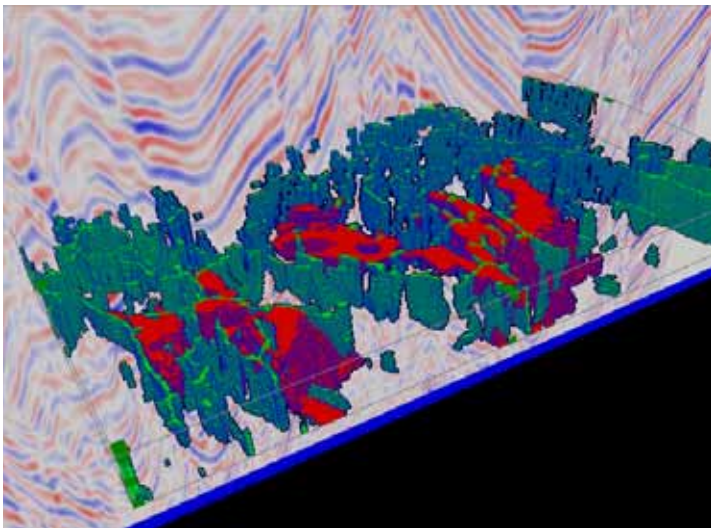
Society of Exploration Geophysicists Annual Conference and Exhibition
New Orleans, October 2006



Faults and amplitudes from ffA's SVI Pro[1]

The message from the SEG Forum was pretty much the same as that coming from the SPE ATCE (TW 0617) that took place the week before the New Orleans SEG. The Forum's focus was 'Energy's Future' and the discussion turned around non conventional reserves, renewables and all that. While this is a great subject, the geophysical content of non conventional is limited. The geophysical audience wanted to know what was in it for them. Not much apparently. One speaker suggested that geophysicists 'could re-train as environmentalists.' All of which contrasted somewhat with what was going on elsewhere in the conference and exhibition – which can be summed up with one word, 'Jack.'

OK there were big discoveries before Jack, but talk of a new sub-salt Gulf of Mexico play 'that could boost the nation's reserves by more than 50 percent,' has moved conventional oil and seismic prospecting back into the limelight. Suddenly all the fancy new imaging technologies, and there are many, have found their justification and more. Acquisition fold and data volumes are rising constantly, shooting patterns are getting exotic, for instance with WesternGeco's wide/rich azimuth surveys and a proposed return to 'over and under' shooting.

The picture is the same on the processing front with under funded R&D programs into seismic wave equation migration getting more attention (see our report from Ebb Pye's Visualization Theatre Academic Session. Pre stack wave equation migration on huge data volumes stress compute resources leading to more esoteric technologies like processing data on GPUs. And computing resources are being re-evaluated along the lines of, as BP's John Etgen says 'processing these data volumes involves buying whatever [hardware] it takes.' Dodd's stuff on Exabyte scale. Also the SEG modeling project is getting some (but likely not enough) attention.

A seismic processing moves from its 'embarrassingly parallel' mode that was well suited to cluster based processing to jobs that require more and more memory, the seismic processor's needs are now similar to the reservoir engineer's. Users clamor for bigger 'traditional' large memory systems that expose a robust, bug-free compiler (any language will do so long as it's Fortran). But such systems are almost a thing of the past. Instead, the IT industry offers vast arrays of clusters exposing complex, dispersed memory, storage and interconnects. All of which is addressed through a proliferation of optimization tools and more or less shaky compilers!

The situation at the workstation is slightly out of sync with this upscaling of acquisition and processing. While acquisition hardware is moving to the 'petascale' cluster, interpretation has downsized to the PC (albeit with the possibility of adding on some rather fancy visualization hardware). Interpretation methods are likewise being tested to the limit. On the one hand, there is the realization that seismic contains a huge amount of information about fractures, fluids and more. On the other hand, there is no accepted way of managing and working with the new volumes. This can cause serious problems as one major company was reported to have no less than 1200 different versions of the same seismic data cube! Many companies are offering more or less domain-savvy storage and archival solutions to manage the exploding data volumes. Tackling the problem earlier on in the food chain is also a possibility for instance, as Paradigm's marketing material has it, 'Why not routinely convert seismic cubes into meaningful reservoir property volumes?'

[1] *Image courtesy Foster Findlay Associates.*

Geophysics has an unlimited appetite for science and particularly for scientific computing. High oil prices and the discovery of huge oilfields on the industry's doorstep in a technically challenging environment has put the industry onto a war footing.

Highlights

'Academic Session' on Algorithms and Computer Technology

De Groot-Bril OpendTect Seismic Stratigraphy Interpretation System

SEG Advanced Modeling Consortium

EarthVision CoViz vendor-independent data browser

Petrel Plug-ins from Ikon and FineTooth

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Technology Watch subscription information

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TW0618_1 Ebb Pye's Visualization Theatre Sessions

0618_1.1 Algorithms and Computer Technology 'Academic Session'

Paul Sava – Colorado School of Mines, 'petaflops, RTM and WEM'

Sava set the scene with a reminder of the tradeoff between Moore's Law and Amdahl's Law which places a theoretical limit to computing speedup that can be expected by parallel processing across multiple cores. Processor speeds have flattened off and we no longer expect a processor that is 10 times faster. But we do expect 10 times as many processors and this affects how we code for processing and visualization. The high performance computing industry is moving to petaflop machines, putting huge compute power in the hands of both industry and academia. GPU computing is also a promising development.

Problems in wave equation modeling (WEM) that can be addressed include elastic and anisotropic wavefields. Reverse time migration is a reality. Inversion gives amplitudes and rock properties corrected for illumination etc.. Wavefield velocity estimation, tomography and passive imaging aka 'seismic interferometry' all generate huge data volumes. One WEM example involves reconstructing source and receiver wavefields – manipulating very large data volumes. When you cross correlate two 4D wavefields you get a very big multi dimensional field. In conventional imaging, most of this information is dumped. Using more of this information is the way forward – and the subject of Sava's paper, Time shift imaging for converted waves.

Art Weglein – University of Houston M-OSRP, 'seismic group therapy!'

Weglein's Mission-Oriented Seismic Research Program (M-OSRP University of Houston) is responding to pressing seismic E&P challenges which require acquisition, computational and algorithmic advances. When industry went to deepwater, demultiple came to fore but this is usually addressed by simplifying acquisition or other processing work-arounds. In the context of wider azimuth and finer sampling, Weglein cautioned that 'no current migration algorithm will correctly model a flat bed beneath a sphere.' Inverse scattering techniques as practiced by the Delphi Consortium and the M-OSRP are promising. But Weglein was most enthusiastic about the possibility of seismic inversion without velocities. This is a 'controversial thought' because previous attempts (notably by Albert Tarantola) failed as they lacked low frequency content. Weglein suggests a method that should work with band limited data. The model starts with water velocity, and events 'talk' to each other – a form of 'seismic group therapy.' A 'closed form' processing technique using Fang Liu's multi-agent genetic algorithm goes straight from recorded data to the depth model.

Earl Dodd – IBM, 'in search of petascale computing'

National Oil Companies today own a quarter of the cluster base[2]. Commodity Linux clusters are deployed for all applications, notwithstanding Microsoft's 2006 HPC push. Microsoft's goal is to 'take over the world.' We will see how they do in petascale computing! Clusters have 'repealed' Moore's Law. Today oil and gas HPC is the second industry to government spy satellites etc. While oil and gas is 'petabyte scale,' spies work with exabytes of satellite data. Data growth is currently 100% annual – making for huge storage requirements. Same issues with 100 million cell models. Cluster 'fuel efficiency' is important (cooling systems, floor space etc.) The need for speed is shown by the 45 petaflops required for the M-OSRP seismic experiment above. The intelligent oilfield will require 1.7×10^{21} Flops[3] (beyond petascale). Even Wal-Mart is buying and implementing multi petascale computing[4]. Data is to grow from Exa, Zetta to Yotta byte and '64 bit file systems will be a thing of the past in 4-5 years[5].' Power issues may mean 'the end of scaling as we know it.' Matching algorithms to fast evolving hardware like multi cores and GPUs is where it's at – possibly by 'virtualizing everything.' Average resource utilization in E&P is about 15%. This is expensive as companies buy for peak usage. On the topic of new parallel languages Dodd recalled Seymour Cray's maxim 'whatever the language of the future will be, it will still be called Fortran.'

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[2] *Not sure if this is the cluster base in oil and gas or of the world total.*

[3] *Not clear how this rather precise number was arrived at!*

[4] *See Oil IT Journal Vol. 11 N° 6.*

[5] *A bold and rather unlikely prediction!*

Ted Barragy – Intel, Top500 supercomputing list[6]

Barragy commented on the Top500 list of HPC installations. The N° 1 spot should pass the petaflop mark by 2009. Note that it takes only 8 years from being N° 1 to disappearing off the bottom of the list. Next year's 'big thing' (from Intel?) is a 4x Infiniband optical cable offering a 100 meter 5GB/s interconnect.

John Etgen – BP, HPC for Wide Azimuth Towed Streamer (WATS) seismic

Survey design for BP's wide azimuth towed streamer (WATS) survey was done on its in-house HPC cluster. The WATS meant that BP had spent $100 million on 'on a scientist's hunch' and needed rapid feed back from survey to check that everything was working. This meant processing in near real time. BP's HPC installation is not run like a contractor's shop, 'We don't use computers to print money – that's your [the contractors] game.' For BP, 'it is important to have idle cycles – we need to be ideas-limited not compute-limited.' Etgen likes big memory machines and is 'not interested in PlayStation IIIs.' In fact Etgen would really like a 'traditional' supercomputer – except they don't exist any more. So BP's own HPC has been configured to be as near as possible to a big memory architecture. BP also needs flexibility – the ability to 'throw away' a big migration job. Returning to the WATS survey – Etgen stated that the minimum fold achieved around the Mad Dog spar was 250, with most survey at 1000 fold. The survey shipped another 'couple of petabytes' last week – processing these data volumes involves 'buying whatever it takes.'

Discussion

People issues

It is a big challenge to find people who know about both geophysics and computing.

People with good skills in either IT or geophysics will be hired especially if they show good-cross over potential.

Dodds complained that industry has not got together with academia to develop such specializations.

There is a problem with HR departments which want a tight job description. We also suffer from 'expert cultures'.

Etgen – People don't have the skills that they had in the late 80s and 90s.

Technology

Weigen – A long time ago we ran a single 2D pre stack migration and smoke came out of the machine! Today we have figured out what to compute before a machine to run the code has even been built.

We need programming tools that simplify parallelization and make jobs scalable across big computers.

Etgen – Almost everything in seismic is memory bound – so the more memory the better. Things were more straightforward in the old days of the Cray. Today if you want to do a 4k x 4k x 4k FFT this requires massive amounts of memory. There is a tension between these large memory requirements and the COTS[7] community.

The number one issue is that the tools aren't there (for HPC on multi core etc.). What are we doing about it?

Barragy – 20 years ago one company claimed to have an optimizing paralellizer.

Etgen – You're probably referring to CM Fortran which went out of business with the demise of Thinking Machines. But the problem today is that Intel is not a really a compiler company.

0618_1.2 Volume visualization in Petrel – Mike Heck, Mercury Computer

Visualization of large E&P data sets doesn't require a supercomputer. Schlumberger's Ocean framework means it's possible to write extensions to Petrel. Mercury's OpenInventor graphics toolkit was used to develop a 3D visualization engine for Petrel, Ocean, Eclipse and Geoframe (other customers include Landmark, Paradigm and SMT). OI is now available as the 3D component of SIS' Ocean framework. Components include VolumeViz for large dataset visualization, MeshViz for meshes and ScaleViz which uses clusters for rendering and immersive virtual reality. Mercury is also partnering with IBM on a Cell BE-based supercomputer which promises 16 TFLOPS in a 6 foot rack. Another demo involved a 125 GB SisMage (Total) dataset. VolumeViz takes advantage of multi core CPUs and GPUs for bump mapping and illumination – both techniques 'stolen' from gaming. Heck showed a demo of a 25 gigavoxel dataset on laptop with 1GB memory and 500 MB texture memory. More from www.mc.com.

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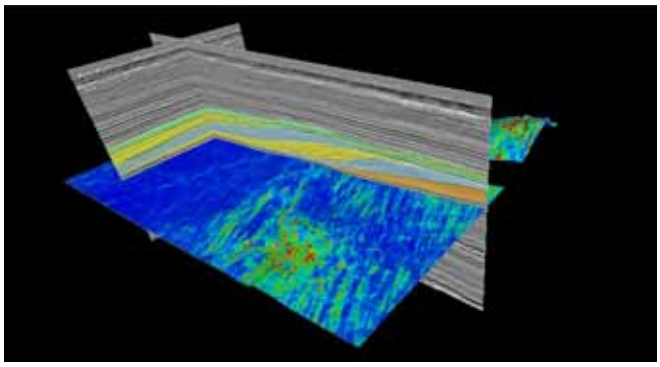
[6] *www.top500.org*.

[7] *Common off-the-shelf hardware – i.e. PC-based clusters.*

0618_1.3 HueSpace 2 – Diderich Buch

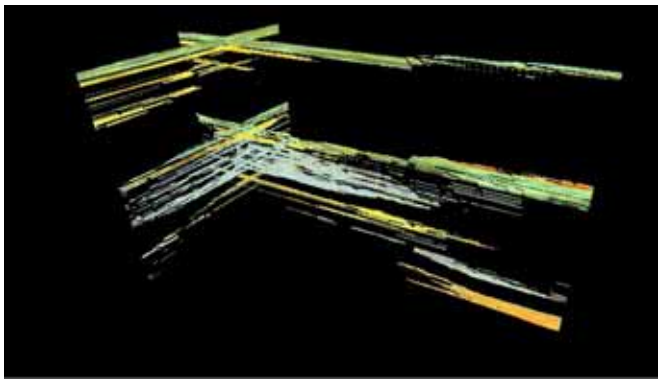
HueSpace 2 is used in Petrel 2007[8] and by Finetooth for pre stack data visualization. The terabyte Southern North Sea dataset from PGS was compressed to 24 GB on an HP workstation and NVIDEA card. 'You don't require clusters – use the GPU as a computational engine.' Hue delivers an SDK[9] with a prototyping interface. Virtually any shaped cursors can be deployed with holes etc. Other tools include a curious magnifying glass with a variable transfer function. www.huespace.com.

0618_1.4 de Groot Bril – OpendTect Seismic Stratigraphy plug-in



High resolution depositional tract autopicking in SIS[10].

The OpendTect Seismic Stratigraphic Interpretation System fills a gap in today's workflows. de Groot quoted Peter Vail as saying, 'You never appreciate seismic stratigraphy until data has been mapped to a Wheeler diagram[11].' The SSIS takes a 3D seismic cube and applied 'dip steering' to track horizons and identify sequence boundaries. The tool provides autotracking of interior bed geometry and autodetection of unconformities.



The same data displayed as Wheeler diagram.

Data is then flattened to Wheeler space. This allows, for example, a better understanding of porosity distribution in prograding and or fining up sequences. A time slice in Wheeler domain shows depositional features that are not visible in conventional time slices that cut through the structure. Phase I of the SSIS consortium is sponsored by Statoil, Shell, BG, TNO SenterNovem. http://www2.dgb-group.com.

TW0618_2 Papers of note

0618_2.1 SEG advanced modeling consortium – Bee Bednar, Panoramtech

The SEG consortium set out last year to build a 3D model in the style of the French Petroleum Institute's earlier Marmousi model. The project appears to be finding it hard to raise adequate funding for a useful model that is to allow for stochastic seismic facies that can be warped into structural section and mild near surface velocity variations. Model design is underway and model execution gurus are investigating the hardware required.

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[8] *Hue Space 1 technology was embedded in Schlumberger's GigaViz.*

[9] *Software development kit.*

[10] *Image courtesy de Groot Bril.*

[11] *The Wheeler diagram shows sediment deposition in space with geological time as the vertical axis. Sequence stratigraphers find this display useful for the study of depositional tracts. See the AAPG paper by Treviño et al. and the (3MB) movie on http://strata.geol.sc.edu/movies/ChronoMovie.mov.*

Current thinking is for a 40km x 40km x 10 km (60 GOM Blocks) area with a memory requirement of around 256GB memory to run[12]. Costing an 8 cable survey over the model at 20 cent/flop/hour amounts to $2 million or 18 months of computing. The conclusion is that acoustic modeling is feasible but not elastic modeling. The consortium is now looking for cheaper FLOPs on GPU[13]s. The IBM Cell BE[14] promises a 460 GFLOP peak – models could run in 4 days. PGS, BHP Billiton, Total, CGG, Shell, Halliburton, Exxon, WesternGeco have all put $50k in the pot.

0618_2.2 Monitoring and modeling production-induced surface deformation.

Geodetic measurement over PDO's Yibal field, Oman showed a 45 mm/year subsidence from 1999 to 2006. Wells traverse a compacting gas layer, some damage has been observed already and Shell's models predicts more. PDO is looking for cheaper alternatives to geodetic measurement and is testing a GPS survey at 50 sites. High accuracy GPS receives cost about $10-20k although these are getting cheaper. The survey deploys 8 receivers, some fixed, some mobile. Trimble NetRS receivers link to the PDO WAN. The system has been in operation since 2003. RMS error around 2-3 mm. Results (GPS) show subsidence of up to 50mm/year (+/–3mm) and horizontal movement towards center of subsidence of a few mm/yr. Also ran InSAR[15] deformation measurement. A section across the field shows the fault responsible for the deformation.

TW0618_3 SEG Forum – Russ Ford, Shell Americas

Today's high oil price has brought unprecedented high costs investment levels but the 'easy oil' is gone and the remaining conventional oil and gas won't satisfy future demand. There is an 'absolute need' to develop unconventional resources. We know where they are located. Worldwide there are around 14 trillion (Gbbl.) barrels with Canada 1.6 Gbbl., US 2 and Venezuela 1.3. A huge potential if they can be extracted economically and in an environmentally acceptable way. In 15 years time they may amount to 35% of world oil supply. Shell is projecting 155k bbls/day from its Athabasca development, rising to 250 k bbls/day by 2010 with an 'aspiration' of 550k bbls/day from a resource base of 6.5 billion barrels.

Another technology under study is the in-situ conversion process (ICP) which enhances the natural maturation of kerogen by slow heating. No mining is required. Other non conventional projects include liquefied natural gas (**LNG**) which could meet 20% of the world's gas demand by 2020 (Shell has around 40% of world LNG capacity with 11 new LNG trains built from 1999-2005). Also ran – Shell's Qatar North Field gas to liquids (**GTL**) project (3 billion boe reserves and 2 x 70 kb/d GTL trains). **Clean Coal** technology is under test at the Buggenem power plant in the Netherlands with a 15% reduction in CO2 production. **Biofuels** are set to grow to 7% of road transport fuel volume in 20 years.

Q&A

What about the politics?

In Fort McMurray, CA there are 'people problems.'

What is the role of geophysics?

In unconventional gas, geophysics can help understand complex reservoirs such as the fractures and karsts of the Fort Worth basin.

Will there be a large scale return to coal?

Today this is very capital intensive. But there has been great take up of clean coal technology in China with a 15-20% emissions reduction.

What are key technologies for Shell?

Deepwater production, heavy oil.

What is your position on CO2?

The debate is over regarding CO2's contribution to global warming. We are still looking to improve our CO2 footprint in Shell. At today's oil prices, CO2 injection is viable and is happening.

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[12] *This is to be compared with the National Space Development Agency of Japan's Earth Simulator. This requires 3 Megawatts of power 'it doesn't just simulate global warming, it causes it!'*

[13] *Graphics processing units.*

[14] *The Cell Broadband Engine is used in the Sony PlayStation III.*

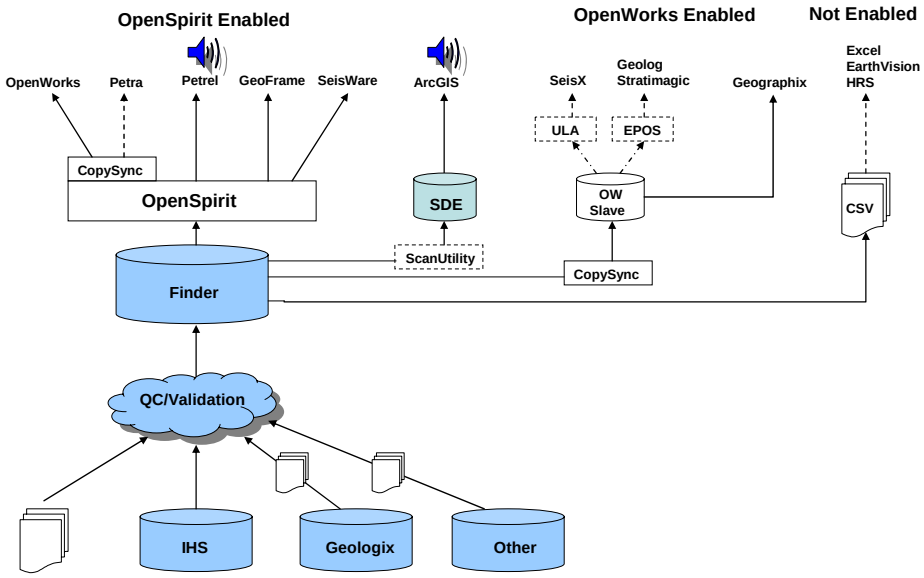
[15] *Interferometric synthetic aperture radar.*

TW0618_4 Exhibitors

0618_4.1 EarthVision – CoViz vendor independent visualizer

EarthVision has released CoViz a vendor-independent browser/viewer for seismic, well and reservoir simulation data. Queries from within the viewer can retrieve core data, well test reports etc. CoViz lets geologists, and reservoir engineers access services and other discipline's data without knowing where it is. Earth Vision wants CoViz to become everyone's 'second viewer' for checking to see if the 'other world' confirms their interpretation. Data goes through a Data Registry where domain specialists can post their key models. Pre-programmed demos can be run and interact with live data. Runs on Linux/Windows or both. We watched a demo on the Aviemore field (UK N. Sea) showing sea bed facilities in wire drawing with life of field seismics. Annotations can be made during a meeting and stored for subsequent re-play. BP has a corporate license for CoViz which it has been using for one and a half years. The viewer and relevant data can be decoupled from the original data sources and taken into the field or for a partner meeting. www.earthvision.com.

0618_4.2 eDecisions (on Open Spirit booth) – IM Best Practices, Mark Chidwick



IM setup for trustworthy data[16].

Chidwick reported on a data management project performed for a large Canadian independent operating a 1,200 wells per year drilling program. The aim was to 'automate processes and make life better for users.' The operator was having problems keeping data in applications up to date and was experiencing issues with QC of data from vendors which was error prone, leading to a lack of trust in data. The solution was to build trust through data governance – the company appointed a full time data custodian. Schlumberger Information Solutions (SIS) ProSource was configured to apply business rules, for instance to check that bottom hole coordinates agree with the last point in the deviation survey. Data coming in from vendors was moved into SIS' Finder which has a 'rich set of business rules for maintaining data quality.' Data was made visible to applications via Open Spirit. Interpretation results fed back to data validation and stored in Finder. Petra and Petrel are the main interpretation applications – ArcGIS and SDE are also deployed. CopySync pushes data to OpenWorks which is accessible to non OS-enabled applications like Epos (Paradigm – 'until they join the OpenSpirit club'). The results of the pilot IM program were that costs were reduced. The 40,000 well database is now managed and QC'd by one person (down from 4). There was also more confidence in data and business decisions. Geotechs now take 20 minutes to build a project – down from 20 days! Now geoscientists and engineers can build their own projects. Open Spirit connectivity 'was easiest part of project.' www.chidwick.ca/edecisions/.

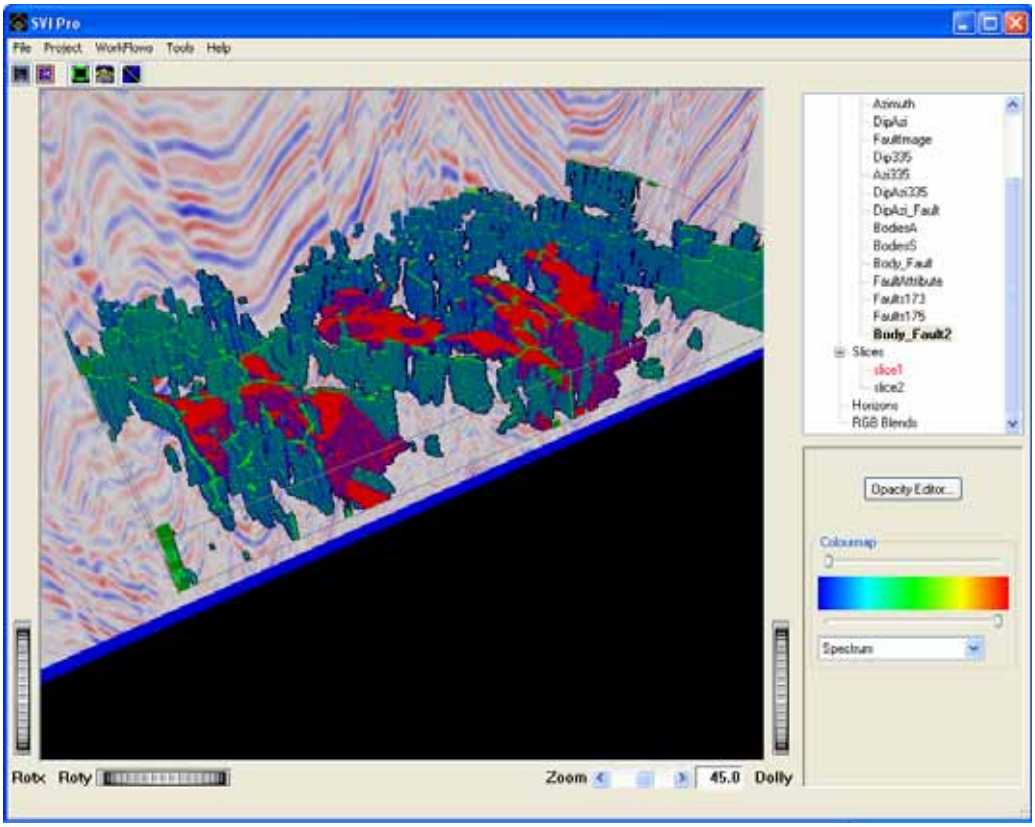
0618_4.3 Enigma Pars 3 archival system

Enigma's Project Archival System PARS has had a major upgrade with a re-write as a Java-based, cross platform tool. PARS 3 archives Kingdom and Petrel projects at project milestones. Project snapshots are captured to the

[16] *Graphic courtesy eDecisions.*

PARS database along with project metadata. PARS also produces corporate thumbnails of OpenWorks projects. www.enigmadata.com.

0618_4.4 FFA - Hydro SVI Pro AVI toolset



SVI Pro composite structural and stratigraphic volume displays faults and amplitudes[17].

Foster Findlay Associates' SVI Pro v2 is due for release early 2007. SVI Pro enables rapid data screening and facilitates delineation of significant geological features within 3D seismic data. The results generated by SVI Pro can be directly integrated into seismic interpretation, 3D modeling and well planning workflows. The package includes frequency decomposition, RGB blending and segmentation developed and tested in collaboration with Hydro. Measurement tools compute volume, surface area and principal lengths of geobodies or area of interest for connectivity studies and reservoir evaluation. A DHI[18] tool detects changes in seismic response with time or depth that may be associated with a fluid contact. www.ffa.co.uk.

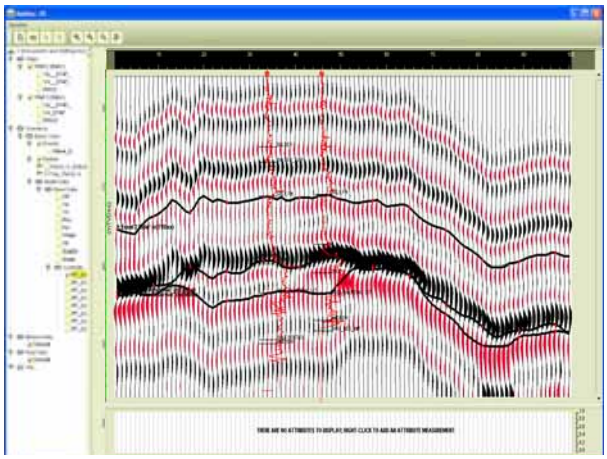
0618_4.5 Finetooth – Prestack plug-in for Petrel

Finetooth (which is changing its name to HeadWave) is offering pre-stack interpretation of data in Petrel. Finetooth uses graphics processing units (GPU) rather than clusters to compress data on the fly. A terabyte of data compresses to 50GB. Finetooth claims that 4 fold, loss-less compression is achievable. Data is compressed and decompressed with Hue Space's technology before blending with Petrel's OpenInventor canvas. Pre-stack data maps into a 4D volume by extending from 2D line in cube. Picking the prestack can be done rather clumsily today – and the results passed to Petrel as a cube. But the tool is really designed to let users compute an attribute on the whole pre stack dataset. This is where GPUs are used for attributes analysis. Finetooth have found the Ocean development environment to be 'much more open than GeoFrame.' www.finetoothinc.com.

[17] *Image courtesy ffA, data courtesy of Seitel.*

[18] *Direct hydrocarbon indicator.*

0618_4.6 IKON – RokDoc as Petrel plug-in



Synthetic seismic created from Ikon's rock physics model[19].

Ikon Science and BG have been working with Schlumberger Information Solutions (SIS) to embed Ikon's RokDoc seismic modeling package within Petrel using the Ocean framework. RokDoc can be launched from inside Petrel with access via the Petrel user interface. www.ikonscience.com.

0618_4.7 Landmark – ezModel for field development planning

This demo showed how Geoprobe's new framework construction tools are used to clean up faults and horizons and export to Landmark's soon-to-be release 'ezModel' earth modeler. Build earth model and pick up in Decision Space Asset Planner. Simulator results from this and other vendor packages can be compared in the Decision Management System to rank and rationalize partner well plans. 300 simulations showed that NPV[20] was independent of the number of wells – so drill few wells to minimize project risk. www.lgc.com.

0618_4.8 Net App – Data OnTap GX cluster storadge management

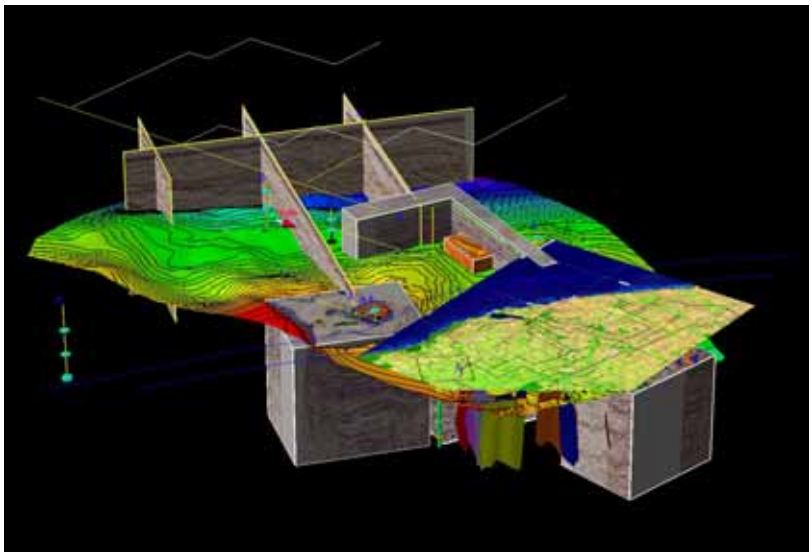
Linux clusters now dominate the HPC market. But they also create issues of CPU overload and 'disk full' warnings while other clusters may be idle. Performance demands stress traditional storage and there are problems with coordinating hardware from multiple vendors. NetApp's Data Ontap GX provides a single system image for 2-24 nodes with 6-8 GB/s reads in an integrated single vendor solution. The namespace can grow to petascale. Connections to the cluster are over gigabit Ethernet. 'Transparent' data movement relocates data to where it is needed according to project demand. Data can be replicated to read-only copies on other storage subsystems for performance. Multiple raid options include tiered storage with FiberChannel disks for performance and SATA for archive. Release 10.0 available today. www.netapp.com.

> *How do you arbitrate between data on disks in the cluster and on the GX system?*
>
> Today's clusters may have diskless clients. Anyhow, disks on clusters are usually just used for boot and scratch storage. Systems can boot from the GX and run diskless.

[19] *Image courtesy Ikon Science.*

[20] *Net present value.*

0618_4.9 Paradigm's Rock & Fluid Canvas 2007



Paradigm's Rock & Fluid Canvas 2007[21].

Paradigm's marketing literature asks the challenging question, 'why not routinely convert seismic cubes into meaningful reservoir property volumes?' This is the intent of Paradigm's Rock and Fluid Canvas 2007 and is part of Paradigm's attempt to 'get serious about integrating the macro realm of geophysics with the micro realm of petrophysics.' In other words – a move from G&G to G&P. RFC 2007 includes ten applications for seismic processing and imaging, interpretation, modeling and reservoir characterization. All tools in the suite are linked via Paradigm's Epos infrastructure. Integration with Open Spirit is not yet a 'done deal.' www.paradigmgeo.com.

0618_4.10 PeakStream Virtual Machine

ATI unit PeakStream was founded mid 2006 to develop 'stream computing' solutions that allow ATI graphics processors (GPUs) to work alongside CPUs to solve compute intensive calculations. A speedup of 20 fold is claimed for seismic imaging. PeakStream is also working on IBM Cell BE-based computing. The hardware uses existing development tools and also the Brook language from Stanford researcher Pat Hanrahan. A Fortran compiler will be available next year. PeakStream combines a runtime Virtual Machine (VM) and a suite of developer tool libraries and extensions running on top of RedHat Linux. The PeakStream VM interoperates with clustering and system management libraries and tools. www.peakstreaminc.com.

0618_4.11 Petris – Semantic Designer, Jeff Pferd

Petris has developed a patented 'dynamic, common to all' data model for integration. XSL mappings provide access to different vendor data sources. XSL has issues with hand programming and maintaining multiple point to point mappings. Enter Petris' Semantic Designer, aka the semantic manager toolkit. Pferd showed a screencam demo[22] of V1 of the Designer. Here an OpenWorks 2003 database load leveraged the Semantic Designer for mappings, parsing and business rules for null values etc. According to Pferd, this represents a 'step forward in standardizing taxonomies across the enterprise' and for accessing geotechnical data in different vendor data stores. Another functionality lets users add a variable – such as an attribute name, description or other variable type. www.petris.com.

Q&A

Where does the extra variable reside?

These variables are not stored – the functionality is used to create variables for data transfer.

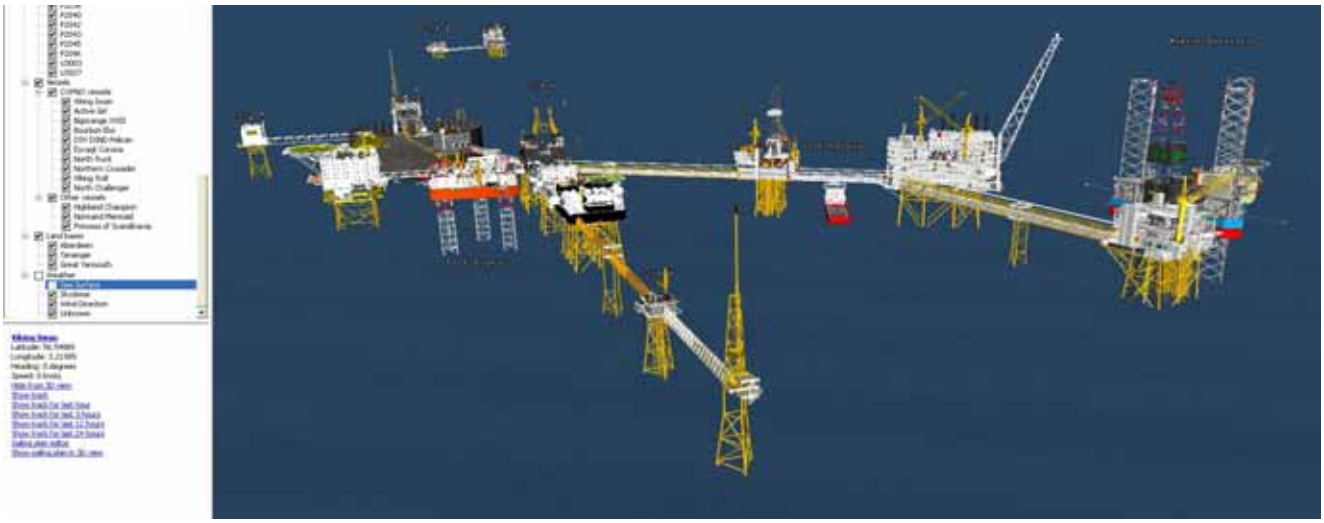
Are the POSC taxonomies used?

We use the PIDD and Schlumberger's taxonomies. The POSC glossaries would be useful in the system. It is just a matter of loading them to the common model.

[21] *Image courtesy Paradigm.*

[22] *Demo used screencam from www.smartguyz.com.*

0618_4.12 SIM real time marine traffic control for ConocoPhillips[23]



Real time operations tracking in VISPO 3D[24].

Norwegian System in Motion's (SIM) VISPO 3D Operations system is used by ConocoPhillips Norway to direct marine traffic around its Ekofisk field. Real time feeds from GPS receivers on vessels are combined with weather feeds, maintenance schedules, duty cycles and deck space limitations. Real time radar data of vessel movements is analyzed to update sailing plans. ETAs can be broadcast through SMS, fax or e-mail. www.sim.no.

Why QT?

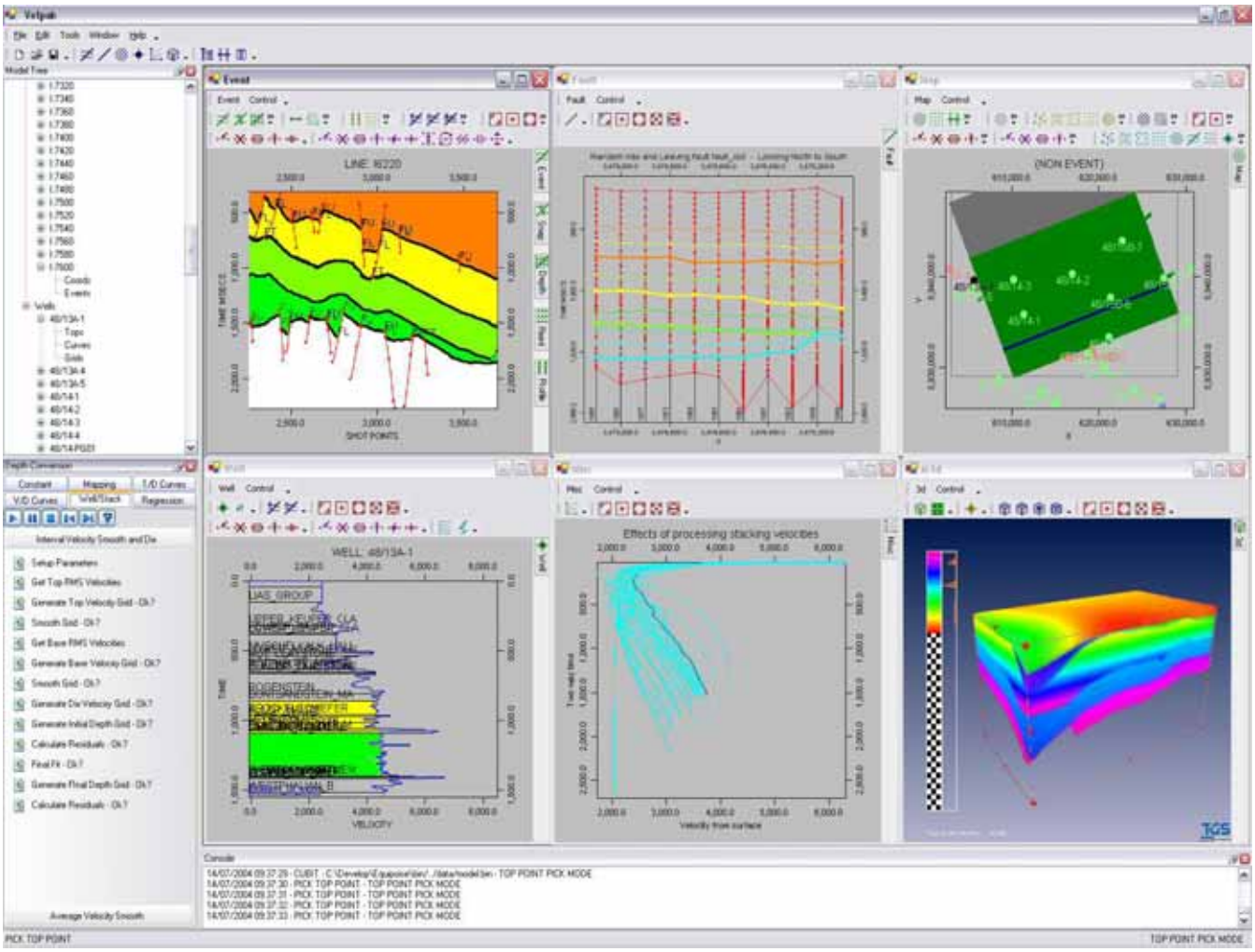
The development is Windows-only so far – but ConocoPhillips wants a Linux port at a later date.

(Trolltech) 50% of our clients use Qt on a single platform – they don't know what the future may bring! Anyhow, even Windows is not a 'single platform.' Google Earth is a QT app as is Skype. Our software is already running on Vista. In the upstream, INT is a major Trolltech partner. www.trolltech.com.

[23] *On Trolltech booth.*

[2424] *Image courtesy Systems in Motion.*

0618_4.13 SMT – VelPak module in Kingdom Suite

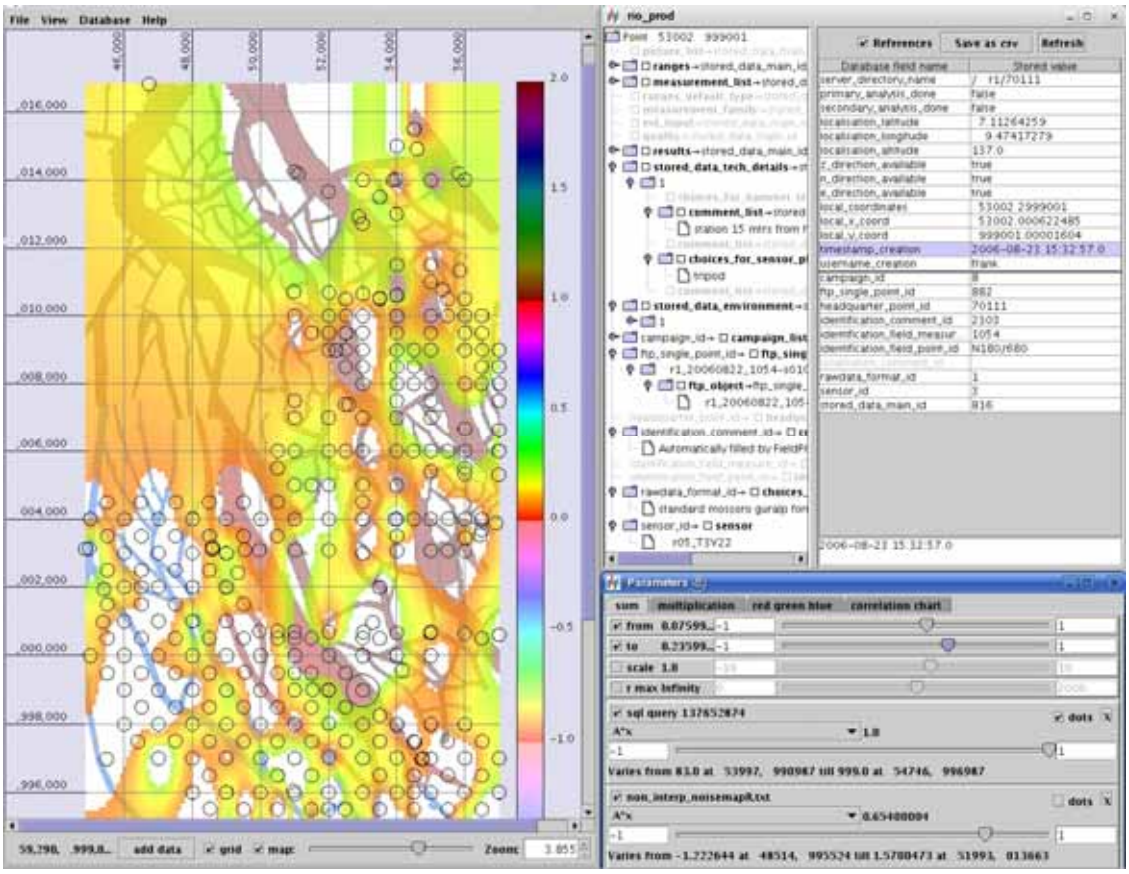


VelPak – SMT/Equipoise Software's velocity modeling Kindom module[25].

SMT was demonstrating the scalability of it Kingdom Suite seismic interpretation package with a 10 million trace survey (PGS' new Southern North Sea 'megasurvey'). SMT in conjunction with UK-based Equipoise Software has released VelPak (aka Scott Pickford's VelIT) an add on for time – depth conversion. VelPak uses stack and well velocities leveraging velocity guru Mahboub Al Chalabi's techniques. VelPak provides a quick look depth conversion with minimal user interaction. A sealed earth model of horizons, grids, and faults is used to generate a continuous volume of velocity data. The package allows for spatial variations in velocity within each layer. www.seismicmicro.com, www.equipoisesolutions.ltd.uk.

[25] *Image courtesy SMT.*

0618_4.14 Spectra Seis – HyMas passive seismic for low frequency component

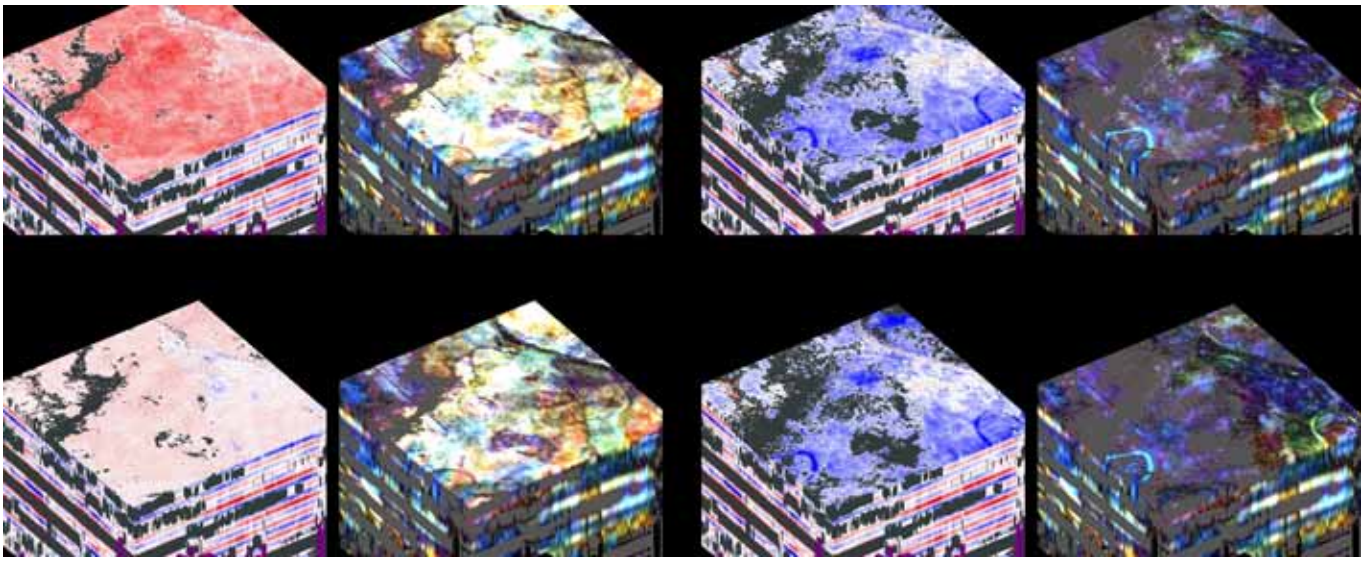


Spectraseis mapping tool for multi-attribute interpretation of passive seismic data[26].

Spectraseis' HyMas records passive, low frequency, multi component seismic data over a field. Spectraseis' RIO software is used to process and interpret survey results. Recording targets a 0.1-20 Hz frequency range. Currently the RIO package is sold as a service. But a mapping and geostatistical product is now available for interpretation and integration of HyMas survey results. Results of seven land surveys currently underway in Brazil, Mexico, Libya and Austria will be used to tune the company's algorithms before a potential market release of a processing suite next year. Shareholder Norsk Hydro has committed to a marine survey on the Norwegian Shelf in 2007. Passive seismic is the subject of an Aramco-sponsored EAGE workshop in Dubai in December. www.spectraseis.com.

[26] *Image courtesy SpectraSeis.*

0618_4.15 Stark Research/Fusion – Spectral decomposition in Wheeler space



Fusion's spectral decomposition in Wheeler space (Stark Research)[27].

Tracy Stark uses his seismic stratigraphic transform technique to map Fusion's Spectral Decomposition cubes into Wheeler space (geologic time as vertical axis). The idea is to be able to see unconformities etc. at very high resolution. The technique involves visually cycling through 1-100 Hz cubes and is highly dependent on the graphics hardware from TerraRecon. tstark3@attglobal.net www.fusiongeo.com.

0618_4.16 TeraRecon – new 'Falcon' graphics accelerator

TeraRecon's new 'Falcon' board, announced for Q1 2007, promises an order of magnitude improvement. TerraRecon eschews the cluster-based approach for visualization, preferring to add graphics accelerators to the PC. The flagship VolumePro card was released in 1999. Today this houses 4GB of texture memory – going to 8/16 GB in 2007. The VolumePro accelerator sits between the CPU and graphic card adding functionality for opacity, volume slicing and dicing. Used by SMT. www.terarecon.com.

0618_4.17 United Devices – Grid MP solution

United Devices Grid MP product virtualizes compute resources across workstations and clusters. Used by both Landmark and Schlumberger. Oil and gas companies have lots of under-used capacity and a requirement to better use resources across geotechnical and transactional computing. GridMP optimizes under-used seismic clusters. A 'meta scheduler' operates across heterogeneous grid schedulers including SGE (Sun), PBS Altair/Open Source, LSF and HP. The system can also integrate (transparently) with utility 'on demand' computing outside of the firewall. UD is an active member of the OpenGrid Forum. www.ud.com.

0618_4.18 WesternGeco – Rich azimuth towed streamer seismics

Egan gave an excellent analogy of migration/imaging of viewing a spoon in a liquid-filled chunky English beer glass. The distortion is analogous to that produced by the thick salt of the Gulf of Mexico. But imaging is about acquisition as well as migration. For proper target illumination, many azimuths are acquired. Egan showed the influence of updip and downdip acquisition. In an ideal world, one would shoot with a symmetric split spread, fore and aft. This is feasible on land or for OBC. In Marine there was some 'anti parallel' shooting in the 1990s but this was costly and inefficient. In the GOM, with its complex overburden, illumination studies are performed before a survey. Raytracing can simulate acquisition over different azimuths. The current technique is to add two more flank source vessels shooting inline and crossline. The shoot over BHP Billiton's Shenzi field was performed in a rotary star acquisition pattern. WesternGeco's Q systems steers the streamer and records during vessel turns. Rich azimuth and multi vessel operations has brought a 'huge improvement' in subsalt imagery. Wide/Rich also has higher population of large offsets so gets better multiple suppression. WesternGeco is now planning to combine these techniques with 'over/under' acquisition using two superimposed streamers to separate up and down going wave fields. www.westerngeco.com.

[27] *Image courtesy Stark Research.*

TW0618_5 Technology Watch subscription information

This report has been produced as part of The Data Room's Technology Watch reporting service. For more on this subscription-based service please visit the Technology Watch home page or email tw@oilit.com.

The Data Room
7 rue des Verrieres
F-92310 Sevres France

Tel (USA)	281 968 0752
Tel (UK)	020 7193 1489
Tel (France)	+33 1 4623 9596
Fax	+33 1 4623 0652

info@oilit.com.