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2019 Intel LLVM Clang Compiler Comparison

Tests for a future article by Michael Larabel.

Automated Executive Summary

LLVM Clang 9.0.1 had the most wins, coming in first place for 32% of the tests.

Based on the geometric mean of all complete results, the fastest (LLVM Clang 10 20191217) was 1.009x the speed of the slowest (LLVM Clang 6.0.1). LLVM Clang 8.0.1 was 0.997x the speed of LLVM Clang 10 20191217, LLVM Clang 9.0.1 was 1x the speed of LLVM Clang 8.0.1, LLVM Clang 7.1.0 was 0.997x the speed of LLVM Clang 9.0.1, LLVM Clang 6.0.1 was 0.997x the speed of LLVM Clang 7.1.0.

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

GraphicsMagick (Operation: HWB Color Space) at 1.294x
Timed PHP Compilation (Time To Compile) at 1.277x
CppPerformanceBenchmarks (Test: Ctype) at 1.148x
Apache Benchmark (Static Web Page Serving) at 1.11x
GraphicsMagick (Operation: Noise-Gaussian) at 1.1x
GraphicsMagick (Operation: Swirl) at 1.086x
Himeno Benchmark (Poisson Pressure Solver) at 1.08x
Coremark (CoreMark Size 666 - Iterations Per Second) at 1.076x

C-Ray (Total Time - 4K, 16 Rays Per Pixel) at 1.067x
Zstd Compression (Compressing ubuntu-16.04.3-server-i386.img, Compression Level 19) at 1.048x.

Test Systems:

LLVM Clang 6.0.1

Processor: Intel Core i7-5960X @ 3.50GHz (8 Cores / 16 Threads), Motherboard: ASRock X99 Extreme3 (P3.70 BIOS), Chipset: Intel Xeon E7 v3/Xeon, Memory: 16384MB, Disk: 120GB INTEL SSDSC2BW12, Graphics: AMD FirePro V7900 2GB, Audio: Realtek ALC1150, Monitor: VA2431, Network: Intel I218-V

OS: Ubuntu 19.10, Kernel: 5.3.0-24-generic (x86_64), Desktop: GNOME Shell 3.34.1, Display Server: X Server 1.20.5, Display Driver: modesetting 1.20.5, Compiler: Clang 6.0.1 + LLVM 6.0.1, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS="-O3 -march=native" CFLAGS="-O3 -march=native"
Compiler Notes: Optimized build; Default target: x86_64-unknown-linux-gnu; Host CPU: haswell
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0x43
Security Notes: itlb_multihit: KVM: Mitigation of Split huge pages + 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 + tsx_async_abort: Not affected

LLVM Clang 7.1.0

Processor: Intel Core i7-5960X @ 3.50GHz (8 Cores / 16 Threads), Motherboard: ASRock X99 Extreme3 (P3.70 BIOS), Chipset: Intel Xeon E7 v3/Xeon, Memory: 16384MB, Disk: 120GB INTEL SSDSC2BW12, Graphics: AMD FirePro V7900 2GB, Audio: Realtek ALC1150, Monitor: VA2431, Network: Intel I218-V

OS: Ubuntu 19.10, Kernel: 5.3.0-24-generic (x86_64), Desktop: GNOME Shell 3.34.1, Display Server: X Server 1.20.5, Display Driver: modesetting 1.20.5, Compiler: Clang 7.1.0 + LLVM 7.1.0, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS="-O3 -march=native" CFLAGS="-O3 -march=native"
Compiler Notes: Optimized build; Default target: x86_64-unknown-linux-gnu; Host CPU: haswell
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0x43
Security Notes: itlb_multihit: KVM: Mitigation of Split huge pages + 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 + tsx_async_abort: Not affected

LLVM Clang 8.0.1

Processor: Intel Core i7-5960X @ 3.50GHz (8 Cores / 16 Threads), Motherboard: ASRock X99 Extreme3 (P3.70 BIOS), Chipset: Intel Xeon E7 v3/Xeon, Memory: 16384MB, Disk: 120GB INTEL SSDSC2BW12, Graphics: AMD FirePro V7900 2GB, Audio: Realtek ALC1150, Monitor: VA2431, Network: Intel I218-V

OS: Ubuntu 19.10, Kernel: 5.3.0-24-generic (x86_64), Desktop: GNOME Shell 3.34.1, Display Server: X Server 1.20.5, Display Driver: modesetting 1.20.5, Compiler: Clang 8.0.1 + LLVM 8.0.1, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS="-O3 -march=native" CFLAGS="-O3 -march=native"
Compiler Notes: Optimized build; Default target: x86_64-unknown-linux-gnu; Host CPU: haswell
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0x43
Security Notes: itlb_multihit: KVM: Mitigation of Split huge pages + 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 + tsx_async_abort: Not affected

LLVM Clang 9.0.1

Processor: Intel Core i7-5960X @ 3.50GHz (8 Cores / 16 Threads), Motherboard: ASRock X99 Extreme3 (P3.70 BIOS), Chipset: Intel Xeon E7 v3/Xeon, Memory: 16384MB, Disk: 120GB INTEL SSDSC2BW12, Graphics: AMD FirePro V7900 2GB, Audio: Realtek ALC1150, Monitor: VA2431, Network: Intel I218-V

OS: Ubuntu 19.10, Kernel: 5.3.0-24-generic (x86_64), Desktop: GNOME Shell 3.34.1, Display Server: X Server 1.20.5, Display Driver: modesetting 1.20.5, Compiler: Clang 9.0.1 + LLVM 9.0.1, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS="-O3 -march=native" CFLAGS="-O3 -march=native"
Compiler Notes: Optimized build; Default target: x86_64-unknown-linux-gnu; Host CPU: haswell
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0x43
Security Notes: itlb_multihit: KVM: Mitigation of Split huge pages + 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 + tsx_async_abort: Not affected

LLVM Clang 10 20191217

Processor: Intel Core i7-5960X @ 3.50GHz (8 Cores / 16 Threads), Motherboard: ASRock X99 Extreme3 (P3.70 BIOS), Chipset: Intel Xeon E7 v3/Xeon, Memory: 16384MB, Disk: 120GB INTEL SSDSC2BW12, Graphics: AMD FirePro V7900 2GB, Audio: Realtek ALC1150, Monitor: VA2431, Network: Intel I218-V

OS: Ubuntu 19.10, Kernel: 5.3.0-24-generic (x86_64), Desktop: GNOME Shell 3.34.1, Display Server: X Server 1.20.5, Display Driver: modesetting 1.20.5, Compiler: Clang 10.0.0, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS="-O3 -march=native" CFLAGS="-O3 -march=native"
Compiler Notes: Optimized build; Default target: x86_64-unknown-linux-gnu; Host CPU: haswell
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0x43
Python Notes: Python 2.7.17rc1 + Python 3.7.5
Security Notes: itlb_multihit: KVM: Mitigation of Split huge pages + 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 + tsx_async_abort: Not affected

	LLVM Clang 6.0.1	LLVM Clang 7.1.0	LLVM Clang 8.0.1	LLVM Clang 9.0.1	LLVM Clang 10 20191217
GraphicsMagick - HWB Color Space (Iterations/min)	109	109	111	112	141
Normalized	77.3%	77.3%	78.72%	79.43%	100%
Standard Deviation	0.5%			2.4%	
Timed PHP Compilation - Time To Compile (sec)	99.443	110.278	112.170	115.967	127.013
Normalized	100%	90.17%	88.65%	85.75%	78.29%
Standard Deviation	0.1%	0%	0.4%	0.1%	0.2%

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CppPerformanceBenchmarks - Ctype (sec)	35.312	35.698	31.093	34.939	32.959
Normalized	88.05%	87.1%	100%	88.99%	94.34%
Standard Deviation	0%	0%	0%	0%	0.1%
Apache Benchmark - S.W.P.S (Reqs/sec)	19278	19825	20225	20345	18326
Normalized	94.76%	97.44%	99.41%	100%	90.08%
Standard Deviation	2.2%	2.5%	1.9%	0.9%	3.2%
GraphicsMagick - Noise-Gaussian (Iterations/min)	20	21	22	22	22
Normalized	90.91%	95.45%	100%	100%	100%
GraphicsMagick - Swirl (Iterations/min)	35	35	36	35	38
Normalized	92.11%	92.11%	94.74%	92.11%	100%
Standard Deviation			1.6%		
Himeno Benchmark - P.P.S (MFLOPS)	2915	3099	3086	3148	3145
Normalized	92.6%	98.44%	98.02%	100%	99.91%
Standard Deviation	0.2%	0.2%	0.3%	0.2%	0.1%
Coremark - CoreMark Size 666 - I.P.S (Iterations/Sec)	222703	228736	222924	215757	212568
Normalized	97.36%	100%	97.46%	94.33%	92.93%
Standard Deviation	0%	0.3%	0.1%	0.2%	0.1%
C-Ray - Total Time - 4.1.R.P.P (sec)	133.539	127.178	127.086	125.180	127.246
Normalized	93.74%	98.43%	98.5%	100%	98.38%
Standard Deviation	0.1%	0%	0.1%	0%	0.1%
Zstd Compression - C.u.1.0.3.s.i.i.C.L.1 (sec)	20.938	20.953	21.339	20.829	20.364
Normalized	97.26%	97.19%	95.43%	97.77%	100%
Standard Deviation	0.6%	0.3%	0.5%	0.9%	1.3%
ebizzy (Records/s)	284282	278134	285846	278849	272998
Normalized	99.45%	97.3%	100%	97.55%	95.51%
Standard Deviation	2.9%	3%	2.9%	2%	3%
TSCP - A.C.P (Nodes/s)	1305161	1312628	1295948	1351272	1345331
Normalized	96.59%	97.14%	95.91%	100%	99.56%
Standard Deviation		0.1%		0.1%	0.1%
libjpeg-turbo tjbench - D.T (Megapixels/sec)	172.995715	169.256304	167.204583	166.392078	168.245614
Normalized	100%	97.84%	96.65%	96.18%	97.25%
Standard Deviation	0.3%	0.5%	0.7%	0.7%	0.2%
John The Ripper - Blowfish (Real C/S)	1337	1343	1293	1293	1293
Normalized	99.55%	100%	96.28%	96.28%	96.28%
Standard Deviation				0%	
Minion - Quasigroup (sec)	140.385022	141.394096	139.842752	141.484902	144.574132
Normalized	99.61%	98.9%	100%	98.84%	96.73%
Standard Deviation	0.1%	0.2%	0.2%	0.2%	2.7%
SciMark - S.M.M (Mflops)	2739	2772	2754	2808	2829
Normalized	96.84%	97.99%	97.38%	99.27%	100%
Standard Deviation	0.4%	0.2%	0.1%	0.4%	0.6%
x264 - H.2.V.E (FPS)	56.26	56.95	57.60	57.37	57.84
Normalized	97.27%	98.46%	99.59%	99.19%	100%
Standard Deviation	3%	2.7%	2.9%	2.4%	2.7%

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GraphicsMagick - Resizing (Iterations/min)	79	79	80	81	80
Normalized	97.53%	97.53%	98.77%	100%	98.77%
Standard Deviation	1.5%			0.7%	
GraphicsMagick - Rotate (Iterations/min)	577	578	578	584	591
Normalized	97.63%	97.8%	97.8%	98.82%	100%
SVT-HEVC - 1.8.b.Y.T.H.V.E (FPS)	35.06	35.11	35.48	35.88	35.90
Normalized	97.66%	97.8%	98.83%	99.94%	100%
Standard Deviation	0.8%	0.9%	0.8%	0.9%	0.9%
Tungsten Renderer - Hair (sec)	35.2842	35.2485	35.6346	34.9660	34.9000
Normalized	98.91%	99.01%	97.94%	99.81%	100%
Standard Deviation	0.2%	0.1%	0.1%	0%	0%
Minion - Graceful (sec)	64.306260	64.366640	63.472231	63.040103	63.623649
Normalized	98.03%	97.94%	99.32%	100%	99.08%
Standard Deviation	0.2%	0.1%	0.1%	0.1%	0.4%
x265 - H.2.1.V.E (FPS)	34.45	34.59	34.52	35.10	34.52
Normalized	98.15%	98.55%	98.35%	100%	98.35%
Standard Deviation	0.7%	1.5%	0.5%	1.6%	0.6%
XZ Compression - C.u.1.0.3.s.i.i.C.L.9 (sec)	32.170	32.111	32.191	31.595	32.128
Normalized	98.21%	98.39%	98.15%	100%	98.34%
Standard Deviation	0.3%	0.3%	0.3%	0.8%	0.6%
asmFish - 1.H.M.2.D (Nodes/s)	21773169	22113202	21716998	22125493	21917065
Normalized	98.41%	99.94%	98.15%	100%	99.06%
Standard Deviation	1.1%	0.8%	1.2%	1.1%	1.9%
NGINX Benchmark - S.W.P.S (Reqs/sec)	25228	25579	25504	25695	25528
Normalized	98.18%	99.55%	99.25%	100%	99.35%
Standard Deviation	1.3%	0.5%	1.1%	0.3%	2%
Timed HMMer Search - P.D.S (sec)	7.307	7.181	7.302	7.311	7.201
Normalized	98.28%	100%	98.34%	98.22%	99.72%
Standard Deviation	2%	1.3%	2.6%	2.1%	1.8%
Tungsten Renderer - Non-Exponential (sec)	9.97024	9.93175	9.95480	10.00685	9.83032
Normalized	98.6%	98.98%	98.75%	98.24%	100%
Standard Deviation	0.7%	0.2%	0.1%	0.7%	0.7%
libgav1 - S.N.1 (FPS)	51.30	50.94	50.88	51.18	51.73
Normalized	99.17%	98.47%	98.36%	98.94%	100%
Standard Deviation	0.3%	0.1%	0.3%	0.3%	0.2%
SVT-VP9 - V.Q.O - Bosphorus 1080p (FPS)	81.14	80.23	81.50	80.82	81.14
Normalized	99.56%	98.44%	100%	99.17%	99.56%
Standard Deviation	0.2%	0.4%	0.7%	0.7%	0.6%
AOBench - 2048 x 2048 - Total Time (sec)	41.549	42.200	41.604	42.109	41.799
Normalized	100%	98.46%	99.87%	98.67%	99.4%
Standard Deviation	0.2%	2.4%	0.3%	2.9%	1.2%
dav1d - Summer Nature 4K (FPS)	105.51	107.13	106.57	106.53	106.56
Normalized	98.49%	100%	99.48%	99.44%	99.47%
Standard Deviation	0.8%	0.3%	0.3%	0.2%	0.2%

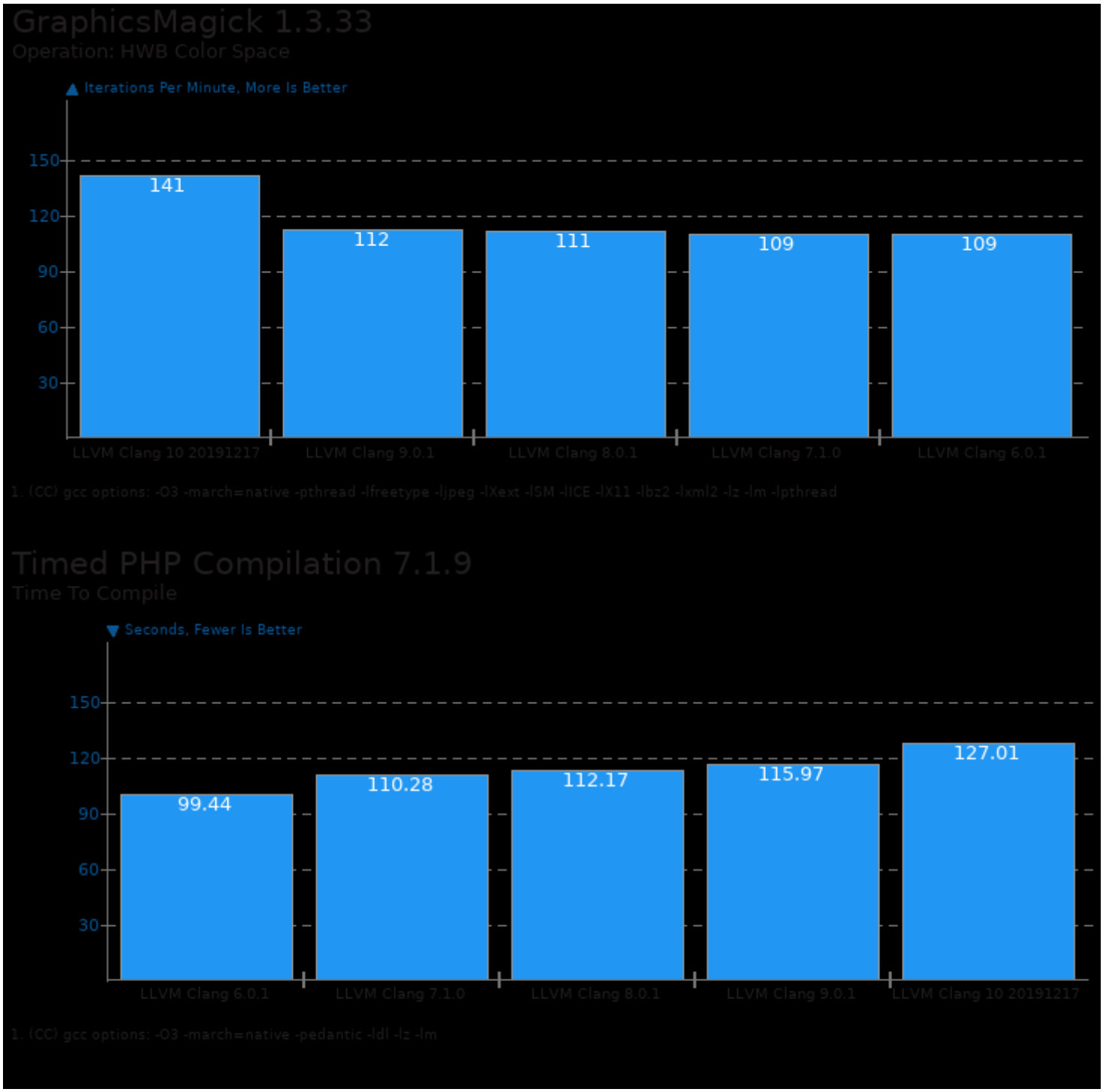
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Tungsten Renderer - Water Caustic (sec)	31.1509	31.4654	31.1359	31.0105	31.1667
Normalized	99.55%	98.55%	99.6%	100%	99.5%
Standard Deviation	0.2%	0.2%	0.4%	0.2%	0.2%
dav1d - S.N.1 (FPS)	300.97	303.93	305.15	304.73	305.08
Normalized	98.63%	99.6%	100%	99.86%	99.98%
Standard Deviation	0.4%	0.4%	0.3%	0.3%	0.2%
SciMark - F.F.T (Mflops)	453.81	459.85	455.34	455.31	455.49
Normalized	98.69%	100%	99.02%	99.01%	99.05%
Standard Deviation	0.1%	0.4%	0.3%	0.7%	0.2%
John The Ripper - MD5 (Real	76421	76487	76623	76627	77384
Normalized	98.76%	98.84%	99.02%	99.02%	100%
Standard Deviation	0.2%	0.4%	0.1%	0.1%	0.2%
CppPerformanceBenchmarks - Function Objects (sec)	16.134	16.139	15.998	16.135	15.939
Normalized	98.79%	98.76%	99.63%	98.79%	100%
Standard Deviation	0.6%	0.6%	0.6%	0.6%	0.6%
Tungsten Renderer - Volumetric Caustic (sec)	12.3110	12.1987	12.2350	12.2433	12.1656
Normalized	98.82%	99.73%	99.43%	99.37%	100%
Standard Deviation	0.8%	0.2%	0.3%	0.9%	0.8%
PostgreSQL pgbench - Buffer Test - Normal Load - Read Only	147464	147812	148727	149135	148891
Normalized	98.88%	99.11%	99.73%	100%	99.84%
Standard Deviation	0%	0.1%	0.2%	0.1%	0.4%
SVT-VP9 - VMAF Optimized - Bosphorus 1080p (FPS)	102.84	102.26	101.77	102.90	102.66
Normalized	99.94%	99.38%	98.9%	100%	99.77%
Standard Deviation	2.8%	2.8%	3%	3%	2.9%
libgav1 - Summer Nature 4K	15.83	15.72	15.76	15.74	15.89
Normalized	99.62%	98.93%	99.18%	99.06%	100%
Standard Deviation	0%	0.1%	0.1%	0.2%	0.1%
SVT-AV1 - Enc Mode 8 - 1080p (FPS)	23.283	23.208	23.419	23.451	23.395
Normalized	99.28%	98.96%	99.86%	100%	99.76%
Standard Deviation	0.6%	0.4%	0.6%	0.6%	0.2%
SVT-VP9 - P.S.O - Bosphorus 1080p (FPS)	110.61	110.17	110.09	109.56	110.25
Normalized	100%	99.6%	99.53%	99.05%	99.67%
Standard Deviation	1.3%	1.7%	1.1%	1%	1.1%
dav1d - Chimera 1080p (FPS)	352.92	354.12	353.14	354.96	351.63
Normalized	99.43%	99.76%	99.49%	100%	99.06%
Standard Deviation	0.4%	0.2%	1.2%	0.9%	1.3%
Timed MrBayes Analysis - P.P.A (sec)	109.252	108.759	108.616	109.030	108.448
Normalized	99.26%	99.71%	99.85%	99.47%	100%
Standard Deviation	0.3%	0.2%	0.5%	0.3%	0.4%
SciMark - Composite (Mflops)	2100	2104	2100	2115	2114
Normalized	99.32%	99.48%	99.31%	100%	99.97%
Standard Deviation	0.2%	0%	0.3%	0.2%	0.2%
SciMark - D.L.M.F (Mflops)	5240	5218	5222	5243	5220
Normalized	99.93%	99.52%	99.59%	100%	99.54%
Standard Deviation	0.4%	0.1%	0.6%	0.5%	0%
libgav1 - Chimera 1080p (FPS)	36.32	36.21	36.25	36.23	36.38

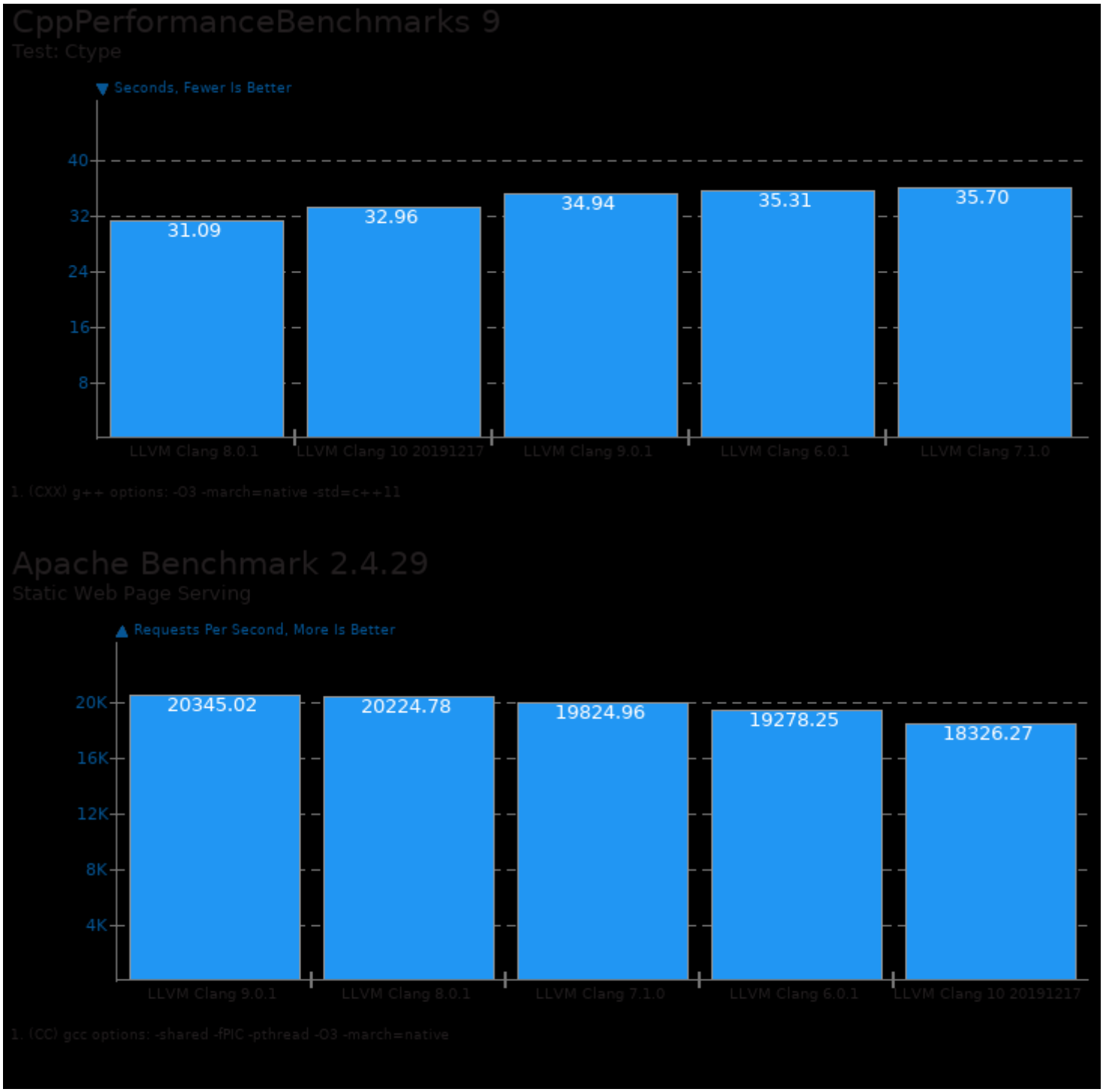
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Normalized	99.84%	99.53%	99.64%	99.59%	100%
Standard Deviation	0.1%	0%	0.1%	0.1%	0.1%
Minion - Solitaire (sec)	**86.677773**	86.975667	86.960693	**87.056188**	86.850014
Normalized	100%	99.66%	99.67%	99.57%	99.8%
Standard Deviation	0.1%	0.3%	0.3%	0.3%	0.3%
CppPerformanceBenchmarks - Math Library (sec)	407.300	**406.432**	406.927	408.076	**408.082**
Normalized	99.79%	100%	99.88%	99.6%	99.6%
Standard Deviation	0.5%	0.1%	0.1%	0.6%	0.5%
SciMark - Monte Carlo (Mflops)	**557.24**	557.10	557.09	555.78	**555.76**
Normalized	100%	99.97%	99.97%	99.74%	99.73%
Standard Deviation	0%	0%	0%	0%	0%
GraphicsMagick - Sharpen (Iterations/min)	12	12	12	12	12
VP9 libvpx Encoding - v.V.1.V.E (FPS)	**110.24**	110.78	**111.71**	111.05	110.98
Normalized	98.68%	99.17%	100%	99.41%	99.35%
Standard Deviation	8.9%	8.9%	8.7%	8.9%	8.9%
Geometric Mean Of All Test Results - Result Composite - 2.I.L.C.C.C (Geometric Mean)	**119.966**	120.269	120.729	120.686	**121.085**
Normalized	99.08%	99.33%	99.71%	99.67%	100%

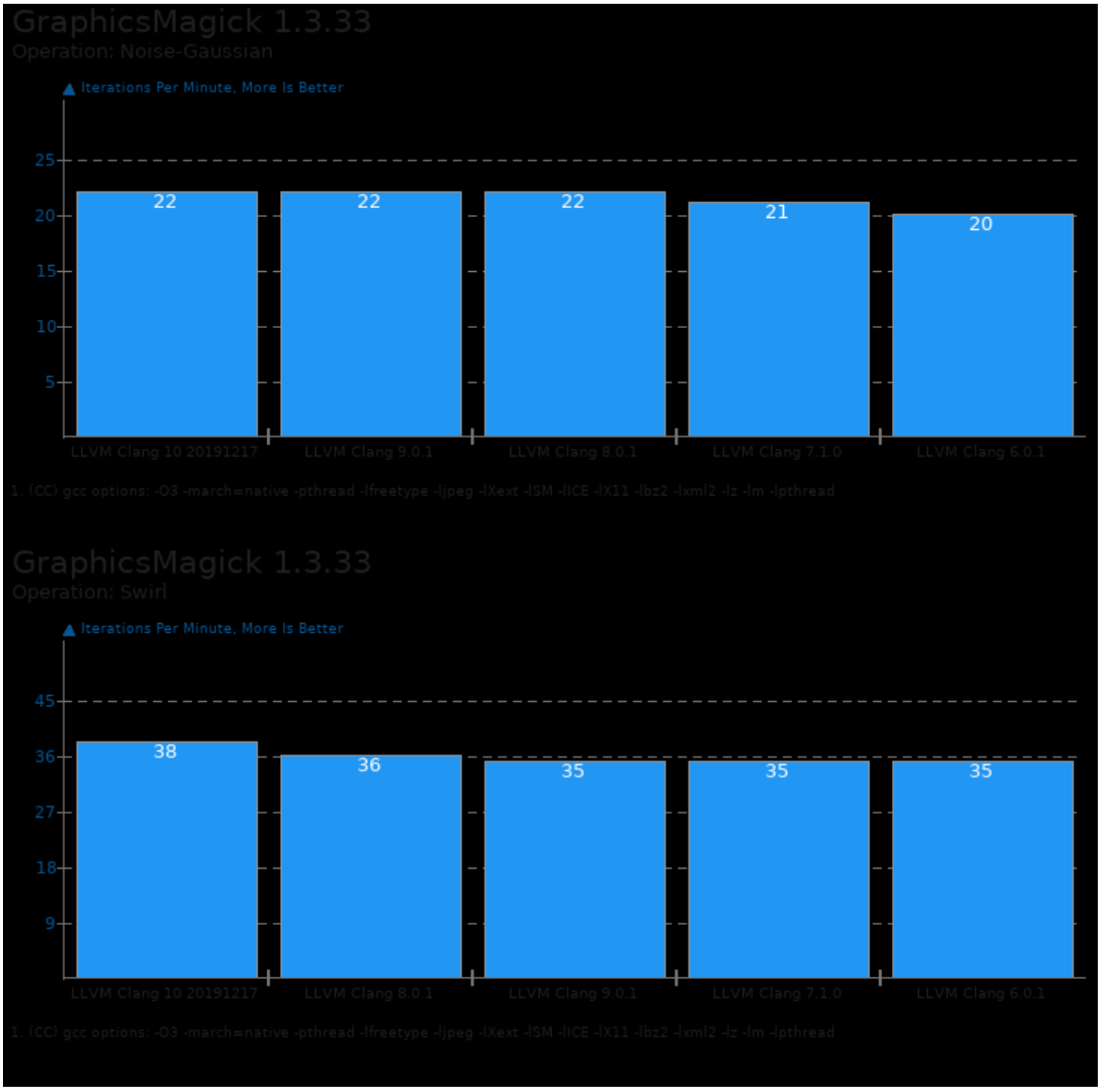
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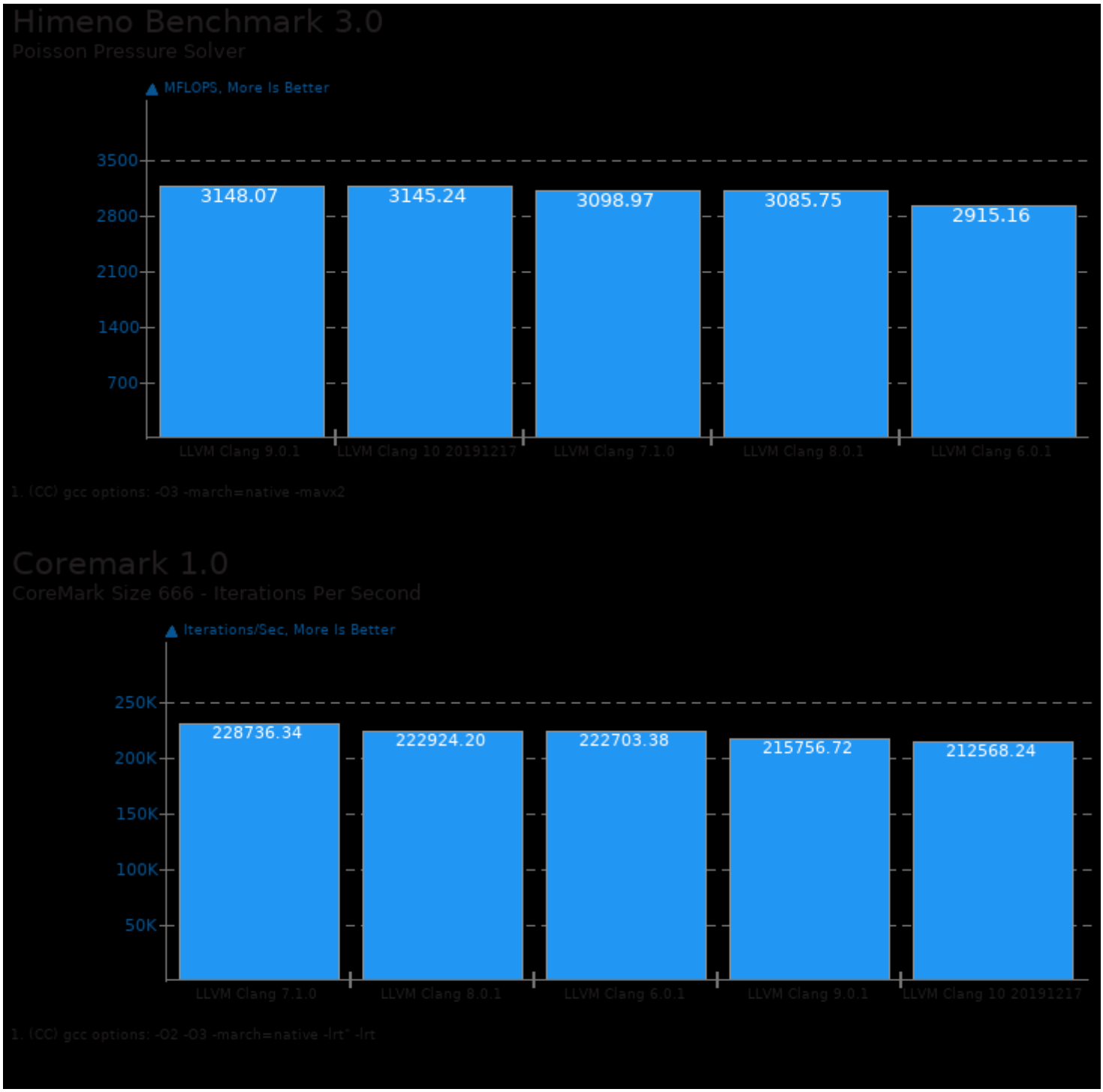
2019 Intel LLVM Clang Compiler Comparison



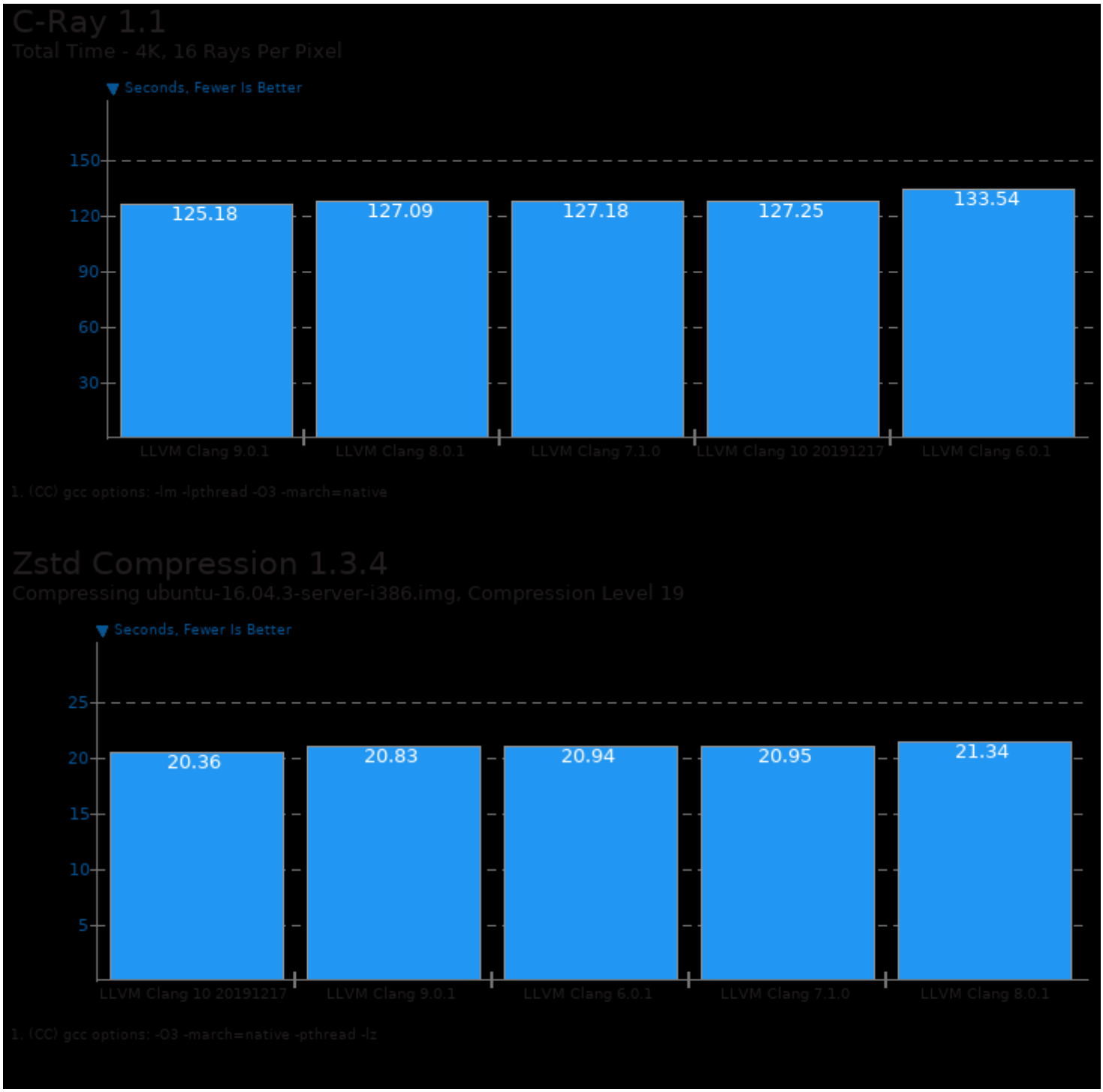
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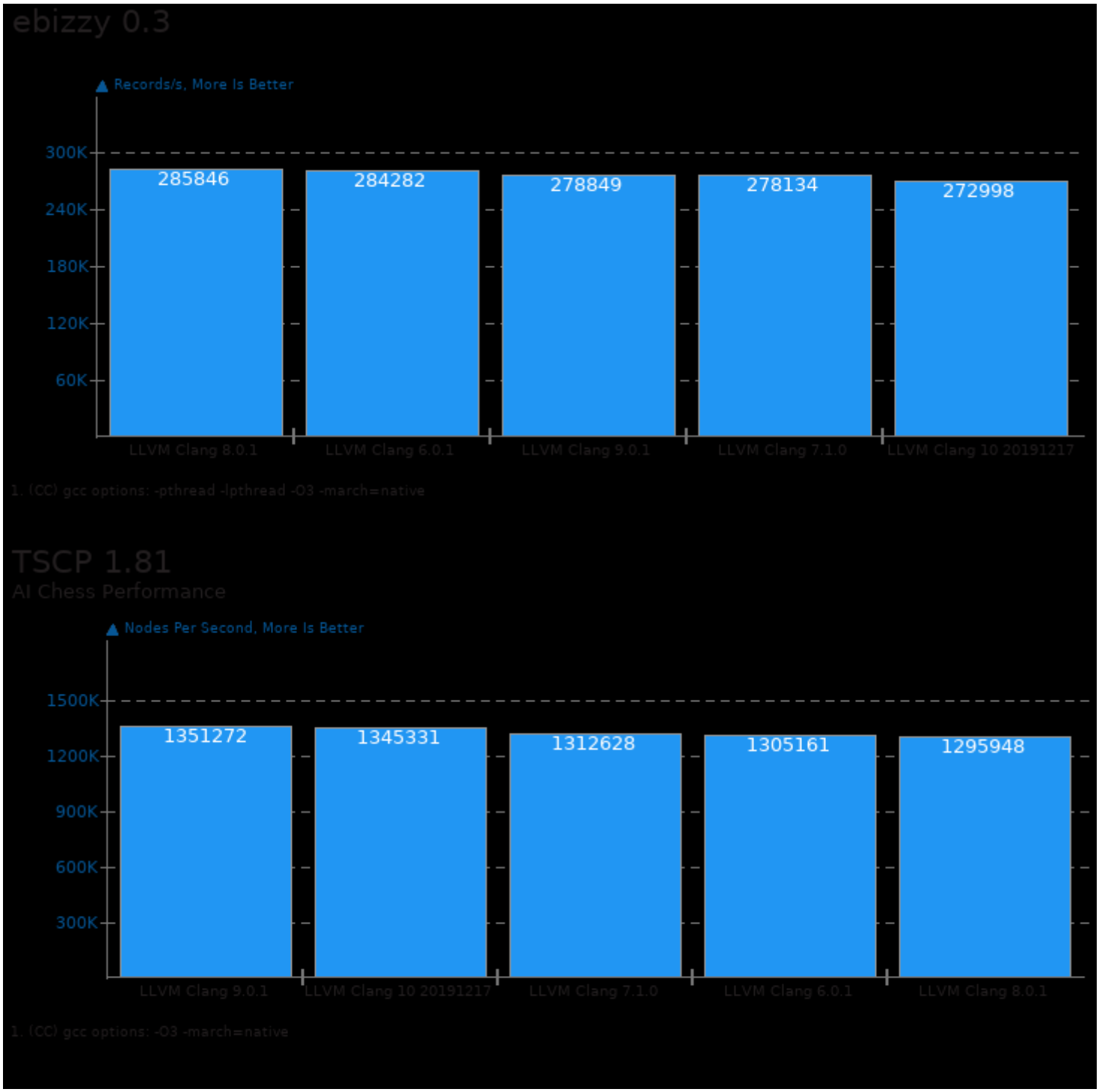
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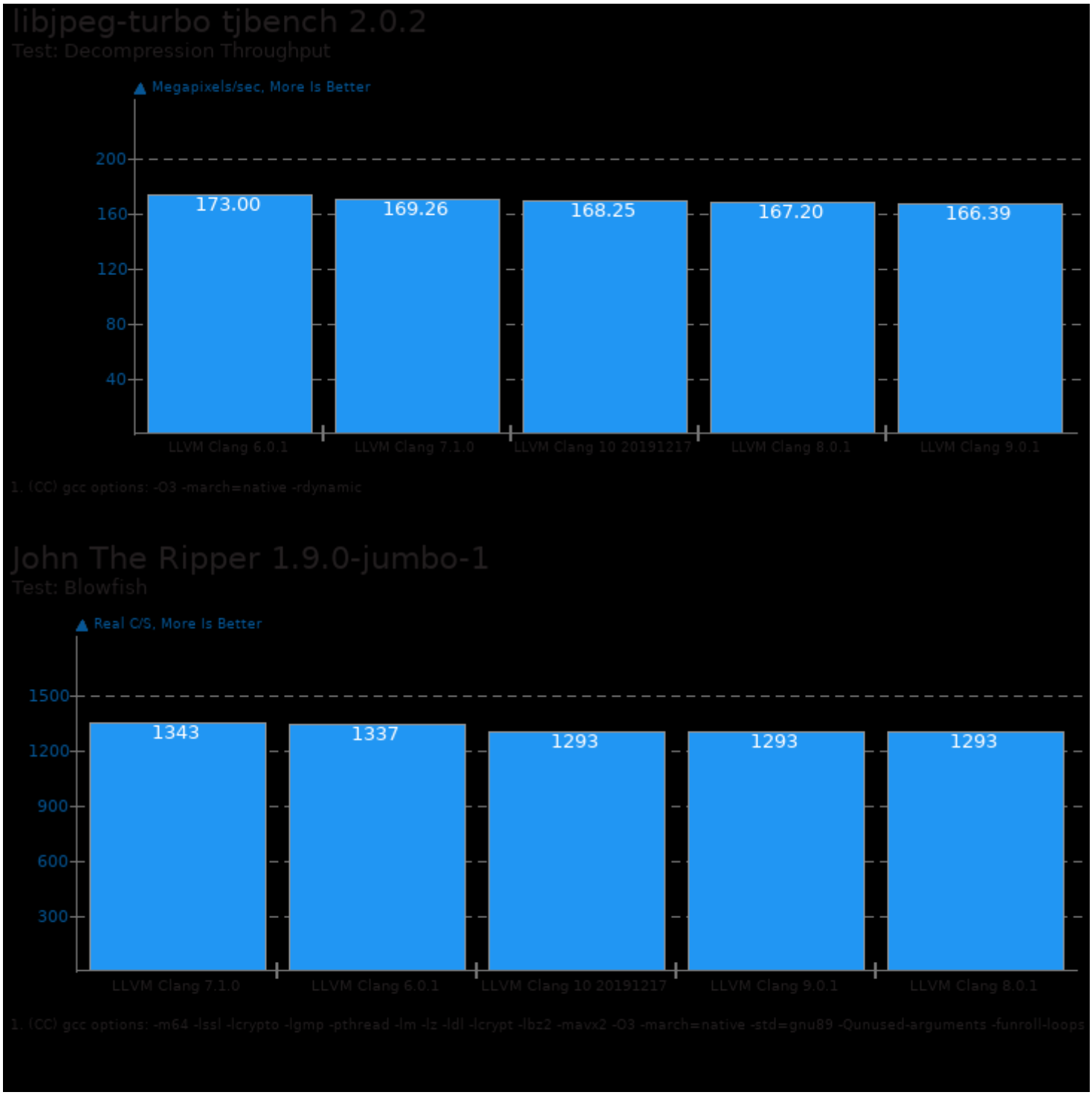
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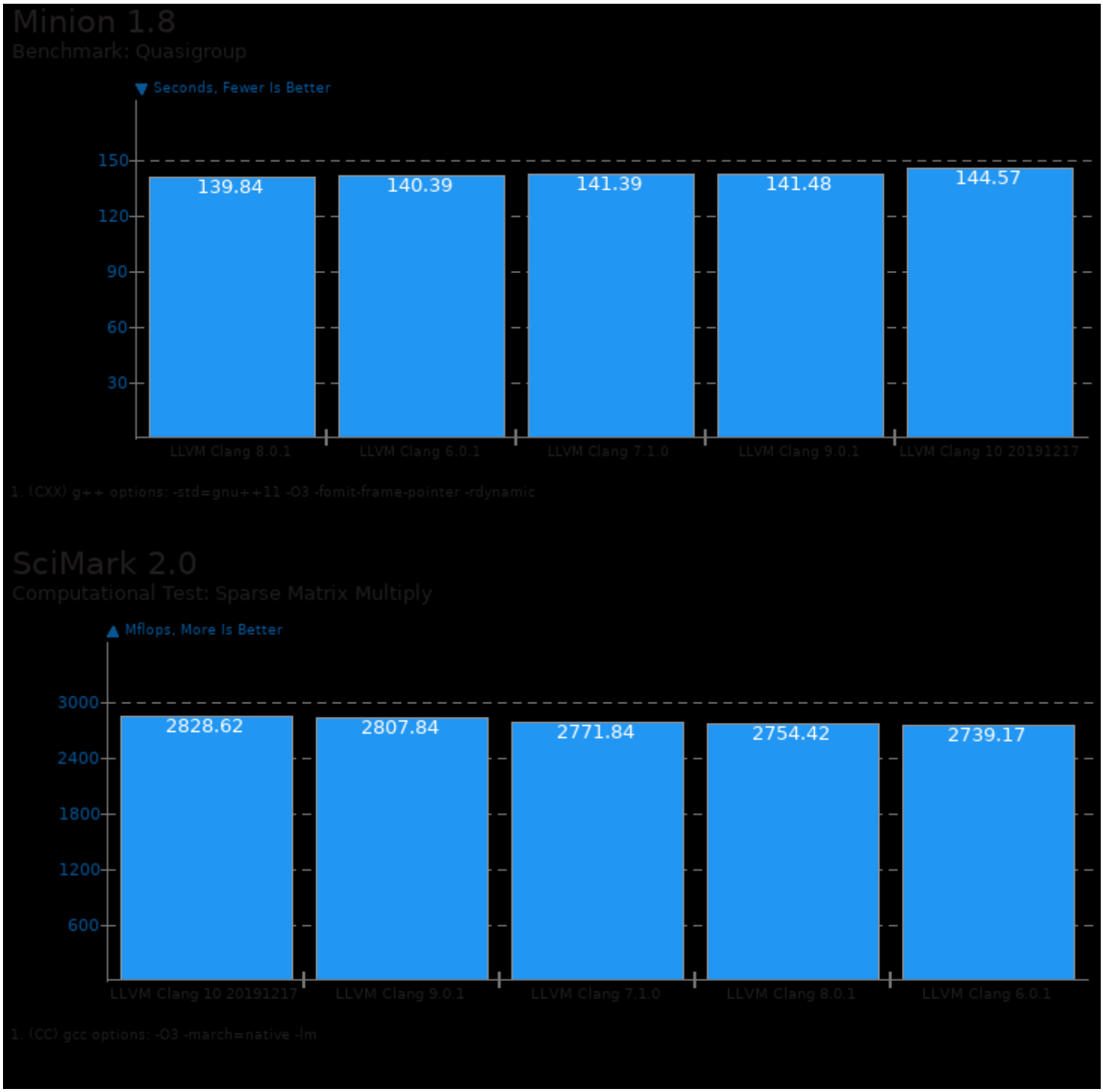
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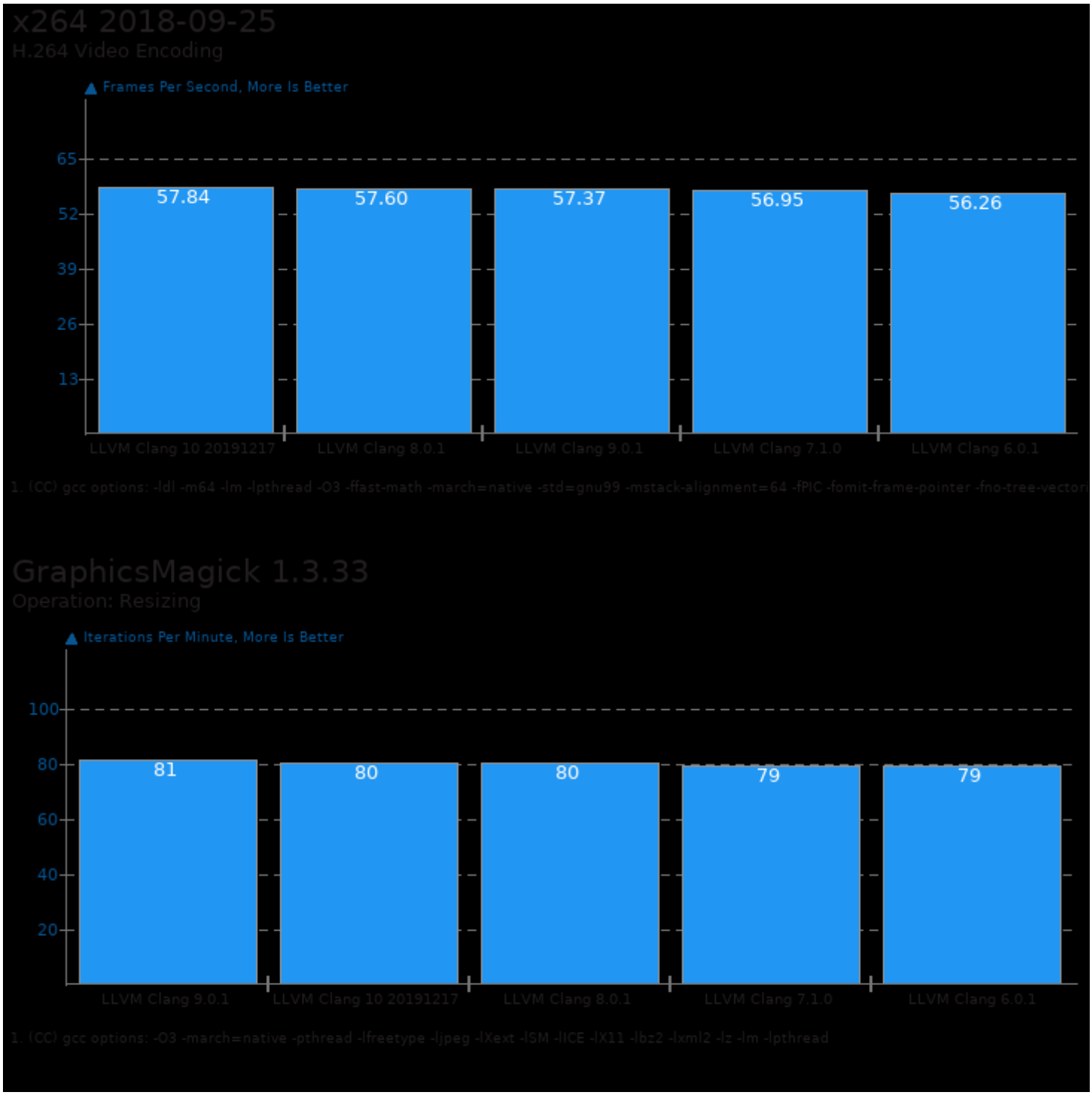
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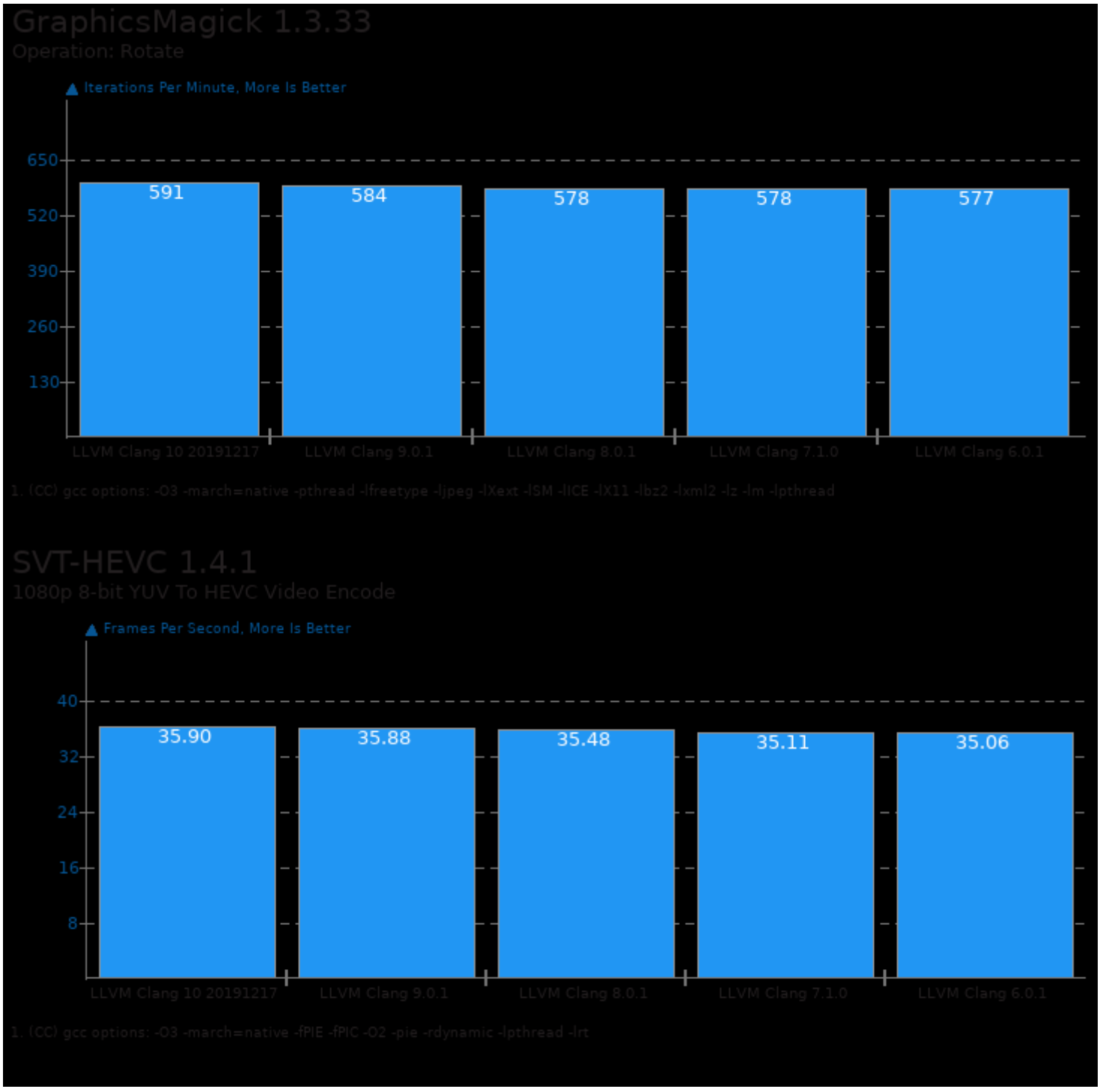
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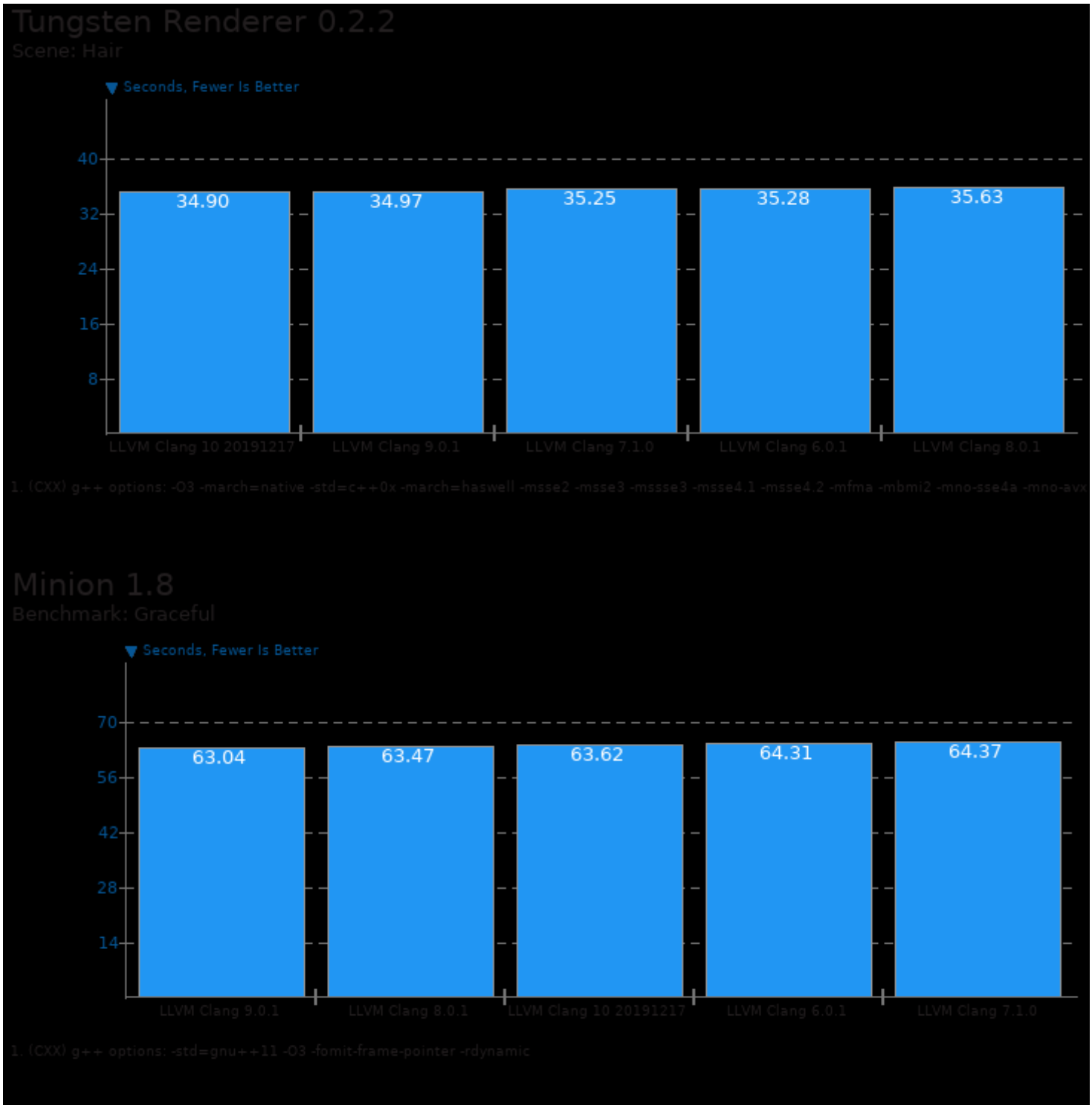
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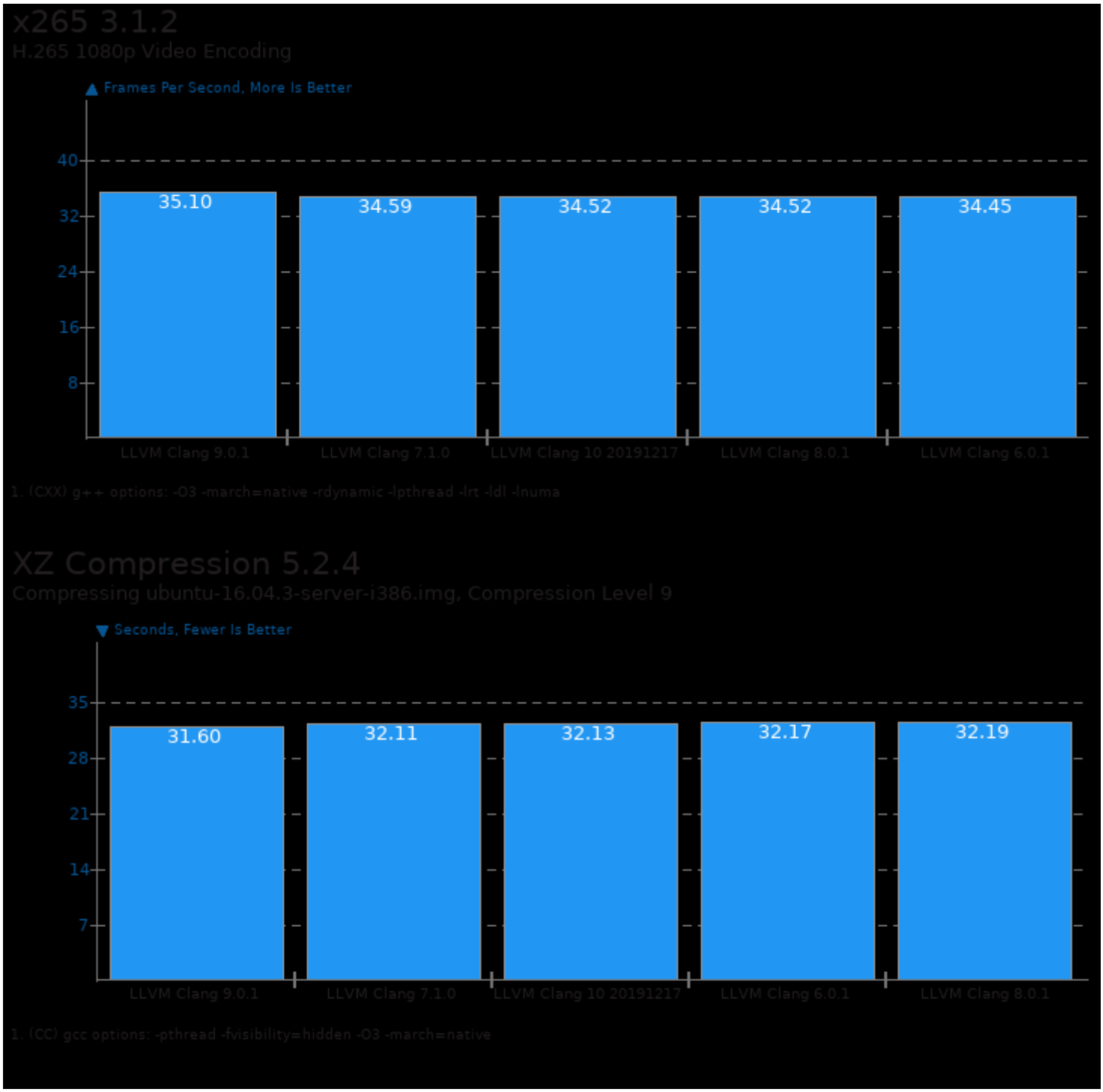
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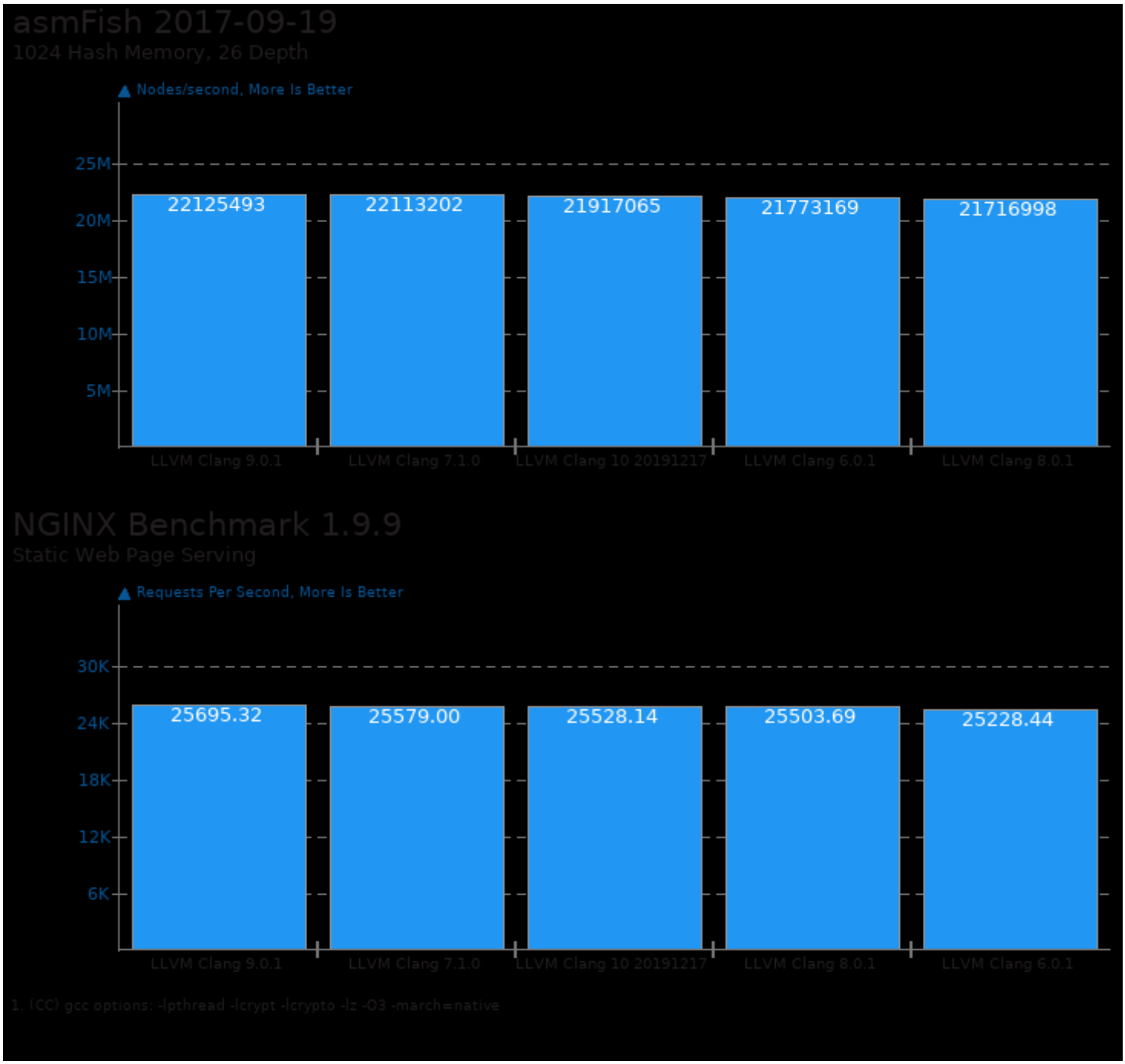
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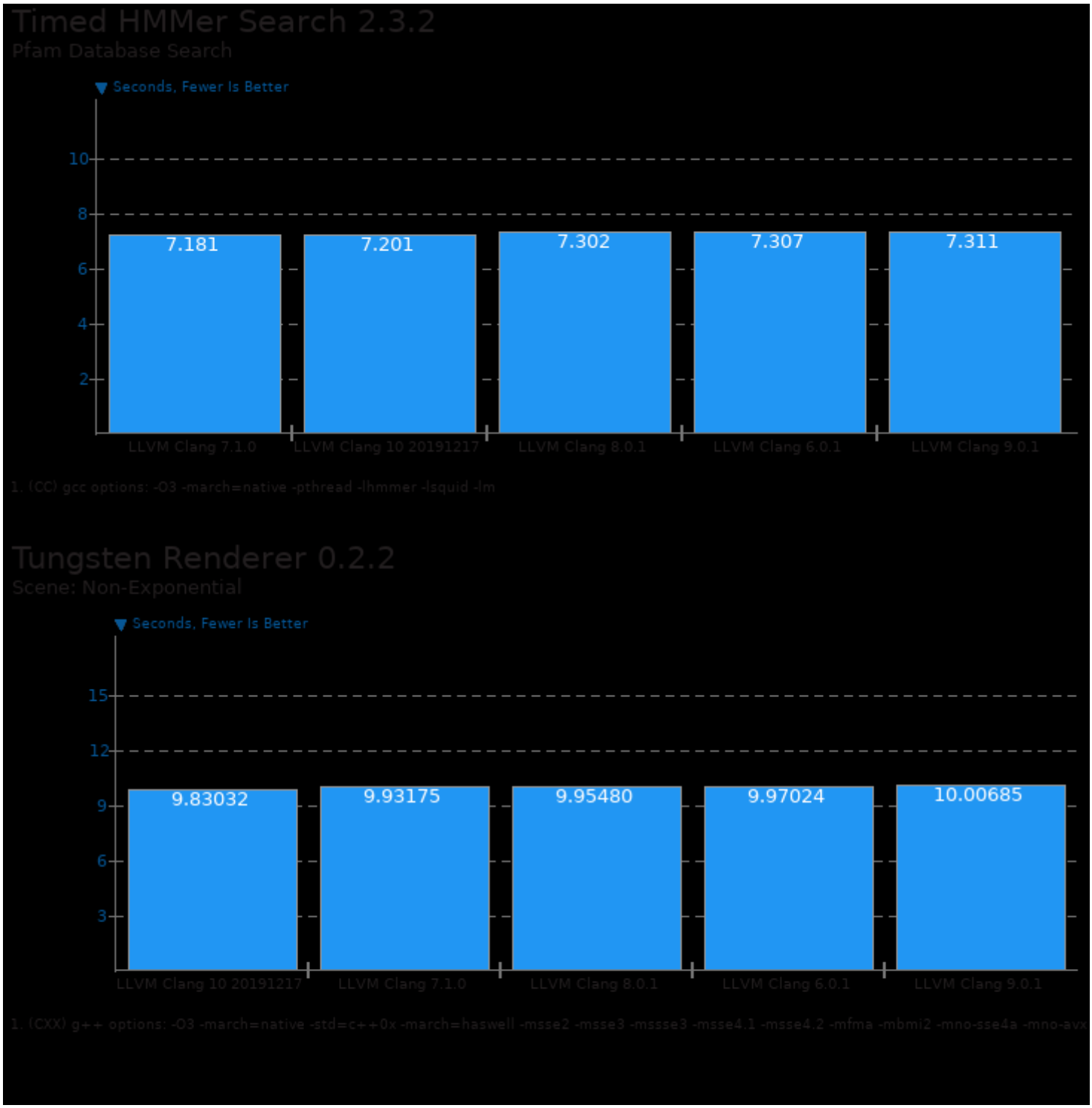
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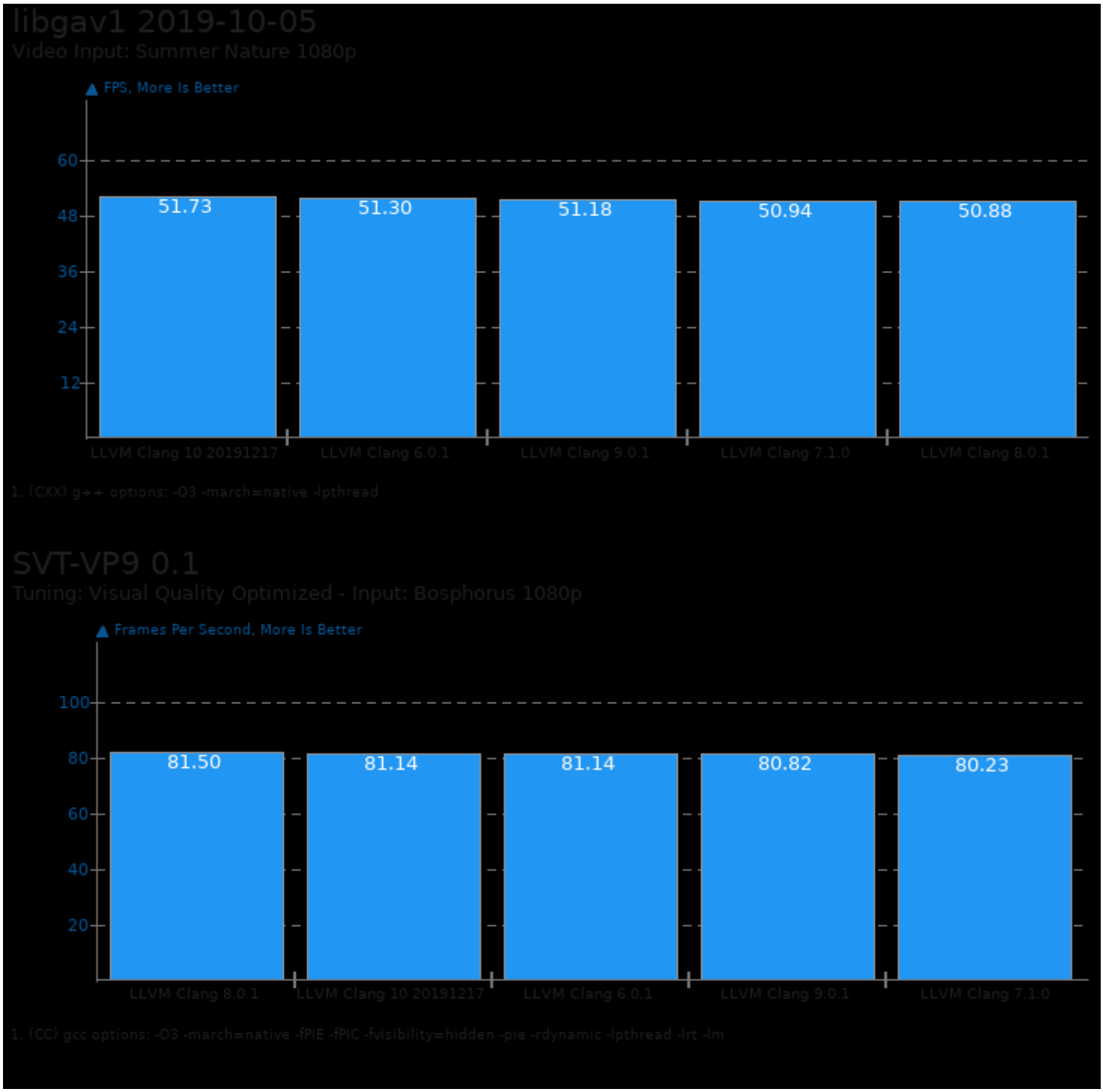
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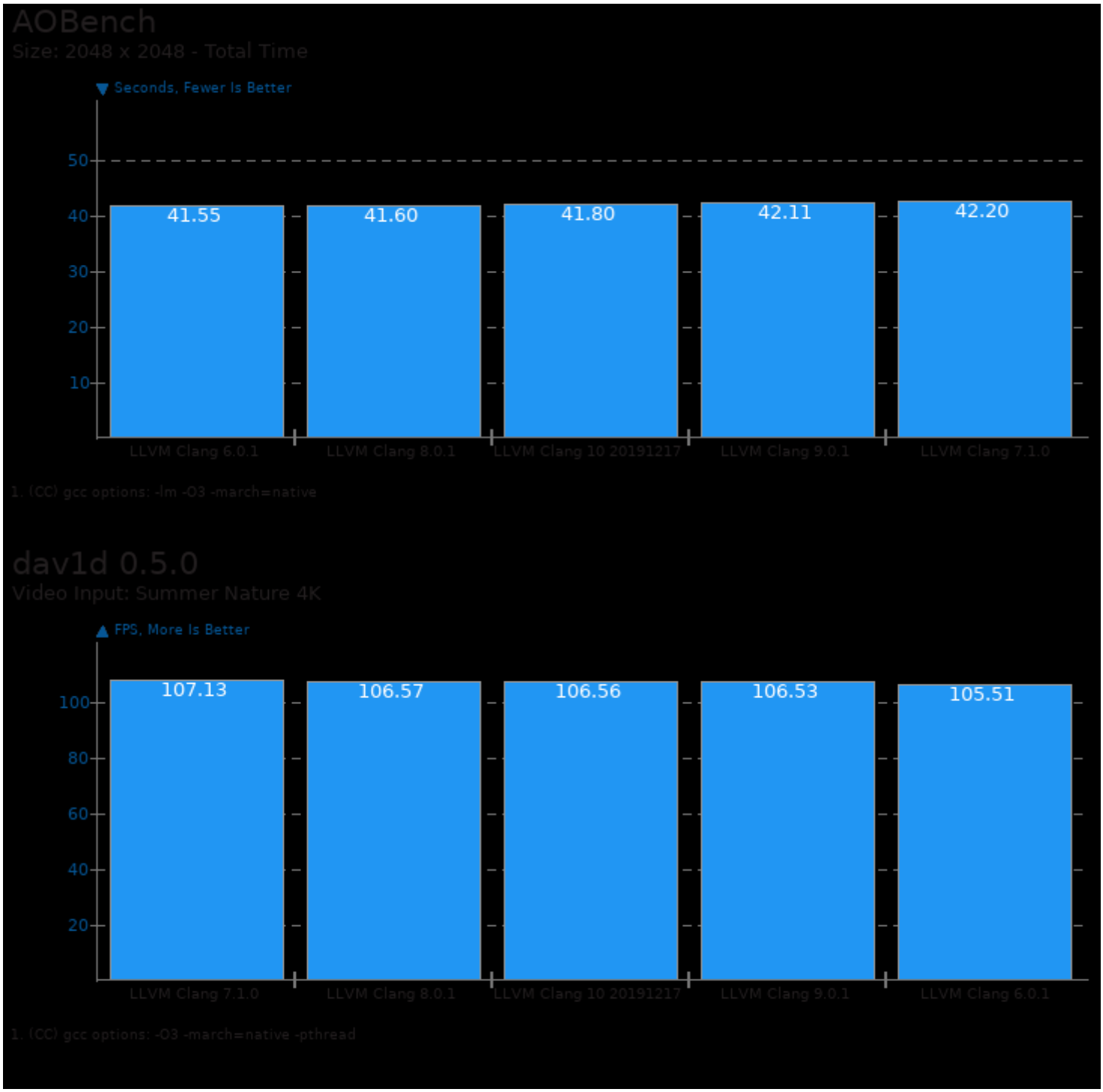
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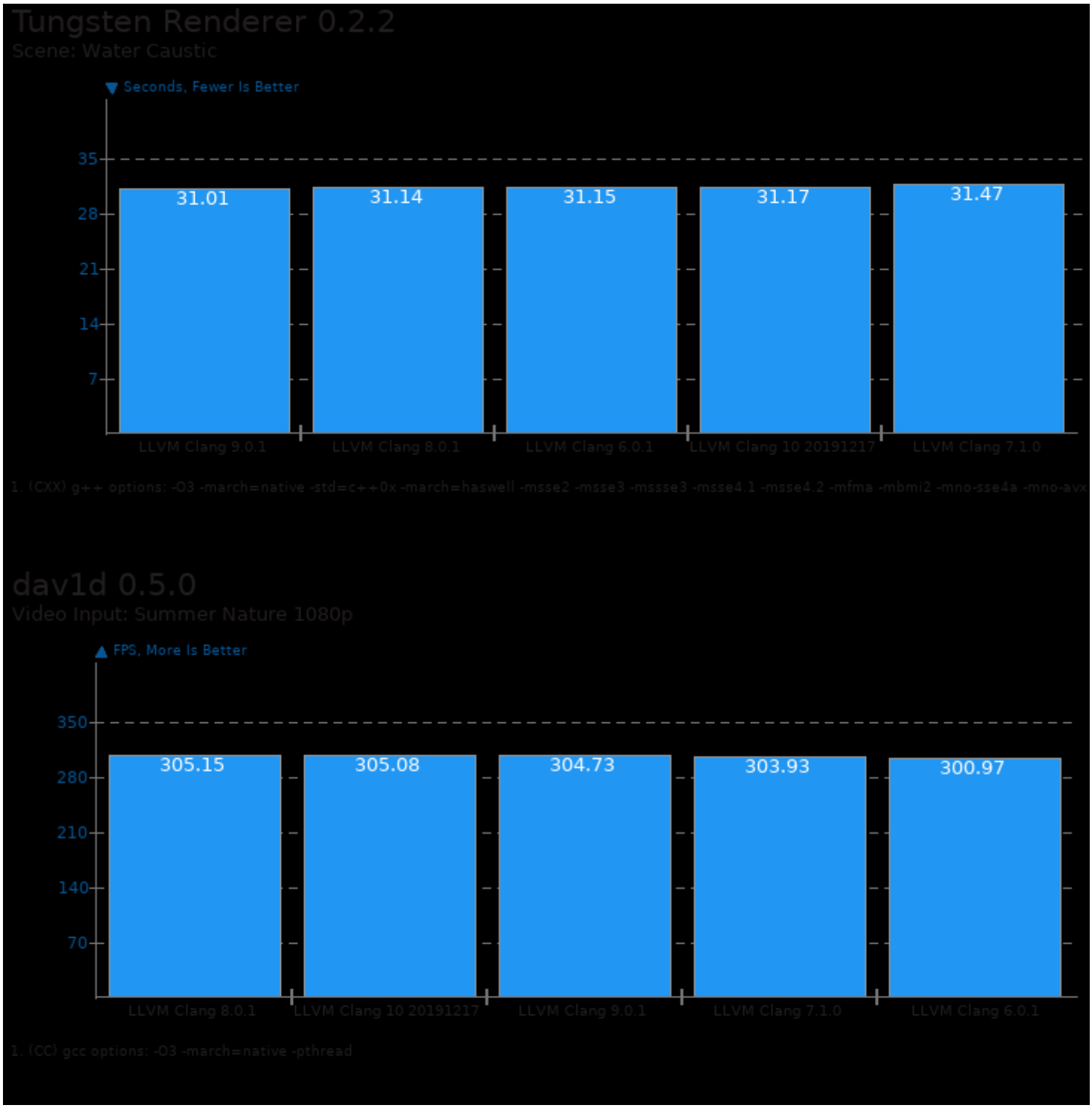
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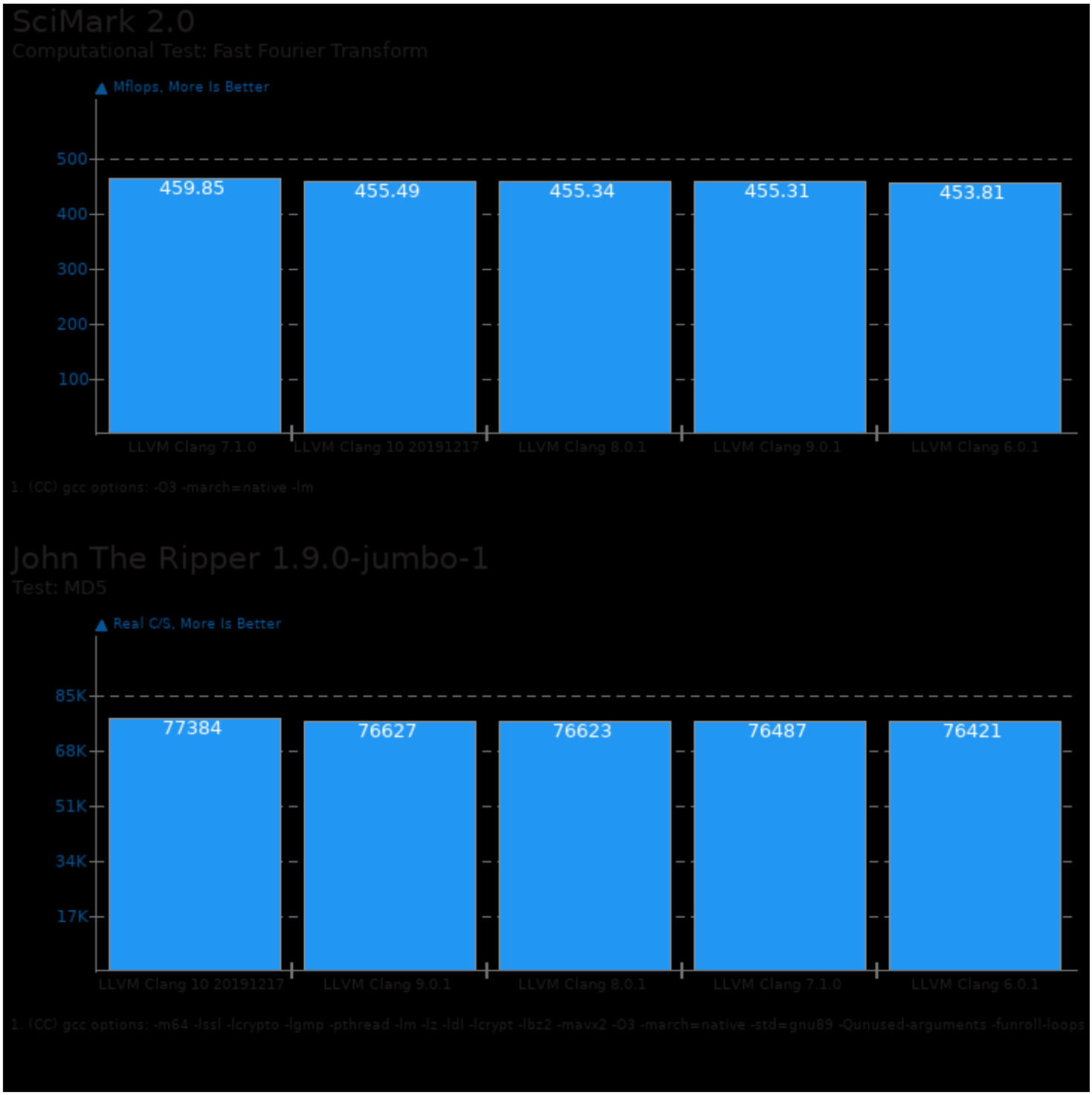
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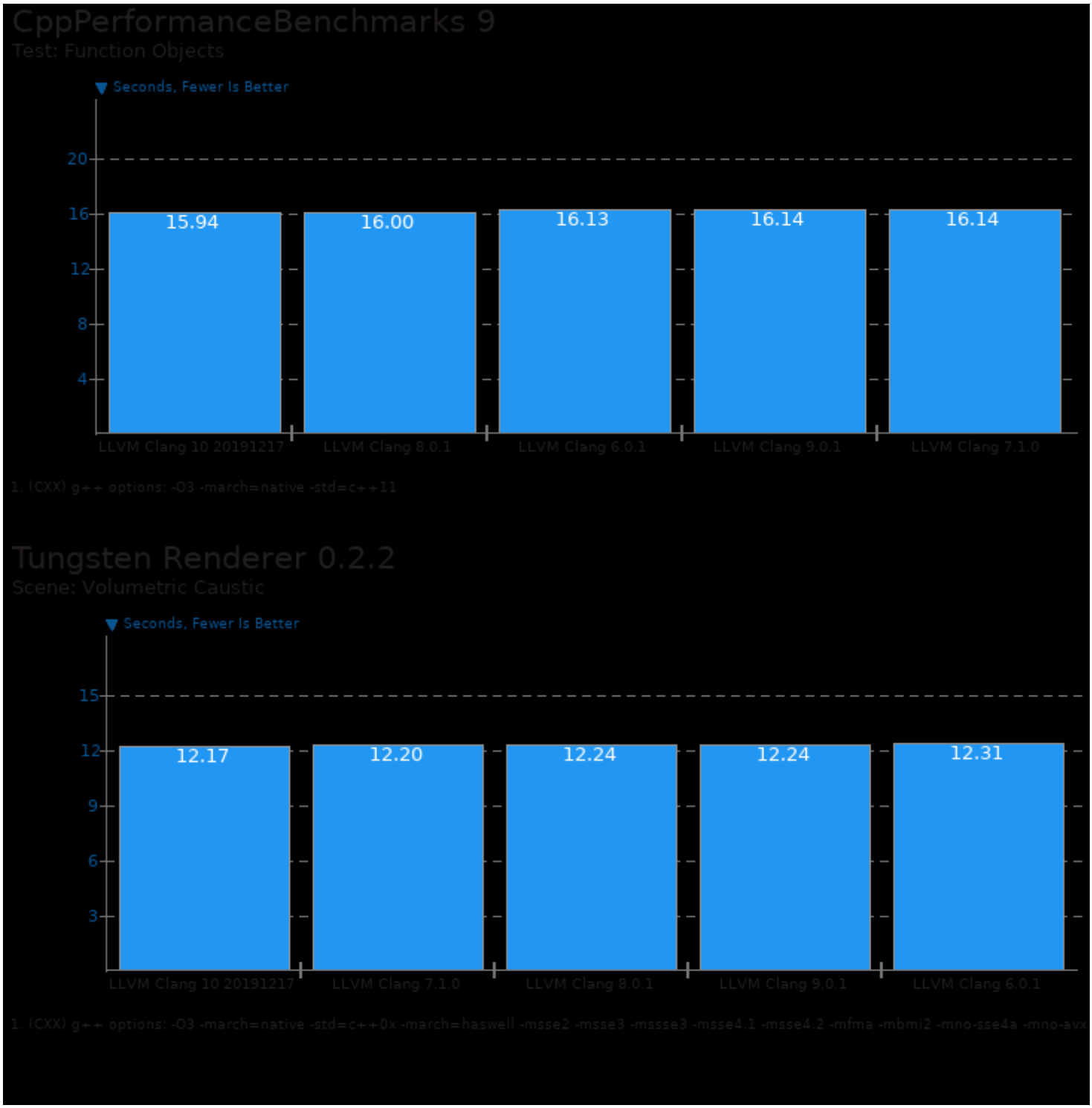
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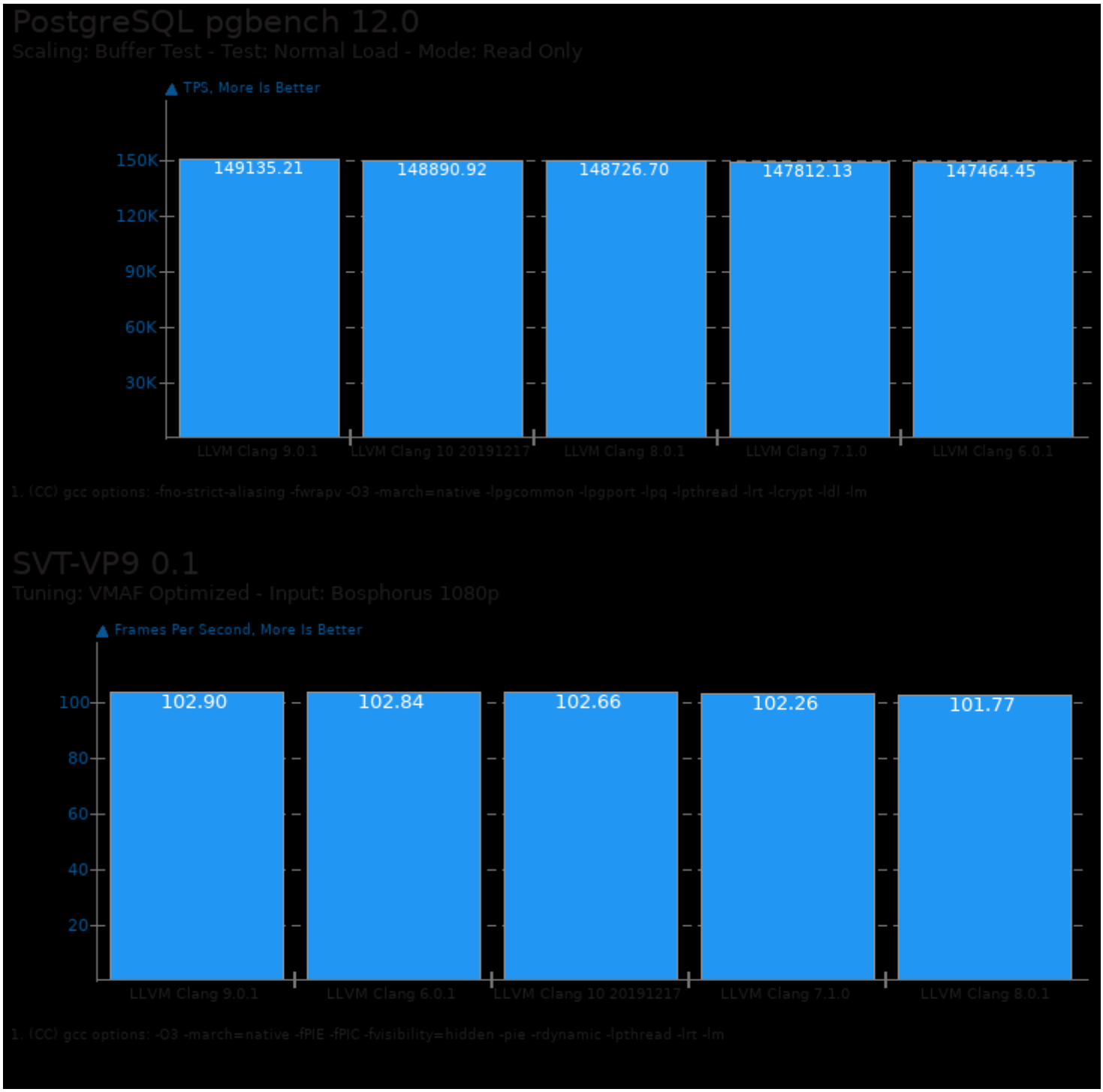
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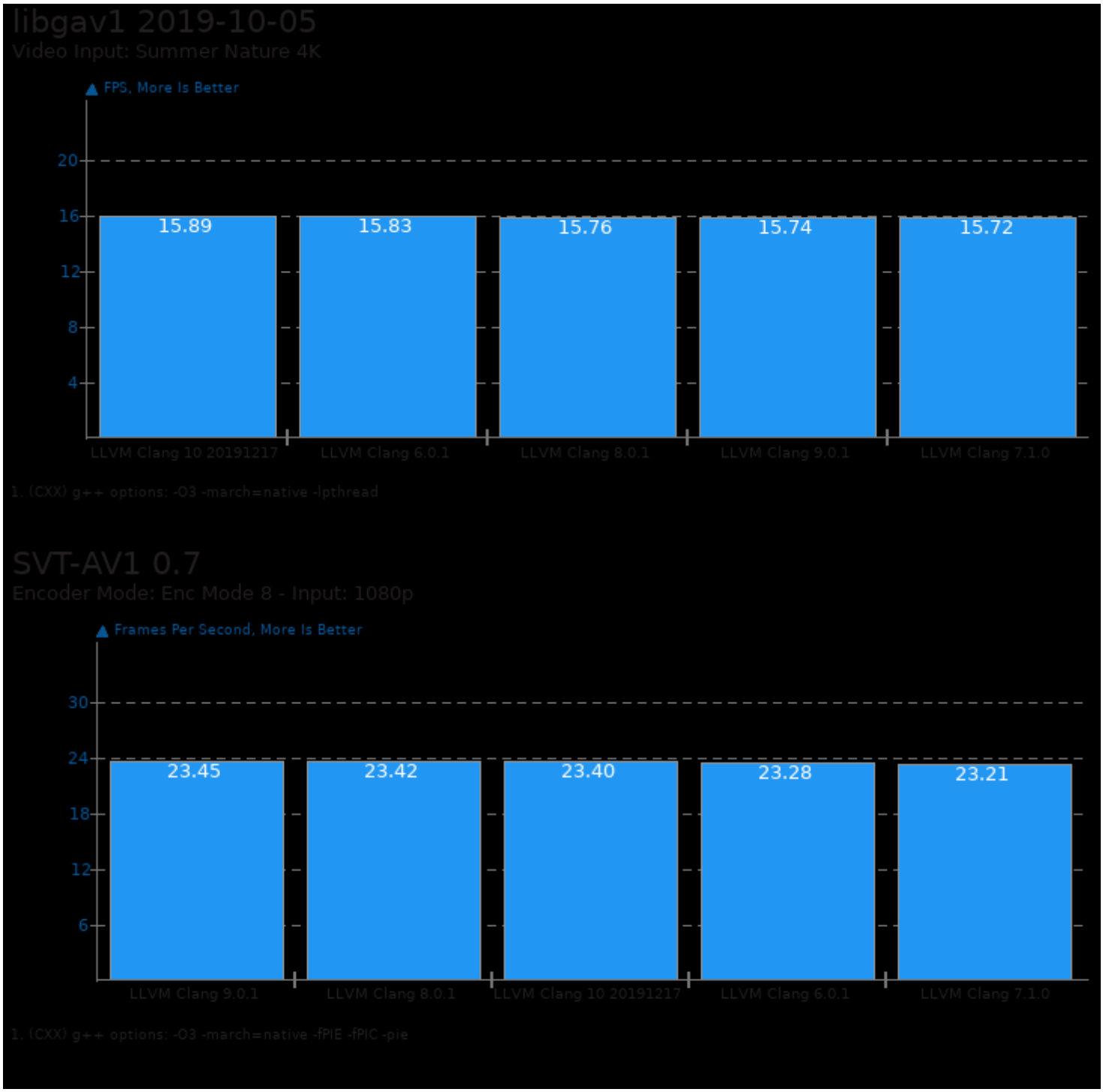
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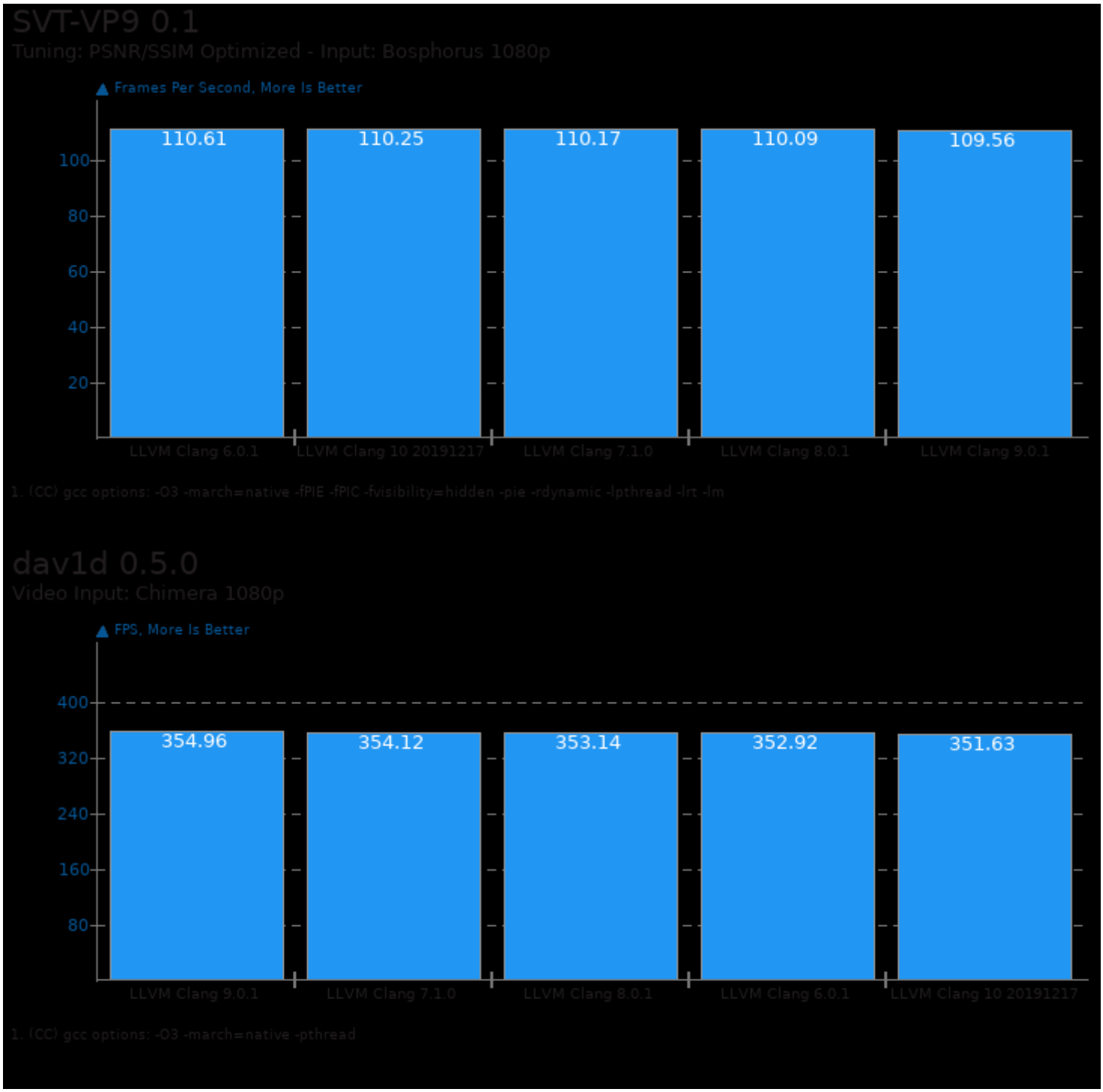
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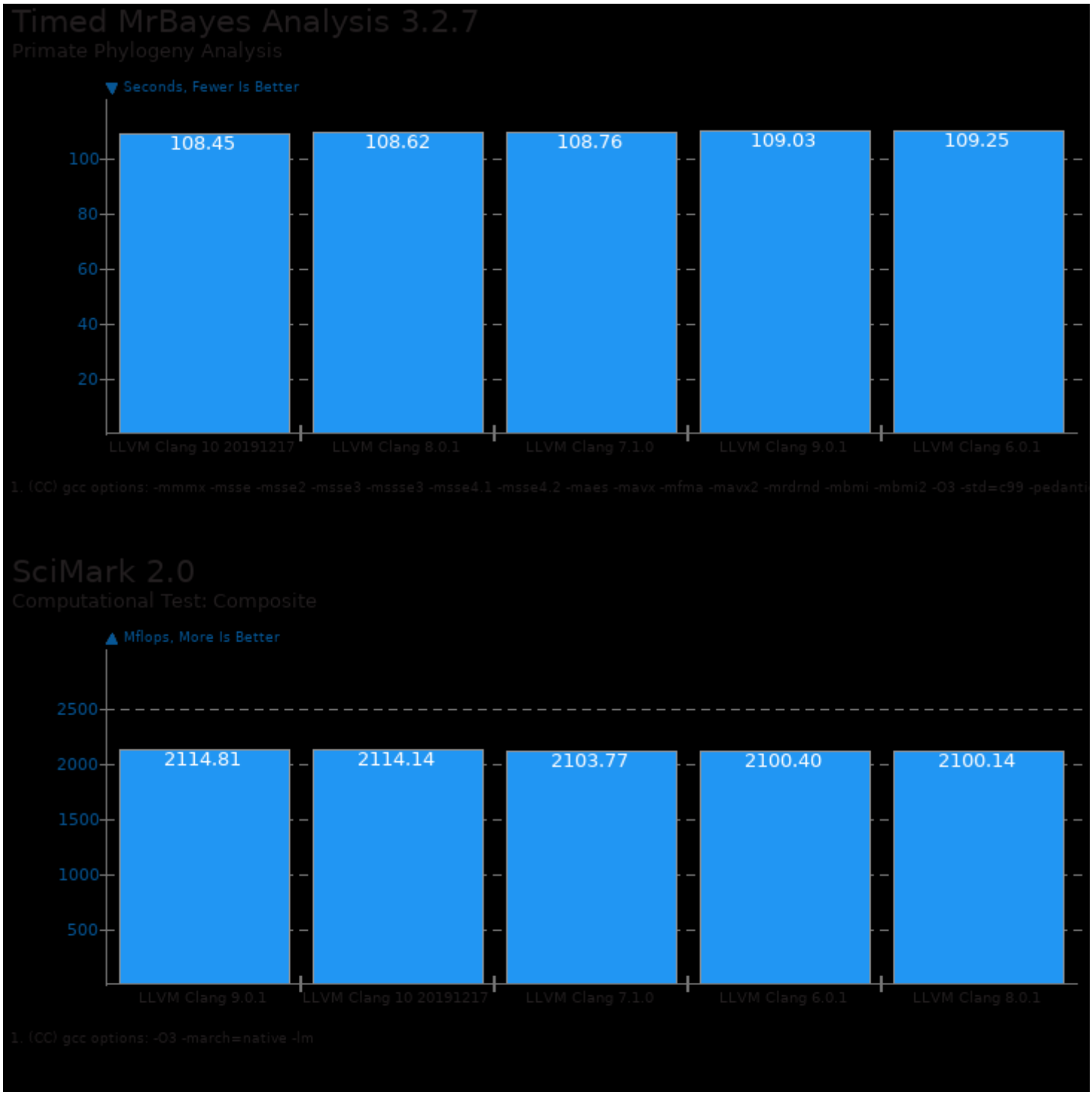
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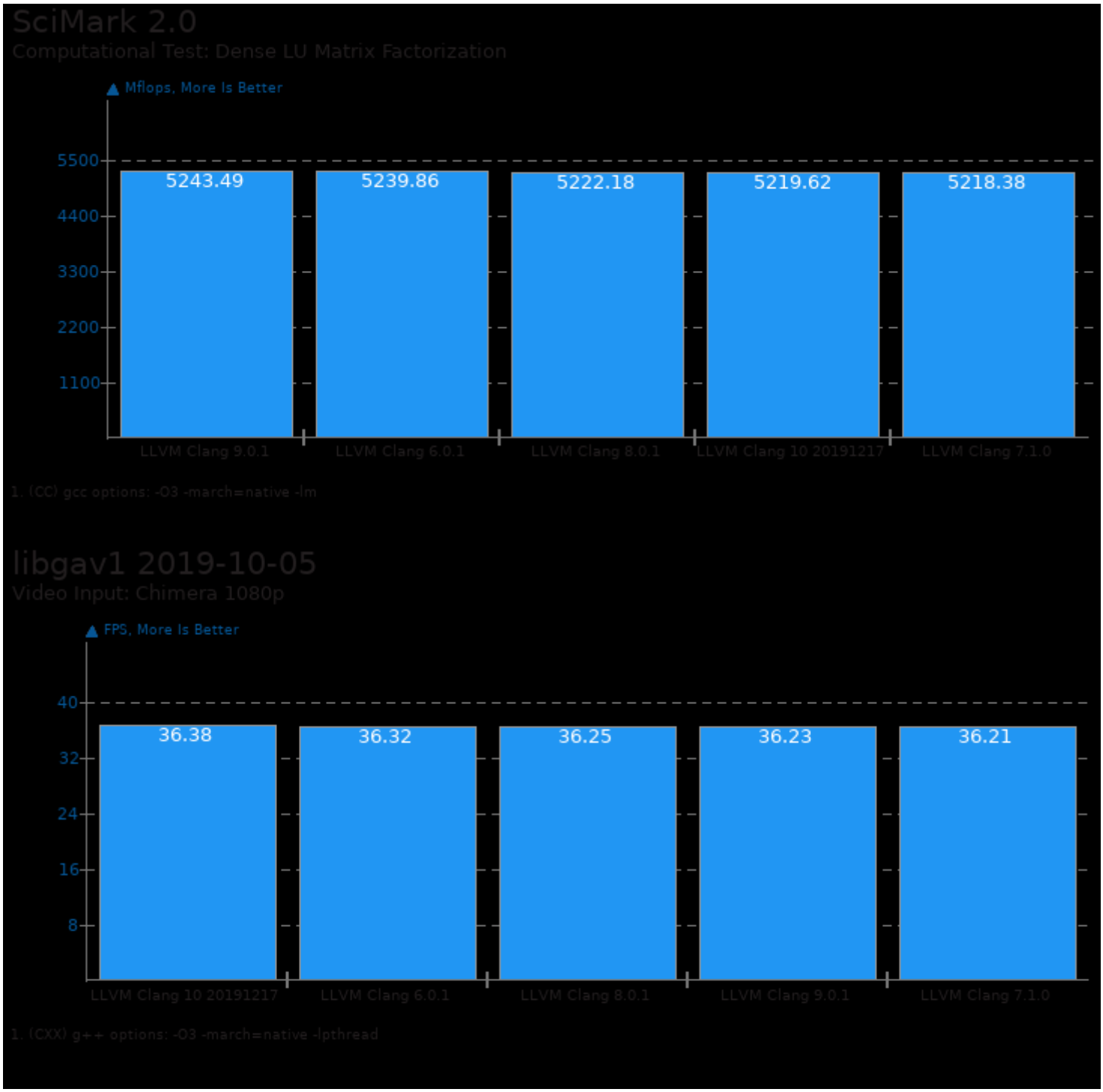
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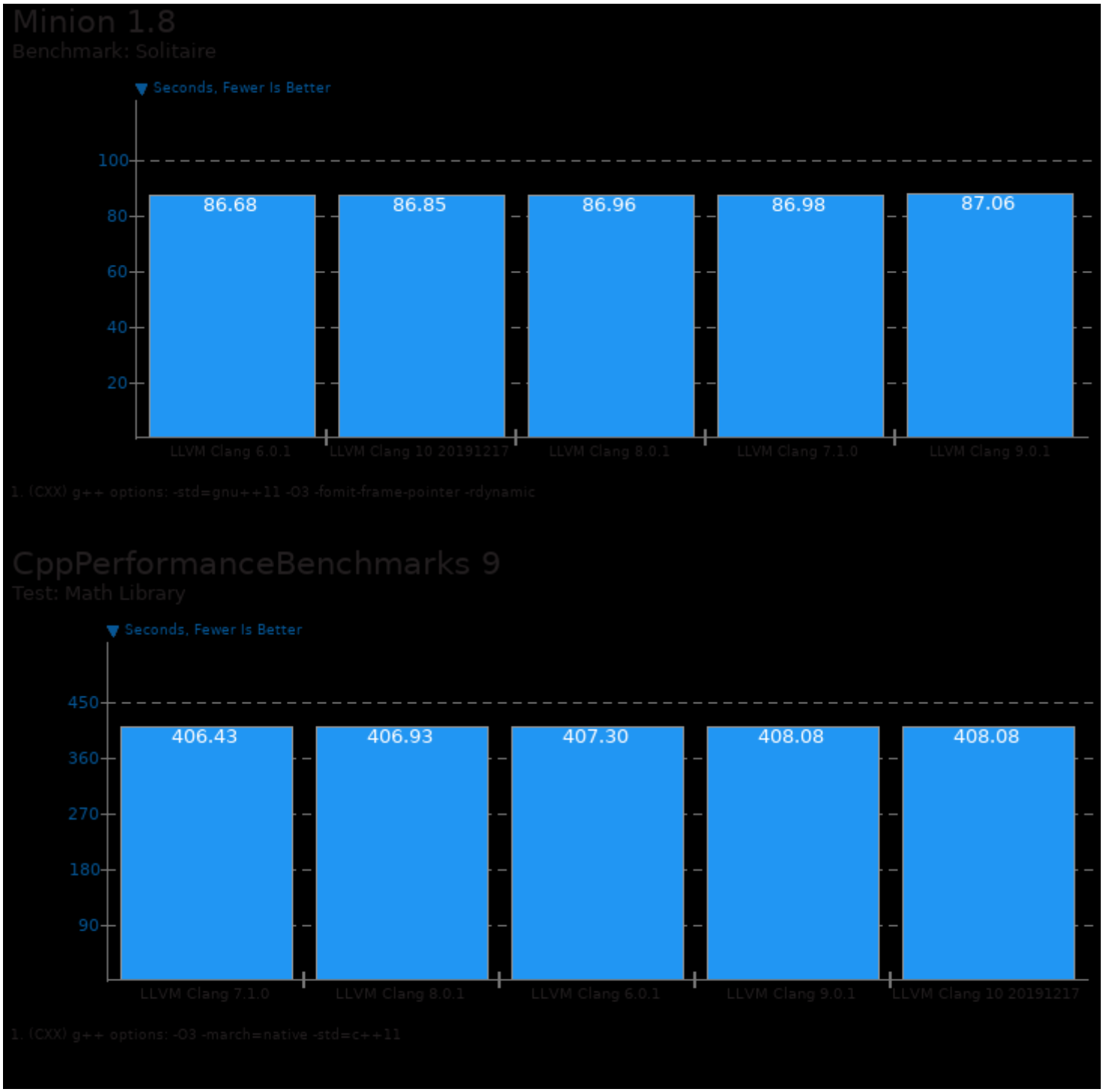
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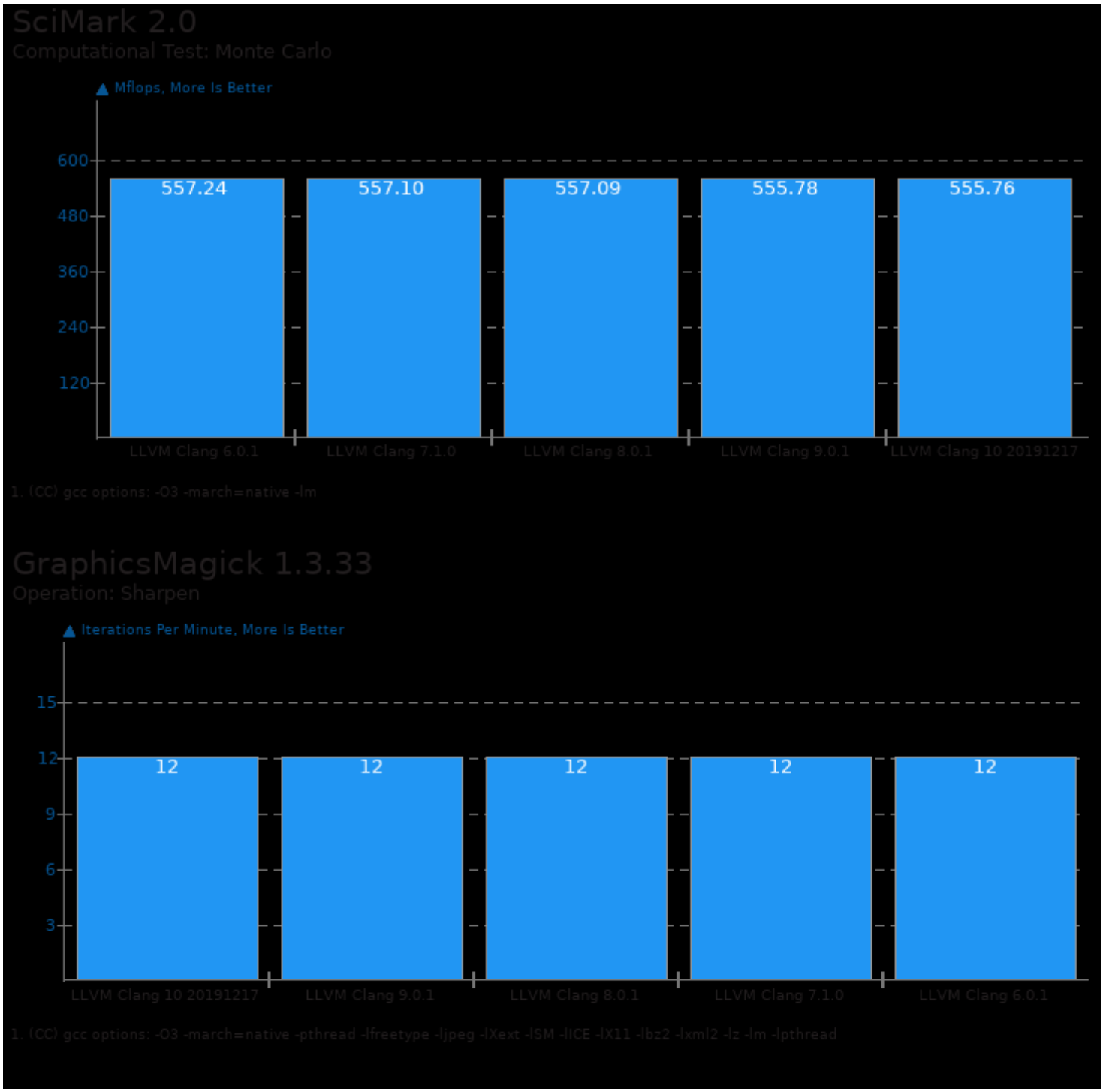
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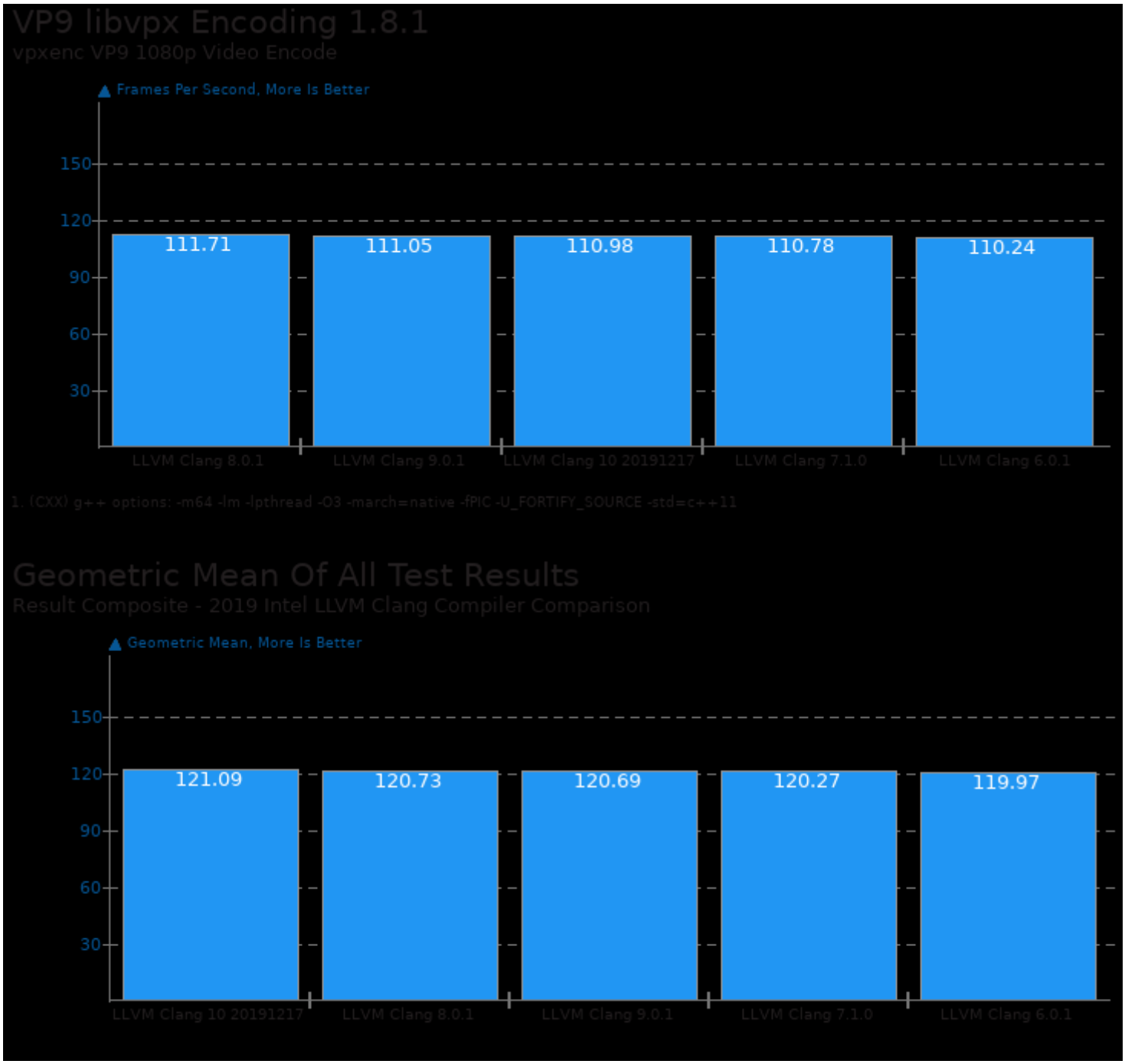
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2019 Intel LLVM Clang Compiler Comparison



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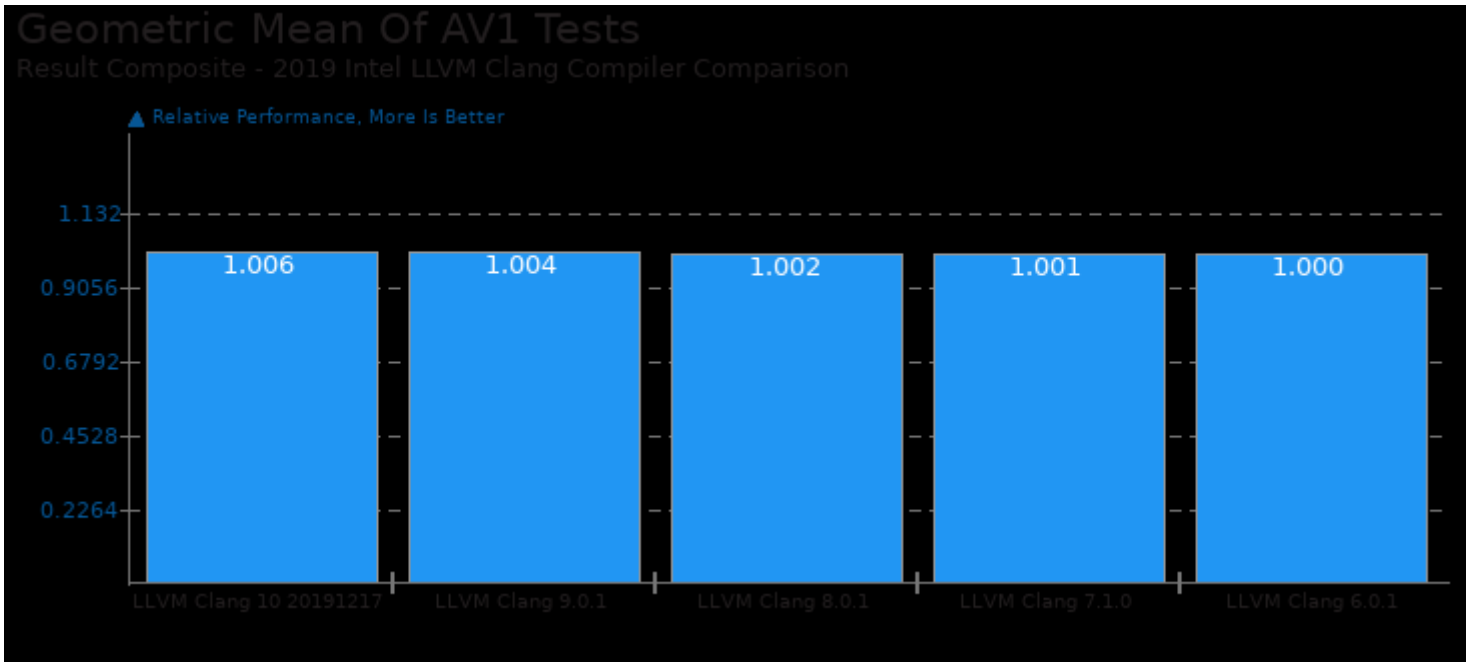


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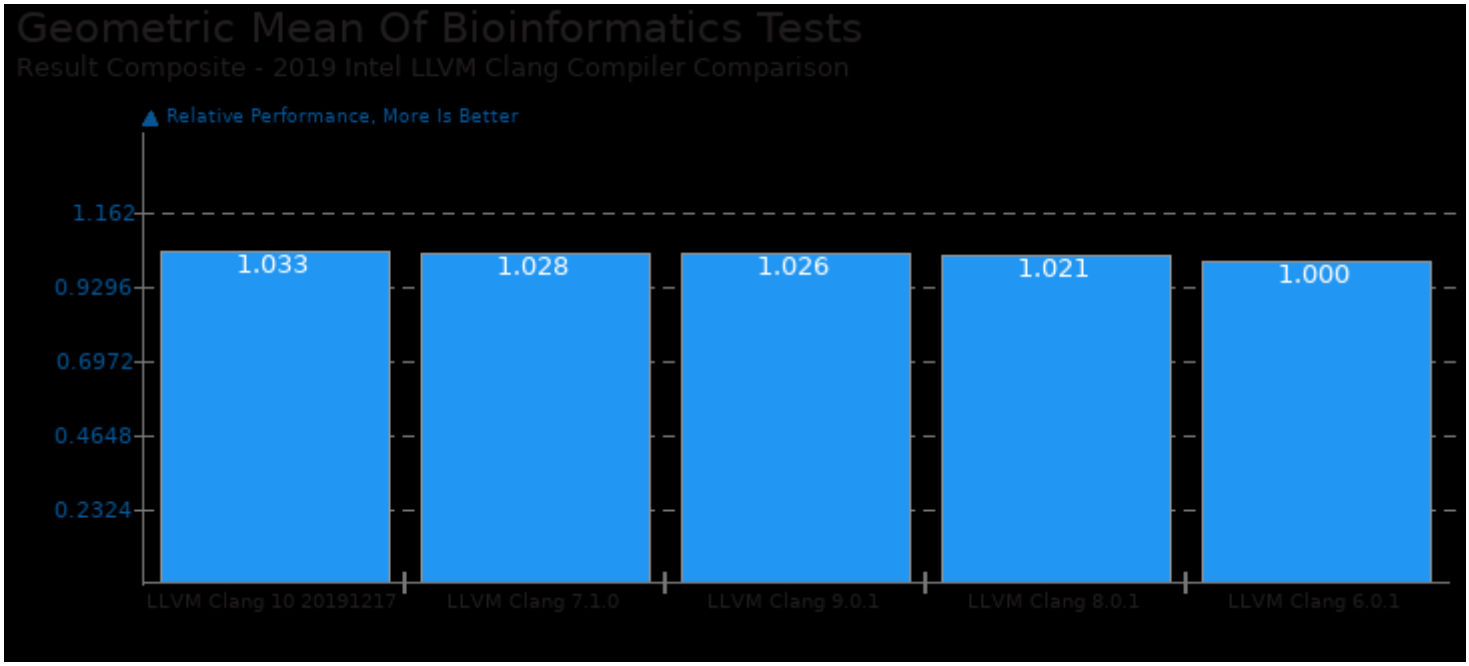


2019 Intel LLVM Clang Compiler Comparison

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

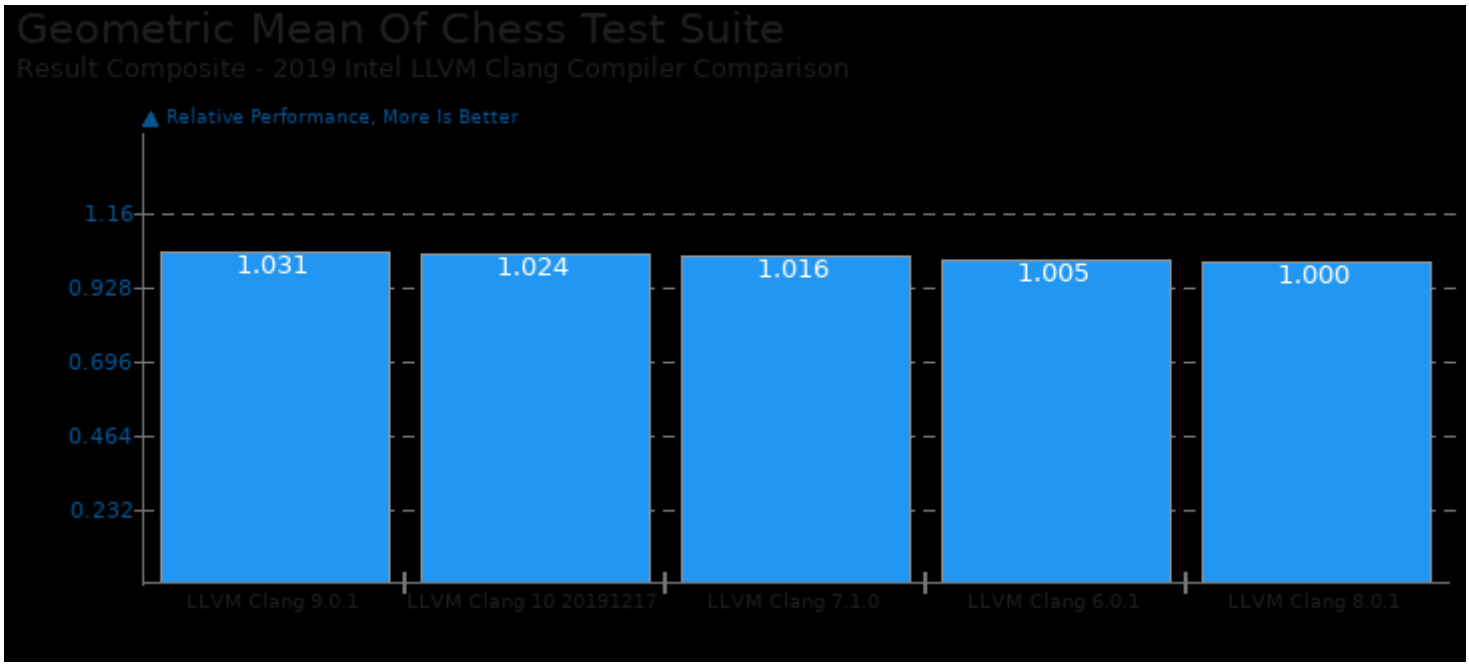


Geometric mean based upon tests: pts/dav1d, pts/svt-av1 and pts/libgav1

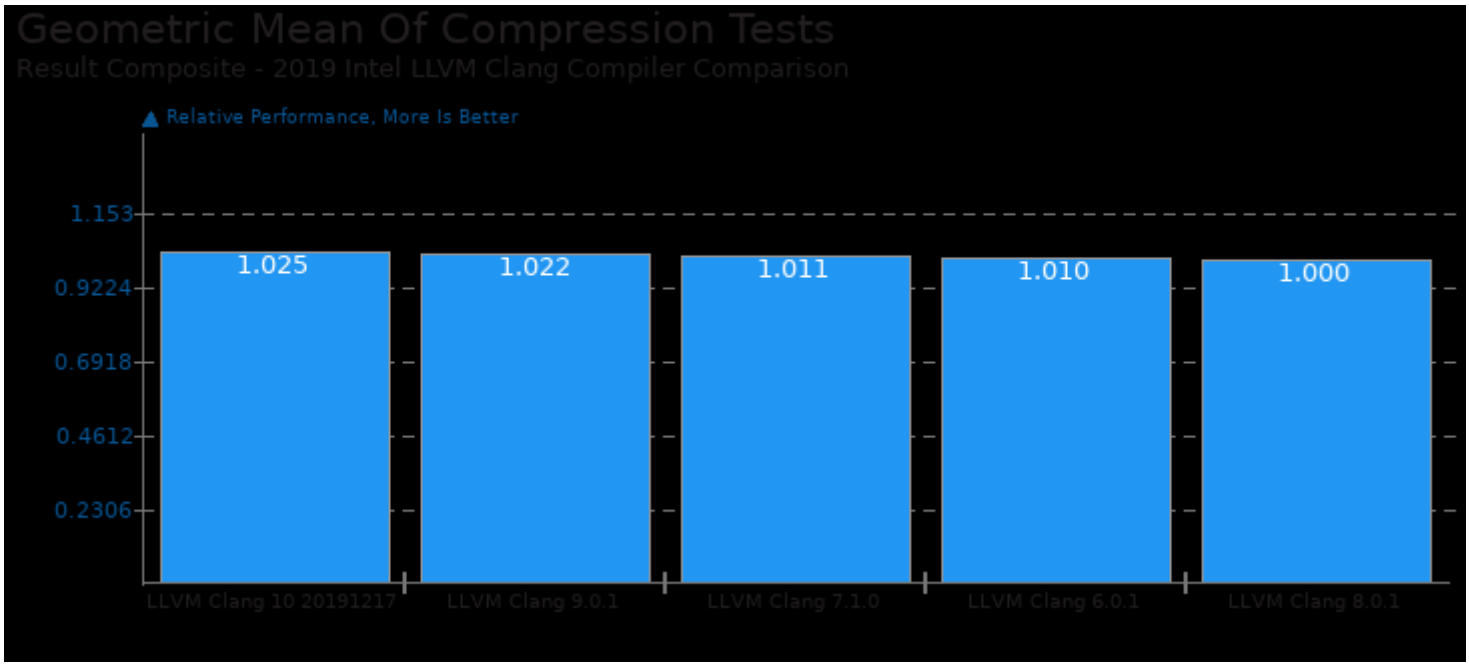


Geometric mean based upon tests: pts/himeno, pts/mrbayes and pts/hmmer

2019 Intel LLVM Clang Compiler Comparison

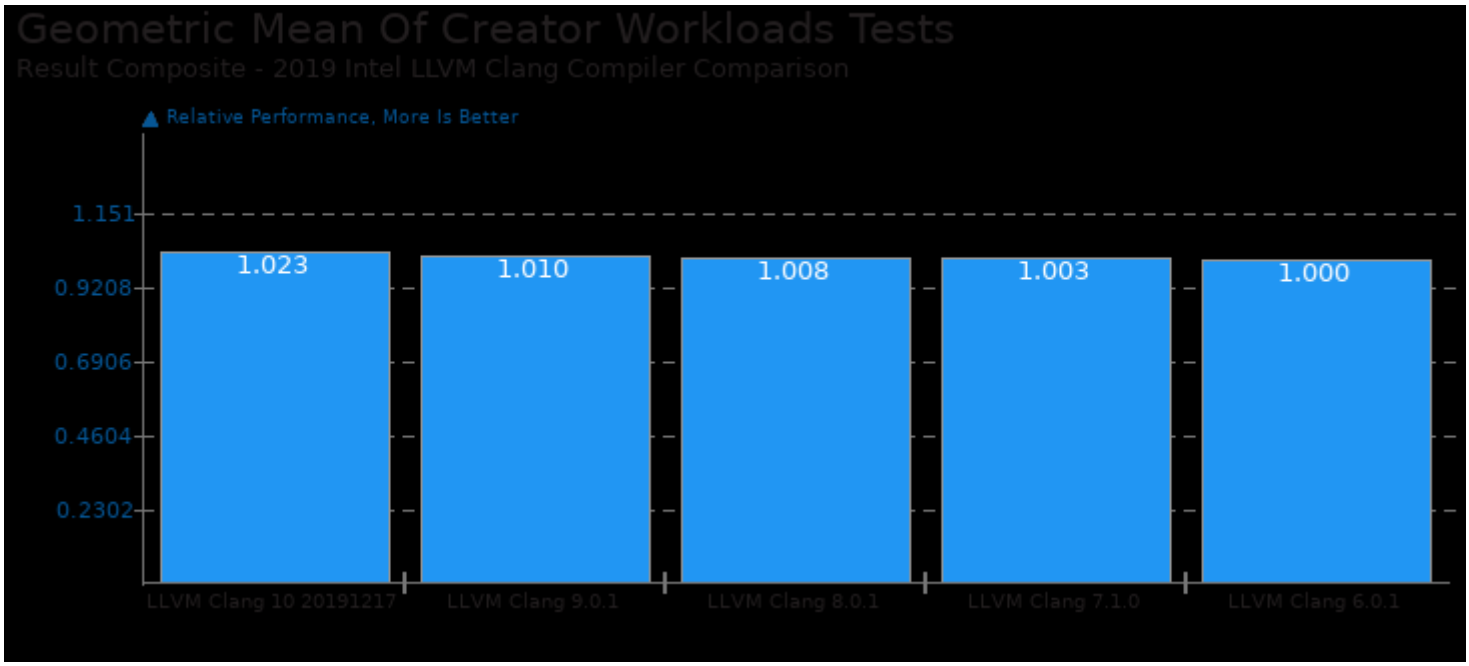


Geometric mean based upon tests: pts/tscp and pts/asmfish

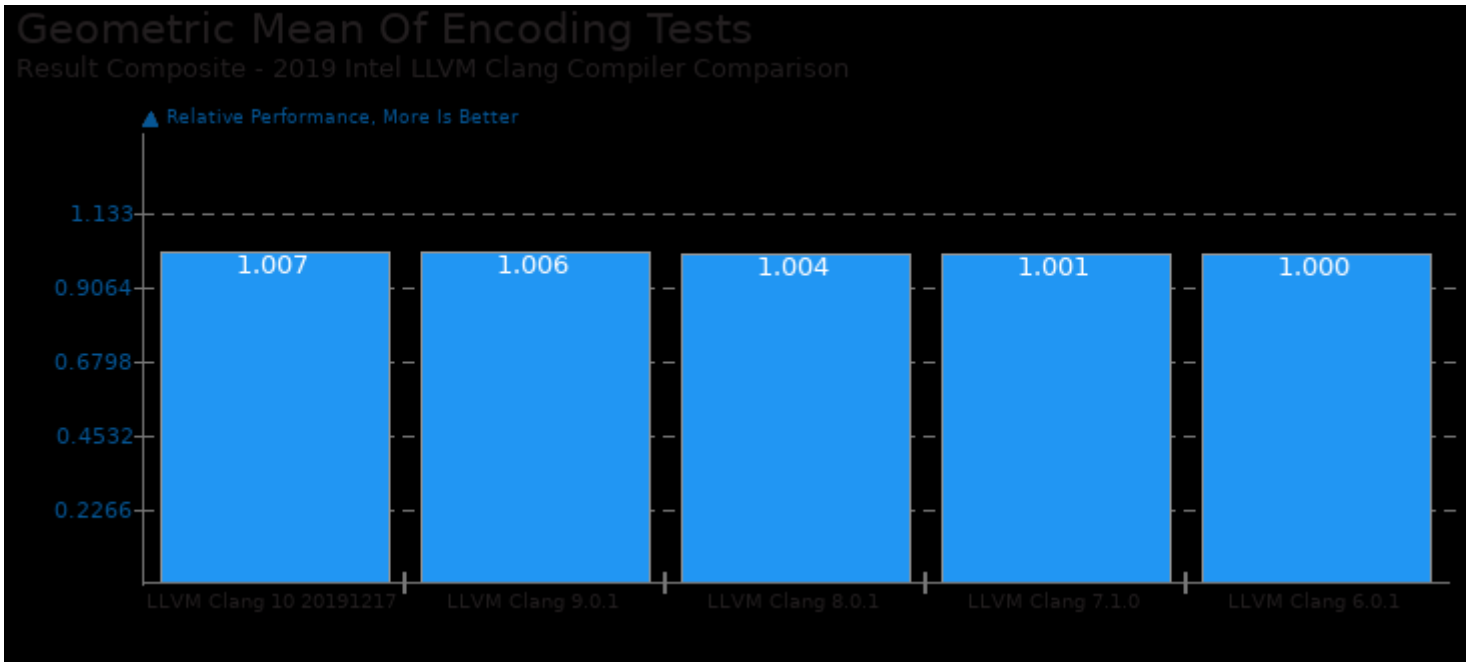


Geometric mean based upon tests: pts/compress-zstd and pts/compress-xz

2019 Intel LLVM Clang Compiler Comparison

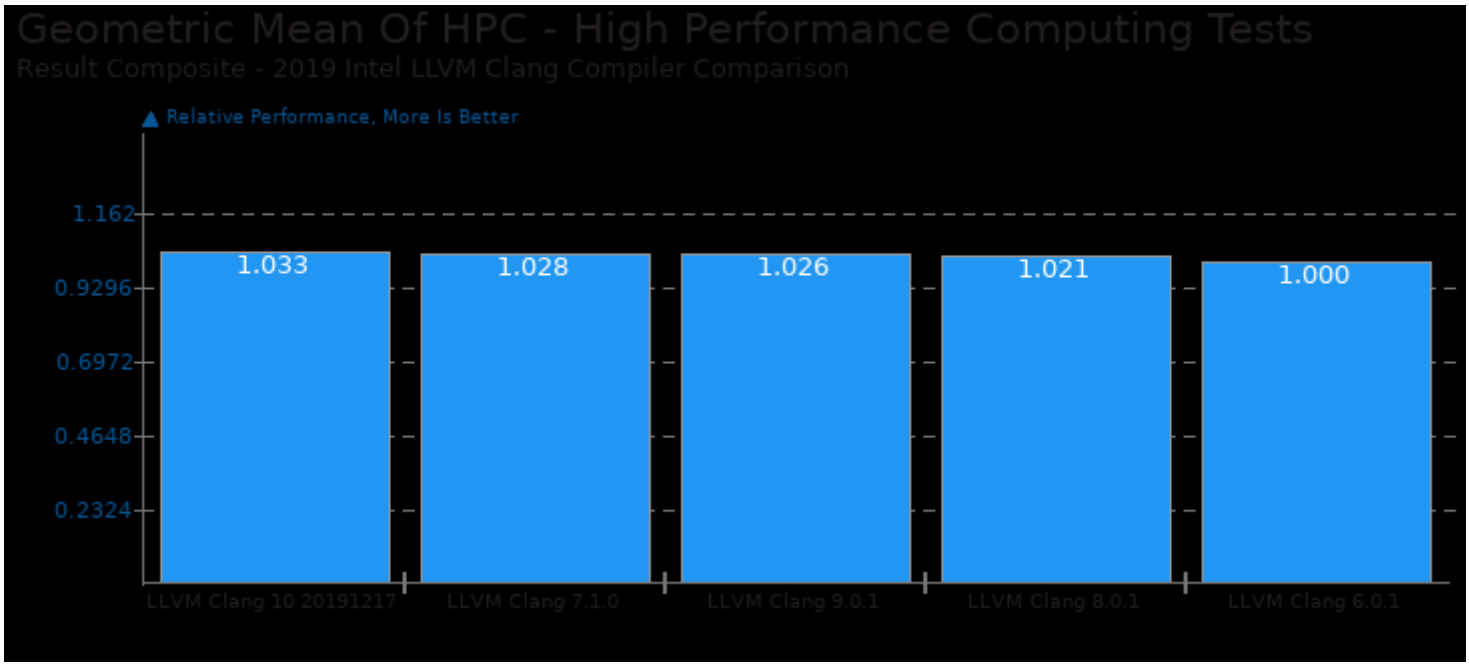


Geometric mean based upon tests: pts/c-ray, pts/tungsten, pts/aobench, pts/svt-vp9, pts/svt-hevc, pts/x264, pts/x265, pts/vpxenc, pts/dav1d, pts/svt-av1, pts/libgav1, pts/graphics-magick and pts/tjbench

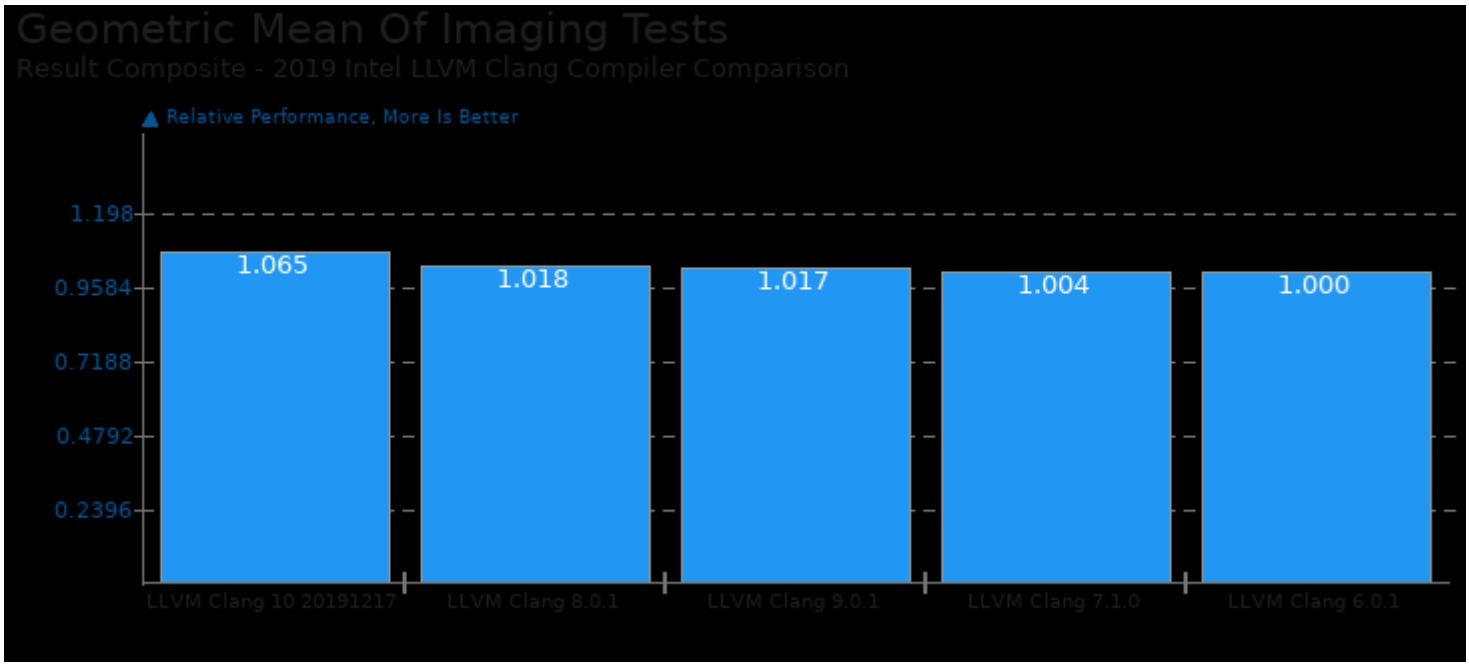


Geometric mean based upon tests: pts/svt-vp9, pts/svt-hevc, pts/x264, pts/x265, pts/vpxenc, pts/dav1d, pts/svt-av1 and pts/libgav1

2019 Intel LLVM Clang Compiler Comparison

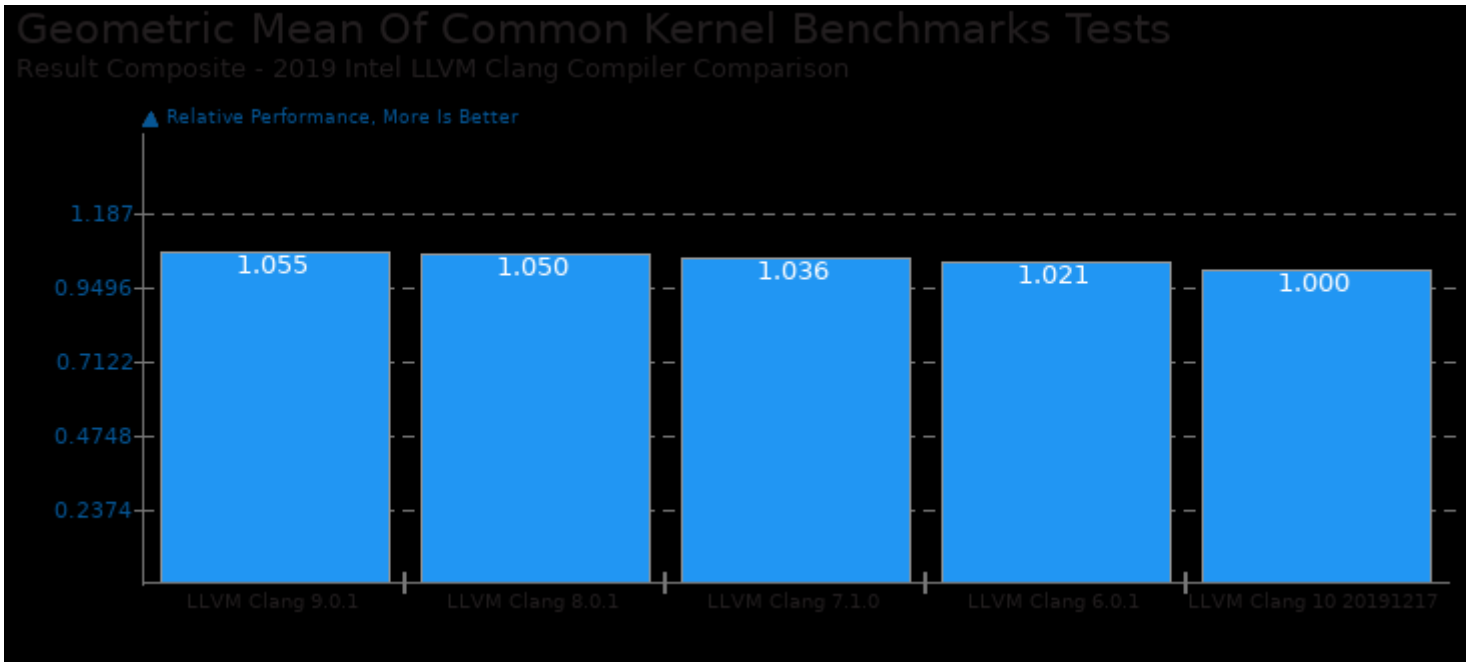


Geometric mean based upon tests: pts/himeno, pts/mrbayes and pts/hmmer

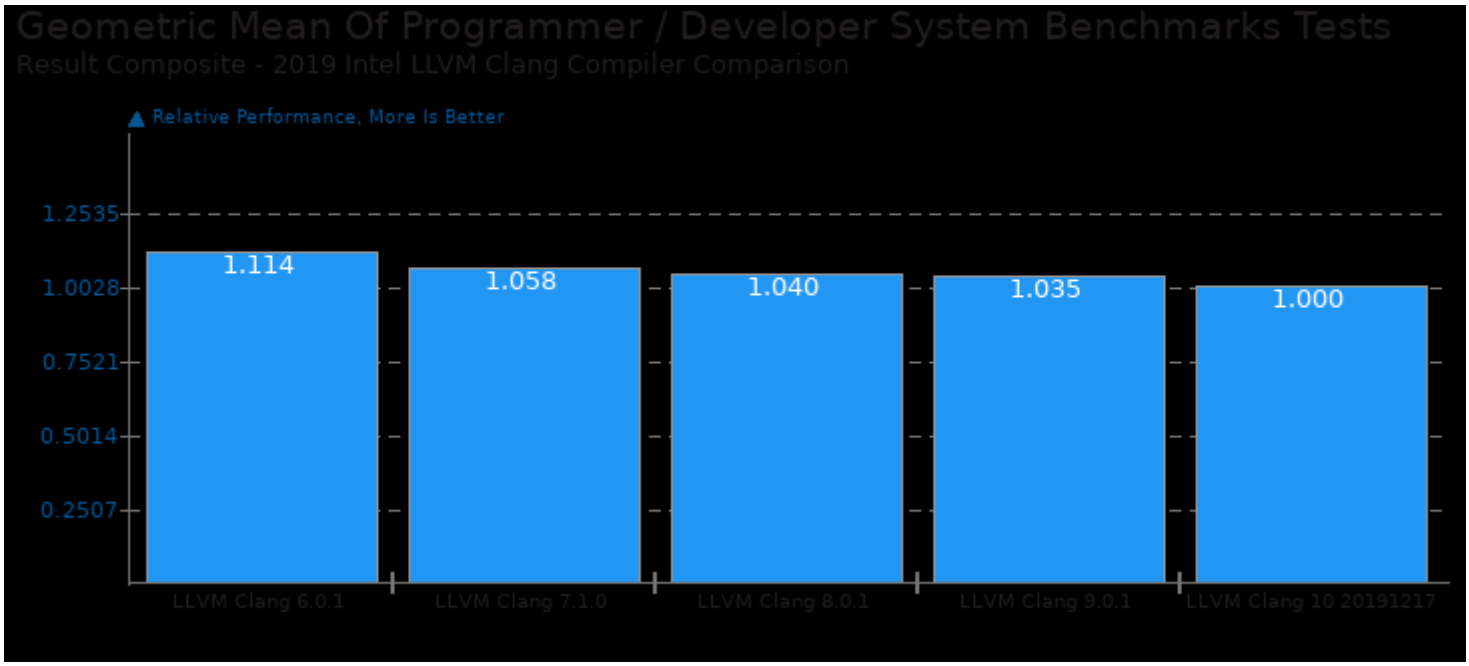


Geometric mean based upon tests: pts/graphics-magick and pts/tjbench

2019 Intel LLVM Clang Compiler Comparison

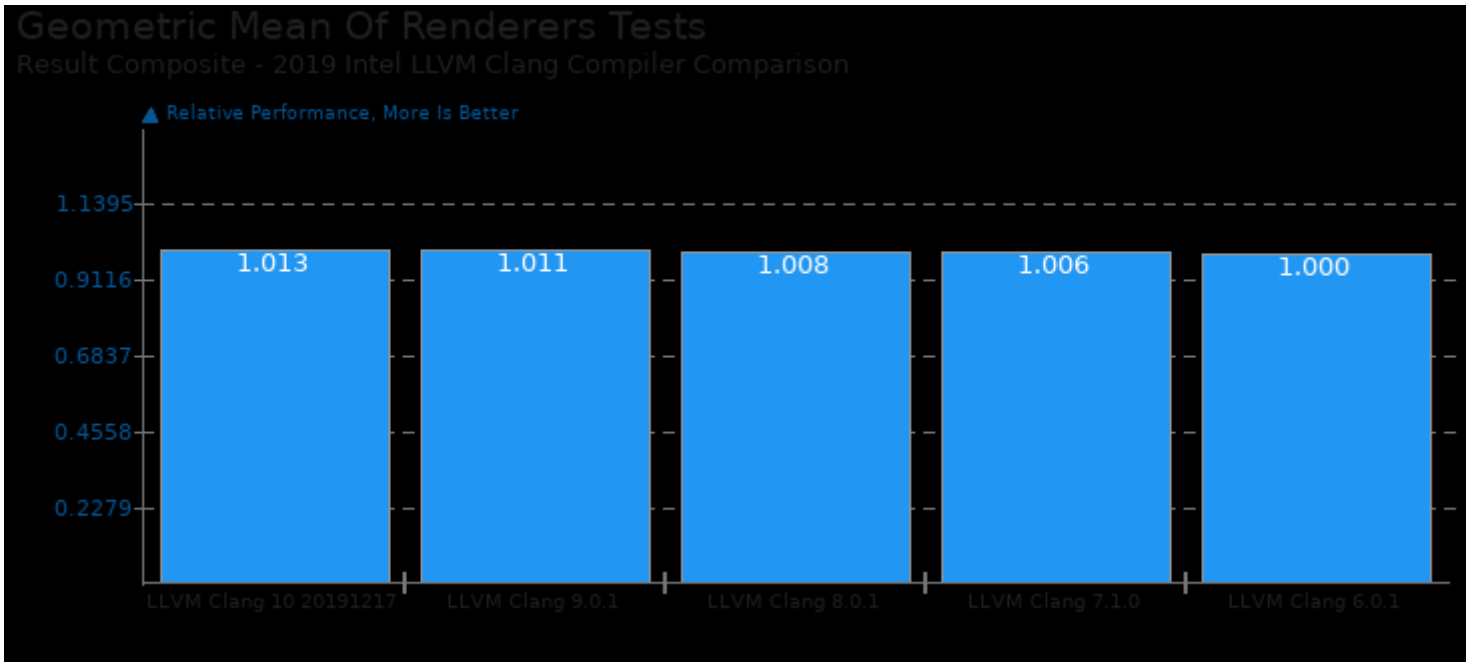


Geometric mean based upon tests: pts/apache and pts/pgbench

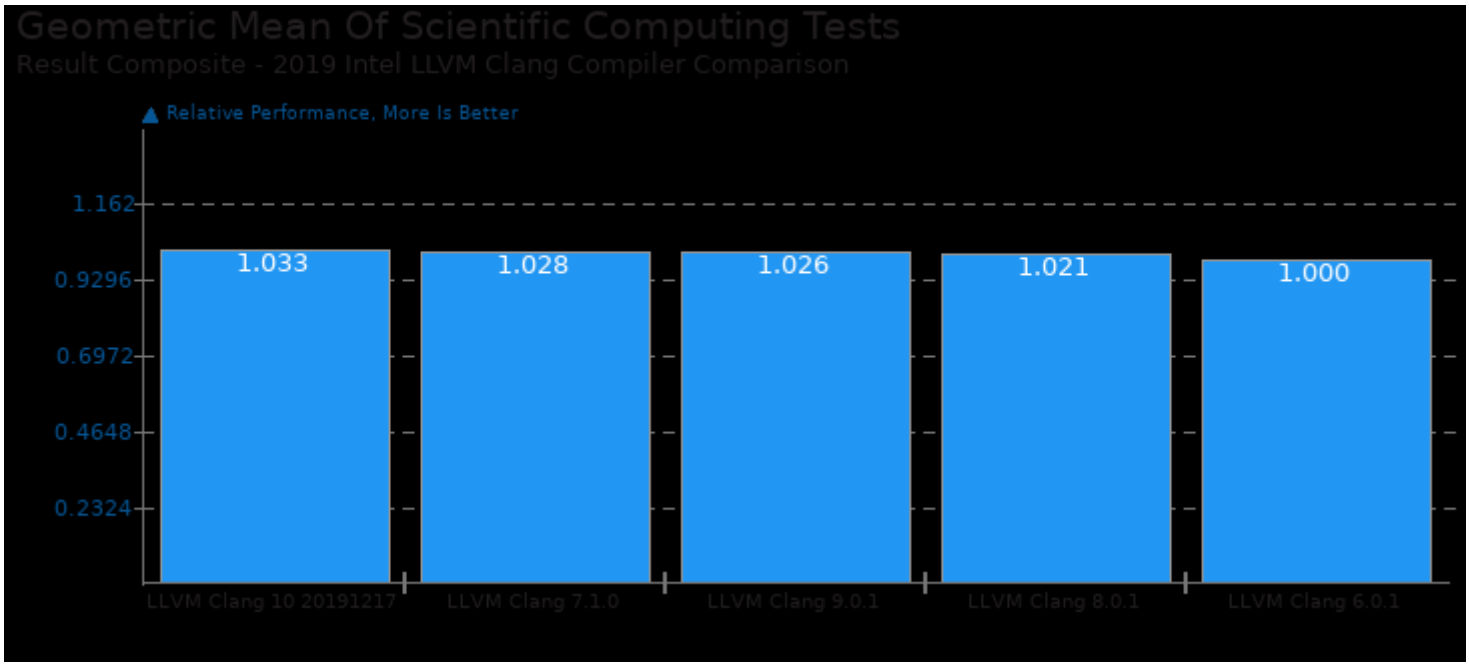


Geometric mean based upon tests: pts/compress-zstd and pts/build-php

2019 Intel LLVM Clang Compiler Comparison

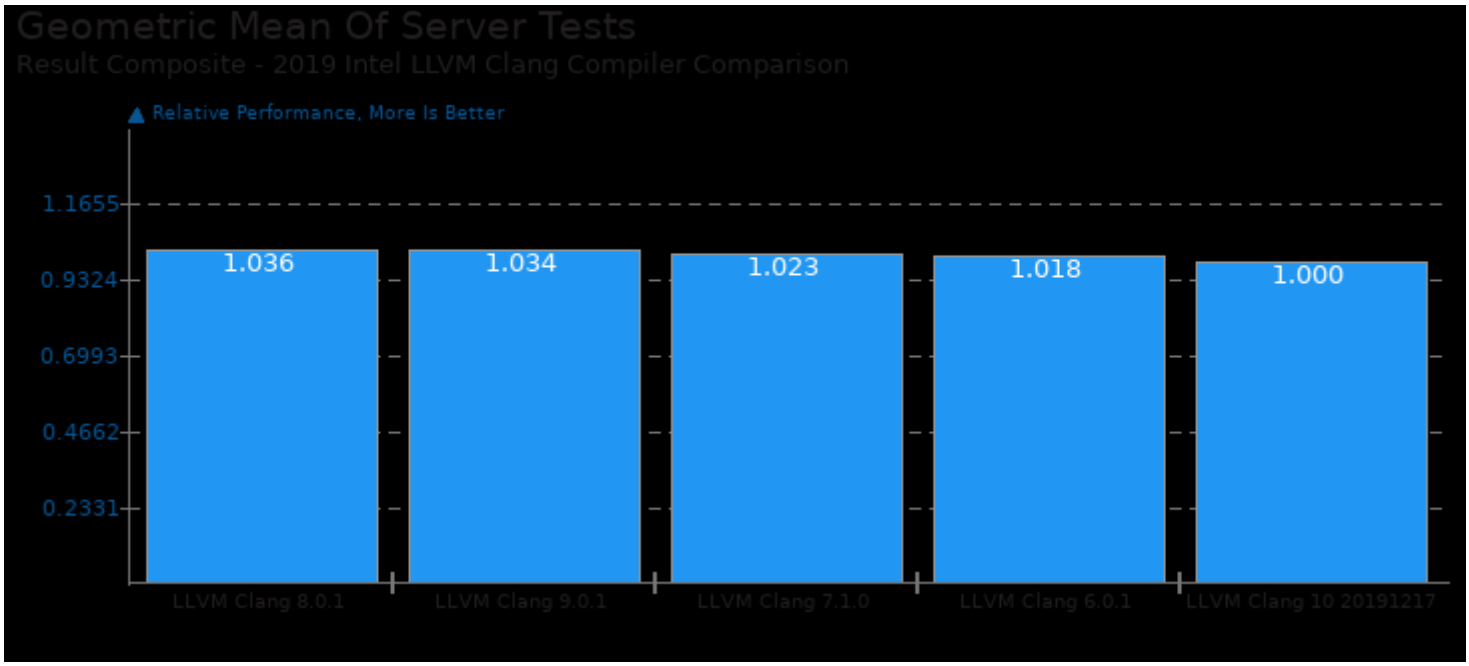


Geometric mean based upon tests: pts/c-ray, pts/tungsten and pts/aobench

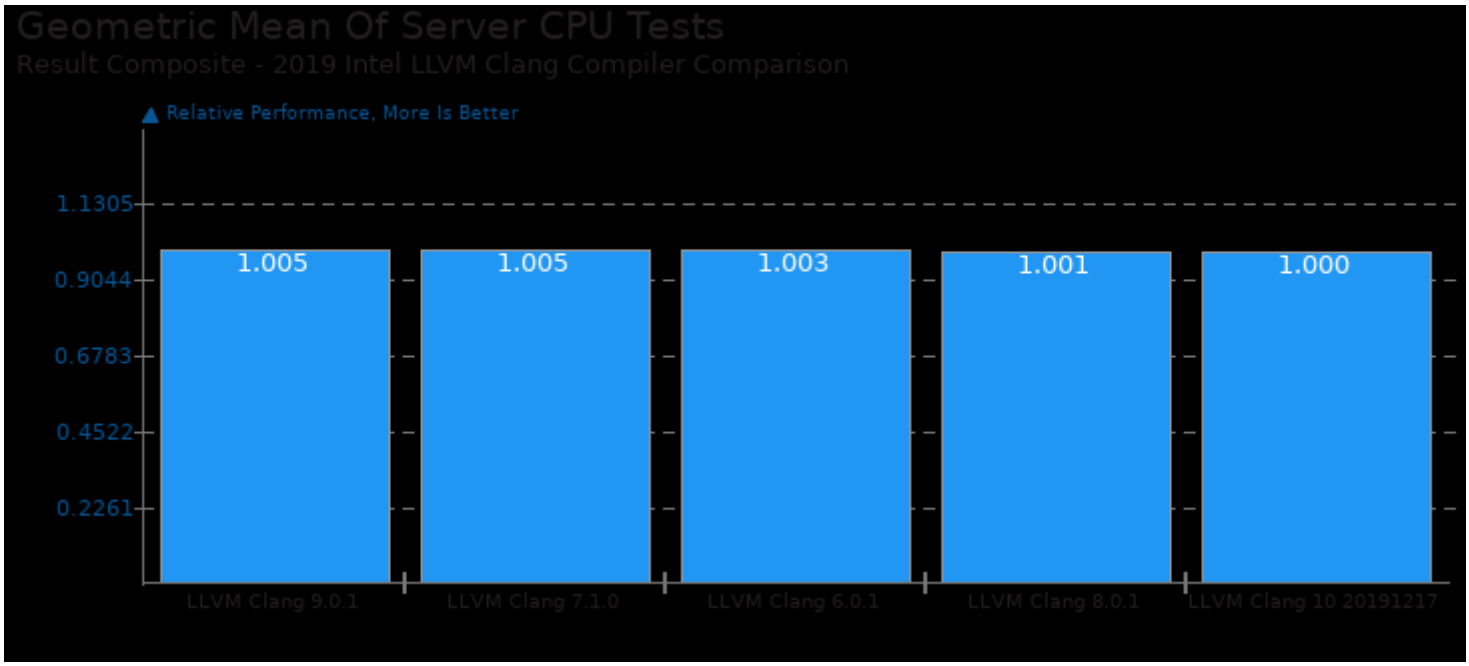


Geometric mean based upon tests: pts/himeno, pts/mrbayes and pts/hmmer

2019 Intel LLVM Clang Compiler Comparison

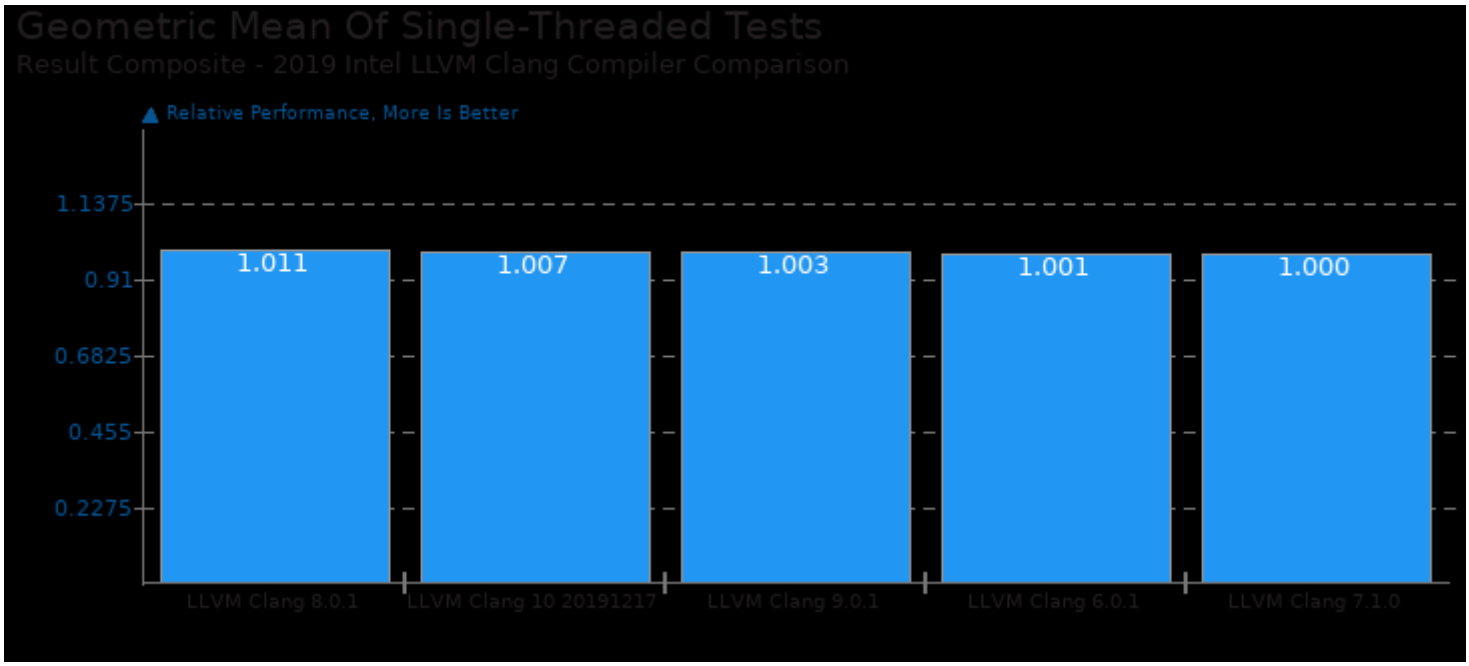


Geometric mean based upon tests: pts/apache, pts/nginx, pts/ebizzy and pts/pgbench

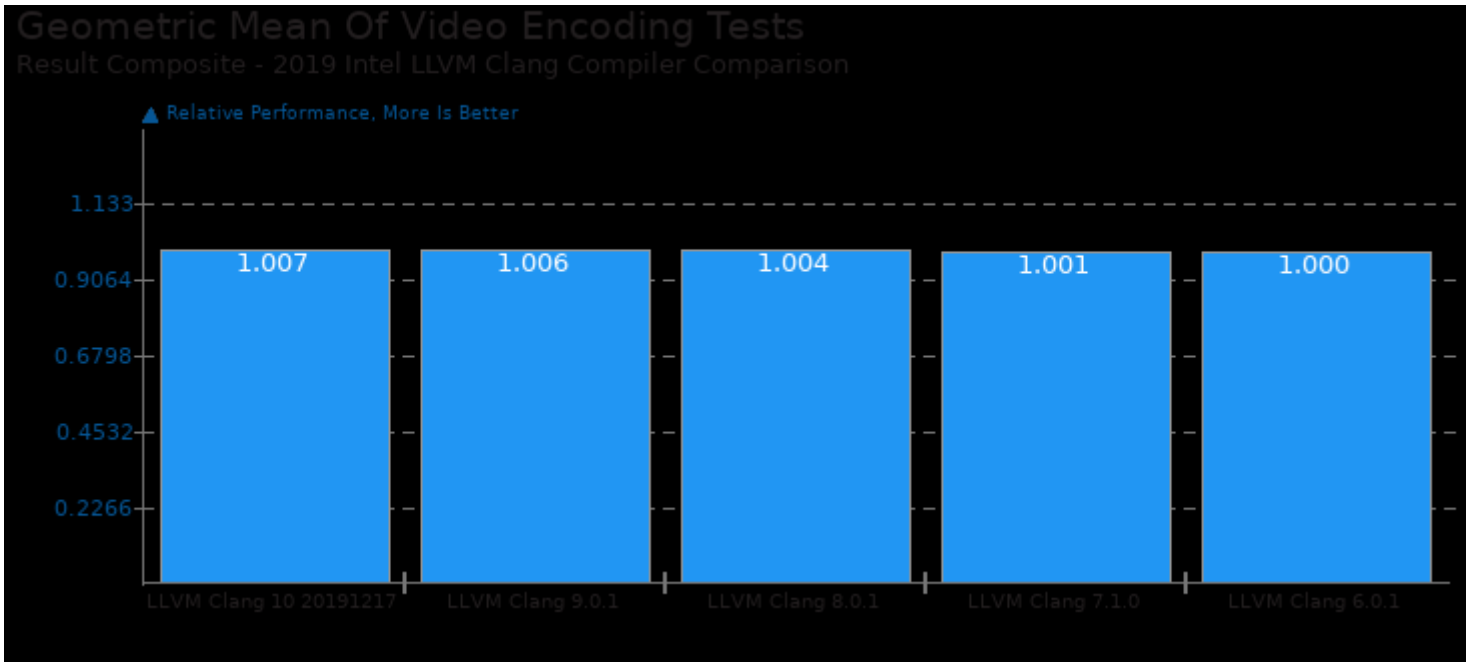


Geometric mean based upon tests: pts/john-the-ripper, pts/svt-av1, pts/svt-hevc, pts/svt-vp9, pts/x264, pts/x265, pts/dav1d, pts/himeno, pts/asmfish, pts/build-php, pts/c-ray, pts/compress-zstd and pts/tjbench

2019 Intel LLVM Clang Compiler Comparison

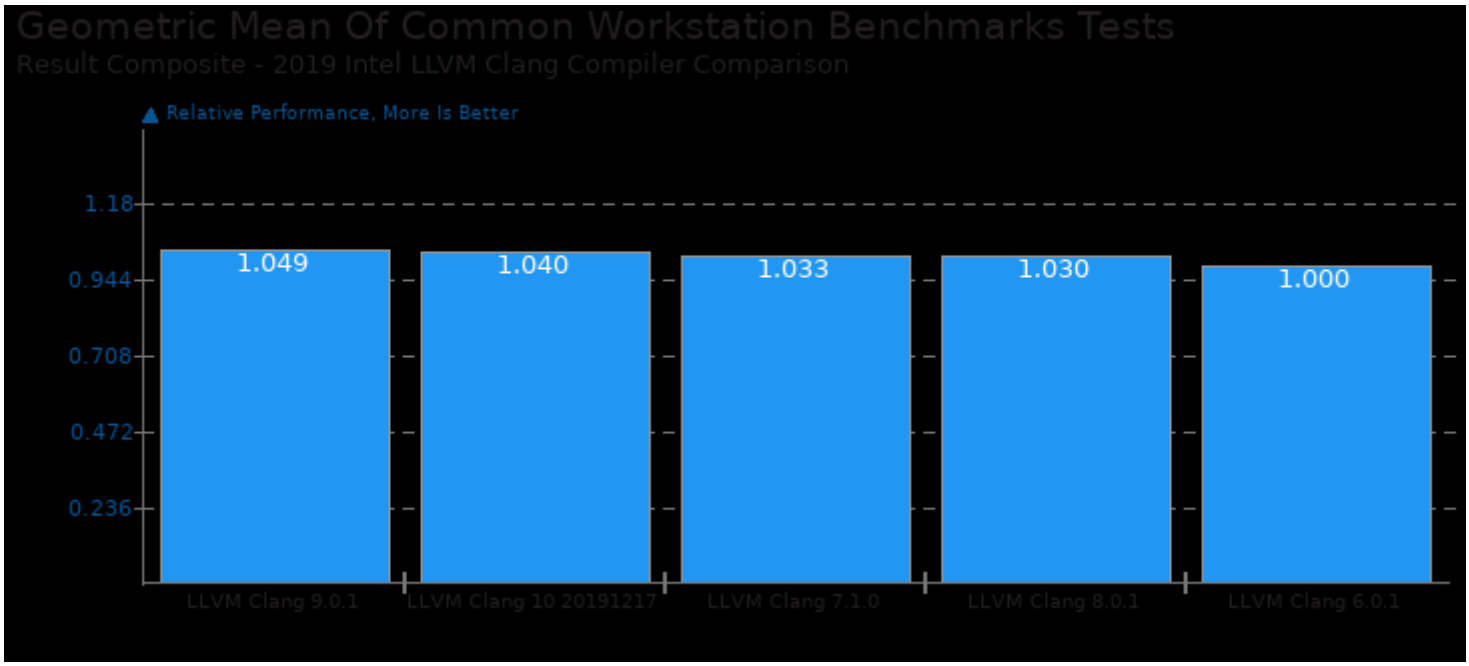


Geometric mean based upon tests: pts/scimark2, pts/minion, pts/tjbench, pts/cpp-perf-bench and pts/nginx



Geometric mean based upon tests: pts/svt-vp9, pts/svt-hevc, pts/x264, pts/x265, pts/vpxenc, pts/dav1d, pts/svt-av1 and pts/libgav1

2019 Intel LLVM Clang Compiler Comparison



Geometric mean based upon tests: pts/himeno and pts/x265

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