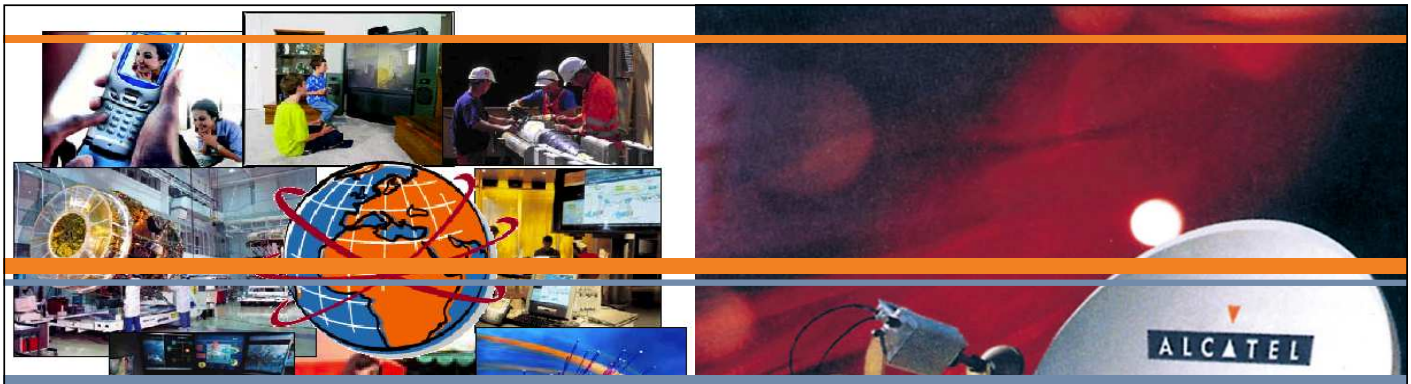

Gaetan Usage at Alcatel Space

Alcatel Space
K. Caire

Gaetan Usage at Alcatel Space

What is the goal of this presentation?

--> an exhaustive view of GAETAN

--> a training session on the software

--> a synthetic view of the advantages of a pre/post-processing tool

--> a global view of a daily usage

Gaetan Usage at Alcatel Space

Which use for GAETAN?

--> Global environment for ESATAN -->Thermal analysis of Antennas and Payload

What interest do we find in GAETAN?

--> Management of THERMICA computations and results
--> Pre- and post-processing of ESATAN
--> Automated multi-case computation with low risk of « human » error
--> A common architecture for each project to make it easy for any colleague to re-use the model and the results
--> An easy archiving process

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Gaetan Usage at Alcatel Space

Management of THERMICA computations and results --> gaetanflux module

Our need : to compute a great number of cases and to manage their results

--> use of a command file to do a sequence of THERMICA run
--> definition of a case name for each computation, to be reused in ESATAN run
--> storage of the GR.TAN and H.TAN files in pre-defined directories
--> possible translation of the H.TAN file in specific format

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Gaetan Usage at Alcatel Space

Example of GAETAN command file for THERMICA :

```
#
####### case1 : winter solstice BOL
$CAS='WSbol'#

        @GEOMETRIE='CDRBOL.SYSBAS'
        @POINTAGE='nominal.PNTINP'
        @TRAJECTOIRE='WSBOL.TRJINP'
        @SIMULATION='WSBOL.THER'
#
####### case2 : Sun declination of -20° BOL
$CAS='m20bol'#

        @GEOMETRIE='CDRBOL.SYSBAS'
        @POINTAGE='nominal.PNTINP'
        @TRAJECTOIRE='m20.TRJINP'
        @SIMULATION='m20BOL.THER'
#
####### case3 : Sun declination of -20° EOL
$CAS='m20eol'#

        @GEOMETRIE='CDREOL.SYSBAS'
        @POINTAGE='nominal.PNTINP'
        @TRAJECTOIRE='m20.TRJINP'
        DTHETN = 144.
        @SIMULATION='m20EOL.THER'

####### case4 : Sun declination of -20° EOL with more steps
$CAS='m20eolT144'#

        @GEOMETRIE='CDREOL.SYSBAS'
        @POINTAGE='nominal.PNTINP'
        @TRAJECTOIRE='m20.TRJINP'
        DTHETN = 144.
        @SIMULATION='m20EOL.THER'
```


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Gaetan Usage at Alcatel Space

For us, what advantage of GAETAN command file for THERMICA ?

Current use :
- two geometrical models (before and after deployment)
- two thermo-optical properties
- parametric study on sun declination to search dimensioning case
- sensitivity analysis on geometrical model

Specific use :
- steerable antenna (multiplication of geometrical models)
- global computation on life duration (parametric study on thermo-optical properties)

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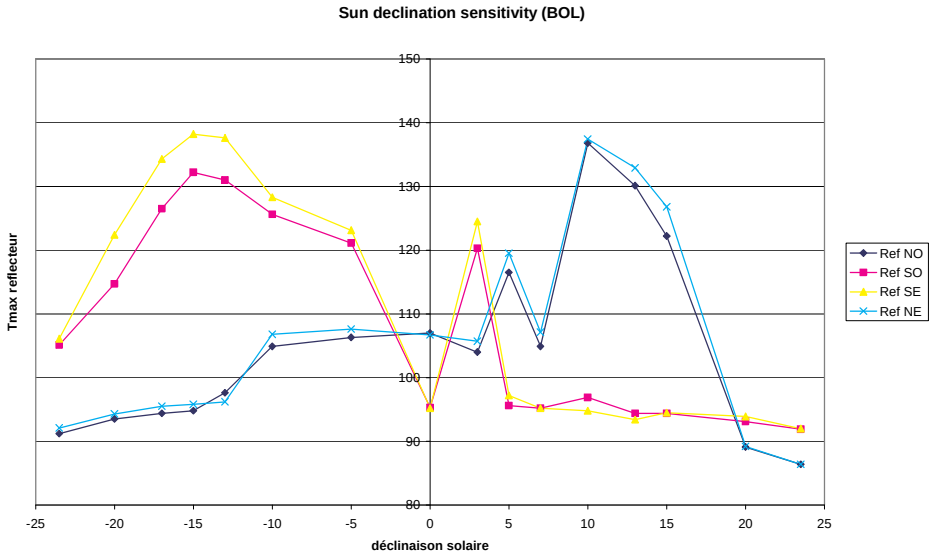
An example of parametric study : maximum temperature according to sun declination



Gaetan Usage at Alcatel Space

Pre-processing of ESATAN :

- Key-words to do parametric study --> notion of « case »
  - to choose the files to read
  - to choose Thermica results
  - to choose boundary conditions or electrical conditions
  - to define any other condition

- High level study
  - a unique file with the description of all these cases
  - the possibility to launch different GAETAN run in sequence, in specified order

What interest for the user?

--> ONE single ESATAN model

--> ONE single command file easy to re-find and to re-run

Gaetan Usage at Alcatel Space

Management of ESATAN computation :

- ESATAN run parameters
  - to choose ESATAN sub-routine and all associated parameters
  - to give initial conditions issued from tables (given by GAETAN from a previous run)
  - to do several computations (with initial conditions for following run issued automatically from the previous one)

- Iterative process for cyclic computation
  - to pilot a transient analysis on an orbit
    - A first transient run
    - --> final temperature and initial one are compared for each node
    - --> the highest difference must be under a user-defined value
    - --> if not, a new run is done, taking final temperature as new initial one
  - The user defines the success criteria and the maximum number of cycle

- A file to follow in real time computation progress

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Gaetan Usage at Alcatel Space

An example of ESATAN run parameters : thermal balance test with 3 different heating power

```
$RUN_ESATAN

     @TRANSIENT
          CALCULATION_CASE_NAME =              'COLD OP';
          CHARGE_CASE_NAME =                   COLD OP;
          CHRONOLOGY_INITIAL_TIME =            36001.;
          CHRONOLOGY_FINAL_TIME =               72000.;
          TIME_STEP =                           300.;
          ESATAN_SOLUTION_ROUTINE_NAME =       'SLFWBK' ;
          ESATAN_CONTROL_CONSTANT =            'RELXCA = 0.0006' ;
          ESATAN_CONTROL_CONSTANT =            'NLOOP = 30000' ;

     @TRANSIENT
          CALCULATION_CASE_NAME =              'TRANS';
          CHARGE_CASE_NAME =                   'TRANS';
          CHRONOLOGY_INITIAL_TIME =            72001.;
          CHRONOLOGY_FINAL_TIME =               91800.;
          TIME_STEP =                           300.;
          ESATAN_SOLUTION_ROUTINE_NAME =       'SLFWBK' ;
          ESATAN_CONTROL_CONSTANT =            'RELXCA = 0.0006' ;
          ESATAN_CONTROL_CONSTANT =            'NLOOP = 30000' ;

     @TRANSIENT
          CALCULATION_CASE_NAME =              'HOT OP';
          CHARGE_CASE_NAME =                   'HOT OP';
          CHRONOLOGY_INITIAL_TIME =            91801.;
          CHRONOLOGY_FINAL_TIME =               144000.;
          TIME_STEP =                           300.;
          ESATAN_SOLUTION_ROUTINE_NAME =       'SLFWBK' ;
          ESATAN_CONTROL_CONSTANT =            'RELXCA = 0.0006' ;
          ESATAN_CONTROL_CONSTANT =      'NLOOP = 30000';
```


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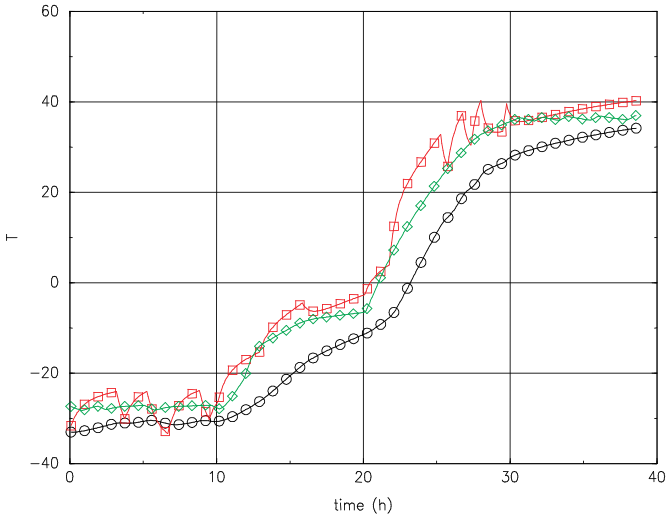
Gaetan Usage at Alcatel Space

An example of ESATAN run sequence : thermal balance test with 3 different heating power



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An example of convergence file : to follow in real time the computation in progress

IORB	TIMEO	TIMEM	TIMEN	TIM1	DTIMEI	DTIMEU	NLOOP	LOOPCT	NBALA	NBALR	
V1	1	0.0	150.0	300.0	150.0	300.0	300.0	30000	0	0.0000	0.0000
V1	1	0.0	150.0	300.0	150.0	300.0	300.0	30000	1	0.0000	0.0000
V2	1	0.0	150.0	300.0	150.0	300.0	300.0	30000	635	0.0000	0.0000
V1	1	300.0	450.0	600.0	450.0	300.0	300.0	30000	635	0.0000	0.0000
V2	1	300.0	450.0	600.0	450.0	300.0	300.0	30000	629	0.0000	0.0000
V1	1	600.0	750.0	900.0	750.0	300.0	300.0	30000	629	0.0000	0.0000
V2	1	600.0	750.0	900.0	750.0	300.0	300.0	30000	669	0.0000	0.0000
V1	1	900.0	1050.0	1200.0	1050.0	300.0	300.0	30000	669	0.0000	0.0000
V2	1	900.0	1050.0	1200.0	1050.0	300.0	300.0	30000	665	0.0000	0.0000
V1	1	1200.0	1350.0	1500.0	1350.0	300.0	300.0	30000	665	0.0000	0.0000
V2	1	1200.0	1350.0	1500.0	1350.0	300.0	300.0	30000	691	0.0000	0.0000
V1	1	1500.0	1650.0	1800.0	1650.0	300.0	300.0	30000	691	0.0000	0.0000
V2	1	1500.0	1650.0	1800.0	1650.0	300.0	300.0	30000	681	0.0000	0.0000
V1	1	1800.0	1950.0	2100.0	1950.0	300.0	300.0	30000	681	0.0000	0.0000
V2	1	1800.0	1950.0	2100.0	1950.0	300.0	300.0	30000	703	0.0000	0.0000
V1	1	2100.0	2250.0	2400.0	2250.0	300.0	300.0	30000	703	0.0000	0.0000
V2	1	2100.0	2250.0	2400.0	2250.0	300.0	300.0	30000	692	0.0000	0.0000
V1	1	2400.0	2550.0	2700.0	2550.0	300.0	300.0	30000	692	0.0000	0.0000
V2	1	2400.0	2550.0	2700.0	2550.0	300.0	300.0	30000	711	0.0000	0.0000
V1	1	2700.0	2850.0	3000.0	2850.0	300.0	300.0	30000	711	0.0000	0.0000

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Gaetan Usage at Alcatel Space

Post-processing of ESATAN results :

Management :
- an exhaustive data-base is available for further treatment by different module
- command file make it easy to run and re-run post-processing

Computation :
- management of groups of nodes
- heat flow exchange between nodes and/or groups of nodes (including towards boundary node)
- min/max values (temperature and heat flow exchange)
- maximum gradient in a group of node, or between groups of nodes
- storage of temperature/flux results to use them further as initial conditions

Outputs :
- tables to sum up all these results
- specific file for thermo-elastic analysis (formatted file to be delivered at mechanical engineers)
- specific file for 3-D visualisation (formatted for THERMICA)
- curves

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Gaetan Usage at Alcatel Space

Post-processing of ESATAN and THERMICA results :

Gaetangraph module developed for Alcatel :
--> use of xmgr tool
--> a command file to define a list of curves and to re-run them without effort (nor errors!)
--> several thermal analysis results on the same curve

Available curves :
- all node attribute (T, QI, QR, QS, etc…)
- min/max temperature for a group of nodes
- average temperature, gradient in a group of nodes or between two groups of nodes
- heat flow exchange

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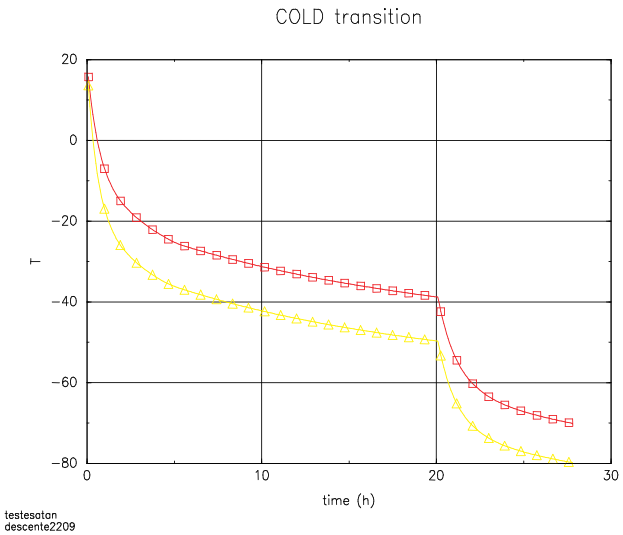
Gaetan Usage at Alcatel Space

An example of curve : temperature of the same node for two different computations



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CONCLUSION

Which advantage of a General Automated Environment for Alcatel?

--> *technical advantages*	-->*human advantages*
to run and re-run lot of cases to extract the relevant results to make a powerful presentation to our customer	to limit errors to run the colleague 's model to exchange model with our sub-contractor

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Gaetan Usage at Alcatel Space

As thermal engineers, we always need more functionnalities in pre/pro aspects.

Pre-pro aspects : GAETAN advantages are numerous, we ask for improvements

Post-pro aspects : additional computations are useful, but new functionalities are welcome;
specific demand on visualisation are developed in an extra-module

Ask to the users and they will demand more!

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