# SPECaccel®2023 Result

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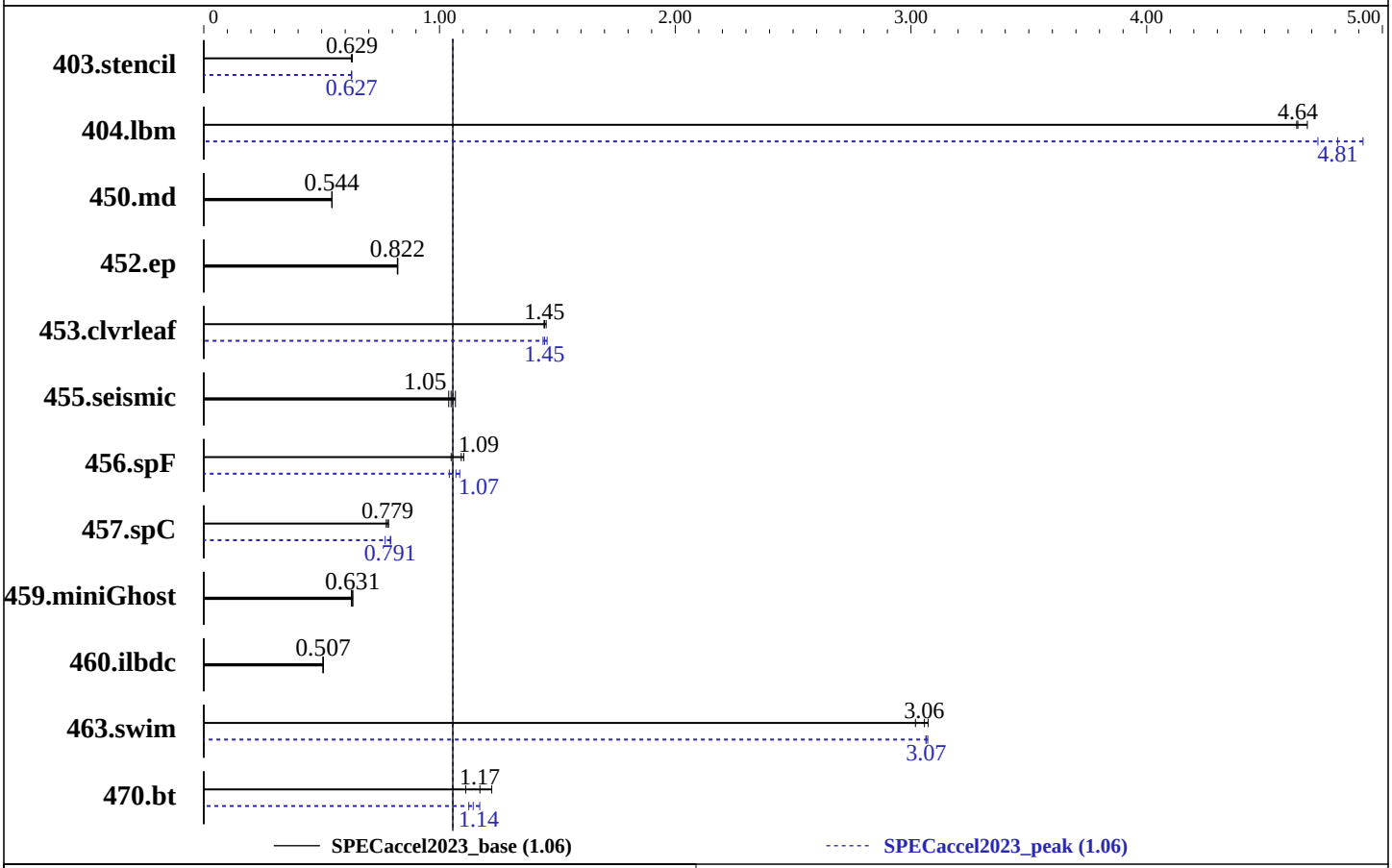
## Supermicro
## Intel Xeon Gold 5520+
## GPU SuperServer SYS-741GE-TNRT

**SPECaccel 2023_base = 1.06**

**SPECaccel 2023_peak = 1.06**

**accel2023 License:** 6569
**Test Sponsor:** Supermicro
**Tested by:** Supermicro

**Test Date:** Feb-2024
**Hardware Availability:** Dec-2023
**Software Availability:** Nov-2023




### Hardware

| | |
|---|---|
| CPU Name: | INTEL Xeon Gold 5520+ |
| Max MHz.: | 4000 |
| Nominal: | 2200 |
| Enabled: | 56 cores, 2 chips, 2 threads/core |
| Orderable: | 1,2 chips |
| Cache L1: | 32 KB I + 48 KB D on chip per core |
| L2: | 2 MB I+D on chip per core |
| L3: | 52.5 MB I+D on chip per chip |
| Other: | None |
| Memory: | 1 TB (16 x 64 GB 2Rx4 PC5-5600B-R, running at 4800) |
| Storage: | 1 x 512 GB M.2 NVMe SSD |
| Other: | None |
| Base Threads Run: | 112 |
| Min. Peak Threads: | 112 |
| Max. Peak Threads: | 112 |

### Accelerator

| | |
|---|---|
| Accel Model Name: | Intel Xeon Gold 5520+ |
| Accel Vendor: | Intel |
| Accel Name: | Intel Xeon Gold 5520+ |
| Type of Accel: | CPU |
| Accel Connection: | N/A |
| Does Accel Use ECC: | Yes |
| Accel Description: | 2 x Intel Xeon Gold 5520+ |
| Accel Driver: | N/A |

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### Software

| | |
|---|---|
| OS: | SUSE Linux Enterprise Server 15 SP5<br>Kernel 5.14.21-150500.53-default |
| Compiler: | C/C++/Fortran: Version 2024.0.0.20231017 of Intel oneAPI DPC++/C++ |
| Firmware: | Version 2.1 released Dec-2023 |
| File System: | xfs |
| System State: | Run level 3 (multi-user) |
| Other: | None |
| Base Parallel Model: | LOP |
| Base Threads Run: | 112 |
| Peak Parallel Models: | LOP |
| Max. Peak Threads: | 112 |
| Min. Peak Threads: | 112 |

## Results Table

| Benchmark | Base | | | | | | | Peak | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | Seconds | Ratio | Seconds | Ratio | Seconds | Ratio | Model | Seconds | Ratio | Seconds | Ratio | Seconds | Ratio |
| 403.stencil | LOP | 699 | 0.630 | 703 | 0.626 | **699** | **0.629** | LOP | 701 | 0.627 | **702** | **0.627** | 703 | 0.626 |
| 404.lbm | LOP | **98.0** | **4.64** | 97.2 | 4.68 | 98.1 | 4.64 | LOP | 96.3 | 4.73 | 92.5 | 4.92 | **94.6** | **4.81** |
| 450.md | LOP | 1102 | 0.544 | **1103** | **0.544** | 1105 | 0.543 | LOP | 1102 | 0.544 | **1103** | **0.544** | 1105 | 0.543 |
| 452.ep | LOP | 505 | 0.821 | 504 | 0.823 | **505** | **0.822** | LOP | 505 | 0.821 | 504 | 0.823 | **505** | **0.822** |
| 453.clvrleaf | LOP | 693 | 1.44 | 688 | 1.45 | **692** | **1.45** | LOP | 695 | 1.44 | **692** | **1.45** | 687 | 1.46 |
| 455.seismic | LOP | 751 | 1.04 | 731 | 1.07 | **744** | **1.05** | LOP | 751 | 1.04 | 731 | 1.07 | **744** | **1.05** |
| 456.spF | LOP | 431 | 1.10 | **435** | **1.09** | 453 | 1.05 | LOP | 456 | 1.04 | **444** | **1.07** | 438 | 1.09 |
| 457.spC | LOP | **693** | **0.779** | 698 | 0.774 | 689 | 0.784 | LOP | 681 | 0.793 | **683** | **0.791** | 702 | 0.769 |
| 459.miniGhost | LOP | **935** | **0.631** | 933 | 0.632 | 942 | 0.626 | LOP | **935** | **0.631** | 933 | 0.632 | 942 | 0.626 |
| 460.ilbdc | LOP | 1098 | 0.505 | 1094 | 0.507 | **1096** | **0.507** | LOP | 1098 | 0.505 | 1094 | 0.507 | **1096** | **0.507** |
| 463.swim | LOP | 143 | 3.07 | **144** | **3.06** | 146 | 3.02 | LOP | 144 | 3.06 | **144** | **3.07** | 143 | 3.07 |
| 470.bt | LOP | 864 | 1.22 | 950 | 1.11 | **901** | **1.17** | LOP | 901 | 1.17 | 938 | 1.12 | **923** | **1.14** |

**SPEC accel2023_base = 1.06**

**SPEC accel2023_peak = 1.06**

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

## Operating System Notes

```
Stack size set to unlimited using "ulimit -s unlimited"
```

## General Notes

```
Environment variables set by runaccel before the start of the run:
FORT_BUFFERED = "true"
KMP_AFFINITY = "compact,0"
KMP_BLOCKTIME = "infinite"
KMP_HW_SUBSET = "2S,28C,2T"
KMP_LIBRARY = "turnaround"
```

**(Continued on next page)**

## General Notes (Continued)

```
OMP_DYNAMIC = "FALSE"
OMP_NUM_THREADS = "56"
OMP_WAIT_POLICY = "active"

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, the CVE-2017-5753 (Spectre variant 1)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2)
is mitigated in the system as tested and documented.
```

## Platform Notes

```
 Sysinfo program /home/accel2023/bin/sysinfo
 Rev: r6622 of 2021-04-07 b1a7d5f8f71be5aff70a755cad7211a0
 running on 135-172-248 Sat Feb  3 07:27:21 2024

 SUT (System Under Test) info as seen by some common utilities.
 For more information on this section, see
    https://www.spec.org/cpu2017/Docs/config.html#sysinfo

 From /proc/cpuinfo
    model name : INTEL(R) XEON(R) GOLD 5520+
       2  "physical id"s (chips)
       112 "processors"
    cores, siblings (Caution: counting these is hw and system dependent. The following
    excerpts from /proc/cpuinfo might not be reliable.  Use with caution.)
       cpu cores : 28
       siblings  : 56
       physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27
       physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27

 From lscpu from util-linux 2.37.4:
      Architecture:                    x86_64
      CPU op-mode(s):                  32-bit, 64-bit
      Address sizes:                   46 bits physical, 57 bits virtual
      Byte Order:                      Little Endian
      CPU(s):                          112
      On-line CPU(s) list:             0-111
      Vendor ID:                       GenuineIntel
      Model name:                      INTEL(R) XEON(R) GOLD 5520+
      CPU family:                      6
      Model:                           207
```

**(Continued on next page)**

## Platform Notes (Continued)

```
      Thread(s) per core:                  2
      Core(s) per socket:                  28
      Socket(s):                           2
      Stepping:                            2
      BogoMIPS:                            4400.00
      Flags:                               fpu vme de pse tsc msr pae mce cx8 apic sep mtrr
      pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx
      pdpe1gb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology
      nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx
      smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt
      tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault
      epb cat_l3 cat_l2 cdp_l3 invpcid_single cdp_l2 ssbd mba ibrs ibpb stibp
      ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1
      hle avx2 smep bmi2 erms invpcid rtm cqm rdt_a avx512f avx512dq rdseed adx smap
      avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw avx512vl xsaveopt
      xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local avx_vnni
      avx512_bf16 wbnoinvd dtherm ida arat pln pts avx512vbmi umip pku ospke waitpkg
      avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme avx512_vpopcntdq
      la57 rdpid bus_lock_detect cldemote movdiri movdir64b enqcmd fsrm md_clear serialize
      tsxldtrk pconfig arch_lbr avx512_fp16 amx_tile flush_l1d arch_capabilities
      Virtualization:                      VT-x
      L1d cache:                           2.6 MiB (56 instances)
      L1i cache:                           1.8 MiB (56 instances)
      L2 cache:                            112 MiB (56 instances)
      L3 cache:                            105 MiB (2 instances)
      NUMA node(s):                        4
      NUMA node0 CPU(s):                   0-13,56-69
      NUMA node1 CPU(s):                   14-27,70-83
      NUMA node2 CPU(s):                   28-41,84-97
      NUMA node3 CPU(s):                   42-55,98-111
      Vulnerability Itlb multihit:         Not affected
      Vulnerability L1tf:                  Not affected
      Vulnerability Mds:                   Not affected
      Vulnerability Meltdown:              Not affected
      Vulnerability Mmio stale data:       Not affected
      Vulnerability Retbleed:              Not affected
      Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via
      prctl and seccomp
      Vulnerability Spectre v1:            Mitigation; usercopy/swapgs barriers and __user
      pointer sanitization
      Vulnerability Spectre v2:            Mitigation; Enhanced IBRS, IBPB conditional, RSB
      filling, PBRSB-eIBRS SW sequence
      Vulnerability Srbds:                 Not affected
      Vulnerability Tsx async abort:       Not affected

 From lscpu --cache:
      NAME ONE-SIZE ALL-SIZE WAYS TYPE        LEVEL  SETS PHY-LINE COHERENCY-SIZE
```

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## Platform Notes (Continued)

```
      L1d       48K     2.6M   12 Data            1    64        1             64
      L1i       32K     1.8M    8 Instruction     1    64        1             64
      L2         2M     112M   16 Unified         2  2048        1             64
      L3      52.5M     105M   15 Unified         3 57344        1             64

 /proc/cpuinfo cache data
    cache size : 53760 KB

 From numactl --hardware
 WARNING: a numactl 'node' might or might not correspond to a physical chip.
   available: 4 nodes (0-3)
   node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 56 57 58 59 60 61 62 63 64 65 66 67 68 69
   node 0 size: 257678 MB
   node 0 free: 256468 MB
   node 1 cpus: 14 15 16 17 18 19 20 21 22 23 24 25 26 27 70 71 72 73 74 75 76 77 78 79 80
   81 82 83
   node 1 size: 258040 MB
   node 1 free: 257360 MB
   node 2 cpus: 28 29 30 31 32 33 34 35 36 37 38 39 40 41 84 85 86 87 88 89 90 91 92 93 94
   95 96 97
   node 2 size: 258040 MB
   node 2 free: 257340 MB
   node 3 cpus: 42 43 44 45 46 47 48 49 50 51 52 53 54 55 98 99 100 101 102 103 104 105
   106 107 108 109 110 111
   node 3 size: 257985 MB
   node 3 free: 257448 MB
   node distances:
   node   0   1   2   3
     0:  10  12  21  21
     1:  12  10  21  21
     2:  21  21  10  12
     3:  21  21  12  10

 From /proc/meminfo
    MemTotal:       1056507444 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

 From /etc/*release* /etc/*version*
    os-release:
       NAME="SLES"
       VERSION="15-SP5"
       VERSION_ID="15.5"
       PRETTY_NAME="SUSE Linux Enterprise Server 15 SP5"
       ID="sles"
       ID_LIKE="suse"
       ANSI_COLOR="0;32"
```

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## Platform Notes (Continued)

```
      CPE_NAME="cpe:/o:suse:sles:15:sp5"

uname -a:
   Linux 135-172-248 5.14.21-150500.53-default #1 SMP PREEMPT_DYNAMIC Wed May 10 07:56:26
   UTC 2023 (b630043) x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit):                          Not affected
CVE-2018-3620 (L1 Terminal Fault):                       Not affected
Microarchitectural Data Sampling:                        Not affected
CVE-2017-5754 (Meltdown):                                Not affected
mmio_stale_data:                                         Not affected
retbleed:                                                Not affected
CVE-2018-3639 (Speculative Store Bypass):                Mitigation: Speculative Store
                                                         Bypass disabled via prctl and
                                                         seccomp
CVE-2017-5753 (Spectre variant 1):                       Mitigation: usercopy/swapgs
                                                         barriers and __user pointer
                                                         sanitization
CVE-2017-5715 (Spectre variant 2):                       Mitigation: Enhanced IBRS, IBPB:
                                                          conditional, RSB filling,
                                                          PBRSB-eIBRS: SW sequence
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort):                 Not affected

run-level 3 Feb 2 17:33

SPEC is set to: /home/accel2023
   Filesystem     Type  Size  Used Avail Use% Mounted on
   /dev/nvme0n1p2 xfs   475G   55G  420G  12% /

From /sys/devices/virtual/dmi/id
    Vendor:         Supermicro
    Product:        X13DEG-QT
    Product Family: Family
    Serial:         1234567890

Additional information from dmidecode 3.4 follows.  WARNING: Use caution when you
interpret this section. The 'dmidecode' program reads system data which is "intended to
allow hardware to be accurately determined", but the intent may not be met, as there are
frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.
  Memory:
    14x SK Hynix HMCG94AGBRA181N 64 GB 2 rank 5600, configured at 4800
    2x SK Hynix HMCG94AGBRA184N 64 GB 2 rank 5600, configured at 4800

BIOS:
```

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## Platform Notes (Continued)

```
    BIOS Vendor:       American Megatrends International, LLC.
    BIOS Version:      2.1
    BIOS Date:         12/12/2023
    BIOS Revision:     5.32

 (End of data from sysinfo program)
```

## Compiler Version Notes

```
==============================================================================
C          | 403.stencil(base, peak) 404.lbm(base, peak) 452.ep(base, peak)
           | 457.spC(base, peak) 470.bt(base, peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler 2024.0.0 (2024.0.0.20231017)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/intel/oneapi/compiler/2024.0/bin/compiler
Configuration file: /opt/intel/oneapi/compiler/2024.0/bin/compiler/../icx.cfg
------------------------------------------------------------------------------

==============================================================================
Fortran    | 450.md(base, peak) 455.seismic(base, peak) 456.spF(base, peak)
           | 460.ilbdc(base, peak) 463.swim(base, peak)
------------------------------------------------------------------------------
ifx (IFX) 2024.0.0 20231017
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
Fortran, C | 453.clvrleaf(base, peak) 459.miniGhost(base, peak)
------------------------------------------------------------------------------
ifx (IFX) 2024.0.0 20231017
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler 2024.0.0 (2024.0.0.20231017)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/intel/oneapi/compiler/2024.0/bin/compiler
Configuration file: /opt/intel/oneapi/compiler/2024.0/bin/compiler/../icx.cfg
------------------------------------------------------------------------------
```

## Base Compiler Invocation

C benchmarks:
icx

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## Base Compiler Invocation (Continued)

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

## Base Portability Flags

450.md: -80
457.spC: -Wl,--no-relax(icx)(*) -mcmodel=medium -shared-intel -Wl,--no-relax(icx)
459.miniGhost: -nofor-main

(*) Indicates a portability flag that was found in a non-portability variable.

## Base Optimization Flags

C benchmarks:
-Ofast -O3 -xsapphirerapids -mprefer-vector-width=512 -qopt-multiple-gather-scatter-by-shuffles -flto -ffast-math -fiopenmp -qopt-dynamic-align -fvec-peel-loops -qopt-streaming-stores always -Xclang -fopenmp-declare-target-scalar-defaultmap-firstprivate -fimf-precision=low

Fortran benchmarks:
-Ofast -O3 -xsapphirerapids -mprefer-vector-width=512 -qopt-multiple-gather-scatter-by-shuffles -flto -ffast-math -fiopenmp -qopt-dynamic-align -fvec-peel-loops -qopt-streaming-stores always -nostandard-realloc-lhs -align array32byte -auto -fimf-accuracy-bits-sqrt=14 -fimf-precision=low

Benchmarks using both Fortran and C:
-Ofast -O3 -xsapphirerapids -mprefer-vector-width=512 -qopt-multiple-gather-scatter-by-shuffles -flto -ffast-math -fiopenmp -qopt-dynamic-align -fvec-peel-loops -qopt-streaming-stores always -Xclang -fopenmp-declare-target-scalar-defaultmap-firstprivate -fimf-precision=low -nostandard-realloc-lhs -align array32byte -auto -fimf-accuracy-bits-sqrt=14

## Peak Compiler Invocation

C benchmarks:
icx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

## Peak Portability Flags

450.md: -80
457.spC: -Wl,--no-relax(icx)(*) -mcmodel=medium -shared-intel
-Wl,--no-relax(icx)
459.miniGhost: -nofor-main

(*) Indicates a portability flag that was found in a non-portability variable.

## Peak Optimization Flags

C benchmarks:

403.stencil: -Ofast -O3 -xsapphirerapids -mprefer-vector-width=512
-qopt-multiple-gather-scatter-by-shuffles -flto -ffast-math
-fiopenmp -qopt-dynamic-align -fvec-peel-loops
-qopt-streaming-stores always -Xclang
-fopenmp-declare-target-scalar-defaultmap-firstprivate
-fimf-precision=low

404.lbm: Same as 403.stencil

452.ep: basepeak = yes

457.spC: Same as 403.stencil

470.bt: Same as 403.stencil

Fortran benchmarks:

450.md: basepeak = yes

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## Peak Optimization Flags (Continued)

455.seismic: `basepeak = yes`

456.spF: `-Ofast -O3 -xsapphirerapids -mprefer-vector-width=512 -qopt-multiple-gather-scatter-by-shuffles -flto -ffast-math -fiopenmp -qopt-dynamic-align -fvec-peel-loops -qopt-streaming-stores always -nostandard-realloc-lhs -align array32byte -auto -fimf-accuracy-bits-sqrt=14 -fimf-precision=low`

460.ilbdc: `basepeak = yes`

463.swim: `Same as 456.spF`

Benchmarks using both Fortran and C:

453.clvrleaf: `-Ofast -O3 -xsapphirerapids -mprefer-vector-width=512 -qopt-multiple-gather-scatter-by-shuffles -flto -ffast-math -fiopenmp -qopt-dynamic-align -fvec-peel-loops -qopt-streaming-stores always -Xclang -fopenmp-declare-target-scalar-defaultmap-firstprivate -fimf-precision=low -nostandard-realloc-lhs -align array32byte -auto -fimf-accuracy-bits-sqrt=14`

459.miniGhost: `basepeak = yes`

The flags files that were used to format this result can be browsed at
`http://www.spec.org/accel2023/flags/Intel_compiler_flags.2024-03-06.html`
`http://www.spec.org/accel2023/flags/Supermicro-Platform-Settings-V1.2-SPR-revG.html`

You can also download the XML flags sources by saving the following links:
`http://www.spec.org/accel2023/flags/Intel_compiler_flags.2024-03-06.xml`
`http://www.spec.org/accel2023/flags/Supermicro-Platform-Settings-V1.2-SPR-revG.xml`


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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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