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EVALUATION METHOD OF INELASTIC SCATTERING CROSS-SECTIONS FOR WEAKLY ABSORBING FISSION-PRODUCT NUCLIDES

A report by the Working Party
on International Evaluation Co-operation
of the NEA Nuclear Science Committee

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FOREWORD

A Working Party on International Evaluation Co-operation was established under the sponsorship of the OECD/NEA Nuclear Science Committee (NSC) to promote the exchange of information on nuclear data evaluations, validation and related topics. Its aim is also to provide a framework for co-operative activities between members of the major nuclear data evaluation projects. This includes the possible exchange of scientists in order to encourage co-operation. Requirements for experimental data resulting from this activity are compiled. The working party determines common criteria for evaluated nuclear data files with a view to assessing and improving the quality and completeness of evaluated data.

The parties to the project are: ENDF (United States), JEF/EFF (NEA Data Bank Member countries) and JENDL (Japan). Co-operation with evaluation projects of non-OECD countries, specifically the Russian BROND and Chinese CENDL projects, are organised through the Nuclear Data Section of the International Atomic Energy Agency (IAEA).

The following report was issued by a subgroup which has investigated methods for evaluating inelastic scattering cross-sections of weakly absorbing fission-product nuclides. Only a few measurements exist and the evaluations are in general based on nuclear theory calculations. Different methods are compared and the importance of the direct component of inelastic scattering is examined. The integral measurements of the reactivity worths of weakly absorbing fission products are sensitive to the inelastic scattering and they are used to assess the quality of the evaluated data.

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SUMMARY

Methods used to evaluate inelastic scattering cross-sections of fission-product nuclides are investigated. The origins of the discrepancy found between calculated and measured sample reactivity worths are also discussed, emphasising the effects of approximations in the inelastic scattering cross-sections and in the reactor neutron direct and adjoint spectra used in the calculations.

Neutron inelastic scattering cross-sections for molybdenum isotopes are calculated using the distorted wave Born approximation (DWBA) and the coupled-channels methods (CC). An anomalous enhancement of the DWBA cross-sections near the threshold energy is examined. Numerical simulations with some simplified optical potentials indicate that the enhancement can be related to the p-wave strength. Differences between the cross-sections calculated using the DWBA method and those calculated using coupled-channels theory are small, and experimental data for ^{92}Mo, ^{98}Mo and ^{100}Mo are well reproduced by the DWBA and the Hauser-Feshbach-Moldauer statistical model using reliable optical potentials.

An intercomparison of integral tests of the fission-product data in the nuclear data libraries JENDL-3.2 and JEF-2.2 has been made, concentrating efforts on the analyses of the sample reactivity worth measurements made in the STEK experiments. It was found that calculations are generally in good agreement with the measured values for strongly absorbing FP nuclides, while there were some large discrepancies when the sample reactivity worth was small, in the case of weakly absorbing FP nuclides. Detailed analyses, with cell calculations which give a precise treatment of cross-sections and rigorous reactor transport theory calculations, have shown that approximations in the methods used to calculate the adjoint spectrum is the major reason for discrepancies. However, it should be noted that some significant discrepancies between the calculated and measured reactivity worths remain, even for several important FP nuclides. Further integral experiments are desirable to resolve such problems.

EVALUATION METHOD OF INELASTIC SCATTERING CROSS-SECTIONS FOR WEAKLY ABSORBING FISSION-PRODUCT NUCLIDES

1. Introduction

Integral tests [1,2] of evaluated fission-product (FP) nuclear data libraries, such as JENDL-3.1 and JEF-1, show that the calculated sample reactivity worths are in good agreement with those measured at STEK [3] for strong absorbers (within about ±20%). However, there is an anomalous behaviour in the results for weak absorbers; calculation underestimates positive components of the worth, these components being due to scattering. It was considered that such a behaviour probably came from inaccurate inelastic scattering cross-section data for most FP nuclides in these libraries [4]. In the usual evaluated data libraries, except for JENDL-3.2, the direct process contributions to inelastic scattering cross-sections were probably disregarded [5]. Subgroup 10 of the NEA NSC Working Party on International Evaluation Co-operation was organised in 1991 in order to review the inelastic scattering cross-sections for the weakly absorbing FP nuclides, to recommend methods and model parameters for the evaluation of inelastic scattering cross-sections of FP nuclides and to explain the discrepancy between the differential and integral data.

The direct process contribution to inelastic scattering can be calculated using the distorted wave Born approximation (DWBA) or with the coupled-channel (CC) theory. The DWBA method has been extensively used for the evaluation of nuclear data for JENDL-3.1 [6,7] because it has a rather simple formulation, and it is regarded as a good approximation to the CC theory when the deformation is small. However, an anomalous enhancement of DWBA cross-sections near the inelastic scattering threshold has been reported [8,9] for nuclides with mass around $A = 100$ when global optical potential parameters were used.

The problem was discussed by Subgroup 10 [10,11] but the reason for the enhancement was not obvious, and it was suggested [8] that the DWBA method might be inappropriate for the evaluation of FP nuclear data. Therefore it became important to validate the DWBA calculation method for evaluating the inelastic scattering cross-sections of FP nuclides and to find out how to use it to obtain reliable results.

Isotopes of molybdenum show typical collective excitation, and the properties of the low-lying states have been studied by means of Coulomb excitation and electron, proton scattering [12,13]. Such studies have indicated that the experimental data can be represented by a coupling of the ground state with the collective one-phonon state. Recent measurements of neutron inelastic scattering [14] by molybdenum isotopes may be interpreted with the same coupling scheme, and a comparison of the DWBA calculation with the CC theory may provide the reason for the enhancement or, alternatively, the limitations of the DWBA.

For the analysis of neutron inelastic scattering data, we need the appropriate neutron optical potential and the deformation parameters, as a reference. Smith, *et al*. [15] have made an optical model analysis of the neutron induced reaction data for nuclides with $Z = 39\sim51$. They obtained the regional optical potential parameters from the differential elastic scattering and the total cross-sections in the energy range 1.5 to 4 MeV. This regional optical potential, together with the deformation parameters obtained by CC analyses of the proton data, provide a good basis for a comparison between DWBA and CC calculations.

The next problem is to clarify whether the direct inelastic scattering cross-sections are the main component producing the discrepancy between measurement and calculation for the FP sample reactivity worths measured in the STEK reactor. An intercomparison of the integral analyses has been made, concentrating on the analysis of the STEK experiments using JENDL-3.2. The contribution of the direct inelastic scattering to the sample reactivity worth has also been calculated for several nuclides. Finally, approximations in the earlier calculations of the neutron and adjoint fluxes were investigated by means of more detailed calculations made using a Monte Carlo code.

In this report, methods for calculating inelastic scattering cross-sections are discussed in Section 2 and the integral tests in Section 3.

2. Inelastic scattering cross-sections

2.1 Intercomparison of evaluated inelastic scattering cross-sections

The applicability of the DWBA method, which was used in the evaluations for the even-mass FP nuclides in JENDL-3, has been investigated by comparing the JENDL-3 data with experimental data and with CC calculations for isotopes of Zr, Mo, Ru, Pd, Cd, Nd and Sm. Figure 2.1.1 shows that the DWBA calculations of the excitation functions for vibrational levels of ^{92}Zr are in good agreement with the experimental data.

The inelastic scattering cross-sections of Pd isotopes have recently been measured at IRMM [16]. The results were well predicted using the CC theory. Recently, we compared the experimental data obtained for natural palladium at both IRMM [16,17] and ANL [18,19], with JENDL-3.2. For Pd isotopes, the JENDL-3.2 evaluation was based on the statistical model and the DWBA, using the following optical model parameters:

V = 50.01 – 0.5528E	R = 5.972	a = 0.56
W_s = 8.165	R_s = 6.594	a_s = 0.44
V_{so} = 5.261	R_{so} = 5.97	a_{so} = 0.267

The inelastic scattering cross-sections of the natural palladium isotopes given in JENDL-3.2 (in the region of E_x = 260 to 560 keV, corresponding to the first excited states of even-even isotopes of Pd) have been summed to give the inelastic scattering cross-section of natural Pd in the same excitation region. This excitation region was determined according to the energy resolution of the experiment at ANL (by Chiba, *et al*. [18]). The following MTs and abundance ratios were adopted:

	MT	Abundance ratio
^{102}Pd	51	1.02
^{104}Pd	51	11.14
^{105}Pd	51-57	22.33
^{106}Pd	51	27.33
^{108}Pd	51	26.46
^{110}Pd	51	11.72

The abundance ratios were normalised to sum to unity. The same averaging procedure was applied to the inelastic scattering cross-sections of the first 2^+ states in ^{104,106,108,110}Pd measured by Meister [16]. The abundance ratio was also normalised to sum to unity. A comparison of the averaged data from JENDL-3.2 for natural Pd with the measurements of Meister and those by Smith, *et al*. and Chiba, *et al*. is given in Figure 2.1.2. The agreement of the JENDL-3.2 data with the data measured by Meister up to 2.5 MeV and by Chiba, *et al*. [18] above 6 MeV is excellent, therefore confirming the method adopted in the evaluation of the JENDL-3.2 data. The reason for the disagreement with the old data of Smith, *et al*. [19] is not clear. In any case, the figure shows that JENDL-3.2 provides a reasonable excitation function curve in the energy region where the direct reaction dominates.

Accordingly, we have reached the conclusion that the DWBA method is widely applicable to the calculation of the direct components of inelastic

scattering cross-sections, by normalising to the measured data or to that calculated using the CC theory. However, the DWBA calculation occasionally provides too high an inelastic scattering cross-section in the mass range around $A = 100$. At ECN, a CC analysis with a two-phonon vibrational model was made [16] for ^{110}Pd. The analysis reproduced well the cross-sections measured at IRMM for the one-phonon level at 373.8 keV. It was guessed that the anomalous behaviour of the DWBA calculation for nuclides around $A = 100$ was a special case due to some singularity in the optical potential peculiar to the parameter set used.

For the heavier nuclides in the deformed region, it was confirmed that the cross-sections for the vibrational levels calculated using the CC theory with a slightly modified imaginary potential strength, W_s, were in general agreement with the DWBA calculations in the energy range up to 20 MeV. The CC theory estimates well the cross-sections for both vibrational and rotational levels of deformed isotopes of Nd and Sm. Figure 2.1.3 shows the level schemes of ^{144}Nd and ^{150}Nd. The CC theory calculations of level excitation functions of ^{144}Nd, made using the code ESIS with $W_s = 7$ MeV, are in general agreement with the experimental data and with the DWBA calculation with $W_s = 9.1$ MeV, as is shown in Figure 2.1.4. As for ^{150}Nd, the CC theory calculations were made by considering the coupling of 0^+-2^+-4^+-6^+-8^+-10^+ (ground state rotational band) and 1^--3^--5^- (octopole vibrational band) with $\beta_2 = 0.2848$ [20] and $\beta_3 = 0.070$ [21]. For the 2^+ level at 1.77 MeV, the result of the CC calculation with $W_s = 4.5$ MeV agrees well with the DWBA calculation with $W_s = 9.13$ MeV, as is shown in Figure 2.1.5.

2.2 Enhancement of the DWBA cross-sections

2.2.1 Global optical potentials

Global optical potentials such as the Walter-Guss potential parameters [22] are widely used for nuclear data evaluation. The Walter-Guss optical potential was obtained from the experimental data above 20 MeV. Yamamuro [23] extrapolated the Walter-Guss potential below 20 MeV by changing the imaginary potential depth to determine the experimental non-elastic cross-sections in this energy range. The modified Walter-Guss potential has an imaginary surface term:

$$\begin{aligned} W_s &= 7.21 - 14.94\varepsilon \text{ MeV} && (E < 20 \text{ MeV}) \\ W_s &= 10.85 - 14.94\varepsilon - 0.1571E \text{ MeV} && (E > 20 \text{ MeV}) \end{aligned} \qquad (1)$$

where $\varepsilon = (N - Z)/A$ and E is the incident neutron energy. The modified potential was used in the evaluation of the inelastic scattering cross-sections of molybdenum isotopes for JENDL-3.2.

The DWBA cross-sections for ^{100}Mo were calculated using CmC [24]. The cross-sections calculated with CmC are almost the same as those calculated with DWUCK4 [25]. The CC calculations are carried out with ECIS88 [19], which solves the coupled equations by a sequential iteration method, and its first iteration corresponds to the DWBA calculation.

The direct inelastic scattering cross-sections are calculated for the low-lying 2^+ (535.6 keV) and 3^- (1 908 keV) levels. We assume these levels are one-phonon states, and the deformation parameters β_2 and β_3 are taken from proton scattering experiments [13], their values being $\beta_2 = 0.214$ and $\beta_3 = 0.208$. The optical potentials for the DWBA calculation are the Walter-Guss [22] and the modified Walter-Guss [23].

The collective inelastic scattering cross-sections for the 2^+ and the 3^- states are shown in Figures 2.2.1 and 2.2.2, respectively. The cross-sections calculated using the CC method are shown in the same figures by the dot-dashed lines. The optical potential used in the CC calculation is the same as that used in the DWBA calculation. One can clearly see the anomalous enhancement of the cross-sections near the threshold energy when the modified Walter-Guss potential is used. This enhancement does not emerge from a problem with the code, because the DWBA calculation made using ECIS88 [26] provides almost the same cross-sections as CmC. The enhancement also appears in the CC result, but it is more moderate than the DWBA enhancement. In the case of the Walter-Guss potential, no enhancement with either the DWBA calculations or the CC calculations is detected. It is known that the unitarity, $|S_{ba}| < 1$, is not necessary for the DWBA calculation, but the CC calculation ensures it [27]. This requirement for unitarity suppresses the anomalous enhancement in the inelastic channel. However, the cross-section excitation function is rather steep just above the threshold energy, therefore adoption of the CC calculation method is not the best way to avoid unusually large direct cross-sections.

The enhancement of the inelastic scattering cross-sections only appears when the modified Walter-Guss potential is used, and one can conclude that the reason is the optical potential used. In order to analyse the effect of the difference between the original Walter-Guss potential and the modified one, we compare the distorted waves at low energies. The squared radial wave functions at a neutron energy of 0.1 MeV are shown in Figure 2.2.3, where the nuclear radius is 5.57 fm. Strong absorption of the p-wave is shown for the modified Walter-Guss potential. The spin-averaged transmission coefficients, T_1 at 0.1 MeV, for these potentials, are 0.158 for the original potential and 0.229 for the modified one.

A size resonance for a 3p-wave is observed for $A = 100$ [28]. The s-wave and p-wave strength functions for the two Walter-Guss optical potentials are tabulated in Table 2.2.1. The strength function calculated with the spherical optical potential of Smith, *et al*. [15] is also tabulated in this table, because they paid attention to the strength functions as well as to the cross-sections in their analyses. The original Walter-Guss potential gives strength functions consistent with the values in Mughabghab's compilation [28]. However, the modified Walter-Guss potential provides a larger p-wave strength function. The strength functions obtained with the optical potential of Smith, *et al*. are in good accord with Mughabghab's values, and the calculated DWBA cross-section does not show the anomalous enhancement. For example, the DWBA cross-section for the 2^+ state at $E_n = 3$ MeV is 117 mb, and this value is near to the DWBA or CC results calculated using the original Walter-Guss potential, as can be seen in Figure 2.2.1.

An increase in the p-wave amplitude enhances the DWBA calculated value. A DWBA transition amplitude contains an angular momentum coupling coefficient and a radial overlap integral between the initial and the final state [27]:

$$I_{ba}^{L} = \frac{\sqrt{4\pi}}{k_a k_b} \int u_b(r) F_L(r) u_a(r) dr \tag{2}$$

where $u_a(r)$ and $u_b(r)$ are the radial parts of distorted waves, L is the orbital angular momentum transfer, and $F_L(r)$ is the form factor. The DWBA cross-section is calculated from the squared transition amplitudes, and it is possible to see the contribution to the DWBA calculation from various partial waves if one compares the overlap integrals. Figure 2.2.4 shows the squared overlap integrals as a function of the radius:

$$\left|I(r)\right|^2 = \left| \int_0^{\gamma} u_b(r') F_L(r') u_a(r') dr' \right|^2 \tag{3}$$

The distorted waves in Figure 2.2.4 are both for p-wave ($j_a = j_b = 3/2$), and the L transfer is 2. We assume the excitation energy of the 2^+ state is zero in order to equate the distorted waves for the entrance and the exit channels. The overlap integral with the modified Walter-Guss potential is very large in comparison with the value for the original potential. This enhancement also appears in the overlap integral between the p-wave and f-wave, and the strong contribution from the p-wave results in the anomalous enhancement of the DWBA cross-section. This enhancement becomes smaller as the incident neutron energy increases, because many partial waves contribute to the total inelastic scattering cross-sections, and the relative importance of the p-wave contribution reduces.

2.2.2 Simplified optical potentials

The difference between the original Walter-Guss potential and the modified one is the depth of the imaginary potential, W_s. The modified Walter-Guss potential has an imaginary depth of W_s = 5.32 MeV at E_n = 0, and the original potential has an imaginary depth of 8.46 MeV. Figure 2.2.5 shows the dependence of the imaginary parts of the S matrix elements for p-waves on W_s. The incident neutron energy is 1 keV. As W_s decreases the imaginary parts of the S matrix elements increase and they become positive at ~3 MeV for j = 3/2 and ~6 MeV for j = 1/2. The calculated DWBA cross-section for the 2^+ level at E_n = 1 MeV is depicted in the same figure by the dot-dashed line. One can see the relationship between the DWBA cross-section and the imaginary part of the S matrix element. When a spherical optical model calculation gives $Im(S_1) > 0$ as $E_n \rightarrow 0$, the calculated DWBA cross-section becomes very large. For example, both $Im(S_1^{3/2})$ and $Im(S_1^{1/2})$ are positive below W_s = 3 MeV, and the DWBA cross-sections are unacceptably large there.

In order to investigate the dependence of the DWBA cross-section on the p-wave S matrix element, we have employed a simplified optical potential:

V = 50 MeV	r_v = 1.2 fm	a_v = 0.6 fm	(4)
W_s = 3 or 5 MeV	r_w = 1.3 fm	a_w = 0.6 fm	

without a spin-orbit term. This optical potential gives $Im(S_1) > 0$ for W_s = 3 MeV, and $Im(S_1) < 0$ for W_s = 5 MeV. The inelastic scattering cross-sections for a 2^+ level whose excitation energy is set to zero are calculated with the DWBA, and the level excitation function is shown in Figure 2.2.6 compared with the partial cross-sections obtained using the spherical optical model (SOM):

$$\sigma_T^l = \frac{2\pi}{k^2}(2l+1)\{1-\mathrm{Re}(S_l)\} \tag{5}$$

Two resonance-like peaks appear in the DWBA cross-section when W_s = 3 MeV, while in the case of W_s = 5 MeV the enhancement of the DWBA cross-section is small. As can be seen in Figure 2.2.6, the first peak near E_n = 500 keV corresponds to the p-wave contribution, and the second one near 2 MeV is the f-wave contribution.

This anomalous enhancement may occur in the mass region where the s-wave strength function has a maxima. The 3s size resonance appears around $A \sim 50$. The imaginary part of the s-wave S matrix element becomes positive when the following optical potential is used:

V = 52 MeV	r_v = 1.2 fm	a_v = 0.6 fm	(4)
W_s = 1 MeV	r_w = 1.3 fm	a_w = 0.6 fm	

The calculated DWBA cross-sections for ^{50}Cr are shown in Figure 2.2.7. Anomalous enhancements of the DWBA cross-section occur near E_n = 2.5 MeV and 4.5 MeV, and they correspond to the d-wave and g-wave contributions, respectively. The imaginary part of the optical potential in Eq. (6) is unphysically shallow. If the imaginary depth increases to 3 MeV, the anomalous enhancement disappears, as indicated by the thin solid line in Figure 2.2.7. The anomalous enhancements of the DWBA cross-sections in Figures 2.2.6 and 2.2.7 are extreme cases, but they imply that the anomaly happens when the imaginary potential is very shallow. Some global optical potentials have a symmetry term $(N-Z)/A \times W_{sym,}$ and the Walter-Guss optical potential contains the term -14.94$(N-Z)/A$ MeV in the surface imaginary part. The imaginary part then becomes small for a nucleus which has an excess of neutrons. Table 2.2.2 shows the DWBA cross-sections calculated with the original Walter-Guss optical potential [22] and with the modified Walter-Guss [23] at E_n = 1 MeV for some stable isotopes: ^{40,48}Ca, ^{78,86}Kr, ^{102,110}Pd and ^{156,164}Dy. The calculated cross-sections are for the collective excited states, J^π of 2^+, β_2 = 0.1, and the excitation energies are assumed to be zero. The enhancement is observed when the modified Walter-Guss potential is used, and the effect is larger for the heavy nuclides.

2.3 Comparisons with experimental data

Measurements of the ($n,n'\gamma$) reaction cross-sections of Mo isotopes have been made at IRMM [14]. To analyse the experimental data we employ the DWBA method and the CC method for the collective direct process, and the Hauser-Feshbach-Moldauer model for the compound process. As shown in Section 2.2, the modified Walter-Guss potential is inadequate to calculate the direct cross-sections at low energies, while the optical potential of Smith, *et al*. [15] is appropriate because this potential gives a p-wave strength function which is in good agreement with the experimental data. Also, the potential is defined in the energy range E_n < 5 MeV which covers the energies where the experimental data exist.

The experimental inelastic scattering data were obtained by means of γ-ray detection [14]. The experimental data for the 535.6 keV level of ^{100}Mo are not resolved, and they contain the cross-sections to the first excited state (535.6 keV) and 88% of the second excited state (695.1 keV). The 535.6 keV excited level is a one-phonon 2^+ state, and the 695.12 keV level is a member of the two-phonon triplet, 0^+ (695.1 keV), 2^+ (1064 keV) and 4^+ (1 136 keV). Since the cross-sections

for the two-phonon triplet are expected to be small, the direct inelastic scattering cross-sections are calculated only for the one-phonon states (2^+ and 3^-). The deformation parameters are $\beta_2 = 0.214$ and $\beta_3 = 0.208$.

The compound cross-sections are calculated using Hauser-Feshbach theory with Moldauer's width fluctuation correction [29]. The discrete levels up to an excitation energy of 2.3 MeV are included in the calculation, and their J^π values are taken from ENSDF [30]. The excited levels are assumed to be overlapping above 2.3 MeV, and Gilbert and Cameron's formulas [31] are used to calculate the level density in the continuum region. The adopted level density parameters are $a = 17.9$ MeV^{-1} and $\Delta = 2.22$ MeV. At low excitation energies, the constant temperature model is used, and its parameters are determined by a, Δ and the discrete levels.

A comparison of the calculated cross-sections with the experimental data is shown in Figure 2.2.8. The thick solid line is an incoherent sum of the DWBA calculation and the Hauser-Feshbach-Moldauer calculation for the 535.6 keV level including the 88% of the 695.1 keV level. The thin solid line is the compound cross-section for the 1 064 keV level. The calculated cross-section for the 1 064 keV level is in good agreement with the data, while the cross-section calculated for the 535.6 keV level is larger than the measured cross-section. There are some possible reasons. These are the incoherent sum of the direct and compound cross-sections, the deformation parameters, the difference between DWBA and CC and the width fluctuation correction. When we added the compound cross-sections incoherently to the direct cross-sections, then a summation of all non-elastic cross-sections exceeded the total reaction cross-section, σ_R, which was calculated using the optical model. However this effect does not explain the overestimation, because the difference between the calculated cross-section and the experimental data is larger than the DWBA cross-section itself.

The deformation parameters were obtained from a (p,p') experiment [13]. It is possible to correct the β for neutron induced reactions if one applies the relation $\beta_p R_p = \beta_n R_n$. This gives $\beta_2 = 0.205$ and $\beta_3 = 0.199$ when the R_n value of Smith's optical potential is used. This correction reduces the direct cross-section slightly, but it is only 0.7% at 1.5 MeV.

In order to calculate the width fluctuation correction factor, it is necessary to know the distribution of level widths in the compound nucleus. A χ^2-distribution with ν degrees of freedom is assumed. Moldauer [29] obtained a practical expression for ν by a Monte Carlo method, and this has been adopted in the present study. The other assumption is $\nu = 1$, which means the distribution is a Porter-Thomas distribution. The calculated cross-sections for the case with $\nu = 1$

are shown in Figure 2.2.8 by the dot-dashed lines. The compound cross-sections decrease and the level excitation function becomes very similar to the experimental data.

CC calculations were made for the 0^+-2^+-3^- coupling scheme using ECIS88, and the results are compared with the experimental data in Figure 2.2.9. The thick dotted line is the direct component, and the thick solid line is the incoherent sum of the direct and the compound cross-sections. The calculated cross-sections are very similar to those obtained with the DWBA method in Figure 2.2.8, and it can be concluded that the DWBA method is a useful tool for an evaluation of the direct process as long as the optical potential is adequate. The experimental data were obtained by means of γ-ray detection [14], and the inelastic scattering to the 535.6 keV level was not resolved. The calculated cross-section for this level can be compared with some neutron measurements [32-35] and the comparison is shown in Figure 2.2.10. The experimental data are scattered; however the calculation reproduces the tendency of the data. The evaluated cross-section in JENDL-3.2, which included DWBA calculations with the modified Walter-Guss potential, is shown in the same figure by the dashed line.

Comparisons of the ^{98}Mo inelastic scattering data with the DWBA and the compound process calculations are shown in Figure 2.2.11. The discrete levels up to 2.57 MeV were included, and the level density parameters used were a = 15.8 MeV^{-1} and Δ = 2.57 MeV. We regarded the 787.4 keV level ($J^\pi = 2^+$) as a collective one-phonon state. The deformation parameter employed is $\beta_2 = 0.162$. The excitation function for the 734.8 keV level ($J^\pi = 0^+$) is depicted by the dotted line. This cannot be measured by γ-ray detection because a γ-ray transition between the states with the same spin and parity is prohibited by the selection rule. The cross-sections for the second (787.4 keV) and the third (1 432 keV) levels are well reproduced by the incoherent sum of the DWBA and the compound cross-sections.

Figure 2.2.12 illustrates the calculated cross-sections for the ^{92}Mo inelastic scattering. The discrete levels included in the compound process calculation are below 3.69 MeV, and the level density parameters a = 10.6 MeV^{-1} and Δ = 2.21 MeV were used in the continuum. The DWBA calculations for the collective state of 1 509 keV ($J^\pi = 2^+$) were made with $\beta_2 = 0.101$. The calculated cross-sections exceed the experimental data above 2 MeV. The overestimation is essentially a problem of the compound calculation because the DWBA cross-sections are very small in this energy range. The compound cross-section for the 1 509 keV level at E_n = 2 MeV is 886 mb, and if ν = 1 is assumed for the width fluctuation correction the cross-section becomes 752 mb, which agrees with the experimental data.

3. Integral tests

3.1 Intercomparison of integral tests

Several programmes of integral measurements in fast reactor spectra have been carried out for individual nuclides in the FP range. At JNDC, the STEK reactivity worth experiments [3,36] and the capture rate measurements made in CFRMF [37] and EBR-II [38] were analysed by Watanabe, *et al*. [2] using 70 group cross-sections generated from JENDL-3.1 and -3.2, and the neutron and adjoint fluxes which were provided by the experimenters. The methods of calculation used for the integral test and the results obtained using JENDL-3.1 were described in detail in Ref. [2]. The fluxes were converted into the 70-group structure in such a way as to preserve the energy integrals. The results which were obtained are given in the Appendix. Average C/E values for the five STEK cores and for the capture rate measurements are given in Table 3.1.1 and Figure 3.1.1. At ECN, Gruppelaar, *et al*. [39] compared JEF-1 calculations with the STEK experiments. Since for the major reactions the cross-section data of JEF-1 and JEF-2.2 in the energy region above resolved resonance region are the same for most nuclides, the results obtained using JEF-1 for hard spectra are expected to be similar to those obtained using JEF-2.2. The C/E values obtained using JEF-1 were compared by Kawai, *et al*. [11] with those obtained using JENDL-3.1 (in Table 1 of Ref. [11]). It was noted that the worths calculated with JEF-1 were largely discrepant, compared with the measured values, and also the discrepancies for the JENDL-3.1 values for the weak absorbers were quite large.

In Cadarache, analyses of the Rossendorf experiments [40] (measuring sample worths in SEG lattice configurations) and the STEK experiments, were performed to test JEF-2.2 by Dietze, *et al*. [41] and Meister [42], respectively. The reactor calculations were performed with the S_N transport code BISTRO in two-dimensional RZ geometry. The cell code ECCO was used to provide the broad group constants for the different reactor regions, with the calculations being made for the heterogeneous compositions. Recently, Dietze [43] has analysed the STEK and Rossendorf experiments with JENDL-3.2, using the reactor core design code system at the Japan Nuclear Fuel Cycle Organisation (JNC). He calculated the neutron and adjoint fluxes taking into account the cell heterogeneity of the core around the samples. Table 3.1.2 gives a summary of the C/E values obtained in the analysis made using JENDL-3.2 for the five STEK experiments. The C/E values were estimated for the reactivity worths of infinitely dilute samples by extrapolating the measured and calculated values to zero sample size. Table 3.1.1 compares the C/E values obtained for two of the STEK cores (STEK-500 and STEK-3000) by Dietze using the JNDC methods and JENDL-3.2, with Meister's analysis using JEF-2.2 and Dietze's analysis of the Rossendorf experiments (SEG-5 and SEG-7A) made using JEF-2.2.

STEK-500 is the core with the hardest spectrum, and STEK-3000 has a soft spectrum. As for the Rossendorf experiments, the SEG-5 core configuration was characterised by a nearly energy-independent adjoint spectrum and consequently the slowing-down component of the reactivity worth was small. SEG7A had an extremely hard spectrum and an adjoint spectrum which increased with neutron energy.

For the STEK experiments, both the JNDC and the Dietze analyses with JENDL-3.2 show good agreement between the measurements and the calculations for the strong absorbers in the tables, while the calculations systematically underestimated the worths by about 10% for the nuclides heavier than $A = 130$, as is shown in Figure 3.1.1. The reasons for this underestimation were investigated by Watanabe, *et al.* [44] by using a detailed model of the STEK core in a Monte Carlo code. As a result, the approximation involved in the group cross-section treatment was identified as one of the reasons. However, there are unexplained discrepancies between the reactivity worth data and the differential cross-section data for several nuclides. Further integral experiments are needed to clarify the reasons for the discrepancies for these strongly absorbing FP nuclides.

On the other hand, there are discrepancies for the worths calculated by JNDC for many weak absorbers, particularly for the oxide samples. Small total reactivity worths are mostly the result of compensating effects (capture: only negative, scattering: negative and positive). The scattering contributions are very sensitive to the calculated adjoint spectrum. A large discrepancy is also found for ^{100}Mo in the Rossendorf experiments. The C/E value for JEF-2.2 in SEG-7A, which has an extremely hard neutron spectrum and an adjoint spectrum which increases with increasing energy (which gives a negative reactivity of scattering), can be interpreted as being caused by the calculated scattering effect being too small (12% and 3% for inelastic and elastic scattering contributions to the worth, respectively) [41]. Gruppelaar [4,39] considered that an underestimation of the inelastic scattering cross-sections was the probable reason. A similar underestimation was observed in the results calculated by Dieze [43] even with JENDL-3.2, despite the direct inelastic scattering component being treated in the cross-section evaluations. On the other hand, Dietze's analysis [43] using JENDL-3.2 for the STEK experiments gives C/E values which are closer to unity than those of the JNDC analysis, as is shown in Table 3.1.2. A major reason for the difference between these analyses must lie in the neutronics calculation, particularly of the adjoint spectrum, although it was caused, to some extent, by a different normalisation of the sample reactivity: JNDC normalised the worth relative to the perturbation denominator, but Dietze normalised relative to the infinite dilute sample worth of the ^{10}B standard sample.

3.2 Contribution of direct inelastic scattering cross-sections to the sample reactivity worths

In order to clarify the question of whether disregard of direct inelastic scattering cross-sections in the earlier nuclear data files, such as JENDL-3.1, JEF-2.2 and ENDF/B-VI, caused the underestimation, we have examined the effect of direct inelastic scattering on the calculated worths in the STEK experiments. Calculations have been made for several typical FP isotopes using the JENDL-3.2 cross-sections and temporary files excluding the direct inelastic scattering cross-sections. Table 3.2.1 gives the C/E values for the reactivity worth of Mo, Ru, Pd and Nd isotopes in STEK-500 and STEK-3000 and the contributions of capture, scattering and direct inelastic scattering to the worth. Capture gave negative worths and scattering positive worths in these cases. The C/E values are scattered about unity, ranging from -2.73 to +4.46, the underestimation being especially large in the case of STEK-500, the core with a hard spectrum. The negative C/E values for ^{92}Mo and ^{98}Mo mean that calculated and measured total reactivity worths are of opposite sign. The worths measured in the STEK-500 core were positive for all Mo isotopes, while the calculated worths for ^{92}Mo and ^{98}Mo were negative. The situation of the calculated values is quite clearly seen in Figures 3.2.1 and 3.2.2 which show the calculated and measured worths plotted against core size (the larger core number has the softer spectrum). The worth is greatest for the core with the hardest spectrum, as is shown in the figures, and becomes positive in STEK-500 for all Mo isotopes. It is also found that the measured values are more positive than the calculated values, as is shown in the figures. Accordingly, the calculated and measured worths for ^{92}Mo and ^{98}Mo are of opposite sign for STEK-500, while the C/E value becomes positive for ^{100}Mo. It is a characteristic, in the case of samples having a large positive worth contribution due to scattering, that the C/E values change violently, sometimes being very large and negative in a particular core. The same situation, the experimental value was larger than the calculated value, was generally observed for Ru, Pd and Nd isotopes.

The fifth and ninth columns of Table 3.2.1 show the contributions of direct inelastic scattering cross-sections to the total scattering worth. They are 10% at most. These small values cannot be a factor to explain the discrepancy between the calculated and measured reactivity worths for weakly absorbing FP nuclides. Therefore, other possible explanations for the discrepancies should be investigated.

It should also be noted that the C/E values are not always a good measure when evaluating the quality of nuclear cross-sections for weakly absorbing nuclides. Figure 3.2.1 is very instructive in showing that the calculations underestimate the scattering component of the worth. In such cases, the absolute

value of the reactivity worth discrepancy is also a useful indicator to show trends, particularly when the worth is the result of a cancellation of a negative reactivity effect due to absorption and a positive one due to scattering.

3.3 Neutron spectrum uncertainty

The neutron spectra of the STEK cores were calculated using the vectorised pointwise Monte Carlo code, MVP [45], for a three-dimensional homogeneous model of the STEK reactor and a cross-section library based on JENDL-3.1. The calculated spectrum was then corrected for heterogeneous effects by means of diffusion theory calculations. The results were compared with the original spectra reported by Petten, and employed by them in their sample worth calculations. Figure 3.3.1 shows a comparison of the neutron spectra calculated with the various models for the test region of the STEK-4000 core with the original spectrum [36] (ECN-ADJUSTED). This spectrum was obtained [36] by adjusting the spectrum calculated using diffusion theory to reproduce the reactivity worths of the standard samples. In the lower energy range, where the capture contribution to the reactivity worth of the strong absorbers in a large core is large, the Monte Carlo calculation, corrected for heterogeneous effects, supports the original Petten spectrum. Table 3.3.1 shows the results obtained for the standard samples and strongly absorbing nuclides. Compared with the results obtained using the original spectra, the present Monte Carlo calculation provides almost the same or better results for several nuclides such as the standard samples of Al and Pb. As for the weakly absorbing FP nuclides, an apparent small improvement of the C/E values is seen in Table 3.3.2, but the C/E values obtained with the Monte Carlo method agree with those calculated using the ECN flux within the statistical errors of the Monte Carlo calculation. Accordingly, it is concluded that the neutron flux difference is not important in the present problem.

Dietze [42] has calculated both the neutron and adjoint fluxes using the JNC reactor core design code system with a geometrical model which gives a detailed representation and with a rigorous treatment of the group cross-section processing. A comparison between the original ECN adjoint spectra and Dietze's calculations is shown in Figures 3.3.2 and 3.3.3 for the STEK-500 and STEK-3000 cores, respectively. Some differences are observed between the adjoint spectra calculated by Dietze and by JNDC, and the ECN spectra. We have calculated sample worths using the three sets of spectra. Figure 3.3.4 shows the sample worths calculated for ^{92}Zr as a function of the core average neutron energy for the different STEK assemblies and for the two sample sizes (mean chord lengths, ld = 0.726 and 1.3). There are systematic differences between the JNDC and Dietze's spectra. The total worths calculated using both the neutron and adjoint spectra from Dietze's analysis are closest to the

experimental values. The position second nearest to the experimental values is occupied by the value calculated with Dietze's adjoint spectrum and the ECN neutron flux. The difference between the top position and the second is very small, while the top position is far from the values calculated with the ECN flux and adjoint spectrum. This means that the flux difference between Dietze and ECN does not play an important role but the adjoint spectrum difference engenders a large effect. In reactor theory, adjoint spectra contribute to the neutron slowing-down component of sample reactivity. Figure 3.3.5 shows the C/E values for the sample worths of ^{92}Zr as a function of average core neutron energy. For the mean chord length, ld = 0.726, the C/E values show a dip at 16.3 keV, i.e. the average neutron energy of the STEK-200 assembly. This unnatural trend is caused by a large experimental value that seems to be erroneous.

Finally, it can be concluded that the origin of the worth discrepancy, a problem which has existed for a number of years, can be identified as due to inaccurate calculations of the scattering components because of approximations in the calculation of the adjoint spectra. However, we find that there are some discrepancies remaining between the calculated and measured values even in the fairly sophisticated analysis made by Dietze. This might mean that the adjoint calculation method should be refined further, by using a very fine group cross-section set having a higher reliability.

4. Conclusions

The present studies confirm that the DWBA method is applicable for estimating the cross-sections for one-phonon vibrational levels. The coupled channel theory is the best to estimate the excitation functions for both vibrational and rotational levels of deformed nuclides and for the mass range around 100.

An anomalous enhancement of the DWBA cross-sections for ^{100}Mo appears near the threshold energy when the optical potential has a small imaginary part. The enhancement tends to occur when global optical potentials with a symmetry term in the imaginary part are used for nuclides which have an excess of neutrons. The problem is also seen in the coupled-channels calculation; however the magnitude of the enhancement is smaller. The enhancement in the case of the DWBA can be attributed to a large p-wave amplitude. An optical potential which yields too large a p-wave strength function tends to give a large DWBA cross-section. When the DWBA cross-sections are physically reasonable, the differences between the DWBA cross-sections and the coupled-channels cross-sections are small.

The DWBA and the Hauser-Feshbach-Moldauer calculations made using the spherical optical potential of Smith, *et al*. provide inelastic scattering cross-sections in the energy range $E_n \leq 5$ MeV, which are in good agreement with the recent IRMM experimental data. The compound cross-section calculation in this energy range is sensitive to the width fluctuation correction.

The discrepancies between the experimental and calculated sample reactivity worths measured in the STEK experiments are partially attributed to the inaccurate inelastic scattering cross-sections used in the calculations. Modification of the inelastic scattering cross-sections reduces the discrepancies to some degree. However, there are discrepancies for some strong absorbers and for the standard samples such as carbon and oxygen whose cross-sections are rather accurately known. This suggests that there remain yet other factors, such as errors in the calculation of the adjoint spectra and the treatment of resonance self-shielding effects. A recent analysis with a more rigorous treatment of the geometrical model and cross-section processing has led to the probable conclusion that the sample reactivity worth discrepancies for weakly absorbing FP nuclides were caused by approximations in the calculation of adjoint spectra. It should also be noted that the worth of C/E value is not always a good measure to use as a test of the accuracy of cross-sections when the worth is a balance between positive and negative components. The absolute values of the measured and calculated worths, the differences between them and their trends should also be studied.

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TABLES

Table 2.2.1. S-wave and p-wave strength functions for ^{100}Mo

	s-wave ($\times 10^{-4}$)	p-wave ($\times 10^{-4}$)
Mughabghab	0.73 ± 0.17	4.4 ± 0.9
Original WG	0.91	5.1
Modified WG	0.61	7.5
Smith, *et al*..	0.75	4.9

Table 2.2.2 DWBA cross-sections calculated with the original Walter-Guss potential and the modified Walter-Guss potential. The values of W_s are at E_n = 0 MeV.

The DWBA cross-sections are for the collective 2^+ state at E_n =1 MeV, assuming β_2 = 0.1 and an excitation energy of zero

	$(N-Z)/A$	Original WG		Modified WG	
		W_s [MeV]	DWBA [mb]	W_s [MeV]	DWBA [mb]
^{40}Ca	0.0	10.85	4.882	7.710	8.647
^{48}Ca	0.167	8.360	11.73	5.220	27.20
^{78}Kr	0.0769	9.701	21.56	6.561	43.39
^{86}Kr	0.163	8.418	32.28	5.278	78.71
^{102}Pd	0.0980	9.385	17.57	6.245	43.62
^{110}Pd	0.164	8.405	20.76	5.265	51.28
^{156}Dy	0.154	8.552	51.94	5.412	174.4
^{164}Dy	0.195	7.935	57.45	4.795	213.1

Table 3.1.1. Average C/E values for JENDL-3.2, JENDL-3.1 and JEF-2.2 calculations

Nuclides	JNDC/JENDL-3.2		JNDC/JENDL-3.1		Dietze/JENDL-3.2		Meister/JEF-2.2		Dietze/JEF-2.2	
	STEK	CFRMF/EBR	STEK	CFRMF/EBR	STEK-500	STEK-3000	STEK-500	STEK-3000	SEG-5	SEG-7A
Standard sample										
^{10}B	0.98	–	0.98	–	1.00[b]	1.00[b]	1.04[b]	1.02[b]	1.00	1.00
^{12}C	–	–	0.83	–	0.94	0.93	0.99	0.98	1.09	
Weak absorber										
^{90}Zr[a]	0.76	–	0.71	–	0.89	0.78	0.90	0.81	–	–
^{91}Zr[a]	0.00	–	0.38	–	1.24	1.37	0.80	(0.86)	–	–
^{92}Zr[a]	0.53	–	0.49	–	0.72	(0.31)	0.78	(0.59)	–	–
^{96}Zr[a]	0.66	–	0.58	–	0.86	–	0.80	(0.56)	–	–
^{92}Mo	0.89	–	0.96	–	–	1.01	2.21	1.30	–	–
^{94}Mo	1.00	–	1.11	–	0.37	0.66	0.96	(1.33)	–	–
^{96}Mo	0.92	–	1.01	–	–	0.91	(2.95)	(2.47)	–	–
^{98}Mo	0.78	1.16	0.98	1.16	–	1.69	(-0.69)	1.66	1.06	1.14
^{100}Mo	0.45	1.00	0.98	0.99	–	1.75	(0.45)	(1.62)	0.89	0.47
^{102}Ru	–		1.07	1.05	1.95	1.05	(2.96)	(1.40)		
^{104}Pd	–	–	1.10	–	1.58	1.46	–	–	–	–
^{106}Pd	1.17	–	1.15	–	1.43	1.47	0.96	0.98	–	–
^{108}Pd	–	–	1.07	0.99	1.17	0.81	1.66	0.93	–	–
^{110}Pd	0.73	–	0.73		–	–	0.49	-4.23	–	–
^{128}Te			0.39		0.54	–	(0.60)	(3.06)	–	–
^{130}Te			0.46	–	–	–	1.37	(0.68)	–	–
^{139}La[a]	0.70	–	0.74	1.00	0.81	1.35	0.98	(-5.74)	–	–
^{140}Ce[a]	0.78	–	0.78	–	0.49	0.55	0.83	0.91	–	–
^{142}Ce[a]	0.66	0.76	0.64	0.84	0.33	0.44	0.79	0.83	–	–
^{141}Pr	0.96	0.93	0.95	0.92	0.80	1.06	(0.62)	(1.20)	–	–
^{142}Nd[a]	0.00	0.85	0.01	–	0.93	0.76	–		–	–
^{144}Nd[a]	0.56	0.76	0.67	0.76	–	0.58	0.62	(1.03)	–	–
^{146}Nd[a]	–	–	0.13	1.24	–	0.87	0.67	0.86	–	–
^{148}Nd	–	–	0.79	0.98	–	0.79			–	–
^{150}Nd[a]	0.67	1.35	0.68	1.35	–	0.92	(0.11)	1.22	–	–

[a] *Oxide sample.*

[b] *Extrapolated to zero sample size, except for values in parentheses.*

Table 3.1.1. Average C/E values for JENDL-3.2, JENDL-3.1 and JEF-2.2 calculations (*cont.*)

Nuclides	JNDC/JENDL-3.2		JNDC/JENDL-3.1		Dietze/JENDL-3.2		Meister/JEF-2.2		Dietze/JEF-2.2	
	STEK	CFRMF/EBR	STEK	CFRMF/EBR	STEK-500	STEK-3000	STEK-500	STEK-3000	SEG-5	SEG-7A
Strong absorber										
^{93}Nb	0.95	–	0.97	–	1.01	1.06	1.12	(1.07)	–	–
^{95}Mo	0.99	–	1.01	–	0.82	0.81	1.54	(1.15)	1.13	0.96
^{97}Mo	0.96	–	1.00	–	0.99	1.22	1.66	1.22	0.95	0.96
^{99}Tc	0.81	–	0.88	1.22	0.88	0.66	1.09	(1.03)	–	–
^{101}Ru	0.94	–	1.00	–	1.04	0.99	(1.11)	(1.07)	–	–
^{103}Rh	0.96	–	1.04	–	0.90	0.97	1.07	0.99	0.90	1.12
^{105}Pd	–	–	0.92	–	0.99	0.85	1.09	0.82	1.06	–
^{107}Pd	0.94	–	0.92	–	1.04	0.92	1.20	0.93	–	–
^{107}Ag	–	0.93	–	0.91	–	–	–	–	–	–
^{109}Ag	0.66	0.72	0.63	0.72	0.76	0.55	0.67	0.98	0.93	0.89
^{111}Cd[a]	1.08	–	0.92	–	0.95	1.10	0.62	0.73	–	–
In	0.95	–	0.88	–	–	–	(0.86)	–	–	–
^{121}Sb	–	0.95	–	1.20	–	–	–	–	–	–
^{123}Sb	–	1.01	–	1.29	–	–	–	–	–	–
^{127}I	0.86	–	0.82	–	0.81	0.82	0.75	(1.03)	–	–
^{129}I	1.06	–	1.06	–	1.12	0.88	0.96	1.48	0.93	–
^{133}Cs (Cl)	0.86	–	0.80	0.91	0.71	0.58	0.87	(0.98)	–	–
^{135}Cs (Cl)	0.92	–	0.88	–	0.23	0.43	0.89	1.17	0.90	–
^{143}Nd[a]	0.90	0.85	0.90	0.85	0.88	0.84	(1.99)	0.96	1.06	–
^{145}Nd[a]	0.84	0.81	0.85	0.81	0.90	0.58	0.43	1.14		
^{147}Pm	–	–	–	–	0.89	0.65	1.80	(1.13)	–	–
^{147}Sm[a]	0.90	–	0.83	0.86	0.96	0.87	1.46	(1.17)	1.19	1.50
^{149}Sm[a]	0.88	0.83	0.88	0.83	1.05	0.89	1.25	(1.24)	–	–
^{150}Sm[a]	0.81	–	0.86	–	0.89	0.75	(1.15)	(1.08)	–	–
^{152}Sm[a]	0.85	–	0.85	1.01	0.92	0.69	1.74	(0.95)	–	–
^{154}Sm[a]	0.86	–	0.81	–	0.84	0.85	(0.80)	(1.00)	1.09	–
^{153}Eu[a]	0.92	0.86	0.92	0.86	0.98	0.94	0.95	(1.07)		

[a] *Oxide sample.*
[b] *Extrapolated to zero sample size, except for values in parentheses.*

Table 3.1.2. C/E values obtained in Dietze's analysis of the STEK experiments

MAT	ID	STEK-4000	STEK-3000	STEK-2000	STEK-1000	STEK-500	Comment
^{10}B	105	1.00±4%	1.00±5%	1.00±4%	1.00±4%	1.00±4%	Normalisation
^{90}Zr	**400**	**0.58±29%**	**0.78±28%**	**0.71±28%**	**0.75±24%**	**0.89±21%**	**Small effect, !**
^{91}Zr	**401**	**1.51±13%**	**1.37±15%**	**1.43±15%**	**1.22±22%**	**1.24±68%**	**!**
^{92}Zr	**409**	x	x	**0.31±55%**	**0.60±31%**	**0.72±25%**	**Small effect, !**
^{93}Zr	**403**	**0.32±43%**	**0.40±59%**	**0.37±54%**	**0.28±57%**	**0.35±44%**	**!**
^{96}Zr	406	2.20±28%	x	2.36±79%	1.13±63%	0.86±29%	Small effect
^{92}Mo	422	1.08±48%	1.01±61%	0.97±54%	0.66±53%	x	
^{94}Mo	424	x	0.66±49%	0.85±37%	1.62±70%	0.37±60%	Small effect
^{95}Mo	425	0.80±12%	0.81±14%	0.87±14%	0.88±13%	0.82±16%	Important FP, **?**
^{96}Mo	426	1.04±36%	0.91±57%	0.96±50%	1.17±51%	x	Small effect
^{97}Mo	427	0.77±16%	0.79±15%	0.93±12%	0.97±9%	0.99±13%	Important FP
^{98}Mo	**428**	**2.33±12%**	**1.69±20%**	**2.14±23%**	x	x	**Important FP, !**
^{100}Mo	**420**	**1.87±15%**	**1.75±27%**	x	x	x	**Important FP, !**
^{99}Tc	**439**	**0.84±11%**	**0.66±12%**	**0.69±15%**	**0.72±17%**	**0.88±8%**	**Important FP, !**
^{101}Ru	441	1.16±12%	0.99±13%	1.03±13%	0.98±14%	1.04±11%	Important FP
^{102}Ru	442	0.67±27%	1.05±20%	1.10±19%	1.43±23%	1.95±61%	Important FP, ?
^{104}Ru	444	1.09±38%	1.09±32%	1.23±39%	1.84±36%	1.24±38%	Important FP
^{103}Rh	453	0.95±8%	0.97±9%	0.93±9%	0.92±7%	0.90±11%	Important FP
^{104}Pd	**464**	**1.30±45%**	**1.46±44%**	**1.55±47%**	**1.40±52%**	**1.58±84%**	**?**
^{105}Pd	465	0.88±10%	0.85±12%	0.96±10%	1.03±9%	0.99±9%	Important FP
^{106}Pd	**466**	**1.59±16%**	**1.47±17%**	**1.44±15%**	**1.40±19%**	**1.43±29%**	**!**
^{107}Pd	467	0.93±9%	0.92±10%	1.07±11%	1.11±11%	1.04±9%	Important FP
^{108}Pd	468	0.97±23%	0.81±17%	0.95±22%	1.39±42%	1.17±39%	Important FP
^{110}Pd	460	1.05±36%	x	0.89±86%	0.59±40%	x	
^{109}Ag	**479**	**0.78±11%**	**0.55±13%**	**0.84±15%**	**0.72±19%**	**0.76±14%**	Important FP, !
^{111}Cd	481	0.95±24%	1.10±25%	1.07±22%	0.89±21%	0.95±22%	
^{128}Te	**528**	x	x	x	x	**0.54±28%**	**Small effect, !**
^{130}Te	533	x	x	0.79±44%	1.02±39%	x	Small effect
^{127}I	**537**	**0.73±11%**	**0.82±17%**	**0.92±14%**	**0.87±16%**	**0.81±20%**	**?**
^{129}I	539	0.86±28%	0.88±29%	0.93±28%	1.08±21%	1.12±26%	Important FP
^{133}Cs	**553**	**0.65±10%**	**0.58±13%**	**0.70±9%**	**0.80±8%**	**0.71±12%**	Important FP, !
^{135}Cs	**555**	x	**0.43±70%**	**0.61±84%**	**0.71±85%**	**0.23±84%**	**Large err., ?**
^{139}La	579	1.17±8%	1.35±55%	x	x	0.81±53%	Small effect
^{140}Ce	580	1.54±64%	0.55±54%	0.68±39%	0.98±24%	0.49±45%	Small effect
^{142}Ce	**582**	x	**0.44±65%**	**0.27±25%**	**0.36±19%**	**0.33±17%**	**!**
^{141}Pr	591	0.99±19%	1.06±25%	0.87±21%	1.49±29%	0.80±38%	Important FP

C/E values of central reactivity worths, normalised to the C/E value of ^{10}B, calculated using the JNC standard route JENDL-3.2/SLAROM/CITATION/ PERKY in 70 energy groups.

x *Measured reactivity or infinitely dilute value is very small or near zero.*

! *Discrepancy significant.*

? *Discrepancy questionable.*

Table 3.1.2. C/E values obtained in Dietze's analysis of the STEK experiments (*cont.*)

MAT	ID	STEK-4000	STEK-3000	STEK-2000	STEK-1000	STEK-500	Comment
^{142}Nd	602	x	0.76±69%	0.98±47%	0.73±40%	0.93±54%	Small effect
^{143}Nd	603	0.66±18%	0.84±25%	0.86±25%	0.99±14%	0.88±24%	Important FP
^{144}Nd	604	0.36±37%	0.58±45%	0.92±54%	0.85±44%	x	
^{145}Nd	605	0.47±25%	0.58±28%	0.71±22%	0.87±18%	0.90±22%	Important FP
^{146}Nd	606	0.82±37%	0.87±72%	1.58±84%	x	x	Small effect
^{148}Nd	608	0.76±23%	0.79±24%	0.92±18%	1.13±19%	x	
^{150}Nd	600	0.75±33%	0.92±49%	1.30±25%	1.69±23%	x	
^{147}Pm	617	0.78±19%	0.65±24%	0.76±21%	0.86±15%	0.89±12%	Important FP
^{147}Sm	627	0.86±15%	0.87±24%	1.11±24%	0.95±12%	0.96±14%	
^{148}Sm	628	0.49±25%	0.59±52%	0.90±33%	1.23±36%	1.54±84%	
^{149}Sm	629	1.25±14%	0.89±15%	0.87±14%	0.88±13%	1.05±10%	Important FP
^{150}Sm	620	0.86±19%	0.75±25%	0.77±21%	0.81±22%	0.89±21%	
^{151}Sm	**621**	**0.46±60%**	**0.42±54%**	**0.44±51%**	**0.50±53%**	**0.55±55%**	Important FP, !
^{152}Sm	622	0.80±25%	0.69±39%	0.75±27%	0.78±26%	0.92±37%	
^{154}Sm	624	0.77±27%	0.85±38%	0.99±32%	1.00±28%	0.84±46%	
^{151}Eu	631	0.84±14%	0.72±17%	0.80±16%	0.86±12%	0.81±17%	From Eu-nat
^{153}Eu	633	0.92±11%	0.94±16%	1.02±14%	0.99±12%	0.98±13%	Important FP
^{156}Gd	646	1.69±18%	1.89±28%	1.43±25%	0.98±27%	1.17±63%	?
^{157}Gd	647	3.19±8%	1.41±11%	1.24±12%	0.99±14%	1.23±21%	?
^{159}Tb	659	0.96±6%	0.92±13%	1.01±7%	1.08±8%	1.10±12%	

C/E values of central reactivity worths, normalised to the C/E value of ^{10}B, calculated using the JNC standard route JENDL-3.2/SLAROM/CITATION/ PERKY in 70 energy groups.

x *Measured reactivity or infinitely dilute value is very small or near zero.*

! *Discrepancy significant.*

? *Discrepancy questionable.*

Table 3.2.1. Sample reactivity worth C/E values and the contributions of capture, scattering and direct inelastic scattering to the worth for Mo, Ru, Pd and Nd isotopes

Nuclides	STEK-500 (hard spectrum)				STEK-3000 (soft spectrum)			
	C/E	Capture/total	Scat./total	Direct/scat.	C/E	Capture/total	Scat./total	Direct/scat.
^{92}Mo	-2.73	-2.31	1.31	-0.60%	1.26	-1.55	0.55	0.70%
^{98}Mo	-0.33	-9.06	8.06	1.20%	1.15	-1.74	0.741	1.40%
^{100}Mo	0.054	-747	748	0.20%	1.24	-1.84	0.84	2.20%
^{102}Ru	2.03	-1.66	0.66	9.9%	1.43	-1.26	0.26	9.8%
^{104}Ru	1.00	-2.08	1.08	5.5%	1.15	-1.34	0.34	5.3%
^{104}Pd	1.65	-1.22	0.22	11%	1.17	-1.08	0.08	12%
^{106}Pd	1.24	-1.29	0.29	5.2%	1.21	-1.13	0.13	7.1%
^{108}Pd	1.74	-1.43	0.43	10%	1.10	-1.11	0.11	8.3%
^{110}Pd	2.68	-1.96	0.96	4.0%	4.33	-1.28	0.28	2.6%
^{142}Nd	0.218	-4.89	5.89	1.9%	4.46	-2.47	1.47	2.3%
^{144}Nd	0.568	-1.87	2.87	6.8%	0.76	-2.61	1.61	5.0%
^{146}Nd	0.387	-5.06	6.06	7.0%	1.14	-2.38	1.38	5.3%
^{148}Nd	1.03	-7.24	6.24	9.3%	0.80	-1.69	0.69	7.2%
^{150}Nd	0.37	-6.37	7.37	5.6%	0.81	-1.79	0.79	4.1%

Table 3.3.1. C/E values for the reactivity worths of standard samples and strongly absorbing FP nuclides (calculation with JENDL-3.1)

Nuclides	C/E value with ECN flux	C/E value with Monte Carlo method
(Stadard samples)		
^{10}B	0.981	0.963 ± 0.018
C	0.829	0.823±0.020
N	0.850	0.847±0.085
O	0.729	0.753±0.030
Al	0.817	0.871±0.037
Pb	0.662	0.823±0.025
^{235}U	0.946	0.962±0.021
(FP nuclides)		
^{95}Mo	0.998	0.969±0.045
^{99}Tc	0.872	0.859±0.026
^{105}Pd	0.894	0.883±0.027
^{107}Pd	0.899	0.888±0.019
^{149}Sm	0.851	0.841±0.018
^{153}Eu	0.899	0.888±0.020
^{159}Tb	1.017	1.009±0.024

Table 3.3.2. C/E values for the reactivity worths of weakly absorbing FP nuclides (calculation with JENDL-3.1)

Nuclides	C/E value with ECN flux	C/E value with Monte Carlo method
^{90}Zr	0.674	0.705±0.123
^{92}Zr	0.479	0.532±0.138
^{96}Zr	0.571	0.622±0.156
^{92}Mo	0.947	0.877±0.338
^{94}Mo	1.099	1.006±0.468
^{98}Mo	1.027	0.975±0.103
^{100}Mo	1.089	1.041±0.190
^{104}Pd	1.101	1.078±0.217
^{106}Pd	1.147	1.120±0.106
^{108}Pd	1.065	0.998±0.149
^{110}Pd	0.722	0.649±0.456
^{128}Te	0.386	0.407±0.279
^{130}Te	0.457	0.549±0.269
^{140}Ce	0.795	0.843±0.118
^{142}Ce	0.642	0.675±0.183
^{142}Nd	0.009	0.043±0.079
^{144}Nd	0.628	0.645±0.336
^{146}Nd	0.590	0.696±0.236
^{148}Nd	0.767	0.728±0.100
^{150}Nd	0.675	0.641±0.097

FIGURES

Figure 2.1.1. Comparison of inelastic scattering cross-sections for ^{92}Zr

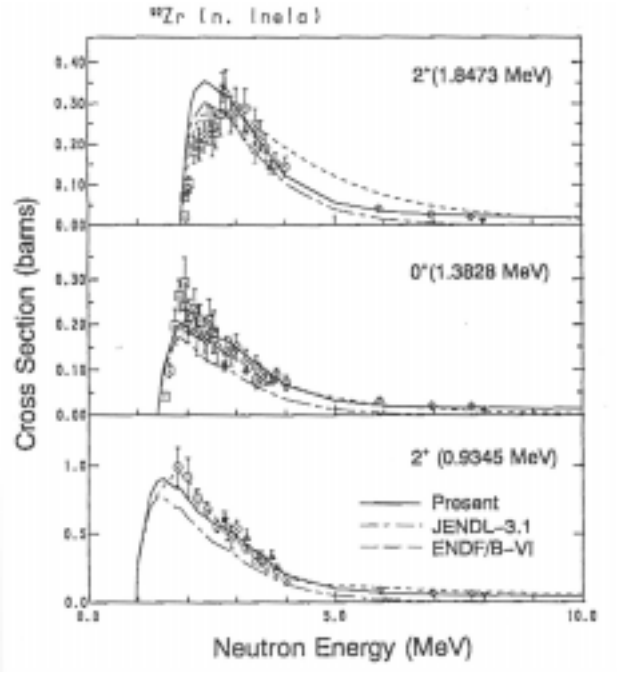


Figure 2.1.2. Comparison of inelastic scattering cross-sections for natural Pd

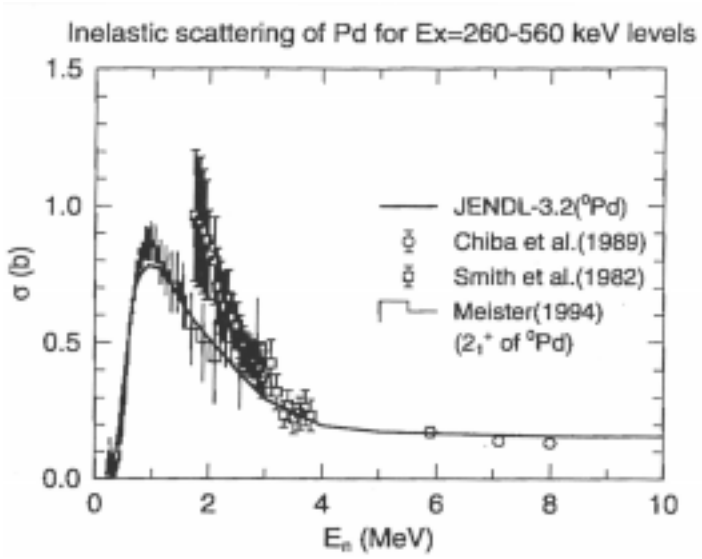


Figure 2.1.3. Level scheme of ^{144}Nd and ^{150}Nd

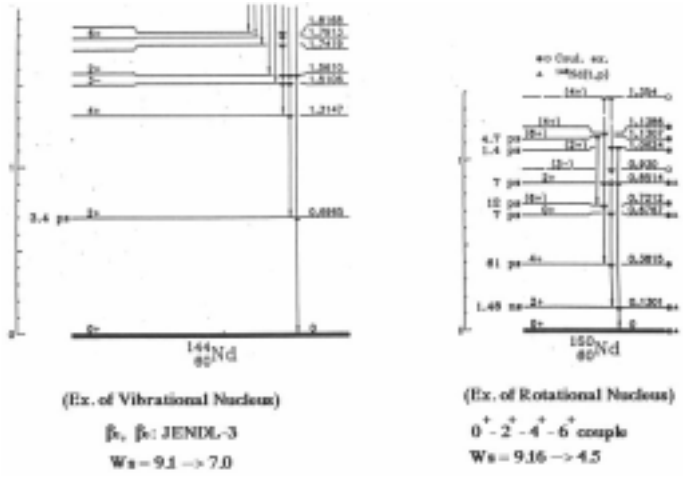


Figure 2.1.4. Comparison of inelastic scattering cross-sections for ^{144}Nd

JENDL-3 is based on DWBA calculation with
W_s = 9.1 MeV and ECIS is denoted to the CC calculation

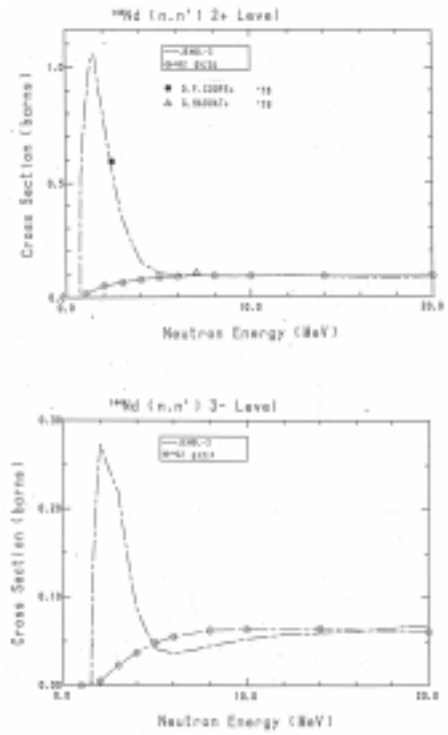


Figure 2.1.5. Comparison of inelastic scattering cross-sections for natural ^{150}Nd

Solid and dashed lines show the CC results with W_s = 4.5 and 9.13 MeV, respectively. JENDL-3 was estimated with DWBA.

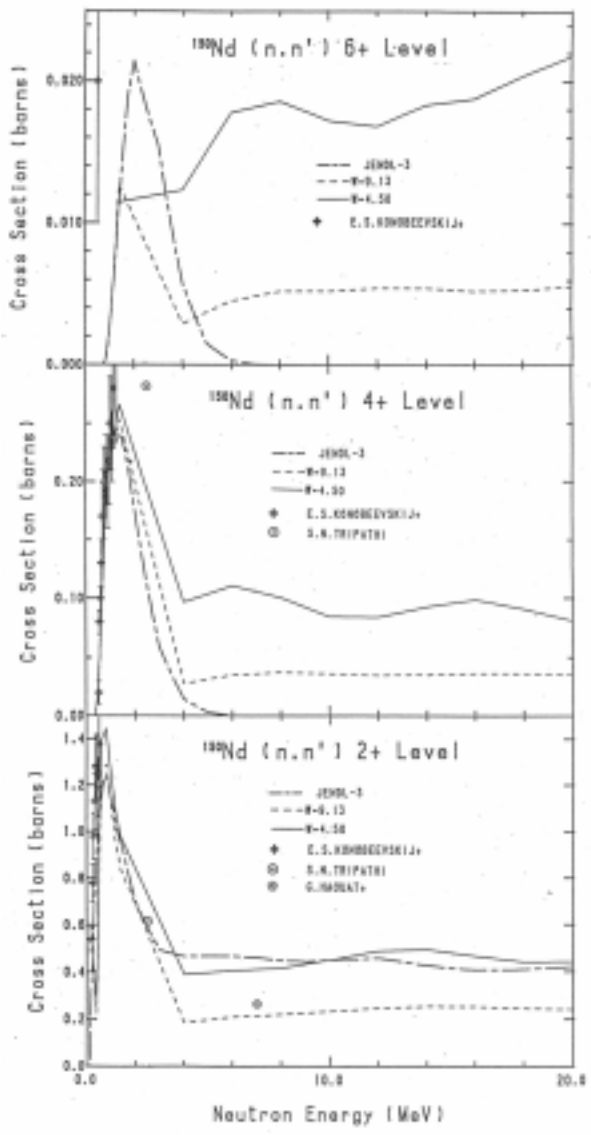


Figure 2.2.1. Direct inelastic scattering cross-sections to 2^+ level calculated with the original Walter-Guss potential (thin lines) and the modified Walter-Guss potential (thick lines). The dot-dashed lines are the CC results with the 0^+-2^+-3^- coupling scheme.

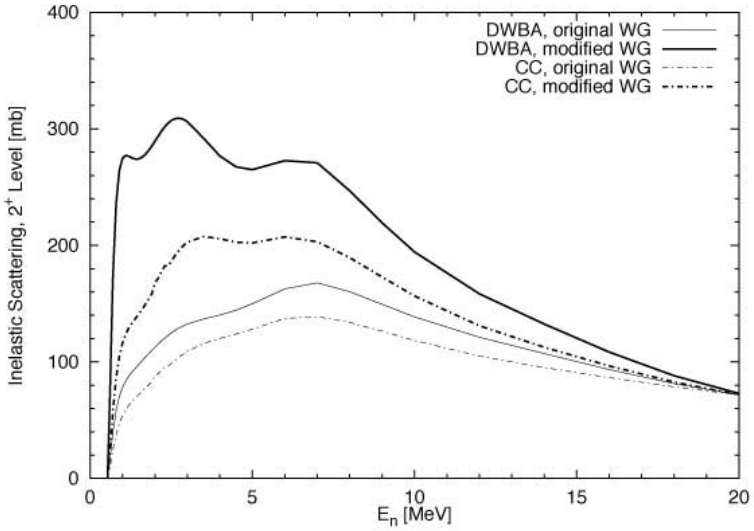


Figure 2.2.2. Direct inelastic scattering cross-sections to 3^- level calculated with the original Walter-Guss potential (thin lines) and the modified Walter-Guss potential (thick lines). The dot-dashed lines are the CC results with the 0^+-2^+-3^- coupling scheme.

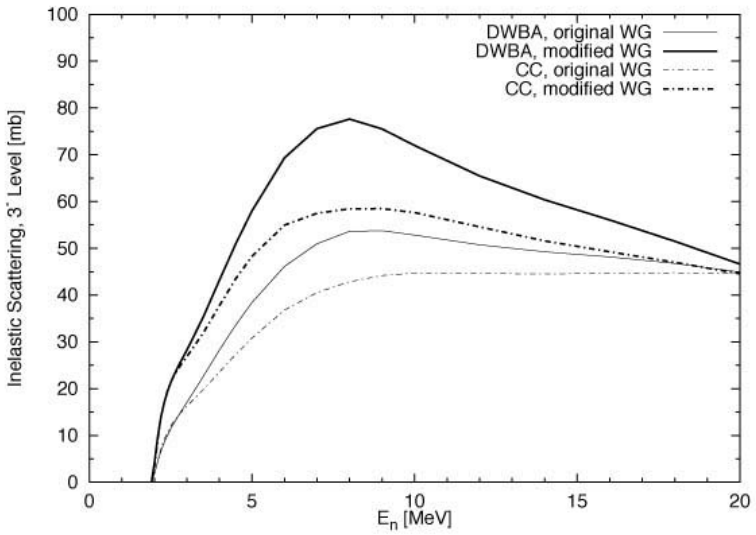


Figure 2.2.3. The squared values of the radial wave functions at E_n = 0.1 MeV

The thin lines are calculated with the original Walter-Guss potential, and the thick lines are with the modified one

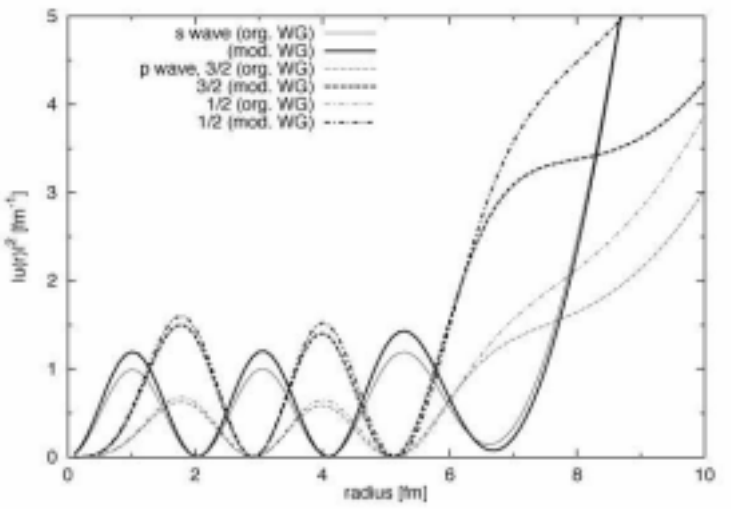


Figure 2.2.4. Comparison of the overlap integral with the original Walter-Guss and the modified Walter-Guss potentials

The entrance channel and the exit channel wave functions are for the p-wave, j = 3/2 at E_n = 0.1 MeV. The collective form factor is shown by the dashed line (real) and the dot-dashed lines (imaginary). The real parts of both potentials are the same.

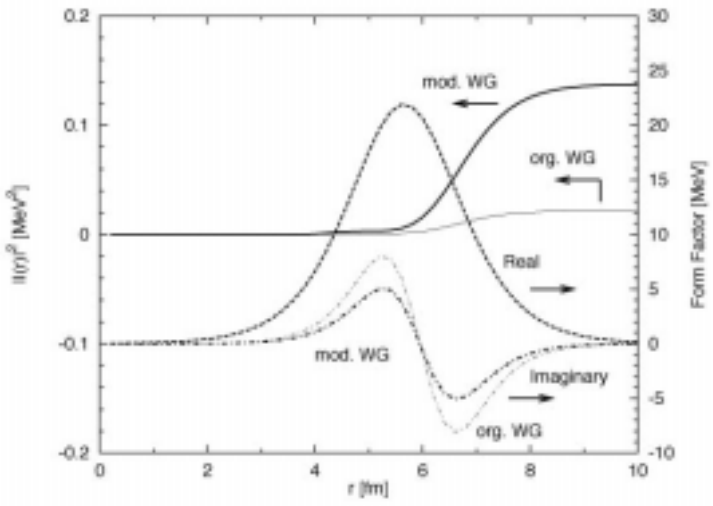


Figure 2.2.5. Imaginary part of S matrix elements at E_n = 1 keV and DWBA cross-sections at E_n = 1.0 MeV as a function of the depth of the imaginary potential, W_s

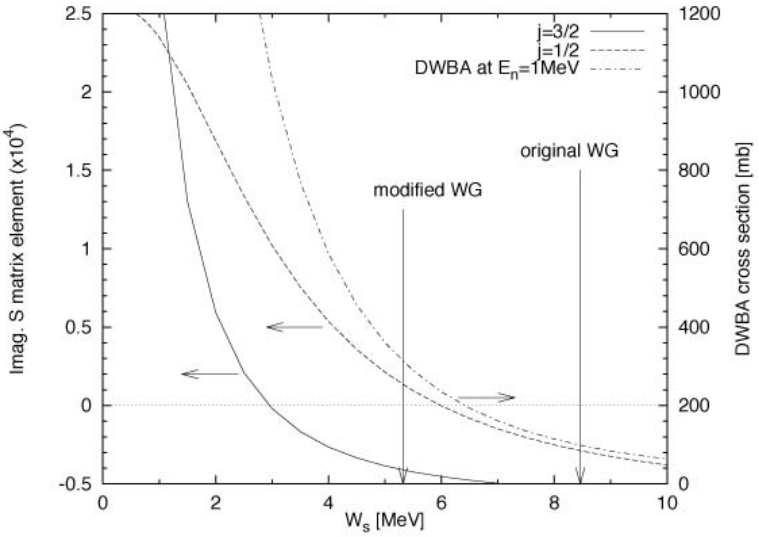


Figure 2.2.6. Comparison of the calculated DWBA cross-sections for ^{100}Mo and the partial cross-sections (dashed lines)

The DWBA cross-sections are calculated for a fictitious level having the excitation energy of 0 MeV and the angular momentum transfer of 2 h

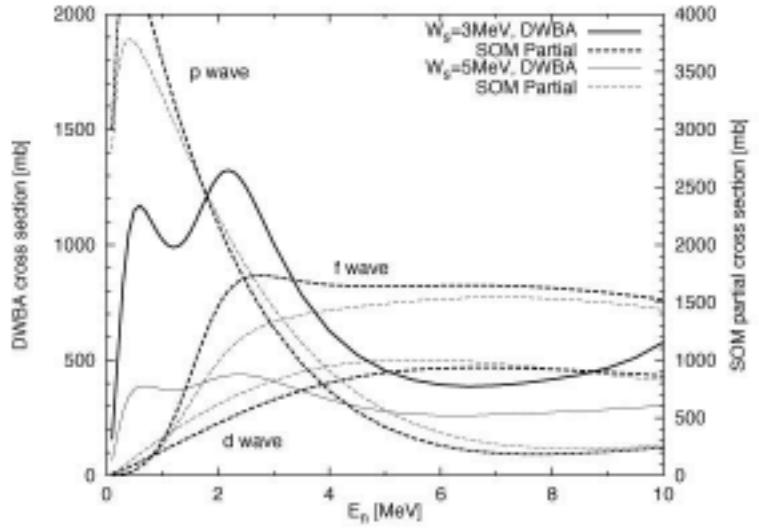


Figure 2.2.7. Comparison of the calculated DWBA cross-sections for ^{50}Cr and the partial cross-sections (dashed lines)

The DWBA cross-sections are calculated for a fictitious level having the excitation energy of 0 MeV and the angular momentum transfer of 2 h

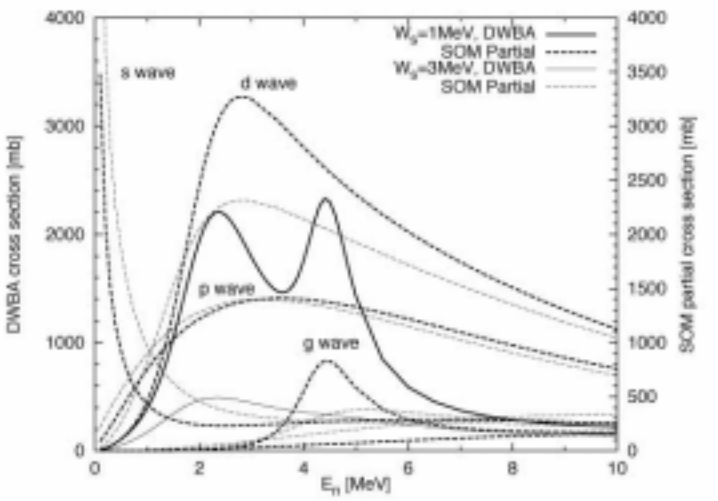


Figure 2.2.8. Comparison of the calculated inelastic scattering cross-sections of ^{100}Mo for the 535.6, 695.1 and 1 064 keV levels with the experimental data

Cross-sections for the first level contain ^{88}Mo of the second level. The direct process is calculated with the DWBA. The dot-dashed line corresponds to the compound cross-section calculation on the assumption that the level widths distribution is the Porter-Thomas distribution.

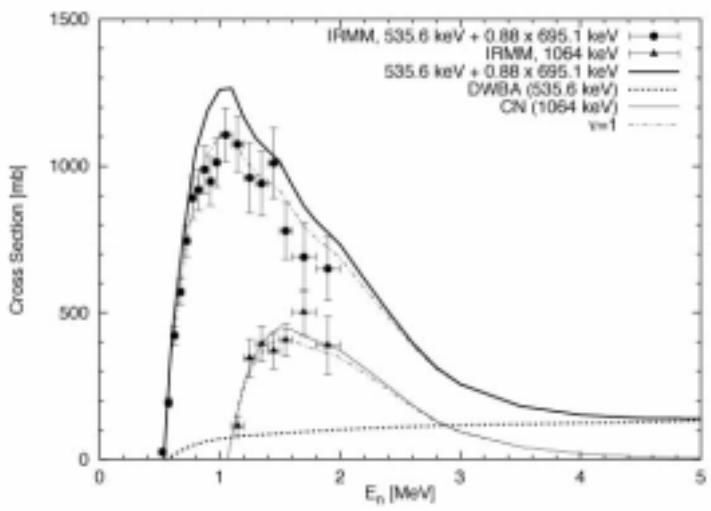


Figure 2.2.9. Same as Figure 2.2.7, but the direct process is calculated with the CC

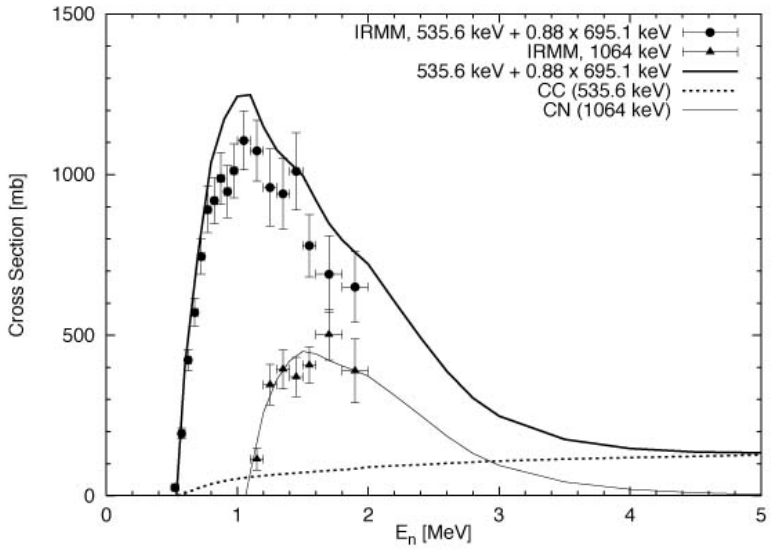


Figure 2.2.10. Comparison of the calculated inelastic scattering cross-sections of ^{100}Mo for the 535.6 keV level with the experimental data

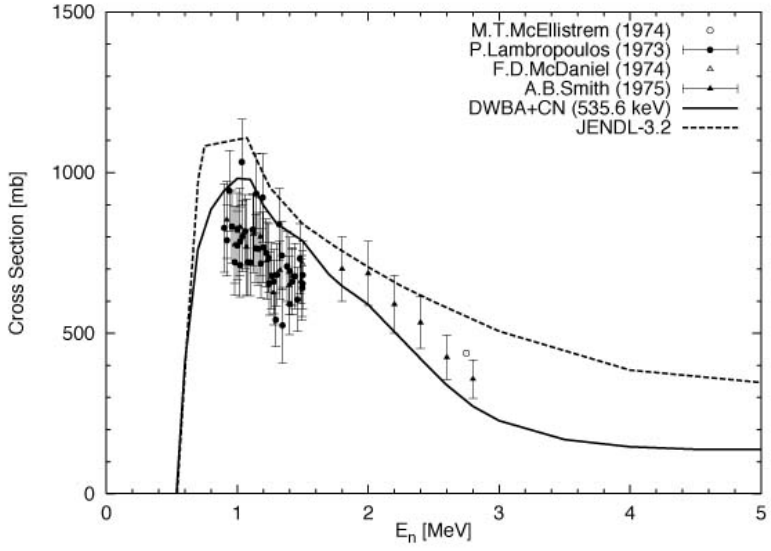


Figure 2.2.11. Comparison of the calculated inelastic scattering cross-sections of ^{98}Mo for the 787.4 and 1 432 keV levels with the experimental data, as well as the calculated cross-sections for 734.8 keV level

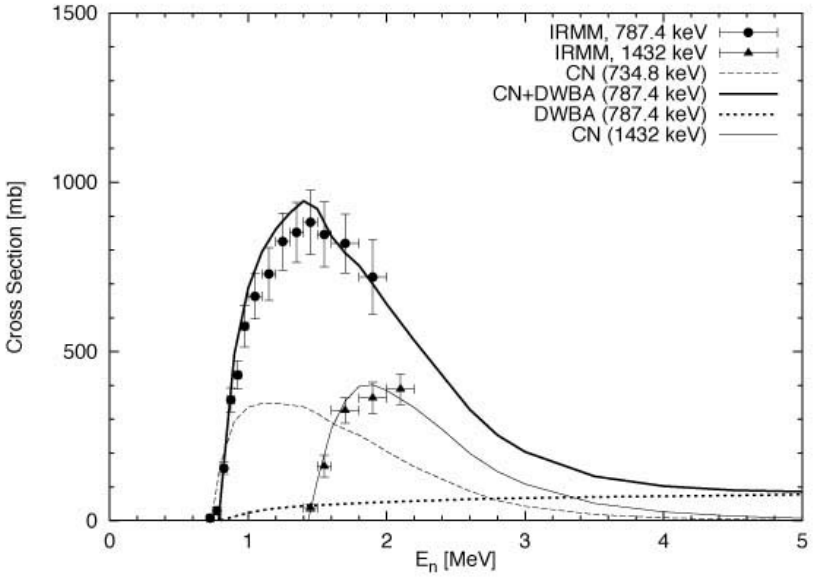


Figure 2.2.12. Comparison of the calculated inelastic scattering cross-sections of ^{92}Mo for the 1 509 keV level with the experimental data

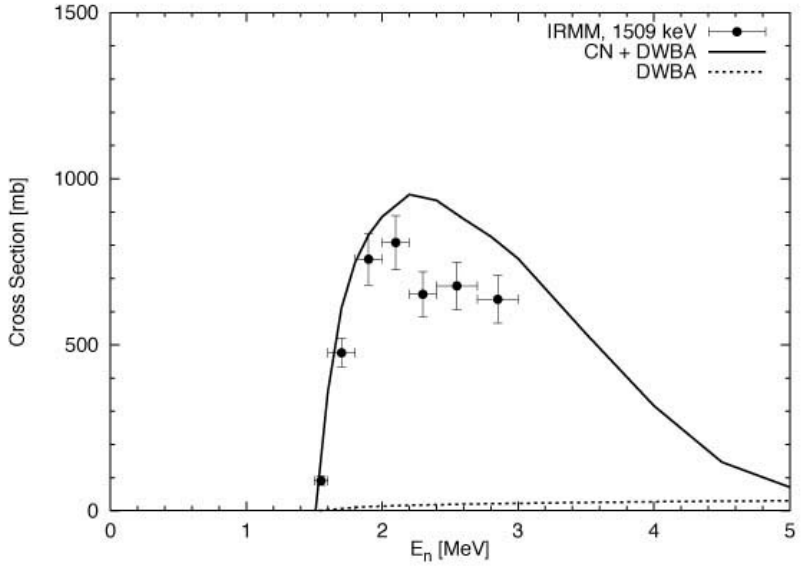


Figure 3.1.1. C/E values of sample reactivity worth for the STEK experiments as a function of mass number

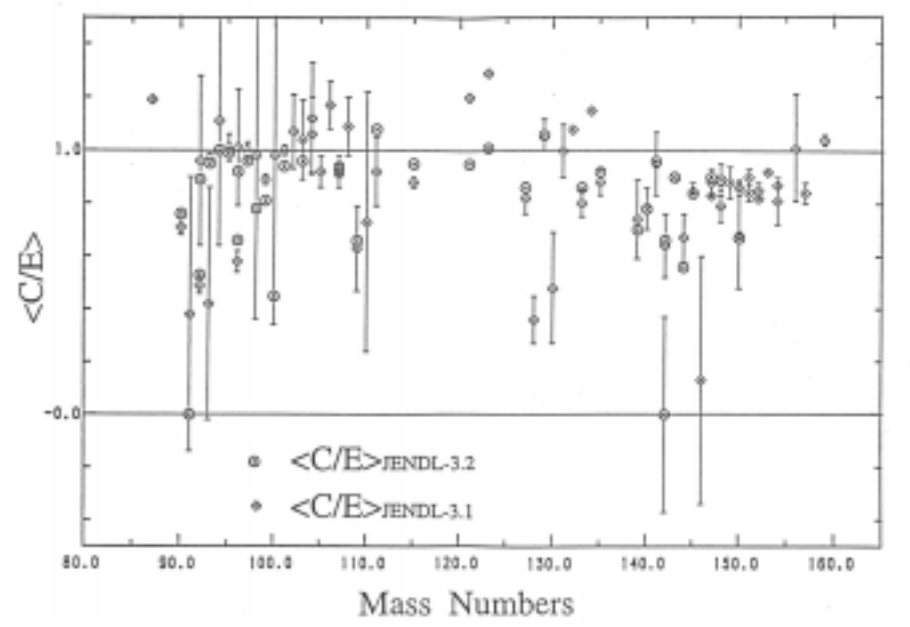


Figure 3.2.1. Comparison of reactivity worth of ^{98}Mo in order of core size for two sample sizes

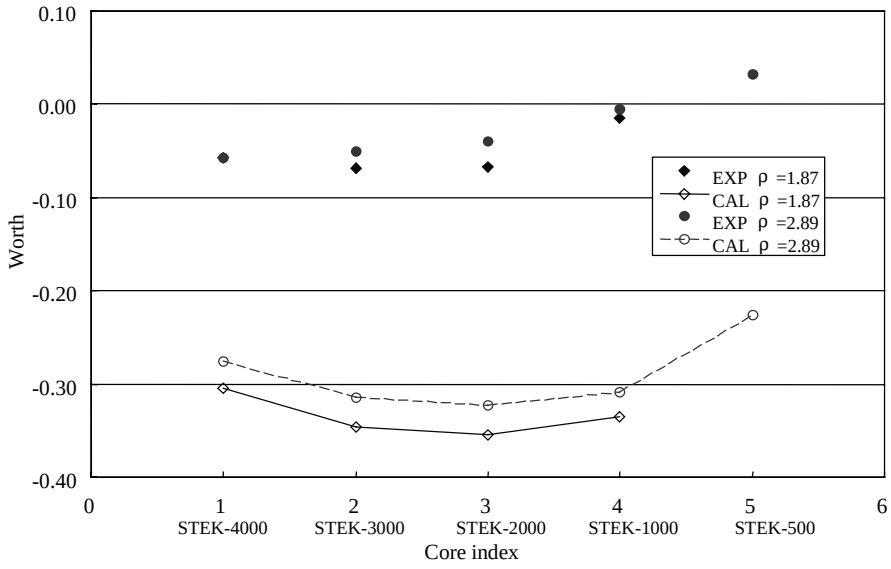


Figure 3.2.2. Reactivity worth of ^{100}Mo in order of core size for three sample sizes

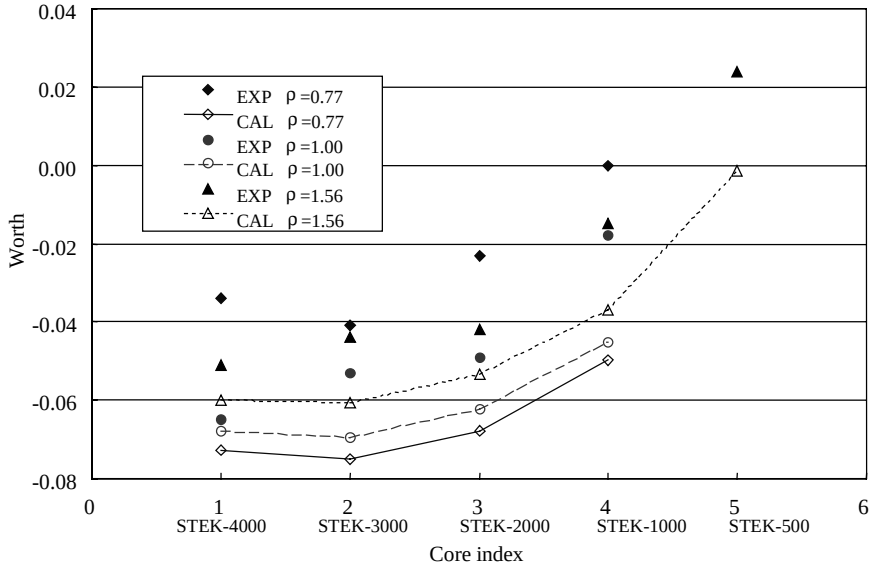


Figure 3.3.1. Comparison of the calculated neutron spectra in the STEK-4000 core

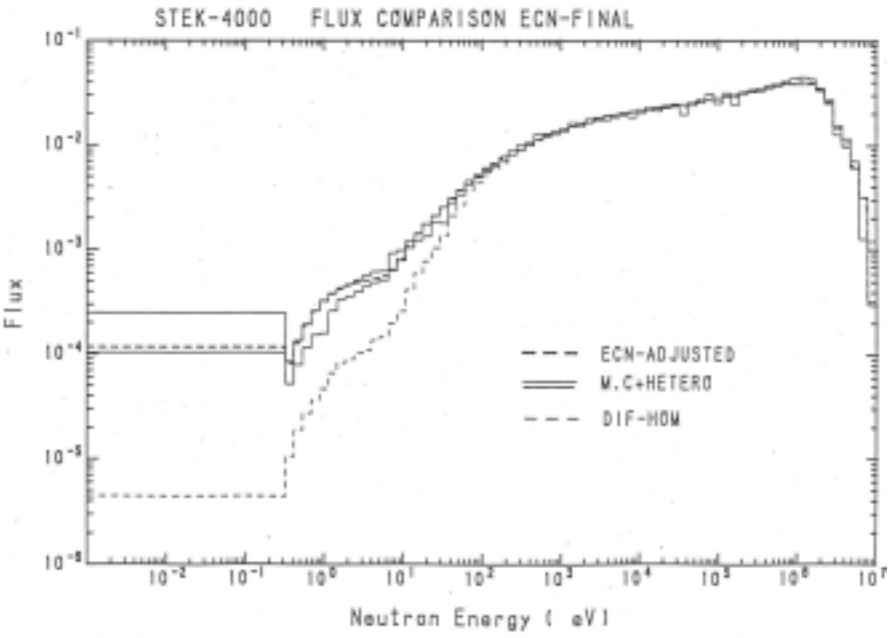


Figure 3.3.2. Comparison of adjoint spectra and ratios to the ECN spectrum in the STEK-3000 core

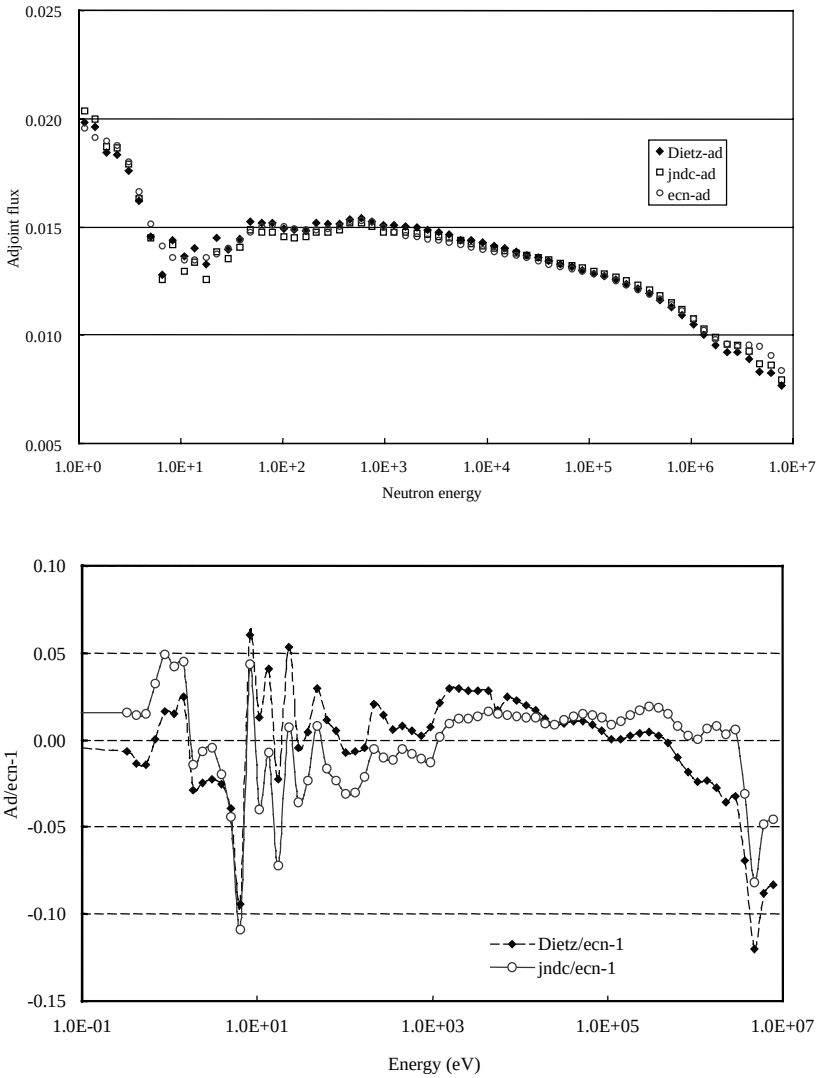


Figure 3.3.3. Comparison of adjoint spectra and ratios to the ECN spectrum in the STEK-500 core

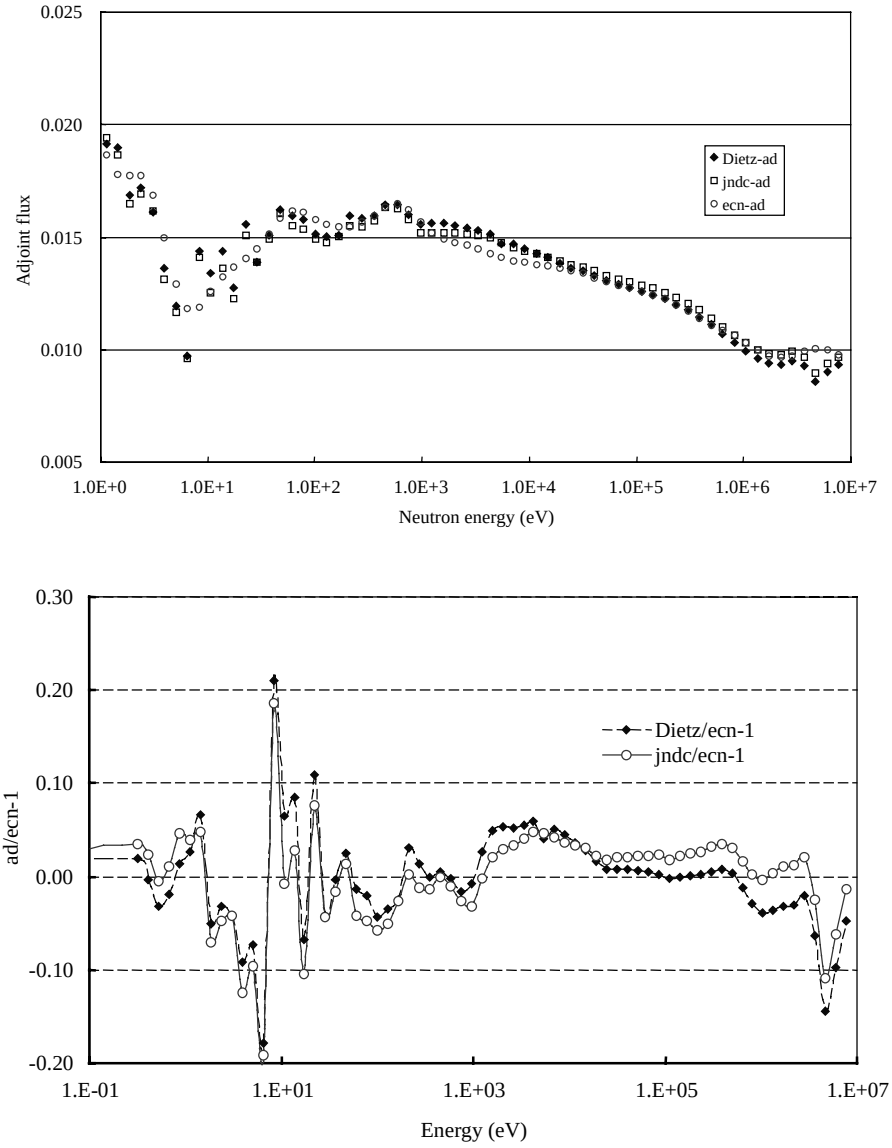
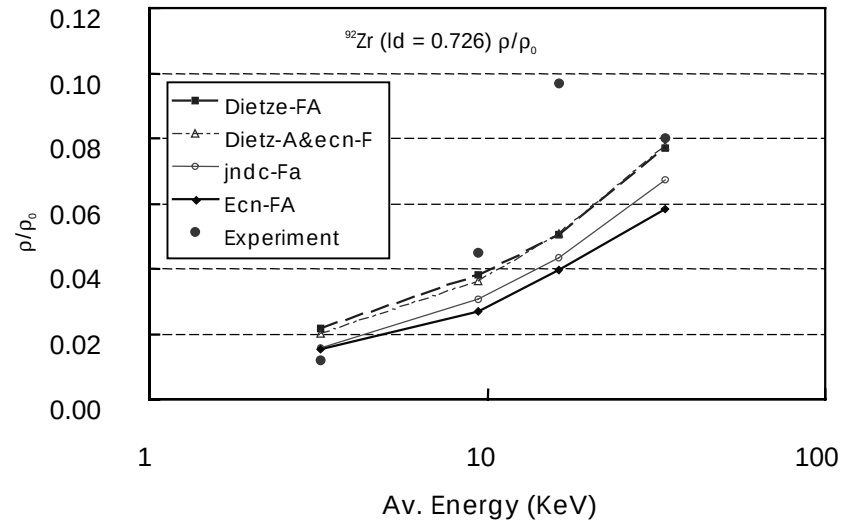


Figure 3.3.4. Comparison of the reactivity worth of ^{92}Zr as a function of average core neutron energy, calculated using various combinations of neutron and adjoint fluxes with the experimental values



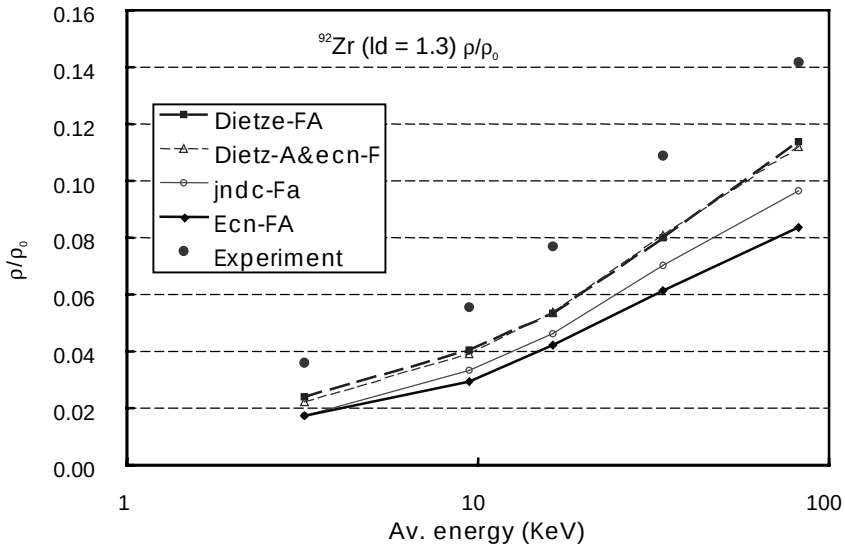
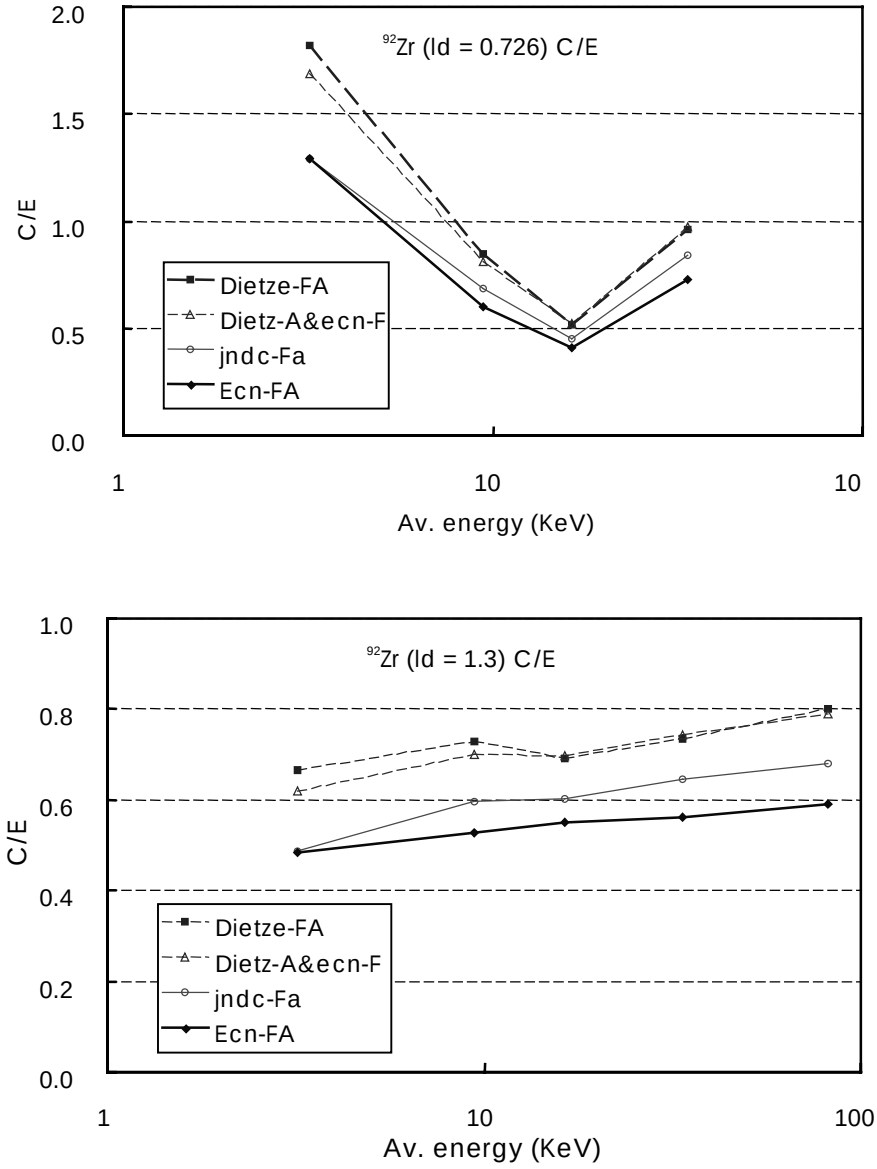


Figure 3.3.5. Comparison of the C/E values for reactivity worth of ^{92}Zr as a function of average core neutron energy, calculated using various combinations of neutron and adjoint fluxes with the experimental values



APPENDIX

Summary of the JNDC Analysis of the STEK Experiments Using JENDL-3.2

Table A.1. Calculated results with ECN spectrum and JENDL-3.2

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
H	P	1.80	0.1246	0.509	0.124	0.698	0.131	0.896	0.129	1.241	0.124	1.600	0.111
	P	3.44	-0.0003	0.509	0.123	0.698	0.131	0.896	0.130	1.241	0.124		
^{7}LI	M	9.55	0.0161	0.010	-0.115	0.083	0.016	0.134	1.372	0.210	1.008		
	N	13.85	-0.0146	0.011	-0.118	0.083	0.015	0.134	1.370	0.209	1.016	0.290	0.852
1-^{10}B	Ph = 0.75	3.26	1.0195	-1.771	1.042	-1.331	1.053	-1.165	1.006	-0.945	0.998	-0.646	0.961
	Ph = 1.50	6.30	1.0033	-1.687	1.040	-1.301	1.027	-1.148	1.003	-0.937	0.975	-0.643	0.948
	Ph = 2.25	9.16		-1.626	1.018	-1.278	1.025	-1.135	1.001	-0.930	0.982		
	Ph = 3.00	11.84		-1.580	1.019	-1.259	1.017	-1.123	0.996	-0.924	0.976	-0.638	0.923
2-^{10}B		0.0038											
		0.0150											
3-^{10}B		0.0130											
C	Ph = 3.0	8.94	0.8635			0.213	0.874	0.276	0.869				
	Ph = 3.5	10.26	-0.0176							0.371	0.819		
	Ph = 5.0	13.72				0.213	0.870						
	Ph = 9.7	23.21		0.145	0.882	0.213	0.884	0.276	0.868	0.371	0.838		
	Ph = 11.2	25.08						0.276	0.868	0.371	0.834		
	Ph = 16.8	32.03				0.213	0.880						
	Ph = 21.0	35.22		0.145	0.891								
	Ph = 31.5	43.47		0.145	0.890							0.460	0.781
1-N	M	17.51	0.7235	0.015	1.242	0.030	0.752	0.044	0.667	0.059	0.676		
	R	29.85	1.1516	0.015	1.000	0.030	0.757	0.044	0.721	0.059	0.654		
2-N	M	18.26	0.4712	0.005	0.327	0.017	0.513	0.026	0.503	0.036	0.497		
	R	29.00	1.3224	0.005	0.337	0.017	0.474	0.027	0.499	0.036	0.467		
1-O	M	11.30	0.7629	0.050	0.749	0.077	0.804	0.101	0.731	0.136	0.760		
	N	17.92	-0.4477	0.050	0.750	0.077	0.780	0.101	0.767	0.136	0.742		
	R	13.65		0.050	0.785	0.077	0.791	0.101	0.770	0.136	0.755	0.172	0.730

N.B. $Av(C/E)_{abs} = (\rho_c/p_0)_{cal}/[(\rho/\rho_0)_{cal} - (\rho_s/\rho_0)_{cal}]$, where $(\rho_c/\rho_0)_{cal}$ is the calculated reactivity worth for capture, $(\rho/\rho_0)_{exp}$ is the experimental reactivity worth and $(\rho_s/\rho_0)_{cal}$ is the calculated reactivity worth for scattering.

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
2-O	N	22.40	0.3654	0.007	0.209	0.020	0.354	0.032	0.404	0.048	0.422		
	R	20.75	-0.8208	0.007	0.203	0.020	0.352	0.032	0.393	0.048	0.420	0.066	0.443
Al	Ph = 2.1	10.52	0.8661			0.053	0.884	0.070	0.909				
	Ph = 3.0	14.17	1.4682	0.033	0.834	0.053	0.870			0.092	0.880	0.116	0.841
	Ph = 3.4	15.77								0.092	0.855		
	Ph = 4.0	18.00				0.053	0.877	0.069	0.884	0.092	0.863	0.116	0.879
	Ph = 4.7	20.97								0.092	0.857		
	Ph = 5.7	24.33		0.033	0.838	0.053	0.886						
	Ph = 6.1	25.78						0.069	0.862	0.092	0.866		
	Ph = 10.3	37.52						0.069	0.881				
	Ph = 13.9	45.61		0.033	0.852								
	Ph = 14.7	47.12		0.033	0.850								
Si	M	13.01	0.6873	0.023	0.629	0.037	0.687	0.047	0.632				
	C	11.25	-0.7613	0.023	0.729	0.037	0.741	0.047	0.717	0.063	0.623		
	R	33.26		0.023	0.700	0.037	0.725	0.048	0.698	0.063	0.670		
Cl	D	13.02	0.0813	-0.005	0.145	0.001	-0.023	0.004	-0.508				
	D	13.71	0.3111	-0.005	0.137	0.001	-0.028	0.004	-0.227	0.008	-0.732		
	L	16.17		-0.005	0.154	0.001	-0.026	0.004	-0.221			0.011	-0.787
	M	19.13		-0.005	0.128	0.001	-0.031	0.004	-0.249	0.008	-0.907	0.011	-0.789
V	Ph = 4.56	22.33	0.5290			0.005	0.235			0.041	0.544		
	Ph = 5.61	27.06	1.3737	-0.010	5.464			0.023	0.521				
	Ph = 6.05	27.38		-0.010	11.510								
	Ph = 10.9	43.04				0.006	0.268	0.024	0.563				
	Ph = 13.3	48.84								0.042	0.587		
	Ph = 17.7	58.48		-0.009	5.949	0.006	0.288	0.024	0.600				

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
Cr	Ph = 1.94	15.91	0.3645			0.007	0.267						
	Ph = 3.06	23.92	1.9231							0.027	0.425		
	Ph = 3.76	28.55						0.017	0.400				
	Ph = 4.75	34.70		-0.003	-0.460	0.008	0.306						
	Ph = 5.7	40.18		-0.003	-0.304	0.008	0.330						
	Ph = 9.22	57.55								0.028	0.464		
	Ph = 12.2	69.75		-0.002	-0.240	0.009	0.360	0.018	0.465				
Mn	Ph = 0.1	1.09	0.2279	0.001	0.043			0.040	1.188	0.071	2.305		
Fe	Ph = 1.0	15.01	0.4448	-0.003	-0.297	0.007	0.311	0.015	0.430	0.026	0.523		
	Ph = 2.0	28.69	1.9483	-0.001	-0.099	0.009	0.397	0.018	0.504				
	Ph = 3.0	41.34		0.000	0.014	0.011	0.446	0.019	0.562	0.030	0.583	0.042	0.610
1-Ni	Ph = 1.5	24.83	1.4847	-0.023	1.390	-0.021	2.279	-0.020	5.305	-0.024	79.758		
	Ph = 3.0	46.32	1.2833	-0.023	1.289	-0.021	2.688						
	Ph = 4.25	61.16								-0.023	-10.428		
	Ph = 4.75	68.09						-0.019	7.001				
	Ph = 5.25	73.74		-0.023	1.367	-0.021	2.606						
	Ph = 7.0	81.97						-0.019	6.695				
	Ph = 7.25	90.51								-0.022	-10.213		
2-Ni	Ph = 10	17.00	1.5173	-0.024	1.528			-0.020	10.433			-0.036	9.866
	Ph = 3.0	46.81	1.2802	-0.023	1.451			-0.019	7.384				
Zr	Ph = 0.25	3.19	0.4580			-0.024	-4.742	-0.018	-1.232				
	Ph = 0.75	9.35	1.3234	-0.021	1.592	-0.018	3.033			-0.003	-0.175		
	Ph = 1.49	18.08		-0.017	1.532	-0.014	14.045	-0.009	-2.684			0.016	0.356
^{90}Zr	K	11.09	0.7415	0.023	0.479	0.036	0.899	0.048	0.700	0.067	0.714		
	M	23.43	-0.5701	0.024	0.740	0.037	0.784	0.049	0.795	0.068	0.749	0.088	0.776
^{91}Zr	K	5.91	0.5837	-0.057	1.422	-0.049	1.406	-0.034	0.627	0.003	-0.007		
	O	6.64	1.0446	-0.054	1.513	-0.047	1.140	-0.032	4.506	0.001	0.060		
	L	9.19		-0.048	1.067	-0.040	0.932	-0.025	1.807	0.006	0.429	0.052	0.637

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
^{92}Zr	O	7.26	0.5403	0.015	1.289	0.027	0.598	0.039	0.407	0.058	0.728		
	M	13.01	0.5403	0.017	0.484	0.029	0.529	0.042	0.549	0.061	0.562	0.084	0.590
^{93}Zr	L	6.51	0.6956	-0.057	0.902	-0.042	1.015	-0.021	2.616	0.018	-0.891	0.066	0.685
	M	5.82	1.0550	-0.059	1.226	-0.043	1.889	-0.022	-5.615	0.017	0.368	0.065	0.564
	M	6.07		-0.058	1.139	-0.043	1.711	-0.022	-3.648	0.017	0.283	0.066	0.596
^{96}Zr	K	13.19	0.6599	-0.004	-0.634	0.011	0.337	0.028	0.748	0.057	0.832		
	L	20.50	1.0354	0.001	-0.512	0.016	0.739	0.032	0.677	0.059	0.688	0.089	0.679
Nb	Ph = 1.0	16.06	0.9802	-0.231	0.981	-0.267	1.020	-0.275	0.992	-0.262	0.985	-0.184	1.014
	Ph = 2.0	30.78	0.9830	-0.197	0.964	-0.229	0.995	-0.237	0.975	-0.227	0.977		
	Ph = 3.0	44.24		-0.179	0.969	-0.208	0.976	-0.215	0.956	-0.207	0.964	-0.148	0.945
Mo	Ph = 0.1	2.18	1.0110	-0.298	1.003	-0.277	0.971	-0.250	1.070	-0.199	1.008	-0.118	1.034
	Ph = 0.2	4.36	1.0230	-0.262	0.971	-0.251	1.059	-0.231	1.006	-0.189	1.079	-0.115	1.171
	Ph = 0.3	6.43		-0.243	0.977	-0.236	1.010	-0.220	1.029	-0.183	1.014		
	Ph = 0.4	8.61		-0.230	0.956	-0.226	1.012	-0.212	1.023			-0.111	1.332
	Ph = 0.8	16.90				-0.201	0.992	-0.192	1.020	-0.165	1.106		
^{92}Mo	H	5.43	0.9107	-0.046	2.847	-0.050	1.027	-0.051	0.800	-0.050	1.517		
	K	7.34	0.9799	-0.044	1.066	-0.048	1.302	-0.049	1.687	-0.048	0.783	-0.040	-2.859
^{94}Mo	H	8.42	1.0264	-0.075	1.522	-0.078	1.109	-0.076	1.340	-0.073	5.204		
	T	8.61	1.0728	-0.074	9.276	-0.077	0.978	-0.076	1.169	-0.073	1.543	-0.056	0.640
^{95}Mo	H	5.25	1.0269	-0.501	0.965	-0.482	1.042	-0.460	0.980	-0.411	0.949	-0.298	1.093
	K	7.56	1.0203	-0.460	0.953	-0.450	0.996	-0.434	1.062	-0.394	1.128	-0.290	1.003
	L	11.48		-0.416	0.973	-0.414	1.030	-0.404	1.066	-0.372	1.085		
^{96}Mo	P	8.59	0.9383	-0.091	1.284	-0.083	0.729	-0.071	0.755	-0.051	6.423		
	S	11.26	0.9932	-0.084	0.941			-0.065	1.102	-0.047	2.043	-0.022	2.164
	H	15.90		-0.075	1.001	-0.068	1.625	-0.058	0.863	-0.041	2.066	-0.018	0.596
^{97}Mo	K	6.83	0.9732	-0.379	0.931	-0.421	1.034	-0.424	0.957	-0.390	0.982	-0.269	0.979
	O	8.77	0.9758	-0.362	0.933	-0.404	1.010	-0.409	0.935	-0.378	0.980	-0.263	1.017
	L	11.30		-0.345	0.974	-0.387	0.987	-0.393	0.986	-0.366	0.993	-0.257	0.901

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
^{98}Mo	T	18.69	1.0167	-0.069	1.197	-0.071	1.043	-0.065	0.969	-0.050	3.323		
	O	28.91	1.1040	-0.058	1.001	-0.058	1.166	-0.052	1.341	-0.039	7.760	-0.010	-0.303
^{100}Mo	T	7.66	1.0587	-0.068	1.998	-0.070	1.709	-0.063	2.738				
	K	10.02	1.0975	-0.063	0.969	-0.065	1.218	-0.057	1.172	-0.040	2.244		
	L	15.59		-0.055	1.077	-0.055	1.258	-0.048	1.145	-0.032	2.140	0.003	0.116
1-^{99}Tc	P	3.26	0.8218	-1.011	0.919	-0.926	0.850	-0.901	0.805	-0.848	0.689	-0.683	0.990
	H	7.52	0.8295	-0.864	0.823	-0.838	0.798	-0.837	0.790	-0.809	0.870	-0.666	0.844
	K	10.53		-0.807	0.823	-0.799	0.824	-0.806	0.815	-0.789	0.830	-0.657	0.904
2-^{99}Tc	Gh = 19.5	6.25	0.8122	-0.897	0.787	-0.859	0.795	-0.853	0.741	-0.819	0.853		
	Gh = 23.0	9.01	0.8152	-0.833	0.809	-0.818	0.786	-0.821	0.797	-0.798	0.868		
	Gh = 16.5	9.92		-0.817	0.817	-0.806	0.791	-0.812	0.812	-0.792	0.880		
^{101}Ru	P	11.31	0.9564	-0.907	0.997	-0.949	1.005	-0.948	0.946	-0.887	0.905	-0.701	1.079
	H	20.81	0.9641	-0.776	0.935	-0.832	0.952	-0.846	0.956	-0.814	0.970	-0.666	0.965
^{102}Ru	S	10.25	1.0745	-0.134	0.961	-0.153	0.925	-0.159	1.052	-0.157	1.278		
	H	14.67	1.0760	-0.126	1.017	-0.144	1.437	-0.149	1.099	-0.148	1.371	-0.117	2.054
^{104}Ru	P	10.59	1.0753	-0.117	0.906	-0.132	1.125	-0.133	1.314	-0.123	1.425		
	H	20.27	1.0658	-0.096	0.996	-0.108	1.165	-0.110	1.166	-0.103	1.283	-0.072	1.018
1-^{103}Rh	Ph = 0.05	1.24	0.9692	-1.640	0.988			-1.045	0.975	-0.942	0.996	-0.727	0.900
	Ph = 0.1	2.49	0.9705	-1.367	0.974	-1.041	0.992	-0.976	0.954	-0.903	0.963	-0.714	1.011
	Ph = 0.2	4.98		-1.115	0.961	-0.924	0.963	-0.896	0.964	-0.855	0.978	-0.695	1.004
	Ph = 0.3	7.34		-0.991	0.963	-0.860	0.960	-0.849	0.965	-0.824	0.978		
	Ph = 0.4	9.83		-0.906	0.952	-0.813	0.967	-0.813	0.965	-0.799	0.980		
2-^{103}Rh	W	6.22	1.0114	-1.058	0.969					-0.841	0.994		
	W	6.22	1.0040			-0.894	0.999	-0.874	0.960	-0.841	0.967		
	W	6.22		-1.058	1.009	-0.894	1.031	-0.874	0.968	-0.841	0.981		
	W	6.22				-0.894	1.112	-0.874	1.012	-0.841	1.058		
3-^{103}Rh	Ph = 0.98	5.19	0.9716	-0.056	1.061								
	Ph = 1.47	7.62	1.1499	-0.052	1.072			0.022	0.770	0.050	0.868	0.083	0.843
	Ph = 2.45	12.19		-0.046	1.040			0.023	0.729	0.050	0.722	0.083	0.848

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
Pd	W	6.08	1.0495	-0.615	1.078	-0.594	1.080	-0.568	0.962			-0.378	0.819
	W	6.08	1.0441	-0.615	1.031					-0.502	1.046		
	W	6.08		-0.615	1.031	-0.594	1.034	-0.568	1.019			-0.378	0.986
	W	6.08								-0.502	1.130		
	W	6.08								-0.502	1.154		
^{104}Pd	S	3.64	1.1400	-0.418	1.497	-0.448	1.220	-0.447	0.931	-0.412	1.790	-0.321	2.470
	S	3.79	1.1377	-0.415	1.476	-0.445	1.190	-0.444	1.932	-0.410	1.139	-0.320	1.686
^{105}Pd	T	7.60	0.9969	-1.144	0.960	-1.226	0.977	-1.247	0.974	-1.194	0.964	-0.960	0.932
	K	7.48	0.9942	-1.147	0.963	-1.229	0.988	-1.249	0.999	-1.195	1.017	-0.960	1.059
	Ah = 0.54	1.67		-1.388	1.020	-1.422	0.954	-1.406	1.019	-1.292	1.025		
	Ah = 1.09	3.24		-1.293	1.016	-1.349	1.007	-1.348	1.029	-1.258	1.030		
^{106}Pd	H	11.76	1.1932	-0.222	1.181	-0.259	1.226	-0.274	1.149	-0.277	1.294	-0.237	1.269
			1.1693										
^{107}Pd	T	12.39	1.0105	-0.993	0.999	-1.030	1.008	-1.023	1.030	-0.949	1.080	-0.745	1.086
	K	15.88	1.0166	-0.954	0.993	-0.998	1.030	-0.998	1.022	-0.933	1.048	-0.738	1.079
	O	20.69		-0.913	0.992	-0.964	1.032	-0.969	1.022	-0.915	1.042	-0.730	1.066
	Dh = 1.39	7.33		-1.073	0.995	-1.092	1.010	-1.073	1.021	-0.979	1.085		
	Dh = 2.78	13.33		-0.982	0.934	-1.020	0.987	-1.016	0.998	-0.945	1.065		
^{108}Pd	H	6.49	1.1095	-0.407	1.111	-0.325	0.997	-0.279	1.044	-0.224	1.866		
	T	7.72	1.1023	-0.386	1.205	-0.310	1.116	-0.268	1.097	-0.218	1.236	-0.167	1.774
^{110}Pd	S	3.60	0.7482	-0.129	1.722	-0.132	-2.132	-0.129	1.170	-0.118	0.588	-0.082	0.744
	S	3.69	0.9243	-0.129	1.355	-0.132	4.393	-0.128	-1.605	-0.117	0.903	-0.082	2.724
^{109}Ag	Ah>.07	>0.44	0.8997	-2.440	1.190	-1.617	0.728	-1.311	1.032	-1.009	0.795		
	Ah>.15	>0.85	0.8969	-2.104	1.031	-1.477	0.839	-1.238	0.998	-0.984	0.871		
	P	5.88		-1.273	0.909	-1.053	0.892	-0.973	0.846	-0.866	0.767	-0.675	0.704
	H	10.57		-1.075	0.918	-0.935	0.899	-0.889	0.881	-0.820	0.921	-0.658	0.967
^{111}Cd	P	3.92	1.0972	-0.667	1.170	-0.719	1.092	-0.741	1.029	-0.734	1.034	-0.643	1.089
	P	3.55	1.0899	-0.675	1.072	-0.725	1.132	-0.746	0.899	-0.738	0.997		
	S	5.07		-0.644	1.193	-0.701	1.310	-0.726	1.084	-0.726	1.230	-0.640	1.163

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
In	Ph = 1.0	14.02	1.0160	-0.913	0.990			-0.763	1.041			-0.652	1.053
	Ph = 3.0	38.61	1.0043	-0.668	0.973			-0.665	1.016				
^{128}Te	O	21.86	0.3816	-0.009	0.785	-0.006	1.594	-0.003	0.324	0.004	0.477	0.014	0.342
			0.9543										
^{130}Te	O	8.08	0.4823	0.006	0.264	0.011	2.160	0.015	0.607	0.021	0.655		
	L	7.25	0.5858	0.006	-2.008	0.011	0.894	0.015	0.604	0.021	1.392	0.029	1.448
^{127}I	Eh = 9.71	11.62	0.8797	-0.455	0.784	-0.444	0.737	-0.421	0.796	-0.363	0.878		
	Dh = 4.71	13.69	0.8826	-0.436	0.849	-0.429	0.859	-0.410	0.888	-0.357	0.906		
	S	5.71		-0.540	0.918	-0.507	1.000	-0.469	0.983	-0.389	1.020	-0.266	0.645
	T	8.40		-0.493	0.889	-0.472	0.888	-0.443	0.931	-0.375	0.846	-0.262	0.860
	O	13.80		-0.436	0.889	-0.429	0.932	-0.410	0.931	-0.357	0.936	-0.256	0.981
^{129}I	T	7.43	1.0735	-0.296	1.160	-0.292	1.148	-0.278	1.010	-0.239	1.025	-0.168	1.303
	K	10.99	1.0661	-0.279	1.083	-0.278	1.059	-0.267	0.997	-0.233	1.113	-0.166	1.043
^{131}Xe	RB	2.14	1.0740	-0.552	0.936	-0.363	1.086	-0.284	1.185	-0.201	1.170	-0.118	1.146
			1.1091										
1-^{133}Cs	Ah = 0.48	2.07	0.8683	-0.861	0.899	-0.693	0.913	-0.606	0.864	-0.474	0.936	-0.313	0.878
	Ah = 1.45	5.95	0.8753	-0.676	0.895	-0.575	0.893	-0.520	0.870	-0.429	0.880	-0.299	0.858
	Bh = 4.3	15.34		-0.524	0.900	-0.467	0.890	-0.437	0.868	-0.379	0.857		
	H	8.75		-0.612	0.835	-0.531	0.850	-0.487	0.846	-0.409	0.886	-0.292	0.646
	K	12.89		-0.550	0.858	-0.487	0.867	-0.452	0.836	-0.388	0.823	-0.284	0.850
	L	18.90		-0.493	0.875	-0.445	0.863	-0.418	0.853	-0.367	0.842	-0.275	0.854
	M	26.24		-0.448	0.885	-0.410	0.875	-0.390	0.854	-0.348	0.845		
2-^{133}Cs	L	17.30											
^{135}Cs	T	7.55	0.9289	-0.421	0.993	-0.346	1.000	-0.304	1.017	-0.239	1.026	-0.160	0.864
	K	10.19	0.9382	-0.394	0.917	-0.328	0.968	-0.291	0.896	-0.232	0.779	-0.158	0.932
	O	15.18		-0.359	0.917	-0.304	0.925	-0.273	0.873	-0.222	0.945	-0.154	0.934
	L	18.83		-0.341	0.937	-0.291	0.925	-0.263	0.917	-0.216	1.104	-0.152	1.094
1-^{139}La	L	17.23	0.6947	-0.016	0.925	-0.001	0.426	0.011	0.683	0.027	0.715	0.047	0.568
	N	23.96	0.9801	-0.013	0.673	0.001	-1.138	0.013	0.825	0.029	0.753	0.048	0.680

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
2-^{139}La	M	15.49	0.8819	-0.017	0.838	-0.002	0.826	0.010	1.286	0.027	0.915		
			0.9644										
^{140}Ce	M	27.38	0.8182	0.019	1.009	0.030	0.889	0.039	0.784	0.052	0.773		
	N	38.02	-0.4884	0.019	0.961	0.030	0.910	0.039	0.824	0.052	0.773	0.064	0.716
^{142}Ce	O	16.65	0.6478	0.016	0.801	0.027	0.830	0.037	0.735	0.052	0.554		
	L	21.80	-0.2248	0.016	1.017	0.027	0.822	0.037	0.841	0.052	0.639	0.067	0.597
1-^{141}Pr	L	15.89	0.9880	-0.085	0.986	-0.077	1.031	-0.064	1.002	-0.034	1.216	0.012	0.537
	M	19.48	1.0337	-0.079	0.978	-0.072	0.982	-0.059	1.000	-0.030	1.599	0.014	0.452
2-^{141}Pr	M	18.71	1.0183	-0.085	0.986	-0.077	1.031	-0.064	1.002	-0.034	1.216	0.012	0.537
	N	25.50	1.0789	-0.079	0.978	-0.072	0.982	-0.059	1.000	-0.030	1.599	0.014	0.452
1-Nd	H	5.39	0.9423	-0.237	0.975	-0.206	0.849	-0.183	1.149	-0.138	0.926		
	L	10.48	1.0168	-0.215	0.886	-0.190	0.992	-0.170	0.997	-0.131	1.177		
2-Nd	L	10.21	0.9557	-0.178	0.870			-0.126	0.998	-0.083	1.253	-0.027	3.415
	M	11.65	1.0772	-0.175	0.892			-0.124	1.029	-0.081	1.234	-0.027	-1.282
	N	22.01		-0.157	0.948	-0.133	1.006	-0.113	1.044	-0.075	1.193	-0.025	-3.098
^{142}Nd	O	5.07	-0.0156	-0.039	12.891	-0.023	1.674	-0.014	-0.480	-0.001	-0.011		
	L	6.39	1.5820	-0.038	1.530	-0.023	-2.560	-0.014	-0.797	-0.001	-0.011		
	M	8.65		-0.038	2.507	-0.022	-4.487	-0.013	-0.519	0.000	-0.004	0.011	0.209
^{143}Nd	H	5.92	0.9194	-0.400	0.911	-0.329	0.858	-0.289	0.929	-0.217	1.247	-0.122	0.901
	L	14.59	0.9473	-0.314	0.905	-0.259	0.931	-0.231	0.919	-0.180	0.949	-0.108	1.560
^{144}Nd	O	6.30	0.6188	-0.047	0.598	-0.035	0.786	-0.024	1.586	-0.003	-2.903		
	L	8.15	0.9927	-0.044	0.662	-0.033	0.973	-0.022	0.746	-0.001	-0.101		
	M	11.52		-0.041	0.797	-0.030	0.862	-0.019	1.110	0.001	0.088	0.025	0.438
^{145}Nd	S	4.85	0.8778	-0.562	0.752	-0.515	0.959	-0.476	0.854	-0.391	0.943	-0.246	0.768
	K	9.11	0.9022	-0.482	0.836	-0.452	0.865	-0.424	0.900	-0.357	0.911	-0.232	1.252
	O	10.89		-0.461	0.858	-0.434	0.882	-0.409	0.917	-0.347	0.980	-0.227	1.505
^{146}Nd	K	8.53	0.6173	-0.042	0.876	-0.034	0.846	-0.023	2.122	-0.005	-0.120		
	L	13.13	1.0268	-0.038	0.874	-0.030	1.039	-0.020	1.522	-0.002	-0.103	0.025	0.574

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
^{148}Nd	T	5.64	0.8179	-0.096	1.098	-0.082	0.974	-0.064	0.691	-0.028	0.660		
	K	7.80	0.9002	-0.089	0.694	-0.075	0.876	-0.058	1.033	-0.024	3.493		
	L	12.61		-0.080	0.829	-0.067	0.783	-0.050	0.926	-0.019	0.904	0.024	1.498
^{150}Nd	S	5.52	0.7171	-0.099	0.659	-0.088	0.861	-0.072	0.352	-0.042	0.451		
	T	9.28	0.8675	-0.083	0.892	-0.073	0.991	-0.060	1.064	-0.033	1.328	0.006	-0.343
	K	11.50		-0.077	0.916	-0.068	0.818	-0.055	0.711	-0.030	2.126	0.008	-0.975
	O	13.97		-0.072	0.749	-0.063	0.854	-0.051	0.778	-0.027	1.673	0.009	0.243
^{147}Pm	T	4.85	0.9161	-2.309	0.935	-1.893	0.906	-1.637	0.909	-1.224	0.927	-0.725	0.929
	K	6.33	0.9143	-2.168	0.943	-1.805	0.945	-1.575	0.900	-1.193	0.897	-0.716	0.862
	O	8.21		-2.035	0.929	-1.719	0.919	-1.513	0.877	-1.161	0.886		
1-^{147}Sm	Gh = 26.4	4.94	0.9239	-1.830	0.893	-1.615	0.000	-1.442	0.974	-1.116	1.053		
	Fh = 25.3	6.85	0.9405	-1.665	0.920	-1.495	0.000	-1.350	0.938	-1.065	0.942		
	Eh = 30.0	9.39		-1.515	0.896	-1.382	0.000	-1.262	0.902	-1.014	1.014		
	H	4.42		-1.888	0.926	-1.657	0.949	-1.473	0.963	-1.133	0.985		
	T	5.33		-1.791	0.948	-1.587	0.928	-1.421	0.929	-1.104	0.995		
	K	6.71		-1.675	0.925	-1.502	0.942	-1.356	0.916	-1.068	0.883		
2-^{147}Sm	S	4.51	0.9184	-1.905	0.972	-1.655	1.015	-1.468	0.900	-1.126	0.766	-0.677	1.074
	T	8.14	0.9124	-1.611	0.959	-1.441	0.948	-1.305	0.919	-1.035	0.877	-0.647	0.874
	O	13.63		-1.379	0.932	-1.264	0.916	-1.165	0.910	-0.951	0.881	-0.616	0.848
^{148}Sm	S	6.46	0.9104	-0.364	0.847	-0.283	0.841	-0.243	0.743	-0.182	1.027	-0.113	-11.338
	H	9.12	0.9340	-0.335	0.905	-0.263	0.985	-0.226	0.992	-0.171	1.050	-0.109	1.818
	T	9.71		-0.330	1.000	-0.259	0.856	-0.223	1.163	-0.169	1.045	-0.108	0.902
^{149}Sm	P	5.39	0.8900	-3.699	0.889	-3.079	0.886	-2.742	0.864	-2.158	0.824	-1.352	0.800
	S	7.32	0.8870	-3.388	0.878	-2.897	0.878	-2.615	0.881	-2.095	0.884	-1.334	0.920
	K	13.91		-2.791	0.908	-2.520	0.911	-2.337	0.896	-1.943	0.891	-1.283	0.847
^{150}Sm	S	3.00	0.8141	-0.659	0.928	-0.476	0.798	-0.401	0.728	-0.308	1.121		
	H	4.23	0.8337	-0.601	0.906	-0.441	0.791	-0.375	0.782	-0.294	0.793		
	T	4.14		-0.605	0.901	-0.443	0.901	-0.377	0.802	-0.295	0.833	-0.207	0.941
	K	5.93		-0.548	0.835	-0.409	0.793	-0.351	0.747	-0.280	0.817	-0.201	0.875
	O	7.06		-0.523	0.886	-0.393	0.806	-0.339	0.771	-0.273	0.736	-0.198	0.840

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
^{151}Sm	Gh = 29.0	7.01	0.9465	-1.901	0.941	-1.430	0.905	-1.198	0.954	-0.874	0.941		
	Fh = 18.0	9.22	0.9443	-1.784	0.920	-1.364	0.909	-1.153	0.930	-0.852	0.992		
	Eh = 30.0	11.83		-1.683	0.978	-1.305	0.967	-1.112	0.943	-0.831	0.977		
	S	4.90		-2.055	0.983	-1.514	0.958	-1.254	0.976	-0.901	0.938	-0.523	0.679
	T	6.54		-1.929	0.979	-1.446	0.945	-1.209	0.975	-0.879	0.860	-0.517	1.076
	O	11.30		-1.702	0.962	-1.317	0.947	-1.120	0.923	-0.835	0.897	-0.503	0.890
^{152}Sm	P	4.19	0.8556	-0.830	0.874	-0.511	0.787	-0.403	0.720	-0.299	0.598	-0.192	1.011
	S	6.14	0.8730	-0.734	0.906	-0.459	0.834	-0.366	0.748	-0.278	0.870	-0.184	0.769
	T	9.09		-0.642	0.931	-0.408	0.874	-0.331	0.807	-0.258	0.856	-0.176	1.356
	K	12.90		-0.567	0.886	-0.367	0.870	-0.302	0.815	-0.240	0.849	-0.169	1.165
^{154}Sm	H	8.47	0.8695	-0.176	0.819	-0.152	0.896	-0.134	1.337	-0.101	1.050	-0.049	0.445
	T	8.80	0.9075	-0.174	0.879	-0.150	0.876	-0.132	0.802	-0.100	0.818	-0.049	0.607
	K	10.92		-0.164	0.930					-0.094	1.311		
Eu	H	4.83	0.8604	-5.086	0.882	-4.237	0.874	-3.799	0.860	-3.061	0.842	-2.035	0.754
	K	6.94	0.8583	-4.746	0.884	-4.058	0.882	-3.680	0.861	-3.004	0.843	-2.019	0.803
	L	9.72		-4.421	0.876	-3.876	0.869	-3.555	0.855	-2.942	0.830	-2.000	0.789
^{153}Eu	H	3.67	0.9482	-4.027	0.959	-3.431	0.981	-3.088	0.959	-2.491	0.899	-1.645	0.844
	K	6.20	0.9447	-3.651	0.951	-3.201	0.964	-2.928	0.942	-2.412	0.918	-1.623	0.917
^{156}Gd	P	3.79	1.0321	-0.638	1.227	-0.617	1.470	-0.580	1.184	-0.482	0.804		
	P	4.04	1.0345	-0.626	1.278	-0.608	1.085	-0.572	1.271	-0.477	0.758	-0.324	0.926
^{157}Gd	P	4.38	0.8485	-2.092	0.850	-1.711	0.900	-1.516	0.886	-1.176	0.713	-0.714	0.000
	P	4.84	0.8519	-2.043	0.848	-1.683	0.846	-1.495	0.835	-1.166	0.827	-0.711	0.948
^{159}Tb	Ph = 0.025	0.35	1.0599	-2.818	1.071	-2.540	1.034	-2.352	1.074	-1.982	1.038	-1.394	1.081
	Ph = 0.05	0.70	1.0602	-2.683	1.044	-2.467	1.062	-2.305	1.057	-1.961	1.041	-1.388	1.021
	Ph = 0.075	1.05		-2.586	1.043	-2.410	1.074	-2.267	1.059	-1.943	1.097	-1.383	1.192
	Ph = 0.1	1.40		-2.509	1.032	-2.362	1.065	-2.234	1.069	-1.927	1.093		
	Ph = 0.125	1.75		-2.444	1.027	-2.321	1.061	-2.205	1.055	-1.912	1.093	-1.374	1.145

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
Hf	H	8.51	1.1076	-1.243	1.110	-0.864	1.060	-0.707	1.062	-0.514	1.097	-0.309	0.953
	K	13.89	1.0955	-1.090	1.090	-0.797	1.086	-0.669	1.094	-0.499	1.111	-0.305	1.197
	L	27.25		-0.901	1.110	-0.709	1.113	-0.616	1.113	-0.476	1.116	-0.299	1.222
W	Ph = 0.06	2.17	0.8551	-0.622	0.879			-0.338	0.927	-0.216	0.804	-0.100	0.821
	Ph = 0.12	4.33	0.8652	-0.523	0.885			-0.301	0.864	-0.199	0.776		
1-Pb	O	44.35	0.5559	0.007	0.589			0.013	0.538	0.017	0.539	0.021	0.443
	M	55.63	-0.2884	0.007	0.553	0.010	0.565	0.013	0.562	0.017	0.522	0.021	0.567
	Dh = 28.0	72.98		0.007	0.584	0.010	0.583	0.014	0.573	0.017	0.557		
2-Pb	Ph = 3.84	73.05	1.2648							0.016	1.145		
	Ph = 4.2	78.05	0.5086					0.013	1.267				
	Ph = 5.0	90.80		0.006	1.296	0.010	1.259	0.013	1.257				
	Ph = 8.8	140.30		0.006	1.280	0.010	1.311	0.013	1.281				
	Ph = 17.5	215.50		0.006	1.305							0.020	1.203
3-Pb	Ah = 1.5	10.38	0.2962			0.010	0.291						
	L	27.86	-0.1991	0.007	0.307	0.011	0.319	0.014	0.289	0.018	0.266	0.021	0.325
	Ch = 6.02	28.28		0.007	0.293	0.011	0.310	0.014	0.316	0.018	0.277		
	Ch = 6.12	28.63				0.011	0.293						
1-^{235}U	Ph = 0.14	4.93	1.0613	0.469	1.125	0.587	1.161	0.647	1.096	0.762	1.063	0.947	1.040
	Ph = 0.28	9.73	1.0943			0.585	1.134	0.644	1.083			0.944	1.021
	Ph = 0.42	14.35		0.470	1.096	0.582	1.118	0.641	1.079	0.756	1.057	0.941	1.009
	Ph = 0.56	18.88				0.579	1.120						
2-^{235}U	Ph = 0.6	3.34	0.9836			0.112	1.014	0.133	0.996				
	Ph = 1.2	6.02	0.9497	0.081	0.986					0.167	0.960		
	Ph = 1.8	9.48				0.112	0.999	0.134	0.975				
	Ph = 3.6	17.78				0.112	1.000	0.133	0.974			0.208	0.929
	Ph = 4.8	23.14		0.081	1.005					0.166	0.949		
	Ph = 6.0	26.65		0.081	1.027			0.133	0.965			0.207	0.942

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
^{236}U	Ah = 1*.5	3.67	0.8612	0.063	1.184	0.178	0.997	0.243	0.818	0.354	0.815	0.515	0.747
	Ah = 2*.5	7.14	0.8556	0.092	1.580	0.193	1.116	0.252	0.847				
	Ah = 3*.5	10.42		0.107	1.759	0.202	1.085			0.360	0.838	0.516	0.780
	Ah = 4*.5	13.53				0.208	1.214	0.262	1.023				
1-^{238}U	Ph = 0.1	0.64	1.0670			-0.060	1.305	-0.018	0.219				
	Ph = 0.2	1.28	1.1768					-0.014	-0.537				
	Ph = 0.3	1.90				-0.048	1.200	-0.011	-1.101				
	Ph = 0.4	2.52				-0.044	2.311						
	Ph = 0.6	3.76		-0.087	1.422	-0.038	2.360	-0.005	-0.356	0.040	0.682	0.089	0.764
	Ph = 0.8	4.91		-0.079	1.234								
	Ph = 1.2	7.29		-0.068	1.356	-0.027	2.486	0.001	0.069	0.042	0.735	0.089	0.863
2-^{238}U	Ph = 0.14	5.15	1.0893	-0.284	1.107	-0.223	1.133	-0.180	1.141	-0.109	1.349	-0.003	-0.463
	Ph = 0.28	10.23	1.0862			-0.183	1.079	-0.151	1.088	-0.094	1.204	0.002	0.137
	Ph = 0.42	15.27		-0.196	1.046	-0.163	1.070	-0.135	1.102	-0.085	1.101	0.005	0.322
^{239}Pu	DC	2.57	0.9701	0.624	1.008	0.807	0.957	0.918	0.956	1.143	0.973		
	DC	8.28	0.9880	0.640	0.974	0.814	0.997	0.923	0.933	1.145	0.884		
	DC	12.00		0.644	1.027	0.815	0.995	0.924	0.953	1.145	0.913		
	DC	16.56		0.646	0.983	0.814	0.987	0.924	0.924	1.144	0.893		
	O	2.74		0.624	1.069			0.918	1.127	1.143	1.042	1.532	0.995
	O	7.71		0.639	1.105			0.923	1.031	1.145	1.005	1.531	0.945
	O	11.94		0.644	1.075			0.924	1.050	1.145	1.029		
	O	13.87		0.645	1.066			0.924	1.049	1.145	1.015	1.529	0.974
1-^{240}Pu	D	0.99	0.9438	-0.504	1.482	0.221	0.763	0.451	1.670	0.697	1.056		
	D	2.50	0.9685	-0.119	0.744	0.326	1.207	0.491	1.363	0.709	1.181		
	D	5.01		0.066	0.734	0.383	0.934	0.516	0.922	0.717	0.834		
	O	0.81		-0.606	1.010			0.442	1.767	0.694	2.314		
	O	2.45		-0.126	0.465			0.490	1.289	0.708	1.124		
	O	5.35		0.080	-2.001			0.518	1.205	0.718	1.176		

Table A.1. Calculated results with ECN spectrum and JENDL-3.2 (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av(C/E) $Av(C/E)_{abs}$	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E	ρ/ρ_0	C/E
2-^{240}Pu	D O	0.59 0.54	0.2737 0.1469	-1.805 -1.891	1.399 1.106	-0.597	-3.316	-0.231 -0.239	-2.564 -4.782	0.104 0.102	0.149 0.925		
O	Al_2O_3 Fe_2O_3 PbO H_2O												
H	H_2O												
H_2O													
B	Natural B												

Table A.2. STEK experimental results

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
H	P	1.80	1.7469	4.090	0.020	5.3210	0.0150	6.954	0.012	10.00	0.03	14.38	0.03
	P	3.44	3.4940	4.121	0.005	5.3340	0.0100	6.913	0.008	9.97	0.03		
^{7}LI	M	9.55	4.8348	-0.091	0.006	0.0214	0.0050	0.098	0.005	0.208	0.008		
	N	13.85	14.2417	-0.091	0.001	0.0224	0.0020	0.098	0.003	0.206	0.004	0.340	0.004
1-^{10}B	Ph = 0.75	3.26	3.1178	-1.699	0.0040	-1.263	0.0090	-1.158	0.0094	-0.947	0.011	-0.672	0.017
	Ph = 1.50	6.30	6.2268	-1.622	0.0030	-1.266	0.0050	-1.145	0.0045	-0.961	0.005	-0.678	0.009
	Ph = 2.25	9.16	9.3564	-1.597	0.0015	-1.246	0.0025	-1.133	0.0035	-0.947	0.004		
	Ph = 3.00	11.84	12.4671	-1.551	0.0013	-1.238	0.0024	-1.128	0.0022	-0.947	0.003	-0.691	0.004
2-^{10}B		0.0038	0.0024	-24.0	11.0								
		0.0150	0.0091	-17.5	2.6	-15.3	3.0	-11.6	3.4	-10.8	3.8		
3-^{10}B		0.0130	0.0080	-85.5	2.8	-62.0	4.6	-52.5	5.0	-49.8	4.3		
C	Ph = 3.0	8.94	9.3308			0.2440	0.0030	0.3181	0.0020				
	Ph = 3.5	10.26	11.0340							0.4531	0.0067		
	Ph = 5.0	13.72	15.6405			0.2450	0.0020						
	Ph = 9.7	23.21	30.4324	0.1639	0.0015	0.2410	0.0010	0.3181	0.0007	0.4424	0.0014		
	Ph = 11.2	25.08	35.2855					0.3181	0.0010	0.4447	0.0011		
	Ph = 16.8	32.03	52.6913			0.2420	0.0010						
	Ph = 21.0	35.22	62.0107	0.1623	0.0012								
	Ph = 31.5	43.47	92.4408	0.1624	0.0010							0.5893	0.0005
1-N	M	17.51	8.8348	0.0120	0.0026	0.0400	0.0030	0.0660	0.0030	0.0880	0.0040		
	R	29.85	81.5671	0.0150	0.0006	0.0398	0.0007	0.0610	0.0010	0.0908	0.0014		
2-N	M	18.26	9.2043	0.0163	0.0022	0.0330	0.0020	0.0525	0.0021	0.0730	0.0060		
	R	29.00	79.5949	0.0163	0.0010	0.0360	0.0010	0.0533	0.0014	0.0780	0.0025		
1-O	M	11.30	5.7182	0.0670	0.0035	0.0954	0.0030	0.1382	0.0040	0.1790	0.0040		
	N	17.92	18.5471	0.0670	0.0017	0.0983	0.0013	0.1315	0.0012	0.1830	0.0030		
	R	13.65	37.9249	0.0640	0.0010	0.0969	0.0012	0.1312	0.0015	0.1800	0.0030	0.2350	0.0036
2-O	N	22.40	22.9686	0.0337	0.0008	0.0577	0.0010	0.0790	0.0007	0.1142	0.0021		
	R	20.75	56.6503	0.0337	0.0008	0.0574	0.0008	0.0807	0.0011	0.1144	0.0023	0.1492	0.0022

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
Al	Ph = 2.1	10.52	10.6950			0.0596	0.0020	0.0765	0.0030				
	Ph = 3.0	14.17	14.9267	0.0401	0.0009	0.0606	0.0020			0.1049	0.0024	0.1382	0.0040
	Ph = 3.4	15.77	16.8668							0.1079	0.0020		
	Ph = 4.0	18.00	19.7348			0.0601	0.0060	0.0784	0.0007	0.1067	0.0015	0.1317	0.0026
	Ph = 4.7	20.97	23.6610							0.1072	0.0014		
	Ph = 5.7	24.33	28.4522	0.0399	0.0009	0.0594	0.0007						
	Ph = 6.1	25.78	30.6548					0.0802	0.0007	0.1058	0.0014		
	Ph = 10.3	37.52	51.2515					0.0781	0.0008				
	Ph = 13.9	45.61	69.4418	0.0391	0.0003								
	Ph = 14.7	47.12	73.3252	0.0392	0.0003								
Si	M	13.01	6.5712	0.0360	0.0040	0.0540	0.0040	0.0750	0.0050				
	C	11.25	7.0271	0.0310	0.0040	0.0500	0.0040	0.0660	0.0060	0.1010	0.0060		
	R	33.26	90.9582	0.0328	0.0005	0.0513	0.0007	0.0681	0.0010	0.0934	0.0016		
Cl	D	13.02	4.6108	-0.0370	0.0040	-0.0270	0.0070	-0.0080	0.0060				
	D	13.71	9.5258	-0.0390	0.0020	-0.0230	0.0030	-0.0180	0.0040	-0.0110	0.0020		
	L	16.17	4.9509	-0.0340	0.0040	-0.0280	0.0050	-0.0189	0.0054			-0.0140	0.0120
	M	19.13	9.6624	-0.0400	0.0020	-0.0260	0.0020	-0.0171	0.0023	-0.0090	0.0030	-0.0140	0.0060
V	Ph = 4.56	22.33	25.0328			0.0194	0.0010			0.0746	0.0020		
	Ph = 5.61	27.06	31.1696	-0.0019	0.0011			0.0442	0.0012				
	Ph = 6.05	27.38	33.5726	-0.0009	0.0008								
	Ph = 10.9	43.04	60.0144			0.0220	0.0005	0.0425	0.0006				
	Ph = 13.3	48.84	73.1053							0.0714	0.0007		
	Ph = 17.7	58.48	98.2700	-0.0015	0.0002	0.0224	0.0003	0.0407	0.0004				

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
Cr	Ph = 1.94	15.91	16.0316			0.0246	0.0020						
	Ph = 3.06	23.92	25.2627							0.0634	0.0027		
	Ph = 3.76	28.55	31.0070					0.0414	0.0011				
	Ph = 4.75	34.70	39.1423	0.0060	0.0026	0.0263	0.0010						
	Ph = 5.7	40.18	47.0407	0.0083	0.0005	0.0252	0.0006						
	Ph = 9.22	57.55	76.0227							0.0612	0.0007		
	Ph = 12.2	69.75	101.3500	0.0070	0.0004	0.0255	0.0003	0.0388	0.0003				
Mn	Ph = 0.1	1.09	1.0016	0.033	0.018			0.034	0.022	0.031	0.030		
Fe	Ph = 1.0	15.01	14.5232	0.0099	0.0020	0.0225	0.0013	0.0353	0.0014	0.0506	0.0027		
	Ph = 2.0	28.69	28.7813	0.0093	0.0011	0.0235	0.0007	0.0349	0.0009				
	Ph = 3.0	41.34	42.9832	0.0092	0.0004	0.0236	0.0005	0.0335	0.0006	0.0511	0.0014	0.0686	0.0014
1-Ni	Ph = 1.5	24.83	20.6644	-0.0169	0.0016	-0.0094	0.0013	-0.0037	0.0012	-0.0003	0.0014		
	Ph = 3.0	46.32	41.3429	-0.0179	0.0009	-0.0078	0.0006						
	Ph = 4.25	61.16	58.5153							0.0022	0.0005		
	Ph = 4.75	68.09	65.4638					-0.0027	0.0005				
	Ph = 5.25	73.74	72.4778	-0.0166	0.0003	-0.0079	0.0004						
	Ph = 7.0	81.97	96.5311					-0.0028	0.0003				
	Ph = 7.25	90.51	98.2743							0.0022	0.0003		
2-Ni	Ph = 10	17.00	15.4812	-0.0155	0.0015			-0.0019	0.0018			-0.0036	0.0032
	Ph = 3.0	46.81	46.9136	-0.0159	0.0004			-0.0026	0.0007				
Zr	Ph = 0.25	3.19	1.6390			0.0050	0.0150	0.0150	0.0170				
	Ph = 0.75	9.35	5.0369	-0.0130	0.0040	-0.0060	0.0040	0.0000	0.0050	0.0150	0.0080		
	Ph = 1.49	18.08	10.0493	-0.0110	0.0020	-0.0010	0.0026	0.0034	0.0027			0.0436	0.0055
^{90}Zr	K	11.09	1.9658	0.048	0.011	0.040	0.012	0.069	0.011	0.094	0.021		
	M	23.43	11.4861	0.032	0.002	0.047	0.002	0.062	0.002	0.091	0.004	0.113	0.006
^{91}Zr	K	5.91	1.0254	-0.040	0.019	-0.035	0.022	-0.054	0.019	0.041	0.070		
	O	6.64	1.5411	-0.036	0.015	-0.041	0.018	-0.007	0.021	0.023	0.027		
	L	9.19	2.8053	-0.045	0.008	-0.043	0.008	-0.014	0.007	0.014	0.014	0.081	0.016
^{92}Zr	O	7.26	1.6822	0.012	0.014	0.045	0.015	0.097	0.019	0.080	0.022		
	M	13.01	6.5572	0.036	0.005	0.056	0.004	0.077	0.005	0.109	0.006	0.142	0.010

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
^{93}Zr	L	6.51	2.0661	-0.063	0.008	-0.041	0.016	-0.008	0.014	-0.020	0.016	0.096	0.024
	M	5.82	2.9523	-0.048	0.007	-0.023	0.008	0.004	0.009	0.046	0.013	0.116	0.020
	M	6.07	3.0644	-0.051	0.007	-0.025	0.007	0.006	0.009	0.061	0.012	0.110	0.018
^{96}Zr	K	13.19	2.3069	0.0060	0.0090	0.0320	0.0100	0.0370	0.0090	0.0680	0.0160		
	L	20.50	6.3264	-0.0020	0.0030	0.0210	0.0040	0.0470	0.0040	0.0860	0.0060	0.1310	0.0075
Mn	Ph = 0.1	1.09	1.0016	0.033	0.018			0.034	0.022	0.031	0.030		
Fe	Ph = 1.0	15.01	14.5232	0.0099	0.0020	0.0225	0.0013	0.0353	0.0014	0.0506	0.0027		
	Ph = 2.0	28.69	28.7813	0.0093	0.0011	0.0235	0.0007	0.0349	0.0009				
	Ph = 3.0	41.34	42.9832	0.0092	0.0004	0.0236	0.0005	0.0335	0.0006	0.0511	0.0014	0.0686	0.0014
1-Ni	Ph = 1.5	24.83	20.6644	-0.0169	0.0016	-0.0094	0.0013	-0.0037	0.0012	-0.0003	0.0014		
	Ph = 3.0	46.32	41.3429	-0.0179	0.0009	-0.0078	0.0006						
	Ph = 4.25	61.16	58.5153							0.0022	0.0005		
	Ph = 4.75	68.09	65.4638					-0.0027	0.0005				
	Ph = 5.25	73.74	72.4778	-0.0166	0.0003	-0.0079	0.0004						
	Ph = 7.0	81.97	96.5311					-0.0028	0.0003				
	Ph = 7.25	90.51	98.2743							0.0022	0.0003		
2-Ni	Ph = 10	17.00	15.4812	-0.0155	0.0015			-0.0019	0.0018			-0.0036	0.0032
	Ph = 3.0	46.81	46.9136	-0.0159	0.0004			-0.0026	0.0007				
Zr	Ph = 0.25	3.19	1.6390			0.0050	0.0150	0.0150	0.0170				
	Ph = 0.75	9.35	5.0369	-0.0130	0.0040	-0.0060	0.0040	0.0000	0.0050	0.0150	0.0080		
	Ph = 1.49	18.08	10.0493	-0.0110	0.0020	-0.0010	0.0026	0.0034	0.0027			0.0436	0.0055
^{90}Zr	K	11.09	1.9658	0.048	0.011	0.040	0.012	0.069	0.011	0.094	0.021		
	M	23.43	11.4861	0.032	0.002	0.047	0.002	0.062	0.002	0.091	0.004	0.113	0.006
^{91}Zr	K	5.91	1.0254	-0.040	0.019	-0.035	0.022	-0.054	0.019	0.041	0.070		
	O	6.64	1.5411	-0.036	0.015	-0.041	0.018	-0.007	0.021	0.023	0.027		
	L	9.19	2.8053	-0.045	0.008	-0.043	0.008	-0.014	0.007	0.014	0.014	0.081	0.016
^{92}Zr	O	7.26	1.6822	0.012	0.014	0.045	0.015	0.097	0.019	0.080	0.022		
	M	13.01	6.5572	0.036	0.005	0.056	0.004	0.077	0.005	0.109	0.006	0.142	0.010

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
^{93}Zr	L	6.51	2.0661	-0.063	0.008	-0.041	0.016	-0.008	0.014	-0.020	0.016	0.096	0.024
	M	5.82	2.9523	-0.048	0.007	-0.023	0.008	0.004	0.009	0.046	0.013	0.116	0.020
	M	6.07	3.0644	-0.051	0.007	-0.025	0.007	0.006	0.009	0.061	0.012	0.110	0.018
^{96}Zr	K	13.19	2.3069	0.0060	0.0090	0.0320	0.0100	0.0370	0.0090	0.0680	0.0160		
	L	20.50	6.3264	-0.0020	0.0030	0.0210	0.0040	0.0470	0.0040	0.0860	0.0060	0.1310	0.0075
Nb	Ph = 1.0	16.06	15.7450	-0.2359	0.0012	-0.2619	0.0015	-0.2778	0.0014	-0.2660	0.0040	-0.1817	0.0051
	Ph = 2.0	30.78	31.5154	-0.2047	0.0007	-0.2299	0.0007	-0.2428	0.0007	-0.2325	0.0018		
	Ph = 3.0	44.24	46.9407	-0.1849	0.0036	-0.2132	0.0015	-0.2253	0.0005	-0.2151	0.0014	-0.1571	0.0012
Mo	Ph = 0.1	2.18	1.9389	-0.297	0.011	-0.285	0.010	-0.234	0.010	-0.197	0.012	-0.114	0.026
	Ph = 0.2	4.36	3.7923	-0.270	0.007	-0.237	0.006	-0.230	0.005	-0.175	0.011	-0.098	0.014
	Ph = 0.3	6.43	5.7577	-0.249	0.004	-0.234	0.004	-0.214	0.005	-0.180	0.008		
	Ph = 0.4	8.61	7.6166	-0.240	0.003	-0.223	0.003	-0.207	0.004			-0.083	0.006
	Ph = 0.8	16.90	15.3339			-0.203	0.002	-0.188	0.002	-0.149	0.003		
^{92}Mo	H	5.43	0.5880	-0.016	0.035	-0.049	0.046	-0.064	0.050	-0.033	0.054		
	K	7.34	1.3247	-0.041	0.016	-0.037	0.019	-0.029	0.024	-0.061	0.019	0.014	0.040
^{94}Mo	H	8.42	0.8727	-0.049	0.025	-0.070	0.030	-0.057	0.032	-0.014	0.046		
	T	8.61	1.0912	-0.008	0.029	-0.079	0.031	-0.065	0.026	-0.047	0.023	-0.088	0.049
^{95}Mo	H	5.25	0.6036	-0.519	0.033	-0.463	0.046	-0.470	0.046	-0.433	0.051	-0.273	0.086
	K	7.56	1.3668	-0.483	0.016	-0.452	0.024	-0.409	0.017	-0.349	0.018	-0.289	0.034
	L	11.48	3.5421	-0.428	0.005	-0.402	0.007	-0.379	0.009	-0.343	0.007		
^{96}Mo	P	8.59	0.4592	-0.071	0.053	-0.114	0.065	-0.094	0.062	-0.008	0.095		
	S	11.26	0.8543	-0.089	0.026			-0.059	0.032	-0.023	0.040	-0.010	0.060
	H	15.90	1.6493	-0.075	0.013	-0.042	0.017	-0.067	0.015	-0.020	0.022	-0.030	0.030
^{97}Mo	K	6.83	1.2320	-0.407	0.016	-0.407	0.024	-0.443	0.046	-0.397	0.025	-0.275	0.036
	O	8.77	2.0323	-0.388	0.011	-0.400	0.012	-0.437	0.013	-0.386	0.016	-0.259	0.022
	L	11.30	3.3182	-0.354	0.007	-0.392	0.008	-0.398	0.008	-0.368	0.007	-0.285	0.016
^{98}Mo	T	18.69	2.2019	-0.058	0.010	-0.068	0.012	-0.067	0.013	-0.015	0.014		
	O	28.91	6.7008	-0.058	0.003	-0.050	0.003	-0.039	0.004	-0.005	0.004	0.033	0.008

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
^{100}Mo	T	7.66	0.9585	-0.034	0.030	-0.041	0.029	-0.023	0.029	0.000	0.030		
	K	10.02	1.8044	-0.065	0.011	-0.053	0.013	-0.049	0.014	-0.018	0.018		
	L	15.59	4.6238	-0.051	0.005	-0.044	0.006	-0.042	0.006	-0.015	0.007	0.024	0.010
1-^{99}Tc	P	3.26	0.1822	-1.100	0.120	-1.090	0.090	-1.120	0.110	-1.230	0.130	-0.690	0.290
	H	7.52	0.8064	-1.050	0.030	-1.050	0.030	-1.060	0.030	-0.930	0.040	-0.790	0.060
	K	10.53	1.8934	-0.980	0.010	-0.970	0.010	-0.990	0.014	-0.950	0.020	-0.726	0.028
2-^{99}Tc	Gh = 19.5	6.25	0.4799	-1.140	0.040	-1.080	0.070	-1.150	0.060	-0.960	0.070		
	Gh = 23.0	9.01	1.2072	-1.030	0.020	-1.040	0.030	-1.030	0.030	-0.920	0.030		
	Gh = 16.5	9.92	1.2785	-1.000	0.030	-1.020	0.020	-1.000	0.020	-0.900	0.020		
^{101}Ru	P	11.31	0.6409	-0.910	0.030	-0.944	0.025	-1.002	0.034	-0.980	0.070	-0.650	0.080
	H	20.81	2.3230	-0.830	0.010	-0.874	0.012	-0.885	0.013	-0.840	0.020	-0.690	0.020
^{102}Ru	S	10.25	0.6979	-0.139	0.024	-0.165	0.028	-0.151	0.038	-0.123	0.058		
	H	14.67	1.6137	-0.124	0.015	-0.100	0.017	-0.136	0.014	-0.108	0.019	-0.057	0.032
^{104}Ru	P	10.59	0.5926	-0.129	0.040	-0.117	0.030	-0.101	0.034	-0.086	0.063		
	H	20.27	1.9765	-0.096	0.010	-0.093	0.016	-0.094	0.013	-0.080	0.020	-0.071	0.024
1-^{103}Rh	Ph = 0.05	1.24	1.1439	-1.6590	0.0190			-1.0720	0.0230	-0.9460	0.0320	-0.8080	0.0440
	Ph = 0.1	2.49	2.1977	-1.4040	0.0090	-1.0500	0.0110	-1.0230	0.0100	-0.9380	0.0150	-0.7060	0.0240
	Ph = 0.2	4.98	4.2845	-1.1610	0.0050	-0.9600	0.0055	-0.9300	0.0060	-0.8740	0.0080	-0.6920	0.0130
	Ph = 0.3	7.34	6.4822	-1.0300	0.0040	-0.8960	0.0034	-0.8800	0.0040	-0.8420	0.0054		
	Ph = 0.4	9.83	8.6162	-0.9520	0.0025	-0.8410	0.0028	-0.8420	0.0040	-0.8150	0.0040		
2-^{103}Rh	W	6.22	0.9876	-1.092	0.023					-0.846	0.027		
	W	6.22	2.0069			-0.895	0.009	-0.910	0.014	-0.870	0.021		
	W	6.22	3.0242	-1.048	0.009	-0.867	0.010	-0.903	0.009	-0.857	0.018		
	W	6.22	5.0308			-0.804	0.005	-0.864	0.006	-0.795	0.007		
3-^{103}Rh	Ph = 0.98	5.19	4.9597	-0.0530	0.0040								
	Ph = 1.47	7.62	7.4322	-0.0487	0.0026			0.0284	0.0032	0.0575	0.0046	0.0985	0.0063
	Ph = 2.45	12.19	12.3919	-0.0447	0.0016			0.0311	0.0024	0.0694	0.0030	0.0975	0.0044

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
Pd	W	6.08	0.4787	-0.570	0.036	-0.550	0.054	-0.590	0.046			-0.462	0.119
	W	6.08	0.9570	-0.596	0.023					-0.480	0.024		
	W	6.08	2.5259	-0.596	0.009	-0.575	0.013	-0.557	0.010			-0.384	0.022
	W	6.08	2.9636							-0.444	0.015		
	W	6.08	5.4900							-0.435	0.010		
^{104}Pd	S	3.64	0.2765	-0.279	0.086	-0.367	0.093	-0.480	0.090	-0.230	0.160	-0.130	0.180
	S	3.79	0.2953	-0.281	0.082	-0.374	0.090	-0.230	0.100	-0.360	0.060	-0.190	0.160
^{105}Pd	T	7.60	0.9208	-1.192	0.025	-1.255	0.025	-1.280	0.030	-1.239	0.040	-1.030	0.053
	K	7.48	1.2964	-1.191	0.019	-1.244	0.015	-1.250	0.020	-1.176	0.026	-0.907	0.038
	Ah = 0.54	1.67	0.7998	-1.361	0.031	-1.491	0.045	-1.380	0.030	-1.261	0.051		
	Ah = 1.09	3.24	1.6020	-1.273	0.018	-1.339	0.022	-1.310	0.020	-1.222	0.022		
^{106}Pd	H	11.76	1.350	-0.188	0.016	-0.211	0.017	-0.238	0.016	-0.214	0.027	-0.187	0.036
^{107}Pd	T	12.39	1.6316	-0.994	0.015	-1.021	0.016	-0.993	0.015	-0.879	0.023	-0.686	0.030
	K	15.88	2.8954	-0.961	0.012	-0.969	0.011	-0.976	0.009	-0.890	0.012	-0.684	0.016
	O	20.69	4.7670	-0.921	0.004	-0.934	0.007	-0.948	0.007	-0.878	0.007	-0.685	0.010
	Dh = 1.39	7.33	1.9947	-1.079	0.012	-1.081	0.018	-1.051	0.019	-0.902	0.019		
	Dh = 2.78	13.33	4.0001	-1.051	0.007	-1.034	0.005	-1.018	0.009	-0.887	0.011		
^{108}Pd	H	6.49	0.6762	-0.366	0.030	-0.326	0.041	-0.267	0.040	-0.120	0.058		
	T	7.72	1.0064	-0.320	0.035	-0.278	0.030	-0.244	0.025	-0.176	0.030	-0.094	0.047
^{110}Pd	S	3.60	0.2884	-0.075	0.078	0.062	0.086	-0.110	0.090	-0.200	0.140	-0.110	0.200
	S	3.69	0.2961	-0.095	0.067	-0.030	0.104	0.080	0.084	-0.130	0.070	-0.030	0.160
^{109}Ag	Ah > .07	>0.44	0.1997	-2.05	0.10	-2.22	0.12	-1.27	0.17	-1.27	0.12		
	Ah > .15	>0.85	0.4015	-2.04	0.04	-1.76	0.07	-1.24	0.08	-1.13	0.10		
	P	5.88	0.3285	-1.40	0.06	-1.18	0.06	-1.15	0.07	-1.13	0.11	-0.96	0.16
	H	10.57	1.1305	-1.17	0.02	-1.04	0.03	-1.01	0.02	-0.89	0.03	-0.68	0.05
^{111}Cd	P	3.92	0.1950	-0.57	0.12	-0.66	0.09	-0.72	0.13	-0.71	0.22	-0.59	0.18
	P	3.55	0.2014	-0.63	0.08	-0.64	0.11	-0.83	0.15	-0.74	0.10		
	S	5.07	0.3976	-0.54	0.07	-0.54	0.06	-0.67	0.07	-0.59	0.11	-0.55	0.13

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
In	Ph = 1.0	14.02	13.1201	-0.9226	0.0018			-0.7330	0.0030			-0.6191	0.0044
	Ph = 3.0	38.61	39.7639	-0.6862	0.0005			-0.6543	0.0009				
^{128}Te	O	21.86	4.9361	-0.011	0.005	-0.004	0.005	-0.008	0.005	0.008	0.005	0.042	0.010
^{130}Te	O	8.08	1.8713	0.023	0.014	0.005	0.012	0.025	0.014	0.032	0.015		
	L	7.25	3.0308	-0.003	0.009	0.012	0.009	0.025	0.010	0.015	0.008	0.020	0.014
^{127}I	Eh = 9.71	11.62	1.0010	-0.580	0.026	-0.602	0.025	-0.529	0.022	-0.414	0.035		
	Dh = 4.71	13.69	4.0123	-0.514	0.006	-0.500	0.010	-0.462	0.009	-0.394	0.014		
	S	5.71	0.4336	-0.588	0.047	-0.507	0.040	-0.477	0.053	-0.381	0.093	-0.413	0.109
	T	8.40	1.0209	-0.554	0.022	-0.532	0.020	-0.476	0.022	-0.444	0.035	-0.305	0.049
	O	13.80	3.1277	-0.490	0.008	-0.460	0.008	-0.440	0.009	-0.381	0.011	-0.261	0.014
^{129}I	T	7.43	0.9030	-0.255	0.026	-0.254	0.030	-0.275	0.030	-0.233	0.042	-0.129	0.065
	K	10.99	1.7974	-0.258	0.011	-0.263	0.014	-0.268	0.032	-0.209	0.022	-0.159	0.025
^{131}Xe	RB	2.14	2.9700	-0.590	0.013	-0.334	0.009	-0.240	0.010	-0.172	0.013	-0.103	0.020
1-^{133}Cs	Ah = 0.48	2.07	0.9985	-0.9570	0.0180	-0.7590	0.0210	-0.7010	0.0220	-0.5060	0.0400	-0.3560	0.0530
	Ah = 1.45	5.95	2.9972	-0.7560	0.0070	-0.6440	0.0090	-0.5980	0.0080	-0.4870	0.0140	-0.3480	0.0180
	Bh = 4.3	15.34	8.9168	-0.5820	0.0030	-0.5250	0.0020	-0.5030	0.0030	-0.4420	0.0050		
	H	8.75	0.9918	-0.7320	0.0240	-0.6240	0.0240	-0.5750	0.0260	-0.4620	0.0300	-0.4520	0.0490
	K	12.89	2.2296	-0.6410	0.0090	-0.5610	0.0130	-0.5410	0.0110	-0.4720	0.0160	-0.3340	0.0200
	L	18.90	6.0016	-0.5630	0.0040	-0.5150	0.0040	-0.4906	0.0046	-0.4360	0.0050	-0.3220	0.0084
	M	26.24	12.9431	-0.5060	0.0020	-0.4690	0.0020	-0.4567	0.0026	-0.4120	0.0030		
2-^{133}Cs	L	17.30	5.4638	-0.468	0.004	-0.417	0.006	-0.396	0.005	-0.310	0.005		
^{135}Cs	T	7.55	0.9674	-0.424	0.026	-0.346	0.026	-0.299	0.037	-0.233	0.038	-0.185	0.047
	K	10.19	1.8085	-0.430	0.010	-0.339	0.013	-0.325	0.019	-0.298	0.023	-0.169	0.026
	O	15.18	3.4285	-0.392	0.007	-0.329	0.007	-0.313	0.009	-0.235	0.012	-0.165	0.015
	L	18.83	5.8041	-0.364	0.004	-0.315	0.005	-0.287	0.005	-0.196	0.007	-0.139	0.010
1-^{139}La	L	17.23	5.4665	-0.0170	0.0030	-0.0020	0.0040	0.0156	0.0036	0.0384	0.0067	0.0830	0.0090
	N	23.96	24.6470	-0.0190	0.0010	-0.0013	0.0009	0.0152	0.0008	0.0381	0.0014	0.0702	0.0022
2-^{139}La	M	15.49	7.7975	-0.0200	0.0030	-0.0020	0.0030	0.0078	0.0038	0.0296	0.0040		

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
^{140}Ce	M	27.38	13.7840	0.0190	0.0020	0.0332	0.0014	0.0492	0.0017	0.0670	0.0040		
	N	38.02	38.7447	0.0200	0.0010	0.0325	0.0006	0.0469	0.0006	0.0670	0.0014	0.0899	0.0014
^{142}Ce	O	16.65	3.8585	0.0200	0.0060	0.0328	0.0065	0.0500	0.0070	0.0930	0.0110		
	L	21.80	6.9082	0.0160	0.0030	0.0334	0.0032	0.0440	0.0040	0.0810	0.0060	0.1120	0.0080
1-^{141}Pr	L	15.89	4.9766	-0.0860	0.0040	-0.0750	0.0044	-0.0640	0.0040	-0.0280	0.0040	0.0230	0.0110
	M	19.48	9.6044	-0.0810	0.0030	-0.0730	0.0020	-0.0590	0.0030	-0.0190	0.0050	0.0310	0.0060
2-^{141}Pr	M	18.71	9.4261	-0.0790	0.0020	-0.0710	0.0020	-0.0524	0.0037	-0.0140	0.0030	0.0324	0.0065
	N	25.50	25.8065	-0.0740	0.0010	-0.0620	0.0010	-0.0457	0.0010	-0.0180	0.0020	0.0324	0.0020
1-Nd	H	5.39	0.6104	-0.243	0.033	-0.243	0.048	-0.159	0.040	-0.149	0.093		
	L	10.48	3.1654	-0.243	0.007	-0.191	0.007	-0.170	0.009	-0.111	0.012		
2-Nd	L	10.21	3.2360	-0.205	0.007			-0.126	0.007	-0.066	0.011	-0.008	0.018
	M	11.65	5.8650	-0.196	0.004			-0.120	0.005	-0.066	0.005	0.021	0.009
	N	22.01	22.8048	-0.166	0.001	-0.132	0.001	-0.108	0.001	-0.063	0.003	0.008	0.003
^{142}Nd	O	5.07	1.1798	-0.003	0.014	-0.014	0.019	0.029	0.017	0.088	0.034		
	L	6.39	1.9767	-0.025	0.012	0.009	0.015	0.017	0.014	0.059	0.015		
	M	8.65	4.3009	-0.015	0.007	0.005	0.006	0.025	0.007	0.038	0.010	0.055	0.014
^{143}Nd	H	5.92	0.6724	-0.439	0.039	-0.383	0.039	-0.311	0.039	-0.174	0.057	-0.135	0.094
	L	14.59	4.6364	-0.347	0.005	-0.278	0.004	-0.251	0.006	-0.190	0.010	-0.069	0.012
^{144}Nd	O	6.30	1.4722	-0.078	0.016	-0.045	0.016	-0.015	0.021	0.001	0.023		
	L	8.15	2.5295	-0.067	0.009	-0.034	0.009	-0.029	0.010	0.013	0.021		
	M	11.52	5.8087	-0.052	0.005	-0.035	0.004	-0.017	0.005	0.008	0.008	0.057	0.009
^{145}Nd	S	4.85	0.3685	-0.747	0.066	-0.537	0.076	-0.558	0.071	-0.415	0.094	-0.320	0.100
	K	9.11	1.6272	-0.577	0.014	-0.522	0.016	-0.471	0.019	-0.392	0.030	-0.185	0.030
	O	10.89	2.5292	-0.537	0.009	-0.492	0.009	-0.446	0.011	-0.354	0.015	-0.151	0.022
^{146}Nd	K	8.53	1.5565	-0.048	0.013	-0.040	0.015	-0.011	0.014	0.038	0.036		
	L	13.13	4.2247	-0.044	0.006	-0.029	0.006	-0.013	0.006	0.017	0.010	0.044	0.013
^{148}Nd	T	5.64	0.7152	-0.087	0.042	-0.084	0.036	-0.092	0.037	-0.043	0.072		
	K	7.80	1.4268	-0.128	0.017	-0.086	0.018	-0.056	0.018	-0.007	0.034		
	L	12.61	3.9100	-0.096	0.006	-0.085	0.006	-0.054	0.007	-0.021	0.009	0.016	0.014

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
^{150}Nd	S	5.52	0.4064	-0.150	0.055	-0.102	0.069	-0.205	0.051	-0.093	0.080		
	T	9.28	1.2100	-0.093	0.025	-0.074	0.020	-0.056	0.023	-0.025	0.040	-0.018	0.040
	K	11.50	2.0968	-0.084	0.012	-0.083	0.011	-0.077	0.013	-0.014	0.016	-0.008	0.020
	O	13.97	3.2441	-0.096	0.007	-0.074	0.007	-0.065	0.010	-0.016	0.008	0.038	0.014
^{147}Pm	T	4.85	0.6215	-2.470	0.040	-2.090	0.040	-1.800	0.040	-1.320	0.060	-0.780	0.080
	K	6.33	1.1216	-2.300	0.020	-1.910	0.022	-1.750	0.025	-1.330	0.040	-0.830	0.050
	O	8.21	1.8521	-2.190	0.010	-1.870	0.013	-1.726	0.017	-1.310	0.016		
1-^{147}Sm	Gh = 26.4	4.94	0.5000	-2.050	0.040			-1.480	0.070	-1.060	0.090		
	Fh = 25.3	6.85	1.0000	-1.810	0.020			-1.440	0.040	-1.130	0.030		
	Eh = 30.0	9.39	2.0000	-1.690	0.010			-1.400	0.020	-1.000	0.020		
	H	4.42	0.5098	-2.040	0.040	-1.747	0.055	-1.530	0.050	-1.150	0.060		
	T	5.33	0.6988	-1.890	0.030	-1.710	0.037	-1.530	0.040	-1.110	0.055		
	K	6.71	1.1960	-1.810	0.020	-1.594	0.022	-1.480	0.026	-1.210	0.027		
2-^{147}Sm	S	4.51	0.2484	-1.960	0.080	-1.630	0.130	-1.630	0.110	-1.470	0.140	-0.630	0.210
	T	8.14	1.1756	-1.680	0.020	-1.520	0.020	-1.420	0.020	-1.180	0.040	-0.740	0.044
	O	13.63	3.1680	-1.480	0.010	-1.380	0.010	-1.280	0.010	-1.080	0.010	-0.726	0.016
^{148}Sm	S	6.46	0.5100	-0.430	0.050	-0.337	0.053	-0.327	0.049	-0.177	0.069	0.010	0.110
	H	9.12	1.0066	-0.370	0.020	-0.267	0.028	-0.228	0.027	-0.163	0.034	-0.060	0.045
	T	9.71	1.2460	-0.330	0.030	-0.303	0.019	-0.192	0.024	-0.162	0.027	-0.120	0.040
^{149}Sm	P	5.39	0.3015	-4.160	0.070	-3.475	0.073	-3.175	0.072	-2.620	0.130	-1.690	0.160
	S	7.32	0.5786	-3.860	0.040	-3.300	0.052	-2.968	0.047	-2.370	0.060	-1.450	0.070
	H	9.27	1.0206	-3.570	0.020	-3.093	0.024	-2.844	0.030	-2.300	0.030	-1.560	0.050
	K	13.91	2.5424	-3.072	0.006	-2.767	0.010	-2.607	0.011	-2.180	0.010	-1.515	0.020
^{150}Sm	S	3.00	0.2248	-0.710	0.091	-0.597	0.089	-0.550	0.120	-0.275	0.160		
	H	4.23	0.4887	-0.664	0.044	-0.558	0.055	-0.480	0.060	-0.371	0.080		
	T	4.14	0.5292	-0.671	0.066	-0.492	0.047	-0.470	0.055	-0.354	0.080	-0.220	0.110
	K	5.93	1.0570	-0.657	0.020	-0.515	0.022	-0.470	0.025	-0.343	0.025	-0.230	0.050
	O	7.06	1.6340	-0.590	0.016	-0.487	0.015	-0.440	0.020	-0.371	0.023	-0.236	0.032

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
^{151}Sm	Gh = 29.0	7.01	0.7741	-2.020	0.030	-1.580	0.040	-1.255	0.040	-0.929	0.050		
	Fh = 18.0	9.22	1.0076	-1.940	0.030	-1.500	0.030	-1.240	0.030	-0.859	0.041		
	Eh = 30.0	11.83	2.5813	-1.720	0.010	-1.350	0.010	-1.180	0.010	-0.851	0.014		
	S	4.90	0.3898	-2.090	0.050	-1.580	0.050	-1.285	0.060	-0.961	0.076	-0.770	0.130
	T	6.54	0.8670	-1.970	0.030	-1.530	0.030	-1.240	0.030	-1.023	0.045	-0.480	0.055
	O	11.30	2.6180	-1.770	0.010	-1.390	0.010	-1.214	0.010	-0.931	0.013	-0.565	0.034
^{152}Sm	P	4.19	0.2366	-0.950	0.090	-0.650	0.100	-0.560	0.080	-0.500	0.170	-0.190	0.220
	S	6.14	0.4730	-0.810	0.040	-0.550	0.060	-0.490	0.056	-0.320	0.060	-0.240	0.120
	T	9.09	1.2169	-0.690	0.040	-0.467	0.025	-0.410	0.020	-0.301	0.023	-0.130	0.040
	K	12.90	2.2912	-0.640	0.010	-0.422	0.010	-0.370	0.010	-0.283	0.014	-0.145	0.024
^{154}Sm	H	8.47	0.9843	-0.215	0.026	-0.169	0.028	-0.100	0.030	-0.096	0.034	-0.110	0.050
	T	8.80	1.1206	-0.198	0.021	-0.171	0.018	-0.165	0.024	-0.122	0.034	-0.080	0.050
	K	10.92	1.4928	-0.176	0.013					-0.072	0.021		
Eu	H	4.83	0.5456	-5.770	0.040	-4.850	0.050	-4.418	0.048	-3.635	0.040	-2.698	0.086
	K	6.94	1.2474	-5.370	0.010	-4.600	0.020	-4.272	0.023	-3.564	0.017	-2.513	0.038
	L	9.72	3.0100	-5.044	0.005	-4.460	0.010	-4.159	0.011	-3.546	0.010	-2.535	0.019
^{153}Eu	H	3.67	0.4276	-4.200	0.060	-3.496	0.065	-3.220	0.060	-2.770	0.098	-1.950	0.120
	K	6.20	1.0914	-3.840	0.020	-3.322	0.025	-3.110	0.025	-2.626	0.032	-1.770	0.050
^{156}Gd	P	3.79	0.2146	-0.52	0.11	-0.42	0.11	-0.49	0.10	-0.60	0.19		
	P	4.04	0.2255	-0.49	0.10	-0.56	0.07	-0.45	0.12	-0.63	0.12	-0.35	0.23
^{157}Gd	P	4.38	0.2289	-2.46	0.11	-1.90	0.09	-1.71	0.13	-1.65	0.18		
	P	4.84	0.2531	-2.41	0.10	-1.99	0.09	-1.79	0.08	-1.41	0.10	-0.75	0.14
^{159}Tb	Ph = 0.025	0.35	0.2945	-2.630	0.080	-2.457	0.084	-2.190	0.060	-1.910	0.140	-1.290	0.150
	Ph = 0.05	0.70	0.6348	-2.570	0.040	-2.323	0.028	-2.180	0.030	-1.885	0.040	-1.360	0.080
	Ph = 0.075	1.05	0.9132	-2.480	0.030	-2.244	0.016	-2.140	0.030	-1.771	0.030	-1.160	0.060
	Ph = 0.1	1.40	1.2539	-2.430	0.020	-2.219	0.020	-2.090	0.020	-1.763	0.027		
	Ph = 0.125	1.75	1.5483	-2.380	0.010	-2.188	0.009	-2.090	0.020	-1.749	0.020	-1.200	0.034

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
Hf	H	8.51	0.9896	-1.120	0.020	-0.815	0.027	-0.665	0.027	-0.469	0.041	-0.324	0.049
	K	13.89	2.5091	-1.000	0.010	-0.734	0.012	-0.611	0.010	-0.449	0.031	-0.255	0.020
	L	27.25	8.6397	-0.812	0.002	-0.637	0.003	-0.553	0.003	-0.427	0.003	-0.245	0.006
W	Ph = 0.06	2.17	1.9799	-0.707	0.009			-0.365	0.016	-0.269	0.018	-0.122	0.024
	Ph = 0.12	4.33	3.9779	-0.591	0.005			-0.348	0.007	-0.256	0.008		
Au	Ph = 0.1	1.13	1.0148	-0.074	0.023			0.021	0.023	0.037	0.031		
1-Pb	O	44.35	8.0350	0.0114	0.0028			0.0250	0.0023	0.0320	0.0030	0.0480	0.0053
	M	55.63	28.0172	0.0122	0.0008	0.0184	0.0010	0.0240	0.0010	0.0331	0.0011	0.0376	0.0018
	Dh = 28.0	72.98	51.8082	0.0116	0.0004	0.0179	0.0010	0.0236	0.0007	0.0311	0.0006		
2-Pb	Ph = 3.84	73.05	77.7990							0.01410	0.00040		
	Ph = 4.2	78.05	84.2960					0.01000	0.00030				
	Ph = 5.0	90.80	101.2600	0.00490	0.00030	0.00779	0.00020	0.01010	0.00030				
	Ph = 8.8	140.30	180.2500	0.00500	0.00020	0.00753	0.00015	0.00997	0.00016				
	Ph = 17.5	215.50	349.8500	0.00494	0.00006							0.01662	0.00015
3-Pb	Ah = 1.5	10.38	5.2485			0.0360	0.0050						
	L	27.86	8.8355	0.0220	0.0020	0.0330	0.0020	0.0480	0.0034	0.0671	0.0036	0.0660	0.0060
	Ch = 6.02	28.28	17.7403	0.0230	0.0010	0.0340	0.0020	0.0440	0.0020	0.0645	0.0034		
	Ch = 6.12	28.63	18.0359			0.0360	0.0030						
1-^{235}U	Ph = 0.14	4.93	4.5873	0.4170	0.0040	0.5060	0.0040	0.5900	0.0050	0.7170	0.0160	0.9110	0.0120
	Ph = 0.28	9.73	9.1077			0.5160	0.0020	0.5950	0.0030			0.9250	0.0050
	Ph = 0.42	14.35	13.5209	0.4290	0.0010	0.5210	0.0020	0.5940	0.0024	0.7150	0.0020	0.9330	0.0040
	Ph = 0.56	18.88	17.9017			0.5170	0.0020						
2-^{235}U	Ph = 0.6	3.34	2.8804			0.1100	0.0070	0.1340	0.0100				
	Ph = 1.2	6.02	5.3497	0.0820	0.0040					0.1740	0.0050		
	Ph = 1.8	9.48	8.6703			0.1120	0.0030	0.1370	0.0040				
	Ph = 3.6	17.78	17.5744			0.1120	0.0014	0.1370	0.0015			0.2240	0.0030
	Ph = 4.8	23.14	23.6028	0.0810	0.0010					0.1750	0.0014		
	Ph = 6.0	26.65	28.9524	0.0793	0.0007			0.1380	0.0010			0.2200	0.0020

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
^{236}U	Ah = 1*.5	3.67	1.7546	0.053	0.013	0.178	0.009	0.297	0.011	0.435	0.018	0.690	0.030
	Ah = 2*.5	7.14	3.5091	0.058	0.012	0.173	0.007	0.298	0.007				
	Ah = 3*.5	10.42	5.2634	0.061	0.007	0.186	0.006			0.430	0.012	0.661	0.026
	Ah = 4*.5	13.53	7.0181			0.171	0.010	0.256	0.017				
1-^{238}U	Ph = 0.1	0.64	0.5825			-0.046	0.019	-0.082	0.055				
	Ph = 0.2	1.28	1.1657					0.026	0.024				
	Ph = 0.3	1.90	1.7534			-0.040	0.014	0.010	0.017				
	Ph = 0.4	2.52	2.4849			-0.019	0.010						
	Ph = 0.6	3.76	3.3272	-0.061	0.006	-0.016	0.005	0.014	0.008	0.058	0.010	0.116	0.016
	Ph = 0.8	4.91	4.1496	-0.064	0.005								
	Ph = 1.2	7.29	6.6349	-0.050	0.004	-0.011	0.004	0.020	0.004	0.057	0.007	0.103	0.006
2-^{238}U	Ph = 0.14	5.15	4.6364	-0.2570	0.0040	-0.1970	0.0040	-0.1580	0.0040	-0.0810	0.0080	0.0075	0.0109
	Ph = 0.28	10.23	9.5822			-0.1700	0.0020	-0.1390	0.0030	-0.0780	0.0040	0.0122	0.0055
	Ph = 0.42	15.27	14.2177	-0.1870	0.0020	-0.1520	0.0020	-0.1230	0.0020	-0.0770	0.0030	0.0157	0.0036
^{239}Pu	DC	2.57	0.4640	0.619	0.037	0.843	0.041	0.960	0.040	1.174	0.061		
	DC	8.28	1.3980	0.657	0.022	0.816	0.017	0.990	0.020	1.295	0.018		
	DC	12.00	2.0270	0.627	0.014	0.819	0.011	0.970	0.010	1.254	0.011		
	DC	16.56	2.8120	0.657	0.009	0.825	0.009	1.000	0.010	1.281	0.009		
	O	2.74	0.4590	0.584	0.050			0.815	0.045	1.097	0.057	1.540	0.110
	O	7.71	1.3880	0.578	0.015			0.895	0.020	1.139	0.023	1.620	0.030
	O	11.94	1.9520	0.599	0.011			0.880	0.014	1.112	0.018		
	O	13.87	2.7550	0.605	0.008			0.881	0.010	1.128	0.012	1.570	0.020
1-^{240}Pu	D	0.99	0.1820	-0.34	0.09	0.29	0.11	0.27	0.10	0.66	0.11		
	D	2.50	0.4570	-0.16	0.03	0.27	0.05	0.36	0.05	0.60	0.05		
	D	5.01	0.9120	0.09	0.02	0.41	0.03	0.56	0.02	0.86	0.03		
	O	0.81	0.1750	-0.60	0.12			0.25	0.11	0.30	0.18		
	O	2.45	0.4530	-0.27	0.05			0.38	0.04	0.63	0.08		
	O	5.35	0.9060	-0.04	0.02			0.43	0.03	0.61	0.04		

Table A.2. STEK experimental results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Weight (g)	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error	ρ/ρ_0	Error
2-^{240}Pu	D	0.59	0.0830	-1.29	0.24	0.18	0.22	0.09	0.22	0.70	0.26		
	O	0.54	0.0820	-1.71	0.26			0.05	0.23	0.11	0.38		
O	Al_2O_3		1.0000	0.0935	0.0028							0.3480	0.0080
	Fe_2O_3		1.0000	0.0908	0.0019							0.3370	0.0080
	PbO		1.0000	0.0990	0.0056							0.3250	0.0240
	H_2O		1.0000	0.0920	0.0020	0.1390	0.0020	0.1890	0.0020	0.2640	0.0030	0.3420	0.0060
H	H_2O		1.0000	27.6700	0.0700	35.5800	0.1400	46.3200	0.1400	66.8800	0.1400	96.5800	0.2100
H_2O			1.0000	3.1780	0.0080	4.1040	0.0160	5.3510	0.0160	7.7180	0.0160	11.1100	0.0240
B	Natural B		1.0000	-16.8400	0.4040	-12.4700	0.1995.2	-11.3800	0.1138	-9.7200	0.0680	-7.4600	0.0522

Table A.3. (C/E)r comparison between recent analysis and previous results

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
H	P	1.80											
	P	3.44											
^{7}LI	M	9.55											
	N	13.85											
1-^{10}B	Ph = 0.75	3.26											
	Ph = 1.50	6.30											
	Ph = 2.25	9.16											
	Ph = 3.00	11.84											
2-^{10}B		0.0038											
		0.0150											
3-^{10}B		0.0130											
C	Ph = 3.0	8.94											
	Ph = 3.5	10.26											
	Ph = 5.0	13.72											
	Ph = 9.7	23.21											
	Ph = 11.2	25.08											
	Ph = 16.8	32.03											
	Ph = 21.0	35.22											
	Ph = 31.5	43.47											
1-N	M	17.51											
	R	29.85											
2-N	M	18.26											
	R	29.00											
1-O	M	11.30											
	N	17.92											
	R	13.65											
2-O	N	22.40											
	R	20.75											

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
Al	Ph = 2.1	10.52											
	Ph = 3.0	14.17											
	Ph = 3.4	15.77											
	Ph = 4.0	18.00											
	Ph = 4.7	20.97											
	Ph = 5.7	24.33											
	Ph = 6.1	25.78											
	Ph = 10.3	37.52											
	Ph = 13.9	45.61											
	Ph = 14.7	47.12											
Si	M	13.01		0.600		0.658		0.607					
	C	11.25		0.696		0.711		0.690		0.604			
	R	33.26		0.668		0.696		0.672		0.650			
Cl	D	13.02											
	D	13.71											
	L	16.17											
	M	19.13											
V	Ph = 4.56	22.33											
	Ph = 5.61	27.06											
	Ph = 6.05	27.38											
	Ph = 10.9	43.04											
	Ph = 13.3	48.84											
	Ph = 17.7	58.48											
Cr	Ph = 1.94	15.91											
	Ph = 3.06	23.92											
	Ph = 3.76	28.55											
	Ph = 4.75	34.70											
	Ph = 5.7	40.18											
	Ph = 9.22	57.55											
	Ph = 12.2	69.75											
Mn	Ph = 0.1	1.09											

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
Fe	Ph = 1.0	15.01											
	Ph = 2.0	28.69											
	Ph = 3.0	41.34											
1-Ni	Ph = 1.5	24.83											
	Ph = 3.0	46.32											
	Ph = 4.25	61.16											
	Ph = 4.75	68.09											
	Ph = 5.25	73.74											
	Ph = 7.0	81.97											
	Ph = 7.25	90.51											
2-Ni	Ph = 10	17.00											
	Ph = 3.0	46.81											
Zr	Ph = 0.25	3.19	0.4580			-4.670	-4.742	-1.210	-1.232				
	Ph = 0.75	9.35	1.3234	1.571	1.592	2.986	3.033			-0.171	-0.175		
	Ph = 1.49	18.08		1.510	1.532	13.814	14.045	-2.631	-2.684			0.349	0.356
^{90}Zr	K	11.09	0.7415	0.474	0.479	0.887	0.899	0.688	0.700	0.701	0.714		
	M	23.43	-0.5701	0.732	0.740	0.774	0.784	0.782	0.795	0.735	0.749	0.762	0.776
^{91}Zr	K	5.91	0.5837	1.402	1.422	1.383	1.406	0.614	0.627	-0.004	-0.007		
	O	6.64	1.0446	1.491	1.513	1.120	1.140	1.120	4.506	0.065	0.060		
	L	9.19		1.051	1.067	0.915	0.932	1.766	1.807	0.430	0.429	0.627	0.637
^{92}Zr	O	7.26	0.5403	1.277	1.289	0.591	0.598	0.400	0.407	0.715	0.728		
	M	13.01	0.5403	0.479	0.484	0.522	0.529	0.541	0.549	0.552	0.562	0.579	0.590
^{93}Zr	L	6.51	0.6956	0.888	0.902	0.997	1.015	2.551	2.616	-0.881	-0.891	0.673	0.685
	M	5.82	1.0550	1.207	1.226	1.853	1.889	-5.473	-5.615	0.364	0.368	0.555	0.564
	M	6.07		1.121	1.139	1.678	1.711	-3.555	-3.648	0.280	0.283	0.586	0.596
^{96}Zr	K	13.19	0.6599	-0.614	-0.634	0.335	0.337	0.738	0.748	0.817	0.832		
	L	20.50	1.0354	-0.560	-0.512	0.734	0.739	0.668	0.677	0.676	0.688	0.667	0.679
Nb	Ph = 1.0	16.06	0.9802		0.981		1.020		0.992		0.985		1.014
	Ph = 2.0	30.78	0.9830		0.964		0.995		0.975		0.977		
	Ph = 3.0	44.24			0.969		0.976		0.956		0.964		0.945

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
Mo	Ph = 0.1	2.18	1.0110		1.003		0.971		1.070		1.008		1.034
	Ph = 0.2	4.36	1.0230		0.971		1.059		1.006		1.079		1.171
	Ph = 0.3	6.43			0.977		1.010		1.029		1.014		
	Ph = 0.4	8.61			0.956		1.012		1.023				1.332
	Ph = 0.8	16.90					0.992		1.020		1.106		
^{92}Mo	H	5.43	0.9107		2.847		1.027		0.800		1.517		
	K	7.34	0.9799		1.066		1.302		1.687		0.783		-2.859
^{94}Mo	H	8.42	1.0264		1.522		1.109		1.340		5.204		
	T	8.61	1.0728		9.276		0.978		1.169		1.543		0.640
^{95}Mo	H	5.25	1.0269		0.965		1.042		0.980		0.949		1.093
	K	7.56	1.0203		0.953		0.996		1.062		1.128		1.003
	L	11.48			0.973		1.030		1.066		1.085		
^{96}Mo	P	8.59	0.9383		1.284		0.729		0.755		6.423		
	S	11.26	0.9932		0.941				1.102		2.043		2.164
	H	15.90			1.001		1.625		0.863		2.066		0.596
^{97}Mo	K	6.83	0.9732		0.931		1.034		0.957		0.982		0.979
	O	8.77	0.9758		0.933		1.010		0.935		0.980		1.017
	L	11.30			0.974		0.987		0.986		0.993		0.901
^{98}Mo	T	18.69	1.0167		1.197		1.043		0.969		3.323		
	O	28.91	1.1040		1.001		1.166		1.341		7.760		-0.303
^{100}Mo	T	7.66	1.0587		1.998		1.709		2.738				
	K	10.02	1.0975		0.969		1.218		1.172		2.244		
	L	15.59			1.077		1.258		1.145		2.140		0.116
1-^{99}Tc	P	3.26	0.8218	0.907	0.919	0.837	0.850	0.790	0.805	0.676	0.689	0.970	0.990
	H	7.52	0.8295	0.814	0.823	0.787	0.798	0.776	0.790	0.853	0.870	0.827	0.844
	K	10.53		0.808	0.823	0.810	0.824	0.799	0.815	0.813	0.830	0.886	0.904
2-^{99}Tc	Gh = 19.5	6.25	0.8122		0.787		0.795		0.741		0.853		
	Gh = 23.0	9.01	0.8152		0.809		0.786		0.797		0.868		
	Gh = 16.5	9.92			0.817		0.791		0.812		0.880		
^{101}Ru	P	11.31	0.9564	0.983	0.997	0.989	1.005	0.929	0.946	0.887	0.905	1.057	1.079
	H	20.81	0.9641	0.923	0.935	0.938	0.952	0.938	0.956	0.950	0.970	0.946	0.965

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
^{102}Ru	S	10.25	1.0745		0.961		0.925		1.052		1.278		
	H	14.67	1.0760		1.017		1.437		1.099		1.371		2.054
^{104}Ru	P	10.59	1.0753		0.906		1.125		1.314		1.425		
	H	20.27	1.0658		0.996		1.165		1.166		1.283		1.018
1-^{103}Rh	Ph = 0.05	1.24	0.9692		0.988				0.975		0.996		0.900
	Ph = 0.1	2.49	0.9705		0.974		0.992		0.954		0.963		1.011
	Ph = 0.2	4.98			0.961		0.963		0.964		0.978		1.004
	Ph = 0.3	7.34			0.963		0.960		0.965		0.978		
	Ph = 0.4	9.83			0.952		0.967		0.965		0.980		
2-^{103}Rh	W	6.22	1.0114		0.969						0.994		
	W	6.22	1.0040				0.999		0.960		0.967		
	W	6.22			1.009		1.031		0.968		0.981		
	W	6.22					1.112		1.012		1.058		
3-^{103}Rh	Ph = 0.98	5.19	0.9716		1.061								
	Ph = 1.47	7.62	1.1499		1.072				0.770		0.868		0.843
	Ph = 2.45	12.19			1.040				0.729		0.722		0.848
Pd	W	6.08	1.0495		1.078		1.080		0.962				0.819
	W	6.08	1.0441		1.031						1.046		
	W	6.08			1.031		1.034		1.019				0.986
	W	6.08									1.130		
	W	6.08									1.154		
^{104}Pd	S	3.64	1.1400		1.497		1.220		0.931		1.790		2.470
	S	3.79	1.1377		1.476		1.190		1.932		1.139		1.686
^{105}Pd	T	7.60	0.9969		0.960		0.977		0.974		0.964		0.932
	K	7.48	0.9942		0.963		0.988		0.999		1.017		1.059
	Ah = 0.54	1.67			1.020		0.954		1.019		1.025		
	Ah = 1.09	3.24			1.016		1.007		1.029		1.030		
^{106}Pd	H	11.76	1.1932		1.181		1.226		1.149		1.294		1.269
			1.1693										

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
^{107}Pd	T	12.39	1.0105	0.985	0.999	0.992	1.008	1.011	1.030	1.057	1.080	1.064	1.086
	K	15.88	1.0166	0.978	0.993	1.013	1.030	1.002	1.022	1.026	1.048	1.057	1.079
	O	20.69		0.975	0.992	1.014	1.032	1.002	1.022	1.019	1.042	1.044	1.066
	Dh = 1.39	7.33		0.849	0.995	0.891	1.010	0.891	1.021	0.994	1.085		
	Dh = 2.78	13.33		0.824	0.934	0.890	0.987	0.910	0.998	0.986	1.065		
^{108}Pd	H	6.49	1.1095		1.111		0.997		1.044		1.866		
	T	7.72	1.1023		1.205		1.116		1.097		1.236		1.774
^{110}Pd	S	3.60	0.7482		1.722		-2.132		1.170		0.588		0.744
	S	3.69	0.9243		1.355		4.393		-1.605		0.903		2.724
^{109}Ag	Ah > .07	>0.44	0.8997		1.190		0.728		1.032		0.795		
	Ah > .15	>0.85	0.8969		1.031		0.839		0.998		0.871		
	P	5.88			0.909		0.892		0.846		0.767		0.704
	H	10.57			0.918		0.899		0.881		0.921		0.967
^{111}Cd	P	3.92	1.0972		1.170		1.092		1.029		1.034		1.089
	P	3.55	1.0899		1.072		1.132		0.899		0.997		
	S	5.07			1.193		1.310		1.084		1.230		1.163
In	Ph = 1.0	14.02	1.0160		0.990				1.041				1.053
	Ph = 3.0	38.61	1.0043		0.973				1.016				
^{128}Te	O	21.86	0.3816		0.785		1.594		0.324		0.477		0.342
			0.9543										
^{130}Te	O	8.08	0.4823		0.264		2.160		0.607		0.655		
	L	7.25	0.5858		-2.008		0.894		0.604		1.392		1.448
^{127}I	Eh = 9.71	11.62	0.8797		0.784		0.737		0.796		0.878		
	Dh = 4.71	13.69	0.8826		0.849		0.859		0.888		0.906		
	S	5.71			0.918		1.000		0.983		1.020		0.645
	T	8.40			0.889		0.888		0.931		0.846		0.860
	O	13.80			0.889		0.932		0.931		0.936		0.981
^{129}I	T	7.43	1.0735		1.160		1.148		1.010		1.025		1.303
	K	10.99	1.0661		1.083		1.059		0.997		1.113		1.043
^{131}Xe	RB	2.14	1.0740		0.936		1.086		1.185		1.170		1.146
			1.1091										

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
1-^{133}Cs	Ah = 0.48	2.07	0.8683		0.899		0.913		0.864		0.936		0.878
	Ah = 1.45	5.95	0.8753		0.895		0.893		0.870		0.880		0.858
	Bh = 4.3	15.34			0.900		0.890		0.868		0.857		
	H	8.75			0.835		0.850		0.846		0.886		0.646
	K	12.89			0.858		0.867		0.836		0.823		0.850
	L	18.90			0.875		0.863		0.853		0.842		0.854
	M	26.24			0.885		0.875		0.854		0.845		
2-^{133}Cs	L	17.30											
^{135}Cs	T	7.55	0.9289		0.993		1.000		1.017		1.026		0.864
	K	10.19	0.9382		0.917		0.968		0.896		0.779		0.932
	O	15.18			0.917		0.925		0.873		0.945		0.934
	L	18.83			0.937		0.925		0.917		1.104		1.094
1-^{139}La	L	17.23	0.6947		0.925		0.426		0.683		0.715		0.568
	N	23.96	0.9801		0.673		-1.138		0.825		0.753		0.680
2-^{139}La	M	15.49	0.8819		0.838		0.826		1.286		0.915		
			0.9644										
^{140}Ce	M	27.38	0.8182		1.009		0.889		0.784		0.773		
	N	38.02	-0.4884		0.961		0.910		0.824		0.773		0.716
^{142}Ce	O	16.65	0.6478		0.801		0.830		0.735		0.554		
	L	21.80	-0.2248		1.017		0.822		0.841		0.639		0.597
1-^{141}Pr	L	15.89	0.9880	0.972	0.986	1.013	1.031	0.982	1.002	1.187	1.216	0.532	0.537
	M	19.48	1.0337	0.963	0.978	0.965	0.982	0.979	1.000	1.559	1.599	0.447	0.452
2-^{141}Pr	M	18.71	1.0183		0.986		1.031		1.002		1.216		0.537
	N	25.50	1.0789		0.978		0.982		1.000		1.599		0.452
1-Nd	H	5.39	0.9423		0.975		0.849		1.149		0.926		
	L	10.48	1.0168		0.886		0.992		0.997		1.177		
2-Nd	L	10.21	0.9557		0.870				0.998		1.253		3.415
	M	11.65	1.0772		0.892				1.029		1.234		-1.282
	N	22.01			0.948		1.006		1.044		1.193		-3.098

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
^{142}Nd	O	5.07	-0.0156		12.891		1.674		-0.480		-0.011		
	L	6.39	1.5820		1.530		-2.560		-0.797		-0.011		
	M	8.65			2.507		-4.487		-0.519		-0.004		0.209
^{143}Nd	H	5.92	0.9194		0.911		0.858		0.929		1.247		0.901
	L	14.59	0.9473		0.905		0.931		0.919		0.949		1.560
^{144}Nd	O	6.30	0.6188		0.598		0.786		1.586		-2.903		
	L	8.15	0.9927		0.662		0.973		0.746		-0.101		
	M	11.52			0.797		0.862		1.110		0.088		0.438
^{145}Nd	S	4.85	0.8778		0.752		0.959		0.854		0.943		0.768
	K	9.11	0.9022		0.836		0.865		0.900		0.911		1.252
	O	10.89			0.858		0.882		0.917		0.980		1.505
^{146}Nd	K	8.53	0.6173		0.876		0.846		2.122		-0.120		
	L	13.13	1.0268		0.874		1.039		1.522		-0.103		0.574
^{148}Nd	T	5.64	0.8179		1.098		0.974		0.691		0.660		
	K	7.80	0.9002		0.694		0.876		1.033		3.493		
	L	12.61			0.829		0.783		0.926		0.904		1.498
^{150}Nd	S	5.52	0.7171		0.659		0.861		0.352		0.451		
	T	9.28	0.8675		0.892		0.991		1.064		1.328		-0.343
	K	11.50			0.916		0.818		0.711		2.126		-0.975
	O	13.97			0.749		0.854		0.778		1.673		0.243
^{147}Pm	T	4.85	0.9161		0.935		0.906		0.909		0.927		0.929
	K	6.33	0.9143		0.943		0.945		0.900		0.897		0.862
	O	8.21			0.929		0.919		0.877		0.886		
1-^{147}Sm	Gh = 26.4	4.94	0.9239	0.878	0.893			0.955	0.974	1.031	1.053		
	Fh = 25.3	6.85	0.9405	0.903	0.920			0.918	0.938	0.922	0.942		
	Eh = 30.0	9.39		0.879	0.896			0.882	0.902	0.991	1.014		
	H	4.42		0.912	0.926	0.933	0.949	0.945	0.963	0.965	0.985		
	T	5.33		0.933	0.948	0.913	0.928	0.911	0.929	0.974	0.995		
	K	6.71		0.911	0.925	0.926	0.942	0.899	0.916	0.899	0.883		

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
2-^{147}Sm	S	4.51	0.9184		0.972		1.015		0.900		0.766		1.074
	T	8.14	0.9124		0.959		0.948		0.919		0.877		0.874
	O	13.63			0.932		0.916		0.910		0.881		0.848
^{148}Sm	S	6.46	0.9104	0.833	0.847	0.825	0.841	0.727	0.743	1.004	1.027	-11.106	-11.338
	H	9.12	0.9340	0.891	0.905	0.966	0.985	0.972	0.992	1.027	1.050	1.027	1.818
	T	9.71		0.981	1.000	0.840	0.856	1.139	1.163	1.022	1.045	0.884	0.902
^{149}Sm	P	5.39	0.8900	0.876	0.889	0.872	0.886	0.847	0.864	0.807	0.824	0.784	0.800
	S	7.32	0.8870	0.863	0.878	0.863	0.878	0.864	0.881	0.866	0.884	0.901	0.920
	H	9.27		0.873	0.885	0.878	0.892	0.868	0.884	0.870	0.888	0.828	0.845
	K	13.91		0.886	0.908	0.890	0.911	0.876	0.896	0.870	0.891	0.829	0.847
^{150}Sm	S	3.00	0.8141	0.943	0.928	0.830	0.798	0.771	0.728	1.227	1.121		
	H	4.23	0.8337	0.919	0.906	0.824	0.791	0.830	0.782	0.871	0.793		
	T	4.14		0.915	0.901	0.939	0.901	0.851	0.802	0.915	0.833	1.073	0.941
	K	5.93		0.848	0.835	0.829	0.793	0.796	0.747	0.900	0.817	1.000	0.875
	O	7.06		0.899	0.886	0.843	0.806	0.822	0.771	0.812	0.736	0.961	0.840
^{151}Sm	Gh = 29.0	7.01	0.9465	0.920	0.941	0.888	0.905	0.937	0.954	0.928	0.941		
	Fh = 18.0	9.22	0.9443	0.889	0.920	0.887	0.909	0.909	0.930	0.976	0.992		
	Eh = 30.0	11.83		0.947	0.978	0.943	0.967	0.922	0.943	0.961	0.977		
	S	4.90		0.965	0.983	0.942	0.958	0.960	0.976	0.926	0.938	0.677	0.679
	T	6.54		0.959	0.979	0.928	0.945	0.958	0.975	0.848	0.860	1.074	1.076
	O	11.30		0.936	0.962	0.926	0.947	0.904	0.923	0.884	0.897	0.888	0.890
^{152}Sm	P	4.19	0.8556	0.860	0.874	0.775	0.787	0.709	0.720	0.590	0.598	1.006	1.011
	S	6.14	0.8730	0.895	0.906	0.823	0.834	0.737	0.748	0.859	0.870	0.765	0.769
	T	9.09		0.905	0.931	0.857	0.874	0.794	0.807	0.845	0.856	1.350	1.356
	K	12.90		0.865	0.886	0.855	0.870	0.803	0.815	0.839	0.849	1.161	1.165
^{154}Sm	H	8.47	0.8695	0.782	0.819	0.841	0.896	1.236	1.337	0.943	1.050	0.372	0.445
	T	8.80	0.9075	0.840	0.879	0.822	0.876	0.741	0.802	0.734	0.818	0.506	0.607
	K	10.92		0.892	0.930					1.174	1.311		
Eu	H	4.83	0.8604		0.882		0.874		0.860		0.842		0.754
	K	6.94	0.8583		0.884		0.882		0.861		0.843		0.803
	L	9.72			0.876		0.869		0.855		0.830		0.789

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
^{153}Eu	H	3.67	0.9482		0.959		0.981		0.959		0.899		0.844
	K	6.20	0.9447		0.951		0.964		0.942		0.918		0.917
^{156}Gd	P	3.79	1.0321		1.227		1.470		1.184		0.804		
	P	4.04	1.0345		1.278		1.085		1.271		0.758		0.926
^{157}Gd	P	4.38	0.8485		0.850		0.900		0.886		0.713		0.000
	P	4.84	0.8519		0.848		0.846		0.835		0.827		0.948
^{159}Tb	Ph = 0.025	0.35	1.0599		1.071		1.034		1.074		1.038		1.081
	Ph = 0.05	0.70	1.0602		1.044		1.062		1.057		1.041		1.021
	Ph = 0.075	1.05			1.043		1.074		1.059		1.097		1.192
	Ph = 0.1	1.40			1.032		1.065		1.069		1.093		
	Ph = 0.125	1.75			1.027		1.061		1.055		1.093		1.145
Hf	H	8.51											
	K	13.89											
	L	27.25											
W	Ph = 0.06	2.17											
	Ph = 0.12	4.33											
1-Pb	O	44.35											
	M	55.63											
	Dh = 28.0	72.98											
2-Pb	Ph = 3.84	73.05											
	Ph = 4.2	78.05											
	Ph = 5.0	90.80											
	Ph = 8.8	140.30											
	Ph = 17.5	215.50											
3-Pb	Ah = 1.5	10.38											
	L	27.86											
	Ch = 6.02	28.28											
	Ch = 6.12	28.63											

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
1-^{235}U	Ph = 0.14	4.93											
	Ph = 0.28	9.73											
	Ph = 0.42	14.35											
	Ph = 0.56	18.88											
2-^{235}U	Ph = 0.6	3.34											
	Ph = 1.2	6.02											
	Ph = 1.8	9.48											
	Ph = 3.6	17.78											
	Ph = 4.8	23.14											
	Ph = 6.0	26.65											
^{236}U	Ah = 1*.5	3.67											
	Ah = 2*.5	7.14											
	Ah = 3*.5	10.42											
	Ah = 4*.5	13.53											
1-^{238}U	Ph = 0.1	0.64											
	Ph = 0.2	1.28											
	Ph = 0.3	1.90											
	Ph = 0.4	2.52											
	Ph = 0.6	3.76											
	Ph = 0.8	4.91											
	Ph = 1.2	7.29											
2-^{238}U	Ph = 0.14	5.15											
	Ph = 0.28	10.23											
	Ph = 0.42	15.27											
^{239}Pu	DC	2.57		0.957		0.919		0.921		0.943			
	DC	8.28		0.922		0.960		0.900		0.858			
	DC	12.00		0.973		0.959		0.921		0.887			
	DC	16.56		0.933		0.954		0.895		0.869			
	O	2.74		1.018				1.084		1.009		0.972	
	O	7.71		1.053				0.992		0.973		0.923	
	O	11.94		1.024				1.024		0.998			
	O	13.87		1.016				1.009		0.983		0.951	

Table A.3. (C/E)r comparison between recent analysis and previous results (*cont.*)

ID & main isotope	Packing code	10*l*d (g/cm^2)	Av((C/E)r) Av((C/E)r)sc	STEK-4000		STEK-3000		STEK-2000		STEK-1000		STEK-500	
				(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r	(C/E)o	(C/E)r
1-^{240}Pu	D	0.99		2.818		0.352		1.479		1.005			
	D	2.50		3.029		0.838		1.236		1.127			
	D	5.01		-1.922		0.761		0.854		0.799			
	O	0.81		0.953				1.688		2.229			
	O	2.45		0.574				1.226		1.082			
	O	5.35		-1.080				1.148		1.133			
2-^{240}Pu	D	0.59											
	O	0.54											
O	Al_2O_3												
	Fe_2O_3												
	PbO												
	H_2O												
H	H_2O												
H_2O													
B	Natural B												