HP Workstations and ANSYS

Running ANSYS Mechanical, Fluent and CFX

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Introduction

The purpose of this document is to provide information that will aid in selection of HP Workstations for running ANSYS Mechanical, Fluent and CFX. A performance study was completed on the ANSYS 14.0 benchmarks. Detailed results are provided for the HP Z820 and HP Z800 Workstations running Windows® 7 Professional 64-bit[1]. Results are also provided with use of the NVIDIA Tesla C2075 on ANSYS Mechanical benchmarks. Recommended configurations are provided for the new HP Workstations HP Z420, HP Z620 and HP Z820. Tips are also provided for running the solutions at ultimate performance.

The HP Z820 speedup compared to the HP Z800 is significant.

All the HP Z820 ANSYS 14.0 Mechanical, Fluent and CFX results were better than HP Z800.

The NVIDIA Tesla C2075 can help with ANSYS 14.0 Mechanical DMP analysis.

The HP Z420, HP Z620 and HP Z820 can be configured with sufficient memory and NVIDIA Tesla C2075[2] to improve ANSYS 14.0 Mechanical.

What type of application is ANSYS Mechanical?

ANSYS Mechanical is used for mechanical and structural engineering analysis/simulation. The solution is used to compute the response of a structural system. The equation solvers that are used to drive the simulation are computational intensive. The solvers can run in central processing units (CPU) or graphics processing unit (GPU). The large arrays of equation solvers and datasets used in the simulation require a large, fast memory system. The data storage files accessed during simulation benefit from dedicated, fast storage I/O systems. The application has the ability to use parallel computing (both shared memory and distributed memory). The distributed memory model can run local on host machine or across machines/nodes connected via high speed interconnect.

What type of application is ANSYS Fluent?

ANSYS Fluent is used for fluid flow design engineering analysis. The solvers are computational intensive and require moderate size, fast memory system. The application has the ability to use parallel computing and can run local on host machine or across machines/nodes connected via high speed interconnect.

What type of application is ANSYS CFX?

ANSYS CFX is used for general purpose computational fluid dynamics (CFD). The solvers are computational intensive require moderate size, fast memory system. The application has the ability to use local parallel computing or distribute parallel computing across multiple machines/nodes connected via high speed interconnect.

How does the new HP Workstation family (HP Z420, HP Z620 and HP Z820) provide ultimate ANSYS performance?

Compute performance is improved over previous-generation Intel® Xeon® processor-based workstations. The new HP Workstations utilize the Intel® Xeon® processor E5 family and the Intel® C602 chipset[3]. Intel® AVX is a new 256 bit instruction set extension to SSE and is designed for applications that are Floating Point (FP) intensive. It was released early 2011 as part of the Intel® Xeon® E5-XXXX processor family[3]. ANSYS 14.0 was compiled to utilize Intel® AVX. The HP Z420, HP Z620 and HP Z820 Workstations provide significant performance gains and utilize the Intel® Xeon® E5-XXXX processors[3].

Memory bandwidth and latency is improved. Dual QPI links in parallel with up to 8 GT/s.

Memory speed (1600 MHz) is improved.

Memory design is improved with 4 channels per processor

HP Z420 supports un-buffered DIMMs (UDIMM)

• 8 DIMM sockets, 4 channels, 2 DIMMs per channel

HP Z620 supports un-buffered DIMMS (UDIMM) and registered DIMMS (RDIMM)

• 12 DIMM sockets, 4 channels

• 2 DIMMs per channel – CPU0 – 8 sockets

• 1 DIMM per channel – CPU1 – 4 sockets

HP Z820 supports un-buffered DIMMs (UDIMM), registered DIMMS (RDIMM) and load-reduced DIMMS 1333 MHz (LRDIMM)
• Mixing UDIMM / RDIMM / LRDIMM is not permitted
• 16 DIMM sockets, 4 channels
• 2 DIMMS per channel – CPU0 – 8 sockets
• 2 DIMMS per channel – CPU1 – 8 sockets

Storage I/O[4,5] performance is improved. PCI-Express 3.0, 6 Gb/s SATA and SAS ports, DMA bandwidth, 6 Gb/s hard drives (HDD) and 6 Gb/s solid state drives (SSD) can be configured with RAID 0 striped volumes for speed, USB 3.0
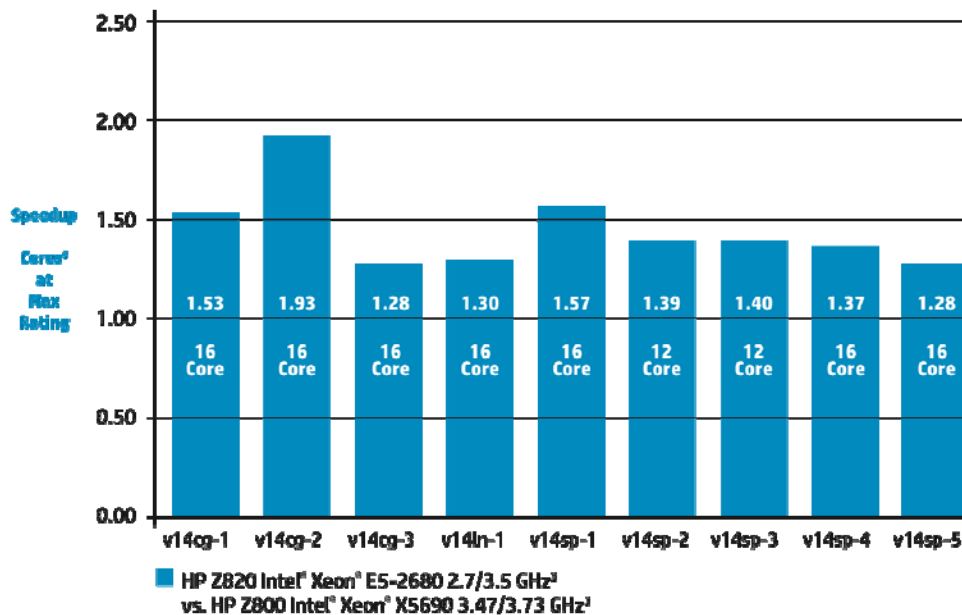
GPU compute acceleration (NVIDIA Tesla C2075) is a supported option in the HP Z420, HP Z620 and HP Z820[2] Workstations.

HP Workstations and ANSYS Performance Benchmarks

HP Z820 vs. HP Z800—DMP

What ANSYS Mechanical 14.0 distributed memory parallel processing (DMP) improvement did HP measure on HP Z820?

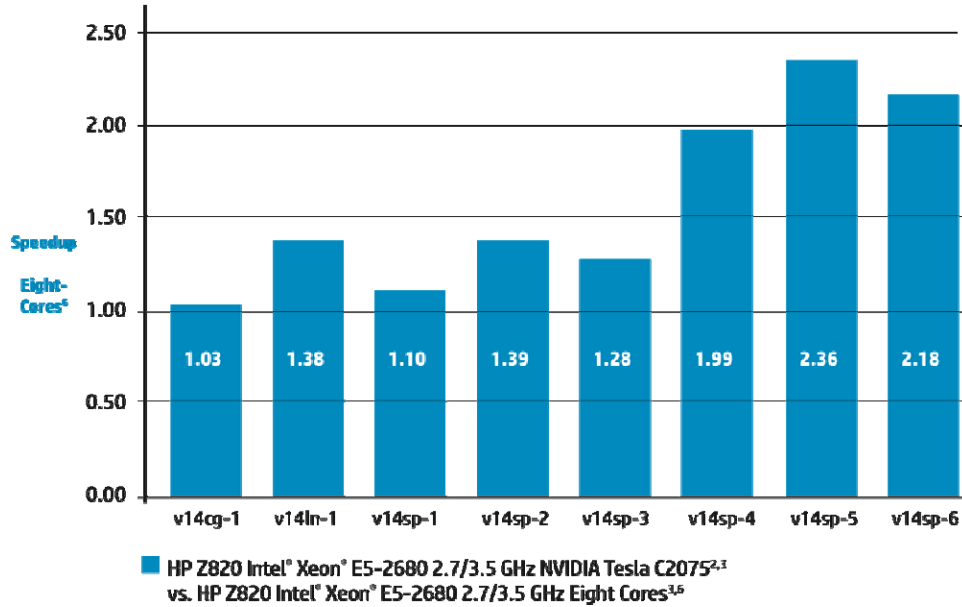• HP Z820 speedup is 1.28 – 1.93 compared to HP Z800 on ANSYS 14.0 DMP benchmarks

Speedup Cores[4] at Max Rating

	v14cg-1	v14cg-2	v14cg-3	v14ln-1	v14sp-1	v14sp-2	v14sp-3	v14sp-4	v14sp-5
Speedup	1.53	1.93	1.28	1.30	1.57	1.39	1.40	1.37	1.28
Cores	16 Core	16 Core	16 Core	16 Core	16 Core	12 Core	12 Core	16 Core	16 Core

■ HP Z820 Intel® Xeon® E5-2680 2.7/3.5 GHz[3]
vs. HP Z800 Intel® Xeon® X5690 3.47/3.73 GHz[3]

HP Z820 with NVIDIA Tesla C2075 versus HP Z820 without NVIDIA Tesla C2075 —DMP

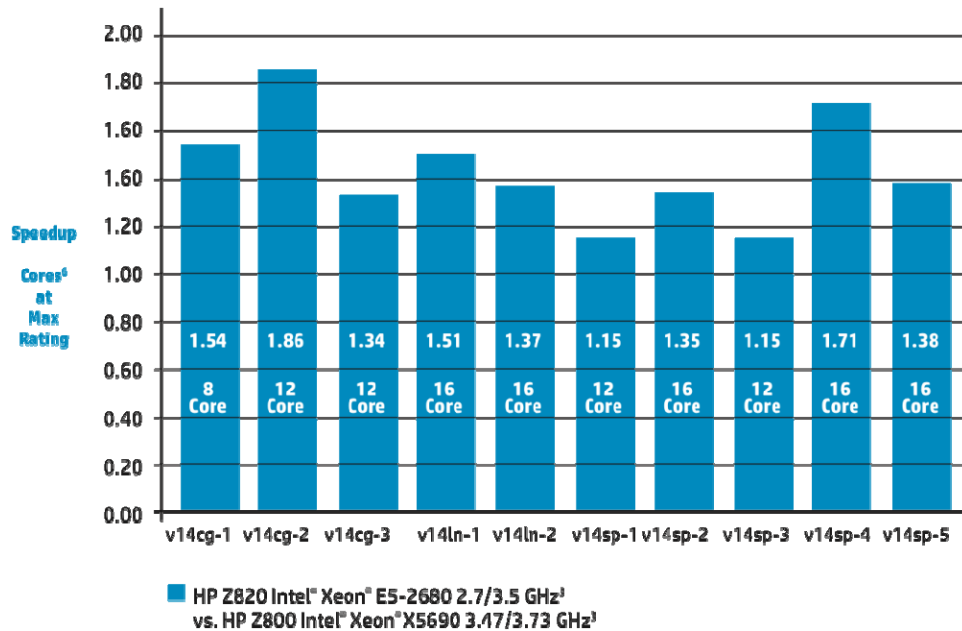How does NVIDIA Tesla C2075 help with ANSYS Mechanical DMP?

• HP Z820 speedup with NVIDIA Tesla C2075[2] is 1.03 – 2.36 compared to HP Z820 without NVIDIA Tesla C2075 Eight-Cores[6] on ANSYS 14.0 DMP benchmarks

• The ANSYS HPC Pack license provides use of Eight-Cores[6] and NIVIDIA Tesla C2075 GPU accelerator

HP Z820 Intel® Xeon® E5-2680 2.7/3.5 GHz NVIDIA Tesla C2075[2,3] vs. HP Z820 Intel® Xeon® E5-2680 2.7/3.5 GHz Eight Cores[3,6]

ANSYS Mechanical 14.0 SMP—HP Z820 Speedup

What ANSYS Mechanical 14.0 shared memory parallel processing (SMP) improvement did HP measure on HP Z820?

• HP Z820 speedup is 1.15 – 1.86 compared to HP Z800 on ANSYS 14.0 SMP Benchmarks
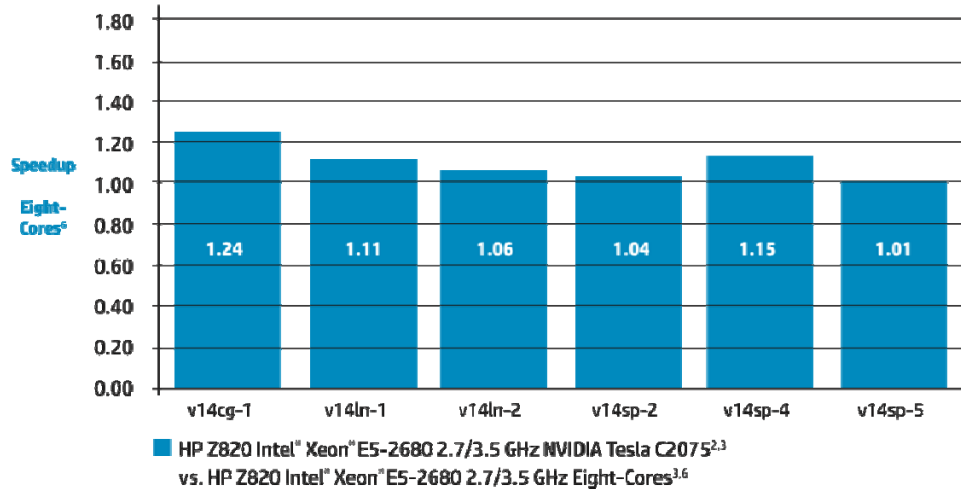

HP Z820 Intel® Xeon® E5-2680 2.7/3.5 GHz[3] vs. HP Z800 Intel® Xeon® X5690 3.47/3.73 GHz[3]

ANSYS Mechanical 14.0 SMP—NVIDIA Tesla C2075 Speedup

How does NVIDIA Tesla C2075 help with ANSYS Mechanical SMP?

• HP Z820 speedup with NVIDIA Tesla C2075[2] is 1.01 – 1.60 compared to HP Z820 without NVIDIA Tesla C2075 on ANSYS 14.0 SMP benchmarks

• The ANSYS HPC Pack license provides use of Eight-Cores[6] and NVIDIA Tesla C2075 GPU accelerator

HP Z820 Intel® Xeon® E5-2680 2.7/3.5 GHz NVIDIA Tesla C2075[2,3]
vs. HP Z820 Intel® Xeon® E5-2680 2.7/3.5 GHz Eight-Cores[3,6]

ANSYS Fluent 14.0—HP Z820 Speedup

What ANSYS Fluent 14.0 performance improvement did HP measure on HP Z820?

• HP Z820 speedup is 1.47 – 1.84 compared to HP Z800 on ANSYS Fluent 14.0 benchmarks
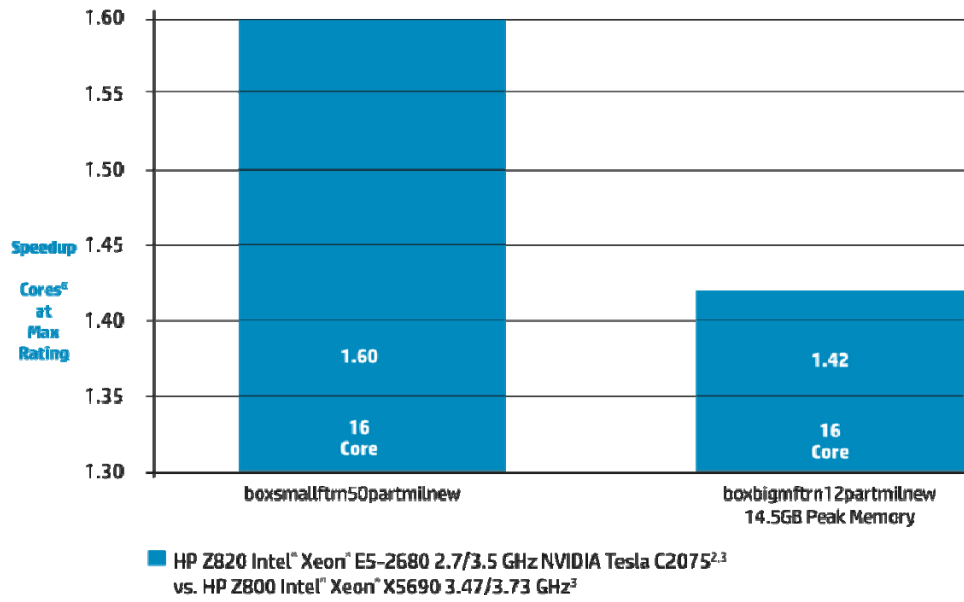

HP Z820 Intel® Xeon® E5-2680 2.7/3.5 GHz[3]
vs. HP Z800 Intel® Xeon® X5690 3.47/3.73 GHz[3]
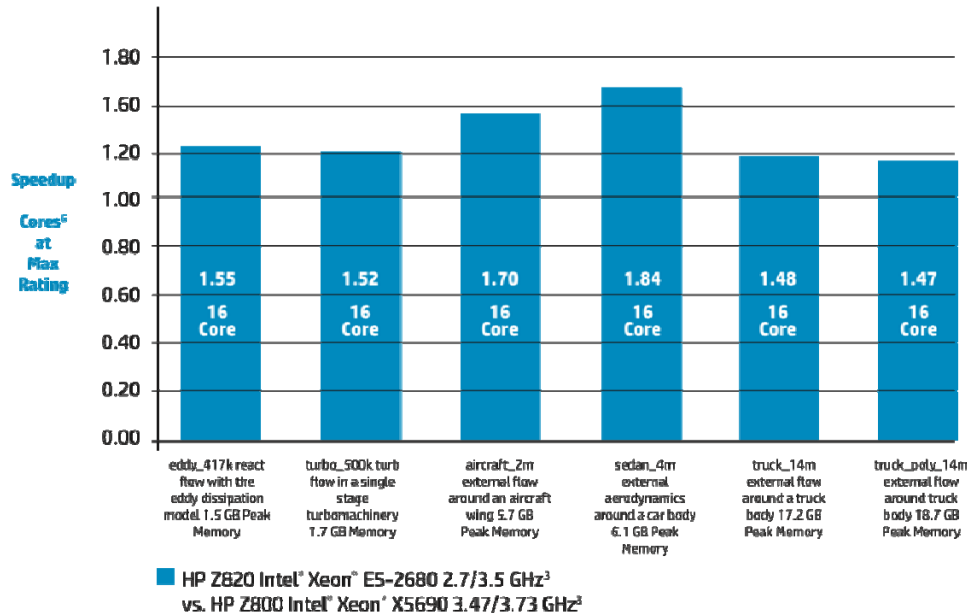
ANSYS CFX 14.0— HP Z820 Speedup

What ANSYS CFX 14.0 performance improvement did HP measure on HP Z820?

• HP Z820 speedup is 1.42 – 1.60 compared to HP Z800 on ANSYS CFX 14.0 benchmarks

Speedup
Cores¤ at Max Rating

	1.60		1.42
	16 Core		16 Core
boxsmallftrn50partmilnew		boxbigmftrn12partmilnew 14.5GB Peak Memory	

■ HP Z820 Intel® Xeon® E5–2680 2.7/3.5 GHz NVIDIA Tesla C2075[2,3]
vs. HP Z800 Intel® Xeon® X5690 3.47/3.73 GHz[3]

HP Workstations Recommendations and Tips for running ANSYS Mechanical 14.0

HP Workstation Recommendations for running ANSYS Mechanical 14.0

DMP: NVIDIA Tesla C2075[2] recommended for DMP

• HP Z620 2x Intel® Xeon® E5-2680 96 GB DDR3 1600 MHz memory NVIDIA Quadro 2000/AMD FirePro V5900[3,5,7,8]

• HP Z820 2x Intel® Xeon® E5-2680 128 GB DDR3 1600 MHz memory NVIDIA Quadro 2000/AMD FirePro V7900[3,5,7,8]

• HP Z420 Intel® Xeon® E5-1660 64 GB DDR3 1600 MHz memory NVIDIA Tesla C2075 NVIDIA Quadro 600[3,5,7]

• HP Z620 2x Intel® Xeon® E5-2680 96 GB DDR3 1600 MHz memory NVIDIA Tesla C2075 NVIDIA Quadro 2000/
  AMD FirePro V5900[3,5,7,8]

• HP Z820 2x Intel® Xeon® E5-2680 128 GB DDR3 1600 MHz memory NVIDIA Tesla C2075 NVIDIA Quadro 2000/
  AMD FirePro V7900[2,3,5,7,8]

• NVIDIA Tesla C2075 improves performance with the ANSYS 14.0 benchmarks.

SMP: NVIDIA Tesla C2075 not recommended for SMP

• HP Z420 Intel® Xeon® E5-1660 64 GB DDR3 1600 MHz memory NVIDIA Quadro 2000/AMD FirePro V5900[3,5,7,8]

• HP Z620 2x Intel® Xeon® E5-2680 96 GB DDR3 1600 MHz memory NVIDIA Quadro 2000/AMD FirePro V5900[3,5,7,8]

• HP Z820 2x Intel® Xeon® E5-2680 128 GB DDR3 1600 MHz memory NVIDIA Quadro 2000/AMD FirePro V7900[3,5,7,8]

• NVIDIA Tesla C2075 improves performance with very few of the ANSYS 14.0 benchmarks.

Memory sizing is critical. Ideal to keep all ANSYS process memory used in physical memory. See the v14sp-6 benchmark results on HP Z800 when analysis is starved of physical memory.

For best performance, use same total memory size on each channel. Use same total size on each CPU.

Models are growing. ANSYS 14.0 benchmarks are real examples.

• V14sp-3 Semi-Submersible 2.3M DOFS 22.7 GB memory[5]

• V14sp-4 Carrier 1M DOFS 29.8 GB memory[5]

• V14sp-5 Turbine 2.1M DOFS 53 GB memory[5]

• V14sp-6 4.9M DOFS 86 GB memory[5]

Windows® 7 64-bit Professional Service Pack 1

Windows® 7 64-bit Professional uses physical memory for dynamic buffer cache when available. The buffer cache prevents slower Disk I/O transactions. Memory is much faster than disk I/O. Additional memory for the OS is necessary.

HP Z420, HP Z620 and HP Z820 chipset design has 6 Gb/s and 3 Gb/s disk I/O ports. The 6 Gb/s I/O ports are recommended for 6 Gb/s devices.

3 Gb/s devices will negotiate 3 Gb/s protocol when plugged into 6 Gb/s ports.
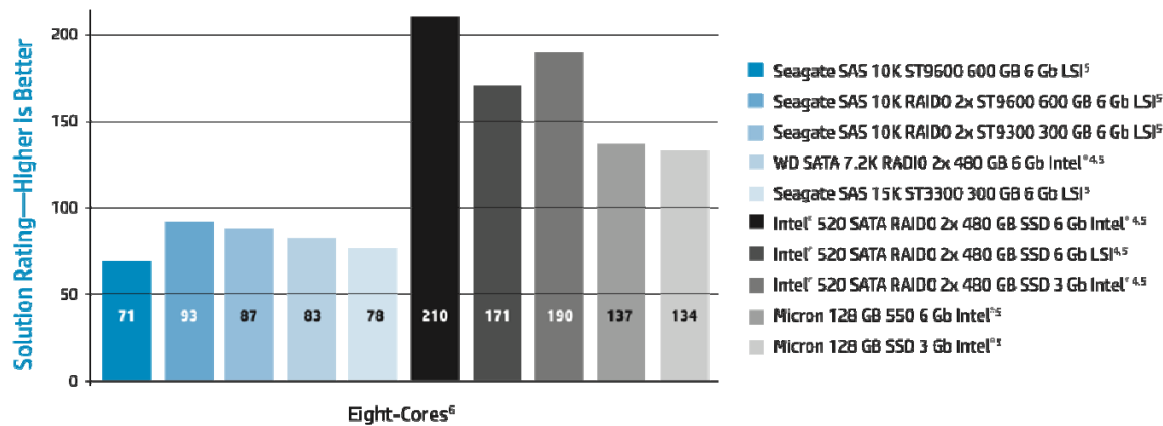
A dedicated RAID0 disk configuration should be used for ANSYS I/O demands. This is particularly important when ANSYS I/O files grow beyond available physical memory.

• 2-3x 6 Gb/s SSD RAID0 disk configurations are recommended.[4]

• 3-4x 6 Gb/s HDD RAID0 disk configurations are recommended. [4]

HP Z820—ANSYS Mechanical 14.0—Test of Disk I/O Storage

V14sp-5, Turbine, Sparse solver, 2.1M OFS, structural analysis with 1 iteration DMP Large sized job, should run in core on machines with 40 GB or more of memory, running out-of-core with 16 GB. [5]

Legend:
- ■ Seagate SAS 10K ST9600 600 GB 6 Gb LSI[5]
- ■ Seagate SAS 10K RAID0 2x ST9600 600 GB 6 Gb LSI[5]
- ■ Seagate SAS 10K RAID0 2x ST9300 300 GB 6 Gb LSI[5]
- ■ WD SATA 7.2K RAID0 2x 480 GB 6 Gb Intel®[4,5]
- ■ Seagate SAS 15K ST3300 300 GB 6 Gb LSI[3]
- ■ Intel® 520 SATA RAID0 2x 480 GB SSD 6 Gb Intel®[4,5]
- ■ Intel® 520 SATA RAID0 2x 480 GB SSD 6 Gb LSI[4,5]
- ■ Intel® 520 SATA RAID0 2x 480 GB SSD 3 Gb Intel®[4,5]
- ■ Micron 128 GB 550 6 Gb Intel®[5]
- ■ Micron 128 GB SSD 3 Gb Intel®[5]

Tips for running ANSYS Mechanical 14.0

Read the ANSYS Mechanical APDL Parallel Processing Guide—
- Chapter 2: Using Shared Memory ANSYS
- Chapter 3: GPU Accelerator Capability
- Chapter 4: Using Distributed ANSYS

Operating System Setting	Default	Recommended
Windows® 7 Professional 64-bit[1]		Service Pack 1
Control Panel/Power Options	Balanced	High Performance

Bios Setting	Default	Recommended
Power/OS Power Management/ Runtime Power Management	Enable	Enable
Power/OS Power Management/Idle Power Savings	Extended	Normal
Power/OS Power Management/Turbo Mode[9]	Enable	Enable
Advance/Device Options/Hyper-Threading[10]	Enable	Disable
Advance/Bus Options/NUMA (HP Z620 and HP Z820 Dual-processor)	Enable	Enable

NVIDIA Tesla C2075 GPU Accelerator Setting	Default	Recommended
ECC Mode	Enable	Enable
Driver Model	TCC Mode	TCC Mode
Driver Version		276.28 and up

There is a Device state management tool that can be used to manage NVIDIA Tesla C2075 settings:

%SystemDrive%\Program Files\NVIDIA Corporation\NVSMI\nvidia-smi.exe

ANSYS SMP, only a single GPU accelerator device can be utilized during solution

ANSYS DMP, only a single GPU accelerator device per machine can be utilized during solution

On machines containing multiple GPU accelerator devices, the ANSYS program will pick the first available GPU accelerator device that is supported.

Conditions that will cause GPU not to be used:
• Partial pivoting is activated when using the sparse solver
• Memory saving option is activated (MSAVE,ON) when using the PCG solver
• A non-supported equation solver is used
• On Windows® OS, the use of Remote Desktop may disable the use of a GPU device when in driver model is WDDM mode.

HP Performance Advisor can be used to install graphics drivers, select BIOS settings and help characterize ANSYS memory usage. Download from hp.com/go/hpperformanceadvisor
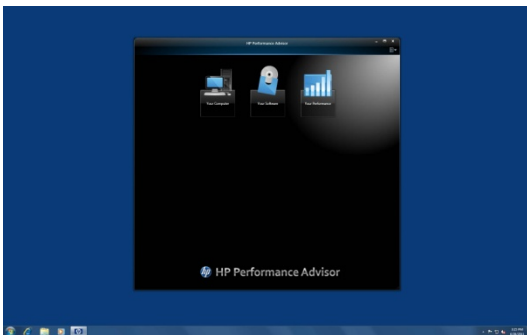
HP recommends Windows® 7.

HP Workstations Recommendations and Tips for running ANSYS Fluent 14.0 and ANSYS CFX 14.0

Fluent and CFX

HP Z620 2x Intel® Xeon® E5-2680 32 GB DDR3 1600 MHz memory NVIDIA Quadro 2000/AMD FirePro V5900[3,5,7,8]

HP Z820 2x Intel® Xeon® E5-2680 64 GB DDR3 1600 MHz memory NVIDIA Quadro 2000/AMD FirePro V7900[3,5,7,8]

• For best performance, use same total memory size on each channel. Use same total size on each CPU.
• HP Z620 and HP Z820 chipset design has 6 Gb/s and 3 Gb/s disk I/O ports. The 6 Gb/s I/O ports are recommended for 6 Gb/s devices.
• 3 Gb/s devices will negotiate 3 Gb/s protocol when plugged into 6 Gb/s ports.

Tips for running ANSYS Fluent 14.0 and ANSYS CFX 14.0

Operating System Setting	Default	Recommended
Windows® 7 Professional 64-bit[1]		Service Pack 1
Control Panel/Power Options	Balanced	High Performance

System Bios Setting	Default	Recommended
Power/OS Power Management/ Runtime Power Management	Enable	Enable
Power/OS Power Management/Idle Power Savings	Extended	Normal
Power/OS Power Management/Turbo Mode[9]	Enable	Enable
Advance/Device Options/Hyper-Threading[10]	Enable	Disable
Advance/Bus Options/NUMA (HP Z620 and HP Z820 Dual-processor)	Enable	Enable

HP Performance Advisor can be used to install graphics drivers, select BIOS settings and help characterize ANSYS memory usage. Download from hp.com/go/hpperformanceadvisor
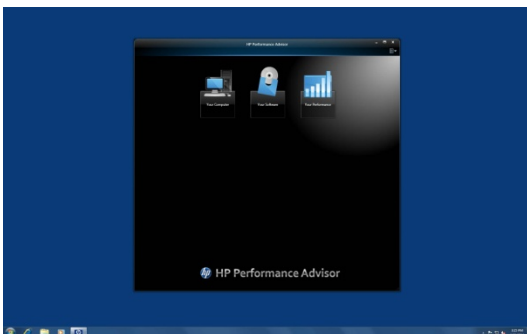
HP Workstations and ANSYS: Benchmark Details

ANSYS Mechanical 14.0 Benchmark Details – DMP

HP Z800 Workstation 48 GB Intel® Xeon® X5690 3.47 GHz – 3.73 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8 and 12-cores[6].

HP Z820 Workstation 128 GB Intel® Xeon® E5-2680 2.70 GHz – 3.50 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8, 12 and 16-cores[6].

The table on the next page provides a summary of the highest rating and number of cores[6] on the HP Z800 and HP Z820, HP Z820 speedup is the HP Z820 Rating divided by the HP Z800 Rating; HP Z820 rating with Dual-Core[6] and HP Z820 Rating with Eight-Cores[6].

Rating is the number of design analysis that can be run in a 24 hour period. Higher rating is better.

Workload DMP	Highest HP Z800 Rating, # Cores[6]	Highest HP Z820 Rating, # Cores[6]	HP Z820 vs. HP Z800 Speedup	HP Z820 Rating with Dual-Core[6]	HP Z820 Rating with Eight-Cores[6]
V14cg-1	189, 12	290, 16	1.53	84	250
V14cg-2	60, 8	116, 16	**1.93**	41	97
V14cg-3	163, 12	208, 12	**1.28**	53	162
V14ln-1	182, 8	236, 16	1.30	90	235
V14sp-1	391, 12	614, 16	1.57	189	492
V14sp-2	164, 12	228, 12	1.39	80	170
V14sp-3	198, 8	277, 12	1.40	92	243
V14sp-4	208, 12	284, 16	1.37	114	237
V14sp-5	237,12	304, 16	1.28	120	226
V14sp-6	40, 2	120, 16		57	106

ANSYS Mechanical 14.0 Benchmark Details—DMP with NVIDIA Tesla C2075 GPU acceleration
HP Z800 Workstation 48 GB Intel® Xeon® X5690 3.47 GHz – 3.73 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8 and 12-cores[6]

HP Z820 Workstation 128 GB Intel® Xeon® E5-2680 2.70 GHz – 3.50 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8, 12 and 16-cores[6]

The table below provides a summary of the highest rating and number of cores[6] on the HP Z800 and HP Z820, HP Z820 speedup is the HP Z820 Rating divided by the HP Z800 Rating; HP Z820 with NVIDIA Tesla C2075[2] compared to HP Z820 without NVIDIA Tesla C2075 speedup is the HP Z820 Rating with NVIDIA Tesla C2075[2] Rating divided by the HP without NVIDIA Tesla C2075 Rating; HP Z820 rating with Dual-Core[6] and HP Z820 with Eight-cores[6].

Rating is the number of design analysis that can be run in a 24 hour period. Higher rating is better.

Workload DMP with NVIDIA Tesla C2075	Highest HP Z800 NVIDA Tesla C2075 Rating, # Cores[6]	Highest HP Z820 NVIDA Tesla[2] C2075 Rating, # Cores[6]	HP Z820 vs. HP Z800 Speedup	HP Z820 without NVIDIA Tesla C2075 Rating, # Cores[6]	HP Z820 with NVIDA Tesla[2] C2075 vs. HP Z820 w/o NVIDIA Tesla C2075	HP Z820 NVIDIA Tesla C2075 Rating with Dual-Core[6]	HP Z820 NVIDIA Tesla C2075 Rating with Eight-Cores[6]
V14cg-1	217, 8	258, 8	**1.19**	250, 8	1.03	201	258
V14ln-1	234, 8	325, 8	1.39	235, 8	1.38	156	325
V14sp-1	431, 8	616, 12	1.43	559, 12	1.10	235	543
V14sp-2	199, 12	265, 12	1.33	228, 12	1.16	149	235
V14sp-3	224, 12	359, 12	1.60	277, 12	1.30	119	311
V14sp-4	313, 8	504, 16	1.61	284, 16	1.77	264	471
V14sp-5	325, 8	534, 8	**1.64**	226, 8	**2.36**	368	534
V14sp-6	57, 1	263, 16		120, 16	2.19	170	232

ANSYS Mechanical 14.0 Benchmark Details – SMP

HP Z800 Workstation 48 GB Intel® Xeon® X5690 3.47 GHz – 3.73 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8 and 12-cores[6]

HP Z820 Workstation 128 GB Intel® Xeon® E5-2680 2.70 GHz – 3.50 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8, 12 and 16-cores[6]

The table below provides a summary of the highest rating and number of cores[6] on the HP Z800 and HP Z820, HP Z820 speedup is the HP Z820 Rating divided by the HP Z800 Rating; HP Z820 with NVIDIA Tesla C2075[2] compared to HP Z820 without NVIDIA Tesla C2075, speedup is the HP Z820 Rating divided by the HP Z800 Rating; HP Z820 rating with Dual-Core[6] and HP Z820 with Eight-Cores[6].

Rating is the number of design analysis that can be run in a 24 hour period. Higher rating is better.

Workload SMP	Highest HP Z800 Rating, # Cores[6]	Highest HP Z820 Rating, # Cores[6]	HP Z820 vs. HP Z800 Speedup	HP Z820 Rating with Dual-Core[6]	HP Z820 Rating with Eight-Cores[6]
V14cg-1	116, 8	179, 8	1.54	85	179
V14cg-2	43, 12	80, 12	1.86	46	74
V14cg-3	84, 8	113, 12	1.34	51	107
V14ln-1	96, 8	145, 8	1.51	86	145
V14ln-2	295, 12	405, 16	1.37	194	363
V14sp-1	333, 12	383, 12	1.15	189	362
V14sp-2	83, 12	112, 16	1.35	57	98
V14sp-3	149,12	172, 12	1.15	90	159
V14sp-4	150, 12	257, 16	1.71	114	226
V14sp-5	269, 12	371, 16	1.38	141	318
V14sp-6	60, 12	187, 16		74	161

ANSYS Mechanical 14.0 Benchmark Details—SMP with NVIDIA Tesla C2075 GPU acceleration

HP Z800 Workstation 48 GB Intel® Xeon® X5690 3.47 GHz – 3.73 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8 and 12-cores[6]

HP Z820 Workstation 128 GB Intel® Xeon® E5-2680 2.70 GHz – 3.50 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8, 12 and 16-cores[6]

The table on the next page provides a summary of the highest rating and number of cores[6] on the HP Z800 and HP Z820, HP Z820 speedup is the HP Z820 Rating divided by the HP Z800 rating; HP Z820 with NVIDIA Tesla C2075[2] compared to HP Z820 without NVIDIA Tesla C2075 speedup, the speedup is the HP Z820 Rating divided by the HP Z800 rating; HP Z820 rating with Dual-Core[6] and HP Z820 with Eight-cores[6].

Rating is the number of design analysis that can be run in a 24 hour period. Higher rating is better.

Workload SMP with NVIDIA Tesla	Highest HP Z800 NVIDA Tesla Rating, # Cores[6]	Highest HP Z820 NVIDA Tesla[2] Rating, # Cores[6]	HP Z820 vs. HP Z800 Speedup	HP Z820 without NVIDA Tesla Rating, # Cores[6]	HP Z820 with NVIDA Tesla[2] vs. HP Z820 w/o NVIDIA Tesla	HP Z820 Rating with Dual-Core[6]	HP Z820 Rating with Eight-Cores[6]
V14cg-1	194, 8	232, 4	1.20	144, 4	1.60	200	223
V14ln-1	121, 8	161, 8	1.33	145, 8	1.11	117	161
V14ln-2	304, 8	385, 16	1.27	405, 16	.95	321	383
V14sp-1	294, 12	348, 12	1.18	383, 12	.91	208	329
V14sp-2	96, 8	109, 12	1.14	107, 12	1.02	101	101
V14sp-3	131, 12	151, 12	1.15	172, 12	.88	95	145
V14sp-4	187, 8	265, 12	1.42	250, 12	1.06	231	260
V14sp-5	284, 12	329	1.16	358, 12	.92	282	319
V14sp-6	62, 12	164,16		187, 16	.88	130	160

ANSYS Fluent 14.0 Benchmark Details

HP Z800 Workstation 48 GB Intel® Xeon® X5690 3.47 GHz – 3.73 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8 and 12-cores[6]

HP Z820 Workstation 128 GB Intel® Xeon® E5-2680 2.70 GHz – 3.50 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8, 12 and 16-cores[6]

The table below provides a summary of the highest rating and number of cores[6] on the HP Z800 and HP Z820, and HP Z820 speedup which is the HP Z820 Rating divided by the HP Z800 rating.

Rating is the number of design analysis that can be run in a 24 hour period. Higher rating is better.

Workload	Highest HP Z800 Rating, # Cores[6]	Highest HP Z820 Rating, # Cores[6]	HP Z820 vs. HP Z800 Speedup
Eddy_417k	1527,12	2359, 16	1.55
Turbo_500k	511,12	8351, 16	1.52
Aircraft_2m	1127, 12	1920, 16	1.70
Sedan_4m	815, 12	1497, 16	**1.84**
Truck_14m	92, 12	136, 16	1.48
Truck_poly_14m	98, 12	144, 16	**1.47**

ANSYS CFX 14.0 Benchmark Details

HP Z800 Workstation 48 GB Intel® Xeon® X5690 3.47 GHz – 3.73 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8 and 12-cores[6]

HP Z820 Workstation 128 GB Intel® Xeon® E5-2680 2.70 GHz – 3.50 GHz Turbo Boost[3,5,8,9]

• Each workload was run with 1, 2, 4, 8, 12 and 16-cores[6]

The table below provides a summary of the highest rating and number of cores[6] on the HP Z800 and HP Z820, and HP Z820 speedup (HP Z820 Rating/HP Z800 Rating).

Rating is the number of design analysis that can be run in a 24 hour period. Higher rating is better.

Workload	Highest HP Z800 Rating, # Cores[6]	Highest HP Z820 Rating, # Cores[6]	HP Z820 vs. HP Z800 Speedup
Boxsmallftrn50partmilnew	6.5, 12	10.5, 16	1.60
Boxbigftrn12partmilnew	7.4, 12	10.5, 16	1.42

Notes

1 64-bit computing on Intel architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel 64 architecture-enabled BIOS. Performance will vary depending on your hardware and software configurations. See intel.com/info/em64t for more information.

2 NVIDIA Tesla C2075 on the HP Z820 requires the 1125W power supply.

3 Intel's numbering is not a measurement of higher performance.

4 SATA hardware RAID is not supported on Linux systems. The Linux kernel, with built-in software RAID, provides excellent functionality and performance. It is a good alternative to hardware-based RAID. Please visit h20000.www2.hp.com/bc/docs/support/SupportManual/c00060684/c00060684.pdf for RAID capabilities with Linux. HP Z200 does not support RAID 10 Because of drive bay limitation.

5 For hard drives, 1 GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 20 GB of hard drive (or system disk) is reserved for system recovery software for Windows 7.

6 Multi-Core technologies are designed to improve performance of multithreaded software products and hardware-aware multitasking operating systems and may require appropriate operating system software for full benefits. Not all customers or software applications will necessarily benefit from use of these technologies.

7 Each processor supports up to 2 channels (HP Z220 CMT/HP Z220 SFF) or 4 channels (HP Z420/HP Z620/HP Z820) of DDR3 memory. To realize full performance at least 1 DIMM must be inserted into each channel. To get full 8 channel support, 2 processors MUST be installed.

8 AMD Graphics are not supported when there are greater than 32 GB of system memory present.

9 Intel® Turbo Boost technology requires a PC with a processor with Intel Turbo Boost capability. Intel Turbo Boost performance varies depending on hardware, software and overall system configuration. See intel.com/technology/turboboost for more information.

10 Intel HT Technology (HT) is designed to improve performance of multi-threaded software products and requires a computer system with a processor supporting HT and an HT-enabled chipset, BIOS and operating system. Please contact your software provider to determine compatibility. Not all customers or software applications will benefit from the use of HT. See intel.com/info/hyperthreading for more information.