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The Advantage of Real Atmospheric Distillation using D7345 Test Method

Presented by

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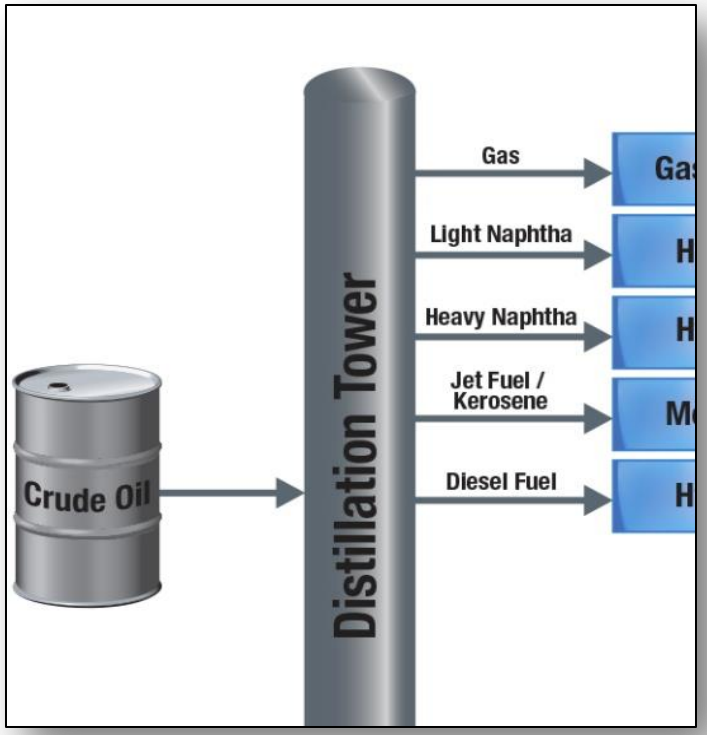
Distillation - a Critical Measurement

- Crude feedstock has a complex mixture of hydrocarbons
  - Separate the hydrocarbons through evaporation and condensation
  - Boiling range gives information on composition, properties of fuels

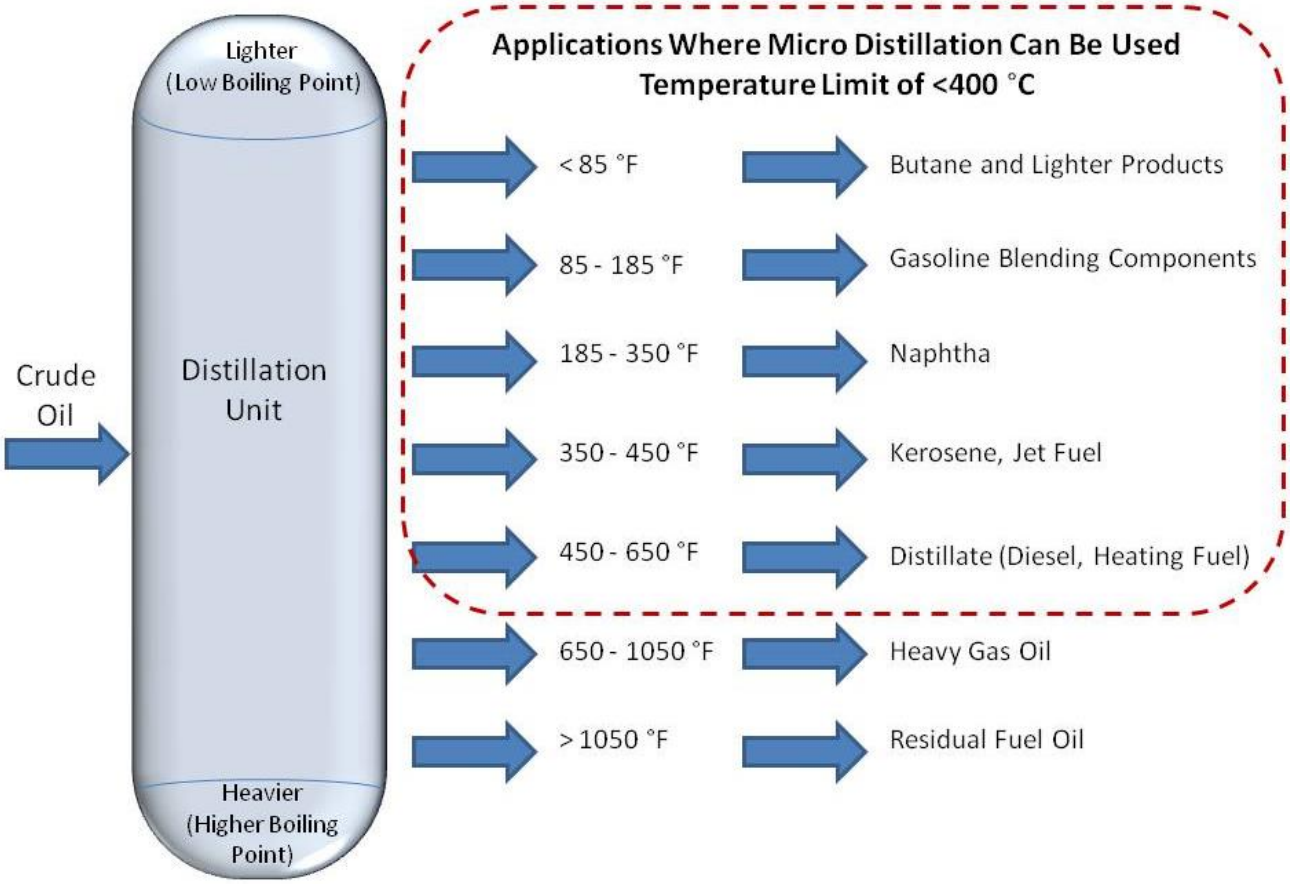


Distillation Method Comparison

ASTM D86	• Historical test method • Determines the boiling range of the product by performing a simple batch distillation
ASTM D7345	• Alternative distillation method • Uses MicroDistilation • Provides fast results using small sample volume

ASTM D7345 - Microdistillation

- Real online distillation analysis
- Demonstrates temperature limitations at 400 °C, 752 ˚F



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Case Studies

Case Study #1: Analyzer Performance

Customer Challenges:

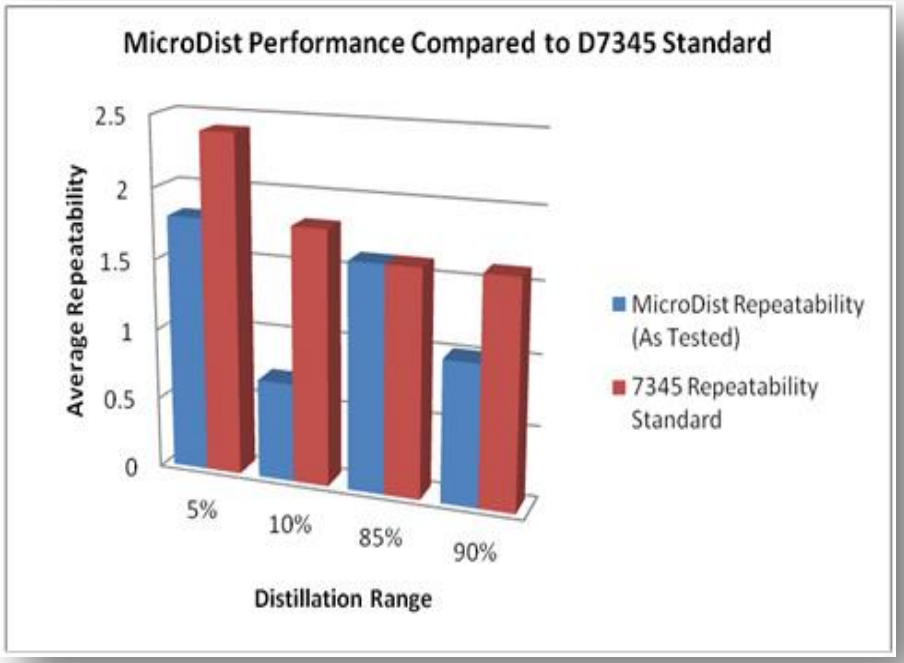
- Large capacity (350,000 bpd)
- Diverse output including:
  - diesel fuel
  - gasoline
  - LPG
  - naphtha
  - kerosene

MicroDist in Distillation Tower

Case Study #1: Analyzer Performance

Microdistillation Solution

- 720 hr Evaluated based on:
  - Operability
  - Robustness
  - Response time
  - Precision
  - Accuracy
  - Ease of Maintenance
- Tested through the distillation range at 5%, 10%, 85%, & 90%



Case Study #1:Analyzer Performance

MicroDist Results

- Repeatability that is superior to ASTM D86 lab standard
- Solutions for several process applications
- Fast analysis cycle of 7 - 10 minutes
- User friendly equipment interface
- Easy installation

*"This **analyzer surpassed** by far our **expectations**....confronting with other technologies that have been used for 14 years, as online chromatography and infrared techniques... we **recommend** the analyzer **implementation*** in direct ***distillation plants** for monitoring and controlling of tower fraction cuts, in cracking plants, hydrotreating unit ... all this **because PAC's MicroDist is a real distillation**."*

~ Plant Supervisor

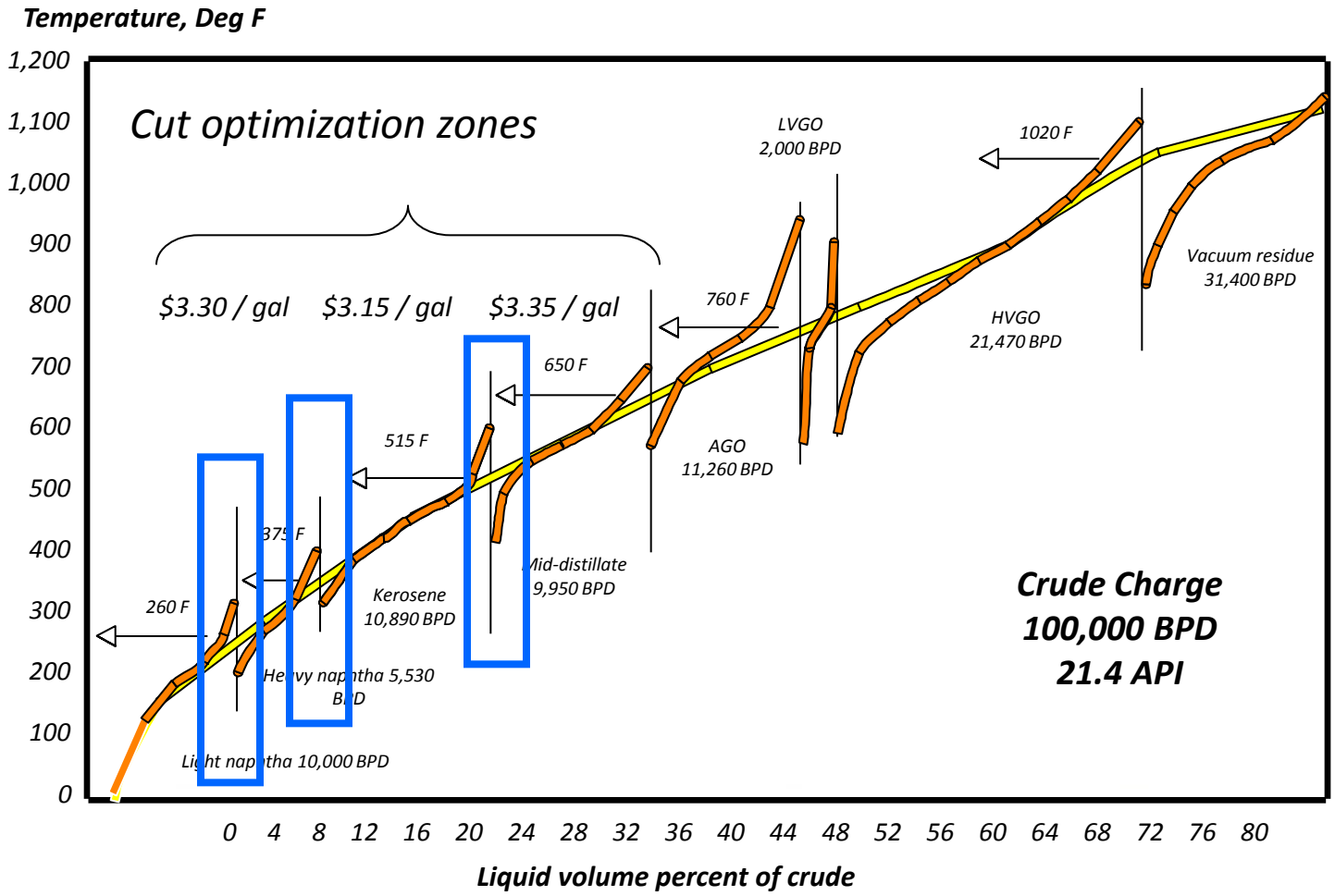
Case Study #2: Diesel Optimization

Microdistillation Solution

- Fast analysis that is ideal for on-line control
- Optimizes cutpoint while permitting diesel specs to be met

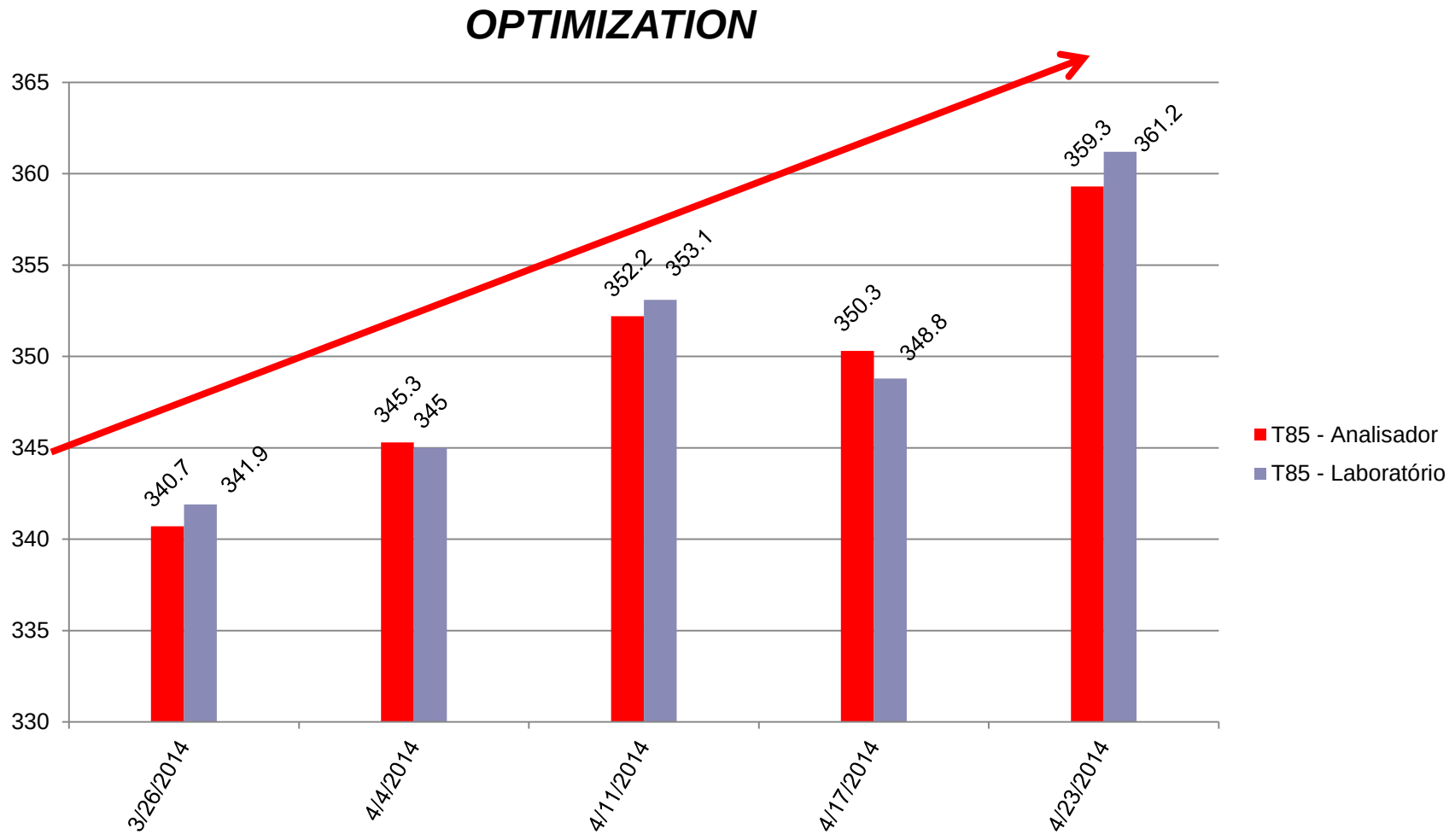
Case Study #2: Cutpoint Optimization

Distillation Cut Points



Diesel Blending Specification

T 85% 360 °C



Case Study #2: Cutpoint Optimization

MicroDist Results

- Tight correlation to ASTM D86 lab standard
- Determine accurate diesel cutpoints to maximize margin
- Complete distillation in under 10 minutes

With microdistillation, optimizing the diesel cut point can result in an additional 0.5% to 1% in production for every 1°C closer to setpoint

Case Study #3: Gasoline Blender Application

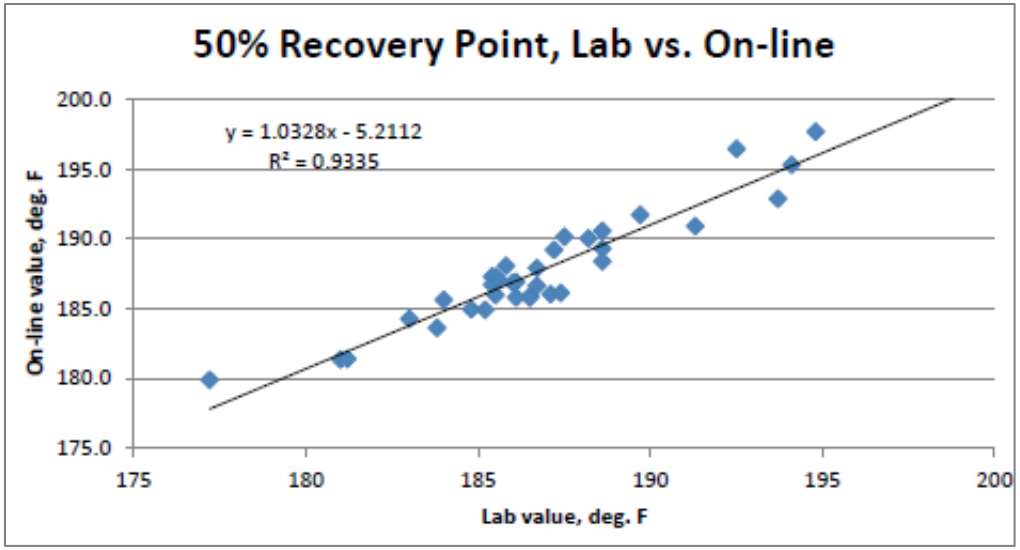
Customer Challenges:

- Blending as economically as possible to
  - Reduce the octane usage
  - Meet required specification.

Case Study #3: Gasoline Blender Application

Excellent Correlation to Lab Results

- 93% regression analysis of the lab and process values at the 50% recovery point
- Allows for good process control for the gasoline production



Case Study #3: Atmospheric Distillation & Boiling Point Analysis in a Gasoline Blender

Achieved a Return on Investment in 36 days with the MicroDist by PAC

Economics of Utilizing a Boiling Point Analyzer in a Gasoline Blender

Investment	
Boiling Point Analyzer and Sample System with Installation costs, including shelter, total per system	$350,000
Economics	
Incremental analyzer earnings $/year 400,000 barrel/day refinery (1 °F closer results to 50% recovery point)	$300,000/month x 12 months= $3,600,000
Analyzer maintenance $/year	$14,160
Net analyzer earnings $/year	[illegible]
Before tax payout, years	0.10 (pay off in 36 days or about 5 weeks)

This table demonstrates a profitability calculation in the gasoline blender for a boiling point analyzer. A return on investment can be obtained in a little over a month.

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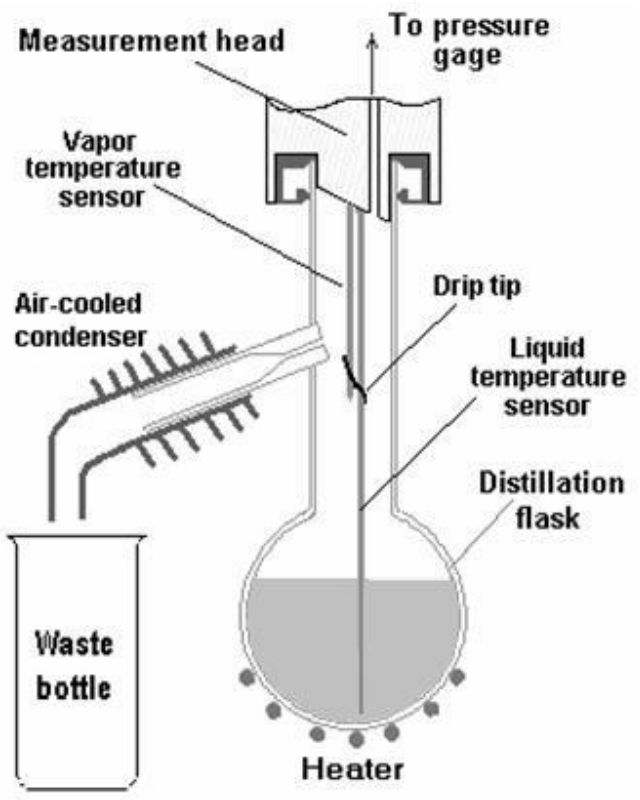
MicroDist by PAC
Technology & Features

ASTM D7345 - Microdistillation

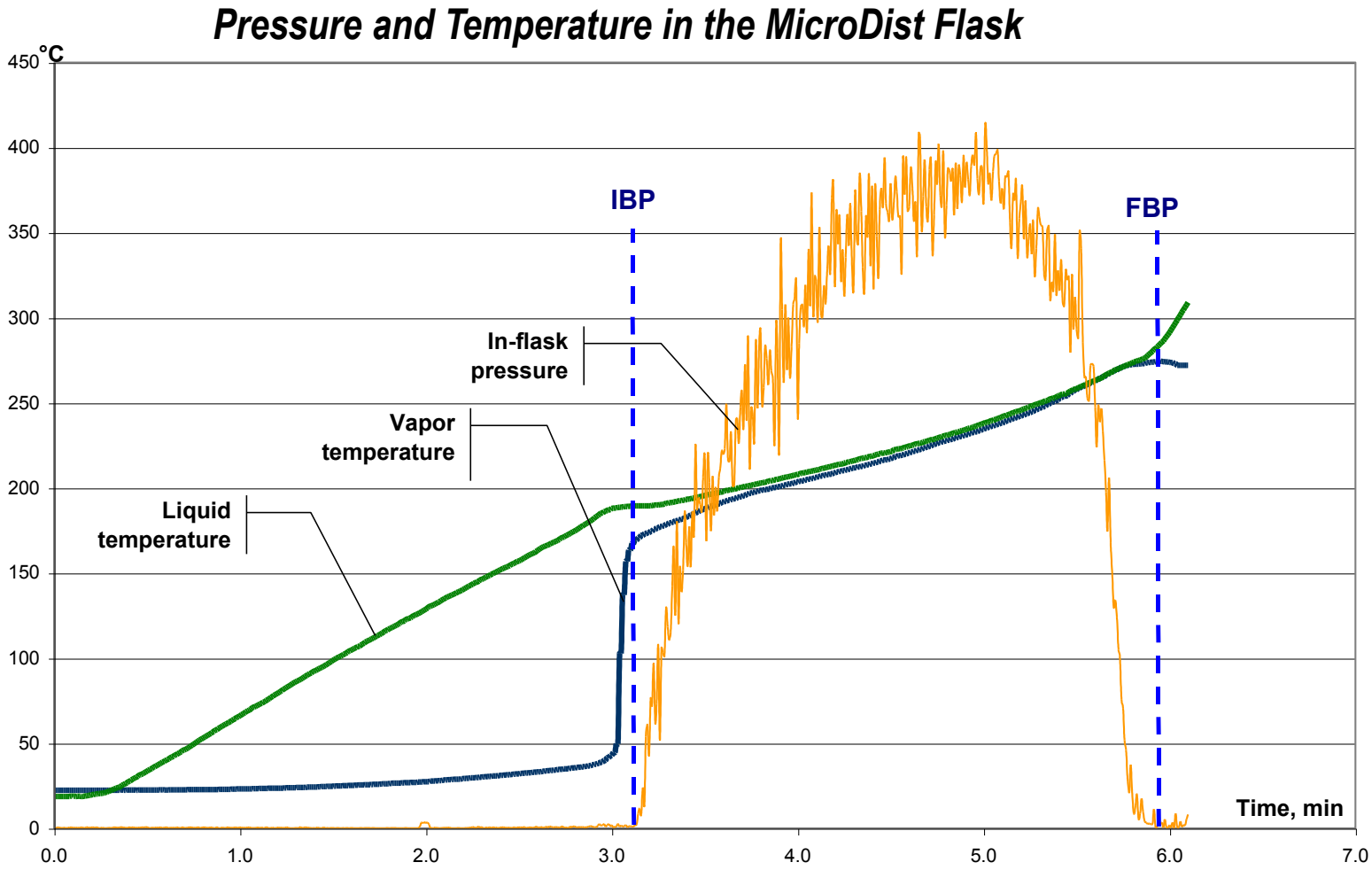
Determines the complete distillation curve using data from a single phase transition – evaporation.

- Based on thermodynamic dependencies
- Measures liquid and vapor variations while monitoring the pressure inside a MicroDistilation flask
- Measured vapor pressure characterizes the product flow rate through the hydrodynamic process in the capillary



MicroDist Technology

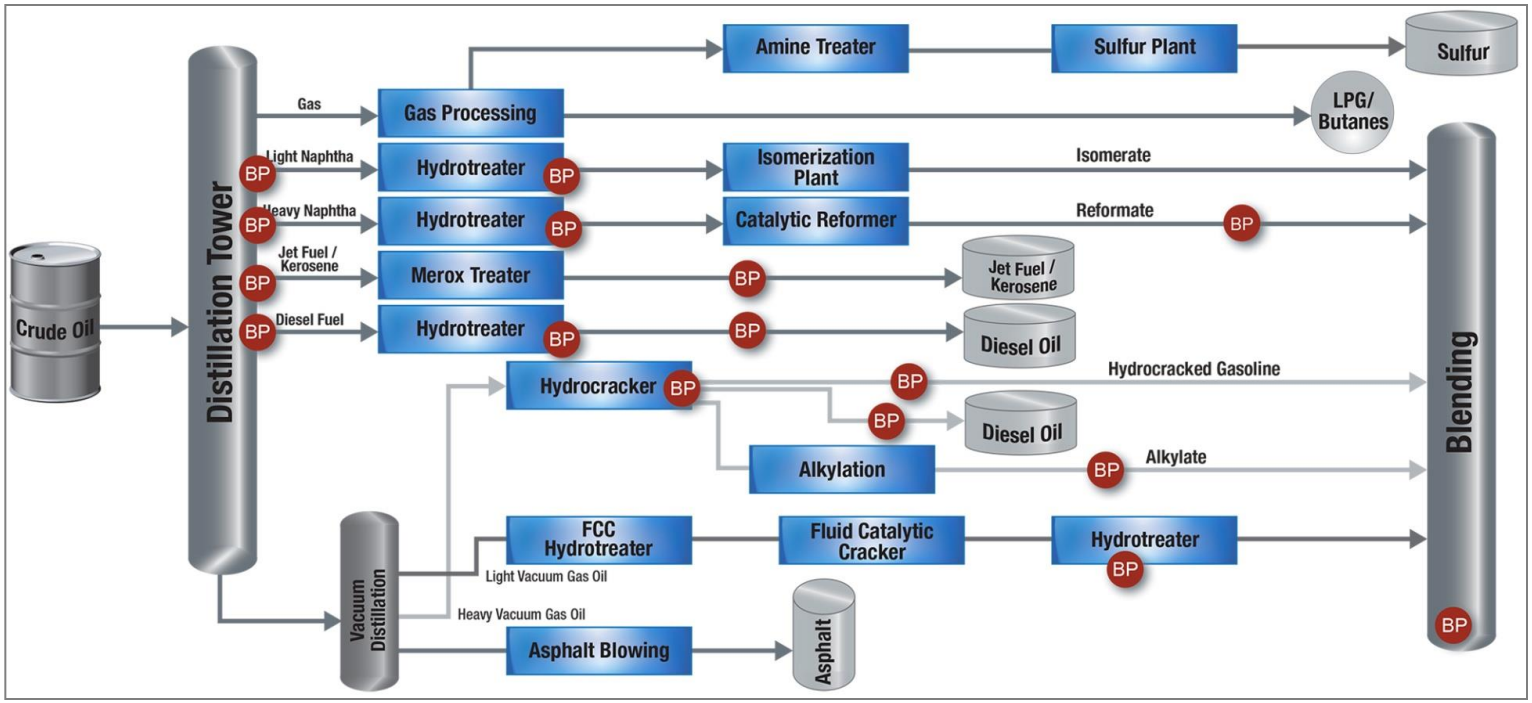
Analytical Principle: **Changes in Temperature and Pressure During an Average 7-minute Distillation Time for Jet Fuel**



Benefits and Applications

- Correlation to primary test method D86
- Robust technology
- Fast response time

- Key Applications include:
  - Cutpoint Optimization
  - Cetane Index
  - Driveability Index
  - Density



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Questions?