Schlumberger

Zodiac™

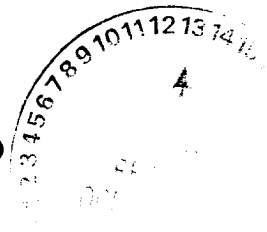
Well Test Interpretation

Report Date 7/10/00

Company:	**Torch Operating , Inc. (Bellwether)**	Test Date:	**Jun 28, 2000**
Well:	**Chaps 12 State Com #1, DST #1**	Report No:	**6203152-MV**

Test Type	**MFE Openhole DST**	Location	**Sec 12/ T19s/ R29e**
Field		County	**Eddy**
Formation	**Morrow**	State	**New Mexico**
Test Interval, ft	**11350 to 11417**	Field Service Order No.	**6203152**

Reservoir Model	**Radial Composite**
Initial Reservoir Pressure, psia	**4293 (at 11359 ft)**
Transmissibility, md-ft/cp	**888.52**
Effective Permeability to GAS, md (inner region)	**2.37 (based on h= 9.5 ft)**
Total Skin Factor	**20.81**
Delta P Due to Skin, psi	**2130**
Mobility Ratio, mr (inner/outer)	**2.43**
Storativity Ratio, sr (inner/outer)	**3.49**
Boundary Type	**Decrease in Mobility**
Distance to Boundaries, ft	**77**
Radius of Investigation, ft	**267 (estimate, based on final shutin time)**



This is a Model Verified™ Interpretation of DST #1 started on Jun 28, 2000 in the Morrow formation. The interval produced gas and condensate during the test. Inspection of the flow regime identification plots (page #5) indicates wellbore storage at early time, changing wellbore storage during transition, a fairly well defined infinite acting region at middle time and some type of boundary behavior at late time.

The data is modeled as being in an infinite, radial composite system with variable wellbore storage and some wellbore damage. The radial composite model assumes a decrease in mobility about 77 from the wellbore. This could be due to a thickness decrease, a permeability decrease or a viscosity increase.

The late time boundary behavior is also modeled as two intersecting faults (see pages #11 and #12). Either solution is possible.but the fault model is not supported by the log data, nor are the faults "seen" in the initial shutin data.

Thank you for using Schlumberger Oilfield Services. Questions concerning this report should be directed to Dick Simper at (915) 684-0700.

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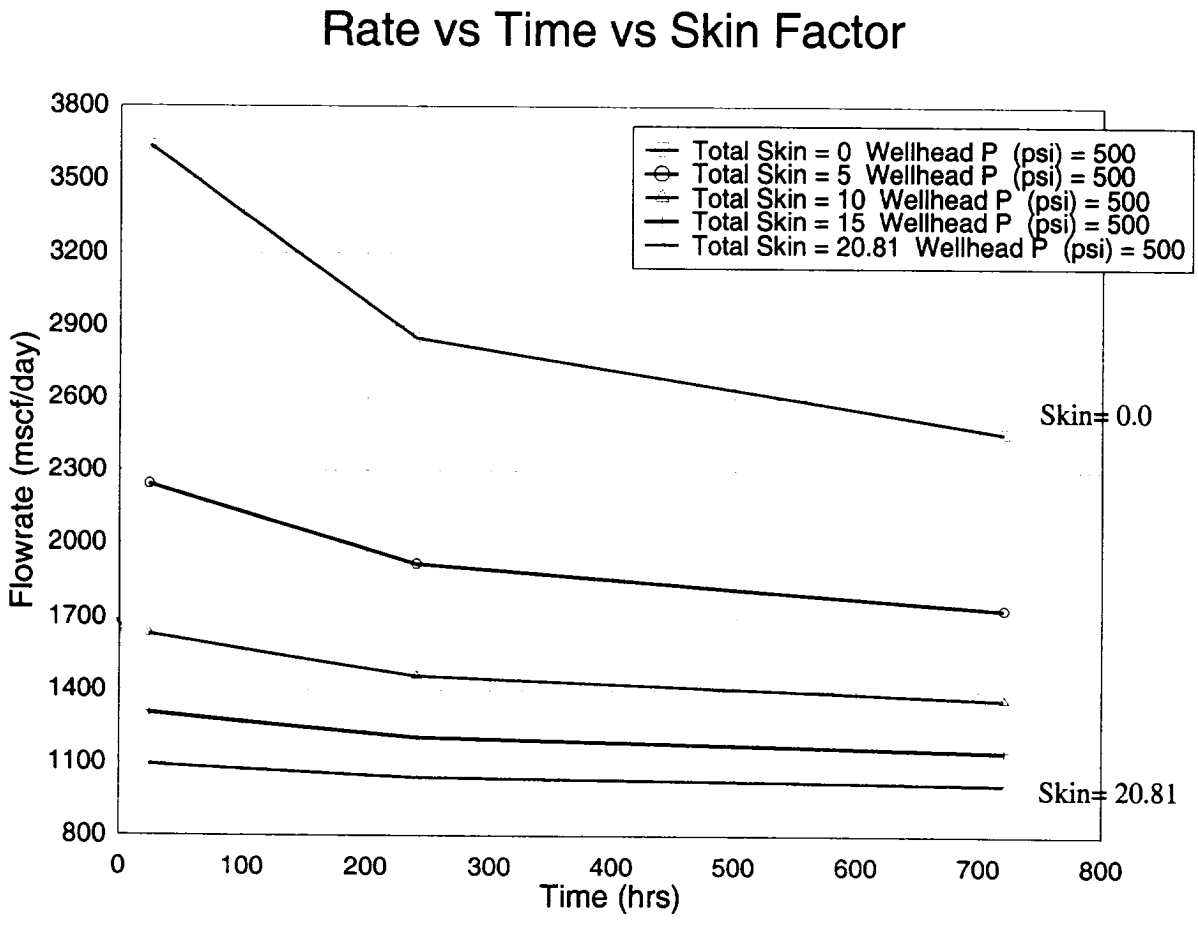
Below is a plot showing the possible production from the tested interval if all of the assumptions used in the solution are satisfied. The plot is based on the radial composite solution and assumes 2 3/8 tubing. The solution shows the effect of removing the apparent skin and the effect of producing time.



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ROCK / WELLBORE DESCRIPTION

Porosity, %	**7**	Water Saturation, %	**30 (estimated)**
Net Thickness, ft	**9.5**	Wellbore Radius, ft	**0.33 (7.875" bit)**

FLUID DESCRIPTION

Gas Liquid Ratio, scf/bbl		Reference Pressure, psia	**4236**
Liquid Gas Ratio, bbl/mmscf	**12.08**	Oil Viscosity, cp	--
Water Cut, %	**0.0**	Gas Viscosity, cp	**0.02534**
Oil Gravity, deg API @ 60 F	**53.7**	Water Viscosity, cp	--
Gas Gravity	**0.65 (estimated)**	Total Form.Vol.Factor, rvb/scf	**0.0006709**
N2/CO2/H2S, mole %	--	Total Compressibility, 1/psi	**1.169 E-04**
Water Salinity, ppm	--		

COMPLETION CONFIGURATION

Total Depth, ft	**11417**	Packer Depths, ft	**11344, 11350**
Casing Size, in / WT, lbs/ft	**8.625 set at 3000 ft**	Shot Density / Dia, in	**Openhole**
Drill Pipe Length, ft / ID, in	**10501 / 3.826**	Perforated Intervals, ft	**Openhole**
Drill Collar Length, ft / I.D., in	**802 / 2.25**	Cushion Type / Length, ft	**None**

TEST CONDITIONS

Wellhead Pressure, psig	**660 (maximum flowing)**	Instrument Depth, ft / No.	**11359 / SLSR-1005**
Bottomhole Pressure, psia	**4236 (final shutin)**	Max. Temperature, deg F	**163**
Final GAS Rate, mscf/d	**960**	Initial Hydrostatic, psia	**6111**
Final OIL Rate, stb/d	**11.6 (average)**	Final Hydrostatic, psia	**6111**
Final WATER Rate, stb/d	--		

COMMENTS

Test conducted by the Hobbs Testing District, Mr. Bill Grayshaw.

A complete listing of the data collected can be found in field data report #6203152.

Company:	**Torch Operating, Inc. (Bellwether)**	Test Date:	**Jun 28, 2000**
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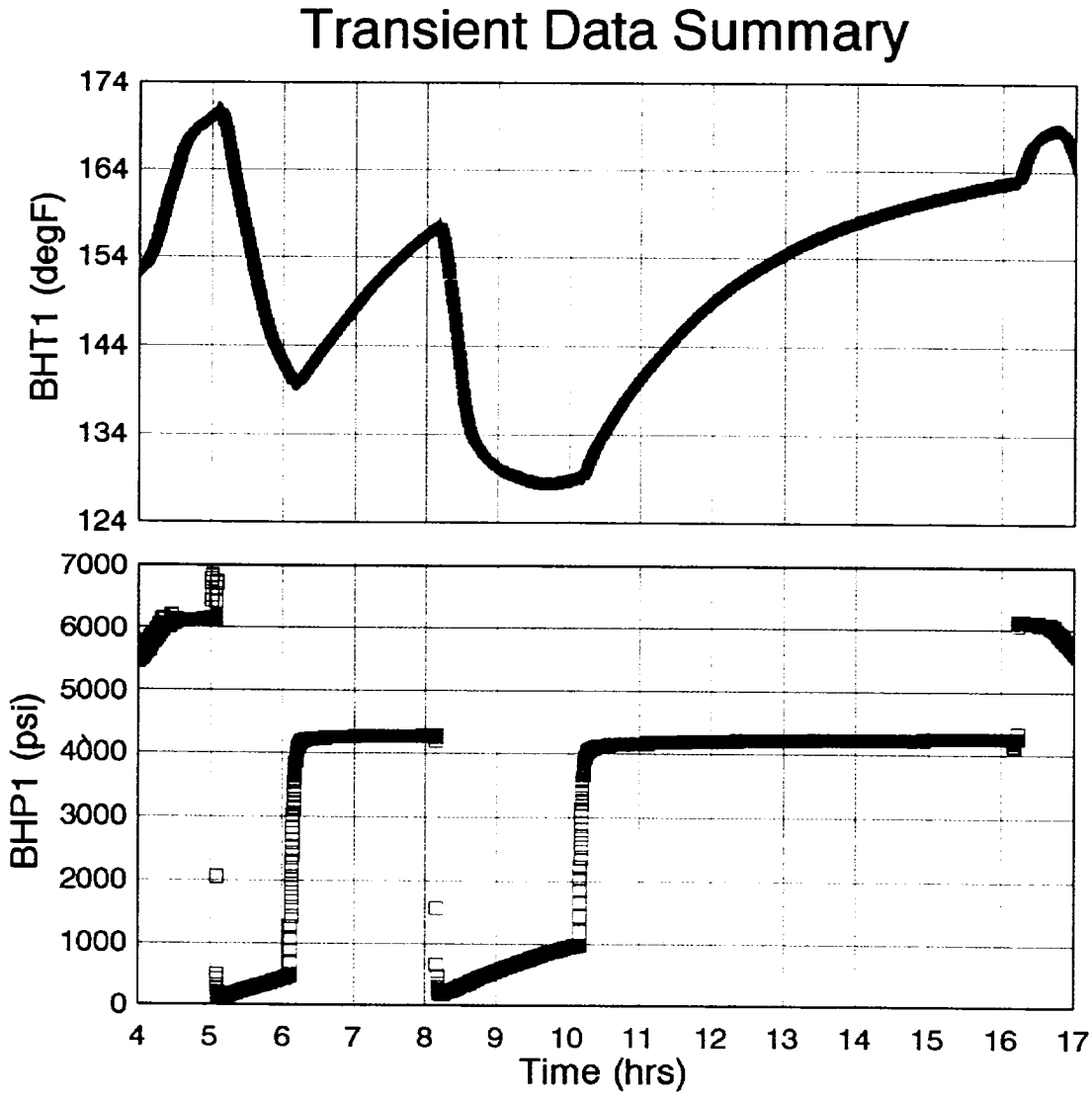
Data and Interpretation Plots

Transient Data Summary



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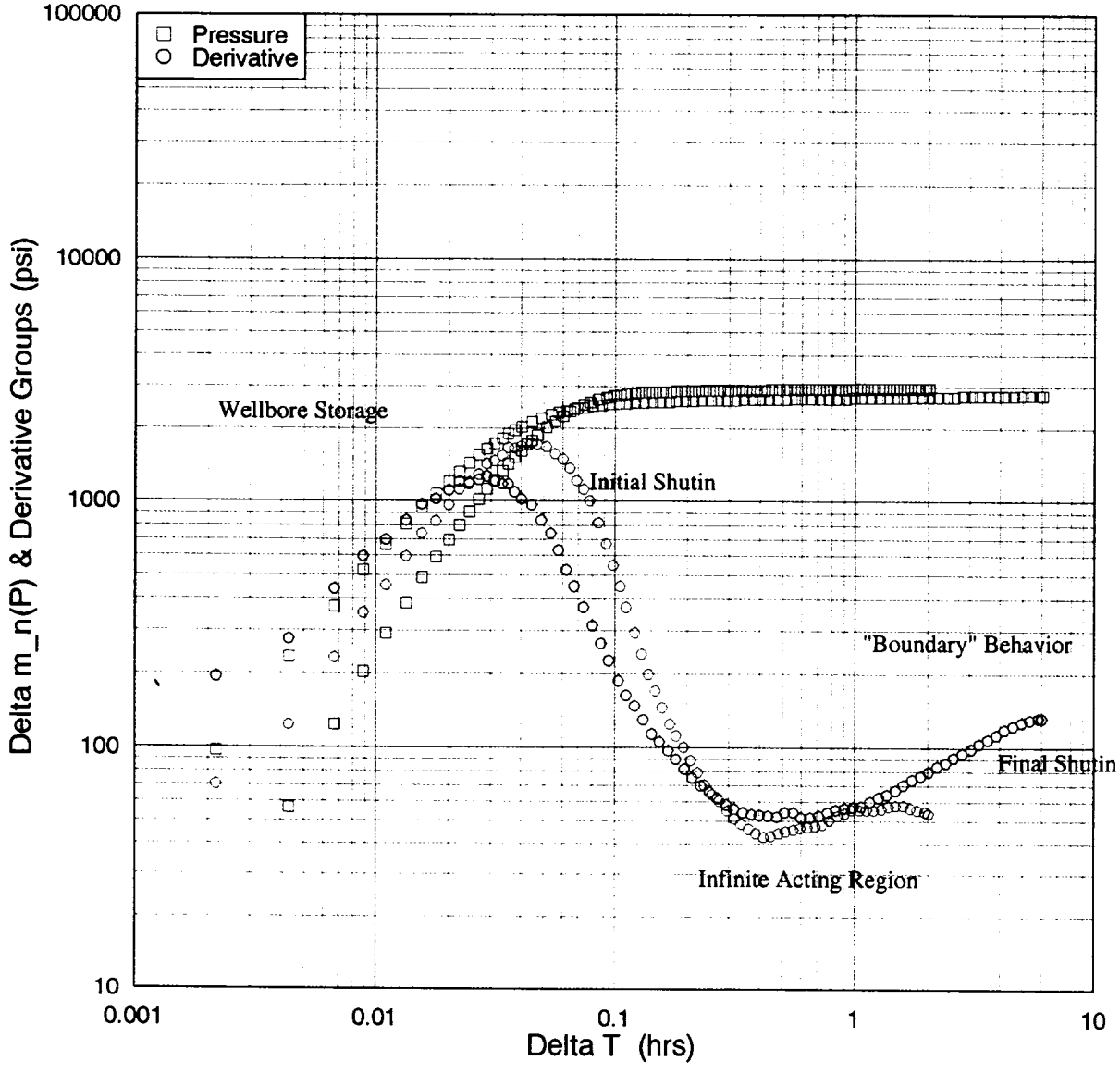
FRID Plots, Smoothing Factor, L= 0.050

Flow Regime Identification Plots

TR2- Initial Shutin and TR4-Final Shutin



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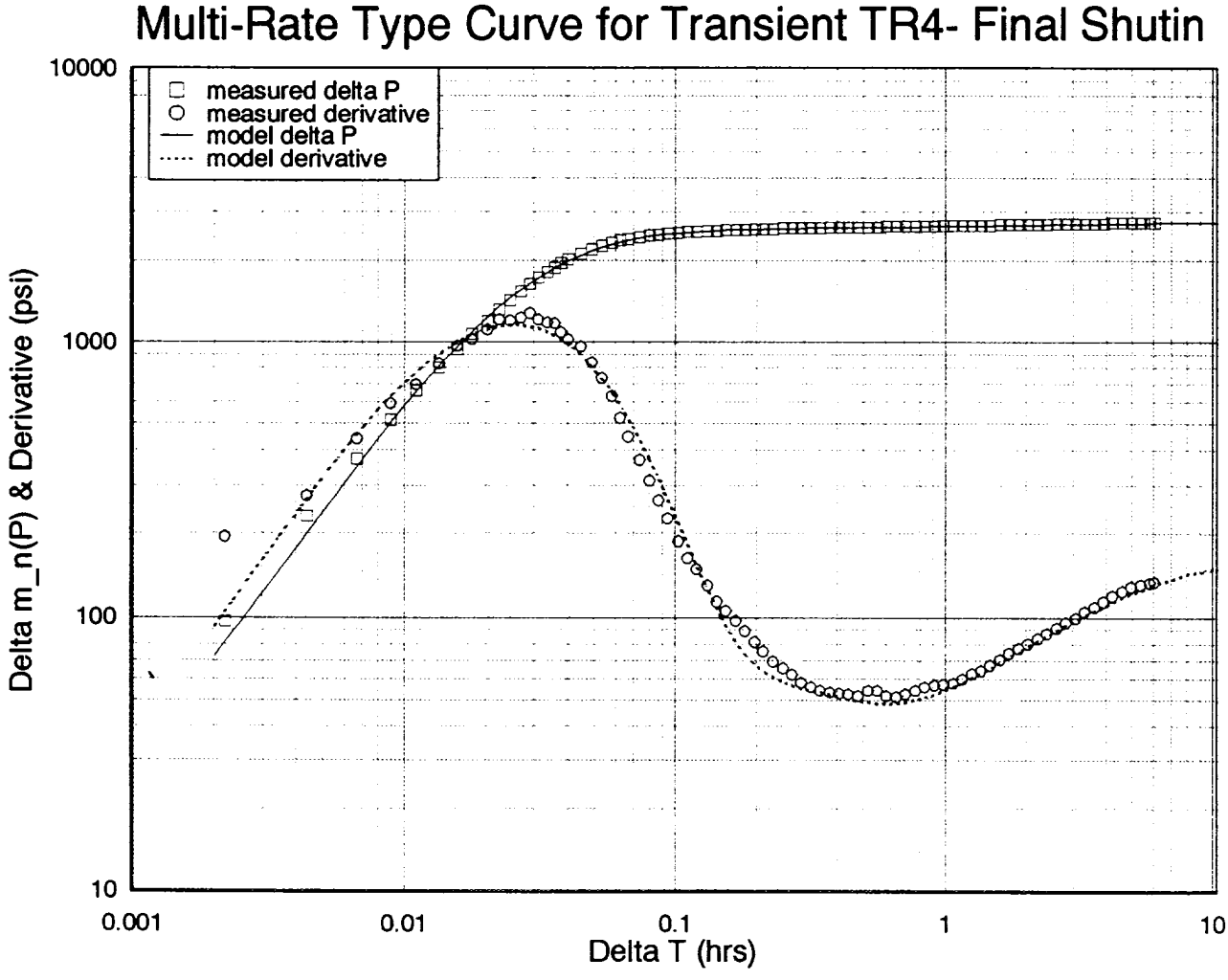
Multi-Rate Type Curve for Transient TR4
RADIAL COMPOSITE MODEL



Fully Completed - Radial Composite - Infinite
k (mD) = 2.37, Total Skin = 20.81, mr = 2.43, sr = 3.49, L1 (ft) = 77.49
Variable Wellbore Storage (Exp): C[wb] (bbl/psi) = 0.0002213, Ca/C[wb] = 4.866, CphiD[wb] = 6.35

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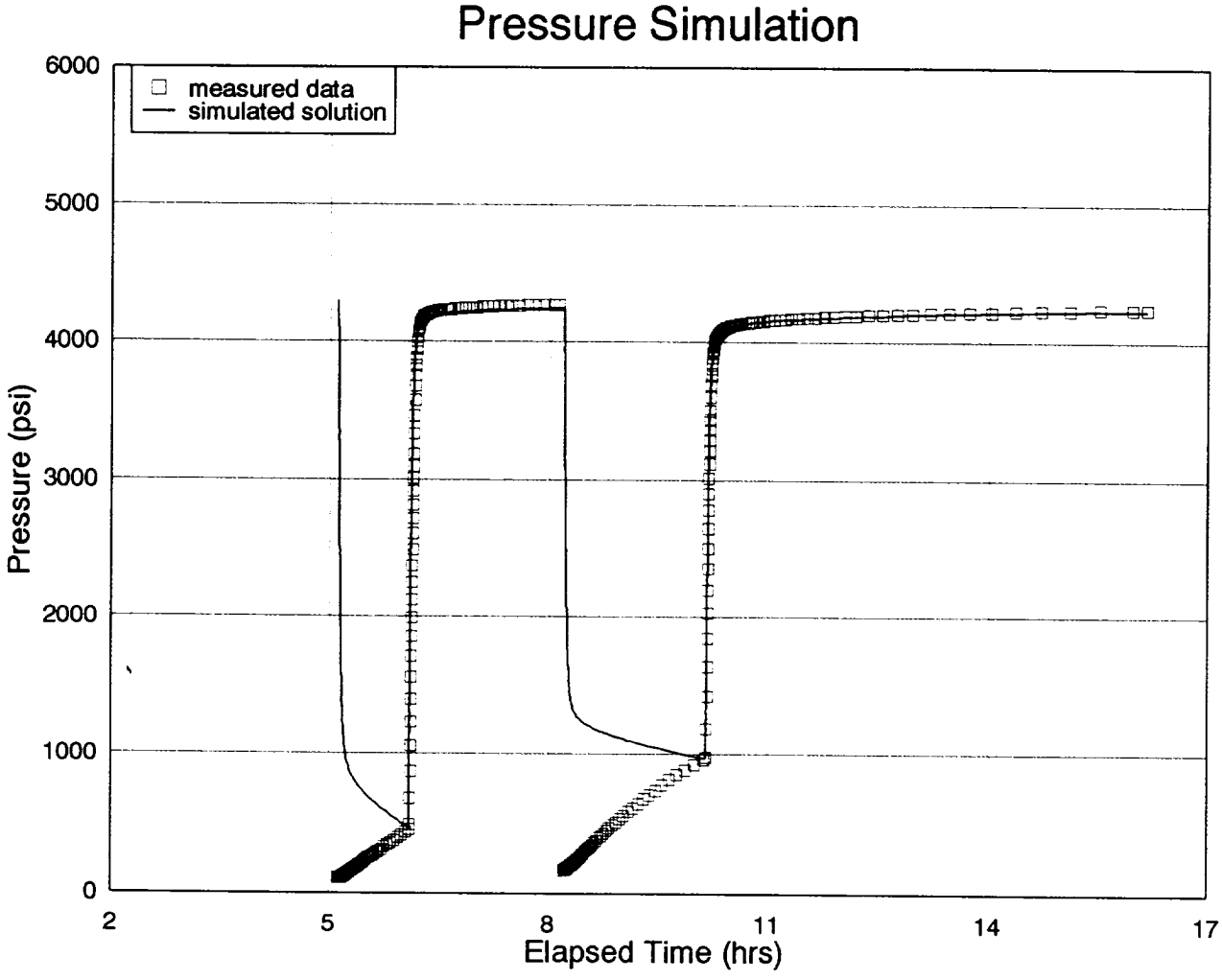
Pressure Simulation
RADIAL COMPOSITE MODEL



Fully Completed - Radial Composite - Infinite
Pi (psi) = 4293, k (mD) = 2.37, Total Skin = 20.81, mr = 2.43, sr = 3.49, L1 (ft) = 77.49
Variable Wellbore Storage (Exp): C[wb] (bbl/psi) = 0.0002213, Ca/C[wb] = 4.866, CphiD[wb] = 6.35

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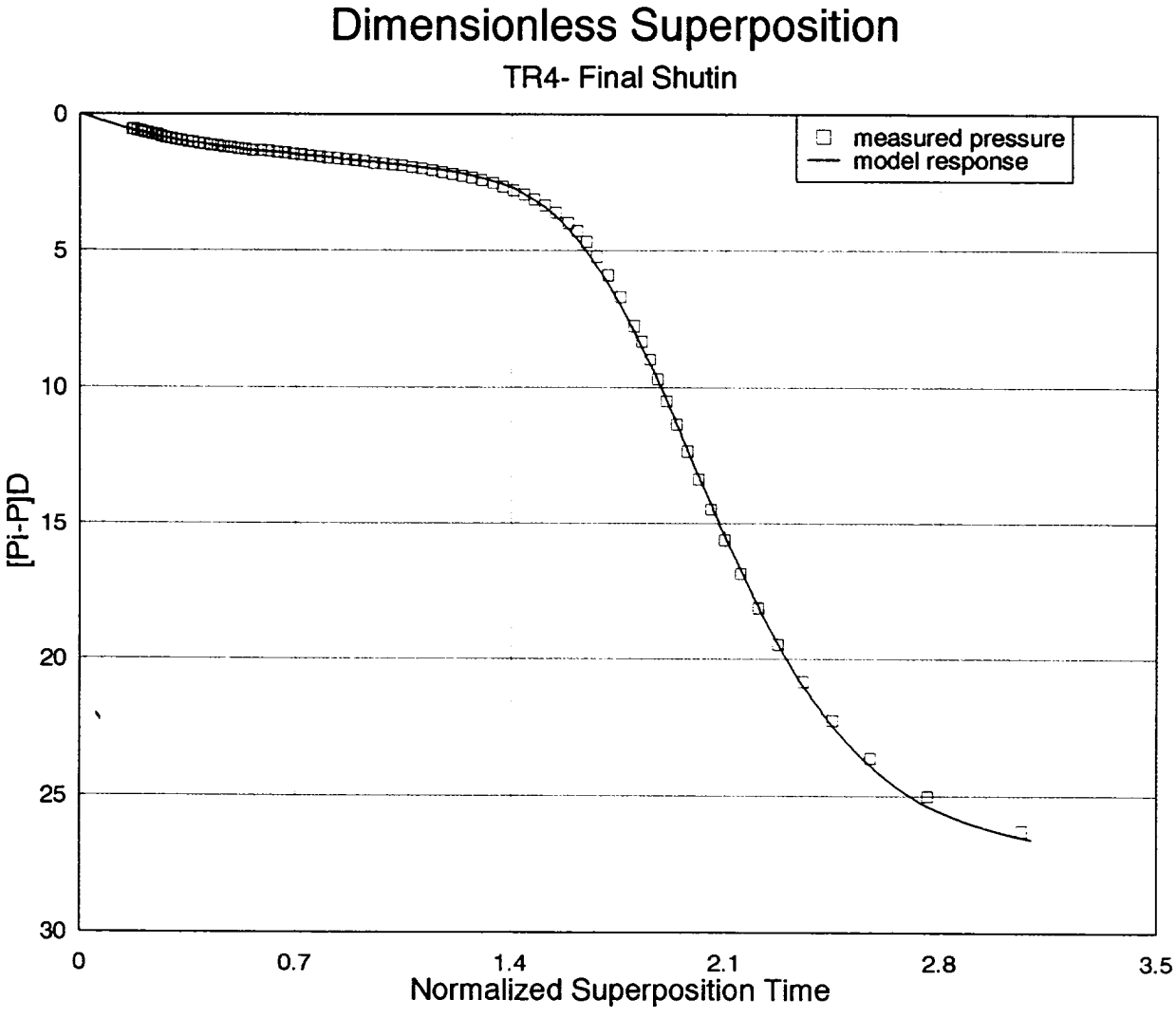
Dimensionless Superposition Plot
RADIAL COMPOSITE MODEL



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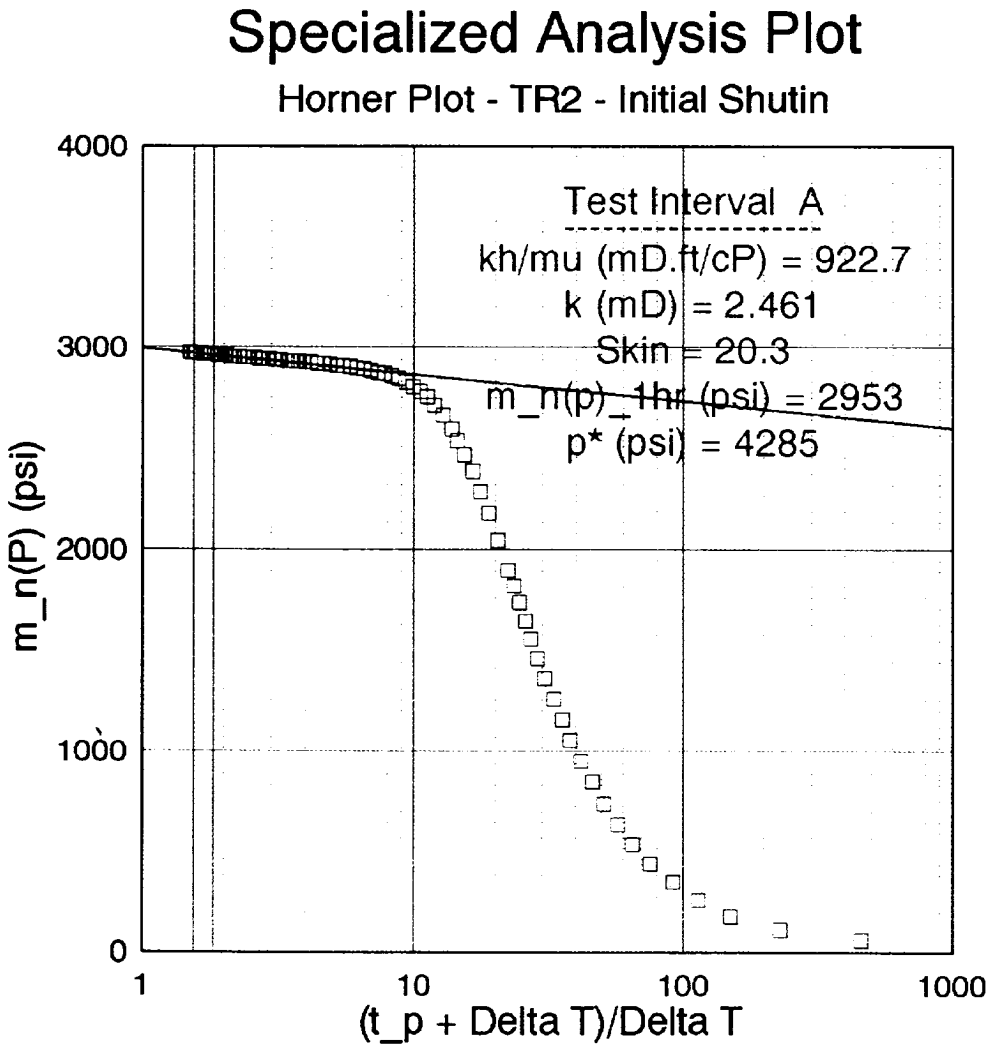
ISI Semi-log Specialized Analysis Plot



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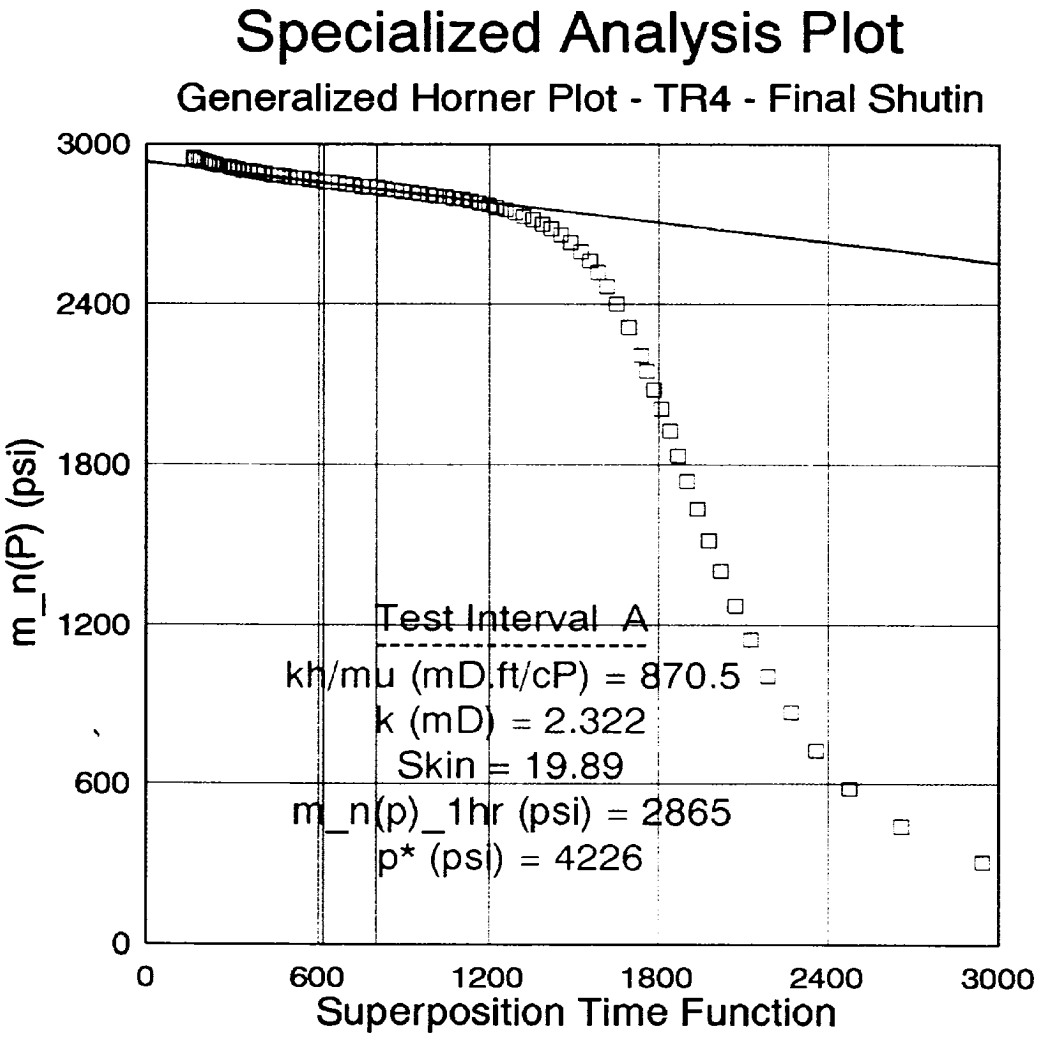
FSI Semi-log Specialized Analysis Plot



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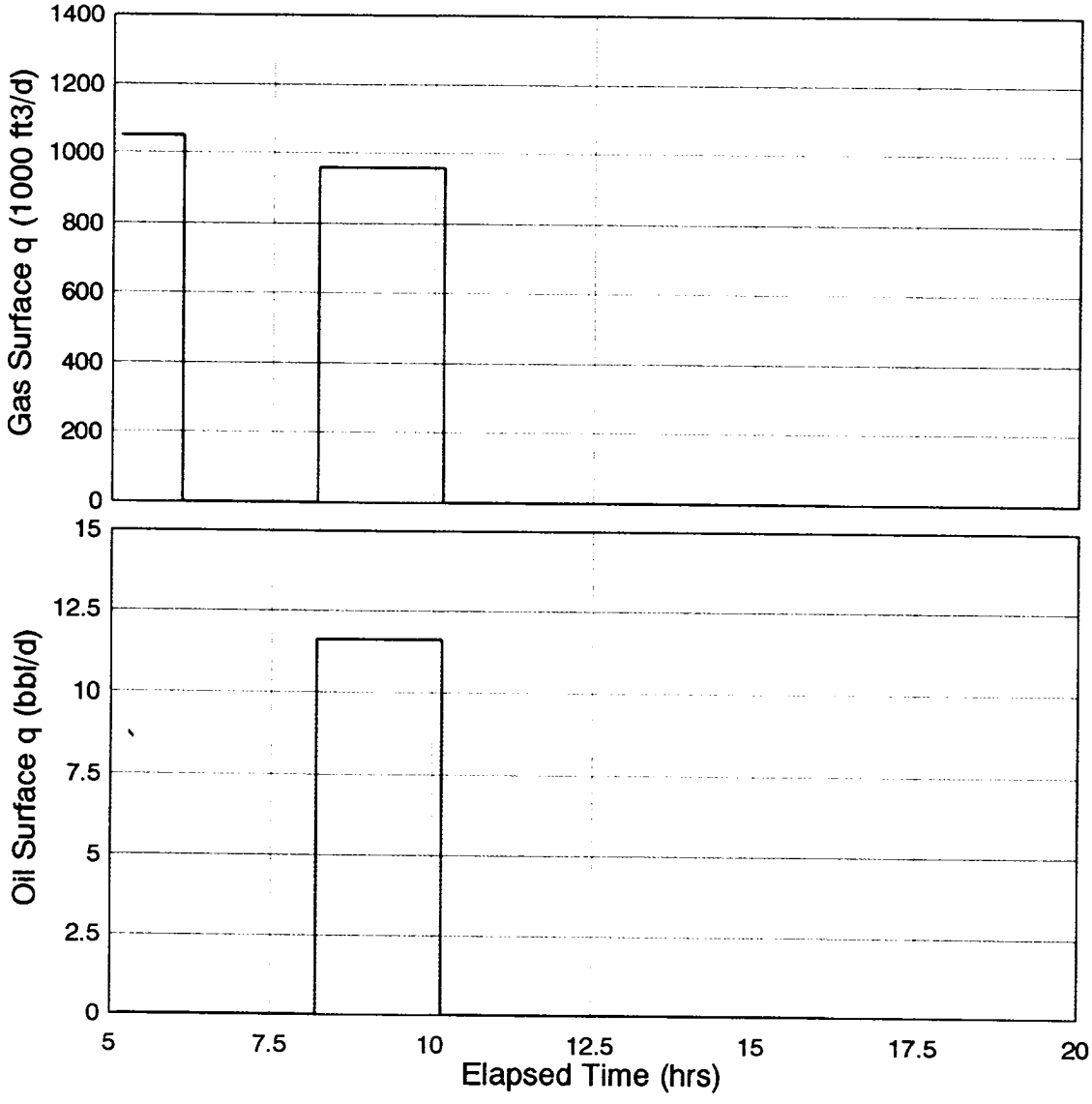
Test History

Reference Date: 28-Jun-2000 00:17 PM



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Test History Reference Date 28-Jun-2000 00:17 PM

TEST HISTORY

Start (hrs)	Duration (hrs)	Qo (bbl/d)	Qw (bbl/d)	Qg (1000 ft3/d)
5.11583	0.9845	0	0	1050
6.10033	2.1	0	0	0
8.20033	1.95337	11.6	0	960
10.1537	5.991	0	0	0

FLOWRATE HISTORY IS BASED ON THE FINAL REPORTED SURFACE GAS RATE, THE AVERAGE CONDENSATE RATE AND THE MEASURED BOTTOMHOLE FLOWING PRESSURE.

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Table 1: Sequence of Events

Date	Time	Description	Instrument Et, mins	BHP, psia	BHT, deg F
JUN 28, 2000	17:25	Start Initial Flow	307.62	99	170
	18:23	End Flow, Start Shutin	366.02	452	140
	20:25	End Shutin	487.88	4262	157
	20:29	Start Second Flow	492.02	162	157
	22:26	End Flow, Start Shutin	609.22	974	129
Jun 29, 2000	04:26	End Shutin	968.68	4236	163

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Generalized Interpretation Procedure

The Model Verified™ Interpretation technique is a methodology that uses as much of the recorded pressure data as possible, not just those data points that fall on a single straight line. The goal of the interpretation is to define the model type and the specific model parameters that give the best match of the entire test pressure data set. The interpretation will generally include the following distinct steps:

1. Collect the required input data: raw pressure data, rock and wellbore properties, completion and test configuration, production history, and fluid description.
2. Construct a flowrate history. This may be as simple as the final reported rate and an equivalent producing time based on total volume produced, or as complex as actual daily production values. If more than one rate is reported, superposition is used to modify the interpretation plots (log-log and semi-log) in order to give the most accurate results.
3. Determine fluid properties. Liquid: the viscosity and formation volume factor are evaluated at final flowing pressure and maximum temperature; total compressibility is evaluated at the average pressure during the buildup. Gas: all fluid properties are evaluated at the maximum shutin pressure and maximum temperature.
4. Construct the Flow Regime Identification Plot (log-log plot of delta pressure and pressure derivative versus delta time). In gas wells the plotting parameter will be either pseudo pressure or normalized pseudo pressure to account for the way the gas fluid properties change with pressure. There may also be a smoothing factor applied to the pressure derivative to improve the presentation quality of the data. A smoothing factor (L) of 0.0 is no smoothing and a factor of 0.10 is quite a lot of smoothing.
5. Inspect the Flow Regime Identification Plot to identify inner boundary conditions, basic reservoir model, and outer boundary behavior types. This plot also evaluates the validity of specialized plots such as the early time cartesian or the middle time semi-log that can give good initial estimates of reservoir parameters.
6. Construct a total system model and compare the actual pressure behavior to the model predicted behavior. Fine tune the model parameters until an acceptable match is obtained. The final match is presented in three different formats: Log-log, Semi-log, and Cartesian plots.

The output of the process can be specific reservoir model parameters such as effective permeability, skin factor, hydraulic fracture half-length, and distance to boundaries. The process can also provide one or two of the following:

P^*, the extrapolated pressure from the infinite acting portion of the semi-log specialized plot, this value is equal to P_i in an infinite system, and is related to P_{ave} in a closed system.

P_i, the reservoir pressure at the start of the production history.

P_{ave}, the current reservoir pressure, in a closed system.

The reservoir model description can be used in the Nodal™ Analysis program to predict future flowrates, and/or evaluate the possible effect of different completion or stimulation designs.

Interpretation Models

The total system reservoir model that is used to match the test data is made from specific inner boundary conditions, a basic reservoir model, and specific outer boundary conditions. The model parameters for each component (such as wellbore storage factor, effective permeability, wellbore skin condition, distance to a boundary) are adjusted until the best match of the test data set is found. The following is a partial list of the model components available to the Schlumberger GeoQuest Analyst.

Inner Boundary Conditions

- Constant Wellbore Storage
- Variable Wellbore Storage
- Partial Penetration with/without Gas Cap or Water Drive
- Horizontal Wellbore with/without Gas Cap or Water Drive
- Finite Conductivity Vertical Fracture
- Infinite Conductivity Vertical Fracture
- Horizontal Fracture

Basic Reservoir Models

- Homogeneous
- Dual Porosity, pseudo steady state or transient interporosity flow
- Triple Porosity
- Dual Permeability
- Radial Composite

Outer Boundary Conditions

- Infinite System
- Single Sealing Fault
- Partially Sealing Fault
- Single Constant Pressure Boundary
- Two Intersecting Faults (wedge geometry)
- Parallel Sealing Faults (channel geometry)
- Closed Circle
- Constant Pressure Circle
- Closed Rectangle
- Mixed Boundary (closed and constant pressure) Rectangle
- Interwell Interference (observation well active or passive)

It is possible that more than one combination of behavior types will match the test data. Information from other evaluation techniques (logs, cores, etc.) should be used to identify the best solution for a given data set.

For some applications, such as horizontal wellbore and dual permeability system, all of the possible combinations are not available. Detailed references on most model components can be found in the SPE technical literature.

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DISTRIBUTION OF REPORTS

Schlumberger GeoQuest has sent copies of this report to the following:

Bellwether Exploration Company
Mr. Bruce Elijah (3 copies)
1331 Lamar
Suite 1455
Houston, TX 77010-3039

Torch Operating, Inc.
(1 copy)
1221 Lamar Street
Suite 1600
Houston, TX 77010

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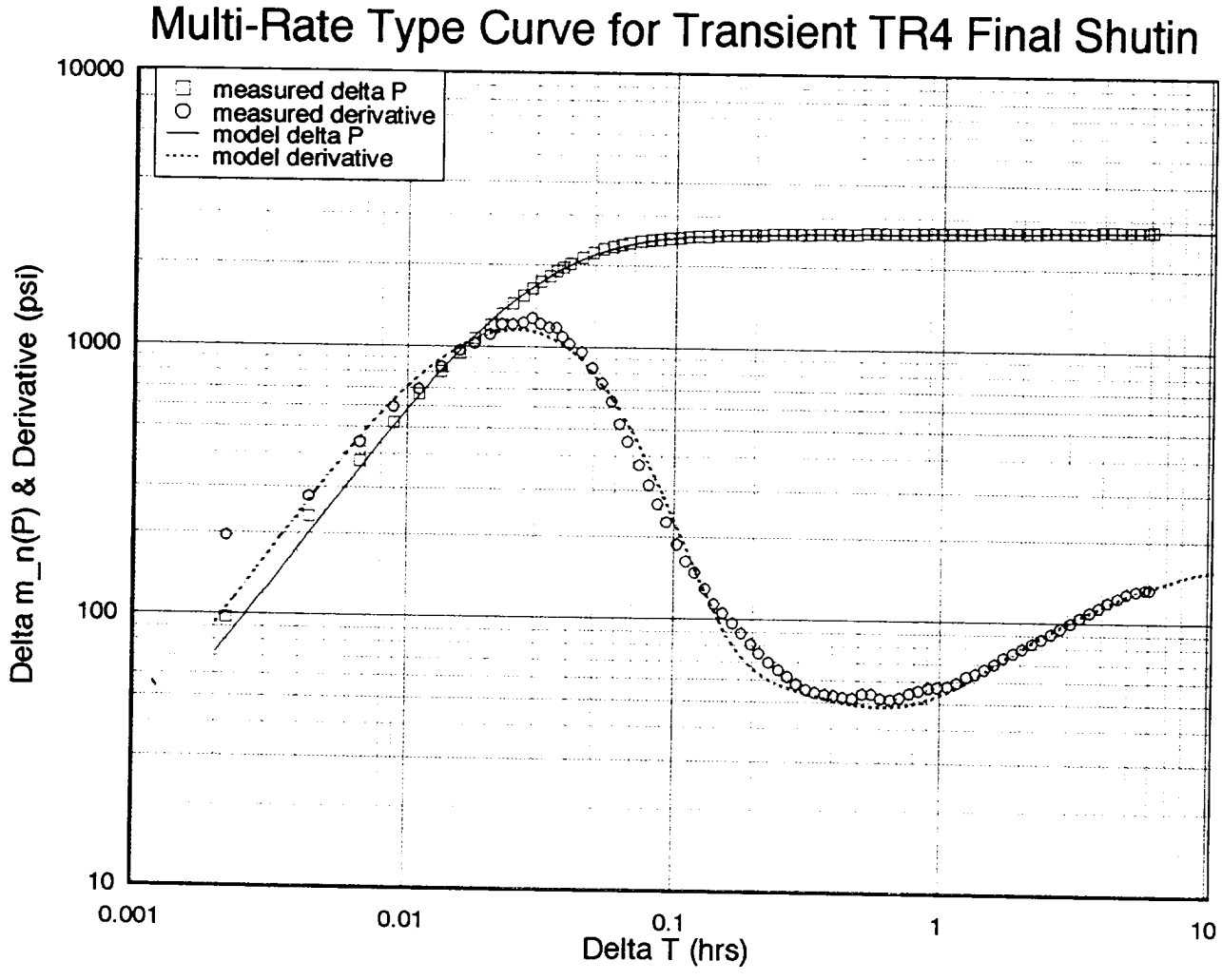
Multi-Rate Type Curve for Transient TR4
2 FAULT MODEL



Fully Completed - Homogeneous - Intersecting Faults
k (mD) = 2.37, Total Skin = 20.8, re (ft) = 97.81, theta (deg) = 90, thetaw (deg) = 45
Variable Wellbore Storage (Exp): C[wb] (bbl/psi) = 0.0002213, Ca/C[wb] = 4.866, CphiD[wb] = 6.35

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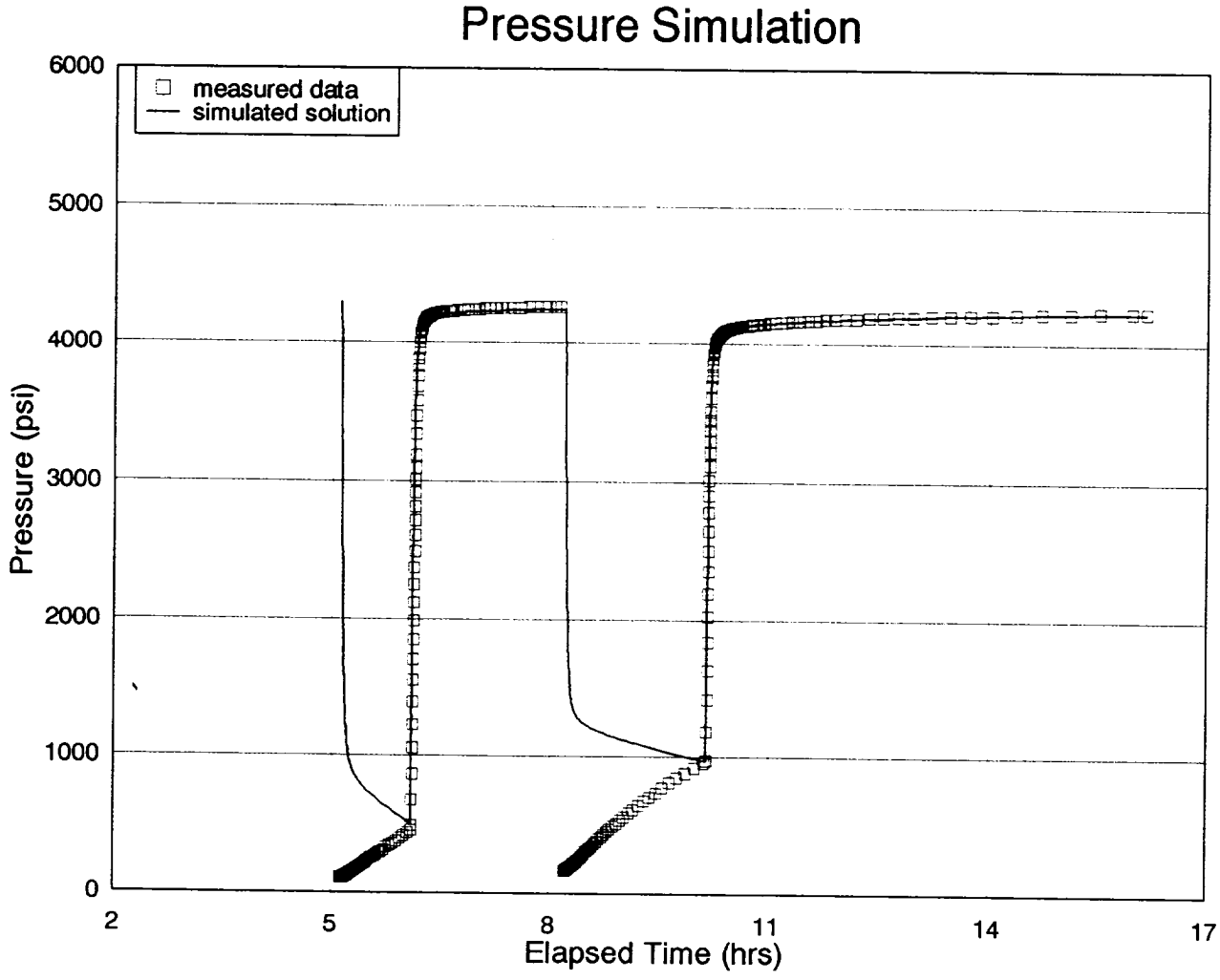
Pressure Simulation
2 FAULT MODEL



Fully Completed - Homogeneous - Intersecting Faults
Pi = 4301, k = 2.37, Total Skin = 20.8, re = 97.81, theta = 90, thetaw = 45
Variable Wellbore Storage (Exp): C[wb] (bbl/psi) = 0.0002213, Ca/C[wb] = 4.866, CphiD[wb] = 6.35