

What do we do with samples?

① Send them to a PVT Laboratory for analysis.

PVT Laboratories:

- * - Core Laboratories
- Schlumberger
- Weatherford (Reslab)
- Expro
- * - Fesco
- Intertek
- SGS

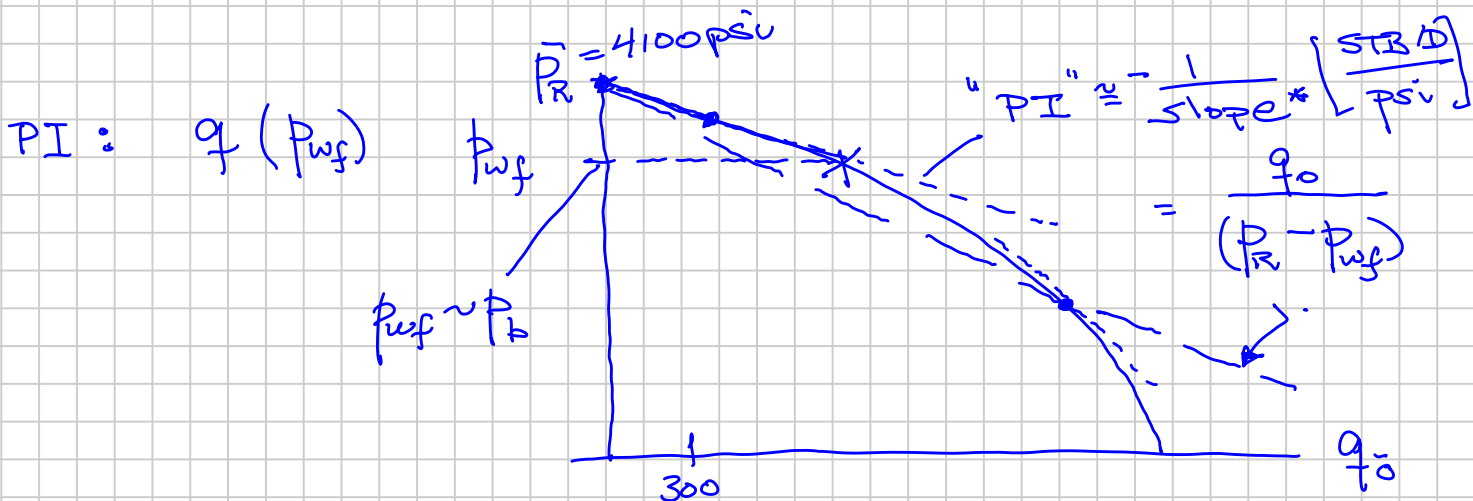
pdf report
Excel

Lab Procedures:

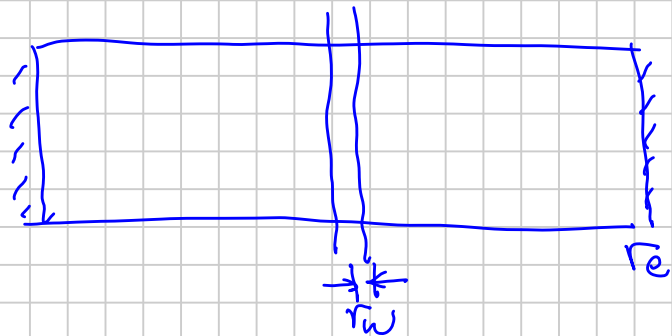
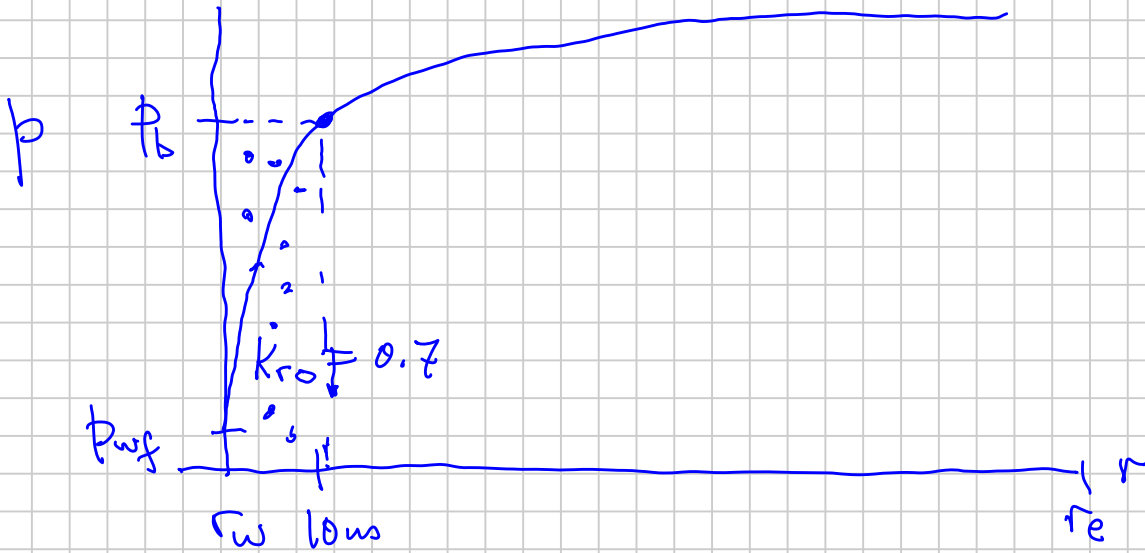
① Information about the samples

- Comes from the operator
 - Date/Time of Sampling
 - Type : "MDT", "BHS", SEP
 - Cylinder ID #s
 - Depths, (PIT)s, GOR @ sampling

Accuracy is important, and it is your responsibility to get right




* Chord Slope



② QC on each cylinder, checking for leaks.

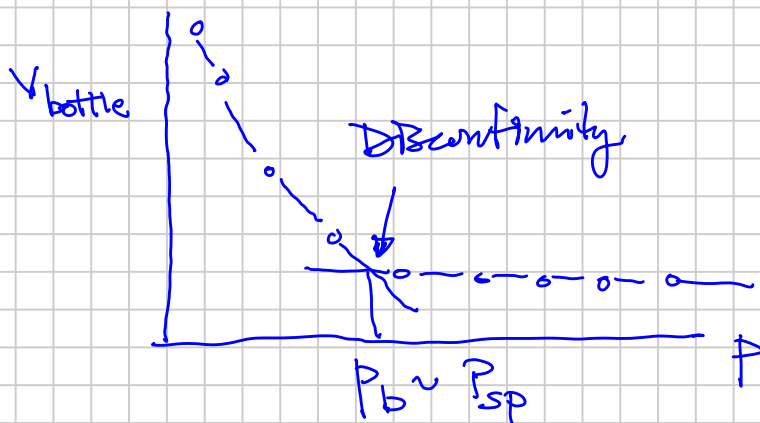
Separator Samples: Collected at (T_{sp}, p_{sp})

- Gas Bottles:  $P_{bottle} \sim P_{sp} = P_{sep}$
 $20\text{ L} \rightarrow T = T_{sp} \parallel \left\{ \begin{array}{l} n_{sample} = \\ n_{bottle@lab} \end{array} \right.$

- Oil Bottles

$$P_b(T_{sp}) \approx p_{sp}$$

$$\frac{P_{sp}}{T_{sp}} \sim \left(\frac{P}{T} \right) \sim \text{const} \frac{1}{T_{lab}}$$



⇒ Reported Back to Company

BHS QC: OILS (Field measurement of $\rho_b(T_{field})$)
 (GOR ≥ 1000 scf/STB) vs Lab measurement of $\rho_b(T_{field})$ $V_L(P)$ plot

QC: GORs ≥ 1000 scf/STB } MDT / BMS
 No good tests

③ You select which samples to use for
 (a) compositional analysis
 (b) PVT properties ($p_s, S_o, \mu, V_L, V_o, \dots, y_i, x_i$)
 @ $f(P)$

④ You decide which tests to conduct on the sample(s) chosen in ③.

* - Constant Composition (CCE)
 Constant Mass (CME)

OILS only

- Multi-stage Separator Test (SEP)
- Differential Liberation Test (DLE)

(Gas Condensate / Higher-GOR Oils)

- Constant Volume Depletion (CVD)

Special PVT Tests: (not so common)

- TBP (True Boiling Point) Distillation of the flashed oil (\bar{o})

Recommended
 ↓ TBP per
 field (R within
 a field)

into SCN fractions C_6, C_7, \dots

$C_{10}, \dots, C_{15}, \dots, C_{2x+}$

C_{20+}, C_{25+}

$$\underbrace{m_i}_{V_i} \quad \rho_{Li} \quad M_i \quad \left. \vphantom{\underbrace{m_i}_{V_i}} \right\} i \quad \bar{T}_{bi}$$

$n-C_{i-1} \rightarrow n-C_i$

Ch. 8

Gas-Injection EOR Projects

- Swelling Test (add inj. gas to oil)
 - 4-6 mixtures : CCE
- Forward & Backward Contact Tests
- Slimtube displacement test to estimate MMP

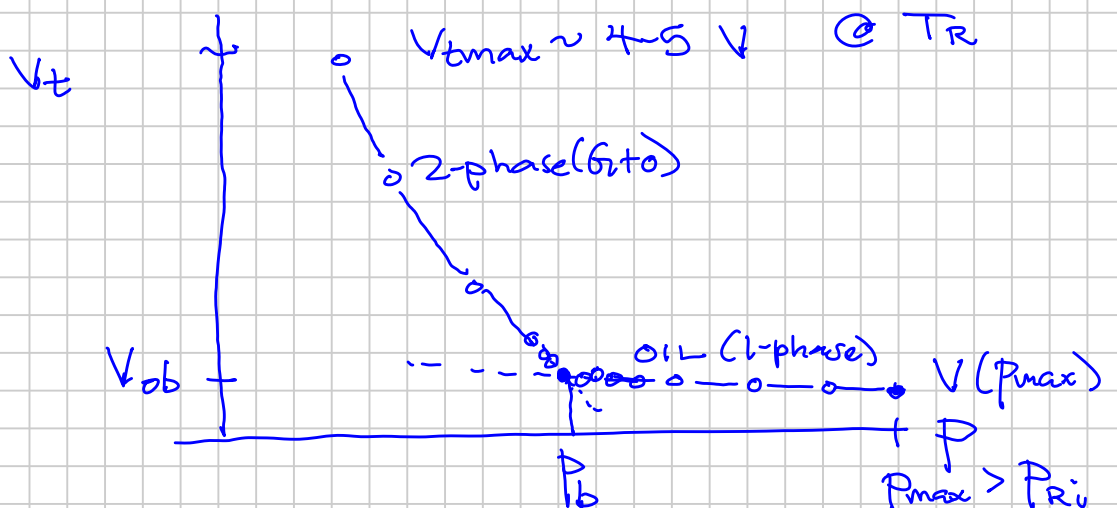
Minimum Miscibility Pressure

CCE : Conducted @ T_R $\left. \begin{array}{l} p > p_s \\ p < p_s \end{array} \right\}$ Determining $p_s(T_R)$

Fill PVT Cell with Sample w/ known m (kg)

(1) Blind cell : $V_t(p)$

Oils w/ GOR ≈ 1000 scf/STB



$$f_o(p \geq p_b) = \frac{m}{V_t}$$

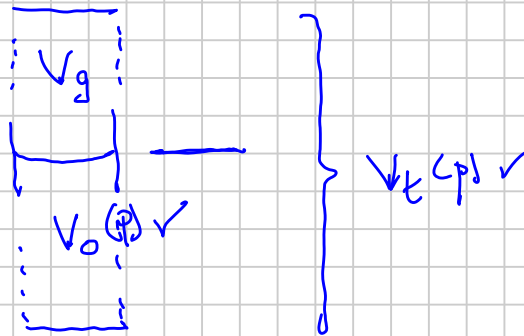
$$V_{rt}(p) = \frac{V_t(p)}{V_{ob}}$$

② Windowed PVT Cell

OILS (GOR \approx 1000 - 1500 scf/STB)

GAS CONDENSATES

Visually looking for gas-oil interface



m in cell known

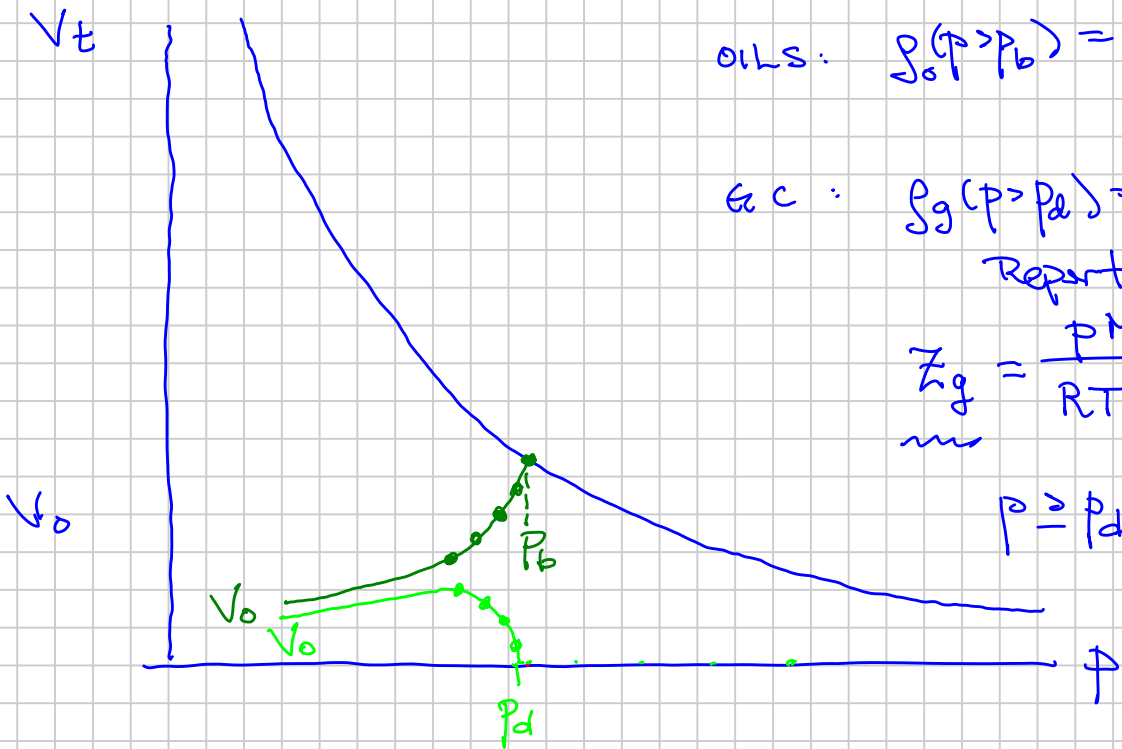
OILS: $f_o(p > p_b) = \frac{m}{V_t}$

GC: $f_g(p > p_b) = \frac{m}{V_t}$

Report

$$Z_g = \frac{PM}{RT f_g}$$

$p \geq p_d$



$$V_{ro} = \frac{V_o(p)}{V_t(p)} \quad \text{OR} \quad \frac{V_o(p)}{V_s(p_s)}$$

$$S = \frac{PM}{RTZ}$$