

IITAS Project

Industrial Implementation of STEP-TAS

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Objectives of IITAS Project

- ! **To get industrial implementation of STEP-TAS within main thermal analysis tools used by the European Space Industry**
 - ESARAD (Alstom Aerospace)
 - THERMICA (EADS Astrium)
 - CORATHERM/CIGAL2 (Thales Alenia Space)

- ! **Industrial means**
 - Robust
 - Fast
 - Fully checked

- ! Developing the STEP-TAS protocol and following its submission within ECSS and ISO
- ! Developing the TASverter converters (including Python SDK), which can be used as input for industrial development and for validation
- ! Developing the STEP-TAS Units Tests Cases
- ! Funding the project and sponsoring the industrial developers

! Industrial Developers are:

- ALSTOM Aerospace for ESARAD
- EADS Astrium France for THERMICA
- Thales (former Alcatel) Alenia Space for CORATHERM/CIGAL2
 - With the help of DOREA (french software and consulting company)

! Role

- Developing and performing units testing of thermal tools / STEP-TAS bidirectional converters
 - Using
 - STEP-TAS SDK (Python or C++)
 - STEP-TAS Acceptance Testsuite
- Maintaining these converters

! Industrial Testers are:

- Rutherford Appleton Laboratory (UK) for ESARAD
- EADS Astrium Germany for THERMICA
- Thales Alenia Space for CORATHERM/CIGAL2

! Role

- Contributing to STEP-TAS Acceptance Testsuite by implementing public "artificial" general models representative of thermal tool capability
- Performing global cross testing of the converters

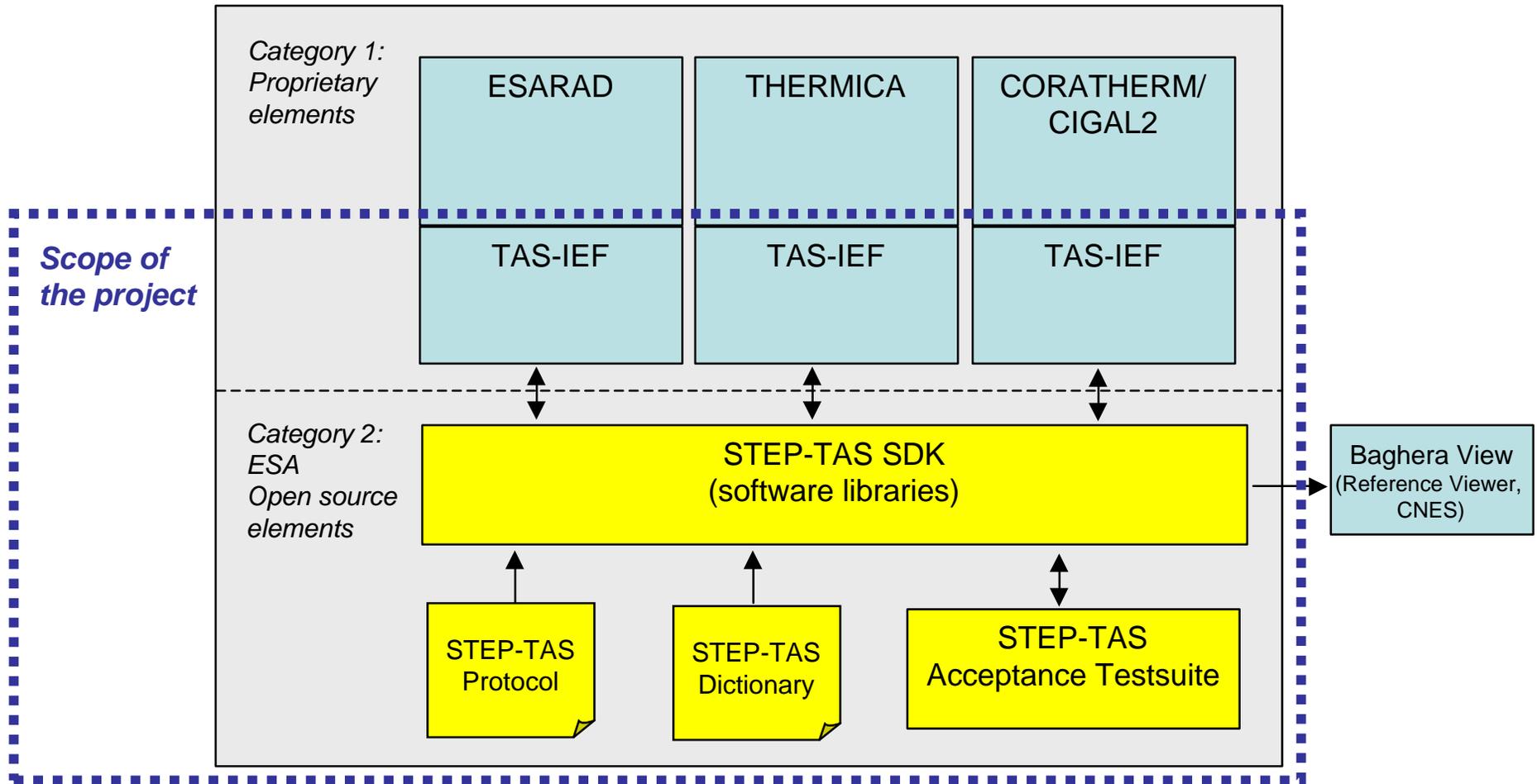
! CSTB is “Centre Scientifique et Technique du Bâtiment”

- ~ equivalent to CNES for construction sector in France

! Role

- General management and coordination of the project for ESA
- Developing, packaging and distributing industrial STEP-TAS SDK
 - Starting from
 - TASverter and Python SDK (ESA)
 - Expressik / C++ (ESA / University of Manchester / CSTB)
- Managing and distributing the STEP-TAS Public Acceptance Testsuite
 - Inputs are:
 - ESA Units Tests Cases
 - Industrial Developers general public models
- Supporting the Industrial developers
- With the help of DOREA, performing the Software Quality Assurance of the project
- Developing Baghera View with CNES

The IITAS Architecture



! Category 1 : Proprietary elements

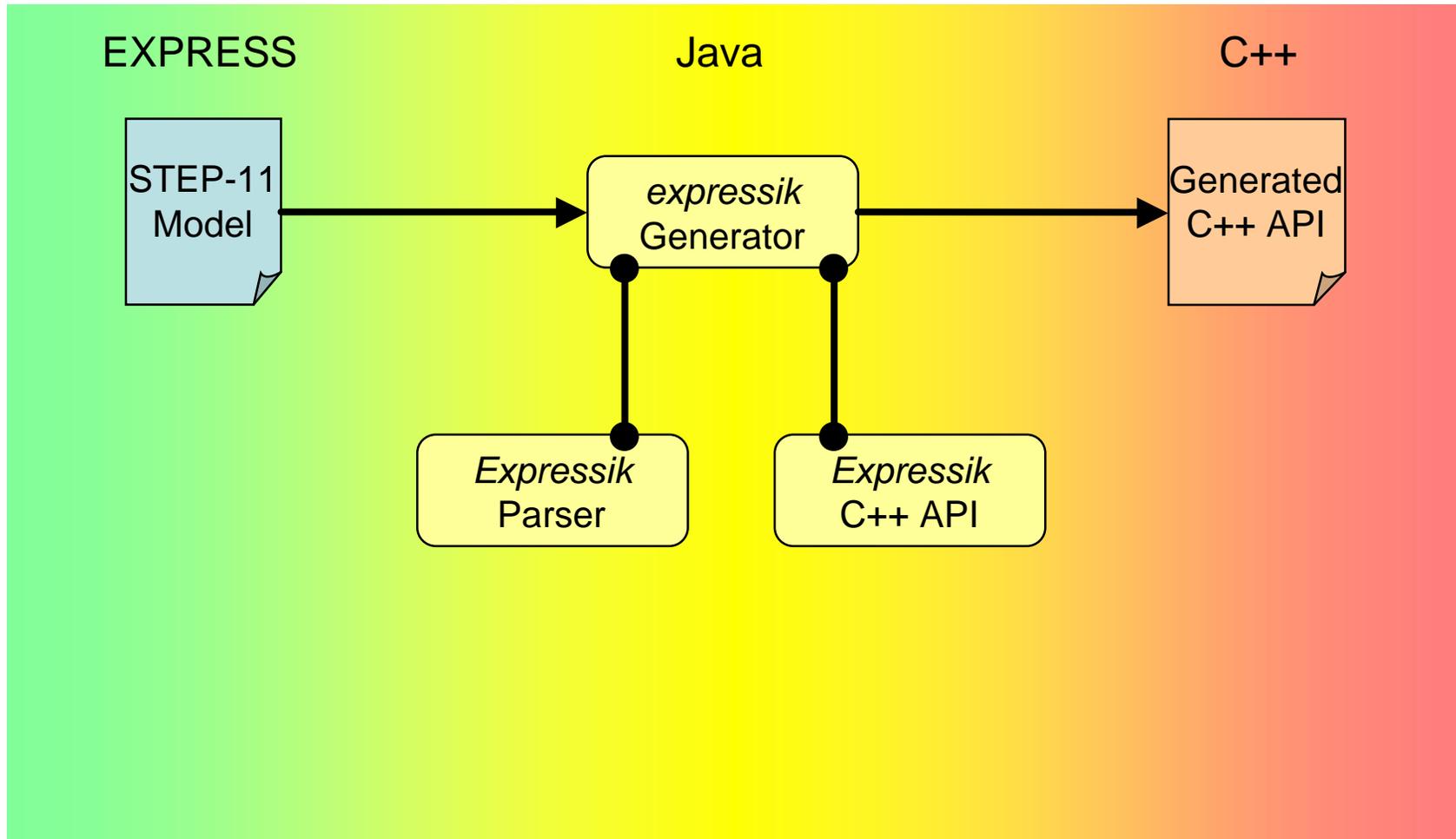
- Converters, developed by the Industrials and that will remain their property
- Distributed integrated within thermal tools

! Category 2 : ESA Open source elements

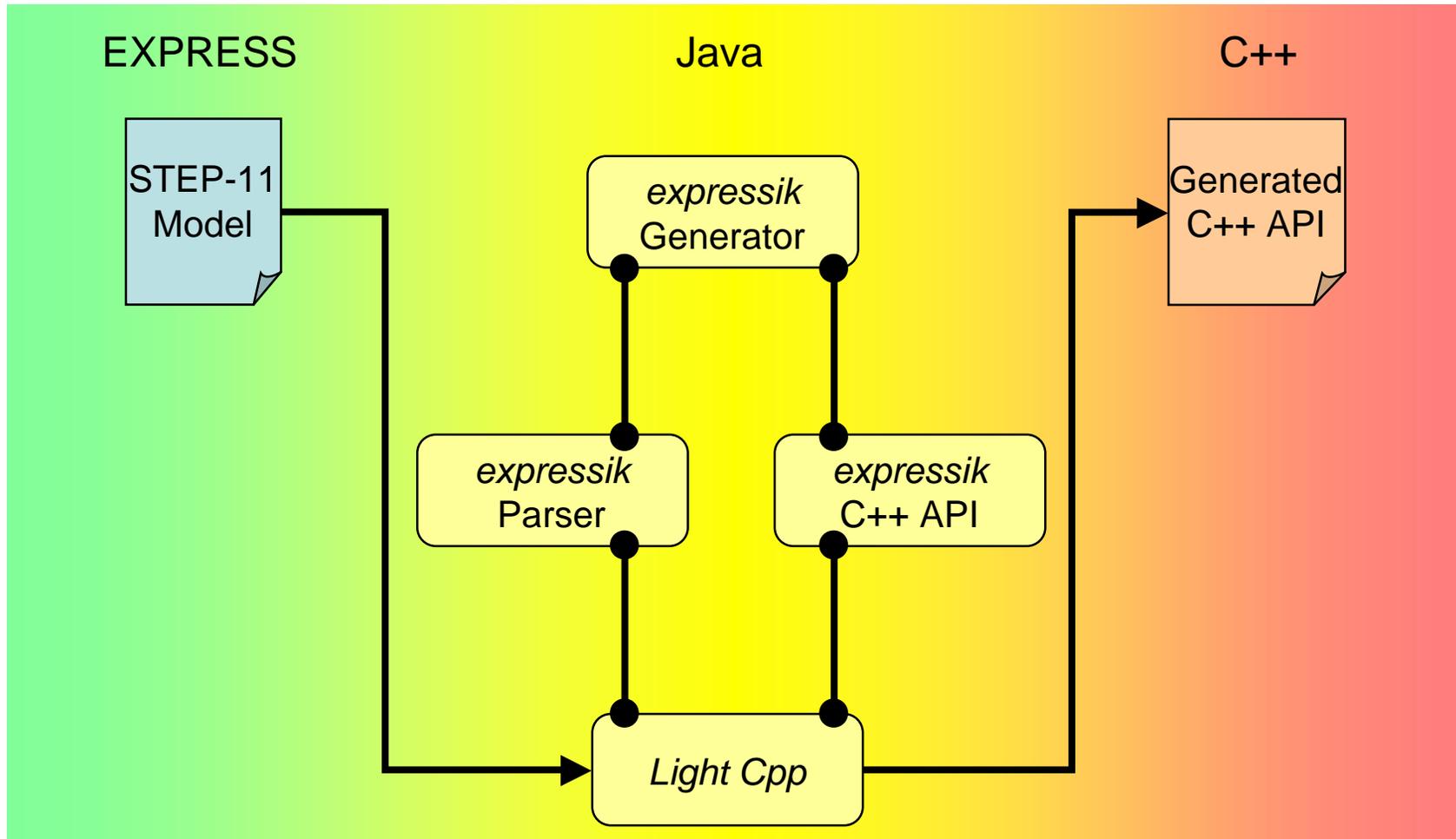
- STEP-TAS SDKs and public Acceptance Test Suite
- Developed by CSTB and ESA
- ESA Open Source license

- | Based on expressik generator
- | Collaboration (technical and co-funding) between ESA, University of Manchester and CSTB

expressik : an early-bound approach of STEP models implementation



Light Cpp reuses core expressik packages



Comparison between Expressik project and CSTB work

- | **expressik Generator (University of Manchester)**
 - Standardized C++ API generation of any Express models
 - Validation of rules and use of defined Express functions

- | **Express2LightCpp (CSTB)**
 - Optimized C++ classes for « simple » Express models (i.e. no ANDOR inheritance) like IFC or TAS
 - Various optimizations, few memory consumption, « lazy » loading of large instance files ...

! Exploiting Standards...

- ISO C++
- STL

! ... Cross-platforms API...

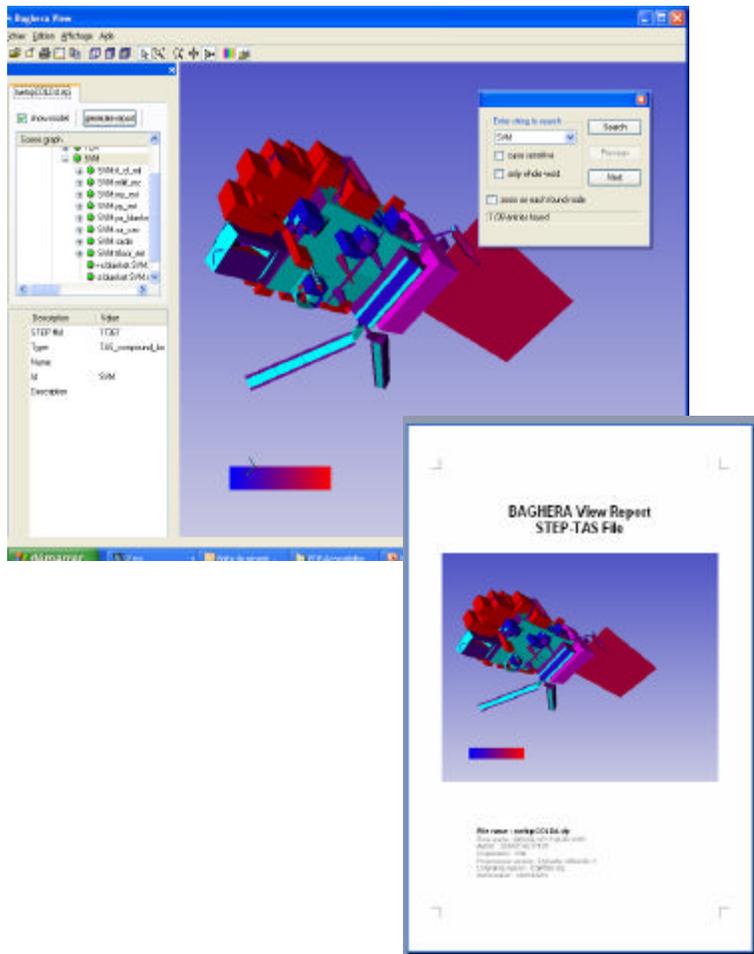
- CMake : makefiles generation, unit testing and installers framework
- Doxygen : Documentation generator

! ... Various patterns and enhancing fonctionnalités

- Classes visitors : Adding functionalities to the API
- Reference pointers : No C++ « delete » anymore
- Memory leak detectors : for debugging purposes

- ! Partially unserialize a STEP-21 file
- ! Dynamically instantiate an object only if needed
- ! Optimize loading time and memory consumption
- ! Duplication and writing of an object could be done in this lazy way (without instantiating it)

Objective of Baghera View

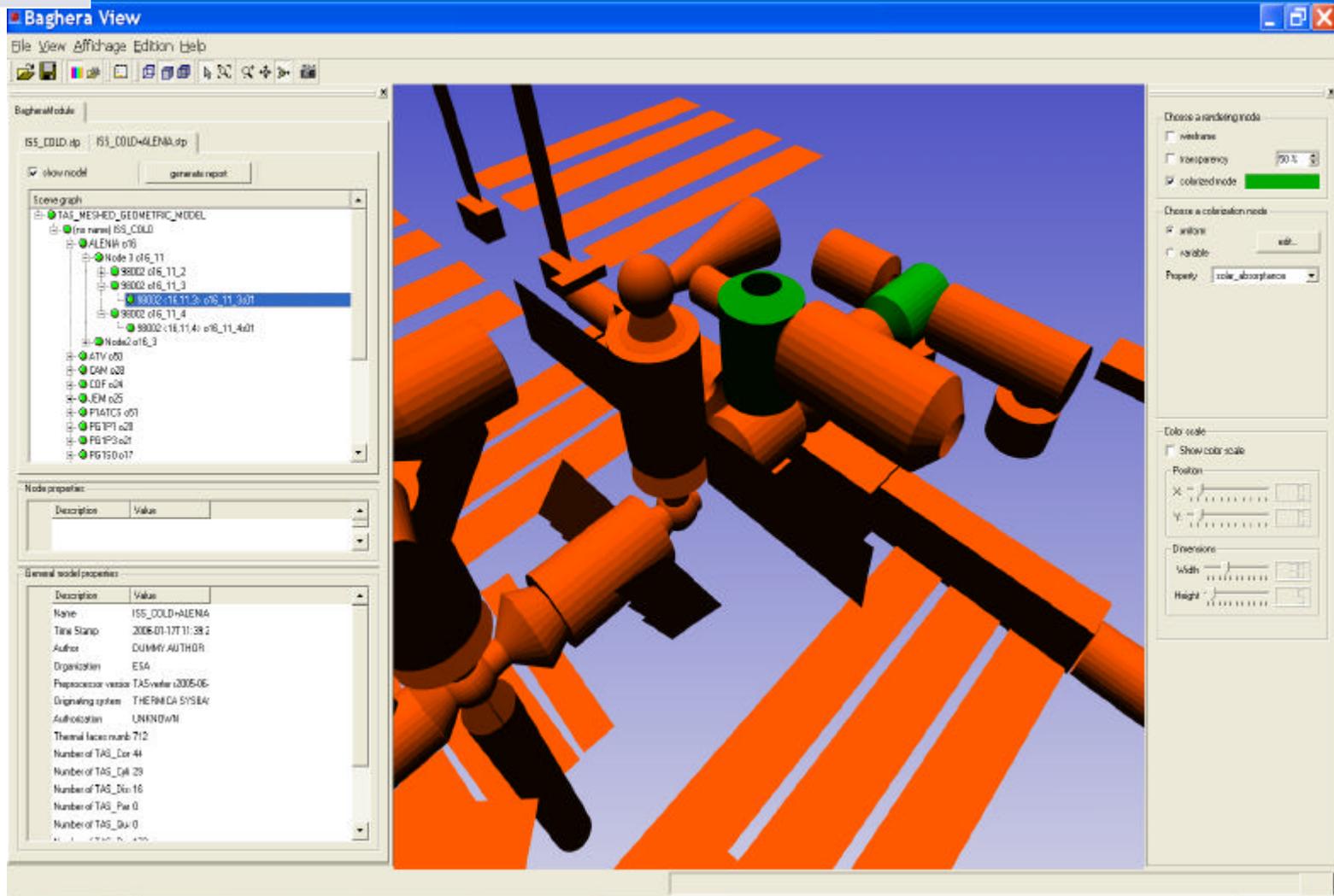


- ! To be the Reference STEP Viewer for the European Space Industry
- ! To be used by sender and receiver of the data, for :
 - Checking 3D geometry
 - Checking assemblies and properties
 - Reporting the exchanged data
- ! Will be used as validation tool for the IITAS project

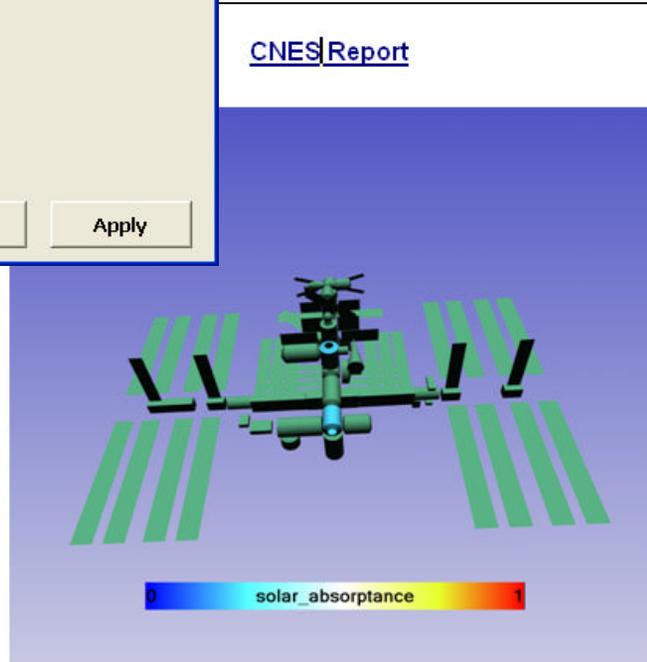
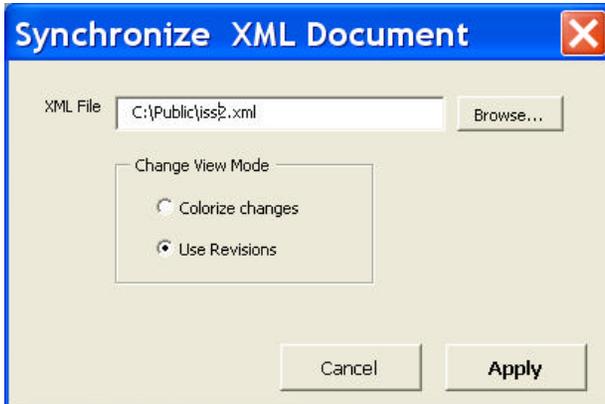
Baghera View Functions

- | **Loading / superposing several STEP models into one 3D session**
 - STEP-TAS, AP203/214
 - Integration of TASverter (ESARAD, THERMICA)
- | **Integrated AP203 to STEP-TAS converter (experimental)**
- | **Browsing hierarchy, searching for elements**
- | **3 rendering modes : wire frame, solid, transparency**
- | **Elements properties display**
 - With table of colours
- | **Generating reports**

Difference checking with colors



Synchronization and Difference reporting in Word document (with keeping layout)



o52_2_1_1s01	material_32	98022	ISS_COLD	o52_2_1_1
o52_3_1_1s01	material_32	98023	ISS_COLD	o52_3_1_1
o53_1s01_B0X8_side_1	material_27	98050	ISS_COLD	o53_1s01_B0X8
o53_1s01_B0X8_side_2	material_27	98050	ISS_COLD	o53_1s01_B0X8
o53_1s01_B0X8_side_3	material_27	98050	ISS_COLD	o53_1s01_B0X8
o53_1s01_B0X8_side_4	material_27	98050	ISS_COLD	o53_1s01_B0X8
o53_1s01_B0X8_side_5	material_27	98050	ISS_COLD	o53_1s01_B0X8
o53_1s01_B0X8_side_6	material_27	98050	ISS_COLD	o53_1s01_B0X8
o16_3_1_1s01	material_14	98001	ISS_COLD	o16_3_1_1
o16_3_2_1s01	material_14	98001	ISS_COLD	o16_3_2_1
o16_3_3_1s01	material_14	98001	ISS_COLD	o16_3_3_1
o16_11_2s01	material_14	98002	ISS_COLD	o16_11_2
o16_11_3s01	material_14	98002	ISS_COLD	o16_11_3
o16_11_4s01	material_14	98002	ISS_COLD	o16_11_4

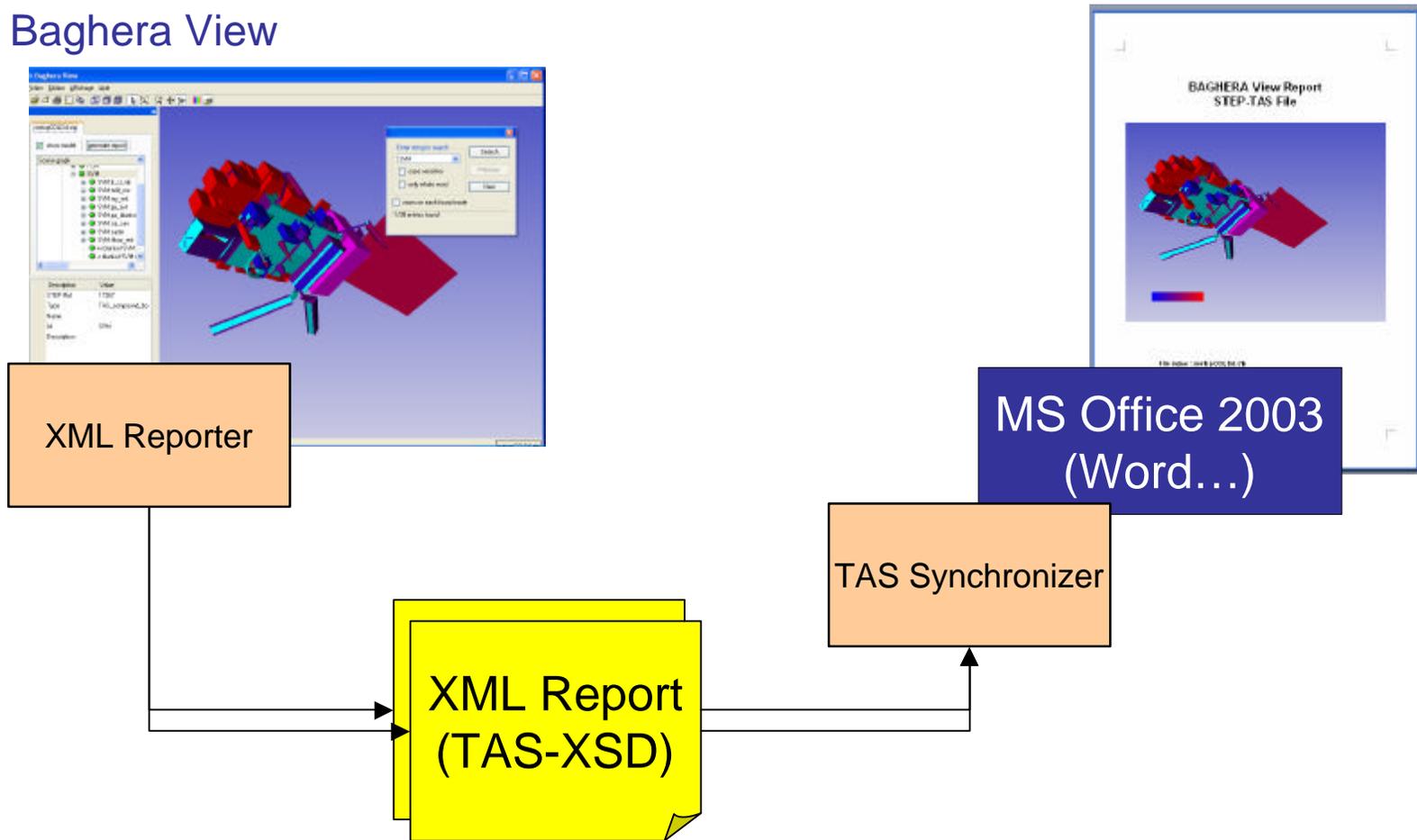
Face Description Model

Name: ISS_COLD+ALENIA.stp
 Author: DUMMY AUTHOR
 Organization: ESA
 Model Designation: STEP-TAS Thermal Analysis for Space dataset

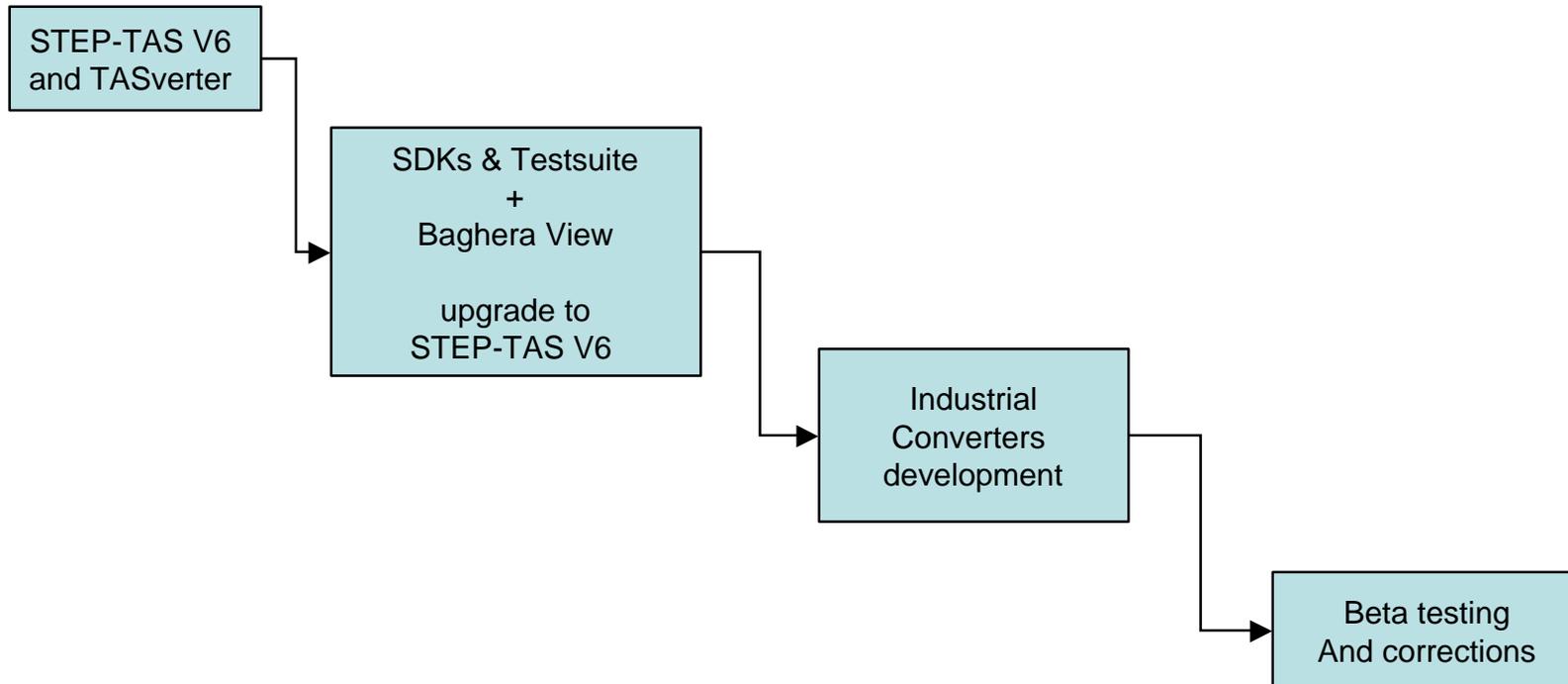
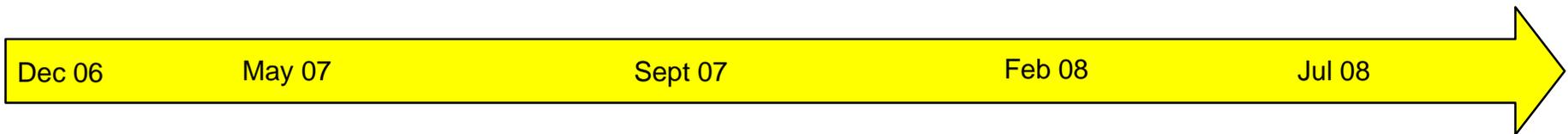
Supprime: Name:
 ISS_COLD.stp

Baghera View / Word Document Synchronization Mechanism

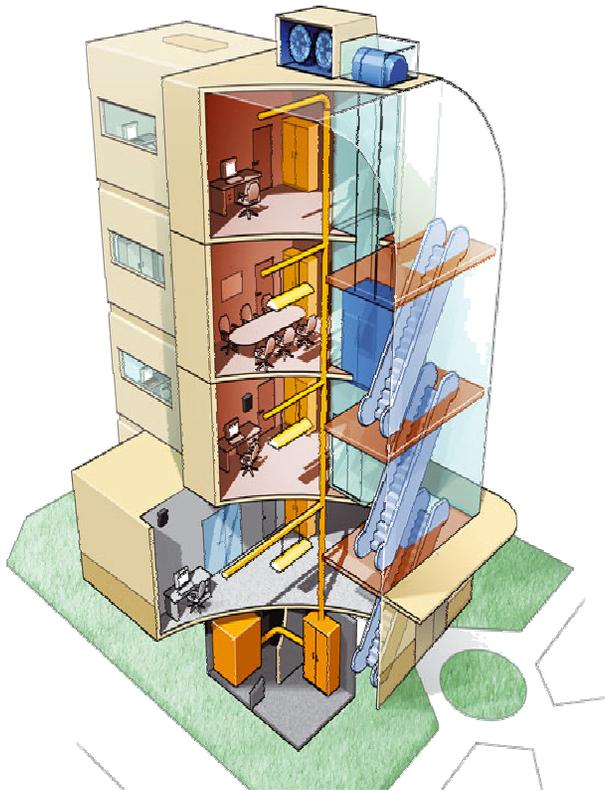
Baghera View



The IITAS Schedule



Why CSTB and construction sector in a NASA-ESA Workshop ?

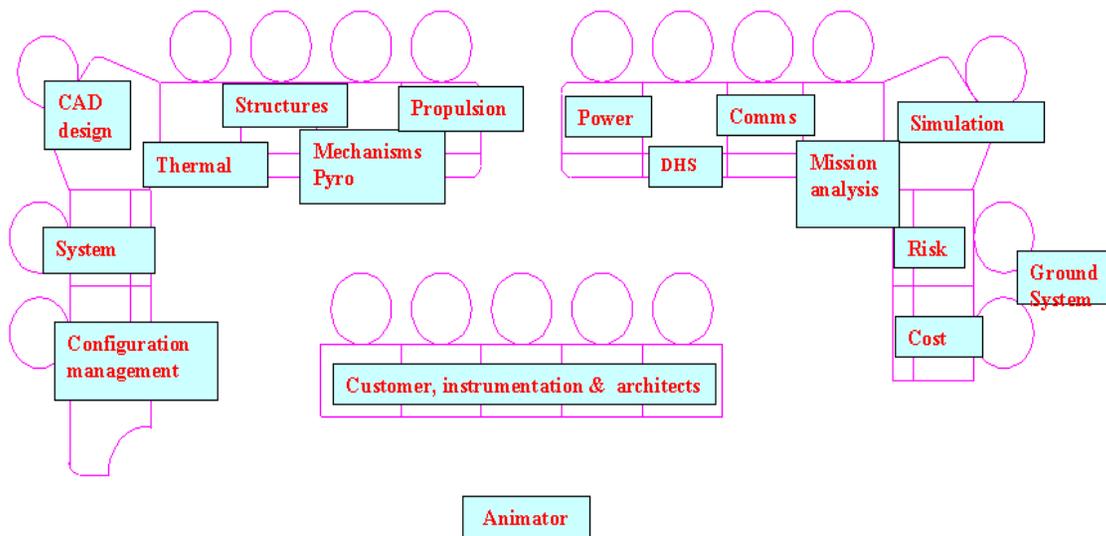


- ! Construction sector is facing more and more cooperation problems in design and maintenance phases
 - For taking into account all **Sustainable Development** objectives
 - Structural, thermal, acoustic, security, comfort...
- ➡ **A building is becoming as much complex as a spacecraft !**
- ! It is possible to share technology between space and construction sectors
 - STEP (IFC in AEC), Ontology, VR technologies...
- ! **A huge potential of users in the Construction sector**
 - For improving the reliability and competitiveness of PDE solutions

In preparation : Extension of Baghera View for the CNES Concurrent Engineering Center

- ! To provide “visibility” to Excel data
 - To be understandable by non specialist of the dedicated discipline

- ! CNES C.E Center to be experimented by some of main French construction companies (Bouygues, Vinci, Eiffage...)
 - For pre-designing a building in few days



Thank you for your attention

! CSTB Contact

- Eric Lebègue – eric.lebegue@cstb.fr

! Download Baghera View at :

- <http://salle-immersive.cstb.fr/en/>
- Item: Download