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Tigerlake Xe Gen12 to Gen8

Tests for a future article

Automated Executive Summary

Gen12 Xe - i7-1165G7 had the most wins, coming in first place for 95% of the tests.

Based on the geometric mean of all complete results, the fastest (Gen12 Xe - i7-1165G7) was 3.256x the speed of the slowest (Gen8 - i7-5600U). Gen11 - i7-1065G7 was 0.618x the speed of Gen12 Xe - i7-1165G7, Gen9 - i7-8565U was 0.609x the speed of Gen11 - i7-1065G7, Gen8 - i7-5600U was 0.815x the speed of Gen9 - i7-8565U.

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

PlaidML (FP16: No - Mode: Inference - Network: IMDB LSTM - Device: OpenCL) at 10.746x
FinanceBench (Benchmark: Black-Scholes OpenCL) at 7.139x
NCNN (Target: Vulkan GPU - Model: vgg16) at 6.171x
PlaidML (FP16: No - Mode: Inference - Network: VGG19 - Device: OpenCL) at 5.772x
PlaidML (FP16: No - Mode: Inference - Network: DenseNet 201 - Device: OpenCL) at 5.754x
PlaidML (FP16: No - Mode: Inference - Network: VGG16 - Device: OpenCL) at 5.746x
SHOC Scalable HeterOgeneous Computing (Target: OpenCL - Benchmark: Max SP Flops) at 5.561x
SHOC Scalable HeterOgeneous Computing (Target: OpenCL - Benchmark: MD5 Hash) at 5.418x
GpuTest (Test: Pixmark Piano - Resolution: 1920 x 1200 - Mode: Fullscreen) at 5.358x

GpuTest (Test: Pixmark Volplosion - Resolution: 1920 x 1200 - Mode: Fullscreen) at 5.264x.

Test Systems:

Gen9 - i7-8565U

Processor: Intel Core i7-8565U @ 4.60GHz (4 Cores / 8 Threads), Motherboard: Dell 0KTW76 (1.0.0 BIOS), Chipset: Intel Cannon Point-LP, Memory: 16GB, Disk: SK hynix PC401 NVMe 256GB, Graphics: Intel UHD 620 3GB (1150MHz), Audio: Realtek ALC3271, Network: Qualcomm Atheros QCA6174 802.11ac

OS: Ubuntu 20.10, Kernel: 5.9.1-050901-generic (x86_64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenGL: 4.6 Mesa 20.3.0-devel (git-fdbc45d 2020-10-21 groovy-oibaf-ppa), OpenCL: OpenCL 3.0, Vulkan: 1.2.145, Compiler: GCC 10.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --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++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/usr,hsa --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=auto --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0xd6 - Thermald 2.3
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: KVM: Mitigation of VMX disabled + 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 + srbds: Mitigation of Microcode + tsx_async_abort: Not affected

Gen11 - i7-1065G7

Processor: Intel Core i7-1065G7 @ 3.90GHz (4 Cores / 8 Threads), Motherboard: Dell 06CDVY (1.0.9 BIOS), Chipset: Intel Device 34ef, Memory: 16GB, Disk: KBG40ZPZ512G NVMe TOSHIBA 512GB, Graphics: Intel Iris Plus G7 3GB (1100MHz), Audio: Realtek ALC289, Network: Intel Killer Wi-Fi 6 AX1650i 160MHz

OS: Ubuntu 20.10, Kernel: 5.9.1-050901-generic (x86_64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenGL: 4.6 Mesa 20.3.0-devel (git-4408131 2020-10-20 groovy-oibaf-ppa), OpenCL: OpenCL 3.0, Vulkan: 1.2.145, Compiler: GCC 10.2.0, File-System: ext4, Screen Resolution: 1920x1200

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --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++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/usr,hsa --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=auto --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0x78 - Thermald 2.3
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: KVM: Mitigation of VMX disabled + l1tf: Not affected + mds: Not affected + 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 Enhanced IBRS IBPB: conditional RSB filling + srbds: Not affected + tsx_async_abort: Not affected

Gen12 Xe - i7-1165G7

Processor: Intel Core i7-1165G7 @ 4.70GHz (4 Cores / 8 Threads), Motherboard: Dell 0GG9PT (1.0.3 BIOS), Chipset: Intel Tiger Lake-LP, Memory: 16GB, Disk: KIOXIA KBG40ZNS256G NVMe 256GB, Graphics: Intel UHD 3GB (1300MHz), Audio: Realtek ALC289, Network: Intel Wi-Fi 6 AX201

OS: Ubuntu 20.10, Kernel: 5.9.1-050901-generic (x86_64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenGL: 4.6 Mesa 20.3.0-devel (git-fdbc45d 2020-10-21 groovy-oibaf-ppa), OpenCL: OpenCL 3.0, Vulkan: 1.2.145, Compiler: GCC 10.2.0, File-System: ext4, Screen Resolution: 1920x1200

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --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++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/usr,hsa --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=auto --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0x60 - Thermald 2.3
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + 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 Enhanced IBRS IBPB: conditional RSB filling + srbds: Not affected + tsx_async_abort: Not affected

Gen8 - i7-5600U

Processor: Intel Core i7-5600U @ 3.20GHz (2 Cores / 4 Threads), Motherboard: LENOVO 20BSCTO1WW (N14ET49W 1.27 BIOS), Chipset: Intel Broadwell-U-OPI, Memory: 8GB, Disk: 128GB SAMSUNG MZNTE128, Graphics: Intel HD 5500 3GB (950MHz), Audio: Intel Broadwell-U Audio, Network: Intel I218-LM + Intel 7265

OS: Ubuntu 20.10, Kernel: 5.9.1-050901-generic (x86_64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenGL: 4.6 Mesa 20.3.0-devel (git-81797fc 2020-10-22 groovy-oibaf-ppa), OpenCL: OpenCL 3.0, Vulkan: 1.2.145, Compiler: GCC 10.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --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++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/usr,hsa --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=auto --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_cpufreq ondemand - CPU Microcode: 0x2f - Thermald 2.3
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: KVM: Mitigation of VMX disabled + l1tf: Mitigation of PTE Inversion; VMX: conditional cache flushes SMT vulnerable + mds: Mitigation of Clear buffers; SMT vulnerable + meltdown: Mitigation of PTI + 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 + srbds: Mitigation of Microcode + tsx_async_abort: Mitigation of Clear buffers; SMT vulnerable

	Gen9 - i7-8565U	Gen11 - i7-1065G7	Gen12 Xe - i7-1165G7	Gen8 - i7-5600U
FinanceBench - B.S.O (ms)	25.826923	6.343	**4.179**	**29.835615**
Normalized	16.18%	65.88%	100%	14.01%
Standard Deviation	0.6%	3.2%	0.5%	0.1%
NCNN - Vulkan GPU - vgg16 (ms)	152.79	96.32	**38.44**	**237.21**
Normalized	25.16%	39.91%	100%	16.21%
Standard Deviation	0.1%	0.1%	0.1%	0.2%
PlaidML - No - Inference - VGG19 - OpenCL (FPS)	6.42	16.03	**17.49**	**3.03**
Normalized	36.71%	91.65%	100%	17.32%
Standard Deviation	0.2%	2.2%	0.2%	0.2%
PlaidML - No - Inference - DenseNet 201 - OpenCL (FPS)	5.81	11.30	**22.44**	**3.90**
Normalized	25.89%	50.36%	100%	17.38%

Standard Deviation	0.4%	1.2%	0.7%	0.4%
PlaidML - No - Inference - VGG16 - OpenCL (FPS)	8.18	19.93	22.18	3.86
Normalized	36.88%	89.86%	100%	17.4%
Standard Deviation	1.6%	5.9%	0.3%	0.4%
SHOC Scalable HeterOgeneous Computing - OpenCL - Max SP Flops (GFLOPS)	1681	5323	7821	1406
Normalized	21.5%	68.06%	100%	17.98%
Standard Deviation	0.1%	0.1%	0%	0%
SHOC Scalable HeterOgeneous Computing - OpenCL - MD5 Hash (GHash/s)	0.3691	0.6778	1.6775	0.3096
Normalized	22%	40.41%	100%	18.46%
Standard Deviation	0%	0.1%	0%	0%
GpuTest - Pixmark Piano - 1920 x 1200 - Fullscreen (Points)	149	288	584	109
Normalized	25.51%	49.32%	100%	18.66%
Standard Deviation		1%	1.9%	1.4%
GpuTest - Pixmark Volplosion - 1920 x 1200 - Fullscreen (Points)	390	761	1595	303
Normalized	24.45%	47.71%	100%	19%
Standard Deviation		1.1%	1.6%	1.1%
MandelGPU - GPU (Samples/sec)	10702353	23689429	44609195	8624284
Normalized	23.99%	53.1%	100%	19.33%
Standard Deviation	0%	1.7%	1.2%	0.1%
PlaidML - No - Inference - Inception V3 - OpenCL (FPS)	15.90	34.82	46.37	9.04
Normalized	34.29%	75.09%	100%	19.5%
Standard Deviation	1.7%	0.4%	0.1%	0.4%
SHOC Scalable HeterOgeneous Computing - OpenCL - FFT SP (GFLOPS)	38.9719	140.162	156.162	31.4218
Normalized	24.96%	89.75%	100%	20.12%
Standard Deviation	0.3%	0.5%	0.8%	0.3%
LeelaChessZero - OpenCL (Nodes/s)	389	579	1535	309
Normalized	25.34%	37.72%	100%	20.13%
Standard Deviation	2.3%	2.4%	0.9%	0.6%
clpeak - S.P.F (GFLOPS)	438.06	1039	1775	362.15
Normalized	24.68%	58.52%	100%	20.41%
Standard Deviation	0%	0.1%	0%	0%
Waifu2x-NCNN Vulkan - 2x - 3 - Yes (sec)	75.252	53.103	27.216	15.832
Normalized	21.04%	29.81%	58.17%	100%
Standard Deviation	0.1%	3%	0.2%	1.3%
NCNN - Vulkan GPU - yolov4-tiny (ms)	62.81	38.95	15.26	72.28
Normalized	24.3%	39.18%	100%	21.11%
Standard Deviation	0.8%	0.7%	0.2%	0.1%
PlaidML - No - Inference - ResNet 50 - OpenCL (FPS)	34.52	75.57	87.29	18.65
Normalized	39.55%	86.57%	100%	21.37%
Standard Deviation	1.8%	2.4%	0.1%	0.1%

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GpuTest - Furmark - 1920 x 1200 - Fullscreen (Points)	672	1062	**1782**	**395**
Normalized	37.71%	59.6%	100%	22.17%
Standard Deviation	2.2%	2.5%	2.6%	1.4%
oneAPI Level Zero Tests - H.T.D.T.H.I.C (GB/s)	**4.83779**	10.5736	**21.6345**	
Normalized	22.36%	48.87%	100%	
Standard Deviation	0.6%	2.9%	0.9%	
Unigine Heaven - 1920 x 1200 - Fullscreen - OpenGL (FPS)	10.3701	16.1363	**28.6453**	**6.45012**
Normalized	36.2%	56.33%	100%	22.52%
Standard Deviation	0.3%	4.5%	0.4%	0.1%
NCNN - Vulkan GPU - resnet50 (ms)	51.46	35.91	**15.49**	**68.17**
Normalized	30.1%	43.14%	100%	22.72%
Standard Deviation	0.1%	0.2%	0.2%	0%
NCNN - Vulkan GPU - resnet18 (ms)	23.89	17.12	**7.18**	**31.41**
Normalized	30.05%	41.94%	100%	22.86%
Standard Deviation	0%	0.2%	0.6%	0.1%
Unigine Valley - 1920 x 1200 - Fullscreen - OpenGL (FPS)	11.4067	17.7436	**30.6054**	**7.09121**
Normalized	37.27%	57.98%	100%	23.17%
Standard Deviation	1%	1.1%	0.5%	0.1%
PlaidML - No - Inference - Mobilenet - OpenCL (FPS)	116.08	242.83	**299.60**	**69.89**
Normalized	38.74%	81.05%	100%	23.33%
Standard Deviation	0%	2.4%	0.5%	1.1%
oneAPI Level Zero Tests - P.H.P.C (GFLOPS)	**751.623**	1352	**3037**	
Normalized	24.75%	44.53%	100%	
Standard Deviation	0.1%	2.5%	0.1%	
ViennaCL - O.L.F (GFLOPS)	24.6746	48.9117	**73.8162**	**18.4897**
Normalized	33.43%	66.26%	100%	25.05%
Standard Deviation	0.3%	1.3%	0.4%	0.3%
NCNN - Vulkan GPU - mobilenet (ms)	25.74	22.36	**9.74**	**38.64**
Normalized	37.84%	43.56%	100%	25.21%
Standard Deviation	2.6%	1.6%	1.2%	0.1%
Unigine Superposition - 1920 x 1200 - Fullscreen - Medium - OpenGL (FPS)	5.8	9.0	**16.4**	**4.2**
Normalized	35.37%	54.88%	100%	25.61%
Standard Deviation	1%	0.6%	0%	1.4%
NCNN - Vulkan GPU - alexnet (ms)	25.77	16.63	**9.47**	**35.72**
Normalized	36.75%	56.95%	100%	26.51%
Standard Deviation	0.1%	0.3%	0.1%	0.2%
Unigine Superposition - 1920 x 1200 - Fullscreen - Low - OpenGL (FPS)	12.2	17.0	**29.6**	**8.0**
Normalized	41.22%	57.43%	100%	27.03%
Standard Deviation	0.5%	0.9%	0.8%	0.7%
JuliaGPU - GPU (Samples/sec)	47930813	85184313	**132508055**	**37370860**
Normalized	36.17%	64.29%	100%	28.2%
Standard Deviation	0%	3%	2.6%	3%
SHOC Scalable HeterOgeneous Computing - OpenCL - T.R.B (GB/s)	**54.2625**	174.162	**189.757**	78.7761
Normalized	28.6%	91.78%	100%	41.51%
Standard Deviation	0%	1.7%	0%	0.4%

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NCNN - Vulkan GPU - squeezenet (ms)	28.27	24.65	**11.51**	**40.21**
Normalized	40.71%	46.69%	100%	28.62%
Standard Deviation	0.4%	2.2%	0.3%	1.7%
oneAPI Level Zero Tests - P.I.C (GFLOPS)	**138.516**	153.147	**439.002**	
Normalized	31.55%	34.89%	100%	
Standard Deviation	3%	2.4%	0.5%	
Waifu2x-NCNN Vulkan - 2x - 3 - No	10.288	7.062	**4.095**	**12.871**
Normalized	39.8%	57.99%	100%	31.82%
Standard Deviation	0.6%	0.9%	0.9%	0.8%
Tesseract - 1920 x 1200 (FPS)	65.22251	109.4669	**140.3486**	**45.21265**
Normalized	46.47%	78%	100%	32.21%
Standard Deviation	1.2%	2.3%	1.1%	1.1%
clpeak - G.M.B (GBPS)	26.73	45.94	**57.02**	**18.59**
Normalized	46.88%	80.57%	100%	32.6%
Standard Deviation	0.6%	0.1%	0.1%	0.2%
oneAPI Level Zero Tests - P.S.P.C (GB/s)	**418.862**	920.207	**1220**	
Normalized	34.35%	75.46%	100%	
Standard Deviation	0.7%	0%	0%	
PlaidML - No - Inference - NASNer Large - OpenCL (FPS)	**1.84**	3.31	**5.14**	
Normalized	35.8%	64.4%	100%	
Standard Deviation	0.5%	0.3%	0%	
NCNN - Vulkan GPU - googlenet (ms)	23.72	18.62	**10.51**	**29.22**
Normalized	44.31%	56.44%	100%	35.97%
Standard Deviation	0.5%	0.1%	0.5%	0.1%
Xonotic - 1920 x 1200 - Ultimate (FPS)	71.6067804	99.2365089	**121.9041377**	**46.3925137**
Normalized	58.74%	81.41%	100%	38.06%
Standard Deviation	1.1%	2.7%	1.5%	0.2%
GpuTest - TessMark - 1920 x 1200 - Fullscreen (Points)	2840	3602	**5080**	**1965**
Normalized	55.91%	70.91%	100%	38.68%
Standard Deviation	1.5%	1.3%	0.9%	1%
NCNN - Vulkan GPU - blazeface (ms)	1.81	1.81	**0.98**	**2.53**
Normalized	54.14%	54.14%	100%	38.74%
Standard Deviation	3.9%	1.8%	3.5%	3.2%
Xonotic - 1920 x 1200 - Ultra (FPS)	93.2094800	123.2383929	**155.3708840**	**61.6756141**
Normalized	59.99%	79.32%	100%	39.7%
Standard Deviation	1%	2.6%	1.5%	0.5%
cl-mem - Read (GB/s)	**22.7**	41.3	**57.1**	
Normalized	39.75%	72.33%	100%	
Standard Deviation	1.8%	0.7%	2.3%	
GpuTest - GiMark - 1920 x 1200 - Fullscreen (Points)	1314	1724	**2017**	**804**
Normalized	65.15%	85.47%	100%	39.86%
Standard Deviation	0.8%	1%	0.1%	0.9%
Xonotic - 1920 x 1200 - High (FPS)	111.6753218	144.1207832	**183.8028138**	**75.1518321**
Normalized	60.76%	78.41%	100%	40.89%
Standard Deviation	1.3%	2.8%	2.4%	0.4%
NCNN - Vulkan GPU-v2-v2 - mobilenet-v2 (ms)	8.27	7.53	**4.62**	**10.73**
Normalized	55.86%	61.35%	100%	43.06%
Standard Deviation	0.8%	1.3%	2.3%	0.3%

Tigerlake Xe Gen12 to Gen8

oneAPI Level Zero Tests - P.F.G.M.B (GB/s)	**24.5276**	34.7522	**56.9391**	
Normalized	43.08%	61.03%	100%	
Standard Deviation	2.1%	0.1%	0.5%	
cl-mem - Copy (GB/s)	**21.6**	35.9	**48.0**	
Normalized	45%	74.79%	100%	
Standard Deviation	1.9%	0.5%	0.1%	
NCNN - Vulkan GPU-v3-v3 - mobilenet-v3 (ms)	9.19	8.65	**5.47**	**11.15**
Normalized	59.52%	63.24%	100%	49.06%
Standard Deviation	0.3%	0.2%	1.4%	0.8%
Xonotic - 1920 x 1200 - Low (FPS)	183.6211229	209.1609960	**307.6345501**	**153.6576092**
Normalized	59.69%	67.99%	100%	49.95%
Standard Deviation	0.1%	2.9%	2.9%	0.8%
PlaidML - No - Inference - IMDB LSTM - OpenCL (FPS)	7.84	20.10	**30.52**	**2.84**
Normalized	25.69%	65.86%	100%	9.31%
Standard Deviation	0.4%	1%	2.3%	2.8%
cl-mem - Write (GB/s)	**24.0**	34.4	**47.9**	
Normalized	50.1%	71.82%	100%	
Standard Deviation	2.7%	5%	0.8%	
oneAPI Level Zero Tests - D.T.H.B (usec)	**19941**	12233	**10057**	
Normalized	50.44%	82.22%	100%	
Standard Deviation	1%	0.1%	0.2%	
oneAPI Level Zero Tests - D.T.H.B (GB/s)	**13.462183**	21.943939	**26.690187**	
Normalized	50.44%	82.22%	100%	
Standard Deviation	1%	0.1%	0.2%	
oneAPI Level Zero Tests - H.T.D.B (usec)	**19750**	12241	**10049**	
Normalized	50.88%	82.09%	100%	
Standard Deviation	0.9%	0.2%	0.3%	
oneAPI Level Zero Tests - H.T.D.B (GB/s)	**13.592119**	21.928612	**26.714162**	
Normalized	50.88%	82.09%	100%	
Standard Deviation	0.9%	0.2%	0.3%	
NCNN - Vulkan GPU - efficientnet-b0 (ms)	16.52	16.72	**11.05**	**20.67**
Normalized	66.89%	66.09%	100%	53.46%
Standard Deviation	0.1%	0.1%	0.4%	0.3%
oneAPI Level Zero Tests - P.S.M.C.t.S.M (GB/s)	**10.7883**	13.8085	**15.0859**	
Normalized	71.51%	91.53%	100%	
Standard Deviation	2.9%	0.3%	0.5%	
clpeak - Kernel Latency (us)	34.12	**36.89**	**29.53**	32.82
Normalized	86.55%	80.05%	100%	89.98%
Standard Deviation	2.3%	0.7%	0.5%	1.4%
GpuTest - Pixmark Volplosion - 1920 x 1200 - Fullscreen (Points/Watt)	**16.06**	45.24	**75.39**	
Normalized	21.3%	60.01%	100%	

Tigerlake Xe Gen12 to Gen8

GpuTest - Pixmark Piano - 1920 x 1200 - Fullscreen (Points/Watt)	6.01	17.13	27.39
Normalized	21.94%	62.54%	100%
GpuTest - TessMark - 1920 x 1200 - Fullscreen (Points/Watt)	100.32	214.06	242.99
Normalized	41.29%	88.09%	100%
GpuTest - Furmark - 1920 x 1200 - Fullscreen (Points/Watt)	25.26	63.19	81.15
Normalized	31.13%	77.87%	100%
GpuTest - GiMark - 1920 x 1200 - Fullscreen (Points/Watt)	47.23	104.65	111.04
Normalized	42.53%	94.25%	100%
Xonotic - 1920 x 1200 - Ultimate (FPS/Watt)	2.65	6.10	5.56
Normalized	43.44%	100%	91.15%
Xonotic - 1920 x 1200 - Ultra	3.44	7.51	7.06
Normalized	45.81%	100%	94.01%
Xonotic - 1920 x 1200 - High	4.25	8.81	8.28
Normalized	48.24%	100%	93.98%
Xonotic - 1920 x 1200 - Low	8.37	12.89	14.14
Normalized	59.19%	91.16%	100%
Unigine Valley - 1920 x 1200 - Fullscreen - OpenGL (FPS/Watt)	0.43	1.13	1.40
Normalized	30.71%	80.71%	100%
Unigine Superposition - 1920 x 1200 - Fullscreen - Medium - OpenGL (FPS/Watt)	0.23	0.50	0.74
Normalized	31.08%	67.57%	100%
Unigine Superposition - 1920 x 1200 - Fullscreen - Low - OpenGL (FPS/Watt)	0.48	0.89	1.34
Normalized	35.82%	66.42%	100%
Unigine Heaven - 1920 x 1200 - Fullscreen - OpenGL (FPS/Watt)	0.38	0.81	1.31
Normalized	29.01%	61.83%	100%
Tesseract - 1920 x 1200 (FPS/Watt)	2.61	5.00	6.28
Normalized	41.56%	79.62%	100%
ET: Legacy - Renderer2 - 1920 x 1200 (FPS/Watt)	3.41	5.40	5.59
Normalized	61%	96.6%	100%
clpeak - T.B.e (GBPS/Watt)	2.60	3.45	3.44
Normalized	75.36%	100%	99.71%
clpeak - G.M.B (GBPS/Watt)	0.92	2.71	2.54
Normalized	33.95%	100%	93.73%
clpeak - S.P.F (GFLOPS/Watt)	20.31	58.93	80.98
Normalized	25.08%	72.77%	100%
MandelGPU - GPU (Samples/sec/Watt)	468417	1544709	1974932
Normalized	23.72%	78.22%	100%
JuliaGPU - GPU (Samples/sec/Watt)	1343813	5650341	5935646
Normalized	22.64%	95.19%	100%

Tigerlake Xe Gen12 to Gen8

PlaidML - No - Inference - NASNer Large - OpenCL (FPS/Watt)	0.06	0.22	0.24	
Normalized	25%	91.67%	100%	
PlaidML - No - Inference - Inception V3 - OpenCL (FPS/Watt)	0.54	2.31	2.14	0.64
Normalized	23.38%	100%	92.64%	27.71%
PlaidML - No - Inference - DenseNet 201 - OpenCL (FPS/Watt)	0.22	0.75	1.02	0.27
Normalized	21.57%	73.53%	100%	26.47%
PlaidML - No - Inference - ResNet 50 - OpenCL (FPS/Watt)	1.10	4.79	4.04	1.34
Normalized	22.96%	100%	84.34%	27.97%
PlaidML - No - Inference - Mobilenet - OpenCL (FPS/Watt)	3.63	15.04	13.59	5.09
Normalized	24.14%	100%	90.36%	33.84%
PlaidML - No - Inference - IMDB LSTM - OpenCL (FPS/Watt)	0.24	1.24	1.40	0.19
Normalized	17.14%	88.57%	100%	13.57%
PlaidML - No - Inference - VGG19 - OpenCL (FPS/Watt)	0.21	0.98	0.86	0.22
Normalized	21.43%	100%	87.76%	22.45%
PlaidML - No - Inference - VGG16 - OpenCL (FPS/Watt)	0.26	1.21	1.07	0.27
Normalized	21.49%	100%	88.43%	22.31%
LeelaChessZero - OpenCL (Nodes/s/Watt)	14.05	37.81	70.05	21.58
Normalized	20.06%	53.98%	100%	30.81%
cl-mem - Write (GB/s/Watt)	1.21	2.31	2.08	
Normalized	52.38%	100%	90.04%	
cl-mem - Read (GB/s/Watt)	1.15	2.70	2.45	
Normalized	42.59%	100%	90.74%	
cl-mem - Copy (GB/s/Watt)	1.09	1.95	2.02	
Normalized	53.96%	96.53%	100%	
ViennaCL - O.L.F (GFLOPS/Watt)	1.86	5.86	6.64	2.34
Normalized	28.01%	88.25%	100%	35.24%
SHOC Scalable HeterOgeneous Computing - OpenCL - T.R.B (GB/s/Watt)	2.59	10.35	8.35	5.65
Normalized	25.02%	100%	80.68%	54.59%
SHOC Scalable HeterOgeneous Computing - OpenCL - Bus Speed Readback (GB/s/Watt)	2.69	6.82	7.39	2.37
Normalized	36.4%	92.29%	100%	32.07%
SHOC Scalable HeterOgeneous Computing - OpenCL - Bus Speed Download (GB/s/Watt)	2.65	6.84	7.04	2.42
Normalized	37.64%	97.16%	100%	34.38%

Tigerlake Xe Gen12 to Gen8

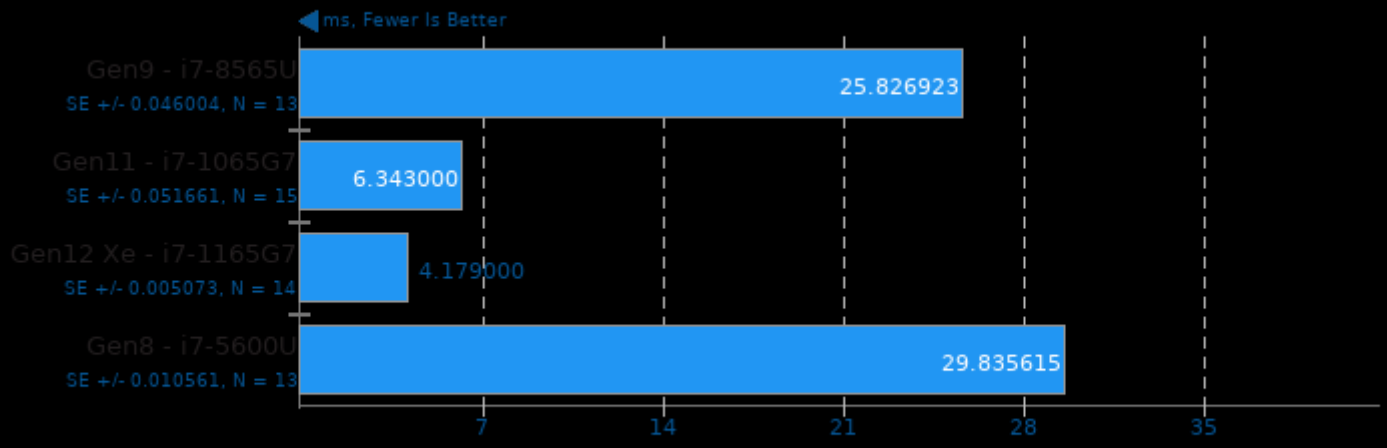
SHOC Scalable HeterOgeneous Computing - OpenCL - Max SP Flops (GFLOPS/Watt)	**72.86**	265.36	**343.74**	97.11
Normalized	21.2%	77.2%	100%	28.25%
SHOC Scalable HeterOgeneous Computing - OpenCL - MD5 Hash (GHash/s/Watt)	**0.02**	0.03	**0.07**	**0.02**
Normalized	28.57%	42.86%	100%	28.57%
SHOC Scalable HeterOgeneous Computing - OpenCL - FFT SP (GFLOPS/Watt)	**2.21**	17.77	**17.81**	2.94
Normalized	12.41%	99.78%	100%	16.51%
SHOC Scalable HeterOgeneous Computing - OpenCL - Triad	0.92	1.68	**1.92**	**0.88**
Normalized	47.92%	87.5%	100%	45.83%
oneAPI Level Zero Tests - P.S.M.C.t.S.M (GB/s/Watt)	**0.36**	**0.90**	0.67	
Normalized	40%	100%	74.44%	
oneAPI Level Zero Tests - P.F.G.M.B (GB/s/Watt)	**0.85**	2.24	**2.49**	
Normalized	34.14%	89.96%	100%	
oneAPI Level Zero Tests - H.T.D.T.H.I.C (GB/s/Watt)	**0.14**	0.68	**0.94**	
Normalized	14.89%	72.34%	100%	
oneAPI Level Zero Tests - P.S.P.C (GB/s/Watt)	**13.93**	**59.52**	54.99	
Normalized	23.4%	100%	92.39%	
oneAPI Level Zero Tests - P.H.P.C (GFLOPS/Watt)	**24.17**	73.98	**135.36**	
Normalized	17.86%	54.65%	100%	
oneAPI Level Zero Tests - P.I.C (GFLOPS/Watt)	**4.31**	9.15	**20.00**	
Normalized	21.55%	45.75%	100%	
ET: Legacy - Renderer2 - 1920 x 1200 (FPS)	72.1	86.4	**122.3**	**60.7**
Normalized	58.95%	70.65%	100%	49.63%
Standard Deviation	0.1%	8.2%	2.9%	0.7%
clpeak - T.B.e (GBPS)	31.64	39.48	**52.15**	**18.28**
Normalized	60.67%	75.7%	100%	35.05%
Standard Deviation	0.1%	6.4%	1%	0.1%
NCNN - Vulkan GPU - mnasnet (ms)	8.36	7.65	**5.14**	**10.59**
Normalized	61.48%	67.19%	100%	48.54%
Standard Deviation	0.3%	1.1%	9.7%	0.4%
NCNN - Vulkan GPU - shufflenet-v2	6.75	5.71	**3.05**	**8.45**
Normalized	45.19%	53.42%	100%	36.09%
Standard Deviation	0.5%	1%	0.9%	8.4%
SHOC Scalable HeterOgeneous Computing - OpenCL - Bus Speed Readback (GB/s)	23.9319	41.7406	**60.4048**	**12.1270**
Normalized	39.62%	69.1%	100%	20.08%
Standard Deviation	9.3%	3.9%	1%	2.3%

Tigerlake Xe Gen12 to Gen8

SHOC Scalable HeterOgeneous Computing - OpenCL - Bus Speed Download (GB/s)	23.3048	40.1640	**58.4143**	**12.1540**
Normalized	39.9%	68.76%	100%	20.81%
Standard Deviation	8.6%	1%	2.9%	2.4%
SHOC Scalable HeterOgeneous Computing - OpenCL - Triad (GB/s)	10.9236	14.0210	**21.3040**	**6.1253**
Normalized	51.27%	65.81%	100%	28.75%
Standard Deviation	6.8%	7.4%	1.9%	0.5%
FinanceBench - Monte-Carlo OpenCL (ms)	**2585**	579.523733	**433.370858**	1032
Normalized	16.77%	74.78%	100%	42%
Standard Deviation	8.3%	7.7%	0.9%	0.2%
RealSR-NCNN - 4x - Yes (sec)	**1615**	1120	538.065	**55.150**
Normalized	3.42%	4.92%	10.25%	100%
Standard Deviation	0.3%	0.5%	0.4%	107.4%
RealSR-NCNN - 4x - No (sec)	**202.601**	143.988	68.311	**65.875**
Normalized	32.51%	45.75%	96.43%	100%
Standard Deviation	0.5%	0.4%	1.1%	68%
oneAPI Level Zero Tests - P.K.L.L (us)	**31.4224**	28.9568	**22.3130**	
Normalized	71.01%	77.06%	100%	
Standard Deviation	1.6%	11%	9.6%	

FinanceBench 2016-06-06

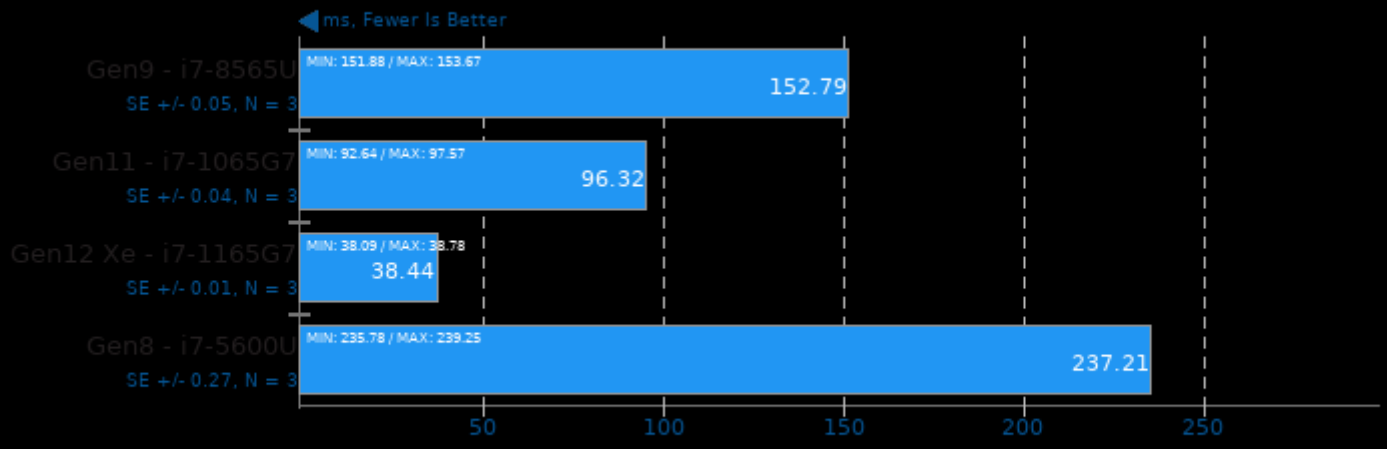
Benchmark: Black-Scholes OpenCL



1. (CXX) g++ options: -O3 -lOpenCL

NCNN 20200916

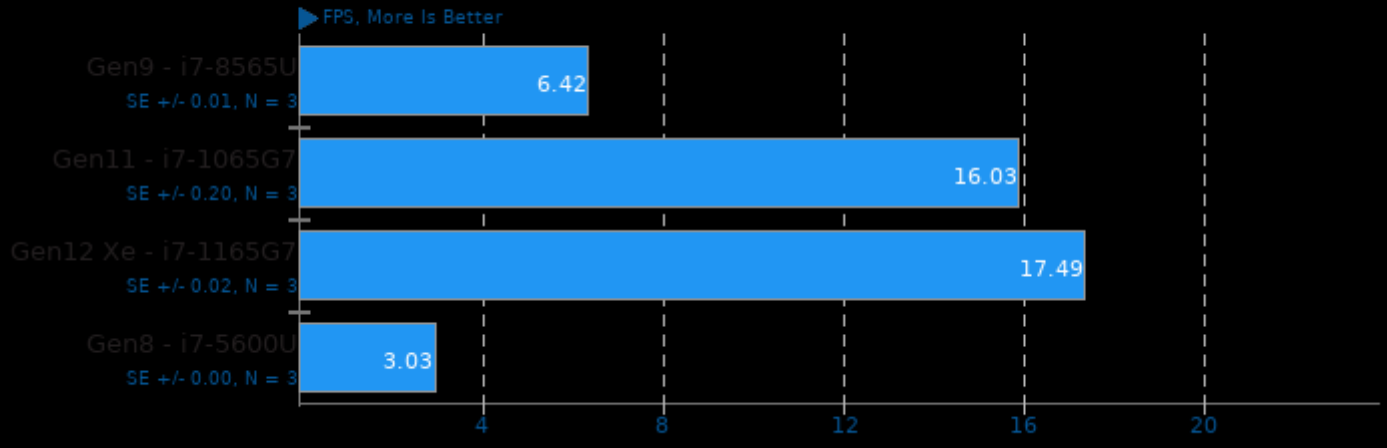
Target: Vulkan GPU - Model: vgg16



1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

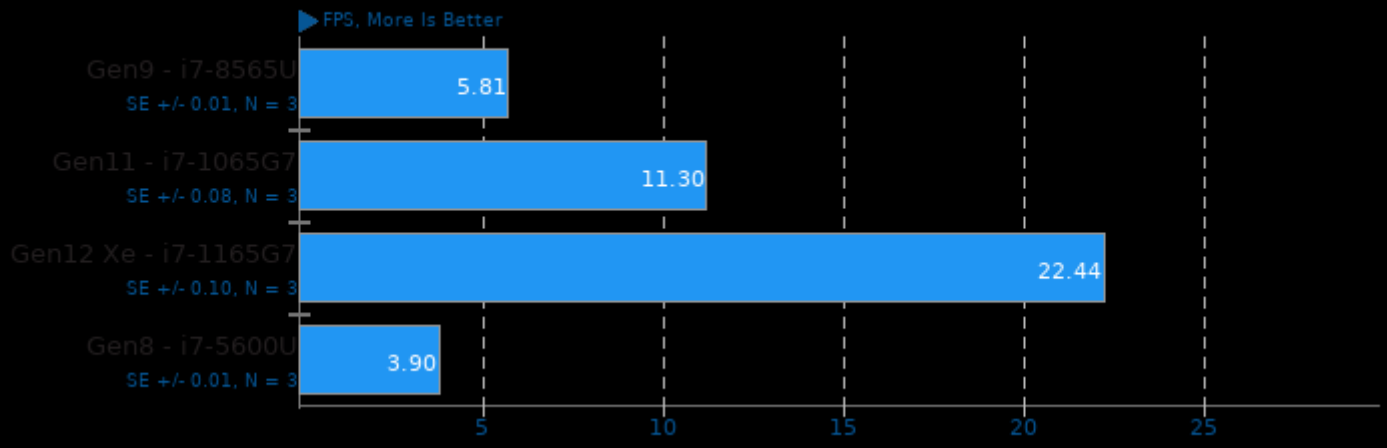
PlaidML

FP16: No - Mode: Inference - Network: VGG19 - Device: OpenCL



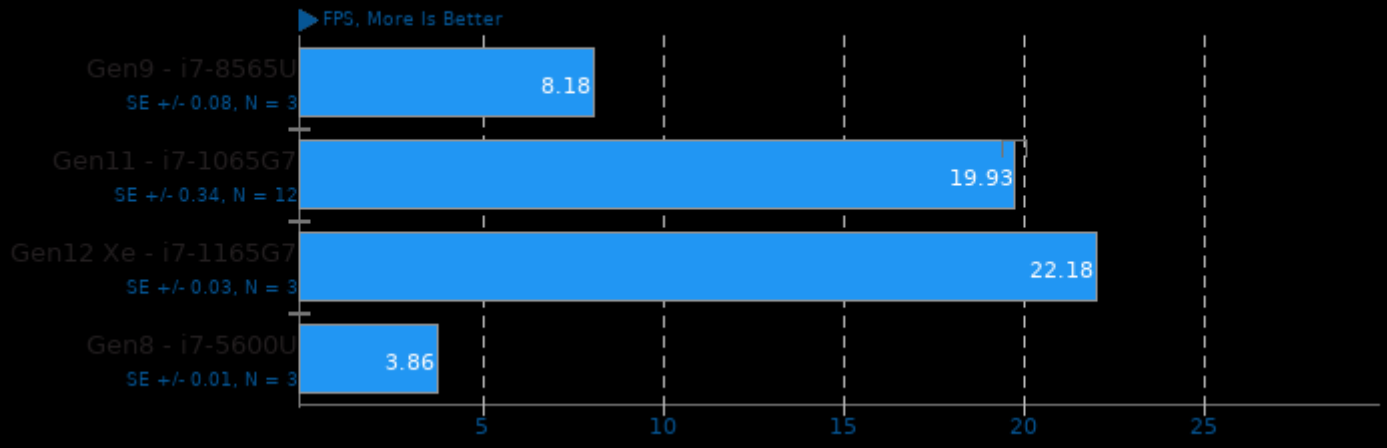
PlaidML

FP16: No - Mode: Inference - Network: DenseNet 201 - Device: OpenCL



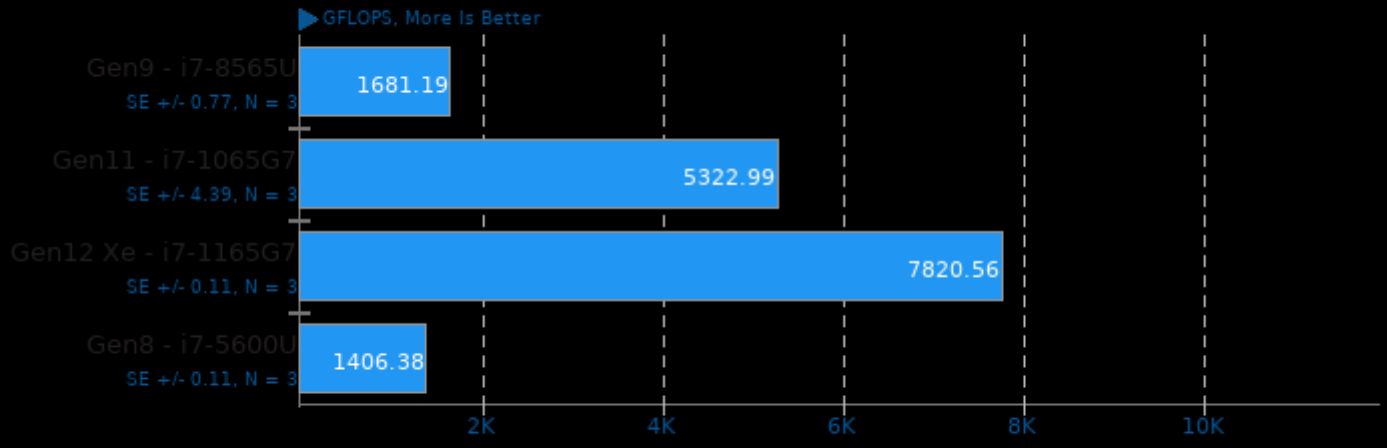
PlaidML

FP16: No - Mode: Inference - Network: VGG16 - Device: OpenCL



SHOC Scalable HeterOgeneous Computing 2015-11-10

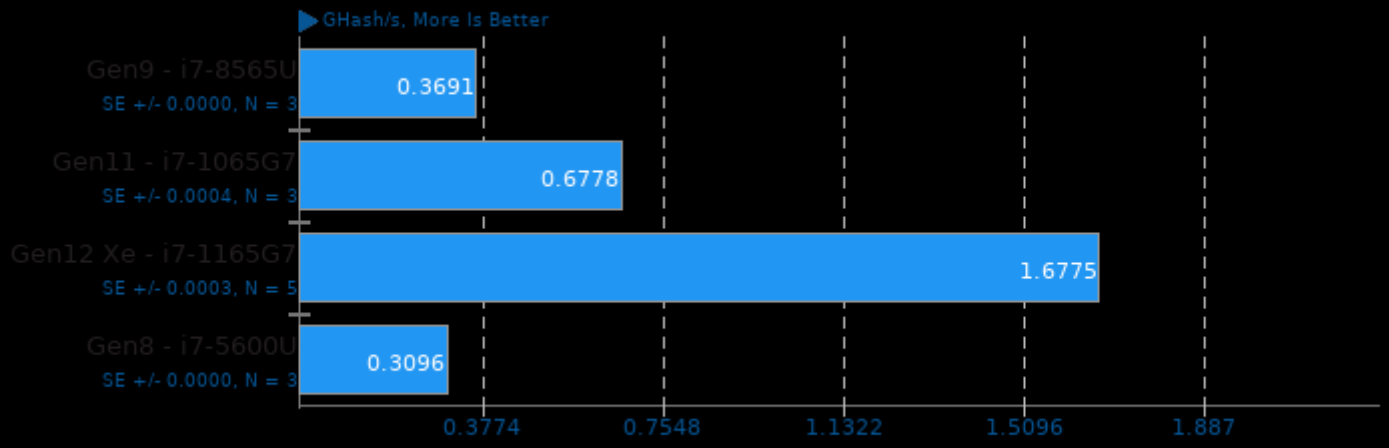
Target: OpenCL - Benchmark: Max SP Flops



1. (CXX) g++ options: -O2 -lSHOCCommonMPI -lSHOCCommonOpenCL -lSHOCCommon -lOpenCL -lrt -pthread -lmpi_cxx -lmpi

SHOC Scalable HeterOgeneous Computing 2015-11-10

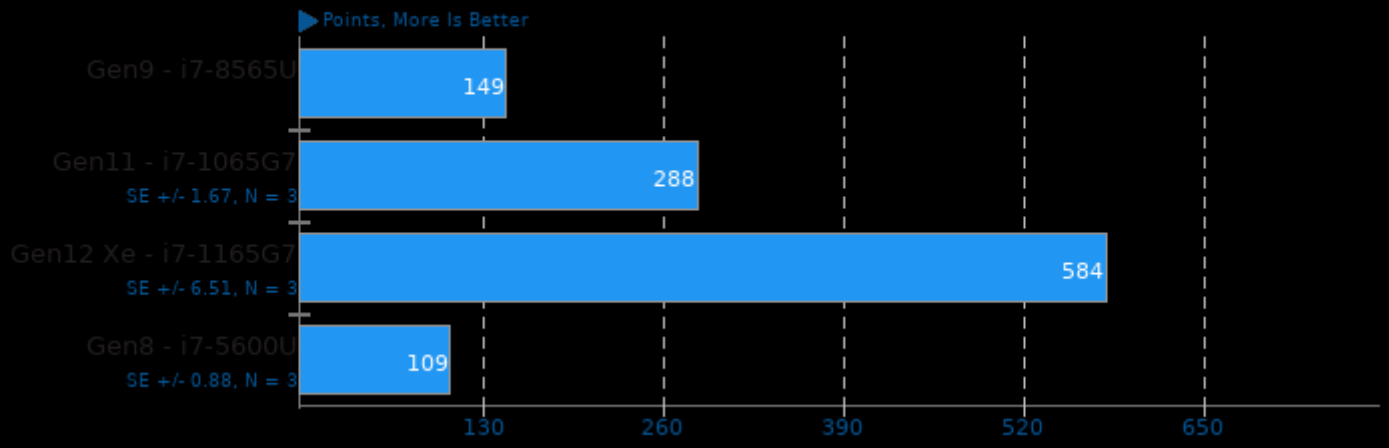
Target: OpenCL - Benchmark: MD5 Hash



1. (CXX) g++ options: -O2 -lSHOCCommonMPI -lSHOCCommonOpenCL -lSHOCCommon -lOpenCL -lrt -pthread -lmpi_cxx -lmpi

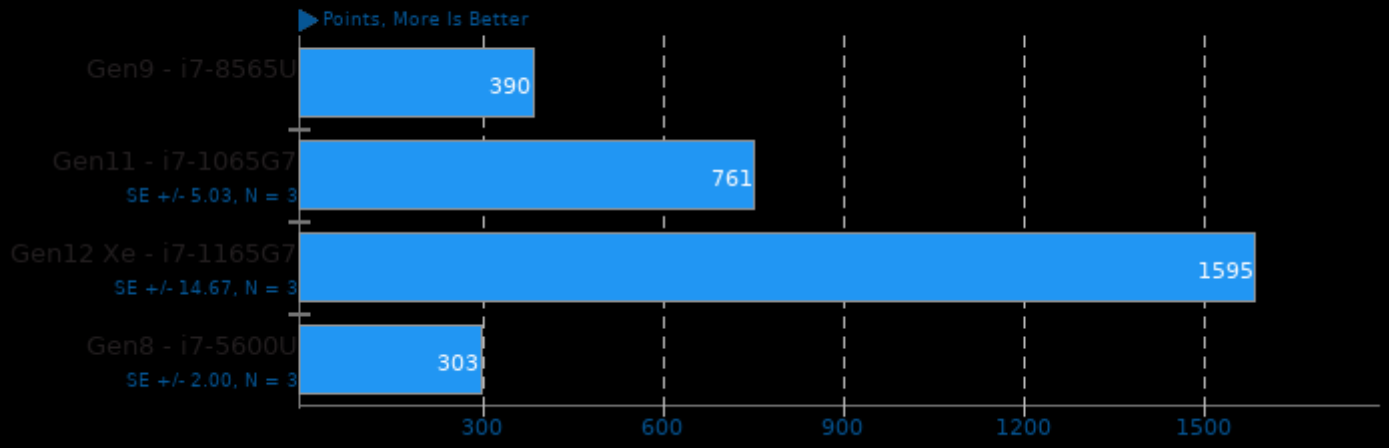
GpuTest 0.7.0

Test: Pixmark Piano - Resolution: 1920 x 1200 - Mode: Fullscreen



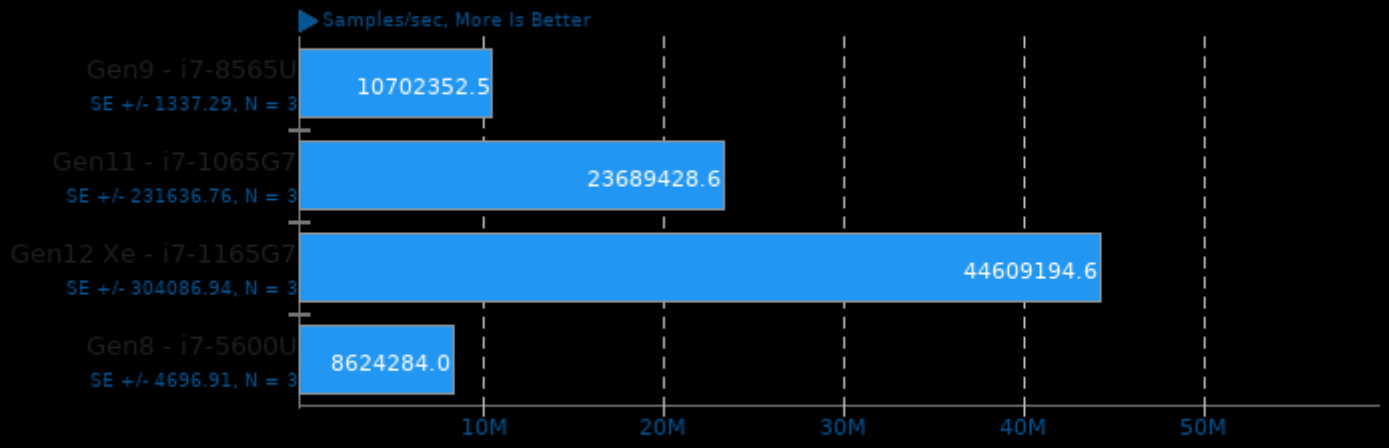
GpuTest 0.7.0

Test: Pixmark Volplosion - Resolution: 1920 x 1200 - Mode: Fullscreen



MandelGPU 1.3pts1

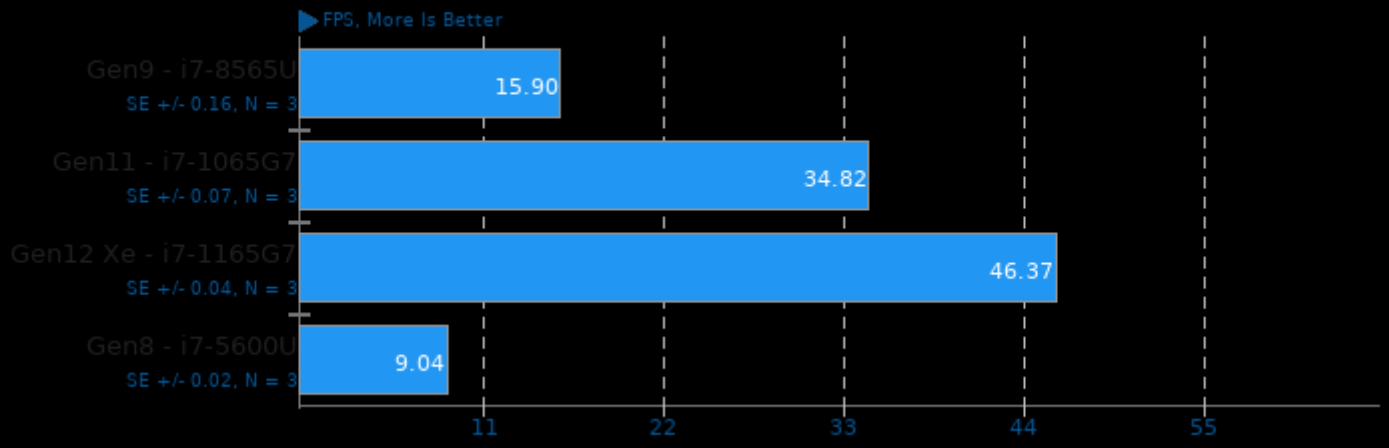
OpenCL Device: GPU



1. (CC) gcc options: -O3 -lm -ftree-vectorize -funroll-loops -lglut -lOpenCL -lGL

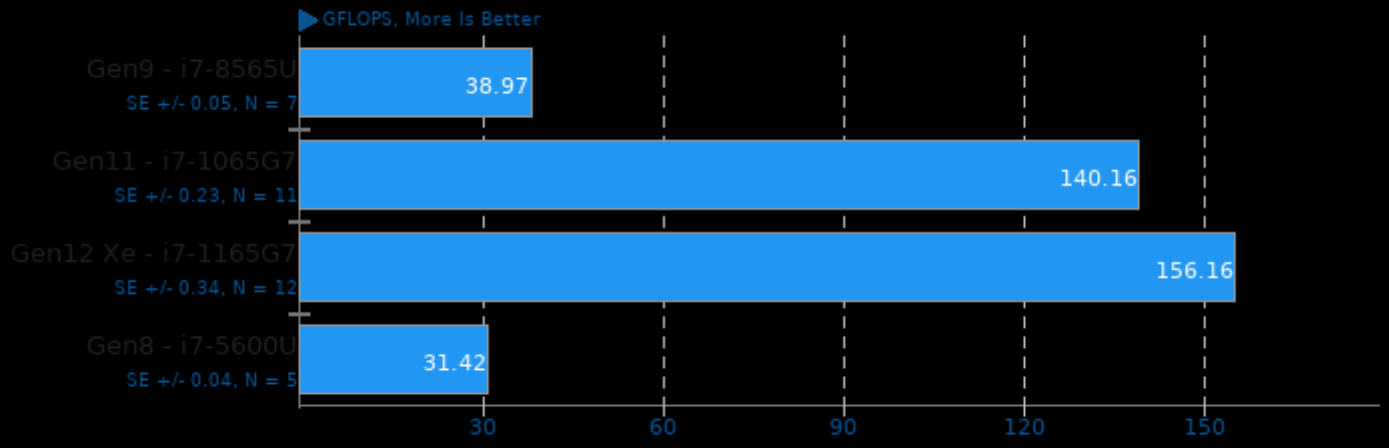
PlaidML

FP16: No - Mode: Inference - Network: Inception V3 - Device: OpenCL



SHOC Scalable HeterOgeneous Computing 2015-11-10

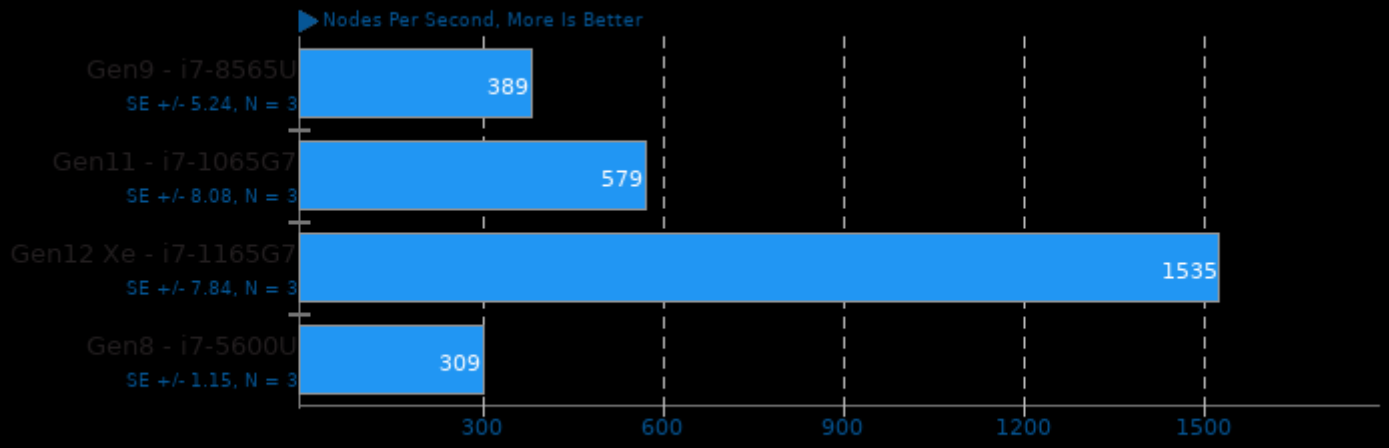
Target: OpenCL - Benchmark: FFT SP



1. (CXX) g++ options: -O2 -lSHOCCommonMPI -lSHOCCommonOpenCL -lSHOCCommon -lOpenCL -lrt -pthread -lmpi_cxx -lmpi

LeelaChessZero 0.26

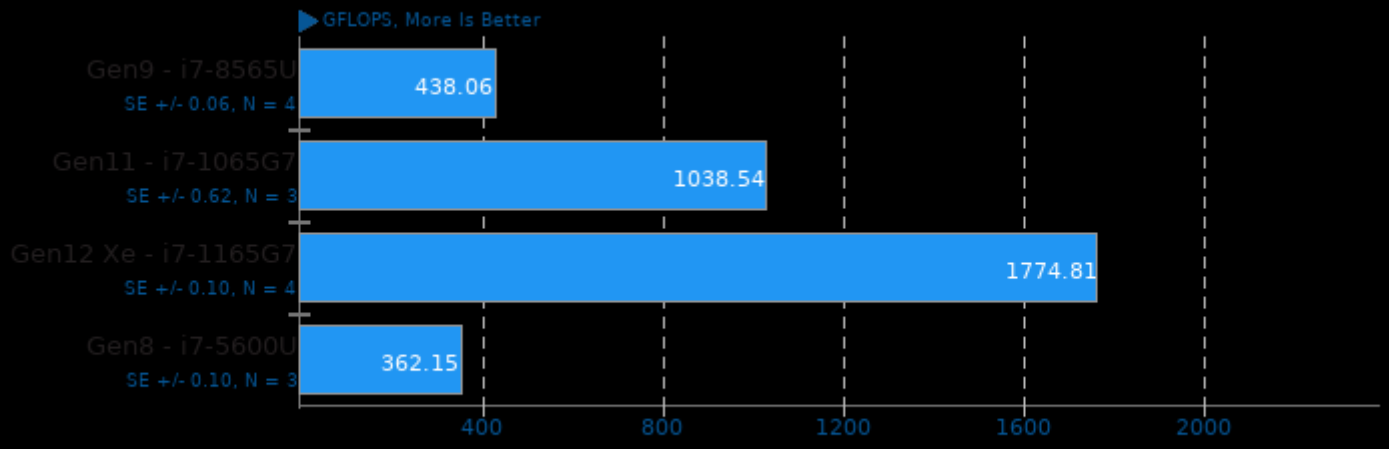
Backend: OpenCL



1. (CXX) g++ options: -flto -pthread

clpeak

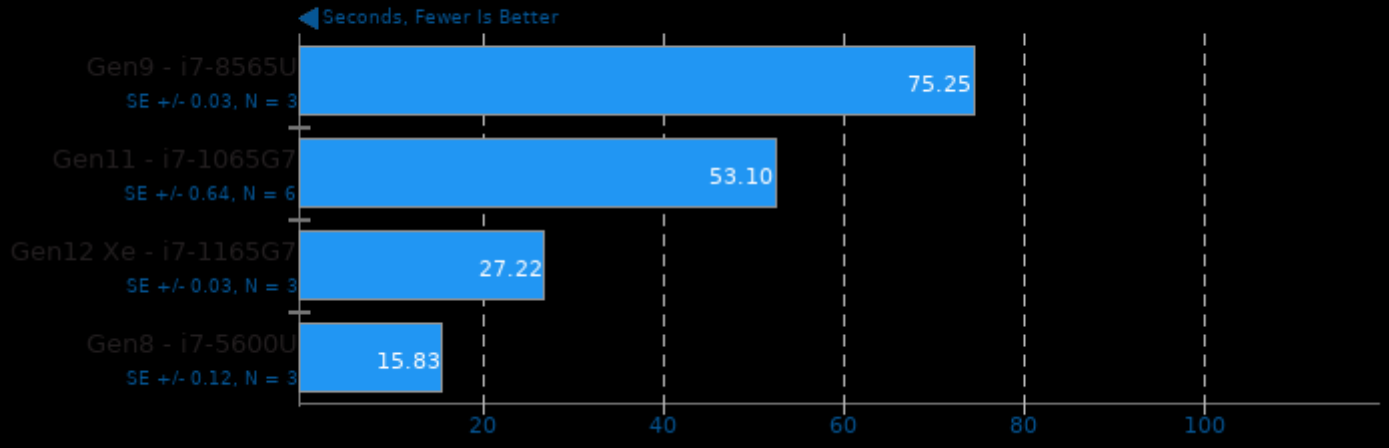
OpenCL Test: Single-Precision Float



1. (CXX) g++ options: -O3 -rdynamic -lOpenCL

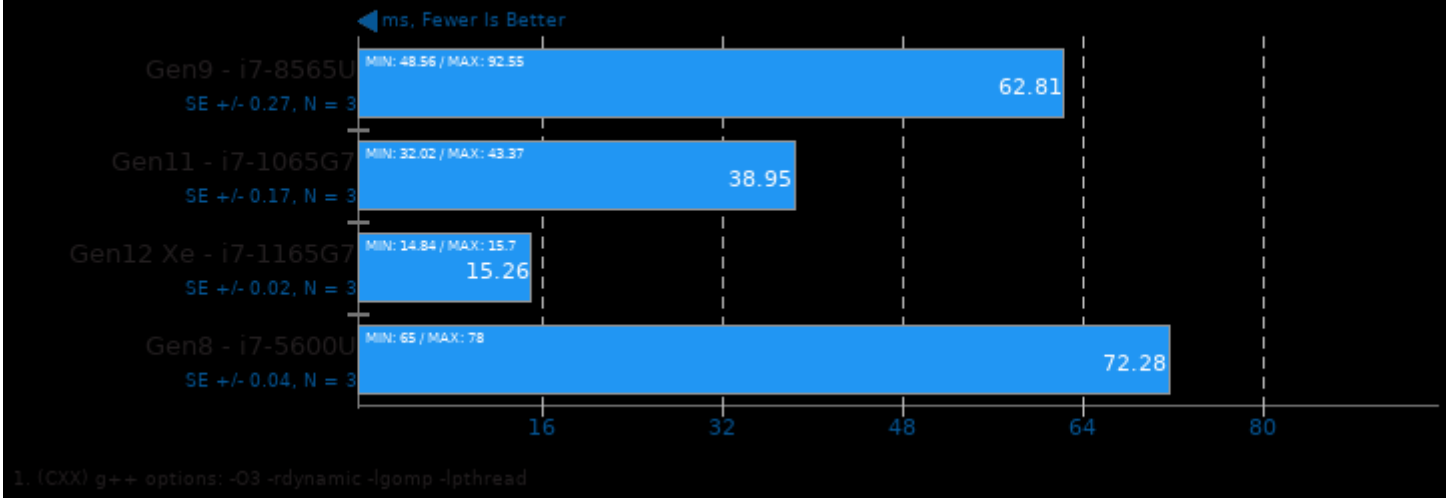
Waifu2x-NCNN Vulkan 20200818

Scale: 2x - Denoise: 3 - TAA: Yes



NCNN 20200916

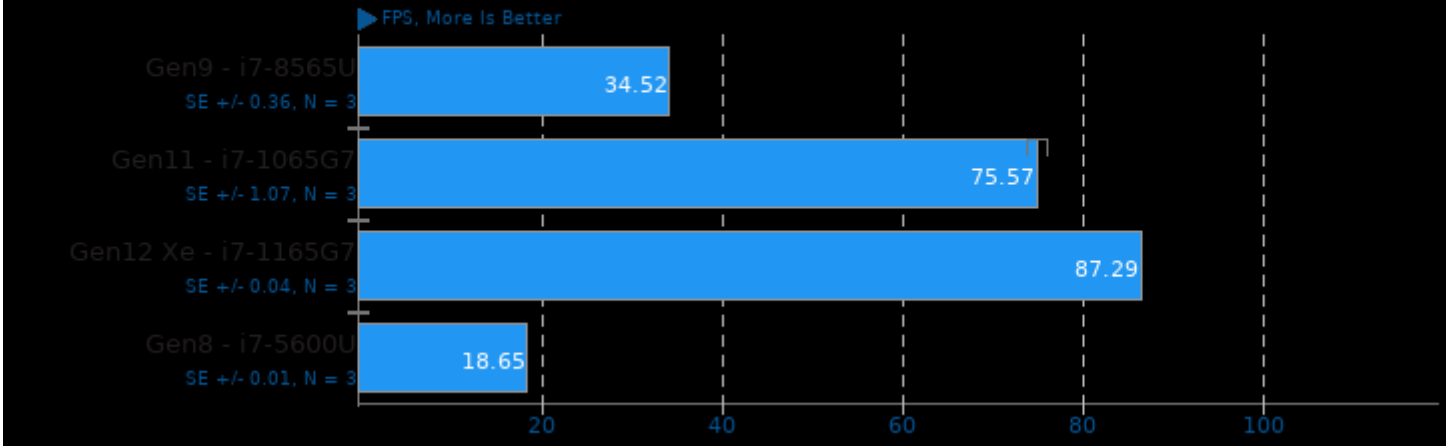
Target: Vulkan GPU - Model: yolov4-tiny



1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

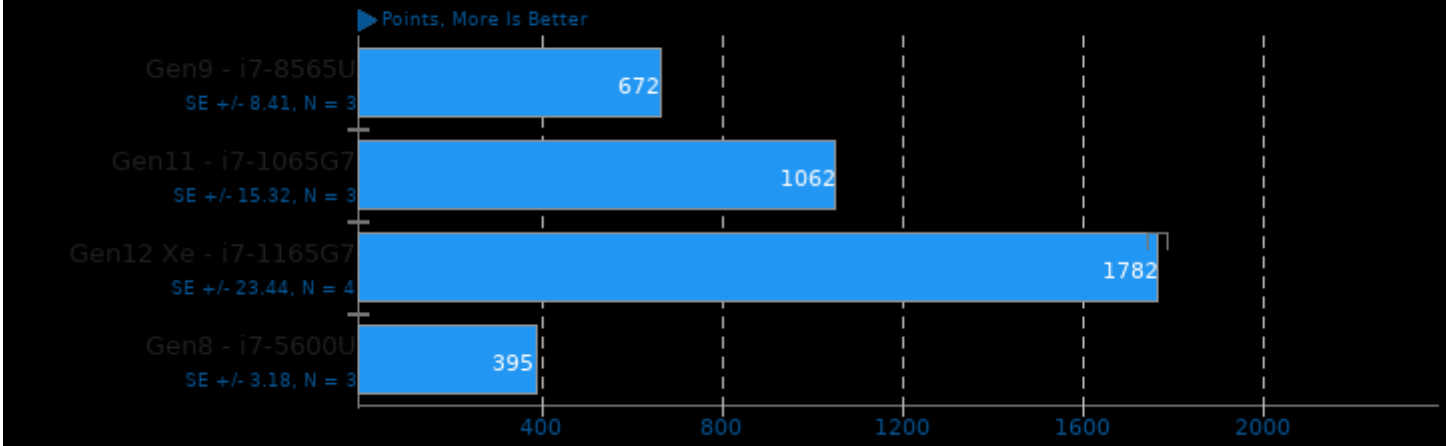
PlaidML

FP16: No - Mode: Inference - Network: ResNet 50 - Device: OpenCL



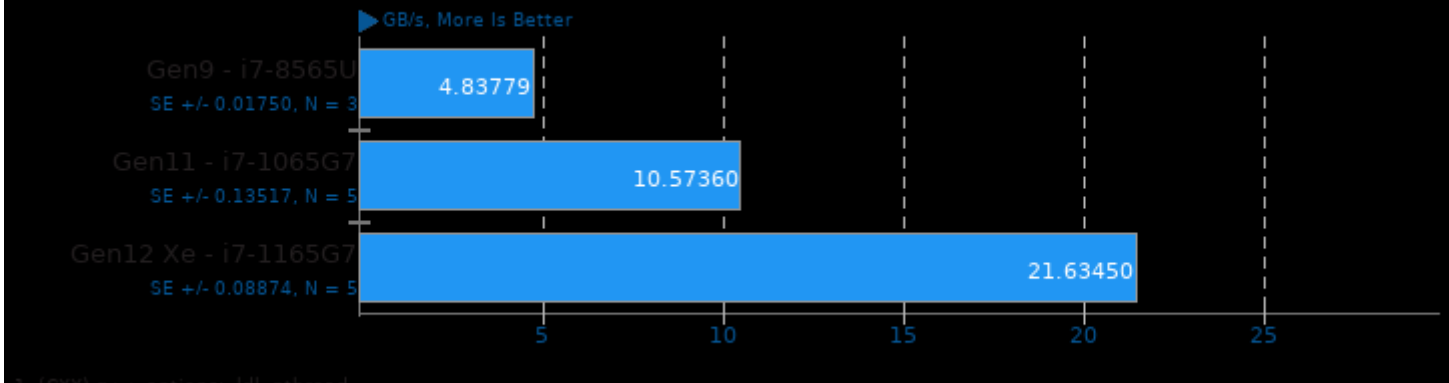
GpuTest 0.7.0

Test: Furmark - Resolution: 1920 x 1200 - Mode: Fullscreen



oneAPI Level Zero Tests

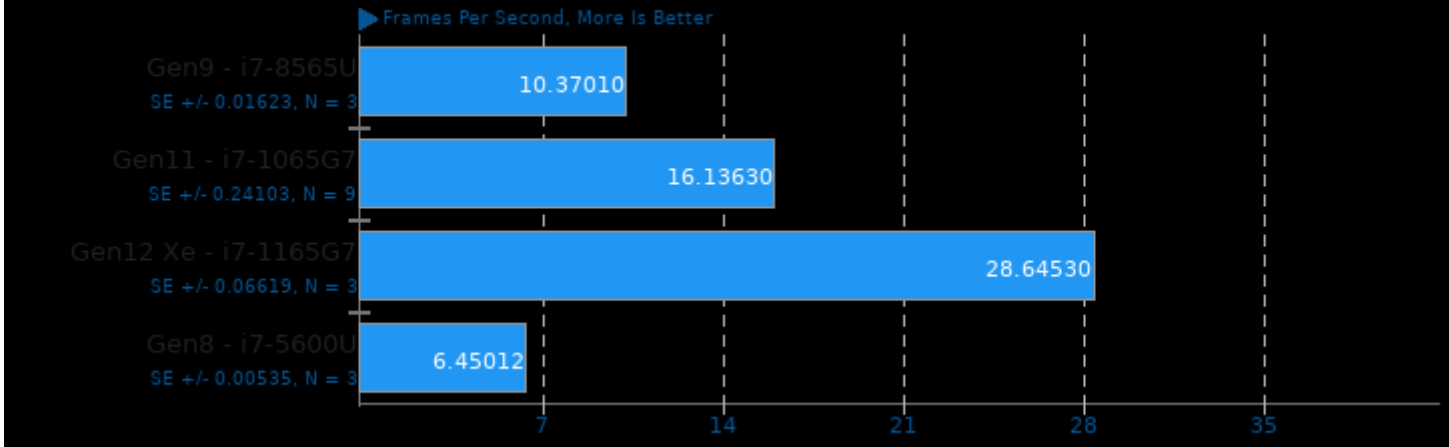
Test: Host-To-Device-To-Host Image Copy



1. (CXX) g++ options: -ldl -pthread

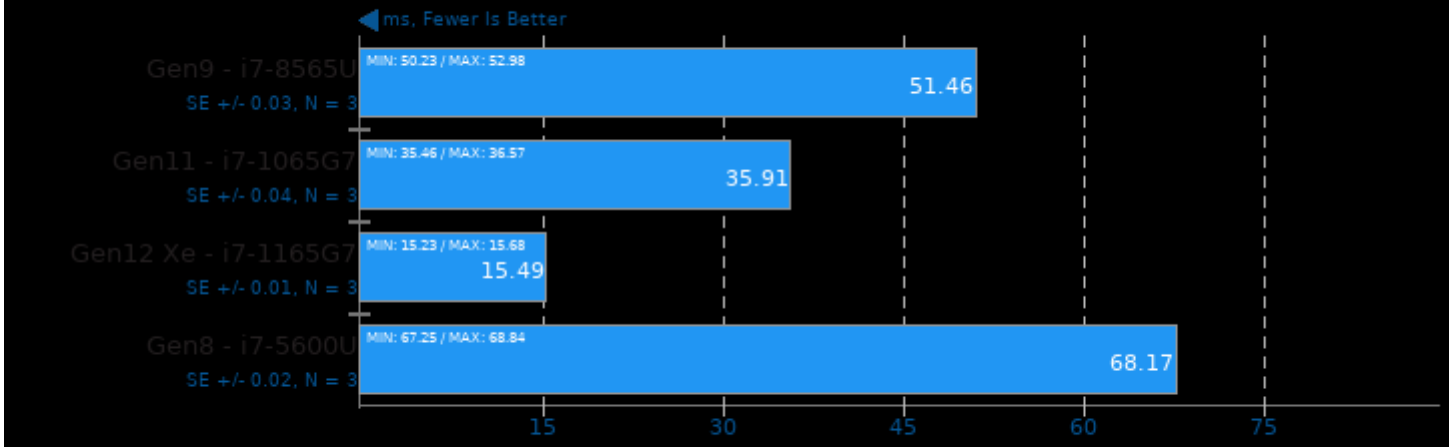
Unigine Heaven 4.0

Resolution: 1920 x 1200 - Mode: Fullscreen - Renderer: OpenGL



NCNN 20200916

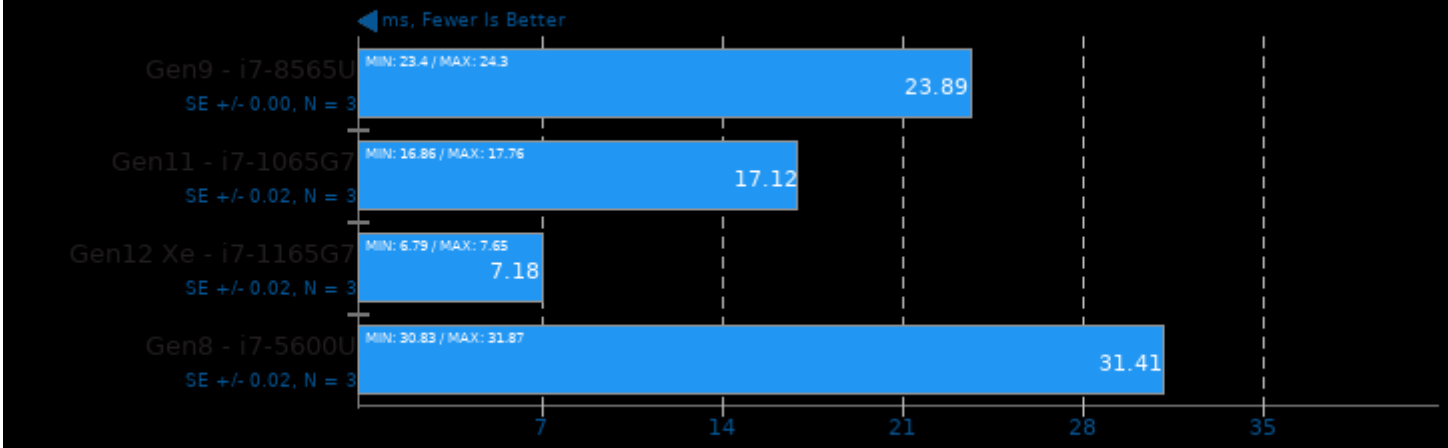
Target: Vulkan GPU - Model: resnet50



1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

NCNN 20200916

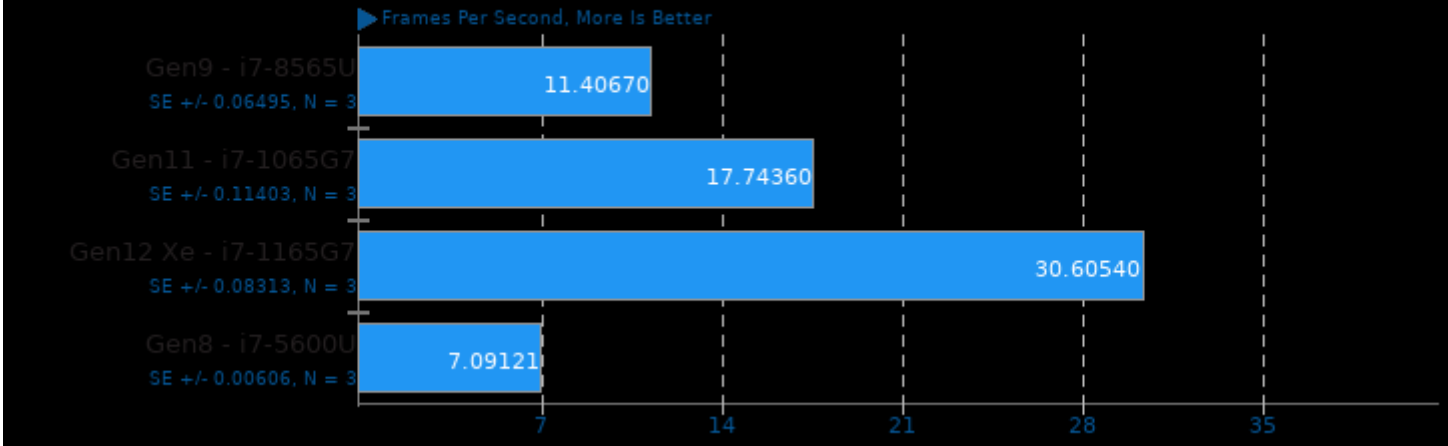
Target: Vulkan GPU - Model: resnet18



1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

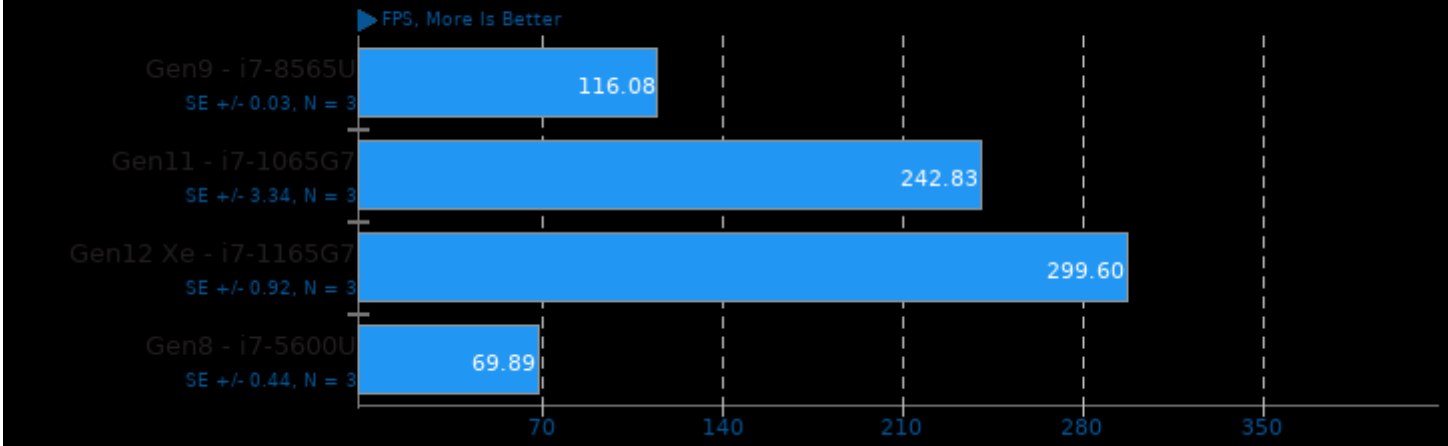
Unigine Valley 1.0

Resolution: 1920 x 1200 - Mode: Fullscreen - Renderer: OpenGL



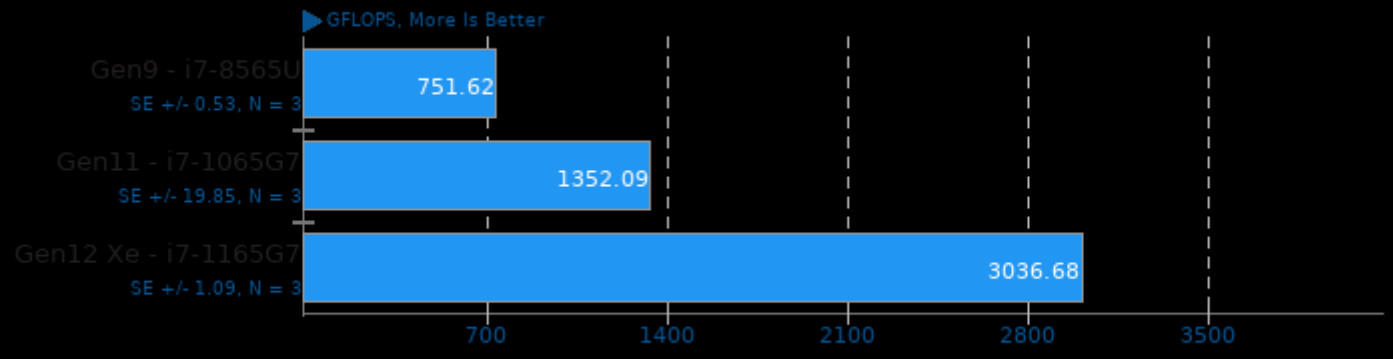
PlaidML

FP16: No - Mode: Inference - Network: Mobilenet - Device: OpenCL



oneAPI Level Zero Tests

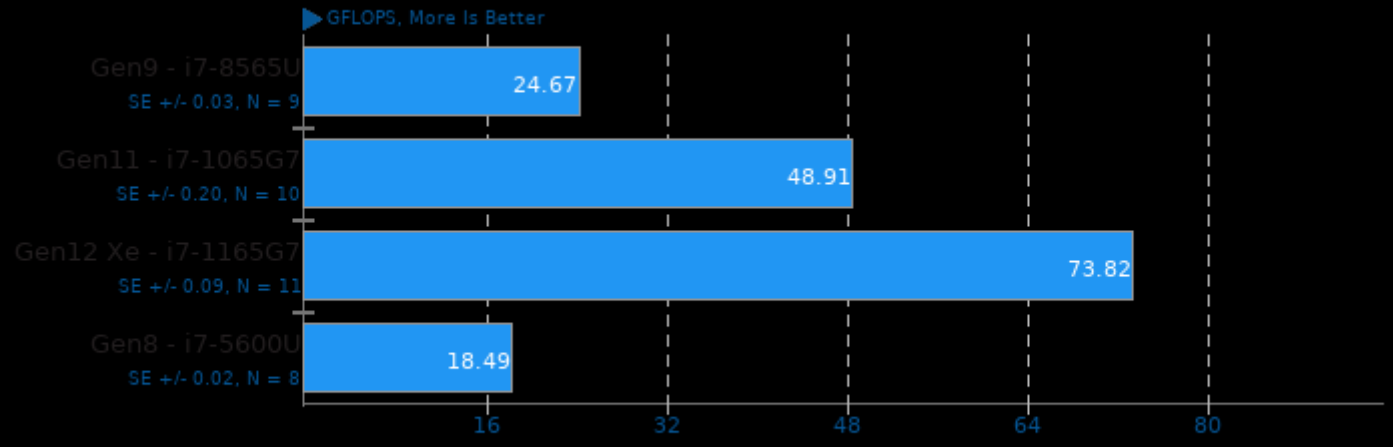
Test: Peak Half-Precision Compute



1. (CXX) g++ options: -ldl -pthread

ViennaCL 1.4.2

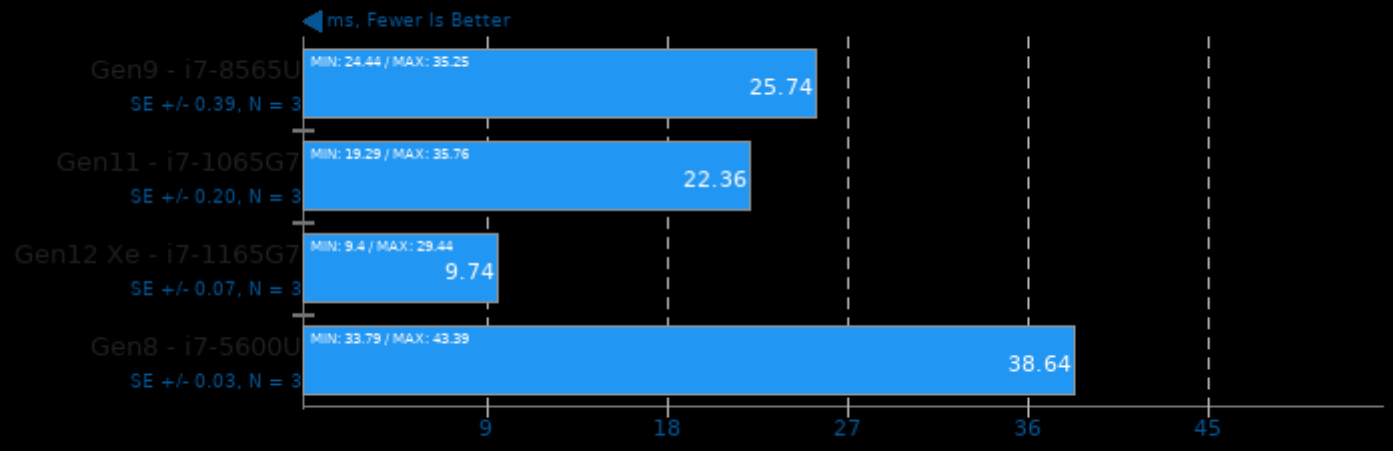
OpenCL LU Factorization



1. (CXX) g++ options: -rdynamic -lOpenCL

NCNN 20200916

Target: Vulkan GPU - Model: mobilenet

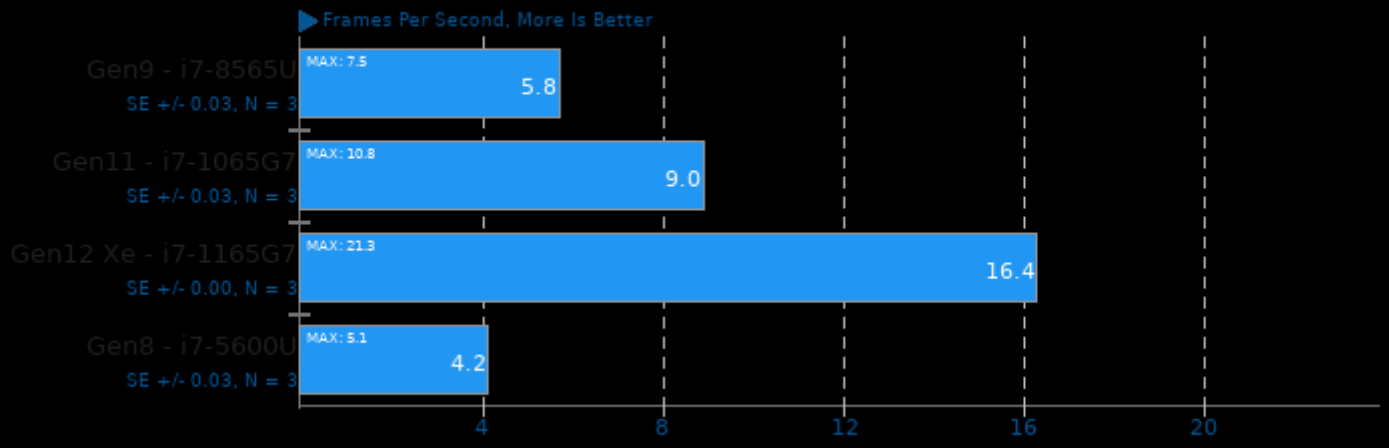


1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

Tigerlake Xe Gen12 to Gen8

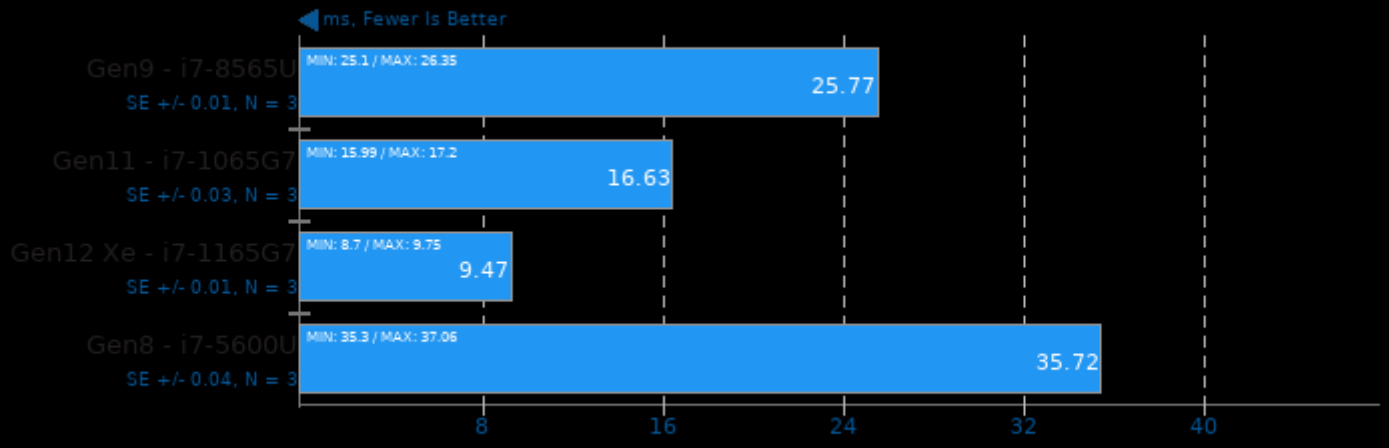
Unigine Superposition 1.0

Resolution: 1920 x 1200 - Mode: Fullscreen - Quality: Medium - Renderer: OpenGL



NCNN 20200916

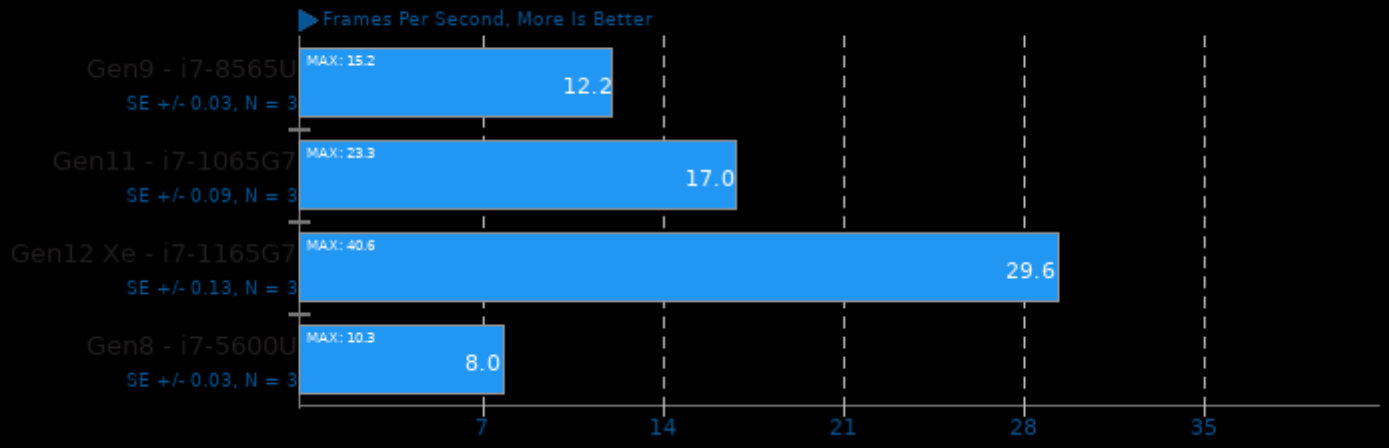
Target: Vulkan GPU - Model: alexnet

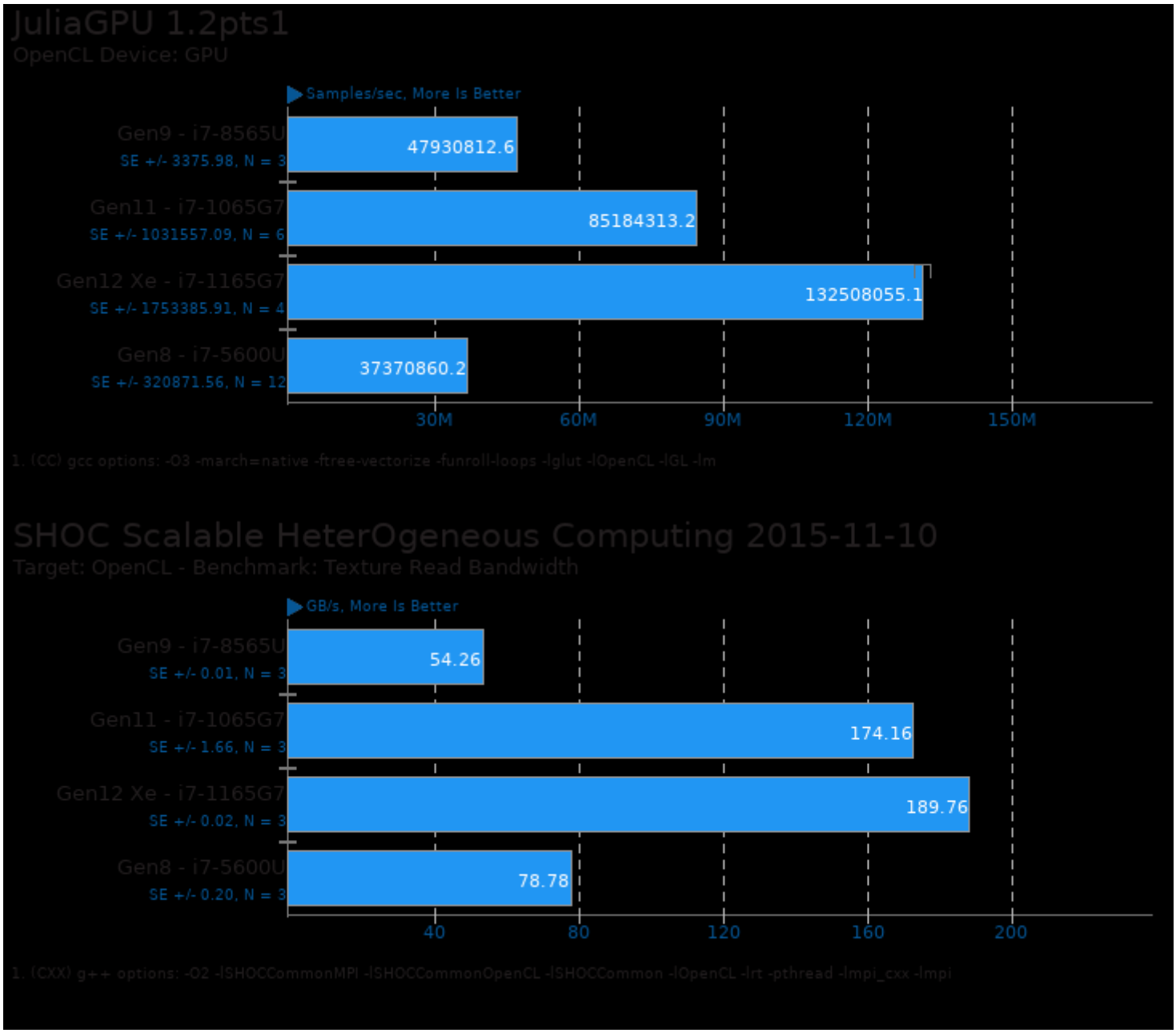


1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

Unigine Superposition 1.0

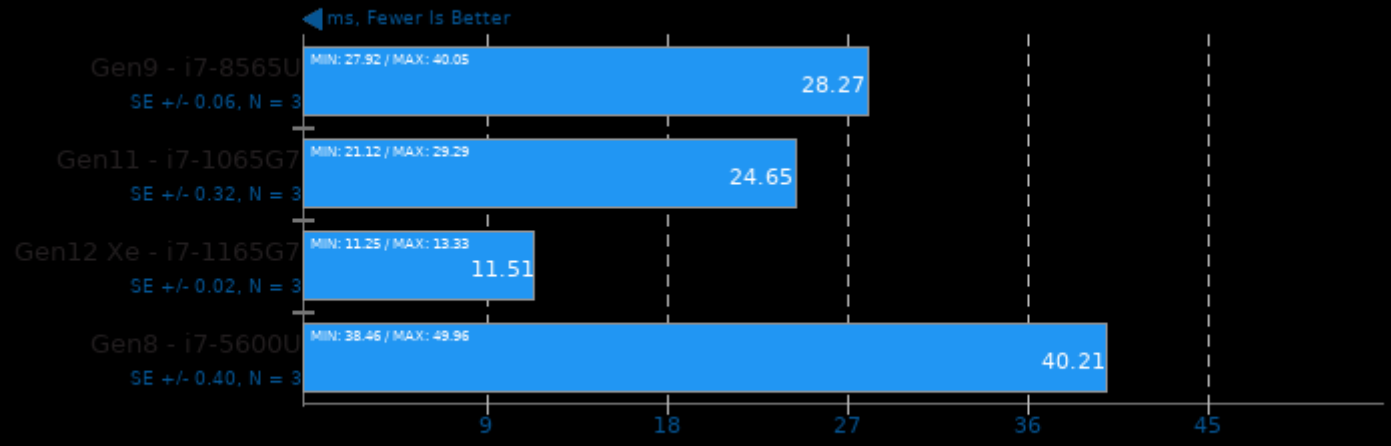
Resolution: 1920 x 1200 - Mode: Fullscreen - Quality: Low - Renderer: OpenGL




JuliaGPU 1.2pts1
OpenCL Device: GPU
Samples/sec, More Is Better
Gen9 - i7-8565U
SE +/- 3375.98, N = 3
47930812.6
Gen11 - i7-1065G7
SE +/- 1031557.09, N = 6
85184313.2
Gen12 Xe - i7-1165G7
SE +/- 1753385.91, N = 4
132508055.1
Gen8 - i7-5600U
SE +/- 320871.56, N = 12
37370860.2
30M
60M
90M
120M
150M
1. (CC) gcc options: -O3 -march=native -ftree-vectorize -funroll-loops -lglut -lOpenCL -lGL -lm
SHOC Scalable HeterOgeneous Computing 2015-11-10
Target: OpenCL - Benchmark: Texture Read Bandwidth
GB/s, More Is Better
Gen9 - i7-8565U
SE +/- 0.01, N = 3
54.26
Gen11 - i7-1065G7
SE +/- 1.66, N = 3
174.16
Gen12 Xe - i7-1165G7
SE +/- 0.02, N = 3
189.76
Gen8 - i7-5600U
SE +/- 0.20, N = 3
78.78
40
80
120
160
200
1. (CXX) g++ options: -O2 -lSHOCCommonMPI -lSHOCCommonOpenCL -lSHOCCommon -lOpenCL -lrt -pthread -lmpi_cxx -lmpi

NCNN 20200916

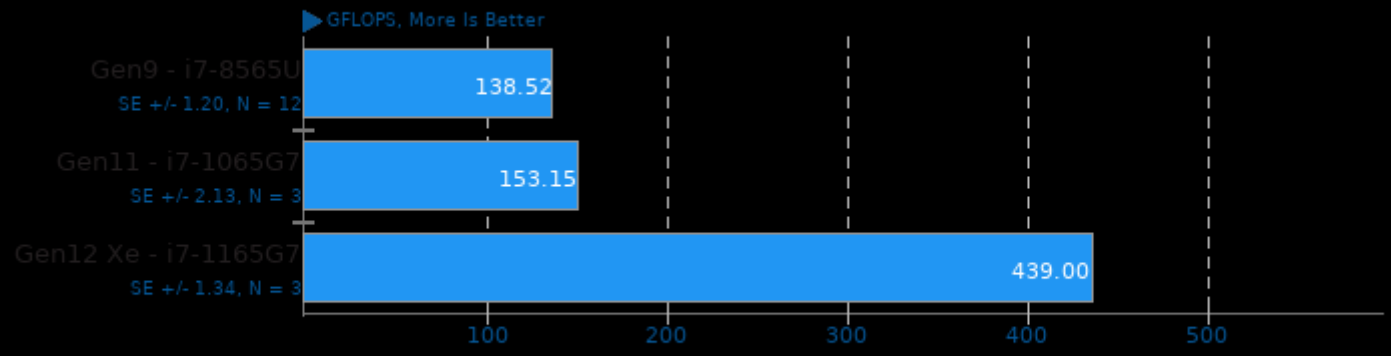
Target: Vulkan GPU - Model: squeezenet



1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

oneAPI Level Zero Tests

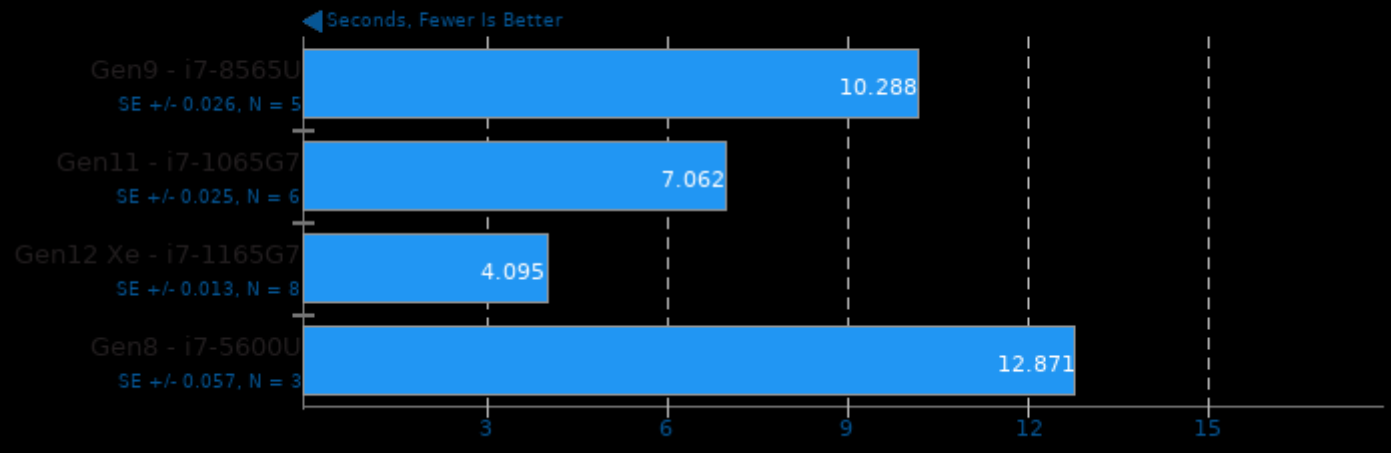
Test: Peak Integer Compute



1. (CXX) g++ options: -ldl -pthread

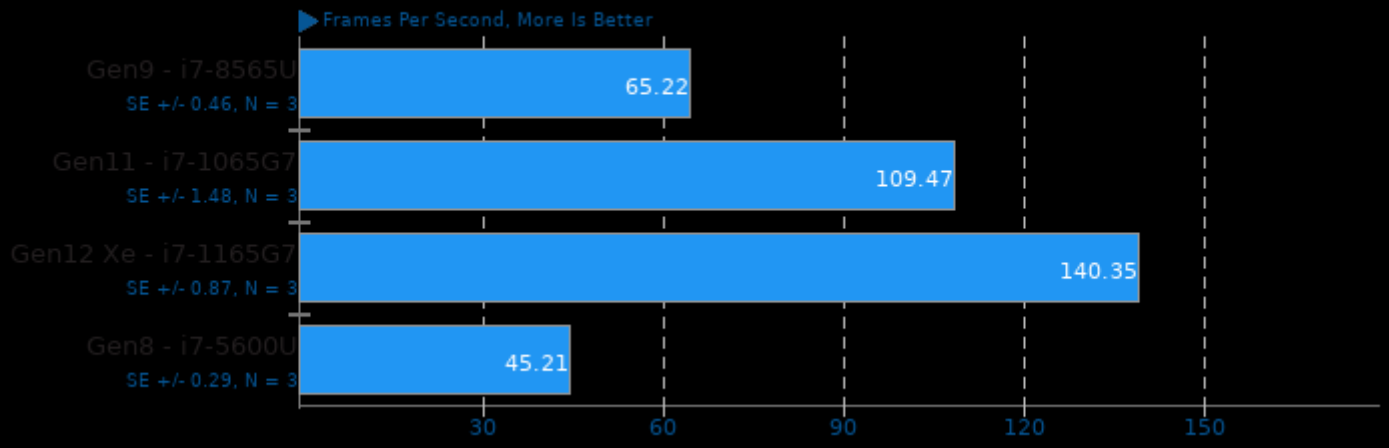
Waifu2x-NCNN Vulkan 20200818

Scale: 2x - Denoise: 3 - TAA: No



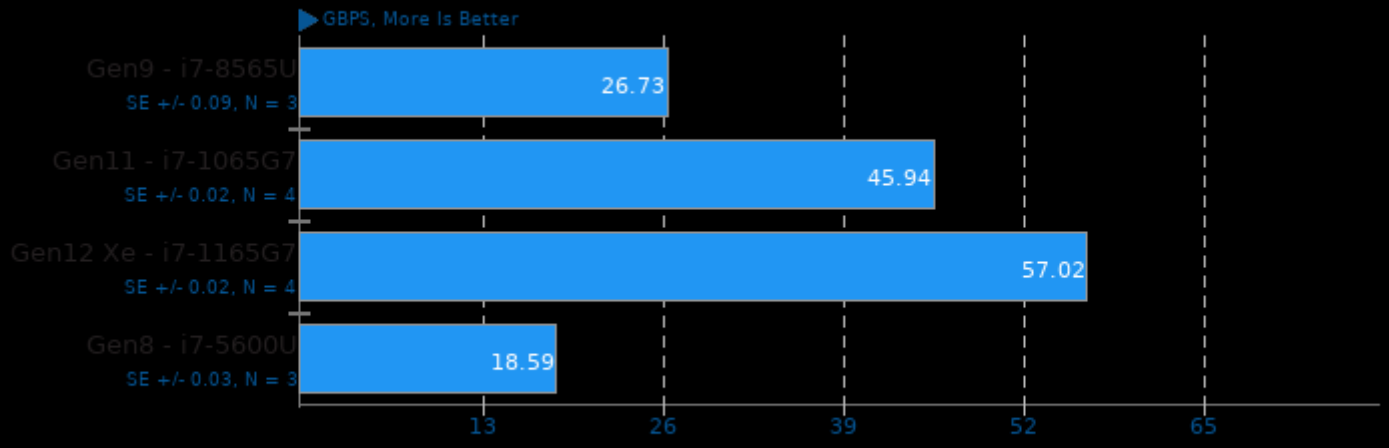
Tesseract 2014-05-12

Resolution: 1920 x 1200



clpeak

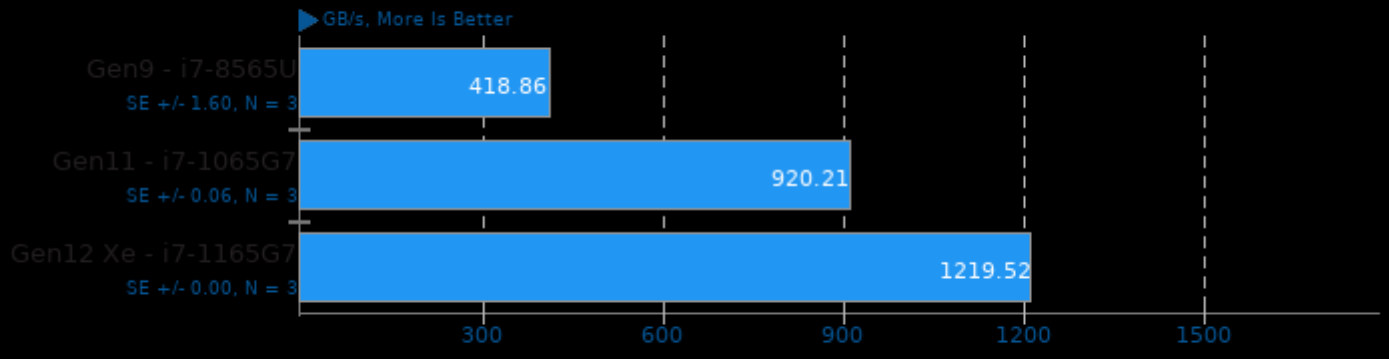
OpenCL Test: Global Memory Bandwidth



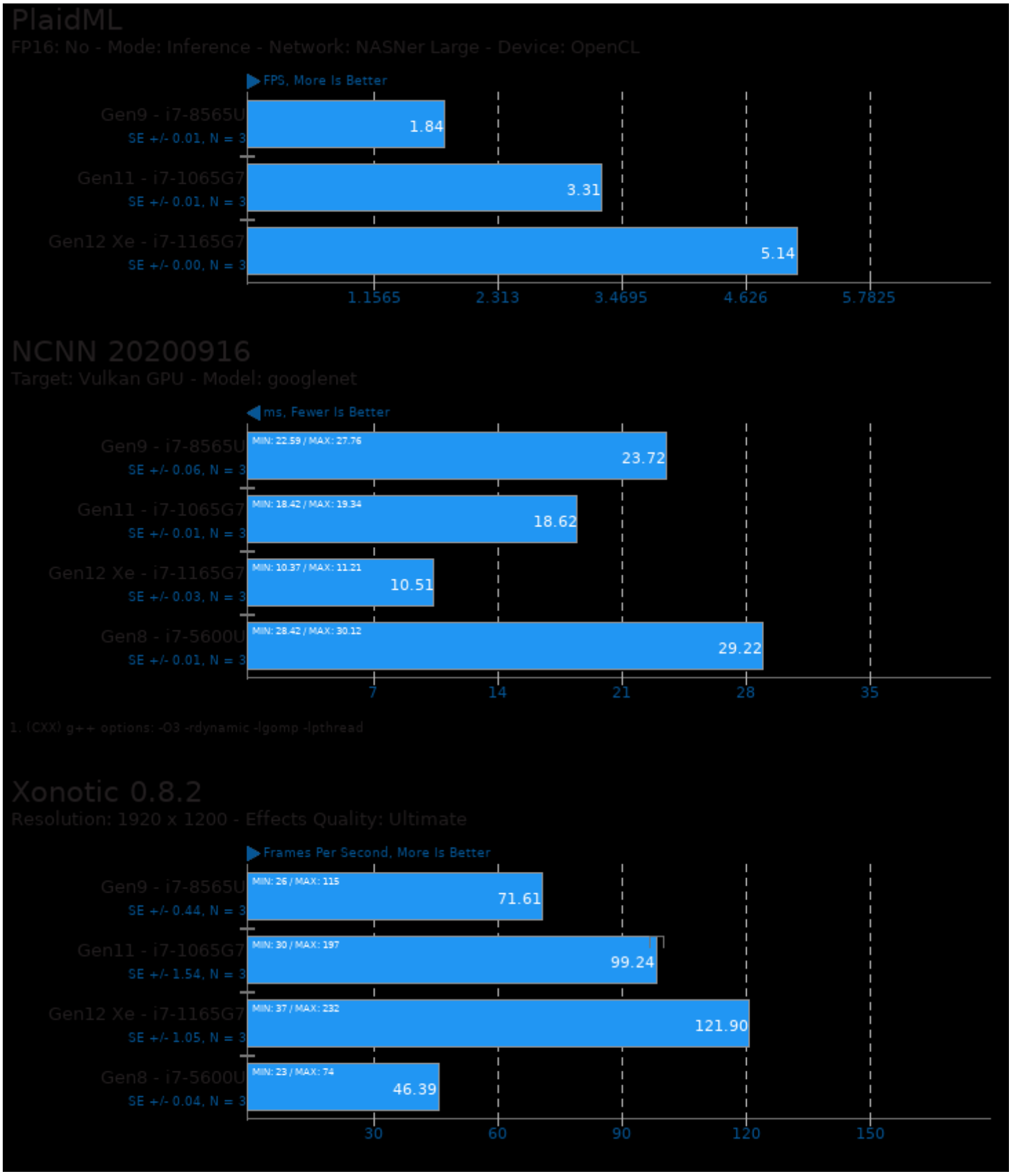
1. (CXX) g++ options: -O3 -rdynamic -lOpenCL

oneAPI Level Zero Tests

Test: Peak Single-Precision Compute

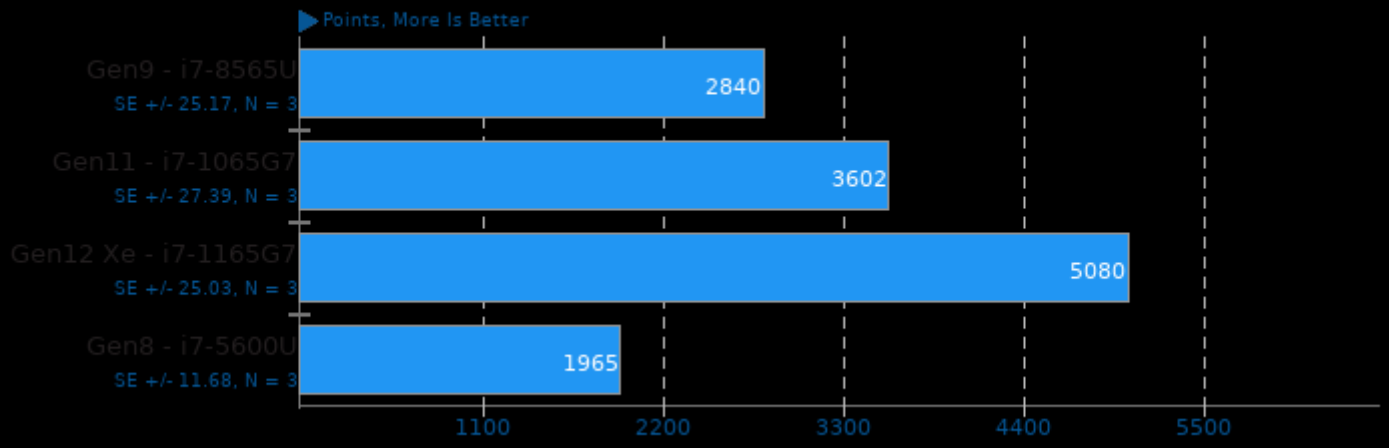


1. (CXX) g++ options: -ldl -pthread


PlaidML
FP16: No - Mode: Inference - Network: NASNet Large - Device: OpenCL
FPS, More Is Better
Gen9 - i7-8565U
SE +/- 0.01, N = 3
1.84
Gen11 - i7-1065G7
SE +/- 0.01, N = 3
3.31
Gen12 Xe - i7-1165G7
SE +/- 0.00, N = 3
5.14
1.1565
2.313
3.4695
4.626
5.7825
NCNN 20200916
Target: Vulkan GPU - Model: googlenet
ms, Fewer Is Better
Gen9 - i7-8565U
SE +/- 0.06, N = 3
MIN: 22.59 / MAX: 27.76
23.72
Gen11 - i7-1065G7
SE +/- 0.01, N = 3
MIN: 18.42 / MAX: 19.34
18.62
Gen12 Xe - i7-1165G7
SE +/- 0.03, N = 3
MIN: 10.37 / MAX: 11.21
10.51
Gen8 - i7-5600U
SE +/- 0.01, N = 3
MIN: 28.42 / MAX: 30.12
29.22
7
14
21
28
35
1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread
Xonotic 0.8.2
Resolution: 1920 x 1200 - Effects Quality: Ultimate
Frames Per Second, More Is Better
Gen9 - i7-8565U
SE +/- 0.44, N = 3
MIN: 26 / MAX: 115
71.61
Gen11 - i7-1065G7
SE +/- 1.54, N = 3
MIN: 30 / MAX: 197
99.24
Gen12 Xe - i7-1165G7
SE +/- 1.05, N = 3
MIN: 37 / MAX: 232
121.90
Gen8 - i7-5600U
SE +/- 0.04, N = 3
MIN: 23 / MAX: 74
46.39
30
60
90
120
150

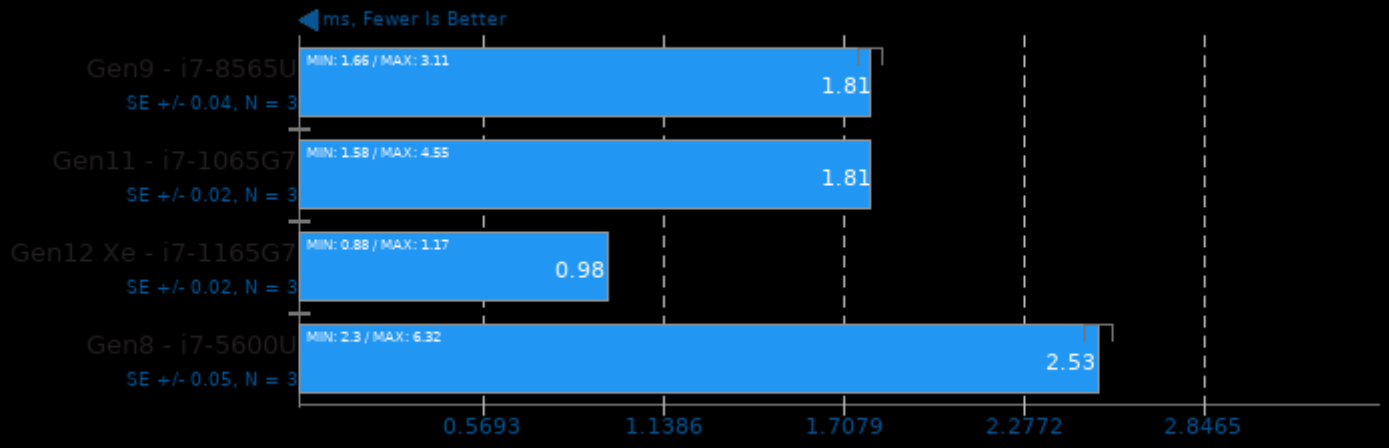
GpuTest 0.7.0

Test: TessMark - Resolution: 1920 x 1200 - Mode: Fullscreen



NCNN 20200916

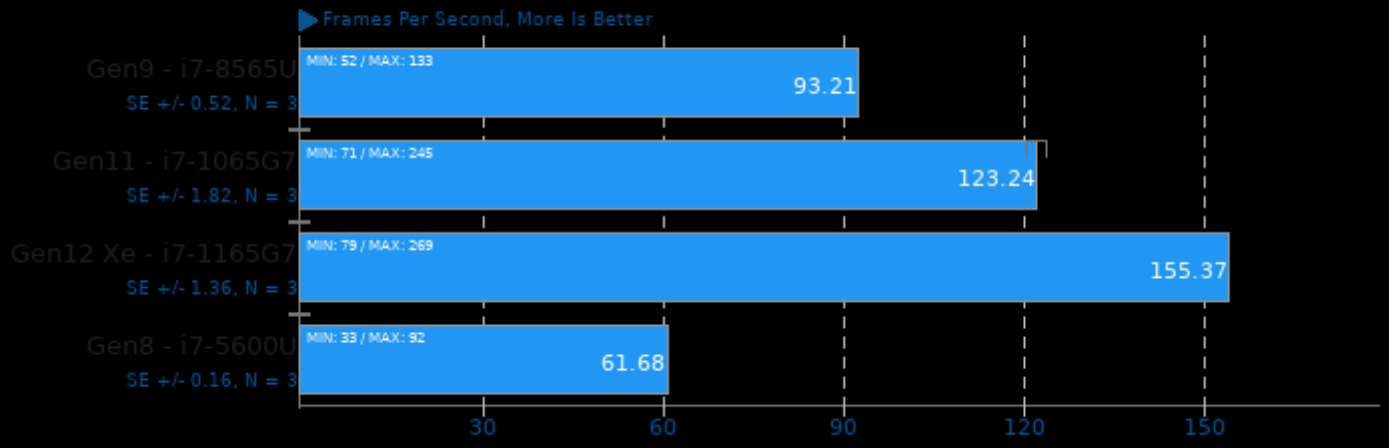
Target: Vulkan GPU - Model: blazeface



1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

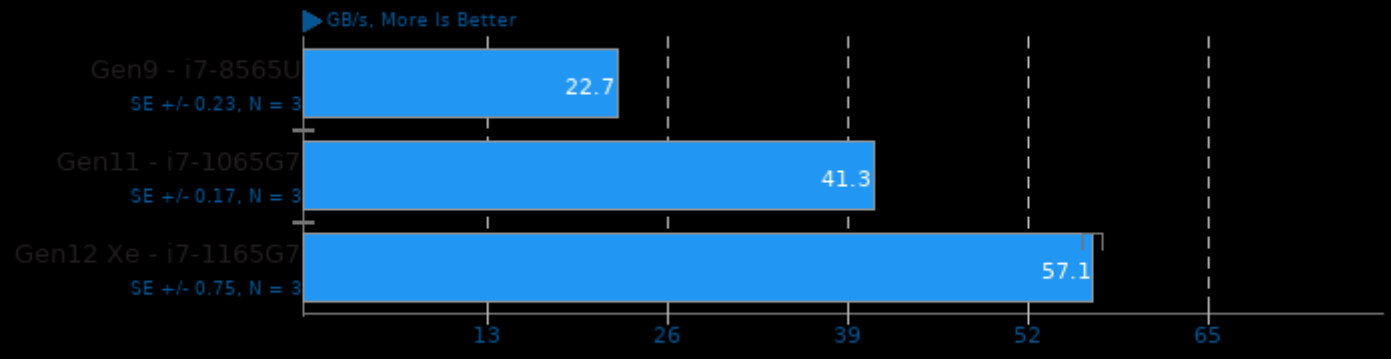
Xonotic 0.8.2

Resolution: 1920 x 1200 - Effects Quality: Ultra



cl-mem 2017-01-13

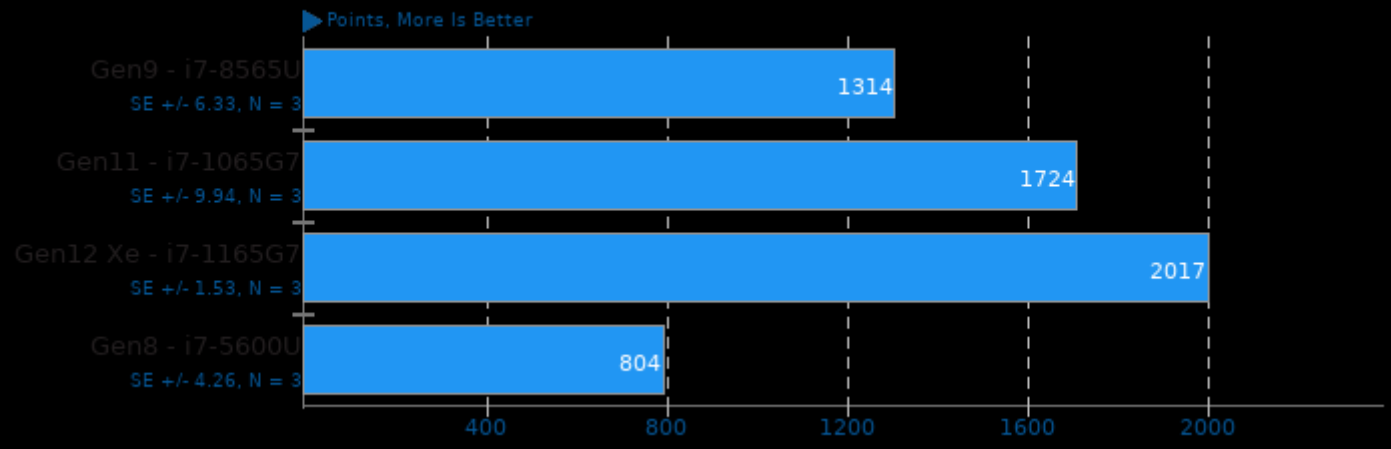
Benchmark: Read



1. (CC) gcc options: -O2 -flto -lOpenCL

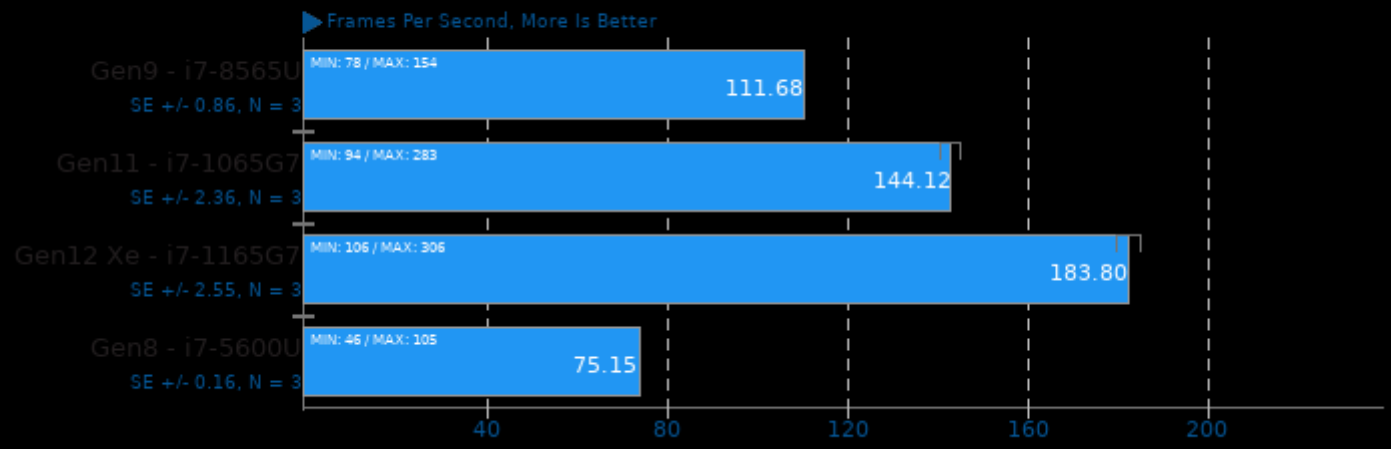
GpuTest 0.7.0

Test: GiMark - Resolution: 1920 x 1200 - Mode: Fullscreen



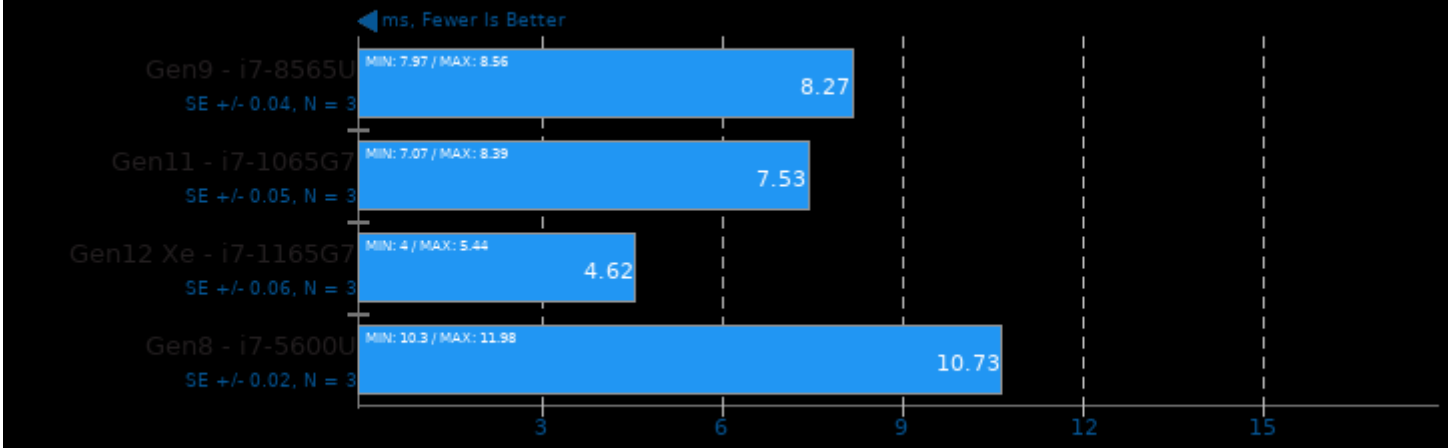
Xonotic 0.8.2

Resolution: 1920 x 1200 - Effects Quality: High



NCNN 20200916

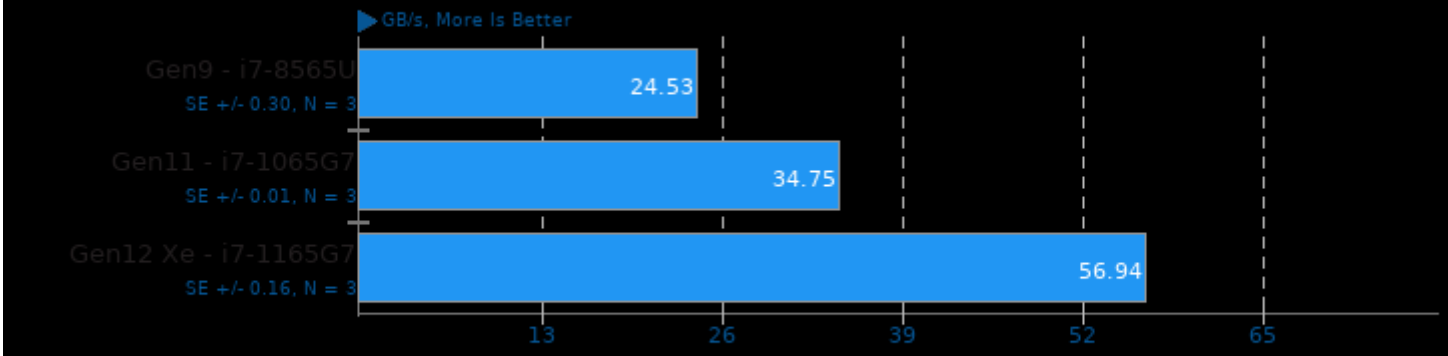
Target: Vulkan GPU-v2-v2 - Model: mobilenet-v2



1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

oneAPI Level Zero Tests

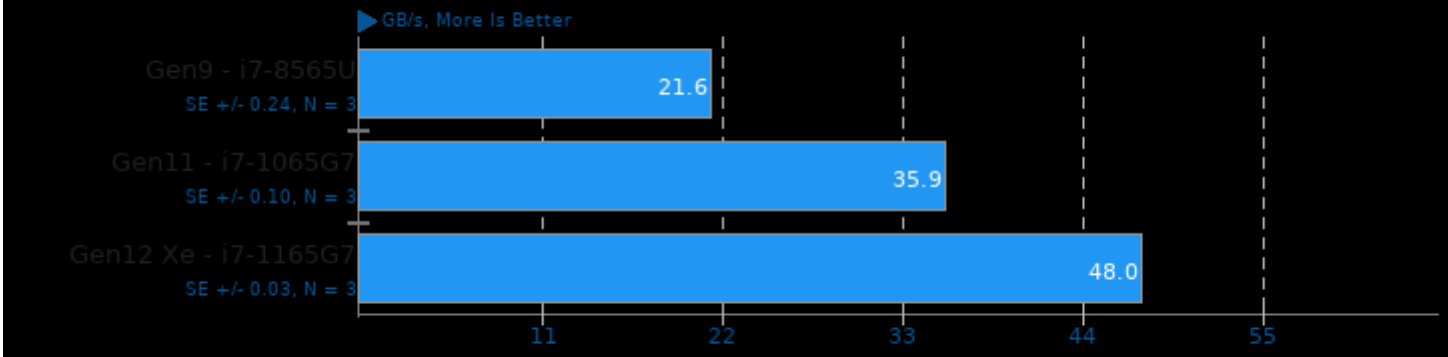
Test: Peak Float16 Global Memory Bandwidth



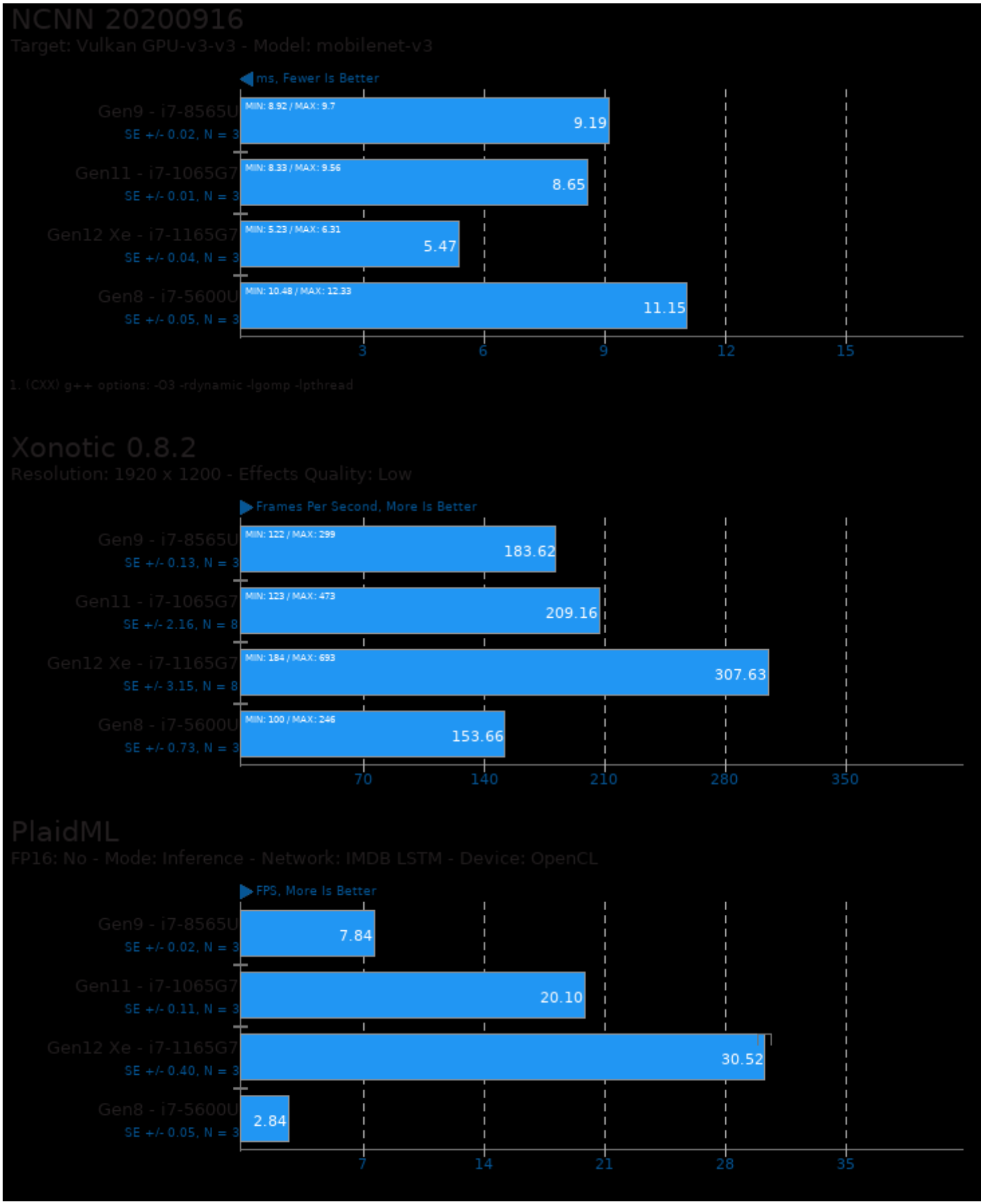
1. (CXX) g++ options: -ldl -pthread

cl-mem 2017-01-13

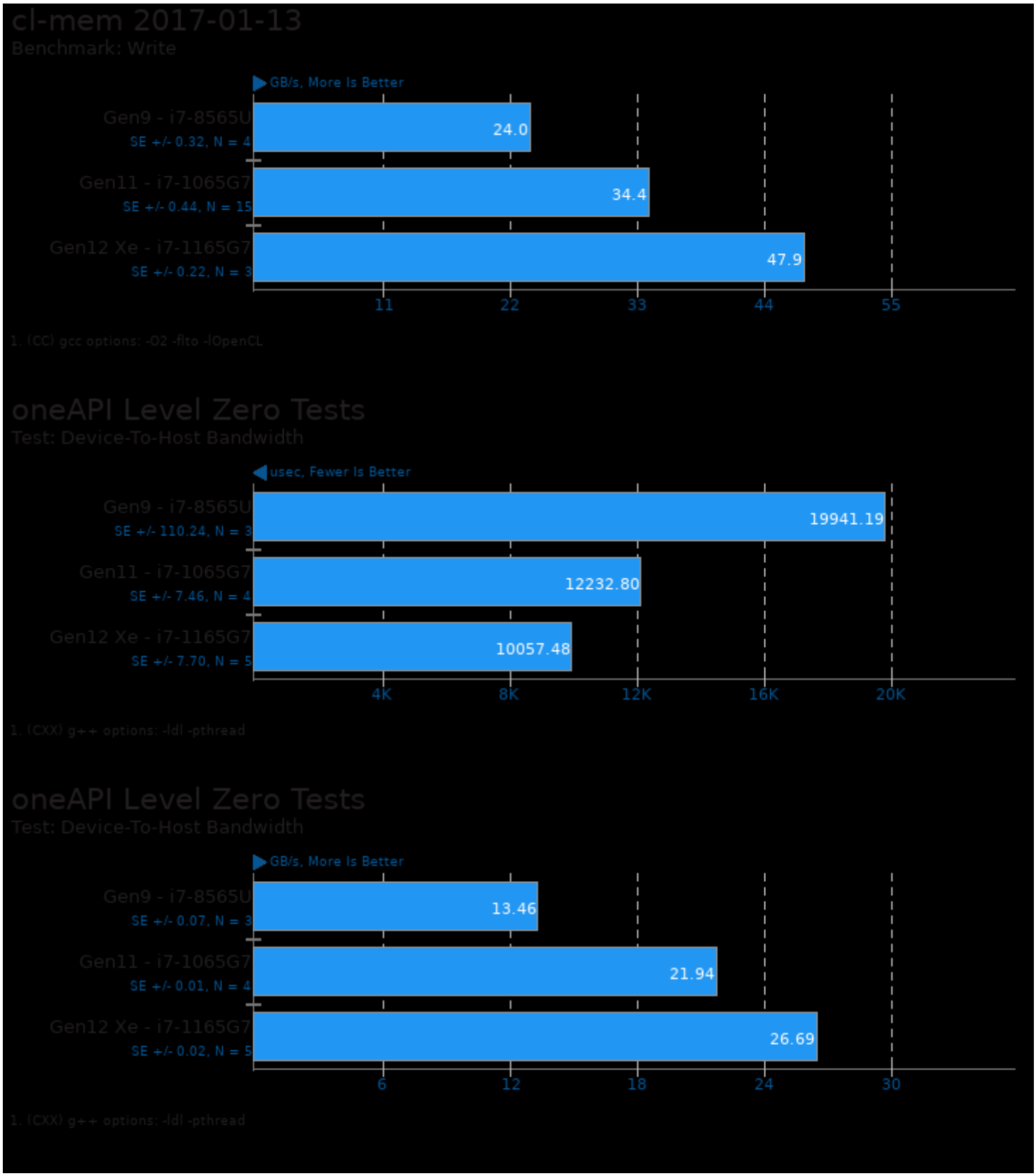
Benchmark: Copy

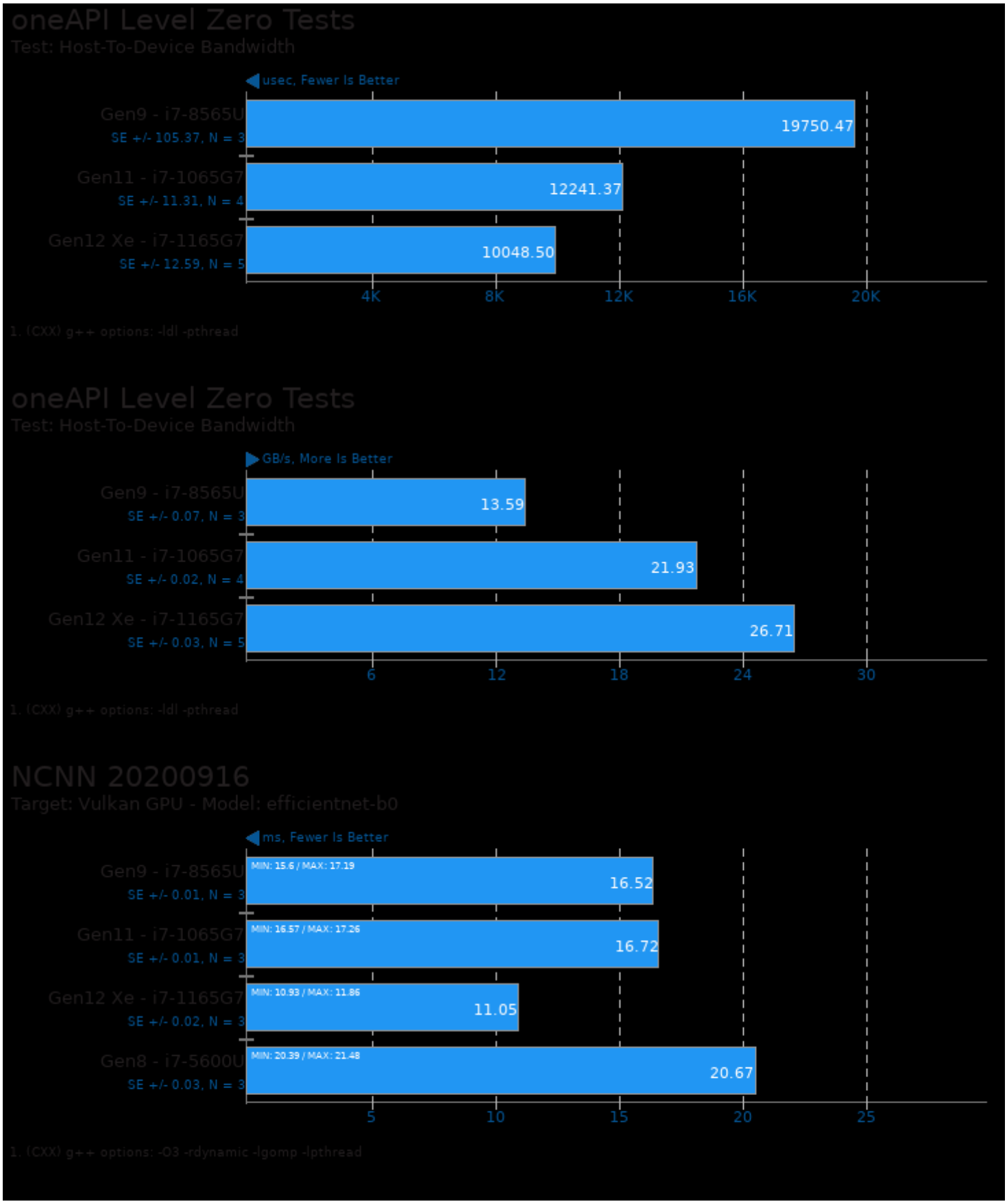


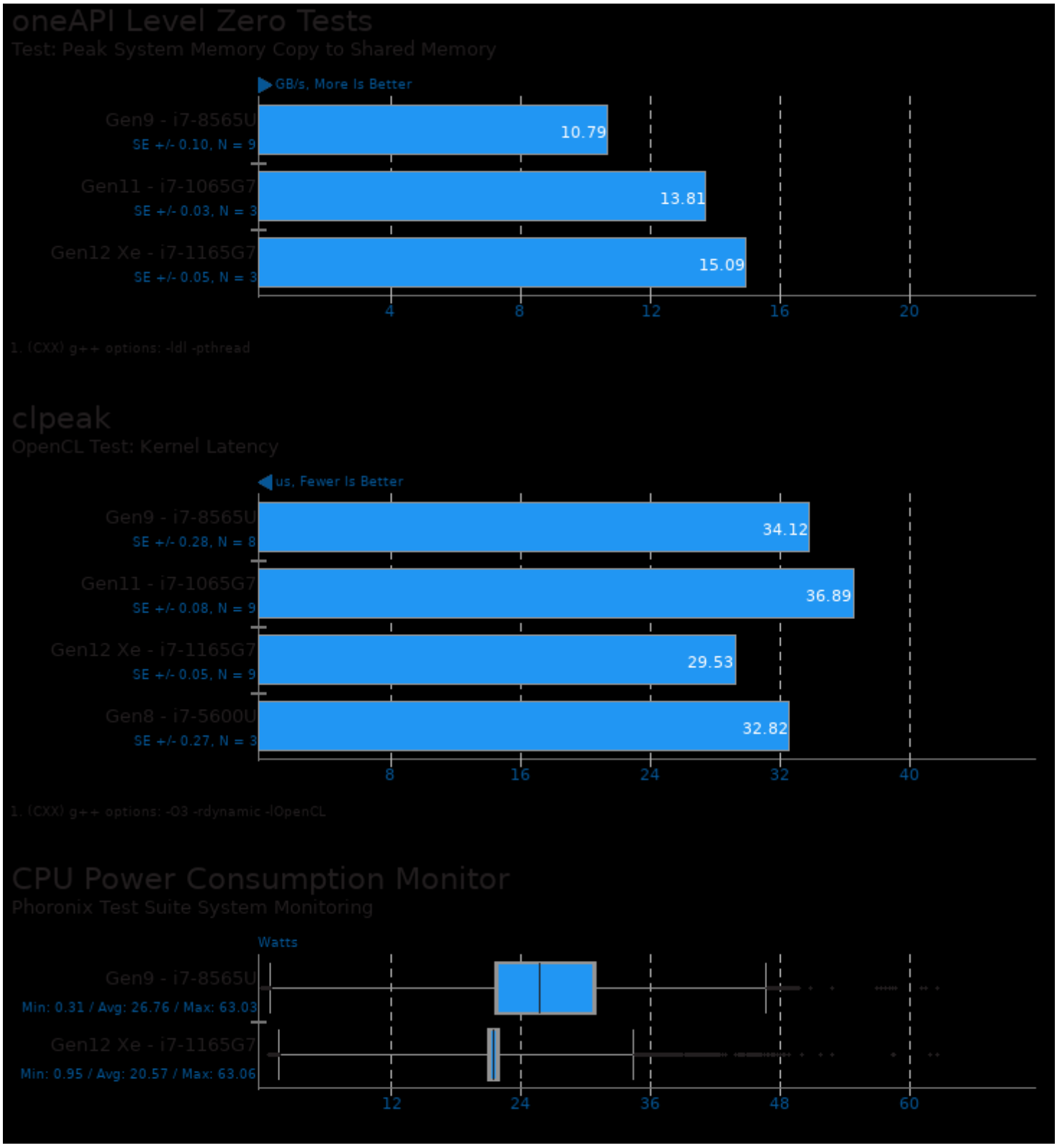
1. (CC) gcc options: -O2 -flto -lOpenCL

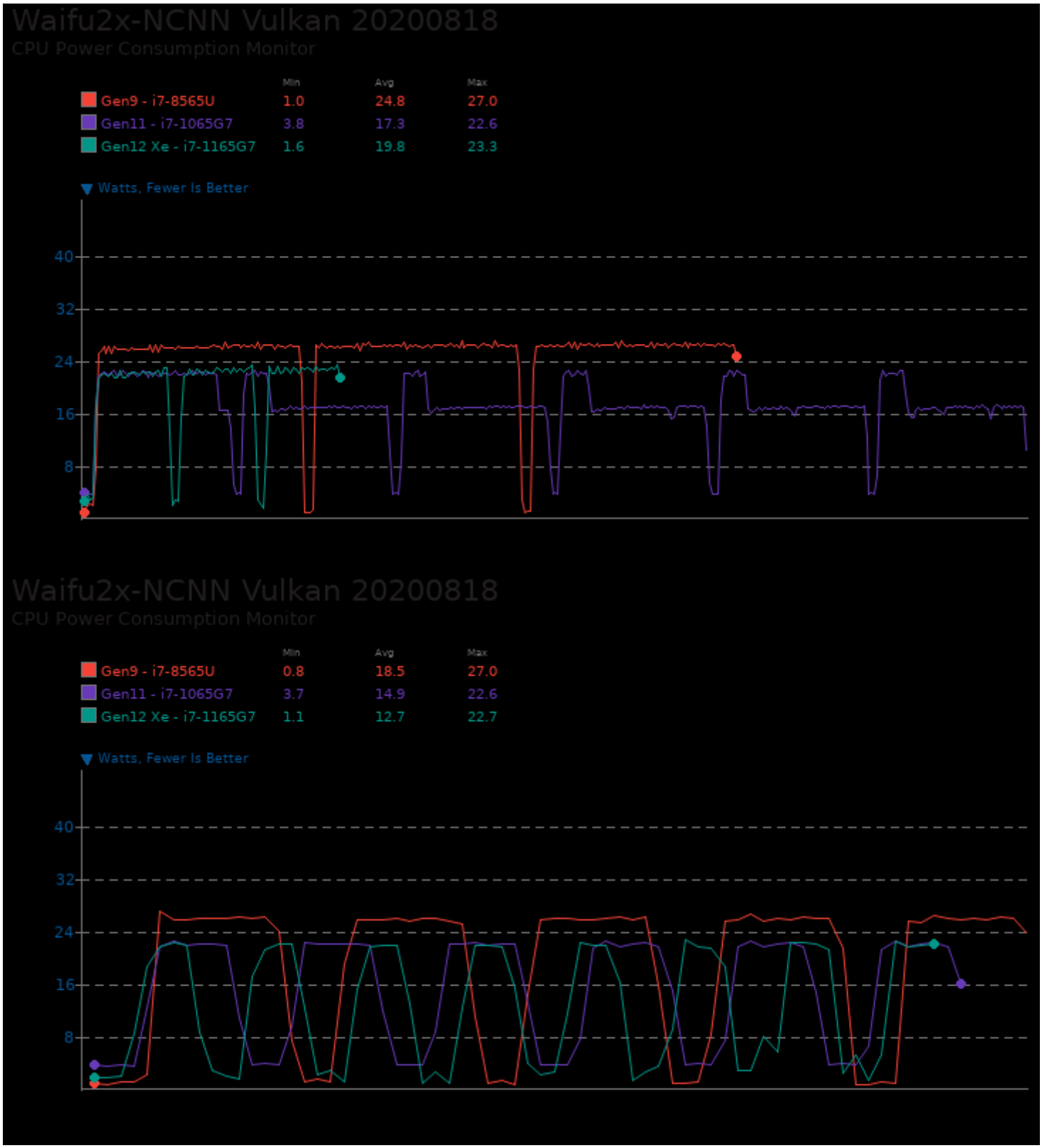

NCNN 20200916
Target: Vulkan GPU-v3-v3 - Model: mobilenet-v3
ms, Fewer Is Better
Gen9 - i7-8565U
SE +/- 0.02, N = 3
MIN: 8.92 / MAX: 9.7
9.19
Gen11 - i7-1065G7
SE +/- 0.01, N = 3
MIN: 8.33 / MAX: 9.56
8.65
Gen12 Xe - i7-1165G7
SE +/- 0.04, N = 3
MIN: 5.23 / MAX: 6.31
5.47
Gen8 - i7-5600U
SE +/- 0.05, N = 3
MIN: 10.48 / MAX: 12.33
11.15
3
6
9
12
15
1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread
Xonotic 0.8.2
Resolution: 1920 x 1200 - Effects Quality: Low
Frames Per Second, More Is Better
Gen9 - i7-8565U
SE +/- 0.13, N = 3
MIN: 122 / MAX: 299
183.62
Gen11 - i7-1065G7
SE +/- 2.16, N = 8
MIN: 123 / MAX: 473
209.16
Gen12 Xe - i7-1165G7
SE +/- 3.15, N = 8
MIN: 184 / MAX: 693
307.63
Gen8 - i7-5600U
SE +/- 0.73, N = 3
MIN: 100 / MAX: 246
153.66
70
140
210
280
350
PlaidML
FP16: No - Mode: Inference - Network: IMDB LSTM - Device: OpenCL
FPS, More Is Better
Gen9 - i7-8565U
SE +/- 0.02, N = 3
7.84
Gen11 - i7-1065G7
SE +/- 0.11, N = 3
20.10
Gen12 Xe - i7-1165G7
SE +/- 0.40, N = 3
30.52
Gen8 - i7-5600U
SE +/- 0.05, N = 3
2.84
7
14
21
28
35

Tigerlake Xe Gen12 to Gen8

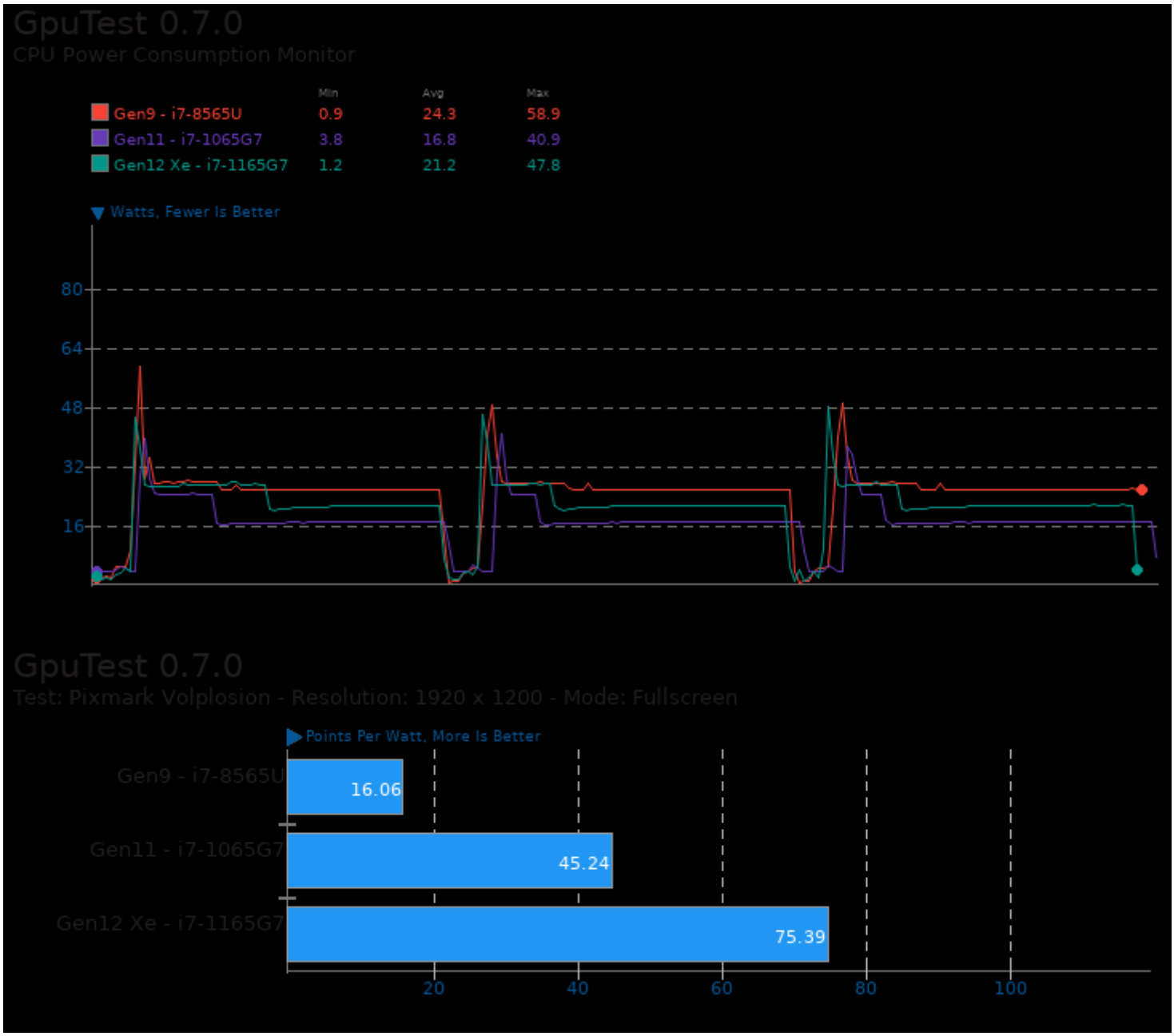



oneAPI Level Zero Tests
Test: Host-To-Device Bandwidth
usec, Fewer Is Better
Gen9 - i7-8565U
SE +/- 105.37, N = 3
19750.47
Gen11 - i7-1065G7
SE +/- 11.31, N = 4
12241.37
Gen12 Xe - i7-1165G7
SE +/- 12.59, N = 5
10048.50
4K
8K
12K
16K
20K
1. (CXX) g++ options: -ldl -pthread
oneAPI Level Zero Tests
Test: Host-To-Device Bandwidth
GB/s, More Is Better
Gen9 - i7-8565U
SE +/- 0.07, N = 3
13.59
Gen11 - i7-1065G7
SE +/- 0.02, N = 4
21.93
Gen12 Xe - i7-1165G7
SE +/- 0.03, N = 5
26.71
6
12
18
24
30
1. (CXX) g++ options: -ldl -pthread
NCNN 20200916
Target: Vulkan GPU - Model: efficientnet-b0
ms, Fewer Is Better
Gen9 - i7-8565U
SE +/- 0.01, N = 3
MIN: 15.6 / MAX: 17.19
16.52
Gen11 - i7-1065G7
SE +/- 0.01, N = 3
MIN: 16.57 / MAX: 17.26
16.72
Gen12 Xe - i7-1165G7
SE +/- 0.02, N = 3
MIN: 10.93 / MAX: 11.86
11.05
Gen8 - i7-5600U
SE +/- 0.03, N = 3
MIN: 20.39 / MAX: 21.48
20.67
5
10
15
20
25
1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread

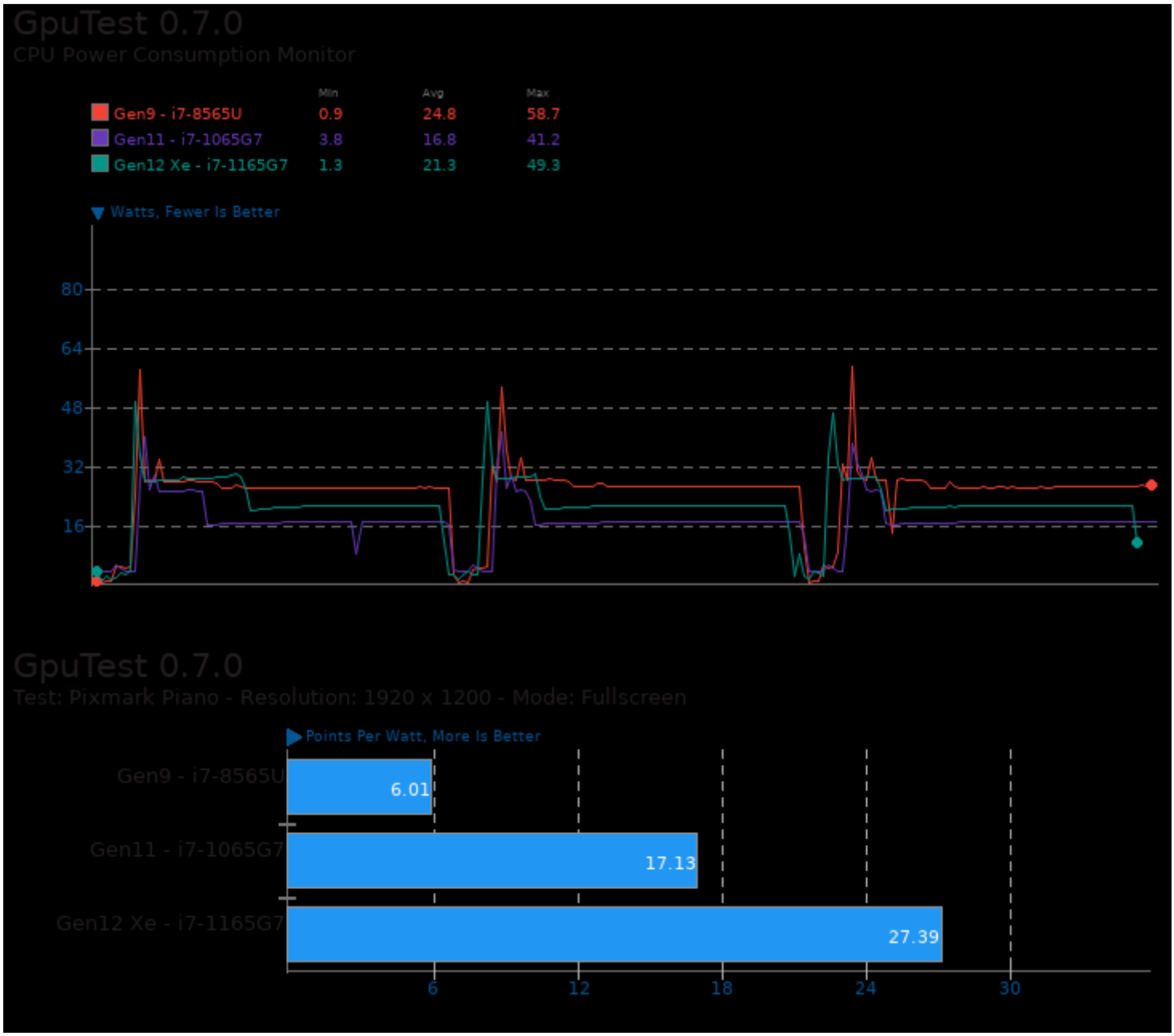

oneAPI Level Zero Tests
Test: Peak System Memory Copy to Shared Memory
GB/s, More Is Better
Gen9 - i7-8565U
SE +/- 0.10, N = 9
10.79
Gen11 - i7-1065G7
SE +/- 0.03, N = 3
13.81
Gen12 Xe - i7-1165G7
SE +/- 0.05, N = 3
15.09
4
8
12
16
20
1. (CXX) g++ options: -ldl -pthread
clpeak
OpenCL Test: Kernel Latency
us, Fewer Is Better
Gen9 - i7-8565U
SE +/- 0.28, N = 8
34.12
Gen11 - i7-1065G7
SE +/- 0.08, N = 9
36.89
Gen12 Xe - i7-1165G7
SE +/- 0.05, N = 9
29.53
Gen8 - i7-5600U
SE +/- 0.27, N = 3
32.82
8
16
24
32
40
1. (CXX) g++ options: -O3 -rdynamic -lOpenCL
CPU Power Consumption Monitor
Phoronix Test Suite System Monitoring
Watts
Gen9 - i7-8565U
Min: 0.31 / Avg: 26.76 / Max: 63.03
Gen12 Xe - i7-1165G7
Min: 0.95 / Avg: 20.57 / Max: 63.06
12
24
36
48
60


Waifu2x-NCNN Vulkan 20200818
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 1.0 24.8 27.0
Gen11 - i7-1065G7 3.8 17.3 22.6
Gen12 Xe - i7-1165G7 1.6 19.8 23.3
Watts, Fewer Is Better
40
32
24
16
8
Waifu2x-NCNN Vulkan 20200818
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 0.8 18.5 27.0
Gen11 - i7-1065G7 3.7 14.9 22.6
Gen12 Xe - i7-1165G7 1.1 12.7 22.7
Watts, Fewer Is Better
40
32
24
16
8

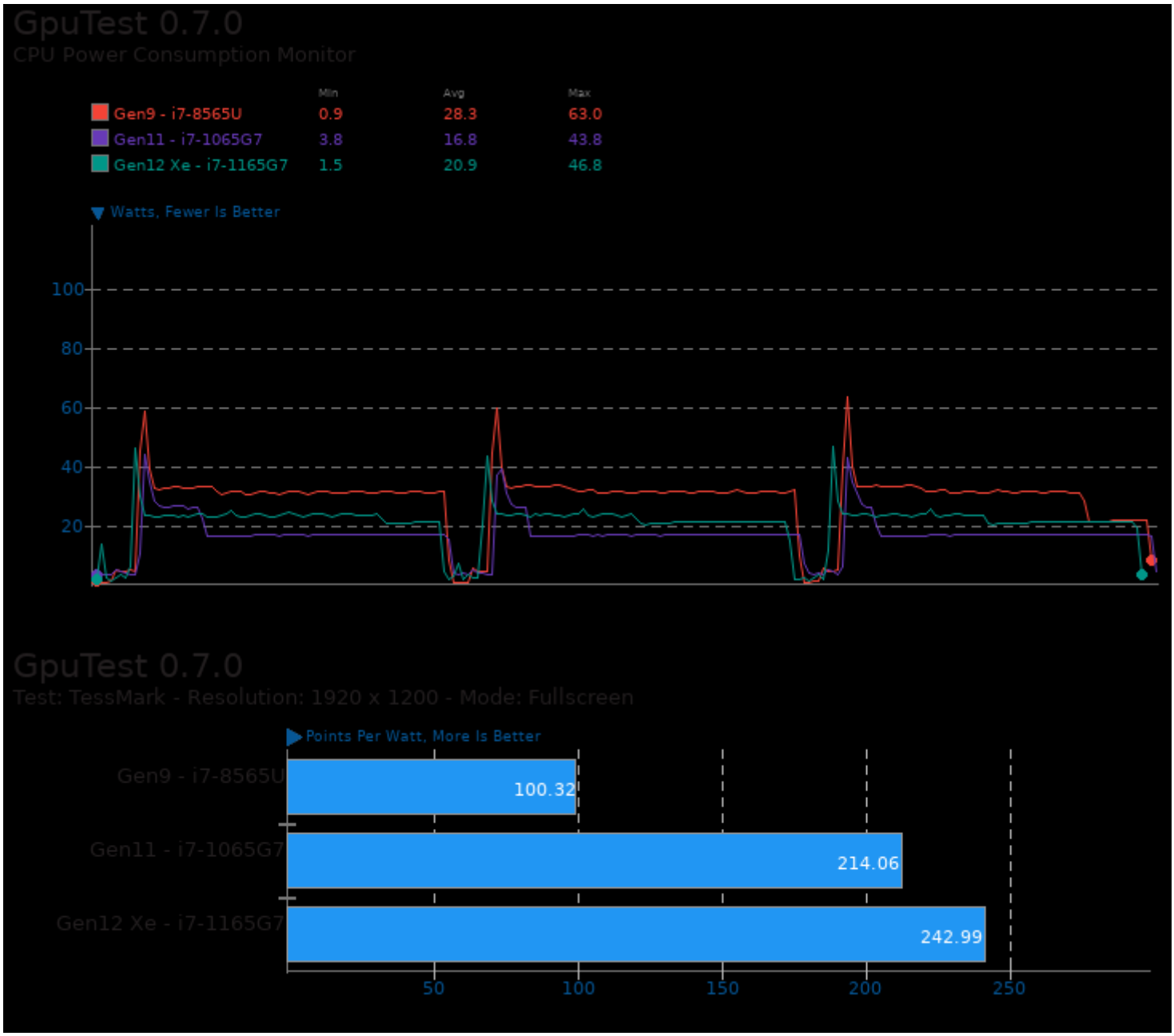
Tigerlake Xe Gen12 to Gen8



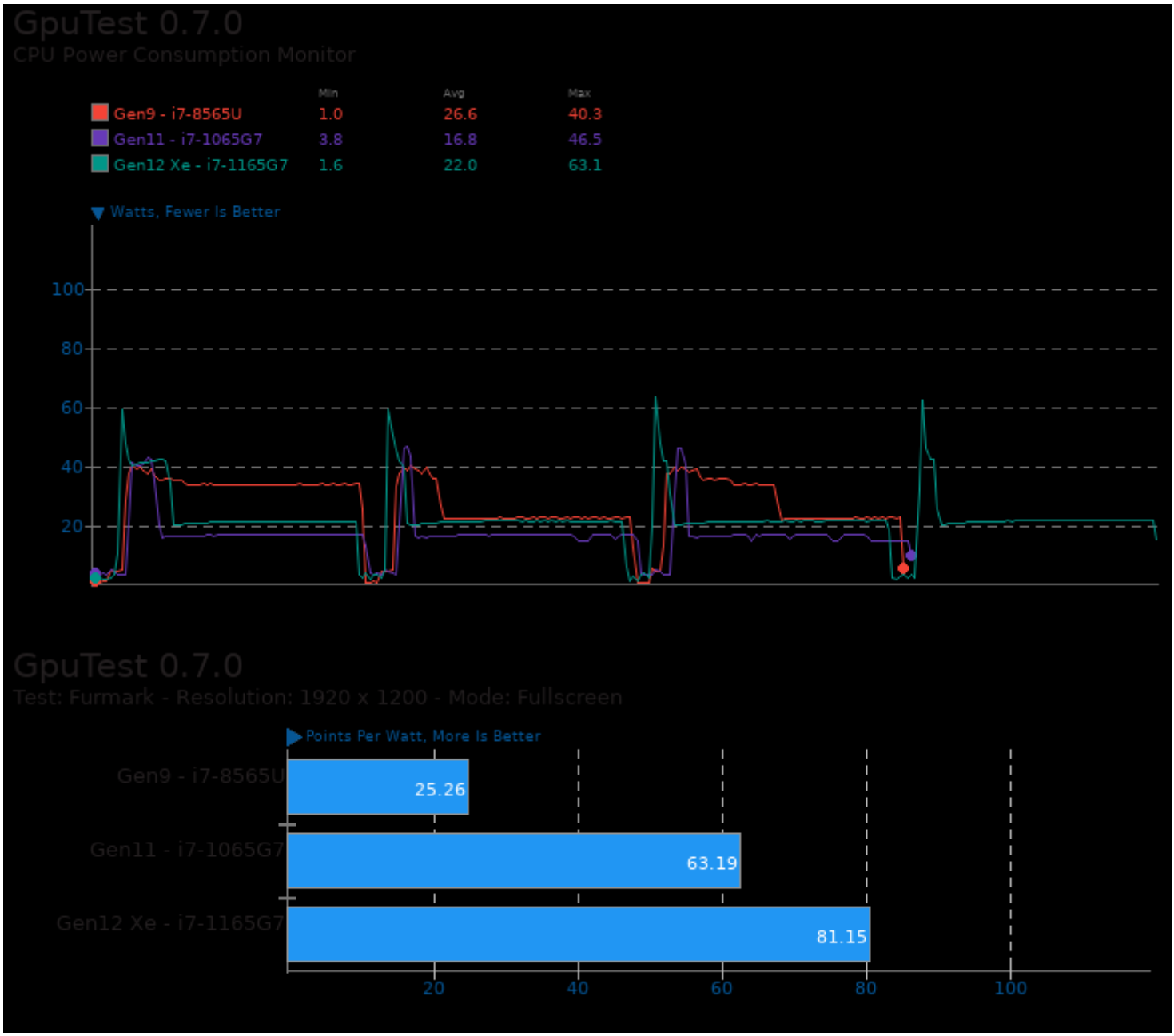
Tigerlake Xe Gen12 to Gen8



Tigerlake Xe Gen12 to Gen8



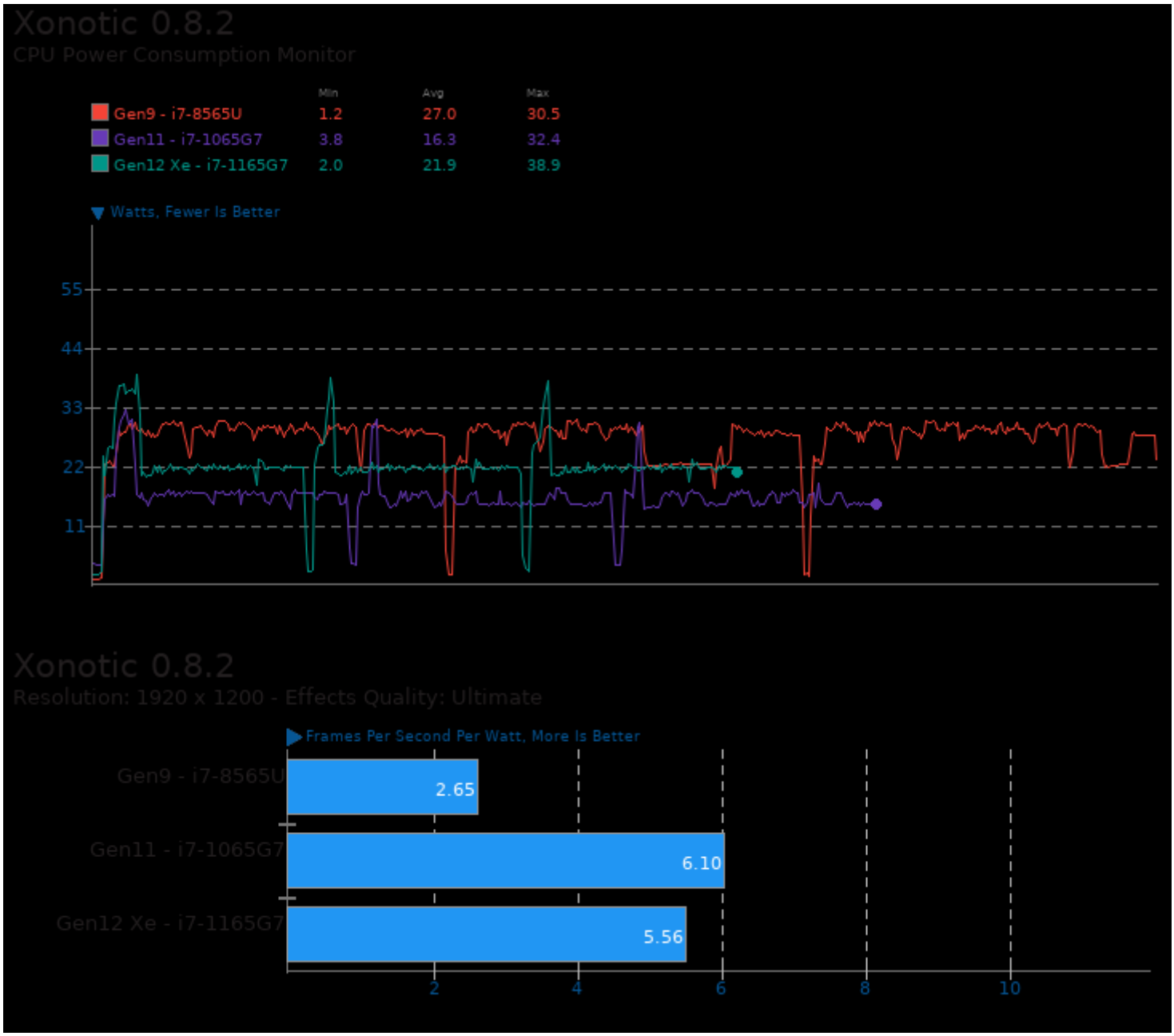
Tigerlake Xe Gen12 to Gen8



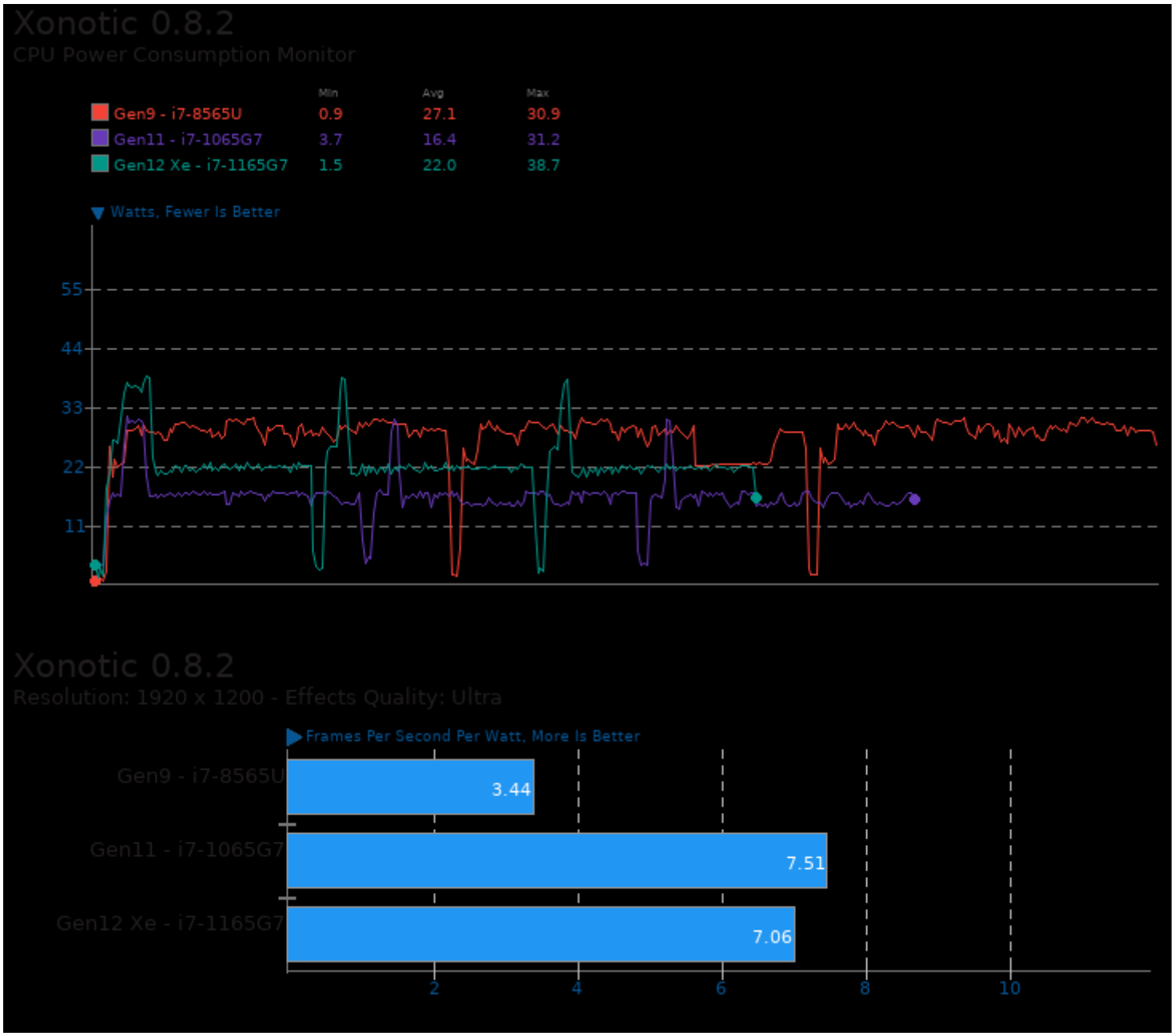
Tigerlake Xe Gen12 to Gen8



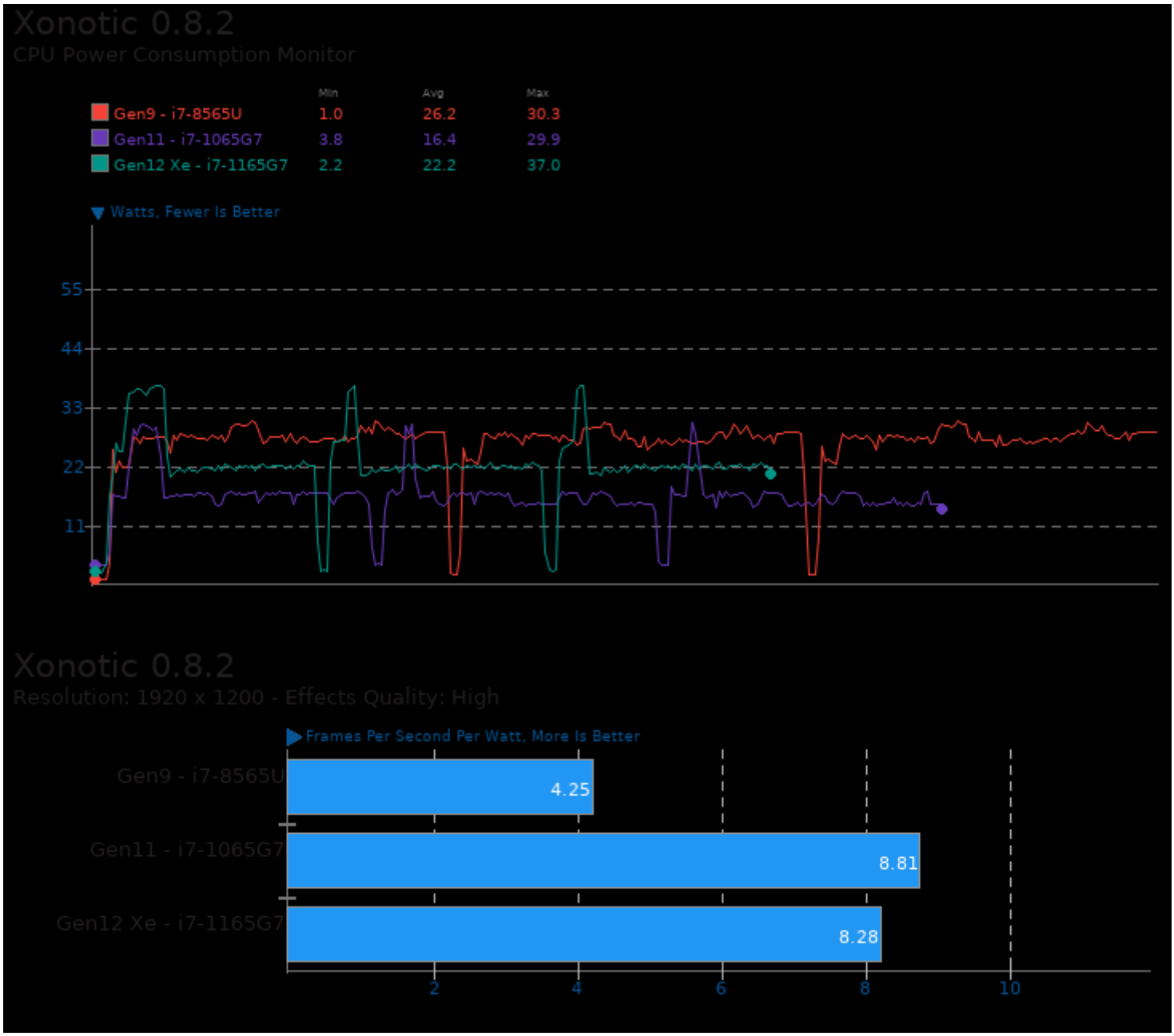
Tigerlake Xe Gen12 to Gen8



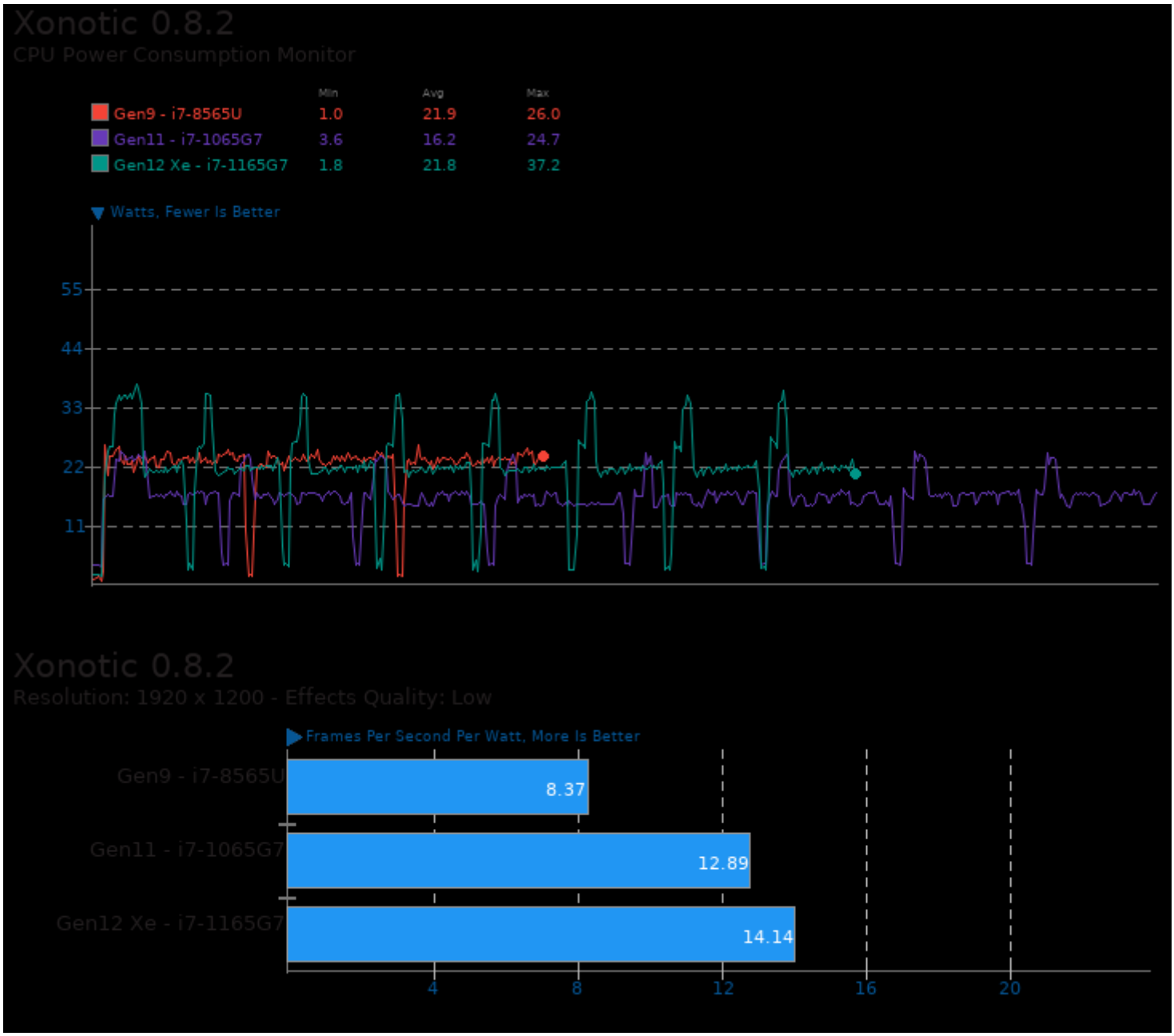
Tigerlake Xe Gen12 to Gen8



Tigerlake Xe Gen12 to Gen8



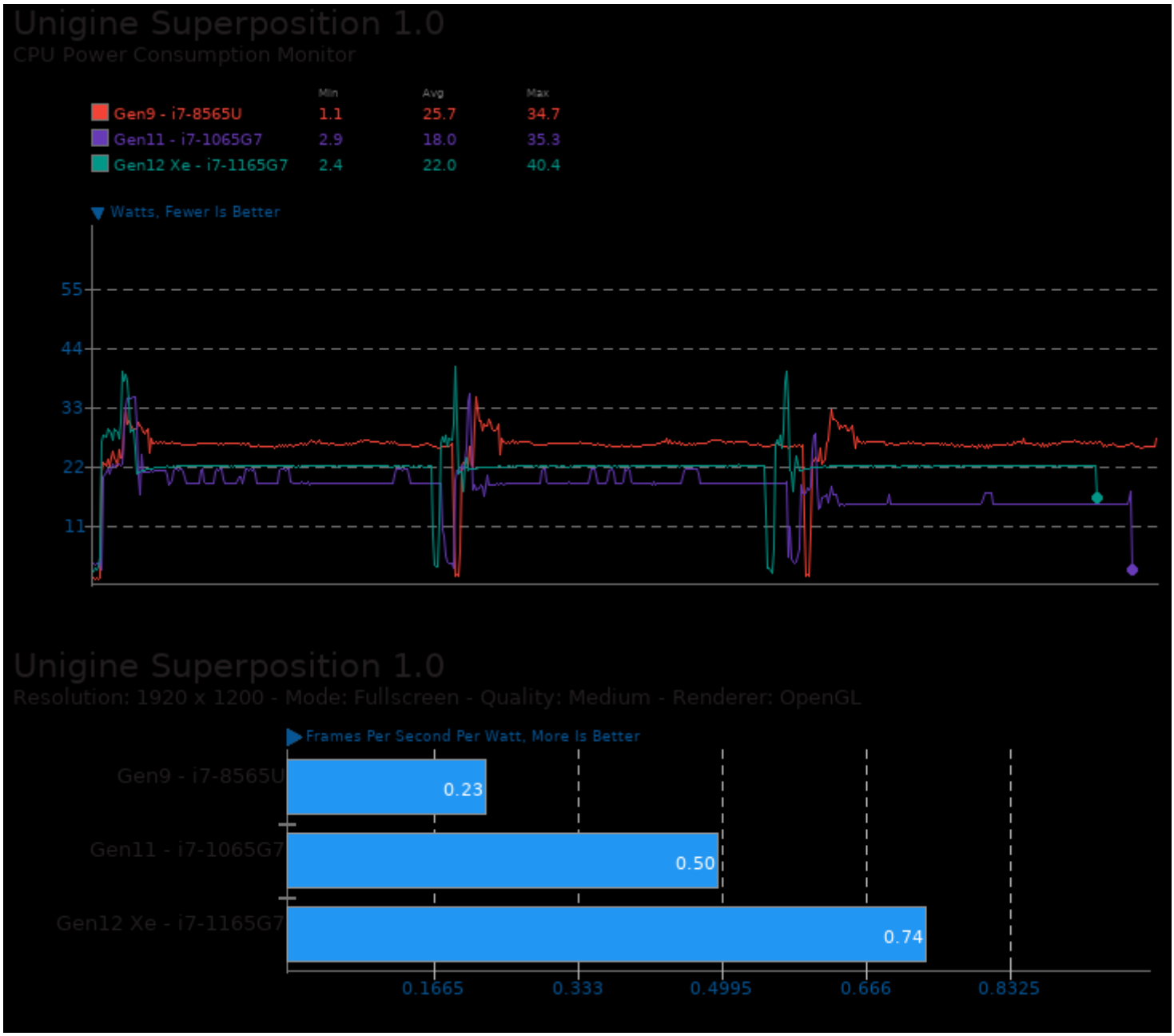
Tigerlake Xe Gen12 to Gen8



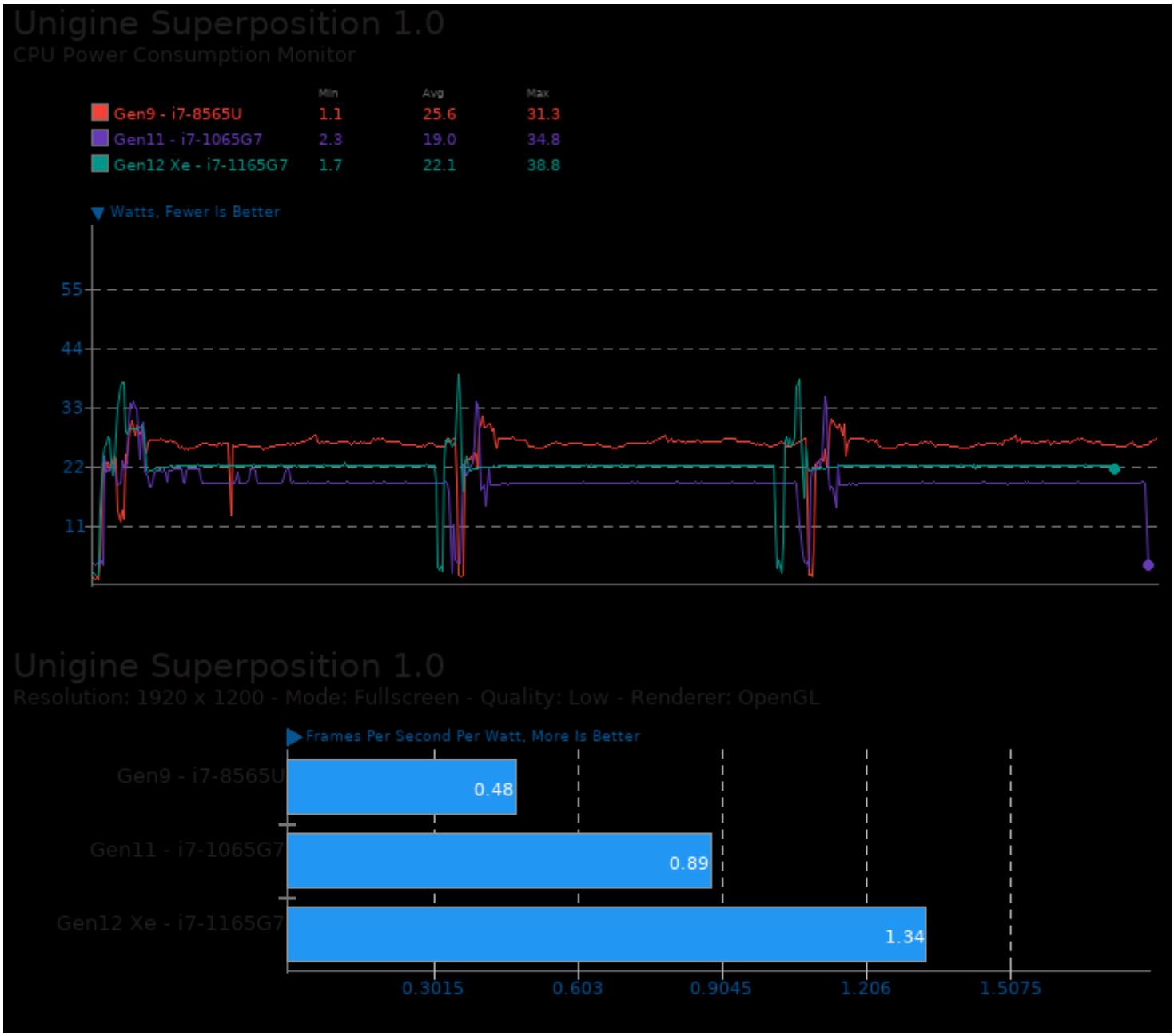
Tigerlake Xe Gen12 to Gen8



Tigerlake Xe Gen12 to Gen8



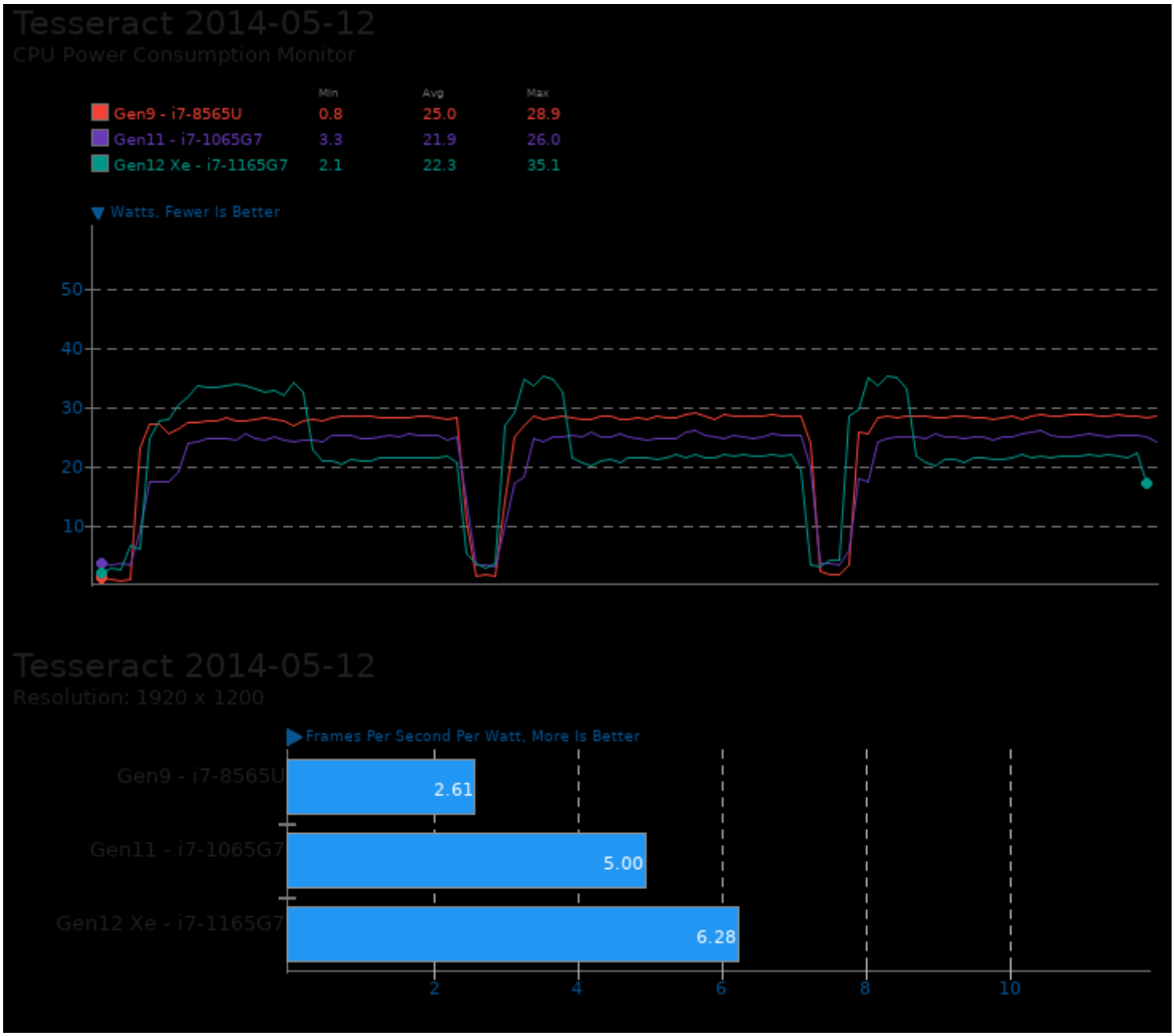
Tigerlake Xe Gen12 to Gen8



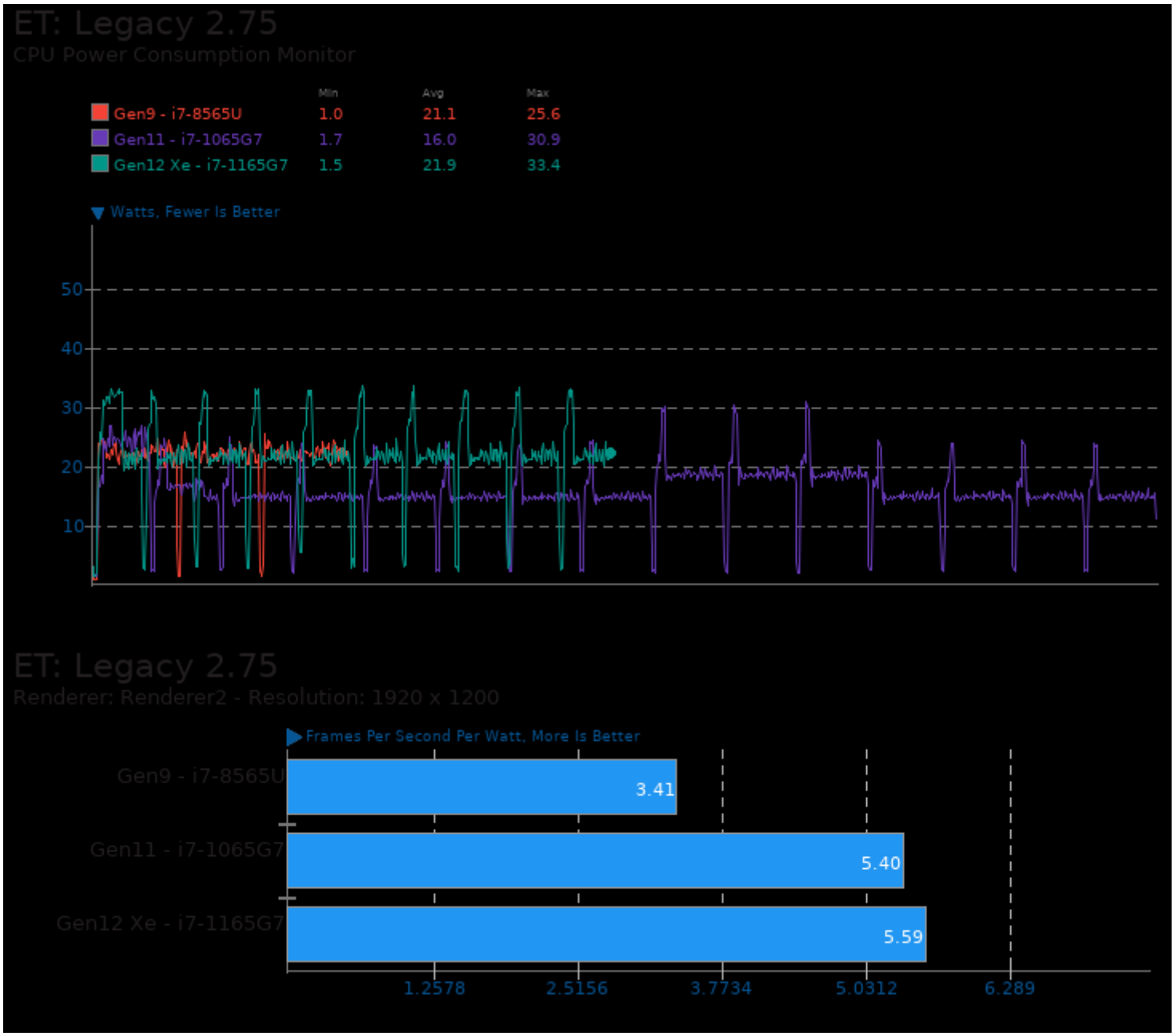
Tigerlake Xe Gen12 to Gen8



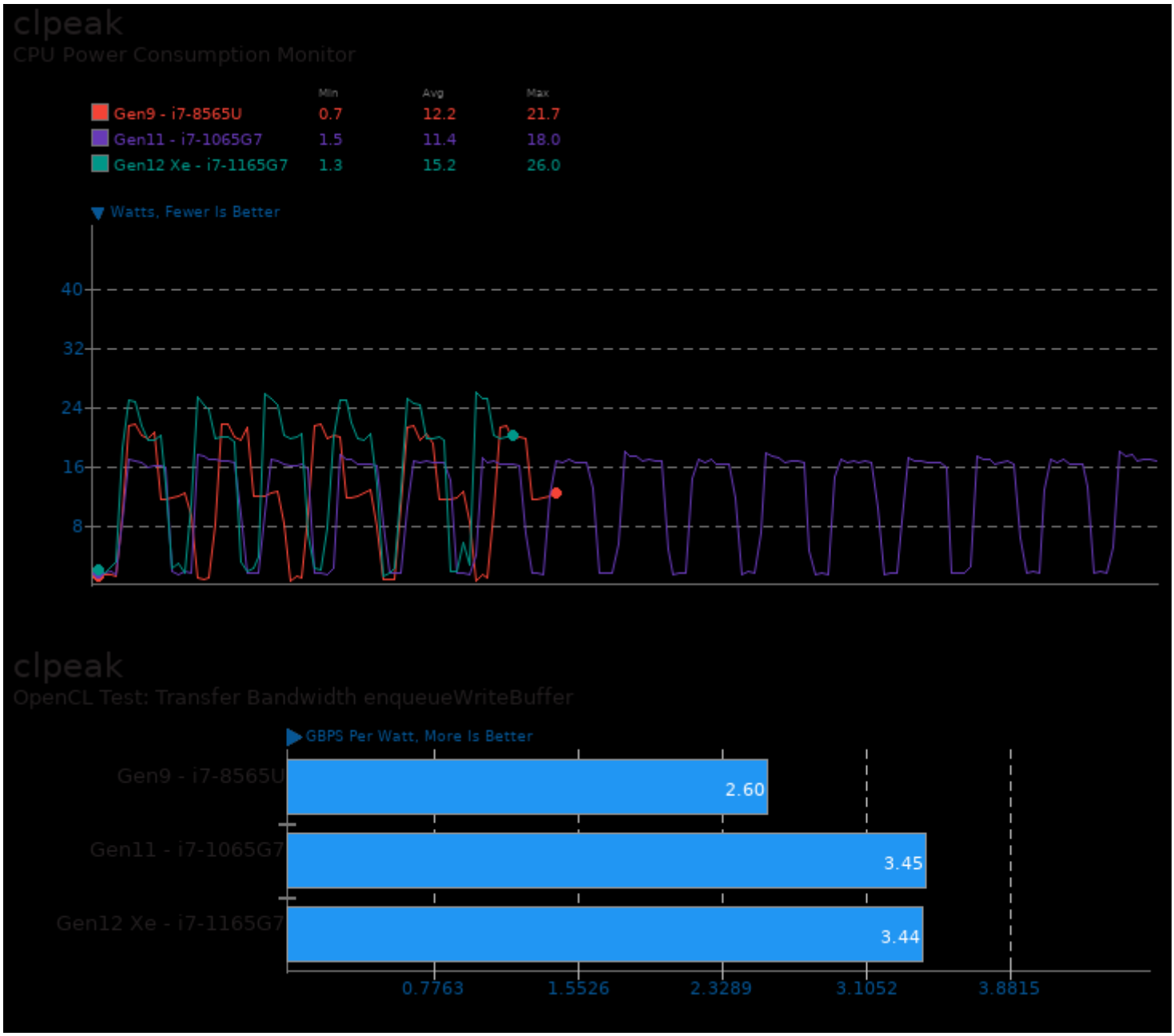
Tigerlake Xe Gen12 to Gen8



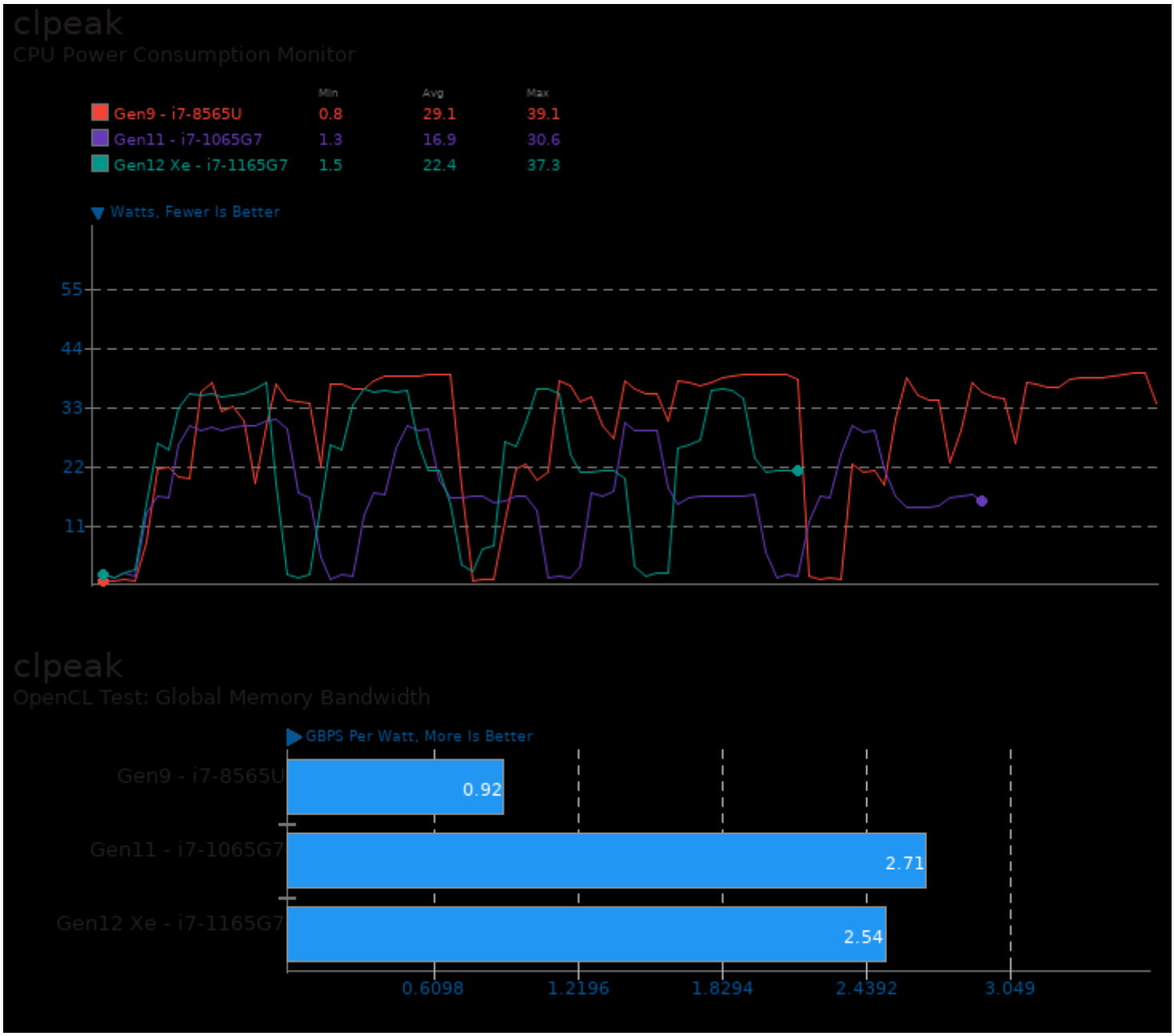
Tigerlake Xe Gen12 to Gen8



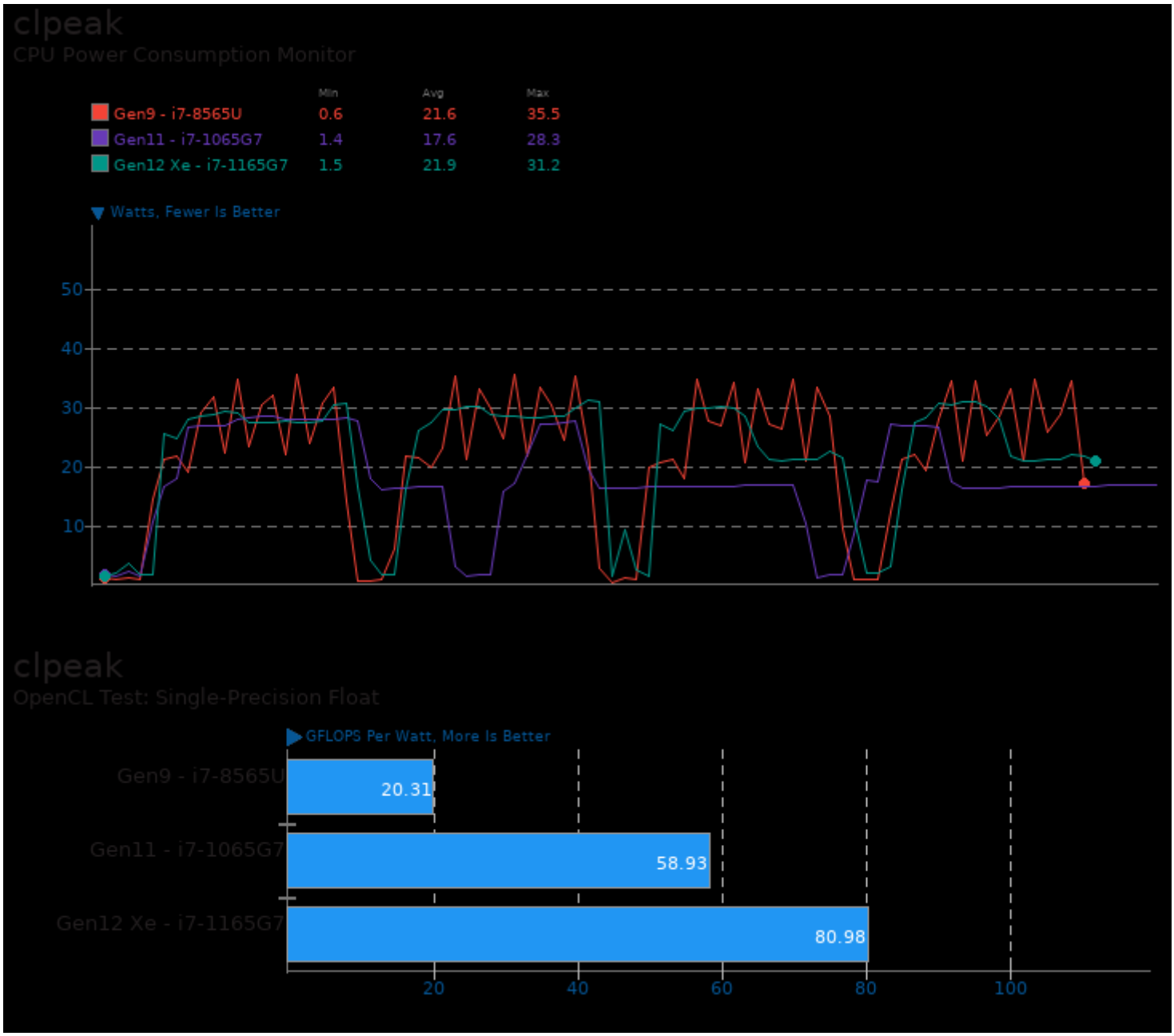
Tigerlake Xe Gen12 to Gen8



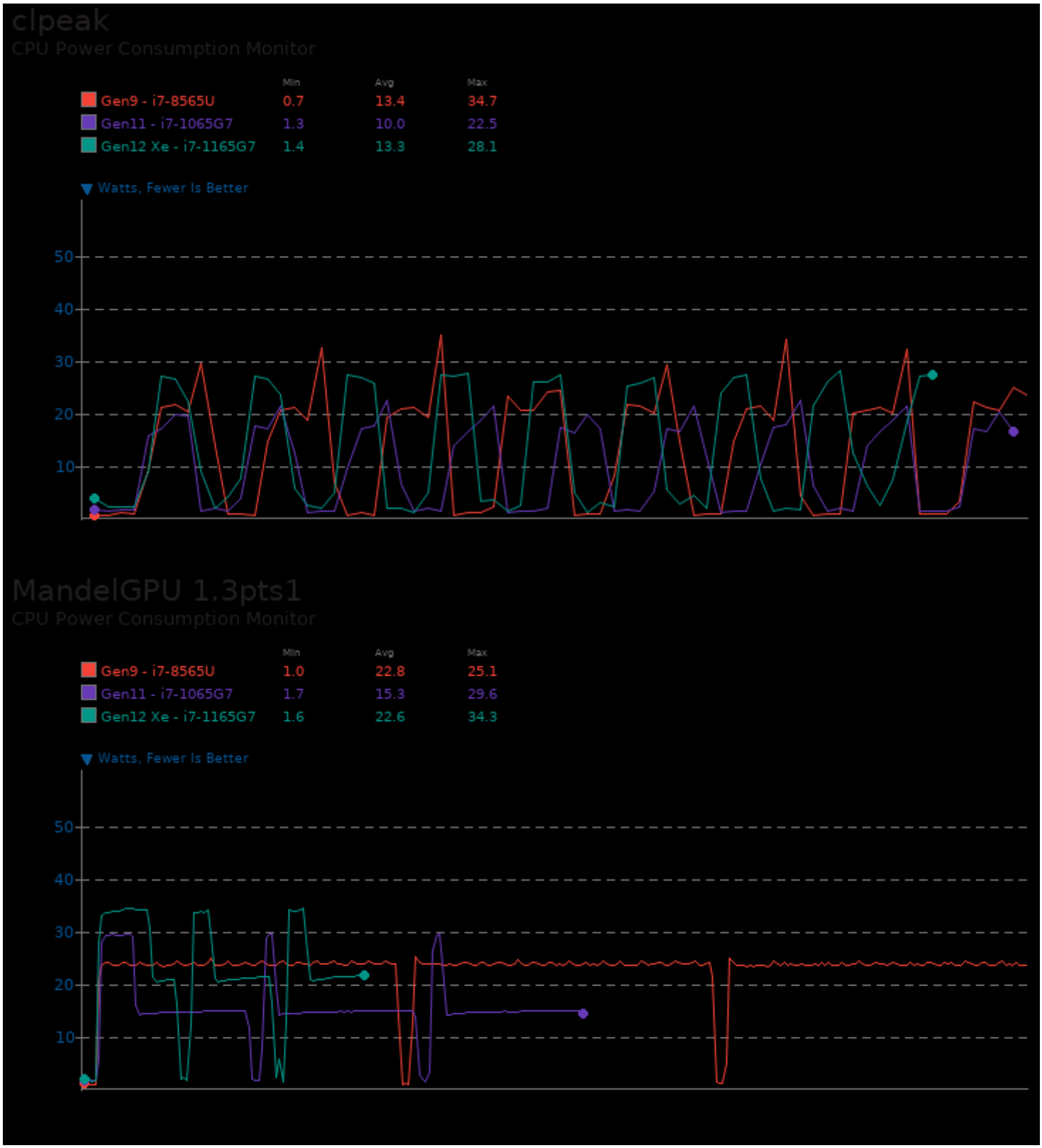
Tigerlake Xe Gen12 to Gen8

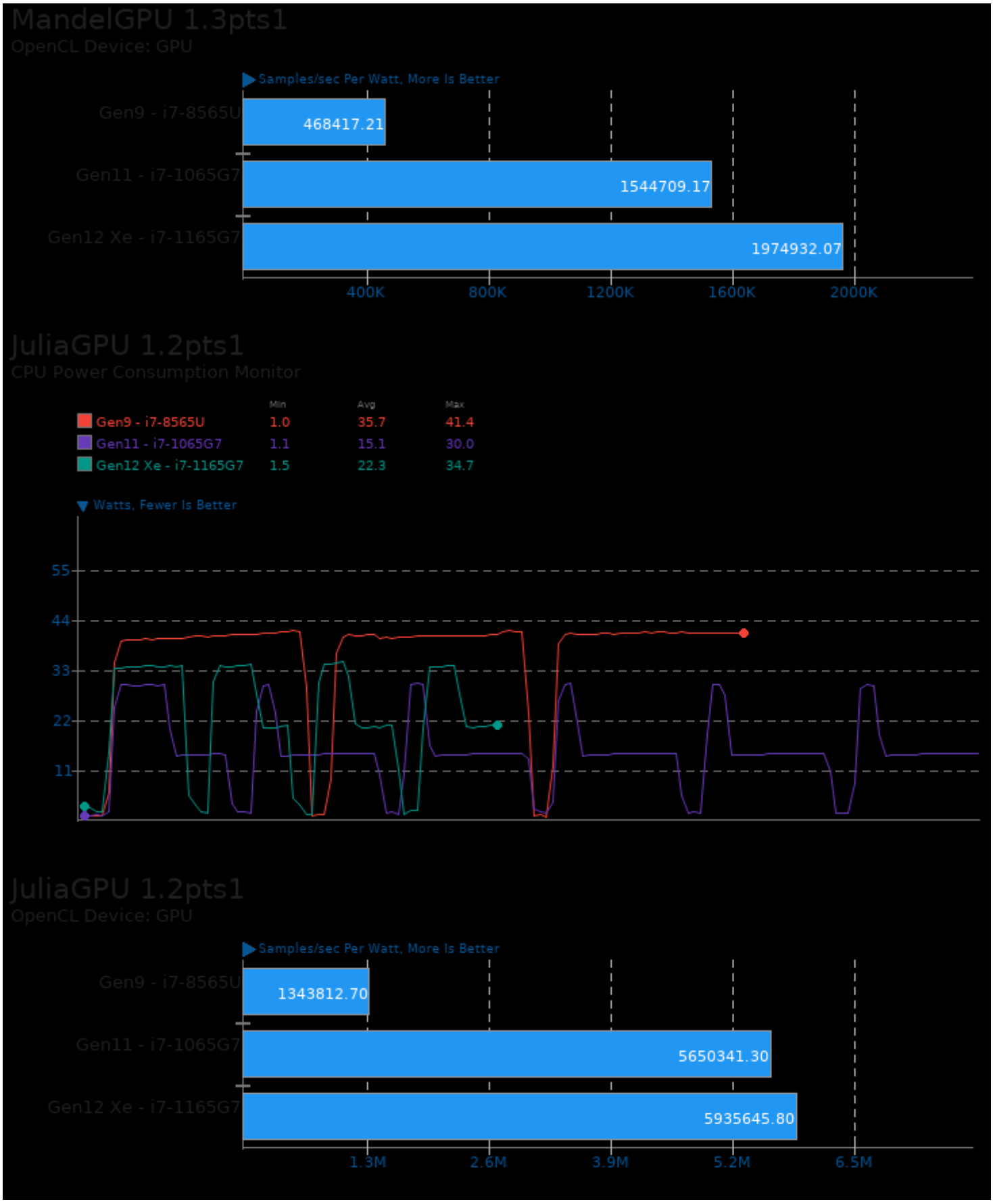


Tigerlake Xe Gen12 to Gen8

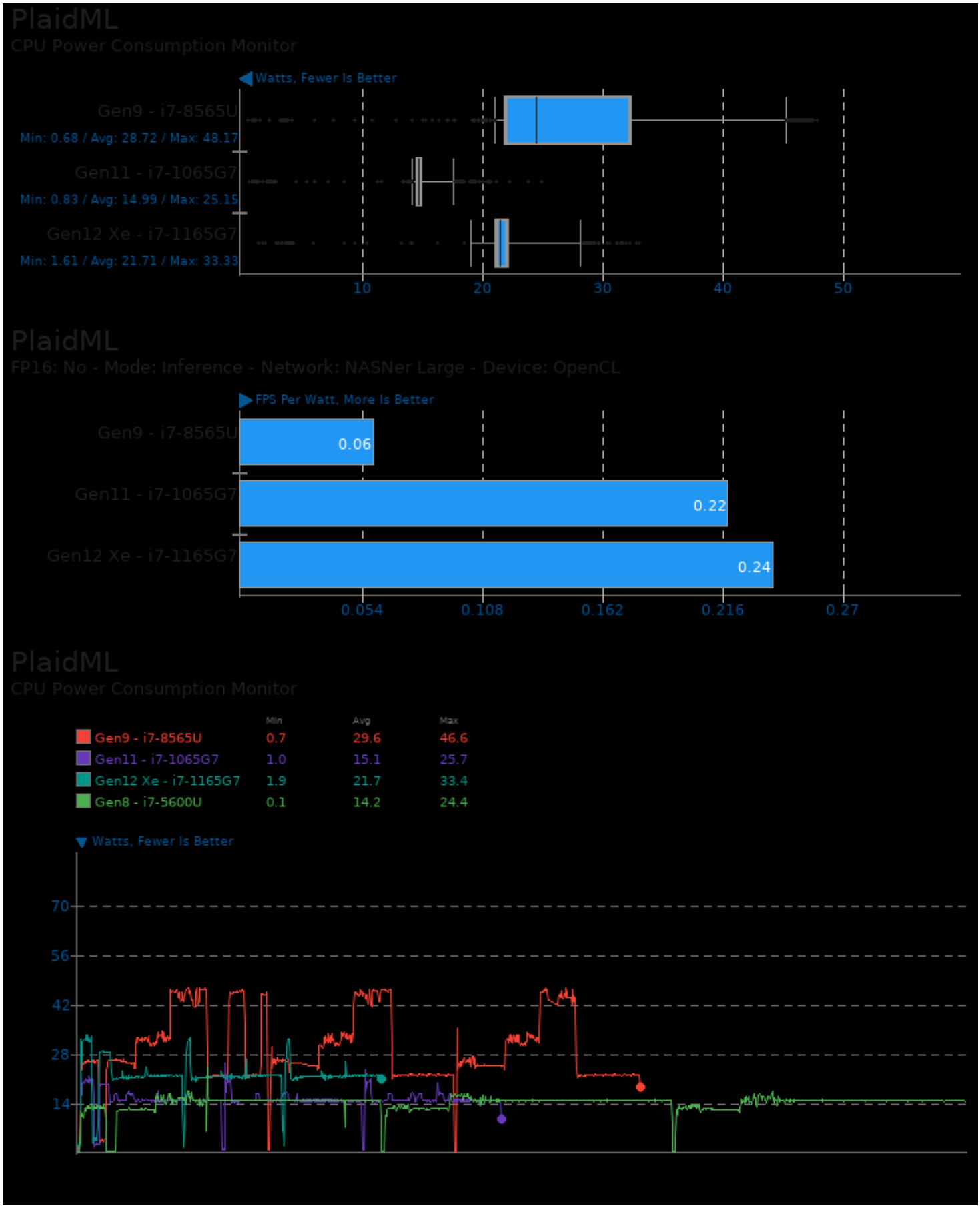


Tigerlake Xe Gen12 to Gen8

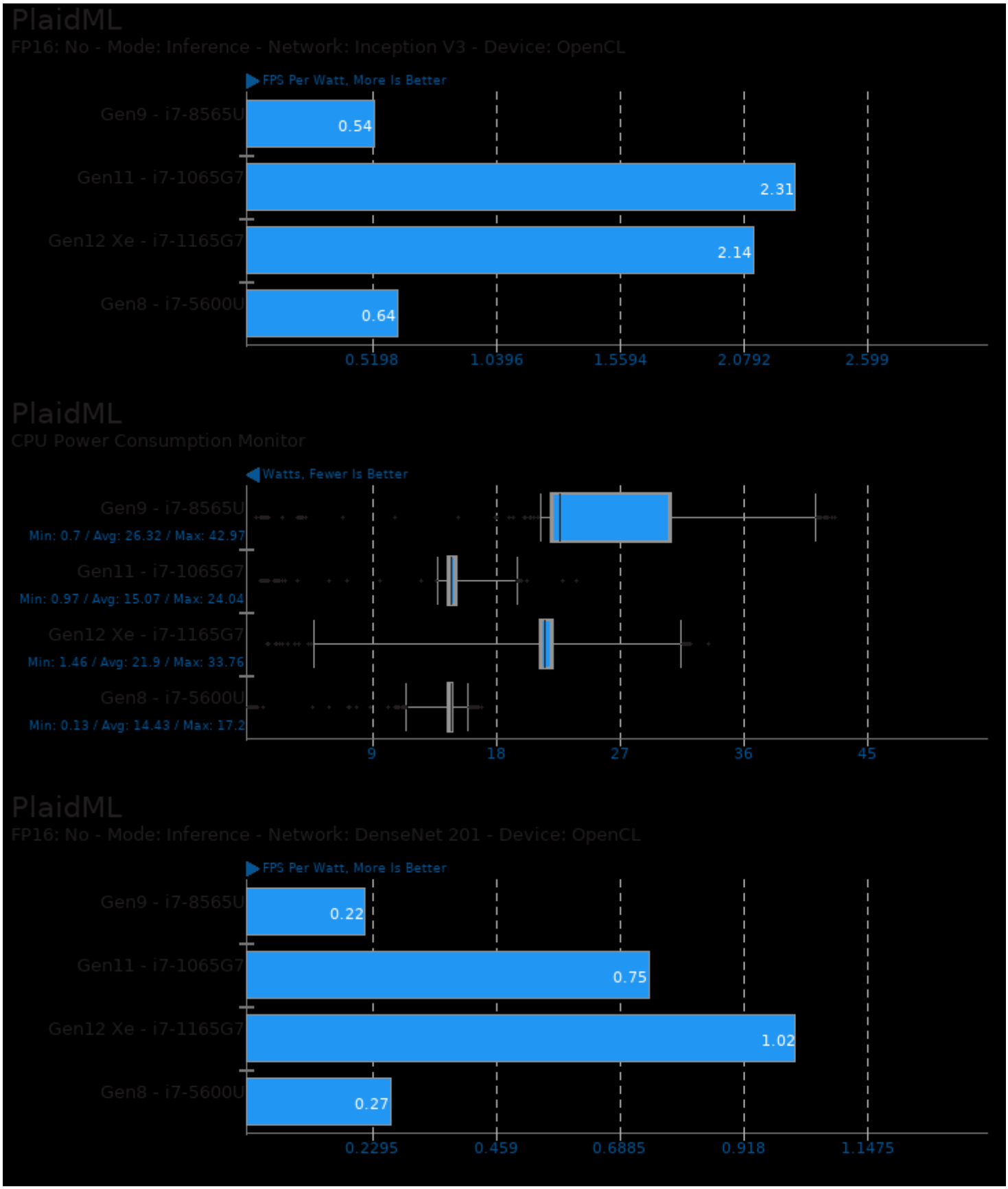


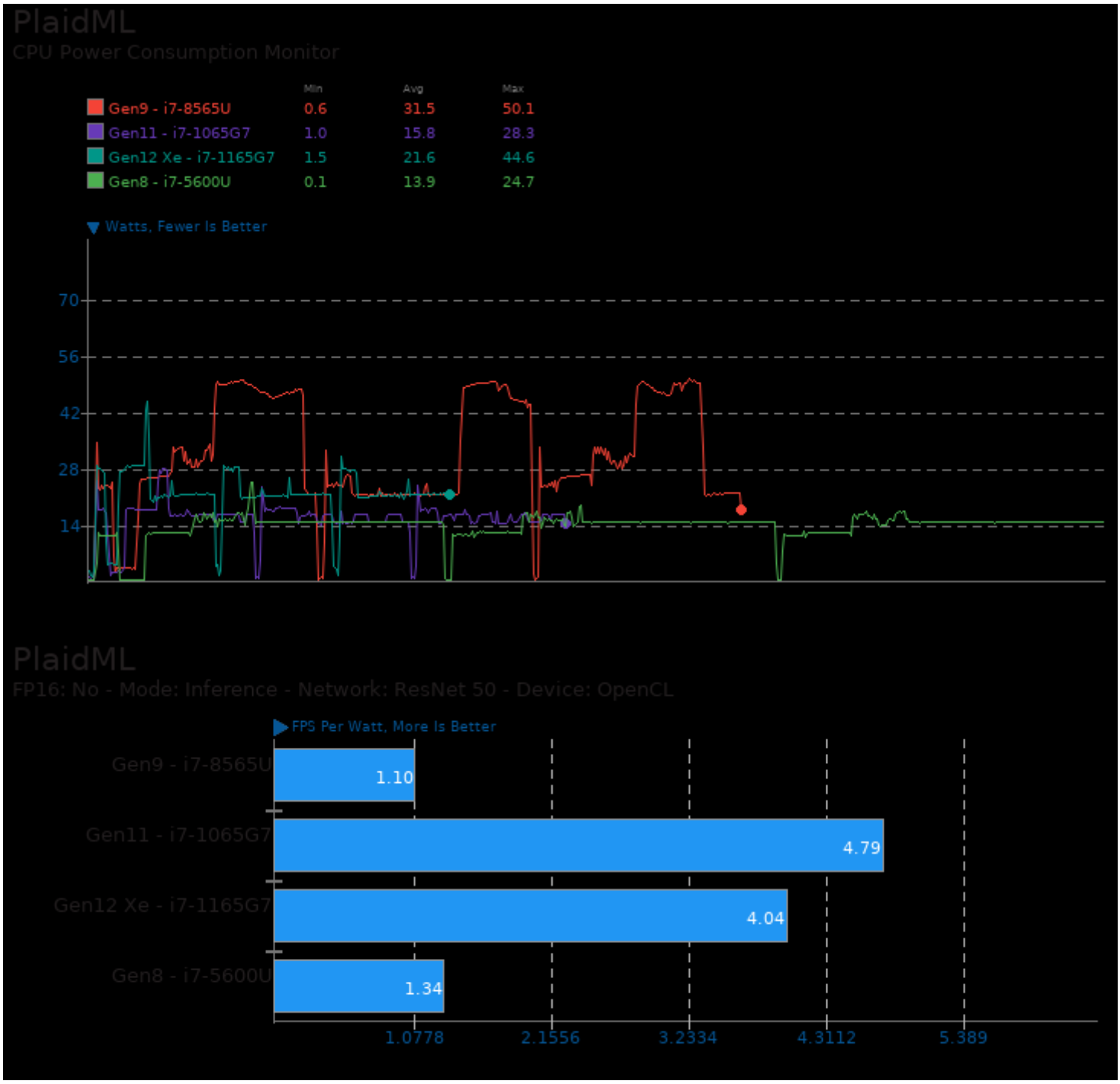

MandelGPU 1.3pts1
OpenCL Device: GPU
Samples/sec Per Watt, More Is Better
Gen9 - i7-8565U
468417.21
Gen11 - i7-1065G7
1544709.17
Gen12 Xe - i7-1165G7
1974932.07
400K
800K
1200K
1600K
2000K
JuliaGPU 1.2pts1
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 1.0 35.7 41.4
Gen11 - i7-1065G7 1.1 15.1 30.0
Gen12 Xe - i7-1165G7 1.5 22.3 34.7
Watts, Fewer Is Better
55
44
33
22
11
JuliaGPU 1.2pts1
OpenCL Device: GPU
Samples/sec Per Watt, More Is Better
Gen9 - i7-8565U
1343812.70
Gen11 - i7-1065G7
5650341.30
Gen12 Xe - i7-1165G7
5935645.80
1.3M
2.6M
3.9M
5.2M
6.5M

Tigerlake Xe Gen12 to Gen8

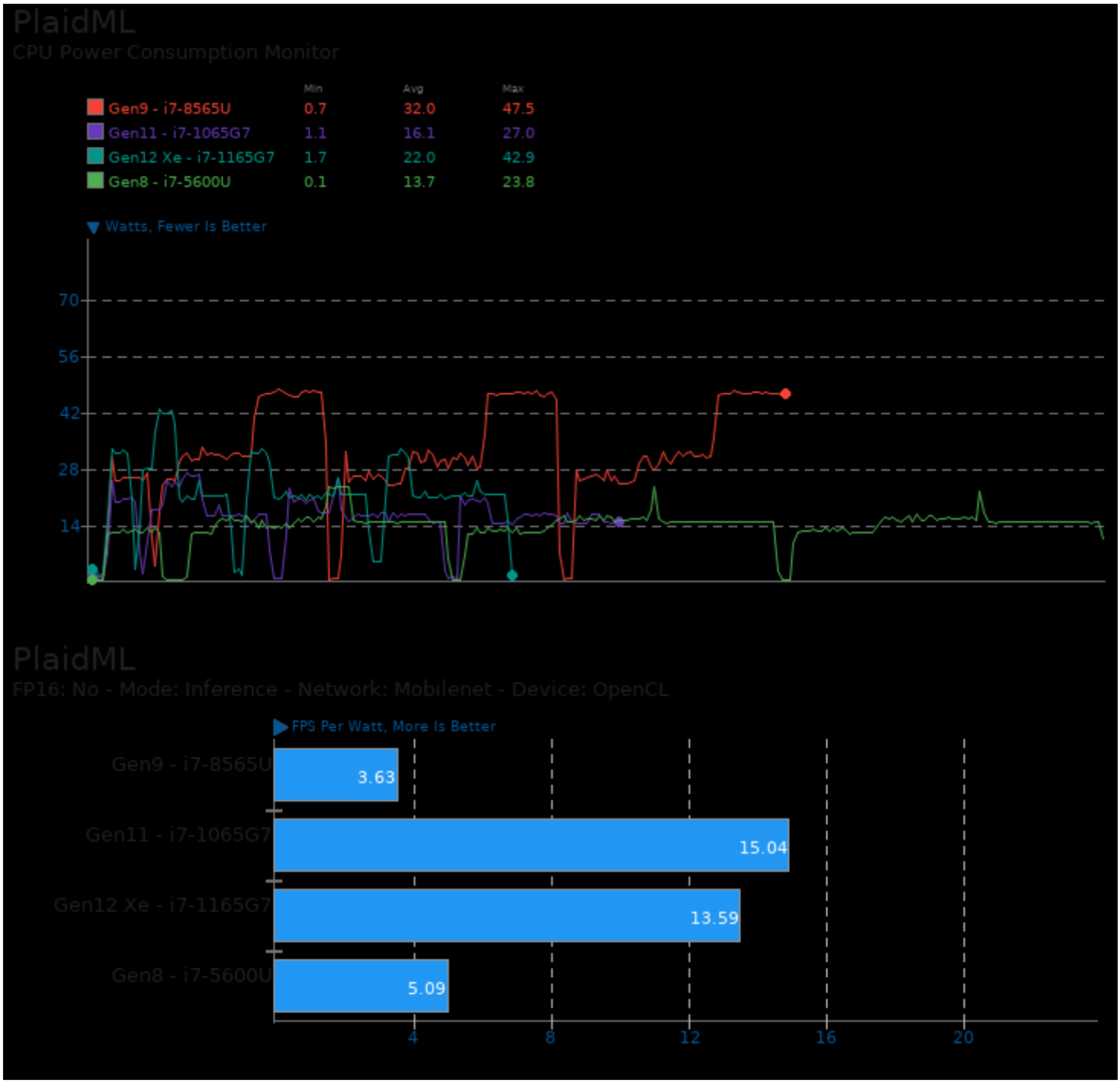


Tigerlake Xe Gen12 to Gen8

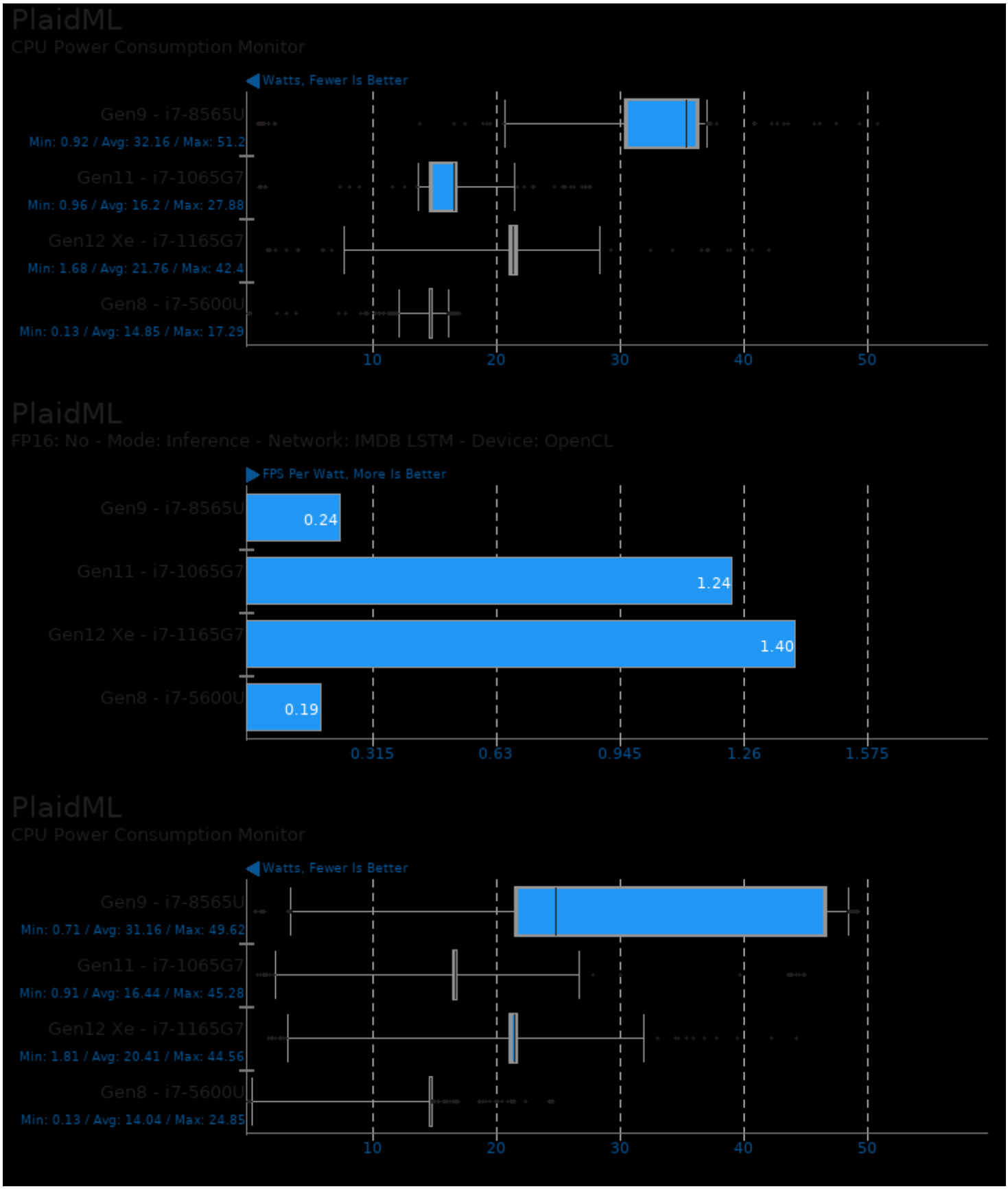



PlaidML
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 0.6 31.5 50.1
Gen11 - i7-1065G7 1.0 15.8 28.3
Gen12 Xe - i7-1165G7 1.5 21.6 44.6
Gen8 - i7-5600U 0.1 13.9 24.7
Watts, Fewer Is Better
70
56
42
28
14
PlaidML
FP16: No - Mode: Inference - Network: ResNet 50 - Device: OpenCL
FPS Per Watt, More Is Better
Gen9 - i7-8565U
1.10
Gen11 - i7-1065G7
4.79
Gen12 Xe - i7-1165G7
4.04
Gen8 - i7-5600U
1.34
1.0778
2.1556
3.2334
4.3112
5.389

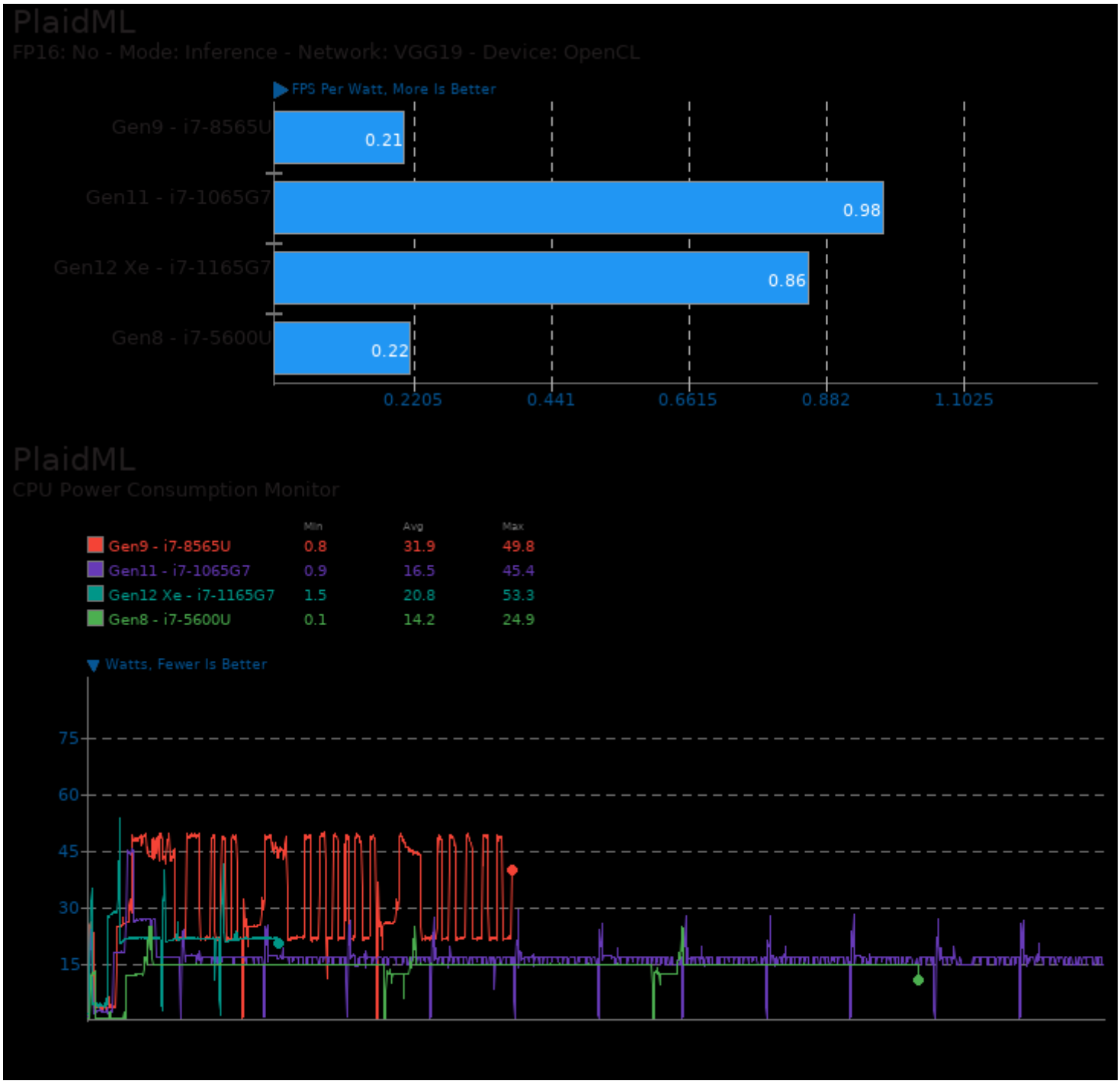
Tigerlake Xe Gen12 to Gen8



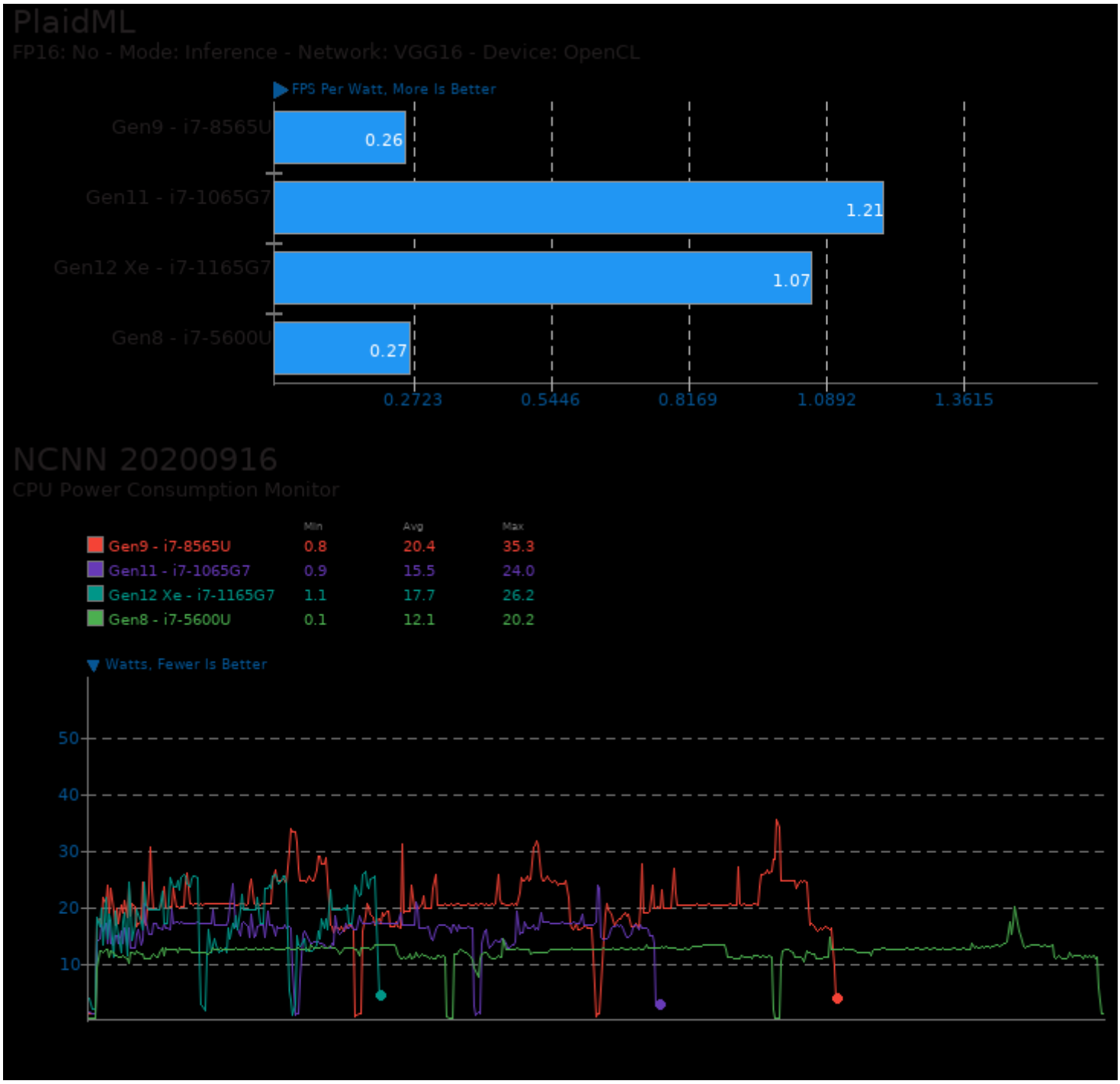
Tigerlake Xe Gen12 to Gen8

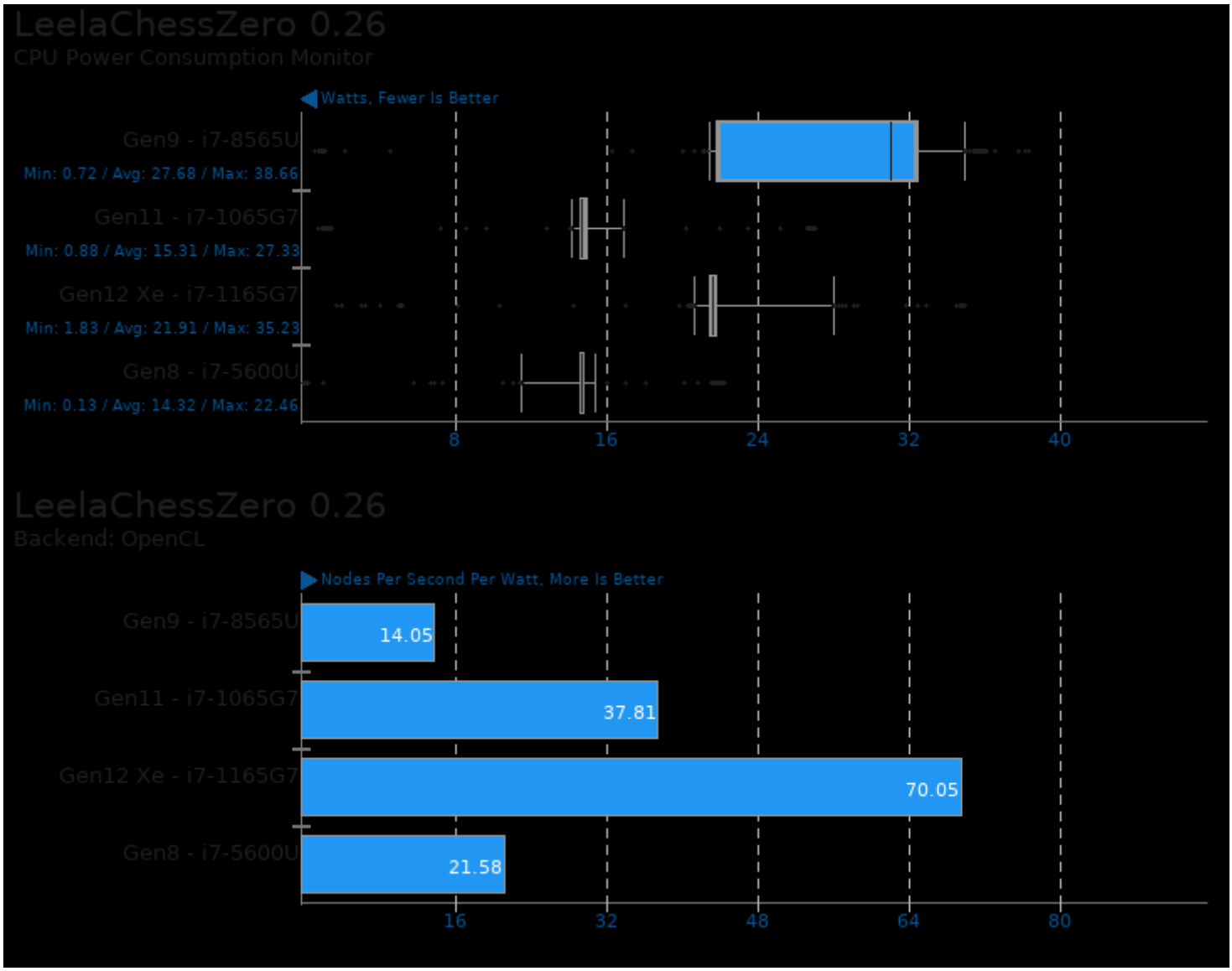


Tigerlake Xe Gen12 to Gen8

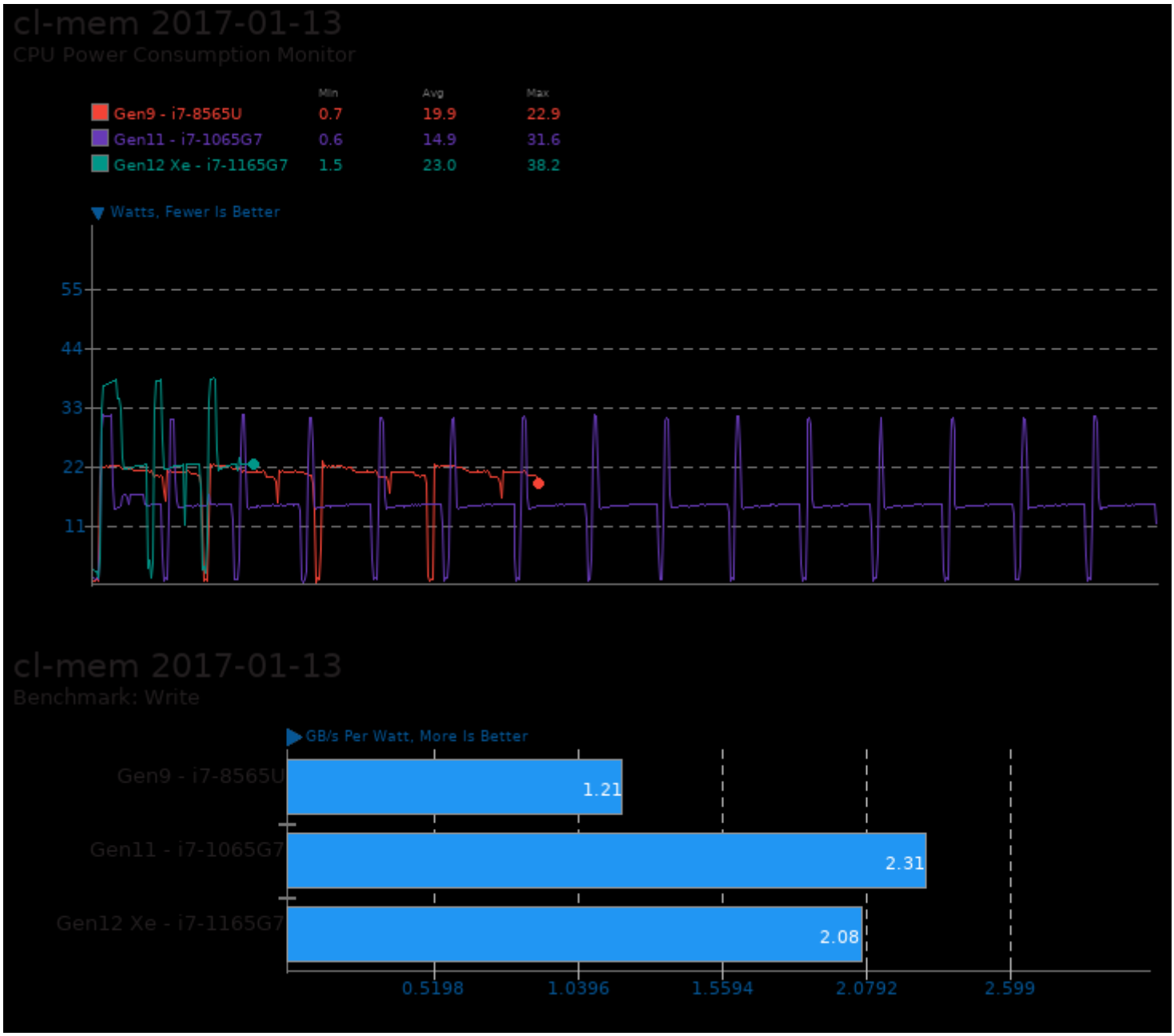


Tigerlake Xe Gen12 to Gen8

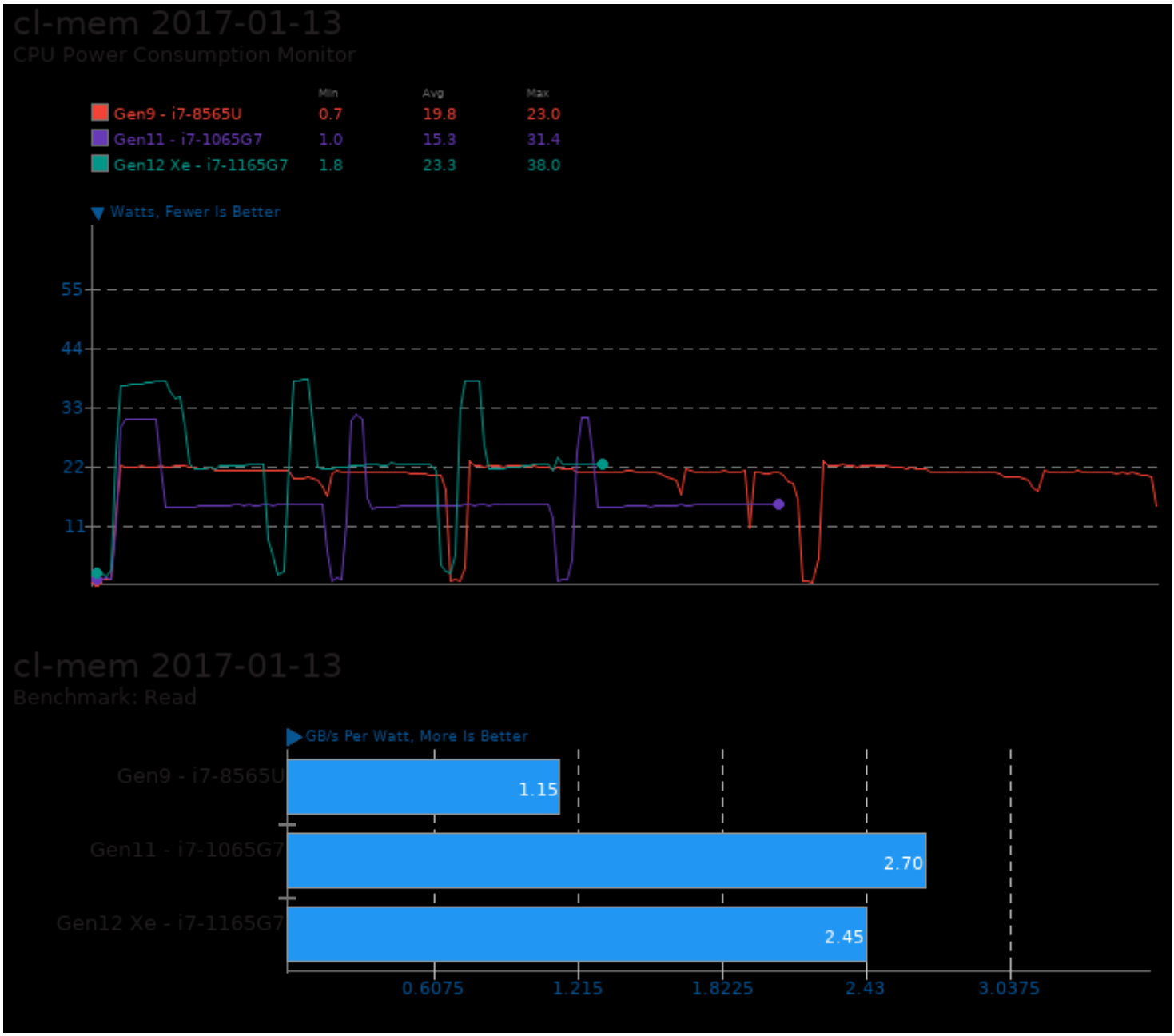



LeelaChessZero 0.26
CPU Power Consumption Monitor
Watts, Fewer Is Better
Gen9 - i7-8565U
Min: 0.72 / Avg: 27.68 / Max: 38.66
Gen11 - i7-1065G7
Min: 0.88 / Avg: 15.31 / Max: 27.33
Gen12 Xe - i7-1165G7
Min: 1.83 / Avg: 21.91 / Max: 35.23
Gen8 - i7-5600U
Min: 0.13 / Avg: 14.32 / Max: 22.46
8
16
24
32
40
LeelaChessZero 0.26
Backend: OpenCL
Nodes Per Second Per Watt, More Is Better
Gen9 - i7-8565U
14.05
Gen11 - i7-1065G7
37.81
Gen12 Xe - i7-1165G7
70.05
Gen8 - i7-5600U
21.58
16
32
48
64
80

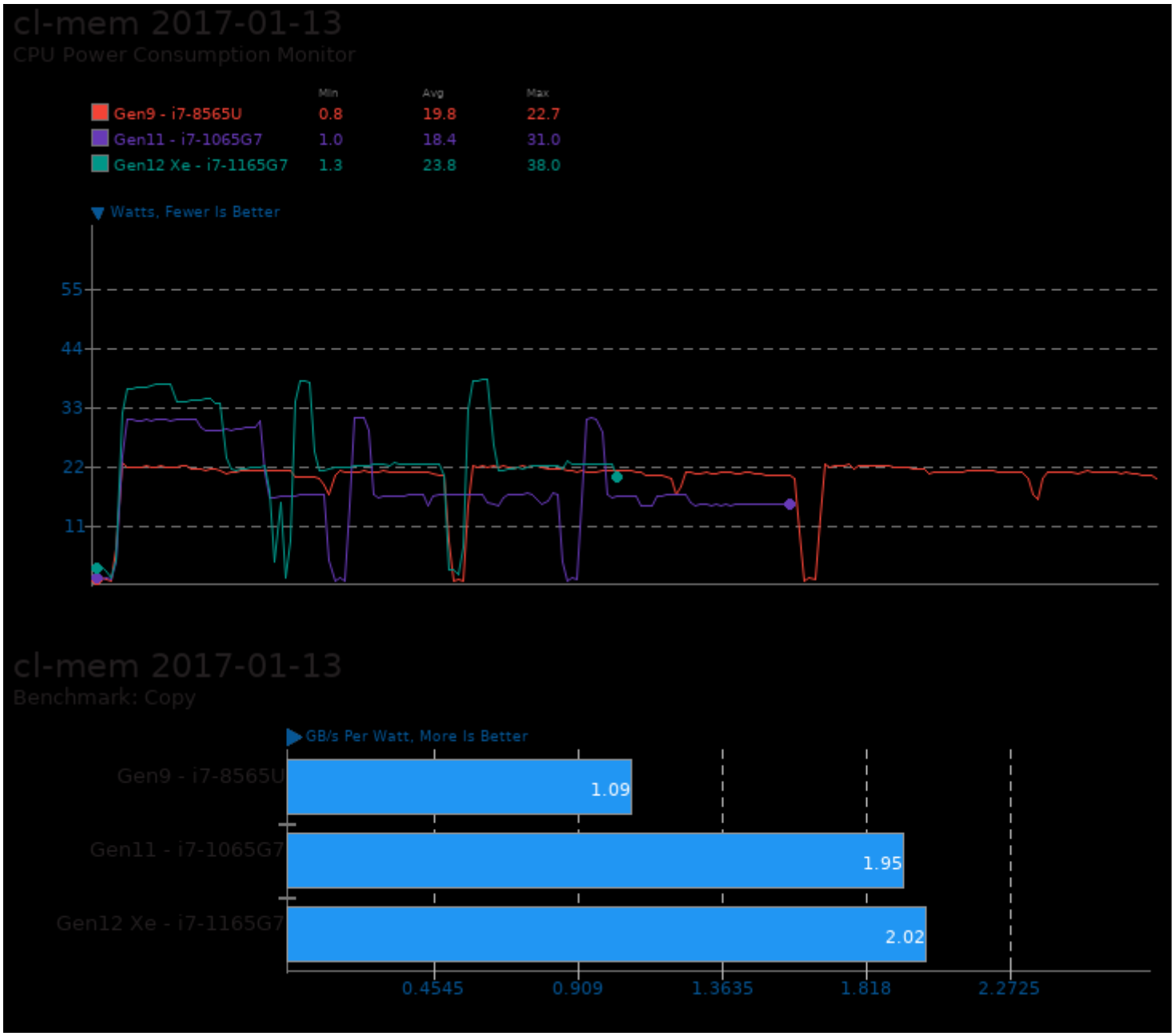
Tigerlake Xe Gen12 to Gen8



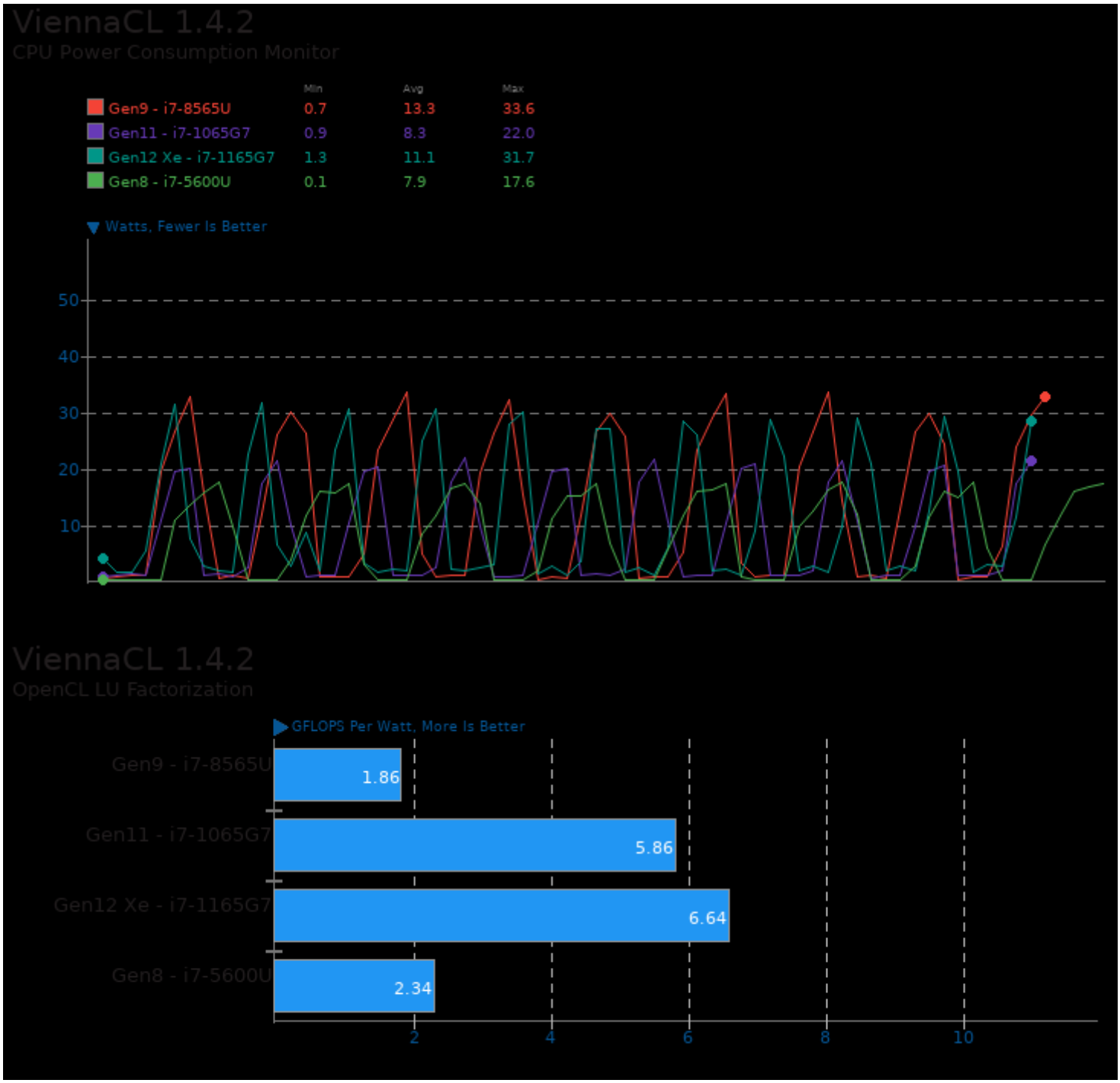
Tigerlake Xe Gen12 to Gen8



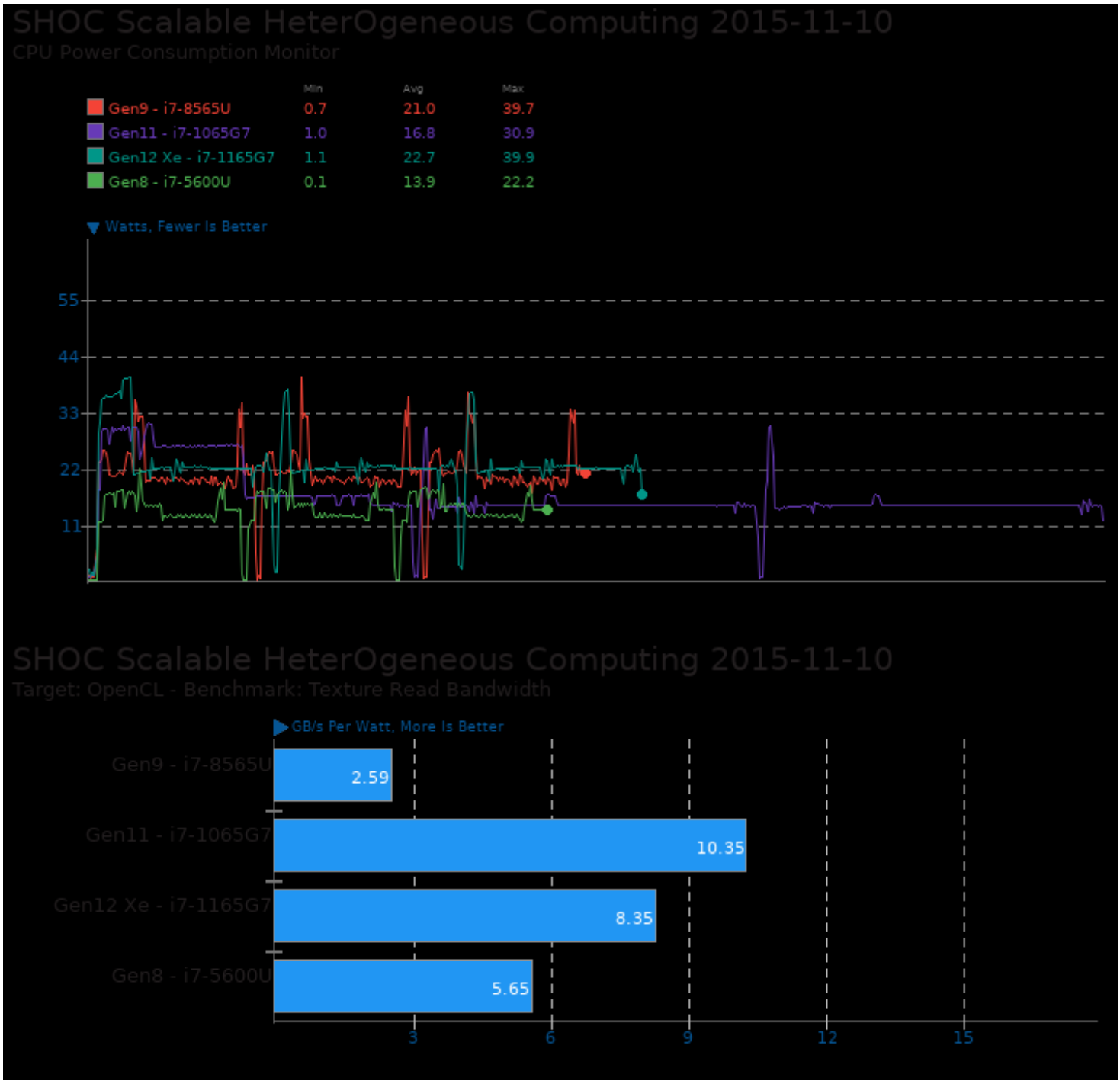
Tigerlake Xe Gen12 to Gen8

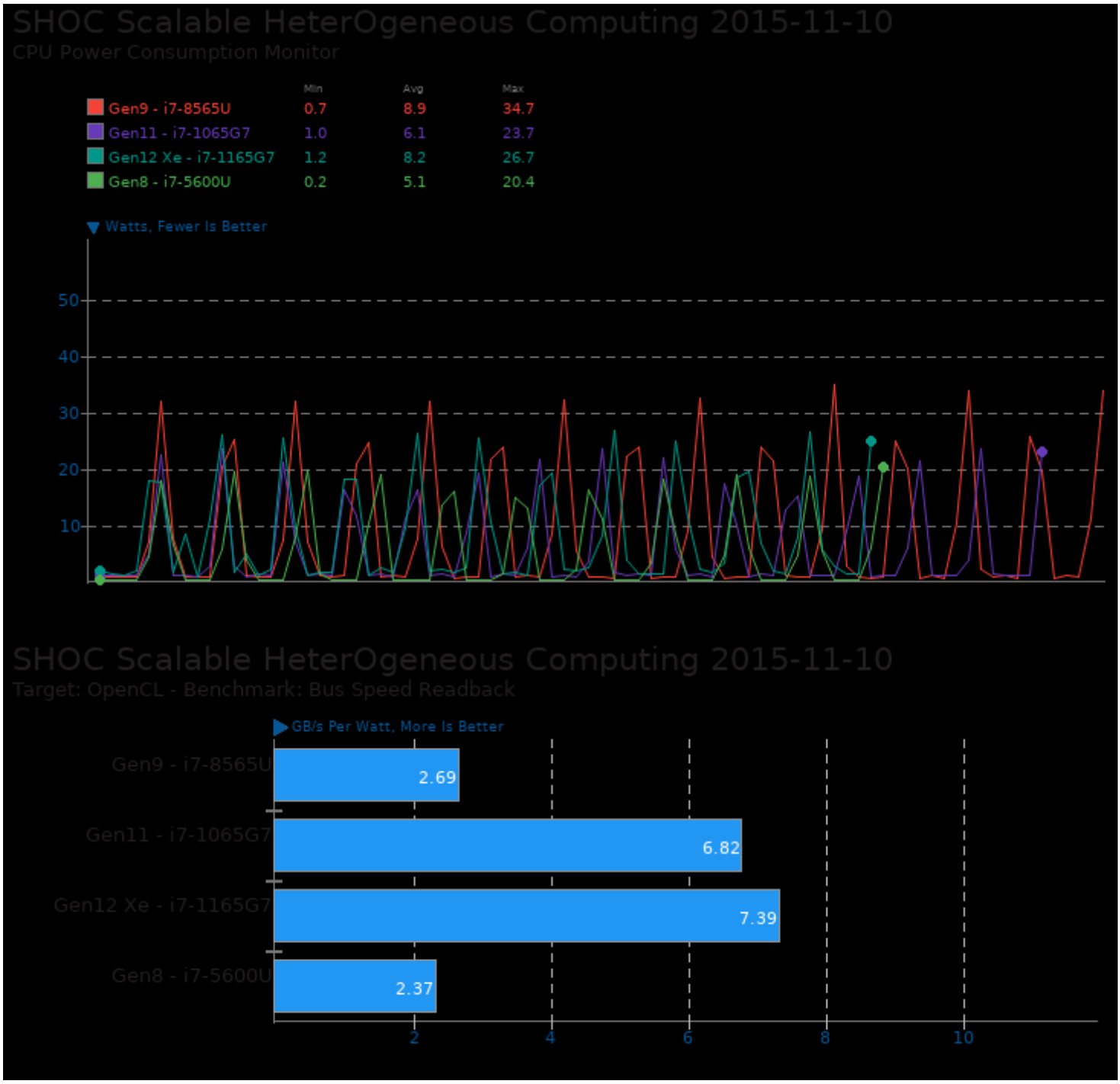


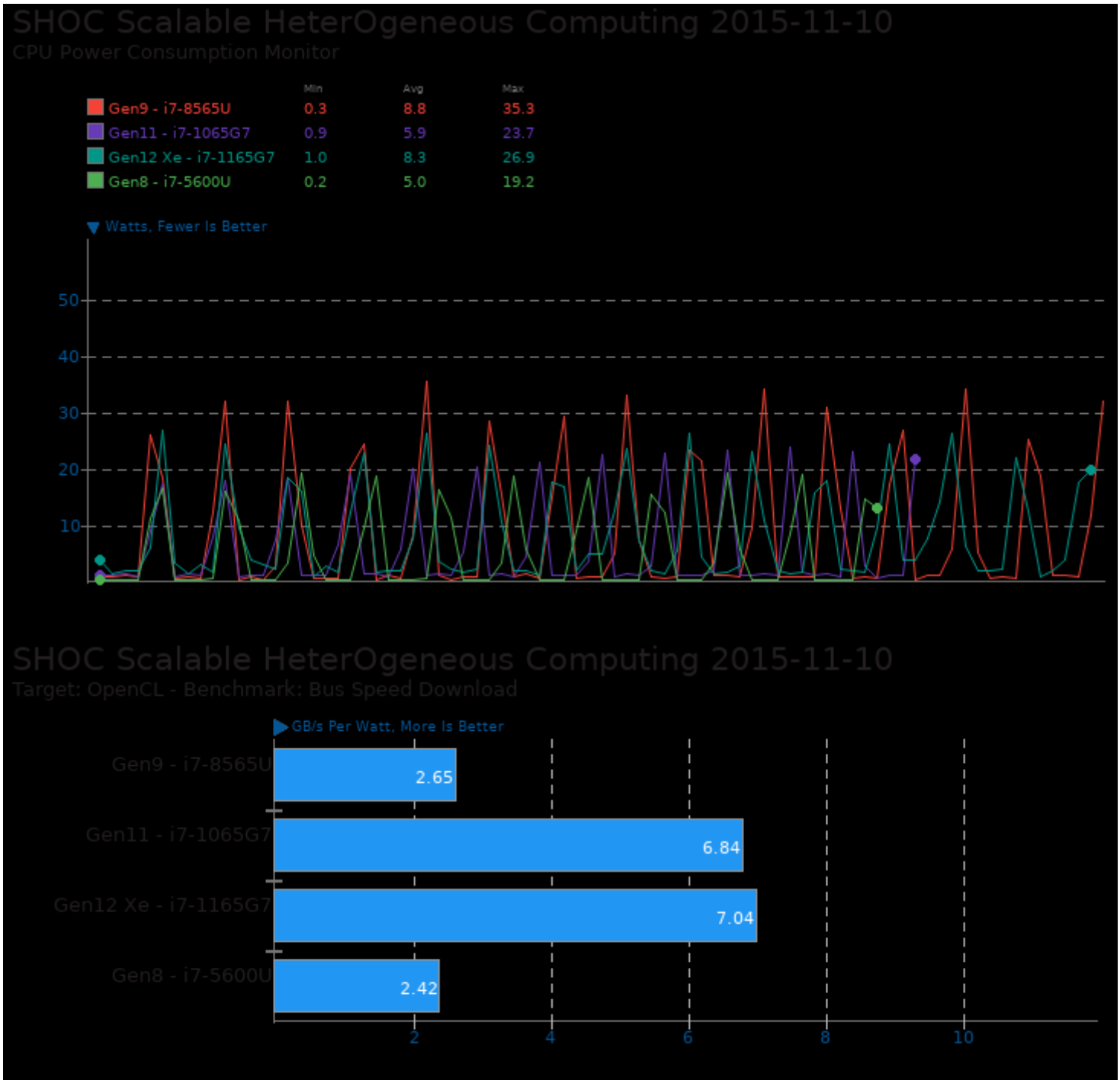
Tigerlake Xe Gen12 to Gen8



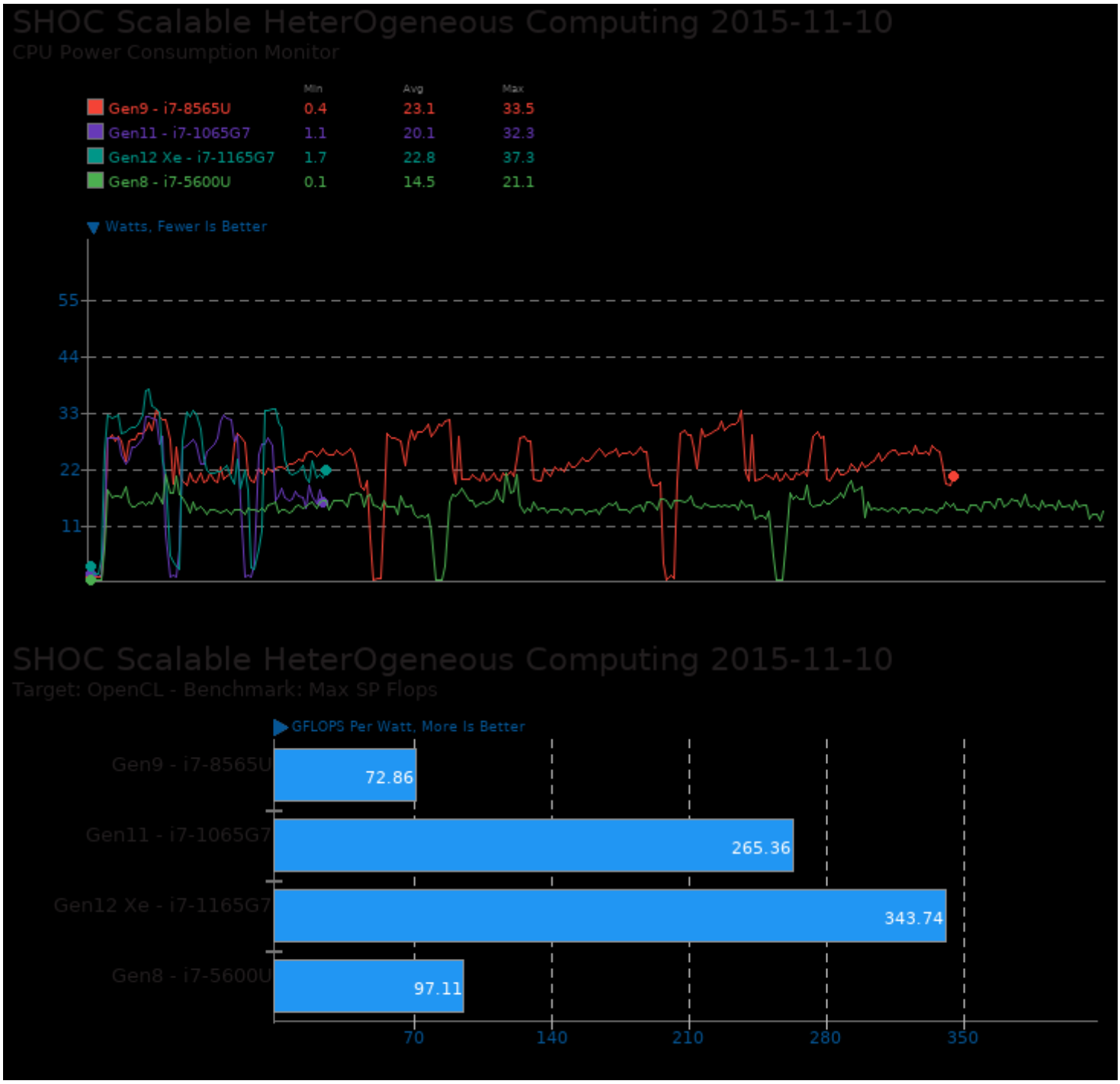
Tigerlake Xe Gen12 to Gen8



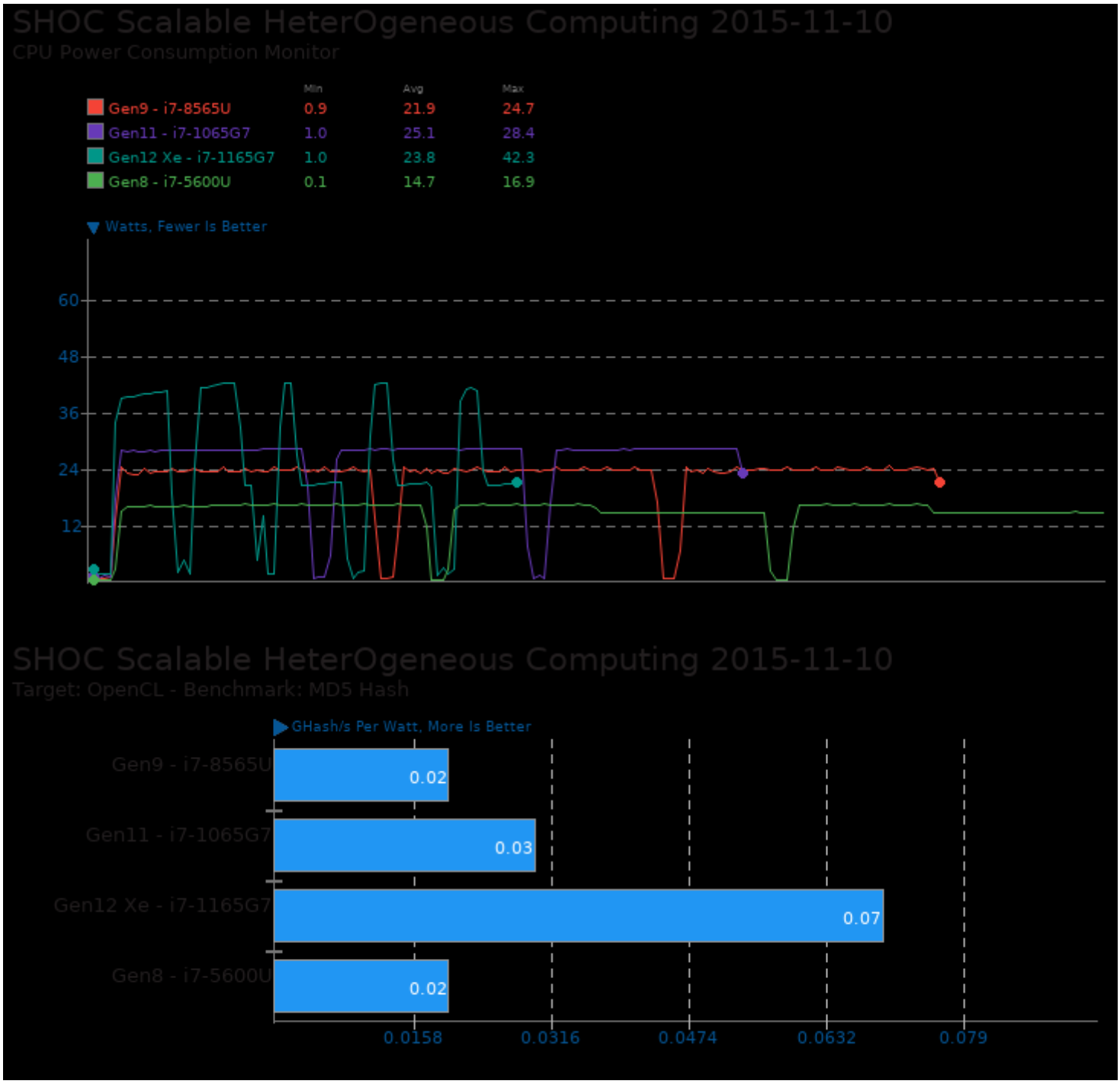

SHOC Scalable HeterOgeneous Computing 2015-11-10
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 0.7 8.9 34.7
Gen11 - i7-1065G7 1.0 6.1 23.7
Gen12 Xe - i7-1165G7 1.2 8.2 26.7
Gen8 - i7-5600U 0.2 5.1 20.4
Watts, Fewer Is Better
50
40
30
20
10
SHOC Scalable HeterOgeneous Computing 2015-11-10
Target: OpenCL - Benchmark: Bus Speed Readback
GB/s Per Watt, More Is Better
Gen9 - i7-8565U
2.69
Gen11 - i7-1065G7
6.82
Gen12 Xe - i7-1165G7
7.39
Gen8 - i7-5600U
2.37
2
4
6
8
10

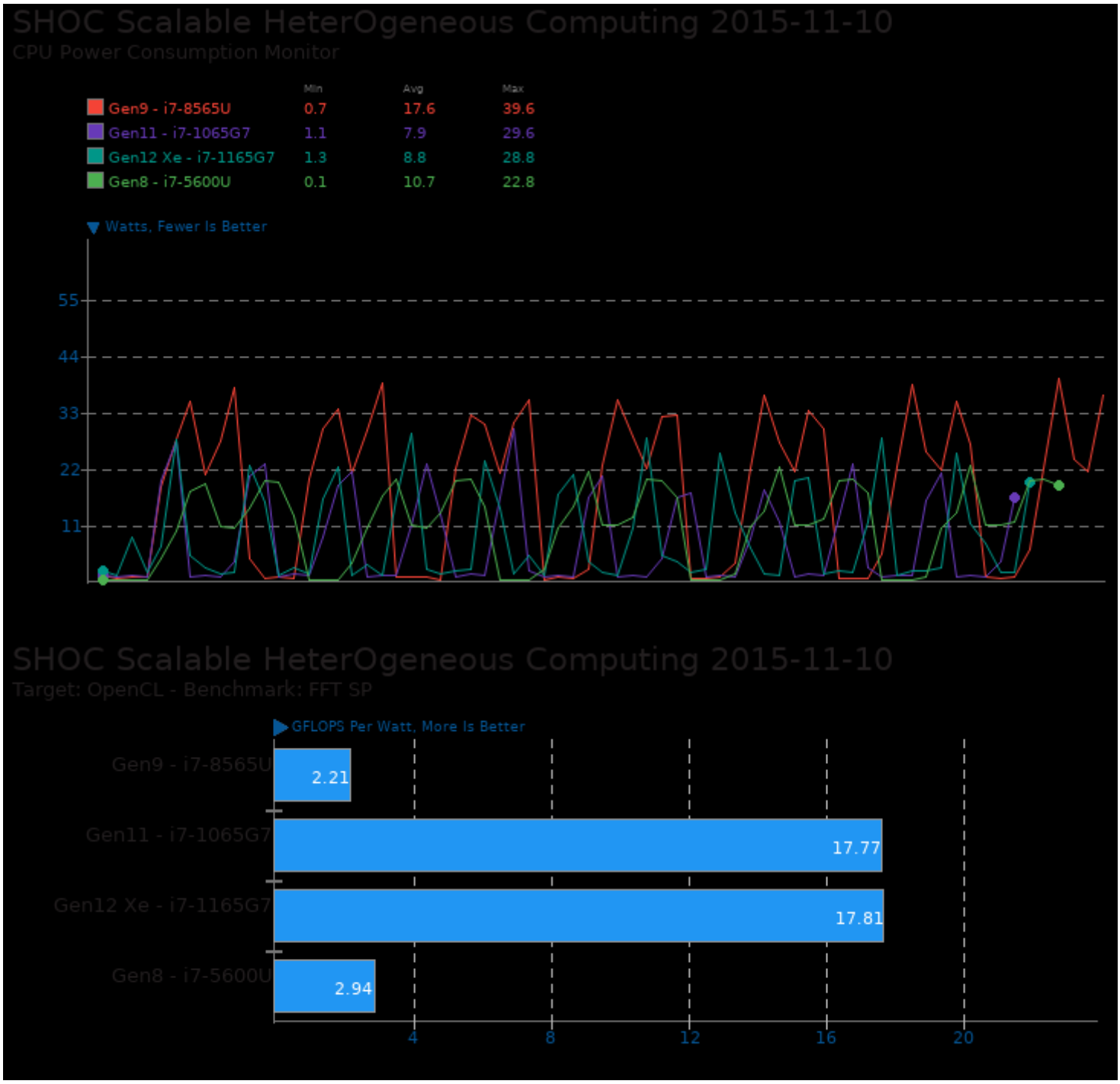

SHOC Scalable HeterOgeneous Computing 2015-11-10
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 0.3 8.8 35.3
Gen11 - i7-1065G7 0.9 5.9 23.7
Gen12 Xe - i7-1165G7 1.0 8.3 26.9
Gen8 - i7-5600U 0.2 5.0 19.2
Watts, Fewer Is Better
50
40
30
20
10
SHOC Scalable HeterOgeneous Computing 2015-11-10
Target: OpenCL - Benchmark: Bus Speed Download
GB/s Per Watt, More Is Better
Gen9 - i7-8565U
2.65
Gen11 - i7-1065G7
6.84
Gen12 Xe - i7-1165G7
7.04
Gen8 - i7-5600U
2.42
2
4
6
8
10

Tigerlake Xe Gen12 to Gen8

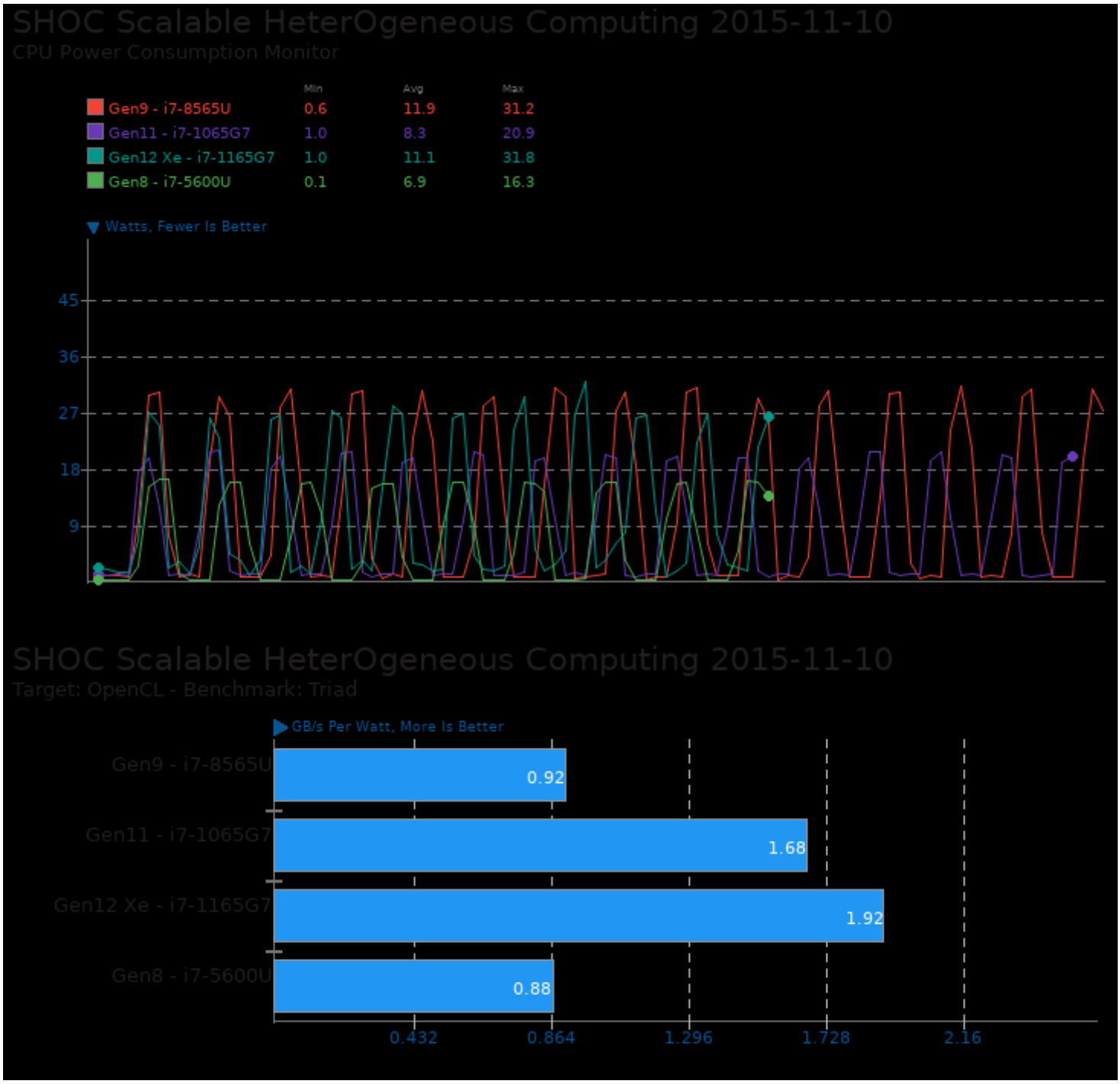


Tigerlake Xe Gen12 to Gen8

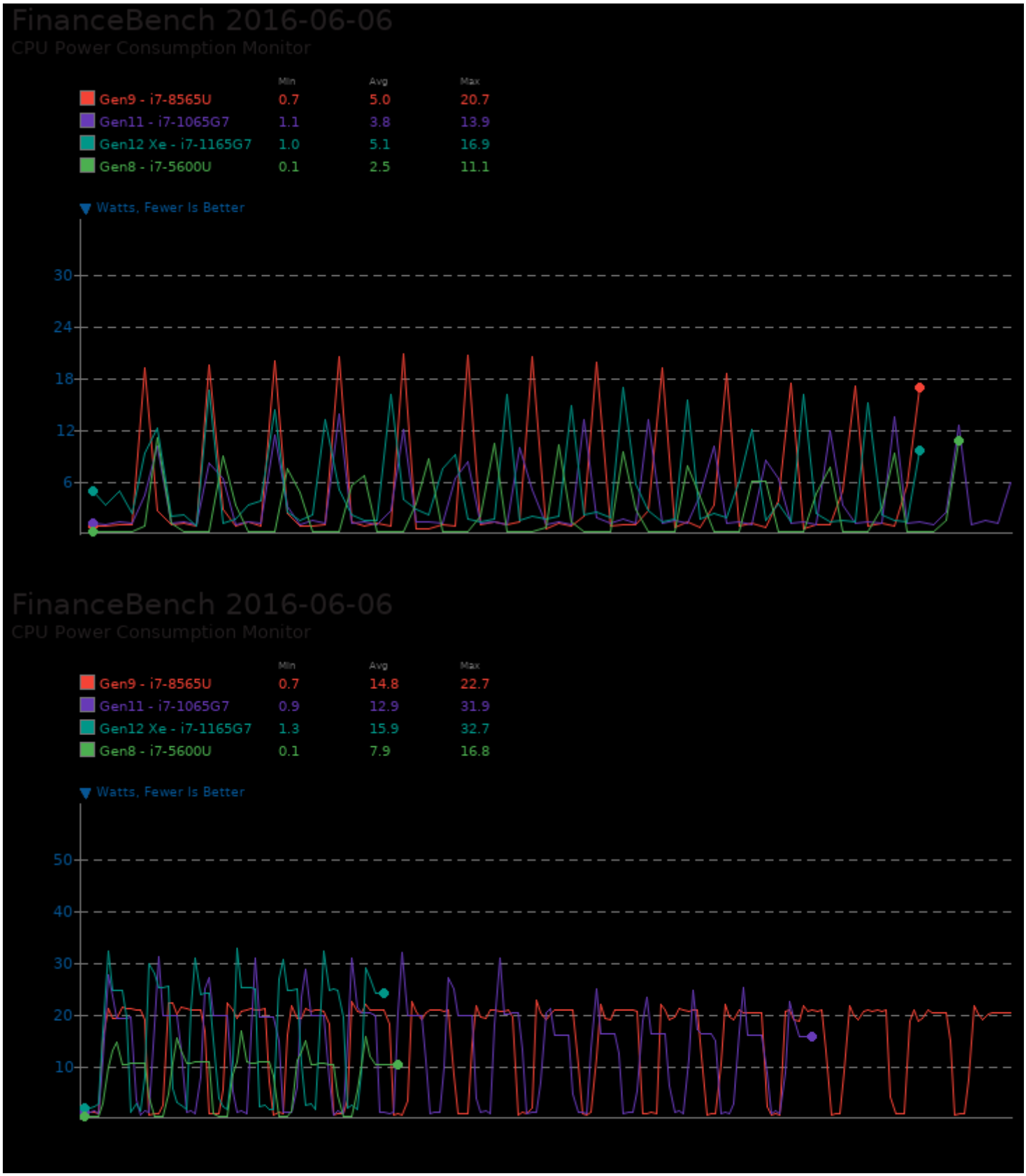


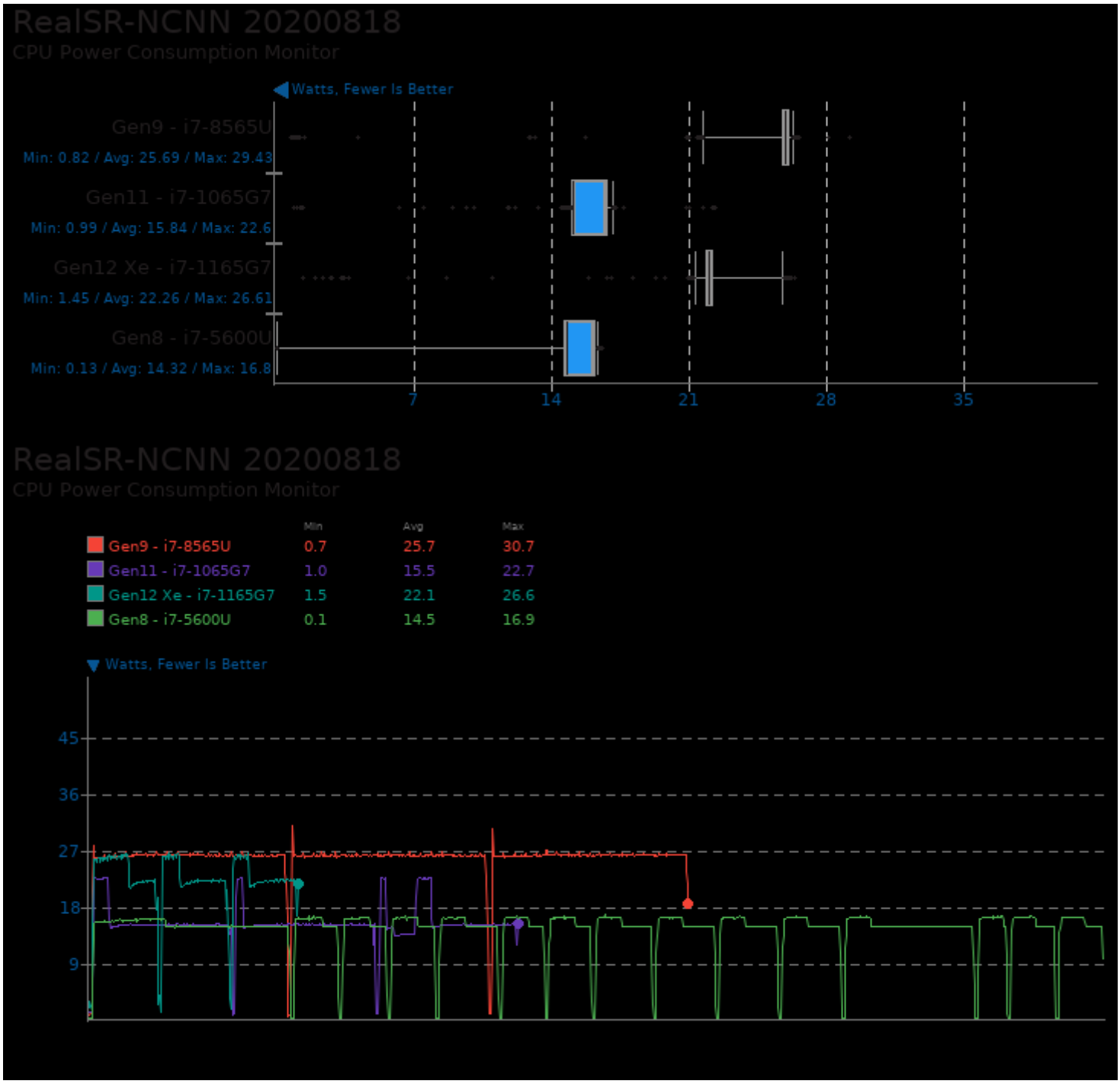

SHOC Scalable HeterOgeneous Computing 2015-11-10
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 0.7 17.6 39.6
Gen11 - i7-1065G7 1.1 7.9 29.6
Gen12 Xe - i7-1165G7 1.3 8.8 28.8
Gen8 - i7-5600U 0.1 10.7 22.8
Watts, Fewer Is Better
55
44
33
22
11
SHOC Scalable HeterOgeneous Computing 2015-11-10
Target: OpenCL - Benchmark: FFT SP
GFLOPS Per Watt, More Is Better
Gen9 - i7-8565U
2.21
Gen11 - i7-1065G7
17.77
Gen12 Xe - i7-1165G7
17.81
Gen8 - i7-5600U
2.94
4
8
12
16
20

Tigerlake Xe Gen12 to Gen8

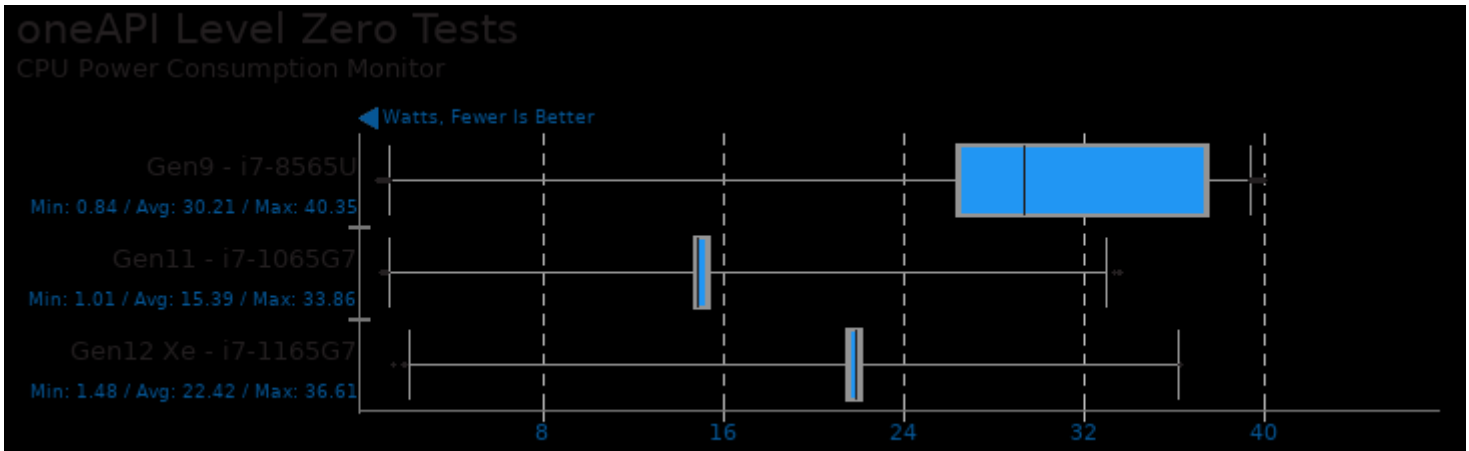


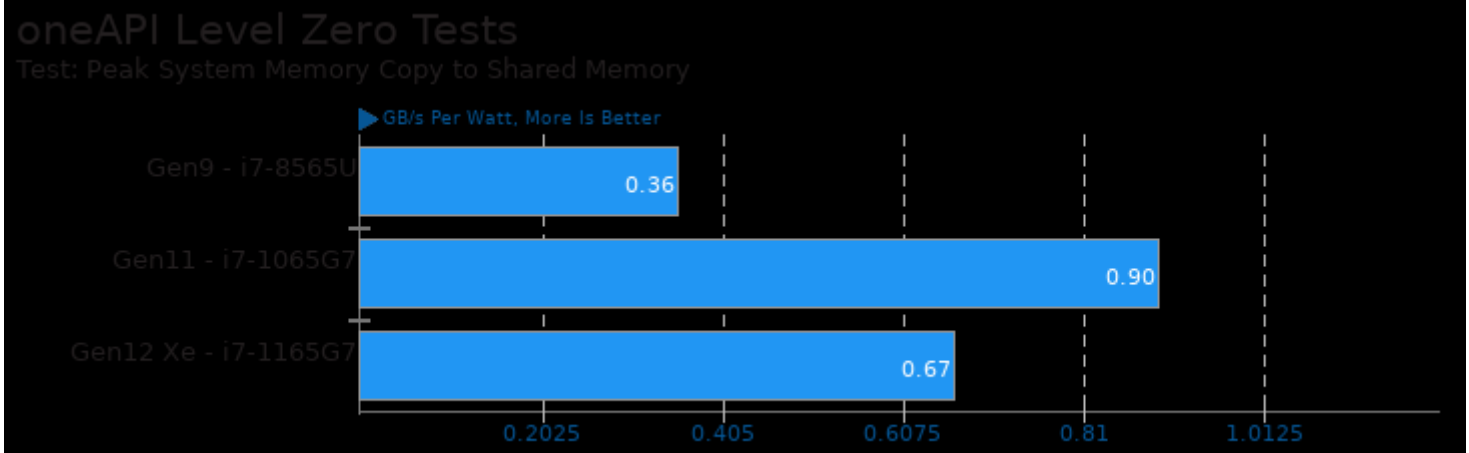
Tigerlake Xe Gen12 to Gen8

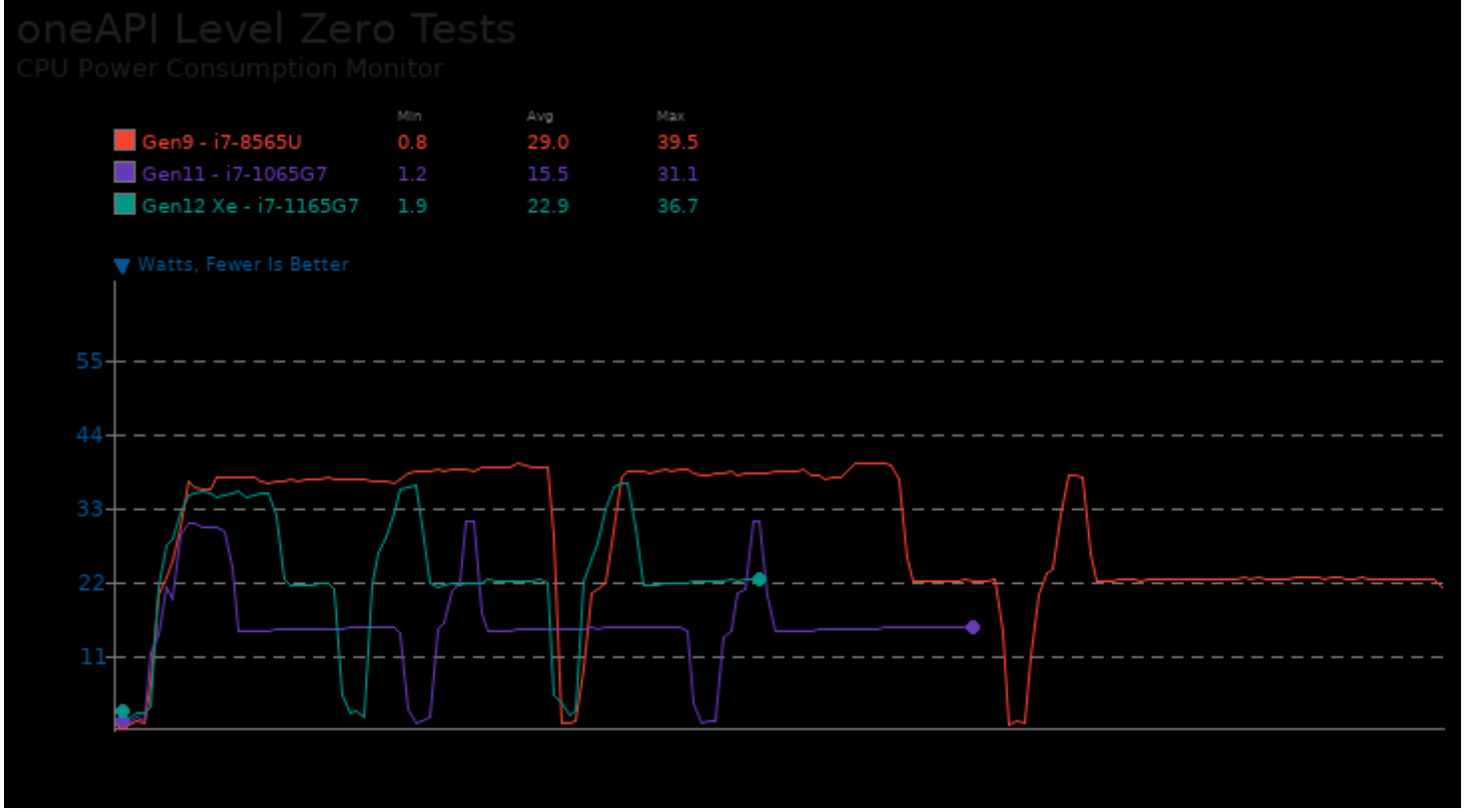


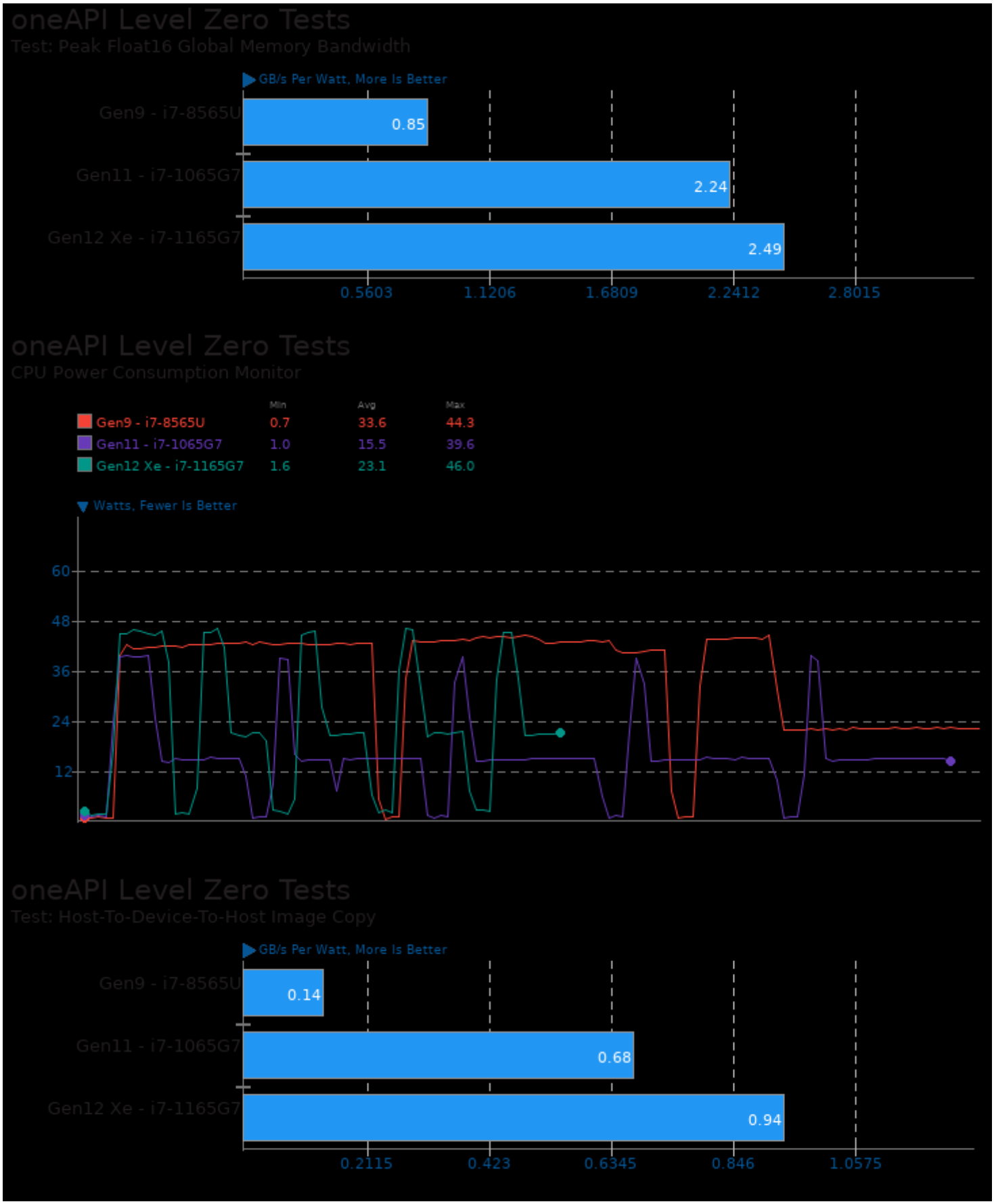

RealSR-NCNN 20200818
CPU Power Consumption Monitor
Watts, Fewer Is Better
Gen9 - i7-8565U
Min: 0.82 / Avg: 25.69 / Max: 29.43
Gen11 - i7-1065G7
Min: 0.99 / Avg: 15.84 / Max: 22.6
Gen12 Xe - i7-1165G7
Min: 1.45 / Avg: 22.26 / Max: 26.61
Gen8 - i7-5600U
Min: 0.13 / Avg: 14.32 / Max: 16.8
7
14
21
28
35
RealSR-NCNN 20200818
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 0.7 25.7 30.7
Gen11 - i7-1065G7 1.0 15.5 22.7
Gen12 Xe - i7-1165G7 1.5 22.1 26.6
Gen8 - i7-5600U 0.1 14.5 16.9
Watts, Fewer Is Better
45
36
27
18
9

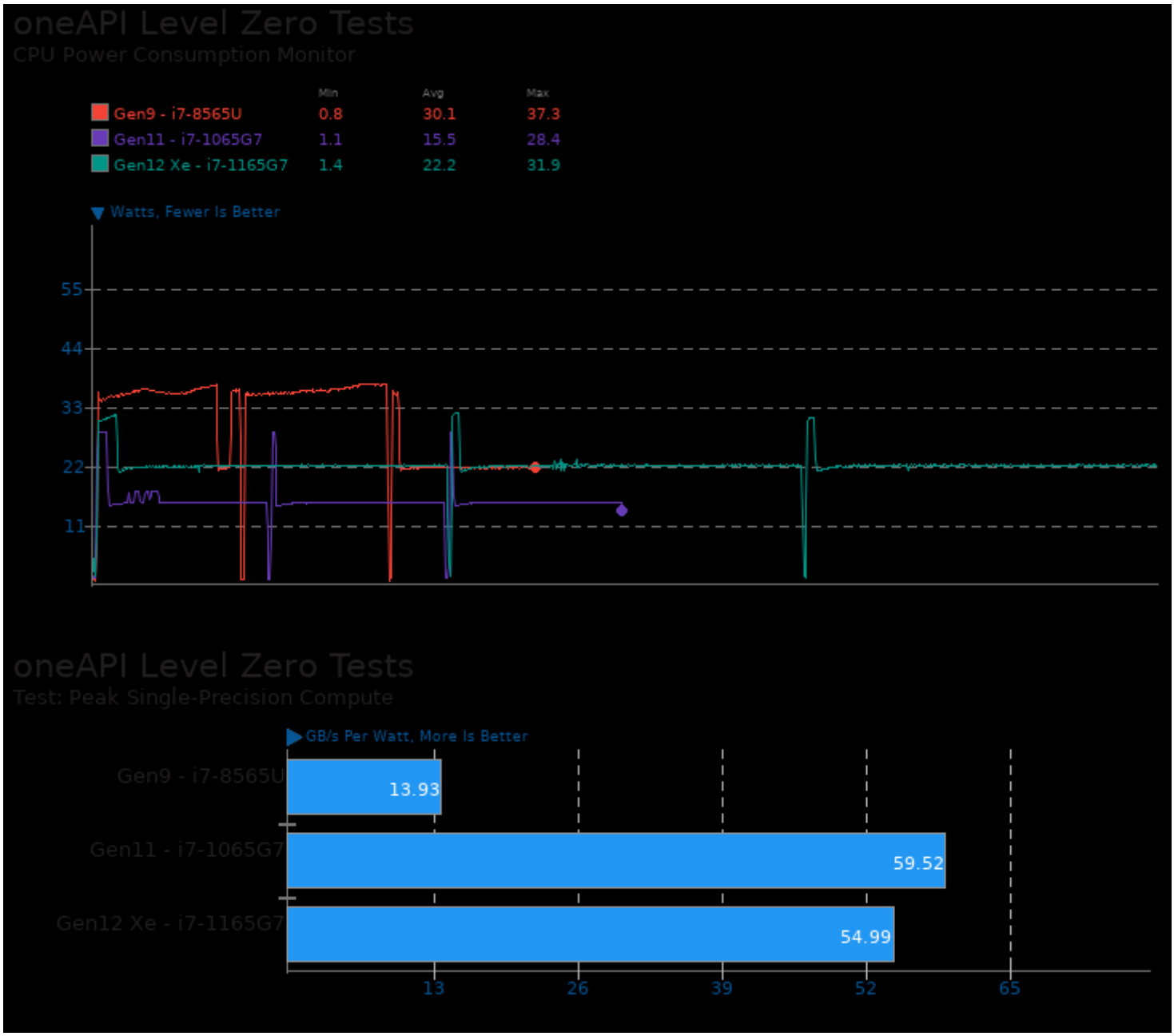
Tigerlake Xe Gen12 to Gen8



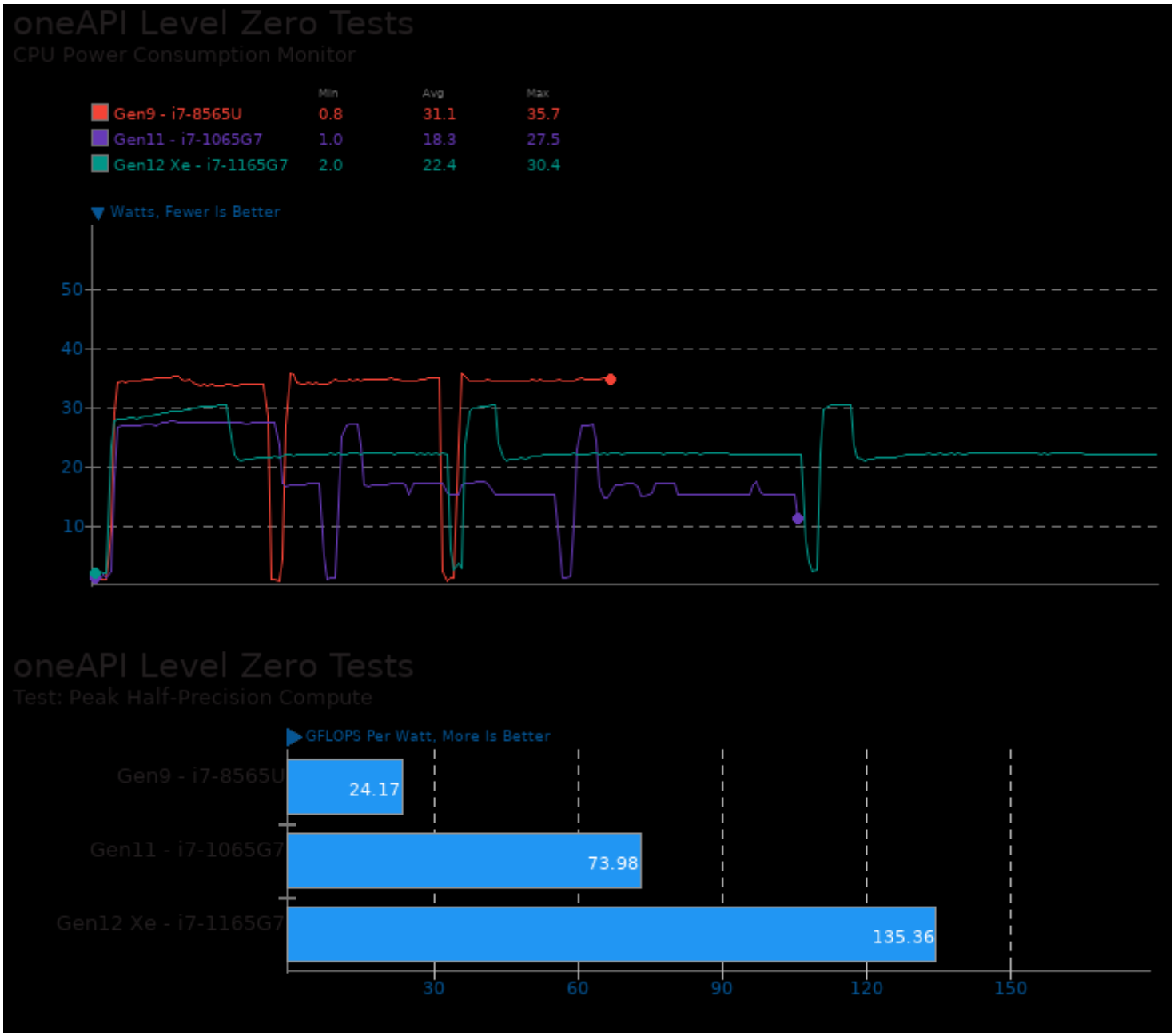




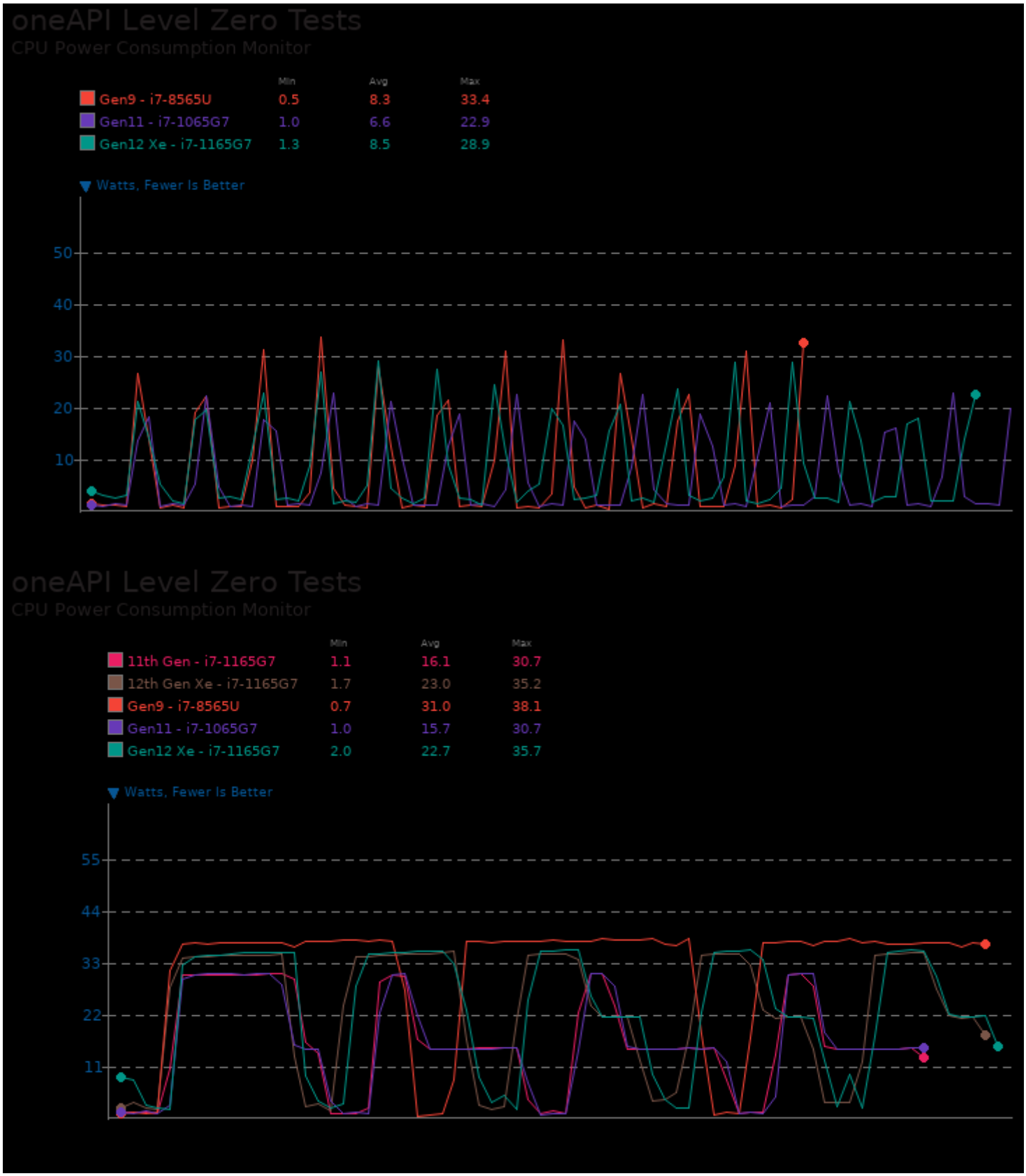

oneAPI Level Zero Tests
Test: Peak Float16 Global Memory Bandwidth
GB/s Per Watt, More Is Better
Gen9 - i7-8565U
Gen11 - i7-1065G7
Gen12 Xe - i7-1165G7
0.85
2.24
2.49
0.5603
1.1206
1.6809
2.2412
2.8015
oneAPI Level Zero Tests
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U 0.7 33.6 44.3
Gen11 - i7-1065G7 1.0 15.5 39.6
Gen12 Xe - i7-1165G7 1.6 23.1 46.0
Watts, Fewer Is Better
60
48
36
24
12
oneAPI Level Zero Tests
Test: Host-To-Device-To-Host Image Copy
GB/s Per Watt, More Is Better
Gen9 - i7-8565U
Gen11 - i7-1065G7
Gen12 Xe - i7-1165G7
0.14
0.68
0.94
0.2115
0.423
0.6345
0.846
1.0575


oneAPI Level Zero Tests
CPU Power Consumption Monitor
Min
Avg
Max
Gen9 - i7-8565U
0.8
30.1
37.3
Gen11 - i7-1065G7
1.1
15.5
28.4
Gen12 Xe - i7-1165G7
1.4
22.2
31.9
Watts, Fewer Is Better
55
44
33
22
11
oneAPI Level Zero Tests
Test: Peak Single-Precision Compute
GB/s Per Watt, More Is Better
Gen9 - i7-8565U
13.93
Gen11 - i7-1065G7
59.52
Gen12 Xe - i7-1165G7
54.99
13
26
39
52
65

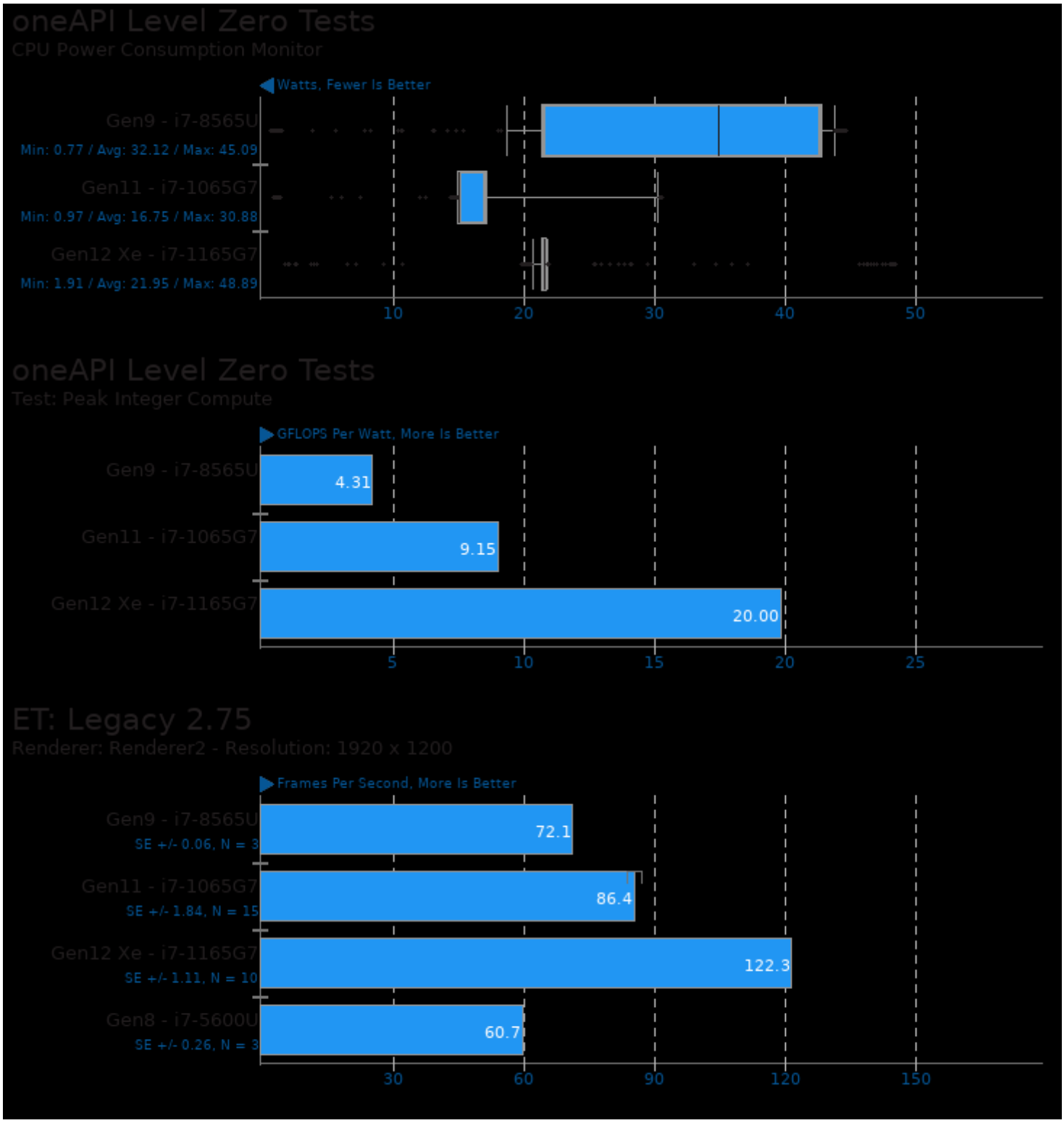
Tigerlake Xe Gen12 to Gen8

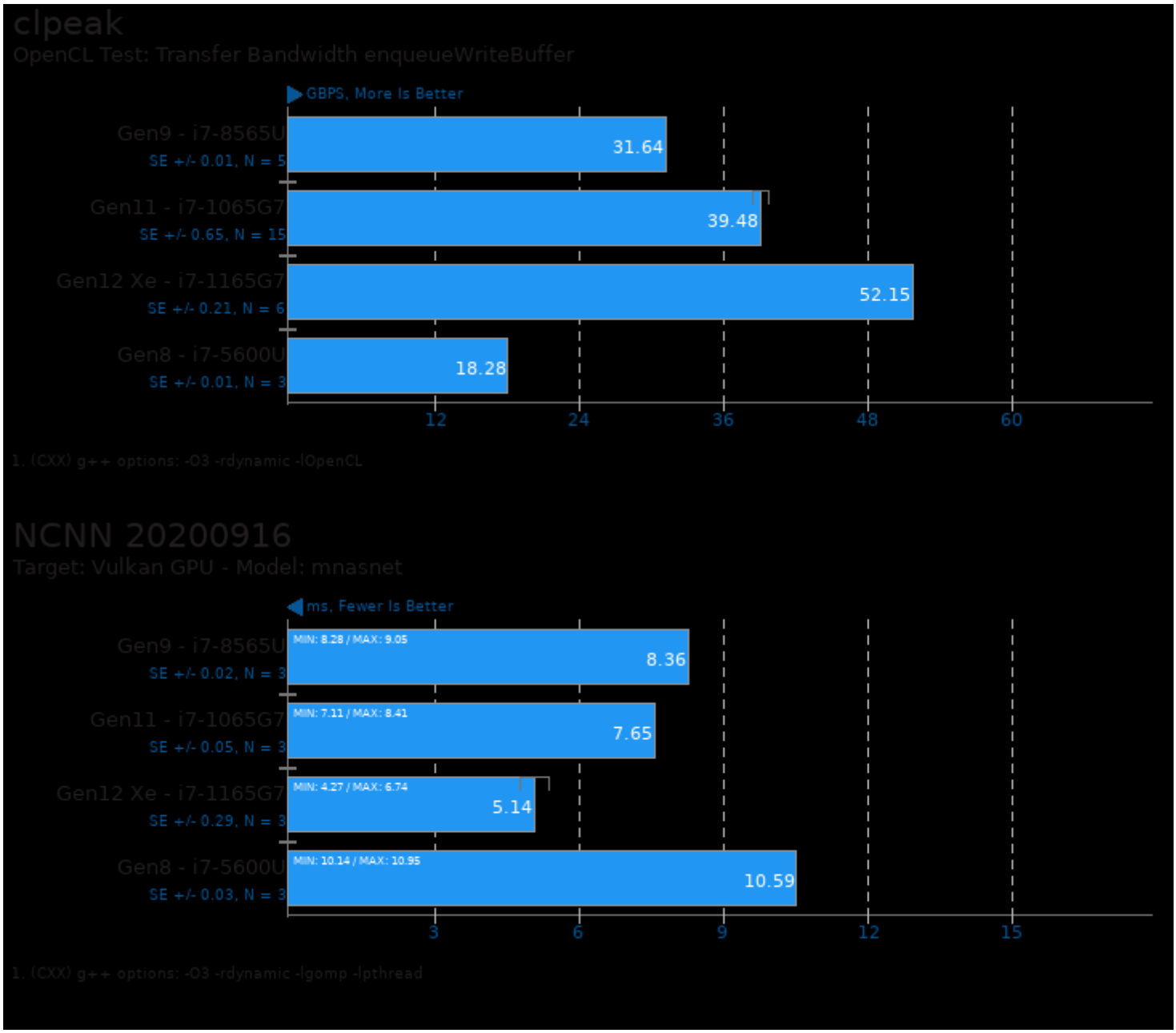


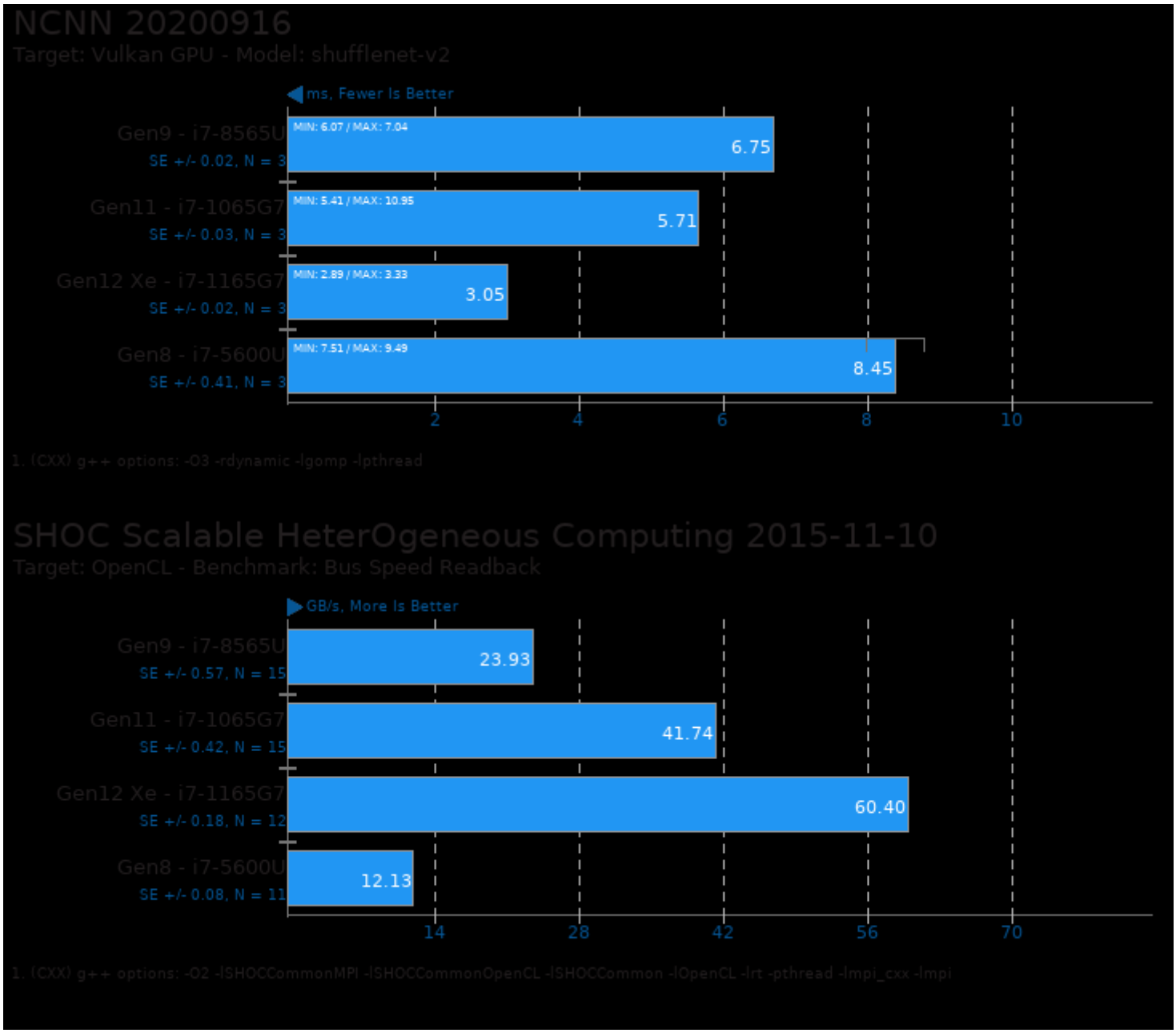
Tigerlake Xe Gen12 to Gen8

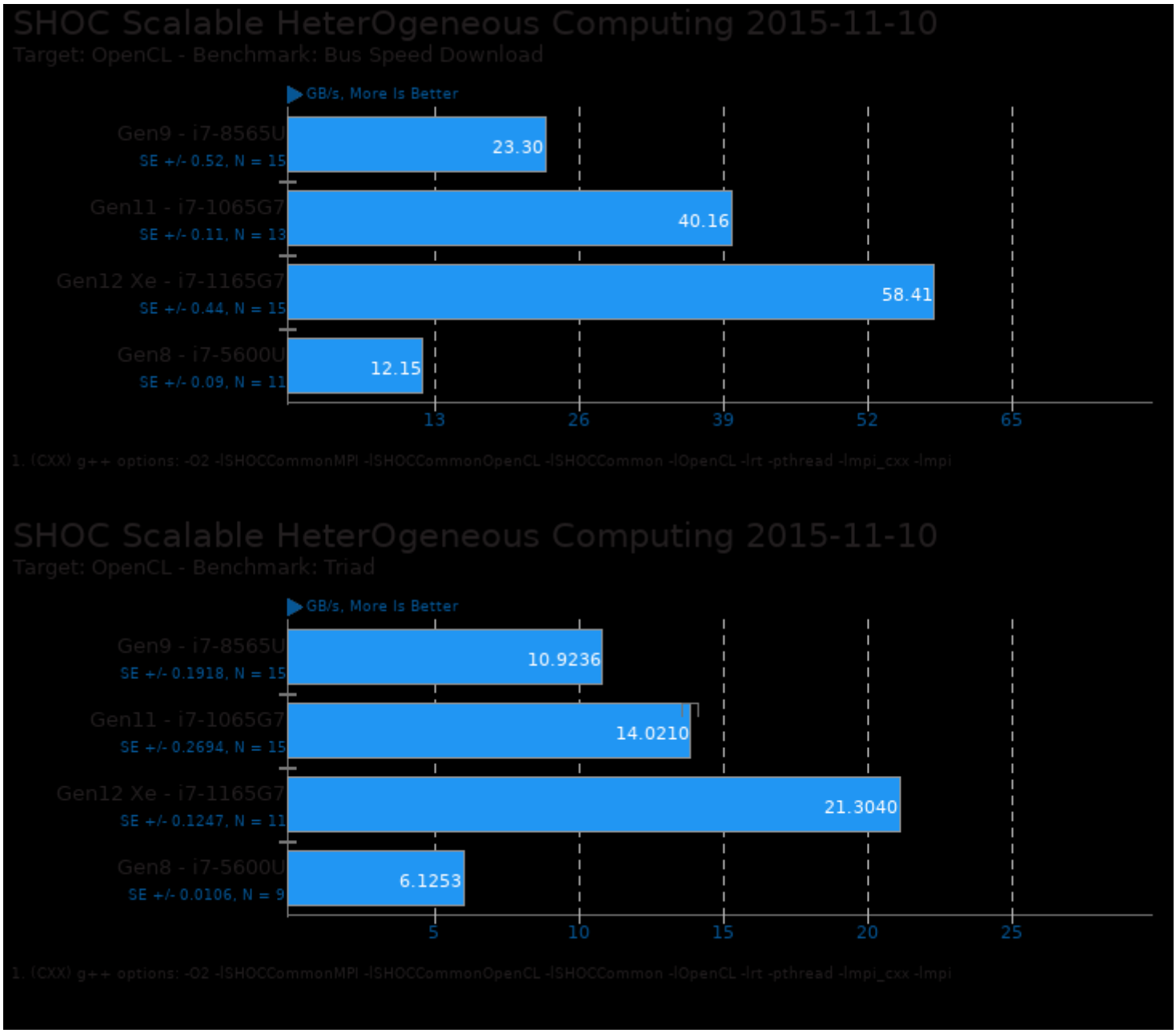


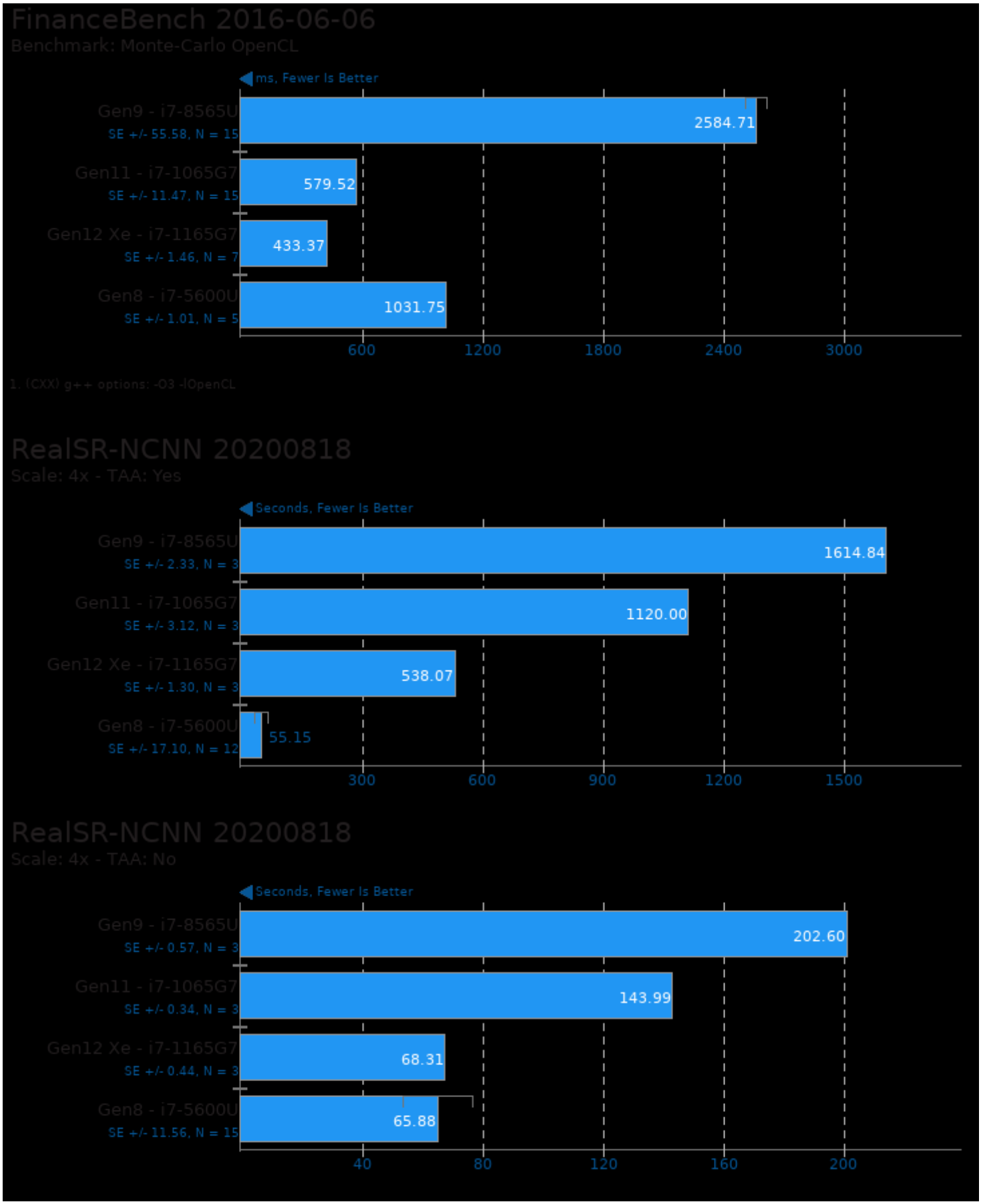
Tigerlake Xe Gen12 to Gen8



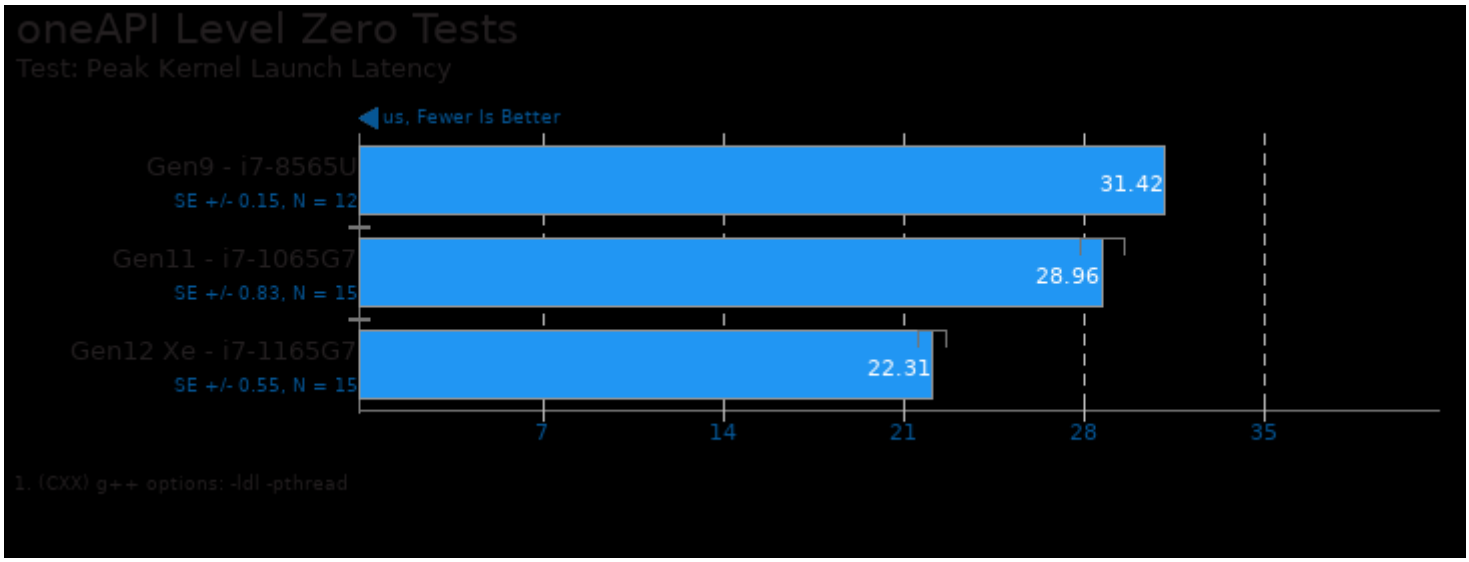

clpeak
OpenCL Test: Transfer Bandwidth enqueueWriteBuffer
GBPS, More Is Better
Gen9 - i7-8565U
SE +/- 0.01, N = 5
31.64
Gen11 - i7-1065G7
SE +/- 0.65, N = 15
39.48
Gen12 Xe - i7-1165G7
SE +/- 0.21, N = 6
52.15
Gen8 - i7-5600U
SE +/- 0.01, N = 3
18.28
12
24
36
48
60
1. (CXX) g++ options: -O3 -rdynamic -lOpenCL
NCNN 20200916
Target: Vulkan GPU - Model: mnasnet
ms, Fewer Is Better
Gen9 - i7-8565U
SE +/- 0.02, N = 3
MIN: 8.28 / MAX: 9.05
8.36
Gen11 - i7-1065G7
SE +/- 0.05, N = 3
MIN: 7.11 / MAX: 8.41
7.65
Gen12 Xe - i7-1165G7
SE +/- 0.29, N = 3
MIN: 4.27 / MAX: 6.74
5.14
Gen8 - i7-5600U
SE +/- 0.03, N = 3
MIN: 10.14 / MAX: 10.95
10.59
3
6
9
12
15
1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread


NCNN 20200916
Target: Vulkan GPU - Model: shufflenet-v2
ms, Fewer Is Better
Gen9 - i7-8565U
SE +/- 0.02, N = 3
MIN: 6.07 / MAX: 7.04
6.75
Gen11 - i7-1065G7
SE +/- 0.03, N = 3
MIN: 5.41 / MAX: 10.95
5.71
Gen12 Xe - i7-1165G7
SE +/- 0.02, N = 3
MIN: 2.89 / MAX: 3.33
3.05
Gen8 - i7-5600U
SE +/- 0.41, N = 3
MIN: 7.51 / MAX: 9.49
8.45
2
4
6
8
10
1. (CXX) g++ options: -O3 -rdynamic -lgomp -lpthread
SHOC Scalable HeterOgeneous Computing 2015-11-10
Target: OpenCL - Benchmark: Bus Speed Readback
GB/s, More Is Better
Gen9 - i7-8565U
SE +/- 0.57, N = 15
23.93
Gen11 - i7-1065G7
SE +/- 0.42, N = 15
41.74
Gen12 Xe - i7-1165G7
SE +/- 0.18, N = 12
60.40
Gen8 - i7-5600U
SE +/- 0.08, N = 11
12.13
14
28
42
56
70
1. (CXX) g++ options: -O2 -lSHOCCommonMPI -lSHOCCommonOpenCL -lSHOCCommon -lOpenCL -lrt -pthread -lmpi_cxx -lmpi

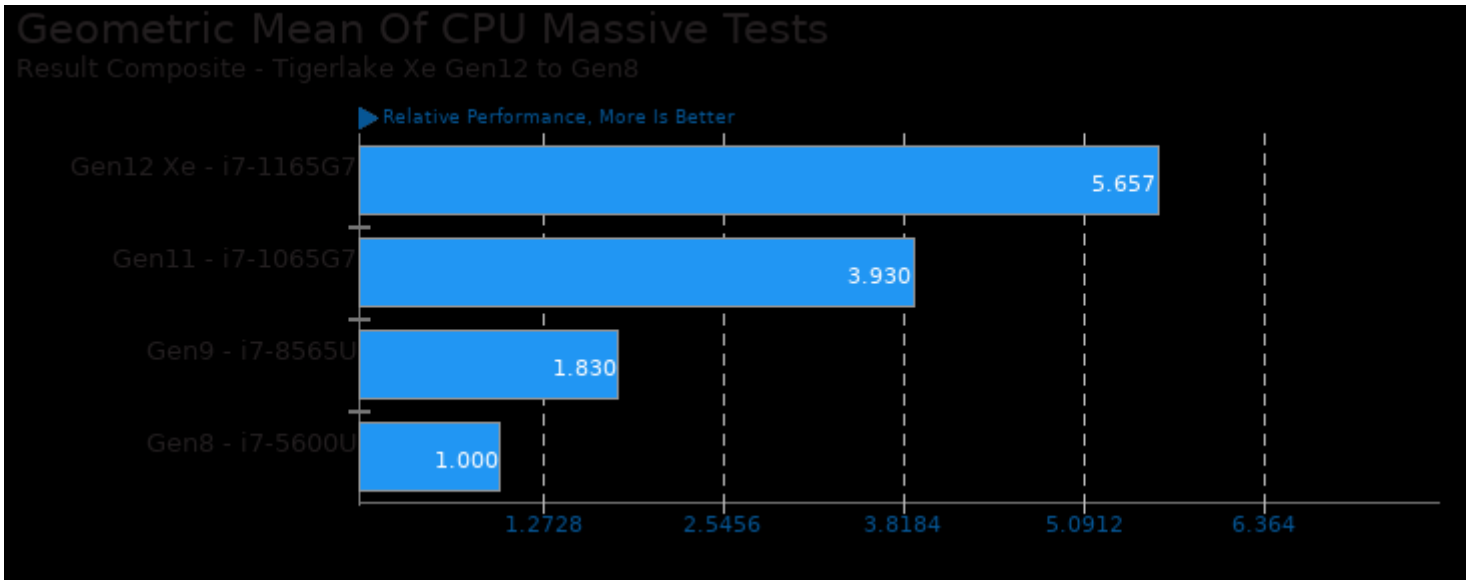

SHOC Scalable HeterOgeneous Computing 2015-11-10
Target: OpenCL - Benchmark: Bus Speed Download
GB/s, More Is Better
Gen9 - i7-8565U
SE +/- 0.52, N = 15
23.30
Gen11 - i7-1065G7
SE +/- 0.11, N = 13
40.16
Gen12 Xe - i7-1165G7
SE +/- 0.44, N = 15
58.41
Gen8 - i7-5600U
SE +/- 0.09, N = 11
12.15
13
26
39
52
65
1. (CXX) g++ options: -O2 -lSHOCCommonMPI -lSHOCCommonOpenCL -lSHOCCommon -lOpenCL -lrt -pthread -lmpi_cxx -lmpi
SHOC Scalable HeterOgeneous Computing 2015-11-10
Target: OpenCL - Benchmark: Triad
GB/s, More Is Better
Gen9 - i7-8565U
SE +/- 0.1918, N = 15
10.9236
Gen11 - i7-1065G7
SE +/- 0.2694, N = 15
14.0210
Gen12 Xe - i7-1165G7
SE +/- 0.1247, N = 11
21.3040
Gen8 - i7-5600U
SE +/- 0.0106, N = 9
6.1253
5
10
15
20
25
1. (CXX) g++ options: -O2 -lSHOCCommonMPI -lSHOCCommonOpenCL -lSHOCCommon -lOpenCL -lrt -pthread -lmpi_cxx -lmpi


FinanceBench 2016-06-06
Benchmark: Monte-Carlo OpenCL
ms, Fewer Is Better
Gen9 - i7-8565U
SE +/- 55.58, N = 15
2584.71
Gen11 - i7-1065G7
SE +/- 11.47, N = 15
579.52
Gen12 Xe - i7-1165G7
SE +/- 1.46, N = 7
433.37
Gen8 - i7-5600U
SE +/- 1.01, N = 5
1031.75
600
1200
1800
2400
3000
1. (CXX) g++ options: -O3 -lOpenCL
RealSR-NCNN 20200818
Scale: 4x - TAA: Yes
Seconds, Fewer Is Better
Gen9 - i7-8565U
SE +/- 2.33, N = 3
1614.84
Gen11 - i7-1065G7
SE +/- 3.12, N = 3
1120.00
Gen12 Xe - i7-1165G7
SE +/- 1.30, N = 3
538.07
Gen8 - i7-5600U
SE +/- 17.10, N = 12
55.15
300
600
900
1200
1500
RealSR-NCNN 20200818
Scale: 4x - TAA: No
Seconds, Fewer Is Better
Gen9 - i7-8565U
SE +/- 0.57, N = 3
202.60
Gen11 - i7-1065G7
SE +/- 0.34, N = 3
143.99
Gen12 Xe - i7-1165G7
SE +/- 0.44, N = 3
68.31
Gen8 - i7-5600U
SE +/- 11.56, N = 15
65.88
40
80
120
160
200

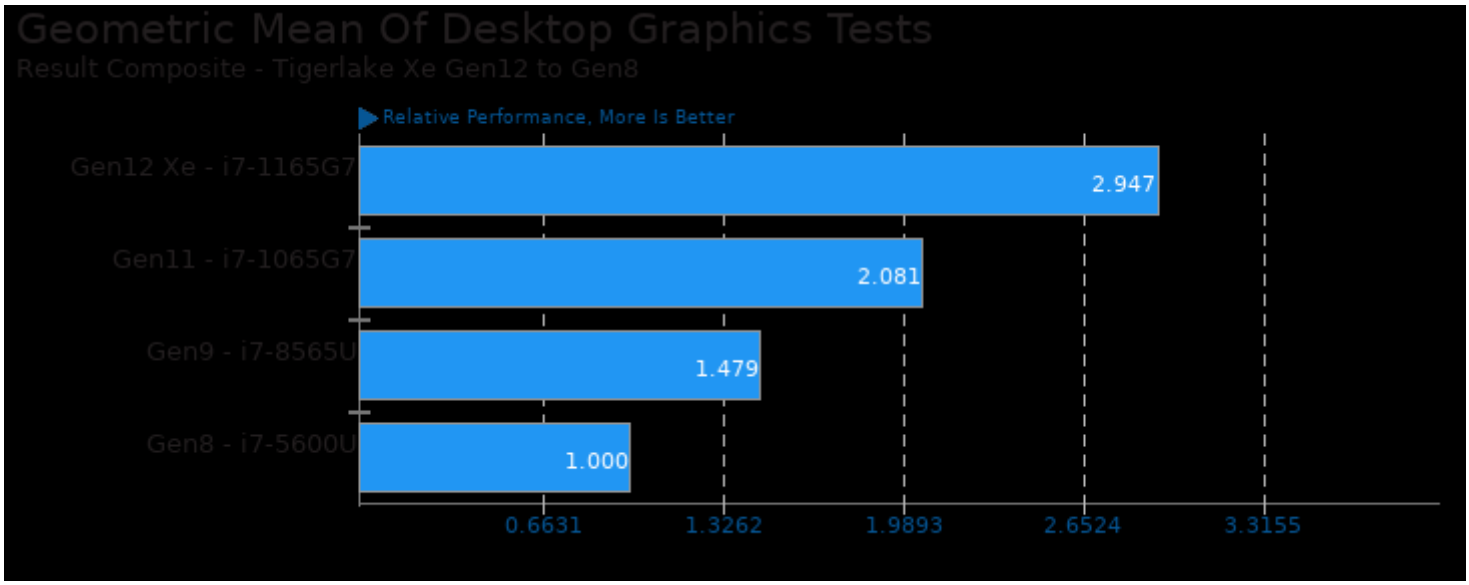
Tigerlake Xe Gen12 to Gen8



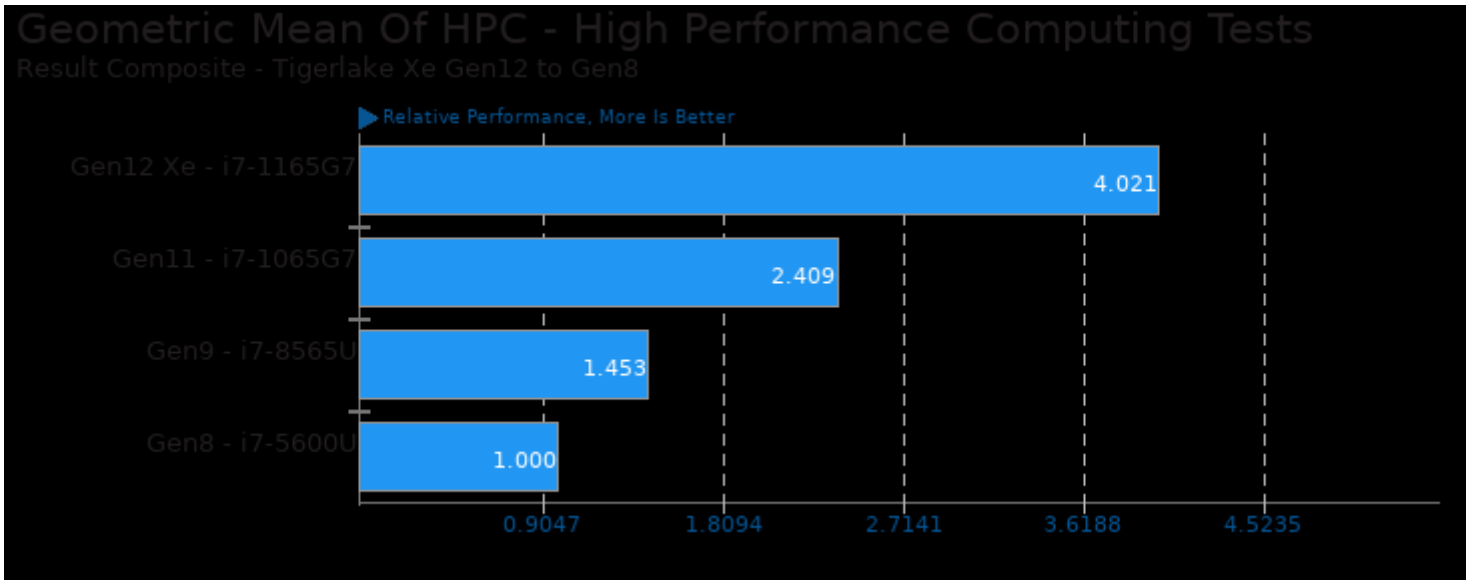
These geometric means are based upon test groupings / test suites for this result file.



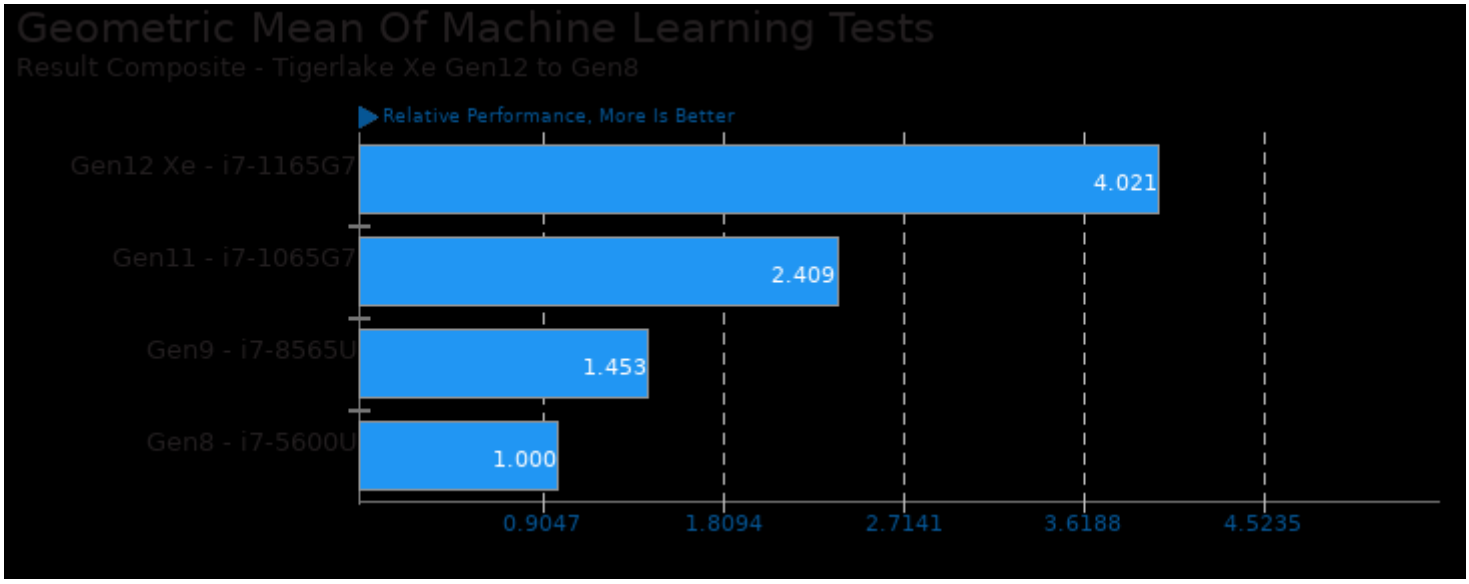
Geometric mean based upon tests: pts/lczero and pts/plaidml



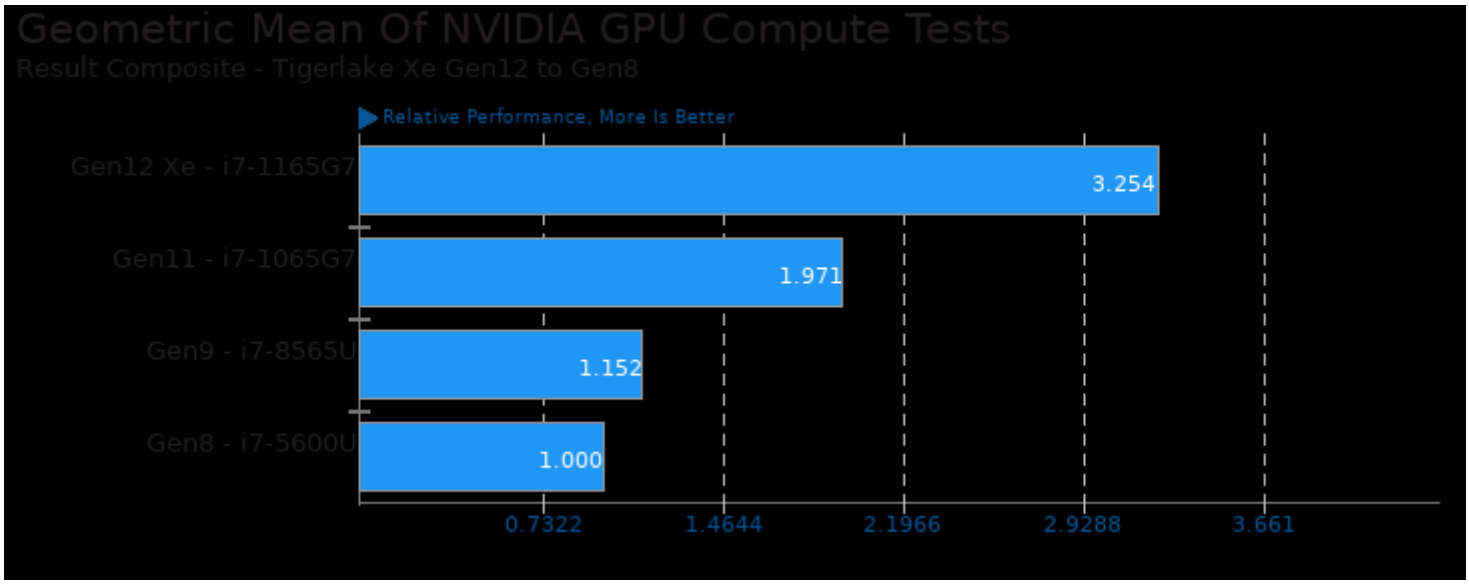
Geometric mean based upon tests: pts/xonotic, pts/tesseract, pts/unigine-valley and pts/unigine-heaven



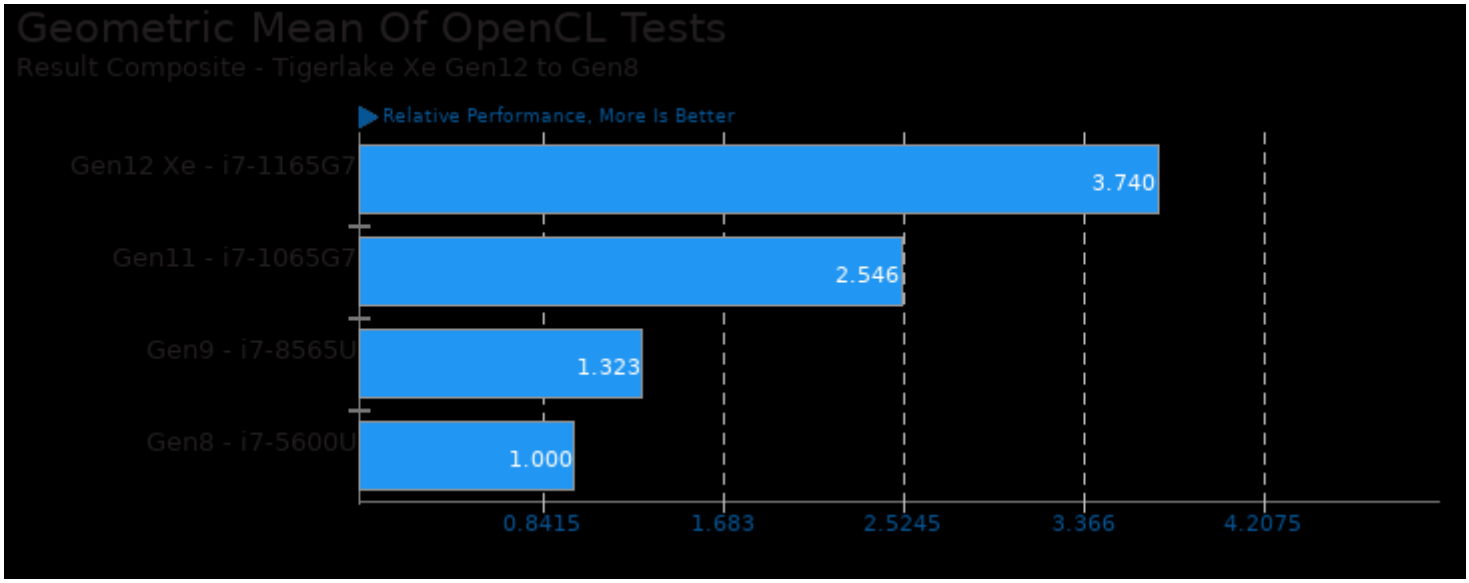
Geometric mean based upon tests: pts/ncnn, pts/shoc, pts/plaidml and pts/lczero



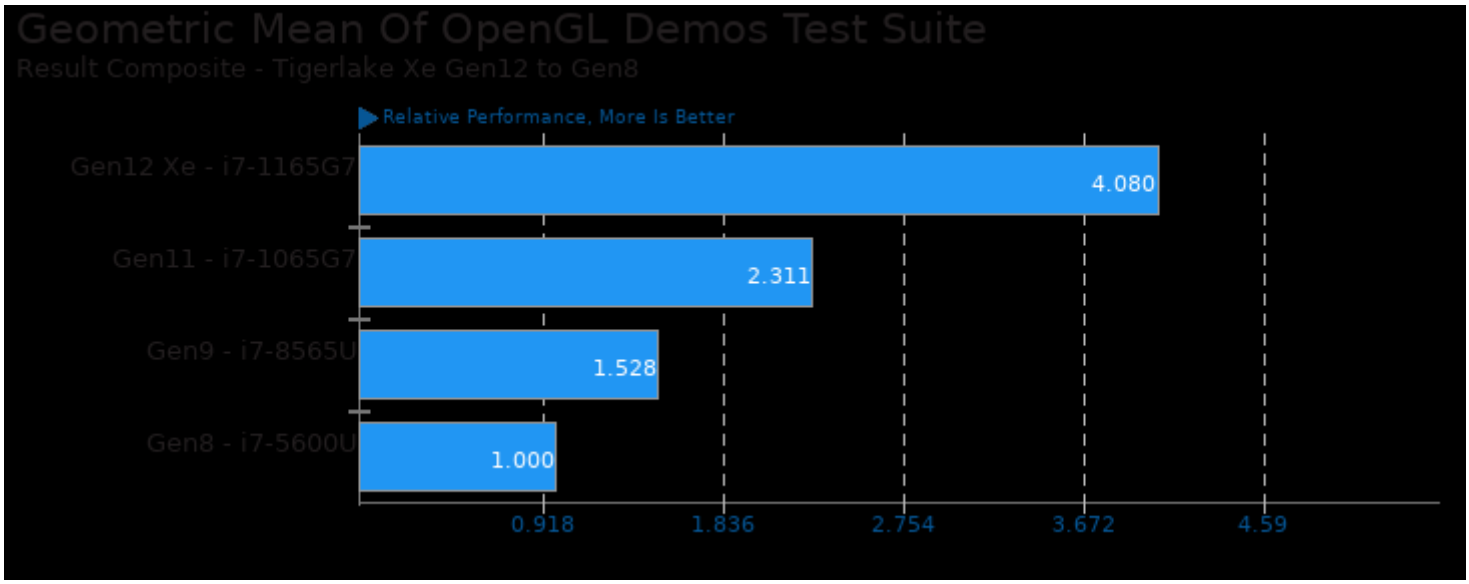
Geometric mean based upon tests: pts/ncnn, pts/shoc, pts/plaidml and pts/lczero



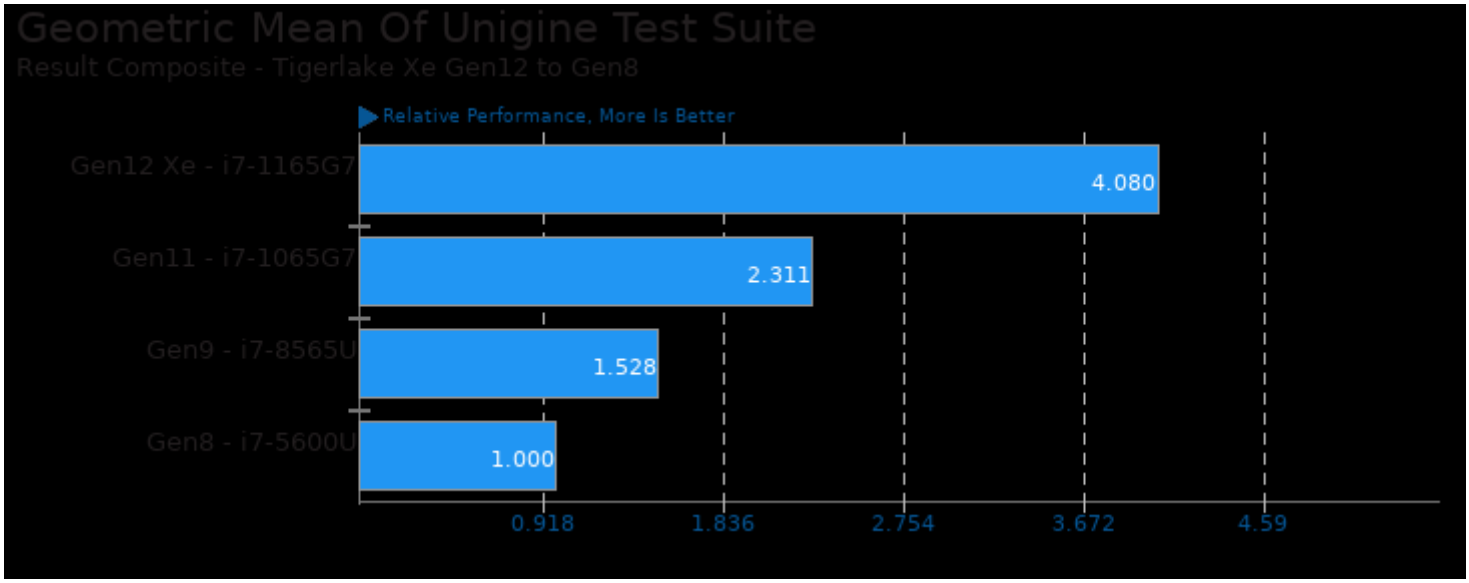
Geometric mean based upon tests: pts/clpeak, pts/financebench, pts/plaidml, pts/lczero, pts/cl-mem, pts/mandelgpu, pts/viennacl, pts/shoc, pts/ncnn, pts/realsr-ncnn and pts/waifu2x-ncnn



Geometric mean based upon tests: pts/juliagpu, pts/mandelgpu, pts/shoc, pts/cl-mem, pts/clpeak and pts/viennacl

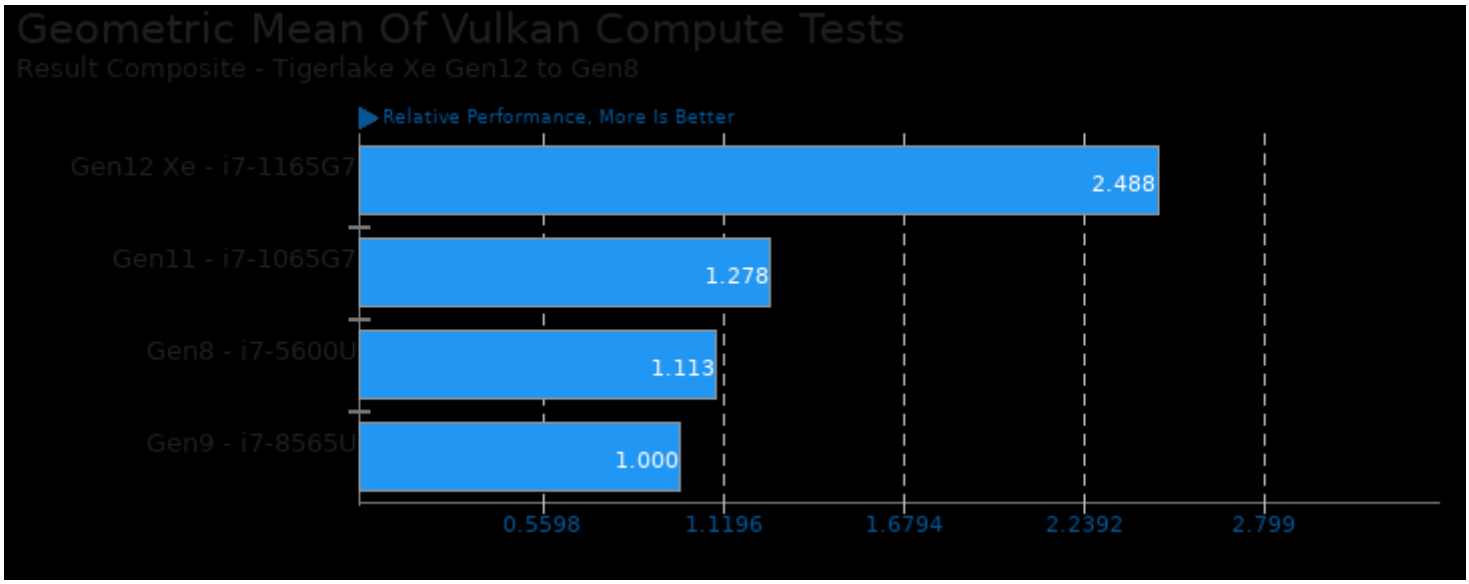


Geometric mean based upon tests: pts/unigine-valley, pts/unigine-heaven and pts/unigine-super



Geometric mean based upon tests: pts/unigine-valley, pts/unigine-heaven and pts/unigine-super

Tigerlake Xe Gen12 to Gen8



Geometric mean based upon tests: pts/ncnn, pts/realsr-ncnn and pts/waifu2x-ncnn

This file was automatically generated via the Phoronix Test Suite benchmarking software on Friday, 29 March 2024 05:00.