

Analysis Report

calculate_collision(float4*, float4*, float)

Duration	39.771 ms (39,770,545 ns)
Grid Size	[250,250,1]
Block Size	[32,32,1]
Registers/Thread	32
Shared Memory/Block	0 B
Shared Memory Requested	96 KiB
Shared Memory Executed	96 KiB
Shared Memory Bank Size	4 B

[0] GeForce GTX 1060 6GB

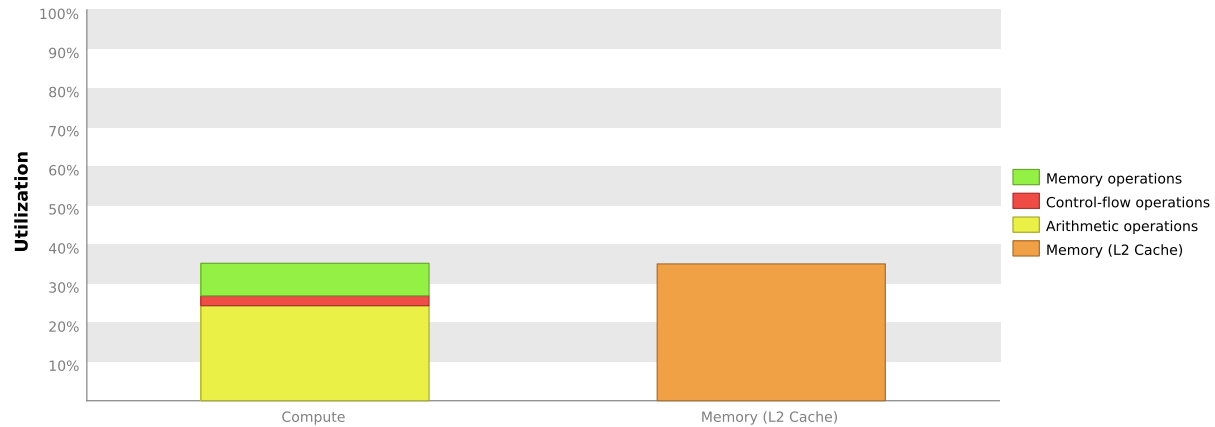
GPU UUID	GPU-f2f57186-70e2-14bd-7bb1-b6461c91b0af
Compute Capability	6.1
Max. Threads per Block	1024
Max. Threads per Multiprocessor	2048
Max. Shared Memory per Block	48 KiB
Max. Shared Memory per Multiprocessor	96 KiB
Max. Registers per Block	65536
Max. Registers per Multiprocessor	65536
Max. Grid Dimensions	[2147483647, 65535, 65535]
Max. Block Dimensions	[1024, 1024, 64]
Max. Warps per Multiprocessor	64
Max. Blocks per Multiprocessor	32
Half Precision FLOP/s	34.93 GigaFLOP/s
Single Precision FLOP/s	4.471 TeraFLOP/s
Double Precision FLOP/s	139.72 GigaFLOP/s
Number of Multiprocessors	10
Multiprocessor Clock Rate	1.746 GHz
Concurrent Kernel	true
Max IPC	6
Threads per Warp	32
Global Memory Bandwidth	192.192 GB/s
Global Memory Size	5.935 GiB
Constant Memory Size	64 KiB
L2 Cache Size	1.5 MiB
Memcpy Engines	2
PCIe Generation	2
PCIe Link Rate	5 Gbit/s
PCIe Link Width	16

1. Compute, Bandwidth, or Latency Bound

The first step in analyzing an individual kernel is to determine if the performance of the kernel is bounded by computation, memory bandwidth, or instruction/memory latency. The results below indicate that the performance of kernel "calculate_collision" is most likely limited by instruction and memory latency. You should first examine the information in the "Instruction And Memory Latency" section to determine how it is limiting performance.

1.1. Kernel Performance Is Bound By Instruction And Memory Latency

This kernel exhibits low compute throughput and memory bandwidth utilization relative to the peak performance of "GeForce GTX 1060 6GB". These utilization levels indicate that the performance of the kernel is most likely limited by the latency of arithmetic or memory operations. Achieved compute throughput and/or memory bandwidth below 60% of peak typically indicates latency issues.

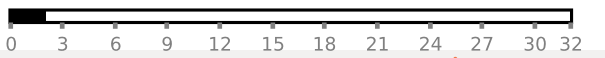


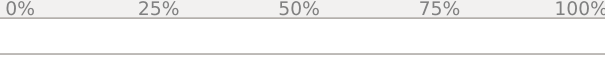



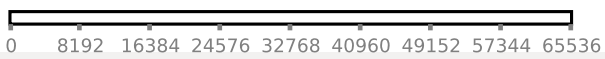


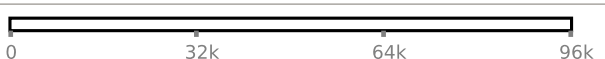
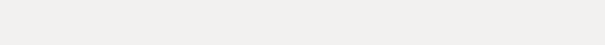


2. Instruction and Memory Latency

Instruction and memory latency limit the performance of a kernel when the GPU does not have enough work to keep busy. The performance of latency-limited kernels can often be improved by increasing occupancy. Occupancy is a measure of how many warps the kernel has active on the GPU, relative to the maximum number of warps supported by the GPU. Theoretical occupancy provides an upper bound while achieved occupancy indicates the kernel's actual occupancy.

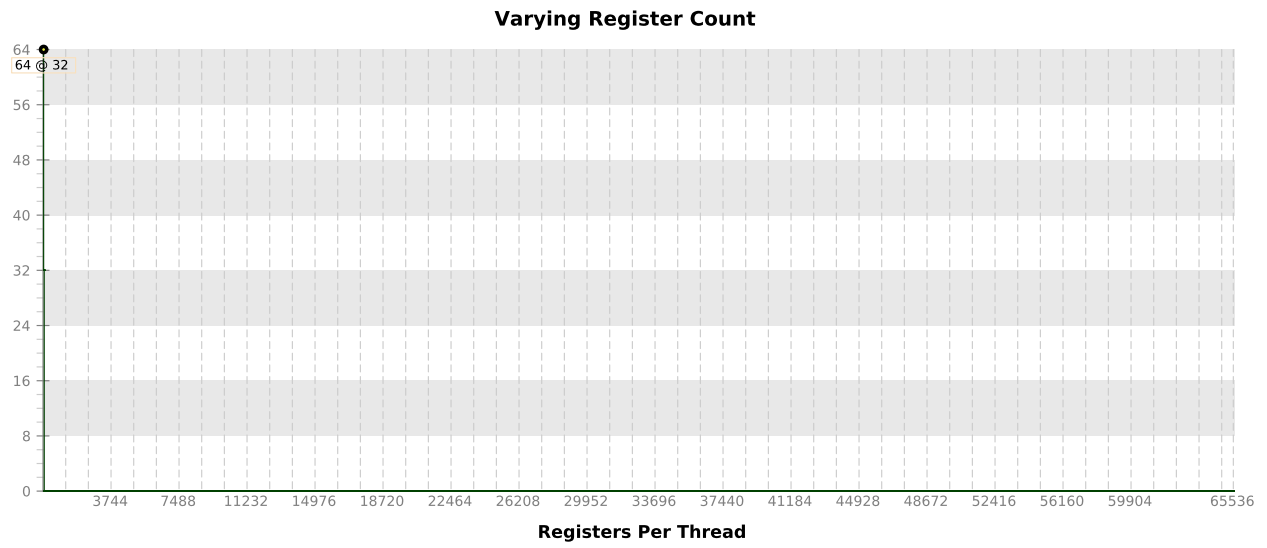
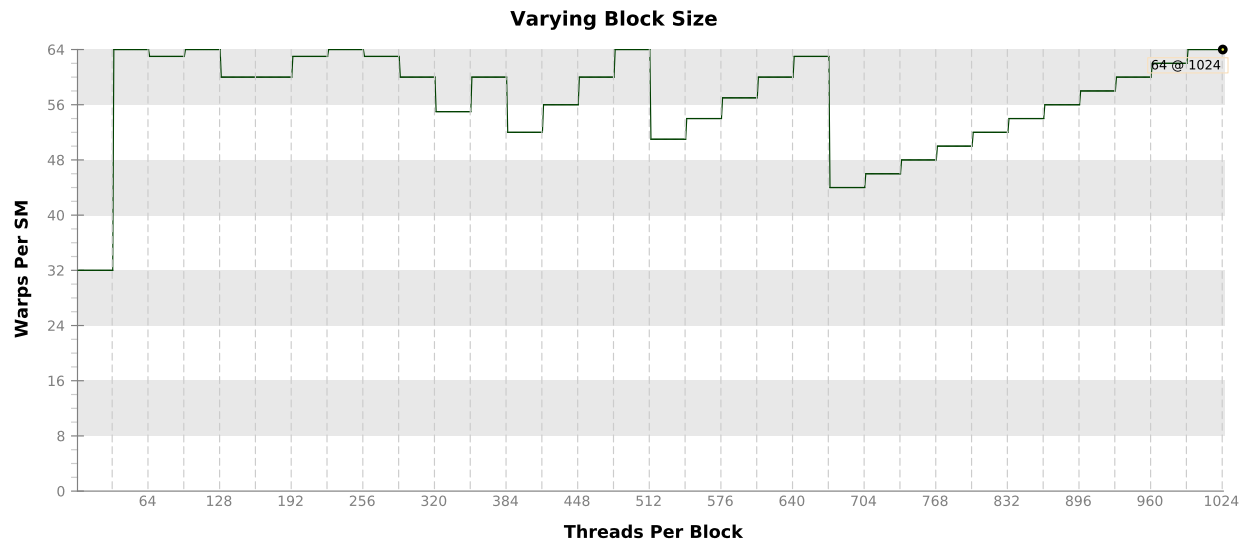
2.1. Occupancy Is Not Limiting Kernel Performance

The kernel's block size, register usage, and shared memory usage allow it to fully utilize all warps on the GPU.

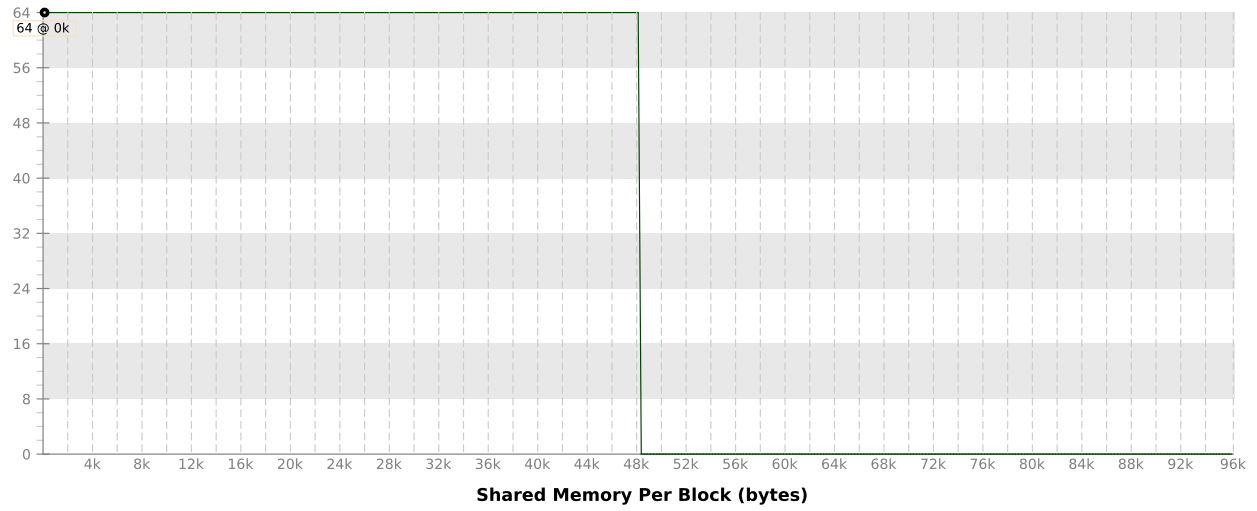
Variable	Achieved	Theoretical	Device Limit	Grid Size: [250,250,1] (62500 blocks) Block Size: [32,32,1] (1024 threads)
Occupancy Per SM				
Active Blocks		2	32	
Active Warps	50.61	64	64	
Active Threads		2048	2048	
Occupancy	79.1%	100%	100%	
Warps				
Threads/Block		1024	1024	
Warps/Block		32	32	
Block Limit		2	32	
Registers				
Registers/Thread		32	65536	
Registers/Block		32768	65536	
Block Limit		2	32	
Shared Memory				
Shared Memory/Block		0	98304	
Block Limit			32	

2.2. Occupancy Charts

The following charts show how varying different components of the kernel will impact theoretical occupancy.



Varying Shared Memory Usage



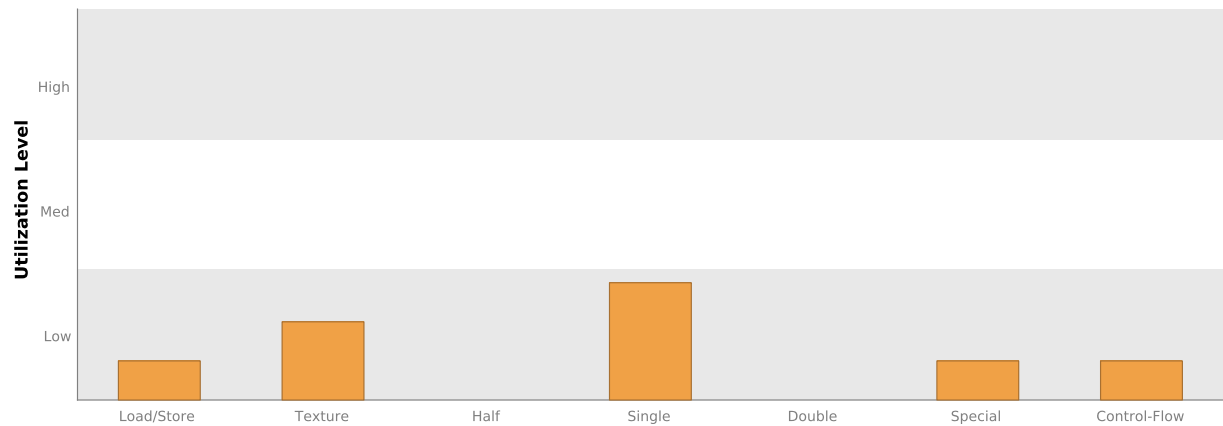
3. Compute Resources

GPU compute resources limit the performance of a kernel when those resources are insufficient or poorly utilized.

3.1. Function Unit Utilization

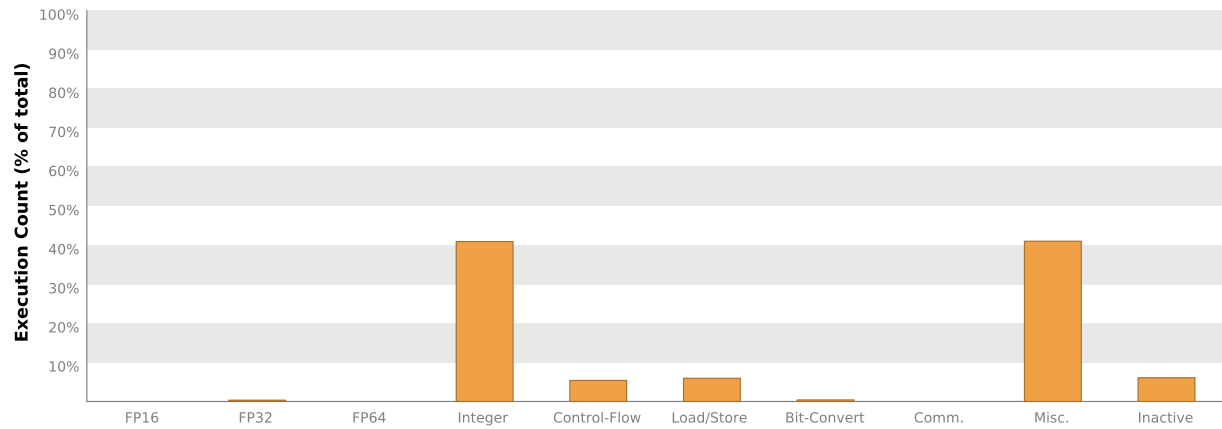
Different types of instructions are executed on different function units within each SM. Performance can be limited if a function unit is over-used by the instructions executed by the kernel. The following results show that the kernel's performance is not limited by overuse of any function unit.

- Load/Store - Load and store instructions for shared and constant memory.
- Texture - Load and store instructions for local, global, and texture memory.
- Half - Half-precision floating-point arithmetic instructions.
- Single - Single-precision integer and floating-point arithmetic instructions.
- Double - Double-precision floating-point arithmetic instructions.
- Special - Special arithmetic instructions such as sin, cos, popc, etc.
- Control-Flow - Direct and indirect branches, jumps, and calls.



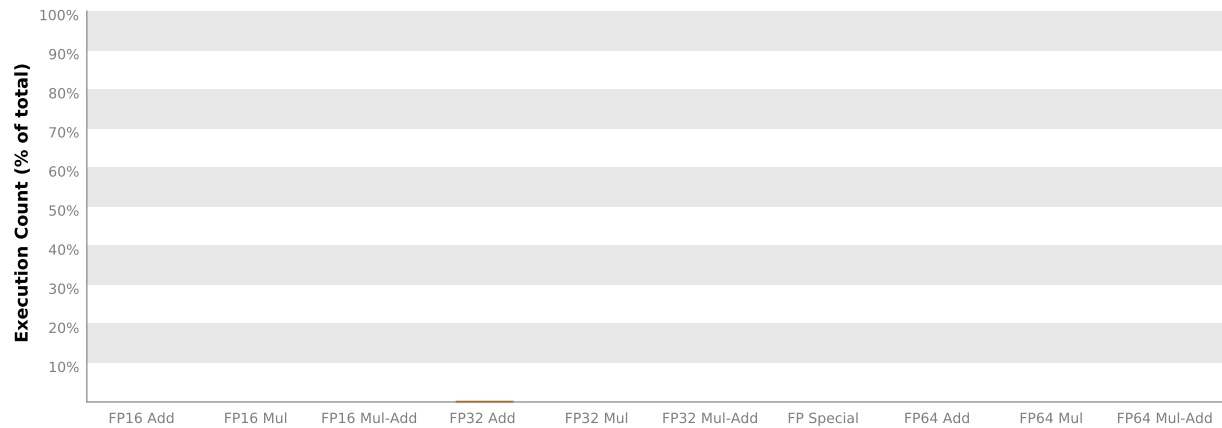
3.2. Instruction Execution Counts

The following chart shows the mix of instructions executed by the kernel. The instructions are grouped into classes and for each class the chart shows the percentage of thread execution cycles that were devoted to executing instructions in that class. The "Inactive" result shows the thread executions that did not execute any instruction because the thread was predicated or inactive due to divergence.



3.3. Floating-Point Operation Counts

The following chart shows the mix of floating-point operations executed by the kernel. The operations are grouped into classes and for each class the chart shows the percentage of thread execution cycles that were devoted to executing operations in that class. The results do not sum to 100% because non-floating-point operations executed by the kernel are not shown in this chart.



4. Memory Bandwidth

Memory bandwidth limits the performance of a kernel when one or more memories in the GPU cannot provide data at the rate requested by the kernel.

4.1. Memory Bandwidth And Utilization

The following table shows the memory bandwidth used by this kernel for the various types of memory on the device. The table also shows the utilization of each memory type relative to the maximum throughput supported by the memory.

Transactions	Bandwidth	Utilization	
Shared Memory			
Shared Loads	0	0 B/s	
Shared Stores	0	0 B/s	
Shared Total	0	0 B/s	
L2 Cache			
Reads	88199272	74.644 GB/s	
Writes	168120013	142.282 GB/s	
Total	256319285	216.925 GB/s	
Unified Cache			
Local Loads	31369884	26.549 GB/s	
Local Stores	168120000	142.282 GB/s	
Global Loads	80020000	57.562 GB/s	
Global Stores	0	0 B/s	
Texture Reads	52468728	44.405 GB/s	
Unified Total	331978612	270.797 GB/s	
Device Memory			
Reads	634872	537.298 MB/s	
Writes	16376683	13.86 GB/s	
Total	17011555	14.397 GB/s	
System Memory			
[PCIe configuration: Gen2 x16, 5 Gbit/s]			
Reads	0	0 B/s	
Writes	5	4.231 kB/s	