Analysis Report

mult_kernel_compressed_data(unsigned char*, unsigned char*, unsigned char*, int, int, int, int)

Duration	8.34978 s (8,349,783,667 ns)
Grid Size	[750,750,1]
Block Size	[32,32,1]
Registers/Thread	32
Shared Memory/Block	16.25 KiB
Shared Memory Executed	32.5 KiB
Shared Memory Bank Size	4 B

[0] GeForce GTX 980 Ti

GPU UUID	GPU-1efff26a-ba19-4be3-1414-34841cb941c3
Compute Capability	5.2
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
Single Precision FLOP/s	7.271 TeraFLOP/s
Double Precision FLOP/s	227.216 GigaFLOP/s
Number of Multiprocessors	22
Multiprocessor Clock Rate	1.291 GHz
Concurrent Kernel	true
Max IPC	6
Threads per Warp	32
Global Memory Bandwidth	336.48 GB/s
Global Memory Size	5.94 GiB
Constant Memory Size	64 KiB
L2 Cache Size	3 MiB
Memcpy Engines	2
PCIe Generation	3
PCIe Link Rate	8 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. Unfortunately, the device executing this kernel can not provide the profile data needed for this analysis.

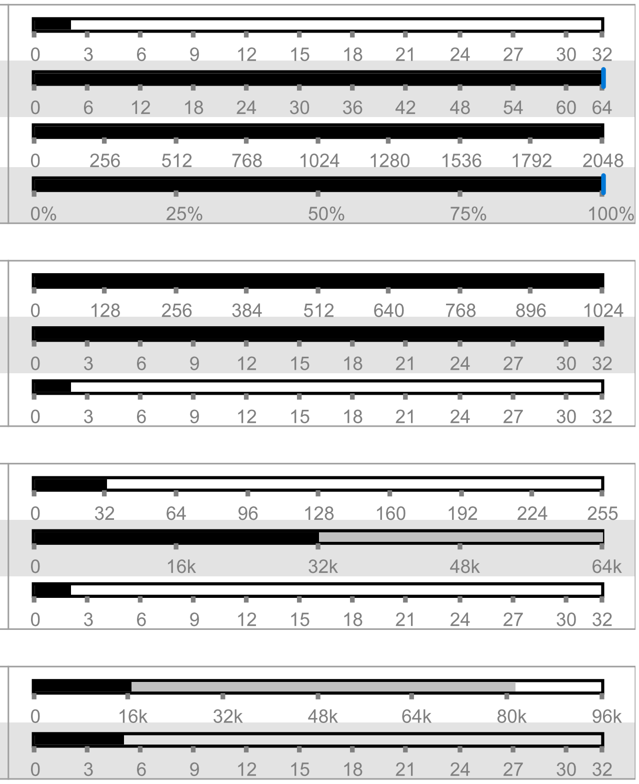
2. Instruction and Memory Latency

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

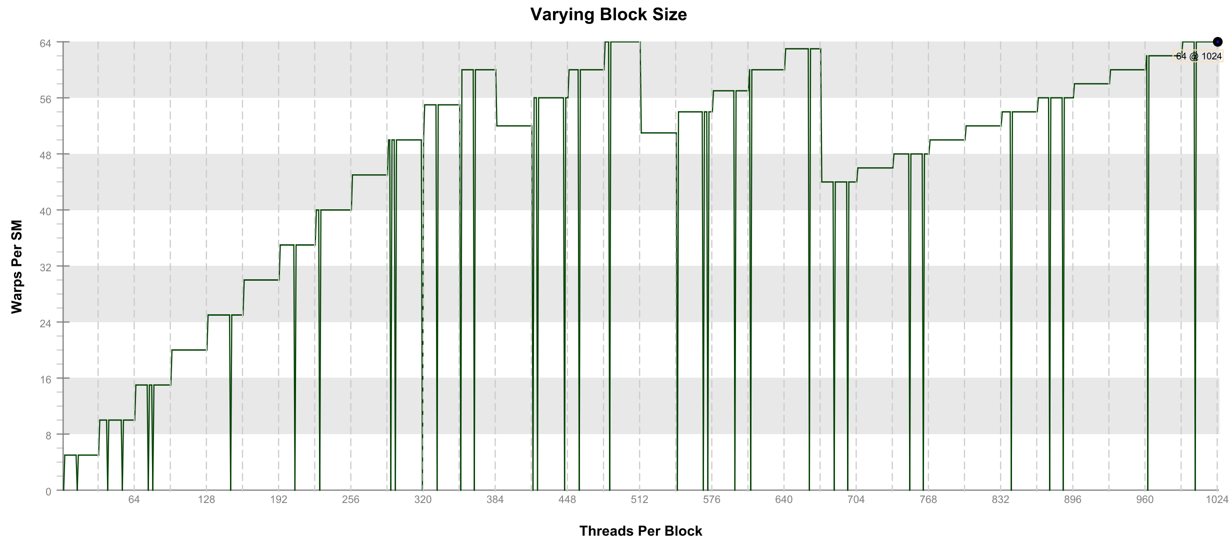
The kernel's block size, register usage, and shared memory usage allow it to fully utilize all warps on the GPU.

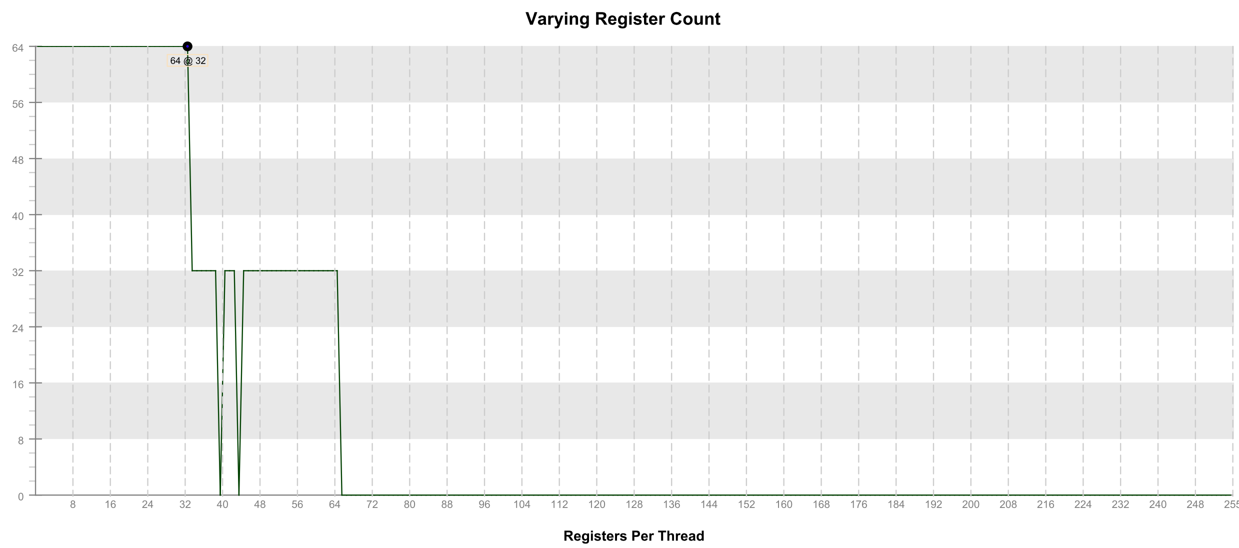
Variable	Achieved	Theoretical	Device Limit	Grid Size: [750,750,1] (562500 blocks) Block Size: [32,32,1] (1024 thread
Occupancy Per SM				
Active Blocks		2	32	
Active Warps	63.98	64	64	
Active Threads		2048	2048	
Occupancy	100%	100%	100%	
Warps				
Threads/Block		1024	1024	
Warps/Block		32	32	
Block Limit		2	32	
Registers				
Registers/Thread		32	255	
Registers/Block		32768	65536	
Block Limit		2	32	
Shared Memory				
Shared Memory/Block		16640	98304	
Block Limit		5	32	

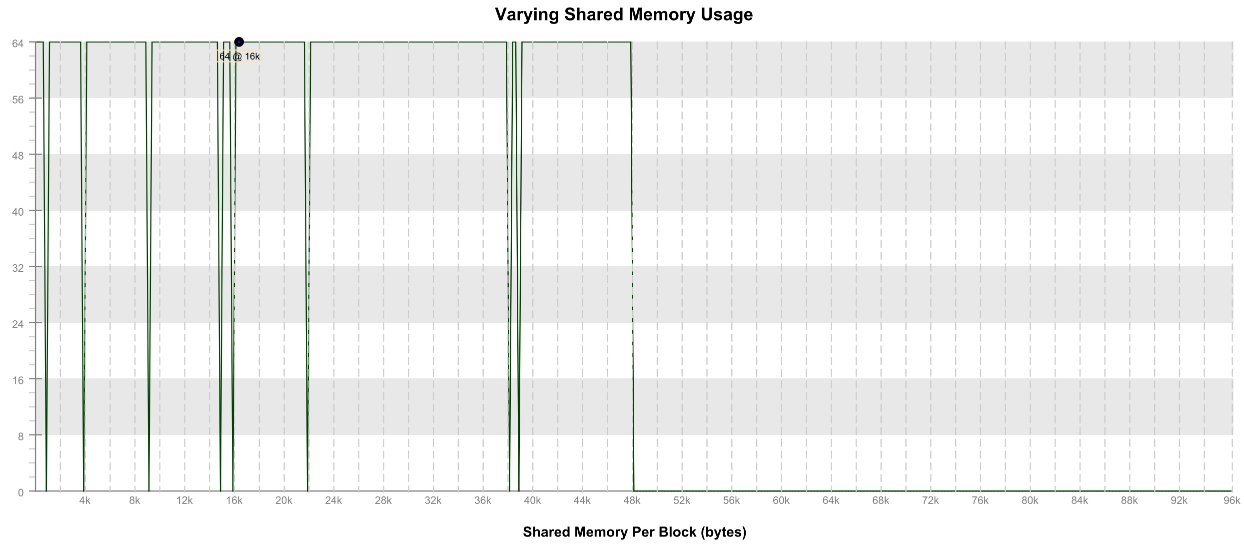


2.2. Occupancy Charts

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

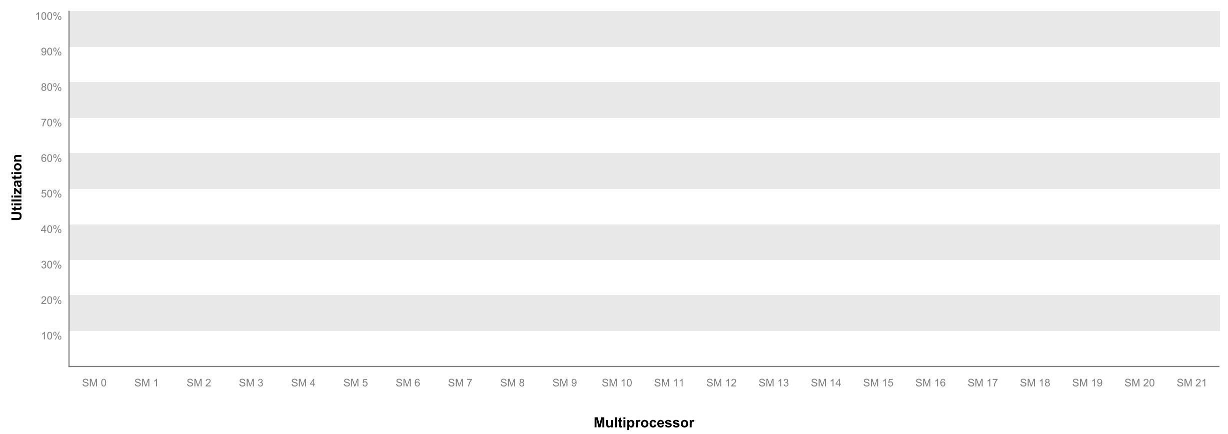

Varying Block Size
Warps Per SM
Threads Per Block
64 @ 1024
0
8
16
24
32
40
48
56
64
64
128
192
256
320
384
448
512
576
640
704
768
832
896
960
1024


Varying Register Count
Registers Per Thread
64 @ 32
0
8
16
24
32
40
48
56
64
8
16
24
32
40
48
56
64
72
80
88
96
104
112
120
128
136
144
152
160
168
176
184
192
200
208
216
224
232
240
248
255



2.3. Multiprocessor Utilization

The kernel's blocks are distributed across the GPU's multiprocessors for execution. Depending on the number of blocks and the execution duration of each block some multiprocessors may be more highly utilized than others during execution of the kernel. The following chart shows the utilization of each multiprocessor during execution of the kernel.



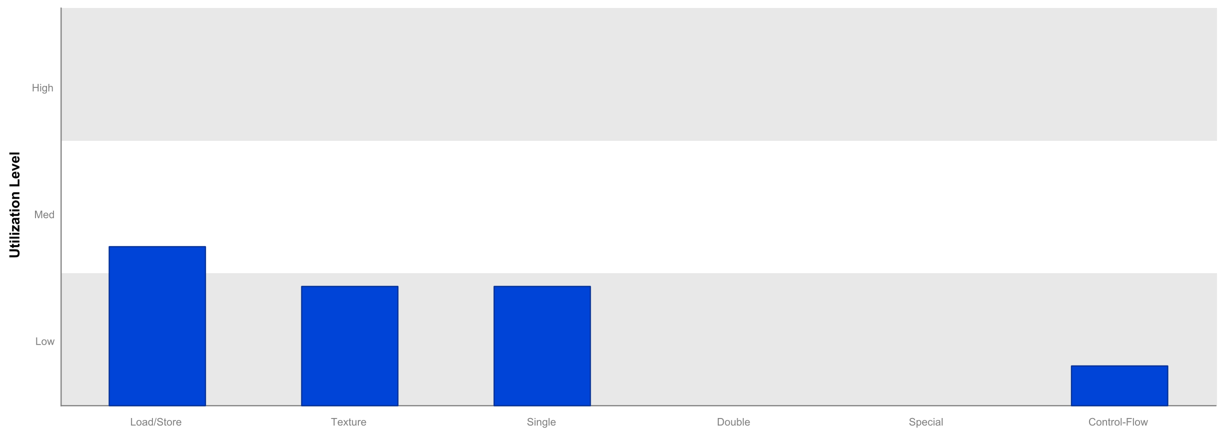
3. Compute Resources

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

3.1. Function Unit Utilization

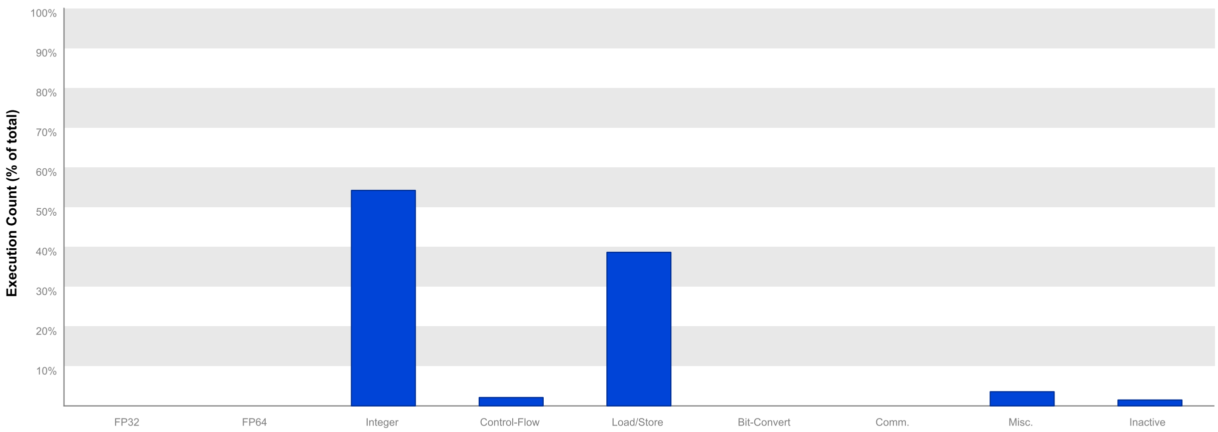
Different types of instructions are executed on different function units within each SM. Performance can be limited if a function unit is over-used by the instructions executed by the kernel. The following results show that the kernel's performance is not limited by overuse of any function unit.

Load/Store - Load and store instructions for shared and constant memory.
Texture - Load and store instructions for local, global, and texture memory.
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.



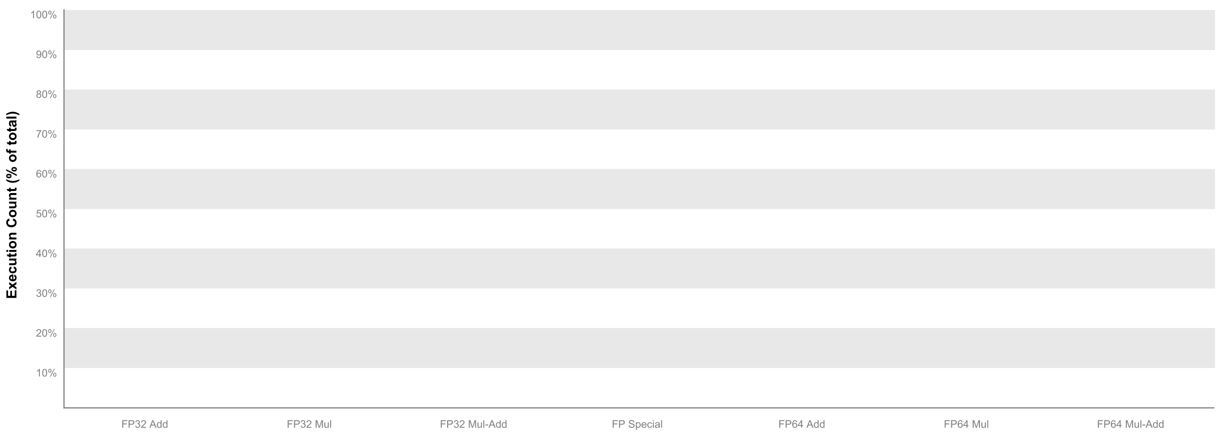
3.2. Instruction Execution Counts

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. Unfortunately, the device executing this kernel can not provide the profile data needed for this analysis.