GOLDUN: MONTE-CARLO SIMULATION, PART OF OUR AFA SUITE OF TOOLS A SIMPLE INTRODUCTION

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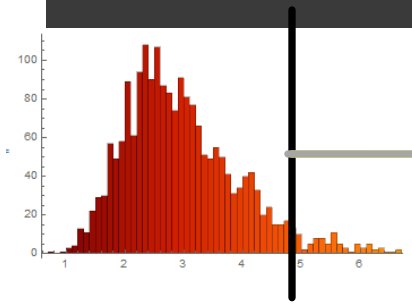
WHY WOLFRAM

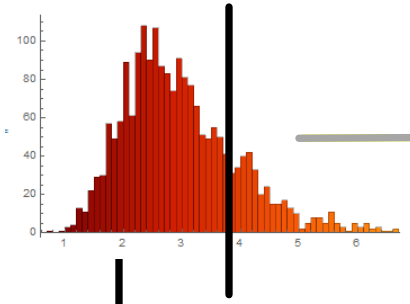
- Our predominant platform for petroleum, chemical, and related calculations is the Wolfram Language, a powerful interactive tool.
- Our model is to development and implement libraries within the cloud which connects easily through API (or other methods) to our data sources ranging from database or even sensor.
- The Wolfram platform is backed by 200+ scientists and engineers. It is a language with the ability to unify algorithms, data, notebooks and linguistics—representing, binding and specifying all elements—is unparalleled. It's at the core of Wolfram's ability to achieve cross-component, cross-department, cross-project workflows with highly readable and executable code across desktop, cloud and mobile
- Wolfram (as opposed to Python and other languages) gives us the speed to generate custom code with rapid deployment of software tools. Additionally, it is easy incporated into our SCADA/Automation services giving us a truly integrated platform from sensor to analysis.

WOLFRAM

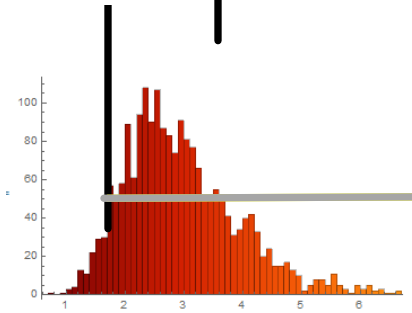
ENGINEERING FLOW "SINGLE REALIZATION"



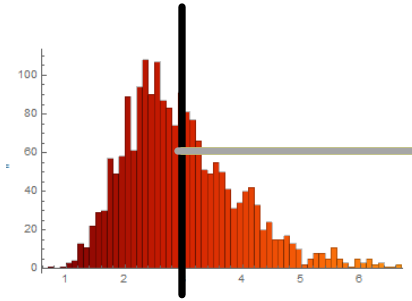
Porosity



Permeability
(dependence on Φ)



Net Pay



Saturations/
Others

Volumetric Model

Well Model/
Deliverability Model

Flexible

Single Forecast

Horizontal/Vertical/
Other Well Model

Permeability Models

PVT Models

Material Balance

The procedure is repeated "n" times to create various distributions

GENERATING DISTRIBUTIONS FOR INITIAL CONDITIONS

Number of realizations in generating distributions. Each value is stored in "n" index of an array

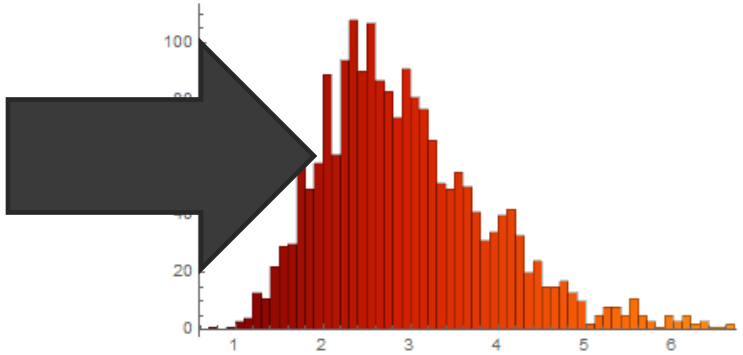
```
(*Loop to Generate Plots*)
For[n=1., n≤testn, n++,

Por[[n]]=RandomReal[
    TruncatedDistribution[{0.,Infinity},
    NormalDistribution[MeanPor,SDPor]],1.]/100;

Perm[[n]]=RandomReal[
    TruncatedDistribution[{0.,Infinity},
    NormalDistribution[MeanPerm,SDPerm]],1.],
```

Bound distribution from 0 to infinite values

RandomReal[ ] generates a single random value according to μ and σ



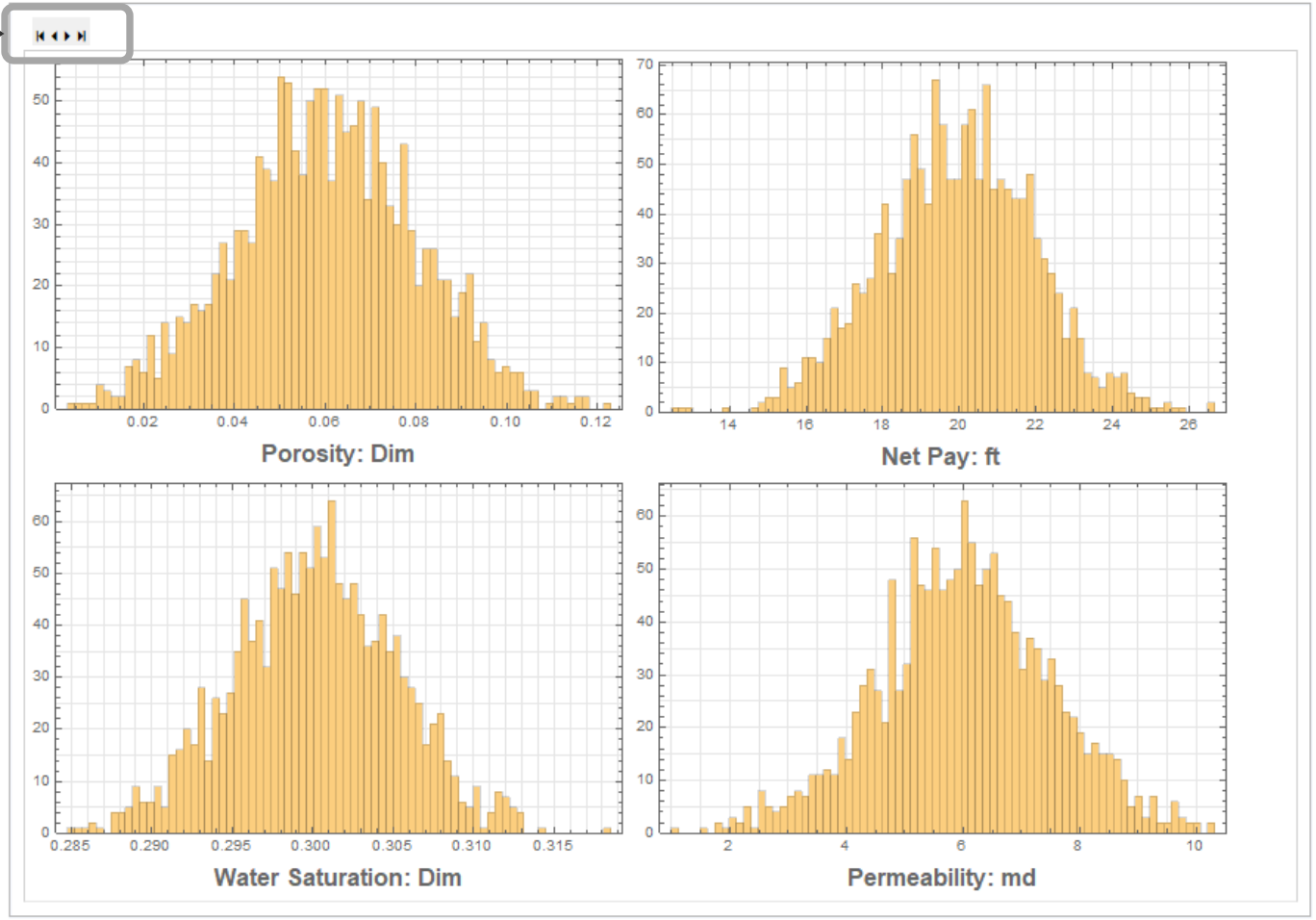
Distributions can be normal, lognormal, and other combinations

Distributions are generated for net pay, porosity, saturations, FVF, and so on

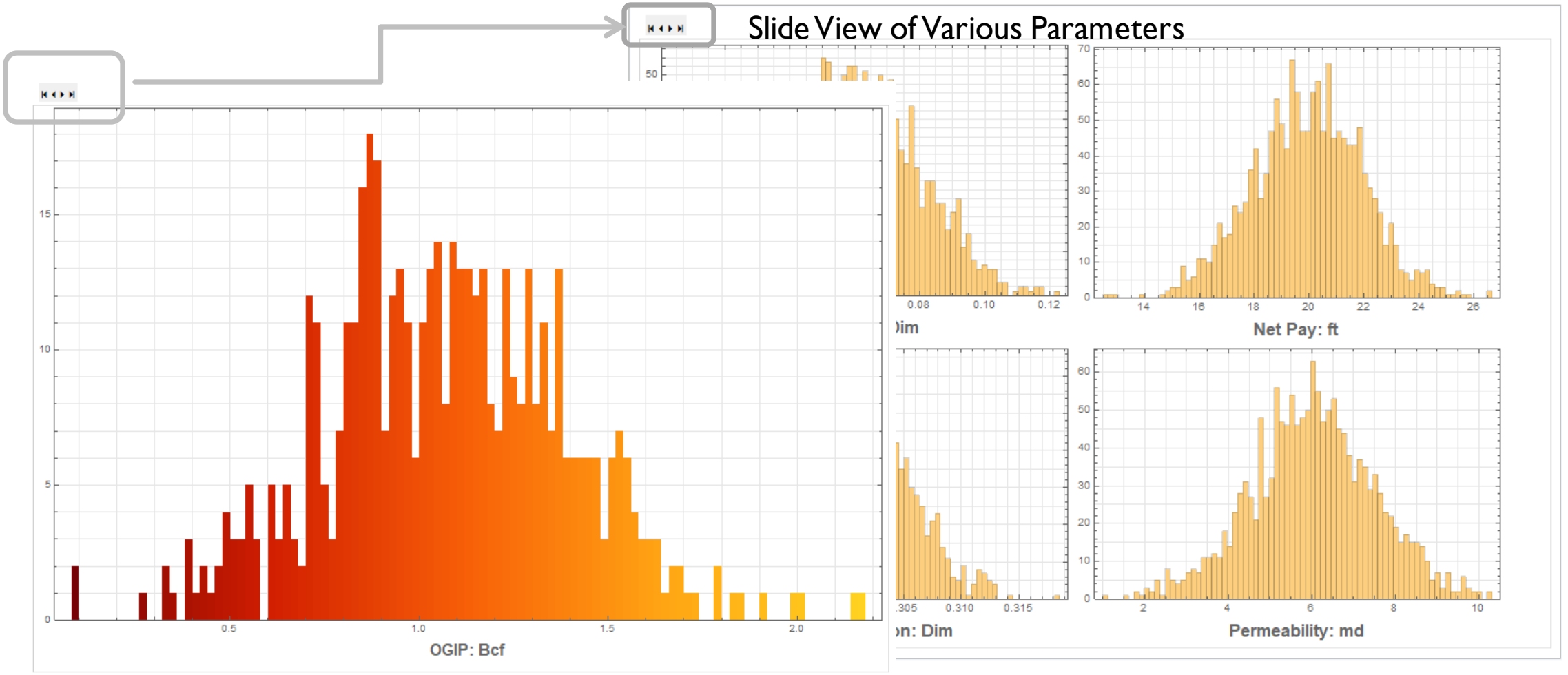
TYPICAL PARAMETER DISTRIBUTION PLOTS

Scroll through a variety of distribution plots of the various petrophysical parameters

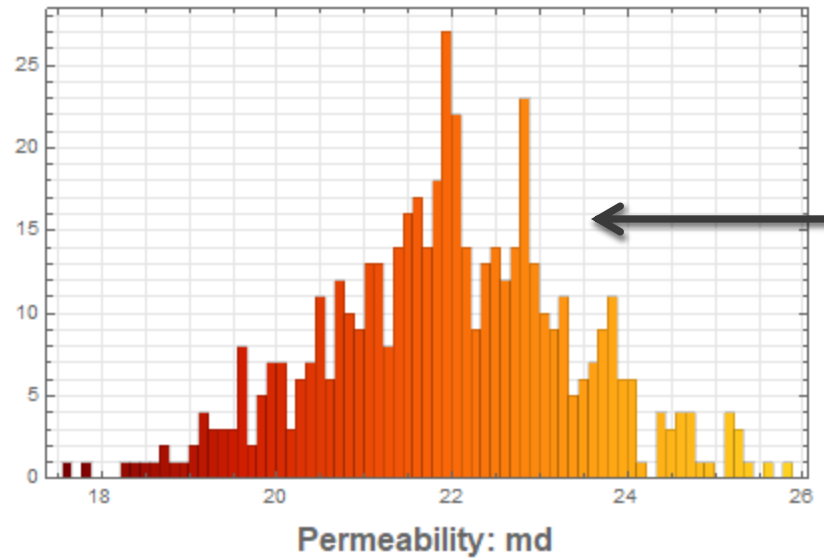
Data can be modelled as normal, lognormal, and more

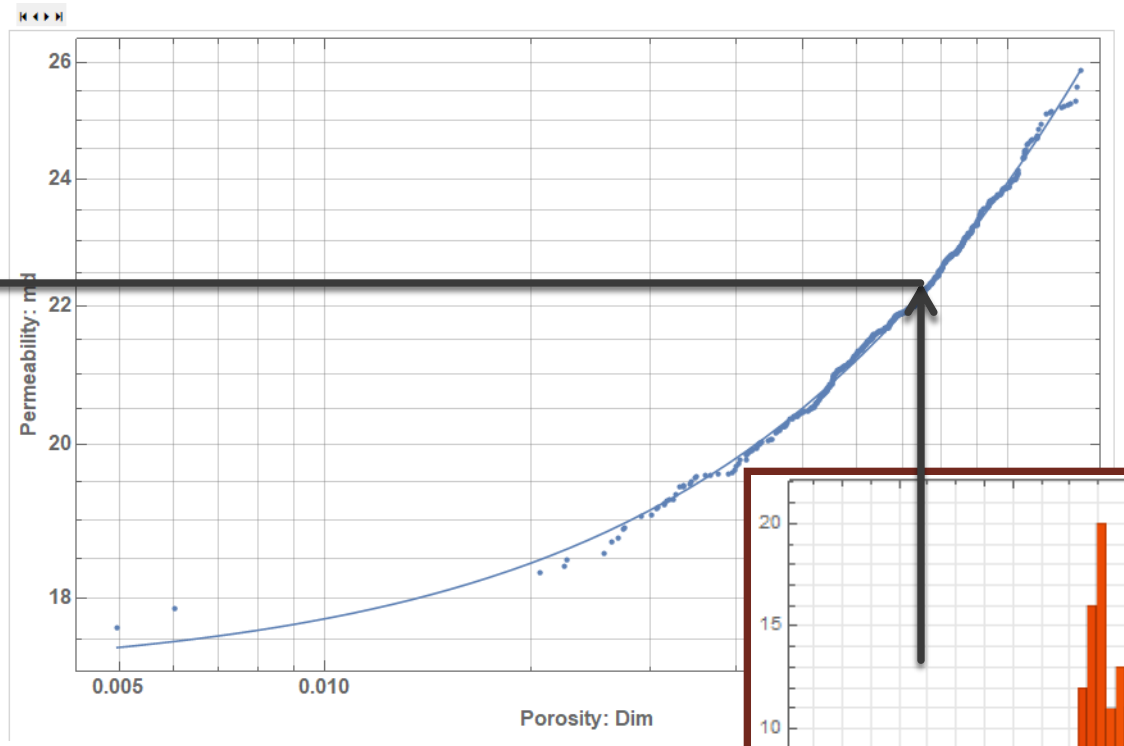


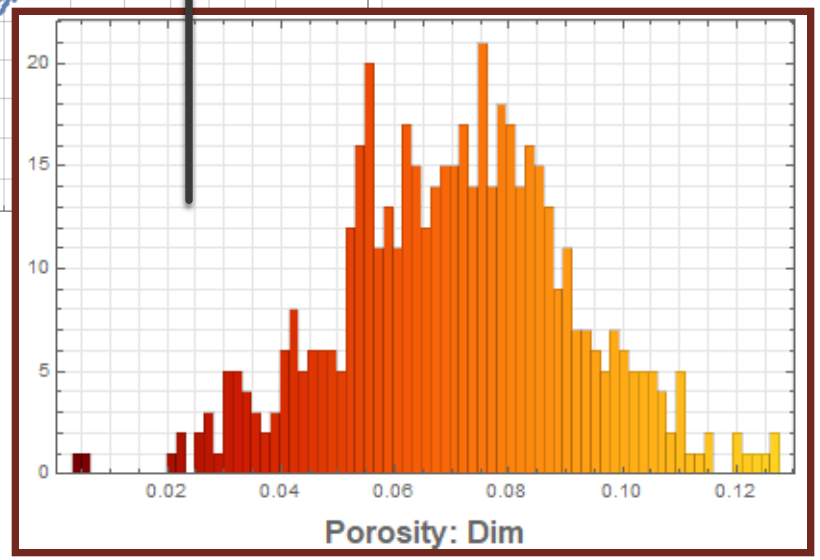
TYPICAL PARAMETER DISTRIBUTION PLOTS



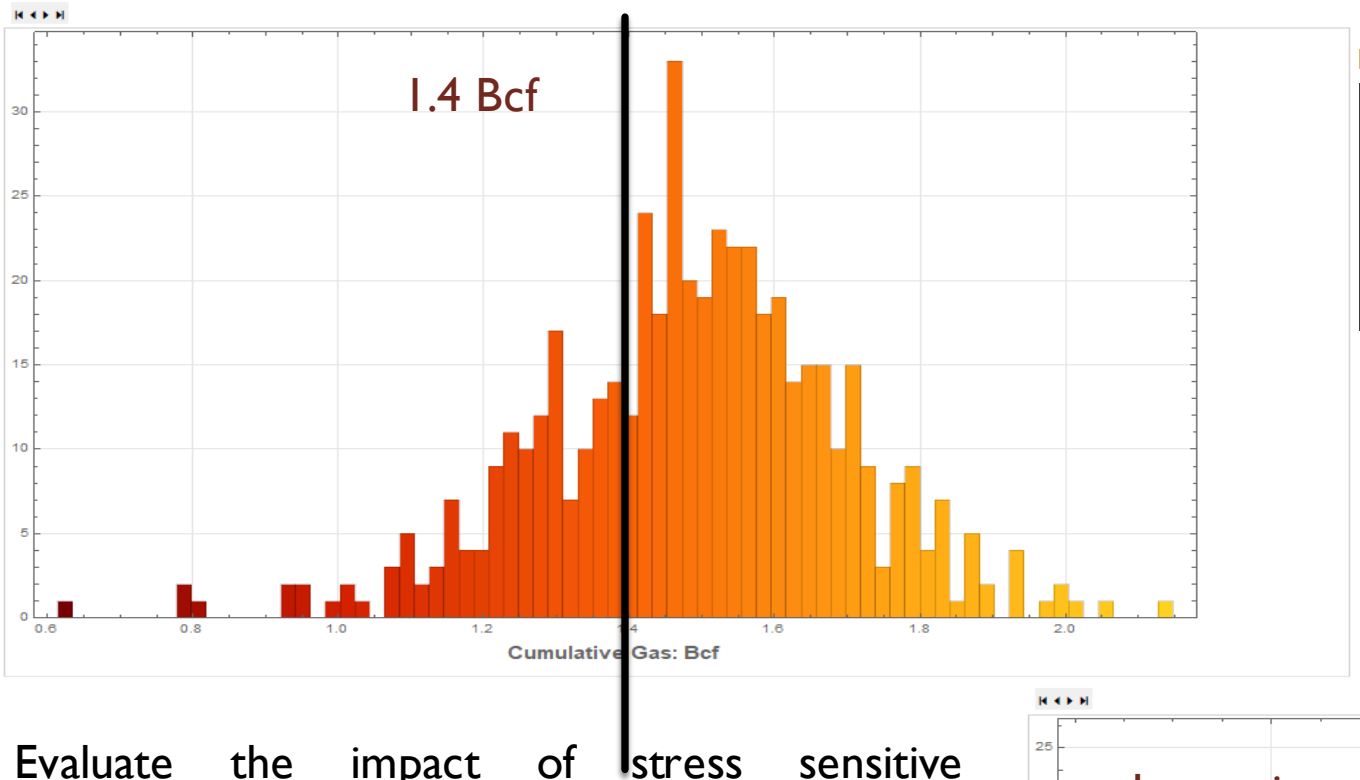
INCORPORATE DEPENDENCIES: PORO-PERM DISTRIBUTIONS



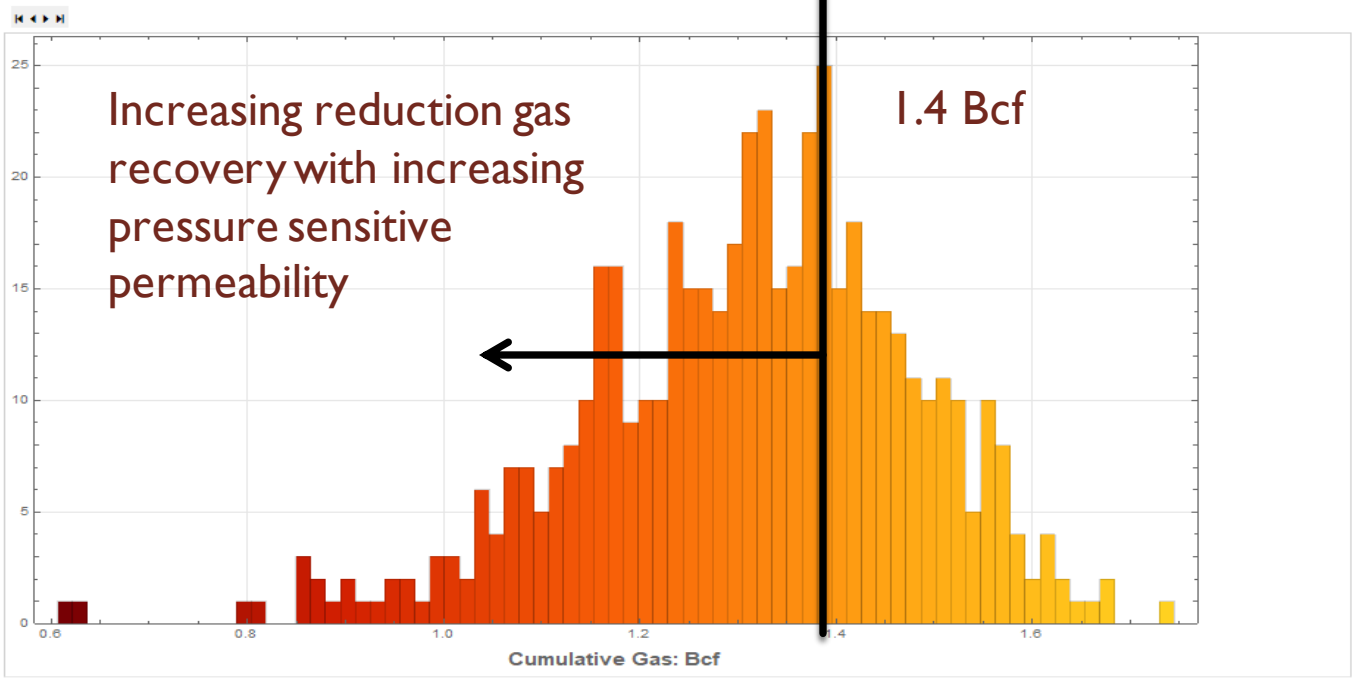




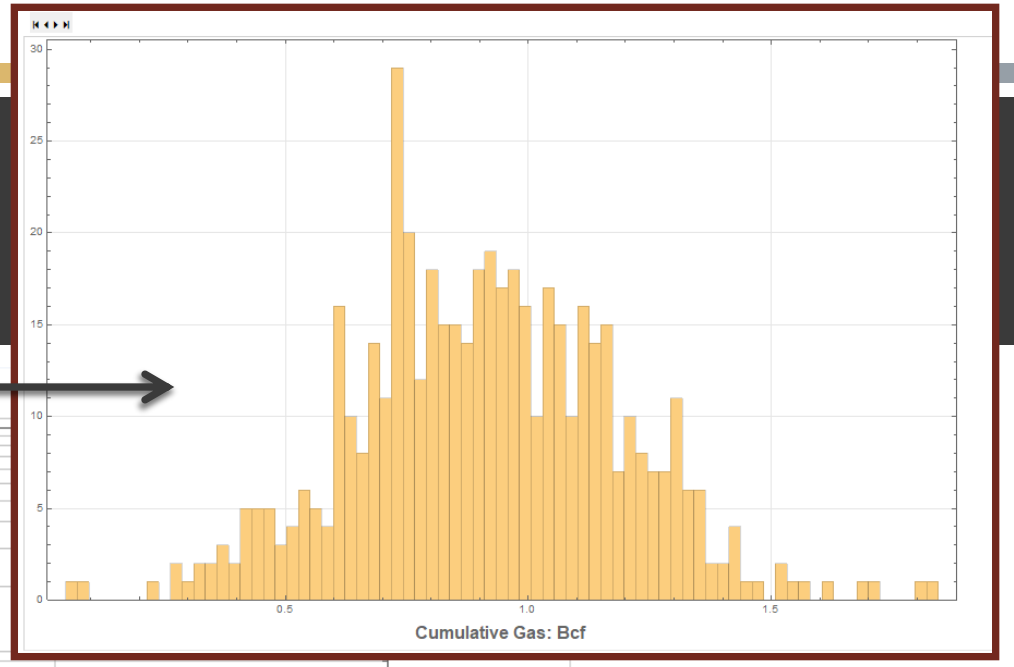
When executing, the software will generate a permeability value based on the porosity generated from the porosity distribution

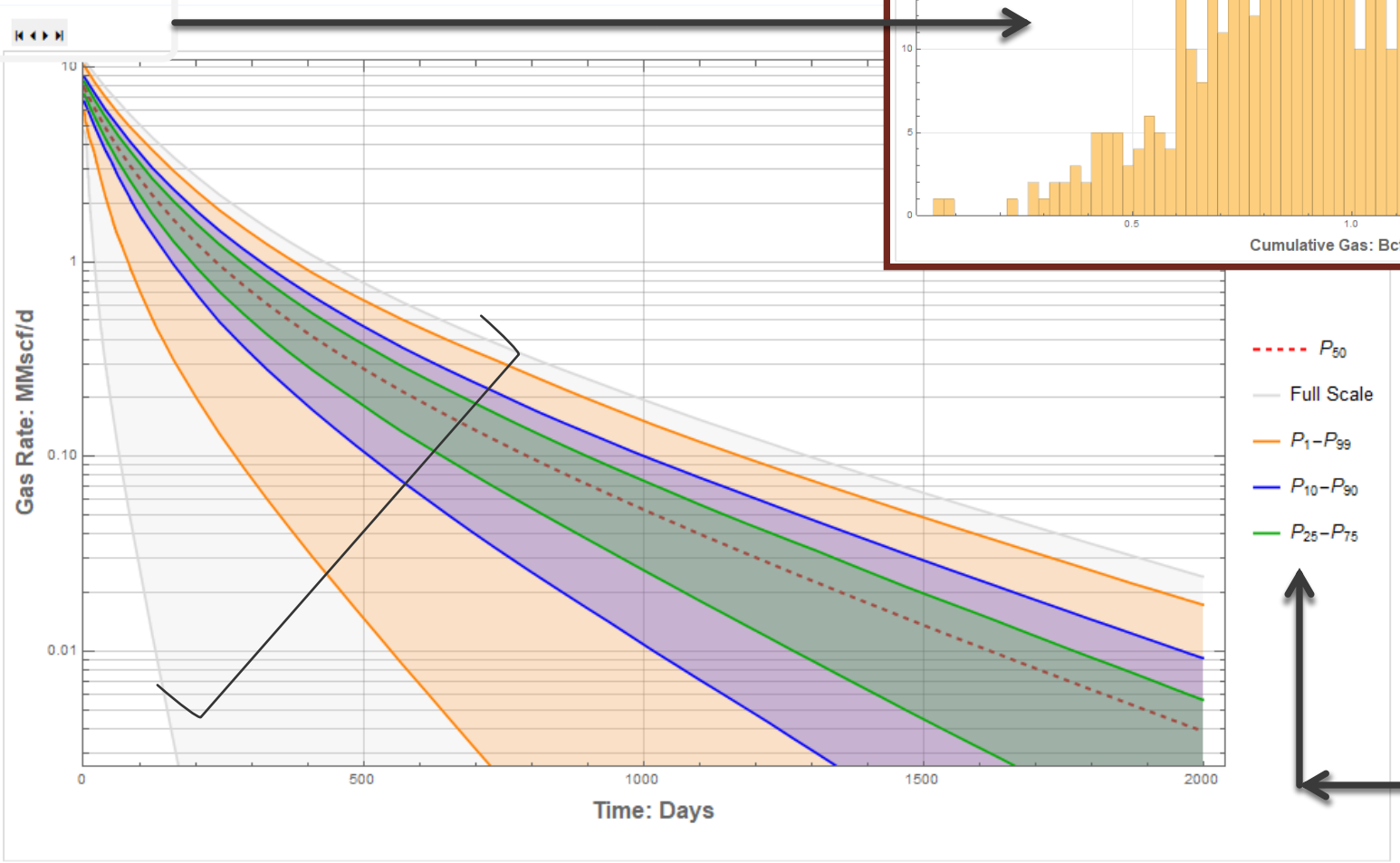


Evaluate the impact of stress sensitive permeability. In this example, increasing "permeability modulus" results in a shift from a normal distribution towards skewed distribution with lower overall recovery.



PROBILISTIC FORECAST





Rate forecasts, including cumulative production distributions, can be generated for any percentile desired by the user.

In this example, we have:

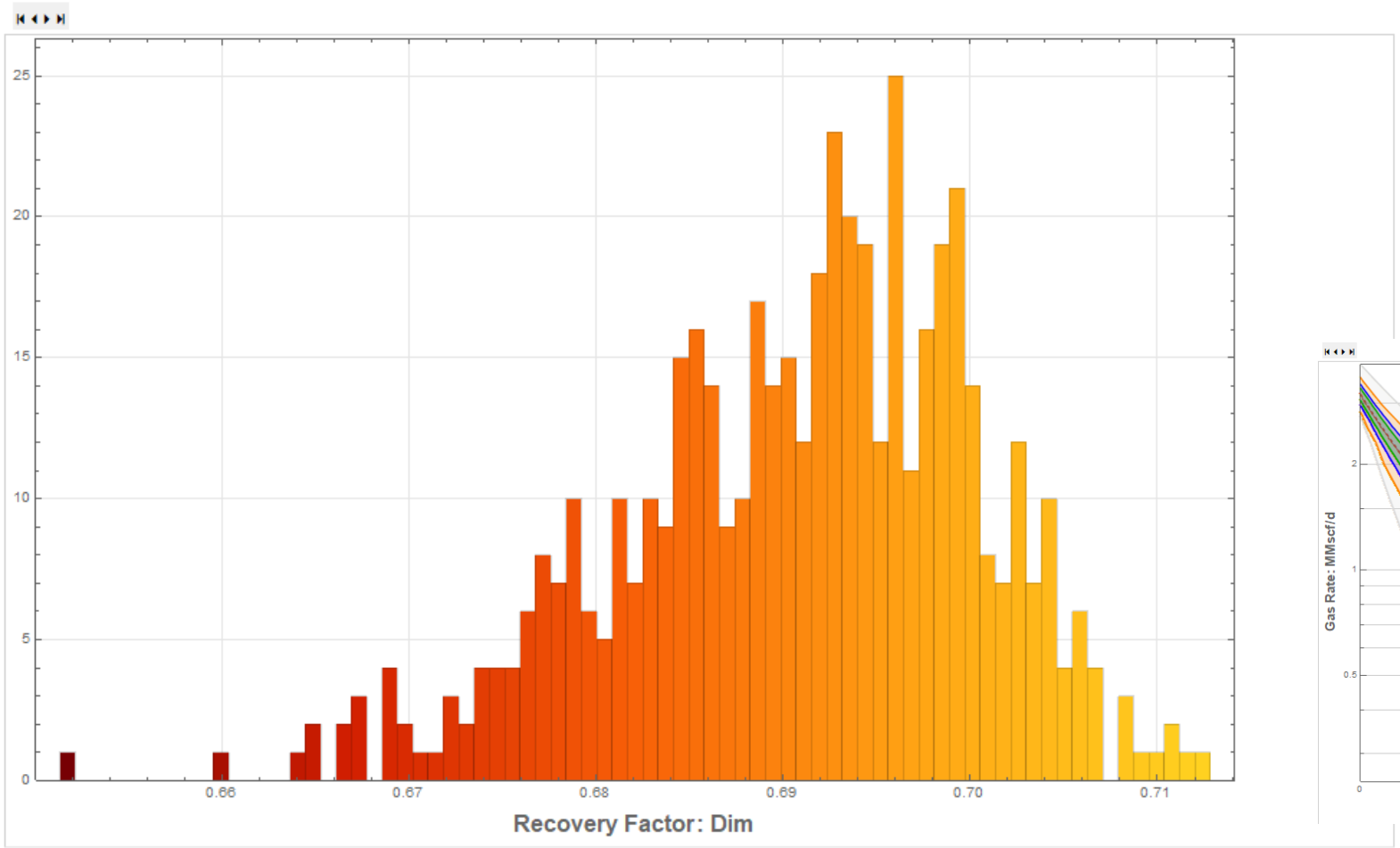
P_1-P_{99}

P_{10}-P_{90}

P_{25}-P_{75}

$P_{0.01}$-$P_{99.99}$

EVALUATE RECOVERY & RECOVERY FACTOR: FUNCTION OF RATE CUT-OFF & BHP (P_{WF})



Recovery factor distributions are generated considering reservoir model, completion model, economic cut-off, and anticipated drawdown