Solution Brief

Product Design, Industrial Design and Manufacturing

Intel® Processors Power Hardware Ray Tracing in Autodesk Inventor

Autodesk Inventor Professional 3D CAD software uses Intel® Core™ Ultra Processor (Series 2) with integrated GPU for full-width ray tracing to render more realistic 3D images in seconds

Computer aided design (CAD) engineers looking for a more realistic view of their 3D graphics turn to ray tracing to simulate how light interacts with the object of their design. Ray tracing works by tracing the path of rays of light onto a 3D CAD object, calculating how each ray reflects, refracts, or is absorbed by surfaces it encounters.

This contrasts with traditional rasterization methods that only show an object with light coming from the point of view of the viewer.

Ray tracing is important in product design for industries like automotive and aerospace, where lighting, material finishes, and reflections are crucial for aesthetic and ergonomic evaluations. But it can also benefit other tasks where visual fidelity is critical, such as architectural rendering, product design, and marketing imagery.

Compute Intensive

Ray tracing requires significant compute cycles. Half-width ray tracing is a lower resolution method that renders an image at half the intended output resolution and then scales it up, which allows for faster rendering times and quicker previews. However, half-width ray tracing comes with a loss in sharpness and detail. This mode is often used for draft-quality previews or iterative design work where speed is more important than perfection.

Full-width ray tracing is the other performance mode, rendering a design at the desired resolution, delivering the highest quality image with maximum detail and clarity. It is used when producing final images for presentations, publication, or print, where the highest visual quality is required.

Half-width ray tracing can be done in software using a CPU but requires significant compute cycles. Full-width ray tracing requires a separate hardware accelerator like an entry-level graphics processing unit (GPU).

The choice between half width and full width depends on the stage of the design process and the purpose of the rendering—early stages benefit from speed and responsiveness, while final stages demand full fidelity.

Ray tracing is an important feature built into Autodesk Inventor Professional 3D CAD software. To achieve hardware ray tracing performance, Autodesk, an Intel® Industry Solution Builders member, has standardized its software for AI PCs based on Intel® Core™ Ultra processors, which come with integrated GPU processing.

Autodesk Inventor Professional Optimized for Mechanical Design

Autodesk Inventor Professional is 3D CAD software that is primarily used for mechanical design, simulation, visualization, and documentation. It enables engineers and designers to create accurate 3D models of parts and assemblies and is a powerful tool for product development and manufacturing workflows.

With a comprehensive toolset, Autodesk Inventor Professional allows users to create detailed assemblies with thousands of parts, simulate motion and interference, and analyze performance under real-world conditions using built-in finite element analysis (FEA). It also supports sheet metal design, weldments, tube and pipe design, and frame generation, making it suitable for a wide range of industrial applications.

Another major advantage of Autodesk Inventor Professional is its support for drawing creation and documentation. It can automatically generate 2D drawings from 3D models, complete with dimensions, annotations, and part lists. Changes to the model trigger dynamic updates. Autodesk Inventor Professional also supports iLogic, a rules-based design feature that automates repetitive tasks and custom configurations.

With its modeling capabilities, analysis tools, automation features, and integration with other Autodesk software, Autodesk Inventor Professional is widely used in industries such as manufacturing, automotive, aerospace, and industrial equipment design.

Performance Driven by Intel

Autodesk Inventor Professional also supports ray tracing that is selectable to either work on the CPU or an available GPU. For ray tracing applications, Autodesk has specified hardware platforms based on Intel Core Ultra processor product families because they offer a multicore CPU, an integrated GPU and, although not used for ray tracing, an integrated neural processing unit (NPU). This processing capability makes the Intel Core Ultra processors a cost-effective solution that is also power efficient.

Intel Core Ultra processor family features a hybrid architecture that combines performance-cores (P-cores) and power efficient-cores (E-cores), delivering optimal performance and energy efficiency for the best possible user experience. This results in a low thermal design power (TDP) in addition to the power savings from the integrated GPU that replaces a discrete GPU, saving the power from this device.

GPU Designed for Compute Intensive Tasks

A key advancement within the Intel Core Ultra processors is the integration of Intel® Arc™ Graphics for compute intensive graphics and other workloads. These GPUs provide up to eight Xe Cores allowing for a high degree of parallelization for ray tracing workloads. They also support rendering libraries from Intel, which are a series of eight open source rendering libraries that enable photorealistic rendering and visualization applications.

The built-in Intel Arc GPUs have up to eight Xe-cores to provide the performance of entry-level discrete GPUs. In a ray tracing use case, the GPU is used for compute-intensive tasks that include:

- Real-time image display
- Image enhancement
- Rendering and 3D visualization

Demonstrating Hardware Ray Tracing Performance

To show the performance benefit of the hardware ray tracing in a system powered by Intel Core Ultra processors (Series 2), Intel engineers measured the time in seconds it takes to render a publicly available jet engine model. Two systems under test (SUT) were used: one powered by Intel® Core™ Ultra 9 Processor 185H (Series 1) and another system powered by Intel® Core™ Ultra 9 Processor 285H (Series 2).

The ray tracing capability on Autodesk Inventor Professional 2025 was set to high, which equates to full width. Table 1 shows the SUT configurations used in the tests.

SUT System Configuration	Intel Core Ultra 9 185H	Intel Core Ultra 9 285H
PL1	45W	45W
PL2	115W	115W
System	Intel® Reference Validation Platform	Intel® Reference Validation Platform
CPU	Intel Core Ultra 9 185H	Intel Core Ultra 9 285H
CPU Core Count	Total cores 16 (P-cores: 6, E-cores: 8, LPE-cores: 2)	
Memory	DDR5-5600, 64GB	DDR5-6400, 64GB
Power Plan	Balanced	Balanced
Power Mode	Best Performance	Best Performance
BKC Version (RVP Only)	PV RC3	PR3
BIOS Version	MR5 CORP	PR3 CORP
OS Version	26100.1882	26100.2454
Gfx Driver Version	32.0.101.6629	32.0.101.6629
Screen Size & Type	12'' eDP 1.4, PSR2	13'' eDP 1.4, PSR2
Resolution	1920x1080	1920x1080

Testing done by Intel in March 2025

Table 1. Configurations for ray tracing systems under test.

Results Demonstrate GPU Advantage

Two tests were conducted for each device, one with the ray tracing being done using the device's CPU and the other test using the device's GPU.

Table 2 shows the results of those tests. As can be expected, the GPU offered 6.8x faster processing compared to the CPU in the Intel Core Ultra 9 Processor 185H and 13.7x better CPU v. GPU performance in the Intel Core Ultra 9 Processor 285H.

GPU performance improvements in the Intel Core Ultra 9 Processor 285H compared to the processing speed of the Intel Core Ultra 9 Processor 185H cut rendering time by 2.1x[1].

[1]Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

Autodesk Inventor Ray Tracing Performance	Intel Core Ultra 9 185H	Intel Core Ultra 9 285H
Autodesk Inventor Professional Ray Tracing - GPU	58 sec.	27 sec.
Autodesk Inventor Professional Ray Tracing - CPU	397 sec.	370 sec.

Table 2. Ray tracing processing time in seconds for CPU and GPU (lower is better).

Conclusion

Ray tracing is an important capability for Autodesk Inventor Professional that makes objects drawn by the program more lifelike and attractive. But ray tracing is a compute intensive functionality that, at full width, is typically only used for final drafts and not for other iterations of a design. What is needed to deliver performance is a GPU, like the one in the Intel Core Ultra processor family, that can execute the computations needed for fast rendering.

Learn More

Autodesk Inventor Professional 2025

Ray Tracing in Inventor

Intel® Core™ Ultra Processor Family

Rendering Libraries from Intel

Intel® Industry Solution Builders

Intel® Arc™ Graphics

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Performance varies by use, configuration and other factors.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See configuration disclosure for details. No product or component can be absolutely secure.

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