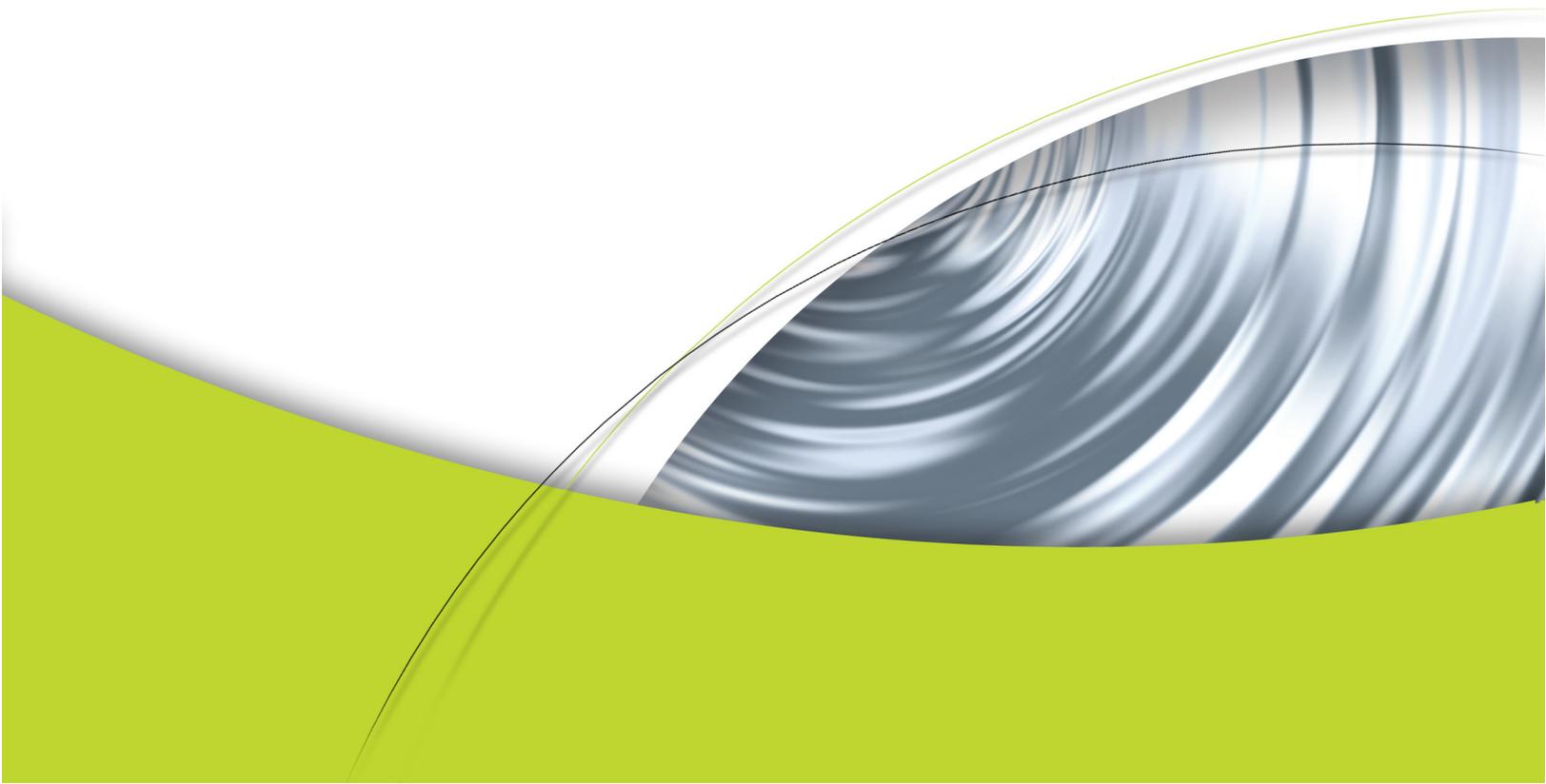




Technical Brief

NVIDIA GeForce FX GPUs
Intellisample Technology



NVIDIA Intellisample Technology and Next-Generation Image Quality

In 2002, several key technological revolutions came together to produce the biggest leap forward in graphics since the advent of dedicated graphics processing units (GPUs). The convergence of real-time and cinematic rendering—features incorporated into the NVIDIA® GeForce™ FX family of GPUs—is dramatically accelerated, bringing a myriad of special effects to artists and game developers.

With this newest generation of graphics processors, image quality continues to play a critical role in the overall user experience. The NVIDIA Intellisample™ technology and other features of the new NVIDIA GeForce FX GPUs improve performance and achieve new levels of realism. This paper explains the latest innovations that distinguish the NVIDIA GeForce FX GPUs with Intellisample technology. Each of the new NVIDIA graphics processors leverages some or all of the described features as appropriate for the target markets.

Image Quality and Performance

Achieving both richness of functionality and optimal performance creates many challenges at the architectural level. To meet these challenges, NVIDIA GeForce FX solutions support high frame rates and the highest levels of image quality with sophisticated compression, anisotropic, and trilinear filtering capabilities. The latest NVIDIA advances include the following technical breakthroughs, taking image quality and performance to the next level.

Color Compression

The new NVIDIA architecture includes hardware-implemented color compression technology. NVIDIA GeForce FX processors employ an advanced proprietary form of loss-less data compression with a 4:1 compression ratio for color information. This industry-unique color compression solution is implemented in hardware and is completely transparent to applications, with both compression and decompression taking place in real time. Because this compression is completely loss-less, there is no reduction in image quality or loss of precision. The result of this NVIDIA technology is a dramatic increase in memory efficiency, overall improved system performance, and unmatched image quality. For the user, this means that antialiasing speed is improved to the point where essentially all modes of antialiasing are free—without any associated loss of performance.

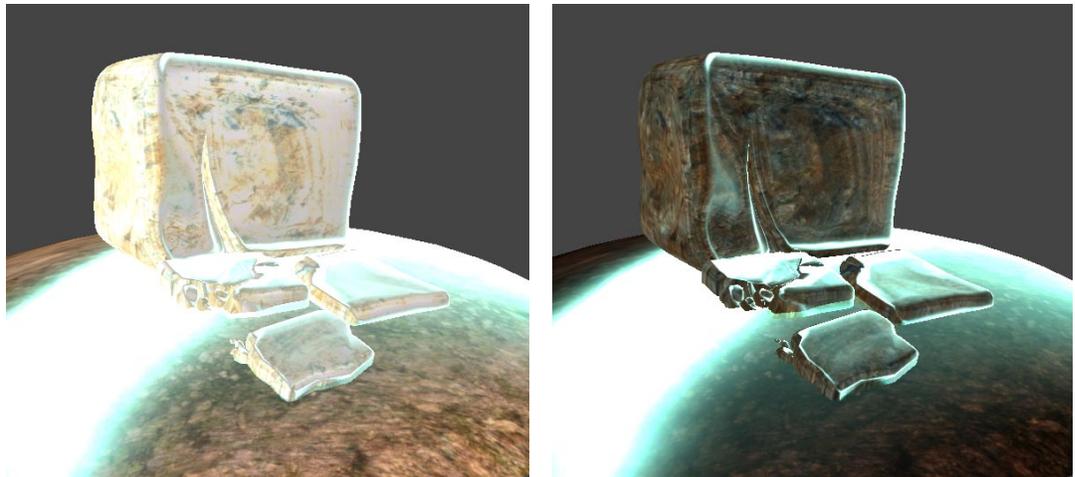
Note: Color compression is not available on the GeForce FX 5200 models.

Fast Clear of the Color Buffer

The NVIDIA GeForce FX GPUs include fast color clears that are executed in hardware. By accelerating this common operation, overall graphics performance is improved.

Dynamic Gamma Correction

Contrary to what a computer monitor shows or how the human eye perceives it, computer graphics programs generally assume a linear color space. And, with most artwork created in some form of gamma space, operations done in the shaders should take place in gamma space as well, but this is not really convenient. Instead, the correct approach should bring color values back into linear space, perform the math, and corrects back into gamma space. Many previous shaders did not take gamma into consideration, resulting in color inaccuracies. However, with built-in gamma correction capabilities, NVIDIA GPUs free developers from the burden of changing gamma spaces. Users see a truer representation of each rendered image's luminance (or brightness). See Figure 1.



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The picture on the right has been corrected using gamma correction.

Figure 1. Gamma Correction Comparison

Adaptive Texture Filtering

The NVIDIA GeForce FX GPU offers a variety of adaptive texture filtering techniques that offer PC users more options to improve their image quality without forcing them to compromise on frame rate to get it. These adaptive techniques require the hardware to monitor both the geometry and the texture content continuously to make intelligent trade-offs that enhance performance but won't produce visual artifacts. If the user chooses to enable these techniques, the hardware will automatically adjust the number and type of samples it takes for texturing operations on a pixel-by-pixel basis. These algorithms are capable of intelligently selecting texel and filter levels for trilinear as well as anisotropic filtering modes. Alternatively, the user can choose to use the most conservative settings and know that all of the texture filtering is done using traditional algorithms.

As part of NVIDIA's Intellisample technology, adaptive texture filtering raises the bar for giving users more choices to get higher image quality without compromising fluid frame rates that gamers crave.

New Antialiasing Modes

The NVIDIA GeForce FX GPUs support a new 6XS mode under Direct3D and new 8X modes for both OGL and Direct3D. These modes, either enabled in the latest Microsoft® DirectX® titles, or available through the control panel settings, provide a higher level of quality than 4X or 4XS antialiasing. By calculating 1.5X as many samples as 4X AA, 6XS takes image quality higher than any 4-sample solution can. Additionally, the new 8X modes provide the highest image quality by calculating twice the number of samples as 4X modes calculate. These new 8X modes are clearly the choice for top antialiasing quality. All of these choices empower PC users to fine-tune their display settings to fit their applications and style of computing: as a result, they get fluid frame rates for intense gaming action and great image quality too.

Conclusion

A host of new NVIDIA image quality and performance enhancements—including an advanced color compression scheme—addresses today's increasingly dynamic and visually rich real-time 3D graphics experiences, and lays a foundation for the future. By improving the efficiency of communications between the host and graphics subsystem, content developers are free to push the geometric richness and visual complexity of their scenes to new levels. This provides users with the most realistic and life-like images, environments, and effects they have ever seen, and marks a new era with studio-quality imaging effects on the desktop.



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