

## 1. List of TRIMON input cards.

Note: Items in red color are not applicable to the public release version of TRIMON. Please refer all equations in Section 2.

Card	Syntax	Description
KRUN	#KRUN <seed> <nhistories> <ncycle> <nskip> <keff-guess>	To specify k-eff calculation parameters.
DIMENSIONS	#DIMENSIONS <radius-ring-A> <radius-ring-B> ... <core-critical-height>	To specify reactor core ring radius and core critical height [cm].
NRINGS	#NRINGS <number-of-core-rings>	To specify the number of core rings. Only two valid values are accepted – 6 or 7.
NLAYERS	#NLAYERS <number-of-core-layers>	To specify the number of core layers.
PFF	#PFF <radial-alpha-1> <radial-alpha-2> ... <axial-alpha-1> <axial-alpha-2> ...	To specify the initial guess of radial power form factors for each core ring and axial power form factors for each core layers. See equation (1).
MACROGROUP	#MACROGROUP <ngroup> <last-mgrp-1> <last-mgrp-2> ...	To specify the total number of neutron energy macro-groups in the simulation; and to specify the last micro-group number for each macro-group. In TRIMON, there are a total of 32 micro-groups.
TCOOL	#TCOOL <ctemp>	To specify the coolant water temperature in [K].
POWER	#POWER <nominal-power>	To specify the nominal core power in [kW].
TEMPREL	#TEMPREL <n08> <Pmin> <Pmax> <a0> <a1> ... <a_n08> <n12> <Pmin> <Pmax> <a0> <a1> ... <a_n12> <n20> <Pmin> <Pmax> <a0> <a1> ... <a_n20>	To specify the coefficients of the fuel cell temperature relation polynomial given by equation (1). Note that n08, n12 and n20 are the degree of the polynomial; Pmin and Pmax are the fuel cell power boundaries defined by the temperature relation; and a0, a1... are the corresponding coefficients.

BURNUP	#BURNUP <dt> ST8 <nj> <beta1> <beta2> ... ST12 <nj> <beta1> <beta2> ... ST20 <nj> <beta1> <beta2> ...	To specify the burnup increment $\Delta t$ in [days]; to specify the degree of power series, $n_j$ , and the beta coefficients, $\beta_1, \beta_2, \dots$ , in equation (2) for each different types of fuel elements.
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## 2. Equations.

The fuel cell temperature relation is given by,

$$T_{el} = T_c + \sum_{n=1}^N a_n \left\{ \alpha_r \alpha_z \frac{m}{M} \left( 1 - \frac{b}{100} \right) P \right\}^n, \quad (1)$$

where  $T_c$  is the temperature of coolant,  $\alpha_r$  is the radial power form factor,  $\alpha_z$  is the axial power form factor,  $m$  is the mass of Uranium in the fuel element,  $M$  is the total mass of Uranium within the reactor core,  $b$  is the fuel element burnup in percent and  $P$  is the nominal core power. The fuel cladding temperature is given by the average of  $T_c$  and  $T_{el}$ .

The burnup,  $b$ , for each fuel element in percent is given by the general form power series correlation,

$$b = \sum_{j=1}^{n_j} \beta_j P_{el}^j (\Delta t)^j \quad (2)$$

where  $n_j$  is the power series limit,  $\beta_j$  are the coefficients of the power series,  $P_{el}^j$  is the fuel element power and  $\Delta t$  is the burnup increment in days. It is important to note that the values of  $\beta_j$  are provided by the user via the input file and these values are dependent on the fuel type and they can be determined experimentally.

## 3. Sample Input.

```
#TRIMON
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Sample problem test...
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#CORECONFIG
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A-01 CHN3
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B-01 9007 B-02 9011 B-03 9093 B-04 9010 B-05 9012 B-06 9046
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C-01 9008 C-02 9005 C-03 9009 C-04 CHN1 C-05 9023 C-06 9015
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C-07 9022 C-08 9016 C-09 9014 C-10 9091 C-11 9013 C-12 9094
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D-01 9092 D-02 9004 D-03 9045 D-04 9006 D-05 9021 D-06 9053  
D-07 9055 D-08 9059 D-09 9054 D-10 9090 D-11 9057 D-12 9003  
D-13 9001 D-14 8999 D-15 9000 D-16 9049 D-17 9056 D-18 9052  
E-01 9002 E-02 8998 E-03 9058 E-04 9020 E-05 9051 E-06 9063  
E-07 9066 E-08 9065 E-09 9077 E-10 9067 E-11 9047 E-12 9024  
E-13 9073 E-14 9078 E-15 9048 E-16 9037 E-17 9060 E-18 9019  
E-19 9050 E-20 9068 E-21 9079 E-22 9038 E-23 9039 E-24 9018  
F-01 COOL F-02 COOL F-03 COOL F-04 COOL F-05 COOL F-06 COOL  
F-07 COOL F-08 9035 F-09 9027 F-10 9087 F-11 9034 F-12 9033  
F-13 9086 F-14 9017 F-15 COOL F-16 COOL F-17 COOL F-18 COOL  
F-19 COOL F-20 COOL F-21 COOL F-22 COOL F-23 COOL F-24 COOL  
F-25 COOL F-26 COOL F-27 COOL F-28 COOL F-29 COOL F-30 COOL  
G-01 COOL G-02 COOL G-03 COOL G-04 COOL G-05 COOL G-06 COOL  
G-07 COOL G-08 COOL G-09 COOL G-10 COOL G-11 COOL G-12 COOL  
G-13 COOL G-14 COOL G-15 COOL G-16 COOL G-17 COOL G-18 COOL  
G-19 COOL G-20 COOL G-21 COOL G-22 COOL G-23 COOL G-24 COOL  
G-25 COOL G-26 COOL G-27 COOL G-28 COOL G-29 COOL G-30 COOL  
G-31 COOL G-32 COOL G-33 COOL G-34 COOL G-35 COOL G-36 COOL

#DIMENSIONS

2.0280 6.0180 9.9630 13.9310 17.9020 21.8740 25.8500  
27.0  
0.00

#NRINGS

7

#NLAYERS

20

#PFF

1.0 0.9 0.8 0.7 0.6 0.5 0.5  
0.5942 0.7010 0.8120 0.9256 1.0142  
1.0898 1.1515 1.1985 1.2301 1.2460  
1.2460 1.2301 1.1985 1.1515 1.0898  
1.0142 0.9256 0.8120 0.7010 0.5942

#MACROGROUP

4  
5 10 21 32

#TCOOL

298.15

#POWER

0.01

#TEMPREL

2

3 0.000 8.000 0.000 67.180 -8.381 0.3843

1 8.000 20.000 157.800 5.000

#BURNUP

0.0

FE08 3 3.33 -0.0102 -0.0000525

FE12 3 2.30 -0.00570 -0.00000748

FE20 3 0.0 0.0 0.0

#KRUN

201 10000 200 30

0.8