

FIRST EXPERIENCE WITH CATIA V5 IN FACILITY USE

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The CAD software CATIA is the leading 3D design tool. Established in the aircraft and space technologies as well as in the automobile and shipbuilding industries, it has also been used at PSI for many years. The current version of this high-end software now runs on a PC, for which capital investments are far lower than for workstations. Thanks to its reliability and analysis possibilities in the display of very complex mechanical structures, CATIA V5 is increasingly used during the coordination process in our accelerator facilities.

INTRODUCTION

The prime task of section 8830, Co-ordination Accelerator Facilities, is to co-ordinate the operation of the large research facilities at PSI. This includes the management of the annual shutdown period, the change-over between experiments but also collaboration in the planning and realisation of new large projects.

Various resources and tools are available to assist us in the execution of all these tasks. During the past years, we have successfully used the CAD software CATIA, made by Dassault Systems, for designing radiation shielding and planning large systems. However, CATIA, up to version 4, was unsuitable for the detailed design of complex installations or for the modelling of entire buildings including the shielding, components and all the infrastructure.

CATIA V5 AND ENOVIA VPM

The completely new design of CATIA, version 5 (V5), opens up utterly new prospects for general plant construction. The models generated in V5 now not only contain the geometric definition but also parametric characteristics.

At PSI, CATIA V5 is deployed together with ENOVIA VPM, a sister product also supplied by Dassault. The ENOVIA VPM (Virtual Product Manager) is a product management database (PDM). This package is capable of managing the complete development process of an installation from the concept design, onto the individual components, the assembly drawings and the installation process. This working method is an essential part of the "Product Lifecycle Management".

CATIA APPLIED TO PROSCAN

In the following, we will demonstrate the application and advantages of this new tool, using the PROSCAN project as an example.

PROSCAN, a complex large project embedded in an existing environment, consists of a multitude of different hardware modules. All these various units had to be designed, manufactured, tested and installed. In operation, the supply of the most varying media is required. The appropriate infrastructure, including electrical cables and cooling water installation, requires space and should be installed as quickly and smoothly as possible. The whole facility requires a radiological shielding using heavy material.

An immense number of interfaces exist between the various components, the infrastructure and the shielding, which had to be documented and defined through discussions with the respective specialists. We should not forget to mention that during the realisation of a complex installation in an existing environment, the space management often represents an underestimated problem.

Many collaborators are involved in the development and realisation of the PROSCAN facility; external companies delivering virtually turnkey parts or components developed in co-operation with PSI, suppliers of off-the-shelf components together with architects, civil engineers and even designers responsible for the formulation of the colour concept. The bulk of the development and co-ordination work was performed internally at PSI. However, this also involved many different professional groups.

All these groups work in different ways. There are variations in their internal processes, their standards, tolerances and rules. Various CAD systems are involved, using diverse standards and file formats.

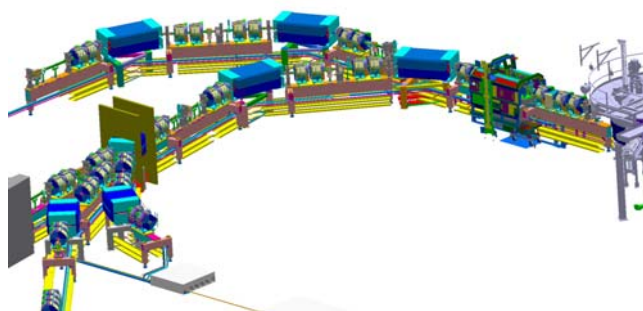


Fig. 1: Overview of the planned PROSCAN beam lines between the COMET cyclotron and the two gantries.

Only a powerful and flexible CAD-system coupled to an equally powerful and transparent PDM tool can transform this conglomeration of disperse file information into a complete 3D-Layout.

In a first phase, the existing models were collected from all internal and external participants. Some files had to be configured into the CATIA format, usually via the standard STEP interface. Little by little, the complete PROSCAN model could be assembled. The current version contains more than 6000 individual components and assemblies.

COOLING WATER PIPEWORK WITH CATIA PIPING

The great advantage of an integrated 3D-description was demonstrated during the planning and design of the cooling pipework for the COMET cyclotron. The space available for this pipework was very limited. Furthermore, all components built into or attached to the cyclotron must be accessible at all times and must be dismountable. In addition, the installation time had to be kept as short as possible. Above all, the latter condition made a precise design and preassembly of the pipework absolutely necessary.

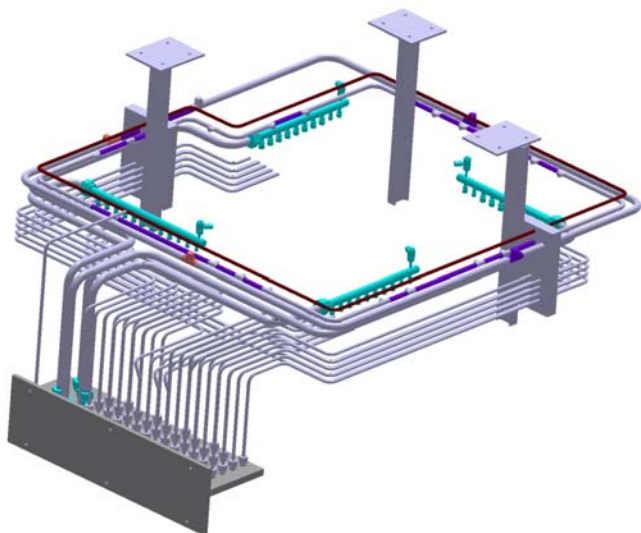


Fig. 2: Complete model of the cooling pipework underneath the cyclotron.

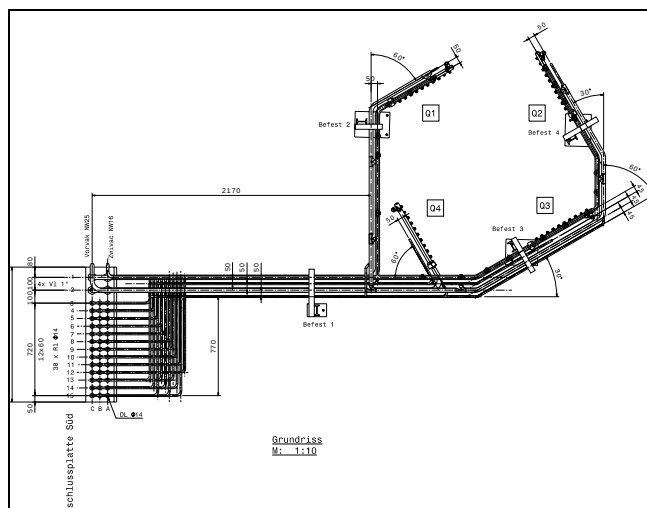


Fig. 3: Design drawing of the COMET water cooling pipe system.

The CATIA piping design module creates and manages physical designs of tubing lines and systems using industry standard conventions, terminology, practices and company standards. Provided industry-oriented functionalities give users the ability to design the tubing systems in a realistic way. For example, it can be used to lay water cooling pipes and their associated fittings between two connection points, optimising the path according to the available space.

The complete water cooling piping system could be designed within the cyclotron model. It was then possible to produce precise prefabricated parts and the actual installation took only a few days.

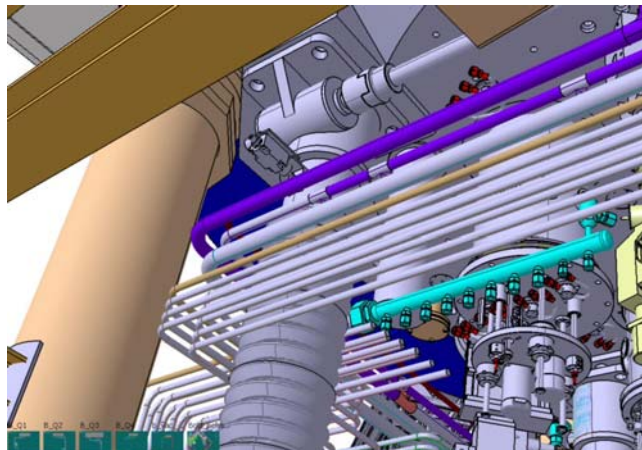


Fig. 4: View of the cooling pipes in CATIA V5.

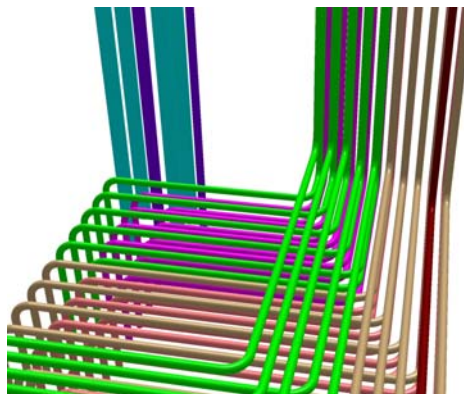


Fig. 5: Computer graphics (upper picture) and reality.

CONCLUSIONS

During the course of the PROSCAN project, it was clearly demonstrated that, faced with such complex tasks in such a restricted space and within such a tight schedule, an instrument was needed, which can not only visualise all the component interfaces but at the same time is capable of accompanying a component from the concept to its realisation and even up to a future dismantling. In our opinion, with CATIA V5 together with ENOVIA VPM, such an instrument is now available at PSI.