Thread Name & Version = mcnp5_RSICC, 4.23

```
                _
     ._ _   _ ._  ._   |_
     | | | (_ | |  |_)  _)
               |
+------------------------------------------------------------------------+
|  This program was prepared by the Regents of the University of         |
|California at Los Alamos National Laboratory (the University) under    |
|  contract number W-7405-ENG-36 with the U.S. Department of Energy      |
|(DoE).  The University has certain rights in the program pursuant to    |
|  the contract and the program should not be copied or distributed      |
| outside your organization.  All rights in the program are reserved     |
|by the DoE and the University.  Neither the U.S. Government nor the     |
| University makes any warranty, express or implied, or assumes any      |
|    liability or responsibility for the use of this software.           |
+------------------------------------------------------------------------+
1mcnp    version 5    ld=07-10-03                03/14/11 18:59:02
************************************************************************          probid =  03/14/11 18:59:02
```

1- **c narrow beam attenuation coefficient Problem (Bi2O3 thickness 1cm) without Bi_2O_3**
2- **c cell card**
3- 1 0 1 imp:p=0
4- 2 1 -1.205e-3 -1 4 #3#4#6#7#8#9 imp:p=2 $air
5- 3 0 -3 imp:p=2 $ source cell possition
6- 4 2 -11.33 -4#5 imp:p=2 $ prefect shield
7- 5 0 -5 -6 7 imp:p=2 $ narrow beam cylinder
8- 6 0 -8 -7 9 imp:p=2 $ cylinder test tube
9- 7 2 -11.33 -10 -11 12#8#9 imp:p=2 $ auxiliary shield
10- 8 0 -13 -11 12#9 imp:p=2 $ detecror hold
11- 9 0 -14 imp:p=2 $ detector
12-
13- **c surface card**
14- 1 sz -60 100
15- 3 so 0.03
16- 4 rpp -3 3 -2 2 -62 -60
17- 5 cz 0.3 $ narrow cylinder (R= 3mm)
18- 6 pz -60
19- 7 pz -62
20- 8 cz 0.5 $ test tube (R= 0.5 cm)
21- 9 pz -62.3
22- 10 cz 2 $ auxiliary shield
23- 11 pz -75
24- 12 pz -80
25- 13 cz 1 $ hol detecror (R= 1 cm)
26- 14 sz -79.1 0.9 $ detector
27-
28- **mode p**
29- sdef pos= 0 0 0 vec= 0 0 -1 sur=3 dir= 1 rad= d1 erg= 0.08 par= 2
30- si1 2
31- nps 2e8
32- *F4:P 9
33- M1 6000 -0.000124 7000 -0.755267 8000 -0.231781 18000 -0.012827 $ Air
34- m2 82000 -1 $lead
35- c m3 1000 -0.111898 8000 -0.888102 $ water
36- c m4 83000 -0.897 8000 -0.103 $ bulk (Bi2o3)
37-

surface 4.5 and surface 6 are the same. 6 will be deleted.
surface 4.6 and surface 7 are the same. 7 will be deleted.
comment. 2 surfaces were deleted for being the same as others.

1cells print table 60

cell	mat	atom density	gram density	volume	photon mass	pieces	importance
1	1	0	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	0.0000E+00
2	2	1	4.98817E-05	1.20500E-03	0.00000E+00	0.00000E+00	0	2.0000E+00
3	3	0	0.00000E+00	0.00000E+00	1.13097E-04	0.00000E+00	1	2.0000E+00

```
   4    4   2  3.29267E-02 1.13300E+01 0.00000E+00 0.00000E+00     0  2.0000E+00
   5    5   0  0.00000E+00 0.00000E+00 5.65487E-01 0.00000E+00     1  2.0000E+00
   6    6   0  0.00000E+00 0.00000E+00 2.35619E-01 0.00000E+00     1  2.0000E+00
   7    7   2  3.29267E-02 1.13300E+01 4.71239E+01 5.33914E+02     0  2.0000E+00
   8    8   0  0.00000E+00 0.00000E+00 1.26543E+01 0.00000E+00     0  2.0000E+00
   9    9   0  0.00000E+00 0.00000E+00 3.05363E+00 0.00000E+00     1  2.0000E+00

 total                              6.36331E+01 5.33914E+02
   minimum source weight = 1.0000E+00    maximum source weight = 1.0000E+00
 ***************************************************
 * Random Number Generator  =                1 *
 * Random Number Seed       =      19073486328125 *
 * Random Number Multiplier =      19073486328125 *
 * Random Number Adder      =                0 *
 * Random Number Bits Used  =               48 *
 * Random Number Stride     =           152917 *
 ***************************************************
1cross-section tables                                                   print table 100
    table    length
                 tables from file mcplib04
  6000.04p    3152  ENDF/B-VI Release 8 Photoatomic Data for 6-C            mat 600     02/07/03
  7000.04p    3194  ENDF/B-VI Release 8 Photoatomic Data for 7-N            mat 700     02/07/03
  8000.04p    3272  ENDF/B-VI Release 8 Photoatomic Data for 8-O            mat 800     02/07/03
 18000.04p    4696  ENDF/B-VI Release 8 Photoatomic Data for 18-AR          mat1800     02/07/03
 82000.04p   10010  ENDF/B-VI Release 8 Photoatomic Data for 82-PB          mat8200     02/07/03
 total       24324
 maximum photon energy set to  100.0 mev (maximum electron energy)
                 tables from file el03
  6000.03e    2333                                                  6/6/98
  7000.03e    2333                                                  6/6/98
  8000.03e    2333                                                  6/6/98
 18000.03e    2341                                                  6/6/98
 82000.03e    2373                                                  6/6/98
 warning. material    2 has been set to a conductor.
******************************************************************************************
 dump no.    1 on file runtpe       nps =          0     coll =            0     ctm =        0.00   nrn =              0
        1 warning message so far.
******************************************************************************************
 dump no.    2 on file runtpe       nps =    69981903     coll =       2264346     ctm =       60.00   nrn =       489607980
****************************************************************************************** dump no.    3 on file runtpe
nps =   139515875     coll =       4516937     ctm =      120.01   nrn =       976102180
1problem summary
     run terminated when 200000000    particle histories were done.
                                                        03/14/11 21:51:29
     c narrow beam attenuation coefficient Problem (Bi2O3 thickness 1cm)               probid =  03/14/11 18:59:02
photon creation     tracks     weight        energy          photon loss        tracks     weight        energy
                          (per source particle)                                        (per source particle)

 source          200000000    1.0000E+00    8.0000E-02          escape          199552451    9.9776E-01    7.9562E-02
                                                energy cutoff           0    0.           2.8640E-08
                                                time cutoff             0    0.           0.
 weight window            0    0.           0.                weight window            0    0.           0.
 cell importance          0    0.           0.                cell importance          0    0.           0.
 weight cutoff            0    0.           0.                weight cutoff            0    0.           0.
 e or t importance        0    0.           0.                e or t importance        0    0.           0.
 dxtran                   0    0.           0.                dxtran                   0    0.           0.
 forced collisions        0    0.           0.                forced collisions        0    0.           0.
 exp. transform           0    0.           0.                exp. transform           0    0.           0.
 from neutrons            0    0.           0.                compton scatter          0    0.           2.6700E-04
 bremsstrahlung       16264    8.1320E-05    7.8233E-07          capture          529401    2.6470E-03    1.7495E-04
 p-annihilation           0    0.           0.                pair production          0    0.           0.
 photonuclear             0    0.           0.                photonuclear abs         0    0.           0.
 electron x-rays          0    0.           0.
 1st fluorescence     65588    3.2794E-04    3.4704E-06
 2nd fluorescence         0    0.           0.
    total        200081852    1.0004E+00    8.0004E-02           total        200081852    1.0004E+00    8.0004E-02
```

```
  number of photons banked                  16264       average time of (shakes)            cutoffs
  photon tracks per source particle     1.0004E+00         escape          5.3455E-01         tco   1.0000E+33
  photon collisions per source particle  3.2366E-02        capture          2.2123E-01          eco   1.0000E-03
  total photon collisions                  6473194          capture or escape 5.3372E-01        wc1  -5.0000E-01
                                           any termination   5.3372E-01        wc2  -2.5000E-01
 computer time so far in this run   172.26 minutes           maximum number ever in bank        2
 computer time in mcrun            172.18 minutes           bank overflows to backup file       0
 source particles per minute           1.1616E+06
 random numbers generated             1399252445          most random numbers used was        107 in history   103972481
 range of sampled source weights = 1.0000E+00 to 1.0000E+00
1photon   activity in each cell                                                    print table 126
            tracks     population   collisions   collisions     number       flux       average      average
      cell    entering                          * weight     weighted      weighted   track weight   track mfp
                                  (per history)    energy       energy     (relative)      (cm)

    2    2   594746925    200003041     6133155    3.0666E-02   7.9836E-02   7.9836E-02   2.0000E+00   4.9901E+03
    3    3   100003984    100003791         0    0.0000E+00   8.0000E-02   8.0000E-02   2.0000E+00   0.0000E+00
    4    4      142154       150197      208717    1.0436E-03   7.5072E-02   7.5072E-02   2.0000E+00   3.2404E-02
    5    5   197628518    197625804         0    0.0000E+00   8.0000E-02   8.0000E-02   2.0000E+00   0.0000E+00
    6    6   197625746    197616553         0    0.0000E+00   7.9999E-02   7.9999E-02   2.0000E+00   0.0000E+00
    7    7       90524        94777      131322    6.5661E-04   7.3537E-02   7.3537E-02   2.0000E+00   3.0844E-02
    8    8   394298607    197148345         0    0.0000E+00   7.9999E-02   7.9999E-02   2.0000E+00   0.0000E+00
    9    9   197130718    197120541         0    0.0000E+00   7.9999E-02   7.9999E-02   2.0000E+00   0.0000E+00

    total    1681667176   1089763049     6473194    3.2366E-02

1tally   4       nps =   200000000
         tally type 4*   track length estimate of energy flux.        units   mev/cm**2
         tally for  photons
         volumes
              cell:      9
                  3.05363E+00
```

cell 9

4.64614E-02 0.0000

```
===========================================================================================
         results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin of tally   4

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure of merit--     -pdf-
 behavior    behavior      value   decrease   decrease rate      value   decrease   decrease rate       value     behavior      slope
 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps          constant    random       >3.00
 observed     random        0.00      yes         yes             0.00      yes         yes           constant    random        2.98
 passed?       yes          yes       yes         yes              yes      yes         yes              yes        yes          no
===========================================================================================
 warning.  the tally in the tally fluctuation chart bin did not pass  1 of the 10 statistical checks.
1analysis of the results in the tally fluctuation chart bin (tfc) for tally   4 with nps =   200000000  print table 160
 normed average tally per history  = 4.64614E-02          unnormed average tally per history  = 1.41876E-01
 estimated tally relative error    = 0.0000               estimated variance of the variance  = 0.0000
 relative error from zero tallies  = 0.0000               relative error from nonzero scores  = 0.0000
 number of nonzero history tallies =   197120539          efficiency for the nonzero tallies  = 0.9856
 history number of largest  tally  =   159034871          largest  unnormalized history tally = 3.30832E-01
 (largest  tally)/(average tally)  = 2.33184E+00          (largest  tally)/(avg nonzero tally)= 2.29827E+00
 (confidence interval shift)/mean  = 0.0000               shifted confidence interval center  = 4.64614E-02
 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:
      estimated quantities           value at nps           value at nps+1           value(nps+1)/value(nps)-1.
      mean                          4.64614E-02            4.64614E-02                  0.000000
      relative error                0.00000E+00            0.00000E+00                  0.000000
      variance of the variance      0.00000E+00            0.00000E+00                  0.000000
      shifted center                4.64614E-02            4.64614E-02                  0.000000
      figure of merit               1.00000E+30            1.00000E+30                  0.000000

 the estimated inverse power slope of the 187 largest  tallies starting at 2.53670E-01 is 2.9773
 the empirical history score probability density function appears to be increasing at the largest  history scores:
 please examine. see print table 161.
 the large score tail of the empirical history score probability density function appears to have no unsampled regions.
 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.162E+06)*( 9.278E+11)**2 = (1.162E+06)*(8.609E+23) = 1.000E+30
```

```
1unnormed tally density for tally   4          nonzero tally mean(m) = 1.439E-01   nps =   200000000  print table 161

 abscissa           ordinate   log plot of tally probability density function in tally fluctuation chart bin(d=decade,slope= 3.0)
  tally  number num den log den:d---------d----------d----------d----------d----------d----------d----------d----------d---------
 2.51-03     3 2.90-05  -4.537 **********|**********|******** |       |       |       |       |       |
 3.16-03     0 0.00+00   0.000         |       |       |       |       |       |       |
 3.98-03     4 2.44-05  -4.612 **********|**********|******** |       |       |       |       |       |
 5.01-03     3 1.46-05  -4.837 **********|**********|*****    |       |       |       |       |       |
 6.31-03     9 3.47-05  -4.460 **********|**********|********* |       |       |       |       |       |
 7.94-03    15 4.59-05  -4.338 **********|**********|**********|       |       |       |       |       |
 1.00-02     8 1.94-05  -4.711 **********|**********|******   |       |       |       |       |       |
 1.26-02    21 4.06-05  -4.392 **********|**********|**********|       |       |       |       |       |
 1.58-02    31 4.76-05  -4.323 **********|**********|**********|       |       |       |       |       |
 2.00-02    49 5.97-05  -4.224 **********|**********|**********|*      |       |       |       |       |
 2.51-02    73 7.07-05  -4.151 **********|**********|**********|**     |       |       |       |       |
 3.16-02   119 9.15-05  -4.039 **********|**********|**********|***    |       |       |       |       |
 3.98-02   165 1.01-04  -3.997 **********|**********|**********|****   |       |       |       |       |
 5.01-02   289 1.40-04  -3.853 **********|**********|**********|*****  |       |       |       |       |
 6.31-02   492 1.90-04  -3.722 **********|**********|**********|******* |       |       |       |       |
 7.94-02   776 2.37-04  -3.624 **********|**********|**********|******** |       |       |       |       |
 1.00-01  1330 3.23-04  -3.490 **********|**********|**********|********* |       |       |       |       |
 1.26-01  2989 5.77-04  -3.239 **********|**********|**********|**********|       |       |       |       |
 1.58-01 2.0+08 3.02+01   1.480
mmmmmmmmmm|mmmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmm
mmmm|mmmmmmmmmm|mmmmmmmmm
 2.00-01  2525 3.08-04  -3.512 **********|**********|**********|********* |       |       |       |       |
 2.51-01  6885 6.66-04  -3.176 **********|**********|**********|**********|*      |       |       |       |
 3.16-01   494 3.80-05  -4.420 **********|**********|**********|      s |       |       |       |       |
 3.98-01     1 6.11-08  -7.214 *         |         |         |    s    |       |       |       |       |
  total 1.97+08 9.86-01        d---------d----------d----------d----------d----------d----------d----------d----------d---------
1status of the statistical checks used to form confidence intervals for the mean for each tally bin
 tally   result of statistical checks for the tfc bin (the first check not passed is listed) and error magnitude check for all bins

    4   missed  1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum acceptable value of 3.0
        passed all bin error check:     1 tally bins all have relative errors less than 0.10 with no zero bins
 he 10 statistical checks are only for the tally fluctuation chart bin and do not apply to other tally bins.
 warning.     1 of the   1 tally fluctuation chart bins did not pass all 10 statistical checks.
1tally fluctuation charts
                tally    4
       nps      mean     error   vov  slope    fom
    16384000   4.6461E-02 0.0000 0.0000 10.0 1.0E+30
    32768000   4.6462E-02 0.0000 0.0000 10.0 1.0E+30
    49152000   4.6462E-02 0.0000 0.0000 10.0 1.0E+30
    65536000   4.6461E-02 0.0000 0.0000  7.6 1.0E+30
    81920000   4.6461E-02 0.0000 0.0000  5.3 1.0E+30
    98304000   4.6461E-02 0.0000 0.0000  3.4 1.0E+30
   114688000   4.6461E-02 0.0000 0.0000  3.1 1.0E+30
   131072000   4.6461E-02 0.0000 0.0000  3.2 1.0E+30
   147456000   4.6461E-02 0.0000 0.0000  3.2 1.0E+30
   163840000   4.6461E-02 0.0000 0.0000  2.9 1.0E+30
   180224000   4.6461E-02 0.0000 0.0000  3.0 1.0E+30
   196608000   4.6461E-02 0.0000 0.0000  2.9 1.0E+30
   200000000   4.6461E-02 0.0000 0.0000  3.0 1.0E+30
************************************************************************************************
 dump no.   4 on file runtpe      nps =   200000000     coll =      6473194     ctm =     172.18   nrn =      1399252445
        3 warning messages so far.
 run terminated when 200000000    particle histories were done.
 computer time =  172.26 minutes
 mcnp     version 5     07-10-03                03/14/11 21:51:29                probid =  03/14/11 18:59:02
```

```
 Thread Name & Version = mcnp5_RSICC, 4.23
                      _
      ._ _   _ ._  ._  |_
      | | |  (_  | |  |_)  _)
                   |
+--------------------------------------------------------------------+
|   This program was prepared by the Regents of the University of    |
|California at Los Alamos National Laboratory (the University) under |
|  contract number W-7405-ENG-36 with the U.S. Department of Energy  |
|(DoE).  The University has certain rights in the program pursuant to|
|  the contract and the program should not be copied or distributed  |
| outside your organization.  All rights in the program are reserved |
|by the DoE and the University.  Neither the U.S. Government nor the |
| University makes any warranty, express or implied, or assumes any  |
|     liability or responsibility for the use of this software.      |
+--------------------------------------------------------------------+
1mcnp     version 5     ld=07-10-03                  03/14/11 16:44:27
*************************************************************************                probid =  03/14/11 16:44:27
   1-      c narrow beam attenuation coefficient Problem (Bi2O3 thickness 1cm )  with Bi2O3
   2-      c cell card
   3-      1    0 1 imp:p=0
   4-      2    1 -1.205e-3 -1 4 #3#4#6#7#8#9 imp:p=2 $air
   5-      3    0 -3 imp:p=2 $ source cell possition
   6-      4    2 -11.33 -4#5 imp:p=2 $ prefect shield
   7-      5    0 -5 -6 7 imp:p=2 $ narrow beam cylinder
   8-      6    4 -8.9 -8 -7 9 imp:p=2 $ cylinder test tube
   9-      7    2 -11.33 -10 -11 12#8#9 imp:p=2 $ auxiliary shield
  10-      8    0 -13 -11 12#9 imp:p=2 $ detecror hold
  11-      9    0 -14 imp:p=2 $ detector
  12-
  13-      c surface card
  14-      1  sz -60 100
  15-      3  so 0.03
  16-      4  rpp -3 3 -2 2 -62 -60
  17-      5  cz  0.3 $ narrow cylinder (R= 3mm)
  18-      6  pz -60
  19-      7  pz -62
  20-      8  cz  0.5 $ test tube (R= 0.5 cm)
  21-      9  pz -62.3
  22-      10  cz  2 $ auxiliary shield
  23-      11  pz -75
  24-      12  pz -80
  25-      13  cz 1 $ hol detecror (R= 1 cm)
  26-      14  sz -79.1 0.9 $ detector
  27-
  28-      mode p
  29-      sdef pos= 0 0 0 vec= 0 0 -1 sur=3 dir= 1 rad= d1 erg= 0.08 par= 2
  30-      si1 2
  31-      nps 2e8
  32-      *F4:P 9
  33-      M1 6000 -0.000124 7000 -0.755267 8000 -0.231781 18000 -0.012827 $ Air
  34-      m2 82000 -1 $lead
  35-      c m3 1000 -0.111898 8000 -0.888102 $ water
  36-      m4 83000 -0.897 8000 -0.103 $ bulk (Bi2o3)
  37-
 surface      4.5 and surface      6   are the same.      6   will be deleted.
 surface      4.6 and surface      7   are the same.      7   will be deleted.
 comment.    2 surfaces were deleted for being the same as others.
1cells                                                          print table 60
                    atom        gram                            photon
     cell  mat    density     density      volume       mass     pieces importance
   1     1    0  0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00      0  0.0000E+00
```

```
   2    2    1  4.98817E-05 1.20500E-03 0.00000E+00 0.00000E+00     0  2.0000E+00
   3    3    0  0.00000E+00 0.00000E+00 1.13097E-04 0.00000E+00     1  2.0000E+00
   4    4    2  3.29267E-02 1.13300E+01 0.00000E+00 0.00000E+00     0  2.0000E+00
   5    5    0  0.00000E+00 0.00000E+00 5.65487E-01 0.00000E+00     1  2.0000E+00
   6    6    4  5.75090E-02 8.90000E+00 2.35619E-01 2.09701E+00     1  2.0000E+00
   7    7    2  3.29267E-02 1.13300E+01 4.71239E+01 5.33914E+02     0  2.0000E+00
   8    8    0  0.00000E+00 0.00000E+00 1.26543E+01 0.00000E+00     0  2.0000E+00
   9    9    0  0.00000E+00 0.00000E+00 3.05363E+00 0.00000E+00     1  2.0000E+00
 total                              6.36331E+01 5.36011E+02
   minimum source weight = 1.0000E+00    maximum source weight = 1.0000E+00
 ***************************************************
 * Random Number Generator  =                1 *
 * Random Number Seed       =      19073486328125 *
 * Random Number Multiplier =      19073486328125 *
 * Random Number Adder      =                0 *
 * Random Number Bits Used  =               48 *
 * Random Number Stride     =           152917 *
 ***************************************************
1cross-section tables                                              print table 100
    table    length
                tables from file mcplib04
   6000.04p    3152  ENDF/B-VI Release 8 Photoatomic Data for 6-C          mat 600     02/07/03
   7000.04p    3194  ENDF/B-VI Release 8 Photoatomic Data for 7-N          mat 700     02/07/03
   8000.04p    3272  ENDF/B-VI Release 8 Photoatomic Data for 8-O          mat 800     02/07/03
  18000.04p    4696  ENDF/B-VI Release 8 Photoatomic Data for 18-AR        mat1800     02/07/03
  82000.04p   10010  ENDF/B-VI Release 8 Photoatomic Data for 82-PB        mat8200     02/07/03
  83000.04p   10373  ENDF/B-VI Release 8 Photoatomic Data for 83-BI        mat8300     02/07/03
  total      34697
 maximum photon energy set to  100.0 mev (maximum electron energy)
                tables from file el03
   6000.03e    2333                                               6/6/98
   7000.03e    2333                                               6/6/98
   8000.03e    2333                                               6/6/98
  18000.03e    2341                                               6/6/98
  82000.03e    2373                                               6/6/98
  83000.03e    2373                                               6/6/98
 warning. material    2 has been set to a conductor.
***********************************************************************************************
 dump no.    1 on file runtpe      nps =          0     coll =            0     ctm =       0.00   nrn =              0
       1 warning message so far.

 ***********************************************************************************************
 dump no.    2 on file runtpe      nps =    96462402     coll =      145955538     ctm =      60.01   nrn =       1792951946
***********************************************************************************************
 dump no.    3 on file runtpe      nps =   192695817     coll =      291570442     ctm =     120.02   nrn =       3581659729
1problem summary
    run terminated when 200000000    particle histories were done.
  +                                                   03/14/11 18:49:13
    c narrow beam attenuation coefficient Problem (Bi2O3 thickness 1cm )            probid =  03/14/11 16:44:27
0
 photon creation     tracks      weight       energy          photon loss        tracks      weight        energy
                        (per source particle)                                        (per source particle)
 source          200000000    1.0000E+00    8.0000E-02         escape            3001468    1.5007E-02    1.0896E-03
                                                energy cutoff          0    0.          1.6586E-05
                                                time cutoff            0    0.          0.
 weight window           0    0.          0.                 weight window           0    0.          0.
 cell importance         0    0.          0.                 cell importance         0    0.          0.
 weight cutoff           0    0.          0.                 weight cutoff           0    0.          0.
 e or t importance       0    0.          0.                 e or t importance       0    0.          0.
 dxtran                  0    0.          0.                 dxtran                  0    0.          0.
 forced collisions       0    0.          0.                 forced collisions       0    0.          0.
 exp. transform          0    0.          0.                 exp. transform          0    0.          0.
 from neutrons           0    0.          0.                 compton scatter         0    0.          6.5333E-04
 bremsstrahlung   11168150    5.5841E-02    6.0331E-04         capture          261788778    1.3089E+00    8.1953E-02
 p-annihilation          0    0.          0.                 pair production         0    0.          0.
 photonuclear            0    0.          0.                 photonuclear abs        0    0.          0.
```

```
electron x-rays         0    0.          0.
1st fluorescence  53622096    2.6811E-01    3.1095E-03
2nd fluorescence        0    0.          0.
   total       264790246    1.3240E+00    8.3713E-02           total       264790246    1.3240E+00    8.3713E-02
  number of photons banked              11168150       average time of (shakes)            cutoffs
  photon tracks per source particle     1.3240E+00        escape          4.5926E-01        tco   1.0000E+33
  photon collisions per source particle  1.5131E+00        capture         1.6459E-01        eco   1.0000E-03
  total photon collisions               302621413        capture or escape 1.6793E-01        wc1  -5.0000E-01
                                                         any termination   1.6793E-01        wc2  -2.5000E-01
computer time so far in this run   124.71 minutes          maximum number ever in bank        2
computer time in mcrun            124.59 minutes          bank overflows to backup file       0
source particles per minute           1.6053E+06
random numbers generated            3717406464          most random numbers used was        151 in history    40950941
range of sampled source weights = 1.0000E+00 to 1.0000E+00
1photon   activity in each cell                                                  print table 126
            tracks     population   collisions   collisions     number       flux       average      average
      cell    entering                          * weight      weighted      weighted   track weight   track mfp
                                   (per history)    energy       energy      (relative)      (cm)
    2    2   201391036    200002148     2454915    1.2275E-02   7.9839E-02   7.9839E-02   2.0000E+00   4.9901E+03
    3    3   100003985    100003792          0    0.0000E+00   8.0000E-02   8.0000E-02   2.0000E+00   0.0000E+00
    4    4     1795460      1858355      2479479    1.2397E-02   6.8596E-02   6.8596E-02   2.0000E+00   2.6266E-02
    5    5   199356463    197644996          0    0.0000E+00   7.9942E-02   7.9942E-02   2.0000E+00   0.0000E+00
    6    6   197620184    208701244    297590776    1.4880E+00   7.9214E-02   7.9214E-02   2.0000E+00   4.9445E-02
    7    7       65042        68469        96243    4.8122E-04   7.9233E-02   7.9233E-02   2.0000E+00   3.6666E-02
    8    8     1046802       529774          0    0.0000E+00   7.9981E-02   7.9981E-02   2.0000E+00   0.0000E+00
    9    9      516147       516125          0    0.0000E+00   7.9993E-02   7.9993E-02   2.0000E+00   0.0000E+00
   total    701795119    709324903    302621413    1.5131E+00

1tally   4       nps =   200000000
        tally type 4*   track length estimate of energy flux.        units   mev/cm**2
        tally for  photons
        volumes
              cell:       9
                   3.05363E+00
```

cell 9

1.20536E-04 0.0014

```
===========================================================================================
        results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin of tally   4
 tfc bin     --mean--     ---------relative error---------      ----variance of the variance----      --figure of merit--    -pdf-
 behavior    behavior      value   decrease   decrease rate      value   decrease   decrease rate       value     behavior      slope
 desired      random       <0.10      yes       1/sqrt(nps)       <0.10      yes         1/nps          constant    random       >3.00
 observed     random        0.00      yes          yes            0.00      yes          yes           constant    random       10.00
 passed?       yes           yes      yes          yes             yes      yes          yes              yes         yes          yes
===========================================================================================
 this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart to verify.
 the results in other bins associated with this tally may not meet these statistical criteria.
 ----- estimated confidence intervals:  -----
 estimated asymmetric confidence interval(1,2,3 sigma): 1.2037E-04 to 1.2070E-04; 1.2020E-04 to 1.2087E-04; 1.2003E-04 to 1.2104E-04
 estimated  symmetric confidence interval(1,2,3 sigma): 1.2037E-04 to 1.2070E-04; 1.2020E-04 to 1.2087E-04; 1.2003E-04 to 1.2104E-04
1analysis of the results in the tally fluctuation chart bin (tfc) for tally   4 with nps =    200000000  print table 160
 normed average tally per history  = 1.20536E-04         unnormed average tally per history  = 3.68073E-04
 estimated tally relative error    = 0.0014              estimated variance of the variance  = 0.0000
 relative error from zero tallies  = 0.0014              relative error from nonzero scores  = 0.0001
 number of nonzero history tallies =       516124          efficiency for the nonzero tallies  = 0.0026
 history number of largest  tally  =   190845069          largest  unnormalized history tally = 2.51383E-01
 (largest  tally)/(average tally)  = 6.82970E+02         (largest  tally)/(avg nonzero tally)= 1.76249E+00
 (confidence interval shift)/mean  = 0.0000              shifted confidence interval center  = 1.20536E-04
 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:
     estimated quantities          value at nps          value at nps+1          value(nps+1)/value(nps)-1.
     mean                        1.20536E-04          1.20537E-04                 0.000003
     relative error                1.39332E-03          1.39332E-03                 0.000000
     variance of the variance        1.94041E-06          1.94042E-06                 0.000006
     shifted center                1.20536E-04          1.20536E-04                 0.000000
     figure of merit               4.13439E+03          4.13439E+03                 0.000001
 the estimated slope of the  22 largest  tallies starting at  1.54166E-01 appears to be decreasing at least exponentially.
```

the empirical history score probability density function appears to be increasing at the largest history scores:
please examine. see print table 161.
the large score tail of the empirical history score probability density function appears to have no unsampled regions.
fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.605E+06)*(5.075E-02)**2 = (1.605E+06)*(2.576E-03) = 4.134E+03
1status of the statistical checks used to form confidence intervals for the mean for each tally bin
tally result of statistical checks for the tfc bin (the first check not passed is listed) and error magnitude check for all bins
4 passed the 10 statistical checks for the tally fluctuation chart bin result
passed all bin error check: 1 tally bins all have relative errors less than 0.10 with no zero bins
the 10 statistical checks are only for the tally fluctuation chart bin and do not apply to other tally bins.
1tally fluctuation charts

tally 4

nps	mean	error	vov	slope	fom
16384000	1.1988E-04	0.0049	0.0000	5.0	4125
32768000	1.2001E-04	0.0034	0.0000	10.0	4126
49152000	1.2013E-04	0.0028	0.0000	10.0	4139
65536000	1.2006E-04	0.0024	0.0000	10.0	4130
81920000	1.2026E-04	0.0022	0.0000	10.0	4133
98304000	1.2027E-04	0.0020	0.0000	10.0	4130
114688000	1.2033E-04	0.0018	0.0000	10.0	4130
131072000	1.2048E-04	0.0017	0.0000	10.0	4136
147456000	1.2055E-04	0.0016	0.0000	10.0	4141
163840000	1.2056E-04	0.0015	0.0000	10.0	4139
180224000	1.2056E-04	0.0015	0.0000	10.0	4137
196608000	1.2054E-04	0.0014	0.0000	10.0	4135
200000000	1.2054E-04	0.0014	0.0000	10.0	4134

****

dump no. 4 on file runtpe nps = 200000000 coll = 302621413 ctm = 124.59 nrn = 3717406464
1 warning message so far.
run terminated when 200000000 particle histories were done.
computer time = 124.71 minutes
mcnp version 5 07-10-03 03/14/11 18:49:13 probid = 03/14/11 16:44:27