Features

FastFDTD is a feature rich FDTD simulation program. It includes multiple accelerated solvers, and features that are unmatched by other FDTD software packages.

Multiple Solvers

FastFDTD has support for multiple solvers to best match the characteristics of your problem to the most effective accelerated platform. EM Photonics produces both GPU and proprietary hardware accelerated solvers for the FDTD method. Our highest end product is the Celerity™ board, which with 16GB of on board memory can solve problems much larger than would be possible with the GPU[1]. When running a problem, FastFDTD will determine the best solver for your problem based on the availability of solvers, the capabilities of each solver, and the characteristics of the problem that you would like to solve. A particular solver can be forced by using a command line switch; "-f" for Celerity™, "-g" for GPU solver. To see the capabilities of each solver, refer to the **Feature Matrix** below.

Feature Matrix

To compare the capabilities of EM Photonics accelerator solutions, see the feature matrix below. Because the XML input file format was designed to be robust, the file format provides support for numerous simulation features, some of which are currently not supported on all platforms. The matrix below describes the capabilities of each solver (as appropriate to the version of the FastFDTD specified on the front page of this document). Please note: this matrix may change in the future as FastFDTD is under continuous development.

General	***2D GPU***	***3D GPU***	***Celerity***
Solve 2D problems	✓		
Solve 3D problems		✓	✓
Maximum Number of Nodes[2]	65 M	100 M	268 M
Maximum Memory	1GB	1GB	16GB
Maximum Number of Timesteps	4.2 B	4.2 B	4.2 B

Boundary Conditions	***2D GPU***	***3D GPU***	***Celerity***
PEC	✓		✓
PML	✓		✓
LIAO		✓	
PMC	✓		
Maximum Number of Layers of PML	∞	N/A	64

[1] For information about the Celerity™ board, see www.emphotonics.com

[2] These numbers are highly dependent on system memory, GPU memory, and problem parameters.

Sources	***2D GPU***	***3D GPU***	***Celerity***
Point	✓	✓	✓
Gaussian Beam	✓	✓	✓
Windowed Plane Wave	✓		✓
Uniform Plane Wave	✓		✓
Circuit (Voltage or Current)			✓
User defined			✓
On-Axis Sources	✓	✓	✓
Off-Axis Sources	✓	✓[3]	

Waveforms	***2D GPU***	***3D GPU***	***Celerity***
SINUSOID	✓	✓	✓
MODULATED_GAUSSIAN	✓	✓	✓

Materials	***2D GPU***	***3D GPU***	***Celerity***
Non-free-space Background	✓	✓	
PEC	✓	✓	✓
PMC	✓	✓	✓
USER defined	✓	✓	✓
Number of Materials Supported	256	256	128

Detectors	***2D GPU***	***3D GPU***	***Celerity***
POINT	✓	✓	✓
PLANE	✓	✓	✓
REGION	✓	✓	✓
WAVEFORM	✓	✓	✓
Calculates Steady-State Results	✓	✓	✓
Maximum Number of Detector Files[4]	255	255	255

Meshing	***2D GPU***	***3D GPU***	***Celerity***
Supports Meshfile	✓	✓	✓
Supports SLICE_RANGE	N/A	✓	

[3] Only off-axis sources in the xy plane are supported.
[4] A detector file is one particular field (E or H) in one particular direction (X or Y or Z). One detector may have several detector files.