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NVIDIA Linux OpenCL CUDA RTX SUPER Compute

NVIDIA GeForce RTX SUPER Linux OpenCL/CUDA GPU compute benchmarks by Michael Larabel for a future article.

Automated Executive Summary

TITAN RTX had the most wins, coming in first place for 89% of the tests.

Based on the geometric mean of all complete results, the fastest (TITAN RTX) was 3.565x the speed of the slowest (GTX 970).

The results with the greatest spread from best to worst included:

LeelaChessZero (Backend: OpenCL) at 15.043x
clpeak (OpenCL Test: Integer Compute INT) at 14.582x
LeelaChessZero (Backend: OpenCL) at 12.548x
clpeak (OpenCL Test: Integer Compute INT) at 12.138x
SHOC Scalable HeterOgeneous Computing (Target: OpenCL - Benchmark: MD5 Hash) at 9.25x
NAMD CUDA (System Power Consumption Monitor) at 8.463x
SHOC Scalable HeterOgeneous Computing (System Power Consumption Monitor) at 8.247x
LeelaChessZero (System Power Consumption Monitor) at 8.163x
LuxMark (System Power Consumption Monitor) at 8.118x
PlaidML (System Power Consumption Monitor) at 8.02x.

Test Systems:

GTX 970

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: eVGA NVIDIA GeForce GTX 970 4GB (1163/3505MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 1664
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 980

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce GTX 980 4GB (1126/3505MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2048
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 980 Ti

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce GTX 980 Ti 6GB (999/3505MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.3.0-999-generic (x86_64) 20190914, Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2816

Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 1060

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce GTX 1060 6GB (1506/4006MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 1280
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 1070

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce GTX 1070 8GB (1506/4006MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 1920
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 1070 Ti

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: Zotac NVIDIA GeForce GTX 1070 Ti 8GB (1607/4006MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2432

Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 1080

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce GTX 1080 8GB (1607/5005MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2560
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 1080 Ti

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce GTX 1080 Ti 11GB (1480/5508MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 3584
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 1660

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: ASUS NVIDIA GeForce GTX 1660 6GB (1530/4001MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 1408

Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

GTX 1660 Ti

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: eVGA NVIDIA GeForce GTX 1660 Ti 6GB (1500/6000MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 1536
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

RTX 2060

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce RTX 2060 6GB (1365/7000MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 1920
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

RTX 2060 SUPER

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce RTX 2060 SUPER 8GB (1470/7000MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.3.0-999-generic (x86_64) 20190914, Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new

--with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2176
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

RTX 2070

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: ASUS NVIDIA GeForce RTX 2070 8GB (1410/7000MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2304
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

RTX 2070 SUPER

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce RTX 2070 SUPER 8GB (1605/7000MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.3.0-999-generic (x86_64) 20190914, Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2560
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

RTX 2080

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: Zotac NVIDIA GeForce RTX 2080 8GB (795/810MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes

--enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 2944
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

RTX 2080 SUPER

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce RTX 2080 SUPER 8GB (1650/7750MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.3.0-999-generic (x86_64) 20190914, Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 3072
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

RTX 2080 Ti

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA GeForce RTX 2080 Ti 11GB (1350/7000MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.0.0-29-generic (x86_64), Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 4352
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

TITAN RTX

Processor: Intel Core i9-9900K @ 5.00GHz (8 Cores / 16 Threads), Motherboard: ASUS PRIME Z390-A (0802 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 16384MB, Disk: Samsung SSD 970 EVO 250GB, Graphics: NVIDIA TITAN RTX 24GB (1350/7000MHz), Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel I219-V

OS: Ubuntu 19.04, Kernel: 5.3.0-999-generic (x86_64) 20190914, Desktop: GNOME Shell 3.32.2, Display Server: X Server 1.20.4, Display Driver: NVIDIA 435.21, OpenGL: 4.6.0, Compiler: GCC 8.3.0, File-System: ext4, Screen

NVIDIA Linux OpenCL CUDA RTX SUPER Compute

Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate performance
OpenCL Notes: GPU Compute Cores: 4608
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: l1tf: Not affected + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling

	GTX 970	GTX 980	GTX 980 Ti	GTX 1060	GTX 1070	GTX 1070 Ti	GTX 1080	GTX 1080 Ti	GTX 1660	GTX 1660 Ti	RTX 2060	RTX 2060 SUPER	RTX 2070	RTX 2070 SUPER	RTX 2080	RTX 2080 SUPER	RTX 2080 Ti	TITAN RTX
SHOC Scalable HeterOgeneous Computing - OpenCL - MD5 Hash (GHash/s/Watt)	0.05	0.08	**0.04**	0.11			0.15		0.26	0.26	0.12		0.15	0.30	0.21	0.32		**0.37**
Normalized	13.51%	21.62%	10.81%	29.73%			40.54%		70.27%	70.27%	32.43%		40.54%	81.08%	56.76%	86.49%		100%
clpeak - S.P.F (GFLOPS/Watt)	39.36	**36.49**	42.00		70.63	84.46	89.11			71.35	109.20	111.74	74.32	121.62	79.25	84.49	**222.09**	103.61
Normalized	17.72%	16.43%	18.91%		31.8%	38.03%	40.12%			32.13%	49.17%	50.31%	33.46%	54.76%	35.68%	38.04%	100%	46.65%
clpeak - G.M.B (GBPS/Watt)	**1.52**	1.65	2.02	1.84	2.63	1.92	2.26	2.73	3.16	2.24		4.88	3.33	5.41	5.09	4.86	**9.15**	6.18
Normalized	16.61%	18.03%	22.08%	20.11%	28.74%	20.98%	24.7%	29.84%	34.54%	24.48%		53.33%	36.39%	59.13%	55.63%	53.11%	100%	67.54%

NVIDIA Linux OpenCL CUDA RTX SUPER Compute

SHOC Scalable HeterOgeneous Computing - OpenCL - MD5 Hash (GHash/s)	**6.50**	7.49	9.22	7.26	10.61	11.70	14.25	19.72	11.87	12.98	16.04	18.22	18.77	21.78	24.07	26.56	34.91	**36.39**
Normalized	17.86%	20.58%	25.34%	19.95%	29.16%	32.15%	39.16%	54.19%	32.62%	35.67%	44.08%	50.07%	51.58%	59.85%	66.14%	72.99%	95.93%	100%
Standard Deviation	0%	0%	0%	0%	0.3%	0%	0.3%	0.4%	0%	0.1%	0.3%	0.2%	0.3%	0.4%	0.1%	0.1%	0.6%	0.3%
SHOC Scalable HeterOgeneous Computing - OpenCL - FFT SP (GFLOPS)	411.29	458.35	725.98	**326.68**	478.54	525.89	614.69	982.23	452.89	665.66	818.44	971.24	976.78	1088	1100	1204	1486	**1578**
Normalized	26.06%	29.04%	46%	20.7%	30.32%	33.32%	38.95%	62.23%	28.69%	42.18%	51.86%	61.54%	61.89%	68.95%	69.7%	76.26%	94.14%	100%
Standard Deviation	0.2%	0.4%	0.7%	2.8%	2.7%	0.1%	1%	0.2%	0.1%	0.4%	0.1%	0.6%	0.5%	0%	0.1%	0.1%	0.3%	0.2%
PlaidML - No - Inference - ResNet 50 - OpenCL (FPS/Watt)	**1.05**	1.15	1.06	1.48	1.80	2.10	2.25	2.66	1.90	1.84	2.16	2.59	3.09	2.89	3.21	3.18	3.70	**5.03**
Normalized	20.87%	22.86%	21.07%	29.42%	35.79%	41.75%	44.73%	52.88%	37.77%	36.58%	42.94%	51.49%	61.43%	57.46%	63.82%	63.22%	73.56%	100%
PlaidML - No - Inference - Mobilenet - OpenCL (FPS/Watt)	**5.20**	5.53	6.64	7.59	9.65	11.30	9.35	10.22	9.56	11.20	11.67	12.98	14.84	19.70	14.16	16.60	22.63	**23.23**
Normalized	22.38%	23.81%	28.58%	32.67%	41.54%	48.64%	40.25%	43.99%	41.15%	48.21%	50.24%	55.88%	63.88%	84.8%	60.96%	71.46%	97.42%	100%

NVIDIA Linux OpenCL CUDA RTX SUPER Compute

SHOC Scalable HeterOgeneous Computing - OpenCL - FFT SP (GFLOPS/Watt)	5.12	5.45	6.92	**4.00**	6.23	6.36	7.87	7.97	5.70	12.25	13.23	**17.59**	8.67	15.58	15.46		11.54	
Normalized	29.11%	30.98%	39.34%	22.74%	35.42%	36.16%	44.74%	45.31%	32.4%	69.64%	75.21%	100%	49.29%	88.57%	87.89%		65.61%	
LuxMark - GPU - Microphone (Score)	7985	8914	11096	**7086**	9983	10259	8716	13721	9794	11003	13754	18509	18441	20499	19916	20164	28631	**30756**
Normalized	25.96%	28.98%	36.08%	23.04%	32.46%	33.36%	28.34%	44.61%	31.84%	35.78%	44.72%	60.18%	59.96%	66.65%	64.75%	65.56%	93.09%	100%
Standard Deviation	0%	0.4%	0.8%	0%	0.1%	0.3%	0%	0.2%	0%	0%	0%	0.4%	0.2%	0.1%	0.1%	0.9%	0.1%	0.9%
Darktable - Server Room - OpenCL (sec)	**3.16**	3.10	1.51	1.28	1.11	1.17	1.09	1.05	1.18	1.15	0.83	0.75	0.75	0.80	0.80	0.79	0.75	**0.74**
Normalized	23.42%	23.87%	49.01%	57.81%	66.67%	63.25%	67.89%	70.48%	62.71%	64.35%	89.16%	98.67%	98.67%	92.5%	92.5%	93.67%	98.67%	100%
Standard Deviation	0.8%	0.2%	0.4%	0.9%	1.3%	0.7%	1.2%	2.6%	0.1%	0.2%	0.6%	0.5%	0.3%	0.6%	0.5%	0.5%	0.3%	1.1%
PlaidML - Yes - Inference - Inception V3 - OpenCL	**88.16**	101.92	116.31	97.83	141.55	147.04	173.79	228.68	137.66	161.33	193.75	219.76	220.99	239.61	268.33	301.11	363.16	**373.71**
Normalized	23.59%	27.27%	31.12%	26.18%	37.88%	39.35%	46.5%	61.19%	36.84%	43.17%	51.85%	58.8%	59.13%	64.12%	71.8%	80.57%	97.18%	100%
Standard Deviation	0%	0.5%	0.4%	0.3%	0.2%	0.1%	0.3%	0.2%	0.3%	0.1%	0.3%	0.3%	0.3%	0.1%	0.4%	0.1%	0.2%	0.2%
PlaidML - Yes - Inference - VGG19 - OpenCL (FPS)	**39.34**	43.63	56.13	44.37	63.56	73.12	83.83	115.03	52.52	58.03	71.07	80.82	83.56	97.82	105.54	115.44	154.20	**162.05**
Normalized	24.28%	26.92%	34.64%	27.38%	39.22%	45.12%	51.73%	70.98%	32.41%	35.81%	43.86%	49.87%	51.56%	60.36%	65.13%	71.24%	95.16%	100%
Standard Deviation	0.8%	2.9%	2.4%	0.5%	0.5%	0.1%	0.6%	0.7%	0.3%	0.3%	0.5%	0.5%	0.7%	0.3%	0.7%	0.3%	0.4%	0.5%

PlaidML - No - Inference - VGG19 - OpenCL (FPS)	47.70	53.49	68.47	54.78	76.89	90.34	101.00	138.68	67.24	73.35	88.04	101.17	103.89	122.32	129.58	143.02	186.19	196.44
Normalized	24.28%	27.23%	34.86%	27.89%	39.14%	45.99%	51.42%	70.6%	34.23%	37.34%	44.82%	51.5%	52.89%	62.27%	65.96%	72.81%	94.78%	100%
Standard Deviation	0%	1.5%	1.6%	0.3%	0.2%	0.1%	0.3%	0.4%	0.4%	0.3%	0.3%	0.3%	0.4%	0.3%	0.6%	0.3%	0.4%	0.5%
PlaidML - Yes - Inference - VGG16 - OpenCL (FPS)	49.76	55.70	71.26	56.07	80.27	92.03	106.09	145.42	66.24	73.18	89.55	102.58	105.60	123.20	133.20	145.65	194.83	204.67
Normalized	24.31%	27.21%	34.82%	27.4%	39.22%	44.97%	51.83%	71.05%	32.36%	35.76%	43.75%	50.12%	51.6%	60.19%	65.08%	71.16%	95.19%	100%
Standard Deviation	0.7%	3%	2.7%	0.6%	0.6%	0.2%	0.7%	0.7%	0.5%	0.3%	0.4%	0.6%	0.6%	0.4%	0.7%	0.3%	0.5%	0.5%
PlaidML - No - Inference - VGG16 - OpenCL (FPS)	60.32	68.95	87.39	69.31	97.32	114.03	128.05	175.37	84.83	92.45	110.93	128.22	131.54	154.64	164.05	180.45	234.65	247.83
Normalized	24.34%	27.82%	35.26%	27.97%	39.27%	46.01%	51.67%	70.76%	34.23%	37.3%	44.76%	51.74%	53.08%	62.4%	66.19%	72.81%	94.68%	100%
Standard Deviation	0.1%	2%	2.7%	0.3%	0.3%	0.1%	0.5%	0.6%	0.4%	0.5%	0.5%	0.5%	0.6%	0.3%	0.8%	0.3%	0.4%	0.3%
PlaidML - Yes - Inference - NASNer Large - OpenCL (FPS)	21.42	24.24	30.64	23.16	33.07	35.41	40.38	56.64	28.99	34.12	41.11	48.96	49.94	55.24	58.47	64.80	84.97	87.17
Normalized	24.57%	27.81%	35.15%	26.57%	37.94%	40.62%	46.32%	64.98%	33.26%	39.14%	47.16%	56.17%	57.29%	63.37%	67.08%	74.34%	97.48%	100%
Standard Deviation	0.2%	1.1%	0.6%	0.3%	0.3%	0.1%	0.3%	0.4%	0.2%	0.2%	0.3%	0.5%	0.4%	0.2%	0.4%	0.2%	0.4%	0.5%
cl-mem - Read	142.10	164.50	265.33	153.50	205.27	205.27	228.80	337.53	162.90	250.23	296.20	395.67	395.70	395.67	395.70	436.27	544.33	566.70
Normalized	25.07%	29.03%	46.82%	27.09%	36.22%	36.22%	40.37%	59.56%	28.75%	44.16%	52.27%	69.82%	69.83%	69.82%	69.83%	76.98%	96.05%	100%
Standard Deviation	3%	0.1%	0.1%	0%	0%	0.1%	0.1%	0.1%	0%	0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
clpeak - D.P.D (GFLOPS)	137.47	159.68	196.60	149.58	223.91	242.63	297.94	414.96	168.44	185.12	231.44	263.11	268.32	310.27	345.81	378.98	521.90	547.97

Normalized	25.09%	29.14%	35.88%	27.3%	40.86%	44.28%	54.37%	75.73%	30.74%	33.78%	42.24%	48.02%	48.97%	56.62%	63.11%	69.16%	95.24%	100%
Standard Deviation	0%	0.1%	0.3%	0.2%	0.5%	0%	0.4%	0.5%	0%	0%	0%	0.5%	0.5%	0.4%	0.5%	0%	0.5%	0.4%
PlaidML - No - Inference - IMDB LSTM - OpenCL (FPS/Watt)	**1.28**	1.43	1.41	1.83	2.37	2.59	2.81	3.00	2.98	3.14	3.10	3.23	3.68	3.67	3.95	4.52	4.56	**5.09**
Normalized	25.15%	28.09%	27.7%	35.95%	46.56%	50.88%	55.21%	58.94%	58.55%	61.69%	60.9%	63.46%	72.3%	72.1%	77.6%	88.8%	89.59%	100%
SHOC Scalable HeterOgeneous Computing - OpenCL - Max SP Flops (GFLOPS)	**4362**	5053	6214	4789	7115	7715	9408	13231	5330	5893	7321	8379	8529	9869	10953	12016	16656	**17334**
Normalized	25.17%	29.15%	35.85%	27.63%	41.05%	44.51%	54.27%	76.33%	30.75%	34%	42.23%	48.34%	49.2%	56.94%	63.19%	69.32%	96.09%	100%
Standard Deviation	0%	0.1%	0.3%	0.2%	0%	0%	0.1%	0.1%	0.4%	0%	0.5%	0.6%	0.9%	0.9%	0.5%	0.9%	0.9%	0.9%
LuxMark - GPU - Luxball HDR	**11732**	13246	16871	12245	17290	16925	13788	21689	15162	16147	21683	30093	30097	29734	29164	30179	42974	**46546**
Normalized	25.21%	28.46%	36.25%	26.31%	37.15%	36.36%	29.62%	46.6%	32.57%	34.69%	46.58%	64.65%	64.66%	63.88%	62.66%	64.84%	92.33%	100%
Standard Deviation	0.1%	0.3%	0.4%	0.1%	0%	0.4%	0.2%	0.1%	0.4%	0.2%	0%	0%	0%	0.6%	0%	0%	0.7%	0.1%
PlaidML - No - Inference - IMDB LSTM - OpenCL (FPS)	**204.32**	231.66	270.00	224.89	315.37	333.03	399.00	523.98	287.68	315.83	389.40	440.79	446.23	499.69	548.83	589.86	758.21	**790.77**
Normalized	25.84%	29.3%	34.14%	28.44%	39.88%	42.11%	50.46%	66.26%	36.38%	39.94%	49.24%	55.74%	56.43%	63.19%	69.4%	74.59%	95.88%	100%
Standard Deviation	0%	0.4%	0.4%	0.1%	0.1%	0.3%	0.1%	0.2%	0%	0.1%	0.2%	0.1%	0.1%	0.2%	0.5%	0.4%	0.2%	0.5%

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PlaidML - Yes - Inference - VGG16 - OpenCL (FPS/Watt)	**0.27**	0.28	0.29	0.37	0.49	0.57	0.56	0.62	0.48	0.48	0.55	0.55	0.61	0.66	0.77	0.80	**1.04**	0.94
Normalized	25.96%	26.92%	27.88%	35.58%	47.12%	54.81%	53.85%	59.62%	46.15%	46.15%	52.88%	52.88%	58.65%	63.46%	74.04%	76.92%	100%	90.38%
PlaidML - Yes - Inference - Mobilenet - OpenCL (FPS/Watt)	**6.98**	7.17	7.67	9.57	12.35	14.16	14.02	15.21	14.79	16.06	18.20	20.68	21.35	24.75	26.21	25.06	**26.71**	22.19
Normalized	26.13%	26.84%	28.72%	35.83%	46.24%	53.01%	52.49%	56.94%	55.37%	60.13%	68.14%	77.42%	79.93%	92.66%	98.13%	93.82%	100%	83.08%
PlaidML - No - Inference - Inception V3 - OpenCL	**0.52**	0.56	0.61	0.70	0.99	1.08	0.94	1.34	0.95	1.02	1.11	1.23	1.18	1.34	1.36	1.52	1.66	**1.95**
Normalized	26.67%	28.72%	31.28%	35.9%	50.77%	55.38%	48.21%	68.72%	48.72%	52.31%	56.92%	63.08%	60.51%	68.72%	69.74%	77.95%	85.13%	100%
PlaidML - Yes - Inference - ResNet 50 - OpenCL (FPS)	**116.05**	142.14	162.63	130.64	196.01	205.85	240.62	333.54	156.50	172.68	220.44	250.98	251.07	283.98	305.76	327.80	424.07	**433.81**
Normalized	26.75%	32.77%	37.49%	30.11%	45.18%	47.45%	55.47%	76.89%	36.08%	39.81%	50.81%	57.85%	57.88%	65.46%	70.48%	75.56%	97.75%	100%
Standard Deviation	0%	0.3%	0.1%	0.2%	0.3%	0.1%	0.1%	0.2%	0.3%	0.1%	0.1%	0.3%	0.4%	0.4%	0.3%	0.1%	0.4%	0.3%
cl-mem - Write	**132.60**	151.50	241.50	144.57	190.90	190.03	214.67	340.27	148.87	208.67	241.20	333.20	322.67	319.57	331.50	345.77	441.23	**495.37**
Normalized	26.77%	30.58%	48.75%	29.18%	38.54%	38.36%	43.34%	68.69%	30.05%	42.12%	48.69%	67.26%	65.14%	64.51%	66.92%	69.8%	89.07%	100%
Standard Deviation	0%	0%	0%	0%	0%	0%	0%	0.1%	0%	0.1%	0.3%	0.4%	0.5%	0.2%	0.1%	0.3%	0.1%	0.5%
LuxMark - GPU - Hotel (Score)	2730	3048	3885	**2648**	3870	4170	3807	5649	3733	3805	4833	6148	6150	6565	6590	6839	9215	**9836**
Normalized	27.76%	30.99%	39.5%	26.92%	39.35%	42.4%	38.7%	57.43%	37.95%	38.68%	49.14%	62.51%	62.53%	66.74%	67%	69.53%	93.69%	100%
Standard Deviation	0.1%	0.2%	0.4%	0.2%	0.1%	0.1%	0%	0.2%	0%		0%	0%	0.1%		0%	0%	0.1%	0%

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clpeak - G.M.B (GBPS)	**143.48**	164.25	263.22	146.62	196.47	197.26	222.09	328.90	157.60	234.67	275.86	367.92	368.96	369.11	368.47	405.00	506.33	**528.89**
Normalized	27.13%	31.06%	49.77%	27.72%	37.15%	37.3%	41.99%	62.19%	29.8%	44.37%	52.16%	69.56%	69.76%	69.79%	69.67%	76.58%	95.73%	100%
Standard Deviation	0.1%	0%	0.3%	0.1%	0.2%	0%	0.1%	0.4%	0%	0.1%	0.1%	0.1%	0%	0.2%	0.1%	0%	0.1%	0.2%
PlaidML - No - Inference - Mobilenet - OpenCL (FPS)	**671.49**	759.43	990.12	726.30	987.69	1009	1124	1673	814.65	1002	1232	1531	1517	1649	1664	1762	2335	**2467**
Normalized	27.22%	30.79%	40.14%	29.44%	40.04%	40.92%	45.56%	67.81%	33.03%	40.62%	49.97%	62.07%	61.5%	66.86%	67.45%	71.43%	94.68%	100%
Standard Deviation	0.2%	0.1%	0%	0.1%	0.3%	0.1%	0.2%	0.5%	0.3%	0.1%	0.3%	0.2%	0.2%	0.1%	0.4%	0.3%	0.5%	1%
PlaidML - No - Inference - Inception V3 - OpenCL	**94.72**	105.64	135.14	104.44	147.17	153.34	184.80	257.55	116.90	140.05	167.87	199.43	198.03	215.85	238.73	259.26	343.49	**347.93**
Normalized	27.22%	30.36%	38.84%	30.02%	42.3%	44.07%	53.11%	74.02%	33.6%	40.25%	48.25%	57.32%	56.92%	62.04%	68.61%	74.51%	98.72%	100%
Standard Deviation	0.3%	0.3%	0.1%	0.2%	0.1%	0.1%	0.4%	0.1%	0.2%	0.3%	0.2%	0.2%	0.3%	0.1%	0.4%	0.1%	0.2%	0.2%
cl-mem - Read (GB/s/Watt)	**1.05**	1.19	1.76	1.34	1.68	1.86	1.90	2.10	1.69	2.67	2.76	3.09	3.28	3.47	3.26	**3.85**	3.38	3.37
Normalized	27.27%	30.91%	45.71%	34.81%	43.64%	48.31%	49.35%	54.55%	43.9%	69.35%	71.69%	80.26%	85.19%	90.13%	84.68%	100%	87.79%	87.53%
clpeak - S.P.F (GFLOPS)	**3888**	4477	5539	4200	6269	6771	8314	11721	4610	4794	5329	7090	7199	8503	8884	10336	13533	**14204**
Normalized	27.37%	31.52%	38.99%	29.57%	44.14%	47.67%	58.54%	82.52%	32.46%	33.75%	37.52%	49.91%	50.68%	59.86%	62.55%	72.77%	95.28%	100%
Standard Deviation	4%	2.9%	3.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.3%	5%	2.5%	4.6%	4.4%	3.5%	0.1%	2.1%	2.7%	6.2%
PlaidML - Yes - Inference - VGG19 - OpenCL (FPS/Watt)	**0.20**	0.22	0.23	0.28	0.37	0.46	0.43	0.49	0.38	0.38	0.40	0.39	0.44	0.49	0.58	0.59	**0.73**	0.71
Normalized	27.4%	30.14%	31.51%	38.36%	50.68%	63.01%	58.9%	67.12%	52.05%	52.05%	54.79%	53.42%	60.27%	67.12%	79.45%	80.82%	100%	97.26%

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PlaidML - Yes - Inference - Inception V3 - OpenCL	**0.56**	0.61	0.60	0.78	0.95	1.12	1.10	1.13	1.22	1.32	1.34	1.49	1.57	1.72	1.75	1.99	**2.04**	**2.04**
Normalized	27.45%	29.9%	29.41%	38.24%	46.57%	54.9%	53.92%	55.39%	59.8%	64.71%	65.69%	73.04%	76.96%	84.31%	85.78%	97.55%	100%	100%
PlaidML - Yes - Inference - ResNet 50 - OpenCL (FPS/Watt)	**0.71**	0.78	0.79	1.01	1.24	1.57	1.51	1.76	1.42	1.47	1.55	1.74	1.69	2.10	2.19	2.22	2.53	**2.56**
Normalized	27.73%	30.47%	30.86%	39.45%	48.44%	61.33%	58.98%	68.75%	55.47%	57.42%	60.55%	67.97%	66.02%	82.03%	85.55%	86.72%	98.83%	100%
cl-mem - Write (GB/s/Watt)	1.07	**1.03**	1.48	1.44	1.54	1.76	1.64	2.02	1.61	2.33	2.24	2.61	**3.71**	2.60	2.74	2.85	3.46	3.13
Normalized	28.84%	27.76%	39.89%	38.81%	41.51%	47.44%	44.2%	54.45%	43.4%	62.8%	60.38%	70.35%	100%	70.08%	73.85%	76.82%	93.26%	84.37%
PlaidML - No - Inference - ResNet 50 - OpenCL (FPS)	**181.87**	203.91	247.47	196.00	276.89	294.36	337.47	496.24	228.14	259.43	319.25	374.71	376.73	421.58	441.24	468.70	634.09	**648.36**
Normalized	28.05%	31.45%	38.17%	30.23%	42.71%	45.4%	52.05%	76.54%	35.19%	40.01%	49.24%	57.79%	58.11%	65.02%	68.05%	72.29%	97.8%	100%
Standard Deviation	0.1%	0%	0.4%	0.1%	0.1%	0.1%	0.2%	0.3%	0.1%	0.3%	0.2%	0.2%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%
OctaneBench - Total Score (Score)	95.60	109.70	142.20	**91.44**	132.86	141.35	147.98	212.04	118.49	132.28	164.52	205.23	206.88	220.76	222.88	233.56	309.04	**322.76**
Normalized	29.62%	33.99%	44.06%	28.33%	41.16%	43.79%	45.85%	65.7%	36.71%	40.98%	50.97%	63.59%	64.1%	68.4%	69.05%	72.36%	95.75%	100%
PlaidML - Yes - Inference - Mobilenet - OpenCL (FPS)	**841.48**	973.39	1203	908.43	1289	1371	1545	2163	1161	1394	1694	1984	1970	2265	2292	2437	2751	**2842**
Normalized	29.6%	34.25%	42.32%	31.96%	45.35%	48.24%	54.34%	76.08%	40.83%	49.05%	59.6%	69.79%	69.29%	79.69%	80.65%	85.75%	96.77%	100%
Standard Deviation	0.3%	0.4%	0.2%	0.5%	0.6%	0.1%	0.5%	0.6%	0.2%	0.3%	0.4%	1%	0.5%	0.4%	0.4%	0.5%	0.9%	0.2%

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cl-mem - Copy (GB/s/Watt)	**0.96**	1.04	1.45	1.25	1.35	1.53	1.65	1.62	1.58	1.96	2.66	2.43	2.44	2.82	2.28	2.83	**3.23**	2.17
Normalized	29.72%	32.2%	44.89%	38.7%	41.8%	47.37%	51.08%	50.15%	48.92%	60.68%	82.35%	75.23%	75.54%	87.31%	70.59%	87.62%	100%	67.18%
PlaidML - Yes - Inference - NASNer Large - OpenCL (FPS/Watt)	**0.11**	0.12	0.13	0.15	0.18	0.23	0.20	0.24	0.21	0.22	0.23	0.25	0.26	0.30	0.29	0.32	**0.37**	**0.37**
Normalized	29.73%	32.43%	35.14%	40.54%	48.65%	62.16%	54.05%	64.86%	56.76%	59.46%	62.16%	67.57%	70.27%	81.08%	78.38%	86.49%	100%	100%
PlaidML - No - Inference - VGG16 - OpenCL (FPS/Watt)	**0.31**	0.32	0.32	0.42	0.56	0.67	0.61	0.75	0.58	0.56	0.62	0.71	0.68	0.81	0.82	0.82	0.98	**1.03**
Normalized	30.1%	31.07%	31.07%	40.78%	54.37%	65.05%	59.22%	72.82%	56.31%	54.37%	60.19%	68.93%	66.02%	78.64%	79.61%	79.61%	95.15%	100%
PlaidML - Yes - Inference - DenseNet 201 - OpenCL (FPS)	**79.71**	92.92	111.46	91.07	127.02	130.15	143.53	191.31	102.83	114.58	154.19	179.51	176.49	190.01	189.28	200.38	254.45	**263.13**
Normalized	30.29%	35.31%	42.36%	34.61%	48.27%	49.46%	54.55%	72.71%	39.08%	43.55%	58.6%	68.22%	67.07%	72.21%	71.93%	76.15%	96.7%	100%
Standard Deviation	0%	0.2%	0.3%	0.3%	0.1%	0%	0%	0%	0.2%	0%	0.1%	0%	0.2%	0.1%	0.2%	0.1%	0.1%	0.1%
FAHBench (Ns/Day)	**91.53**	102.86	116.02	102.61	140.29	138.21	155.22	198.25	126.64	139.81	183.41	205.20	204.71	229.12	242.75	256.83	301.89	**301.93**
Normalized	30.31%	34.07%	38.43%	33.98%	46.46%	45.78%	51.41%	65.66%	41.94%	46.31%	60.75%	67.96%	67.8%	75.89%	80.4%	85.06%	99.99%	100%
Standard Deviation	0.1%	0.1%	0.1%	0.3%	0.5%	0.1%	0.6%	0.4%	0.4%	0.2%	0.6%	0.3%	0.5%	0.5%	0.7%	0.5%	0.5%	0.4%
PlaidML - No - Inference - VGG19 - OpenCL (FPS/Watt)	**0.24**	0.26	0.25	0.32	0.43	0.50	0.48	0.56	0.42	0.44	0.46	0.52	0.53	0.61	0.56	0.64	0.74	**0.75**
Normalized	32%	34.67%	33.33%	42.67%	57.33%	66.67%	64%	74.67%	56%	58.67%	61.33%	69.33%	70.67%	81.33%	74.67%	85.33%	98.67%	100%
Rodinia - O.P.F (sec)	**12.99**	11.69	9.95	11.93	8.26	7.88	6.49	4.96	11.87	10.82	8.90	7.87	7.75	6.82	6.22	5.74	4.39	**4.24**
Normalized	32.64%	36.27%	42.61%	35.54%	51.33%	53.81%	65.33%	85.48%	35.72%	39.19%	47.64%	53.88%	54.71%	62.17%	68.17%	73.87%	96.58%	100%

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Standard Deviation	0.3%	1.1%	0.6%	0.3%	0.1%	1.5%	0.2%	0.8%	0.2%	0.3%	0.3%	0%	0.1%	1.8%	0.4%	0.3%	0.6%	0.4%
PlaidML - Yes - Inference - DenseNet 201 - OpenCL (FPS/Watt)	**0.54**	0.59	0.58	0.72	0.94	1.01	0.95	0.94	0.96	0.99	1.15	1.26	1.27	**1.53**	1.29	1.41	1.47	1.52
Normalized	35.29%	38.56%	37.91%	47.06%	61.44%	66.01%	62.09%	61.44%	62.75%	64.71%	75.16%	82.35%	83.01%	100%	84.31%	92.16%	96.08%	99.35%
clpeak - D.P.D (GFLOPS/Watt)	**0.98**	1.09	1.09	1.46	1.90	2.14	2.20	2.49	1.73	1.72	1.84	1.85	1.95	2.25	2.25	2.50	2.65	**2.70**
Normalized	36.3%	40.37%	40.37%	54.07%	70.37%	79.26%	81.48%	92.22%	64.07%	63.7%	68.15%	68.52%	72.22%	83.33%	83.33%	92.59%	98.15%	100%
Darktable - Boat - OpenCL (sec)	**4.42**	3.92	3.27	3.65	2.89	2.93	2.72	2.29	3.35	2.92	2.22	1.95	1.93	1.93	1.90	1.82	**1.64**	**1.64**
Normalized	37.1%	41.84%	50.15%	44.93%	56.75%	55.97%	60.29%	71.62%	48.96%	56.16%	73.87%	84.1%	84.97%	84.97%	86.32%	90.11%	100%	100%
Standard Deviation	0.2%	0.2%	0.3%	0.2%	0.2%	0.1%	0.3%	0.6%	0.5%	0.1%	0.4%	0.5%	0.3%	0.3%	0.2%	0.2%	0.2%	1.7%
SHOC Scalable HeterOgeneous Computing - OpenCL - Max SP Flops (GFLOPS/Watt)	**29.29**	31.40	32.05	40.06	50.30	61.43	59.87	66.26	50.17	49.63	50.36	56.38	57.13	65.76	63.93	73.23	76.69	**77.72**
Normalized	37.69%	40.4%	41.24%	51.54%	64.72%	79.04%	77.03%	85.25%	64.55%	63.86%	64.8%	72.54%	73.51%	84.61%	82.26%	94.22%	98.67%	100%
JuliaGPU - GPU (Samples/sec/Watt)	1275494	1325998	**1099178**	1658142	1809790	2260230	1906370	1682593	2790570	**2880366**	2469451	2670027	2271142	2632330	2691799	2379445	1910019	1923117
Normalized	44.28%	46.04%	38.16%	57.57%	62.83%	78.47%	66.18%	58.42%	96.88%	100%	85.73%	92.7%	78.85%	91.39%	93.45%	82.61%	66.31%	66.77%
cl-mem - Copy	**124.77**	143.40	216.83	137.20	182.00	182.70	205.93	283.20	145.37	208.50	237.77	287.80	284.43	291.87	289.20	301.23	**324.40**	322.20
Normalized	38.46%	44.2%	66.84%	42.29%	56.1%	56.32%	63.48%	87.3%	44.81%	64.27%	73.3%	88.72%	87.68%	89.97%	89.15%	92.86%	100%	99.32%
Standard Deviation	0%	0%	0.1%	0.1%	0.1%	0%	0%	0.2%	0%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.2%	0.4%

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ViennaCL - O.L.F (GFLOPS/Watt)	0.66	0.79	0.60	1.00	0.80	0.71	0.70	**0.59**	1.08	1.10	0.73	**1.40**	1.35	0.90	0.71	1.18	1.31	1.35
Normalized	47.14%	56.43%	42.86%	71.43%	57.14%	50.71%	50%	42.14%	77.14%	78.57%	52.14%	100%	96.43%	64.29%	50.71%	84.29%	93.57%	96.43%
FAHBench (Ns/Day/Watt)	**0.62**	0.65	**0.62**	0.83	0.96	1.10	1.00	1.02	1.11	1.10	1.21	1.27	1.29	1.42	1.38	**1.45**	1.38	1.33
Normalized	42.76%	44.83%	42.76%	57.24%	66.21%	75.86%	68.97%	70.34%	76.55%	75.86%	83.45%	87.59%	88.97%	97.93%	95.17%	100%	95.17%	91.72%
LuxMark - GPU - Luxball HDR	**65.07**	67.87	70.64	83.34	95.03	111.54	76.55	88.26	108.70	102.75	112.43	131.33	130.30	136.85	119.09	130.92	131.66	**137.34**
Normalized	47.38%	49.42%	51.43%	60.68%	69.19%	81.21%	55.74%	64.26%	79.15%	74.81%	81.86%	95.62%	94.87%	99.64%	86.71%	95.33%	95.86%	100%
LuxMark - GPU - Microphone (Score/Watt	**44.91**	46.08	47.25	51.14	58.63	70.32	50.29	57.68	71.22	70.33	72.11	83.09	83.92	**92.78**	82.60	89.58	89.77	91.00
Normalized	48.4%	49.67%	50.93%	55.12%	63.19%	75.79%	54.2%	62.17%	76.76%	75.8%	77.72%	89.56%	90.45%	100%	89.03%	96.55%	96.76%	98.08%
LuxMark - GPU - Hotel (Score/Watt	**13.72**	14.16	15.21	17.00	19.59	25.64	18.51	20.02	24.22	22.50	22.92	26.38	25.52	27.18	24.50	27.41	26.99	**27.46**
Normalized	49.96%	51.57%	55.39%	61.91%	71.34%	93.37%	67.41%	72.91%	88.2%	81.94%	83.47%	96.07%	92.94%	98.98%	89.22%	99.82%	98.29%	100%
LeelaChess Zero - OpenCL (Nodes/s)	**207.84**	280.99	466.84	262.41	642.12	753.69	1147	1886	335.86	420.04	704.69	998.17	999.75	1604	1880	2105	3032	**3126**
Normalized	6.65%	8.99%	14.93%	8.39%	20.54%	24.11%	36.68%	60.33%	10.74%	13.43%	22.54%	31.93%	31.98%	51.31%	60.13%	67.34%	96.98%	100%
Standard Deviation	3.6%	1.7%	4.7%	2.8%	7.4%	2.8%	2.2%	3%	4.7%	5.4%	0.5%	7%	6.6%	2.9%	2%	2.5%	0.5%	1.6%
clpeak - I.C.I (GIOPS/Wat	9.19	**8.44**	9.00	10.83	23.89	25.59	26.82	16.52	79.94	61.38	63.25	80.74	52.78	60.39	**123.07**	72.16	54.76	66.58
Normalized	7.47%	6.86%	7.31%	8.8%	19.41%	20.79%	21.79%	13.42%	64.95%	49.87%	51.39%	65.6%	42.89%	49.07%	100%	58.63%	44.5%	54.1%
LeelaChess Zero - OpenCL (Nodes/s/Watt)	**1.26**	1.83	2.16	1.90	4.21	5.86	7.10	8.75	2.84	3.13	4.79	6.57	5.78	8.98	10.73	12.32	14.00	**15.81**
Normalized	7.97%	11.57%	13.66%	12.02%	26.63%	37.07%	44.91%	55.34%	17.96%	19.8%	30.3%	41.56%	36.56%	56.8%	67.87%	77.93%	88.55%	100%
clpeak - I.C.I (GIOPS)	**1140**	1312	1610	1268	1685	2077	2431	3302	4658	4775	5269	7023	7161	8571	9661	10405	13609	**13841**

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Normalized	8.24%	9.48%	11.63%	9.16%	12.17%	15.01%	17.56%	23.86%	33.65%	34.5%	38.07%	50.74%	51.74%	61.92%	69.8%	75.17%	98.32%	100%
Standard Deviation	3%	0%	2.5%	4.1%	2.5%	0.1%	1.9%	3.5%	1.2%	5.2%	2.1%	4.2%	4.6%	3.7%	0.1%	3.1%	0.7%	4.4%
NAMD CUDA - ATPase Simulation - 327,506 Atoms (days/ns)	**0.36368**	0.33110	0.28675	0.31789	0.23957	0.22269	0.20978	0.19669	0.25031	0.23185	0.20250	0.19336	0.19440	0.19501	0.19307	0.19385	0.18909	**0.18867**
Normalized	51.88%	56.98%	65.8%	59.35%	78.75%	84.72%	89.94%	95.92%	75.37%	81.38%	93.17%	97.57%	97.05%	96.75%	97.72%	97.33%	99.78%	100%
Standard Deviation	0.1%	0.8%	0.6%	1.7%	1.4%	0.8%	0.9%	0.4%	2%	1.4%	1.5%	2.2%	2.2%	2.2%	1.8%	2.1%	2.2%	2.7%
JuliaGPU - GPU (Samples/sec)	**16925804 5**	18188271 0	19565372 8	18218831 9	21694214 5	22044775 6	23791497 4	26224889 9	23091964 2	23930083 8	25192517 7	26417244 1	26708627 5	27586815 1	28016247 0	28681833 1	29983472 9	**30319857 4**
Normalized	55.82%	59.99%	64.53%	60.09%	71.55%	72.71%	78.47%	86.49%	76.16%	78.93%	83.09%	87.13%	88.09%	90.99%	92.4%	94.6%	98.89%	100%
Standard Deviation	0.4%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.4%	0.1%	0.4%	0.1%	0.2%	0.4%	0.2%	0.1%	0.7%	0%	0.3%
OctaneBench - Total Score (Score/Watt	**0.60**	0.61	0.64	0.76	0.84	**1.07**	0.88	0.89	0.93	0.91	0.87	0.97	0.96	1.04	0.93	1.04	0.96	0.99
Normalized	56.07%	57.01%	59.81%	71.03%	78.5%	100%	82.24%	83.18%	86.92%	85.05%	81.31%	90.65%	89.72%	97.2%	86.92%	97.2%	89.72%	92.52%
Rodinia - OpenCL Myocyte (sec)	45.48	47.38	**52.13**	34.69	35.10	38.70	34.87	35.91	30.97	30.67	31.11	**30.42**	31.64	30.76	31.65	30.63	31.05	31.69
Normalized	66.89%	64.2%	58.35%	87.69%	86.67%	78.6%	87.24%	84.71%	98.22%	99.18%	97.78%	100%	96.14%	98.89%	96.11%	99.31%	97.97%	95.99%
Standard Deviation	0.2%	0.2%	0.6%	0.5%	0.4%	0.6%	0.2%	0.1%	0.5%	0.3%	0.3%	0.2%	0.2%	0.8%	0.2%	0.2%	0.4%	0.2%
Darktable - Masskrug - OpenCL (sec)	**5.78**	5.74	4.12	4.07	3.92	3.97	3.94	3.92	4.01	4.02	3.73	3.68	3.67	3.71	3.71	3.69	**3.66**	**3.66**
Normalized	63.32%	63.76%	88.83%	89.93%	93.37%	92.19%	92.89%	93.37%	91.27%	91.04%	98.12%	99.46%	99.73%	98.65%	98.65%	99.19%	100%	100%
Standard Deviation	0.8%	0.7%	0.3%	0.7%	0.4%	0.3%	0.6%	0.5%	0.4%	0.1%	0.2%	0.7%	0.6%	0.7%	0.5%	0.4%	0.5%	0.7%
ViennaCL - O.L.F (GFLOPS)	**56.95**	59.21	62.01	58.67	63.86	64.68	66.67	69.09	65.10	66.06	67.92	69.17	69.41	70.45	70.96	71.47	72.71	**72.96**
Normalized	78.06%	81.15%	84.99%	80.41%	87.53%	88.65%	91.38%	94.7%	89.23%	90.54%	93.09%	94.81%	95.13%	96.56%	97.26%	97.96%	99.66%	100%
Standard Deviation	0.3%	0.1%	0.1%	0.1%	0.1%	0%	0.5%	0.8%	0.1%	0.1%	0.5%	0.1%	0.1%	0.1%	0.2%	0.6%	1.7%	1.4%

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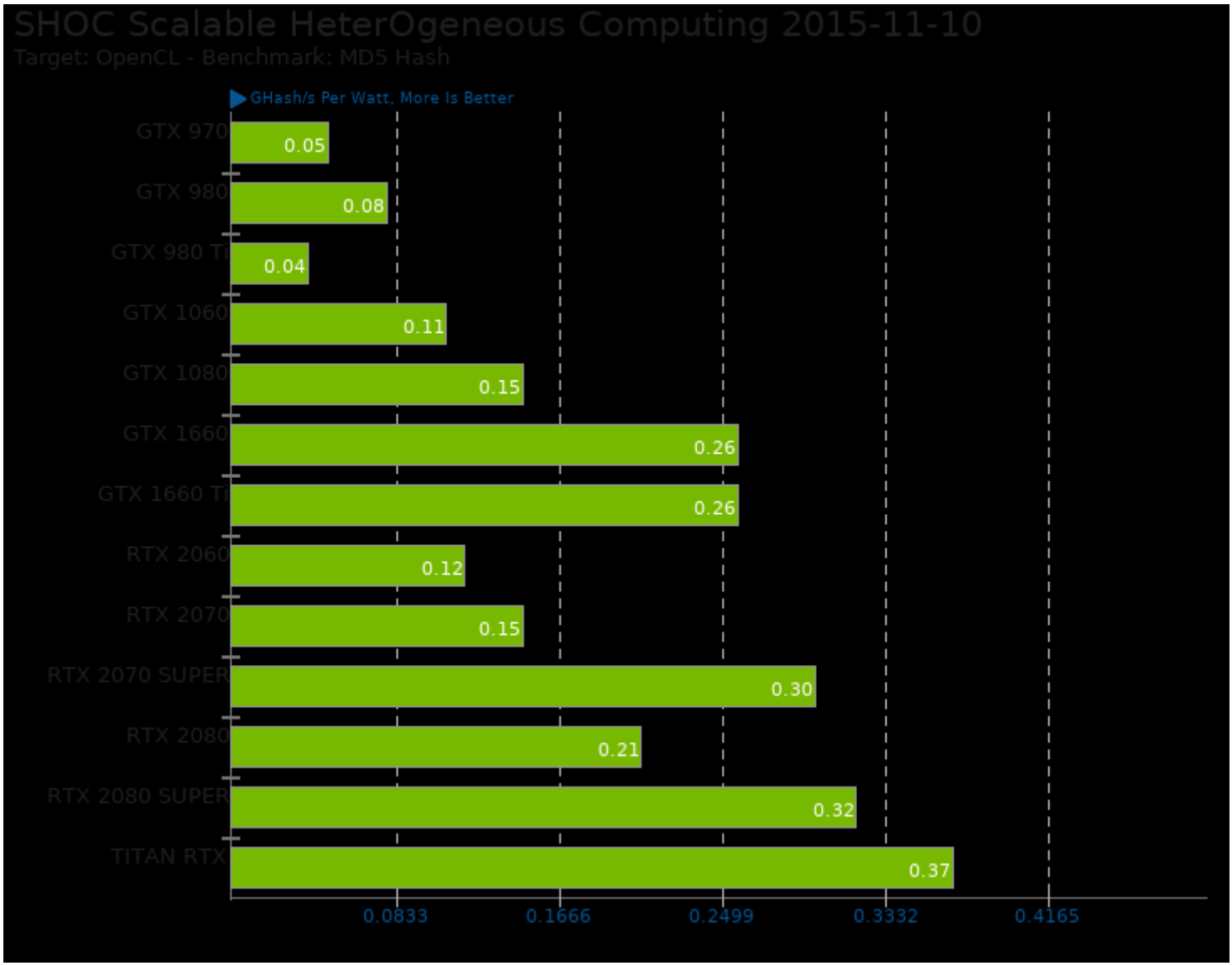
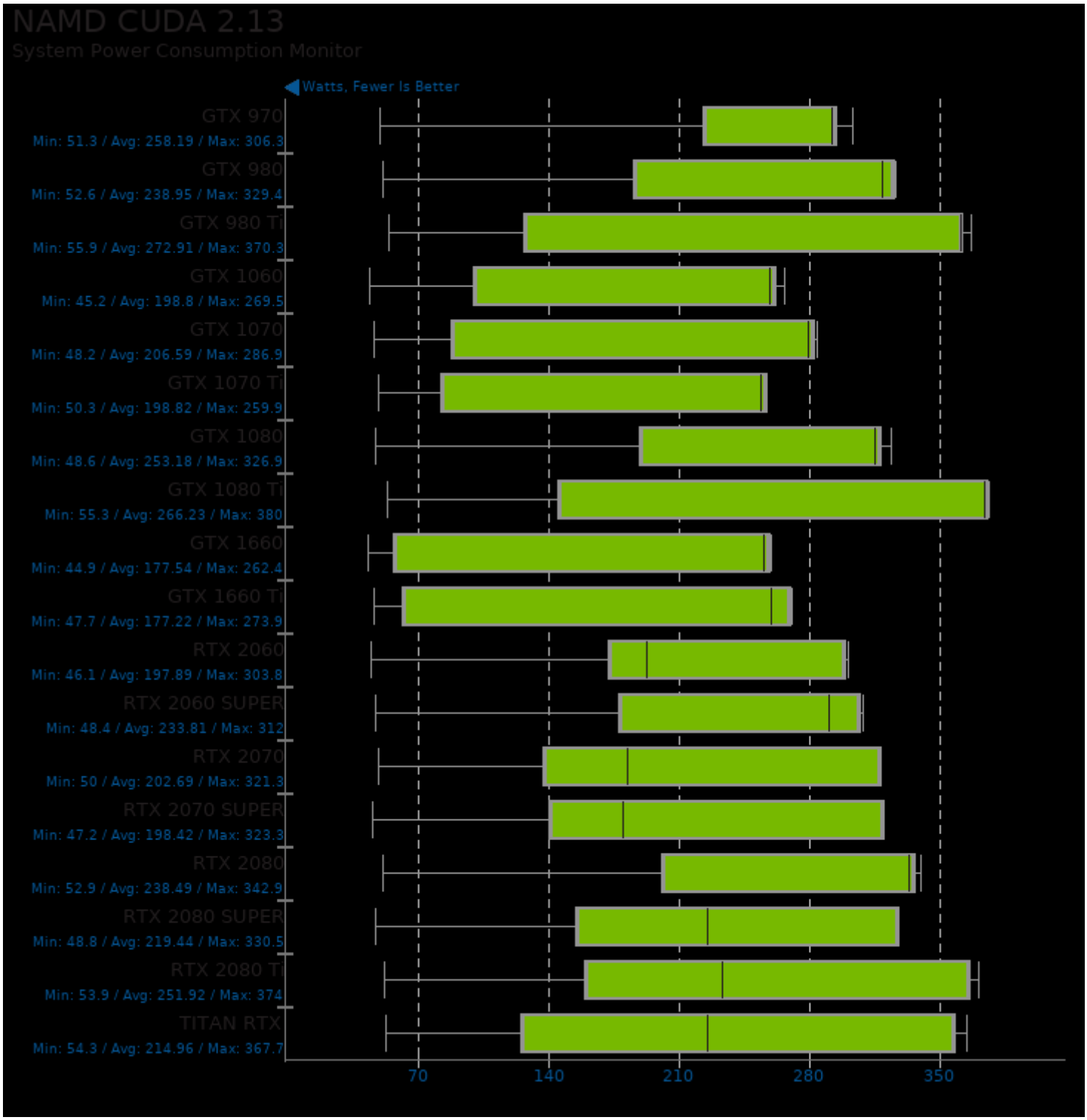
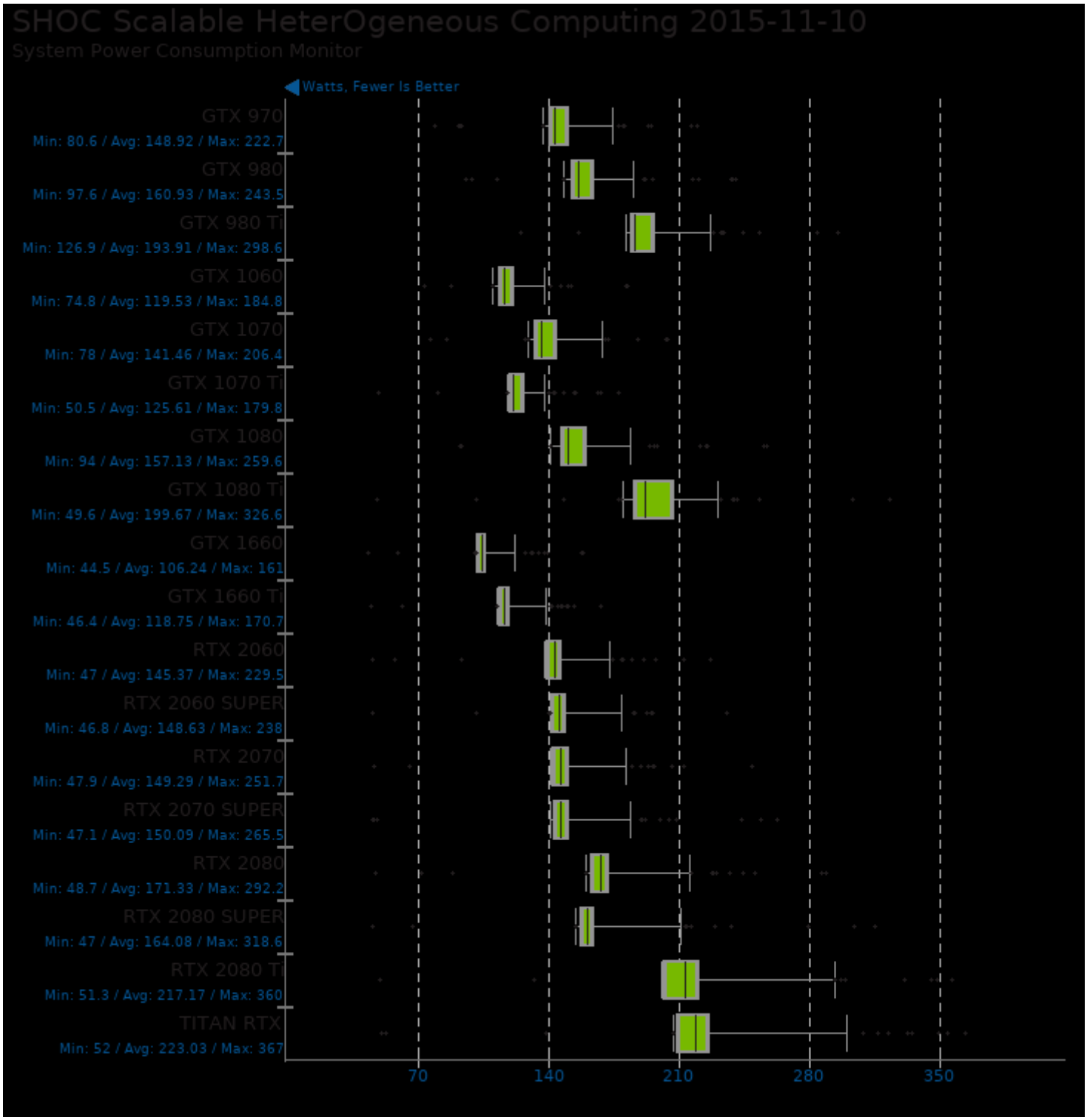
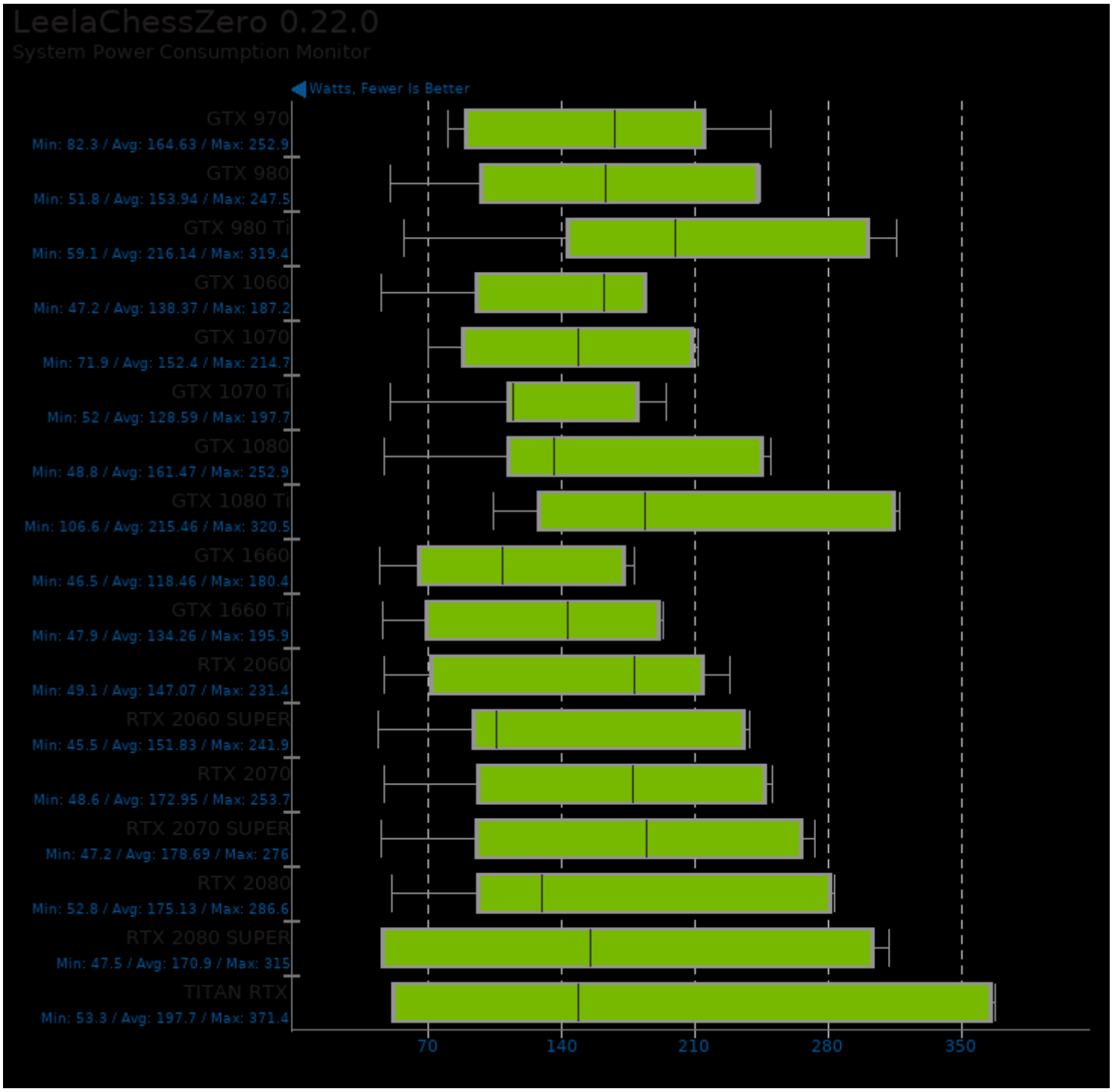



NAMD CUDA 2.13
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 51.3 / Avg: 258.19 / Max: 306.3
GTX 980
Min: 52.6 / Avg: 238.95 / Max: 329.4
GTX 980 Ti
Min: 55.9 / Avg: 272.91 / Max: 370.3
GTX 1060
Min: 45.2 / Avg: 198.8 / Max: 269.5
GTX 1070
Min: 48.2 / Avg: 206.59 / Max: 286.9
GTX 1070 Ti
Min: 50.3 / Avg: 198.82 / Max: 259.9
GTX 1080
Min: 48.6 / Avg: 253.18 / Max: 326.9
GTX 1080 Ti
Min: 55.3 / Avg: 266.23 / Max: 380
GTX 1660
Min: 44.9 / Avg: 177.54 / Max: 262.4
GTX 1660 Ti
Min: 47.7 / Avg: 177.22 / Max: 273.9
RTX 2060
Min: 46.1 / Avg: 197.89 / Max: 303.8
RTX 2060 SUPER
Min: 48.4 / Avg: 233.81 / Max: 312
RTX 2070
Min: 50 / Avg: 202.69 / Max: 321.3
RTX 2070 SUPER
Min: 47.2 / Avg: 198.42 / Max: 323.3
RTX 2080
Min: 52.9 / Avg: 238.49 / Max: 342.9
RTX 2080 SUPER
Min: 48.8 / Avg: 219.44 / Max: 330.5
RTX 2080 Ti
Min: 53.9 / Avg: 251.92 / Max: 374
TITAN RTX
Min: 54.3 / Avg: 214.96 / Max: 367.7
70
140
210
280
350


SHOC Scalable HeterOgeneous Computing 2015-11-10
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 80.6 / Avg: 148.92 / Max: 222.7
GTX 980
Min: 97.6 / Avg: 160.93 / Max: 243.5
GTX 980 Ti
Min: 126.9 / Avg: 193.91 / Max: 298.6
GTX 1060
Min: 74.8 / Avg: 119.53 / Max: 184.8
GTX 1070
Min: 78 / Avg: 141.46 / Max: 206.4
GTX 1070 Ti
Min: 50.5 / Avg: 125.61 / Max: 179.8
GTX 1080
Min: 94 / Avg: 157.13 / Max: 259.6
GTX 1080 Ti
Min: 49.6 / Avg: 199.67 / Max: 326.6
GTX 1660
Min: 44.5 / Avg: 106.24 / Max: 161
GTX 1660 Ti
Min: 46.4 / Avg: 118.75 / Max: 170.7
RTX 2060
Min: 47 / Avg: 145.37 / Max: 229.5
RTX 2060 SUPER
Min: 46.8 / Avg: 148.63 / Max: 238
RTX 2070
Min: 47.9 / Avg: 149.29 / Max: 251.7
RTX 2070 SUPER
Min: 47.1 / Avg: 150.09 / Max: 265.5
RTX 2080
Min: 48.7 / Avg: 171.33 / Max: 292.2
RTX 2080 SUPER
Min: 47 / Avg: 164.08 / Max: 318.6
RTX 2080 Ti
Min: 51.3 / Avg: 217.17 / Max: 360
TITAN RTX
Min: 52 / Avg: 223.03 / Max: 367
70
140
210
280
350


LeelaChessZero 0.22.0
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 82.3 / Avg: 164.63 / Max: 252.9
GTX 980
Min: 51.8 / Avg: 153.94 / Max: 247.5
GTX 980 Ti
Min: 59.1 / Avg: 216.14 / Max: 319.4
GTX 1060
Min: 47.2 / Avg: 138.37 / Max: 187.2
GTX 1070
Min: 71.9 / Avg: 152.4 / Max: 214.7
GTX 1070 Ti
Min: 52 / Avg: 128.59 / Max: 197.7
GTX 1080
Min: 48.8 / Avg: 161.47 / Max: 252.9
GTX 1080 Ti
Min: 106.6 / Avg: 215.46 / Max: 320.5
GTX 1660
Min: 46.5 / Avg: 118.46 / Max: 180.4
GTX 1660 Ti
Min: 47.9 / Avg: 134.26 / Max: 195.9
RTX 2060
Min: 49.1 / Avg: 147.07 / Max: 231.4
RTX 2060 SUPER
Min: 45.5 / Avg: 151.83 / Max: 241.9
RTX 2070
Min: 48.6 / Avg: 172.95 / Max: 253.7
RTX 2070 SUPER
Min: 47.2 / Avg: 178.69 / Max: 276
RTX 2080
Min: 52.8 / Avg: 175.13 / Max: 286.6
RTX 2080 SUPER
Min: 47.5 / Avg: 170.9 / Max: 315
TITAN RTX
Min: 53.3 / Avg: 197.7 / Max: 371.4
70
140
210
280
350

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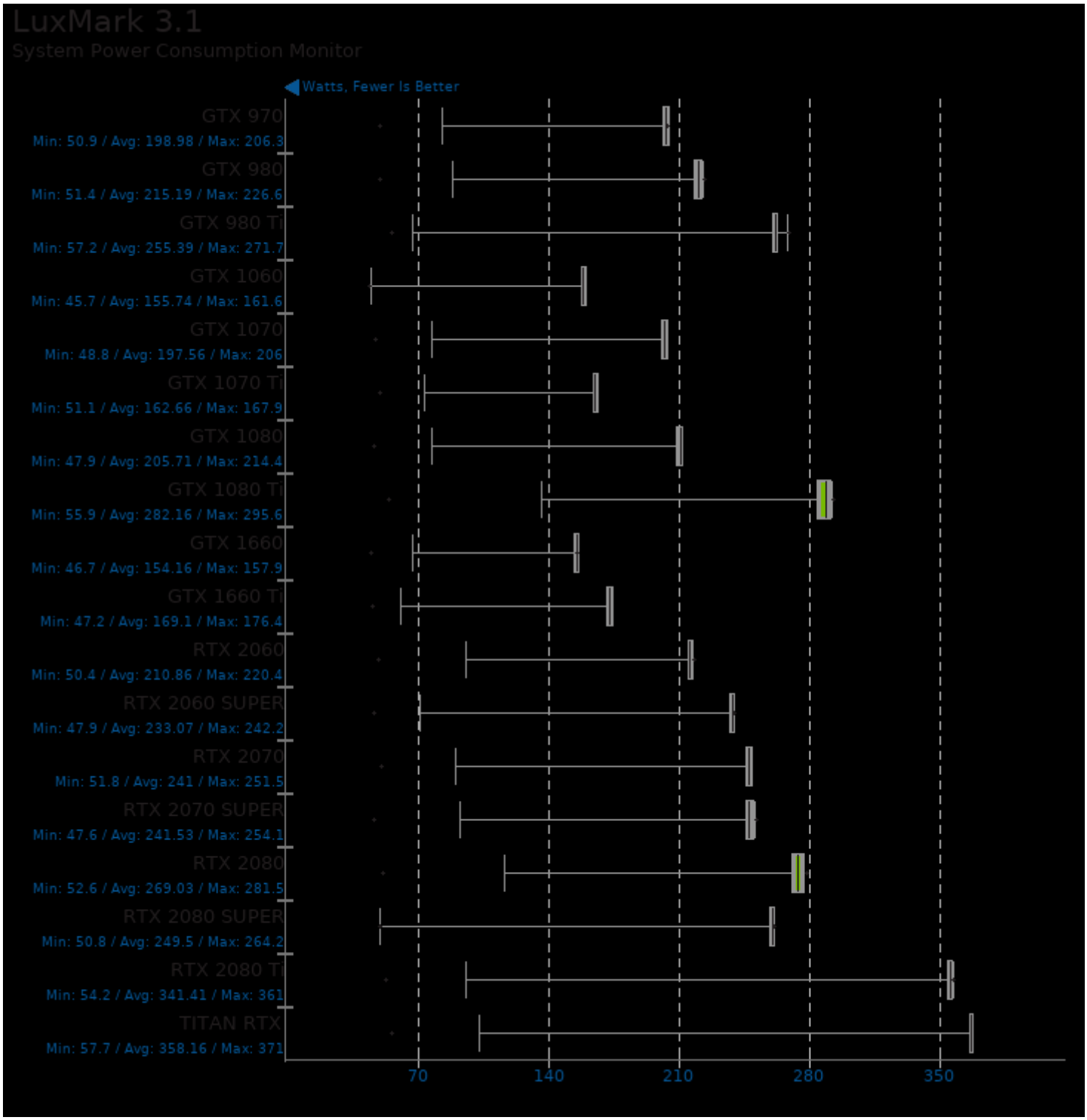
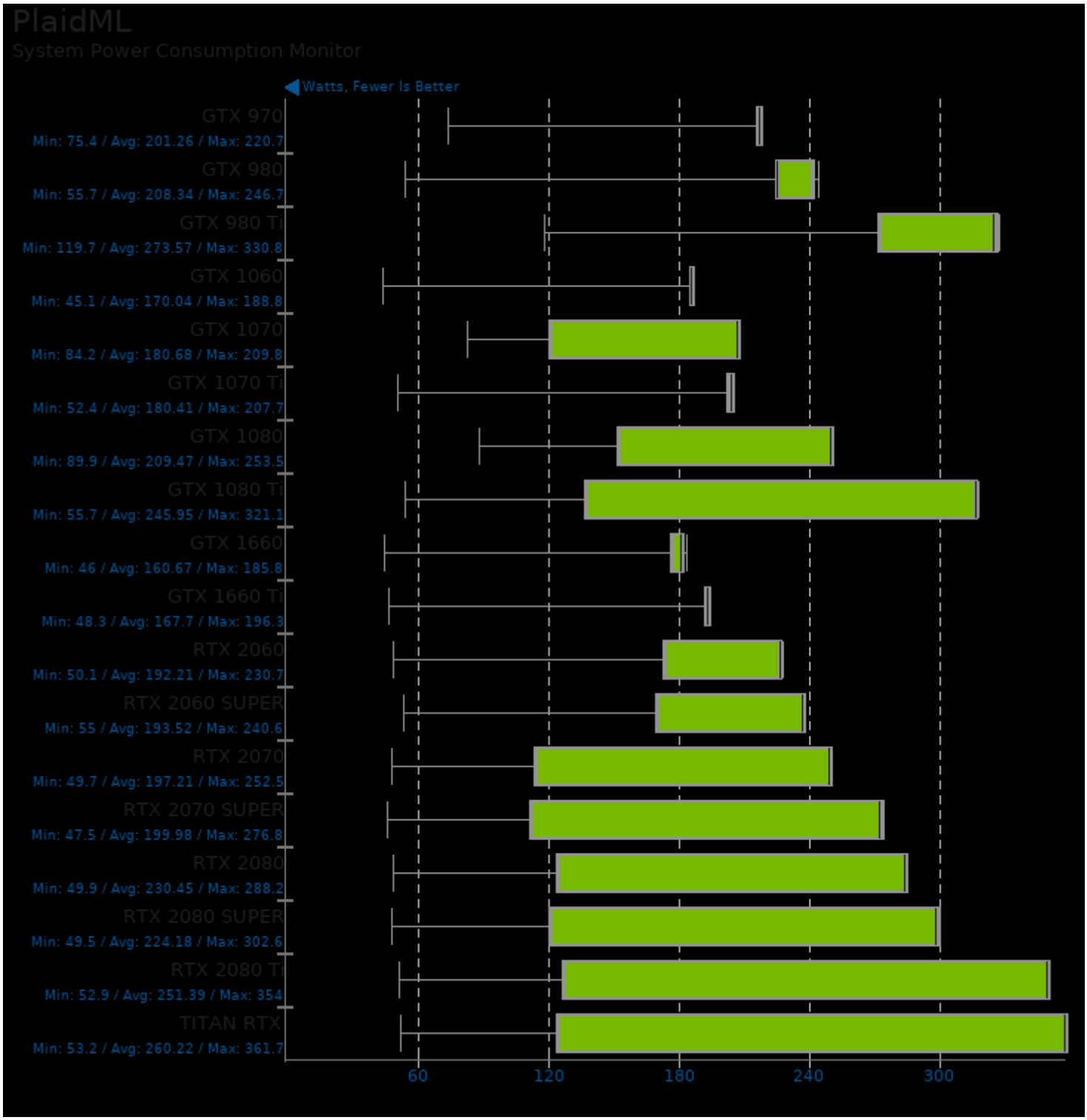
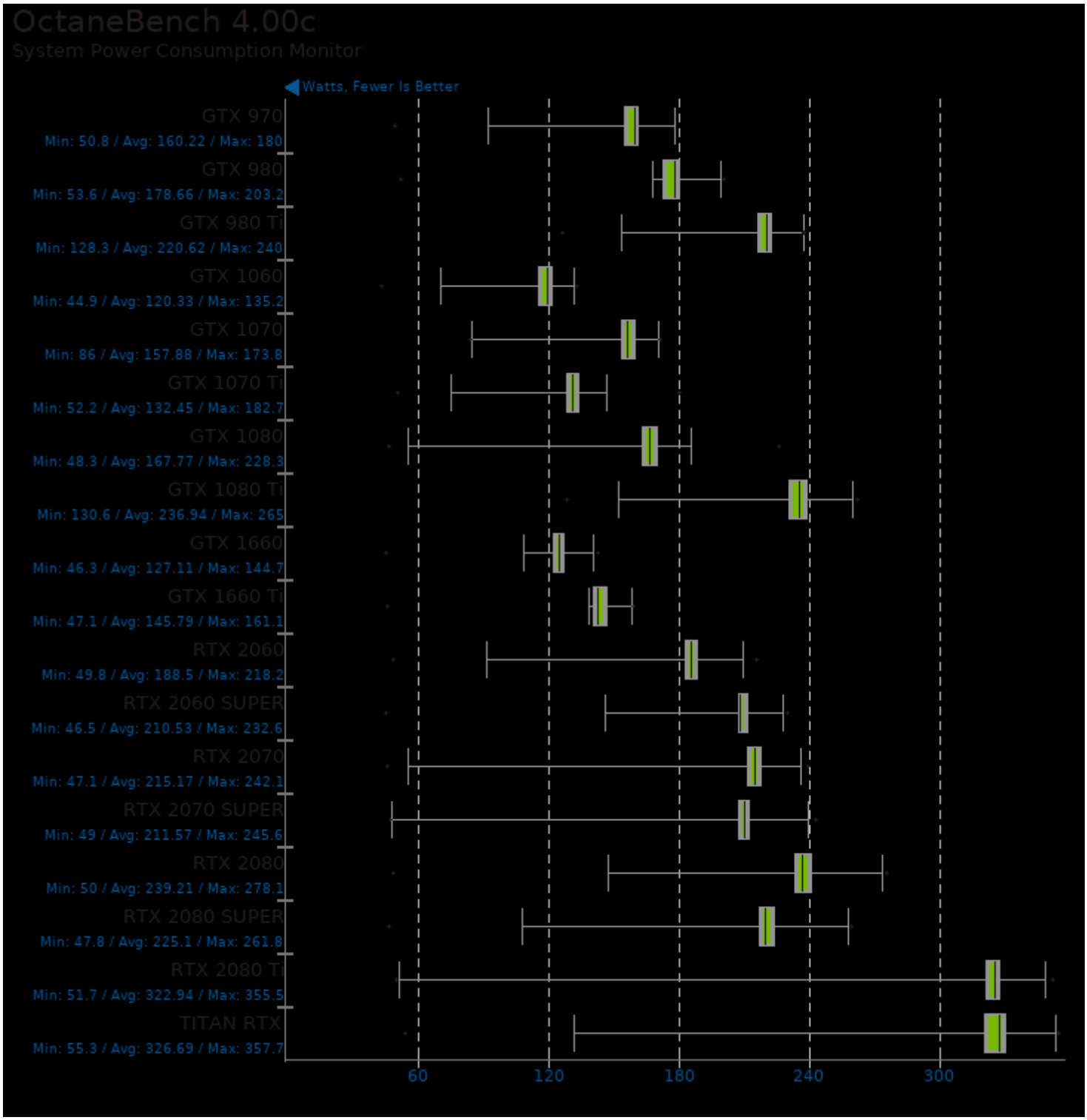
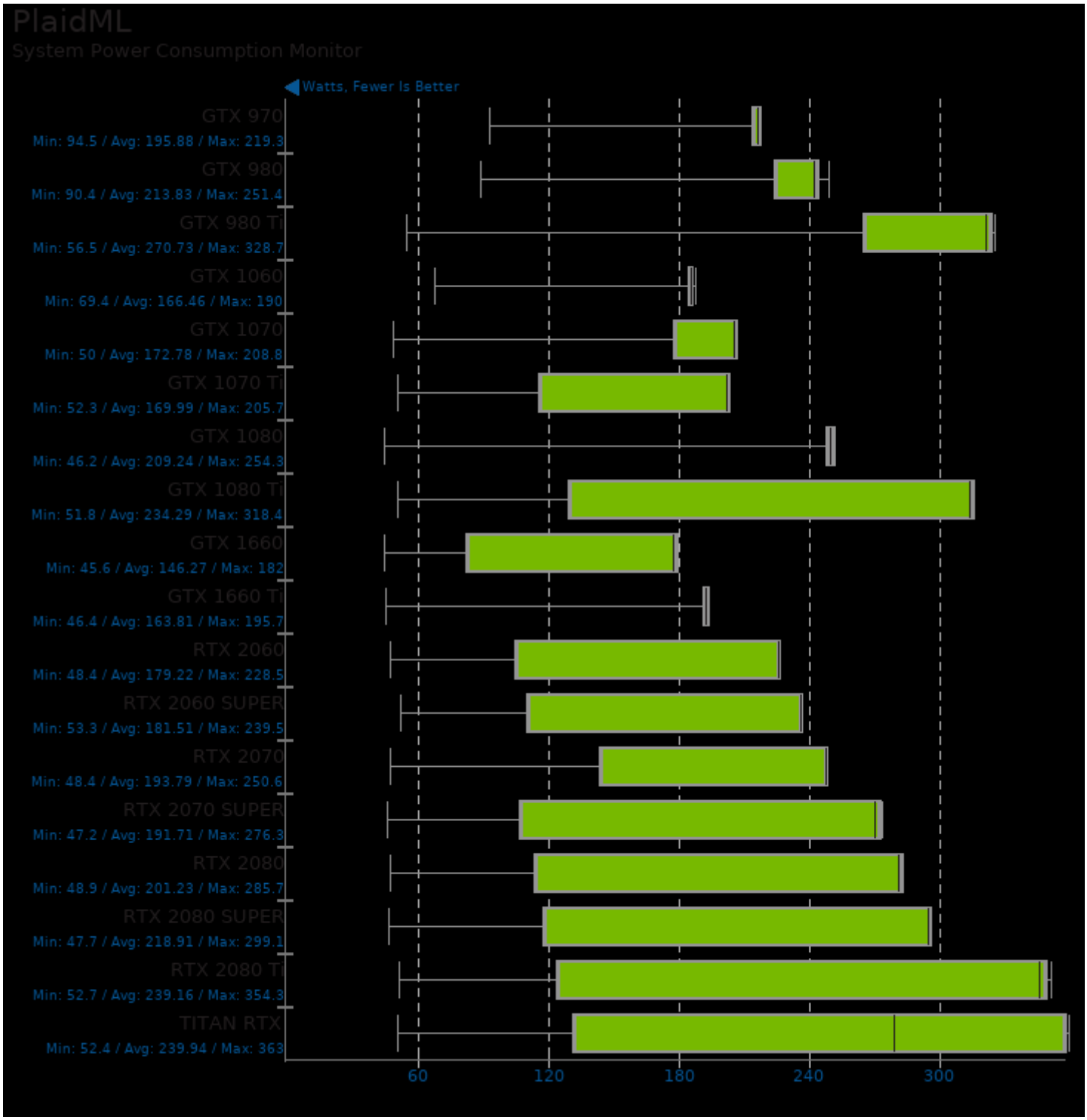
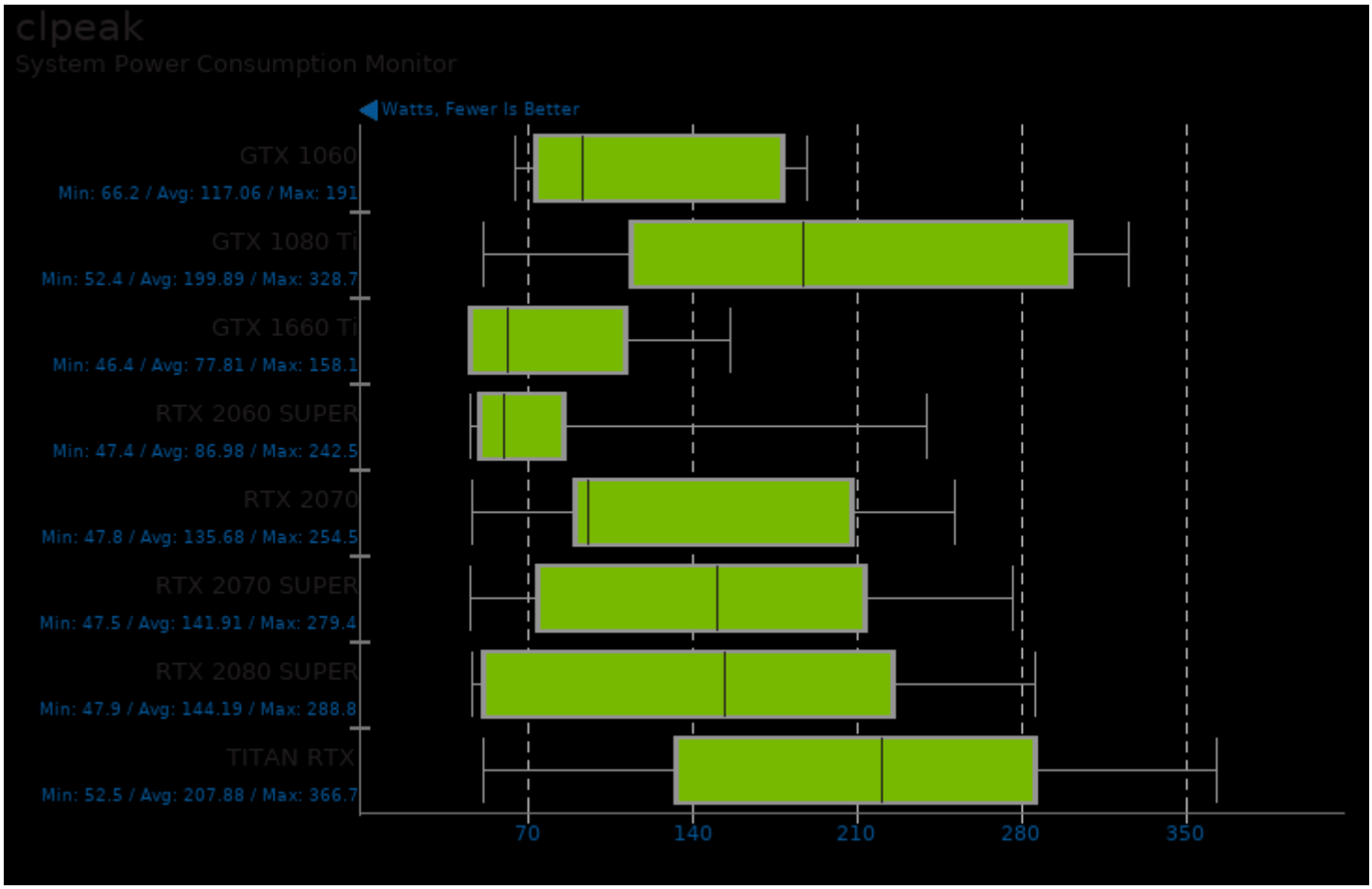



PlaidML
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 75.4 / Avg: 201.26 / Max: 220.7
GTX 980
Min: 55.7 / Avg: 208.34 / Max: 246.7
GTX 980 Ti
Min: 119.7 / Avg: 273.57 / Max: 330.8
GTX 1060
Min: 45.1 / Avg: 170.04 / Max: 188.8
GTX 1070
Min: 84.2 / Avg: 180.68 / Max: 209.8
GTX 1070 Ti
Min: 52.4 / Avg: 180.41 / Max: 207.7
GTX 1080
Min: 89.9 / Avg: 209.47 / Max: 253.5
GTX 1080 Ti
Min: 55.7 / Avg: 245.95 / Max: 321.1
GTX 1660
Min: 46 / Avg: 160.67 / Max: 185.8
GTX 1660 Ti
Min: 48.3 / Avg: 167.7 / Max: 196.3
RTX 2060
Min: 50.1 / Avg: 192.21 / Max: 230.7
RTX 2060 SUPER
Min: 55 / Avg: 193.52 / Max: 240.6
RTX 2070
Min: 49.7 / Avg: 197.21 / Max: 252.5
RTX 2070 SUPER
Min: 47.5 / Avg: 199.98 / Max: 276.8
RTX 2080
Min: 49.9 / Avg: 230.45 / Max: 288.2
RTX 2080 SUPER
Min: 49.5 / Avg: 224.18 / Max: 302.6
RTX 2080 Ti
Min: 52.9 / Avg: 251.39 / Max: 354
TITAN RTX
Min: 53.2 / Avg: 260.22 / Max: 361.7
60
120
180
240
300

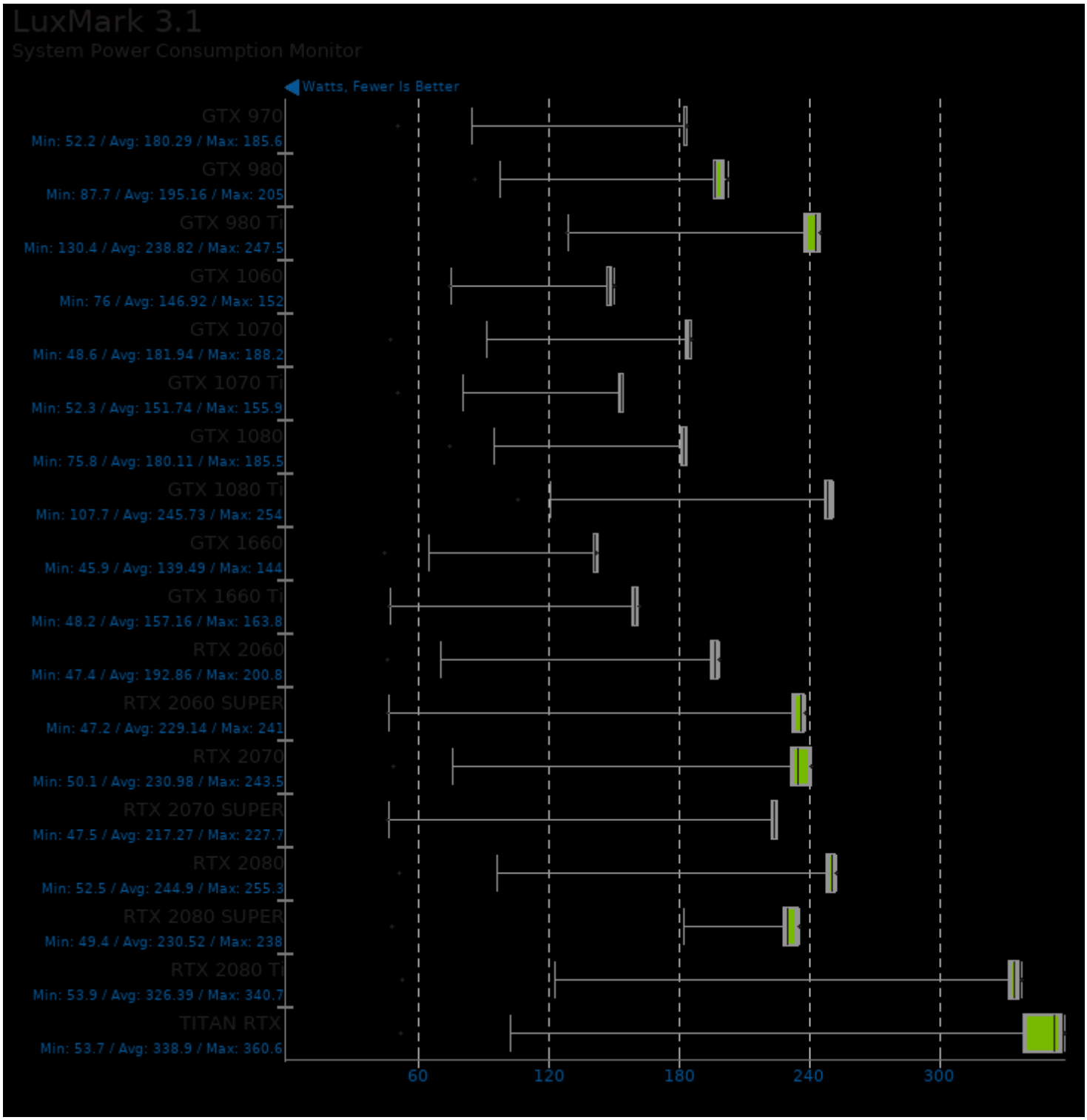

OctaneBench 4.00c
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 50.8 / Avg: 160.22 / Max: 180
GTX 980
Min: 53.6 / Avg: 178.66 / Max: 203.2
GTX 980 Ti
Min: 128.3 / Avg: 220.62 / Max: 240
GTX 1060
Min: 44.9 / Avg: 120.33 / Max: 135.2
GTX 1070
Min: 86 / Avg: 157.88 / Max: 173.8
GTX 1070 Ti
Min: 52.2 / Avg: 132.45 / Max: 182.7
GTX 1080
Min: 48.3 / Avg: 167.77 / Max: 228.3
GTX 1080 Ti
Min: 130.6 / Avg: 236.94 / Max: 265
GTX 1660
Min: 46.3 / Avg: 127.11 / Max: 144.7
GTX 1660 Ti
Min: 47.1 / Avg: 145.79 / Max: 161.1
RTX 2060
Min: 49.8 / Avg: 188.5 / Max: 218.2
RTX 2060 SUPER
Min: 46.5 / Avg: 210.53 / Max: 232.6
RTX 2070
Min: 47.1 / Avg: 215.17 / Max: 242.1
RTX 2070 SUPER
Min: 49 / Avg: 211.57 / Max: 245.6
RTX 2080
Min: 50 / Avg: 239.21 / Max: 278.1
RTX 2080 SUPER
Min: 47.8 / Avg: 225.1 / Max: 261.8
RTX 2080 Ti
Min: 51.7 / Avg: 322.94 / Max: 355.5
TITAN RTX
Min: 55.3 / Avg: 326.69 / Max: 357.7
60
120
180
240
300

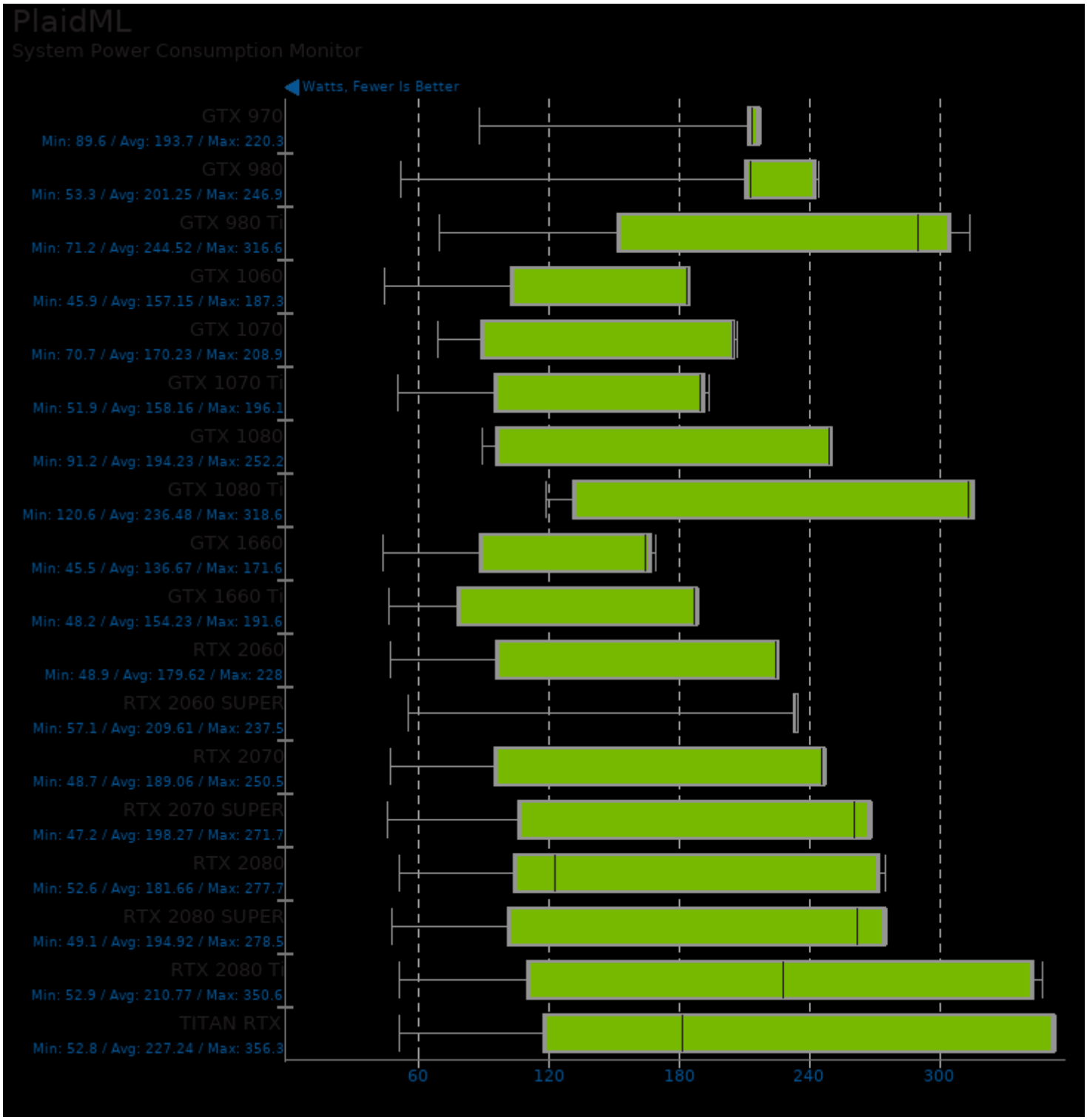
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



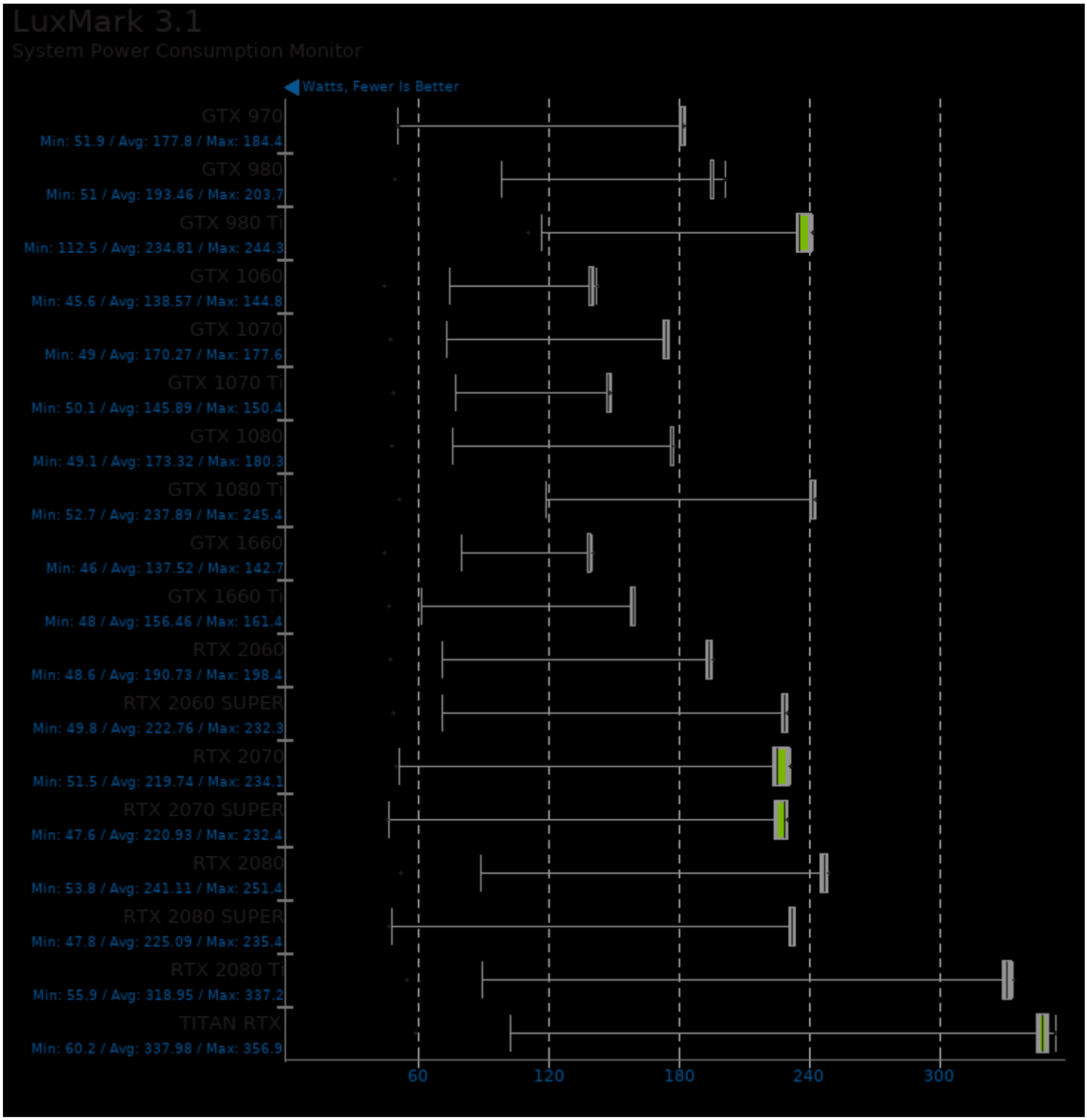

clpeak
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 1060
Min: 66.2 / Avg: 117.06 / Max: 191
GTX 1080 Ti
Min: 52.4 / Avg: 199.89 / Max: 328.7
GTX 1660 Ti
Min: 46.4 / Avg: 77.81 / Max: 158.1
RTX 2060 SUPER
Min: 47.4 / Avg: 86.98 / Max: 242.5
RTX 2070
Min: 47.8 / Avg: 135.68 / Max: 254.5
RTX 2070 SUPER
Min: 47.5 / Avg: 141.91 / Max: 279.4
RTX 2080 SUPER
Min: 47.9 / Avg: 144.19 / Max: 288.8
TITAN RTX
Min: 52.5 / Avg: 207.88 / Max: 366.7
70
140
210
280
350

NVIDIA Linux OpenCL CUDA RTX SUPER Compute

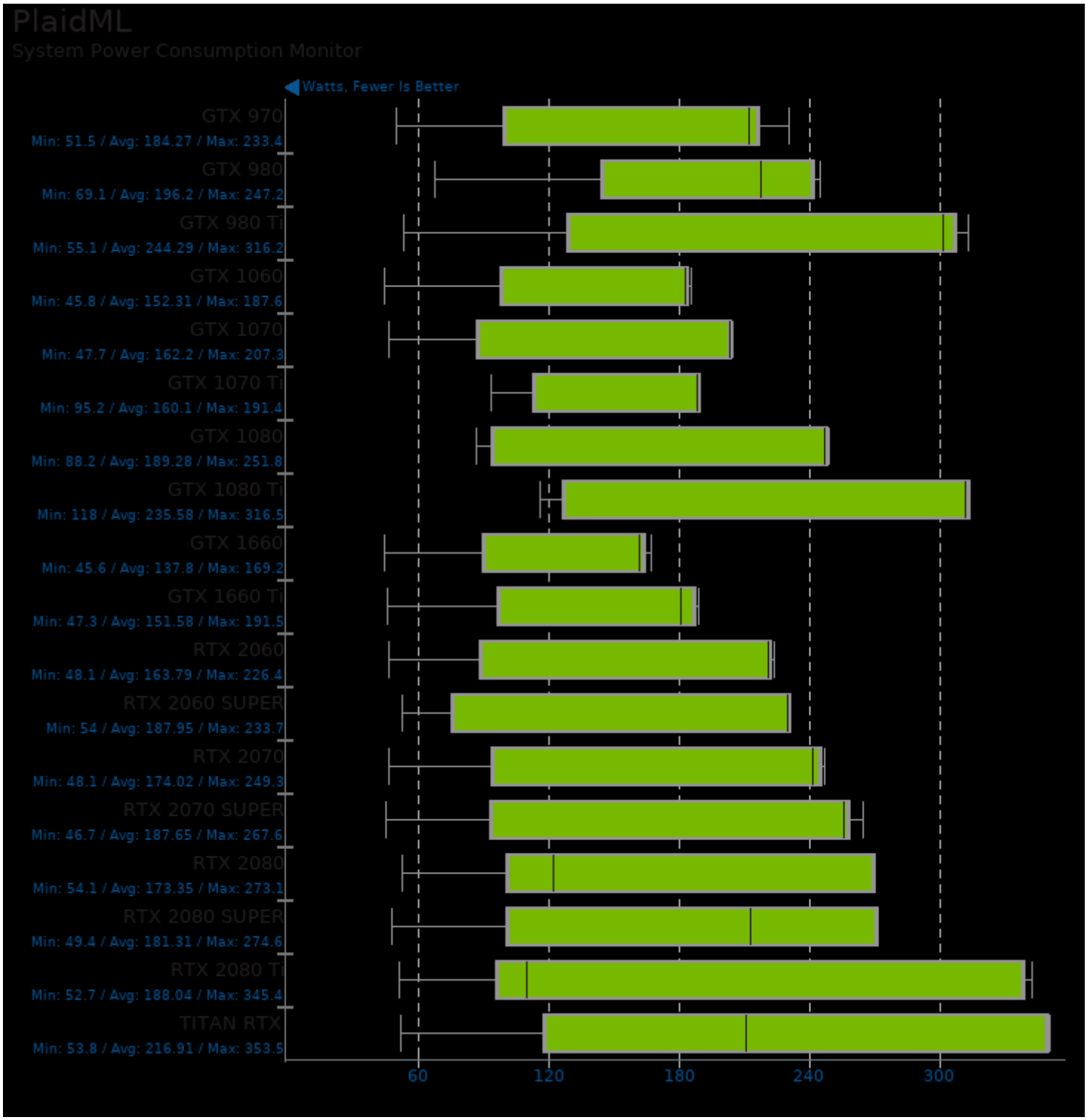


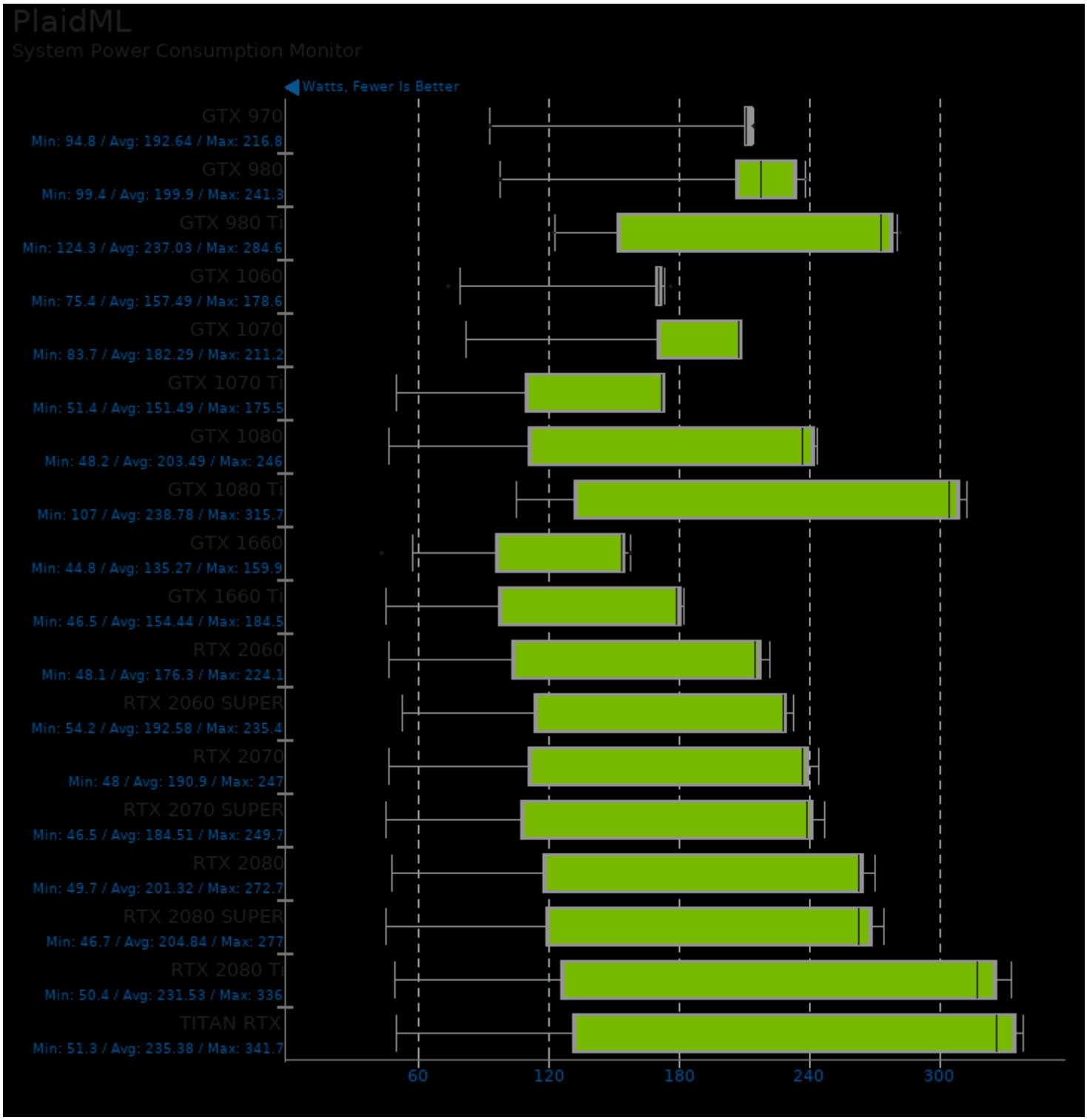

PlaidML
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 89.6 / Avg: 193.7 / Max: 220.3
GTX 980
Min: 53.3 / Avg: 201.25 / Max: 246.9
GTX 980 Ti
Min: 71.2 / Avg: 244.52 / Max: 316.6
GTX 1060
Min: 45.9 / Avg: 157.15 / Max: 187.3
GTX 1070
Min: 70.7 / Avg: 170.23 / Max: 208.9
GTX 1070 Ti
Min: 51.9 / Avg: 158.16 / Max: 196.1
GTX 1080
Min: 91.2 / Avg: 194.23 / Max: 252.2
GTX 1080 Ti
Min: 120.6 / Avg: 236.48 / Max: 318.6
GTX 1660
Min: 45.5 / Avg: 136.67 / Max: 171.6
GTX 1660 Ti
Min: 48.2 / Avg: 154.23 / Max: 191.6
RTX 2060
Min: 48.9 / Avg: 179.62 / Max: 228
RTX 2060 SUPER
Min: 57.1 / Avg: 209.61 / Max: 237.5
RTX 2070
Min: 48.7 / Avg: 189.06 / Max: 250.5
RTX 2070 SUPER
Min: 47.2 / Avg: 198.27 / Max: 271.7
RTX 2080
Min: 52.6 / Avg: 181.66 / Max: 277.7
RTX 2080 SUPER
Min: 49.1 / Avg: 194.92 / Max: 278.5
RTX 2080 Ti
Min: 52.9 / Avg: 210.77 / Max: 350.6
TITAN RTX
Min: 52.8 / Avg: 227.24 / Max: 356.3
60
120
180
240
300

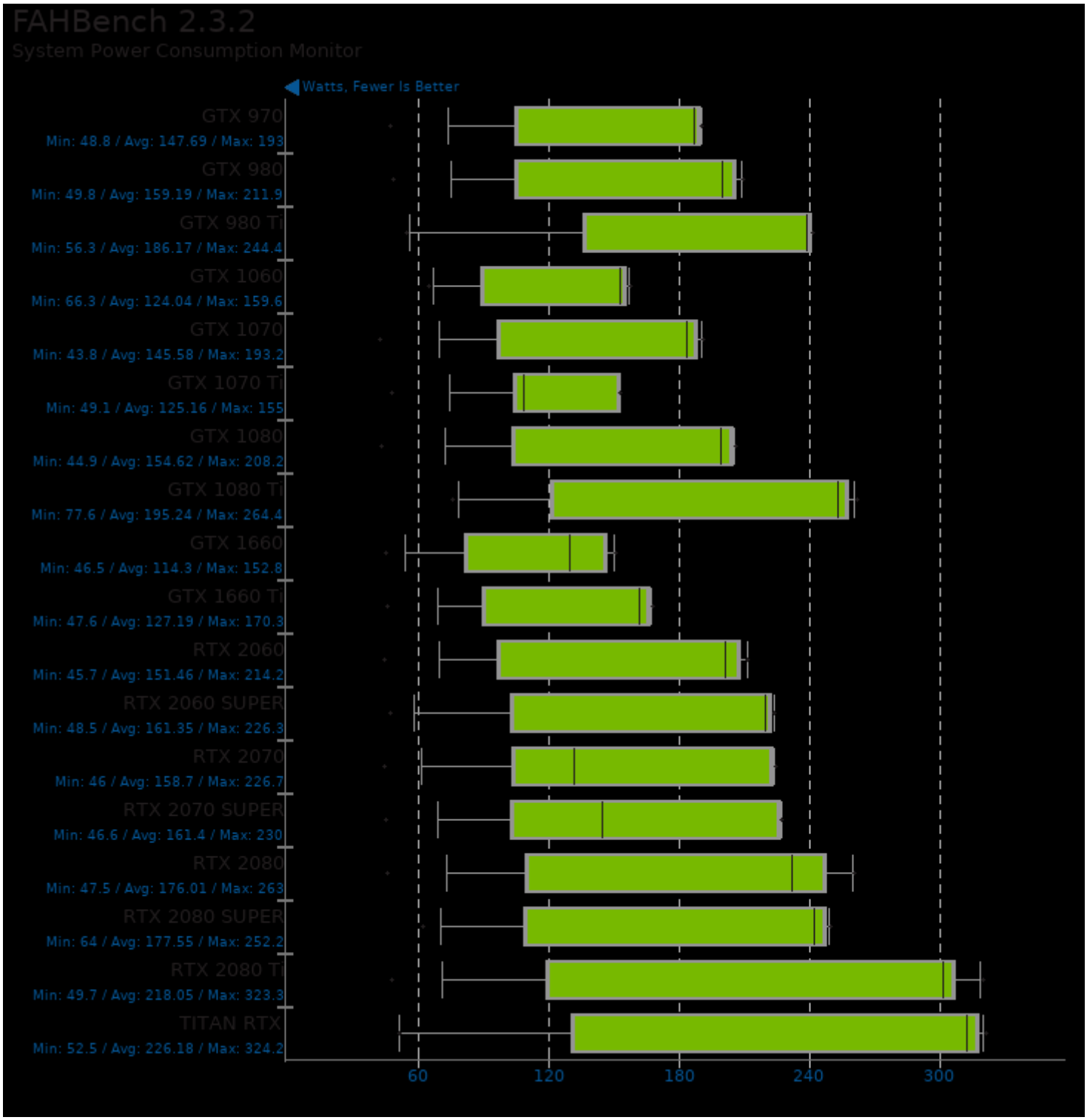
NVIDIA Linux OpenCL CUDA RTX SUPER Compute

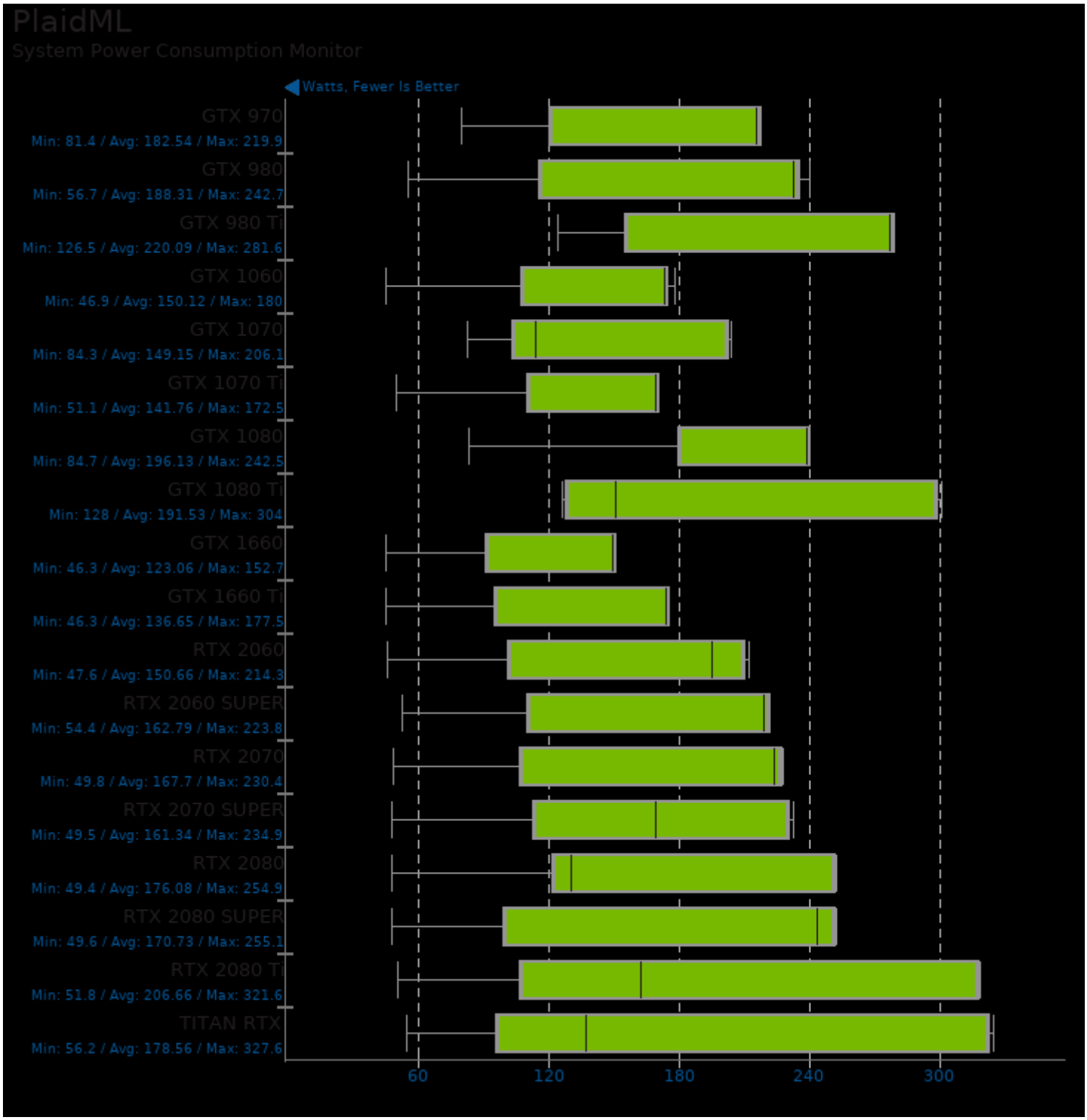


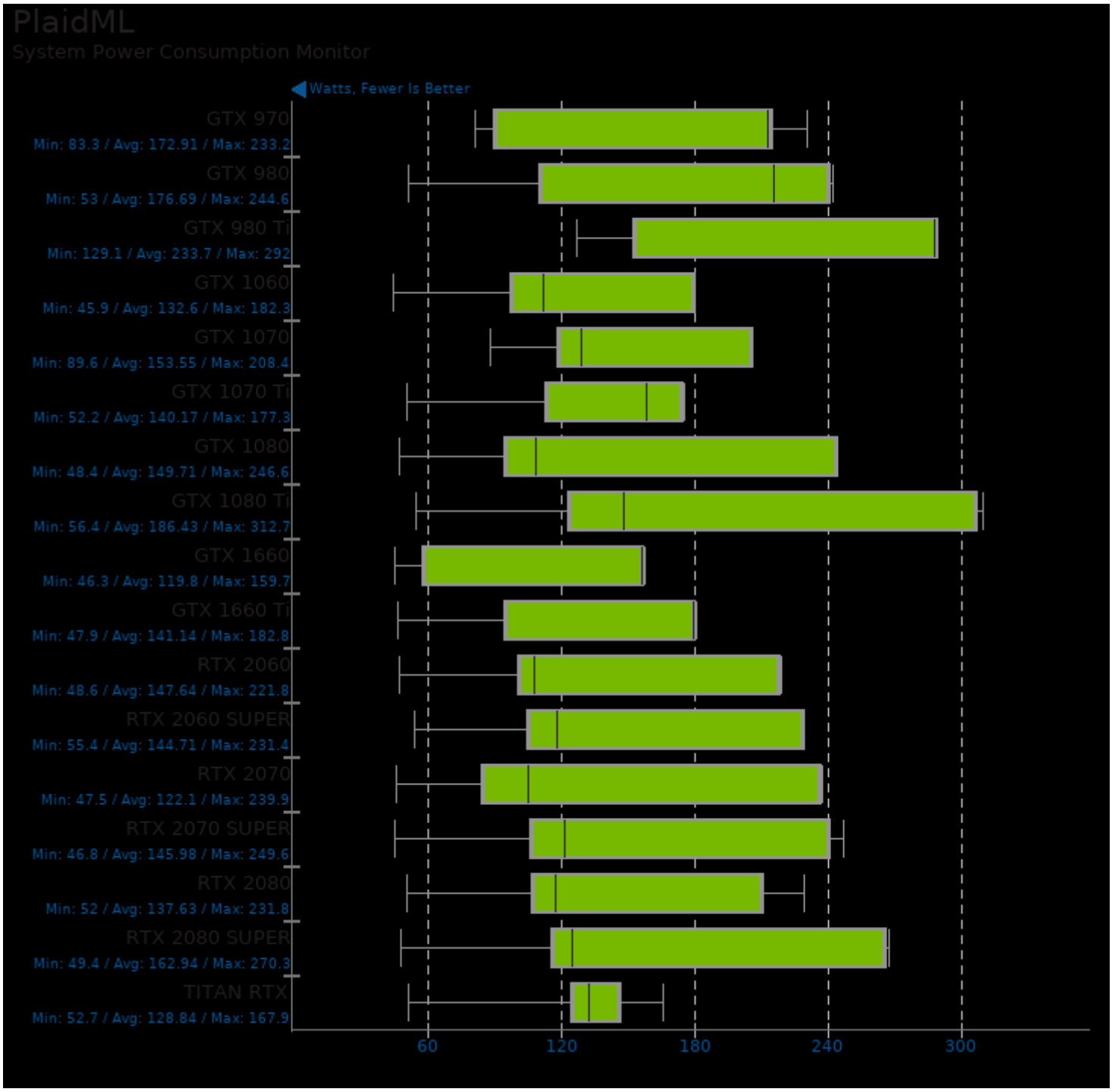
NVIDIA Linux OpenCL CUDA RTX SUPER Compute

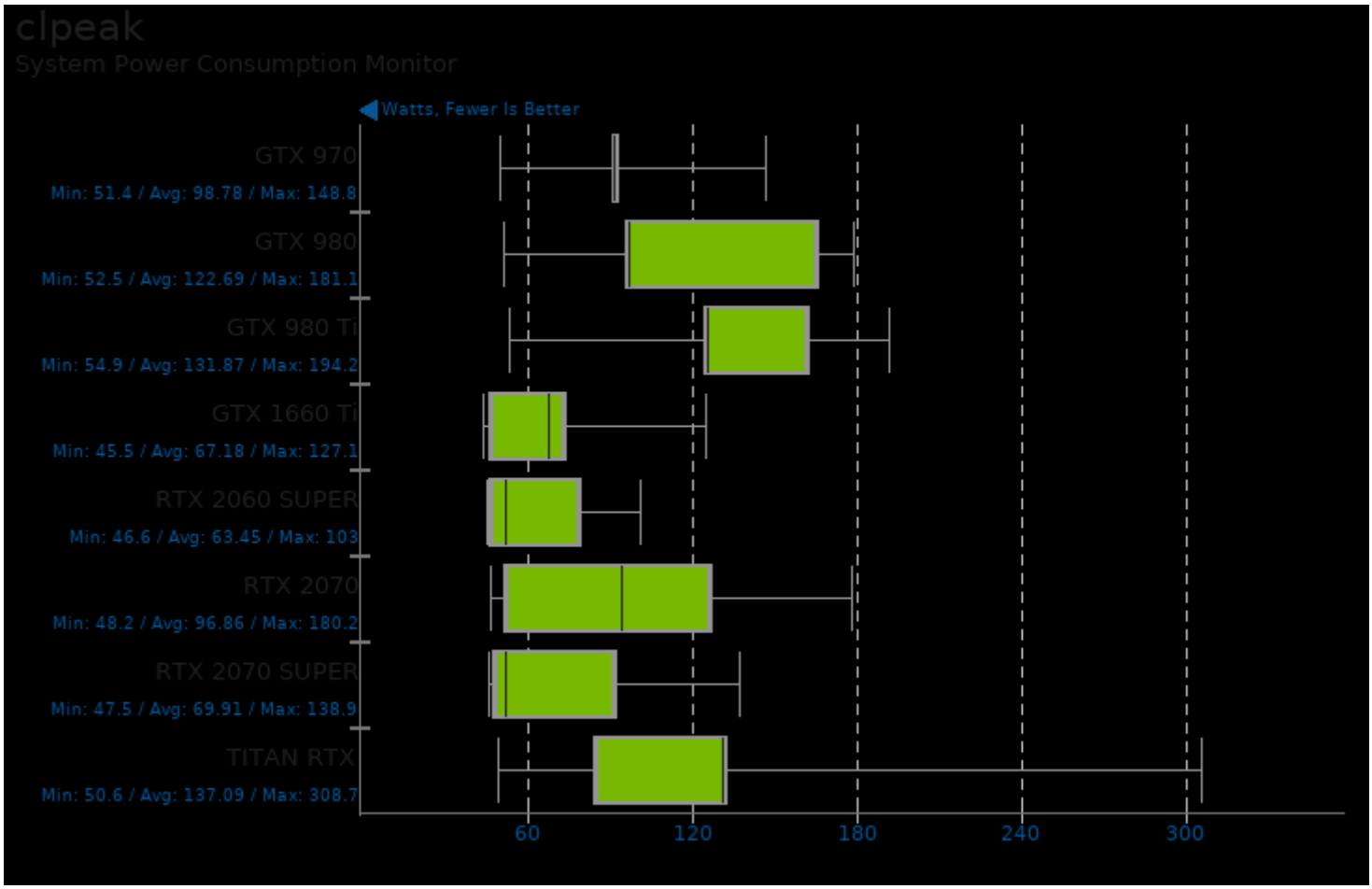



PlaidML
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 94.8 / Avg: 192.64 / Max: 216.8
GTX 980
Min: 99.4 / Avg: 199.9 / Max: 241.3
GTX 980 Ti
Min: 124.3 / Avg: 237.03 / Max: 284.6
GTX 1060
Min: 75.4 / Avg: 157.49 / Max: 178.6
GTX 1070
Min: 83.7 / Avg: 182.29 / Max: 211.2
GTX 1070 Ti
Min: 51.4 / Avg: 151.49 / Max: 175.5
GTX 1080
Min: 48.2 / Avg: 203.49 / Max: 246
GTX 1080 Ti
Min: 107 / Avg: 238.78 / Max: 315.7
GTX 1660
Min: 44.8 / Avg: 135.27 / Max: 159.9
GTX 1660 Ti
Min: 46.5 / Avg: 154.44 / Max: 184.5
RTX 2060
Min: 48.1 / Avg: 176.3 / Max: 224.1
RTX 2060 SUPER
Min: 54.2 / Avg: 192.58 / Max: 235.4
RTX 2070
Min: 48 / Avg: 190.9 / Max: 247
RTX 2070 SUPER
Min: 46.5 / Avg: 184.51 / Max: 249.7
RTX 2080
Min: 49.7 / Avg: 201.32 / Max: 272.7
RTX 2080 SUPER
Min: 46.7 / Avg: 204.84 / Max: 277
RTX 2080 Ti
Min: 50.4 / Avg: 231.53 / Max: 336
TITAN RTX
Min: 51.3 / Avg: 235.38 / Max: 341.7
60
120
180
240
300

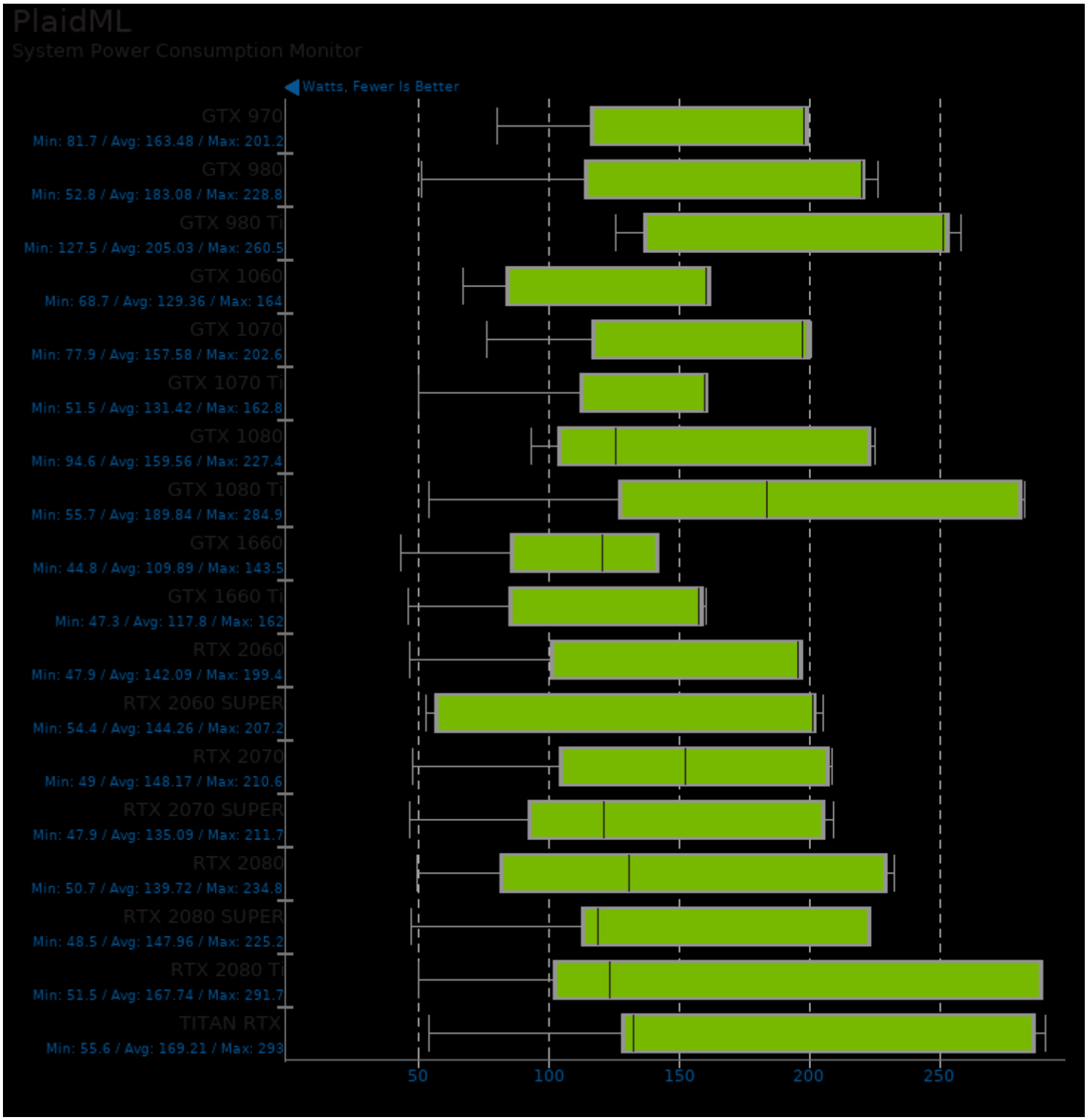

FAHBench 2.3.2
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 48.8 / Avg: 147.69 / Max: 193
GTX 980
Min: 49.8 / Avg: 159.19 / Max: 211.9
GTX 980 Ti
Min: 56.3 / Avg: 186.17 / Max: 244.4
GTX 1060
Min: 66.3 / Avg: 124.04 / Max: 159.6
GTX 1070
Min: 43.8 / Avg: 145.58 / Max: 193.2
GTX 1070 Ti
Min: 49.1 / Avg: 125.16 / Max: 155
GTX 1080
Min: 44.9 / Avg: 154.62 / Max: 208.2
GTX 1080 Ti
Min: 77.6 / Avg: 195.24 / Max: 264.4
GTX 1660
Min: 46.5 / Avg: 114.3 / Max: 152.8
GTX 1660 Ti
Min: 47.6 / Avg: 127.19 / Max: 170.3
RTX 2060
Min: 45.7 / Avg: 151.46 / Max: 214.2
RTX 2060 SUPER
Min: 48.5 / Avg: 161.35 / Max: 226.3
RTX 2070
Min: 46 / Avg: 158.7 / Max: 226.7
RTX 2070 SUPER
Min: 46.6 / Avg: 161.4 / Max: 230
RTX 2080
Min: 47.5 / Avg: 176.01 / Max: 263
RTX 2080 SUPER
Min: 64 / Avg: 177.55 / Max: 252.2
RTX 2080 Ti
Min: 49.7 / Avg: 218.05 / Max: 323.3
TITAN RTX
Min: 52.5 / Avg: 226.18 / Max: 324.2
60
120
180
240
300


PlaidML
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 81.4 / Avg: 182.54 / Max: 219.9
GTX 980
Min: 56.7 / Avg: 188.31 / Max: 242.7
GTX 980 Ti
Min: 126.5 / Avg: 220.09 / Max: 281.6
GTX 1060
Min: 46.9 / Avg: 150.12 / Max: 180
GTX 1070
Min: 84.3 / Avg: 149.15 / Max: 206.1
GTX 1070 Ti
Min: 51.1 / Avg: 141.76 / Max: 172.5
GTX 1080
Min: 84.7 / Avg: 196.13 / Max: 242.5
GTX 1080 Ti
Min: 128 / Avg: 191.53 / Max: 304
GTX 1660
Min: 46.3 / Avg: 123.06 / Max: 152.7
GTX 1660 Ti
Min: 46.3 / Avg: 136.65 / Max: 177.5
RTX 2060
Min: 47.6 / Avg: 150.66 / Max: 214.3
RTX 2060 SUPER
Min: 54.4 / Avg: 162.79 / Max: 223.8
RTX 2070
Min: 49.8 / Avg: 167.7 / Max: 230.4
RTX 2070 SUPER
Min: 49.5 / Avg: 161.34 / Max: 234.9
RTX 2080
Min: 49.4 / Avg: 176.08 / Max: 254.9
RTX 2080 SUPER
Min: 49.6 / Avg: 170.73 / Max: 255.1
RTX 2080 Ti
Min: 51.8 / Avg: 206.66 / Max: 321.6
TITAN RTX
Min: 56.2 / Avg: 178.56 / Max: 327.6
60
120
180
240
300

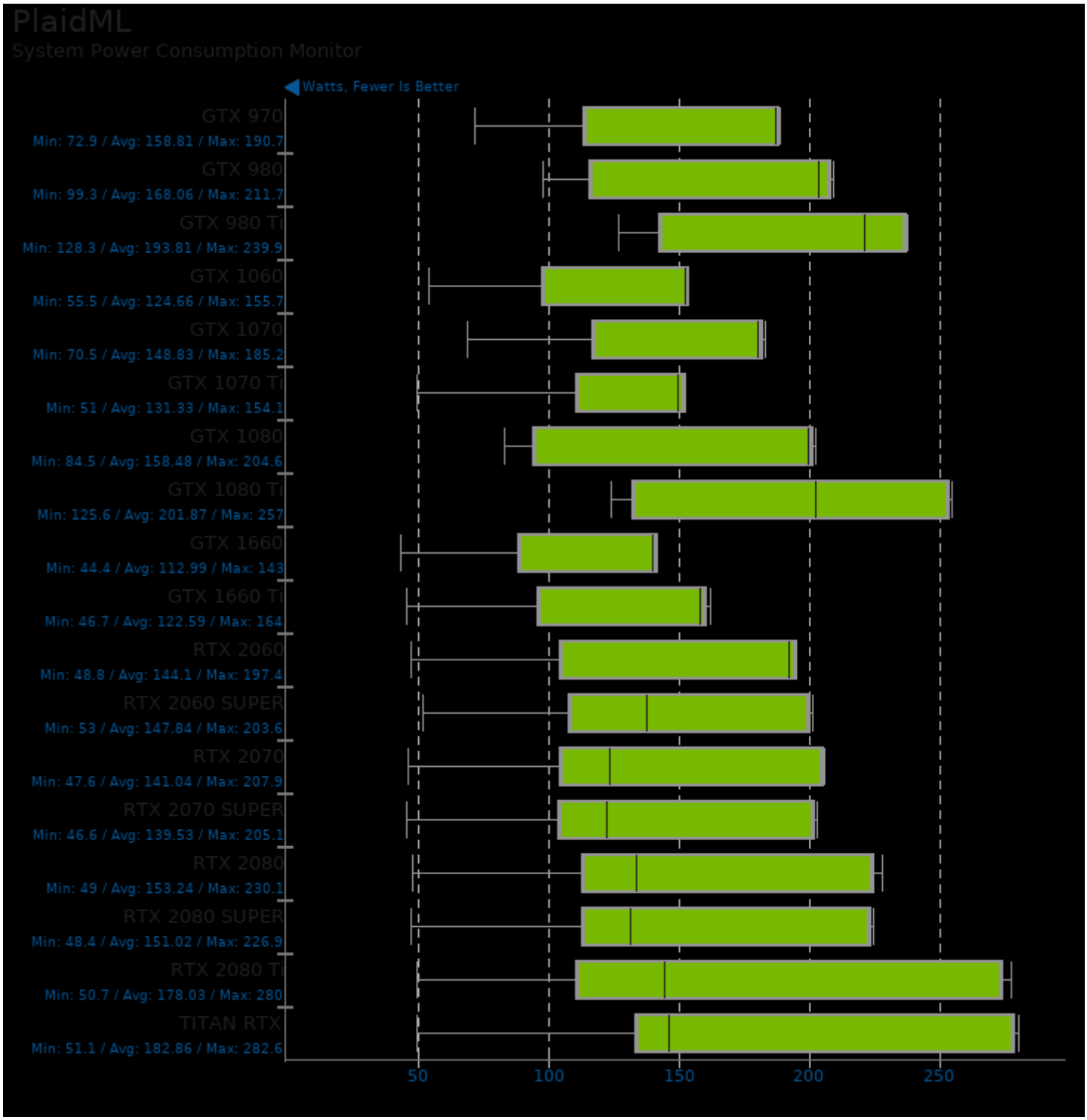

PlaidML
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 83.3 / Avg: 172.91 / Max: 233.2
GTX 980
Min: 53 / Avg: 176.69 / Max: 244.6
GTX 980 Ti
Min: 129.1 / Avg: 233.7 / Max: 292
GTX 1060
Min: 45.9 / Avg: 132.6 / Max: 182.3
GTX 1070
Min: 89.6 / Avg: 153.55 / Max: 208.4
GTX 1070 Ti
Min: 52.2 / Avg: 140.17 / Max: 177.3
GTX 1080
Min: 48.4 / Avg: 149.71 / Max: 246.6
GTX 1080 Ti
Min: 56.4 / Avg: 186.43 / Max: 312.7
GTX 1660
Min: 46.3 / Avg: 119.8 / Max: 159.7
GTX 1660 Ti
Min: 47.9 / Avg: 141.14 / Max: 182.8
RTX 2060
Min: 48.6 / Avg: 147.64 / Max: 221.8
RTX 2060 SUPER
Min: 55.4 / Avg: 144.71 / Max: 231.4
RTX 2070
Min: 47.5 / Avg: 122.1 / Max: 239.9
RTX 2070 SUPER
Min: 46.8 / Avg: 145.98 / Max: 249.6
RTX 2080
Min: 52 / Avg: 137.63 / Max: 231.8
RTX 2080 SUPER
Min: 49.4 / Avg: 162.94 / Max: 270.3
TITAN RTX
Min: 52.7 / Avg: 128.84 / Max: 167.9
60
120
180
240
300


clpeak
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 51.4 / Avg: 98.78 / Max: 148.8
GTX 980
Min: 52.5 / Avg: 122.69 / Max: 181.1
GTX 980 Ti
Min: 54.9 / Avg: 131.87 / Max: 194.2
GTX 1660 Ti
Min: 45.5 / Avg: 67.18 / Max: 127.1
RTX 2060 SUPER
Min: 46.6 / Avg: 63.45 / Max: 103
RTX 2070
Min: 48.2 / Avg: 96.86 / Max: 180.2
RTX 2070 SUPER
Min: 47.5 / Avg: 69.91 / Max: 138.9
TITAN RTX
Min: 50.6 / Avg: 137.09 / Max: 308.7
60
120
180
240
300

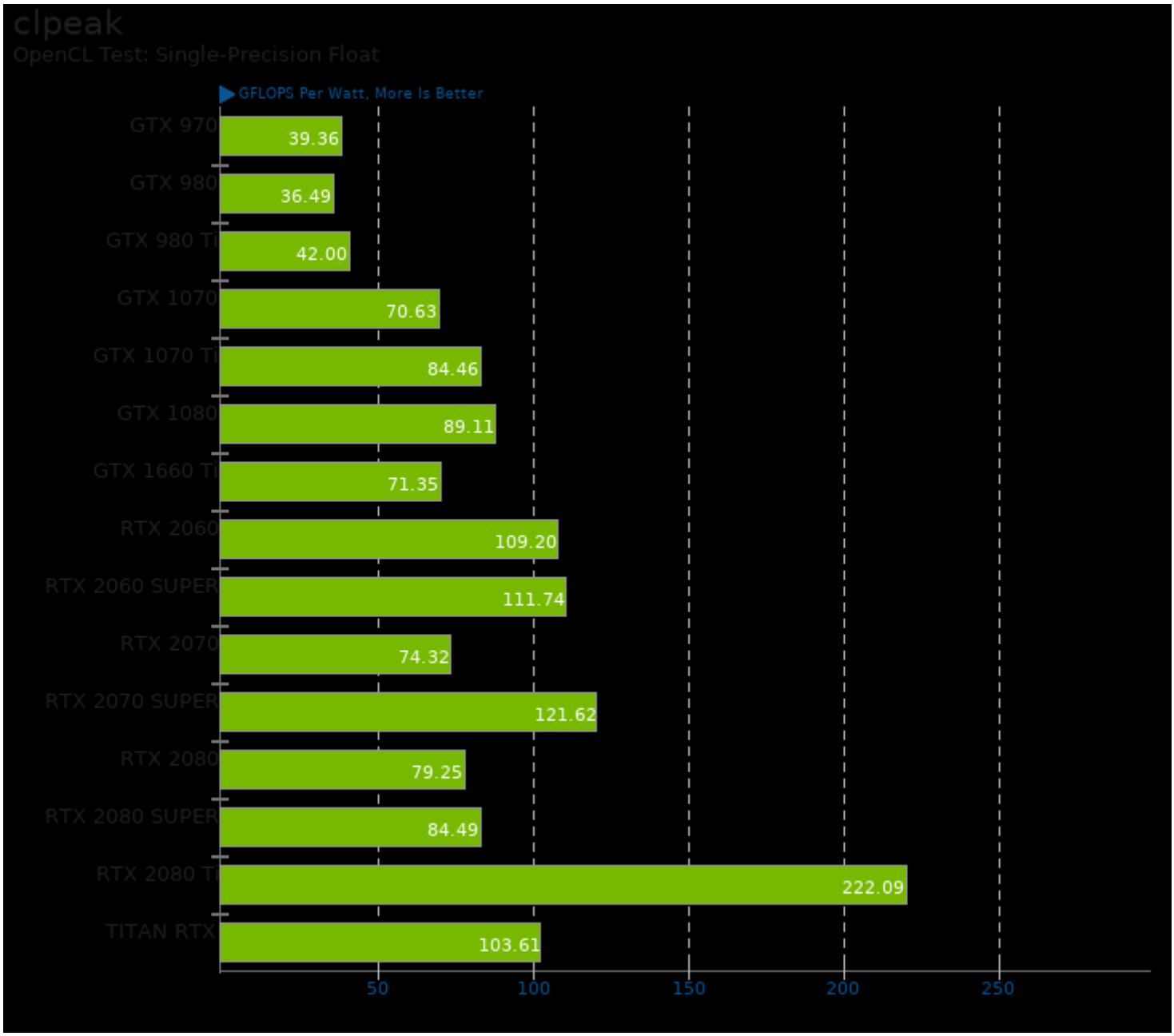
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



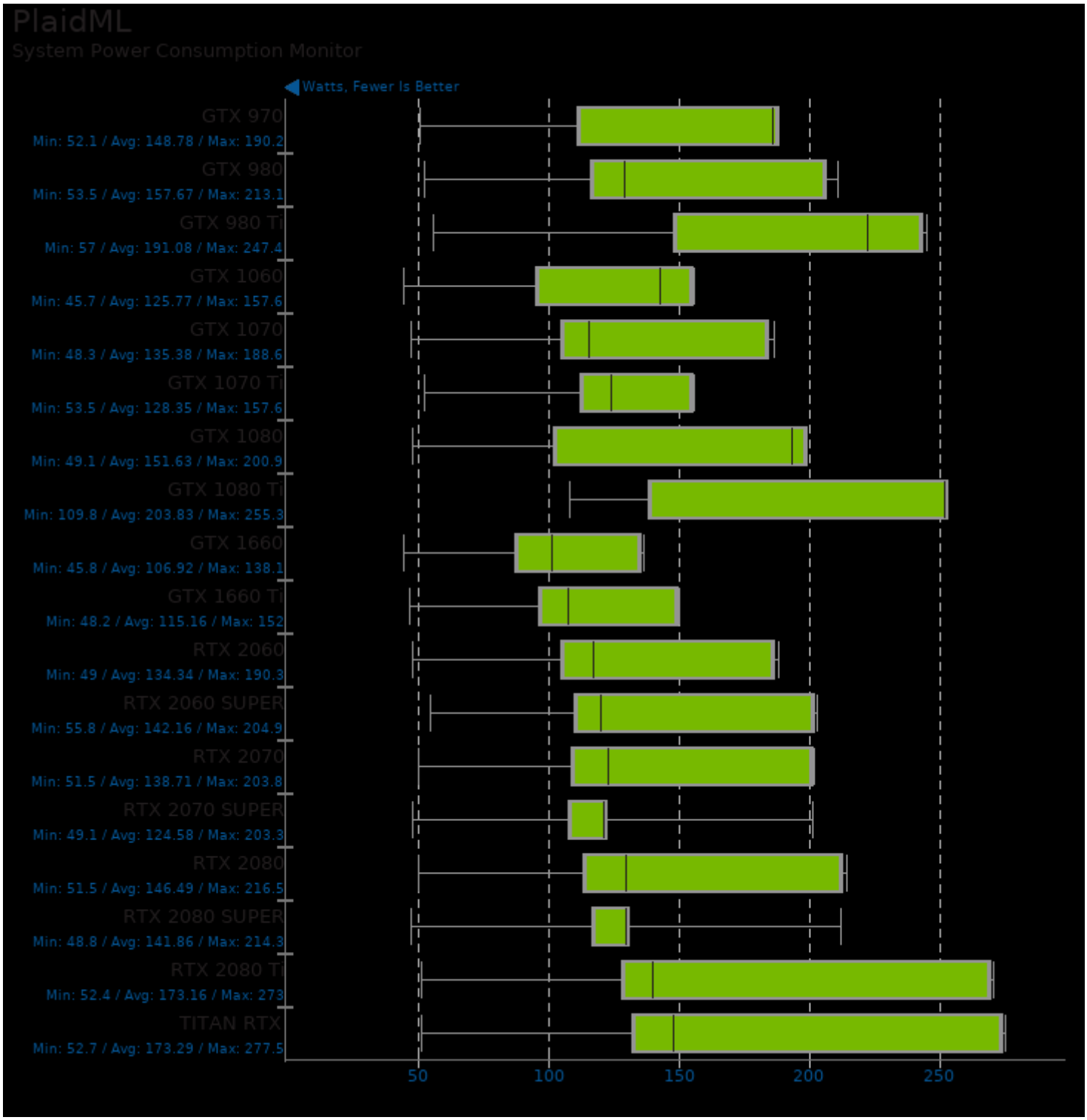
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



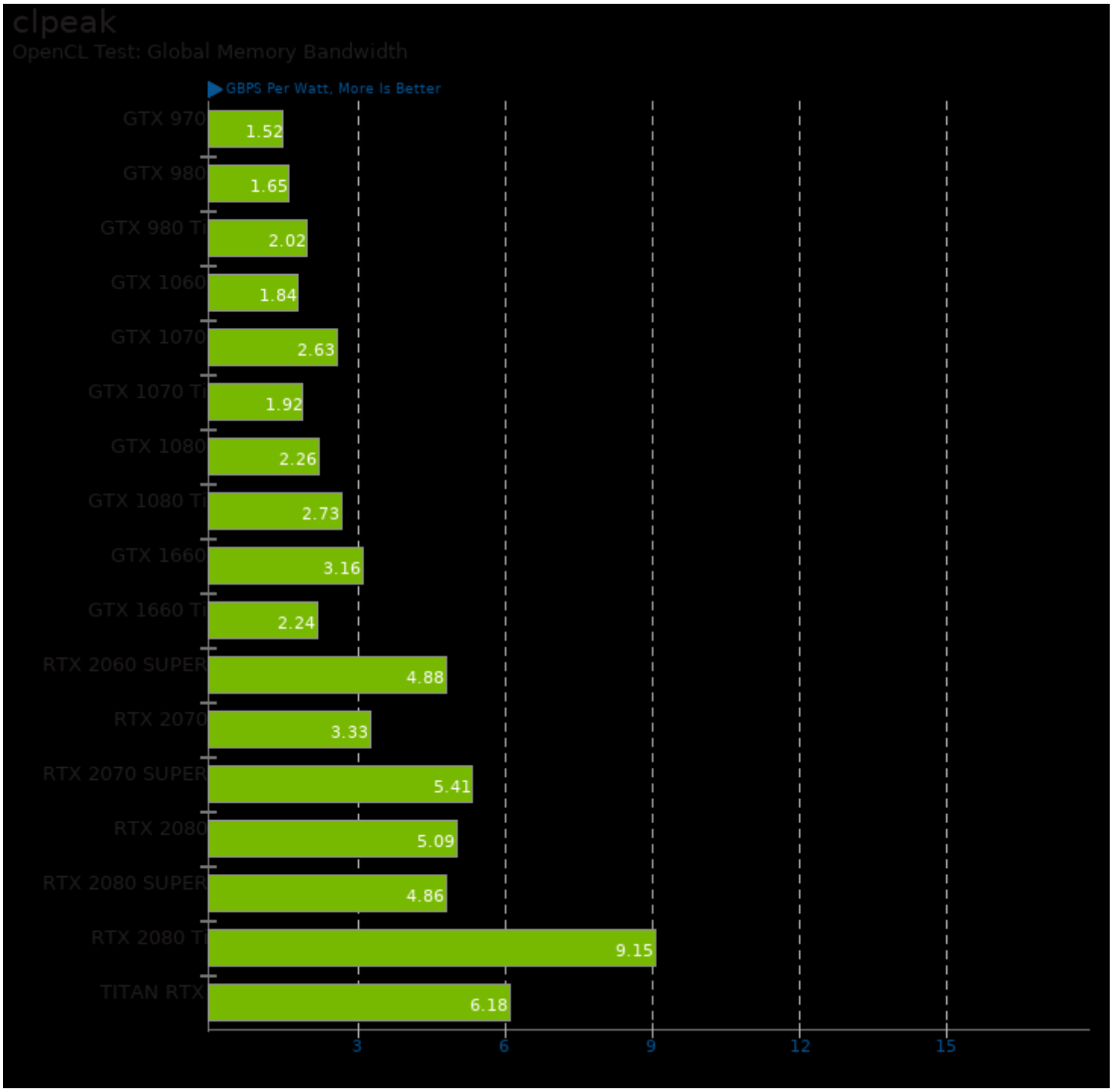
NVIDIA Linux OpenCL CUDA RTX SUPER Compute

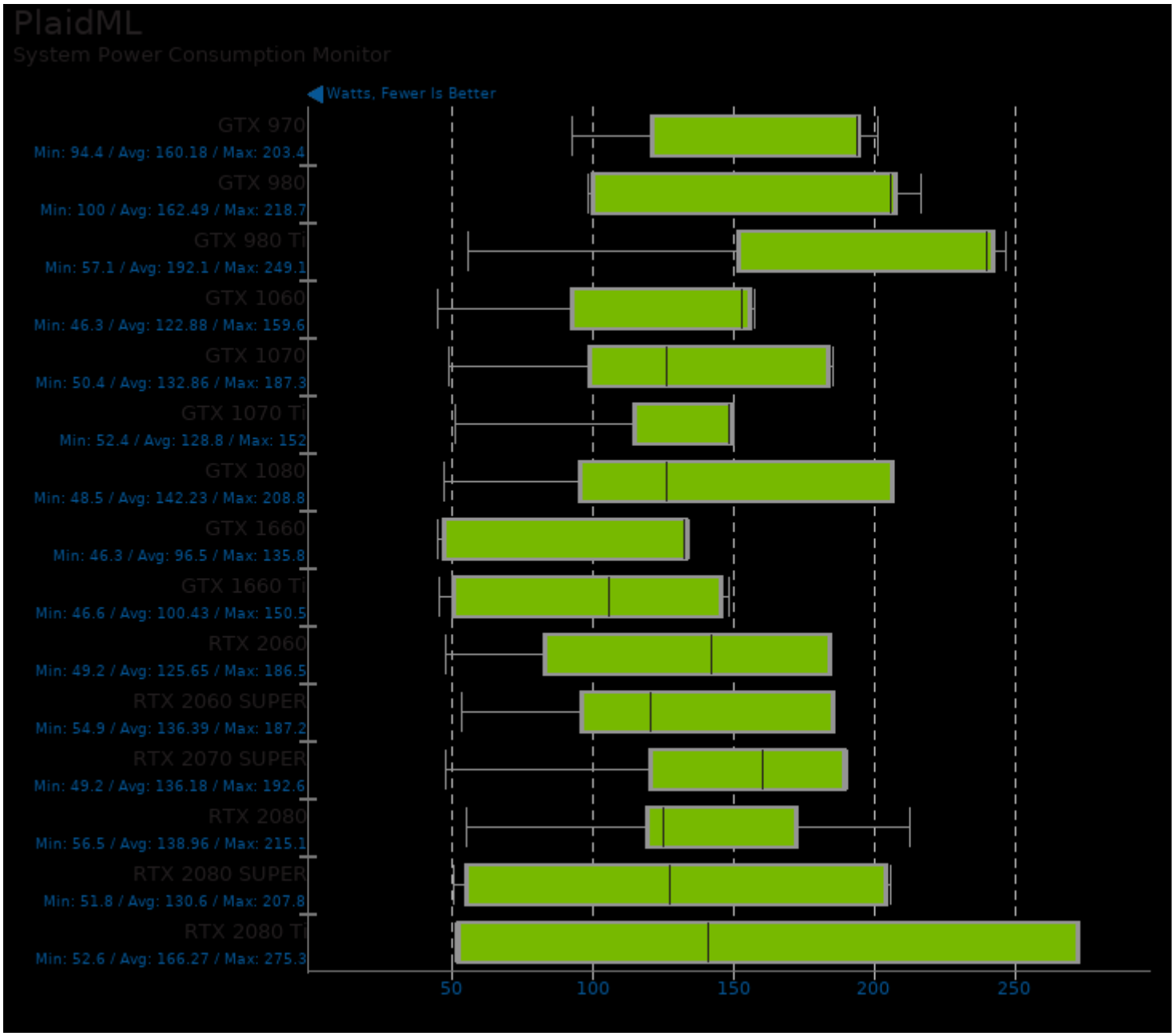


NVIDIA Linux OpenCL CUDA RTX SUPER Compute

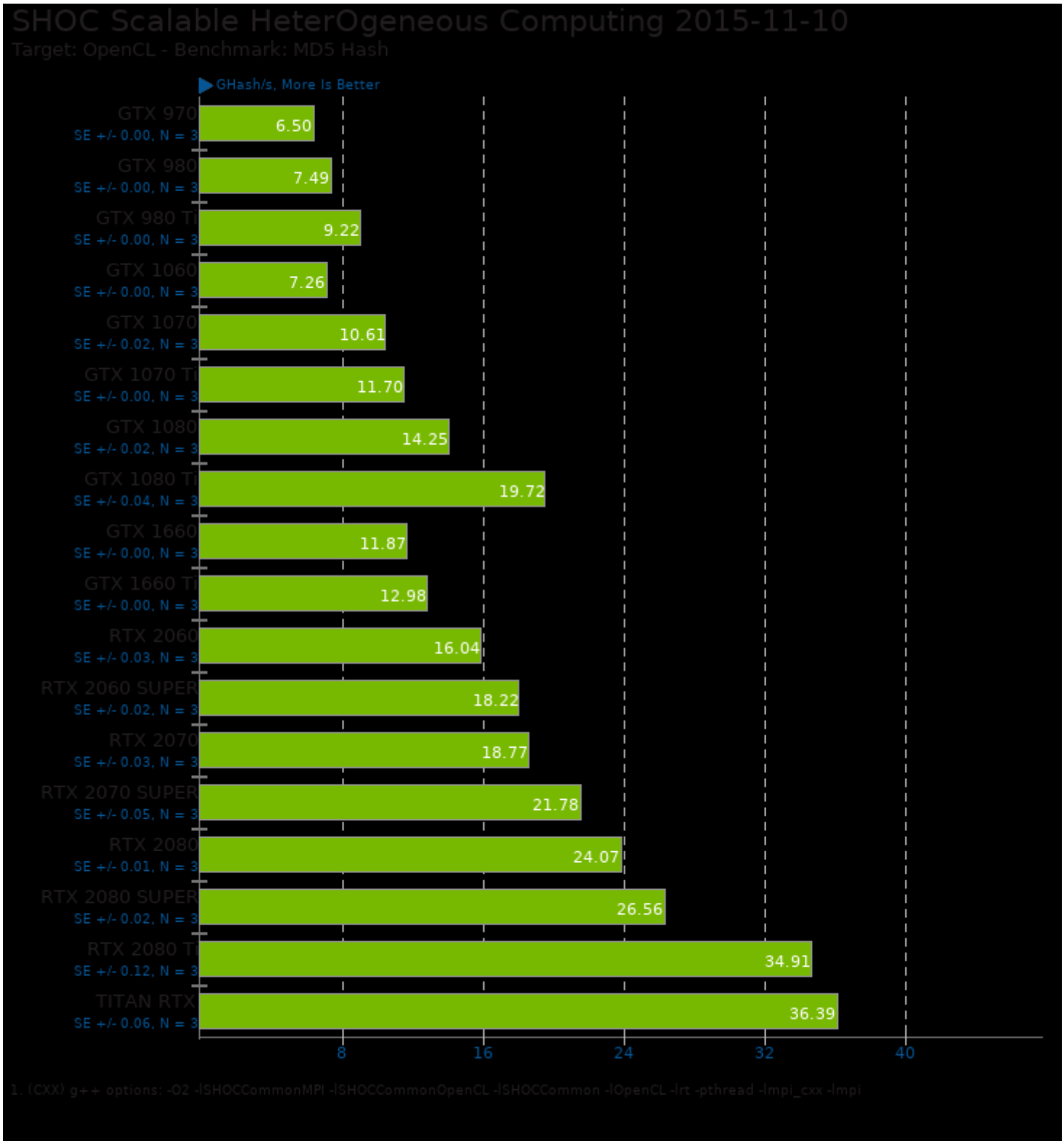


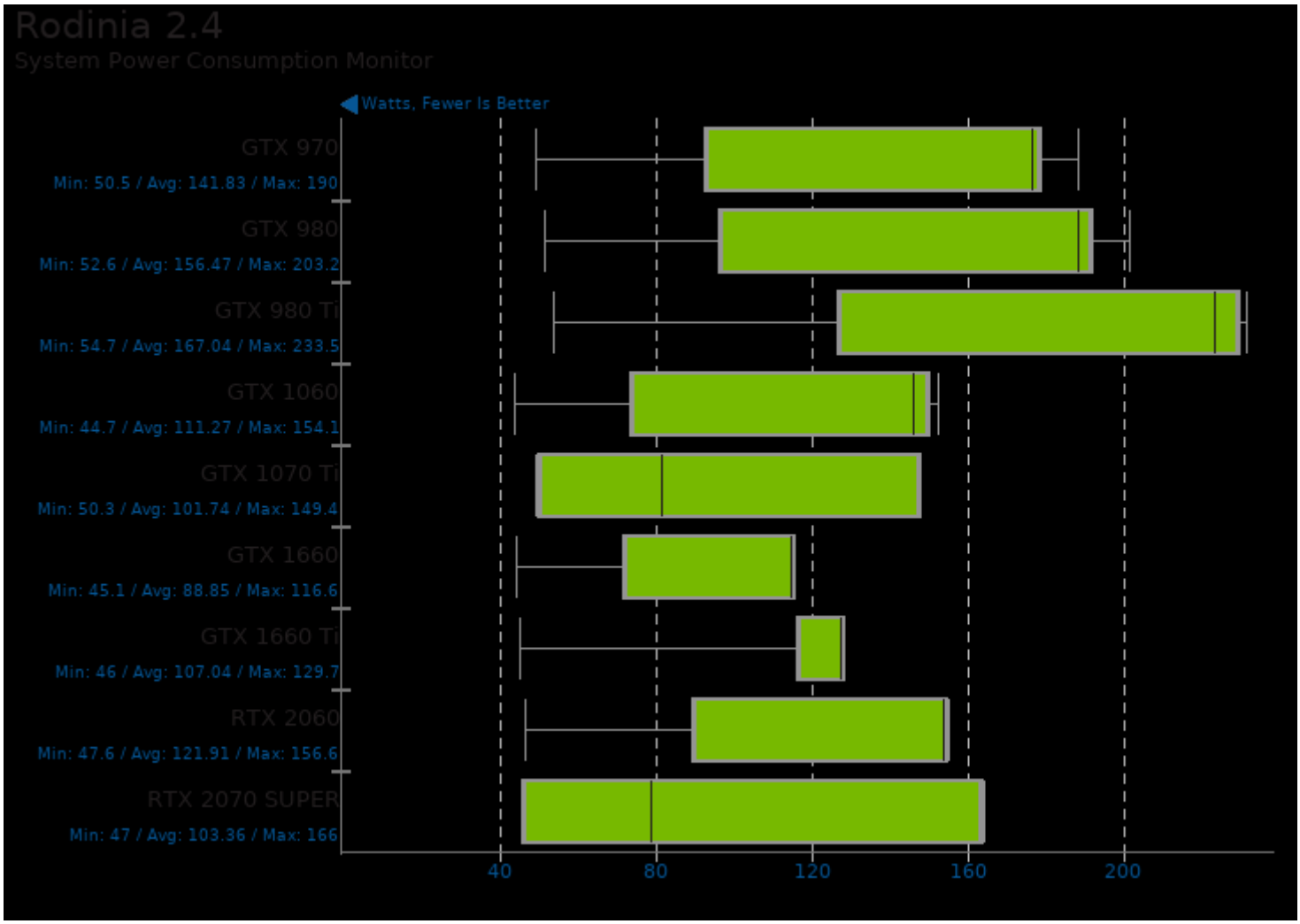
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



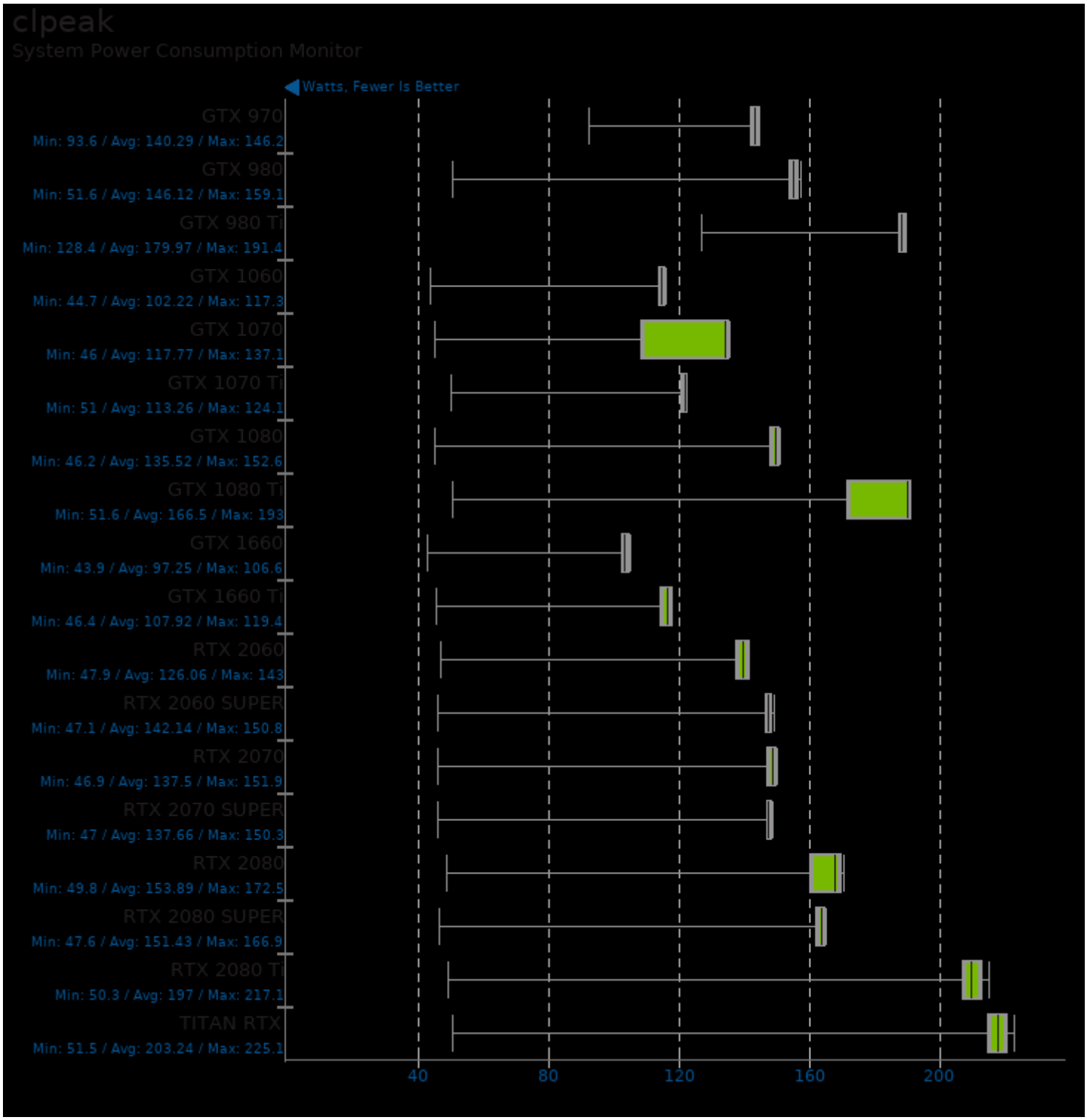

PlaidML
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 94.4 / Avg: 160.18 / Max: 203.4
GTX 980
Min: 100 / Avg: 162.49 / Max: 218.7
GTX 980 Ti
Min: 57.1 / Avg: 192.1 / Max: 249.1
GTX 1060
Min: 46.3 / Avg: 122.88 / Max: 159.6
GTX 1070
Min: 50.4 / Avg: 132.86 / Max: 187.3
GTX 1070 Ti
Min: 52.4 / Avg: 128.8 / Max: 152
GTX 1080
Min: 48.5 / Avg: 142.23 / Max: 208.8
GTX 1660
Min: 46.3 / Avg: 96.5 / Max: 135.8
GTX 1660 Ti
Min: 46.6 / Avg: 100.43 / Max: 150.5
RTX 2060
Min: 49.2 / Avg: 125.65 / Max: 186.5
RTX 2060 SUPER
Min: 54.9 / Avg: 136.39 / Max: 187.2
RTX 2070 SUPER
Min: 49.2 / Avg: 136.18 / Max: 192.6
RTX 2080
Min: 56.5 / Avg: 138.96 / Max: 215.1
RTX 2080 SUPER
Min: 51.8 / Avg: 130.6 / Max: 207.8
RTX 2080 Ti
Min: 52.6 / Avg: 166.27 / Max: 275.3
50
100
150
200
250

NVIDIA Linux OpenCL CUDA RTX SUPER Compute

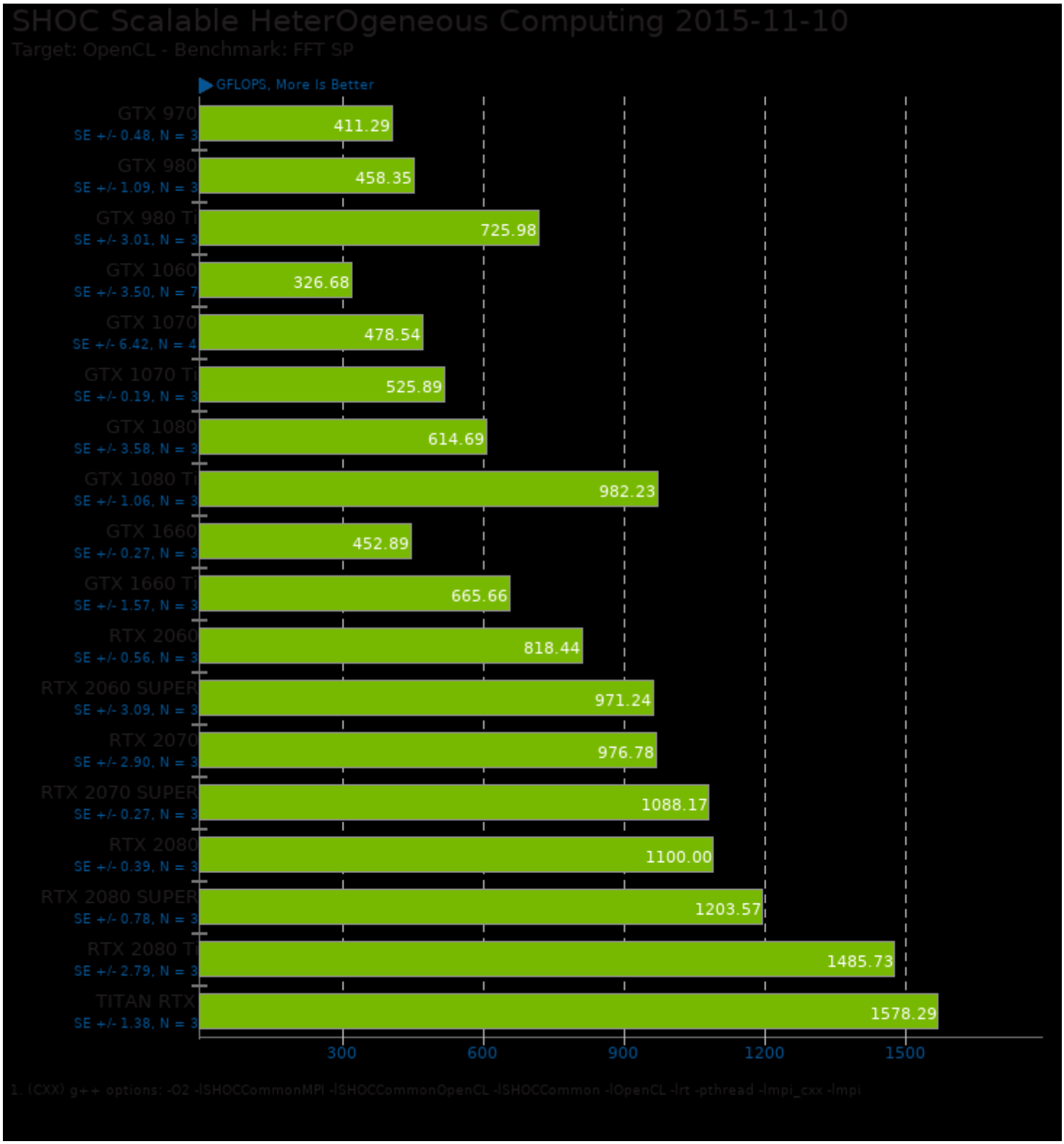


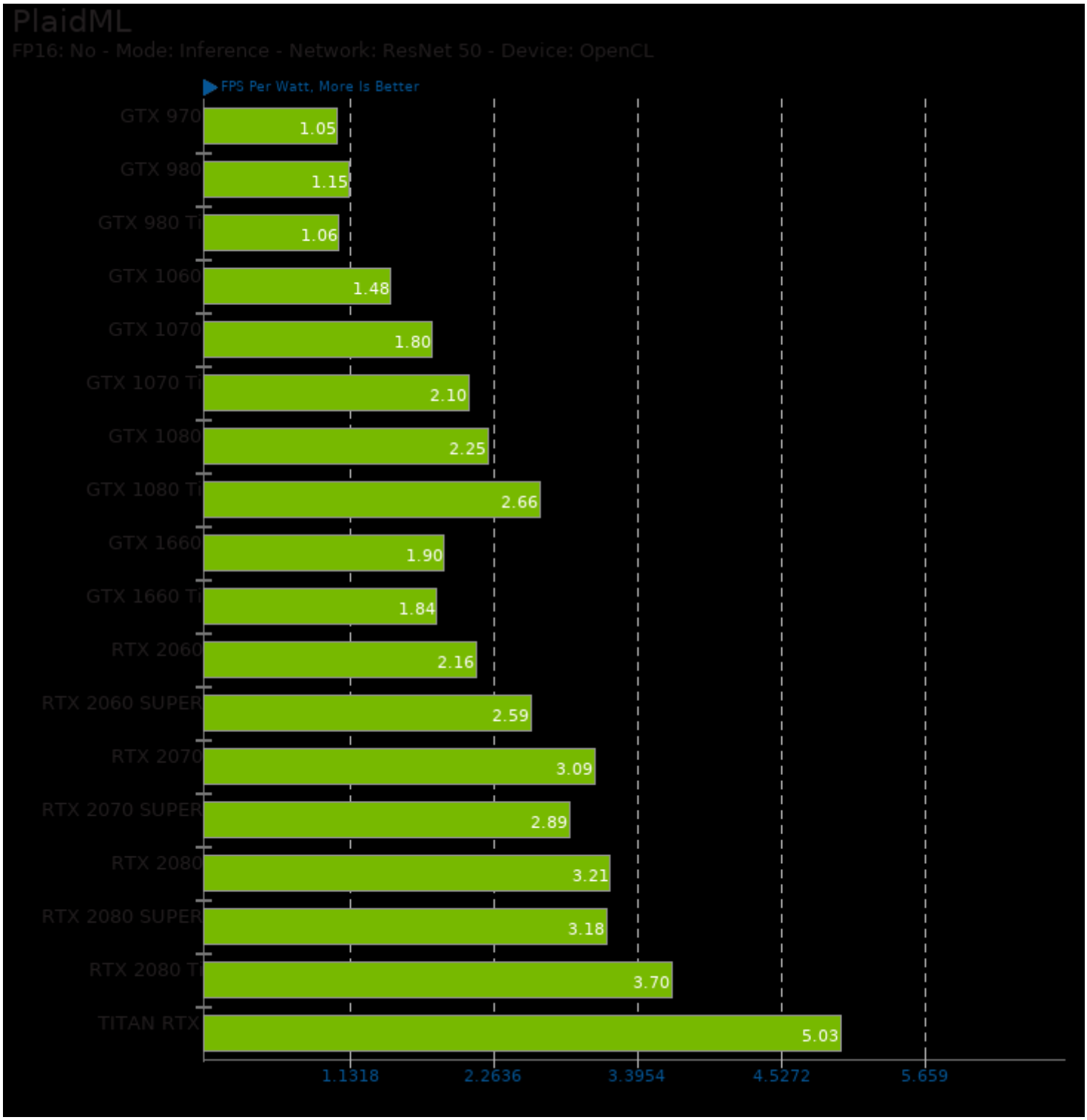

Rodinia 2.4
System Power Consumption Monitor
Watts, Fewer Is Better
GTX 970
Min: 50.5 / Avg: 141.83 / Max: 190
GTX 980
Min: 52.6 / Avg: 156.47 / Max: 203.2
GTX 980 Ti
Min: 54.7 / Avg: 167.04 / Max: 233.5
GTX 1060
Min: 44.7 / Avg: 111.27 / Max: 154.1
GTX 1070 Ti
Min: 50.3 / Avg: 101.74 / Max: 149.4
GTX 1660
Min: 45.1 / Avg: 88.85 / Max: 116.6
GTX 1660 Ti
Min: 46 / Avg: 107.04 / Max: 129.7
RTX 2060
Min: 47.6 / Avg: 121.91 / Max: 156.6
RTX 2070 SUPER
Min: 47 / Avg: 103.36 / Max: 166
40
80
120
160
200

NVIDIA Linux OpenCL CUDA RTX SUPER Compute

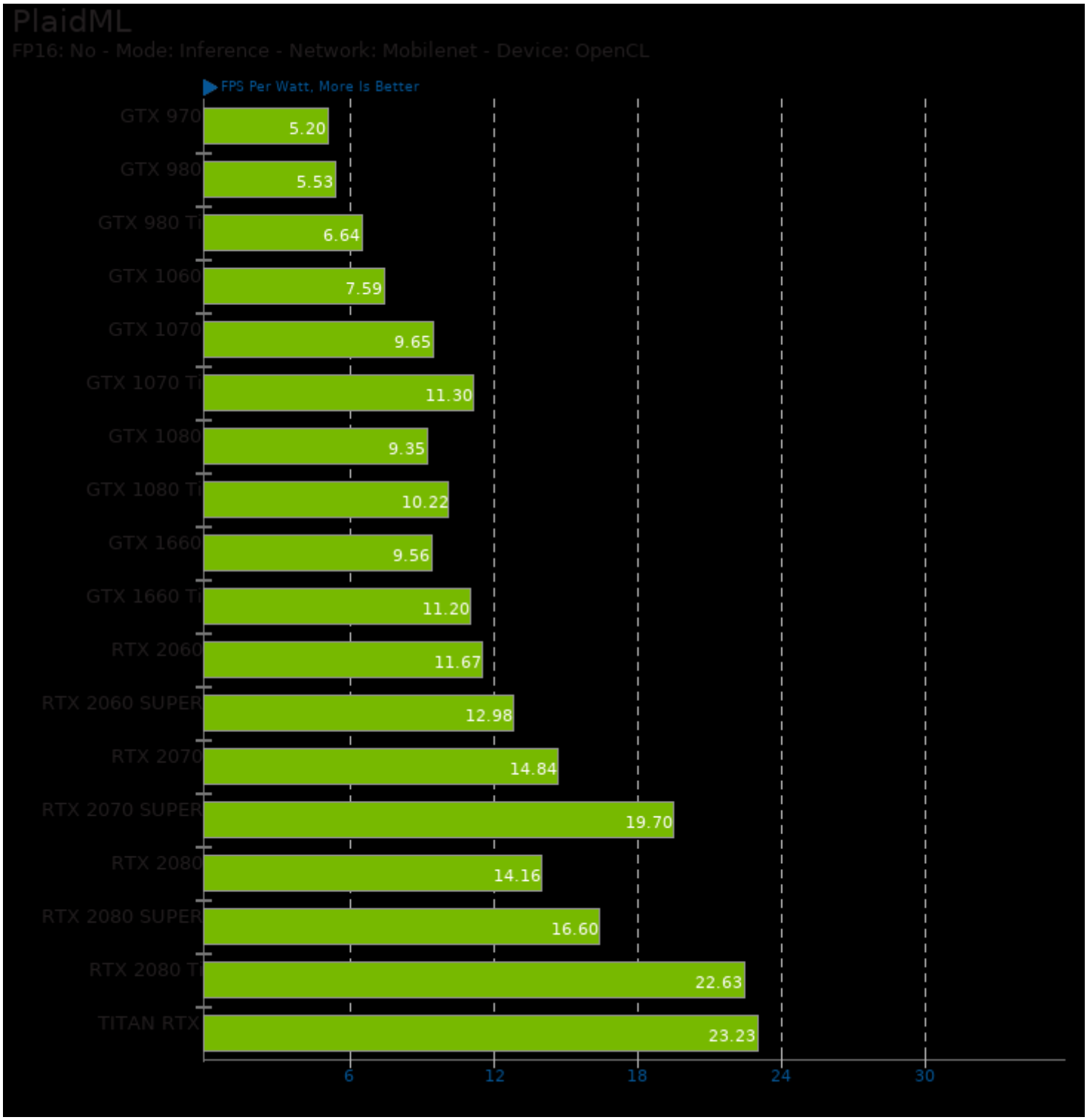


NVIDIA Linux OpenCL CUDA RTX SUPER Compute

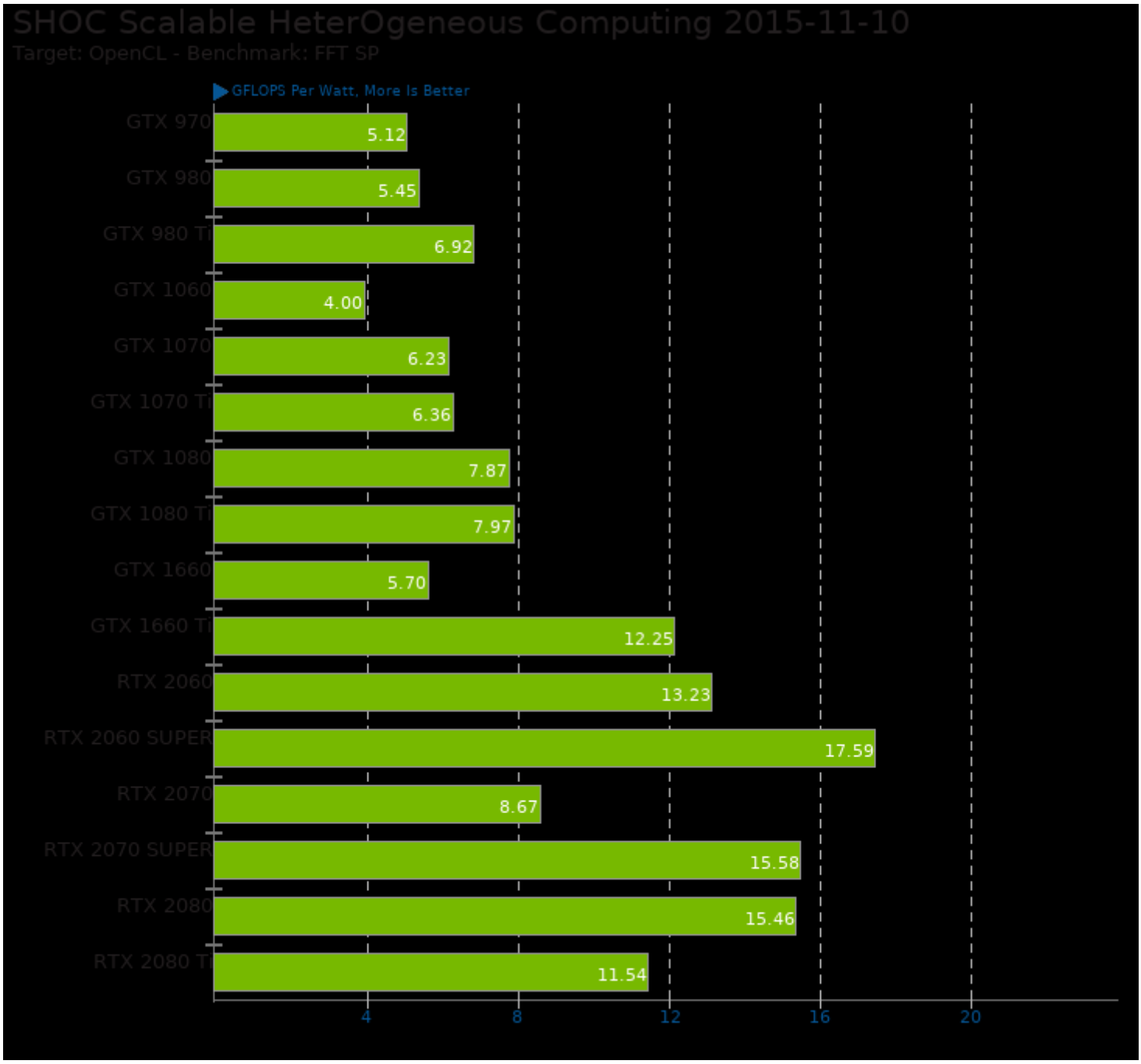



PlaidML
FP16: No - Mode: Inference - Network: ResNet 50 - Device: OpenCL
FPS Per Watt, More Is Better
GTX 970
1.05
GTX 980
1.15
GTX 980 Ti
1.06
GTX 1060
1.48
GTX 1070
1.80
GTX 1070 Ti
2.10
GTX 1080
2.25
GTX 1080 Ti
2.66
GTX 1660
1.90
GTX 1660 Ti
1.84
RTX 2060
2.16
RTX 2060 SUPER
2.59
RTX 2070
3.09
RTX 2070 SUPER
2.89
RTX 2080
3.21
RTX 2080 SUPER
3.18
RTX 2080 Ti
3.70
TITAN RTX
5.03
1.1318
2.2636
3.3954
4.5272
5.659

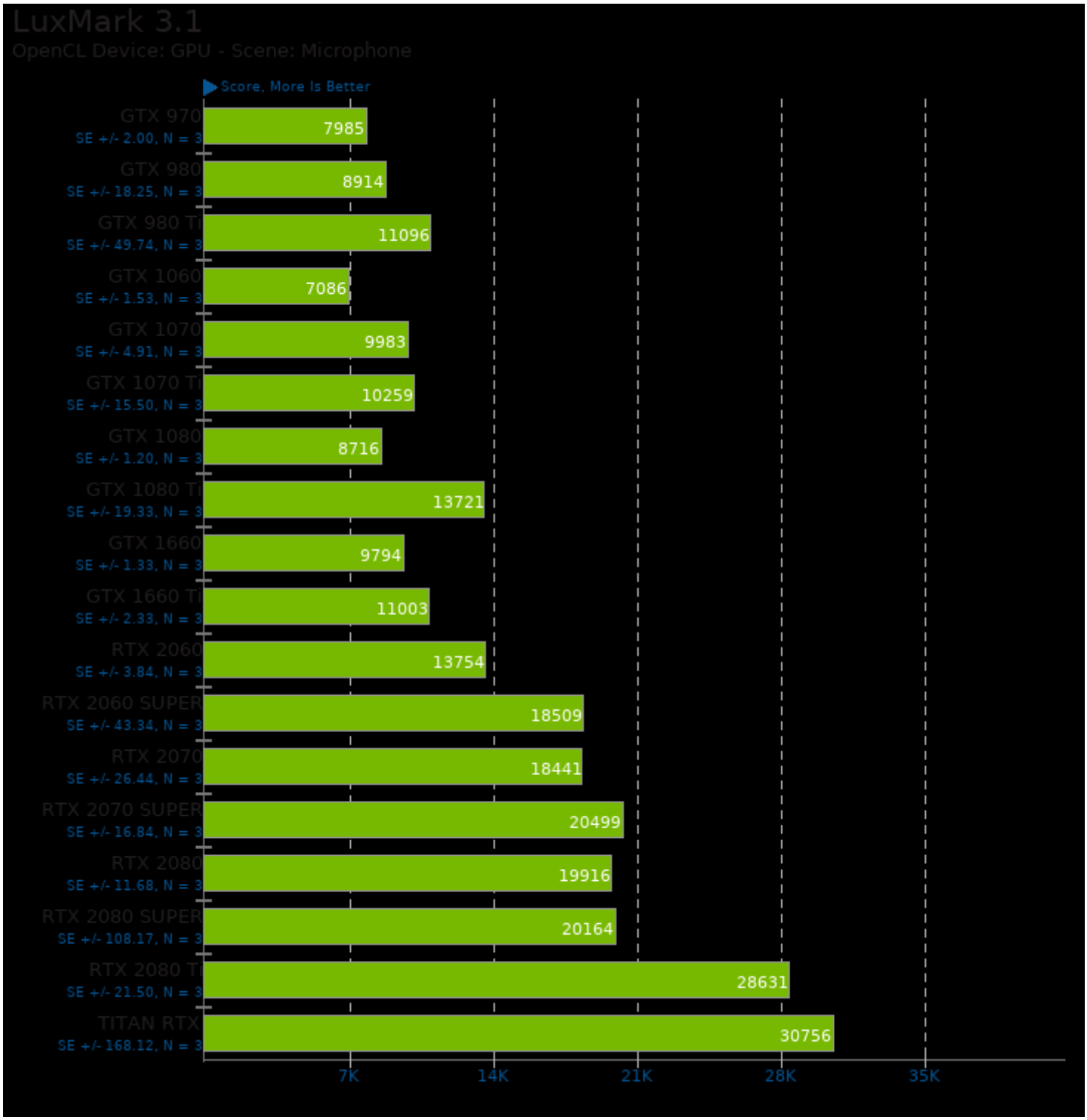
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



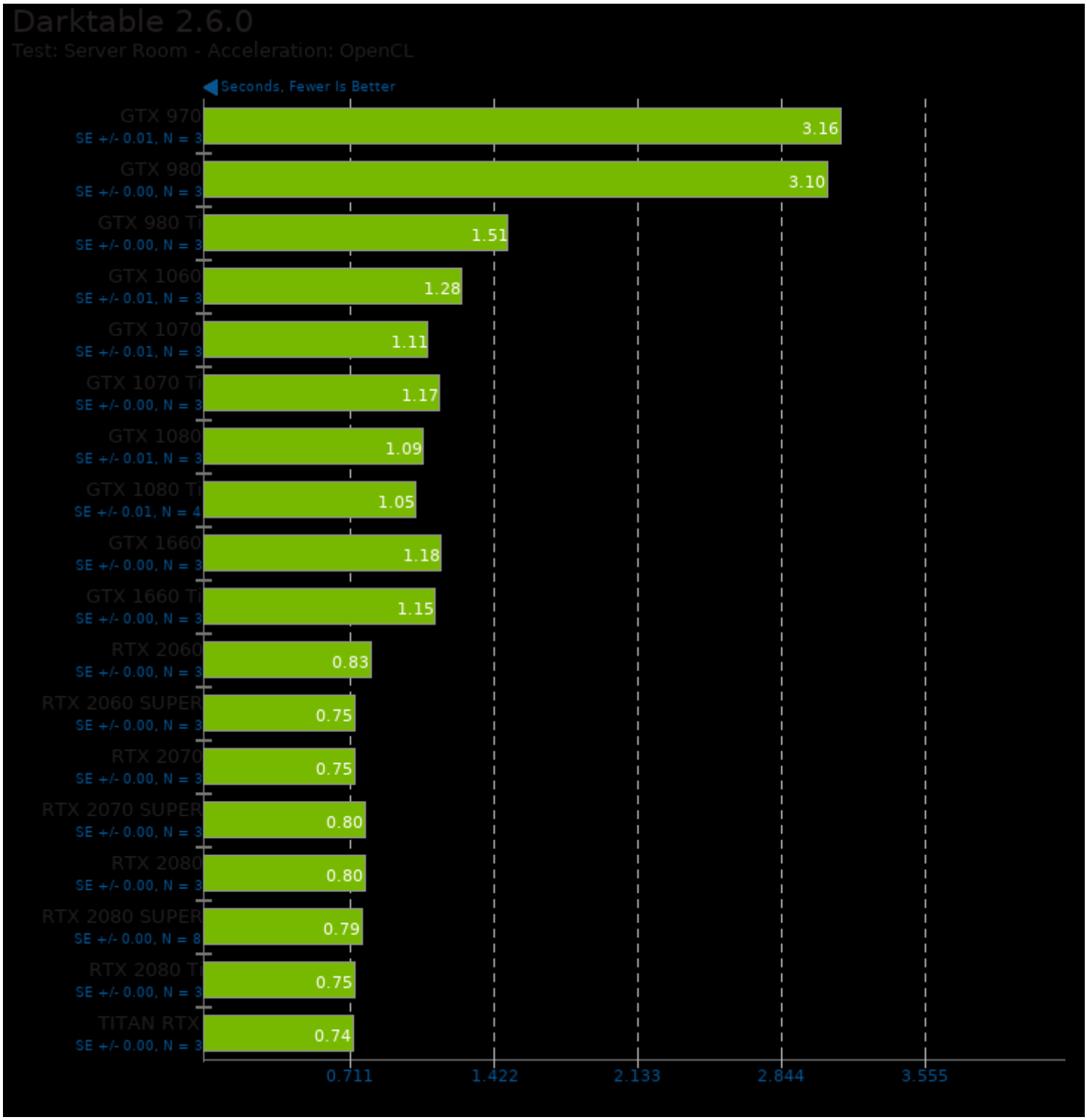
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



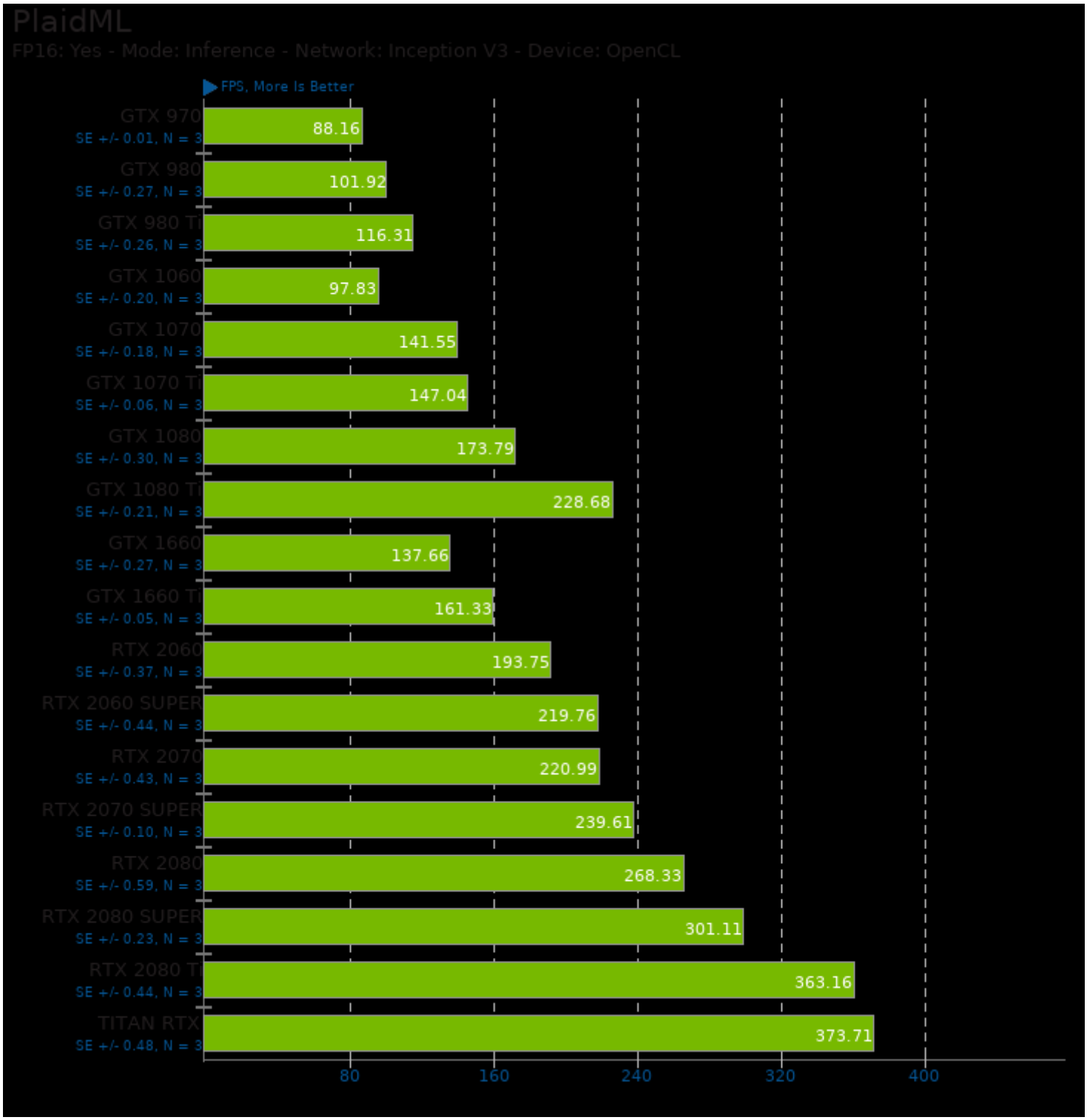
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



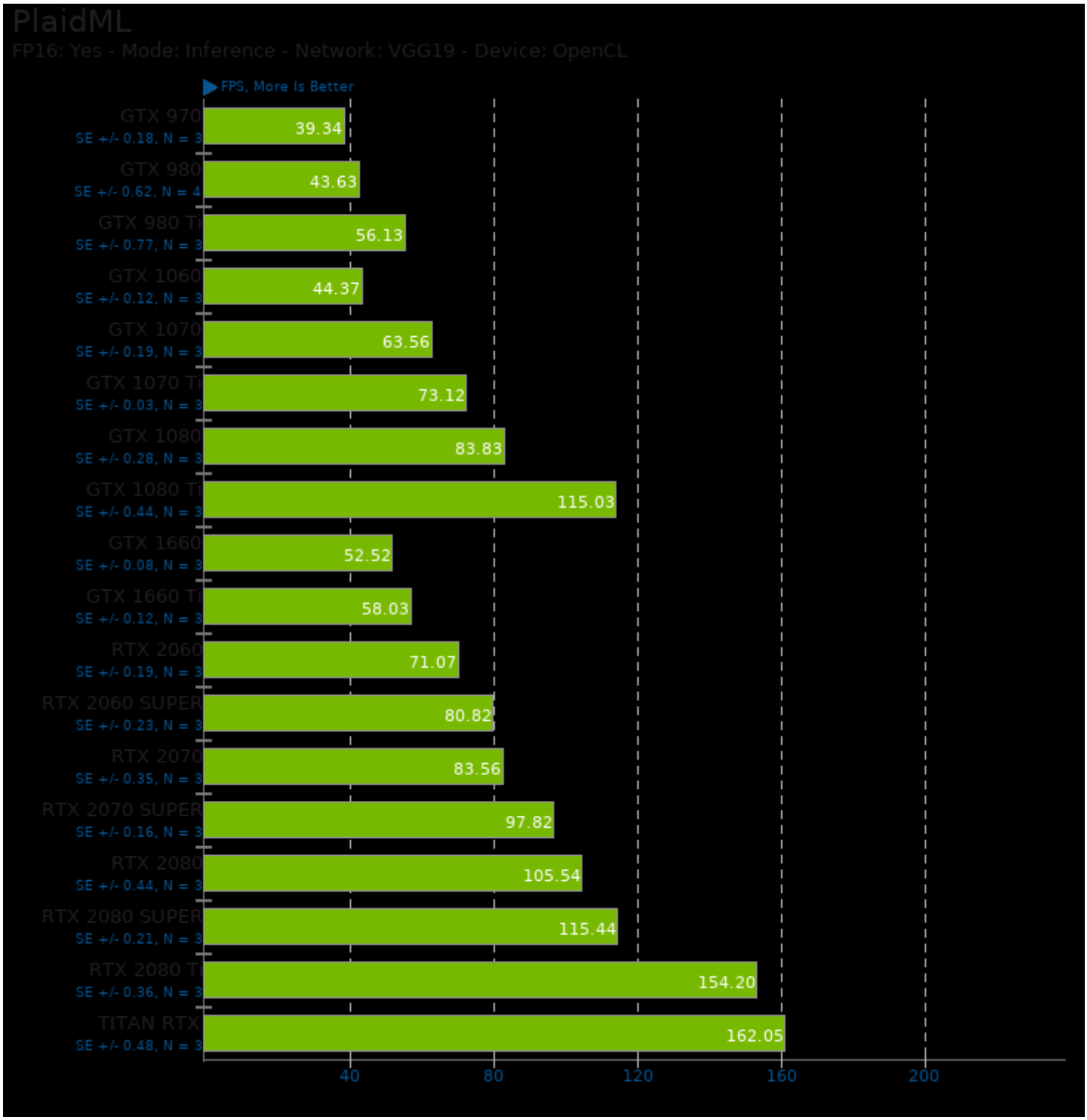
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



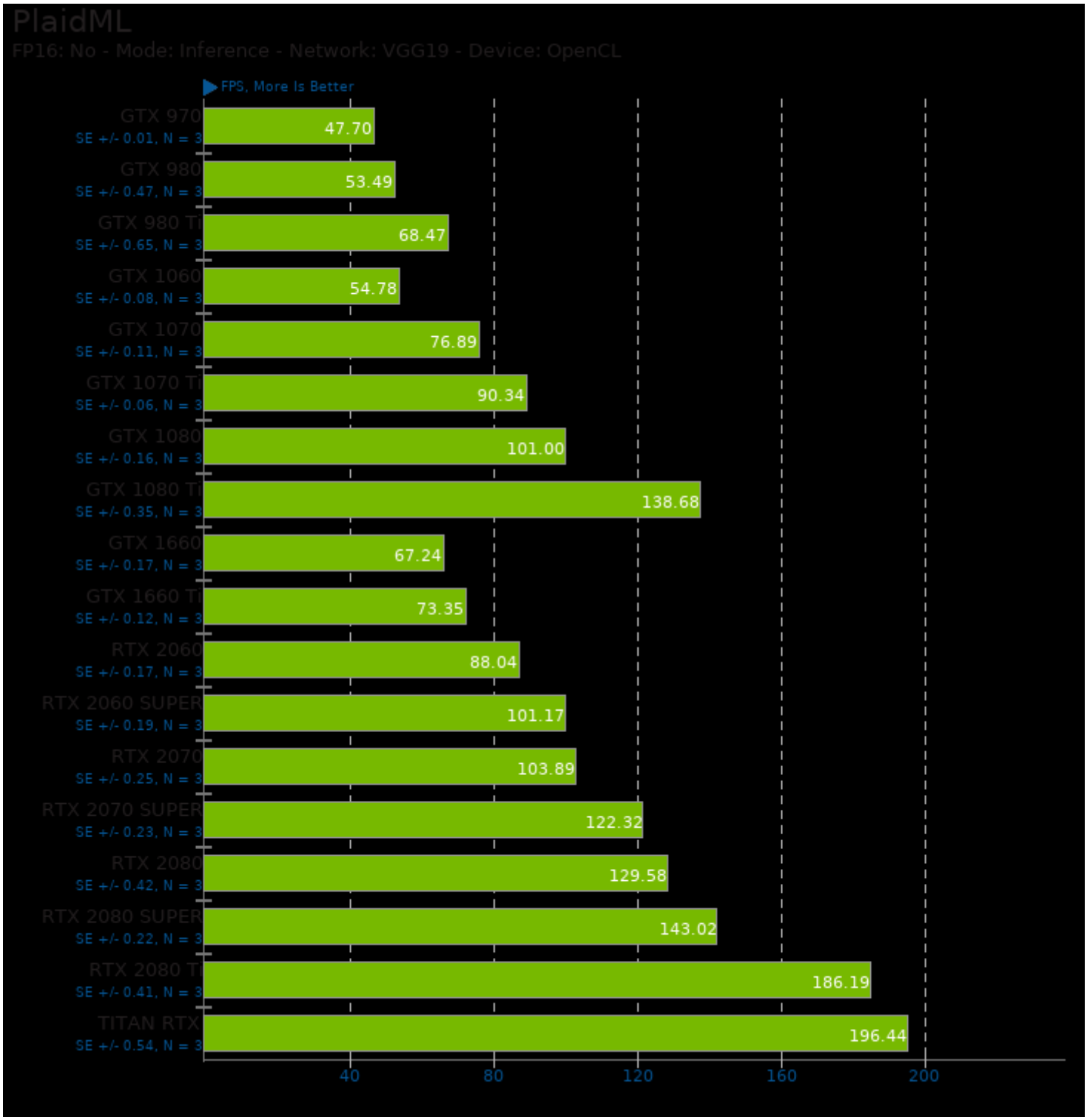
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



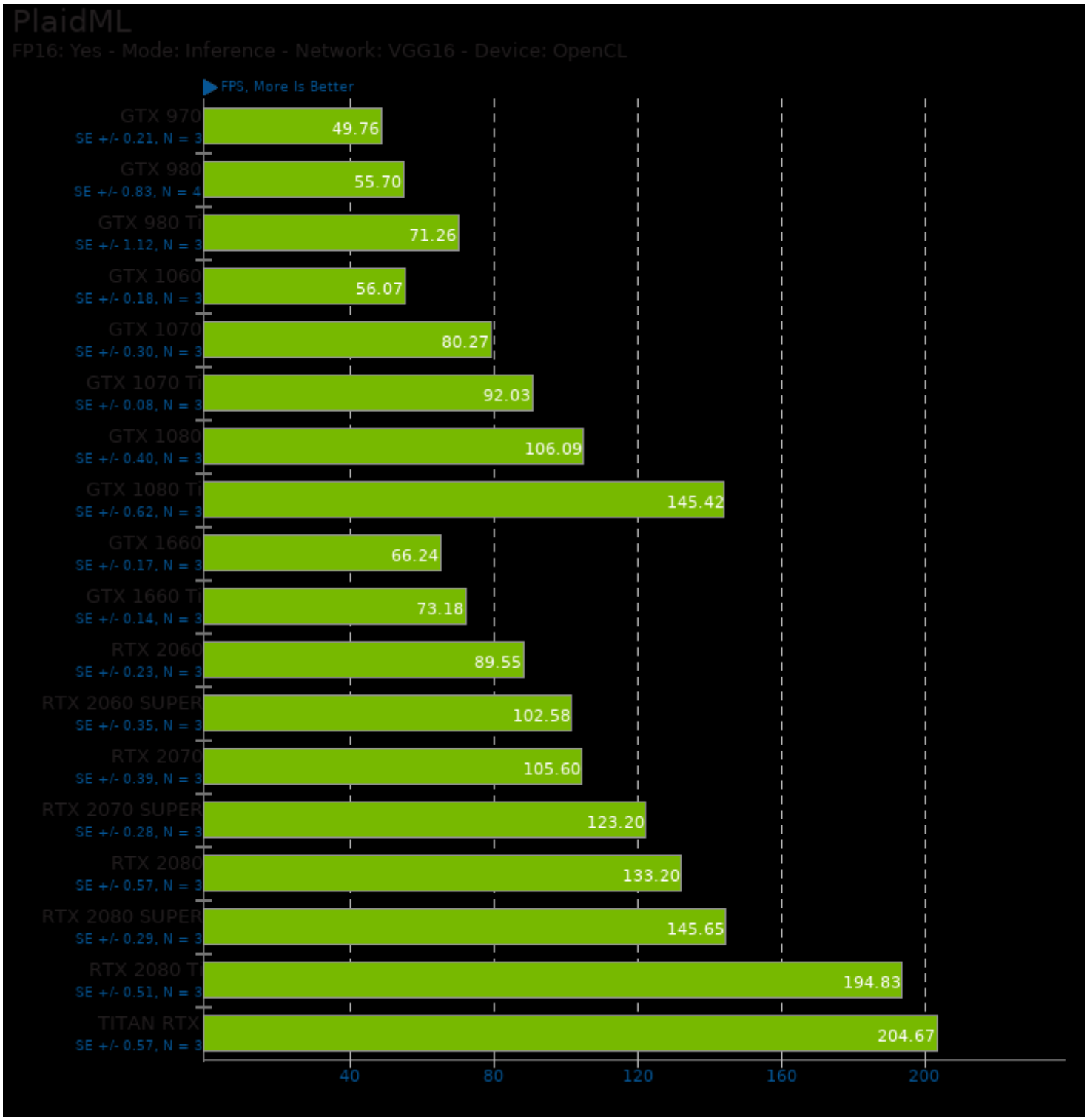
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



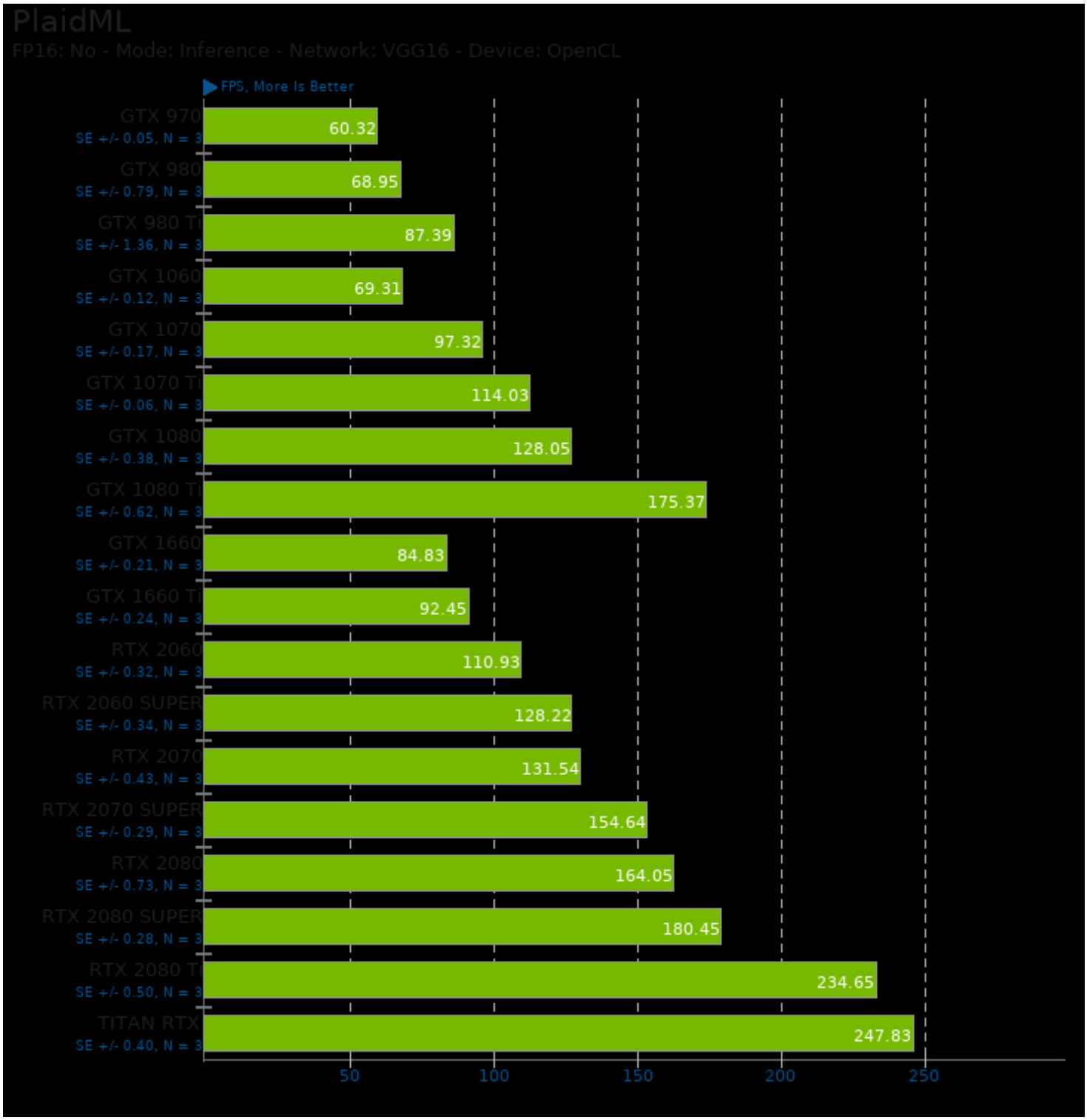
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



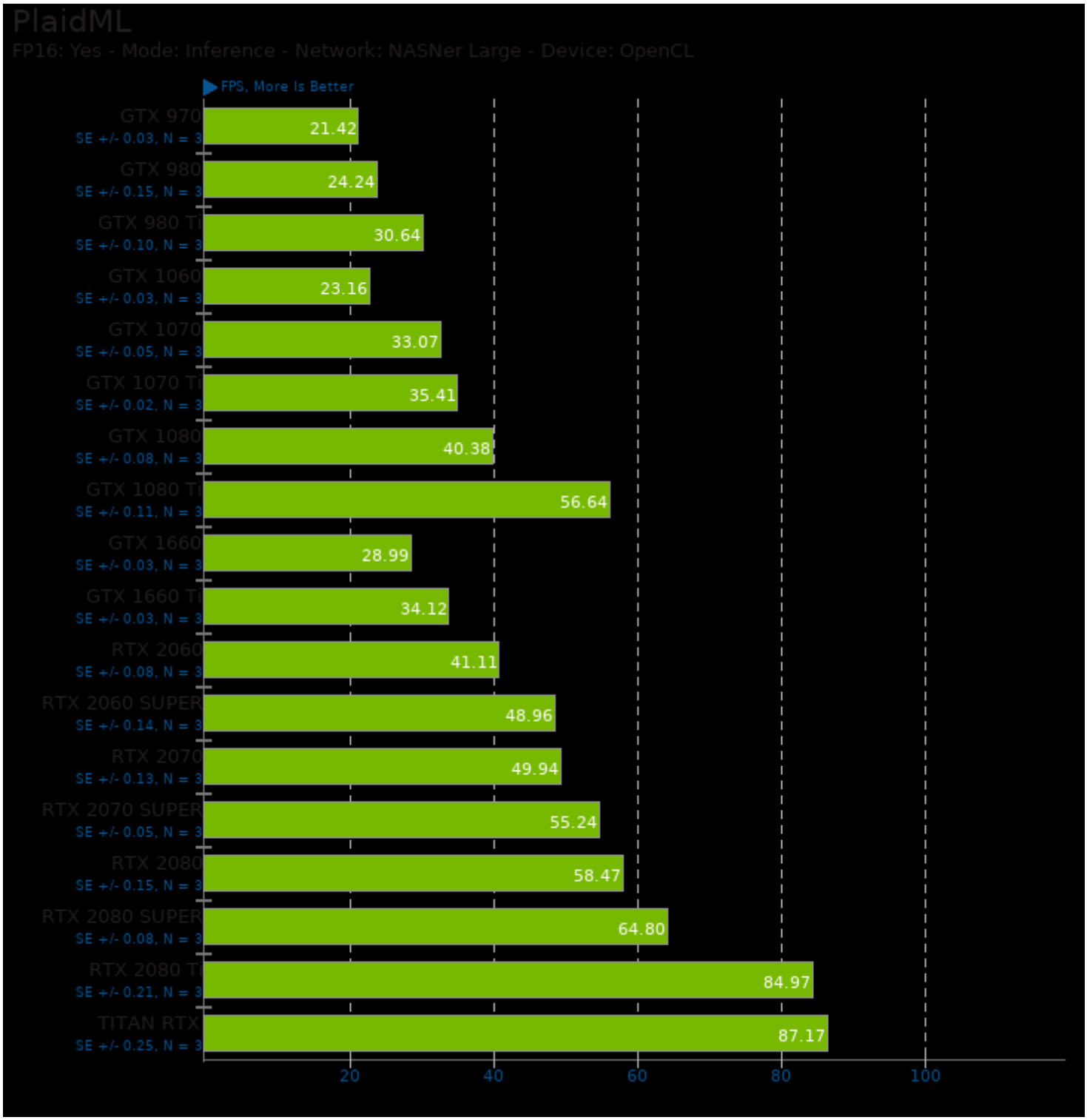
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



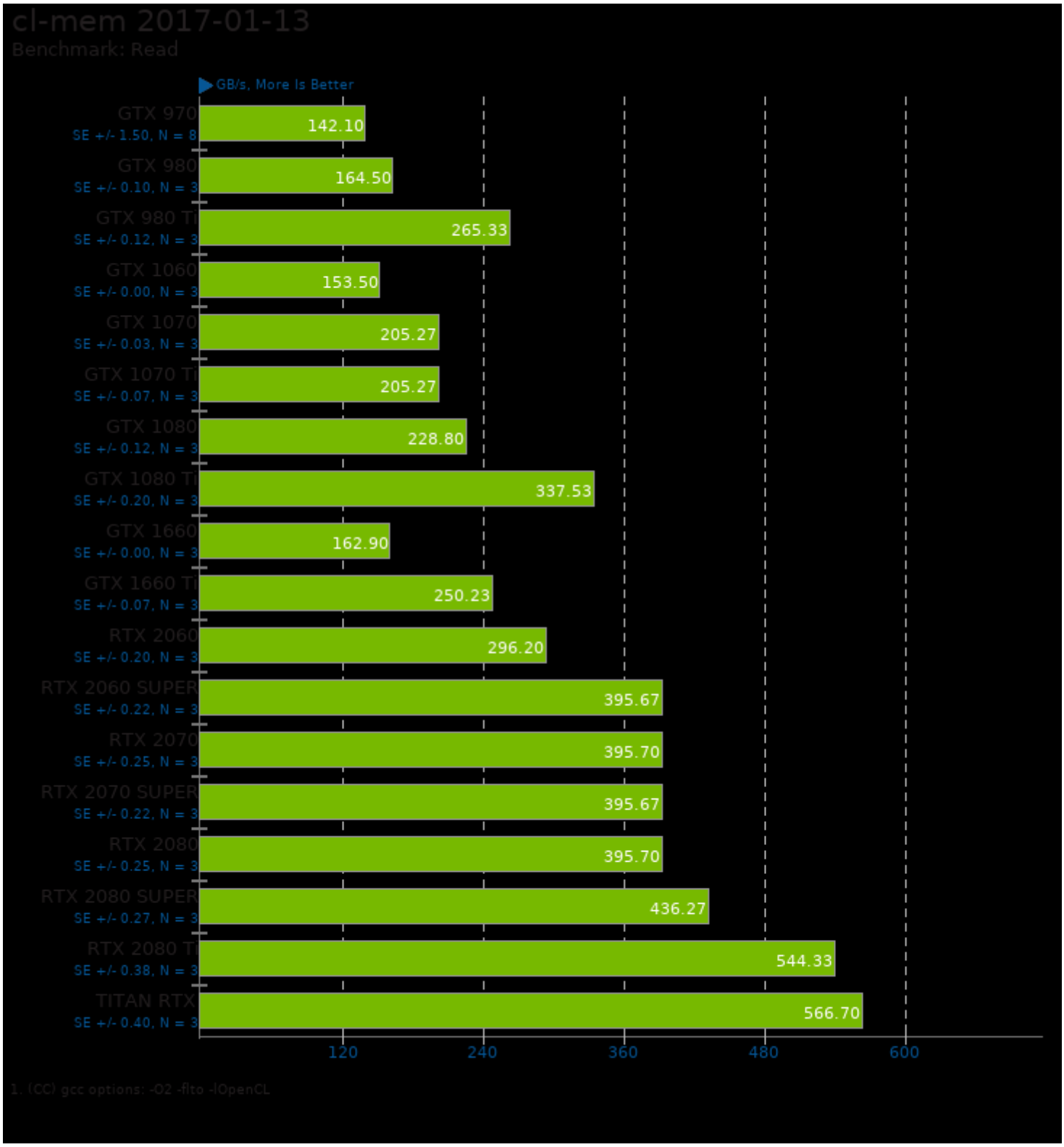
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



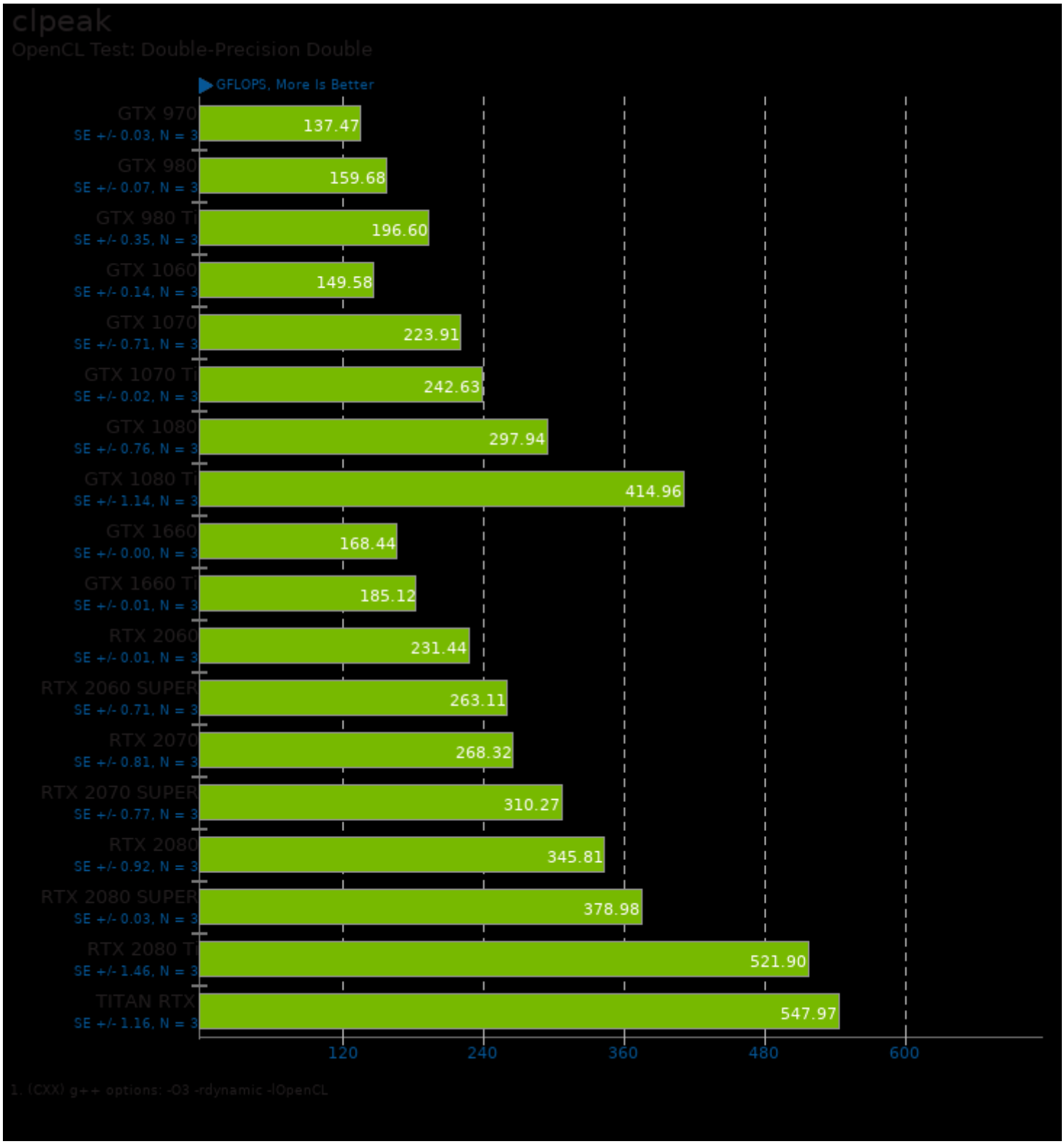
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



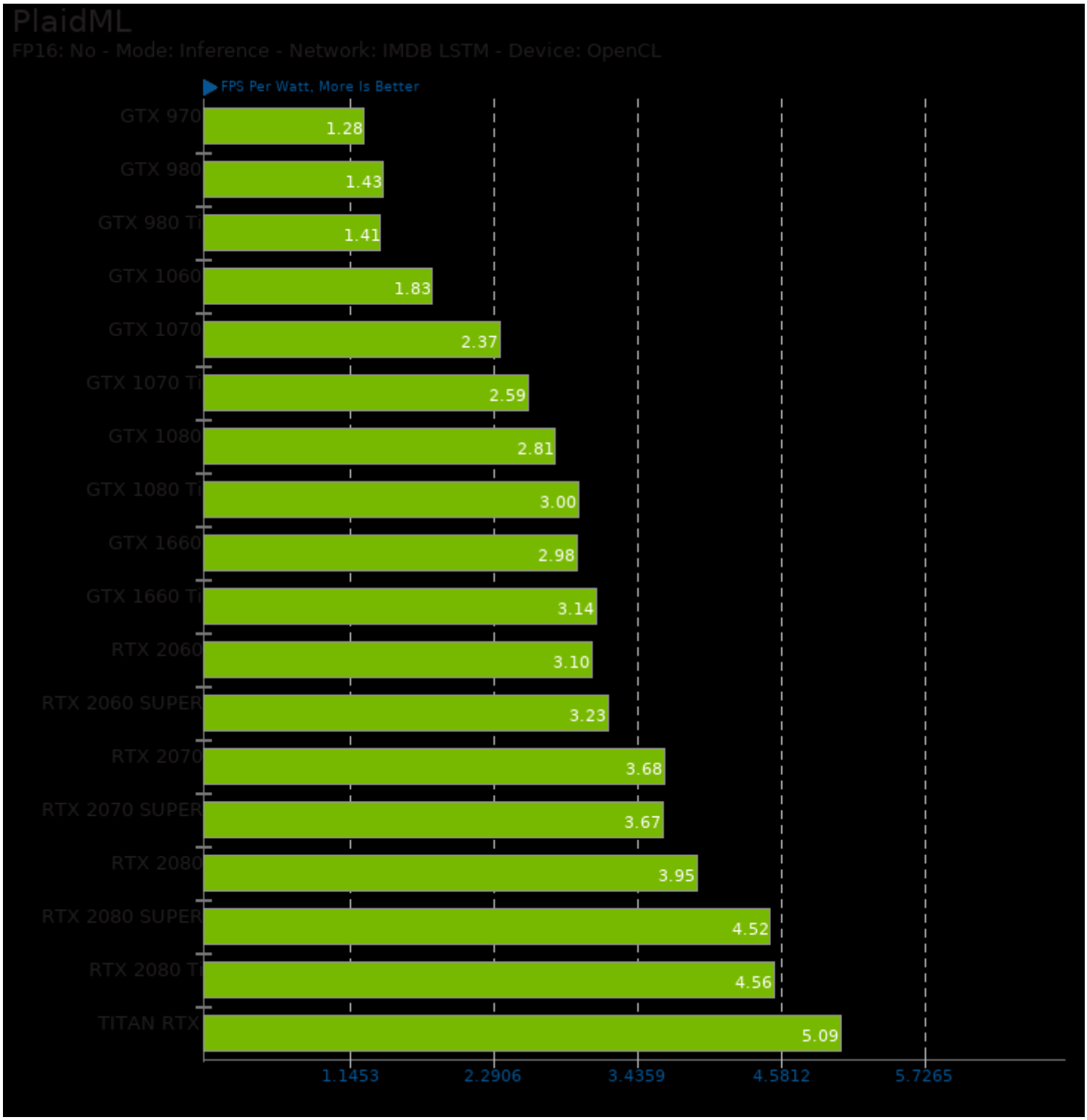
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



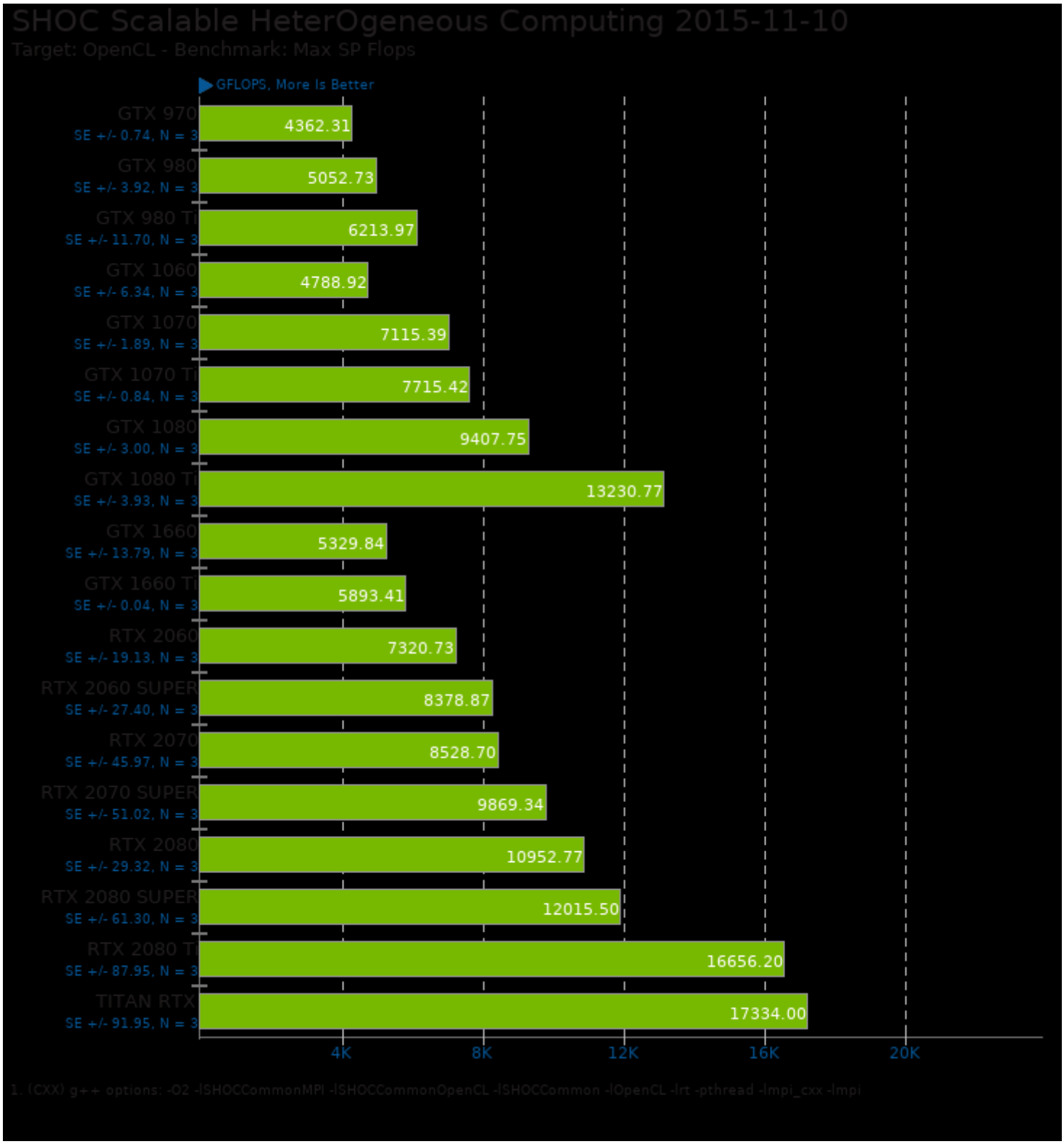
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



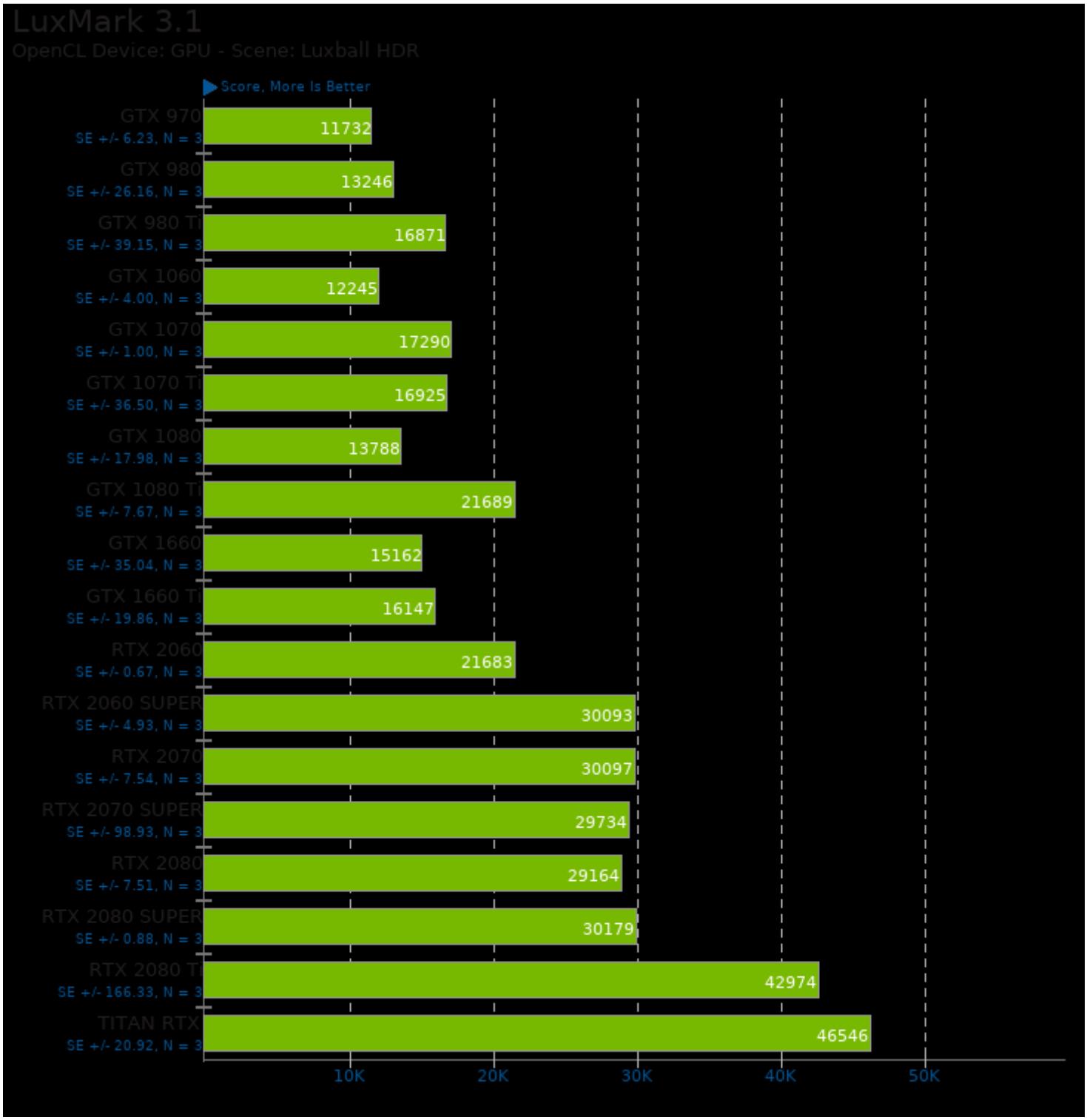
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



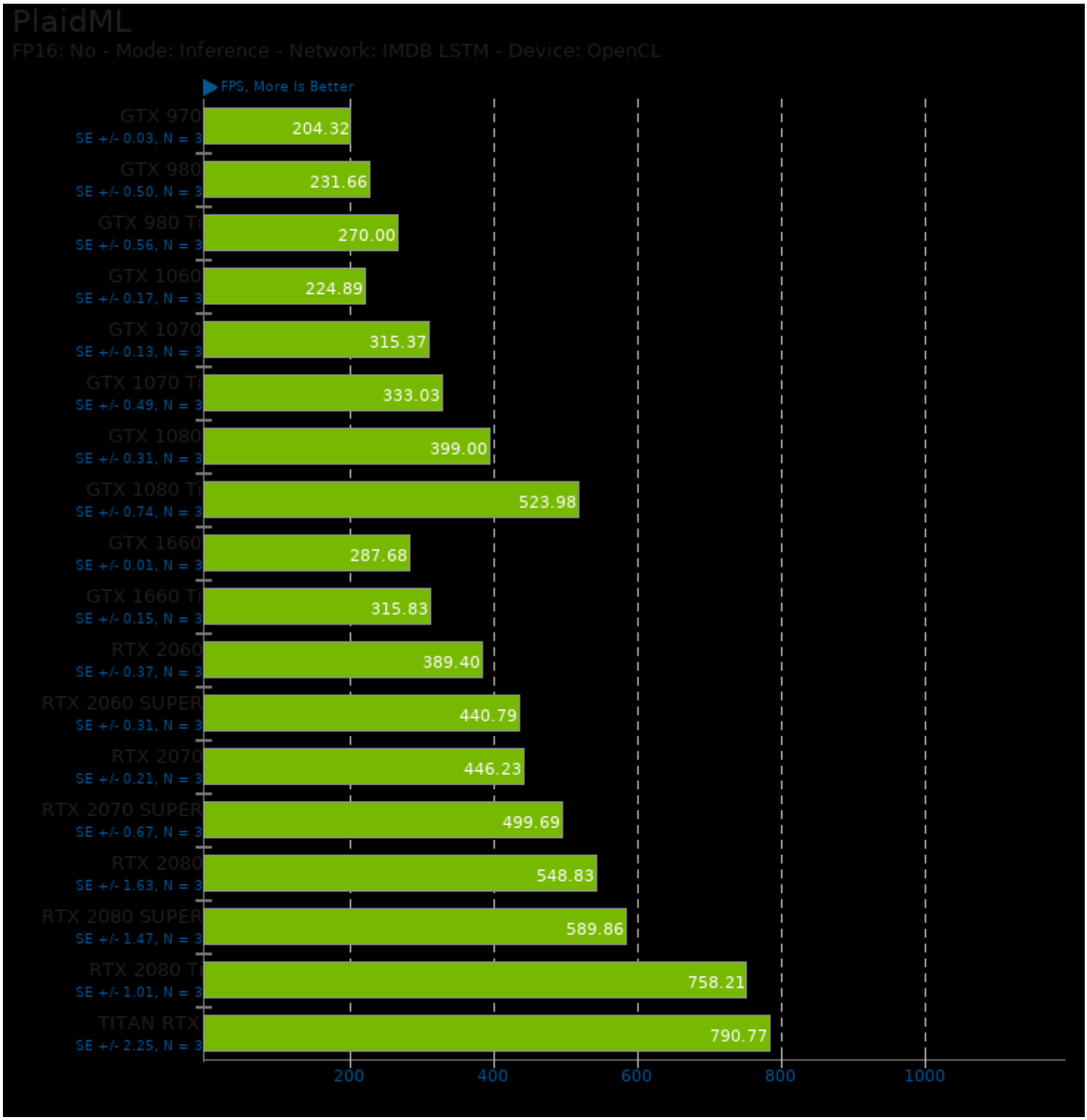
NVIDIA Linux OpenCL CUDA RTX SUPER Compute

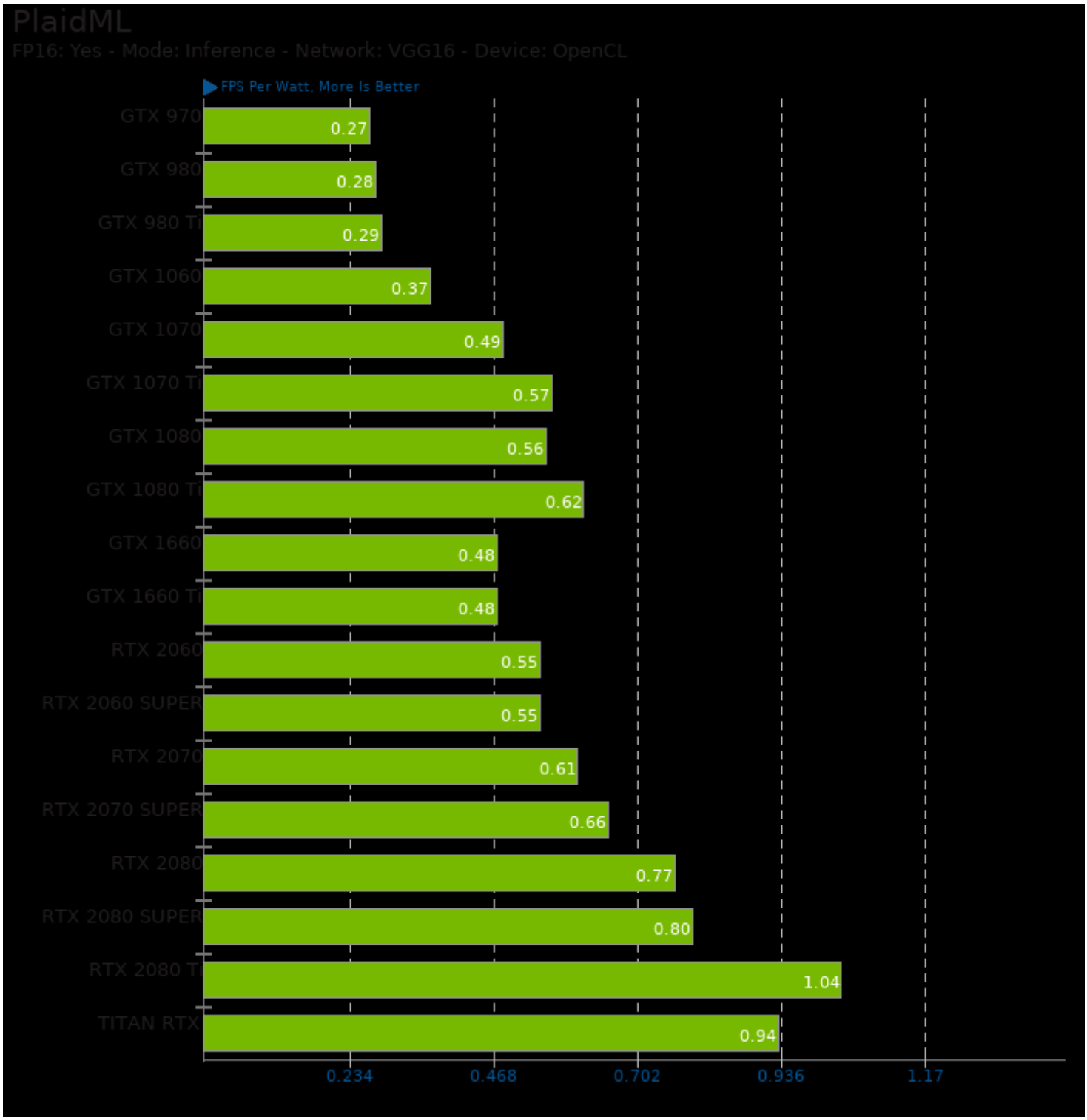


NVIDIA Linux OpenCL CUDA RTX SUPER Compute

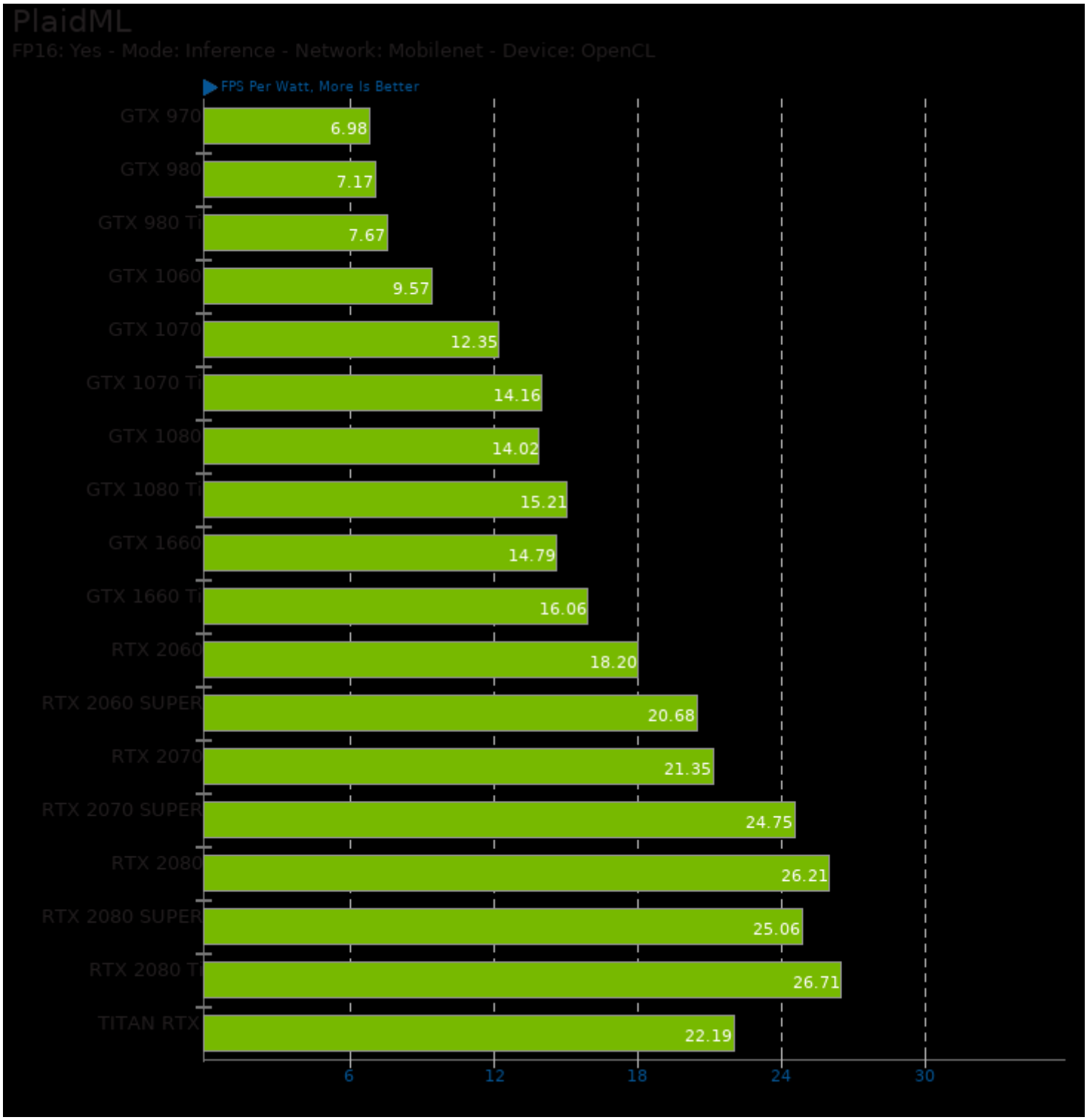


NVIDIA Linux OpenCL CUDA RTX SUPER Compute

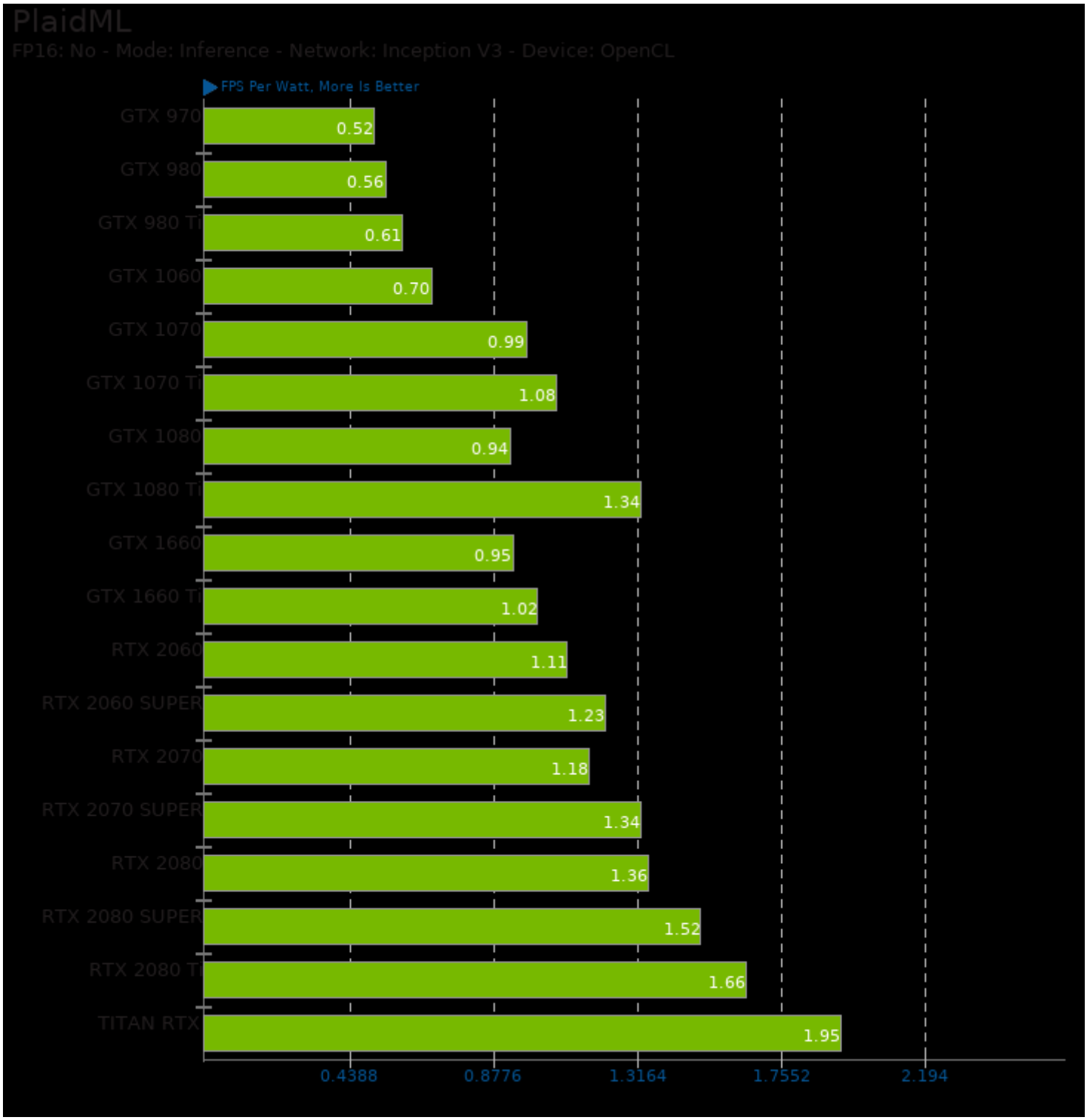



PlaidML
FP16: Yes - Mode: Inference - Network: VGG16 - Device: OpenCL
FPS Per Watt, More Is Better
GTX 970
0.27
GTX 980
0.28
GTX 980 Ti
0.29
GTX 1060
0.37
GTX 1070
0.49
GTX 1070 Ti
0.57
GTX 1080
0.56
GTX 1080 Ti
0.62
GTX 1660
0.48
GTX 1660 Ti
0.48
RTX 2060
0.55
RTX 2060 SUPER
0.55
RTX 2070
0.61
RTX 2070 SUPER
0.66
RTX 2080
0.77
RTX 2080 SUPER
0.80
RTX 2080 Ti
1.04
TITAN RTX
0.94
0.234
0.468
0.702
0.936
1.17

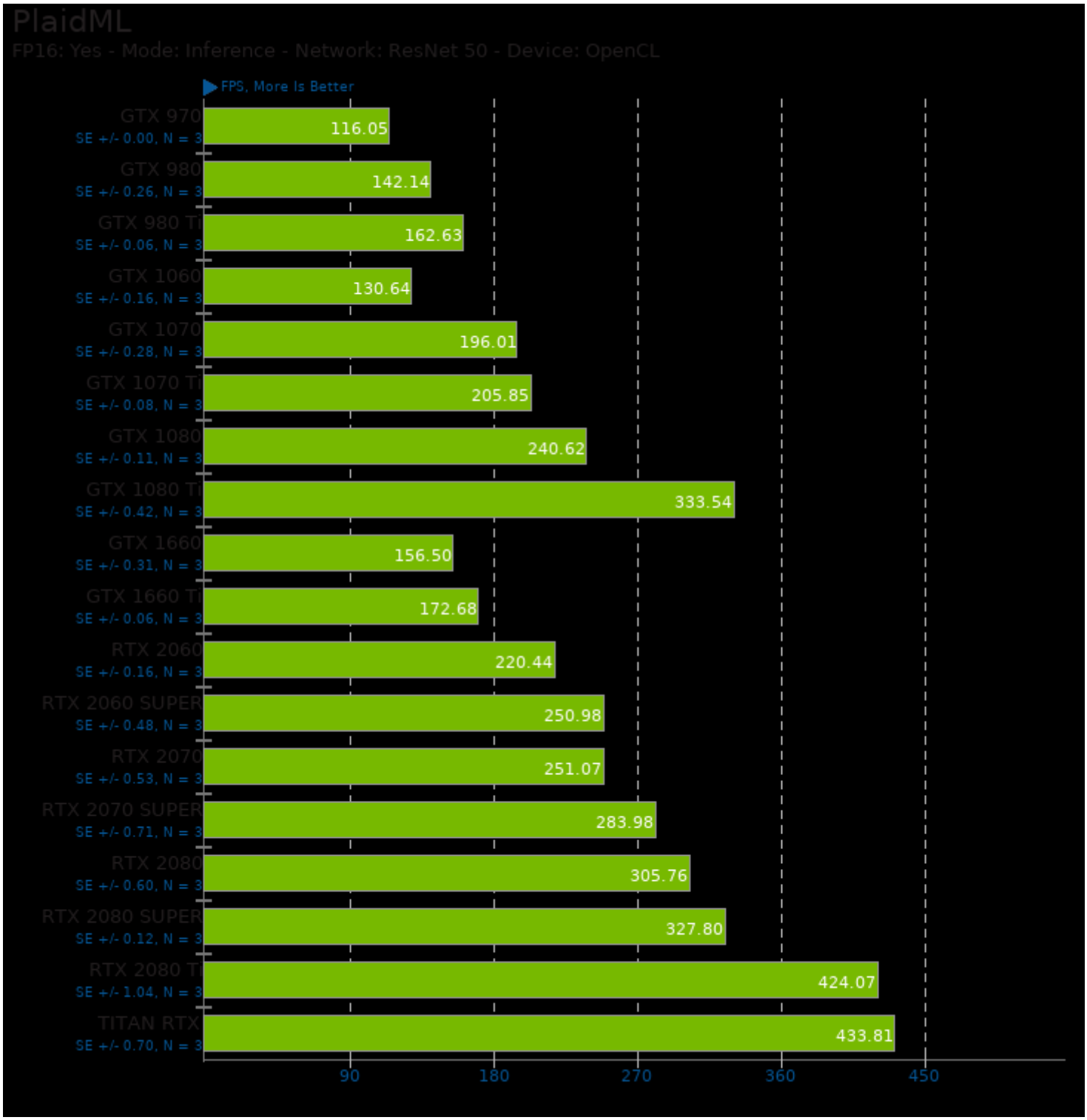
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



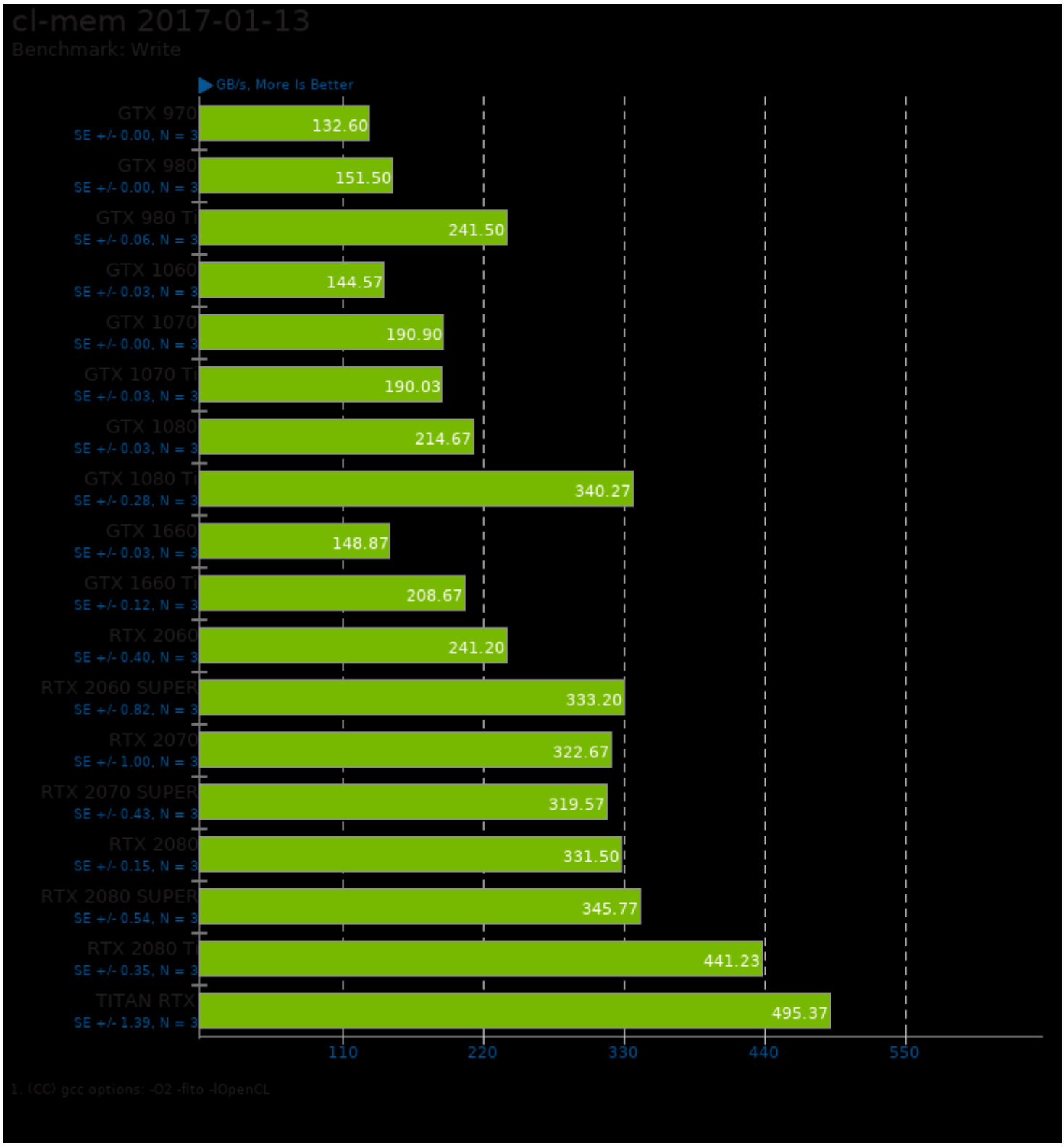
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



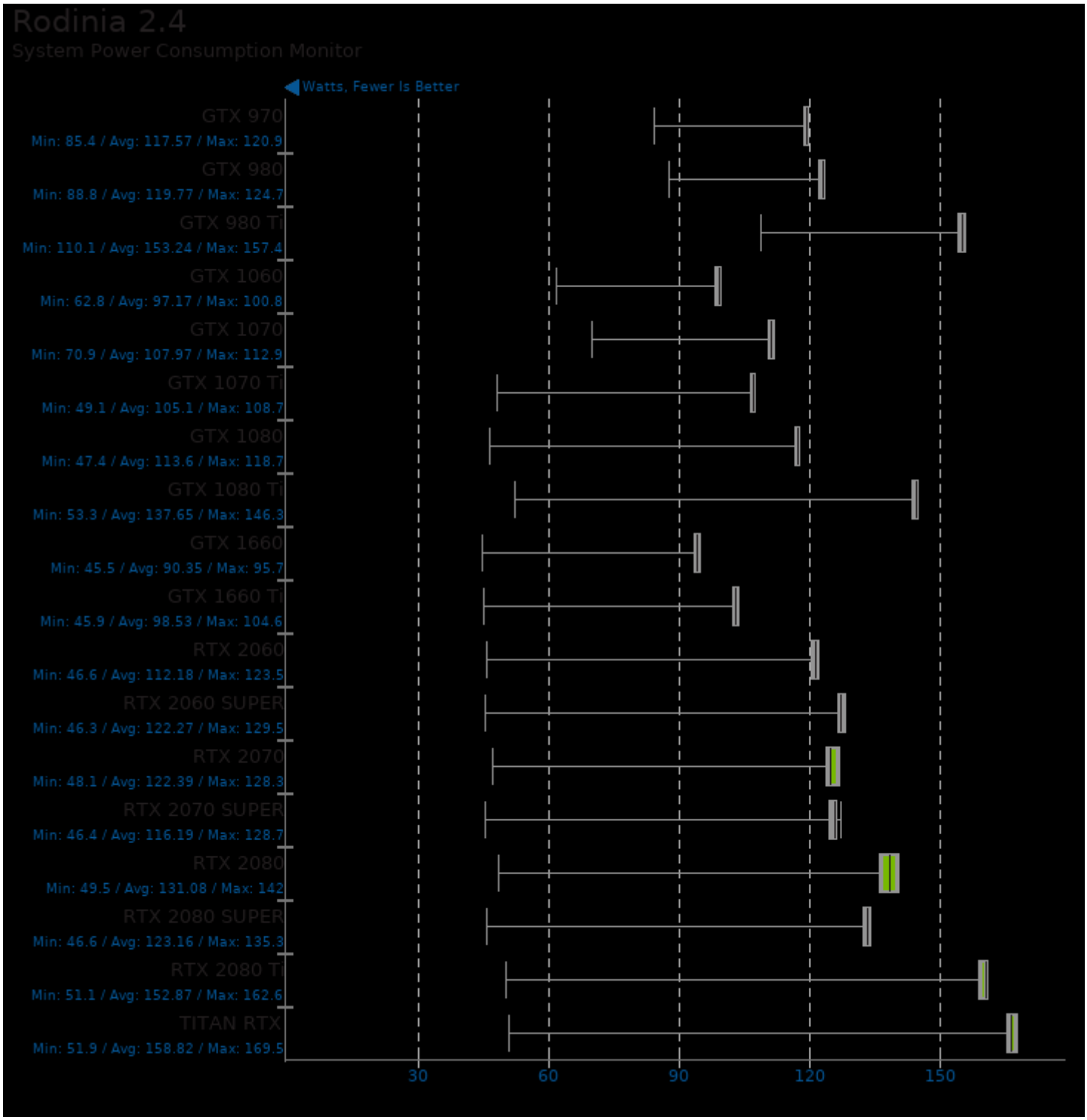
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



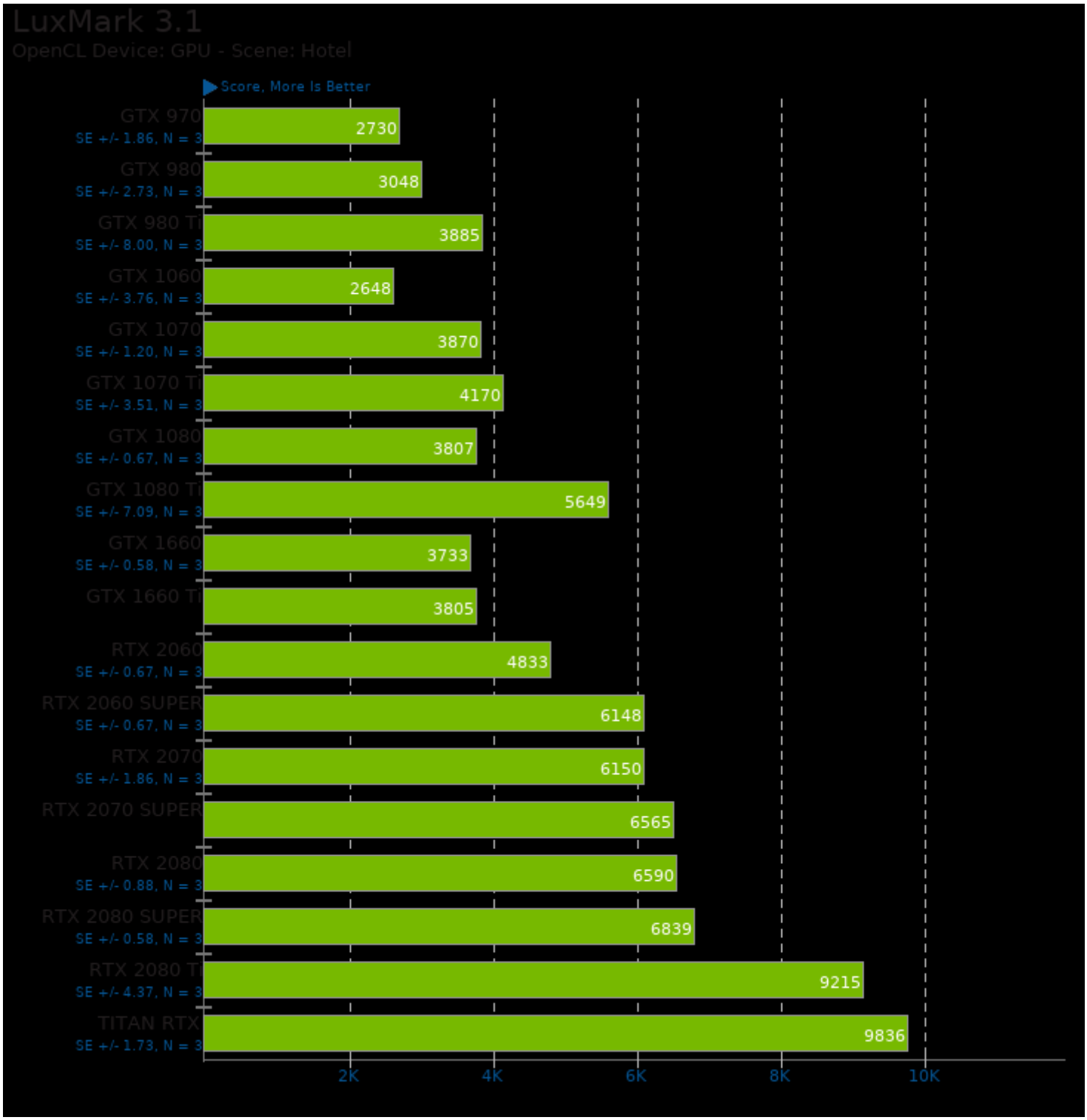
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



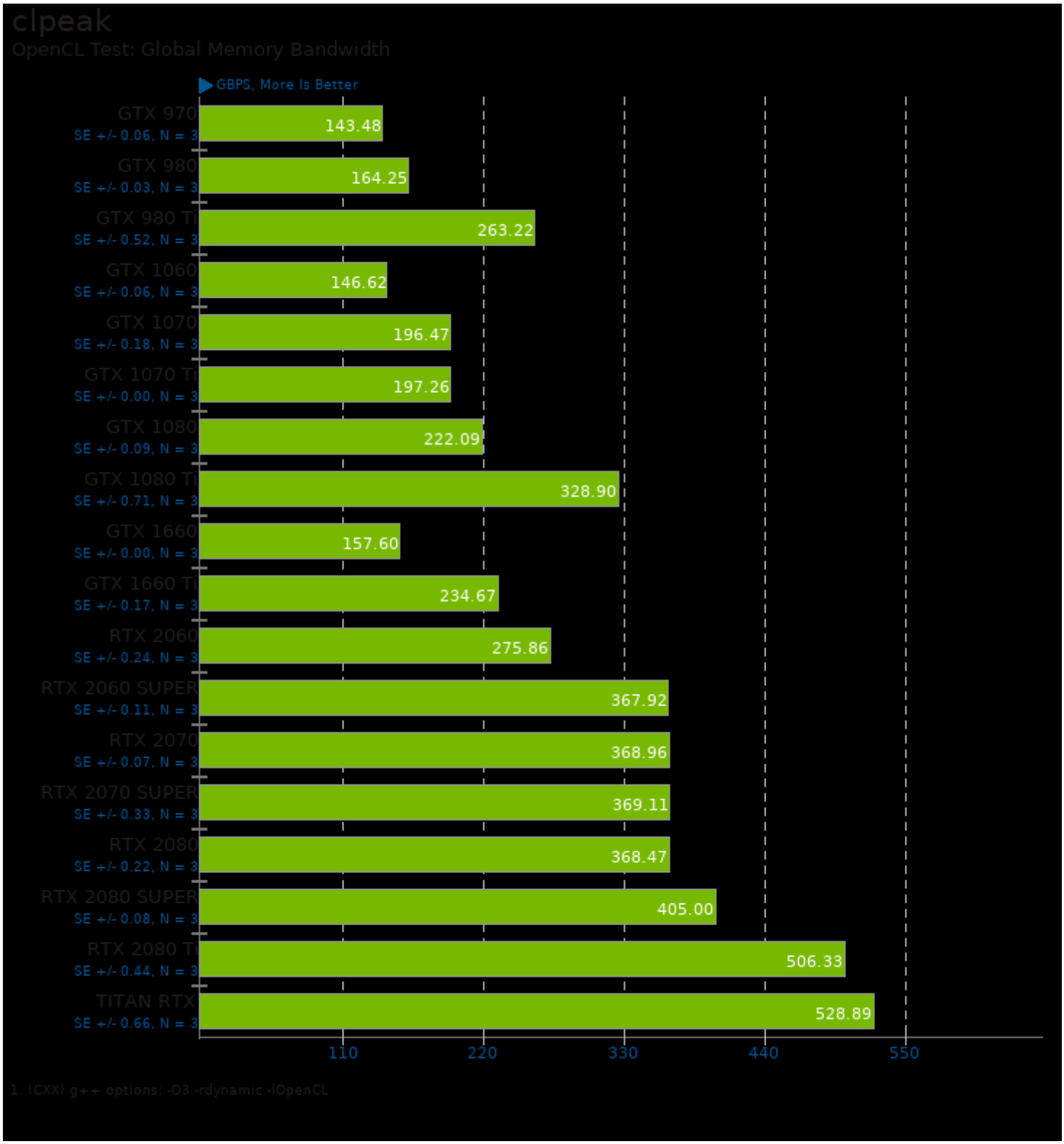
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



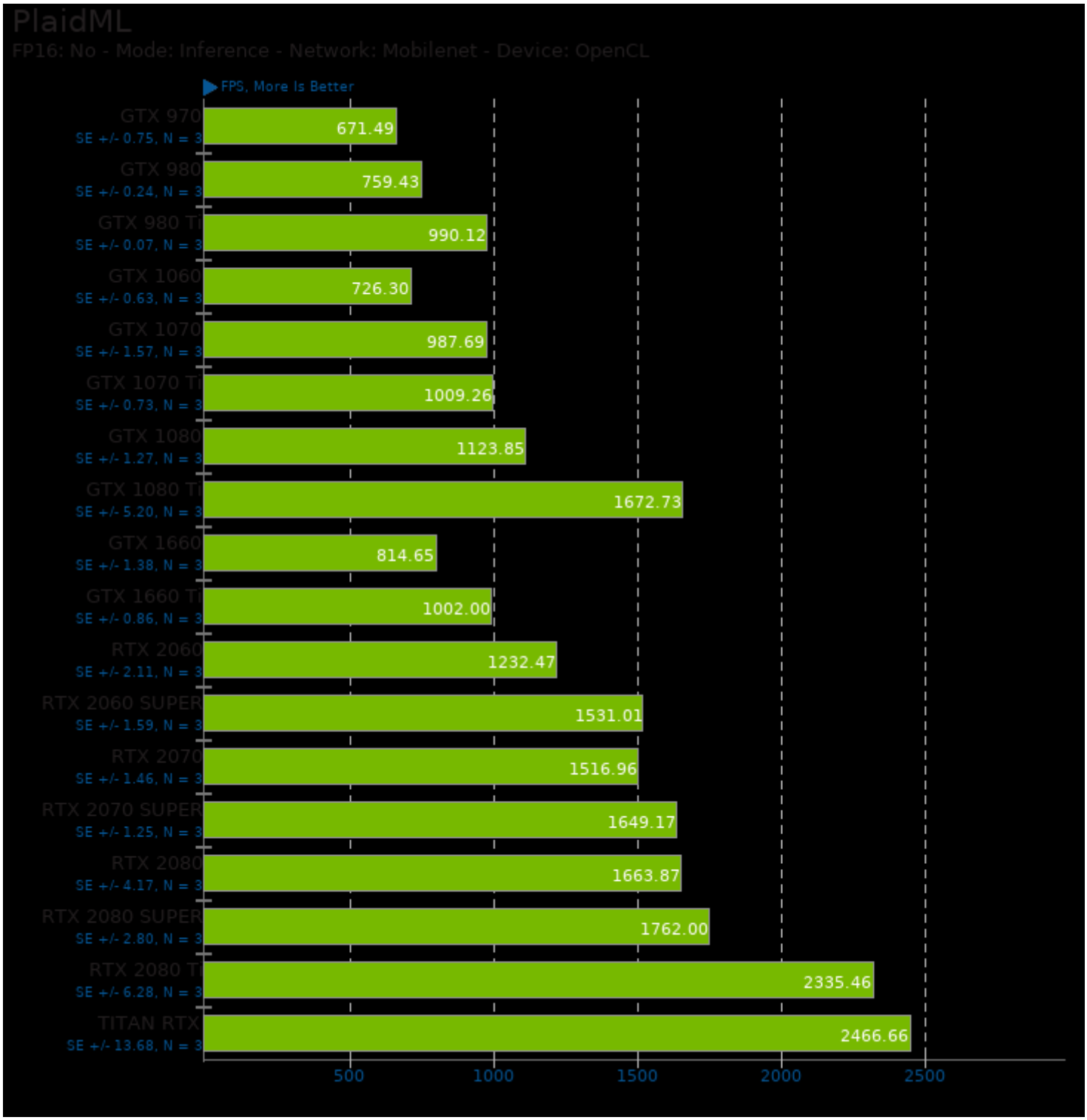
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



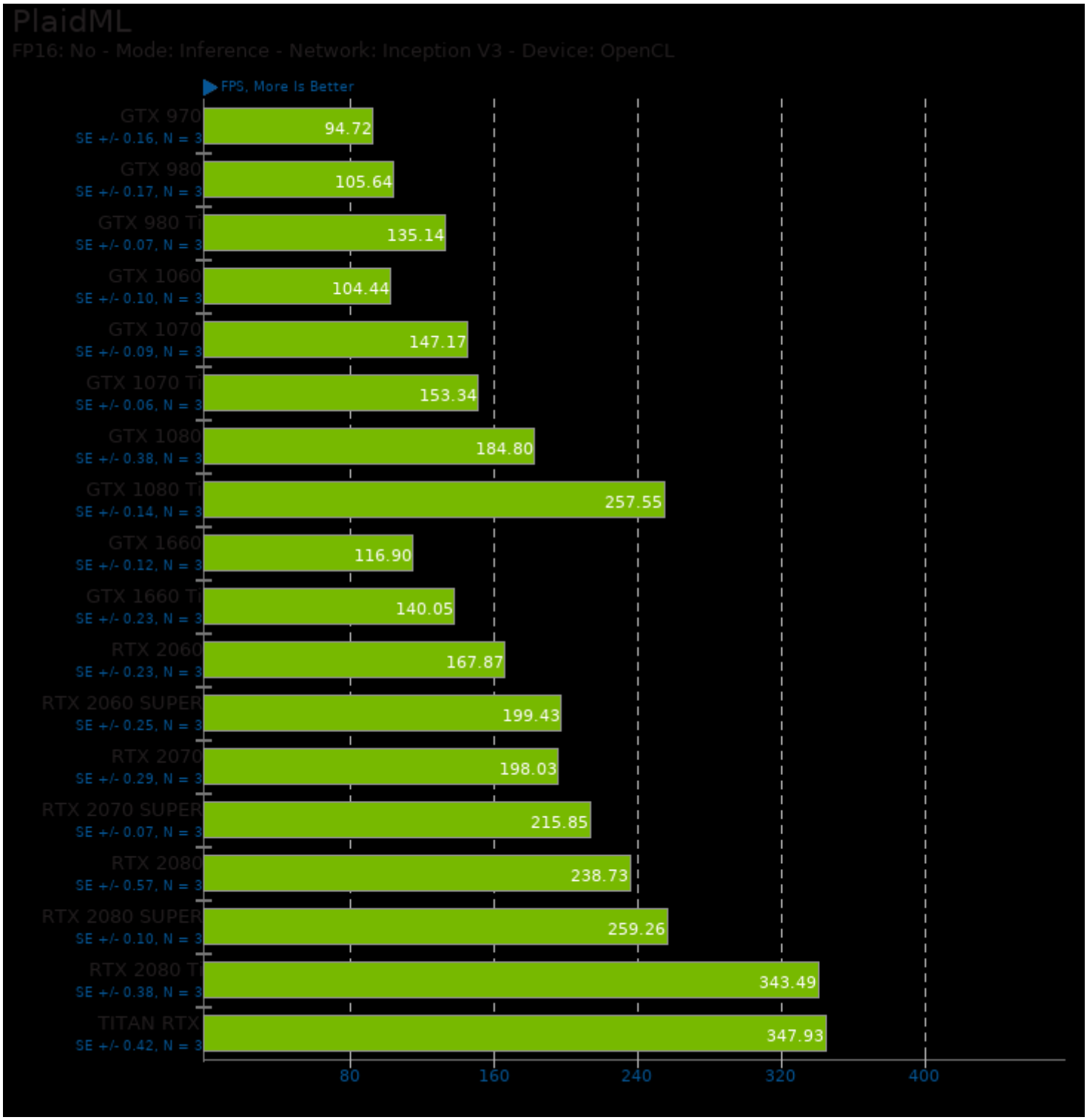
NVIDIA Linux OpenCL CUDA RTX SUPER Compute

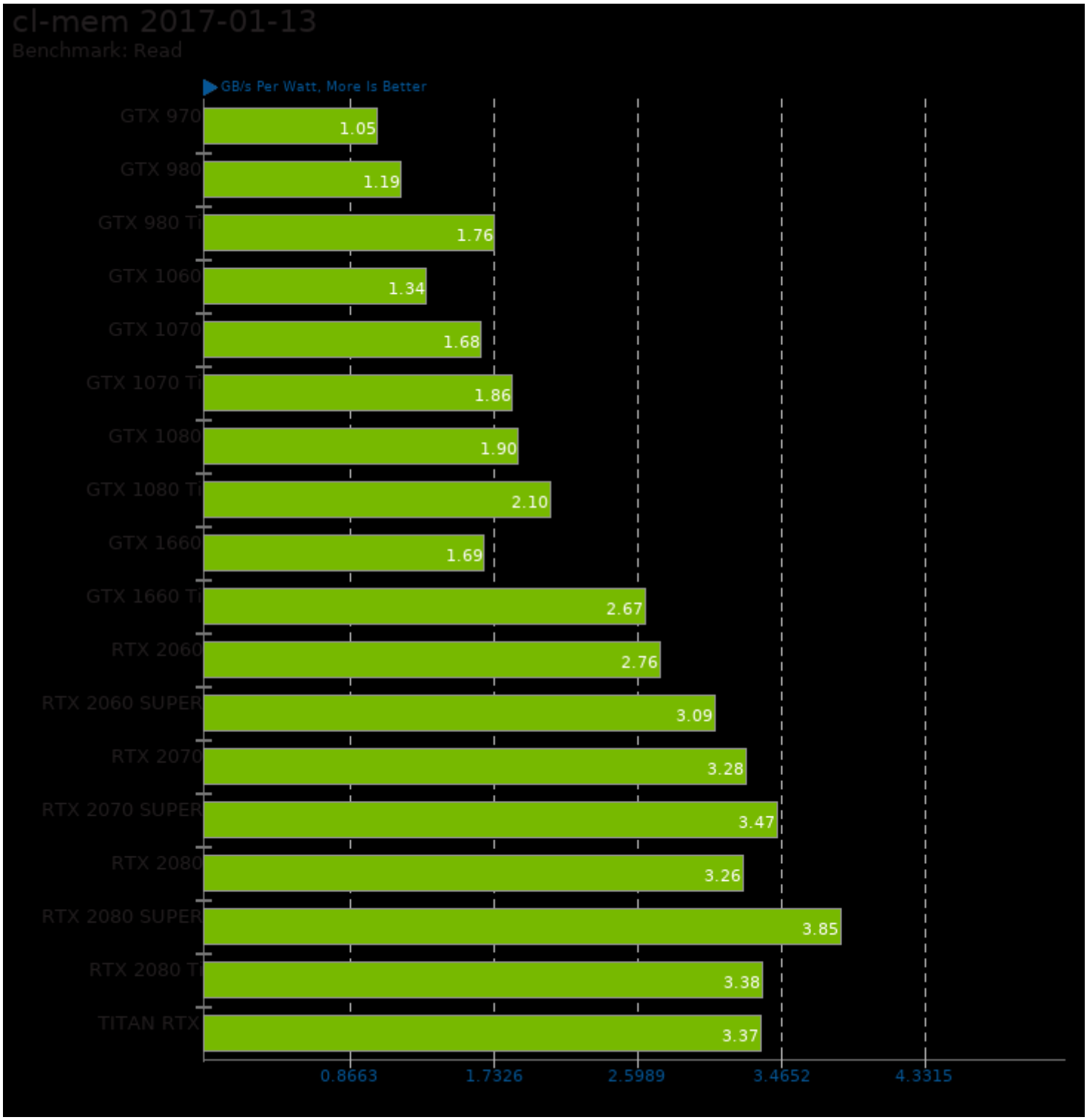


NVIDIA Linux OpenCL CUDA RTX SUPER Compute

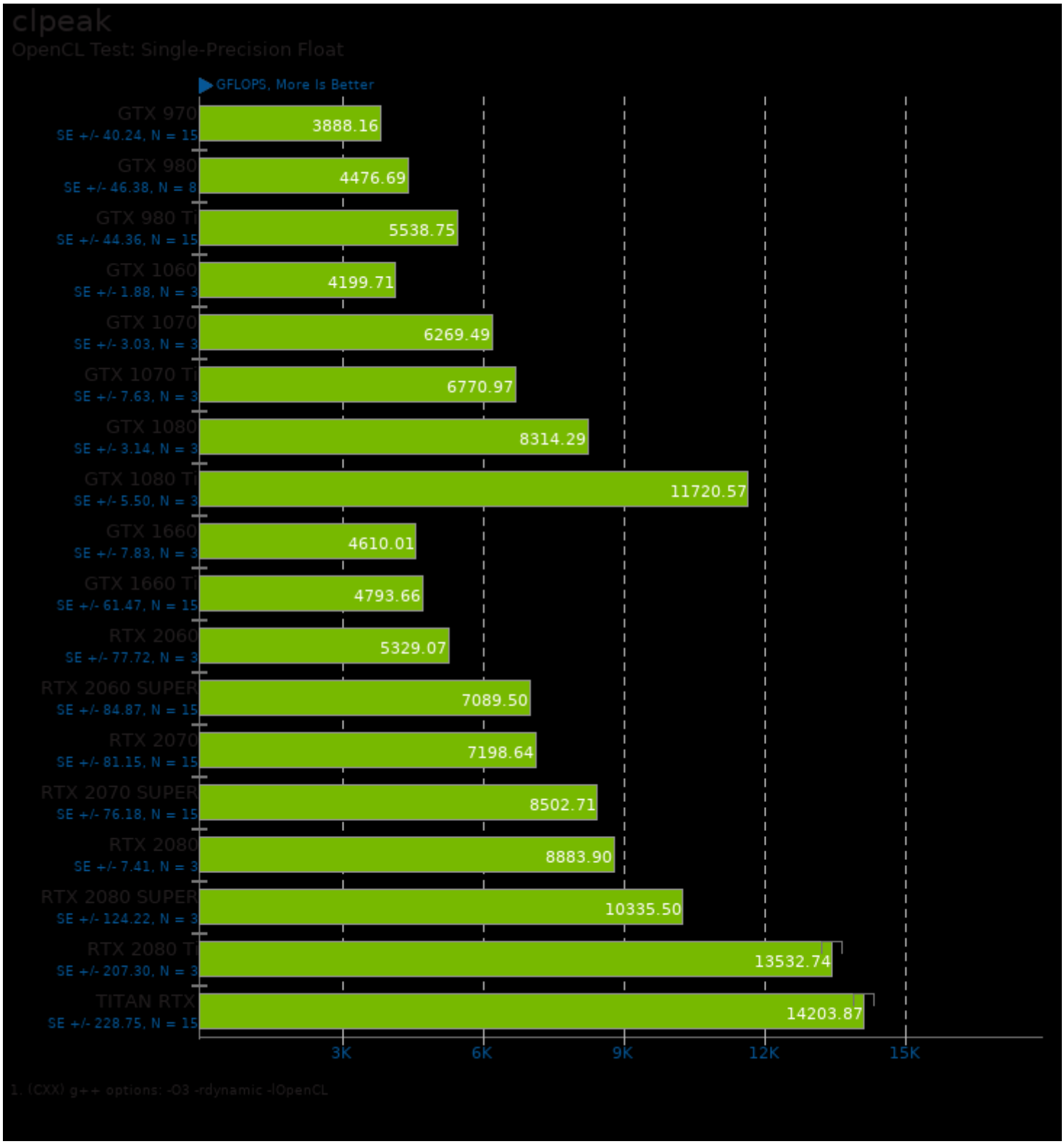


NVIDIA Linux OpenCL CUDA RTX SUPER Compute

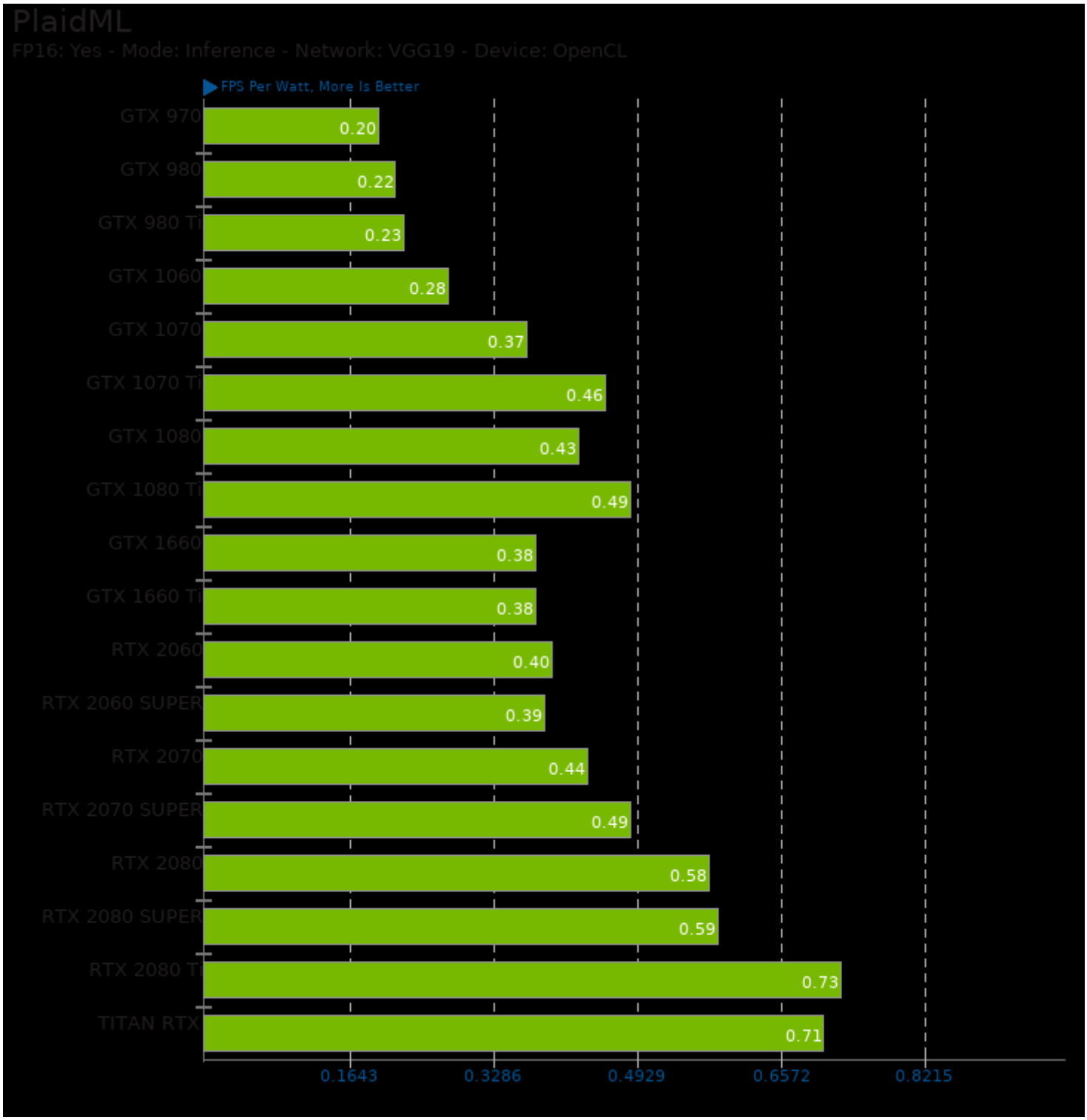


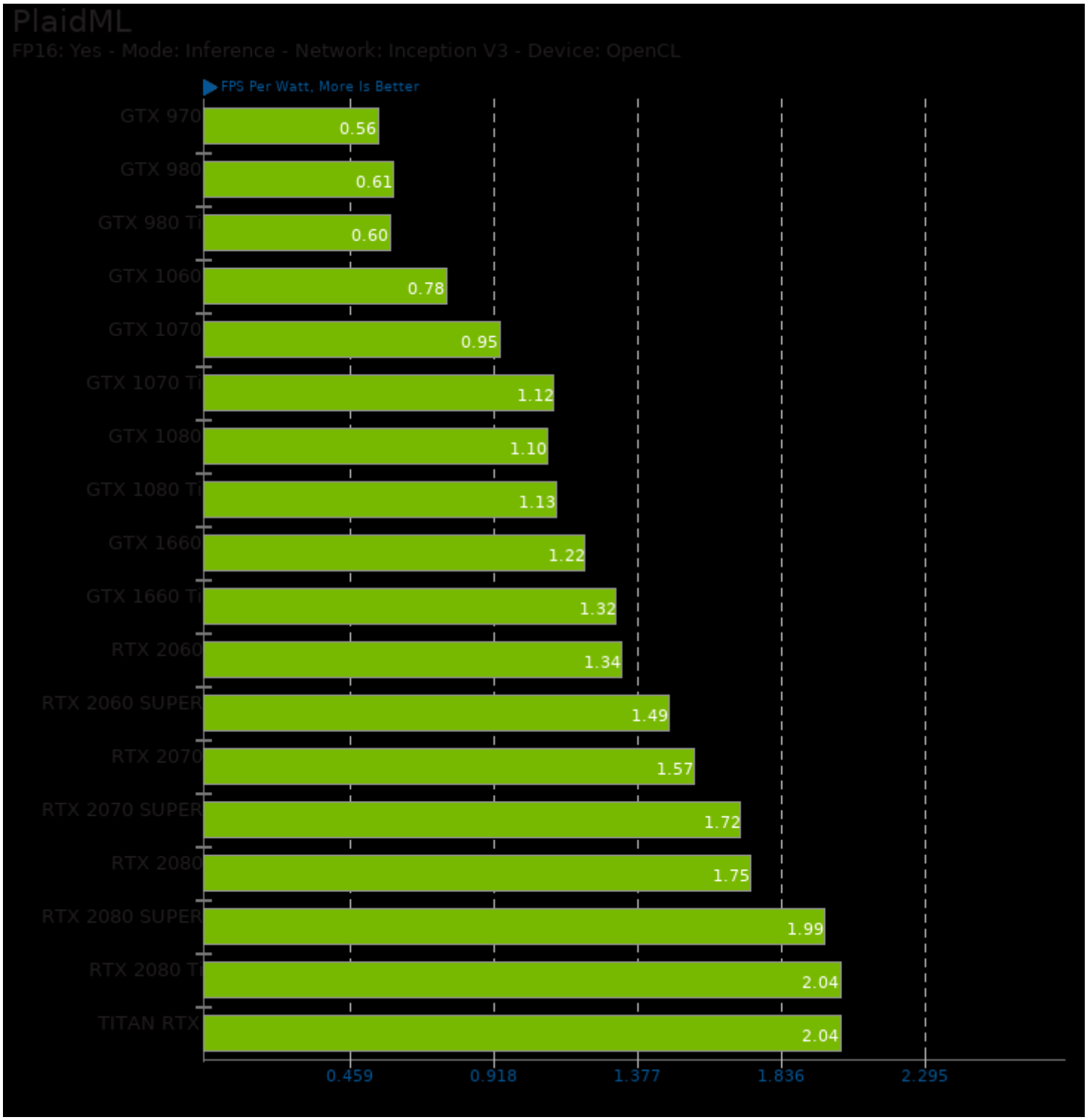

cl-mem 2017-01-13
Benchmark: Read
GB/s Per Watt, More Is Better
GTX 970
1.05
GTX 980
1.19
GTX 980 Ti
1.76
GTX 1060
1.34
GTX 1070
1.68
GTX 1070 Ti
1.86
GTX 1080
1.90
GTX 1080 Ti
2.10
GTX 1660
1.69
GTX 1660 Ti
2.67
RTX 2060
2.76
RTX 2060 SUPER
3.09
RTX 2070
3.28
RTX 2070 SUPER
3.47
RTX 2080
3.26
RTX 2080 SUPER
3.85
RTX 2080 Ti
3.38
TITAN RTX
3.37
0.8663
1.7326
2.5989
3.4652
4.3315

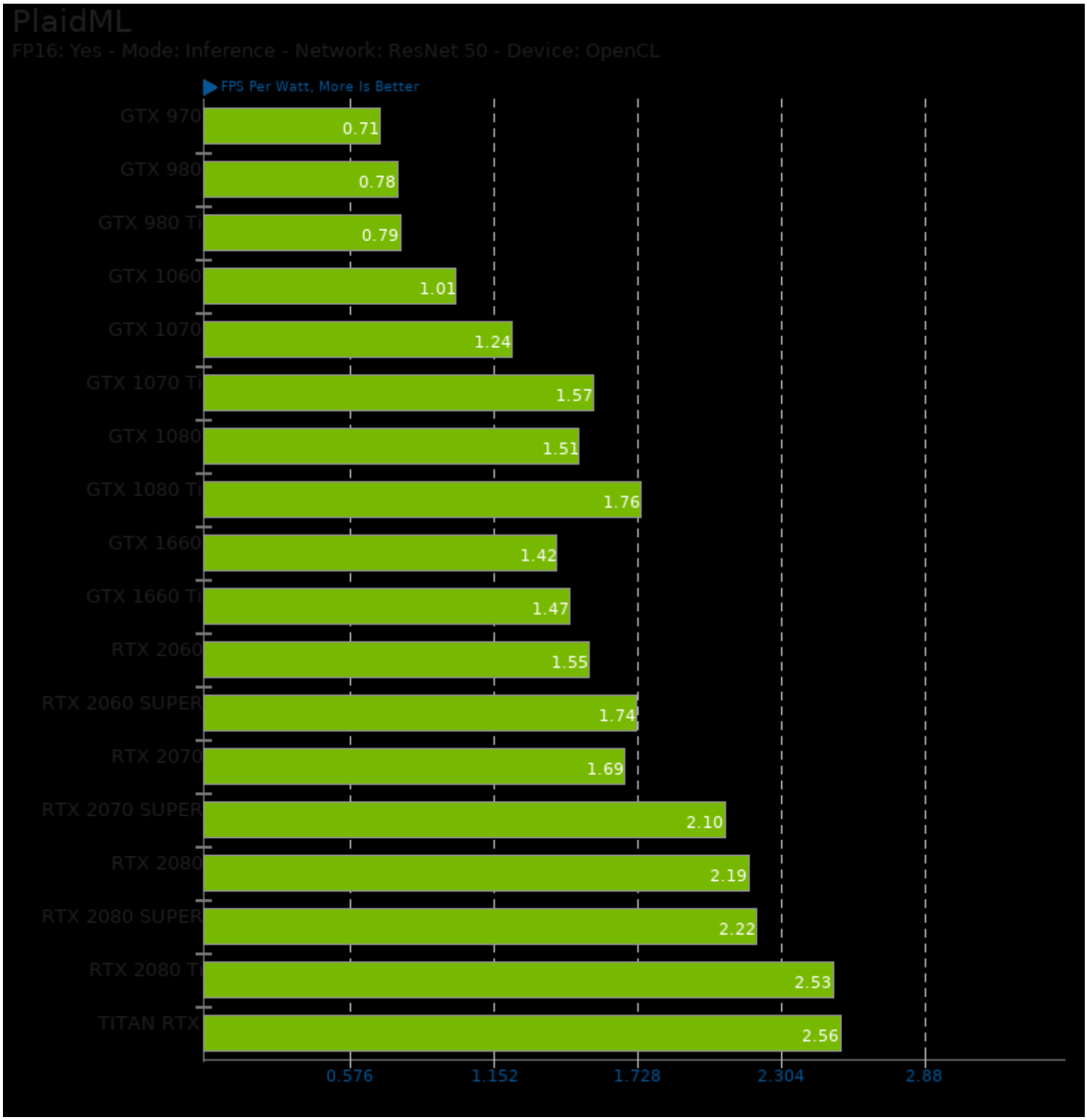
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



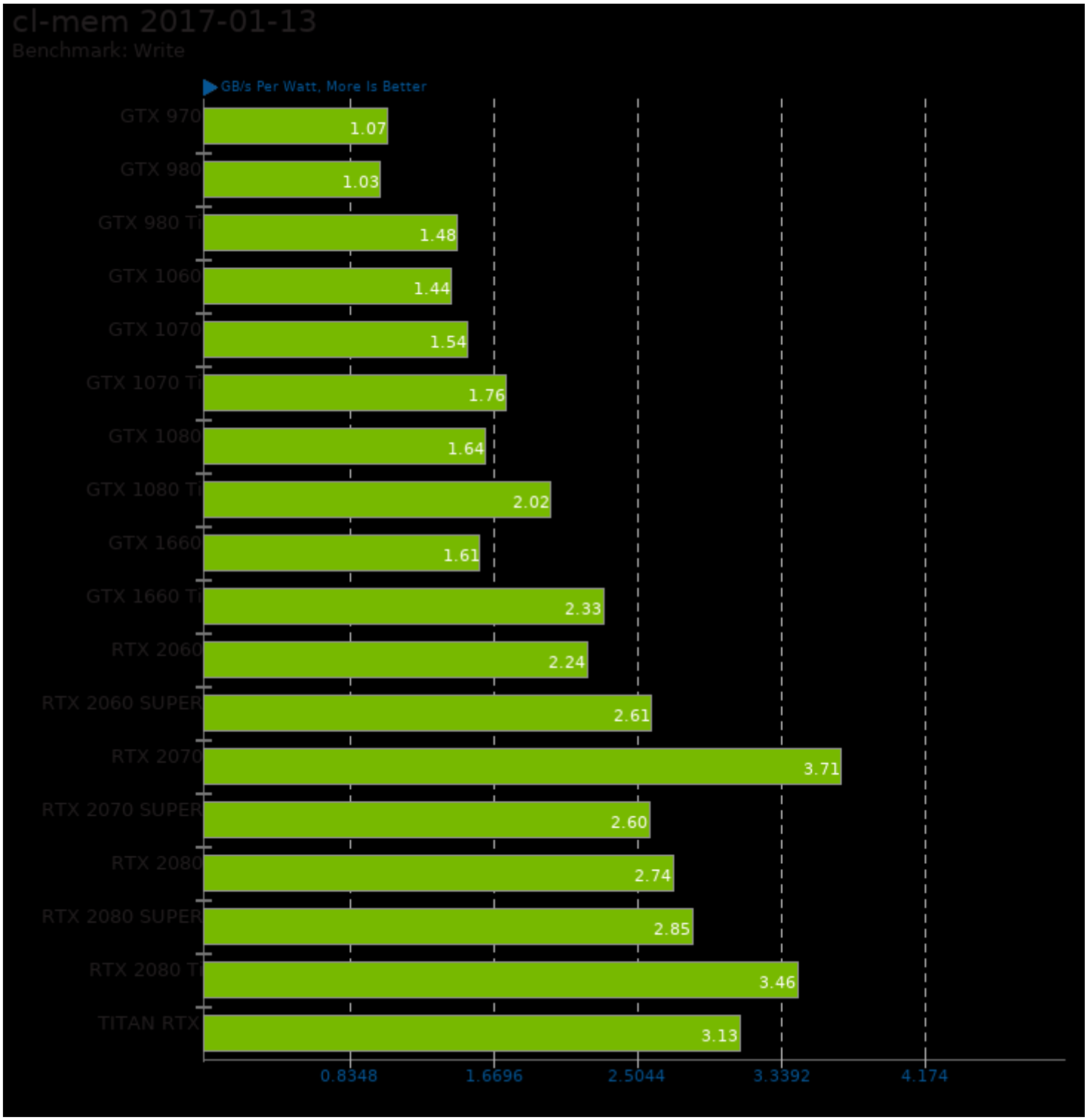
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



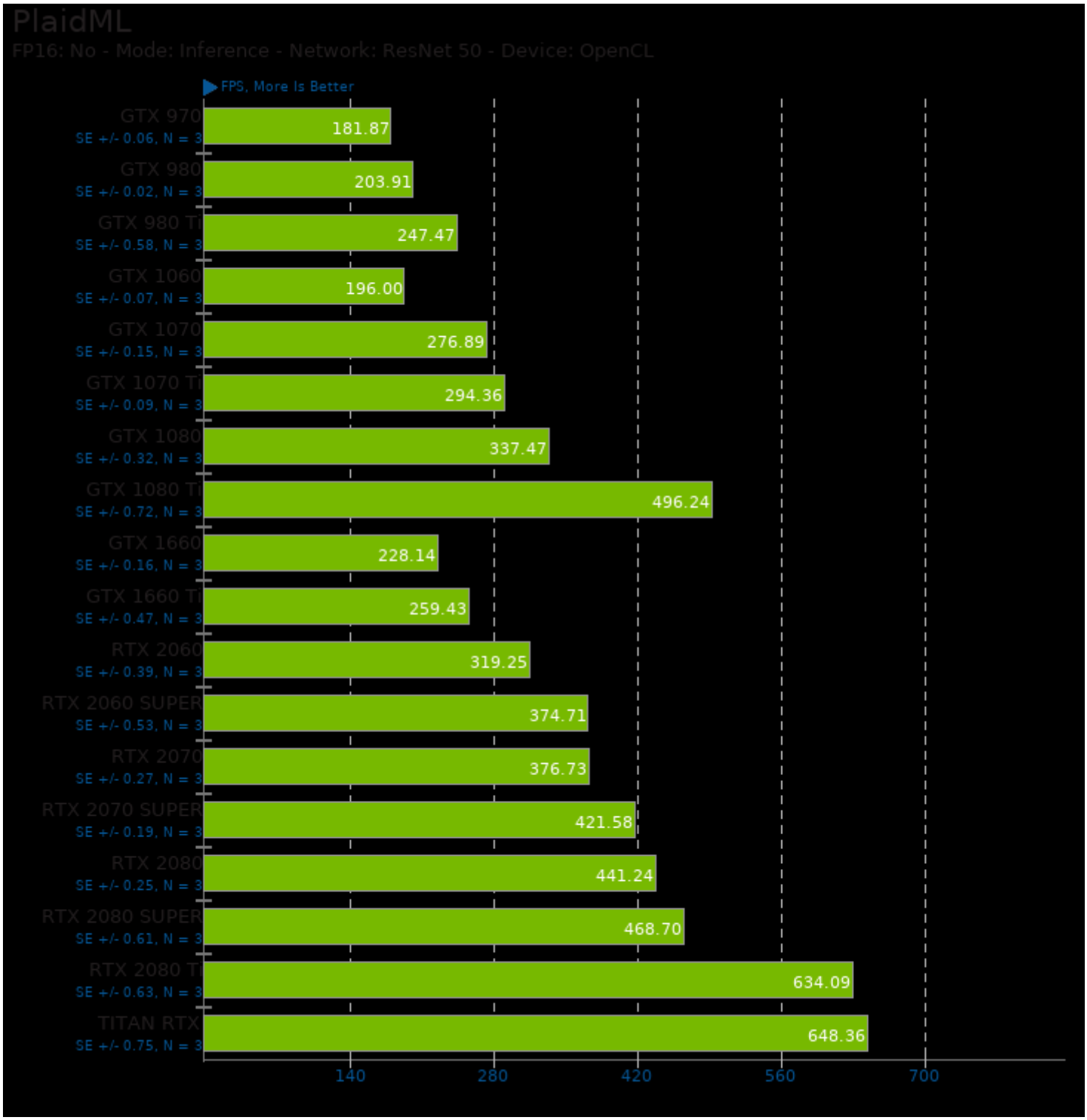

PlaidML
FP16: Yes - Mode: Inference - Network: Inception V3 - Device: OpenCL
FPS Per Watt, More Is Better
GTX 970
0.56
GTX 980
0.61
GTX 980 Ti
0.60
GTX 1060
0.78
GTX 1070
0.95
GTX 1070 Ti
1.12
GTX 1080
1.10
GTX 1080 Ti
1.13
GTX 1660
1.22
GTX 1660 Ti
1.32
RTX 2060
1.34
RTX 2060 SUPER
1.49
RTX 2070
1.57
RTX 2070 SUPER
1.72
RTX 2080
1.75
RTX 2080 SUPER
1.99
RTX 2080 Ti
2.04
TITAN RTX
2.04
0.459
0.918
1.377
1.836
2.295


PlaidML
FP16: Yes - Mode: Inference - Network: ResNet 50 - Device: OpenCL
FPS Per Watt, More Is Better
GTX 970
0.71
GTX 980
0.78
GTX 980 Ti
0.79
GTX 1060
1.01
GTX 1070
1.24
GTX 1070 Ti
1.57
GTX 1080
1.51
GTX 1080 Ti
1.76
GTX 1660
1.42
GTX 1660 Ti
1.47
RTX 2060
1.55
RTX 2060 SUPER
1.74
RTX 2070
1.69
RTX 2070 SUPER
2.10
RTX 2080
2.19
RTX 2080 SUPER
2.22
RTX 2080 Ti
2.53
TITAN RTX
2.56
0.576
1.152
1.728
2.304
2.88

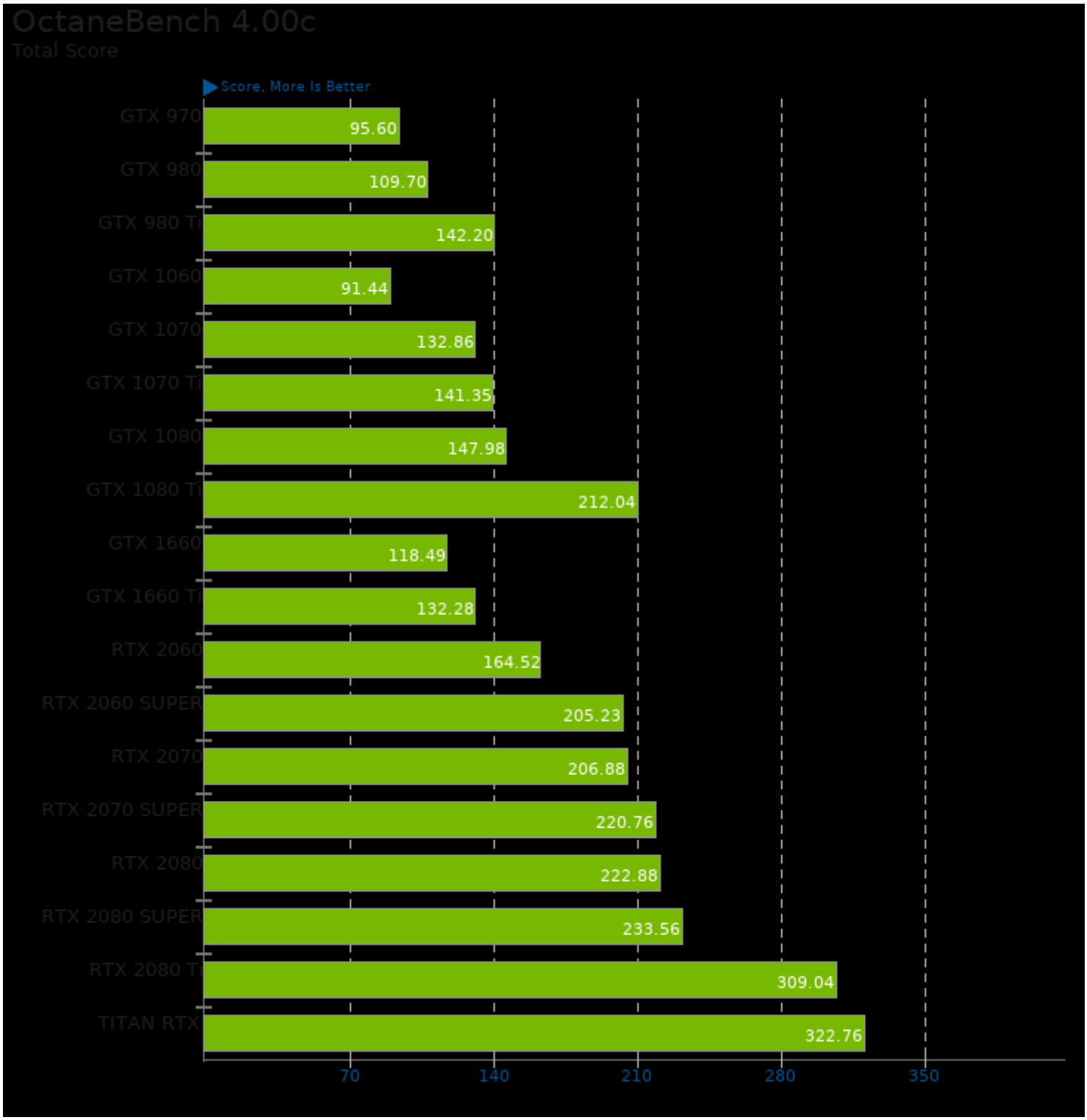
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



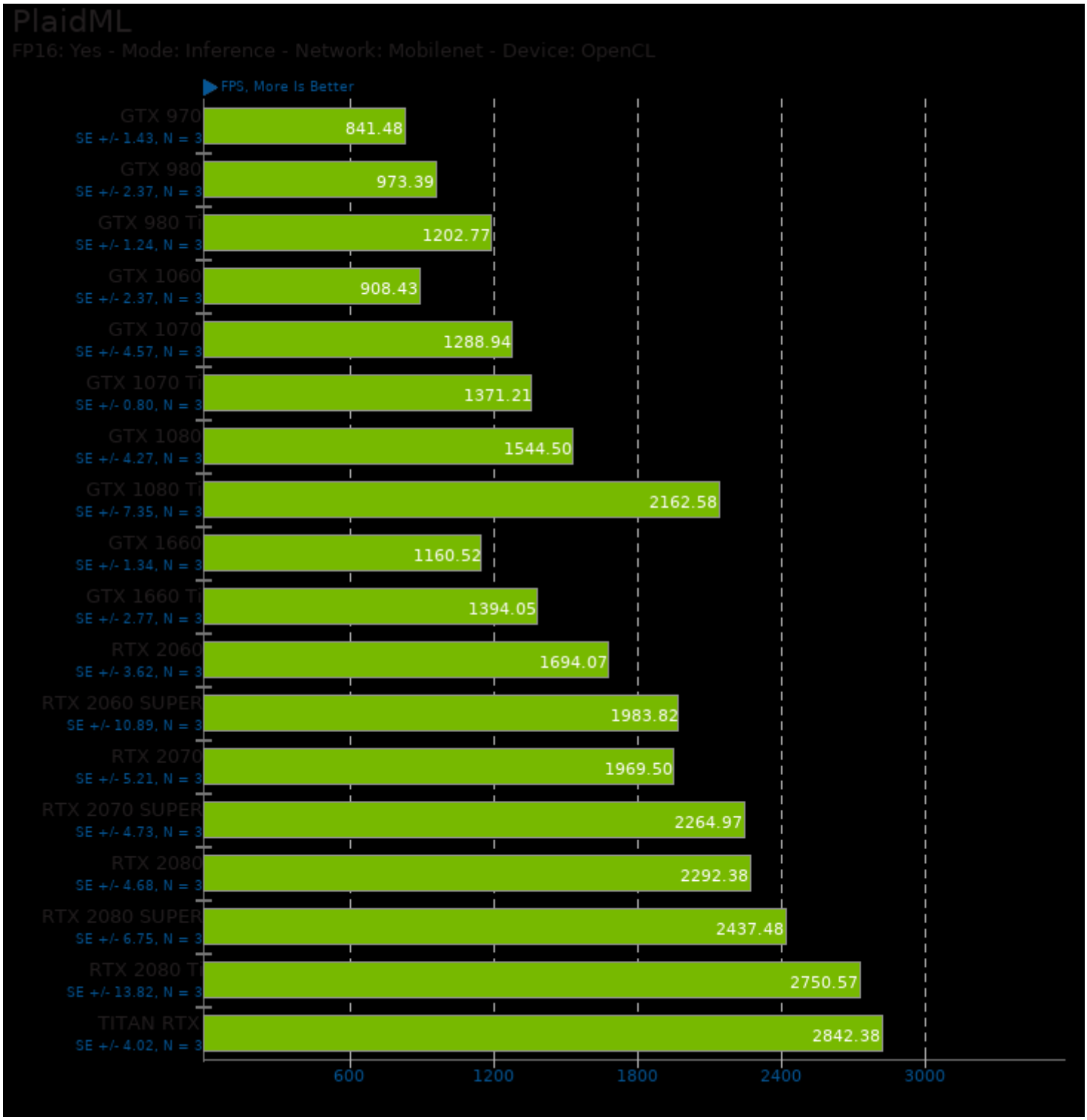
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



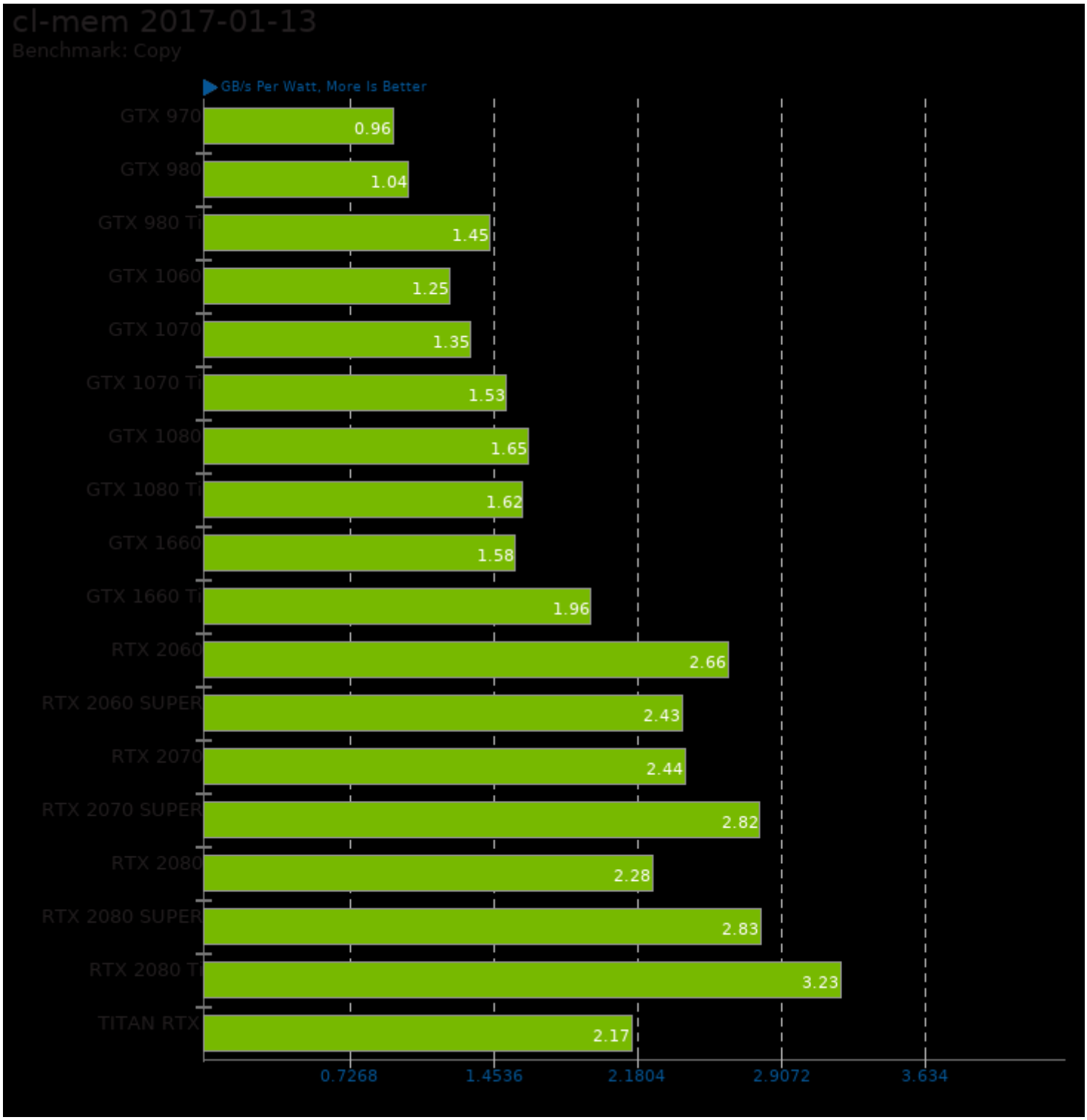
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



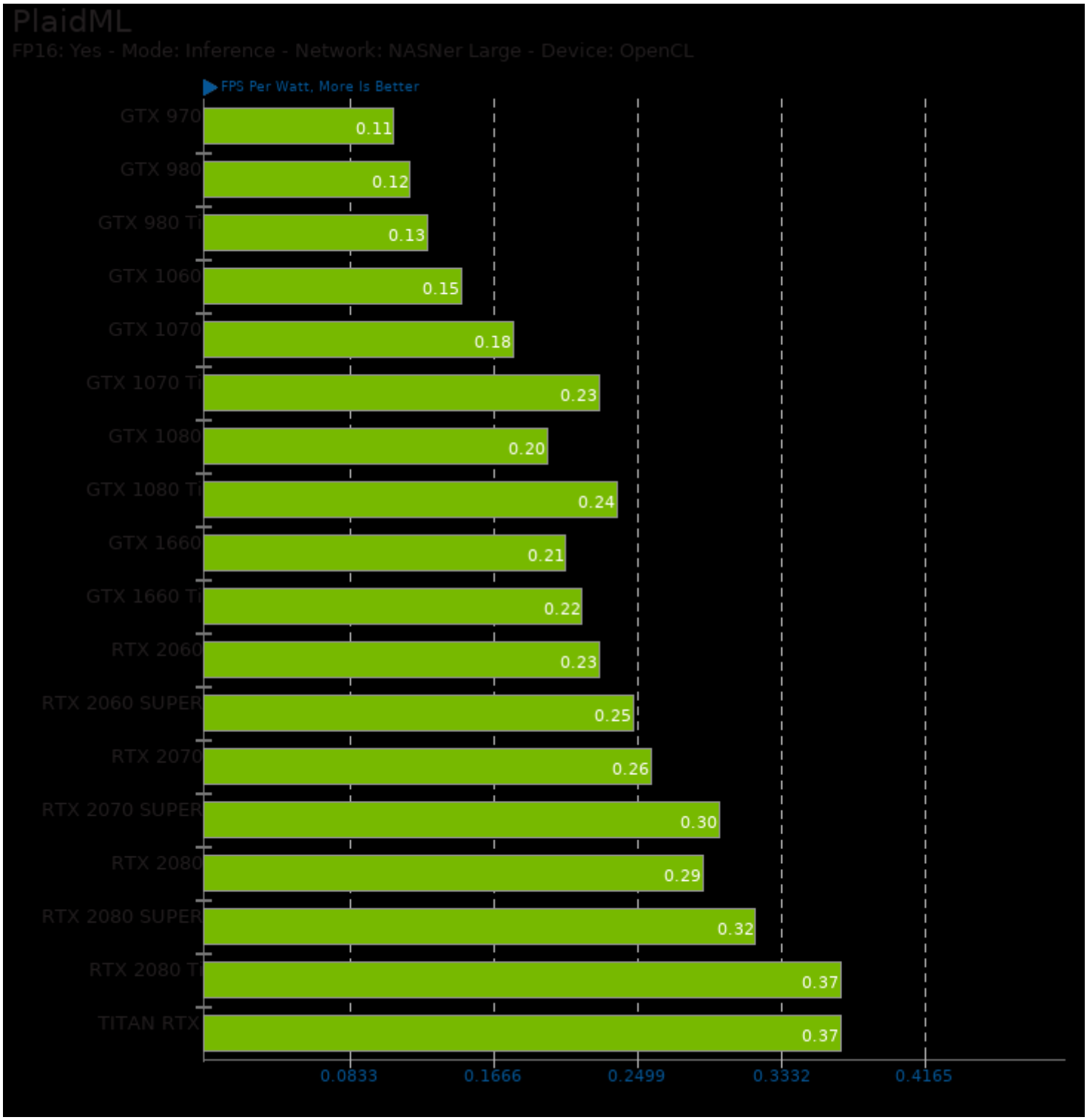
NVIDIA Linux OpenCL CUDA RTX SUPER Compute

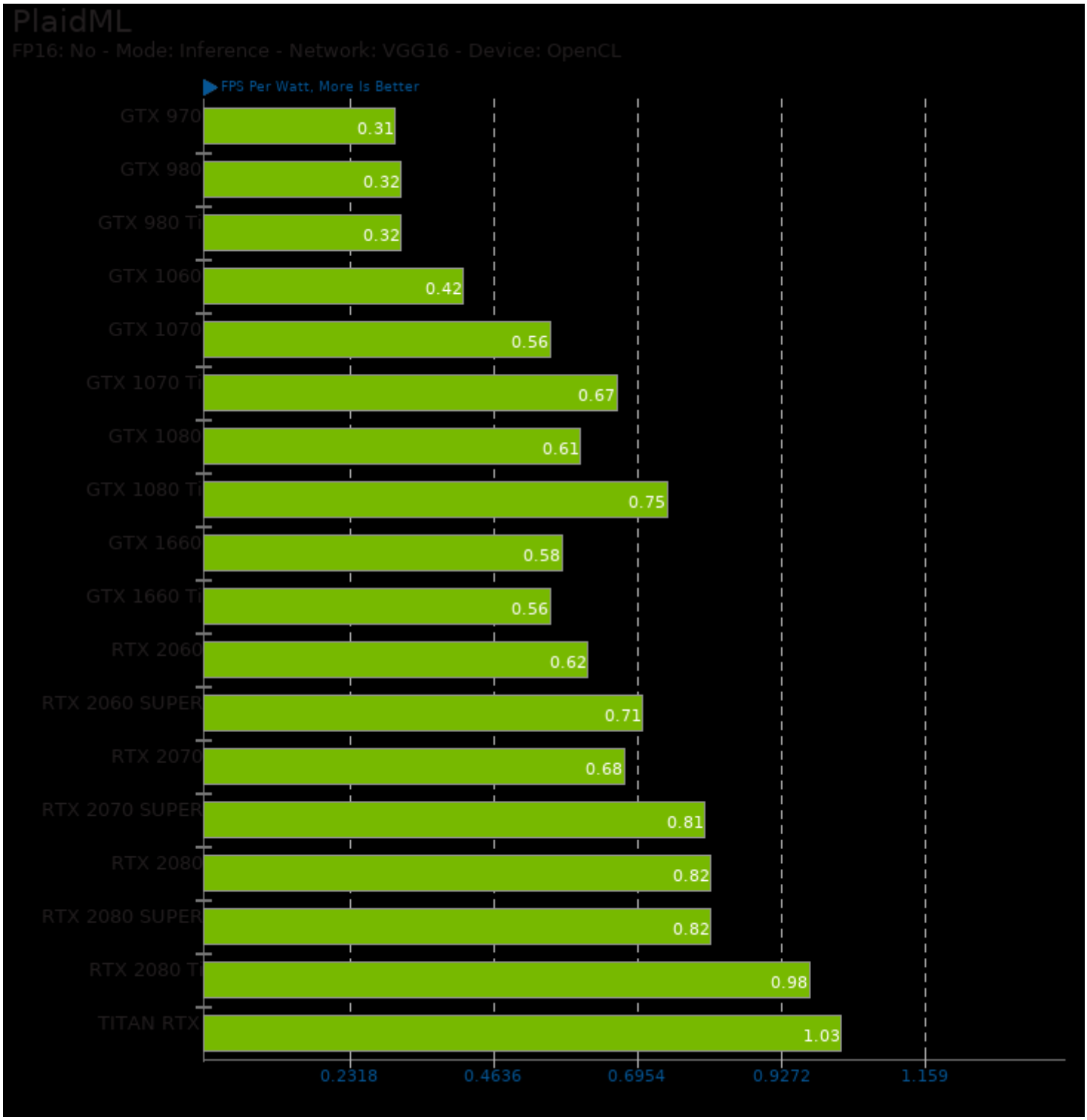


NVIDIA Linux OpenCL CUDA RTX SUPER Compute



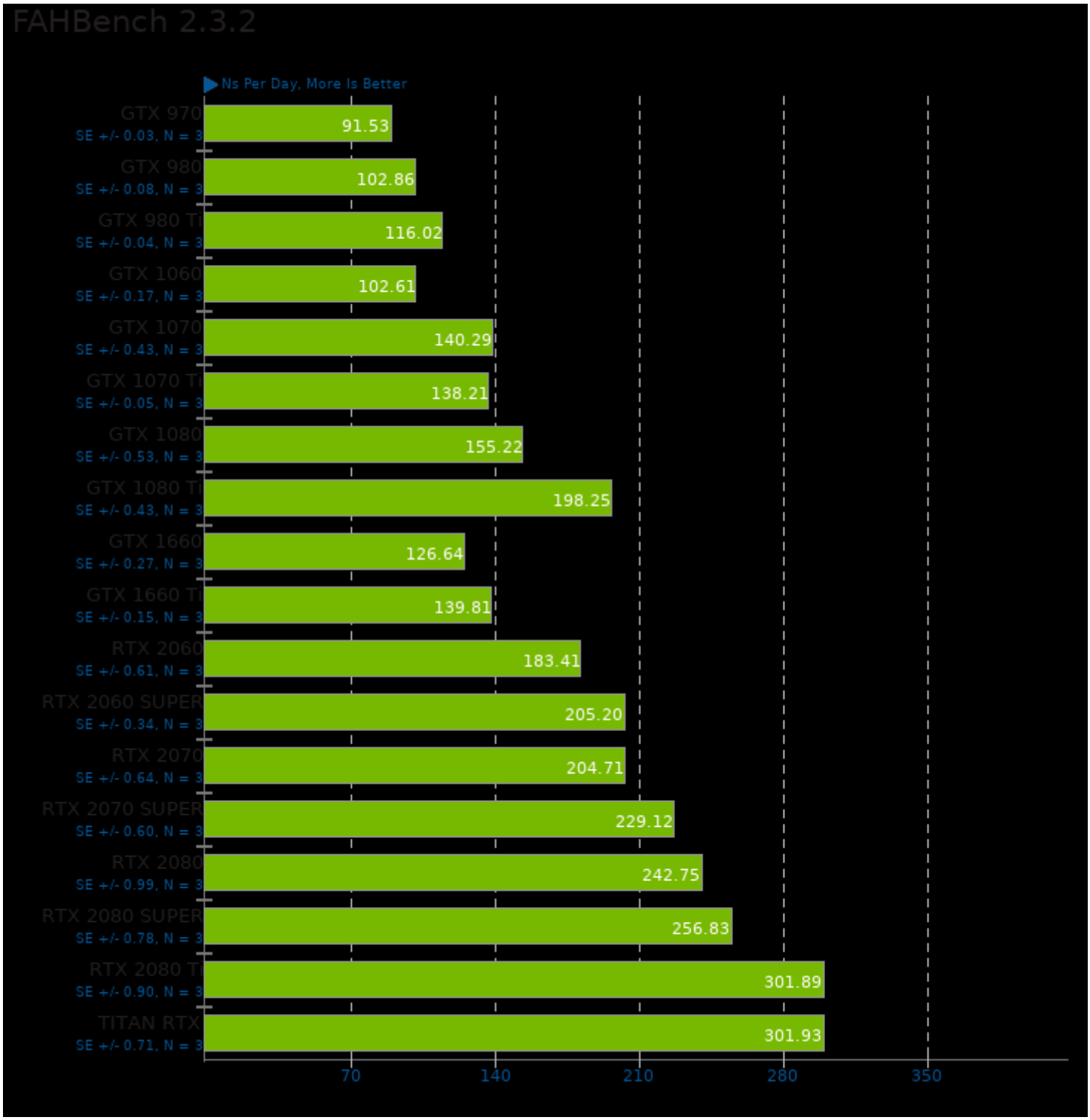
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



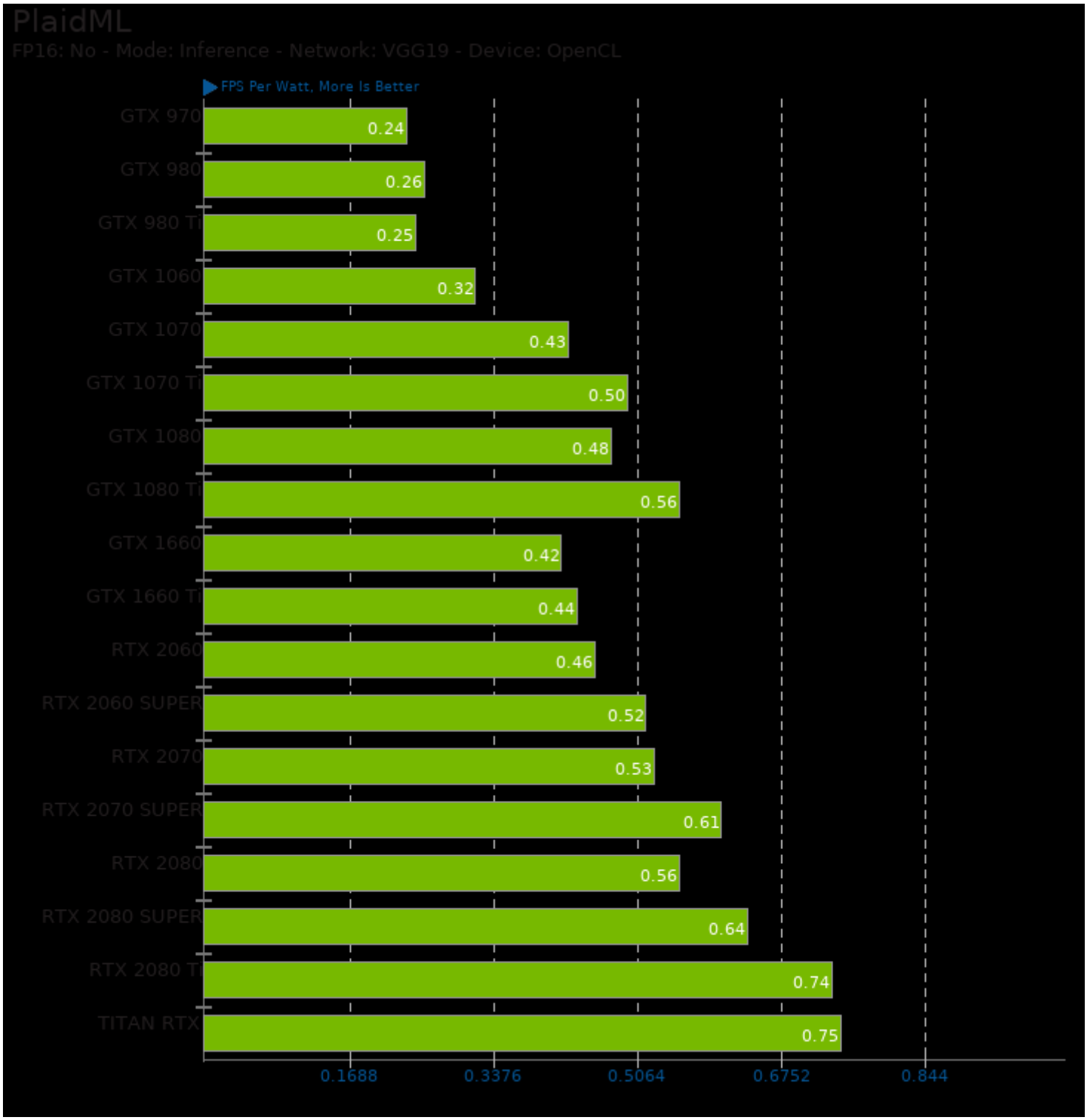

PlaidML
FP16: No - Mode: Inference - Network: VGG16 - Device: OpenCL
FPS Per Watt, More Is Better
GTX 970
0.31
GTX 980
0.32
GTX 980 Ti
0.32
GTX 1060
0.42
GTX 1070
0.56
GTX 1070 Ti
0.67
GTX 1080
0.61
GTX 1080 Ti
0.75
GTX 1660
0.58
GTX 1660 Ti
0.56
RTX 2060
0.62
RTX 2060 SUPER
0.71
RTX 2070
0.68
RTX 2070 SUPER
0.81
RTX 2080
0.82
RTX 2080 SUPER
0.82
RTX 2080 Ti
0.98
TITAN RTX
1.03
0.2318
0.4636
0.6954
0.9272
1.159

NVIDIA Linux OpenCL CUDA RTX SUPER Compute

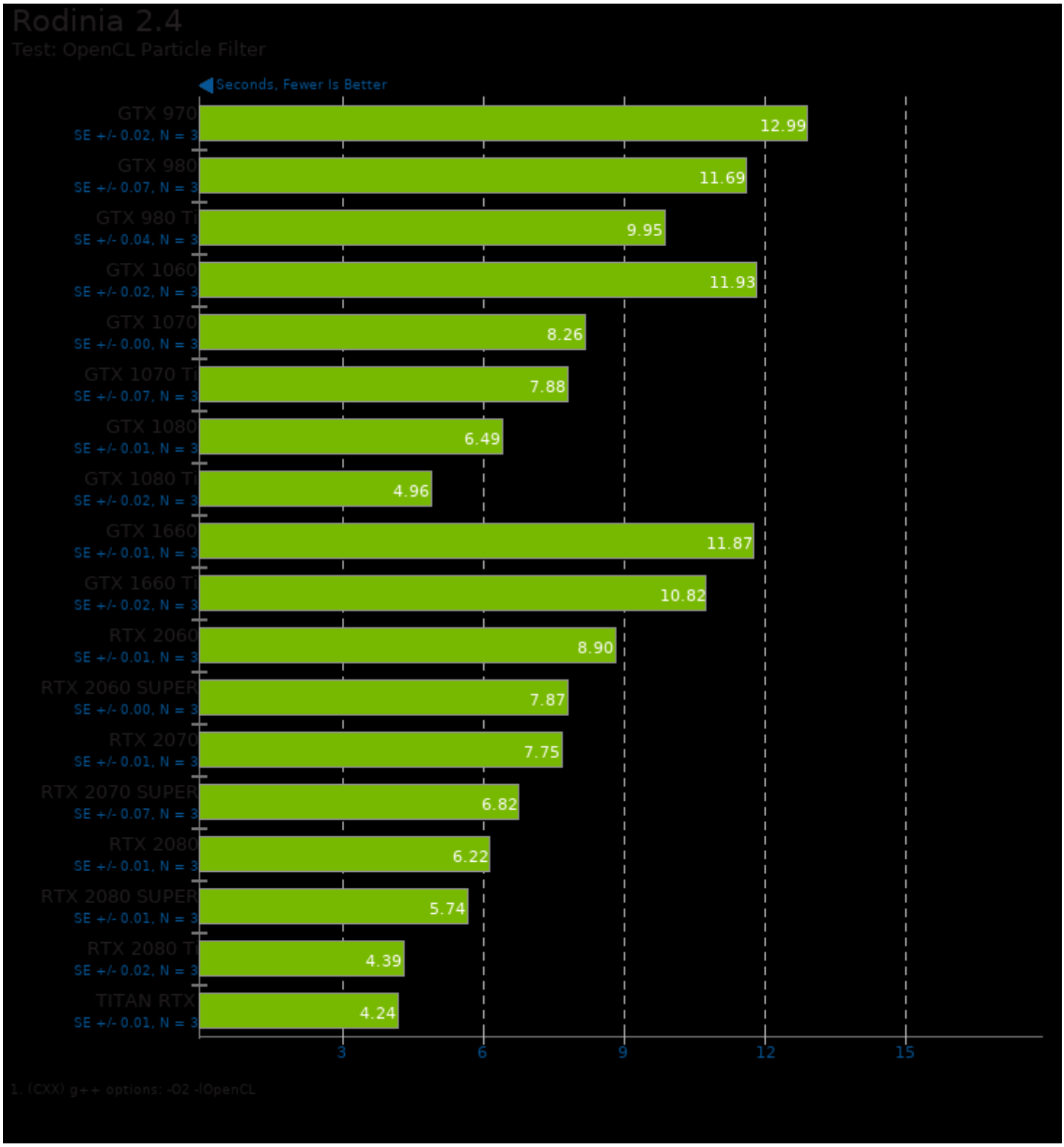
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



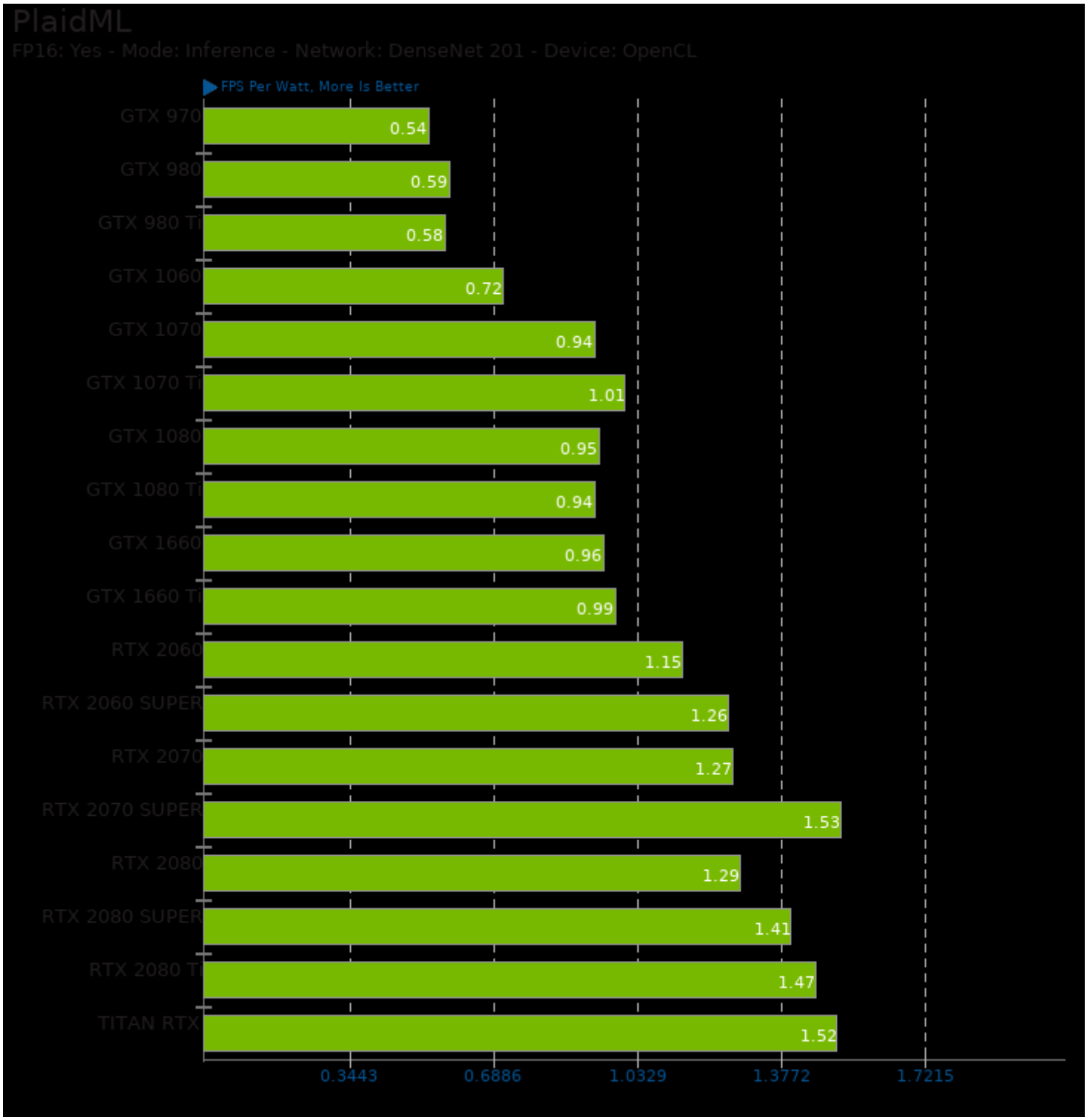
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



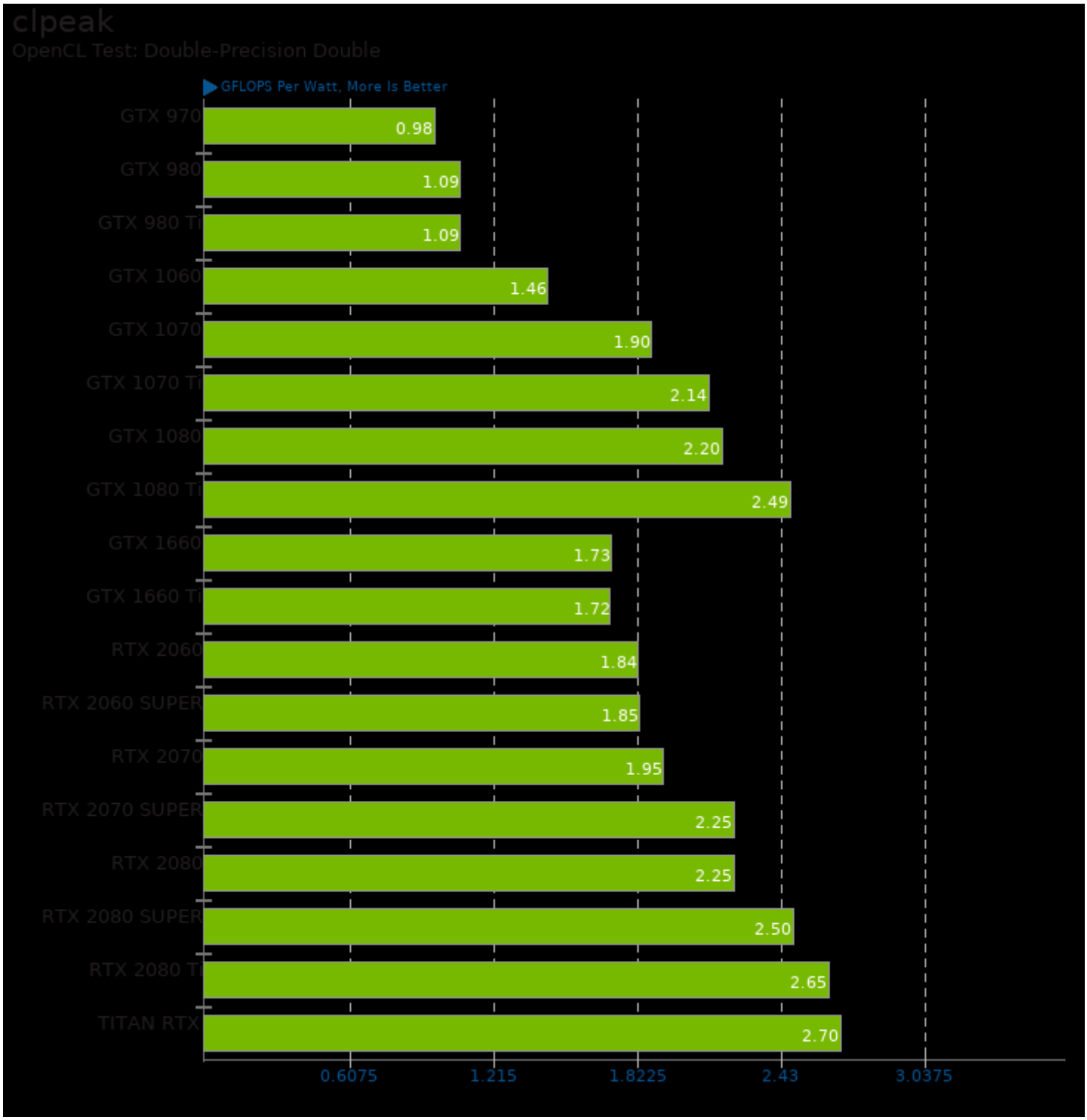
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



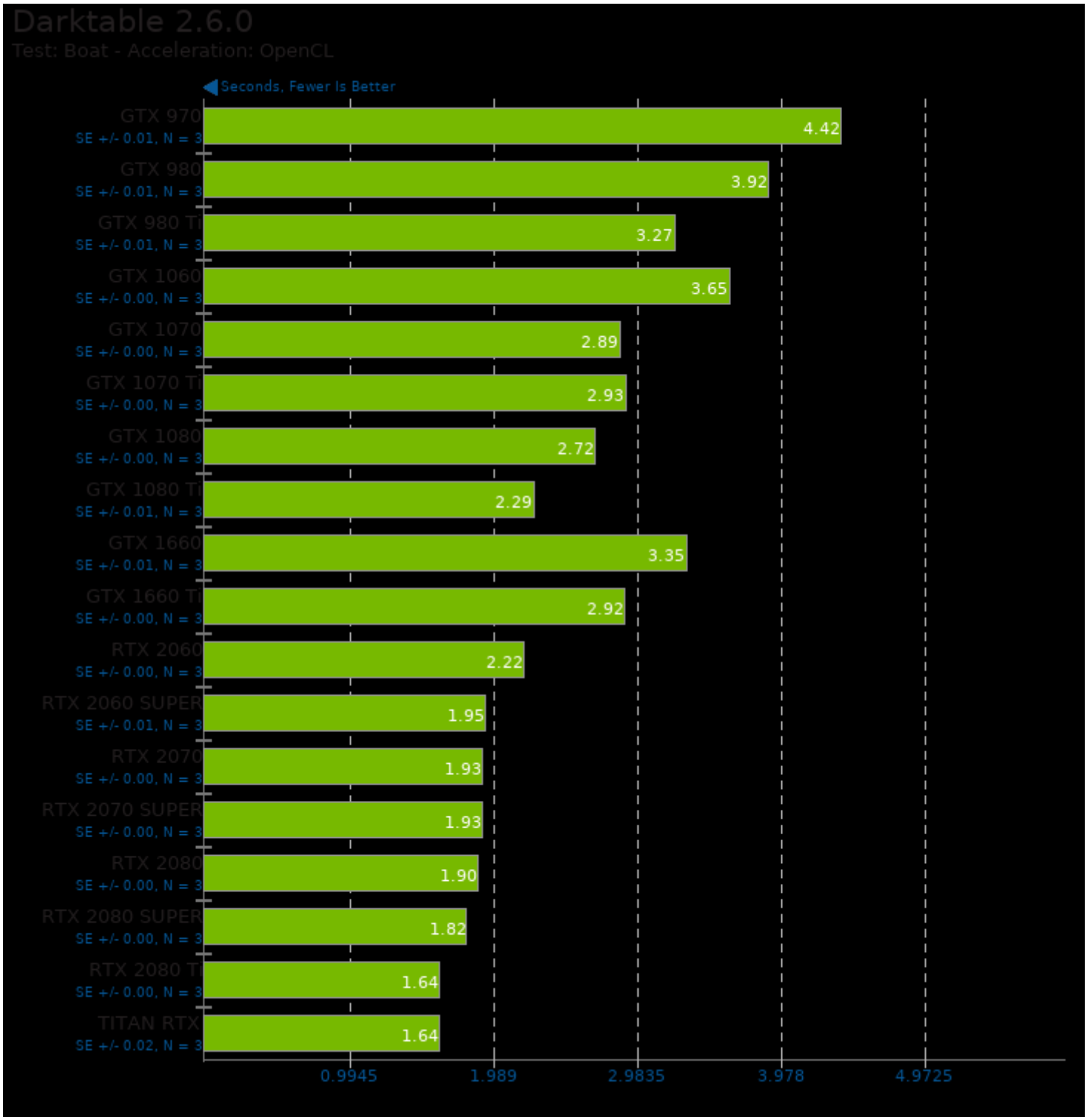
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



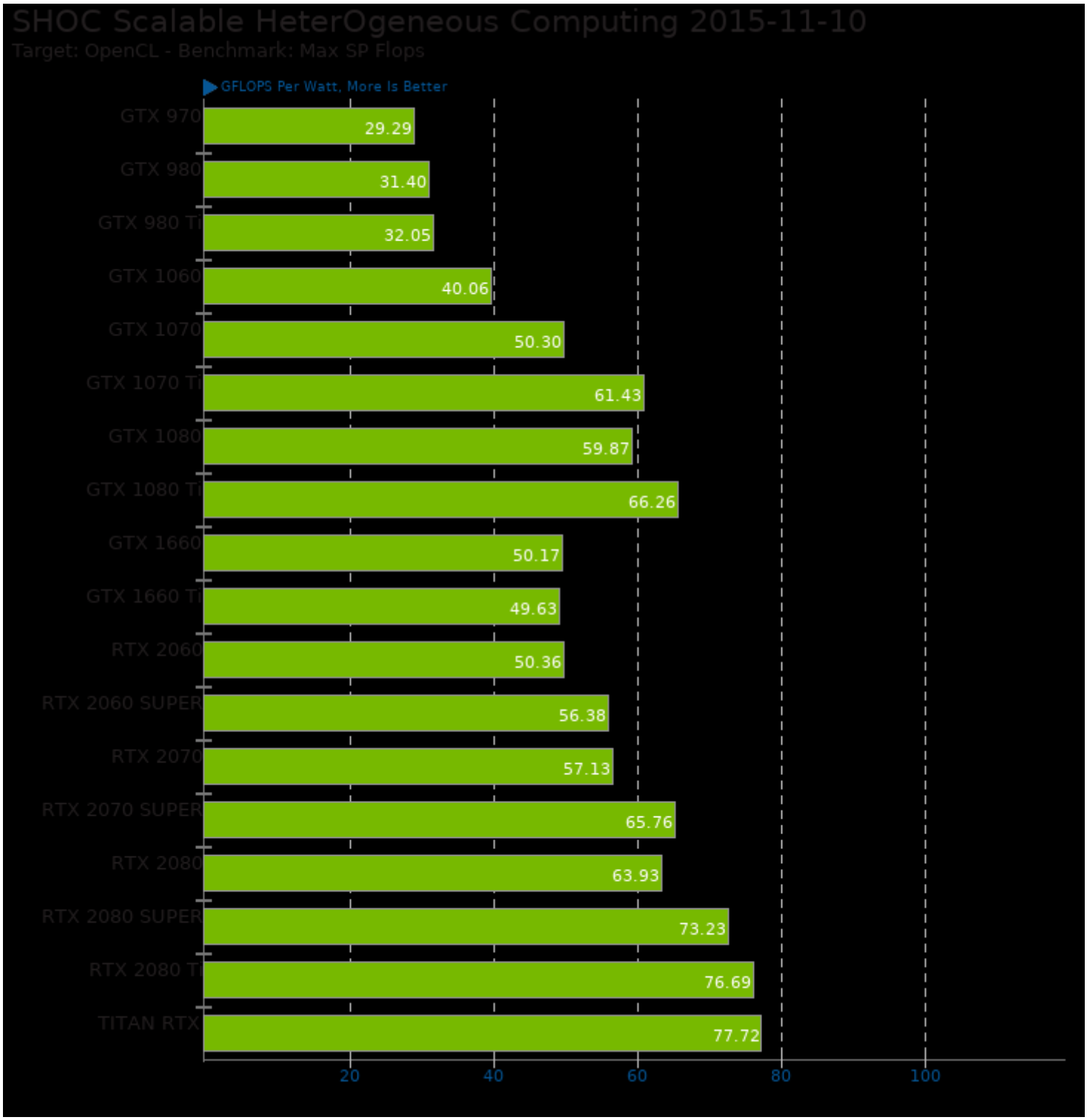
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



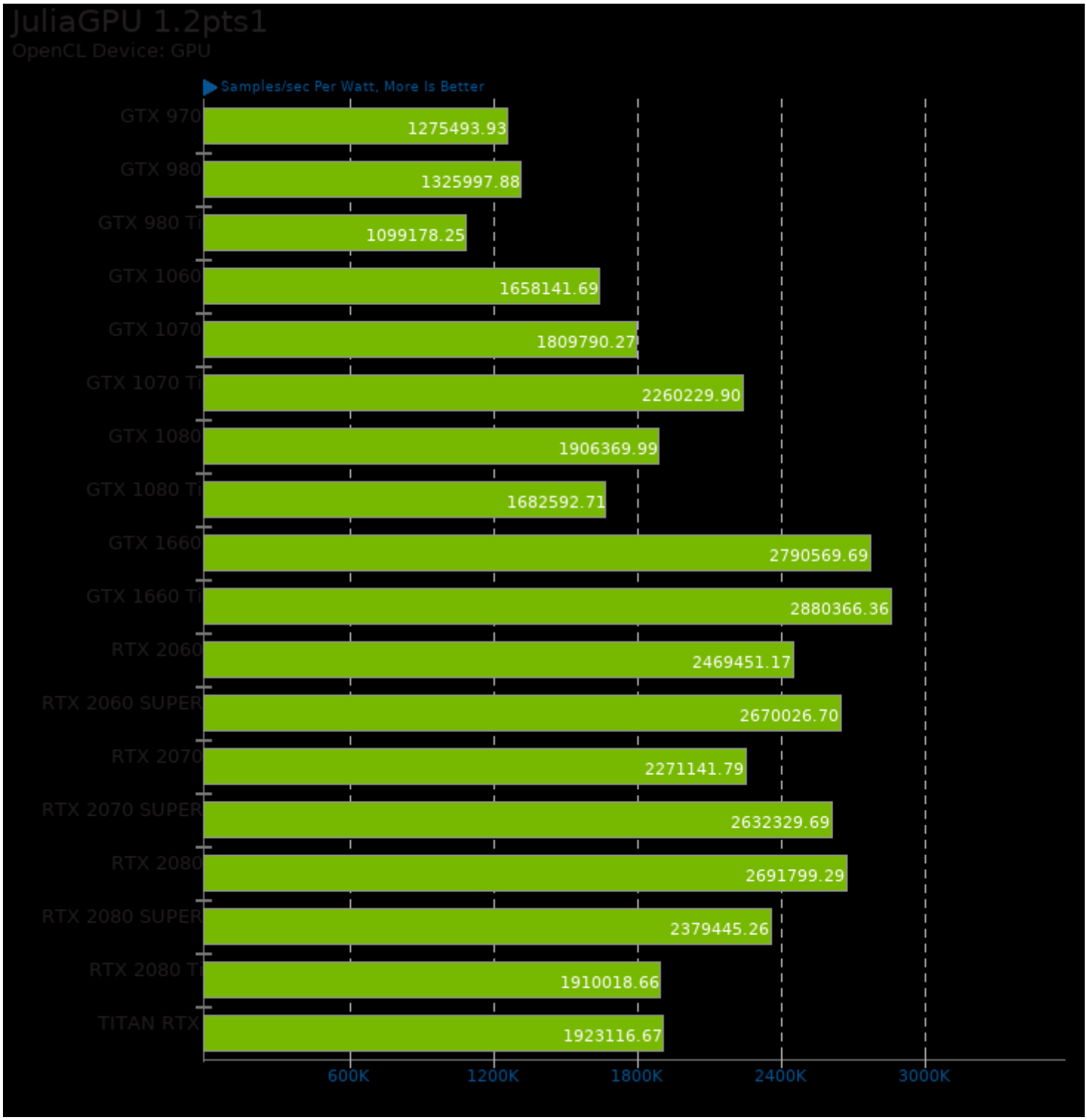
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



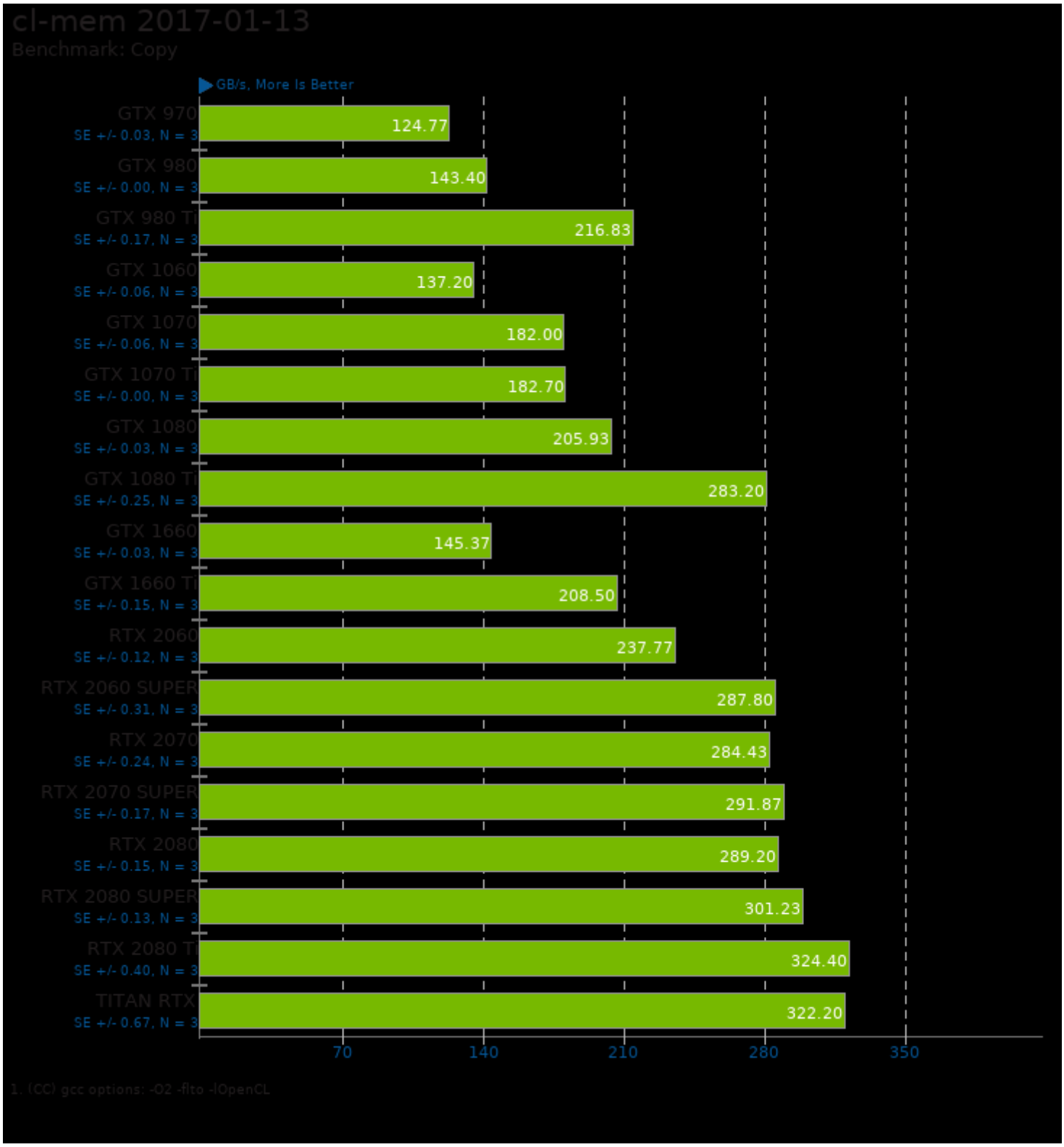
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



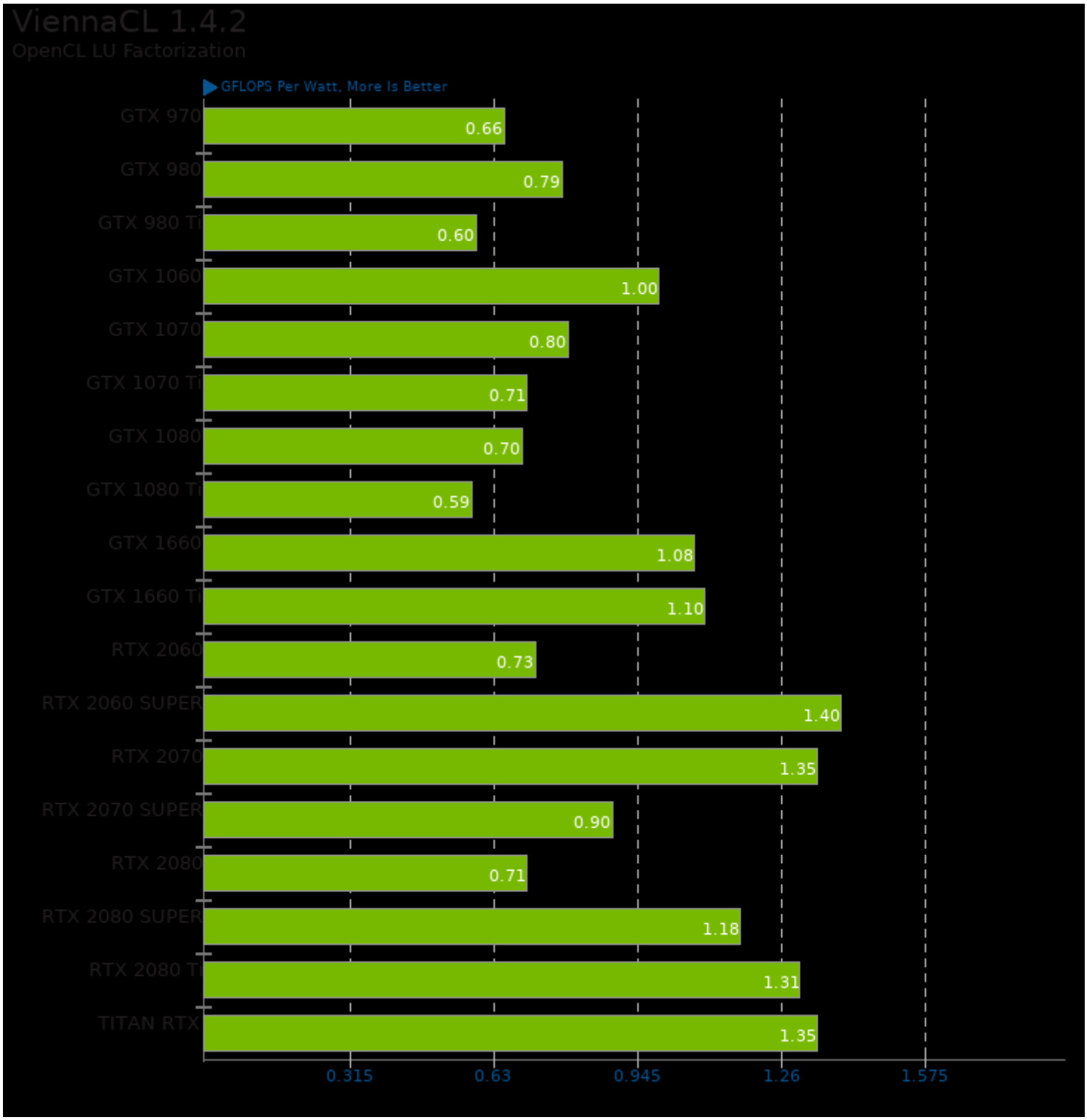
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



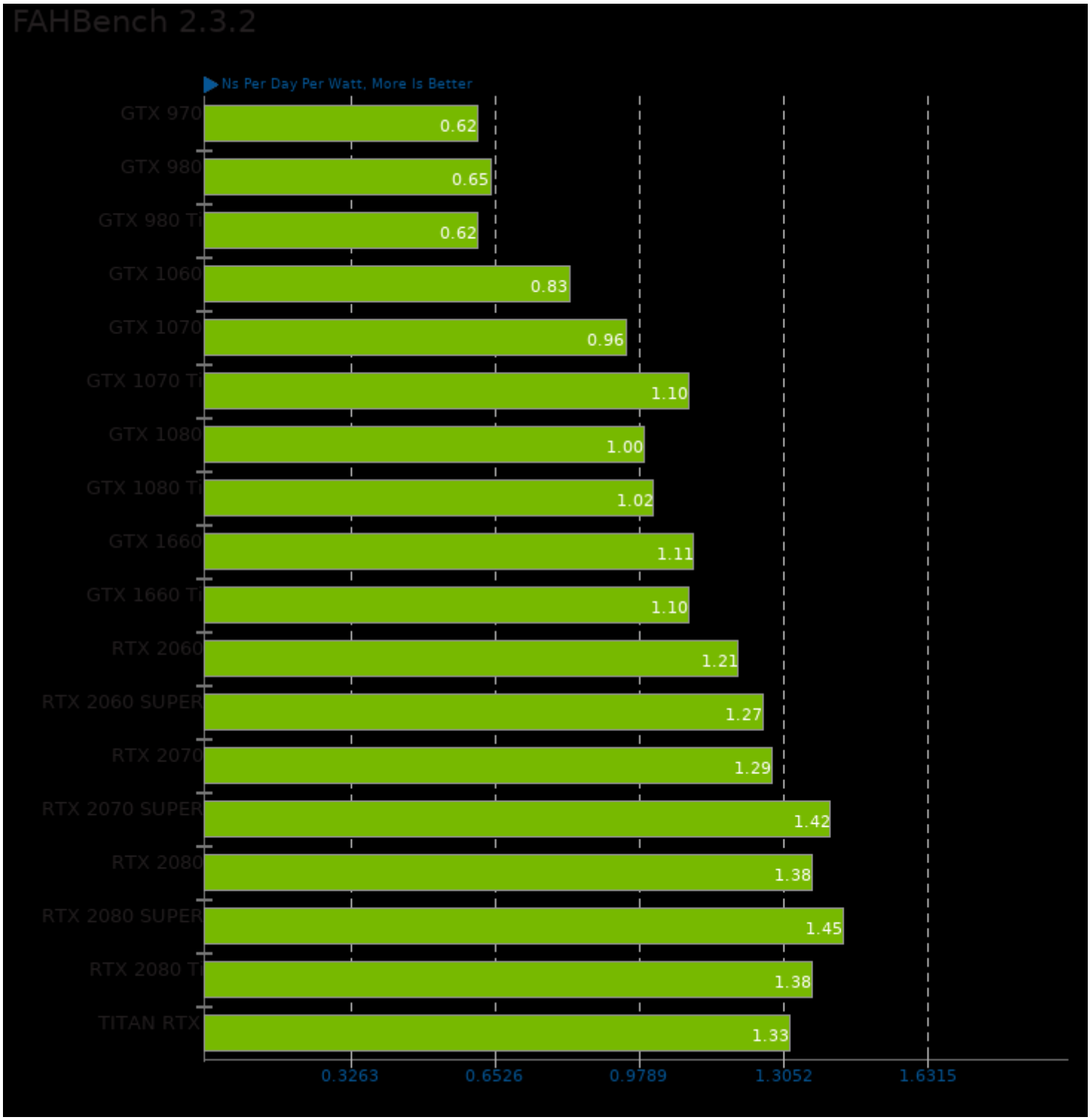
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



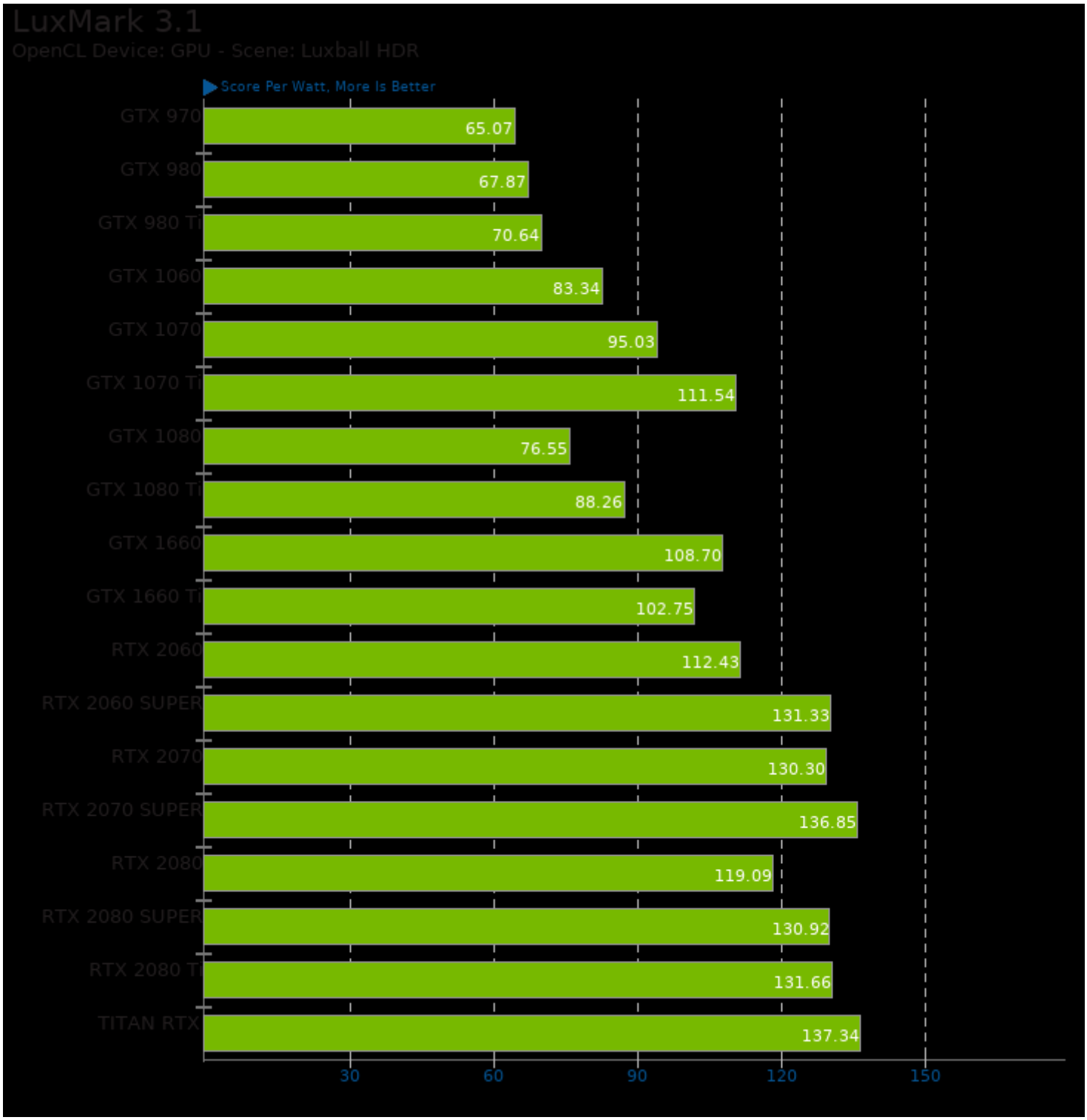
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



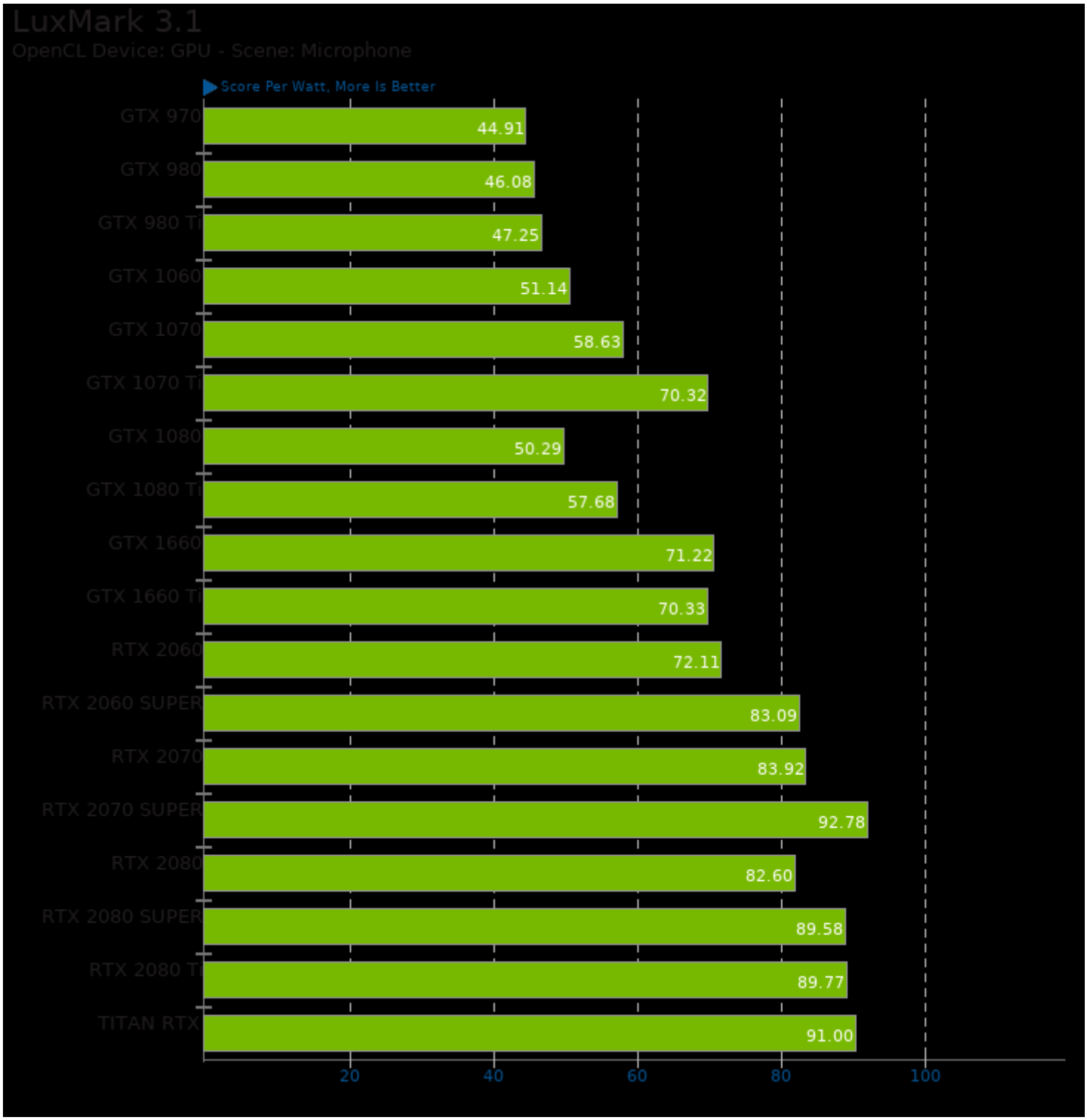
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



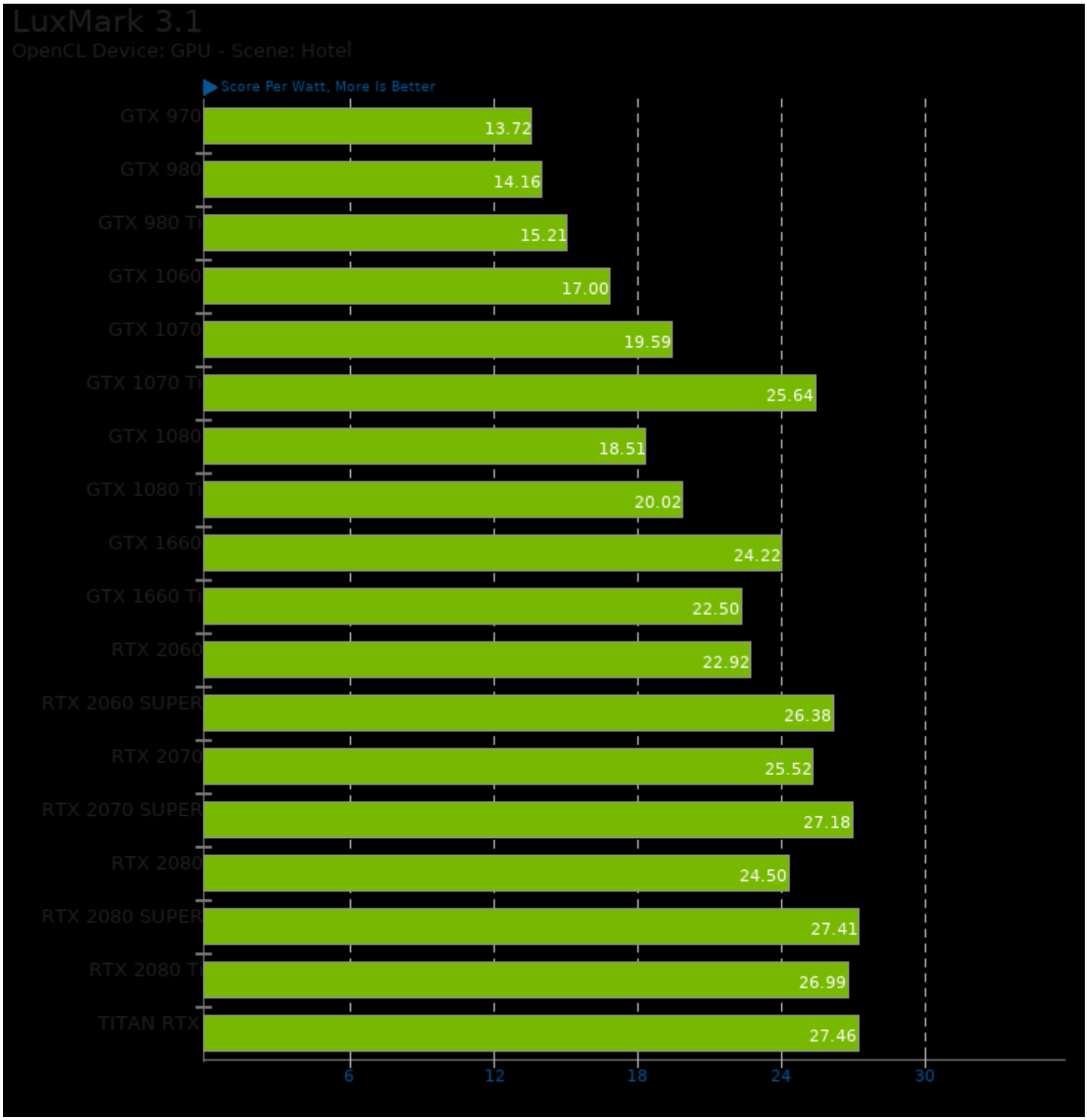
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



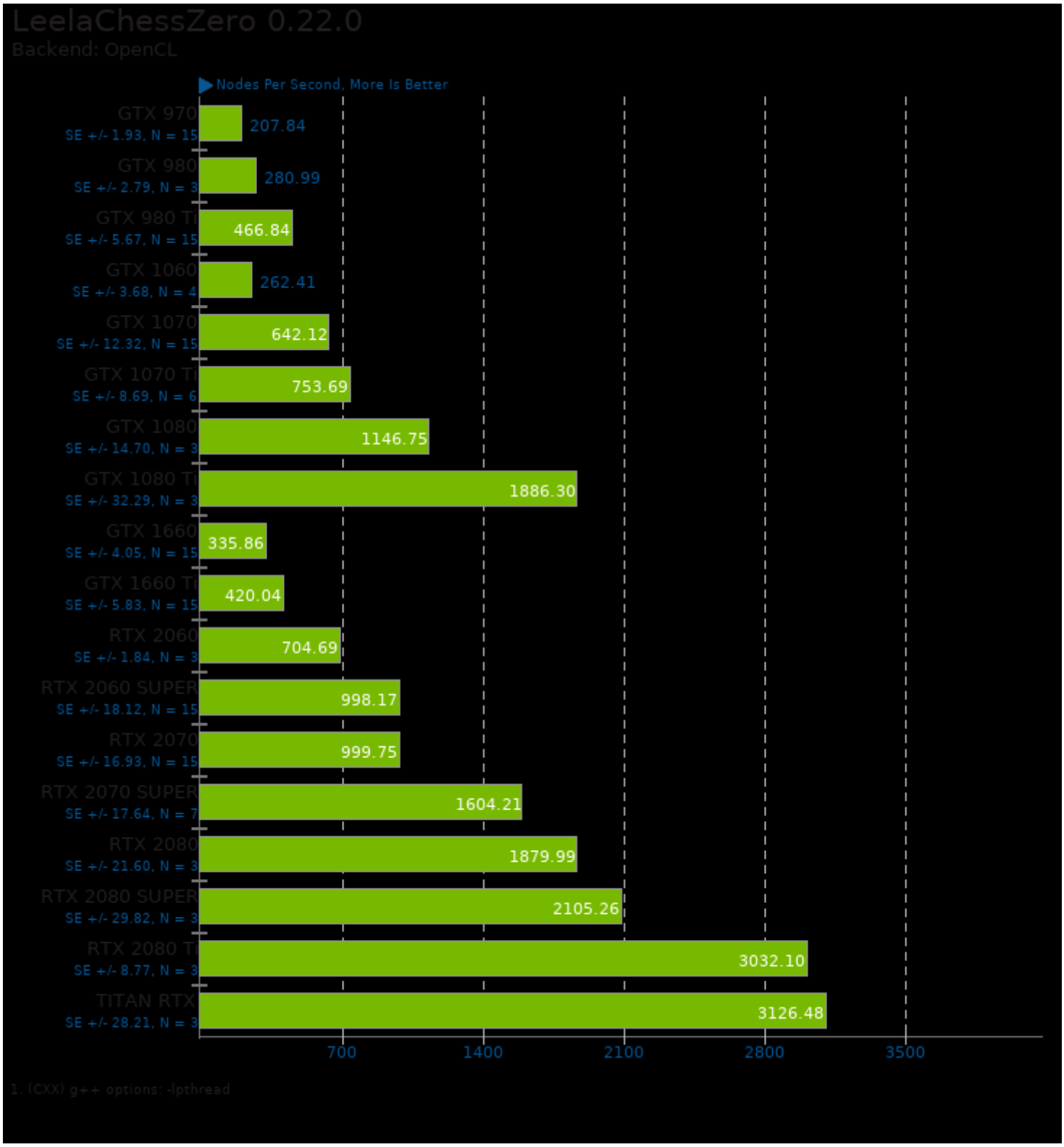
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



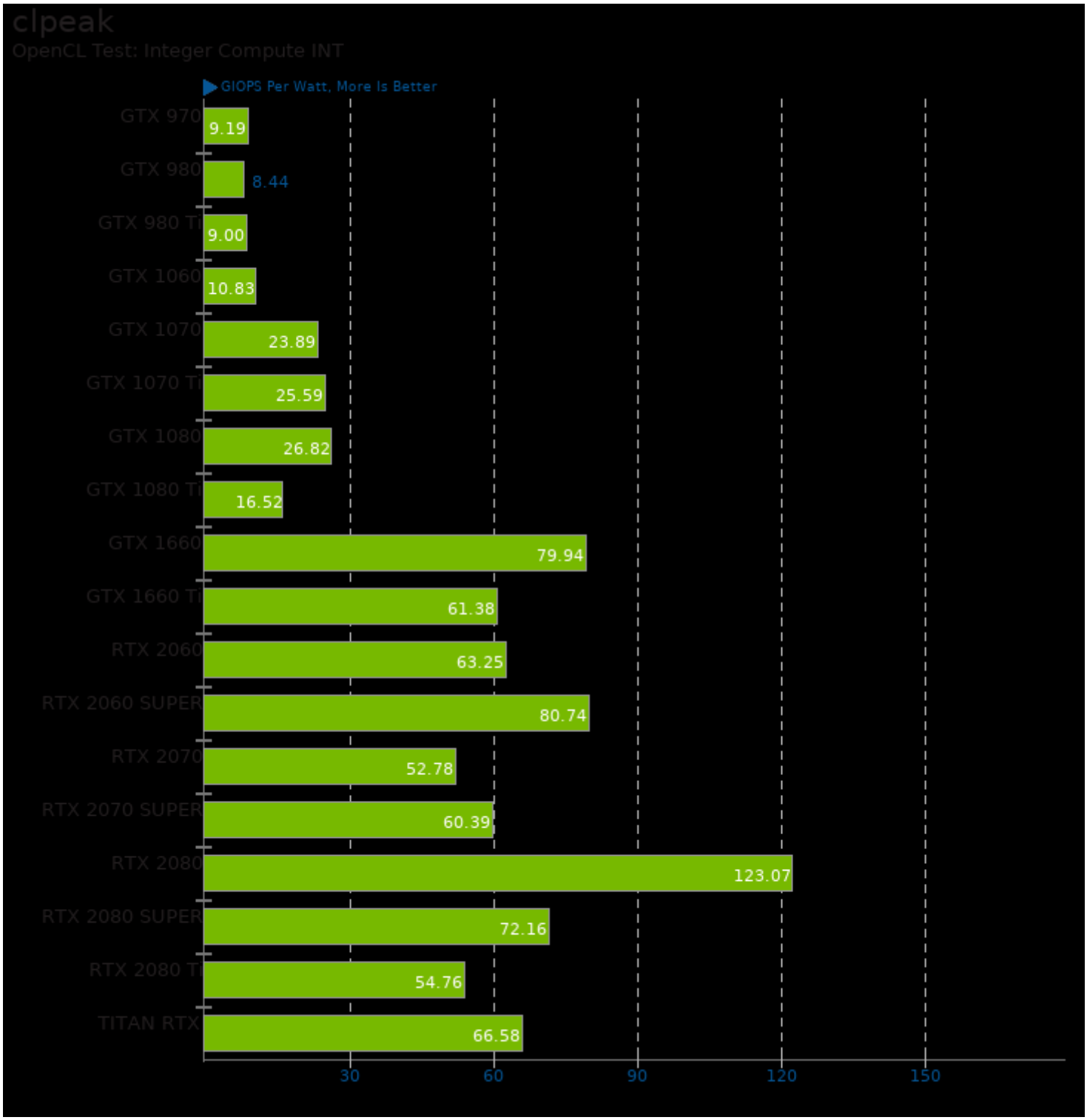
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



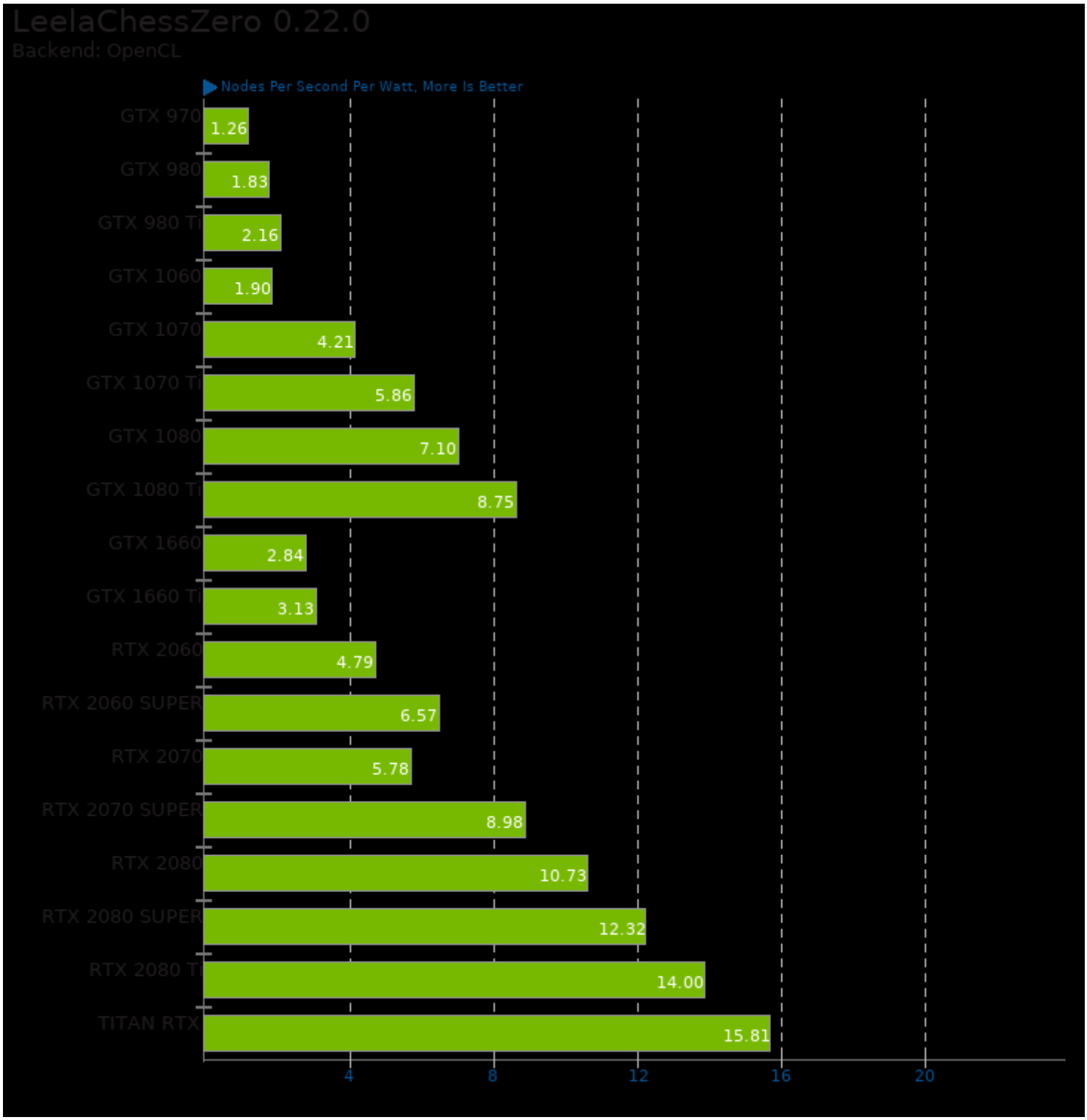
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



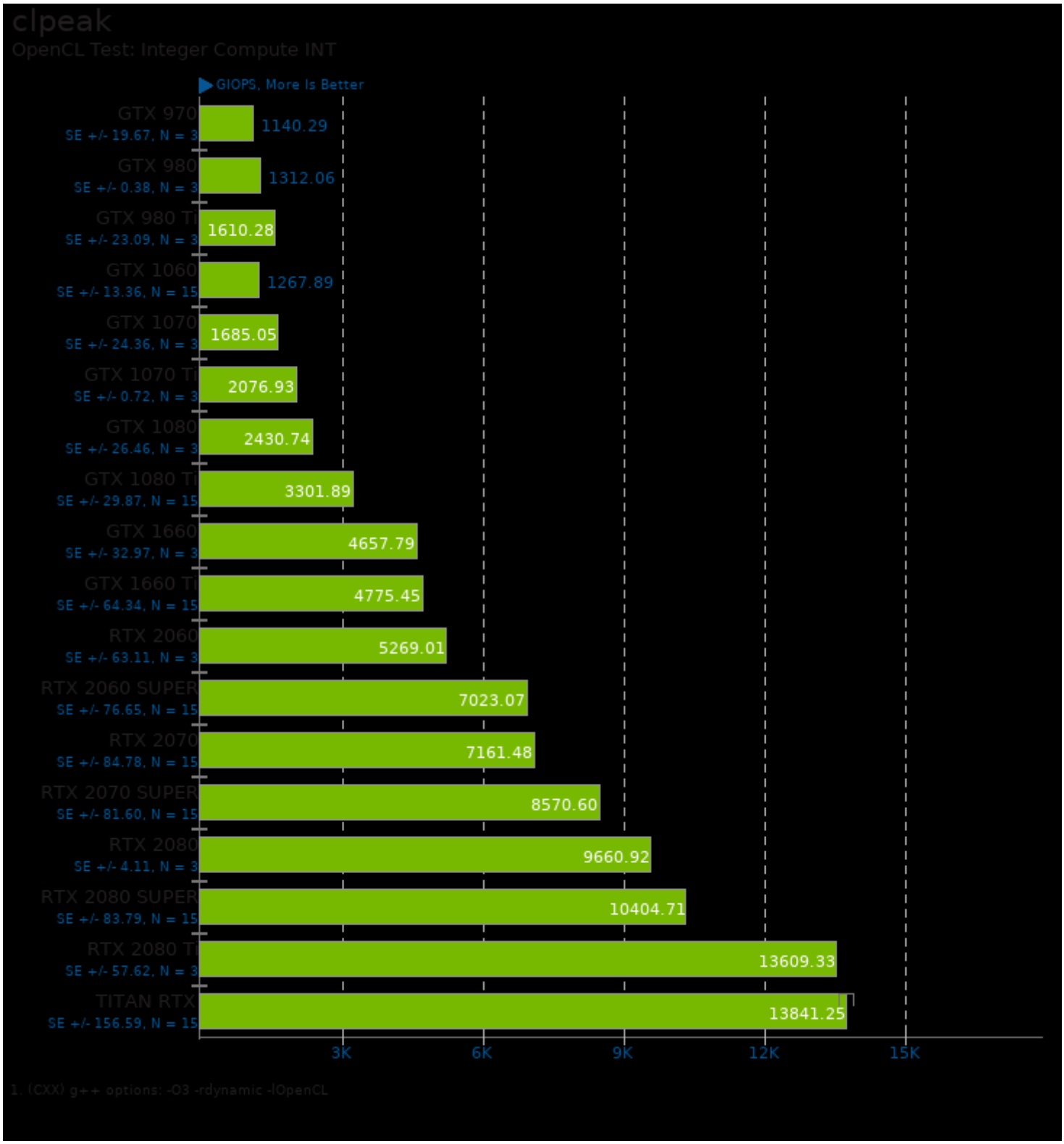
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



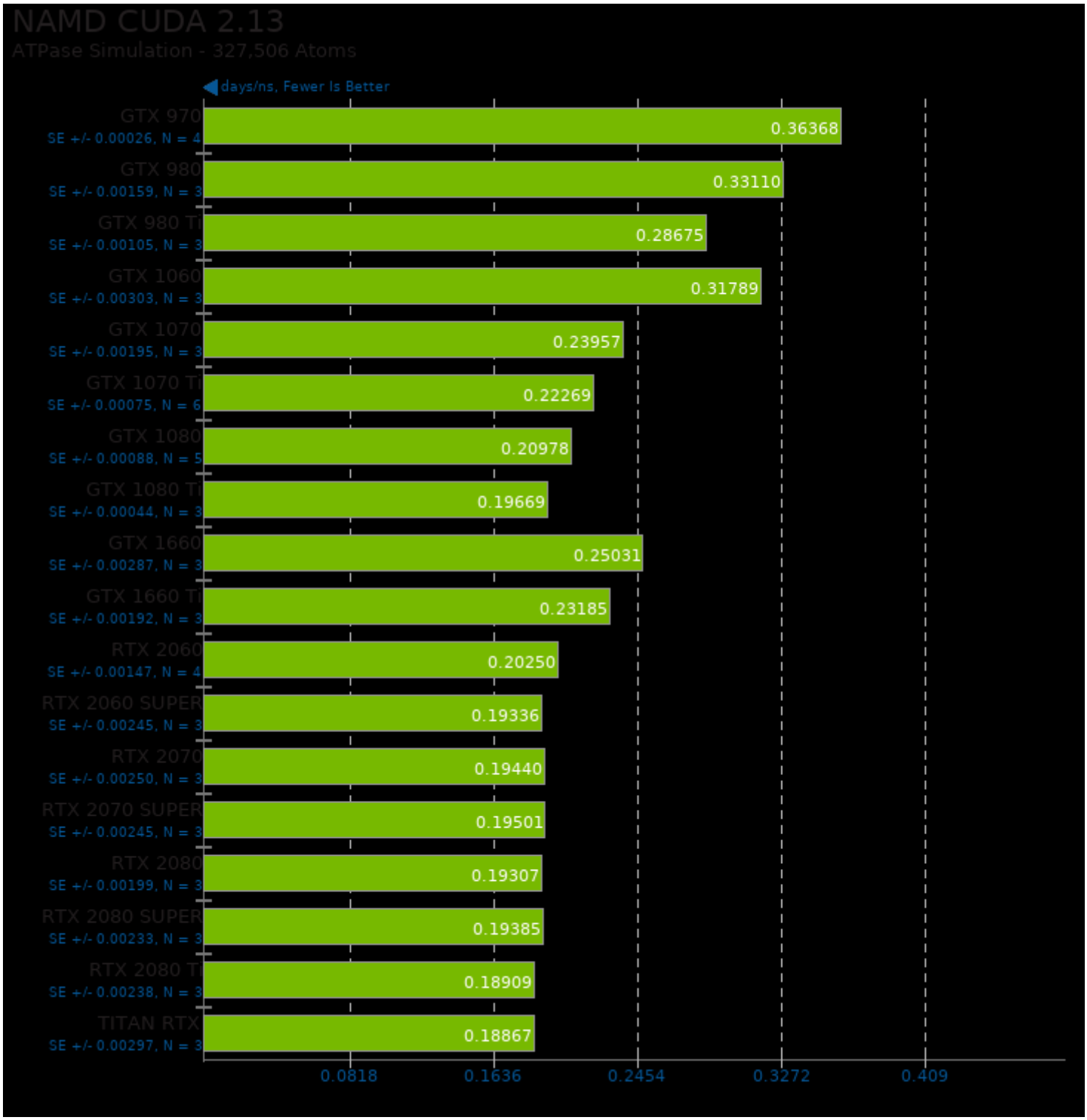
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



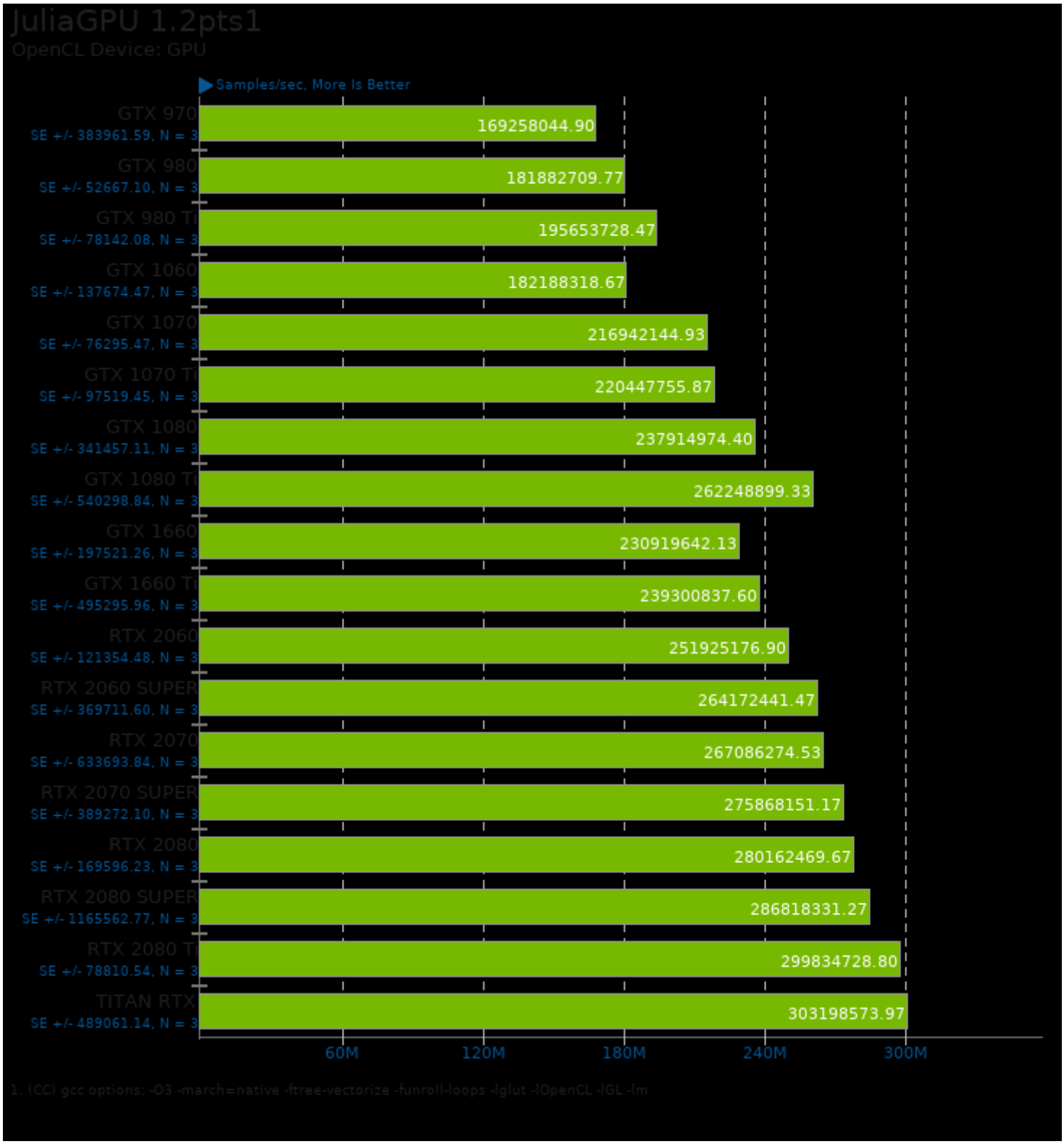
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



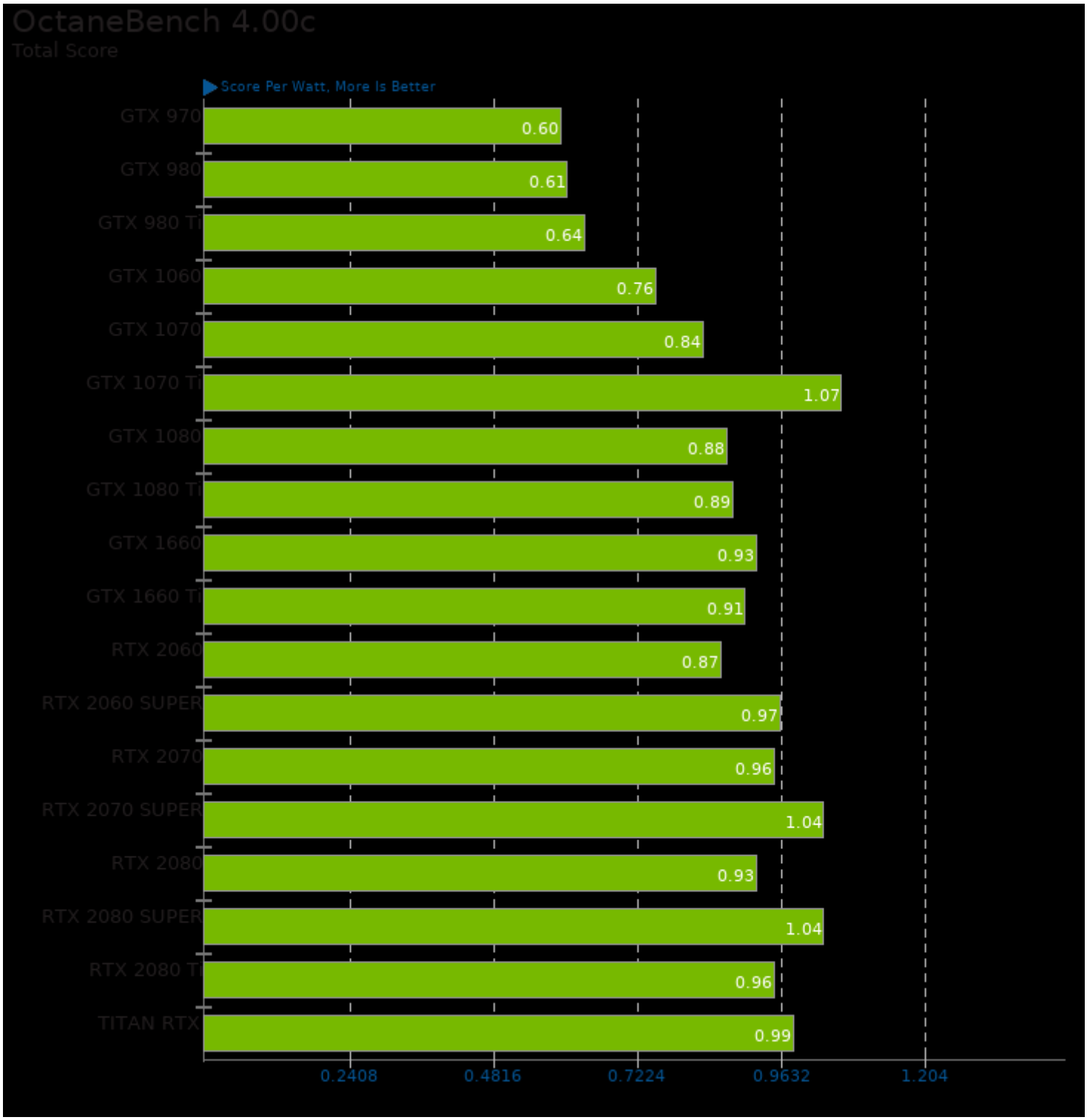
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



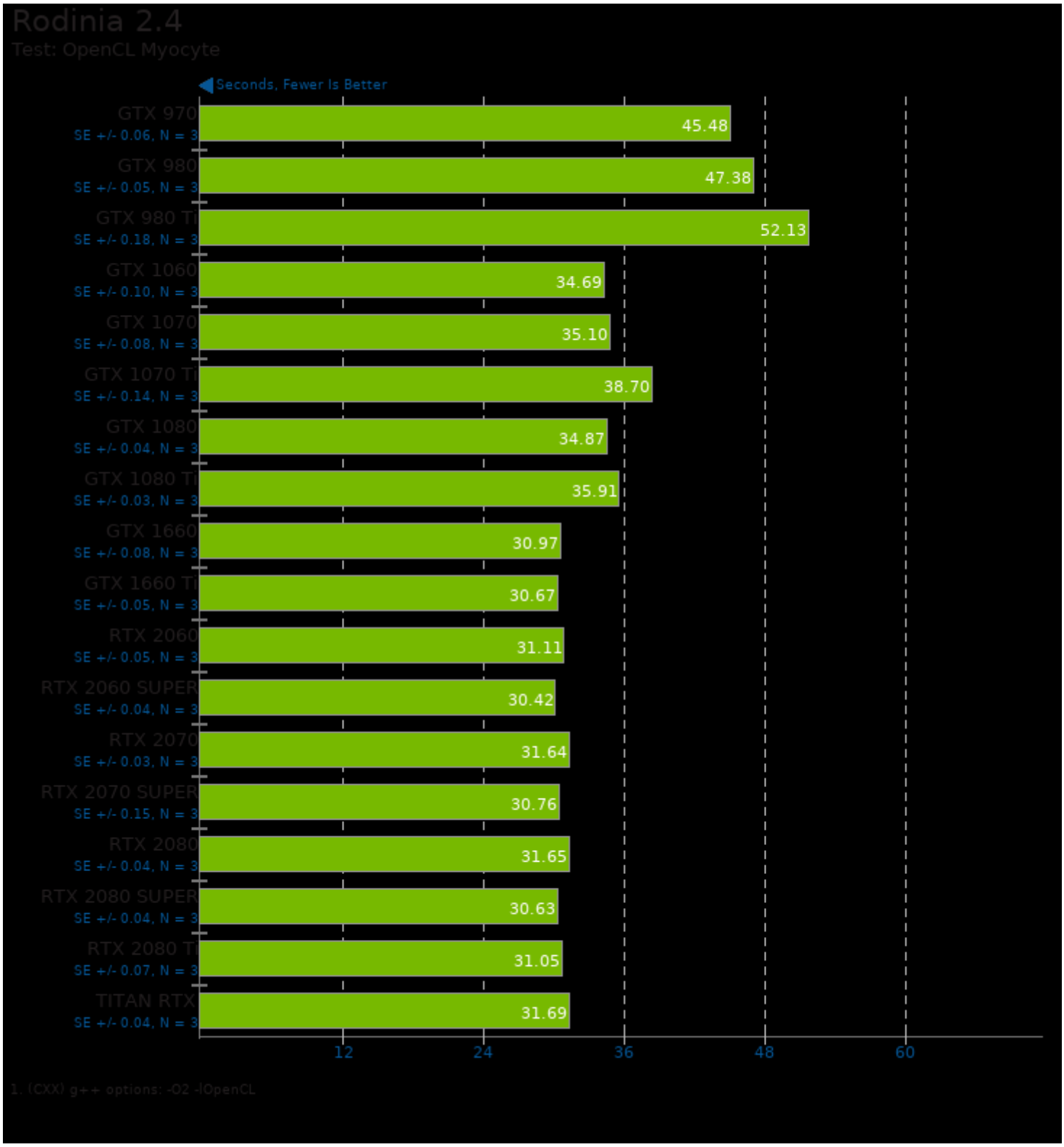
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



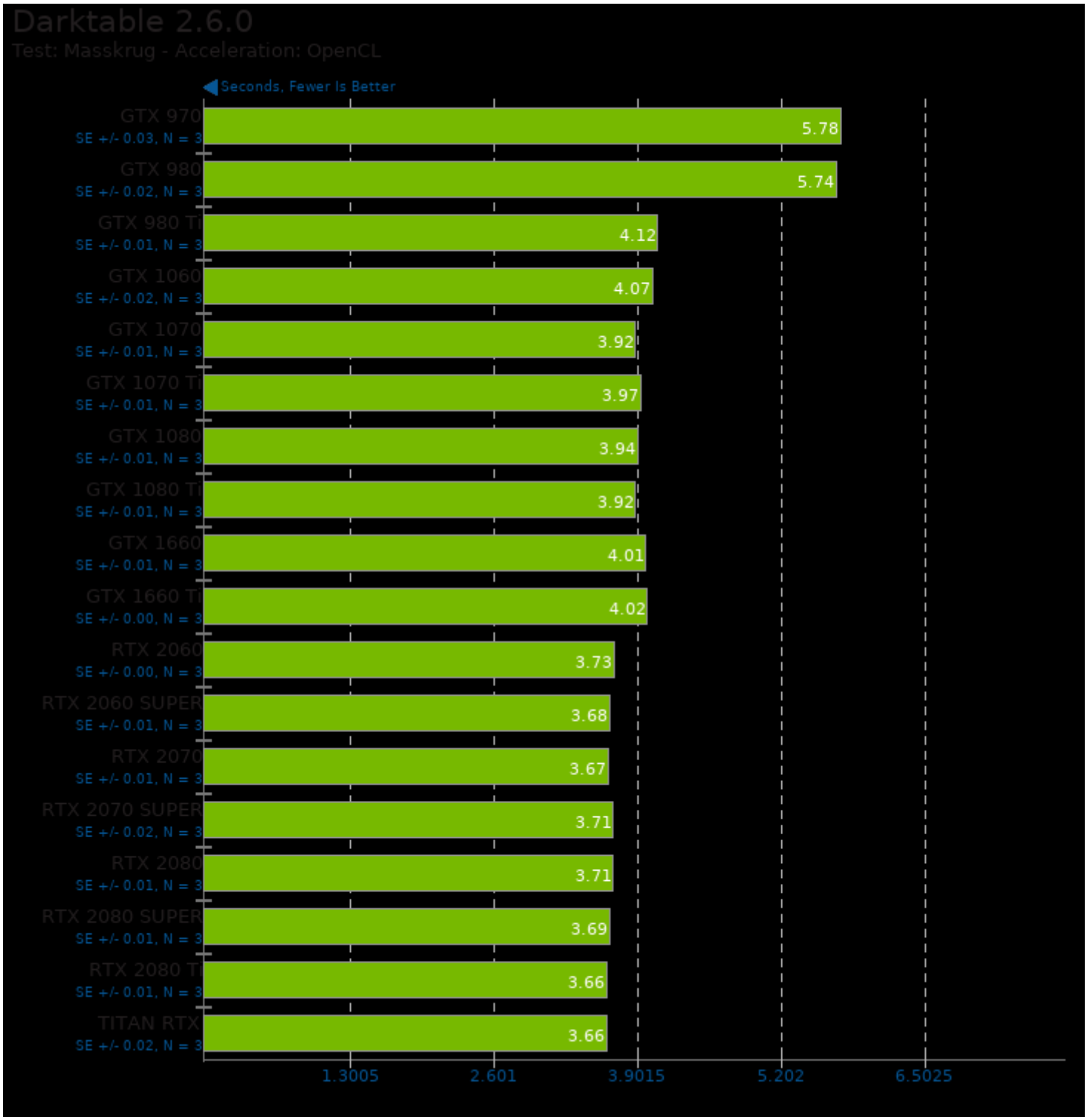
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



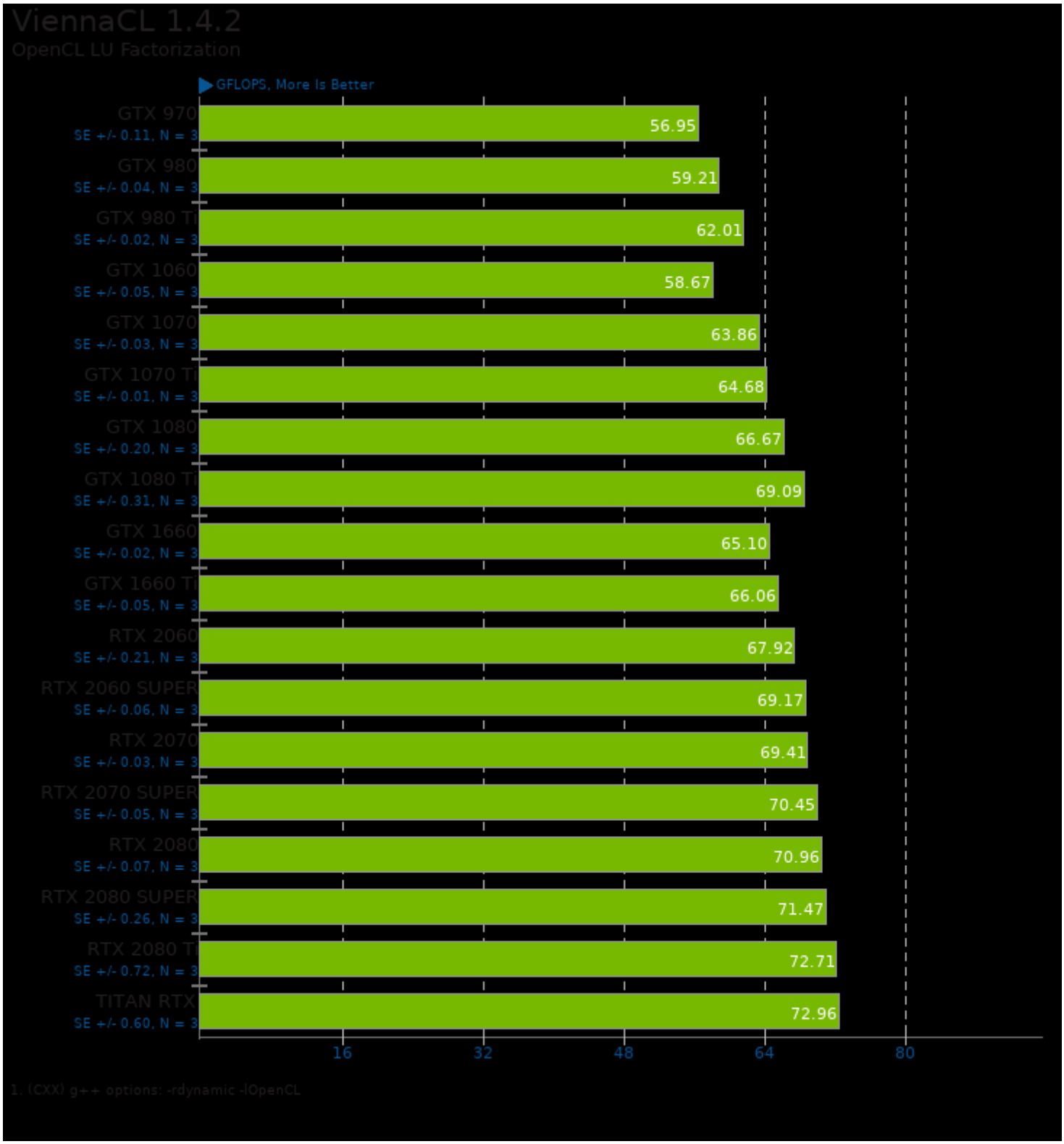
NVIDIA Linux OpenCL CUDA RTX SUPER Compute



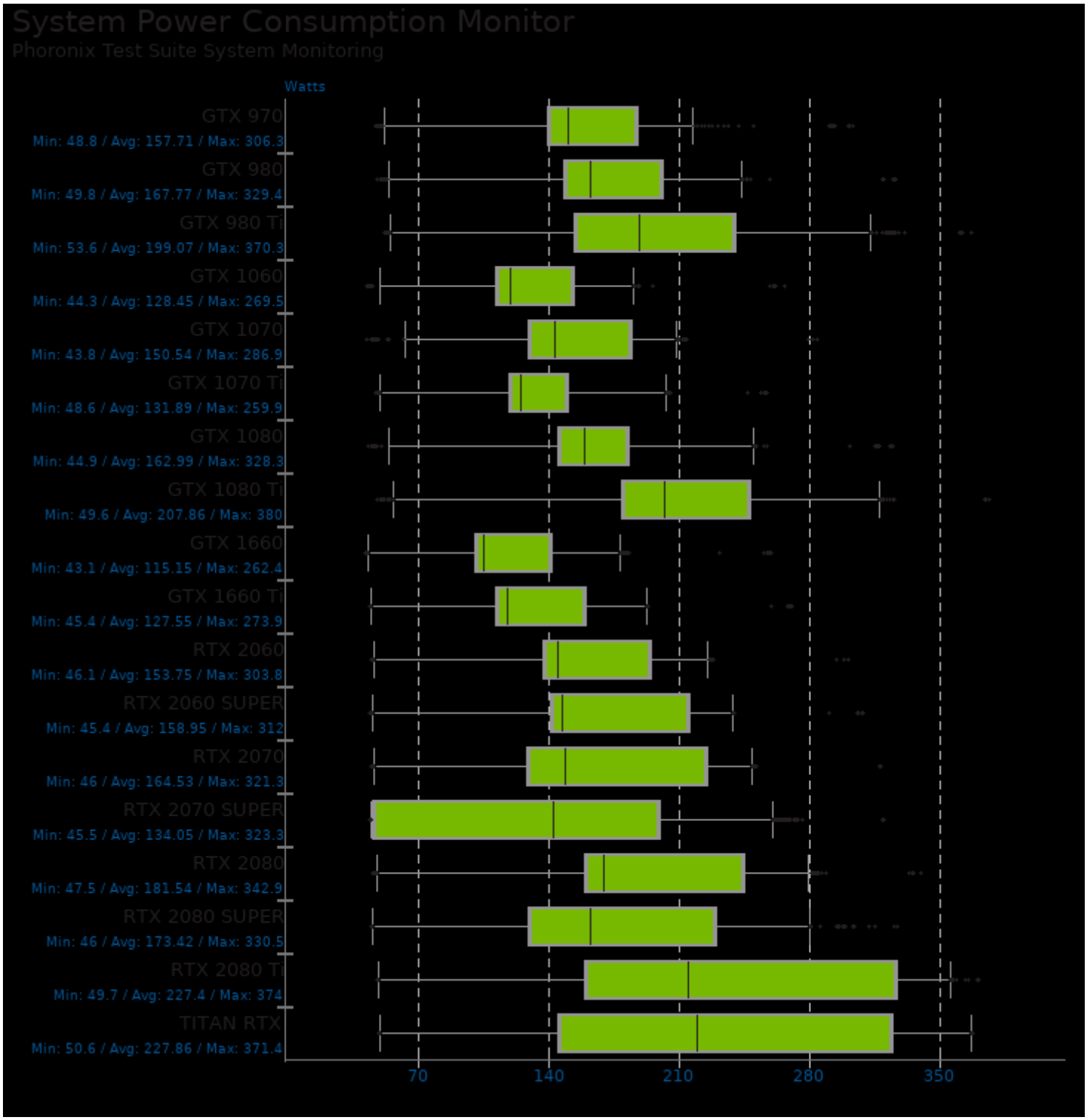
NVIDIA Linux OpenCL CUDA RTX SUPER Compute

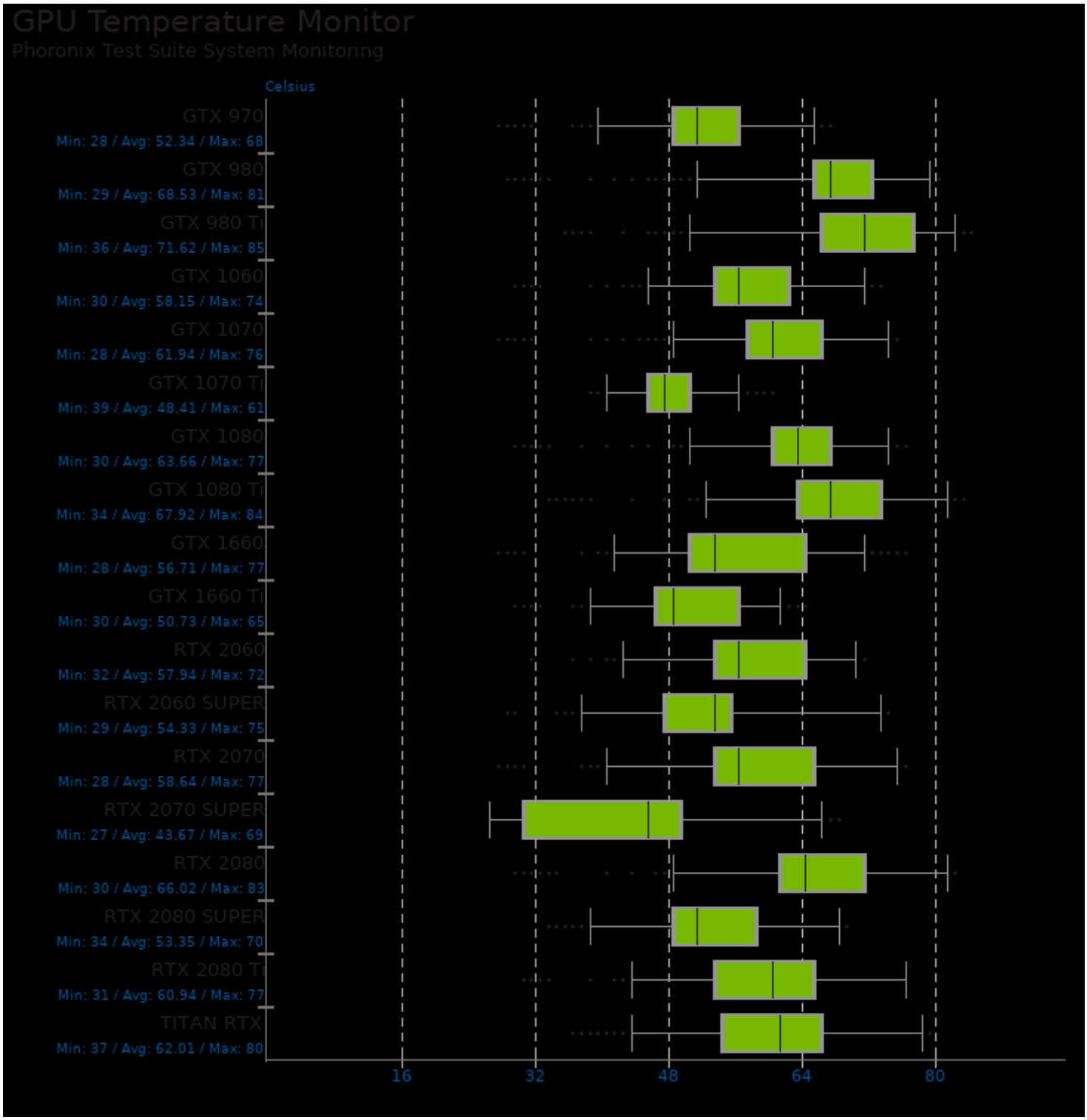


NVIDIA Linux OpenCL CUDA RTX SUPER Compute

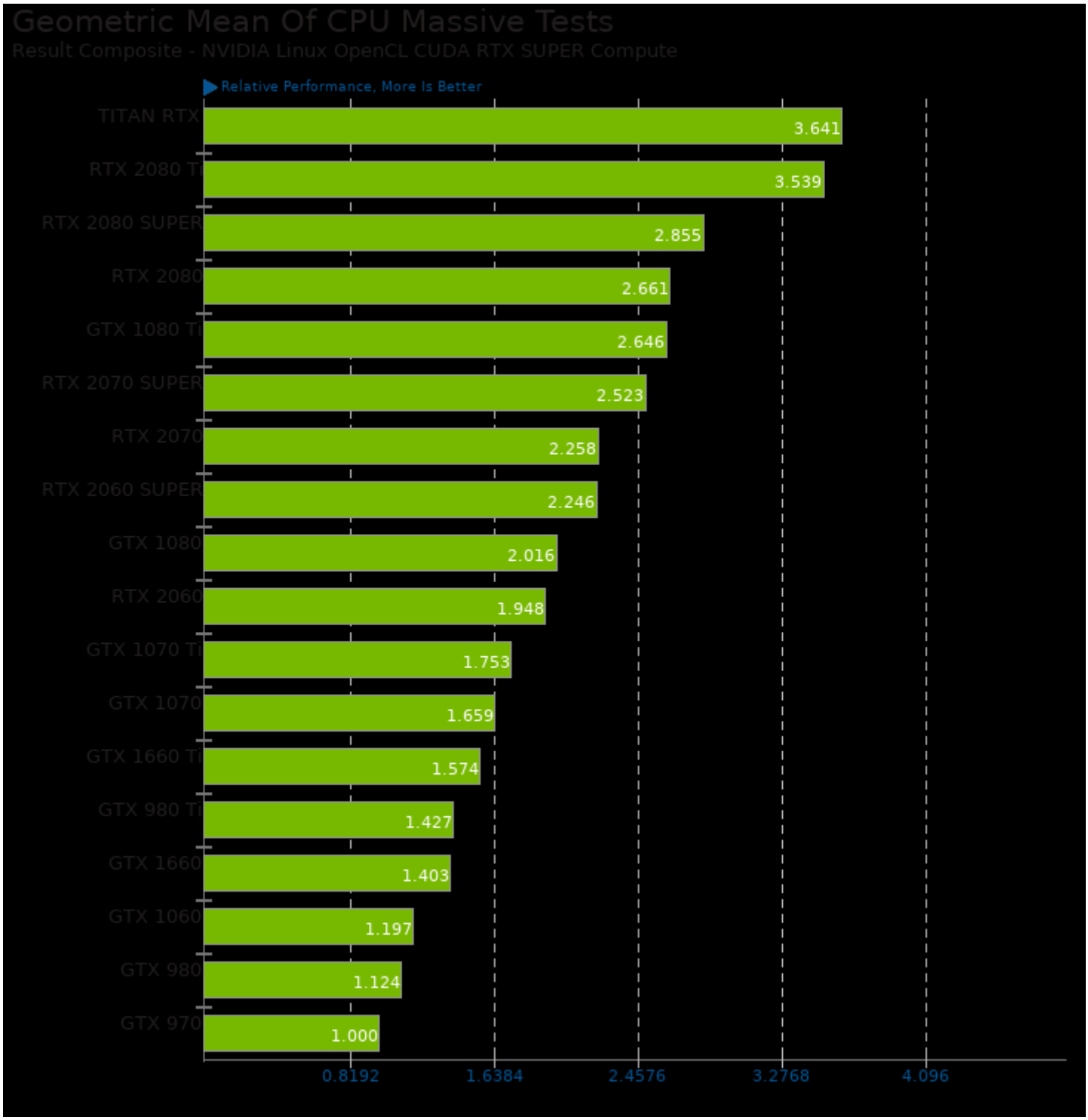


NVIDIA Linux OpenCL CUDA RTX SUPER Compute



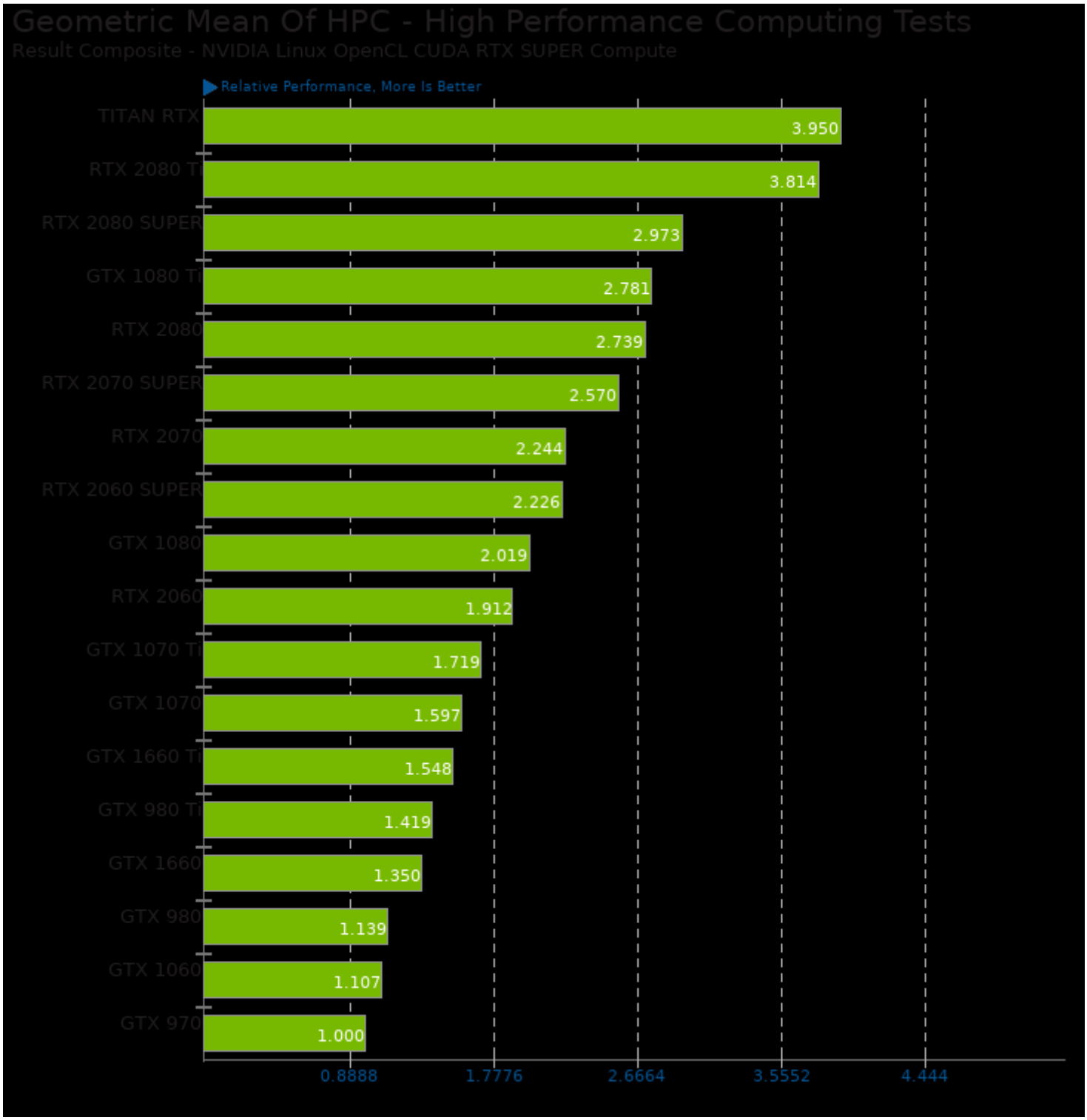

GPU Temperature Monitor
Phoronix Test Suite System Monitoring
Celsius
GTX 970
Min: 28 / Avg: 52.34 / Max: 68
GTX 980
Min: 29 / Avg: 68.53 / Max: 81
GTX 980 Ti
Min: 36 / Avg: 71.62 / Max: 85
GTX 1060
Min: 30 / Avg: 58.15 / Max: 74
GTX 1070
Min: 28 / Avg: 61.94 / Max: 76
GTX 1070 Ti
Min: 39 / Avg: 48.41 / Max: 61
GTX 1080
Min: 30 / Avg: 63.66 / Max: 77
GTX 1080 Ti
Min: 34 / Avg: 67.92 / Max: 84
GTX 1660
Min: 28 / Avg: 56.71 / Max: 77
GTX 1660 Ti
Min: 30 / Avg: 50.73 / Max: 65
RTX 2060
Min: 32 / Avg: 57.94 / Max: 72
RTX 2060 SUPER
Min: 29 / Avg: 54.33 / Max: 75
RTX 2070
Min: 28 / Avg: 58.64 / Max: 77
RTX 2070 SUPER
Min: 27 / Avg: 43.67 / Max: 69
RTX 2080
Min: 30 / Avg: 66.02 / Max: 83
RTX 2080 SUPER
Min: 34 / Avg: 53.35 / Max: 70
RTX 2080 Ti
Min: 31 / Avg: 60.94 / Max: 77
TITAN RTX
Min: 37 / Avg: 62.01 / Max: 80
16
32
48
64
80

These geometric means are based upon test groupings / test suites for this result file.



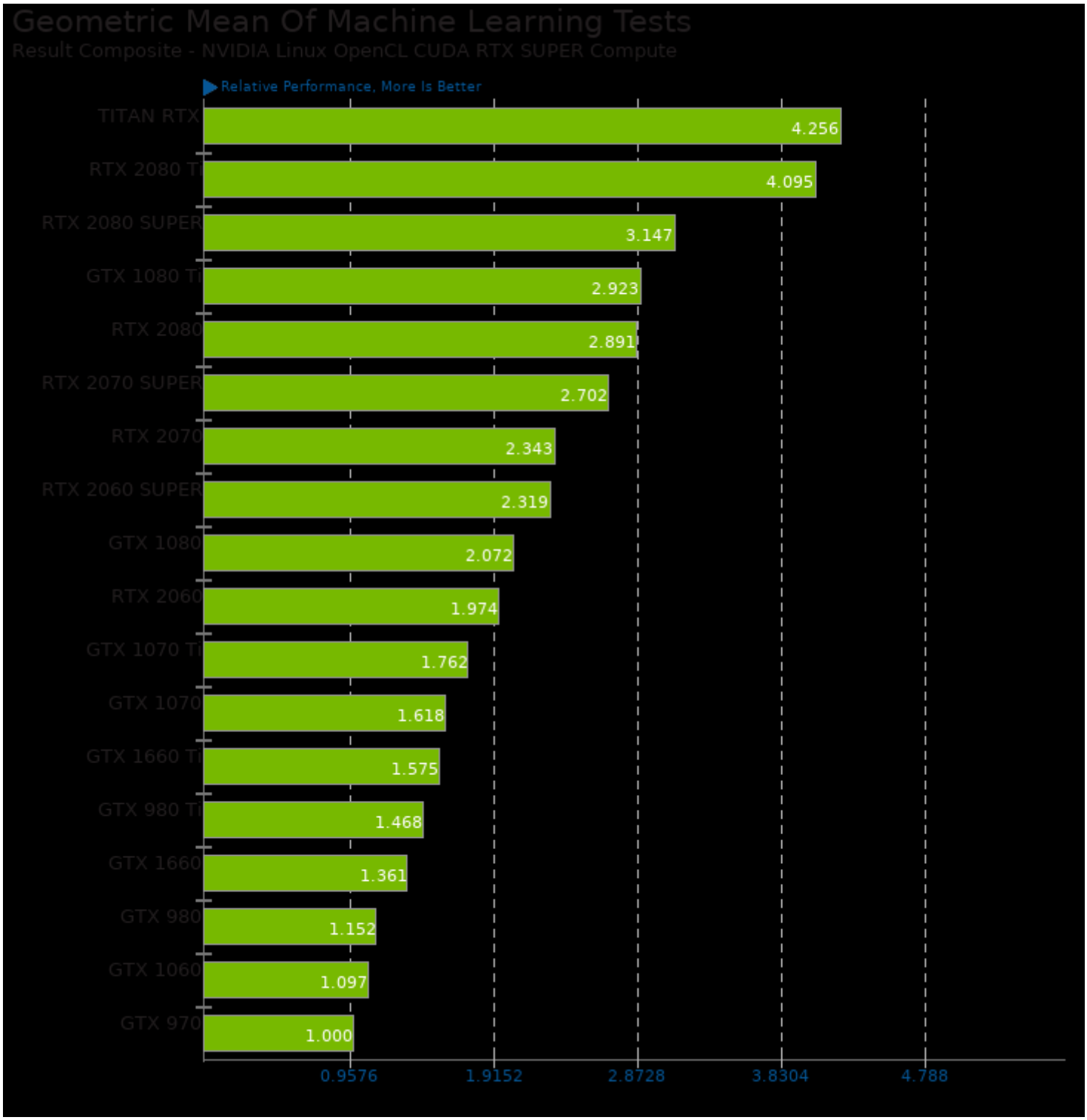
Geometric mean based upon tests: pts/lczero, pts/plaidml, pts/rodinia and system/darktable

NVIDIA Linux OpenCL CUDA RTX SUPER Compute



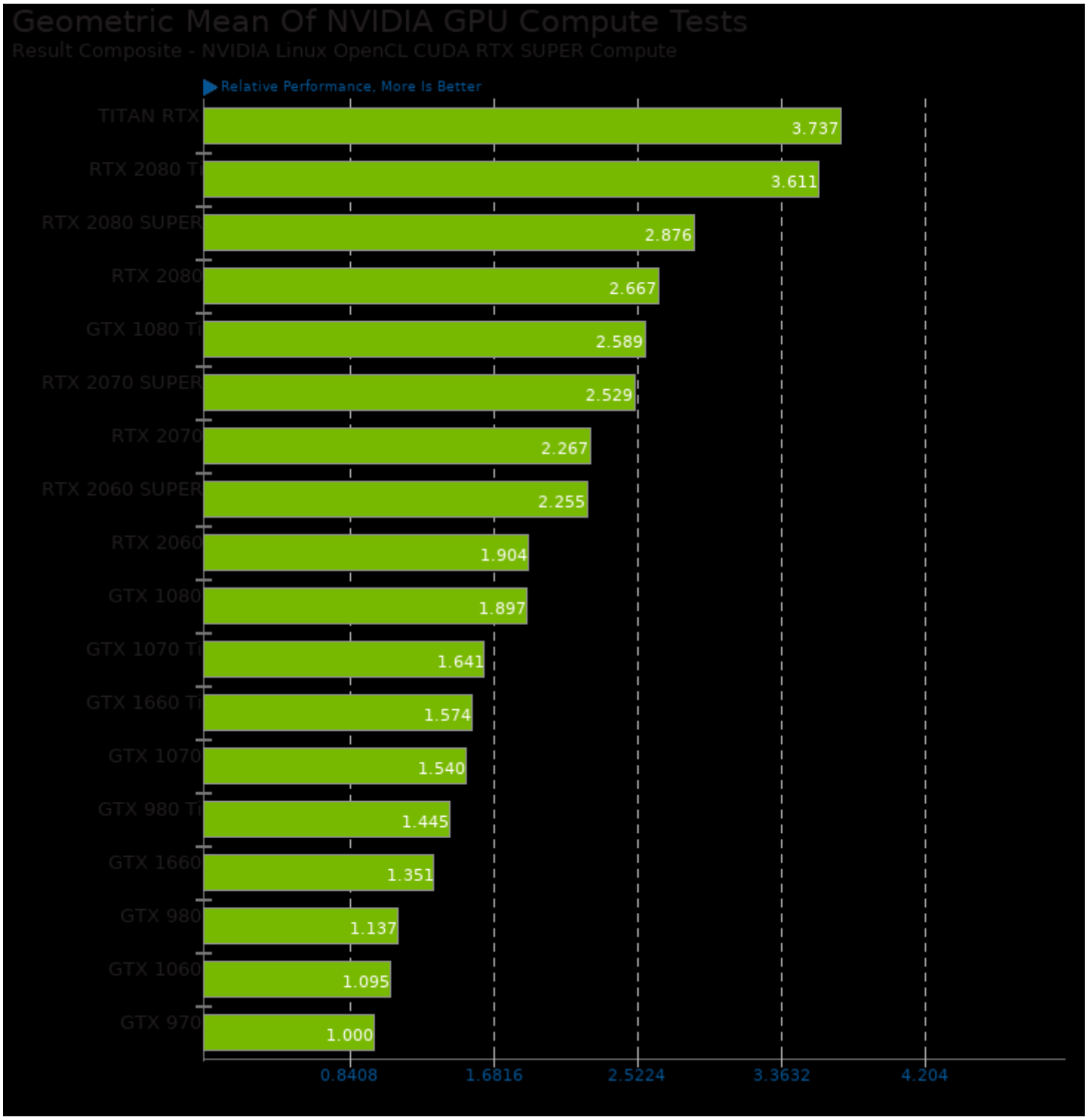
Geometric mean based upon tests: pts/rodinia, pts/shoc, pts/plaidml and pts/lczero

NVIDIA Linux OpenCL CUDA RTX SUPER Compute



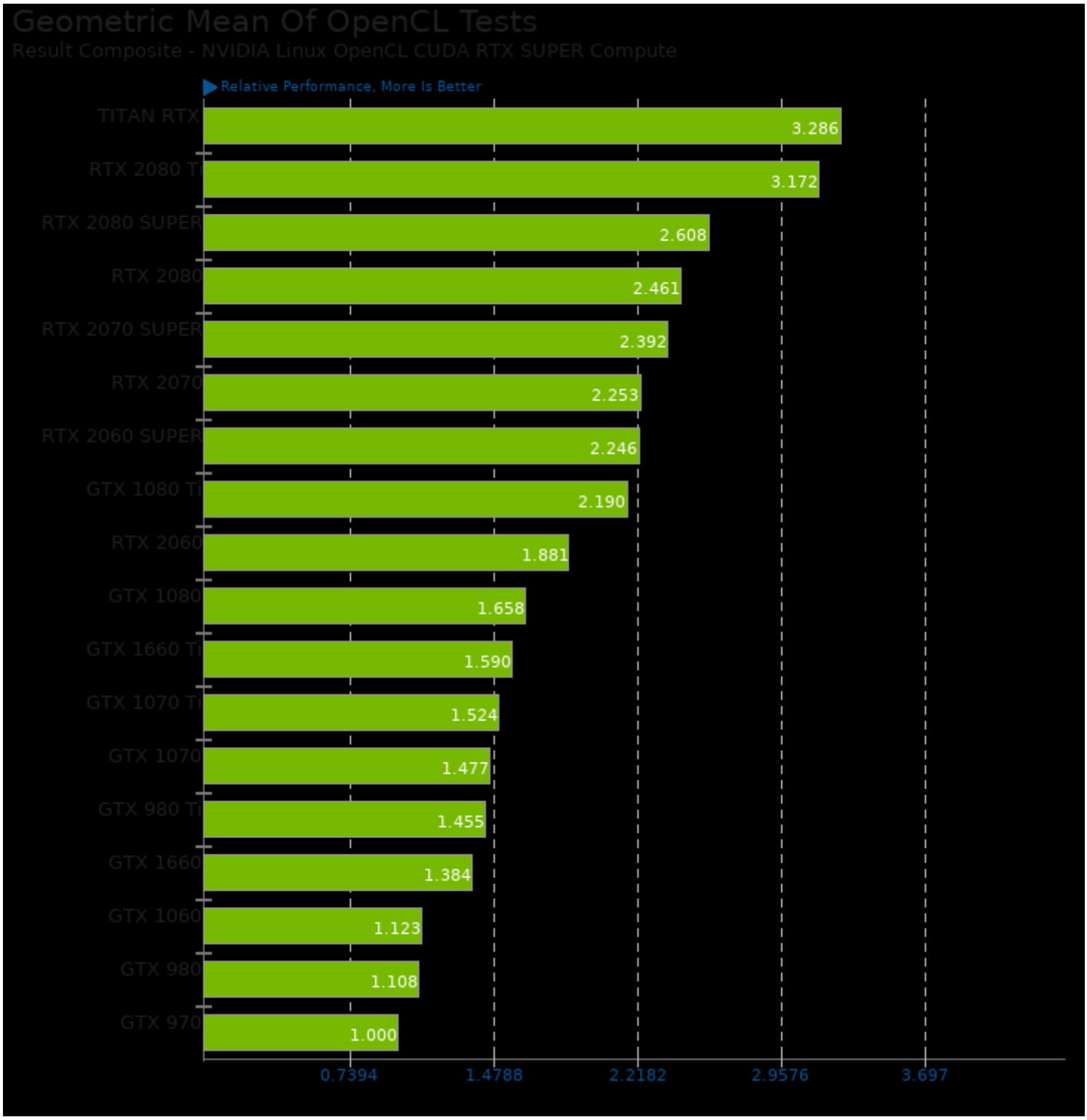
Geometric mean based upon tests: pts/shoc, pts/plaidml and pts/lczero

NVIDIA Linux OpenCL CUDA RTX SUPER Compute



Geometric mean based upon tests: pts/fahbench, pts/namd-cuda, pts/octanebench, pts/rodinia, pts/clpeak, pts/plaidml, pts/lczero, pts/cl-mem, pts/viennacl and pts/shoc

NVIDIA Linux OpenCL CUDA RTX SUPER Compute



Geometric mean based upon tests: pts/juliagpu, pts/luxmark, pts/shoc, pts/cl-mem, pts/clpeak, pts/rodinia, system/darktable and pts/viennacl

This file was automatically generated via the Phoronix Test Suite benchmarking software on Sunday, 22 December 2024 11:39.