

# Map3D V58 - Multi-Processor Version

Announcing the multi-processor version of Map3D.

How fast would you like to go?  
2x, 4x, 6x? - it's now up to you.

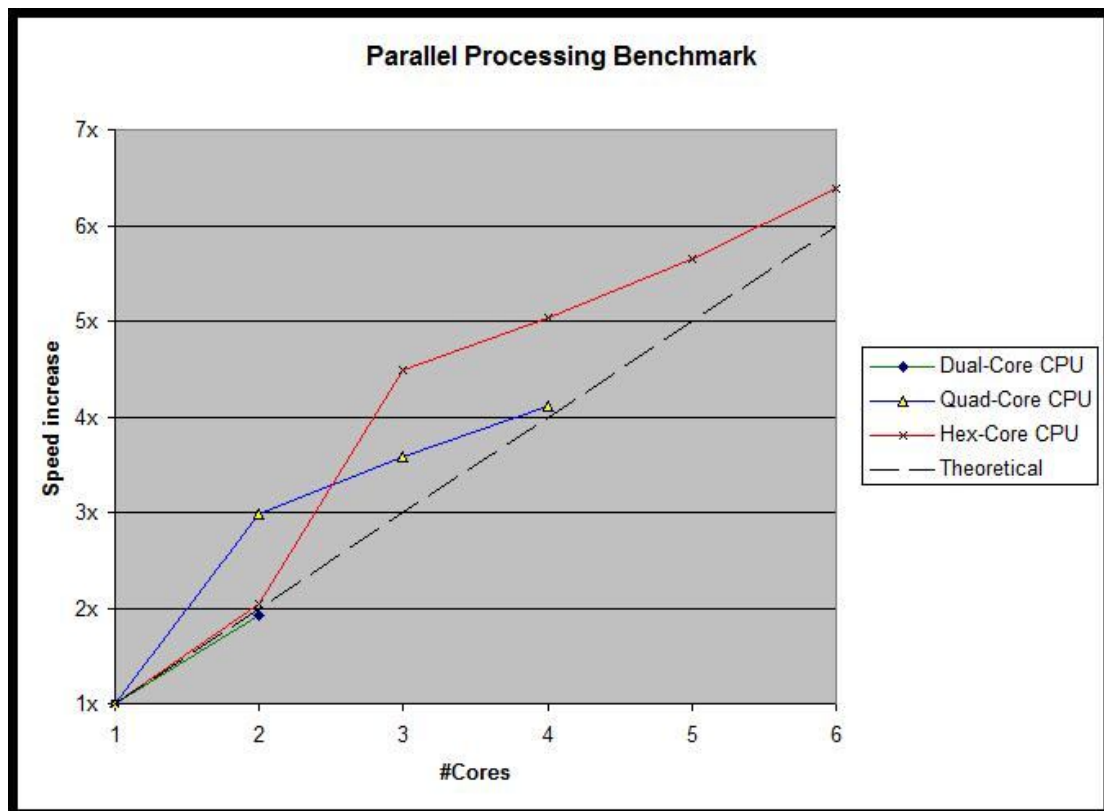
In order to achieve these performance gains it is necessary to improve both the processing power and/or disk I/O rate.

**CPU:** Recent CPU's are now available as dual, quad and hex cores.  
Map3D V58 now supports parallel processing which allows faster computational rates.  
This results in more than 6x reduction in matrix assembly and grid assembly times.  
Multi-CPU computers would go even faster.

The following parallel processing benchmark clearly shows that you can expect dual cores CPU's to perform more than twice as fast, quad cores to perform more than 4 times as fast and hex-cores to perform more than 6 times faster.

In hyper-threading enabled CPUs, 2 computational threads are superimposed on the same core.

This is the reason why Map3D-MP actually achieves performance better than the theoretical maximum.

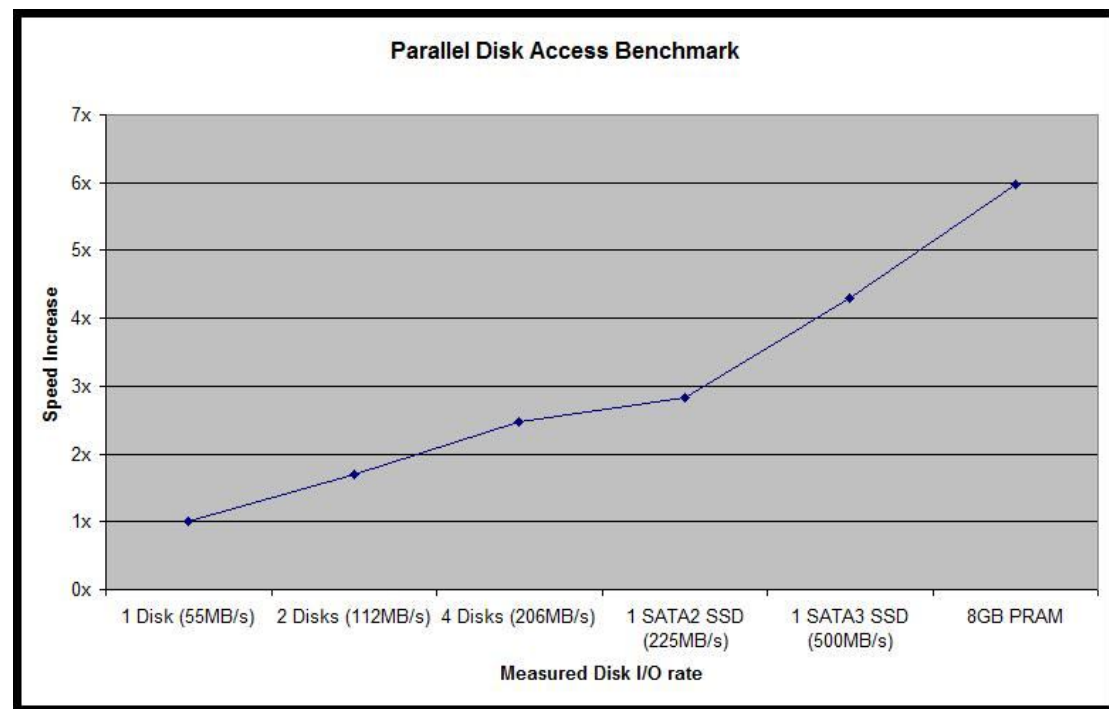


**Disk:** Recent disks are now available as 250MB/sec SATA2 and 500MB/sec SATA3. Map3D V58 now supports asynchronous parallel disk access which allows for faster disk I/O rates.

This results in 6x or more reduction in matrix solution times.

Multi-disk computers would go even faster.

The following parallel disk benchmark clearly shows that you can expect the speed increase to be proportional to the disk read rate.



## Parallel Processing:

Map3D now supports multi-core CPUs.

Performance gains are approximately proportional to the number of cores.

Matrix assembly and grid assembly are CPU intensive operations that depend only on the calculation rate of your computer.

Matrix solution is also CPU intensive when the solution matrix fits into RAM.

The effects of disk speed are discussed below.

In the following benchmark, a relatively large model (66000 elements - 200000 dof) has a solution matrix 7GB in size.

In this example the model is run on an Intel Core2 Duo T7700 @2.4GHz laptop computer (no hyper-threading).

This computer has a fast Intel X-25M SSD and no PRAM was assigned.

The entire 7GB matrix is stored on disk.

| Time (hours)         | 1 core | 2 cores |
|----------------------|--------|---------|
| Matrix Assembly      | 0.410  | 0.221   |
| Matrix Solution      | 0.250  | 0.206   |
| Grid Assembly        | 0.431  | 0.256   |
| Total Time           | 1.091  | 0.683   |
| Total Speed Increase | 1x     | 1.6x    |

Now the same model is run on an Intel Core2 Duo E8500 @3.8GHz desktop computer (no hyper-threading).  
8GB PRAM is assigned for matrix storage so that the entire matrix fits into RAM.

| Time (hours)    | 1 core | 2 cores |
|-----------------|--------|---------|
| Matrix Assembly | 0.206  | 0.108   |
| Matrix Solution | 0.123  | 0.050   |
| Grid Assembly   | 0.276  | 0.158   |
| Total Time      | 0.605  | 0.316   |
| Speed Increase  | 1x     | 1.9x    |

In this case the same model is run on an Intel quad-core i7-975 @3.33GHz desktop computer (with hyper-threading).  
8GB PRAM is assigned for matrix storage so that the entire matrix fits into RAM.

| Time (hours)         | 1 core | 2 cores | 4 cores |
|----------------------|--------|---------|---------|
| Matrix Assembly      | 0.216  | 0.110   | 0.042   |
| Matrix Solution      | 0.090  | 0.056   | 0.033   |
| Grid Assembly        | 0.219  | 0.097   | 0.032   |
| Total Time           | 0.525  | 0.263   | 0.107   |
| Total Speed Increase | 1x     | 2.0x    | 4.9x    |

The same model is now run on an Intel hex-core i7-970 @3.2GHz desktop computer (with hyper-threading).  
8GB PRAM is assigned for matrix storage so that the entire matrix fits into RAM.

| Time (hours)         | 1 core | 2 cores | 4 cores | 6 cores |
|----------------------|--------|---------|---------|---------|
| Matrix Assembly      | 0.221  | 0.113   | 0.035   | 0.030   |
| Matrix Solution      | 0.093  | 0.057   | 0.032   | 0.026   |
| Grid Assembly        | 0.231  | 0.098   | 0.042   | 0.032   |
| Total Time           | 0.546  | 0.269   | 0.109   | 0.088   |
| Total Speed Increase | 1x     | 2.0x    | 5.0x    | 6.2x    |

Current pricing of Intel CPU's is as follows:

E7500 Core 2 duo \$140.

i7-960 Quad-Core \$300.

i7-970 Hex-Core \$600.

Current pricing of DDR3 RAM is as follows:

4GB \$105

8GB \$125

12GB \$200

24GB \$600

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## Parallel Disk Access:

Map3D now supports multi-disk computers.

Performance gains are approximately proportional to the number of disks.

When the solution matrix is too big to fit into RAM, Matrix solution becomes an I/O intensive operation that depends only on the I/O rate of your computer.

In this case, a large part of the analysis time can be spent in the solution stage due to slow disk performance.

To overcome this problem it is imperative that the user install a high speed disks.

In the following benchmark, the same model as above is run with 1, 2 and 4 disks.

|                                   | 1 disk | 2 disks | 4 disks | 1 SATA2 SSD | 2 SATA2 SSDs or 1 SATA3 SSD* | 8GB PRAM        |
|-----------------------------------|--------|---------|---------|-------------|------------------------------|-----------------|
| Measured Disk Throughput (MB/sec) | 55     | 112     | 206     | 225         | 550                          | 1000 equivalent |
| Matrix Solution (hours)           | 0.546  | 0.282   | 0.163   | 0.133       | 0.055                        | 0.033           |
| Solution Speed Increase           | 1x     | 1.9x    | 3.3x    | 4.1x        | 10x                          | 16x             |
| Total Analysis Time (8 cores)     | 0.640  | 0.376   | 0.257   | 0.227       | 0.149                        | 0.107           |
| Total Speed Increase              | 1x     | 1.7x    | 2.5x    | 2.8x        | 4.3x                         | 6x              |

\*estimated only - this configuration will be tested shortly

The disks used in this benchmark are older 50-60 MB/sec drives (Seagate Barracuda 7200.7).

More recent mechanical drives perform at 100 MB/sec (Seagate Momentus 7200.4).

SATA2 SSDs can provide over 250 MB/sec per drive.

SATA3 SSDs can provide over 500 MB/sec per drive.

Multiple SSDs can be expected to perform as fast as PRAM.

Note that some motherboards have limitations on the total combined throughput and may require add-in controller adapters.

Expected disk performance can be measured using CrystalDiskMark

(<http://crystalmark.info/?lang=en>).

The results obtained from CrystalDiskMark match the results obtained from Map3D very closely.

Note that large drives are not required as most Map3D analyses require less than 20GB matrix storage.

Current pricing of small size disks is as follows:

100MB/sec Barracuda \$50.

250MB/sec SATA2 SSD \$200.

500MB/sec SATA3 SSD \$330.

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## Map3D Performance History:

Now comparing processors and Map3D versions.

|                      |        |                       |              |                               |                                  |                               |                               |                              |
|----------------------|--------|-----------------------|--------------|-------------------------------|----------------------------------|-------------------------------|-------------------------------|------------------------------|
| Processor            | T7700  | T7700                 | T7700        | T7700                         | i7-975                           | i7-975                        | i7-975                        | i7-970                       |
| Map3D Version        | V55    | V56                   | V57          | V58                           | V58                              | V58                           | V58                           | V58                          |
| Cores                | 1      | 1                     | 1            | 2                             | 1                                | 2                             | 4                             | 6                            |
| Total Time (hours)   | 2.456  | 1.935                 | 1.095        | 0.683                         | 0.524                            | 0.194                         | 0.107                         | 0.088                        |
| Total Speed Increase | 1x     | 1.3x                  | 2.2x         | 4x                            | 5x                               | 13x                           | 23x                           | 28x                          |
| Date                 | Nov/09 | Aug/10                | Dec/10       | May/11                        | May/11                           | May/11                        | May/11                        | May/11                       |
| Notes                |        | New disk I/O routines | New compiler | Dual-core parallel processing | Support for large amount of PRAM | Dual-core parallel processing | Quad-core parallel processing | Hex-core parallel processing |

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## Pricing and Availability:

Map3D-MP is available now.

At this time, the matrix assembly, solution and grid assembly routines have been parallelised.

Other parts of the code (pre-processing etc.) will be done in the coming months.

Pro-rata upgrades are available.

Pricing is set at a fixed premium for each doubling in performance.

Contact your agent for a quotation.

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