

Introducing SES 3.0

**BOOTH
3041**

Stoner Engineering LLC
Golden, Colorado

www.makinhole.com

San Antonio SPE ATCE 2006

SES 3.0

- Dr. Michael S. Stoner – Founder
- SES = Stoner Engineering Software
 - Directional/Horizontal planning & execution software
 - Steering is main focus
- SES 3.0 significant enhancements
 - Realistic Wellsite 3D Geosteering
 - Realistic Wellsite Steering Guidance (Patented Fuzzy Logic Controller)

SMART STEERING with SES

Know where The Zone is

Stoner Engineering Software



**SES integrates 5 components to create
1 highly effective 'Smart' Steering System**

SMART STEERING with SES

Know where The Zone is

Stoner Engineering Software

Planning &
Surveying

Geologic
Model

Geo-
steering

THD
Logs

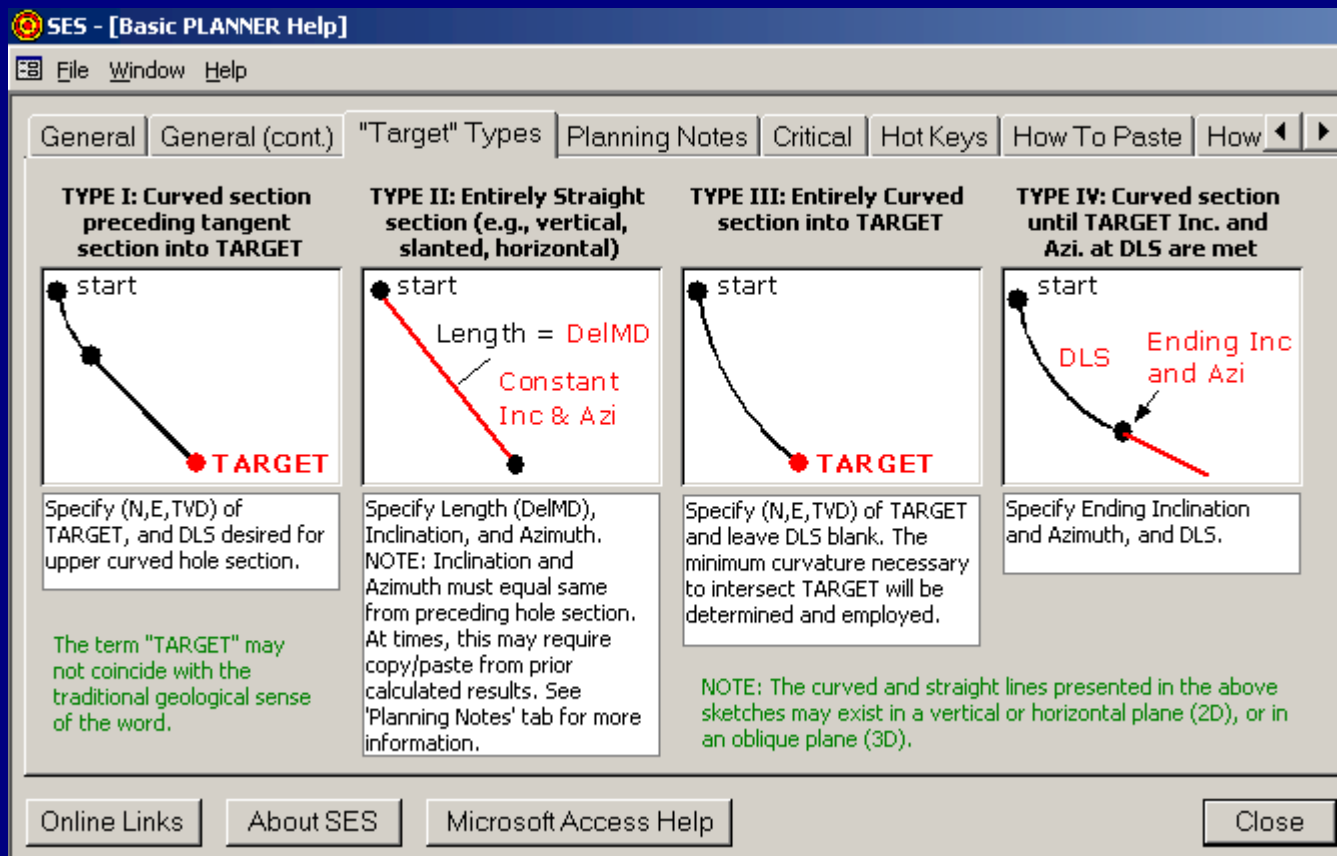
Steering
Guidance
p

**SES integrates 5 components to create
1 highly effective 'Smart' Steering System**

Planning & Surveying



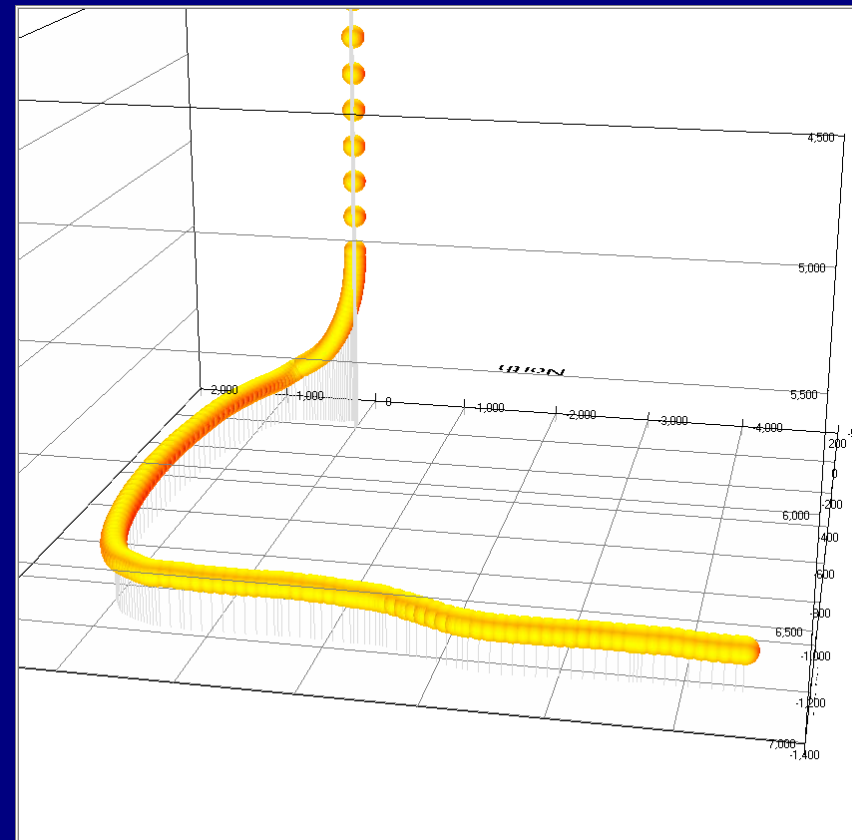
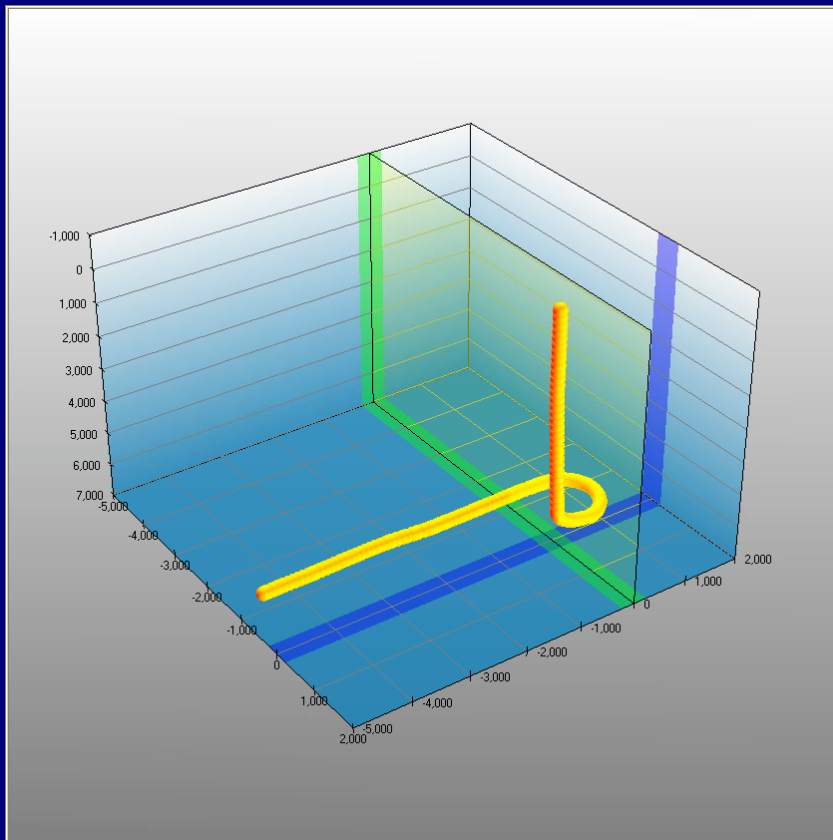
- 3D planner and survey calc FREE since 2000 at www.makinhole.com



Planning & Surveying



- 3D survey data viewer (rotate/zoom/pan)



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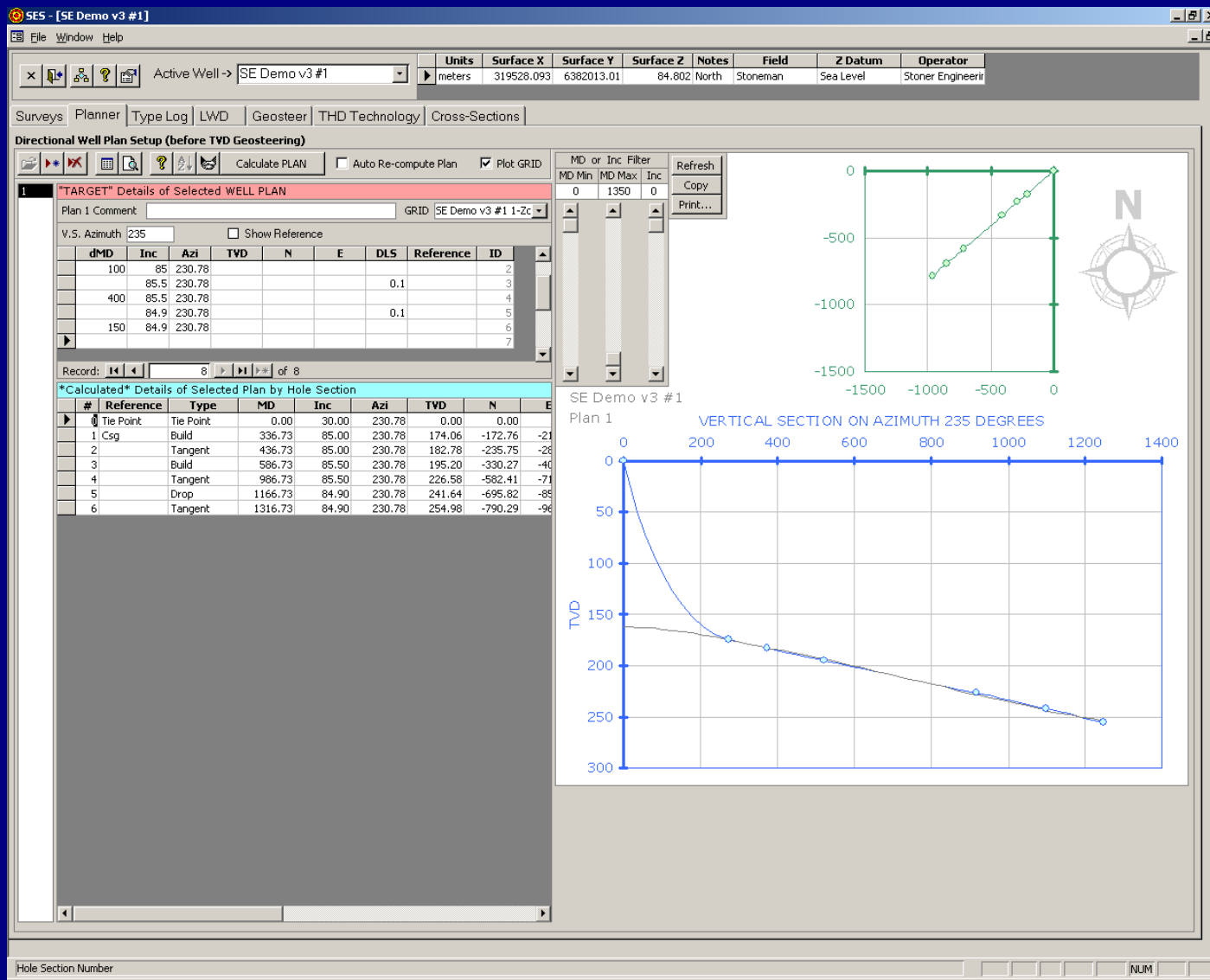
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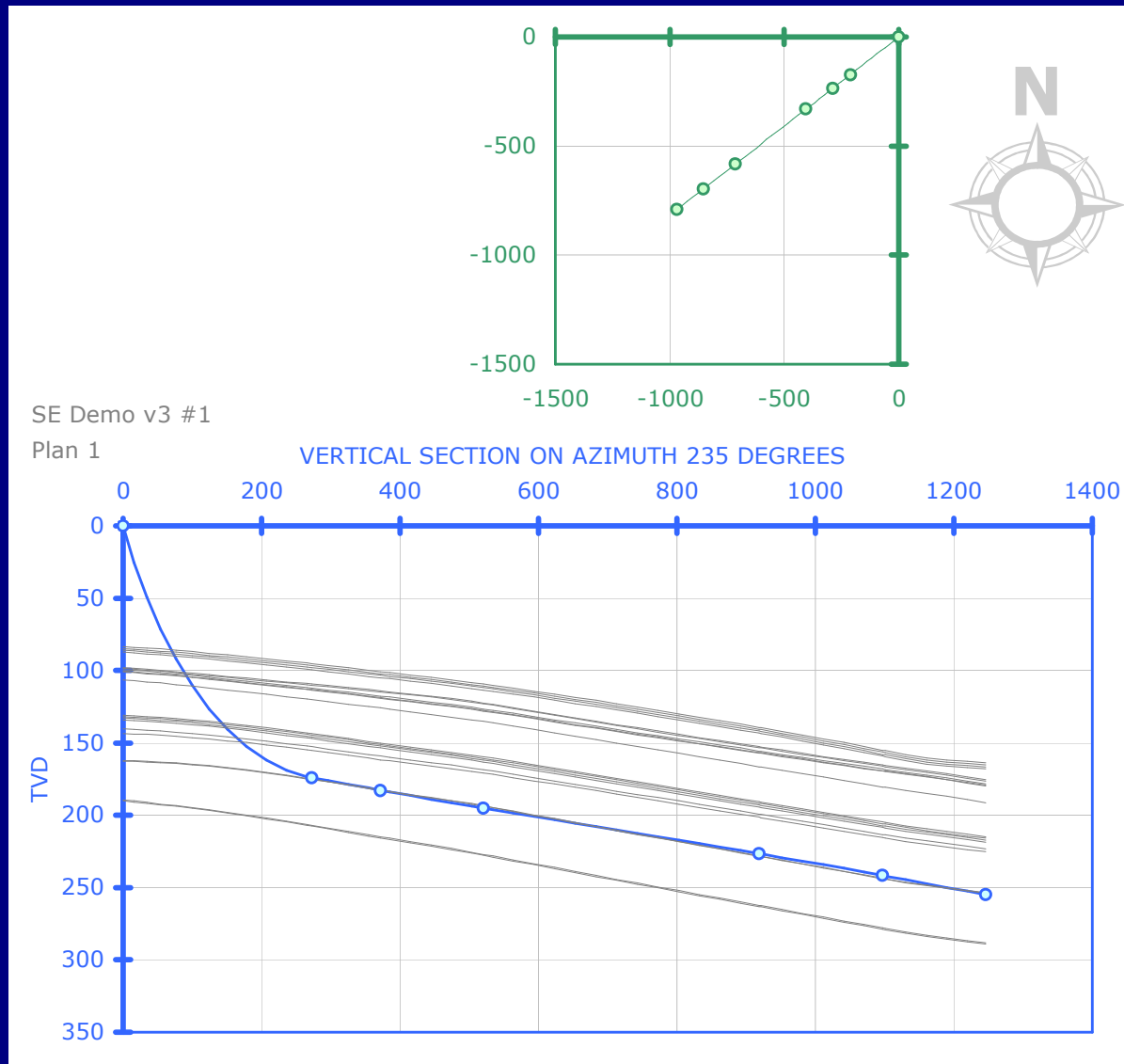
Steering
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Geologic Model



Geologic Model



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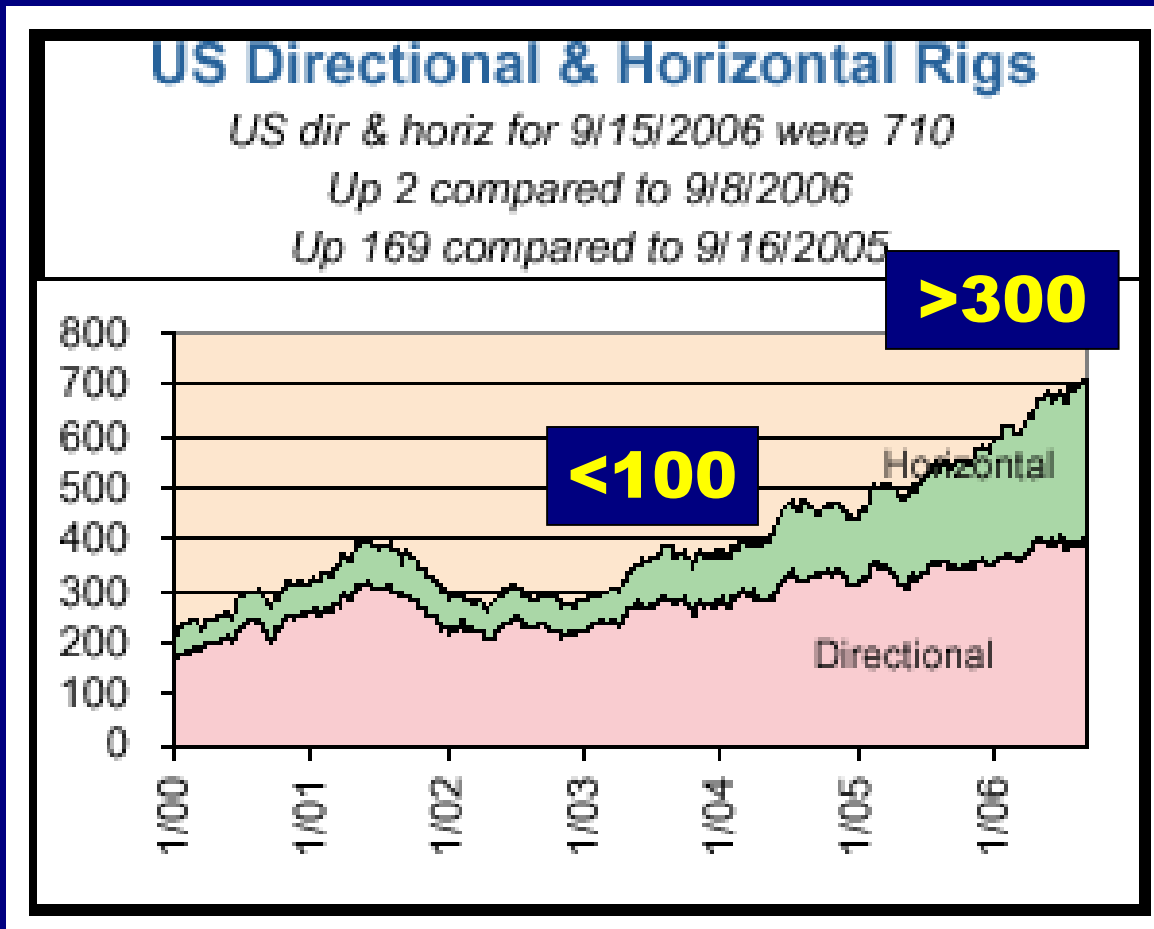


**SES integrates 5 components to create
1 highly effective 'Smart' Steering System**

Geosteering



- Location of payzone relative to well



- Challenge on every horizontal well

Source:
http://www.bakerhughes.com/investor/rig/rig_na.htm

Geosteering



- Current Practice
 - 2D with Vertical Section View
 - Dependent on service companies for directional calculations
- Go 3D
 - Why?
 - What is meant by “3D”? How?
 - New geologic terminology



A fisheye photograph of a building corner, showing a door and several windows. The image is distorted, with straight lines appearing curved, illustrating the concept of optical distortion. The building has a light-colored, textured facade. A green door is visible in the center, and a small green sign with the number '21' is above it. The windows are rectangular with white frames. The foreground shows a curved sidewalk and a circular manhole cover.

Projections Distort...
Distortions Mislead

Geosteering

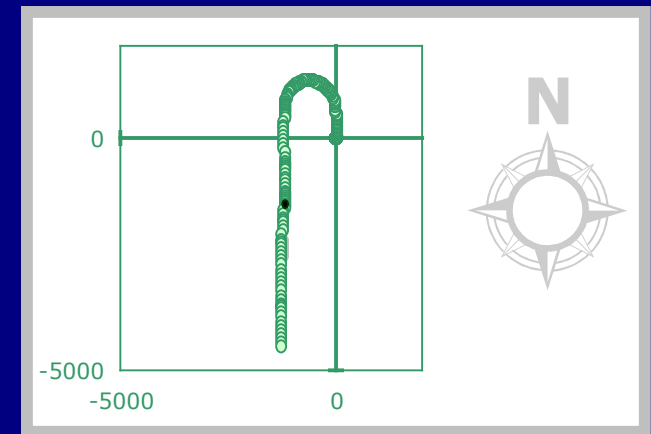
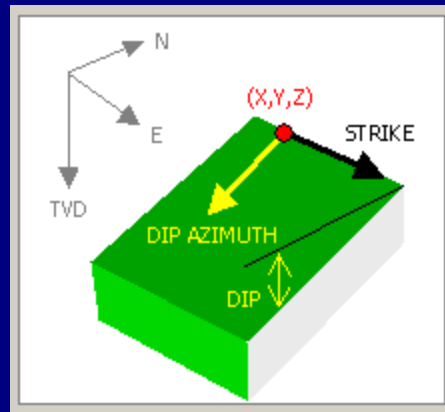


- Why go 3D?
 - A. Eliminate distortion from V.S. projection
- What is meant by “3D”? How?
- New geologic terminology

Geosteering



- Why go 3D?
 - A. Eliminate distortion from V.S. projection
- What is meant by “3D”? How?
 - 3DStratBlock
 - RSD



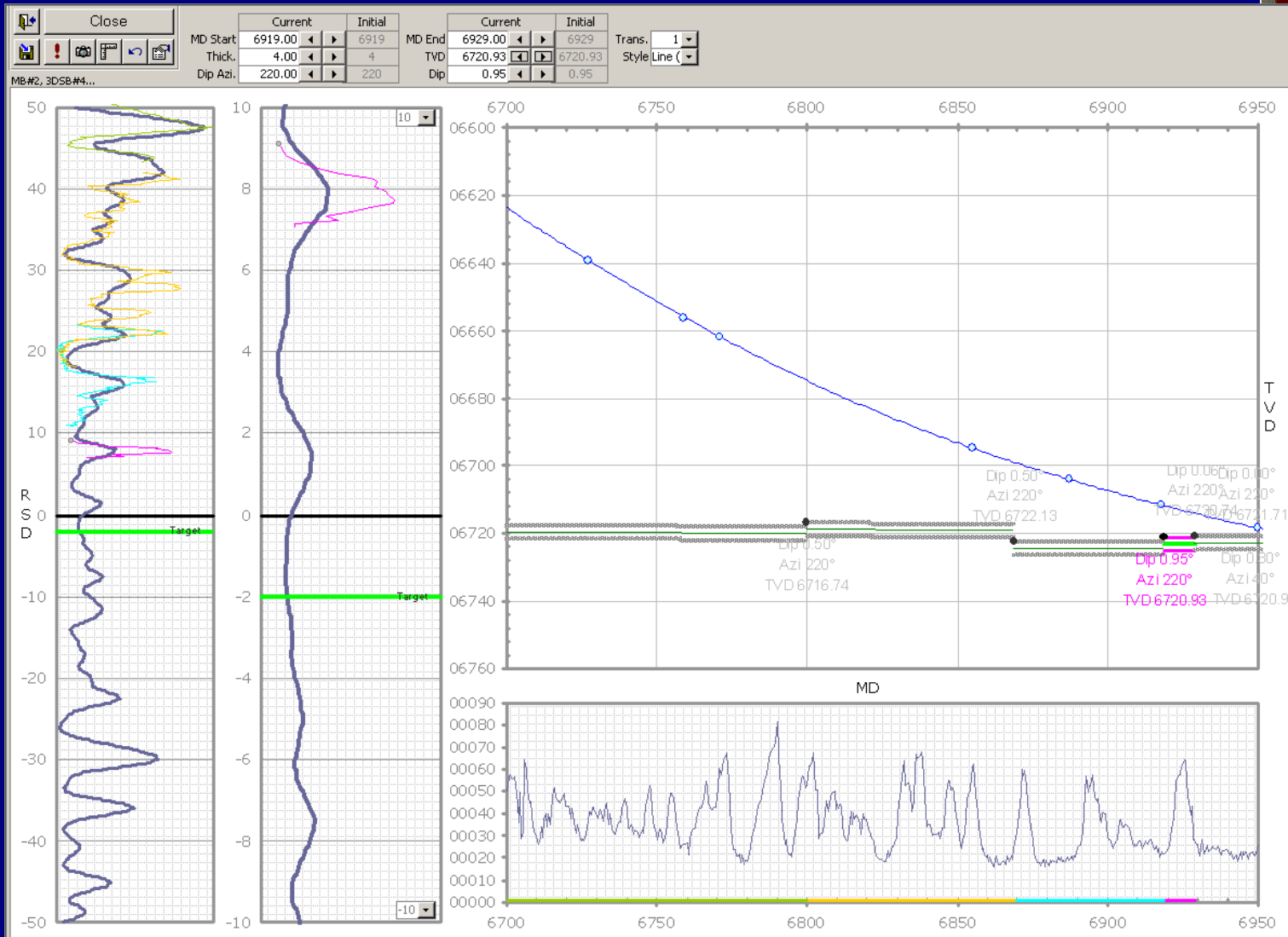
- New geologic terminology

Geosteering

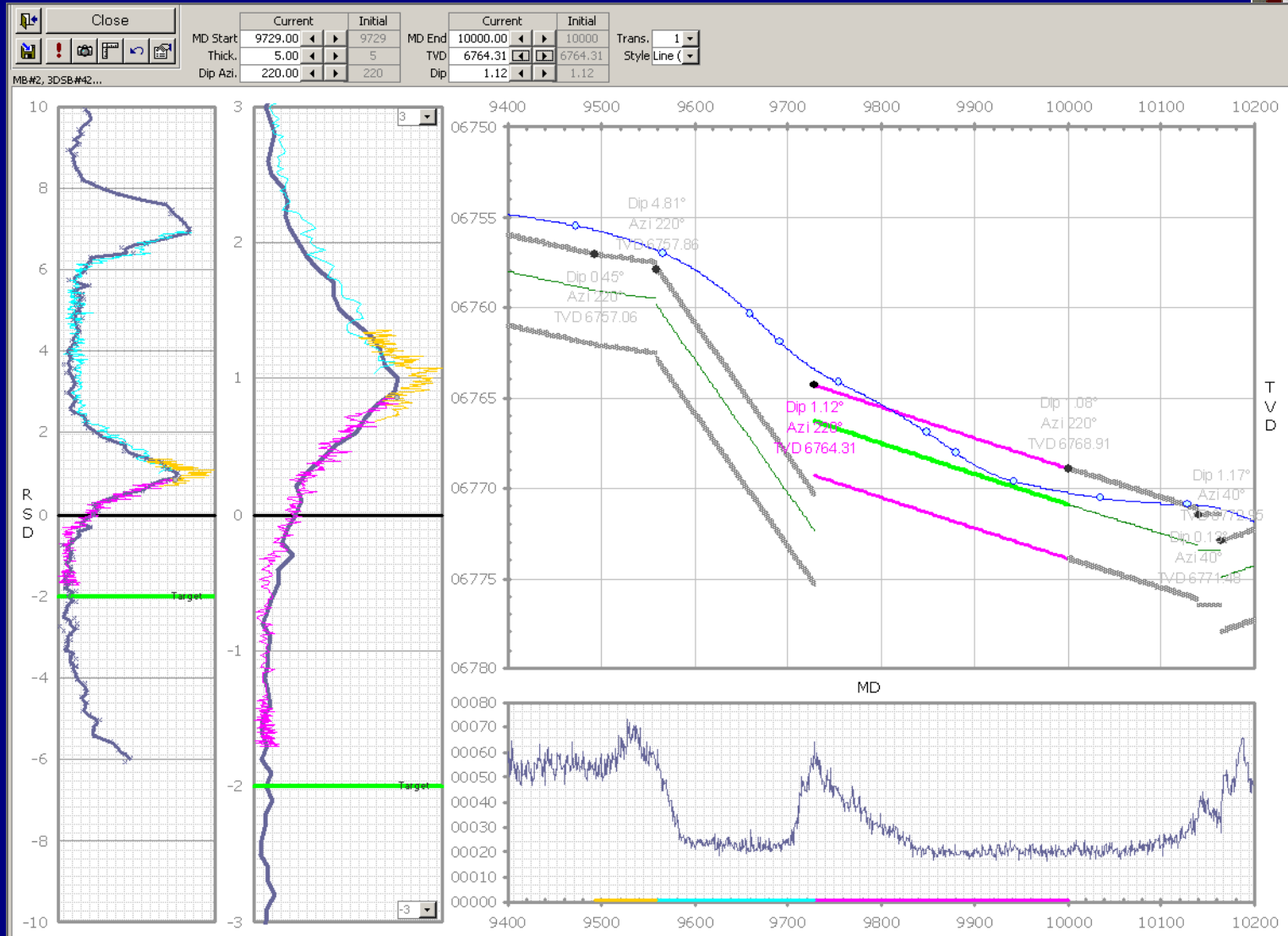


- Why go 3D?
 - A. Eliminate distortion from V.S. projection
- What is meant by “3D”? How?
 - A. 3DStratBlocks & RSD
- New geologic terminology
 - 3DStratBlock...planar surface that defines the geologic payzone marker bed top (or base) over a finite MD range of the associated survey
 - Relative Stratigraphic Depth (RSD)...minimum distance to the 3DStratBlock from the wellbore location that emitted the LWD signal

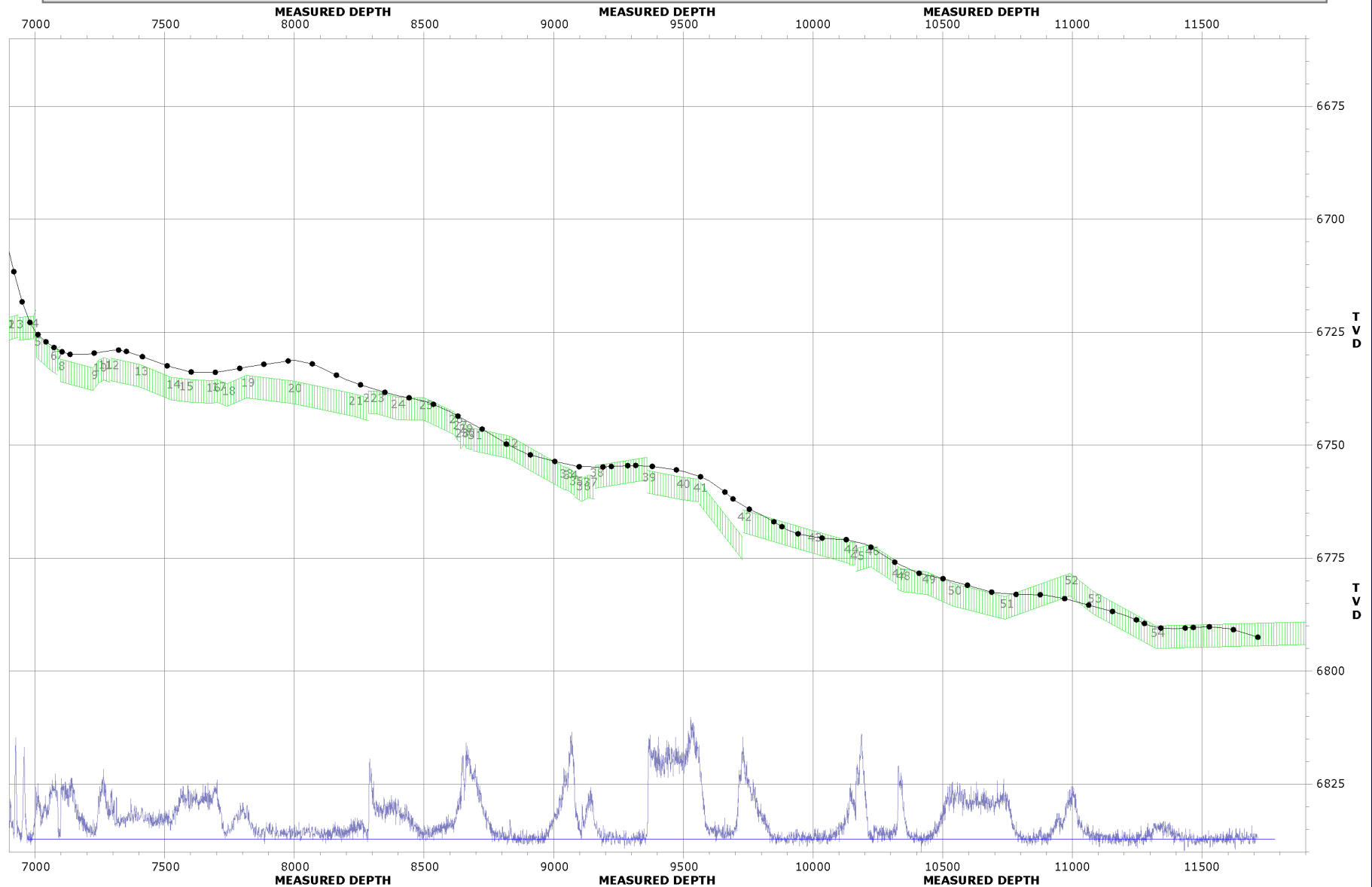
Geosteering



Geosteering



Well Name	Davis-Harvey Unit 2H	SurfaceX	4264013	Units	feet	Survey #	2	Plan #	
Field	Huxley	SurfaceY	10633796	ID	42-419-31092	Start MD	6900	Marker Bed #	2
Operator	Ellora Operating	SurfaceZ	399	Country	USA	End MD	11715		



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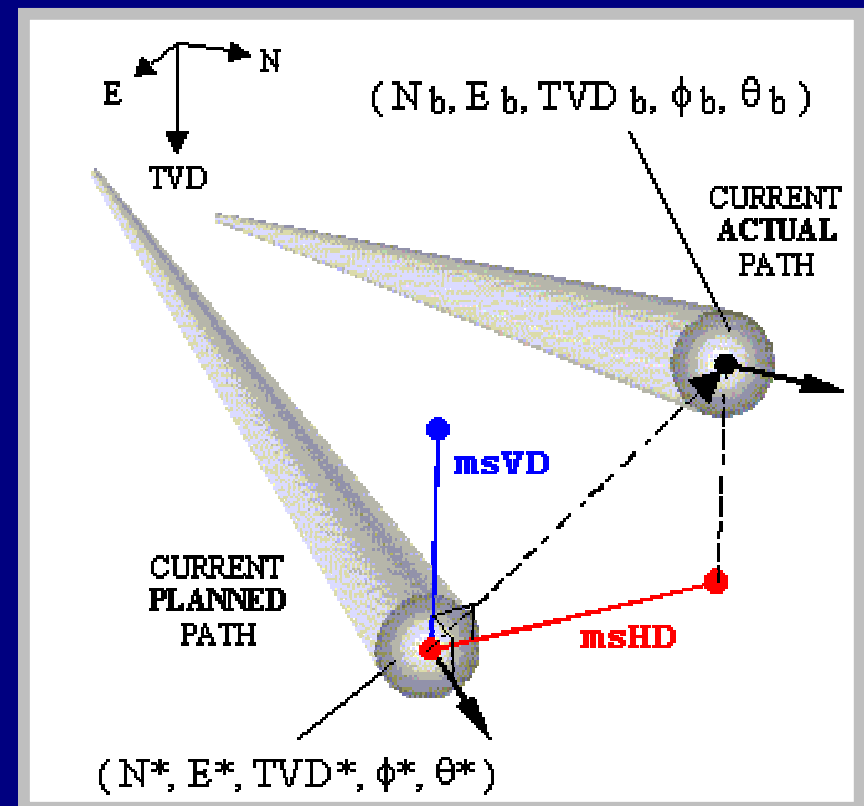


**SES integrates 5 components to create
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THD...since 2000



- Technical Hole Deviation (THD)
 - quantifies how a dir. well path differs from its planned trajectory
 - any type of dir. drilling
 - any type of dir. drilling system
 - any planned well path profile
- Log/Table formats
- Geometry OR Geosteer
- No distortion like vertical section projection



THD Components



THD Component	Description	Deviation "Sense"	Unit	Order	Lineal Deviation	Angular Deviation	Verbal Descriptor
msVD	vertical deviation	Vertical	ft or m	1st	X		High/Low
RCVD	relative change in vertical deviation	Vertical	ft/1000ft or m/304.8m	2nd	X		Positive/Negative
msID	inclinational deviation	Vertical	deg	1st		X	High/Low
RCID	relative change in inclinational deviation	Vertical	deg/100ft or deg/30.48m	2nd		X	Positive/Negative
msHD	horizontal deviation	Horizontal	ft or m	1st	X		Left/Right
RCHD	relative change in horizontal deviation	Horizontal	ft/1000ft or m/304.8m	2nd	X		Positive/Negative
msAD	azimuthal deviation	Horizontal	deg	1st		X	High/Low
RCAD	relative change in azimuthal deviation	Horizontal	deg/100ft or deg/30.48m	2nd		X	Positive/Negative

VERTICAL TECHNICAL HOLE DEVIATION LOG™

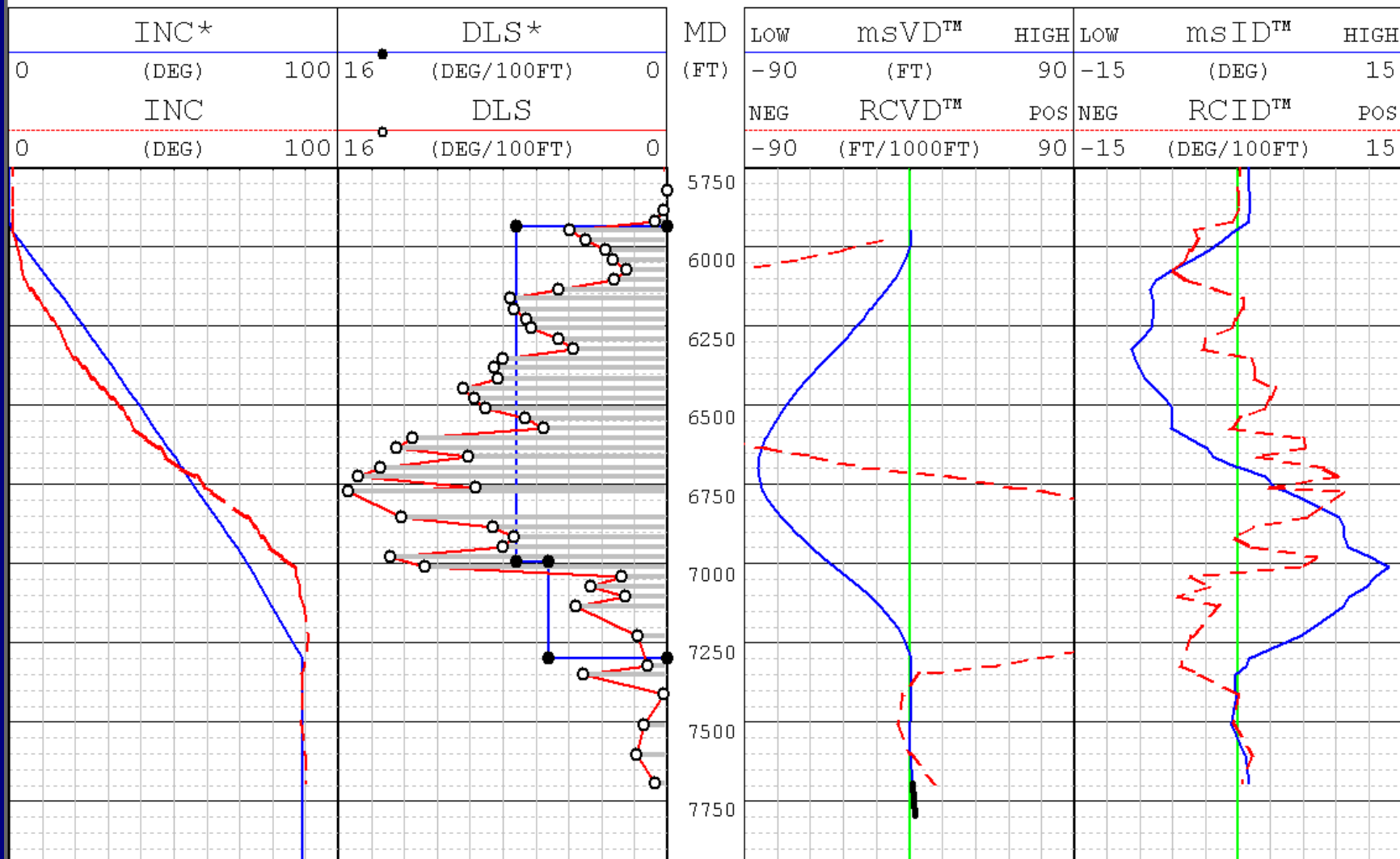
WELLNAME:

Excess Measured Depth: 81 FT 1.3%
based on footage of: 6368 FT

Average Absolute msVD: 37.8 FT

Average Absolute msID: 3.65 DEG

THD Grid Values (FT~DEG): 18~3

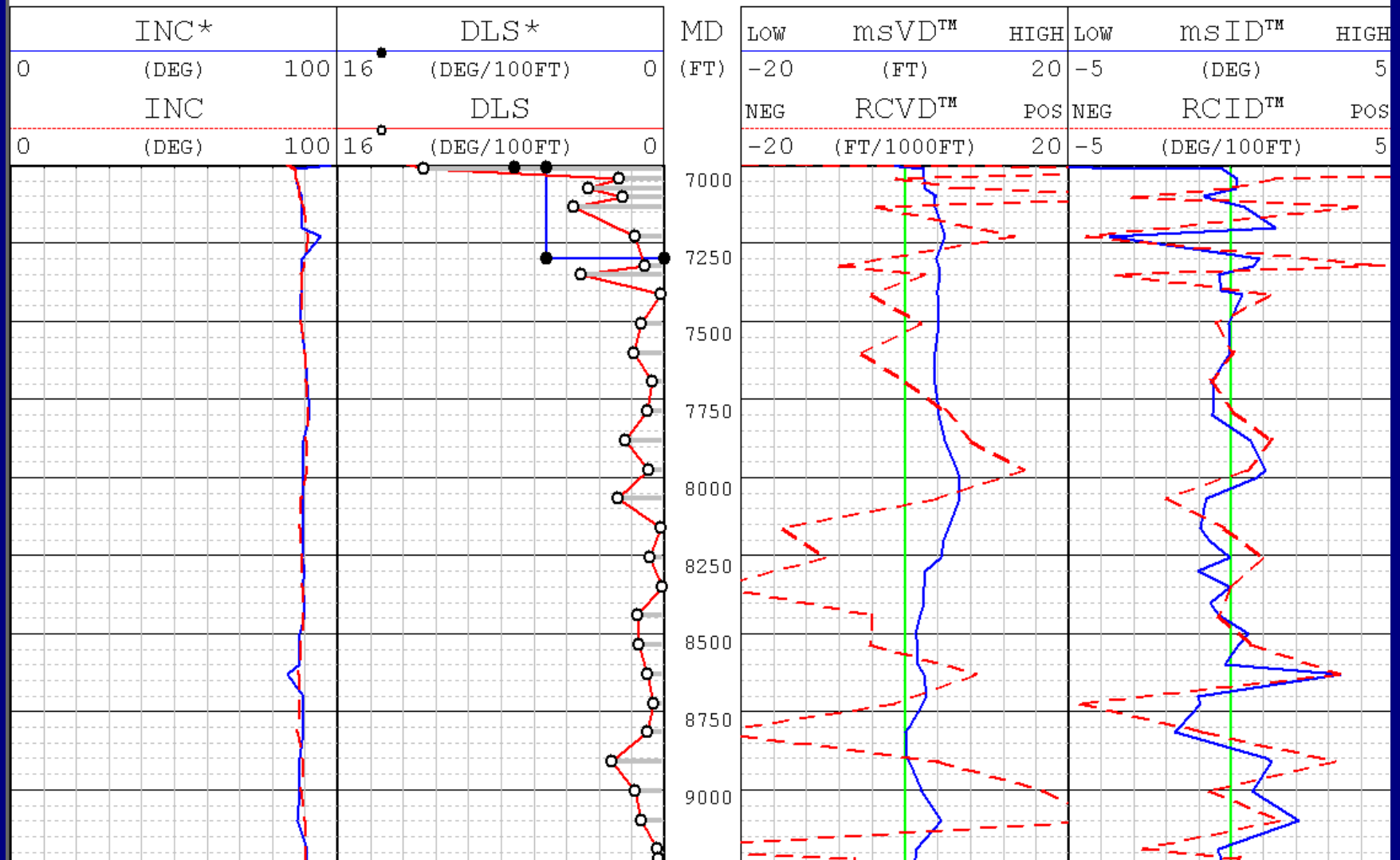


VERTICAL TECHNICAL HOLE DEVIATION LOG™

WELLNAME:

Excess Measured Depth: -27 FT -0.5%
based on footage of: 4988 FT

Average Absolute msVD: 6.0 FT
Average Absolute msID: 2.90 DEG
THD Grid Values (FT~DEG): 4~1



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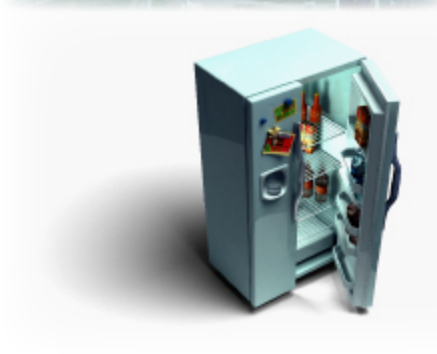
THD...Why?



- Monitor progress; convey details
- Rationalization of tool settings / mode
- System input for steering automation
- Guidance to directional driller
 - How to systematize a rule-based process?
 - What technology?



**What do these
commercial products
have in common...**

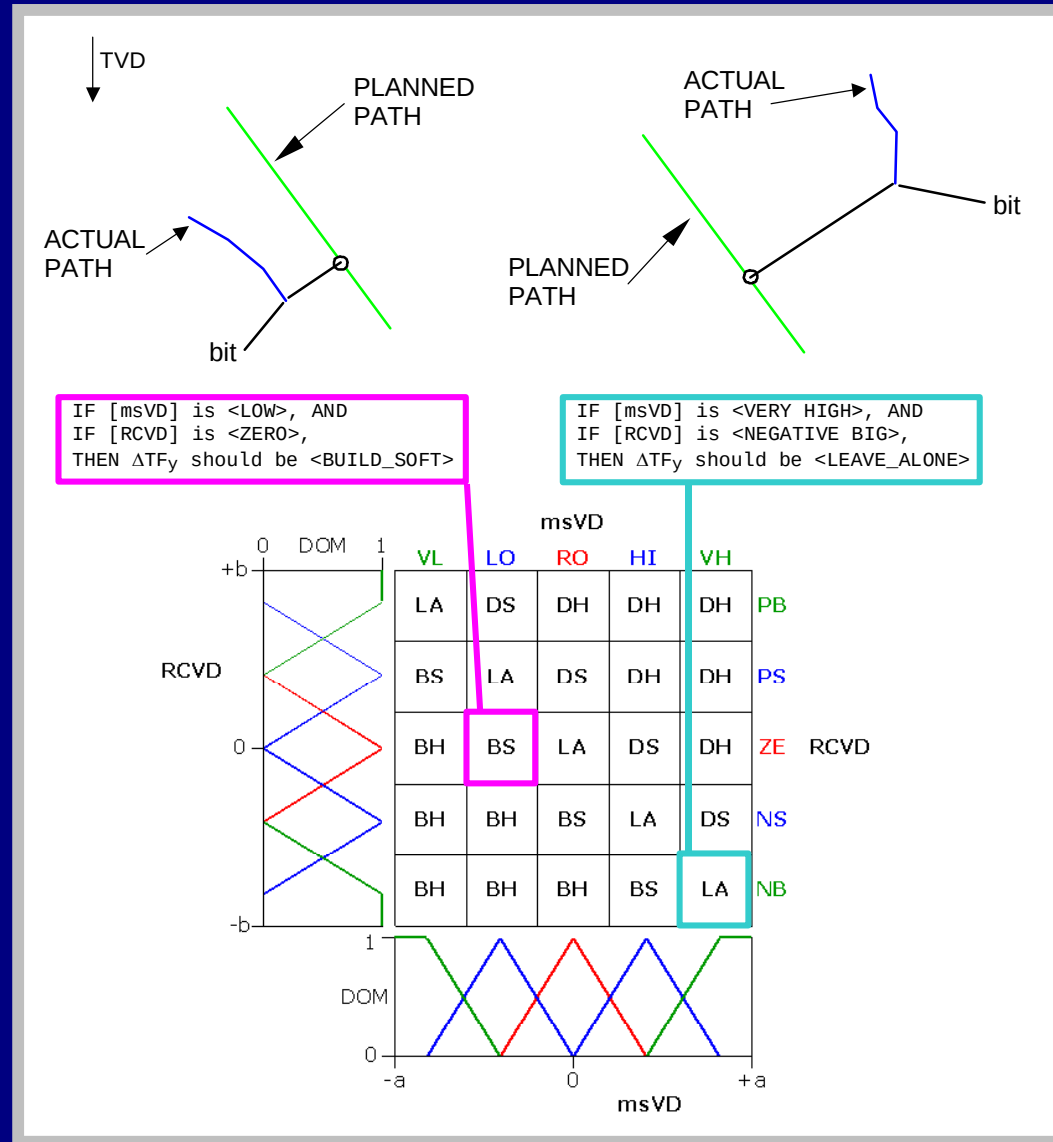




**They all use
Fuzzy Logic
controllers!**



Fuzzy Logic for Steering



Steering Guidance



MD	Δ High/Low Side	Δ Right/Left Side	VD	RCVD	ID	RCID	HD	RCHD	AD	RCAD
5888.00					1.14	0.1				
5920.00					0.97	-0.5				
5950.00			1.33		-0.23	-4.0				
5981.00	Towards BUILD 80%		0.88	-14	-1.36	-3.6				
6011.00	Towards BUILD 100%		-0.18	-35	-2.67	-4.4				
6043.00	Towards BUILD 100%		-2.12	-61	-4.21	-4.8				
6074.00	Towards BUILD 100%		-4.91	-91	-6.02	-5.9				
6105.00	Towards BUILD 100%		-8.56	-120	-7.46	-4.7	-55.54		6.12	
6135.00	Towards BUILD 100%	Towards LEFT 30%	-12.62	-139	-8.02	-1.9	-55.18	12	8.14	6.9
6165.00	Towards BUILD 90%	Towards RIGHT 20%	-16.80	-143	-7.86	0.5	-54.68	17	6.91	-4.2
6198.00	Towards BUILD 90%	Towards LEFT 30%	-21.32	-142	-7.74	0.4	-54.01	21	6.93	0.1
6229.00	Towards BUILD 100%	NO CHANGE	-25.55	-142	-7.81	-0.2	-53.28	24	6.05	-3.0
6259.00	Towards BUILD 100%	Towards LEFT 40%	-29.72	-145	-7.96	-0.5	-52.39	31	7.87	6.3
6291.00	Towards BUILD 100%	Towards LEFT 40%	-34.52	-158	-8.86	-3.0	-50.90	49	11.83	13.0
6323.00	Towards BUILD 100%	Towards LEFT 50%	-39.95	-180	-9.83	-3.2	-48.76	71	14.55	9.1
6354.00	Towards BUILD 80%	Towards LEFT 20%	-45.41	-189	-9.48	1.2	-46.33	84	13.67	-3.1
6384.00	Towards BUILD 80%	NO CHANGE	-50.47	-182	-9.05	1.5	-43.92	87	12.00	-6.0
6416.00	Towards BUILD 80%	Towards LEFT 50%	-55.61	-174	-8.56	1.6	-41.24	91	11.92	-0.3
6447.00	Towards BUILD 80%	Towards LEFT 60%	-60.20	-162	-7.56	3.5	-38.36	101	11.92	0.0
6479.00	Towards BUILD 80%	Towards LEFT 30%	-64.43	-145	-6.71	2.9	-35.19	109	11.21	-2.4
6511.00	Towards BUILD 80%	Towards LEFT 50%	-68.25	-131	-6.02	2.3	-31.77	117	11.65	1.5
6542.00	Towards BUILD 90%	Towards LEFT 60%	-71.78	-126	-5.97	0.2	-28.07	132	12.27	2.2
6573.00	Towards BUILD 100%	Towards LEFT 40%	-75.35	-128	-6.16	-0.7	-24.15	140	11.97	-1.1
6603.00	Towards BUILD 80%	NO CHANGE	-78.41	-113	-4.53	6.0	-20.42	138	10.49	-5.5
6634.00	Towards BUILD 80%	NO CHANGE	-80.58	-78	-2.79	6.2	-16.97	124	8.23	-8.1
6665.00	Towards BUILD 80%	NO CHANGE	-82.07	-53	-2.28	1.8	-14.18	100	6.03	-7.9
6697.00	Towards BUILD 50%	Towards LEFT 10%	-82.77	-24	0.01	7.9	-11.82	82	5.01	-3.5
6727.00	Towards DROP 60%	Towards LEFT 30%	-82.16	23	2.52	9.3	-9.78	76	4.60	-1.5
6759.00	Towards DROP 60%	Towards LEFT 60%	-80.56	55	3.39	3.0	-7.59	76	4.62	0.1
6771.00	Towards DROP 60%	Towards LEFT 60%	-79.76	74	4.45	9.8	-6.73	80	4.84	2.0
6855.00	Towards DROP 60%	Towards RIGHT 20%	-69.73	132	9.37	6.5	-2.46	56	1.63	-4.2
6887.00	Towards DROP 60%	Towards RIGHT 20%	-64.41	183	9.79	1.5	-1.85	21	0.67	-3.3
6918.00	Towards DROP 40%	Towards RIGHT 40%	-59.15	186	9.74	-0.2	-1.80	2	-0.48	-4.1
6950.00	Towards DROP 60%	Towards RIGHT 20%	-53.63	188	10.14	1.4	-2.08	-10	-0.56	-0.3
6980.00	Towards DROP 60%	Towards RIGHT 20%	-47.83	210	12.16	7.3	-2.40	-11	-0.65	-0.3
7011.00	Towards DROP 60%	Towards RIGHT 60%	-40.88	241	13.83	5.8	-3.01	-21	-1.62	-3.4
7042.00	NO CHANGE	Towards RIGHT 10%	-33.80	244	12.58	-4.3	-3.74	-25	-1.09	1.8
7073.00	NO CHANGE	Towards RIGHT 60%	-27.25	223	11.85	-2.5	-4.50	-26	-1.71	-2.1
7104.00	NO CHANGE	Towards RIGHT 10%	-21.32	200	10.22	-5.5	-5.25	-25	-1.09	2.1
7135.00	NO CHANGE	Towards RIGHT 60%	-15.95	179	9.71	-1.7	-6.01	-25	-1.71	-2.1

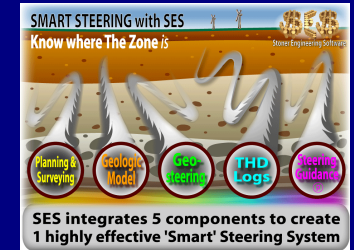
Record: 96 of 96

Steering Guidance



MD	Δ High/Low Side	Δ Right/Left Side	-	VD	RCVD	ID	RCID	-	HD	RCHD	AD	RCAD	-
9004.00	Towards DROP 20%	Towards LEFT 50%	-	2.07	17	0.65	-0.7	-	12.90	15	0.23	-1.3	-
9098.00	Towards DROP 100%	Towards LEFT 60%	-	4.36	24	2.08	1.5	-	13.71	9	0.75	0.6	-
9190.00	Towards BUILD 60%	Towards LEFT 60%	-	1.42	-32	-0.39	-2.7	-	14.85	12	0.67	-0.1	-
9222.00	Towards DROP 10%	Towards LEFT 60%	-	1.22	-6	-0.30	0.3	-	15.22	12	0.67	0.0	-
9285.00	Towards BUILD 20%	Towards LEFT 70%	-	0.84	-6	-0.39	-0.1	-	16.24	16	1.19	0.8	-
9316.00	Towards BUILD 40%	Towards LEFT 50%	-	0.60	-8	-0.48	-0.3	-	16.70	15	0.49	-2.3	-
9380.00	Towards DROP 90%	Towards LEFT 60%	-	3.10	39	0.23	1.1	-	17.49	12	0.93	0.7	-
9473.00	Towards DROP 50%	Towards LEFT 80%	-	3.35	3	0.06	-0.2	-	19.50	22	1.55	0.7	-
9566.00	Towards DROP 90%	Towards LEFT 80%	-	3.39	0	2.83	3.0	-	22.87	36	2.60	1.1	-
9660.00	Towards DROP 80%	Towards LEFT 80%	-	6.93	38	1.25	-1.7	-	27.34	48	2.86	0.3	-
9691.00	Towards DROP 100%	Towards LEFT 70%	-	7.69	25	1.34	0.3	-	28.82	48	2.60	-0.8	-
9754.00	Towards BUILD 20%	Towards LEFT 80%	-	2.57	-81	-0.40	-2.8	-	31.67	45	2.60	0.0	-
9849.00	Towards BUILD 50%	Towards LEFT 60%	-	1.43	-12	-1.02	-0.7	-	35.25	38	1.72	-0.9	-
9880.00	Towards BUILD 70%	Towards LEFT 70%	-	0.84	-19	-1.19	-0.5	-	36.25	32	1.98	0.8	-
9942.00	Towards DROP 30%	Towards LEFT 50%	-	0.32	-8	0.21	2.3	-	37.64	22	0.58	-2.3	-
10035.00	Towards DROP 50%	Towards LEFT 50%	-	0.92	7	0.52	0.3	-	38.43	9	0.40	-0.2	-
10128.00	Towards DROP 80%	Towards LEFT 70%	-	2.08	12	0.88	0.4	-	39.80	15	1.28	0.9	-
10223.00	Towards BUILD 10%	Towards LEFT 70%	-	1.37	-7	0.15	-0.8	-	41.84	22	1.19	-0.1	-
10315.00	Towards DROP 20%	Towards LEFT 60%	-	1.51	2	-0.02	-0.2	-	43.47	18	0.84	-0.4	-
10409.00	NO CHANGE	Towards LEFT 50%	-	1.50	0	-0.44	-0.4	-	43.91	5	-0.30	-1.2	-
10501.00	Towards DROP 80%	Towards LEFT 40%	-	2.07	6	0.80	1.3	-	43.15	-8	-0.65	-0.4	-
10595.00	Towards DROP 40%	Towards LEFT 50%	-	2.42	4	-0.26	-1.1	-	42.37	-8	-0.30	0.4	-
10689.00	Towards DROP 50%	Towards LEFT 50%	-	2.27	-2	0.09	0.4	-	41.73	-7	-0.48	-0.2	-
10783.00	Towards BUILD 40%	Towards LEFT 40%	-	1.62	-7	-1.06	-1.2	-	40.81	-10	-0.65	-0.2	-
10876.00	Towards BUILD 80%	Towards LEFT 60%	-	-0.38	-21	-1.41	-0.4	-	40.18	-7	-0.12	0.6	-
10970.00	Towards BUILD 100%	Towards LEFT 20%	-	-3.18	-30	-2.03	-0.7	-	38.83	-14	-1.53	-1.5	-
11063.00	Towards DROP 70%	Towards LEFT 40%	-	-1.82	15	1.67	4.0	-	36.84	-21	-0.92	0.7	-
11155.00	Towards DROP 20%	Towards LEFT 50%	-	-0.10	19	0.98	-0.8	-	35.86	-11	-0.30	0.7	-
11247.00	NO CHANGE	Towards LEFT 40%	-	0.97	12	0.37	-0.7	-	35.10	-8	-0.65	-0.4	-
11278.00	Towards DROP 20%	Towards LEFT 60%	-	1.14	6	0.28	-0.3	-	34.84	-8	-0.30	1.1	-
11341.00	Towards DROP 10%	Towards LEFT 20%	-	1.49	5	-0.40	-1.1	-	34.13	-11	-1.00	-1.1	-
11435.00	Towards DROP 50%	Towards LEFT 50%	-	1.35	-1	0.22	0.7	-	33.13	-11	-0.21	0.8	-
11466.00	Towards DROP 20%	Towards LEFT 40%	-	1.44	3	0.13	-0.3	-	32.95	-6	-0.48	-0.9	-
11528.00	Towards DROP 20%	Towards LEFT 40%	-	1.49	1	-0.05	-0.3	-	32.29	-11	-0.74	-0.4	-
11621.00	Towards BUILD 60%	Towards LEFT 40%	-	0.71	-8	-0.93	-0.9	-	31.30	-11	-0.48	0.3	-
11715.00	Towards BUILD 80%	Towards LEFT 20%	-	-1.10	-19	-1.28	-0.4	-	29.58	-18	-1.62	-1.2	-
Record: 69 of 69													

SES 3.0



- Steering Guidance
- 3D Geosteering
- Cross-sections of TVD versus MD and 3DStratBlocks
- "Self-derived" Type Logs from the landing
- Geo model from grid data during well planning
- Revise the geologic model
- 3D Graphics
- Multi-user environment
- Imports from LAS files
- US & Metric units
- Transfers data between SES users using XML
- THD & THD Logs

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