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PULSE HEIGHT EFFECTS IN THE MEASUREMENT OF U-233 FISSION CROSS SECTIONS.

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Experiments were performed at the ORELA facility as a continuation of our investigation into fission fragment pulse height effects[1]. Significant differences were found in the partial fission cross sections corresponding to different pulse height cuts[2].

Experimental conditions were as follows: a 4 cm^2 solid state detector viewed a 6 cm^2, 100 $\mu g/cm^2$ thick target located 8.68 meters from the neutron source. Event-by-event recording enabled us subsequently to analyze the time-of-flight data with the accompanying energy of the fission fragment.

The partial fission cross sections were calculated for different energy cuts in the fission fragment distribution. Figure 1 shows the single fragment energy spectrum of U-233 with the different energy cuts indicated. Figure 2 displays several partial fission cross sections for U-233 in the energy region of 8 eV to 25 eV corresponding to the cuts in Figure 1. Statistically significant differences exist between different cuts. It can also be seen that some of the levels which were assumed in the past to be single levels are split into two or more structures (10.4 eV, 12.8 eV, 22.4 eV, etc.). There is a strong correlation between the behavior of the partial cross sections of low energy fragments and those corresponding to near symmetric fission. This behavior suggests the possible existence of two different fission modes.

The differences between the pulse height cuts are especially striking at the resonance at 12.8 eV. This structure shows a definite split and a nonparametric statistical test (Kolmogorov-Smirnov) gives a 2% probability that the distributions of two different cuts are members of the same family. The correlation coefficient shows a large negative value indicating strong anticorrelation between the two cuts.

A consequence of this pulse height effect is the biasing of fission cross sections by varying amounts when not all the fragments are detected. An accompanying paper calculates the effect of this bias in ionization chambers[3].

In cases where the fission cross sections are needed to a few percent accuracy, this type of bias will be unacceptable. Corrections to the already measured cross sections can be calculated on the basis of the present unbiased measurements.

In summary, we have demonstrated that the fission cross sections are sensitive to pulse height bias and that level parameters calculated from biased measurements may be in error.

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1. J. P. Pelvinci and E. Melkonian, "Proceedings of the Third Conference on Neutron Cross Sections and Technology" (CONF-710301) v.2 (1971), p.855.

2. J. P. Pelvinci, E. Melkonian, and F. Pleasonton, "Fission Fragment Pulse Height Effects in U-233", BAPS 19 596 (1974).

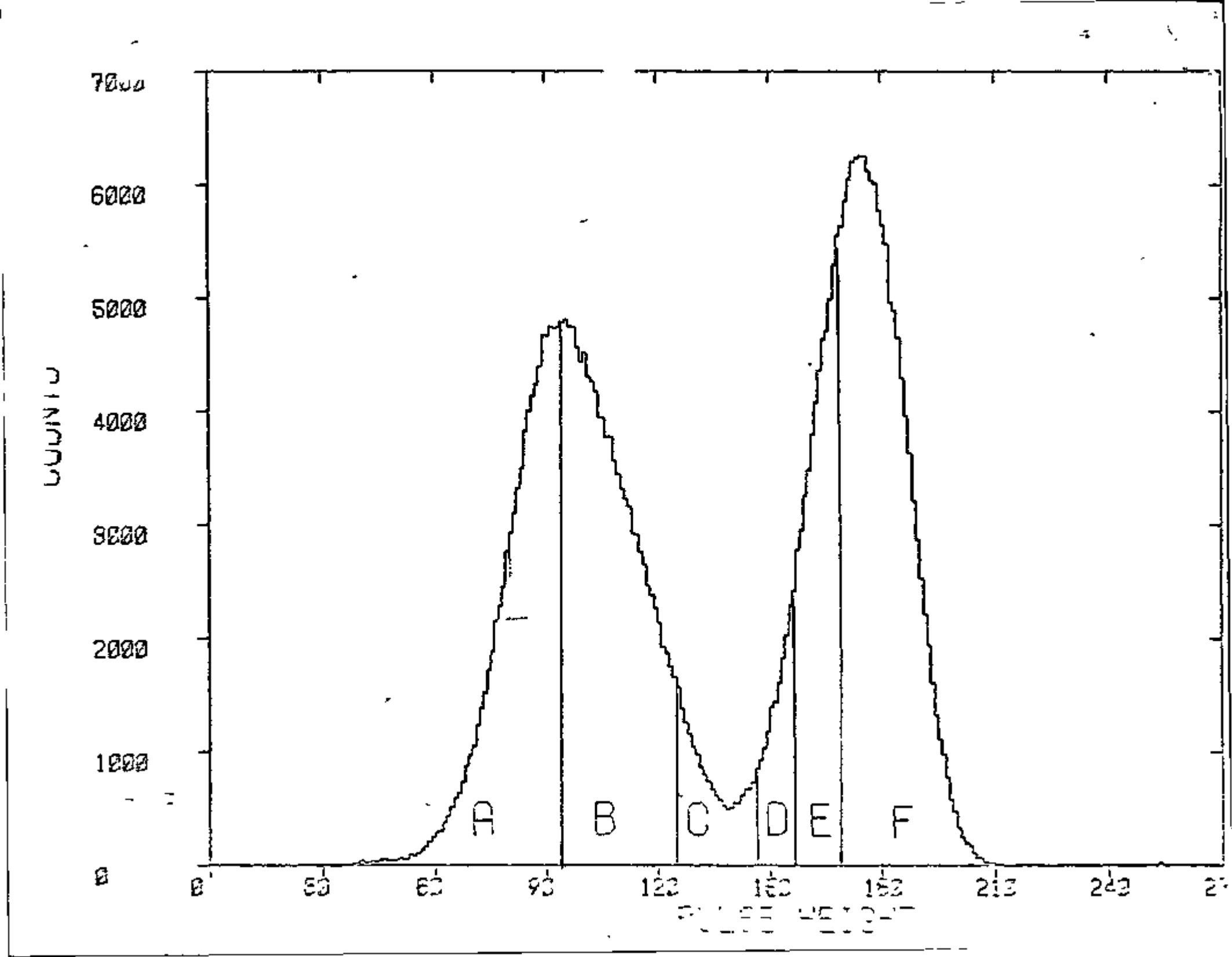
3. F. Cohensedgh, J. P. Pelvinci, and E. Melkonian, "Fragment Energy Dependent Biases in Ionization Chamber Measurements of Fission Cross Sections", submitted to ANS Winter Meeti

DISCLAIMER

FIGURE CAPTIONS:

Figure 1. U-233 pulse height distribution. The lines drawn indicate the cuts made.

Figure 2. U-233 relative partial fission cross sections with Gaussian smoothing, from 8 eV to 25 eV. The subsequent curves starting from the bottom correspond to the increasing energy pulse height cuts indicated in Figure 1.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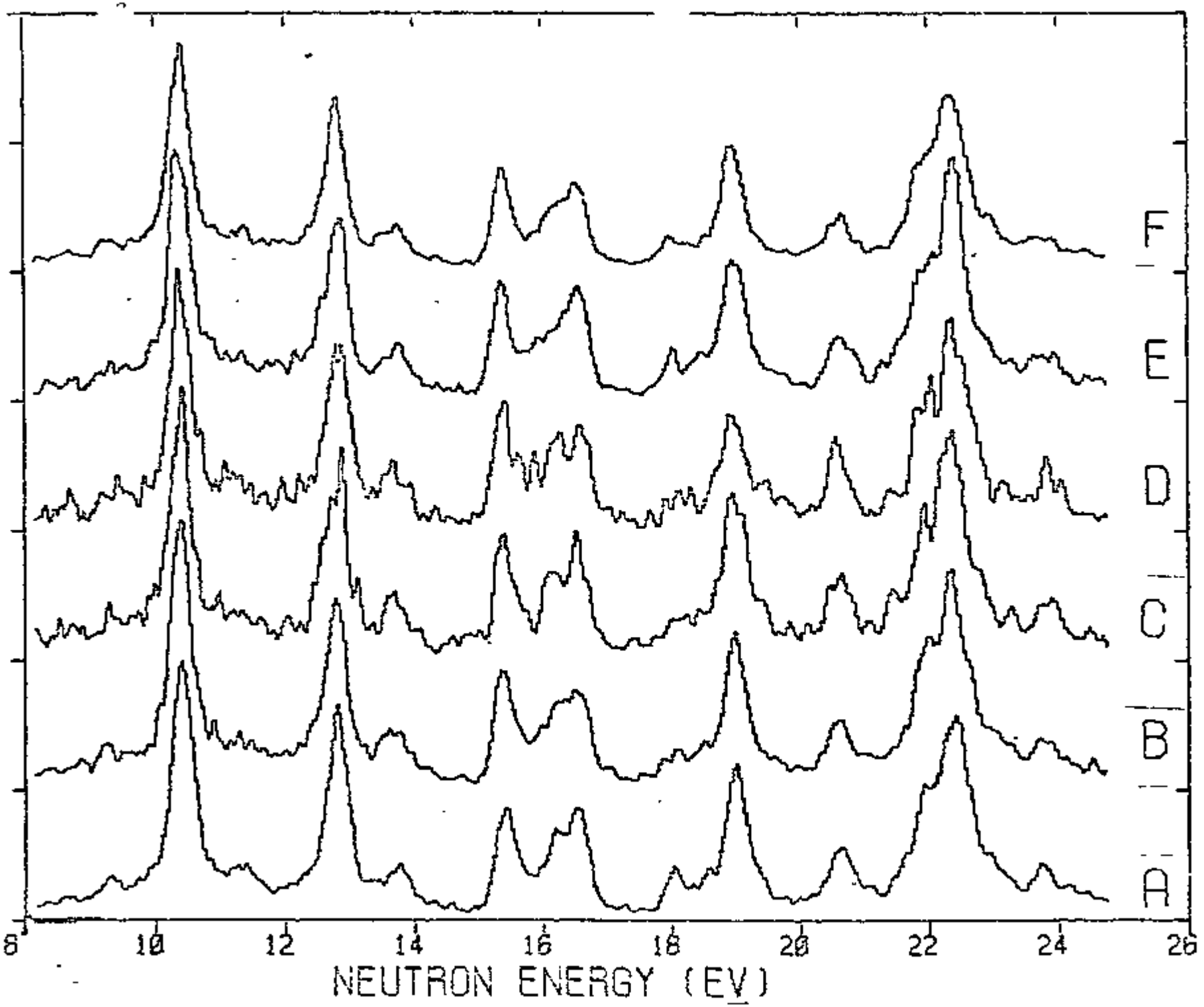
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