FEA Information

WORLDWIDE NEWS

JULY 2004

Participant's Articles, Information, Product Announcements

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Letter to the Engineering Community
Trent Eggleston & Marsha Victory

July 2004

We welcome the following participants to join FEA Information to share information with the worldwide engineering community.

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Bangalore - India

Correction in June issue: We have corrected the URL in our Consulting Directory for Len Schwer

August we will feature:

Derailment and Crash Simulation of
Waterfall Train Accident

LEAP Pty Ltd

Feel free to contact us to contribute an article, or to inquire about becoming an active participant.

Sincerely,

Trent Eggleston & Marsha Victory

Session 12 & 16 Computing/Code Technology
8th International LS-DYNA Users Conference 2004
FEA Information Participant Publications
Art Shapiro

LS-DYNA Communication Performance Studies
Ananthanarayanan Sugavanam
High Performance Computing, IBM

Determining the MPP LS-DYNA Communication and ComputationCosts with the 3-Vehicle Collision Model and the Infiniband Interconnect
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Experiences with LS-DYNA Implicit MPP
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Livermore Software Technology Corporation

Benefits of Scalable Server with Global Addressable Memory for Crash Simulation
Christian Tanasecu
SGI, Inc.

Improved LS-DYNA Parallel Scaling From Fast Collective Communication Operations on High-Performance Compute Clusters
Lars Jonsson
Intel Corporation

A Mesh-free Analysis of Shell Structures
C.T. Wu
Livermore Software Technology Corporation

Company Success Stories
AMD Processor-Based Systems Drive Design of Lance Armstrong's Trek Bikes

Fast And Steady Wins The Race

Profile: AMD Processor-Based Systems Drive Design Of Lance Armstrong's Trek Bikes

"Competing in a race such as the Tour de France demands using every resource to remain ahead of the competition, and AMD's superior technology has enabled Trek to design standard road, climbing and time trial bicycles that are truly cutting-edge."

http://www.trekbikes.com

When Lance Armstrong faces the grueling climbs and breathtaking descents through the mountain stages of the 2004 Tour de France, he will rely on a steadiness born of the strength, determination and passion that make him a five-time Tour de France winner.

As he streaks past the Arc de Triomphe and along the Champs-Elysées attempting to re-write the record books with an unprecedented sixth straight yellow jersey, his speed and power will come from endless training, sacrifice and commitment.

And unlike the fable of the tortoise and the hare where slow and steady wins the race, the yellow jersey goes to the fast and steady. That is why Lance and his teammates on the United States Postal Service Pro Cycling Team presented by Berry Floor rely on Trek bicycles, developed to demanding specifications by a team of talented designers and engineers who depend on powerful AMD Opteron™ and AMD Athlon™ processor-based computers.

The AMD/Trek/Armstrong tale began when Trek designer Michael Sagan – along with Trek's carbon fiber expert Jim Colgrove and lead frame engineer Doug Cusack – developed a time trial bike for Lance Armstrong's 2000 Tour de France effort. "Lance was on a Litespeed titanium time trial bike for the 1999 Tour de France," Sagan recalls. "We knew we could make a faster, lighter, better bike using Trek's patented OCLV process."

With the dedication that makes champions and a reliance on AMD processor-based systems, the designers at Trek pushed the bike to completion in half the normal time. “We had been using older, slower systems that were super expensive. I thought that was crazy,” said Sagan.

When slow systems and fast deadlines conspired to stretch Sagan’s work hours, he built a system to use at home that he “was comfortable working with and had plenty of horsepower.” Two weeks later, Sagan had built from scratch a new workstation “with a 750 MHz AMD Athlon processor and 512K of RAM,” he recalls, laughing as he wistfully recites yesteryear’s state-of-the-art specs. “That seems like a decade ago.”

“I didn’t sacrifice performance,” Sagan says. “I gained performance. There were occasions that I got a lot more done with the AMD Athlon. I had fewer system lock-ups. It was really stable, and I could do rendering and modeling. In the course of getting my job done, nobody’s asking me how much time I spend, just whether I got the job done. But with AMD, I spent less time.”

Four years later, Sagan still uses his trusty homemade system and has introduced AMD processor-powered computing to Trek’s Industrial Design and Advanced Concept groups. The engineers and designers work “from concept all the way to tooling,” Sagan says. “We don’t pass pieces off to anyone else. We can do end-to-end design, working with tolerances to within a ten-thousandth of a millimeter.”

The Trek crew’s latest achievements: The Madone SSL, a new bike for Lance Armstrong (now used by USPS teammate and defending Olympic gold medalist Viatcheslav Ekimov) for the uphill Alpe D’Huez time trial; the Madone SL; and the Madone 5.9, the official bike of the USPS Cycling Team. Using AMD Opteron processor-based systems, Sagan and his squad re-shaped the bike, narrowing it from front to back.

The improvements reduced drag coefficient by one-tenth of a pound, in addition to the three-tenths of a pound reduction Trek achieved in the three years prior. According to Sagan, given variations in rider height, weight and riding style, this year’s drag coefficient reduction alone can save five seconds during a 50-kilometer time trial.

That may not sound like much, but consider for a moment that Lance won last year’s 3,400-kilometer Tour de France by just 61 seconds. Sagan also proudly proclaims Trek’s new designs reduced the frame’s weight by 50 grams.

With so little separating the winner from the rest of the pack, every advantage is critical. The 50-gram weight savings equates to a five-second time savings up Alpe D'Huez.

"Competing in a race such as the Tour de France demands using every resource to remain ahead of the competition, and AMD's superior technology has enabled Trek to design standard road, climbing and time trial bicycles that are truly cutting-edge," says Lance Armstrong. "By enabling sophisticated solutions that have advanced bike design, testing and overall communication, AMD has provided the USPS Pro Cycling team with a distinct competitive advantage."

As in any enterprise – creative, industrial, technological or otherwise – the USPS Pro Cycling Team relies not just on talent, teamwork and character, but also on a sturdy infrastructure. For these record-setting champions, Trek bikes are a chief component of their infrastructure, and AMD provides the best-available tools for designing this foundation.

The 15 members of Trek's Industrial Design and Advanced Concepts groups increasingly rely on AMD processor-based computing. "We're able to source the best equipment, and since I had so much confidence in AMD, it just made sense to use it more," Sagan says. "The reliability is great and the performance and the value are super high. I don't have to worry about the blue screen."

That way, we can all focus on the yellow jersey.

HP Lab Goes Hollywood © HP
http://www.hp.com/hpinfo/newsroom/feature_stories/2004/04hollywood.html (by Jamie Beckett)

May 2004 -- Ogres, princesses and fairy godmothers aren't the usual fare for scientists at HP Labs. But thanks to a unique partnership between HP and DreamWorks, researchers got to play a part in the soon-to-be-released film, "Shrek 2."

The animated fairy tale, a sequel to DreamWorks' Academy Award™-winning blockbuster "Shrek," came to life with help from technology developed by HP Labs for providing scalable off-site rendering capacity to the production. Rendering is the process that converts animators' computer-generated wire models into finished frames by adding color, light, texture and other details.

The HP Utility Rendering Service ran on a data center researchers built in HP Labs' Palo Alto, Calif., headquarters -- the first time DreamWorks has moved the critical rendering process outside its own facilities.

Resources On tap

The data center became a remote extension of DreamWorks' IT infrastructure, providing the computing boost needed for peak periods in the production process.

"We had to build not only a robust, high-performance system, but also to provide a secure, trustworthy environment so nothing about the film leaked out," says Gene Becker, who led the HP team on the project. "And we had to do it in about 12 weeks."

The data center that resulted consisted of 500 HP servers (1,000 processors) connected to DreamWorks' studio 20 miles away in Redwood City, Calif., via a secure fiber optic link. It is an example of HP's Adaptive Enterprise model for computing as a service, in which companies can draw on expanded computing resources when they need it most, without having to purchase or manage physical computing assets.

Breaking New Ground

In working with DreamWorks, HP researchers developed advanced capabilities for service configuration and management of data centers. In addition, they created comprehensive instrumentation to collect terabytes of system data used to optimize performance and reliability.

The data center also uses HP's "smart" cooling and "smart" power solutions to provide the maximum compute capability in the smallest, most cost-efficient footprint possible.

HP’s partnership with DreamWorks began in 2001, when the companies worked together on "Shrek." HP provides the filmmaker’s computing infrastructure, which DreamWorks has credited for helping it break new ground technically, creatively and financially on several feature films.

"Shrek 2," to be released on May 21, picks up the ogre’s story after he and Princess Fiona are married, and the newlyweds' parents extend an invitation to the couple to visit.

The Partnership

HP's partnership with DreamWorks began in 2001, when the companies worked together on 'Shrek'. HP provides the filmmaker's computing infrastructure, which DreamWorks has credited for helping it break new ground technically, creatively and financially on several feature films. For Shrek 2, HP has not only partnered with DreamWorks on technology, but is also partnering with a worldwide promotion that includes advertising, online activities and a sweepstakes that offers consumers the chance to be animated into an upcoming DreamWorks DVD

Excerpt from: ANIMATING RESEARCH
http://www.hpl.hp.com/news/2004/apr-jun/nab_becker

As a researcher at HP Labs, Gene Becker typically doesn't spend much time thinking about moviemaking. His research interests lie primarily in the areas of mobility, digital media and ubiquitous computing .

That all changed a little more than six months ago, when DreamWorks tapped HP Labs technology to help make "Shrek 2." Becker lead a team that, in a few short months, built a 1,000-processor data center inside HP Labs and turned it into a remote IT resource with unique capabilities for the film studio.

Among those capabilities was HP’s Utility Rendering Service, which provides a simple, flexible and scalable solution to manage the enormous amount of computational power needed to render high-quality film animation. The service gave DreamWorks the flexibility to add significant peak capacity for the final stages of rendering "Shrek 2.".

"Shrek 2," the sequel to DreamWorks' animated blockbuster about an ogre who falls in love, opens on May 21.

In this interview, Becker talks about what it was like to work with DreamWorks and how HP technologies for delivering computing as a service could transform the economics and technical infrastructure of the animation industry and eventually, many other industries as well.

Well, let me give you some background. A little over a year ago, researchers in our Bristol , UK , laboratory were working on the problem of delivering computing as a service. Bristol is home to such well-known digital animators as Aardman Animations (creators of Wallace and Gromit) and our eventual partners, 422, which has worked on projects for Discovery Channel, National Geographic TV, PBS, MTV and others.

What's more, digital animation is incredibly compute-intensive. The process of rendering the wire models into finished frames (adding color, light, texture and other details) requires enormous amounts of computing horsepower -- processing, storage, network, bandwidth. So we chose digital animation as a model to work with in delivering computing as a service. Together with 422, the team in Bristol produced a four-minute film called "The Painter" in just a fraction of the time typically needed.

When DreamWorks found out we'd done this, they proposed something a bit more ambitious. They wanted us to build a new data center from the ground up that would consist of about a thousand processors, 500 servers. They wanted to do it in, oh, about 12 weeks. And they wanted to use that system to render part of the movie "Shrek 2."

After we picked our jaws up off the floor, we said "Yeah, that sounds like a great challenge." It's really a wonderful match -- HP's technological expertise with DreamWorks' filmmaking prowess and animation technology

We gathered a small group of really talented HP Labs researchers who were very interested in working not only at the forefront of technology, but also specifically excited about the challenging problems that a customer like DreamWorks would have in the real world.

We built this new data center at HP Labs' facility here in Palo Alto. In the past, DreamWorks had always used its own data center at its own facility. So it was a significant step, moving to a completely remote environment that was on another company's premises and managed and built by another company's engineers.

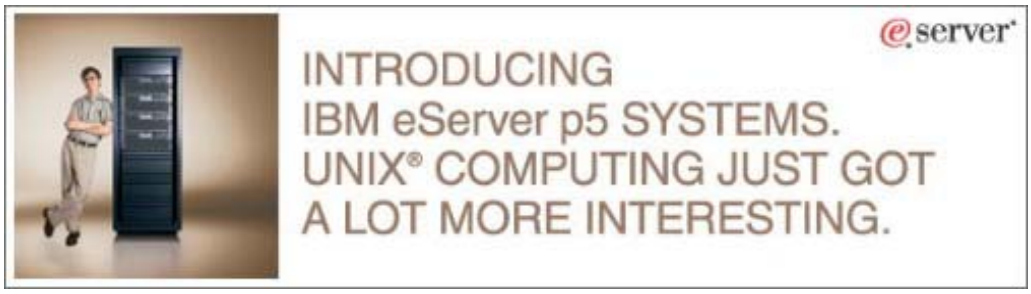
The data center would be capable of running our Utility Rendering Service for digital animation. What our center did was act as an extension of DreamWorks' Redwood City IT facility, giving the studio 50 precent more capacity for the final stages of rendering "Shrek 2."

Instead of selling boxes with disk drives and processors and that sort of thing, we've made it possible for businesses to submit computing jobs into HP's environment and have those jobs run independently without them actually having to build a data center, buy computers, install racks, manage a system and so forth.

It's computing as a service -- a utility like electricity or water that you purchase as needed.

For The Complete Interview: **http://www.hpl.hp.com/news/2004/apr-jun/nab_becker**

For full coverage please visit:
www.IBM.com



The IBM @serverp5 systems revolutionize IT economics with lightning-quick POWER5™ processors and IBM Virtualization Engine™ options that can help ease administrative burdens and increase system utilization and performance.

New Innovative Features From IBM

IBM Virtualization Engine systems technology options are opening the door to exciting new possibilities for server consolidation.

- Micro-Partitioning™—Allows the creation of highly granular dynamic logical partitions or virtual servers as small as a tenth of a processor with increments of 1/100th of a processor
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- Virtual I/O—Supports sharing of physical disk storage and network communications adapters helping reduce the number of expensive devices and improve system utilization and administration
- Virtual LAN—Allows high-speed, secure partition-to-partition communications to help improve performance

Powered by IBM's most advanced 64-bit microprocessor, POWER5, the eServer p5 systems are up to the task of driving business transformation in today's on demand world. The POWER5 processor is designed to deliver extraordinary power and reliability.

- The new chip includes simultaneous multi-threading which makes each processor look like two to the operating system, increasing commercial performance and system utilization over servers without simultaneous multi-threading capabilities.

Full Article is available at www.IBM.com

2004 ANSYS – CHINA Conference

http://ansys.com.cn/conference/con_2004/index_en.php

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&
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(Listed in Alphabetical Order)

www.amd.com

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China	**MSC. Software – China** **www.mscsoftware.com.cn**
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Germany	**Dyna*More*** **www.dynamore.de**
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India	**Altair Engineering India** **www.altair.com**
Italy	**Altair Engineering Italy** **www.altairtorino.it**
Italy	**Numerica SRL** **www.numerica-srl.it**
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Taiwan	**Flotrend** **www.flotrend.com.tw**
USA	**Altair Western Region** **www.altair.com**
USA	**Engineering Technology Associates** **www.eta.com**
USA	**Dynamax** **www.dynamax-inc.com**
USA	**Livermore Software Technology Corp.** **www.lstc.com**
USA	**ANSYS Inc.** **www.ansys.com**
UK	**Oasys, LTC** **www.arup.com/dyna/**

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USA	**Dr. Ted Belytschko**	**Northwestern University**
USA	**Dr. David Benson**	**University of California – San Diego**
USA	**Dr. Bhavin V. Mehta**	**Ohio University**
USA	**Dr. Taylan Altan**	**The Ohio State U – ERC/NSM**
USA	**Prof. Ala Tabiei**	**University of Cincinati**
USA	**Tony Taylor**	**Irvin Aerospace Inc.**

Informational Websites

FEA Informational websites	**www.feainformation.com**
TopCrunch – Benchmarks	**www.topcrunch.org**
LS-DYNA Examples (more than 100 Examples)	**www.dynaexamples.com**
LS-DYNA Conference Site	**www.ls-dynaconferences.com**
LS-DYNA Publications to Download On Line	**www.dynalook.com**
LS-DYNA Publications Index	**www.feapublications.com**
LS-DYNA Forum	**http://portal.ecadfem.com/Forum.1372.0.html**
LS-DYNA CADFEM Portal	**http://www.lsdyna-portal.com**

www.feainformation.com
News for June Archived on Site & Events

June 7	**MSC.Dytran**
	The Japan Research Institute
	Distributor – Russian - Strela
June 14	**SGI InfiniteStorage Data Lifecycle Management Server**
	ETA – FEMB
	Distributor – Taiwan - Flotrend
June 21	**Oasys and Arup**
	HP workstations
	Distributor – Germany - DYNAmore
June 28	**The Intel® Itanium® 2 processor**
	Fujitsu's PRIMEPOWER servers
	Distributor – Italy – Altair Italy

2004	Events & Announcements
Sept. 7-9	**The Seventh International Conference on Computational Structures Technology, Lisbon, Portugal**
Sept. 21-22	**2004 Japanese LS-DYNA Users Conference hosted by JRI, will be held at Akasaka Prince Hotel in Tokyo.**
Sept 21-23	**ANSYS CHINA - Annual User Conference**
Oct. 11-12	**The Nordic LS-DYNA Users' Conference 2004 will be held at Quality Hotel 11, Goteborg**
Oct.14-15	**3rd local LS-DYNA Conference - Bamberg, Germany sponsored by DYNAmore**
Oct. 18 - 20	**MSC.Software's 2004 Americas Virtual Product Development Conference - October 18 - October 20 2004 Hyatt Regency Huntington Beach, CA, USA**
Nov 10-12	**22. CAD-FEM Users' Meeting 2004 - International Congress on FEM Technology & ANSYS CFX @ ICEM CFD Conference**
2005 & 2006	
May 25-26, 2005	**5th European LS-DYNA Conference - The ICC, Birmingham UK**
July 25-27	**8th U.S. National Congress on Computational Mechanics – Austin, Texas**
June 3, 2006	**9th LS-DYNA International Users Conference – Dearborn, Michigan**

http://www.fujitsu.com/

Fujitsu Limited

Fujitsu Unveils New PRIMEPOWER Models, World's First UNIX Servers Using 90-nm Technology

Latest SPARC Processors Deliver World's Highest Performance in Java Applications

Tokyo, June 22, 2004 — Fujitsu Limited today announced the launch of five new high-end and mid-range models in its PRIMEPOWER server lineup. The new products incorporate 1.89GHz[(1)] SPARC64™ V processors based on 90-nm semiconductor technology, offering a dramatic improvement in performance. The new models represent the world's first use of 90-nm technology in UNIX® servers.

The new PRIMEPOWER models continue to offer the superior reliability and scalability of previous models while delivering greatly enhanced performance. PRIMEPOWER servers are ideal for mission critical environments, creating new value for customers and enhancing their global competitiveness. The new models are being launched globally today through Fujitsu Limited in the Asia/Pacific region as well as Fujitsu Siemens Computers in Europe, the Middle East and Africa, and Fujitsu Computer Systems in North America.

Today's IT systems must offer superior reliability and be able to rapidly respond a variety of peak demand situations on a 24/7 basis.

MSC.Dytran Simulation of a Shaped Charge Penetrating Two Thick Plates

(Multi-Material with Strength Euler solver)

Peiran Ding
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Ann Arbor, Michigan
peiran.ding@mscsoftware.com

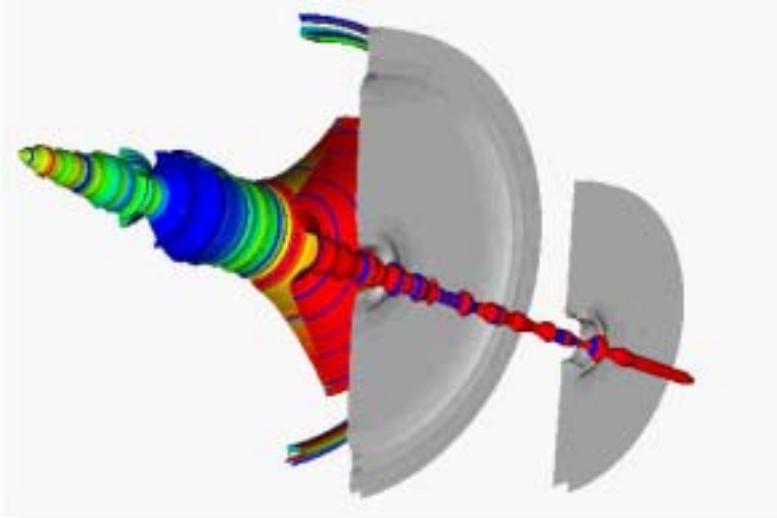

Image: Courtesy of CEI/Ensight

1. Problem Description

When a metal cone is explosively collapsed onto its axis, a high-velocity rod of molten metal, the jet, is ejected out of the open end of the cone. The cone is called a liner and is typically made of copper. The jet has a mass approximately 20 percent of the cone mass, and elongates rapidly due to its high velocity gradient. This molten rod is followed by the rest of the mass of the collapsed cone, the slug.

Typical shaped charges have liner slope angles of less than 42 degrees ensuring the development of a jet; with jet velocities ranging from 3000 to 8000 m/s. With larger liner angles, e.g. greater than about 60 degrees, a self-forging fragment is developed, and it is uncertain whether any jet will form.

A typical construction of a shaped charge is shown in Figure 1 [1]. The charge has a cylindrical construction with two dimensions as shown in the figure. An aluminum casting is provided to contain the explosives. A detonator is fitted at one end of the casting and a conical copper liner is fitted at the other end with the explosive in between. The liner angle is 42 degrees and its thickness is 1909mm. An aluminum retaining ring is fitted to retain the liner in its position.

When the explosives are detonated, the explosive pressure on the outside of the liner causes the conical thin wall to move inward at a high velocity nearly perpendicular to its surface. The moving liner material retains a conical shape with the apex moving away from the explosives. Very high

pressures are developed in the liner material at the apex. Behind the apex, a mass of collapsed cone containing material from outer cone part follows the apex and travels at a high velocity along the axis.

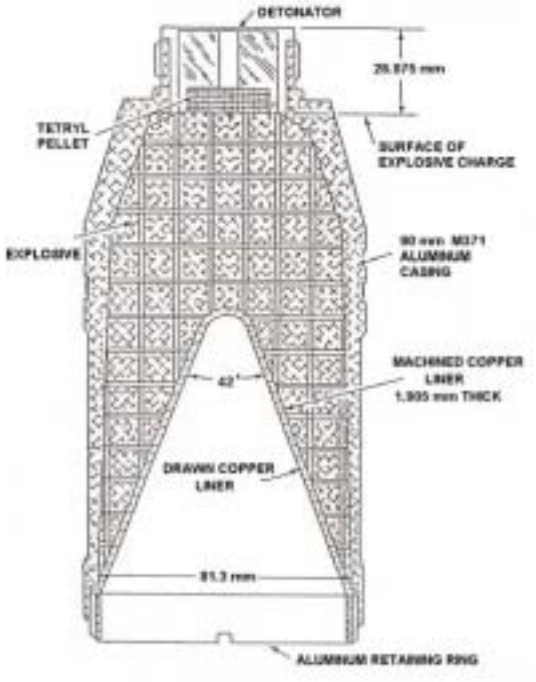

Figure 1 A Typical construction of a shaped charge

2. Numerical Simulation

In design of shaped charges, it is very important to obtain information on the influence of liner and casing geometry, and the material properties of casting, explosives and liner on the jet shape, mass and velocity. Numerical simulation can help obtain such information while drastically reducing the need for experimental work.

An example simulation of shaped charge formation is carried out to demonstrate the ability of MSC.Dytran to perform such a simulation. A simplified axisymmetric model of explosives and a copper liner is created in a finite volume Euler mesh. Explosive are detonated starting from a point on the axis of symmetry at the end of the explosives. The simulation is carried out for 60 μs after detonation of the explosives. The jet is formed and penetrates two thick plates. Figure 2 shows the model layout.

Typical shaped charges are axisymmetric. However, aiming at higher velocity, 3-D designs are targeted. 3-D simulation of shaped charge formation would be necessary to avoid excessive experimental work. MSC.Dytran has full abilities to perform such a 3-D simulation.

3. MSC.Dytran Model

The model is simplified as shown in Figure 2.

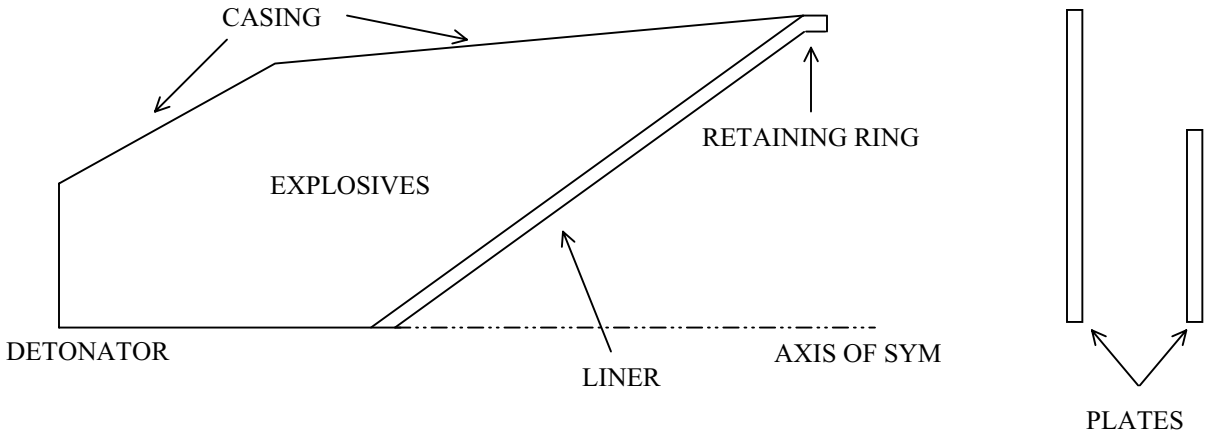

Figure 2 Dytran Model Setup.

A) Euler mesh and liner:

A triangular prismatic Finite Volume Euler mesh is used.

The liner is made of copper. It is very easy to define the shape and position of the liner within the Euler domain by using the method of geometrical regions when creating the initial conditions of the liner material.

B) Casting and retaining ring:

The casting and retaining ring are assumed to be rigid.

C) Plates:

Two thick plates are placed in this Euler mesh. Plate material is defined as steel. The shapes and positions of the plates are again defined by using the method of geometrical regions.

D) Explosive:

The explosive is modeled by Ignition and Growth equation of state (IG model).

The Jones-Wilkins-Lee equation of state is used in the ignition and growth calculations for both the un-reacted and the reaction products.

The explosive material is taken from the database that is build into MSC.Dytran.

4. Results

The figure below shows the initial position of the copper liner and two thick plates at 0μs, snap shots of liner collapse, jet formation and plates penetrated at 10μs, 20μs, 30μs, 40μs, 50μs and 60μs.

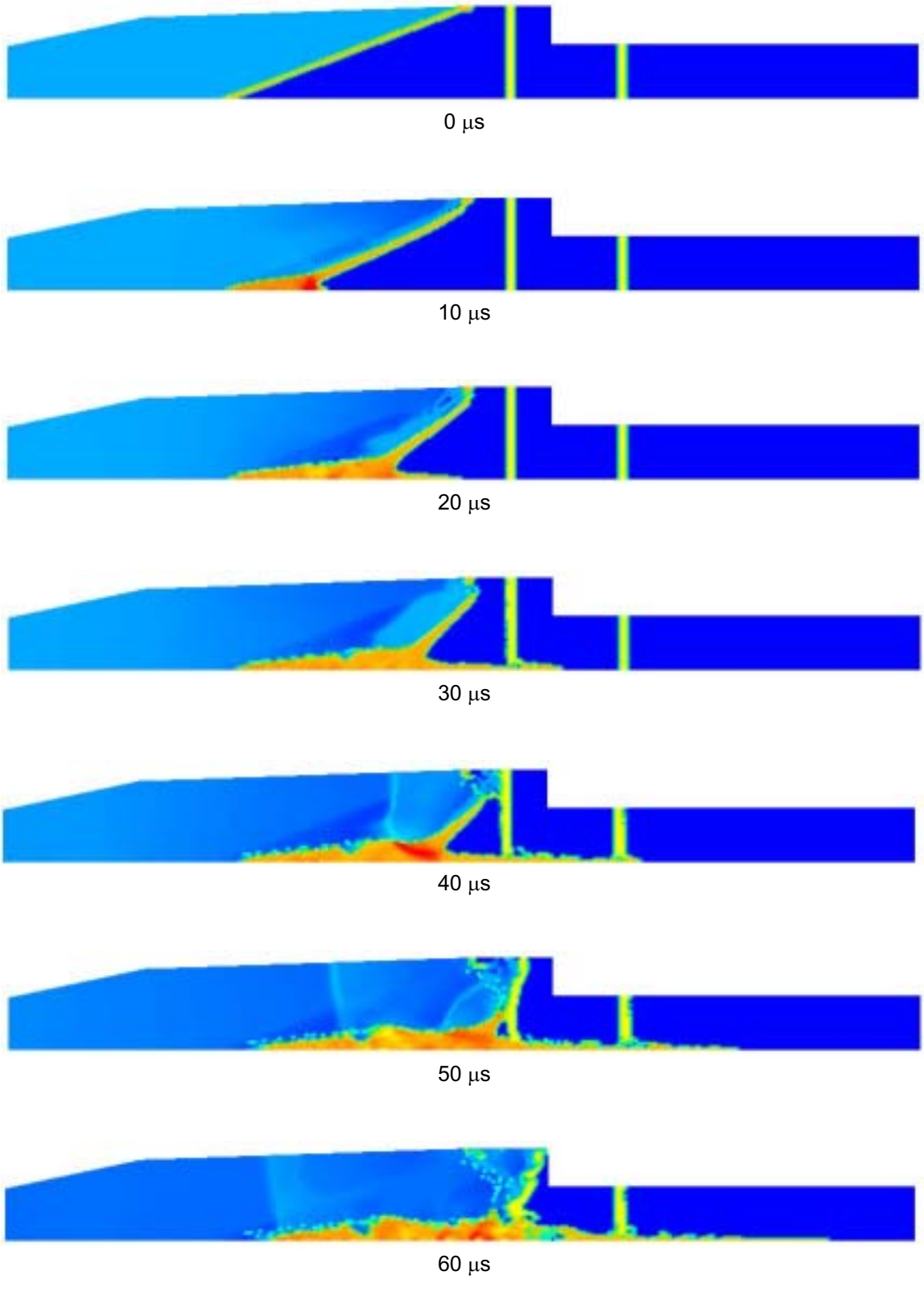

Figure 4 Initial position of the copper liner and two thick plates,

snap shots of liner collapse, jet formation and plates penetrated

(Courtesy – Post-processing by CEI Ensight)

Figure 5 shows the velocity field of explosive gases, liner and jet at 20μs. A jet velocity of about 6000m/s is achieved.

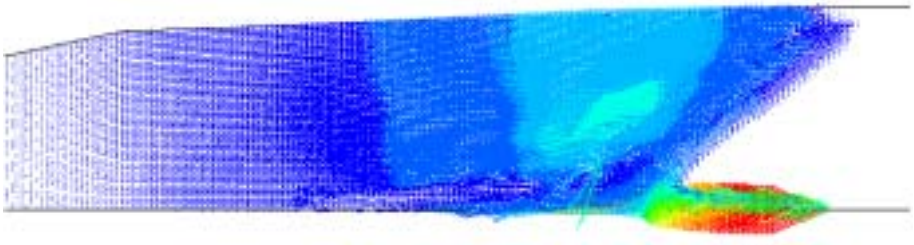

Figure 5 Velocity field of explosive gases, liner and jet

Reference

1) W.P. Walters and J.A. Zukas, “Fundamentals of Shaped Charges”, Wiley Interscience, 1989.