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JEF/DOC-428

COMPLETE ANALYSIS OF THE ERASME EXPERIMENTS USING CEA93 LIBRARIES

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ERASME

Within the framework of a cooperation between the French atomic Energy Commission, (CEA), and the national electricity supplier (EDF), in collaboration

- with the industrial company FRAMATOME, an extensive experimental program was undertaken to validate design studies on light water high conversion reactors loaded with mixed oxide fuel.

The ERASME experiment was performed

- to reduce uncertainties on basic and fundamental parameters of HCLWR.

Three lattices were originaly foreseen

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EXPERIMENT VALIDATION OF HCLWR NEUTRONIC PARAMETERS

FUNDAMENTAL PARAMETERS

k_∞
Conversion factor
Spectrum indices
Absorbers and clusters worths
Power distribution
Void coefficient

BURN-UP PROBLEMS

Capture of :

- the main heavy isotopes
- minor actinides
- fission products

ERASME

Large size critical experiment
in EOLE at CADARACHE

EXPERIMENT	MODERATOR/FUEL RATIO
ERASME/S	0.5
ERASME/R	0.9
ERASME/L	2.1

ICARE

Irradiation of individual isotopes
in MELUSINE at GRENOBLE

EXPERIMENT	MODERATOR/FUEL RATIO
ICARE/S	0.5
ICARE/R	0.9

MORGANE

Oscillations of irradiated fuel samples
in MINERVE at CADARACHE

EXPERIMENT	MODERATOR/FUEL RATIO
MORGANE/S	0.5
MORGANE/R	0.9

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The ERASME experiments consist of a large cylindrical undermoderated plutonium fueled test lattice centered inside a driver core

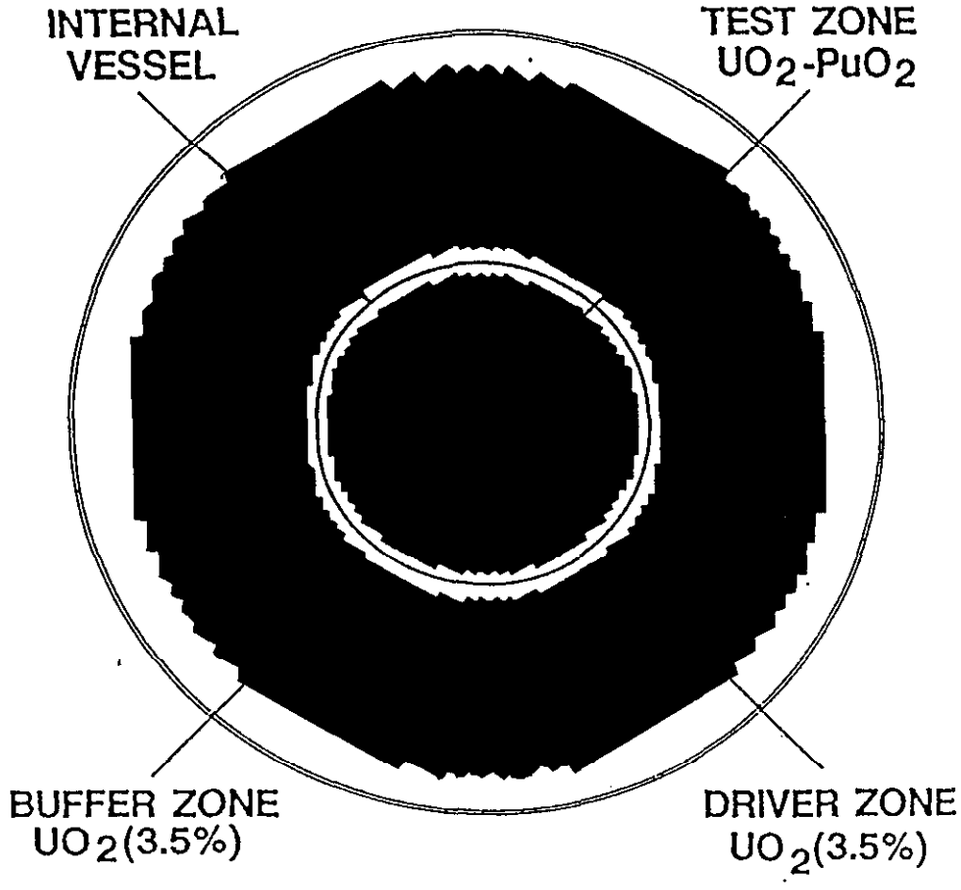
The measurement of standard parameters carried out concerned :

- Determination of the buckling
- Conversion factor
- Fission rates of the main heavy isotopes
- Absorber worth and cluster configurations

Furthermore, an extensive experiment has been devoted to the configuration with a water void in the central test zone.

In this configuration, the measurements concerned :

- Integral void coefficient
- Material Buckling
- Ratios of the main reaction rates



THE ERASME EXPERIMENT IN EOLE : FIRST CONFIGURATION

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INTEGRAL PARAMETER CALCULATIONS

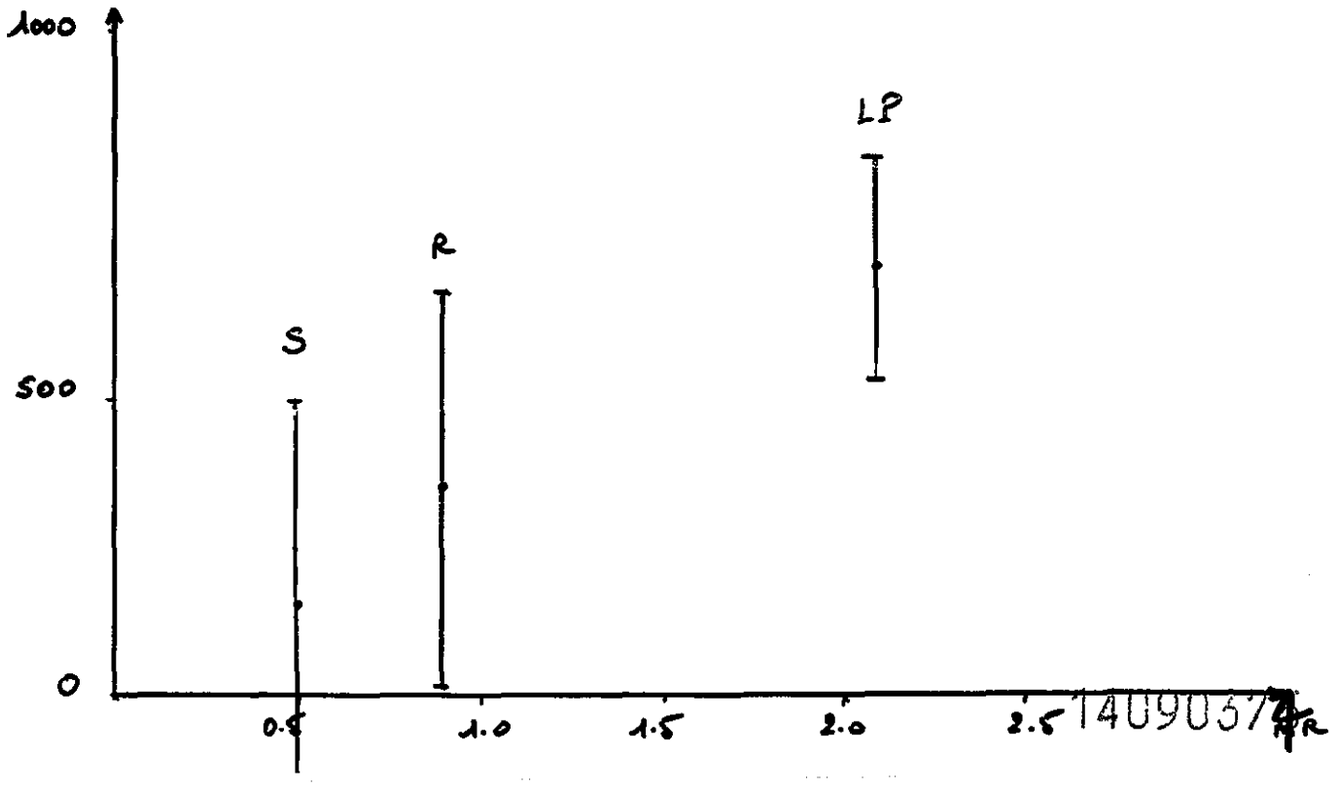
- CEA 93 LIBRARY 172 groups
  JEF 2.2 Evaluations

- APOLLO-2 CODE REFERENCE CALCULATION SCHEME

k_{eff} CALCULATIONS

	ERASME /S MR = 0.5 0 ppm	ERASME /R MR = 0.9 0 ppm	ERASME /LG MR = 2.1 1650 ppm	ERASME /LP MR = 2.1 0 ppm
E-C/C	+220	+ 370	+460	+730
σ (pcm)	± 280	± 270	± 150	± 150

→ UNDER ESTIMATION OF k_{EFF} WHICH INCREASES WITH THE MODERATION RATIO



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SPECTRAL INDICES CALCULATIONS

(E-C)/C in %.

SPECTRAL INDICE	ERASME/S	ERASME/R	ERASME/L
$\frac{\sigma_f\ ^{238}U}{\sigma_f\ ^{235}U}$	-4.7 ± 2.5 *	-5.6 ± 2.5	-5.6 ± 2.5
$\frac{\sigma_f\ ^{239}Pu}{\sigma_f\ ^{235}U}$	-1.0 ± 2.0	$+0.3 \pm 2.0$	$+2.5 \pm 1.8$
$\frac{\sigma_f\ ^{240}Pu}{\sigma_f\ ^{235}U}$	$+12.7 \pm 4.0$	$+7.9 \pm 4.0$	-4.1 ± 4.0
$\frac{\sigma_f\ ^{241}Pu}{\sigma_f\ ^{235}U}$	-4.9 ± 3.0	-0.9 ± 3.0	$+0.7 \pm 3.0$
$\frac{\sigma_f\ ^{242}Pu}{\sigma_f\ ^{235}U}$	$+2.52 \pm 5.0$	-4.1 ± 5.0	-3.5 ± 5.0
$\frac{\sigma_c\ ^{238}U}{\sigma_f\ ^{235}U}$	-4.1 ± 2.3	-2.1 ± 2.1	—

* 1 standard deviation.

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THESE RESULTS HAVE BEEN USED IN THE CROSS-SECTION ADJUSTMENT PERFORMED BY THE AMARA-CODE

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* SENSITIVITIES MATRICES
* (E-C)/C AND σ
* CROSS-SECTIONS VARIANCE AND COVARIANCES MATRICES

  • 44 INTEGRAL PARAMETERS
  (19 k_{eff}, 25 spectral Indices)

  * TRX 1, 2 (METALLIC ?)
  * [illegible]
  * [illegible]
  * [illegible]
  * [illegible]
  * [illegible]
  * [illegible]
  * [illegible]

- Epithermal, thermal and "very thermal" spectrum.
- Several fuel

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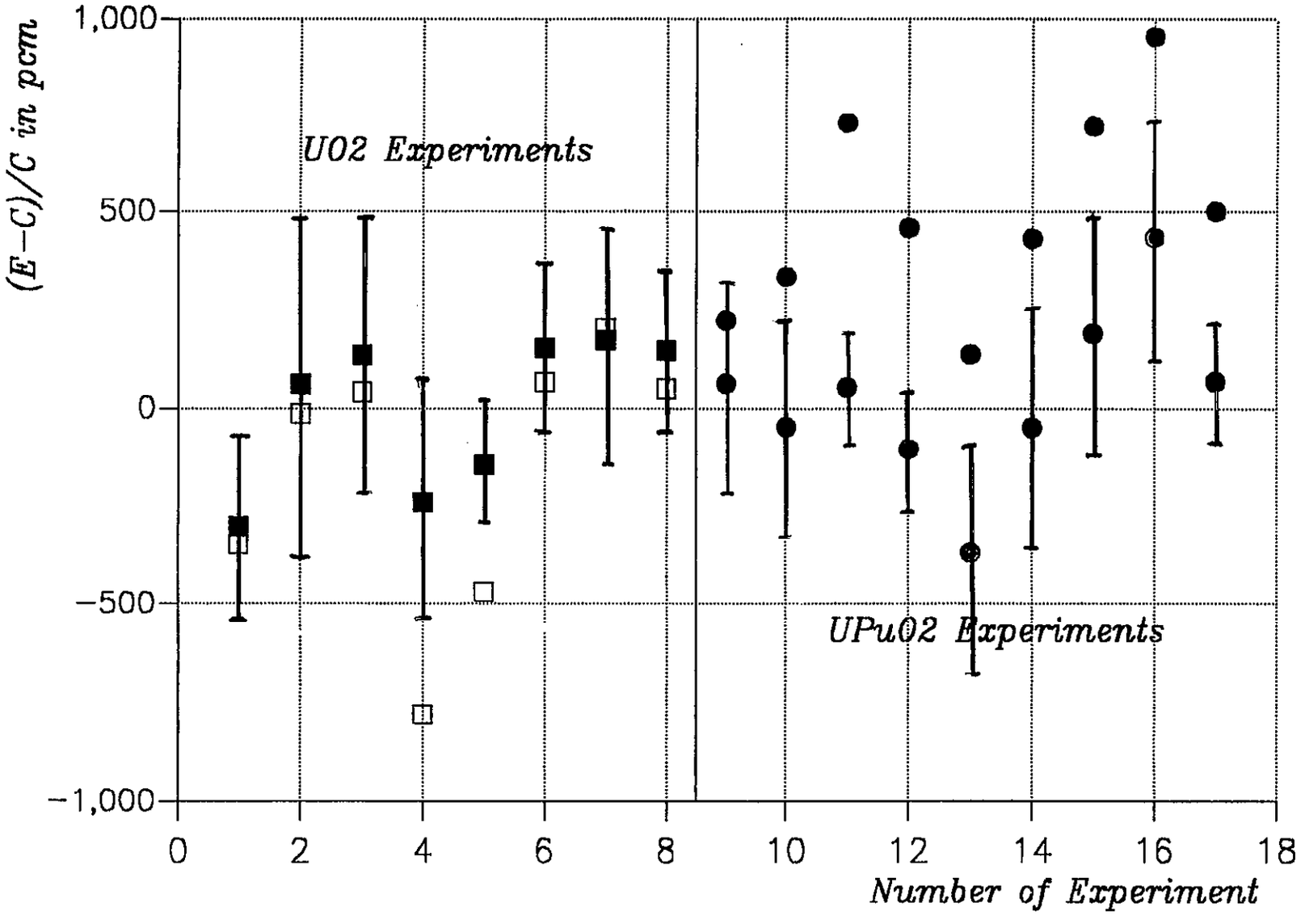
Keff Values



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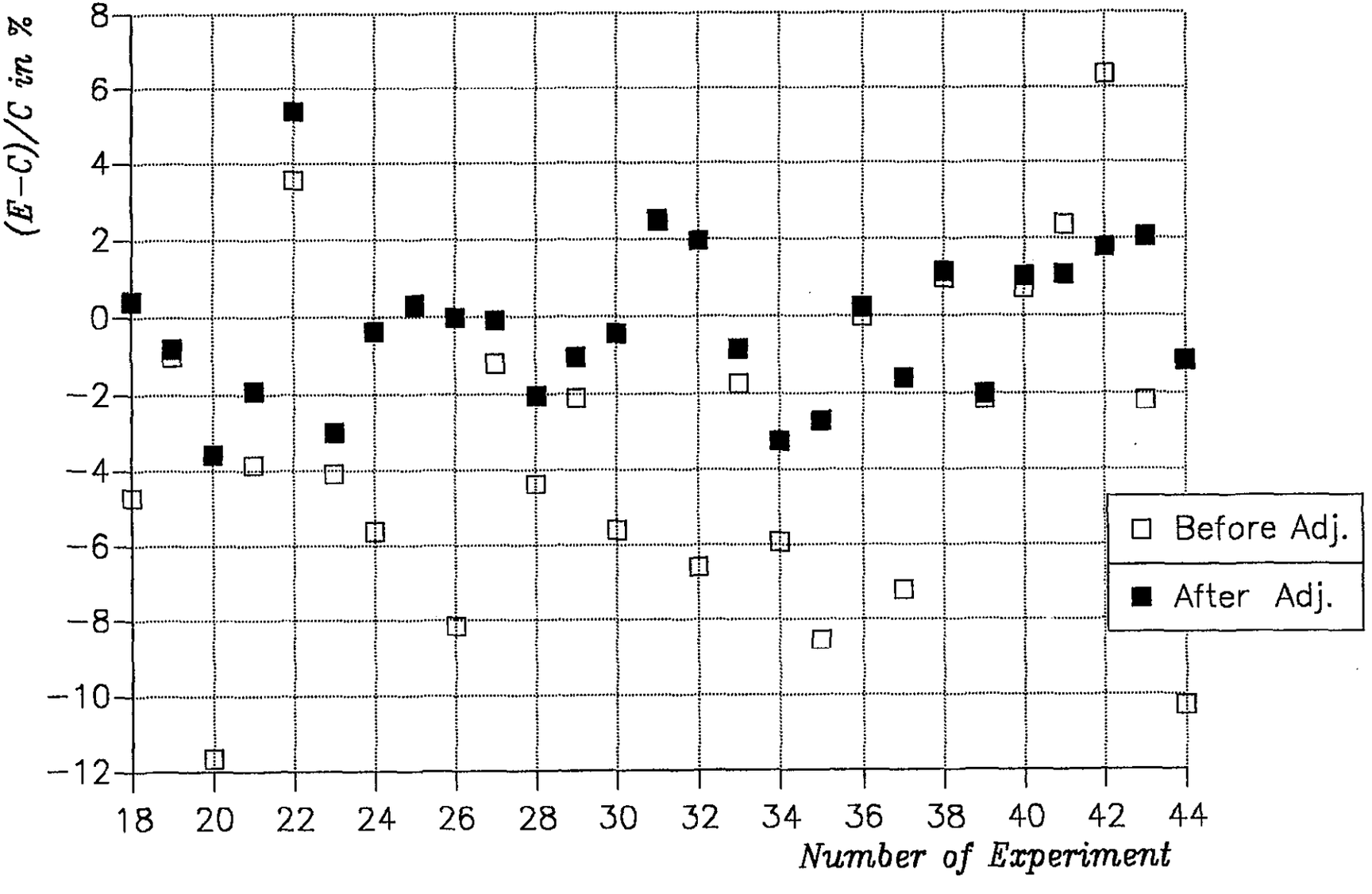
Spectral Indices Values



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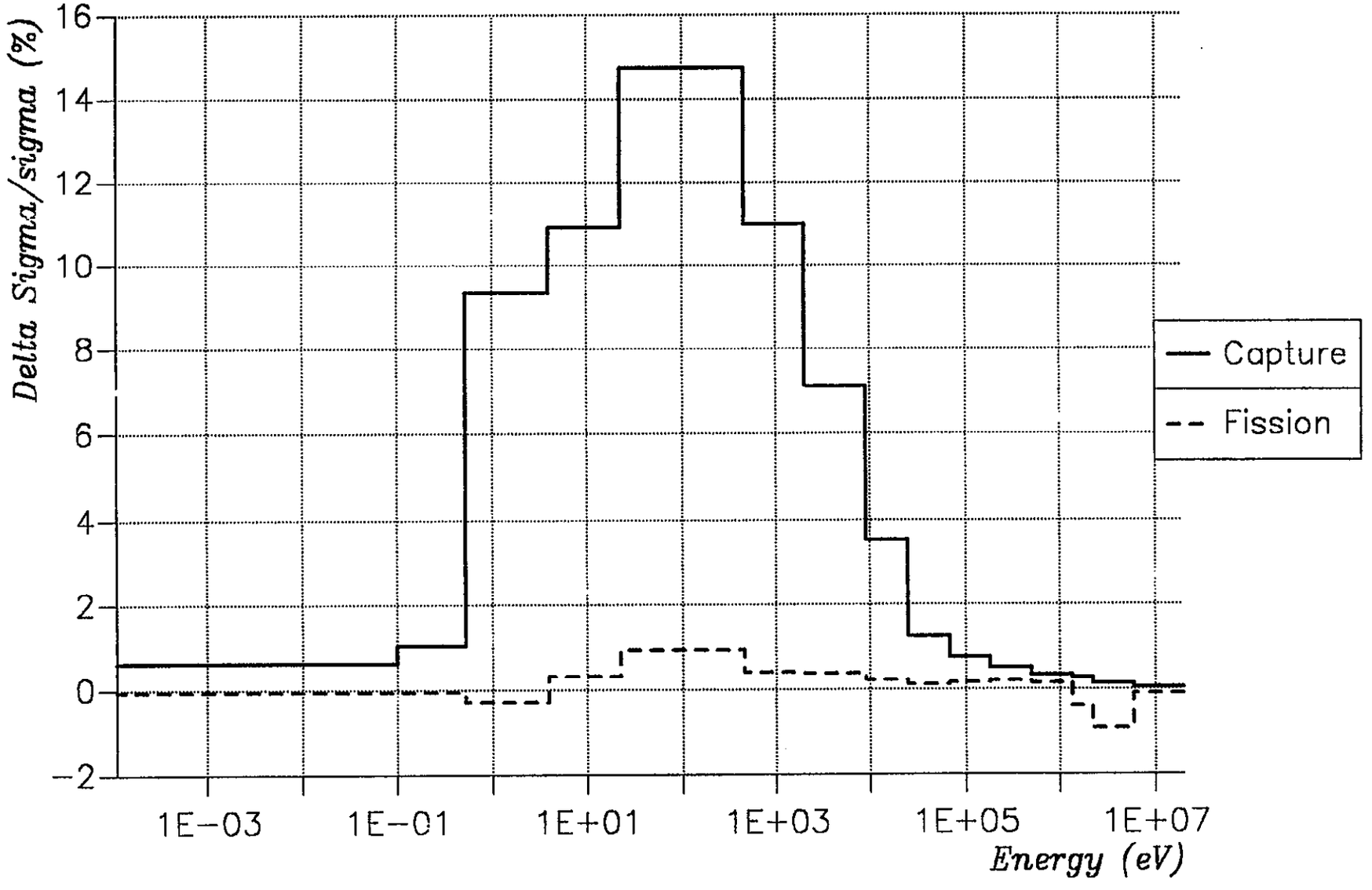
235U Cross-Sections



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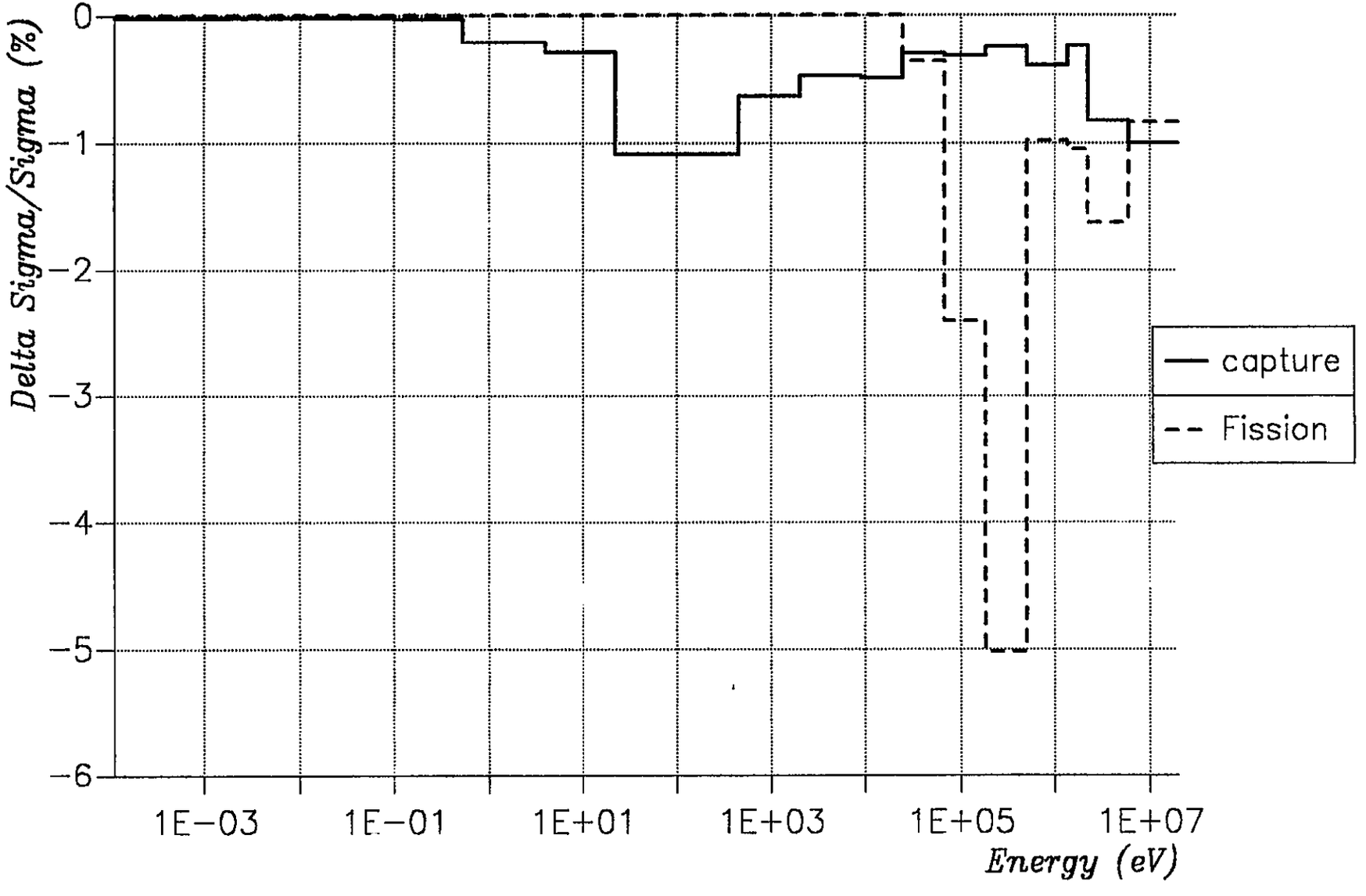
238U Cross-Section



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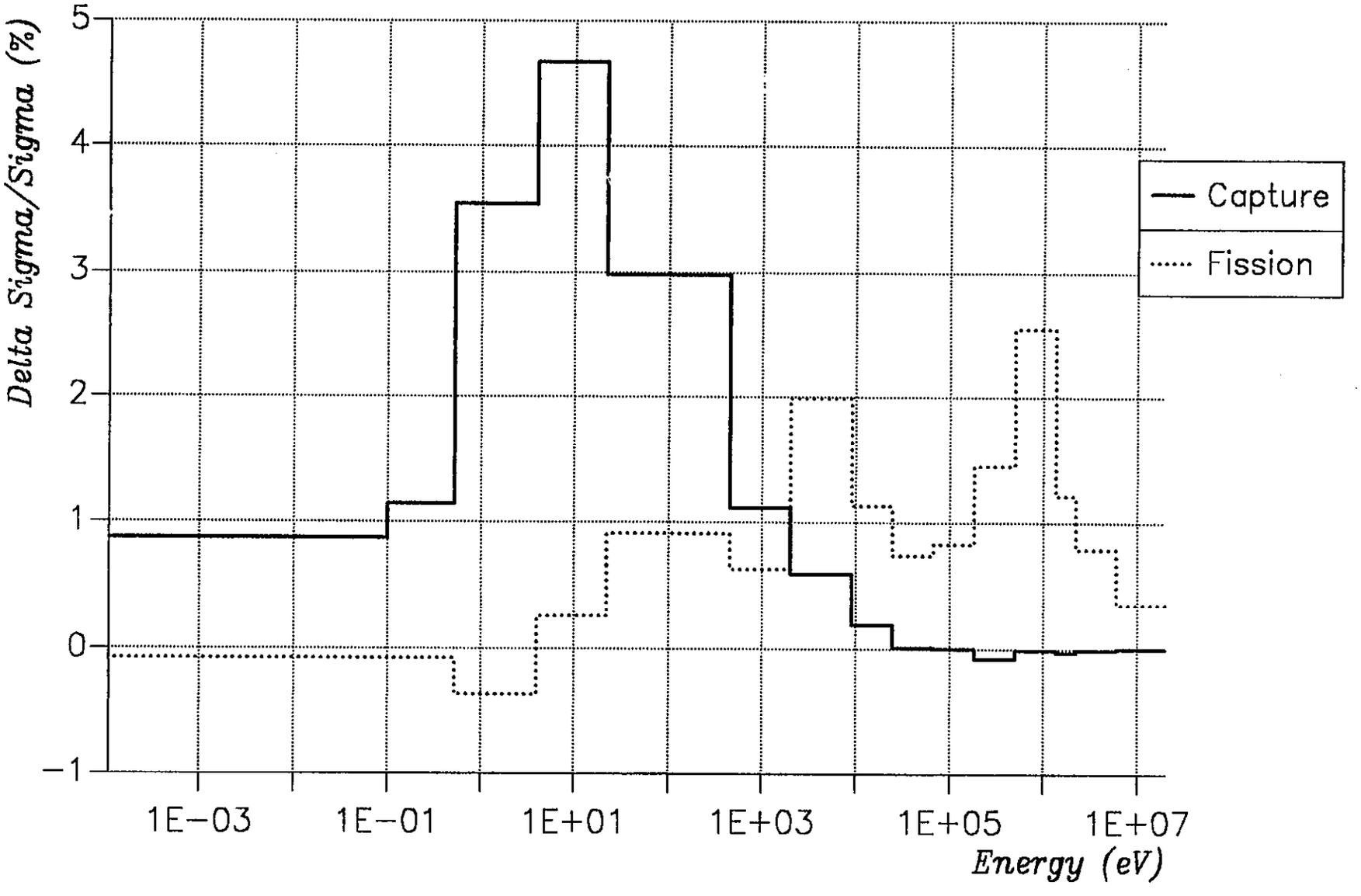
239Pu Cross-Sections



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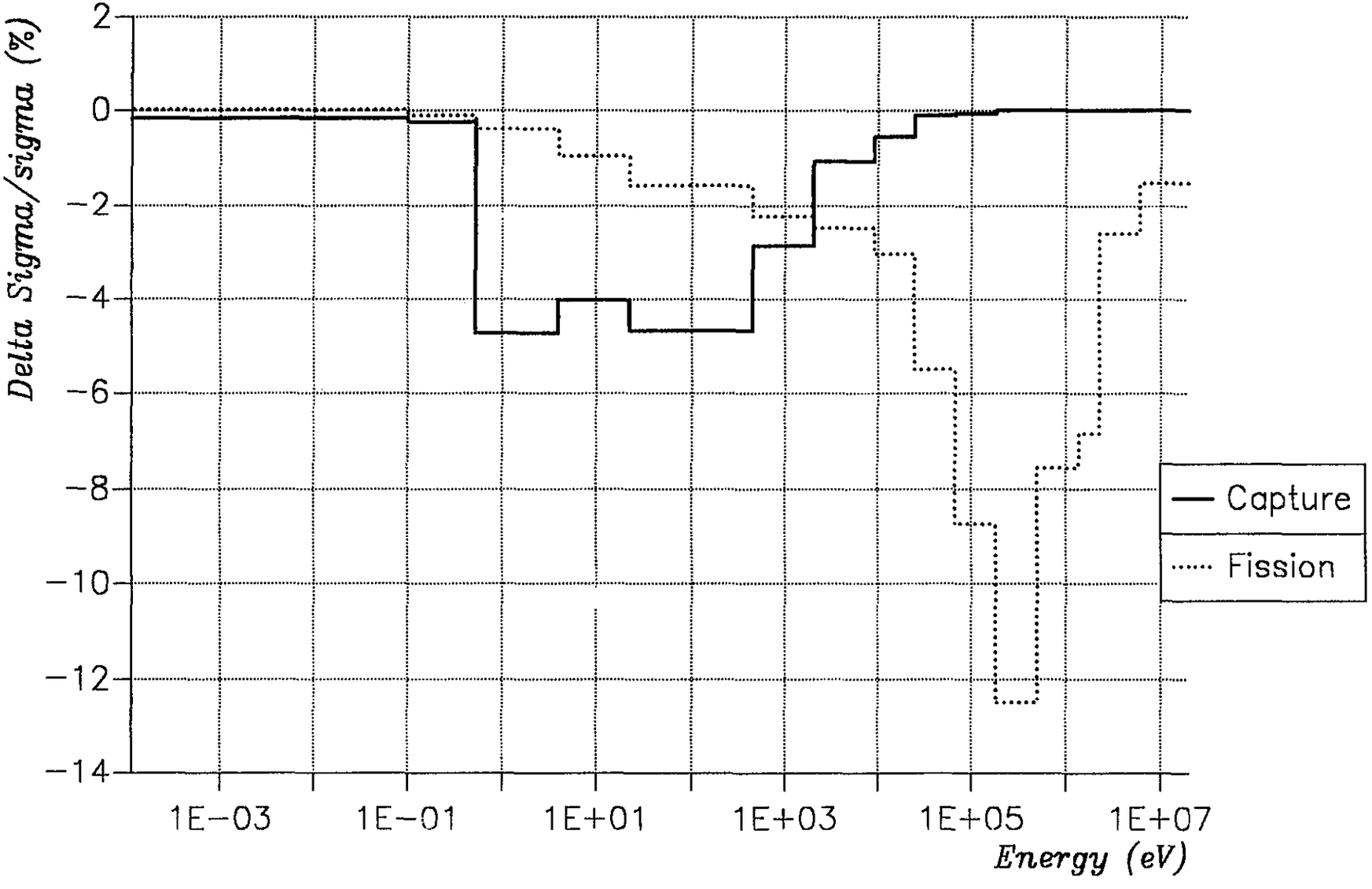
240Pu Cross-Sections



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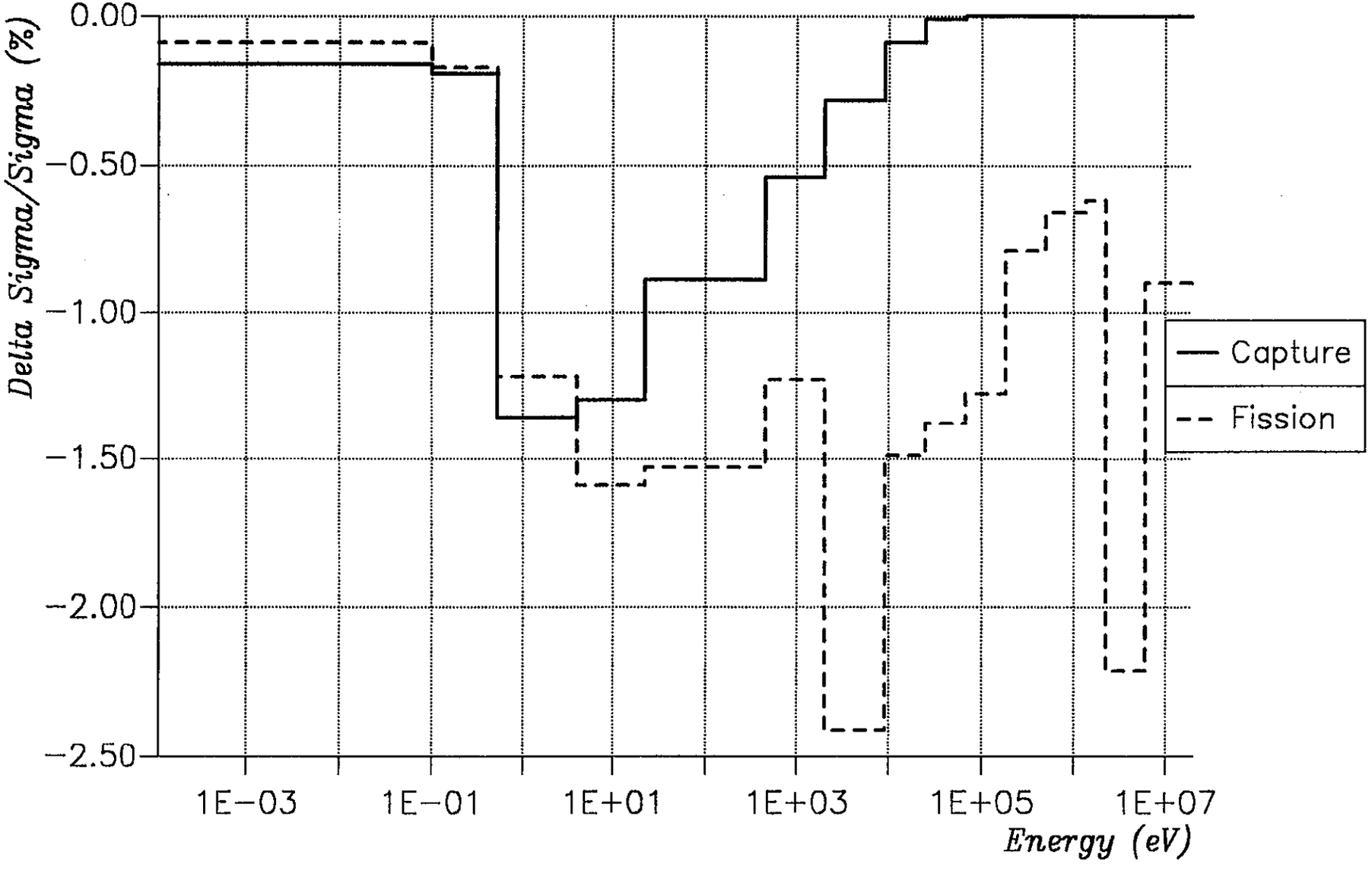
241Pu Cross-Sections



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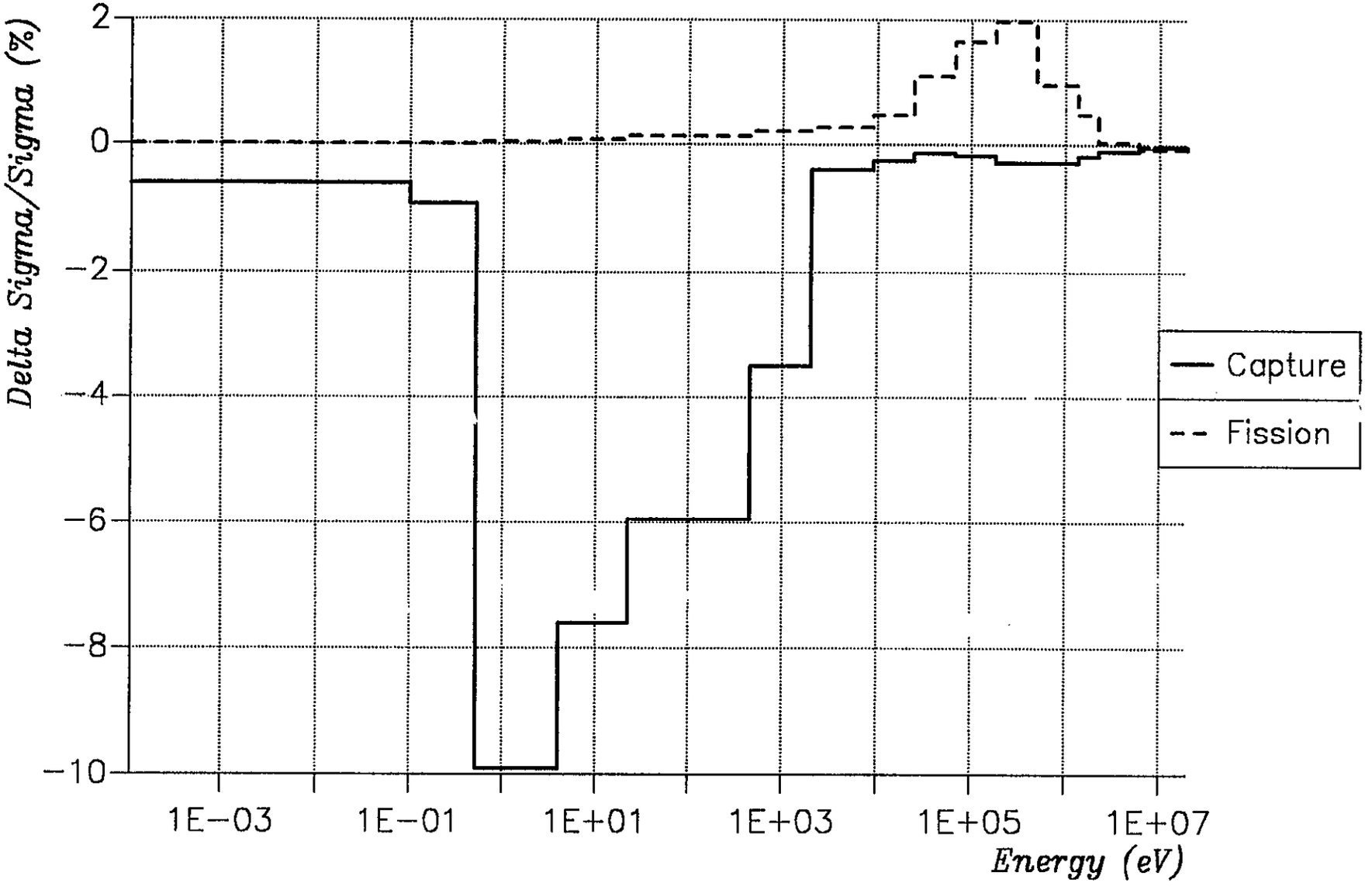
242Pu Cross-Section



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