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FLUID-MIXING STUDIES IN A HEXAGONAL 217-PIN WIRE-WRAPPED
ROD BUNDLE

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ABSTRACT

Mixing, pressure drop, and flow split experiments were performed on a 217 pin LMFBR fuel bundle with a pitch to diameter ratio of 1.25 and a lead length of 12 inches. It was found that the turbulent flow data could best be characterized by the energy parameter $C_{1L} = .106$, which is 9% higher than the value from the correlation of Chiu et al. Chiu's correlation was developed on a data base of 61 and 91 pins. The spread of existing data about the correlation is $\pm 25\%$, but the error band on our data is expected to be less ($\sim \pm 10\%$ since injection depth effects were not previously considered). Our result is consistent with the concept of increased swirl flow in larger bundles (more pins). This is due to the decreasing effect on the corner subchannel reduction of swirl flow. The interior region mixing parameter, ϵ_{1L}^* was not determined in this work, since its turbulent value has been unambiguously set for this geometry by earlier investigators. Low Reynolds number data for C_{1L} was also obtained to verify the laminar-transition sweeping flow correlation of K. Burns et al. Pressure drop and flow split measurements were also taken, and the data was compared to the correlations of Hawley and Chiu.

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NOMENCLATURE

A	Subchannel area
C_1	Swirl velocity ratio
C_{1L}	$= C_1/X_2$
De	Hydraulic diameter
D	Rod diameter
D_w	Wire diameter
f	Friction factor
F	Bundle looseness factor
P	Pitch
Re	Reynolds number
T_{ff}	Flat-to-flat tolerance
V	Subchannel average velocity
X	Flow split parameter
ΔP	Pressure drop
ϵ_{1L}^*	Effective enhanced eddy diffusivity

SUBSCRIPTS

1	Interior subchannel
2	Edge subchannel
3	Corner subchannel
b	Bundle average

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INTRODUCTION

Hydraulic tests were run on a hexagonal 217 pin wire wrapped bundle with a pitch to diameter ratio of 1.25, and a wire wrap lead length of 12 inches. Mixing, pressure drop, and flow split experiments were taken to provide a larger data base for the respective correlations [references 13, 4, and 3]. Reference 4 includes the turbulent flowsplit correlation of reference 3, with the addition of laminar and transition flowsplit parameters, and friction factors for the laminar, transition, and turbulent flow regimes. Reference 13 gives correlations for the mixing parameters ϵ_{1L}^* and C_{1L} for turbulent flow. The behavior of ϵ_{1L}^* and C_{1L} in laminar flow is also of interest for modeling heat transfer in low flow and natural circulation conditions. Burns developed a laminar-transition sweeping flow correlation (reference 14), which brings in a Reynolds number effect. Both of these correlations were verified with experimental mixing data taken in this test.

CHAPTER 1

FLOWSPLIT MEASUREMENTS

1.1 Measurement Technique

Flow measurements were made on the 217 pin bundle using the isokinetic technique discussed in reference 1. A diagram of the subchannels is given in figure 1.1. There are 48 edge subchannels, 384 interior subchannels, and 6 corner subchannels. In taking data, the flow in all of the edge subchannels was measured for each Reynolds number. No measurements were made on the corner subchannels, as they are of little importance. The large number of interior subchannels made it impractical to sample all of them. A collector was designed which sampled four interior subchannels at a time (drawings of this collector, along with some general comments on flow collector construction are given in Appendix A). Thus the entire interior region could be sampled with 96 measurements. Utilizing the "flat to flat" sampling technique developed by T. Chiu (reference 2) this number was reduced to 42. Figure 1.2 shows the numbering scheme used. Only those interior "measuring channels" which are numbered were sampled. A "measuring channels" consists of the four subchannels which are covered by the central collector for a particular measurement. The 217 pin bundle has 8 rings of interior subchannels (figure 1.1) but only 4 rings of interior " measuring channels" (figure 1.2).

The rotometer used in this experiment (designated as R2 in reference 15) was found to be in error. It was calibrated using

the technique discussed in appendix A of reference 2, by measuring the pressure drop across the orifice. The calibration curve is given in figure 1.3.

1.2 Calculation of Reynolds Number and Flow Split Parameters

The bundle Reynolds Number, Re_b is found from:

$$Re_b = \frac{\rho V_b De_b}{\mu} \quad (1)$$

Where:

$$V_b = \frac{Q_b}{A_b} \quad (2)$$

Substituting 2 into 1 gives:

$$Re_b = \frac{\rho}{\mu} \frac{De_b}{A_b} Q_b \quad (3)$$

The ratio of ρ/μ was calculated as a function of temperature.

De_b and A_b can be found from table 1.1, which lists the bundle geometric parameters. Equation 3 can then be expressed as

$$Re_b = f(T) Q_b \quad (4)$$

Where Q_b is the bundle flow rate in GPM and $f(T)$ is a function of fluid temperature which can be obtained from the graph in figure 1.4.

The flowsplit parameters X_1 and X_2 can be calculated from:

$$\begin{aligned} X_1 &= \frac{V_1}{V_b} \\ X_2 &= \frac{V_2}{V_b} \end{aligned} \quad (5)$$

The velocities are obtained from:

$$V(\text{Ft/Min}) = \frac{Q(\text{Gal/Min})/7.481(\text{Gal/Ft}^3)}{\text{Area}(\text{Ft}^2)}$$

Or:

$$V_1 = \frac{Q_1/7.481}{N_1 A_1/144} = 3.59 Q_1 \text{ Ft/Min}$$

$$V_2 = \frac{Q_2/7.481}{N_2 A_2/144} = 14.32 Q_2 \text{ Ft/Min} \quad (6)$$

$$V_b = \frac{Q_b/7.481}{N_1 A_1 + N_2 A_2 + N_3 A_3} = 2.85 Q_b \text{ Ft/Min}$$

The flowsplits are obtained by substituting the velocities of EQ 6 into EQ 5.

1.3 Results Expressed as X_1 and X_2 , with Comparison to Hawley-Chiu Correlations.

Flowsplit data is usually expressed in terms of the parameters X_1 and X_2 discussed in section 1.2. This presentation assumes that uniform flow is achieved in the interior and edge regions of the bundle. The validity of this assumption will be investigated later. Results of this form are used as an input to the ENERGY series of codes.

Figure 1.5 gives the flowsplit data plotted against Reynolds number. The "Fully Turbulent" regime is considered $Re_b > 6,000$ since the data saturates to a relatively constant value for $Re > 6,000$, though a slight decrease with Reynolds number can still

be seen. Average flowsplit values for the fully turbulent regime are $X_1 = .994$ and $X_2 = 1.055$. These results are in good agreement with the values from the turbulent flowsplit correlation of Chiu et al (reference 3), which gives $X_1 = .992$ and $X_2 = 1.027$ (.2% error and 2.7% error on X_1 and X_2 respectively).

The isokinetic collecting technique breaks down for low flow rates, so no good data was obtained for $Re < 1,500$. For this reason it is impossible to test the validity of the laminar flow flowsplit correlation of Hawley et al (reference 4), because the laminar flow correlation is valid for $Re < 500$. The values from the correlation are $X_{1L} = .861$ and $X_{2L} = 1.53$, and are plotted in figure 1.5. The transition flowsplit from the Hawley correlation are also drawn in. The agreement is within $\pm 5\%$ for $Re > 3,000$, though considerable scatter exists in the data for $Re < 3,000$.

1.4 Flow Distribution in the Edge Region

In the previous sections, a uniform flow was assumed in the edge region. Examination of figure 1.1 indicates the existence of six different types of edge subchannels, corresponding to six different wire wrap orientations. If the bundle is broken up into six triangular sectors, each sector identification number (figure 1.1) corresponds to a different wire wrap orientation for the edge subchannels.

Figure 1.6 shows a plot of edge subchannel flow rate (in ml per second) versus sector ID number for turbulent flow. The eight subchannels of a particular sector should have the same flow rate, so the results of each sector were averaged together.

The mean is indicated by the horizontal lines, and the error bar is a standard deviation about the mean (a 68% confidence interval). This figure shows a significant variation in edge subchannel flow rate along the bundle periphery.

Following this reasoning, six edge flowsplit parameters can be calculated as:

$$X_{2i} = \frac{V_{2i}}{V_b} \quad i=1,2,3,\dots,6$$

Where: V_{2i} is the average velocity for the 8 edge subchannels in sector i .

V_b is the bundle average velocity.

These edge flow split parameters are presented in figure 1.7 as a function of Reynolds Number. Again the variation in the edge subchannel velocity is apparent. The flowsplit parameters for $Re > 6,000$ (fully turbulent regime) for each sector are averaged, and plotted against sector ID number in figure 1.8. The error bar is a standard deviation about the mean. Maximum X_{2i} occurs in sector 1, while minimum X_{2i} occurs in sector 5. The percentage variation is found from:

$$\frac{\text{Max}(X_i) - \text{Min}(X_i)}{\text{Max}(X_i)} = 23.5\%$$

Figure 1.9 shows the same plot for the laminar flow data. A similar trend is observed, but the result for sector 4 is not

consistent with expectations. The variation about the mean is larger for the laminar flow data, but a similar trend is indicated with maximum X_i occurring in sector 1, and minimum X_i occurring in sector 5. The percentage variation is:

$$\frac{\text{Max}(X_i) - \text{Min}(X_i)}{\text{Max}(X_i)} = 10.9\%$$

This is considerably less than the variation in the turbulent flow data. These results indicate that flow sweeping effect induced by the wire wrap decreases in the laminar flow regime.

These results can be compared with the MIT LDA experiments (reference 5) where the subchannel averaged axial velocity was measured as a function of wire wrap angle. The position of the wire wrap was measured relative to the clock face shown on figure 1.10. The wire is at 1:30 in the configuration shown. Figure 1.10 summarizes the results of the LDA measurements, which were performed on a 61 pin bundle with geometric characteristics ($P/D = 1.25$ $H/D = 48,24$) similar to the bundle under investigation. The figures of interest are the ones for the 12 inch lead (or 12 inches pinch in 11TR nomenclature) bundle. Measurements were made for Reynolds Numbers of 640 and 4500. The average value of V'_A/V_B (dotted line in figure 1.10) is the edge flowsplit parameter, X_2 . V'_A/V_B is seen to decrease with Reynolds Numbers, as in the present study. The percentage variation in edge subchannel flow rate with wire wrap position increases with Reynolds Number (12% for $Re=640$ and 14% for $Re=4500$ from the data of figure 1.10) but

not as dramatically as in our results.

The LDA results for $Re=4500$ are reproduced in figure 1.11, along with results of the 217 pin bundle. We can see from figure 1.11, that the following correspondence exists between sector ID number and wire wrap orientation:

<u>Sector ID #</u>	<u>Wire Wrap Position</u>
1	7:00
2	5:00
3	3:00
4	1:00
5	11:00
6	9:00

Plotted with the LDA data are the average values utilizing the isokinetic extraction technique in the turbulent flow regime ($Re > 6,000$), and results from a single flowsplit map with $Re=5300$ (closest Re to 4500 in our experiments). Initially, from 12:00 to 4:30 the right trend is obtained, but the laser data starts to decrease while the isokinetic sampling data increases up to 7:00 and then goes down.

The LDA data reaches a minimum at 9:00 then increases. The isokinetic data continues to decrease up to 11:00. It seems that a phase shift exists of 2 to $2\frac{1}{2}$ hours between the two sets of data.

A number of reasons may be cited to explain the observed discrepancies. The swirl flow will tend to affect the axial

velocities in the first few subchannels down stream (in the direction of the swirl flow) of the corner. This would effect the average values obtained from the isokinetic technique, but not the LDA measurements, since they were not made near a corner. Also the isokinetic technique may not give a good indicator of axial velocity in the presence of strong swirl flows, since the collector is not normal to the incoming flow. For the calculations made here an average edge subchannel area was used, but in actuality the flow area varies with wire wrap position. In the LDA measuring technique, the edge subchannel was divided into a large number of square regions, and a local velocity measurement was made at the center of most of the regions. Figure 1.12 taken from reference 5 shows a typical set of axial velocity measurements. It was impossible to take readings in all of the regions due to laser reflection. The velocities in the empty squares adjacent to the wall were estimated by an interpolation scheme, then the velocity field was averaged to allow the flow split to be calculated. The interpolation is an additional source of error, though the errors in the LDA technique are smaller than the less sophisticated isokinetic technique.

CHAPTER 2

PRESSURE DROP

2.1 Determination of Friction Factors

Pressure measurements were taken using the injector rod technique discussed in reference 6. Measurements were made at axial levels of 12, 24, and 36 inches for an interior and an edge subchannel. For purposes of calculating friction factor the pressure drop over a 12 inch length was taken as:

$$\Delta P = \frac{1}{2}[P(36") - P(12")] \quad (2.1)$$

Friction factors were then calculated from:

$$f_i = \Delta P_i \frac{De_i}{L} \frac{2}{\rho (x_i V_b)^2} \quad (2.2)$$

ΔP_i is the measured gage pressure difference, V_b is determined from the bundle flow rate, and x_i is determined from the flow-split measurements. For interior subchannels 2.2 becomes:

$$f_1 = 676.22 \frac{\Delta P}{(x_1 G)^2} \quad (2.3)$$

And for edge subchannels

$$f_2 = 829.13 \frac{\Delta P}{(x_2 G)^2} \quad (2.4)$$

Where G is the bundle flow rate in GPM. The subchannel Reynolds number is calculated from:

$$Re_i = Re_b x_i \frac{De_i}{De_b} \quad (2.5)$$

Flowsplit parameters were taken as:

$$x_1 = .99$$

$$x_2 = 1.03$$

For $Re_b > 2500$, and:

$$x_1 = .93$$

$$x_2 = 1.26$$

For $Re_b < 2500$. Table 2.1 gives the experimental data, along with the results of the calculations discussed above. Figure 2.1 gives a plot of f_1 versus Re_1 , and figure 2.2 shows f_2 versus Re_2 .

2.2 Comparison With the Hawley Correlation

In figures 2.1 and 2.2 the friction factors from the Hawley correlation (equation 34 of reference 4) are plotted along with the data. The agreement is quite good, particularly for the edge friction factors. The subchannel Reynolds numbers were calculated from equation 2.5 where x_i was obtained from the transition flowsplit correlation of reference 4.

CHAPTER 3

MIXING TEST

3.1 Overview

Mixing test were performed on the 217 pin bundle using the salt injection technique described in reference 7. A salt solution was injected into an edge subchannel at axial levels of 12, 24, 36, and 48 inches to determine the mixing parameter c_{1L} . No central subchannel injection runs were made, so no determination was made for the mixing parameter ϵ_{1L}^* . Central subchannel injection runs were made in the 217 pin bundle test at HEDL (reference 8). Also ϵ_{1L}^* was determined for a geometry very close to the one presently under investigation in reference 9, but for a 61 pin bundle. Bundle size is not expected to have any effect on the determination of ϵ_{1L}^* , so sufficient data on ϵ_{1L}^* was believed to exist for this geometry, and no further mixing tests were made. Bundle size is believed to have some effect on c_{1L} , and it is the determination of this effect as well as a recheck of the HEDL results (8) that are the goals of the present study.

3.2 Determination of Salt Concentration Distributions

The MIT laboratory data aquisition system (reference 7) was used to collect and store the mixing data on a floppy disk in the form of probe resistances.

The data is then transferred to a VAX - 11/780 for processing. The processing routine in reference 7 required modification for the 217 pin bundle test. A listing of the program is given in

appendix C. A hardware error made necessary an additional modification which read in the calibration data from files typed on to the VAX by hand.

The subchannel numbering scheme for the 217 pin bundle is given in figure 3.1. It is the same numbering scheme used in references 10 and 11. It was not necessary to instrument each subchannel in the bundle. Preliminary runs with SUPERENERGY-DRV using conservative values for the mixing parameters indicated that the instrumentation scheme of figure 3.2 would be adequate. This figure indicates the probe numbering scheme used, and which subchannels were instrumented. The dimensionless ratios of salt concentration calculated by the data processing routine are given in appendix B for each probe number, and each run (row 1 has the concentrations for probes 1 - 16, and row 2 has concentrations for probes 17 - 32, etc.).

3.3 Analysis of Mixing Data

The data reduction code SUPERENERGY-DRV was used to determine C_1 from the experimental dimensionless salt concentration values. A minor modification in the code was required to allow input of data for the instrumented subchannels only. The main program with modifications is given in appendix D. Table 3.1 gives the bundle flowrate, Reynolds number, edge flowsplit parameter, and salt solution injection flowrate for runs 1 - 51 (runs 51 - 64 of table 3.2 were made at a later date to increase the data base in the laminar flow regime). Note that the edge flowsplit parameter is required to calculate the injection flowrate, and is input to

both the data processing program to calculate dimensionless ratios and mass balances, and to SUPERENERGY-DRV. From the flowsplit data, the dependence of x_2 on Reynolds number was approximated as follows:

$0 < \text{Re} < 2500$	$x_2 = 1.26$
$2500 < \text{Re} < 5500$	$x_2 = 1.15$
$\text{Re} > 5500$	$x_2 = 1.04$

Also given in table 3.1 is the mass balance ratio calculated by the data processing program, and the value of C_1 calculated by SUPERENERGY-DRV-1. C_{1L} ($= \frac{C_1}{x_2}$) is also given.

Figure 3.3 gives the mass balance ratio (ratio of salt detected to salt injected) as a function of Reynolds number for three injection depths. To the right of the figure, the average mass balance ratio is plotted with an error bar representing one standard deviation. The average mass balance decreases with injection depth, and is close to one for both the 24" and 36" injection depths. Note that considerable scatter exists for the low Reynolds number data, which explains the large error bar for the 36" injection data (most of the low Reynolds number data was taken at an injection depth of 36 inches).

3.4 Effect of Injection Velocity on C_{1L}

It was suggested in reference 9 that the component of the injection velocity in the transverse direction could increase the value of C_1 calibrated by SUPERENERGY-DRV-1 by giving the salt an initial displacement along the bundle periphery. The deep

injection results were considered to give the best data, since the displacement of the salt due to the swirl velocity would dominate any injection effect. Runs 8 - 12 were made to investigate this effect (run 10 was invalidated by a bad mass balance). These runs were made at a constant flow rate with a 12 inch injection, but the injection flow rate was increased with each run. The resulting concentrations are plotted along the bundle periphery in figure 3.4. These plots show that the injection velocity does have an effect on C_1 . As injection flow rate (and velocity) is increased, the distribution is displaced along the bundle periphery, and the value of C_1 is increased. The value for C_1 for run 11 is slightly greater than for run 12 (opposite the expected result), and the concentrations for those two runs are quite close. But runs 8, 9, and 11 dramatically exhibit the effect of the injection velocity.

Figure 3.5 presents the values obtained for C_1 calibrated by SUPERENERGY-DRV-1 as a function of Reynolds number for four injection depths for the first set of data (runs 1 - 50). The 48 inch results (runs 49 and 50) were made with side pressure tap injection into subchannel number 421. All of the other runs were made with injector rod injection into subchannel number 424 (see figure 3.1). In all of these cases, the injection flow rate was calculated by equating the axial component of the injection velocity with the subchannel axial velocity to minimize the disturbance to the flow. The results are seen to vary with injection depth, but saturate to a constant value for the 36 and 48

inch injection runs for fully turbulent flow, $Re > 5500$. Also shown is the value from the turbulent flow correlation of Chiu et al (reference 13) with an error bar of $\pm 25\%$ representing the spread of existing data about the correlation. Unlike the 61 pin bundle mixing test results, the shallow injection results are below, not above the deep injection data, but the variation with injection depth is not as large (the fully turbulent results for all injection depths are within the error bar). For this data, we would not expect injection effects to be as important since our injection velocities are about 25% less than they were calculated to be because of the error due to the flowmeter.

The mixing data was also reduced using the SUPERENERGY-DRV-2 code, which requires as input two sets of data taken at the same Reynolds number but different axial levels. As found in reference 9, the deep injection results from DRV-1 were better than any combination of injection depths using DRV-2.

3.5 Dependence of C_{1L} on Bundle Size

The recommended value of C_{1L} for the 217 pin bundle is based on the deep injection results. For the fully turbulent regime the value for C_{1L} ($C_{1L} = C_1/x_2$, $C_1 = .11$ from figure 3.5, $x_2 = 1.04$ from figure 1.5) is .106, which is above the value from the correlation by 9 %. It seems reasonable that C_{1L} will increase with bundle size, since the effect of the restricted swirl flow due to the corner subchannel is small. The concept of reduced swirl flow in edge subchannels next to a corner subchannel was also presented in reference 13. Two separate

correlations were presented for C_{1L} . One was for edge to edge subchannel sweeping flow when the donor edge subchannel is next to a corner pin (valid for 7 and 19 pin bundles) and one for edge to edge subchannel sweeping flow when the donor edge subchannel is not adjacent to a corner pin (valid for 37 pin bundles, and larger). The correlation for small bundles has the same calibration constants as the correlation for large bundles (there is no significant data base for 7 and 19 pin bundles). It differs only in subchannel centroid to centroid distance and relevant areas, which comes out of the physical modeling.

The two correlations are plotted in Figure 3.6 along with the old data points and two new data points, one from the present analysis, and the other from the experimental work of Burns (reference 14) on the 37 pin $p/d=1.15$ geometry. The data of Burns is expected to be in error, and the test will be repeated in the near future. The 217 pin data point is above the correlation by 9%, but within the 25% variation in data points. The 25% variation is in part due to injection depth effects, which were ignored in the early MIT tests. The variation may be attributed to a small bundle size effect, or errors in the determination of C_{1L} .

3.6 Dependence of C_{1L} on Reynolds Number

A correlation for C_{1L} and ε_{1L}^* in the laminar and transition flow regimes was developed by Burns et al in reference 14. The correlation for C_{1L} is:

$$C_{1L} = \frac{c'}{k'} \left\{ \frac{A_r}{A_s} \right\}^{0.5} Re_b^{0.35} \left\{ \frac{D_g}{\eta} \right\}^{n/2} \left\{ \sin\theta \left(\frac{D_w}{De} \right) \left(1 - \frac{D_w}{2De} \right) \right\} \quad (3.1)$$

where:

$$D_g = \frac{1}{2} (1-F) \cdot T_{ff} + D_w$$

$$A_r = \left\{ \pi \left(\frac{1}{2} D + D_w \right)^2 - \frac{1}{4} \pi D^2 \right\} / 4$$

$$A'_s = P \left(\frac{1}{2} D + D_g \right) - \pi D^2 / 8$$

$$A_s = P \left(\frac{1}{2} D + D_g \right) - \frac{\pi D^2}{8} - \frac{\pi D_w^2}{8 \cos\theta} \quad (3.2)$$

$$P_w = P + \frac{\pi D}{2} + \frac{\pi D_w}{2 \cos\theta}$$

$$De = 4 A_s / P_w$$

$$\eta = P$$

$$\sin\theta = \frac{\pi (D + D_w)}{\sqrt{\pi^2 (D + D_w)^2 + H^2}}$$

It was assumed that the value of n' was the same as the value of n' in the turbulent flow correlation of reference 13:

$$n' = .70 \quad (3.3)$$

And c'/k' was determined from limited available low Reynolds

number data to be:

$$c'/k' = .81 \quad (3.4)$$

While this correlation was being developed, only the data of table 3.1 was available for calibration of c'/k' . The data of table 3.2 was taken at a later time to verify, and possibly modify the laminar/transition correlation.

Figure 3.7 shows the low Reynolds number data ($Re < 4,000$) from table 3.1 and table 3.2 for the geometry under investigation, equation 3.1 becomes, with known constants from 3.3 and 3.4:

$$C_{1L} = .00747 Re_b^{.35}$$

This curve is drawn in on figure 3.7, along with the turbulent flow value from reference 13. The low Reynolds number data from table 3.2 verifies Burns' correlation up to a Reynolds number of about 2,000. Beyond $Re=2000$, the turbulent flow correlation does a better job of correlating the data. Note that prior to collection of the data of table 3.2, the only low Reynolds number data point for this geometry was the $Re_b=340$ point from run # 25 , and that the calibration constant was adjusted to fit this point. The additional data shows that the low C_{1L} from run # 25 was not due to chance, and that the physical modeling of reference 14 correctly predicts the variation of C_{1L} with Reynolds number.

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FIGURES

FIGURE 1.1
WIRE WRAP ORIENTATION AND SECTOR
I.D. NUMBERS

FIGURE 1.2
MEASURING CHANNELS FOR FLOWSPLIT
EXPERIMENT

Note: -Each numbered channel was sampled.
-Each interior measuring channel consists of four subchannels.

FIGURE 1.3

CALIBRATION OF FLOWMETER

FIGURE 1.4

PLOT TO ACCOUNT FOR FLUID PROPERTY
VARIATION WITH TEMPERATURE IN CALCULATION
OF BUNDLE AVERAGE REYNOLDS NUMBER

WIRE LOCATION

FIGURE 1.10 SUBCHANNEL AVERAGED AXIAL VELOCITY MEASUREMENT
FROM THE MIT LDA EXPERIMENTS (REF 5)

OPERATING CONDITIONS

DATE: 6/9/74
FLOW RATE: 15% S
REYNOLDS NUMBER: 640
T: 70° F
LASER POWER: 55 mWatts
FREQUENCY: 150 K

GEOMETRY

WIRE AXIAL PITCH: 12"
PLANE 15, 7:30 O'CLOCK
RESULT

$$\frac{\bar{V}_{AXIAL \text{ SC}}}{\bar{V}_{BUNDLE}} = 1.17$$

FIGURE 3.1

SUBCHANNEL NUMBERING SCHEME

FIGURE 3.2

PROBE NUMBERING SCHEME

↑ - side tap injection location

Q₁ - injector rod injection location

FIGURE 3.3
 MASSBALANCE RATIO VS. REYNOLDS NUMBER
 ▽ - 12 in. injection depth
 ○ - 24 in. injection depth
 □ - 36 in. injection depth

mean value with
 error bar of one
 standard deviation

FIGURE 3.4

EFFECT OF VARYING INJECTION VELOCITY
ON CONCENTRATION DISTRIBUTION

symbol	run #	inj. flow rate (GPM)	C_1
○	8	.01	.06
+	9	.02	.08
□	11	.04	.10
△	12	.05	.09

FIGURE 3.6

TABLES

TABLE 1.1

BUNDLE GEOMETRIC PARAMETERS

TOTAL NO. OF RODS = 217
RINGS OF PINS = 8
NO. OF INTERIOR SUBCHANNELS = 384
NO. OF EDGE SUBCHANNELS = 48
NO. OF CORNER SUBCHANNELS = 6

P TO D RATIO = 1.25000
H TO D RATIO = 51.72414
DIA. OF FUEL PIN = 0.23200 IN
DIA. OF WIRE = 0.05800 IN
PITCH = 0.29000 IN
WIRE LEAD LENGTH = 12.00000 IN
GAP BETWEEN RODS AND WALL = 0.05800 IN
FLOW AREA FOR INTERIOR SUBCHANNEL = 0.01356 IN**2
HYDRAULIC DIA. FOR INTERIOR SUBCHANNEL = 0.12250 IN
FLOW AREA FOR EDGE SUBCHANNEL = 0.02800 IN**2
HYDRAULIC DIA. FOR EDGE SUBCHANNEL = 0.15019 IN
FLOW AREA FOR CORNER SUBCHANNEL = 0.00999 IN**2
HYDRAULIC DIA. FOR CORNER SUBCHANNEL = 0.11330 IN
BUNDLE FLOW AREA = 6.76315 IN**2
BUNDLE AVG. HYDRAULIC DIA. = 0.12707 IN

TABLE 2.1PRESSURE DROP RESULTS

BUNDLE			INTERIOR			EDGE		
INDICATED GPM	TRUE GPM	Re_b	Re_1	ΔP_1 (psi)	f_1	Re_2	ΔP_2 (psi)	f_2
3.8	3.8	173	155	.0072	.388	258	.0091	
5.7	5.7	259	233	.0108	.259	386	.0144	.231
7.6	7.6	346	311	.0162	.218	515	.0180	.163
9.5	9.5	432	388	.0198	.171	643	.0216	.125
11.4	11.4	519	466	.0289	.173	773	.0289	.116
13.3	13.3	605	543	.0325	.143	901	.0325	.096
15.2	15.2	692	621	.0379	.128	1030	.0397	.090
17.1	17.1	778	699	.0433	.115	1158	.0451	.081
19.0	19.0	865	777	.0505	.109	1288	.0505	.073
22.2	22.2	1010	907	.0541	.085	1504	.0577	.061
25.9	25.9	1178	1058	.0649	.075	1754	.0685	.053
29.6	29.6	1347	1216	.0812	.072	2006	.0812	.048
33.3	33.3	1515	1360	.0938	.066	2256	.0992	.047
37.0	37.0	1684	1512	.1209	.069	2507	.1227	.047
40	50	2273	2041	.1714	.053	2759	.1894	.060
50	63	2864	2738	.2274	.039	3477	.2653	.053
60	73	3319	3173	.2886	.037	4029	.3211	.047
70	83	3774	3608	.3644	.036	4582	.3968	.045
80	95	4320	4130	.4383	.033	5244	.4960	.043
90	105	4774	4564	.5339	.033	5796	.6007	.043
100	115	5229	4999	.5862	.030	6348	.6963	.041
110	127	5775	5521	.6620	.028	7011	.8117	.040
120	135	6138	5868	.8057	.030	7452	.9489	.041
130	147	6684	6390	.9849	.031	8114	1.0785	.039
140	160	7275	6955	1.0875	.029	8832	1.1905	.037

TABLE 2.1 (Cont.)PRESSURE DROP RESULTS

BUNDLE			INTERIOR			EDGE		
INDICATED GPM	TRUE GPM	Re_b	Re_1	ΔP_1 (psi)	f_1	Re_2	ΔP_2 (psi)	f_2
150	170	7730	7390	1.1780	.028	9384	1.3260	.036
160	180	8185	7825	1.2935	.027	9937	1.456	.039
170	190	8639	8259	1.3640	.026	10488	1.586	.035
180	200	9094	8694	1.6000	.027	11040	1.772	.035
190	210	9549	9129	1.7440	.027	11592	1.907	.034
200	225	10231	9781	1.8760	.025	12421	2.033	.032
210	232	10549	10085	2.0925	.027	12806	2.152	.031

TABLE 3.1

	RUN #	BUNDLE FLOW RATE (GPM)	Re _b	X ₂	MASS BALANCE	C ₁	C _{1L}
12 INCH INJECTION DEPTH	1	120	4950	1.15	1.24	.10	.087
	2	140	5440	1.04	1.07	.09	.087
	3	160	6120	1.04	1.17	.09	.087
	4	180	6800	1.04	1.24	.09	.087
	5	200	7480	1.04	1.12	.09	.087
	6	220	8160	1.04	1.10	.09	.087
	7	240	8840	1.04	1.46	.09	.087
	8	200	7480	1.04	1.34	.06	.058
	9	200	7480	1.04	1.26	.08	.077
	10	200	7480	1.04	.36		
	11	200	7480	1.04	1.10	.10	.096
	12	200	7480	1.04	1.46	.09	.087
24 INCH INJECTION DEPTH	13	20	680	1.26	.95	.07	.056
	14	40	1360	1.26	.95	.08	.063
	15	20	2380	1.26	.96	.09	.071
	16	95	3230	1.15	1.23	.08	.070
	17	115	3910	1.15	1.12	.08	.070
	18	135	4590	1.15	.99	.08	.070
	19	160	5440	1.15	1.03	.09	.078
	20	180	6120	1.04	1.29	.08	.077
	21	200	6800	1.04	1.07	.08	.077
	22	220	7480	1.04	.99	.08	.077
	23	240	8160	1.04	.96	.08	.077
	24	260	8840	1.04	.94	.08	.077
36 INCH INJECTION DEPTH	25	10	340	1.26	1.23	.07	.056
	26	20	680	1.26	.096		
	27	30	1020	1.26	1.24	.14	.111
	28	40	1360	1.26	.91	.13	.103

TABLE 3.1 (Cont.)

	RUN #	BUNDLE FLOW RATE (GPM)	Re _b	X ₂	MASS BALANCE	C ₁	C _{1L}
	29	50	1700	1.26	1.44	.14	.111
	30	70	2380	1.26	1.21	.14	.111
	31	85	2890	1.15	1.22	.12	.104
	32	95	3230	1.15	1.48	.13	.113
	33	105	3570	1.15	1.15	.13	.113
	34	115	3910	1.15	.99	.12	.104
	35	125	4250	1.15	1.23	.14	.122
	36	135	4590	1.15	1.15	.12	.104
	37	147	4998	1.15	.92	.12	.104
	38	160	5440	1.15	1.03	.12	.104
	39	170	5780	1.04	.97	.11	.106
	40	180	6120	1.04	1.03	.11	.106
	41	190	6460	1.04	.98	.11	.106
	42	200	6800	1.04	1.33	.12	.115
	43	210	7140	1.04	1.17	.11	.106
	44	220	7480	1.04	1.08	.11	.106
	45	230	7820	1.04	1.13	.11	.106
	46	240	8160	1.04	1.03	.11	.106
	47	250	8500	1.04	1.02	.11	.106
	48	260	8840	1.04	.96	.11	.106
48 INCH INJECTION DEPTH	49	220	7480	1.04	1.30	.11	.106
	50	220	7480	1.04	1.17	.11	.106

TABLE 3.2

36 INCH INJECTION DEPTH	RUN #	BUNDLE FLOW RATE (GPM)	Re_b	X_2	MASS BALANCE	C_1	C_{1L}
	51	4.5	200	1.26	.850	.04	.032
	52	3.6	160	1.26	.973	.05	.040
	53	1.8	80	1.26	.860	.11	.087
	54	59.0	2625	1.15	.956	.10	.087
	55	37.0	1646	1.26	1.521	.12	.095
	56	25.7	1143	1.26	1.493	.11	.087
	57	14.5	645	1.26	1.132	.10	.079
	58	10.5	467	1.26	.910	.10	.079
	59	5.5	245	1.26	.734	.07	.056
	60	1.0	45	1.26	.196	.06	.048
	61	1.0	45	1.26	.178	.06	.048
	62	1.9	85	1.26	.279	.04	.032
	63	3.2	142	1.26	.360	.03	.024
	64	14.5	645	1.26	.951	.10	.079

APPENDIX

APPENDIX A

NOTES ON FLOW COLLECTOR CONSTRUCTION

APPENDIX A

FLOW COLLECTOR CONSTRUCTION

These pages summarize a few points on flow collector construction which should be made clear on diagrams given to machine shop personnel.

In constructing a collector with the correct pitch, and correct area, the collector wall thickness must be properly accounted for. Two ways of doing this are described here for interior collectors. For edge collectors similar reasoning must be applied.

For the first method, the collector wall is constructed as shown in figure A-2, with a total width of $P+2\sqrt{3}t$, where t is the collector wall thickness, and P is the pitch. The ends are filed off at 30° angles as shown so that the inside dimension is equal to a pitch. The collector leg is then cut as shown in figure A-1, with 2 notches of width t intersecting at the center of the leg. The wall is inserted into the leg such that line AB of the wall coincides with line AB of the leg. In this way the correct pitch and correct area is obtained.

For the second method, the collector wall is constructed as in figure A-4, with the correct pitch midway between the inside and outside dimensions. The notches in the leg must be cut as shown in figure A-3 with the center of the notch intersecting the center of the pin. When assembled, edge ABC of the collector wall coincides with ABC of the leg. The correct pitch (measured

from B to B') is obtained, but half of a wall thickness must be
filed from inside the collector to obtain the right area.

FIGURE A-1
NOTCHING OF COLLECTOR LEG

FIGURE A-2
COLLECTOR SIDE WALL

FIGURE A-3
NOTCHING OF COLLECTOR LEG

FIGURE A-4
COLLECTOR SIDE WALL

APPENDIX B

DIMENSIONLESS RATIOS OF SALT CONCENTRATION
FROM MIXING EXPERIMENT

RUN 1

0.0	0.0	1.0	6.0	18.5	29.4	19.5	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.0	0.0
0.0	0.0	0.0	0.0	1.3	4.3	8.3	4.5	15.9	2.5	2.1	0.0	0.7	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.2	0.3	0.1	0.0	0.8	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 2

0.0	0.0	0.9	7.3	20.4	29.2	15.7	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	0.0	0.0	0.0
0.0	0.0	0.0	0.0	1.6	5.3	9.1	5.0	15.5	1.8	1.7	0.0	0.4	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 3

0.0	0.0	0.4	6.3	18.7	28.7	18.1	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	0.0	0.0	0.0
0.0	0.0	0.0	0.1	1.3	4.6	8.3	4.5	15.3	1.9	2.1	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.7	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 4

0.0	0.0	0.4	6.7	19.5	29.4	16.8	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	0.0	0.0	0.0
0.0	0.0	0.0	0.1	1.4	5.1	8.6	4.6	15.5	1.7	1.7	0.0	0.5	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.1	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.5	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 5

0.0	0.0	0.4	6.8	19.5	28.9	16.7	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.9	0.0	0.0	0.0
0.0	0.0	0.0	0.1	1.4	5.1	8.3	4.5	15.3	1.7	1.8	0.0	0.5	0.0	0.0	0.0
0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 6

0.0	0.0	0.6	7.0	19.8	27.9	16.8	8.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0
0.1	0.3	0.0	0.2	1.6	5.0	8.0	4.3	14.8	1.7	1.8	0.0	0.8	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.1	0.2	0.1	0.0	0.7	0.3	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 7

0.3	0.2	0.7	6.1	15.8	22.0	13.5	6.7	0.4	0.2	0.3	0.3	0.5	0.5	0.3	0.1
0.2	0.3	0.3	0.3	0.3	0.2	0.4	0.5	0.3	0.5	0.0	0.4	7.3	0.2	0.0	0.1
0.3	0.6	0.3	0.5	1.5	4.5	6.9	3.9	11.8	1.7	1.7	0.4	0.6	0.0	0.1	0.7
0.5	0.3	0.3	0.4	0.5	0.0	0.2	1.0	0.5	0.3	0.0	0.0	0.0	0.5	0.4	0.2
0.3	0.2	0.2	0.2	0.3	0.1	0.2	0.0	0.2	0.2	0.2	0.0	0.0	0.1	0.0	0.4
0.4	1.0	0.2	0.2	0.7	0.2	0.2	0.9	0.2	0.4	0.2	0.3	0.5	0.1	0.5	0.5
0.3	0.2	0.3	0.4	0.4	0.9	0.6	0.8	0.4	0.4	0.6	0.3	0.2	0.2	0.3	0.7
0.0	0.2	0.3	0.3	0.3	0.1	0.0	0.6	0.5	0.6	0.6	0.6	0.0	0.1	0.3	0.2

RUN 8

0.0	0.0	1.1	14.1	24.7	21.6	7.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.7	0.0	0.0	0.0
0.0	0.0	0.0	0.8	3.6	11.6	14.1	7.7	11.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.1	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.3	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.1	0.0	1.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 9

0.0	0.0	0.5	9.4	22.7	28.5	11.4	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.4	0.0	0.0	0.0
0.0	0.0	0.0	0.2	1.9	6.9	10.2	5.5	14.9	1.2	1.1	0.0	0.4	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1

RUN 10

0.0	0.0	0.0	0.0	21.0	33.6	18.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 11

0.0	0.1	0.6	5.1	15.3	26.7	19.2	13.7	0.0	0.0	0.0	0.2	0.3	0.1	0.0	0.3	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	6.8	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.4	1.3	3.7	7.2	4.1	14.4	2.0	2.5	0.2	1.4	0.0	0.1	0.0	0.0
0.1	0.1	0.1	0.4	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.7	0.7	0.0	0.0	0.0	0.0	0.1
0.1	0.0	0.1	0.1	0.0	0.7	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.2	0.1	0.0

RUN 12

0.0	0.0	0.5	4.8	14.0	26.3	20.0	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.4	1.0	3.4	7.0	3.9	14.3	2.2	2.5	0.1	1.9	0.0	0.1	0.0	0.0
0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.8	0.2	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0

RUN 13

0.0	0.1	0.8	2.3	11.4	26.4	11.0	17.0	0.5	0.6	0.2	0.1	0.0	0.0	0.4	9.6	0.0
0.4	0.1	0.0	0.5	0.0	0.2	0.2	0.1	0.4	0.0	0.1	0.0	4.8	0.5	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.5	1.1	2.4	1.4	16.7	6.9	1.9	0.3	0.7	0.2	0.8	0.3	0.0
0.5	0.2	0.0	0.6	0.7	1.0	0.1	0.0	0.1	0.2	0.9	0.1	0.1	0.0	0.0	0.2	0.0
0.4	0.2	0.4	0.1	0.4	0.0	0.4	0.5	0.2	0.0	0.1	0.3	0.2	0.0	0.1	0.0	0.0
0.0	0.0	0.0	0.1	0.0	0.6	0.0	0.0	0.1	0.0	1.5	1.1	0.3	0.0	0.0	0.0	0.0
0.0	0.1	0.0	0.3	0.5	2.5	0.0	0.3	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
0.1	0.2	0.6	0.5	0.5	0.3	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.2	0.2	0.2

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RUN 20

0.1	0.1	0.3	1.7	3.4	6.3	7.5	14.5	0.2	0.1	0.0	0.3	1.2	7.5	12.1	8.0
0.0	0.5	0.1	0.3	0.2	0.0	0.4	0.4	0.2	0.3	0.0	0.1	1.9	0.5	0.0	0.1
0.2	0.4	0.3	0.4	1.1	2.0	6.0	4.2	6.5	6.8	5.7	4.4	4.2	1.3	2.6	0.9
2.8	1.2	0.9	0.5	0.4	0.0	0.1	0.6	0.3	0.2	0.0	0.0	0.0	0.0	0.3	0.2
0.2	0.1	0.1	0.1	0.2	0.1	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.1	0.0	0.6
0.5	0.6	0.1	0.1	0.4	0.1	0.2	1.1	0.2	0.3	0.7	0.3	0.4	0.0	0.5	0.3
0.5	0.8	0.5	1.9	0.7	2.8	1.0	2.5	0.8	0.4	0.4	0.2	0.1	0.1	0.1	0.1
0.3	0.2	0.3	0.5	0.5	0.1	0.0	0.0	0.3	0.0	0.2	0.2	0.0	0.0	0.2	0.2

RUN 21

0.2	0.3	0.6	2.0	3.9	7.3	8.4	15.1	0.0	0.0	0.0	0.0	0.5	8.0	13.2	9.0
0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.6	0.0	0.2	0.0	0.1	2.1	0.4	0.1	0.1
0.1	0.0	0.0	0.5	1.2	2.2	6.6	4.7	7.4	7.4	6.2	4.3	4.4	0.6	2.5	0.8
2.6	1.0	0.5	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.5	0.0	0.0	0.0
0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
0.4	0.4	0.4	1.8	0.6	3.0	0.8	2.9	0.9	0.0	0.2	0.1	0.1	0.0	0.1	0.1
0.3	0.3	0.3	0.3	0.5	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1

RUN 22

0.0	0.1	0.8	2.1	4.1	7.8	9.0	15.8	0.0	0.0	0.0	0.0	0.6	8.3	13.5	9.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.4	0.0	0.0
0.0	0.0	0.0	0.5	0.9	2.3	6.9	4.9	7.9	7.9	6.2	4.3	4.5	0.6	2.5	0.9
2.6	1.1	0.7	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	1.5	0.3	3.0	0.9	3.0	0.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 23

0.0	0.0	0.8	1.6	4.1	8.0	8.9	16.0	0.0	0.0	0.0	0.0	0.9	8.7	14.4	9.6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0
0.1	0.2	0.0	0.2	0.9	1.9	6.7	4.8	8.0	8.1	6.4	4.4	4.6	0.5	2.4	0.4
2.7	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.3	0.2	1.5	0.0	3.0	1.0	2.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 24

0.0	0.0	0.8	1.7	4.2	8.0	9.0	15.6	0.0	0.0	0.0	0.0	1.0	8.8	13.9	9.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0
0.2	0.6	0.0	0.1	0.9	1.9	6.9	4.9	8.0	7.9	6.4	4.3	4.3	0.6	2.4	0.3
2.4	0.8	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.4	0.3	1.6	0.2	3.0	1.1	2.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 25

0.1	0.1	0.4	2.2	3.7	5.6	9.8	38.4	0.4	0.4	0.2	0.4	0.2	0.0	3.6	20.0
0.3	0.1	0.1	0.5	0.1	0.4	0.5	0.4	0.3	0.1	0.2	0.2	1.4	0.4	0.3	0.0
0.3	0.5	0.2	0.5	0.2	1.7	0.7	0.7	3.4	1.1	1.1	0.5	1.0	0.5	0.6	0.7
0.5	0.4	0.7	0.8	0.6	1.4	0.4	0.2	0.3	0.2	0.9	0.1	0.1	0.0	0.4	0.2
0.4	0.2	0.3	0.1	0.3	0.1	0.4	0.4	0.3	0.1	0.3	0.5	0.3	0.0	0.1	0.1
0.1	0.1	0.2	0.2	0.0	0.6	0.0	0.0	0.5	0.1	1.1	1.1	0.3	0.0	0.0	0.4
0.6	0.6	0.6	0.5	0.4	0.5	0.2	0.8	0.4	0.0	0.1	0.4	0.5	0.2	0.3	0.6
0.0	0.1	0.3	0.4	0.3	0.2	0.1	0.1	0.3	0.0	0.1	0.0	0.1	0.2	0.4	0.3

RUN 26

0.1	0.5	0.0	4.1	6.4	9.9	13.1	17.3	0.1	0.6	0.0	0.4	0.9	10.9	21.5	10.5
0.0	0.1	0.1	0.0	0.0	0.1	0.6	0.2	0.0	0.1	0.4	0.4	4.9	0.7	0.3	1.3
0.5	0.0	0.2	1.5	1.3	3.2	5.9	4.0	8.2	6.5	6.2	9.3	4.4	0.7	1.2	0.0
0.1	0.3	0.8	1.1	1.1	2.6	0.7	0.0	0.2	0.0	2.6	0.1	0.1	0.0	0.0	0.0
0.7	0.2	0.4	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.5	1.4	1.6	0.0	0.1	0.1
0.0	0.0	0.2	0.1	0.0	1.0	0.0	0.0	0.5	0.0	1.6	1.3	0.0	0.0	0.0	0.6
0.2	0.4	0.2	3.3	0.5	2.3	0.0	2.0	0.9	0.0	0.0	0.3	0.2	0.2	0.3	0.6
0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1

RUN 27

0.0	0.1	0.0	2.0	3.8	6.1	8.0	10.5	0.0	0.0	0.0	1.1	4.8	14.1	12.9	8.8
0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.0	2.3	3.4	0.0	0.6
0.2	0.0	0.1	2.6	1.9	2.1	4.2	2.7	6.0	5.9	6.2	7.0	6.6	4.0	6.3	1.9
0.9	0.3	0.0	0.5	0.6	1.7	0.4	0.0	0.0	0.0	1.4	0.0	0.1	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.5	1.0	0.0	0.1	0.0
0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.9	0.9	0.0	0.0	0.0	0.1
0.2	1.4	0.2	3.0	1.7	2.7	0.3	1.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 28

0.0	0.1	0.1	2.3	3.7	5.7	7.5	9.8	0.0	0.0	0.6	3.1	6.0	11.4	11.1	7.7
0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	2.4	5.6	0.0	0.8
0.3	0.0	0.2	2.5	2.1	2.5	5.1	3.5	6.1	6.6	6.3	6.9	7.3	3.7	5.5	2.2
1.7	0.6	0.1	0.7	0.8	2.1	0.4	0.0	0.0	0.0	1.6	0.0	0.1	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.6	1.1	0.0	0.1	0.0
0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.0	1.1	0.0	0.0	0.0	0.2
0.1	1.3	0.1	2.8	1.4	2.8	0.5	1.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 29

0.0	0.0	0.0	1.5	2.7	4.3	6.0	8.1	0.0	0.1	2.9	5.6	8.1	12.5	9.8	6.2
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	1.5	8.2	0.0	0.5
0.2	0.0	0.1	1.4	1.5	1.8	3.9	2.8	5.1	6.0	5.8	6.7	7.9	5.1	6.1	4.0
3.2	1.8	2.0	1.1	1.4	1.5	0.2	0.6	0.2	0.1	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
0.7	2.1	0.7	3.0	1.5	2.8	0.7	1.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.3	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 30

0.0	0.0	0.0	1.4	2.4	3.9	5.3	7.5	0.0	0.5	3.3	5.7	8.2	11.3	8.8	6.0
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	1.6	8.4	0.0	0.5
0.2	0.0	0.1	1.0	1.5	1.7	3.8	2.8	4.9	5.8	5.4	6.5	7.1	4.4	6.2	3.6
3.5	2.1	2.7	1.5	1.9	1.7	0.2	0.7	0.3	0.1	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.7	0.0	0.1	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
0.7	1.9	0.7	2.9	1.4	2.7	0.9	1.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 31

0.0	0.0	0.0	1.3	2.4	3.9	5.1	7.4	0.0	0.7	3.3	5.8	8.2	10.9	8.8	5.9
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	1.7	8.7	0.0	0.5
0.2	0.0	0.1	0.9	1.4	1.7	4.0	3.1	4.8	5.7	5.5	6.4	6.8	4.1	6.1	3.9
3.7	2.3	3.1	1.7	2.0	1.8	0.0	0.7	0.3	0.2	1.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.7	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5
0.4	1.6	0.4	2.8	1.5	2.7	1.0	2.1	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.4	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 32

0.5	0.1	0.2	1.4	2.2	3.3	4.3	6.5	0.5	1.0	3.0	5.1	7.3	9.8	7.7	4.9
0.0	0.4	0.4	0.0	0.3	0.0	0.5	0.5	0.2	0.5	0.0	0.3	1.7	7.5	0.0	0.7
0.4	0.4	0.3	1.1	1.4	1.6	4.0	3.1	4.1	5.0	4.8	5.7	5.6	4.0	5.2	3.9
3.7	2.3	3.0	1.6	1.8	0.8	0.1	1.5	0.7	0.4	0.5	0.0	0.0	0.0	0.2	0.1
0.2	0.3	0.1	0.1	0.2	0.1	0.1	0.0	0.2	0.0	0.3	0.3	0.3	0.0	0.0	0.7
0.5	0.2	0.1	0.1	0.3	0.2	0.2	1.1	0.2	0.4	0.0	0.0	0.2	0.2	0.4	1.1
1.1	2.1	1.1	2.8	1.6	2.6	1.3	2.1	1.1	0.4	0.6	0.3	0.2	0.1	0.2	0.4
0.4	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.3	0.0	0.1	0.2	0.0	0.0	0.2	0.1

RUN 33

0.0	0.0	0.0	1.5	2.5	3.6	4.7	7.2	0.0	0.5	3.2	5.5	7.9	11.7	8.7	5.7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.9	8.2	0.0	0.0
0.7	2.1	0.1	0.9	1.4	1.5	4.2	3.3	4.5	5.5	5.3	6.0	6.3	4.0	5.8	4.3
3.7	2.9	4.8	2.2	1.7	0.0	0.0	1.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9	0.0	0.3	0.0	0.0	0.0	0.2	0.0	0.6
0.7	1.8	0.7	2.7	1.4	2.8	1.5	2.4	0.8	0.0	0.3	0.0	0.0	0.0	0.1	0.2
0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

RUN 34
 70 2

[illegible]

RUN 35
 2 2 2

[illegible]

RUN 36

[illegible]

RUN 37

[illegible]

RUN 38

[illegible]

RUN 39

0.0	0.0	0.0	1.6	2.4	3.5	4.6	7.0	0.0	0.6	3.3	5.9	7.8	10.9	8.8	5.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	8.5	0.0	0.3
0.1	0.0	0.0	1.0	1.3	1.6	4.6	3.5	4.6	5.6	5.5	6.1	6.5	3.9	5.7	4.0
3.7	1.2	0.0	0.5	1.6	1.2	0.0	0.5	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.0	0.0	0.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
0.5	1.7	0.5	2.8	1.7	2.9	1.4	2.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 40

0.0	0.0	0.0	1.5	2.3	3.5	4.5	6.9	0.0	0.8	3.5	6.2	7.9	10.6	8.6	5.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	8.8	0.0	0.0
0.0	0.0	0.0	0.9	1.2	1.6	4.4	3.4	4.4	5.3	5.3	6.3	6.2	4.0	5.6	4.3
3.8	1.3	0.0	1.0	2.2	1.3	0.2	0.7	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0	0.0	0.0	0.2
0.2	1.5	0.2	2.7	1.5	2.8	1.5	2.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 41

0.0	0.0	0.0	1.5	2.3	3.5	4.6	6.9	0.0	0.9	3.7	6.1	7.8	10.8	8.6	5.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	8.8	0.0	0.0
0.0	0.0	0.0	1.0	1.2	1.6	4.3	3.4	4.5	5.4	5.5	6.2	6.3	4.1	5.6	4.2
3.8	1.3	0.0	0.6	1.9	1.1	0.0	0.7	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
0.6	1.7	0.6	2.8	1.6	2.8	1.5	2.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 42

0.2	0.0	0.2	1.6	1.8	2.8	3.7	5.7	0.5	1.2	3.2	5.1	6.4	8.9	6.8	4.4
0.2	0.4	0.4	0.3	0.4	0.2	0.2	0.5	0.5	0.5	0.0	0.3	1.3	7.3	0.1	0.2
0.3	0.5	0.3	1.1	1.2	1.6	3.8	2.9	3.7	4.6	4.4	4.9	4.9	3.4	4.3	3.9
3.5	2.3	3.0	2.1	2.2	0.9	0.4	1.6	0.8	0.5	0.0	0.0	0.0	0.1	0.5	0.2
0.0	0.2	0.1	0.1	0.4	0.1	0.2	0.3	0.2	0.2	0.2	0.0	0.0	0.2	0.0	0.4
0.4	0.5	0.2	0.2	0.5	0.2	0.3	1.0	0.2	0.5	0.7	1.1	0.4	0.3	0.5	0.9
0.8	1.7	0.8	2.5	1.7	2.6	1.5	2.0	0.9	0.5	0.6	0.3	0.2	0.2	0.2	0.4
0.5	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.3	0.0	0.3	0.4	0.0	0.0	0.2	0.1

RUN 43

0.0	0.0	0.3	1.7	2.0	3.0	3.8	6.1	0.4	0.9	3.7	5.4	6.9	10.0	7.2	4.8
0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.2	1.5	8.2	0.0	0.0
0.9	2.8	0.0	1.0	1.0	1.3	3.6	2.9	4.0	4.9	4.6	5.2	5.4	3.5	4.8	4.4
3.7	3.2	5.6	2.4	1.8	0.0	0.0	1.3	0.5	0.3	0.0	0.0	0.0	0.2	0.4	0.2

0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.2	0.0	0.7
0.4	0.8	0.0	0.1	0.3	0.0	0.1	0.8	0.0	0.3	0.0	0.0	0.4	0.4	0.1	0.5
0.8	1.7	0.8	2.4	1.4	2.7	1.8	2.1	0.6	0.0	0.3	0.1	0.0	0.0	0.1	0.3
0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.3	0.3	0.0	0.0	0.0	0.0

RUN 44

0.0	0.0	0.9	1.5	2.1	3.1	4.2	6.6	0.1	0.9	4.2	5.8	7.6	11.2	8.0	4.9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	8.4	0.0	0.0
0.0	0.1	0.0	0.5	1.1	1.4	3.9	3.0	4.1	5.2	5.1	5.8	5.8	3.8	4.7	4.2
3.7	2.4	3.1	1.6	1.8	0.0	0.0	1.3	0.5	0.2	0.0	0.0	0.0	0.3	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.0
0.0	0.9	0.0	0.0	0.3	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.2	0.4	0.2	0.0
0.0	1.3	0.0	2.4	1.5	2.9	2.0	2.2	0.6	0.0	0.2	0.0	0.0	0.0	0.0	0.0
0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.6	0.1	0.6	0.3	0.2	0.0	0.0	0.0	0.0

RUN 45

0.1	0.0	1.1	1.8	2.0	3.0	4.0	6.2	0.4	1.2	4.0	5.5	6.8	10.2	7.3	4.8
0.2	0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.3	0.0	0.0	0.2	1.3	8.1	0.0	0.0
0.2	0.5	0.0	0.9	1.1	1.3	3.7	2.9	4.0	5.0	4.7	5.3	5.7	3.2	4.8	4.1
3.6	2.4	3.2	2.0	2.3	0.5	0.1	1.3	0.5	0.2	0.0	0.0	0.0	0.4	0.2	0.1
0.0	0.0	0.1	0.1	0.3	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.1
0.1	0.7	0.0	0.1	0.5	0.0	0.0	0.1	0.0	0.0	0.3	0.5	0.6	0.4	0.2	0.1
0.0	1.1	0.0	2.3	1.7	2.9	1.9	2.1	0.7	0.0	0.3	0.1	0.1	0.0	0.2	0.3
0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.7	0.3	0.6	0.5	0.2	0.0	0.0	0.0	0.0

RUN 46

0.0	0.3	0.7	2.0	2.1	3.3	4.3	6.5	0.1	1.3	4.1	5.9	7.3	10.2	7.7	5.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	8.6	0.0	0.0
0.1	0.1	0.0	0.8	1.2	1.8	3.9	3.1	4.1	5.0	5.1	5.6	5.9	4.1	5.3	3.8
3.3	2.3	3.2	1.9	2.2	0.8	0.0	1.1	0.5	0.2	0.1	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.2	0.4
0.5	1.7	0.5	2.6	1.7	2.8	1.7	2.2	0.8	0.0	0.1	0.0	0.0	0.0	0.2	0.3
0.5	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0

RUN 47

0.0	0.0	0.7	1.5	2.2	3.3	4.4	6.6	0.1	1.1	4.5	6.4	7.9	10.7	8.4	5.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	9.1	0.0	0.0
0.1	0.3	0.1	1.0	1.2	1.5	4.1	3.3	4.3	5.4	5.3	6.0	6.3	4.1	5.4	4.4
3.9	1.3	0.0	0.6	1.9	0.6	0.0	0.9	0.4	0.3	0.0	0.0	0.0	0.1	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2
0.3	1.6	0.3	2.6	1.6	3.0	1.9	2.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 48

0.0	0.0	0.7	1.5	2.2	3.4	4.3	6.9	0.1	1.1	4.4	6.1	7.8	10.7	8.3	5.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	8.7	0.0	0.0
0.2	0.6	0.1	1.0	1.2	1.4	4.1	3.1	4.4	5.3	5.4	5.8	6.0	4.1	5.3	3.9
3.5	1.2	0.0	0.7	2.1	0.2	0.0	0.9	0.4	0.2	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3
0.8	1.9	0.8	2.8	1.7	3.0	2.0	2.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 49

1.4	1.6	3.0	2.8	3.5	4.6	4.2	5.8	0.0	0.1	0.9	1.9	3.0	5.4	5.5	3.8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.8	0.0	1.9
2.8	4.3	2.8	3.0	2.5	2.9	4.7	3.4	4.0	3.4	2.8	2.6	2.9	1.2	2.3	1.3
1.6	8.0	22.2	8.2	1.1	0.7	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.2	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.4
0.1	0.3	0.2	0.0	0.0	0.0	0.4	0.1	0.3	0.0	0.8	1.3	0.3	0.3	0.2	0.1
0.0	0.4	0.0	1.1	0.6	1.8	1.4	2.1	1.9	0.9	1.9	1.9	2.3	0.9	0.2	0.4
0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0

RUN 50

2.6	3.1	3.9	3.6	4.1	4.8	3.9	5.2	0.0	0.0	0.6	1.4	2.3	4.3	4.4	3.2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.1	0.0
4.2	5.1	3.3	3.6	2.6	3.3	4.4	3.1	3.8	2.9	2.3	2.1	2.3	0.9	1.8	1.0
1.3	8.5	24.0	8.6	0.8	0.5	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.2	0.2	0.0	0.0	0.0	0.3	0.1	0.3	0.1	0.6	0.9	0.2	0.2	0.0	0.3
0.1	0.3	0.1	0.9	0.4	1.5	1.1	1.8	1.9	1.1	2.3	2.3	3.4	1.2	0.3	0.5
0.4	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0

RUN 51

2.1	1.2	0.9	3.2	13.3	4.7	15.4	17.0	0.0	1.1	0.4	0.0	0.5	0.2	1.3	1.9
0.0	0.1	0.7	0.4	1.4	0.7	0.4	0.0	0.1	0.0	0.0	0.4	9.5	0.1	0.0	0.8
1.2	1.2	1.5	5.6	0.7	8.7	18.3	6.7	7.6	2.0	0.3	2.0	0.4	0.0	0.4	0.0
0.3	0.0	0.4	0.4	0.0	0.2	1.3	0.4	0.7	1.0	0.0	0.0	0.7	0.7	2.0	0.9
1.0	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.7	0.2	0.2	0.4	0.0
0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.3	0.1	0.6	0.0	0.2	0.5	0.5	0.0
1.0	0.0	0.0	1.3	0.4	0.0	0.7	0.0	0.0	1.0	0.0	0.6	0.0	0.2	0.0	0.7
1.1	0.0	0.7	0.1	0.0	0.5	0.0	0.1	0.0	0.7	0.0	0.9	0.3	0.1	0.5	0.3

RUN 52

2.4	2.2	1.6	2.7	5.7	3.9	16.5	2.3	0.0	1.4	0.9	0.0	1.0	1.3	1.2	2.2
0.0	1.0	1.1	1.0	1.8	0.0	1.0	0.7	0.7	0.4	0.6	1.2	5.1	0.0	0.2	1.5
1.6	1.7	2.1	5.3	0.8	5.6	10.5	6.1	2.2	2.0	0.9	1.7	0.9	0.4	0.9	0.0
0.0	0.0	0.7	0.9	0.0	1.3	1.6	1.0	1.3	1.4	0.0	0.6	1.2	1.3	2.3	1.4
0.2	0.3	0.0	0.5	0.0	1.0	0.3	0.7	0.9	0.9	0.2	1.5	0.8	1.2	0.6	0.2
0.5	1.5	0.9	0.7	1.0	0.5	0.5	0.4	0.9	0.8	1.1	0.4	0.7	1.0	1.0	0.1
0.3	0.5	0.7	1.7	1.1	1.1	1.3	0.4	0.7	1.5	0.8	1.3	0.8	0.9	0.5	1.4
1.6	0.0	1.3	0.8	0.2	1.0	0.6	0.0	0.7	1.2	0.5	1.4	1.0	0.8	1.1	1.1

RUN 53

2.7	2.7	1.9	2.4	2.1	2.0	2.0	2.1	0.8	2.0	1.7	0.6	1.9	2.1	2.3	2.5
0.6	1.6	1.3	1.8	0.2	1.1	1.7	1.5	1.5	1.3	1.4	1.8	2.4	1.0	1.2	2.1
2.2	2.0	2.5	5.2	0.3	2.0	2.3	2.4	2.6	2.2	1.1	2.3	1.2	1.4	1.8	0.6
0.0	0.5	1.5	1.2	1.1	2.0	2.3	1.9	2.0	2.1	0.6	1.6	1.9	1.0	2.8	2.0
1.2	1.3	0.0	1.3	0.0	1.7	1.6	1.5	1.6	1.5	1.2	1.9	1.6	1.2	0.9	0.7
1.4	2.0	1.7	1.5	2.0	1.0	1.4	1.2	1.9	1.6	1.9	1.5	1.6	1.2	1.7	1.2
1.3	1.4	1.5	2.3	1.8	1.9	2.0	1.0	1.7	2.1	1.6	1.8	1.5	1.6	1.3	2.0
2.4	1.0	1.9	1.5	1.0	1.7	1.4	1.5	1.5	2.1	1.4	2.1	1.7	1.5	1.8	1.7

RUN 54

0.0	0.1	0.0	0.5	1.0	2.0	4.0	4.7	7.1	7.4	9.6	7.3	5.3	5.1	2.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	7.0	0.0	0.0
0.1	0.0	0.2	0.8	0.3	1.3	2.4	2.8	4.0	5.2	6.6	4.1	5.4	4.6	5.5	0.0
5.4	2.8	1.3	1.9	1.9	1.0	1.3	0.7	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.6	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.5	0.1	0.2	0.1	0.3	0.5	0.0	0.0
0.3	2.3	0.9	1.9	1.5	2.3	1.9	0.0	0.3	0.2	0.4	0.2	0.2	1.7	21.1	0.0
0.5	0.1	0.2	0.0	0.0	0.2	0.1	0.0	0.2	0.2	0.2	0.1	0.0	0.7	0.1	0.0

RUN 55

0.0	1.3	1.7	1.2	0.9	1.0	0.0	2.6	3.7	3.1	13.5	6.3	2.6	2.6	0.3	0.0
0.0	0.0	1.5	0.0	0.5	4.0	0.1	0.7	0.0	0.0	0.2	0.1	0.6	6.2	0.0	0.0
0.0	0.0	1.6	5.0	1.6	1.5	5.3	0.0	0.0	15.5	6.8	2.5	3.9	1.7	4.1	3.0
4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.6	3.5	1.4	0.1	2.0	4.0	0.0
0.7	4.1	0.0	0.0	4.2	5.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
0.0	0.0	1.5	0.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	1.3	0.0
0.3	0.0	0.0	0.0	1.7	0.0	0.0	0.2	4.0	0.0	0.0	1.7	0.9	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RUN 56

3.0	1.3	1.4	1.5	1.4	2.4	.	3.4	2.2	4.1	12.4	5.2	3.1	2.4	1.3	0.
2.3	.	1.4	.	2.3	4.1	2.	2.2	1.3	1.3	2.2	0.1	1.1	9.2	0.5	0.
1.3	1.1	1.5	3.3	1.2	2.3	5.2	1.0	2.2	15.1	2.3	4.1	4.6	1.2	5.2	2.
1.	1.3	2.2	2.2	1.3	2.2	2.2	7.4	2.2	1.4	3.2	1.3	0.2	2.2	4.1	1.
1.5	3.3	.	.	4.1	4.2	1.	2.2	2.2	2.2	0.1	2.1	4.3	0.2	3.2	0.
2.2	1.1	1.5	2.2	2.4	2.2	2.5	1.2	2.2	2.2	2.1	2.7	2.9	2.2	1.5	1.
2.1	1.2	.	.	2.1	.	1.	5.3	4.2	1.2	1.5	1.5	2.2	2.2	2.2	1.
2.1	1.7	3.3	1.5	1.1	2.2	2.2	2.5	1.5	2.2	2.2	2.2	2.2	0.2	0.2	0.

RUN 57

3.0	1.5	2.0	1.7	1.9	3.3	1.9	4.1	21.2	7.0	27.4	5.1	0.0	0.0	0.0	0.0
3.2	0.0	1.7	1.0	5.0	5.5	2.5	3.2	0.0	0.0	0.3	0.3	1.0	5.0	0.0	0.0
1.0	2.2	1.0	5.2	1.6	1.0	7.5	1.0	0.0	11.3	0.0	3.0	3.2	0.0	4.2	2.4
3.1	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	1.7	4.3	1.5	0.2	2.1	4.4	0.6
0.7	4.5	0.0	0.0	4.8	5.5	0.0	0.0	0.0	0.0	0.0	0.3	5.8	0.0	0.0	0.0
0.0	0.0	0.0	0.1	0.4	0.0	0.7	0.0	0.0	0.0	0.0	0.0	3.5	1.2	0.0	1.3
2.3	0.0	0.0	0.0	1.1	0.0	0.0	0.3	4.2	0.0	0.0	2.0	0.0	0.0	0.0	0.0
0.0	2.1	3.2	0.6	0.0	0.0	0.0	0.9	0.7	0.0	0.0	0.0	0.0	0.0	0.2	0.0

RUN 58

0.0	1.9	2.	1.4	0.6	2.0	0.0	4.8	20.0	12.7	27.4	2.3	0.0	0.0	0.0	0.
3.6	0.0	1.9	.0	5.7	6.	2.8	3.6	0.0	0.0	0.4	0.4	1.0	4.9	0.0	0.
0.0	2.2	2.1	7.2	1.6	0.2	5.9	0.0	0.0	11.2	12.7	4.2	3.4	0.0	3.9	0.
2.7	0.0	.0	0.7	0.0	.0	.0	8.7	0.0	1.2	5.3	1.7	0.4	2.0	3.4	0.
0.9	5.0	0.1	0.0	5.1	6.1	0.1	0.0	0.0	0.0	0.0	0.4	7.2	0.0	0.0	0.
0.0	0.0	0.7	0.1	0.1	0.0	0.9	0.0	0.0	0.0	0.0	3.9	1.3	0.0	1.7	5.
2.5	0.0	1.	.0	1.1	.0	0.0	9.3	4.6	0.0	0.8	2.1	0.0	0.0	0.0	0.
0.0	2.2	4.3	0.7	0.0	0.0	0.0	3.3	0.8	0.0	0.0	0.0	0.0	0.0	0.5	0.

RUN 59

0.0	1.8	2.2	1.5	2.7	5.2	2.0	7.6	3.2	2.4	2.5	1.2	0.0	0.0	0.5	0.0
3.5	0.0	2.0	1.0	5.4	5.9	2.0	3.4	1.0	0.0	0.4	0.5	1.8	0.5	0.0	0.0
0.0	2.3	2.0	7.3	1.7	1.9	0.0	0.0	0.0	10.7	12.6	0.0	3.6	0.0	2.3	1.0
1.2	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	1.0	4.0	1.0	0.3	1.9	4.1	0.0
0.7	5.0	0.0	0.0	5.2	6.1	0.0	0.0	0.0	0.0	0.0	0.5	6.8	0.0	0.0	0.0
0.0	0.0	0.0	0.2	0.2	0.0	0.9	0.0	0.0	0.0	0.0	3.7	1.2	0.0	1.4	4.0
2.4	0.0	0.0	1.0	1.2	0.0	0.0	12.5	4.4	0.0	0.8	1.9	0.0	0.0	0.0	0.0
0.0	2.1	4.1	0.6	0.0	0.0	0.0	2.7	0.6	0.0	0.0	0.0	0.0	0.0	0.3	0.0

RUN 60

[illegible]

RUN 61

0.2	0.2	0.4	0.3	4.7	6.7	38.3	40.0	2.5	1.2	0.2	0.2	0.6	0.5	0.3	0.
0.3	0.1	0.3	0.3	0.2	0.3	0.2	0.2	0.0	0.3	0.2	0.2	1.4	3.5	0.2	0.
0.1	0.2	0.3	0.7	0.5	4.9	3.3	4.7	24.7	5.3	11.0	1.2	2.9	1.0	1.0	0.
0.4	0.4	0.5	0.2	0.5	0.3	0.4	0.3	0.2	0.3	0.4	0.2	0.1	0.2	0.0	0.
0.1	0.7	1.3	0.1	0.8	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.1	0.2	5.3	0.
0.1	0.1	0.0	0.0	0.3	0.3	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.
0.3	0.5	0.1	0.2	0.3	1.1	0.5	19.4	0.7	0.3	0.3	0.0	0.0	0.0	0.0	0.
0.3	0.3	0.3	0.2	0.1	0.0	0.2	0.3	0.2	0.2	0.1	0.1	0.0	0.0	0.1	0.

RUN 62

0.	0.	0.1	2.1	0.8	7.6	31.8	17.1	0.7	0.4	0.2	0.2	0.1	0.0	0.0	0.
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	1.3	0.0	0.
0.0	0.0	0.1	0.2	0.0	12.0	37.6	7.9	21.6	2.2	4.0	2.3	1.1	0.4	0.3	0.
0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
0.0	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
0.0	0.2	0.0	0.0	0.0	0.8	0.3	24.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.
0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.

RUN 63

0.0	0.0	0.1	4.2	19.0	10.6	28.1	16.6	1.2	0.2	0.1	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.2	0.1	0.0	0
0.0	0.0	0.1	0.1	1.5	7.9	47.6	6.9	24.3	2.1	4.9	2.6	0.8	0.0	0.2	0
0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.9	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

RUN 64

0.0	0.1	0.	0.8	3.2	3.9	5.4	5.8	20.8	13.7	20.3	6.4	0.4	0.1	0.0	0.
0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	5.4	0.0	0.
0.1	0.	0.2	0.4	0.5	1.6	4.2	2.9	3.4	2.0	7.2	3.4	3.7	2.0	4.0	0.
2.4	0.5	1.1	0.2	0.6	0.3	0.2	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.6	0.
0.0	0.3	1.2	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.
0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.1	0.5	4.
0.1	1.0	0.	0.3	0.0	1.3	0.1	0.2	0.3	0.1	0.3	0.3	0.1	1.3	12.0	0.
0.0	0.1	0.	0.2	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.0	1.6	0.5	0.3	0.

APPENDIX C
DATA REDUCTION PROGRAM FOR 217 PIN
MIXING EXPERIMENT

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100 C THIS PROGRAM CONVERTS THE DATA ON THE FLOPPY DISK FROM
20 C RESISTANCES TO SALT CONCENTRATION TO DIMENSIONLESS RATIOS AND
30 C COMPUTES MASSBALANCE. IN ADDITION IT ALLOWS A VARIETY OF
40 C PRINT OUT ROUTINES, INCLUDING PUNCHED CARDS.
50 C
60 C NOTE THAT PUNCHED CARDS REQUIRES THE USER TO RJPUNCH AT END.
70 C ALSO NOTE THAT PRINTER UNIT CHANGED TO UNIT 1, AND THAT THE FILE
80 C BE PRINTED WITH THE PRINT COMMAND AFTER THE PUN.
90 C NOTE THAT LU'S HAVE BEEN MESSED WITH FOR JCF-VAX COMPATIBILITY.
100 C
110 C MODIFICATIONS MADE SEPT-OCT, 1979, BY NEAL LIPPMAN, MIT-JCF
120 C
130 C MAKE EVERYTHING INTEGER*2
140 C     IMPLICIT INTEGER*2 (I-N)
150 C     INTEGER*2 F(128)
160 C AVGGPM IS THE AVERAGE FLOW THROUGH THE SUBCHANNELS:
170 C     REAL AVGGPM
180 C VAVG IS THE AVERAGE VELOCITY THROUGH THE SUBCHANNELS:
190 C     REAL VAVG
200 C NETSLT IS THE AMOUNT OF SALT INJECTED INTO THE BUNDLE.
210 C OUTSLT IS THE AMOUNT OF SALT DETECTED:
220 C     REAL NETSLT, OUTSLT
230 C ISALTF IS THE INJECTED SALT FLOW, ISALTC IS THE INJECTED
240 C SALT CONCENTRATION:
250 C     REAL ISALTF, ISALTC
260 C     REAL T(546)
265 C     REAL DRV(128)
270 C ARRAY M(512) IS A BUFFER FOR THE DATA:
280 C     REAL M(546)
290 C EQUAL IS A FUNCTION THAT RETURNS A LOGIC VALUE:
300 C     LOGICAL EQUAL
310 C SUM IS A GENERAL PURPOSE VARIABLE:
320 C     REAL SUM
330 C NAME AND MXNAME ARE ASCII CHARACTER DATA:
340 C     INTEGER*2 NAME(5), MXNAME(5)
350 C APRAY FLOW CONTAINS FLOWSPLIT FOR INTERIOR, EDGE AND CORNER
360 C CHANNELS, PLUS REYNOLDS NUMBERS, RESPECTIVELY. AREA CONTAINS
370 C THE AREAS OF THE BUNDLE SUBCHANNEL:
380 C     REAL FLOW(4,20), AREA(3), TOTALF
390 C FLONM CONTAINS THE NUMBER OF DIFFERENT REYNOLDS
400 C     INTEGER*2, IFLOM
410 C NUMBERS FOR WHICH FLOWSPLIT HAS BEEN INPUT:
420 C RATIO IS A DATA BUFFER:
430 C     REAL RATIO(512)
440 C CALNUM IS THE NUMBER OF CALIBRATION BLOCKS IN A PARTICULAR
450 C SERIES, HDRNUM IS THE NUMBER OF HEADER BLOCKS ON THE FLOPPY,
460 C PRONUM IS THE NUMBER OF PROBES SAMPLED, ARRAY SALT CONTAINS CONC.
470 C VALUES FOR THE CALIBRATION SERIES, RECORD IS THE NUMBER OF
480 C RECORDS STORED IN A PARTICULAR DATA SET.:
490 C     INTEGER*2 CALNUM, HDRNUM, Q, PRONUM, SALT(11), RECORD
500 C THE FOLLOWING ARE DATA BLOCK BUFFERS:
510 C     INTEGER*2 MXDATA(512), PROSEQ(512), CALCOR(512), CALIB(11,512)
520 C THE FOLLOWING ARE POINTERS:
530 C     INTEGER*2 SETPOS, CALPOS, DTAPOS, CORPOS
540 C ARRAY IBUFA IS A HEADER BLOCK BUFFER:
550 C     INTEGER*2 IBUFA(24)
56 C
57 C ARG IS A GENERAL PURPOSE VARIABLE:
58 C     REAL ARG
59 C GENERAL PURPOSE REAL VARIABLES:
60 C     REAL AREAL, PREAL, CREAL, DREAL

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6100 C MASBAL IS THE MASS-BALANCE:
6200 REAL MASBAL
6300 C //////////////////////////////////////////
6400 C DEFINE FILES CHANGED TO OPEN
6500 OPEN(UNIT=1,NAME='GLASTXT',TYPE='OLD',ACCESS='DIRECT',
6600 * FORM='UNFORMATTED',ASSOCIATEVARIABLE=ITEXT,RECORDSIZE=64)
6700 OPEN(UNIT=2,NAME='GLASHDR',TYPE='OLD',ACCESS='DIRECT',
6800 * FORM='UNFORMATTED',ASSOCIATEVARIABLE=IHRD,RECORDSIZE=12)
6900 OPEN(UNIT=3,NAME='GLASDAT',TYPE='OLD',ACCESS='DIRECT',
7000 * FORM='UNFORMATTED',ASSOCIATEVARIABLE=IDAT,RECORDSIZE=64)
7100 C DEFINE FILE 1 (2,64,U,ITEXT)
7200 C DEFINE FILE 2 (800,12,U,IHRD)
7300 C DEFINE FILE 3 (1000,64,U,IDAT)
7400 C //////////////////////////////////////////
7500 LU=9 !TO BE WRITTEN TO FOR RJPUNCH FILE
7600 ICHAN=0
7700 C IONE IS 0 WHEN EXAMINING ALL MIX BLOCKS AT ONCE,ELSE 1
7800 IONE=0
7900 IFLOMM=0
8000 IBEGIN=0
8100 C THE FOLLOWING CODE MAKES THE PROBE NUMBERS AND THE SUBCHANNEL
8200 C NUMBERS CORRESPOND.
8300 C INPUT THE CHANNEL NUMBERS:
8400 C FOR EDGE CHANNELS:
8500 DO 7 I=1,12
8600 7 F(I)=I+420
8700 DO 13 I=13,28
8800 13 F(I)=I+372
8900 C FOR CORNER CHANNELS:
9000 F(29)=438
9100 F(30)=433
9200 F(31)=434
9300 C FOR CENTRAL CHANNELS:
9400 DO 8 I=32,53
9500 8 F(I)=I+331
9600 DO 9 I=54,77
9700 9 F(I)=I+241
9800 DO 14 I=78,91
9900 14 F(I)=308-I
10000 DO 11 I=92,109
10100 11 F(I)=386-I
10200 DO 12 I=110,123
10300 12 F(I)=I+93
10400 F(124)=151
10500 F(125)=141
10600 F(126)=142
10700 F(127)=143
10800 F(128)=144
10900 READ(2,1)IBUFA
11000 C HDRNUM CONTAINS THE NUMBER OF HEADER BLOCKS ON THE FLOPPY:
11100 HDRNUM=IBUFA(1)-1
11200 C IPUNCH DICTATES WHETHER OR NOT CARDS ARE TO BE PUNCHED:
11300 IPUNCH=0
11400 C IXI IS THE PRINTER DEVICE:
11500 IXI=99
11600 C OPEN OUTPUT FILE FOR PRINTER:
11700 OPEN(UNIT=99,NAME='SALTDAT.PAT',TYPE='NEW')
11800 C ICI IS THE INTERACTIVE DEVICE:
11900 ICI=6
12000 C IRI IS INTERACTIVE READ
12100 IRI=5

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12200 4-7 FORMAT(* NO SUCH BLOCK EXISTS.*)
12300 4-7 FORMAT(5A2)
12400 3 11 FORMAT(12)
12500 3 10 FORMAT(* *)
12600 2 11 FORMAT(* BUNDLE P.E. :*,I5)
12700 2 13 FORMAT(* INJ. SUBCHANNEL :*,I5)
12800 2 14 FORMAT(* AXIAL LEVEL (IN.) :*,F6.2)
12900 0
13000 C THIS CODE INPUTS FLOW SPLIT DATA:
13100 WRITE(ICI,490)
13200 490 FORMAT(* ENTER SUBCHANNEL AREAS,(IN SQUARE INCHES),*/
13300 1 * FOR INTERIOR,EDGE,AND CORNER SUBCHANNELS:*,S)
13400 READ(IRI,491) AREA(1),AREA(2),AREA(3)
13500 491 FORMAT(3F7.4)
13600 WRITE(ICI,493)
13700 493 FORMAT(* INPUT NUMBER OF REYNOLDS NUMBERS:*,S)
13800 READ(IRI,494) IFLOM
13900 494 FORMAT(I5)
14000 DO 499 N=1,IFLOM
14100 WRITE(ICI,495)
14200 495 FORMAT(* ENTER R.E.,AND VELOCITY/VELOCITY AVERAGE *,/
14300 1 * FOR INTERIOR,EDGE,AND CORNER CHANNELS:*,S)
14400 READ(IRI,496) FLOW(4,N),FLOW(1,N),FLOW(2,N),FLOW(3,N)
14500 496 FORMAT(4F10.4)
14600 499 CONTINUE
14700 C END OF CODE FOR INPUTING FLOWSPLIT DATA.
14800 C
14900 IY=2
15000 WRITE(ICI,100)
15100 100 FORMAT(* DO YOU WANT ALL MIXING DATA CONVERTED AT ONCE? *,S)
15200 READ(IRI,3011) IANS
15300 IF(EQUAL(IANS,0,%REF(*Y*),0,1)) GO TO 180
15400 IF(EQUAL(IANS,0,%REF(*Q*),0,1)) GO TO 9000
15500 IONE=1
15600 106 WRITE(ICI,102)
15700 102 FORMAT(* INPUT TITLE OF DESIRED BLOCK:*,S)
15800 READ(IRI,480) NAME
15900 IF(EQUAL(NAME,0,%REF(*Q*),0,1)) GO TO 9000
16000 DO 103 I=2,HDPNUM
16100 READ(2*I)IBUFA
16200 IF(EQUAL(IBUFA,0,NAME,0,10)) GO TO 104
16300 103 CONTINUE
16400 WRITE(ICI,487)
16500
16600 GO TO 106
16700 104 GO TO 700
16800 180 WRITE(ICI,115)
16900 115 FORMAT(* DO YOU WANT CARDS PUNCHED ALSO?*,S)
17000 READ(IRI,3011) IANS
17100 IF(EQUAL(IANS,0,%REF(*N*),0,1)) IPUNCH=1
17200 C THE TECHNIQUE USED FOR PJPUN IS JUST TO HAVE A FILE OPENED CALLED
17300 C SALTRJUN.DAT AND WRITE TO IT. THEN THE USER MUST RJPLNCH IT HIMSELF.
17400 C FILE OPEN CAN BE DONE JUST BEFORE WRITE.
17500 C IF(EQUAL(IANS,0,%REF(*Y*),0,1)) CALL RJPUN(LU,*STANDARD*)
17600 WRITE(ICI,9090)
17700 9090 FORMAT(* ENTER NUMBER OF FIRST BLOCK TO BE ANALYZED:*,S)
17800 READ(IRI,494) ISTART
17900 4494 FORMAT(5A2)
18000 ICONCE=1
18100 IDIMEN=1
18200 WRITE(ICI,4321)

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18300  +321  FORMAT(' DO YOU WANT CONCENTRATIONS AND OR DIMENSIONLESS',
18400  1 /, ' RATIOS?(C/D/B/N):',3)
18500  READ(IPI,3011) IANS
18600  IF(EQUAL(IANS,0,%REF('C'),0,1)) IDIMEN=1
18700  IF(EQUAL(IANS,0,%REF('D'),0,1)) ICONCE=1
18800  IF(EQUAL(IANS,0,%REF('B'),0,1)) IDIMEN=1
18900  IF(EQUAL(IANS,0,%REF('N'),0,1)) ICONCE=1
19000  2 0  READ(2*IY)(IBUFA(N),N=1,24)
19100  IF(IBUFA(9).EQ.3) IBEGIN=IBEGIN+1
19200  IF(IBEGIN.LT.ISTART) GO TO 950
19300  IF(IBUFA(9).EQ.3) GO TO 700
19400  IF(IY.GE.HDRNUM) GO TO 9100
19500  GO TO 950
19600  7 0  WRITE(ICI,3000)
19700  C
19800  C
19900  C ASSUME THAT BY NOW THE APPROPRIATE MIXING HEADER BLOCK
20000  C HAS BEEN STORED IN ARRAY IBUFA(24),-WE FIRST HAVE TO STORE
20100  C DATA OF INTEREST FROM THIS BLOCK:
20200  C THE NEXT TWO LINES STORE THE TITLE:
20300  DO 3014 N=1,5
20400  3014  MXNAME(N)=IBUFA(N)
20500  C INJECTED SALT CONCENTRATION (1000 GRMS.SALT/LB.WATER):
20600  ISALTC=IBUFA(20)
20700  C SALT FLOW (GPM*100000):
20800  ISALTF=IBUFA(21)
20900  C BUNDLE FLOW IN G.P.M.:
21000  IGPM=IBUFA(17)
21100  C DTAPOS CONTAINS THE POSITION OF THE FIRST RECORD OF DATA:
21200  DTAPOS=IBUFA(6)
21300  C RECORD CONTAINS THE NUMBER OF RECORDS INVOLVED:
21400  RECORD=IBUFA(7)
21500  C SETPOS IS A PTR TO THE SETUP BLOCK:
21600  SETPOS=IBUFA(10)
21700  C CALPOS IS THE PTR TO THE CALIBRATION SERIES:
21800  CALPOS=IBUFA(11)
21900  C CORPOS IS THE PTR TO THE CALIBRATION CORRECTION BLOCK:
22000  CORPOS=IBUFA(24)
22100  C THE AXIAL POSITION OF INJECTED SALT:
22200  IAXIAL=IBUFA(23)
22300  C REYNOLDS NUMBER OF THE BUNDLE:
22400  IREYNO=IBUFA(19)
22500  C INJECTION SUBCHANNEL:
22600  ISUBCH=IBUFA(22)
22700  C
22800  C ALL DATA FROM HEADER BLOCK HAS BEEN STORED.
22900  C NOW WE HAVE TO ACCESS THE MIXING DATA BLOCK:
23000  IX=1
23100  3015  IH=IX+127
23200  READ(3*DTAPOS)(MXDATA(N),N=IX,IH)
23300  RECORD=RECORD-1
23400  DTAPOS=DTAPOS+1
23500  IF(RECORD.EQ.0) GO TO 3013
23600  IX=IX+128
23700  GO TO 3015
23800  C NOW WE HAVE THE MIXING DATA READ INTO MXDATA(512).
23900  C
24000  C NO SETUP BLOCK ON THE FLOPPY
24100  C GET BLOCK SEARCH ROUTINE DELETED
24200  C INPUT THE PROBE SAMPLING SEQUENCE
24300  C AND NUMBER OF PROBES IN NEXT THREE LINES

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24430 3 13 CONTINUE
24910 PROMUM=128
24915 DO 3017 I=1,PROMUM
25920 3 17 PROSEQ(I)=I
27000 C
27100 C NOW WE HAVE TO SET UP THE CALIBRATION BLOCKS:
27200 3200 IF(CALPOS.EQ.IOLDCL) GO TO 3300
27300 IOLDCL=CALPOS
27400 C CHECKING TO SEE IF POINTER MAKES SENSE:
27500 IF((CALPOS.LE.0).OR.(CALPOS.GT.HDRNUM)) GO TO 950
27600 C IF IT DOES,EXECUTE CHARACTER SEARCH ROUTINE:
27700 IANUM=256*(CALPOS/10 +48)+MOD(CALPOS,10)+48
27800 CALL MOVE(*CAL*,0,NAME,1,3)
27900 CALL MOVE(IANUM,1,NAME,3,2)
28000 DO 1 I=2,HDRNUM
28100 READ(2*I)IBUFA
28200 IF(EQUAL(IBUFA,0,NAME,0,5)) GO TO 33
28300 1 CONTINUE
28400 TYPE *,* THIS CALIBRATION SET COULD NOT BE FOUND.*
28500 GO TO 950
28600 33 CALPOS=I
28700 CALNUM=0
28800 J=1
28900 3210 IZ=CALPOS+J-1
29000 READ(2*IZ)IBUFA
29100 IF(J.EQ.7)GO TO 3300
29200 C WE IGNORE ALL BLOCKS WITH SALT>=10000.
29300 IF(IBUFA(17).GE.10000) GO TO 3400
29400 IF(CALNUM.LE.0) GO TO 3240
29500 C IF TWO CALIBRATION BLOCKS WERE TAKEN AT THE SAME CONCENTRATION,
29600 C WE REPLACE THE OLD ONE WITH THE NEW ONE:
29700 DO 3212 N=1,CALNUM
29800 IF(SALT(N).EQ.IBUFA(17)) GO TO 3230
29900 3212 CONTINUE
30000 GO TO 3240
30100 3230 IX=1
30200 DTAPOS=IBUFA(6)
30300 RECCPD=IBUFA(7)
30400 3231 IH=IX+127
30500 READ(3*DTAPOS)(CALIB(N,IZ),IZ=IX,IH)
30600 DTAPOS=DTAPOS+1
30700 RECCPD=RECCPD-1
30800 IF(RECCPD.LE.0) GO TO 3400
30900 IX=IX+128
31000 GO TO 3231
31100 3240 SALT(J)=IBUFA(17)
31200 CALNUM=CALNUM+1
31300 DTAPOS=IBUFA(6)
31400 RECCPD=IBUFA(7)
31500 IX=1
31600 3250 IH=IX+127
31700 READ(3*DTAPOS)(CALIB(J,N),N=IX,IH)
31800 DTAPOS=DTAPOS+1
31900 RECCPD=RECCPD-1
32000 -IF(RECCPD.LE.0) GO TO 34
32100 IX=IX+128
32200 GO TO 3250
32300 3400 J=J+1
32400 GO TO 3210
32500 C END OF ROUTINE FOR READING IN CALIBRATION SETS.
32600 C

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32611 330 CONTINUE
32612 OPEN(UNIT=11,NAME='CAL1.DAT',TYPE='OLD')
32613 OPEN(UNIT=12,NAME='CAL2.DAT',TYPE='OLD')
32614 OPEN(UNIT=13,NAME='CAL3.DAT',TYPE='OLD')
32615 OPEN(UNIT=14,NAME='CAL4.DAT',TYPE='OLD')
32616 OPEN(UNIT=15,NAME='CAL5.DAT',TYPE='OLD')
32617 READ(11,277)(CALIB(1,J),J=1,128)
32618 READ(12,277)(CALIB(2,J),J=1,128)
32619 READ(13,277)(CALIB(3,J),J=1,128)
32620 READ(14,277)(CALIB(4,J),J=1,128)
32621 READ(15,277)(CALIB(5,J),J=1,128)
32622 277 FORMAT(815)
32623 CLOSE(UNIT=11)
32624 CLOSE(UNIT=12)
32625 CLOSE(UNIT=13)
32626 CLOSE(UNIT=14)
32627 CLOSE(UNIT=15)
32628 SALT(1)=0
32629 SALT(2)=40
32630 SALT(3)=80
32631 SALT(4)=120
32632 SALT(5)=200
32700 C NOW WE HAVE TO SET UP THE CALIBRATION CORRECTION BLOCK:
32800 IF(CORPOS.LE.0) GO TO 3305
32900 IANUM=256*(CORPOS/10 +48)+MOD(CORPOS,10)+48
33000 CALL MOVE('CAL',C.NAME,0,3)
33100 CALL MOVE(IANUM,C.NAME,3,2)
33200 DO 3301 I=2,HDRNUM
33300 READ(2*I)IBUFA
33400 IF(EQUAL(IBUFA,0,NAME,0,5)) GO TO 3302
33500 3301 CONTINUE
33525 TYPE *,'CALCOR BLOCK NOT FOUND-USE DEFAULT CALCOR'
33550 GO TO 3304
33600 3302 IX=1
33700 DTAPOS=IBUFA(6)
33800 RECORD=IBUFA(7)
33900 3303 IH=IX+127
34000 READ(3*DTAPOS)(CALCOR(N),N=IX,IH)
34100 RECORD=RECORD-1
34200 DTAPOS=DTAPOS+1
34300 IF(RECORD.LE.0) GO TO 3304
34400 IX=IX+128
34500 GO TO 3303
34600 C WE MUST SEARCH FOR THE CALIBRATION BLOCK TAKEN AT ZERO SALT
34700 C CONCENTRATION,AS THE CALIBRATION CORRECTION BLOCK WAS TAKEN
34800 C UNDER THE SAME CONDITIONS:
34900 3304 DO 1234 IZERO=1,CALNUM
35000 IF(SALT(IZERO).EQ.0) Q=IZERO
35100 1234 CONTINUE
35200 DO 3309 N=1,PRONUM
35300 C NOW WE SHIFT THE MIXING DATA TO CORRECT FOR THE EFFECTS OF
35400 C TEMPERATURE AND PROBE OXIDATION:
35500 MXDATA(N)=MXDATA(N)+CALIB(Q,N)-CALCOR(N)
35600 3309 CONTINUE
35700 C END OF CALIBRATION CORRECTION PROCEDURE.
35800 C
35900 C THIS PART OF THE PROGRAM CONVERTS THE RAW RESISTANCE VALUES
36000 C INTO SALT CONCENTRATIONS BY LINEARLY INTERPOLATING WITH THE
36100 C CALIBRATION SERIES:
36200 CALNUM=5
36300 3305 IF(CALNUM.LE.0) WRITE(ICI,3306)

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36500 3650  FORMAT(* THERE ARE NOT ENOUGH CALIBRATION BLOCKS.*)
36600  IF(CALNUM.LE.0) GO TO 3670
36700  DO 3700 J=1,PRONUM
36800  ILO=
36900  IHI=20000
37000  DO 3710 N=1,CALNUM
37100  IF(CALIB(N,J).LE.MXDATA(J)) GO TO 3701
37200  IF(CALIB(N,J).GE.IHI) GO TO 3701
37300  IHI=CALIB(N,J)
37400  IZ=SALT(N)
37500  GO TO 3700
37600 3701 IF(CALIB(N,J).LE.ILO) GO TO 3700
37700  ILO=CALIB(N,J)
37800  IH=SALT(N)
37900 3700 CONTINUE
38000  C BY NOW WE SHOULD HAVE ILO JUST BELOW THE VALUE OF THE MIXING
38100  C DATA AT THIS POINT,AND IHI JUST ABOVE.IH AND IZ ARE CORRESPONDING
38200  C SALT CONCENTRATIONS:
38300  C CHECKING TO SEE IF IT IS POSSIBLE TO INTERPOLATE:
38400  3710 IF(IHI.NE.20000) GO TO 3720
38500  C IF NOT,WE SET THE VALUE TO ZERO AND CONTINUE:
38600  RATIO(J)=0
38700  GO TO 3800
38800  C THE NEXT SEVERAL LINES OF CODE DOES THE ACTUAL INTERPOLATION:
38900 3720 IF(ILO.EG.IHI)RATIO(J)=IX
39000  IF(ILO.EG.IHI) GO TO 3800
39100  AREAL=MXDATA(J)-ILO
39200  BREAL=IHI-ILO
39300  AREAL=AREAL/BREAL
39400  BREAL=IH
39500  ARG=IZ-IH
39600  RATIO(J)=BREAL+ARG*AREAL
39700  IF(IHI.EG.20000) RATIO(J)=0.1
39800 3800 CONTINUE
39900  C THIS CODE ASSIGNS REASONABLE SALT VALUES
40000  C TO FAILED PROBES
40100  RATIO(33)=(RATIO(32)+RATIO(34)+RATIO(109))/3.
40200  RATIO(40)=(RATIO(104)+RATIO(39))/2.
40300  RATIO(41)=(RATIO(42)+RATIO(6))/2.
40400  RATIO(50)=(RATIO(94)+RATIO(51)+RATIO(49))/3.
40500  RATIO(52)=(RATIO(51)+RATIO(53)+RATIO(92))/3.
40600  RATIO(57)=(RATIO(56)+RATIO(58)+RATIO(89))/3.
40700  RATIO(73)=(RATIO(23)+RATIO(72)+RATIO(74))/3.
40800  RATIO(75)=(RATIO(24)+RATIO(76)+RATIO(74))/3.
40900  RATIO(83)=(RATIO(87)+RATIO(89))/3.
40950  RATIO(90)=RATIO(97)
41000  RATIO(98)=(RATIO(46)+RATIO(97)+RATIO(99))/3.
41100  RATIO(100)=(RATIO(44)+RATIO(99)+RATIO(101))/3.
41200  RATIO(102)=(RATIO(42)+RATIO(101)+RATIO(103))/3.
41300  RATIO(123)=(RATIO(124)+RATIO(122)+RATIO(93))/3.
41400  RATIO(110)=RATIO(108)/2.
41500  RATIO(111)=RATIO(112)/2.
41600  RATIO(125)=RATIO(126)/2.
41700  RATIO(128)=(RATIO(116)+RATIO(127))/3.
41800  C THIS ENDS THE BASIC COMPUTATIONAL CODE.
41900  C
42000  C NOW WE STORE IN M(N) THE SALT VALUES IN PROPER ORDER
42100  C FIRST INITIALIZE TO ZERO
42200  DO 500 N=1,546
42300  M(N)=0.0
42400  DO 505 N=1,PRONUM

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42500      IX=F(N)
42600      M(IX)=RATIO(N)
42700      CONTINUE
42800
42900      VAVG=IGPM
43000      VAVG=VAVG/6.763
43100      C NOW WE HAVE TO SEARCH FOR THE FLOWSPLIT DATA:
43200      SUM=5.00000
43300      ARG=IPEYNO
43400      DO 250 N=1,IFLCNM
43500      IF(ABS(ARG-FLOW(4,N)).GT.SUM) GO TO 250
43600      SUM=ABS(ARG-FLOW(4,N))
43700      ISTORE=N
43800      250 CONTINUE
43900      C END OF SEARCH FOR FLOWSPLIT DATA..
44000      C INITIALIZING DETECTED SALT AT ZERO.
44100      OUTSLT=0.0
44200      C ADDING UP THE DETECTED SALT FOR THE INTERIOR CHANNELS:
44300      DO 3940 N=32,128
44400      IINT=F(N)
44500      3940 OUTSLT=OUTSLT+FLOW(1,ISTORE)*AREA(1)*M(IINT)*VAVG
44600      C ADDING UP THE DETECTED SALT FOR THE EDGE CHANNELS:
44700      DO 3950 N=1,28
44800      IEDG=F(N)
44900      3950 OUTSLT=OUTSLT+FLOW(2,ISTORE)*AREA(2)*M(IEDG)*VAVG
45000      C ADDING UP THE DETECTED SALT FOR THE CORNER CHANNELS:
45100      DO 3960 N=29,31
45200      ICOR=F(N)
45300      3960 OUTSLT=OUTSLT+FLOW(3,ISTORE)*AREA(3)*M(ICOR)*VAVG
45400      C NET SALT INJECTED IS THE PRODUCT OF FLOW AND CONC.:
45500      NETSLT=ISALTF*ISALTC
45600      C THE MASS-BALANCE RATIO IS THE RATIO OF SALT DETECTED TO SALT
45700      C INJECTED, AND IDEALLY =1.
45800      MASBAL=OUTSLT*100000.0/NETSLT
45900      C THAT ENDS THE BASIC COMPUTATIONAL ROUTINES.
46000      C THIS IS THE PRINTOUT ROUTINE:
46100      IF((ICNE.EQ.0).AND.(ICONCE.EQ.0)) GO TO 119
46200      IF(ICNE.EQ.0) GO TO 433
46300      WRITE(ICI,95)
46400      95 FORMAT(' DO YOU WANT TRUE SALT CONC. PRINTED OUT?*,S)
46500      READ(IRI,3011) IANS
46600      IF(EQUAL(IANS,0,%REF(*N*),2,1)) GO TO 96
46700      433 IYSALT=1
46800      GO TO 97
46900      96 WRITE(ICI,98)
47000      98 FORMAT(' DO YOU WANT A PRINTOUT OF DIMENSIONLESS R.HS?*,S)
47100      READ(IRI,3011) IANS
47200      IF(EQUAL(IANS,0,%REF(*N*),3,1)) GO TO 950
47300      119 IYSALT=0
47400      IF((ICNE.EQ.0).AND.(IDIMEN.EQ.0)) GO TO 392
47500      IF(ISUBCH.LE.96) CMI=ISALTF*0.00001+VAVG*FLOW(1,ISTORE)*AREA(1)
47600      IF(ISUBCH.GT.96) CMI=ISALTF*0.00001+VAVG*FLOW(2,ISTORE)*AREA(2)
47700      DO 392 N=1,PRCNUM
47800      IX=F(N)
47900      392 M(IX)=M(IX)*CMI/OUTSLT*100
48000      97 CONTINUE
48100      C CODE FOR PLOTTING A MAP OF MIXING DATA.
48200      DO 1235 JK=1,2
48300      IF(JK.EQ.1) IXI=6
48400      IF(JK.EQ.2) IXI=99
48500      WRITE(IXI,80)

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45400 8      FORMAT(*1      SALT CONCENTRATION DISTRIBUTION MAP:*/)
45500      IF(IYSALT.EQ.1) WRITE(IXI,395)
45600 395    FORMAT(* SALT CONCENTRATION(CM.SALT/LSWATER)*1000.0)
45700      IF(IYSALT.EQ.0) WRITE(IXI,396)
45800 396    FORMAT(* DIMENSIONLESS RATIOS OF SALT CONCENTRATION*0.01*)
45900      WRITE(IXI,481)MXNAME
46000 481    FORMAT(1X,5A2)
46100      WRITE(IXI,2011) IPEY:0
46200      ARG=IAXIAL
46300      ARG=ARC/100.
46400      WRITE(IXI,2014) ARG
46500      WRITE(IXI,2013) ISUSCH
46600      WRITE(IXI,1111) FLOW(1,ISTORE),FLOW(2,ISTORE),FLOW(3,ISTORE)
46700 1111   FORMAT(* FLOW SPLITS      :*,/,*, X1=*,F7.4,
46800      1 * X2=*,F7.4,*, X3=*,F7.4)
46900      WRITE(IXI,111) MASBAL
47000 111    FORMAT(* MASSBALANCE RATIO :*,F6.3)
47100      WRITE(IXI,3003)
47200      DO 482 I=1,546
47300 482    T(I)=M(I)

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100	WRITE (IXI, 721) T(545), T(508), T(507), T(506), T(505), T(504), T(503),
200	1T(502), T(501), T(500)
300	WRITE (IXI, 722) T(489), T(484), T(483), T(482), T(481), T(480), T(479),
400	1T(448), T(447), T(446)
500	WRITE (IXI, 723) T(435), T(400), T(399), T(398), T(397), T(396), T(395),
600	1T(394), T(393), T(434)
700	WRITE (IXI, 724) T(324), T(322), T(320), T(318), T(316), T(314), T(312),
800	1T(310)
900	WRITE (IXI, 725) T(304), T(455), T(401), T(325), T(323), T(321), T(319),
1000	1T(317), T(315), T(313), T(311), T(309), T(392), T(446), T(500)
1100	WRITE (IXI, 726) T(324), T(242), T(240), T(238), T(236), T(234), T(232),
1200	1T(230), T(308)
1300	WRITE (IXI, 727) T(510), T(456), T(402), T(327), T(243), T(241), T(239),
1400	1T(237), T(235), T(233), T(231), T(229), T(307), T(391), T(445), T(499)
1500	WRITE (IXI, 728) T(328), T(244), T(172), T(170), T(168), T(166), T(164),
1600	1T(162), T(226), T(306)
1700	WRITE (IXI, 729) T(511), T(457), T(403), T(329), T(245), T(173), T(171),
1800	1T(169), T(167), T(165), T(163), T(161), T(227), T(305), T(390), T(444),
1900	1T(498)
2000	WRITE (IXI, 730) T(330), T(246), T(174), T(114), T(112), T(110), T(108),
2100	1T(106), T(160), T(226), T(304)
2200	WRITE (IXI, 731) T(512), T(458), T(404), T(331), T(247), T(175), T(115),
2300	1T(113), T(111), T(109), T(107), T(105), T(159), T(225), T(303), T(389),
2400	2T(443), T(497)
2500	WRITE (IXI, 732) T(332), T(248), T(176), T(116), T(68), T(66), T(64), T(62),
2600	1T(104), T(158), T(224), T(302)
2700	WRITE (IXI, 733) T(513), T(459), T(405), T(333), T(249), T(177), T(117),
2800	1T(69), T(67), T(65), T(63), T(61), T(123), T(157), T(223), T(301), T(388),
2900	2T(442), T(496)
3000	WRITE (IXI, 734) T(334), T(250), T(178), T(118), T(70), T(34), T(32), T(30),
3100	1T(60), T(102), T(156), T(222), T(300)
3200	WRITE (IXI, 735) T(514), T(460), T(406), T(335), T(251), T(179), T(119),
3300	1T(71), T(35), T(33), T(31), T(29), T(59), T(101), T(155), T(221), T(299),
3400	2T(387), T(441), T(495)
3500	WRITE (IXI, 736) T(336), T(252), T(180), T(120), T(72), T(36), T(12), T(10),
3600	1T(28), T(58), T(100), T(154), T(220), T(298)
3700	WRITE (IXI, 737) T(515), T(461), T(407), T(337), T(253), T(181), T(121),
3800	1T(73), T(37), T(13), T(11), T(9), T(27), T(57), T(99), T(153), T(219),
3900	2T(297), T(386), T(440), T(494)
4000	WRITE (IXI, 738) T(338), T(254), T(182), T(122), T(74), T(38), T(14), T(12),
4100	1T(8), T(26), T(56), T(98), T(152), T(218), T(296)
4200	WRITE (IXI, 739) T(516), T(462), T(408), T(339), T(255), T(183), T(123),
4300	1T(75), T(39), T(15), T(3), T(1), T(7), T(25), T(55), T(97), T(151), T(217),
4400	WRITE (IXI, 740) T(544), T(490), T(436), T(433), T(487), T(541)
4500	WRITE (IXI, 741) T(517), T(463), T(409), T(340), T(256), T(184), T(124),
4600	1T(76), T(40), T(16), T(4), T(6), T(24), T(54), T(96), T(150), T(216),
4700	2T(294), T(384), T(432), T(486), T(540)
4800	WRITE (IXI, 742) T(341), T(257), T(185), T(125), T(77), T(41), T(17), T(15),
4900	1T(23), T(53), T(95), T(149), T(215), T(293), T(383)
5000	WRITE (IXI, 743) T(518), T(464), T(410), T(342), T(258), T(186), T(126),
5100	1T(78), T(42), T(18), T(20), T(22), T(52), T(94), T(148), T(214), T(292),
5200	2T(382), T(431), T(485), T(539)
5300	WRITE (IXI, 744) T(343), T(259), T(187), T(127), T(79), T(43), T(19), T(17),
5400	1T(51), T(93), T(147), T(213), T(291), T(381)
5500	WRITE (IXI, 745) T(519), T(465), T(411), T(344), T(260), T(188), T(128),
5600	1T(80), T(44), T(46), T(48), T(50), T(92), T(146), T(212), T(290), T(380),
5700	2T(430), T(484), T(538)
5800	WRITE (IXI, 746) T(345), T(261), T(189), T(129), T(81), T(45), T(47), T(49),
5900	1T(91), T(145), T(211), T(289), T(379)
6000	WRITE (IXI, 747) T(520), T(466), T(412), T(346), T(262), T(190), T(130),
6100	1T(82), T(84), T(86), T(88), T(90), T(144), T(210), T(288), T(378), T(429)


```

620      2T(483),T(537)
630      WRITE(IXI,711) T(347),T(263),T(191),T(131),T(83),T(85),T(87),T(
640      1T(143),T(209),T(287),T(377)
6500     WRITE(IXI,709) T(521),T(467),T(413),T(348),T(264),T(192),T(132),
6600     1T(134),T(136),T(138),T(140),T(142),T(218),T(286),T(376),T(428),
6700     2T(482),T(536)
6800     WRITE(IXI,708) T(349),T(265),T(193),T(133),T(135),T(137),T(139)
6900     1T(141),T(207),T(285),T(375)
7000     WRITE(IXI,707) T(522),T(468),T(414),T(351),T(266),T(194),T(196)
7100     1T(198),T(200),T(202),T(204),T(206),T(284),T(374),T(427),T(481),
7200     2T(535)
7300     WRITE(IXI,706) T(351),T(267),T(195),T(197),T(159),T(201),T(203)
7400     1T(205),T(283),T(373)
7500     WRITE(IXI,705) T(523),T(469),T(415),T(352),T(268),T(270),T(272)
7600     1T(274),T(276),T(278),T(280),T(282),T(372),T(426),T(480),T(534)
7700     WRITE(IXI,704) T(353),T(269),T(271),T(273),T(275),T(277),T(279)
7800     1T(281),T(371)
7900     WRITE(IXI,703) T(524),T(470),T(416),T(354),T(356),T(358),T(360)
8000     1T(362),T(364),T(366),T(368),T(370),T(425),T(479),T(533)
8100     WRITE(IXI,702) T(355),T(357),T(359),T(361),T(363),T(365),T(367)
8200     1T(369)
8300     WRITE(IXI,701) T(437),T(417),T(418),T(419),T(420),T(421),T(422)
8400     1T(423),T(424),T(438)
8500     WRITE(IXI,722) T(491),T(471),T(472),T(473),T(474),T(475),T(476)
8600     1T(477),T(478),T(492)
8700     WRITE(IXI,721) T(545),T(525),T(526),T(527),T(528),T(529),T(530)
8800     1T(531),T(532),T(546)
8900     701   FORMAT(32X,10F5.1)
9000     702   FORMAT(37X,8F5.1/)
9100     703   FORMAT(19X,15F5.1/)
9200     704   FORMAT(34X,9F5.1/)
9300     705   FORMAT(17X,16F5.1/)
9400     706   FORMAT(32X,10F5.1/)
9500     707   FORMAT(14X,17F5.1/)
9600     708   FORMAT(29X,11F5.1/)
9700     709   FORMAT(12X,18F5.1/)
9800     710   FORMAT(27X,12F5.1/)
9900     711   FORMAT(9X,19F5.1/)
10000    712   FORMAT(24X,13F5.1/)
10100    713   FORMAT(7X,23F5.1/)
10200    714   FORMAT(22X,14F5.1/)
10300    715   FORMAT(4X,21F5.1/)
10400    716   FORMAT(19X,15F5.1/)
10500    717   FORMAT(2X,22F5.1/)
10600    718   FORMAT(1X,3F5.1,82X,3F5.1)
10700    719   FORMAT(32X,10F5.1/)
10800    720   FORMAT(2X,22F5.1)
10900    721   FORMAT(22X,F5.1,10X,8F5.1,10X,F5.1)
11000    722   FORMAT(27X,F5.1,5X,8F5.1,5X,F5.1)
11200    IF((IYSALT.EQ.1).AND.(IONE.EQ.2)) GO TO 119
11300    IF(IYSALT.EQ.1) GO TO 96
11400    C NOW PRINT CONCENTRATIONS IN ORDER OF PROBE NUMBER
11500    C FOR CONVENIENCE IN TYPING DATA CARDS
11600     WRITE(IXI,730)
11700    730   FORMAT(1H1)
11800     WRITE(IXI,481) MXNAME
11900     WRITE(IXI,3000)
12000     DO 483 I=1,PPONUM
12100     IX=F(I)
12200     DRV(I)=T(IX)
12300     483   CONTINUE

```

```

12400 WRITE(IXI,145) (DRV(I),I=1,128)
12500 1235 CONTINUE

C PUNCHED CARD OUTPUT ROUTINE
30 IF(IONE.EQ.1) GO TO 35
31 IF(IONE.EQ.1) GO TO 432
40 WRITE(ICI,101)
50 101 FORMAT(' DO YOU WANT PUNCHED CARD OUTPUT?',5)
60 READ(IFI,3011) IAFS
70 IF(EQUAL(IANS,0,REF('N'),0,1)) GO TO 950
80 OPEN(UNIT=LU,NAME='SALTRJPN.CAT',TYPE='NEW') ! OPEN PUNCH DAT
90 432 CONTINUE
95 WRITE(LU,481) MXNAME
100 WRITE(LU,145) (DRV(I),I=1,128)
140 145 FORMAT(16F5.1)
150 CLOSE(UNIT=LU)
160 950 IY=IY+1
170 IF(IONE.EQ.1) GO TO 106
180 GO TO 200
190 900 TYPE '*' PROGRAM ENDS NOW*
200 C CLOSE PRINTER FILE
210 CLOSE(UNIT=99)
220 C GOODBYE
2300 END

```

APPENDIX D
SUPERENERGY DRV MAIN PROGRAM FOR
217 PIN MIXING EXPERIMENT

```

REAL LENGTH, LEAD, LXX
COMMON/PROP1/RHO, CP, COND, CONDW, ALPHA 0000004
COMMON/GEO /DR(1), DW(1), LEAD(1), P(1), DFLAT(1), POD(1), GAP(1), A1(1),
1A2(1), A3(1), A4(1), A5(3), A6(1), A7(1), ATOTAL(1), ATOTLG(1), DE1(1),
2DE2(1), DE3(1), DE6(1), DE7(1), HP1(1), HP2(1), HP3(1), HPTOTL(1),
3ETA1(1), ETA2(1), ETA3(1), ETA4(1), ETA6(1), ETA8(1), X1(1), X2(1), X3(3),
4S1(1), S2(1), LENGTH(1), VIR(1), V2R(1), V3R(1), V6R(1), V7R(1)
COMMON/NUM /NROD(1), NRING(1), NCHANL(1), N1(1), N2(1), N3(1), N4(1),
IN5(1), N6(1), N7(1), N8(1), LC(1,550,4), MROD(1,440,3)
COMMON/TEMP/T(550)
COMMON/WEND/Y11(500), NINJ, LXX, REE
COMMON FACTOR(3,3) 0000013
DIMENSION SALT(550), CINDI(50)
DIMENSION FLOW(01), FLOWGP(01), G(01), GGAP(01), VAVG(01), VAVGG(01), 0000014
1V1(01), V2(01), V3(01), V6(01), V7(01), VSWIRL(01)
DIMENSION ITYPE(01), NGGFAX(01), AXIAL(50,01), FAX(50,01), NA(01,6) 0000016
DIMENSION EH1(01), EH2(01), EH3(01), EH4(01), Y(500)
DIMENSION PE2(01), PE3(01), PE6(01), PE7(01), NU2(01), NU3(01), NU6(02),
1NU7(01), RES2(01), RES3(01), RES6(01), RES7(01)
DIMENSION QTOTAL(01), DIFFH(01), DIFFHG(01), QSA(01), QS8(01), QSC(01) 0000020
DIMENSION QTPRIM(550,01), QTP(550,01), SUMM(440,01), POWER(220) 00000 11
DIMENSION T1(550,01), T2(550,01), T3(550,01), QAVG(01), TAVG(01) 0000022
DIMENSION PRNT(30)
DIMENSION SL(550)
INTEGER F(128)
1234 CONTINUE
IWC=0
READ(5,10,END=1235) JXQ, NCOE, NINJ, JDRV
10 FORMAT(4I5)
READ(5,50) CHIVA, CHIUI, CHIUC, REE, FLOW(1), LENGTH(1)
50 FORMAT(8E10.3)
FACTOR(1,1)=1. 0000027
FACTOR(1,2)=0.5 0000028
FACTOR(2,1)=2. 0000029
FACTOR(2,2)=1. 0000030
CONTINUE 0000031
FLOW(1)=FLOW(1)*500.57
TIN=0.0
S1(1)=0
S2(1)=0
TT=60.0
CALL PROP(TT)
NOASSM=1
KOND=0
INDIC=0
NDINCR=500
ISOLAT=2
K=1
L=1
WRITE(6,16)
16 FORMAT(1H1)
NOPRNT=L
FLOWGP(1)=0.0
QAVG(1)=0.0
DR(K)=.232
DW(K)=.058
DDW1=.058
LEAD(K)=12.0

```

```
P(K)=.290
DFLAT(K)=4.33
NRQD(K)=217
PRVT(1)=LENGTH(1)
CALL NUMB(K)
CALL GEOM(K)
5000 READ(5,50) V1R(1),V2R(1),V3R(1)
M2=N2(K)
M3=N3(K)
M4=N4(K)
M6=N6(1)
MK2=M2+1
MK3=M3+1
DO 7 I=1,12
7 F(I)=I+420
DO 13 I=13,28
13 F(I)=I+372
F(29)=438
F(30)=433
F(31)=434
DO 8 I=32,53
8 F(I)=I+331
DO 9 I=54,77
9 F(I)=I+241
DO 14 I=78,91
14 F(I)=308-I
DO 11 I=92,109
11 F(I)=386-I
DO 12 I=110,123
12 F(I)=I+93
F(124)=151
F(125)=141
F(126)=142
F(127)=143
F(128)=144
9997 FORMAT(16E5.0)
DO 501 N=1,546
501 SALT(N)=0.0
READ(5,9997) (SALT(F(I)),I=1,128)
9993 CONTINUE
IF(JDRV.EQ.1) GO TO 9974
DO 502 N=1,546
502 SL(N)=0.0
READ(5,9997)(SL(F(I)),I=1,128)
9974 CONTINUE
DO 7776 JXS=1,JXQ
K=1
IF(NCOE.EQ.1) GO TO 9999
EHSTA1=CHIUC
EHSTA2=CHIUC
EHSTA3=CHIUC
EHSTA4=CHIUC
IF(IWC.EQ.1) C1=CHIUA
IF(IWC.NE.1) C1=(CHIUA-CHIUI)/FLOAT(JXQ-1)*FLOAT(JXS-1)+CHIUI
GO TO 9998
9999 CONTINUE
C1=CHIUC
IF(IWC.EQ.1) CHIUK=CHIUA
```

```

IF(IWC.NE.1) CHIUK=(CHIU A-CHIUI)/FLOAT(JXQ-1)*FLOAT(JXS-1)+CHIUI
EHSTA1=CHIUK
EHSTA2=CHIUK
EHSTA3=CHIUK
EHSTA4=CHIUK

```

```

9998 CONTINUE

```

```

G(L)=(FLOW(L)/ATOTAL(K))*144.0

```

```

VAVG(L)=G(L)/RHO

```

0000114

```

V1(L)=VAVG(L)*V1R(K)

```

0000116

```

V2(L)=VAVG(L)*V2R(K)

```

0000117

```

V3(L)=VAVG(L)*V3R(K)

```

0000118

```

CONVER=VAVG(L)*DEL(K)/12.

```

```

EH1(L)=EHSTA1*CONVER

```

```

EH2(L)=EHSTA2*CONVER

```

```

EH3(L)=EHSTA3*CONVER

```

```

EH4(L)=EHSTA4*CONVER

```

```

VSWIRL(L)=C1*VAVG(L)

```

```

RES2(L)=10000.0

```

```

RES3(L)=10000.0

```

```

IPRINT=1

```

```

PRINT=PRNT(IPRINT)

```

```

LXX=PRINT

```

```

DZ=LENGTH(1)/NOINCR

```

```

Z=DZ/2.

```

```

M6=N6(1)

```

```

IF(JDRV.EQ.1) GO TO 8728

```

```

DO 8728 I=1,M4

```

```

T2(I,L)=SL(I)

```

```

8728 CONTINUE

```

```

IF(JDRV.EQ.2) GO TO 1000

```

```

DO 110 I=1,M4

```

```

T2(I,L)=TIN

```

```

110 CONTINUE

```

```

T2(NINJ,L)=700.0

```

```

1000 CONTINUE

```

```

120 CONTINUE

```

```

K=1

```

```

M1=N1(K)

```

0000174

```

M2=N2(K)

```

0000175

```

M3=N3(K)

```

0000176

```

M4=N4(K)

```

0000177

```

M5=N5(K)

```

0000178

```

M6=N6(K)

```

0000179

```

M7=N7(K)

```

```

MK1=N1(K)+1

```

0000182

```

MK2=N2(K)+1

```

0000183

```

MK3=N3(K)+1

```

0000184

```

MK4=N4(K)+1

```

0000185

```

MK5=N5(K)+1

```

0000186

```

MK6=N6(K)+1

```

0000187

```

MK7=N7(K)+1

```

```

DO 150 I=1,M1

```

```

MM1=LC(K,I,1)

```

0000190

```

MM2=LC(K,I,2)

```

0000191

```

MM3=LC(K,I,3)

```

0000192

```

T3(I,L)=T2(I,L)+((P(K)-DR(K))*DZ/

```

```

1A1(K))*((ALPHA+EH1(L))/V1(L))*(T2(MM1,L)+T2(MM2,L)+T2(MM3,L)-

```

0000194

```

23*T2(I,L))/ETA1(K)*12

```

0000195

```
150 CONTINUE                                00001970
DO 160 I=MK1,M2                             00001980
MM1=LC(K,I,1)                               00001990
MM2=LC(K,I,2)                               00002000
MM3=LC(K,I,3)                               00002010
R=(I-1)/6.                                  00002020
N=SQRT(R)+1.0001
IQ=(I-6*(N-1)*(N-1)-1)/(2*N-1)+0.0001      00002040
IR=I-6*(N-1)*(N-1)-IQ*(2*N-1)+0.0001        00002050
J=IR/2                                       00002060
IF(IR.EQ.2*J) GO TO 1160                    00002070
EHA=EH1(L)                                  00002080
EHB=EH2(L)                                  00002090
ETAA=ETA1(K)                                00002100
ETAB=ETA2(K)                                00002110
GO TO 2160                                   00002120
1160 CONTINUE                                00002130
EHA=EH1(L)                                  00002140
ETAA=ETA1(K)
EHB=EH1(L)                                  00002150
ETAB=ETA1(K)                                00002170
2160 CONTINUE                                00002180
T3(I,L)=T2(I,L)+((P(K)-DR(K))*DZ)/
1(A1(K)*V1(L))*((ALPHA+EHA)*(T2(MM1,L)+T2(MM2,L)-2*T2(I,L))/ETAA+
2(ALPHA+EHB)*(T2(MM3,L)-T2(I,L))/ETAB)*12    00002200
160 CONTINUE                                00002210
DO 170 I=MK2,M3                             00002230
MM1=LC(K,I,1)                               00002240
MM2=LC(K,I,2)                               00002250
MM3=LC(K,I,3)                               00002260
IF(MM2.GT.M3) GO TO 1170                    00002290
ETAA=ETA3(K)                                00002300
EHA=EH3(L)                                  00002310
GO TO 2170                                   00002320
1170 CONTINUE                                00002330
ETAA=ETA4(K)                                00002340
EHA=EH4(L)                                  00002350
2170 CONTINUE                                00002360
IF(MM3.GT.M3) GO TO 3170                    00002370
ETAB=ETA3(K)                                00002380
EHB=EH3(L)                                  00002390
GO TO 4170                                   00002400
3170 CONTINUE                                00002410
ETAB=ETA4(K)                                00002420
EHB=EH4(L)                                  00002430
4170 CONTINUE                                00002440
MM4=LC(K,I,4)                               00002280
RES1=RES2(L)
TTT=T2(I,L)
T3(I,L)=T2(I,L)+( CDW1*DZ/A2(K))*
1(VSWIRL(L)/V2(L))*(T2(MM2,L)-T2(I,L))+12*(P(K)-DR(K))*DZ/A2(K)* 00002460
2((ALPHA+EHB)/V2(L))*(T2(MM1,L)-T2(I,L))/ETA2(K)+12*( CDW1*DZ/
3(V2(L)*A2(K)))*((ALPHA+EHA)*(T2(MM2,L)-T2(I,L))/ETAA+(ALPHA+EHB)* 00002480
4(T2(MM3,L)-T2(I,L))/ETAB)
170 CONTINUE                                00002220
DO 180 I=MK3,M4                             00002530
MM1=LC(K,I,1)                               00002540
MM2=LC(K,I,2)                               00002550
```

```
MM3=LC(K,I,3)                                0000256
TTT=T2(I,L)
RESI=RES3(L)
T3(I,L)=T2(I,L)+(GAP(K)*DZ/A3(K))*
1(VSWIRL(L)/V3(L))*(T2(MM1,L)-T2(I,L))+ (GAP(K)*DZ/A3(K))*12* 0000258
2((ALPHA+EH4(L))/V3(L))*(T2(MM1,L)+T2(MM2,L)-2*T2(I,L))/ETA4(K)
180 CONTINUE                                0000262
DO 170 I=MK4,M6
MM1=LC(K,I,1)                                0000264
T3(I,L)=T3(MM1,L)
190 CONTINUE
K=1
270 CONTINUE
DO 240 I=1,M4
T2(I,L)=T3(I,L)
240 CONTINUE                                0000352
Z=Z+DZ                                        0000354
DIFF=PRINT-Z                                0000355
IF(DIFF.GT.DZ) GO TO 1000                    0000356
K=1
M2=N2(K)                                    0000360
M3=N3(K)                                    0000361
M4=N4(K)                                    0000362
M5=N5(K)                                    0000363
M6=N6(K)                                    0000364
MK2=M2+1                                    0000367
MK3=M3+1
MK6=M6+1                                    0000369
MK7=M7+1                                    0000370
IF(JDRV.EQ.1) GO TO 260
DO 260 I=1,M4
Y(I)=T2(I,L)
T(I)=Y(I)*2.0
260 CONTINUE                                0000374
IF(JDRV.EQ.2) GO TO 265
DO 265 I=1,M4
Y(I)=((T2(I,L)-TIN)/(700.0-TIN))*100.0
T(I)=Y(I)*2.0
265 CONTINUE
T11=0                                        0000375
T22=0                                        0000376
T33=0                                        0000377
T66=0                                        0000378
T77=0                                        0000379
CINDI(JXS)=0.0
DO 9995 I=1,M4
CINDI(JXS)=CINDI(JXS)+(Y(I)-SALT(I))*2
9995 CONTINUE
CINDI(JXS)=CINDI(JXS)**0.5
IF(JXS.EQ.1) GO TO 9990
IF(CINDI(JXS).GT.CINDI(JXS-1)) INDIC=INDIC+1
DIFFHG(L)=0.0
9976 CONTINUE
IF(IWC.EQ.1) INDIC=1
IF(IWC.NE.1) GO TO 9967
DO 5556 I=1,M4
Y11(I)=Y(I)
5556 CONTINUE
```



```
9967 CONTINUE
      INDIC=1
      IF(INDIC.EQ.1) CALL PRIN(K)
      IF(IWC.EQ.1) GO TO 9975
      PRINT 9994,CINDI(JXS-1)
7994  FORMAT(//,5X,'MEAN SQUARE INDICATOR =',F10.3)
      WRITE(6,18)
      18  FORMAT(5X,'EFFECTIVE EDDY DIFFUSIVITY AND SWIRL VELOCITY RATIO')
      WRITE(6,40) EHC1,CCC1
      40  FORMAT(8F10.3)
9975 CONTINUE
9990 CONTINUE
      DO 9979 I=1,M4
      Y11(I)=Y(I)
9979 CONTINUE
      EHC1=EHSTA1
      EHC2=EHSTA2
      EHC3=EHSTA3
      EHC4=EHSTA4
      CCC1=C1
      IPRINT=IPRINT+1
      IF(IPRINT.GT.NOPRNT) GO TO 2450
      PRINT=PRNT(IPRINT)
      LXX=PRINT
      GO TO 2550
2450 PRINT=LENGTH(1)+10.0
2550 CONTINUE
      IF(PRINT.GT.LENGTH(1)) GO TO 2000
      GO TO 1000
2000 CONTINUE
3000 CONTINUE
7776 CONTINUE
      GO TO 1234
1235 CONTINUE
      STOP
      END
```