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Highlights in thermal engineering at CGS:

1) Thermal Stability in the frequency domain

2) THERMAL DESKTOP® translation tools

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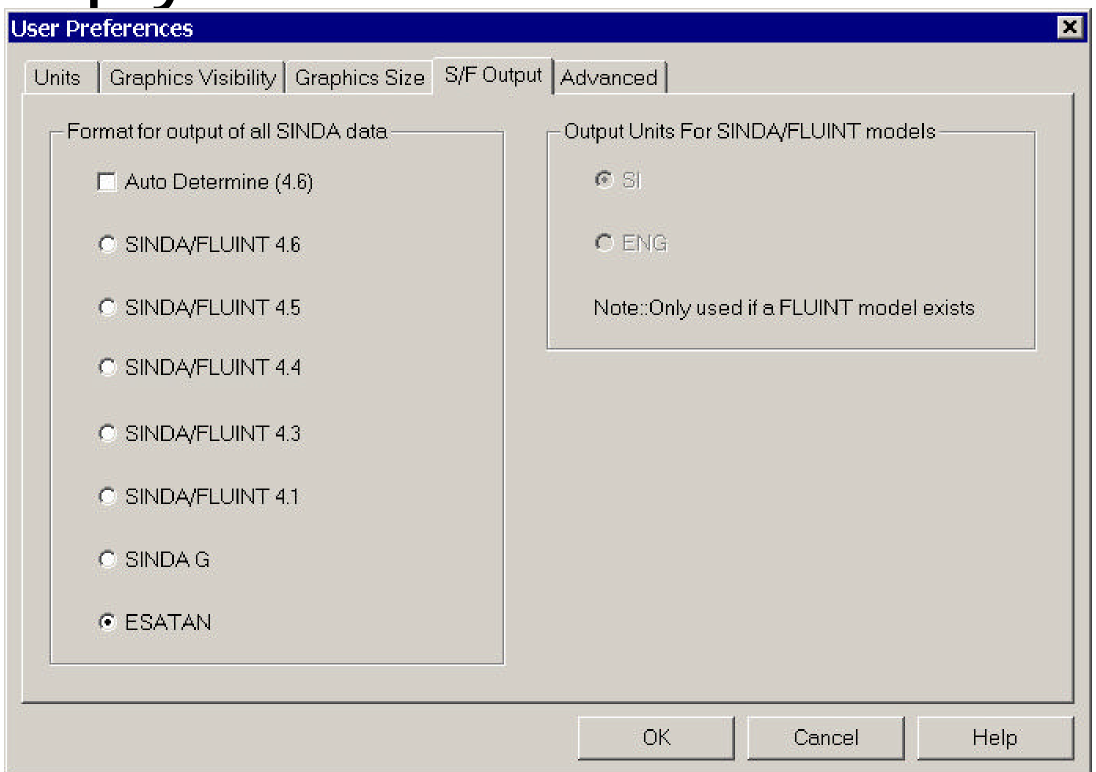
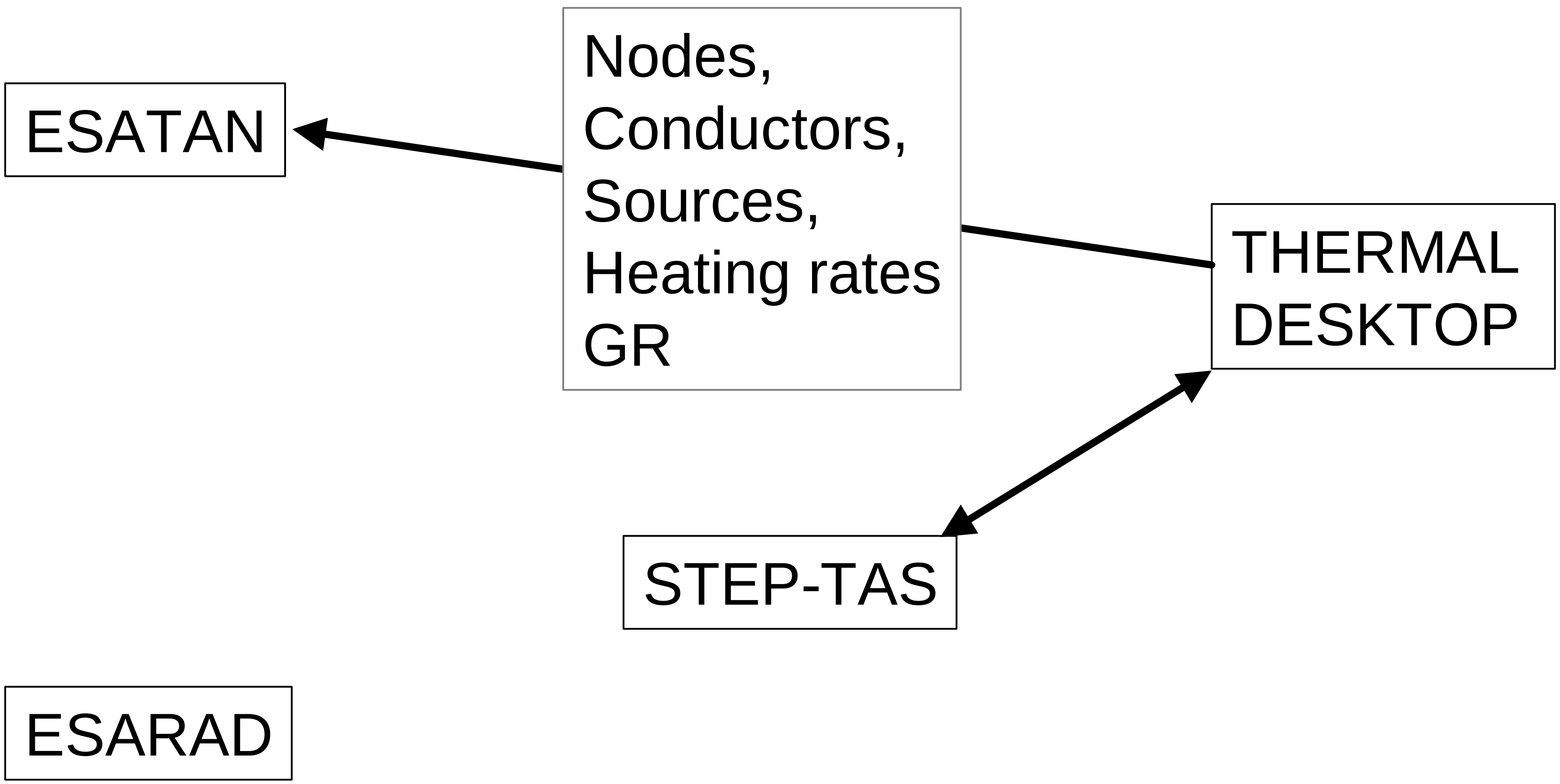
2) ESARAD (via STEP-TAS)/ESATAN translation from Thermal Desktop® 4.6

Enabling ESATAN Output

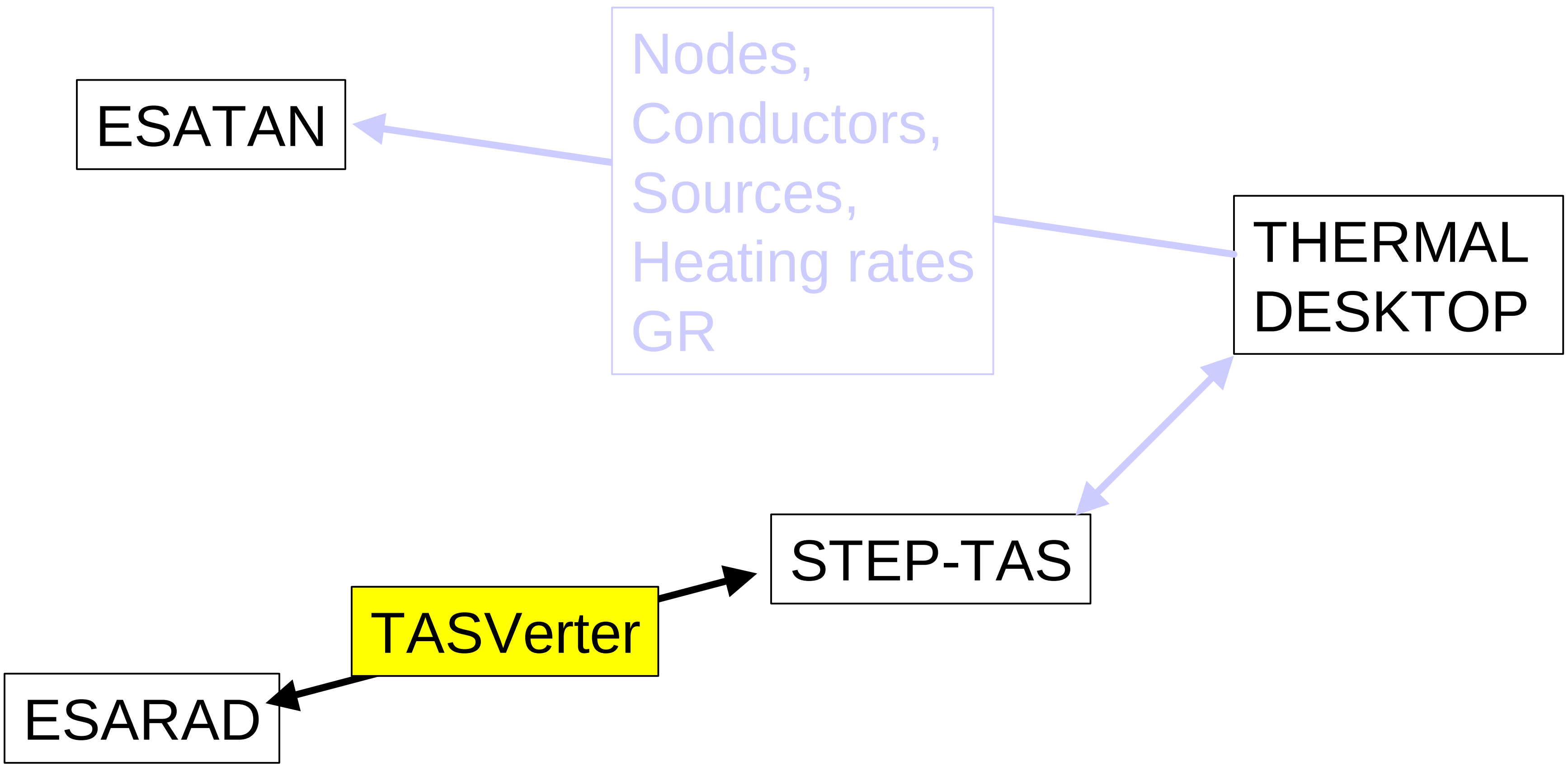
- Simply turn on the ESATAN button



Thermal Desktop® 4.6 features



How to fill the gap



Thermal Desktop ® Radiation Calculations

- Geometries built in Thermal Desktop are exported in STEP-TAS format
  - Current limitations
    - all geometry must be placed in a single submodel
- STEP-TAS can be imported into Thermal Desktop
- RADK and Heating Rate calculations are output in ESATAN format

Sample Output (RADKS)

```
C    SINDA/FLUINT data created with Thermal Desktop 4.6
C    Generated on Fri Oct 17 08:41:04 2003
C    Generated from database BASE-RcOptics.rck
C    Bij Cutoff factor:      0.0010000
C    Conductor units are: m^2
C
C   radk format:
C   node_1     node_2     Area*e*Bij $  Bij   Bji
C
        GR(      1,     999)=       0.50000;  $      1.0000
        GR(      2,     999)=       0.50000;  $      1.0000
        GR(      3,     999)=       0.50000;  $      1.0000
        GR(      4,     999)=       0.50000;  $      1.0000
C
C Summary data for nodes with Bij sums < 1.0000 or > 1.0000
C BijSum always contains Bij Self
C
C         node          area          rays     emiss      Bij     Bij     Bij   Weighted
C                                                         sum     self   inact   % Error
C         MAIN.1     0.50000      5000    1.0000    1.0000                        0.0
C         MAIN.2     0.50000      5000    1.0000    1.0000                        0.0
C         MAIN.3     0.50000      5000    1.0000    1.0000                        0.0
C         MAIN.4     0.50000      5000    1.0000    1.0000                        0.0
```

Sample Output (Heating Rates)

```
#
    GENMOR
#
    IF(NSOL.GT.1.0)THEN
      QS:1=INTCYC(TIMEM,ARTIME,ARSAMAIN1,1,5676.98D0,0.0D0)
      QS:2=INTCYC(TIMEM,ARTIME,ARSAMAIN2,1,5676.98D0,0.0D0)
      QS:3=INTCYC(TIMEM,ARTIME,ARSAMAIN3,1,5676.98D0,0.0D0)
      QS:4=INTCYC(TIMEM,ARTIME,ARSAMAIN4,1,5676.98D0,0.0D0)
    ELSE
      QS:1=193.242
      QS:2=192.891
      QS:3=191.811
      QS:4=192.912
    ENDIF
```

Sample Output (Heating Rates)

```
# Time Array
 ARTIME(17)=        0.0,4.730820e+002,9.461640e+002,1.419250e+003
          1.764227e+003,1.767633e+003,1.892330e+003,2.365410e+003
          2.838490e+003,3.311570e+003,3.784650e+003,3.909347e+003
          3.912753e+003,4.257740e+003,4.730820e+003,5.203900e+003
          5.676980e+003;
#
# solar albedo planetshine - MAIN.1 Area = 0.500000 Avg = 112.887535 31.783997 48.570499
 ARSAMAIN1(17)=4.880749e+002,4.282346e+002,2.696814e+002,5.125848e+001
            1.733135e+002,4.857050e+001,4.857050e+001,4.857050e+001
            4.857050e+001,4.857050e+001,4.857050e+001,4.857050e+001
            1.734149e+002,5.122900e+001,2.669101e+002,4.294877e+002
            4.880749e+002;
#
# solar albedo planetshine - MAIN.2 Area = 0.500000 Avg = 113.716866 31.922405 47.252102
 ARSAMAIN2(17)=4.929644e+002,4.238430e+002,2.660976e+002,4.994052e+001
            1.747323e+002,4.725210e+001,4.725210e+001,4.725210e+001
            4.725210e+001,4.725210e+001,4.725210e+001,4.725210e+001
            1.762022e+002,5.012827e+001,2.717307e+002,4.300657e+002
            4.929644e+002;
```

…..More Arrays…

ESATAN

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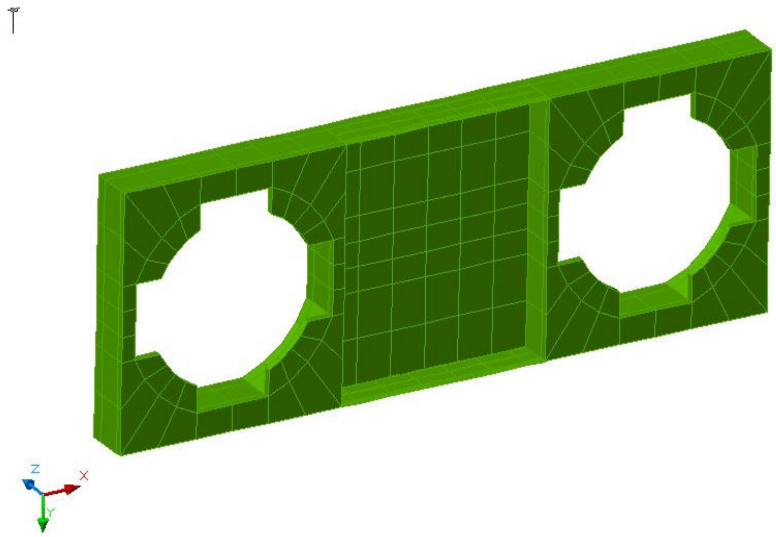
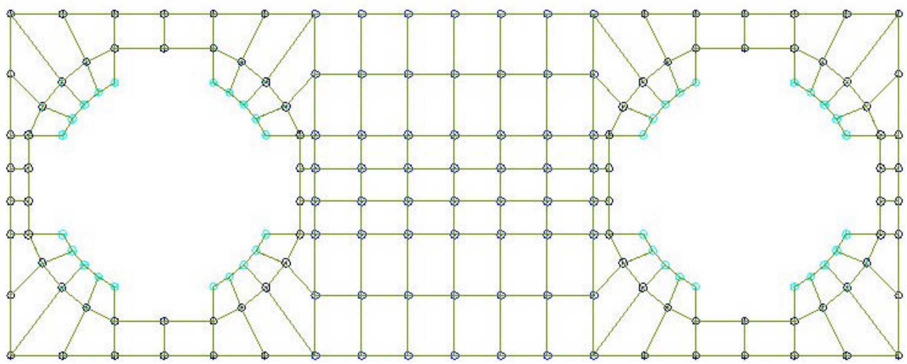
- Node, Conductor, and Heatloads are output in ESATAN format





ESATAN Sample Output (from Thermal Desktop® 4.6)

```
#    SINDA Data generated with Thermal Desktop 4.6
#    Generated on Fri Oct 17 08:35:37 2003
#    TDUNITS,   Energy   =    J
#    TDUNITS,   Time     =    sec
#    TDUNITS,   Temp     =    K
#    TDUNITS,   Mass     =    kg
#    TDUNITS,   Length   =    m
#    TDUNITS,   Orbit    =    km
#    TDUNITS,   Pressure =    Pa
$NODES
 D1='MAIN #1', T=293.15, C=INTRP1(T1,AR2,1)*0.00025;
 D2='MAIN #2', T=293.15, C=INTRP1(T2,AR2,1)*0.00025;
 D3='MAIN #3', T=293.15, C=INTRP1(T3,AR2,1)*0.00025;
 D4='MAIN #4', T=293.15, C=INTRP1(T4,AR2,1)*0.00025;
 B999='MAIN #999', T=0.;
```

```
$ARRAYS
# DEFAULT.k
 AR1(10)=
   0., 1.
   100., 5.
   200., 7.
   300., 10.
   1000., 11.
# DEFAULT.rhocp
 AR2(8)=    0., 100.

   100., 105.
   200., 150.
   500., 175.
$CONDUCTORS
 GL(1,2)=INTRP1( (T1+T2)*.5, AR1,1)*0.001;
 GL(1,3)=INTRP1( (T1+T3)*.5, AR1,1)*0.001;
 GL(2,4)=INTRP1( (T2+T4)*.5, AR1,1)*0.001;
 GL(3,4)=INTRP1( (T3+T4)*.5, AR1,1)*0.001;
$VARIABLES1
```

Conclusions

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- Thermal Desktop 4.6 translates model+sources+heating rates into ESATAN
- Translation to STEP-TAS under testing
- Open point
  - How to ‘certify’ the compatibility with STEP-TAS?
- Important applications
  - ISS (NASA standard required)
  - Large Space Simulator (@ESTEC): GMM and TMM models now only available in ESATAN/ESARAD.