PTC Creo View

A Solution for Enterprise Validation and Review

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PTC Creo View

Digital data content, previously the private domain of design and manufacturing engineers, has now become an essential factor in the interactions and decision-making of a broad range of enterprise-wide product contributors. PTC Creo View technology, which is the basis of a comprehensive Enterprise Validation and Review solution, supports visualization of and interaction with product models. It delivers a scalable visual collaboration and digital mockup capability for product data that can be deployed throughout the enterprise. CIMdata reviews the capabilities of PTC Creo View and its ability to pair mechanical and electronic product data for full product visualization and interaction. Highlights include PTC Creo View's support for a Model-based Enterprise strategy and its strong interference analysis and animation capabilities.

Executive Summary

Visualization technology was born to provide non-engineering stakeholders the ability to collaborate on product models.

Once the sole domain of design and manufacturing, digital data content has become an essential factor in the interaction and decision-making of enterprise-wide product contributors. Visualization technology was born to provide these non-engineering product stakeholders the ability to interact with product model data. The technology relies on a lightweight, compact format of model data delivered with a simplified, intuitive user interface.

PTC Creo View traces its roots back to PTC's 1999 acquisition of Division Group, a visualization software provider, and to Division's own 1998 acquisition of Object Logic, which developed the initial ProductView 3D model visualization tool. Since then, PTC has incorporated additional capabilities across their full visualization product suite, and made significant software architecture changes that resulted in a new-generation product, rebranded as PTC Creo View, in the 2010-2011 timeframe.

The company positions PTC Creo View as their visual collaboration and digital mockup capability for product data. PTC Creo View and its options are built on a common, scalable architecture that can handle the display of a single CAD model up to an assembly containing over a million components, through the use of a Massive Assembly option. In addition, PTC implemented a fully open and interoperable solution that can accommodate not only PTC native CAD files but those of other providers in both mechanical (MCAD) and electrical (ECAD) computer-aided design, as well as other text and graphic image files. The user interface across all its option variations uses a Microsoft "Fluent" ribbon experience that is consistent with other Creo applications as well as supporting a tight integration with PTC Windchill.

Aside from these important attributes, PTC has paid attention to current trends in both design methodology and product quality. PTC Creo View's core markup

functions and the Design Check option support the methodology of Model-based Enterprise, the approach to dimensioning and annotating a 3D product model and avoiding the need to generate 2D drawings. Further, the company moves toward mobile technology with a free PTC Creo View Mobile application.

PTC Creo View's basic capabilities target visual collaboration between product stakeholders.

PTC Creo View is architected with basic capabilities that target its primary use case as a visual collaboration tool used by stakeholders across the extended enterprise. A suite of capabilities for measure and markup can be used to explore the product design and comment on its progress with colleagues, regardless of their location. PTC supports adapters for the import of 3D mechanical as well as 2D electrical model data generated in competitive CAD programs and industry-standard formats. PTC Creo View's lightweight files are secure by being comprised of compressed data with parametric and form-feature structures removed in order to protect a company's intellectual property (IP).

One aspect of PTC Creo View MCAD highly emphasized by PTC is the ability to filter overloaded bill-of-material (BOM) structures to create and view variant product structures. Close interconnections between the viewable geometric data and the product structure information allow the user to visualize and explore alternative product configurations.

Manufacturing engineers interact with PTC Creo View to define and visualize manufacturing process plans, including tooling design and work instructions for factory-floor operations and for product assembly. Marketing and sales organizations can use virtual product data before the first physical product prototype or deliverable is built to facilitate interactions with potential customers. While visualization's use expands throughout the enterprise, it remains important in engineering, and is critical to meeting product quality and delivery schedules. Three specific use areas must be noted as essential to a successful product development and launch: design checking; interference analysis; and animation of both functional simulation, and assembly and disassembly, for manufacturing and service.

PTC Creo View offers a strong response to today's product development pressures.

New product development is reaching new bounds with sophisticated designs that challenge many engineering and manufacturing organizations. The need to place accurate, up-to-date digital product data in the hands of all stakeholders is now a necessary and critical aspect for delivering new high-quality products on time. With PTC Creo View, the company has armed their clients with a strong response to these pressures.

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Introduction

The need to view, query, and interact with product models is now essential throughout the enterprise.

As product development evolves in the twenty-first century, high-value digital data content that was previously the private domain of design and manufacturing engineers has grown to be an essential factor in the interactions and decision-making of a broad range of enterprise-wide product contributors. The need to view, query, and interact with product models is now essential to the work tasks in quality management, sourcing, product support, marketing, documentation, and sales. Visualization technology was born to alleviate the need for these non-engineering product stakeholders to purchase and learn the sophisticated computer-aided design (CAD) capabilities used by designers in order to interact with product models. Visualization technology relies on a lightweight, compact format of product model data that when delivered with a simplified, intuitive user interface empowers the functional needs of a broad range of enterprise users. It allows them to expand their use of actual product designs to support evaluations and decision making in their everyday responsibilities.

CIMdata, Inc. recently reviewed the PTC Creo View software for visualization and digital mockup of product models to broadly assess its capabilities and its ability to satisfy user needs in a number of specific areas that are critical in today's product development environment.

PTC Creo View Heritage

PTC Creo View traces its roots back to PTC's 1999 acquisition of Division Group, and Division's previous acquisition of Object Logic.

The historic roots of PTC Creo View trace back to PTC's 1999 acquisition of Division Group, a visualization software provider based in Bristol, UK. Knowledgeable professionals at the time regarded Division as a global visualization supplier with an outstanding reputation due in part to Division's own 1998 acquisition of Object Logic, a small San Diego-based US company that developed the ProductView 3D model visualization tool. PTC merged the technologies under the ProductView brand, and extended the application by integrating it with PTC Windchill—PTC's product data management (PDM) and product lifecycle management (PLM) platform.

The CAD/CAM/CAE industry witnessed a lot of change in the late 1990s. There was the initial emergence of what today we call PLM solutions, addressing product development domains beyond those of engineering design and manufacturing engineering. Small, independent software providers captured the market's attention by introducing product visualization technology, using lightweight part and assembly display models as an initial gateway into the growing array of applications including CAD, CAE, and CAM. Rather than start their day within a CAD program and invoke supporting applications from it, product developers were being encouraged to start in a visualization application

that could quickly display the product, query its metadata, and then launch other applications, including CAD. The large solution providers who had previously positioned their CAD as the premier tool from which all product development solutions flowed, found themselves in danger of losing their leading positions in the minds of users. They began a determined effort to acquire or develop their own visualization capabilities. With the acquisition of Division, PTC obtained one of the best visualization tools in the market.

Soon after the acquisition PTC integrated the ProductView technology with PTC Windchill to manage numerous processes in support of users of visualization tools. In 2004 PTC incorporated electrical design viewing after acquiring OHIO Design Automation and their electrical design collaboration product, InterComm. The visualization and collaboration solution allowed for the import of a wide range of design databases authored in leading electrical design automation (EDA) tools, including Cadence Design Systems, Mentor Graphics, and Zuken.

Over the following decade, PTC incorporated additional capabilities across the full mechanical and electrical visualization product suite and made software architecture changes that resulted in a new generation of ProductView. In the 2010-2011 timeframe, the company renamed the technology PTC Creo View to stay current with their major product rebranding to the full Creo suite of products.

PTC Creo View Market Position

PTC positions PTC Creo View as a scalable, high-performance visual collaboration solution.

The stated goal of PTC is to position PTC Creo View as a "scalable, easy-to-use, high-performance" visual collaboration and digital mockup tool for product data. In order to accomplish those lofty goals, PTC has built PTC Creo View and its options on a common scalable architecture that can handle the display of a single CAD model up to an assembly containing over a million components, through the use of a Massive Assembly option. Fully cognizant that today's product developers operate in a multi-CAD world where native models from different application providers must work together, PTC implemented an open and interoperable solution that can accommodate not only PTC native CAD files but those of other providers in both mechanical (MCAD) and electrical (ECAD) computer-aided design. PTC Creo View can display a wide range of document types, including PDF documents (and the ability to automatically publish PDF from Microsoft Office formats), as well as numerous graphical image formats. PTC Creo View data can be embedded in Microsoft Office documents, spreadsheets and presentations.

In another important consideration, PTC Creo View provides a consistent user interface across all its option variations using a Microsoft "Fluent" ribbon experience that is consistent with other Creo applications. This uniformity aids in user adoption of the varied Creo applications. Users can also configure the interface for specific tasks and user roles. In addition, a custom user interface can be developed in Java or HTML using a PTC Toolkit. The toolkit opens

product visualization to tailoring for specific company needs. Use case examples can include product visuals for sales presentations and developing shop floor interfaces specific to an operator or task.

Aside from these important attributes that PTC has incorporated into PTC Creo View for data scalability, openness, and usability, they have responded to trends in today's product development industry in both design methodology and product quality. Companies are increasing their consideration of a model-based enterprise (or model-based definition) strategy to support product design. Initially adopted in the Aerospace industry, the term Model-based Enterprise is used to describe a design methodology that is founded upon the ability of engineering designers to dimension and annotate a 3D model of the product and avoid the need to generate 2D drawings. The approach totally avoids the errors that can occur when drawings become out of date with the 3D product model. The "Enterprise" aspect of the term alludes to the use of the annotated 3D model downstream in the full product development process from simulation, analysis, validation, manufacturing, and product documentation, in effect, across the entire enterprise. PTC Creo View's Design Check option supports the methodology.

A second major trend in the PLM industry, seen as well in many other industries, is the use of mobile applications (apps). The move toward mobile apps relies on visual display interaction. PTC has developed the visual components in PTC Creo View's core technology to be used in all current and future PTC Windchill mobile apps. The current PTC Creo View Mobile app can view data from email, preloaded, or from a server using an Apple-style multi-touch navigation interface. It is available free of charge from the App Store.

PTC Creo View in Action

PTC has architected PTC Creo View with basic capabilities targeting its primary use as a visual collaboration tool, for design engineers and their colleagues in downstream organizations including manufacturing and quality. Atop broad viewing capabilities that zoom, pan, and rotate product models, a suite of capabilities for measure and markup help users explore the product design and comment on its progress with colleagues regardless of their geographic location.

Companies are able to improve the effectiveness of their product design reviews using workflows that serve up the necessary visual information; capturing markups offered by each user in the review process and on each iteration. This content is preserved with the iteration for future traceability. With the addition of a PLM connection, users may perform color-coded search based on PLM attributes including lifecycle state, iteration state, release state, and pending changes. Access to ERP connected attributes such as inventory and cost is possible.

Mechanical Visualization

PTC has structured PTC Creo View MCAD around the concept of "Create-Evaluate-Deploy." In the initial create phase users generate lightweight formatted "viewables" using proprietary compression algorithms that result in a major reduction in file size while maintaining geometric accuracy. The resultant files include assembly structure (with part positions), metadata and key characteristics necessary for decision making; geometric data in a generic format; together with GD&T (geometric dimensioning and tolerancing), layers, colors, and textures.

PTC supports adapters to import 3D model data generated in competitive CAD applications and industry standard formats such as IGES, JT, and STEP. PTC Creo View's lightweight files are secure; they are highly compressed, designed for rapid retrieval and can have any parametric and form-feature structures removed in order to protect a company's IP. The file formats also support the delivery of interactive technical illustrations, viewed in PTC Creo View and authored in PTC Creo Illustrate.

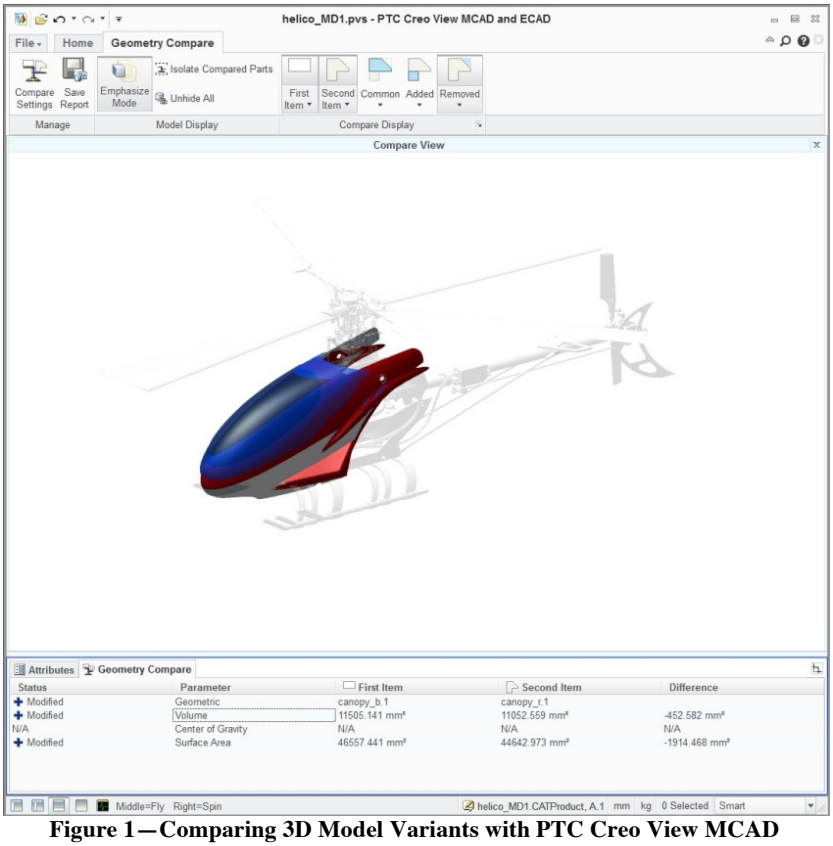

Figure 1—Comparing 3D Model Variants with PTC Creo View MCAD
(Courtesy of PTC)

The evaluate phase encompasses the use of the PTC Creo View viewable data in the full suite of user solutions that must interact with CAD data. While the primary purpose of viewable model data is in collaborative sessions and design reviews, as previously noted, it is also the source data for "walk-throughs" or "fly-throughs" of complex product models in order to explore detailed facets of

the design. In addition, PTC Creo View allows users to better understand design changes by providing a graphical compare for 2D drawings and 3D models.

One aspect of PTC Creo View MCAD highly emphasized by PTC is the ability to filter overloaded bill-of-material (BOM) structures to create and view variant product structures in the context of PTC Windchill. Close interconnections between the viewable geometric data and the product structure information allow the user to visualize and explore alternative product configurations. PTC Creo View also contains a construct of dynamic grouping to control what is visualized. Users can can specify a distance or size and collect all objects into a 'group.' The software dynamically updates the group when product changes are made, facilitating user efficiency.

The deploy phase of PTC Creo View MCAD highlights its use throughout the enterprise. Manufacturing engineers interact with PTC Creo View to define and visualize manufacturing process plans, including tooling design and work instructions, for factory-floor operations and product assembly. Regulatory compliance engineers can visually identify component parts that are out of compliance according to pre-defined colors. Marketing and sales organizations can use virtual product data, before the first physical product prototype or deliverable is built, to better interface with potential customers.

While the use of visualization expands throughout the enterprise, its primary deployment remains in engineering, and is critical to meeting product quality and delivery schedules. However, visualization is more than just seeing the model. Today companies want to improve product development with better decisions, less rework, fewer prototypes, and greater understanding outside engineering in domains such as manufacturing and services. PTC Creo View continues to evolve to handle these expectations. Today PTC Creo View MCAD includes three specific areas that must be noted as essential to today's product development and launch: design checking, interference analysis, and animation of both functional simulation and assembly and disassembly for manufacturing and service.

Design Checking

Design Check adheres to Model-based Enterprise methodology for design.

PTC Creo View Design Check aligns with the tenets of Model-based Enterprise methodology and gives users the ability to ensure that all necessary geometric dimensions and tolerances are present on the model and unambiguously defined. This data is often called product manufacturing information (PMI), and the industry is rapidly moving toward a standardized version of what the dimensions and other annotations must look like. The solution also allows a user to create a note on any item of the model and then tracks the history of the note, thereby allowing users to track design decisions: "who" said "what" and "when." Domain experts and contributors in different geographic locations can then communicate about facets of the product in development. A company can additionally define their own notation symbols for internal use.

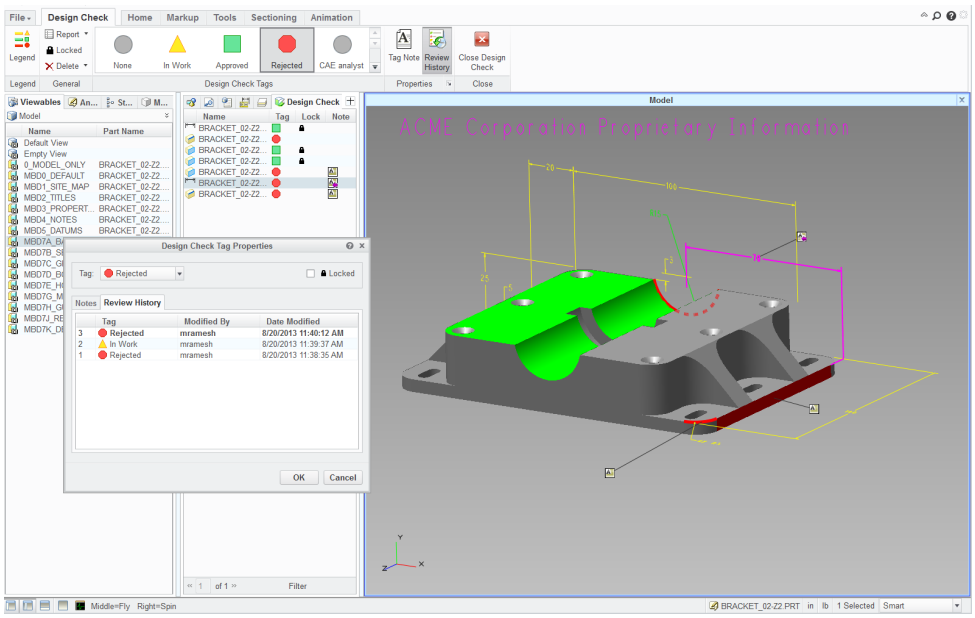

Figure 2—Exploring the Results of PTC Creo View Design Check
(Courtesy of PTC)

Interference Detection

One of the most challenging aspects faced by developers of complex product assemblies is determining if any model components or subassemblies interfere with each other during product operation or during the manufacturing assembly process. The difficulty is compounded when a company relies on outsourcing elements of the product design to suppliers.

A wealth of operational issues must be faced beyond the heavy computational aspects of interference calculations that deal with intersecting intrusions, contacts, and clearance violations. Engineering management must be able to initiate interference checks between any combination of product components, then record and track violations for corrective action.

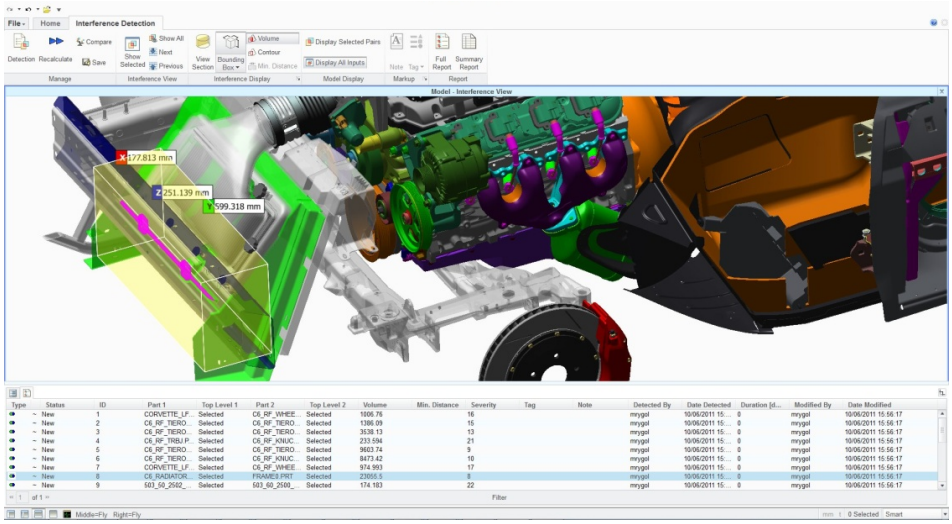

Figure 3—Investigating an Interference using PTC Creo View Interference Analysis
(Courtesy of PTC)

PTC Creo View Interference Analysis provides a fully capable implementation for all variations of interference detection. The software can generate detailed reports with complete visual representations of component clashes. When combined with PTC Windchill, users can schedule server-based execution and management of resulting interferences. Design managers can distribute selected interference issues to their staff for review and to engineering to make design changes that correct the problems. Each individually identified interference can be tracked and routed through PLM-managed workflows in order to get items fixed and to get signoff by individuals, teams, and even outside design partners. This capability makes it possible for companies to institute process-driven improvements for design reviews and quality initiatives.

Interference Analysis combined with PTC Windchill provides server-based execution and results management.

Animation

Downstream in product development, numerous deliverables must be planned and executed to both manufacture and service the product. Manufacturing engineers develop detailed product assembly instructions, often with a number of variations if the product will be built in different factories around the world. Varied assembly steps may be necessary because different facilities have different capabilities, and assembly instructions may need to be generated in multiple languages. Rather than follow conventional methodology by producing static images of manufacturing assembly steps, many leading product developers are animating the sequence, adding a richer description of the process that improves product quality by reducing errors in production.

Similar issues arise when planning for service of the product once it reaches the customer. Service technicians require both disassembly and reassembly documentation to repair or replace failed product components. All such tasks take time and money. Again, leading product developers have turned to assembly animation tools to lessen the burden.

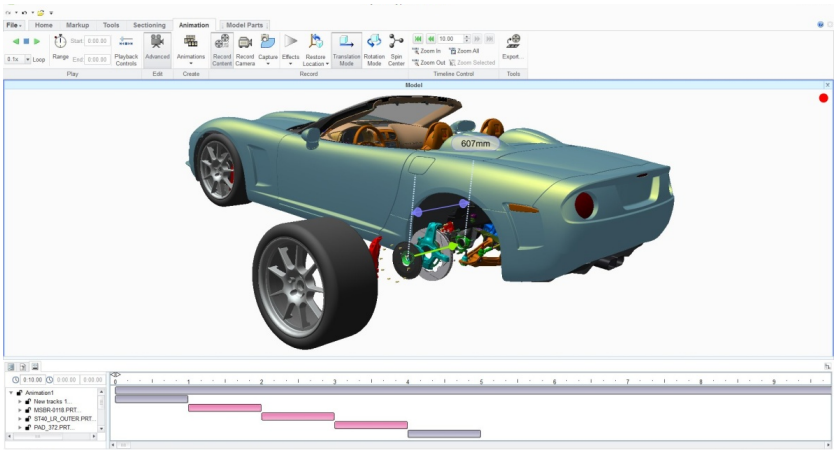

Figure 4—Animating a Disassembly using PTC Creo View Animator
(Courtesy of PTC)

PTC Creo View provides users an optional package for product assembly animation. PTC Creo View Animator provides a fully featured facility to stage the functional simulation, assembly and disassembly steps for a single CAD model, a group of parts, or a large assembly model. Users can define movement

PTC Creo View Animator allows functional simulation, assembly, and disassembly animation.

paths for components and control the timing of their execution. In addition, the animations can be exported in industry standard formats for use in other software tools to add sound.

Beyond the operational aspects for the use of animation technology in the engineering, manufacturing, and service domains, many companies are also exploring its use in product marketing and sales to better present their products to potential customers.

Electronic Visualization

Electronic product designers face ever-mounting pressure to deliver competitive product capabilities. Customer requests to add new product functions or to customize existing product options drive development toward increasingly sophisticated electrical designs with complex schematics and heavily populated printed circuit board (PCB) layouts. As complexity increases, so does the difficulty in not only assessing changes between design revisions but also in resolving the fit of the PCBs within the product's 3D mechanical domain. These demands are further compounded when having to deal with multiple geographically distributed design and manufacturing sites.

Before the introduction of visualization technology, sharing electrical design data between product development colleagues required licensing and using expensive, complex EDA tools, which in addition to the added cost, required detailed training in their use. The PTC Creo View ECAD product allows users to interact and share electrical data using a straightforward, cost-effective user interface.

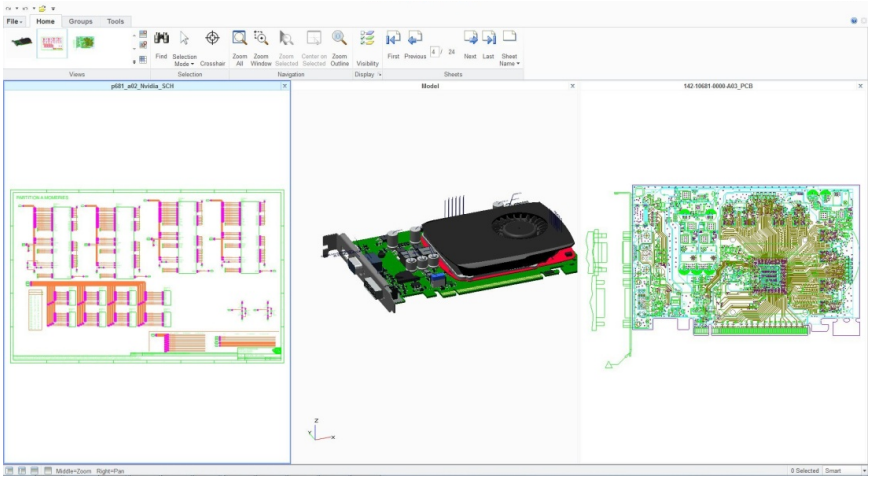

Figure 5—Displaying an Electronic Schematic, 3D PCB, and PCB Layout Views
(Courtesy of PTC)

PTC Creo View ECAD supports an extensive list of capabilities to aid electrical designers throughout the product development process. The application offers a structure navigator with multi-line query in addition to the ability to change visibility and colors on the fly to assist in exploring PCB designs. Selection filters can be used based on varied aspects of the design such as components, nets, and markups, to better interact with the design. Designers gain added

PTC Creo View ECAD, when paired with PTC Creo View MCAD, allows display and interaction with all three views: schematic, 2D PCB layout, and 3D model.

insight from the ability to do cross-selection of items in a dual display of the schematic and the PCB layout. More importantly, when paired with PTC Creo View MCAD, a user can add the display of the 3D PCB product model and interact with all three views.

ECAD Compare

In order to assess changes to electrical designs between revisions, PTC Creo View ECAD offers product options for both *compare* and *validate*. There are many different views of the electrical design. Figure 5 above depicts three views, but additional views can exist for manufacturing. With PTC Creo View ECAD Compare, a user can determine whether different views of a design are functionally equivalent. Product developers across the electrical, mechanical, and manufacturing domains can take advantage of the solution to discover problems before they become issues that affect the overall product design and force delays.

With PTC Creo View ECAD Validate, users can identify individual changes that represent a revision change, such as a component movement or a net path edit, and proceed methodically to accept or reject each. Design teams can converge more quickly on a final design they can commit to manufacturing by interrogating and tracking version-to-version changes.

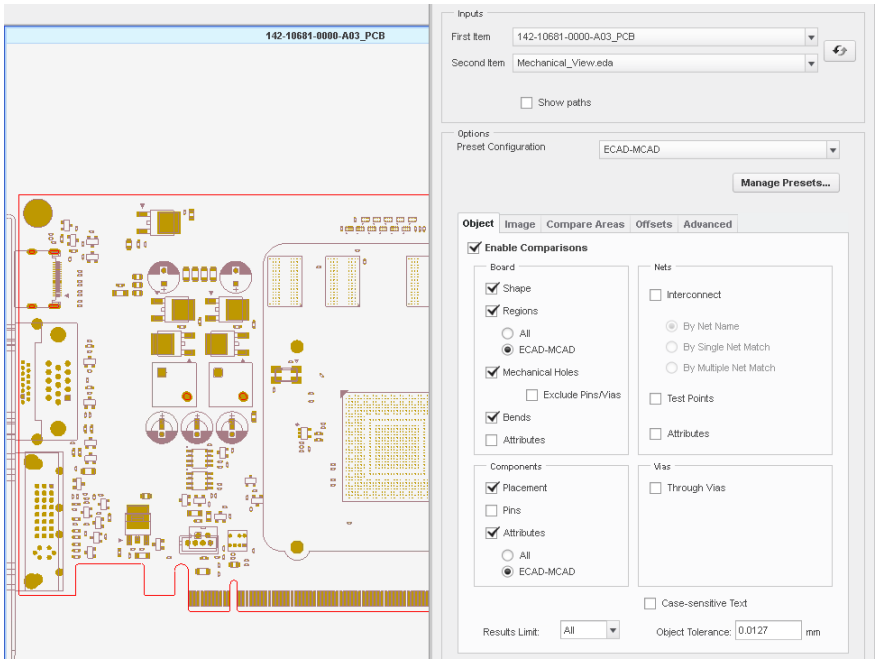

Figure 6—Performing an ECAD-MCAD Compare
(Courtesy of PTC)

PTC Windchill Integration

For PTC Windchill clients, the integration of PTC Creo View adds the ability to manage the scheduling and queuing of processes critical to visualization—such as interference checking, printing, and data conversion of CAD geometry into a lightweight format, including access to foreign, non-PTC-native CAD data. The

execution of these processes, which PTC has named "CAD workers," can be automatically distributed across multiple CPUs to load-balance tasks.

PTC Windchill services can also manage the storage of all visualization data including markups, annotations, watermarking, and color-coded reporting schemes, in addition to 2D and 3D thumbnail representations.

PTC Creo View Packaging

PTC presents PTC Creo View in a suite of flexible packages, to fit the needs of individual roles within a product development enterprise, and with pricing adjusted to match capabilities. All are built upon the common foundation of PTC Creo View's core visualization technology (Figure 7). A free "reader" of PTC Creo View and PTC Creo Parametric content, PTC Creo View Express, is available for use across the enterprise to view and evaluate rich 3D models. While there are no markup capabilities, PTC Creo View Express does display previously prepared PMI/3D drawings, fitting well with model-based enterprise initiatives.

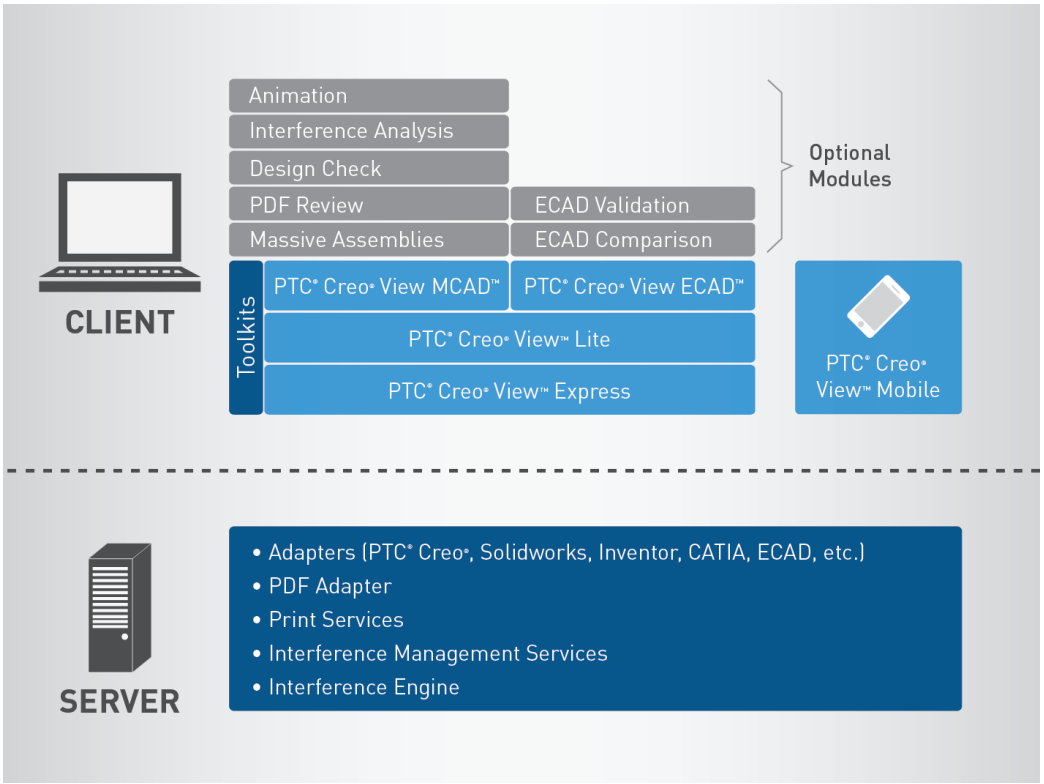

Figure 7—PTC Creo View's Product Packaging
(Courtesy of PTC)

PTC Creo View Lite is the basic visualization product. As a browser plug-in, PTC Creo View Lite automatically installs and administers itself. The Lite version supports the display of product assemblies, models, drawings, numerous image formats, and documents. In addition, facilities exist to measure, markup, and annotate the viewed content, making PTC Creo View Lite suitable for many design checking tasks and collaborative design reviews.

The bulk of PTC Creo View's dominant capabilities get delivered with two major packages next in the progression: PTC Creo View MCAD and PTC Creo View ECAD. Three-dimensional mechanical assemblies and models, together with their related two-dimensional drawings, are viewed using PTC Creo View MCAD. On the electrical side, PTC Creo View ECAD supports the display of both electrical printed circuit board schematics and layout. Both the MCAD and ECAD packages are built on the same architecture with a common packaging structure and integration methodology. Each offers a consistent user interface, and they can work together to provide a single, composite, digital product-data-model visualization environment.

The available modules for PTC Creo View MCAD include PDF Review, Design Check, Interference Analysis, and Animator. In addition, for users who deal with very large product assembles, PTC offers a PTC Creo View MCAD product add-on named the Massive Assembly Option, for 64-bit platforms. On the electrical side, PTC packages PTC Creo View ECAD with two options: ECAD Compare and Validate for ECAD.

Combining services, best practices templates and learning tools with PTC Creo View technology creates a complete solution that allows everyone, both inside and outside the company, to be simultaneously involved in the design, validation and review process.

Summary & Opinion

Product visualization gives all stakeholders access to the product's single source of truth.

The impact of sharing visual product data authored in engineering departments across the enterprise is generating positive benefits for product development companies. Sophisticated products are being designed and built at a more rapid pace and with better quality, because knowledgeable domain experts in engineering, analysis, and manufacturing are able to more easily communicate with each other during development, using visualization technology. The easy and intuitive accessibility of product views helps foster a broad usage of product digital data throughout the enterprise, giving all stakeholders a direct, tangible link to the product's single source of truth. PTC Creo View embodies characteristics of the industry's best visualization capabilities.

PTC Creo View's open, scalable architecture satisfies the pressing needs voiced across the product development landscape, from small consumer goods developers to massive product constructions in aerospace and shipbuilding. PTC proves they understand the nature of today's multi-CAD environment by providing open access to foreign databases and industry-standard formats through the use of optional adapters. In addition, PTC Creo View's ability to unite both 2D and 3D mechanical product visualization with electrical display of both schematic and PCB layout data, addresses the dilemma faced by product developers across most industries—the dramatic growth of electrical components in designs that previously were predominantly mechanical in nature.

High marks must be given to PTC Creo View for its attention to a number of the major trends sweeping the industry. The capabilities to dimension and annotate 3D views together with the functional capabilities offered with PTC Creo View MCAD's Design Checking option provides users all the necessary tools to exploit a Model-based Enterprise methodology within their organization. Strong credit must also be given to PTC's Interference Checking product. PTC Creo View technology forms the basis of an enterprise-wide validation and review capability. The delivery of critical technology for computing intersecting intrusions, contacts, and clearance violations, together with the optional integration with PTC Windchill to deliver a full batch-execution and issue-tracking facility, must be lauded.

Further, given the growing complexity in product designs, PTC Creo View delivers strong, competitive capabilities for both the mechanical and electrical side of product development. In the mechanical arena, sophisticated product structure becomes a positive aspect that companies can leverage to explore alternative product configurations. In electrical, the growing design complexity demanded in new product development can overwhelm many companies. PTC Creo View ECAD's ability to compare and validate gives those users a competitive advantage.

PTC Creo View offers a strong response to today's product development pressures.

In the twenty-first century, new product development is reaching new boundaries with sophisticated designs that challenge many engineering and manufacturing organizations. The need to place accurate, up-to-date digital product data in the hands of all stakeholders is now a necessary and critical aspect for delivering new products on time and with quality. PTC has armed their clients with a strong response to these pressures with their PTC Creo View solutions.

About CIMdata

CIMdata, a leading independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM) solutions. Since its founding over thirty years ago, CIMdata has delivered world-class knowledge, expertise, and best-practice methods on PLM solutions. These solutions incorporate both business processes and a wide-ranging set of PLM-enabling technologies.

CIMdata works with both industrial organizations and providers of technologies and services seeking competitive advantage in the global economy. CIMdata helps industrial organizations establish effective PLM strategies, assists in the identification of requirements and selection of PLM technologies, helps organizations optimize their operational structure and processes to implement solutions, and assists in the deployment of these solutions. For PLM solution providers, CIMdata helps define business and market strategies, delivers worldwide market information and analyses, provides education and support for internal sales and marketing teams, as well as overall support at all stages of

business and product programs to make them optimally effective in their markets.

In addition to consulting, CIMdata conducts research, provides PLM-focused subscription services, and produces several commercial publications. The company also provides industry education through PLM certification programs, seminars, and conferences worldwide. CIMdata serves clients around the world from offices in North America, Europe, and Asia-Pacific.

To learn more about CIMdata's services, visit our website at www.CIMdata.com or contact CIMdata at: 3909 Research Park Drive, Ann Arbor, MI 48108, USA. Tel: +1 734.668.9922. Fax: +1 734.668.1957; or at Oogststraat 20, 6004 CV Weert, The Netherlands. Tel: +31 (0) 495.533.666.