WHY MONTE CARLO?

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Ammonite Resources

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Project Evaluation

➢ **Scope and Time appropriate to project goals**

➢ **Probability of Success**
  ✓ **Trap**
  ✓ **Seal**
  ✓ **Reservoir**
  ✓ **Source**
  ✓ **Timing and Migration**
➢ **Geology**
  ✓ **Trap / structure mapping**
  ✓ **Definable depositional environment for reservoir**
  ✓ **Reservoir packages correlate**
  ✓ **Reservoir parameters are realistic and within definable ranges**
  ✓ **Reservoir geometry accounted for**
➢ **Engineering**
  ✓ **Reservoir engineering parameters**
    • **Recovery Efficiency**
    • **Formation Volume Factor**
  ✓ **Drainage area**
 ✓ **Reserves and Resources**
➢ **Financial Return**

Why Monte Carlo?

➢ **Need to understand project uncertainty and risk to focus your efforts**

➢ **Determine what the important parameters are**

➢ ***"Point Estimates"* do not reflect the uncertainty in the parameters**
  - ✓ **They provide no information on the reality of variation, especially in the high risk areas of the project that drive reserves, Pg, costs, NPV, IRR, etc.**
  - ✓ **Hides the estimation (probability) of financial failure.**
  - ✓ **Your point estimates will hypnotize your team into believing the outcome and you become accountable for hitting that number.**
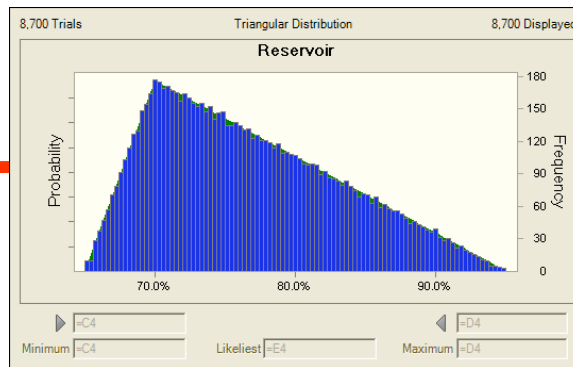
Probability of Success (POSg)

➢ **Qualitative analysis results in range of probability**
➢ **Trap**
  ✓ **Presence of a trap**
    • **4-way closure**
    • **Fault closure**
    • **Hydrocarbon retention capability (lateral seal)**
➢ **Seal**
  ✓ **Retention capability of top sealing unit**
➢ **Reservoir**
  ✓ **Presence of adequate quality reservoir rock**
  ✓ **Better than cutoff parameter values**
➢ **Source**
  ✓ **Presence of source rock capable of generating hydrocarbons**
➢ **Timing and Migration**
  ✓ **Trap formation / timing**
  ✓ **Hydrocarbon generation timing**
  ✓ **Hydrocarbon expulsion timing**
  ✓ **Route and distance of migration pathway**

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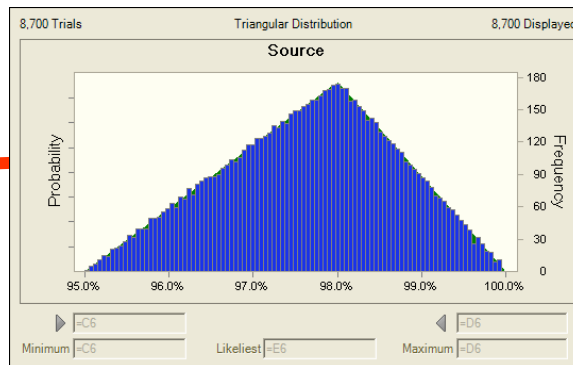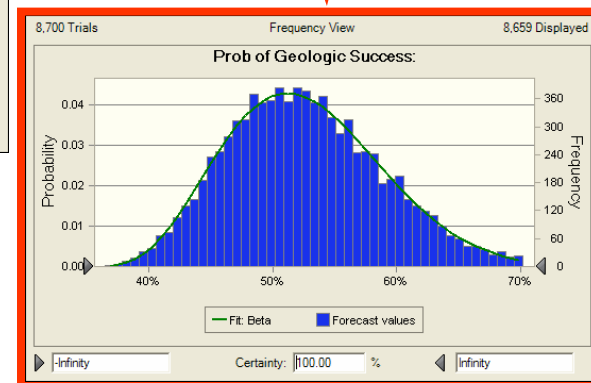
Pg = Probability of Finding Hydrocarbons
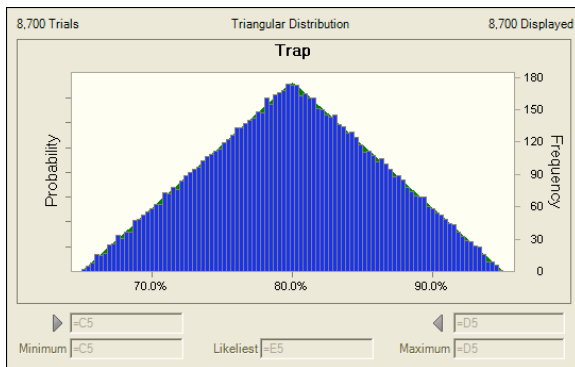
Trap

Reservoir
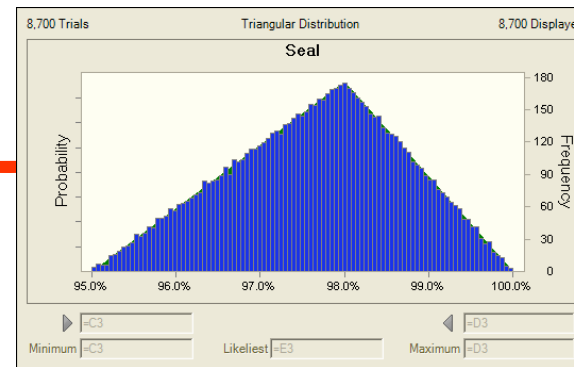
Seal
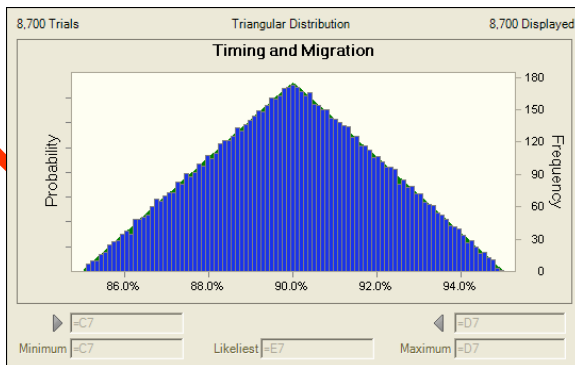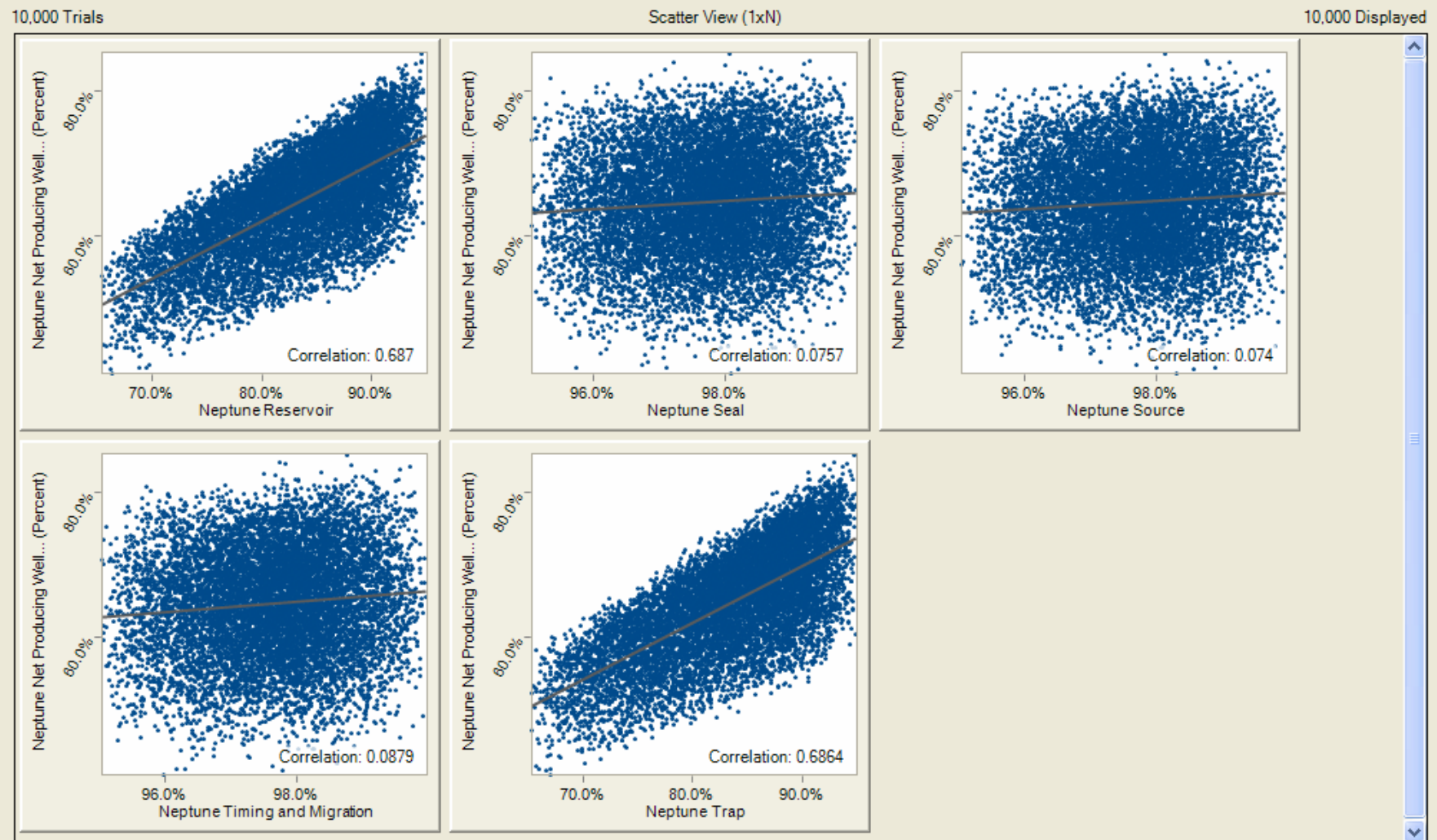
Timing & Migration

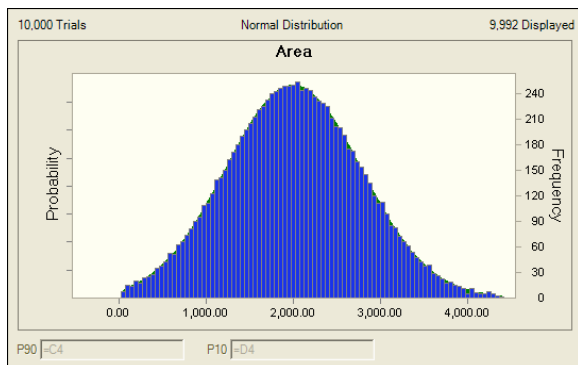**Source**

Probability of Success

Pg Scatter Plots

Geology & Reservoir Engineering

- ➢ **Trap mapped appropriately**
  - ✓ **Assess uncertainty of size**
  - ✓ **Define P10 and P90 range for potential Area of accumulation**
- ➢ **Define reservoir packages**
  - ✓ **Heterogeneity, i.e. compartmentalization**
- ➢ **Depositional environment of reservoir**
- ➢ **Reservoir parameters within definable ranges**
  - ✓ **Net pay**
  - ✓ **Porosity**
  - ✓ **Water saturation**
  - ✓ **Permeability**
- ➢ **Reservoir geometry**
- ➢ **Recovery Factor**
- ➢ **Drainage Area**
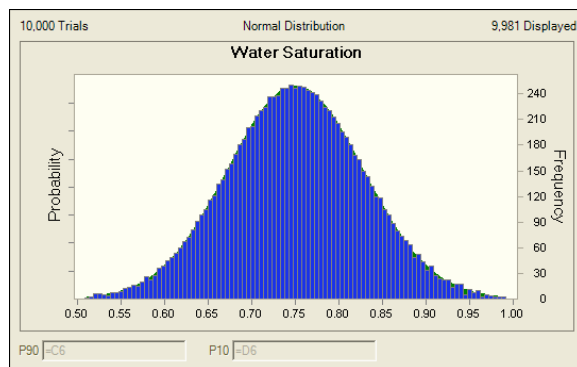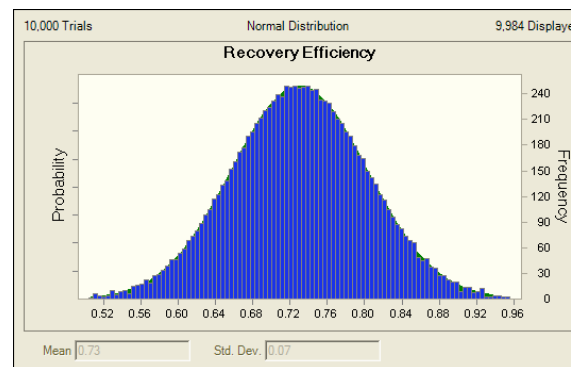 - ✓ **Number of wells**

Reserves Calculation

Prospect Area
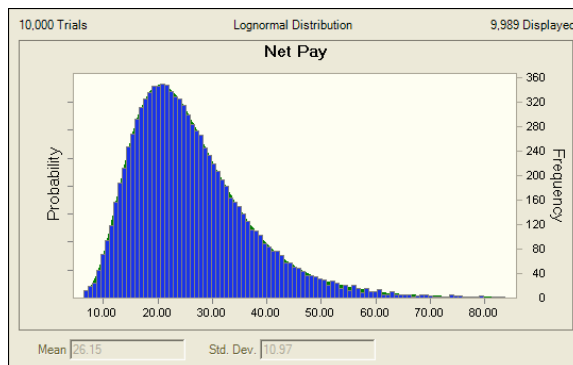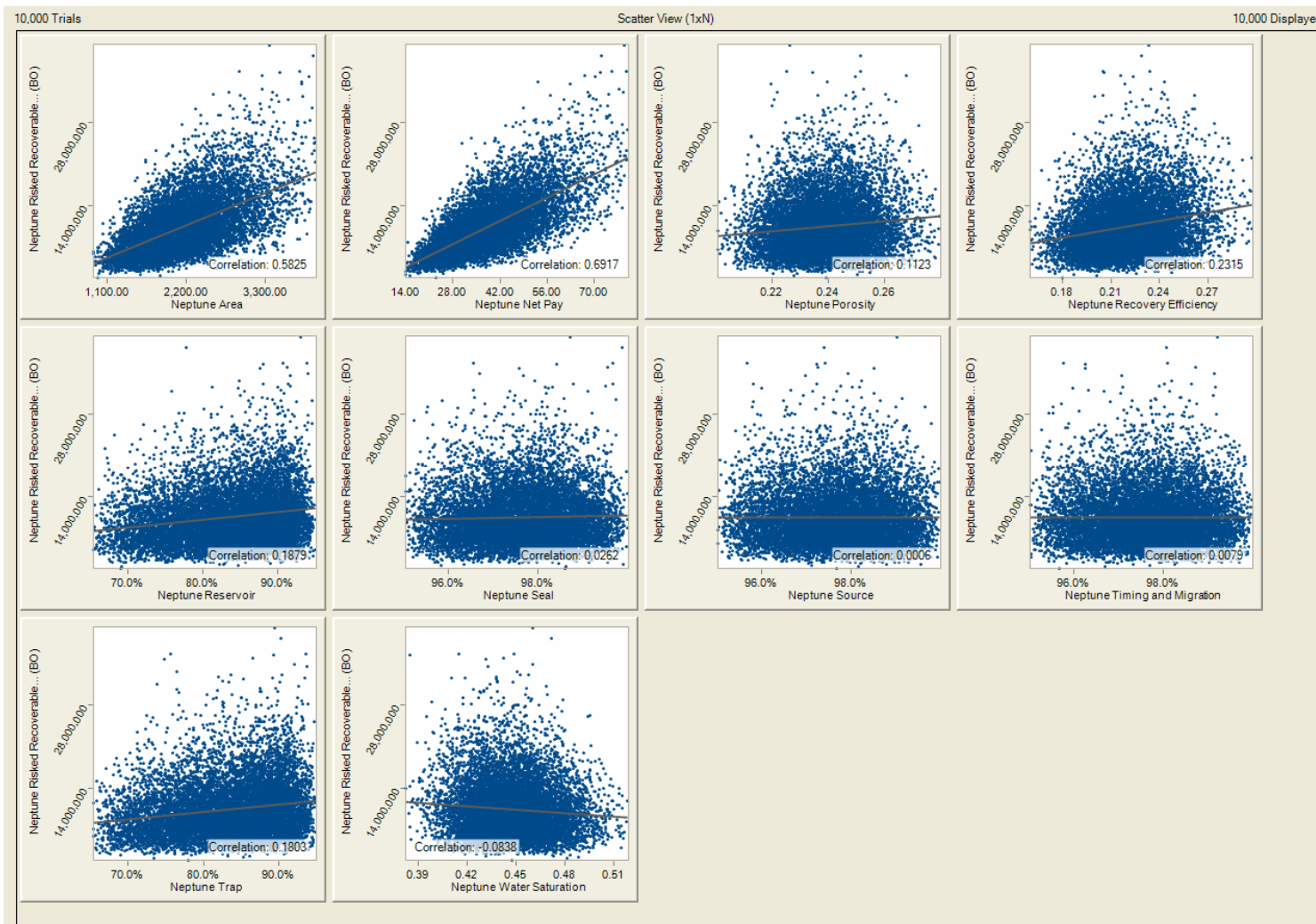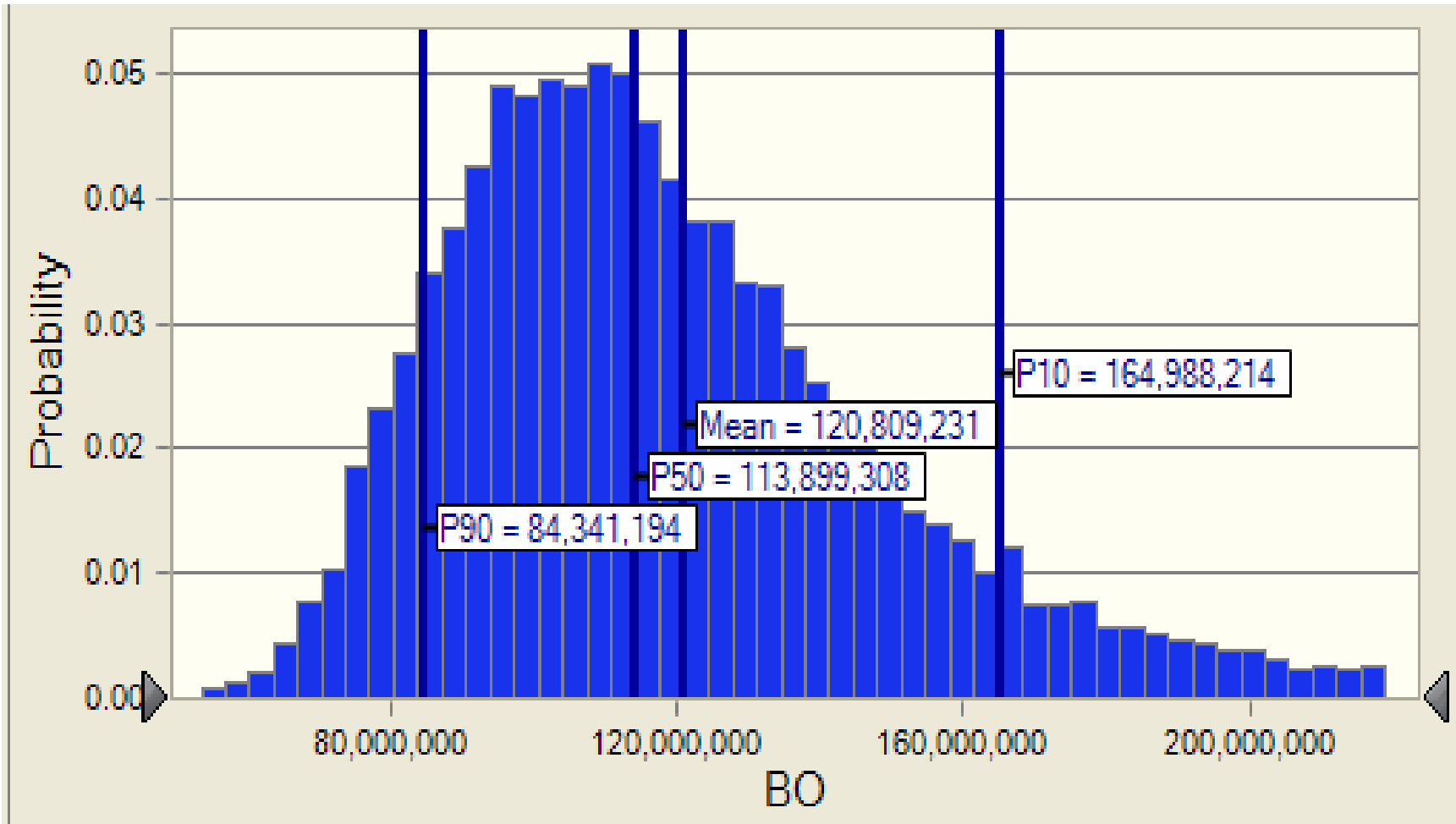

Net Pay
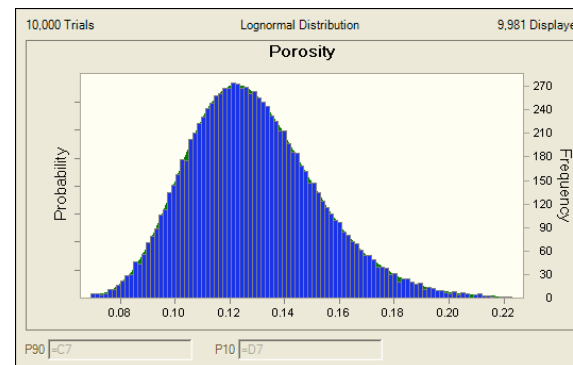
Porosity
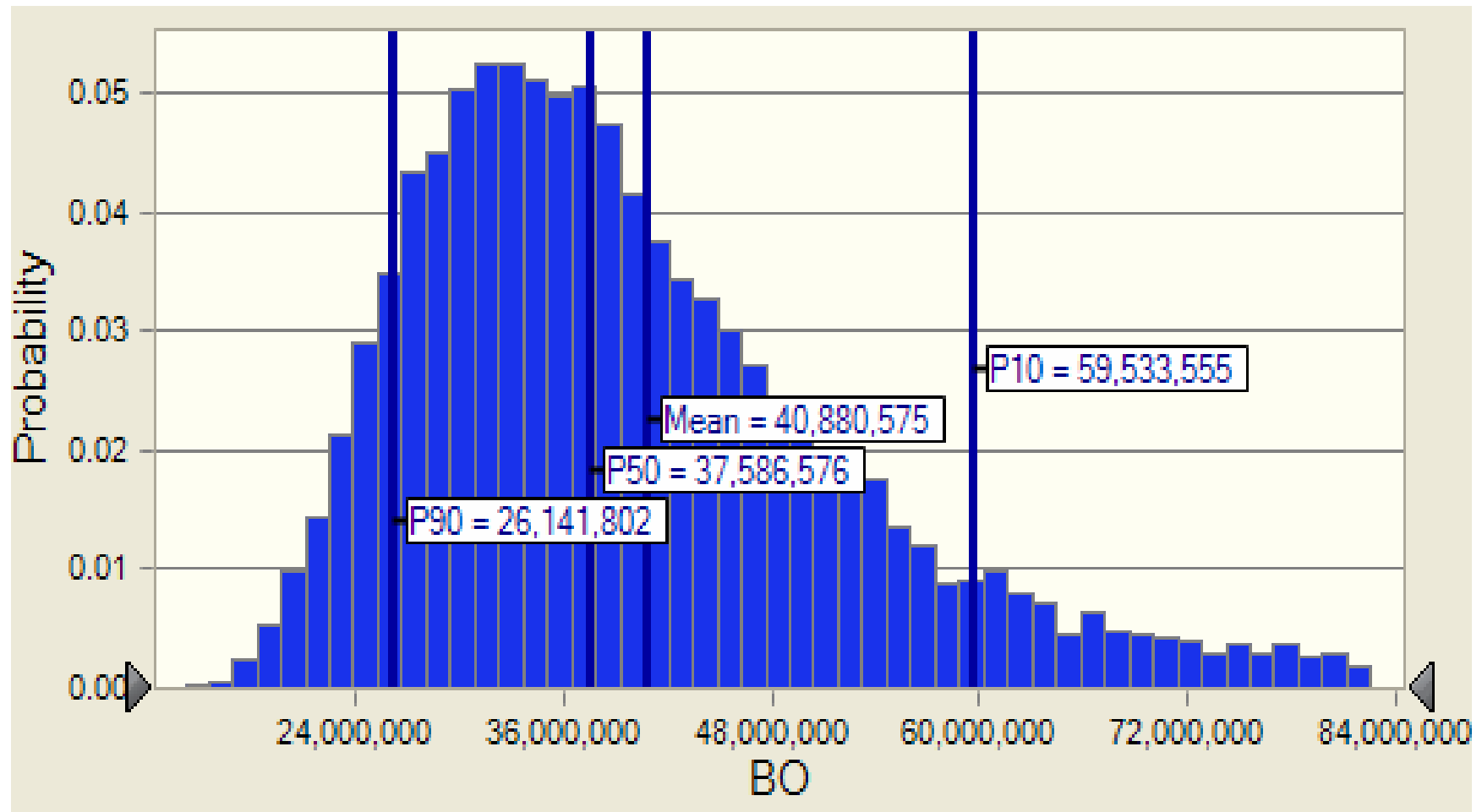

Water Saturation
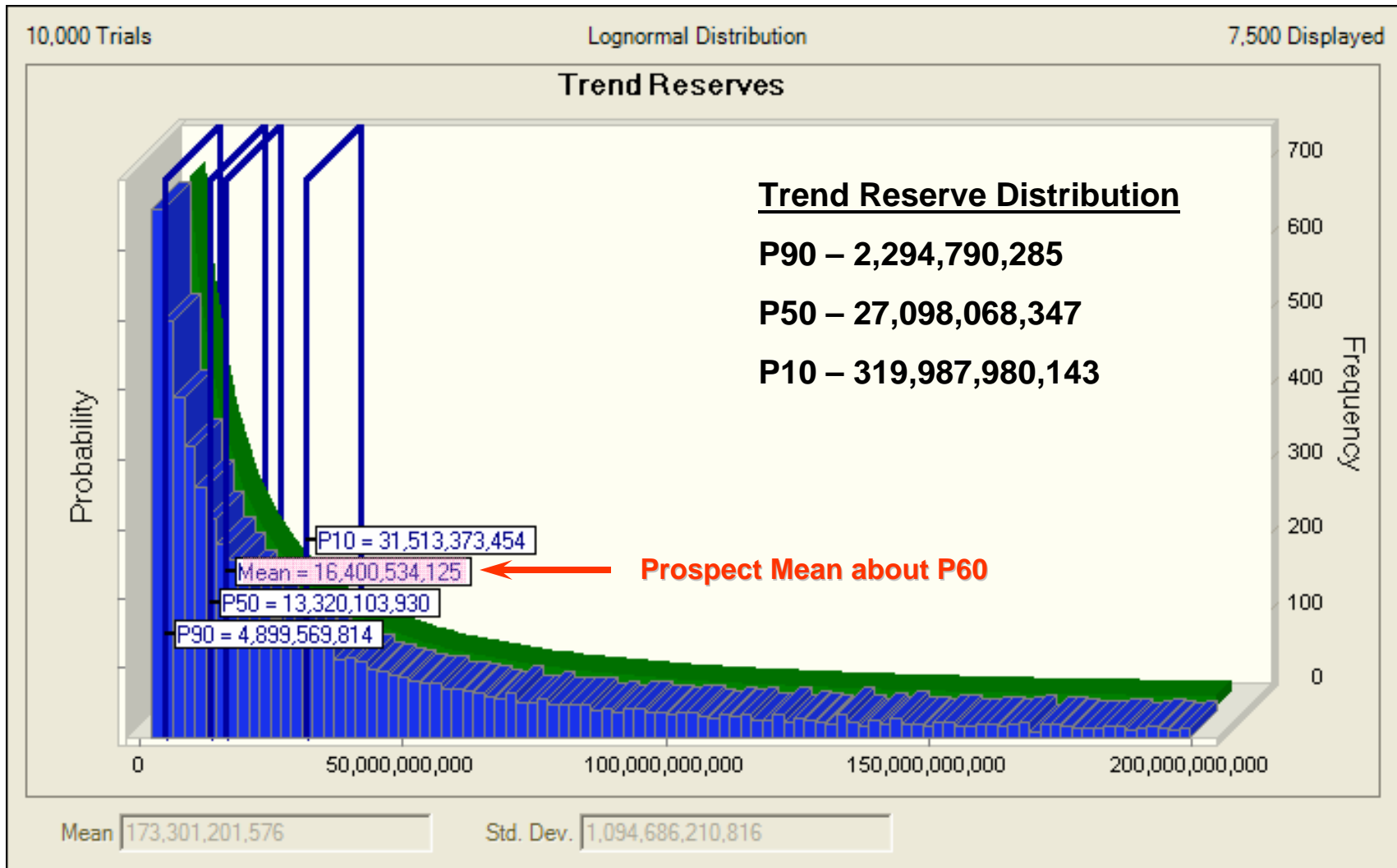

Recovery Efficiency

Risked Recoverable Resource Plots

Total Unrisked Resource

Total Risked Resource

Validate with Trend Reserves

Trend Reserve Distribution

P90 – 2,294,790,285

P50 – 27,098,068,347

P10 – 319,987,980,143

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Sensitivity – What's Important

10,000 Trials   **Contribution to Variance View**

Sensitivity: Recoverable Gas

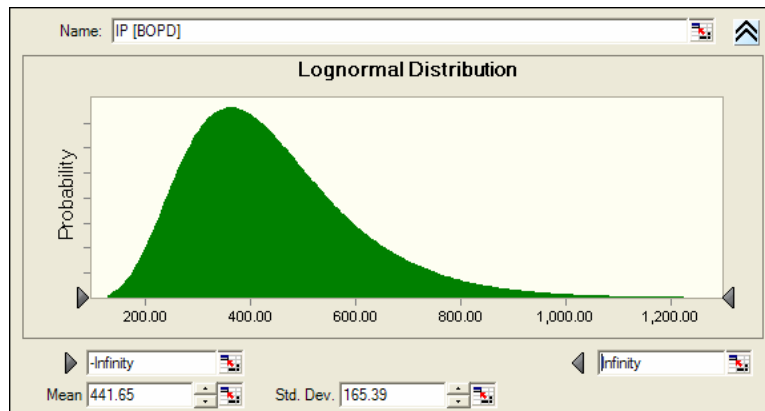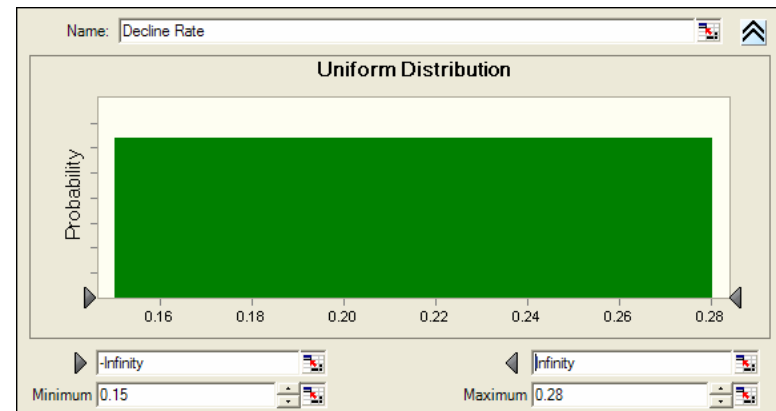|	
Net Pay	42.3%
Water Saturation	-27.8%
Area	19.3%
Porosity	8.1%
Recovery Efficiency	2.5%
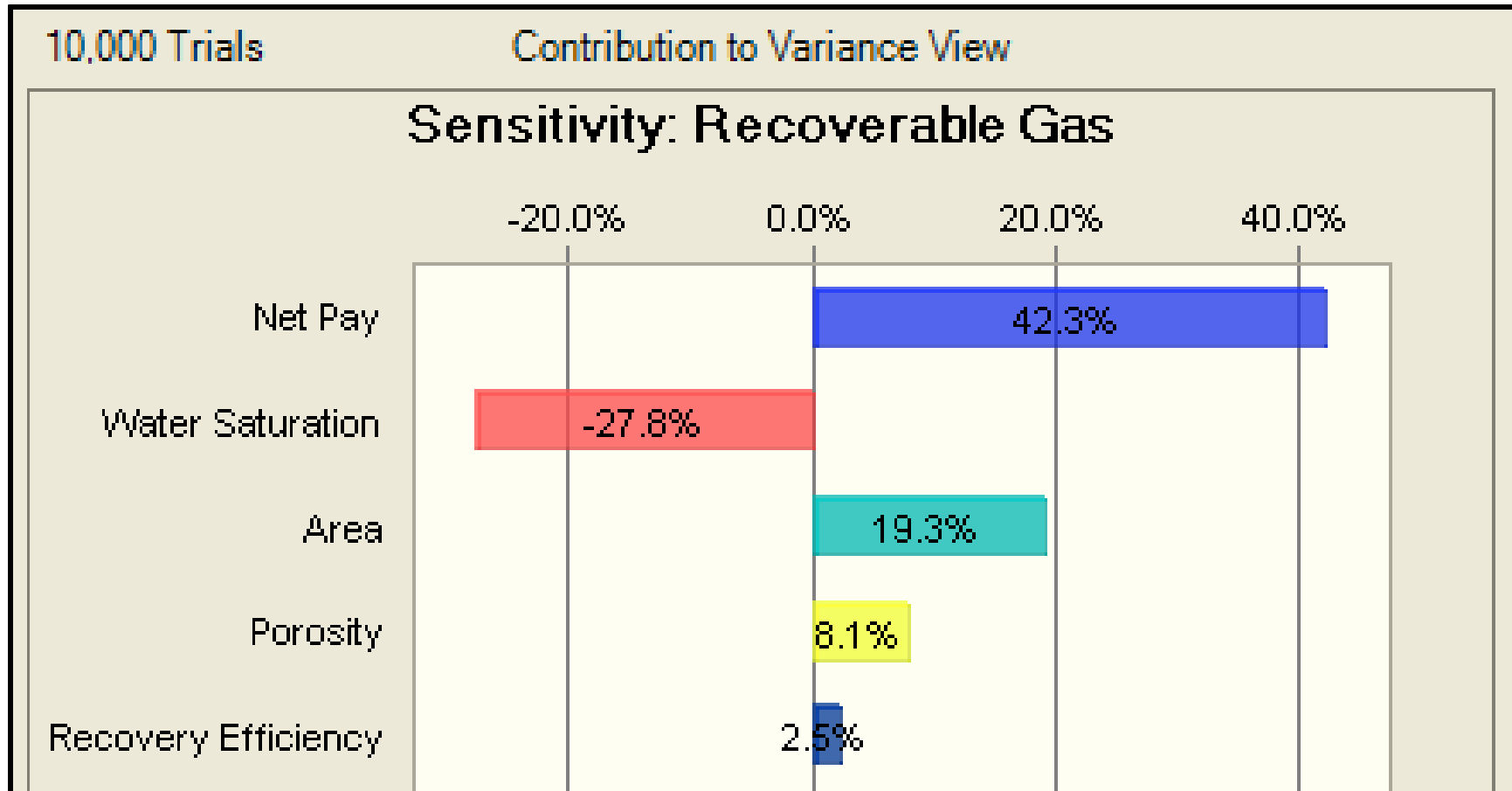
Economics

➢ **Resources**

➢ **Historical or analogous decline for reservoir**

➢ **Historical distributions for expenses**

➢ **NPV Forecast compatible with historical data**
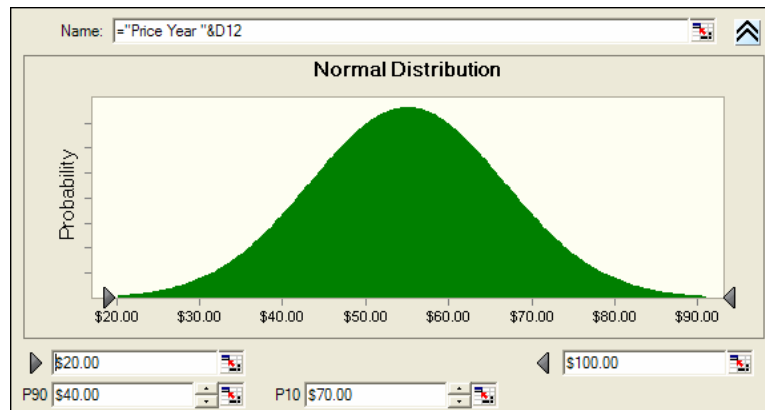
➢ **Portfolio analysis**

Production Schedule & Price
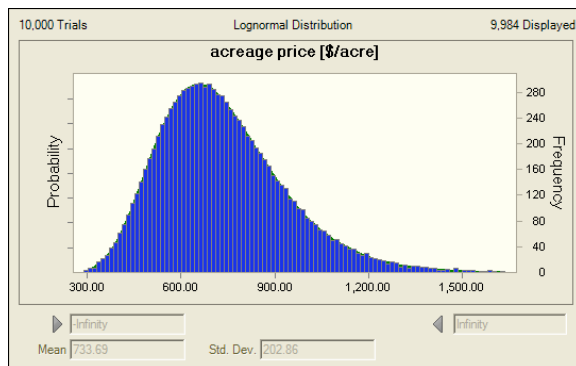

Initial Potential (IP)
(Range of possible IP's)
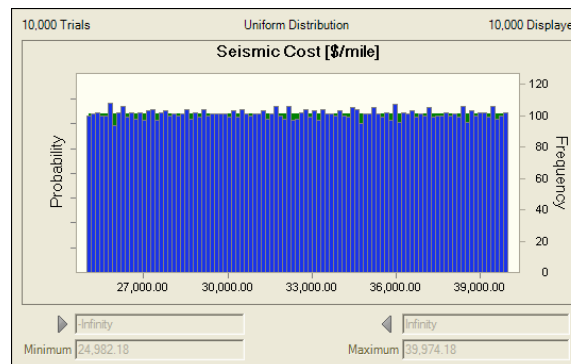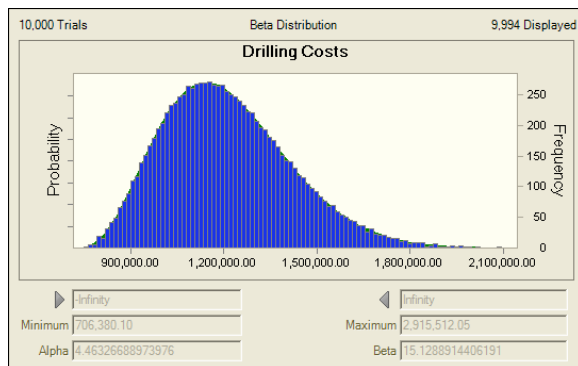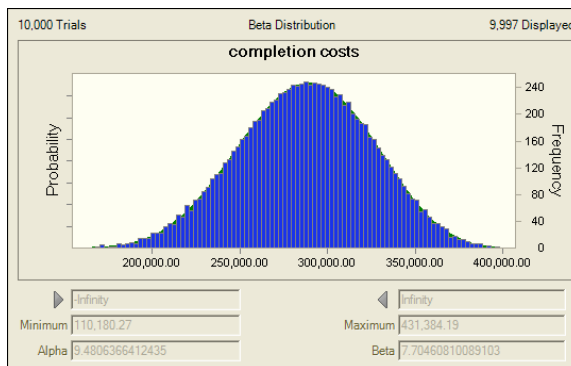

Decline Rate

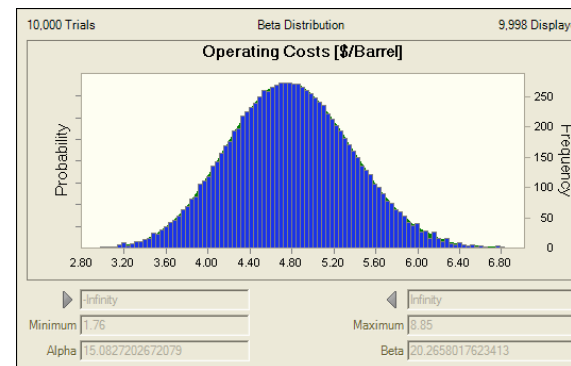

Price

Distributions Built from Historical Costs

Acreage

Seismic Cost

Drilling Cost

Completion Cost

Operating Cost

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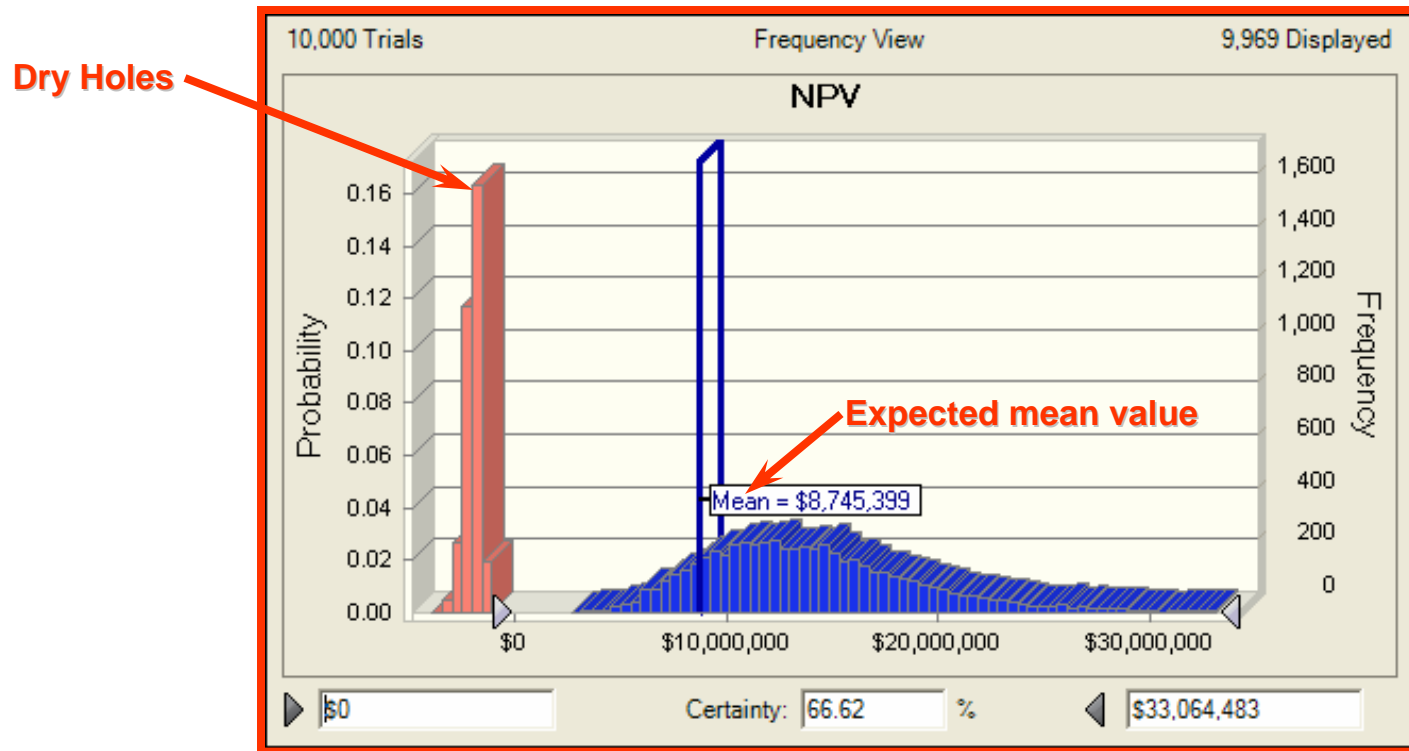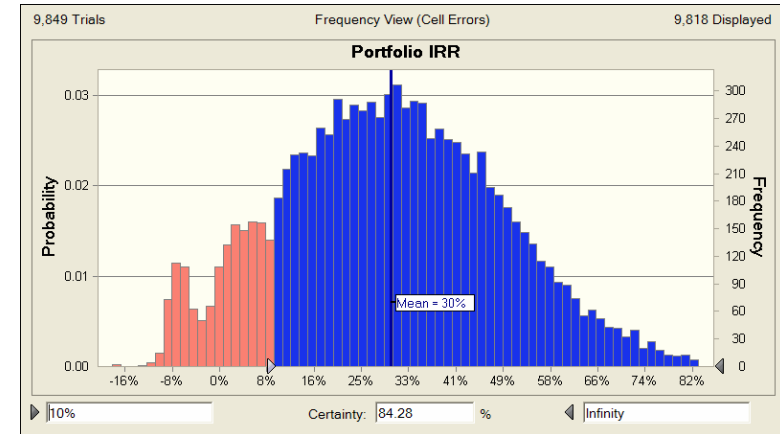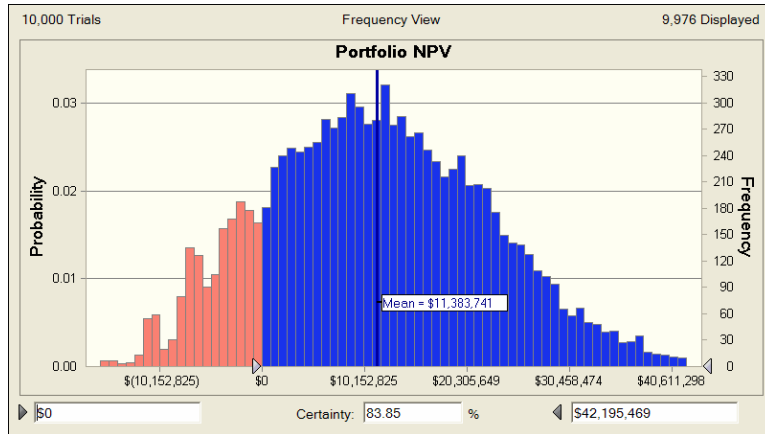
Net Present Value

Portfolio Management

➢ **Examine portfolio value**

➢ **Optimize portfolio given uncertainties of each project**

Why Monte Carlo: Summary

➢ **Answer the important questions**

➢ **Focus your efforts by modelling project uncertainty**
- ✓ **Provide information on the reality of variation, e.g., resources, Pg, costs, NPV, IRR, etc.**
- ✓ **Determine the important parameters**

➢ ***No more "Point Estimates"***
- ✓ **Determine the probability of financial failure.**
- ✓ **You are now accountable for a range of uncertainty, not a point estimate.**

"You will spend many years in a luxurious mansion sprawled in front of a warm fireplace."

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