User Guide

HDR FP16x2

This code sample demonstrates an HDR rendering technique using FP16 render targets (RT's) and shows that it can be accelerated by efficiently using features of the GeForce 6 and GeForce 7 series GPUs such as fp16 texture filtering, vertex texture fetch (VTF), multiple render target (MRT) rendering and sRGB gamma correction.

In this sample we convert an HDR RGBE cube texture into a 4 channel 16 bit precision float texture at load time by applying the exponent to the RGB channels and we use it as a cube map to light a 3D model. The rendered image is blurred to improve the final appearance and, to provide a more realistic experience, a luminance self-adaptation step is added to simulate the slow response of the human eye to sudden changes of brightness. Then we apply a tone mapping pass using the adapted reference luminance key value to determine the displayable range of colors and obtain a clamped and gamma corrected final image for display.

The sample code uses diffuse cubemaps for shading a solid object and Fresnel reflection/refraction to shade a transparent version of the same object. All light probes are courtesy of Paul Debevec (www.debevec.org).

The main optimizations that help us to reach high quality and frame rates are:

- **Floating point texture filtering (bilinear and anisotropic):** it is used extensively for rendering the environment and lighting the 3D model. Also the image decimation, blurring and luminance calculation steps take great advantage reducing the number of steps required to converge.
- **VTF:** tone mapping requires scaling the colors with a constant luminance value calculated in the self-adaptation process. Instead of reading the value from its original 1x1 texture for each pixel of the final image (up to 1600x1200), the luminance can be read in the vertex program (3 or 4 vertices for a fullscreen primitive) and passed down to the pixel shaders as a texture coordinate.
- **MRT and split RTs:** on GeForce 6 series and later GPUs we can show that by splitting each 4 channel float resource into two 2 channel `D3DFMT_G16R16F` we obtain a better texture performance, increasing the overall speed 20% to 30% faster. The rendering is achieved by a combination of dual pass and MRT rendering techniques.
- **sRGB:** the final tone mapping pass requires a gamma correction that can be avoided by using the hardware supported sRGB DirectX feature.

HDR FP16x2 Controls

Table 1 lists the controls necessary to manipulate the HDR demo.

Table 1. Controls

Key	Description
Left Mouse Button	Rotate the object in the scene
Right Mouse Button	Rotate the camera around the scene
Mouse Wheel	Move the camera forwards and backwards
Toggle 2xRT/1xRT	Toggles from using 2 channel RT's and two 2 channel split cubemap to using 4 channel RT's and a single 4 channel cubemap.
Use aniso decimation	Toggles on/off the use of anisotropy capabilities for decimation of the full size image for blurring and luminance adaptation.
Reflection / Refraction	Toggles between an opaque object, illuminated using IBL techniques, to a refractive object.
Midgrey level	Varies the reference grey level for the luminance self-adaptation process. This is based in the zone system by Ansel Adams and sets the luminance value for the middle grey color of the scene. Values increase/decrease by a factor of two, indicating that the total amount of light considered as "average key" of the image. Increasing the key value will produce burned out images while decreasing will produce darker images allowing to see the real color of extremely bright light sources.
F1	Show help text
F2	Change Device
H	Hide all UI components
Alt + Enter	Toggle Full screen mode
Esc	Exit

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NVIDIA Corporation
2701 San Tomas Expressway
Santa Clara, CA 95050
www.nvidia.com