

# 5 Day Online Training On Practical Reservoir Engineering Methods Using Python



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## ABOUT THIS TRAINING

- You will learn python as we go. This training provides the participants with great insights on applications of python for reservoir engineering and reservoir monitoring and surveillance and how it's used to solve various problems and create engaging dashboards.
- This training is designed by oil and gas professional for professionals likewise, where real oil and gas data sets are used for training with diversity in data sets.

## SKILLS GAINED

 Introduction to Python Ecosystem

 Python Basics and Uses for Oil and Gas

## AUDIENCE

 Reservoir Engineers.

 Production engineers.

 Chemical engineers.

 Drilling engineers.

 Geologists and petrophysics

 AL and workover engineers.

 Undergraduate students.

## PREREQUISITE

- No knowledge is required.
- A working laptop with Windows OS.

## WHAT YOU WILL GET FROM JOINING

 Access to Video Recordings on daily basis.

 Study materials ppt, pdf

 Oil and Gas Datasets

# DAY 1 - PYTHON: RESERVOIR ENGINEER'S BEST FRIEND (TO BE)

## TOPICS

- Why Reservoir Engineers Should Use Python
- Python Data as Related to Oil and Gas Industry
- Data types and Structures in Python
- Introduction to Data Visualization
- Working with Tabulated Data using Pandas
- Basics of Data Cleaning and Transformation using Pandas.
- Creating Calculations and Data Exports.
- Linking Excel, CSV, TXT to Python

## EXERCISES

- Oil and Gas Data Reading and excel connection to python
- Simple Reservoir Data Visualization.
- Filtering Reservoir Data based on Wells (single or Multiple)
- Cleaning and organizing historical data, with proper datetime conversion.

## WHAT YOU WILL LEARN

- Understand the Basics of Python Programming: Gain a foundational understanding of the Python programming language, including its syntax, structure, and common uses.
- Navigate the Python Environment and Ecosystem: Familiarize yourself with the Python environment, including IDEs, libraries, and tools that form the Python ecosystem.
- Identify and Utilize Python Data Types and Structures: Learn to work with various data types and structures in Python, such as lists, dictionaries, tuples, and sets, for efficient data management.



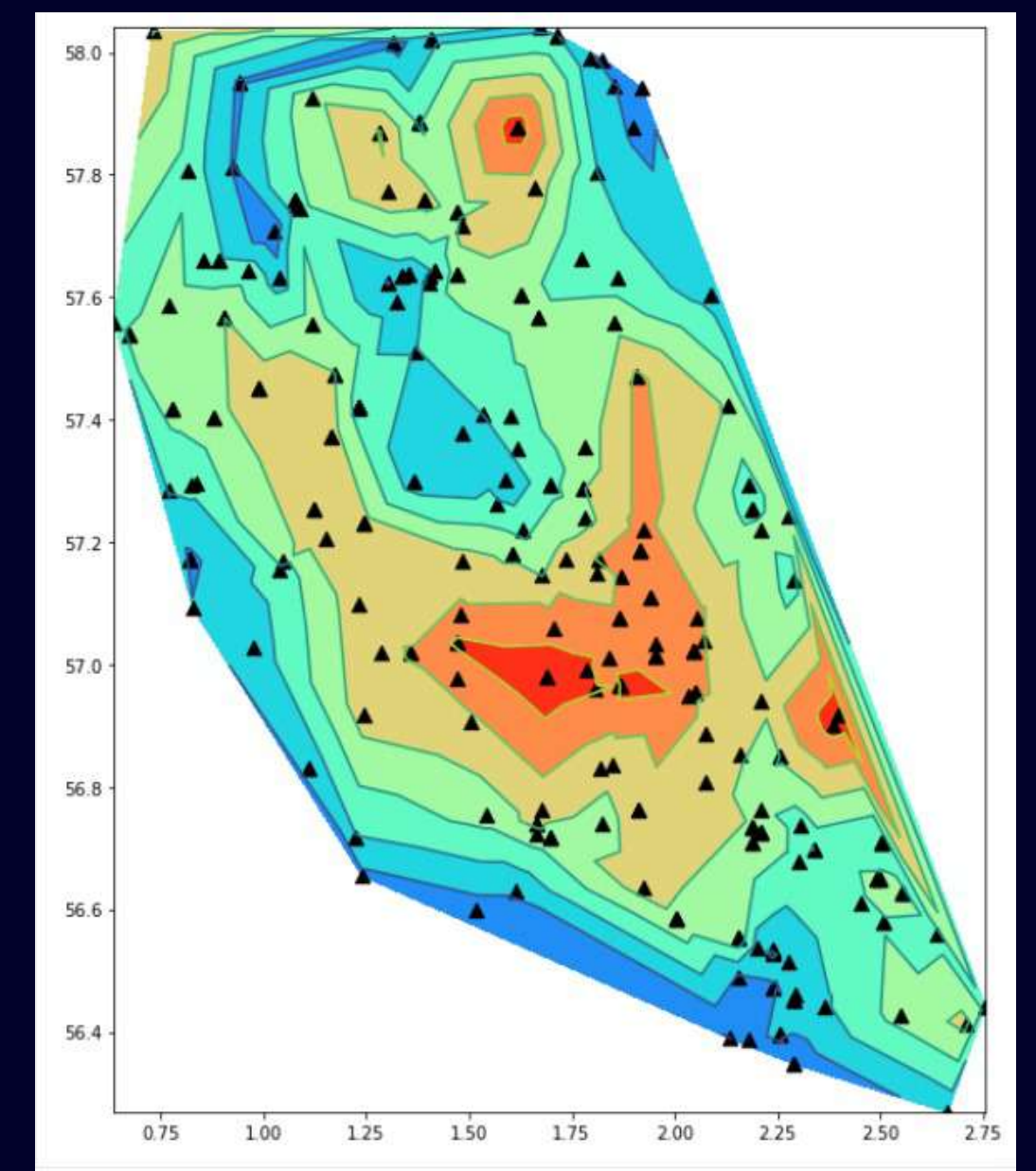
# DAY 2 - BRING RESERVOIR DATA TO LIFE VIA DASHBOARDS

## TOPICS

- Visualization in depth.
- Introduction to Delaunay Triangular Maps
- Introduction to Interactive Dashboards
- What is Metrics and KPI and How to visually display them
- More on visualization.
- Detecting undeveloped reservoir areas by using base map with drainage bubbles.

## EXERCISES

- Subsurface Contour Mapping
- Interactive Reservoir Data Dashboards.
- Interactive Well Selection and Dynamic Data Filtering.
- Cumulative Production Calculation
- Bubble Map for Well Drainage Extent



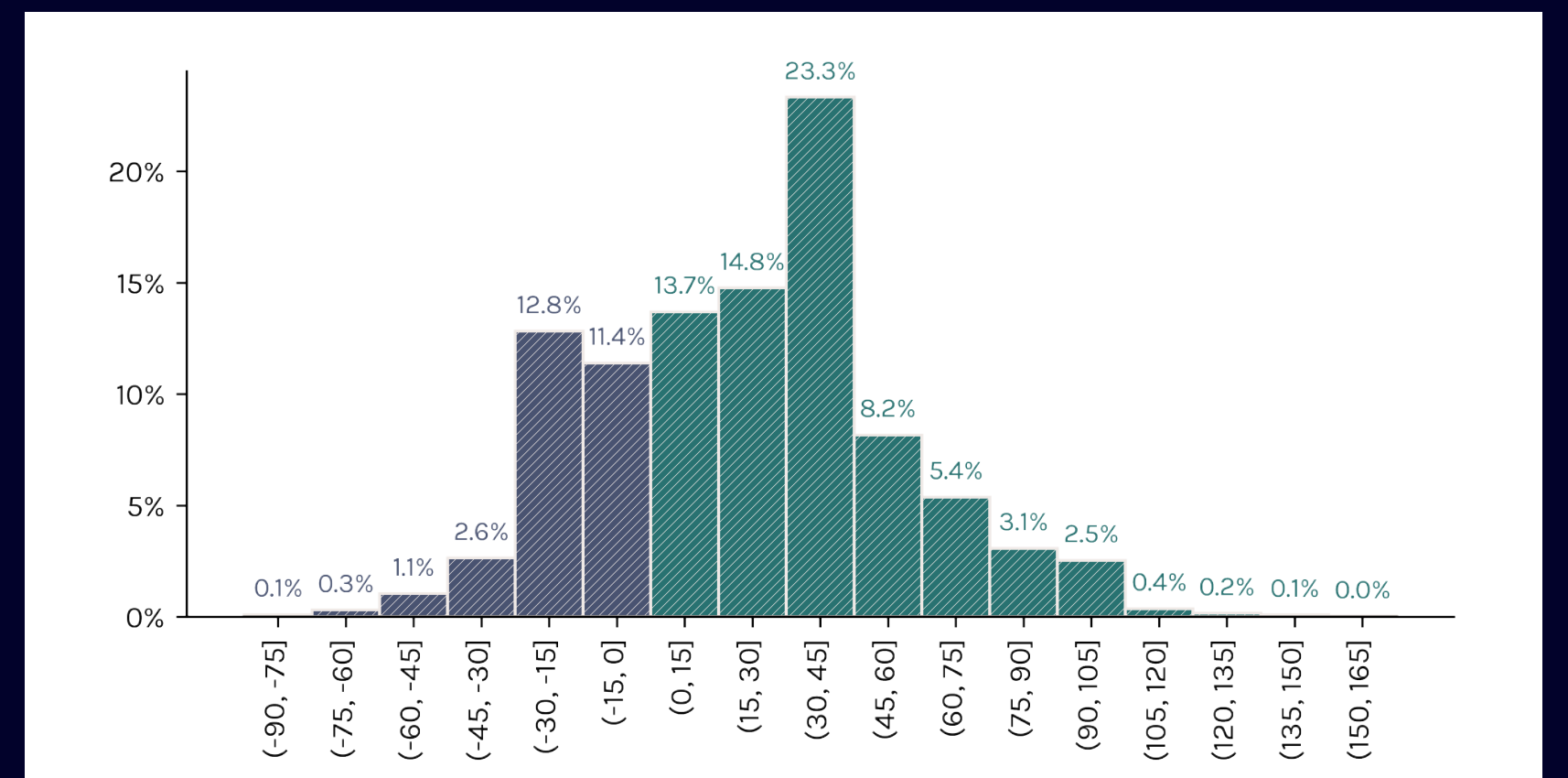
## WHAT YOU WILL LEARN

- In-depth Visualization Techniques: Explore advanced visualization methods to represent complex subsurface data effectively.
- Introduction to Delaunay Triangular Maps: Understand how Delaunay triangulation is applied in mapping and data visualization.
- Interactive Dashboards: Learn how to design interactive dashboards to showcase reservoir data and enhance decision-making processes.
- Metrics and KPIs Visualization: Grasp how to display key performance indicators (KPIs) and metrics visually to monitor and analyze reservoir performance.
- Advanced Visualization Techniques: Delve deeper into visualization strategies for improved interpretation of oil and gas data.
- Reservoir Area Detection: Learn how to identify undeveloped reservoir areas using base maps with drainage bubbles to optimize field development strategies

# DAY 3 - RESERVOIR SURVEILLANCE IN ACTION

## TOPICS

- Introduction to Time Series Analysis using Auto Regression
- Introduction to Water Cut Production
- Selection based Water Cut Analysis and WOR prediction.
- Introduction to Chan Plot for Water Oil Ratio Diagnostics
- Flowing Material balance and Linear fitting.
- Linear and Non-Linear curve fitting and coefficient calculation.
- Linear Production Forecasting



## EXERCISES

- Chan Plot for Waterflooded reservoirs.
- Using Auto Regression for Non empirical time series prediction (WOR, GOR, etc.).
- X Plot
- Flowing Material balance and Recover estimation.

## WHAT YOU WILL LEARN

- Introduction to Time Series Analysis using Auto Regression: Understand how to apply autoregressive models for time series analysis in oil and gas data.
- Water Cut Prediction: Learn techniques for predicting water cut in reservoirs, an essential parameter for production monitoring and optimization.
- Selection-Based Water Cut Analysis and WOR Prediction: Master methods to select data for accurate water cut and water-oil ratio (WOR) prediction, optimizing reservoir management.
- Introduction to Chan Plot for Water-Oil Ratio Diagnostics: Learn how to use Chan plots for diagnosing water-oil ratio behavior and identifying reservoir performance issues.
- Flowing Material Balance and Linear Fitting: Understand the principles of flowing material balance and how to apply linear fitting for accurate reservoir evaluation.
- Linear and Non-Linear Curve Fitting and Coefficient Calculation: Explore techniques for both linear and non-linear curve fitting and learn how to calculate relevant coefficients for production forecasts.
- Linear Production Forecasting: Gain insights into using linear models to forecast production rates and assess long-term reservoir performance.

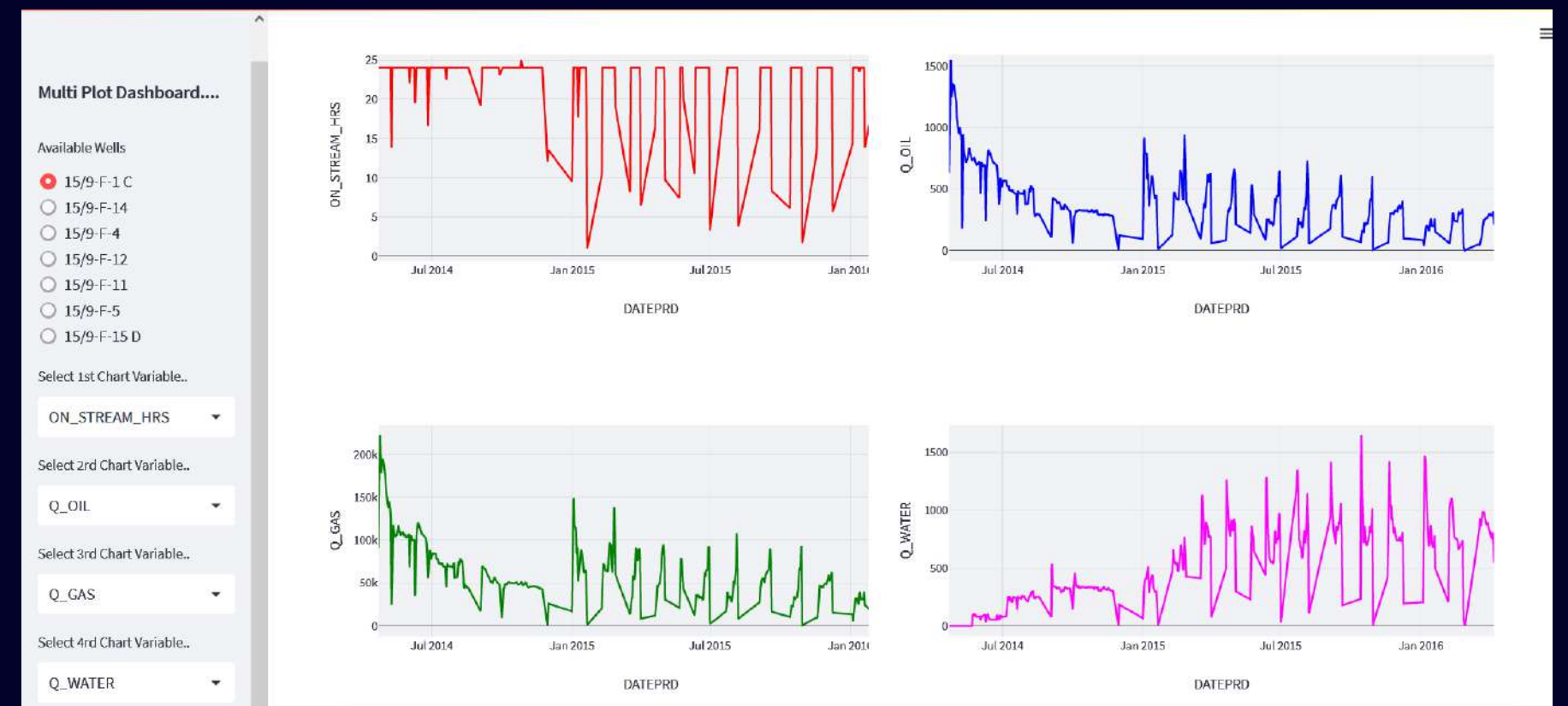
# DAY 4 - MATERIAL BALANCE AND 1D SIMULATION

## TOPICS

- Reservoir Tank Modeling connection with Python
- Controlling Tank Model using Python code.
- Production Schedule Control
- Well Performance evaluation based on numerical simulation
- Reservoir PVT property calculation and tabular reporting and plotting using python

## EXERCISES

- Connect MBAL software to Python.
- Do a 1d simulation and control the simulation using python PVT property calculation



## WHAT YOU WILL LEARN

- Reservoir Tank Modeling Connection with Python: Learn how to integrate reservoir tank models with Python for automated simulations and analysis.
- Controlling Tank Model Using Python Code: Understand how to control and manipulate tank models using Python to run customized simulations.
- Production Schedule Control: Gain insights into how Python can be used to manage and optimize production schedules for reservoirs.
- Well Performance Evaluation Based on Numerical Simulation: Learn to evaluate well performance by running and analyzing numerical simulations.
- Reservoir PVT Property Calculation and Tabular Reporting: Master techniques to calculate PVT (Pressure, Volume, Temperature) properties and generate tabular reports and visual plots using Python. Calculate relevant coefficients for production forecasts.
- Linear Production Forecasting: Gain insights into using linear models to forecast production rates and assess long-term reservoir performance.

# DAY 5 - STATISTICS FOR RESERVOIR ENGINEERS

## TOPICS

- Introduction to NumPy
- Introduction Random data Class
- Introduction to Statistical Distribution
- Introduction to Pareto principle and opportunity identification.
- Introduction to Control Chart and Well performance classification.
- Introduction to Monte Carlo simulation.
- Interactive Monte Carlo simulation and controlling the histogram Reservoir Data
- Aggregation.
- Production Data Aggregation (Yearly, Monthly).

## EXERCISES

- Pareto Well Analysis 80/20 rule.
- Create Reservoir Data Distribution
- Monte Carlo simulation on IOIP.
- Creating Histograms.
- Statistical Well Performance Evaluation using Control Chart

## WHAT YOU WILL LEARN

- Introduction to NumPy: Understand the basics of NumPy for efficient numerical operations and data manipulation in Python.
- Introduction to Random Data Class: Learn how to generate and manipulate random data using Python's random class for simulation and analysis.
- Introduction to Statistical Distribution: Gain foundational knowledge of statistical distributions and how they are used in reservoir and performance analysis.
- Introduction to Pareto Principle and Opportunity Identification: Learn how the Pareto Principle (80/20 rule) applies to oil and gas reservoir analysis and identifying opportunities for improvement.
- Introduction to Control Chart and Well Performance Classification: Understand how to use control charts to classify well performance and monitor reservoir behavior.
- Introduction to Monte Carlo Simulation: Learn the fundamentals of Monte Carlo simulation and how it can be applied to predict outcomes in reservoir modeling and analysis.
- Interactive Monte Carlo Simulation and Controlling the Histogram: Gain hands-on experience with interactive Monte Carlo simulations and learn to control and interpret histograms generated during simulations.