

Appendix W

Thermal Concept Design Tool 5th Year

Matteo Gorlani Andrea Tosetto
(Blue Engineering, Italy)

Harrie Rooijackers
(ESA/ESTEC, The Netherlands)

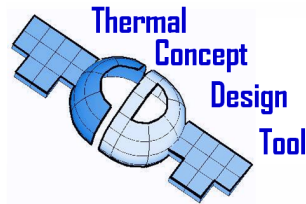
Abstract

The TCDT is in the 5th year of distribution and maintenance. During this period the tool has evolved both according to the improvements required by the users and the enhancements included in the development plan in the frame of the maintenance contract. The TCDT version 1.5.0, developed within this year, will be ready for the delivery to the European Thermal Community. This last version implements the following new functionalities required by the users and ESA:

- ESARAD Import
- ESATAN Import
- Geometric Assembly Merge
- Improved post processing

The engineers can easily use TCDT models of older versions thanks to the automatic converter provided by the 1.5.0 version.

Thermal Concept Design Tool Distribution & Maintenance



Andrea Tosetto
Matteo Gorlani

Blue Engineering, Torino, Italy

Harrie Rooijackers

European Space Agency, Noordwijk, The Netherlands

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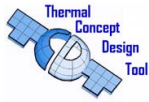


Overview

- **Background**
- **Version 1.5.0 Improvements**
- **Maintenance Activity**
- **Modeling with TCDT**

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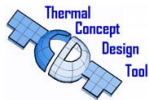


Background

5° YEAR OF DISTRIBUTION & MAINTENANCE STARTED APRIL 2011

- TCDT is distributed FREE of CHARGE to the European Thermal Community
- TCDT web pages available for download, PR, FR
- TCDT is regularly maintained by BLUE
- Small developments are regularly implemented to improve operability
- TCDT version 1.5.0 will be available before the end of 2011

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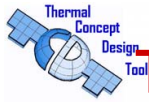


TCDT 1.5.0 Improvements

- Import Geometric Model from ESARAD
- Import Thermal Model from ESATAN
- Merge a meshed assembly
- Improved 3D Viewer Post processor
- Version Converter Updated to 1.5.0

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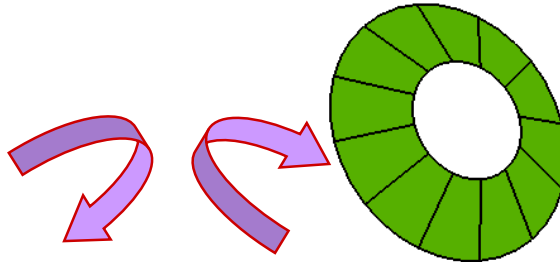


TCDT Improvements (1/10)

ESARAD Geometry Import

ESARAD erg files can be imported and translated into TCDT geometric model data.

```
SHELL AFT2_CON;
AFT2_CON = SHELL_CONE
([label=" AFT_CONE ",
point1=[ -1.139395, 0.0, 0.0000],
point2=[ 0.000000, 0.0, 0.0000],
point3=[ 0.00000, 2.238600, 0.000000],
point5=[ -0.61552, 0.00, 0.000000],
nodes1 = 12,
side2="INACTIVE",
nbase1 = 36200,
ndelta1 = 5,
opt1=ALENIA_NODE2_MDPS_BOL);
```



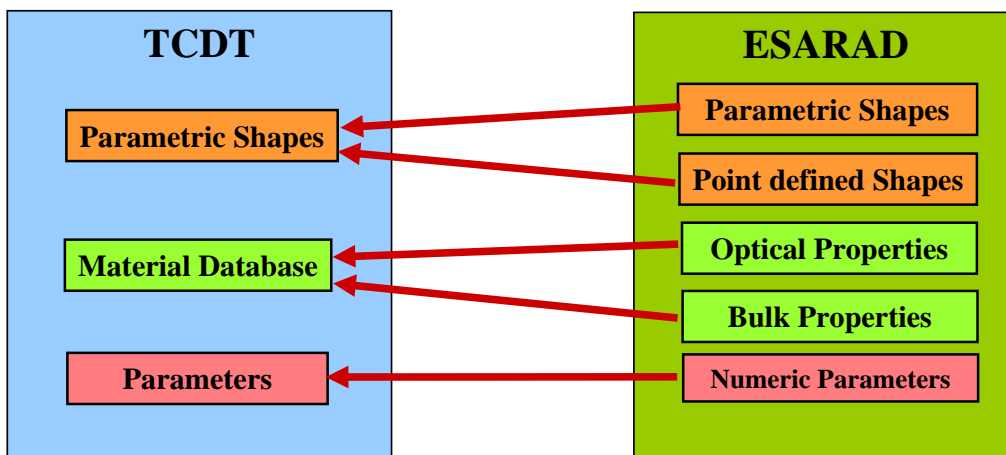
BEGIN		AFT2_CON	90	0	90	-1.139395	0	0	Cone	63.024971	0	90	0.523875	1.139395	0
36200	0		0	0	0	0	0	0	Cone	63.024971	90	180	0.523875	1.139395	0
36215	1		0	0	0	0	0	0	Cone	63.024971	180	270	0.523875	1.139395	0
36230	2		0	0	0	0	0	0	Cone	63.024971	270	360	0.523875	1.139395	0
36245	3		0	0	0	0	0	0	Cone	63.024971					

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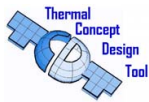
TCDT Improvements (2/10)

ESARAD Geometry Import



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TCDT Improvements (3/10)

ESARAD Geometry Import

Rotation and translation transformation computed each time that an operation is requested into the ESARAD file.

A final Transformation Matrix is converted back to Translation vector and Rotation angles.

The matrix to euler angles routine is Gimbal Lock free.

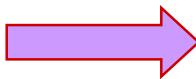


TCDT Improvements (4/10)

ESATAN Model Import

```
D10080* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;
D10081* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;
D10082* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;
D10083* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;
D10084* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;
D10085* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;
D10086* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;
D10087* 'Stiffness,angle -kx-y-z', C+125,, T=0.0;

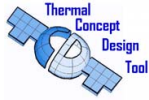
# panel 1 y
D10140* 'Panel 1, y-z, -kx, msh', C-4.20/100.*3300,, T=0.0;
D10141* 'Panel 1, y-z, -kx, msh', C-4.20/100.*3300,, T=0.0;
D10142* 'Panel 1, y-z, -kx, msh', C-4.50/100.*3300,, T=0.0;
D10143* 'Panel 1, y-z, -kx, msh', C-3.50/100.*3300,, T=0.0;
D10100* 'Panel 1, y-z, -kx, msh', C-4.50/100.*3300,, T=0.0;
D10101* 'Panel 1, y-z, -kx, msh', C-4.20/100.*3300,, T=0.0;
D10102* 'Panel 1, y-z, -kx, msh', C-4.20/100.*3300,, T=0.0;
D10110* 'Panel 1, y-z, -kx, msh', C-4.20/100.*3300,, T=0.0;
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D10146* 'Panel 1, y-z, -kx, msh', C-4.20/100.*3300,, T=0.0;
D10147* 'Panel 1, y-z, -kx, msh', C-4.20/100.*3300,, T=0.0;
```



ESATAN Thermal Node												
Node Number	Type	x	y	z	U	V	W	Phi	Theta	Gamma	U ₀	V ₀
10000	1	0	0	0	0	0	0	0	0	0	0	0
10001	1	0	0	0	0	0	0	0	0	0	0	0
10002	1	0	0	0	0	0	0	0	0	0	0	0
10003	1	0	0	0	0	0	0	0	0	0	0	0
10004	1	0	0	0	0	0	0	0	0	0	0	0
10005	1	0	0	0	0	0	0	0	0	0	0	0
10006	1	0	0	0	0	0	0	0	0	0	0	0
10007	1	0	0	0	0	0	0	0	0	0	0	0
10008	1	0	0	0	0	0	0	0	0	0	0	0
10009	1	0	0	0	0	0	0	0	0	0	0	0
10010	1	0	0	0	0	0	0	0	0	0	0	0
10011	1	0	0	0	0	0	0	0	0	0	0	0
10012	1	0	0	0	0	0	0	0	0	0	0	0
10013	1	0	0	0	0	0	0	0	0	0	0	0
10014	1	0	0	0	0	0	0	0	0	0	0	0
10015	1	0	0	0	0	0	0	0	0	0	0	0
10016	1	0	0	0	0	0	0	0	0	0	0	0
10017	1	0	0	0	0	0	0	0	0	0	0	0
10018	1	0	0	0	0	0	0	0	0	0	0	0
10019	1	0	0	0	0	0	0	0	0	0	0	0
10020	1	0	0	0	0	0	0	0	0	0	0	0
10021	1	0	0	0	0	0	0	0	0	0	0	0
10022	1	0	0	0	0	0	0	0	0	0	0	0
10023	1	0	0	0	0	0	0	0	0	0	0	0
10024	1	0	0	0	0	0	0	0	0	0	0	0
10025	1	0	0	0	0	0	0	0	0	0	0	0
10026	1	0	0	0	0	0	0	0	0	0	0	0
10027	1	0	0	0	0	0	0	0	0	0	0	0
10028	1	0	0	0	0	0	0	0	0	0	0	0
10029	1	0	0	0	0	0	0	0	0	0	0	0
10030	1	0	0	0	0	0	0	0	0	0	0	0
10031	1	0	0	0	0	0	0	0	0	0	0	0
10032	1	0	0	0	0	0	0	0	0	0	0	0
10033	1	0	0	0	0	0	0	0	0	0	0	0
10034	1	0	0	0	0	0	0	0	0	0	0	0
10035	1	0	0	0	0	0	0	0	0	0	0	0
10036	1	0	0	0	0	0	0	0	0	0	0	0
10037	1	0	0	0	0	0	0	0	0	0	0	0
10038	1	0	0	0	0	0	0	0	0	0	0	0
10039	1	0	0	0	0	0	0	0	0	0	0	0
10040	1	0	0	0	0	0	0	0	0	0	0	0
10041	1	0	0	0	0	0	0	0	0	0	0	0
10042	1	0	0	0	0	0	0	0	0	0	0	0
10043	1	0	0	0	0	0	0	0	0	0	0	0
10044	1	0	0	0	0	0	0	0	0	0	0	0
10045	1	0	0	0	0	0	0	0	0	0	0	0
10046	1	0	0	0	0	0	0	0	0	0	0	0
10047	1	0	0	0	0	0	0	0	0	0	0	0
10048	1	0	0	0	0	0	0	0	0	0	0	0
10049	1	0	0	0	0	0	0	0	0	0	0	0
10050	1	0	0	0	0	0	0	0	0	0	0	0

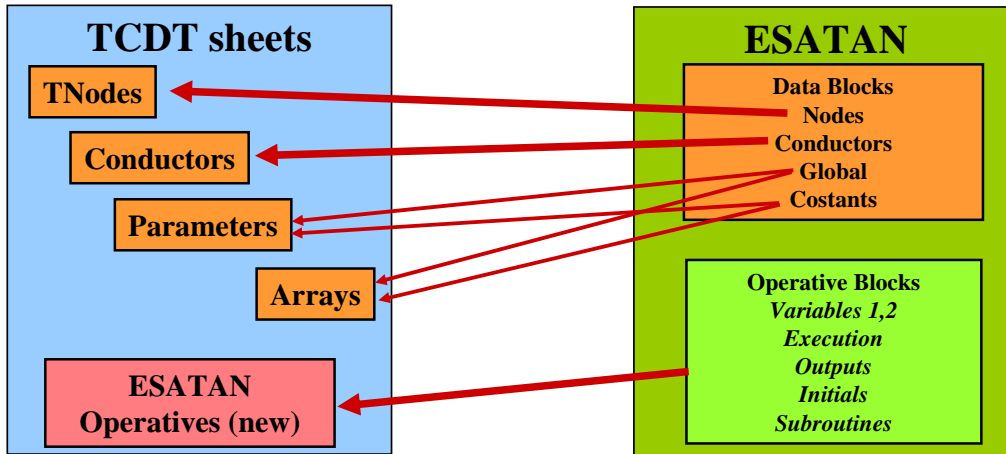
ESATAN Models can be imported





TCDT Improvements (5/10)

ESATAN Model Import



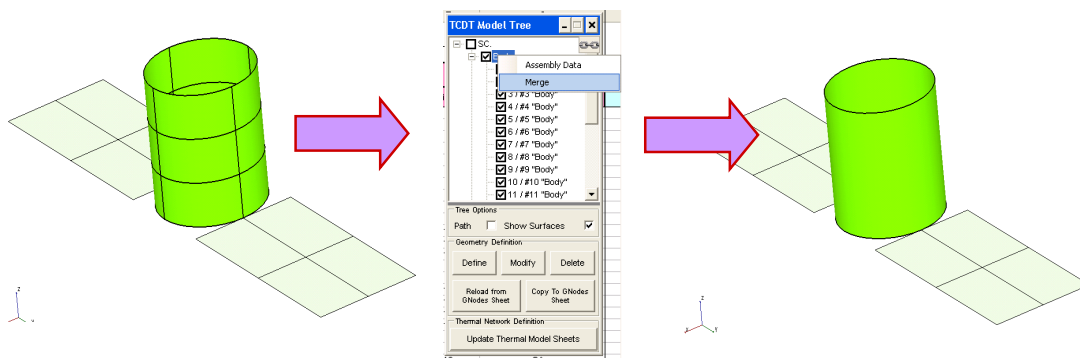
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TCDT Improvements (6/10)

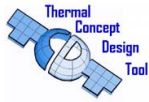
Merge

TCDT creates one surface for each element of the mesh definition. This operation now can be undone with the merge functionality.



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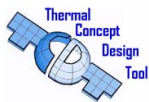
TCDT Improvements (7/10)

Merge

The Merge algorithm defines a shell of the same type of the shells contained into the original assembly with the proper dimensions.

Property	Weighth Factor
Thickness	Volume
Height	Area
Optical Properties	Area
Bulk Properties	
Density	Volume or Area
Thermal Capacity	Volume or Area
Normal K	Area/Thick. Or Area
Planar K	Thickness Or geom.

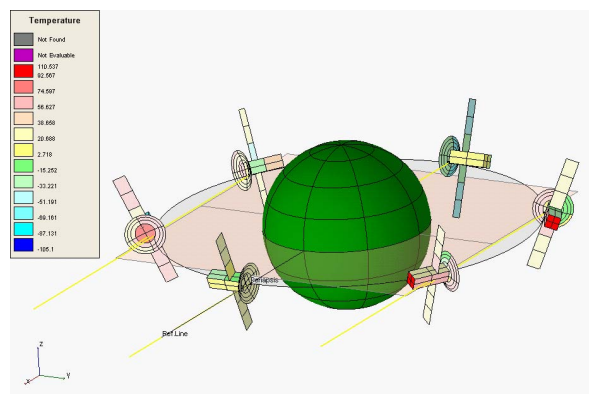
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TCDT Improvements (8/10)

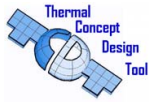
Improved Post Process

The improved post processor can show the temperatures and fluxes values by coloring the shapes of the geometric model, also when the viewer displays the mission.



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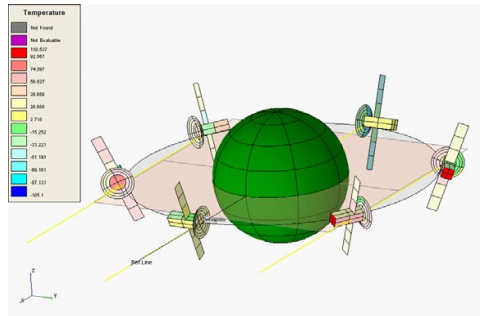


TCDT Improvements (9/10)

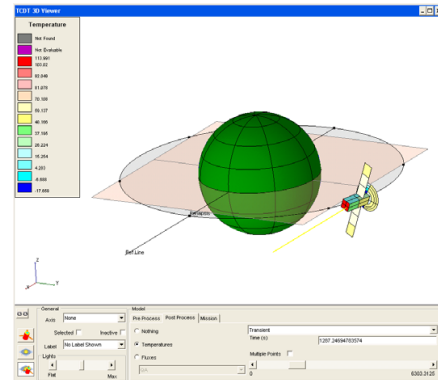
Improved Post Process

Two type of views are possible:

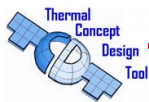
Time Dependent View



Multiple Points View



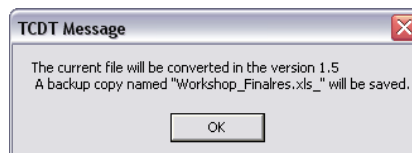
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TCDT Improvements (10/10)

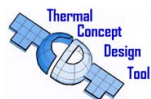
Version Converter

Performs the necessary operations to update an old model file (created with version 1.3.x, 1.4.0) to the new template, maintaining all the data present in the model.



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TCDT Maintenance Activity (1/2)

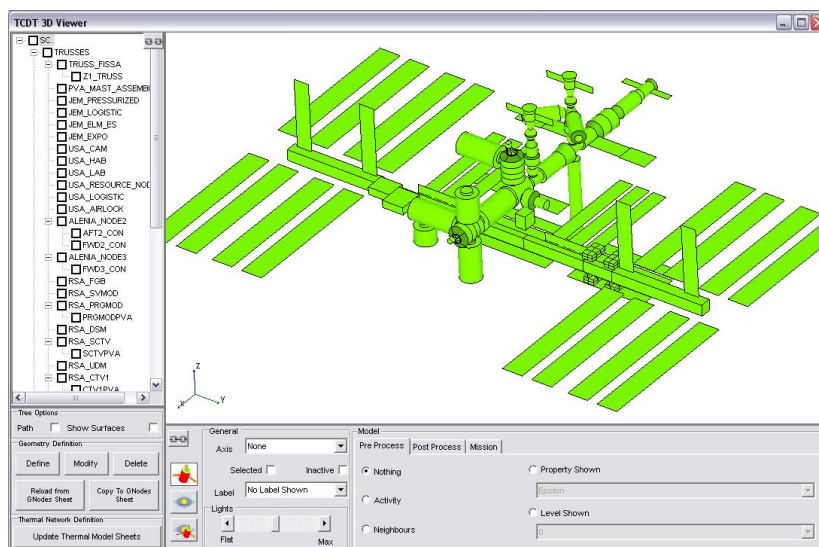
The 3D Control is updated to have a behaviour more understandable.

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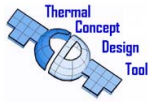
Importing ESARAD Geometry with the TCDT (1/2)

ISS (400 nodes)



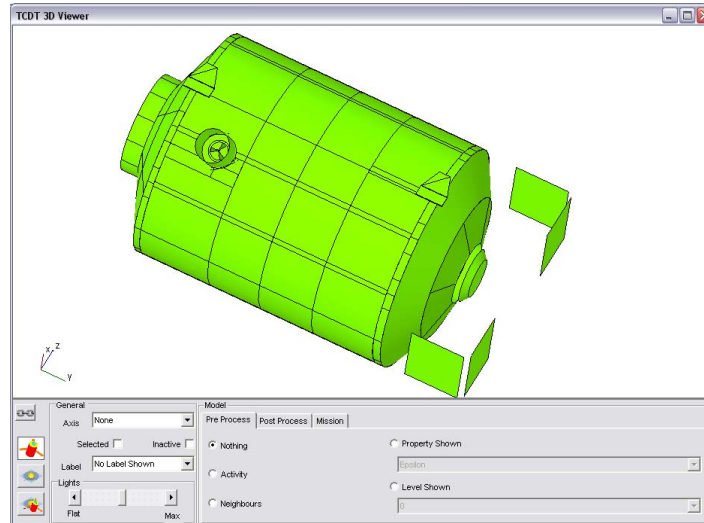
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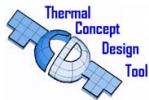


Importing ESARAD Geometry with the TCDT (2/2)

Columbus Reduced Model (400 Nodes)



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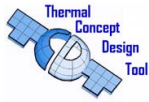
TCDT Tips

With the TCDT is possible to :

- Model Visual Check
- Postprocess results
- Model Parameterization
- Parametric Analysis

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TCDT Team

DISTRIBUTION & MAINTENANCE

BLUE ENGINEERING S.R.L.

Matteo Gorlani - Project Manager

m.gorlani@blue-group.it

Andrea Tosetto - Software Development

a.tosetto@blue-group.it

Support

tcdtsw@blue-group.it

Blue Group - Engineering & Design

WEB: <http://www.blue-group.it>

ESA - ESTEC

Benoit Laine - Head of Thermal Analysis and Verification Section

Benoit.Laine@esa.int

Dr. Harrie Rooijackers - Project Manager

harrie.rooijackers@esa.int

ESTEC-D/TEC-TEC-MTV

WEB: <http://www.esa.int>

WEB: www.blue-group.it/TCDT
EMAIL: tcdtsw@blue-group.it

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