT *et al., Tableau des isotopes radioactifs et des principaux rayonnements émis*, Rapport CEA-R-5329, CE SACLAY, France.

[2] J. K. DICKENS et al., Nucl. Sci. Eng., Vol. 74, p. 106 (1980), Vol. 78, p. 126 (1981).

[3] J. L. YARNELL and P. J. BENDT, *Decay heat from products of U235 thermal fission by fast response boil of calorimetry*, LA NUREG-6713-NRC 3 (1977), USA.

Calorimetric fission product decay heat measurements for Pu239, U233 and U235, NUREG/CR 0349 - LA 7452 MS - Informal report l3,(1978), USA.

[4] M. AKIYAMA et al., Jour. At. En. Soc., n° 9, Vol. 24, p. 709, and n° 10, p. 803, (1982).

[5] J. KATAKURA and T. R. ENGLAND, *Augmentation of ENDF/B fission product gamma-ray spectra by calculated spectra*, LA-12125-MS/ENDF-352, UC-413, (1991).

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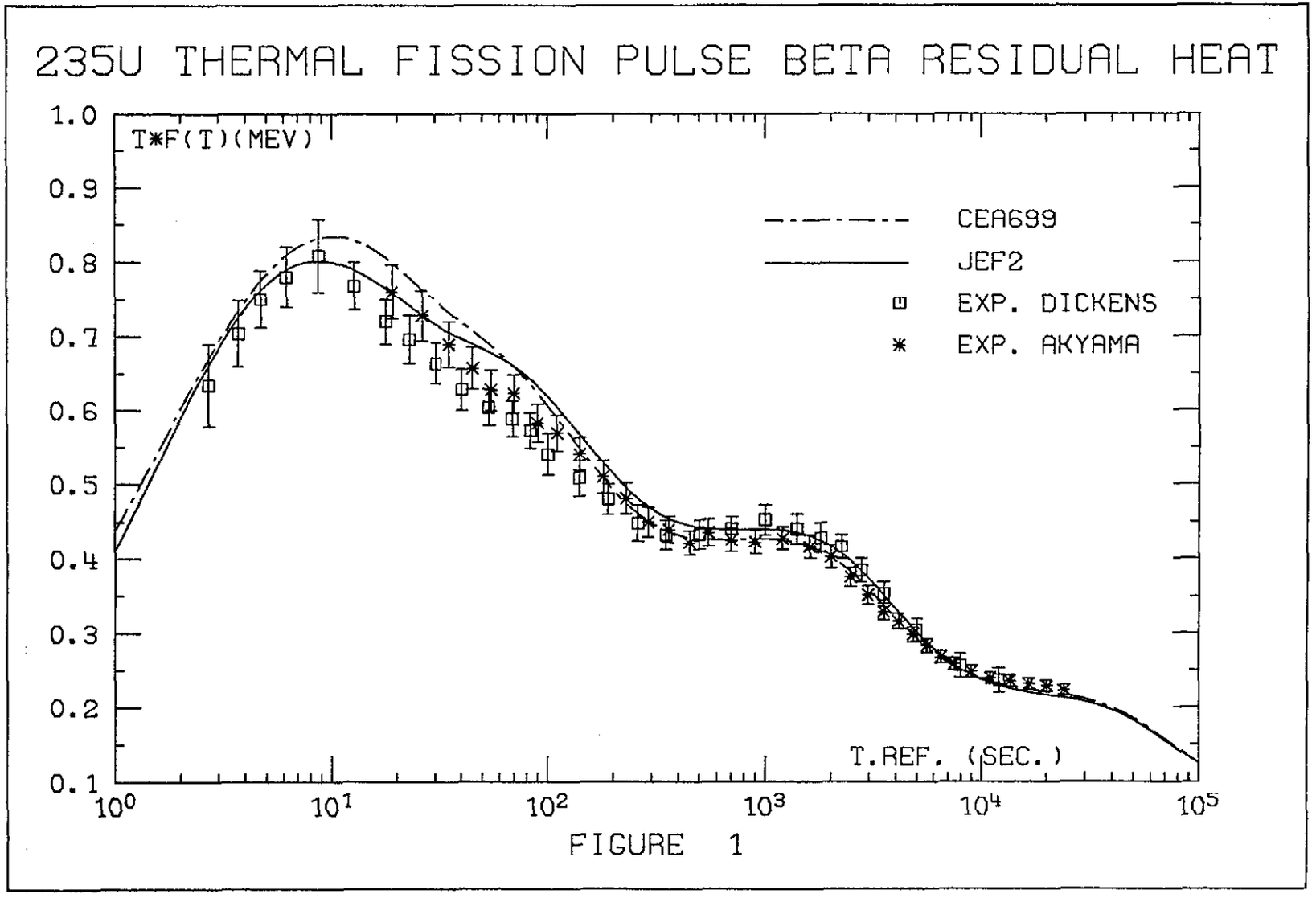

FIGURE 1

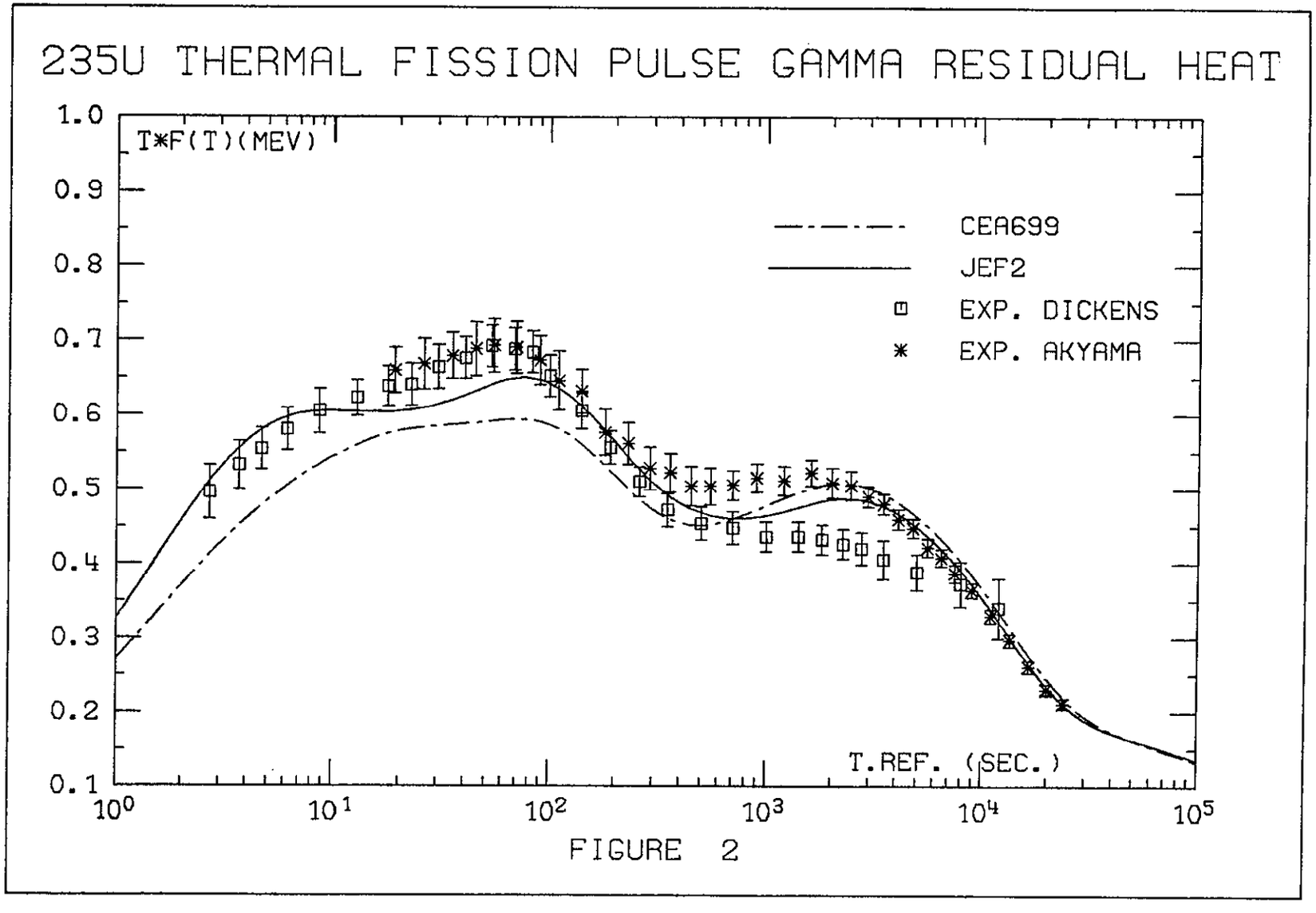

FIGURE 2

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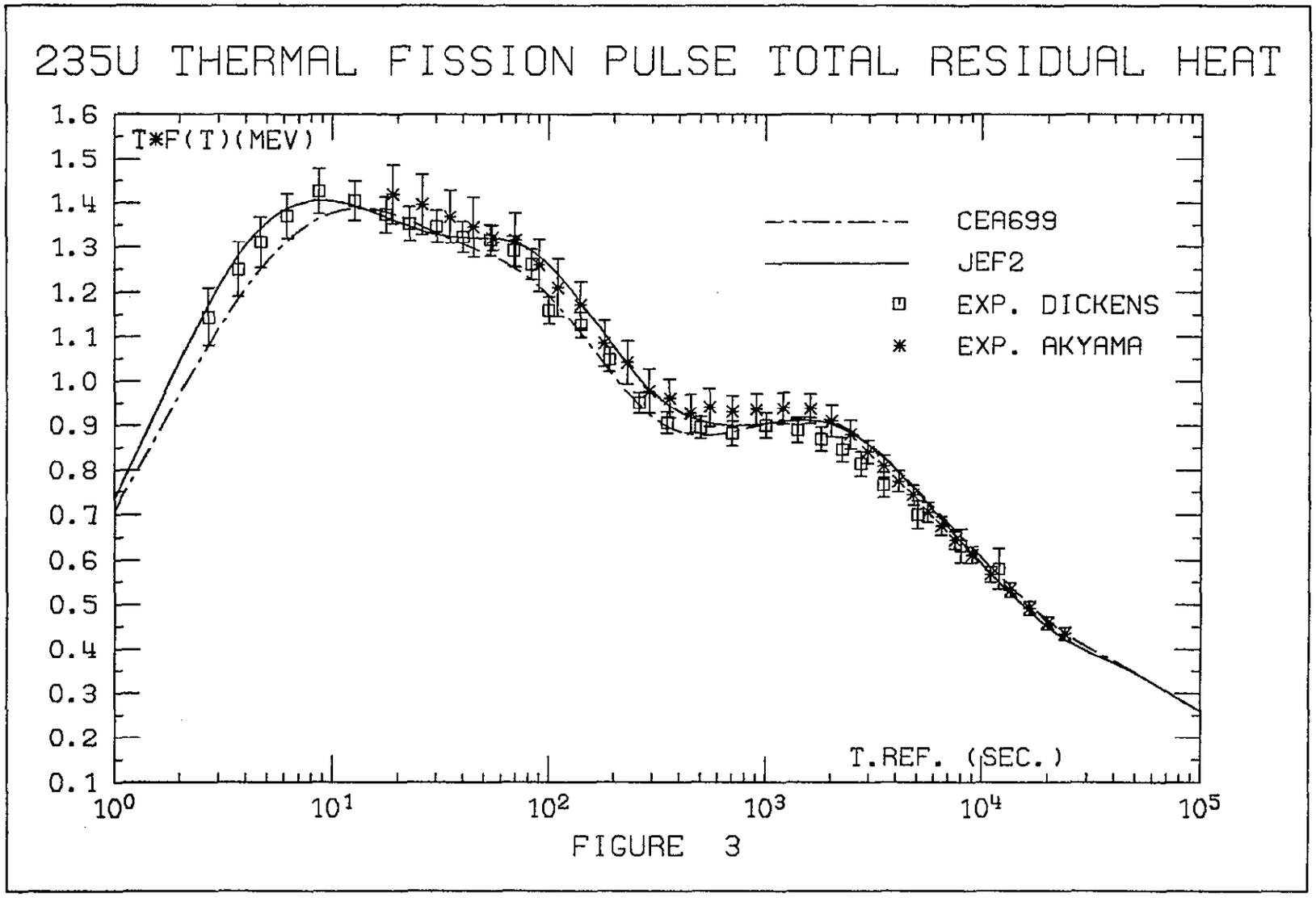

FIGURE 3

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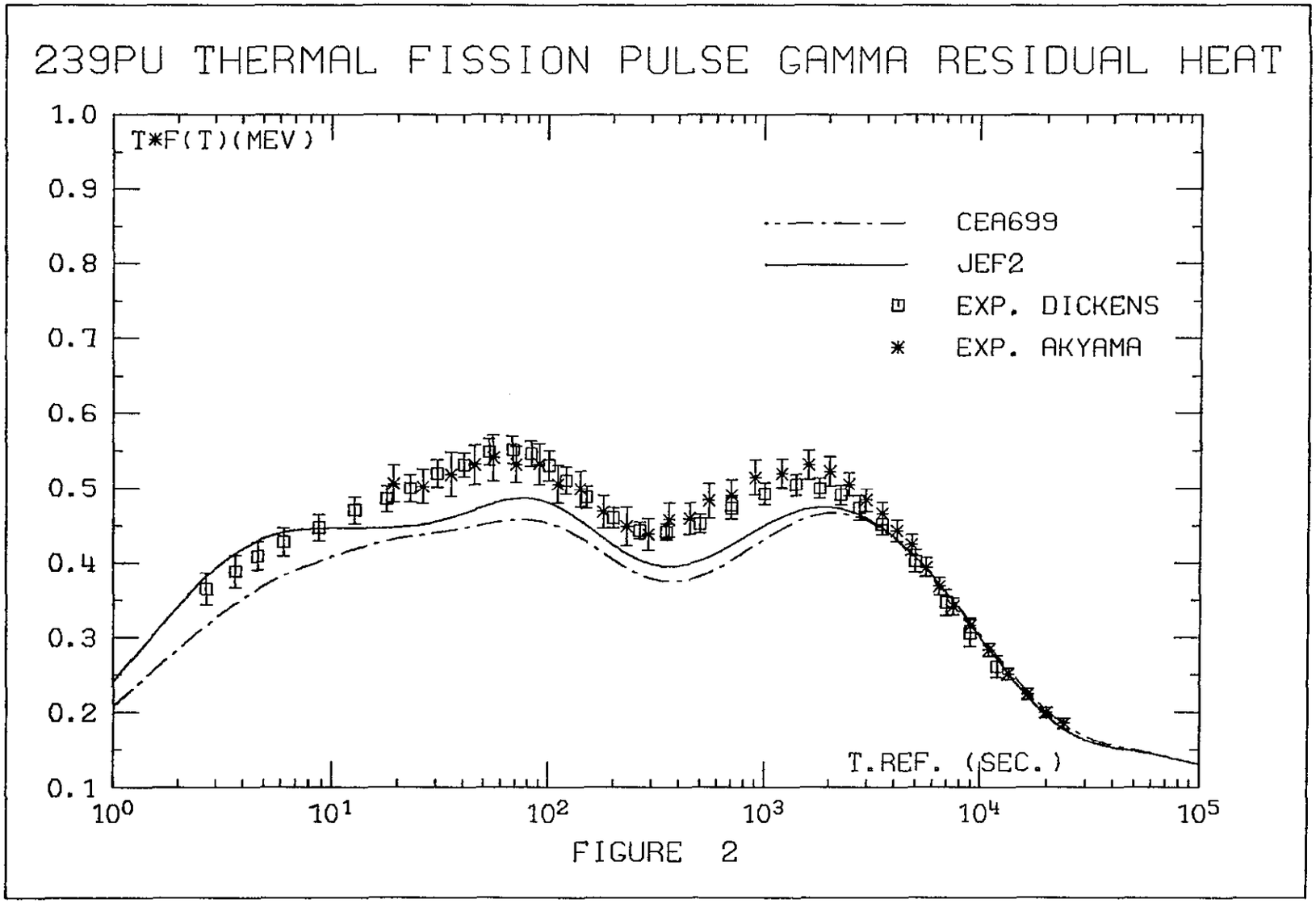

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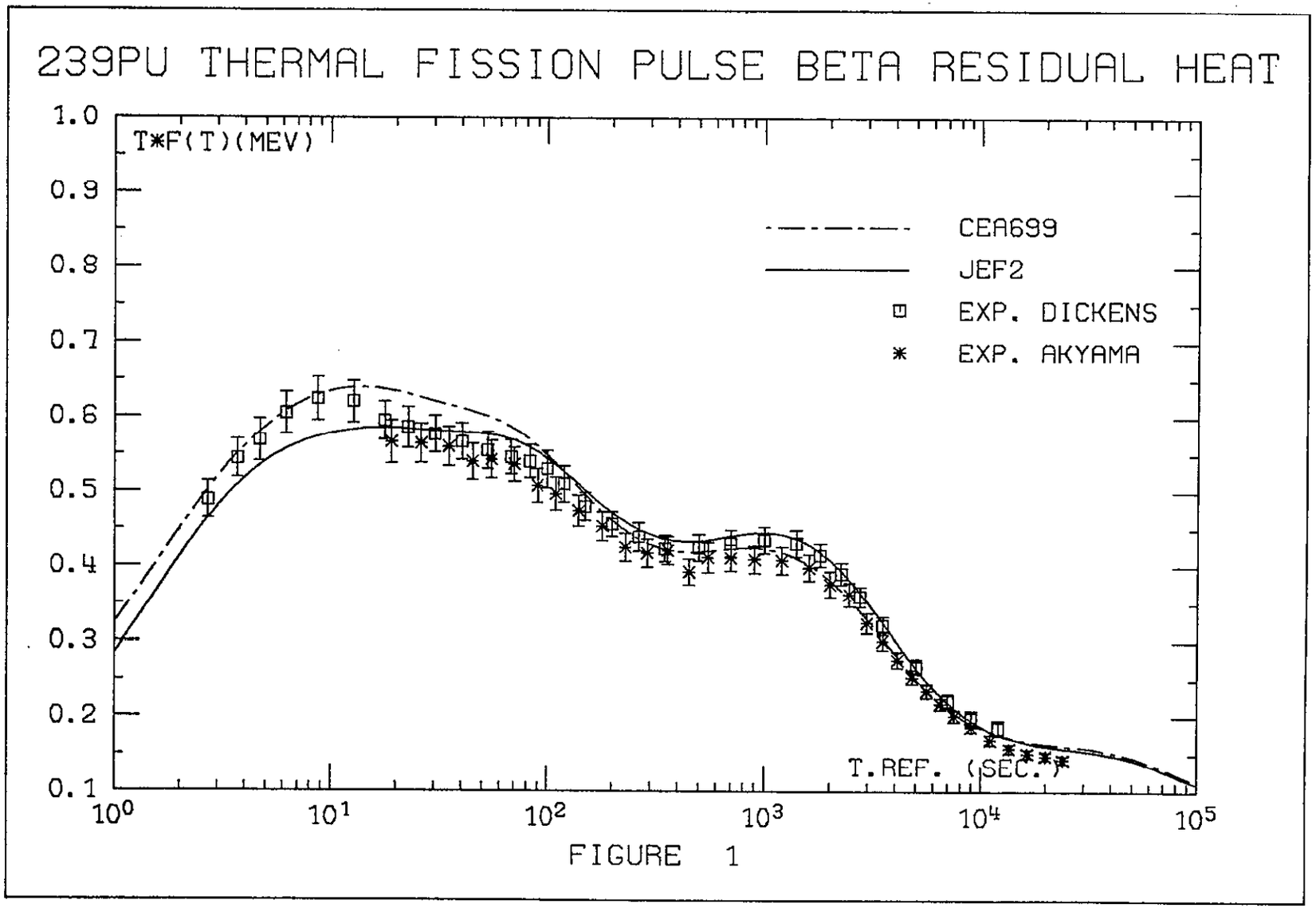

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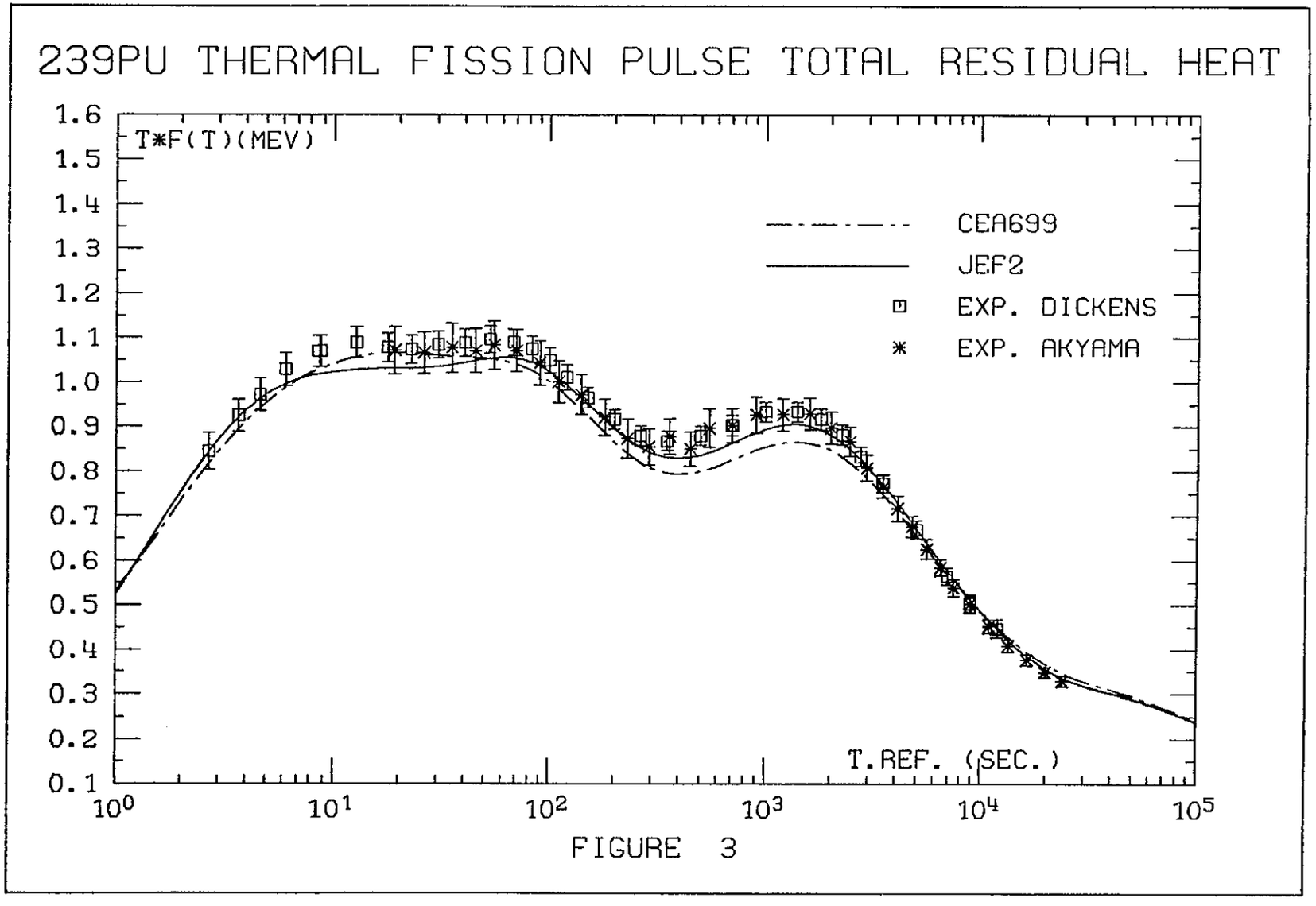

FIGURE 3

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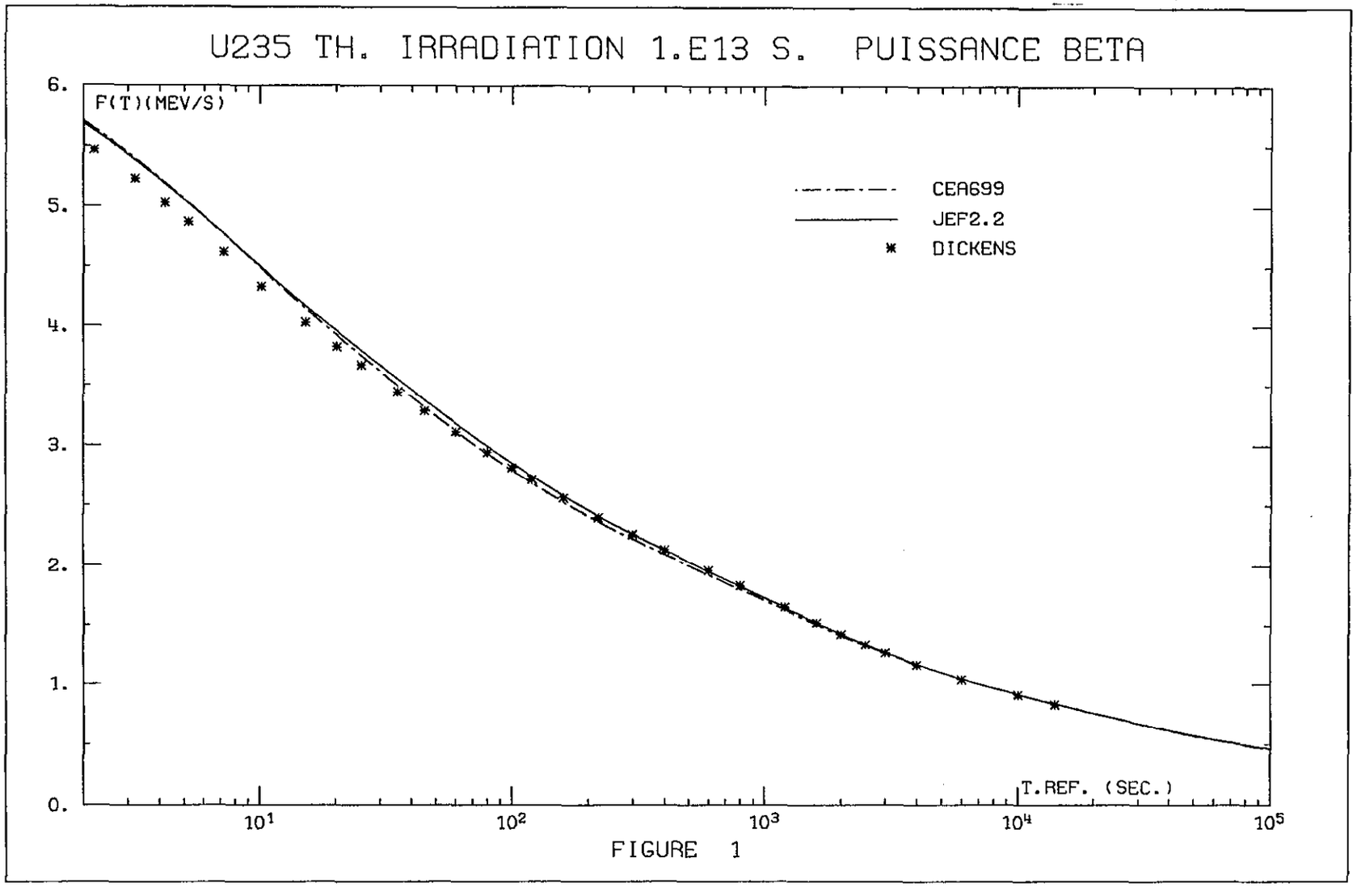

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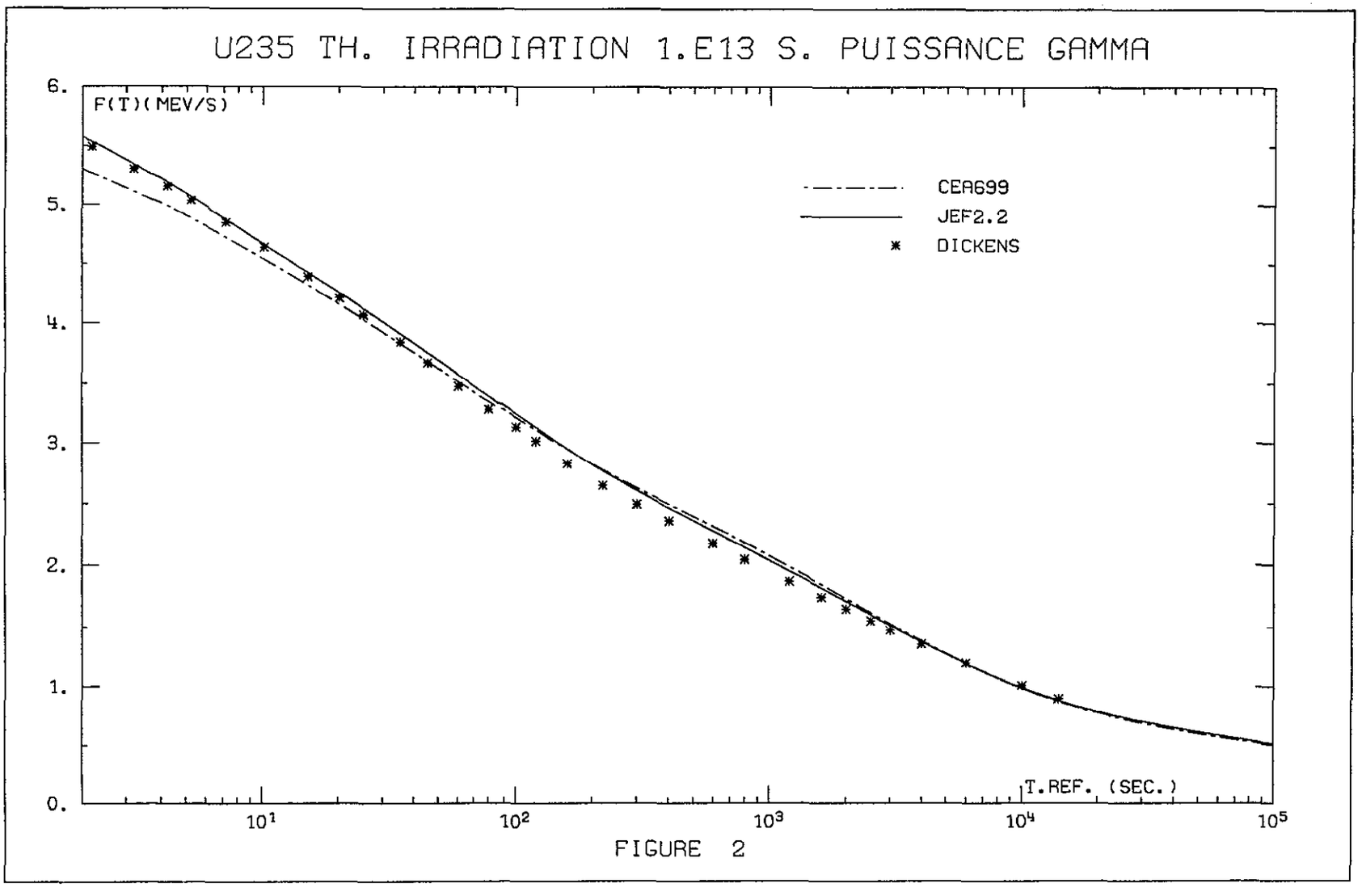

FIGURE 2

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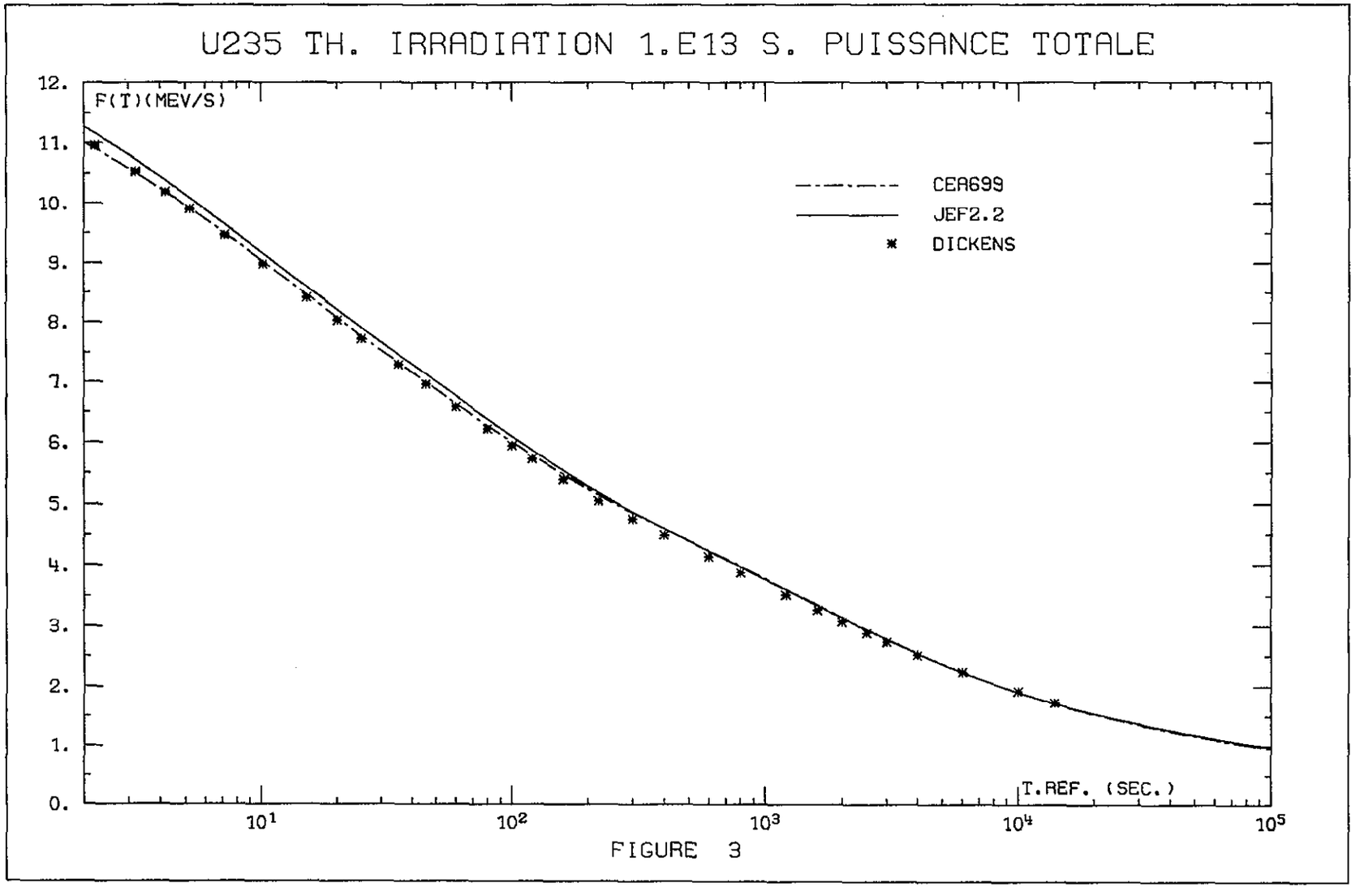

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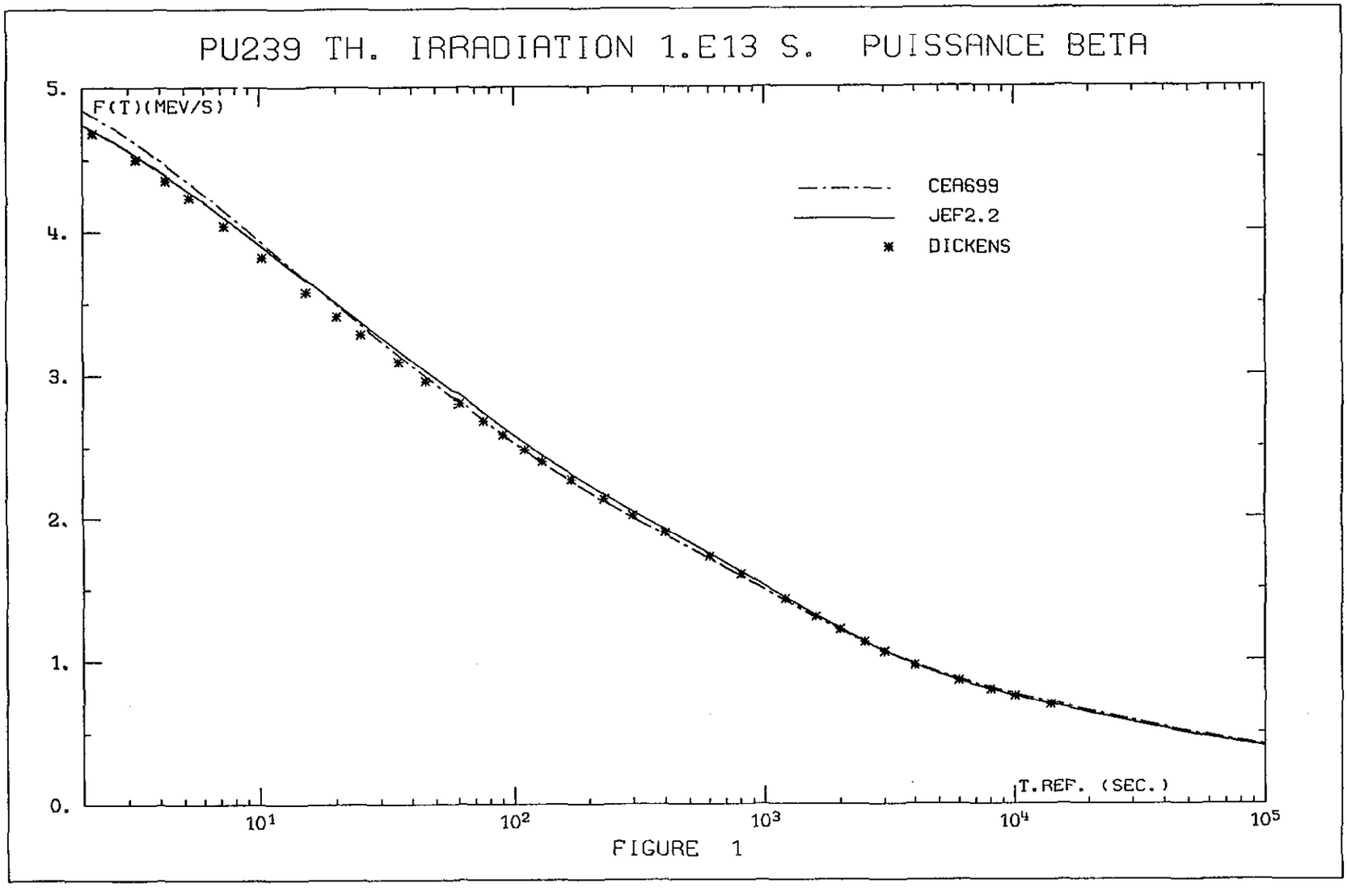

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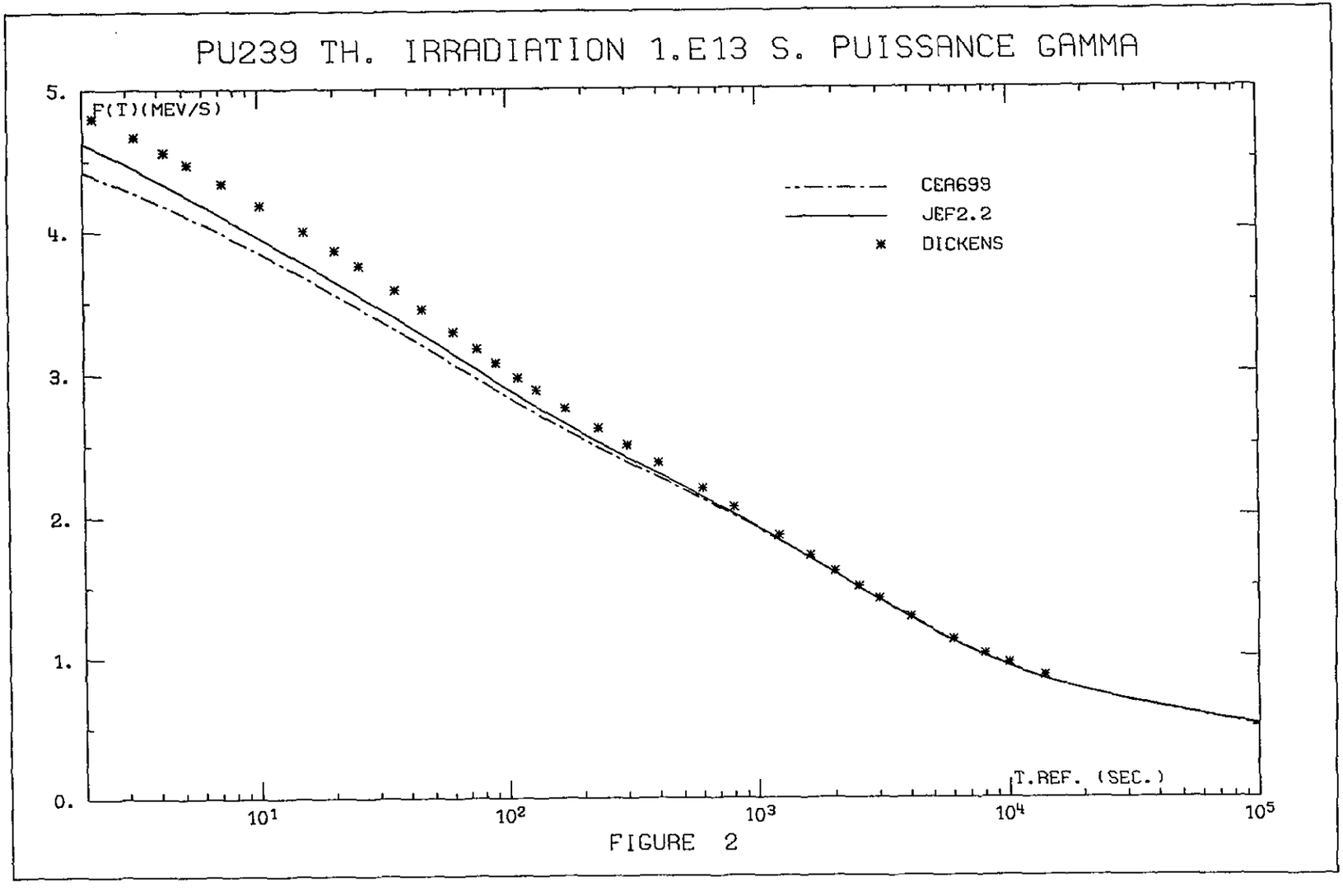
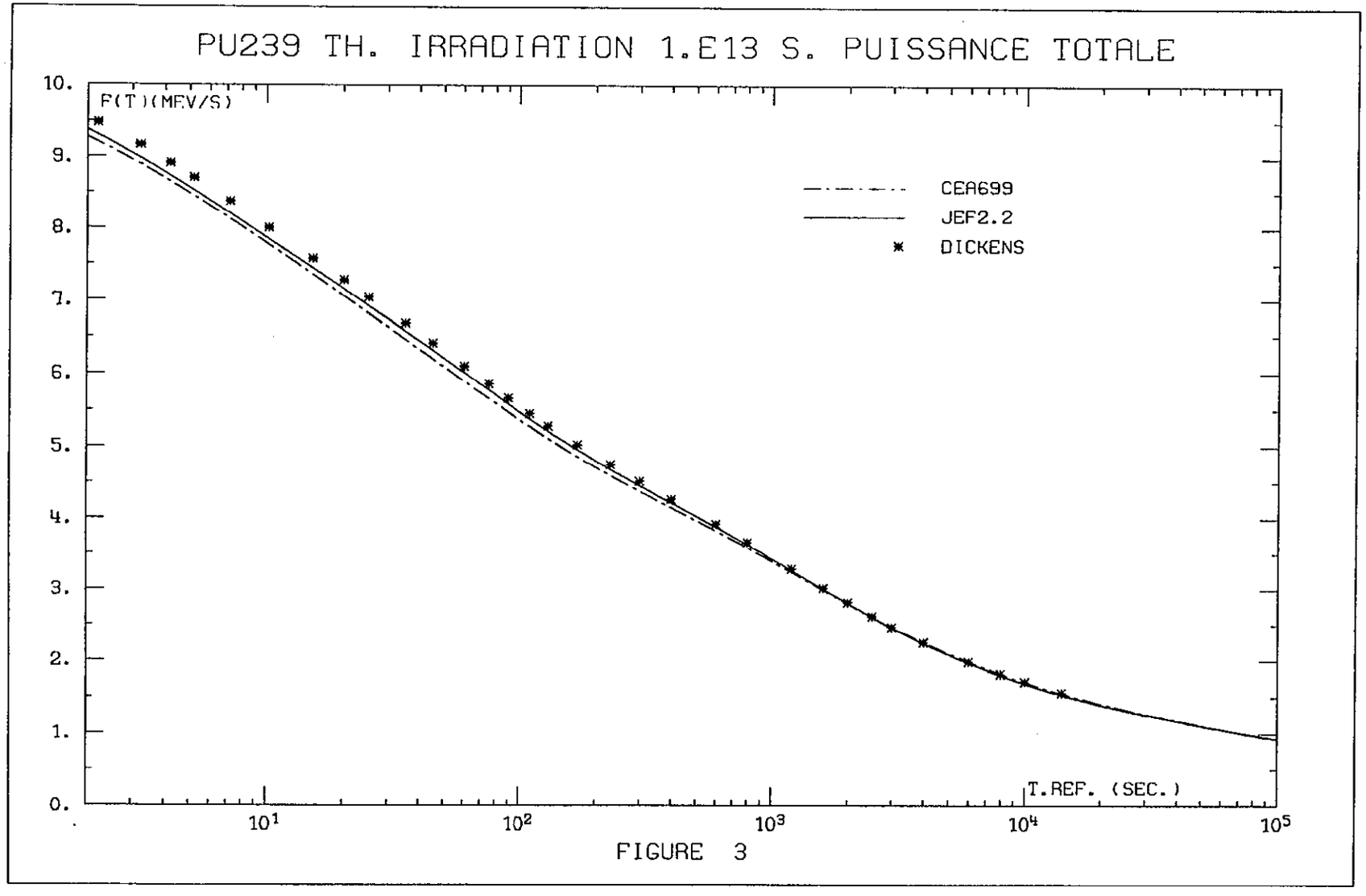


FIGURE 2



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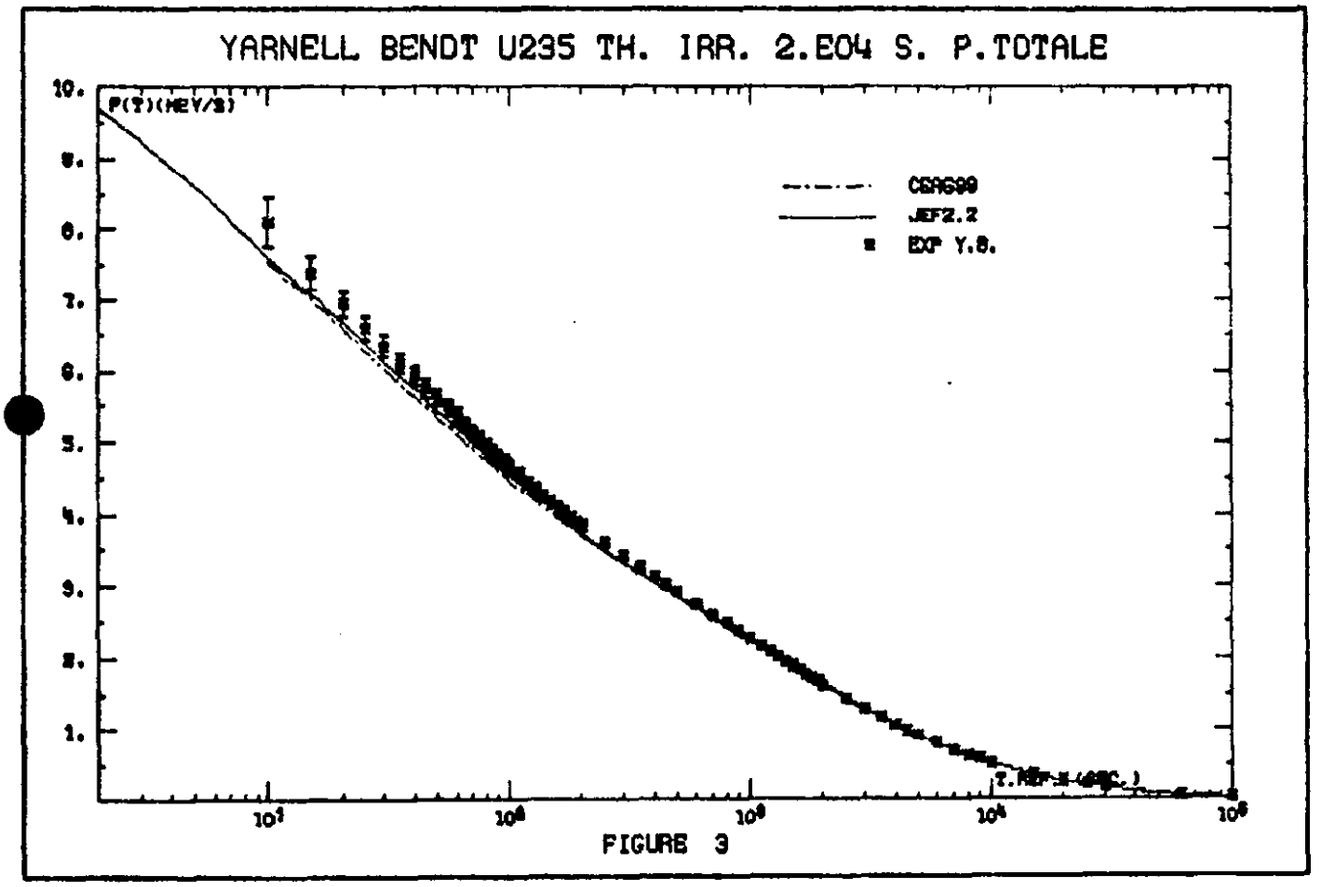
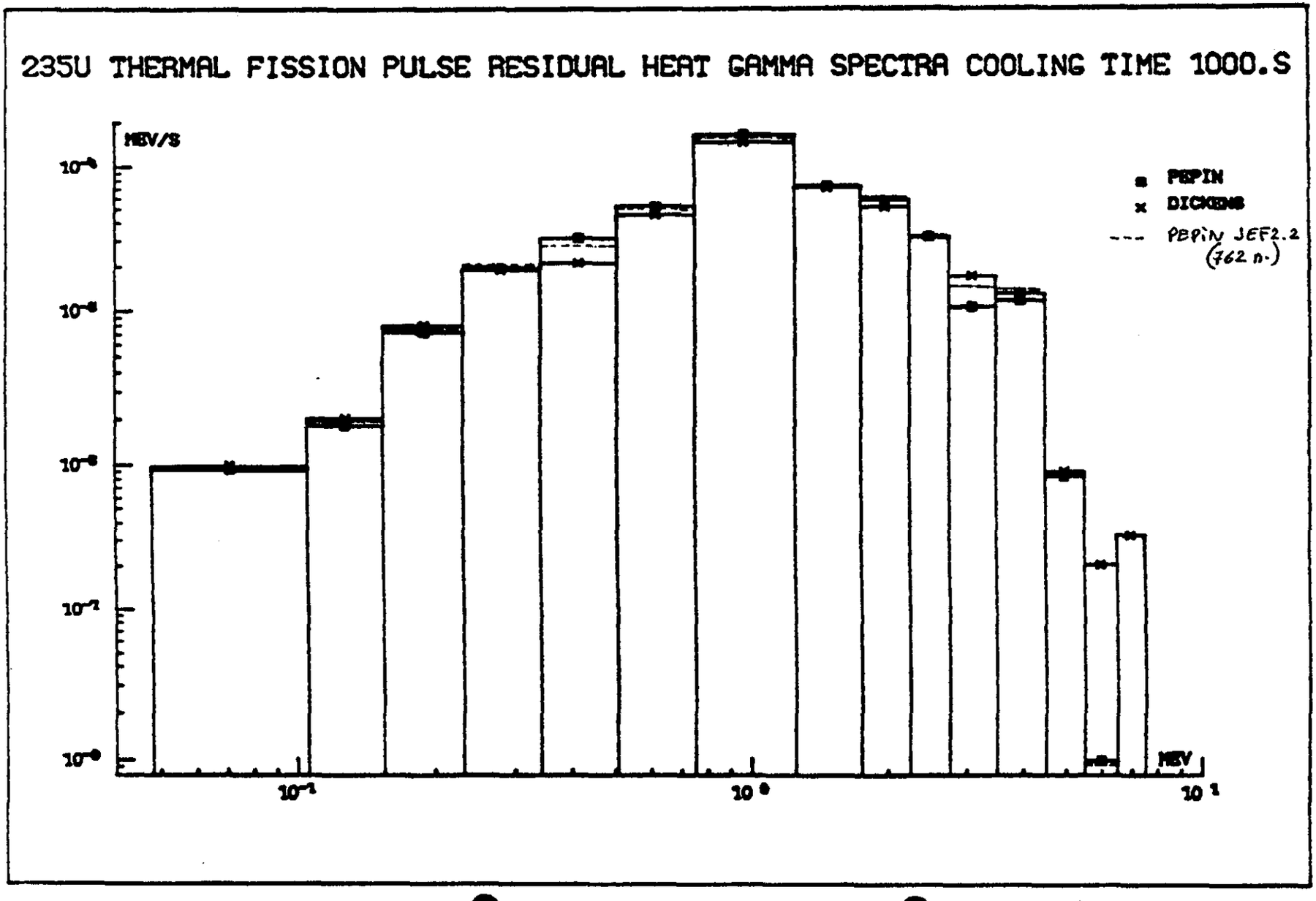


FIGURE 3


235U THERMAL FISSION PULSE RESIDUAL HEAT GAMMA SPECTRA COOLING TIME 1000.S
MEV/S
PEPIN
DICKENS
PEPIN JEF2.2
(762 n.)
MEV

14090103

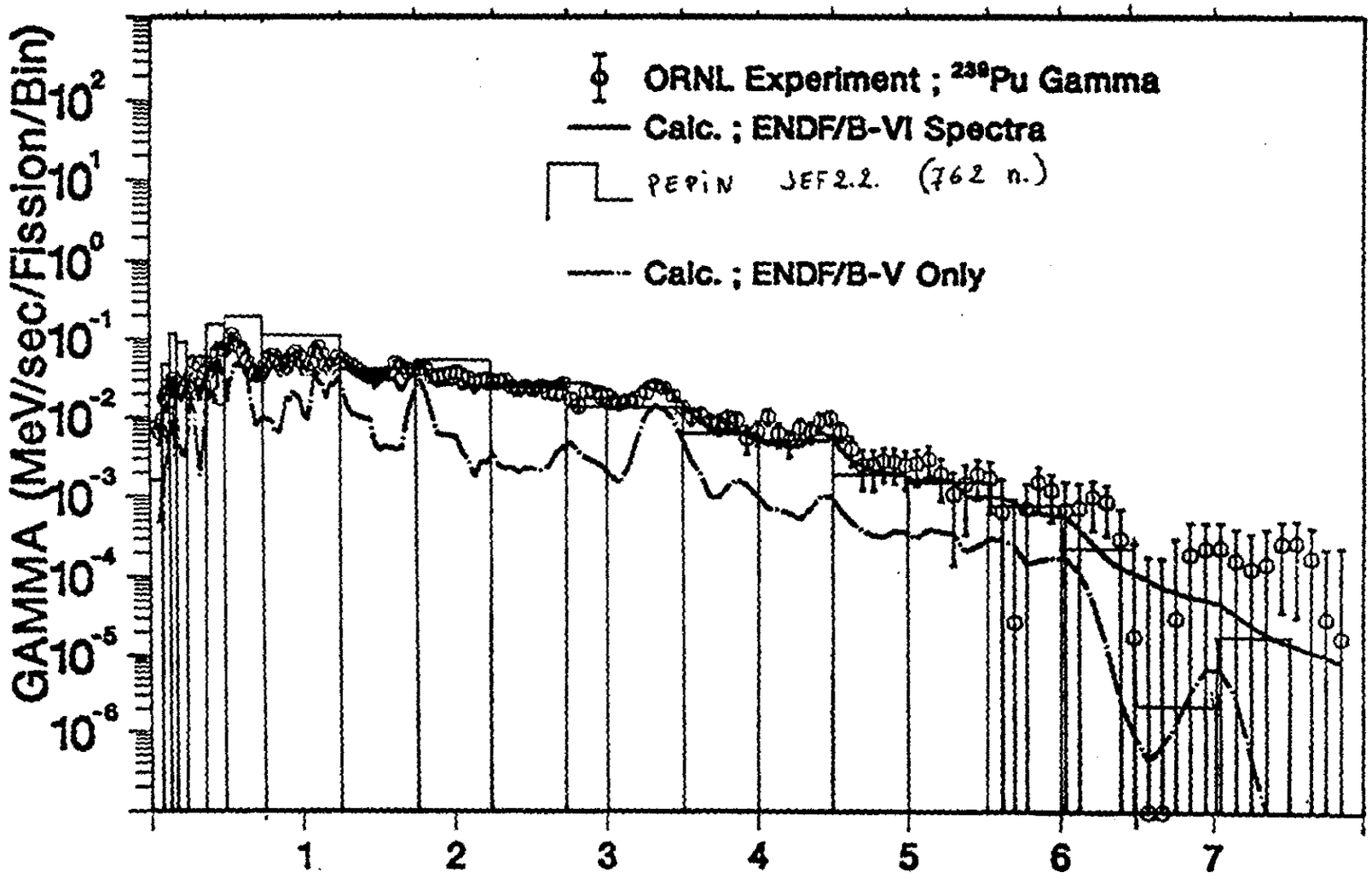


Fig. GAMMA SPECTRUM AFTER ^{239}Pu THERMAL NEUTRON FISSION
(T_{irr} = 1.0 s, $T_{cool.}$ = 2.2 s)