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Raspberry Pi 400

Test to compare Ubuntu 21.10b and THP settings to Phoronix results.

Automated Executive Summary

Raspberry Pi 400 had the most wins, coming in first place for 82% of the tests.

Based on the geometric mean of all complete results, the fastest (Raspberry Pi 400) was 2.574x the speed of the slowest (Raspberry Pi 3 Model B). Raspberry Pi 4 Model B was 0.877x the speed of Raspberry Pi 400, Raspberry Pi 4 Model B GUI was 0.93x the speed of Raspberry Pi 4 Model B, Raspberry Pi 4 Model B THP+defrag always was 0.99x the speed of Raspberry Pi 4 Model B GUI, Raspberry Pi 3 Model B was 0.481x the speed of Raspberry Pi 4 Model B THP+defrag always.

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

GEGL (Operation: Reflect) at 20.838x
Himeno Benchmark (Poisson Pressure Solver) at 5.077x
DaCapo Benchmark (Java Test: H2) at 4.526x
GraphicsMagick (Operation: Rotate) at 3.821x
GraphicsMagick (Operation: Enhanced) at 3.5x
TNN (Target: CPU - Model: SqueezeNet v1.1) at 3.361x
TNN (Target: CPU - Model: MobileNet v2) at 3.249x

GraphicsMagick (Operation: HWB Color Space) at 3.058x
GraphicsMagick (Operation: Noise-Gaussian) at 3x
PyBench (Total For Average Test Times) at 2.983x.

Test Systems:

Raspberry Pi 3 Model B

Processor: ARMv8 Cortex-A53 @ 1.40GHz (4 Cores), Motherboard: BCM2835 Raspberry Pi 3 Model B Plus Rev 1.3, Memory: 913MB, Disk: 32GB GB1QT, Graphics: vc4drmfb, Monitor: VA2431

OS: Debian 10, Kernel: 5.4.51-v8+ (aarch64), Desktop: LXDE 0.10.0, Display Server: X Server 1.20.4, Display Driver: modesetting 1.20.4, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 1920x1080

Kernel Notes: snd_bcm2835.enable_compat_alsa=0 snd_bcm2835.enable_hdmi=1 snd_bcm2835.enable_headphones=1
Compiler Notes: --build=aarch64-linux-gnu --disable-libphobos --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++ --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-nls --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-default-libstdcxx-abi=new --with-gcc-major-version-only -v
Processor Notes: Scaling Governor: cpufreq-dt ondemand
Disk Mount Options Notes: noatime,rw
Java Notes: OpenJDK Runtime Environment (build 11.0.8+10-post-Debian-1deb10u1)
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Not affected + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Not affected + srbds: Not affected + tsx_async_abort: Not affected

Raspberry Pi 4 Model B

Processor: ARMv8 Cortex-A72 @ 1.50GHz (4 Cores), Motherboard: BCM2835 Raspberry Pi 4 Model B Rev 1.1, Memory: 2048MB, Disk: 32GB GB1QT, Graphics: vc4drmfb, Monitor: VA2431

OS: Debian 10, Kernel: 5.4.51-v8+ (aarch64), Desktop: LXDE 0.10.0, Display Server: X Server 1.20.4, Display Driver: modesetting 1.20.4, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 1920x1080

Kernel Notes: snd_bcm2835.enable_compat_alsa=0 snd_bcm2835.enable_hdmi=1 snd_bcm2835.enable_headphones=1
Compiler Notes: --build=aarch64-linux-gnu --disable-libphobos --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++ --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-nls --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-default-libstdcxx-abi=new --with-gcc-major-version-only -v
Processor Notes: Scaling Governor: cpufreq-dt ondemand
Disk Mount Options Notes: noatime,rw
Java Notes: OpenJDK Runtime Environment (build 11.0.8+10-post-Debian-1deb10u1)
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Vulnerable + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Vulnerable + srbds: Not affected + tsx_async_abort: Not affected

Raspberry Pi 400

Processor: ARMv8 Cortex-A72 @ 1.80GHz (4 Cores), Motherboard: BCM2835 Raspberry Pi 400 Rev 1.0, Memory: 4096MB, Disk: 32GB GB1QT, Graphics: vc4drmfb, Monitor: VA2431

OS: Debian 10, Kernel: 5.4.51-v8+ (aarch64), Desktop: LXDE 0.10.0, Display Server: X Server 1.20.4, Display Driver: modesetting 1.20.4, Compiler: GCC 8.3.0, File-System: ext4, Screen Resolution: 1920x1080

Kernel Notes: snd_bcm2835.enable_compat_alsa=0 snd_bcm2835.enable_hdmi=1 snd_bcm2835.enable_headphones=1
Compiler Notes: --build=aarch64-linux-gnu --disable-libphobos --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++ --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-nls --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-default-libstdcxx-abi=new --with-gcc-major-version-only -v
Processor Notes: Scaling Governor: cpufreq-dt ondemand
Disk Mount Options Notes: noatime,rw
Java Notes: OpenJDK Runtime Environment (build 11.0.8+10-post-Debian-1deb10u1)
Python Notes: Python 2.7.16 + Python 3.7.3
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Vulnerable + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Vulnerable + srbds: Not affected + tsx_async_abort: Not affected

Raspberry Pi 4 Model B GUI

Processor: ARMv8 Cortex-A72 @ 1.50GHz (4 Cores), Motherboard: BCM2835 Raspberry Pi 4 Model B Rev 1.1, Memory: 4096MB, Disk: 124GB USB DISK 3.0 + 32GB 00000, Graphics: V3D 4.2 4GB, Monitor: SyncMaster

OS: Ubuntu 20.10, Kernel: 5.8.0-1008-raspi (aarch64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenGL: 2.1 Mesa 21.0.0-devel (git-7c075ba 2020-12-07 groovy-oibaf-ppa), Vulkan: 1.0.155, Compiler: GCC 10.2.0, File-System: btrfs, Screen Resolution: 1600x1200

Kernel Notes: snd_bcm2835.enable_compat_alsa=0 snd_bcm2835.enable_hdmi=1 snd_bcm2835.enable_headphones=1
Compiler Notes: --build=aarch64-linux-gnu --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-nls --enable-objc-gc=auto --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-target-system-zlib=auto -v
Disk Notes: MQ-DEADLINE / relatime,rw,space_cache,subvol=/pts,subvolid=257
Processor Notes: Scaling Governor: cpufreq-dt ondemand
Java Notes: OpenJDK Runtime Environment (build 11.0.9.1+1-Ubuntu-0ubuntu1.20.10)
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Vulnerable + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Vulnerable + srbds: Not affected + tsx_async_abort: Not affected

Raspberry Pi 4 Model B THP+defrag always

Processor: ARMv8 Cortex-A72 @ 1.50GHz (4 Cores), Motherboard: BCM2835 Raspberry Pi 4 Model B Rev 1.1, Chipset: Broadcom BCM2711, Memory: 4096MB, Disk: 124GB USB DISK 3.0 + 32GB 00000, Graphics: V3D 4.2 4GB, Monitor: SyncMaster

OS: Ubuntu 21.10, Kernel: 5.11.0-1009-raspi (aarch64), Desktop: GNOME Shell 40.2, Display Server: X Server 1.20.11, OpenGL: 2.1 Mesa 21.3.0-devel (git-513fb54 2021-08-12 impish-oibaf-ppa), Vulkan: 1.0.185, Compiler: GCC 11.2.0, File-System: btrfs, Screen Resolution: 1920x1200

Kernel Notes: snd_bcm2835.enable_compat_alsa=0 snd_bcm2835.enable_hdmi=1 - Transparent Huge Pages: always
Compiler Notes: --build=aarch64-linux-gnu --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-serialization=2 --enable-multiarch --enable-nls --enable-objc-gc=auto --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-target-system-zlib=auto -v
Disk Notes: MQ-DEADLINE / relatime,rw,space_cache,subvol=/pts,subvolid=257 / Block Size: 4096
Processor Notes: Scaling Governor: cpufreq-dt ondemand
Java Notes: OpenJDK Runtime Environment (build 16.0.1+9-Ubuntu-1)
Python Notes: Python 3.9.6
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Vulnerable + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Vulnerable + srbds: Not affected + tsx_async_abort: Not affected

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	Raspberry Pi 3 Model B	Raspberry Pi 4 Model B	Raspberry Pi 400	Raspberry Pi 4 Model B GUI	Raspberry Pi 4 Model B THP+defrag always
Zstd Compression - 19 (MB/s)		2.50	**2.75**	**1.12**	
Normalized		90.91%	100%	40.73%	
Standard Deviation		1.2%	2%	4.4%	
Timed GDB GNU Debugger Compilation - Time To Compile (sec)		1019	**924.107**	1298	**1364**
Normalized		90.7%	100%	71.21%	67.73%
Standard Deviation		2.8%	1.1%	1.5%	4.8%
Numpy Benchmark (Score)	**25.77**	46.88	**54.69**		46.65
Normalized	47.12%	85.72%	100%		85.3%
Standard Deviation	1%	0.4%	0.2%		0.4%
Build2 - Time To Compile (sec)		**1714**	**1569**		
Normalized		91.51%	100%		
Standard Deviation		1%	1.8%		
C-Ray - Total Time - 4.1.R.P.P (sec)	**1979**	607.312	**539.718**	599.126	678.675
Normalized	27.27%	88.87%	100%	90.08%	79.53%
Standard Deviation	0.1%	1.1%	9.6%	1.5%	11.6%
Mobile Neural Network - inception-v3 (ms)	**854.295**	427.886	**366.491**		423.471
Normalized	42.9%	85.65%	100%		86.54%
Standard Deviation	0.2%	0.1%	1.2%		0.5%
Mobile Neural Network - mobilenet-v1-1.0 (ms)	**112.955**	65.299	**56.044**		64.681
Normalized	49.62%	85.83%	100%		86.65%
Standard Deviation	0.1%	0.3%	0.1%		1.6%
Mobile Neural Network - MobileNetV2_224 (ms)	**68.440**	37.700	**32.784**		38.023
Normalized	47.9%	86.96%	100%		86.22%
Standard Deviation	0.4%	0.3%	0.3%		3.7%
Mobile Neural Network - resnet-v2-50 (ms)	**599.905**	325.661	**283.985**		327.725
Normalized	47.34%	87.2%	100%		86.65%
Standard Deviation	0%	0.4%	1.1%		1.4%
Mobile Neural Network - SqueezeNetV1.0 (ms)	**124.589**	67.211	**57.236**		64.914
Normalized	45.94%	85.16%	100%		88.17%
Standard Deviation	0.3%	1%	0.8%		0.4%
asmFish - 1.H.M.2.D (Nodes/s)		2428892	**2779745**	**2337247**	2635220
Normalized		87.38%	100%	84.08%	94.8%
Standard Deviation		2.2%	1.6%	1.2%	3.6%
Zstd Compression - 3 (MB/s)	121	194.7	**214.1**	**2.82**	7.64
Normalized	56.52%	90.94%	100%	1.32%	3.57%
Standard Deviation		0.3%	3.5%	13.3%	23.5%
SQLite Speedtest - Timed Time - Size 1,000 (sec)	**987.198**	537.637	**466.329**		786.098
Normalized	47.24%	86.74%	100%		59.32%
Standard Deviation	2.2%	3%	2.6%		1.3%

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Timed PHP Compilation - Time To Compile (sec)		801.272	**731.514**	**935.327**	906.640
Normalized		91.29%	100%	78.21%	80.68%
Standard Deviation		0.5%	0.9%	0.4%	0.3%
Kvazaar - Bosphorus 1080p - Very Fast (FPS)	**0.53**	1.27	**1.53**	1.46	1.50
Normalized	34.64%	83.01%	100%	95.42%	98.04%
Standard Deviation	0%	0%	0.4%	0%	5.1%
OCRMyPDF - P.6.P.P.D (sec)	**849.612**	339.025	**294.326**		
Normalized	34.64%	86.82%	100%		
Standard Deviation	2.2%	1.1%	3.3%		
PyPerformance - raytrace (Milliseconds)	**6.78**	3.41	2.84		**2.47**
Normalized	36.43%	72.43%	86.97%		100%
Standard Deviation	0.2%	0%	0%		0.4%
GIMP - rotate (sec)					161.560
Standard Deviation					9.7%
DaCapo Benchmark - Tradebeans (msec)	**51166**	31281	**28292**	29694	
Normalized	55.29%	90.44%	100%	95.28%	
Standard Deviation	5.9%	10.1%	12%	5.1%	
GEGL - Color Enhance (sec)	**522.034**	297.290	**257.795**		391.590
Normalized	49.38%	86.71%	100%		65.83%
Standard Deviation	0.9%	2.6%	0.3%		5.1%
Timed ImageMagick Compilation - Time To Compile (sec)		570.425	**513.651**	**584.696**	562.015
Normalized		90.05%	100%	87.85%	91.39%
Standard Deviation		1.6%	0.7%	0.1%	0.4%
eSpeak-NG Speech Engine - T.T.S.S (sec)	**297.746**	161.560	154.696		**125.807**
Normalized	42.25%	77.87%	81.33%		100%
Standard Deviation	2.2%	6.1%	1.7%		3.8%
GIMP - auto-levels (sec)					172.460
Standard Deviation					13%
PyPerformance - 2to3 (Milliseconds)	**4**	2.21	**1.87**		**1.87**
Normalized	46.75%	84.62%	100%		100%
Standard Deviation		0%	0%		0%
FLAC Audio Encoding - WAV To FLAC (sec)	**300.952**	94.648	**82.552**		101.824
Normalized	27.43%	87.22%	100%		81.07%
Standard Deviation	1.4%	2.3%	2.9%		8.9%
PyPerformance - go	**3.23**	1.68	1.4		**1.29**
Normalized	39.94%	76.79%	92.14%		100%
Standard Deviation	0%	0%	0%		0.4%
Dolfyn - C.F.D (sec)	**344.278**	106.986	**95.521**	109.931	117.659
Normalized	27.75%	89.28%	100%	86.89%	81.18%
Standard Deviation	6.1%	1%	0.7%	2.1%	7.4%
GEGL - Rotate 90 Degrees (sec)	**382.494**	216.108	**192.390**		320.495
Normalized	50.3%	89.02%	100%		60.03%
Standard Deviation	0.3%	0.9%	0.3%		6.5%
librsvg - SVG Files To PNG (sec)	125.042	71.543	**62.183**		**254.158**
Normalized	49.73%	86.92%	100%		24.47%
Standard Deviation	4.2%	0.9%	2%		6%

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OCRMyPDF - P.6.P.P.D (sec)					304.801
Standard Deviation					0.5%
Kvazaar - Bosphorus 1080p - Ultra Fast (FPS)	1.07	2.53	3.02	2.69	2.85
Normalized	35.43%	83.77%	100%	89.07%	94.37%
Standard Deviation	0%	0.2%	0%	0.9%	0.7%
RNNoise (sec)	175.305	71.126	61.961		65.265
Normalized	35.34%	87.11%	100%		94.94%
Standard Deviation	1.5%	3.2%	3.9%		12.9%
LibRaw - P.P.B (Mpix/sec)	2.40	5.66	6.57	5.60	5.58
Normalized	36.53%	86.15%	100%	85.24%	84.93%
Standard Deviation	0.6%	0.1%	0.4%	1.4%	0.4%
Hierarchical INTegration - FLOAT (QUIPs)	62697907	105866488	126728793		110467110
Normalized	49.47%	83.54%	100%		87.17%
Standard Deviation	0%	0%	0.3%		0.1%
GNU Octave Benchmark (sec)	86.950	40.614	36.662		
Normalized	42.16%	90.27%	100%		
Standard Deviation	7.5%	1.5%	1.2%		
Timed Apache Compilation - Time To Compile (sec)	349.969	197.374	155.907	226.879	248.16
Normalized	44.55%	78.99%	100%	68.72%	62.83%
Standard Deviation	0.4%	1.1%	1.1%	0.6%	0.5%
WebP Image Encode - Q.1.L.H.C (Encode Time - sec)		216.139	195.378	219.615	211.255
Normalized		90.39%	100%	88.96%	92.48%
Standard Deviation		0.3%	0.4%	0.3%	0.3%
GraphicsMagick - Rotate (Iterations/min)	28	98	107	98	104
Normalized	26.17%	91.59%	100%	91.59%	97.2%
Standard Deviation		3.8%	4.8%	2.7%	4.5%
GIMP - unsharp-mask (sec)					202.259
Standard Deviation					1%
GEGL - Reflect (sec)	27.231	13.441	11.589		241.496
Normalized	42.56%	86.22%	100%		4.8%
Standard Deviation	0.8%	0.3%	0.3%		5.3%
DaCapo Benchmark - Jython (msec)	55388	29475	28481	28697	32585
Normalized	51.42%	96.63%	100%	99.25%	87.41%
Standard Deviation	2.7%	5.4%	10.2%	1.3%	42.4%
WebP Image Encode - Q.1.L (Encode Time - sec)	153.353	92.951	84.688	95.741	91.936
Normalized	55.22%	91.11%	100%	88.46%	92.12%
Standard Deviation	0.1%	0.8%	3.5%	0.8%	0.9%
DaCapo Benchmark - H2 (msec)	63605	15200	14053	15814	14643
Normalized	22.09%	92.45%	100%	88.86%	95.97%
Standard Deviation	0.6%	4.6%	3%	3%	1.3%
TNN - CPU - MobileNet v2 (ms)	3985	1640	1356		1226
Normalized	30.78%	74.77%	90.47%		100%
Standard Deviation	2.9%	1%	0.6%		2.2%
Tesseract OCR - T.T.O.7.I (sec)	269.375	121.650	102.837		
Normalized	38.18%	84.54%	100%		
Standard Deviation	1.6%	0%	0.5%		
GNU Octave Benchmark (sec)					35.090

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Standard Deviation					2.5%
PyBench - T.F.A.T.T	13254	5758	4784		4443
Normalized	33.52%	77.16%	92.87%		100%
Standard Deviation	0.1%	0.9%	0.4%		0.7%
GEGL - Crop (sec)	79.574	47.762	40.613		111.450
Normalized	51.04%	85.03%	100%		36.44%
Standard Deviation	2.1%	1.8%	2.3%		19.4%
AOBench - 2048 x 2048 - Total Time (sec)	262.532	124.471	103.725		119.198
Normalized	39.51%	83.33%	100%		87.02%
Standard Deviation	0%	0%	0.1%		0%
Smallpt - G.I.R.1.S (sec)	269.788	121.564	101.358	129.684	130.024
Normalized	37.57%	83.38%	100%	78.16%	77.95%
Standard Deviation	0.2%	0.4%	0.6%	1.6%	0.3%
Inkscape - SVG Files To PNG (sec)	209.427	117.213	100.848		
Normalized	48.15%	86.04%	100%		
Standard Deviation	0.7%	0.6%	1.3%		
IOR - Read Test (MB/s)	19.19	37.77	40.47	91.64	59.33
Normalized	20.94%	41.22%	44.16%	100%	64.74%
Standard Deviation	1.3%	2.3%	0.7%	7%	1.1%
IOR - Write Test (MB/s)	7.44	9.90	10.72	28.68	16.26
Normalized	25.94%	34.52%	37.38%	100%	56.69%
Standard Deviation	2%	1.7%	17.4%	11.3%	7.9%
PyPerformance - python_startup (Milliseconds)	76.3	43.6	38.1		55.2
Normalized	49.93%	87.39%	100%		69.02%
Standard Deviation	0.1%	0%	0.2%		0%
PyPerformance - django_template (Milliseconds)	841	466	390		312
Normalized	37.1%	66.95%	80%		100%
Standard Deviation		0.2%	0.3%		0.2%
Perl Benchmarks - Pod2html	1.12228333	0.56889272	0.47305417		0.67002612
Normalized	42.15%	83.15%	100%		70.6%
Standard Deviation	0.8%	1%	0.2%		0.4%
Tesseract OCR - T.T.O.7.I (sec)					124.276
Standard Deviation					1.8%
TNN - CPU - SqueezeNet v1.1 (ms)	3284	1329	1148		977.256
Normalized	29.75%	73.53%	85.1%		100%
Standard Deviation	1.2%	1%	0.7%		1.3%
GraphicsMagick - Noise-Gaussian (Iterations/min)	9	23	27	27	26
Normalized	33.33%	85.19%	100%	100%	96.3%
Standard Deviation	5.5%				0%
PHPBench - P.B.S (Score)	56935	124303	149237		
Normalized	38.15%	83.29%	100%		
Standard Deviation	0.2%	1.1%	0.7%		
Himeno Benchmark - P.P.S (MFLOPS)	143.553754	580.679620	728.803695	539.428464	525.997113
Normalized	19.7%	79.68%	100%	74.02%	72.17%
Standard Deviation	3%	1.3%	1.2%	1.4%	0.5%

Raspberry Pi 400

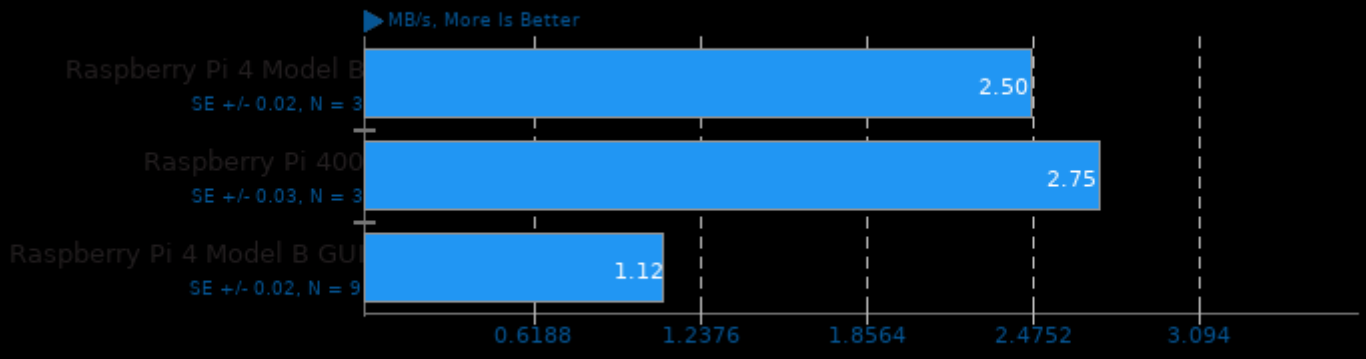
PyPerformance - pathlib (Milliseconds)	262	162	136		239
Normalized	51.91%	83.95%	100%		56.9%
Standard Deviation					0%
GraphicsMagick - Enhanced (Iterations/min)	6	18	21	18	18
Normalized	28.57%	85.71%	100%	85.71%	85.71%
Standard Deviation					0%
GraphicsMagick - Sharpen (Iterations/min)	7	15	17	18	17
Normalized	38.89%	83.33%	94.44%	100%	94.44%
Standard Deviation					0%
GraphicsMagick - Resizing (Iterations/min)	21	50	55	51	56
Normalized	37.5%	89.29%	98.21%	91.07%	100%
Standard Deviation					1%
GraphicsMagick - HWB Color Space (Iterations/min)	52	137	159	135	145
Normalized	32.7%	86.16%	100%	84.91%	91.19%
Standard Deviation			0.4%		0.8%
Perl Benchmarks - Interpreter	0.00661400	0.00417488	0.00370104		0.01030860
Normalized	55.96%	88.65%	100%		35.9%
Standard Deviation	0.7%	0.5%	0.4%		0.3%
CloverLeaf - L.E.H (sec)	88.07	46.04	45.05	46.79	47.44
Normalized	51.15%	97.85%	100%	96.28%	94.96%
Standard Deviation	1.3%	0.2%	0.3%	0.3%	0.8%
LAME MP3 Encoding - WAV To MP3 (sec)	54.957	29.235	24.405		28.830
Normalized	44.41%	83.48%	100%		84.65%
Standard Deviation	0.1%	0.1%	0.3%		2.5%
LAMMPS Molecular Dynamics Simulator - Rhodopsin Protein (ns/day)	0.203	0.509	0.574	0.495	0.497
Normalized	35.37%	88.68%	100%	86.24%	86.59%
Standard Deviation	0.6%	0.5%	1.1%	1.1%	0.3%
PyPerformance - json_loads (Milliseconds)	290	153	127		106
Normalized	36.55%	69.28%	83.46%		100%
Standard Deviation	0.3%				0%
OpenSSL - R.4.b.P (Signs/sec)	63.9	95.5	114.3		95.6
Normalized	55.91%	83.55%	100%		83.64%
Standard Deviation	2.7%	0.3%	0.2%		0.3%
PyPerformance - pickle_pure_python	6.64	3.58	3.00		2.58
Normalized	38.86%	72.07%	86%		100%
Standard Deviation	0.1%	0.3%	0.4%		0.2%
WebP Image Encode - Quality 100 (Encode Time - sec)	19.877	12.212	10.259	11.849	11.588
Normalized	51.61%	84.01%	100%	86.58%	88.53%
Standard Deviation	4.3%	0.2%	0.4%	0.3%	0.5%
WebP Image Encode - Q.1.H.C (Encode Time - sec)	46.048	27.795	23.155	27.620	27.030
Normalized	50.28%	83.31%	100%	83.83%	85.66%

Raspberry Pi 400

Standard Deviation	0.4%	0.3%	0.5%	0.3%	0.1%
GIMP - unsharp-mask (sec)	**9.702**	4.298	**3.116**		
Normalized	32.12%	72.5%	100%		
Standard Deviation	33.1%	26.6%	1.8%		
GIMP - auto-levels (sec)	**8.134**	4.976	**3.100**		
Normalized	38.11%	62.3%	100%		
Standard Deviation	29.9%	44.6%	1.2%		
TSCP - A.C.P (Nodes/s)	**184288**	344454	**412801**	363070	354154
Normalized	44.64%	83.44%	100%	87.95%	85.79%
Standard Deviation	3.9%	0.3%	0.2%	0%	0.3%
GIMP - rotate (sec)	**8.544**	3.643	**3.111**		
Normalized	36.41%	85.4%	100%		
Standard Deviation	29.7%	1.4%	1.1%		
Coremark - CoreMark Size 666 - I.P.S (Iterations/Sec)	**15603**	33044	**39684**	32807	33212
Normalized	39.32%	83.27%	100%	82.67%	83.69%
Standard Deviation	0.1%	0.3%	0.1%	0.3%	0.2%
WebP Image Encode - Default (Encode Time - sec)	**16.036**	8.937	**7.464**	8.466	8.321
Normalized	46.55%	83.52%	100%	88.16%	89.7%
Standard Deviation	0.2%	0.4%	0.3%	0.3%	0.2%
FFTE - N.2.3.C.F.R (MFLOPS)	**978.40**	1932	**1972**	1857	1509
Normalized	49.62%	98.01%	100%	94.18%	76.51%
Standard Deviation	0.6%	0.8%	0.9%	1.4%	5.3%

Zstd Compression 1.4.5

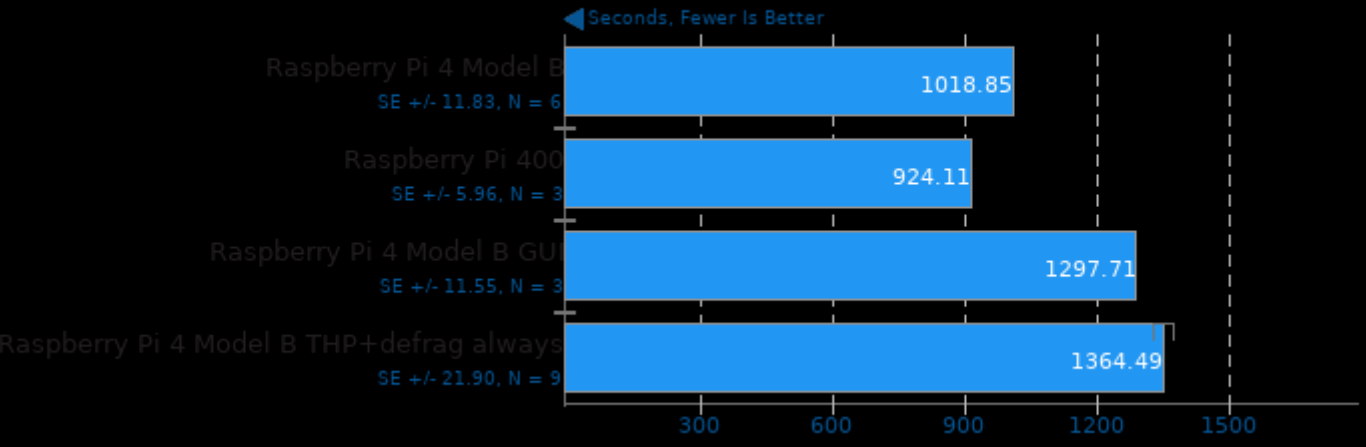
Compression Level: 19



1. (CC) gcc options: -O3 -pthread -lz

Timed GDB GNU Debugger Compilation 9.1

Time To Compile

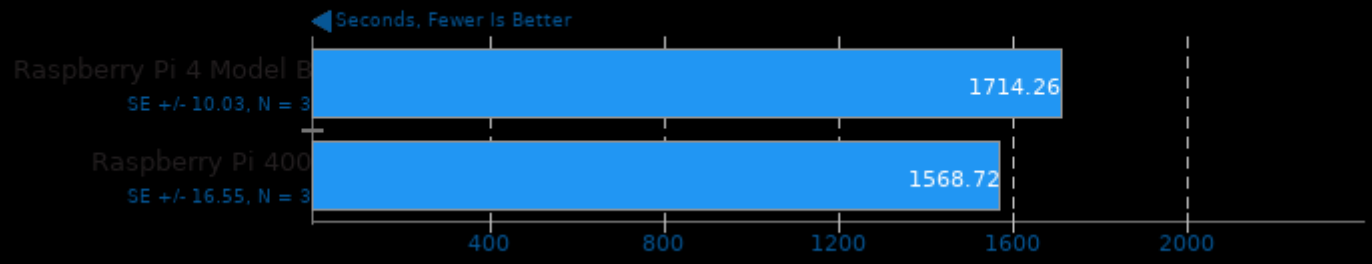


Numpy Benchmark



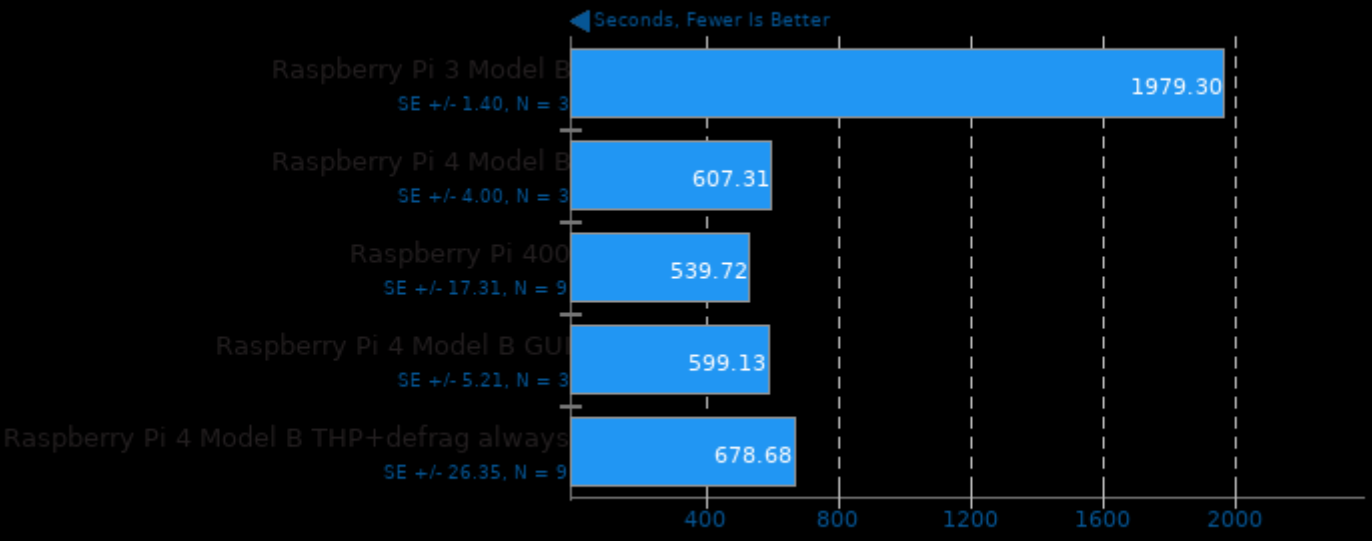
Build2 0.12

Time To Compile



C-Ray 1.1

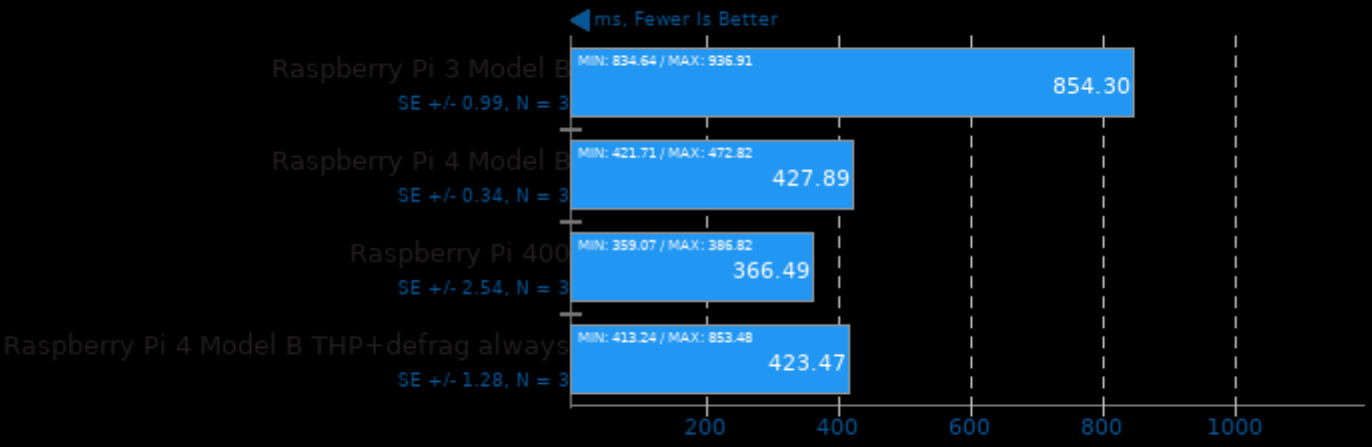
Total Time - 4K, 16 Rays Per Pixel



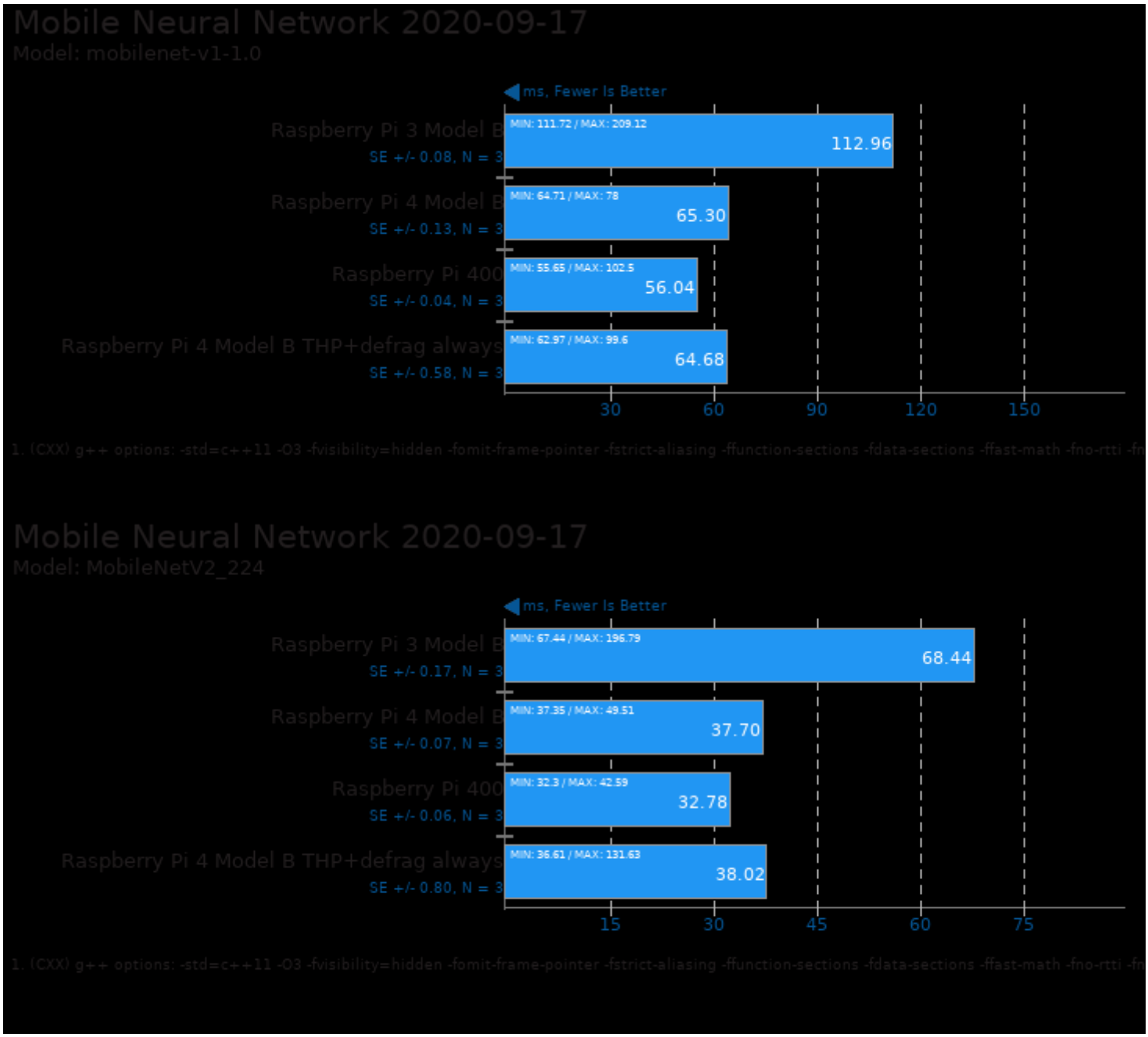
1. (CC) gcc options: -lm -lpthread -O3

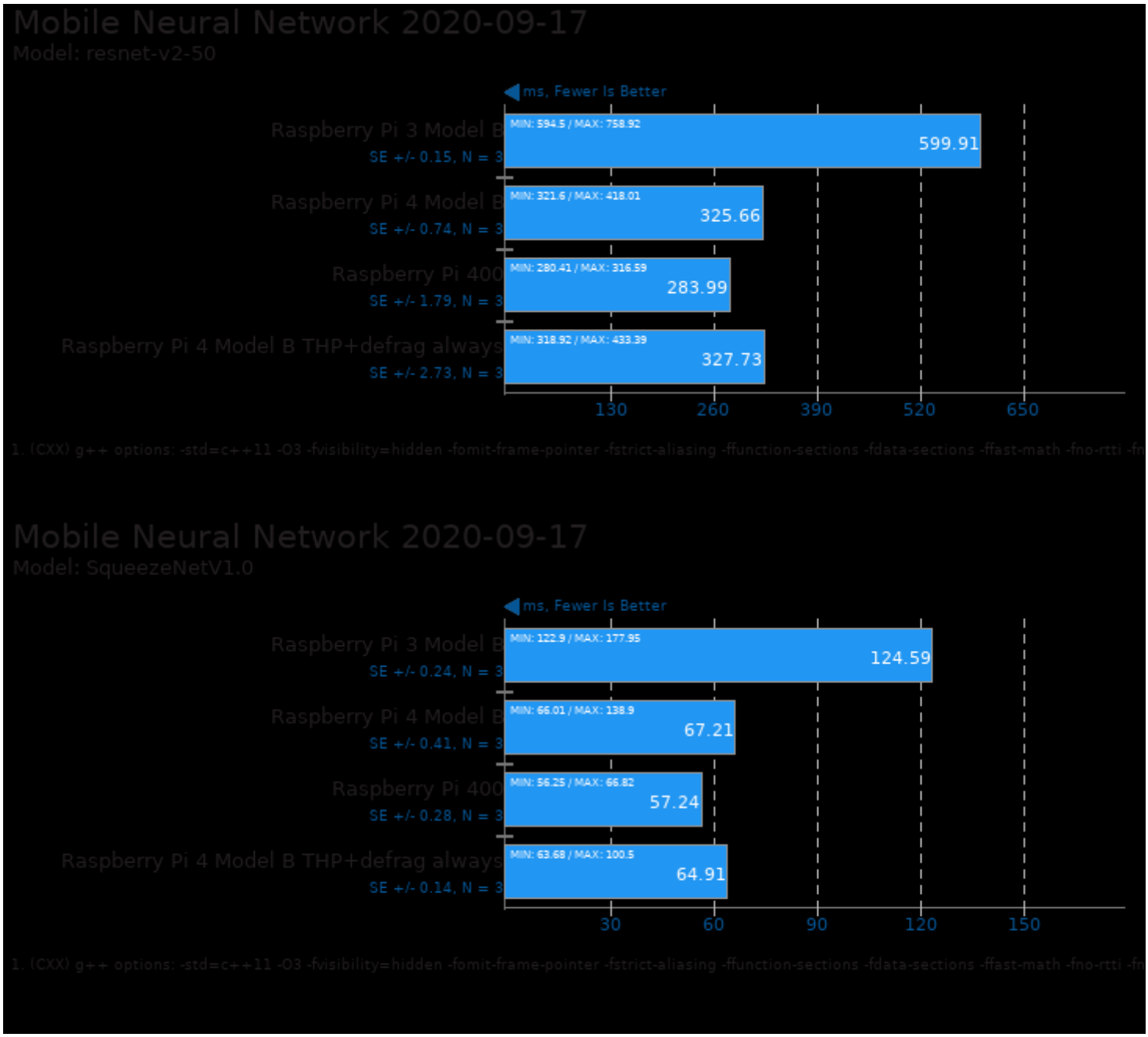
Mobile Neural Network 2020-09-17

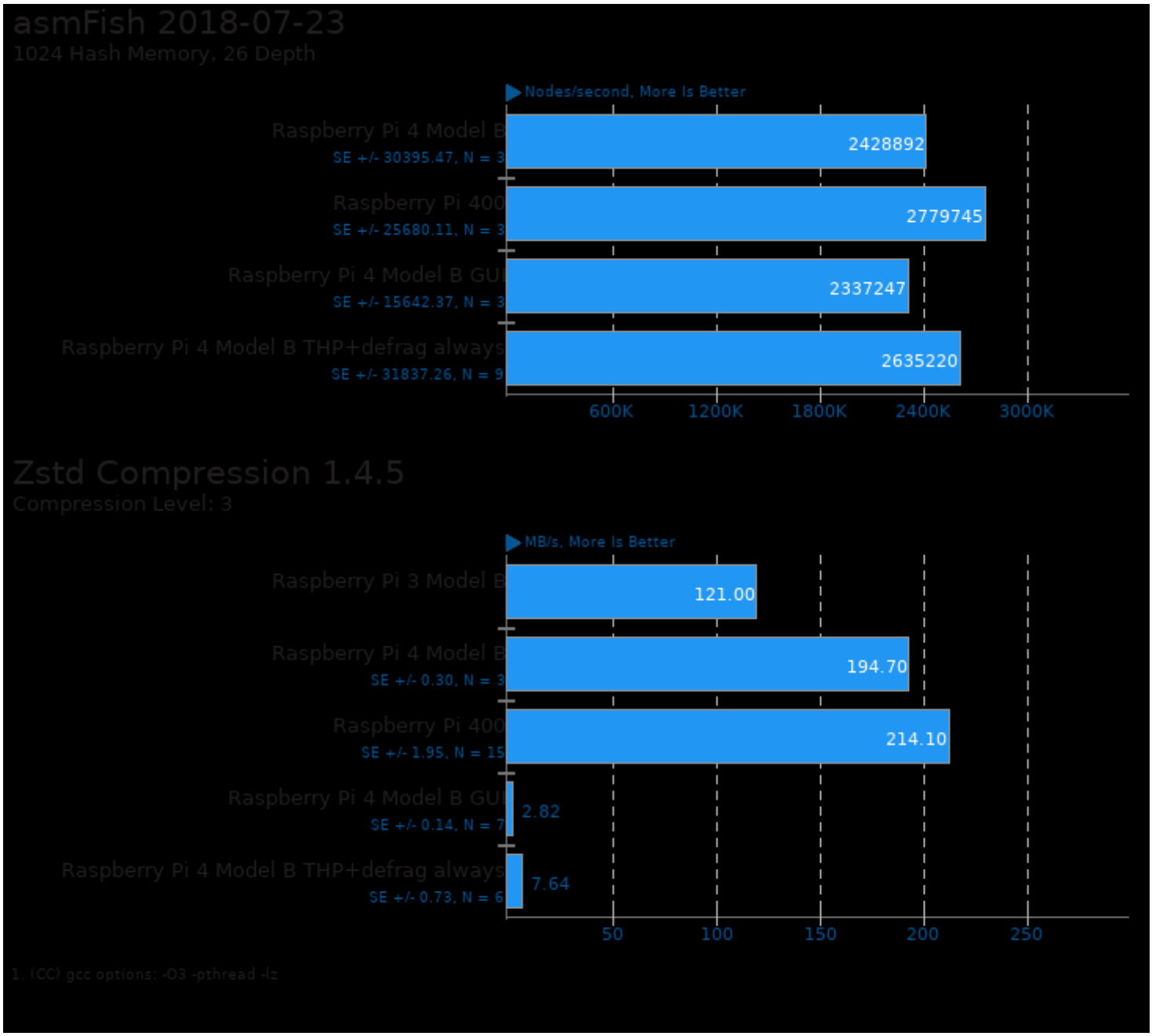
Model: inception-v3

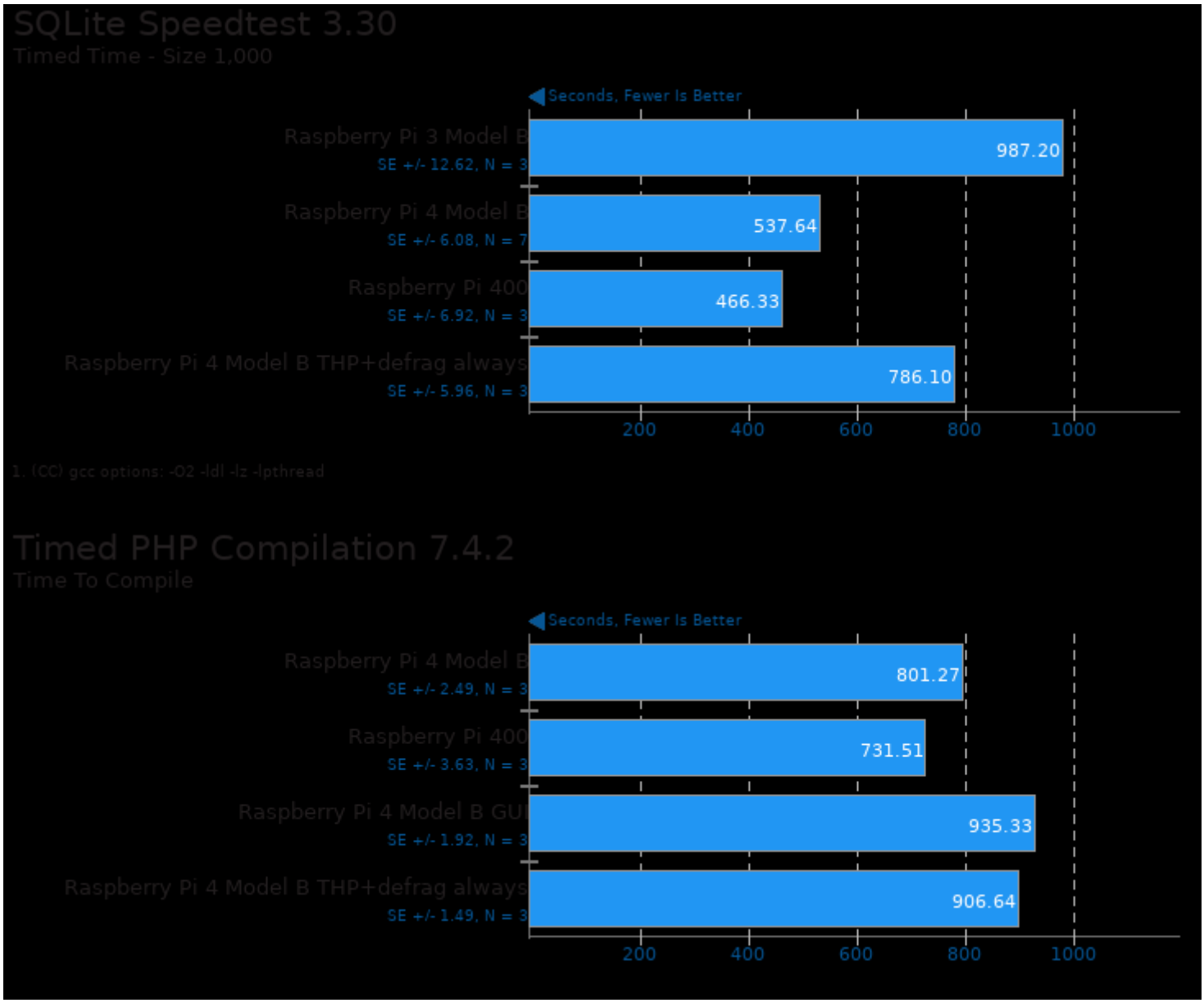


1. (CXX) g++ options: -std=c++11 -O3 -fvisibility=hidden -fomit-frame-pointer -fstrict-aliasing -ffunction-sections -fdata-sections -ffast-math -fno-rtti -fn


Mobile Neural Network 2020-09-17
Model: mobilenet-v1-1.0
ms, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.08, N = 3
MIN: 111.72 / MAX: 209.12
112.96
Raspberry Pi 4 Model B
SE +/- 0.13, N = 3
MIN: 64.71 / MAX: 78
65.30
Raspberry Pi 400
SE +/- 0.04, N = 3
MIN: 55.65 / MAX: 102.5
56.04
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.58, N = 3
MIN: 62.97 / MAX: 99.6
64.68
30
60
90
120
150
1. (CXX) g++ options: -std=c++11 -O3 -fvisibility=hidden -fomit-frame-pointer -fstrict-aliasing -ffunction-sections -fdata-sections -ffast-math -fno-rtti -fr
Mobile Neural Network 2020-09-17
Model: MobileNetV2_224
ms, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.17, N = 3
MIN: 67.44 / MAX: 196.79
68.44
Raspberry Pi 4 Model B
SE +/- 0.07, N = 3
MIN: 37.35 / MAX: 49.51
37.70
Raspberry Pi 400
SE +/- 0.06, N = 3
MIN: 32.3 / MAX: 42.59
32.78
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.80, N = 3
MIN: 36.61 / MAX: 131.63
38.02
15
30
45
60
75
1. (CXX) g++ options: -std=c++11 -O3 -fvisibility=hidden -fomit-frame-pointer -fstrict-aliasing -ffunction-sections -fdata-sections -ffast-math -fno-rtti -fr


Mobile Neural Network 2020-09-17
Model: resnet-v2-50
ms, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.15, N = 3
MIN: 594.5 / MAX: 758.92
599.91
Raspberry Pi 4 Model B
SE +/- 0.74, N = 3
MIN: 321.6 / MAX: 418.01
325.66
Raspberry Pi 400
SE +/- 1.79, N = 3
MIN: 280.41 / MAX: 316.59
283.99
Raspberry Pi 4 Model B THP+defrag always
SE +/- 2.73, N = 3
MIN: 318.92 / MAX: 433.39
327.73
130
260
390
520
650
1. (CXX) g++ options: -std=c++11 -O3 -fvisibility=hidden -fomit-frame-pointer -fstrict-aliasing -ffunction-sections -fdata-sections -ffast-math -fno-rtti -fr
Mobile Neural Network 2020-09-17
Model: SqueezeNetV1.0
ms, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.24, N = 3
MIN: 122.9 / MAX: 177.95
124.59
Raspberry Pi 4 Model B
SE +/- 0.41, N = 3
MIN: 66.01 / MAX: 138.9
67.21
Raspberry Pi 400
SE +/- 0.28, N = 3
MIN: 56.25 / MAX: 66.82
57.24
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.14, N = 3
MIN: 63.68 / MAX: 100.5
64.91
30
60
90
120
150
1. (CXX) g++ options: -std=c++11 -O3 -fvisibility=hidden -fomit-frame-pointer -fstrict-aliasing -ffunction-sections -fdata-sections -ffast-math -fno-rtti -fr

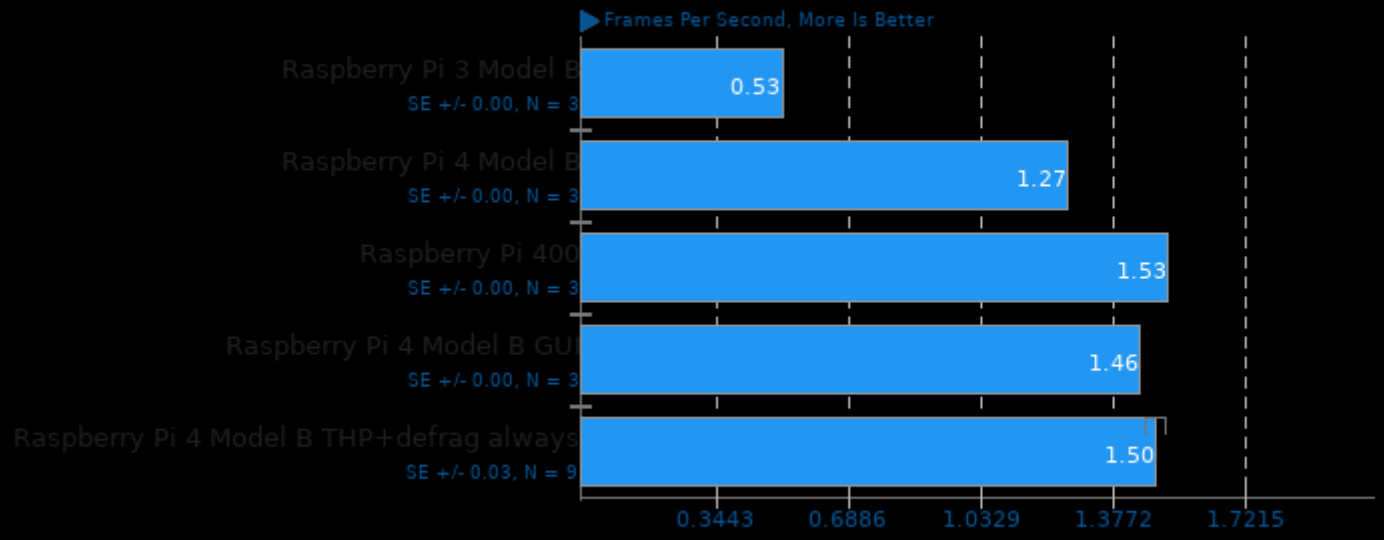

asmFish 2018-07-23
1024 Hash Memory, 26 Depth
Nodes/second, More Is Better
Raspberry Pi 4 Model B
SE +/- 30395.47, N = 3
2428892
Raspberry Pi 400
SE +/- 25680.11, N = 3
2779745
Raspberry Pi 4 Model B GUI
SE +/- 15642.37, N = 3
2337247
Raspberry Pi 4 Model B THP+defrag always
SE +/- 31837.26, N = 9
2635220
600K
1200K
1800K
2400K
3000K
Zstd Compression 1.4.5
Compression Level: 3
MB/s, More Is Better
Raspberry Pi 3 Model B
121.00
Raspberry Pi 4 Model B
SE +/- 0.30, N = 3
194.70
Raspberry Pi 400
SE +/- 1.95, N = 15
214.10
Raspberry Pi 4 Model B GUI
SE +/- 0.14, N = 7
2.82
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.73, N = 6
7.64
50
100
150
200
250
1. (CC) gcc options: -O3 -pthread -lz


SQLite Speedtest 3.30
Timed Time - Size 1,000
Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 12.62, N = 3
987.20
Raspberry Pi 4 Model B
SE +/- 6.08, N = 7
537.64
Raspberry Pi 400
SE +/- 6.92, N = 3
466.33
Raspberry Pi 4 Model B THP+defrag always
SE +/- 5.96, N = 3
786.10
200
400
600
800
1000
1. (CC) gcc options: -O2 -ldl -lz -lpthread
Timed PHP Compilation 7.4.2
Time To Compile
Seconds, Fewer Is Better
Raspberry Pi 4 Model B
SE +/- 2.49, N = 3
801.27
Raspberry Pi 400
SE +/- 3.63, N = 3
731.51
Raspberry Pi 4 Model B GUI
SE +/- 1.92, N = 3
935.33
Raspberry Pi 4 Model B THP+defrag always
SE +/- 1.49, N = 3
906.64
200
400
600
800
1000

Raspberry Pi 400

Kvazaar 2.0

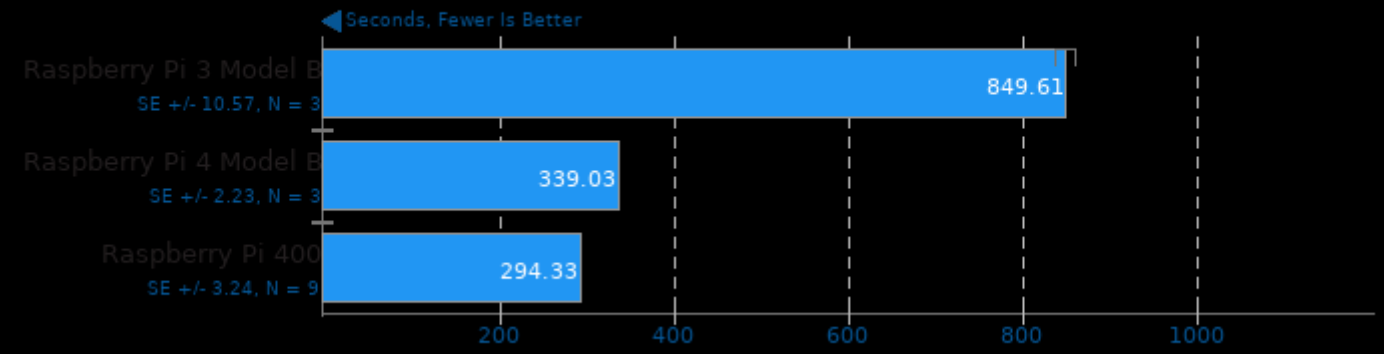
Video Input: Bosphorus 1080p - Video Preset: Very Fast



1. (CC) gcc options: -pthread -ftree-vectorize -fvisibility=hidden -O2 -lpthread -lm -lrt

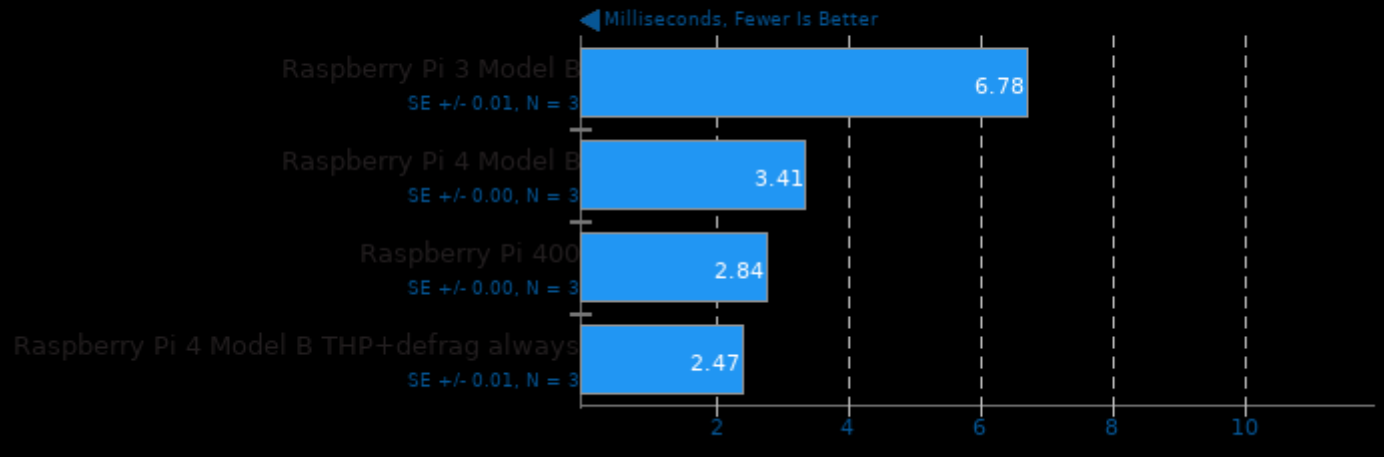
OCRMyPDF 8.0.1+dfsg

Processing 60 Page PDF Document

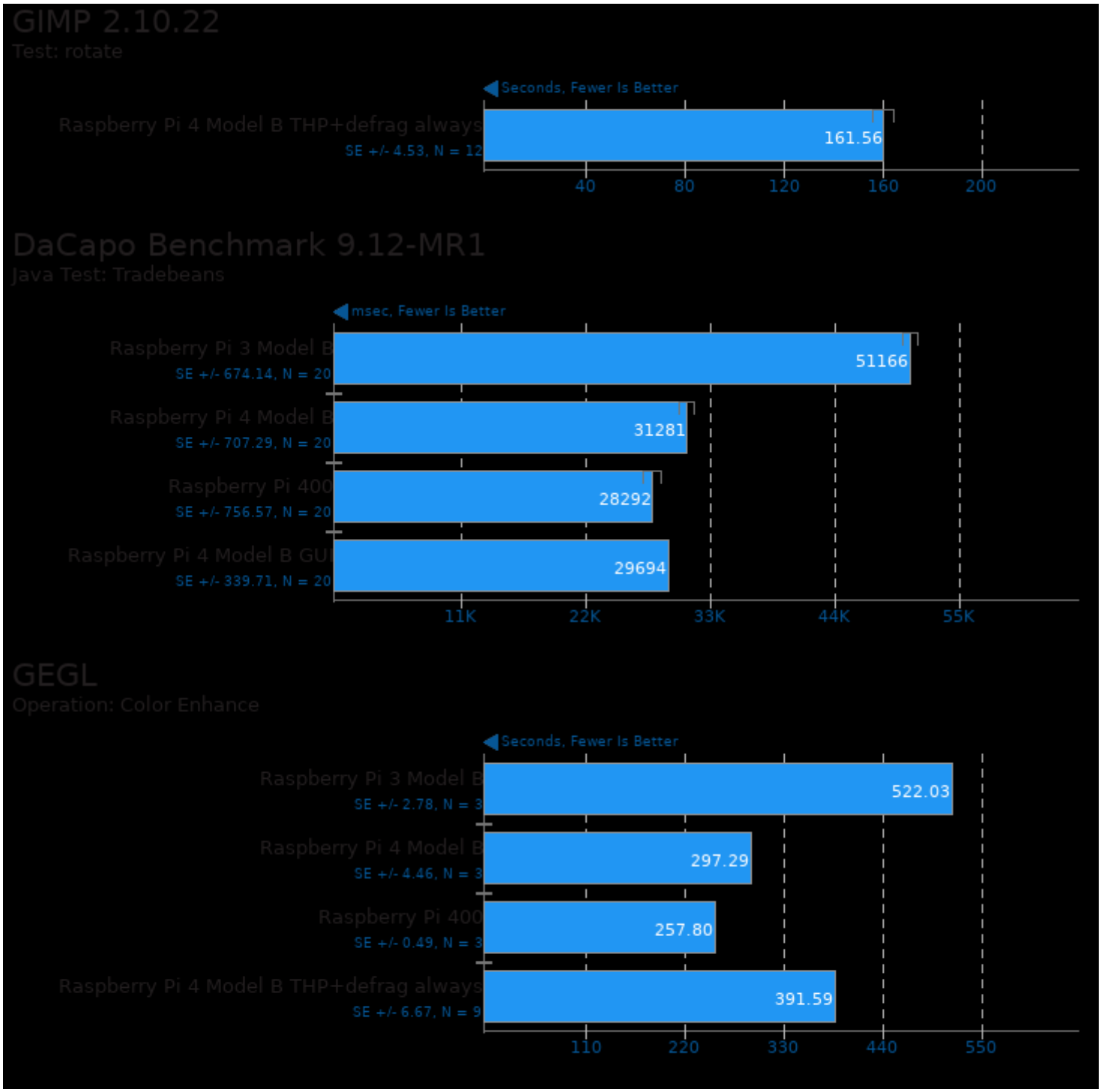


PyPerformance 1.0.0

Benchmark: raytrace

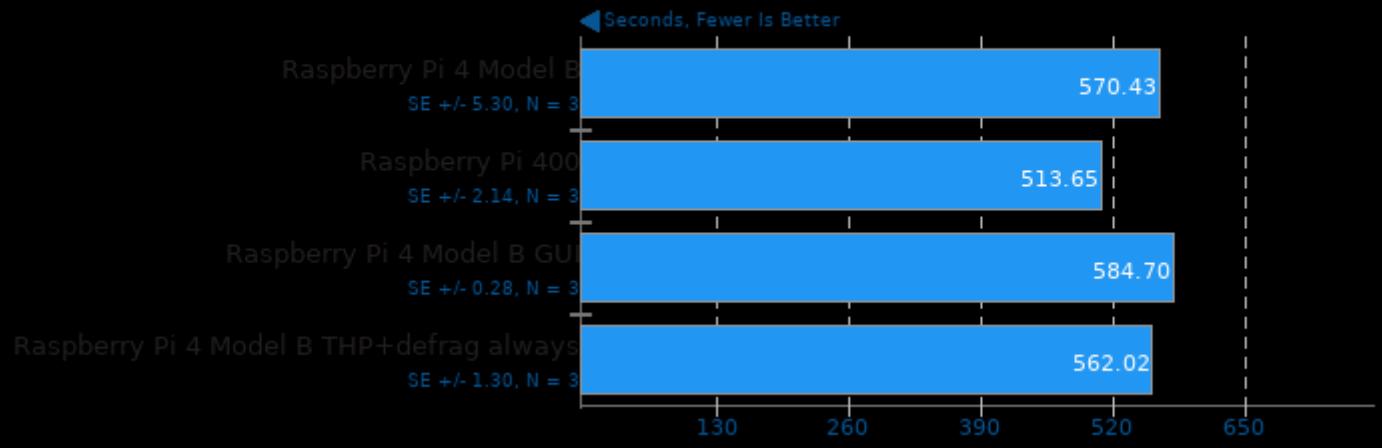


Raspberry Pi 400



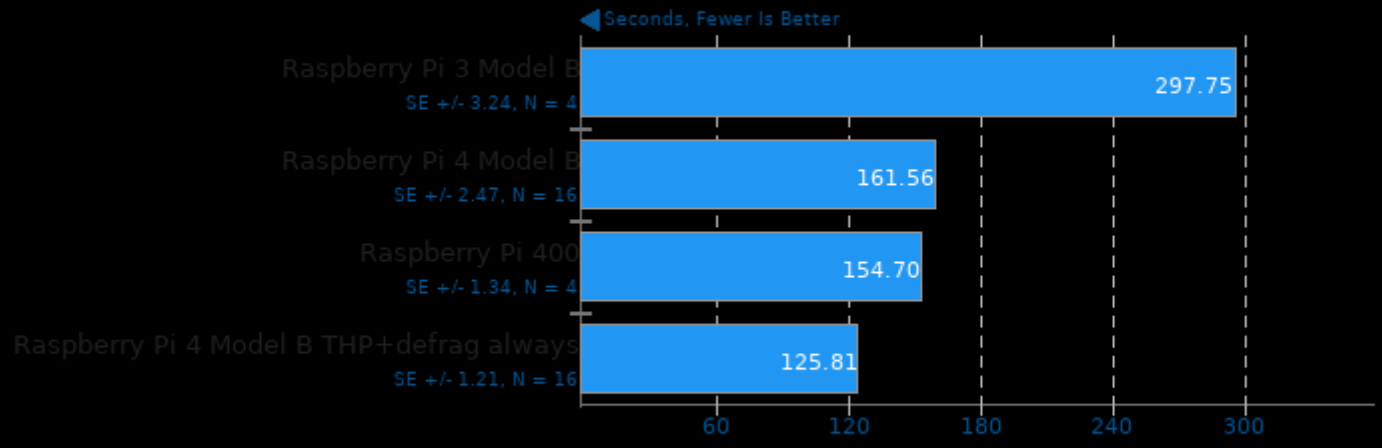
Timed ImageMagick Compilation 6.9.0

Time To Compile



eSpeak-NG Speech Engine 20200907

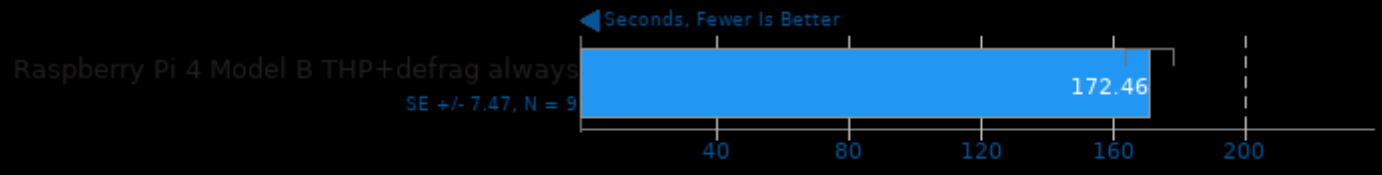
Text-To-Speech Synthesis



1. (CC) gcc options: -O2 -std=c99

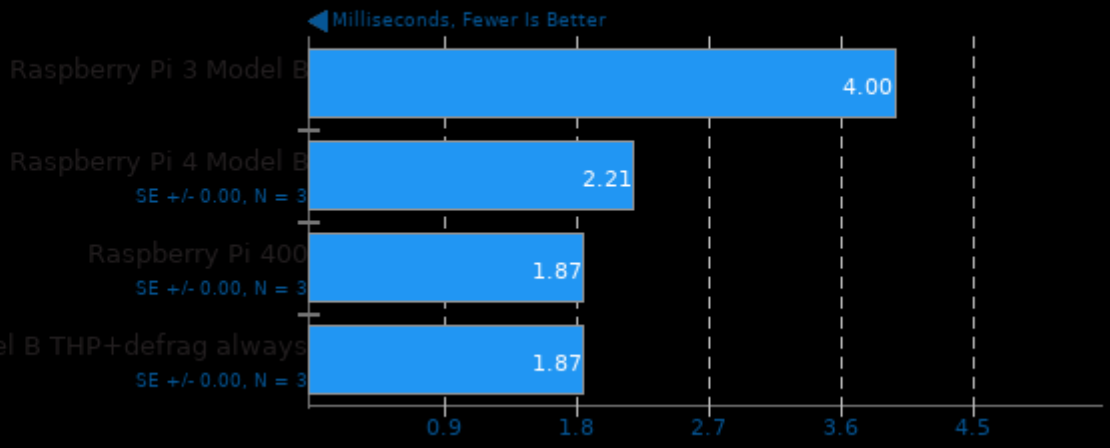
GIMP 2.10.22

Test: auto-levels



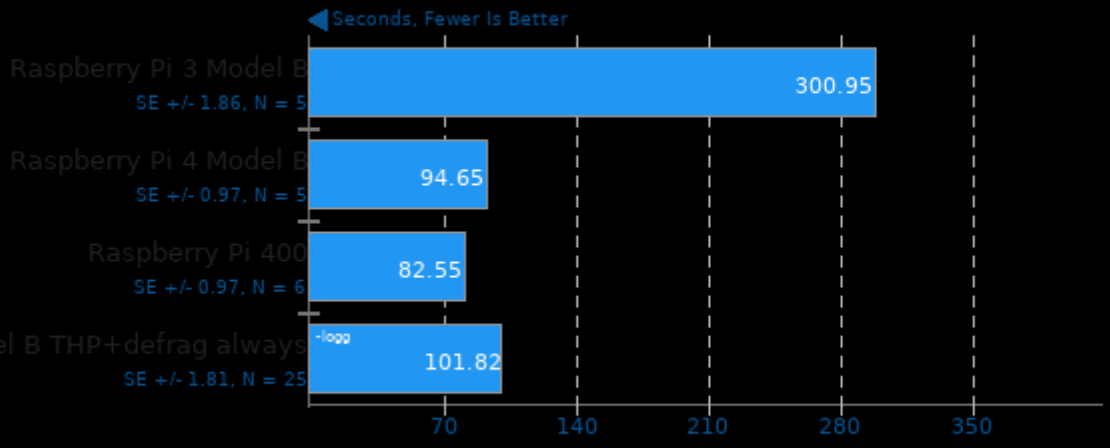
PyPerformance 1.0.0

Benchmark: 2to3



FLAC Audio Encoding 1.3.2

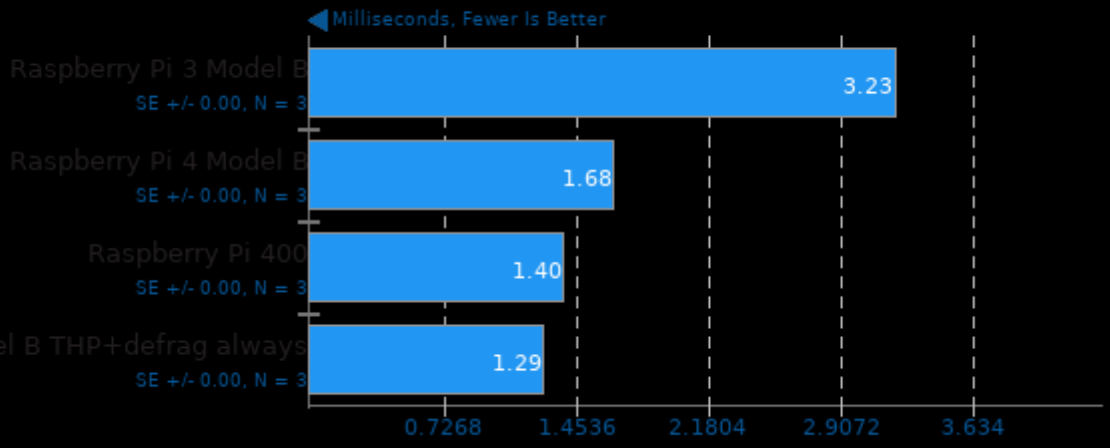
WAV To FLAC



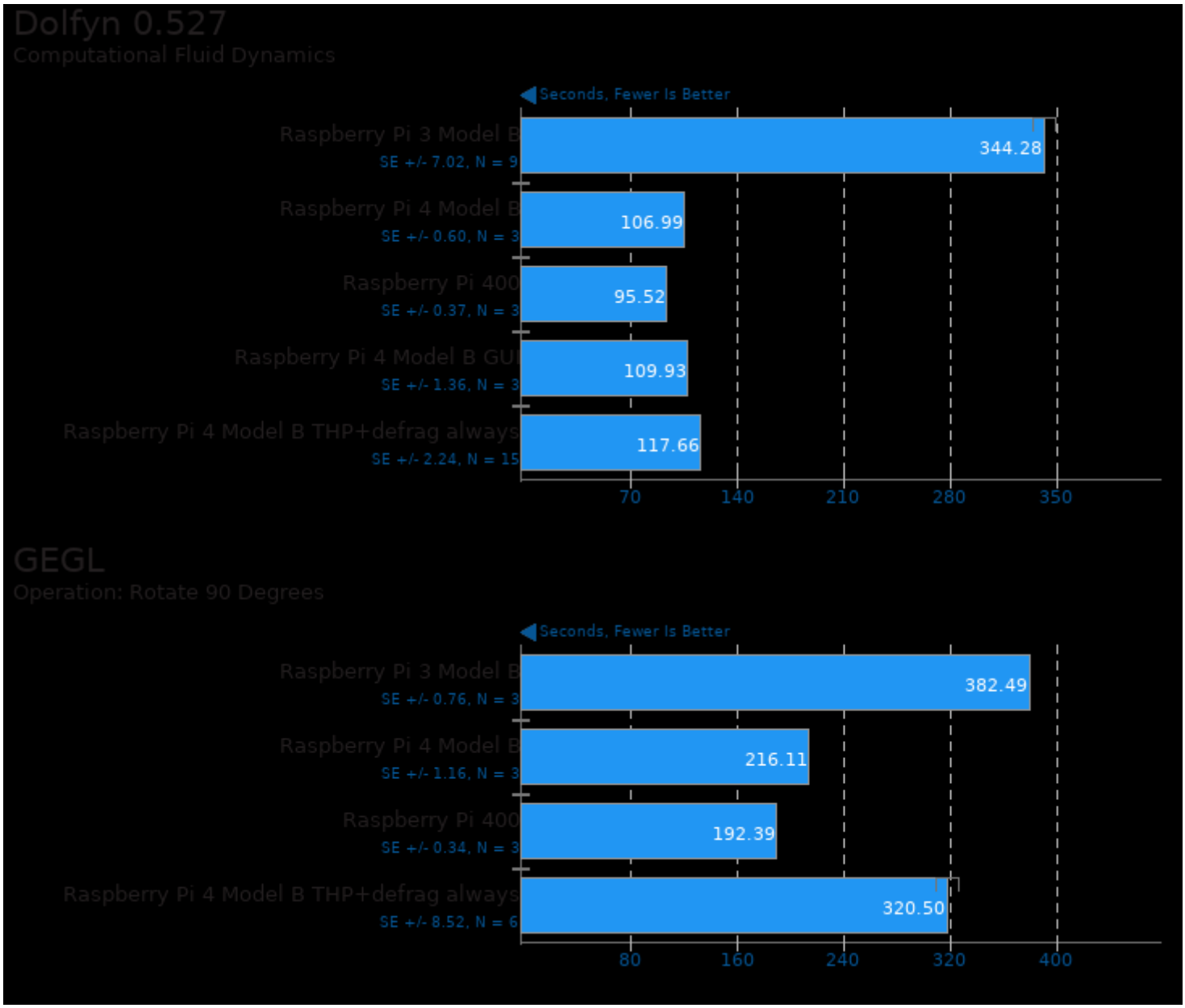
1. (CXX) g++ options: -O2 -fvisibility=hidden -lm

PyPerformance 1.0.0

Benchmark: go

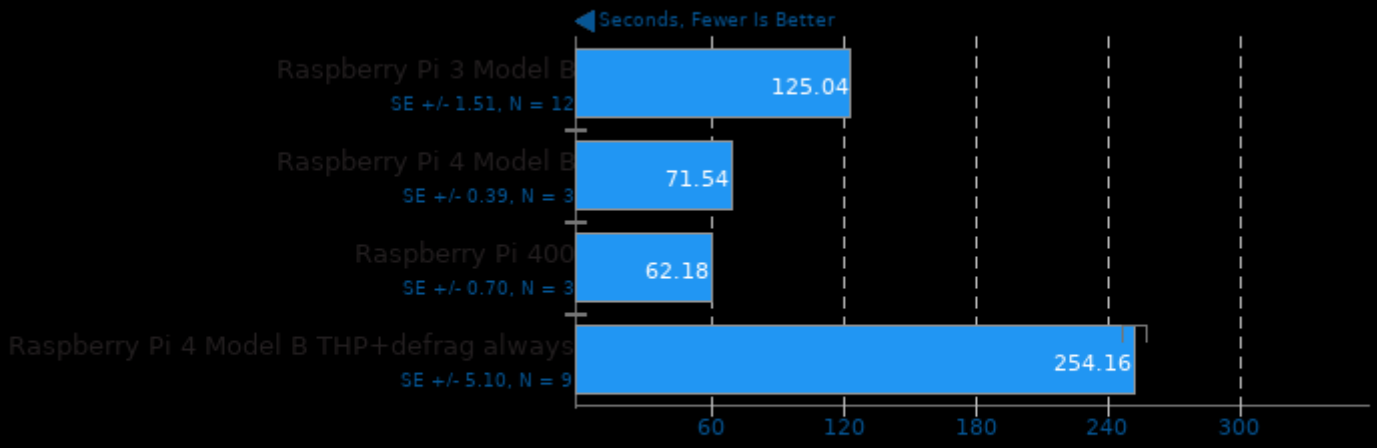


Raspberry Pi 400



librsvg

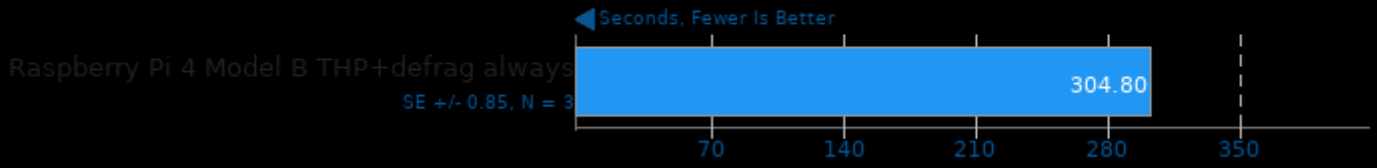
Operation: SVG Files To PNG



1. Raspberry Pi 3 Model B: rsvg-convert version 2.44.10
2. Raspberry Pi 4 Model B: rsvg-convert version 2.44.10
3. Raspberry Pi 400: rsvg-convert version 2.44.10
4. Raspberry Pi 4 Model B THP+defrag always: rsvg-convert version 2.50.7

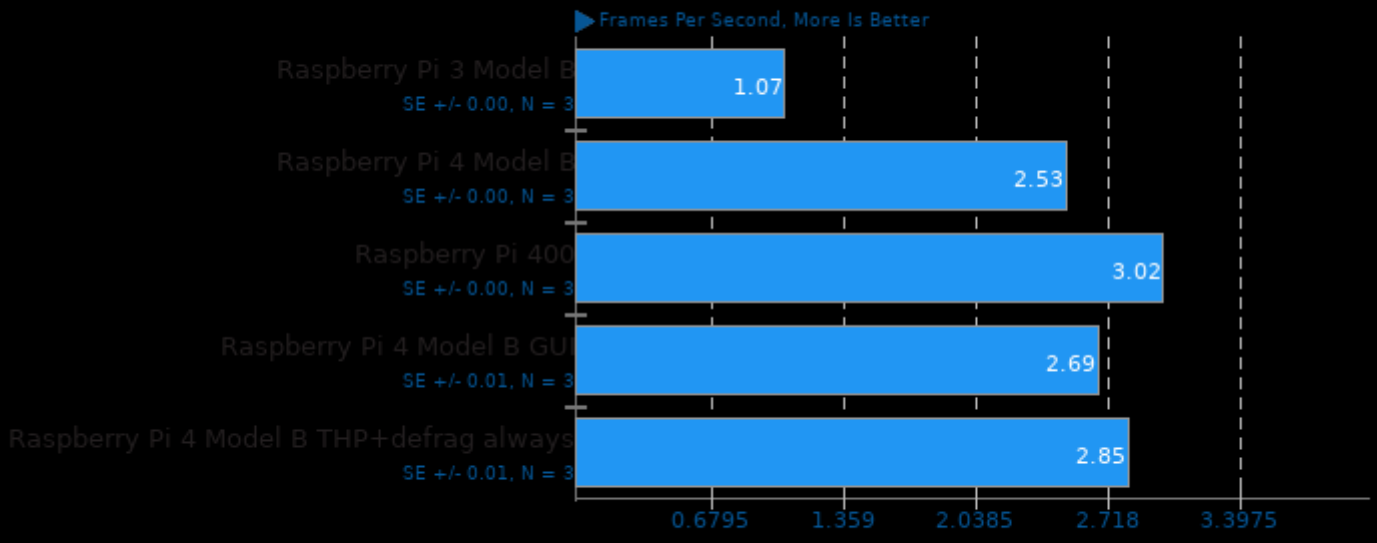
OCRMyPDF 10.3.1+dfsg

Processing 60 Page PDF Document



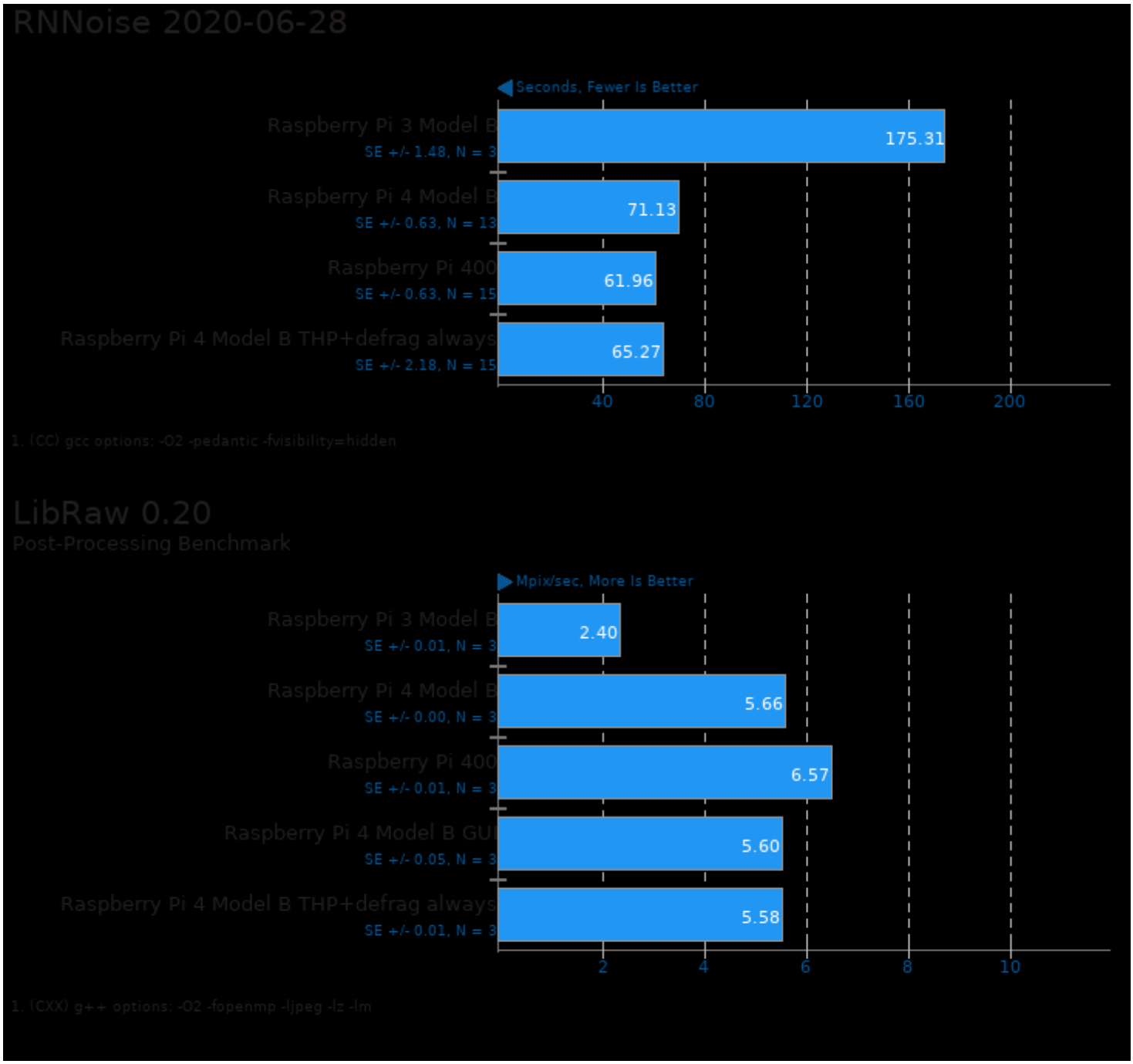
Kvazaar 2.0

Video Input: Bosphorus 1080p - Video Preset: Ultra Fast



1. (CC) gcc options: -pthread -ftree-vectorize -fvisibility=hidden -O2 -lpthread -lm -lrt

Raspberry Pi 400



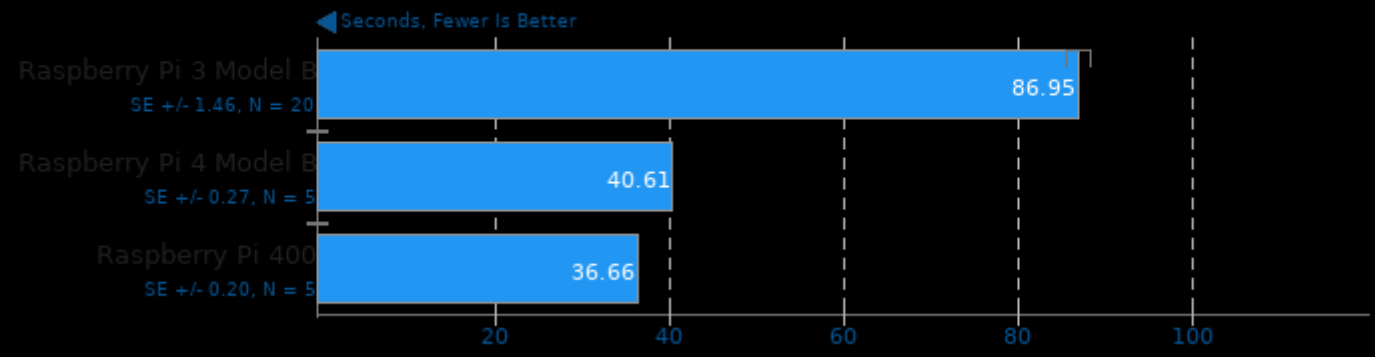
Hierarchical INTegration 1.0

Test: FLOAT



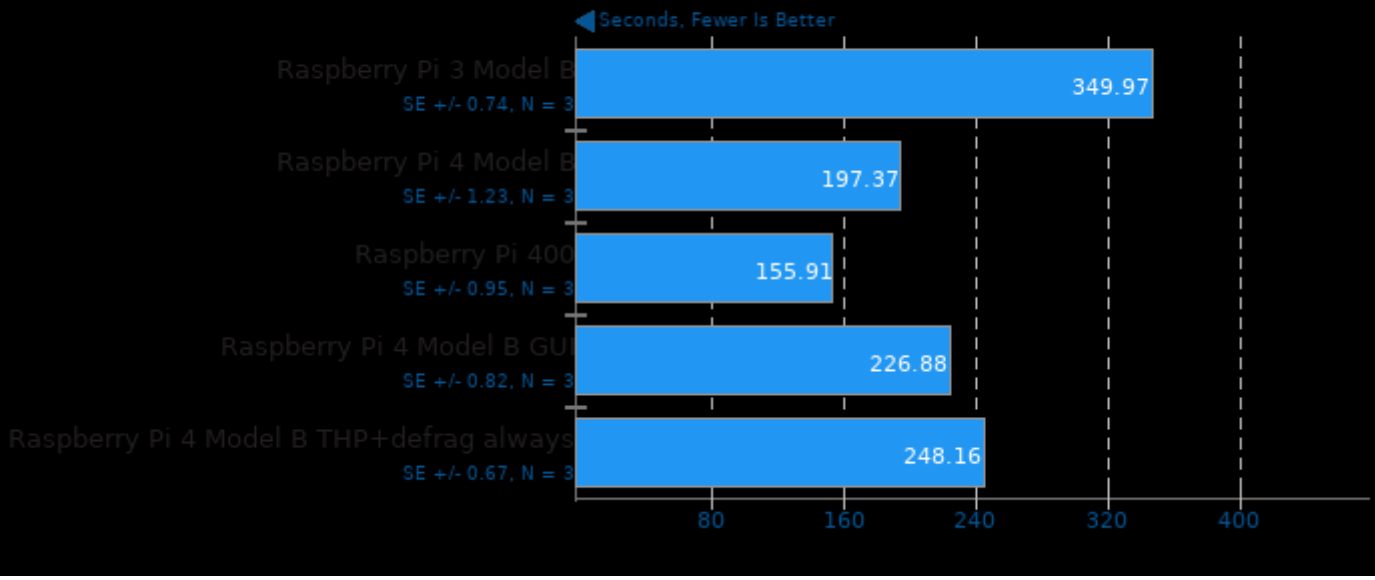
1. (CC) gcc options: -O3 -march=native -lm

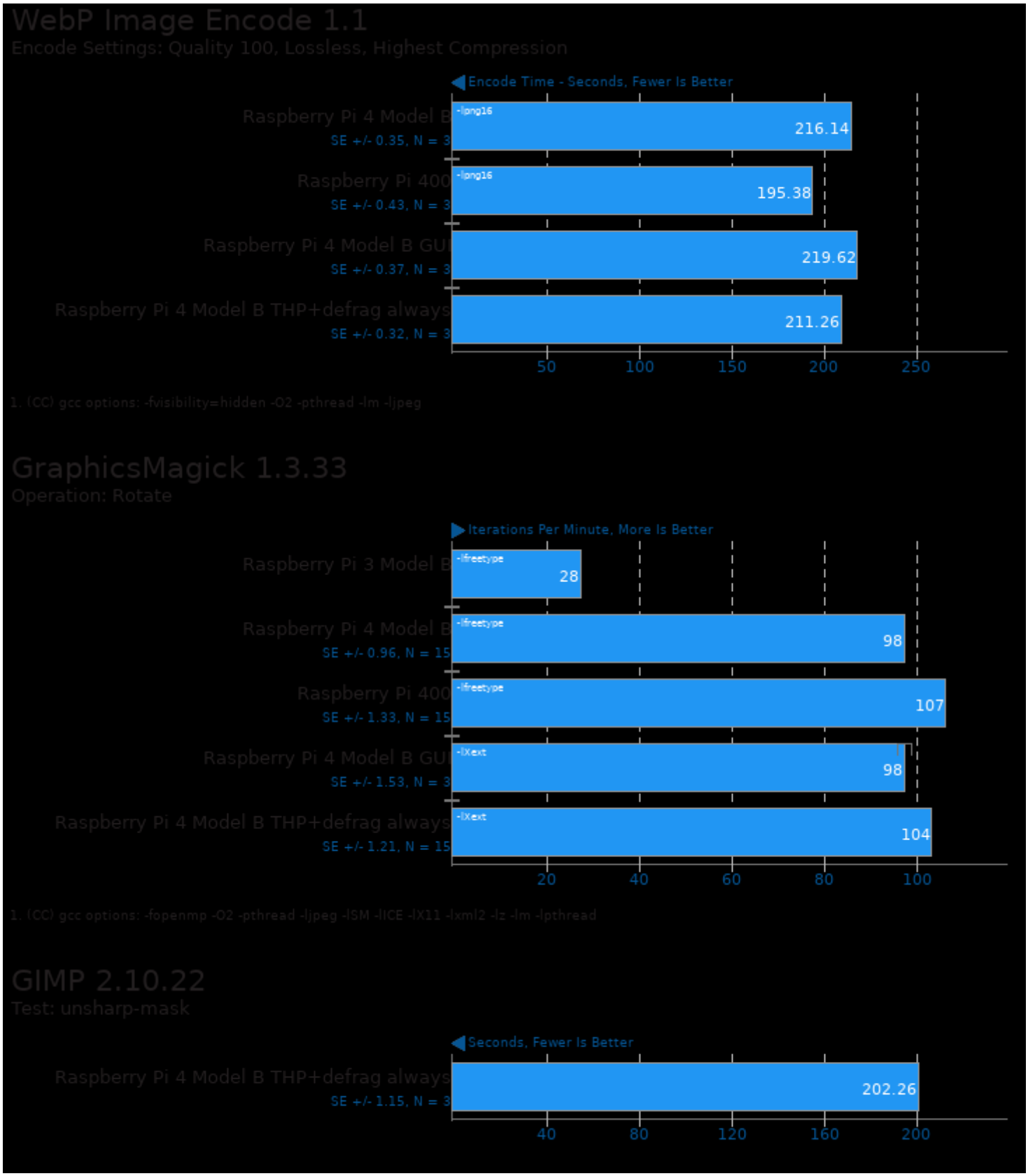
GNU Octave Benchmark 4.4.1

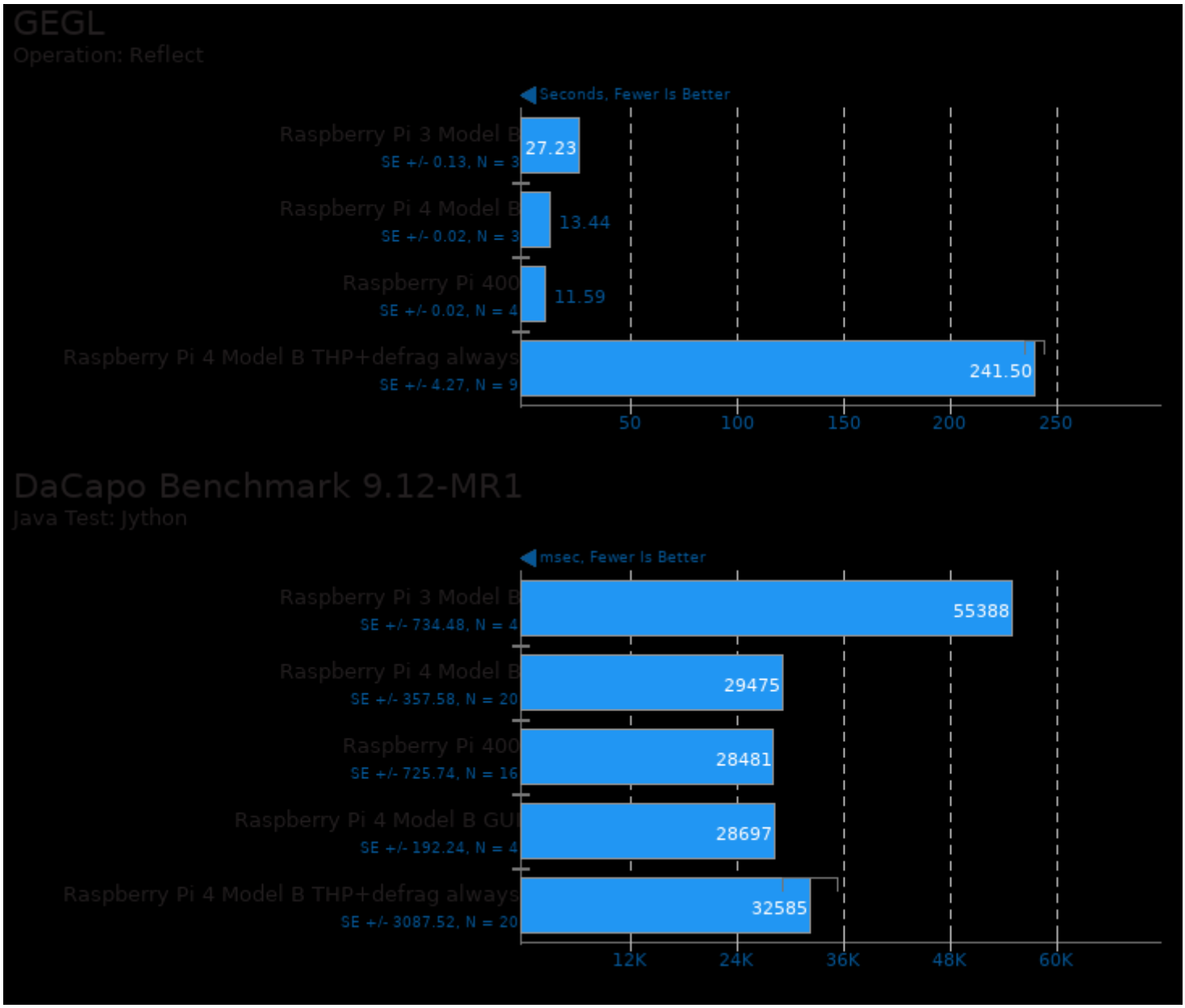


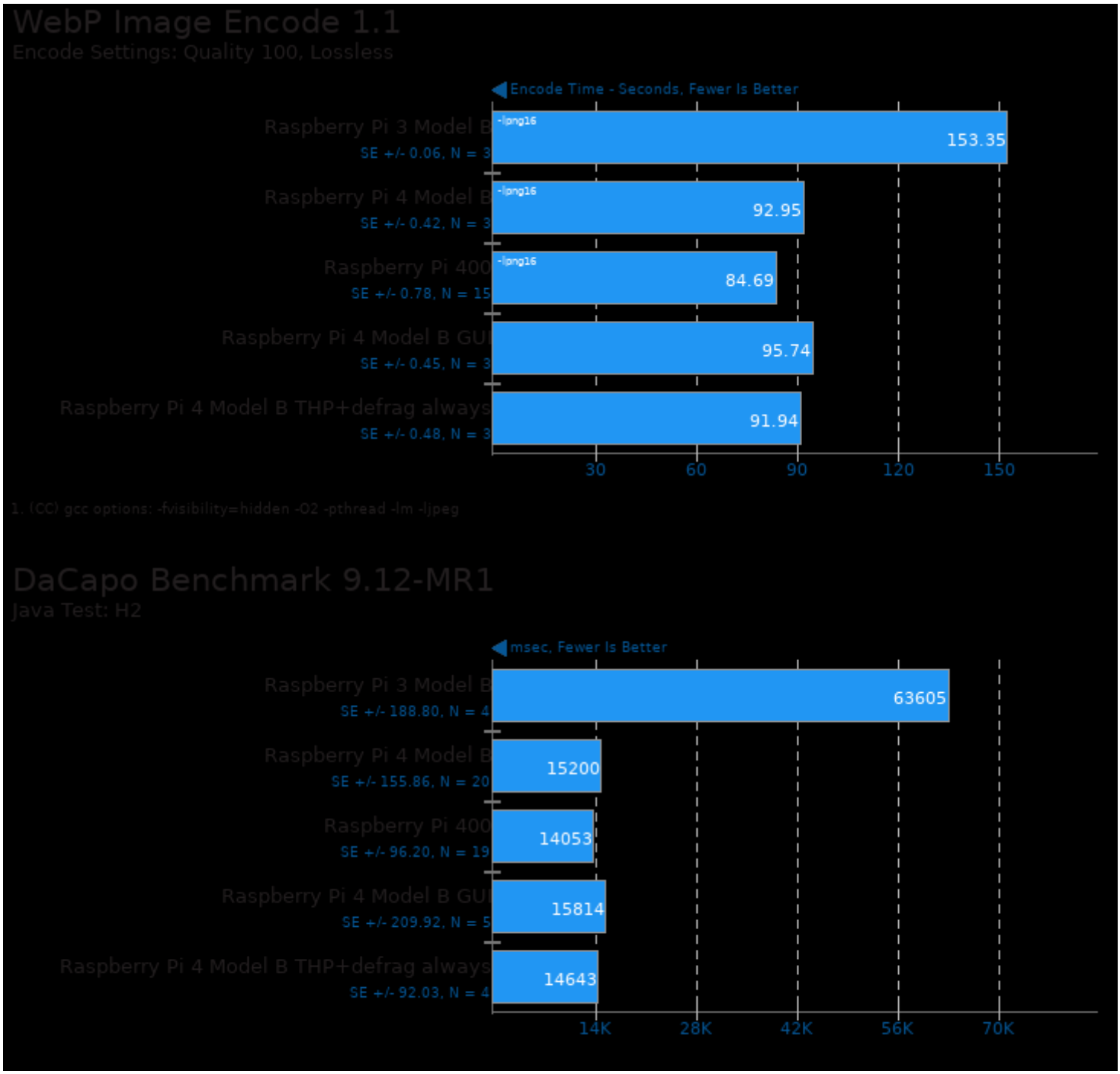
Timed Apache Compilation 2.4.41

Time To Compile



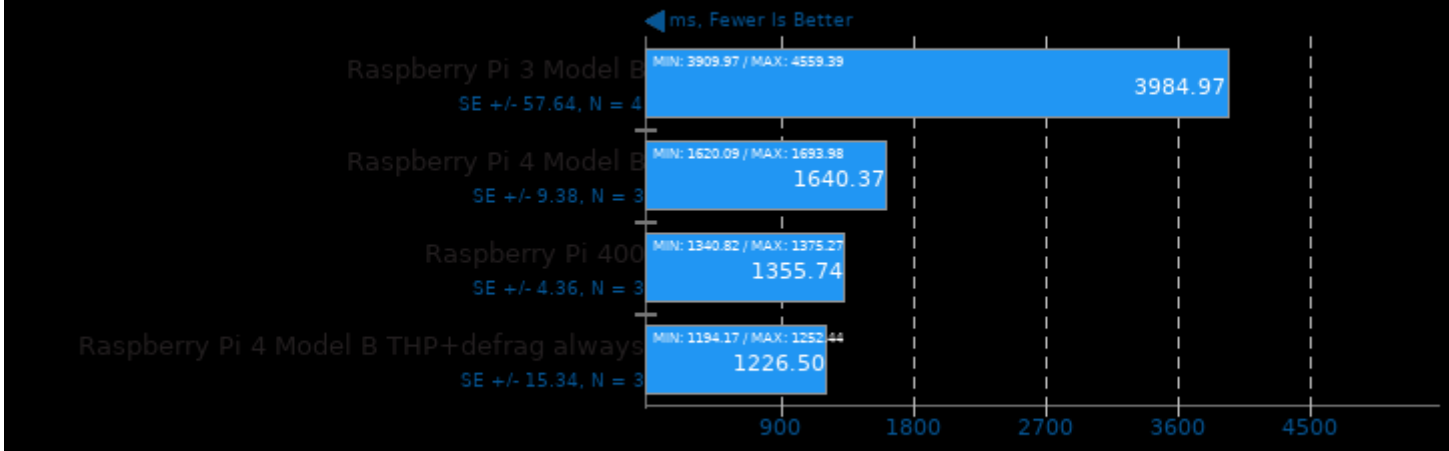

WebP Image Encode 1.1
Encode Settings: Quality 100, Lossless, Highest Compression
Encode Time - Seconds, Fewer Is Better
Raspberry Pi 4 Model B
SE +/- 0.35, N = 3
-lpng16
216.14
Raspberry Pi 400
SE +/- 0.43, N = 3
-lpng16
195.38
Raspberry Pi 4 Model B GUI
SE +/- 0.37, N = 3
219.62
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.32, N = 3
211.26
50
100
150
200
250
1. (CC) gcc options: -fvisibility=hidden -O2 -pthread -lm -ljpeg
GraphicsMagick 1.3.33
Operation: Rotate
Iterations Per Minute, More Is Better
Raspberry Pi 3 Model B
-lfreetype
28
Raspberry Pi 4 Model B
SE +/- 0.96, N = 15
-lfreetype
98
Raspberry Pi 400
SE +/- 1.33, N = 15
-lfreetype
107
Raspberry Pi 4 Model B GUI
SE +/- 1.53, N = 3
-lXext
98
Raspberry Pi 4 Model B THP+defrag always
SE +/- 1.21, N = 15
-lXext
104
20
40
60
80
100
1. (CC) gcc options: -fopenmp -O2 -pthread -ljpeg -lSM -lICE -lX11 -lxml2 -lz -lm -lpthread
GIMP 2.10.22
Test: unsharp-mask
Seconds, Fewer Is Better
Raspberry Pi 4 Model B THP+defrag always
SE +/- 1.15, N = 3
202.26
40
80
120
160
200


GEGL
Operation: Reflect
Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.13, N = 3
27.23
Raspberry Pi 4 Model B
SE +/- 0.02, N = 3
13.44
Raspberry Pi 400
SE +/- 0.02, N = 4
11.59
Raspberry Pi 4 Model B THP+defrag always
SE +/- 4.27, N = 9
241.50
50
100
150
200
250
DaCapo Benchmark 9.12-MR1
Java Test: Jython
msec, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 734.48, N = 4
55388
Raspberry Pi 4 Model B
SE +/- 357.58, N = 20
29475
Raspberry Pi 400
SE +/- 725.74, N = 16
28481
Raspberry Pi 4 Model B GUI
SE +/- 192.24, N = 4
28697
Raspberry Pi 4 Model B THP+defrag always
SE +/- 3087.52, N = 20
32585
12K
24K
36K
48K
60K


WebP Image Encode 1.1
Encode Settings: Quality 100, Lossless
Encode Time - Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.06, N = 3
-lpng16
153.35
Raspberry Pi 4 Model B
SE +/- 0.42, N = 3
-lpng16
92.95
Raspberry Pi 400
SE +/- 0.78, N = 15
-lpng16
84.69
Raspberry Pi 4 Model B GUI
SE +/- 0.45, N = 3
95.74
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.48, N = 3
91.94
30
60
90
120
150
1. (CC) gcc options: -fvisibility=hidden -O2 -pthread -lm -ljpeg
DaCapo Benchmark 9.12-MR1
Java Test: H2
msec, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 188.80, N = 4
63605
Raspberry Pi 4 Model B
SE +/- 155.86, N = 20
15200
Raspberry Pi 400
SE +/- 96.20, N = 19
14053
Raspberry Pi 4 Model B GUI
SE +/- 209.92, N = 5
15814
Raspberry Pi 4 Model B THP+defrag always
SE +/- 92.03, N = 4
14643
14K
28K
42K
56K
70K

TNN 0.2.3

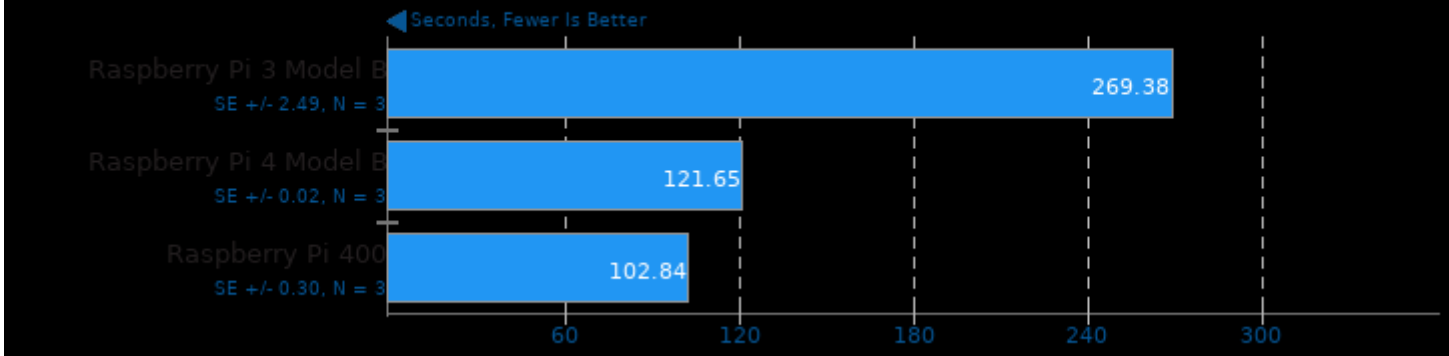
Target: CPU - Model: MobileNet v2



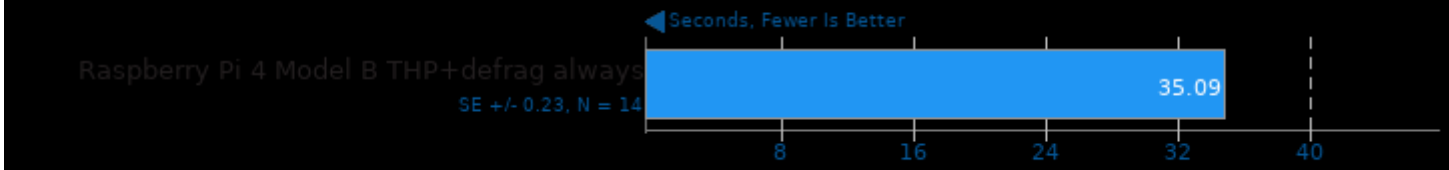
1. (CXX) g++ options: -fopenmp -pthread -fvisibility=hidden -O3 -rdynamic -ldl

Tesseract OCR 4.0.0

Time To OCR 7 Images



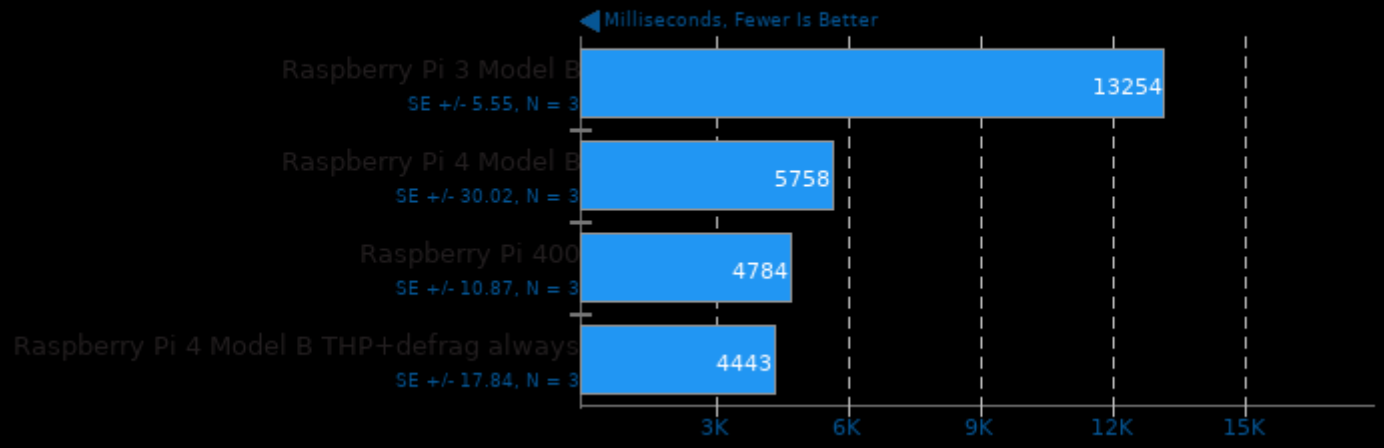
GNU Octave Benchmark 6.2.0



Raspberry Pi 400

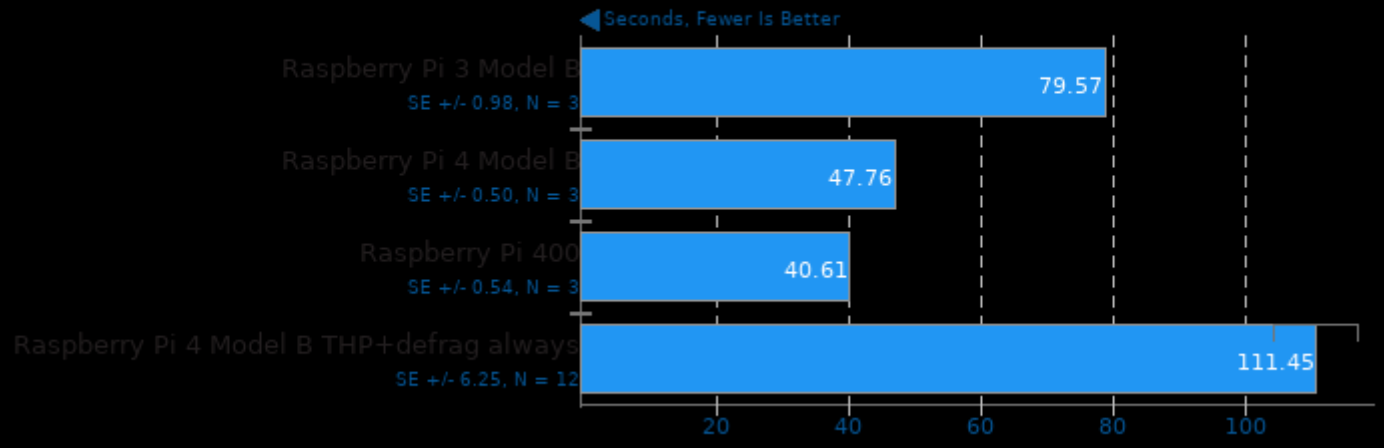
PyBench 2018-02-16

Total For Average Test Times



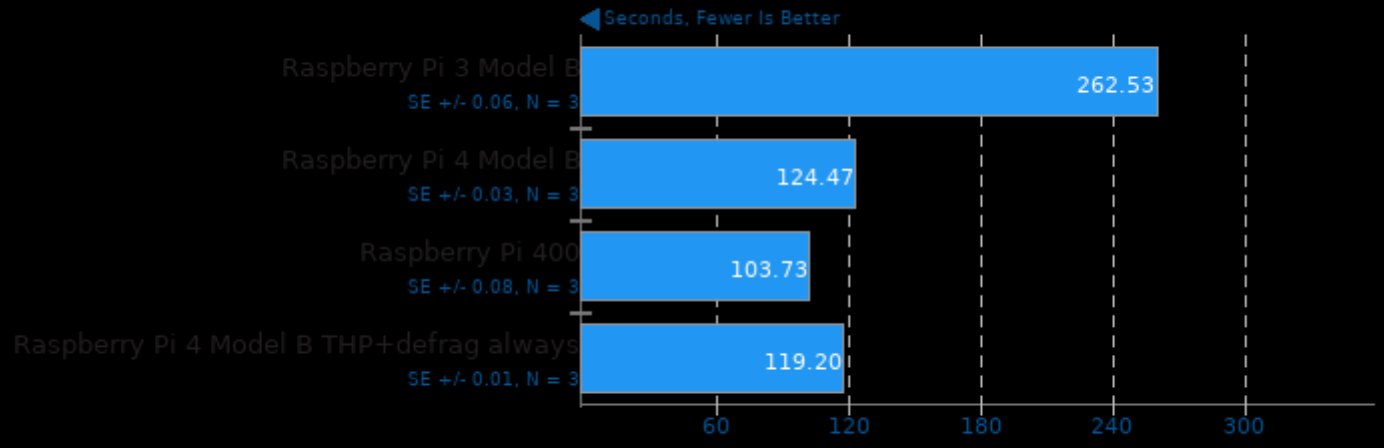
GEGL

Operation: Crop

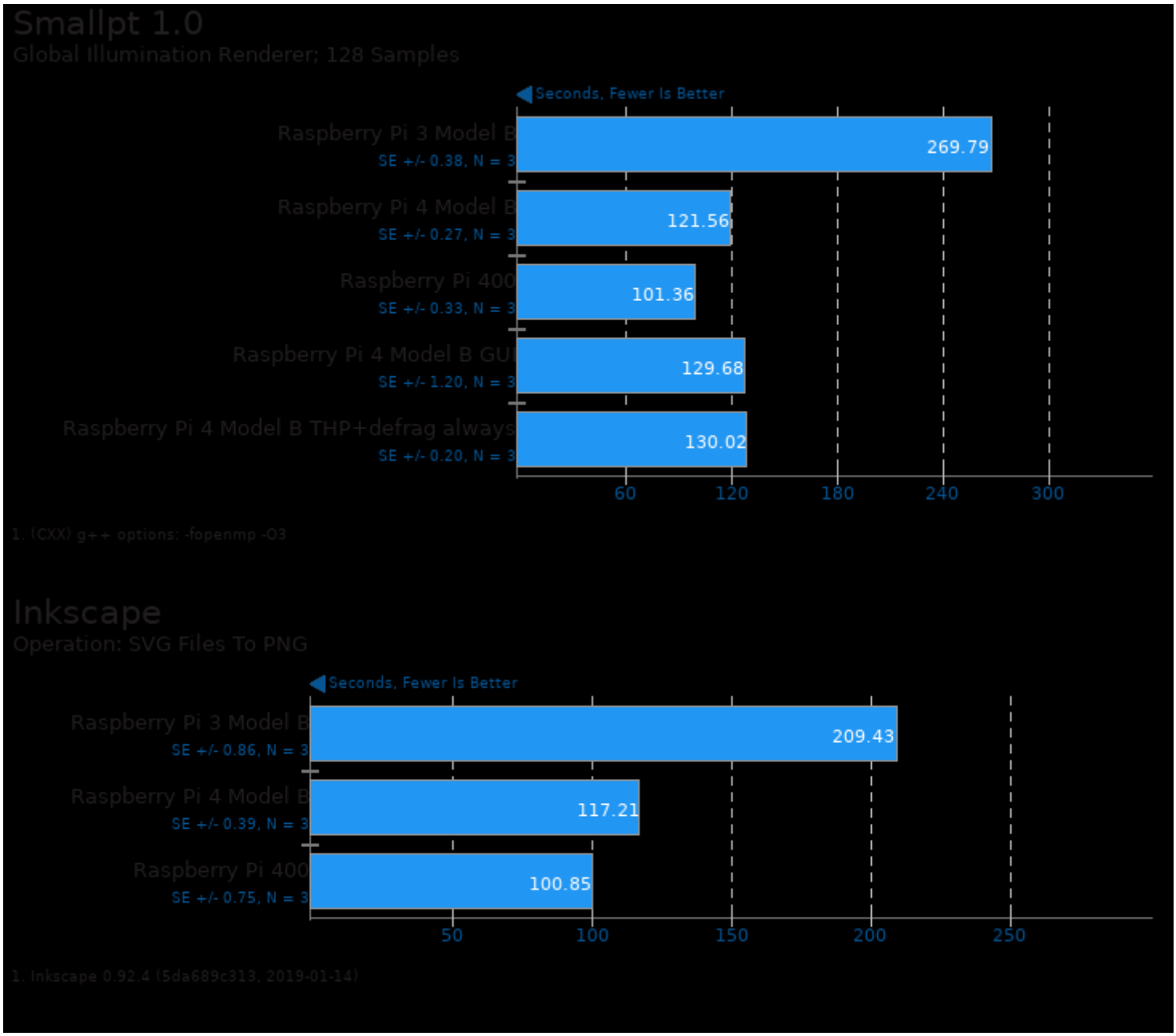


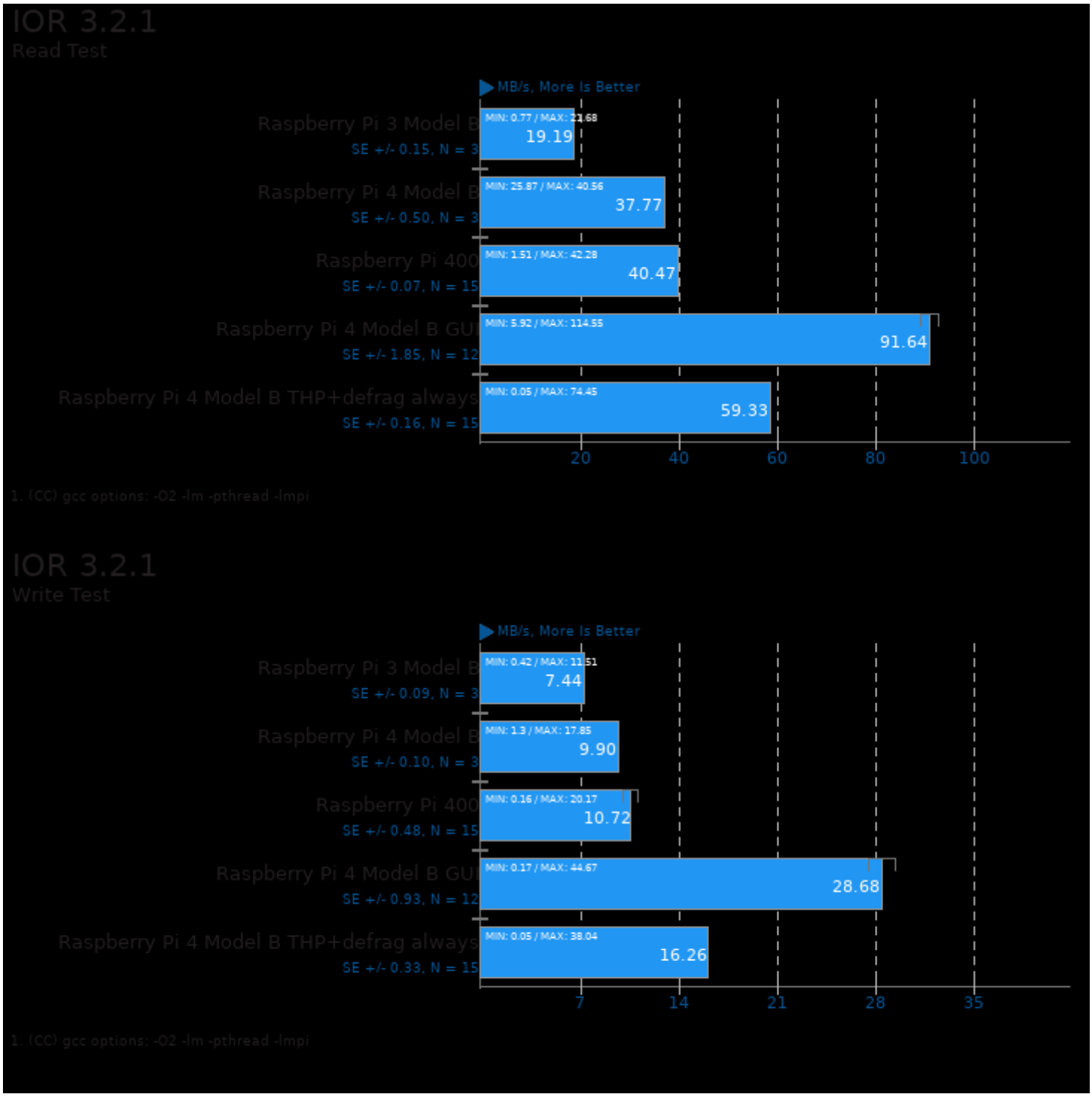
AOBench

Size: 2048 x 2048 - Total Time



1. (CC) gcc options: -lm -O3

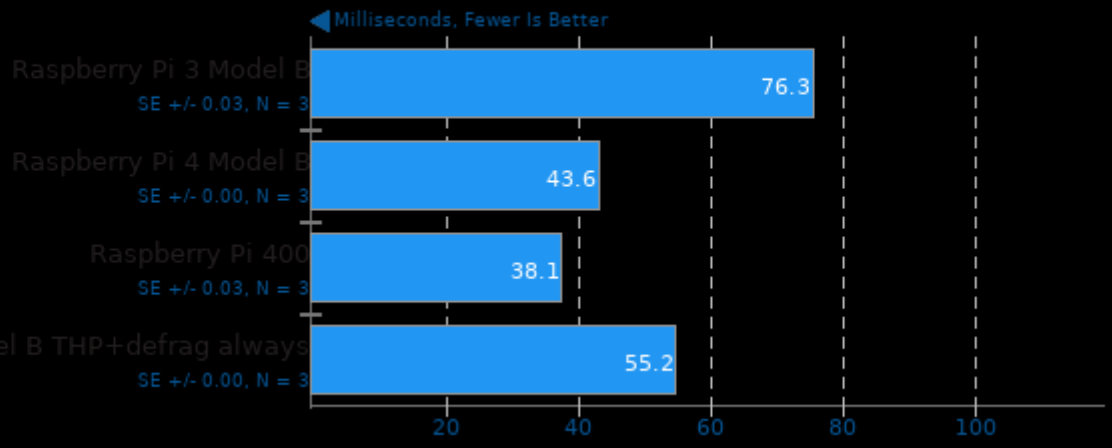

Smallpt 1.0
Global Illumination Renderer; 128 Samples
Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.38, N = 3
269.79
Raspberry Pi 4 Model B
SE +/- 0.27, N = 3
121.56
Raspberry Pi 400
SE +/- 0.33, N = 3
101.36
Raspberry Pi 4 Model B GUI
SE +/- 1.20, N = 3
129.68
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.20, N = 3
130.02
60
120
180
240
300
1. (CXX) g++ options: -fopenmp -O3
Inkscape
Operation: SVG Files To PNG
Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.86, N = 3
209.43
Raspberry Pi 4 Model B
SE +/- 0.39, N = 3
117.21
Raspberry Pi 400
SE +/- 0.75, N = 3
100.85
50
100
150
200
250
1. Inkscape 0.92.4 (5da689c313, 2019-01-14)


IOR 3.2.1
Read Test
MB/s, More Is Better
Raspberry Pi 3 Model B
SE +/- 0.15, N = 3
MIN: 0.77 / MAX: 21.68
19.19
Raspberry Pi 4 Model B
SE +/- 0.50, N = 3
MIN: 25.87 / MAX: 40.56
37.77
Raspberry Pi 400
SE +/- 0.07, N = 15
MIN: 1.51 / MAX: 42.28
40.47
Raspberry Pi 4 Model B GUI
SE +/- 1.85, N = 12
MIN: 5.92 / MAX: 114.55
91.64
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.16, N = 15
MIN: 0.05 / MAX: 74.45
59.33
20
40
60
80
100
1. (CC) gcc options: -O2 -lm -pthread -lmpi
IOR 3.2.1
Write Test
MB/s, More Is Better
Raspberry Pi 3 Model B
SE +/- 0.09, N = 3
MIN: 0.42 / MAX: 11.51
7.44
Raspberry Pi 4 Model B
SE +/- 0.10, N = 3
MIN: 1.3 / MAX: 17.85
9.90
Raspberry Pi 400
SE +/- 0.48, N = 15
MIN: 0.16 / MAX: 20.17
10.72
Raspberry Pi 4 Model B GUI
SE +/- 0.93, N = 12
MIN: 0.17 / MAX: 44.67
28.68
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.33, N = 15
MIN: 0.05 / MAX: 38.04
16.26
7
14
21
28
35
1. (CC) gcc options: -O2 -lm -pthread -lmpi

Raspberry Pi 400

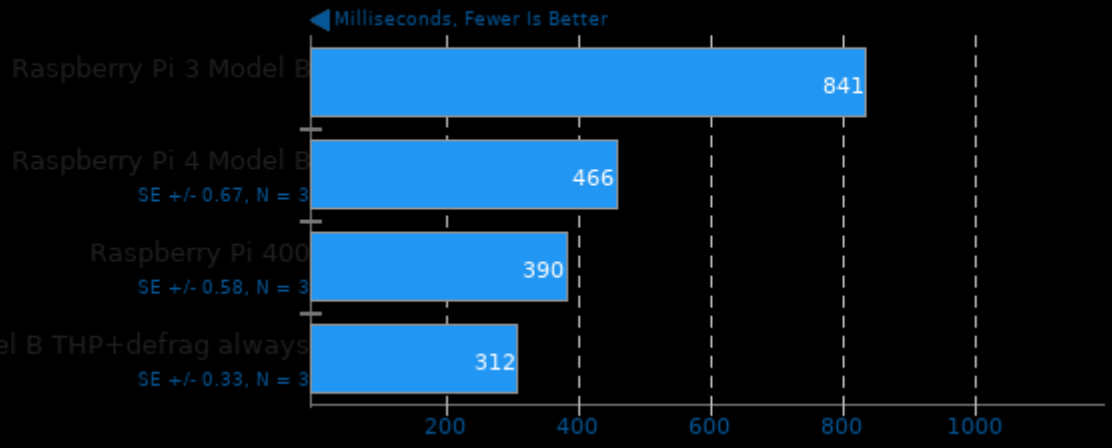
PyPerformance 1.0.0

Benchmark: python_startup



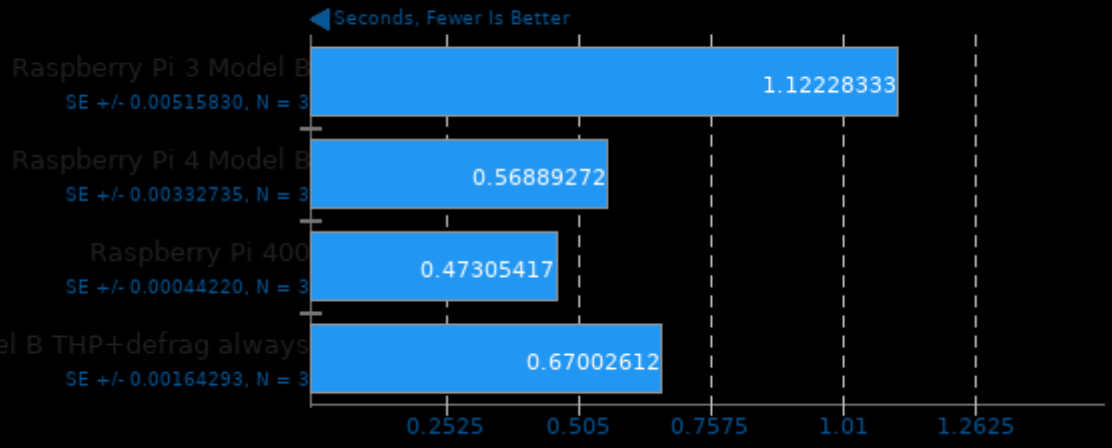
PyPerformance 1.0.0

Benchmark: django_template



Perl Benchmarks

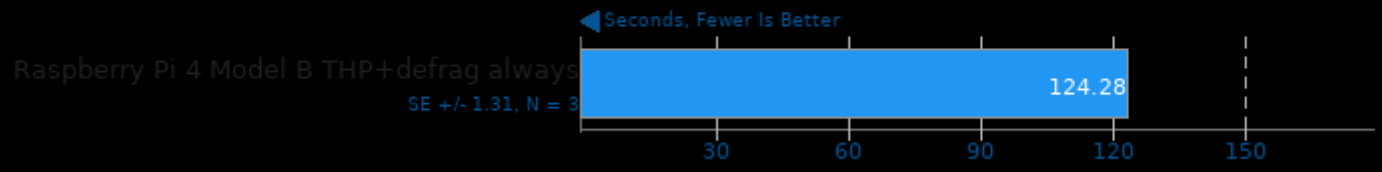
Test: Pod2html



Raspberry Pi 400

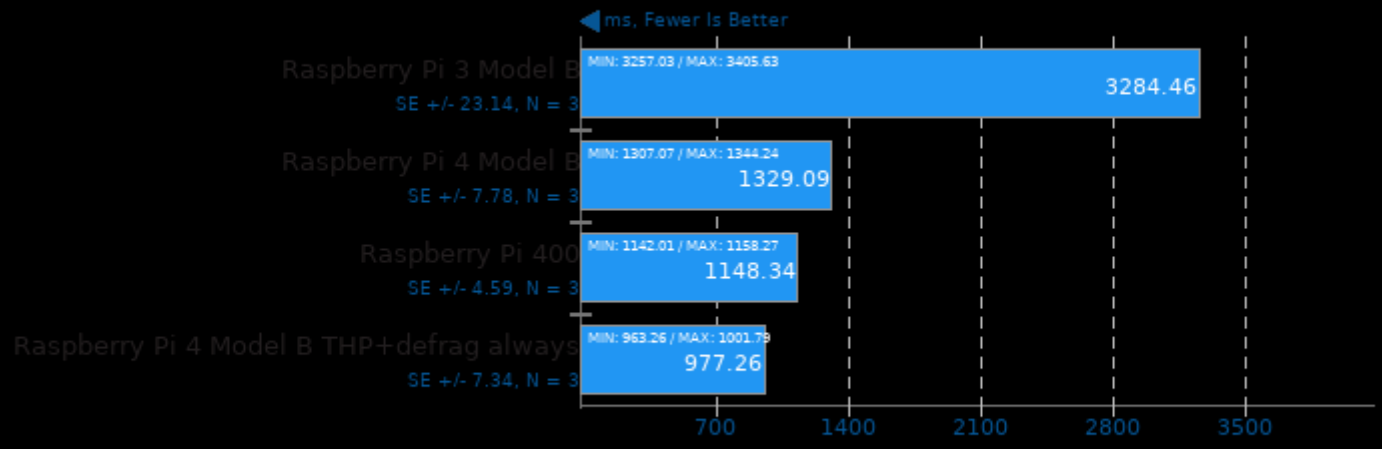
Tesseract OCR 4.1.1

Time To OCR 7 Images



TNN 0.2.3

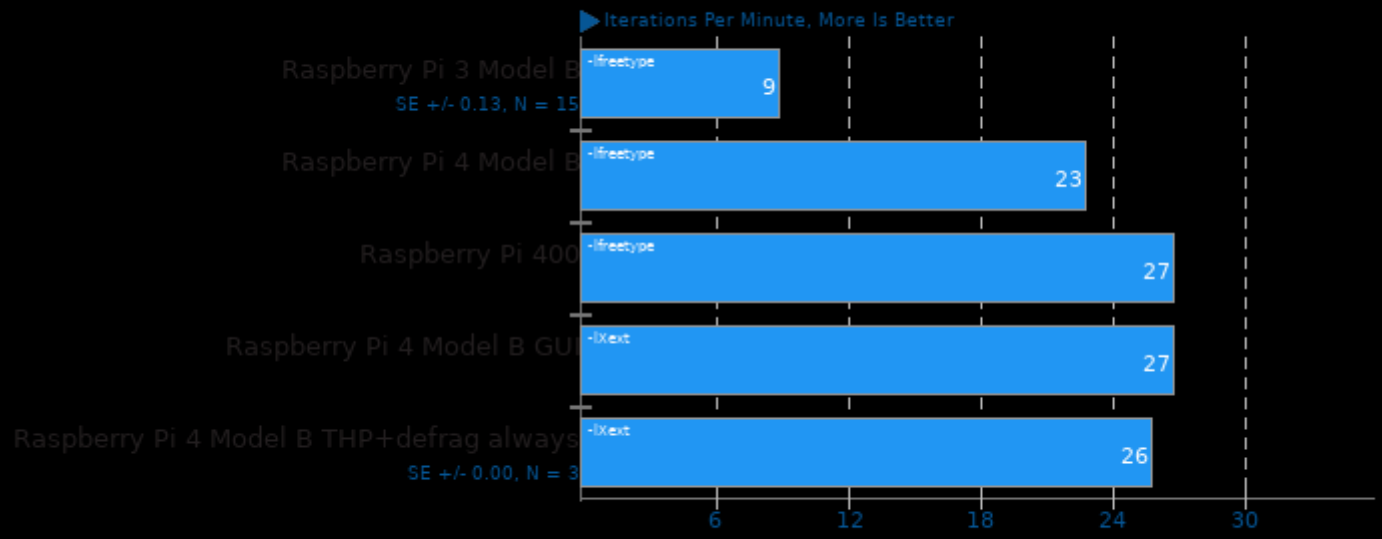
Target: CPU - Model: SqueezeNet v1.1



1. (CXX) g++ options: -fopenmp -pthread -fvisibility=hidden -O3 -rdynamic -ldl

GraphicsMagick 1.3.33

Operation: Noise-Gaussian

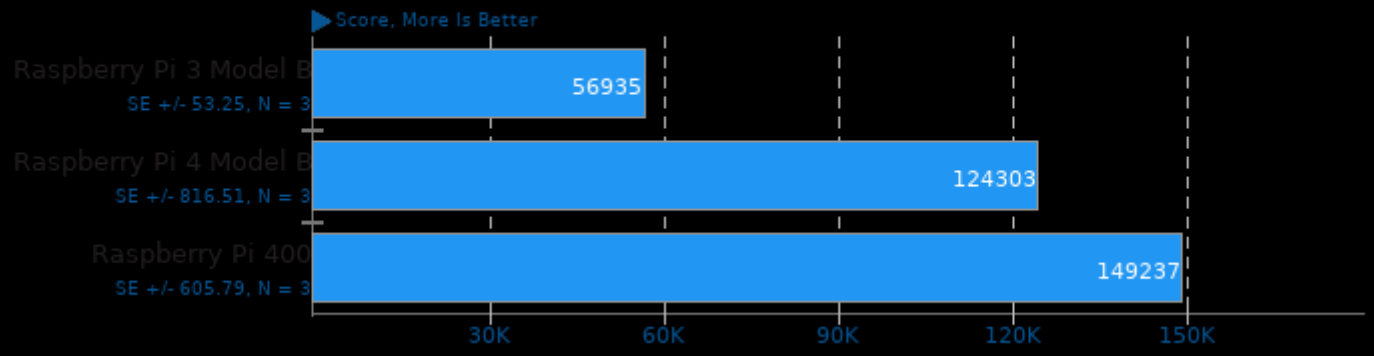


1. (CC) gcc options: -fopenmp -O2 -pthread -ljpeg -lSM -lICE -lX11 -lxml2 -lz -lm -lpthread

Raspberry Pi 400

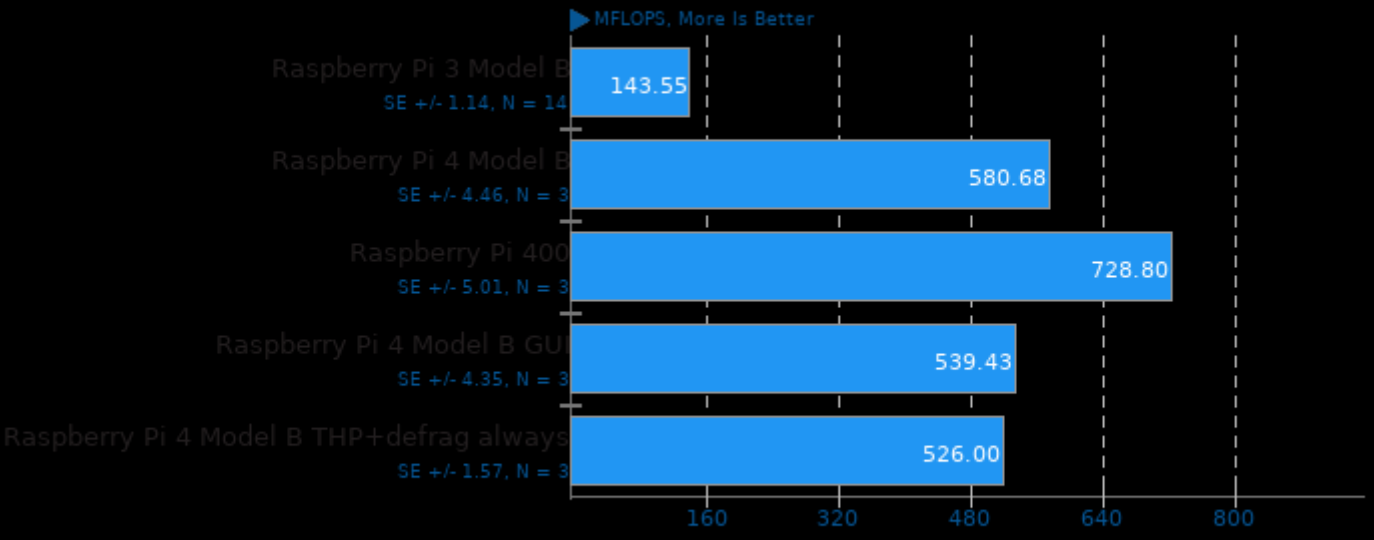
PHPBench 0.8.1

PHP Benchmark Suite



Himeno Benchmark 3.0

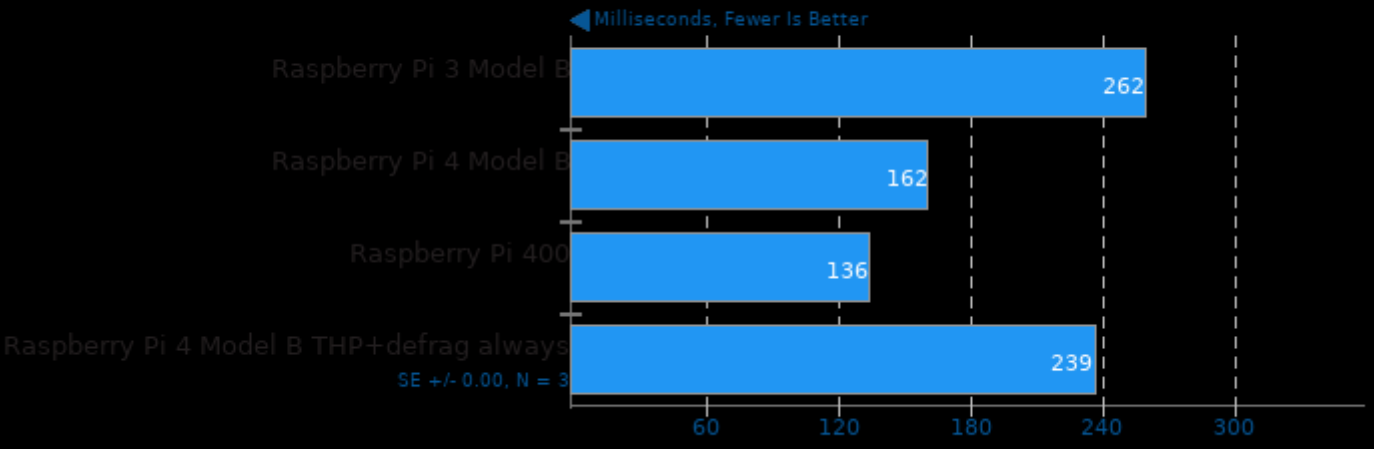
Poisson Pressure Solver

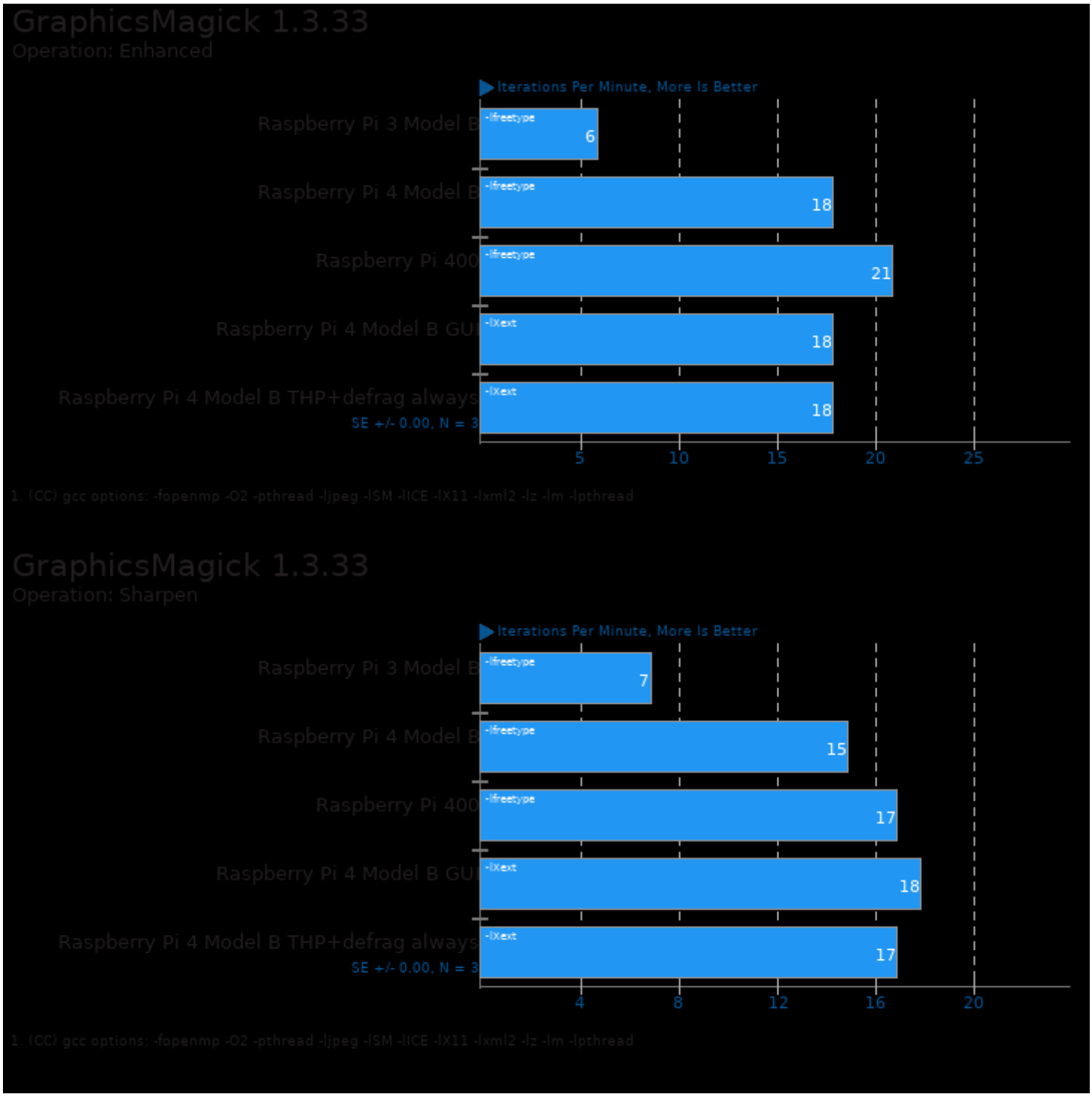


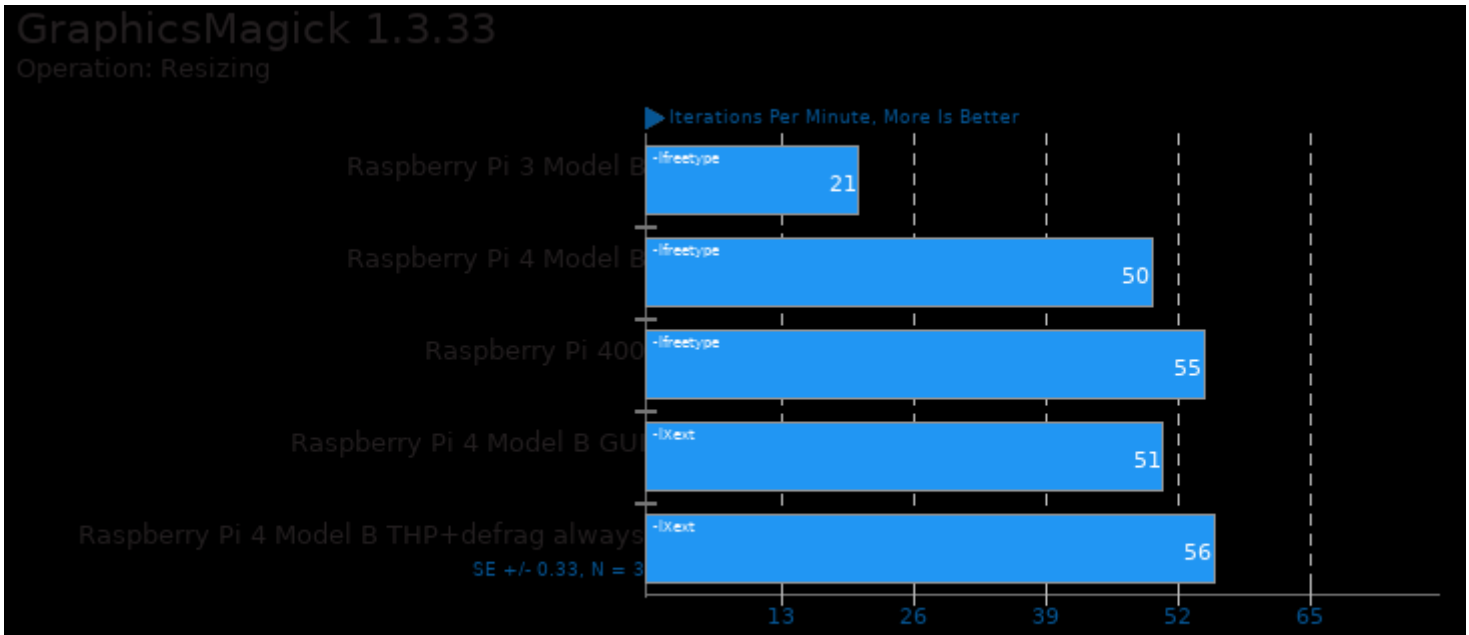
1. (CC) gcc options: -O3

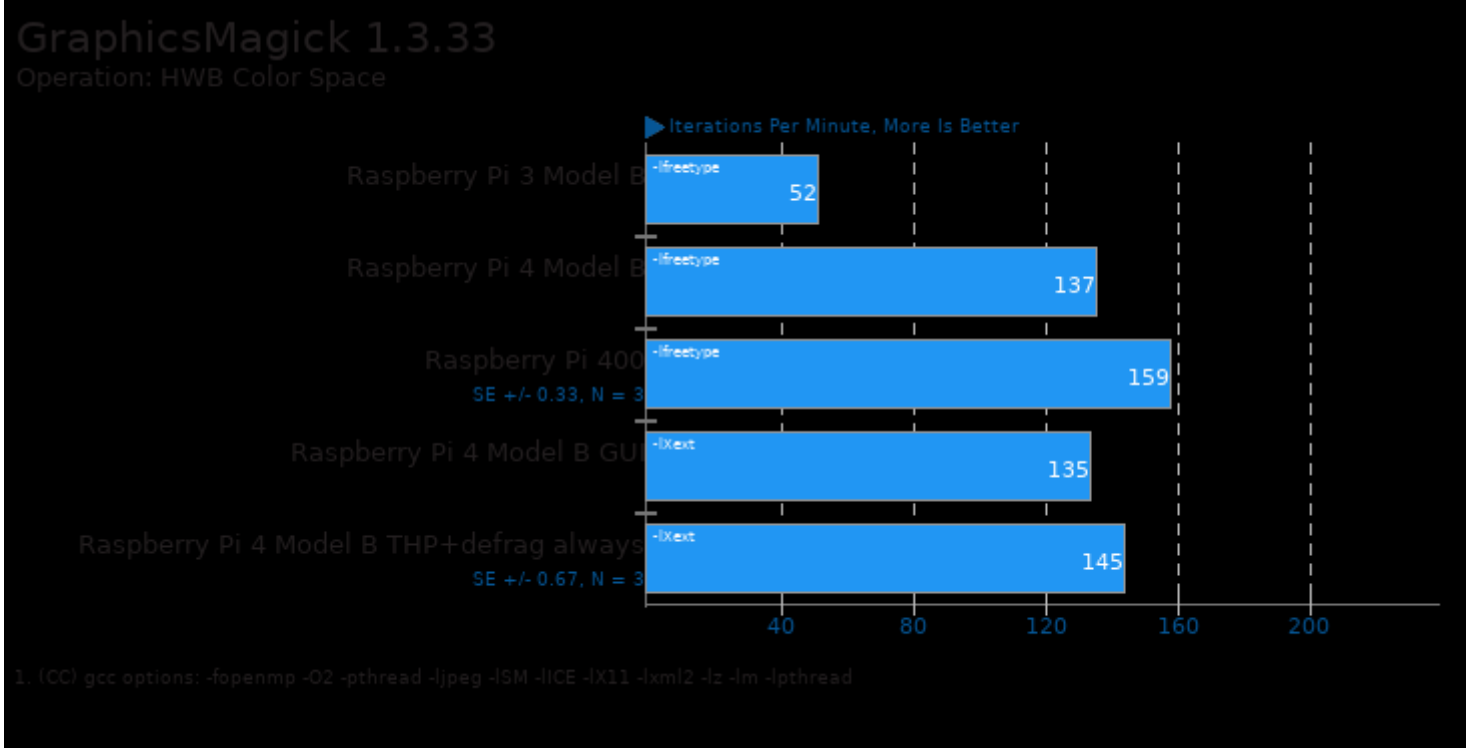
PyPerformance 1.0.0

Benchmark: pathlib

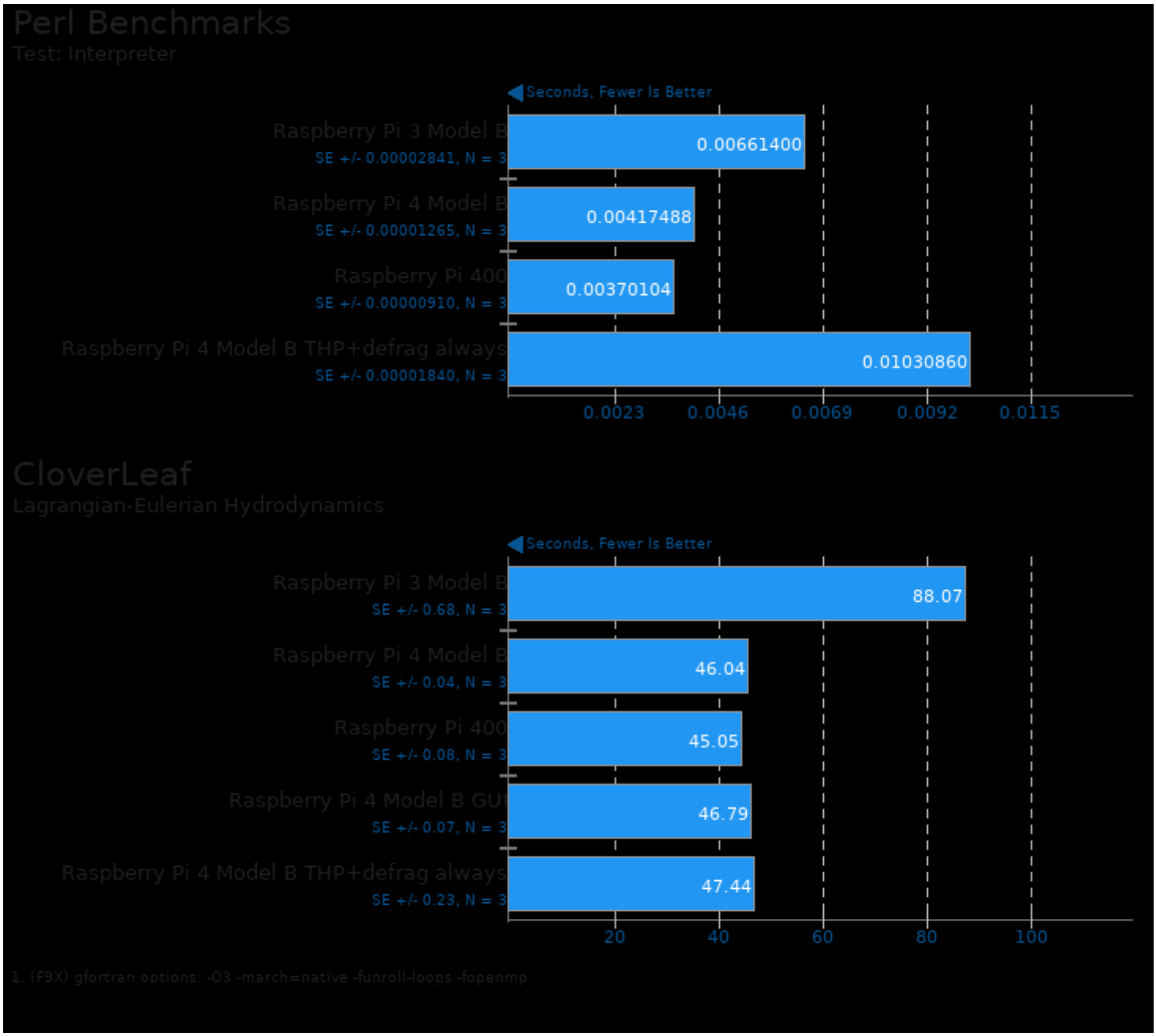


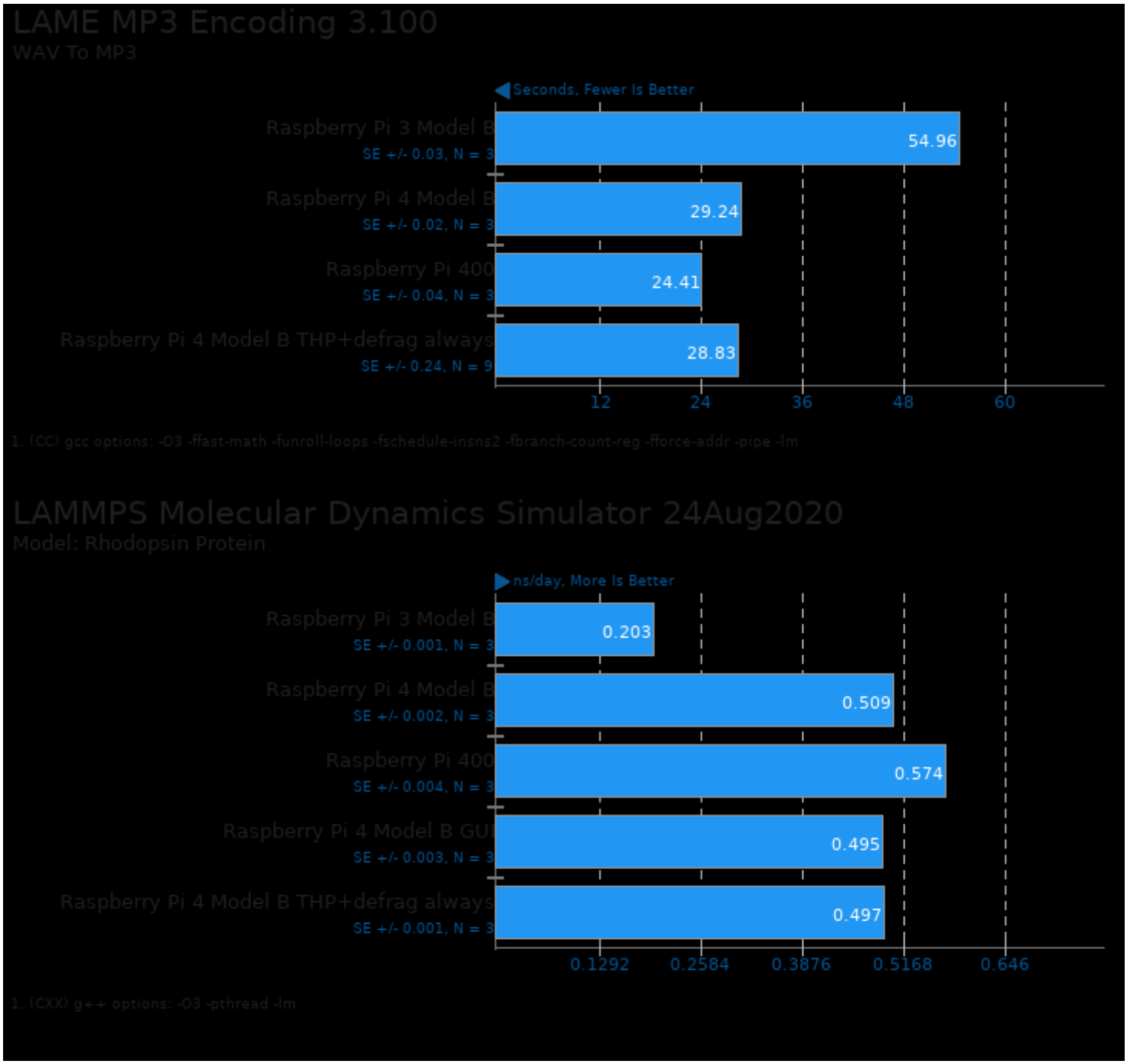

GraphicsMagick 1.3.33
Operation: Enhanced
Iterations Per Minute, More Is Better
Raspberry Pi 3 Model B
Raspberry Pi 4 Model B
Raspberry Pi 400
Raspberry Pi 4 Model B GUI
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.00, N = 3
-lfreetype
-lXext
6
18
21
18
18
5
10
15
20
25
1. (CC) gcc options: -fopenmp -O2 -pthread -ljpeg -lSM -lICE -lX11 -lxml2 -lz -lm -lpthread
GraphicsMagick 1.3.33
Operation: Sharpen
Iterations Per Minute, More Is Better
Raspberry Pi 3 Model B
Raspberry Pi 4 Model B
Raspberry Pi 400
Raspberry Pi 4 Model B GUI
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.00, N = 3
-lfreetype
-lXext
7
15
17
18
17
4
8
12
16
20
1. (CC) gcc options: -fopenmp -O2 -pthread -ljpeg -lSM -lICE -lX11 -lxml2 -lz -lm -lpthread


GraphicsMagick 1.3.33
Operation: Resizing
Iterations Per Minute, More Is Better
Raspberry Pi 3 Model B
Raspberry Pi 4 Model B
Raspberry Pi 400
Raspberry Pi 4 Model B GUI
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.33, N = 3
-lfreetype
-lXext
21
50
55
51
56
13
26
39
52
65
1. (CC) gcc options: -fopenmp -O2 -pthread -ljpeg -lSM -lICE -lX11 -lxml2 -lz -lm -lpthread


GraphicsMagick 1.3.33
Operation: HWB Color Space
Iterations Per Minute, More Is Better
Raspberry Pi 3 Model B
Raspberry Pi 4 Model B
Raspberry Pi 400
SE +/- 0.33, N = 3
Raspberry Pi 4 Model B GUI
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.67, N = 3
-lfreetype
-lXext
52
137
159
135
145
40
80
120
160
200
1. (CC) gcc options: -fopenmp -O2 -pthread -ljpeg -lSM -lICE -lX11 -lxml2 -lz -lm -lpthread

Raspberry Pi 400

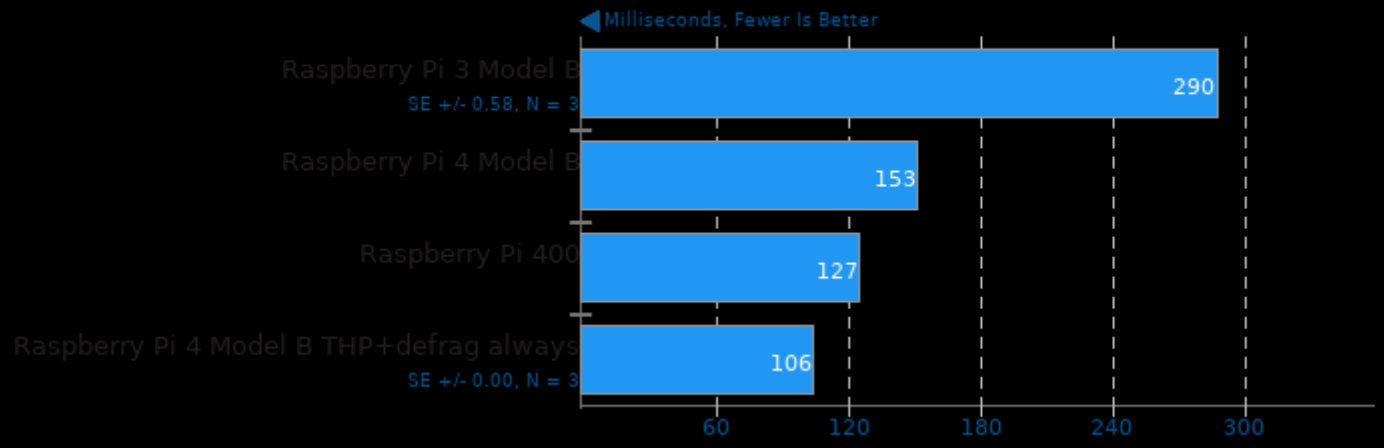



LAME MP3 Encoding 3.100
WAV To MP3
Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.03, N = 3
54.96
Raspberry Pi 4 Model B
SE +/- 0.02, N = 3
29.24
Raspberry Pi 400
SE +/- 0.04, N = 3
24.41
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.24, N = 9
28.83
12
24
36
48
60
1. (CC) gcc options: -O3 -ffast-math -funroll-loops -fschedule-insns2 -fbranch-count-reg -fforce-addr -pipe -lm
LAMMPS Molecular Dynamics Simulator 24Aug2020
Model: Rhodopsin Protein
ns/day, More Is Better
Raspberry Pi 3 Model B
SE +/- 0.001, N = 3
0.203
Raspberry Pi 4 Model B
SE +/- 0.002, N = 3
0.509
Raspberry Pi 400
SE +/- 0.004, N = 3
0.574
Raspberry Pi 4 Model B GUI
SE +/- 0.003, N = 3
0.495
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.001, N = 3
0.497
0.1292
0.2584
0.3876
0.5168
0.646
1. (CXX) g++ options: -O3 -pthread -lm

Raspberry Pi 400

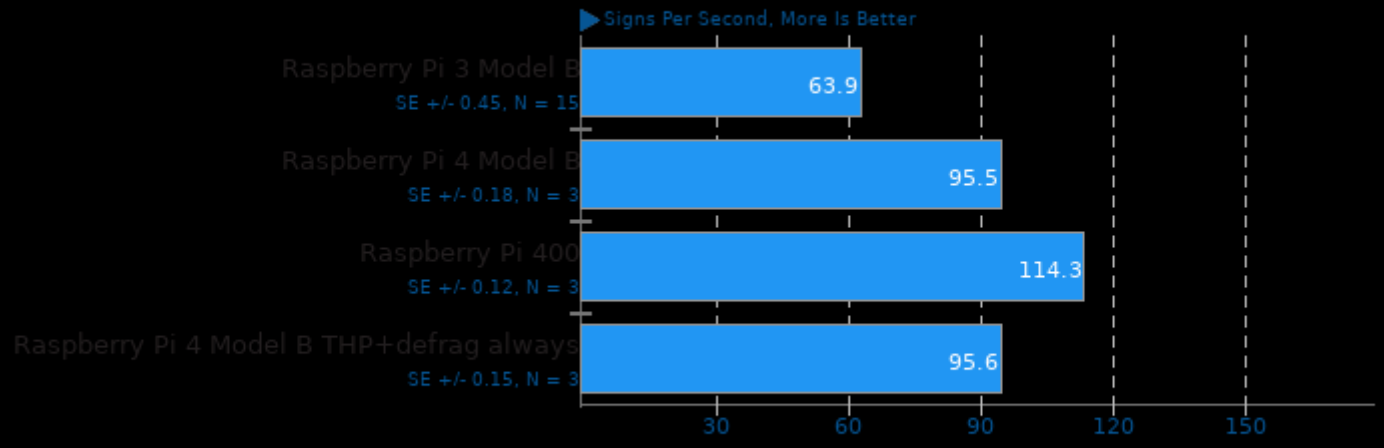
PyPerformance 1.0.0

Benchmark: json_loads



OpenSSL 1.1.1

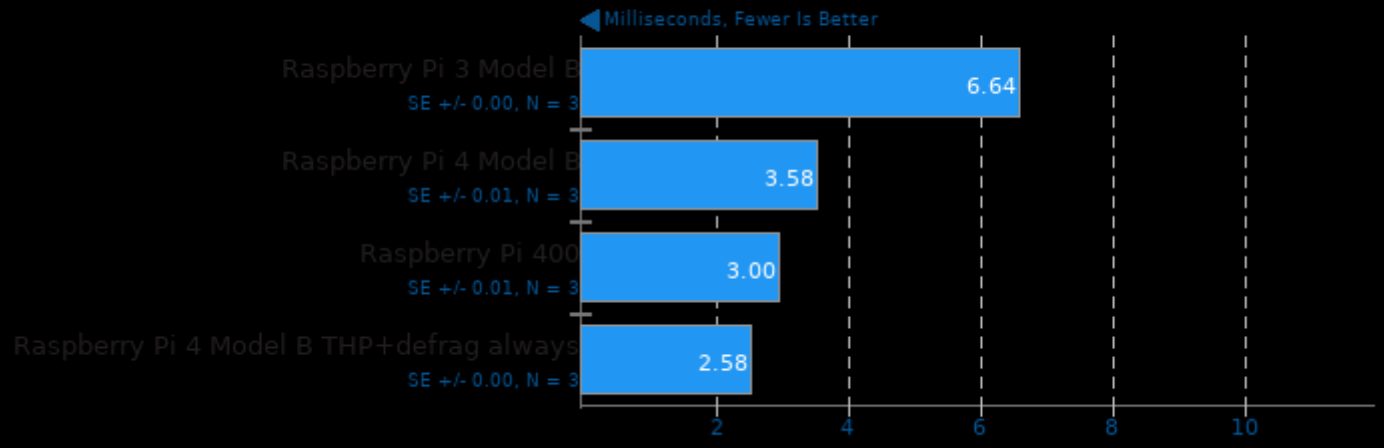
RSA 4096-bit Performance

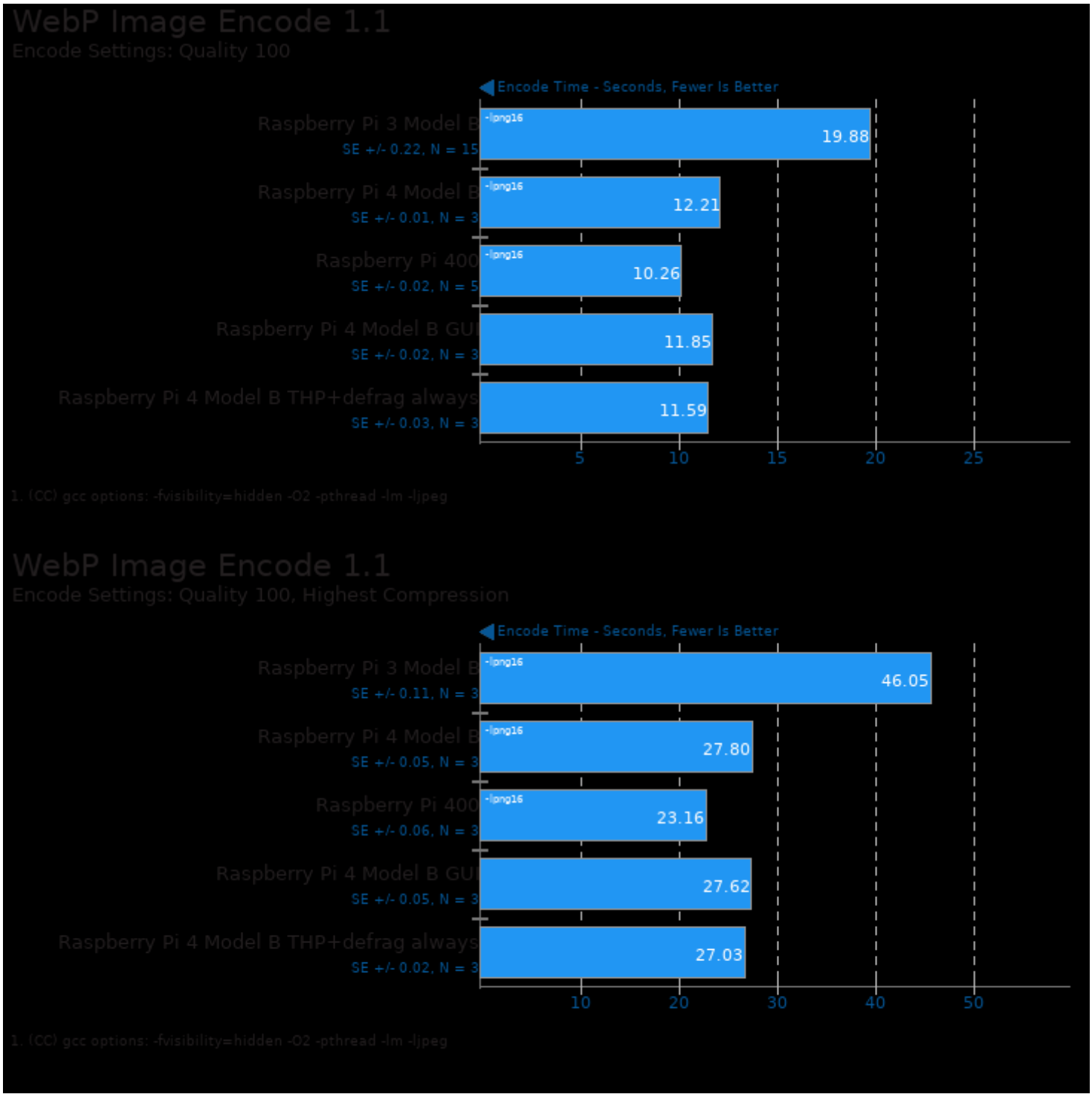


1. (CC) gcc options: -pthread -O3 -lssl -lcrypto -ldl

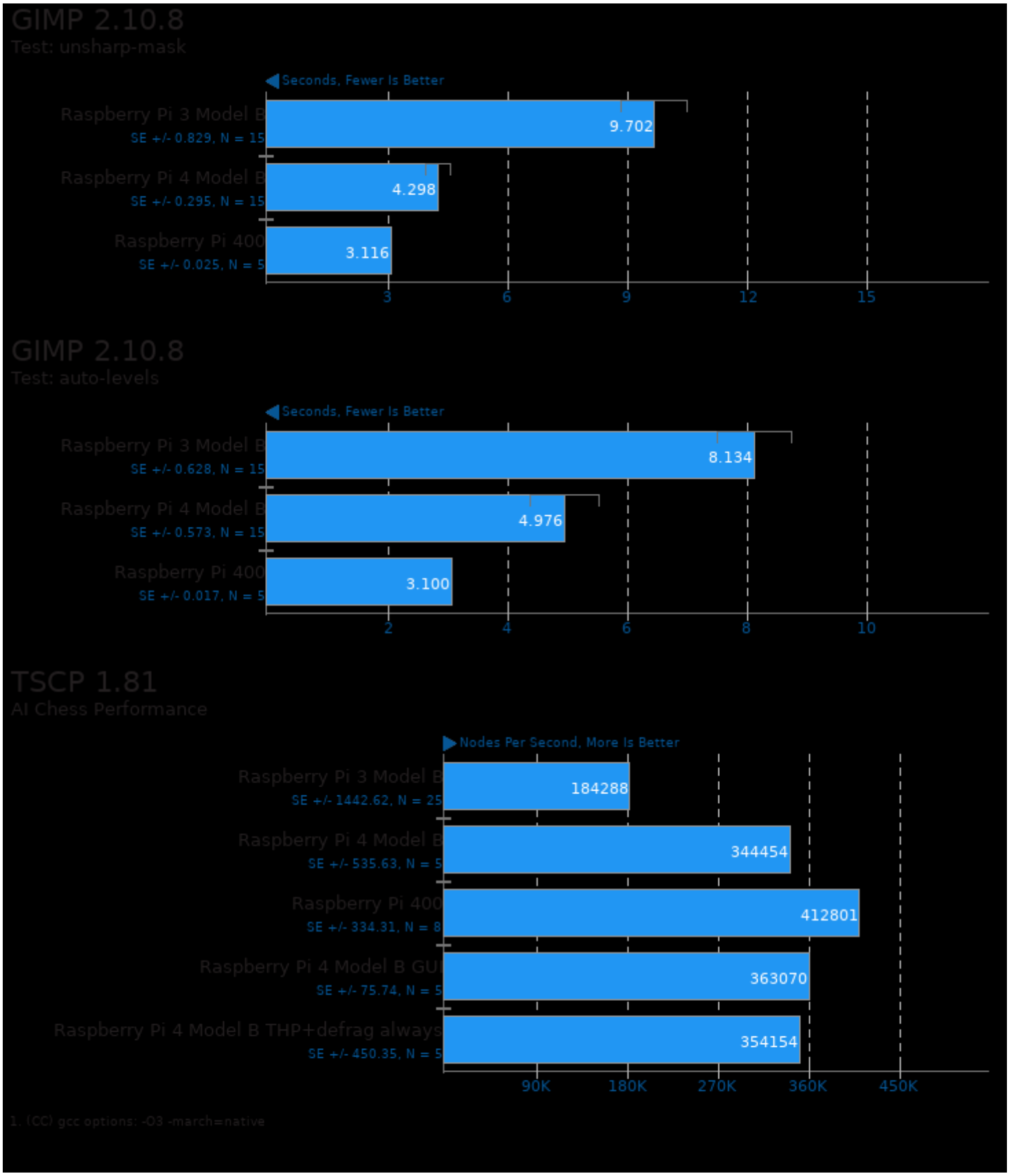
PyPerformance 1.0.0

Benchmark: pickle_pure_python

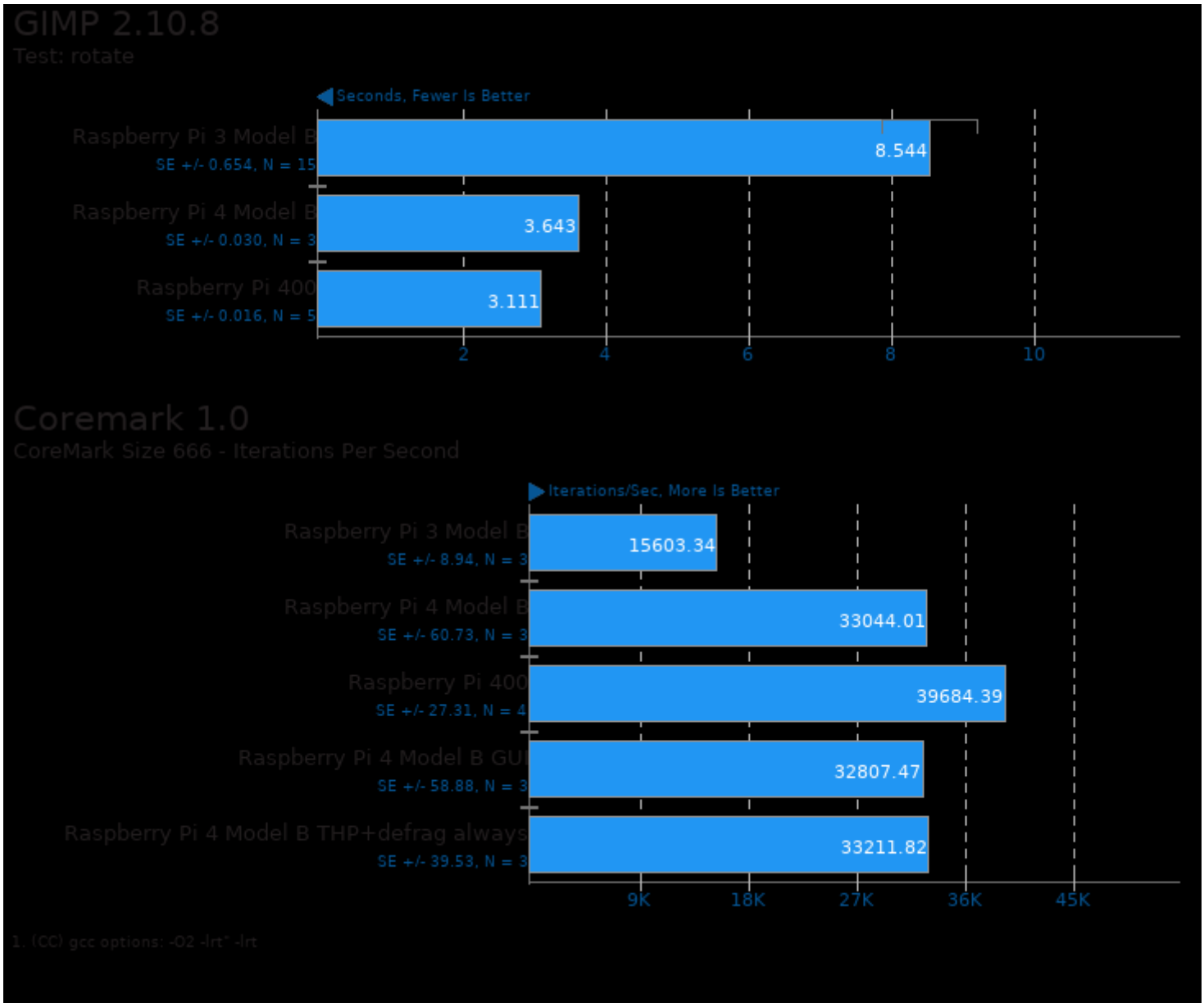



WebP Image Encode 1.1
Encode Settings: Quality 100
Encode Time - Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.22, N = 15
19.88
Raspberry Pi 4 Model B
SE +/- 0.01, N = 3
12.21
Raspberry Pi 400
SE +/- 0.02, N = 5
10.26
Raspberry Pi 4 Model B GUI
SE +/- 0.02, N = 3
11.85
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.03, N = 3
11.59
5
10
15
20
25
1. (CC) gcc options: -fvisibility=hidden -O2 -pthread -lm -ljpeg
WebP Image Encode 1.1
Encode Settings: Quality 100, Highest Compression
Encode Time - Seconds, Fewer Is Better
Raspberry Pi 3 Model B
SE +/- 0.11, N = 3
46.05
Raspberry Pi 4 Model B
SE +/- 0.05, N = 3
27.80
Raspberry Pi 400
SE +/- 0.06, N = 3
23.16
Raspberry Pi 4 Model B GUI
SE +/- 0.05, N = 3
27.62
Raspberry Pi 4 Model B THP+defrag always
SE +/- 0.02, N = 3
27.03
10
20
30
40
50
1. (CC) gcc options: -fvisibility=hidden -O2 -pthread -lm -ljpeg

Raspberry Pi 400

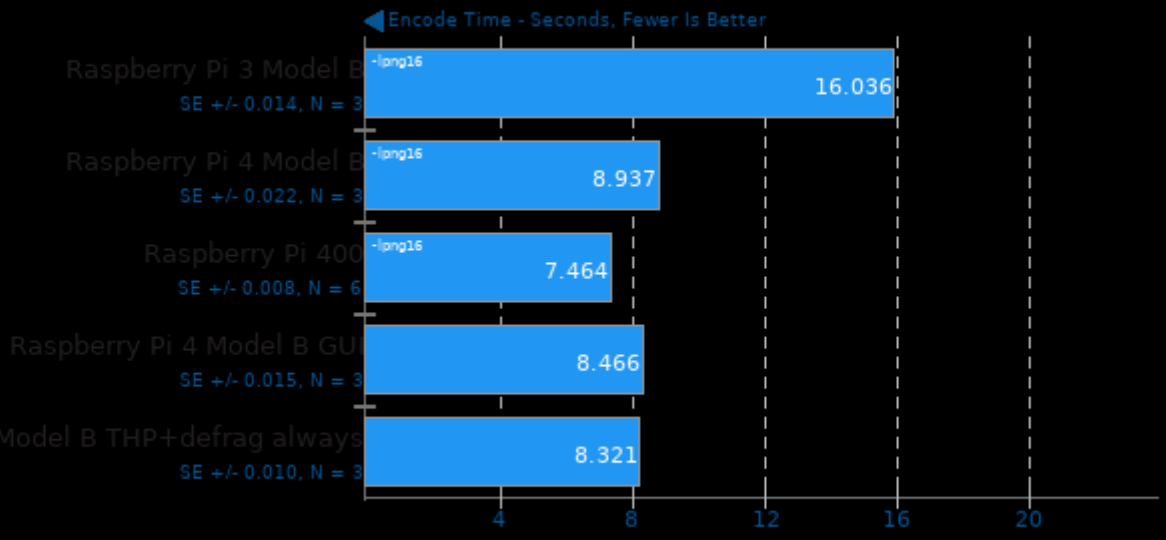


Raspberry Pi 400



WebP Image Encode 1.1

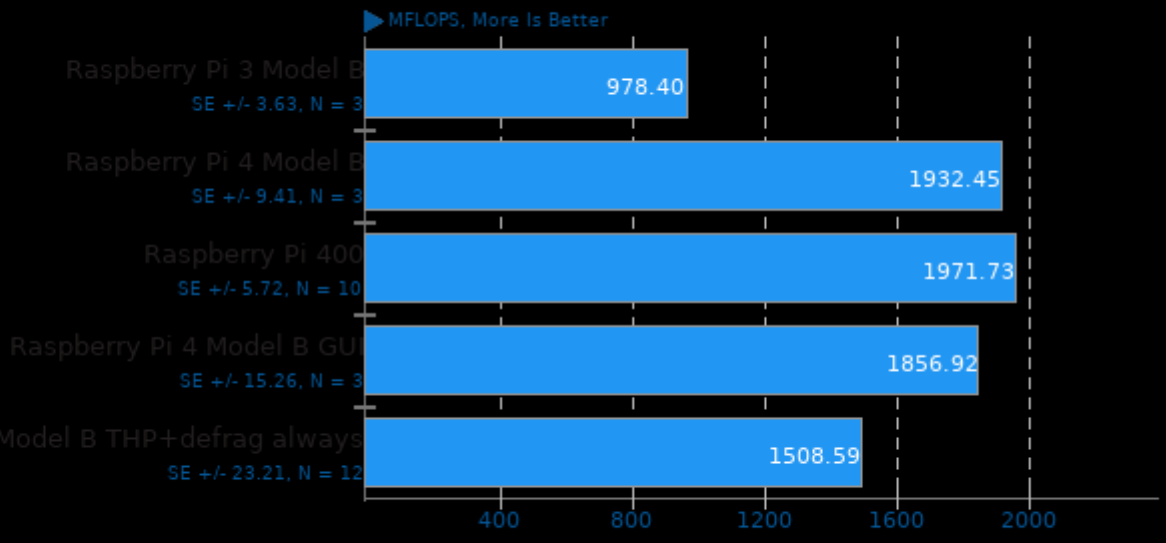
Encode Settings: Default



1. (CC) gcc options: -fvisibility=hidden -O2 -pthread -lm -ljpeg

FFTE 7.0

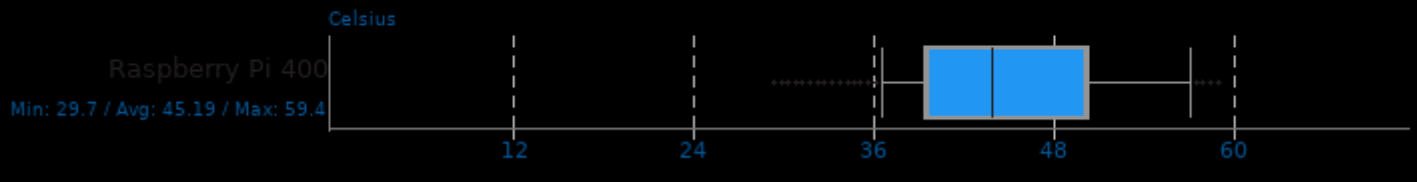
N=256, 3D Complex FFT Routine



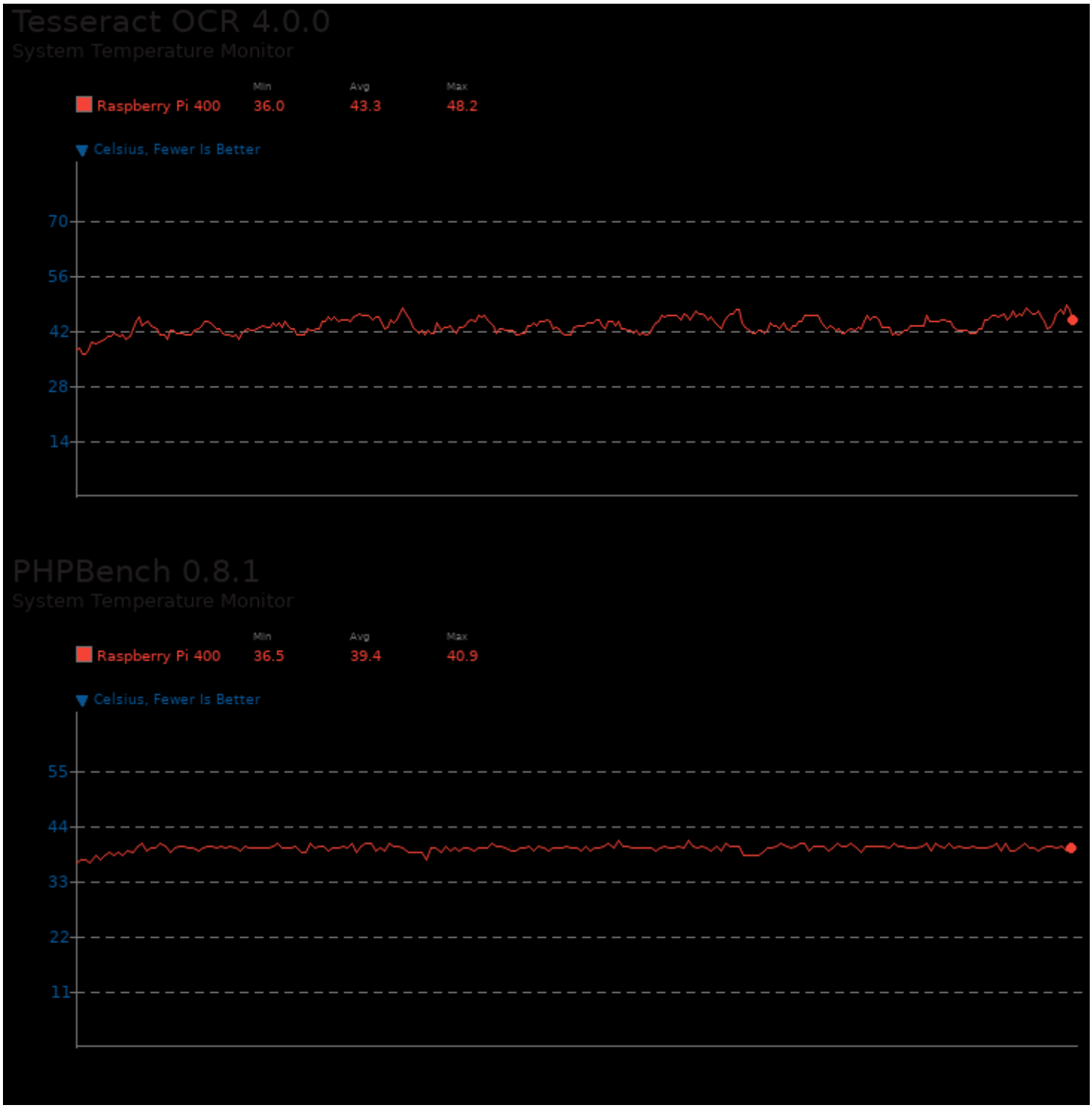
1. (F9X) gfortran options: -O3 -fomit-frame-pointer -fopenmp

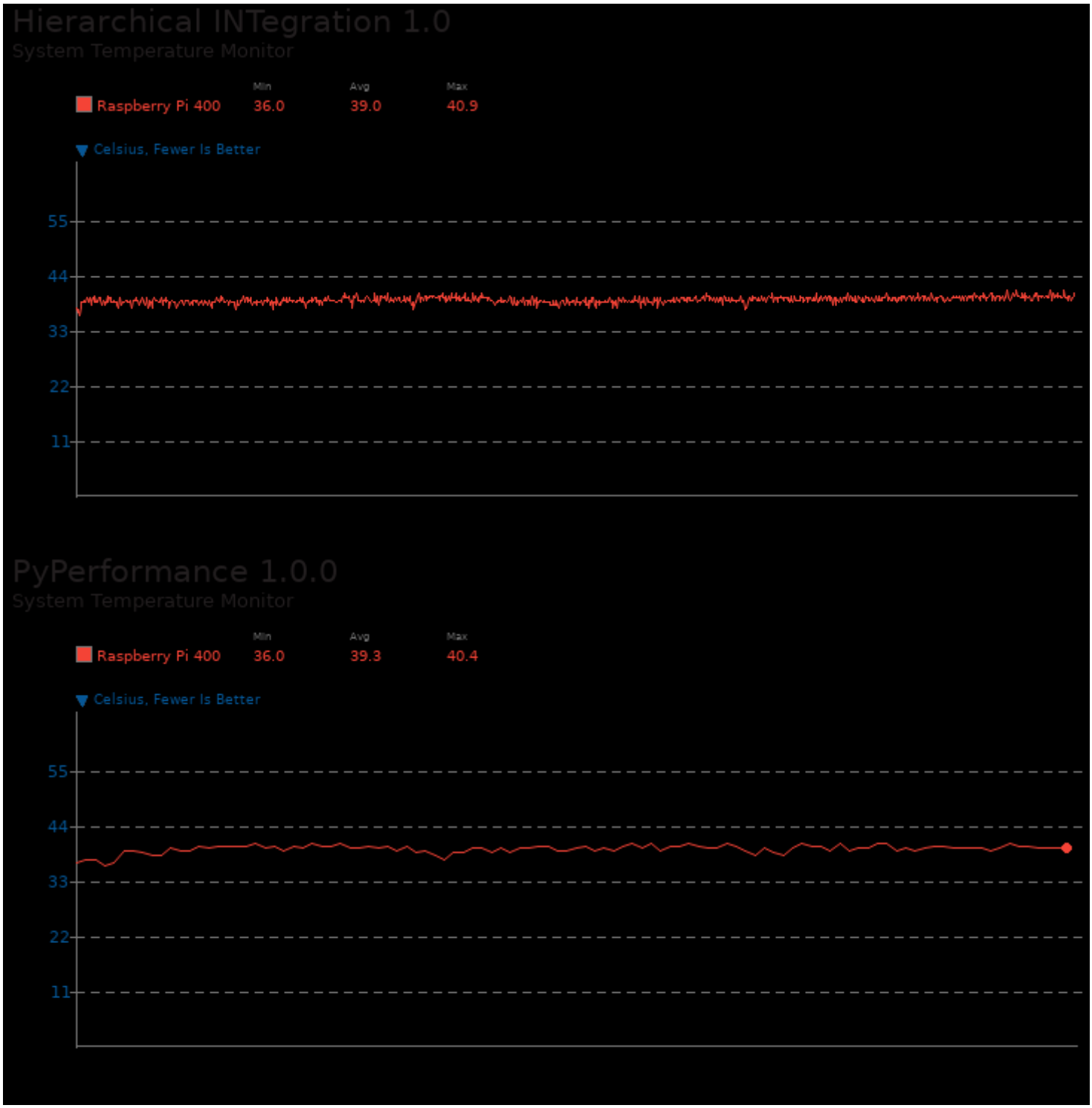
System Temperature Monitor

Phoronix Test Suite System Monitoring

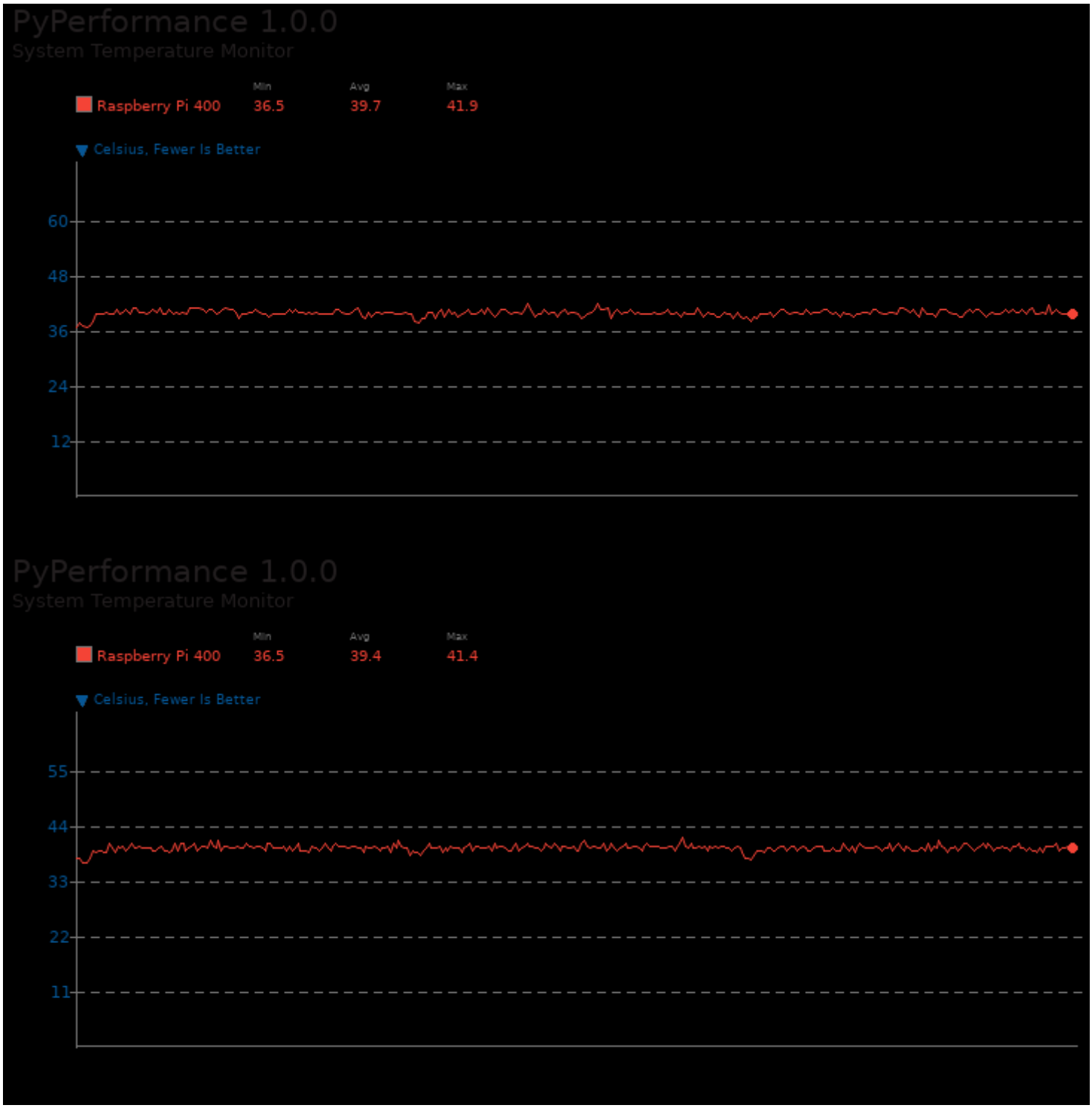


Raspberry Pi 400

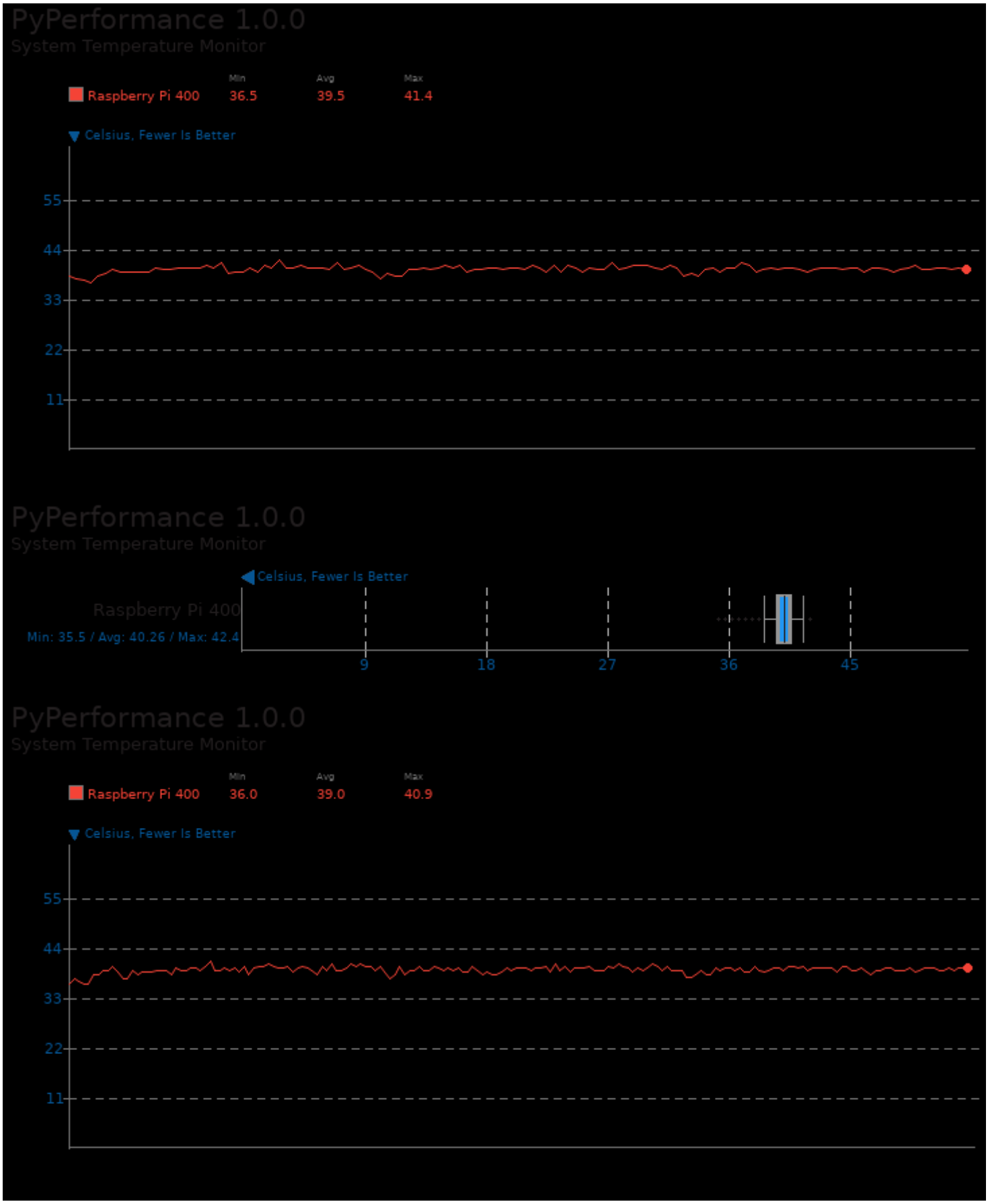



Hierarchical INTegration 1.0
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
36.0
39.0
40.9
Celsius, Fewer Is Better
55
44
33
22
11
PyPerformance 1.0.0
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
36.0
39.3
40.4
Celsius, Fewer Is Better
55
44
33
22
11

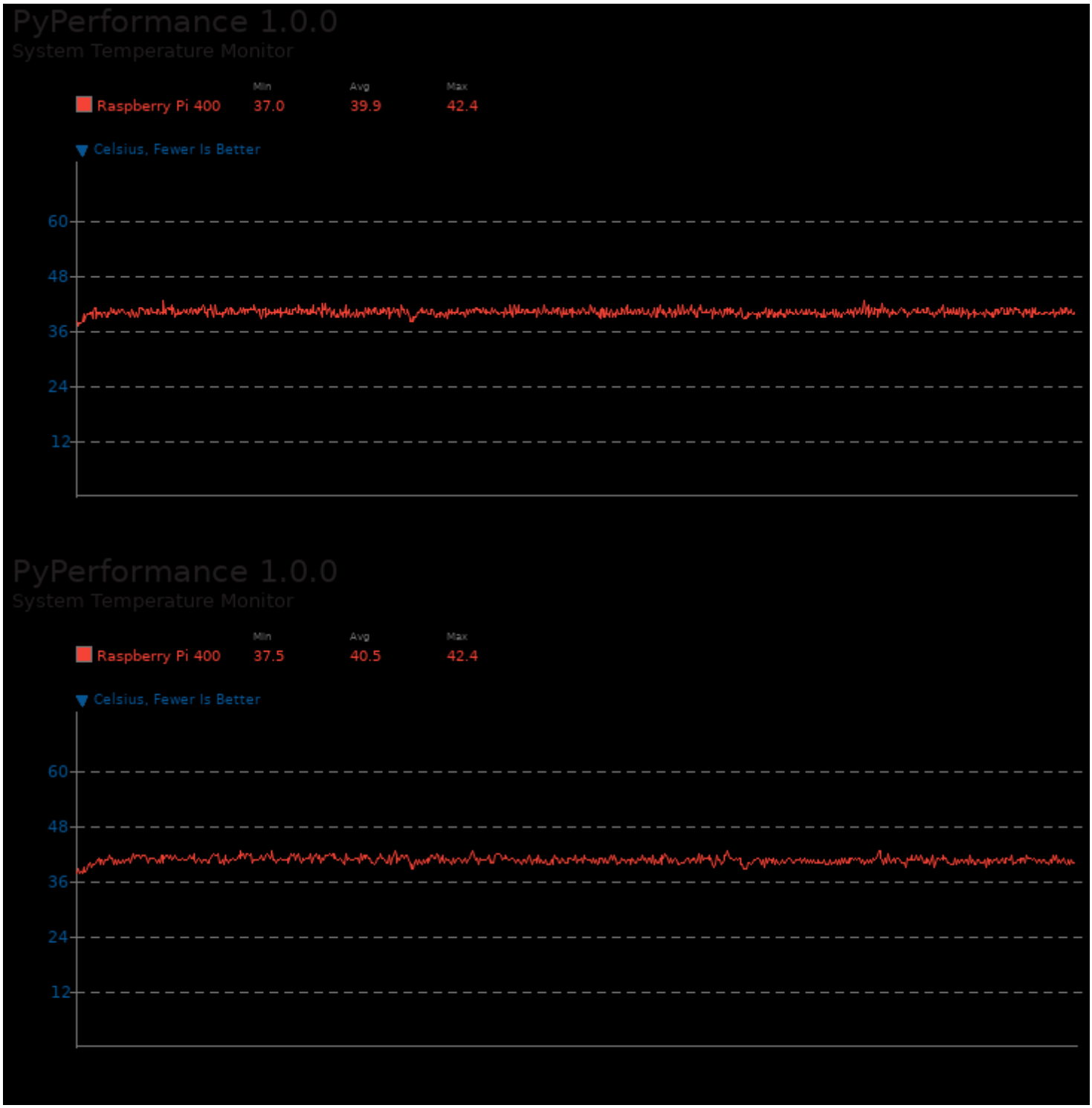
Raspberry Pi 400



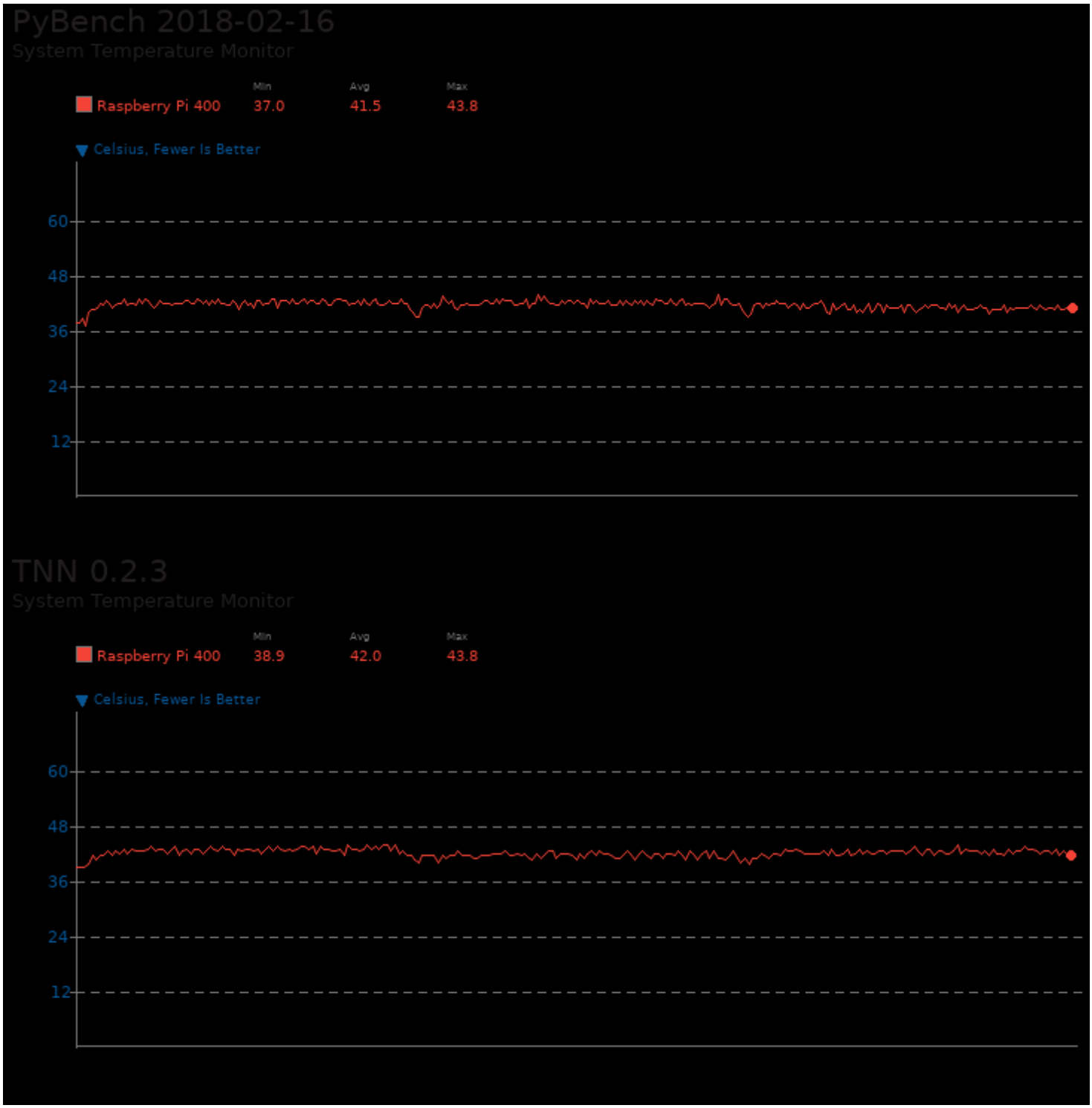
Raspberry Pi 400



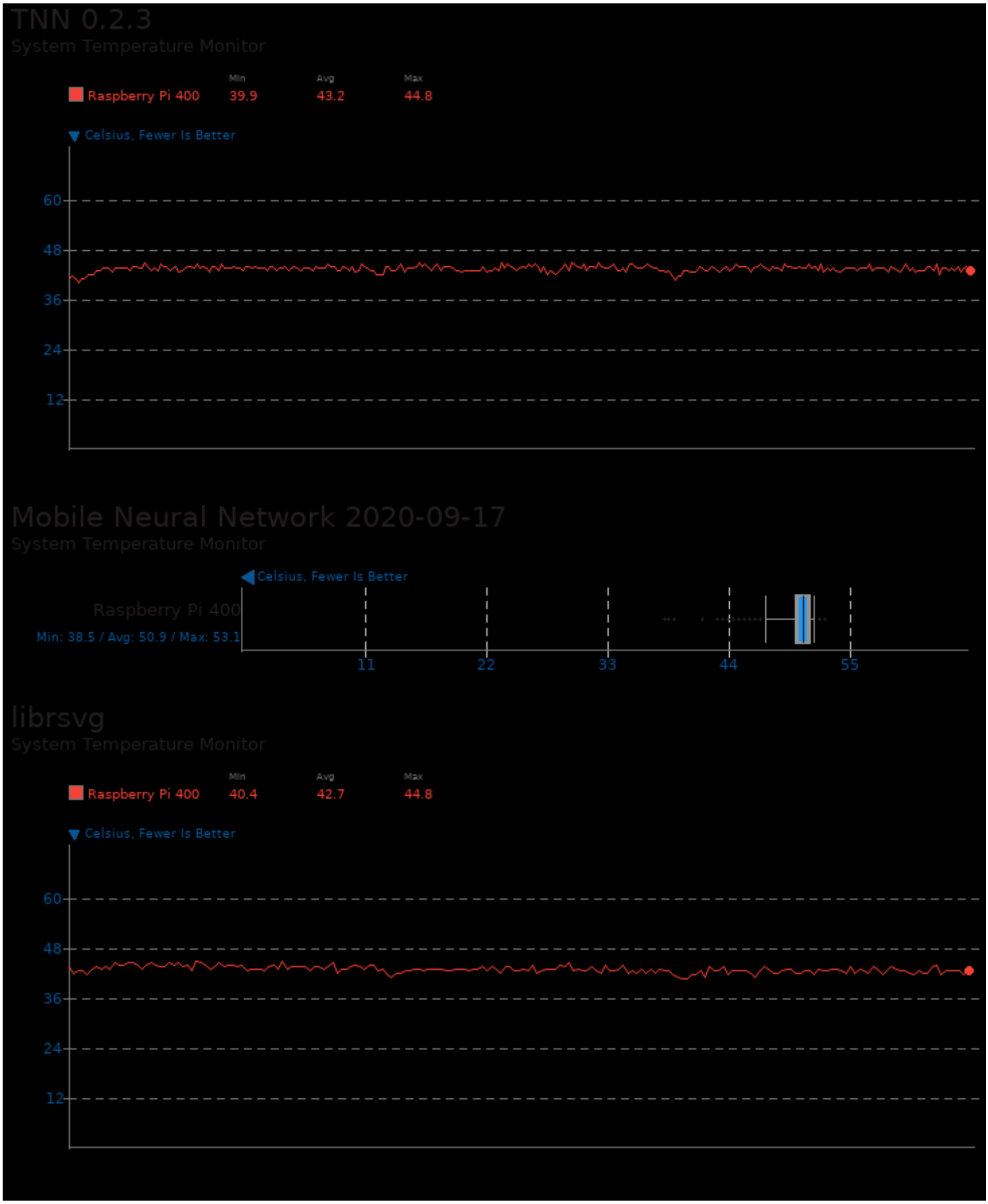
Raspberry Pi 400

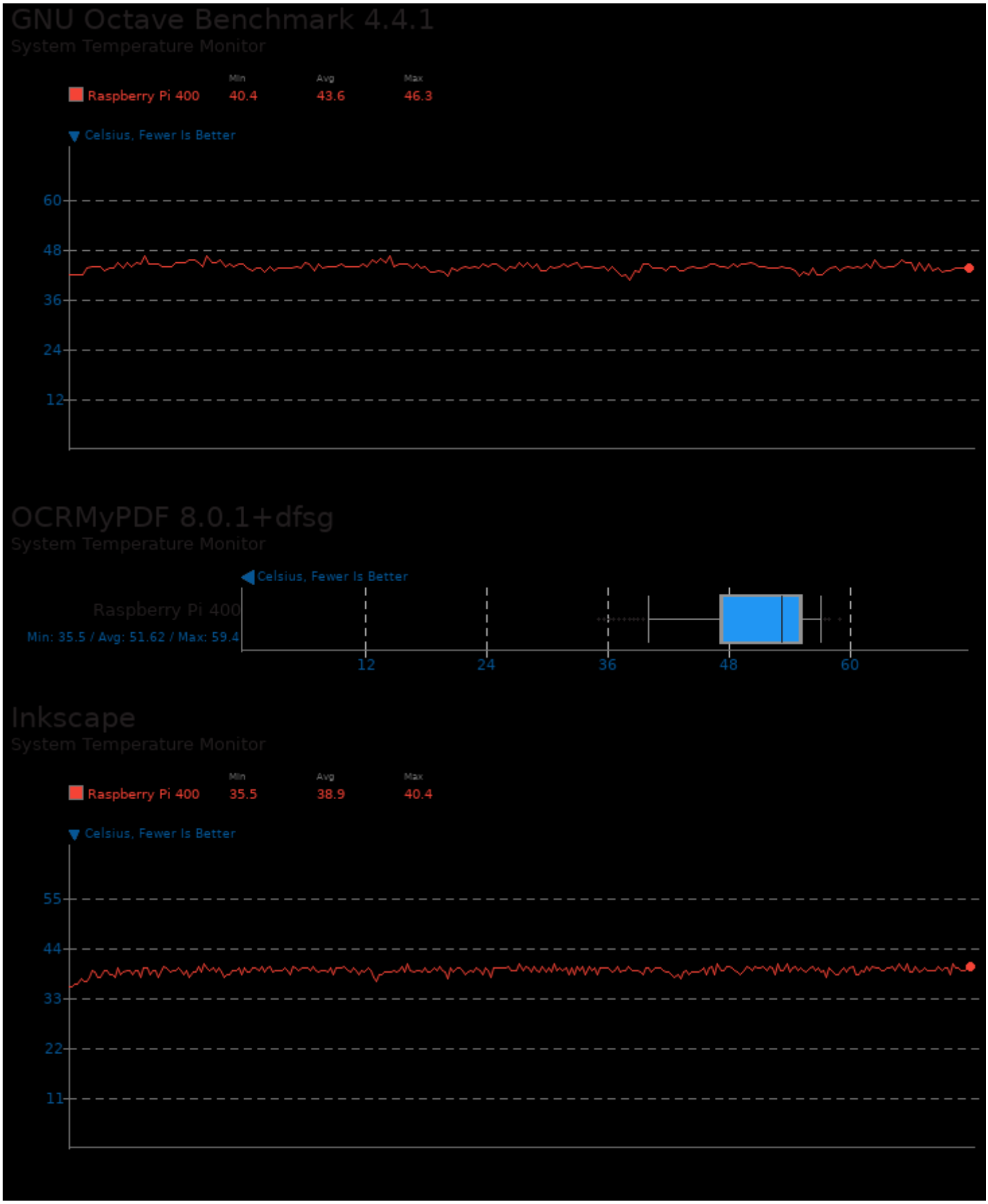


Raspberry Pi 400

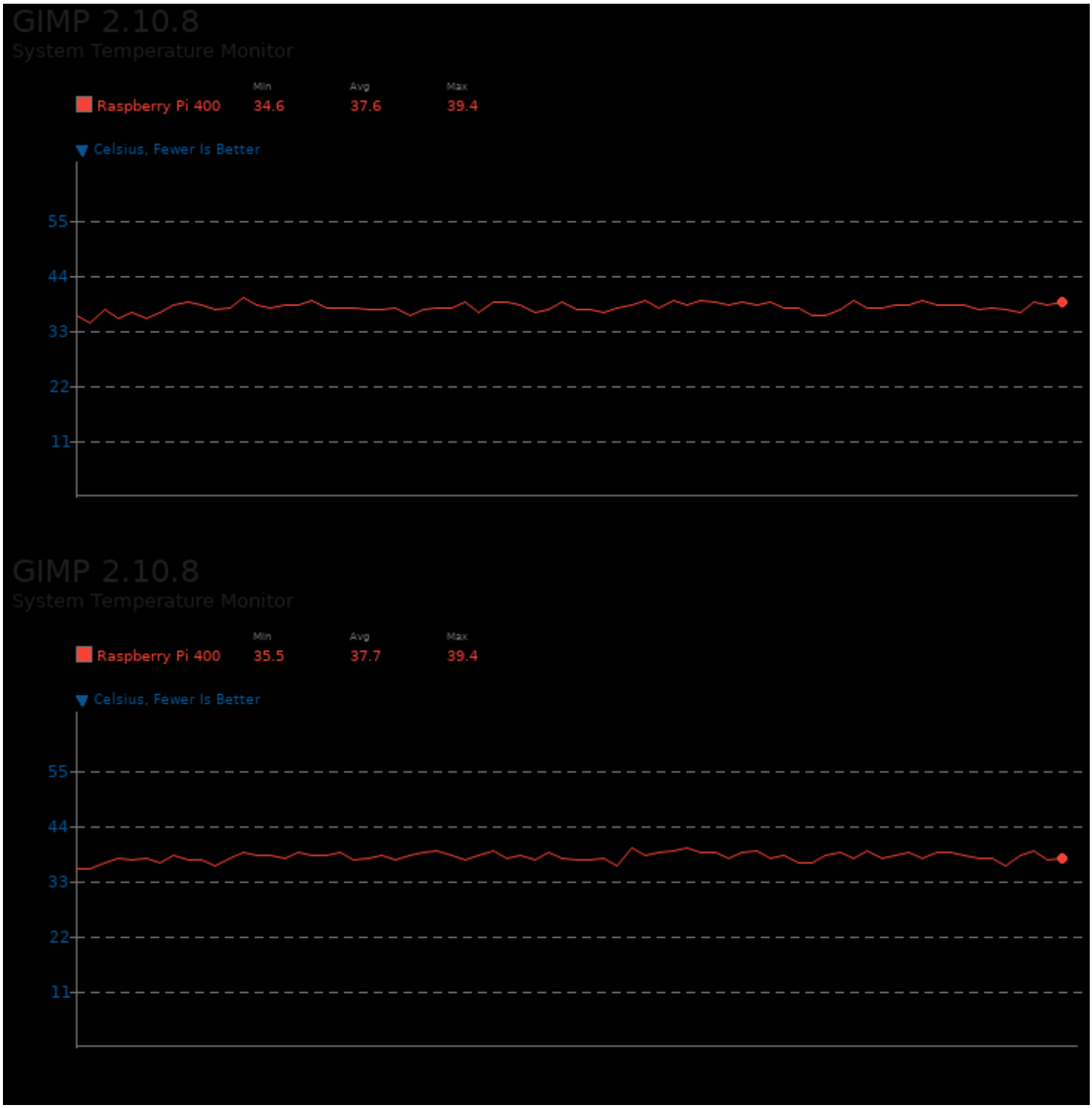


Raspberry Pi 400

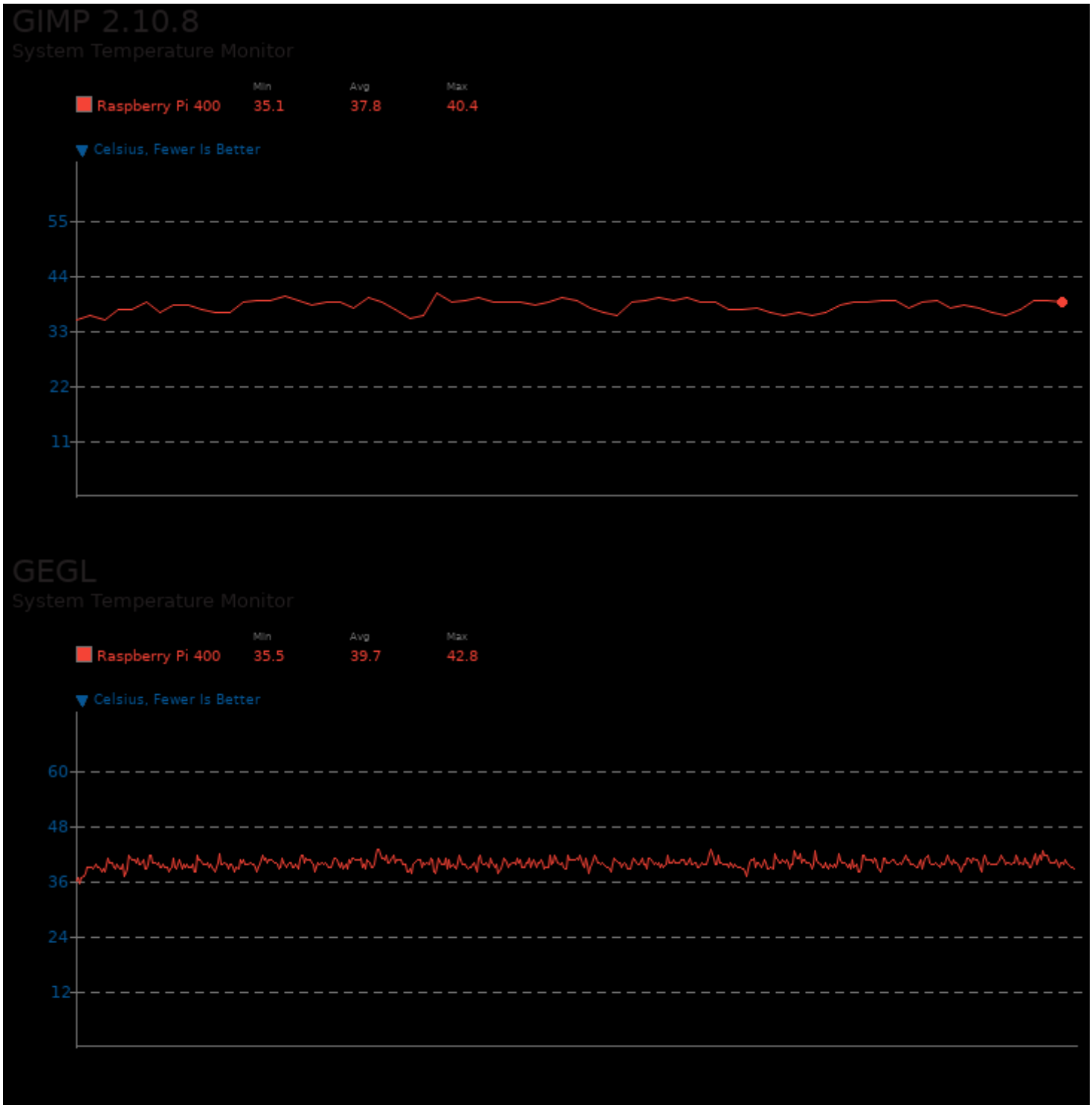



GNU Octave Benchmark 4.4.1
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
40.4
43.6
46.3
Celsius, Fewer Is Better
60
48
36
24
12
OCRMyPDF 8.0.1+dfsg
System Temperature Monitor
Celsius, Fewer Is Better
Raspberry Pi 400
Min: 35.5 / Avg: 51.62 / Max: 59.4
12
24
36
48
60
Inkscape
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
35.5
38.9
40.4
Celsius, Fewer Is Better
55
44
33
22
11

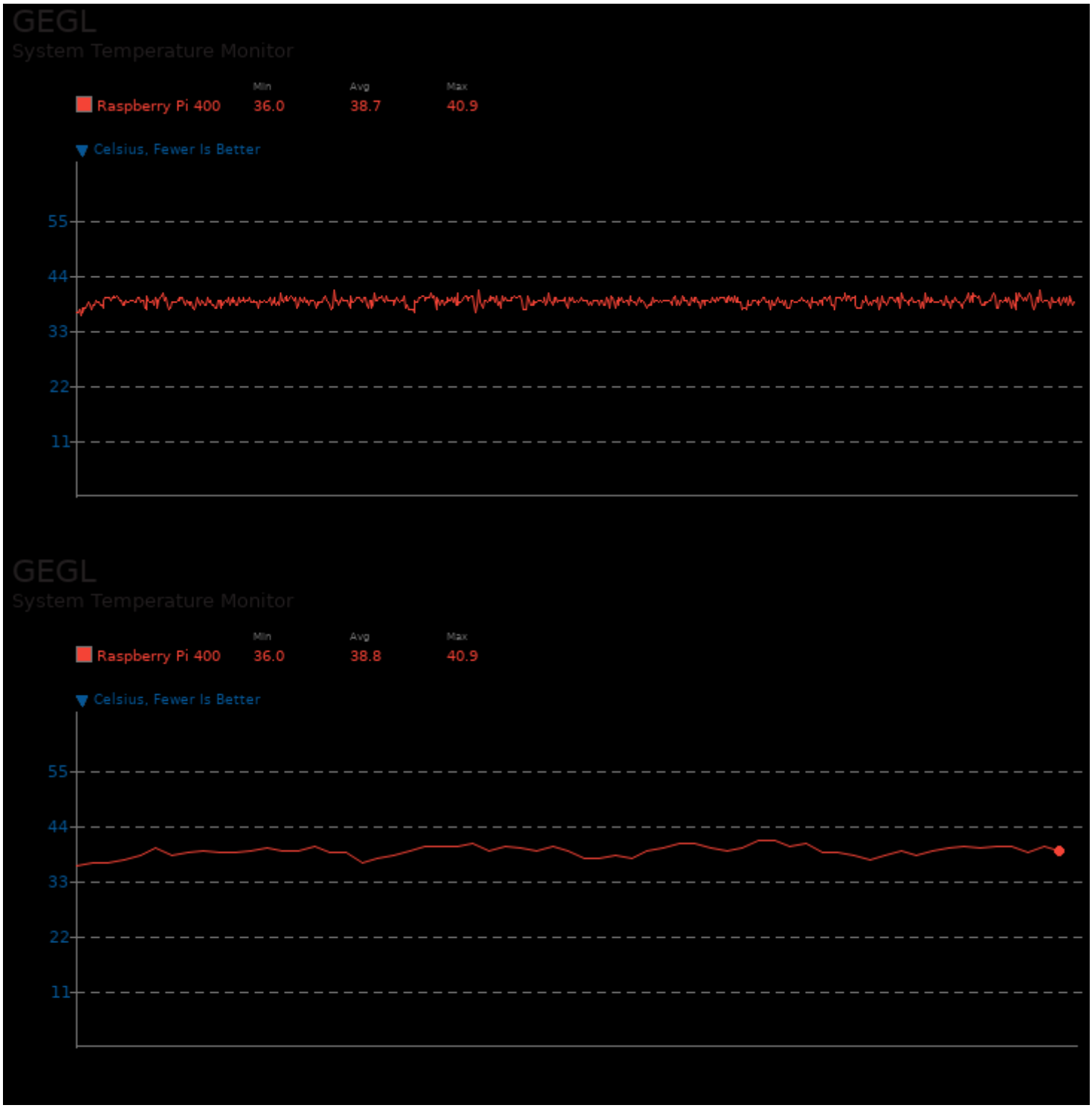
Raspberry Pi 400



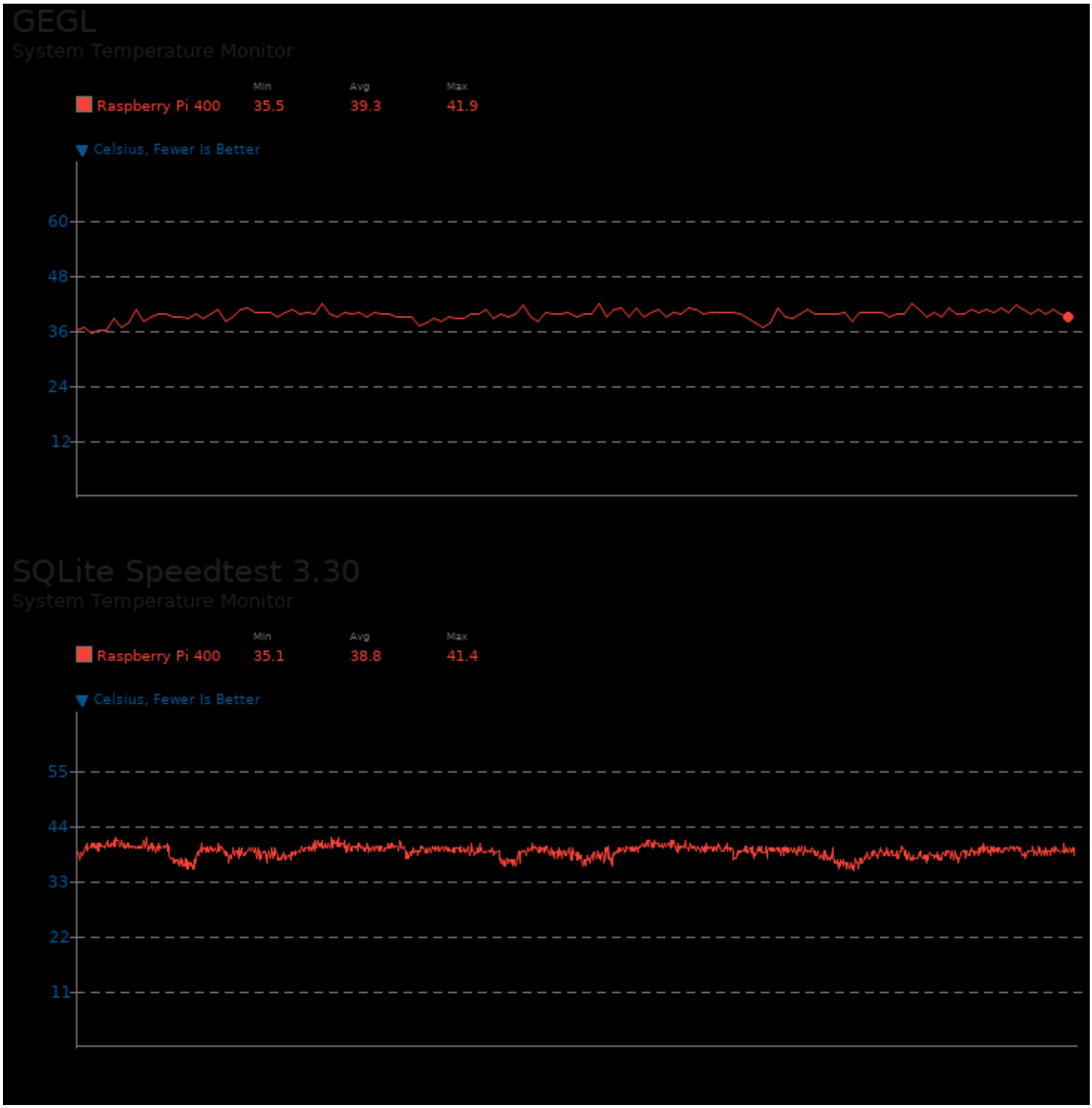
Raspberry Pi 400



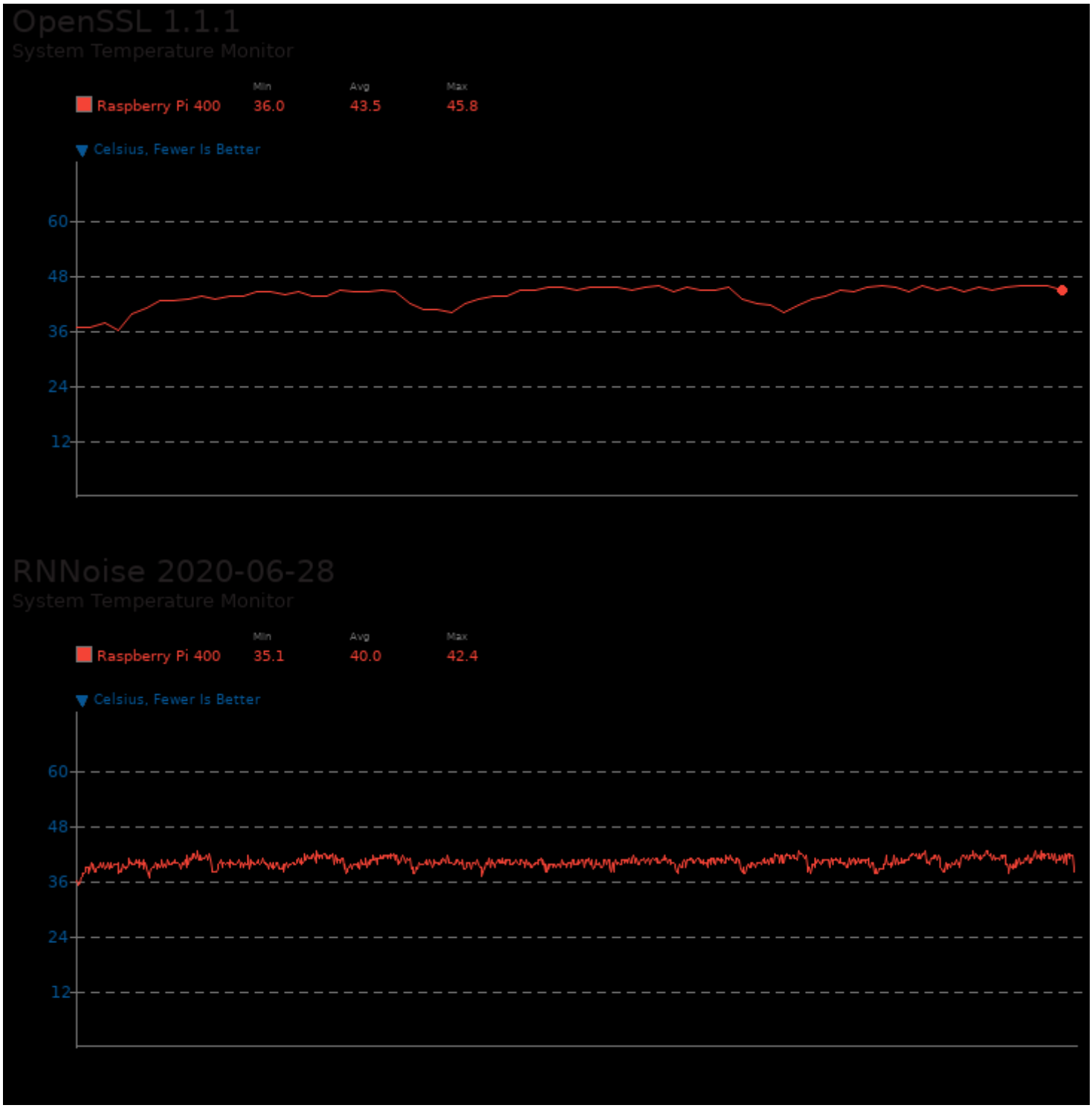
Raspberry Pi 400



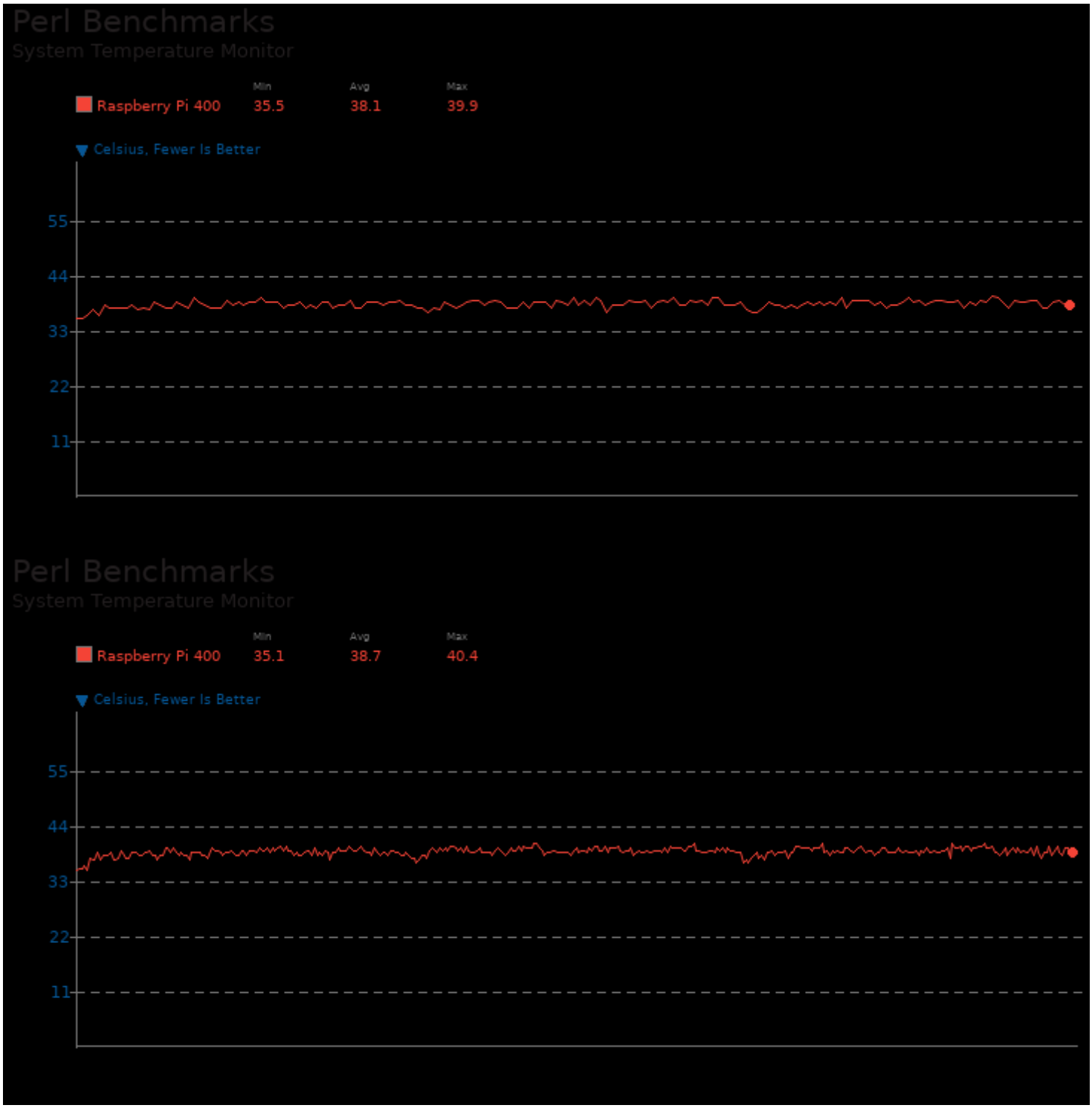
Raspberry Pi 400



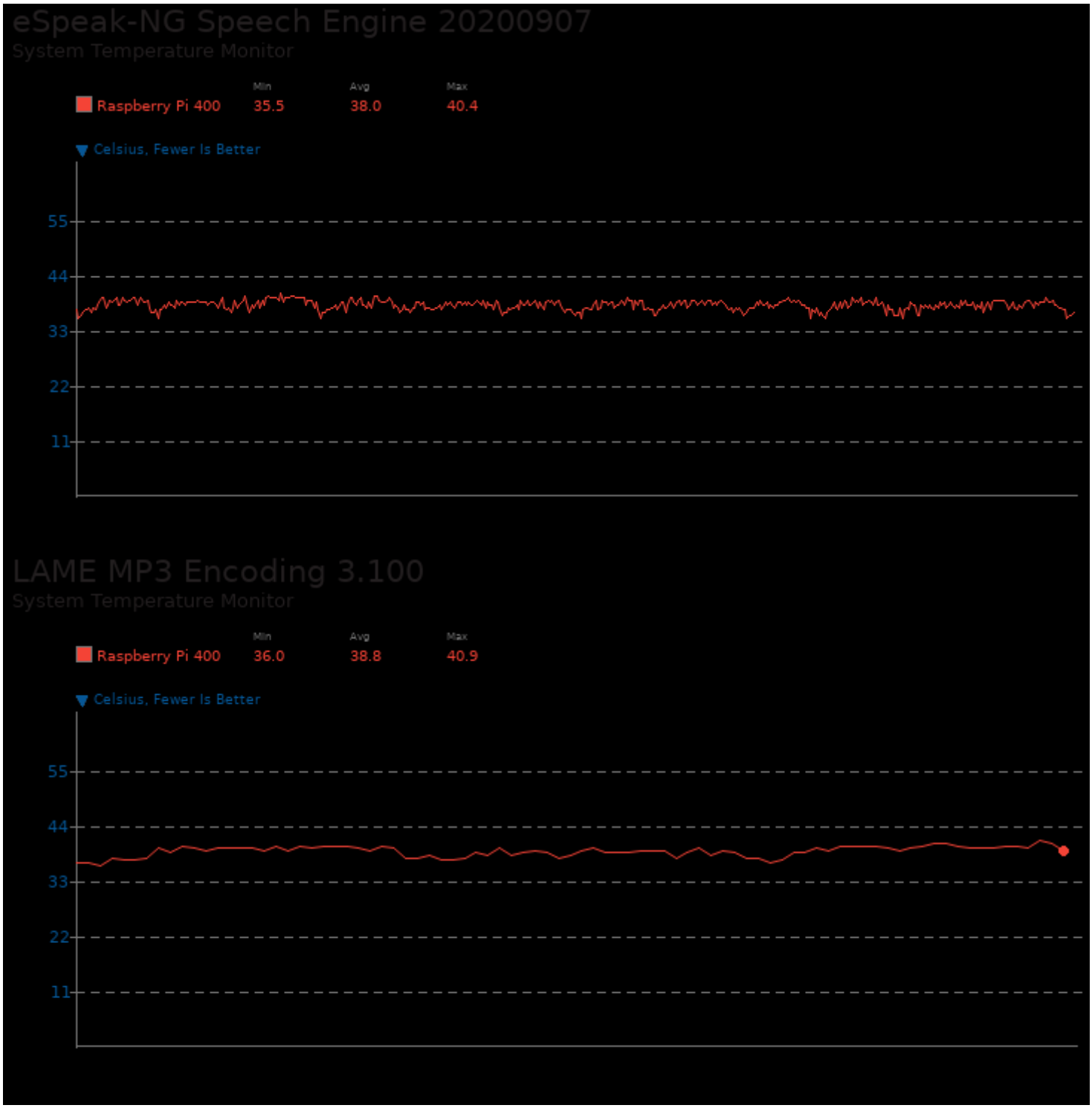
Raspberry Pi 400



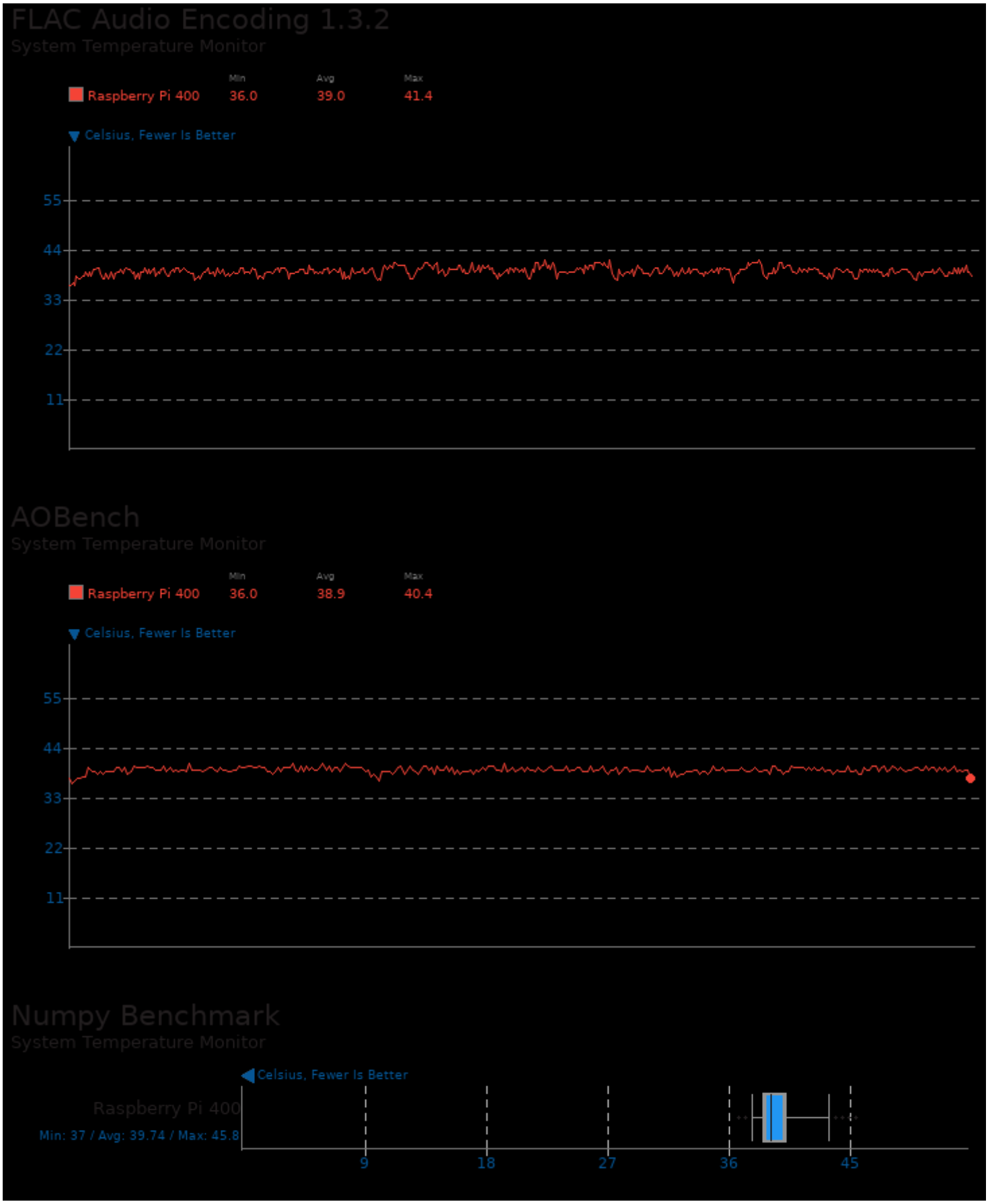
Raspberry Pi 400



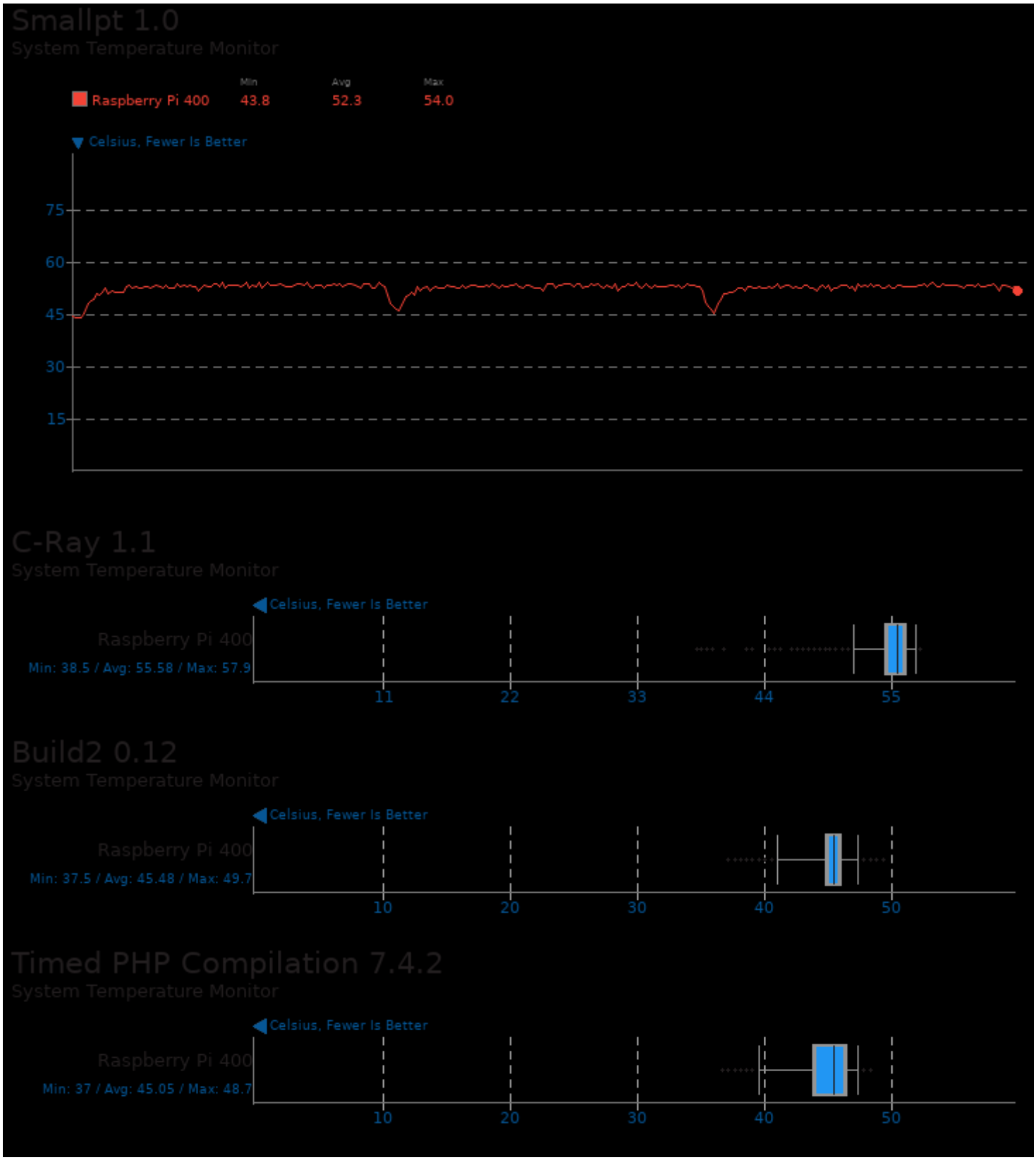
Raspberry Pi 400



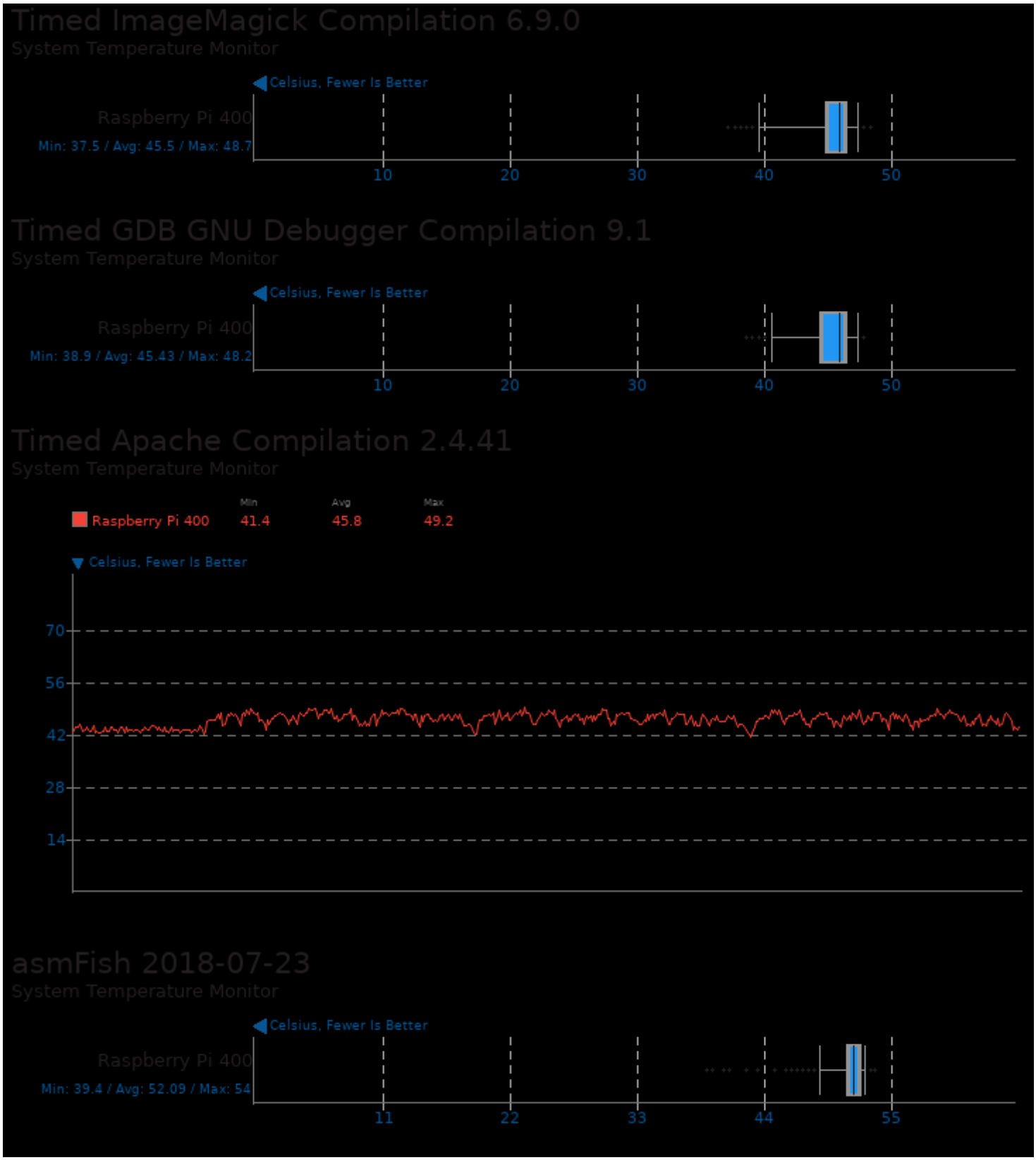
Raspberry Pi 400



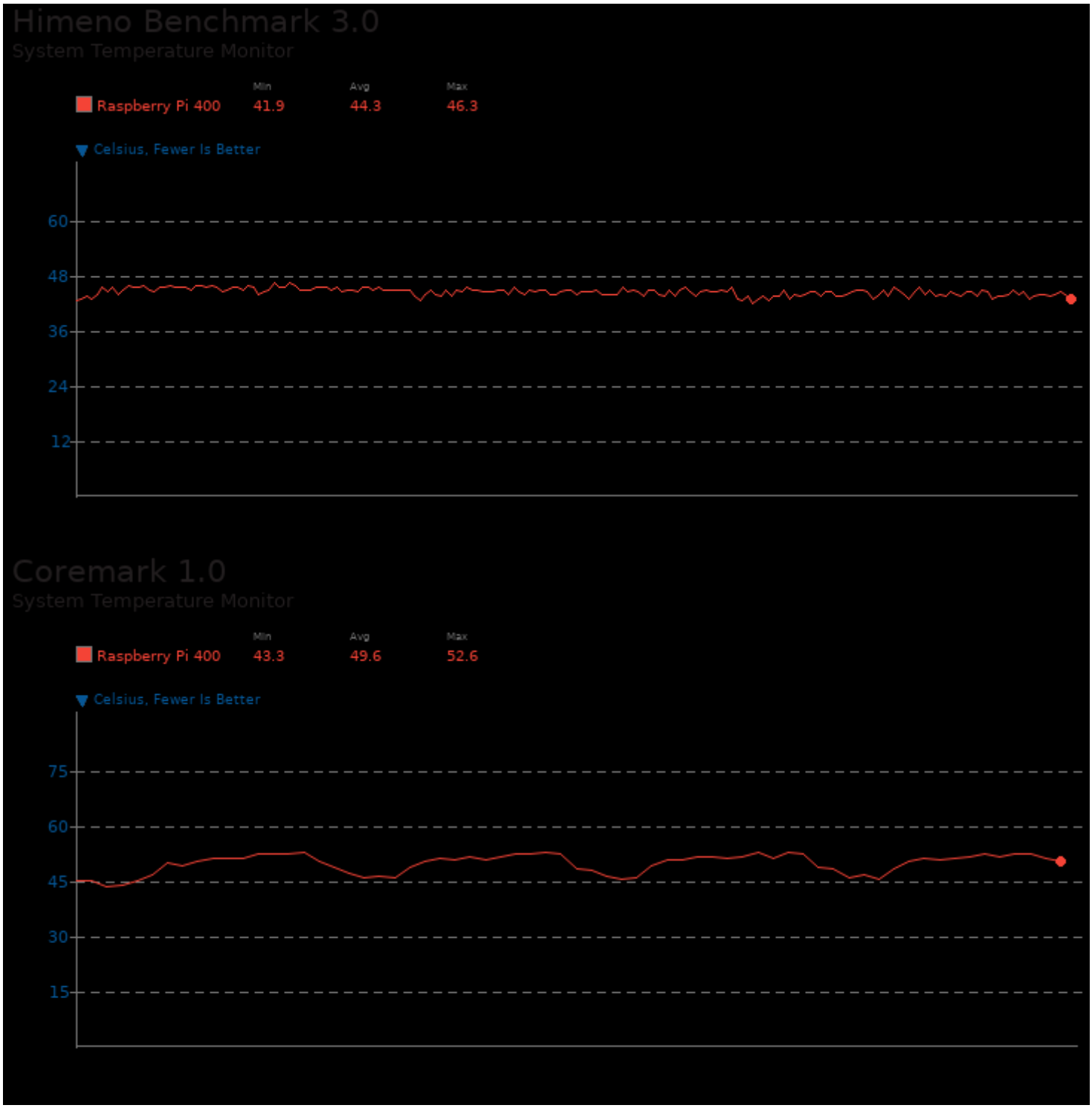
Raspberry Pi 400



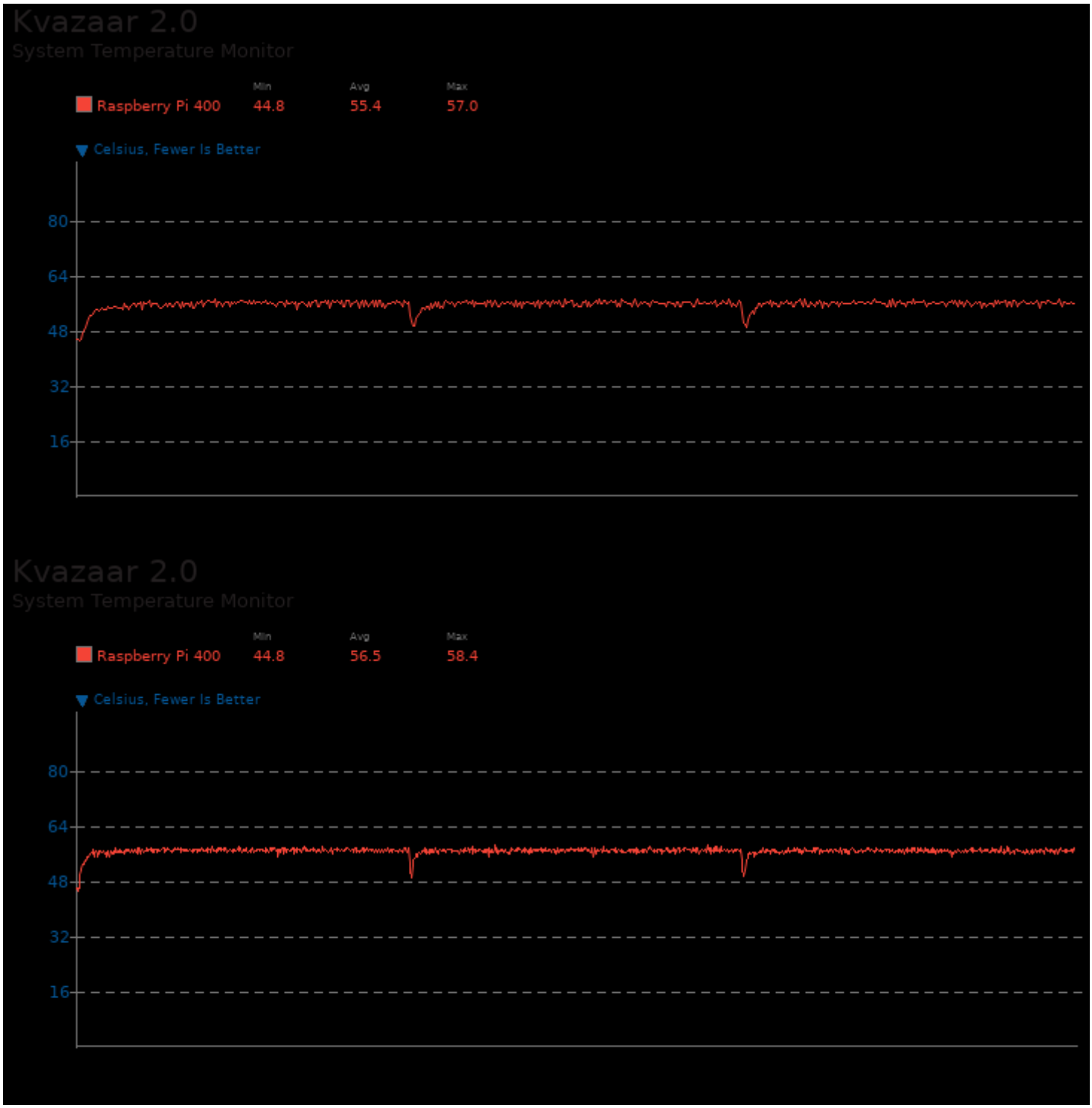
Raspberry Pi 400



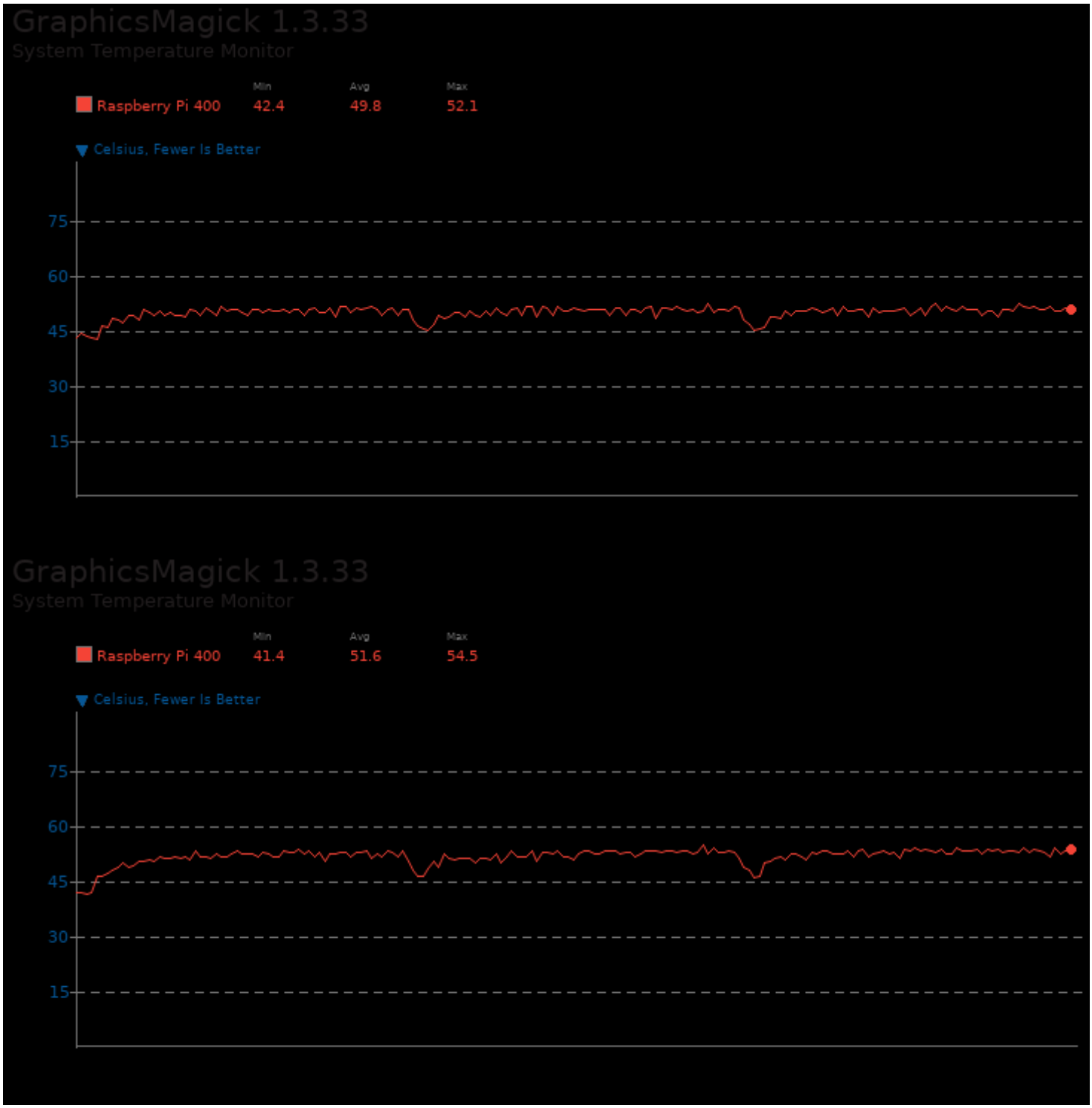
Raspberry Pi 400

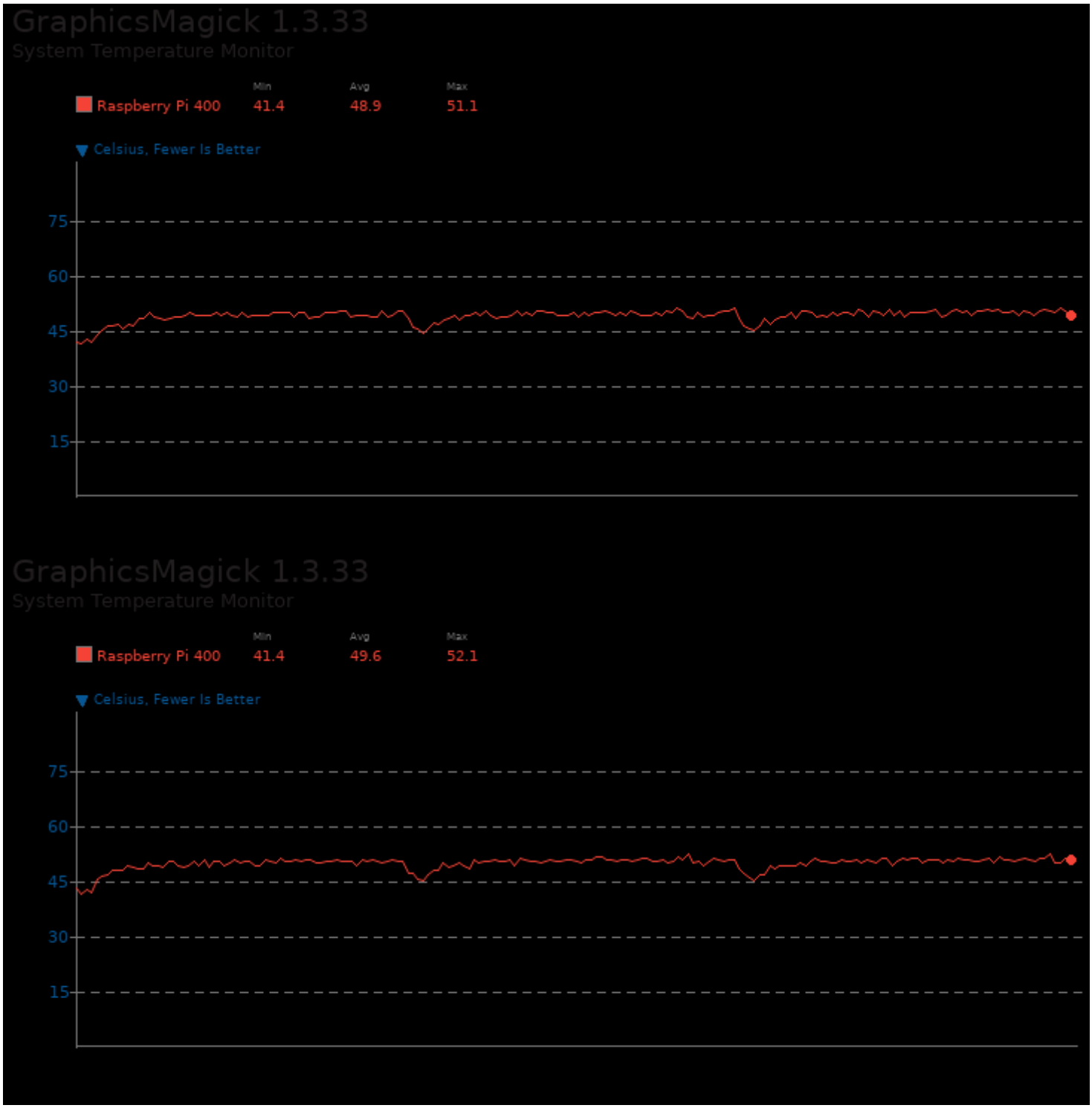


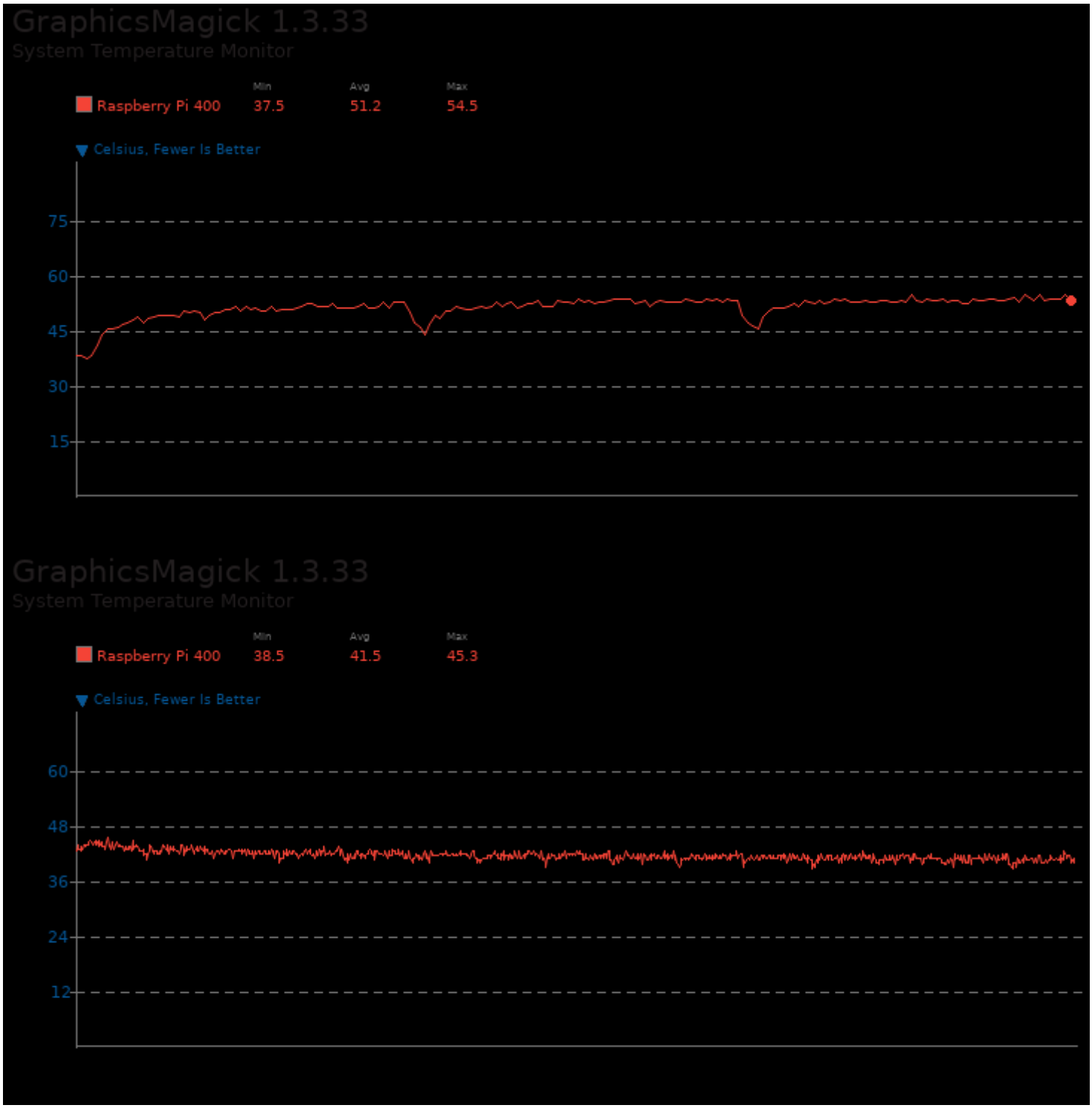
Raspberry Pi 400



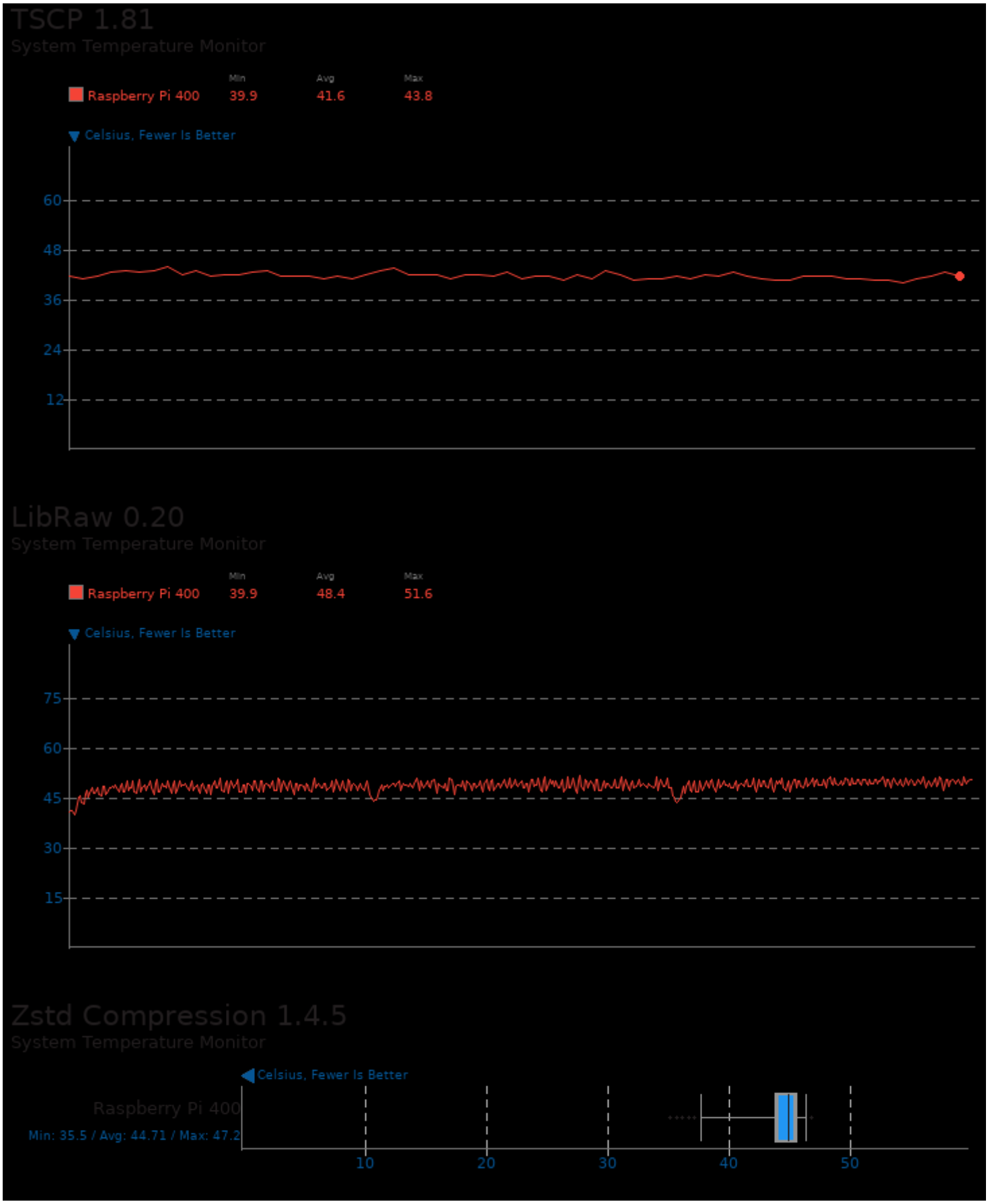
Raspberry Pi 400



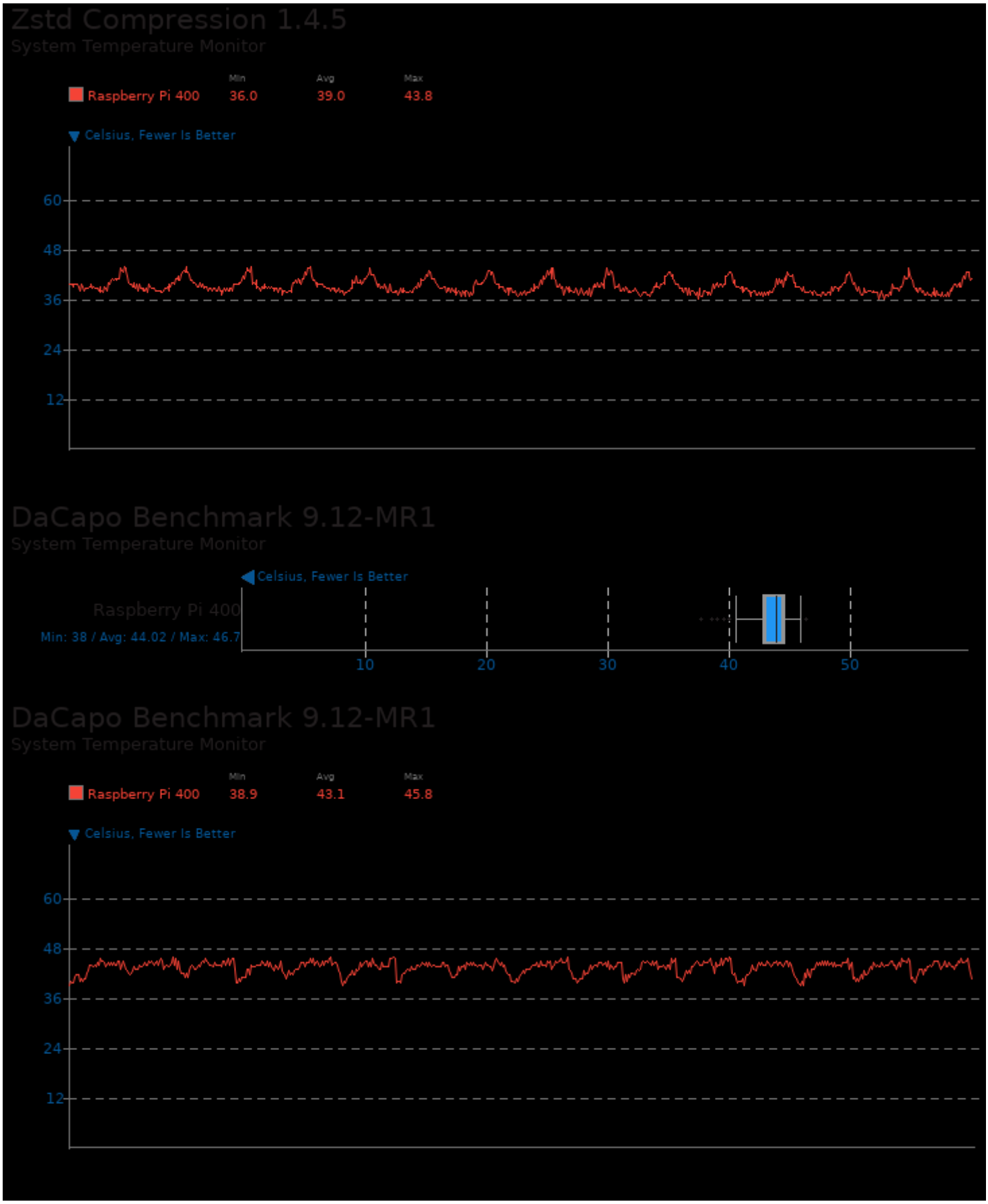

GraphicsMagick 1.3.33
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
41.4
48.9
51.1
Celsius, Fewer Is Better
75
60
45
30
15
GraphicsMagick 1.3.33
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
41.4
49.6
52.1
Celsius, Fewer Is Better
75
60
45
30
15


GraphicsMagick 1.3.33
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
37.5
51.2
54.5
Celsius, Fewer Is Better
75
60
45
30
15
GraphicsMagick 1.3.33
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
38.5
41.5
45.3
Celsius, Fewer Is Better
60
48
36
24
12

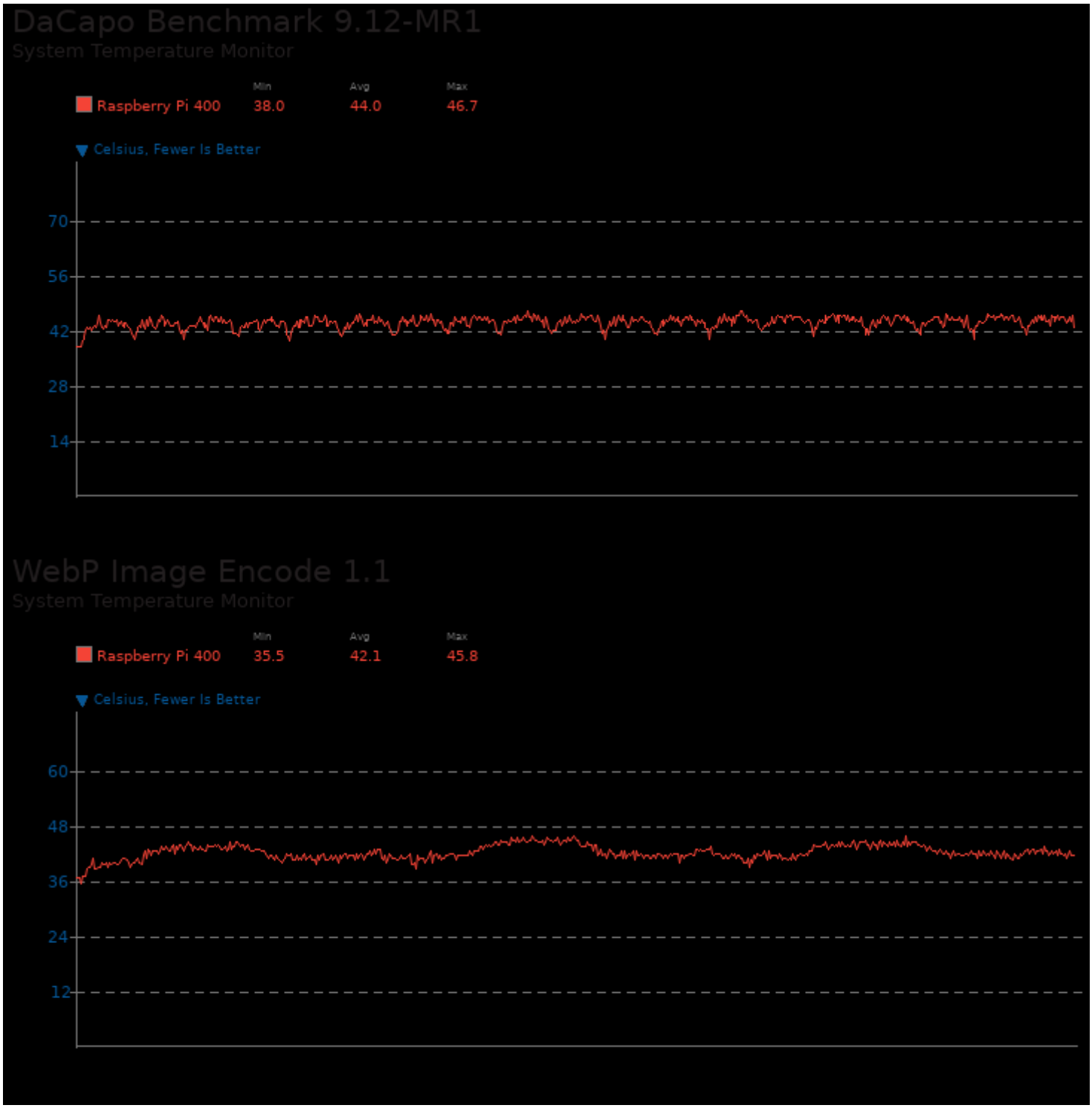
Raspberry Pi 400

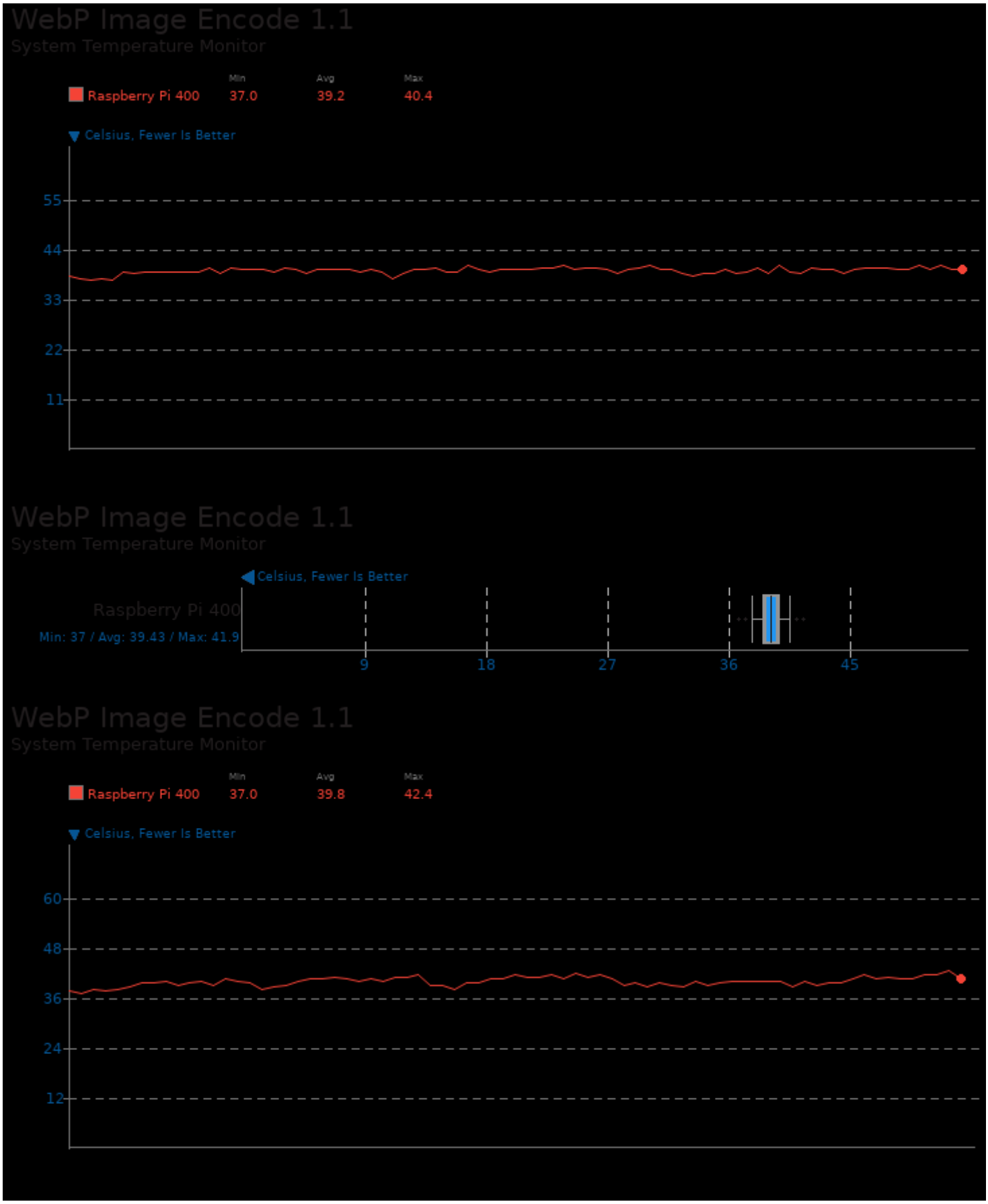


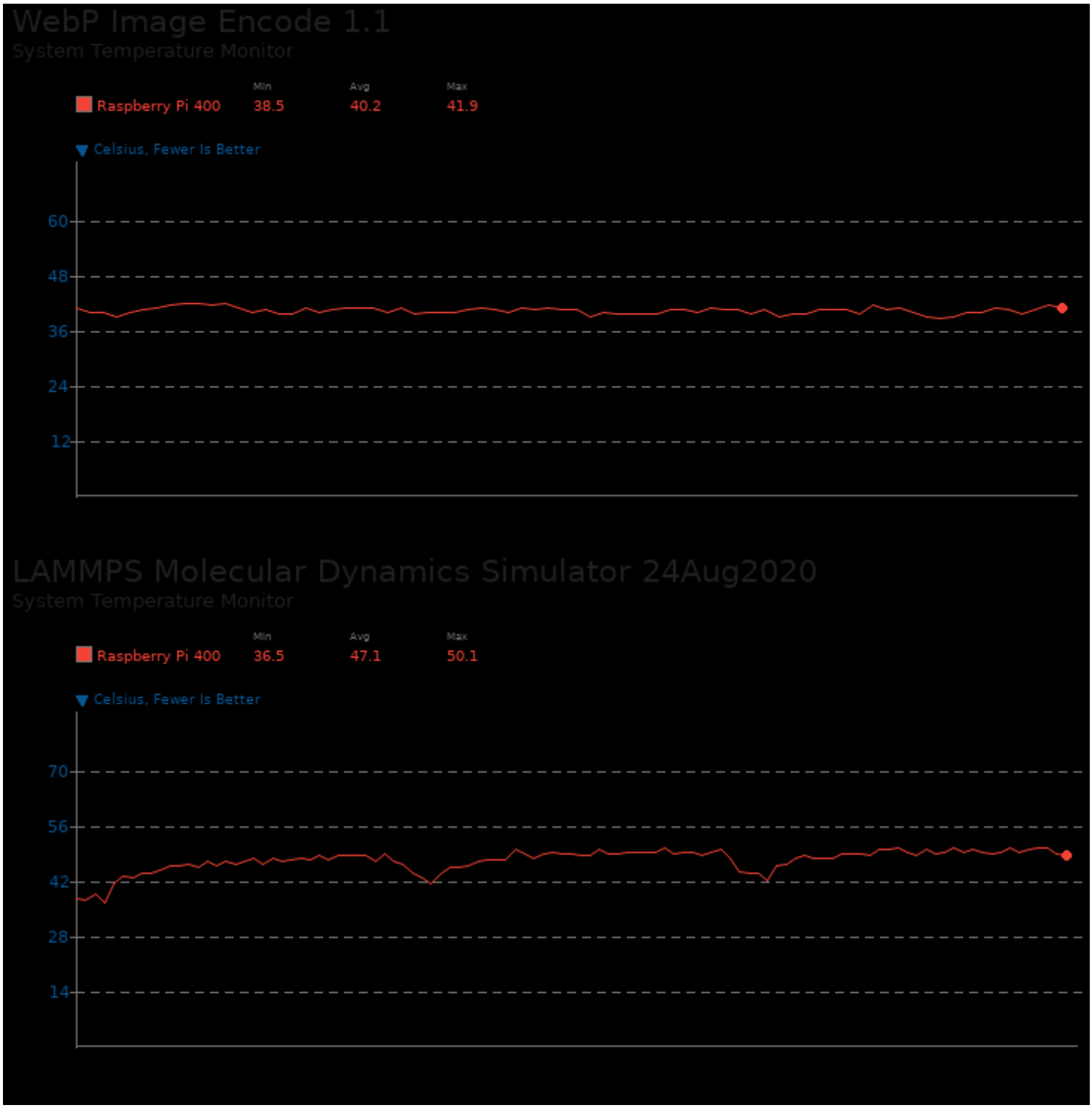
Raspberry Pi 400



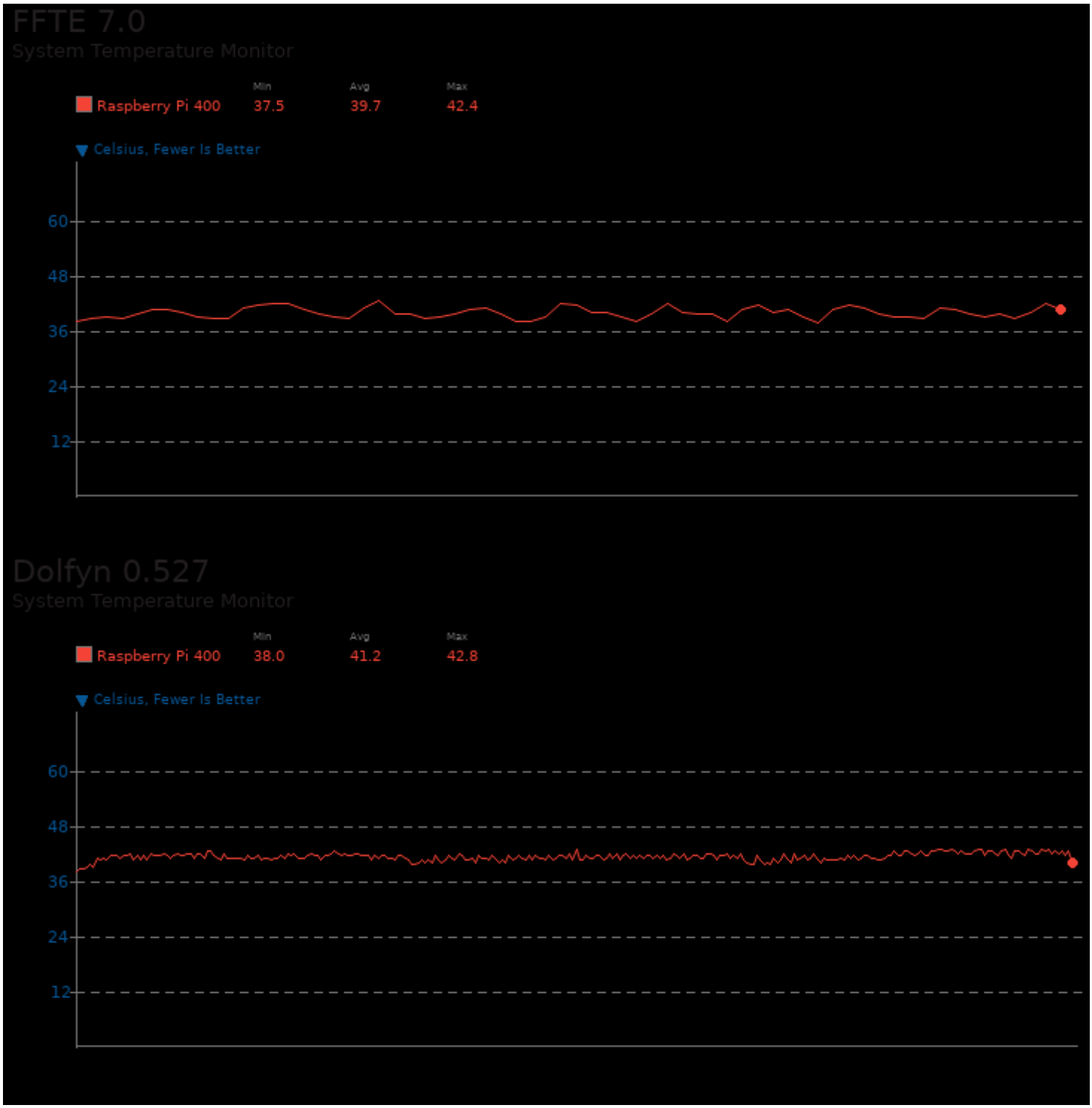
Raspberry Pi 400



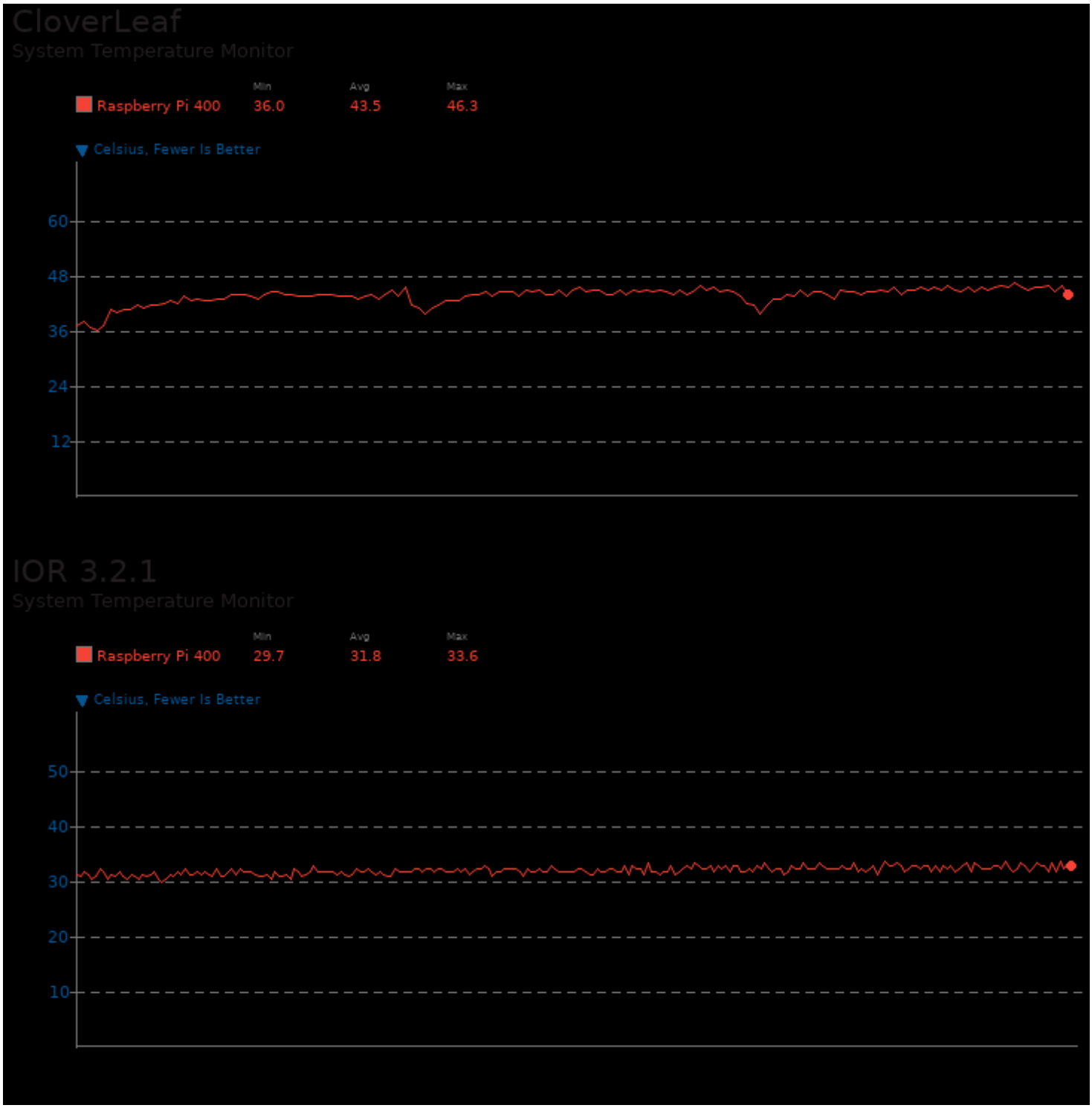

WebP Image Encode 1.1
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
37.0
39.2
40.4
Celsius, Fewer Is Better
55
44
33
22
11
WebP Image Encode 1.1
System Temperature Monitor
Celsius, Fewer Is Better
Raspberry Pi 400
Min: 37 / Avg: 39.43 / Max: 41.9
9
18
27
36
45
WebP Image Encode 1.1
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
37.0
39.8
42.4
Celsius, Fewer Is Better
60
48
36
24
12


WebP Image Encode 1.1
System Temperature Monitor
Min
Avg
Max
Raspberry Pi 400
38.5
40.2
41.9
Celsius, Fewer Is Better
60
48
36
24
12
LAMMPS Molecular Dynamics Simulator 24Aug2020
System Temperature Monitor
Min
Avg
Max
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36.5
47.1
50.1
Celsius, Fewer Is Better
70
56
42
28
14

Raspberry Pi 400

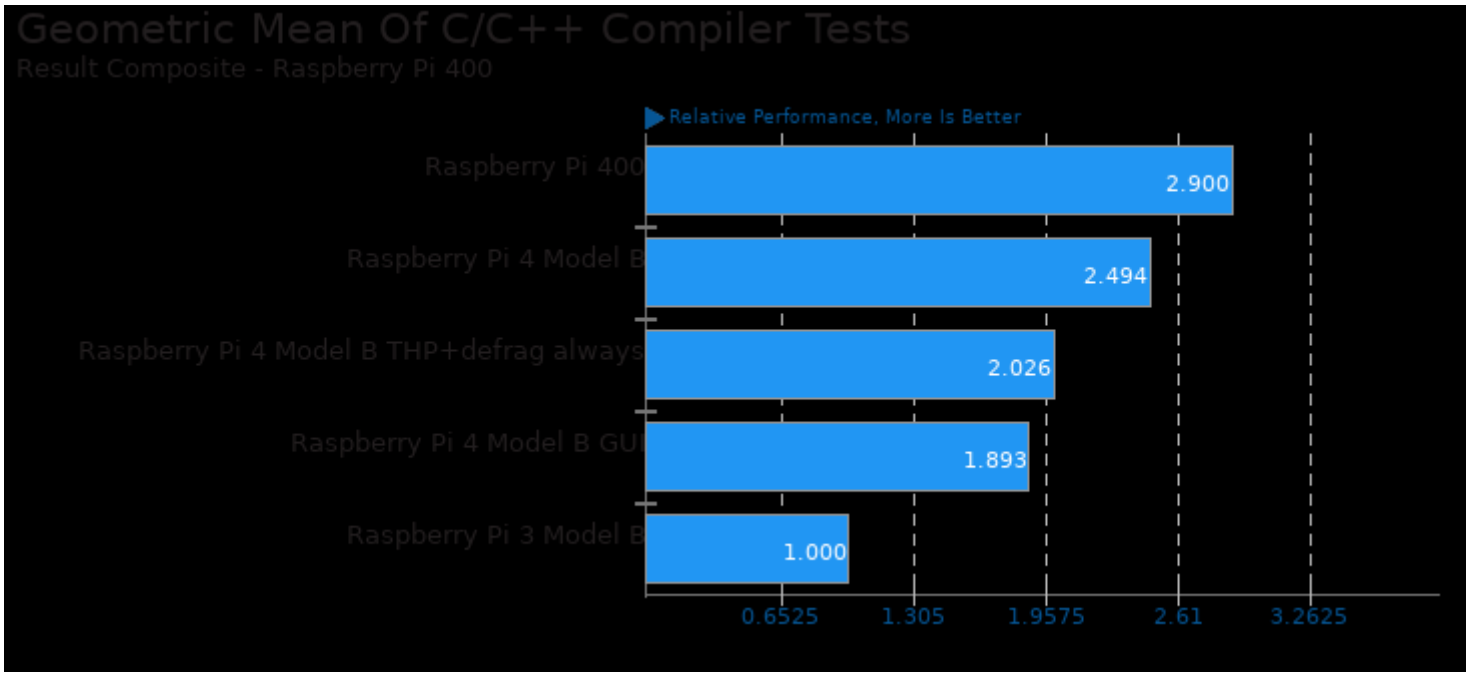


Raspberry Pi 400

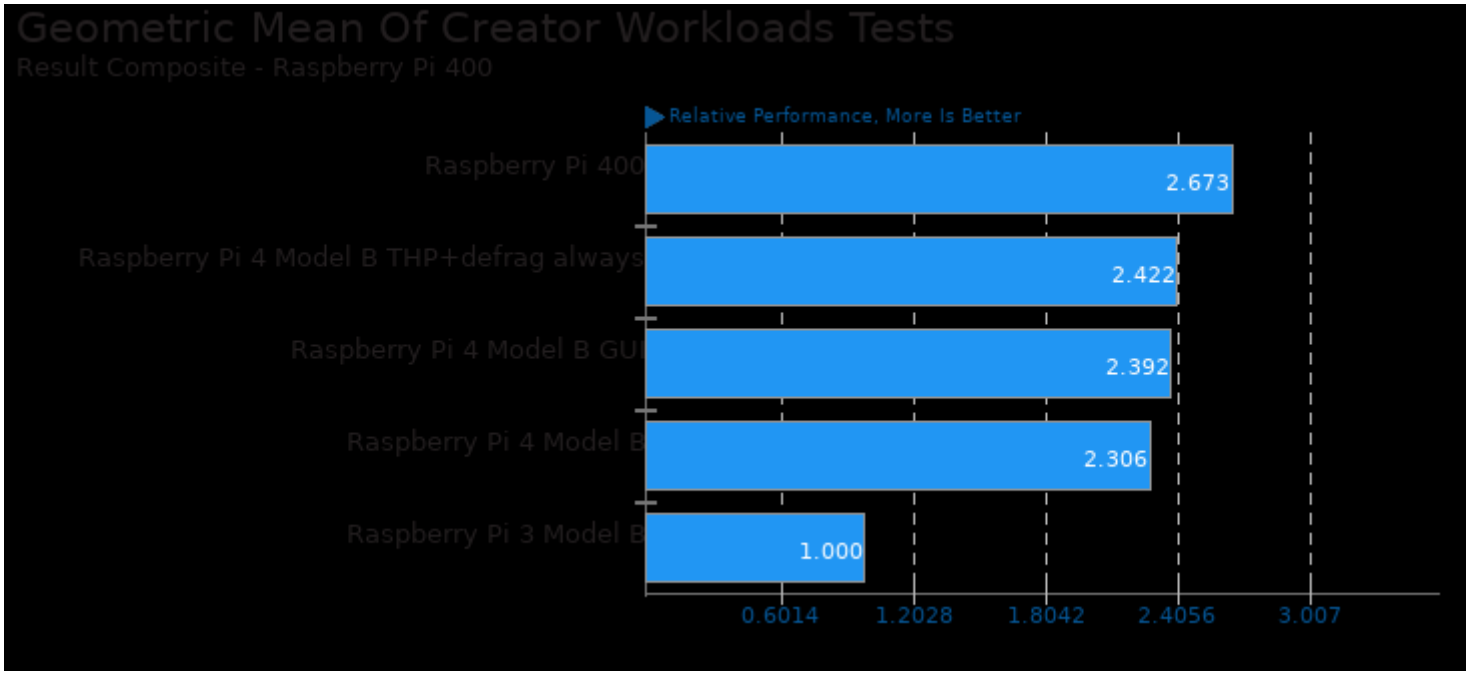


Raspberry Pi 400

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

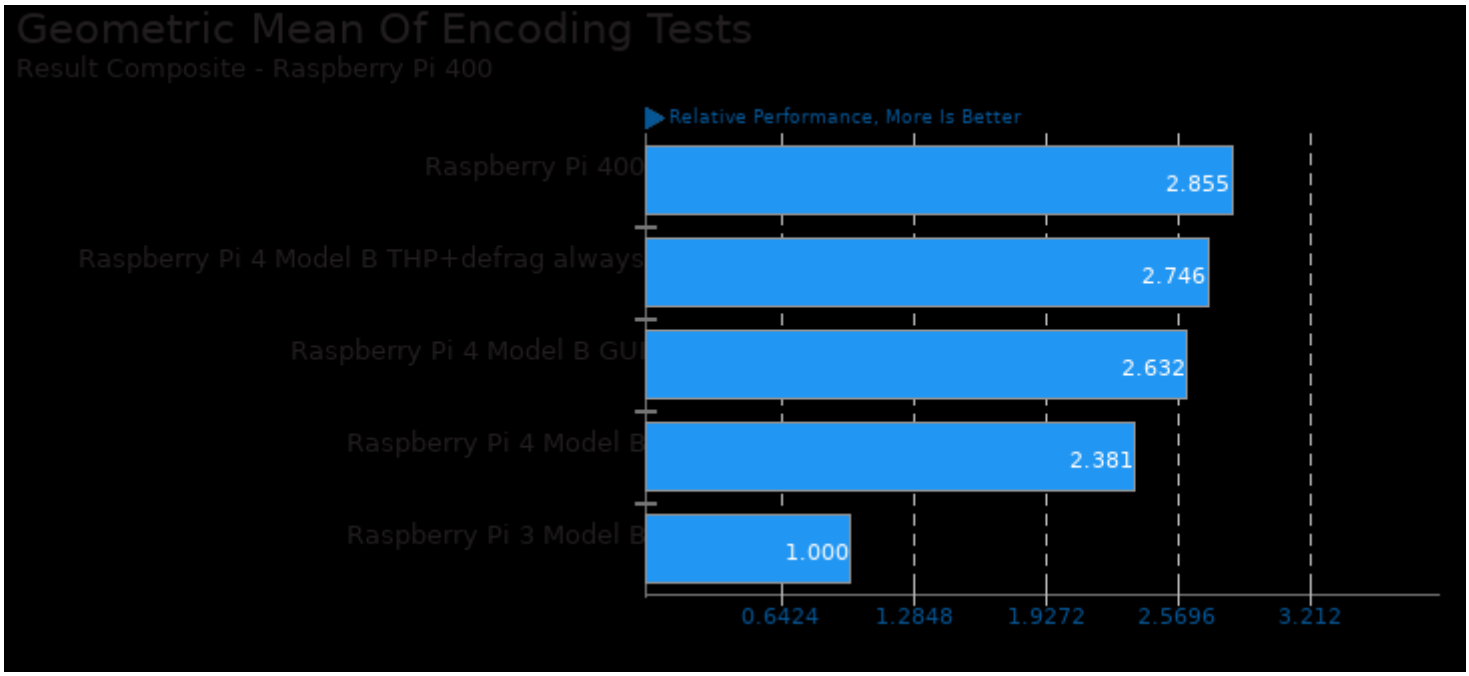


Geometric mean based upon tests: pts/aobench, pts/tscp, pts/graphics-magick, pts/himeno, pts/build-php, pts/build-imagemagick, pts/c-ray, pts/encode-mp3, pts/encode-flac, pts/sqlite-speedtest, pts/kvazaar, pts/compress-zstd, pts/openssl, pts/lammps, pts/build-gdb and pts/build-apache

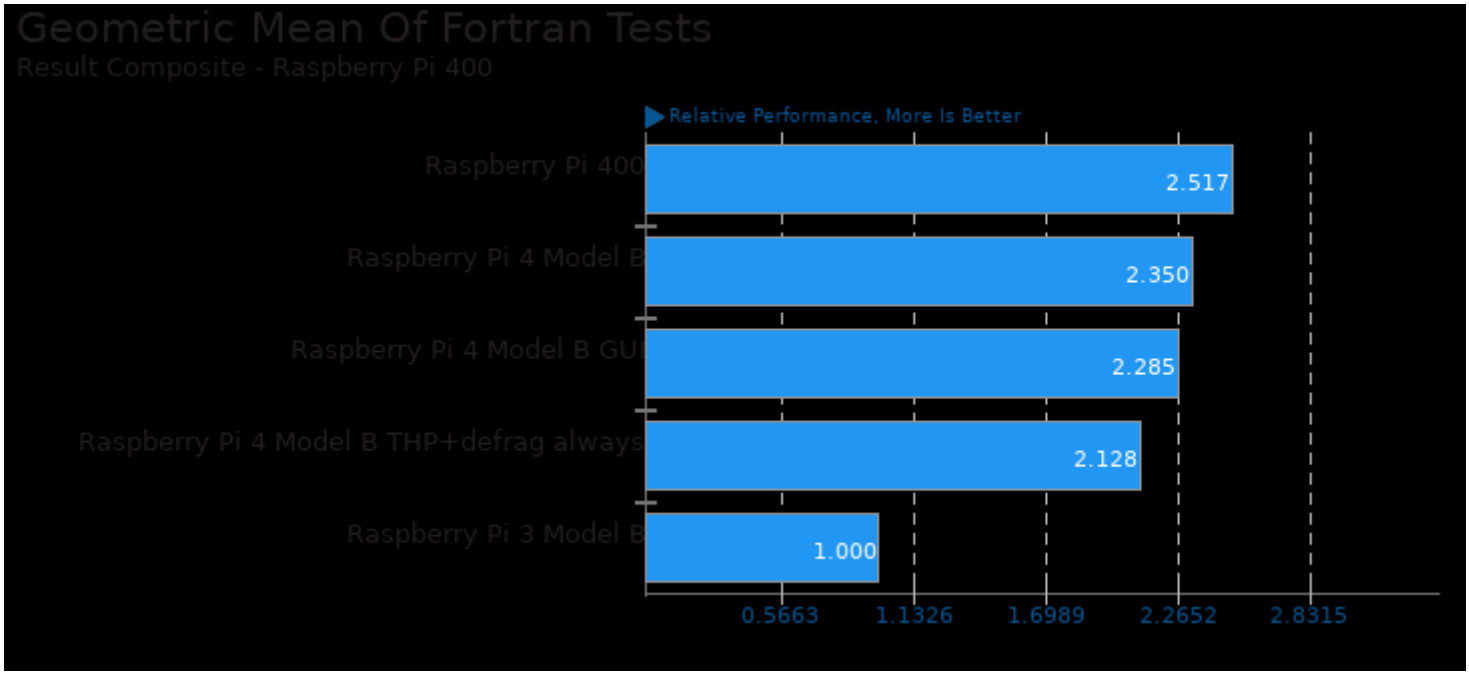


Geometric mean based upon tests: pts/c-ray, pts/aobench, pts/smallpt, system/tesseract-ocr, system/ocrmypdf, pts/kvazaar, pts/encode-mp3, pts/encode-flac, pts/graphics-magick, system/inkscape, pts/libraw, pts/webp, system/gimp, system/rsvg, system/gegl, pts/espeak and pts/rnnoise

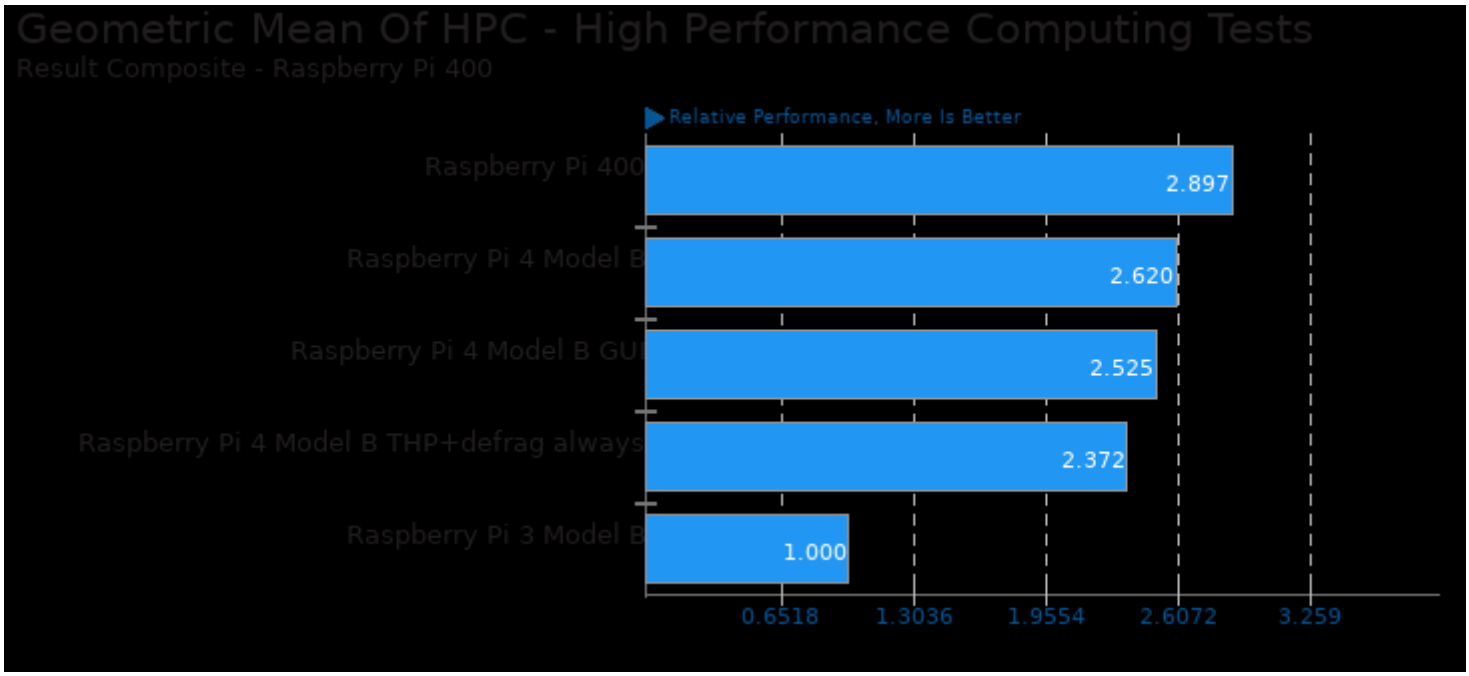
Raspberry Pi 400



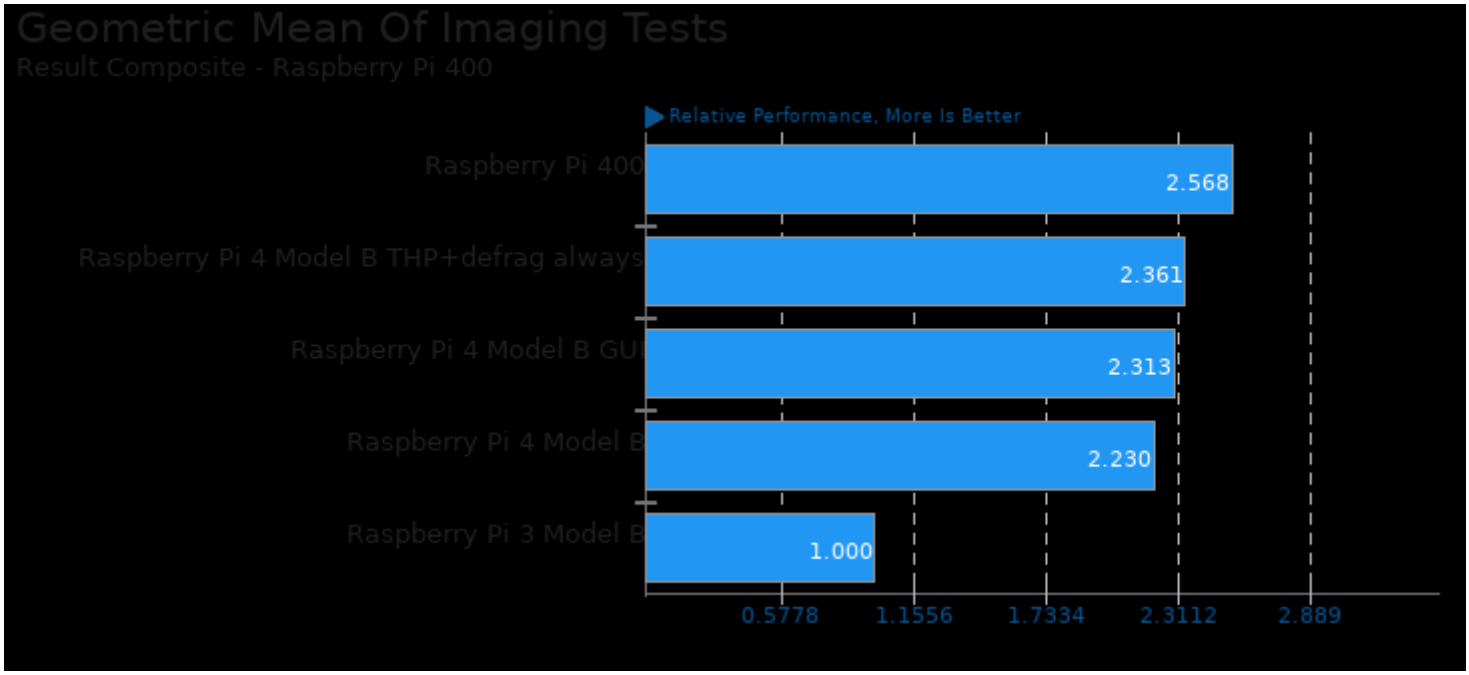
Geometric mean based upon tests: pts/encode-mp3, pts/encode-flac and pts/kvazaar



Geometric mean based upon tests: pts/dolfyn, pts/cloverleaf, pts/lammps and pts/ffte

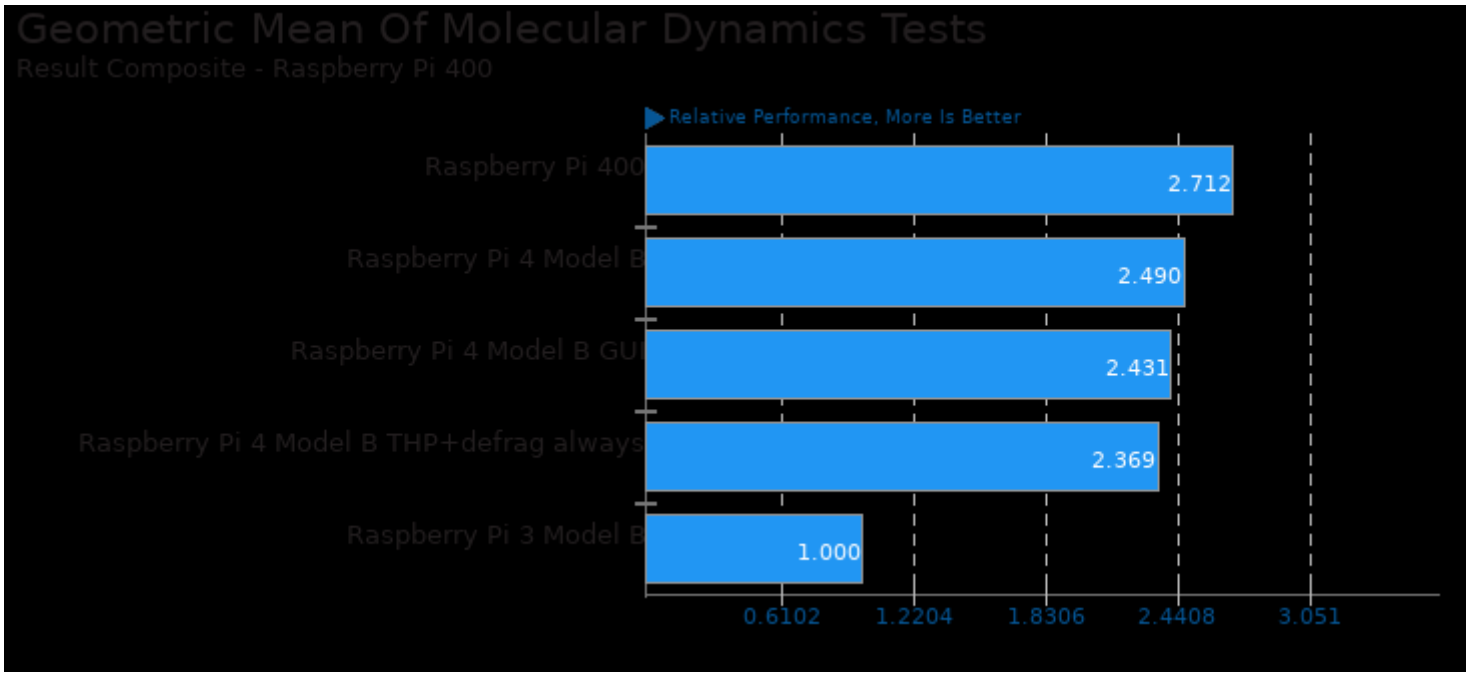


Geometric mean based upon tests: pts/ffte, system/octave-benchmark, pts/dolfyn, pts/cloverleaf, pts/lammps, pts/himeno, pts/mnn, pts/tnn, pts/numpy and pts/rnnoise

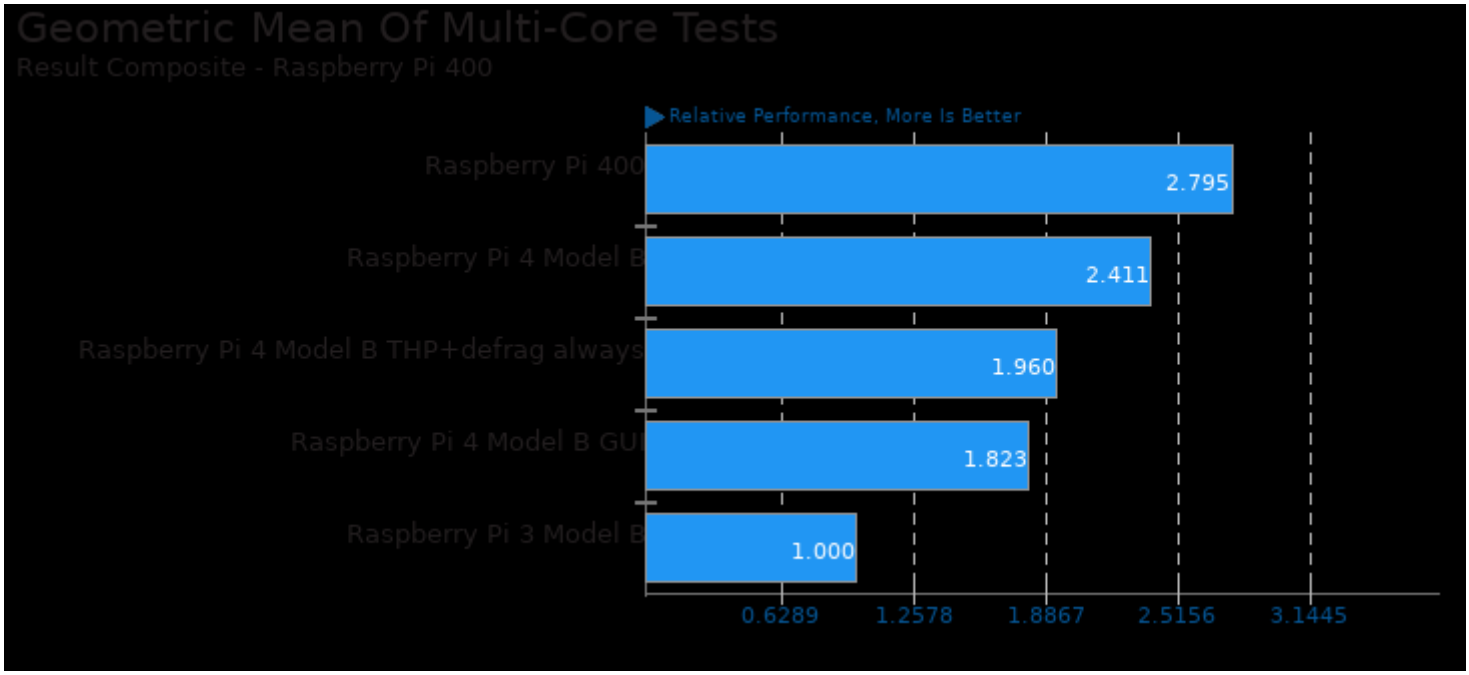


Geometric mean based upon tests: pts/graphics-magick, system/inkscape, pts/libraw, pts/webp, system/gimp, system/rsvg and system/gegl

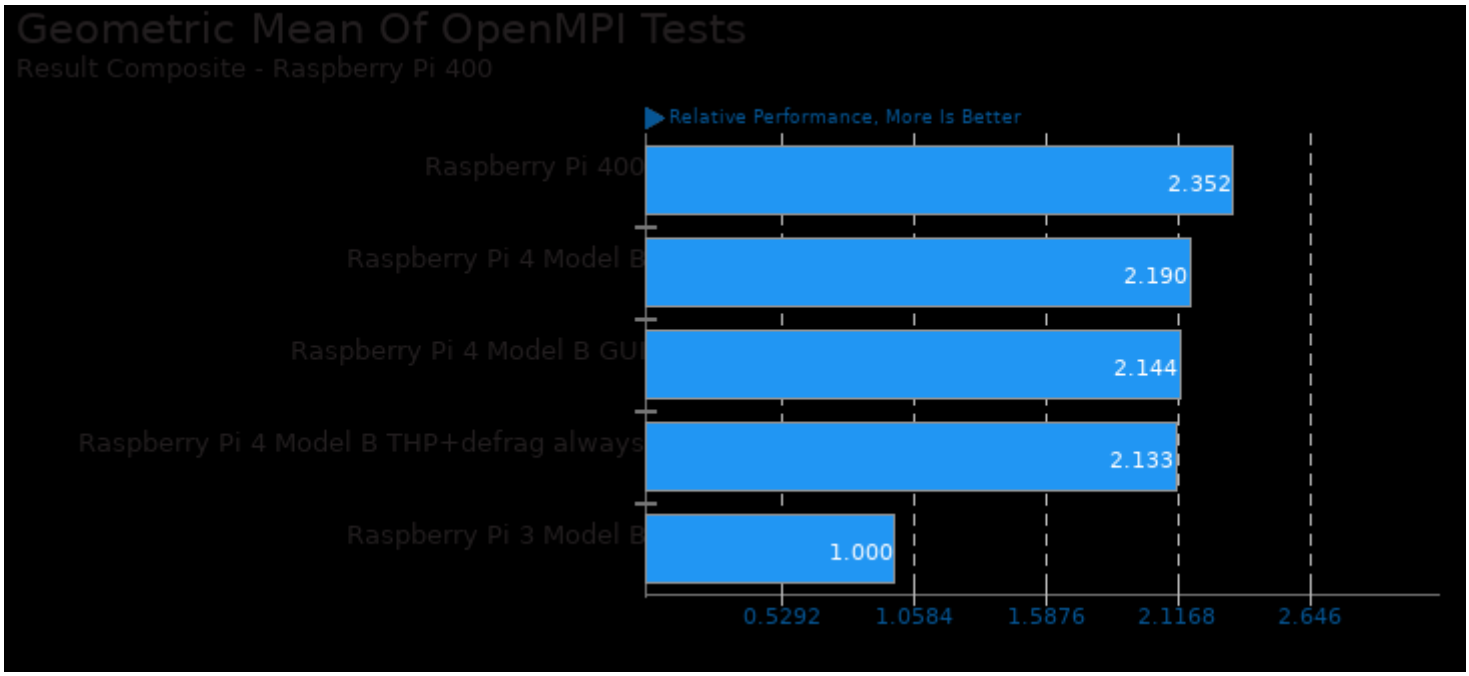
Raspberry Pi 400



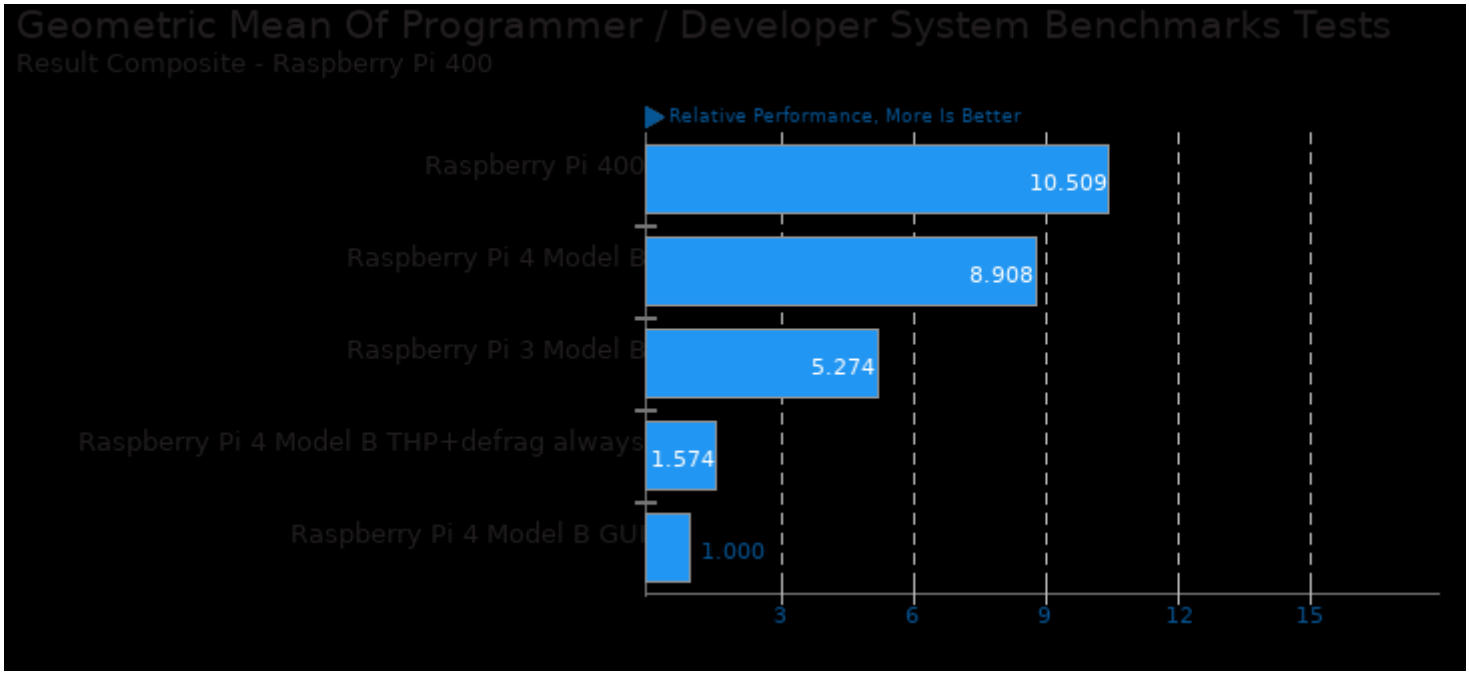
Geometric mean based upon tests: pts/dolfyn, pts/cloverleaf and pts/lammps



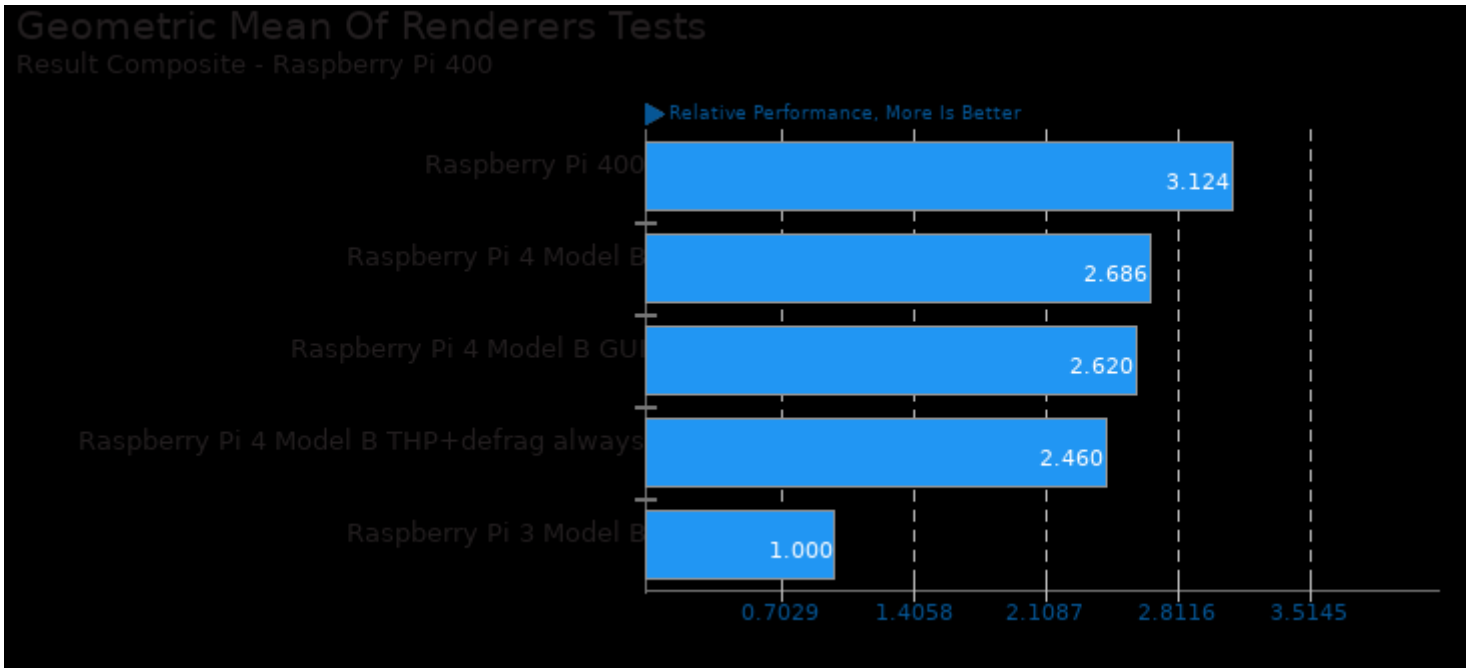
Geometric mean based upon tests: pts/c-ray, pts/coremark, pts/kvazaar, pts/smallpt, pts/asmfish, pts/graphics-magick, pts/lammps, pts/compress-zstd, pts/build-apache, pts/build-php, pts/build-imagemagick, pts/build-gdb, pts/build2 and pts/aobench



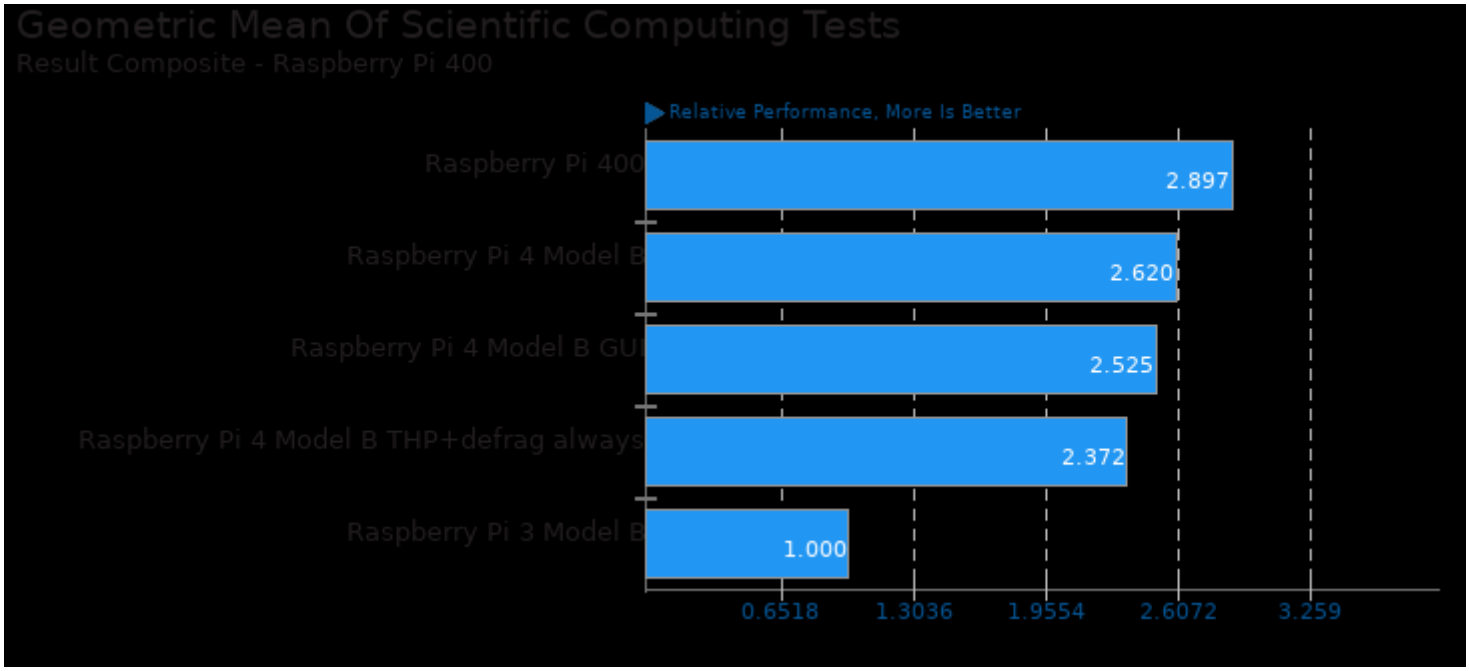
Geometric mean based upon tests: pts/cloverleaf and pts/lammps



Geometric mean based upon tests: pts/sqlite-speedtest, pts/compress-zstd, pts/pyperformance, pts/pybench, pts/build-apache, pts/build-php, pts/build-imagemagick, pts/build-gdb and pts/build2

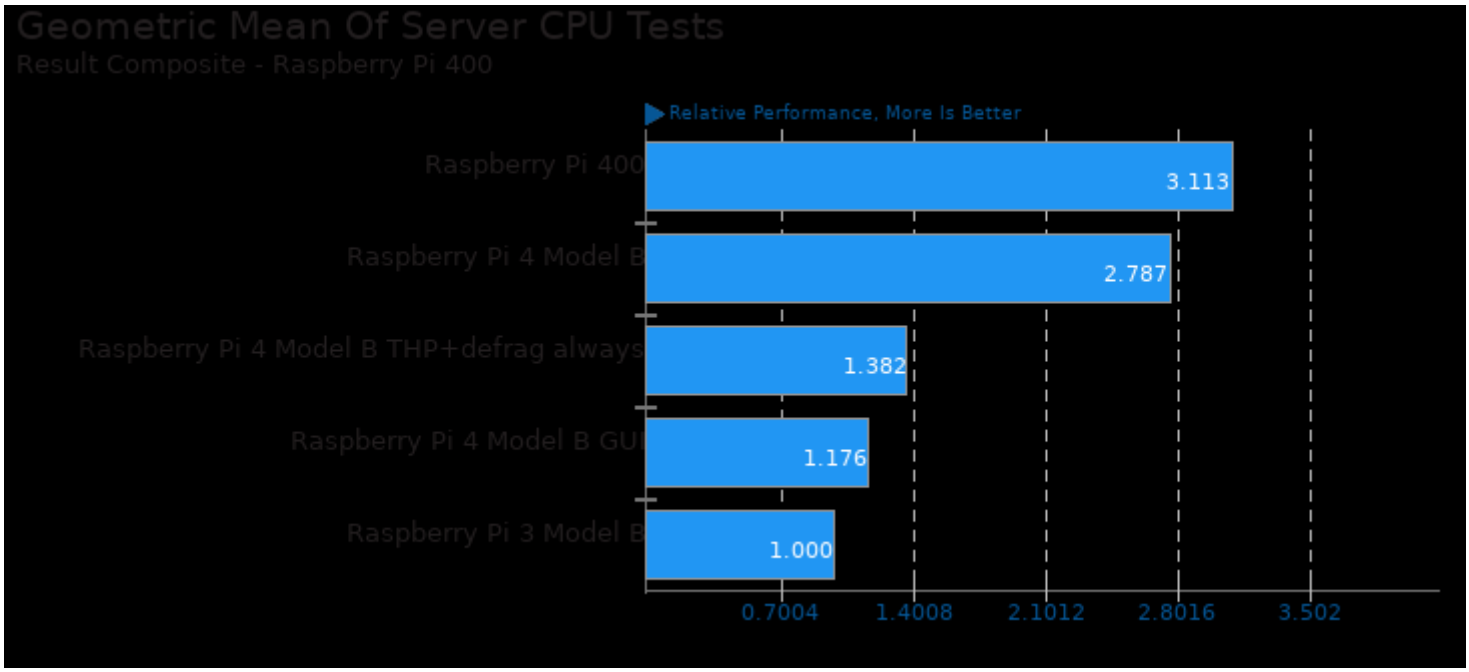


Geometric mean based upon tests: pts/c-ray, pts/aobench and pts/smallpt



Geometric mean based upon tests: pts/ffte, system/octave-benchmark, pts/dolfyn, pts/cloverleaf, pts/lammps and pts/himeno

Raspberry Pi 400



Geometric mean based upon tests: pts/dacapobench, pts/himeno, pts/asmfish, pts/build-php, pts/c-ray, pts/compress-zstd, pts/openssl, system/gimp, pts/pybench, pts/numpy, pts/phpbench and system/tesseract-ocr

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