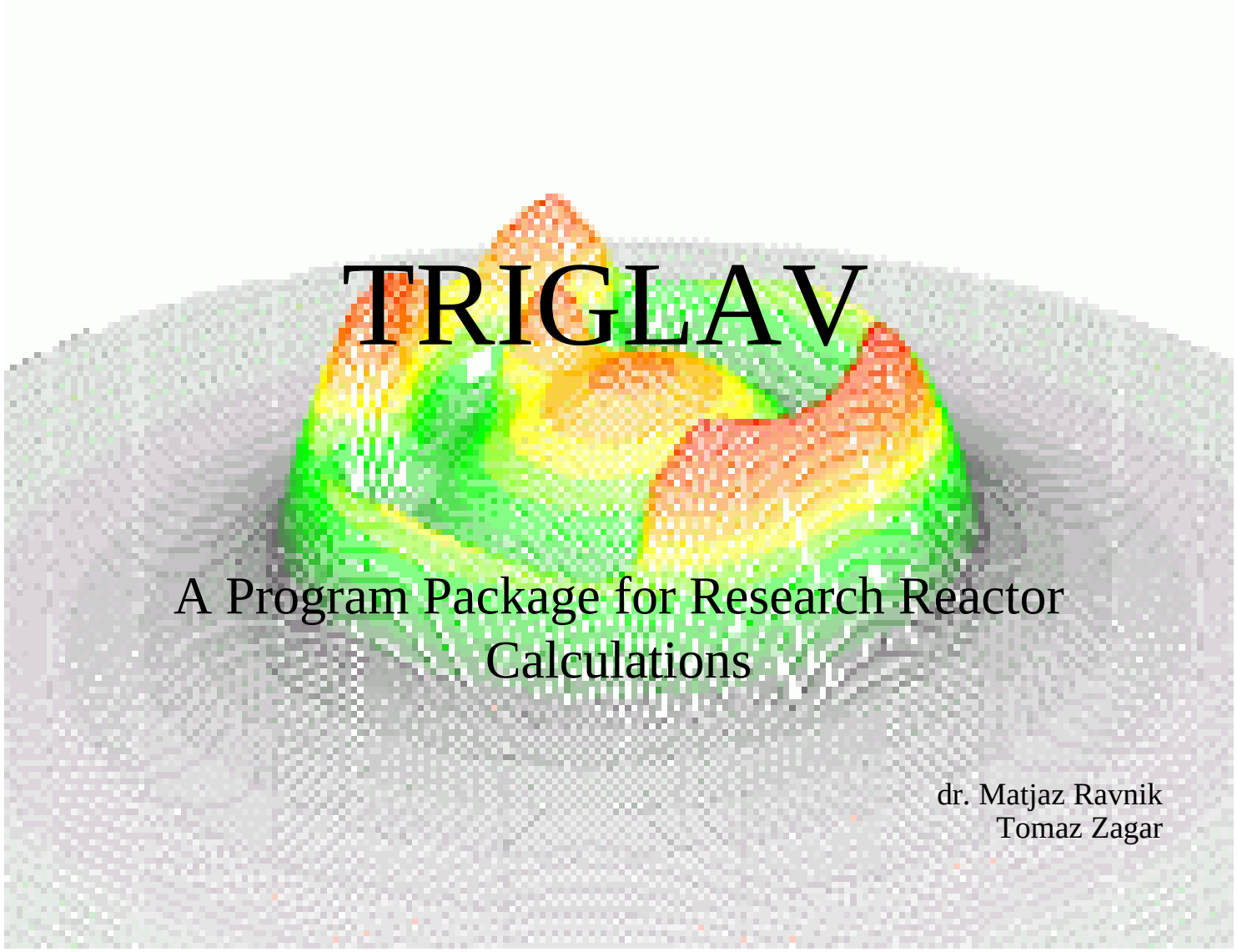


TRIGLAV

A Program Package for Research Reactor Calculations

dr. Matjaz Ravnik
Tomaz Zagar

Introduction

reactor calculations in TRIGA research reactor:

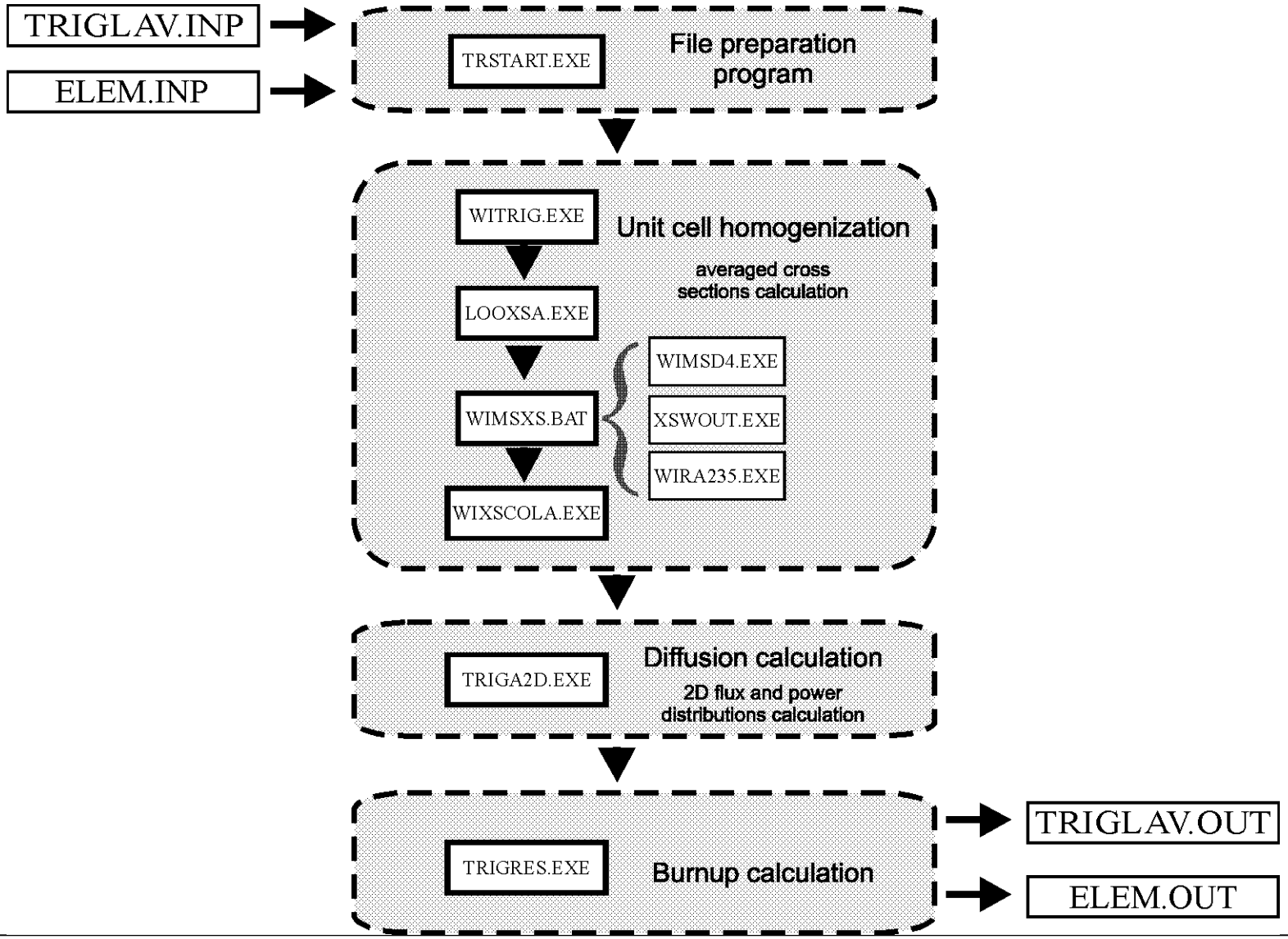
- fuel element burnup calculations
- power and flux distributions calculations
- criticality predictions

Reactor core calculation: - four group time independent diffusion equation in two dimensional cylindric (r,ϑ) geometry.

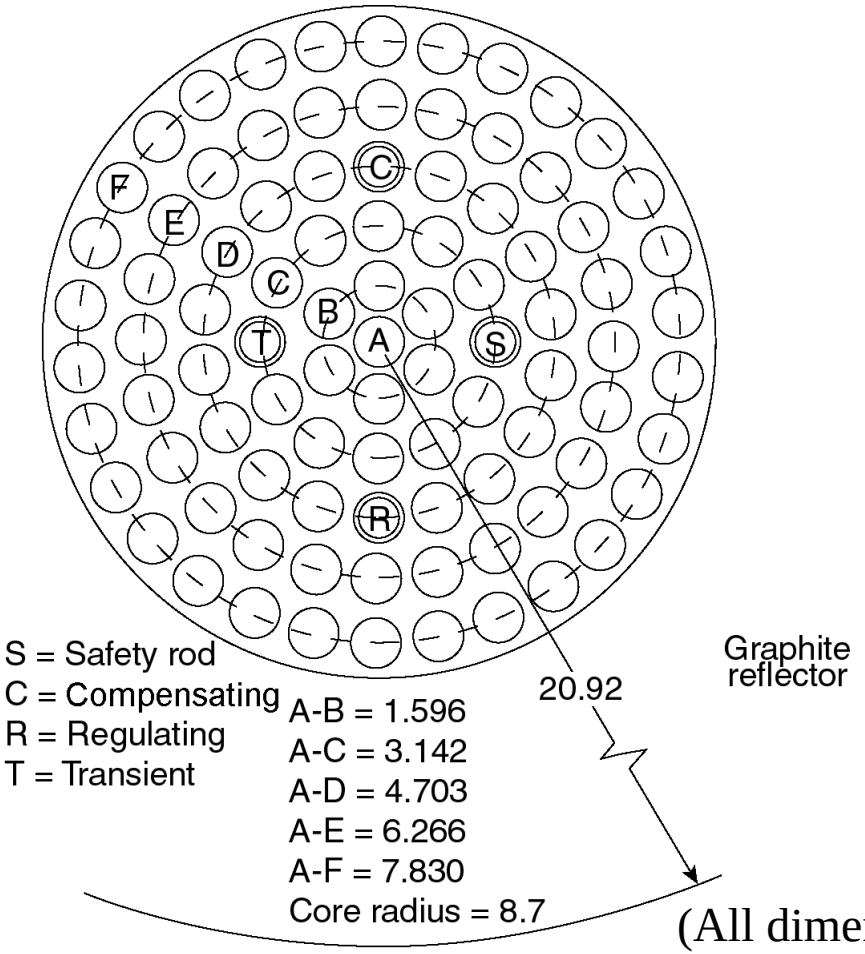
Unit cell calcualtions: - standard lattice code WIMSD4 + TRIGA specific library

Option: WIMSD5 + ENDF/B-VI based library

TRIGLAV schematic flow-chart

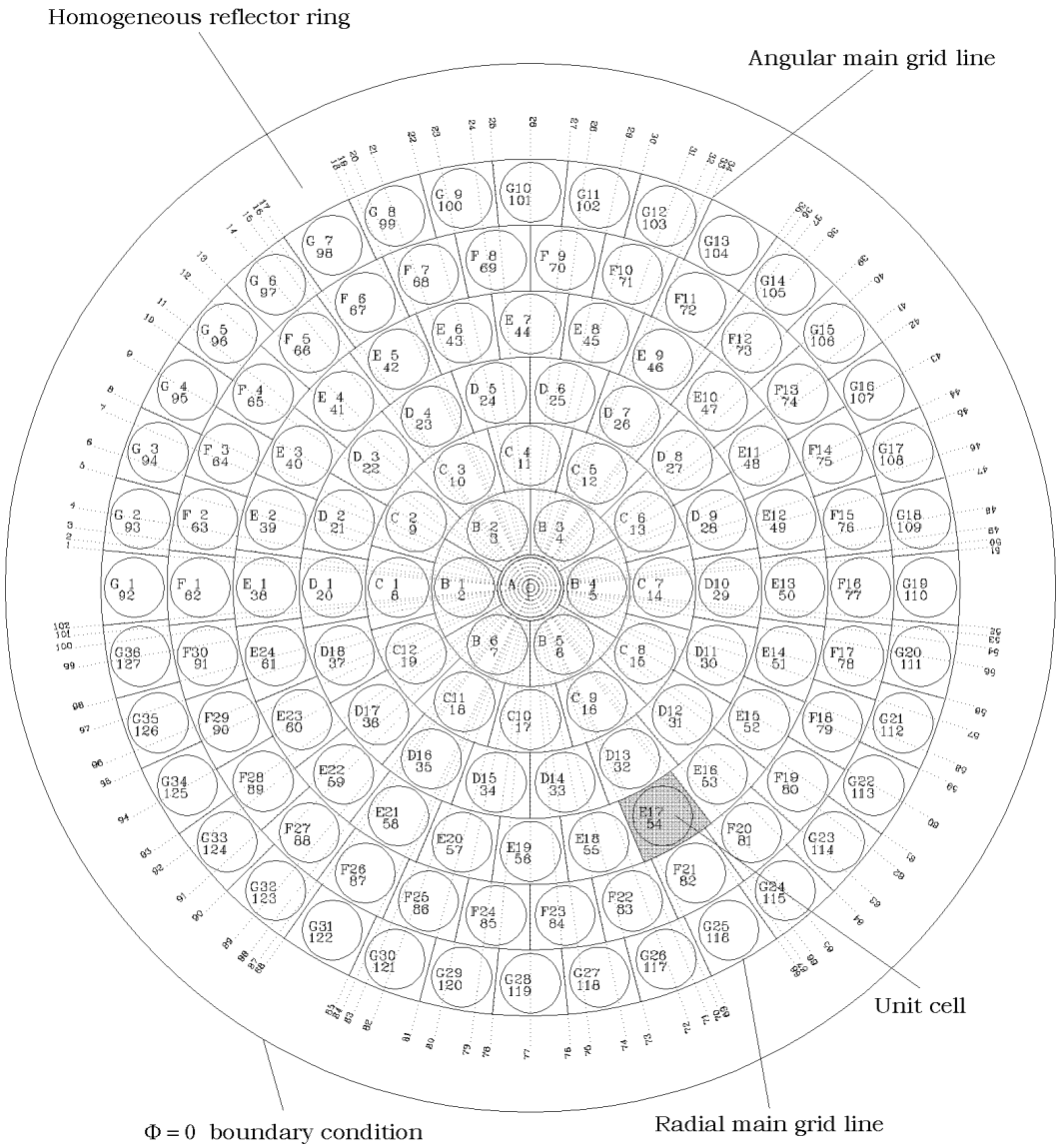


TRIGA reactor core geometry



(All dimensions are in inches)

TRIGLAV core geometry



TRIGLAV
general characteristics

geometry	two dimensional cylindric
number of energy groups in diffusion calculation	4
upscattering	not neglected
method of solution	finite differences method fission density iteration
unit cell homogenization	online with lattice cell program WIMS-D/4 in unit-cell approximation
number of energy groups in WIMS calculation	32
CPU time (Pentium PC)	≈1000*s*

Unit-cell homogenisation

Standard lattice code WIMSD4

- Supported fuel unit-cells:
  - ST8
  - ST12
  - FLIP
  - LEU
- Supported non-fuel unit-cells:
  - GR
  - BE
  - IC1 (void tube)
  - IC2 (half void tube)
  - LW
- Reflector types: W or G

Unit-cell homogenisation

General description of supported fuel elements

Fuel elements considered in TRIGLAV.

	ST8	ST12	FLIP	LEU
Dimension [cm]				
Fuel length	38.1	38.1	38.1	38.1
Element diameter	3.75	3.75	3.75	3.75
Fuel diameter	3.64	3.64	3.64	3.64
Zr-rod diameter	0.635	0.635	0.635	0.635
Cladding thickness	0.05	0.05	0.05	0.05
Composition				
part of U in fuel [wt %]	8.5	12	8.5	20
$\rho_{init.}$ [gcm^{-3}]	5.8	6.1	5.9	6.4
$m_{init.}(U)$ [g]	190.2	276.6	191.8	494.9
$(wt\ \%\ ^{235}U)_{init.}$ [wt %]	0.017	0.023	0.059	0.040
$e_{init.}$ [%]	19.9	19.9	70.0	19.8
$(wt\ \%\ ^{166}Er)_{init.}$ [wt %]			0.005	0.001
$m(^{166}Er)_{init.}$ [g]			11.5	3.6
$(wt\ \%\ ^{167}Er)_{init.}$ [wt %]			0.003	0.001
$m(^{167}Er)_{init.}$ [g]			7.9	2.5

Sample WIMSD input file

```
* WIMS-D/4 :********************  No.,Id.=  8  7255 ST12
* RoUr    6.22438 W235    0.02332 W166    0.00000  W167   0.00000  PEl   6.06718
* TUran 496.21127 TWate 311.29999 RoWat   0.99094r MUrR 281.16000  BuMWR 0.00000
* st. 12% triga fuel.el., P=10kW/el., P(spec.)=35.971kW/kgU
* IDENT    ST12
CELL 6
SEQUENCE 1
NGROUP 32
NMESH 11 11
NREGION 5 0 5
NMATERIAL 4 1
PREOUT
INITIATE
ANNULUS 1 0.31750 4
ANNULUS 2 1.82245 1
ANNULUS 3 1.82626 0
ANNULUS 4 1.87706 2
ANNULUS 5 2.31317 3
FEWGROUP 2 4 6 11 14 21 23 25 26 27 28 29 30 32 33 35 38 $
         40 41 43 45 47 49 52 54 55 56 57 60 63 66 69
MESH 1 4 1 1 4
BUCKLING 0.0  0.00464
MATERIAL 1 6.2244 496.21  1   235.4  0.0233190  2238.4  0.0938579  91    0.8670113 $
                           5001    0.0158076  3239.1  0.0000000
MATERIAL 2 7.8890 403.76  2  1056    1.0000000
MATERIAL 3 0.9909 311.30  3  2001    0.1119000  16      0.8881000
MATERIAL 4 6.4900 496.21  2  91      1.0000000
POWERC 0 0
BEGINC
LEAKAGE 5
BUCKLING 0.0  0.00464
BEGINC
POWERC 0 0
BEGINC
BEGINC
* EOF
```

TRIGLAV

Institut Jozef Stefan, Reactor Physics Department

TRIGLAV input file description

Input is in free format, data are read in line following the keyword.

$* TRIGLAV
max 2 lines of comments

$* FLAGS (for output formation control)

1st flag: XS
2nd flag: inner iterations } TRIGLAV.OUT (for control)
3rd flag: flux data

! 4th flag: flux data to special file

$* ITERATIONS (max number of)

$* CONVERGENCE

$* BUCKLING
axial B^2 in [cm^{-2}]
TRIGA fuel 38.1cm $\Rightarrow B^2 \approx 0.0068 cm^{-2}$

$* POWER
in [kW] (avoid 0kW power)

$* XENON
`POWERC 0 0` keyword added to WIMSD input

$* BURNUP
burnup core time step in [days]

$* RINGS
two types of TRIGAs with 6 or 7 rings

$* MESH
1 very coarse 8x102
2 coarse 54x102
3 normal 90x102
11 coarse
12 normal } approx. equidistant
13 fine

$* LOADING

fixed format

␣␣␣B-01␣ 6574␣...

location — fuel element number or non-fuel element symbol

GR, BE, IC1, IC2, IC3, LW

ELEMENT file description

Fixed format! First two lines are for comments and are ignored.

ELEM.INP

id	type	mU[g]	e[%]	Er166[g]	Er167[g]	BU[MWd]	BU[%]	BUi[MWd]
6574	ST12	279.00	19.90	0.00	0.00	0.000	0.00	
6753	ST12	272.94	19.90	0.00	0.00	0.000	0.00	

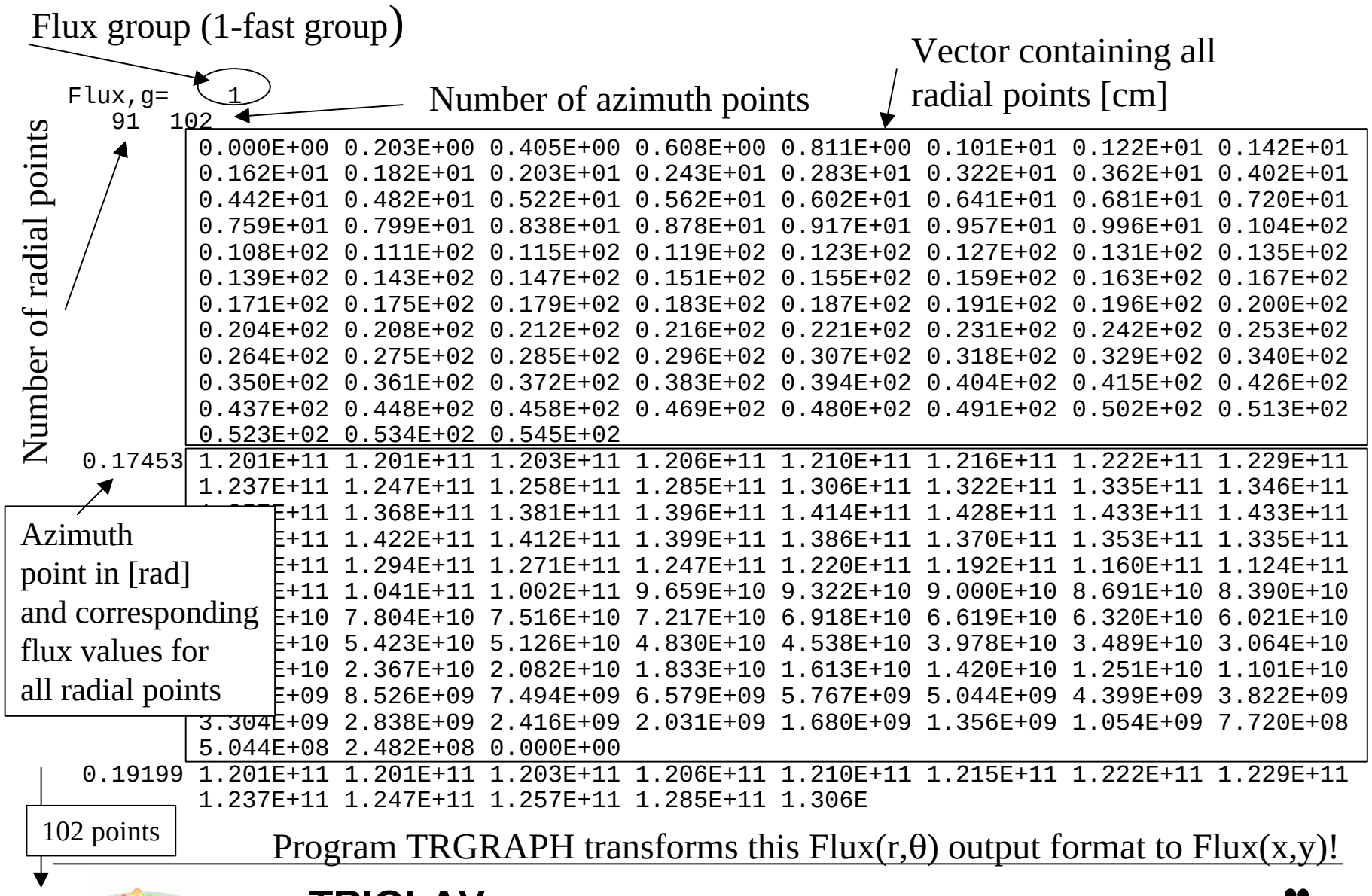
columns

1-4	6-9	11-20	21-30	31-40	41-50	51-60	61-70	71-80

ELEM.OUT

6077	ST8	192.00	19.99	0.00	0.00	5.344	17.49	0.464
6078	ST8	192.00	19.99	0.00	0.00	5.775	18.87	0.470

TRIGA2D.FLU file



Program TRGRAPH transforms this Flux(r,θ) output format to Flux(x,y)!

Subroutines

TRSTART

WITRIG (WIMSD input files preparation)

- power per element calculation
- material composition calculation
- temperature calculation
- burnup correction, xenon correction

LOOXA

WIMSXS (WIMSD runs)

WIXSCOLA

TRIGA2D (diffusion equation solution)

TRIGRES (burnup increment calculation)

Subroutine WITRIG (1)

Initial guess for power distribution is calculated as follows:

$$P_{el} = \alpha_P(R)\frac{m_{el}(U)}{\overline{m}}(1 - \frac{BU_2}{100})\overline{P}, \quad (3)$$

$$\overline{m} = \frac{\sum_{el} m_{el}(U)}{N}, \quad (4)$$

$$\overline{P} = \frac{P}{N}, \quad (5)$$

where:

$\alpha_P(R)$	is power form factor of the ring R (see Table 3),
$m_{el}(U)$	is mass of ^{235}U in element,
$\overline{m}$	is average mass of ^{235}U per element in the core,
BU_2	is burnup of the element in percent of ^{235}U,
P	is thermal power of the reactor and
$\overline{P}$	is average power in the core,
N	is number of fuel elements in core.

It is important to note, that this guess is used only for temperature profile calculation needed in the cross section homogenization and for xenon concentration calculation.

Subroutine WITRIG (2)

Fuel element composition

The density of the fuel and the weight-percent of the ^{235}U for the specific fuel element are calculated according to the input data $m(U)$ and e read from input file (`ELEM.INP` file).

$$\rho_{fuel} = \rho_{init.} \frac{m(U)}{m_{init.}(U)}, \tag{6}$$

$$wt\%^{235}U = (wt\%^{235}U)_{init.} \frac{e}{e_{init.}}. \tag{7}$$

$m_{init.}$, $\rho_{init.}$, $e_{init.}$ and $(wt\%^{235}U)_{init.}$ are typical values built in the model. FLIP and LEU fuel elements contain also burnable absorbers ^{166}Er and ^{167}Er. The weight-percent for both Er isotopes is calculated for every FLIP and LEU element:

$$wt\%Er = (wt\%Er)_{init.} \frac{m(Er)}{m(Er)_{init.}}. \tag{8}$$

Fuel temperature

Is calculated according to the following empirical relation between power of the element and its fuel temperature:

$$T_{fuel,el} = T_{fuel}(P_{el}) = a_1 P_{el} + a_2 P_{el}^2 + a_3 P_{el}^3 + T_{water}, \tag{9}$$

$$a_1 = 67.18 K/kW, a_2 = -8.381 K/kW^2, a_3 = 0.3843 K/kW^3,$$

where specific element power P_{el} in [kW] is calculated in equation(3).

Subroutine WITRIG (3)

Burnup correction

The unit cell cross sections are calculated at given burnup with WIMS using the BURNUP option. Burnup of fuel element (BU_1 in [MWd]) is given on the input. It is divided into *n* intervals, each 1MWd in size and a reminder γ of correct size (interval *n*+1) to accommodate the prescribed burnup value BU_1:

$$BU_1 = nb + \gamma \tag{11}$$

$$\gamma = BU_1 \bmod b \tag{12}$$

$$b = 1MWd$$

Xenon correction

The equilibrium concentration of ^{143}Xe is calculated for each fuel element at it s specific power using WIMS code. As the initial fuel element specific power distribution is unknown, its distribution P_{el} is given by equation (3).

Subroutine TRIGA2D

TRIGA2D was developed as a stand-alone two-dimensional multigroup diffusion code. In TRIGLAV program, TRIGA2D is used as a subroutine. In TRIGA2D diffusion equation is solved, using finite diferences method, with iteration of fission density.

$$- \bigtriangledown D^g \bigtriangledown \Phi^g + \Sigma_r^g \Phi^g = (\frac{1}{k}) \chi^g F + \sum_{g'=1, g' \neq g}^{4} \Sigma^{g' \rightarrow g} \Phi^{g'}; g = 1, \ldots, 4, \qquad (1)$$

where:

Φ^g	neutron flux,
D^g	diffusion constant,
Σ_r^g	removal cross section $(\Sigma_r^g = \Sigma_a^g + \sum_{g'=1, g' \neq g}^{4} \Sigma^{g \rightarrow g'} + D^g B_z^2)$,
$\Sigma^{g' \rightarrow g}$	scattering cross section from group g' into group g,
χ^g	part of fission spectrum in group g (default TRIGLAV: $\chi_1 = 1$, $\chi_2 = \chi_3 = \chi_4 = 0$),
k	multiplication factor,
F	fission density, which is defined as:

$$F = \sum_{g=1}^{4} \nu^g \Sigma_f^g \Phi^g, \qquad (2)$$

Subroutine TRIGRES (1)

TRIGRES calculates the burnup increment of each element if required. Reactor power P and burnup time step Δt are taken from subroutine. Element power P_{el} values are calculated from fission density distribution $F(r,\vartheta)$. Element power is normalized as follows:

$$P_{el} = \beta_P \frac{c}{\nu} \int_{V_{el}} F(r,\vartheta) dV, \qquad (13)$$

where normalization factor β_P is defined as

$$\beta_P = \frac{P}{\frac{c}{\nu} \int_{V_{core}} F(r,\vartheta) dV}. \qquad (14)$$

In first equation integration takes place over volume of each particular fuel element V_{el} and in last equation integration takes place over entire core volume V_{core}. Here P is thermal reactor power in [kW], c=3,15 •10^{-11} J and ν= 2.45.
Burnup increments are then calculated as follows:

$$\Delta BU_{1,el} = P_{el} \Delta t. \qquad (15)$$

Results of TRIGRES are burnup increments ΔBU_{el} for all fuel elements in the reactor core ($\Delta BU_{1,el}$ in [MWd] and $\Delta BU_{2,el}$ in [%]).

Subroutine TRIGRES (2)

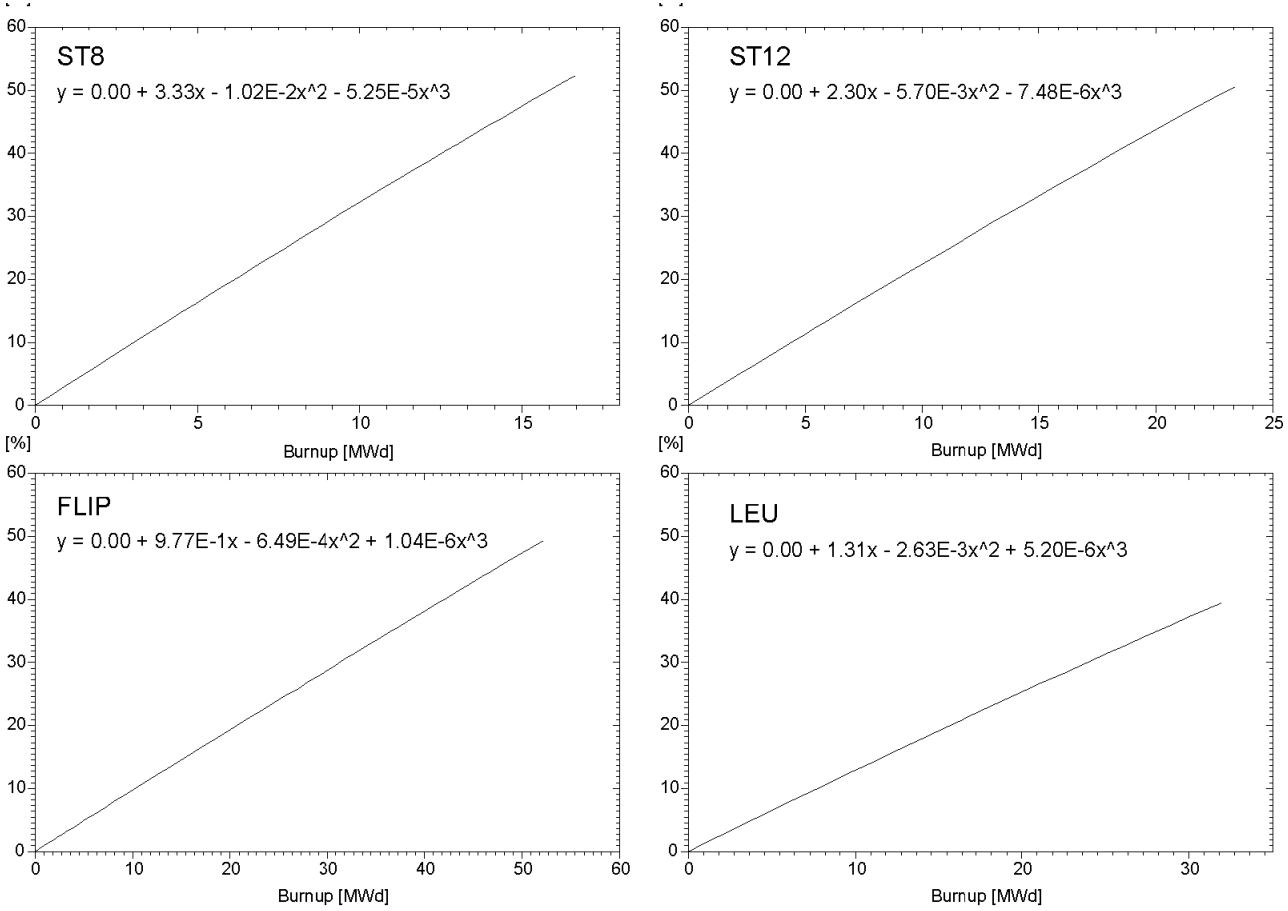


Figure 4: Relations between element burnup in [MWd] and in [%] for considered fuel elements.

```
$* TRIGLAV
Reactor core No:132, 19.9.1991
(P=0.01kW, Tw=296.65K, Xe=0, t=0d, R=6, M=3)
$* FLAGS         ! print control flags:
   0             ! (0-no, 1-yes) cross sections printout
   0             ! (0-no, 1-yes) inner iterations data printout
   0             ! (0-no, 1-yes) flux data printout
   0             ! (0-no, 1-yes) flux data printout TRIGA2D.FLU
$* ITERATIONS    ! maximum allowed number of:
   900           ! inner iterations
   900           ! outer iterations
$* CONVERGENCE   ! convergence criterion for:
   0.0000001     ! inner iterations
   0.001         ! outer iterations
   0.00001       ! multiplication factor
$* BUCKLING      ! squared axial buckling for all four groups
   0.0041        ! [cm-2]
$* POWER         ! thermal reactor power
   0.01          ! [kW]
$* TWATER        ! water temperature
   296.65        ! [K]
$* XENON         ! xenon correction flag
   0             ! (0-Xe free, 1-Xe in equilibrium)
$* BURNUP        ! burnup interval in days
   0.0           ! [days]
$* RINGS         ! number of rings in reactor
   6             ! (6-rings A-F, 7-rings A-G)
$* MESH          ! finite difference mesh type
   2             ! (select 1, 2, 3, 11, 12, or 13)
$* LOADING       ! core loading pattern
   A-01 6753
   B-01 6574 B-02 6945 B-03 6947 B-04 7251 B-05 6754 B-06 7248
   C-01 7255 C-02 7212 C-03 7213 C-04 IC4  C-05 7214 C-06 7249
   C-07 7282 C-08 7217 C-09 7257 C-10 7178 C-11 7219 C-12 7220
   D-01 7177 D-02 7235 D-03 7256 D-04 7223 D-05 7247 D-06 7268
   D-07 7228 D-08 7229 D-09 7266 D-10 7179 D-11 7232 D-12 7233
   D-13 7270 D-14 7236 D-15 7225 D-16 7265 D-17 7245 D-18 7218
   E-01 LW   E-02 LW   E-03 LW   E-04 7250 E-05 7259 E-06 7254
   E-07 7252 E-08 7253 E-09 7258 E-10 7261 E-11 LW   E-12 IC1
   E-13 LW   E-14 LW   E-15 LW   E-16 LW   E-17 LW   E-18 LW
   E-19 LW   E-20 LW   E-21 LW   E-22 LW   E-23 LW   E-24 LW
   F-01 LW   F-02 LW   F-03 LW   F-04 LW   F-05 LW   F-06 LW
   F-07 LW   F-08 LW   F-09 LW   F-10 LW   F-11 LW   F-12 LW
   F-13 LW   F-14 LW   F-15 LW   F-16 LW   F-17 LW   F-18 LW
   F-19 LW   F-20 LW   F-21 LW   F-22 LW   F-23 LW   F-24 LW
   F-25 LW   F-26 LW   F-27 LW   F-28 LW   F-29 LW   F-30 LW
      R G
```

```
 ------------------------------------------------------------------------------
 I                Program TRIGLAV,   At-PC-execution:  xx-xxx-xx  xx:xx:xx    I
 ------------------------------------------------------------------------------

 File names               :
 -------------------------
 Cross sections input file:TRIGA2D.XS
 Triga2D input file       :TRIGA2D.INP
 Triga2D output file      :TRIGA2D.OUT
 Output power file        :TRIGA2D.P
 Flux output file         :TRIGA2D.FLU

 Comments:
 ---------
Reactor core No:132, 19.9.1991,
(B2=0.0057, P=0.01kW, Tw=296.65K, Xe=0, t=0d, R=6, M=3)

 Print control flags:
 --------------------
 Cross sections     :  0
 Inner iterations   :  0
 Flux               :  0
 Flux output file   :  0

 Physical model           :
 -------------------------
 No. of groups            :  4
 1st group boundaries[MeV] :     10.00000000      0.00911800
 2nd group boundaries[eV]  :   9118.00000000      4.00000000
 3rd group boundaries[eV]  :      4.00000000      0.62500000
 4th group boundaries[eV]  :      0.62500000      0.00000000
 Chi(ig),ig=1,4           :  1.0000  0.0000  0.0000  0.0000
 Buckling(ig),ig=1,4      :  0.0050  0.0050  0.0050  0.0050
 Thermal power[kW]        :  0.0100
 Water temperature[K]     :296.6500
 Xenon correction         :  0
 Burnup time[days]        :  0.0000

 Core geometry parameters  :
 --------------------------
 No. of fuel rings        :  6
 Fuel ring outer radius[cm]:  2.0270  6.0175  9.9595 13.9270 17.9020 22.0600
 Reflector outer radius[cm]: 54.5000
 No. of unit cells/ring   :  1  6 12 18 24 30
 Reflector type           :G

 Numerical parameters     :
 -------------------------
 Inner iterations limit   :900
 Outer iterations limit   :900
 Inner iter. con. criterion:   0.100000E-06
 Outer iter. con. criterion:   0.100000E-02
 K-eff conver. criterion  :   0.100000E-04

 Mesh type                :  3

 Radial mesh points
 No. of points/ring       : 10 10 10 10 10 10
 No. of points/reflector  : 30
 Sum. of radial mesh points: 90
```

file: TRIGLAV.OUT (part 1)

```
Angular mesh points
No. of basic points       :102
Mesh densification factor :  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
for each basic angular    :  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
mesh point                :  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
                             1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
                             1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
                             1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
Sum. of angular points    :102

Loading pattern:
----------------
 1 A-01 6753
 2 B-01 6574  3 B-02 6945  4 B-03 6947  5 B-04 7251  6 B-05 6754  7 B-06 7248
 8 C-01 7255  9 C-02 7212 10 C-03 7213 11 C-04 IC4  12 C-05 7214 13 C-06 7249
14 C-07 7282 15 C-08 7217 16 C-09 7257 17 C-10 7178 18 C-11 7219 19 C-12 7220
20 D-01 7177 21 D-02 7235 22 D-03 7256 23 D-04 7223 24 D-05 7247 25 D-06 7268
26 D-07 7228 27 D-08 7229 28 D-09 7266 29 D-10 7179 30 D-11 7232 31 D-12 7233
32 D-13 7270 33 D-14 7236 34 D-15 7225 35 D-16 7265 36 D-17 7245 37 D-18 7218
38 E-01 LW   39 E-02 LW   40 E-03 LW   41 E-04 7250 42 E-05 7259 43 E-06 7254
44 E-07 7252 45 E-08 7253 46 E-09 7258 47 E-10 7261 48 E-11 LW   49 E-12 IC1
50 E-13 LW   51 E-14 LW   52 E-15 LW   53 E-16 LW   54 E-17 LW   55 E-18 LW
56 E-19 LW   57 E-20 LW   58 E-21 LW   59 E-22 LW   60 E-23 LW   61 E-24 LW
62 F-01 LW   63 F-02 LW   64 F-03 LW   65 F-04 LW   66 F-05 LW   67 F-06 LW
68 F-07 LW   69 F-08 LW   70 F-09 LW   71 F-10 LW   72 F-11 LW   73 F-12 LW
74 F-13 LW   75 F-14 LW   76 F-15 LW   77 F-16 LW   78 F-17 LW   79 F-18 LW
80 F-19 LW   81 F-20 LW   82 F-21 LW   83 F-22 LW   84 F-23 LW   85 F-24 LW
86 F-25 LW   87 F-26 LW   88 F-27 LW   89 F-28 LW   90 F-29 LW   91 F-30 LW
92    R G

Results of direct diffusion equation:
-------------------------------------

Outer iterations:
OUT:     no.     k            max.F dif.    rel.max.F dif.  loc.of max.dif.

OUT:      1      0.0000183      0.0121990      1.0000000      45  12
OUT:      2      0.9374548    873.3286130      0.9999862      19  26
OUT:      3      0.9766758    108.7785640      0.1238151      11  26
OUT:      4      0.9893101     42.6564331      0.0463289      11  24
OUT:      5      0.9941360     17.0064087      0.0181516      11  22
OUT:      6      0.9960248      6.8236694      0.0072669      11  17
OUT:      7      0.9967791      2.7925415      0.0029752      11  13
OUT:      8      0.9970848      1.1760254      0.0012640      12   9
OUT:      9      0.9972122      0.5245361      0.0005816      15   5

Multiplication factor: 0.9972122
------------------------ =========
Excess reactivity    :    -279.6
------------------------ =========

CPU - elapsed time:     452.48 sec
-------------------

Power per element:
------------------
```

FUEL ELMENTS DATA

id	type	mU[g]	e[%]	Er166[g]	Er167[g]	BU[MWd]	BU[%]	BUi[MWd]
6076	ST8	192.00	19.79	0.00	0.00	7.308	23.76	
6077	ST8	192.00	19.79	0.00	0.00	5.828	19.04	
6078	ST8	192.00	19.79	0.00	0.00	5.812	18.99	
6079	ST8	192.00	19.79	0.00	0.00	7.450	24.21	
6080	ST8	192.00	19.79	0.00	0.00	7.900	25.63	
6081	ST8	192.00	19.79	0.00	0.00	5.643	18.45	
6082	ST8	192.00	19.79	0.00	0.00	6.337	20.67	
6083	ST8	192.00	19.79	0.00	0.00	6.885	22.42	
6084	ST8	192.00	19.79	0.00	0.00	5.983	19.54	
6086	ST8	192.00	19.79	0.00	0.00	5.554	18.16	
7217	ST12	279.51	19.90	0.00	0.00	0.641	1.48	0.015
7218	ST12	277.20	19.90	0.00	0.00	0.467	1.08	0.011
7219	ST12	278.74	19.90	0.00	0.00	1.938	4.44	0.013
7220	ST12	278.45	19.90	0.00	0.00	1.936	4.44	0.013
7221	ST12	276.31	19.90	0.00	0.00	0.825	1.90	0.008
7223	ST12	277.97	19.90	0.00	0.00	1.604	3.68	0.010
7225	ST12	277.32	19.90	0.00	0.00	1.681	3.86	0.011
7228	ST12	277.97	19.90	0.00	0.00	1.580	3.63	0.009
7229	ST12	277.25	19.90	0.00	0.00	1.604	3.68	0.006
7232	ST12	278.45	19.90	0.00	0.00	0.437	1.01	0.010
7233	ST12	278.45	19.90	0.00	0.00	1.693	3.89	0.010
7234	ST12	274.48	19.90	0.00	0.00	0.530	1.22	0.009
7235	ST12	280.47	19.90	0.00	0.00	0.517	1.19	0.011
7255	ST12	281.16	19.90	0.00	0.00	1.933	4.43	0.013
7256	ST12	280.11	19.90	0.00	0.00	1.598	3.67	0.010
7257	ST12	280.78	19.90	0.00	0.00	1.993	4.57	0.013
7258	ST12	274.88	19.90	0.00	0.00	0.476	1.10	0.009
7259	ST12	275.13	19.90	0.00	0.00	0.482	1.11	0.006
7260	ST12	275.61	19.90	0.00	0.00	0.000	0.00	
7261	ST12	275.37	19.90	0.00	0.00	0.816	1.88	0.009
7265	ST12	277.20	19.90	0.00	0.00	1.607	3.69	0.011
7266	ST12	276.50	19.90	0.00	0.00	0.475	1.09	0.010
7268	ST12	279.24	19.90	0.00	0.00	1.694	3.89	0.010
7270	ST12	276.38	19.90	0.00	0.00	1.666	3.82	0.010
7272	ST12	276.14	19.90	0.00	0.00	0.820	1.89	0.009
7274	ST12	274.89	19.90	0.00	0.00	0.579	1.33	0.008
7276	ST12	275.01	19.90	0.00	0.00	0.496	1.14	0.008
7278	ST12	275.49	19.90	0.00	0.00	0.827	1.90	0.009
7280	ST12	274.87	19.90	0.00	0.00	0.437	1.01	0.008
7282	ST12	277.39	19.90	0.00	0.00	1.969	4.51	0.012
7478	FLIP	192.00	69.90	11.36	7.76	13.243	12.83	
7479	FLIP	192.00	69.90	11.13	7.60	12.761	12.37	
7480	FLIP	192.00	69.90	11.13	7.60	14.378	13.92	
7481	FLIP	192.00	69.90	11.43	7.81	11.827	11.47	
7482	FLIP	192.00	69.90	12.66	8.65	12.809	12.41	
8279	FLIP	192.70	69.98	11.51	7.86	11.087	10.75	
8281	FLIP	188.70	69.98	11.05	7.55	13.631	13.20	
8283	FLIP	190.06	69.98	11.13	7.60	11.673	11.32	
8284	FLIP	187.69	69.98	11.13	7.60	12.165	11.79	
8285	FLIP	191.33	69.98	11.13	7.60	11.283	10.94	