AGAR CORPORATION

OW-200

OW-200 系列分析仪是 Agar 公司继 1985 年向市场首推测量范围 0-100%含水分析仪以后的第二代改良产品，是基于微波原理的液/液分析仪。

AGAR CORPORATION

- Founded in 1980 and based in Houston, TX.
- 成立于1980年，总部位于美国休斯顿。
- Agar Corporation is world wide known as one of the most important manufacturers of interface detectors, water cut meters and multiphase flow meters.
- Agar公司是世界闻名的界面探测仪，含水量分析仪和多相流量计，最重要的制造商之一。
- Unique systems for hydrocarbon, water and natural gas measurements, downstream and upstream in oil and gas
- 应用于水和天然气上下游的油，水，气独特测量系统。
- There are more than 122 countries with Agar installations.
- 目前有122个国家采用Agar公司的产品。
- Agar systems standardization : Shell, Conoco-phillips, ExxonMobil and Saudi Aramco.
- 壳牌，康菲，美孚和沙特阿美等石油公司将Agar产品作为标准化应用。

AGAR CORPORATION

1 在线连续测量原油含水量是原油开采、脱水、集输、计量、销售及炼制等过程中亟待解决的问题。若原油含水量测量不准确， 将直接影响油井及油层的动态分析；破坏电脱水器中电场．降低脱水效果；给原油集输造成很大的能源浪费；在原油炼制中易引起突沸等恶性事故。

2 目前，监测原油含水量的方法较多：有传统的人工取样蒸馏法，有在线测量的电容法，近来又出现了射线法，重力分析法等。传统人工取样蒸馏法费时、费工、随机误差大，越来越不能满足油田生产自动化管理的要求。电容法受介质温度影响及制造工艺的影响，检测误差大，可靠性差。射线法人身安全问题引起用户的质疑， 且造价高、使用和维修困难。重力分析法的分析精度还满足不了较高的要求。虽然采用上述方法的原油含水监测仪都有应用，但终因各自的不足使其应用受到限制.

3 应用微波法检测原油含水量是目前最先进的一种方法。它的主要特点是：在全量程范围内(原油含水0～100％)测量原油含水量，稳定可靠，且有较高的测量精度，弥补了以往各种测量方法的缺点和不足。经大量的实验及工业现场运行表明：采用该方法研制的原油含水监测仪较好地解决了原油含水在线连续测量的技术问题。

Out with the old…

In with the new… The OW-201

OW-200 系列含水分析仪，包括 OW-201 和 OW-202 两种，利用一种微波发射器 （频率为 2.45GHz）测量流体电介质性能。不受连续相影响，它们可测量浓度从 0-100% 整个范围烃/水混合物。不同于其它基于微波、密度或电容的测试仪器，AGAR 公司的 油/水分析仪是唯一一种精确度不受分析组分盐度、密度、粘度、温度和速度等条件 改变影响的仪表。即使 在有会影响光学仪器准确性的工艺涂层工况下，高频信号的精 确度也不会改变。

AGAR OW精度高的原因

- The big difference between our OWM technologies and others is that we work at a constant frequency of 2.5 GHz and measure the Complex Dielectric Constant ε of the fluid, while the others are using a resonance technique and measure the resonance frequency Wr .
- The resonance frequency Wr $\propto$ $1/\sqrt{\xi}$ so if ξ is 1 in air and 81 in water, the resonance frequency in water will be 9 times lower than air.
- Now the Complex Dielectric ξ = ξ real + ξ imaginary = $\xi + \sigma/jw$ where σ is conductivity of the fluid. The more saline the water is, the higher is the conductivity an the higher is the effect on ξ . However, the higher w is lower is this effect. So if we have 1% error due to salinity, the competitive instrument will give 9% error since in water we are operating at nine times the frequency they are operating in.
- Our Salinity effect is 9 times smaller.

应 用:

Crude Oil and finished pipeline monitoring 原油和成品油管线监

Oil in wastewater 含油废水

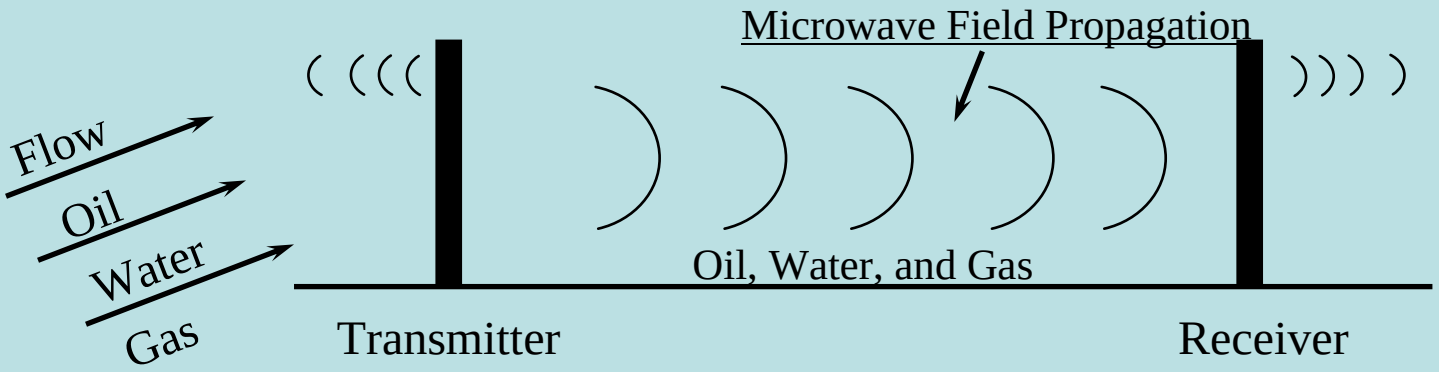
Glycol and water 乙二醇和水

Aqueous / organic measurement 水/有机物测量

Microwave Measurement

PAMS

Phase and Amplitude Measuring System



Phase (Wavelenght) ⟶ Propagation

Amplitude ⟶ Microwave Attenuation

Microwave Phase and amplitude are affected by the Permittivity and salinity of the fluid mixture.

OW-201 Operating Principle

- The OW-201 is an AGAR on-line microwave water-cut meter.
- Accurately measures volumetric water concentration over full range 0-100%.
- Operation principle is based on measurement of the complex permittivity eM of the water/oil mixture (emulsion) which is related to the Water Cut through the Bruggeman's equation:

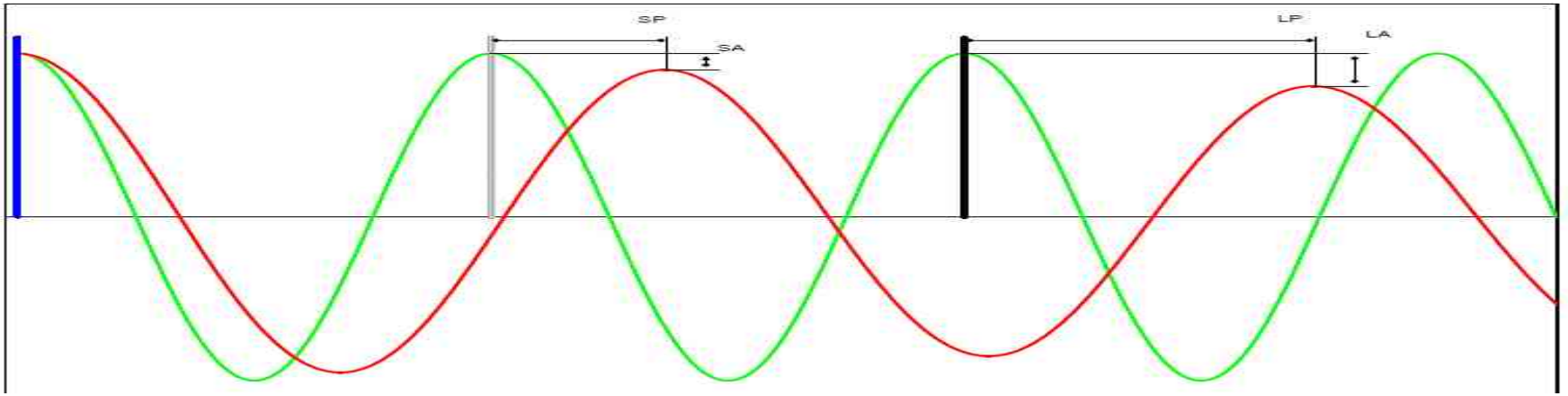
ε_O: Oil Permittivity

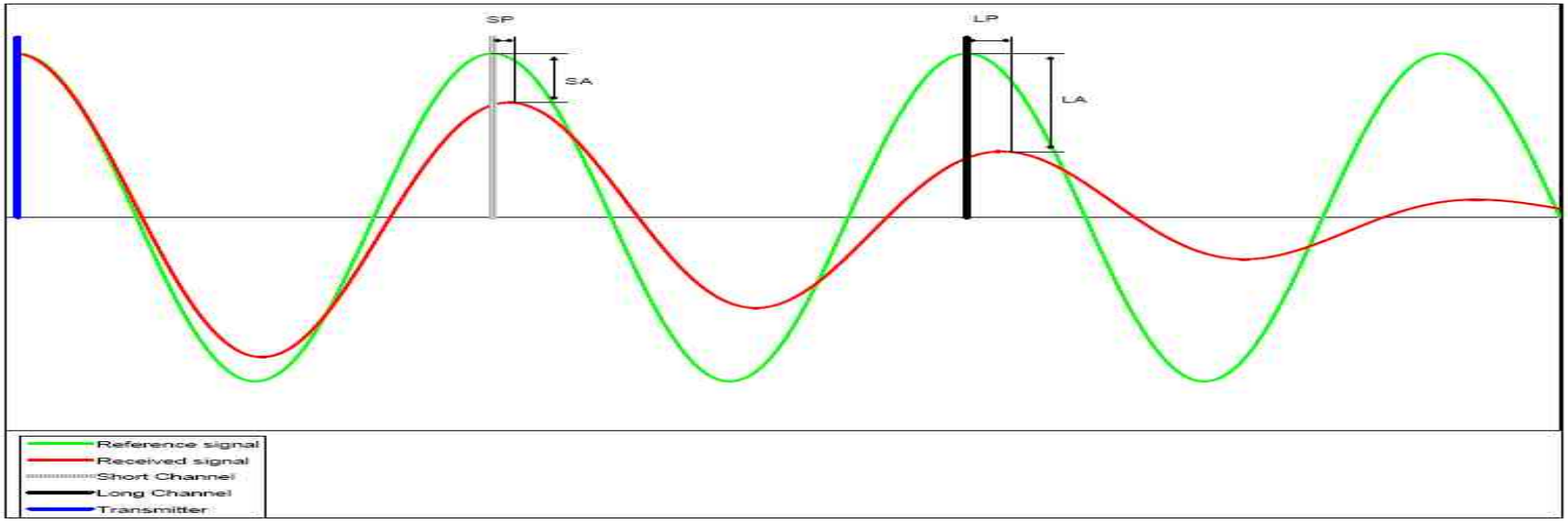
$\varepsilon_{W:}$ Water Permittivity

$\varepsilon_{M:}$ Oil/Water mixture Complex Permittivity (Emulsion Permittivity)

$$\text{Water Cut} = 1 - \frac{(\varepsilon_W - \varepsilon_M) * (\varepsilon_O)^{1/3}}{(\varepsilon_W - \varepsilon_O) * (\varepsilon_M)^{1/3}}$$

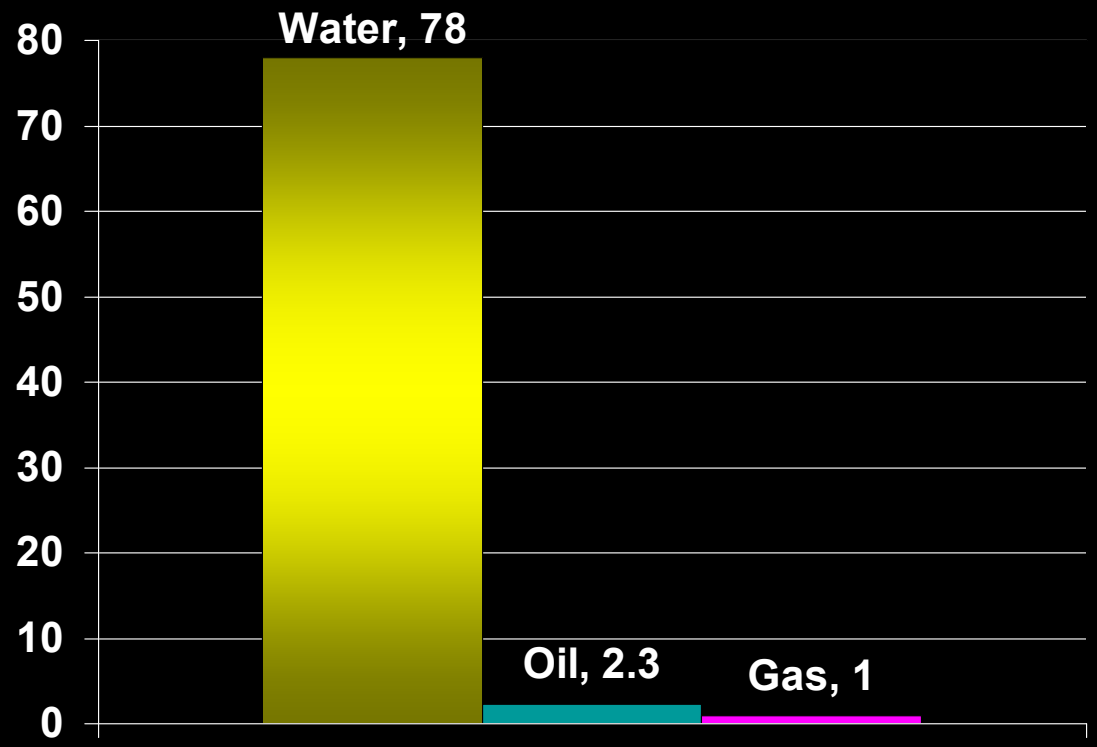
Microwave Behavior and PAMS Measurement





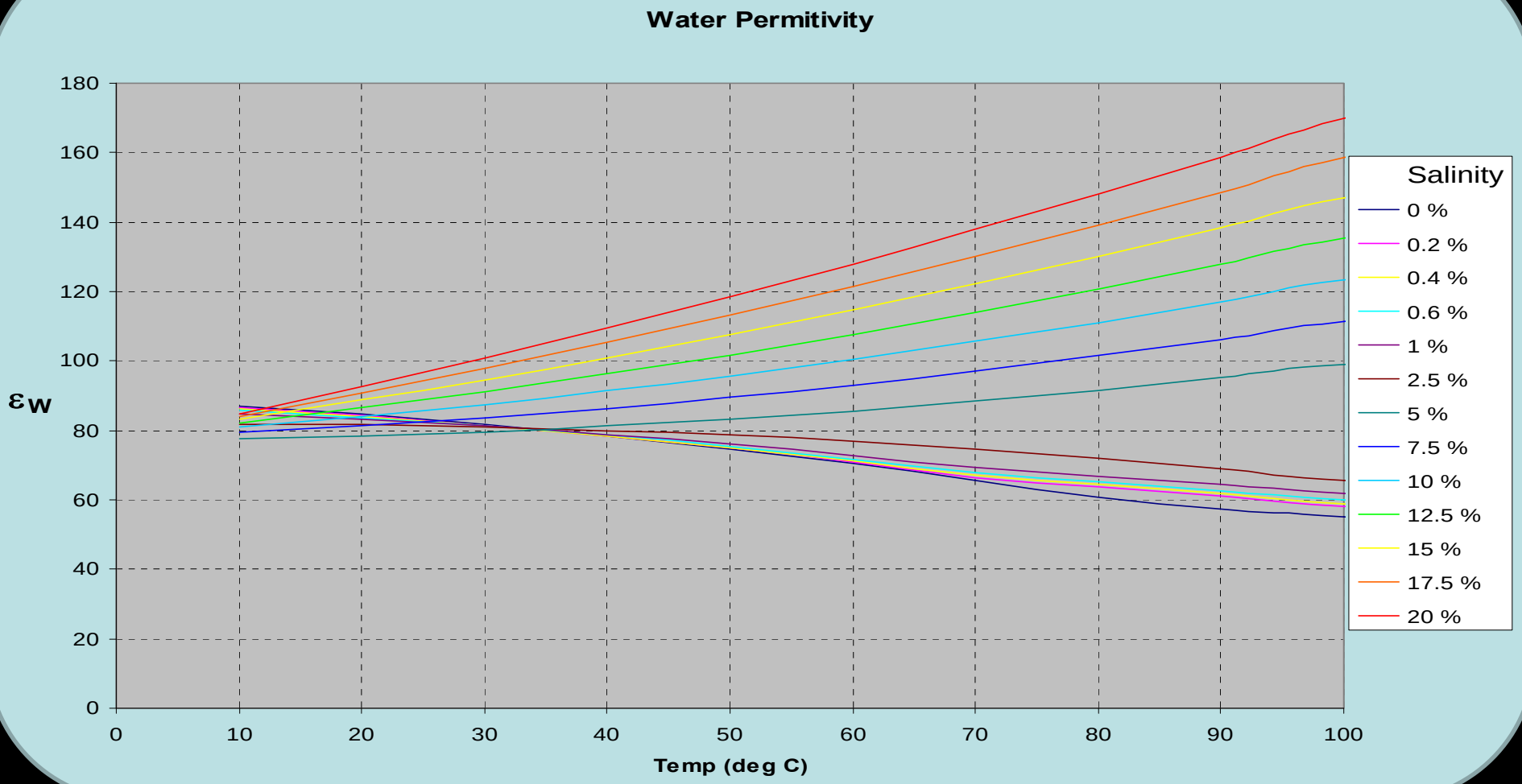
Temperature & Salinity

Why do we look at Salinity and temperature?

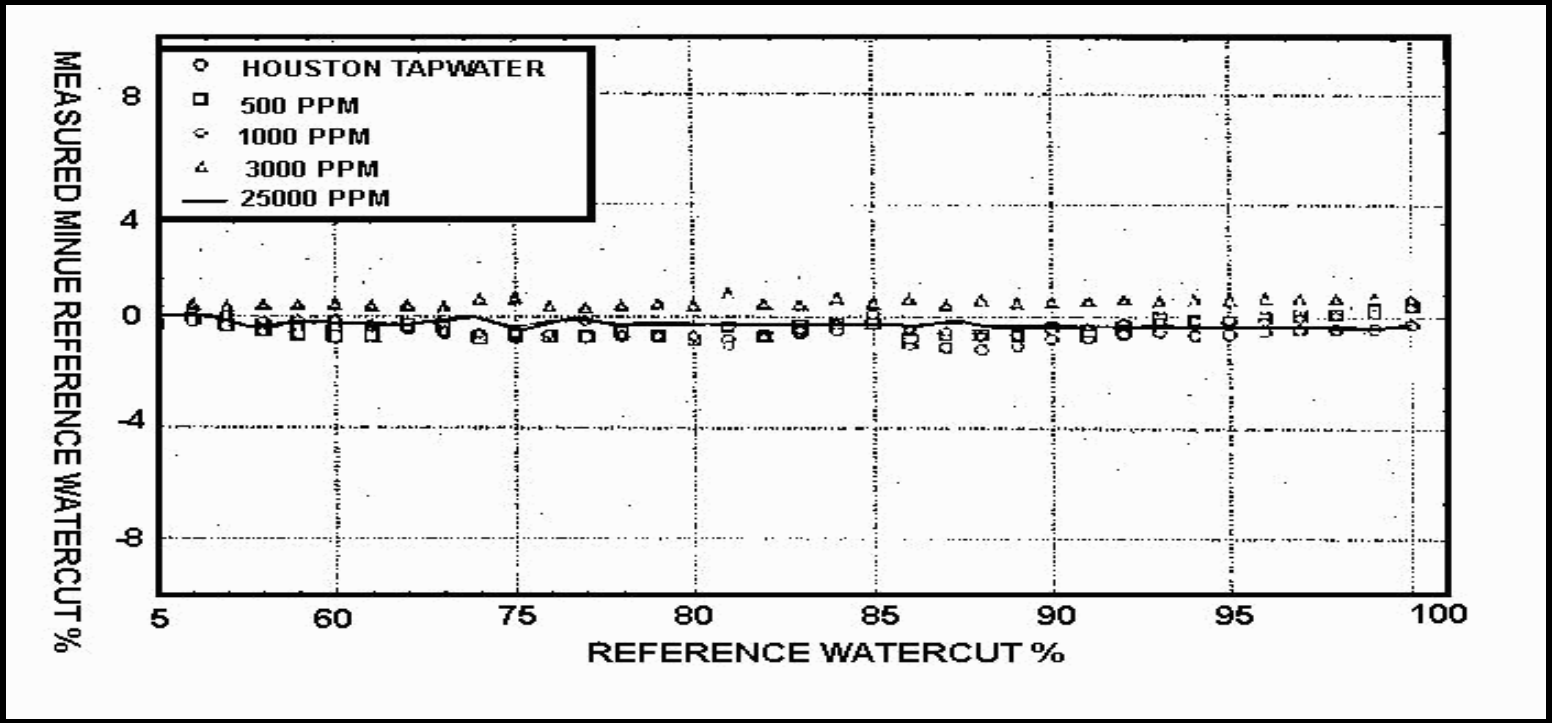


Because Temperature and salinity changes the water dielectric constant!

Water Permittivity

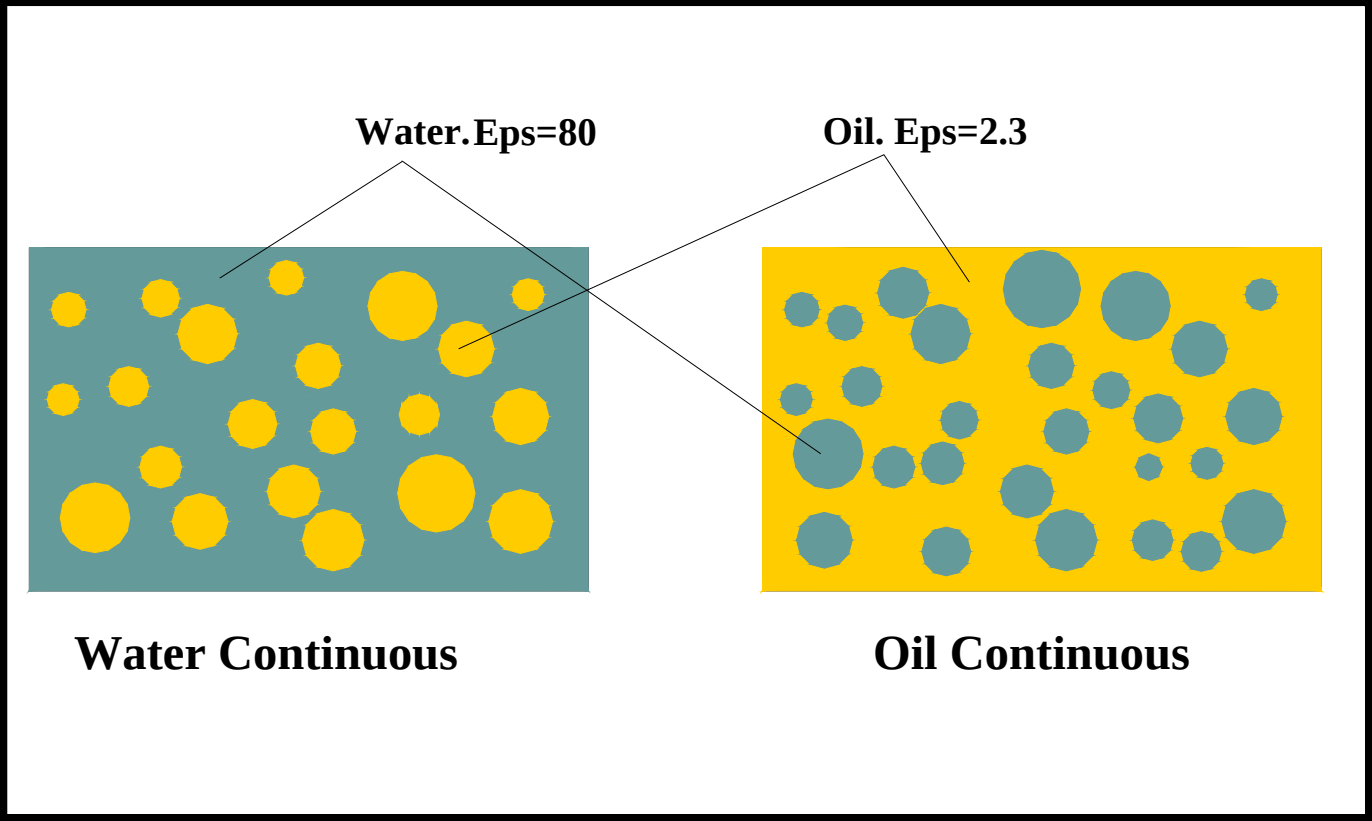


Water Salinity Test

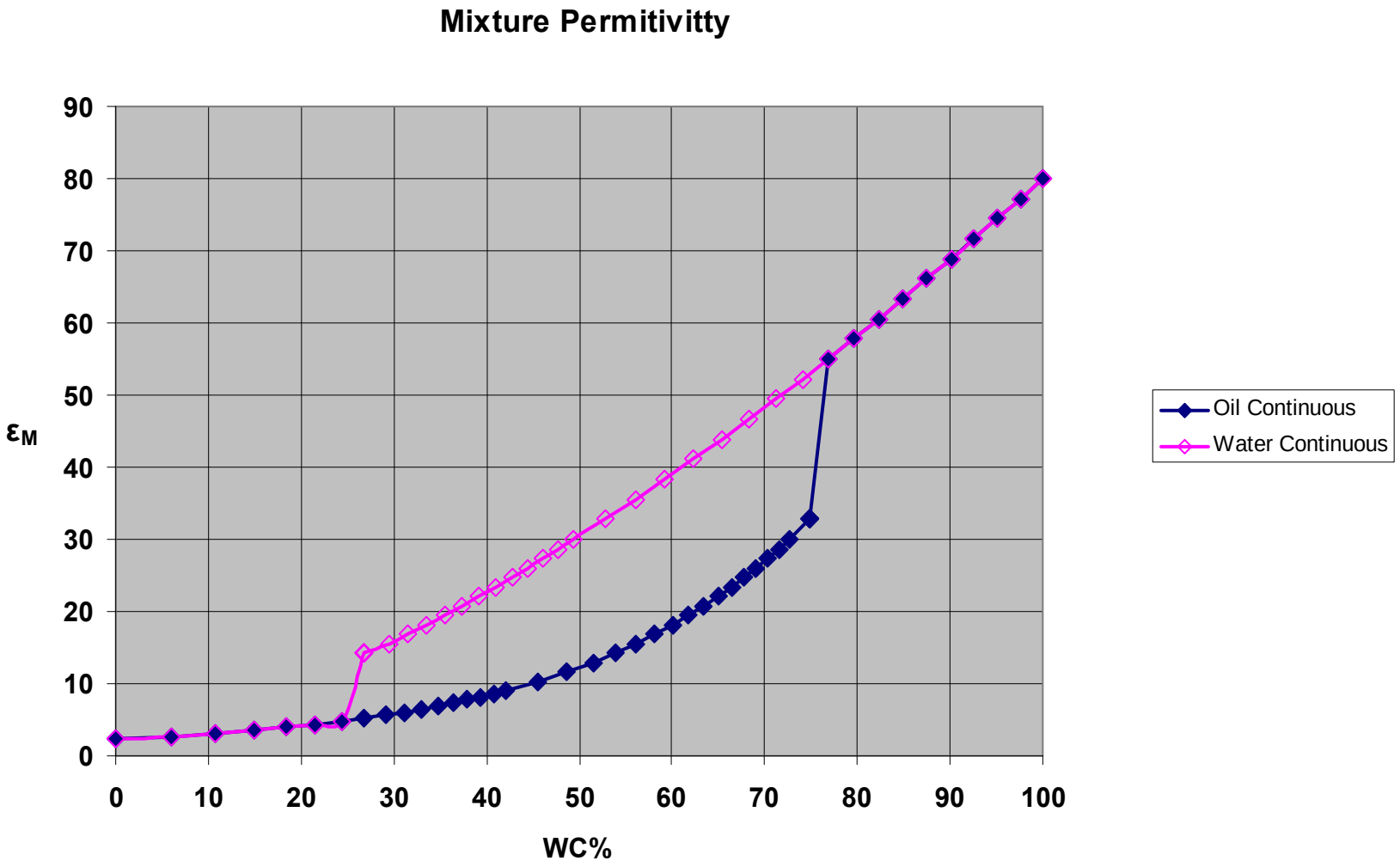


This graph shows the independence of Agar OW-201 on changing salinity of the process water. In cases where steam or ocean water is used to recover oil, the salinity of the process fluid changes drastically. Salinity has a tremendous effect on water cut since the NaCl ions are good conductors. The Agar OW-201 monitors and measures not only the water cut but also the salinity of the process water and compensates the water cut with this salinity reading….

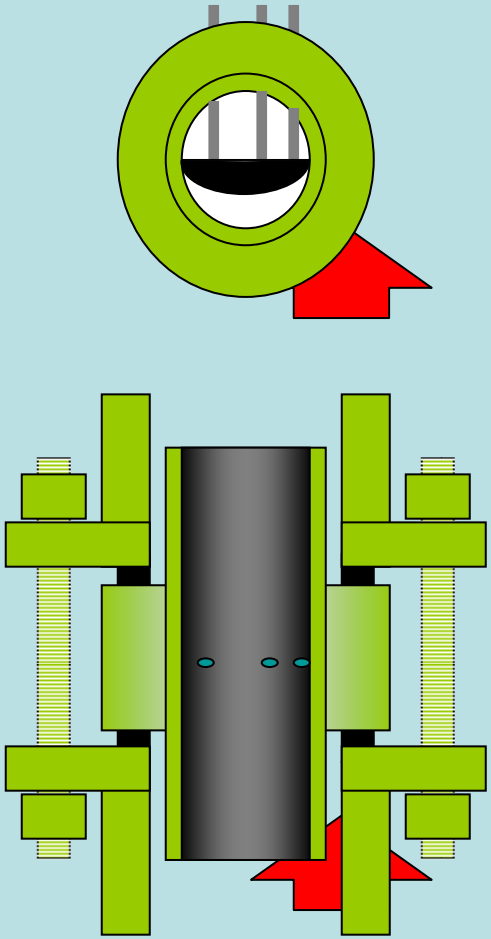
Types of Emulsions



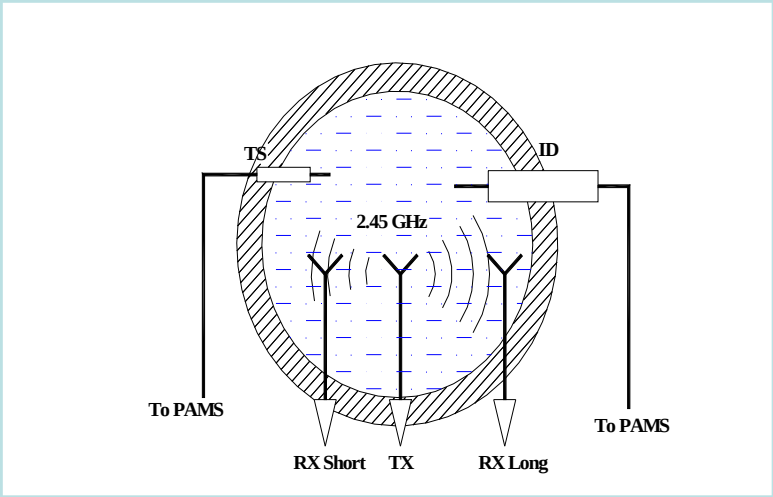
Mixture Permittivity Behavior



OWM 201 Sensor



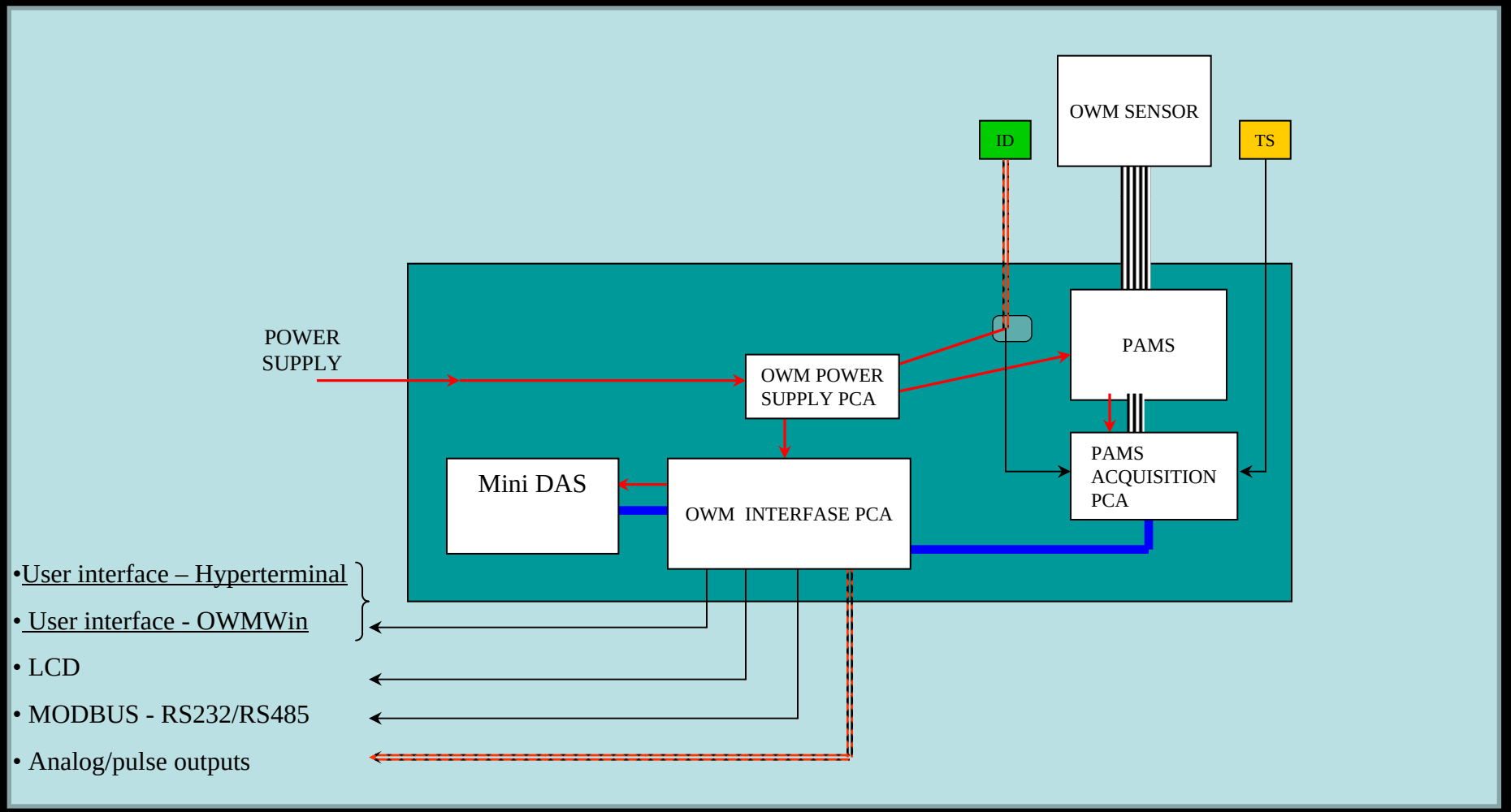
The OW sensor contains three microwave antennas: two receiving antennas and one transmitting at 2.45 GHz.



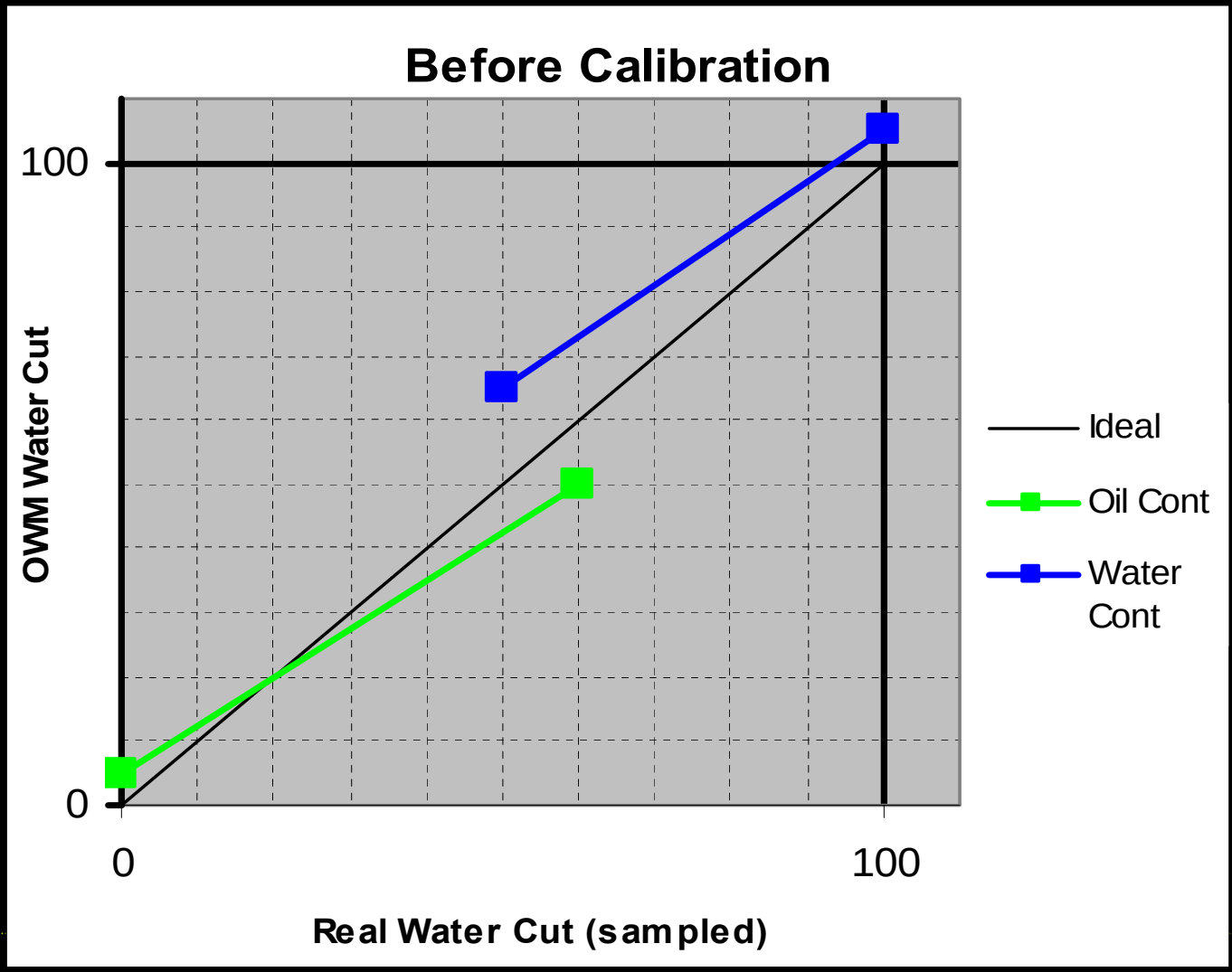
The Frequency Interface Detector (ID-201) allows to determine the continuous status of the oil/water emulsion.

An RTD Temperature element provides the flowing temperatures.

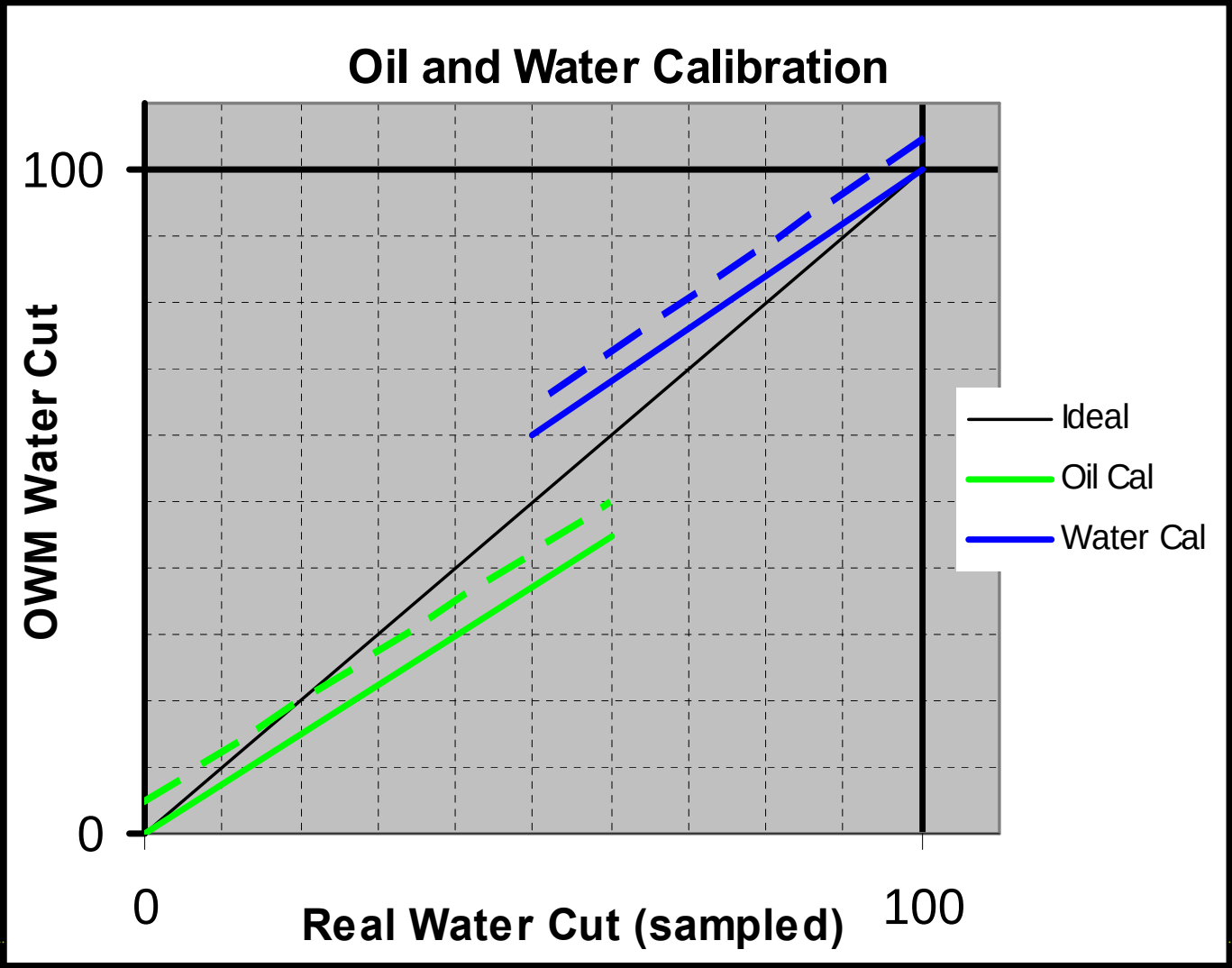
Block Diagram



Four Point Calibration



Zero Calibrations



Span Calibrations