Examples of Logging Intervals Used to Train and Predict Pay

#1

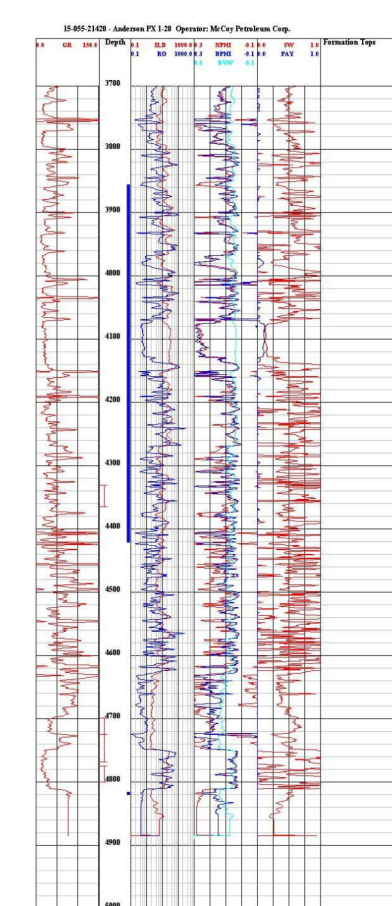### Training well
API: 15-055-21182
Operator: BEREXCO INC
Field: Terry
Lease: RUBY JEAN
Well 2-34
Location: T22S R34W, Sec. 34, C NE SW 1980 North, 3300 West, from SE corner
Longitude: -101.04038
Latitude: 38.09606
Spud Date: 13-MAR-1993
Completion Date: 03-JUN-1993
Plugging Date:
Status: OIL
Total Depth: 4850
Elevation: 2962 KB
Formation: MISSISSIPPIAN
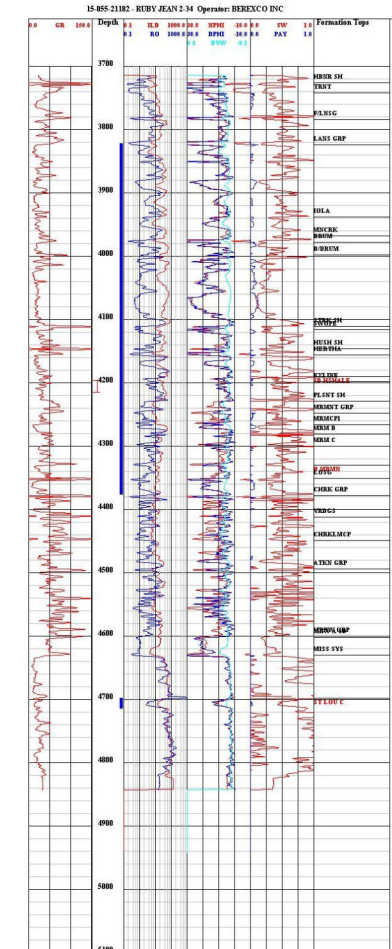
#2

Prediction – Dry Hole
API: 15-055-21420
Operator: McCoy Petroleum Corp.
Field: Amazon Ditch
Lease: Anderson PX
Well 1-28
Location: T22S R34W, Sec. 28, SE SE NE 2970 North, 330 West, from SE corner
Longitude: -101.04857
Latitude: 38.11315
County: Finney
Spud Date: 17-JUN-1995
Completion Date: 26-JUN-1995
Plugging Date: 28-JUN-1995
Status: D&A
Total Depth: 4880
Elevation: 2958 KB
Formation: MISSISSIPPIAN

#3

Prediction – producing well
API: 15-055-21080
Operator: BEREXCO INC
Field: Terry
Lease: MIKE ROME
Well 3-34
Location: T22S R34W, Sec. 34, NW NE SE 2310 North, 990 West, from SE corner
Longitude: -101.03236
Latitude: 38.09697
County: Finney
Spud Date: 25-FEB-1992
Completion Date: 16-APR-1992
Plugging Date:
Status: OIL
Total Depth: 4900
Elevation: 2953 KB
Formation: MISSISSIPPIAN
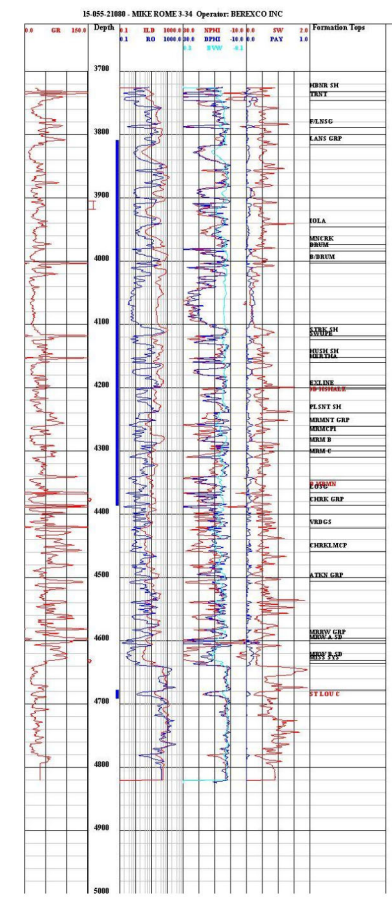
#4

Prediction well – predict pay at 5320'
API: 15-067-21481
Operator: Anadarko Petroleum Corporation
Field: Ryus East
Lease: HJV Reed 'B'
Well 2
Location: T30S R35W, Sec. 1, NE SW SW 870 North, 1100 East, from SW corner
Longitude: -101.10331
Latitude: 37.46284
County: Grant
Spud Date: 23-FEB-2002
Completion Date: 14-MAR-2002
Plugging Date:
Status: O&G
Total Depth: 5750
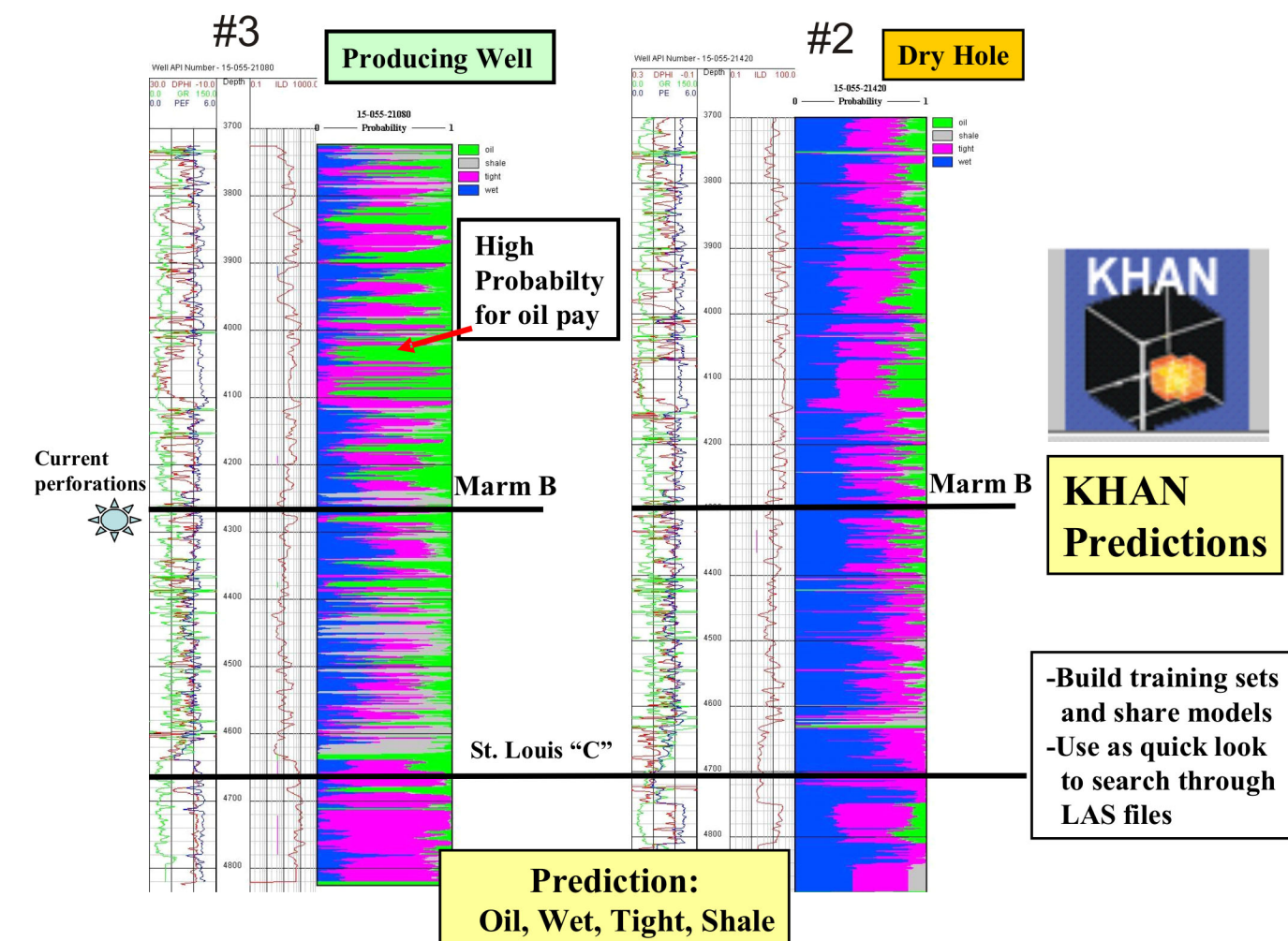Elevation: 3014 GL
Formation:
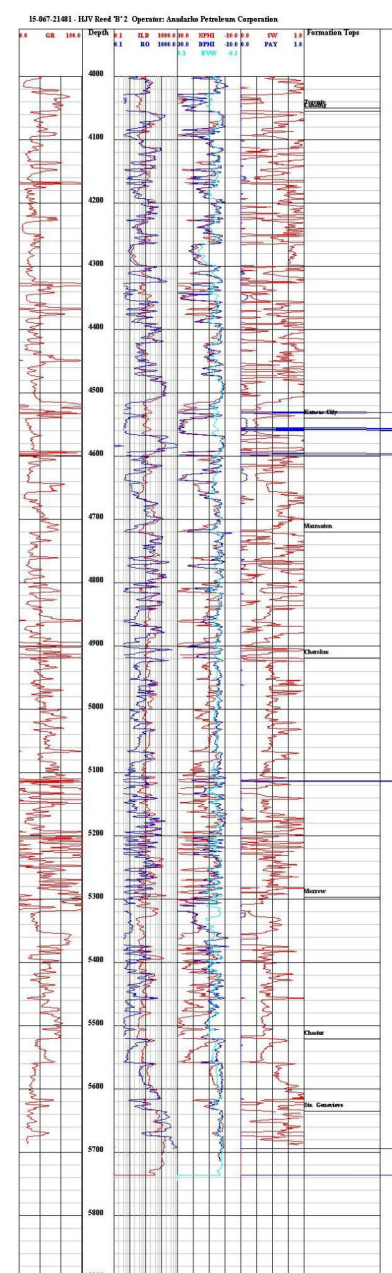
Views of LAS (log ASCII) Files Using GEMINI Well-Profile Module

– showing DST intervals (vertical thin lines and cross bars) * dots for well perforations in depth track, formation tops found in database are annotated along margin..

Pay (incremental hydrocarbon*Phi*h) (blue curve) and Sw (red curve) are shown in Track 4 using a single set of cutoffs:

Phi = 0.1
Sw = 0.5
Vsh = 0.3
BVW = 0.08

KHAN is used to predict pay in these wells, illustrated to the right side of this panel.

#3 Producing Well

#2 Dry Hole

High Probabilty for oil pay

Marm B

Marm B

Current perforations

St. Louis "C"

KHAN Predictions

-Build training sets and share models
-Use as quick look to search through LAS files

Prediction: Oil, Wet, Tight, Shale

Example of pay predictions from KHAN for the producing well Mike Rome 3-34 (from the Marmaton B oomoldic carbonate) and prediction for dry hole (Anderson PX 1-28). Note the low probability for pay (green areas) in the dry hole compared to the producing well. Other zones in the producing well appear to have probable potential beyond the interval currently perforated.

#4

Pay Prediction

From well Profile

Morrow Sandstone
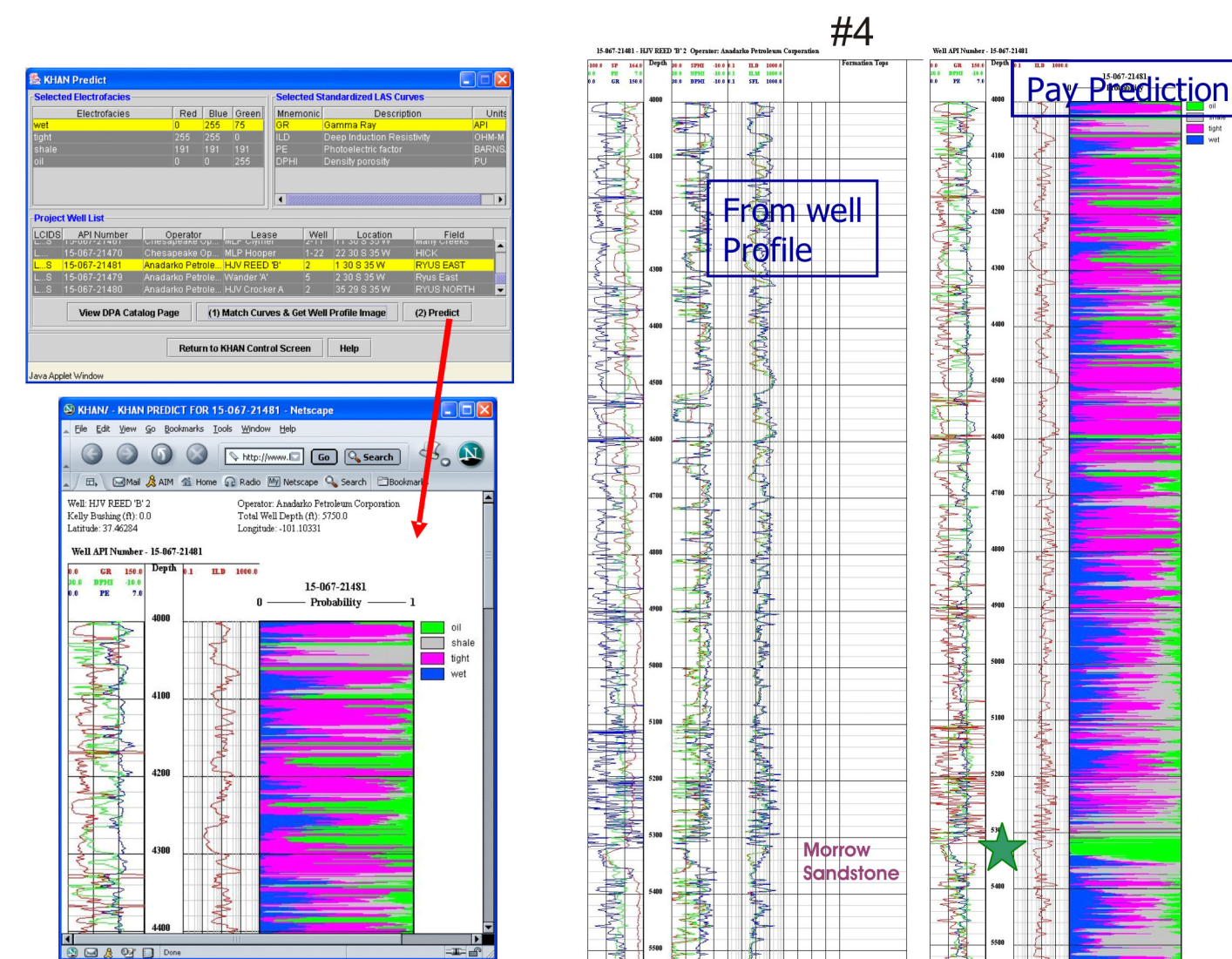
Dialogs and web browser of prediction output from KHAN.

After the training set is built to characterize oil, wet, tight, and shale zones, the model was applied to a well outside the original dataset. User selects the model and applies it to a well. User must select the log curves that match those curves used in training and then KHAN predict the probability of pay

KHAN pay model was applied to a well (HJV Reed "B-2" in Ryus East Field, Kansas) 40 miles south of the Terry Field dataset. The well profile above shows a thick zone that is highly probable (almost certain) oil reservoir in a Morrow sandstone. The completion records indicate that this zone was perforated for production. Lease records indicate 41,000 bbls of oil was produced from the zone in just over one year. Other shallower zones that indicate probably pay remain untested.

KHAN
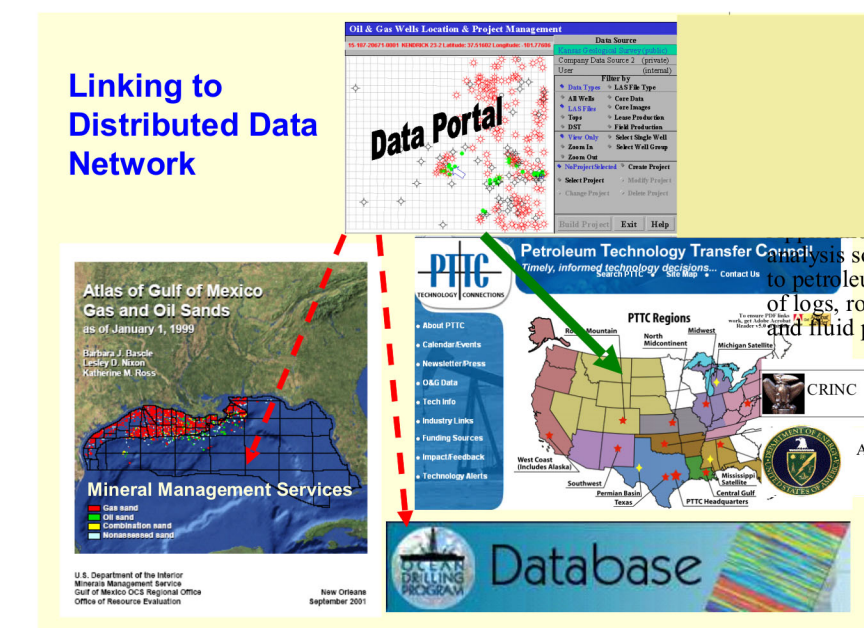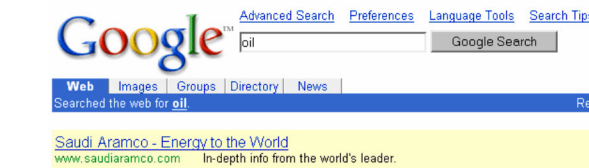
* **Exploration for Bypassed Pay (Example)**
• Classifying Lithofacies
• Defining Genetic Stratigraphic Units
• Classifying Coals?

kipling.xla
An Excel Add-in for Nonparametric Regression and Classification

www.kgs.ku.edu www.kgs.ku.edu
Software – Geoff Bohling & John Doveton

Intelligent search engine; looking for patterns to find oil and gas through petrophysics

Linking to Distributed Data Network

Data Portal

Atlas of Gulf of Mexico Gas and Oil Sands

Petroleum Technology Transfer Council

Mineral Management Services

Database

Bottom-up processing of pay by KHAN and similar software utilizing LAS files obtained from the growing public-domain databases will be an increasing possibility as these databases become interconnected.

Future

• Create applets and Web Start applications of software modules

• Access distributed databases

• Integrate software tools through XML databases

It is anticipated that businesses and academia will expect public-domain websites that serve data to be capable of providing:

• quick geospatial viewing of the data to refine a search and compare trends and patterns,

• rapid access to many data types and large volumes of data for use in tailored applications,

• utilization of web-based technical applications to "dig deeper into/mine" the database by analyzing the information in real-time as it is accessed,

• assembly of data into projects founded on the public-domain data and integrated with their own to perform essential analytical procedures in such a manner as to enable distant collaborations and decision making, and

• seamless integration of these results with commercial softwares to further analyze results and improve models to minimize risks and maintain competitiveness.

GEMINI PROJECT TEAM
Lynn Watney and Tim Carr (petroleum geologists), John Victorine (lead Java programmer), Saibal Bhattacharya (petroleum engineer), John Doveton and Bill Guy (log petrophysicists), Alan Byrnes (core petrophysicists), Geoff Bohling (program designer), Melissa Moore (data manager), Kurt Look and Glen Gagnon (systems programmers), JP Pakalapati (Java programmer)
Marty Dubois (petroleum geologist)
Balaji Rajagopalan (programming)
Ken Stalder (web interface, help functions)

A 3-year DOE contract (Fall, 2000 - 2003)

Participating companies