This paper is concerned with the information extracted from the subject blanket using foil activation methods, which may be summarized as follows:

1. Vertical and horizontal traverses were made with Au, Mo, and In foils to determine that an energy-independent buckling was achieved to characterize the transverse leakage. These measurements showed that the expected cosine-shaped fluxes were achieved throughout, except for a region about 15 cm thick around the periphery, where streaming and backscatter effects were dominant.

2. The above foils plus those representing blanket constituents such as ^{238}U were used to make traverses through the blanket, from the "core" interface to deep within the reflector. Selected results, together with traverses calculated using the 26-group Russian (ABBN) cross-section set and the ANISN code in the S_8 option, are shown in Fig. 1. In general, the agreement is good, except in the iron reflector where the well-known difficulties regarding adequate few-group description of keV-range neutron diffusion in this material are evident.

3. Multiple-foil packets containing resonance and threshold absorbers were irradiated at various locations within the blanket and neutron spectra unfolded from the measured activities using both the SAND-II code and a program developed at MIT. Agreement with calculation is good, in general, except for the energy range below 1 keV, where the unfolded data show more neutrons than calculated. This result is also consistent with larger than pre-estimated heterogeneous self-shielding measured in the ^{238}U metal fuel rods. It is anticipated that this discrepancy will be decreased by application of more sophisticated self-shielding corrections to both the foil activities and multigroup cross sections.

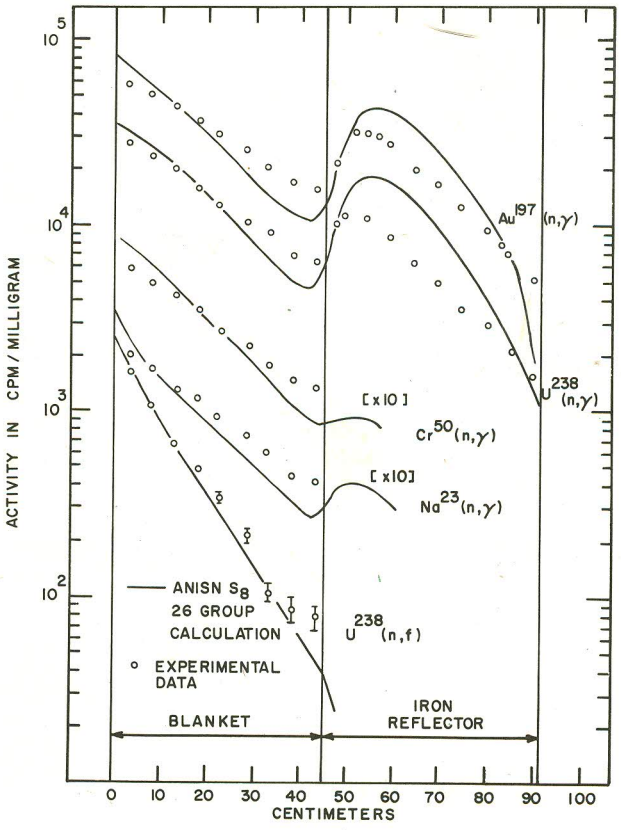

Fig. 1. Foil activation traverses.

1. I. A. FORBES, M. J. DRISCOLL, T. J. THOMPSON, I. KAPLAN, and D. D. LANNING, "Design, Construction and Evaluation of a Facility for the Evaluation of Fast Reactor Blankets," MIT-4105-2, MITNE-110, Massachusetts Institute of Technology (February 1970).

2. I. A. FORBES, M. J. DRISCOLL, T. J. THOMPSON, I. KAPLAN, and D. D. LANNING, "Design, Construction and Evaluation of an LMFBR Blanket Test Facility," *Trans. Am. Nucl. Soc.*, **13**, 88 (1970).

8. Dispersion of a 1.68-MeV Neutron Pulse in a Lead Prism, *S. Paiano, M. Paiano (IEA-Brazil), E. E. Carroll, Jr., M. J. Ohanian (U of Fla)*

When a nanosecond burst of monoenergetic fast neutrons is injected into a large prism of nonmoderating material, a study of the space-time dispersion of the pulse may be expected to yield interesting information about the details of neutron transport in the material under study. In particular, it may be possible to measure several components of the differential-elastic scattering cross section.[1] Some earlier experimental measurements of this sort in an iron block exhibited source interference, slowing down, and cross-section structure effects that were difficult to correct and interpret.[2,3]

The present experiment in a lead prism corresponded closely to the theoretical analysis of Ohanian et al.[1] avoided some of the experimental difficulties of Napolitano et al.,[2,3] and the slowing-down effects were smaller and more accurately represented.

A 120-cm-long prism of lead, of 20- × 25-cm transverse dimensions, was aligned at 108 deg with the direction of the incident neutrons. All of the prism was heavily shielded from the incident neutrons except for the first few cm of the front end; 1.5-nsec neutron bursts of 1.680 ± 0.030 MeV energy were used. No important interference effects existed between uncollided neutrons and the propagating pulse, and time-dependent background could be measured accurately by removing the front end of the prism.

An NE-213 proton-recoil liquid scintillator was the detector and was positioned at 6 points along the prism axis. Detector pulses were fed into a two-parameter multichannel analyzer and stored in eight time spectra, each corresponding to a different discriminator bias level. All biases were above ~ 1.2 MeV so that inelastically scattered neutrons were not detected. The spectra were Fourier analyzed in time and the amplitudes and phases fitted to exponential and linear space functions to determine the observed dispersion law $K(\omega) = \alpha(\omega) + i\zeta(\omega)$.

Neutron slowing down causes decreased detection efficiency and a distortion of the time axis. Corrections were applied for these effects to arrive at the final dispersion law.

The theoretical infinite-medium P-5 dispersion law was calculated by method of Paiano and Paiano et al.,[4] corrected for finite prism size using $K^2_{inf}(\omega) + B^2 = K^2_{fin}(\omega)$. The experimental results are compared with theory in Fig. 1. (The cross sections used were taken from Refs. 5 and 6, reduced by 5% to account for the lower average density of the assembly. Major impurities in the lead were 2% tin and 0.5% antimony.)

The oscillatory behavior of the experimental points for $\omega > 30$ MHz is probably due to poor statistics. The agreement is good for low ($\omega \leq 10$ MHz) and high ($\omega \geq 35$ MHz) frequencies, but theory could not be matched to the ex-

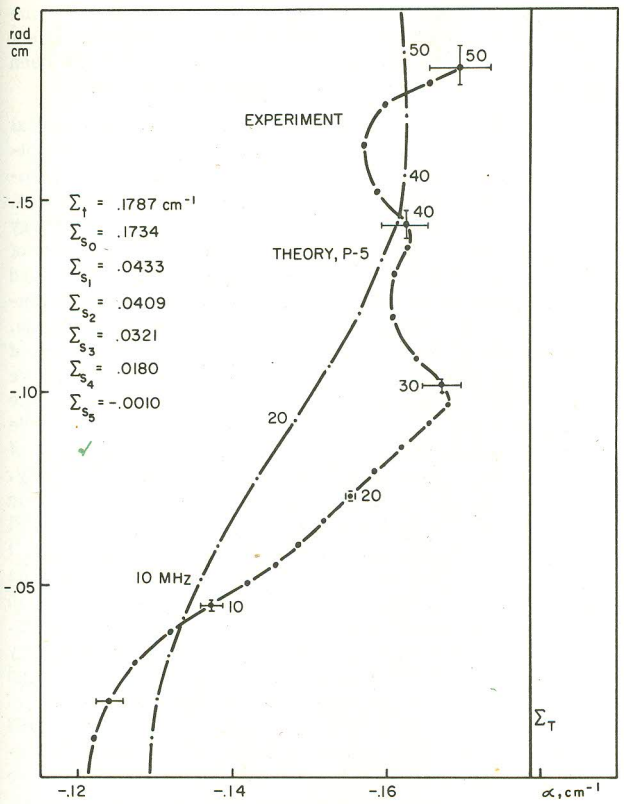

Fig. 1. The experimental and the theoretical (P-5) dispersion law for 1.68-MeV neutrons in a 120- × 20- × 25-cm lead prism. (Error bars are typical).

periment in the intermediate frequency range even by changing scattering cross-section components by up to 30%.

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9. Temperature Dependence of K_∞ for a ThO_2-$^{233}UO_2$ HTGR Lattice, *E. P. Lippincott (PNL)*

The temperature dependence of the infinite-medium neutron multiplication factor, k_∞, for a ThO_2-$^{233}UO_2$ lattice has been measured in the high temperature lattice test reactor (HTLTR). These measurements were carried out as part of a program to measure nuclear parameters in lattices typical of high-temperature gas-cooled reactors (HTGR).

The ThO_2-$^{233}UO_2$ lattice was constructed of graphite blocks 24-in. long containing fuel channels on a 0.75-in.-sq pitch. Each fuel channel was 0.470-in. in diameter and was loaded with a mixture of ThO_2 powder, graphite powder, and ThO_2-$^{233}UO_2$ microspheres coated with pyrocarbon. Each fuel channel was sealed with a $\frac{1}{2}$-in. end cap on each end. The average carbon-to-thorium atom ratio is about 205 and the carbon-to-^{233}U ratio is 11,000.

Room-temperature measurements of k_∞ in the physical constants test reactor (PCTR) have been described previously.[1] As in the PCTR experiment, the measurements in the HTLTR were made using the unpoisoned technique.[2] In this technique the reactivity worth of a small sample of the lattice (central cell) at the center of the reactor is normalized to the worth of a 1/v absorber (copper), and k_∞ is evaluated using the two-energy-group expression[3]

$$k_\infty = 1 - \left[\frac{\Delta\rho^{cell}}{\Delta\rho^{Cu}}\right]\frac{(\Sigma\phi V)_2^{Cu}}{(\Sigma\phi V)_2^{cell}}\left[1 + \frac{(\phi_1^+\Sigma_1\phi_1)^{Cu}}{(\phi_2^+\Sigma_2\phi_2)^{Cu}}\right]$$
$$- \frac{(1+\tau B^2)(1+L^2B^2)(1-p)L^2B^2}{1+(1-p)L^2B^2} + \frac{\tau B^2(1+L^2B^2)[\tau B^2 - \eta_1 f_1(1-p)]}{1+\tau B^2 - \eta_1 f_1 (1-p)}.$$

The k_∞ defined in this expression is for fluxes in the fundamental mode (a bare critical system), and a small correction is necessary if the flux ratio at the reactor center differs from the fundamental-mode value. The two correction terms dependent on the buckling are calculated using a buckling consistent with the experimental value of k_∞-1. The PCTR absorption measurements were used and corrections for changes in central cell neutron absorption relative to the absorption in the normalizing copper absorber were calculated as a function of temperature.

The values of k_∞ derived from the measured reactivity data at each temperature are presented in Table I, together with the experimental error. Presented also are calculated values of k_∞ using the computer codes GRANIT,[4] a modification of THERMOS,[5] which includes particle size effects in the fuel for the thermal region, and EGGNIT[6] for the epithermal region. Several improvements in these codes since the earlier report[1] have resulted in slightly modified values of k_∞.

A comparison of the calculated and experimental results indicates that the calculated k_∞ is consistently smaller than the experimental value, about 0.008 at room temperature. This difference is larger than the experimental error, but may be due largely to uncertainties in the exact fuel loading (mainly in the ^{233}U particles) which would affect the theoretical value. However, fuel loading uncertainties have little effect on the temperature variation of k_∞. The measured change in k_∞ from 20 to 1000°C is 0.035 ± 0.002 compared to the calculated change of 0.047. The source of this significant discrepancy has not yet been identified.

TABLE I

Temperature °C	Measured k_∞	Calculated k_∞
20	1.0587 ± 0.0014	1.0507
150	1.0471 ± 0.0017	1.0370
300	1.0367 ± 0.0014	1.0256
500	1.0297 ± 0.0011	1.0156
750	1.0245 ± 0.0011	1.0081
1000	1.0237 ± 0.0012	1.0034