

New Features T7.1 Release

CONTENTS

Introduction	2	2

Main Features

3D Stress Analysis System	. 3
Cell-Grid Property Modelling QC Tools	. 6

Usability Improvements

Intelligent Window Placement	9
Context Sensitive Help Access	10
Multi-Object Edit Sequential Colour Option	12
Volume Editor - Object Menu	13
T7-Control Menu - Colour Scheme Option	15
Well-Editor - Attribute Loading Filter	

Functional Enhancements

Horizon Data Interpolation	17
Use of Velocity Volumes For On-Demand Time/Depth Conversion	19
Time/Depth Conversion Using Mixed Domain Velocity Volumes	20
Time Depth Conversion Of "Active" Database Content	21
Creation of Well Time/Depth Curves from Velocity Volumes	22
ECLIPSE Cell-Grid Export - Filter Selection Option	23
2D Line Navigation Filtering	24
Extraction of Z-Values From Horizon Tri-Mesh Data	26
Editable Lithology & Reservoir Quality Names	27
Compression Option for 3D Seismic Volumes	28
2D Seismic Volume Header Editing Improvements	29
Seismic Slicer Windowed Sampling Options	30
Offset Utility Options For Arbitrary Axis Rotation	32
Create Well Horizon And Fault Picks In Volume Editor	33
Create Arbitrary Lines Along Wellbore Paths	34
Property modelling: creating facies proportion curves	35





Introduction

This document describes the new features and enhancements that make up the T7.1 release and differentiate it from the latest T7.0xx releases. T7.1 is distributed as a full release and cannot be installed over a T7.0xx installation as a patch. For a more detailed description of the new features please refer to the relevant sections in the T7 usermanual. This document and the end-user manual uses the term "T7" when referring to the current release version of the software.

Important Notes:

- 1) T7 license feature versions are "7.1". T7.1 will not function with a T7.0 (or ealier) license. Please send T7.1 license requests to support@badleys.co.uk.
- 2) T7 uses FlexNet 11.12 for its licensing. The installation will include the 11.12 version of the FlexNet license manager daemon.
- 3) Once installed, T7 will need to run a database upgrade on existing TrapTester projects. **Please backup you projects before using them with T7.1**. Once a project has been upgraded it will not be accessible using T7.0 or earlier.
- 4) After a project has been upgraded, the volume editor default shortcut file (defining hotkeys) will be replaced with a more fully featured set of hotkeys and shortcuts. The original shortcut definition file will be renamed to "default.tt6".



3D Stress Analysis System

A new scenario-based system has been added to T7 to allow for in-situ stress analysis using 3D stress fields; this supersedes the earlier 1D approach.



Stress Scenario Accessed From Database Explorer

A stress field, defined by a Stress Scenario, is used to calculate the resolved stresses on critical faults (*e.g.* a boundary fault containing a hydrocarbon reservoir) or fracture network surfaces and to analyse the likelihood of Slip and/or Dilation and hence the likelihood of seal failure and leakage. It is also possible to compute a Fracture Stability attribute for Horizon Surfaces. Analysis of Slip Tendency provides a way of assessing which faults are near the ideal orientation for slip and are therefore the most likely to be associated with increased fracture density and enhanced permeability, *i.e.* the higher the estimated Slip Tendency of a fault, the more likely the fault is to leak. Similarly the Dilation Tendency of faults is controlled by the resolved stresses at the fault surfaces (lithostatic, tectonic and fluid pressure) and the greater the Dilation Tendency of a fault surface, the greater its ability to transmit fluids or gas.

Prior to the 7.1 release, stress analysis in T7 used a 1D stress field whereby the component stress inputs only varied with depth. The 1D approach is still supported and any pre-existing stress-field data in the database will be converted to the new scenario-

NEW FEATURES

based system when a project is first opened in T7.1. The ability to construct a 3D stressfield is accomplished by defining the same 1D stress components along one or more wellpaths. The spatial position and trajectory of the well-paths provides the horizontal variation of the stress data.

T7.1 includes a new dedicated tool for defining the well-based stress data. The "Borehole Stress Editor" may be accessed through the Database Explorer or from the main T7 Control menu.

The Borehole Stress Editor

The Borehole Stress Editor enables the creation of "Borehole Stress" data that can be used in the Stress Scenario to define a 3D stress field. A Borehole Stress is essentially a set of stress "component" profiles (or curves) defined along a well path. The component profiles that are required are:

- **Sv** Vertical stress (average overburden pressure derived by integrating density logs + average sonic velocity from check-shot data)
- **SH** (or **SHmax**) Maximum Horizontal Stress (constrained by data from borehole breakout, induced fracturing & the world in-situ stress map- *Mueller et al., 2000*)
- **Sh** (or **SHmin**) Minimum Horizontal Stress (*e.g.* based on leak-off tests & formation integrity tests)
- SH-Azi the azimuth of the Maximum Horizontal Stress (Sh and SH are mutually perpendicular)
- **Pf** the Pore Fluid pressure (from repeat formation tests)
- **Boit** Biot's poro-eleastic coefficient (from porosity and/or velocity logs)
- Coh the rock's intrinsic material strength or Cohesivity
- mu-Int the coefficient of internal friction
- **mu-Stat** the coefficient of static friction

The Borehole Stress Editor provides various means of defining the various component profiles - including: the integration of density log data, the copying of existing log data, a linear function or a simple constant value.

NEW FEATURES

An additional feature of the new 3D stress analysis system is the generation of SHmax trajectory data. This optional output from a Horizon Surface Attribute Sync in the Volume Editor is enabled in the Stress Scenario by switching on the option, **Enable 'SH' trajectory creation**.

Name &	k Colour:	StressSce	enario#1							
		Currently	'Active'							
Option	ns:	🔲 Use Pr	essure Profiles	where defined	🗌 Vary static	friction with SG	R where possible	💌 Enable '	SH' trajectory cre	eation
Extr	apolation poir	nts								
	TVDSS (ft)	Sv (MPa)	Sh (MPa)	SH (MPa)	SH-Azi (deg)	Pf (MPa)	Biot (~)	Coh (MPa)	🧾 mu-Int (~)	mu-Stat (~)
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Boreh	ole Stress Selei	tion Graph	nical Display	Static Fri	ction / SGR					
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Well 1	ist < All >	 V	Edit Create	│ <mark>∠⊙</mark> ×≡≶	=R =× 21 🔍					[0/4
Well-1SELECTED>>> Well-1 :: (Stress_Profiles_1)										
Mell-2SELECTED>> Mell-3 :: (Stress Profiles 3)										
Well-3SELECTED>> Well-4 :: (Stress Profiles 4)										

Enable 'SH' trajectory creation option in Stress Scenario Editor

With this option enabled, the 'SH' trajectory data is created and stored as a Polyline-Set Shape object in the T7 database during the creation of the horizon surface stress attributes. The name of the Shape object will be made up from the horizon name and stress scenario name.

The Shape object can be loaded in to the Volume Editor via the Data Manager in the Surveys & Grids module as shown below. The picture on the right shows a horizon colour coded with the Fracture Stability attribute. The black lines are the 'SHmax' trajectory lines that have been computed at that horizon and are stored in the Shape object that has been loaded independently.

Cell-Grid Property Modelling QC Tools

Additional QC tools have been added to the property modelling workflow. Two new "subsystems" can be found. The first, checks the well-to-cell upscaling method and how well the upscaling captured the variability in the source well data (petrophysical logs). The second enables the user to check the output results from a single realisation by comparing the model data (for all cells) against the control cells (those with upscaled log data).

Checking the upscaling method

The well to cell upscaling QC tool provides a number of plots which compare the raw log data against the upscaled data for the cell values; the data is compared in terms of both their position along the well path and population statistics. Also provided, are the well-cell intersection points (solid black lines). Furthermore, the data used for comparison can be filtered in terms of stratigraphy or true vertical depth.

Using the tool it is possible to examine whether or not the CPG dimensions (such as layer spacing) results in upscaled control data that diverges significantly from the actual well data.

Low resolution CPG: 11 layers

Note that in this lower resolution CPG model the population statistics of the upscaled data (blue) departs from the expected distribution of the raw data (red). Therefore, the current CPG dimensions are too coarse; failing to capture the variation in the source data (well data) after the well-to-cell upscaling.

High resolution CPG: 101 layers

Using the same well data and attribute, but a different and higher resolution CPG model, we can accurately capture the well data distribution in the upscaled data.

Checking the output models

The principal stochastic modelling method employed for continuous variables in T7 is the sequential Gaussian simulation (SGS); here one expects, for each SGS output, a close approximation between the population distribution for the model output (after property modelling) and the input control cells (derived from the well-to-cell upscaling). A new option is available in the Cell Grid Property Modelling dialog: Model QC to test this. Here the output from an SGS model can be compared with the control cell input data. The user

NEW FEATURES

has to select an attribute model, an attribute definition (e.g. V-Shale, Porosity) and a control attribute model (this is automatically produced during the SGS run and is denoted by the "(control)" qualifier). If a trend was used for the SGS modelling then the appropriate trend attribute model should also be selected; as with the control attribute model this will be created automatically during the modelling phase. It's important to note that if a trend was used then a comparison should be made using the control and model residuals.

Note that we're QCing a model where a trend was used during modelling. A quick comparison between the residual populations shows good correspondence between the control and model data distributions. These comparisons can be further refined by depth and/or filtered using by attribute filters (if those were used during modelling).

Intelligent Window Placement

A new system has been added to T7.1 to improve the way in which multi-monitor screen configurations are handled when applications and application dialog windows are popped-up. The new system ensures that, unless otherwise dictated by application saved settings, new applications will attempt to start on the same monitor as that of the application from which it is started. Application dialog windows will open so that they are centred within the host application window. For example, with a dual monitor configuration, the user may move the T7 control menu on to the right-hand monitor (its default location is on the left). Any applications started up from the control menu will then open on that monitor. The "Intelligent window placement" system may be disabled in the T7 Control Menu's Start-up options.

Color scheme	[>
Show splash screen	
🖌 Console initially visible	
Perform version check	
🖌 Project deadwood check	
🖌 Project offset check	
🖌 Start Well-Check server	
😿 Start StructureSolver server	
🖌 Advanced graphics	
🖌 Intelligent window placement	

Context Sensitive Help Access

Context Sensitive Help (**CXH**) is a powerful help system available for most T7 applications. It can be accessed in any of the following ways:

- Click on the "?" button in a main application window (normally at the top right corner of the main window). This will change the mouse pointer in to a "?". Move the mouse pointer to a part of the application user interface about which more help is required and simply *click* with the mouse <MB1> button. This will result in the display of the CXH popup window.
- Move the mouse pointer to a part of the application user interface about which more help is required and simply press the **F1** key. This will result in the display of the CXH popup window.
- Move the mouse pointer to a part of the application user interface about which more help is required and simply press the F2 key. This will bypass the CXH popup window and, go straight to the T7 Reference Manual if a link is defined.

The image below shows the CXH popup displayed by pressing F1 in the T7 Control Menu.

Help	
The Control Menu 	
dismiss go up 🗌 active more information	

At the time the CXH help is requested, the part of the application user-interface to which the help text is linked will flash several times.

Clicking on the "**go up**" button will attempt to access additional help that is associated with a higher-level component of the user-interface.

If the CXH popup window shows a **more information** link, clicking on this will open a browser window showing a relevant topic in the T7 Reference Manual.

If it is required to keep only one CXH help window open on your display, and update the contents of the CXH help window each time you press **F1**, then press the **active** toggle button.

To close the current CXH help window, press the **dismiss** button.

Control Menu

Help System Access

Multi-Object Edit Sequential Colour Option

The Muti-Object Edit window allows simple bulk changes to multiple objects of the same type selected in the Database Explorer or in any list view that supports object editing. The multi-object editor tool can be used modify the colours and/or names of the selected items. The tool has been extended with an option to modify the colours from a set of colours accessed sequentially from the T7 colour palette.

List: < All >		V Edit
🖌 🖸 🗙 🎫 🞫 🕰 🔍 🔜 🌌		[8/23]
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Top C6 Depth		
Top F3	\diamond Set sequential palette colours	
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Top H1 Depth		
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Top J8	\wedge 0t beginning \wedge 0t and \wedge 0mmbang	
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Top K7	1	
Top L2 Depth		
Top M1 Depth	\Rightarrow At beginning \diamond At end \diamond Replace	
Top MG Depth		
Top 01 Depth		
Top 06 Depth Apply Links	Close	
Top R1 Depth		
Top S1 Depth		

Multi-Object Edit Window accessed from a Horizon List

Volume Editor - Object Menu

This new Right-Mouse-Button (MB3) menu option in the Volume Editor provides access to a number of options specific to the currently selected object in a viewer.

	Selected Fault Su	rface	
Single-Selecti		TAUN	E Object
Viewer		\mathcal{D}	🔊 00ject
Hide		ACHA	
Object	Properties	Alt+P	Fault surfa
Survey	^D Style	Alt+S	A O S
Shape	Show in Database Explorer	Alt+D	★ [×] 🐼 📝
Section	P	11/11/1	R, 13 9,
Fault surface	P Hr Standy III		
Harp	> YHYK NUHYIN II		
			(日人王)))

The options are:

Properties - this opens the object-specific editor window (as would normally be accessed via the Database Explorer or from the "Edit" button in an object list-view).

		Мо	dify Fault s	surface 'Z.6'		
Parent Fa	ault plane:	Z.6	• •			*** V
Fault II	0:	Z.6				
Number o Number o Last mod UNLOCKEI	of triangles: of vertices: dified:)	3410 1819 Fri Mar 1	7 3:44pm 2017			
n 1	index	X(m)	Y(m)	Z(ms)		
-	305 303 318	389053.9 389303.9 389253.9	71621.9 71596.9 71446.9	1704.1 1917.9 1910.1		
2	1698 1730	396303.9 396428.9	78346.9 78346.9	958.5 959.6		
3	1643	396303.9	78246.9	1136.0		
5						
Maximum o	data lines sho	own: 1000	Show	all Copy	Save as	ſ
ОК	Apply					Cancel

Example properties window (with a Fault Surface selected)

Style - this will open the Style Editor window showing and highlighting the style controls specific to the selected object.

			S	tyle Eo	litor: [-]	
Master S	Surveys 8 Grids	k Interpret	Model & Map	Geon	nodel		
Horizons	Faults	Polygons	Patches	Wells	Trap Analyst	Fracture Networks	
Sho	w Fault S	urfaces					
▼ Sol Displa	id fill y Method:	KNone>				💌 🚾 Smooth	
🖌 🗹 Sho	w Fault R	aw Data					
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Show in Database Explorer - this will open the Database Explorer window and select the object in its tree-view (provided its "Allow remote object selection" option is enabled).

4	Database Explore	r:Weca		
File Edit Tools Options Create				•
	: 🛃 🕒			
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ural Hostract fault group □ □ Cellular model □ □ Cellular model □ □ □ Splacement control profile	Parent Fault plane:	Z.6		***
Fault plane (20 items)	Fault ID:	Z.6		
E Fault B E Unassigned E ■ 2.2 C ■ 2.2	Number of triangles: Number of vertices: Last modified:	3410 1819 Fri Mar 17 3:44pm 2017		
	n index	X(m) Y(m)	Z(ms)	
Fault based fault segment	305 303 318	389053.9 71621.9 389303.9 71596.9 389253.9 71446.9	1704.1 1917.9 1910.1	
Fault correlation Fault point-set Fault surface (1 items)	2 1698 1730 1643	396303.9 78346.9 396428.9 78346.9 396303.9 78346.9	958.5 959.6 1136.0	
☐- Z.6	3 29 98	387428.9 70396.9 387553.9 70571.9	672.0 1028.8	
바르켈 FaultED element-run 마르네 FaultED model-run 마 湯 Horizon patch	26 4 10 93	387378.9 70446.9 387478.9 70696.9 387553 9 70796 9	965.4 477.2 575.5	
B→ Polygon	94 5 94	387553.9 70721.9 387553.9 70721.9	676.0 676.0	
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E 2.17 E Z.17 E Z.18 7	Apply Revert		Р	evious Next
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T7-Control Menu - Colour Scheme Option

A new startup-option has been added to control the T7 user-interface colour-scheme.

The available colour schemes are:

Well-Editor - Attribute Loading Filter

The Well Editor load selection window now incorporates a filter toggle for well attributes. When enabled the filter will only list attributes that possess log data for all of the wells selected for loading.

One well	Filter off, all
selected	attributes listed
🚄 Well Selec	tion – 🗆 🗙
k Mells	Attribute logs
< All > The second seco	
	AA-Azimuth-Log (Generic Curve Data) 🛁
Well-1	AA-Dip-Az-Samples (Generic Vector Data)
We11-2	AA-Dip-Log (Generic Curve Data)
Well-3	Azimuth-Points (Generic Point Data)
Well-4	Cell-I (Generic Curve Data)
	Cell-J (Generic Curve Data)
	Cell-K (Generic Curve Data)
	Cell-Volume (Generic Curve Data)
	Cell_I_User1 (Generic Curve Data)
	Cell_J_User2 (Generic Curve Data)
	Cell_K_User2 (Generic Curve Data)
	INENCO (Nonoitu)
Close	Load Wells Add Attribute

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< A11 >	🔻 🔽 Edit 🖉 🖸 📉 🗉 🗐 🗐 🗐	[0/1]
	[4/4] Vshale (Active : V-Shale)	
Well-1 Well-3 Well-4		
Close	Load Wells	Add Attribute

Horizon Data Interpolation

The process for interpolating over gaps in horizon interpretation data belonging to Horizon Data-Volumes has been available in T7 since TrapTester 5.0. The process requires the selection of a Horizon Data-Volume in the Volume Editor and uses the existing data in that Data-Volume, within a user-specified polygonal region, to act as the "interpolation resource". The unpicked data (or null data) within the same defined region and in the same Data-Volume is then interpolated using the "interpolation resource" data.

T7.1 sees this concept extended so that different and multiple interpolation resources may be used to influence the interpolation results. This is especially useful around faults (in particular, reverse faults), where gaps in the interpretation may be in-filled using both the existing data in the Data-Volume and also other data such as a footwall or hangingwall polygon, well horizon picks, horizon point-set data or indeed data belonging to other Horizon Data-Volumes. The workflow to add additional interpolation resources is as follows:

1) With Horizon area mode set to 'PICK'

- I. Select the Horizon Data Volume to be interpolated
- II. Enter the Interpolation mode: *MB3->Horizon->Edit raw data->Area interpolate (inside)*.
- III. Use Ctrl+MB1 to select additional interpolation resources. (NOTE: This step may be performed before step 2 provided only one Horizon Data Volume is selected)
- IV. Use MB1 to digitize a polygonal region around the required interpolation resources and area to be interpolated. The closure of the polygon will then highlight all interpolation resource points that lie within the polygon.
- V. Use MB3 to perform the interpolation.

2) With Horizon area mode set to 'SHAPE'

- I. Select the Horizon Data Volume to be interpolated
- II. Use Ctrl+MB1 to select additional interpolation resources. (NOTE: no further Horizon Data Volumes should be selected as this will disable the interpolation option)
- III. Enter the Interpolation mode: *MB3->Horizon->Edit raw data->Area interpolate (inside)*.
- IV. Choose the required polygon Shape from the pop-up list and press OK to perform the interpolation.

The pictures below illustrate the process of interpolation using multiple resources.

Use of Velocity Volumes For On-Demand Time/Depth Conversion

When working with time-domain data, there are certain work-flows in T7 that require data to be converted to depth in order to generate meaningful output. Examples of such work-flows include:

- Creating Hydrocarbon Column Height fault attributes,
- Creating CSP fault attributes.
- Creating stress analysis attributes,
- Creating fault attributes using pressure-profiles,
- Performing fault displacement back-stripping.

Such processes use information from the Project Parameters in order to perform the timeto-depth conversion as and when it is required. Prior to the 7.1 release, the Project Parameters only provided a means of defining a simple, linear velocity function with a time and depth datum. T7.1 includes an option to specify a velocity volume.

With a velocity volume specified, all on-demand time-to-depth conversion will use the velocity data defined by that volume in preference to the "Default time-depth conversion velocity & datum".

When a velocity volume is selected it will be loaded in to shared-memory the first time it is required. After that point the volume will remain loaded in shared memory while the project is open. The shared memory volume will be relinquished when the project is closed or the velocity volume selection in the Project Parameters is changed.

The volume will be loaded in to shared memory by the first T7 application that requires it. Depending on the volume size this loading process can potentially add a significant delay at that time (e.g. when starting the Volume Editor).

Dimensions						
Project type:	DEPT	н				
Project offset:	X: 4	06570.0 m, Y: 3175	5866.0 m (I	eviation: X: 892	209.6 m, Y: 199593	9.0 m)
Project extents:	X: Y: Z: D:	386445.2 - 6053 3159020.0 - 7184 -2000.0 - 1303 -37.5 - 6629	114.0 (2 4590.0 (4 74.3 (1 9.7 (6	18668.8) m 025570.0) m 5074.3) m 667.2) m		
Coord ref system (CP	RS): KUn	defined>				
-Time-to-Depth C	onversi	on				
Default time-depth	convers	ion velocity (m/s)	:	2500.000		
Default time-depth	datum:		Depth(m)	0.000	TWT(ms)	0.000
Velocity volume:				[KNone>		۷

Velocity volume selection option in Project Parameters

Time/Depth Conversion Using Mixed Domain Velocity Volumes

Velocity volumes can exist in the time or depth domain - ie a time-domain velocity volume contains velocity data varying with two-way-time whereas a depth-domain velocity volume contains velocity data varying with depth. Prior to T7.1, conversion of time-to-depth required a time-domain velocity volume while the inverse conversion required a depth-domain velocity volume. This restriction is lifted in T7.1 though using a velocity volume that is not of the same domain as the data being converted will be a little slower.

The ability to use either a time or depth domain velocity volume to perform a time or depth conversion means that a single volume may be used to perform two-way conversions (ie conversion to depth and then back from depth to time). (The Seismic Volume Manager can be used to create a link to a volume in a different project - this permits volumes to be shared between multiple projects).

Target project path Valantis-8/TTprojects Target project name Veca_DEPTH Velocity volume IntVels Frameworl volume velocity Other> Vuse single velocity & TD-datum (in Project Parameters) Project database Only convert active data Convert seisnic volumes Solact 20 Volumes Solact 20 Volumes InffVels InffVels InffVels InffVels InffVels InffVels InffVels Solact 20 Volumes Velse Velse Velse Velse Velse	Depth Conversion : Weca				
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 ♦ Velocity volume IntVels Create Manage ♦ Frameworl volume velocity ♦ Use single velocity & TD-datum (in Project Parameters) Project Parameters ♥ Convert project database Only convert active data Convert seisnic volumes Select 2D Volumes Select 2D Volumes Select 2D Volumes Define the range and cample interval for the conversion of selected volumes Depth range (m) Hint D Haxt 10000.000 Sample Interval; 1000 	Target project name	Weca_DEPTH			v
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Messages:	Convert project database Only convert active data Convert seismic volumes Solact 2D Volumes DiffVol InffVol I				
CXH Author mode enabled for: t2dctr1	Messages:				

Time Depth Conversion Of "Active" Database Content

The T7.1 Time/Depth conversion tool has been given an option so that only the "Active" content of the T7 database is converted to the chosen target project. This provides the user with the ability to be more discerning about what data is created in the target project.

The "Active"/"Inactive" state of database content is managed in the Database Explorer.

Depth Conversion : Weca			
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♦ Frameworl volume velocity	<no.re></no.re>	×	3639730 1
🔷 Use single velocity & TD-da	tum (in Project Parameters)	Projec	et Parameters
Select 20 Volume	is 💋 DiffVol IntVelo Geog	Select ID Volumes	
Define the rance an	d cample interval for the conver	sion of selected vo	lumes
Bepth range (m) Him	Han: [1.0000.000	Sample Interv	h1: [5.000
Messages:			
SL			
Close		Start D	epth Conversion

Creation of Well Time/Depth Curves from Velocity Volumes

It is now possible to create a Well Time-Depth Curve using the velocity model defined in the Project Parameters. If the Project Parameters is set with a velocity volume then this will be used - otherwise the basic velocity and datum values will be used.

Modif	y Time-depth curve '	FDCurve#3'		
arent Well: Well#0 (pseudo)				
lame: [TDCurve#3 Colour: Assigned to well: No				
Jepth Mode: 🔷 True Vertical Dep	th (TVDSS) 💠 Measured Dep	th (M]))		
TWT (ms)	4000 5000	Set From Zonal Vels	Set From Well Picks	Set From Proj. Params
	E S	TVDSS (m)	THT (me)	Velocitu (m/s)
1000	E a	0	0	
2000		114,000	91.038	2504,449
	E H	228,000	181.747	2513,532
~3000		342,000	272.130	2522,598
	E S	459.000	364,557	2531.728
		577.000	457.433	2541.022
	E	696.000	550,755	2550.310
Q.000		829.000	654,655	2560,153
F 8000	<u> </u>	911.000	718,370	2573,964
		1140.000	848,866	3509,685
7000-		1279.000	927,758	3523,806
		1332.000	957,625	3549.067
8000-		1573.000	1086.042	3753,397
E		1584.000	1092,212	3565,615
3000-3		1675.000	11/15 686	2402 592
TWT=-20.699 (ms), TVDSS=9260.137 (m), V=0.000 ·	Compare curves	Insert Before	Insert After	Delete

The above picture shows a time-depth curve created using the "Set From Proj. Params" option. In this instance, a time-domain velocity volume is specified. The volume only contains velocities to 2000ms - the velocity at the base of the volume is extended to the last point in the well trajectory at 9000m.

ECLIPSE Cell-Grid Export - Filter Selection Option

In order to provide a more flexible way to control the export of active Cell-Grid cells from a Cell-Model in T7, the ECLIPSE export tool has been provided with an option to choose (or create) a filter. The filter can be an existing filter for filtering the display of Cell-Grid property data in the Volume Editor or it can be created from within the ECLIPSE export tool. The cells that do not pass the filter will be exported with a corresponding zero ACTNUM value. The below example shows a filter that ensures any cells with a negative volume a given a zero ACTNUM.

📕 вс	iL ECLIPSE Export		
Model Selection Data S	election Export Options		
Choose a Cellular Model	from which to export:-		
New-cell-model		Edit	
Choose a Cellular Model	Scenario from which to export:-		
New-cell-model (locked)		Edit	
Choose an optional filte	r to define the active cells to	export:-	
Positive Volumes (attri	oute cutoff)	Edit	
basic Positive Volumes (attri	bute cutoff)		
		Fliter Editor	×
Close	Positive	Select filter Volumes (attribute cutoff)	
Welcome to the BGL ECLIPSE	: data export		
CXH Author mode enabled fo	pr: ecl_export	л.	
Performants and any end and included and an an and an an and a	Edit	New	Delete
	Close		
	Attribut	e Cut-off Filter	×
	Filter name	Positive Volumes	
	Attribute to use	Čell-Volume	V
	Value range	-2.06378e+08 + to 2.20541e+10	(1
	Cut-off	Þ (1)	
	Okay Apply	CI	ose

2D Line Navigation Filtering

2D Seismic lines may be represented in the Volume Editor as basemap lines and as seismic section displays. The points (traces) that define the 2D path of the line in the XY plane are known as the "navigation" data. The navigation data is stored at is full resolution in the T7 database. When it comes to displaying this data in the Volume Editor a filter is applied so that only those points that are seen to act as significant turning points (or way-points) are used. This can greatly reduce the graphics overhead - especially when there are a significant number of lines or the lines are particularly long. On occasions, the navigation data can lack precision in its trace XY locations; this can often be the case if the data has been imported from ASCII files that omit XY decimal places. In such cases, every point can be identified as a turning point so the default filtering is ineffective.

A new parameter has been added to the 2D line navigation properties that controls and stores the level of filtering along 2D lines. This can be edited by hand on a per-line basis in the Database Explorer or by accessing the 2D Line Navigation properties editor from the Volume Editor. Alternatively, the filter values can be increased or decreased by pre-set amounts using MB3 popup-menu options in the Volume Editor. This latter option can be applied to a multiple selection of 2D basemap lines.

Single-Selection		
Viewer D		
Hide D		
Object Properties		
Survey 🔅 Style	Modify L	ine navigation 'AF-1997-A'
Shape D Show in Database	Parent Line:	AF-1997-A
Section D	Survey ID+	QF (20)
Harp D	Survey ID.	ni (20)
	Line Type:	20
	Number of nodes:	1106 (630 filtered)
Manually set filter value	Node spacing:	15.0 m
	First Node ID.	Ø
	Node ID step:	h.
	Node ID range:	0 to 1105
	Display filter tolerance:	(x node-spacing)
Filter results (1=display)	Node ID/Trace SP 0 425,000 1 1 434,500 2 2 434,000 3 3 433,500 4 4 433,000 5 5 432,500 6 432,000 5 432,000	X(m) Y(m) 740508.000 9296181.000 740496.000 9296171.000 740476.000 9296170.000 740476.000 9296139.500 740456.000 9296139.500 740444.000 9296118.500 1 1 1 1 1 1 1 1 1 1 1 1 1
	OK Apply	Cancel

The following pictures show how the filtering levels effect a typical 2D basemap line in the Volume Editor.

The filter value itself is applied as a multiple of the local trace-spacing along the 2D lines. If the filtering is made too severe it may result in the line being insufficiently defined when interpreting on sections. When using the MB3 popup menu options, *Increase nav filtering* and/or *Decrease nav filtering*, the filter value is increased and decreased in steps of 0.1. The minimum and default value is 0.1 and the maximum is 2.0.

Extraction of Z-Values From Horizon Tri-Mesh Data

This new option in the Horizon Volume Utility provides a means of setting a Horizon Data Volume values to the Z values extracted from a horizon tri-mesh. This can be a useful feature when it is required to obtain grid-form data that may be displayed and edited on sections when the only original data for the horizon is in the form of a surface tri-mesh.

4	Horizon Volur	ne Utility	_ _ X
Operation	OUT = Surfa	ace tri-mesh Z	
Survey	List: < All >	weca (3D)	7
Controls Output			
-Output Horizon	Yolume		
	Volume name	Data-type	Working Units
Output volume	[Z] LOPLIO_1092 :: (L(🍟	◆Depth-TWT	(Milliseconds)
🗆 Clip values 🔇	ise 🗌 🔘	to NUL	(Milliseconds)
🗌 Clip values 🗦	1999 🔲 📢	to NUL	(Milliseconds)
🗌 Clear ouput vo	lume before processing		
	AT QUES	STION **	
	Processing fini	ished successfully.	
	Keep Changes	Revert	
Messages:			E 🗎 🗙
341205 points proc	essed. 42173 N-pull+ 16	Min+ 1100 May+ 1	401 Quet 12
======================End 0	f Operation========	nin, 1100 nax, 1	.401 HV9; 12.
		AI	oply Close

This option in the Horizon Volume Utility has no "Input" tab as the surface tri-mesh is taken from the horizon to which the output Horizon Data Volume belongs.

Editable Lithology & Reservoir Quality Names

Lithology and reservoir quality types may be assigned to T7 horizons. These may be used to colour code the intervals between horizons when they are displayed in the Well Editor or when stratigraphic intervals are displayed upon fault surfaces in the Volume Editor. These assignments can also be used as the basis for creating Display Method colour-maps and filters for controlling the display of fault surface attributes.

Up to the release of T7.1 the lithology and reservoir quality type names were fixed. Using the Database Explorer, these names can now be edited and tailored to a given project's requirements.

	Modify Lithology
Editable type	Lithology
names	Undefined
	Šandstone
	Šhaly sandstone
	Šhale
	Čarbonate mud
	Limestone
	[Chalk
	[Coal
	Hard rock (basement, volcanics)
	Reservoir Quality
	Ğood
	Poor
	None
	OK Apply Cancel

The Lithology Editor window showing the default type-names

Compression Option for 3D Seismic Volumes

The Seismic Volume Manager has been extended to cater for the optional compression of 3D seismic volumes (including velocity volumes or any other data stored in this form).

The compression algorithm used is lossless meaning that the data quality is in no way compromised in the compression/decompression cycle. The compression ratio achieved will depend greatly on the type of data. For example, some 32-bit floating-point velocity volumes may achieve a 100:1 compression or more while an 8 bit seismic volume may achieve only a 2:1 ratio.

Once a volume has been compressed it may be used in much the same way as a noncompressed volume; it cannot, however, be used as a target volume for a merge operation.

The advantages of compressing 3D volumes are:

- Reduce disk space overhead
- Can improve volume load-times (in high compression cases)

The compression ratio is reported as the compression progresses. If the process is not achieving the required compression level it may be stopped.

2D Seismic Volume Header Editing Improvements

The 2D Seismic Line Header Editor in the Seismic Volume Manager has been improved to handle a multiple line selection and to permit changes to be made in a more controllable way.

BGL Volume	Manager _ 🗆 🕻	<
3D Volumes 2D Volumes	•	•
Volume Path: ./bglod		Multi-line selection
Volume Name(s) SF88-ALG-1 SF96-ALG-2 SF96-ALG-TimeMig		
Line Name(s)		
96-102 96-411	Line Header Editor: S	F96-ALG-TimeMig: 8 Lines 🗙
96-413 96-414 96-415 96-416	First trace id: Trace id increment:	jų
96-508 96-511M	✓ Z of first sample + □ □ Sample interval: = □	25] (ms) ¥4.000 (ms)
Information	Okay Cancel	

The Line Header Editor permits any of the following header properties to be modified:

- First trace id
- Trace id increment
- Z of first sample
- Sample interval

Only those properties which are toggled ON will be updated. The modification of each of the chosen line header properties can be applied in the following ways:

- = set the property to the supplied value
- + add the supplied value to the existing header property
- subtract the supplied value from the existing header property
- x multiply the existing header property by the supplied value
- divide the existing header property by the supplied value

Seismic Slicer Windowed Sampling Options

The Seismic Slicer utility (accessed from the Volume Editor) is a tool for extracting seismic data at fault and/or horizon surface tri-meshes. The data can then be displayed on the host surface using a corresponding Display Method. The T7.1 release includes an extension to the Seismic Slicer that permits the extraction of the data to be performed over a nominated vertical window; the data extracted as a surface attribute from the seismic volume can be chosen from one of the following properties calculated over the window:

- Minimum amplitude
- Maximum amplitude
- Mean amplitude
- RMS amplitude
- Max magnitude
- Average energy

🞽 Seismic	Slicer : Weca 📃 🗆 🗙
Seismic Data	
Seismic Access Definition	BGL-Seismic1.0 : Generic : "weca" -31 🐨
Window above	12.000 (Window below 12.000 (ms)
Seismic attribute	Min amplitude 😐
-Slicing Controls]
Faults <pre>Kaults</pre> <pre>Kault</pre> <pre>Kault<th>Slice spacing(m): 10.00</th></pre>	Slice spacing(m): 10.00
	Footwall output attributes
Fault A	Seismic slice #1: F-wall @ 10.00m
Fault B	Seismic slice #2: F-wall @ 20.00m
Z.2	Hangingwall output attributes
Z.3	Seismic slice #1: H-wall @ 10.00m
Z.4	Seismic slice #2: H-wall @ 20.00m
7.5	Coionia alian #7. H-un11 0 70 00m
Horizons	Output attributes
< All > 🛛 💎 Ed	it Seismic #1
🖌 🔾 🗙 🗉 🖘 🛃 🔍 🗐	Seismic #2
LOPLIORF	Seismic #3
LOPLIOFL	Seismic #4
LOPLIOF	🗆 Seismic #5
LOPLIO	
SB55	
TODATODE	
Done	
Close	Start

The following images show the results of some of the available seismic attributes extracted for a horizon surface (input seismic volume sampling interval = 4ms).

Min amplitude: Window above = 0ms, Window below = 0ms (Default)

Min amplitude: Window above = 12ms, Window below = 12ms

Max amplitude: Window above = 12ms, Window below = 12ms

Mean amplitude: Window above = 12ms, Window below = 12ms

Offset Utility Options For Arbitrary Axis Rotation

The Data Offset Utility has been extended to apply to additional object types (Fracture Networks, Cellular Models and Shapes) and given a new option to apply a rotational transform to the chosen data items. The option to apply an "Arbitrary axis rotation" is mutually exclusive to the option to apply an XYZ scale & offset.

🚄 🛛 🗛 Data-Offset 🔤 🗆 🗙								
Data Relocation Utility.								
Select Data Items								
Faults [1]	Horizons [0]	Fracture Netwo [0]	orks	Cell Models [0]	Shapes [0]			
List: < All >								
Unassigned								
FAULT 1								
Select Data Types								
□ Fault Segments								
Point-Sets								
Surface Tri-Meshes								
🗌 Homizon Data Volumes (Z-scale/offset only)								
Polygons								
🗆 (ell Sanda + (ell Faulta								
I Shaper								
√ XYZ Scale & Offset								
Output X	- (X 🗙	<u>ئ</u> ا000000) 🛨	(m) 00.0				
Output Y	= (Y 🗙	ji000000) 🕀	(m) 00.0				
Output 2	= (Z 🗵	ji000000) 🗄	(m) 000.(t				
Arbitrary Axis Rotation								
Axis:	Dip:)90.00 (deg)	Azi:	10.00 (deg)				
Point or	axis:X:	¥06570.00 (m)₿	۷:	3175866 (m)	🖰 Z:	(m) 000.0	Ð	
Rotation	angle:	Ď.00 (deg)						
					А	pphy C	lose	

The option to apply an "Arbitrary axis rotation" requires the specification of an axis dip and azimuth, an XYZ location along the axis and an angle of rotation about the axis.

Create Well Horizon And Fault Picks In Volume Editor

The interactive well-editing capabilities have been improved in T7.1 with the Volume Editor now providing the functionality to add new fault and horizon well picks.

Once a well is loaded in the Volume Editor the MB3 popup menu will provide access to the well pick creation and editing options. The picks created will be assigned to the currently "Active" horizon/fault as set in the Volume Editor.

Entering the mode to "Add horizon pick" or to "Add fault pick" will create new picks as the mouse is clicked at the required point along the well-path. If the picks are need to be moved the "Move picks" mode can be used to click and drag well picks up or down the well path. If the "Active" horizon is set to be a marker horizon the location mode for the well pick will be set to "Absolute" as a default. This can be altered in the Well Editor.

Create Arbitrary Lines Along Wellbore Paths

T7 already provides a simple means of creating arbitrary seismic lines that follow the path of a chosen well trajectory. This option is available in the Volume Editor's MB3 Popup Menu and Shortcut Toolbar for a single or multiple well selection. The T7.1 release includes a more sophisticated tool for creating arbitrary lines based on wellbores. The new tool is accessed from the Volume Editor's Interpret Tab: *Sections->Create Arbitrary Lines* and caters for the creation of multiple parallel lines that follow and optionally extend the path of a chosen wellbore. Such arbitrary lines provide a powerful tool for checking the seismic data ahead and to the flank of a well as it is being drilled.

Property modelling: creating facies proportion curves

The stochastic facies modelling workflow has been enhanced with the option of computing the facies proportion curves (FPC) prior to modelling; these are automatically produced during well-to-cell upscaling. FPCs show the proportion of each facies type, as captured by the control cells – they are computed for each layer in the model. The data is outputted to an eponymous file in the project area with a "_fpc" suffix and ".txt" extension. So for example if the output attribute model is called "TestModel" then the file containing the FPC will be called "TestModel_fpc.txt".

Geo	statistical Wizard	×						
Implana Settings								
Modelling parameters								
Optimisation: High								
Stereological factors: Inter-layer similarity:								
Global Transformations: Lateral Scali								
Number of neighbouring controls: 4								
Use search list - this improves performance								
📕 Pad nulls with median filter.	Toggle on in order to use the							
📕 Use the vertical facies proportions to modul	FPC as the prior during							
All category defintions are provided below. If a category as either a reservoir or non-reservoir	modelling.							
Reservoir Category value = 1		1						
Reservoir Category value = 2								
□ Reservoir Category value = 3								
	- 1 2 3 1 0.208333 0 0.791667 0% 20%							
	2 0.291667 0 0.708333 1	40% 80% 100%						
	3 0.304348 0 0.695652 4 4 0.208333 0 0.791667							
	5 0.375 0 0.625 10							
Close	6 0.409091 0 0.590909 13							
	7 0.32 0.08 0.6 8 0.434783 0.086957 0.478261							
	9 0.521739 0.043478 0.434783							
	10 0.409091 0.090909 0.5 22							
	11 0.36 0 0.64 28							
	12 0.272727 0 0.727273 31							
	14 0.478261 0.086957 0.434783							
	15 0.44 0.04 0.52 ³⁷							
	16 0.27907 0.093023 0.627907 40							
	17 0.361111 0.027778 0.611111 48 45	Chappel						
	18 0.296296 0.111111 0.592593 40 10 0.275959 0.0592593 49							
The data as autoutted on file	20 0.314286 0.171429 0.514286 52	Elood plain						
The data as outputted on the	21 0.25 0.071429 0.678571 55							
and plotted showing the relative	22 0.204545 0.113636 0.681818 ⁵⁸							
proportions of each facies type	23 0.131148 0.081967 0.786885 61							
down the model (as computed	24 0.266667 0.266667 0.466667 64							
from control cells).	26 0.4 0.15 0.45 70							
	27 0.391304 0.304348 0.304348 73							
	28 0.5 0.136364 0.363636 76							
	29 0.52381 0.047619 0.428571 79							
	30 0.619048 0.095238 0.285714 82							
	31 0.454545 0.090909 0.454545 85 32 0.52381 0.142857 0.323232 88							
	33 0.391304 0.130435 0.478261 91							
	34 0.454545 0.136364 0.409091 94							
	35 0.545455 0.045455 0.409091 97							
	36 0.55 0.1 0.35 100							
	37 0.541667 0.041667 0.416667							
	38 0.571429 0.142857 0.285714							

If the FPC is used during modelling (toggled-on in the Geostatistical Wizard dialog) then the facies proportions are used as a priori during the modelling the phase – i.e. the facies proportion in the model tend to honour the facies proportions captured in the FPC as opposed to the training image (the converse is true).

