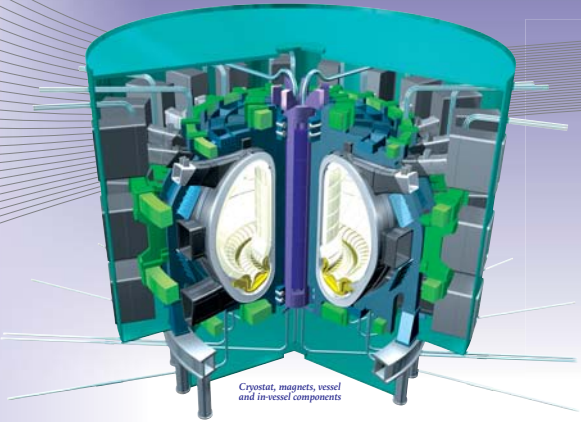
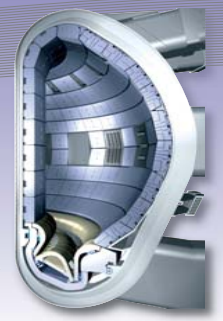
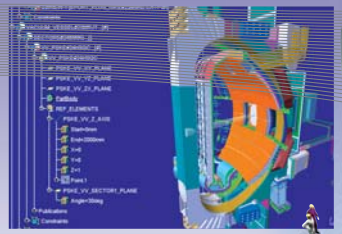
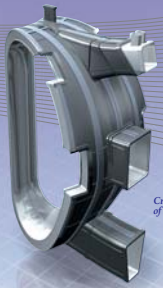


Cryostat, magnets, vessel and in-vessel components



Cross-section of vessel and internal components





Cross-section of vessel

ITER – the Energy of Tomorrow with DS PLM

Harnessing nuclear fusion as a new energy source for mankind is the goal of ITER, the world's largest fusion energy research project. ITER's objective is to build a demonstration fusion power plant capable of producing electricity in a safe and environmentally friendly way. ITER selected Dassault Systèmes' CATIA, ENOVIA, and DELMIA to engineer the reactor and plant, structure its design methodology, and ensure long-term data interoperability across the organization.

Inside the tokamak

ITER is an international organization comprised of the central ITER body and seven Domestic Agencies: the European Union, Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation, and the USA. Each Domestic Agency will develop elements of the ITER power plant, which will cost €10 billion to construct and operate, and that will be located in Cadarache in the south of France.

ITER's key business challenge is to orchestrate a pioneering international scientific research project via a small central team. Real-time coordination and collaboration are vital to the project's success since the participants span the globe. Considerable effort will be spent on coordinating the design of a phenomenally complex facility made up of 10 million parts with extremely rigorous quality requirements.

CATIA: A GLOBAL DESIGN SOLUTION

CATIA is the master 3D design solution for both the tokamak (a toroidal device for producing controlled nuclear fusion) and the plant that will house it. The ITER Design Office creates the Plant Breakdown Structure up to 'build to print' level, and Domestic Agencies then take over the design of specific components. Using the digital mock-up (DMU) capabilities available in CATIA and ENOVIA, the Design Office ensures that the millions of complex critical parts in and around the tokamak will interface clash-free at assembly time.

ENOVIA VPLM: SINGLE-SOURCE DATABASE

ENOVIA VPLM acts as a single repository for all design data. It enables engineers to work together on the most current designs within the context of a part, a large assembly, or an entire product; important capabilities that both improve decision-making and promote design reuse.

ENOVIA VPLM gives ITER design teams access to the same up-to date product information. The ability to design concurrently on a project of this complexity is essential. Concurrent design also permits ITER to keep the size of its design office to a minimum. "We have a limited team of about 90 designers meaning that the design effort has to be distributed. Without ENOVIA VPLM, it would be very difficult to do the job, and we would need a much larger Design Office team," said Eric Martin, Design Office Head, ITER.

ENOVIA VPLM also provides a rich search capability. For plant design, for example, engineers use virtual 'Room Books' that provide full details of all assemblies and systems found in a given 'room'. ENOVIA enables them to use 3D to search and download all components for a given room using a customized automatic location attribute function, simplifying the process of verifying component compliancy or the impact of a design change.

Without ENOVIA VPLM, we would need a much larger Design Office team.

DELMIA: PROCESS ANALYSIS PLATFORM

ITER is introducing DELMIA as its process analysis platform. DELMIA planning tools will be used to optimize resource usage throughout assembly and maintenance processes. The process detailing features, including tools for defining equipment kinematics and robotics, will allow deeper analysis of critical processes and the associated equipment, using 3D models directly linked to the latest digital mock-up.

ITER simulates collision-free paths in the assembly and maintenance context thanks to the solutions of DS software partner Kineo CAM. ITER also uses DELMIA to simulate and validate critical parts of the assembly schedule by linking DELMIA operations to the project master schedule in Primavera. ITER is considering a possible integration of DELMIA with remote-handling supervision tools.

CONCURRENT ENGINEERING, QUALITY ASSURANCE

The ITER Design Office selected Dassault Systèmes PLM solutions because it is the only integrated solution that could deliver a unified vision of the mechanical and plant design data, enable concurrent engineering over a widely distributed network, and ensure control by a small central design team. ITER Design Office engineers use CATIA to create 'skeletons' or design templates. By providing a rigorous yet flexible framework to the sub-contractors who will create ITER's highly complex components, the skeletons ensure adherence to quality standards. The reuse of design skeletons also reduces the time needed to make duplicate components.

"One designer took my methodology and added his own ideas to the skeleton. The first component took him six weeks, the second one week, and the third just days," said David Lightowlers, Vacuum-Vessel Design Coordinator, ITER.

INTERNATIONAL COLLABORATION: LOCAL OWNERSHIP

Using DS PLM, the ITER Design Office provides master designs to distributed teams of designers, engineers and subcontractors around the world. The ability to delocalize has given Domestic Agencies a sense of local ownership of their work. It is also crucial in a project where fusion expertise is rare and cooperation among multi-national teams is essential.

FUTURE TRENDS

ITER plans to expand its DS PLM solutions to drive the project forward and further optimize control over the data and its distribution. ENOVIA, for example, will be used to provide the backbone for a procurement tool, enabling bidding agencies to have upstream access to complex data.

ITER is investigating the use of ENOVIA MatrixOne to manage project workflows and as a repository for all engineering data, including product/geometry breakdown structure views, documents, configurations, requirements, 2D/3D coherency, and more, in a collaborative mode.

Finally, a key element of the DELMIA implementation will be to verify virtually whether the intended plant assembly will operate to specifications. This could save hundreds of millions of euros in testing the project's numerous interfaces before building begins •

For more information:
www.iter.org

Vacuum vessel - Mechanical design