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**Spectrum of Neutrons Emitted from
a Thick Beryllium Target Bombarded with 7 MeV Deuterons**

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A. Smith, P. Guenther, and B. Micklich

January 1988

**ARGONNE NATIONAL LABORATORY,
ARGONNE, ILLINOIS 60439, U.S.A.**

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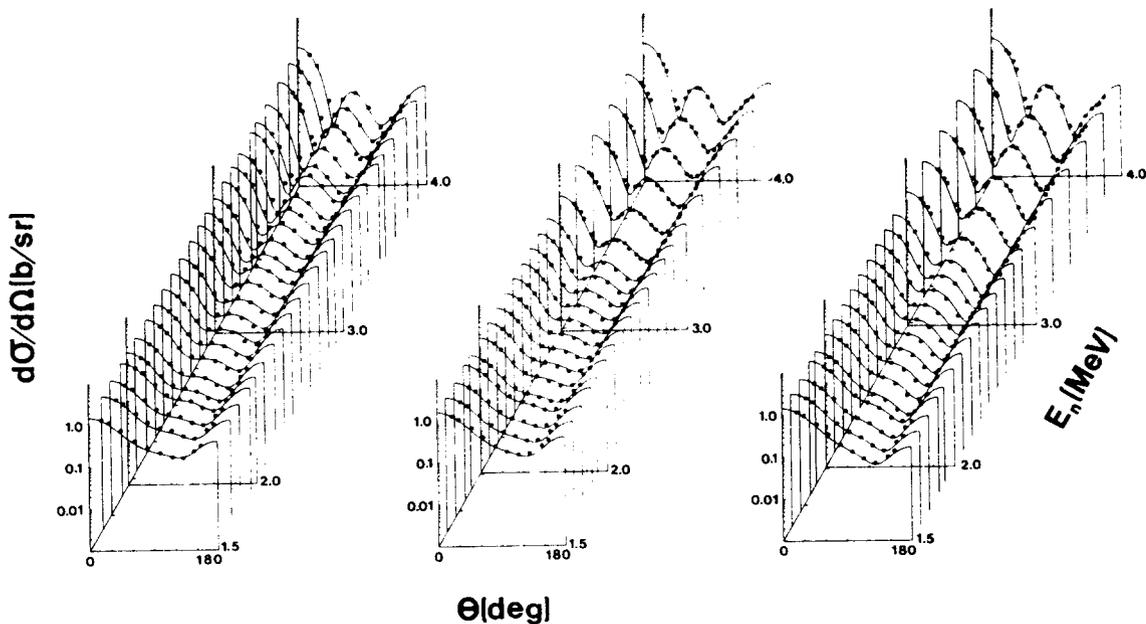
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ABSTRACT

The spectrum of neutrons emitted from a thick beryllium target bombarded with 7 MeV deuterons is measured at 25 reaction angles distributed between 0° and 158° , and over the neutron energy range $\approx < 0.8$ to > 11.0 MeV. The spectrum is determined relative to the standard ^{252}Cf prompt-fission-neutron-spectrum using fast time-of-flight techniques. The results are presented as angle-energy differential distributions and as relative numerical group cross sections suitable for establishing a reference field for applied studies.

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I. INTRODUCTION

The exothermic ${}^9\text{Be}(d,n){}^{10}\text{B}$ reaction is a prolific source of neutrons at relatively low incident-deuteron energies.¹⁻¹¹ Using thick beryllium targets, intense continuum neutron spectra consisting of direct (stripping¹²⁻¹⁵) and compound-nucleus processes are obtained. The resulting neutron field is strongly angular dependent, with the higher-energy portions of the energy distributions tending to follow $\ell = 1$ and 2 stripping distributions. The spectra are similar to those encountered in fusion-energy-system blankets, and thus the spectra are favorable for studying radiation damage, dosimetry, activity production, and integral neutronic performance in fusion-energy systems. The source has been used for integral tests of differential data^{16,17}, and the determination of differential data using unfolding techniques has been proposed¹⁸, particularly for the determination of very small cross sections resulting in long-lived activities that are a concern in fusion-energy development. Furthermore, the reaction is of interest for medical purposes.¹⁹ A wide range of incident-deuteron energies has been used, but energies of ≈ 7.0 MeV are within the capabilities of a number of modest accelerators and yet still result in the production of very intense neutron fields.

Many of the above applications require a precise knowledge of the neutron spectrum at a variety of angles and incident deuteron energies, resulting from the bombardment of thick beryllium targets. Most important are the yield and spectrum at very-forward reaction angles, but other angles are a consideration in a number of applications. There have been several measurements of the spectra at a 7.0 MeV incident-deuteron energy^{1,2}, with emphasis on the zero-degree reaction angle. These measurements are not entirely independent, as common detector sensitivities were involved, and the angular detail is not appropriate for some integral investigations.²⁰

The present investigations were undertaken to provide a more detailed knowledge of the neutron spectrum resulting from the bombardment of a thick beryllium target with 7.0 MeV deuterons, with particular attention to independent detector calibrations. The measurements were made in explicit support of the cooperative University of Illinois/Argonne National Laboratory studies of the macroscopic interaction of fast neutrons with bulk materials of importance in fusion-energy and other applications.

II. EXPERIMENTAL METHODS

The measurements were made using the time-of-flight technique and the 10-angle detection apparatus long used at the Argonne Fast Neutron Generator for neutron-scattering studies.²¹ The unusual experimental problems were: a very large neutron and γ -ray source intensity (rapidly changing with angle), a range of neutron energies extending over more than an order of magnitude, and a reference standard that was many orders of magnitude less intense than the primary source. The apparatus is designed to optimize sensitivity as it is primarily used for neutron-scattering studies where the interest is in a relatively weak secondary source due to scattering from a small sample.

The energy of the 7.0 MeV incident deuteron beam was determined to $\approx \pm 50$ keV using a time-isochronous magnet system. The beam was focused into a several mm diameter spot on a ≈ 1.5 cm diameter metallic beryllium target sufficiently thick to stop all of the incident deuterons. The beryllium target was mounted on a thin-wall (≈ 0.125 mm thick) stainless-steel tube lined with a tantalum foil thick enough to stop back-scattered deuterons. The chemical purity of the beryllium target was greater than 99%. Alternate targets of high-purity tantalum were used for background determinations.

The deuteron beam was pulsed at a repetition rate of 3.906 kHz, with a burst duration of ≈ 1 nsec. The time scale of interest was 1000 nsec following each burst, divided into ≈ 2 nsec time bins. The very low pulse-repetition rate resulted in average beam currents of a few nano-amps., and a commensurate reduction in source intensity. Backgrounds determined with the alternate tantalum targets were appropriately normalized to the foreground by integrating the beam current and subtracted from the foregrounds. Metering pulsed nano-amp currents with high accuracy is not trivial and some uncertainties were present; however, they made little difference as the backgrounds were very small. Electronic systems counted the number of pulses striking the target so as to guard against undue beam fluctuations.

Ten detectors, placed within a massive shield, were concurrently used. The flight paths from the source to the detectors were defined by precision collimators, and were nominally 5 m long. The exact lengths were determined to within several mm. The ten detectors were located over an arc extending

from 0° to 158° in reaction angle. Three separate settings of the collimator system were used, resulting in 25 separate angular measurements at each measurement period (26 angles were measured but one was redundant). The angles were believed known to better than 0.5° .

The detectors were 12.7 cm diameter, 2 cm thick, organic-liquid scintillators. Fast logic units determined the time of response of each detector. These responses were combined and processed by slower logic using a digital computer. The dead time of the system was governed by the slower logic. Despite the low pulse rates and small deuteron-beam currents, the dead times were large ($\approx 30\%$). Values of this magnitude can be a very serious concern using a conventional single-detector system. However, two of the detectors of the 10-angle system were left fixed in angle at 148° and 158° , respectively. In that region the spectrum does not change rapidly with angle. These two detectors not only determined the spectrum at the respective angles, but also served as monitors to correct for changes in dead times incurred by moving the other eight detectors. Within a given angular setting of the system the dead times cancelled since they were governed by the same circuitry. Pulse-shape discrimination techniques were used to reduce the γ -ray responses of the detectors. However, the source was directly observed by the detectors and it was a prolific γ -ray emitter. Therefore, even though the γ -ray suppression circuitry was very effective, a large number of γ -rays were still observed and they contributed to the dead-time effects.

The time zero was determined to ≈ 1.5 nsec by observing the γ -rays from the target. The time scale of the measurement system was calibrated to a small fraction of a percent using precision delay lines. The reproducibility of the time calibration over a number of months was good.

The relative neutron-detection efficiency of each detector was determined by observing the standard fission-neutron spectrum resulting from ^{252}Cf fission²² in the manner described in ref. 23. The calibrations were independently repeated at each measurement period, and a variety of detector bias points were used. The lowest-energy detector sensitivity was ≈ 300 to 500 keV. The ^{252}Cf calibration method was effective from the detector thresholds to ≈ 10.0 MeV. At higher energies the ^{252}Cf becomes less reliable, and an extrapolation from the lower-energy

sensitivity values was used. The results were reasonable consistent with the predictions of Monte-Carlo calculations²⁴, and calibration uncertainties above 10.0 MeV are not very important as there are few source neutrons in that region and other sources of uncertainty are dominant factors.

III. EXPERIMENTAL RESULTS

The measurements were made in six chronological periods, with four independent ²⁵²Cf detector calibrations. At each measurement period three settings of the 10-angle detector system were used, resulting in 25 spectra distributed in reaction angle between 0° and 158°. The angular settings were the same for all six measurement periods. The first set of measurements was of a preliminary nature, and was not used in constructing the final results. In one measurement set a detector was observed to drift, and those results obtained with that detector were abandoned. The results obtained in five accepted measurement sets were normalized to the same 0° yield, integrating the 0° spectra over the energy region 1.5 to 3.0 MeV. In this energy region, and at this angle, the yield is both large and relatively energy independent. The normalized spectra were combined, angle by angle, propagating the respective statistical uncertainties. A representative set of time spectra, obtained in a given measurement period, are shown in Fig. 1. The various spectra, when normalized as described above, agreed to within a few percent. The spectra are characterized by broad energy-dependent shapes, upon which are superimposed some fine structure. The latter is relatively consistent from set to set. The measurements extended down to ≈ 0.5 MeV. However, below ≈ 0.8 MeV the detector sensitivities were rapidly changing with energy. Thus the low-energy values were less reliable, and therefore the spectra were truncated to a minimum energy of 0.8 MeV. The structure was particularly prominent below this cutoff energy, but it was not clear to what, if any, extent the fluctuations were due to changing detector sensitivities and/or small times-scale effects. No corrections were made for the effect of the air in the ≈ 5 m flight paths as the same flight paths were used for the ²⁵²Cf detector calibrations and thus the effects due to air scattering should cancel out. The individual detector calibrations did show some small fluctuations that could be associated with resonances in oxygen or nitrogen.

The composite time spectra were converted to energy spectra using the known time scales, flight paths and γ -ray positions. The conversion was not relativistic as relativistic effects are

small in regions of appreciable intensity. The resulting energy spectra reflected the fine structure evident in the time spectra. However, the structure remained of relatively small magnitude and thus was not of interest in the integral studies for which the spectra were primarily intended. Therefore, the energy spectra were averaged in energy. A "fine" average was constructed using 100 keV averaging intervals to 6.0 MeV, 200 keV from 6.0 to 10.0 MeV, and 300 keV at higher energies. The resulting averaged spectra are shown in Fig. 2, and the numerical values are listed in the appendix. A "coarse" average, having twice the energy-averaging increments of the "fine" average cited above, is shown in Fig. 3. Residual fluctuations persist in the "fine" average, and can be followed over a number of angles where the results were obtained with entirely different detectors having independent calibrations.

The present results are qualitatively consistent with those of ref. 2, as illustrated by the comparisons of Fig. 4. There are systematic differences of a few percent, particularly in the 3.0 to 5.0 MeV region. The results of ref. 2 were obtained with a single detector whose sensitivity was calibrated using the earlier work of ref. 1. Thus it appears that the detector calibrations of the present work are somewhat different from that of ref. 1. A number of detectors with independent calibrations were used in the present work and the discrepancies with respect to the results of ref. 1 persisted in each. The present results give a good definition of the relative angular distribution of the neutrons at each energy, with values very similar to those of ref. 2. Both sets of results show the influence of stripping reactions at higher energies where $\ell = 1$ and $= 2$ angular-momentum transfer leads to angular distributions peaking at $\approx 15^\circ$ rather than 0° .

Uncertainties associated with the present results are very complex, making quantitative specification very difficult or impossible. The listing of the appendix gives only statistical uncertainties. These are generally very small in regions of appreciable yield. Systematic uncertainties due to detector calibrations and time uncertainties are probably considerably larger. Some guidance is given by the reproducibility of the independent measurements. This reproducibility suggests that the total uncertainties are several percent in the regions of large yield, increasing to 10% or more in regions of low yield. There are also uncertainties due to the measurement resolution function, which is qualitatively represented by the "fine" averaging procedures outline above. No corrections were made for the resolution functions, but their effects would probably be

small as the results obtained with "fine" and "coarse" averages are relatively consistent with one another, and with those of ref. 2, in regions where the energy dependence of yield is rapidly changing. Resolution effects may be more of a concern at higher energies (e.g., ≈ 6.0 MeV).

IV. SUMMARY COMMENT

The present experimental results improve the knowledge of the neutron field resulting from the bombardment of thick beryllium targets with 7.0 MeV deuterons. The results are of particular value for integral tests of differential neutron data and for integral macroscopic studies in support of fusion-energy development.

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FIGURE CAPTIONS

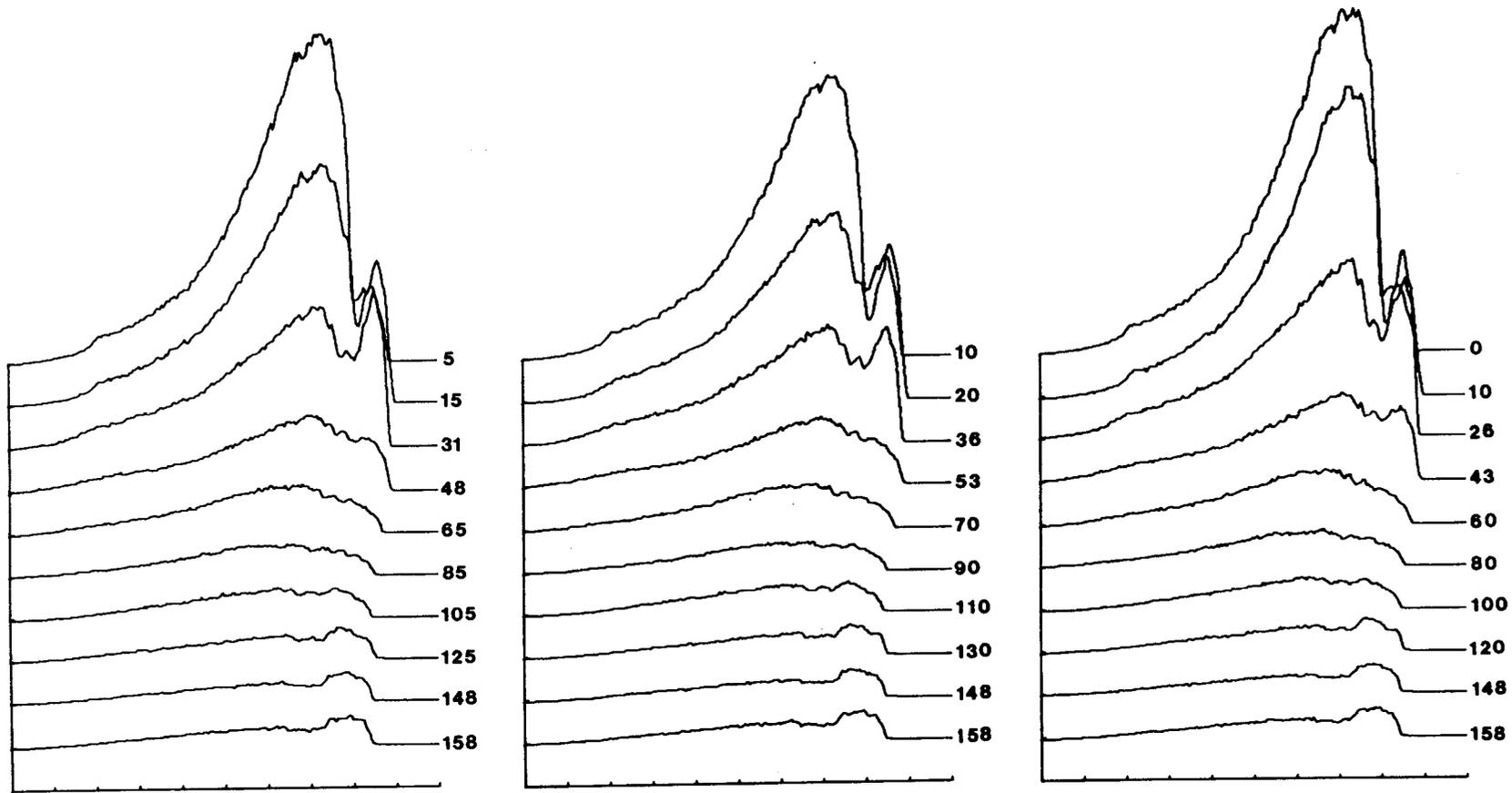
Fig. 1. Illustrative time spectra resulting from the bombardment of a thick beryllium target with 7.0 MeV deuterons. Angles are numerically given in degrees.

Fig. 2. Energy spectra resulting from the bombardment of a thick beryllium target with 7.0 MeV deuterons. Angles are numerically given in degrees. The data have been averaged by 100 keV to 6.0 MeV, by 200 keV from 6.0 to 10.0 MeV, and by 300 keV at higher energies.

Fig. 3. Energy spectra resulting from the bombardment of a thick beryllium target with 7.0 MeV deuterons. Angles are numerically given in degrees. Data have been averaged by 200 keV to 6.0 MeV, by 400 keV from 6.0 to 10.0 MeV, and by 600 keV above 10.0 MeV.

Fig. 4. Illustrative comparisons of the present results (as per Fig. 2, data points) with those of ref. 2 (curves). Reaction angles (in degrees) are cited in each section of the figure.

Relative Intensity



← TIME

FIGURE 1

FIGURE 2

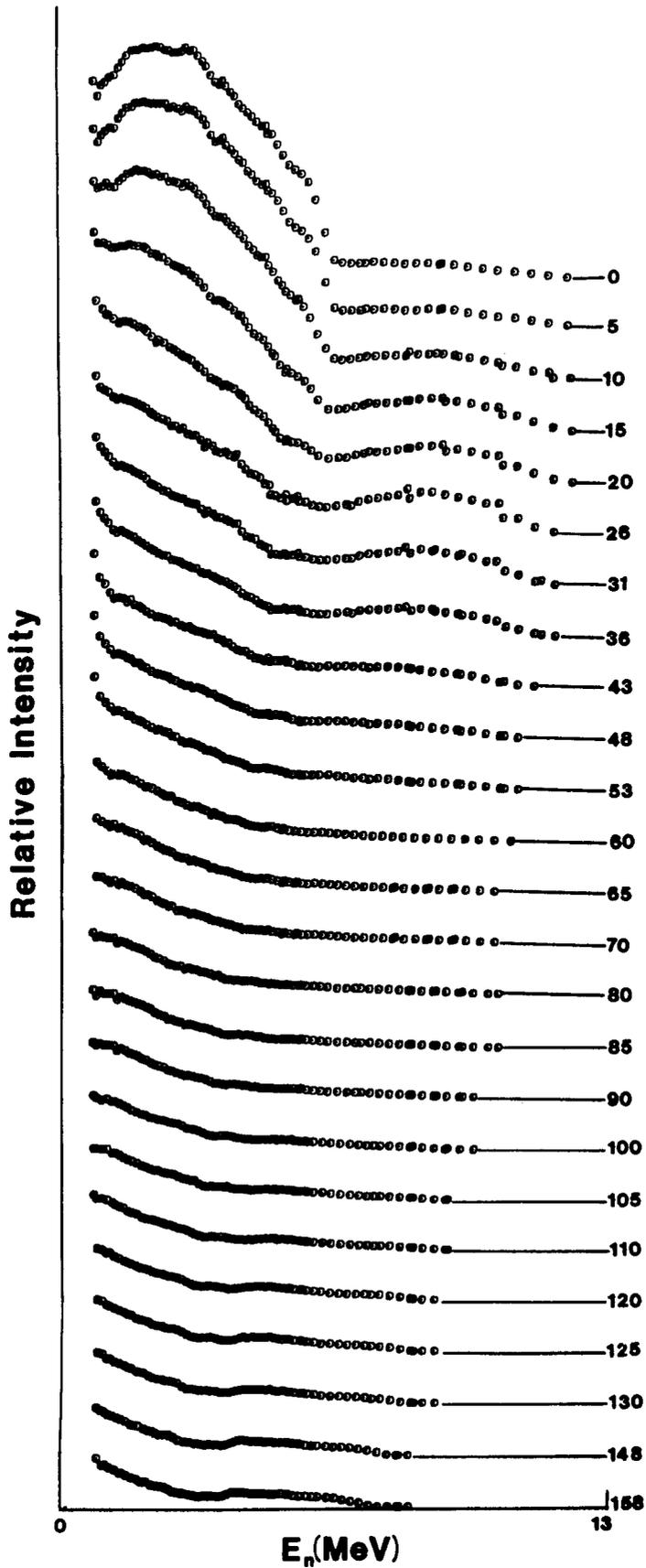


FIGURE 3

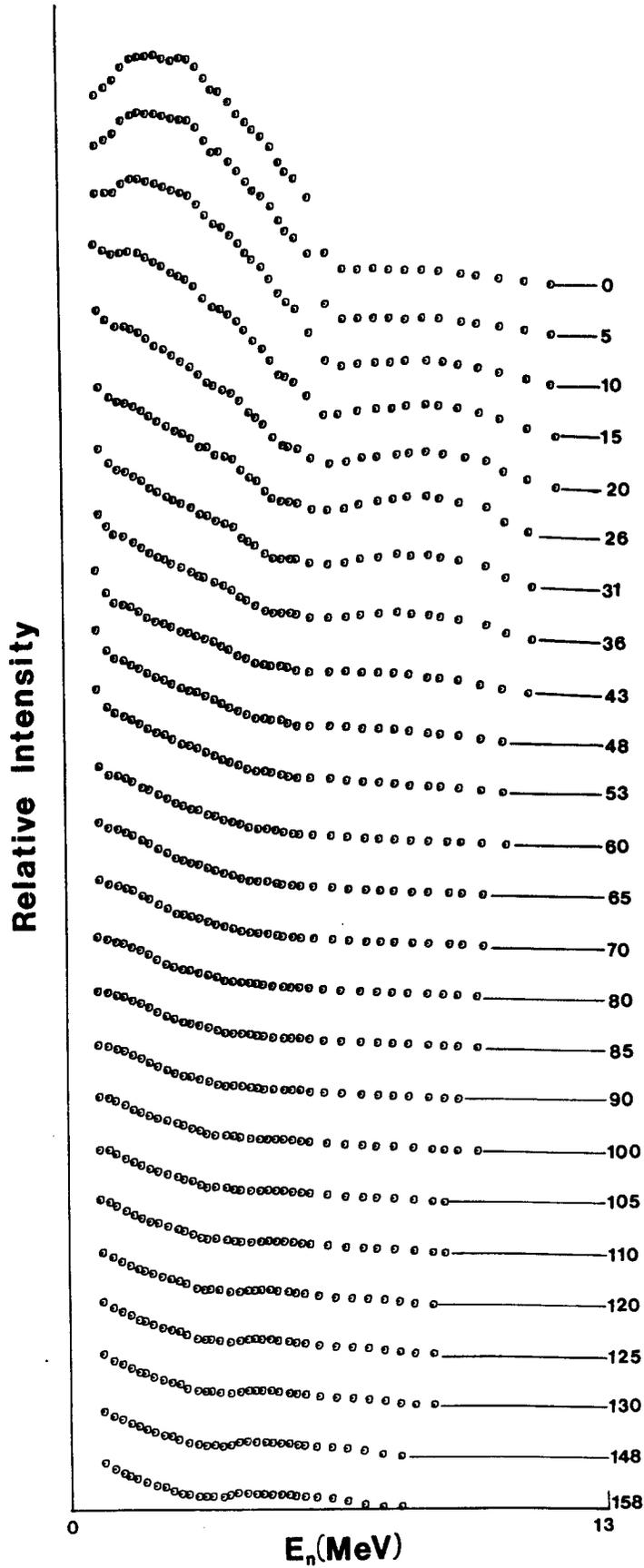
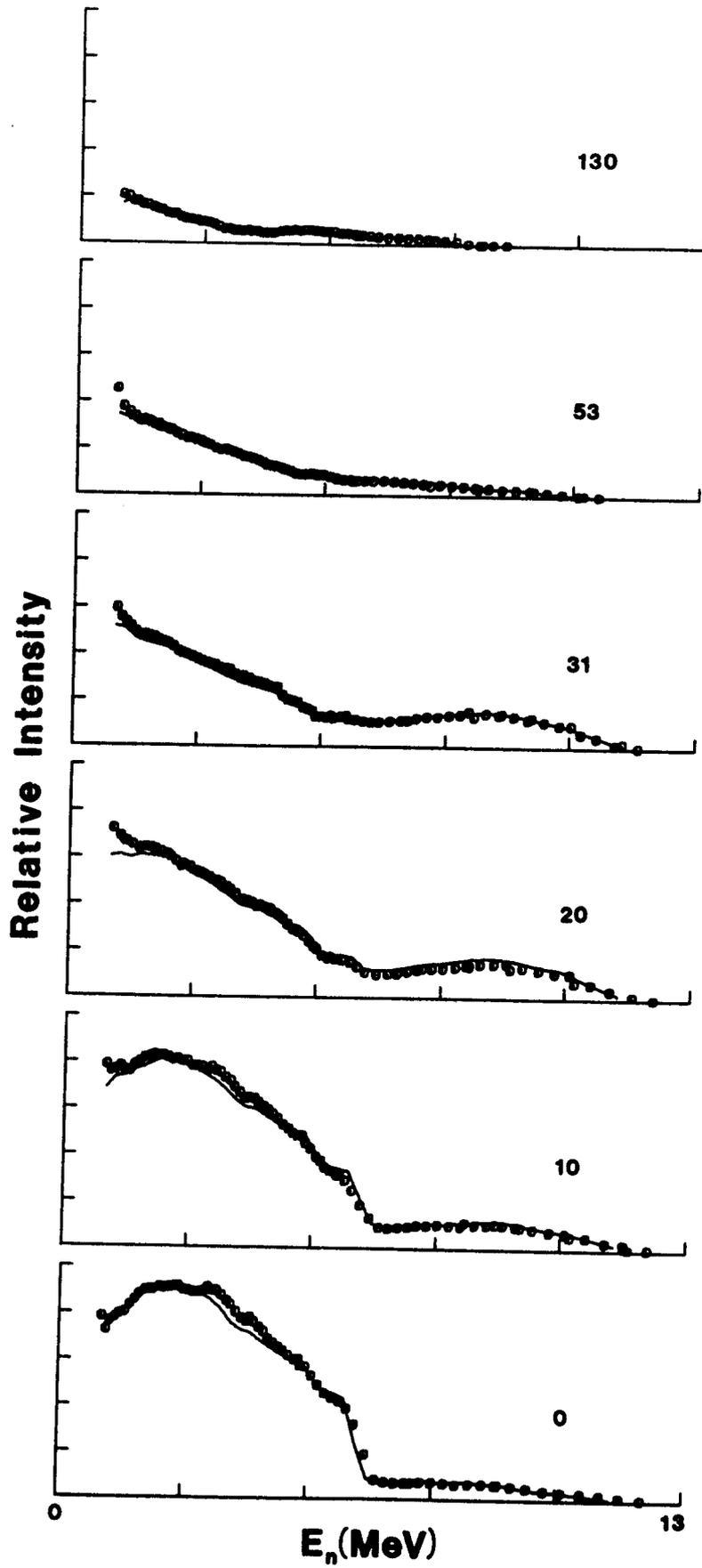


FIGURE 4



APPENDIX

Tabulation of experimental results. The values given are those of the "fine" average defined in the text and illustrated in Fig. 2. The three columns at each angle refer to i) energy (MeV), ii) relative yield, and iii) statistical uncertainty in the relative yield.

ANG=0.0

0.88594E+00 0.11776E+00 0.42420E-03
0.98270E+00 0.10893E+00 0.69665E-03
0.10634E+01 0.11519E+00 0.48427E-03
0.11641E+01 0.11709E+00 0.48047E-03
0.12633E+01 0.11975E+00 0.50842E-03
0.13625E+01 0.12075E+00 0.48333E-03
0.14650E+01 0.12525E+00 0.51112E-03
0.15613E+01 0.12859E+00 0.52522E-03
0.16650E+01 0.13246E+00 0.47630E-03
0.17880E+01 0.13521E+00 0.45196E-03
0.18800E+01 0.13565E+00 0.73247E-03
0.19625E+01 0.13577E+00 0.51441E-03
0.20700E+01 0.13706E+00 0.52977E-03
0.21700E+01 0.13658E+00 0.51211E-03
0.22675E+01 0.13705E+00 0.55085E-03
0.23650E+01 0.13775E+00 0.55034E-03
0.24800E+01 0.13750E+00 0.46256E-03
0.25833E+01 0.13559E+00 0.68667E-03
0.26717E+01 0.13523E+00 0.50997E-03
0.27800E+01 0.13400E+00 0.54507E-03
0.28850E+01 0.13408E+00 0.52805E-03
0.29917E+01 0.13453E+00 0.53508E-03
0.30800E+01 0.13691E+00 0.75314E-03
0.31750E+01 0.13505E+00 0.48774E-03
0.32700E+01 0.13510E+00 0.68028E-03
0.33700E+01 0.13197E+00 0.46676E-03
0.34750E+01 0.12884E+00 0.64164E-03
0.35625E+01 0.12594E+00 0.55039E-03
0.36800E+01 0.12108E+00 0.51094E-03
0.37933E+01 0.11691E+00 0.46933E-03
0.39000E+01 0.11521E+00 0.57205E-03
0.39700E+01 0.11759E+00 0.85517E-03
0.40525E+01 0.11441E+00 0.49847E-03
0.41650E+01 0.11109E+00 0.54896E-03
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0.43600E+01 0.10363E+00 0.51818E-03
0.44600E+01 0.10128E+00 0.50084E-03
0.45650E+01 0.98845E-01 0.47978E-03
0.46750E+01 0.96305E-01 0.46781E-03
0.47850E+01 0.93232E-01 0.45381E-03
0.49050E+01 0.90790E-01 0.44366E-03
0.50100E+01 0.90845E-01 0.64101E-03
0.50400E+01 0.86598E-01 0.57080E-03
0.51500E+01 0.85929E-01 0.41464E-03
0.52850E+01 0.80291E-01 0.39429E-03
0.54150E+01 0.74215E-01 0.37461E-03
0.55550E+01 0.68464E-01 0.35534E-03
0.57050E+01 0.65836E-01 0.34225E-03
0.58550E+01 0.63172E-01 0.33134E-03
0.60150E+01 0.58415E-01 0.31431E-03
0.61850E+01 0.48246E-01 0.28263E-03
0.64100E+01 0.28918E-01 0.18004E-03
0.66250E+01 0.12383E-01 0.14560E-03
0.68200E+01 0.10940E-01 0.13484E-03
0.70200E+01 0.10587E-01 0.13139E-03
0.72300E+01 0.10526E-01 0.12911E-03
0.73600E+01 0.10644E-01 0.17020E-03
0.75600E+01 0.11355E-01 0.13160E-03

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0.98270E+00 0.11034E+00 0.70266E-03
0.10634E+01 0.11468E+00 0.48267E-03
0.11641E+01 0.11690E+00 0.47854E-03
0.12633E+01 0.11887E+00 0.50274E-03
0.13625E+01 0.11853E+00 0.47632E-03
0.14650E+01 0.12427E+00 0.50556E-03
0.15613E+01 0.12744E+00 0.51974E-03
0.16650E+01 0.13055E+00 0.47046E-03
0.17880E+01 0.13071E+00 0.44350E-03
0.18800E+01 0.13335E+00 0.72724E-03
0.19625E+01 0.13319E+00 0.50543E-03
0.20700E+01 0.13428E+00 0.52114E-03
0.21700E+01 0.13324E+00 0.50222E-03
0.22675E+01 0.13292E+00 0.53737E-03
0.23650E+01 0.13294E+00 0.53583E-03
0.24800E+01 0.13284E+00 0.44700E-03
0.25833E+01 0.13296E+00 0.67703E-03
0.26717E+01 0.13008E+00 0.49312E-03
0.27800E+01 0.13082E+00 0.52189E-03
0.28850E+01 0.12957E+00 0.50975E-03
0.29917E+01 0.12814E+00 0.51777E-03
0.30800E+01 0.13071E+00 0.73451E-03
0.31750E+01 0.12909E+00 0.47259E-03
0.32700E+01 0.12857E+00 0.66126E-03
0.33700E+01 0.12613E+00 0.45202E-03
0.34750E+01 0.12347E+00 0.62423E-03
0.35625E+01 0.11999E+00 0.53590E-03
0.36800E+01 0.11397E+00 0.49268E-03
0.37933E+01 0.11001E+00 0.44981E-03
0.39000E+01 0.11077E+00 0.55588E-03
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0.42600E+01 0.10339E+00 0.51488E-03
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0.44600E+01 0.97911E-01 0.48313E-03
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0.61850E+01 0.46157E-01 0.27526E-03
0.64100E+01 0.27566E-01 0.17549E-03
0.66250E+01 0.12776E-01 0.14503E-03
0.68200E+01 0.11159E-01 0.13506E-03
0.70200E+01 0.11112E-01 0.13167E-03
0.72300E+01 0.11195E-01 0.12878E-03
0.73600E+01 0.11929E-01 0.17404E-03

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0.10695E+01 0.11499E+00 0.35889E-03
0.11703E+01 0.11722E+00 0.33076E-03
0.12695E+01 0.11483E+00 0.32456E-03
0.13694E+01 0.11433E+00 0.30642E-03
0.14725E+01 0.11805E+00 0.31956E-03
0.15684E+01 0.12004E+00 0.32413E-03
0.16716E+01 0.12261E+00 0.30351E-03
0.17847E+01 0.12340E+00 0.30040E-03
0.18774E+01 0.12480E+00 0.37934E-03
0.19652E+01 0.12396E+00 0.32026E-03
0.20687E+01 0.12394E+00 0.32166E-03
0.21692E+01 0.12330E+00 0.31031E-03
0.22696E+01 0.12173E+00 0.32118E-03
0.23700E+01 0.12195E+00 0.31783E-03
0.24812E+01 0.12062E+00 0.30182E-03
0.25769E+01 0.12070E+00 0.36118E-03
0.26710E+01 0.11785E+00 0.30599E-03
0.27775E+01 0.11781E+00 0.31701E-03
0.28800E+01 0.11699E+00 0.32048E-03
0.29860E+01 0.11445E+00 0.32001E-03
0.30833E+01 0.11700E+00 0.35825E-03
0.31800E+01 0.11472E+00 0.32100E-03
0.32738E+01 0.11339E+00 0.36491E-03
0.33738E+01 0.11006E+00 0.30305E-03
0.34787E+01 0.10799E+00 0.34349E-03
0.35706E+01 0.10417E+00 0.32799E-03
0.36775E+01 0.10057E+00 0.30864E-03
0.37820E+01 0.97318E-01 0.29957E-03
0.38825E+01 0.96931E-01 0.30637E-03
0.39864E+01 0.96529E-01 0.33084E-03
0.40729E+01 0.94104E-01 0.32588E-03
0.41744E+01 0.91832E-01 0.30433E-03
0.42750E+01 0.89489E-01 0.30264E-03
0.43750E+01 0.86914E-01 0.29279E-03
0.44775E+01 0.84100E-01 0.28472E-03
0.45813E+01 0.80091E-01 0.27299E-03
0.46925E+01 0.77742E-01 0.26555E-03
0.47900E+01 0.74497E-01 0.31400E-03
0.48925E+01 0.73172E-01 0.24961E-03
0.49850E+01 0.73314E-01 0.33974E-03
0.50533E+01 0.68312E-01 0.25966E-03
0.51700E+01 0.64548E-01 0.22719E-03
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0.57700E+01 0.48481E-01 0.29954E-03
0.58788E+01 0.44028E-01 0.17547E-03
0.60388E+01 0.37643E-01 0.16179E-03
0.62050E+01 0.28174E-01 0.14017E-03
0.64070E+01 0.19612E-01 0.10653E-03
0.66037E+01 0.13671E-01 0.94161E-04
0.67938E+01 0.13032E-01 0.90532E-04
0.69937E+01 0.13468E-01 0.89638E-04

0.77900E+01 0.10879E-01 0.13033E-03
0.80400E+01 0.10471E-01 0.12308E-03
0.82950E+01 0.98538E-02 0.11259E-03
0.85650E+01 0.10143E-01 0.11257E-03
0.88450E+01 0.10086E-01 0.11163E-03
0.91200E+01 0.93818E-02 0.15085E-03
0.91700E+01 0.97602E-02 0.14806E-03
0.94550E+01 0.88608E-02 0.10248E-03
0.97850E+01 0.76521E-02 0.94624E-04
0.10150E+02 0.63402E-02 0.84840E-04
0.10500E+02 0.53435E-02 0.78637E-04
0.10900E+02 0.43952E-02 0.70138E-04
0.11300E+02 0.33858E-02 0.62918E-04
0.11700E+02 0.22115E-02 0.51778E-04
0.12150E+02 0.89918E-03 0.37988E-04

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0.77900E+01 0.11956E-01 0.12739E-03
0.80400E+01 0.11820E-01 0.12333E-03
0.82950E+01 0.10946E-01 0.11487E-03
0.85650E+01 0.11076E-01 0.11426E-03
0.88450E+01 0.11572E-01 0.11573E-03
0.91200E+01 0.11184E-01 0.16106E-03
0.91700E+01 0.11545E-01 0.16000E-03
0.94550E+01 0.10979E-01 0.11040E-03
0.97850E+01 0.92902E-02 0.99560E-04
0.10150E+02 0.80350E-02 0.91250E-04
0.10500E+02 0.68714E-02 0.84131E-04
0.10900E+02 0.60094E-02 0.76756E-04
0.11300E+02 0.45735E-02 0.67310E-04
0.11700E+02 0.29472E-02 0.52521E-04
0.12150E+02 0.13202E-02 0.34624E-04

0.72025E+01 0.14080E-01 0.89604E-04
0.73800E+01 0.15018E-01 0.10213E-03
0.75863E+01 0.14930E-01 0.90479E-04
0.78200E+01 0.15385E-01 0.90574E-04
0.80700E+01 0.15267E-01 0.88792E-04
0.83033E+01 0.14716E-01 0.10465E-03
0.83850E+01 0.17244E-01 0.15348E-03
0.85950E+01 0.15837E-01 0.87778E-04
0.88567E+01 0.15861E-01 0.10644E-03
0.90325E+01 0.16109E-01 0.11720E-03
0.91950E+01 0.15808E-01 0.97843E-04
0.94667E+01 0.14754E-01 0.10092E-03
0.95600E+01 0.14002E-01 0.13313E-03
0.98212E+01 0.13161E-01 0.77400E-04
0.10175E+02 0.11845E-01 0.73166E-04
0.10500E+02 0.10430E-01 0.82424E-04
0.10600E+02 0.85964E-02 0.10023E-03
0.10925E+02 0.78759E-02 0.59218E-04
0.11325E+02 0.51348E-02 0.47668E-04
0.11700E+02 0.43449E-02 0.61691E-04
0.11800E+02 0.11587E-02 0.33032E-04
0.12200E+02 0.10363E-02 0.20761E-04

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0.97422E+00 0.11256E+00 0.69604E-03
0.11029E+01 0.11254E+00 0.50941E-03
0.12067E+01 0.11126E+00 0.50106E-03
0.13078E+01 0.10966E+00 0.49976E-03
0.14067E+01 0.10987E+00 0.47898E-03
0.15067E+01 0.11046E+00 0.49626E-03
0.16080E+01 0.11040E+00 0.45669E-03
0.17117E+01 0.11151E+00 0.48688E-03
0.18106E+01 0.11096E+00 0.47822E-03
0.19303E+01 0.11061E+00 0.39676E-03
0.20600E+01 0.11020E+00 0.63177E-03
0.21322E+01 0.10888E+00 0.46411E-03
0.22450E+01 0.10615E+00 0.38393E-03
0.23600E+01 0.10579E+00 0.61096E-03
0.24083E+01 0.10426E+00 0.44009E-03
0.25100E+01 0.10355E+00 0.49496E-03
0.26293E+01 0.10129E+00 0.37138E-03
0.27650E+01 0.99411E-01 0.60132E-03
0.28488E+01 0.97966E-01 0.40000E-03
0.29500E+01 0.97230E-01 0.61422E-03
0.30067E+01 0.95629E-01 0.42076E-03
0.30950E+01 0.95800E-01 0.54391E-03
0.31867E+01 0.93404E-01 0.52868E-03
0.32800E+01 0.91850E-01 0.43011E-03
0.33783E+01 0.88942E-01 0.49842E-03
0.35000E+01 0.85634E-01 0.34990E-03
0.36360E+01 0.80645E-01 0.37220E-03
0.37500E+01 0.77963E-01 0.61540E-03

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0.92539E+00 0.10858E+00 0.46840E-03
0.10744E+01 0.10383E+00 0.57538E-03
0.11600E+01 0.10067E+00 0.79877E-03
0.12067E+01 0.99937E-01 0.45506E-03
0.13347E+01 0.97980E-01 0.35016E-03
0.14700E+01 0.95344E-01 0.67701E-03
0.15067E+01 0.96071E-01 0.44386E-03
0.16080E+01 0.96572E-01 0.40953E-03
0.17117E+01 0.96074E-01 0.43112E-03
0.18106E+01 0.94930E-01 0.42497E-03
0.19303E+01 0.93435E-01 0.34817E-03
0.20600E+01 0.92258E-01 0.54689E-03
0.21322E+01 0.90598E-01 0.40644E-03
0.22450E+01 0.87606E-01 0.33741E-03
0.23600E+01 0.84144E-01 0.53977E-03
0.24083E+01 0.85255E-01 0.38267E-03
0.25360E+01 0.84195E-01 0.33673E-03
0.26656E+01 0.81340E-01 0.38603E-03
0.27650E+01 0.80257E-01 0.51270E-03
0.28488E+01 0.78588E-01 0.34618E-03
0.29500E+01 0.76898E-01 0.54208E-03
0.30067E+01 0.75592E-01 0.35998E-03
0.30950E+01 0.75012E-01 0.45701E-03
0.31867E+01 0.73876E-01 0.45096E-03
0.33038E+01 0.70913E-01 0.29793E-03
0.33800E+01 0.69384E-01 0.58827E-03
0.35000E+01 0.66741E-01 0.30010E-03
0.36360E+01 0.63150E-01 0.31484E-03
0.37500E+01 0.61957E-01 0.51820E-03

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0.11119E+01 0.86987E-01 0.40580E-03
0.12144E+01 0.85805E-01 0.40087E-03
0.13142E+01 0.83090E-01 0.39686E-03
0.14133E+01 0.81416E-01 0.38780E-03
0.15150E+01 0.82066E-01 0.38456E-03
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0.17095E+01 0.80681E-01 0.36490E-03
0.18117E+01 0.79773E-01 0.40008E-03
0.19087E+01 0.78350E-01 0.37706E-03
0.20050E+01 0.77174E-01 0.38871E-03
0.21000E+01 0.76142E-01 0.37270E-03
0.22050E+01 0.73781E-01 0.35499E-03
0.22700E+01 0.72602E-01 0.50275E-03
0.23650E+01 0.70979E-01 0.37049E-03
0.24933E+01 0.69525E-01 0.29179E-03
0.26100E+01 0.68540E-01 0.37176E-03
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0.28050E+01 0.65617E-01 0.34710E-03
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0.29800E+01 0.64451E-01 0.47598E-03
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0.39500E+01 0.77525E-01 0.64113E-03
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0.43500E+01 0.69814E-01 0.40974E-03
0.44100E+01 0.69254E-01 0.57313E-03
0.44900E+01 0.66234E-01 0.39152E-03
0.45933E+01 0.62679E-01 0.37388E-03
0.47033E+01 0.58804E-01 0.35723E-03
0.48133E+01 0.57290E-01 0.34909E-03
0.49333E+01 0.55398E-01 0.33748E-03
0.50400E+01 0.51341E-01 0.42006E-03
0.51400E+01 0.47355E-01 0.30076E-03
0.52100E+01 0.45679E-01 0.42777E-03
0.53133E+01 0.40471E-01 0.27664E-03
0.54400E+01 0.35911E-01 0.33842E-03
0.54800E+01 0.38294E-01 0.38024E-03
0.55933E+01 0.35583E-01 0.24939E-03
0.57367E+01 0.33795E-01 0.24064E-03
0.58967E+01 0.30915E-01 0.22684E-03
0.60567E+01 0.26536E-01 0.20902E-03
0.62167E+01 0.19973E-01 0.17931E-03
0.64620E+01 0.14559E-01 0.11933E-03
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0.73067E+01 0.16968E-01 0.15283E-03
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0.76033E+01 0.17718E-01 0.15408E-03
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0.83900E+01 0.19287E-01 0.22147E-03
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0.92500E+01 0.18662E-01 0.20788E-03
0.95133E+01 0.18589E-01 0.14953E-03
0.98467E+01 0.17281E-01 0.14422E-03
0.10200E+02 0.15296E-01 0.13434E-03
0.10500E+02 0.14829E-01 0.17635E-03
0.10600E+02 0.10371E-01 0.14588E-03
0.10933E+02 0.97210E-02 0.10928E-03
0.11333E+02 0.59176E-02 0.84840E-04
0.11800E+02 0.25841E-02 0.58088E-04
0.12233E+02 0.25128E-03 0.17779E-04

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0.12075E+01 0.77686E-01 0.33541E-03
0.13082E+01 0.74314E-01 0.32354E-03
0.14075E+01 0.72114E-01 0.32319E-03

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0.39500E+01 0.58695E-01 0.55419E-03
0.40100E+01 0.59480E-01 0.37712E-03
0.41150E+01 0.57940E-01 0.34672E-03
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0.43500E+01 0.54268E-01 0.34669E-03
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0.44900E+01 0.50746E-01 0.32769E-03
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0.47033E+01 0.44308E-01 0.29681E-03
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0.49333E+01 0.40302E-01 0.27511E-03
0.50400E+01 0.36790E-01 0.33805E-03
0.51400E+01 0.33356E-01 0.24283E-03
0.52100E+01 0.31375E-01 0.35193E-03
0.53133E+01 0.27592E-01 0.21822E-03
0.54400E+01 0.25845E-01 0.26899E-03
0.54800E+01 0.26723E-01 0.31623E-03
0.55933E+01 0.25135E-01 0.20122E-03
0.57367E+01 0.24861E-01 0.19785E-03
0.58967E+01 0.22967E-01 0.18698E-03
0.60567E+01 0.19931E-01 0.17288E-03
0.62167E+01 0.16804E-01 0.15628E-03
0.64620E+01 0.15226E-01 0.11537E-03
0.66967E+01 0.15619E-01 0.14646E-03
0.68933E+01 0.15773E-01 0.14443E-03
0.71000E+01 0.17146E-01 0.14870E-03
0.73067E+01 0.18145E-01 0.15102E-03
0.74200E+01 0.19284E-01 0.23258E-03
0.76033E+01 0.18960E-01 0.15255E-03
0.78400E+01 0.19278E-01 0.15225E-03
0.80900E+01 0.20105E-01 0.15382E-03
0.83200E+01 0.20999E-01 0.20399E-03
0.83900E+01 0.20864E-01 0.22756E-03
0.86133E+01 0.22118E-01 0.15845E-03
0.89033E+01 0.22198E-01 0.15828E-03
0.91700E+01 0.22833E-01 0.20908E-03
0.92500E+01 0.19087E-01 0.20846E-03
0.95133E+01 0.20033E-01 0.14810E-03
0.98467E+01 0.18524E-01 0.14259E-03
0.10200E+02 0.16749E-01 0.13472E-03
0.10500E+02 0.16234E-01 0.17377E-03
0.10600E+02 0.10415E-01 0.14546E-03
0.10933E+02 0.98263E-02 0.10458E-03
0.11333E+02 0.56619E-02 0.79513E-04
0.11800E+02 0.21471E-02 0.48914E-04
0.12233E+02 0.16132E-03 0.11857E-04

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0.99604E+00 0.75643E-01 0.37110E-03
0.10941E+01 0.72228E-01 0.35745E-03
0.11957E+01 0.69473E-01 0.34022E-03
0.12977E+01 0.65159E-01 0.32899E-03
0.13968E+01 0.63829E-01 0.32772E-03

0.37700E+01 0.50480E-01 0.48639E-03
0.38917E+01 0.49812E-01 0.25247E-03
0.40150E+01 0.50000E-01 0.34267E-03
0.41050E+01 0.48283E-01 0.33215E-03
0.42225E+01 0.46824E-01 0.28537E-03
0.42800E+01 0.48587E-01 0.47818E-03
0.43900E+01 0.42745E-01 0.30042E-03
0.44950E+01 0.39718E-01 0.28694E-03
0.46000E+01 0.37270E-01 0.27298E-03
0.47100E+01 0.36340E-01 0.26753E-03
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0.49400E+01 0.31361E-01 0.24201E-03
0.50500E+01 0.30421E-01 0.34500E-03
0.50800E+01 0.24760E-01 0.28879E-03
0.51900E+01 0.24333E-01 0.21031E-03
0.53250E+01 0.23055E-01 0.20040E-03
0.54400E+01 0.24753E-01 0.30033E-03
0.54700E+01 0.21198E-01 0.25632E-03
0.56050E+01 0.22574E-01 0.19305E-03
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0.59050E+01 0.20361E-01 0.17871E-03
0.60650E+01 0.18683E-01 0.16966E-03
0.62300E+01 0.17614E-01 0.16428E-03
0.64000E+01 0.17138E-01 0.15914E-03
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0.69900E+01 0.17931E-01 0.21020E-03
0.71750E+01 0.20564E-01 0.16464E-03
0.73900E+01 0.21558E-01 0.16775E-03
0.76200E+01 0.22493E-01 0.16948E-03
0.78500E+01 0.23220E-01 0.17086E-03
0.81000E+01 0.23944E-01 0.17208E-03
0.83300E+01 0.27561E-01 0.27141E-03
0.83800E+01 0.22156E-01 0.21651E-03
0.86250E+01 0.25776E-01 0.17527E-03
0.89150E+01 0.25584E-01 0.17332E-03
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0.95250E+01 0.22553E-01 0.16128E-03
0.98550E+01 0.20833E-01 0.15350E-03
0.10200E+02 0.18853E-01 0.14514E-03
0.10500E+02 0.18891E-01 0.21838E-03
0.10600E+02 0.10100E-01 0.13096E-03
0.10950E+02 0.97004E-02 0.10409E-03
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0.12274E+01 0.57347E-01 0.30123E-03
0.13145E+01 0.53741E-01 0.37630E-03
0.14037E+01 0.54392E-01 0.23817E-03

0.15080E+01 0.72305E-01 0.31931E-03
0.16030E+01 0.71303E-01 0.32943E-03
0.17041E+01 0.70547E-01 0.30347E-03
0.18053E+01 0.68753E-01 0.32304E-03
0.19045E+01 0.67838E-01 0.30441E-03
0.20020E+01 0.66514E-01 0.31620E-03
0.20967E+01 0.64649E-01 0.30203E-03
0.22013E+01 0.61872E-01 0.28669E-03
0.22789E+01 0.60806E-01 0.36457E-03
0.23700E+01 0.59613E-01 0.30447E-03
0.24907E+01 0.57888E-01 0.24539E-03
0.26047E+01 0.56790E-01 0.28973E-03
0.27050E+01 0.55068E-01 0.28770E-03
0.28050E+01 0.54156E-01 0.27852E-03
0.29090E+01 0.53195E-01 0.26800E-03
0.29833E+01 0.52809E-01 0.39245E-03
0.30900E+01 0.50791E-01 0.26460E-03
0.31990E+01 0.50038E-01 0.24339E-03
0.32867E+01 0.49660E-01 0.35833E-03
0.34014E+01 0.46805E-01 0.24730E-03
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0.35667E+01 0.45582E-01 0.32770E-03
0.36943E+01 0.44144E-01 0.23029E-03
0.37800E+01 0.42202E-01 0.35498E-03
0.38900E+01 0.41565E-01 0.21318E-03
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0.41050E+01 0.39370E-01 0.29837E-03
0.42150E+01 0.38122E-01 0.22023E-03
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0.43980E+01 0.33254E-01 0.23440E-03
0.45020E+01 0.30467E-01 0.22176E-03
0.46080E+01 0.29787E-01 0.21498E-03
0.47180E+01 0.28708E-01 0.20955E-03
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0.74020E+01 0.19648E-01 0.14045E-03
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0.19860E+01 0.48022E-01 0.26418E-03
0.20867E+01 0.46188E-01 0.26543E-03
0.22052E+01 0.44357E-01 0.22888E-03
0.23211E+01 0.43047E-01 0.31049E-03
0.23920E+01 0.43066E-01 0.26821E-03
0.25031E+01 0.42137E-01 0.22013E-03
0.26078E+01 0.41383E-01 0.31180E-03
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0.39100E+01 0.29019E-01 0.26610E-03
0.39775E+01 0.27452E-01 0.22839E-03
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0.48080E+01 0.17580E-01 0.17015E-03
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0.54200E+01 0.16948E-01 0.26347E-03
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0.10633E+02 0.88919E-02 0.10398E-03
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0.11820E+02 0.44726E-03 0.20708E-04

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0.86375E+01 0.17364E-01 0.13772E-03
0.89067E+01 0.17006E-01 0.15794E-03
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0.96000E+01 0.13126E-01 0.23443E-03
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0.10650E+02 0.59130E-02 0.10247E-03
0.10950E+02 0.45231E-02 0.70494E-04
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0.10160E+02 0.48893E-02 0.68066E-04
0.10500E+02 0.30724E-02 0.92432E-04
0.10600E+02 0.31099E-02 0.63496E-04
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0.11052E+01 0.57439E-01 0.25683E-03
0.12274E+01 0.53598E-01 0.29026E-03
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0.18052E+01 0.45912E-01 0.22793E-03
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0.19860E+01 0.44133E-01 0.25405E-03
0.20867E+01 0.43021E-01 0.25685E-03
0.22052E+01 0.41064E-01 0.22016E-03
0.23211E+01 0.39732E-01 0.30270E-03
0.23920E+01 0.39373E-01 0.25579E-03
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0.26910E+01 0.36211E-01 0.24205E-03
0.27890E+01 0.35438E-01 0.23444E-03
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0.35910E+01 0.28535E-01 0.17972E-03
0.37000E+01 0.27224E-01 0.25729E-03
0.38029E+01 0.25429E-01 0.19446E-03
0.39100E+01 0.24512E-01 0.24054E-03
0.39775E+01 0.23555E-01 0.20920E-03
0.40717E+01 0.22482E-01 0.25966E-03
0.41680E+01 0.20855E-01 0.18255E-03
0.42780E+01 0.20206E-01 0.19569E-03
0.43780E+01 0.19420E-01 0.18929E-03

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0.12274E+01 0.49966E-01 0.27050E-03
0.13145E+01 0.47760E-01 0.34682E-03
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0.17150E+01 0.45006E-01 0.31589E-03
0.18052E+01 0.43043E-01 0.21267E-03
0.19200E+01 0.42181E-01 0.30955E-03
0.19860E+01 0.41452E-01 0.23660E-03
0.20867E+01 0.39629E-01 0.23610E-03
0.22052E+01 0.37938E-01 0.20541E-03
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0.25031E+01 0.35796E-01 0.19236E-03
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0.26910E+01 0.33040E-01 0.22223E-03
0.27890E+01 0.32336E-01 0.21651E-03
0.29071E+01 0.30284E-01 0.20039E-03
0.30200E+01 0.28999E-01 0.21169E-03
0.31133E+01 0.29455E-01 0.25616E-03
0.31960E+01 0.28402E-01 0.22185E-03
0.32920E+01 0.27734E-01 0.22615E-03
0.33930E+01 0.26551E-01 0.20830E-03
0.34920E+01 0.24966E-01 0.22375E-03
0.35910E+01 0.24529E-01 0.16148E-03
0.37000E+01 0.23545E-01 0.23120E-03
0.38029E+01 0.22402E-01 0.17515E-03
0.39100E+01 0.20918E-01 0.21665E-03
0.39775E+01 0.19790E-01 0.18346E-03
0.40717E+01 0.19348E-01 0.23556E-03
0.41680E+01 0.18669E-01 0.16610E-03
0.42780E+01 0.17750E-01 0.17598E-03
0.43780E+01 0.16816E-01 0.16951E-03

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0.12350E+01 0.40412E-01 0.41904E-03
0.13133E+01 0.43226E-01 0.23481E-03
0.14300E+01 0.40302E-01 0.41556E-03
0.14930E+01 0.41439E-01 0.27973E-03
0.15980E+01 0.40029E-01 0.25978E-03
0.17013E+01 0.38654E-01 0.27088E-03
0.18158E+01 0.37713E-01 0.22769E-03
0.19450E+01 0.35559E-01 0.23566E-03
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0.21034E+01 0.33857E-01 0.24972E-03
0.22178E+01 0.33040E-01 0.22175E-03
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0.51740E+01 0.14791E-01 0.14959E-03
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0.86040E+01 0.72247E-02 0.86091E-04
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0.98300E+01 0.43217E-02 0.63896E-04
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0.80740E+01 0.61938E-02 0.78065E-04
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0.86040E+01 0.49584E-02 0.68689E-04
0.88880E+01 0.43573E-02 0.63722E-04
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0.68250E+01 0.54768E-02 0.81564E-04
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0.72400E+01 0.45816E-02 0.71667E-04
0.74600E+01 0.41830E-02 0.67251E-04
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0.79300E+01 0.36973E-02 0.61370E-04
0.81850E+01 0.34151E-02 0.57501E-04
0.84500E+01 0.30234E-02 0.53732E-04
0.87250E+01 0.25755E-02 0.47880E-04
0.90250E+01 0.24597E-02 0.46009E-04
0.93300E+01 0.21739E-02 0.42731E-04
0.96550E+01 0.18997E-02 0.39269E-04
0.99850E+01 0.14045E-02 0.32768E-04
0.10350E+02 0.90657E-03 0.25991E-04
0.10750E+02 0.44801E-03 0.17922E-04

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0.12171E+01 0.40022E-01 0.33201E-03
0.13086E+01 0.41685E-01 0.21062E-03
0.14133E+01 0.39247E-01 0.31948E-03
0.14904E+01 0.39764E-01 0.24175E-03
0.15960E+01 0.38299E-01 0.22380E-03
0.16990E+01 0.36710E-01 0.23378E-03
0.18125E+01 0.36062E-01 0.20061E-03
0.19340E+01 0.34801E-01 0.21309E-03
0.20267E+01 0.32274E-01 0.29073E-03
0.20967E+01 0.32573E-01 0.21792E-03
0.22114E+01 0.30977E-01 0.19371E-03
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0.11340E+01 0.38977E-01 0.23423E-03
0.12171E+01 0.37360E-01 0.31398E-03
0.13086E+01 0.38550E-01 0.19439E-03
0.14133E+01 0.36038E-01 0.29972E-03
0.14904E+01 0.37138E-01 0.22484E-03
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0.16990E+01 0.34898E-01 0.21895E-03
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0.19340E+01 0.32167E-01 0.19941E-03
0.20267E+01 0.30255E-01 0.27833E-03
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0.25089E+01 0.26546E-01 0.26029E-03
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0.51840E+01 0.67568E-02 0.98295E-04
0.53050E+01 0.64121E-02 0.10789E-03
0.54033E+01 0.64047E-02 0.12250E-03
0.54700E+01 0.64230E-02 0.11825E-03
0.55940E+01 0.61659E-02 0.90298E-04
0.57200E+01 0.60793E-02 0.14374E-03
0.57600E+01 0.62581E-02 0.11330E-03
0.58940E+01 0.58984E-02 0.85708E-04
0.60540E+01 0.55309E-02 0.81966E-04
0.62200E+01 0.52618E-02 0.78938E-04
0.63960E+01 0.47316E-02 0.72480E-04
0.66200E+01 0.42228E-02 0.58343E-04
0.68420E+01 0.42353E-02 0.67082E-04
0.70460E+01 0.39213E-02 0.63284E-04
0.71833E+01 0.39999E-02 0.81182E-04
0.73820E+01 0.36832E-02 0.60233E-04
0.76060E+01 0.34021E-02 0.56895E-04
0.78420E+01 0.31741E-02 0.54572E-04
0.80880E+01 0.27770E-02 0.50317E-04
0.83100E+01 0.26180E-02 0.79498E-04
0.83733E+01 0.25495E-02 0.59642E-04
0.86180E+01 0.22637E-02 0.43839E-04
0.88850E+01 0.19186E-02 0.44377E-04
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0.92000E+01 0.15370E-02 0.35229E-04
0.94950E+01 0.91289E-03 0.29219E-04
0.95800E+01 0.13339E-02 0.72164E-04
0.98420E+01 0.50835E-03 0.19000E-04
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0.10433E+02 0.14456E-03 0.12788E-04

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0.10683E+01 0.33450E-01 0.23391E-03
0.11660E+01 0.33483E-01 0.23523E-03
0.12891E+01 0.33199E-01 0.19074E-03
0.13753E+01 0.29848E-01 0.29809E-03
0.14617E+01 0.31313E-01 0.21596E-03
0.15662E+01 0.30112E-01 0.21712E-03
0.16636E+01 0.28852E-01 0.20695E-03
0.17680E+01 0.28263E-01 0.20399E-03
0.18670E+01 0.27275E-01 0.21199E-03
0.19620E+01 0.26604E-01 0.20264E-03
0.20640E+01 0.25348E-01 0.19977E-03
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0.22673E+01 0.22195E-01 0.19229E-03
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0.25800E+01 0.18092E-01 0.22812E-03
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0.27750E+01 0.17058E-01 0.16238E-03
0.28850E+01 0.16630E-01 0.14887E-03
0.29867E+01 0.15044E-01 0.19139E-03
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0.42860E+01 0.91426E-02 0.12814E-03
0.43880E+01 0.86320E-02 0.12416E-03
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0.45920E+01 0.83585E-02 0.11674E-03
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0.50700E+01 0.66242E-02 0.12349E-03
0.51840E+01 0.61583E-02 0.94450E-04
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0.54033E+01 0.60928E-02 0.11888E-03
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0.57600E+01 0.60892E-02 0.10908E-03
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0.10683E+01 0.32210E-01 0.22098E-03
0.11660E+01 0.31974E-01 0.22301E-03
0.12891E+01 0.31845E-01 0.18019E-03
0.13753E+01 0.28849E-01 0.29039E-03
0.14617E+01 0.29909E-01 0.20468E-03
0.15662E+01 0.28723E-01 0.20531E-03
0.16636E+01 0.27175E-01 0.19512E-03
0.17680E+01 0.26433E-01 0.19053E-03
0.18670E+01 0.25658E-01 0.19847E-03
0.19620E+01 0.24198E-01 0.18653E-03
0.20640E+01 0.23128E-01 0.18493E-03
0.21660E+01 0.21723E-01 0.17343E-03
0.22673E+01 0.20657E-01 0.17992E-03
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0.24867E+01 0.18735E-01 0.13670E-03
0.25800E+01 0.17116E-01 0.21874E-03
0.26677E+01 0.16959E-01 0.14912E-03
0.27750E+01 0.15573E-01 0.14998E-03
0.28850E+01 0.15053E-01 0.13616E-03
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0.58940E+01 0.53323E-02 0.78140E-04
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0.63960E+01 0.42412E-02 0.66763E-04
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0.87971E+00 0.32319E-01 0.24664E-03
0.10057E+01 0.31073E-01 0.19558E-03
0.11327E+01 0.31747E-01 0.19307E-03
0.12491E+01 0.30054E-01 0.27404E-03
0.13188E+01 0.29945E-01 0.21813E-03
0.14208E+01 0.28947E-01 0.20448E-03
0.15220E+01 0.27651E-01 0.21171E-03
0.16166E+01 0.26379E-01 0.20570E-03
0.17174E+01 0.24779E-01 0.18520E-03
0.18324E+01 0.23683E-01 0.16172E-03
0.19540E+01 0.22623E-01 0.18750E-03
0.20493E+01 0.21949E-01 0.18337E-03
0.21500E+01 0.20531E-01 0.17145E-03
0.22444E+01 0.19929E-01 0.21375E-03
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0.26190E+01 0.17713E-01 0.17037E-03
0.27173E+01 0.17219E-01 0.16007E-03
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0.29190E+01 0.15654E-01 0.14823E-03
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0.51967E+01 0.69830E-02 0.12367E-03
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0.55400E+01 0.71024E-02 0.12726E-03
0.56100E+01 0.63128E-02 0.11276E-03
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0.68420E+01 0.40418E-02 0.64911E-04
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0.71833E+01 0.37583E-02 0.76876E-04
0.73820E+01 0.35438E-02 0.58525E-04
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0.83733E+01 0.24052E-02 0.57903E-04
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0.88850E+01 0.17980E-02 0.43512E-04
0.89600E+01 0.16263E-02 0.78658E-04
0.92000E+01 0.12370E-02 0.31244E-04
0.94950E+01 0.87443E-03 0.29932E-04
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0.98420E+01 0.41454E-03 0.17834E-04
0.10200E+02 0.14271E-03 0.10707E-04
0.10433E+02 0.22995E-04 0.58894E-05

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0.70460E+01 0.37812E-02 0.59908E-04
0.71833E+01 0.35570E-02 0.72327E-04
0.73820E+01 0.31582E-02 0.53306E-04
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0.78420E+01 0.26425E-02 0.47433E-04
0.80880E+01 0.23373E-02 0.43513E-04
0.83100E+01 0.20125E-02 0.68377E-04
0.83733E+01 0.20891E-02 0.50503E-04
0.86180E+01 0.16221E-02 0.35386E-04
0.88850E+01 0.12861E-02 0.33604E-04
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0.73033E+01 0.34709E-02 0.77451E-04
0.74640E+01 0.31936E-02 0.56527E-04
0.76233E+01 0.29404E-02 0.66862E-04
0.78380E+01 0.28542E-02 0.52109E-04
0.80820E+01 0.25684E-02 0.48688E-04
0.83300E+01 0.20383E-02 0.48556E-04
0.83900E+01 0.23483E-02 0.98233E-04
0.86140E+01 0.15525E-02 0.36370E-04
0.88980E+01 0.10715E-02 0.30026E-04
0.91600E+01 0.36287E-03 0.27669E-04
0.92167E+01 0.71599E-03 0.31147E-04
0.95100E+01 0.18682E-03 0.11804E-04
0.98400E+01 0.89955E-04 0.79540E-05

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0.10057E+01 0.31510E-01 0.19831E-03
0.11327E+01 0.31511E-01 0.19079E-03
0.12491E+01 0.29106E-01 0.27271E-03
0.13188E+01 0.29413E-01 0.21574E-03
0.14208E+01 0.28057E-01 0.20010E-03
0.15220E+01 0.26414E-01 0.20761E-03
0.16166E+01 0.25293E-01 0.20071E-03
0.17174E+01 0.24445E-01 0.18327E-03
0.18324E+01 0.23193E-01 0.15871E-03
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0.20493E+01 0.20996E-01 0.17914E-03
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0.22444E+01 0.19003E-01 0.21198E-03
0.23328E+01 0.18827E-01 0.14749E-03
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0.39633E+01 0.88090E-02 0.13188E-03
0.40033E+01 0.94423E-02 0.18165E-03
0.41171E+01 0.82130E-02 0.10686E-03

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0.11327E+01 0.30770E-01 0.18244E-03
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0.13188E+01 0.28115E-01 0.20500E-03
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0.15220E+01 0.26038E-01 0.19848E-03
0.16166E+01 0.24147E-01 0.18832E-03
0.17174E+01 0.23231E-01 0.17317E-03
0.18324E+01 0.22340E-01 0.14996E-03
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0.30210E+01 0.12882E-01 0.15440E-03
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0.32100E+01 0.10671E-01 0.35096E-03
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0.34220E+01 0.89137E-02 0.13180E-03
0.35210E+01 0.89386E-02 0.97757E-04
0.36260E+01 0.93756E-02 0.14311E-03
0.37229E+01 0.88959E-02 0.11103E-03
0.38440E+01 0.88592E-02 0.10545E-03
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0.41171E+01 0.77248E-02 0.99482E-04

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0.40300E+01 0.77532E-02 0.14837E-03
0.40617E+01 0.75974E-02 0.11261E-03
0.41860E+01 0.79188E-02 0.12690E-03

0.42280E+01 0.75532E-02 0.11822E-03
0.43220E+01 0.77062E-02 0.11545E-03
0.44260E+01 0.76024E-02 0.11406E-03
0.45260E+01 0.73444E-02 0.10958E-03
0.46067E+01 0.70004E-02 0.13224E-03
0.46980E+01 0.72988E-02 0.10772E-03
0.48140E+01 0.73615E-02 0.10609E-03
0.49320E+01 0.75209E-02 0.10658E-03
0.50450E+01 0.74265E-02 0.11772E-03
0.51367E+01 0.78605E-02 0.14164E-03
0.51967E+01 0.69587E-02 0.12241E-03
0.53140E+01 0.71203E-02 0.99476E-04
0.54350E+01 0.68154E-02 0.10758E-03
0.55400E+01 0.67284E-02 0.12573E-03
0.56100E+01 0.62319E-02 0.11087E-03
0.57340E+01 0.59900E-02 0.86924E-04
0.58600E+01 0.60259E-02 0.14509E-03
0.59100E+01 0.56045E-02 0.10177E-03
0.60500E+01 0.54875E-02 0.81321E-04
0.62571E+01 0.51095E-02 0.66721E-04
0.64620E+01 0.45222E-02 0.70200E-04
0.66814E+01 0.40023E-02 0.55178E-04
0.69160E+01 0.36539E-02 0.61836E-04
0.71200E+01 0.34002E-02 0.58488E-04
0.73033E+01 0.30523E-02 0.73181E-04
0.74640E+01 0.30821E-02 0.54952E-04
0.76233E+01 0.28573E-02 0.65007E-04
0.78380E+01 0.26896E-02 0.50061E-04
0.80820E+01 0.22259E-02 0.45005E-04
0.83300E+01 0.17002E-02 0.43281E-04
0.83900E+01 0.17447E-02 0.85014E-04
0.86140E+01 0.12803E-02 0.32663E-04
0.88980E+01 0.65165E-03 0.22280E-04
0.91600E+01 0.15513E-03 0.19085E-04
0.92167E+01 0.39841E-03 0.21186E-04

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0.11140E+01 0.28693E-01 0.28759E-03
0.11897E+01 0.27546E-01 0.21079E-03
0.12910E+01 0.26561E-01 0.20355E-03
0.14076E+01 0.25431E-01 0.17198E-03
0.15278E+01 0.24075E-01 0.20041E-03
0.16123E+01 0.22817E-01 0.25303E-03
0.16876E+01 0.22552E-01 0.18335E-03
0.18088E+01 0.20494E-01 0.15166E-03
0.19133E+01 0.19711E-01 0.23903E-03
0.19920E+01 0.19311E-01 0.16153E-03
0.20947E+01 0.18528E-01 0.18789E-03
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0.23110E+01 0.15949E-01 0.13196E-03
0.24320E+01 0.15792E-01 0.17502E-03
0.25050E+01 0.14910E-01 0.21922E-03
0.25933E+01 0.14553E-01 0.13163E-03

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0.55400E+01 0.69973E-02 0.12398E-03
0.56100E+01 0.64412E-02 0.10948E-03
0.57340E+01 0.61138E-02 0.84791E-04
0.58600E+01 0.58881E-02 0.13581E-03
0.59100E+01 0.55456E-02 0.97837E-04
0.60500E+01 0.54463E-02 0.77883E-04
0.62571E+01 0.50771E-02 0.63422E-04
0.64620E+01 0.46985E-02 0.69632E-04
0.66814E+01 0.40606E-02 0.52998E-04
0.69160E+01 0.37113E-02 0.60305E-04
0.71200E+01 0.33290E-02 0.56726E-04
0.73033E+01 0.34012E-02 0.75702E-04
0.74640E+01 0.29937E-02 0.52282E-04
0.76233E+01 0.28523E-02 0.63056E-04
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0.80820E+01 0.22348E-02 0.43314E-04
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0.88980E+01 0.65095E-03 0.22036E-04
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0.11140E+01 0.27116E-01 0.27565E-03
0.11897E+01 0.27167E-01 0.20214E-03
0.12910E+01 0.25338E-01 0.19363E-03
0.14076E+01 0.24596E-01 0.16165E-03
0.15278E+01 0.23293E-01 0.19057E-03
0.16123E+01 0.21920E-01 0.24642E-03
0.16876E+01 0.21663E-01 0.17388E-03
0.18088E+01 0.19870E-01 0.14329E-03
0.19133E+01 0.19266E-01 0.23068E-03
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0.20947E+01 0.17188E-01 0.17393E-03
0.21900E+01 0.16227E-01 0.15052E-03
0.23110E+01 0.15409E-01 0.12442E-03
0.24320E+01 0.14984E-01 0.16584E-03
0.25050E+01 0.14033E-01 0.20583E-03
0.25933E+01 0.13925E-01 0.12396E-03

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0.45880E+01 0.88761E-02 0.12622E-03
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0.50067E+01 0.94245E-02 0.16156E-03
0.51000E+01 0.88646E-02 0.11908E-03
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0.58840E+01 0.65902E-02 0.93924E-04
0.60460E+01 0.61509E-02 0.90245E-04
0.62140E+01 0.55958E-02 0.84427E-04
0.64300E+01 0.48874E-02 0.66838E-04
0.66420E+01 0.44881E-02 0.74329E-04
0.68320E+01 0.42998E-02 0.71690E-04
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0.72400E+01 0.39903E-02 0.67038E-04
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0.75940E+01 0.35690E-02 0.62410E-04
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0.80740E+01 0.21912E-02 0.47136E-04
0.83200E+01 0.12551E-02 0.37870E-04
0.83900E+01 0.73559E-03 0.61264E-04
0.86040E+01 0.47298E-03 0.20723E-04
0.88900E+01 0.23422E-03 0.14535E-04

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0.11331E+01 0.24747E-01 0.15155E-03
0.12297E+01 0.24050E-01 0.14869E-03
0.13287E+01 0.22947E-01 0.14016E-03
0.14293E+01 0.22058E-01 0.13652E-03
0.15457E+01 0.20800E-01 0.11019E-03
0.16625E+01 0.19052E-01 0.17769E-03
0.17296E+01 0.18531E-01 0.12120E-03
0.18470E+01 0.18124E-01 0.10288E-03
0.19740E+01 0.16371E-01 0.12382E-03
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0.22393E+01 0.14098E-01 0.10534E-03
0.23380E+01 0.12867E-01 0.11243E-03
0.24429E+01 0.13077E-01 0.96506E-04
0.25667E+01 0.12703E-01 0.12205E-03

0.26800E+01 0.14468E-01 0.19577E-03
0.27864E+01 0.13511E-01 0.14529E-03
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0.30057E+01 0.10924E-01 0.12744E-03
0.31167E+01 0.96091E-02 0.15309E-03
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0.58840E+01 0.62452E-02 0.91978E-04
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0.64300E+01 0.47949E-02 0.66234E-04
0.66420E+01 0.44393E-02 0.73121E-04
0.68320E+01 0.41934E-02 0.70160E-04
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0.72400E+01 0.37756E-02 0.64795E-04
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0.40300E+01 0.71174E-02 0.13961E-03
0.40617E+01 0.72790E-02 0.10357E-03
0.41860E+01 0.80176E-02 0.12126E-03
0.42780E+01 0.85117E-02 0.12442E-03
0.43780E+01 0.88682E-02 0.12590E-03
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0.62140E+01 0.50161E-02 0.76691E-04
0.64300E+01 0.46263E-02 0.62427E-04
0.66420E+01 0.43988E-02 0.70215E-04
0.68320E+01 0.42274E-02 0.68114E-04
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0.78320E+01 0.20459E-02 0.44937E-04
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0.83200E+01 0.35219E-03 0.19023E-04
0.83900E+01 0.13136E-03 0.22293E-04
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0.77460E+01 0.69279E-03 0.20350E-04
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0.48780E+01 0.79350E-02 0.81488E-04
0.49900E+01 0.76063E-02 0.10547E-03
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0.51220E+01 0.77381E-02 0.78652E-04
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0.54000E+01 0.76679E-02 0.11377E-03
0.55320E+01 0.70642E-02 0.72597E-04
0.56720E+01 0.65516E-02 0.69276E-04
0.58260E+01 0.63824E-02 0.67285E-04
0.59700E+01 0.60751E-02 0.86948E-04
0.61086E+01 0.59383E-02 0.53252E-04
0.63220E+01 0.55898E-02 0.61107E-04
0.64960E+01 0.52716E-02 0.58440E-04
0.66860E+01 0.41545E-02 0.51243E-04
0.68820E+01 0.31240E-02 0.44194E-04
0.70860E+01 0.23770E-02 0.38074E-04
0.72960E+01 0.98698E-03 0.23697E-04
0.75160E+01 0.17272E-03 0.98688E-05
0.77500E+01 0.13720E-03 0.88870E-05
0.79800E+01 0.13078E-03 0.11884E-04
0.80200E+01 0.95422E-04 0.11090E-04
0.82500E+01 0.10379E-03 0.74644E-05