

General presentation of SALOME open-source platform

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 - SALOME platform presentation
 - Architecture overview
 - Main SALOME components: GEOM, SMESH, MED, YACS, PARAVIS

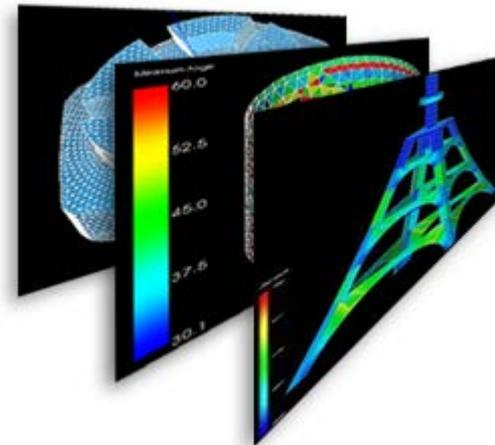
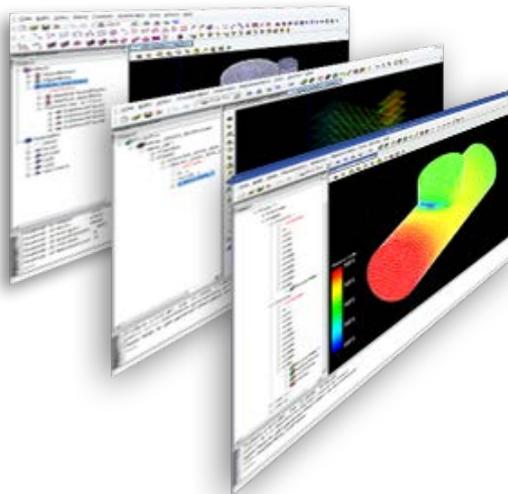
- Integration of a code in the SALOME platform

- Implementation of MED files in a Fortran code

- Live demonstration of the SALOME post-processing capabilities

SALOME platform

- SALOME is an open-source platform:
 - More than 40000 download per year.
 - More than 4000 user registered.
 - Open source integration platform for numerical simulation.
 - Great possibilities of use in developing countries.
- SALOME provides a generic platform for Pre- and Post-Processing for numerical simulation.
- It can be downloaded from <http://www.salome-platform.org>



SALOME platform downloads (International)

- From 16.8.2014 to 30.3.2015: **55.151 downloads.**
- Open source website: <http://salome-platform.org/>
- <http://www2.clustrmaps.com/fr/counter/maps.php?url=htt>

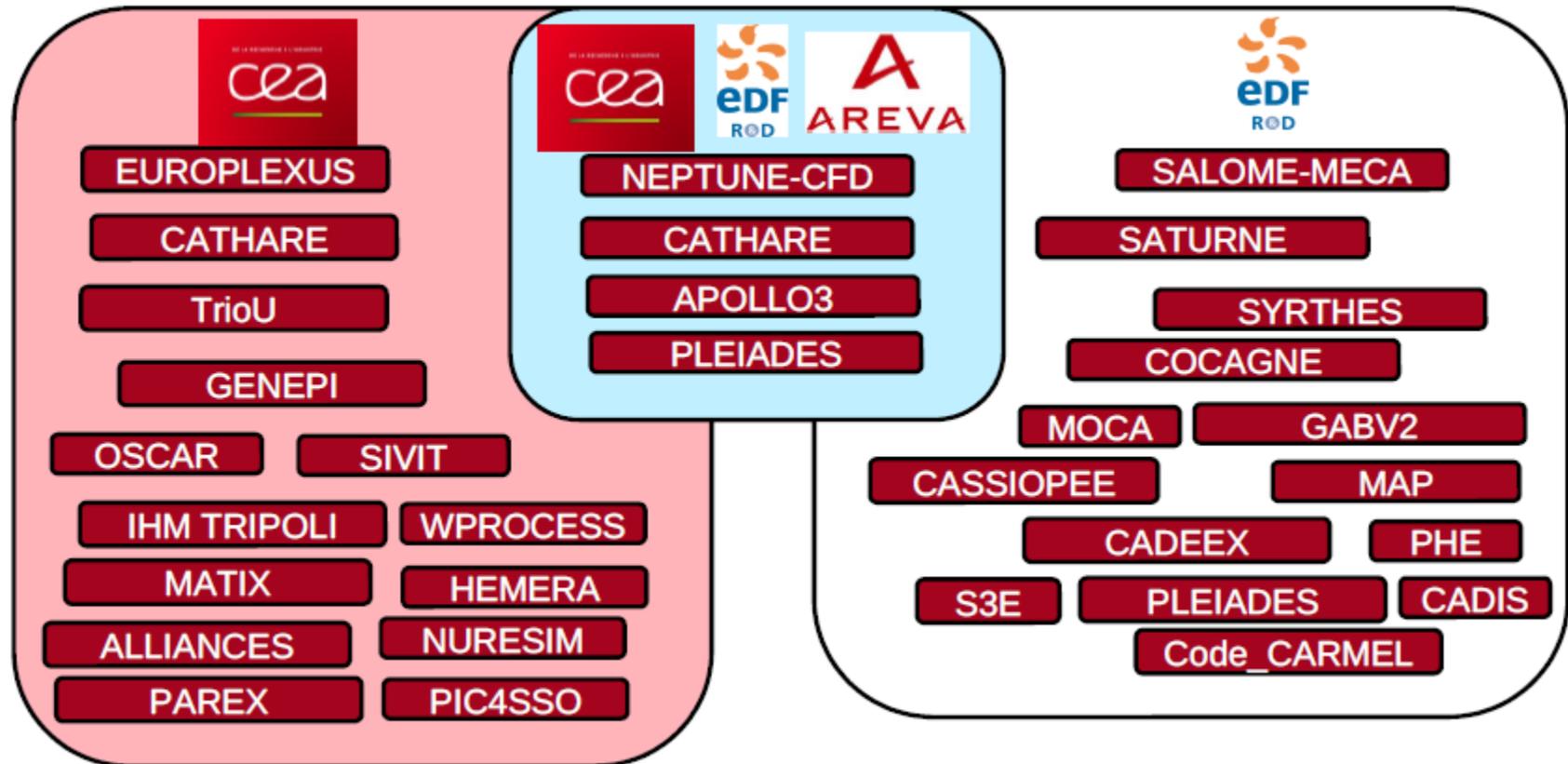


| | |
|---|-------|
|  France (FR) | 7,042 |
|  Germany (DE) | 6,770 |
|  United States (US) | 6,410 |
|  Italy (IT) | 3,313 |
|  Russian Federation (RU) | 2,940 |
|  Japan (JP) | 2,541 |
|  United Kingdom (GB) | 2,204 |
|  Spain (ES) | 1,789 |
|  Switzerland (CH) | 1,754 |
|  Brazil (BR) | 1,646 |
|  China (CN) | 1,538 |
|  India (IN) | 1,422 |
|  Canada (CA) | 1,182 |
|  Austria (AT) | 896 |
|  Poland (PL) | 878 |
|  Korea, Republic of (KR) | 848 |
|  Netherlands (NL) | 767 |
|  Australia (AU) | 742 |
|  Czech Republic (CZ) | 707 |
|  Sweden (SE) | 643 |
|  Finland (FI) | 538 |
|  Mexico (MX) | 506 |
|  Colombia (CO) | 485 |
|  Belgium (BE) | 456 |

distance dans laquelle les individus sont regroupés
 tailles des points ● = 1,000+ ● = 100 - 999 ● = 10 -
 ● = Récentes [?]

Projects using SALOME at CEA & EDF

- in 2013, 33 Projects have been identified as using one or several module of SALOME platform.



What offers the SALOME platform?

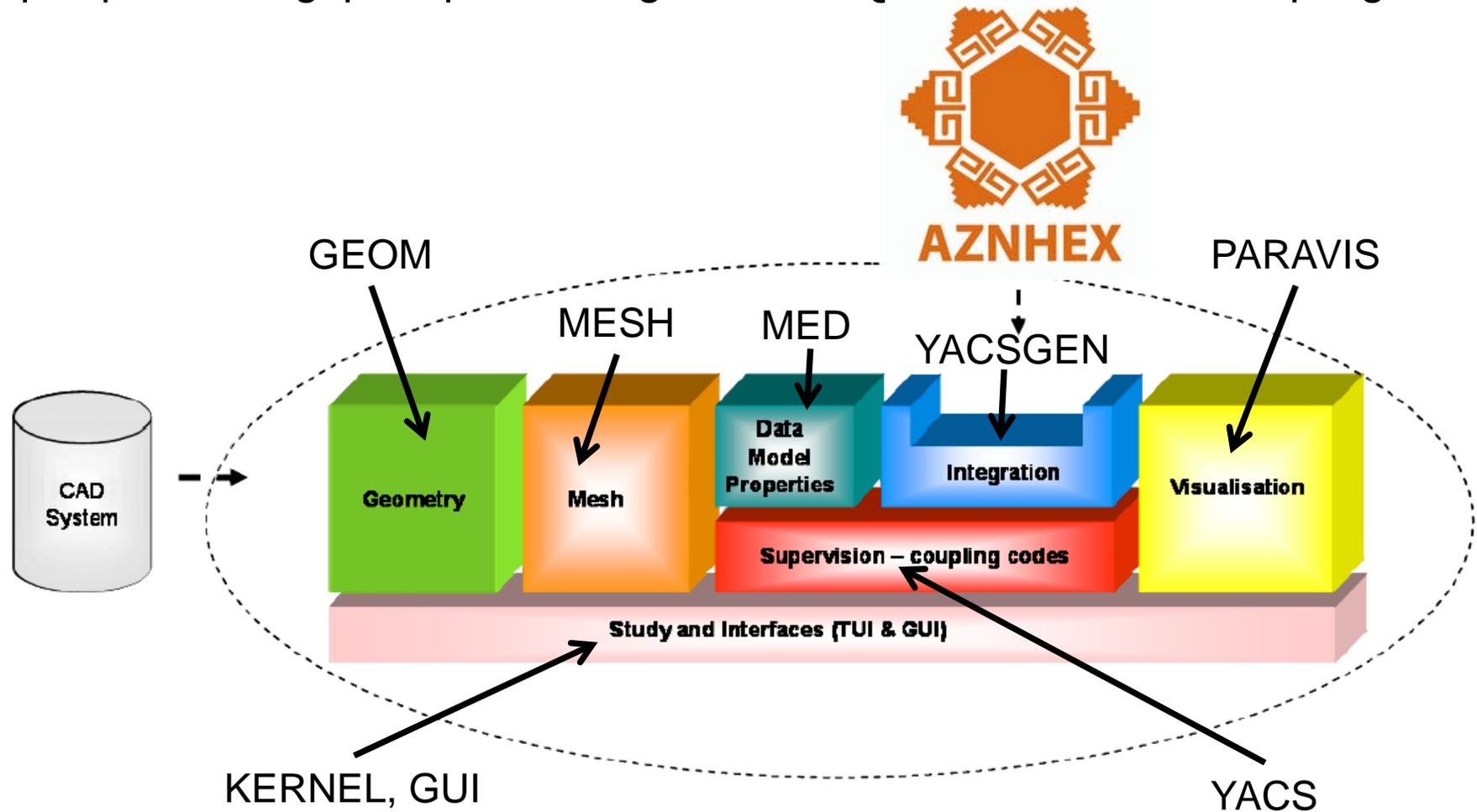
- The SALOME software platform:
 - is an open framework
 - can integrate scientific solvers for modelling various physical domains
 - Allows to perform a wide range of computing simulations
- The main features of the SALOME platform are:
 - **The design of the geometry representation** of physical systems (CAD modelling) and its associated discretized model (meshing functions for FE/FV solvers)
 - **The ability to integrate domain specific solvers** into normalized software components with standard interfaces to facilitate the coupling of different physical domains.
 - **The supervision of computation workflows** defined as graphs of distributed software components.
 - **The analysis of simulation data**, in particular using visualization of physical fields resulting from computation workflows.

Main SALOME modules

- **KERNEL**: distributed components management, study management, general services
- **GUI**: graphical user interface
- **GEOM**: create, edit, import/export CAD models
- **MESH**: mesh a CAD model using a standard meshing algorithm or any external mesher (plugin-system)
- **MED**: MED data files management
- **PARAVIS**: new post-processing module based on KitWare ParaView application
- **YACS**: an easy way to describe a computational schema involving multi-solver coupling.

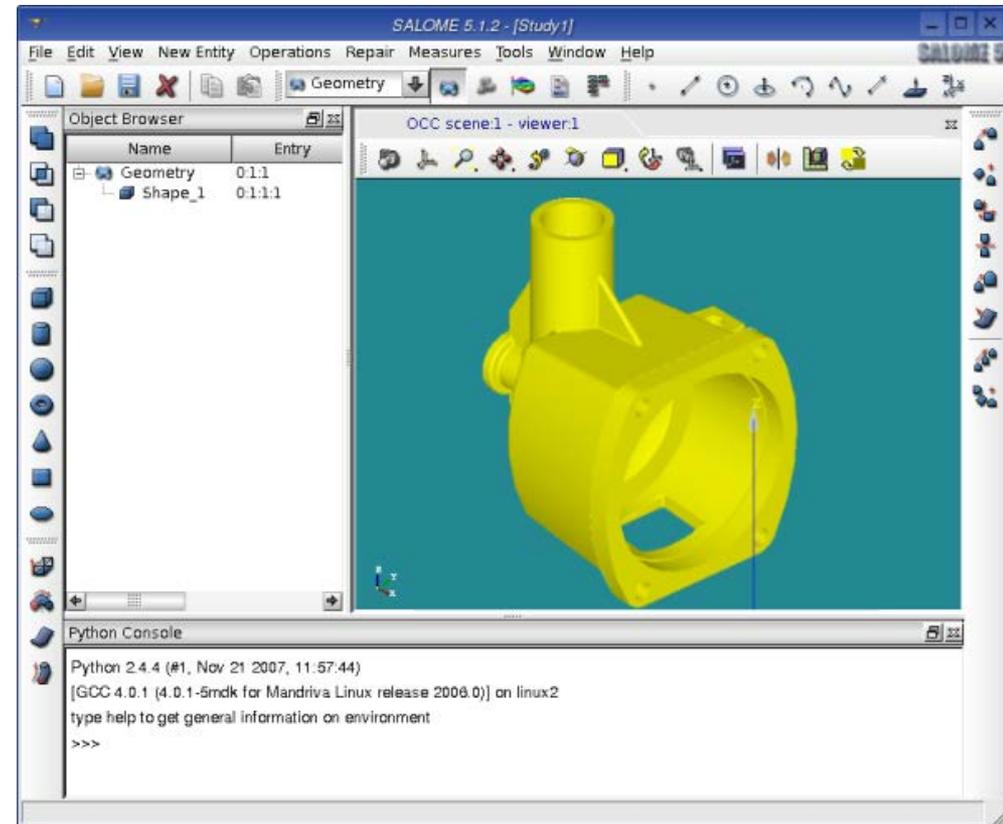
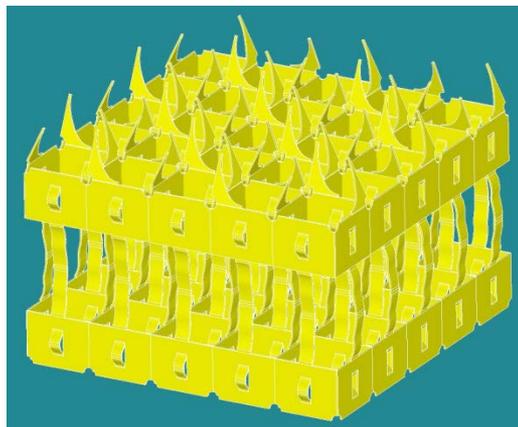
Global view of the SALOME Platform

- pre-processing, post-processing, code integration and code coupling



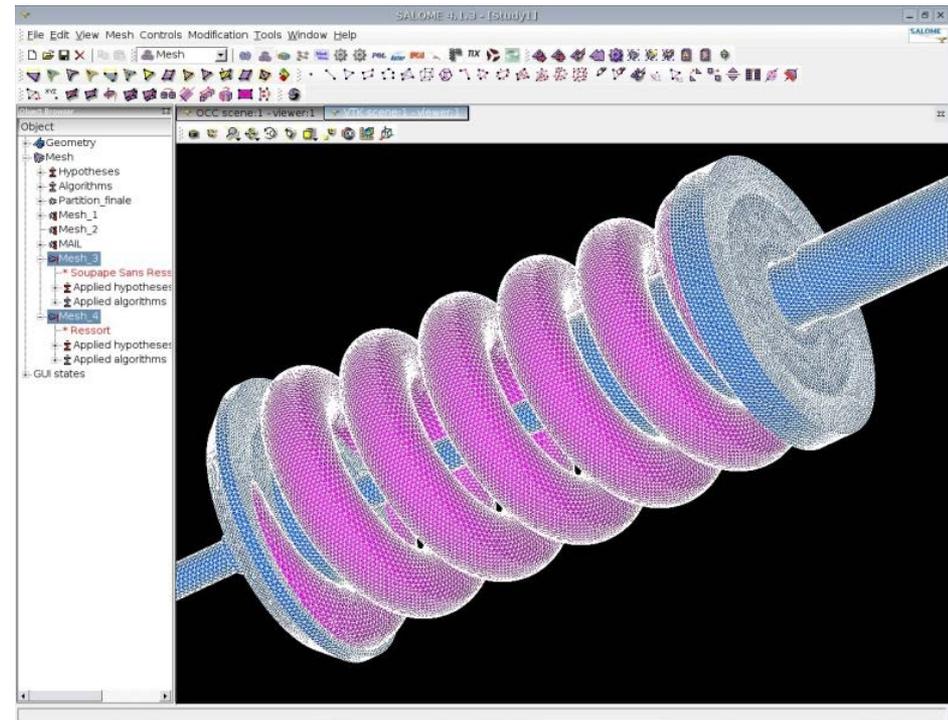
GEOM module

- The GEOM module is a CAD modeller based upon Cascade Technology.
- Import/Export CAD from standard formats,
- Design new geometric objects,
- Repair/correct imported CAD models,
- Adapt CAD Models to computer simulation.



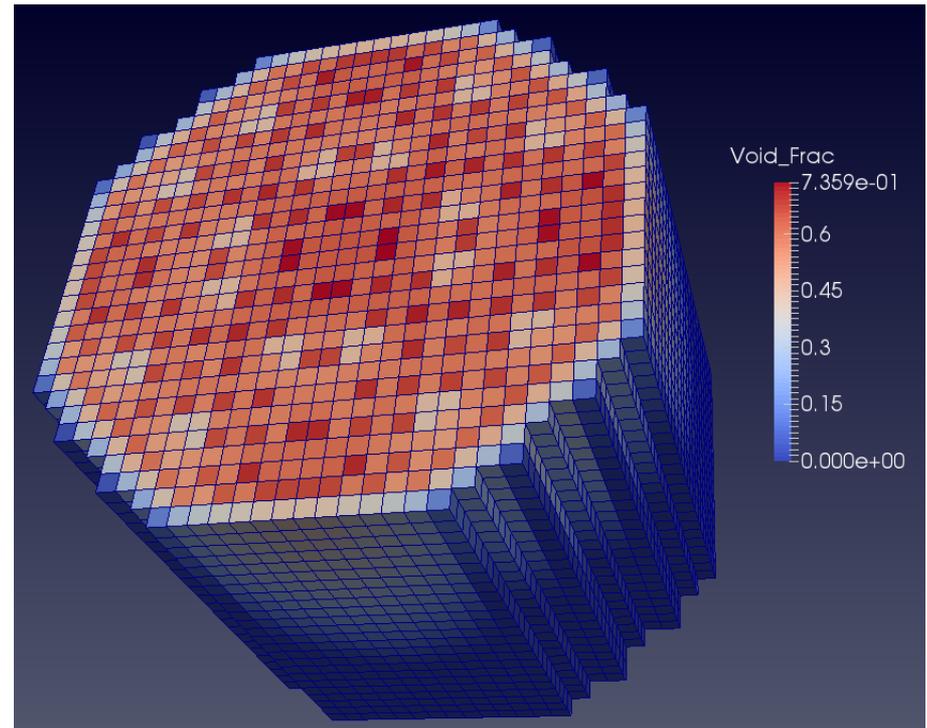
MESH module

- This module is used to mesh geometrical models previously created or imported by GEOM.
- Modification and Quality control of generated meshes,
- Import and export of meshes in MED or UNV formats,
- C++ API to connect external mesh algorithms (plug-in)
 - Open-source:
 - NETGEN, MEFISTO
 - Commercial (from DISTENE):
 - MG-Tetra, MG-CADSurf,
 - MG-Hexa, MG-Hybrid,
 - MG-Cleaner, MG-Tetra-HPC



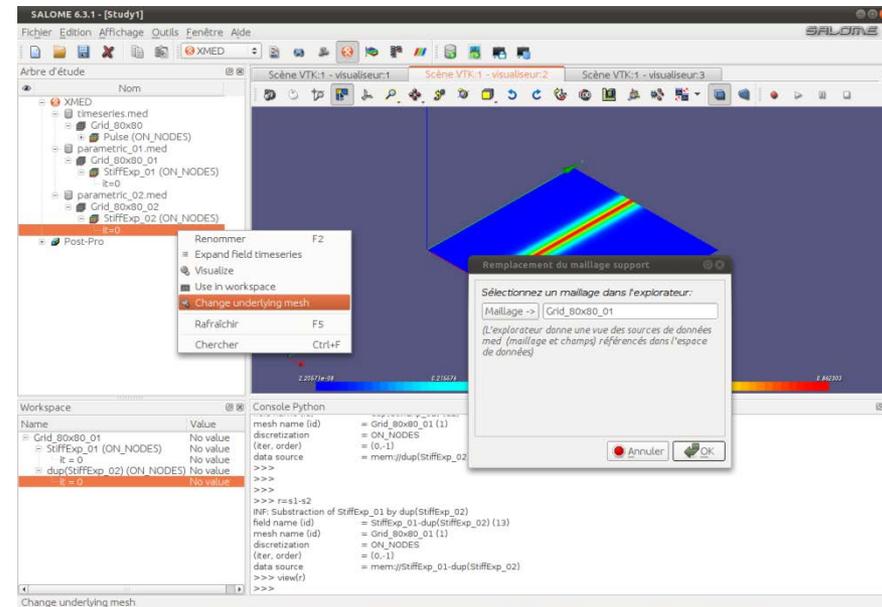
PARAVIS module

- SALOME module based upon the high performance data analysis and visualization library [Paraview](#).
- extremely large datasets
visualization using distributed memory
- Interactive or programmatic 3D data exploration
 - Scalars, vectors, meshes, section planes, streamlines, deformations, iso-Values . . .
- Animations
- Video wall stereo display



MED module

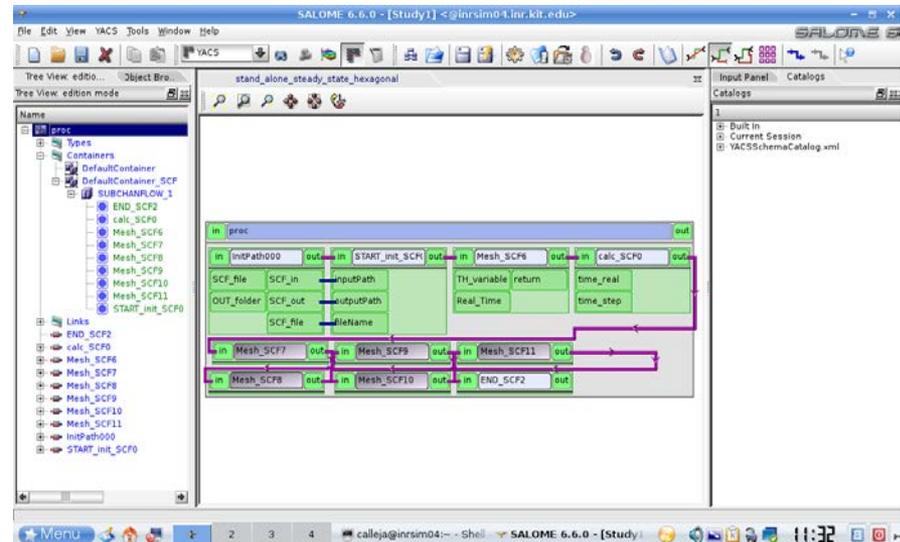
- Data Exchange Model for numerical meshes and fields
- A file layer (called **medfile**) for persistence of meshes and fields
 - based upon HDF Library
- A memory layer **MEDCoupling**
 - structures to hold data
 - a lot of algorithms and services (like interpolations)
- A Salome module (**MED**), which combines a graphical interface (**GUI**) to select and prepare data, with a textual interface (the python console) for field manipulation and work on data.



YACS module

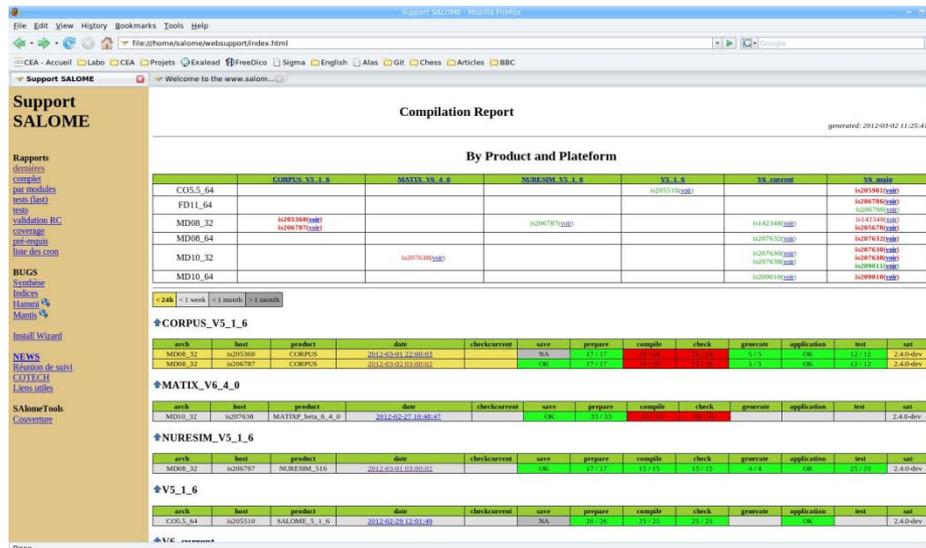
- Definition of coupled computational schemes and supervision
- YACS GUI assists users in editing computational schemes as graphs and specifying computational resources. A runtime mode supervises their execution.

- integrated codes (with **YACSGEN**) are coupled or chained
- Automatic task parallelism and MPI support
- Link with the **JOBMANAGER** module for the execution on clusters and supercomputers
- Link with Salome pre/post processing, debug mode



SalomeTool

- **Sat** is a suite of commands which mutualizes the maintenance tasks of the SALOME platform and its applications.
 - Management of multiple source repositories (CVS, SVN, GIT, . . .)
 - Compilation of modules and prerequisites
 - Module generation (wrapping of **YACSGEN** module)
 - Standardized and automatic testing procedures
 - Creation and installation of packages for various OS



The screenshot displays the 'Compilation Report' page in a web browser. The report is organized by product and platform. Below is a summary of the data presented in the tables.

By Product and Platform

| Product | Platform | Build ID | Status |
|----------|----------|----------|--------|
| COS_5_64 | VS_1_6 | h20510 | OK |
| FD11_64 | VS_1_6 | h206796 | OK |
| MD08_32 | VS_1_6 | h205363 | OK |
| MD08_64 | VS_1_6 | h206797 | OK |
| MD10_32 | VS_1_6 | h207630 | OK |
| MD10_64 | VS_1_6 | h209910 | OK |

Product Build Details

| Product | Build ID | Platform | Date | CheckCurrent | Save | Prepare | Compile | Check | Generate | Application | Test | Sat |
|-----------------|----------|------------------|---------------------|--------------|------|---------|---------|-------|----------|-------------|------|-----------|
| *CORPUS_V5_1_6 | | | | | | | | | | | | |
| MD08_32 | h205363 | CORPUS | 2012-03-01 12:30:03 | OK | OK | OK | OK | OK | OK | OK | OK | 2.4.0-dev |
| MD08_64 | h206797 | CORPUS | 2012-03-01 13:00:03 | OK | OK | OK | OK | OK | OK | OK | OK | 2.4.0-dev |
| *MATIX_V6_4_0 | | | | | | | | | | | | |
| MD08_32 | h207630 | MATIX_beta_6_4_0 | 2012-02-27 10:45:42 | OK | OK | OK | OK | OK | OK | OK | OK | 2.4.0-dev |
| *NURESIM_V5_1_6 | | | | | | | | | | | | |
| MD08_32 | h206797 | NURESIM_016 | 2012-03-01 03:00:03 | OK | OK | OK | OK | OK | OK | OK | OK | 2.4.0-dev |
| *VS_1_6 | | | | | | | | | | | | |
| COS_5_64 | h20510 | SALOME_5_1_6 | 2012-02-29 12:01:40 | OK | OK | OK | OK | OK | OK | OK | OK | 2.4.0-dev |

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Code integration in SALOME

1.- Code modularization is needed:

- Initialization, output writing, calculations, mesh creation, transients, etc...

2.- Fortran subroutines: read & write in MED binary format (Optional):

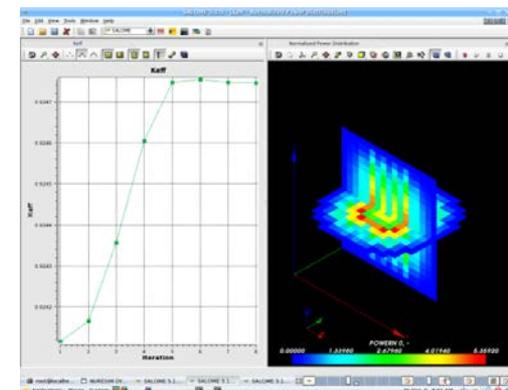
- **MESHES**: Virtual structure based on the geometry of the problem.
- **FIELDS**: Store information in each node of the MESH (**data exchange**).

3.- C++ interface to call the source code via “methods” (C++ Class):

- Can be called from Python via SWIG library.

4.- Generation of the Code API using the tool HXX2SALOME:

- The code becomes a component of the platform.



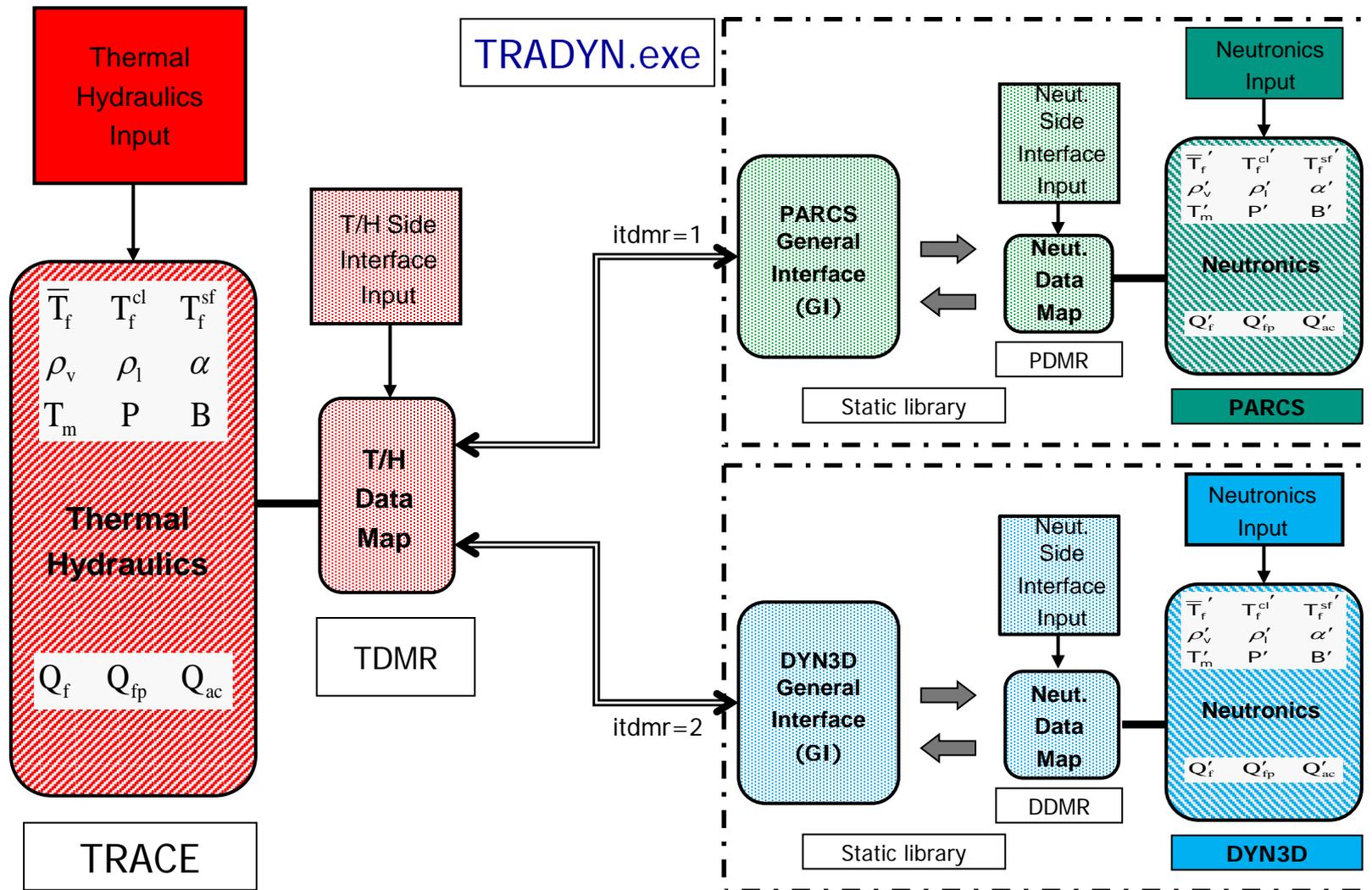
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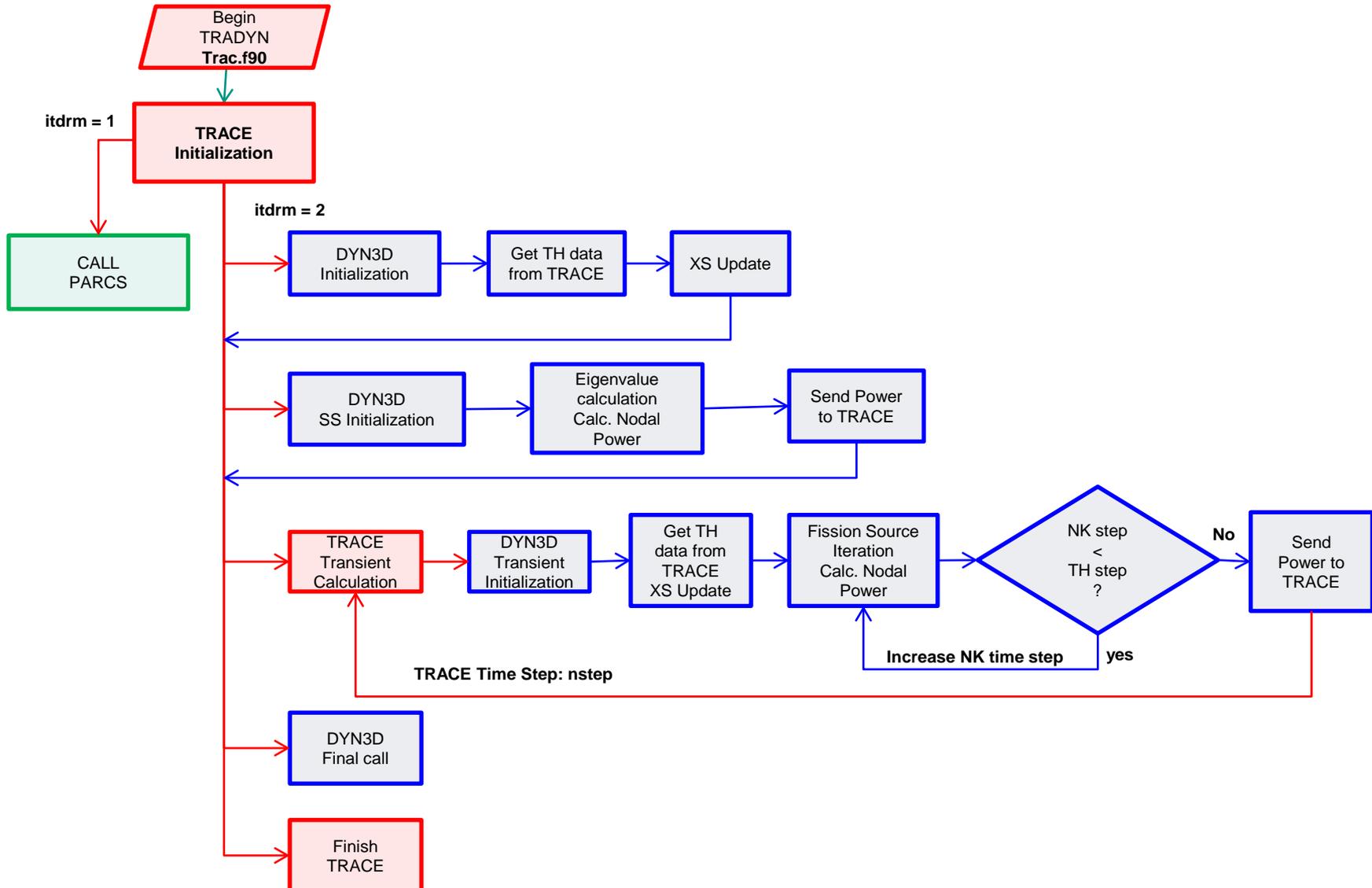
Implementation of MED files in a FORTRAN code

- At KIT we are developing TRADYN coupled code system:
 - The system code TRACE (V5 Patch 4) is internally coupled to two reactor dynamics codes: (PARCS and DYN3D) using the General Interface (GI)
 - For TRACE-DYN3D, Internal generation of **MED files for post processing** inside SALOME Platform
- Some fortran subroutines were added for adding the support
 - Create the mesh and open the MED file.
 - Write the desired data fields inside the MED file.
- The executable needs to be linked with the corresponding **hdf5** and **med** libraries.
 - `gfortran -DMEDLIB -o TEST test.o -lmed -lhdf5`
- Other coupled codes benefit already from the MED files at KIT:
 - DYN3D, SUBCHANFLOW, SERPENT-SUBCHANFLOW

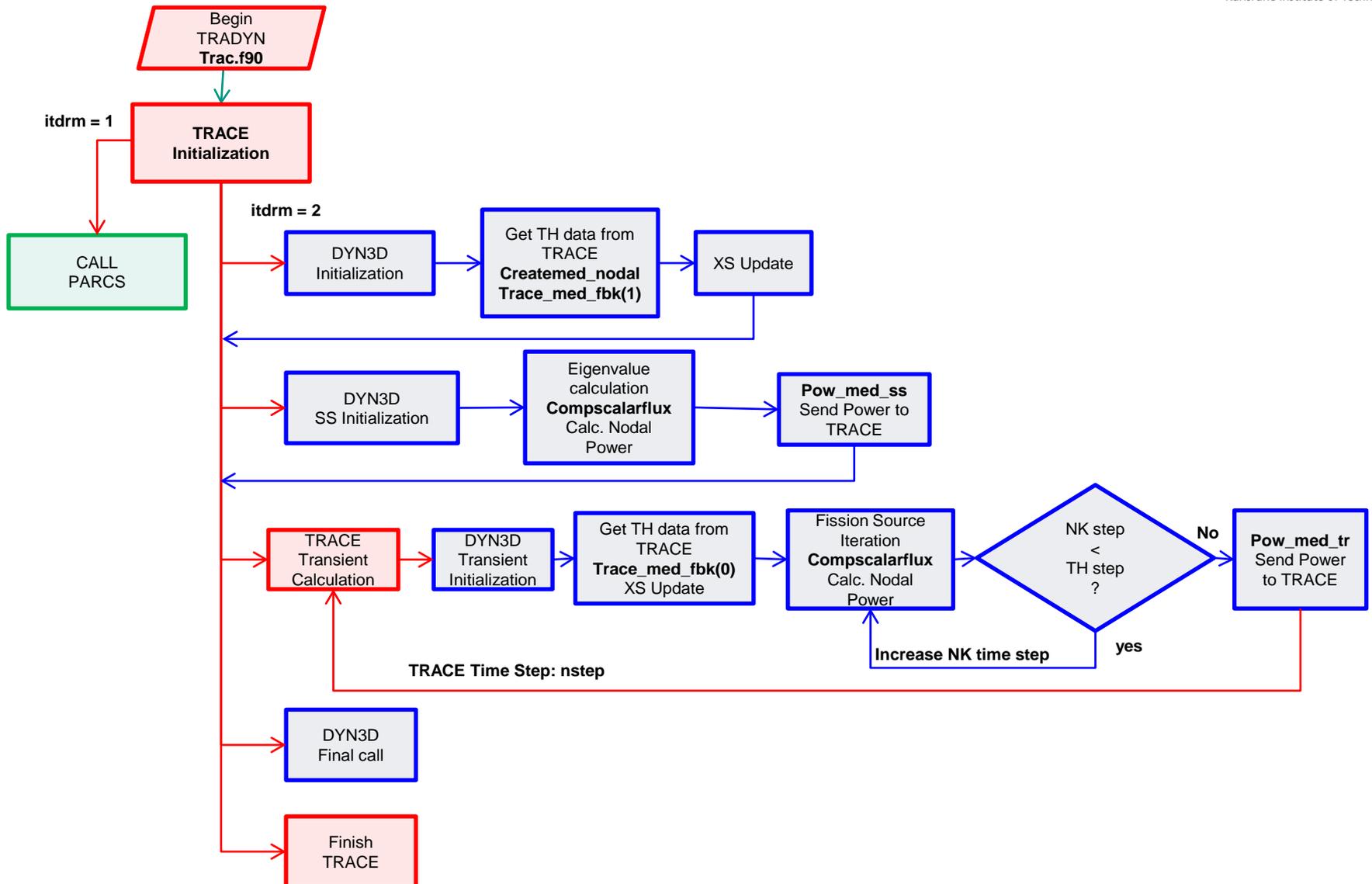
TRADYN System Description



TRADYN Transient flowchart



TRADYN Transient flowchart



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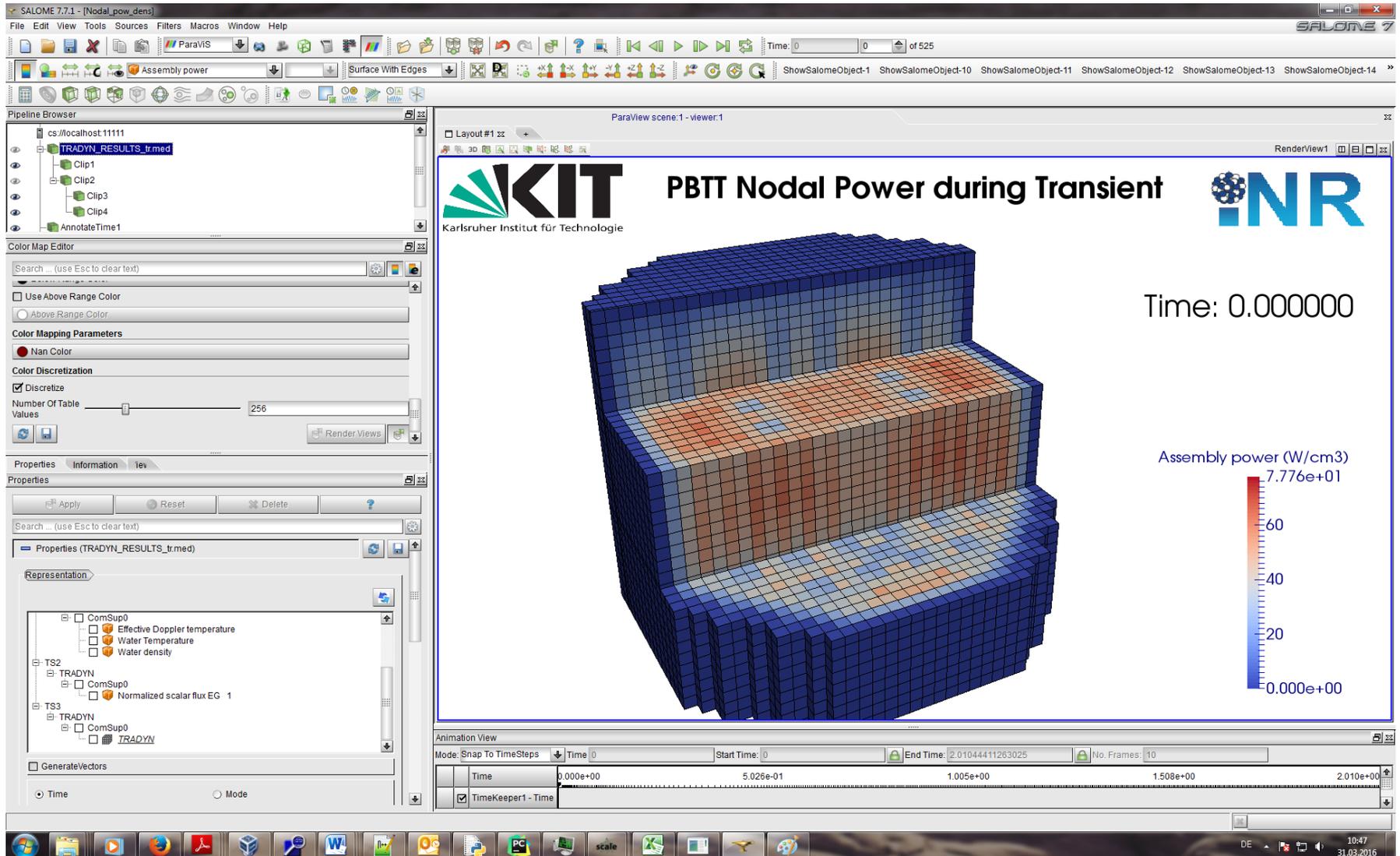
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- **Live demonstration of the SALOME post-processing capabilities**

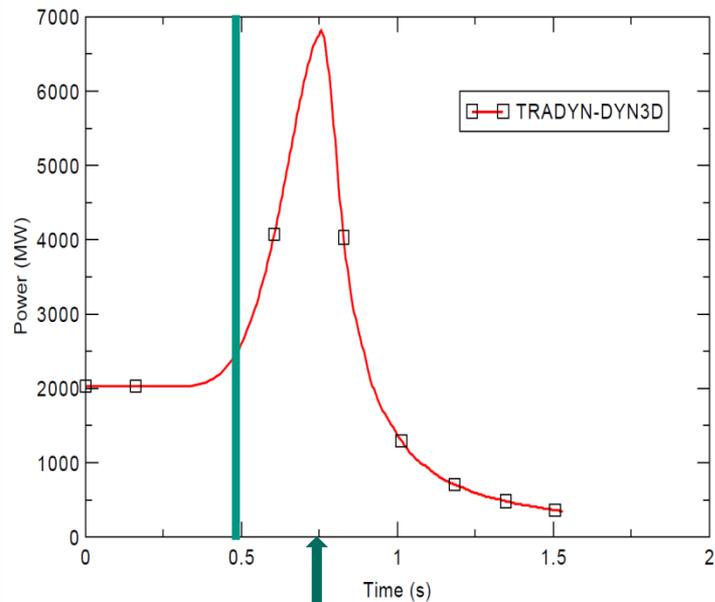
MED file post-processing in SALOME



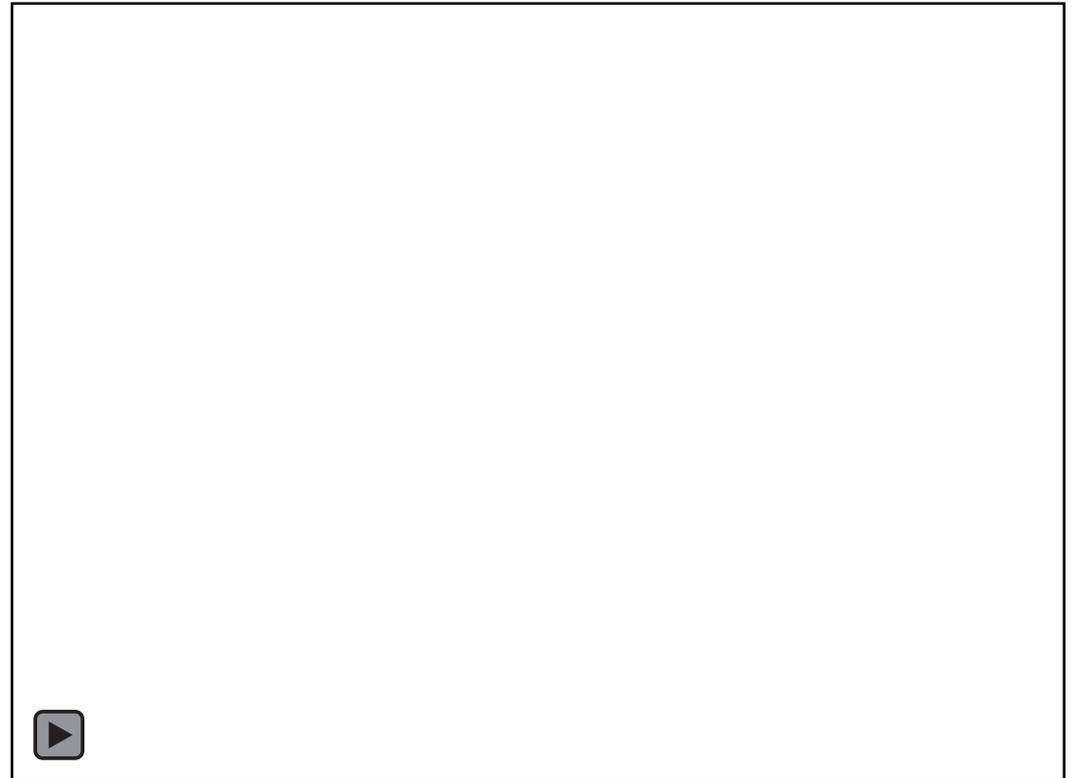
The screenshot displays the SALOME 7.7.1 software interface for post-processing a MED file. The main window shows a 3D visualization of a reactor core assembly, rendered as a grid of blue blocks. The visualization is titled "PBT Nodal Power during Transient" and includes the KIT logo and the INR logo. The time displayed is "Time: 0.000000". A color scale legend on the right indicates the assembly power in W/cm³, ranging from 0.000e+00 (blue) to 7.776e+01 (red). The interface also shows a Pipeline Browser on the left with a tree structure including "TRADYN_RESULTS_tr.med", "Clip1", "Clip2", "Clip3", "Clip4", and "AnnotateTime1". The Color Map Editor is open, showing settings for "Color Mapping Parameters" and "Color Discretization". The Properties panel shows the "Representation" of the selected object, including "ComSup0", "Effective Doppler temperature", "Water Temperature", "Water density", "Normalized scalar flux EG 1", and "TRADYN". The Animation View at the bottom shows the time range from 0.000e+00 to 2.010e+00, with a "TimeKeeper1 - Time" track.

MED file post-processing in SALOME

TOTAL POWER DURING TRANSIENT



0.75s scram



References

- <http://www.salome-platform.org>
- The Salome platform, Nicolas Crouzet, CEA, NURESAFE final seminar, Brussels - November 4, 2015

**THANKS FOR YOUR ATTENTION
QUESTIONS?**