



# GPU-ACCELERATED APPLICATIONS



# GPU-ACCELERATED APPLICATIONS

Accelerated computing has revolutionized a broad range of industries with over three hundred applications optimized for GPUs to help you accelerate your work.

## CONTENTS

- 01 Computational Finance
- 02 Data Science & Analytics
- 02 Defense and Intelligence
- 03 Deep Learning and Machine Learning
- 04 Manufacturing: CAD and CAE
  - COMPUTATIONAL FLUID DYNAMICS
  - COMPUTATIONAL STRUCTURAL MECHANICS
  - DESIGN AND VISUALIZATION
  - ELECTRONIC DESIGN AUTOMATION
- 07 Media and Entertainment
  - ANIMATION, MODELING AND RENDERING
  - COLOR CORRECTION AND GRAIN MANAGEMENT
  - COMPOSITING, FINISHING AND EFFECTS
  - EDITING
  - ENCODING AND DIGITAL DISTRIBUTION
  - ON-AIR GRAPHICS
  - ON-SET, REVIEW AND STEREO TOOLS
  - WEATHER GRAPHICS
- 11 Oil and Gas
- 12 Research: Higher Education and Supercomputing
  - COMPUTATIONAL CHEMISTRY AND BIOLOGY
  - NUMERICAL ANALYTICS
  - PHYSICS
  - SCIENTIFIC VISUALIZATION
- 18 Safety & Security

## Test Drive the World's Fastest Accelerator – Free!

Take the GPU Test Drive, a free and easy way to experience accelerated computing on GPUs. You can run your own application or try one of the preloaded ones, all running on a remote cluster. Try it today.

[www.nvidia.com/gputestdrive](http://www.nvidia.com/gputestdrive)



# Computational Finance

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Aon Benfield Pathwise™</b>	Specialized platform for real-time hedging, valuation, pricing and risk management	Spreadsheet-like modeling interfaces, Python-based scripting environment and Grid middleware	Yes
<b>Altimesh's Hybridizer C#</b>	Multi-target C# framework for data parallel computing.	C# with translation to GPU or Multi-Core Xeon	Yes
<b>Elsen Accelerated Computing Engine (TM)</b>	Secure, accessible, and accelerated back-testing, scenario analysis, risk analytics and real-time trading designed for easy integration and rapid development.	Web-like API with Native bindings for Python, R, Scala, C. Custom models and data streams are easy to add	Yes
<b>Global Valuation Esther</b>	In-memory risk analytics system for OTC portfolios with a particular focus on XVA metrics and balance sheet simulations.	High quality models not admitting closed form solutions, efficient solvers based on full matrix linear algebra powered by GPUs and Monte Carlo algorithms.	Yes
<b>Hanweck Associates</b>	Real-time options analytical engine (Volera)	Real-time options analytics engine	Yes
<b>MiAccLib 2.0.1</b>	Accelerated libraries which encompasses high speed multi-algorithm search engines, data security engine and also video analytics engines for text processing, encryption/ decryption and video surveillance respectively.	Text Processing : Exact Match, Approximate\Similarity Text, Wild Card, MultiKeyword and MultiColumnMultiKeyword, etc Data Security: Accelerated Encryption/Description for AES-128 Vide Analytics: Accelerated Intrusion Detection Algorithm	Yes
<b>MISYS Global Risk</b>	Regulatory compliance and enterprise wide risk transparency package	Risk analytics	Yes
<b>Murex MACS Analytics Library</b>	Analytics library for modeling valuation and risk for derivatives across multiple asset classes	Market standard models for all asset classes paired with the most efficient resolution methods (Monte Carlo simulations and Partial Differential Equations)	Yes
<b>Numerical Algorithms Group (NAG)</b>	Random number generators, Brownian bridges, and PDE solvers	Monte Carlo and PDE solvers	Single only
<b>QuantAlea's Alea.cuBase F#</b>	F# package enabling a growing set of F# capability to run on a GPU	F# for GPU accelerators	Yes
<b>RMS</b>	Catastrophic risk modeling for FSI (earthquakes, hurricanes, terrorism, infectious diseases)	Risk analytics	Yes
<b>SciComp, Inc</b>	Derivative pricing (SciFinance)	Monte Carlo and PDE pricing models	Single only
<b>SunGard- Adaptiv Analytics</b>	A flexible and extensible engine for fast calculations of a wide variety of pricing and risk measures on a broad range of asset classes and derivatives.	Existing models code in C# supported transparently, with minimal code changes, Supports multiple backends including CUDA and OpenCL, Switches transparently between multiple GPUs and CPUS depending on the deal support and load factors.	Yes
<b>Synerscope- Synerscope Data Visualization</b>	Visual big data exploration and insight tools	Graphical exploration of large network datasets including geo-spatial and temporal components.	Single only
<b>Tanay ZX Lib (Fuzzy Logic)</b>	Financial analytics and data mining library	Monte Carlo simulations, pricing of vanilla and exotic options, fixed income analytics, data mining.	Yes
<b>Xcelerit SDK</b>	Software Development Kit (SDK) to boost the performance of Financial applications (e.g. Monte-Carlo, Finite-difference) with minimum changes to existing code.	C++ programming language, cross-platform (back-end generates CUDA and optimized CPU code), supports Windows and Linux operating systems.	Yes

## Data Science & Analytics

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>BIDMach - UC Berkeley</b>	Fastest Big Data tools on the web. Holds the records for many common machine learning problems, on single nodes or clusters. Interactive environment for easily building and deploying machine learning models.	Scala interface. Supports linear regression, logistic regression, SVM, LDA, K-Means and other operations.	Yes
<b>GPUdb</b>	A distributed database for many core devices. GPUdb is a scalable, distributed database with SQL-style query capability for Big Data. Full suite of geospatial calculation capability.	Query against Big Data in real time. No pre-indexing allows for complex, ad-hoc query chains. Interactively explore large, streaming data sets.	Yes
<b>Jedox</b>	Helps with portfolio analysis, management consolidation, liquidity controlling, cash flow statements, profit center accounting, treasury management, customer value analysis and many more applications, all accessible in a powerful web and mobile application or Excel environment.	This database holds all relevant data in GPU memory and is thus an ideal application to utilize the Tesla K40's 12 GB on-board RAM. Scale that up with multiple GPUs and keep close to 100 GB of compressed data in GPU memory on a single server system for fast analysis, reporting and planning.	Yes
<b>MapD</b>	MapD is GPU-powered big data analytics and visualization platform that is hundreds of times faster than CPU in-memory systems.	MapD uses GPUs to execute SQL queries on multi-billion row datasets and optionally render the results, all in milliseconds.	Yes
<b>Systap - Blazegraph GPU</b>	First and fastest GPU accelerated platform for graph query. It provides drop-in acceleration for existing RDF/Sparql and Tinkerpop/ Blueprints graph applications. It provides high-level graph database APIs with transparent GPU acceleration for graph query.	GPU-accelerated SPARQL graph query, Data Management using the RDF interchange model, Tinkerpop/Blueprints Graph Support, Billions of edges on a single multi-GPU node, SaaS and Appliance models available.	Yes
<b>Systap - Blazegraph HPC</b>	It marries the power and speed of CUDA. It delivers graph analytics at over 32 billion traversed edges per second and easily integrates with Spark and other data management platforms.	Scala-based graph analytic and machine learning application language, Ease of integration into Spark and Hadoop data ecosystems, Support for GPU cluster deployment.	Yes

## Defense and Intelligence

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Comprimato JPEG2000 Codec</b>	A high performing, GPU powered, JPEG2000 encoder and decoder SDK which can be integrated into almost any application.	Very large image processing, specific area decoding, multi resolution/quality decoding supporting all GEOSPATIAL image formats. (eg NITF, BIIF). Mobile and embedded platform friendly.	Yes
<b>DigitalGlobe - Advanced Ortho Series</b>	Geospatial visualization	Image orthorectification	Yes
<b>Elcomsoft</b>	High-performance distributed password recovery software with NVIDIA GPU acceleration and scalability to over 10,000 workstations.	GPU acceleration for password recovery, 10-100x speedup for password recovery.	Yes
<b>Esri ArcGIS for Desktop (ArcMap and ArcGIS Pro) – Spatial Analyst and 3D Analyst</b>	Determines the raster surface locations visible to a set of observer features, using geodesic methods.	Viewshed2 transforms the elevation surface into a geocentric 3D coordinate system and runs 3D sightlines to each transformed cell center.	Yes
<b>Eternix - Blaze Terra</b>	Geospatial visualization	3D visualization of geospatial data	Yes
<b>Exelis (ITT) ENVI</b>	Geospatial visualization	Image orthorectification, Image transformation, atmospheric correction.	Yes
<b>GeoWeb3d Desktop</b>	Geospatial visualization	3D visualization of geospatial data	Yes
<b>GPUdb</b>	Multi-GPU, Multi-Machine distributed object store providing SQL style query capability, advanced geospatial query capability, heatmap generation, and distributed rasterization services.	Query against big data in real time. No pre-indexing allows for complex, ad-hoc query chains. Interactively explore large, streaming data sets.	Yes

<b>Intergraph Motion Video Analyst</b>	Video filters and mosaic'ing - Geo-fuses FMV analytics with intelligence data.	Full motion video ortho mosaic processing, de-hazing algorithms.	Single only
<b>Intuition Panoptes 3.0</b>	Video analytics	Object recognition and change detection	Yes
<b>LuciadLightspeed</b>	Geospatial visualization and analysis	Geospatial situational awareness	Single only
<b>Manifold Systems</b>	Full-featured GIS, vector/raster processing & analysis	Manifold surface tools	Yes
<b>MotionDSP - Ikena ISR</b>	Real-time Full Motion Video and WAMI enhancement and analytics.	Real-time super-resolution-based video enhancement, filtering, mosaicing, video analytics, and transcoding.	Yes
<b>NerVve Visual Search Solution (NVSS)</b>	Video/Image Live and Forensic Search	Video and image content search	Yes
<b>OpCoast SNEAK</b>	Electromagnetic signals propagation modeling for complex urban and terrain environments.	Ray tracing, DTED and remote sensing inputs.	Yes
<b>PCI Geomatics GXL</b>	Image processing	Image orthorectification and additional image processing	Yes
<b>Skyline Software - Terrabuilder PhotoMesh</b>	PhotoMesh integrates a GPU-based, fast algorithm, able to automatically build 3D models from simple photographs. PhotoMesh revolutionizes the use of geospatial data by fully automating the generation of high-resolution, textured, 3D mesh models from standard 2D images.	3D model building from imagery; building texture generation.	Yes
<b>SocetGXP - BAE Systems</b>	The Automatic Spatial Modeler (ASM) is designed to generate 3-D point clouds with accuracy similar to LiDAR, which can extract 3-D objects from stereo images. ASM can extract dense 3-D point clouds from stereo images, and extract accurate building edges and corners from stereo images with high resolution, large overlaps, and high dynamic range.	Automated 3D feature extraction	Yes
<b>SynerScope</b>	Big data visualization and data discovery, for combining Analytics on Analytics with IoT compute-at-the-edge smart sensors.	Real-time Interaction with data	No

## Deep Learning and Machine Learning

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Caffe</b>	The Caffe deep learning framework makes implementing state-of-the-art deep learning easy.	Process over 40M images per day with a single NVIDIA K40 or Titan GPU.	Single only
<b>Caffe* Parallel</b>	This is a faster framework for deep learning, it's forked from BVLC/caffe (master branch). This allows data-parallel via MPI.	Using the GPU cluster processing mass image data	Yes
<b>Clarifai</b>	Clarifai brings a new level of understanding to visual content through deep learning technologies. Clarifai uses GPUs to train large neural networks to solve practical problems in advertising, media, and search across a wide variety of industries.	GPU-based training and inference. Recognizes and indexes images with predefined classifiers, or with custom classifiers.	Yes
<b>Chainer</b>	DL framework that makes the construction of neural networks (NN) flexible and intuitive.	Dynamic NN construction, which makes debugging easier. CPU/GPU-agnostic coding, which is promoted by CuPy, partially NumPy-compatible multidimensional array library for CUDA. Data-dependent NN construction, which fully exploits the control flows of Python without magic.	Yes
<b>Deeplearning4j</b>	Deeplearning4j is the most popular deep learning framework for the JVM, and includes all major neural nets such as convolutional, recurrent (LSTMs) and feedforward.	Integrates with Hadoop and Spark to run distributed. Java and Scala APIs. Composable framework that facilitates building your own nets. Includes ND4J, the Numpy for Java.	Yes

<b>Dextro</b>	Dextro's API uses deep learning systems to analyze and categorize videos in real-time.	Object and scene detection, Machine transcription for audio Motion and movement detection.	Yes
<b>Labellio</b>	The world's easiest deep learning web service for computer vision, which allows everyone to build own image classifier with only web browser.	Neural net fine-tuning for image data, data crawling, data browsing as well as drag-and-drop style data cleansing backed by AI support.	Yes
<b>MetaMind</b>	Provides a deep learning API for image recognition and text sentiment analysis. Uses either prebuilt, public, or custom classifiers.	GPU-based training and inference. Recognizes image and analyzes text, creates and trains classifiers with tooling for uploading and managing datasets.	Yes
<b>Nervana</b>	Nervana builds a scalable deep learning platform that enables the creation of disruptive new applications across a variety of data problems and vertical industries.	Training and inference for deep learning in cloud-based GPU cluster.	Yes
<b>Theano</b>	Theano is a symbolic expression compiler that powers large-scale computationally intensive scientific investigations.	Abstract expression graphs for transparent GPU acceleration.	Single only
<b>Torch7</b>	Torch7 is an interactive development environment for machine learning and computer vision.	Computational back-ends for multicore GPUs.	Single only
<b>Trakomatic OSense, Otrack</b>	Video Analytics Solution for retail, supermarkets, shopping mall and banking.	People detection & tracking, Crowd density estimation, Gender classification and age estimation, Person re-identification.	Yes

## Manufacturing: CAD and CAE

### COMPUTATIONAL FLUID DYNAMICS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Altair AcuSolve</b>	General purpose CFD software	Linear equation solver	Yes
<b>ANSYS - Fluent</b>	General purpose CFD software	Radiation heat transfer model, linear equation solver	Yes
<b>Autodesk - Moldflow</b>	Plastic mold injection software	Linear equation solver	Single only
<b>CPFD Barracuda-VR and Barracuda</b>	Fluidized bed modeling software	Linear equation solver, particle calculations	Single only
<b>DHI - MIKE 21</b>	2D hydrological modelling of coast and sea	Hydrodynamics; Advection-dispersion; sand and mud transport; coupled modelling; particle tracking; oil spill; ecological modelling; agent based modelling; various wave models.	Yes
<b>DHI - MIKE FLOOD</b>	1D & 2D urban, coastal, and riverine flood modelling	Hydrodynamics	Yes
<b>FluiDyna aeroFluidX</b>	Incompressible single-phase CFD software	Finite volume solver	Yes
<b>FluiDyna - Culises for OpenFOAM</b>	Solver library for general purpose CFD software	Linear equation solvers	Yes
<b>FluiDyna nanoFluidX</b>	General purpose CFD software	SPH solver	Yes
<b>FluiDyna ultraFluidX</b>	General purpose CFD software	Lattice-Boltzmann solver	Yes
<b>midas NFX(CFD)</b>	General purpose CFD software based on FEM	Linear equation solver (Iterative Solver and AMG Preconditioner)	Single only
<b>Prometech - Particleworks</b>	Particle-based CFD software	Implicit and explicit solvers	Yes
<b>Turbostream Ltd.</b>	CFD software for turbomachinery flows	Explicit solver	Yes
<b>Vratis Speed IT FLOW</b>	Incompressible single-phase CFD software	Finite volume solver	Single only
<b>Vratis SpeedIT for OpenFOAM</b>	Solver library for general purpose CFD software	Linear equation solvers	Yes

## Research CFD Developments

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>DualSPHysics</b>	SPH-based CFD software	SPH model	Yes
<b>FEFLO (GMU - Lohner)</b>	General purpose CFD software for compressible and incompressible flows	Implicit and explicit solver	Yes
<b>GIN3D (Boise St - Senocak)</b>	General purpose CFD software for incompressible flows	Implicit solver	Yes
<b>HiFILES (Stanford - Jameson)</b>	General purpose CFD software for compressible flows.	Explicit solver	Yes
<b>HiPSTAR (University of Southampton - Sandberg)</b>	CFD software for compressible reacting flows	Explicit solver	Yes
<b>JENRE, Propel (NRL)</b>	CFD software for compressible flows	Explicit solver	Yes
<b>NASA FUN3D</b>	General purpose CFD software	Linear equation solver	Single only
<b>PyFR (Imperial College - Vincent)</b>	General purpose CFD software for compressible flows.	High-order FR solver	Yes
<b>S3D (Sandia and Oak Ridge NL)</b>	Direct numerical solver (DNS) for turbulent combustion	Chemistry model	Yes

## COMPUTATIONAL STRUCTURAL MECHANICS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Altair OptiStruct</b>	Industry proven, modern structural analysis solver and solution for structural design and optimization.	Direct and iterative solvers	Yes
<b>Altair RADIOSS Implicit</b>	Simulation and analysis tool for structural mechanics	Direct and iterative solvers	Yes
<b>ANSYS - Mechanical</b>	Simulation and analysis tool for structural mechanics	Direct and iterative solvers	Yes
<b>Dassault Systèmes SIMULIA Abaqus/Standard</b>	Simulation and analysis tool for structural mechanics	Direct sparse solver	Yes
<b>Dassault Systèmes SIMULIA 3DEXPERIENCE</b>	Realistic simulation solution (Uses Abaqus Standard for GPU computing).	Direct sparse solver	Single only
<b>Impetus Afea</b>	Predicts large deformations of structures and components exposed to extreme loading conditions.	Linear equation solver	Yes
<b>LS-DYNA Implicit</b>	Simulation and analysis tool for structural mechanics	Linear equation solver	Yes
<b>midas GTS NX</b>	Simulation tool for geo-technical analysis	Linear equation solver(Multi Frontal Solver)	Single only
<b>midas NFX(Structural)</b>	Simulation and analysis tool for structural mechanics	Linear equation solver(Multi Frontal Solver)	Single only
<b>MSC - Marc</b>	Simulation and analysis tool for structural mechanics	Direct sparse solver	Yes
<b>MSC Nastran</b>	Simulation and analysis tool for structural mechanics	Direct sparse solver	Yes
<b>Rocky DEM</b>	Discrete Element Modeling (DEM)-based particle simulation software.	Explicit DEM solver (dry/sticky contact rheologies), 1-way & 2-way coupling with ANSYS Fluent and ANSYS Mechanical.	Single only
<b>Siemens NX Nastran</b>	Simulation and analysis tool for structural mechanics.	Linear equation solver	Single only

## DESIGN AND VISUALIZATION

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Allegorithmic Substance Designer</b>	Material shader edition, market reference for procedural texture creation.	Iray rendering including textures/substances and bitmap texture export to render in any Iray powered compatible with MDL.	Yes
<b>Autodesk - AutoCAD</b>	2D and 3D CAD design, drafting, modeling, architectural drawing, and engineering software. Supports Open GL. Native DWG™ support.	Surface, mesh, and solid modeling tools, model documentation tools, parametric drawing capabilities. Native DWG™ support.	Single only
<b>Autodesk - AutoCAD Design Suite</b>	AutoCAD 2014 software, plus tools to create, capture, connect, and showcase designs.	2D/3D display of designs, interactive 3D presentation with realistic materials, rendering-ray tracing.	Single only
<b>Autodesk - 3ds Max</b>	3D animation creative toolset for modeling, animation, simulation, and rendering for product and building designs.	3D modeling, mesh and surface modeling, improved Nitrous viewport performance, Iray rendering.	Yes
<b>Autodesk - Inventor</b>	3D mechanical design, documentation, and product simulation.	Uses BIM for intelligent building components to improve design accuracy.	Single only
<b>Autodesk - Revit</b>	Building Information Modeling (BIM) for architecture, engineering, and construction.	Modeling (BIM) to design, build, and maintain higher-quality, more energy-efficient buildings.	Single only
<b>Chaos Group - V-Ray RT</b>	GPU renderer	CUDA interactive GPU rendering	Yes
<b>Dassault Systèmes - CATIA</b>	Accelerated UI rendering	Full OpenGL implementation including menus and dialog box.	Single only
<b>Dassault Systèmes - CATIA Live Rendering</b>	Realistic 3D Rendering on full CATIA 3D CAD model	Physically Based Rendering with no data preparation thanks to native NVIDIA Iray Photoreal integration and interactive realistic rendering using NVIDIA Iray IRT.	Yes + NVIDIA Quadro VCA
<b>Dassault Systèmes - 3DEXCITE Bunkspeed Suite</b>	Easy to use photorealistic rendering software	Iray-based ray-tracing, animation support, network rendering.	Yes
<b>Dassault Systèmes - 3DEXCITE DeltaGen</b>	Redefines high-end 3D visualization and realtime interaction. This latest version gives users a broad suite of robust new features to truly revolutionize processes and help increase visual quality, speed, and flexibility.	Interactive ray tracing and global illumination. Integration with Siemens TeamCenter. Cluster support Realtime & Offline Production Process Integration and scene building. Scene Analysis, Xplore DeltaGen, SDK for DeltaGen.	Yes
<b>Dassault Systèmes - SOLIDWORKS</b>	Covers all aspects of product development process with a seamless, integrated workflow—design, verification, sustainable design, communication and data management.	High performance in Shaded, Shaded w/ Edges, and RealView modes, FSAA for sharp edges, Order Independent Transparency Real time photorealistic renderings.	Single only
<b>NVIDIA Iray</b>	A ready-to-integrate, physically-based, photorealistic rendering solution.	Iray Interactive; Iray Photoreal; Iray Cluster. Fast interactive ray tracing; Physically-based, global-illumination rendering; Distributed cluster rendering.	Yes
<b>Otoy - Octane Render</b>	GPU renderer	GPU rendering	Yes
<b>PTC Creo Parametric</b>	Parametric design solution suite.	Anti-aliasing, better lighting and enhanced shaded-with-edges mode. Immersive design environment with realistic materials. GRID Support.	Single only
<b>Siemens PLM Software NX and Teamcenter</b>	Product lifecycle management solutions from design to simulation to production to service.	Design software, NX, and PLM viewer applications, TcVis and Active Workspace.	Single only

## ELECTRONIC DESIGN AUTOMATION

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Altair FEKO</b>	3D EM modeling and simulation	FDTD solver MoM solver	Yes
<b>ANSYS - HFSS</b>	Simulation tool for modeling 3-D full-wave electromagnetic fields in high-frequency and high-speed electronic components.	Transient solver	Yes



<b>ANSYS - Nexxim</b>	Circuit simulation engine for RF/analog/mixed-signal IC design; IBIS-AMI analysis speedup with GPU computing.	AMI analysis	Single only
<b>CST STUDIO SUITE</b>	3D Electromagnetic modeling and simulation	Several different solvers	Yes
<b>D2S TrueMask</b>	GPGPU-based computational lithography acceleration technology.	Simulation and data preparation for Mask Writing, Geometric manipulation of large semiconductor design & manufacturing data, eBeam, Mask Process, and lithography aerial image Simulation, image processing.	Yes
<b>Delcross- Savant</b>	Simulation tool for installed antenna performance and antenna-to-antenna coupling.	High-frequency solver	Yes
<b>JMAG</b>	FEA software for electromechanical design. Fast solver / High quality mesh / Advanced modeling technologies.	EM transient solver EM time harmonic solver EM static solver	Yes
<b>KeySight - ADS</b>	Simulation tool for design of RF, microwave and high speed digital circuits.	Transient Convolution simulation with BSIM4 models	Single only
<b>KeySight - EMPro</b>	Modeling and simulation environment for analyzing 3D EM effects of high speed and RF/Microwave components.	FDTD solver	Yes
<b>Remcom - XFDTD</b>	3D EM modeling and simulation	FDTD solver	Yes
<b>Rocketick - RocketSim</b>	Verilog simulation	Verilog simulation	Yes
<b>SPEAG - SEMCAD-X</b>	3D EM modeling and simulation	FDTD solver	Yes

## Media and Entertainment

### ANIMATION, MODELING AND RENDERING

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>3DAliens- Glu3d</b>	SPH fluid simulation	Faster simulation	Single only
<b>AAA Studio - FurryBall</b>	GPU renderer	CUDA and DirectX GPU rendering	Single only
<b>Autodesk - 3ds Max + NVIDIA Iray</b>	3D modeling, animation, and rendering	Iray interactive, photorealistic and physically correct rendering	Yes
<b>Autodesk - Maya</b>	3D modeling, animation, and rendering	Increased model complexity, larger scenes	Yes
<b>Autodesk - Motion Builder</b>	Character animation and motion capture	Increased model complexity at interactive rates	Single only
<b>Autodesk - Mudbox</b>	3D sculpting	Increased model complexity at interactive rates	Single only
<b>Blastcode - Kilton/Megaton</b>	Physics-based simulation plug in	Faster simulation	Single only
<b>Cebas - moskitoRender</b>	GPU renderer	CUDA-based GPU rendering	Yes
<b>Chaos Group - V-Ray RT</b>	GPU renderer	CUDA interactive GPU rendering	Yes
<b>Jawset - TurbulenceFD</b>	Physics-based simulation plug-in	Maximus supported GPU simulation using CUDA	Single only
<b>Maxon - Cinema 4D</b>	3D modeling, animation, and rendering	Increased model complexity at interactive rates	Single only
<b>NewTek - Lightwave</b>	3D modeling, animation, and rendering	Increased model complexity at interactive rates	Single only
<b>Otoy - Octane Render</b>	GPU renderer	GPU rendering	Yes
<b>Pixologic - Sculpttris</b>	3D sculpting	Increased model complexity at interactive rates	Single only
<b>Redshift - Renderer</b>	GPU-accelerated, biased renderer	CUDA-based GPU final-frame rendering	Yes
<b>Side Effects - Houdini</b>	3D modeling, animation, and rendering	Maximus supported GPU simulation using OpenCL	Single only
<b>The Foundry - Mari</b>	3D paint	Increased model complexity at interactive rates	Single only
<b>The Foundry - Modo</b>	3D modeling, animation and rendering	Increased model complexity, larger scenes	Single only

## COLOR CORRECTION AND GRAIN MANAGEMENT

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Adobe - SpeedGrade CC</b>	Color grading	Real-time grading and finishing with Lumetri Deep Color Engine.	Single only
<b>ARRI - RAW Converter</b>	RAW de-Bayering and primary grading	CUDA-accelerated de-bayering and grading	Single only
<b>Assimilate - Scratch</b>	Color grading and finishing	Accelerated debayering for real-time digital finishing	Single only
<b>Blackmagic Design - DaVinci Resolve</b>	Color grading	Real-time color correction and de-noising	Yes
<b>Canon - Cinema RAW SDK</b>	RAW de-bayering	GPU-accelerated de-Bayering	Single only
<b>Cinnafilm - Dark Energy</b>	Application and plug-in for image enhancement	Image de-noising and restoration	Yes
<b>Digital Vision - Nucoda</b>	Color grading	Real-time color correction	Single only
<b>Fastvideo - Debayer</b>	High performance GPU debayer	High performance debayer on CUDA	Yes
<b>FilmLight - Baselight</b>	Color grading	Real-time color correction	Yes
<b>Marquise Technologies - Rain</b>	Color grading	CUDA-based real-time color correction	Single only
<b>Red Digital Cinema - REDCINE-X PRO</b>	Primary color grading	CUDA-accelerated de-bayering and grading	Single only
<b>Red Giant - Magic Bullet Looks</b>	Color and finishing tools	Faster effects	Single only
<b>Snell Advanced Media - Pablo Rio</b>	Color grading and finishing	Real time color correction	Yes
<b>SGO - Mistika</b>	Color grading and finishing	Real-time color correction and finishing	Single only
<b>The Foundry - COLORWAY</b>	Color grading	Accelerated color grading	Single only
<b>The Pixel Farm PFClean</b>	Image restoration and remastering	CUDA-based image processing acceleration	Single only
<b>Wavelet Beam - Grain and Noise Reducer</b>	Video noise reduction	CUDA-accelerated grain and noise reduction	Yes

## COMPOSITING, FINISHING AND EFFECTS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Adobe - After Effects CC</b>	Motion graphics and effects	3D ray tracing engine based on NVIDIA OptiX	Yes
<b>Autodesk - Flame Premium</b>	Finishing and color grading	Integrated toolset for 3D VFX, editorial, and color grading	Yes
<b>Blackmagic Design - Fusion</b>	Effects and compositing	Faster effects	Single only
<b>Boris FX - Continuum Complete</b>	Visual effects plug-in	Faster effects	Single only
<b>CoreMelt - Complete</b>	Visual effects plug-in	Faster effects	Single only
<b>GenArts - Monsters GT</b>	Visual effects plug-in	Faster effects	Single only
<b>GenArts - Sapphire</b>	Visual effects plug-in	Faster effects	Single only
<b>Neat Video - Open FX</b>	Video noise reduction plug-in	Faster effects	Single only
<b>NewBlueFX - Video Essentials</b>	Video effects plug-in	Faster effects	Single only
<b>Pixelan - FilmTouch</b>	Video effects plug-in	Faster effects	Single only
<b>Re:Vision Effects - Twixtor</b>	Visual effects plug-in	Faster effects	Single only
<b>Red Giant - Effects Suite</b>	Visual effects plug-in	Faster effects	Single only
<b>ROBUSKEY</b>	Chroma keyer plug-in	Faster effects	Single only
<b>SGO - Mamba FX</b>	High-end compositing	Faster keying, tracking, painting and restoration	Single only

<b>The Foundry - HIERO</b>	Shot management, conform and review timeline	Better interactivity	Single only
<b>The Foundry - NUKE, NUKEX and NUKE Studio</b>	Compositing tools with 3D tracker	Faster effects	Single only
<b>Video Copilot - Element 3D</b>	3D object based particle system	Faster effects	Yes
<b>Video Copilot - Twitch</b>	Video effects plug-in for After Effects	Faster effects	Single only

## EDITING

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Adobe - Photoshop CC</b>	Image editing	Over 30 effects for smoother image manipulation in Mercury Graphics Engine	Single only
<b>Adobe - Premiere Pro CC</b>	Video editing	Mercury Playback Engine for real-time video editing & accelerated rendering	Yes
<b>Apple - Final Cut Pro</b>	Video editing	Faster effects	Single only
<b>Autodesk - Smoke</b>	Finishing and editing	Faster effects	Single only
<b>Avid - Media Composer</b>	Video editing	Faster video effects, unique stereo 3D capabilities	Single only
<b>EditShare - Lightworks</b>	Video editing	Faster effects	Single only
<b>Grass Valley - Edius Pro</b>	Video editing	Faster effects	Single only
<b>Imagine Communications - Velocity</b>	Video editing	Faster effects	Single only
<b>Snell Advanced Media - Qube</b>	Broadcast video editing	Faster video effects, unique stereo 3D capabilities	Single only
<b>Sony - Catalyst Browse, Prepare and Edit</b>	Video editing	Faster effects, transitions and encoding	Single only
<b>Sony - Vegas Pro</b>	Video editing	Faster video effects and encoding	Single only

## ENCODING AND DIGITAL DISTRIBUTION

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>ArcVideo - Core</b>	Video processing and transcoding	Accelerated transcoding and encoding	Yes
<b>ArcVideo - Live</b>	High-density, real-time video processing and encoding.	Accelerated broadcast encoding with NVIDIA CUDA and NVENC.	Yes
<b>Cinnafilm - Tachyon</b>	Standards conversion	Video processing and frame rate conversion	Yes
<b>Comprimato - JPEG2000 Codec</b>	JPEG2000 encoding and decoding for DCP, IMF, video editing, broadcast contribution, and archiving.	Faster than real-time UltraHD / 4K, lossy and mathematically lossless, high bit-depth (HDR), performance scalable, GPU accelerated.	Yes
<b>Dalet - Amberfin</b>	Transcoding and video quality analysis	GPU-accelerated video procession and encoding	Single only
<b>Elemental - Elemental Live</b>	Live streaming video processing and encoding	Video encoding and video processing	Yes
<b>Elemental - Elemental Server</b>	File-based video processing and encoding	Video encoding and video processing	Yes
<b>ERLAB - Multiplatform Transcoder</b>	Video processing and encoding software	Pre-processing encoding, Decoding, Post-processing and delivery	Single only
<b>Fastvideo - H.264 encoder</b>	H.264 encoding on GPU	NVENC accelerated video encoding	Yes
<b>Fastvideo - Resizer</b>	Batch JPEG resizer	Batch JPEG resize on CUDA	Yes
<b>Fastvideo - SDK</b>	JPEG, JPEG2000, Raw Bayer codecs	Fast JPEG, JPEG2000, Raw Bayer encoding and decoding on CUDA	Yes
<b>Interra - Baton</b>	Video quality analysis	GPU accelerated video quality assessment	Single only
<b>isovideo - Viarte</b>	Video standards conversion	CUDA-accelerated video procession and encoding	Yes
<b>METUS - Ingest</b>	Video recording, Transcoding, and Streaming Software.	CUDA Accelerated video recording, encoding and broadcast transcoding	Single only

<b>Root6 - Content Agent</b>	Automated transcoding and workflow management	GPU-accelerated video procession and encoding	Yes
<b>Sorenson Media - Squeeze</b>	Video transcoding application and plug-In	Video encoding and video processing	Yes
<b>Snell Advanced Media - Alchemist on Demand</b>	Video standards conversion	GPU-accelerated video procession and encoding	Yes
<b>Tektronix - Aurora</b>	Automated video quality measurement	GPU-accelerated video quality assessment	Single only
<b>Telestream - Vantage</b>	Video transcoding and processing	Video encoding and video processing	Yes
<b>Wowza - Transcoder</b>	H.264 video encoding	NVENC accelerated video encoding	Single only

## ON-AIR GRAPHICS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Brainstorm - eStudio</b>	Virtual sets and motion graphics	Real-time rendering	Single only
<b>ChyronHego - GS2 Graphics Engine</b>	On-air graphics	Real-time rendering	Single only
<b>ChyronHego - Mosaic</b>	On-air graphics	Real-time rendering	Single only
<b>Cinegy - Type</b>	On-air Graphics	Real-time rendering	Single only
<b>Dalet - Cube</b>	On-air Graphics	Real-time rendering	Single only
<b>Grass Valley - Miranda Vertigo</b>	On-air Graphics	Real-time rendering	Single only
<b>Imagine Communications - Nexio Channelbrand</b>	On-air graphics	Real-time rendering	Yes
<b>Imagine Communications - Nexio G8</b>	On-air graphics	Real-time rendering	Single only
<b>Imagine Communications - Nexio TitleOne</b>	On-air graphics	Real-time rendering	Single only
<b>Monarch - Brodcaast Dscript 3D</b>	3D on-air graphics	Real-time rendering	Single only
<b>Monarch - Virtuoso</b>	Virtual sets and motion graphics	Real-time rendering	Single only
<b>Pixel Power - Clarity</b>	On-air graphics	Real-time rendering	Single only
<b>RT Software - tOG</b>	On-air graphics	Real-time rendering	Single only
<b>Vizrt - Viz Engine</b>	On-air graphics and virtual sets	Real-time rendering	Single only
<b>Wasp3D - CG</b>	On-air graphics and virtual sets	Real-time rendering	Single only

## ON-SET, REVIEW AND STEREO TOOLS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Autodesk - RV</b>	Review and approval of 4K content	Real-time	Single only
<b>3ality Technica - Intellicam</b>	3D stereo camera adjustment	CUDA-based 3D imaging	Single only
<b>Binocle3D - Disparity Killer</b>	3D stereoscopic workflow	CUDA-based 3D imaging	Single only
<b>Blackmagic Design - Dimension</b>	3D stereoscopic workflow	Real-time	Single only
<b>BlueFish - Fluid 4K Review</b>	Review and approval of 4K content	Real-time video review	Single only
<b>Colorfront - On-Set Dailies</b>	Review, color grading and transcoding on set	Real-time	Yes
<b>Fastvideo - SDK</b>	Full image processing pipeline on CUDA	Full image processing pipeline for real time machine vision and camera applications. Data unpacking, Shading correction, Color correction, Debayer, LUT, Resize, Sharp, JPEG, JPEG2000, Raw Bayer, H.264 encoding.	Yes
<b>Lightcraft - Previzion</b>	On-set virtual production	Real-time, virtual set production	Single only

<b>MTI Film - Cortex Dailies</b>	Review, color grading and transcoding on set	CUDA accelerated grading and transcoding	Single only
<b>The Pixel Farm - PFTrack</b>	3D scene creation and tracking	CUDA-accelerated tracking	Yes

## WEATHER GRAPHICS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Accuweather - Cinematic HD</b>	Weather graphics	Real-time	Single only
<b>Accuweather - Storyteller</b>	Weather graphics	Real-time	Single only
<b>MeteoGraphics - MeteoEarth</b>	Weather graphics	Real-time	Single only
<b>WSI - Max Weather</b>	Weather graphics	Real-time	Single only

## Oil and Gas

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Acceleware AxRTM AxKTM</b>	Seismic processing	RTM, Kirchhoff, control source, electromagnetism, forward modeling.	Yes
<b>BRS Labs AISight for SCADA</b>	Proactive integrity management and real-time precursor alerts for enhanced SCADA operations in oil and gas.	24/7 real-time analysis and alerting scaling to thousands of sensors across remote and geographically dispersed locations including historical analysis and trend reports.	Yes
<b>CGG- GeoVation</b>	Seismic processing	Multiple algorithms (RTM, etc)	Yes
<b>CGG- Inside Earth</b>	Seismic interpretation	Horizon orientation attributes; automated fault extraction, Curvature Attributes.	Yes
<b>Echelon Stoneridge Technology</b>	Reservoir simulator	Fully GPU-accelerated reservoir model, including dual-perm, dual porosity, pressure varying perm and porosity. Eclipse compatible input deck.	Yes
<b>Esri ArcGIS for Desktop (ArcMap and ArcGIS Pro) – Spatial Analyst and 3D Analyst</b>	Determines the raster surface locations visible to a set of observer features, using geodesic methods.	Viewshed2 transforms the elevation surface into a geocentric 3D coordinate system and runs 3D sightlines to each transformed cell center.	Yes
<b>ffa Geoteric</b>	Seismic interpretation	Attributes calculations, geobodies extraction	Yes
<b>ffa SEA3D Pro</b>	Seismic interpretation	Attributes calculations, geobodies extraction	Yes
<b>ffa SVI Pro</b>	Seismic interpretation	Attributes calculations, geobodies extraction	Yes
<b>GeoMage Multifocusing</b>	Seismic processing	Advanced seismic imaging technologies and services, as well as interpretation, geological modeling, and reservoir characterization.	Yes
<b>HUE Headwave Suite</b>	Seismic interpretation	Attributes calculations, Volume Rendering	Yes
<b>HUE HUESpace</b>	Seismic interpretation	Interpretation development platform	Yes
<b>OpenGeo Solutions OpenSeis</b>	Seismic processing	Spectral Decomposition	Yes
<b>Panorama Tech</b>	Seismic processing, Modeling	Multiple algorithms (RTM, etc)	Yes
<b>Paradigm Echos RTM</b>	Seismic processing	RTM algorithm	Yes
<b>Paradigm Geophysical VoxelGeo</b>	Seismic interpretation	Volume Rendering, Horizon Flattening	Yes
<b>Paradigm SKUA</b>	Reservoir modeling	Faults, Horizons and Flow Simulation Grid	Yes
<b>PumaFlow IFP</b>	Reservoir simulation	GPU-accelerated linear solver	Yes
<b>Ridgeway Kite Simulator</b>	Reservoir simulation	Fully GPU-accelerated reservoir model, including surface facilities and multiple realization history matching.	Yes

<b>Roxar RMS</b>	Reservoir modeling	Multi GPU capabilities via HUEspace	Yes
<b>Schlumberger Omega2 RTM</b>	Seismic processing	Multiple algorithms (RTM, etc)	Yes
<b>Seismic City Prestack Interpretation</b>	Seismic processing	Multiple algorithms (RTM, etc)	Yes
<b>SpectraSeis</b>	Seismic processing	Full elastic wave-equation imaging and analysis of microseismic fracture data.	Yes
<b>Stoneridge Technologies GAMPACK</b>	Reservoir simulation	GPU Algebraic MultiGrid Package	Yes
<b>Tsunami A2011</b>	Seismic processing/Imaging package	RTM processing	Yes
<b>Tsunami RTM</b>	Seismic processing	RTM algorithm	Yes

## Research: Higher Education and Supercomputing

### COMPUTATIONAL CHEMISTRY AND BIOLOGY

#### Bioinformatics

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Arioc</b>	High-throughput read alignment with GPU-accelerated exploration of the seed-and-extend search space	Single-end alignment, paired-end alignment <ul style="list-style-type: none"> <li>Output in SAM or database-ready binary formats</li> <li>Multiple GPU implementation</li> </ul>	Yes
<b>BarraCUDA</b>	Sequence mapping software	Alignment of short sequencing reads, alignment of indels with gap openings and extensions.	Yes
<b>BEAGLE-lib</b>	BEAGLE is a high-performance library that can perform the core calculations at the heart of most Bayesian and Maximum Likelihood phylogenetics packages. It can make use of highly-parallel processors such as those in graphics cards (GPUs) found in many PCs.	Evaluation of likelihood for sequence evolution on trees and Arbitrary models (e.g. nucleotide, amino acid, codon) Speed-ups (over CPU only version): nucleotide model = up to 25x, codon model = up to 50x.	Yes
<b>Campaign</b>	An open-source library of GPU-accelerated data clustering algorithms and tools.	K-means (and Kps-means, a K-means variant for GPUs with parallel sorting for improved performance), K-medoids, K-centers (a K-medoids variant in which medoids are placed only once according to a heuristic), Hierarchical clustering and Self-organizing map.	Single only
<b>CUDASW++</b>	Open source software for Smith-Waterman protein database searches on GPUs.	Parallel search of Smith-Waterman database.	Yes
<b>CUSHAW</b>	Parallelized short read aligner	Parallel, accurate long read aligner for large genomes	Yes
<b>G-BLASTN</b>	GPU-accelerated nucleotide alignment tool based on the widely used NCBI-BLAST.	Blastn and megablast modes of NCBI-BLAST	Single only
<b>GPU-Blast</b>	Local search with fast k-tuple heuristic	Protein alignment according to BLASTP	Single only
<b>mCUDA-MEME</b>	Ultrafast scalable motif discovery algorithm based on MEME .	Scalable motif discovery algorithm based on MEME.	Yes
<b>MUMmer GPU</b>	High-throughput local sequence alignment program	Aligns multiple query sequences against reference sequence in parallel.	TBD
<b>NVBIO</b>	NVBIO is an open source C++ library of reusable components designed to accelerate bioinformatics applications using CUDA.	Data structures, algorithms, and utility routines useful for building complex computational genomics applications on CPU-GPU systems.	Yes
<b>NVBowtie</b>	A largely complete implementation of the Bowtie2 aligner on top of NVBIO.	Good coverage of Bowtie2 features and comparable quality results.	Yes

<b>PEANUT</b>	Read mapper for DNA or RNA sequence reads to a known reference genome.	Achieves supreme sensitivity and speed compared to current state of the art read mappers like BWA MEM, Bowtie2 and RazerS3. PEANUT reports both only the best hits or all hits.	Single only
<b>REACTA</b>	A modified version of GCTA with improved computational performance, support for Graphics Processing Units (GPUs), and additional features. The purpose of REACTA is to quantify the contribution of genetic variation to phenotypic variation for complex traits.	GRM creation, REML analysis, Regional Heritability (including multi-GPU).	Yes
<b>SeqNFind</b>	SeqNFind® is a powerful tool suite that addresses the need for complete and accurate alignments of many small sequences against entire genomes utilizing a unique hardware/software cluster system for facilitating bioinformatics research in Next Generation sequencing and genomic comparisons.	Hardware and software for reference assembly, blast, SW, HMM, de novo assembly.	Yes
<b>SOAP3</b>	GPU-based software for aligning short reads with a reference sequence. It can find all alignments with k mismatches, where k is chosen from 0 to 3.	Short read alignment tool that is not heuristic based; reports all answers.	Yes
<b>SOAP3-dp</b>	SOAP3-dp: Ultra-fast GPU-based tool for short read alignment via index-assisted dynamic programming.	Borrows-Wheeler Transformation, Dynamic Programming.	Yes
<b>UGene</b>	Open source Smith-Waterman for SSE/CUDA, Suffix array based repeats finder and dotplot.	Fast short read alignment.	Yes
<b>WideLM</b>	Fits numerous linear models to a fixed design and response.	Parallel linear regression on multiple similarly-shaped models.	Yes

## Molecular Dynamics

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Abalone</b>	Molecular modeling program focused on molecular dynamics of biopolymers. In addition, it can interact with external quantum chemical programs.	Molecular graphics , Molecular model building, Geometry optimization, Molecular dynamics simulations, Hybrid Monte Carlo, Adaptive Temperature Hybrid Monte Carlo, Replica exchange, Implicit and explicit water models, Interaction with quantum programs, GPU acceleration.	Single only
<b>ACEMD</b>	GPU simulation of molecular mechanics force fields, implicit and explicit solvent	Written for use only on GPUs.	Yes
<b>AMBER</b>	Suite of programs to simulate molecular dynamics on biomolecule.	PMEMD Explicit Solvent and GB Implicit Solvent	Yes
<b>CHARMM</b>	MD package to simulate molecular dynamics on biomolecule.	Implicit (5x), Explicit (2x) Solvent via OpenMM, now ported natively to GPUs.	Yes
<b>DESMOND</b>	High-speed molecular dynamics simulations of biological systems.	The code uses novel parallel algorithms and numerical techniques to achieve high performance and accuracy.	Yes
<b>ESPResSo</b>	Highly versatile software package for performing and analyzing scientific Molecular Dynamics many-particle simulations of coarse-grained atomistic or bead-spring models as they are used in soft-matter research in physics, chemistry and molecular biology.	Hydrodynamic / Electrokinetic forces P3M electrostatics.	Yes
<b>Folding@Home</b>	A distributed computing project that studies protein folding, misfolding, aggregation, and related diseases.	Powerful distributed computing molecular dynamics system; implicit solvent and folding.	Yes
<b>GPUgrid.net</b>	A distributed computing project that uses GPUs for molecular simulations.	High-performance all-atom biomolecular simulations; explicit solvent and binding.	Yes

<b>GROMACS</b>	Simulation of biochemical molecules with complicated bond interactions.	Implicit (5x), Explicit (2x) Solvent	Yes
<b>HALMD</b>	Large-scale simulations of simple and complex liquids.	Simple fluids and binary mixtures (pair potentials, high-precision NVE and NVT, dynamic correlations).	Single only
<b>HOOMD-Blue</b>	Particle dynamics package written grounds up for GPUs.	Written for use only on GPUs	Yes
<b>LAMMPS</b>	Classical molecular dynamics package	Lennard-Jones, Gay-Berne, Tersoff, and dozens more potentials	Yes
<b>NAMD</b>	Designed for high-performance simulation of large molecular systems.	Full electrostatics with PME and most simulation features; 100M atom capable.	Yes
<b>OpenMM</b>	Library and application for molecular dynamics for HPC with GPUs.	Implicit and explicit solvent, custom forces	Yes
<b>PolyFTS</b>	Classical molecular simulation code for studying polymer self-assembly and thermodynamics.	Uses auxiliary fields as the fundamental simulation degrees of freedom, Uses cuFFT extensively (~ 80%), CUDA code is ~20%, Multi CPU or single GPU per job, 1x = Ivy Bridge E5-2690 CPU all 10 cores, 3-8X on K40 or K80 (utilizing 1/2 of the K80).	Single only
<b>SOP-GPU</b>	SOP-GPU package, where SOP stands for the Self Organized Polymer Model fully implemented on a GPU, is a scientific software package designed to perform Langevin Dynamics Simulations of the mechanical or thermal unfolding, and mechanical indentation of large biomolecular systems in the experimental subsecond (millisecond-to-second) timescale.	Langevin dynamics simulations using the coarse-grained Self Organized Polymer (SOP) model, Multiple simulation trajectories can be performed simultaneously on a single GPU, Calpha and Calpha-Cbeta models are supported, Simulations of protein forced unfolding, Novel simulations of nanoindentation in silico, Support for hydrodynamic interactions, Up to ~100 ms of simulation time per day, Systems of up to 1,000,000 amino-acids (on GPUs with 6GB or great memory).	Single only

## Quantum Chemistry

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Abinit</b>	Allows to find total energy, charge density and electronic structure of systems made of electrons and nuclei within DFT.	Local Hamiltonian, non-local Hamiltonian, LOBPCG algorithm, diagonalization/orthogonalization.	Yes
<b>ACES III</b>	Takes best features of parallel implementations of quantum chemistry methods for electronic structure.	Integrating scheduling GPU into SIAL programming language and SIP runtime environment.	Yes
<b>ADF</b>	Density Functional Theory (DFT) software package that enables first-principles electronic structure calculations.	Geometry optimizations and frequency calculations with GGA functionals.	Yes
<b>BigDFT</b>	Implements density functional theory by solving the Kohn-Sham equations describing the electrons in a material.	DFT; Daubechies wavelets, part of Abinit	Yes
<b>CASTEP [In development]</b>	CASTEP is a leading code for calculating the properties of materials from first principles. Using density functional theory, it can simulate a wide range of properties of materials proprieties including energetics, structure at the atomic level, vibrational properties, electronic response properties etc.	TBD	Yes
<b>CP2K</b>	Program to perform atomistic and molecular simulations of solid state, liquid, molecular and biological systems.	DBCSR (space matrix multiply library)	Yes
<b>GAMESS-UK</b>	The general purpose ab initio molecular electronic structure program for performing SCF-, DFT- and MCSCF-gradient calculations.	(ss/ss) type integrals within calculations using Hartree-Fock ab initio methods and density functional theory. Supports organics and inorganics.	Yes



<b>GAMESS-US</b>	Computational chemistry suite used to simulate atomic and molecular electronic structure.	Libqc with Rys Quadrature Algorithm, Hartree-Fock, MP2 and CCSD.	Yes
<b>Gaussian [In development]</b>	Predicts energies, molecular structures, and vibrational frequencies of molecular systems.	Joint NVIDIA, PGI and Gaussian collaboration.	Yes
<b>GPAW</b>	Real-space grid DFT code written in C and Python	Electrostatic poisson equation, orthonormalizing of vectors, residual minimization method (rmm-diis).	Yes
<b>gWL-LSMS</b>	Materials code for investigating the effects of temperature on magnetism.	Generalized Wang-Landau method	Yes
<b>LATTE</b>	Density matrix computations	CU_BLAS, SP2 Algorithm	Yes
<b>MOLCAS</b>	Methods for calculating general electronic structures in molecular systems in both ground and excited states.	CU_BLAS	Single only Additional GPU support coming in Version 8
<b>MOPAC2012</b>	Semiempirical Quantum Chemistry	Pseudodiagonalization, full diagonalization, and density matrix assembling via Magma libraries.	Single only
<b>NWChem</b>	Calculations	Triples part of Reg-CCSD(T), CCSD and EOMCCSD task schedulers.	Yes
<b>Octopus</b>	Used for ab initio virtual experimentation and quantum chemistry calculations.	Full GPU support for ground-state, real-time calculations; Kohn-Sham Hamiltonian, orthogonalization, subspace diagonalization, poisson solver, time propagation.	TBD
<b>ONETEP [In development]</b>	ONETEP (Order-N Electronic Total Energy Package) is a linear-scaling code for quantum-mechanical calculations based on density-functional theory.	TBD	Yes
<b>PEtot</b>	First principles materials code that computes the behavior of the electron structures of materials.	Density functional theory (DFT) plane wave pseudopotential calculations.	Yes
<b>PWMat</b>	The fastest plane wave pseudopotential code for density functional theory simulations based on GPU.	It can perform extremely fast plane wave DFT calculations based on GPU machines and single precision and double precision mixed algorithm. It deploys the state-of-the-art electronic structure calculation methods with many new features and algorithm innovations. It performs ab initio material science simulations, designed for both theoretical and experimental groups.	Yes
<b>Q-CHEM</b>	Computational chemistry package designed for HPC clusters.	Various features including RI-MP2	Single Only
<b>QMCPACK</b>	Solves the many-body Schrodinger equation for electronic structures using a quantum Monte Carlo method.	Main features	Yes
<b>Quantum Espresso/ PWscf</b>	An integrated suite of computer codes for electronic structure calculations and materials modeling at the nanoscale.	PWscf package: linear algebra (matrix multiply), explicit computational kernels, 3D FFTs.	Yes
<b>QUICK</b>	QUICK is a GPU-enabled ab initio quantum chemistry software package.	Running Hartree-Fock and DFT energy on GPU, Supports s, p, d, f orbitals on energy calculation, HF gradient with s,p,d orbital support, GPU-based ERI generator.	Yes
<b>TeraChem</b>	Quantum chemistry software designed to run on NVIDIA GPU.	Full GPU-based solution; Performance compared to GAMESS CPU version.	Yes
<b>VASP</b>	Complex package for performing ab-initio quantum-mechanical molecular dynamics (MD) simulations using pseudopotentials or the projector-augmented wave method and a plane wave basis set.	Blocked Davidson (ALGO = NORMAL & FAST), RMM-DIIS (ALGO = VERYFAST & FAST), K-Points and optimization for critical step in exact exchange calculations.	Yes

## Visualization and Docking

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Amira®</b>	A multifaceted software platform for visualizing, manipulating, and understanding Life Science and bio-medical data.	3D visualization of volumetric data and surfaces	Single only
<b>BINDSURF</b>	A virtual screening methodology that uses GPUs to determine protein binding sites.	Allows fast processing of large ligand databases	Single only
<b>BUDE</b>	Molecular docking program	Empirical Free Energy Force field	Single only
<b>FastROCS</b>	Molecule shape comparison application	Real-time shape similarity searching/ comparison	Yes
<b>Molegro Virtual Docker 6</b>	Method for performing high accuracy flexible molecular docking.	Energy grid computation, pose evaluation and guided differential evolution.	Single only
<b>PaPaRa 2.0</b>	A Vectorized Algorithm for Probabilistic Phylogeny-Aware Alignment Extension.	Up to 15-fold run time improvements by deploying SIMD vector intrinsics to accelerate the alignment kernel.	Single only
<b>PIPER Protein Docking</b>	Protein-protein docking program	Molecule docking	TBD
<b>PyMol</b>	User-sponsored molecular visualization system on an open-source foundation	Lines: 460% increase Cartoons: 1246% increase Surface: 1746% increase Spheres: 753% increase Ribbon: 426% increase	Single only
<b>VEGA ZZ</b>	Molecular Modeling Toolkit	Virtual logP, molecular surface values	Single only
<b>VMD</b>	Visualization and analyzing large bio-molecular systems in 3-D graphics	High quality rendering, large structures (100M atoms), analysis and visualization tasks, multiple GPU support for display of molecular orbitals	Yes

## NUMERICAL ANALYTICS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Accelereyes- ArrayFire</b>	Comprehensive GPU function library	Hundreds of functions for math, signal/ image processing, statistics, and more.	Yes
<b>HiPLAR</b>	3High Performance Linear Algebra in R	Supports GPU and multi-core platforms, compatible with legacy R code, no new data types or operators, auto-tuning, support for R Matrix package.	Yes (for algebra functions via Magma 1.5 or later)
<b>Mathematica Wolfram</b>	A symbolic technical computing language and development environment.	Development environment for CUDA and OpenCL. GPU acceleration for Wolfram Finance Platform.	Yes
<b>Mathworks - MATLAB</b>	GPU acceleration for MATLAB (high-level technical computing language).	Support for 200+ of most used MATLAB functions (incl. Signal Processing, Image Processing, Communications Systems, etc).	Yes
<b>NMath Premium</b>	GPU-accelerated math and statistics for .NET, automatically detects the presence of a CUDA-enabled GPU at runtime and seamlessly redirects appropriate computations to it.	Automatically offloads computations to the GPU.	Single only

## PHYSICS

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>AWP</b>	The Anelastic Wave Propagation, AWP-ODC, independently simulates the dynamic rupture and wave propagation that occurs during an earthquake. Dynamic rupture produces friction, traction, slip, and slip rate information on the fault. The moment function is constructed from this fault data and used to initialize wave propagation.	3D Finite Difference Computation	No
<b>BQCD</b>	Lattice quantum chromodynamics application, used for nuclear and high energy physics calculations.	Wilson-clover fermion linear solver	Yes

<b>Changa</b>	Astrophysics code performs collisionless N-body simulations. It can perform cosmological simulations with periodic boundary conditions in comoving coordinates or simulations of isolated stellar systems.	Gravitational Model has been accelerated using CUDA	No
<b>Chemora</b>	Chemora is a system for performing simulations of systems described by differential equations running on accelerated computational clusters.	Chemora embeds the equations' computational kernels into dynamically compiled loop nests shaped for input size and GPU structure.	Yes
<b>Chroma</b>	Lattice Quantum Chromodynamics (LQCD)	Wilson-clover fermions, Krylov solvers, Domain-decomposition	Yes
<b>CPS</b>	Lattice quantum chromodynamics application, used for nuclear and high energy physics calculations.	Wilson, domain-wall and Möbius fermion linear solvers	Yes
<b>ENZO</b>	3D block-structured AMR code for cosmological structure formation.	Accelerated magneto hydrodynamics solvers	Yes
<b>GTC</b>	Simulates microturbulence and transport in magnetically confined fusion plasma.	Electron push and shift (accounting for >80% of run time)	Yes
<b>GTC-P</b>	A development code for optimization of plasma physics. Full science and data sets are included, but in a simplified form to allow performance testing and tuning.	Optimized with CUDA. OpenACC development underway	Yes
<b>GTS</b>	Simulates microturbulence and the motion of charged particles and interactions in fusion plasma.	Push and shift for both electron and ion dynamics	Yes
<b>HACC</b>	Simulates N-Body Astrophysics	This code has been optimized with CUDA runs in full production mode.	Yes
<b>MILC</b>	Lattice Quantum Chromodynamics (LQCD) codes simulate how elemental particles are formed and bound by the "strong force" to create larger particles like protons and neutrons.	Staggered fermions, Krylov solvers, Gauge-link fattening.	Yes
<b>OSIRIS</b>	Simulates Plasma Physics including Laser interaction	2 dimensions of the particle push have been optimized with CUDA. Additional optimization is being planned with OpenACC.	Yes
<b>PIConGPU</b>	A relativistic Particle-in-Cell code that describes the dynamics of a plasma by computing the motion of electrons and ions subject to the Maxwell-Vlasov equation.	Simulation of laser-wakefield acceleration of electrons.	Yes
<b>PPM</b>	Piecewise parabolic method, a higher-order extension of Godunov's method which uses spatial interpolation and allows for a steeper representation of discontinuities, particularly contact discontinuities.	Turbulent, compressible mixing of gases in the context of stars near the ends of their lives and also in inertial confinement fusion.	No
<b>QUDA</b>	Library for Lattice QCD calculations using GPUs.	CUDA supports the following fermion formulations: Wilson, Wilson-clover, Twisted mass, Improved staggered (asqtad or HISQ) and Domain wall.	Yes
<b>RAMSES</b>	Simulates astrophysical problems on different scales (e.g. star formation, galaxy dynamics, cosmological structure formation).	CUDA acceleration is applied for radiative transfer for reionization, and the hydrodynamic solver using AMR.	Yes
<b>XGC</b>	Simulates edge effects for MHD plasma physics	The particle push portion has been optimized with CUDA and is being fully optimized with OpenACC and CUDA.	Yes

## SCIENTIFIC VISUALIZATION

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>3D Slicer</b>	Medical visualization & segmentation	Rendering, image processing	No
<b>CEI EnSight</b>	Visualization and analysis application for CAE	Rendering	Yes
<b>FluoRender (SCI, U of Utah)</b>	Interactive rendering tool for confocal microscopy data visualization.	Multi-channel volume rendering	No
<b>GPULib for IDL</b>	Data analysis application	Analysis tasks	No
<b>HVR (LCSE, U of Minnesota)</b>	Interactive volume rendering application	Volume rendering	Yes
<b>ImageVis3D (SCI, U of Utah)</b>	Simple, scalable, and interactive volume rendering application.	Out-of-core volume rendering	No
<b>IntelligentLight FieldView</b>	Visualization application for CFD	Rendering	No
<b>MathWorks - MATLAB</b>	Data analysis and visualization application	Rendering and analysis tasks	No
<b>ParaView</b>	Scalable data analysis and visualization application	Rendering and analysis tasks	Yes
<b>Seg3D (SCI, U of Utah)</b>	Segmentation application for medical data	Rendering, image processing	No
<b>Visualization Toolkit (VTK)</b>	Data analysis and visualization toolkit	Rendering	No
<b>VisIt</b>	Scalable data analysis and visualization application	Rendering and analysis tasks	Yes
<b>vl3 (Argonne National Lab)</b>	Large dataset visualization in cosmology, astrophysics, and biosciences fields.	Volume rendering of particles	Yes
<b>VMD (U of Illinois, Urbana-Champaign)</b>	Visualization and analysis of large bio-molecular systems in 3-D graphics.	High-quality rendering, large structures (100M atoms), analysis and visualization tasks, multiple GPU support for display of molecular orbitals.	Yes

## Safety & Security

APPLICATION	DESCRIPTION	SUPPORTED FEATURES	MULTI-GPU SUPPORT
<b>Herta Security - BioSurveillance NEXT, BioFinder</b>	Real time facial recognition and forensic alerts against multiple watchlists.	Supports crowded scenes, difficult lighting, faster than real-time analysis, partial face concealment.	Yes
<b>Intuvision</b>	Video Analytics	Object recognition and change detection	Yes
<b>Mi-AccLib 2.0.1</b>	Accelerated libraries which encompasses high speed multi-algorithm search engines, data security engine and also video analytics engines for text processing, encryption/ decryption and video surveillance respectively.	Text Processing : Exact Match, Approximate Similarity Text, Wild Card, MultiKeyword and MultiColumnMultiKeyword, etc Data Security: Accelerated Encryption/Description for AES-128 Vide Analytics: Accelerated Intrusion Detection Algorithm.	Yes
<b>MotionDSP - Ikena Forensic Pro, Ikena ISR, Ikena WAMI</b>	Real-time Image Processing and Computer Vision software for Full Motion Video and Wide Area Imagery exploitation.	Real-time super-resolution-based video fidelity improvement, geospatial image processing, and CV detection and tracking.	Yes
<b>NEC NeoFace® Watch</b>	Face recognition for real-time video surveillance and offline search compared against multiple watch-lists.	Detects & recognizes multiple faces simultaneously in crowds and variable lighting, scales to more cameras, larger face databases.	Yes
<b>NerVve - Visual Search Solution (NVSS)</b>	Video / Image Search and Analysis	Video and Image content search	Yes

For more information on GPU-accelerated applications please visit, [www.nvidia.com/teslaapps](http://www.nvidia.com/teslaapps)