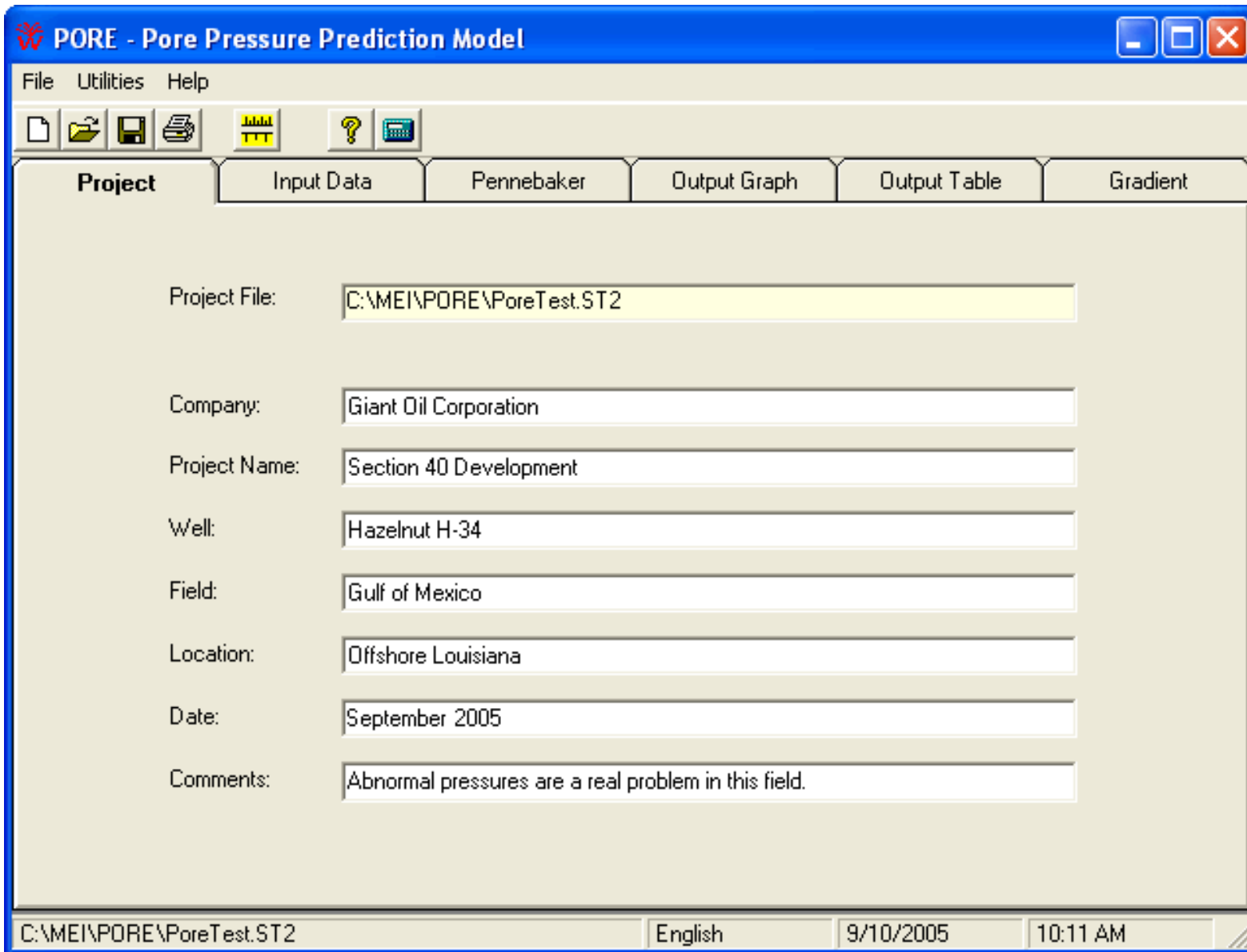


PORE – Abnormal Formation Pressure Detection and Estimation Model

PORE makes use of Pennebaker plots to determine formation pore pressures from seismic stacking velocity data. The program calculates formation depth, average velocity, interval velocity and 500-ft travel time based on two-way time and RMS velocity input.

PORE presents various time *versus* depth tables for identifying abnormal pressure sequences in which seismic velocities deviate from normal compaction trends. These results allow more accurate selection of casing-seat depths.

NOTE: Computer screens within this PDF document may appear slightly distorted. This is due to limitations in the Adobe Acrobat Viewer when displaying graphics. To clearly view details in the graphics, zoom in or print the document.

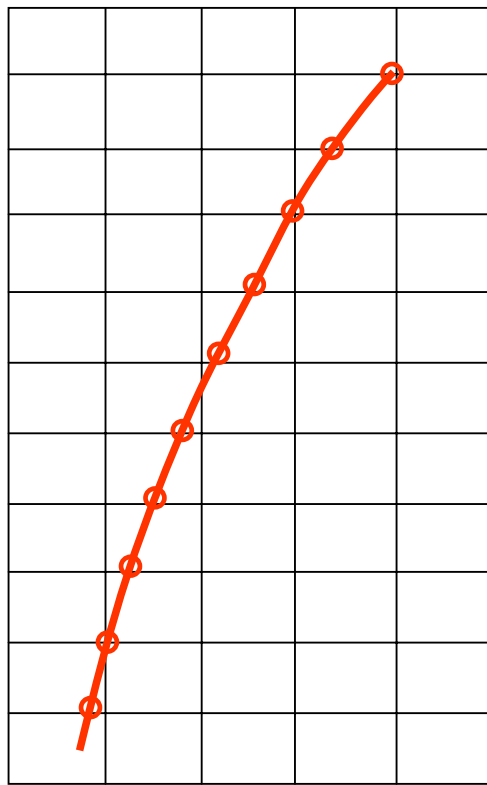


PORE

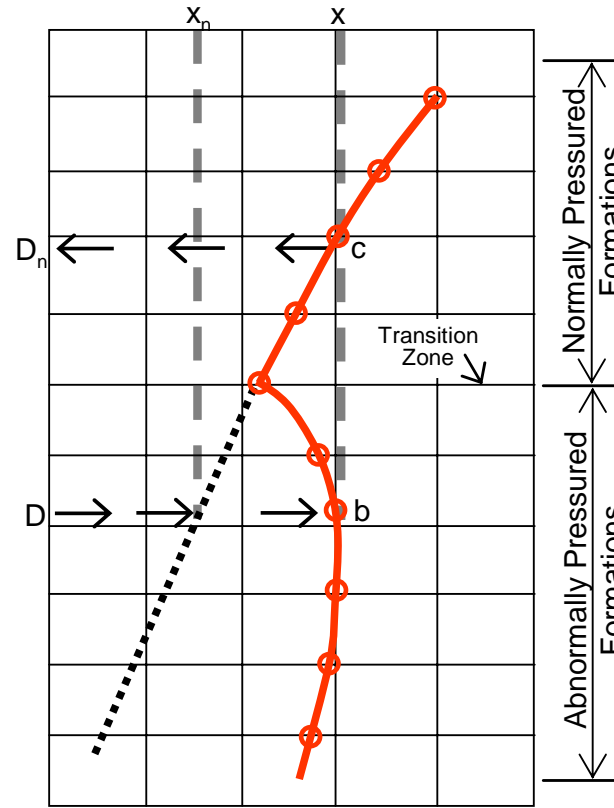
PORE is a user-friendly software package with a variety of powerful features. The first input screen, the Project page, stores documentation to identify specific clients, wells, fields, etc.

Slide
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Porosity-Dependent Parameter (x)



Normally Pressured Formation



Abnormally Pressured Formation

Most methods for detecting and estimating abnormal formation pressures are based on the fact that formations with abnormal pressures also tend to be **less compacted** and have a **higher porosity** than similar formations with normal pressures at the same burial depth. Thus, any measurement that reflects changes in formation porosity also can be used to detect abnormal pressures.

PORE - Pore Pressure Prediction Model

File Utilities Help

Project **Input Data** Pennebaker Output Graph Output Table Gradient

Lithologically Compensated Pennebaker Plot
 Eaton Fracture-Pressure Gradient Correlation

Matrix Velocity Eaton Parameters

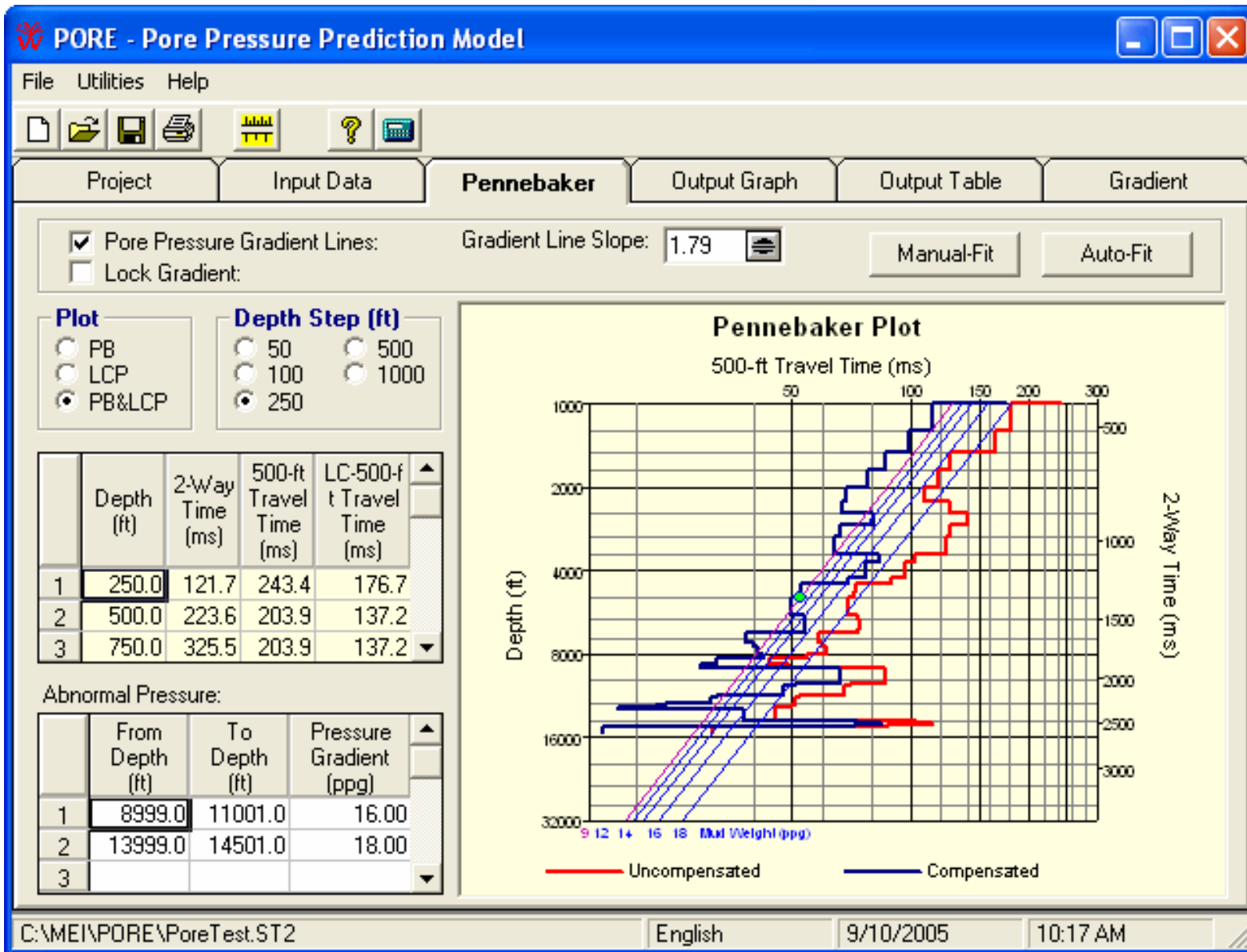
	2-Way Time (ms)	RMS Velocity (ft/s)	Matrix Velocity (ft/s)	Depth (ft)	Average Velocity (ft/s)	Interval Velocity (ft/s)	500-ft Travel Time (ms)	LC-500-ft Travel Time (ms)
1	0	3773	9000	0.0	3937	3937	254.0	187.3
2	100	3937	9000	196.9	3937	3937	254.0	187.3
3	364	4659	9000	844.3	4639	4905	203.9	137.2
4	484	4823	9000	1161.7	4800	5289	189.1	122.4
5	604	5085	9000	1523.3	5044	6027	165.9	99.2
6	700	5610	15000	1915.6	5473	8173	122.4	82.4
7	796	6152	15000	2356.4	5921	9183	108.9	68.9
8	915	6283	10000	2778.7	6074	7097	140.9	80.9
9	1108	6627	10000	3556.5	6420	8061	124.1	64.1
10	1276	7218	30000	4421.6	6930	10299	97.1	77.1
11	1348	6266	30000	4915.5	7293	13720	72.9	52.9
12	1468	7267	30000	5774.6	7867	14317	69.8	49.8
13	1612	5643	30000	6745.6	8369	13487	74.1	54.1
14	1684	6562	30000	7363.1	8745	17152	58.3	38.3
15	1780	5118	50000	8151.3	9159	16421	60.9	48.9

Insert
Delete
Append
Calculate

C:\ME\PORE\PoreTest.ST2 English 9/10/2005 10:13 AM

PORE

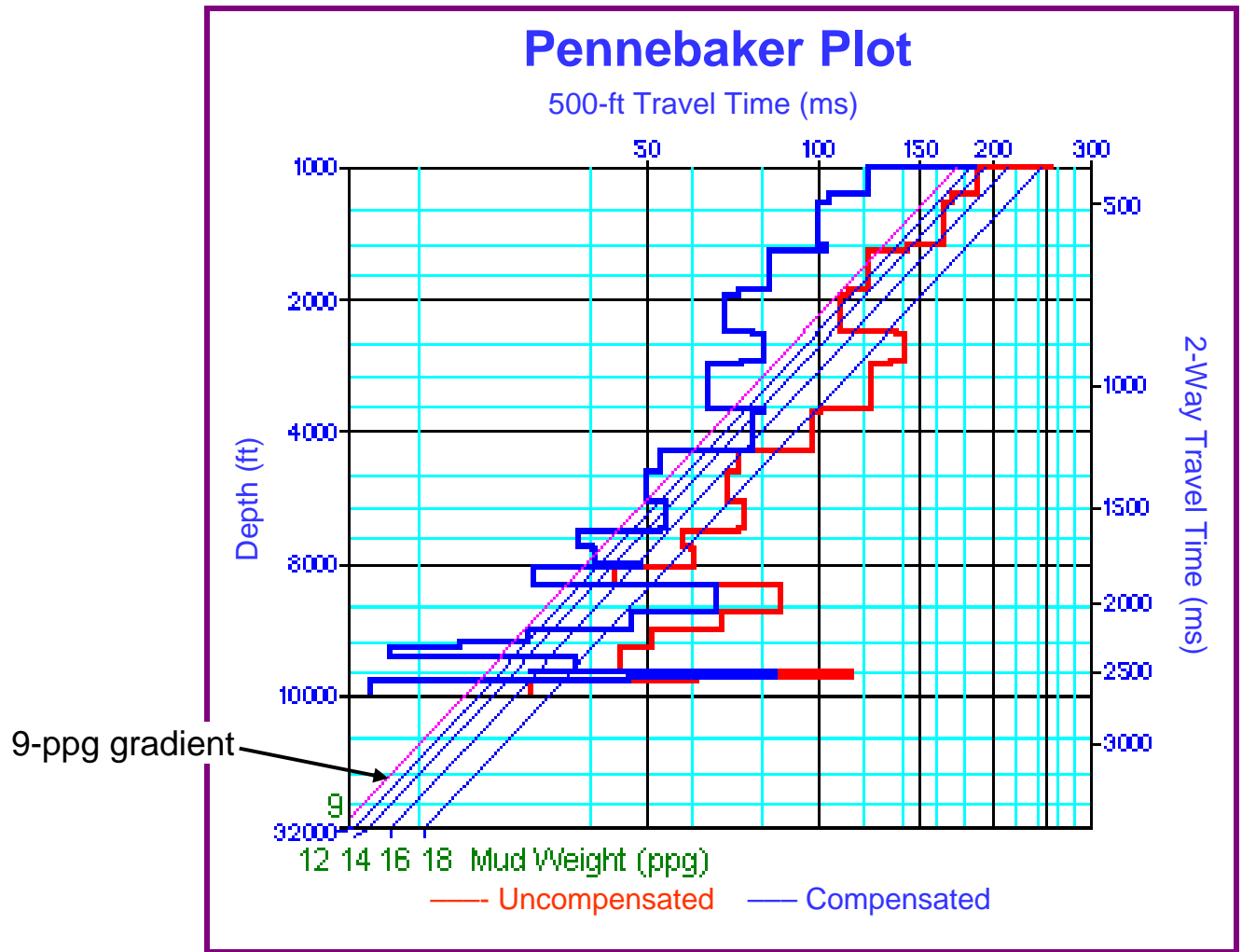
The first two columns on the Input Data page are input from seismic data. The other columns are calculated based the first two columns of data. The output can be compensated for changes in lithology if matrix velocity data are available.



PORE

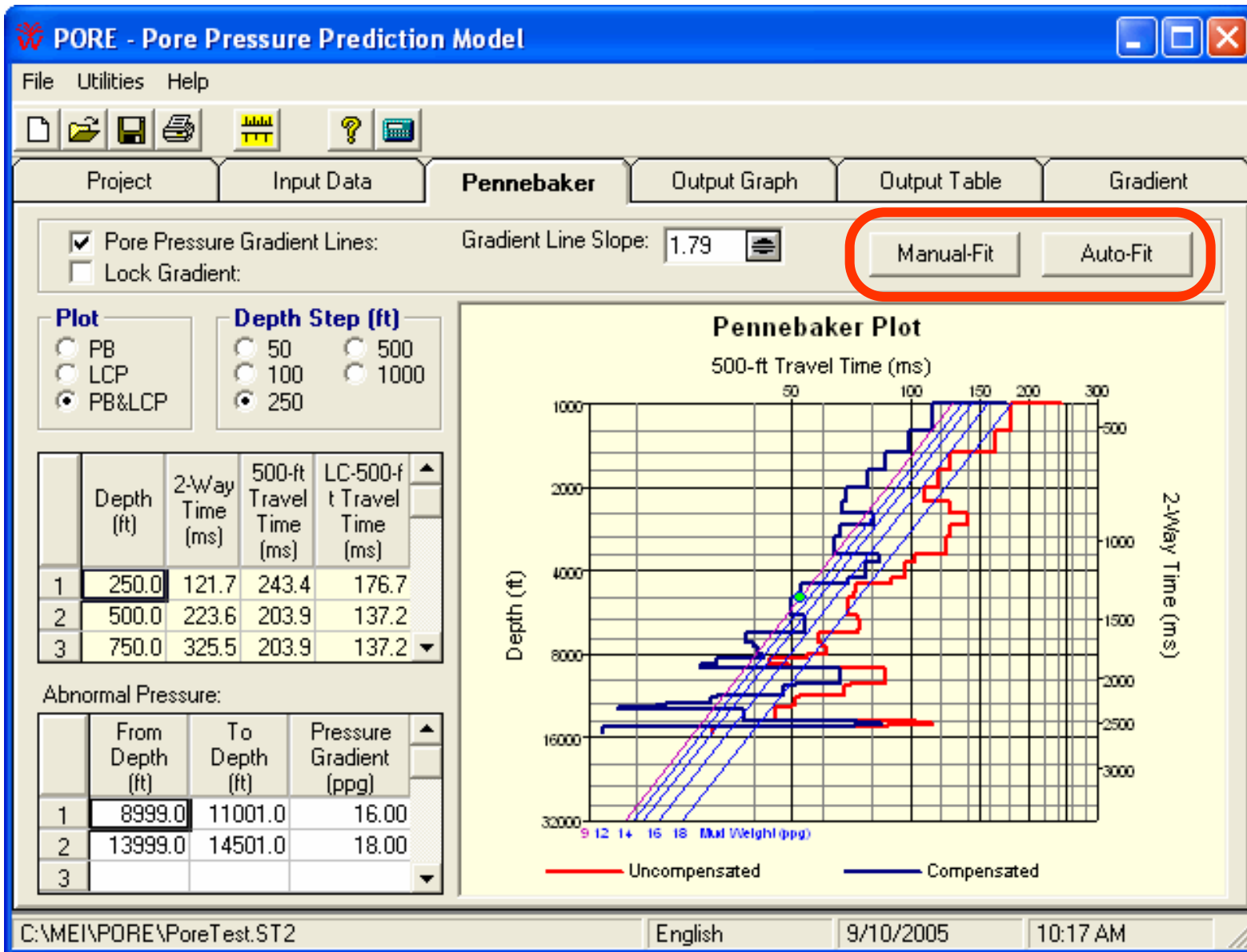
After data are entered, go to the Pennebaker page to see the results. This type of plot rapidly highlights interval travel times that deviate from the normal trend. This deviation may be caused by abnormal pressure zones or changes in lithology (uncompensated, compensated, or both).

Slide
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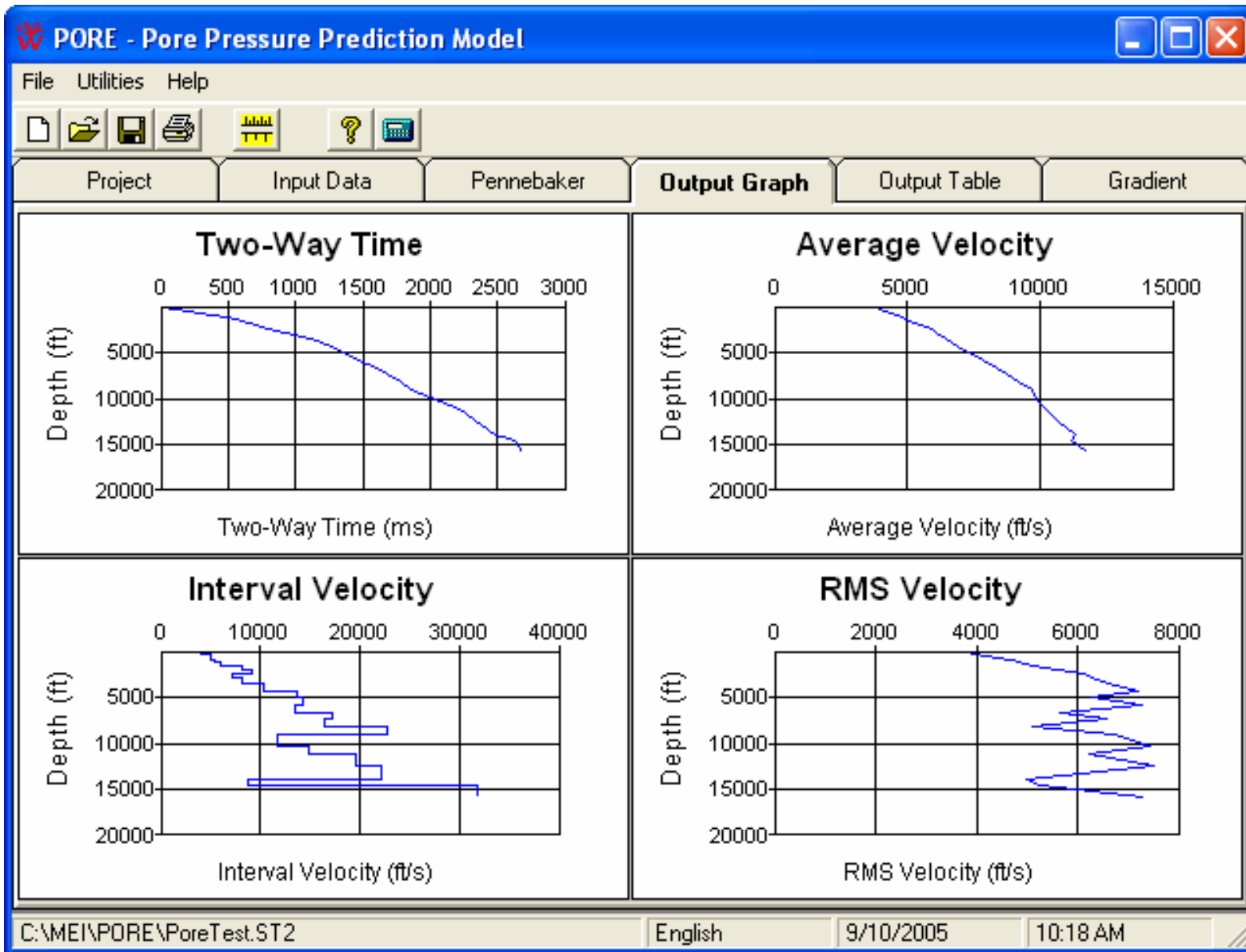
PORE

A normal 9-ppg gradient line along with several overpressured baselines are superimposed on the transit times in the Pennebaker plot to help you gauge the degree of overpressuring that may be present.



PORE

Manual Fit can be used to precisely position the mud-weight curves laterally (left to right). The slope of the fit can also be adjusted. Alternatively, Auto-Fit can be used to let the computer calculate the least-squares linear fit to the data.



PORE

Additional output is presented on the Output Graph page for evaluation in four tiled windows. These include **Two-Way Time vs. Depth**, **Average Velocity vs. Depth**, **Interval Velocity vs. Depth** and **RMS Velocity vs. Depth**.

PORE - Pore Pressure Prediction Model

File Utilities Help

Project Input Data Pennebaker Output Graph **Output Table** Gradient

Step for

Depth
 Time

Step

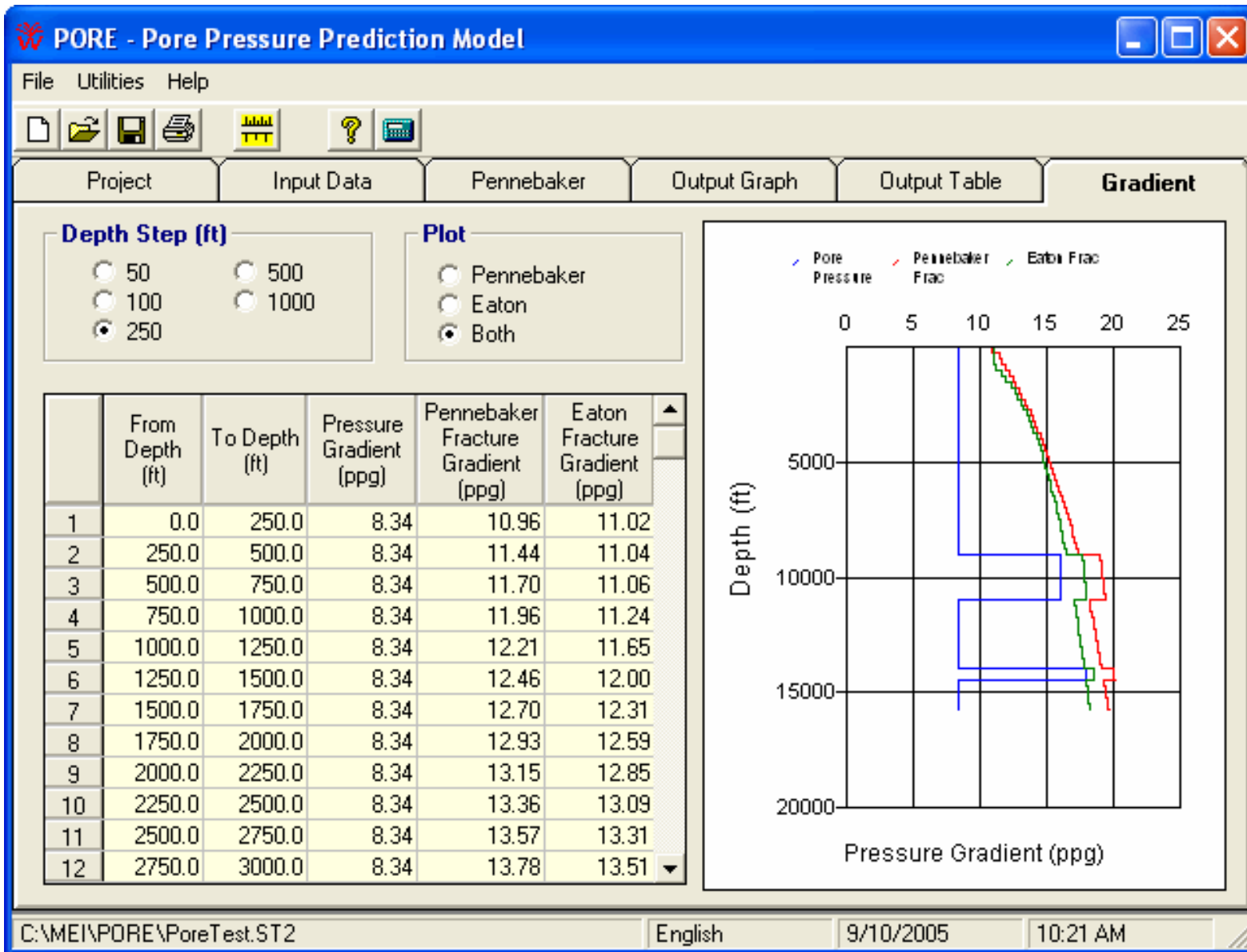
10
 25
 50
 100
 250
 500

	Depth (ft)	2-Way Time (ms)	RMS Velocity (ft/s)	Matrix Velocity (ft/s)	Average Velocity (ft/s)	Interval Velocity (ft/s)	500-ft Travel Time	LC-500-ft Travel Time
1	0.0	0.0	3773.0	9000.0	3937.0	3937.0	254.0	187.3
2	500.0	223.6	4275.1	9000.0	4265.7	4390.2	230.5	163.9
3	1000.0	422.9	4739.5	9000.0	4718.1	5093.5	196.6	129.9
4	1500.0	596.3	5068.1	9000.0	5028.3	5979.7	167.4	100.7
5	2000.0	718.4	5713.8	15000.0	5558.8	8366.5	119.8	79.8
6	2500.0	836.5	6196.6	10000.0	5972.6	8473.9	119.8	59.8
7	3000.0	969.9	6380.9	10000.0	6172.1	7371.4	136.1	76.1
8	3500.0	1094.0	6602.0	10000.0	6394.6	7990.5	125.3	65.3
9	4000.0	1194.1	6930.0	30000.0	6681.5	9207.9	110.2	90.2
10	4500.0	1287.4	7066.9	30000.0	6988.0	10841.7	93.3	73.3
11	5000.0	1359.8	6364.4	30000.0	7349.5	13778.6	72.6	52.6
12	5500.0	1429.6	6947.1	30000.0	7683.7	14126.3	70.8	50.8
13	6000.0	1501.4	6890.0	30000.0	7983.8	14124.4	70.8	50.8
14	6500.0	1575.6	6053.8	30000.0	8242.3	13696.8	73.1	53.1
15	7000.0	1641.7	6021.6	30000.0	8523.9	14996.7	67.6	47.6
16	7500.0	1700.7	6311.1	30000.0	8816.7	17024.9	58.8	38.8
17	8000.0	1761.6	5395.2	30000.0	9079.3	16561.6	60.4	40.4
18	8500.0	1810.7	5803.6	50000.0	9383.5	19105.9	53.7	41.7

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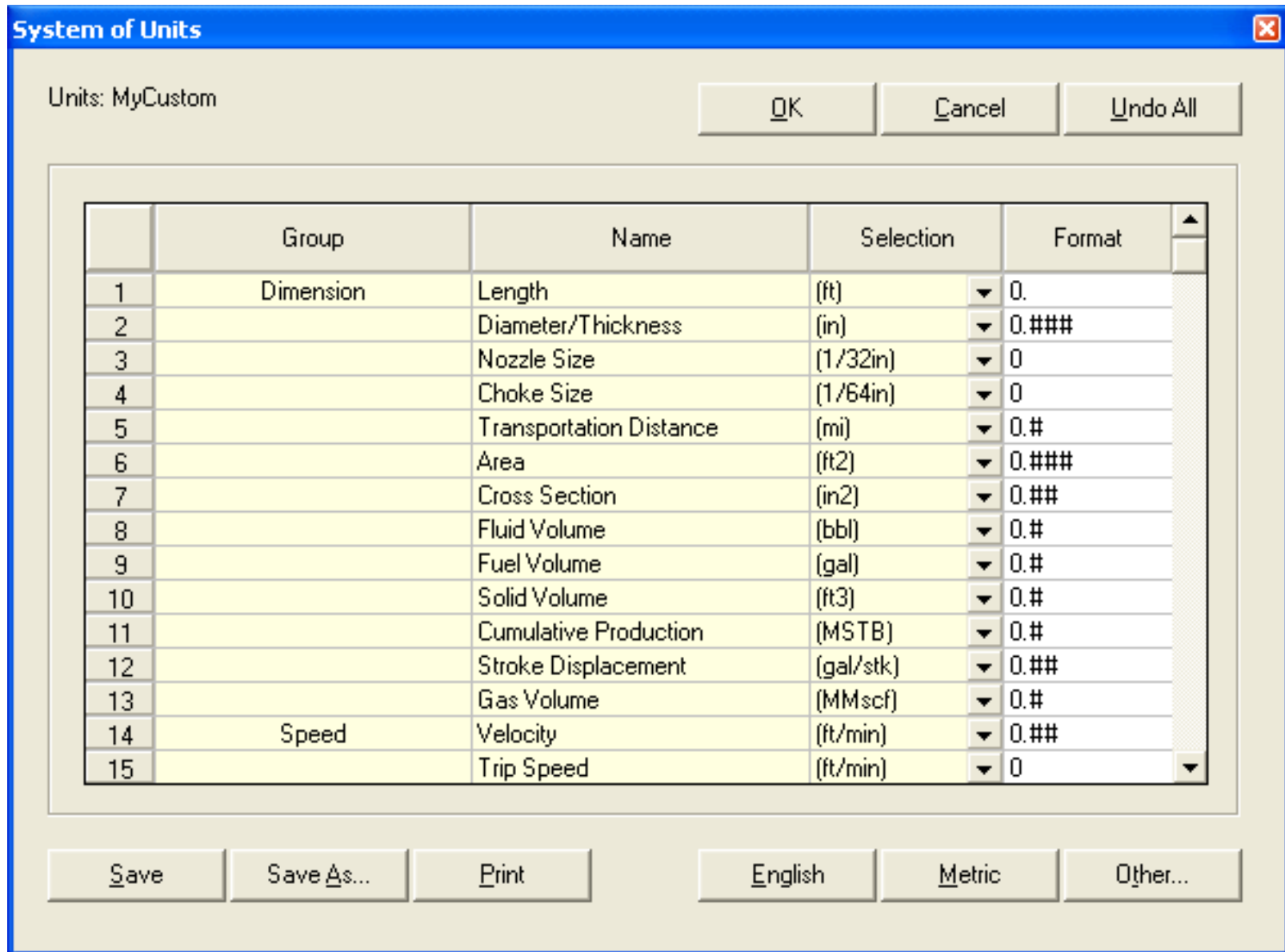
PORE

The Output Table page displays all results numerically. These can be printed and saved to a file for exporting into other applications.



PORE

The Gradient page displays pore and fracture-pressure gradients. Fracture-pressure gradient can be calculated based on either Pennebaker's or Eaton's correlation. These results can be printed and saved to a file for exporting into other applications.



PORE

Units for input and output displays are easy to select and customize. Choose between the default metric or English systems, or a custom combination of units. Custom systems are saved and automatically recalled in future sessions.

PORE

File Edit Bookmark Options Help

Back Print

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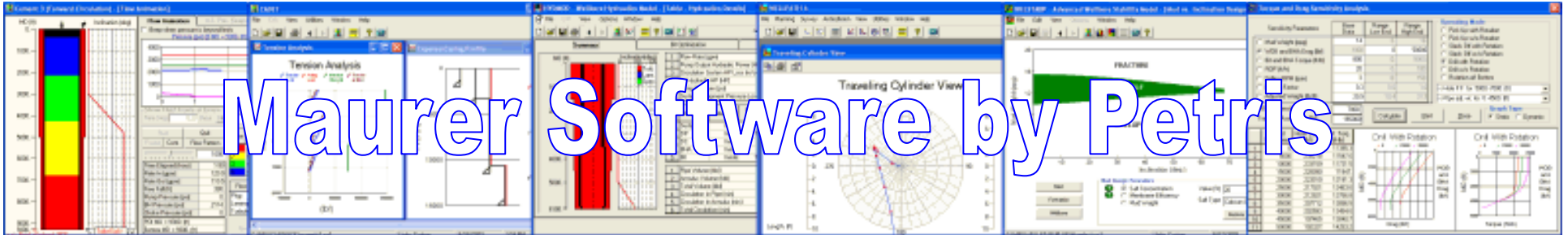
- Introduction
 - Background
 - Features
 - Theoretical Basis
- Input/Output Windows
 - Project Page
 - Input Data Page
 - Pennebaker Page
 - Output Graph Page
 - Output Table Page
 - Gradient Page
- Menus and Icons
- Other MTI Software

PORE uses **Pennebaker plots** to determine formation pore pressures from seismic stacking velocity data. A Pennebaker plot compares depth versus velocity on a log/log scale. With logarithmic scaling, the normal shale velocity (transit time) compaction trend should roughly fall along a straight line. Any divergence (velocity changes) from this normal compaction line in shales may be an indication of undercompaction and overpressuring.

It should be noted that major lithological changes can also create large velocity changes that are not related to overpressuring, and the Pennebaker technique should always make best use of all available geological data and previous experience to constrain the interpretation. Based on numerous well calibrations from various areas, it is known that the degree of overpressuring is directly proportional to the amount of velocity departure from the normal baseline. The primary purpose of the Pennebaker plot is

PORE

A comprehensive **On-Line Help System** is also provided. Tips on program operation, program structure, and basic theoretical background are immediately available at the click of a button.



Thanks for your interest in **PORE**

For more information on Maurer Software by Petris,

email:

sales@petris.com

or visit us on the web at

www.petris.com

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