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GENERAL ATOMIC

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STAT, GAPS, STRAIN, DRWDIM
A SYSTEM OF COMPUTER CODES FOR
ANALYZING HTGR FUEL TEST ELEMENT
METROLOGY DATA
USER's MANUAL

by
J. J. SAURWEIN

MASTER

Prepared under
Contract EY-76-C-03-0167
Project Agreement No. 17
for the San Francisco Operations Office
U.S. Energy Research and Development Administration

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ABSTRACT

A system of computer codes has been developed to statistically reduce Peach Bottom fuel test element metrology data and to compare the material strains and fuel rod - fuel hole gaps computed from these data with HTGR design code predictions. The codes included in this system are STAT, STRAIN, GAPS, and DRWDIM. The function of each is summarized below.

STAT - Statistically evaluates test element metrology data yielding fuel rod, fuel body, and sleeve irradiation-induced strains; fuel rod anisotropy; and additional data characterizing each analyzed fuel element.

STRAIN - Compares test element fuel rod and fuel body irradiation-induced strains computed from metrology data with the corresponding design code predictions.

GAPS - Compares test element fuel rod - fuel hole heat transfer gaps computed from metrology data with the corresponding design code predictions.

DRWDIM - Plots the measured and predicted gaps and strains.

Although specifically developed to expedite the analysis of Peach Bottom fuel test elements, this system can be applied, without extensive modification, to the analysis of Fort St. Vrain or other HTGR-type fuel test elements.

This document was prepared in order to provide potential users with the know-how required to make use of each of the codes in this system.

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1. INTRODUCTION

Two of the objectives of the test element program being conducted by General Atomic are to demonstrate the dimensional stability of fuel element components and to confirm the calculational methods for thermal performance and material strain. The Peach Bottom series of the test element program included 33 fuel test elements, 20 of which underwent postirradiation examination (PIE). The structure of a typical Peach Bottom fuel test element is shown in Fig. 1-1. Because of the enormous quantity of metrology data available from the PIE of these 20 elements, it became obvious early in the evaluation stage that data reduction methods which employ the computer had to be developed before this information could be utilized to accomplish the objectives mentioned above. The STAT, STRAIN, GAPS, and DRWDIM computer codes were written to satisfy this need. These codes employ the statistical methods described in Ref. 1* to reduce fuel test element metrology data and to compare material strains and fuel rod - fuel hole heat transfer gaps computed from this information with predictions obtained using the TREVER (Ref. 2) computer code. The flow of information through these codes is illustrated in Fig. 1-2. Each code has been validated through comparison of sample problem results with the corresponding results obtained from hand calculations.

*The following difference between the algorithm described for the combined random error in Ref. 1 and the algorithm used in these codes should be noted. In Ref. 1, the precision of the measurement is defined as the lower limit for the sample random error and is accounted for in the combined random error equation by the term for the sample random error. In the computer codes, both a precision term and a sample random error term are included in the combined random error equations. Therefore, by definition, both algorithms agree at the lower limit. When the sample random error term is large, the precision term becomes insignificant in the computer code algorithm.

Fig. 1-1. Fuel test element assembly

Fig. 1-2. Flow of information through data reduction system

This system of codes provides the means to organize and permanently store metrology data and to document the results for each analyzed test element. STAT creates data files containing the metrology data for each test element which, when transferred to magnetic tapes, provide a permanent record of all available fuel test element metrology data. The output from these codes is in the form of tables and figures which, along with other test element information, are included in a data package to be assembled for each analyzed test element.

2. STAT

In March 1976, the Fuel Test Element Activity (FTEA), realizing the need for a computer program to statistically reduce Peach Bottom fuel test element metrology data, arranged for the Computer Services Department (CSD) to write STAT, a code designed to perform this task. STAT, completed in May, was written by R. F. Korts (Ref. 3) to specifications supplied by J. J. Saurwein of FTEA. This code has since undergone numerous modifications to maintain consistency with the statistical methods employed by FTEA and to optimize it with regard to the needs of Peach Bottom test element metrology data reduction. CSD custodial responsibility for STAT is currently assigned to J. E. Gratteau. Input instructions and a sample problem are given in Appendix A and Appendix B, respectively.

2.1 CALCULATIONS

The calculations performed by STAT are as follows:

Group I: Total element length and fuel body weight calculations

Total element length calculations

Fuel body weight calculations

Group II: Fuel rod calculations

Individual fuel rod calculations

Fuel stack average fuel rod calculations

Arbitrarily defined stratum average fuel rod calculations

Element average fuel rod calculations

Group III: Fuel body calculations

Calculations based on fuel body diameter measurements at
given locations along the fuel bodies

Fuel body length and average diameter calculations

Element average fuel body calculations

Group IV: Fuel hole diameter calculations

Calculations based on fuel hole diameter measurements at
given locations along the element

Group V: Sleeve calculations

Calculations based on outer sleeve diameter measurements
at given locations along the sleeve

Element average sleeve O.D. calculations

Calculations based on inner sleeve diameter measurements at
given locations along the sleeve

Element average sleeve I.D. calculations

Group VI: Fuel stack calculations

Fuel stack length calculations

Fuel body average fuel stack length calculations

Element average fuel stack length calculations

Arbitrarily defined stratum average fuel stack length
calculations

Whether or not the calculations in each of these six groups will be performed during a given STAT run is optional. After checking the options specified via input, STAT will either bypass or execute each group of calculations. With the exception of VI, which requires fuel body length information computed in III, the calculations in each group are completely independent of one another.

A feeling for the scope of the calculations performed by STAT and the type of information provided by them can be obtained from the results of the sample problem given in Appendix B. It is suggested that the reader use this sample problem as an illustration of the text.

A summary of the basic calculations performed by STAT is given in Table 2-1. The equations given in this table are used for all STAT calculations except those which determine stratum average dimensions and sample random errors. A stratum consists of two or more entities having similar properties which can logically be grouped together, such as fuel rods from the same fuel stack, fuel body diameter measurement locations within the

TABLE 2-1
BASIC CALCULATIONS PERFORMED BY STAT

Error	Symbol	Measurements		Analysis Function			
		Preirradiation x_1	Postirradiation x_2	Difference $x_{21} = x_2 - x_1$	Relative Change (Strain) $u = \frac{x_2}{x_1} - 1$	Average (Radial Plus Axial Strain) $v = \frac{1}{2} \left(\frac{x_2}{x_1} + \frac{y_2}{y_1} - 2 \right)$	Anisotropy (Axial Versus Radial Strain) $w = \left(\frac{y_2}{y_1} - 1 \right) \left(\frac{x_2}{x_1} - 1 \right)^{-1}$
Measuring system							
Precision	e	From Table 2-3		$e_{21} = e_1 + e_2$	$e_u = e_x = \frac{1}{\bar{x}_1} \left(e_1 \frac{\bar{x}_2}{\bar{x}_1} + e_2 \right)$	$e_v = \frac{1}{2} (e_x + e_y)$	$e_w = (e_y + e_x \bar{w}) \left(\frac{\bar{x}_2}{\bar{x}_1} - 1 \right)^{-1}$
Random error	r	From Table 2-3		$r_{21} = \left(r_1^2 + r_2^2 \right)^{\frac{1}{2}}$	$r_u = r_x = \frac{1}{\bar{x}_1} \left[r_1^2 \left(\frac{\bar{x}_2}{\bar{x}_1} \right)^2 + r_2^2 \right]^{\frac{1}{2}}$	$r_v = \frac{1}{2} \left(r_x^2 + r_y^2 \right)^{\frac{1}{2}}$	$r_w = \left(r_y^2 + r_x^2 \bar{w}^2 \right)^{\frac{1}{2}} \left(\frac{\bar{x}_2}{\bar{x}_1} - 1 \right)^{-1}$
Sample							
Number of measurements	n	n_1	n_2	$n_1; n_2$	$n_1; n_2$	$n_{x_1}; n_{x_2}; n_{y_1}; n_{y_2}$	$n_{x_1}; n_{x_2}; n_{y_1}; n_{y_2}$
Sample mean	$\bar{x}, \bar{u}, \bar{v}, \bar{w}$	$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$		$\bar{x}_{21} = \bar{x}_2 - \bar{x}_1$	$u = \frac{\bar{x}_2}{\bar{x}_1} - 1$	$\bar{v} = \frac{1}{2} \left(\frac{\bar{x}_2}{\bar{x}_1} + \frac{\bar{y}_2}{\bar{y}_1} - 2 \right)$	$\bar{w} = \left(\frac{\bar{y}_2}{\bar{y}_1} - 1 \right) \left(\frac{\bar{x}_2}{\bar{x}_1} - 1 \right)^{-1}$
Random error	s_j	$s_j = \left[\frac{1}{n_j - 1} \left(\sum_{i=1}^{n_j} (x_{ji}^2) - n_j \bar{x}_j^2 \right) \right]^{\frac{1}{2}}$		$s_{21} = \left(s_1^2 + s_2^2 \right)^{\frac{1}{2}}$	$s_u = s_x = \frac{1}{\bar{x}_1} \left[s_1^2 \left(\frac{\bar{x}_2}{\bar{x}_1} \right)^2 + s_2^2 \right]^{\frac{1}{2}}$	$s_v = \frac{1}{2} \left(s_x^2 + s_y^2 \right)^{\frac{1}{2}}$	$s_w = \left(s_y^2 + s_x^2 \bar{w}^2 \right)^{\frac{1}{2}} \left(\frac{\bar{x}_2}{\bar{x}_1} - 1 \right)^{-1}$
Combined random error	ϵ_j	$\epsilon_j = \left[\frac{e_j^2}{12n_j} + \frac{s_j^2}{n_j} + r_j^2 \right]^{\frac{1}{2}}$		$\epsilon_{21} = \left(\epsilon_1^2 + \epsilon_2^2 \right)^{\frac{1}{2}}$	$\epsilon_u = \epsilon_x = \frac{1}{\bar{x}_1} \left[\epsilon_1^2 \left(\frac{\bar{x}_2}{\bar{x}_1} \right)^2 + \epsilon_2^2 \right]^{\frac{1}{2}}$	$\epsilon_v = \frac{1}{2} \left(\epsilon_x^2 + \epsilon_y^2 \right)^{\frac{1}{2}}$	$\epsilon_w = \left(\epsilon_y^2 + \epsilon_x^2 \bar{w}^2 \right)^{\frac{1}{2}} \left(\frac{\bar{x}_2}{\bar{x}_1} - 1 \right)^{-1}$
Total error (2σ)	d	$d_{x_1} = 1.96\epsilon_1$	$d_{x_2} = 1.96\epsilon_2$	$d_{x_{21}} = 1.96\epsilon_{21}$	$d_u = 1.96\epsilon_u$	$d_v = 1.96\epsilon_v$	$d_w = 1.96\epsilon_w$
Accuracy	α	$\alpha_1 = (e_1 + 2r_1)$	$\alpha_2 = (e_2 + 2r_2)$	$\alpha_{21} = (e_{21} + 2r_{21})$ or $\alpha_{21} = \alpha_1 + \alpha_2$	$\alpha_u = \alpha_x = \left(e_x + 2r_x \right)$ or $\alpha_u = \alpha_x = \frac{1}{\bar{x}_1} \left(\alpha_1 \frac{\bar{x}_2}{\bar{x}_1} + \alpha_2 \right)$	$\alpha_v = (e_v + 2r_v)$ or $\alpha_v = \frac{1}{2} (\alpha_x + \alpha_y)$	$\alpha_w = (e_w + 2r_w)$ or $\alpha_w = (\alpha_y + \alpha_x \bar{w}) \left(\frac{\bar{x}_2}{\bar{x}_1} - 1 \right)^{-1}$

same fuel body, all the fuel stacks in a fuel element, etc. The equations for these calculations are given in Table 2-2. As can be seen, there are two different equations for calculating stratum average sample random errors. Equation 2a is the more correct statistical statement and is used whenever the number of measurements associated with each sample random error being stratified is equal to or greater than two. If the number of measurements associated with any of the sample random errors being stratified is equal to one, Eq. 2b is used.

The information required before a given set of calculations can be performed by STAT includes sample measurements (i.e., preirradiation and postirradiation lengths and diameters) and the errors associated with these measurements. Errors associated with the Peach Bottom fuel test element metrology are tabulated in Table 2-3. The sample random errors listed in this table are "default" values which STAT assigns to a given sample if there are insufficient measurements (less than two) to allow the code to calculate a true sample random error. With the exception of the preirradiation sleeve diameter errors, which were obtained from measurements on an archive sample (Ref. 4), all sample random errors given in Table 2-3 were calculated from test element metrology data.

"Default" sample random errors for all fuel rod dimensions and for the fuel body diameter are calculated by STAT using Eq. 3 of Table 2-2. Errors for the remaining test element parameters are calculated by hand from STAT code results using the same equation. The errors associated with the metrology of each analyzed Peach Bottom fuel test element are compiled in tables (one per element) and a summary table giving the errors associated with the collective metrology of all analyzed elements is maintained. This summary table provides the errors which are used for the analysis of each test element. Upon completion of the analysis of an element, the table is updated to incorporate the new information. The default sample random errors contained in the summary table are calculated from the default errors for the individual test elements using the equation

TABLE 2-2
EQUATIONS USED FOR STRATIFICATION

Key to Symbols

- m number of substrata in stratum
- $\bar{x}_j$ sample mean for substratum j
- n_j number of measurements for substratum j
- $\bar{x}$ grand mean for stratum
- $(s_x)_j$ sample random error of all measurements for substratum j
- s_x sample random error of all measurements for stratum
- $\bar{s}_x$ average $(s_x)_j$ for all substrata in stratum
- e precision of measurement
- r equipment random error associated with measurement
- ϵ_x combined random error on stratum grand mean

1. Stratum Grand Mean

$$\bar{x} = \frac{1}{\sum_{j=1}^m n_j} \sum_{j=1}^m n_j \bar{x}_j$$

2. Sample Random Error of all Measurements for Stratum

- a. If all $n_j > 1$

$$s_x = \left\{ \frac{1}{\left(\sum_{j=1}^m n_j \right) - 1} \left[\sum_{j=1}^m (n_j - 1) (s_x)_j^2 + \sum_{j=1}^m n_j (\bar{x}_j - \bar{x})^2 \right] \right\}^{1/2}$$

- b. If any $n_j = 1$

$$s_x = \left\{ \frac{1}{m} \left[\sum_{j=1}^m (s_x)_j^2 + \sum_{j=1}^m (\bar{x}_j - \bar{x})^2 \right] \right\}^{1/2}$$

TABLE 2-2 Cont.

3. Average $(s_x)_j$ for all Substrata in Stratum

$$\bar{s}_x = \left[\frac{\sum_{j=1}^m (s_x)_j^2}{m} \right]^{\frac{1}{2}}$$

4. Combined Random Error on Grand Mean

$$\epsilon_{\bar{x}} = \left(\frac{e^2}{12 \sum_{j=1}^m n_j} + \frac{s_x^2}{\sum_{j=1}^m n_j} + r^2 \right)^{\frac{1}{2}}$$

TABLE 2-3
 ERRORS ASSOCIATED WITH PEACH BOTTOM FUEL TEST ELEMENT METROLOGY

	Symbol	Fuel Rod Diameter (in.)	Fuel Rod Length (in.)	Fuel Hole Diameter (in.)	Fuel Body O. D. (in.)	Fuel Body Length (in.)	Sleeve I.D. (in.)	Sleeve O.D. (in.)	Fuel Stack Length (in.)	Plenum Length (in.)	Element Length (in.)	Fuel Body Weight
Preirradiation nominal value	x_1, y_1, g_1	(a)	(a)	(a)	(a)	(a)	2.7522 ^(b)	3.4868 ^(b)	(a)	(a)	144.0	(a)
Precision	Pre: e_1	± 0.0001	± 0.0001	± 0.0002	± 0.0003	± 0.0006	± 0.0002	± 0.0002	± 0.006	± 0.0003	± 0.01125	—
	Post: e_2	± 0.0001	± 0.0001	± 0.0002	± 0.0003	± 0.0006	± 0.0003	± 0.0003	± 0.0006	± 0.0003	± 0.01125	—
Equipment random error	Pre: r_1	± 0.0006	± 0.0001	± 0.00015	± 0.00035	± 0.002	± 0.00015	± 0.00015	± 0.007	± 0.00035	± 0.01	—
	Post: r_2	± 0.0001	± 0.0001	± 0.00015	± 0.00035	± 0.002	± 0.00015	± 0.00035	± 0.002	± 0.00035	± 0.01	—
Accuracy	Pre: α_1	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	1.0
	Post: α_2	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	1.0
Sample random error on measurement (1σ)	Pre: s_{x1}	$\pm 0.0007^{(d)}$	$\pm 0.0019^{(e)}$	± 0.0001	0.0	$\pm 0.0071^{(e)}$	$\pm 0.0008^{(b)}$	$\pm 0.0007^{(b)}$	(c)	(c)	(c)	(c)
	Post: s_{x2}	$\pm 0.0015^{(d)}$	$\pm 0.0019^{(f)}$	± 0.0004	± 0.0013	$\pm 0.0071^{(d)}$	$\pm 0.0005^{(f)}$	$\pm 0.0006^{(f)}$	(c)	(c)	(c)	(c)

(a) Check appropriate drawing.

(b) Determine from measurements on archive sample.

(c) Not required by STAT.

(d) Based on FTE-3, -4, and -6 metrology data.

(e) Postirradiation information used in absence of preirradiation data.

(f) Based on FTE-4 metrology data.

$$\bar{\bar{S}}_u = \left[\frac{1}{\sum_{j=1}^m n_j} \sum_{j=1}^m n_j (\bar{S}_u)_j^2 \right]^{1/2}$$

where m = total number of test elements,
 n = number of S_u on which $(\bar{S}_u)_j$ is based,
 $(\bar{S}_u)_j$ = default sample random error for fuel test element j .

Table 2-3 contains the errors associated with the collective metrology of FTEs 3, 4, and 6 which constitute the test elements analyzed to date.

Comments which should help explain the calculations performed by the code are given below.

2.1.1. Total Element Length and Fuel Body Weight Calculations (Group I)

These calculations, being very elementary and straightforward, do not require comment.

2.1.2. Fuel Rod Calculations (Group II)

Individual fuel rod calculations will be performed only for fuel rods having postirradiation diameter measurements.

If a fuel rod has postirradiation diameter but no postirradiation length measurements, all calculations requiring length information will be omitted. When stratifying such a rod with other rods within a stratum, the rod will only be included in diameter-related stratification calculations.

The strata in group II are individual fuel stacks, arbitrarily defined groups of fuel stacks, and the entire test element (all fuel stacks).

Stratum average calculations will be performed only for strata which include at least one fuel rod having postirradiation diameter measurements.

A stratum containing all fuel rods having postirradiation diameter but no postirradiation length measurements will be treated in the same manner as a fuel rod having only diameter data (see comment above on fuel rods with no length measurements).

Equation 2a of Table 2-2 is always used when stratifying fuel stack average fuel rod sample random errors. The loss of fuel stack average sample random error information, should the number of measurements associated with a stack average sample random error be equal to 1 (which is very unlikely), is avoided by setting the value for this number of measurements equal to 2. Although somewhat arbitrary, this should guarantee that each fuel stack receives nearly the proper weighting.

2.1.3. Fuel Body Calculations (Group III)

When no preirradiation fuel body diameter data are available at axial locations at which postirradiation diameter measurements were taken, STAT scans the available data and assigns the preirradiation diameter at the nearest axial location (within the same fuel body) to the location being considered. If no preirradiation diameter data are input for a fuel body having postirradiation diameter measurements, STAT will terminate execution by calling the MERR subroutine. If no postirradiation fuel body diameter measurements are available, none of the calculations in this group will be performed.

When performing calculations at fuel body diameter measurement locations or stratifying these locations to obtain average fuel body diameter information, only axial locations at which postirradiation diameter measurements were taken will be considered.

If a fuel body has postirradiation diameter but no postirradiation length measurements, all calculations requiring length information will be omitted. When stratifying such a fuel body with other fuel bodies in a test element, the body will be included only in the diameter-related stratification calculations.

A fuel body having no postirradiation diameter data will not be included in any stratification calculations.

As an exception to the general rule concerning the use of Eq. 2b of Table 2-2, Eq. 2a of Table 2-2 is always used when stratifying fuel body average fuel body diameter sample random errors. If the number of measurements associated with a sample random error being stratified is equal to 1, it is arbitrarily set to 2. The criteria described in Section 2.1 concerning the use of Eq. 2a or Eq. 2b of Table 2-2 in stratifying sample random errors are used to determine which equation to use in stratifying fuel body lengths.

If there are no postirradiation length measurements available for any fuel bodies within an element, all total element average fuel body calculations requiring fuel body length information will be omitted.

2.1.4. Fuel Hole Diameter Calculations (Group IV)

Only calculations at individual measurement locations are performed in this group. No stratification calculations are included.

Calculations at a given measurement location are performed only if both preirradiation and postirradiation fuel hole diameter information has been supplied for that location.

2.1.5. Sleeve Calculations (Group V)

The calculations based on the sleeve I.D. and the sleeve O.D. are identical. They are also completely independent so that sleeve I.D. calculations can be performed even if there is no sleeve O.D. information and vice versa.

When performing calculations at sleeve diameter measurement locations or stratifying these locations to obtain test element average sleeve diameter

information, only the locations at which postirradiation diameter measurements were taken will be considered. If no postirradiation diameter measurements were taken, no calculations will be performed.

2.1.6 Fuel Stack Calculations (Group VI)

Although the individual fuel stack calculations are quite elementary, they can be very confusing with respect to what data should be used as input. The potential for confusion is a result of the different ways in which the fuel stack length can be obtained. There are three possible methods: (1) summing up the lengths of the component fuel rods, (2) measuring the total length of the component rods when laid end to end, and (3) measuring the fuel hole depth and subtracting the fuel hole plenum and compact pusher lengths. If method 1 is used, the result is an "accumulated" stack length. Method 2 yields a "composite" stack length, and an "indirect composite" stack length is provided by method 3. The preferred input for these calculations is composite or indirect composite preirradiation stack lengths and accumulated postirradiation stack lengths. Inputting accumulated preirradiation and composite postirradiation stack lengths is also acceptable.

Calculations for individual fuel stacks are performed if a preirradiation stack length and postirradiation fuel hole plenum length are provided. Otherwise the fuel stack will be skipped. These data enable STAT to perform the indirect fuel stack length calculations (assuming that fuel body length data are available and the group III calculations were executed). If no postirradiation stack length is available, the stack will still be considered but the direct stack length calculations will not be performed. When stratifying these fuel stacks to obtain stratum average fuel stack lengths and associated errors, each fuel stack will be considered only when stratifying parameters which are available for that stack.

The first N strata for which stratum average fuel stack calculations are performed are the N fuel bodies of the fuel test element. These N strata are then stratified to obtain total element average fuel stack information. If there are no fuel stack data for a given fuel body, it will not be included in these stratification calculations.

2.2 STRUCTURE

The STAT program logic consists of a rather simple main program called MAIN which invokes a series of subroutines, the first of which reads and validates the input and the remainder of which perform the calculations and print the results. A listing of these subroutines and their functions is given below.

<u>Subroutine</u>	<u>Function</u>
AERF	Computes combined random errors (ϵ_j as defined in Table 2-1).
AMEAN	Computes sample means (X as defined in Table 2-1).
BASIC	Computes stratum average fuel and fuel hole plenum lengths and the associated errors for group VI strata.
BDYSAV	Saves fuel body statistical data calculated in group III for use in group VI calculations.
DIFANL	Computes the "analysis functions" and errors given in Table 2-1.
G2STAT	Collects and stratifies fuel body length statistics for use in group VI stratum average calculations.
INPUT	Reads and validates input and creates a data file.
LODSTK	Stores fuel stack average fuel rod data into printing arrays.
LSTAT	Computes total element average fuel stack and fuel hole plenum lengths and the associated errors.

<u>Subroutine</u>	<u>Function</u>
PARCOM	PDP element defining parameters used to set array sizes and common blocks T4DATA and GENERL.
PRINT8	Does elementary group VI fuel stack length calculations and prints all group VI results.
SLVSTR	Performs all group V calculations.
STDEV	Computes sample random errors (S_j as defined in Table 2-1).
STRAT	Combines fuel rods into strata and initiates stratum average fuel rod calculations and printing of results.
STRAT8	Combines fuel stacks into strata and initiates group VI stratum average fuel stack calculations and printing of results.
SUMS	Stratifies individual fuel rods to obtain fuel stack average fuel rod information.
SVSTCK	Saves fuel stack average fuel rod statistical data.
TABLE4	Prepares and computes (via subroutines) individual fuel rod and stack average fuel rod data.
TABLE5	Prepares and computes (via subroutines) fuel body data at individual measurement locations and average fuel body data.
TABLE6	Assembles average fuel body data and computes (via subroutine) and prints element average fuel body data.
TAB5A	Performs (via subroutine) all group IV calculations.
TB4PRT	Prints all group II results.
TB5PRT	Prints all group III (excluding element average fuel body results) and group IV results.
TB7PRT	Prints all group V results.
TEDATA	Performs group I calculations and prints results.
TELEMT	Assembles fuel stack average fuel rod data and performs (via subroutines) element average fuel rod calculations.

<u>Subroutine</u>	<u>Function</u>
TSTRAT	Employs the equations of Table 2-2 to calculate stratum average dimensions and sample random errors. Performs all stratification calculations except for those performed in SUMS and LSTAT.
T8CALC	Performs (via subroutines and internal equations) all group VI stratum average calculations.

2.3 PROGRAM LIMITS

As currently dimensioned, STAT requires approximately 60K words of memory. The dimensions of the arrays used in the program are specified by various parameters defined in the PDP element, PARCOM. These parameters and their specified values are listed below.

<u>Parameter</u>	<u>Description</u>	<u>Value</u>
MFB	Maximum number of fuel bodies	6
MFH	Maximum number of fuel stacks per fuel body	8
MFR	Maximum number of fuel rods per fuel stack	14
MCH	Maximum number of axial measurement locations per fuel body	25
MS	Maximum number of strata which can be specified for group I or group VI calculations	20
MMS	Maximum number of substrata per stratum	12
MMP	Maximum number of measurements for a given parameter at a given measurement location	6

In order to change one of these parameters, the parameter statement in PARCOM must be changed. If this is done, all subroutines which include PARCOM must be recompiled and the program must be remapped. Three

subroutines, STRATS, SUMS, and TELEMT, do not include PARCOM but contain parameter statements specifying these parameters. These statements must also be changed. Since the memory required by STAT is already near the 65K limit, the effect of any parameter change should be estimated before revising the code in order to avoid exceeding this limit.

2.4 INPUT

Before STAT can be run, all available metrology data for the test element to be analyzed must be put on computer cards. Instructions for assembling this card deck are given in Appendix A. The first time STAT is run for a given element, a catalogued file, which will serve as the input for subsequent STAT runs, is created from the data deck. This catalogued file will then be copied onto a magnetic tape (see Section 2.6) which will provide a permanent record of the data.

The user must examine the metrology data for the test element being analyzed to ascertain whether the data required by each of the six groups of STAT calculations are available (see Sections 2.1.1 and 2.1.6). If not, STAT must be instructed via the option card in the input data deck to bypass the calculations for which there are insufficient data. On the other hand, if the available metrology data exceed any of the STAT code limits (Section 2.3), these limits must be adjusted, if possible, in order for all the data to be processed. Otherwise STAT will load all the excessive data into the last available space in the involved arrays such that all excessive data except the last set are lost. When this is done, the code prints an error message indicating which limit has been exceeded and the numbers of the cards on which the excessive data were given. This procedure has proven to be a valuable means of identifying certain keypunch errors in the data deck as well as a check on the quantity of data being supplied. It should be noted, however, that the code will not detect all keypunch errors in the data deck, so it is important that users validate their input.

Whenever postirradiation data are supplied to the code, the STAT calculations will assume that preirradiation data are also available. Therefore, preirradiation data must be supplied whenever postirradiation data are available. If no preirradiation measurements were made, the nominal value for the parameter must be assigned and assumed to be one measurement.

In the INPUT subroutine, STAT adds 0.003 in. to each preirradiation fuel rod diameter if instructed to do so via input. This is done to account for the statistically determined discrepancy between measurements made with an air gauge and with a micrometer (see Ref. 5). Since preirradiation fuel rod diameters were generally measured with an air gauge and postirradiation fuel rod diameters were always measured with a micrometer, this correction is necessary if valid fuel rod radial strains are to be obtained. It is up to the user to ascertain the measuring technique used to obtain preirradiation fuel rod diameters for each test element and to specify whether or not this correction should be made.

The errors associated with Peach Bottom fuel test element metrology required by STAT (Table 2-3) are defined within the program by DATA or equivalence statements. The subroutines including these statements are listed below.

<u>Parameter</u>	<u>Errors</u>	<u>Subroutine</u>
Fuel rod length and diameter	All	TABLE4
Fuel body diameter	Sample random error	TABLE5
Fuel body diameter	Precision and equipment random error	MAIN & G2STAT
Fuel body length	All	TABLE5
Fuel hole diameter	All	TAD5A
Sleeve I.D. and O.D.	All	SLVSTR
Fuel element length	Accuracy	TEDATA
Fuel body weight	Accuracy	TEDATA

<u>Parameter</u>	<u>Errors</u>	<u>Subroutine</u>
Fuel stack length	Precision and equipment random error	BASIC
Fuel hole plenum length	Precision and equipment random error	BASIC

2.5 OUTPUT

STAT prints out all results in tables suitable for inclusion in written reports. In addition to these tables, the code provides punched cards containing fuel rod anisotropy and fuel body and sleeve dimensional data, and a catalogued file (unit 11) containing fuel rod dimensional data. The cards and the catalogued file provide information required by STRAIN, GAPS, and the DRWDIM computer codes.

2.6 USAGE CONSIDERATIONS

The source, relocatable, and absolute elements for the STAT code are contained on the first file of tape 5415. The following run streams show three ways of running the program:

1. All input from cards

```

▽Run Card
▽ASG,UP          DATA* (element name)//(write key),F2
▽DATA,IL         DATA* (element name)
    Data Cards
▽END
▽ASGT            X,U,5415
▽COPY,G          X.,TPFS.
▽FREE            X.
▽ASG, options    STRAIN* (element name)
▽USE             11, STRAIN* (element name)
▽XQT             SMAP
    Option Card
▽ADD             DATA* (element name)
▽PMD,REDL

```


2. Input from previously created file

```
▽Run Card
▽ASG,T          X,U,5415
▽COPY,G         X.,TPFS.
▽FREE          X.
▽ASG, options   STRAIN* (element name) or scratch file
▽USE            11, STRAIN* (element name)
▽ASG,AX         DATA* (element name)
▽XQT           SMAP
      Option Card
▽ADD            DATA* (element name).
▽PMD,REDL
```

3. Input from previously created file - changes required

```
▽Run Card
▽ASG,AX         DATA* (element name)
▽ASG,T          DATA1,F2
▽DATA,L         DATA* (element name)., DATA1.
      Change Cards
▽END
▽ASG,T          X,U,5415
▽COPY          X.,TPFS.
▽FREE          X.
▽ASG, options   STRAIN* (element name) or scratch file
▽USE            11, STRAIN* (element name)
▽XQT           SMAP
      Option Card
▽ADD            DATA1.
▽PMD,REDL
```

A minimum of 100 pages, a maximum time of 2 minutes, and a maximum of 400 cards should be sufficient for the majority of STAT runs.

After the catalogued file DATA* (element name) has been created by STAT, it should be put on magnetic tape in order to provide a permanent record of the metrology data. The following technique is suggested:

```
▽ASG,T          X, U, SAVE
▽SAVTAP         X.
      Metrology Data (element name)
▽ASG,AX         DATA* (element name)
▽COPY,GM        DATA* (element name).,X.
```

Since these data files are not very large, several of them can be stacked on one tape. In order to use a tape created in this fashion as the input for a STAT run, the appropriate file on the tape must be copied back into a catalogued or temporary fastrand file using the G option. The file is then added as shown in 1 through 3 above.

3. STRAIN

The STRAIN computer code, written in August 1976, generates and compares fuel body and fuel rod strains based on Peach Bottom fuel test element metrology data with the corresponding predicted strains obtained from the TREVER code (Ref. 2) using the methods outlined in Ref. 1.

3.1. CALCULATIONS

The calculations performed by STRAIN can be divided into two groups. The calculations in the first group are performed in order to compute and compare the following measured strains with the corresponding predicted strains:

1. The fuel body strain at each fuel body diameter measurement location.
2. The average fuel rod strain for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics at each core height corresponding to the center of a layer of fuel rods.

The second group of calculations stratify group I calculation results in order to compute and compare the following measured and predicted strains:

1. The average fuel rod strain in each fuel body for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics.
2. The average fuel rod strain in the entire fuel element for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics.

3. The average fuel body strain for each fuel body.
4. The average fuel body strain for the entire fuel element.

3.1.1. Group I Calculations

The calculations included in this group are summarized in Table 3-1. As can be seen, the fuel rod data obtained from STAT must be stratified in order to obtain the average fuel rod dimensions for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics. The manner in which the fuel rods will be stratified is dictated by the way the fuel stacks were grouped for the TREVER analysis of the test element being considered and is specified via input by assigning a fuel type number to each fuel stack. For each fuel rod layer, the rods in fuel stacks which have been assigned the same fuel type number will be stratified to give average fuel rod dimensional data for that fuel type. For example, if fuel stacks 1 and 2 in fuel body 1 were grouped together for the TREVER analysis, these stacks will be assigned the same fuel type number and the fuel rods in these stacks will be stratified at each fuel rod layer so that measured strains which correspond to the predicted strains calculated by TREVER can be computed.

Because of the way STAT processes fuel rod metrology data (Section 2.1.2), all fuel rods included in the STAT results which serve as input to the STRAIN code have postirradiation diameter information, but not always postirradiation length information. When stratifying fuel rods in order to compute the average preirradiation and postirradiation length information required for axial strain calculations, STRAIN considers only the fuel rods having postirradiation length data. As can be seen in Table 3-1, the measured fuel rod strain which is compared with the corresponding predicted strain is the average of the radial and axial fuel rod strains. However, in cases where an axial fuel rod strain cannot be calculated due to an absence of postirradiation fuel rod length information, the measured strain is assumed to equal the radial strain.

TABLE 3-1
EQUATIONS FOR COMPUTING AND COMPARING FUEL ROD AND FUEL BODY STRAINS

Parameter	Symbol	Fuel Body Diameter ^(a) (in.)	Average Fuel Rod Length and Diameter ^(b) (in.)	Analysis Functions					
				Relative Change (Axial or Radial Strain) (%)	Average Strain ^(c) (Axial and Radial) (%)	Predicted Strain (%)	Relative Difference (%)	Comparison	
								Test 1	Test 2
Mean value	As given	$\bar{x}$	$\bar{x} = \frac{1}{\sum_{j=1}^m n_j} \sum_{j=1}^m n_j x_j$	$u_x = \frac{\bar{x}_2}{\bar{x}_1} - 1$	$v = \frac{1}{2}(u_x + u_y)$	u_t	$z = \frac{u_t}{v} - 1$	$D = z/\epsilon_z$	$D2 = D^2$
Errors									
<u>Measuring system</u>									
Precision	e	From Table 2-3		$e_{u_x} = \frac{1}{\bar{x}_1} \left(\frac{e_1}{\sqrt{n_{x_1}}} \frac{\bar{x}_2}{\bar{x}_1} + \frac{e_2}{\sqrt{n_{x_2}}} \right)$	$e_v = \frac{1}{2} (e_{u_x} + e_{u_y})$	—	$e_z = \frac{1}{v} \left(e_v \frac{u_t}{v} \right)$	—	—
Equipment random error	r	From Table 2-3		$r_{u_x} = \frac{1}{\bar{x}_1} \left[r_1^2 \left(\frac{\bar{x}_2}{\bar{x}_1} \right)^2 + r_2^2 \right]^{\frac{1}{2}}$	$r_v = \frac{1}{2} (r_{u_x}^2 + r_{u_y}^2)^{\frac{1}{2}}$	—	$r_z = \frac{1}{v} \left(r_v \frac{u_t}{v} \right)$	—	—
<u>Sample</u>									
Number of measurements	n	n_x	$n_x = \sum_{j=1}^m n_j$	—	—	—	—	—	—
Random error	s	s_x	$s_x = \left\{ \frac{1}{\sum_{j=1}^m n_j - 1} \left[\sum_{j=1}^m (n_j - 1) s_j^2 + \sum_{j=1}^m n_j (x_j - \bar{x})^2 \right] \right\}^{\frac{1}{2}}$	$s_{u_x} = \frac{1}{\bar{x}_1} \left[\frac{s_1^2}{n_{x_1}} \left(\frac{\bar{x}_2}{\bar{x}_1} \right)^2 + \frac{s_2^2}{n_{x_2}} \right]^{\frac{1}{2}}$	$s_v = \frac{1}{2} (s_{u_x}^2 + s_{u_y}^2)^{\frac{1}{2}}$	—	$s_z = \frac{1}{v} \left(s_v \frac{u_t}{v} \right)$	—	—
<u>Total</u>									
Combined random error (1σ)	ε	$\epsilon_x = \left(\frac{e_x^2}{12n_x} + \frac{s_x^2}{n_x} + r^2 \right)^{\frac{1}{2}}$		$\epsilon_{u_x} = \frac{1}{\bar{x}_1} \left[\epsilon_1^2 \left(\frac{\bar{x}_2}{\bar{x}_1} \right)^2 + \epsilon_2^2 \right]^{\frac{1}{2}}$	$\epsilon_v = \frac{1}{2} (\epsilon_{u_x}^2 + \epsilon_{u_y}^2)^{\frac{1}{2}}$	—	$\epsilon_z = \frac{1}{v} \left(\epsilon_v \frac{u_t}{v} \right)$	—	—
Combined random error (2σ)	d	$d_x = 1.96\epsilon_x$	$d_x = 1.96\epsilon_x$	$d_{u_x} = 1.96\epsilon_{u_x}$	$d_v = 1.96\epsilon_v$	—	$d_z = 1.96\epsilon_z$	—	—

(a) $\bar{x}$, n_x , and s_x are obtained from STAT results.

(b) x_j , n_j , and s_j are obtained from STAT results.

(c) For fuel rods only.

Since the 30 TREVER calculation points do not correspond to the mid-points of the fuel rod layers, STRAIN interpolates the strains obtained from TREVER in order to determine the predicted strains at the locations at which measured strains have been computed. At the present time, the means for determining the errors associated with predicted strains have yet to be developed, so these errors are assumed to be zero. Consequently, the terms representing these errors have not been included in the equations for the errors associated with the analysis function Z (Table 3-1).

The analysis functions D and D2 are statistical tests used to determine the agreement between measured and predicted strains. These tests are discussed in Ref. 1.

3.1.2. Group 2 Calculations

The calculations included in this group are summarized in Table 3-2. These calculations are performed in order to provide statistical information to be used in determining the overall agreement between measured and predicted strains within each fuel body and within the entire test element. The statistical tests employed in making these comparisons are discussed in Ref. 1.

3.2. STRUCTURE

STRAIN consists of a main program, called STRAIN, and a series of short subroutines which perform various calculations. The main program is responsible for reading the input data, performing or calling the subroutines to perform the calculations, and printing the results. The subroutines and their functions are listed below.

<u>Subroutine</u>	<u>Function</u>
AERF	Calculates combined random errors using Eq. 3b of Table 3-2

TABLE 3-2
EQUATIONS FOR FUEL BODY AVERAGE AND TEST ELEMENT
AVERAGE CALCULATIONS

Key to Symbols

m = total number of substrata in stratum

$\bar{a}$ = stratum average value for a given parameter

$\bar{a}_j$ = mean value of a given parameter for substrata j .

See Table 3-1 for explanation of all other symbols

1. Stratum Means

$$\bar{a} = \frac{1}{m} \sum_{j=1}^m a_j \quad (a = v, u_t, z, D, D2)$$

2. Root Mean Squares (rms)

$$rms_a = \left[\frac{1}{m} \sum_{j=1}^m (\bar{a}_j - \bar{a})^2 \right]^{1/2} \quad (a = v, u_t, z)$$

3. Average Errors on Substrata Means

$$a. \quad \bar{\epsilon}_{\bar{a}} = \left[\frac{1}{m} \sum_{j=1}^m (\epsilon_{\bar{a}})_j^2 \right]^{1/2} \quad (\epsilon_a = s_v, e_v, r_v, s_z, e_z, r_z)$$

$$b. \quad \bar{\epsilon}_{\bar{a}} = \left[\frac{\bar{e}_{\bar{a}}^2}{12} + \frac{\bar{s}_{\bar{a}}^2}{m} + \frac{\bar{r}_{\bar{a}}^2}{m} \right]^{1/2} \quad (a = v, z)$$

4. Errors on Stratum Means

$$a. \quad s_{\bar{a}} = \frac{\bar{s}_{\bar{a}}}{\sqrt{m}} \quad (a = v, z)$$

TABLE 3-2 Cont.

$$b. \quad \epsilon_{\bar{a}} = \left[\frac{\bar{e}_{\bar{a}}^2}{12m} + \frac{\bar{s}_{\bar{a}}^2}{m} + \bar{r}_{\bar{a}}^2 \right]^{\frac{1}{2}} \quad (a = v, z)$$

5. Parameters Required for Statistical Tests

a. Group Agreement Test (Test 1)

$$T1 = \sqrt{m} * \bar{\bar{D}}$$

b. Group Goodness of Fit Test (Test 2)

$$T2 = \bar{\bar{D}}^2$$

These tests are explained in detail in Section 4.1.3.2 of Ref. 1

6. Upper 95 Percentile Point for Chi-squared Distribution with m Degrees of Freedom. (To be used in Test 2)

$$x_{0.95}^2/m = (1 - 2/9m + 1.645 \sqrt{2/9m})^3$$

This is an approximation only for large m (Ref. 6). A more precise value has to be obtained from statistical tables.

SubroutineFunction

AMEAN	Computes $\bar{a}$ as defined in Table 3-2
RMS	Computes RMS_a as defined in Table 3-2
STRAT	Computes all $\bar{E}_a$ as defined in Table 3-2
CALC	Computes average fuel rod dimensions and sample random errors as shown in Table 3-1
CALC1	Computes the "analysis functions" and their associated errors as shown in Table 3-1

3.3. PROGRAM LIMITS

The dimensions of the arrays used in STRAIN are specified by parameters which are defined in STRAIN, CALC, and CALC1. These parameters and their specified values are listed below.

<u>Parameter</u>	<u>Description</u>	<u>Value</u>
NB	Maximum number of fuel bodies	6
NS	Maximum number of fuel stacks per fuel body	8
NR	Maximum number of fuel rods per fuel stack	14
NPØS	Maximum number of axial measurement locations per fuel body	25
NFT	Maximum number of fuel blends	10

As can be seen, all of these parameters with the exception of NFT are common to both STAT and STRAIN. As long as the values for these parameters are at least as large as those specified in STAT, no difficulties should be encountered in STRAIN over the array sizes. The STRAIN code currently requires approximately 20K words of memory.

3.4. INPUT

The following input is required by the STRAIN code:

1. A card deck formulated as specified by the input instructions given in Appendix C.
2. A TREVER results tape containing predicted strains (unit 15).
3. A STAT results tape or catalogued file containing fuel rod and fuel body diameter data (unit 10).

The precision and equipment random errors associated with Peach Bottom fuel test element metrology are assigned internally via DATA statements in the main program. These errors are identified below.

<u>Variable Name in Code</u>	<u>Description (Notations from Table 2-3)</u>
EY1,EY2,RX1, and RX2	e_1, e_2, r_1 , and r_2 for fuel rod length
EX1(1),EX2(1),RX1(1),RX2(1)	e_1, e_2, r_1 , and r_2 for fuel rod diameter
EX1(2),EX2(2),RX1(2),RX2(2)	e_1, e_2, r_1 , and r_2 for fuel body diameter

The errors assigned in the DATA statements should be consistent with those given in Table 2-3.

3.5. OUTPUT

The results from the STRAIN code are printed out in a tabular form suitable for inclusion in test reports. The format and content of these tables is illustrated by the sample problem results given in Appendix D. STRAIN also provides punched card output containing strain and error information required as input for the DRWDIM code.

3.6. USAGE CONSIDERATIONS

The STRAIN code is currently contained on the second file of tape 5415. The following run stream should be used to execute the code:

VRUN Card

VASG,T	X,U,5415
VMOVE	X.,1
VCOPY,G	X.,TPFS.
VFREE	X.
VASG,AX	STRAIN* (element name)
VUSE	10,STRAIN* (element name)
VASG,T	15,U, (TREVER results type)
VXQT	SMAP

Data Deck

VPMD,REDL

A maximum of 50 pages, a maximum time of 1 minute, and a maximum of 30 cards should be sufficient for the majority of STRAIN runs.

4. GAPS

The GAPS computer code, written in August 1976, computes fuel rod - fuel hole and sleeve - fuel body radial heat transfer gaps for Peach Bottom fuel test elements based on test element metrology data and compares the fuel rod - fuel hole gaps with the corresponding predicted gaps obtained from the TREVER code using the methods outlined in Ref. 1.

4.1. CALCULATIONS

GAPS is divided into the following four groups of calculations:

Group I: Comparison of measured and predicted fuel rod - fuel hole gaps

Computes postirradiation fuel rod - fuel hole gaps for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics and compares them with the corresponding predicted gaps obtained from the TREVER computer code.

Group II: Fuel rod - fuel hole gap calculations

Calculates the fuel rod - fuel hole gap for each fuel rod and for each combination of fuel rods considered by the STAT code.

Group III: Sleeve - fuel body gap calculations

Calculates sleeve - fuel body gaps based on outer sleeve diameter measurements.

Group IV: Sleeve - fuel body gap calculations

Calculates sleeve - fuel body gaps based on inner sleeve diameter measurements.

Whether or not each of these groups of calculations will be performed for a given GAPS run depends on the available metrology data and the output desired. After reading the specified options supplied in the

input data deck, GAPS will either bypass or execute each group, all of which are entirely independent of one another. The calculations included in each of these four groups are discussed below.

4.1.1. Comparison of Measured and Predicted Fuel Rod - Fuel Hole Gaps (Group I)

The calculations included in this group can be divided into two subgroups. The calculations in the first subgroup are performed in order to compute fuel rod - fuel hole gaps at each core height corresponding to the center of a layer of fuel rods and to compare them with the corresponding predicted gaps. The second subgroup of calculations stratify subgroup 1 calculation results in order to compute and compare measured and predicted fuel body average and test element average fuel rod - fuel hole gaps for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics.

The calculations included in subgroup 1 are summarized in Table 4-1. As in the fuel rod strain calculations, the fuel rod data obtained from STAT must be stratified in order to obtain average fuel rod dimensional data for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics. Once again, the manner in which the fuel rods will be stratified is dictated by the way the fuel stacks were grouped for the TREVER analysis of the test element being considered and is specified via input by assigning a fuel type number to each fuel stack. For each fuel rod layer, the rods in fuel stacks which have been assigned the same fuel type number will be stratified to give average fuel rod diameter data for that fuel type.

In order to obtain average fuel hole diameter data corresponding to the average fuel rod diameter data, the fuel hole diameters must be grouped together in the same manner as the fuel rod diameters and stratified as shown in Table 4-1. Since at the time GAPS was written, postirradiation fuel hole diameter measurements were either sparse or nonexistent for the

TABLE 4-1
EQUATIONS FOR COMPUTING AND COMPARING FUEL ROD - FUEL HOLE GAPS

Parameter	Symbol	Stratum Average Dimensions		Analysis Functions				
		Postirradiation Fuel Rod Diameter	Postirradiation Fuel Hole Diameter ^(a)	Measured Gap	Predicted Gap	Relative Difference	Comparison	
		(in.)	(in.)	(in.)	(in.)	(%)	Test 1	Test 2
Mean value	As given	$\bar{x} = \frac{1}{\sum_{j=1}^m n_j} \sum_{j=1}^m n_j \bar{x}_j$	$\bar{h} = \frac{1}{m} \sum_{j=1}^m \bar{h}_j$	$v = (\bar{h} - \bar{x})/2$	u_t	$z = \frac{u_t}{v} - 1$	$D = z/\epsilon_z$	$D2 = D^2$
<u>Errors</u>								
<u>Measuring system</u>								
Precision	e	From Table 2-3	$\bar{e}_h = \left[\frac{1}{m} \sum_{j=1}^m (e_h)_j^2 \right]^{1/2}$	$e_v = \frac{1}{2} \left(\frac{e_x}{n_x} + \bar{e}_h \right)$	—	$e_z = \frac{1}{v} \left(e_v \frac{u_t}{v} \right)$	—	—
Equipment random error	r	From Table 2-3	$\bar{r}_h = \left[\frac{1}{m} \sum_{j=1}^m (r_h)_j^2 \right]^{1/2}$	$r_v = \frac{1}{2} \left(r_x^2 + \bar{r}_h^2 \right)^{1/2}$	—	$r_z = \frac{1}{v} \left(r_v \frac{u_t}{v} \right)$	—	—
<u>Sample</u>								
Number of measurements	n	$n_x = \sum_{j=1}^m n_j$	m	—	—	—	—	—
Random error	s	$s_x = \left[\frac{1}{\sum_{j=1}^m n_j - 1} \left[\sum_{j=1}^m (n_j - 1) s_j^2 + \sum_{j=1}^m n_j (\bar{x}_j - \bar{x})^2 \right] \right]^{1/2}$	$\bar{s}_h = \left[\frac{1}{m} \left[\sum_{j=1}^m (s_h)_j^2 + \sum_{j=1}^m (\bar{h}_j - \bar{h})^2 \right] \right]^{1/2}$	$s_v = \frac{1}{2} \left(\frac{s_x^2}{n_x} + \bar{s}_h^2 \right)^{1/2}$	—	$s_z = \frac{1}{v} \left(s_v \frac{u_t}{v} \right)$	—	—
<u>Total</u>								
Combined random error (1σ)	ε	$\epsilon_{\bar{x}} = \left[\frac{e_x^2}{12n_x} + \frac{s_x^2}{n_x} + r_x^2 \right]^{1/2}$	$\epsilon_h = \left[\frac{\bar{e}_h^2}{12m} + \frac{\bar{s}_h^2}{m} + \bar{r}_h^2 \right]^{1/2}$	$\epsilon_v = \frac{1}{2} \left(\epsilon_x^2 + \epsilon_h^2 \right)^{1/2}$	—	$\epsilon_z = \frac{1}{v} \left(\epsilon_v \frac{u_t}{v} \right)$	—	—
Combined random error (2σ)	d	$d_{\bar{x}} = 1.96\epsilon_{\bar{x}}$	$d_h = 1.96\epsilon_h$	$d_z = 1.96\epsilon_z$	—	$d_z = 1.96\epsilon_z$	—	—

(a) Postirradiation fuel hole diameters and errors are calculated as shown in Table 4-2.

majority of the Peach Bottom fuel test elements, it was decided to have GAPS compute postirradiation diameters and their associated errors from preirradiation and postirradiation fuel body diameter data and preirradiation fuel hole diameter data as shown in Table 4-2. This approach assumes that the relative shrinkage of each fuel hole and of the entire fuel body will be approximately the same at each axial location. When calculating fuel rod - fuel hole gaps at a given core height, the fuel body diameter data for the closest fuel body diameter measurement location within the same fuel body is used to compute the local postirradiation fuel hole diameter.

Since all test element metrology is performed at room temperature, the contribution of thermal strain to the predicted end-of-life gaps must be eliminated before comparing measured and predicted gaps. Therefore, instead of using the end-of-life gaps calculated by the TREVER code, predicted gaps which are computed from the end-of-life irradiation-induced fuel body and fuel rod strains calculated by TREVER are compared with measured strains. These are calculated using the equation

$$GAP_2 = GAP_1 + d_{fh} U_{fb} - d_{fr} U_{fr}$$

where GAP_1 = as-built preirradiation fuel rod - fuel hole gap,
 d_{fh} = preirradiation fuel hole diameter,
 d_{fr} = preirradiation fuel rod diameter,
 U_{fb} = end-of-life irradiation-induced fuel body strain calculated by TREVER,
 U_{fr} = end-of-life irradiation-induced fuel rod strain calculated by TREVER.

Since the 30 TREVER calculation points do not correspond to the mid-points of the fuel rod layers, GAPS interpolates the gaps obtained from TREVER in order to determine the predicted gaps for the locations at which measured gaps have been computed. As with the predicted strains, the means for determining the errors associated with the predicted gaps have yet to be developed, so these errors are assumed to be zero.

TABLE 4-2

EQUATIONS FOR COMPUTING POSTIRRADIATION FUEL HOLE AND
INNER SLEEVE DIAMETERS AND ERRORS

Key to Symbols

- b_1 Preirradiation fuel body diameter or outer sleeve diameter
 b_2 Postirradiation fuel body diameter or outer sleeve diameter
 h_1 Preirradiation fuel hole diameter or inner sleeve diameter
 h_2 Postirradiation fuel hole diameter or inner sleeve diameter
 All other symbols, see Table 3-2.

1. Postirradiation fuel hole diameter

$$h_2 = h_1 \frac{b_2}{b_1}$$

2. Precision (Group I only)

$$e_{h_2} = \frac{1}{b_1} \left[\frac{e_{b_2}}{\sqrt{n_{b_2}}} h_1 + \frac{e_{h_1}}{\sqrt{n_{h_1}}} b_2 + \frac{e_{b_1}}{\sqrt{n_{b_1}}} \left(\frac{b_2 h_1}{b_1} \right) \right]$$

3. Equipment Random Error (Group I only)

$$r_{h_2} = \frac{1}{b_1} \left[r_{b_2}^2 h_1^2 + r_{h_1}^2 b_2^2 + r_{b_1}^2 \left(\frac{b_2 h_1}{b_1} \right)^2 \right]^{\frac{1}{2}}$$

4. Sample Random Error

a. Group I (on mean)

$$s_{h_2} = \frac{1}{b_1} \left[\frac{s_{b_2}^2}{n_{b_2}} h_1^2 + \frac{s_{h_1}^2}{n_{h_1}} b_2^2 + \frac{s_{b_1}^2}{n_{b_1}} \left(\frac{b_2 h_1}{b_1} \right)^2 \right]^{\frac{1}{2}}$$

TABLE 4-2 Cont.

b. Groups II and III (on sample)

$$s_{h_2} = \frac{1}{b_1} \left[s_{b_2}^2 h_1^2 + s_{h_1}^2 b_2^2 + s_{b_1}^2 \left(\frac{b_2 h_1}{b_1} \right)^2 \right]^{\frac{1}{2}}$$

5. Combined Random Error (Groups II and III)

$$\epsilon_{h_2} = \frac{1}{b_1} \left[\epsilon_{b_2}^2 h_1^2 + \epsilon_{h_1}^2 b_2^2 + \epsilon_{b_1}^2 \left(\frac{b_2 h_1}{b_1} \right)^2 \right]^{\frac{1}{2}}$$

The calculations included in subgroup 2 are identical in nature to the group 2 calculations of the STRAIN code (see Sections 3.1 and 3.1.2) and are summarized in Table 3-2. The only difference is that V and U_T are gaps instead of strains.

4.1.2. Fuel Rod - Fuel Hole Gap Calculations (Group II)

Fuel rod - fuel hole gaps for individual fuel rods and average fuel rod - fuel hole gaps for single and arbitrarily defined combinations of fuel holes are computed in this group. These calculations are summarized in Table 4-3. All fuel rod data required by these calculations are obtained from STAT code results and once again all postirradiation fuel hole diameters and errors are computed from preirradiation fuel hole diameter data and preirradiation and postirradiation fuel body diameter data using the equations given in Table 4-2. When computing the average gaps for an arbitrarily defined combination of fuel holes, additional calculations are performed to determine stratum average preirradiation fuel hole and preirradiation and postirradiation fuel body diameters and errors. The equations for these calculations are given in Table 2-2.

4.1.3. Sleeve - Fuel Body Gap Calculations (Based on Sleeve O.D.) (Group III)

Sleeve - fuel body gaps at each sleeve O.D. measurement location and fuel body and fuel element average sleeve - fuel body gaps based on sleeve O.D. measurements are computed in this group. These calculations are also summarized in Table 4-3. All fuel body diameter data required by these calculations are obtained from STAT code results and all postirradiation sleeve I.D.s and errors are computed from preirradiation sleeve I.D. data and preirradiation and postirradiation sleeve O.D. data using the equations given in Table 4.2. When calculating sleeve-fuel body gaps at a given sleeve O.D. measurement location, the code searches through the fuel body diameter data and selects the data at the nearest fuel body diameter measurement location. If the sleeve O.D. measurement location is outside

TABLE 4-3
EQUATIONS FOR FUEL ROD - FUEL HOLE AND SLEEVE - FUEL BODY GAP CALCULATIONS

Parameter	Symbol	Dimensions				Analysis Functions			
		Preirrad. Inner Diam. (a) (in.)	Preirrad. Outer Diam. (b) (in.)	Postirrad. Inner Diam. (a) (in.)	Postirrad. Outer Diam. (b) (in.)	BOL Gap (mils)	EOL Gap (mils)	Difference (mils)	Relative Change (%)
Mean value	As given	x_1	y_1	x_2	y_2	$g_1 = (y_1 - x_1)/2$	$g_2 = (y_2 - x_2)/2$	$g_{21} = g_2 - g_1$	$u = \frac{g_2}{g_1} - 1$
Errors									
Sample random error	s	s_{x_1}	s_{y_1}	s_{x_2}	s_{y_2}	$s_{g_1} = 1/2(s_{y_1}^2 + s_{x_1}^2)^{1/2}$	$s_{g_2} = 1/2(s_{y_2}^2 + s_{x_2}^2)^{1/2}$	$s_{g_{21}} = (s_{g_1}^2 + s_{g_2}^2)^{1/2}$	$s_u = \frac{1}{g_1} \left[s_{g_2}^2 \left(\frac{g_2}{g_1} \right)^2 + s_{g_2}^2 \right]^{1/2}$
Combined random error	c	c_{x_1}	c_{y_1}	c_{x_2}	c_{y_2}	$c_{g_1} = 1/2(c_{y_1}^2 + c_{x_1}^2)^{1/2}$	$c_{g_2} = 1/2(c_{y_2}^2 + c_{x_2}^2)^{1/2}$	$c_{g_{21}} = (c_{g_1}^2 + c_{g_2}^2)^{1/2}$	$c_u = \frac{1}{g_1} \left[c_{g_2}^2 \left(\frac{g_2}{g_1} \right)^2 + c_{g_2}^2 \right]^{1/2}$

(a) Fuel rod or outer fuel body diameter.

(b) Fuel hole or inner sleeve diameter. For group 2 and group 3 calculations, the postirradiation fuel hole or inner sleeve diameters are calculated as shown in Table 4-2.

the active core, the corresponding preirradiation and postirradiation fuel body diameters are assumed to equal the element average preirradiation fuel body diameter.

When computing fuel body average gaps, stratification calculations (Table 2-2) are performed to determine fuel body average preirradiation inner sleeve and preirradiation and postirradiation outer sleeve diameters and errors. Element average inner and outer sleeve diameters and errors are then obtained by stratifying the fuel body average results. The sleeve O.D. measurement locations outside of the active core are excluded from the element average gap calculations. If sleeve O.D. measurements are not available for more than one fuel body, the element average gap calculations will not be performed.

4.1.4. Sleeve - Fuel Body Gap Calculations (Based on Sleeve I.D.) (Group IV)

The calculations included in this group compute sleeve - fuel body gaps at each sleeve I.D. measurement location and fuel body and fuel element average sleeve - fuel body gaps based on sleeve I.D. measurements. These calculations are identical to the group 3 calculations with the exception that sleeve I.D. information is obtained directly from STAT code results rather than being calculated from the sleeve strain as determined from preirradiation and postirradiation sleeve outer diameter measurements.

4.2 STRUCTURE

GAPS consists of a main program, called MAIN, and a series of short subroutines, each of which performs a specific calculation or group of calculations. The main program is responsible for reading the input data, performing or calling subroutines to perform calculations, and printing the results. The subroutines and their functions are listed below.

<u>Subroutine</u>	<u>Function</u>
AERF	Solves the equation $\epsilon_{\bar{x}} = \left[\frac{e^2}{12} + S_{\bar{x}} + r^2 \right]^{1/2}$
AMEAN	Solves the equation $\bar{x} = \frac{1}{M} \sum_{j=1}^m \bar{x}_j$
CALC	Computes the "analysis functions" of Table 4-3 and the associated errors.
CALC1	Computes the "analysis functions" of Table 4-1 and the associated errors.
CALC2	Computes stratum average grand means and errors using Eqs. 1, 2a, and 4 of Table 2-2.
CONVT	Solves Eqs. 1, 4b and 5 of Table 4-2. Computes postirradiation fuel hole and inner sleeve diameters and errors for use in group II, III, and IV calculations.
CONVT1	Solves equations 1, 2, 3, and 4a of Table 4-2. Computes postirradiation fuel hole diameters and errors for use in group 1 calculations.
RMS	Computes RMS_a as defined in Table 3-2.
STRAT	Computes all $\bar{E}_a$ as defined in Table 3-2.

4.3 PROGRAM LIMITS

The dimensions of the arrays used in GAPS are specified by parameters which are defined in MAIN, CALC, and CALC1. These parameters and their currently assigned values are listed below.

<u>Parameter</u>	<u>Description</u>	<u>Value</u>
NB	Maximum number of fuel bodies	6
NH	Maximum number of fuel holes per fuel body	8
NR	Maximum number of fuel rods per fuel stack	14
NS	Maximum number of strata which can be specified in group 2	24
NSS	Maximum number of fuel stacks in one of the strata specified in group 2	24
NL or NBS	Maximum number of axial measurement locations per fuel body	25
NFT	Maximum number of fuel blends	10

As long as the values of these parameters are at least as large as those specified for the corresponding parameters in the STAT code, no difficulties concerning array size should be encountered. The GAPS code currently requires approximately 25K words of memory.

4.4 INPUT

The following input is required by the GAPS code:

1. A card deck formulated as specified by the input instructions given in Appendix E.
2. A TREVER results tape containing predicted strains (unit 15).
3. A STAT results tape or catalogued file containing fuel rod data (unit 10).

Items 2 and 3 are the same as items 2 and 3 required as input to the STRAIN code. The precision and equipment random errors associated with Peach Bottom fuel test element metrology are assigned internally via DATA statements in MAIN and in CALC2. These errors are identified below.

<u>Subroutine</u>	<u>Variable Name in Code</u>	<u>Description (Notations from Table 2-3)</u>
CALC1	E(1) and R(1)	e_1 and r_1 for fuel body O.D.
CALC1	E(2) and R(2)	e_2 and r_2 for fuel body O.D.
CALC1	E(3) and R(3)	e_1 and r_1 for fuel hole diameter
CALC1	E(4) and R(4)	e_1 and r_1 for sleeve I.D. or O.D.
CALC1	E(5) and R(5)	e_2 and r_2 for sleeve I.D. or O.D.
MAIN	EX2 and RX2	e_2 and r_2 for fuel rod diameter
MAIN	EH1 and RH1	e_1 and r_1 for fuel hole diameter
MAIN	EB1 and RB1	e_1 and r_1 for fuel body O.D.
MAIN	EB2 and RB2	e_2 and r_2 for fuel body O.D.

The errors assigned via these DATA statements should be consistent with those given in Table 2-3.

4.5 OUTPUT

The results from the GAPS code are printed out in tabular form suitable for inclusion in test reports. The format and content of these tables are illustrated by the sample problem results given in Appendix F. GAPS also provides punched card output containing gap and error information required as input for the DRWDIM code.

4.6 USAGE CONSIDERATIONS

The GAPS code is currently contained on the third file of tape 5415. The following run stream should be used to execute the code:

Run Card	
VASG,T	X,U,5415
VMOVE	X.,2
VCOPY,G	X.,TPFS.
VFREE	X.
VASG,AX	STRAIN* (element name)
VUSE	10, STRAIN* (element name)
VASG,T	15, U, (TREVER results tape)
VXQT	SMAP

Input Data Deck
VPMD,REDL

A minimum of 100 pages, a maximum time of 2 minutes, and a maximum of 200 cards should be sufficient for the majority of GAPS runs.

5. DRWDIM

DRWDIM is a short plotting program which utilizes the CSD*PLOT package to prepare graphs which compare measured test element strains and gaps with the corresponding TREVER design code predictions. The measured strains and gaps, along with their 2σ errors, are read into the program from cards which have been punched by the STAT, STRAIN, and GAPS codes. Predicted end-of-life strains are read from the TREVER results tape and then used to calculate end-of-life sleeve - fuel body and fuel rod - fuel hole gaps as follows:

Sleeve - fuel body gap

$$\text{Gap}_2 = \left[\text{Gap}_1 - (r_{fb})_1 \frac{U_{fb}}{100} + (r_s)_1 \frac{U_{sl}}{100} \right] \times 1000$$

Fuel rod - fuel hole gap

$$\text{Gap}_2 = \left[\text{Gap}_1 - (r_{fr})_1 \frac{U_{fr}}{100} + (r_{fh})_1 \frac{U_{fb}}{100} \right] \times 1000,$$

where Gap_2 = postirradiation gap in mils,
 Gap_1 = preirradiation gap in inches,
 $(r_{fb})_1$ = nominal preirradiation fuel body radius in inches,
 $(r_s)_1$ = nominal preirradiation inner sleeve radius in inches,
 $(r_{fr})_1$ = nominal preirradiation fuel rod radius in inches,
 $(r_{fh})_1$ = nominal preirradiation fuel hole radius in inches,

U_{fb} = end-of-life fuel body irradiation strain in %
 U_{sl} = end-of-life sleeve irradiation strain in %
 U_{fr} = end-of-life fuel rod irradiation strain in %.

DRWDIM will plot all or any combination of the following sets of data depending on the instructions provided in the input data deck:

1. Measured and predicted sleeve - fuel body gaps.
2. Measured and predicted fuel rod - fuel body gaps.
3. Measured and predicted sleeve strains.
4. Measured and predicted fuel body strains.
5. Measured and predicted fuel rod strains.

When plotting fuel rod - fuel hole gaps or fuel rod strains, DRWDIM will produce one plot for each fuel blend or group of fuel blends having similar irradiation-induced strain characteristics (see Sections 3.1 and 4.1).

The following run stream is required to execute the program:

```

VRun Card
VASG,T           10,U (TREVER results tape)
VPLTREQ, (options)
VASG,AX          CSD*PLOT
  Program Deck
VPREP
VMAP,I           PLOTIT,PLOTIT
  IN DRWDIM
  LIB            CSD*PLOT
VXQT
  Data Deck
VPMD,REDL
  
```

The input instructions for this program are given in Appendix G and a sample run has been included as Appendix H.

REFERENCES

1. Wallroth, C. F., J. F. Holzgraf, and D. D. Jensen, "PostIrradiation Examination and Evaluation of Peach Bottom Fuel Test Element FTE-6," Section 4.1, General Atomic Report GA-A-13943, to be published.
2. Saurwein, J. J., "Peach Bottom Test Element Thermal Analysis," General Atomic unpublished data, April 19, 1976.
3. Korts, R. F., "Program STAT," General Atomic unpublished data, May 27, 1976.
4. Holzgraf, J. F., and M. Miller, "Preirradiation Measurements of Sleeve Sections from Peach Bottom Historical Specimens," General Atomic unpublished data, May 19, 1976.
5. Vrouwes, J., "Diameter of Phase 2 Test Element Fuel Rods - Comparison Between Micrometer and Air Gauge Measurements Implying Possible Decrease in Heat Transfer Characteristics," General Atomic unpublished data, July 22, 1971.
6. Dixon, W. J. and F. J. Massey, Jr., Introduction to Statistical Analysis, McGraw-Hill Book Company, 1969.

APPENDIX A
STAT INPUT INSTRUCTIONS

Column	I-6	7-12	13-18	19-24	25-30	31-36	37-42	
Format	I6	I6	I6	I6	I6	I6	I6	
Name	IOPT(1)	IOPT(2)	IOPT(3)	IOPT(4)	IOPT(5)	IOPT(6)	JOPT	
1	1- Process element length and fuel body weight data 0- Do not process these data	1- Process fuel rod diameter and length data 0- Do not process these data	1- Process fuel body diameter and length data 0- Do not process these data	1- Process fuel hole diameter data 0- Do not process these data	1- Process inner and outer sleeve diameter data 0- Do not process these data	1- Process fuel stack and fuel hole plenum length data 0- Do not process these data	1- Add 0.003 in. to all pre-irradiation fuel rod measurements 0- Do not add 0.003 in.	

Comments

This card is part of the initial data deck but is not included in the catalogued file. It must be included with all STAT runs. See Section 2.6.

Column	1-80
Format	13A6, A2
Name	CARD
2	Comment cards giving general information concerning the test element being analyzed

As many comment cards as desired may be included here. If no comment cards are desired, they may be omitted.

Column	
Format	
Name	
3	Blank card

This card must always be present

Column	1-12	13-24	25-36	
Format	2A6	F12.0	F12.0	
Name	ID(1) & ID(2)	EBL	EAL	
4	Test element name (left justified)	Preirradiation fuel element length (inches)	Postirradiation element length (inches)	

Comments

Column	1-6	7-18	19-30	
Format	I6	F12.0	F12.0	
Name	I	BBW(I)	ABW(I)	
5	Fuel body number	Preirradiation weight (grams)	Postirradiation weight (grams)	

One card must be present for each fuel body in the test element even if no weight data are available. In such cases, input arbitrary numbers.

Column	
Format	
Name	
6	Blank card

This card must always be present

Column	1-80
Format	13A6, A2
Name	CARD
7	Comment cards giving general information concerning the fuel rod length and diameter data

Comments
As many comments cards as desired may be included

Column	
Format	
Name	
8	Blank card

This card must always be present

--

Column	1-6	7-12	13-18	19-30	31-36	37-42	43-48	49-54	
Format	I6	I6	I6	F12.0	I6	I6	I6	I6	
Name	IB	IH	IR	CHR(IB,IH,IR)	NP(1)	NP(2)	NP(3)	NP(4)	
9	Fuel body number	Fuel hole number	Fuel rod number	Total core height of fuel rod center (inches)	Number of preirradiation length measurements for this fuel rod	Number of postirradiation length measurements for this fuel rod	Number of preirradiation diameter measurements for this fuel rod	Number of postirradiation diameter measurements for this fuel rod	

Comments

Column	1-72
Format	6F12.0
Name	(BLR(IB,IH,IR,K), K = 1, NP(1))
10	Preirradiation fuel rod length measurements for rod IB, IH, IR (inches)

Omitted if NP(1) = 0. However if NP(2) ≠ 0, some data must be given.

Column	1-72
Format	6F12.0
Name	(ALR(IB,IH,IR,K), K = 1, NP(2))
11	Postirradiation fuel rod length measurements for rod IB, IH, IR (inches)

Omitted if NP(2) = 0

Column	1-72
Format	6F12.0
Name	(BDR(IB,IH,IR,K), K = 1, NP(3))
12	Preirradiation fuel rod diameter measurements for rod IB, IH, IR (inches)

Comments

Omitted if NP(3) = 0.
However, if NP(4) ≠ 0,
some data must be given.

Column	1-72
Format	6F12.0
Name	(ADR(IB,IH,IR,K), K = 1, NP(4))
13	Postirradiation fuel rod diameter measurements for rod IB, IH, IR (inches)

Omitted if NP(4) = 0.
Cards 9-13 are repeated
until all fuel rod
measurements have been
given.

Column	
Format	
Name	
14	Blank card

This card must always
be present

Column	1-6	7-9	10-12	13-78
Format	I6	I3	I-3	22I3
Name	ISN	NRSD(ISN,1,1)	NRSD(ISN,1,2)	NRSD(ISN,J,1), NRSD(ISN,J,2)
15	Stratum identification number	Fuel body in which first fuel stack in stratum is located	Fuel hole in which first fuel stack in stratum is located	Identification of fuel bodies and fuel holes for all fuel stacks included in the stratum. NRSD(ISN,J,1) and NRSD(ISN,J,2) will alternate and be given in I3 format.

Comments

There may be up to 12 (J = 12) fuel stacks in a stratum. Up to 20 stratum may be defined.

Column	
Format	
Name	
16	Blank card

This card must always be present

Column	1-80
Format	13A6, A2
Name	CARD
17	Comment cards giving general information concerning the fuel body length data

As many comment cards as desired may be included

Column	
Format	
Name	
18	Blank card

Comments
Must always be present

Column	1-6	7-12	13-18	
Format	I6	I6	I6	
Name	IB	NP(1)	NP(2)	
19	Fuel body number	Number of pre-irradiation fuel body length measurements	Number of post-irradiation fuel body length measurements	

Comments

Column	1-72
Format	6F12.0
Name	(BLB(IB,K), K = 1, NP(1))
20	Preirradiation fuel body length measurements for body IB (inches)

Comments
Omitted if NP(1) = 0

Column	1-72
Format	6F12.0
Name	BLB(IB,K), K = 1,NP(2))
21	Postirradiation fuel body length measurements for body 1B (inches)

Comments

Omitted if NP(2) = 0.
Cards 19, 20, and 21
are repeated until all
fuel body length data
have been given.

Column	
Format	
Name	
22	Blank card

Must always be present

Column	1-78
Format	13A6, 2A
Name	CARD
23	Comment cards giving general information concerning the fuel body diameter data

As many cards as de-
sired may be included

Column		Comments
Format		
Name		
24	Blank card	Must always be present

Column	1-12	13-24	25-30	31-36	
Format	I12	F12,0	I6	I6	
Name	IB	HM(IB,ICH)	NP(1)	NP(2)	
25	Fuel body number	Total core height of fuel body diameter measurement location	Number of pre-irradiation fuel body diameter measurements at this location	Number of post-irradiation fuel body diameter measurements at this location	

Column	1-72	
Format	6F12,0	
Name	(BDB(IB,ICH,K), K = 1 NP(1))	
26	Preirradiation fuel body diameter measurements at HM(IB,ICH) (inches)	Omit if NP(1) = 0

Column	1-72
Format	6F12.0
Name	(ADB(IB,ICH,K), K = 1, NP(2))
27	Postirradiation fuel body diameter measurements at HM(IB,ICH) (inches)

Comments

Omit if NP(2) = 0.
Repeat cards 25-27
until all fuel body
diameter data have
been given.

Column	
Format	
Name	
28	Blank card

Must always be present

Column	1-80
Format	13A6, A2
Name	CARD
29	Comment cards giving general information concerning the fuel hole diameter data

Column						Comments
Format						
Name						
30	Blank card					Must always be present

Column	1-6	7-12	13-24	25-30	31-36	
Format	I6	I6	F12.0	I6	I6	
Name	IB	IH	HHM(IB,IH,J)	NP(1)	NP(2)	
31	Fuel body number	Fuel hole number	Axial position of measurement (total core height)	Number of pre-irradiation fuel hole diameter measurements at this location	Number of post-irradiation fuel hole diameter measurements at this location	

Column	1-72	
Format	6F12.0	
Name	BDH(IB,IH,J,K), K = 1, NP(1))	
32	Preirradiation fuel hole diameter measurements at HHM(IB,IH,J) (inches)	

Omit if NP(1) ≠ 0.
If NP(2) ≠ 0 then
NP(1) cannot equal 0.

Column	1-72
Format	6F12.0
Name	(ADH(IB,IH,J,K), K = 1 NP(2))
33	Postirradiation fuel hole diameter measurements at HHM(IB,IH,J) (inches)

Comments

Omit if NP(2) = 0.
Repeat cards 31-33
until all fuel hole
diameter data have
been given.

Column	
Format	
Name	
34	Blank card

Must always be present

Column	1-80
Format	13A6, A2
Name	CARD
35	Comment cards giving general information concerning the outer sleeve diameter data

As many comment cards
as desired may be
included

Column	
Format	
Name	
36	Blank card

Comments

Must always be present

Column	1-12	13-18	19-24	
Format	F12.0	I6	I6	
Name	HOS(ICH)	NP(1)	NP(2)	
37	Axial location of sleeve diameter measurements (total core height)	Number of pre-irradiation outer sleeve diameter measurements	Number of post-irradiation outer sleeve diameter measurements	

If NP(2) $\neq$ 0, NP(1) cannot be equal to 0

Column	1-72
Format	6F12.0
Name	(BOSD(ICH,K), K = 1, NP(1))
38	Preirradiation sleeve outer diameter measurements at HOS(ICH) (inches)

Omit if NP(1) = 0

Column	1-72
Format	6F12.0
Name	(AOSD(ICH,K), K = 1 NP(2))
39	Postirradiation sleeve outer diameter measurements at HOS(ICH)

Comments

Omit if NP(2) = 0.
Repeat cards 37-39
until all outer sleeve
diameter data have
been given.

Column	
Format	
Name	
40	Blank card

Must always be present

Column	
Format	
Name	
41-46	Cards giving inner sleeve diameter data. Cards 41-46 have the same format as cards 35-40 and provide the same type of data for the inner sleeve diameter as cards 35-40 provide for the outer sleeve diameter.

Column	1-80
Format	13A6, A2
Name	CARD
47	Comment cards giving general information regarding fuel stack length data.

Comments

As many comment cards as desired may be included

Column	
Format	
Name	
48	Blank card

Must always be present

Column	1-6	7-12	13-24	25-36	
Format	I6	I6	F12.0	F12.0	
Name	IB	IH	FSL(IB,IH,1)	FSL(IB,IH,2)	
49	Fuel body to which fuel stack belongs	Fuel hole to which fuel stack belongs	Preirradiation fuel stack length measurement (see Section 1.1.6)	Postirradiation fuel stack length measurement (see Section 1.1.6)	

It is assumed that the stack length is only measured once. Repeat card 49 until all stack length data have been given.

Column	
Format	
Name	
50	Blank card

Comments

Must always be present

Column	1-6	7-78	
Format	I6	24I3	
Name	ISN	NSLS(ISN,J,1), NSLS(ISN,J,2)	
51	Stratum identification number	Identification of fuel bodies and fuel holes for all fuel stacks included in the stratum. NSLS(ISN,J,1) and NSLS(ISN,J,2) will alternate and be given in I3 format.	

There may be up to 12 (J=12) fuel stacks in a stratum. Up to 20 stratum may be defined.

Column	
Format	
Name	
52	Blank card

Must always be present

Column	1-80
Format	13A6, A2
Name	CARD
53	Comment cards giving general information regarding fuel hole plenum length data.

Comments

As many comment cards as desired may be included

Column	
Format	
Name	
54	Blank card

Must always be present

Column	1-6	7-12	13-24	25-36	
Format	I6	I6	F12.0	F12.0	
Name	IB	IH	FHPL(IB,IH,1)	FHPL(IB,IH,2)	
55	Fuel body number	Fuel hole number	Preirradiation fuel hole plenum length	Postirradiation fuel hole plenum length	

It is assumed that the plenum lengths are only measured once. Repeat card 55 until all plenum length data have been given.

Column	
Format	
Name	
56	Blank card

Comments
Must always be present

Column	
Format	
Name	

Comments

Column	
Format	
Name	

Comments

APPENDIX B
STAT SAMPLE PROBLEM

CONTROL CARDS FOR STAT SAMPLE PROBLEM RUN

```

  @RUN,M/R 37821,3224943001,169278SAIRWE/6/2450,2,100/400
  @ASG,AX  STAT4*FTE
  @ASG,AX  STRAIN*RTF6//RITE
  @USE 11,STRAIN*RTF6
  @ASG,AX  DATA*RTF6
  @XQT  STAT4*FTE,SWAP
  1 1 1 0 1 1 0
  @ADD,P  DATA*RTF6
  @PMD,REDL
  
```


INPUT DATA FILE FOR STAT SAMPLE PROBLEM RUN

```

1. PEACH BOTTOM TEST ELEMENT RTE-6
2. CORE LOCATION : D10-06
3. GAUGE LOCATION : REGION 59 COLUMN 5
4. IRRADIATION PERIOD : 900 EFPD
5. ALL MEASUREMENTS ARE IN INCHES EXCEPT FUEL BODY WEIGHT (GRAMS)
6.
7. RTE-6      143.9375      143.1875
8.      1 2376.0      2376.0
9.      2 2400.0      2400.0
10.     3 2516.0      2516.0
11.     4 2400.0      2400.0
12.     5 2409.0      2409.0
13.     6 2536.0      2536.0
14.
15. FUEL ROD LENGTHS AND DIAMETERS
16. INFORMATION IS LISTED AS FOLLOWS:
17. LINE 1 : BODY #, FUEL HOLE #, ROD #, CORE HEIGHT, #Y1, #Y2, #X1, #X2
18. LINE 2 : PRE-IRRADIATION LENGTH MEASUREMENTS (Y1)
19. LINE 3 : POST-IRRADIATION LENGTH MEASUREMENTS (Y2)
20. LINE 4 : PRE-IRRADIATION DIAMETER MEASUREMENTS (X1)
21. LINE 5 : POST-IRRADIATION DIAMETER MEASUREMENTS (X2)
22. LINES 1-5 ARE REPEATED UNTIL ALL FUEL ROD DATA HAS BEEN GIVEN.
23.
24.      1      1      1      27.01      0      0      1      6
25.      .4900
26.      .4779      .4783      .4790      .4822      .4851      .4847
27.      1      1      2      28.83      0      0      1      6
28.      .4900
29.      .4761      .4766      .4769      .4774      .4777      .4785
30.      1      1      3      30.64      0      0      1      6
31.      .4900
32.      .4738      .4734      .4738      .4758      .4750      .4753
33.      1      1      4      32.46      0      0      1      6
34.      .4900
35.      .4708      .4713      .4723      .4721      .4731      .4732
36.      1      1      5      34.27      0      0      1      6
37.      .4900
38.      .4703      .4700      .4713      .4713      .4708      .4707
39.      1      1      6      36.09      0      0      1      6
40.      .4900
41.      .4699      .4703      .4713      .4705      .4699      .4696
42.      1      1      7      37.90      0      0      1      6
43.      .4900
44.      .4707      .4703      .4710      .4708      .4717      .4713
45.      2      1      1      42.51      0      0      1      6
46.      .4900
47.      .4739      .4735      .4770      .4752      .4799      .4800
48.      2      1      2      44.33      0      0      1      6
49.      .4900
50.      .4728      .4740      .4759      .4756      .4774      .4773
51.      2      1      3      46.15      0      0      1      6
52.      .4900
53.      .4756      .4755      .4761      .4760      .4753      .4740
54.      2      1      4      47.97      0      0      1      6
55.      .4900

```

56.	.4764		.4758	.4744	.4762	.4741	.4746	
57.	2	1	5	49.79	0	0	1	6
58.	.4900							
59.	.4743		.4742	.4753	.4749	.4752	.4753	
60.	2	1	6	51.61	0	0	1	6
61.	.4900							
62.	.4750		.4745	.4736	.4731	.4713	.4713	
63.	2	1	7	53.43	0	0	1	6
64.	.4900							
65.	.4771		.4774	.4768	.4752	.4772	.4743	
66.	3	1	1	58.23	1	0	2	6
67.	2.162							
68.	.486		.491					
69.	.4728		.4729	.4742	.4739	.4750	.4750	
70.	3	1	2	60.37	1	0	2	6
71.	2.147							
72.	.486		.490					
73.	.4720		.4718	.4734	.4727	.4741	.4737	
74.	3	1	3	62.51	1	0	2	6
75.	2.169							
76.	.487		.493					
77.	.4754		.4752	.4746	.4742	.4703	.4707	
78.	3	1	4	64.65	1	0	2	6
79.	2.147							
80.	.485		.490					
81.	.4717		.4721	.4733	.4737	.4747	.4749	
82.	3	1	5	66.79	1	1	2	6
83.	2.150							
84.	2.0772							
85.	.488		.493					
86.	.4723		.4725	.4732	.4736	.4743	.4737	
87.	3	1	6	68.93	1	0	2	6
88.	2.148							
89.	.486		.491					
90.	.4739		.4749	.4747	.4757	.4747	.4751	
91.	3	2	1	58.23	1	0	2	0
92.	2.152							
93.	.486		.491					
94.	3	2	2	60.37	1	0	2	0
95.	2.133							
96.	.488		.493					
97.	3	2	3	62.51	1	0	2	0
98.	2.141							
99.	.487		.491					
100.	3	2	4	64.65	1	0	2	0
101.	2.150							
102.	.488		.491					
103.	3	2	5	66.79	1	0	2	0
104.	2.130							
105.	.487		.491					
106.	3	2	6	68.93	1	0	2	0
107.	2.142							
108.	.486		.491					
109.	3	3	1	58.23	1	1	2	6
110.	2.1430							
111.	2.0787							
112.	.488		.493					

113.	.4768		.4771	.4779	.4771	.4779	.4776	
114.	3	3	2	60.37	1	1	2	6
115.	2.1520							
116.	2.0793							
117.	.487		.489					
118.	.4736		.4733	.4742	.4741	.4737	.4737	
119.	3	3	3	62.51	1	1	2	6
120.	2.1490							
121.	2.0816							
122.	.486		.493					
123.	.4734		.4709	.4722	.4727	.4741	.4746	
124.	3	3	4	64.65	1	1	2	6
125.	2.1430							
126.	2.0718							
127.	.486		.491					
128.	.4732		.4728	.4731	.4723	.4723	.4717	
129.	3	3	5	66.79	1	1	2	6
130.	2.1490							
131.	2.0825							
132.	.487		.494					
133.	.4776		.4769	.4756	.4758	.4751	.4734	
134.	3	3	6	68.93	1	1	2	6
135.	2.142							
136.	2.0733							
137.	.485		.494					
138.	.4739		.4739	.4727	.4733	.4716	.4721	
139.	3	4	1	58.23	1	0	2	0
140.	2.143							
141.	.487		.491					
142.	3	4	2	60.37	1	0	2	0
143.	2.145							
144.	.487		.492					
145.	3	4	3	62.51	1	0	2	0
146.	2.143							
147.	.486		.494					
148.	3	4	4	64.65	1	0	2	0
149.	2.110							
150.	.488		.494					
151.	3	4	5	66.79	1	0	2	0
152.	2.175							
153.	.487		.494					
154.	3	4	6	68.93	1	0	2	0
155.	2.145							
156.	.487		.494					
157.	3	5	1	58.23	1	0	2	6
158.	2.162							
159.	.486		.492					
160.	.4771		.4773	.4718	.4717	.4722	.4724	
161.	3	5	2	60.37	1	1	2	6
162.	2.1490							
163.	2.0524							
164.	.485		.492					
165.	.4750		.4750	.4746	.4737	.4733	.4732	
166.	3	5	3	62.51	1	0	2	6
167.	2.1520							
168.	.486		.493					
169.	.4742		.4747	.4753	.4750	.4739	.4737	

170.	3	5	4	64.65	1	1	2	6
171.	2.1440							
172.	2.0641							
173.	.488		.493					
174.	.4737		.4736	.4736	.4733		.4739	.4742
175.	3	5	5	66.79	1	0	2	6
176.	2.161							
177.	.488		.491					
178.	.4746		.4742	.4744	.4746		.4742	.4746
179.	3	5	6	68.93	1	0	2	6
180.	2.164							
181.	.487		.492					
182.	.4715		.4719	.4717	.4721		.4723	.4725
183.	3	6	1	58.23	1	0	2	0
184.	2.142							
185.	.489		.491					
186.	3	6	2	60.37	1	0	2	0
187.	2.167							
188.	.488		.492					
189.	3	6	3	62.51	1	0	2	0
190.	2.130							
191.	.486		.492					
192.	3	6	4	64.65	1	0	2	0
193.	2.141							
194.	.486		.492					
195.	3	6	5	66.79	1	0	2	0
196.	2.151							
197.	.487		.491					
198.	3	6	6	68.93	1	0	2	0
199.	2.154							
200.	.487		.493					
201.	3	7	1	58.23	1	1	2	6
202.	2.1450							
203.	2.0742							
204.	.487		.494					
205.	.4800		.4801	.4750	.4744		.4734	.4734
206.	3	7	2	60.37	1	1	2	6
207.	2.1370							
208.	2.0410							
209.	.488		.494					
210.	.4742		.4738	.4743	.4756		.4790	.4793
211.	3	7	3	62.51	1	1	2	6
212.	2.1600							
213.	2.0955							
214.	.488		.492					
215.	.4747		.4747	.4742	.4747		.4737	.4739
216.	3	7	4	64.65	1	1	2	6
217.	2.1450							
218.	2.0729							
219.	.486		.492					
220.	.4723		.4726	.4727	.4724		.4725	.4729
221.	3	7	5	66.79	1	1	2	6
222.	2.1410							
223.	2.0672							
224.	.485		.493					
225.	.4752		.4750	.4735	.4715		.4721	.4708
226.	3	7	6	68.93	1	1	2	6

227.	2.1550								
228.	2.0872								
229.	.487		.493						
230.	.4727		.4728	.4723	.4725	.4747	.4761		
231.	3	8	1	58.23	1	0	2	0	
232.	2.134								
233.	.489		.493						
234.	3	8	2	60.37	1	0	2	0	
235.	2.137								
236.	.486		.492						
237.	3	8	3	62.51	1	0	2	0	
238.	2.145								
239.	.486		.491						
240.	3	8	4	64.65	1	0	2	0	
241.	2.143								
242.	.488		.493						
243.	3	8	5	66.79	1	0	2	0	
244.	2.150								
245.	.486		.493						
246.	3	8	6	68.93	1	0	2	0	
247.	2.146								
248.	.486		.491						
249.	4	1	1	73.67	0	0	1	6	
250.	.4900								
251.	.4715		.4727	.4727	.4747	.4752	.4758		
252.	4	1	2	75.49	0	0	1	6	
253.	.4900								
254.	.4710		.4724	.4724	.4742	.4737	.4741		
255.	4	1	3	77.31	0	0	1	6	
256.	.4900								
257.	.4712		.4714	.4732	.4738	.4727	.4752		
258.	4	1	4	79.13	0	0	1	6	
259.	.4900								
260.	.4713		.4714	.4723	.4733	.4746	.4739		
261.	4	1	5	80.94	0	0	1	6	
262.	.4900								
263.	.4737		.4735	.4747	.4745	.4737	.4734		
264.	4	1	6	82.76	0	0	1	6	
265.	.4900								
266.	.4740		.4734	.4726	.4727	.4713	.4718		
267.	4	1	7	84.58	0	0	1	6	
268.	.4900								
269.	.4742		.4736	.4748	.4738	.4755	.4732		
270.	5	1	1	89.22	0	0	1	6	
271.	.4900								
272.	.4716		.4720	.4746	.4732	.4762	.4757		
273.	5	1	2	91.04	0	0	1	6	
274.	.4900								
275.	.4717		.4711	.4723	.4719	.4723	.4727		
276.	5	1	3	92.86	0	0	1	6	
277.	.4900								
278.	.4737		.4728	.4740	.4729	.4724	.4719		
279.	5	1	4	94.67	0	0	1	6	
280.	.4900								
281.	.4752		.4732	.4748	.4734	.4727	.4743		
282.	5	1	5	96.49	0	0	1	6	
283.	.4900								

284.	.4715		.4727	.4735	.4727	.4751	.4715
285.	5	1	6 98.31	0	0	1	6
286.	.4900						
287.	.4747		.4743	.4738	.4734	.4728	.4719
288.	5	1	7 100.12	0	0	1	6
289.	.4900						
290.	.4728		.4723	.4713	.4718	.4713	.4715
291.	6	1	1 104.72	1	0	1	6
292.	2.104						
293.	.4880						
294.	.4753		.4753	.4752	.4759	.4767	.4774
295.	6	1	2 106.85	1	1	1	6
296.	2.10						
297.	2.0761						
298.	.4895						
299.	.4757		.4764	.4763	.4792	.4776	.4791
300.	6	1	3 108.98	1	1	1	6
301.	2.1020						
302.	2.1029						
303.	.4890						
304.	.4770		.4768	.4777	.4784	.4780	.4790
305.	6	1	4 111.12	1	1	1	6
306.	2.1310						
307.	2.0970						
308.	.4895						
309.	.4786		.4784	.4767	.4786	.4771	.4780
310.	6	1	5 113.25	1	1	1	6
311.	2.1350						
312.	2.0792						
313.	.4870						
314.	.4785		.4789	.4788	.4776	.4797	.4793
315.	6	1	6 115.38	1	0	1	6
316.	2.127						
317.	.4895						
318.	.4767		.4769	.4782	.4792	.4785	.4796
319.	6	5	1 104.72	1	1	1	6
320.	2.1120						
321.	2.1146						
322.	.4896						
323.	.4776		.4777	.4779	.4773	.4772	.4763
324.	6	5	2 106.85	1	1	1	6
325.	2.1380						
326.	2.0811						
327.	.488						
328.	.4783		.4777	.4812	.4792	.4787	.4785
329.	6	5	3 108.98	1	1	1	6
330.	2.1710						
331.	2.0475						
332.	.488						
333.	.4807		.4808	.4791	.4795	.4777	.4780
334.	6	5	5 113.25	1	1	1	6
335.	2.1100						
336.	2.0536						
337.	.4899						
338.	.4776		.4774	.4780	.4777	.4785	.4780
339.	6	5	6 115.38	1	1	1	6
340.	2.1270						

341.	2.0868									
342.	.4888									
343.	.4795		.4798		.4782		.4782		.4780	.4766
344.	6	7	2	106.85		1	1	1	6	
345.	2.1620									
346.	2.1092									
347.	.489									
348.	.4785		.4792		.4797		.4802		.4805	.4804
349.	6	7	3	108.98		1	1	1	6	
350.	2.1430									
351.	2.0977									
352.	.4885									
353.	.4801		.4803		.4797		.4802		.4790	.4797
354.	6	7	4	111.12		1	1	1	6	
355.	2.1610									
356.	2.1136									
357.	.4885									
358.	.4802		.4800		.4805		.4807		.4801	.4803
359.	6	7	5	113.25		1	1	1	6	
360.	2.1440									
361.	2.0981									
362.	.4895									
363.	.4803		.4815		.4795		.4816		.4807	.4817
364.	6	7	6	115.38		1	1	1	6	
365.	2.1530									
366.	2.1181									
367.	.490									
368.	.4825		.4815		.4813		.4805		.4795	.4792
369.										
370.		1	3	1	3	3	5	3	7	
371.		2	6	1	6	5	6	7		
372.		3	2	1	4	1	5	1		
373.										
374.										
375.										
376.										
377.										
378.										
379.										
380.										
381.		1		1						
382.		15.559								
383.		15.5195								
384.		2		1						
385.		15.556								
386.		15.4136								
387.		3		1						
388.		15.558								
389.		15.4024								
390.		4		1						
391.		15.555								
392.		15.360								
393.		5		1						
394.		15.553								
395.		15.3779								
396.		6		1						
397.		15.557								

398.	15.4769				
399.					
400.	FUEL BODY DIAMETERS				
401.	POST-IRRADIATION DIAMETERS MEASURED ACROSS HOLES 1&5 , 3&7				
402.	INFORMATION IS LISTED AS FOLLOWS:				
403.	LINE 1 : FUEL BODY #, CORE HEIGHT, #X1, #X2				
404.	LINE 2 : PRE-IRRADIATION MEASUREMENT (X1)				
405.	LINE 3 : POST-IRRADIATION MEASUREMENT (X2)				
406.	LINES 1-3 ARE REPEATED UNTIL ALL FUEL BODY DIAMETER MEASUREMENTS HAVE BEEN GIVEN				
407.					
408.	1	25.675	0	2	
409.	2.7353	2.7351			
410.	1	26.675	0	2	
411.	2.7349	2.7346			
412.	1	27.675	0	2	
413.	2.7349	2.7343			
414.	1	28.675	0	2	
415.	2.7348	2.7342			
416.	1	29.675	0	2	
417.	2.7345	2.7345			
418.	1	30.675	0	2	
419.	2.7345	2.7343			
420.	1	31.675	0	2	
421.	2.7345	2.7341			
422.	1	32.675	0	2	
423.	2.7333	2.7329			
424.	1	33.675	0	2	
425.	2.7335	2.7329			
426.	1	34.675	0	2	
427.	2.7330	2.7327			
428.	1	35.675	0	2	
429.	2.7331	2.7327			
430.	1	36.675	0	2	
431.	2.7331	2.7328			
432.	1	37.675	0	2	
433.	2.7326	2.7325			
434.	1	38.675	0	2	
435.	2.7315	2.7308			
436.	1	39.675	0	2	
437.	2.7313	2.7304			
438.	1	40.425	1	0	
439.	2.740				
440.	2	41.225	2	2	
441.	2.739	2.739			
442.	2.7264	2.7274			
443.	2	42.225	0	2	
444.	2.7265	2.7268			
445.	2	43.225	0	2	
446.	2.7265	2.7282			
447.	2	44.225	0	2	
448.	2.7274	2.7273			
449.	2	45.225	0	2	
450.	2.7271	2.7265			
451.	2	46.225	0	2	
452.	2.7271	2.7258			
453.	2	47.225	0	2	
454.	2.7258	2.7251			

455.		2	48.225	2	2
456.	2.737		2.737		
457.	2.7242		2.7246		
458.		2	49.225	0	2
459.	2.7236		2.7242		
460.		2	50.225	0	2
461.	2.7232		2.7240		
462.		2	51.225	0	2
463.	2.7238		2.7238		
464.		2	52.225	0	2
465.	2.7242		2.7250		
466.		2	53.225	0	2
467.	2.7252		2.7261		
468.		2	54.225	0	2
469.	2.7242		2.7264		
470.		2	55.225	2	2
471.	2.737		2.737		
472.	2.7191		2.7237		
473.		3	56.83	0	2
474.	2.7271		2.7265		
475.		3	57.83	0	2
476.	2.7287		2.7286		
477.		3	58.83	0	2
478.	2.7273		2.7278		
479.		3	59.83	0	2
480.	2.7250		2.7263		
481.		3	60.83	0	2
482.	2.7239		2.7257		
483.		3	61.83	0	2
484.	2.7238		2.7253		
485.		3	62.83	0	2
486.	2.7247		2.7261		
487.		3	63.83	0	2
488.	2.7256		2.7266		
489.		3	64.830	0	2
490.	2.7258		2.7253		
491.		3	65.83	0	2
492.	2.7360		2.7264		
493.		3	66.83	0	2
494.	2.7347		2.7263		
495.		3	67.83	0	2
496.	2.7237		2.7272		
497.		3	68.83	0	2
498.	2.7253		2.7287		
499.		3	69.83	0	2
500.	2.7290		2.7310		
501.		3	70.83	1	2
502.	2.740				
503.	2.7289		2.7295		
504.		4	72.383	0	2
505.	2.7265		2.7262		
506.		4	73.383	0	2
507.	2.7268		2.7291		
508.		4	74.383	0	2
509.	2.7266		2.7297		
510.		4	75.383	0	2
511.	2.7267		2.7295		

512.		4	76.383	0	2
513.	2.7287		2.7298		
514.		4	77.383	0	2
515.	2.7291		2.7289		
516.		4	78.383	0	2
517.	2.7295		2.7293		
518.		4	79.383	0	2
519.	2.7295		2.7296		
520.		4	80.383	0	2
521.	2.7299		2.7307		
522.		4	81.383	0	2
523.	2.7304		2.7307		
524.		4	82.383	0	2
525.	2.7302		2.7303		
526.		4	83.383	0	2
527.	2.7305		2.7300		
528.		4	84.383	0	2
529.	2.7288		2.7301		
530.		4	85.383	0	2
531.	2.7304		2.7311		
532.		4	86.383	1	2
533.	2.740				
534.	2.7287		2.7295		
535.		5	87.72	0	2
536.	2.7278		2.7263		
537.		5	88.72	0	2
538.	2.7305		2.7284		
539.		5	89.72	0	2
540.	2.7305		2.7275		
541.		5	90.72	0	2
542.	2.7303		2.7277		
543.		5	91.72	0	2
544.	2.7310		2.7302		
545.		5	92.72	0	2
546.	2.7318		2.7296		
547.		5	93.72	0	2
548.	2.7313		2.7286		
549.		5	94.72	0	2
550.	2.7317		2.7291		
551.		5	95.72	0	2
552.	2.732		2.7286		
553.		5	96.72	0	2
554.	2.7323		2.7289		
555.		5	97.72	0	2
556.	2.7319		2.7293		
557.		5	98.72	0	2
558.	2.7320		2.7307		
559.		5	99.72	0	2
560.	2.7326		2.7304		
561.		5	100.72	0	2
562.	2.7340		2.7316		
563.		5	101.72	1	2
564.	2.740				
565.	2.733		2.7312		
566.		6	103.494	0	2
567.	2.7263		2.7235		
568.		6	104.494	0	2

569.	2.7255	2.7256		
570.		6 105.494	0	2
571.	2.7259	2.7254		
572.		6 106.494	0	2
573.	2.7271	2.7264		
574.		6 107.494	0	2
575.	2.7276	2.7285		
576.		6 108.494	0	2
577.	2.7285	2.7283		
578.		6 109.494	0	2
579.	2.7291	2.7289		
580.		6 110.494	0	2
581.	2.7295	2.7296		
582.		6 111.494	0	2
583.	2.7302	2.7304		
584.		6 112.494	0	2
585.	2.7299	2.7307		
586.		6 113.494	0	2
587.	2.7309	2.7312		
588.		6 114.494	0	2
589.	2.7318	2.7323		
590.		6 115.494	0	2
591.	2.7326	2.7330		
592.		6 116.494	0	2
593.	2.7336	2.7338		
594.		6 117.494	1	2
595.	2.74			
596.	2.7344	2.7332		
597.				
598.	NO PRE OR POST IRRADIATION FUEL HOLE DIAMETER DATA AVAILABLE.			
599.				
600.				
601.	OUTER SLEEVE DIAMETERS			
602.	INFORMATION IS LISTED AS FOLLOWS:			
603.	LINE 1 : CORE HEIGHT, #X1, #X2			
604.	LINE 2 : PRE-IRRADIATION MEASUREMENTS (X1)			
605.	LINE 3 : POST-IRRADIATION MEASUREMENTS (X2)			
606.	LINES 1-3 ARE REPEATED UNTIL ALL SLEEVE O.D. MEASUREMENTS HAVE BEEN GIVEN.			
607.				
608.	27.00	1	4	
609.	3.4868			
610.	3.4791	3.4801	3.4805	3.4791
611.	34.00	1	4	
612.	3.4868			
613.	3.4754	3.4787	3.4761	3.4735
614.	41.00	1	4	
615.	3.4868			
616.	3.4794	3.4701	3.4787	3.4670
617.	49.00	1	4	
618.	3.4868			
619.	3.4763	3.4640	3.4791	3.4668
620.	57.00	1	4	
621.	3.4868			
622.	3.4731	3.4673	3.4712	3.4624
623.	64.5	1	4	
624.	3.4868			
625.	3.4687	3.4701	3.4684	3.4689

626.	72.0	1	4		
627.	3.4868				
628.	3.4731	3.4635		3.4763	3.4687
629.	80.0	1	4		
630.	3.4868				
631.	3.4696	3.4640		3.4680	3.4645
632.	88.0	1	4		
633.	3.4868				
634.	3.4747	3.4638		3.4701	3.4596
635.	95.5	1	4		
636.	3.4868				
637.	3.4742	3.4705		3.4724	3.4682
638.	103.0	1	4		
639.	3.4868				
640.	3.4801	3.4752		3.4749	3.4740
641.	112.0	1	4		
642.	3.4868				
643.	3.4756	3.4752		3.4749	3.4740
644.	117.0	1	4		
645.	3.4868				
646.	3.4798	3.4810		3.4810	3.4805
647.					
648.	INNER SLEEVE DIAMETERS				
649.	INFORMATION IS LISTED AS FOLLOWS				
650.	LINE 1 : CORE HEIGHT, #X1, #X2				
651.	LINE 2 : PRF-IRRADIATION MEASUREMENTS (X1)				
652.	LINE 3 : POST-IRRADIATION MEASUREMENTS (X2)				
653.	LINES 1-3 ARE REPEATED UNTIL ALL SLEEVE I.D. MEASUREMENTS HAVE BEEN GIVEN				
654.	SLEEVE I.D.S WERE OBTAINED FROM O.D. AND WALL THICKNESS MEASUREMENTS.				
655.					
656.	27.00	1	4		
657.	2.7522				
658.	2.7500	2.7470		2.7499	2.7470
659.	34.00	1	4		
660.	2.7522				
661.	2.7459	2.7440		2.7459	2.7440
662.	41.00	1	4		
663.	2.7522				
664.	2.7371	2.7380		2.7371	2.7380
665.	49.00	1	4		
666.	2.7522				
667.	2.7384	2.7407		2.7385	2.7407
668.	57.00	1	4		
669.	2.7522				
670.	2.7443	2.7369		2.7440	2.7370
671.	64.5	1	4		
672.	2.7522				
673.	2.7479	2.7379		2.7475	2.7381
674.	72.0	1	4		
675.	2.7522				
676.	2.7371	2.7345		2.7370	2.7346
677.	80.0	1	4		
678.	2.7522				
679.	2.7272	2.7335		2.7274	2.7334
680.	88.0	1	4		
681.	2.7522				
682.	2.7354	2.7331		2.7353	2.7332

683.	95.5	1	4		
684.	2.7522				
685.	2.7394	2.7368	2.7394	2.7369	
686.	103.0	1	4		
687.	2.7522				
688.	2.7435	2.7414	2.7435	2.7414	
689.	112.0	1	4		
690.	2.7522				
691.	2.7431	2.7426	2.7431	2.7426	
692.	117.0	1	4		
693.	2.7522				
694.	2.7501	2.7499	2.7501	2.7499	
695.					
696.	FUEL STACK LENGTHS				
697.	LINE 1: FUEL BODY #, FUEL HOLE #, PRE-IRRAD. STACK LENGTH, POST-IRRAD.				
698.	STACK LENGTH.				
699.	LINE 1 IS REPEATED UNTIL ALL FUEL STACK LENGTHS HAVE BEEN GIVEN.				
700.	POST IRRADIATION STACK LENGTHS ARE ACCUMULATED FUEL ROD LENGTHS				
701.	FUEL STACKS IN BODIES 1,2,4, AND 5 CONTAIN 6 RODS WITH A NOMINAL LENGTH				
702.	OF 1.968 IN. AND 1 SHORT ROD HAVING A NOMINAL LENGTH OF 1.01 IN.				
703.					
704.	1	1	12.742		
705.	1	2	12.709		
706.	1	3	12.713		
707.	1	4	12.661		
708.	1	5	12.670		
709.	1	6	12.740		
710.	1	7	12.684		
711.	1	8	12.678		
712.	2	1	12.766		
713.	2	2	12.763		
714.	2	3	12.752		
715.	2	4	12.767		
716.	2	5	12.664		
717.	2	6	12.735		
718.	2	7	12.717		
719.	2	8	12.738		
720.	3	1	12.881		
721.	3	2	12.806		
722.	3	3	12.846	12.467	
723.	3	4	12.811		
724.	3	5	12.876		
725.	3	6	12.873		
726.	3	7	12.855	12.438	
727.	3	8	12.787		
728.	4	1	12.696		
729.	4	2	12.750		
730.	4	3	12.792		
731.	4	4	12.706		
732.	4	5	12.673		
733.	4	6	12.808		
734.	4	7	12.714		
735.	4	8	12.718		
736.	5	1	12.719		
737.	5	2	12.738		
738.	5	3	12.738		
739.	5	4	12.689		

740.	5	5	12.709	
741.	5	6	12.636	
742.	5	7	12.788	
743.	5	8	12.733	
744.	6	1	12.790	12.533
745.	6	2	12.814	
746.	6	3	12.850	
747.	6	4	12.811	
748.	6	5	12.752	12.460
749.	6	6	12.665	
750.	6	7	12.853	12.644
751.	6	8	12.849	
752.				
753.	1	2	1	2
754.				
755.	FUEL HOLE PLENUM LENGTHS			
756.	INFORMATION IS GIVEN AS FOLLOWS:			
757.	LINE 1 : FUEL BODY #, L1, L2			
758.	LINE 1 IS REPEATED UNTIL ALL FUEL HOLE PLENUM LENGTHS HAVE BEEN GIVEN.			
759.				
760.	1	1	1.628	1.724
761.	1	2	1.661	
762.	1	3	1.657	
763.	1	4	1.709	
764.	1	5	1.700	1.842
765.	1	6	1.630	
766.	1	7	1.686	1.910
767.	1	8	1.692	
768.	2	1	1.609	1.808
769.	2	2	1.612	
770.	2	3	1.623	
771.	2	4	1.608	
772.	2	5	1.711	1.800
773.	2	6	1.640	
774.	2	7	1.658	1.754
775.	2	8	1.637	
776.	3	1	1.475	1.563
777.	3	2	1.550	
778.	3	3	1.510	1.602
779.	3	4	1.545	
780.	3	5	1.480	1.542
781.	3	6	1.483	
782.	3	7	1.501	1.577
783.	3	8	1.569	
784.	4	1	1.689	1.609
785.	4	2	1.635	
786.	4	3	1.593	
787.	4	4	1.679	
788.	4	5	1.712	1.770
789.	4	6	1.577	
790.	4	7	1.671	1.644
791.	4	8	1.667	
792.	5	1	1.641	1.769
793.	5	2	1.622	
794.	5	3	1.622	
795.	5	4	1.671	
796.	5	5	1.651	1.735

797.	5	6	1.724	
798.	5	7	1.572	1.860
799.	5	8	1.627	
800.	6	1	1.560	1.671
801.	6	2	1.530	
802.	6	3	1.495	
803.	6	4	1.534	
804.	6	5	1.593	1.648
805.	6	6	1.680	
806.	6	7	1.492	1.515
807.	6	8	1.506	
808.				

END DATA.

KEY TO SYMBOLS IN RESULTS TABLES

	#	indicates number
	*	indicates letter
1.	*1	indicates preirradiation
2.	*2	indicates postradiation
3.	Y#	fuel rod length
4.	G#	fuel body length
5.	X#	diameter (fuel rod, fuel body, etc).
6.	N*#	number of measurements
7.	S*#	sample random error for * = X, Y, or G
8.	E*#	combined random error for * = X, Y, or G
9.	*21	represents analysis function $*2 - *1$
10.	S*21	sample random error for analysis function $*2 - *1$
11.	D*21	total error (2σ) for analysis function $*2 - *1$
12.	UY	fuel rod axial strain - analysis function $(Y2/Y1) - 1$
13.	UX	radial strain - analysis function $(X2/X1) - 1$
14.	UG	fuel body axial strain - analysis function $(G2/G1) - 1$
15.	V	average strain - analysis function $((UY \text{ or } UG) + UX)/2$
16.	W	anisotropy - analysis function $((UY \text{ or } UG)/UX) \times 100$
17.	E#	precision error on strain or anisotropy
18.	R#	equipment random error on strain or anisotropy
19.	S#	sample random error on strain or anisotropy
20.	EP#	combined random error on strain or anisotropy
21.	D#	total error (2σ) on strain or anisotropy
22.	L#	fuel stack length
23.	P#	fuel hole plenum length
24.	UL	fuel stack axial strain - analysis function $(L2/L1) - 1$
25.	G2'	$G2 \times [(L1 + P1)/G1]$
26.	LI	indirect fuel stack length ($LI = G2' - P2$)
27.	ULI	fuel stack axial strain calculated from the indirect fuel stack length - analysis function $(LI/LI) - 1$
28.	E ^(a)	precision error

SAMPLE PROBLEM RESULTS

TOTAL ELEMENT DATA, TEST ELEMENT RTE-6

PARAMETER	VALUE	ACCURACY
PRE-IRRADIATION LENGTH (L1) (IN)	143.9375	.03125
POST-IRRADIATION LENGTH (L2) (IN)	143.1875	.03125
DIFFERENCE (L2-L1) (IN)	-.75000	.06250
STRAIN (L2/L1-1) (%)	-.52106	.04331

FUEL BODY WEIGHT, TEST ELEMENT RTE-6

FUEL BODY	PRE-IRRADIATION WEIGHT	PRE-IRRADIATION ACCURACY	POST-IRRADIATION WEIGHT	POST-IRRADIATION ACCURACY	DIFFERENCE WEIGHT	DIFFERENCE ACCURACY	REL. CHANGE VALUE	REL. CHANGE ACCURACY
	G	G	G	G	G	G	%	%
1	2376.00	1.0000	2376.00	1.0000	.00	2.0000	.0000	.0842
2	2400.00	1.0000	2400.00	1.0000	.00	2.0000	.0000	.0833
3	2518.00	1.0000	2518.00	1.0000	.00	2.0000	.0000	.0794
4	2400.00	1.0000	2400.00	1.0000	.00	2.0000	.0000	.0833
5	2409.00	1.0000	2409.00	1.0000	.00	2.0000	.0000	.0830
6	2536.00	1.0000	2536.00	1.0000	.00	2.0000	.0000	.0789

FUEL TEST ELEMENT

S T A T I S T I C A L P R O G R A M

@ADD,P DATA1. PEACH BOTTOM TEST ELEMENT RTE-6
-- CORE LOCATION : D10-06
GAUGE LOCATION : REGION 59 COLUMN 5
IRRADIATION PERIOD : 900 EFPD
ALL MEASUREMENTS ARE IN INCHES EXCEPT FUEL BODY WEIGHT (GRAMS)

FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 1 FUEL HOLE 1

PRECISION: LENGTH = .00010 DIAMETER = .00010 EQUIPMENT RANDOM ERROR: LENGTH = .00010 DIAMETER = .00060	PRECISION: LENGTH = .00010 DIAMETER = .00010 EQUIPMENT RANDOM ERROR: LENGTH = .00010 DIAMETER = .00010
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FUEL ROD CODE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DX21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SY21	DX21	UX	EX	RX	SX	EPX	DX
B-20	1-1- 1 27.01	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	1.0000	.4812	6	3.244	1.328	-.0009	3.342	3.259	-1.796	.040	.122	.681	.337	.661
		(Y+X)/2											-1.796	.040	.122	.681	.337	.661
		Y/X											.00	.0	.0	.0	.0	.0
	1-1- 2 28.83	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	1.0000	.4772	6	.860	.365	-.0013	1.174	2.087	-2.612	.040	.121	.237	.212	.416
		(Y+X)/2											-2.612	.040	.121	.237	.212	.416
		Y/X											.00	.0	.0	.0	.0	.0
	1-1- 3 30.64	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	1.0000	.4745	6	.981	.413	-.0015	1.265	2.121	-3.160	.040	.120	.255	.215	.421
		(Y+X)/2											-3.160	.040	.120	.255	.215	.421
		Y/X											.00	.0	.0	.0	.0	.0
	1-1- 4 32.46	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	1.0000	.4721	6	.960	.405	-.0018	1.250	2.115	-3.646	.040	.120	.251	.213	.418
		(Y+X)/2											-3.646	.040	.120	.251	.213	.418
		Y/X											.00	.0	.0	.0	.0	.0
	1-1- 5 34.27	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	1.0000	.4707	6	.527	.238	-.0019	.958	2.015	-3.932	.040	.119	.190	.202	.396
		(Y+X)/2											-3.932	.040	.119	.190	.202	.396
		Y/X											.00	.0	.0	.0	.0	.0
	1-1- 6 36.09	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	1.0000	.4702	6	.610	.269	-.0020	1.076	2.030	-4.031	.040	.119	.200	.203	.399
		(Y+X)/2											-4.031	.040	.119	.200	.203	.399
		Y/X											.00	.0	.0	.0	.0	.0
	1-1- 7 37.90	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	1.0000	.4710	6	.497	.227	-.0019	.942	2.010	-3.884	.040	.119	.187	.202	.395
		(Y+X)/2											-3.884	.040	.119	.187	.202	.395
		Y/X											.00	.0	.0	.0	.0	.0
	FUEL STACK AVERAGE	Y		.0000	.0000	.0000	0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
		X		.4900	7.800	.4739	42	4.036	.631	-.0016	4.115	1.806	-3.294	.040	.120	.839	.185	.362
		(Y+X)/2											-3.294	.040	.120	.839	.185	.362
		Y/X											.00	.0	.0	.0	.0	.0

FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 2 FUEL HOLE 1

PRECISION:

LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00060

PRECISION:

LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
2-1- 1	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
42.51	X	.4900	1	.800	1.000	.4766	6	2.882	1.181	-.013	2.991	3.033	-2.738	.040	.121	.609	.312	.612
	(Y+X)/2												-2.738	.040	.121	.609	.312	.612
	Y/X												.00	.0	.0	.0	.0	.0
2-1- 2	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
44.33	X	.4900	1	.800	1.000	.4755	6	1.823	.751	-.015	1.991	2.452	-2.959	.040	.121	.404	.250	.491
	(Y+X)/2												-2.959	.040	.121	.404	.250	.491
	Y/X												.00	.0	.0	.0	.0	.0
2-1- 3	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
46.15	X	.4900	1	.800	1.000	.4754	6	.762	.327	-.015	1.105	2.063	-2.976	.040	.121	.222	.209	.410
	(Y+X)/2												-2.976	.040	.121	.222	.209	.410
	Y/X												.00	.0	.0	.0	.0	.0
2-1- 4	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
47.97	X	.4900	1	.800	1.000	.4752	6	1.002	.421	-.015	1.282	2.128	-3.010	.040	.121	.259	.216	.423
	(Y+X)/2												-3.010	.040	.121	.259	.216	.423
	Y/X												.00	.0	.0	.0	.0	.0
2-1- 5	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
49.79	X	.4900	1	.800	1.000	.4749	6	.510	.231	-.015	.949	2.012	-3.088	.040	.120	.189	.203	.399
	(Y+X)/2												-3.088	.040	.120	.189	.203	.399
	Y/X												.00	.0	.0	.0	.0	.0
2-1- 6	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
51.61	X	.4900	1	.800	1.000	.4731	6	1.571	.649	-.017	1.763	2.337	-3.442	.040	.120	.357	.238	.466
	(Y+X)/2												-3.442	.040	.120	.357	.238	.466
	Y/X												.00	.0	.0	.0	.0	.0
2-1- 7	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
53.43	X	.4900	1	.800	1.000	.4763	6	1.277	.531	-.014	1.507	2.220	-2.789	.040	.121	.305	.226	.443
	(Y+X)/2												-2.789	.040	.121	.305	.226	.443
	Y/X												.00	.0	.0	.0	.0	.0
FUEL	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
STACK	X	.4900	7	.800	.672	.4753	42	1.806	.296	-.015	1.975	1.439	-3.000	.040	.121	.401	.146	.286
AVERAGE	(Y+X)/2												-3.000	.040	.121	.401	.146	.286
	Y/X												.00	.0	.0	.0	.0	.0

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FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 3 FUEL HOLE 1

<p>PRECISION: LENGTH = .00010 DIAMETER = .00010 EQUIPMENT RANDOM ERROR: LENGTH = .00010 DIAMETER = .00060</p>	<p>PRECISION: LENGTH = .00010 DIAMETER = .00010 EQUIPMENT RANDOM ERROR: LENGTH = .00010 DIAMETER = .00010</p>
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FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	OY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
3-1- 1	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
58.23	X	.4885	2	3.536	2.571	.4740	6	.974	.410	-.015	3.668	5.104	-2.975	.040	.121	.730	.518	1.014
	(Y+X)/2												-2.975	.040	.121	.730	.518	1.014
	Y/X												.00	.0	.0	.0	.0	.0
3-1- 2	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
60.37	X	.4880	2	2.829	2.089	.4729	6	.942	.398	-.015	2.982	4.167	-3.084	.040	.121	.594	.423	.829
	(Y+X)/2												-3.084	.040	.121	.594	.423	.829
	Y/X												.00	.0	.0	.0	.0	.0
3-1- 3	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
62.51	X	.4900	2	4.243	3.060	.4734	6	2.293	.941	-.017	4.823	6.275	-3.388	.040	.120	.959	.633	1.241
	(Y+X)/2												-3.388	.040	.120	.959	.633	1.241
	Y/X												.00	.0	.0	.0	.0	.0
3-1- 4	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
64.65	X	.4875	2	3.536	2.571	.4734	6	1.318	.547	-.014	3.774	5.153	-2.892	.040	.121	.754	.524	1.028
	(Y+X)/2												-2.892	.040	.121	.754	.524	1.028
	Y/X												.00	.0	.0	.0	.0	.0
3-1- 5	Y	2.1500	1	1.900	1.903	2.0772	1	1.900	1.903	-.073	2.687	5.274	-3.386	.009	.006	.123	.123	.241
66.79	X	.4905	2	3.536	2.571	.4733	6	.765	.328	-.017	3.618	5.081	-3.513	.040	.120	.713	.510	1.000
	(Y+X)/2												-3.450	.025	.060	.362	.262	.514
	Y/X												96.37	1.4	3.3	19.9	14.4	28.3
3-1- 6	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
68.93	X	.4885	2	3.536	2.571	.4748	6	.597	.264	-.014	3.586	5.066	-2.798	.040	.121	.714	.515	1.008
	(Y+X)/2												-2.798	.040	.121	.714	.515	1.008
	Y/X												.00	.0	.0	.0	.0	.0
FUEL	Y	2.1500	1	1.900	1.903	2.0772	1	1.900	1.903	-.073	2.687	5.274	-3.386	.009	.006	.123	.123	.241
STACK	X	.4888	12	2.855	1.020	.4736	36	1.336	.244	-.015	3.152	2.055	-3.109	.040	.121	.628	.208	.408
AVERAGE	(Y+X)/2												-3.247	.025	.060	.320	.121	.237
	Y/X												108.92	1.7	4.2	22.4	8.3	16.3

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FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 3 FUEL HOLE 3

PRECISION:	PRECISION:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00010	DIAMETER = .00010
EQUIPMENT RANDOM ERROR:	EQUIPMENT RANDOM ERROR:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00010	DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN		MIL		IN		MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	OY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	OX21	UX	EX	RX	SX	EPX	DX
3-3- 1	Y	2.1430	1	1.900	1.903	2.0787	1	1.900	1.903	-.064	2.687	5.274	-3.000	.009	.007	.124	.124	.242
58.23	X	.4905	2	3.536	2.571	.4774	6	.472	.217	-.013	3.567	5.058	-2.671	.040	.121	.708	.512	1.004
	(Y+X)/2												-2.836	.025	.060	.359	.263	.516
	Y/X												112.35	2.0	5.1	30.1	22.0	43.2
3-3- 2	Y	2.1520	1	1.900	1.903	2.0793	1	1.900	1.903	-.073	2.687	5.274	-3.378	.009	.006	.123	.123	.241
60.37	X	.4880	2	1.415	1.167	.4738	6	.347	.174	-.014	1.457	2.313	-2.917	.040	.121	.290	.235	.460
	(Y+X)/2												-3.147	.025	.061	.158	.133	.260
	Y/X												115.83	1.9	4.8	12.3	10.2	20.1
3-3- 3	Y	2.1490	1	1.900	1.903	2.0816	1	1.900	1.903	-.067	2.687	5.274	-3.136	.009	.006	.123	.123	.242
62.51	X	.4895	2	4.950	3.551	.4730	6	1.351	.561	-.017	5.131	7.046	-3.374	.040	.120	1.015	.710	1.392
	(Y+X)/2												-3.255	.025	.060	.511	.360	.706
	Y/X												92.95	1.4	3.3	28.2	19.9	39.0
3-3- 4	Y	2.1430	1	1.900	1.903	2.0718	1	1.900	1.903	-.071	2.687	5.274	-3.322	.009	.006	.123	.124	.242
64.65	X	.4885	2	3.536	2.571	.4726	6	.582	.258	-.016	3.584	5.065	-3.262	.040	.121	.710	.512	1.003
	(Y+X)/2												-3.292	.025	.060	.360	.263	.516
	Y/X												101.86	1.5	3.8	22.5	16.4	32.2
3-3- 5	Y	2.1490	1	1.900	1.903	2.0825	1	1.900	1.903	-.066	2.687	5.274	-3.094	.009	.006	.123	.123	.242
66.79	X	.4905	2	4.950	3.551	.4757	6	1.466	.607	-.015	5.162	7.061	-3.011	.040	.120	1.023	.713	1.397
	(Y+X)/2												-3.052	.025	.060	.515	.362	.709
	Y/X												102.79	1.7	4.1	35.2	24.7	48.4
3-3- 6	Y	2.1420	1	1.900	1.903	2.0733	1	1.900	1.903	-.069	2.687	5.274	-3.207	.009	.006	.123	.124	.242
68.93	X	.4895	2	6.364	4.540	.4729	6	.954	.402	-.017	6.435	8.933	-3.388	.040	.120	1.271	.900	1.764
	(Y+X)/2												-3.298	.025	.060	.639	.454	.890
	Y/X												94.67	1.4	3.4	35.7	25.4	49.8
FUEL	Y	2.1463	6	4.262	1.743	2.0779	6	4.425	1.609	-.068	6.144	4.924	-3.190	.009	.006	.282	.115	.226
STACK	X	.4894	12	3.397	1.150	.4742	36	1.995	.347	-.015	3.939	2.354	-3.103	.040	.121	.786	.238	.467
AVERAGE	(Y+X)/2												-3.147	.025	.060	.418	.132	.260
	Y/X												102.79	1.6	4.0	27.6	8.7	17.1

FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 3 FUEL HOLE 5

PRECISION: PRECISION:
LENGTH = .00010 LENGTH = .00010
DIAMETER = .00010 DIAMETER = .00010
EQUIPMENT RANDOM ERROR: EQUIPMENT RANDOM ERROR:
LENGTH = .00010 LENGTH = .00010
DIAMETER = .00060 DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN		MIL		IN		MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
B-24 3-5- 1 58.23	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	X	.4890	2	4.243	3.059	.4737	6	2.688	1.102	-.015	5.022	6.374	-3.119	.040	.121	1.004	.647	1.267
	(Y+X)/2												-3.119	.040	.121	1.004	.647	1.267
	Y/X												.00	.0	.0	.0	.0	.0
3-5- 2 60.37	Y	2.1490	1	1.900	1.903	2.0524	1	1.900	1.903	-.097	2.687	5.274	-4.495	.009	.006	.122	.122	.240
	X	.4885	2	4.950	3.551	.4741	6	.838	.357	-.014	5.020	6.995	-2.941	.040	.121	.998	.709	1.390
	(Y+X)/2												-3.718	.025	.061	.503	.360	.705
	Y/X												152.84	2.4	6.3	52.0	37.1	72.7
3-5- 3 62.51	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	X	.4895	2	4.950	3.551	.4745	6	.642	.281	-.015	4.991	6.982	-3.071	.040	.121	.989	.706	1.383
	(Y+X)/2												-3.071	.040	.121	.989	.706	1.383
	Y/X												.00	.0	.0	.0	.0	.0
3-5- 4 64.65	Y	2.1440	1	1.900	1.903	2.0641	1	1.900	1.903	-.080	2.687	5.274	-3.727	.009	.006	.123	.123	.241
	X	.4905	2	3.536	2.571	.4737	6	.316	.164	-.017	3.550	5.050	-3.422	.040	.120	.699	.507	.995
	(Y+X)/2												-3.574	.025	.060	.355	.261	.512
	Y/X												108.91	1.5	3.8	22.5	16.5	32.4
3-5- 5 66.79	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	X	.4895	2	2.121	1.616	.4744	6	.216	.134	-.015	2.132	3.178	-3.078	.040	.121	.422	.321	.629
	(Y+X)/2												-3.078	.040	.121	.422	.321	.629
	Y/X												.00	.0	.0	.0	.0	.0
3-5- 6 66.93	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	X	.4895	2	3.536	2.571	.4720	6	.388	.188	-.018	3.557	5.053	-3.575	.040	.120	.701	.508	.996
	(Y+X)/2												-3.575	.040	.120	.701	.508	.996
	Y/X												.00	.0	.0	.0	.0	.0
FUEL STACK AVERAGE	Y	2.1465	2	3.140	2.223	2.0582	2	6.151	4.350	-.088	6.906	9.575	-4.111	.009	.006	.319	.226	.442
	X	.4894	12	3.029	1.060	.4737	36	1.397	.253	-.016	3.336	2.137	-3.201	.040	.120	.664	.216	.423
	(Y+X)/2												-3.656	.025	.060	.368	.156	.306
	Y/X												128.44	1.9	4.8	28.4	11.2	21.9

FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 3 FUEL HOLE 7

PRECISION:

LENGTH = .00010
DIAMETER = .00010

EQUIPMENT RANDOM ERROR:

LENGTH = .00010
DIAMETER = .00060

PRECISION:

LENGTH = .00010
DIAMETER = .00010

EQUIPMENT RANDOM ERROR:

LENGTH = .00010
DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
3-7- 1	Y	2.1450	1	1.900	1.903	2.0742	1	1.900	1.903	-.071	2.687	5.274	-3.301	.009	.006	.123	.123	.242
58.23	X	.4905	2	4.950	3.551	.4760	6	3.160	1.294	-.014	5.872	7.408	-2.946	.040	.120	1.172	.751	1.471
	(Y+X)/2												-3.123	.025	.060	.589	.380	.745
	Y/X												112.04	1.8	4.6	44.8	28.8	56.5
3-7- 2	Y	2.1370	1	1.900	1.903	2.0410	1	1.900	1.903	-.096	2.687	5.274	-4.492	.009	.006	.123	.123	.241
60.37	X	.4910	2	4.243	3.659	.4760	6	2.493	1.023	-.015	4.921	6.323	-3.048	.040	.120	.980	.639	1.252
	(Y+X)/2												-3.770	.025	.060	.494	.325	.638
	Y/X												147.37	2.2	5.8	47.5	31.2	61.1
3-7- 3	Y	2.1600	1	1.900	1.903	2.0955	1	1.900	1.903	-.065	2.687	5.274	-2.986	.009	.006	.123	.123	.241
62.51	X	.4900	2	2.829	2.039	.4743	6	.458	.212	-.016	2.866	4.115	-3.201	.040	.120	.567	.415	.813
	(Y+X)/2												-3.093	.025	.060	.290	.216	.424
	Y/X												93.30	1.5	3.5	17.0	12.7	24.9
3-7- 4	Y	2.1450	1	1.900	1.903	2.0729	1	1.900	1.903	-.072	2.687	5.274	-3.361	.009	.006	.123	.123	.242
64.65	X	.4890	2	4.243	3.659	.4726	6	.241	.141	-.016	4.249	6.003	-3.361	.040	.120	.840	.605	1.186
	(Y+X)/2												-3.361	.025	.060	.424	.309	.605
	Y/X												100.02	1.5	3.6	25.3	18.4	36.0
3-7- 5	Y	2.1410	1	1.900	1.903	2.0672	1	1.900	1.903	-.074	2.687	5.274	-3.447	.009	.006	.123	.124	.242
66.79	X	.4890	2	5.657	4.045	.4730	6	1.847	.761	-.016	5.951	8.067	-3.269	.040	.120	1.181	.815	1.598
	(Y+X)/2												-3.358	.025	.060	.594	.412	.808
	Y/X												105.46	1.6	3.9	38.3	26.6	52.1
3-7- 6	Y	2.1550	1	1.900	1.903	2.0872	1	1.900	1.903	-.068	2.687	5.274	-3.146	.009	.006	.123	.123	.241
68.93	X	.4900	2	4.243	3.660	.4735	6	1.536	.635	-.016	4.513	6.125	-3.364	.040	.120	.894	.617	1.210
	(Y+X)/2												-3.255	.025	.060	.451	.315	.617
	Y/X												93.53	1.4	3.3	25.1	17.5	34.4
FUEL	Y	2.1472	6	8.150	3.329	2.0730	6	17.266	7.049	-.074	19.092	15.280	-3.454	.009	.006	.884	.361	.707
STACK	X	.4899	12	3.370	1.143	.4742	36	2.262	.390	-.016	4.059	2.367	-3.198	.040	.120	.810	.239	.469
AVERAGE	(Y+X)/2												-3.326	.025	.060	.599	.217	.424
	Y/X												108.02	1.6	4.1	38.9	13.9	27.2

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FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 4 FUEL HOLE 1

PRECISION:
LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00010

PRECISION:
LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL			IN	MIL			IN	MIL		%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
4-1- 1	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
73.67	X	.4900	1	.800	1.000	.4738	6	1.704	.703	-.016	1.883	2.397	-3.313	.040	.120	.382	.244	.478
	(Y+X)/2												-3.313	.040	.120	.382	.244	.478
	Y/X												.00	.0	.0	.0	.0	.0
4-1- 2	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
75.49	X	.4900	1	.800	1.000	.4730	6	1.256	.523	-.017	1.489	2.212	-3.476	.040	.120	.301	.224	.439
	(Y+X)/2												-3.476	.040	.120	.301	.224	.439
	Y/X												.00	.0	.0	.0	.0	.0
4-1- 3	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
77.31	X	.4900	1	.800	1.000	.4729	6	1.510	.624	-.017	1.708	2.311	-3.486	.040	.120	.346	.235	.460
	(Y+X)/2												-3.486	.040	.120	.346	.235	.460
	Y/X												.00	.0	.0	.0	.0	.0
4-1- 4	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
79.13	X	.4900	1	.800	1.000	.4728	6	1.357	.563	-.017	1.576	2.250	-3.510	.040	.120	.319	.228	.447
	(Y+X)/2												-3.510	.040	.120	.319	.228	.447
	Y/X												.00	.0	.0	.0	.0	.0
4-1- 5	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
80.94	X	.4900	1	.800	1.000	.4739	6	.548	.245	-.016	.970	2.019	-3.282	.040	.120	.194	.204	.399
	(Y+X)/2												-3.282	.040	.120	.194	.204	.399
	Y/X												.00	.0	.0	.0	.0	.0
4-1- 6	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
82.76	X	.4900	1	.800	1.000	.4726	6	.998	.420	-.017	1.279	2.126	-3.544	.040	.120	.257	.215	.421
	(Y+X)/2												-3.544	.040	.120	.257	.215	.421
	Y/X												.00	.0	.0	.0	.0	.0
4-1- 7	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
84.58	X	.4900	1	.800	1.000	.4742	6	.851	.362	-.016	1.168	2.085	-3.228	.040	.120	.235	.211	.413
	(Y+X)/2												-3.228	.040	.120	.235	.211	.413
	Y/X												.00	.0	.0	.0	.0	.0
FUEL STACK	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
AVERAGE	X	.4900	7	.800	.672	.4733	42	1.279	.221	-.017	1.509	1.387	-3.406	.040	.120	.305	.140	.274
	(Y+X)/2												-3.406	.040	.120	.305	.140	.274
	Y/X												.00	.0	.0	.0	.0	.0

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FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 5 FUEL HOLE 1

PRECISION:
LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00060

PRECISION:
LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	OY21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	OX21	UX	EX	RX	SX	EPX	DX
5-1- 1	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
89.22	X	.4900	1	.800	1.000	.4739	6	1.922	.791	-.016	2.081	2.500	-3.289	.040	.120	.423	.255	.500
	(Y+X)/2												-3.289	.040	.120	.423	.255	.500
	Y/X												.00	.0	.0	.0	.0	.0
5-1- 2	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
91.04	X	.4900	1	.800	1.000	.4720	6	.567	.252	-.018	.981	2.022	-3.673	.040	.120	.195	.203	.398
	(Y+X)/2												-3.673	.040	.120	.195	.203	.398
	Y/X												.00	.0	.0	.0	.0	.0
5-1- 3	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
92.86	X	.4900	1	.800	1.000	.4729	6	.795	.340	-.017	1.128	2.071	-3.480	.040	.120	.226	.209	.409
	(Y+X)/2												-3.480	.040	.120	.226	.209	.409
	Y/X												.00	.0	.0	.0	.0	.0
5-1- 4	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
94.67	X	.4900	1	.800	1.000	.4739	6	.987	.415	-.016	1.270	2.123	-3.279	.040	.120	.256	.215	.421
	(Y+X)/2												-3.279	.040	.120	.256	.215	.421
	Y/X												.00	.0	.0	.0	.0	.0
5-1- 5	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
96.49	X	.4900	1	.800	1.000	.4728	6	1.358	.564	-.017	1.576	2.251	-3.503	.040	.120	.319	.228	.447
	(Y+X)/2												-3.503	.040	.120	.319	.228	.447
	Y/X												.00	.0	.0	.0	.0	.0
5-1- 6	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
98.31	X	.4900	1	.800	1.000	.4735	6	1.726	.431	-.017	1.301	2.135	-3.371	.040	.120	.262	.216	.423
	(Y+X)/2												-3.371	.040	.120	.262	.216	.423
	Y/X												.00	.0	.0	.0	.0	.0
5-1- 7	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
100.12	X	.4900	1	.800	1.000	.4718	6	.612	.270	-.018	1.008	2.031	-3.707	.040	.120	.201	.204	.400
	(Y+X)/2												-3.707	.040	.120	.201	.204	.400
	Y/X												.00	.0	.0	.0	.0	.0
FUEL STACK	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
AVERAGE	X	.4900	7	.800	.672	.4730	42	1.308	.225	-.017	1.533	1.389	-3.472	.040	.120	.310	.140	.275
	(Y+X)/2												-3.472	.040	.120	.310	.140	.275
	Y/X												.00	.0	.0	.0	.0	.0

FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 6 FUEL HOLE 1

PRECISION:	PRECISION:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00010	DIAMETER = .00010
EQUIPMENT RANDOM ERROR:	EQUIPMENT RANDOM ERROR:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00060	DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN							
		IN		MIL	MIL	IN		MIL	MIL	IN	MIL	MIL	%	%	%	%	%	%		
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	DY		
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX		
													V	EV	RV	SV	EPV	DV		
6-1- 1 104.72	Y X (Y+X)/2 Y/X	.0000 .4880	0 1	.000 .807	.000 1.000	.0000 .4760	0 6	.000 .910	.000 .385	.000 -.012	.000 1.212	.000 2.101	.000 -2.466 -2.466 .00	.000 .040 .040 .0	.000 .122 .122 .0	.000 .246 .246 .0	.000 .215 .215 .0	.000 .421 .421 .0		
6-1- 2 106.85	Y X (Y+X)/2 Y/X	2.1000 .4895	1 1	1.900 .800	1.903 1.000	2.0761 .4774	1 6	1.900 1.505	1.903 .623	-.024 -.012	2.687 1.705	5.274 2.310	-1.138 -2.475 -1.807 45.98	.009 .040 .025 1.1	.007 .121 .061 2.3	.127 .346 .184 8.2	.127 .236 .134 6.8	.250 .463 .263 13.3		
6-1- 3 108.98	Y X (Y+X)/2 Y/X	2.1020 .4890	1 1	1.900 .800	1.903 1.000	2.1029 .4778	1 6	1.900 .842	1.903 .358	.001 -.011	2.687 1.161	5.274 2.083	.043 -2.287 -1.122 -1.87	.010 .040 .025 .4	.007 .122 .061 .3	.128 .235 .134 5.6	.128 .213 .124 5.6	.251 .417 .243 11.0		
6-1- 4 111.12	Y X (Y+X)/2 Y/X	2.1310 .4895	1 1	1.900 .800	1.903 1.000	2.0970 .4779	1 6	1.900 .821	1.903 .350	-.034 -.012	2.687 1.146	5.274 2.077	-1.595 -2.370 -1.983 67.33	.009 .040 .025 1.5	.007 .121 .061 3.5	.125 .231 .132 8.4	.125 .212 .123 8.0	.246 .415 .241 15.7		
6-1- 5 113.25	Y X (Y+X)/2 Y/X	2.1350 .4870	1 1	1.900 .800	1.903 1.000	2.0792 .4788	1 6	1.900 .728	1.903 .314	-.056 -.008	2.687 1.082	5.274 2.055	-2.614 -1.684 -2.149 155.22	.009 .041 .025 4.3	.007 .123 .062 11.3	.124 .220 .126 21.6	.124 .212 .123 20.9	.244 .416 .241 41.0		
6-1- 6 115.38	Y X (Y+X)/2 Y/X	.0000 .4895	0 1	.000 .800	.000 1.000	.0000 .4782	0 6	.000 1.188	.000 .495	.000 -.011	.000 1.432	.000 2.188	.000 -2.312 -2.312 .00	.000 .040 .040 .0	.000 .121 .121 .0	.000 .291 .291 .0	.000 .224 .224 .0	.000 .439 .439 .0		
FUEL STACK AVERAGE	Y X (Y+X)/2 Y/X	2.1170 .4887	4 6	16.190 1.239	8.096 .785	2.0888 .4777	4 36	11.554 1.306	5.778 .240	-.028 -.011	19.890 1.800	19.494 1.609	-1.332 -2.266 -1.799 58.79	.009 .040 .025 1.5	.007 .122 .061 3.2	.931 .364 .500 42.2	.466 .164 .247 21.0	.913 .322 .484 41.1		

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FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 6 FUEL HOLE 5

PRECISION:

LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00060

PRECISION:

LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00010

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
6-5- 1	Y	2.1120	1	1.900	1.903	2.1146	1	1.900	1.903	.003	2.687	5.274	.123	.009	.007	.127	.127	.250
104.72	X	.4896	1	.807	1.000	.4773	6	.576	.256	-.012	.985	2.024	-2.505	.040	.121	.198	.206	.404
	(Y+X)/2												-1.191	.025	.061	.118	.121	.237
	Y/X												-4.91	.3	.4	5.1	5.1	10.0
6-5- 2	Y	2.1380	1	1.900	1.903	2.0811	1	1.900	1.903	-.057	2.687	5.274	-2.661	.009	.007	.124	.124	.243
106.85	X	.4880	1	.800	1.000	.4789	6	1.219	.508	-.009	1.458	2.199	-1.858	.041	.122	.297	.227	.444
	(Y+X)/2												-2.260	.025	.061	.161	.129	.253
	Y/X												143.24	3.6	9.4	23.9	18.7	36.7
6-5- 3	Y	2.1710	1	1.900	1.903	2.0475	1	1.900	1.903	-.123	2.687	5.274	-5.689	.009	.006	.120	.120	.236
108.98	X	.4880	1	.800	1.000	.4793	6	1.310	.544	-.009	1.535	2.232	-1.783	.041	.122	.313	.230	.451
	(Y+X)/2												-3.736	.025	.061	.168	.130	.255
	Y/X												319.09	7.8	21.9	56.4	41.7	81.8
6-5- 5	Y	2.1100	1	1.900	1.903	2.0536	1	1.900	1.903	-.056	2.687	5.274	-2.673	.009	.007	.126	.126	.247
113.25	X	.4899	1	.800	1.000	.4779	6	.403	.193	-.012	.896	1.997	-2.456	.040	.121	.179	.203	.398
	(Y+X)/2												-2.565	.025	.061	.109	.119	.234
	Y/X												108.82	2.2	5.4	9.4	10.4	20.3
6-5- 6	Y	2.1270	1	1.900	1.903	2.0868	1	1.900	1.903	-.040	2.687	5.274	-1.890	.009	.007	.125	.125	.246
115.38	X	.4888	1	.800	1.000	.4784	6	1.157	.483	-.010	1.407	2.177	-2.131	.040	.122	.286	.223	.438
	(Y+X)/2												-2.011	.025	.061	.156	.128	.251
	Y/X												88.69	2.1	5.1	13.3	11.0	21.6
FUEL	Y	2.1316	5	22.286	9.967	2.0767	5	24.340	10.885	-.055	33.001	28.928	-2.575	.009	.007	1.530	.684	1.341
STACK	X	.4889	5	1.124	.783	.4784	30	1.178	.237	-.010	1.628	1.603	-2.147	.040	.122	.330	.164	.321
AVERAGE	(Y+X)/2												-2.361	.025	.061	.783	.352	.690
	Y/X												119.91	2.7	6.8	73.6	33.2	65.0

FUEL ROD DATA, TEST ELEMENT RTE-6
FUEL BODY 6 FUEL HOLE 7

PRECISION:

LENGTH = .00010
DIAMETER = .00010

EQUIPMENT RANDOM ERROR:

LENGTH = .00010
DIAMETER = .00060

PRECISION:

LENGTH = .00010
DIAMETER = .00010

EQUIPMENT RANDOM ERROR:

LENGTH = .00010
DIAMETER = .00010

B-30

FUEL ROD CORE HEIGHT (IN)	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN Y1 X1	MIL NY1 NX1	MIL SY1 SX1	MIL EY1 EX1	IN Y2 X2	MIL NY2 NX2	MIL SY2 SX2	MIL EY2 EX2	IN Y21 X21	MIL SY21 SX21	MIL DY21 DX21	% UY UX V W EW	% EY EX EV V EW	% RY RX RV SV RW	% SY SX SV SW	% EPY EPX EPV EPW	% DY DX DV DW
6-7- 2 106.85	Y X (Y+X)/2 Y/X	2.1620 .4890	1 1	1.900 .800	1.903 1.000	2.1092 .4797	1 6	1.900 .785	1.903 .336	-.053 -0.009	2.687 1.121	5.274 2.068	-2.442 -1.892 -2.167 129.11	.009 .041 .025 3.2	.006 .122 .061 8.3	.123 .227 .129 16.8	.123 .212 .123 15.9	.241 .416 .240 31.1
6-7- 3 108.98	Y X (Y+X)/2 Y/X	2.1430 .4885	1 1	1.900 .800	1.903 1.000	2.0977 .4798	1 6	1.900 .487	1.903 .223	-.045 -0.009	2.687 .937	5.274 2.009	-2.114 -1.774 -1.944 119.15	.009 .041 .025 3.2	.007 .122 .061 8.2	.124 .189 .113 14.5	.124 .206 .120 15.5	.244 .404 .236 30.4
6-7- 4 111.12	Y X (Y+X)/2 Y/X	2.1610 .4885	1 1	1.900 .800	1.903 1.000	2.1136 .4803	1 6	1.900 .274	1.903 .151	-.047 -0.008	2.687 .846	5.274 1.983	-2.193 -1.679 -1.936 130.67	.009 .041 .025 3.7	.006 .122 .061 9.5	.123 .171 .105 15.2	.123 .204 .119 17.5	.241 .399 .233 34.2
6-7- 5 113.25	Y X (Y+X)/2 Y/X	2.1440 .4895	1 1	1.900 .800	1.903 1.000	2.0981 .4809	1 6	1.900 .885	1.903 .375	-.046 -0.009	2.687 1.193	5.274 2.094	-2.141 -1.760 -1.951 121.62	.009 .040 .025 3.3	.007 .122 .061 8.4	.124 .242 .136 18.1	.124 .215 .124 16.4	.243 .421 .243 32.2
6-7- 6 115.38	Y X (Y+X)/2 Y/X	2.1530 .4900	1 1	1.900 .800	1.903 1.000	2.1181 .4807	1 6	1.900 1.264	1.903 .526	-.035 -0.009	2.687 1.496	5.274 2.215	-1.621 -1.888 -1.754 85.87	.009 .040 .025 2.3	.007 .122 .061 5.6	.124 .304 .164 15.3	.124 .227 .129 12.2	.243 .445 .254 24.0
FUEL STACK AVERAGE	Y X (Y+X)/2 Y/X	2.1526 .4891	5 5	8.286 .990	3.707 .746	2.1073 .4803	5 30	8.424 .889	3.768 .191	-.045 -0.009	11.816 1.331	10.361 1.509	-2.103 -1.799 -1.951 116.90	.009 .041 .025 3.1	.007 .122 .061 8.0	.543 .269 .303 34.9	.243 .155 .144 16.8	.476 .303 .282 33.0

FUEL ROD DATA, TEST ELEMENT RTE-6
STRATUM 1

<p>PRECISION: LENGTH = .00010 DIAMETER = .00010 EQUIPMENT RANDOM ERROR: LENGTH = .00010 DIAMETER = .00060</p>	<p>PRECISION: LENGTH = .00010 DIAMETER = .00010 EQUIPMENT RANDOM ERROR: LENGTH = .00010 DIAMETER = .00010</p>
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		PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN						
BODY HOLE	LENGTH DIAMETER LEN + DIAM ANISOTROPY	IN		MIL	MIL	IN		MIL	MIL	IN	MIL	MIL	%	%	%	%	%	%	
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	OY21	UY	EY	RY	SY	EPY	DY	
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX	
													V	EV	RV	SV	EPV	DV	
													W	EW	RW	SW	EPW	DW	
3	1	Y	2.1500	2	1.900	1.903	2.0772	2	1.900	1.903	-.073	2.687	5.274	-3.386	.009	.006	.123	.123	.241
		X	.4888	12	2.855	1.020	.4736	36	1.336	.244	-.015	3.152	2.055	-3.109	.040	.121	.628	.208	.408
		(Y+X)/2												-3.247	.025	.060	.320	.121	.237
		Y/X												108.92	1.7	4.2	22.4	8.3	16.3
3	3	Y	2.1463	6	4.262	1.743	2.0779	6	4.425	1.809	-.068	6.144	4.924	-3.190	.009	.006	.282	.115	.226
		X	.4894	12	3.397	1.150	.4742	36	1.995	.347	-.015	3.939	2.354	-3.103	.040	.121	.786	.238	.467
		(Y+X)/2												-3.147	.025	.060	.418	.132	.260
		Y/X												102.79	1.6	4.0	27.6	8.7	17.1
3	5	Y	2.1465	2	3.140	2.223	2.0582	2	6.151	4.350	-.088	6.906	9.575	-4.111	.009	.006	.319	.226	.442
		X	.4894	12	3.029	1.060	.4737	36	1.397	.253	-.016	3.336	2.137	-3.201	.040	.120	.664	.216	.423
		(Y+X)/2												-3.656	.025	.060	.368	.156	.306
		Y/X												128.44	1.9	4.8	28.4	11.2	21.9
3	7	Y	2.1472	6	8.150	3.329	2.0730	6	17.266	7.049	-.074	19.092	15.280	-3.454	.009	.006	.864	.361	.707
		X	.4899	12	3.370	1.143	.4742	36	2.262	.390	-.016	4.059	2.367	-3.198	.040	.120	.810	.239	.469
		(Y+X)/2												-3.326	.025	.060	.599	.217	.424
		Y/X												108.02	1.6	4.1	38.9	13.9	27.2
STRATUM	Y	2.1471	16	5.522	1.384	2.0735	16	12.216	3.056	-.074	13.406	6.575	-3.429	.009	.006	.621	.155	.304	
AVERAGE	X	.4894	48	3.093	.748	.4740	144	1.794	.180	-.015	3.575	1.508	-3.153	.040	.120	.713	.152	.299	
	(Y+X)/2												-3.291	.025	.060	.473	.109	.213	
	Y/X												108.75	1.7	4.2	31.5	7.2	14.1	

FUEL ROD DATA, TEST ELEMENT RTE-6
STRATUM 2

PRECISION:	PRECISION:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00010	DIAMETER = .00010
EQUIPMENT RANDOM ERROR:	EQUIPMENT RANDOM ERROR:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00060	DIAMETER = .00010

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BODY HOLE	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN Y1 X1	NY1 NX1	MIL SY1 SX1	MIL EY1 EX1	IN Y2 X2	NY2 NX2	MIL SY2 SX2	MIL EY2 EX2	IN Y21 X21	MIL SY21 SX21	MIL DY21 DX21	% UY UX V W	% EY EX EV EW	% RY RX RV RW	% SY SX SV SW	% EPY EPX EPV EPW	% DY DX DV DW
6	1	Y 2.1170 X .4887 (Y+X)/2 Y/X		4 16.190 6 1.239	8.096 .785	2.0888 .4777 36	4 11.554 1.306	5.778 .240		-0.028 -0.011 19.890 1.800	19.494 1.609		-1.332 -2.266 -1.799 58.79	.009 .040 .025 1.5	.007 .122 .061 3.2	.931 .364 .500 42.2	.466 .164 .247 21.0	.913 .322 .484 41.1
6	5	Y 2.1316 X .4889 (Y+X)/2 Y/X		5 22.286 5 1.124	9.967 .783	2.0767 .4784 30	5 24.340 1.178	10.885 .237		-0.055 -0.010 33.001 1.628	28.928 1.603		-2.575 -2.147 -2.361 119.91	.009 .040 .025 2.7	.007 .122 .061 6.8	1.530 .330 .783 73.6	.684 .164 .352 33.2	1.341 .321 .690 65.0
6	7	Y 2.1526 X .4891 (Y+X)/2 Y/X		5 8.286 5 .990	3.707 .746	2.1073 .4803 30	5 8.424 .989	3.768 .191		-0.045 -0.009 11.816 1.331	10.361 1.509		-2.103 -1.799 -1.951 116.90	.009 .041 .025 3.1	.007 .122 .061 8.0	.543 .269 .303 34.9	.243 .155 .144 16.8	.476 .303 .282 33.0
STRATUM AVERAGE	Y X (Y+X)/2 Y/X	2.1349 .4889	14 16	21.394 1.064	5.719 .656	2.0911 .4787 96	14 20.433 1.593	5.462 .191		-0.044 -0.010 29.584 1.916	15.500 1.340		-2.053 -2.083 -2.068 98.55	.009 .040 .025 2.4	.007 .122 .061 5.8	1.371 .389 .713 68.4	.366 .137 .196 18.8	.718 .269 .383 36.8

FUEL ROD DATA, TEST ELEMENT RTE-6
STRATUM 3

PRECISION:	PRECISION:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00010	DIAMETER = .00010
EQUIPMENT RANDOM ERROR:	EQUIPMENT RANDOM ERROR:
LENGTH = .00010	LENGTH = .00010
DIAMETER = .00060	DIAMETER = .00010

BODY HOLE	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN Y1 X1	NY1 NX1	MIL SY1 SX1	MIL EY1 EX1	IN Y2 X2	NY2 NX2	MIL SY2 SX2	MIL EY2 EX2	IN Y21 X21	MIL SY21 SX21	MIL DY21 DX21	% UY UX V W	% EY EX EV EW	% RY RX RV RW	% SY SX SV SW	% EPY EPX EPV EPW	% DY DX DV DW
2	1	Y .0000 X .4900 (Y+X)/2 Y/X	0 7	.000 .800	.000 .672	.0000 .4753	0 42	.000 1.876	.000 .296	.000 -0.015	.000 1.975	.000 1.439	.000 -3.000 -3.000 .00	.000 .040 .040 .0	.000 .121 .121 .0	.000 .401 .401 .0	.000 .146 .146 .0	.000 .286 .286 .0
4	1	Y .0000 X .4900 (Y+X)/2 Y/X	0 7	.000 .800	.000 .672	.0000 .4733	0 42	.000 1.279	.000 .221	.000 -0.017	.000 1.509	.000 1.387	.000 -3.406 -3.406 .00	.000 .040 .040 .0	.000 .120 .120 .0	.000 .305 .305 .0	.000 .140 .140 .0	.000 .274 .274 .0
5	1	Y .0000 X .4900 (Y+X)/2 Y/X	0 7	.000 .800	.000 .672	.0000 .4730	0 42	.000 1.308	.000 .225	.000 -0.017	.000 1.533	.000 1.389	.000 -3.472 -3.472 .00	.000 .040 .040 .0	.000 .120 .120 .0	.000 .310 .310 .0	.000 .140 .140 .0	.000 .275 .275 .0
STRATUM AVERAGE	Y X (Y+X)/2 Y/X	2.1349 .4900	14 21	21.394 .759	5.719 .622	2.0911 .4739	14 126	20.433 1.794	5.462 .189	-0.044 -0.016	29.584 1.948	15.500 1.275	.000 -3.293 -3.293 .00	.000 .040 .040 .0	.000 .120 .120 .0	.000 .396 .396 .0	.000 .129 .129 .0	.000 .252 .252 .0

FUEL ROD DATA, TEST ELEMENT RTE-6

PRECISION:
LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00060

PRECISION:
LENGTH = .00010
DIAMETER = .00010
EQUIPMENT RANDOM ERROR:
LENGTH = .00010
DIAMETER = .00010

B-34

BODY HOLE	LENGTH DIAMETER LEN + DIAM ANISOTROPY	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
		Y1	NY1	SY1	EY1	Y2	NY2	SY2	EY2	Y21	SY21	DY21	UY	EY	RY	SY	EPY	DY
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
1	1	Y	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
		X	.4900	7	.800	.672	.4739	42	4.036	.631	-.016	4.115	1.806	-3.294	.040	.120	.839	.185
		(Y+X)/2												-3.294	.040	.120	.839	.185
		Y/X												.00	.0	.0	.0	.0
2	1	Y	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
		X	.4900	7	.800	.672	.4753	42	1.806	.296	-.015	1.975	1.439	-3.000	.040	.121	.401	.146
		(Y+X)/2												-3.000	.040	.121	.401	.146
		Y/X												.00	.0	.0	.0	.0
3	1	Y	2.1500	2	1.900	1.903	2.0772	2	1.900	1.903	-.073	2.687	5.274	-3.386	.009	.006	.123	.123
		X	.4888	12	2.855	1.020	.4736	36	1.336	.244	-.015	3.152	2.055	-3.109	.040	.121	.628	.208
		(Y+X)/2												-3.247	.025	.060	.320	.121
		Y/X												108.92	1.7	4.2	22.4	8.3
3	3	Y	2.1463	6	4.262	1.743	2.0779	6	4.425	1.809	-.068	6.144	4.924	-3.190	.009	.006	.282	.115
		X	.4894	12	3.397	1.150	.4742	36	1.995	.347	-.015	3.939	2.354	-3.103	.040	.121	.786	.238
		(Y+X)/2												-3.147	.025	.060	.418	.132
		Y/X												102.79	1.6	4.0	27.6	8.7
3	5	Y	2.1465	2	3.140	2.223	2.0582	2	6.151	4.350	-.088	6.906	9.575	-4.111	.009	.006	.319	.226
		X	.4894	12	3.729	1.060	.4737	36	1.397	.253	-.016	3.336	2.137	-3.201	.040	.120	.664	.216
		(Y+X)/2												-3.656	.025	.060	.368	.156
		Y/X												128.44	1.9	4.8	28.4	11.2
3	7	Y	2.1472	6	8.150	3.329	2.0730	6	17.266	7.049	-.074	19.092	15.280	-3.454	.009	.006	.884	.361
		X	.4899	12	3.370	1.143	.4742	36	2.262	.390	-.016	4.059	2.367	-3.198	.040	.120	.810	.239
		(Y+X)/2												-3.326	.025	.060	.599	.217
		Y/X												108.02	1.6	4.1	38.9	13.9
4	1	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
		X	.4900	7	.800	.672	.4733	42	1.279	.221	-.017	1.509	1.387	-3.406	.040	.120	.305	.140
		(Y+X)/2												-3.406	.040	.120	.305	.140
		Y/X												.00	.0	.0	.0	.0
5	1	Y	.0000	0	.000	.000	.0000	0	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
		X	.4900	7	.800	.672	.4730	42	1.308	.225	-.017	1.533	1.389	-3.472	.040	.120	.310	.140
		(Y+X)/2												-3.472	.040	.120	.310	.140
		Y/X												.00	.0	.0	.0	.0
6	1	Y	2.1170	4	16.190	8.096	2.0888	4	11.554	5.778	-.028	19.890	19.494	-1.332	.009	.007	.931	.466

		X	.4887	6	1.239	.785	.4777	36	1.306	.240	-.011	1.800	1.609	-2.266	.040	.122	.364	.164	.322
		(Y+X)/2												-1.799	.025	.061	.500	.247	.484
		Y/X												58.79	1.5	3.2	42.2	21.0	41.1
6	5	Y	2.1316	5	22.286	9.967	2.7767	5	24.340	10.885	-.055	33.001	28.928	-2.575	.009	.007	1.530	.684	1.341
		X	.4889	5	1.124	.783	.4784	30	1.178	.237	-.010	1.628	1.603	-2.147	.040	.122	.330	.164	.321
		(Y+X)/2												-2.361	.025	.061	.783	.352	.690
		Y/X												119.91	2.7	6.8	73.6	33.2	65.0
6	7	Y	2.1526	5	8.286	3.707	2.1073	5	8.424	3.768	-.045	11.816	10.361	-2.103	.009	.007	.543	.243	.476
		X	.4891	5	.990	.746	.4803	30	.889	.191	-.009	1.331	1.509	-1.799	.041	.122	.269	.155	.303
		(Y+X)/2												-1.951	.025	.061	.303	.144	.282
		Y/X												116.90	3.1	8.0	34.9	16.8	33.0
FUEL		Y	2.1414	30	16.101	2.941	2.0817	30	18.550	3.388	-.060	24.563	8.794	-2.788	.009	.007	1.133	.207	.406
ELEMENT		X	.4895	92	2.333	.647	.4750	408	2.917	.176	-.014	3.736	1.315	-2.952	.040	.121	.754	.133	.261
AVERAGE		(Y+X)/2												-2.870	.025	.060	.681	.123	.241
		Y/X												94.45	1.6	3.9	45.3	8.2	16.1

FUEL ROD AVERAGE SAMPLE STANDARD DEVIATIONS

FUEL BODY	FUEL HOLE	PRE-IRRAD. LENGTH	POST-IRRAD. LENGTH	PRE-IRRAD. DIAMETER	POST-IRRAD. DIAMETER
1	1			.8000	1.4165
2	1			.8000	1.5843
3	1	1.9000	1.9000	3.5595	1.2762
3	3	1.9000	1.9000	4.4067	.9631
3	5	1.9000	1.9000	4.0106	1.1997
3	7	1.9000	1.9000	4.4442	1.9250
4	1			.8000	1.2320
5	1			.8000	1.1271
6	1	1.9000	1.9000	.8000	1.0344
6	5	1.9000	1.9000	.8000	1.0036
6	7	1.9000	1.9000	.8000	.8135
TOTAL ELEMENT				4.1208	1.2840

ALL STANDARD DEVIATIONS ARE GIVEN IN MILS

THE AVERAGE SAMPLE RANDOM ERROR FOR EACH FUEL STACK IS LISTED. HOWEVER, WHEN CALCULATING THE AVERAGE SAMPLE RANDOM ERROR FOR THE ENTIRE ELEMENT, ONLY NON-DEFAULT FUEL STACK AVERAGE SAMPLE RANDOM ERRORS ARE INCLUDED

FUEL BODY DATA, TEST ELEMENT RTE-6
FUEL BODY 1

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

CORE HEIGHT	OUTER DIAMETER	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN		MIL	MIL	IN		MIL	MIL	IN	MIL	MIL	%	%	%	%	%	%
		X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
25.67		2.7400	1	.070	.361	2.7352	2	.428	.467	-.0048	.428	1.156	-.175	.022	.018	.016	.022	.042
26.67		2.7400	1	.060	.361	2.7348	2	.212	.386	-.0053	.212	1.035	-.192	.022	.018	.008	.019	.038
27.67		2.7400	1	.000	.361	2.7346	2	.586	.546	-.0054	.586	1.282	-.197	.022	.018	.021	.024	.047
28.67		2.7400	1	.000	.361	2.7345	2	.586	.546	-.0055	.586	1.282	-.201	.022	.018	.021	.024	.047
29.67		2.7400	1	.000	.361	2.7345	2	.000	.355	-.0055	.000	.992	-.201	.022	.018	.000	.018	.036
30.67		2.7400	1	.000	.361	2.7344	2	.428	.467	-.0056	.428	1.156	-.204	.022	.018	.016	.022	.042
31.67		2.7400	1	.000	.361	2.7343	2	.493	.498	-.0057	.493	1.205	-.208	.022	.018	.018	.022	.044
32.68		2.7400	1	.000	.361	2.7331	2	.283	.408	-.0069	.283	1.067	-.252	.022	.018	.010	.020	.039
33.68		2.7400	1	.000	.361	2.7332	2	.586	.546	-.0068	.586	1.282	-.248	.022	.018	.021	.024	.047
34.68		2.7400	1	.000	.361	2.7328	2	.456	.480	-.0072	.456	1.176	-.261	.022	.018	.017	.022	.043
35.68		2.7400	1	.000	.361	2.7329	2	.283	.408	-.0071	.283	1.067	-.259	.022	.018	.010	.020	.039
36.68		2.7400	1	.000	.361	2.7330	2	.212	.386	-.0071	.212	1.035	-.257	.022	.018	.008	.019	.038
37.68		2.7400	1	.000	.361	2.7325	2	.071	.359	-.0075	.071	.997	-.272	.022	.018	.003	.019	.036
38.68		2.7400	1	.000	.361	2.7312	2	.495	.499	-.0089	.495	1.206	-.323	.022	.018	.018	.022	.044
39.68		2.7400	1	.000	.361	2.7308	2	.754	.640	-.0092	.754	1.440	-.334	.022	.018	.028	.027	.053
BODY AVG.	G X (G+X)/2 G/X	15.5590 2.7400	1 15	7.200 .000	7.475 .351	15.5195 2.7335	1 30	7.200 1.321	7.475 .425	-.0395 -.0065	10.182 1.321	20.719 1.081	-.254 -.239 -.246 106.25	.008 .022 .015 13.0	.018 .018 .013 11.1	.065 .048 .041 34.8	.068 .020 .035 29.8	.133 .039 .069 58.4

FUEL BODY DATA, TEST ELEMENT RTE-6
FUEL BODY 2

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

CORE HEIGHT	OUTER DIAMETER	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			% UX	% EX	STRAIN			
		IN X1	NX1	MIL SX1	MIL EX1	IN X2	NX2	MIL SX2	MIL EX2	IN X21	MIL SX21	MIL DX21			% RX	% SX	% EPX	% DX
41.22		2.7390	2	.000	.355	2.7269	2	.814	.676	-.0121	.814	1.498	-.442	.022	.018	.030	.028	.055
42.22		2.7390	2	.000	.355	2.7266	2	.212	.386	-.0123	.212	1.028	-.451	.022	.018	.008	.019	.037
43.22		2.7390	2	.000	.355	2.7273	2	1.202	.921	-.0116	1.202	1.935	-.425	.022	.018	.044	.036	.071
44.22		2.7390	2	.000	.355	2.7273	2	.071	.359	-.0116	.071	.990	-.425	.022	.018	.003	.018	.036
45.22		2.7370	2	.000	.355	2.7268	2	.585	.545	-.0102	.585	1.276	-.373	.022	.018	.021	.024	.047
46.22		2.7370	2	.000	.355	2.7264	2	1.004	.794	-.0105	1.004	1.704	-.385	.022	.018	.037	.032	.062
47.22		2.7370	2	.000	.355	2.7255	2	.495	.499	-.0115	.495	1.200	-.422	.022	.018	.018	.022	.044
48.22		2.7370	2	.000	.355	2.7244	2	.492	.497	-.0126	.492	1.198	-.460	.022	.018	.018	.022	.044
49.22		2.7370	2	.000	.355	2.7239	2	.585	.545	-.0131	.585	1.276	-.479	.022	.018	.021	.024	.047
50.22		2.7370	2	.000	.355	2.7236	2	.566	.535	-.0134	.566	1.259	-.490	.022	.018	.021	.023	.046
51.22		2.7370	2	.000	.355	2.7238	2	.000	.355	-.0132	.000	.985	-.482	.022	.018	.000	.018	.036
52.22		2.7370	2	.000	.355	2.7246	2	.695	.606	-.0124	.695	1.377	-.453	.022	.018	.025	.026	.050
53.22		2.7370	2	.000	.355	2.7256	2	.753	.640	-.0114	.753	1.435	-.415	.022	.018	.028	.027	.052
54.22		2.7370	2	.000	.355	2.7253	2	1.607	1.191	-.0117	1.607	2.435	-.427	.022	.018	.059	.045	.089
55.22		2.7370	2	.000	.355	2.7214	2	3.253	2.327	-.0156	3.253	4.614	-.570	.022	.018	.119	.086	.169
BODY AVG.	G X (G+X)/2 G/X	15.5560 2.7375	1 30	7.200 .900	7.475 .387	15.4136 2.7253	1 30	7.200 1.849	7.475 .486	-.1424 -.0122	10.182 2.056	20.719 1.218	-.915 -.447 -.681 204.96	.008 .022 .015 11.8	.018 .018 .013 9.2	.065 .075 .050 37.4	.068 .023 .036 18.4	.133 .044 .070 36.0

FUEL BODY DATA, TEST ELEMENT RTF-6
FUEL BODY 3

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

CORE HEIGHT	OUTER DIAMETER	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			ε UX	ε FX	STRAIN				
		IN X1	NX1	MIL SX1	MIL EX1	IN Y2	NX2	MIL SY2	MIL FX2	IN X21	MIL SX21	MIL DX21			ε RX	ε SX	ε FPX	ε OX	
56.83		2.7400	1	.000	.361	2.7268	2	.585	.545	-.0132	.585	1.282	-.482	.022	.018	.021	.024	.047	
57.83		2.7400	1	.000	.361	2.7287	2	.071	.359	-.0114	.071	.997	-.414	.022	.018	.003	.019	.036	
58.83		2.7400	1	.000	.361	2.7275	2	.354	.434	-.0125	.354	1.107	-.454	.022	.018	.013	.021	.040	
59.83		2.7400	1	.000	.361	2.7256	2	1.004	.794	-.0144	1.004	1.709	-.524	.022	.018	.037	.032	.062	
60.83		2.7400	1	.000	.361	2.7248	2	1.273	.968	-.0152	1.273	2.024	-.555	.022	.018	.046	.038	.074	
61.83		2.7400	1	.000	.361	2.7246	2	1.061	.830	-.0155	1.061	1.774	-.564	.022	.018	.039	.033	.065	
62.83		2.7400	1	.000	.361	2.7254	2	.990	.785	-.0146	.990	1.693	-.533	.022	.018	.036	.031	.062	
63.83		2.7400	1	.000	.361	2.7261	2	.707	.613	-.0139	.707	1.395	-.507	.022	.018	.026	.026	.051	
64.83		2.7400	1	.000	.361	2.7255	2	.536	.520	-.0145	.536	1.240	-.527	.022	.018	.020	.023	.045	
65.83		2.7400	1	.000	.361	2.7312	2	6.800	4.822	-.0088	6.800	2.477	-.321	.022	.018	.248	.176	.346	
66.83		2.7400	1	.000	.361	2.7305	2	5.953	4.225	-.0095	5.953	8.310	-.347	.022	.018	.217	.155	.303	
67.83		2.7400	1	.000	.361	2.7254	2	2.507	1.878	-.0146	2.507	3.614	-.531	.022	.018	.092	.067	.132	
68.83		2.7400	1	.000	.361	2.7270	2	2.438	1.760	-.0130	2.438	3.521	-.474	.022	.018	.089	.066	.128	
69.83		2.7400	1	.000	.361	2.7310	2	1.471	1.099	-.0150	1.471	2.267	-.365	.022	.018	.054	.042	.083	
70.83		2.7400	1	.000	.361	2.7297	2	.585	.546	-.0108	.585	1.282	-.394	.022	.018	.021	.024	.047	
BODY AVG.	G X (6+X)/2 G/X	15.5580 2.7400	1 15	7.200 .000	7.475 .351	15.4624 2.7272	1 30	7.200 2.850	7.475 .627	-.1556 -.0128	10.182 2.850	20.712 1.409	-1.500 -.466	.008 .022	.018 .018	.065 .198	.068 .026	.133 .051	
													-.733 214.54	.015 11.7	.013 2.2	.061 42.2	.036 18.2	.071 37.0	

FUEL BODY DATA, TEST ELEMENT RTE-6
FUEL BODY 4

PRECISION: LENGTH = .00060 DIAMETER = .00030 EQUIPMENT RANDOM ERROR: LENGTH = .00200 DIAMETER = .00035	PRECISION: LENGTH = .00060 DIAMETER = .00030 EQUIPMENT RANDOM ERROR: LENGTH = .00200 DIAMETER = .00035
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		PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
CORE	OUTER	IN	MIL	MIL		IN	MIL	MIL		IN	MIL	MIL	%	%	%	%	%	%
HEIGHT	DIAMETER	X1	NX1	SX1	EX1	X2	NX2	SX2	EX2	X21	SX21	DX21	UX	EX	RX	SX	EPX	DX
72.38		2.7400	1	.000	.361	2.7264	2	.212	.386	-.0137	.212	1.035	-.498	.022	.018	.008	.019	.038
73.38		2.7400	1	.000	.361	2.7279	2	1.676	1.237	-.0121	1.676	2.525	-.440	.022	.018	.061	.047	.092
74.38		2.7400	1	.000	.361	2.7281	2	2.229	1.616	-.0119	2.229	3.244	-.432	.022	.018	.081	.060	.118
75.38		2.7400	1	.000	.361	2.7281	2	1.980	1.444	-.0119	1.980	2.918	-.434	.022	.018	.072	.054	.106
76.38		2.7400	1	.000	.361	2.7292	2	.876	.714	-.0108	.876	1.568	-.392	.022	.018	.032	.029	.057
77.38		2.7400	1	.000	.361	2.7290	2	.427	.466	-.0110	.427	1.156	-.401	.022	.018	.016	.021	.042
78.38		2.7400	1	.000	.361	2.7294	2	.427	.466	-.0106	.427	1.156	-.387	.022	.018	.016	.021	.042
79.38		2.7400	1	.000	.361	2.7296	2	.071	.359	-.0105	.071	.997	-.381	.022	.018	.003	.019	.036
80.38		2.7400	1	.000	.361	2.7303	2	.695	.606	-.0097	.695	1.383	-.354	.022	.018	.025	.026	.050
81.38		2.7400	1	.000	.361	2.7305	2	.212	.386	-.0095	.212	1.035	-.345	.022	.018	.008	.019	.038
82.38		2.7400	1	.000	.361	2.7303	2	.071	.359	-.0098	.071	.997	-.356	.022	.018	.003	.019	.036
83.38		2.7400	1	.000	.361	2.7303	2	.354	.434	-.0098	.354	1.107	-.356	.022	.018	.013	.021	.040
84.38		2.7400	1	.000	.361	2.7294	2	1.004	.794	-.0106	1.004	1.709	-.385	.022	.018	.037	.032	.062
85.38		2.7400	1	.000	.361	2.7307	2	.495	.499	-.0093	.495	1.206	-.338	.022	.018	.018	.022	.044
86.38		2.7400	1	.000	.361	2.7291	2	.695	.676	-.0109	.695	1.383	-.398	.022	.018	.025	.026	.050
BODY	G	15.5550	1	7.270	7.475	15.3600	1	7.200	7.475	-.1950	10.182	20.719	-1.254	.008	.018	.065	.068	.132
AVG.	X	2.7400	15	.000	.351	2.7292	30	1.378	.431	-.0108	1.378	1.790	-.393	.022	.018	.050	.020	.040
	(G+X)/2												-.823	.015	.013	.041	.035	.069
	G/X												318.83	19.7	15.3	44.0	23.8	46.6

FUEL BODY DATA, TEST ELEMENT RTE-6
FUEL BODY 5

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

CORE HEIGHT	OUTER DIAMETER	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			% UX	% EX	STRAIN			
		IN X1	NX1	MIL SX1	MIL EX1	IN X2	NX2	MIL SX2	MIL EX2	IN X21	MIL SX21	MIL OX21			% RX	% SX	% EPX	% DX
87.72		2.7400	1	.000	.361	2.7271	2	1.761	.830	-.0130	1.061	1.774	-.473	.022	.018	.039	.033	.065
88.72		2.7400	1	.000	.361	2.7294	2	1.539	1.145	-.0106	1.539	2.352	-.385	.022	.018	.056	.044	.086
89.72		2.7400	1	.000	.361	2.7290	2	2.121	1.542	-.0110	2.121	3.103	-.401	.022	.018	.077	.058	.113
90.72		2.7400	1	.000	.361	2.7290	2	1.838	1.348	-.0110	1.838	2.734	-.401	.022	.018	.067	.051	.100
91.72		2.7400	1	.000	.361	2.7306	2	.566	.535	-.0094	.566	1.265	-.343	.022	.018	.021	.024	.046
92.72		2.7400	1	.000	.361	2.7307	2	1.607	1.191	-.0093	1.607	2.438	-.339	.022	.018	.059	.045	.089
93.72		2.7400	1	.000	.361	2.7299	2	1.951	1.425	-.0101	1.951	2.881	-.367	.022	.018	.071	.054	.105
94.72		2.7400	1	.000	.361	2.7304	2	1.838	1.348	-.0096	1.838	2.734	-.350	.022	.018	.067	.051	.100
95.72		2.7400	1	.000	.361	2.7303	2	2.438	1.760	-.0097	2.438	3.521	-.354	.022	.018	.089	.066	.128
96.72		2.7400	1	.000	.361	2.7306	2	2.404	1.737	-.0094	2.404	3.477	-.343	.022	.018	.088	.065	.127
97.72		2.7400	1	.000	.361	2.7306	2	1.838	1.348	-.0094	1.838	2.734	-.343	.022	.018	.067	.051	.100
98.72		2.7400	1	.000	.361	2.7313	2	1.704	.794	-.0087	1.004	1.709	-.316	.022	.018	.037	.032	.062
99.72		2.7400	1	.000	.361	2.7315	2	1.556	1.156	-.0085	1.556	2.373	-.310	.022	.018	.057	.044	.087
100.72		2.7400	1	.000	.361	2.7328	2	1.744	1.284	-.0072	1.744	2.613	-.263	.022	.018	.064	.049	.095
101.72		2.7400	1	.000	.361	2.7321	2	1.273	.968	-.0079	1.273	2.024	-.288	.022	.018	.046	.038	.074
BODY AVG.	G X (G+X)/2 G/X	15.5530 2.7400	1 15	7.200 .000	7.475 .351	15.3779 2.7304	1 30	7.200 1.848	7.475 .486	-.1751 -.0096	10.182 1.848	20.719 1.175	-1.126 -.352 -.739 320.00	.008 .022 .015 22.1	.018 .018 .013 17.2	.065 .067 .047 64.1	.068 .022 .036 27.6	.132 .043 .070 54.2

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FUEL BODY DATA, TEST ELEMENT RTE-6
FUEL BODY 6

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

CORE HEIGHT	OUTER DIAMETER	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN X1	NX1	MIL SX1	MIL EX1	IN X2	NX2	MIL SX2	MIL EX2	IN X21	MIL SX21	MIL DX21	% UX	% EX	% RX	% SX	% EPX	% DX
103.49		2.7400	1	.000	.361	2.7249	2	1.980	1.444	-.0151	1.980	2.918	-.551	.022	.018	.072	.054	.106
104.49		2.7400	1	.000	.361	2.7255	2	.071	.359	-.0145	.071	.997	-.527	.022	.018	.003	.019	.036
105.49		2.7400	1	.000	.361	2.7256	2	.536	.520	-.0144	.536	1.240	-.524	.022	.018	.020	.023	.045
106.49		2.7400	1	.000	.361	2.7267	2	.638	.574	-.0133	.638	1.329	-.484	.022	.018	.023	.025	.048
107.49		2.7400	1	.000	.361	2.7280	2	.753	.640	-.0120	.753	1.440	-.436	.022	.018	.027	.027	.053
108.49		2.7400	1	.000	.361	2.7284	2	.427	.466	-.0116	.427	1.156	-.423	.022	.018	.016	.021	.042
109.49		2.7400	1	.000	.361	2.7290	2	.427	.466	-.0110	.427	1.156	-.401	.022	.018	.016	.021	.042
110.49		2.7400	1	.000	.361	2.7296	2	.071	.359	-.0105	.071	.997	-.381	.022	.018	.003	.019	.036
111.49		2.7400	1	.000	.361	2.7303	2	.427	.466	-.0097	.427	1.156	-.354	.022	.018	.016	.021	.042
112.49		2.7400	1	.000	.361	2.7303	2	.695	.606	-.0097	.695	1.383	-.354	.022	.018	.025	.026	.050
113.49		2.7400	1	.000	.361	2.7310	2	.456	.480	-.0090	.456	1.176	-.327	.022	.018	.017	.022	.043
114.49		2.7400	1	.000	.361	2.7321	2	.354	.434	-.0080	.354	1.107	-.290	.022	.018	.013	.021	.040
115.49		2.7400	1	.000	.361	2.7328	2	.283	.408	-.0072	.283	1.067	-.263	.022	.018	.010	.020	.039
116.49		2.7400	1	.000	.361	2.7337	2	.428	.467	-.0063	.428	1.156	-.230	.022	.018	.016	.022	.042
117.49		2.7400	1	.000	.361	2.7338	2	.940	.753	-.0062	.940	1.637	-.226	.022	.018	.034	.030	.060
BODY AVG.	G X (G+X)/2 G/X	15.5570 2.7400	1 15	7.200 .000	7.475 .351	15.4769 2.7295	1 30	7.200 2.921	7.475 .638	-.0801 -.0105	10.182 2.921	20.719 1.427	-.515 -.385 -.450 133.81	.008 .022 .015 9.6	.018 .018 .013 7.8	.065 .107 .063 40.8	.068 .027 .036 19.9	.133 .052 .071 39.0

FUEL BODY AVERAGE SAMPLE STANDARD DEVIATIONS (MILS)		
FUEL BODY	PRE-IRRAD. DIAMETER	POST-IRRAD. DIAMETER
1	.0000	.4407
2	.0000	1.1216
3	.0000	2.6130
4	.0000	1.0090
5	.0000	1.7254
6	.0000	.7166

TEST ELEMENT RTE-6
FUEL BODY DATA

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

PRECISION:
LENGTH = .00060
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
LENGTH = .00200
DIAMETER = .00035

FUEL BODY	LENGTH DIAMETER	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
		IN G1 X1	NG1 NX1	MIL SG1 SX1	MIL EG1 EX1	IN G2 X2	NG2 NX2	MIL SG2 SX2	MIL EG2 EX2	IN G21 X21	MIL SG21 SX21	MIL DG21 DX21	% UG UX V W	% EG EX EV EW	% RG RX RV RW	% SG SX SV SW	% EPG EPX EPV EPW	% D6 DX DV DW
1	LEN + DIAM ANISOTROPY																	
	G	15.5590	1	7.200	7.475	15.5195	1	7.200	7.475	-.0395	10.182	20.719	-.254	.008	.018	.065	.068	.133
	X	2.7400	15	.000	.351	2.7335	30	1.321	.425	-.0065	1.321	1.081	-.239	.022	.018	.048	.120	.039
	(G+X)/2 G/X												-.246	.015	.013	.041	.035	.069
													106.25	13.0	11.1	34.8	29.8	58.4
2	G	15.5560	1	7.200	7.475	15.4136	1	7.200	7.475	-.1424	10.182	20.719	-.915	.008	.018	.065	.068	.133
	X	2.7375	30	.900	.387	2.7253	30	1.849	.486	-.0122	2.056	1.218	-.447	.022	.018	.075	.023	.044
	(G+X)/2 G/X												-.681	.015	.013	.050	.036	.070
													204.96	11.8	9.2	37.4	18.4	36.0
3	G	15.5580	1	7.200	7.475	15.4024	1	7.200	7.475	-.1556	10.182	20.719	-1.000	.008	.018	.065	.068	.133
	X	2.7400	15	.000	.351	2.7272	30	2.850	.627	-.0128	2.850	1.409	-.466	.022	.018	.104	.026	.051
	(G+X)/2 G/X												-.733	.015	.013	.061	.036	.071
													214.54	11.7	9.2	49.9	18.9	37.0
4	G	15.5550	1	7.200	7.475	15.3600	1	7.200	7.475	-.1950	10.182	20.719	-1.254	.008	.018	.065	.068	.132
	X	2.7400	15	.000	.351	2.7292	30	1.378	.431	-.0108	1.378	1.090	-.393	.022	.018	.050	.020	.040
	(G+X)/2 G/X												-.823	.015	.013	.041	.035	.069
													318.83	19.7	15.3	44.0	23.8	46.6
5	G	15.5530	1	7.200	7.475	15.3779	1	7.200	7.475	-.1751	10.182	20.719	-1.126	.008	.018	.065	.068	.132
	X	2.7400	15	.000	.351	2.7304	30	1.848	.486	-.0096	1.848	1.175	-.352	.022	.018	.067	.022	.043
	(G+X)/2 G/X												-.739	.015	.013	.047	.036	.070
													320.00	22.1	17.2	64.1	27.6	54.2
6	G	15.5570	1	7.200	7.475	15.4769	1	7.200	7.475	-.0801	10.182	20.719	-.515	.008	.018	.065	.068	.133
	X	2.7400	15	.000	.351	2.7295	30	2.921	.638	-.0105	2.921	1.427	-.385	.022	.018	.107	.027	.052
	(G+X)/2 G/X												-.450	.015	.013	.063	.036	.071
													133.81	9.6	7.8	40.8	19.9	39.0
TEST	G	15.5563	6	7.465	3.646	15.4250	6	56.301	23.072	-.1313	56.794	45.782	-.844	.008	.018	.365	.150	.294
ELEMENT	X	2.7393	105	1.216	.370	2.7292	180	3.295	.428	-.0101	3.512	1.108	-.370	.022	.018	.128	.021	.040
AVERAGE	(G+X)/2 G/X												-.607	.015	.013	.193	.076	.148
													228.35	15.6	12.2	126.6	42.6	83.4

TEST ELEMENT RTE-6
SLEEVE DATA (BASED ON O.D. MEASUREMENTS)

PRECISION:
DIAMETER = .00020
EQUIPMENT RANDOM ERROR:
DIAMETER = .00015

PRECISION:
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
DIAMETER = .00035

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CORE HEIGHT	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
	IN X1	NX1	MIL SX1	MIL EX1	IN X2	NX2	MIL SX2	MIL EX2	IN X21	MIL SX21	MIL DX21	% UX	% EX	% RX	% SX	% EPX	% DX
27.00	3.4868	1	.700	.718	3.4797	4	.885	.566	-.0071	1.128	1.792	-.204	.014	.011	.032	.026	.051
34.00	3.4868	1	.700	.718	3.4759	4	2.168	1.140	-.0109	2.278	2.640	-.312	.014	.011	.065	.039	.076
41.00	3.4868	1	.700	.718	3.4738	4	6.222	3.131	-.0130	6.261	6.296	-.373	.014	.011	.180	.092	.181
49.00	3.4868	1	.700	.718	3.4715	4	7.288	3.661	-.0152	7.321	7.312	-.437	.014	.011	.210	.107	.210
57.00	3.4868	1	.700	.718	3.4685	4	4.737	2.394	-.0183	4.788	4.900	-.525	.014	.011	.137	.072	.140
64.50	3.4868	1	.700	.718	3.4690	4	.790	.530	-.0178	1.056	1.749	-.510	.014	.011	.030	.026	.050
72.00	3.4868	1	.700	.718	3.4704	4	5.574	2.809	-.0164	5.618	5.684	-.470	.014	.011	.161	.083	.163
80.00	3.4868	1	.700	.718	3.4665	4	2.777	1.433	-.0203	2.864	3.141	-.581	.014	.011	.082	.046	.090
88.00	3.4868	1	.700	.718	3.4670	4	6.691	3.364	-.0197	6.727	6.742	-.566	.014	.011	.193	.099	.193
95.50	3.4868	1	.700	.718	3.4713	4	2.613	1.353	-.0155	2.705	3.003	-.444	.014	.011	.078	.044	.086
103.00	3.4868	1	.700	.718	3.4760	4	2.773	1.431	-.0107	2.860	3.137	-.308	.014	.011	.082	.046	.090
112.00	3.4868	1	.700	.718	3.4749	4	.818	.540	-.0119	1.077	1.761	-.341	.014	.011	.031	.026	.050
117.00	3.4868	1	.700	.718	3.4806	4	.626	.471	-.0062	.939	1.684	-.179	.014	.011	.027	.025	.048
TEST ELEMENT AVG.	3.4868	13	.700	.246	3.4727	52	5.692	.864	-.0141	5.735	1.760	-.404	.014	.011	.164	.026	.050

TEST ELEMENT RTE-6
SLEEVE DATA (BASED ON I.D. MEASUREMENTS)

PRECISION:
DIAMETER = .00020
EQUIPMENT RANDOM ERROR:
DIAMETER = .00015

PRECISION:
DIAMETER = .00030
EQUIPMENT RANDOM ERROR:
DIAMETER = .00035

CORE HEIGHT	PRE-IRRADIATION				POST-IRRADIATION				DIFFERENCE			STRAIN					
	IN X1	NX1	MIL SX1	MIL EX1	IN X2	NX2	MIL SX2	MIL EX2	IN X21	MIL SX21	MIL DX21	% UX	% EX	% RX	% SX	% EPX	% DX
27.00	2.7522	1	.800	.816	2.7485	4	1.751	.944	-.0037	1.925	2.446	-.135	.018	.014	.070	.045	.089
34.00	2.7522	1	.800	.816	2.7449	4	1.192	.693	-.0073	1.436	2.098	-.263	.018	.014	.052	.039	.076
41.00	2.7522	1	.800	.816	2.7375	4	.772	.523	-.0147	1.112	1.900	-.532	.018	.014	.040	.035	.069
49.00	2.7522	1	.800	.816	2.7396	4	1.320	.749	-.0126	1.544	2.170	-.459	.018	.014	.056	.040	.079
57.00	2.7522	1	.800	.816	2.7405	4	4.172	2.116	-.0117	4.248	4.444	-.423	.018	.014	.154	.082	.161
64.50	2.7522	1	.800	.816	2.7428	4	5.618	2.831	-.0094	5.675	5.775	-.340	.018	.014	.206	.107	.210
72.00	2.7522	1	.800	.816	2.7358	4	1.518	.837	-.0164	1.716	2.291	-.596	.018	.014	.062	.042	.083
80.00	2.7522	1	.800	.816	2.7304	4	3.560	1.814	-.0218	3.648	3.899	-.793	.018	.014	.133	.072	.141
88.00	2.7522	1	.800	.816	2.7342	4	1.334	.755	-.0180	1.556	2.178	-.652	.018	.014	.056	.040	.079
95.50	2.7522	1	.800	.816	2.7381	4	1.545	.849	-.0141	1.740	2.338	-.511	.018	.014	.063	.043	.084
103.00	2.7522	1	.800	.816	2.7424	4	1.212	.701	-.0098	1.453	2.109	-.354	.018	.014	.053	.039	.076
112.00	2.7522	1	.800	.816	2.7428	4	.439	.415	-.0094	.912	1.795	-.340	.018	.014	.033	.033	.065
117.00	2.7522	1	.800	.816	2.7500	4	.482	.427	-.0022	.934	1.805	-.080	.018	.014	.034	.033	.066
TEST ELEMENT AVG.	2.7522	13	.800	.268	2.7406	52	5.773	.874	-.0116	5.828	1.791	-.421	.018	.014	.212	.033	.065

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FUEL STACK DATA : TEST ELEMENT RTE-6

FUEL BODY	FUEL HOLE	FUEL STACK LENGTH				FUEL HOLE PLENUM LENGTH			INDIRECT FUEL STACK LENGTH			
		(IN) L1	(IN) L2	(IN) L21	% UL	(IN) P1	(IN) P2	(IN) P21	(IN) G2	(IN) G2'	(IN) LI	% ULI
1	1	12.7420				1.6280	1.7240	.0960	15.5195	14.3335	12.6095	-1.0397
1	5	12.6700				1.7000	1.8420	.1420	15.5195	14.3335	12.4915	-1.4087
1	7	12.6840				1.6860	1.9100	.2240	15.5195	14.3335	12.4235	-2.0536
2	1	12.7660				1.6090	1.8080	.1990	15.4136	14.2434	12.4354	-2.5896
2	5	12.6640				1.7110	1.8000	.0890	15.4136	14.2434	12.4434	-1.7419
2	7	12.7170				1.6580	1.7540	.0960	15.4136	14.2434	12.4894	-1.7896
3	1	12.8810				1.4750	1.5630	.0880	15.4024	14.2124	12.6494	-1.7978
3	3	12.8460	12.4670	-.3790	-2.9503	1.5100	1.6020	.0920	15.4024	14.2124	12.6104	-1.8339
3	5	12.8760				1.4800	1.5420	.0620	15.4024	14.2124	12.6704	-1.5966
3	7	12.8550	12.4380	-.4170	-3.2439	1.5010	1.5770	.0760	15.4024	14.2124	12.6354	-1.7081
4	1	12.6960				1.6890	1.6590	-.0300	15.3600	14.2047	12.5957	-.7903
4	5	12.6730				1.7120	1.7700	.0580	15.3600	14.2047	12.4347	-1.8806
4	7	12.7140				1.6710	1.6440	-.0270	15.3600	14.2047	12.5607	-1.2060
5	1	12.7190				1.6410	1.7690	.1280	15.3779	14.1983	12.4293	-2.2775
5	5	12.7090				1.6510	1.7350	.0840	15.3779	14.1983	12.4633	-1.9330
5	7	12.7880				1.5720	1.8600	.2880	15.3779	14.1983	12.3383	-3.5163
6	1	12.7900	12.5330	-.2570	-2.0094	1.5600	1.6710	.1110	15.4769	14.2761	12.6051	-1.4455
6	5	12.7520	12.4600	-.2920	-2.2898	1.5930	1.6480	.0550	15.4769	14.2711	12.6231	-1.0105
6	7	12.8530	12.6440	-.2090	-1.6261	1.4920	1.5150	.0230	15.4769	14.2711	12.7561	-.7536

FUEL STACK DATA : TEST ELEMENT RTE-6

FUEL BODY	FUEL HOLE	FUEL STACK LENGTH				FUEL HOLE PLENUM LENGTH				INDIRECT FUEL STACK LENGTH			
		(IN) L1	(IN) L2	(IN) L21	% UL	(IN) P1	(IN) P2	(IN) P21	(IN) G2	(IN) G21	(IN) L1	% UL1	
1	1	12.7420				1.6280	1.7240	.0960	15.5195	14.3335	12.6095	-1.0397	
1	5	12.6700				1.7000	1.8420	.1420	15.5195	14.3335	12.4915	-1.4087	
1	7	12.6840				1.6860	1.9100	.2240	15.5195	14.3335	12.4235	-2.0536	
STRATUM	L,P,G,U (IN OR %)	12.6987	.0000	.0000	.0000	1.6713	1.8253	.1540	15.5195	14.3335	12.5082	-1.5000	
AVG	E (IN OR %)	.0060	.0000	.0000	.0000	.0003	.0003	.0006	.0006	.0006	.0009	.0533	
	R (IN OR %)	.0070	.0000	.0000	.0000	.0003	.0003	.0005	.0020	.0018	.0019	.0563	
STRATUM	S (IN OR %)	.0382	.0000	.0000	.0000	.0382	.0941	.1016	.0072	.0066	.0943	.7999	
1	EP (IN OR %)	.0232	.0000	.0000	.0000	.0220	.0543	.0586	.0075	.0069	.0548	.4673	
	D (IN OR %)	.0454	.0000	.0000	.0000	.0432	.1065	.1149	.0147	.0135	.1074	.9159	
2	1	12.7660				1.6090	1.8080	.1990	15.4136	14.2434	12.4354	-2.5896	
2	5	12.6640				1.7110	1.8000	.0890	15.4136	14.2434	12.4434	-1.7419	
2	7	12.7170				1.6580	1.7540	.0960	15.4136	14.2434	12.4894	-1.7896	
STRATUM	L,P,G,U (IN OR %)	12.7157	.0000	.0000	.0000	1.6593	1.7873	.1280	15.4136	14.2434	12.4561	-2.0415	
AVG	E (IN OR %)	.0060	.0000	.0000	.0000	.0003	.0003	.0006	.0006	.0006	.0009	.0529	
	R (IN OR %)	.0070	.0000	.0000	.0000	.0003	.0003	.0005	.0020	.0018	.0019	.0559	
STRATUM	S (IN OR %)	.0511	.0000	.0000	.0000	.0510	.0291	.0588	.0072	.0067	.0299	.4583	
2	EP (IN OR %)	.0303	.0000	.0000	.0000	.0295	.0168	.0339	.0075	.0069	.0182	.2739	
	D (IN OR %)	.0594	.0000	.0000	.0000	.0577	.0330	.0665	.0147	.0135	.0357	.5369	
3	1	12.8410				1.4750	1.5630	.0880	15.4024	14.2124	12.6494	-1.7978	
3	3	12.8460	12.4670	-.3790	-2.9503	1.5100	1.6020	.0920	15.4024	14.2124	12.6104	-1.8339	
3	5	12.8760				1.4800	1.5420	.0620	15.4024	14.2124	12.6704	-1.5966	
3	7	12.8550	12.4300	-.4170	-3.2439	1.5010	1.5770	.0760	15.4024	14.2124	12.6354	-1.7081	
STRATUM	L,P,G,U (IN OR %)	12.8645	12.4525	-.4120	-3.2026	1.4915	1.5710	.0795	15.4024	14.2124	12.6414	-1.7341	
AVG	E (IN OR %)	.0060	.0006	.0066	.0498	.0003	.0003	.0006	.0006	.0006	.0009	.0525	
	R (IN OR %)	.0070	.0020	.0073	.0549	.0003	.0003	.0005	.0020	.0018	.0019	.0554	
STRATUM	S (IN OR %)	.0168	.0205	.0265	.2034	.0167	.0252	.0302	.0072	.0066	.0260	.2397	
3	EP (IN OR %)	.0110	.0146	.0183	.1406	.0084	.0126	.0151	.0075	.0069	.0144	.1396	
	D (IN OR %)	.0215	.0287	.0358	.2755	.0164	.0247	.0296	.0147	.0135	.0281	.2735	
4	1	12.6960				1.6890	1.6090	-.0800	15.3600	14.2047	12.5957	-.7903	
4	5	12.6730				1.7120	1.7700	.0580	15.3600	14.2047	12.4347	-1.8806	
4	7	12.7140				1.6710	1.6440	-.0270	15.3600	14.2047	12.5607	-1.2060	

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STRATUM	L,P,G,U (IN UR %)	12.6943	.0000	.0000	.0000	1.6907	1.6743	-.0163	15.3600	14.2047	12.5303	-1.2919
AVG	E (IN UR %)	.0060	.0000	.0000	.0000	.0003	.0003	.0006	.0006	.0006	.0009	.0534
	R (IN UR %)	.0070	.0000	.0000	.0000	.0003	.0003	.0005	.0020	.0018	.0019	.0564
STRATUM	S (IN UR %)	.0207	.0000	.0000	.0000	.0206	.0847	.0871	.0072	.0067	.0849	.6881
4	EP (IN UR %)	.0139	.0000	.0000	.0000	.0119	.0489	.0503	.0075	.0069	.0494	.4036
	D (IN UR %)	.0272	.0000	.0000	.0000	.0233	.0958	.0986	.0147	.0135	.0968	.7911
5	1	12.7190				1.6410	1.7690	.1280	15.3779	14.1983	12.4293	-2.2775
5	5	12.7090				1.6510	1.7350	.0840	15.3779	14.1983	12.4633	-1.9330
5	7	12.7840				1.5720	1.8600	.2880	15.3779	14.1983	12.3383	-3.5163
STRATUM	L,P,G,U (IN UR %)	12.7347	.0000	.0000	.0000	1.6213	1.7880	.1667	15.3779	14.1983	12.4103	-2.5775
AVG	E (IN UR %)	.0060	.0000	.0000	.0000	.0003	.0003	.0006	.0006	.0006	.0009	.0526
	R (IN UR %)	.0070	.0000	.0000	.0000	.0003	.0003	.0005	.0020	.0018	.0019	.0555
STRATUM	S (IN UR %)	.0431	.0000	.0000	.0000	.0430	.0646	.0776	.0072	.0066	.0650	.6071
5	EP (IN UR %)	.0259	.0000	.0000	.0000	.0248	.0373	.0448	.0075	.0069	.0379	.3575
	D (IN UR %)	.0507	.0000	.0000	.0000	.0487	.0731	.0879	.0147	.0135	.0744	.7008
6	1	12.7900	12.5330	-.2570	-2.0094	1.5600	1.6710	.1110	15.4769	14.2761	12.6051	-1.4455
6	5	12.7520	12.4600	-.2920	-2.2898	1.5930	1.6480	.0550	15.4769	14.2711	12.6231	-1.0105
6	7	12.8530	12.6440	-.2090	-1.6261	1.4920	1.5150	.0230	15.4769	14.2711	12.7561	-.7536
STRATUM	L,P,G,U (IN UR %)	12.7983	12.5457	-.2527	-1.9742	1.5483	1.6113	.0630	15.4769	14.2728	12.6615	-1.0694
AVG	E (IN UR %)	.0060	.0006	.0066	.0506	.0003	.0003	.0006	.0006	.0006	.0009	.0530
	R (IN UR %)	.0070	.0020	.0073	.0558	.0003	.0003	.0005	.0020	.0018	.0019	.0561
STRATUM	S (IN UR %)	.0511	.0927	.1058	.8229	.0515	.0842	.0987	.0072	.0066	.0845	.7691
6	EP (IN UR %)	.0303	.0535	.0615	.4784	.0297	.0486	.0570	.0075	.0069	.0491	.4496
	D (IN UR %)	.0594	.1049	.1206	.9377	.0583	.0953	.1117	.0147	.0135	.0963	.8613
TEST	L,P,G,U (IN UR %)	12.7576	12.5084	-.2492	-1.9536	1.6073	1.7023	.0949	15.4250	14.2437	12.5415	-1.6945
ELEMENT	E (IN UR %)	.0060	.0006	.0066	.0508	.0003	.0003	.0006	.0006	.0006	.0009	.0529
AVERAGE	R (IN UR %)	.0070	.0020	.0073	.0560	.0003	.0003	.0005	.0020	.0018	.0019	.0559
	S (IN UR %)	.0739	.0925	.1184	.9211	.0832	.1163	.1430	.0563	.0520	.1274	1.1494
	EP (IN UR %)	.0183	.0414	.0453	.3540	.0191	.0267	.0328	.0231	.0213	.0341	.3027
	D (IN UR %)	.0359	.0812	.0888	.6939	.0374	.0523	.0643	.0452	.0418	.0669	.5932

FUEL STACK DATA TEST ELEMENT RTE-6

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		FUEL STACK LENGTH				FUEL HOLE PLENUM LENGTH			INDIRECT FUEL STACK LENGTH			
FUEL BODY	FUEL HOLE	(IN) L1	(IN) L2	(IN) L21	% UL	(IN) P1	(IN) P2	(IN) P21	(IN) G2	(IN) G21	(IN) LI	% UL1
2	1	12.7660				1.6090	1.8080	.1990	15.5195	14.2434	12.4354	-2.5896
2	5	12.6640				1.7110	1.6000	.0890	15.5195	14.2434	12.4434	-1.7419
2	7	12.7170				1.6580	1.7540	.0960	15.5195	14.2434	12.4894	-1.7896
4	1	12.6960				1.6890	1.6090	-.0800	15.5195	14.2047	12.5957	-.7903
4	5	12.6730				1.7120	1.7700	.0580	15.5195	14.2047	12.4347	-1.8806
4	7	12.7140				1.6710	1.6440	-.0270	15.5195	14.2047	12.5607	-1.2060
5	1	12.7190				1.6410	1.7690	.1280	15.5195	14.1983	12.4293	-2.2775
5	5	12.7090				1.6510	1.7350	.0840	15.5195	14.1983	12.4633	-1.9330
5	7	12.7880				1.5720	1.8600	.2880	15.5195	14.1983	12.3383	-3.5163
STRATUM	L,P,G,U (IN OR %)	12.7162	.0000	.0000	.0000	1.6571	1.7499	.0928	15.3838	14.2155	12.4656	-1.9710
AVG	E (IN OR %)	.0060	.0000	.0000	.0000	.0003	.0003	.0006	.0006	.0006	.0009	.0530
	R (IN OR %)	.0070	.0000	.0000	.0000	.0003	.0003	.0005	.0020	.0018	.0019	.0560
STRATUM	S (IN OR %)	.0400	.0000	.0000	.0000	.0461	.0791	.0916	.0236	.0218	.0821	.7153
7	EP (IN OR %)	.0151	.0000	.0000	.0000	.0154	.0264	.0305	.0081	.0075	.0274	.2450
	D (IN OR %)	.0295	.0000	.0000	.0000	.0301	.0517	.0598	.0159	.0147	.0538	.4801

PUNCHED CARD OUTPUT FROM STAT SAMPLE PROBLEM RUN

FUEL BODY

FUEL HOLE

FUEL RODS

.490000	.000800	.000672	.473857	.004036	.000631	1 1	FUEL STACK AVERAGE FUEL ROD DATA
.490000	.000800	.000672	.475298	.001806	.000296	2 1	
.963746+00	.282781+00					3 1	FUEL ROD ANISOTROPY AND ERROR (2σ)
.488833	.002855	.001020	.473636	.001336	.000244	3 1	
.112346+01	.431917+00					3 3 1	FUEL ROD
.115826+01	.200645+00					3 3 2	
.929508+00	.393124+00					3 3 3	
.101863+01	.322041+00					3 3 4	
.102788+01	.443841+00					3 3 5	
.946712+00	.498115+00					3 3 6	
.489417	.003397	.001150	.474228	.001995	.000347	3 3	
.152844+01	.727131+00					3 5 2	
.106914+01	.324331+00					3 5 4	
.489417	.003029	.001060	.473750	.001397	.000253	3 5	
.112041+01	.565455+00					3 7 1	
.147375+01	.610761+00					3 7 2	
.932961+00	.248653+00					3 7 3	
.100021+01	.360369+00					3 7 4	
.105458+01	.520744+00					3 7 5	
.935262+00	.343875+00					3 7 6	
.489917	.003370	.001143	.474250	.002262	.000390	3 7	
.490000	.000800	.000672	.473312	.001279	.000221	4 1	
.490000	.000800	.000672	.472988	.001308	.000225	5 1	
.459778+00	.132625+00					6 1 2	
.673271+00	.157055+00					6 1 4	
.155221+01	.409504+00					6 1 5	
.488750	.001239	.000785	.477675	.001306	.000240	6 1	
.143244+01	.366521+00					6 5 2	
.319086+01	.818253+00					6 5 3	
.108822+01	.202902+00					6 5 5	
.888871+00	.215587+00					6 5 6	
.488660	.001124	.000783	.478363	.001178	.000237	6 5	
.129106+01	.311074+00					6 7 2	
.119148+01	.304239+00					6 7 3	
.130670+01	.342456+00					6 7 4	
.121619+01	.322174+00					6 7 5	
.858689+00	.240037+00					6 7 6	
.489100	.000990	.000746	.480303	.000889	.000191	6 7	
.489396	.003093	.000748	.473966	.001794	.000180	STRAT 1	STRATUM AVERAGE FUEL ROD DATA
.488894	.001064	.000656	.478711	.001593	.000191	STRAT 2	
.490000	.000759	.000622	.473866	.001794	.000189	STRAT 3	
.489492	.002333	.000647	.475040	.002917	.000176	RT=6	

FUEL BODIES

25.6750	2.7400	.0000	.0004	2.7352	.0004	.0005	1	FUEL BODY DIAMETER DATA
26.6750	2.7400	.0000	.0004	2.7348	.0002	.0004	1	
27.6750	2.7400	.0000	.0004	2.7346	.0006	.0005	1	
28.6750	2.7400	.0000	.0004	2.7345	.0006	.0005	1	
29.6750	2.7400	.0000	.0004	2.7345	.0000	.0004	1	
30.6750	2.7400	.0000	.0004	2.7344	.0004	.0005	1	
31.6750	2.7400	.0000	.0004	2.7343	.0005	.0005	1	

AXIAL POSITION	X ₁	S _{X1}	ε _{X1}	X ₂	S _{X2}	ε _{X2}	FUEL BODY
↓	↓	↓	↓	↓	↓	↓	↙
32.6750	2.7400	.0000	.0004	2.7331	.0003	.0004	1)
33.6750	2.7400	.0000	.0004	2.7332	.0006	.0005	1
34.6750	2.7400	.0000	.0004	2.7328	.0005	.0005	1
35.6750	2.7400	.0000	.0004	2.7329	.0003	.0004	1
36.6750	2.7400	.0000	.0004	2.7330	.0002	.0004	1
37.6750	2.7400	.0000	.0004	2.7325	.0001	.0004	1
38.6750	2.7400	.0000	.0004	2.7312	.0005	.0005	1
39.6750	2.7400	.0000	.0004	2.7308	.0008	.0006	1
2.7400 15	.000000	.000351	2.7335 30	.001321	.000425	BODY 1	← FUEL BODY AVERAGE FUEL BODY DIAMETER DATA
41.2250	2.7390	.0000	.0004	2.7269	.0008	.0007	2
42.2250	2.7390	.0000	.0004	2.7266	.0002	.0004	2
43.2250	2.7390	.0000	.0004	2.7273	.0012	.0009	2
44.2250	2.7390	.0000	.0004	2.7273	.0001	.0004	2
45.2250	2.7370	.0000	.0004	2.7268	.0006	.0005	2
46.2250	2.7370	.0000	.0004	2.7264	.0010	.0008	2
47.2250	2.7370	.0000	.0004	2.7255	.0005	.0005	2
48.2250	2.7370	.0000	.0004	2.7244	.0005	.0005	2
49.2250	2.7370	.0000	.0004	2.7239	.0006	.0005	2
50.2250	2.7370	.0000	.0004	2.7236	.0006	.0005	2
51.2250	2.7370	.0000	.0004	2.7238	.0000	.0004	2
52.2250	2.7370	.0000	.0004	2.7246	.0007	.0006	2
53.2250	2.7370	.0000	.0004	2.7256	.0008	.0006	2
54.2250	2.7370	.0000	.0004	2.7253	.0016	.0012	2
55.2250	2.7370	.0000	.0004	2.7214	.0033	.0023	2
2.7375 30	.000900	.000387	2.7253 30	.001849	.000486	BODY 2	
56.8300	2.7400	.0000	.0004	2.7268	.0006	.0005	3
57.8300	2.7400	.0000	.0004	2.7287	.0001	.0004	3
58.8300	2.7400	.0000	.0004	2.7275	.0004	.0004	3
59.8300	2.7400	.0000	.0004	2.7256	.0010	.0008	3
60.8300	2.7400	.0000	.0004	2.7248	.0013	.0010	3
61.8300	2.7400	.0000	.0004	2.7246	.0011	.0008	3
62.8300	2.7400	.0000	.0004	2.7254	.0010	.0008	3
63.8300	2.7400	.0000	.0004	2.7261	.0007	.0006	3
64.8300	2.7400	.0000	.0004	2.7255	.0005	.0005	3
65.8300	2.7400	.0000	.0004	2.7312	.0068	.0048	3
66.8300	2.7400	.0000	.0004	2.7305	.0060	.0042	3
67.8300	2.7400	.0000	.0004	2.7254	.0025	.0018	3
68.8300	2.7400	.0000	.0004	2.7270	.0024	.0018	3
69.8300	2.7400	.0000	.0004	2.7300	.0015	.0011	3
70.8300	2.7400	.0000	.0004	2.7292	.0006	.0005	3
2.7400 15	.000000	.000351	2.7272 30	.002850	.000627	BODY 3	
72.3830	2.7400	.0000	.0004	2.7264	.0002	.0004	4
73.3830	2.7400	.0000	.0004	2.7279	.0017	.0012	4
74.3830	2.7400	.0000	.0004	2.7291	.0022	.0016	4
75.3830	2.7400	.0000	.0004	2.7281	.0020	.0014	4
76.3830	2.7400	.0000	.0004	2.7292	.0009	.0007	4
77.3830	2.7400	.0000	.0004	2.7290	.0004	.0005	4
78.3830	2.7400	.0000	.0004	2.7294	.0004	.0005	4
79.3830	2.7400	.0000	.0004	2.7296	.0001	.0004	4
80.3830	2.7400	.0000	.0004	2.7303	.0007	.0006	4
81.3830	2.7400	.0000	.0004	2.7305	.0002	.0004	4
82.3830	2.7400	.0000	.0004	2.7303	.0001	.0004	4
83.3830	2.7400	.0000	.0004	2.7303	.0004	.0004	4
84.3830	2.7400	.0000	.0004	2.7294	.0010	.0008	4
85.3830	2.7400	.0000	.0004	2.7307	.0005	.0005	4
2.7400 15	.000000	.000351	2.7292 30	.001376	.000431	BODY 4	

87.7200	2.7400	.0000	.0004	2.7271	.0011	.0008	5
88.7200	2.7400	.0000	.0004	2.7294	.0015	.0011	5
89.7200	2.7400	.0000	.0004	2.7290	.0021	.0015	5
90.7200	2.7400	.0000	.0004	2.7290	.0018	.0013	5
91.7200	2.7400	.0000	.0004	2.7306	.0006	.0005	5
92.7200	2.7400	.0000	.0004	2.7307	.0016	.0012	5
93.7200	2.7400	.0000	.0004	2.7299	.0020	.0014	5
94.7200	2.7400	.0000	.0004	2.7304	.0018	.0013	5
95.7200	2.7400	.0000	.0004	2.7303	.0024	.0018	5
96.7200	2.7400	.0000	.0004	2.7306	.0024	.0017	5
97.7200	2.7400	.0000	.0004	2.7306	.0018	.0013	5
98.7200	2.7400	.0000	.0004	2.7313	.0010	.0008	5
99.7200	2.7400	.0000	.0004	2.7315	.0016	.0012	5
100.7200	2.7400	.0000	.0004	2.7328	.0017	.0013	5
101.7200	2.7400	.0000	.0004	2.7321	.0013	.0010	5
2.7400 15	.000000	.000351	2.7304 30	.001848	.000486	80DY 5	
103.4940	2.7400	.0000	.0004	2.7249	.0020	.0014	6
104.4940	2.7400	.0000	.0004	2.7255	.0001	.0004	6
105.4940	2.7400	.0000	.0004	2.7256	.0005	.0005	6
106.4940	2.7400	.0000	.0004	2.7267	.0006	.0006	6
107.4940	2.7400	.0000	.0004	2.7280	.0008	.0006	6
108.4940	2.7400	.0000	.0004	2.7284	.0004	.0005	6
109.4940	2.7400	.0000	.0004	2.7290	.0004	.0005	6
110.4940	2.7400	.0000	.0004	2.7296	.0001	.0004	6
111.4940	2.7400	.0000	.0004	2.7303	.0004	.0005	6
112.4940	2.7400	.0000	.0004	2.7303	.0007	.0006	6
113.4940	2.7400	.0000	.0004	2.7310	.0005	.0005	6
114.4940	2.7400	.0000	.0004	2.7321	.0004	.0004	6
115.4940	2.7400	.0000	.0004	2.7328	.0003	.0004	6
116.4940	2.7400	.0000	.0004	2.7337	.0004	.0005	6
117.4940	2.7400	.0000	.0004	2.7338	.0009	.0008	6
2.7400 15	.000000	.000351	2.7295 30	.002921	.000638	80DY 6	
SLEEVE STRAINS (1, 0,)							
27.0000+02	2.03626-02	.513322-03	SLEEVE STRAIN AND ERROR (20)				
27.0000	3.4868	.0007	.0007	3.4797	.0009	.0006	SLEEVE DIAMETER DATA
34.0000+02	3.11890-02	.756579-03					
34.0000	3.4868	.0007	.0007	3.4759	.0022	.0011	
41.0000+02	3.372835-02	.187525-02					
41.0000	3.4868	.0007	.0007	3.4738	.0062	.0031	
49.0000+02	3.437364-02	.209677-02					
49.0000	3.4868	.0007	.0007	3.4715	.0073	.0037	
57.0000+02	3.524836-02	.140459-02					
57.0000	3.4868	.0007	.0007	3.4685	.0047	.0024	
64.5000+02	3.509780-02	.499987-03					
64.5000	3.4868	.0007	.0007	3.4690	.0008	.0005	
72.0000+02	3.470346-02	.162954-02					
72.0000	3.4868	.0007	.0007	3.4704	.0056	.0028	
80.0000+02	3.581479-02	.899850-03					
80.0000	3.4868	.0007	.0007	3.4665	.0028	.0014	
88.0000+02	3.566422-02	.193310-02					
88.0000	3.4868	.0007	.0007	3.4670	.0067	.0034	
95.5000+02	3.443817-02	.860429-03					
95.5000	3.4868	.0007	.0007	3.4713	.0026	.0014	
103.0000+03	3.308305-02	.899228-03					
103.0000	3.4868	.0007	.0007	3.4700	.0028	.0014	
112.0000+03	3.340570-02	.504004-03					
112.0000	3.4868	.0007	.0007	3.4749	.0008	.0005	

.117000+03	= .178530-02	.442338-03				
117.0000	3.4868	.0007	.0007	3.4806	.0006	.0005
SLEEVE STRAINS I. D.						
.270000+02	= .135347-02	.888054-03				
27.0000	2.7522	.0008	.0008	2.7485	.0018	.0009
.340000+02	= .263427-02	.761070-03				
34.0000	2.7522	.0008	.0008	2.7449	.0012	.0007
.410000+02	= .532303-02	.687001-03				
41.0000	2.7522	.0008	.0008	2.7375	.0008	.0005
.490000+02	= .458724-02	.786248-03				
49.0000	2.7522	.0008	.0008	2.7396	.0013	.0007
.570000+02	= .423299-02	.161394-02				
57.0000	2.7522	.0008	.0008	2.7405	.0042	.0021
.645000+02	= .339729-02	.209763-02				
64.5000	2.7522	.0008	.0008	2.7428	.0056	.0028
.720000+02	= .595888-02	.829998-03				
72.0000	2.7522	.0008	.0008	2.7358	.0015	.0008
.800000+02	= .793003-02	.141468-02				
80.0000	2.7522	.0008	.0008	2.7304	.0036	.0018
.880000+02	= .652207-02	.788083-03				
88.0000	2.7522	.0008	.0008	2.7342	.0013	.0008
.955000+02	= .511411-02	.836629-03				
95.5000	2.7522	.0008	.0008	2.7381	.0015	.0008
.103000+03	= .354262-02	.764698-03				
103.0000	2.7522	.0008	.0008	2.7424	.0012	.0007
.112000+03	= .339729-02	.650279-03				
112.0000	2.7522	.0008	.0008	2.7428	.0004	.0004
.117000+03	= .799374-03	.655461-03				
117.0000	2.7522	.0008	.0008	2.7500	.0005	.0004

APPENDIX C
STRAIN INPUT INSTRUCTIONS

Column	1-6	7-12	13-18	19-24	25-30	
Format	I6	I6	I6	I6	I6	
Name	NBODY	NSTACK	NFR	NNFT	NTIME1	
1	Number of fuel bodies	Number of fuel holes per fuel body	Number of fuel rods per fuel stack	Number of different fuel blends in test element	Number of time intervals test element was in the core	

Comments

Column	1-72	
Format	12I6	
Name	((ID(J,K), K = 1,NSTACK), J = 1,NBODY)	
2	Array identifying the fuel group to which each fuel rod stack belongs. The numbers of the fuel groups depend on the TREVER results tape (unit 15). Fuel group 1 is the group for which predicted strains are given in file 1 of this tape, fuel group 2 is the group for which predicted strains are given in file 2, and so on.	

Number of cards required is

NSTACK*NBODY

12

Column	1-6	
Format	A6	
Name	FTE	
3	Test element name	

Column	1-72
Format	6E12.0
Name	(TPOS(J), J = 1,30)
4	Core height of each of the 30 TREVER nodes

Comments

5 cards required

Column	1-72
Format	6E12.0
Name	((RPOS(I,J), J = 1,NFR), I = 1,NBODY)
5	Core height of each fuel rod

Number of cards
required is
$$\frac{NFR * NBODY}{6}$$

Column	1-78
Format	13A6
Name	TITLE
6	<p>Description of fuel group</p> <p>Example: holes 1 and 2, UO_2 TRISO (22% fuel vol.) and ThO_2 BISO (78% fuel vol.) fuel</p>

Column	1-78
Format	13-A6
Name	TITLE (CONT.)
7	<p>If the fuel group consists of two fuel blends having similar irradiation-induced strain characteristics, the second fuel blend would be described on this card. If the fuel group consists of only one fuel blend, this card will be blank.</p>

Comments

NNFT sets of cards
6 and 7 are required.

Column	1-6	7-12	
Format	I6	I6	
Name	NX1	NX2	
8	<p>Number of pre-irradiation fuel body diameter measurements per measurement location</p>	<p>Number of post-irradiation fuel body diameter measurements per measurement location</p>	

Column	1-6	
Format	I6	
Name	MM(J)	
9	<p>Number of fuel body diameter measurement locations for fuel body J</p>	

Column	1-10	11-20	21-30	31-40	41-50	51-60	61-70
Format	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0
Name	RPO(J,K)	X1	SX1	EPX1	X2	SX2	EPX2
10	Core height of measurement location K in fuel body J (inches)	Average pre-irradiation fuel body diameter at measurement location K (inches)	Sample random error for X1 (inches)	Combined random error for X1 (inches)	Average post-irradiation fuel body diameter at measurement location (inches)	Sample random error for X2 (inches)	Combined random error for X2 (inches)

Comments

These cards are punched by the STAT code.

MM(J) of these cards are required for fuel body J.

NBODY sets of cards 8, 9, and 10 are required.

Column	
Format	
Name	

Column	
Format	
Name	

APPENDIX D
STRAIN SAMPLE PROBLEM

CONTROL CARDS FOR STRAIN SAMPLE PROBLEM RUN

```

*RUN,M/R 53391,3224943001,1692789AURWE/6/2450,1,50/300
*ASG,AX PB*STRAIN
*ASG,AX STRAIN*FTE4
*USE 10,STRAIN*FTE4
*ASG,T 15,11,8990
*XQT PB*STRAIN,SMAP
    
```

INPUT DATA DECK FOR STRAIN SAMPLE PROBLEM RUN

3	8	14	3	9								
1	1	2	2	3	3	2	2	1	1	2	2	
3	3	2	2	1	1	2	2	3	3	2	2	

FTE=4

27.51	30.24	32.97	35.70	38.43	41.16
43.89	46.61	49.34	52.07	58.62	61.35
64.08	66.81	69.54	72.27	74.99	77.72
80.45	83.18	89.72	92.45	95.18	97.91
100.64	103.37	106.09	108.82	111.55	114.28
27.12	29.07	31.02	32.97	34.92	36.87
38.82	40.77	42.72	44.67	46.61	48.56
50.51	52.46	58.23	60.18	62.13	64.08
66.03	67.98	69.93	71.88	73.83	75.78
77.72	79.67	81.62	83.57	89.33	91.28
93.23	95.18	97.13	99.08	101.03	102.98
104.93	106.88	108.82	110.77	112.72	114.67

HOLES 1&2 UQ2 TRISO (22% FUEL VOL) AND THQ2 BISO (78% FUEL VOL.) FUEL

HOLES 3&4 (TH,U)C2 TRISO (78% FUEL VOL.) AND THC2 BISO (21% FUEL VOL.) FUEL

HOLES 7&8 UC2 TRISO (64% FUEL VOL.) AND THC2 BISO (36% FUEL VOL.) FUEL

HOLES 5&6 (TH,U)C2 TRISO (79% FUEL VOL.) AND THC2 TRISO (21% FUEL VOL.) FUEL

2	2						
16							
29.5900	2.7400	.0000	.0004	2.7379	.0004	.0005	1
31.5900	2.7400	.0000	.0004	2.7374	.0006	.0005	1
33.5900	2.7400	.0000	.0004	2.7375	.0008	.0007	1
35.5900	2.7400	.0000	.0004	2.7368	.0011	.0008	1
36.5900	2.7400	.0000	.0004	2.7380	.0000	.0004	1
38.4500	2.7400	.0000	.0004	2.7392	.0005	.0005	1
39.9600	2.7400	.0000	.0004	2.7390	.0000	.0004	1
41.9600	2.7400	.0000	.0004	2.7381	.0004	.0005	1
43.9600	2.7400	.0000	.0004	2.7382	.0005	.0005	1
45.9600	2.7400	.0000	.0004	2.7385	.0007	.0006	1
47.9600	2.7400	.0000	.0004	2.7381	.0004	.0005	1
49.9600	2.7400	.0000	.0004	2.7360	.0014	.0011	1
51.9600	2.7400	.0000	.0004	2.7368	.0011	.0008	1
52.9600	2.7400	.0000	.0004	2.7371	.0006	.0006	1
53.9600	2.7400	.0000	.0004	2.7362	.0005	.0005	1
54.9600	2.7400	.0000	.0004	2.7357	.0005	.0005	1

2	2							
16								
59.9600	2.7400	.0000	.0004	2.7375	.0008	.0007	2	
60.9600	2.7400	.0000	.0004	2.7377	.0005	.0005	2	
61.9600	2.7400	.0000	.0004	2.7362	.0005	.0005	2	
62.9600	2.7400	.0000	.0004	2.7362	.0005	.0005	2	
64.9600	2.7400	.0000	.0004	2.7350	.0000	.0004	2	
66.9600	2.7400	.0000	.0004	2.7345	.0008	.0007	2	
68.9600	2.7400	.0000	.0004	2.7345	.0015	.0011	2	
70.9600	2.7400	.0000	.0004	2.7335	.0007	.0006	2	
72.9600	2.7400	.0000	.0004	2.7340	.0000	.0004	2	
74.9600	2.7400	.0000	.0004	2.7337	.0005	.0005	2	
76.9600	2.7400	.0000	.0004	2.7332	.0011	.0008	2	
78.9600	2.7400	.0000	.0004	2.7332	.0005	.0005	2	
80.9600	2.7400	.0000	.0004	2.7327	.0004	.0004	2	
82.9600	2.7400	.0000	.0004	2.7325	.0008	.0007	2	
85.2100	2.7400	.0000	.0004	2.7310	.0015	.0011	2	
86.2100	2.7400	.0000	.0004	2.7292	.0011	.0009	2	
2	2							
19								
88.0600	2.7400	.0000	.0004	2.7360	.0014	.0011	3	
89.0600	2.7400	.0000	.0004	2.7355	.0007	.0006	3	
90.0600	2.7400	.0000	.0004	2.7335	.0021	.0015	3	
91.0600	2.7400	.0000	.0004	2.7327	.0025	.0018	3	
93.0600	2.7400	.0000	.0004	2.7320	.0007	.0006	3	
95.0600	2.7400	.0000	.0004	2.7330	.0000	.0004	3	
97.0600	2.7400	.0000	.0004	2.7315	.0007	.0006	3	
99.0600	2.7400	.0000	.0004	2.7320	.0000	.0004	3	
101.0600	2.7400	.0000	.0004	2.7340	.0015	.0011	3	
103.0600	2.7400	.0000	.0004	2.7320	.0015	.0011	3	
104.5600	2.7400	.0000	.0004	2.7327	.0004	.0004	3	
106.1900	2.7400	.0000	.0004	2.7355	.0007	.0006	3	
108.1900	2.7400	.0000	.0004	2.7362	.0005	.0005	3	
110.1900	2.7400	.0000	.0004	2.7362	.0005	.0005	3	
112.1900	2.7400	.0000	.0004	2.7370	.0000	.0004	3	
113.1900	2.7400	.0000	.0004	2.7377	.0005	.0005	3	
114.1900	2.7400	.0000	.0004	2.7377	.0005	.0005	3	
115.1900	2.7400	.0000	.0004	2.7380	.0000	.0004	3	
116.1900	2.7400	.0000	.0004	2.7385	.0007	.0006	3	
PHD,REOL								

THE NUMBERS APPEARING ON THE RIGHT SIDE OF THE FUEL BODY
DATA CARDS ARE PUNCHED BY STAT TO IDENTIFY THE FUEL BODY.
THESE NUMBERS ARE NOT REQUIRED AS INPUT TO THE STRAIN CODE.

RESULTS FOR STRAIN SAMPLE PROBLEM RUN - PRINTED OUTPUT

FTE-4 COMPARISON OF MEASURED AND CALCULATED FUEL ROD STRAIN
MOLES 1&2 UO2 TRISO (22% FUEL VOL) AND THO2 BISO (78% FUEL VOL.) FUEL

FUEL BODY	FUEL ROD	CALCULATED			MEASURED			RELATIVE DIFFERENCE			COMPARISON	
		STRAIN %	S(1 SIGMA) %	E(1 SIGMA) %	STRAIN %	S(1 SIGMA) %	E(1 SIGMA) %	CALC/MEAS-1 Z(%)	S(1 SIGMA) SZ(%)	E(1 SIGMA) EZ(%)	TEST1 D=Z/EZ	TEST2 D**2
1	2	-1.912			-1.523	.035	.071	25.54	2.91	5.82	4.39	19.23
	5	-2.970			-1.693	.076	.098	75.45	7.89	10.13	7.45	55.51
	7	-3.314			-2.240	.059	.085	47.46	3.88	5.59	8.58	73.63
	10	-3.569			-2.428	.053	.081	46.99	3.20	4.88	9.63	92.83
	13	-3.660			-2.650	.152	.164	38.87	7.97	8.58	4.53	20.51
BODY AVERAGE		-3.089			-2.107	.085	.105	46.96	5.65	7.28	6.92	52.34
RMS/ERROR/TESTS		.637			.431	.038	.047	16.35	7.31	2.53	3.26	15.46
2	1	-3.720			-2.530	.050	.079	47.07	2.90	4.57	10.31	106.21
	2	-3.730			-2.767	.146	.158	34.82	7.12	7.71	4.52	20.39
	3	-3.739			-2.876	.061	.086	30.00	2.77	3.89	7.72	59.62
	4	-3.746			-2.625	.110	.126	42.70	6.00	6.85	6.24	38.89
	5	-3.748			-3.019	.077	.098	24.16	3.19	4.04	5.98	35.78
	6	-3.751			-2.844	.083	.103	31.88	3.84	4.75	6.71	44.97
	7	-3.752			-2.827	.091	.110	32.70	4.28	5.14	6.36	40.46
	8	-3.747			-2.852	.099	.116	31.39	4.54	5.32	5.89	34.75
	9	-3.738			-2.802	.086	.106	33.42	4.11	5.03	6.65	44.20
	10	-3.729			-2.856	.050	.078	30.56	2.27	3.58	8.54	72.90
	11	-3.719			-2.894	.132	.146	28.49	5.88	6.46	4.41	19.44
	12	-3.704			-2.853	.203	.212	29.81	9.25	9.65	3.09	9.55
	13	-3.686			-2.870	.082	.102	28.43	3.66	4.55	6.25	39.04
	14	-3.667			-2.727	.068	.091	34.47	3.35	4.48	7.69	59.12
BODY AVERAGE		-3.727			-2.810	.104	.120	32.85	4.88	5.67	6.45	44.66
RMS/ERROR/TESTS		.025			.116	.028	.032	5.64	1.51	1.30	1.51	24.15
3	2	-3.598			-2.781	.045	.076	29.41	2.10	3.52	8.36	69.84
	5	-3.451			-2.645	.036	.070	30.47	1.77	3.47	8.77	76.94
	7	-3.291			-2.674	.075	.096	23.07	3.43	4.43	5.21	27.15
	10	-2.921			-2.292	.087	.106	27.47	4.83	5.90	4.66	21.70
	13	-2.096			-2.019	.124	.138	3.79	6.35	7.09	.54	.29
BODY AVERAGE		-3.071			-2.482	.080	.100	22.84	4.07	5.08	5.51	39.18
RMS/ERROR/TESTS		.537			.284	.036	.045	9.86	4.41	1.82	2.27	12.31
ELEMENT AVERAGE		-3.457			-2.595	.095	.113	33.71	4.90	5.93	6.35	45.12
RMS/ERROR/TESTS		.497			.378	.019	.023	12.50	2.55	1.00	1.21	31.12

LEGEND

BODY AVERAGE	$\bar{U}_T$	$\bar{V}$	$\bar{S}_V$	$\bar{E}_V$	$\bar{Z}$	$\bar{S}_Z$	$\bar{E}_Z$	$\bar{D}$	$\bar{D}^2$
RMS/ERROR/TESTS	RMS_{U_T}	RMS_V	S_V	E_V	RMS_Z	$\frac{RMS_Z}{\sqrt{M}}$	S_Z	E_Z	$T1$
									$X^2_{.95}/M$

See Tables 3-1 and 3-2 for explanation of symbols.

FTE-4 COMPARISON OF MEASURED AND CALCULATED FUEL ROD STRAIN
 HOLES 3&4 (TH,U)C2 TRISO (78% FUEL VOL.) AND THC2 BISO (21% FUEL VOL.) FUEL
 HOLES 7&8 UC2 TRISO (64% FUEL VOL.) AND THC2 BISO (36% FUEL VOL.) FUEL

FUEL BODY	FUEL ROD	CALCULATED			MEASURED			RELATIVE DIFFERENCE			COMPARISON		
		STRAIN %	S(1 SIGMA) %	E(1 SIGMA) %	STRAIN %	S(1 SIGMA) %	E(1 SIGMA) %	CALC/MEAS-1 Z(%)	S(1 SIGMA) SZ(%)	E(1 SIGMA) EZ(%)	TEST1 D=Z/EZ	TEST2 D**2	
1	2	-1.312			-.799	.049	.079	64.24	10.12	16.21	3.96	15.70	
	5	-1.909			-1.244	.152	.164	53.50	18.79	20.26	2.64	6.97	
	7	-2.094			-1.585	.118	.133	32.13	9.83	11.06	2.90	8.44	
	10	-2.235			-1.861	.057	.083	20.09	3.66	5.37	3.74	13.98	
	13	-2.300			-1.887	.085	.105	21.90	5.50	6.75	3.24	10.51	
BODY AVERAGE		-1.970			-1.475	.100	.117	38.37	10.92	13.19	3.30	11.12	
RMS/ERROR/TESTS		.355			.410	.045	.052	17.56	7.86	4.88	5.90	7.37	2.21
2	2	-2.331			-2.122	.075	.096	9.87	3.87	4.98	1.98	3.92	
	5	-2.343			-2.234	.120	.135	4.88	5.64	6.32	.77	.60	
	7	-2.346			-2.087	.099	.117	12.39	5.35	6.28	1.97	3.90	
	10	-2.330			-1.967	.115	.130	18.47	6.91	7.82	2.36	5.58	
	13	-2.304			-1.955	.281	.287	17.61	16.92	17.31	1.03	1.06	
BODY AVERAGE		-2.331			-2.073	.156	.168	12.69	9.05	9.64	1.62	3.01	
RMS/ERROR/TESTS		.015			.104	.070	.075	5.07	2.27	4.05	4.31	3.63	2.21
3	2	-2.252			-2.329	.114	.129	-3.32	4.75	5.37	-.62	.38	
	5	-2.168			-2.015	.100	.117	7.62	5.33	6.24	1.22	1.49	
	7	-2.081			-2.080	.080	.100	.08	3.84	4.83	.02	.00	
	10	-1.883			-1.731	.062	.087	8.77	3.87	5.45	1.61	2.59	
	13	-1.421			-1.459	.059	.085	-2.56	3.93	5.67	-.45	.20	
BODY AVERAGE		-1.961			-1.923	.086	.105	2.12	4.38	5.53	.36	.93	
RMS/ERROR/TESTS		.296			.300	.038	.047	5.10	2.28	1.96	2.47	.80	2.21
ELEMENT AVERAGE		-2.087			-1.824	.118	.133	17.73	8.57	9.96	1.76	5.02	
RMS/ERROR/TESTS		.318			.393	.030	.034	18.76	4.84	2.21	2.57	6.81	1.67

FTE-4 COMPARISON OF MEASURED AND CALCULATED FUEL ROD STRAIN
HOLES 5&6 (TH,U)C2 TRISO (79% FUEL VOL.) AND THC2 TRISO (21% FUEL VOL.) FUEL

	FUEL BODY	FUEL ROD	CALCULATED		MEASURED		RELATIVE DIFFERENCE			COMPARISON			
			STRAIN %	S(1 SIGMA) %	STRAIN %	S(1 SIGMA) %	CALC/MEAS-1 Z(%)	S(1 SIGMA) SZ(%)	E(1 SIGMA) EZ(%)	TEST1 D=Z/EZ	TEST2 D**2		
D-5	1	2	-1.586		-1.464	.031	.069	26.09	8.39	18.76	1.39	1.93	
		5	-1.901		-1.858	.059	.085	5.01	7.18	10.41	.48	.23	
		7	-1.008		-1.206	.108	.124	-16.41	7.46	8.59	-1.91	3.65	
		10	-1.098		-1.259	.099	.117	-12.81	6.86	8.07	-1.59	2.52	
		13	-1.145		-1.526	.111	.127	-24.95	5.48	6.26	-3.99	15.91	
		BODY AVERAGE											
			-1.948		-1.063	.087	.107	-4.62	7.14	11.30	-1.12	4.85	
		RMS/ERROR/TESTS											
			.199		.367	.039	.048	18.19	8.14	3.19	5.05	2.51	2.21
		2	1	-1.165		-1.486	.083	.103	-21.59	4.38	5.45	-3.96	15.70
		2	-1.171		-1.563	.039	.072	-25.07	1.85	3.47	-7.22	52.11	
		3	-1.176		-1.575	.074	.096	-25.33	3.50	4.54	-5.58	31.09	
		4	-1.180		-1.661	.035	.071	-28.94	1.51	3.03	-9.56	91.40	
		5	-1.182		-1.528	.052	.080	-22.65	2.62	4.06	-5.57	31.08	
		6	-1.183		-1.665	.035	.070	-28.93	1.48	2.99	-9.66	93.35	
		7	-1.184		-1.658	.065	.089	-28.59	2.60	3.85	-7.43	55.25	
		8	-1.181		-1.722	.182	.192	-31.44	7.24	7.63	-4.12	16.98	
		9	-1.176		-1.510	.076	.098	-22.15	3.92	5.03	-4.40	19.37	
		10	-1.170		-1.602	.057	.083	-26.96	2.58	3.80	-7.09	50.29	
		11	-1.165		-1.476	.026	.067	-21.10	1.41	3.58	-5.90	34.84	
		12	-1.157		-1.675	.054	.081	-30.94	2.21	3.36	-9.22	85.00	
		13	-1.148		-1.703	.038	.072	-32.50	1.49	2.84	-11.46	131.31	
		14	-1.139		-1.541	.024	.066	-26.09	1.13	3.15	-8.28	68.56	
		BODY AVERAGE											
			-1.170		-1.597	.071	.094	-26.60	3.15	4.24	-7.10	55.45	
		RMS/ERROR/TESTS											
			.013		.080	.019	.025	3.66	.98	.84	1.13	26.58	
	3	2	-1.110		-1.587	.083	.103	-30.06	3.64	4.53	-6.64	44.05	
		5	-1.054		-1.634	.066	.090	-35.47	2.62	3.56	-9.95	98.99	
		7	-1.000		-1.418	.027	.067	-29.43	1.35	3.34	-8.82	77.81	
		10	-.885		-1.437	.048	.078	-38.40	2.05	3.34	-11.51	132.47	
		13	-.640		-1.363	.179	.189	-53.06	6.17	6.52	-8.14	66.31	
		BODY AVERAGE											
			-1.938		-1.488	.096	.114	-37.28	3.58	4.43	-9.01	83.93	
		RMS/ERROR/TESTS											
			.166		.104	.043	.051	8.57	3.83	1.60	1.98	20.15	
		ELEMENT AVERAGE											
			-1.075		-1.463	.080	.101	-24.24	4.37	6.42	-6.26	50.84	
		RMS/ERROR/TESTS											
			.163		.279	.016	.021	14.53	2.97	.89	1.31	30.65	

FTE-4 COMPARISON OF MEASURED AND CALCULATED FUEL BODY STRAIN

FUEL BODY	CORE HEIGHT	STRAIN %	CALCULATED		STRAIN %	MEASURED		RELATIVE DIFFERENCE			COMPARISON	
			S(1 SIGMA) %	E(1 SIGMA) %		S(1 SIGMA) %	E(1 SIGMA) %	CALC/MEAS-1 Z(%)	S(1 SIGMA) SZ(%)	E(1 SIGMA) EZ(%)	TEST1 D=Z/EZ	TEST2 D**2
1	29.59	-.005			-.077	.010	.021	-93.22	.91	1.86	-50.10	*****
	31.59	-.031			-.095	.015	.024	-67.14	5.36	8.27	-8.12	65.89
	33.59	-.061			-.091	.021	.027	-32.96	15.17	20.19	-1.63	2.67
	35.59	-.092			-.117	.028	.034	-21.47	19.09	22.64	-.95	.90
	36.59	-.105			-.073	.000	.018	43.28	.00	35.46	1.22	1.49
	38.45	-.128			-.029	.013	.022	338.12	193.61	333.18	1.01	1.03
	39.96	-.145			-.036	.000	.018	297.49	.00	196.75	1.51	2.29
	41.96	-.167			-.069	.010	.021	140.44	35.79	72.13	1.95	3.79
	43.96	-.187			-.066	.013	.022	164.26	55.83	96.04	1.92	3.68
	45.96	-.205			-.055	.018	.026	274.55	123.59	174.77	1.57	2.47
	47.96	-.222			-.069	.010	.021	220.11	47.65	96.02	2.29	5.25
	49.96	-.238			-.146	.036	.040	62.95	40.33	45.08	1.40	1.95
	51.96	-.253			-.117	.028	.034	116.60	52.65	62.39	1.67	3.49
	52.96	-.261			-.106	.015	.024	146.14	36.01	55.32	2.64	6.98
	53.96	-.268			-.139	.013	.022	93.29	17.98	30.93	3.02	9.10
	54.96	-.276			-.157	.013	.022	75.62	14.44	24.83	3.05	9.27
	BODY AVERAGE											
	RMS/ERROR/TESTS	-.165 .085			-.090 .037	.018 .004	.025 .006	111.13 125.67	64.36 31.42	116.41 16.09	-2.33 9.34	164.40 1.64
2	59.96	-.279			-.091	.021	.027	205.90	69.22	91.96	2.24	5.01
	60.96	-.285			-.084	.013	.022	239.18	52.14	89.68	2.67	7.11
	61.96	-.290			-.139	.013	.022	109.38	19.48	33.50	3.27	10.66
	62.96	-.296			-.139	.013	.022	113.50	19.66	34.16	3.32	11.04
	64.96	-.306			-.182	.000	.018	67.92	.00	16.61	4.09	16.73
	66.96	-.315			-.201	.021	.027	57.10	16.16	21.46	2.66	7.08
	68.96	-.324			-.201	.039	.043	61.48	31.14	34.36	1.79	3.20
	70.96	-.330			-.237	.018	.026	39.30	10.61	14.99	2.62	6.87
	72.96	-.335			-.219	.000	.018	52.66	.00	12.00	4.20	17.61
	74.96	-.337			-.230	.013	.022	46.64	8.23	14.15	3.30	10.67
	76.96	-.339			-.248	.028	.034	36.63	15.63	16.52	1.98	3.91
	78.96	-.339			-.248	.013	.022	36.72	7.11	12.22	3.00	9.03
	80.96	-.338			-.266	.010	.021	26.90	4.92	9.90	2.72	7.38
	82.96	-.336			-.274	.021	.027	22.63	9.25	12.28	1.84	3.39
	85.21	-.333			-.328	.039	.043	1.36	11.95	13.18	.10	.01
	86.21	-.332			-.394	.028	.034	-15.84	6.06	7.18	-2.21	4.86
	BODY AVERAGE											
	RMS/ERROR/TESTS	-.320 .021			-.218 .079	.021 .005	.028 .007	68.85 66.59	25.35 16.65	37.29 9.32	2.35 9.40	7.80 1.64
3.	88.06	-.333			-.146	.036	.040	127.69	56.40	63.05	2.03	4.11
	89.06	-.329			-.164	.018	.026	100.12	22.01	31.12	3.22	10.35
	90.06	-.325			-.237	.054	.057	36.84	31.26	32.95	1.12	1.25

91.06	-.321	-.266	.065	.067	20.33	29.14	30.26	.67	.45
93.06	-.312	-.292	.018	.026	6.70	6.60	9.33	.72	.52
95.06	-.300	-.255	.000	.018	17.50	.00	8.30	2.11	4.45
97.06	-.288	-.310	.018	.026	-7.32	5.40	7.63	-.96	.92
99.06	-.272	-.292	.000	.018	-6.83	.00	5.76	-1.19	1.41
101.06	-.254	-.219	.039	.043	16.14	20.53	22.65	.71	.51
103.06	-.236	-.292	.039	.043	-19.22	10.71	11.82	-1.63	2.65
104.56	-.221	-.266	.010	.021	-16.93	3.22	6.48	-2.61	6.82
106.19	-.205	-.164	.018	.026	24.89	13.74	19.42	1.28	1.64
108.19	-.181	-.139	.013	.022	30.73	12.16	20.92	1.47	2.16
110.19	-.155	-.139	.013	.022	11.97	10.42	17.91	.67	.45
112.19	-.127	-.109	.000	.018	15.81	.00	19.10	.83	.69
113.19	-.111	-.084	.013	.022	32.24	20.33	34.96	.92	.85
114.19	-.095	-.084	.013	.022	13.44	17.44	29.99	.45	.20
115.19	-.079	-.073	.000	.018	6.82	.00	26.92	.33	.11
116.19	-.064	-.055	.018	.026	16.26	38.36	54.25	.30	.09
BODY AVERAGE -									
	-.221	-.189	.027	.032	22.60	21.45	28.26	.55	2.09
RMS/ERROR/TESTS	.090	.084	.006	.007	35.04	8.04	4.92	6.48	2.39
ELEMENT AVERAGE									
	-.235	-.167	.023	.029	64.88	40.90	70.61	.21	54.80
RMS/ERROR/TESTS	.096	.089	.003	.004	90.25	12.64	5.73	9.89	1.49

***EXIT LOC**016776

*PMD,REDL

*FIN

CR

LOAD 8990 6/2 15 -1 53391

PUNCHED CARD OUTPUT FROM STRAIN SAMPLE PROBLEM RUN

<u>FUEL ROD STRAIN</u>			
29.0700	-1.5230	.1385	
34.9200	-1.6930	.1915	
38.8200	-2.2400	.1659	
44.6700	-2.4280	.1579	
50.5100	-2.6498	.3210	
58.2300	-2.5295	.1540	
60.1800	-2.7665	.3101	
62.1300	-2.8758	.1685	
64.0800	-2.6249	.2469	
66.0300	-3.0169	.1925	
67.9800	-2.8444	.2009	
69.9300	-2.8275	.2147	
71.8800	-2.8519	.2265	
73.8300	-2.8019	.2069	
75.7800	-2.8559	.1535	
77.7200	-2.8940	.2853	
79.6700	-2.8530	.4156	
81.6200	-2.8703	.1993	
83.5700	-2.7274	.1782	
91.2800	-2.7807	.1482	
97.1300	-2.6448	.1380	
101.0300	-2.6741	.1885	
106.8800	-2.2918	.2078	
112.7200	-2.0193	.2703	
29.0700	-1.7988	.1546	
34.9200	-1.2436	.3217	
38.8200	-1.5843	.2000	
44.6700	-1.8610	.1632	
50.5100	-1.8866	.2049	
60.1800	-2.1215	.1887	
66.0300	-2.2341	.2638	
69.9300	-2.0869	.2284	
75.7800	-1.9668	.2544	
81.6200	-1.9554	.5632	
91.2800	-2.3291	.2536	
97.1300	-2.0150	.2290	
101.0300	-2.0795	.1967	
106.8800	-1.7308	.1700	
112.7200	-1.4588	.1663	
29.0700	-1.4645	.1354	
34.9200	-1.8576	.1667	
38.8200	-1.2061	.2429	
44.6700	-1.2595	.2285	
50.5100	-1.5260	.2493	
58.2300	-1.4863	.2024	
60.1800	-1.5627	.1420	
62.1300	-1.5745	.1877	
64.0800	-1.6607	.1387	
66.0300	-1.5277	.1573	
67.9800	-1.6650	.1375	

FUEL HOLES
1 AND 2

FUEL HOLES
3, 4, 7, AND 8

CORE HEIGHT (INCHES)	STRAIN (%)	2 σ ERROR (%)	
↓	↓	↓	
69.9300	-1.6578	.1750	
71.8800	-1.7223	.3757	
73.8300	-1.5102	.1914	
75.7800	-1.6021	.1635	
77.7200	-1.4761	.1311	
79.6700	-1.6752	.1596	
81.6200	-1.7029	.1407	
83.5700	-1.5414	.1268	
91.2800	-1.5869	.2014	
97.1300	-1.6339	.1769	
101.0300	-1.4177	.1314	
106.8800	-1.4374	.1526	
112.7200	-1.3631	.3708	
FUEL HOLES 5 AND 6			
↓			
FUEL BODY STRAIN			
29.5900	-.0766	.0412	
31.5900	-.0949	.0466	
33.5900	-.0912	.0538	
35.5900	-.1168	.0660	
36.5900	-.0737	.0354	
38.4500	-.0292	.0435	
39.9600	-.0365	.0354	
41.9600	-.0593	.0408	
43.9600	-.0657	.0435	
45.9600	-.0547	.0501	
47.9600	-.0693	.0408	
49.9600	-.1460	.0792	
51.9600	-.1168	.0659	
52.9600	-.1058	.0466	
53.9600	-.1387	.0435	
54.9600	-.1569	.0435	
59.9600	-.0912	.0538	
60.9600	-.0839	.0435	
61.9600	-.1387	.0435	
62.9600	-.1387	.0435	
64.9600	-.1825	.0354	
66.9600	-.2707	.0537	
68.9600	-.2007	.0837	
70.9600	-.2372	.0500	
72.9600	-.2190	.0354	
74.9600	-.2299	.0435	
76.9600	-.2482	.0659	
78.9600	-.2482	.0435	
80.9600	-.2664	.0407	
82.9600	-.2737	.0537	
85.2100	-.3285	.0837	
86.2100	-.3942	.0659	
88.0600	-.1460	.0792	
89.0600	-.1642	.0501	
90.0600	-.2372	.1120	
91.0600	-.2664	.1313	
93.0600	-.2920	.0500	
95.0600	-.2555	.0354	
97.0600	-.3102	.0500	
99.0600	-.2920	.0354	
101.0600	-.2190	.0837	
103.0600	-.2920	.0837	
104.5600	-.2664	.0407	

106.1900	-.1642	.0501
108.1900	-.1387	.0435
110.1900	-.1387	.0435
112.1900	-.1095	.0354
113.1900	-.0839	.0435
114.1900	-.0639	.0435
115.1900	-.0730	.0354
116.1900	-.0547	.0501

APPENDIX E
GAPS INPUT INSTRUCTIONS

Column	1-6	
Format	I6	
Name	FTE	
1	Test element name	

Comments

Column	1-6	7-12	13-18	19-24	25-30	
Format	I6	I6	I6	I6	I6	
Name	IOPT(1)	IOPT(2)	IOPT(3)	IOPT(4)	IOPT(5)	
2	1- Calculate and compare fuel rod - fuel hole gaps with TREVER predictions (group 1 calculations) 0- Omit calculations	1- Perform fuel rod - fuel hole gap calculations (group 2 calculations) 0- Omit calculations	1- Perform sleeve - fuel body gap calculations based on sleeve O.D. (group 3 calculations) 0- Omit calculations	1- Perform sleeve - fuel body gap calculations based on sleeve I.D. (group 4 calculations) 0- Omit calculations	1- Punched output 0- No punched output	

Punched output from this program is used in the plotting code.

Column	1-6	7-12	13-18	19-24	25-30	31-36	37-42	43-48	
Format	I6	I6	I6	I6	I6	I6	I6	I6	
Name	NBODY	NSTACK	NFR	NNFT	NTIME 1	LR1	LR2	LR3	
3	Number of fuel bodies	Number of fuel stacks per fuel body	Number of fuel rods per fuel stack	Number of different fuel groups in test element	Number of time intervals test element was in the core	Fuel body number of last fuel rod considered by STAT	Fuel stack number of last fuel rod considered by STAT	Fuel rod number of last fuel rod considered by STAT	

Column	1-72
Format	12I6
Name	(NUM(J), J = 1,NBODY)
4	Number of measurement locations for each fuel body (O.D.)

Comments

Column	1-12	13-72	
Format	E12.6	5E12.6	
Name	BEGIN	(END(J), J = 1,NBODY)	
5	Core height of first fuel body O.D. measurement location in element	Core height of last fuel body O.D. measurement location in each fuel body	

These should be total core heights given in inches.

Column	1-6	7-12	13-72	
Format	I6	I6	10I6	
Name	NBOD1(1)	NBOD2(1)	(NBOD1(L),NBOD2(L), L = 2,NBODY)	
6	Number of preirradiation fuel body O.D. measurements per measurement location in fuel body 1	Number of postirradiation fuel body O.D. measurements per measurement location in fuel body 1	Number of preirradiation and postirradiation fuel body diameter measurements per measurement location in fuel bodies 2 through NBODY	

Column	1-10	11-20	21-30	31-40	41-50	51-60	61-70
Format	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0
Name	BPOS(I,J)	DFB1(I,J)	SDFB1(I,J)	EDFB1(I,J)	DFB2(I,J)	SDFB2(I,J)	EDFB2(I,J)
7	Core height of measurement location J in fuel body I	Preirradiation fuel body diameter at measurement location J (average of NDFB1 measurements)	Sample random error of preirradiation fuel body diameter measurements at measurement location J	Combined random error for preirradiation fuel body diameter at measurement location J	Postirradiation fuel body diameter at measurement location J (average of NDFB2 measurements)	Sample random error of postirradiation fuel body diameter measurements at measurement location J	Combined random error for postirradiation fuel body diameter at measurement location J

Comments

NUM(J) cards of type 7 are required for fuel body I. These cards are punched by the STAT code.

Column	1-9	10-12	13-24	25-36	37-45	46-48	49-60	61-72
Format	E9.0	I3	E12.0	E12.0	E9.0	I3	E12.0	E12.0
Name	B1(I)	NB1(I)	SB1(I)	EPB1(I)	B1(I)	NB2(I)	SB2(I)	EPB2(I)
8	Average preirradiation O.D. for fuel body I (inches)	Total number of O.D. measurements for fuel body I	Sample random error for average preirradiation fuel body O.D. for fuel body I (inches)	Combined random error for average preirradiation fuel body O.D. for fuel body I (inches)	Average postirradiation O.D. for fuel body I (inches)	Total number of postirradiation O.D. measurements for fuel body I	Sample random error for average postirradiation fuel body O.D. for fuel body I (inches)	Combined random error for average postirradiation fuel body O.D. for fuel body I (inches)

This information is obtained from STAT code results. NBODY sets of cards 7 and 8 are required.

Column	1-12	13-24	25-36	37-48	
Format	E12.0	I12	E12.0	E12.0	
Name	FH1(I,J)	NFH1(I,J)	SFH1(I,J)	EFH1(I,J)	
9	Preirradiation fuel hole diameter for fuel hole J, fuel body I (inches)	Number of measurements for FH1(I,J)	Sample random error for FH1(I,J) (inches)	Combined random error for FH1(I,J) (inches)	

This information must be supplied for each fuel stack for which postirradiation fuel rod diameter measurements were made

Column	1-72
Format	12I6
Name	((ID(J,K), K = 1,NSTACK), J = 1,NBODY)
10	Array identifying the fuel group to which each fuel rod stack belongs. The numbers of the fuel groups depend on the organization of the TREVER results tape (unit 15). Fuel group 1 is the group for which predicted strains are given in file 1 of this tape, fuel group 2 is the group for which predicted strains are given in file 2, and so on.

Comments

Only required if
IOPT(1) = 1.
Number of cards re-
quired is
NSTACK*NBODY
12

Column	1-72
Format	6E12.0
Name	(TPOS(K), K = 1,30)
11	Core height of each TREVER calculation node (<u>total</u> core heights in <u>inches</u>)

Only required if
IOPT(1) = 1.
5 cards are required.

Column	1-72
Format	6E12.0
Name	((RPOS(J,K), K = 1,NFR), J = 1, NBODY)
12	Core height of the center of each fuel rod layer (<u>total</u> core heights in <u>inches</u>)

Column	1-78
Format	13A6
Name	TITLE B
13	<p>Description of fuel group</p> <p>Example: HOLES 1 AND 2, UO₂ TRISO (22% FUEL VOL.) AND THO₂ BISO (78% FUEL VOL.) FUEL</p>

Comments

Column	1-78
Format	13A6
Name	TITLE B (Cont.)
14	<p>If the fuel group consists of two fuel blends having similar irradiation-induced strain characteristics, the second fuel blend would be identified on this card. If the fuel group consists of only one fuel blend, this card will be blank.</p>

NNFT sets of cards 13
and 14 are required,
but only if IOPT(1) = 1

Column	1-78
Format	13A6
Name	TITLE
15	<p>Heading for fuel rod - fuel hole gaps table. This card should always read:</p> <p>12Δ Name 2Δ FUEL ROD - FUEL HOLE GAPS ↑ Test element name</p>

Only required if
IOPT(2) = 1

Column	1-12	13-24	25-36	37-48	49-60	61-72	
Format	E12.0	E12.0	E12.0	E12.0	E12.0	E12.0	
Name	FR1(I,J)	SFR1(I,J)	EFR1(I,J)	FR2(I,J)	SFR2(I,J)	EFR2(I,J)	
16	Average preirradiation fuel rod diameter for fuel stack J, fuel body I (inches)	Sample random error for FR1(I,J) (inches)	Combined random error for FR1(I,J) (inches)	Average postirradiation fuel rod diameter for fuel stack J, fuel body I (inches)	Sample random error for FR2(I,J) (inches)	Combined random error for FR2(I,J) (inches)	

Comments

Only required if IOPT(2) = 1.

These cards are punched by the STAT code.

A card must be supplied for each fuel stack having postirradiation fuel rod diameter measurements.

Column	1-6	
Format	I6	
Name	NSTRAT	
17	Number of arbitrarily defined combinations of fuel stacks (strata)	

Only required if IOPT(2) = 1

Column	1-3	4-72
Format	I3	23I3
Name	NUMB	(IBODY(L), ISTACK(L), L = 1, NUMB)
18	Number of fuel stacks in stratum	IBODY (L) = body number of fuel stack L ISTACK(L) = fuel hole number of fuel stack L

Only required if IOPT(2) = 1

All fuel stacks* in each fuel group should be stratified.

The last stratum must include all fuel stacks.*

*All fuel stacks for which postirradiation fuel rod diameter measurements are available.

Column	1-12	13-24	24-36	37-48	49-60	61-72	
Format	E12.0	E12.0	E12.0	E12.0	E12.0	E12.0	
Name	R1	SR1	ER1	R2	SR2	ER2	
19	Average preirradiation fuel rod diameter for stratum (inches)	Sample random error for R1 (inches)	Combined random error for ER1 (inches)	Average postirradiation fuel rod diameter for stratum (inches)	Sample random error for R2 (inches)	Combined random error for ER2 (inches)	

Comments

Only required if IOPT(2) = 1.
 These cards are punched by the STAT code.
 NSTRAT pairs of cards 16 and 17 are required.

Column	1-12	13-24	24-36	37-48	49-60	61-72	
Format	E12.0	E12.0	E12.0	E12.0	E12.0	E12.0	
Name	DB1	SDB1	EDB1	DB2	SDB2	EDB2	
20	Element average preirradiation fuel body diameter (inches)	Sample random error for DB1 (inches)	Combined random error for EDB1 (inches)	Element average postirradiation fuel body diameter (inches)	Sample random error for DB2 (inches)	Combined random error for EDB2 (inches)	

These data are obtained from STAT code results. Only required if either option 2, 3, or 4 is non-zero.

Column	1-78
Format	13A6
Name	TITLE
21	<p>Heading for sleeve - fuel body gaps (from sleeve O.D.) table. This card should always read:</p> <p>17Δ Name 2Δ SLEEVE - FUEL BODY GAPS (FROM SLEEVE O.D.)</p> <p>↑</p> <p>Element name</p>

Only required if IOPT(3) = 1

Column	1-6	
Format	I6	
Name	NPOS	
22	Number of sleeve outer diameter measurement locations	

Comments

Only required if
IOPT(3) = 1

Column	1-6	7-12	
Format	I6	I6	
Name	NS1(I)	NS2(I)	
23	Number of preirradiation sleeve O.D. measurements at measurement location I	Number of postirradiation sleeve O.D. measurements at measurement location I	

Only required if
IOPT(3) = 1

Column	1-10	11-20	21-30	31-40	41-50	51-60	61-70
Format	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0
Name	SPOS(I)	S1(I)	SS1(I)	ES1(I)	S2(I)	SS2(I)	ES2(I)
24	Core height of measurement location I (inches)	Preirradiation sleeve outer diameter at measurement location I (inches)	Sample random error for S1(I) (inches)	Combined random error for S1(I) (inches)	Postirradiation sleeve outer diameter at measurement location I (inches)	Sample random error for S2(I) (inches)	Combined random error for S2(I) (inches)

Only required if
IOPT(3) = 1.
These cards are punched
by the STAT code.

Column	1-12	13-24	25-36	
Format	E12.0	E12.0	E12.0	
Name	SI1	SSI1	ESI1	
25	Preirradiation sleeve inner diameter at measurement location 1 (inches)	Sample random error for SI1 (inches)	Combined random error for SI1 (inches)	

Comments

Only required if
IOPT(3) = 1.

NPOS sets consisting
of cards 23, 24, and
25 are required.

Column	1-12	13-24	25-36	
Format	E12.0	E12.0	E12.0	
Name	SI1	SSI1	ESI1	
26	Average preirradiation inner sleeve diameter for fuel body I (inches)	Sample random error for SI1 (inches)	Combined random error for SI1 (inches)	

Only required if
 $IOPT(3) = 1$.

Required for each fuel
 body having a post-
 irradiation sleeve
 O.D. measurement.

These data are
 obtained by hand
 calculations.

Column	1-12	13-24	25-36		Comments
Format	E12.0	E12.0	E12.0		
Name	SI1	SSI1	ESI1		
27	Average preir-radiation inner sleeve diameter for entire element (inches)	Sample random error for SI1 (inches)	Combined random error for SI1 (inches)		

Column	1-78	
Format	13A6	
Name	TITLE	
28	<p>Heading for fuel body - sleeve gap table (from sleeve I.D.) This card should always read:</p> <p>17Δ Name 2Δ SLEEVE - FUEL BODY GAPS (FROM SLEEVE I.D.)</p> <p>↑ Element name</p>	

Column	1-6	
Format	I6	
Name	NPOS	
29	Number of sleeve inner diameter measurement locations	

Column	1-6	7-12	
Format	I6	I6	
Name	NS1(I)	NS2(I)	
30	Number of preirradiation sleeve I.D. measurements at measurement location I	Number of postirradiation sleeve I.D. measurements at measurement location I	

Comments

Only required if IOPT(4) = 1.
NP0S pairs of cards 30 and 31 are required.

Column	1-10	11-20	21-30	31-40	41-50	51-60	61-70
Format	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0	E10.0
Name	SPOS(I)	S1(I)	SS1(I)	ES1(I)	S2(I)	SS2(I)	ES2(I)
31	Core height of measurement location I (inches)	Preirradiation sleeve inner diameter at measurement location I (inches)	Sample random error for S1(I) (inches)	Combined random error for S1(I) (inches)	Postirradiation sleeve inner diameter at measurement location I (inches)	Sample random error for S2(I) (inches)	Combined random error for S2(I) (inches)

Only required if IOPT(4) = 1.
These cards are punched by the STAT code.

Column	
Format	
Name	

APPENDIX F
GAPS SAMPLE PROBLEM

CONTROL CARDS FOR GAPS SAMPLE PROBLEM RUN

```

PRUN,M/R 40914,3224943001,1692789AURWE/8/2450,2,200/400
PASG,AX PB*GAPS
PASG,AX STRAIN*FTE4
PUSE 10,STRAIN*FTE4
PASG,T 15,U,8990
PXQT PB*GAPS,SMAP
  
```

INPUT DATA DECK FOR GAPS SAMPLE PROBLEM RUN

FTE=4

0	0	1	1	0				
3	8	14	3	9	3	7	13	
16	16	19						
29.59		54.96		86.27		116.19		
2	2	2	2	2	2			
29.5900	2.7400	.0000	.0004	2.7379	.0004	.0005	1	
31.5900	2.7400	.0000	.0004	2.7374	.0006	.0005	1	
33.5900	2.7400	.0000	.0004	2.7375	.0008	.0007	1	
35.5900	2.7400	.0000	.0004	2.7368	.0011	.0008	1	
36.5900	2.7400	.0000	.0004	2.7380	.0000	.0004	1	
38.4500	2.7400	.0000	.0004	2.7392	.0005	.0005	1	
39.9600	2.7400	.0000	.0004	2.7390	.0000	.0004	1	
41.9600	2.7400	.0000	.0004	2.7381	.0004	.0005	1	
43.9600	2.7400	.0000	.0004	2.7382	.0005	.0005	1	
45.9600	2.7400	.0000	.0004	2.7385	.0007	.0006	1	
47.9600	2.7400	.0000	.0004	2.7381	.0004	.0005	1	
49.9600	2.7400	.0000	.0004	2.7360	.0014	.0011	1	
51.9600	2.7400	.0000	.0004	2.7368	.0011	.0008	1	
52.9600	2.7400	.0000	.0004	2.7371	.0006	.0006	1	
53.9600	2.7400	.0000	.0004	2.7362	.0005	.0005	1	
54.9600	2.7400	.0000	.0004	2.7357	.0005	.0005	1	
2.7400 32	.000000	.000350	2.7375 32	.001137	.000404	BODY 1		
59.9600	2.7400	.0000	.0004	2.7375	.0008	.0007	2	
60.9600	2.7400	.0000	.0004	2.7377	.0005	.0005	2	
61.9600	2.7400	.0000	.0004	2.7362	.0005	.0005	2	
62.9600	2.7400	.0000	.0004	2.7362	.0005	.0005	2	
64.9600	2.7400	.0000	.0004	2.7350	.0000	.0004	2	
66.9600	2.7400	.0000	.0004	2.7345	.0008	.0007	2	
68.9600	2.7400	.0000	.0004	2.7345	.0015	.0011	2	
70.9600	2.7400	.0000	.0004	2.7335	.0007	.0006	2	
72.9600	2.7400	.0000	.0004	2.7340	.0000	.0004	2	
74.9600	2.7400	.0000	.0004	2.7337	.0005	.0005	2	
76.9600	2.7400	.0000	.0004	2.7332	.0011	.0008	2	
78.9600	2.7400	.0000	.0004	2.7332	.0005	.0005	2	
80.9600	2.7400	.0000	.0004	2.7327	.0004	.0004	2	
82.9600	2.7400	.0000	.0004	2.7325	.0008	.0007	2	
85.2100	2.7400	.0000	.0004	2.7310	.0015	.0011	2	
86.2100	2.7400	.0000	.0004	2.7292	.0011	.0009	2	

2.7400 32	.000000	.000350	2.7341 32	.002273	.000533	BODY 2
88.0600	2.7400	.0000	.0004	2.7360	.0014	.0011 3
89.0600	2.7400	.0000	.0004	2.7355	.0007	.0006 3
90.0600	2.7400	.0000	.0004	2.7335	.0021	.0015 3
91.0600	2.7400	.0000	.0004	2.7327	.0025	.0018 3
93.0600	2.7400	.0000	.0004	2.7320	.0007	.0006 3
95.0600	2.7400	.0000	.0004	2.7330	.0000	.0004 3
97.0600	2.7400	.0000	.0004	2.7315	.0007	.0006 3
99.0600	2.7400	.0000	.0004	2.7320	.0000	.0004 3
101.0600	2.7400	.0000	.0004	2.7340	.0015	.0011 3
103.0600	2.7400	.0000	.0004	2.7320	.0015	.0011 3
104.5600	2.7400	.0000	.0004	2.7327	.0004	.0004 3
106.1900	2.7400	.0000	.0004	2.7355	.0007	.0006 3
108.1900	2.7400	.0000	.0004	2.7362	.0005	.0005 3
110.1900	2.7400	.0000	.0004	2.7362	.0005	.0005 3
112.1900	2.7400	.0000	.0004	2.7370	.0000	.0004 3
113.1900	2.7400	.0000	.0004	2.7377	.0005	.0005 3
114.1900	2.7400	.0000	.0004	2.7377	.0005	.0005 3
115.1900	2.7400	.0000	.0004	2.7380	.0000	.0004 3
116.1900	2.7400	.0000	.0004	2.7385	.0007	.0006 3
2.7400 38	.000000	.000350	2.7348 38	.002455	.000530 <td>BODY 3</td>	BODY 3
2.7400	.0000	.00035	2.7354	.00252	.00043	
.4994	1	.0001	.00017			
.4990	1	.0001	.00017			
.4992	1	.0001	.00017			
.4992	1	.0001	.00017			
.5000	1	.0001	.00017			
.5000	1	.0001	.00017			
.4998	1	.0001	.00017			
.4996	1	.0001	.00017			
.4996	1	.0001	.00017			
.4998	1	.0001	.00017			
.4998	1	.0001	.00017			
.4997	1	.0001	.00017			
.4995	1	.0001	.00017			
.4995	1	.0001	.00017			
.4995	1	.0001	.00017			
.4995	1	.0001	.00017			
1	1	2	2	1	1	2
3	3	2	2	3	3	2
27.51	30.24	32.97	35.70	38.43	41.16	
43.89	46.61	49.34	52.07	58.62	61.35	
64.08	66.81	69.54	72.27	74.99	77.72	
80.45	83.18	89.72	92.45	95.18	97.91	
100.64	103.37	106.09	108.82	111.55	114.28	
27.12	29.07	31.02	32.97	34.92	36.87	
38.82	40.77	42.72	44.67	46.61	48.56	
50.51	52.46	54.23	60.18	62.13	64.08	
66.03	67.98	69.93	71.88	73.83	75.78	
77.72	79.67	81.62	83.57	84.33	91.28	
93.23	95.18	97.13	99.08	101.03	102.98	
104.93	106.88	108.82	110.77	112.72	114.67	

HOLES 182 UO2 TRISO (22% FUEL VOL) AND THO2 BISO (78% FUEL VOL.) FUEL

HOLES 384 (TH,U)C2 TRISO (78% FUEL VOL.) AND THC2 BISO (21% FUEL VOL.) FUEL

HOLES 788 UC2 TRISO (64% FUEL VOL.) AND THC2 BISO (36% FUEL VOL.) FUEL

HOLES 586 (TH,U)C2 TRISO (79% FUEL VOL.) AND THC2 TRISO (21% FUEL VOL.) FUEL

FTE-4 FUEL ROD - FUEL HOLE GAPS

.489600	.000601	.000620	.479243	.002619	.000488	1 1
.491356	.001671	.000731	.483957	.002300	.000432	1 3
.490573	.000541	.000616	.485557	.002623	.000489	1 5
.490987	.000641	.000622	.482690	.002615	.000488	1 7
.489365	.000628	.000608	.475301	.001554	.000197	2 1
.489367	.000578	.000687	.475550	.002993	.001226	2 2
.490613	.000795	.000634	.480157	.001061	.000218	2 3
.489800	.000183	.000610	.480117	.001465	.000607	2 4
.490086	.001185	.000627	.482268	.001269	.000171	2 5
.490500	.000468	.000658	.482950	.001531	.000633	2 6
.490613	.000328	.000600	.478550	.002679	.000516	2 7
.490633	.001196	.000915	.479233	.001121	.000469	2 8
.489073	.000311	.000605	.477140	.002675	.000499	3 1
.490644	.001783	.000747	.481313	.001583	.000306	3 3
.490437	.002165	.000808	.482723	.001619	.000312	3 5
.490333	.000637	.000622	.479543	.002179	.000410	3 7

2 2 1 2 2	.489365	.000619	.000607	.475318	.001661	.000202STRAT 5
2 2 3 2 4	.490478	.000789	.000628	.480150	.001114	.000211STRAT 6
2 2 5 2 6	.490113	.001154	.000624	.482313	.001290	.000169STRAT 7
2 2 7 2 8	.490617	.000507	.000612	.478671	.002477	.000436STRAT 8
4 1 1 2 1 2 2 3 1	.489354	.000586	.000604	.476467	.002611	.000235STRAT 13
4 1 3 2 3 2 4 3 3	.490812	.001480	.000635	.481703	.002324	.000257STRAT 14
4 1 5 2 5 2 6 3 5	.490270	.001344	.000619	.483044	.002111	.000199STRAT 15
4 1 7 2 7 2 8 3 7	.490637	.000633	.000607	.480232	.002964	.000322STRAT 16
16 1 1 1 3 1 5 1 7 2 1 2 2 2 3 2 4 2 5 2 6 2 7 2	.490171	.001219	.000605	.480229	.003654	.000193FTE-4

FTE-4 SLEEVE - FUEL BODY GAPS (FROM SLEVE O.D.)

6	1	2				
7,1560	3,4868	.0007	.0007	3,4892	.0006	.0005
2,7522	.0008	.00049				
1	2					
31,1560	3,4868	.0007	.0007	3,4863	.0006	.0006
2,7522	.0008	.00049				
1	2					
55,1560	3,4868	.0007	.0007	3,4809	.0004	.0004
2,7522	.0008	.00049				
1	2					
79,1560	3,4868	.0007	.0007	3,4806	.0008	.0007
2,7522	.0008	.00049				
1	2					
103,1560	3,4868	.0007	.0007	3,4844	.0005	.0005
2,7522	.0008	.00049				
1	2					
119,7300	3,4868	.0007	.0007	3,4873	.0038	.0027

2.7522	.0008	.00049				
2.7522	.0008	.00049				
2.7522	.0008	.00049				
2.7522	.0008	.00049				
2.7522	.0008	.00049				
FTE-4 SLEEVE - FUEL BODY GAPS (FROM SLEEVE I.D.)						
3						
1	2					
24.7500	2.7522	.0008	.0008	2.7516	.0003	.0004
1	2					
72.2400	2.7522	.0008	.0008	2.7500	.0003	.0004
1	2					
119.7300	2.7522	.0008	.0008	2.7533	.0007	.0006
EPMD, BREL						

THE NUMBERS AND NOTATIONS APPEARING IN THE IDENTIFICATION FIELD (COLUMNS 73-80) OF THE ABOVE CARDS ARE PUNCHED BY STAT TO HELP IDENTIFY THE DATA CONTAINED ON THE CARDS. THESE NUMBERS AND NOTATIONS ARE NOT REQUIRED AS INPUT TO THE GAPS CODE.

RESULTS OF GAPS SAMPLE PROBLEM RUN - PRINTED OUTPUT

FTE-4 COMPARISON OF MEASURED AND CALCULATED FUEL ROD FUEL HOLE GAPS
HOLES 1&2 UN2 TRISO (22% FUEL VOL) AND THO2 RISO (78% FUEL VOL.) FUEL

FUEL BODY	CORE HEIGHT	GAP MIL	CALCULATED		GAP MIL	MEASURED		RELATIVE DIFFERENCE			COMPARISON	
			S(1 SIGMA) MIL	E(1 SIGMA) MIL		S(1 SIGMA) MIL	E(1 SIGMA) MIL	CALC/MEAS-1	S(1 SIGMA) SZ(X)	E(1 SIGMA) EZ(X)	TEST1 D=Z/EZ	TEST2 D**2
1	29.07	9.683			8.117	.140	.227	19.29	2.05	3.34	5.77	33.31
	34.92	12.074			9.083	.345	.389	32.92	5.05	5.70	5.78	33.40
	38.82	12.790			10.185	.223	.287	25.57	2.76	3.53	7.24	52.35
	44.67	13.261			10.561	.174	.250	25.56	2.07	2.97	8.61	74.09
	50.51	13.410			11.360	.330	.376	18.04	3.43	3.90	4.62	21.38
BODY AVERAGE												
RMS/ERROR/TESTS		12.244			9.861	.256	.313	24.28	3.27	4.01	6.40	42.91
		1.362			1.139	.114	.140	5.32	2.38	1.79	14.32	2.21
2	58.23	13.441			11.439	.240	.313	17.50	2.47	3.21	5.45	29.72
	60.18	13.437			11.605	.242	.314	15.79	2.42	3.13	5.04	25.39
	62.13	13.431			11.953	.221	.298	12.36	2.08	2.80	4.41	19.45
	64.08	13.421			11.494	.428	.473	16.77	4.35	4.80	3.49	12.20
	66.03	13.406			11.757	.341	.395	14.03	3.31	3.83	3.66	13.38
	67.98	13.390			11.973	.290	.352	11.84	2.71	3.29	3.60	12.94
	69.93	13.373			11.844	.328	.383	12.91	3.13	3.65	3.54	12.50
	71.88	13.348			12.007	.367	.418	11.17	3.40	3.87	2.89	8.33
	73.83	13.320			12.061	.312	.371	10.44	2.86	3.39	3.08	9.46
	75.78	13.290			12.217	.245	.316	8.79	2.18	2.81	3.12	9.75
	77.72	13.261			11.688	.586	.619	13.46	5.69	6.01	2.24	5.01
	79.67	13.226			11.946	.211	.291	10.71	1.96	2.69	3.98	15.82
	81.62	13.188			11.851	.295	.356	11.29	2.77	3.34	3.38	11.40
	83.57	13.148			11.866	.268	.334	10.81	2.51	3.12	3.46	11.97
BODY AVERAGE												
RMS/ERROR/TESTS		13.334			11.836	.327	.383	12.70	3.14	3.67	3.67	14.09
		.094			.212	.087	.102	2.46	.66	.84	13.72	1.69
3	91.28	13.017			11.610	.261	.316	12.12	2.52	3.06	3.97	15.74
	97.13	12.736			11.059	.157	.238	15.17	1.63	2.48	6.11	37.34
	101.03	12.426			11.220	.377	.418	10.75	3.72	4.12	2.61	6.81
	106.88	11.665			10.040	.408	.445	16.19	4.72	5.15	3.14	9.87
	112.72	9.839			9.365	.605	.631	5.06	6.78	7.07	.71	.51
BODY AVERAGE												
RMS/ERROR/TESTS		11.937			10.659	.391	.431	11.86	4.27	4.67	3.31	14.05
		1.142			.829	.175	.193	3.93	1.76	1.91	2.09	2.21
ELEMENT AVERAGE												
RMS/ERROR/TESTS		12.816			11.179	.329	.380	14.94	3.43	3.97	4.16	20.09
		1.024			1.053	.175	.193	5.98	1.22	1.91	2.09	1.52
LEGEND												
BODY AVERAGE		$\bar{U}_T$			$\bar{V}$	$\bar{S}_V$	$\bar{E}_V$	$\bar{Z}$	$\bar{S}_Z$	$\bar{E}_Z$	$\bar{D}$	$\bar{D}^2$
RMS/ERROR/TESTS		RMS_{U_T}			RMS_V	S_V	E_V	RMS_Z	$\frac{RMS_Z}{\sqrt{M}}$	S_Z	E_Z	$T1 \quad X^2_{95/M}$

- See Tables 4-1 and 3-2 for explanation of symbols

FTE-4 COMPARISON OF MEASURED AND CALCULATED FUEL ROD FUEL HOLE GAPS
HOLES 384 (THU)C2 TRISO (78% FUEL VOL.) AND THC2 BISO (21% FUEL VOL.) FUEL
HOLES 788 UC2 TRISO (64% FUEL VOL.) AND THC2 BISO (36% FUEL VOL.) FUEL

FUEL BODY	CORE HEIGHT	GAP MIL	CALCULATED		GAP MIL	MEASURED		RELATIVE DIFFERENCE			COMPARISON	
			S(1 SIGMA) MIL	E(1 SIGMA) MIL		S(1 SIGMA) MIL	E(1 SIGMA) MIL	CALC/MEAS-1 Z(%)	S(1 SIGMA) SZ(%)	E(1 SIGMA) EZ(%)	TEST1 D=Z/EZ	TEST2 D**2
1	29.07	8.213			6.113	.177	.251	34.36	3.89	5.51	6.24	38.90
	34.92	9.473			6.671	.192	.261	42.00	4.08	5.56	7.55	57.06
	38.82	9.800			8.052	.244	.301	21.70	3.68	4.55	4.77	22.72
	44.67	9.992			8.619	.153	.234	15.93	2.06	3.15	5.06	25.58
	50.51	10.030			8.902	.207	.272	12.66	2.61	3.44	3.68	13.51
BODY AVERAGE												
		9.502			7.672	.197	.265	25.33	3.36	4.56	5.46	31.56
RMS/ERROR/TESTS		.674			1.094	.048	.118	11.15	4.99	1.50	2.04	2.21
2	60.18	10.010			9.884	.330	.385	1.27	3.39	3.94	.32	.10
	66.03	9.963			9.848	.356	.407	1.16	3.66	4.18	.28	.08
	69.93	9.927			9.705	.156	.251	2.29	1.65	2.65	.87	.75
	75.78	9.864			9.280	.500	.537	6.29	5.72	6.15	1.02	1.04
	81.62	9.801			9.580	.222	.297	2.31	2.37	3.17	.73	.53
BODY AVERAGE												
		9.913			9.660	.334	.388	2.66	3.63	4.20	.64	.50
RMS/ERROR/TESTS		.074			.218	.150	.174	1.88	.84	1.62	1.44	2.21
3	91.28	9.718			9.380	.308	.355	3.59	3.40	3.92	.92	.84
	97.13	9.595			9.438	.248	.305	1.67	2.67	3.28	.51	.26
	101.03	9.462			9.295	.252	.308	1.80	2.76	3.37	.53	.29
	106.88	9.120			8.744	.248	.305	4.30	2.95	3.63	1.18	1.40
	112.72	8.187			8.215	.184	.256	4.35	2.24	3.10	.11	.01
BODY AVERAGE												
		9.216			9.014	.251	.307	2.20	2.83	3.47	.61	.56
RMS/ERROR/TESTS		.552			.470	.112	.137	1.63	.73	1.26	1.36	2.21
ELEMENT AVERAGE												
		9.544			8.782	.267	.324	10.07	3.29	4.10	2.24	10.87
RMS/ERROR/TESTS		.580			1.084	.112	.137	12.65	3.27	1.26	1.36	1.67

FTE-4 COMPARISON OF MEASURED AND CALCULATED FUEL ROD FUEL HOLE GAPS
HOLES 5&6 (TH,U)C2 TRISO (79% FUEL VOL.) AND THC2 TRISO (21% FUEL VOL.) FUEL

FUEL BODY	CORE HEIGHT	GAP MIL	CALCULATED			GAP MIL	MEASURED			RELATIVE DIFFERENCE			COMPARISON	
			S(1 SIGMA)	E(1 SIGMA)			S(1 SIGMA)	E(1 SIGMA)		CALC/MEAS-1	S(1 SIGMA)	E(1 SIGMA)	TEST1	TEST2
										Z(%)	SZ(X)	EZ(X)	D=Z/EZ	D**2
1	29.07	6.434				4.975	.154	.236		29.31	3.99	6.14	4.77	22.79
	34.92	7.003				6.000	.299	.349		16.71	5.82	6.79	2.46	6.06
	38.82	7.140				7.210	.194	.264		-9.98	2.66	3.63	-2.27	.07
	44.67	7.207				6.953	.476	.509		3.66	7.10	7.59	.48	.23
	50.51	7.201				7.886	.492	.524		-8.68	5.70	6.06	-1.43	2.05
BODY AVERAGE														
		6.997				6.605	.352	.395		8.00	5.29	6.19	1.20	6.24
RMS/ERROR/TESTS		.291				1.015	.157	.177		13.47	6.03	2.36	2.69	2.21
2	58.23	7.182				8.089	.367	.418		-11.21	4.03	4.59	-2.44	5.98
	60.18	7.168				8.555	.171	.263		-16.22	1.68	2.57	-6.30	39.69
	62.13	7.152				8.095	.298	.358		-11.65	3.25	3.91	-2.98	8.87
	64.08	7.135				8.628	.163	.258		-17.30	1.56	2.47	-7.01	49.08
	66.03	7.117				8.215	.083	.216		-15.37	.88	2.28	-5.86	34.32
	67.98	7.099				8.040	.152	.251		-11.70	1.66	2.75	-4.25	18.07
	69.93	7.081				8.207	.222	.297		-13.72	2.33	3.12	-4.39	19.29
	71.88	7.061				7.107	.606	.638		-6.66	8.46	8.91	-.07	.01
	73.83	7.041				8.211	.290	.352		-14.25	3.02	3.67	-3.88	15.06
	75.78	7.022				8.201	.175	.265		-14.37	1.82	2.77	-5.19	26.95
	77.72	7.004				8.080	.109	.227		-13.32	1.17	2.44	-5.46	29.82
	79.67	6.987				8.380	.110	.228		-16.63	1.10	2.27	-7.33	53.68
	81.62	6.970				8.209	.109	.227		-15.09	1.13	2.35	-6.42	41.17
	83.57	6.954				7.958	.118	.232		-12.62	1.30	2.55	-4.95	24.54
BODY AVERAGE														
		7.069				8.141	.252	.321		-15.01	3.05	3.73	-4.75	26.18
RMS/ERROR/TESTS		.073				.339	.067	.086		3.87	1.03	.82	17.78	1.69
3	91.28	6.920				7.960	.249	.307		-13.06	2.72	3.36	-3.89	15.14
	97.13	6.866				8.500	.173	.249		-19.23	1.64	2.37	-8.12	65.87
	101.03	6.815				7.886	.135	.224		-13.59	1.48	2.46	-5.53	30.55
	106.88	6.677				8.065	.110	.210		-17.21	1.13	2.16	-7.96	63.44
	112.72	6.272				6.924	.280	.333		-9.42	3.67	4.35	-2.16	4.68
BODY AVERAGE														
		6.710				7.867	.200	.269		-14.50	2.32	3.05	-5.53	35.94
RMS/ERROR/TESTS		.233				.517	.090	.120		3.42	1.53	1.04	12.37	2.21
ELEMENT AVERAGE														
		6.979				7.764	.267	.328		-8.94	3.52	4.25	-3.67	24.06
RMS/ERROR/TESTS		.228				.838	.090	.120		11.18	2.28	1.04	12.37	1.52

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 1 FUEL HOLE 1

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
29.07	.4994	.0001	.4904	.0002	4.52	.12	.4990	.0001	.4828	.0006	8.12	.32	3.60	.34	79.71	8.60
34.92	.4994	.0001	.4892	.0004	5.08	.22	.4988	.0002	.4806	.0016	9.08	.83	4.00	.85	78.69	17.93
38.82	.4994	.0001	.4897	.0005	4.87	.24	.4993	.0001	.4789	.0011	10.19	.53	5.32	.58	109.29	14.91
44.67	.4994	.0001	.4894	.0006	5.02	.28	.4991	.0001	.4779	.0008	10.56	.41	5.54	.50	110.52	14.42
50.51	.4994	.0001	.4894	.0007	5.02	.37	.4987	.0003	.4759	.0015	11.36	.78	6.34	.86	126.45	22.65
STACK AVERAGE																
X, SX	.4994	.0001	.4896	.0006	4.90	.30	.4989	.0002	.4792	.0026	9.85	1.31	4.95	1.35	101.03	29.60
EX		.0002		.0006		.32		.0002		.0005		.26		.42		14.24

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 1 FUEL HOLE 3

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
29.07	.4990	.0001	.4901	.0002	4.43	.10	.4986	.0001	.4867	.0010	5.94	.49	1.51	.50	34.03	11.45
34.92	.4990	.0001	.4913	.0004	3.83	.22	.4984	.0002	.4859	.0009	6.26	.47	2.43	.52	63.27	15.36
38.82	.4990	.0001	.4931	.0027	2.95	1.36	.4989	.0001	.4838	.0009	7.51	.44	4.56	1.43	154.59	118.17
44.67	.4990	.0001	.4906	.0002	4.22	.13	.4987	.0001	.4822	.0007	8.24	.38	4.02	.40	95.32	10.78
50.51	.4990	.0001	.4911	.0005	3.97	.24	.4983	.0003	.4811	.0006	8.58	.35	4.61	.43	116.24	15.89
STACK AVERAGE																
X, SX	.4990	.0001	.4914	.0017	3.82	.84	.4985	.0002	.4840	.0023	7.29	1.16	3.47	1.43	90.84	51.58
EX		.0002		.0007		.38		.0002		.0004		.24		.44		19.74

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 1 FUEL HOLE 5

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
29.07	.4992	.0001	.4909	.0001	4.13	.07	.4988	.0001	.4889	.0007	4.98	.36	.84	.36	20.37	8.83
34.92	.4992	.0001	.4906	.0001	4.28	.07	.4986	.0002	.4866	.0014	6.00	.71	1.72	.71	40.08	16.74
38.82	.4992	.0001	.4907	.0005	4.23	.24	.4991	.0001	.4846	.0009	7.21	.46	2.98	.52	70.33	14.45
44.67	.4992	.0001	.4907	.0003	4.25	.16	.4989	.0001	.4850	.0023	6.95	1.16	2.70	1.17	63.59	27.98
50.51	.4992	.0001	.4899	.0008	4.67	.42	.4985	.0003	.4827	.0024	7.89	1.19	3.22	1.26	68.98	29.69
STACK AVERAGE																
X, SX	.4992	.0001	.4906	.0005	4.31	.28	.4987	.0002	.4856	.0026	6.59	1.32	2.28	1.34	52.86	32.04
EX		.0002		.0006		.32		.0002		.0005		.26		.41		12.86

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D. / BOL FUEL BODY O.D.

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FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 1 FUEL HOLE 7

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
29.07	.4992	.0001	.4910	.0010	4.12	.51	.4988	.0001	.4862	.0013	6.28	.64	2.17	.82	52.64	24.62
34.92	.4992	.0001	.4911	.0006	4.07	.30	.4986	.0002	.4844	.0009	7.08	.46	3.02	.55	74.18	17.24
38.82	.4992	.0001	.4902	.0001	4.48	.06	.4991	.0001	.4819	.0016	8.59	.80	4.11	.81	91.68	18.09
44.67	.4992	.0001	.4912	.0003	4.00	.17	.4989	.0001	.4809	.0005	9.00	.24	5.00	.29	125.07	11.11
50.51	.4992	.0001	.4914	.0005	3.92	.24	.4985	.0003	.4800	.0015	9.23	.74	5.31	.78	135.59	23.97
STACK AVERAGE																
X, SX	.4992	.0001	.4910	.0006	4.12	.32	.4987	.0002	.4827	.0026	8.03	1.31	3.91	1.35	95.00	35.39
EX		.0002		.0006		.32		.0002		.0005		.26		.42		16.55

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. + EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 2 FUEL HOLE 1

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
58.23	.5000	.0001	.4891	.0002	5.43	.13	.4995	.0002	.4767	.0011	11.44	.57	6.01	.58	110.53	11.58
60.18	.5000	.0001	.4899	.0005	5.03	.24	.4995	.0002	.4763	.0011	11.61	.57	6.57	.62	130.57	15.75
62.13	.5000	.0001	.4902	.0003	4.88	.16	.4993	.0001	.4754	.0010	11.95	.53	7.07	.55	144.78	13.51
64.08	.5000	.0001	.4894	.0007	5.30	.36	.4991	.0001	.4761	.0021	11.49	1.04	6.19	1.10	116.86	24.50
66.03	.5000	.0001	.4899	.0006	5.05	.31	.4990	.0002	.4755	.0016	11.76	.82	6.71	.88	132.80	21.53
67.98	.5000	.0001	.4894	.0006	5.32	.28	.4990	.0003	.4750	.0013	11.97	.67	6.66	.73	125.20	17.51
69.93	.5000	.0001	.4890	.0003	5.48	.17	.4990	.0003	.4751	.0013	11.96	.66	6.48	.68	118.20	13.79
71.88	.5000	.0001	.4893	.0007	5.33	.34	.4988	.0002	.4748	.0018	12.01	.89	6.67	.95	125.13	21.91
73.83	.5000	.0001	.4883	.0007	5.84	.34	.4989	.0001	.4748	.0015	12.06	.76	6.22	.83	106.61	17.70
75.78	.5000	.0001	.4889	.0001	5.53	.07	.4989	.0001	.4744	.0012	12.22	.59	6.68	.59	120.79	10.94
77.72	.5000	.0001	.4895	.0003	5.23	.16	.4988	.0002	.4754	.0028	11.69	1.42	6.45	1.43	123.34	28.04
79.67	.5000	.0001	.4892	.0001	5.42	.07	.4988	.0001	.4749	.0010	11.95	.50	6.53	.51	120.55	9.67
81.62	.5000	.0001	.4894	.0002	5.32	.13	.4987	.0001	.4750	.0014	11.85	.71	6.53	.72	122.90	14.53
83.57	.5000	.0001	.4898	.0005	5.10	.24	.4986	.0002	.4749	.0013	11.87	.64	6.77	.68	132.66	16.57
STACK AVERAGE																
X, SX	.5000	.0001	.4894	.0006	5.32	.32	.4989	.0004	.4753	.0016	11.81	.81	6.49	.87	122.12	20.15
EX		.0002		.0006		.32		.0002		.0002		.14		.35		13.45

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 2 FUEL HOLE 2

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
69.93	.5000	.0001	.4894	.0006	5.32	.29	.4990	.0003	.4755	.0030	11.72	1.50	6.41	1.53	120.50	30.79
STACK AVERAGE																
X, SX	.5000	.0001	.4894	.0006	5.32	.29	.4989	.0004	.4755	.0030	11.69	1.51	6.37	1.54	119.82	30.91
EX		.0002		.0007		.35		.0002		.0012		.62		.72		18.73

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 2 FUEL HOLE 3

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
60.18	.4998	.0001	.4907	.0004	4.53	.19	.4993	.0002	.4809	.0010	9.22	.49	4.69	.53	103.43	13.66
66.03	.4998	.0001	.4915	.0003	4.15	.15	.4988	.0002	.4806	.0006	9.11	.32	4.96	.36	119.44	11.04
69.93	.4998	.0001	.4896	.0008	5.10	.41	.4988	.0003	.4797	.0008	9.56	.45	4.46	.61	87.39	17.56
75.78	.4998	.0001	.4902	.0004	4.82	.22	.4987	.0001	.4797	.0007	9.47	.36	4.65	.42	96.55	11.58
81.62	.4998	.0001	.4911	.0002	4.37	.09	.4985	.0001	.4799	.0016	9.28	.80	4.92	.80	112.62	18.80
STACK																
AVERAGE																
X, SX	.4998	.0001	.4906	.0008	4.59	.40	.4987	.0004	.4802	.0011	9.28	.57	4.69	.70	102.10	21.58
EX		.0002		.0006		.33		.0002		.0002		.15		.36		14.80

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 2 FUEL HOLE 4

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
69.93	.4996	.0001	.4898	.0002	4.90	.10	.4986	.0003	.4801	.0015	9.24	.75	4.34	.75	88.58	15.77
STACK AVERAGE																
X, SX	.4996	.0001	.4898	.0002	4.90	.10	.4985	.0004	.4801	.0015	9.20	.76	4.30	.77	87.83	16.07
EX		.0002		.0006		.32		.0002		.0006		.32		.45		13.79

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 2 FUEL HOLE 5

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
58.23	.4996	.0001	.4897	.0003	4.95	.15	.4991	.0002	.4830	.0018	8.09	.89	3.14	.90	63.41	18.55
60.18	.4996	.0001	.4897	.0003	4.95	.15	.4991	.0002	.4820	.0008	8.56	.39	3.61	.42	72.84	9.42
62.13	.4996	.0001	.4906	.0007	4.52	.34	.4989	.0001	.4827	.0014	8.10	.72	3.58	.79	79.23	20.83
64.08	.4996	.0001	.4893	.0003	5.15	.14	.4987	.0001	.4814	.0008	8.63	.38	3.48	.41	67.52	8.77
66.03	.4996	.0001	.4896	.0007	5.00	.33	.4986	.0002	.4822	.0002	8.22	.14	3.22	.36	64.30	11.30
67.98	.4996	.0001	.4909	.0004	4.33	.21	.4986	.0003	.4825	.0005	8.04	.30	3.71	.36	85.54	11.35
69.93	.4996	.0001	.4896	.0005	5.00	.27	.4986	.0003	.4816	.0007	8.49	.37	3.49	.46	69.80	11.78
71.88	.4996	.0001	.4924	.0024	3.58	1.22	.4984	.0002	.4842	.0029	7.11	1.48	3.53	1.92	98.81	79.49
73.83	.4996	.0001	.4901	.0007	4.75	.35	.4985	.0001	.4821	.0014	8.21	.70	3.46	.79	72.87	19.60
75.78	.4996	.0001	.4901	.0008	4.75	.38	.4985	.0001	.4820	.0008	8.20	.41	3.45	.56	72.65	16.30
77.72	.4996	.0001	.4890	.0001	5.28	.09	.4984	.0002	.4822	.0003	8.08	.20	2.80	.22	52.93	4.50
79.67	.4996	.0001	.4895	.0006	5.05	.29	.4984	.0001	.4816	.0005	8.38	.24	3.33	.37	65.94	10.53
81.62	.4996	.0001	.4902	.0006	4.68	.28	.4983	.0001	.4818	.0005	8.21	.24	3.53	.37	75.29	11.77
83.57	.4996	.0001	.4896	.0002	5.00	.10	.4982	.0002	.4823	.0005	7.96	.25	2.96	.27	59.16	5.94
STACK AVERAGE																
X, SX	.4996	.0001	.4901	.0012	4.76	.59	.4985	.0004	.4823	.0013	8.13	.67	3.37	.90	70.87	25.58
EX		.0002		.0006		.32		.0002		.0002		.13		.35		12.00

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. + EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS

FUEL BODY 2 FUEL HOLE 6

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
69.93	.4998	.0001	.4905	.0005	4.65	.24	.4988	.0003	.4829	.0015	7.92	.78	3.27	.81	70.40	18.91
STACK AVERAGE																
X, SX	.4998	.0001	.4905	.0005	4.65	.24	.4987	.0004	.4829	.0015	7.89	.79	3.24	.83	69.61	19.19
EX		.0002		.0007		.34		.0002		.0006		.33		.48		14.31

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

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FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 2 - FUEL HOLE 7

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CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D.	BOL	S.D.	BOL	S.D.	EOH	S.D.	EOH	S.D.	EOH	S.D.	VALUE	S.D.	VALUE	S.D.
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
60.18	.4998	.0001	.4907	.0002	4.55	.10	.4993	.0002	.4782	.0025	10.55	1.24	6.00	1.24	131.80	27.74
66.03	.4998	.0001	.4902	.0000	4.80	.05	.4988	.0002	.4776	.0027	10.59	1.37	5.79	1.37	120.63	28.57
69.93	.4998	.0001	.4907	.0001	4.53	.09	.4988	.0003	.4782	.0013	10.29	.68	5.76	.69	126.99	15.68
75.78	.4998	.0001	.4905	.0002	4.63	.13	.4987	.0001	.4807	.0053	9.00	2.66	4.37	2.66	94.25	57.60
81.62	.4998	.0001	.4909	.0005	4.45	.24	.4985	.0001	.4787	.0013	9.88	.65	5.43	.69	121.93	18.76
STACK AVERAGE																
X, SX	.4998	.0001	.4906	.0003	4.59	.17	.4987	.0004	.4785	.0027	10.09	1.36	5.49	1.37	119.59	30.64
EX		.0002		.0006		.31		.0002		.0005		.28		.42		16.21

EOH FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOH FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 2 FUEL HOLE 8

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
69.93	.4997	.0001	.4906	.0012	4.53	.60	.4987	.0003	.4792	.0011	9.73	.58	5.20	.83	114.67	31.16
STACK AVERAGE																
X, SX	.4997	.0001	.4906	.0012	4.53	.60	.4986	.0004	.4792	.0011	9.70	.60	5.16	.85	113.86	31.25
EX		.0002		.0009		.47		.0002		.0005		.26		.53		22.67

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 3 FUEL HOLE 1

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
91.28	.4995	.0001	.4889	.0001	5.32	.07	.4982	.0005	.4749	.0010	11.61	.54	6.29	.54	118.36	10.57
97.13	.4995	.0001	.4891	.0003	5.20	.16	.4980	.0002	.4758	.0007	11.06	.36	5.86	.39	112.66	9.59
101.03	.4995	.0001	.4889	.0001	5.30	.06	.4984	.0003	.4760	.0018	11.22	.90	5.92	.90	111.69	17.09
106.88	.4995	.0001	.4896	.0002	4.97	.12	.4987	.0002	.4786	.0020	10.04	.99	5.07	1.00	102.14	20.49
112.72	.4995	.0001	.4889	.0001	5.28	.07	.4991	.0001	.4803	.0029	9.37	1.48	4.08	1.48	77.26	28.01
STACK AVERAGE																
X, SX	.4995	.0001	.4891	.0003	5.21	.16	.4986	.0005	.4771	.0027	10.71	1.36	5.49	1.37	105.35	26.81
EX		.0002		.0006		.31		.0002		.0005		.27		.41		13.41

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 3 FUEL HOLE 3

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	FOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
91.28	.4995	.0001	.4921	.0032	3.70	1.61	.4982	.0005	.4804	.0018	8.90	.91	5.20	1.84	140.57	107.27
97.13	.4995	.0001	.4909	.0007	4.32	.34	.4980	.0002	.4802	.0013	8.86	.66	4.54	.75	105.22	22.24
101.03	.4995	.0001	.4901	.0006	4.72	.31	.4984	.0003	.4809	.0011	8.77	.59	4.05	.66	85.93	17.34
106.88	.4995	.0001	.4894	.0002	5.07	.13	.4987	.0002	.4818	.0006	8.43	.33	3.36	.35	66.41	7.83
112.72	.4995	.0001	.4903	.0003	4.58	.16	.4991	.0001	.4833	.0006	7.90	.31	3.32	.35	72.33	9.00
STACK AVERAGE																
X, SX	.4995	.0001	.4906	.0018	4.43	.89	.4986	.0005	.4813	.0016	8.62	.82	4.19	1.22	94.66	43.44
EX		.0002		.0007		.38		.0002		.0003		.18		.43		17.35

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 3 FUEL HOLE 5

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
91.28	.4995	.0001	.4898	.0010	4.83	.52	.4982	.0005	.4822	.0009	7.96	.51	3.13	.73	64.68	20.71
97.13	.4995	.0001	.4894	.0008	5.05	.39	.4980	.0002	.4809	.0008	8.50	.40	3.45	.56	68.32	15.32
101.03	.4995	.0001	.4899	.0004	4.82	.19	.4984	.0003	.4826	.0004	7.89	.24	3.07	.31	63.73	8.06
106.88	.4995	.0001	.4894	.0002	5.05	.12	.4987	.0002	.4825	.0004	8.06	.23	3.01	.26	59.70	5.96
112.72	.4995	.0001	.4929	.0034	3.31	1.69	.4991	.0001	.4852	.0013	6.92	.67	3.61	1.82	109.02	108.57
STACK AVERAGE																
X, SX	.4995	.0001	.4904	.0022	4.53	1.08	.4986	.0005	.4827	.0016	7.91	.84	3.38	1.37	74.66	45.71
EX		.0002		.0008		.41		.0002		.0003		.19		.45		16.44

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
FUEL BODY 3 FUEL HOLE 7

CORE HEIGHT	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
91.28	.4995	.0001	.4908	.0001	4.37	.07	.4982	.0005	.4784	.0018	9.86	.93	5.49	.93	125.79	21.58
97.13	.4995	.0001	.4897	.0011	4.92	.54	.4980	.0002	.4779	.0011	10.02	.57	5.10	.79	103.73	25.30
101.03	.4995	.0001	.4903	.0003	4.60	.17	.4984	.0003	.4788	.0015	9.82	.74	5.22	.76	113.47	17.90
106.88	.4995	.0001	.4905	.0005	4.48	.26	.4987	.0002	.4806	.0022	9.06	1.11	4.57	1.14	102.00	27.40
112.72	.4995	.0001	.4904	.0005	4.55	.27	.4991	.0001	.4820	.0014	8.53	.73	3.98	.77	87.52	19.48
STACK AVERAGE																
X,SX	.4995	.0001	.4903	.0006	4.58	.32	.4986	.0005	.4795	.0022	9.50	1.11	4.92	1.16	107.36	28.33
EX		.0002		.0006		.32		.0002		.0004		.23		.40		15.42

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS

STRATA 1

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
2 1																
X, SX	.5000	.0001	.4894	.0006	5.32	.32	.4989	.0004	.4753	.0016	11.81	.81	6.49	.87	122.12	20.15
EX		.0002		.0006		.32		.0002		.0002		.14		.35		13.45
2 2																
X, SX	.5000	.0001	.4894	.0006	5.32	.29	.4989	.0004	.4755	.0030	11.69	1.51	6.37	1.54	119.82	30.91
EX		.0002		.0007		.35		.0002		.0012		.62		.72		18.73
STRATA AVERAGE																
X, SX	.5000	.0000	.4894	.0006	5.32	.31	.4989	.0004	.4753	.0017	11.80	.86	6.49	.91	121.96	20.63
EX		.0002		.0006		.31		.0002		.0002		.14		.34		13.33

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS

STRATA 2

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	FUL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
2 3																
X, SX	.4998	.0001	.4906	.0008	4.59	.40	.4987	.0004	.4802	.0011	9.28	.57	4.69	.70	102.10	21.58
EX		.0002		.0006		.33		.0002		.0002		.15		.36		14.80
2 4																
X, SX	.4996	.0001	.4898	.0002	4.90	.10	.4985	.0004	.4801	.0015	9.20	.76	4.30	.77	87.83	16.07
EX		.0002		.0006		.32		.0002		.0006		.32		.45		13.79
STRATA AVERAGE																
X, SX	.4997	.0001	.4905	.0008	4.61	.40	.4986	.0004	.4801	.0011	9.24	.60	4.63	.72	100.33	21.71
EX		.0002		.0006		.33		.0002		.0002		.15		.36		14.59

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD = FUEL HOLE GAPS
STRATA 3

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
2 5																
X, SX	.4996	.0001	.4901	.0012	4.76	.59	.4985	.0004	.4823	.0013	8.13	.67	3.37	.90	70.87	25.58
EX	.0002		.0006			.32	.0002		.0002		.13		.35			12.00
2 6																
X, SX	.4998	.0001	.4905	.0005	4.65	.24	.4987	.0004	.4829	.0015	7.89	.79	3.24	.83	69.61	19.19
EX	.0002		.0007			.34	.0002		.0006		.33		.48			14.31
STRATA AVERAGE																
X, SX	.4997	.0001	.4901	.0012	4.79	.58	.4986	.0004	.4823	.0013	8.16	.68	3.36	.90	70.14	25.05
EX	.0002		.0006			.33	.0002		.0002		.14		.35			11.89

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
STRATA 4

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
2 7																
X, SX	.4998	.0001	.4906	.0003	4.59	.17	.4987	.0004	.4785	.0027	10.09	1.36	5.49	1.37	119.59	30.64
EX		.0002		.0006		.31		.0002		.0005		.28		.42		16.21
2 8																
X, SX	.4997	.0001	.4906	.0012	4.53	.60	.4986	.0004	.4792	.0011	9.70	.60	5.16	.85	113.86	31.25
EX		.0002		.0009		.47		.0002		.0005		.26		.53		22.67
STRATA AVERAGE																
X, SX	.4997	.0001	.4906	.0005	4.57	.26	.4987	.0004	.4787	.0025	10.00	1.26	5.43	1.28	119.02	30.12
EX		.0002		.0006		.32		.0002		.0004		.24		.40		16.06

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
STRATA 5

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
1 1																
X, SX	.4994	.0001	.4896	.0006	4.90	.30	.4989	.0002	.4792	.0026	9.85	1.31	4.95	1.35	101.03	29.60
EX		.0002		.0006		.32		.0002		.0005		.26		.42		14.24
2 1																
X, SX	.5000	.0001	.4894	.0006	5.32	.32	.4989	.0004	.4753	.0016	11.81	.81	6.49	.87	122.12	20.15
EX		.0002		.0006		.32		.0002		.0002		.14		.35		13.45
2 2																
X, SX	.5000	.0001	.4894	.0006	5.32	.29	.4989	.0004	.4755	.0030	11.69	1.51	6.37	1.54	119.82	30.91
EX		.0002		.0007		.35		.0002		.0012		.62		.72		18.73
3 1																
X, SX	.4995	.0001	.4891	.0003	5.21	.16	.4986	.0005	.4771	.0027	10.71	1.36	5.49	1.37	105.35	26.81
EX		.0002		.0006		.31		.0002		.0005		.27		.41		13.41
STRATA AVERAGE																
X, SX	.4997	.0003	.4894	.0006	5.19	.33	.4988	.0006	.4765	.0026	11.18	1.33	6.00	1.38	115.66	29.25
EX		.0002		.0006		.32		.0002		.0002		.17		.36		13.77

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
STRATA 6

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
1 3																
X, SX	.4990	.0001	.4914	.0017	3.82	.84	.4985	.0002	.4840	.0023	7.29	1.16	3.47	1.43	90.84	51.58
EX		.0002		.0007		.38		.0002		.0004		.24		.44		19.74
2 3																
X, SX	.4998	.0001	.4906	.0008	4.59	.40	.4987	.0004	.4802	.0011	9.28	.57	4.69	.70	102.10	21.58
EX		.0002		.0006		.33		.0002		.0002		.15		.36		14.80
2 4																
X, SX	.4996	.0001	.4898	.0002	4.90	.10	.4985	.0004	.4801	.0015	9.20	.76	4.30	.77	87.83	16.07
EX		.0002		.0006		.32		.0002		.0006		.32		.45		13.79
3 3																
X, SX	.4995	.0001	.4906	.0014	4.43	.89	.4986	.0005	.4813	.0016	8.62	.82	4.19	1.22	94.66	43.44
EX		.0002		.0007		.38		.0002		.0003		.18		.43		17.35
STRATA AVERAGE																
X, SX	.4995	.0003	.4908	.0015	4.33	.76	.4986	.0006	.4817	.0023	8.44	1.20	4.11	1.42	94.86	43.93
EX		.0002		.0006		.34		.0002		.0003		.18		.38		15.73

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
STRATA 7

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
1 5																
X, SX	.4992	.0001	.4906	.0005	4.31	.28	.4987	.0002	.4856	.0026	6.59	1.32	2.28	1.34	52.86	32.04
EX		.0002		.0006		.32		.0002		.0005		.26		.41		12.86
2 5																
X, SX	.4996	.0001	.4901	.0012	4.76	.59	.4985	.0004	.4823	.0013	8.13	.67	3.37	.90	70.87	25.58
EX		.0002		.0006		.32		.0002		.0002		.13		.35		12.00
2 6																
X, SX	.4998	.0001	.4905	.0005	4.65	.24	.4987	.0004	.4829	.0015	7.89	.79	3.24	.83	69.61	19.19
EX		.0002		.0007		.34		.0002		.0006		.33		.48		14.31
3 5																
X, SX	.4995	.0001	.4904	.0022	4.53	1.08	.4986	.0005	.4827	.0016	7.91	.84	3.38	1.37	74.66	45.71
EX		.0002		.0008		.41		.0002		.0003		.19		.45		16.44
STRATA AVERAGE																
X, SX	.4995	.0002	.4903	.0013	4.63	.68	.4986	.0005	.4830	.0021	7.79	1.09	3.17	1.28	68.45	34.22
EX		.0002		.0006		.32		.0002		.0002		.15		.36		12.25

EOL FUEL HOLE DIA. * BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
STRATA 8

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 = 1	
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	EOL IN.	S.D IN.	EOL IN.	S.D IN.	EOL MIL	S.D MIL	VALUE MIL	S.D MIL	VALUE %	S.D %
1 7																
X, SX	.4992	.0001	.4910	.0006	4.12	.32	.4987	.0002	.4827	.0026	8.03	1.31	3.91	1.35	95.00	35.39
EX		.0002		.0006		.32		.0002		.0005		.26		.42		16.55
2 7																
X, SX	.4998	.0001	.4906	.0003	4.59	.17	.4987	.0004	.4785	.0027	10.09	1.36	5.49	1.37	119.59	30.64
EX		.0002		.0006		.31		.0002		.0005		.28		.42		16.21
2 8																
X, SX	.4997	.0001	.4906	.0012	4.53	.60	.4986	.0004	.4792	.0011	9.70	.60	5.16	.85	113.86	31.25
EX		.0002		.0009		.47		.0002		.0005		.26		.53		22.67
3 7																
X, SX	.4995	.0001	.4903	.0006	4.58	.32	.4986	.0005	.4795	.0022	9.50	1.11	4.92	1.16	107.36	28.33
EX		.0002		.0006		.32		.0002		.0004		.23		.40		15.42
STRATA AVERAGE																
X, SX	.4995	.0003	.4906	.0006	4.46	.34	.4987	.0005	.4802	.0030	9.21	1.51	4.76	1.54	106.74	37.34
EX		.0002		.0006		.32		.0002		.0003		.20		.38		15.48

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 FUEL ROD - FUEL HOLE GAPS
STRATA 9

BODY HOLE	FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP1		FUEL HOLE DIAMETER		FUEL ROD DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1		
	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	BOL IN.	S.D IN.	BOL IN.	S.D IN.	BOL MIL	S.D MIL	VALUE		VALUE		
													MIL	S.D MIL	MIL	S.D MIL	%
1 1	X, SX	.4994	.0001	.4896	.0006	4.90	.30	.4989	.0002	.4792	.0026	9.85	1.31	4.95	1.35	101.03	29.60
	EX		.0002		.0005		.32		.0002		.0005		.26		.42		14.24
1 3	X, SX	.4990	.0001	.4914	.0017	5.82	.84	.4985	.0002	.4840	.0023	7.29	1.16	3.47	1.43	90.84	51.58
	EX		.0002		.0007		.38		.0002		.0004		.24		.44		19.74
1 5	X, SX	.4992	.0001	.4906	.0005	4.31	.28	.4987	.0002	.4856	.0026	6.59	1.32	2.28	1.34	52.86	32.04
	EX		.0002		.0006		.32		.0002		.0005		.26		.41		12.86
1 7	X, SX	.4992	.0001	.4910	.0006	4.12	.32	.4987	.0002	.4827	.0026	8.03	1.31	3.91	1.35	95.00	35.39
	EX		.0002		.0006		.32		.0002		.0005		.26		.42		16.55
2 1	X, SX	.5000	.0001	.4894	.0006	5.32	.32	.4989	.0004	.4753	.0016	11.81	.81	6.49	.87	122.12	20.15
	EX		.0002		.0006		.32		.0002		.0002		.14		.35		13.45
2 2	X, SX	.5000	.0001	.4894	.0006	5.32	.29	.4989	.0004	.4755	.0030	11.69	1.51	6.37	1.54	119.82	30.91
	EX		.0002		.0007		.35		.0002		.0012		.62		.72		18.73
2 3	X, SX	.4998	.0001	.4906	.0008	4.59	.40	.4987	.0004	.4802	.0011	9.28	.57	4.69	.70	102.10	21.58
	EX		.0002		.0006		.33		.0002		.0002		.15		.36		14.80
2 4	X, SX	.4996	.0001	.4898	.0002	4.90	.10	.4985	.0004	.4801	.0015	9.20	.76	4.30	.77	87.83	16.07
	EX		.0002		.0006		.32		.0002		.0006		.32		.45		13.79
2 5	X, SX	.4996	.0001	.4901	.0012	4.76	.59	.4985	.0004	.4823	.0013	8.13	.67	3.37	.90	70.87	25.58
	EX		.0002		.0006		.32		.0002		.0002		.13		.35		12.00
2 6	X, SX	.4998	.0001	.4905	.0005	4.65	.24	.4987	.0004	.4829	.0015	7.89	.79	3.24	.83	69.61	19.19
	EX		.0002		.0007		.34		.0002		.0006		.33		.48		14.31

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2	7																
X, SX	.4998	.0001	.4906	.0003	4.59	.17	.4987	.0004	.4785	.0027	10.09	1.36	5.49	1.37	119.59	30.64	
EX		.0002		.0006		.31		.0002		.0005		.28		.42		16.21	
2	8																
X, SX	.4997	.0001	.4906	.0012	4.53	.60	.4986	.0004	.4792	.0011	9.70	.60	5.16	.85	113.86	31.25	
EX		.0002		.0009		.47		.0002		.0005		.26		.53		22.67	
3	1																
X, SX	.4995	.0001	.4891	.0003	5.21	.16	.4986	.0005	.4771	.0027	10.71	1.36	5.49	1.37	105.35	26.81	
EX		.0002		.0006		.31		.0002		.0005		.27		.41		13.41	
3	3																
X, SX	.4995	.0001	.4906	.0018	4.43	.89	.4986	.0005	.4813	.0016	8.62	.62	4.19	1.22	94.66	43.44	
EX		.0002		.0007		.38		.0002		.0003		.18		.43		17.35	
3	5																
X, SX	.4995	.0001	.4904	.0022	4.53	1.08	.4986	.0005	.4827	.0016	7.91	.84	3.38	1.37	74.66	45.71	
EX		.0002		.0008		.41		.0002		.0003		.19		.45		16.44	
3	7																
X, SX	.4995	.0001	.4903	.0006	4.58	.32	.4986	.0005	.4795	.0022	9.50	1.11	4.92	1.16	107.36	28.33	
EX		.0002		.0006		.32		.0002		.0004		.23		.40		15.42	

STRATA

AVERAGE

X, SX	.4996	.0003	.4902	.0012	4.70	.63	.4987	.0005	.4802	.0037	9.25	1.85	4.55	1.95	96.87	47.24	
EX		.0002		.0006		.31		.0002		.0002		.14		.34		13.46	

EOL FUEL HOLE DIA. = BOL FUEL HOLE DIA. * EOL FUEL BODY O.D./BOL FUEL BODY O.D.

FTE-4 SLEEVE - FUEL BODY GAPS (FROM SLEEVE O.D.)

CORE HEIGHT	SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP1		SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
7.16	2.7522	.0008	2.7400	.0000	6.10	.40	2.7541	.0011	2.7400	.0000	7.05	.54	.95	.67	15.53	11.66
31.16	2.7522	.0008	2.7400	.0000	6.10	.40	2.7518	.0011	2.7374	.0006	7.20	.62	1.10	.74	18.08	12.76
55.16	2.7522	.0008	2.7400	.0000	6.10	.40	2.7475	.0010	2.7375	.0008	5.02	.65	-1.08	.76	-17.68	11.92
79.16	2.7522	.0008	2.7400	.0000	6.10	.40	2.7473	.0012	2.7332	.0005	7.05	.63	.95	.75	15.62	12.82
103.16	2.7522	.0008	2.7400	.0000	6.10	.40	2.7503	.0010	2.7320	.0015	9.15	.92	3.05	1.00	50.05	17.94
119.73	2.7522	.0008	2.7400	.0000	6.10	.40	2.7526	.0032	2.7400	.0000	6.30	1.58	.20	1.63	3.23	26.72

EOL SLEEVE DIA. = BOL SLEEVE I.D. * EOL SLEEVE O.D./BOL SLEEVE O.D.

FTE-4 SLEEVE - FUEL BODY GAPS (FROM SLEEVE O.D.)

FUEL BODY	SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP1		SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL IN.	S.O IN.	BOL IN.	S.O IN.	BOL MIL	S.O MIL	EOL IN.	S.O IN.	EOL IN.	S.O IN.	EOL MIL	S.O MIL	VALUE MIL	S.O MIL	VALUE %	S.O %
1	2.7522	.0008	2.7400	.0000	6.10	.40	2.7518	.0011	2.7375	.0011	7.15	.78	1.05	.88	17.26	14.98
2	2.7522	.0008	2.7400	.0000	6.10	.40	2.7474	.0009	2.7341	.0023	6.66	1.22	.56	1.29	9.22	21.30
3	2.7522	.0008	2.7400	.0000	6.10	.40	2.7503	.0010	2.7348	.0025	7.75	1.33	1.65	1.39	27.10	23.42
ELEMENT																
AVERAGE																
X, SX	2.7522	.0008	2.7400	.0000	6.10	.40	2.7492	.0022	2.7354	.0025	6.92	1.67	.82	1.72	13.44	26.43
EX		.0005		.0003		.30		.0009		.0004		.51		.59		10.07

EOL SLEEVE DIA. = BOL SLEEVE I.D. * EOL SLEEVE O.D./BOL SLEEVE O.D.

FTE-4 SLEEVE - FUEL BODY GAPS (FROM SLEEVE I.D.)

CORE HEIGHT	SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP1		SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
24.75	2.7527	.0008	2.7400	.0000	6.10	.40	2.7516	.0003	2.7400	.0000	5.80	.15	-.30	.43	-4.92	6.70
72.24	2.7522	.0008	2.7400	.0000	6.10	.40	2.7500	.0003	2.7340	.0000	8.00	.15	1.90	.43	31.15	8.94
119.73	2.7522	.0008	2.7400	.0000	6.10	.40	2.7533	.0007	2.7400	.0000	6.65	.35	.55	.53	9.02	9.17

F-36

FTE-4 SLEEVE - FUEL BODY GAPS (FROM SLEEVE I.D.)

FUEL BODY	SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP1		SLEEVE DIAMETER		FUEL BODY DIAMETER		GAP2		DIFFERENCE GAP2-GAP1		RELATIVE CHANGE GAP2/GAP1 - 1	
	BOL	S.D	BOL	S.D	BOL	S.D	EOL	S.D	EOL	S.D	EOL	S.D	VALUE	S.D	VALUE	S.D
	IN.	IN.	IN.	IN.	MIL	MIL	IN.	IN.	IN.	IN.	MIL	MIL	MIL	MIL	%	%
2	2.7522	.0008	2.7400	.0000	6.10	.40	2.7500	.0003	2.7341	.0023	7.95	1.15	1.85	1.21	30.33	20.64

F-37

EXIT LOC022326

OPMD,BREL

OPIN

CR

LOAD 8990 6/7 15 -1 40914

SERVICE 7/7 8990 40914

PUNCHED CARD OUTPUT FROM GAPS SAMPLE PROBLEM RUN

FUEL ROD=FUEL HOLE GAPS

HOLES 1&2 UO2 TRISO (22% FUEL VOL.) AND THO2 BISO (78% FUEL VOL.) FUEL

29.0700	8.1170	.4458
34.9200	9.0834	.7630
38.8200	10.1854	.5619
44.6700	10.5610	.4896
50.5100	11.3605	.7361
56.2500	11.4386	.6126
60.1800	11.6052	.6155
62.1300	11.9533	.5845
64.0800	11.4938	.9262
66.0300	11.7565	.7740
67.9800	11.0732	.6904
69.9300	11.5440	.7506
71.8800	12.0069	.8191
73.8300	12.0009	.7264
75.7800	12.2169	.6194
77.7200	11.6879	1.2139
79.6700	11.9462	.5698
81.6200	11.8506	.6979
83.5700	11.8657	.6555
91.2800	11.6096	.6202
97.1300	11.0586	.4673
101.0300	11.2198	.8184
106.8800	10.0398	.8728
112.7200	9.3654	1.2360

HOLES 3&4 (TH,U)C2 TRISO (78% FUEL VOL.) AND THO2 BISO (21% FUEL VOL.) FUEL

HOLES 7&8 UO2 TRISO (64% FUEL VOL.) AND THO2 BISO (36% FUEL VOL.) FUEL

29.0700	6.1129	.4012
34.9200	6.6711	.5120
38.8200	8.0521	.5904
44.6700	8.6194	.4549
50.5100	8.9024	.5335
60.1800	9.8845	.7547
66.0300	9.8484	.7981
69.9300	9.7047	.4922
75.7800	9.2804	1.0532
81.6200	9.5800	.5821
91.2800	9.3804	.6961
97.1300	9.4377	.5969
101.0300	9.2948	.6033
106.8800	8.7440	.5969
112.7200	8.2154	.5014

HOLES 5&6 (TH,U)C2 TRISO (79% FUEL VOL.) AND THO2 TRISO (21% FUEL VOL.) FUEL

29.0700	4.9754	.4630
34.9200	6.0002	.6841
38.8200	7.2105	.5175
44.6700	6.9527	.9974

CORE HEIGHT (INCHES)	GAP (MILS)	2 σ ERROR (MILS)
50.5100	7.8856	1.0265
58.2300	8.0887	.8189
60.1800	8.5554	.5153
62.1300	8.0952	.7025
64.0800	8.6275	.5050
66.0300	8.2152	.4241
67.9800	8.0402	.4913
69.9300	8.2068	.5822
71.8800	7.1074	1.2497
73.8300	8.2113	.6893
75.7800	8.2006	.5197
77.7200	8.0801	.4457
79.6700	8.3801	.4470
81.6200	8.2095	.4458
83.5700	7.9579	.4546
91.2800	7.9598	.6024
97.1300	8.5002	.4887
101.0300	7.8864	.4399
106.8800	8.0648	.4124
112.7200	6.9237	.6523
SLEEVE-FUEL BODY GAPS (FROM SLEEVE I.D.)		
7.1560	7.0472	.8898
31.1560	7.2027	.9895
55.1560	5.0215	1.0432
79.1560	7.0531	1.0272
103.1560	9.1528	1.3545
119.7300	6.2973	2.2369
SLEEVE-FUEL BODY GAPS (FROM SLEEVE I.D.)		
24.7500	5.8000	.5209
72.2400	8.0000	.5584
119.7300	6.6500	.6807

. APPENDIX G
DRWDIM INPUT INSTRUCTIONS

Column	1-6	7-12	13-18	19-24	
Format	I6	I6	I6	I6	
Name	NB	NPB	NTAPMV	NTP	
1	Number of fuel bodies in test element	Number of TREVER nodes per fuel body	Number of files on the TREVER output tape. Each file contains the results for a given fuel blend.	Number of TREVER time points for which the element was in the core	

Comments

Column	1-72
Format	6E12.0
Name	(X1(J,K), K = 1, NPB)
2	Core heights of TREVER calculation nodes in fuel body J

Column	1-72
Format	6E12.0
Name	(X1(J,K), K = 7, NPB)
3	Core heights of remaining TREVER calculation nodes in fuel body J

NB sets of cards 2 and 3 are required

Column	1-12	13-24	25-36	37-48	49-60	61-72	
Format	E12.0	E12.0	E12.0	E12.0	E12.0	E12.0	
Name	RTSLEV	RFHOLE	SGAPI	FGAPI	RBODY	RROD	
4	Nominal pre-irradiation inner radius of sleeve (inches)	Nominal pre-irradiation radius of fuel hole (inches)	Nominal pre-irradiation sleeve - fuel body gap (inches)	Nominal pre-irradiation fuel rod - fuel hole gap (inches)	Nominal pre-irradiation fuel body radius (inches)	Nominal pre-irradiation fuel rod radius (inches)	

Comments

Column	1-6	7-12	13-18	19-24	25-30	
Format	I6	I6	I6	I6	I6	
Name	M1(1)	M1(2)	M1(3)	M1(4)	M1(5)	
5	1 - Plot sleeve - fuel body gaps and 2 σ errors 0 - Do not plot	1 - Plot fuel rod - fuel hole gaps and 2 σ errors 0 - Do not plot	1 - Plot sleeve strains and 2 σ errors 0 - Do not plot	1 - Plot fuel body strains and 2 σ errors 0 - Do not plot	1 - Plot fuel rod strains and 2 σ errors 0 - Do not plot	

One set of cards 6-12 is required for each M1(X) $\neq$ 0.

NTAPMV sets of cards 5-12 are required.

Column	1-12	13-24	25-36	37-48	
Format	F12.4	F12.4	F12.4	F12.4	
Name	SIZE(1)	SIZE(2)	SIZE(3)	SIZE(4)	
6	Minimum X coordinate for plot frame (millimeters)	Maximum X coordinate for plot frame (millimeters)	Minimum Y coordinate for plot frame (% or mils)	Maximum Y coordinate for plot frame (% or mils)	

Column	1-6	-78	
Format	I6	12A6	
Name		FTIT	
7	Number of alpha-numeric characters in FTIT. Must be right justified.	Title of plot frame	

Comments

Column	1-6	7-66	
Format	I6	10A6	
Name		YNAM	
8	Number of alpha-numeric characters in YNAM. Must be right justified.	Label for Y axis of plot frame	

--

Column	1-12		
Format	2A6		
Name	YUN		
9	Units of Y axis (% or mils)		

--

Column	1-6	
Format	I6	
Name	NUMB	
10	Number of sets of measured data to be plotted on plot frame	

Comments

Will always be 1 when plotting fuel rod or fuel body strain or fuel rod - fuel rod gaps. Could be 2 when plotting sleeve strain or sleeve - fuel body gaps.

Column	1-6	
Format	I6	
Name	NPOS	
11	Number of axial positions at which measured data will be plotted	

Column	1-12	12-24	25-36	
Format	E12.0	E12.0	E12.0	
Name	XPOS	YAV	ERROR	
12	Axial position of measured data to be plotted	Value of strain or gap to be plotted	2 σ combined random error on YAV	These cards are punched output from GAPS, STRAIN, or STAT

NPOS type 12 cards are required.
NUMB sets of cards 11 and 12 are required.

APPENDIX H
DRWDIM SAMPLE PROBLEM

CONTROL CARDS AND PROGRAM DECK FOR DRWDIM SAMPLE PROBLEM

```

*RUN,E/R 49704,3224943001,169278SAHRWE/6/2450,1,50
*ASG,T 10,U,8990
*PLTREQ,QV
*ASG,AX CSD*PLOT
*FOR,IS DRWDIM,DRWDIM
  COMPILER(DATA=SHORT)
  DIMENSION XDUM(25)
  DIMENSION M1(5)
  DIMENSION SIZE(4),FTIT(13),XNAM(11),YNAM(11),XUN(2),YUN(2),SG(5,30
    ),DUM(10),IC(5),X1(6,10),X2(10)
  DATA XNAM/14,14,AXIAL POSITION/XUN/1PH( MM ) /
  DATA IC/42,42,42,42,42/
  READ(5,10)NH,NPH
  DO 5 J=1,NH
    READ(5,1000)(X1(J,K),K=1,NPH)
    READ(5,1000)RISLEV,RFHOLE,SGAPI,FGAPI,RBODY,RRUD
    CALL SETUP(0,0,16)
    READ(5,10)NTAPMV,NTP
  10 FORMAT(12I6)
  C IF(NTP.GT.12) NCRD=16
  C IF(NTP.LE.12) NCRD=8
  DO 1101 NTP=1,NTAPMV
    READ(5,10) (M1(I),I=1,5)
    WRITE(6,11)
  11 FORMAT(1H1,20X,'FUEL HOLE = FUEL BODY GAP',/,29X,'MILS',////)
  C THESE DUMMY READS CAN CHANGE -ACCORDING TO THE NUMBER OF TIME POINTS
  DO 990 J=1,31
  DO 991 JD=1,NCRD
  DO 991 JD=1,8
  991 READ(10,25,END=20) (XDUM(JJ),JJ=1,NTP)
  25 FORMAT(12F6.0)
  C SG(1,J)=SLVGAP,SG(2,J)=FGAP,SG(3,J)=SLVSTRAIN,SG(4,J)=BODY STRAIN,
  C SG(5,J)=FUEL STRAIN
  READ(10,1000)(SG(M,J),M=1,5)
  SG(1,J)=(SGAPI - RBODY*SG(4,J)/100.+RISLEV*SG(3,J)/100.)*1000.
  SG(2,J)=(FGAPI-RRUD*SG(5,J)/100.+RFHOLE*SG(4,J)/100.)*1000.
  WRITE(6,12)SG(2,J)
  12 FORMAT(24X,F12.4)
  990 CONTINUE
  1000 FORMAT(6F12.4)
  20 CONTINUE
  DO 1100 M=1,5
    IF(M1(M).EQ.0)GO TO 1100
    READ(5,1101)(SIZE(J),J=1,4)
  1101 FORMAT(4F12.4)
    READ(5,1110)FTIT
    READ(5,1110)YNAM
    READ(5,2000)YUN
  2000 FORMAT(2A6)
  1110 FORMAT(16,12A6)
    CALL FORMIT(SIZE,FTIT,XNAM,XUN,1,YNAM,YUN,1)

```



```

      CALL ERPLUT(M)
      DO 1250 J = 1,NPB
      DO 1240 K = 1,NPB
      X2(K) = X1(J,K)
      HQ = (J-1)*10 + K
1240 DUM(K) = SG(M,MQ)
1250 CALL GRAFIT(NPB,X2,DUM,1,IC(M),1)
1100 CONTINUE
1801 CONTINUE
      CALL FINISH
      CALL EXIT
      END
*FOR,IS      ERPLUT,ERPLUT
      SUBROUTINE ERPLUT(M)
      DIMENSION XDUM(3),IPLT(2),DUM(3)
      DATA IPLT/32,44/
      READ(5,5)NUMB
5      FORMAT(I6)
10     FORMAT(6F12.0)
      DO 100 J = 1,NUMB
      READ(5,5)NPIS
      DO 50 K = 1,NPIS
      READ(5,10)XPIS,YAV,ERROR
      IF (M.EQ.3)YAV=YAV*100.
      IF (M.EQ.3)ERROR=ERROR*100.
C      CHANGES INCHES TO MILLIMETERS
      XPIS = XPIS * 25.4
      YMAX = YAV + ERROR
      YMIN = YAV - ERROR
      DUM(1) = YMIN
      DUM(2) = YAV
      DUM(3) = YMAX
      DO 65 L = 1,3
65     XDUM(L) = XPIS
      IZ = IPLT(J)
      CALL GRAFIT(3,XDUM,DUM,1,IZ,1)
50     CONTINUE
100    CONTINUE
      RETURN
      END
*PREP
*MAP,I      PLNTIT,PIUTIT
      IN      DRWDIM
      LIB      CSD*PLOT
      *XQT

```

INPUT DATA DECK FOR DRWDIM SAMPLE PROBLEM

3	10				
698.9	768.2	837.5	906.8	976.1	1045.4
1114.7	1184.0	1253.3	1322.6		
1489.0	1558.4	1627.7	1697.0	1766.3	1835.6
1904.9	1974.2	2043.5	2112.8		
2279.0	2348.3	2417.6	2486.9	2556.2	2625.5

2694.8	2764.1	2833.4	2902.7		
1.376	.25	.006	.005	1.37	.2437
3	9				
1	1	1	1		
0.0	3200.	2.4	12.0		
51FTE=4 MEASURED AND CALCULATED SLEEVE-FUEL BODY GAPS					
21SLEEVE-FUEL BODY GAPS					
MILS					
2					
6					
7.1560	7.0472	.8898			
31.1560	7.2027	.9895			
55.1560	5.0215	1.0432			
79.1560	7.0531	1.0272			
103.1560	9.1524	1.3545			
119.7300	6.2473	2.2369			
3					
24.7500	5.8000	.5209			
72.2400	8.0000	.5544			
119.7300	6.6500	.6807			
600.	3000.	5.0	16.0		
65FTE=4 MEASURED AND CALCULATED FUEL ROD-FUEL HOLE GAPS (HOLES 1&2)					
22FUEL ROD-FUEL HOLE GAP					
MILS					
1					
24					
29.0700	8.1170	.4458			
34.9200	9.0834	.7630			
38.8200	10.1854	.5619			
44.6700	10.5610	.4896			
50.5100	11.3605	.7361			
58.2300	11.4386	.8126			
60.1800	11.6052	.6155			
62.1300	11.9533	.5845			
64.0600	11.4938	.9262			
66.0300	11.7565	.7749			
67.9800	11.9732	.6904			
69.9300	11.8440	.7508			
71.8800	12.0069	.8191			
73.8300	12.0609	.7264			
75.7800	12.2169	.6194			
77.7200	11.6879	1.2139			
79.6700	11.9462	.5696			
81.6200	11.8502	.6979			
83.5700	11.8657	.6555			
91.2800	11.6096	.6202			
97.1300	11.0586	.4673			
101.0300	11.2198	.8184			
106.8800	10.0398	.8728			
112.7200	9.3654	1.2360			
0.0	3200.	.24	.16		
43FTE=4 MEASURED AND CALCULATED SLEEVE STRAIN					
13SLEEVE STRAIN					
(ΔD/D-1) (%)					
2					
6					
.715600+01	.702647-03	.505688-03			

.311560+02	-.143396-03	.513914-03
.551560+02	-.167775-02	.471263-03
.791560+02	-.177813-02	.562194-03
.103156+03	-.673971-03	.486074-03
.119730+03	.157738-03	.156676-02
3		
.247500+02	-.218011-03	.649507-03
.722400+02	-.799363-03	.649205-03
.119730+03	.399671-03	.724395-03
600.	3000.	-.5 .12
46FTE-4 MEASURED AND CALCULATED FUEL BODY STRAIN		
16FUEL BODY STRAIN		
(90/0-1) (%)		
1		
51		
29.5400	-.0766	.0412
31.5900	-.0949	.0468
33.5900	-.0912	.0538
35.5900	-.1168	.0660
36.5900	-.0730	.0354
38.4500	-.0292	.0435
39.9000	-.0365	.0354
41.9600	-.0693	.0408
43.9600	-.0657	.0435
45.9600	-.0547	.0501
47.9600	-.0693	.0408
49.9600	-.1460	.0792
51.9600	-.1168	.0659
52.9600	-.1058	.0466
53.9600	-.1387	.0435
54.9600	-.1569	.0435
59.9600	-.0912	.0538
60.9600	-.0832	.0435
61.9600	-.1387	.0435
62.9600	-.1387	.0435
64.9600	-.1825	.0354
66.9600	-.2007	.0537
68.9600	-.2007	.0837
70.9600	-.2372	.0500
72.9600	-.2190	.0354
74.9600	-.2299	.0435
76.9600	-.2482	.0659
78.9600	-.2482	.0435
80.9600	-.2664	.0407
82.9600	-.2737	.0537
85.2100	-.3285	.0837
86.2100	-.3942	.0659
88.0600	-.1460	.0792
89.0600	-.1642	.0501
90.0600	-.2372	.1120
91.0600	-.2664	.1313
93.0600	-.2920	.0500
95.0600	-.2555	.0354
97.0600	-.3102	.0500
99.0600	-.2420	.0354
101.0600	-.2190	.0837
103.0600	-.2920	.0837

104.5600	-.2664	.0407
106.1900	-.1642	.0501
108.1900	-.1387	.0435
110.1900	-.1387	.0435
112.1900	-.1095	.0354
113.1900	-.0839	.0435
114.1900	-.0839	.0435
115.1900	-.0730	.0354
116.1900	-.0547	.0501
600.	3000.	-5.0 0.0

57FE-4 MEASURED AND CALCULATED FUEL ROD STRAIN (HOLES 1&2)

15FUEL ROD STRAIN

($\Delta D/D-1$) (%)

1		
24		
29.0700	-1.5230	.1385
34.9200	-1.6930	.1915
38.8200	-2.2400	.1659
44.6700	-2.4280	.1579
50.5100	-2.6498	.3210
58.2300	-2.5295	.1540
60.1800	-2.7665	.3191
62.1300	-2.8758	.1685
64.0800	-2.6249	.2464
66.0300	-3.0189	.1425
67.9800	-2.8444	.2009
69.9300	-2.8275	.2147
71.8800	-2.4519	.2265
73.8300	-2.8019	.2069
75.7800	-2.8559	.1535
77.7200	-2.8940	.2853
79.6700	-2.8530	.4156
81.6200	-2.8703	.1993
83.5700	-2.7274	.1782
91.2800	-2.7807	.1482
97.1300	-2.6448	.1380
101.0300	-2.6741	.1885
106.8800	-2.2918	.2078
112.7200	-2.0193	.2703
0	1	0 1
600.	3000.	4.0 12.8

76FE-4 MEASURED AND CALCULATED FUEL ROD-FUEL HOLE GAPS (HOLES 3,4,7&8)

22FUEL ROD-FUEL HOLE GAP
MILS

1		
15		
29.0700	6.1129	.4912
34.9200	6.6711	.5120
38.8200	8.0521	.5904
44.6700	8.6194	.4589
50.5100	8.9024	.5335
60.1800	9.5845	.7547
66.0300	9.8484	.7481
69.9300	9.7047	.4922
75.7800	9.2604	1.0532
81.6200	9.5800	.5821
91.2800	9.3804	.6961

97.1300	9.4377	.5969
101.0300	9.2948	.6033
106.8800	8.7440	.5969
112.7200	8.2154	.5014
600.	3000.	-3.2
62 FTE-4 MEASURED AND CALCULATED FUEL ROD STRAIN (HOLES 3,4,7&8)		
15 FUEL ROD STRAIN		
(D/D-1) (%)		
1		
15		
29.0700	-.7988	.1546
34.9200	-1.2436	.3217
38.8200	-1.5848	.2600
44.6700	-1.8610	.1632
50.5100	-1.8866	.2049
60.1800	-2.1215	.1847
66.0300	-2.2341	.2636
69.9300	-2.0869	.2284
75.7800	-1.9668	.2544
81.6200	-1.9554	.5632
91.2800	-2.3291	.2536
97.1300	-2.0150	.2290
101.0300	-2.0795	.1967
106.8800	-1.7308	.1700
112.7200	-1.4588	.1663
0	1	0
600.	3000.	3.6
65 FTE-4 MEASURED AND CALCULATED FUEL ROD-FUEL HOLE GAPS (HOLES 5&6)		
22 FUEL ROD-FUEL HOLE GAP		
MILS		
1		
24		
29.0700	4.9754	.4630
34.9200	6.0002	.6841
38.8200	7.2105	.5175
44.6700	6.9527	.9974
50.5100	7.8856	1.0265
58.2300	8.0887	.8189
60.1800	8.5554	.5153
62.1300	8.0952	.7025
64.0800	8.6275	.5050
66.0300	8.2152	.4241
67.9800	8.0402	.4913
69.9300	8.2068	.5422
71.8800	7.1074	1.2497
73.8300	8.2113	.6893
75.7800	8.2006	.5197
77.7200	8.0801	.4457
79.6700	8.3801	.4470
81.6200	8.2095	.4458
83.5700	7.9579	.4546
91.2800	7.9596	.6024
97.1300	8.5002	.4887
101.0300	7.8864	.4599
106.8800	8.6648	.4124
112.7200	6.9237	.6523
600.	3000.	-2.6
0.0		

57FTE-4 MEASURED AND CALCULATED FUEL ROD-STRAIN (HOLFS 5&6)		
15FUEL ROD STRAIN		
(RO/D-1) (%)		
1		
24		
29.0700	-.4645	.1354
34.9200	-.6576	.1667
38.8200	-1.2061	.2429
44.6700	-1.2595	.2285
50.5100	-1.5260	.2493
58.2300	-1.4863	.2024
60.1800	-1.5627	.1420
62.1300	-1.5745	.1677
64.0800	-1.6607	.1387
66.0300	-1.5277	.1573
67.9800	-1.6650	.1375
69.9300	-1.6578	.1750
71.8800	-1.7223	.3757
73.8300	-1.5102	.1914
75.7800	-1.6021	.1635
77.7200	-1.4761	.1311
79.6700	-1.6752	.1596
81.6200	-1.7029	.1407
83.5700	-1.5414	.1288
91.2800	-1.5869	.2014
97.1300	-1.6339	.1769
101.0300	-1.4177	.1314
106.8800	-1.4374	.1526
112.7200	-1.3631	.3708

FTE-4 MEASURED AND CALCULATED FUEL ROD STRAIN (HOLES 1&2)

FTE-4 MEASURED AND CALCULATED FUEL ROD-FUEL HOLE GAPS (HOLES 586)

FTE-4 MEASURED AND CALCULATED FUEL ROD-FUEL HOLE GAPS (HOLES 3,4,7,8)

FTE-4 MEASURED AND CALCULATED FUEL ROD-FUEL HOLE GAPS (HOLES 1&2)

FTE-4 MEASURED AND CALCULATED SLEEVE STRAIN

FTE-4 MEASURED AND CALCULATED SLEEVE-FUEL BODY GAPS

FTE-4 MEASURED AND CALCULATED FUEL ROD STRAIN (HOLES 3,4,7&8)

FTE-4 MEASURED AND CALCULATED FUEL BODY STRAIN

FTE-4 MEASURED AND CALCULATED FUEL ROD-STRAIN (HOLES 5&6)

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