



# **GUIDELINES FOR GEFORCE RTX TECHNOLOGIES**

**Ray Tracing, NVIDIA DLSS, NVIDIA Image Scaling, NVIDIA DLAA,  
NVIDIA Reflex and NVIDIA Adaptive Shading**

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## NVIDIA DLSS

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[Deep Learning Super Sampling](#) (DLSS) is an NVIDIA RTX technology which uses deep learning neural networks and Tensor Cores on RTX GPUs to deliver faster frame rates, better image quality, and great responsiveness. It provides games with performance headroom to maximize quality settings and increase output resolution and enhances image quality for intense ray traced content.

DLSS is a single feature comprising DLSS Frame Generation, DLSS Super Resolution, DLSS Ray Reconstruction, NVIDIA DLAA, and NVIDIA Reflex which delivers boosted frame rates, great responsiveness, and great IQ. To

deliver this intended gaming experience, it is important for users to be able to easily toggle all components of DLSS with one global switch.

- **DLSS Frame Generation** uses AI to boost frame rates by generating additional high-quality frames, all while optimizing responsiveness with [NVIDIA Reflex](#). DLSS Frame Generation uses the new Optical Flow Accelerator in GeForce RTX 40 Series GPUs along with NVIDIA Tensor Cores. DLSS Frame Generation requires a GeForce RTX 40 Series GPU and a Reflex SDK integration.
- **DLSS Super Resolution** uses AI to boost frame rates by rendering fewer pixels and reconstructing high resolution frames. This feature is available for all RTX GPUs.
- **DLSS Ray Reconstruction** uses AI to enhance image quality and generate additional pixels for intensive ray-traced scenes. Ray Reconstruction replaces hand-tuned denoisers with an NVIDIA supercomputer-trained AI network that generates higher-quality pixels in between sampled rays. This feature is available for all RTX GPUs and requires Super Resolution to be enabled.
- **NVIDIA DLAA (Deep Learning Anti-Aliasing)** uses AI to provide higher image quality with an AI-based anti-aliasing technique. DLAA uses the same Super Resolution technology developed for DLSS, reconstructing a native resolution image to maximize image quality.
- **NVIDIA Reflex** helps DLSS Frame Generation achieve maximum performance in addition to reducing latency.

## UI Tooltip or Setting Description

- **NVIDIA DLSS:** *NVIDIA DLSS uses AI to boost frame rates while maintaining great image quality and responsiveness. This feature requires a GeForce RTX graphics card.*
  - **Frame Generation:** *Frame Generation boosts frame rates by using AI to render additional frames. This feature requires a GeForce RTX 40 Series graphics card.*
  - **Super Resolution:** *Super Resolution boosts frame rates by rendering fewer pixels and using AI to output high resolution frames. This feature requires a GeForce RTX graphics card.*
  - **Ray Reconstruction:** *Ray Reconstruction enhances image quality by generating high-quality pixels between sampled rays for intensive ray traced content. This feature requires a GeForce RTX graphics card.*
  - **DLAA:** *NVIDIA DLAA is an AI-based anti-aliasing mode to improve image quality. This feature requires a GeForce RTX graphics card.*
  - **NVIDIA Reflex Low Latency -** *NVIDIA Reflex reduces system latency and increases PC responsiveness.*

## UI Menu Options

Developers can expose NVIDIA DLSS either as a standalone UI element or combined with other performance boosting features (NVIDIA Image Scaling, etc).

When DLSS Super Resolution is ON, please disable scaling technologies (Resolution Scaling, NVIDIA Image Scaling), and Anti-Aliasing. DLSS Super Resolution is available for all RTX graphics cards.

When DLSS Frame Generation is ON, please enable NVIDIA Reflex and disable VSYNC. DLSS Frame Generation is available for RTX 40 Series RTX graphics cards.

Standalone UI: DLSS ON

NVIDIA DLSS	◀	ON	▶	ON (Default), OFF
FRAME GENERATION	◀	ON	▶	ON (Default), OFF
NVIDIA REFLEX LOW LATENCY	◀	ON	▶	NVIDIA Reflex is enabled ON when DLSS Frame Generation is ON
SUPER RESOLUTION	◀	AUTO	▶	AUTO (Default), Quality, Balanced, Performance, Ultra Performance, Custom, DLAA, OFF
RAY RECONSTRUCTION	◀	AUTO	▶	AUTO (Default), OFF
SHARPNESS	0	<div><div></div></div>		0 (Default, Value dependent on developer choice), 0 TO 1
NVIDIA IMAGE SCALING	◀	DISABLED	▶	Feature is disabled when DLSS Super Resolution is ON
SHARPNESS	0	<div><div></div></div>		Feature is disabled when DLSS Super Resolution is ON
ANTI-ALIASING	◀	DISABLED	▶	Feature is disabled DLSS Super Resolution is ON
RESOLUTION SCALE	100	<div><div></div></div>		Feature is disabled DLSS Super Resolution is ON
VSYNC	◀	DISABLED	▶	Feature is disabled DLSS Frame Generation is ON

Standalone UI: DLSS OFF

NVIDIA DLSS	◀	OFF	▶	
FRAME GENERATION	◀	DISABLED	▶	Disabled when Global DLSS toggle is OFF
NVIDIA REFLEX LOW LATENCY	◀	DISABLED	▶	Disabled when Global DLSS toggle is OFF
SUPER RESOLUTION	◀	DISABLED	▶	Disabled when Global DLSS toggle is OFF
RAY RECONSTRUCTION	◀	DISABLED	▶	Disabled when Global DLSS toggle is OFF
SHARPNESS	0	<div><div></div></div>		Disabled when Global DLSS toggle is OFF
NVIDIA IMAGE SCALING	◀	OFF	▶	Feature is restored to previous setting when DLSS Super Resolution is OFF
SHARPNESS	0	<div><div></div></div>		Feature is restored to previous setting when DLSS Super Resolution is OFF
ANTI-ALIASING	◀	TAA	▶	Feature is restored to previous setting when DLSS Super Resolution is OFF
RESOLUTION SCALE	100	<div><div></div></div>		Feature is restored to previous setting when DLSS Super Resolution is OFF
VSYNC	◀	OFF	▶	Feature is restored to previous setting when DLSS Frame Generation is OFF

Combo UI: DLSS ON

PERFORMANCE BOOST	◀	NVIDIA DLSS	▶	
FRAME GENERATION	◀	ON	▶	ON (Default), OFF
SUPER RESOLUTION	◀	AUTO	▶	AUTO (Default), Quality, Balanced, Performance, Ultra Performance, Custom, DLAA, OFF
RAY RECONSTRUCTION	◀	AUTO	▶	AUTO (Default), OFF
SHARPNESS	0	<div><div></div></div>		0 (Default, Value dependent on developer choice), 0 TO 1
ANTI-ALIASING	◀	DISABLED	▶	Feature is disabled DLSS Super Resolution is ON
RESOLUTION SCALE	100	<div><div></div></div>		Feature is disabled DLSS Super Resolution is ON
VSYNC	◀	DISABLED	▶	Feature is disabled DLSS Frame Generation is ON
NVIDIA REFLEX LOW LATENCY	◀	ON	▶	NVIDIA Reflex is enabled ON when DLSS Frame Generation is ON

## Combo UI: DLSS OFF

PERFORMANCE BOOST	<	OFF	>	
FRAME GENERATION	<	ON	>	Disabled when DLSS is OFF
SUPER RESOLUTION	<	AUTO	>	Disabled when DLSS is OFF
RAY RECONSTRUCTION	<	AUTO	>	Disabled when DLSS is OFF
SHARPNESS	0			Disabled when DLSS is OFF
ANTI-ALIASING	<	TAA	>	Feature is restored to previous setting when DLSS Super Resolution is OFF
RESOLUTION SCALE	100			Feature is restored to previous setting when DLSS Super Resolution is OFF
VSYNC	<	OFF	>	Feature is restored to previous setting when DLSS Frame Generation is OFF
NVIDIA REFLEX LOW LATENCY	<	OFF	>	Feature is restored to previous setting when DLSS Frame Generation is OFF

## Developer UI Checklist

- DLSS Feature Support
  - We **strongly** recommend a global DLSS Feature toggle, which enables DLSS Frame Generation, DLSS Super Resolution, Ray Reconstruction, and NVIDIA Reflex. This is the easiest way for end users to get the targeted performance, image quality, and latency benefits of DLSS.
  - Please make sure NVIDIA DLSS is **disabled** when on unsupported hardware or drivers. Note, NVIDIA Reflex should be enabled for PC latency on non NVIDIA GPUs if possible.
- DLSS Frame Generation
  - DLSS Frame Generation **requires** NVIDIA Reflex integration and enablement. Users should not be able to disable NVIDIA Reflex when Frame Generation is ON.
  - DLSS Frame Generation **requires** Windows OS "Hardware-accelerated GPU Scheduling" and fails to initialize if not enabled. If this occurs, the game should notify the user to enable this feature.
- DLSS Super Resolution
  - The DLSS mode titled "Auto" should be the first option in the UI after Off and be enabled by default when NVIDIA RTX hardware is detected. The Auto mode isn't itself a true mode and should select the appropriate default mode from the table below depending on the current output resolution.
  - When the UI shows the DLSS modes horizontally or in a left-right scrolling list, the order should be: Off, Auto, Quality, Balanced, Performance, Ultra-Performance, DLAA.
  - When the UI shows the DLSS modes vertically or in an up-down scrolling list, the order should be:
    1. Off
    2. Auto
    3. Quality
    4. Balanced
    5. Performance
    6. Ultra-Performance
    7. DLAA
  - When DLSS Super Resolution is turned on, **make sure the anti-aliasing settings are disabled** (both UI, as itself)
  - When DLSS Super Resolution is turned on, **make sure the resolution scale settings are disabled** (UI disables, the application uses render target size from DLSS optimal settings)

- DLSS Ray Reconstruction
  - The DLSS mode titled “Auto” should be the first option in the UI after Off, and be enabled by default when NVIDIA RTX hardware is detected, DLSS Super Resolution is enabled, and when Ray Tracing content is enabled.
  - **Requires DLSS Super Resolution to be ON.** Disable when Super Resolution is not enabled.
  - Requires Ray Tracing to be ON. Disable when Ray Tracing is not enabled.
- Sharpness Slider
  - Sharpness slider is a requirement for DLSS integration. When sharpness is on for DLSS, make sure other sharpening features are disabled.

## DLSS Frame Generation Options

Mode	Description	Resolution Support	GPU Support
<b>OFF</b>	Turns DLSS Frame Generation off.	N/A	N/A
<b>ON</b>	Generates an additional frame for each rendered frame	ALL RESOLUTIONS	RTX 40 Series RTX GPUs

## DLSS Super Resolution Options

Mode	Description	Resolution Support	GPU Support
<b>OFF</b>	Turns DLSS Super Resolution off.	N/A	N/A
<b>AUTO</b>	Selects the best DLSS Mode for the current output resolution.	ALL RESOLUTIONS	ALL RTX GPUs
<b>QUALITY</b>	Offers higher image quality than balanced mode.	ALL RESOLUTIONS	ALL RTX GPUs
<b>BALANCED</b>	Offers both optimized performance and image quality.	ALL RESOLUTIONS	ALL RTX GPUs
<b>PERFORMANCE</b>	Offers a higher performance boost than balanced mode.	ALL RESOLUTIONS	ALL RTX GPUs
<b>ULTRA PERFORMANCE</b>	Offers the highest performance boost. <b>Recommended for 8K gameplay only.</b>	ALL RESOLUTIONS	ALL RTX GPUs
<b>DLAA</b>	Recommended placement for DLAA.	ALL RESOLUTIONS	ALL RTX GPUs

These are the recommended DLSS settings based on output resolution. This is automatically set when user sets to 'AUTO'

Default DLSS Mode	Output (Resolution)	Output (Megapixels)
Disabled	Below 1920x1080	Below 2.03
Quality mode	Equal to 1920x1080, equal or below 2560x1440	Up to 3.68
Performance mode	Greater than 2560x1440, equal or below 3840x2160	3.69 - 8.29
Ultra Performance mode	Greater than 3840x2160 (e.g. 5120x2880 and 7680x4320)	8.30+

## DLSS Ray Reconstruction Options

Mode	Description	Resolution Support	GPU Support
OFF	Turns Ray Reconstruction OFF	N/A	N/A
AUTO	Automatically enables Ray Reconstruction when Ray Tracing is ON, or disables it when Ray Tracing is OFF	ALL RESOLUTIONS	ALL RTX GPUs

## DLSS Super Resolution & Dynamic Resolution Systems

As detailed in the DLSS Programming Guide, DLSS Super Resolution can support dynamically varying input sizes if the renderer has a Dynamic Resolution System (DRS).

If DRS is enabled, the game UI should:

1. Present only two options for DLSS Super Resolution: "Off" and "On"; or
2. If the UI system does not allow the DLSS Super Resolution options to change, disable (hide or gray out) all DLSS Modes and only allow the user to select "Off" or "Auto".

# NVIDIA REFLEX

The Reflex SDK is an easy-to-integrate set of NVAPIs that provide both system latency optimization and measurement capabilities, giving players a more responsive feel in-game. The SDK strives to keep players at the lowest possible latency by dynamically adjusting submission timing of rendering work to the GPU so that they are processed just-in-time. The SDK includes the ability to measure PC Latency and automatically configure Reflex Analyzer which helps gamers optimize settings. Reflex also helps DLSS Frame Generation achieve maximum performance in addition to reducing latency.

## UI Tooltip or Setting Description

- NVIDIA Reflex Low Latency** - *NVIDIA Reflex reduces system latency and increases PC responsiveness.*

## UI Menu Options

Low Latency Mode - "NVIDIA Reflex Low Latency"

General   Display   **Graphics**   Stats

Frame Rate Limiter   <   Unlimited   >

NVIDIA Reflex Low Latency   <   On   >

Overall Graphics Quality   <   Medium   >

Options are Off,  
On, On + Boost

## Settings Options

NVIDIA Reflex Low Latency

Mode	Description	Driver Support	GPU Support
Off	Low Latency mode is disabled.	N/A	N/A
On	Low Latency mode is now enabled and optimizes system latency.	R455+	Maxwell GPUs+ (Pascal+ for VK)
On+ Boost	Low Latency mode is now enabled and optimizes system latency. In Boost mode, NVIDIA Reflex will save slightly more latency and attempt to optimize latency in CPU bound cases. This option can slightly decrease FPS and increase GPU power draw.	R455+	Maxwell GPUs+ (Pascal+ for VK)

## Settings Defaults

Reflex "On" is the recommended default setting for Reflex that has little to no tradeoffs.



# NVIDIA IMAGE SCALING

NVIDIA Image Scaling enables developers to complement their NVIDIA DLSS integrations, so they can provide the best image quality with NVIDIA DLSS, and cross-platform support with NVIDIA Image Scaling. NVIDIA Image Scaling offers best-in-class spatial scaling and sharpening and supports all GPUs.

## Naming Guidelines

There is no strict requirement to brand this as an NVIDIA feature. Here are optional recommendations for UI names:

- “NVIDIA Image Scaling”
- “Image Scaling”

## UI Tooltip or Setting Description

- *NVIDIA Image Scaling boosts frame rates using GPU scaling and sharpening.*

## UI Menu Options

Developers can expose NVIDIA Image Scaling either as a standalone UI element or combined with other performance boosting features (NVIDIA DLSS, etc)

### Standalone UI: NVIDIA Image Scaling

NVIDIA IMAGE SCALING

<AUTO>

SHARPNESS

0

RESOLUTION SCALE

100

AUTO (Default), ULTRA QUALITY, QUALITY, BALANCED, PERFORMANCE, CUSTOM, OFF

0 (Default, Value dependent on developer choice), 0 TO 1

Feature is disabled when NVIDIA Image Scaling is ON

### Combo UI: NVIDIA Image Scaling

PERFORMANCE BOOST

<NVIDIA IMAGE SCALING>

IMAGE SCALING MODE

<AUTO>

SHARPNESS

0

RESOLUTION SCALE

100

AUTO (Default), ULTRA QUALITY, QUALITY, BALANCED, PERFORMANCE, CUSTOM, OFF

0 (Default, Value dependent on developer choice), 0 TO 1

Feature is disabled when NVIDIA Image Scaling is ON

## Mode Defaults

These are the default NVIDIA Image Scaling Mode settings based on output resolution:

Quality Preset	Scale Factor	Input Resolution for 2160P Output	Input Resolution for 1440P Output	Input Resolution for 1080P Output
Ultra Quality	77%	2954x1662	1970x1108	1477x831
Quality	66.667%	2560x1440	1706x960	1280x720

<b>Balanced</b>	59%	2259x1271	1506x847	1129x635
<b>Performance</b>	50%	1920x1080	1280x720	960x540
<b>Custom</b>	50%-100%	1920x1080 to 3840x2160	1280x720 to 2560x1440	960x540 to 1920x1080

# RAY TRACING

Ray tracing is the holy grail of gaming graphics, simulating the physical behavior of light. [GeForce RTX graphics cards](#) have dedicated RT Cores to accelerate ray tracing, enabling higher quality and performance.

Additional details on Ray Tracing Best Practices can be found [here](#).

## Ray Tracing: Settings Options

The recommended RT settings are “**ON**”, “**HIGH**”, and “**ULTRA**.” When ray tracing is “**ON**,” there should be a noticeable image quality difference. Additionally, there should be a very noticeable difference between each quality level, otherwise fewer setting options are appropriate. In the case of path tracing, individual Ray Tracing effects settings such as Shadows or Reflections should be grayed out and a global Ray Tracing setting should be set to “**ULTRA**”.

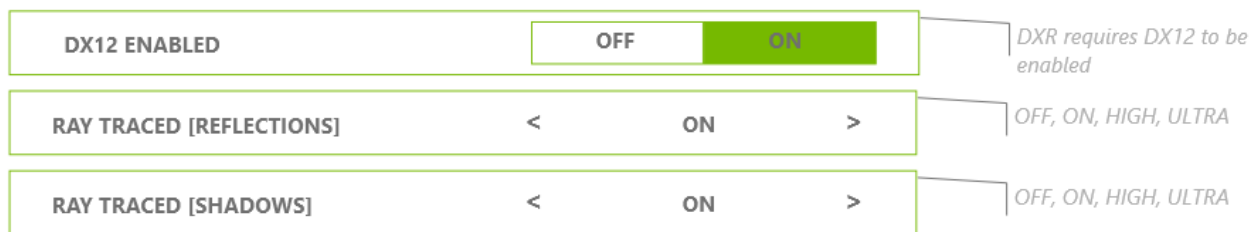
## Ray Tracing: Target Performance

We recommend the following targets for 60 fps average gameplay in your benchmark or areas of the game that are relatively heavy for ray tracing effects.

- **GeForce RTX 3060 Ti:** Ray tracing set to “**ON**” at 1920x1080 with DLSS enabled
- **GeForce RTX 3070/3080:** Ray tracing set to “**HIGH**” at 2560x1440 with DLSS enabled
- **GeForce RTX 4070/4080:** Ray tracing set to “**ULTRA**” at 2560x1440 or 4K with DLSS enabled

## Ray Tracing: Recommended UI

DISPLAY **GRAPHICS** ADVANCED



## UI Tooltip or Setting Description

- **DXR:** Enable DirectX Raytracing (DXR) for life-like [EFFECT NAME] (i.e., Shadows, Reflections, etc)
- **NON-DXR:** Enable ray tracing for life-like [EFFECT NAME] (i.e., Shadows, Reflections, etc)

## NVIDIA ADAPTIVE SHADING (NAS)

NVIDIA Adaptive Shading (NAS) boosts performance by selectively lowering pixel shading rate, without affecting perceived image quality. Screen regions without high contrast details or with fast motion speeds are identified and shaded in lower rate, using the Variable Rate Shading (VRS) feature introduced on Turing.

### Game Options

The recommended NAS settings are **"OFF"**, **"BALANCED"**, **"PERFORMANCE,"** and **CUSTOM**.

### UI Options

DISPLAY GRAPHICS **ADVANCED**

NVIDIA ADAPTIVE SHADING (NAS)	<	BALANCED	>
DETAIL SENSITIVITY	50%	<div><div></div></div>	
LOW-LIGHT SENSITIVITY	50%	<div><div></div></div>	
MOTION SENSITIVITY	50%	<div><div></div></div>	

OFF, PERFORMANCE, BALANCED,  
QUALITY, AND CUSTOM

#### Notes:

**NAS changes to Custom mode when user changes the default settings (Detail sensitivity, low-light sensitivity, and motion sensitivity).**

### UI Copy

- **NVIDIA ADAPTIVE SHADING:** Boost frame rates by adapting shading rate based on content and motion information. This will disable deferred rendering.
- **DETAIL SENSITIVITY:** Shading rate sensitivity to image details
- **LOW-LIGHT SENSITIVITY:** Shading rate sensitivity to dark regions
- **MOTION SENSITIVITY:** Shading rate sensitivity to motion

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