ANEXO II. EJEMPLOS DE RESULTADOS NUMÉRICOS OBTENIDOS DE MODELIZACIÓN.

Se muestran a continuación los archivos que resultan de la ejecución de uno de los modelos matemáticos desarrollados. Corresponden a resultados de la simulación de dos pruebas en las condiciones utilizadas en el reactor experimental de laboratorio en régimen de fluidización de burbujas con absorción de H_2S en sólido de titanato de cinc, descritas en el capítulo 5, apartado 5.7, para el sólido RTI.

Tipo	Pruebas	Temperatura	Velocidad de gas	Masa de sólido
Uno	2a, 2b	600ºC	0.07 m/s	275 g
Dos	2c	600ºC	0.07 m/s	184 g
Tres	4, 5, 6, 7, 8	600ºC	0.14 m/s	184 g

Tipo Uno:

```
 ========================================================================
 CALCULATION RESULTS
 Reactor is used as : ABSORBER
 Reactor staged ?   :   NOT
 BFB Reactor number :   1
========================================================================


  GAS PHASE                      ^       v              SOLID PHASE
  GLOB. CONV   99.383 %          |       |
            .2154E-04 kmol/m3    |       |  X_in   .0000
               99.383 % Conv.    |       |  X_max  .0000
            T   881.5 K          |       |  T     873.0 K
                              -------------
                N stages      |           |
                              |    ABS    |
                      1       |           |
                              |  25.0 Bar |
                              | 881.5 K   |
                              |           |
                              |           |
                              -------------
            T   873.0 K          |       |  T      881.5 K
                 .000 m3/s       |       |  X_avg  .0048
            .3492E-02 kmol/m3    |       |  X_max  .0000
                                 |       |  Flow   .0100  kg/s
                                 ^       v
```

```
RRR 1
 ================================================================================
 Height Bubble Bubble   Specific C Bubble  C Dense  Tb    Mass     Overall
        Dia.   Volume   Area     Phase     Phase          Transfer Gas Phase
               Fraction                                            Conversion
 (m)    (m)    (-)      (m2/m3)  (kmol/m3) (kmol/m3)(K)    (s-1)
 ================================================================================

  .001   .001    .0864     .2090 .3140E-02 .8792E-03   875.0 .209E+03  .10078425
  .001   .001    .0864     .2090 .2824E-02 .7906E-03   876.5 .209E+03  .19141104
  .002   .001    .0864     .2090 .2539E-02 .7109E-03   877.7 .209E+03  .27290407
  .002   .001    .0864     .2090 .2283E-02 .6392E-03   878.6 .209E+03  .34618389
  .003   .001    .0864     .2090 .2053E-02 .5748E-03   879.3 .209E+03  .41207825
  .006   .003    .3335  606.6460 .1521E-02 .5797E-03   881.0 .153E+02  .68897547
  .017   .005    .2837  322.4773 .8562E-03 .9005E-04   881.5 .859E+01  .85611459
  .032   .008    .2590  195.7604 .4899E-03 .1778E-04   881.5 .497E+01  .92214067
```

```
 .055   .011    .2478  130.8753 .2804E-03 .4711E-05   881.5 .304E+01  .95614875
 .085   .015    .2466   96.7800 .1575E-03 .1495E-05   881.5 .200E+01  .97551906
 .124   .019    .2526   78.3729 .7744E-04 .4809E-06   881.5 .142E+01  .98563611
 .170   .023    .2621   68.3767 .3979E-04 .1791E-06   881.5 .109E+01  .99118469
 .206   .026    .2646   62.2594 .2599E-04 .9478E-07   881.5 .939E+00  .99383133


Reactor Dimensions and Operation:
*********************************


Diameter Bed   (m):     .041   Reactor used as   :
Static Height  (m):     .153   Reactor Staged?   :NOT
Dynamic Height (m):     .206   Reactor Number    :  1
Jet Height     (m):     .003   Include Jet Zone? :YES
Temperature    (K):  881.523
Pressure     (Bar):   25.000

U   (m/s):     .070    Geldart Solid Class        :      B
Umf (m/s):     .012    Porosity at Umf         (-):     .429
Umb (m/s):     .012    Porosity at Umb         (-):     .429
Ut  (m/s):     .466    Porosity of Dense Phase (-):     .429

Solid Class Defined by User       :B
Solid Class Calculated by Program :B

Gas Distributor:
****************

Distributor type                           :PERFORATED
Number of Orifice                     (m-2): 110000.0
Orifice Diameter                        (m):    .0010
Orifice Type                            (-):
Initial Bubble Size                     (m):    .0025

Area Fraction Orifice                   (-):    .0864
Velocity in Orifice                   (m/s):    .8102
Pressure Drop Bed                     (Bar):    .0206
Recommended Ratio Pressure Drop Grid/Bed (-):    .3000
Recommended Pressure Drop Distributor (Bar):    .0062
Calculated Pressure Drop Orifices     (Bar):    .0001


Solid Reaction Kinetics:
************************

Solid Conversion Behaviour            :grmed
Order in Gas Component                :
Effective Reaction Rate Constant (s-1):  88.8817
Efficiency Concept                    :
Beta Factor Concept                   :


Gas Phase:
**********

Gas Flow                                (m3/s):    .920E-04
Gas Density                            (kg/m3):    .785E+01
Gas Viscosity                           (Pa.s):    .402E-04
Gas Specific Heat                     (J/kg K):    .415E+04
Gas Conductivity                       (W/m.K):    .129E+00
Diffusion Coefficient Reactant          (m2/s):    .515E-05
Concentration Reactant Inlet        (kmol/m3):    .349E-02
Concentration Reactant Oulet        (kmol/m3):    .215E-04
Total Conversion Gas Phase Reactant        (-):    .994E+02


Solid Phase:
```

```
************

Solid Mass Flow                        (kg/s):    .100E-01
Average Solid Residence Time              (s):    .271E+02
Total Weight of Solids in Bed            (kg):    .271E+00
Initial Conversion Extent                 (-):    .000E+00
Average Outlet Conversion Extent          (-):    .480E-02
Maximum Conversion Extent                 (-):    .000E+00
Beta Factor Value                         (-):    .800E+00
Diameter Particles                        (m):    .185E-03
Density                                (kg/m3):    .240E+04
Stoichiomeetric Coefficient b             (-):    .100E+01
Weight Fraction Component B               (-):    .541E+00
Molecular Weight Component B        (kg/kmol):    .814E+02
Spherical Factor                          (-):    .800E+00
Solid Specific Heat                  (J/kg.K):    .101E+04
Heat Conductivity                     (W/m/K):    .000E+00
Effective Diffusion in Particle        (m2/s):


Heat Balance:
*************

Produced Heat                             (kW):    -.112
U overall                              (W/m2K):
h Coef. Bed to Surface                 (W/m2K):
h Coef. Tube Side                      (W/m2K):
Log. Delta Temperature                     (K):

Exchange Area Needed                      (m2):
Outside Tube Diameter                      (m):
Inside Tube Diameter                       (m):
Number of Tubes Needed                     (-):
Percentage Tubes                           (%):
Distance Between Tubes                     (m):
                                           (m):
Diameter Reactor                           (m):
Corrected Diameter                         (m):


================================================================================


==========================  END RESULTS ========================================
```

Tipo Dos:

Tipo	Pruebas	Temperatura	Velocidad de gas	Masa de sólido
Dos	2c	600ºC	0.07 m/s	184 g

```
=========================================================================
  CALCULATION RESULTS
  Reactor is used as :   ABSORBER
  Reactor staged ?   :   NOT
  BFB Reactor number :   1
 =========================================================================


   GAS PHASE                      ^       v              SOLID PHASE
   GLOB. CONV   98.895 %          |       |
             .3859E-04 kmol/m3    |       |  X_in   .0000
                98.895 % Conv.    |       |  X_max  .0000
             T   881.5 K          |       |  T     873.0 K
                                  -------------
                 N stages         |           |
                                  |    ABS    |
                       1          |           |
                                  |  25.0 Bar |
                                  | 881.5 K   |
                                  |           |
                                  |           |
                                  -------------
             T   873.0 K          |       |  T      881.5 K
                  .000 m3/s       |       |  X_avg  .0048
             .3492E-02 kmol/m3    |       |  X_max  .0000
                                  |       |  Flow   .0100  kg/s
                                  ^       v


RRR 1
 ===========================================================================
 Height Bubble Bubble   Specific C Bubble  C Dense  Tb    Mass     Overall
        Dia.   Volume   Area     Phase     Phase          Transfer Gas Phase
               Fraction                                            Conversion
 (m)    (m)    (-)      (m2/m3)  (kmol/m3) (kmol/m3)(K)    (s-1)
 ===========================================================================

  .001   .001    .0864     .2090 .3043E-02 .1123E-02   875.0 .314E+03  .12876925
  .001   .001    .0864     .2090 .2651E-02 .9786E-03   876.5 .314E+03  .24095697
  .002   .001    .0864     .2090 .2309E-02 .8526E-03   877.7 .314E+03  .33869837
  .002   .001    .0864     .2090 .2012E-02 .7428E-03   878.6 .314E+03  .42385368
  .003   .001    .0864     .2090 .1753E-02 .6472E-03   879.3 .314E+03  .49804361
  .006   .003    .3335  606.6460 .1298E-02 .4949E-03   881.0 .153E+02  .73445416
  .017   .005    .2837  322.4773 .7310E-03 .7688E-04   881.4 .859E+01  .87715395
  .032   .008    .2590  195.7604 .4182E-03 .1518E-04   881.5 .497E+01  .93352555
  .055   .011    .2478  130.8753 .2394E-03 .4022E-05   881.5 .304E+01  .96256090
  .085   .015    .2466   96.7800 .1345E-03 .1276E-05   881.5 .200E+01  .97909883
  .137   .020    .2542   76.1753 .5749E-04 .3382E-06   881.5 .135E+01  .98895027


 Reactor Dimensions and Operation:
 *********************************


 Diameter Bed   (m):     .041   Reactor used as   :
 Static Height  (m):     .103   Reactor Staged?   :NOT
 Dynamic Height (m):     .137   Reactor Number    :  1
 Jet Height     (m):     .003   Include Jet Zone? :YES
 Temperature    (K):  881.481
 Pressure     (Bar):   25.000
```

```
U   (m/s):     .070    Geldart Solid Class        :      B
Umf (m/s):     .012    Porosity at Umf         (-):     .429
Umb (m/s):     .012    Porosity at Umb         (-):     .429
Ut  (m/s):     .466    Porosity of Dense Phase (-):     .429

Solid Class Defined by User       :B
Solid Class Calculated by Program :B

Gas Distributor:
****************

Distributor type                           :PERFORATED
Number of Orifice                    (m-2): 110000.0
Orifice Diameter                       (m):    .0010
Orifice Type                           (-):
Initial Bubble Size                    (m):    .0025

Area Fraction Orifice                  (-):    .0864
Velocity in Orifice                  (m/s):    .8102
Pressure Drop Bed                    (Bar):    .0138
Recommended Ratio Pressure Drop Grid/Bed (-):    .3000
Recommended Pressure Drop Distributor  (Bar):    .0041
Calculated Pressure Drop Orifices      (Bar):    .0001


Solid Reaction Kinetics:
************************

Solid Conversion Behaviour            :grmed
Order in Gas Component                :
Effective Reaction Rate Constant (s-1):  88.8829
Efficiency Concept                    :
Beta Factor Concept                   :


Gas Phase:
**********

Gas Flow                               (m3/s):    .920E-04
Gas Density                           (kg/m3):    .785E+01
Gas Viscosity                          (Pa.s):    .402E-04
Gas Specific Heat                    (J/kg K):    .415E+04
Gas Conductivity                      (W/m.K):    .129E+00
Diffusion Coefficient Reactant         (m2/s):    .515E-05
Concentration Reactant Inlet        (kmol/m3):    .349E-02
Concentration Reactant Oulet        (kmol/m3):    .386E-04
Total Conversion Gas Phase Reactant        (-):    .989E+02


Solid Phase:
************

Solid Mass Flow                        (kg/s):    .100E-01
Average Solid Residence Time              (s):    .180E+02
Total Weight of Solids in Bed            (kg):    .180E+00
Initial Conversion Extent                 (-):    .000E+00
Average Outlet Conversion Extent          (-):    .478E-02
Maximum Conversion Extent                 (-):    .000E+00
Beta Factor Value                         (-):    .800E+00
Diameter Particles                        (m):    .185E-03
Density                               (kg/m3):    .240E+04
Stoichiomeetric Coefficient b             (-):    .100E+01
Weight Fraction Component B               (-):    .541E+00
Molecular Weight Component B        (kg/kmol):    .814E+02
Spherical Factor                          (-):    .800E+00
Solid Specific Heat                  (J/kg.K):    .101E+04
Heat Conductivity                     (W/m/K):    .000E+00
```

```
Effective Diffusion in Particle        (m2/s):


Heat Balance:
*************

Produced Heat                             (kW):     -.111
U overall                               (W/m2K):
h Coef. Bed to Surface                  (W/m2K):
h Coef. Tube Side                       (W/m2K):
Log. Delta Temperature                      (K):

Exchange Area Needed                       (m2):
Outside Tube Diameter                       (m):
Inside Tube Diameter                        (m):
Number of Tubes Needed                      (-):
Percentage Tubes                            (%):
Distance Between Tubes                      (m):
                                            (m):
Diameter Reactor                            (m):
Corrected Diameter                          (m):


================================================================================


=========================  END RESULTS ==========================================
```

Tipo	Pruebas	Temperatura	Velocidad de gas	Masa de sólido
Tres	4, 5, 6, 7, 8	600ºC	0.14 m/s	184 g

Tipo tres:

```
================================================================================
  CALCULATION RESULTS
  Reactor is used as :   ABSORBER
  Reactor staged ?   :   NOT
  BFB Reactor number :   1
 ================================================================================


   GAS PHASE                      ^       v              SOLID PHASE
   GLOB. CONV   97.009 %          |       |
             .1045E-03 kmol/m3    |       |  X_in   .0000
                97.009 % Conv.    |       |  X_max  .0000
             T   886.6 K          |       |  T     873.0 K
                              -------------
                 N stages     |           |
                              |    ABS    |
                        1     |           |
                              |  25.0 Bar |
                              | 886.6 K   |
                              |           |
                              |           |
                              -------------
             T   873.0 K          |       |  T      886.6 K
                  .000 m3/s       |       |  X_avg  .0094
             .3492E-02 kmol/m3    |       |  X_max  .0000
                                  |       |  Flow   .0100  kg/s
                                  ^       v


RRR 1
 ================================================================================
 Height Bubble Bubble   Specific C Bubble  C Dense  Tb    Mass     Overall
        Dia.   Volume   Area     Phase     Phase          Transfer Gas Phase
               Fraction                                            Conversion
 (m)    (m)    (-)      (m2/m3)  (kmol/m3) (kmol/m3)(K)    (s-1)
 ================================================================================

  .001   .001    .0864     .3614 .3076E-02 .1207E-02   875.9 .345E+03  .11927500
  .002   .001    .0864     .3614 .2709E-02 .1063E-02   878.1 .345E+03  .22432347
  .003   .001    .0864     .3614 .2386E-02 .9361E-03   879.9 .345E+03  .31684229
  .004   .001    .0864     .3614 .2101E-02 .8244E-03   881.3 .345E+03  .39832592
  .005   .001    .0864     .3614 .1851E-02 .7261E-03   882.4 .345E+03  .47009059
  .010   .005    .4644  533.3072 .1510E-02 .6461E-03   885.3 .937E+01  .66798935
  .019   .008    .4322  310.2436 .1185E-02 .1821E-03   886.2 .500E+01  .77717831
  .030   .011    .4220  234.4939 .9200E-03 .5919E-04   886.4 .353E+01  .83659383
  .044   .014    .4186  175.8897 .7073E-03 .2265E-04   886.5 .240E+01  .87702303
  .062   .018    .4233  142.9639 .5374E-03 .1060E-04   886.5 .176E+01  .90733874
  .083   .022    .4343  120.6534 .4020E-03 .5486E-05   886.5 .132E+01  .93097068
  .109   .026    .4343  101.0880 .2689E-03 .2611E-05   886.5 .103E+01  .94728932
  .139   .030    .4343   88.0060 .1847E-03 .1312E-05   886.5 .848E+00  .95870327
  .171   .033    .4343   79.5799 .1314E-03 .7388E-06   886.6 .735E+00  .96694009
  .187   .036    .4343   73.3383 .1142E-03 .5360E-06   886.6 .655E+00  .97008515


 Reactor Dimensions and Operation:
 *********************************


 Diameter Bed   (m):     .041   Reactor used as   :
```

```
Static Height  (m):     .107   Reactor Staged?   :NOT
Dynamic Height (m):     .187   Reactor Number    :  1
Jet Height     (m):     .005   Include Jet Zone? :YES
Temperature    (K):  886.550
Pressure     (Bar):   25.000

U   (m/s):     .140    Geldart Solid Class        :      B
Umf (m/s):     .012    Porosity at Umf         (-):     .429
Umb (m/s):     .012    Porosity at Umb         (-):     .429
Ut  (m/s):     .466    Porosity of Dense Phase (-):     .429

Solid Class Defined by User       :B
Solid Class Calculated by Program :B

Gas Distributor:
****************

Distributor type                           :PERFORATED
Number of Orifice                       (m-2): 110000.0
Orifice Diameter                          (m):    .0010
Orifice Type                              (-):
Initial Bubble Size                       (m):    .0035

Area Fraction Orifice                     (-):    .0864
Velocity in Orifice                     (m/s):   1.6211
Pressure Drop Bed                       (Bar):    .0144
Recommended Ratio Pressure Drop Grid/Bed (-):    .3000
Recommended Pressure Drop Distributor   (Bar):    .0043
Calculated Pressure Drop Orifices       (Bar):    .0003


Solid Reaction Kinetics:
************************

Solid Conversion Behaviour            :grmed
Order in Gas Component                :
Effective Reaction Rate Constant (s-1):  88.6504
Efficiency Concept                    :
Beta Factor Concept                   :


Gas Phase:
**********

Gas Flow                                (m3/s):    .184E-03
Gas Density                            (kg/m3):    .785E+01
Gas Viscosity                           (Pa.s):    .402E-04
Gas Specific Heat                     (J/kg K):    .415E+04
Gas Conductivity                       (W/m.K):    .129E+00
Diffusion Coefficient Reactant          (m2/s):    .515E-05
Concentration Reactant Inlet         (kmol/m3):    .349E-02
Concentration Reactant Oulet         (kmol/m3):    .104E-03
Total Conversion Gas Phase Reactant         (-):    .970E+02


Solid Phase:
************

Solid Mass Flow                         (kg/s):    .100E-01
Average Solid Residence Time               (s):    .184E+02
Total Weight of Solids in Bed             (kg):    .184E+00
Initial Conversion Extent                  (-):    .000E+00
Average Outlet Conversion Extent           (-):    .937E-02
Maximum Conversion Extent                  (-):    .000E+00
Beta Factor Value                          (-):    .800E+00
Diameter Particles                         (m):    .185E-03
Density                                 (kg/m3):    .240E+04
Stoichiomeetric Coefficient b              (-):    .100E+01
```

```
Weight Fraction Component B               (-):     .541E+00
Molecular Weight Component B        (kg/kmol):     .814E+02
Spherical Factor                          (-):     .800E+00
Solid Specific Heat                (J/kg.K):     .101E+04
Heat Conductivity                   (W/m/K):     .000E+00
Effective Diffusion in Particle       (m2/s):


Heat Balance:
*************

Produced Heat                            (kW):     -.219
U overall                              (W/m2K):
h Coef. Bed to Surface                 (W/m2K):
h Coef. Tube Side                      (W/m2K):
Log. Delta Temperature                     (K):

Exchange Area Needed                      (m2):
Outside Tube Diameter                      (m):
Inside Tube Diameter                       (m):
Number of Tubes Needed                     (-):
Percentage Tubes                           (%):
Distance Between Tubes                     (m):
                                           (m):
Diameter Reactor                           (m):
Corrected Diameter                         (m):

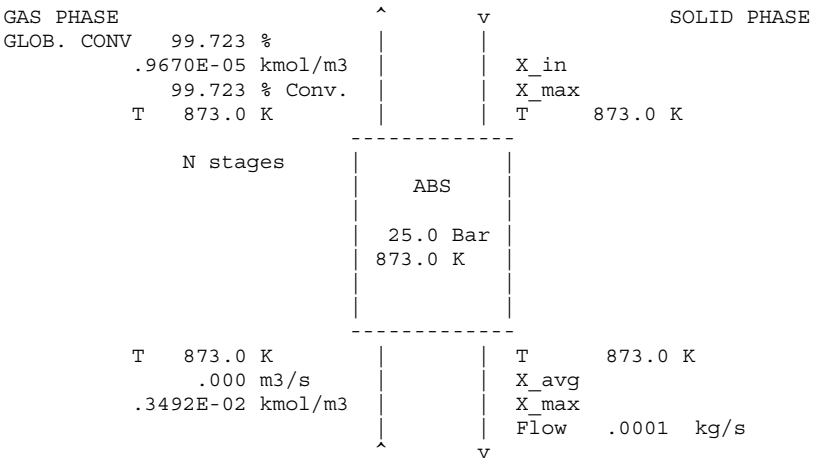
================================================================================


=========================  END RESULTS ==========================================
```

ANEXO II.1: DISTRIBUCIÓN DE TAMAÑOS.

A continuación se incluyen resultados de modelización BFB, considerando sólido RTI con la distribución de tamaño experimental. Se ha conectado el ciclón a la zona del freeboard.

RESULTADOS DE SIMULACIÓN PARA 7 cm/s



jet zone

Height (m)	Jet Dia. (m)	Jet Volume Fraction (-)	Specific Area (m2/m3)	C Jet Phase (kmol/m3)	C Dense Phase (kmol/m3)	Tj (K)	Te (K)	Mass Transfer (s-1)	Overall Gas Phase Conversion (-)
.001	.1000E-02	.8639E-01	345.5760	.3087E-02	.1695E-02	873.0	873.0	410.9938	.11598036
.001	.1000E-02	.8639E-01	345.5760	.2729E-02	.1498E-02	873.0	873.0	410.9938	.21850927
.002	.1000E-02	.8639E-01	345.5760	.2413E-02	.1325E-02	873.0	873.0	410.9938	.30914684
.002	.1000E-02	.8639E-01	345.5760	.2133E-02	.1171E-02	873.0	873.0	410.9938	.38927224
.003	.1000E-02	.8639E-01	345.5760	.1885E-02	.1035E-02	873.0	873.0	410.9938	.46010466

bubble zone

Height (m)	Bubble Dia. (m)	Bubble Volume Fraction (-)	Specific Area (m2/m3)	C Bubble Phase (kmol/m3)	C Cloud Phase (kmol/m3)	C Emulsion Phase (Kmol/m3)	Tb (K)	Te (K)	Mass Transfer (s-1)	Overall Gas Phase Conversion (-)
.004	.001	.365	1998.4808	.1614E-02	.1506E-02	.1329E-02	873.0	873.0	65.3106	.54290672
.006	.002	.334	1294.7434	.1285E-02	.1134E-02	.8543E-03	873.0	873.0	41.9004	.67368401
.007	.002	.313	957.0075	.9766E-03	.8213E-03	.5146E-03	873.0	873.0	30.9314	.77669756
.010	.002	.293	704.2388	.7219E-03	.5798E-03	.2867E-03	873.0	873.0	22.8332	.85215852
.013	.003	.273	522.7196	.5260E-03	.4054E-03	.1488E-03	873.0	873.0	17.0688	.90332101
.017	.004	.255	393.6344	.3821E-03	.2847E-03	.7360E-04	873.0	873.0	12.9865	.93825085
.022	.005	.238	295.0764	.2793E-03	.2024E-03	.3528E-04	873.0	873.0	9.8697	.95773429
.028	.006	.227	229.7668	.2053E-03	.1460E-03	.1718E-04	873.0	873.0	7.5569	.97027993
.035	.007	.219	181.2470	.1518E-03	.1063E-03	.8592E-05	873.0	873.0	5.7828	.97865889
.044	.009	.213	146.6391	.1127E-03	.7768E-04	.4482E-05	873.0	873.0	4.5085	.98445449

```
 .054   .010   .209  121.3753 .8369E-04 .5679E-04  .2433E-05  873.0  873.0   3.5713  .98859182
 .066   .012   .207  102.2188 .6202E-04 .4134E-04  .1356E-05  873.0  873.0   2.8549  .99161434
 .080   .014   .207   88.2695 .4574E-04 .2991E-04  .7774E-06  873.0  873.0   2.3288  .99385065
 .096   .016   .208   77.9547 .3130E-04 .2006E-04  .4315E-06  873.0  873.0   1.9365  .99541648
 .114   .018   .210   70.0900 .2171E-04 .1363E-04  .2445E-06  873.0  873.0   1.6346  .99652687
 .131   .020   .212   64.3600 .1590E-04 .9783E-05  .1512E-06  873.0  873.0   1.4126  .99723266
freeboard zone
==================================================
Height Gas    Tg       Ts    Overall
       Conc.                 Gas Phase
                             Conversion
(m) (kmol/m3) (K)      (K)    (-)
==================================================

 .148  .967E-05  873.0  873.0  .99723019
 .183  .967E-05  873.0  873.0  .99723029
 .218  .967E-05  873.0  873.0  .99723039
 .253  .967E-05  873.0  873.0  .99723049
 .288  .967E-05  873.0  873.0  .99723060
 .323  .967E-05  873.0  873.0  .99723070
 .358  .967E-05  873.0  873.0  .99723080
 .393  .967E-05  873.0  873.0  .99723091
 .428  .967E-05  873.0  873.0  .99723101
 .463  .967E-05  873.0  873.0  .99723111


Reactor Dimensions and Operation:
*********************************


Diameter Bed   (m):     .041   Reactor used as   :
Static Height  (m):     .103   Reactor Staged?   :
Dynamic Height (m):     .131   Reactor Number    :
Jet Height     (m):     .003   Include Jet Zone? :YES
Temperature    (K):  873.000
Pressure     (Bar):   25.000

U   (m/s):     .070    Geldart Solid Class        :      B
Umf (m/s):     .020    Porosity at Umf         (-):     .419
Umb (m/s):     .020    Porosity at Umb         (-):     .419
Ut  (m/s):     .638    Porosity of Dense Phase (-):     .419

Solid Class Defined by User       :
Solid Class Calculated by Program :B

Gas Distributor:
****************

Number of Orifice                       (m-2): 110000.0
Orifice Diameter                          (m):    .0010
Orifice Type                              (-):
Initial Bubble Size                       (m):    .0011

Area Fraction Orifice                     (-):    .0864
Velocity in Orifice                     (m/s):    .8105
Pressure Drop Bed                       (Bar):    .0148
Recommended Ratio Pressure Drop Grid/Bed (-):    .3000
Recommended Pressure Drop Distributor   (Bar):    .0044
Calculated Pressure Drop Orifices       (Bar):    .0001


Solid Reaction Kinetics:
************************

Solid Conversion Behaviour            :
Order in Gas Component                :
Effective Reaction Rate Constant (s-1):  89.0981
Efficiency Concept                    :
```

```
Beta Factor Concept                  :


Gas Phase:
**********

Gas Flow                               (m3/s):    .920E-04
Gas Density                           (kg/m3):    .786E+01
Gas Viscosity                          (Pa.s):    .402E-04
Gas Specific Heat                    (J/kg K):
Gas Conductivity                      (W/m.K):
Diffusion Coefficient Reactant         (m2/s):    .515E-05
Concentration Reactant Inlet        (kmol/m3):    .349E-02
Concentration Reactant Oulet        (kmol/m3):    .967E-05
Total Conversion Gas Phase Reactant        (-):    .997E+02


Solid Phase:
************

Solid Mass Flow                        (kg/s):    .100E-03
Average Solid Residence Time              (s):
Total Weight of Solids in Bed            (kg):    .197E+00
Initial Conversion Extent                 (-):
Average Outlet Conversion Extent          (-):
Maximum Conversion Extent                 (-):
Beta Factor Value                         (-):
Diameter Particles                        (m):    .236E-03
Density                               (kg/m3):    .252E+04
Stoichiomeetric Coefficient b             (-):    .100E+01
Weight Fraction Component B               (-):    .541E+00
Molecular Weight Component B        (kg/kmol):    .814E+02
Spherical Factor                          (-):    .100E+01
Solid Specific Heat                  (J/kg.K):
Heat Conductivity                     (W/m/K):
Effective Diffusion in Particle        (m2/s):


================================================================================


Gas Composition:
****************

CO    :56.0000
CO2   : 4.0000
H2    :20.0000
CH4   :  .0000
N2    : 9.0000
H2O   :10.0000
NH3   :  .0000
CH4   :  .0000
HCl   : 1.0000
H2S   :  .0000
COS   :  .0000



Solid aditional data:
*********************

E0                                  =     .500
Pvol                                =     .210
W                                   =     .541
Densop                              =    3.840
Denrec                              =    5.470
Pmp                                 =   97.500
```

```
Pmr                                 =   81.400
Rhoi                                = 2400.000
Mol gas/Mol solid                   =    1.000
Mol solid prod/Mol solid reactant   =    1.000
Denpro                              =    6.000
Skd                                 =     .000


Cyclones:
*********

Series                      =    1.000
Paralel                     =    1.000
Diameter                    =     .010
Type                        =LAPPLE
Cyclon capture efficiency
 .9975  .9975  .9975  .9975  .9976  .9976  .9976  .9976  .9977  .9977
 .9995  .9995  .9995  .9995  .9995  .9995  .9995  .9995  .9995  .9995
 .9997  .9997  .9997  .9997  .9997  .9997  .9997  .9997  .9997  .9997
 .9998  .9998  .9998  .9999  .9999  .9999  .9999  .9999  .9999  .9999
 .9999  .9999  .9999  .9999  .9999  .9999  .9999  .9999  .9999  .9999
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000


Tots               =      12.856
Totn               =    .325E+09
Diamed             = .112E-03
Diamas             = .236E-03
Densmed            = 2523.791


Solid currents data:
********************

Sflot
 .105E-03
F
    .0119     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0693     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0799     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .3019     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .1532     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .2896     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0940     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0001     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0001     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0001     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000

    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000

    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
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.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
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.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
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.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
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.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

Hinp

.010 .000 .000 .000 .000

Sflow

.000 .000 .000 .000 .000

Conv

.000 .110 .220 .330 .440 .550 .670 .780 .890
1.000

Diam

.000040 .000090 .000113 .000163 .000225 .000325 .000450 .000500 .000600
.000700

Tsinp

600.000 .000 .000 .000 .000

Fi

.0014	.0013	.0012	.0012	.0011	.0011	.0010	.0009	.0009	.0018
.0081	.0076	.0072	.0067	.0063	.0064	.0056	.0054	.0055	.0103
.0094	.0088	.0083	.0078	.0073	.0074	.0065	.0063	.0064	.0119
.0355	.0333	.0312	.0293	.0275	.0278	.0245	.0237	.0241	.0450
.0180	.0169	.0158	.0149	.0140	.0141	.0125	.0120	.0122	.0228
.0340	.0319	.0299	.0281	.0264	.0267	.0235	.0227	.0231	.0432
.0110	.0104	.0097	.0091	.0086	.0087	.0076	.0074	.0075	.0140
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

Nij

.174E+08	.161E+08	.149E+08	.139E+08	.129E+08	.129E+08	.112E+08	.107E+08	.108E+08	.199E+08
.888E+07	.824E+07	.764E+07	.709E+07	.659E+07	.658E+07	.574E+07	.547E+07	.551E+07	.102E+08
.517E+07	.480E+07	.445E+07	.413E+07	.384E+07	.383E+07	.334E+07	.319E+07	.321E+07	.593E+07
.651E+07	.604E+07	.560E+07	.520E+07	.483E+07	.483E+07	.421E+07	.401E+07	.404E+07	.747E+07
.126E+07	.117E+07	.108E+07	.100E+07	.932E+06	.931E+06	.812E+06	.774E+06	.779E+06	.144E+07
.788E+06	.731E+06	.678E+06	.629E+06	.585E+06	.584E+06	.509E+06	.486E+06	.489E+06	.904E+06
.964E+05	.894E+05	.829E+05	.769E+05	.715E+05	.714E+05	.623E+05	.594E+05	.598E+05	.111E+06
.748E+02	.693E+02	.643E+02	.597E+02	.554E+02	.554E+02	.483E+02	.460E+02	.463E+02	.857E+02
.433E+02	.401E+02	.372E+02	.345E+02	.321E+02	.321E+02	.279E+02	.266E+02	.268E+02	.496E+02
.272E+02	.253E+02	.234E+02	.217E+02	.202E+02	.202E+02	.176E+02	.168E+02	.169E+02	.312E+02

Fnij

.535E-01	.496E-01	.460E-01	.427E-01	.397E-01	.397E-01	.346E-01	.330E-01	.332E-01	.614E-01
.274E-01	.254E-01	.235E-01	.218E-01	.203E-01	.203E-01	.177E-01	.169E-01	.170E-01	.314E-01
.159E-01	.148E-01	.137E-01	.127E-01	.118E-01	.118E-01	.103E-01	.982E-02	.988E-02	.183E-01

~~~
 .201E-01  .186E-01  .173E-01  .160E-01  .149E-01  .149E-01  .130E-01  .124E-01  .124E-01  .230E-01
 .387E-02  .359E-02  .333E-02  .309E-02  .287E-02  .287E-02  .250E-02  .239E-02  .240E-02  .444E-02
 .243E-02  .225E-02  .209E-02  .194E-02  .180E-02  .180E-02  .157E-02  .150E-02  .151E-02  .279E-02
 .297E-03  .275E-03  .256E-03  .237E-03  .220E-03  .220E-03  .192E-03  .183E-03  .184E-03  .341E-03
 .230E-06  .214E-06  .198E-06  .184E-06  .171E-06  .171E-06  .149E-06  .142E-06  .143E-06  .264E-06
 .133E-06  .124E-06  .115E-06  .106E-06  .988E-07  .988E-07  .861E-07  .821E-07  .826E-07  .153E-06
 .839E-07  .778E-07  .722E-07  .670E-07  .622E-07  .622E-07  .542E-07  .517E-07  .520E-07  .963E-07
Outin
     1.00     -1.00       .00       .00       .00
Scurnam
     `````      `````      `````      `````      `````
Solid porosity at bed surface
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01


 ====================================================
 Height    Phi       Kbc       Kce       Kh
           value

 (m)       (-)       (s-1)     (s-1)     (s-1)
 ====================================================

     .004     .6500  .202E+03  .965E+02     .137E+08
     .006     .6500  .136E+03  .605E+02     .969E+07
     .007     .6500  .104E+03  .441E+02     .764E+07
     .010     .6500  .792E+02  .321E+02     .602E+07
     .013     .6500  .611E+02  .237E+02     .479E+07
     .017     .6500  .479E+02  .178E+02     .386E+07
     .022     .6500  .375E+02  .134E+02     .310E+07
     .028     .6500  .298E+02  .101E+02     .253E+07
     .035     .6500  .238E+02  .764E+01     .207E+07
     .044     .6500  .194E+02  .588E+01     .172E+07
     .054     .6500  .160E+02  .460E+01     .145E+07
     .066     .6500  .134E+02  .363E+01     .123E+07
     .080     .6500  .114E+02  .293E+01     .107E+07
     .096     .7127  .991E+01  .241E+01     .939E+06
     .114     .7823  .872E+01  .201E+01     .836E+06
     .131     .8537  .782E+01  .172E+01     .758E+06

Aditional calculated values-1:
*****************************

Kinetic value             =
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
Fraction solid atrictioned =
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
~~~

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    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
Vtotfr                    =.5682E-09
Mtotfr                    =.1425E-05
Vtotem                    =.7814E-04
Mtotem                    =.1972E+00
Nt                        =.6401E+08
Fcyout                    =
    .1563     .1376     .1210     .1062     .0931     .0876     .0713     .0637     .0599     .1031
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
Egj                       =.1000E+01
Ege                       =.4193E+00
Ec                        =.4193E+00
Dif                       =.7814E-04
Vsoltot                   =

Aditional calculated values-2:
*****************************

Res_time
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
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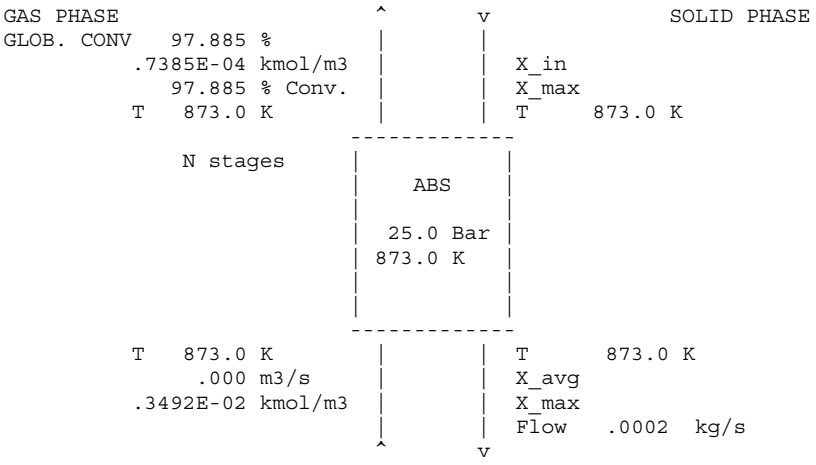
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
Rhotot                    =.0000E+00
Number of solid diam. cuts = 10
Number of solid dens. cuts = 10
Number of solid currents   =  1
Calculation cicles         = 21
Bubbling zone nodes        = 16
Jet zone nodes             =  5
Freeboard zone nodes       = 10
Total number of nodes      = 21
R1                         =   .0000E+00
Solmol                    =.6652E-03
Gasmol                    =.3213E-03
Expo                      =.0000E+00
Err                       =.0000E+00
TDH                       =
    .3500     .3500     .3500     .3500     .3500     .3500     .3500     .3500     .3500     .3500
    .0026     .0026     .0026     .0027     .0027     .0027     .0027     .0027     .0027     .0027
    .0034     .0034     .0034     .0034     .0034     .0034     .0035     .0035     .0035     .0035
    .0050     .0050     .0050     .0050     .0050     .0051     .0051     .0051     .0051     .0051
    .0069     .0069     .0069     .0069     .0070     .0070     .0070     .0071     .0071     .0071
    .0098     .0098     .0099     .0099     .0099     .0100     .0100     .0100     .0101     .0101
    .0133     .0133     .0134     .0134     .0135     .0135     .0136     .0136     .0137     .0137
    .0146     .0147     .0147     .0148     .0148     .0149     .0149     .0150     .0150     .0151
    .0173     .0173     .0174     .0174     .0175     .0176     .0176     .0177     .0178     .0178
    .0198     .0199     .0200     .0201     .0201     .0202     .0203     .0203     .0204     .0205
UT                        =
```

.0519	.0525	.0532	.0538	.0544	.0550	.0557	.0563	.0569	.0575
.2043	.2060	.2078	.2095	.2112	.2129	.2147	.2164	.2181	.2198
.2650	.2672	.2695	.2717	.2739	.2761	.2785	.2807	.2829	.2851
.4028	.4062	.4096	.4130	.4163	.4197	.4233	.4267	.4300	.4333
.5822	.5871	.5920	.5969	.6018	.6066	.6119	.6167	.6215	.6263
.8864	.8938	.9013	.9087	.9161	.9235	.9315	.9388	.9461	.9534
1.2857	1.2965	1.3073	1.3181	1.3288	1.3395	1.3511	1.3618	1.3724	1.3829
1.4502	1.4624	1.4746	1.4868	1.4989	1.5109	1.5240	1.5360	1.5480	1.5599
1.7862	1.8012	1.8162	1.8312	1.8461	1.8609	1.8771	1.8919	1.9066	1.9212
2.1303	2.1482	2.1661	2.1840	2.2017	2.2194	2.2387	2.2563	2.2739	2.2914

RESULTADOS DE SIMULACIÓN PARA 14 cm/s



jet zone

Height (m)	Jet Dia. (m)	Jet Volume Fraction (-)	Specific Area (m2/m3)	C Jet Phase (kmol/m3)	C Dense Phase (kmol/m3)	Tj (K)	Te (K)	Mass Transfer (s-1)	Overall Gas Phase Conversion (-)
.001	.1000E-02	.8639E-01	345.5760	.3112E-02	.1812E-02	873.0	873.0	477.2885	.10882066
.002	.1000E-02	.8639E-01	345.5760	.2774E-02	.1615E-02	873.0	873.0	477.2885	.20579939
.003	.1000E-02	.8639E-01	345.5760	.2472E-02	.1439E-02	873.0	873.0	477.2885	.29222482
.004	.1000E-02	.8639E-01	345.5760	.2203E-02	.1282E-02	873.0	873.0	477.2885	.36924538
.005	.1000E-02	.8639E-01	345.5760	.1963E-02	.1143E-02	873.0	873.0	477.2885	.43788452

bubble zone

Height (m)	Bubble Dia. (m)	Bubble Volume Fraction (-)	Specific Area (m2/m3)	C Bubble Phase (kmol/m3)	C Cloud Phase (kmol/m3)	C Emulsion Phase (Kmol/m3)	Tb (K)	Te (K)	Mass Transfer (s-1)	Overall Gas Phase Conversion (-)
.007	.002	.524	1360.2005	.1754E-02	.1599E-02	.1407E-02	873.0	873.0	28.5718	.52137710
.011	.004	.507	832.4033	.1471E-02	.1239E-02	.8918E-03	873.0	873.0	15.7668	.63955733
.016	.005	.465	551.9979	.1189E-02	.9277E-03	.4949E-03	873.0	873.0	10.3777	.74069056
.023	.007	.440	380.6861	.9400E-03	.6863E-03	.2437E-03	873.0	873.0	6.8008	.81595256
.032	.009	.423	273.0253	.7339E-03	.5081E-03	.1108E-03	873.0	873.0	4.5713	.86758825
.044	.012	.415	204.0246	.5674E-03	.3758E-03	.4939E-04	873.0	873.0	3.1426	.90348742
.060	.016	.415	159.7907	.4336E-03	.2754E-03	.2294E-04	873.0	873.0	2.2239	.92814332
.079	.019	.423	130.8561	.3258E-03	.1981E-03	.1140E-04	873.0	873.0	1.6192	.94673938
.103	.023	.437	112.2611	.2217E-03	.1290E-03	.5742E-05	873.0	873.0	1.2267	.96009892
.130	.027	.437	95.9402	.1505E-03	.8356E-04	.2844E-05	873.0	873.0	.9805	.96939285
.161	.031	.437	84.4872	.1052E-03	.5592E-04	.1503E-05	873.0	873.0	.8176	.97602326
.179	.034	.437	76.4219	.8631E-04	.4421E-04	.1003E-05	873.0	873.0	.7082	.97885956

freeboard zone

Height (m)	Gas Conc. (kmol/m3)	Tg (K)	Ts (K)	Overall Gas Phase Conversion (-)

```
 .196  .739E-04  873.0  873.0  .97884582
 .231  .739E-04  873.0  873.0  .97884673
 .266  .739E-04  873.0  873.0  .97884764
 .301  .739E-04  873.0  873.0  .97884855
 .336  .739E-04  873.0  873.0  .97884946
 .371  .739E-04  873.0  873.0  .97885037
 .406  .739E-04  873.0  873.0  .97885128
 .441  .739E-04  873.0  873.0  .97885219
 .476  .739E-04  873.0  873.0  .97885310
 .511  .738E-04  873.0  873.0  .97885401


Reactor Dimensions and Operation:
*********************************


Diameter Bed   (m):     .041   Reactor used as   :
Static Height  (m):     .103   Reactor Staged?   :
Dynamic Height (m):     .179   Reactor Number    :
Jet Height     (m):     .005   Include Jet Zone? :YES
Temperature    (K):  873.000
Pressure     (Bar):   25.000

U   (m/s):     .140    Geldart Solid Class        :      B
Umf (m/s):     .020    Porosity at Umf         (-):     .419
Umb (m/s):     .020    Porosity at Umb         (-):     .419
Ut  (m/s):     .638    Porosity of Dense Phase (-):     .419

Solid Class Defined by User       :
Solid Class Calculated by Program :B

Gas Distributor:
****************

Number of Orifice                      (m-2): 110000.0
Orifice Diameter                         (m):    .0010
Orifice Type                             (-):
Initial Bubble Size                      (m):    .0023

Area Fraction Orifice                    (-):    .0864
Velocity in Orifice                    (m/s):   1.6211
Pressure Drop Bed                      (Bar):    .0147
Recommended Ratio Pressure Drop Grid/Bed (-):    .3000
Recommended Pressure Drop Distributor  (Bar):    .0044
Calculated Pressure Drop Orifices      (Bar):    .0003


Solid Reaction Kinetics:
************************

Solid Conversion Behaviour            :
Order in Gas Component                :
Effective Reaction Rate Constant (s-1):  89.0981
Efficiency Concept                    :
Beta Factor Concept                   :


Gas Phase:
**********

Gas Flow                                (m3/s):    .184E-03
Gas Density                            (kg/m3):    .786E+01
Gas Viscosity                           (Pa.s):    .402E-04
Gas Specific Heat                     (J/kg K):
Gas Conductivity                       (W/m.K):
Diffusion Coefficient Reactant          (m2/s):    .515E-05
Concentration Reactant Inlet        (kmol/m3):    .349E-02
Concentration Reactant Oulet        (kmol/m3):    .738E-04
```

```
Total Conversion Gas Phase Reactant       (-):    .979E+02


Solid Phase:
************

Solid Mass Flow                        (kg/s):    .200E-03
Average Solid Residence Time              (s):
Total Weight of Solids in Bed            (kg):    .198E+00
Initial Conversion Extent                 (-):
Average Outlet Conversion Extent          (-):
Maximum Conversion Extent                 (-):
Beta Factor Value                         (-):
Diameter Particles                        (m):    .236E-03
Density                                (kg/m3):    .252E+04
Stoichiomeetric Coefficient b             (-):    .100E+01
Weight Fraction Component B               (-):    .541E+00
Molecular Weight Component B        (kg/kmol):    .814E+02
Spherical Factor                          (-):    .100E+01
Solid Specific Heat                 (J/kg.K):
Heat Conductivity                    (W/m/K):
Effective Diffusion in Particle        (m2/s):


================================================================================


Gas Composition:
****************

CO    :56.0000
CO2   : 4.0000
H2    :20.0000
CH4   :  .0000
N2    : 9.0000
H2O   :10.0000
NH3   :  .0000
CH4   :  .0000
HCl   : 1.0000
H2S   :  .0000
COS   :  .0000



Solid aditional data:
*********************

E0                                =     .500
Pvol                              =     .210
W                                 =     .541
Densop                            =    3.840
Denrec                            =    5.470
Pmp                               =   97.500
Pmr                               =   81.400
Rhoi                              = 2400.000
Mol gas/Mol solid                 =    1.000
Mol solid prod/Mol solid reactant =    1.000
Denpro                            =    6.000
Skd                               =     .000



Cyclones:
*********

Series                    =    1.000
Paralel                   =    1.000
```

```
Diameter                   =     .010
Type                       =LAPPLE
Cyclon capture efficiency
 .9987  .9987  .9988  .9988  .9988  .9988  .9988  .9988  .9988  .9988
 .9997  .9998  .9998  .9998  .9998  .9998  .9998  .9998  .9998  .9998
 .9998  .9998  .9998  .9998  .9998  .9998  .9999  .9999  .9999  .9999
 .9999  .9999  .9999  .9999  .9999  .9999  .9999  .9999  .9999  .9999
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Tots              =      12.867
Totn              =    .325E+09
Diamed            = .112E-03
Diamas            = .236E-03
Densmed           = 2521.509



Solid currents data:
********************

Sflot
 .210E-03
F
    .0119     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0693     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0799     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .3019     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .1532     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .2896     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0940     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0001     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0001     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
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Hinp
     .010        .000        .000        .000        .000
Sflow
     .000        .000        .000        .000        .000
Conv
     .000        .110        .220        .330        .440        .550        .670        .780        .890
1.000
Diam
  .000040     .000090     .000113     .000163     .000225     .000325     .000450     .000500     .000600
.000700
Tsinp
  600.000        .000        .000        .000        .000
Fi
    .0014     .0013     .0013     .0012     .0011     .0011     .0010     .0009     .0009     .0017
    .0084     .0078     .0073     .0068     .0064     .0064     .0056     .0054     .0054     .0098
    .0097     .0090     .0084     .0079     .0074     .0074     .0065     .0062     .0062     .0113
    .0365     .0341     .0319     .0298     .0278     .0279     .0245     .0234     .0235     .0425
    .0185     .0173     .0162     .0151     .0141     .0142     .0124     .0119     .0119     .0216
    .0350     .0327     .0306     .0285     .0267     .0268     .0235     .0224     .0225     .0408
    .0114     .0106     .0099     .0093     .0087     .0087     .0076     .0073     .0073     .0132
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
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Nij
 .179E+08  .165E+08  .153E+08  .141E+08  .130E+08  .129E+08  .112E+08  .106E+08  .105E+08  .188E+08
 .915E+07  .845E+07  .780E+07  .720E+07  .666E+07  .661E+07  .572E+07  .541E+07  .538E+07  .962E+07
 .533E+07  .492E+07  .455E+07  .420E+07  .388E+07  .385E+07  .333E+07  .315E+07  .313E+07  .560E+07
 .671E+07  .620E+07  .572E+07  .528E+07  .488E+07  .484E+07  .419E+07  .396E+07  .394E+07  .706E+07
 .129E+07  .120E+07  .110E+07  .102E+07  .942E+06  .935E+06  .809E+06  .765E+06  .761E+06  .136E+07
 .812E+06  .750E+06  .693E+06  .639E+06  .591E+06  .586E+06  .507E+06  .480E+06  .477E+06  .854E+06
 .993E+05  .917E+05  .847E+05  .782E+05  .722E+05  .717E+05  .620E+05  .587E+05  .583E+05  .104E+06
 .770E+02  .711E+02  .657E+02  .606E+02  .560E+02  .556E+02  .481E+02  .455E+02  .452E+02  .810E+02
 .446E+02  .412E+02  .380E+02  .351E+02  .324E+02  .322E+02  .278E+02  .263E+02  .262E+02  .469E+02
 .281E+02  .259E+02  .239E+02  .221E+02  .204E+02  .203E+02  .175E+02  .166E+02  .165E+02  .295E+02
Fnij
 .551E-01  .509E-01  .470E-01  .434E-01  .401E-01  .398E-01  .344E-01  .325E-01  .324E-01  .579E-01
 .282E-01  .260E-01  .240E-01  .222E-01  .205E-01  .203E-01  .176E-01  .166E-01  .166E-01  .296E-01
 .164E-01  .152E-01  .140E-01  .129E-01  .119E-01  .118E-01  .103E-01  .969E-02  .964E-02  .173E-01
 .207E-01  .191E-01  .176E-01  .163E-01  .150E-01  .149E-01  .129E-01  .122E-01  .121E-01  .217E-01
 .399E-02  .368E-02  .340E-02  .314E-02  .290E-02  .288E-02  .249E-02  .235E-02  .234E-02  .419E-02
 .250E-02  .231E-02  .213E-02  .197E-02  .182E-02  .180E-02  .156E-02  .148E-02  .147E-02  .263E-02
 .306E-03  .282E-03  .261E-03  .241E-03  .222E-03  .221E-03  .191E-03  .181E-03  .180E-03  .321E-03
 .237E-06  .219E-06  .202E-06  .187E-06  .172E-06  .171E-06  .148E-06  .140E-06  .139E-06  .249E-06
 .137E-06  .127E-06  .117E-06  .108E-06  .998E-07  .990E-07  .857E-07  .810E-07  .806E-07  .144E-06
 .864E-07  .798E-07  .737E-07  .680E-07  .628E-07  .624E-07  .540E-07  .510E-07  .508E-07  .908E-07
Outin
     1.00     -1.00       .00       .00       .00
Scurnam
     `````       `````       `````       `````       `````
Solid porosity at bed surface
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
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 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01
 .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01  .100E+01


 ====================================================
 Height    Phi       Kbc       Kce       Kh
           value

 (m)       (-)       (s-1)     (s-1)     (s-1)
 ====================================================

     .007     .6500  .863E+02  .427E+02     .649E+07
     .011     .6500  .514E+02  .227E+02     .411E+07
     .016     .6500  .357E+02  .146E+02     .297E+07
     .023     .6500  .250E+02  .934E+01     .216E+07
     .032     .6500  .181E+02  .612E+01     .161E+07
     .044     .6500  .134E+02  .411E+01     .123E+07
     .060     .6500  .102E+02  .285E+01     .963E+06
     .079     .6500  .800E+01  .203E+01     .773E+06
     .103     .7245  .651E+01  .151E+01     .642E+06
     .130     .8252  .548E+01  .119E+01     .548E+06
     .161     .9291  .477E+01  .987E+00     .483E+06
     .179    1.0000  .427E+01  .849E+00     .437E+06

Aditional calculated values-1:
****************************

Kinetic value             =
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
  89.0981   83.5066   77.4691   70.9555   63.8078   55.9738   46.3100   36.0065   23.2223     .0000
Fraction solid atrictioned =
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
Vtotfr                    =.1398E-08
Mtotfr                    =.3522E-05
Vtotem                    =.7834E-04
Mtotem                    =.1975E+00
Nt                        =.6417E+08
Fcyout                    =
    .1330     .1216     .1111     .1014     .0927     .0911     .0779     .0728     .0716     .1268
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
```

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    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
    .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
Egj                       =.1000E+01
Ege                       =.4193E+00
Ec                        =.4193E+00
Dif                       =.7834E-04
Vsoltot                   =

Aditional calculated values-2:
*****************************

Res_time
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
.0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00 .0000E+00
Rhotot                    =.0000E+00
Number of solid diam. cuts = 10
Number of solid dens. cuts = 10
Number of solid currents   =  1
Calculation cicles         = 21
Bubbling zone nodes        = 12
Jet zone nodes             =  5
Freeboard zone nodes       = 10
Total number of nodes      = 17
R1                        =   .0000E+00
Solmol                    =.1330E-02
Gasmol                    =.6426E-03
Expo                      =.0000E+00
Err                       =.0000E+00
TDH                       =
    .3500     .3500     .3500     .3500     .3500     .3500     .3500     .3500     .3500     .3500
    .0049     .0050     .0050     .0050     .0050     .0050     .0050     .0051     .0051     .0051
    .0061     .0061     .0061     .0061     .0061     .0062     .0062     .0062     .0062     .0063
    .0085     .0086     .0086     .0086     .0087     .0087     .0087     .0088     .0088     .0088
    .0115     .0116     .0116     .0117     .0117     .0117     .0118     .0118     .0119     .0119
    .0162     .0162     .0163     .0164     .0164     .0165     .0165     .0166     .0166     .0167
    .0217     .0218     .0219     .0219     .0220     .0221     .0222     .0223     .0223     .0224
    .0239     .0239     .0240     .0241     .0242     .0243     .0244     .0245     .0245     .0246
    .0281     .0282     .0283     .0284     .0285     .0286     .0287     .0288     .0289     .0290
    .0322     .0323     .0324     .0325     .0326     .0327     .0329     .0330     .0331     .0332
UT                        =
    .0519     .0525     .0532     .0538     .0544     .0550     .0557     .0563     .0569     .0575
    .2043     .2060     .2078     .2095     .2112     .2129     .2147     .2164     .2181     .2198
    .2650     .2672     .2695     .2717     .2739     .2761     .2785     .2807     .2829     .2851
    .4028     .4062     .4096     .4130     .4163     .4197     .4233     .4267     .4300     .4333
    .5822     .5871     .5920     .5969     .6018     .6066     .6119     .6167     .6215     .6263
    .8864     .8938     .9013     .9087     .9161     .9235     .9315     .9388     .9461     .9534
   1.2857    1.2965    1.3073    1.3181    1.3288    1.3395    1.3511    1.3618    1.3724    1.3829
   1.4502    1.4624    1.4746    1.4868    1.4989    1.5109    1.5240    1.5360    1.5480    1.5599
   1.7862    1.8012    1.8162    1.8312    1.8461    1.8609    1.8771    1.8919    1.9066    1.9212
   2.1303    2.1482    2.1661    2.1840    2.2017    2.2194    2.2387    2.2563    2.2739    2.2914
```