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The COVERX Service Module of the FORSS System

J. D. Drischler

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Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
NTIS price codes—Printed Copy: A03; Microfiche A01

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ORNL/TM-7181
Distribution Category UC-79d
(ENDF-291)

Contract No. W-7405-eng-26

Engineering Physics Division

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J. D. Drischler

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Date Published - April 1980

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ABSTRACT

The COVERX Service Module includes seven execution paths to aid in understanding and using multigroup cross-section covariance matrices contained in the standard interface file COVERX. The execution paths provide the following operations on COVERX file(s):

1. List the contents of a COVERX file.
2. Allow adding new multigroup cross-section covariance matrices to an existing COVERX file.
3. Allow deletion of multigroup covariance matrices from an existing COVERX file.
4. Merge two COVERX files and creates a new file.
5. Change the mode of a file from unformatted to formatted and conversely.
6. Allow modification of the records contained in a COVERX file.
7. Selectively edits or copies a file.

I. INTRODUCTION

Multigroup cross-section covariance matrices are created using the PUFF covariance file processing code¹ and placed on a proposed CCCC² file, COVERX.³ Each covariance matrix is identified by the matrix control record of the COVERX file. The material and reaction type identification numbers are the MAT and MT numbers used in the ENDF/B⁴ files. Libraries⁵ of multigroup matrices in COVERX format are currently available through the Engineering Physics Information Center (EPIC) at Oak Ridge National Laboratory and the National Nuclear Data Center (NNDC) at Brookhaven National Laboratory. The COVERX format is described in Appendix A. A sample problem utilizing the seven execution paths of the COVERX Service Module is described in Appendix B.

When the generation of a COVERX file(s) is complete for a study, a careful review is recommended before it is used. The COVERX service module is available to aid in this review. If identification problems or errors are detected, they can often be quickly corrected by the COVERX service module. At present, the module has seven execution paths which perform the following tasks:

1. Lists the contents of a COVERX file.
2. Allows additional multigroup cross-section covariance matrices to be added to an existing COVERX file.
3. Allows deletions of multigroup cross-section covariance matrices from an existing COVERX file.
4. Merges two COVERX files and creates a new file.
5. Changes the mode of a file from unformatted to formatted and conversely.

6. Allows modification of the records contained in the COVERX file.
7. Selectively edits or copies a file.

The user selects the desired execution path by entering one of the following words on a card beginning in column 1: LIST, ADD, DELETE, MERGE, CONVERT, FIX, EDIT. Additional FIDO⁶ input requirements are described for each execution path.

II. COVERX FILE EXECUTION PATHS

A. List

Input Data

LIST

1\$\$ Integer Parameter [1]

NBIN - Unit number of the COVERX file, if NBIN < 0, only the matrix control records will be listed.

T

B. Add

This execution path allows multigroup cross-section covariance matrices to be added by creating a new file from the card input. The existing and newly created files are then merged producing a new COVERX file.

Input Data

ADD

1\$\$ Integer Parameters [4]

NOLD - Unit number of existing COVERX file

NADD - The number of covariance matrices to be added

NEW - Unit number of new COVERX file

NSSS - Unit number of a scratch device (default = 31)

T

2\$\$ Integer Parameters [4]. The MATRIX CONTROL record of the COVERX file.

MAT1 - Material 1 ID

MT1 - Reaction type 1 ID

MAT2 - Material 2 ID

MT2 - Reaction type 2 ID

T

3** Floating Point Parameters [NG]. The MATERIAL REACTION TYPE CROSS SECTION AND STANDARD DEVIATIONS record of the COVERX file. NG is the number of groups of the existing COVERX file. The standard deviations are automatically calculated by the code.

(CRS(J),J=1,NG)

CRS - Cross sections (from E_{\max} - E_{\min})

T

[The 3** card is omitted if (MAT1.NE.MAT2.OR.MT1.NE.MT2)]

4\$\$ Integer Parameters [NG*2+1]. The BLOCK CONTROL record of the COVERX file.

Block control = (JBAND(J),IJJ(J),J=1,NG),(LGRP(N),N=1,NBLOK)

For simplicity in creating the block control record of a covariance matrix, let NG equal the number of groups of the existing COVERX file and let NBLOK=1. The current version of FORSS⁷ requires that NBLOK=1.

Then: the 4\$\$ card for a three-group problem with NBLOK=1 would be:

```
4$$ 3 1 3 2 3 3 3
```

OR: using the improved FIDO

```
4$$ 0 1 [NG-1]Q2 A1 [NG] 1 1@ [NG-1]Q2 0@ [NG]
```

This is especially useful if matrices are large.

5** Floating Point Parameters [NG*NG]. The MATRIX DATA record of the COVERX FILE. If the preceding scheme for blocking is exercised, then the entire matrix can be input in one block.

COV - Matrix data (input by col.)

T

The 2\$\$, 3**, 4\$\$, and 5** sequence is repeated until NADD entries are complete.

C. Delete

This execution path allows multigroup cross-section covariance matrices to be deleted from a COVERX file.

Input Data

DELETE

1\$\$ Integer Parameters [3]

NBIN - Unit number of existing COVERX file

NEW - Unit number of new COVERX file

NDEL - The number of covariances to be deleted

T

2\$\$ Integer Parameters [4*NDEL]. The MATRIX CONTROL record of the COVERX FILE.

MAT1 - Material 1 ID

MT1 - Reaction type 1 ID

MAT2 - Material 2 ID

MT2 - Reaction type 2 ID

.

.

.

Sequence is repeated for each covariance to be deleted

T

D. Merge

This execution path merges two existing COVERX files and creates a third file.

Input Data

MERGE

1\$\$ Integer Parameters [3]

N1 - Unit number of original COVERX file

If identical matrix control records are encountered on both the original files (N1) and the file to be merged (N2), the matrix found on unit (N2) is written on unit (N3), and the matrix found on unit (N1) is skipped.

E. Format Conversion

This execution path implements features of the COVERT⁸ code which converts the COVERX file from unformatted (binary) to formatted card images and conversely, and also lists a COVERX file.

CONVERT

1\$\$ Integer Parameters [4]

NBE - Select conversion mode

= 0, unformatted to formatted

≠ 0, formatted to unformatted

NIN - Unit number of existing COVERX file (DEFAULT = 23)

NOUT - Unit number of COVERX file to be prepared by COVERT
(DEFAULT = 24)

N06 - Print option

> 0, file is printed on unit N06

≤ 0, reduced file edit on unit |N06|

T

F. Record Modification

This execution path allows modification to the records contained in a COVERX file. FIX modifies only those covariances which have been selected by previously using EDIT and updates the existing COVERX file by using MERGE.

Input Data

FIX

1\$\$ Integer Parameter [5]

NOLD - Unit number of existing COVERX file
 > 0, complete listing
 < 0, reduced listing

NEW - Unit number of new COVERX file

NFIX - Number of covariance matrices to be repaired

NHOL - Modify file description record
 = 0, file description record not modified
 ≠ 0, prepare 2## card

NSSS - Unit number of a scratch device (default = 31)

T

2##

Doubled Precision Parameters [200(A6) words max.]. The FILE DESCRIPTION record of the COVERX file (omit if NHOL = 0).

NUNIT - Unit number where Hollerith description of file is input

NH - Number of (A6) words in Hollerith description

Then: using the improved FIDO

[NUNIT]G[NH] 6H(12A6) 6Hbbbbbb E T (b = blank)

would allow NH (A6) words to be input from unit NUNIT.

3\$\$

Integer Parameters [8]

NMAT1 - Material 1 ID

NMT1 - Reaction type 1 ID

NMAT2 - Material 2 ID

NMT2 - Reaction type 2 ID

NCRS - Modify cross sections

= 0, do not modify cross sections

≠ 0, prepare 4** card

NMT - Modify matrix control record

= 0, no modification

≠ 0, prepare 5\$\$ card

NBLK - Modify block control record

= 0, no modification

≠ 0, prepare 6\$\$ card

NCOV - Modify matrix data record

< 0, switch rows and columns

= 0, no modification

> 0, prepare 7** card

T

4** Floating Point Parameters [NG]. The MATERIAL-REACTION TYPE CROSS SECTIONS record of the COVERX file (omit if NCRS = 0). NG is the number of groups of the existing COVERX file. The standard deviations are automatically calculated by the code.

(CRS(J), J=1, NG)

CRS - Cross sections (from E_{max} - E_{min})

T

5\$\$ Integer Parameters [4]. The MATRIX CONTROL record of the COVERX file (omit if NMT = 0).

MAT1 - Material 1 ID

MT1 - Reaction type 1 ID

MAT2 - Material 2 ID

MT2 - Reaction type 2 ID

6\$\$ Integer Parameters [NG*2+1]. The BLOCK CONTROL record of the COVERX file (omit if NBLK = 0).

Block control = (JBAND(J),IJJ(J),J=1,NG),(LGRP(N),N=1,NBLOK)

JBAND(J) - Band for group (J)

IJJ(J) - Position of diagonal element for group (J)

LGRP(N) - Number of groups in block (N)

For simplicity in creating the block control record of a covariance matrix, let NG equal the number of groups of the existing COVERX file and let NBLOK = 1. The current version of FORSS requires that NBLOK = 1.

Then: the 6\$\$ card for a three-group problem with NBLOK = 1 would be:

6\$\$ 3 1 3 2 3 3 3

OR: using the improved FIDO

6\$\$ 0 1 [NG-1]Q2 A1 [NG] 1 1@ [NG-1]Q2 0@ [NG]

This is especially useful if matrices are large.

7** Floating Point Parameters [NG*NG]. The MATRIX DATA record of the COVERX file (omit if NCOV = 0). If the preceding scheme for blocking is exercised, then the entire matrix can be input in one block.

COV - Matrix data (input by col.)

T

The 3\$\$ through 7** sequence if repeated until NFIX entries are complete.

G. File Edit/Copy

This execution path permits selective listing and copying of a COVERX file. Each multigroup cross-section covariance matrix in a COVERX file is identified by the COVERX matrix control record. This record contains five

numbers: Material 1 (MAT1), reaction type 1 (MT1), Material 2 (MAT2), reaction type 2 (MT2), and the number of blocks into which matrix is subdivided (not used as input). Correlations between material-reaction types are extracted from the COVERX file using MAT1, MT1 as the first material-reaction type (column designation), and MAT2, MT2 the second material-reaction type (row designation).

As each covariance matrix is read from the COVERX file, its first four identifiers are compared with the corresponding identifiers in each edit command. If equality is found between all of the identifiers in an edit command and the corresponding identifiers from the matrix control record of the COVERX file, the multigroup cross-section covariance matrix qualifies for the edit/copy operation.

Input Data

EDIT

1\$\$ Integer Parameters [4]

NBIN - Unit number of existing COVERX file

> 0, complete listing

< 0, file identification

NC - Number of edit commands

NEW - Copy option

> 0, the unit number of a COVERX file to be written containing only those matrices edited

≤ 0, file not written

NSS - Unit number of a scratch device (default = 31)

T

2\$\$ Integer Parameters [4*NC]

MAT1 - Material 1 ID

MT1 - Reaction type 1 ID

MAT2 - Material 2 ID

MT2 - Reaction type 2 ID

•
•
•
•

Complete NC edit commands

T

ACKNOWLEDGEMENTS

The author wishes to acknowledge and thank J. L. Lucius, J. H. Marable, and C. R. Weisbin for their useful suggestions and thorough review of this paper. Much of the important feedback, debugging, etc. was obtained through discussions with J. D. Smith. Finally, deep gratitude is given to Sandi Henry for her expert and patient typing of the several drafts of this report.

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APPENDIX A

The Format for Standard Interface File COVERX for
Multigroup Cross-Section Covariance Matrices


```

C*****
C          REVISED 11/01/77
C
CF          COVERX
CE          THIS FILE CONTAINS CROSS SECTIONS,
CE          STANDARD DEVIATIONS, AND
CE          BY DESIGNATION EITHER COVARIANCE,
CE          RELATIVE COVARIANCE,
CE          OR CORRELATION MATRICES.
C
CE          A FILE SUCH AS THIS IS NEEDED BY ORNL - FORSS
C
C          J. L. LUCIUS
C*****

```

```

C-----
CS          FILE STRUCTURE
CS
CS          RECORD TYPE          PRESENT IF
CS          =====
CS          FILE IDENTIFICATION  ALWAYS
CS          FILE CONTROL          ALWAYS
CS          FILE DESCRIPTION      NHOLL.GT.0
CS          NEUTRON GROUP BOUNDARIES NNGRUP.GT.0
CS          GAMMA GROUP BOUNDARIES NGGRUP.GT.0
CS          MAT - MT CONTROL      ALWAYS
CS          ***** (REPEAT FOR ALL MATERIAL-
CS          *          REACTION TYPE PAIRS)
CS          *          MAT-MT CROSS SECTION AND  ALWAYS
CS          *          STANDARD DEVIATIONS
CS          *****
CS
CS          ***** (REPEAT FOR ALL MATPICES)
CS          *          MATRIX CONTROL          ALWAYS
CS          *          BLOCK CONTROL          ALWAYS
CS          *          ***** (REPEAT FOR ALL BLOCKS)
CS          * *          MATRIX DATA        ALWAYS
CS          *****
C-----

```

```

C-----
CR          FILE IDENTIFICATION
C
CL          HNAME, (HUSE(I), I=1,2), IVERS
CW          1+3*MULT
C
CB          FORMAT(11H 0V COVERX ,A6,1H*,2A6,1H*,I6)
CD          HNAME          HOLLERITH FILE NAME-COVERX (A6)
CD          HUSE          HOLLERITH USER IDENTIFICATION (A6)
CD          IVERS          FILE VERSION NUMBER
CD          MULT          1 - A6 IS SINGLE PRECISION WORD
CD          2 - A6 IS DOUBLE PRECISION WORD
C-----

```

```

C-----
CR          FILE CONTROL
C
CL    NNGROUP, NNGRUP, NGGRUP, NTYPE, NMMP, NMTRIX, NHOLL
C
CW    7
C
CB    FORMAT(4H 1D ,7I6)
C
CD    NNGROUP      NUMBER OF ENERGY GROUPS
CD    NNGRUP       NUMBER OF NEUTRON GROUPS
CD    NGGRUP       NUMBER OF GAMMA GROUPS
CD    NTYPE        TYPE OF DATA
CD                    1 - COVARIANCE MATRIX, STANDARD DEVIATION
CD                    2 - RELATIVE COVARIANCE MATRIX,
CD                      RELATIVE STANDARD DEVIATION
CD                    3 - CORRELATION MATRIX, STANDARD DEVIATION
CD    NMMP         NUMBER OF MAT - MT PAIRS
CD    NMTRIX       NUMBER OF MATRICES
CD    NHOLL        NUMBER OF HOLLERITH WORDS IN DESCRIPTION
C-----

```

```

C-----
CR          FILE DESCRIPTION
C
CL    (WORDS(J) ,J=1, NHOLL)
CW    MULT*NHOLL
C
CB    FORMAT(4H 2D ,1H*,11A6/(11A6))
C
CD    WORDS(J)     HOLLERITH DESCRIPTION OF FILE
C-----

```

```

C-----
CR          NEUTRON GROUP BOUNDARIES
C
CL    (GPBN(J) ,J=1, NNGRUP) ,ENMIN
C
CC          PRESENT IF NNGRUP.GT.0
CW    NNGRUP+1
C
CB    FORMAT(4H 3D ,5E12.4/(6E12.4))
CD    GPBN(J)     MAXIMUM ENERGY BOUND OF NEUTRON GROUP(J) (EV)
CD    ENMIN       MINIMUM ENERGY OF NEUTRON ENERGY RANGE
C-----

```

```

C-----
CR          GAMMA GROUP BOUNDARIES
C
CL    (GPBG(J) ,J=1, NGGRUP) ,EGMIN
C
CC          PRESENT IF NGGRUP.GT.0
CW    NGGRUP+1
C
CB    FORMAT(4H 4D ,5E12.4/(6E12.4))
CD    GPBG(J)     MAXIMUM ENERGY BOUND OF GAMMA GROUP(J) (EV)
CD    EGMIN       MINIMUM ENERGY OF GAMMA ENERGY RANGE
C-----

```

```

C-----
CR          MAT - MT CONTROL
C
CL      (MATID(I) , MTID(I) , MWGT(I) , I=1 , NMMP)
C
CW      3*NMMP
C
CB      FORMAT(4H 5D , 11I6/(12I6))
C
CD      MATID(I)      MATERIAL IDENTIFICATION NUMBER
CD      MTID(I)       REACTION TYPE IDENTIFICATION NUMBER
CD      MWGT(I)       CROSS SECTION WEIGHTING OPTION
CD
CD              1 - CONSTANT
CD              2 - 1/E
CD              3 - THERMAL + 1/E + FISSION
CD              4 - ARBITRARY
CD              5 - COMBINED CTR CRBR
C-----

```

```

C-----
CR          MATERIAL - REACTION TYPE CROSS SECTIONS
CR          AND ERROR FILES
CL      (CRS(J) , J=1 , NGROUP) , (ERROR(J) , J=1 , NGROUP)
CW      2*NGROUP
C
CB      FORMAT(4H 6D , 5E12.4/(6E12.4))
C
CD      CRS          CROSS SECTION
CD      ERROR        STANDARD DEVIATION
C-----

```

```

C-----
CR          MATRIX CONTROL
CL      MAT1, MT1, MAT2, MT2, NBLOK
CW      5
C
CB      FORMAT(4H 7D , 5I6)
C
CD      MAT1          MATERIAL 1 IDENTIFICATION NUMBER
CD      MT1           REACTION TYPE 1 IDENTIFICATION NUMBER
CD      MAT2          MATERIAL 2 IDENTIFICATION NUMBER
CD      MT2           REACTION TYPE 2 IDENTIFICATION NUMBER
CD      NBLOK         NUMBER OF BLOCKS INTO WHICH MATRIX IS SUBDIVIDED
C-----

```

```

C-----
CR          BLOCK CONTROL
CL      (JBAND(J) , IJJ(J) , J=1 , NGROUP) , (LGRP(N) , N=1 , NBLOK)
C
CW      2*NGROUP + NBLOK
C
CB      FORMAT(4H 8D , 11I6/(12I6))
C
CD      JBAND(J)      BANDWIDTH FOR GROUP J
CD      IJJ(J)        POSITION OF DIAGONAL ELEMENT FOR GROUP J
CD      LGRP(N)       NUMBER OF GROUPS IN BLOCK(N)
C-----

```

```
C-----  
CR          MATRIX DATA  
CL          (COV(K),K=1,KMAX)  
C  
CC          KMAX=SUM OVER JBAND(J) FOR ALL J IN BLOCK N  
CW          KMAX  
C  
CB          FORMAT(4H 9D ,5E12.4/(6E12.4))  
C  
C  
CD          COV          NTYPE MATRIX DATA  
C-----  
COEF
```

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APPENDIX B.

Sample Problem

The following sample input and output problem utilizes the seven execution paths available in the COVERX Service Module. The user should be aware that although all the execution paths are utilized in the sample problem, the input parameters may vary depending on the user's requirements.

A description of the input to the sample problem follows:

1. CONVERT - The formatted card image COVERX file residing on unit 24 is converted to a binary file on unit 32, and the resulting file is listed using the reduced file edit option.
2. EDIT - The $^{235}\text{U}(n,f)$ covariance matrix is extracted from the binary COVERX file and copied to unit 33 creating a new COVERX file containing one covariance matrix. The output for EDIT gives a complete listing of the COVERX file.
3. FIX - The $^{235}\text{U}(n,f)$ covariance data residing on unit 33 is changed as follows:

The Hollerith description of the file is modified
(2##),

The cross sections were modified (4**),

The matrix control record was modified renaming the
 $^{235}\text{U}(n,f)$ covariance data (5\$\$),

The block control record was modified (6\$\$), and

The covariance data was modified (7**).

The output of FIX resides on unit 34, and a complete listing of the input plus all modifications is given.

4. EDIT - Three additional covariance matrices were extracted from unit 32 and copied to unit 35.
5. MERGE - The COVERX file residing on unit 35 and the one residing on unit 34 are merged to produce a single COVERX file on unit 33 containing four covariance matrices.
6. DELETE - The covariance matrix indicated in the 2\$\$ array is deleted from unit 33, and the remaining covariances are placed on unit 34.
7. ADD - A new covariance indicated in the 2\$\$ array was added to the COVERX file residing on unit 34 with inclusion of the Block control record (4\$\$) and covariance data (5**). This produced a new COVERX file on unit 33.
8. LIST - The entire COVERX file residing on unit 33 was listed.

APPENDIX B.1. Job Control Cards for Local Use and Sample Input
for the COVERX Service Module

```

//JDD00002 JCE (18075),'J DRISCHLER, 6025'
//*CLASS CPU91=10S,IC=02.0,R=270K
//STEP1 EXEC FCRTHLG,FARM.LKED='NOMAF,NOLIST',REGION.GO=270K
//LKED.COVERX.CC UNIT=3330,VCL=SER=ZX0000,DISP=SHR.
// DSN=JDD.JAN2180.CCOVERX.SERVICE
//LKED.SYSIN CC *
  INCLUDE CCOVERX
/*
//GO.FT24F001 DD UNIT=SP0A,DISP=(SHR,CATLG),VCL=,
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120),
// SPACE=(TRK,(20,20),PLSE),
// DSN=T.JDD1E075.TEMP1.JAN1780
//GO.FT31F001 DD UNIT=SYSDA,SPACE=(TRK,(010,010)),
// DCB=(RECFM=VRST,LRECL=X,BLKSIZE=3120)
//GO.FT32F001 DD UNIT=SYSDA,SPACE=(TRK,(010,010)),
// DCB=(RECFM=VRST,LRECL=X,BLKSIZE=3120)
//GO.FT33F001 DD UNIT=SYSDA,SPACE=(TRK,(010,010)),
// DCB=(RECFM=VRST,LRECL=X,BLKSIZE=3120)
//GO.FT34F001 DD UNIT=SYSDA,SPACE=(TRK,(010,010)),
// DCB=(RECFM=VRST,LRECL=X,BLKSIZE=3120)
//GO.FT35F001 DD UNIT=SYSDA,SPACE=(TRK,(010,010)),
// DCB=(RECFM=VBST,LRECL=X,BLKSIZE=3120)
//GO.FT41F001 DD UNIT=SYSDA,
// SPACE=(TRK,(05,05)),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT42F001 DD UNIT=SYSDA,
// SPACE=(TRK,(05,05)),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT05F001 DD *
CONVERT
0
1## 1 24 32 0 T
EDIT
1## 32 1 33 0 T
2## 1261 18 1261 18 T
FIX
1## 33 34 1 1 0 T
2##
SG4 6H(12A6) 6+ E T
THIS IS A SAMPLE PROCELEM
3## 1261 18 1261 18 1 1 1 1 T
4## F1.0 T
5## 1266 18 1266 18
6## 0 1 502 A1 6 1 18 502 06 6
7## 17 35 32 35 32 35 32 35 32 35 32 35 22 T
EDIT
1## 32 3 35 0 T
2##
1262 18 1262 18
1264 18 1264 18
1262 18 1264 18
T
MERGE
1## 35 34 33 T
DELETE
1## 33 34 1 T
2## 1262 18 1264 18 T
ADD
1## 34 1 33 0 T
2## 1261 452 1266 452 T
4## 0 1 502 A1 6 1 18 502 06 6
5## F1.33226-5 T
LIST
1## 33 T
/*
//
IHC002I STCP 0

```


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APPENDIX B.2. Sample Output for the COVERX Service Module

I. CONVERT OUTPUT

COVERX EXECUTION PATH SELECTED... CONV

PRT CN UC
118 1 24 32 0 T

15 ARRAY 4 ENTRIES READ

OT

IN CONV, CORE AVAILABLE 25000 CORE NEEDED 127
A CROSS-SECTION COVARIANCE FILE IN COVERX FORMAT WILL BE READ IN RECDIC FROM UNIT 24
AND WILL BE WRITTEN IN BINARY CNTC UNIT 32

*****AN EDIT OF THE COVERX CROSS-SECTION COVARIANCE FILE IS PRINTED HERE*****
FILE IDENTIFICATION RECORD..... 0V COVERX COVERX*CRNL - FORSS* 13 1 32 11
FILE CONTROL RECORD..... 1D 6 6 3 2 13 32 11
FILE DESCRIPTION..... 2D *FISSION SPECTRUM COVARIANCE MATRIX LIBRARY (CODIVA WEIGHTING).

NEUTRON GROUP BOUNDARIES..... 3D 2.0000E 07 3.6720E 06 1.3530E 06 4.9790E 05 1.8320E 05
4.0870E 04 1.0000E-05

| | | | | | | | |
|-------------------------------|------|----|------|-----|------|-----|---|
| MATRIX CONTROL RECCRC.....NO. | 1.. | 7D | 1261 | 18 | 1261 | 18 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 2.. | 7D | 1261 | 452 | 1261 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 3.. | 7D | 1261 | 102 | 1261 | 102 | : |
| MATRIX CONTROL RECCRC.....NO. | 4.. | 7D | 1261 | 18 | 1262 | 18 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 5.. | 7D | 1261 | 18 | 1264 | 18 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 6.. | 7D | 1261 | 452 | 1262 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 7.. | 7D | 1261 | 452 | 1264 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 8.. | 7D | 1261 | 452 | 1265 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 9.. | 7D | 1261 | 452 | 1266 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 10.. | 7D | 1262 | 18 | 1262 | 18 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 11.. | 7D | 1262 | 452 | 1262 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 12.. | 7D | 1262 | 51 | 1262 | 51 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 13.. | 7D | 1262 | 52 | 1262 | 52 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 14.. | 7D | 1262 | 53 | 1262 | 53 | : |
| MATRIX CONTROL RECCRC.....NO. | 15.. | 7D | 1262 | 54 | 1262 | 54 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 16.. | 7D | 1262 | 102 | 1262 | 102 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 17.. | 7D | 1262 | 18 | 1264 | 18 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 18.. | 7D | 1262 | 452 | 1264 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 19.. | 7D | 1262 | 452 | 1265 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 20.. | 7D | 1262 | 452 | 1266 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 21.. | 7D | 1264 | 18 | 1264 | 18 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 22.. | 7D | 1264 | 452 | 1264 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 23.. | 7D | 1264 | 102 | 1264 | 102 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 24.. | 7D | 1264 | 18 | 1264 | 102 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 25.. | 7D | 1264 | 452 | 1265 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 26.. | 7D | 1264 | 452 | 1266 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 27.. | 7D | 1265 | 452 | 1265 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 28.. | 7D | 1265 | 102 | 1265 | 102 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 29.. | 7D | 1265 | 452 | 1266 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 30.. | 7D | 1266 | 18 | 1266 | 18 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 31.. | 7D | 1266 | 452 | 1266 | 452 | 1 |
| MATRIX CONTROL RECCRC.....NO. | 32.. | 7D | 1266 | 102 | 1266 | 102 | 1 |

*****END CF EDIT OF COVERX COVARIANCE MATRIX FILE*****

THE FILE HAS BEEN SUCCESSFULLY COPIED.

II. EDIT OUTPUT

COVERX EXECUTION PATH SELECTED... EDIT

195 32 1 33 0 T

1S ARRAY 4 ENTRIES READ

DT

IN EDIT. CORE AVAILABLE 25000 CORE NEEDED

149

2ES 1261 13 1261 13 T

2S ARRAY 4 ENTRIES READ

DT

MMMP= 1E NNTFIX= 32 NC= 1
1261 1P 1261 1R

FILE ID. COVERXCRNL - FORSS 1

FILE CONTROL 6 6 0 2 1E 32 11

FILE DESCRIPTION
FISSION SPECTRUM COVARIANCE MATRIX LIBRARY (GODIVA WEIGHTING).

GROUP BOUNDARIES
2.0000E 07 3.6790E 06 1.3530E 06 4.9790E 05 1.8320E 05 4.0870E 04
1.0000E-05

MAT-MT CONTROL
1261 18 4

MAT - MT TYPE CROSS SECTIONS AND STANDARD DEVIATIONS
1.22100E 00 1.25400E 00 1.18600E 00 1.25500E 00 1.56000E 00 2.23600E 00 3.08300E-02 2.34200E-02 2.67800E-02 2.81100E-02
2.79500E-02 3.29000E-02

MATRIX CONTROL
1261 18 1261 18 1

BLOCK CONTROL
6 1 6 6 2 6 3 6 4 6 5
E E E E E E E E E E E

RELATIVE COVARIANCE MATRIX

| | | | | | |
|-------------|-------------|-------------|-------------|-------------|-------------|
| 9.50400E-04 | 3.64100E-04 | 1.51900E-04 | 4.25900E-05 | 8.14900E-06 | 0.0 |
| 3.74100E-04 | 5.48400E-04 | 7.24000E-04 | 1.59900E-04 | 4.56900E-05 | 0.0 |
| 1.51900E-04 | 3.24000E-04 | 7.17300E-04 | 5.63900E-04 | 2.24700E-04 | 0.0 |
| 4.29900E-05 | 1.59900E-04 | 5.63900E-04 | 7.90100E-04 | 3.90600E-04 | 2.60900E-04 |
| 8.14900E-06 | 4.56900E-05 | 2.24700E-04 | 3.90600E-04 | 7.26200E-04 | 5.40300E-04 |
| 0.0 | 0.0 | 0.0 | 2.60900E-04 | 5.40300E-04 | 1.08200E-03 |

III. FIX OUTPUT

```

COVERX EXECUTION PATH SELECTED... FIX
1# ARRAY      5 ENTRIES READ          1# 33 34 1 1 0 T

0T
2# ARRAY      200 ENTRIES READ        2#
EG4 6F(1245) 6H          E T

0T
IN PREFIX, CORE AVAILABLE 25000 CORE NEEDED 123
NMMP=      1 NMTRIX=      1 NCF=      1
FILE ID, COVERXCORNL - FCRES      2
3# ARRAY      8 ENTRIES READ          3# 1261 18 1261 18 1 1 1 1 T

0T
4# ARRAY      6 ENTRIES READ          4# F1.0 T

0T
5# ARRAY      4 ENTRIES READ          5# 1266 18 1266 18
6# 0 1 502 A1 6 1 12 502 00 6
7# ARRAY      13 ENTRIES READ         7# 12 35 12 35 32 35 32 35 32 35 32 35 22 T
7# ARRAY      36 ENTRIES READ

```

III. FIX OUTPUT (cont'd.)

```

DT
FILE CONTROL      E      6      0      2      1      1      4
FILE DESCRIPTION
THIS IS A SAMPLE PROGRAM
GROUP BOUNDARIES
2.0000E-07 3.6790E-06 1.3530E-05 4.5790E-05 1.8320E-05 4.0970E-04
1.0000E-05
MAT-MT CONTROL
1266 18 4
MAT - MT TYPE CROSS SECTIONS AND STANDARD DEVIATIONS
1.00000E-00 1.00000E-00 1.00000E-00 1.00000E-00 1.00000E-00 1.00000E-00 0.0 3.34170E-02 2.67825E-02 2.81087E-02
0.0 0.0
MATRIX CONTROL
1266 18 1266 18 1
BLOCK CONTROL
E 1 C 2 6 J 6 4 6 5
E 6 6
RELATIVE COVARIANCE MATRIX
0.0 0.0 0.0 0.0 0.0 0.0
3.24100E-04 5.48400E-04 1.24000E-04 1.59900E-04 4.56900E-05 0.0
1.51900E-04 1.24000E-04 7.17200E-04 5.63900E-04 2.24700E-04 0.0
4.29900E-05 1.59900E-04 5.63900E-04 7.60100E-04 3.90600E-04 2.63900E-04
0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0

```

IV. EDIT OUTPUT

COVERX EXECUTION PATH SELECTED... EDIT

185 32 3 35 0 T

18 ARRAY 4 ENTRIES READ

DT

IN RESULT, CORE AVAILABLE 25000 CORE NEEDED

181
285
1262 18 1262 18
1264 18 1264 18
1262 18 1264 18
T

28 ARRAY 12 ENTRIES READ

DT

NNND= 18 18 NNTFIX= 32 NC= 18 1264 3 18 1262 18 1264 18

FILE ID, COVERXCRNL - FORSS 1

FILE CONTROL 6 6 0 2 18 32 11

FILE DESCRIPTION
FISSION SPECTRUM COVARIANCE MATRIX LIBRARY (GODIVA WEIGHTING).

GROUP BOUNDARIES
2.0000E-07 3.2790E-06 1.3530E-06 4.5790E-05 1.8320E-05 4.0870E-04
1.0000E-05

MAT-MT CONTROL
1262 18 4 1264 18 4

MAT - MT TYPE CROSS SECTIONS AND STANDARD DEVIATIONS
6.43200E-01 4.70200E-01 1.53300E-02 1.04400E-04 4.43500E-05 7.01900E-05 3.12000E-02 2.45100E-02 2.59000E-02 3.14600E-02
7.82000E-02 1.07100E-00
1.82800E-00 1.90400E-00 1.69300E-00 1.53300E-00 1.55300E-00 1.69700E-00 3.09700E-02 2.37800E-02 2.73100E-02 2.84200E-02
2.77300E-02 3.40000E-02

MATRIX CONTROL
1262 18 1262 18 1

BLOCK CONTROL
6 1 6 2 6 3 6 4 6 5
6 6 6

IV. EDIT OUTPUT (cont'd.)

RELATIVE COVARIANCE MATRIX

| | | | | | |
|--------------|-------------|--------------|-------------|--------------|--------------|
| 9.73800E-04 | 4.14700E-04 | 2.19800E-04 | 5.19700E-05 | -5.91800E-06 | -3.34700E-07 |
| 4.14700E-04 | 6.00900E-04 | 3.94100E-04 | 1.86000E-04 | 6.23000E-05 | 2.54700E-07 |
| 2.19800E-04 | 3.94100E-04 | 6.70900E-04 | 2.87000E-04 | 8.17800E-05 | -6.07900E-07 |
| 5.19700E-05 | 1.86000E-04 | 2.87000E-04 | 9.89500E-04 | 1.16800E-03 | 2.26700E-04 |
| -5.91800E-06 | 6.23000E-05 | 8.17800E-05 | 1.16800E-03 | 6.11600E-03 | 6.46200E-04 |
| -3.34700E-07 | 2.54700E-07 | -6.07900E-07 | 2.26700E-04 | 6.46200E-04 | 1.14600E-03 |

MATRIX CONTROL
1262

19 1264 18 1

BLOCK CONTROL
6 6

1 6 2 6 3 6 4 6 5

RELATIVE COVARIANCE MATRIX

| | | | | | |
|-------------|-------------|-------------|-------------|-------------|-------------|
| 9.50400E-04 | 3.94100E-04 | 1.51500E-04 | 4.25900E-05 | 8.14900E-06 | 0.0 |
| 3.94100E-04 | 5.48400E-04 | 3.24000E-04 | 1.59900E-04 | 4.56500E-05 | 0.0 |
| 1.51900E-04 | 3.24000E-04 | 7.17300E-04 | 5.63900E-04 | 2.24700E-04 | 0.0 |
| 4.25900E-05 | 1.59900E-04 | 5.63900E-04 | 7.90100E-04 | 3.50600E-04 | 2.60900E-04 |
| 8.14900E-06 | 4.56900E-05 | 2.24700E-04 | 3.50600E-04 | 7.26200E-04 | 5.40300E-04 |
| 0.0 | 0.0 | 0.0 | 2.60900E-04 | 5.40300E-04 | 1.08200E-03 |

MATRIX CONTROL
1264

13 1264 18 1

BLOCK CONTROL
6 6

1 6 2 6 3 6 4 6 5

RELATIVE COVARIANCE MATRIX

| | | | | | |
|-------------|--------------|-------------|-------------|-------------|--------------|
| 9.59100E-04 | 4.00500E-04 | 1.55900E-04 | 4.46000E-05 | 7.99400E-06 | 2.28500E-07 |
| 4.00500E-04 | 5.65700E-04 | 3.31700E-04 | 1.63800E-04 | 4.88000E-05 | -7.83800E-07 |
| 1.55900E-04 | 3.31700E-04 | 7.45700E-04 | 5.80400E-04 | 2.34800E-04 | 9.08200E-07 |
| 4.46000E-05 | 1.63800E-04 | 5.80400E-04 | 8.07400E-04 | 4.00900E-04 | 2.62200E-04 |
| 7.99400E-06 | 4.88000E-05 | 2.34800E-04 | 4.00900E-04 | 7.68700E-04 | 5.37200E-04 |
| 2.28500E-07 | -7.83800E-07 | 9.08200E-07 | 2.62200E-04 | 5.37200E-04 | 1.15600E-03 |

V. MERGE OUTPUT

COVERX EXECUTION PATH SELECTED... MERG

198 35 34 33 T

18 ARRAY 3 ENTRIES READ

DT

IN-MERG, CORE AVAILABLE 25000 CORE NEEDED 190

| MERGE | 35 | 34 | 33 | | | | | | | | | | |
|-------|------|----|----|---|---|------|----|--|---|------|----|--|---|
| IFC | 6 | 6 | 0 | 2 | 2 | 3 | 11 | | | | | | |
| JFC | 6 | 6 | 0 | 2 | 1 | 1 | 4 | | | | | | |
| | 1262 | | 18 | 4 | | 1264 | 18 | | 4 | 1266 | 18 | | 4 |

VI. DELETE OUTPUT

COVERX EXECUTION PATH SELECTED... DELE

115 33 34 1 T

1# ARRAY 3 ENTRIES READ

QT

IN FDCL. CORE AVAILAELE 25000 CORE NEEDED

114

21# 1262 13 1264 18 T

2# ARRAY 4 ENTRIES READ

QT

NBINE= 33 NEW= 34 NC= 1
1262 18 1264 18

***** DELETED ***** MATRIX CONTROL RECORD... NO. 2. 1262 18 1264 18

VII. ADD OUTPUT

COVERX EXECUTION PATH SELECTED... ADD

138 34 1 33 0 T

13 ARRAY 4 ENTRIES READ

0T

IN FADD, CORE AVAILABLE 25000 CORE NEEDED

84
218 1261 452 1266 452 T

23 ARRAY 4 ENTRIES READ

0T

488 0 1 502 A1 E 1 13 502 03 6
5** F1.33225-5 T

43 ARRAY 13 ENTRIES READ

53 ARRAY 36 ENTRIES READ

0T

IN FMERG, CORE AVAILABLE 25000 CORE NEEDED 190

MERGE 34 31 33

IFC 6 6 0 2 3 3 4

JFC 6 6 0 2 0 1 4

1262 18 4 1264 18 4 1266 18 4

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