TWBS

Thermal Wellbore Simulator

- ***Detailed Segment Modeling of the flow of fluids and energy in the various tubing strings of a vertical or horizontal well.***
- ***Computes the Oil, Water, Gas and Steam Rates in the tubing strings and inflow/outflow to the reservoir.***
- ***Displays the Steady State Pressure, Temperature and Fluid Saturation Profiles in the pipe strings.***
- ***Multiple Choke or Venturi FCDs - Liner or Tubing Deployed***
- ***Computes Null flow points due to convergent or divergent flow automatically.***

TWBS V6 Release Updates

- **Easily create multicase data sets for sensitivity evaluation.**
- **New Multicase Results module to compare several cases as tables or graphs**
- **2 cases can be run simultaneously.**
- **Overall Heat Transfer coefficients computed automatically for each segment range.**
- **Flow Control Device measured tables of Pressure drop, steam rates and steam quality for steam injection.**

TWBS V5 Updates:

- **Steam Circulation Period, Reservoir Temperature can be estimated as function of time using internal heat conduction model,**
- **Reservoir Pressure for Steam injection, circulation entered at a datum depth. The reservoir pressure at segment depth will be calculated using fluid gradient from datum depth.**
- **Segment Data Table summary color coded by pipe.**
- **Review results of Pipe segments color coded by pipe.**
- **Improved well schematic for plugged segments.**
- **Complete set of Tutorial Movies to learn how to use TWBS**
  - **Examples: (click on Movie Name to view)**

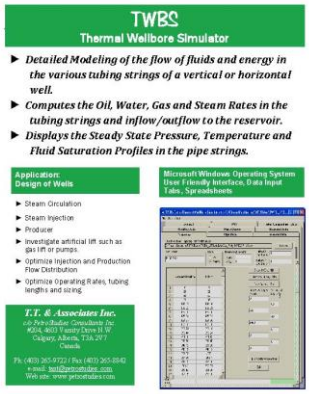
TWBS-Overview

TWBS-Data Preparation-General Tab

Additional movies in Youtube channel

https://www.youtube.com/playlist?list=PLL7cbAoGCdeJ0v0FleSnbtfGLNVdGsVfd

Click on image below to download the TWBS brochure as a .pdf file (will require Adobe Acrobat)



APPLICATION: DESIGN OF WELLS

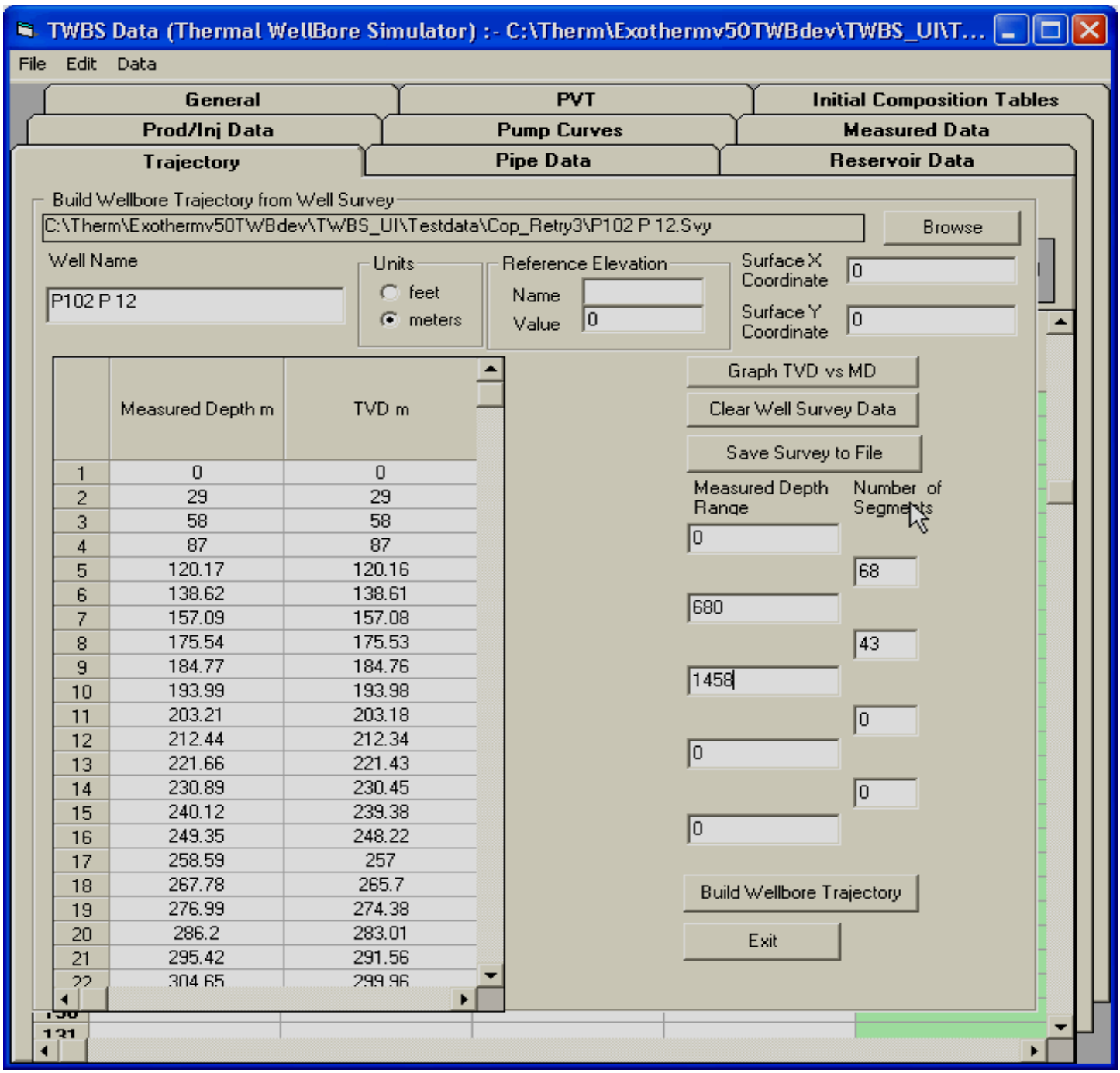
► Steam Circulation

- Steam Injection
- Producer with fixed rate profile or variable rate f(DeltaP)
- Investigate artificial lift such as gas lift or pumps.
- Optimize Injection and Production Flow Distribution, FCD placement.
- Optimize Operating Rates, tubing lengths and sizing.
- Downhole Steam Generation using Electric Heater
- Multicomponent Solvent and Steam Injection

SPECIFICS

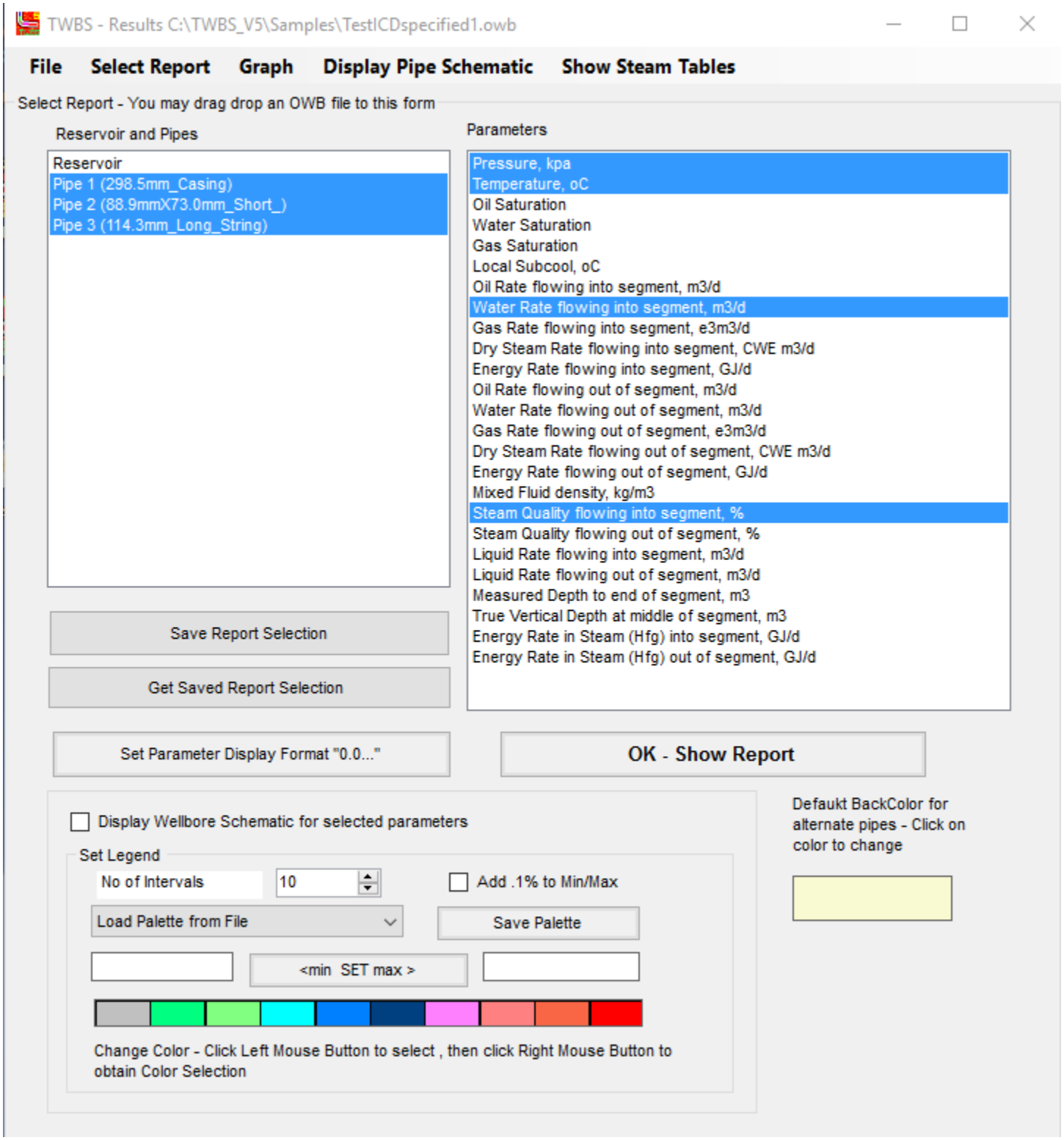
- Enter PVT data for up to 7 components. Internal Steam Tables.
- Import a Well Deviation survey. Automatically subdivide the well trajectory into segments of various lengths
- Specify and enter up to 5 pipes of various lengths and diameters, concentric or side by side.
- Model reservoir boundary conditions. Change reservoir properties permeability, pressure, temperature, saturation along the well length.
- Set the inflow rates of oil, gas, water at each reservoir segment, or calculate the variable influx based on current reservoir and pipe conditions. Offtake and injection points may be set at any segment and offtake/injection pressures specified. Injection rates, steam quality, injection temperature may be set.
- For calibration, observed data versus measured depth can be entered

DATA PREPARATION INPUT FORM



RESULTS

Tabular Reports – select from many series


TWBS - Results C:\TWBS_V5\Samples\TestICDspecified1.owb
File
Select Report
Graph
Display Pipe Schematic
Show Steam Tables
Select Report - You may drag drop an OWB file to this form
Reservoir and Pipes
Reservoir
Pipe 1 (298.5mm_Casing)
Pipe 2 (88.9mmX73.0mm_Short_)
Pipe 3 (114.3mm_Long_String)
Parameters
Pressure, kpa
Temperature, oC
Oil Saturation
Water Saturation
Gas Saturation
Local Subcool, oC
Oil Rate flowing into segment, m3/d
Water Rate flowing into segment, m3/d
Gas Rate flowing into segment, e3m3/d
Dry Steam Rate flowing into segment, CWE m3/d
Energy Rate flowing into segment, GJ/d
Oil Rate flowing out of segment, m3/d
Water Rate flowing out of segment, m3/d
Gas Rate flowing out of segment, e3m3/d
Dry Steam Rate flowing out of segment, CWE m3/d
Energy Rate flowing out of segment, GJ/d
Mixed Fluid density, kg/m3
Steam Quality flowing into segment, %
Steam Quality flowing out of segment, %
Liquid Rate flowing into segment, m3/d
Liquid Rate flowing out of segment, m3/d
Measured Depth to end of segment, m3
True Vertical Depth at middle of segment, m3
Energy Rate in Steam (Hfg) into segment, GJ/d
Energy Rate in Steam (Hfg) out of segment, GJ/d
Save Report Selection
Get Saved Report Selection
Set Parameter Display Format "0.0..."
OK - Show Report
Display Wellbore Schematic for selected parameters
Set Legend
No of Intervals
10
Add .1% to Min/Max
Load Palette from File
Save Palette
<min SET max >
Change Color - Click Left Mouse Button to select , then click Right Mouse Button to obtain Color Selection
Defaukt BackColor for alternate pipes - Click on color to change

TWBS - Results C:\TWBS_V5\Samples\TestICDspecified1.owb

File | Select Report | Graph | Display Pipe Schematic | Show Steam Tables

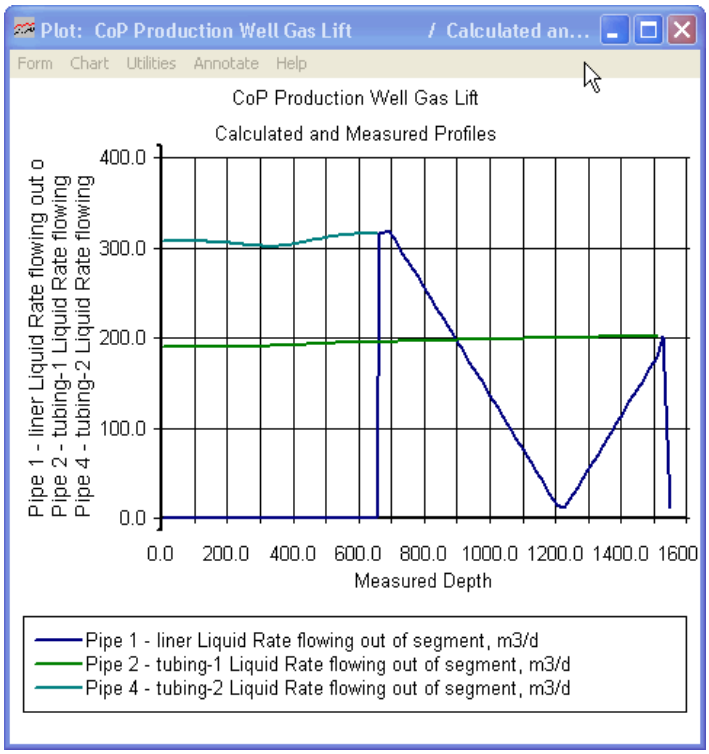
Production/Injection Report for each Pipe

	Point #	Pipe #	Segment #	Status	Type	Pressure kpa	Oil Rate m3/d	Water Rate m3/d	Gas Rate e3m3/d	Steam Rate CWE	Heat Rate GJ/d
1	1	mmX73.0r	1	On	Inj	3117.614	0	-64.99998	0	-64.99998	-175.283
2	2	4.3mm Lo	1	On	Inj	3429.12	0	-235	0	-235	-633.716
3		Reservoir					0	299.9991	0	269.3809	808.997
4		NET					0	.850098E-(	0	-30.61908	.197266E

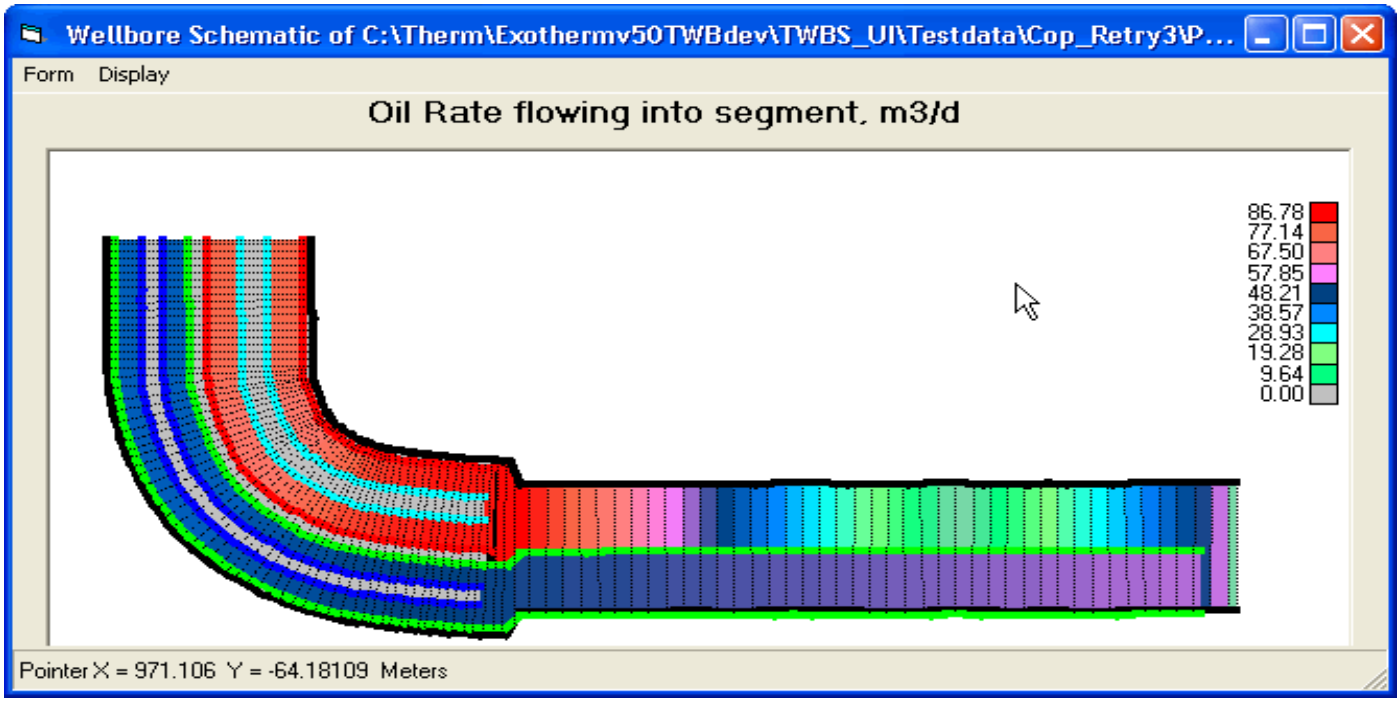
Segment Report for Selected Pipes and Series - RED is Plugged segment, GREEN is ICD segment, PURPLE is Pump Se

Segment	(298.5m_Casing) Pressur	(298.5m_Casing) Temperature.	ng) Water Rate flowing	ng) Steam Quality flowing	(88.9mm X73.0m_Short_) Pressur	X73.0m_Short_) Tempera	m_Short_) Water Rate flowing	m_Short_) Steam Quality flowing	(114.3m_Long_String) Pressur	(114.3m_Long_String) Temperature. oC	_String) Water Rate flowing	
39	310.083	209.394	.0	.0	3121.891	236.009	64.975	88.411	3343.343	239.871	234.973	91
40	310.143	209.378	.0	.0	3121.296	235.998	64.977	88.245	3340.325	239.82	234.975	91
41	310.2	209.36	.0	.0	3120.65	235.986	64.979	88.078	3337.254	239.768	234.977	91
42	310.253	209.343	.0	.0	3119.955	235.973	64.98	87.911	3334.129	239.716	234.978	91
43	310.302	209.324	.0	.0	3119.204	235.96	64.982	87.745	3330.946	239.662	234.979	91
44	310.346	209.305	.0	.0	3118.396	235.945	64.983	87.579	3327.702	239.607	234.981	9
45	310.386	209.286	.0	.0	3117.52	235.929	64.985	87.412	3324.387	239.552	234.982	91
46	310.421	209.266	.0	.0	3116.572	235.912	64.987	87.246	3320.995	239.494	234.984	91
47	310.451	209.245	.0	.0	3115.564	235.893	64.988	87.079	3317.54	239.436	234.986	91
48	310.479	209.224	.0	.0	3114.523	235.875	64.989	86.913	3314.049	239.377	234.987	91
49	310.505	209.203	.0	.0	3113.462	235.855	64.99	86.746	3310.534	239.318	234.988	91
50	310.529	209.182	.0	.0	3112.374	235.835	64.991	86.58	3306.988	239.258	234.988	91
51	310.549	209.16	.0	.0	3111.236	235.815	64.992	86.414	3303.389	239.198	234.99	91
52	310.565	209.138	.0	.0	3110.029	235.793	64.994	86.248	3299.717	239.136	234.992	91
53	310.575	209.115	.0	.0	3108.751	235.77	64.996	86.081	3295.971	239.073	234.994	91
54	310.582	209.091	.0	.0	3107.424	235.745	64.997	85.915	3292.171	239.009	234.996	90
55	310.586	207.97	.0	.0	3106.065	235.721	64.998	85.749	3288.336	238.944	234.997	90
56	3101.906	212.37	.0	85.52	3102.148	235.649	64.999	85.607	3284.475	238.879	234.998	90
57	3102.114	235.649	65.0	85.49	To Pipe 1				3280.607	238.814	234.998	90
58	3102.057	235.648	64.999	85.52					3276.712	238.748	234.999	90
59	3101.992	235.647	60.165	85.55					3272.797	238.682	234.999	90
60	3101.927	235.645	55.484	85.583					3268.869	238.616	235.0	90
61	3101.866	235.644	50.957	85.617					3264.934	238.549	235.0	90
62	3101.814	235.643	46.575	85.654					3260.998	238.483	235.0	90
63	3101.769	235.643	42.317	85.694					3257.059	238.417	235.0	90
64	3101.724	235.642	38.167	85.736					3253.109	238.35	235.0	90
65	3101.672	235.641	34.125	85.783					3249.145	238.283	235.0	90
66	3101.614	235.64	30.207	85.834					3245.166	238.216	235.001	90
67	3101.554	235.639	26.428	85.891					3241.177	238.149	235.001	90
68	3101.505	235.638	22.79	85.954					3237.192	238.082	235.001	90

Graphs – plot multiple series for various pipes



Wellbore Schematics – colored segments represent parameter values



For more information, contact:-

T.T. & Associates Inc
C/o PetroStudies Consultants Inc
#204, 4603 Varsity Drive NW
Calgary, Alberta, T3A 2V7, Canada
Phone: 403-265-9722
Email: tant@petrostudies.com
Website: www.petrostudies.com