

Performance Optimizations Using the GPU

INTRODUCTION

Graphics cards today have a programmable processor unit which can be exploited as a general processing device. This programmable unit is called Graphic Processor Unit or GPU.

Given their highly parallel multicore architecture, many GPUs show a great computational power and are often used as co-processors.

If your graphics card is listed at:

<http://www.khronos.org/conformance/adopters/conformant-products>

Please remember to also update the driver. Go to your GPU producer (NVIDIA, Intel, AMD/ATI) website to get the latest driver.

CINES PROCESSED ON GPU

The following conditions have to be met in order for a GPU to be used for accelerating a cine processing:

- GPU usage must be enabled as described in '**Enable GPU Usage**'
- A physical GPU must be available as described in '**Establishing GPU Availability for Processing and Rendering Cines**'
- All of the following must be met for the input cine:
 - a ph16 camera cine
 - a raw cine
 - a color cine
 - a 16bit cine
 - a cine with width and height less than or equal to 256
 - a CFA_BAYER cine
- Color interpolation must be enabled and set to one of the following:
 - Fast
 - Fastest, or
 - Best

Key Features:

Using the GPU to accelerate processing and displaying cines images

Using the GPU to accelerate processing cine images during save/convert operations

Both features are available only if the cine fulfills the conditions under **Cines Processed on GPU**

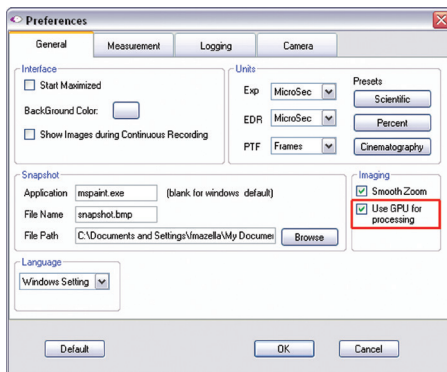
Performance Optimizations Using the GPU

- None of the following processing operations should be active:
 - Flip
 - Rotate
 - Filter
 - Resample
 - Crop
 - Border
- Sensitivity should be set to its default value 1.0f

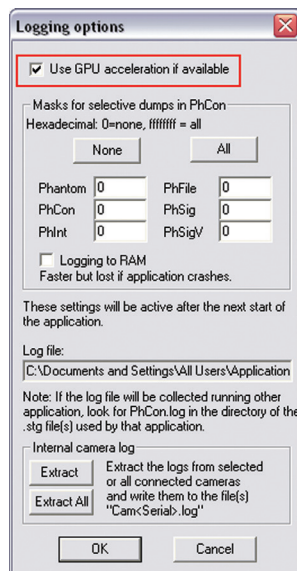
ENABLE GPU USAGE

To enable GPU usage:

1. In PCC go to Preferences>General and check “Use GPU”.



2. In Phantom go to Help> About> Logging and check “Use GPU”.



IMPORTANT NOTES

No attempt to accelerate cine processing on GPU will take place if the ‘Use GPU’ option is left unchecked. GPU usage option is persistent.

ESTABLISHING GPU AVAILABILITY FOR PROCESSING AND RENDERING CINES

Once the option to use the GPU has been enabled, the software goes through the following steps:

- It selects the GPU currently attached to the display.
- Searches and loads the following files:
 - opengl.dll
 - opengl32.dll

These files typically reside on System32/SysWOW64 folders and come with the display driver.

However, since OpenCL is a relative new technology, it may be necessary to update the driver for the display adapter.

- Checks if the selected GPU supports OpenCL.

Graphics card supporting OpenCL are enumerated at

<http://www.khronos.org/conformance/adopters/conformant-products>

- Check if the specifications of the selected GPU fulfill a set of minimum requirements.

If any of these steps is not successful, the software will not use the graphics card for accelerations.

OTHER KNOWN RESTRICTIONS

Processing and rendering cines using an AMD graphics card is not currently working. This is a driver issue expected to be solved in future versions.

Our applications have not been run yet on any Intel graphics card. However, no reasons for this scenario to be unsuccessful are known.

Performance Optimizations Using the GPU

EXPECTED PERFORMANCE IMPROVEMENTS

For ph16 source cines meeting all the conditions under Cines Processed on GPU, the main operations expected to benefit from using the GPU are:

- Live mode
- Play from Ram/CineMag
- Play from file

The performance in all the above three cases is also determined by the data transfer rate from camera/file, and it cannot exceed a certain maximum frame rate. To obtain this maximum frame rate follow these steps:

- disable all image processing (Disable button pressed in Image Tools)
- make sure Smooth Zoom from Preferences/General is unchecked
- close the Image Tools dialog window
- set zoom 1 (actual size)
- Save/Convert from cine raw to any color interpolated format.

The performance in this situation is limited by the performance of the device the data is written to. The duration of such a save/convert operation cannot be much lower than when saving:

- without GPU and
- using Fastest color interpolation.

“Best” color interpolation is the color interpolation for which the greatest performance improvement has been observed.

If GPU acceleration is enabled, there should be no performance penalty when enabling Smooth Zoom or setting the Zoom level to a value other than 1.

NOTES ON TESTING GPU FEATURES ON NVIDIA GRAPHICS CARDS

In terms of OpenCL features and technical specifications, NVIDIA GPUs can be divided into several categories. All graphics cards belonging to a certain category share the same OpenCL capabilities. To test our applications' correct functioning it should be enough to take any card from each category.

The term '*Compute Capability*' denotes one such category, and it can be: *1.0, 1.1, 1.2, 1.3, 2.x, 3.0* or *3.5*.

Go to <https://developer.nvidia.com/cuda-GPUs> to find the compute capability for an NVIDIA GPU.

Please note that while all GPUs belonging to a certain Compute Capability group should have the same compute features they have distinct technical specifications and reach different performance levels.

The following tables group desktop and notebook GPUs based on Compute Capability and suggest graphics cards with minimum, medium and maximum performance gains for our applications.

The minimum, medium, maximum performance classification is based on technical specifications, and a complete benchmarking has not been performed for these cards. Additionally, the classification is relative to a certain Compute Capability group. A card with “Maximum Performance” with Compute Capability 1.0 may have lower performances than a “Minimum Performance” card with Compute Capability 3.0.

Performance Optimizations Using the GPU

Table 1: NVIDIA Desktop GPUs				
COMPUTE CAPABILITY	GPUs	MINIMUM PERFORMANCE	MEDIUM PERFORMANCE	MAXIMUM PERFORMANCE
1.0	GeForce GT 420 GeForce 8800 Ultra GeForce 8800 GTX GeForce GT 340 GeForce GT 330 GeForce GT 320 GeForce 315 GeForce 310 GeForce 9800 GT GeForce 9600 GT GeForce 9400 GT	GeForce 9400 GT	GeForce GT 320	GeForce 8800 Ultra GeForce GT 340 GeForce 8800 GTX GeForce 9600 GT
1.1	GeForce GTS 250 GeForce GTS 150 GeForce GT 130 GeForce GT 120 GeForce G100 GeForce 9800 GX2 GeForce 9800 GTX+ GeForce 9800 GTX GeForce 9600 GSO GeForce 9500 GT GeForce 8800 GTS GeForce 8800 GT GeForce 8800 GS GeForce 8600 GTS GeForce 8600 GT GeForce 8500 GT GeForce 8400 GS GeForce 9400 mGPU GeForce 9300 mGPU GeForce 8300 mGPU GeForce 8200 mGPU GeForce 8100 mGPU	GeForce G100	GeForce 9600 GSO GeForce 9500 GT	GeForce GTS 250 GeForce 9800 GTX+ GeForce 9800 GX2
1.2	GeForce GT 240 GeForce GT 220 GeForce GT 210	GeForce GT 220	GeForce GT 220 GeForce GT 240	GeForce GT 240

Performance Optimizations Using the GPU

Table 1: NVIDIA Desktop GPUs				
COMPUTE CAPABILITY	GPUs	MINIMUM PERFORMANCE	MEDIUM PERFORMANCE	MAXIMUM PERFORMANCE
1.3	GeForce GTX 295 GeForce GTX 285 GeForce GTX 280 GeForce GTX 275	GeForce GTX 260	GeForce GTX 280 GeForce GTX 275 GeForce GTX 285	GeForce GTX 295
2.x	GeForce GTX 560 Ti GeForce GTX 550 Ti GeForce GTX 460 GeForce GTS 450 GeForce GTX 590 GeForce GTX 580 GeForce GTX 570 GeForce GTX 480 GeForce GTX 470 GeForce GTX 465 GeForce GT 640 GeForce GT 630 GeForce GT 620 GeForce GT 610 GeForce GT 520 GeForce GT 440 GeForce GT 430	GeForce GT 610 GeForce GT 520	GeForce GTX 550 Ti	GeForce GTX 590 GeForce GTX 580
3.0	GeForce GTX 690 GeForce GTX 680 GeForce GTX 670 GeForce GTX 660Ti GeForce GTX 660 GeForce GTX 650Ti GeForce GTX 650	GeForce GTX 650	GeForce GTX 660 Ti GeForce GTX 670 GeForce GTX 660	GeForce GTX 690
3.5	-			

Performance Optimizations Using the GPU

Table 2: NVIDIA Notebook GPUs				
COMPUTE CAPABILITY	GPUs	MINIMUM PERFORMANCE	MEDIUM PERFORMANCE	MAXIMUM PERFORMANCE
1.0	-			
1.1	GeForce GTX 285M GeForce GTX 280M GeForce GTX 260M GeForce 9800M GTX GeForce 8800M GTX GeForce GTS 260M GeForce GTS 250M GeForce 9800M GT GeForce 9600M GT GeForce 8800M GTS GeForce 9800M GTS GeForce GT 230M GeForce 9700M GT GeForce 9650M GS GeForce 9700M GT GeForce 9650M GS GeForce 9600M GT GeForce 9600M GS GeForce 9500M GS GeForce 8700M GT GeForce 8600M GT GeForce 8600M GS GeForce 9500M G GeForce 9300M G GeForce 8400M GS GeForce G210M GeForce G110M GeForce 9300M GS GeForce 9200M GS GeForce 9100M G GeForce 8400M GT GeForce G105M	GeForce G105M GeForce 9100M G GeForce 9200M GS GeForce 9300M GS	GeForce 8800M GTS GeForce GTS 250M GeForce 9800M GT GeForce GTS 260M GeForce 9800M GT GeForce 8800M GTX	GeForce GTX 280M GeForce GTX 285M
1.2	GeForce GTS 360M GeForce GTS 350M GeForce GT 335M GeForce GT 330M GeForce GT 325M GeForce GT 240M GeForce G210M GeForce 310M GeForce 305M	GeForce 305M GeForce G210M GeForce 310M	GeForce GT 325M GeForce GT 330M GeForce GT 240M	GeForce GTS 350M GeForce GTS 360M
1.3	-			

NOTES/ALERTS

Table 2: NVIDIA Notebook GPUs

COMPUTE CAPABILITY	GPUs	MINIMUM PERFORMANCE	MEDIUM PERFORMANCE	MAXIMUM PERFORMANCE
2.x	GeForce GTX 675M GeForce GTX 670M GeForce GT 635M GeForce GT 630M GeForce GT 625M GeForce GT 620M GeForce 610M GeForce GTX 580M GeForce GTX 570M GeForce GTX 560M GeForce GT 555M GeForce GT 550M GeForce GT 540M GeForce GT 525M GeForce GT 520MX GeForce GT 520M GeForce GTX 485M GeForce GTX 470M GeForce GTX 460M GeForce GT 445M GeForce GT 435M GeForce GT 420M GeForce GT 415M GeForce GTX 480M	GeForce GT 415M GeForce GT 520M GeForce 610M GeForce GT 520MX	GeForce GT 555M GeForce GT 635M GeForce GT 445M	GeForce GTX 675M GeForce GTX 670M GeForce GTX 570M GeForce GTX 485M GeForce GTX 580M
3.0	GeForce GTX 680MX GeForce GTX 680M GeForce GTX 675MX GeForce GTX 670MX GeForce GTX 660M GeForce GT 650M GeForce GT 645M GeForce GT 640M GeForce GT 640M LE	GeForce GT 640M LE GeForce GT 640M GeForce GT 645M GeForce GT 650M GeForce GTX 660M	GeForce GTX 670MX GeForce GTX 675MX	GeForce GTX 680M GeForce GTX 680MX
3.5	-			

100 Dey Road
 Wayne, NJ 07470 USA
 +1.973.696.4500

www.phantomhighspeed.com

