October 2005

ESARAD Status

Bruno CASTELLI

ALSTOM

Status Overall

ALSTOM

- ESARAD 5.6 released in February 2005
  - Patch 5.6.1, released in June 2005
- Next release, version 5.8, end of 2005
- Current version's features
- Next version's features
- Next development work

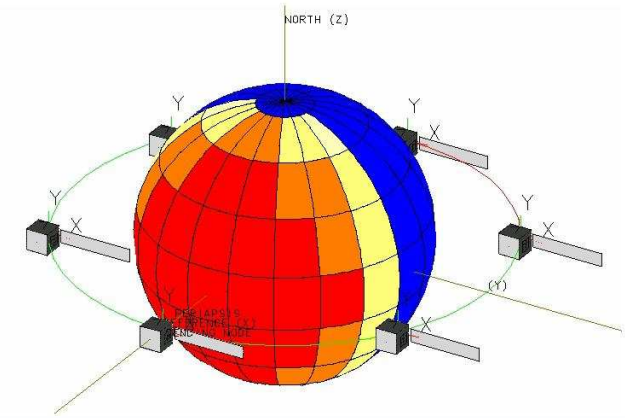
ESARAD 5.6

- 8 digits node numbering
- Sun finite distance
- Performance enhancement
- Planet temperature map
- Optical property sets

Product Status – ESARAD 5.6

Planet Temperature mapping

- Planet temperature map
  - used in planet flux calculation
  - uniform temperature option retained



New options ….

- 5.6 Features -

Planet Temperature mapping

ALSTOM

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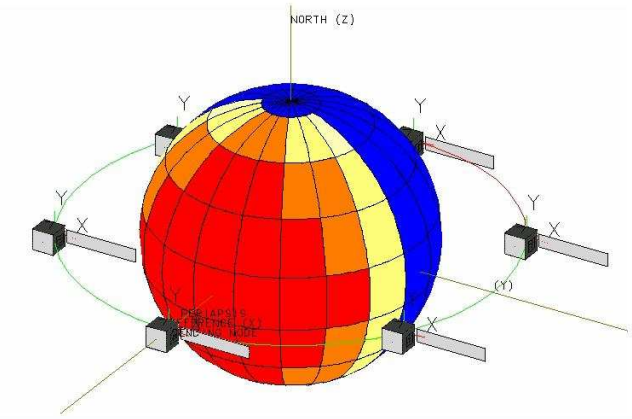


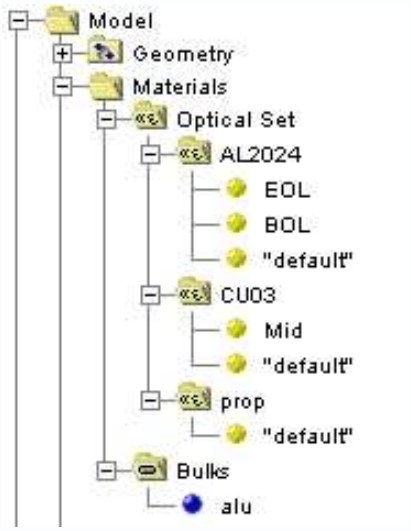
New options ….

- Matrix of temperature
  - T° vs. longitude/latitude
- Auto calculate map from:
  - solar absorptivity
  - infra-red emissivity
  - minimum night side temp

Optical Property Set

ALSTOM

What are optical property sets ?

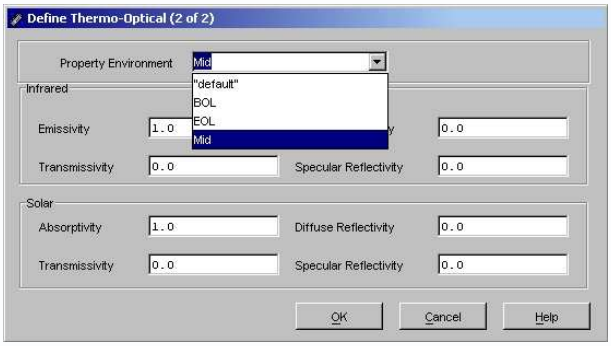


- Ability to define multiple optical property sets
- Enables easy simulation of:
  - material degradation
  - surface finish effects
- No need to duplicate geometry or kernel.

Optical Property Set

Application of optical property sets

- Select existing property environment to modify or
- Add new property environment
- Update IR/UV values



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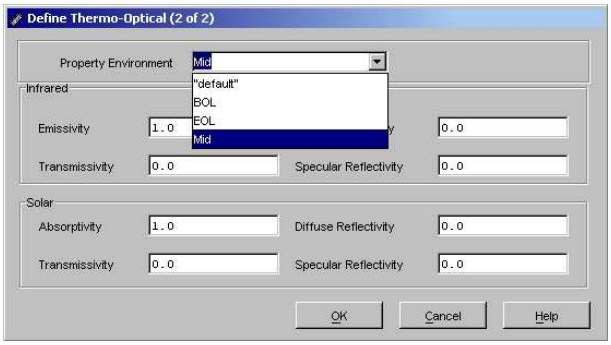

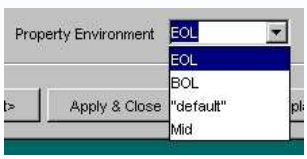

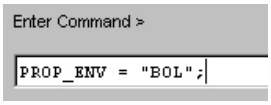

- Select set within radiative case
- Default property (“default”)
- Visualisation of property set
- Dynamic binding of properties

- 5.6 Features -

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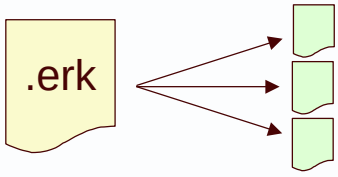
ESARAD 5.8

- Parallel Kernel
- Orbital Arc
- OpenGL
- Linux Support
- Visualisation improvements
- ACG
- Interfaces

Parallel Kernel

- Split the Kernel file into several files (from the GUI)
- Each file has a part of the solution to run (in batch)
  - File1 runs REFs
  - File2 runs HF for positions 1 to 5
  - File3 runs HF for positions 6 to 10
  - (…)



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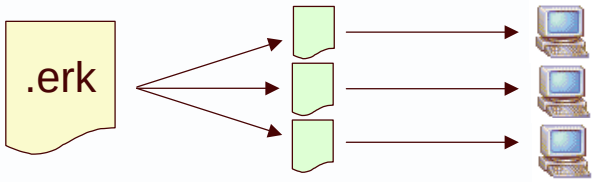
- Each individual kernel file can be run at the same time



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  - File1 runs REFs
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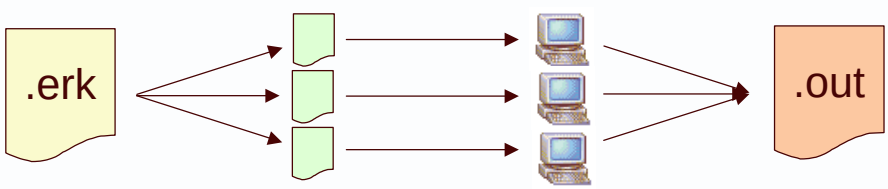
  - (…)
- Each individual kernel file can be run at the same time
- Runs on different machines across network
- Runs on different processors of the same machine



- New 5.8 Features -
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Orbital Arc

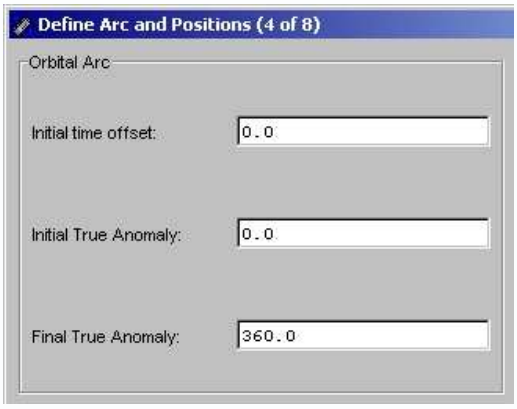
Definition

- Define a complete or partial orbit
  - Define the initial anomaly {-360° ; 360°}
  - Define the final anomaly {init_anom ; init_anom +360°}
- Define your positions on the orbit
  - Define number of positions or equal angles spacing
  - Define/Select an anomalies vector
- Chain multiple arcs in the analysis case
  - Full 360° orbits can be cycled more than once
  - Can set an time offset between consecutive arcs
  - With no offset, can choose which end point result

Orbital Arc

Defining a Partial Arc

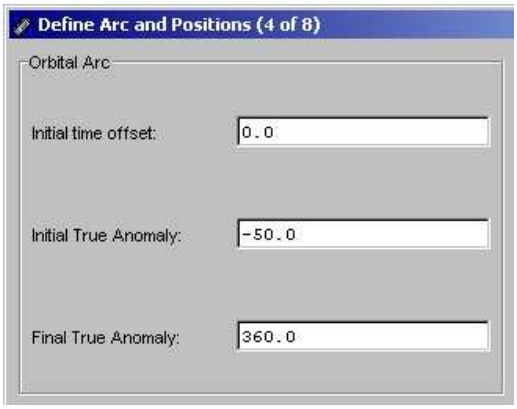
```
init_anomaly = -50.0;
```



Orbital Arc

Defining a Partial Arc

```
init_anomaly = -50.0;
final_anomaly = 170.0;
```



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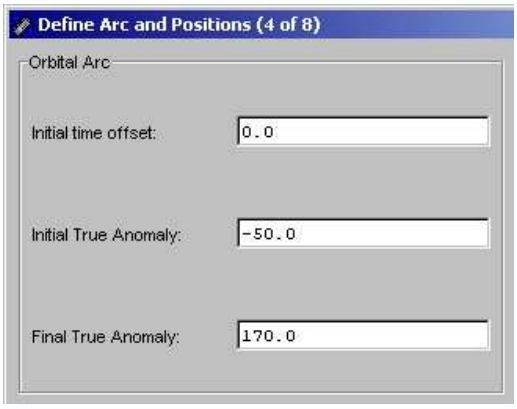

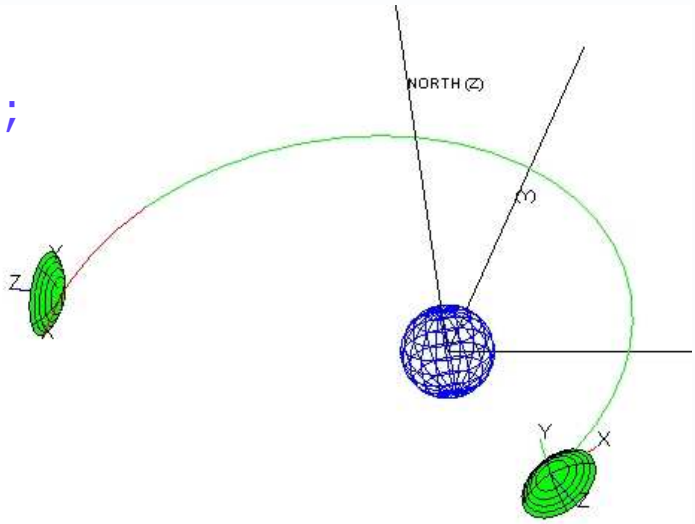

- New 5.8 Features -
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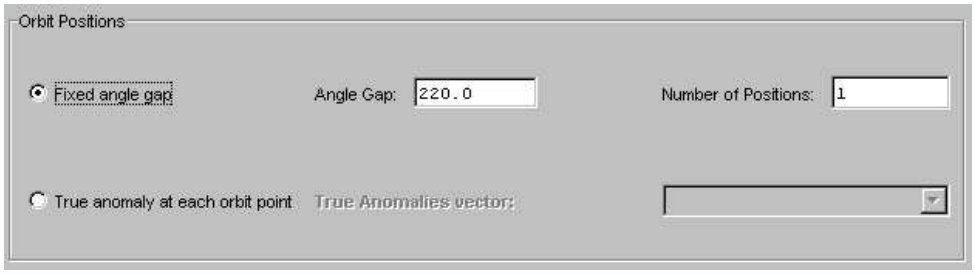
Orbital Arc

Defining the Positions

```
REAL arcAnoms[5] = {
   -25.0, 0.0, 25.0,
   50.0, 110.0
};
```



Orbital Arc

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- New 5.8 Features -
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Orbital Arc

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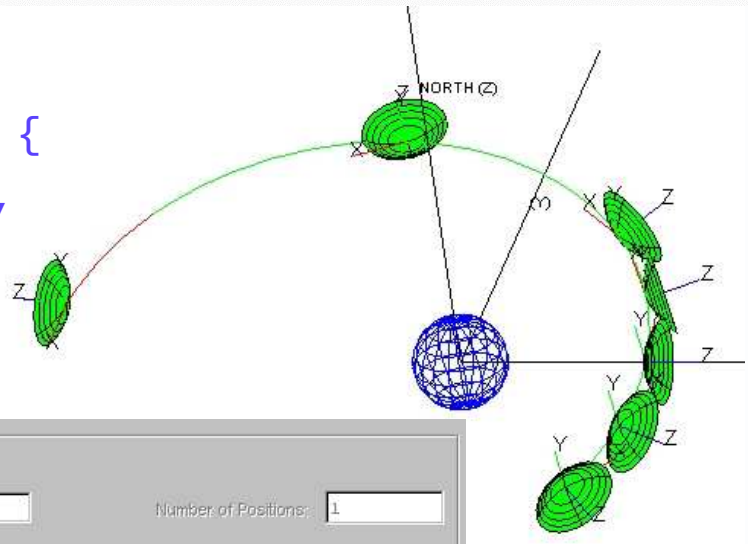


- New 5.8 Features -

Orbital Arc

ALSTOM

Radiative Case Report

```
Ellipse Parameters:
    Altitude at Apogee              5.000000E+007
    Altitude at Perigee             5.000000E+006
    Inclination                     140.00
    Right ascension                 180.00
    Periapsis argument              0.00
    Ellipse semi major axis         33878140.00
    Ellipse semi minor axis         25327423.28
    Ellipse eccentricity            0.66
    Solar beta angle                7.53
```

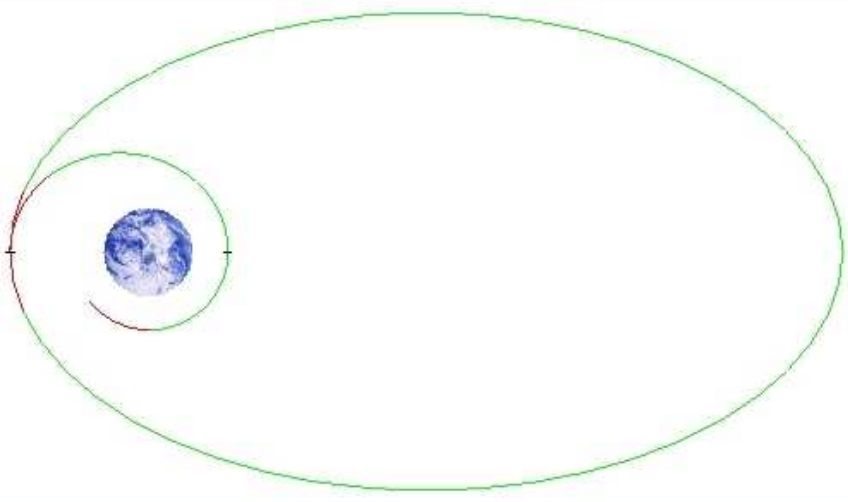
```
Orbit Arc and Positions:
    Anomaly at first position       220.00
    Anomaly at last position        360.00
    Initial time / Offset           0.00
    Position method                 ANGLE
    Eclipse entry                   450.28
    Eclipse exit                    269.72
    Percent time in Eclipse         35.51
    Percent time Sunlit             64.49
    Orbit period                    1970.61
```

```
Ephemeris Report:
  Angle  Elapsed Time   Sunlit          Position Coordinates  X,Y,Z
    [°]           [s]    [Y/N]                                  [m]
   0.00,         0.00,      NO,    -11378140,           0,           0
 120.00,      6700.66,     YES,     14174350,    18806924,    15780883
 200.00,     42860.22,     YES,     47333321,   -13197352,   -11073893
 240.00,     55329.78,     YES,     14174350,   -18806924,   -15780883
 360.00,     62030.43,      NO,    -11378140,          -0,          -0
```

- New 5.8 Features -

Orbital Arc

Chaining Multiple Arcs



Orbital Arc

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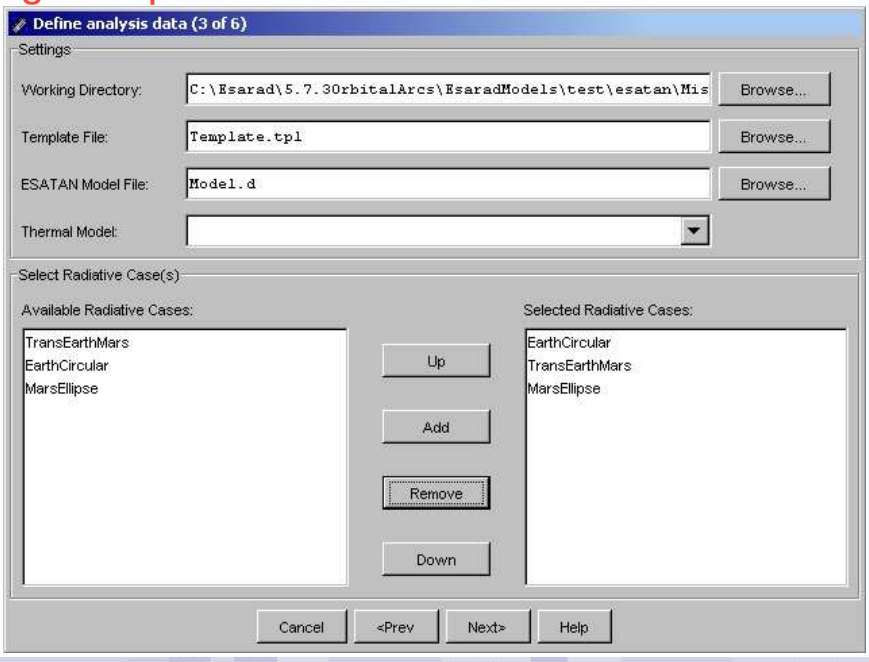

- New 5.8 Features -

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Orbital Arc

ALSTOM

Chaining Multiple Arcs

Define analysis data (4 of 6)

Orbital Arc Cycles

Enter number of cycles to perform for each complete arc:

Radiative Case	Arc Type	Cycles
EarthCircular	Partial Arc	1
TransEarthMars	Partial Arc	1
MarsEllipse	Complete Arc	3

Common Point Criteria

Select result to use at common points for arc-pairs with zero time offset:

First Arc	Second Arc	Result Selection
EarthCircular	TransEarthMars	Last Point First Arc
TransEarthMars	MarsEllipse	First Point Second Arc

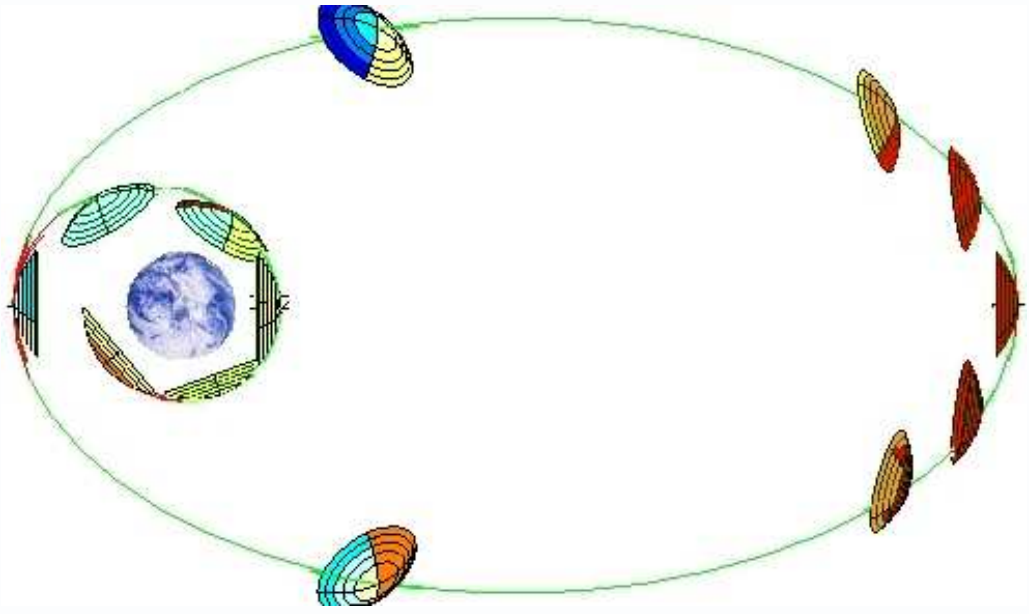
Cancel | <Prev | Next> | Help

- New 5.8 Features -

Orbital Arc

ALSTOM

Chaining Multiple Arcs



- New 5.8 Features -

Orbital Arc

ALSTOM

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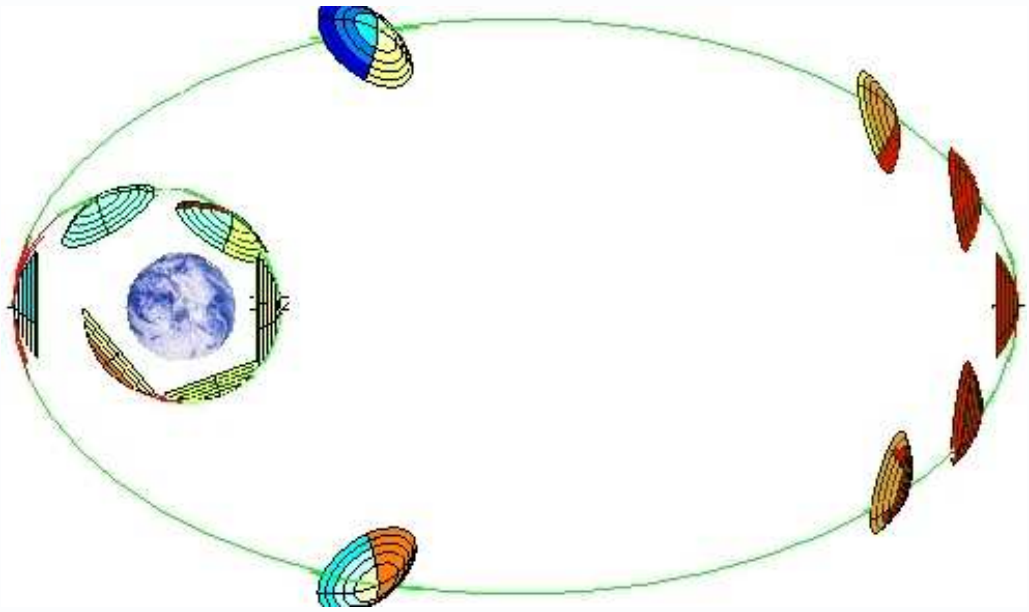
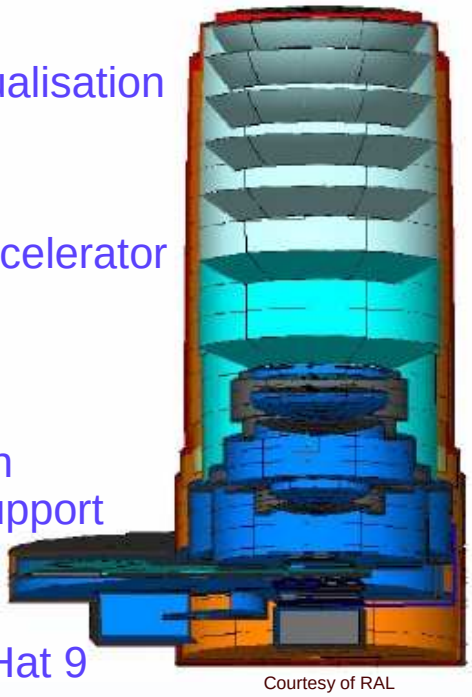


OpenGL and Linux

ALSTOM

- ESARAD now uses OpenGL for its visualisation
  - 3D graphics using OpenGL
  - no third-party licence restrictions
  - makes use of hardware graphics accelerator
    - performance improvements
  - potential for powerful 3D graphics
- Software Rendering can be used as an alternative if graphics card does not support OpenGL, or with VNC
- ESARAD now available on Linux RedHat 9

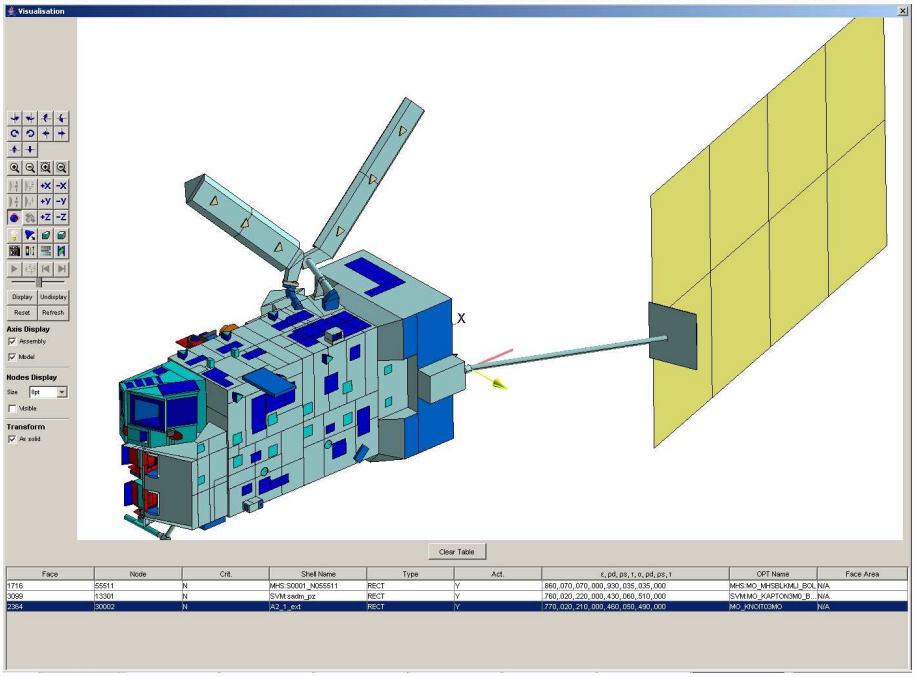


Courtesy of RAL

Visualisation Improvements

ALSTOM

- Display screen no longer square
- Solid Rotation Mode
- Smoother Video Mode



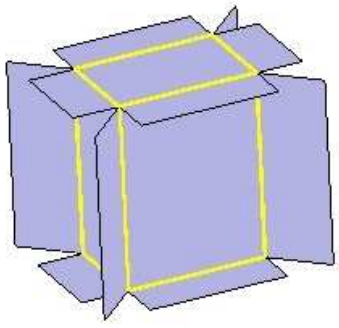
- New 5.8 Features -

ACG

ALSTOM

Automatic Conductance Generator

- ESARAD's ACG capabilities enhanced:
  - Use of far-field method (previously presented)
  - Handles cuts within a shell
  - Handles non coincident mesh
  - Identify most conductive interfaces
  - No longer need to run radiative case



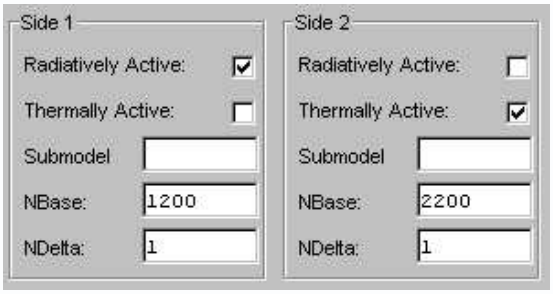
- New face activity: Thermally active/inactive
- Shell can have different bulk properties on either side

- New 5.8 Features -

Thermally active face

Face can be:

- Radiatively active: used in radiative calculations
- Thermally active: used in conductive calculations
- Active: both radiatively and thermally active
- Inactive



ACG

ALSTOM

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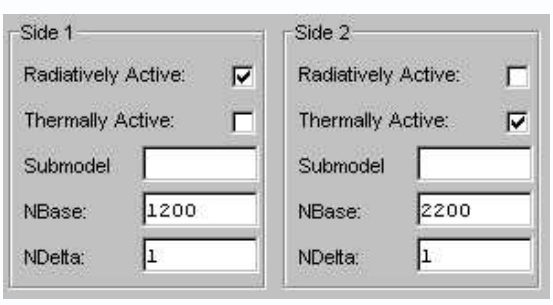

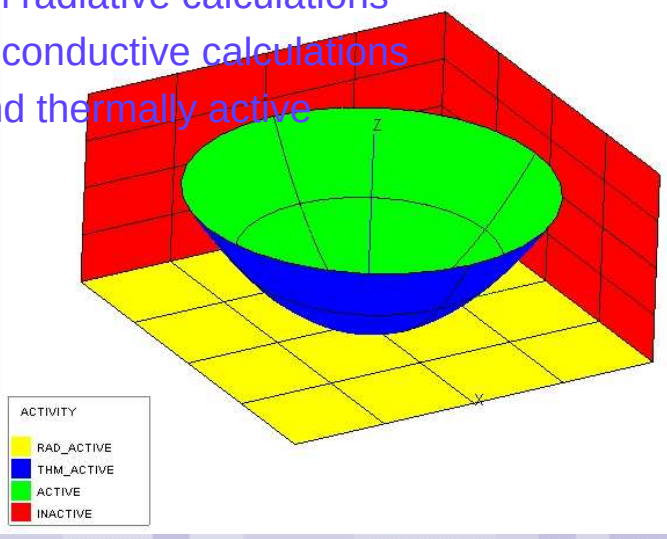

- New 5.8 Features -

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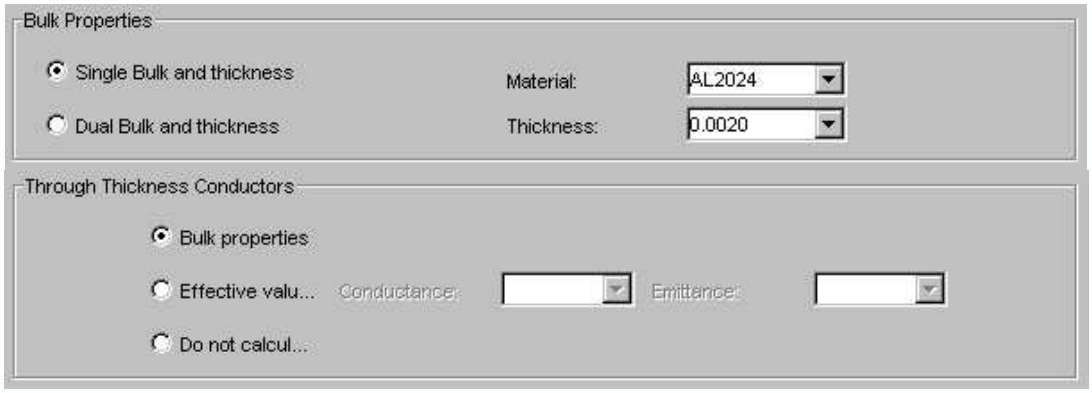
Bulk and Thickness assignment

- Different bulks and thicknesses can be specified on each face of a shell
- Can calculate through thickness conductances



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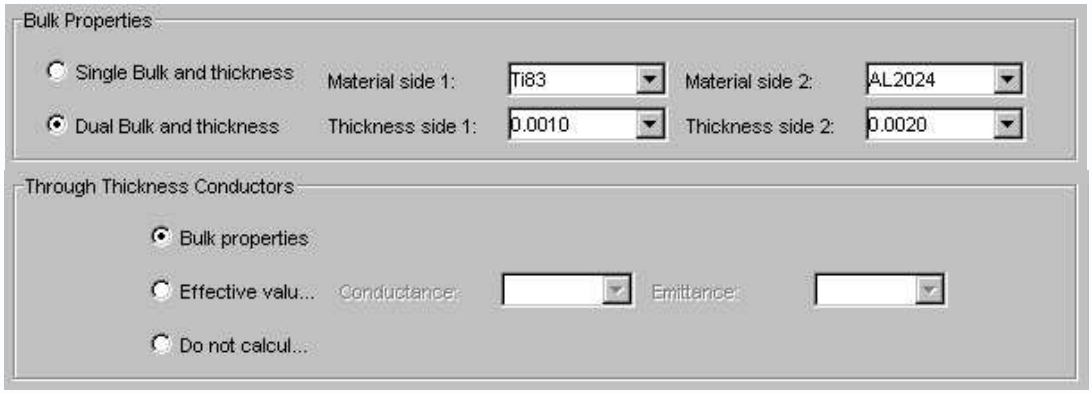
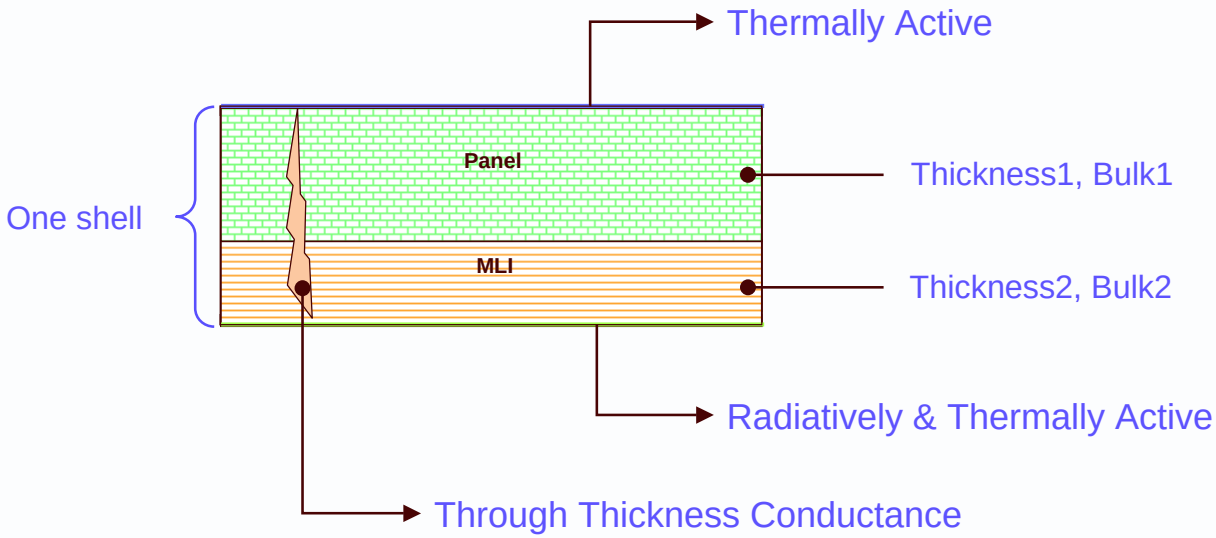


ALSTOM

Example



- New 5.8 Features -

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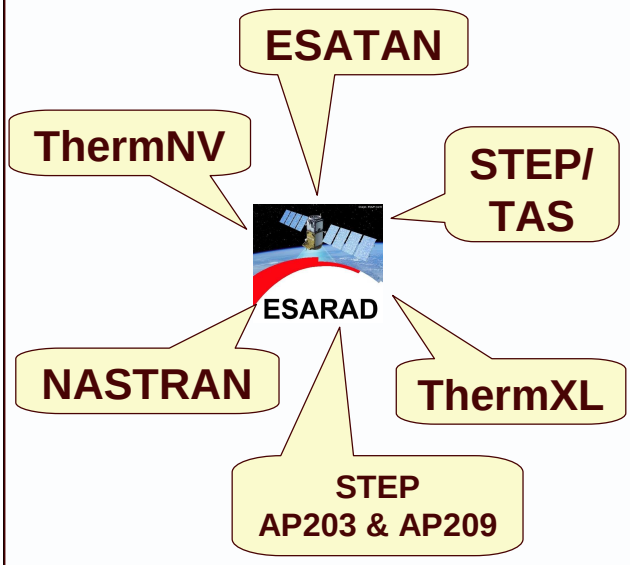


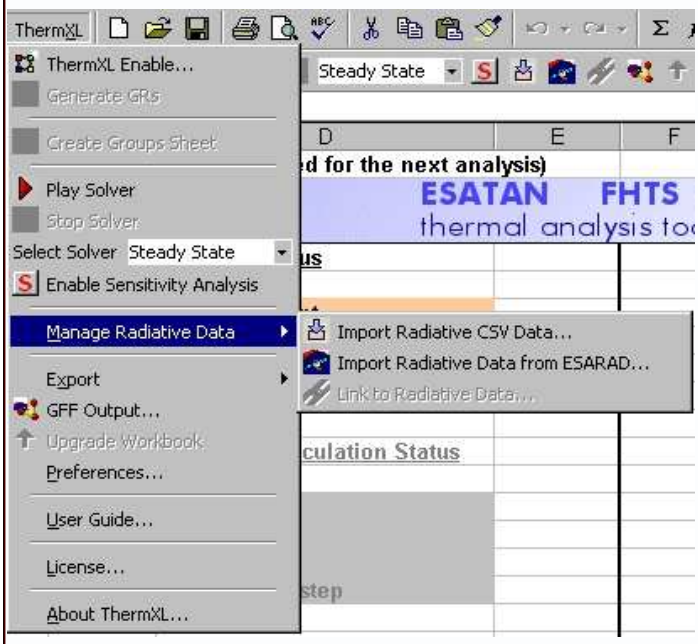
- Converter to ThermXL
- CAD Interface

Product Status – ESARAD …

ESARAD ↔ ThermXL 4.2

ALSTOM

ESARAD Radiative Data Converter



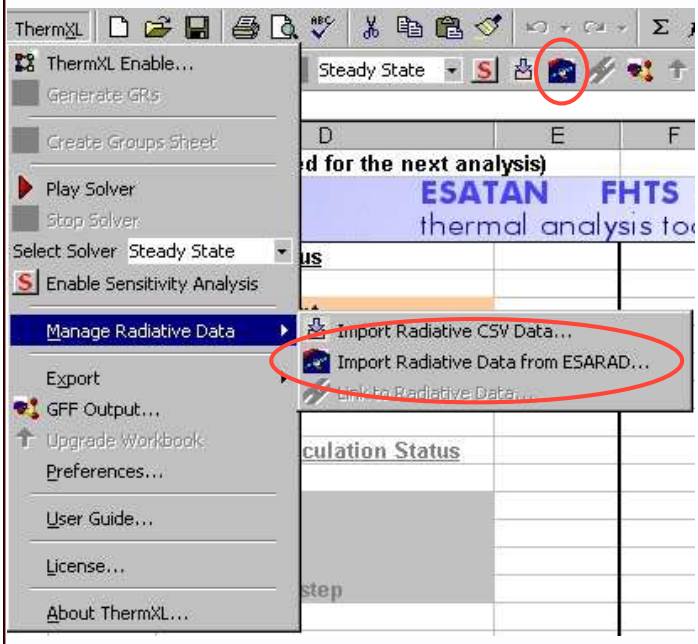
- Available from ThermXL 4.2

- ESARAD & ThermXL -

ESARAD ↔ ThermXL 4.2

ALSTOM

ESARAD Radiative Data Converter



- Available from ThermXL 4.2
- Converts from an ESARAD generated ESATAN file into ThermXL data

- ESARAD & ThermXL -

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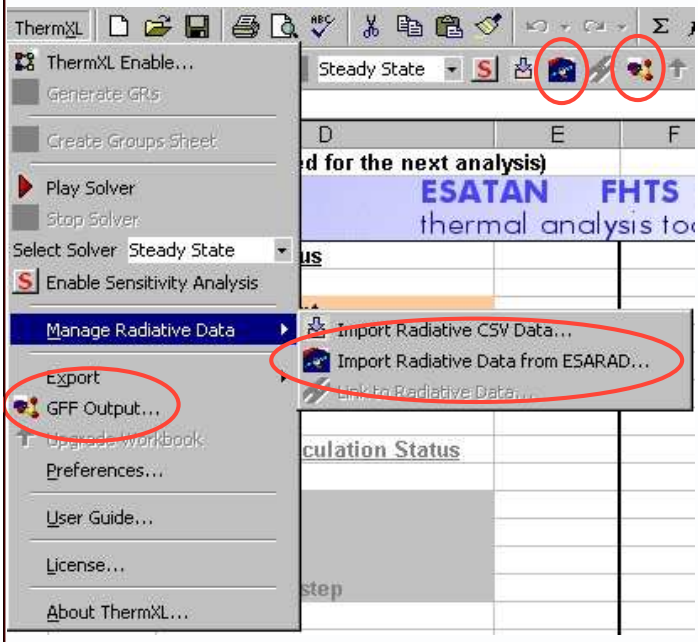
ESARAD ↔ ThermXL 4.2

ALSTOM

ESARAD Radiative Data Converter



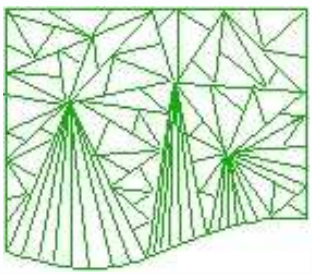
- Available from ThermXL 4.2
- Converts from an ESARAD generated ESATAN file into ThermXL data
- ThermXL produces a GFF file that can be imported back into ESARAD

ESARAD CAD Interface

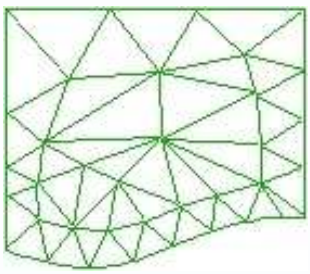
ALSTOM

Importing a STEP file

- Working with Incka to refine the triangulation meshing on surfaces
- More details with Eric Lebègue's presentation tomorrow



Good for curve representation



More suitable for analysis

Summary

ALSTOM

- New features:
  - Orbital Arcs
  - OpenGL/Visualisation and Linux
  - ACG
  - To be released before the end of the year (2005)
- Keep up-to-date with the latest version :
  - Contains new important features
  - Contains bug fixes and enhancements
  - Will be the supported version

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www.aerospace.power.alstom.com
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