



Mostra Convegno delle Soluzioni
e Applicazioni Verticali di Automazione,
Strumentazione, Sensori.



Mostra Convegno della
Manutenzione Industriale.



Mostra Convegno delle Tecnologie
per l'Analisi, la Distribuzione
e il Trattamento.



Mostra Convegno della Domotica
e delle Building Technologies.

24 ottobre



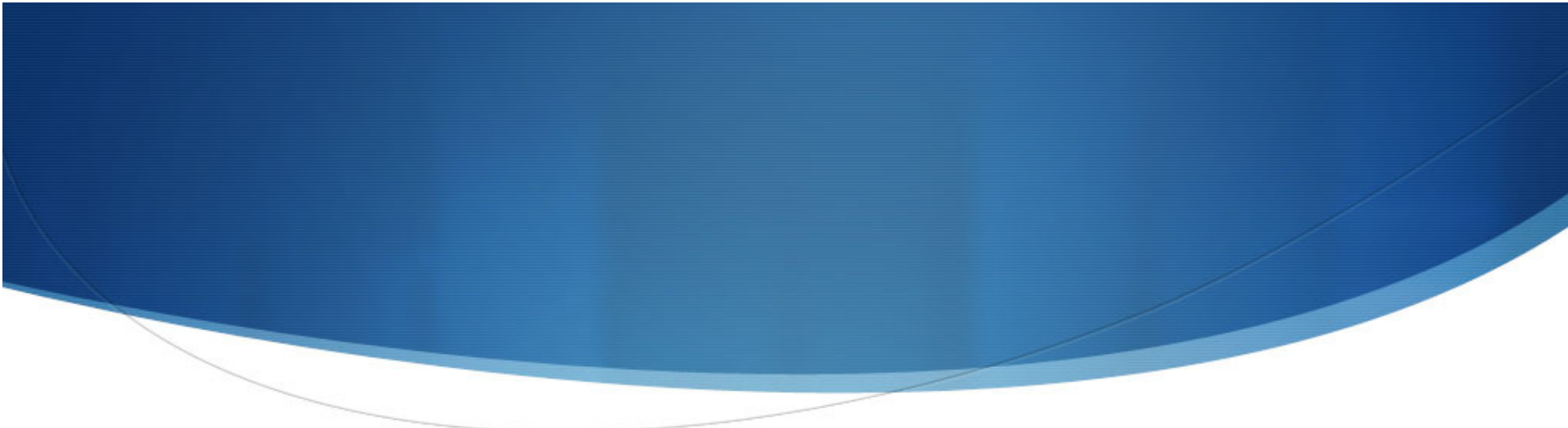
25 ottobre



**VALVOLE POMPE
COMPONENTI**

Veronafiere 24 - 25 ottobre



A large, dark blue curved shape at the top of the slide, resembling a stylized wave or a partial arc.

microCoriolis Technology

Integrated Sensing Systems

Ann Arbor, Michigan

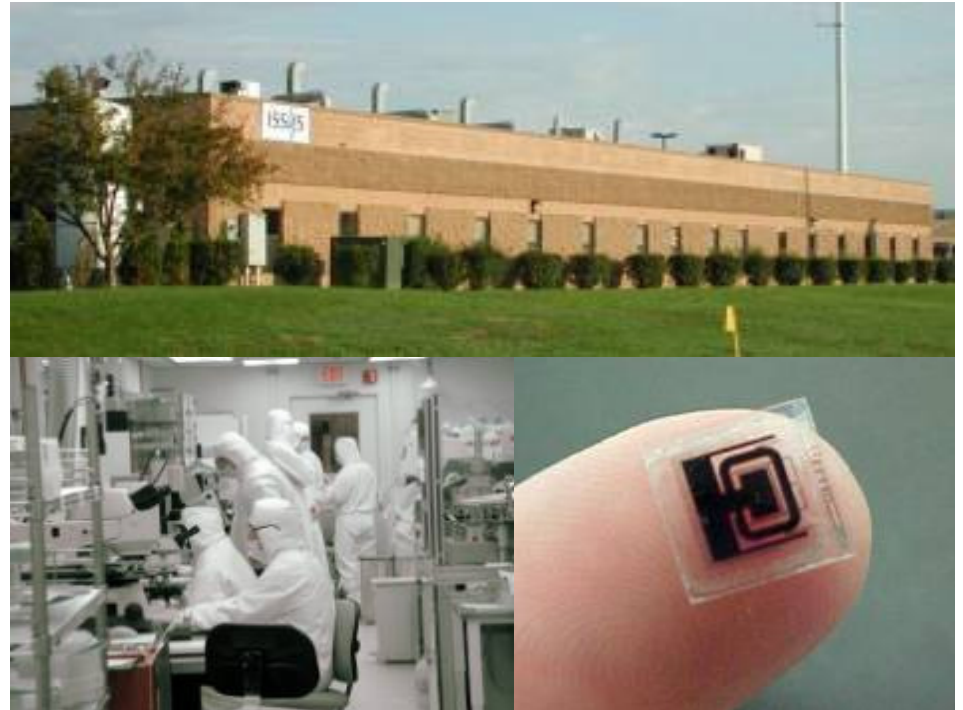
“Big things come in small packages”



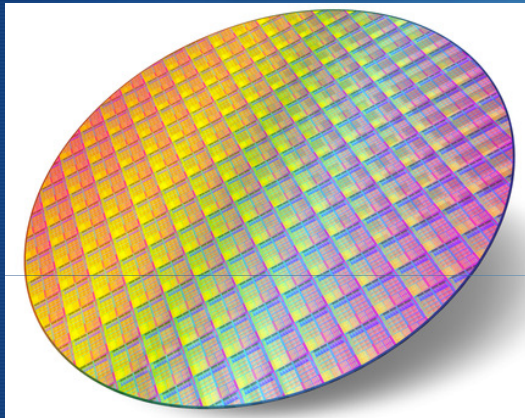
ISSYS Company Confidential

Integrated Sensing Systems, Inc.

- ISSYS formed in 1995
- MEMS technology company
 - Fluidic and pressure technology
 - Systems approach
- MEMS fabrication
 - Sensors fabricated in-house

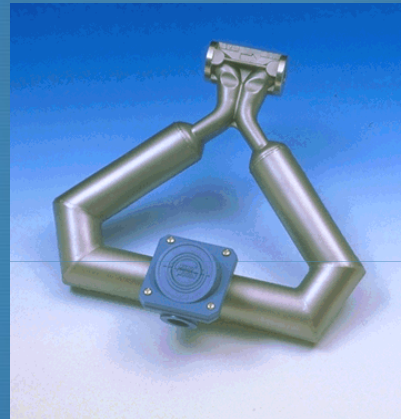


ISSYS Introduces New Liquid and Gas Density Measurement using Silicon Fabrication Technology



High Volume
Semiconductor Processing
Technology

+



Traditional
Coriolis Design
Concepts

=



Revolutionary
Density and Flow
Performance

ISSYS microCoriolis Measurement Capabilities

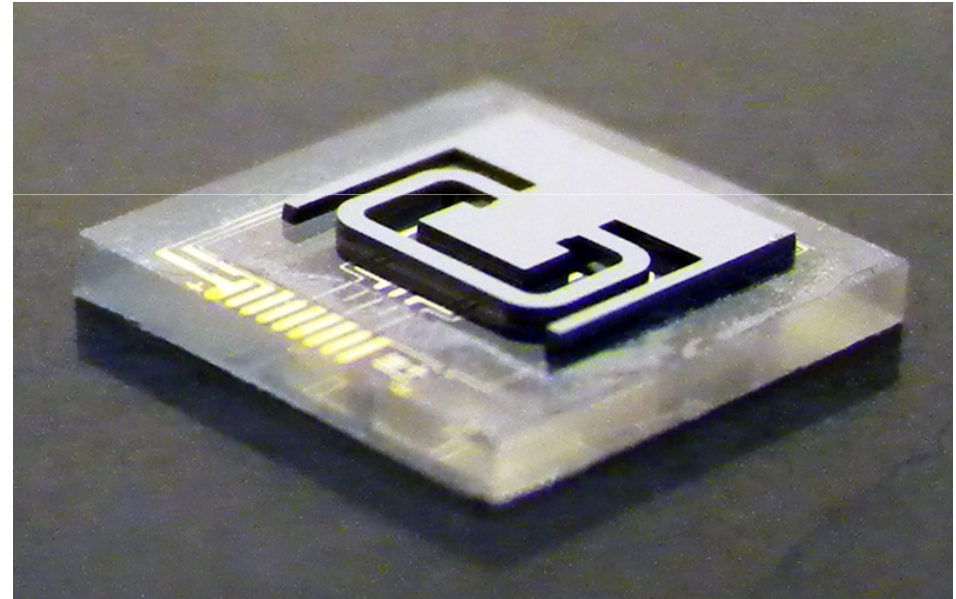
- 💧 Liquid density measurement
 - 💧 Reference density or specific gravity
 - 💧 Binary liquid concentration measurement
- 💧 Liquid viscosity measurement
 - 💧 Dynamic and kinematic
- 💧 Gas density measurement
 - 💧 Average molecular weight
 - 💧 Specific gravity measurement
- 💧 Liquid mass flow measurement



The Heart of microCoriolis is Fluidic MEMS Technology



Mechanical MEMS Chip

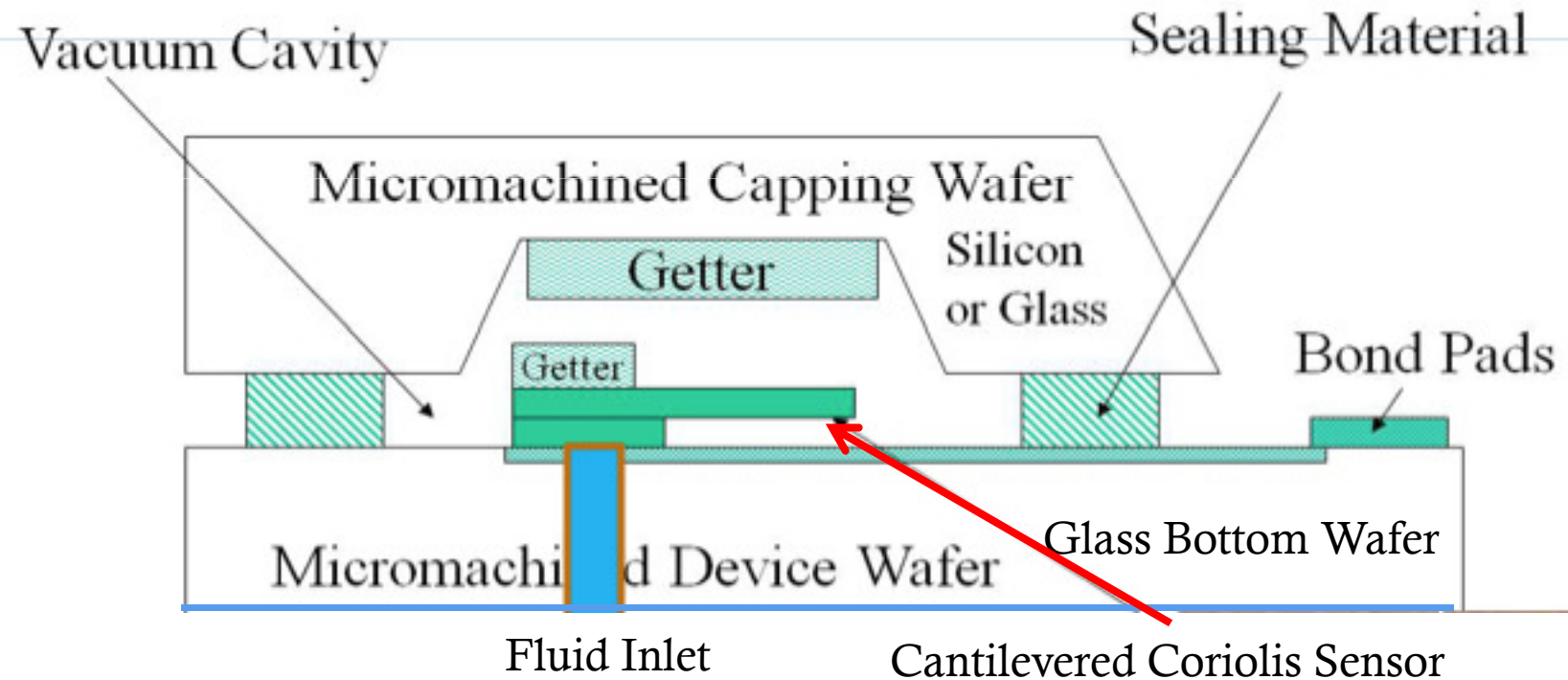


Fluidic MEMS Chip

Why use Silicon?

Silicon is 3x lighter and 3x stronger than SS

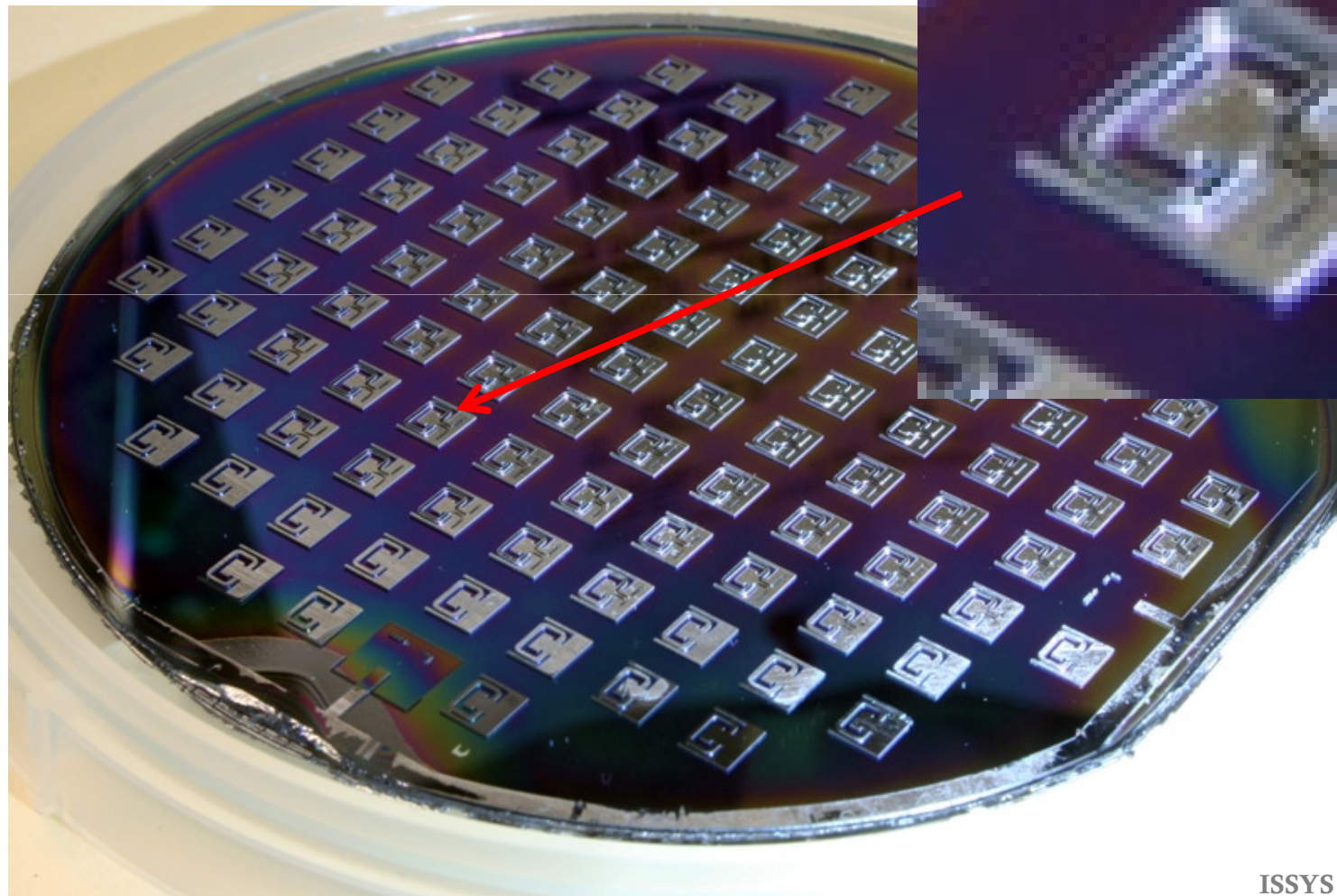
Components of Patented ISSYS MEMS Coriolis Sensor Technology



Sensor is comprised of 4 wafers (2 glass, 2 silicon)

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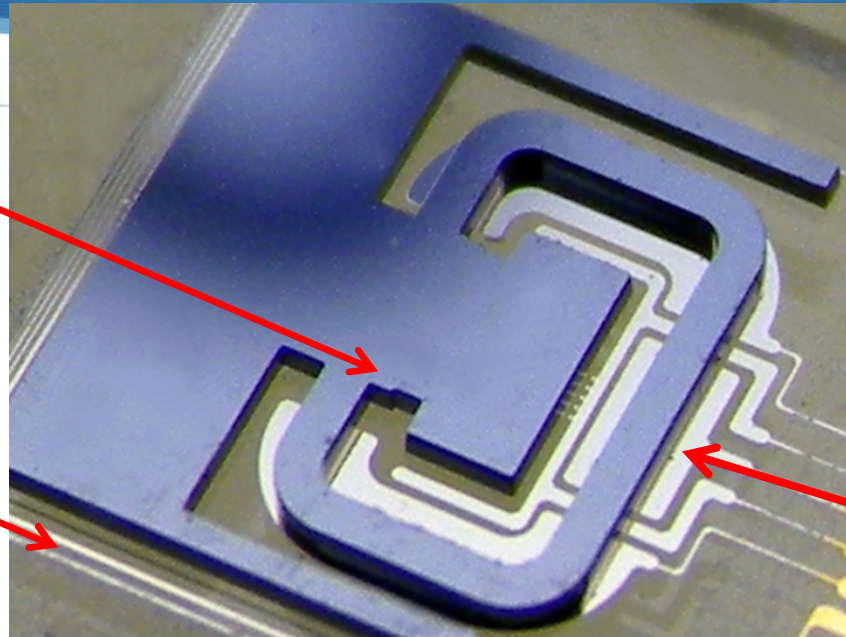
Fabrication of Sensor on Silicon Wafer



Close Coupled Integrated Temp Sensor for Precision Concentration and Reference Density Measurement

Density Sensor
Tube

PT100
Temp
Sensor



Silicon has high
thermal
conductivity
for fast temp
measurement

Drive plate

Reference density and binary liquid concentration is a function of density and temperature. Errors in reference density and concentration measurement can occur when the measured temperature does not match liquid temperature.

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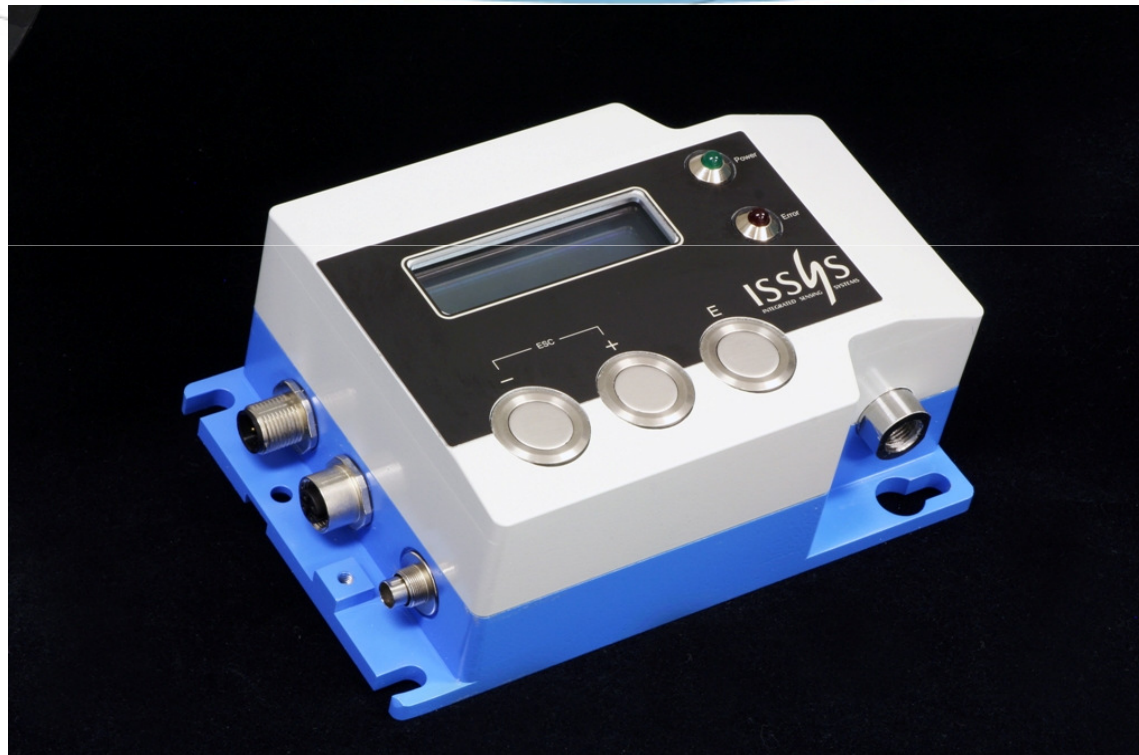
MassSense™ Gas and Liquid Density Meter

Hazardous
Area
Approved

Pressure
to 300 psig

Analog
Outputs

Digital
Communications



Fast Response

Vibration Proof

Flow Detection

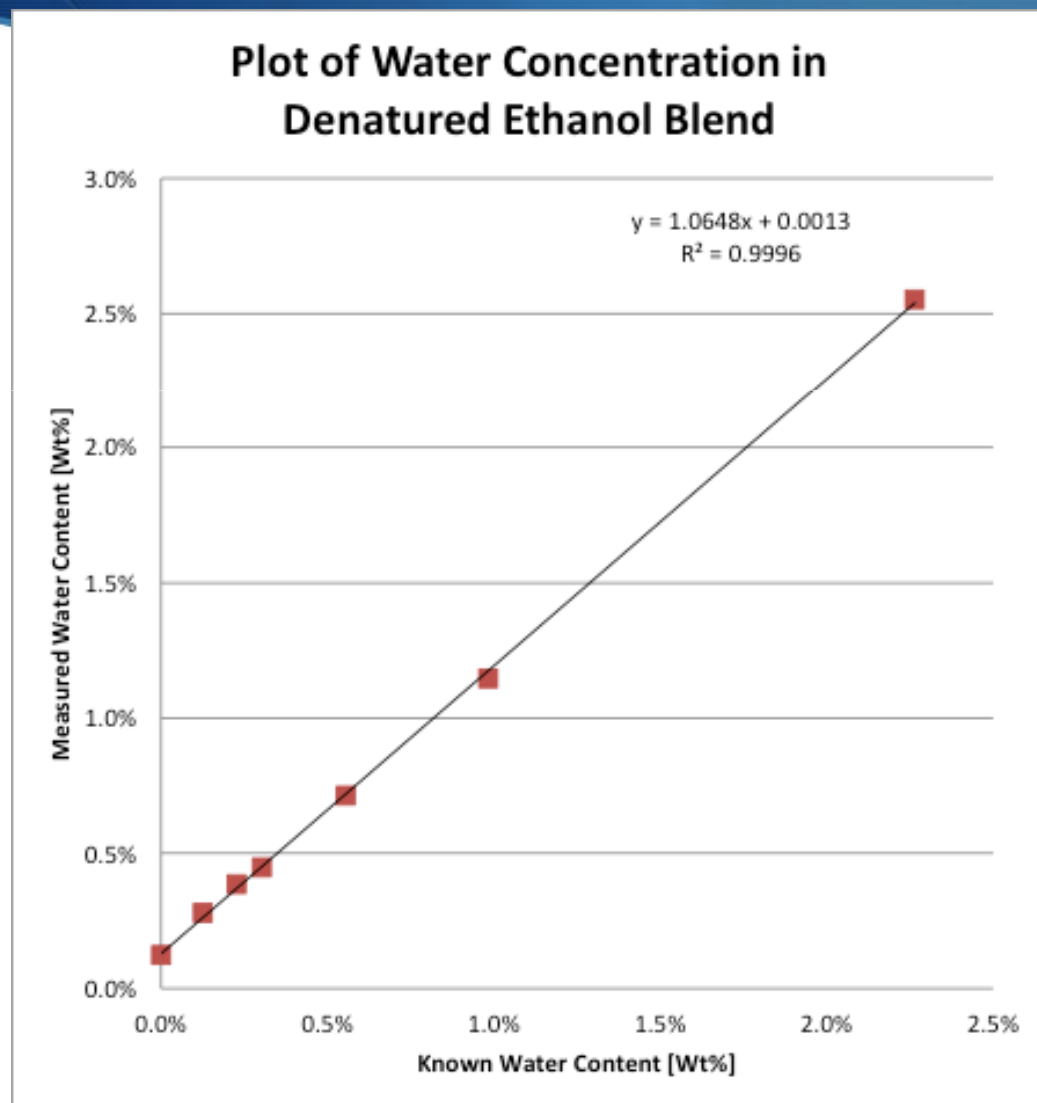
IP67 Sealed

Liquid Viscosity Measurement

ISSYS Density Applications

- 💧 Water density for water purity measurement
- 💧 Distillation column control using avg mol weight
- 💧 Hydrogen concentration measurement
- 💧 Liquid fuel density measurement in custody transfer
- 💧 Detection of adulterants in liquid fuels
- 💧 Low cost method for upgrading volumetric flow to mass flow

ISSYS Liquid Density to Measure Water Content in Fuel Ethanol

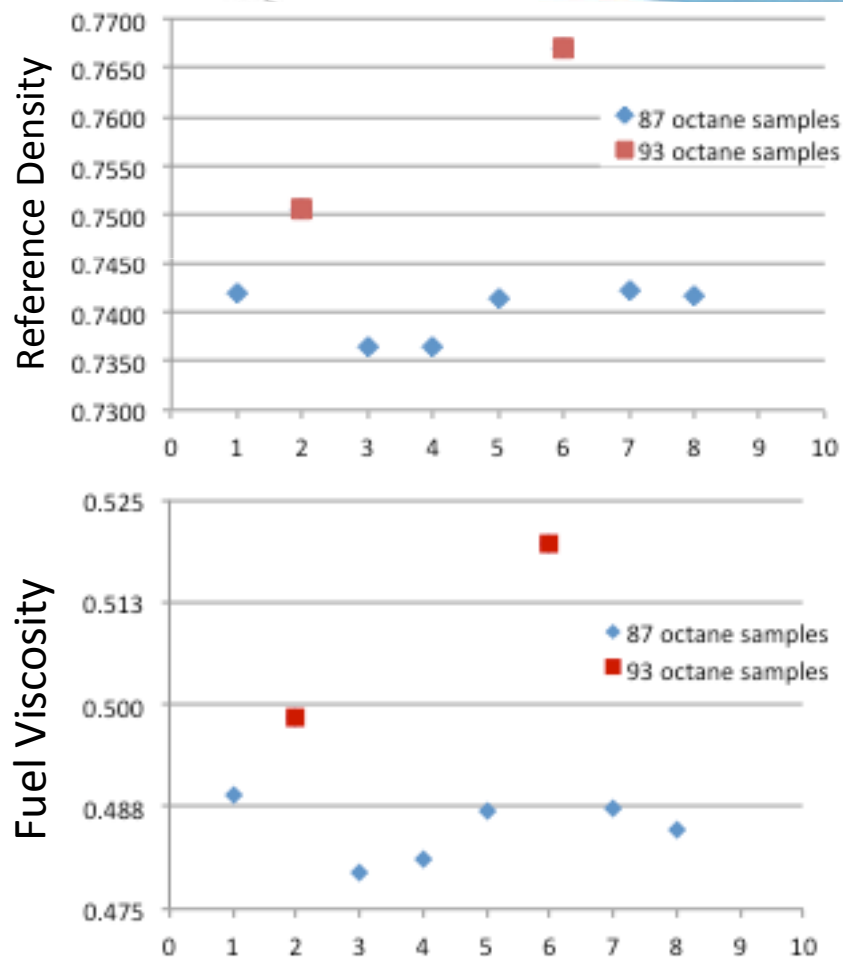


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Liquid Density for Fuel Adulteration Detection

- Fuel adulteration is a worldwide problem
 - Criminals replace a portion of fuel with liquids that are miscible but do not have the characteristics of the base fuel.
- Adulteration is difficult to detect in a cost effective manner. Laboratory instruments are slow, expensive and require trained operators.
- Density is the fuel fingerprint as it leaves the refinery or terminal.
 - Any change in density is an indication that the fuel has changed either through evaporation of light components or with the introduction of foreign hydrocarbons
- The challenge is to detect adulteration in 87 vs 93 octane gasoline when the octane is not known
 - Adulteration is much easier to detect if the density of the fuel from the refinery is known.

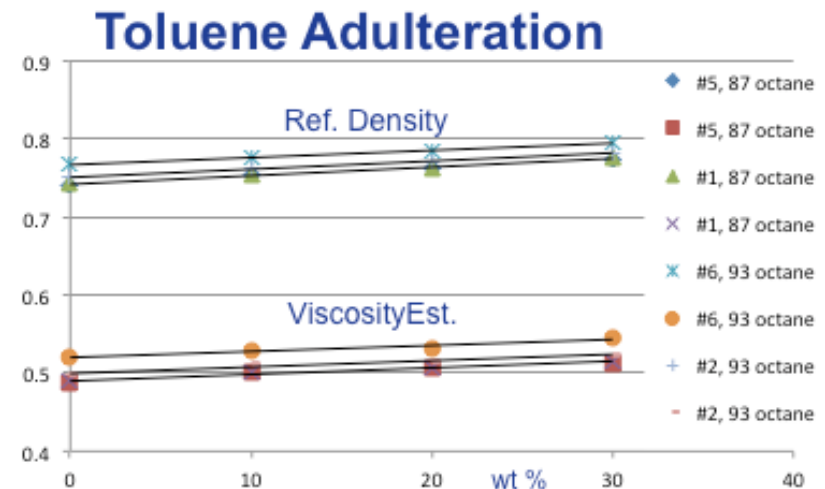
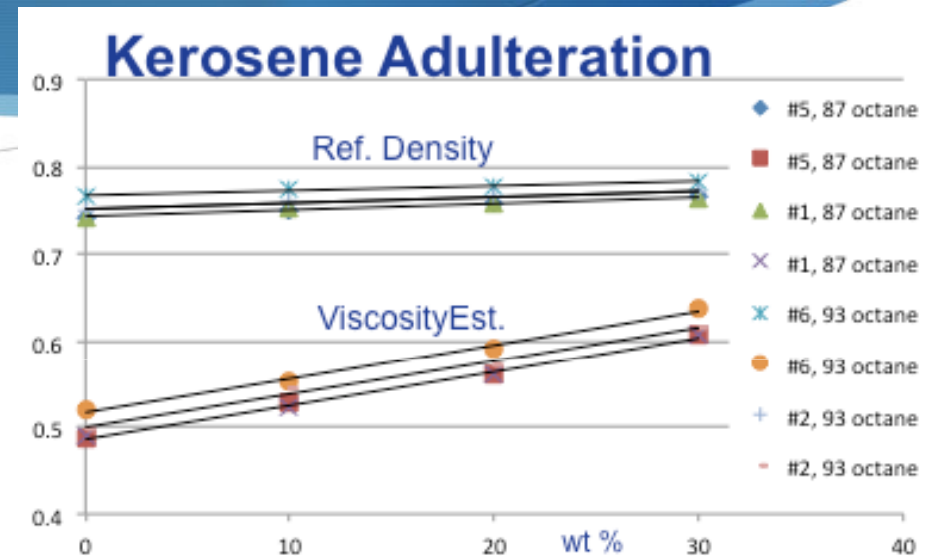
ISSYS Density Measurement for Fuel Identification



Gasoline Adulteration Detection Testing

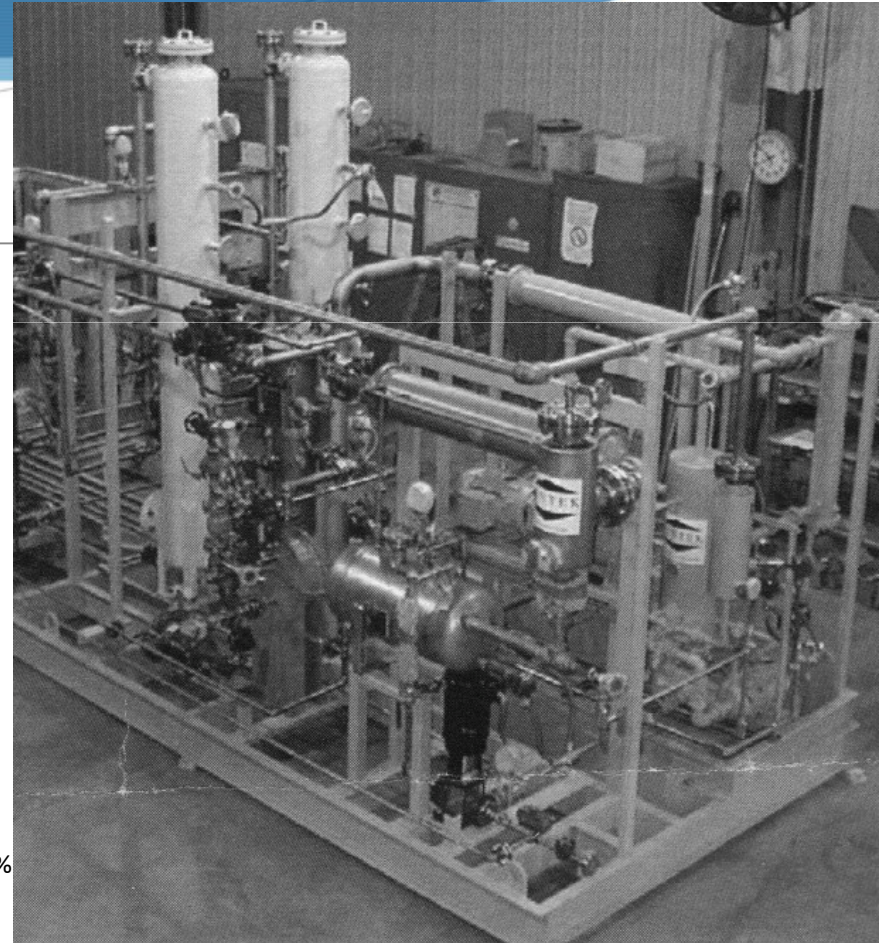
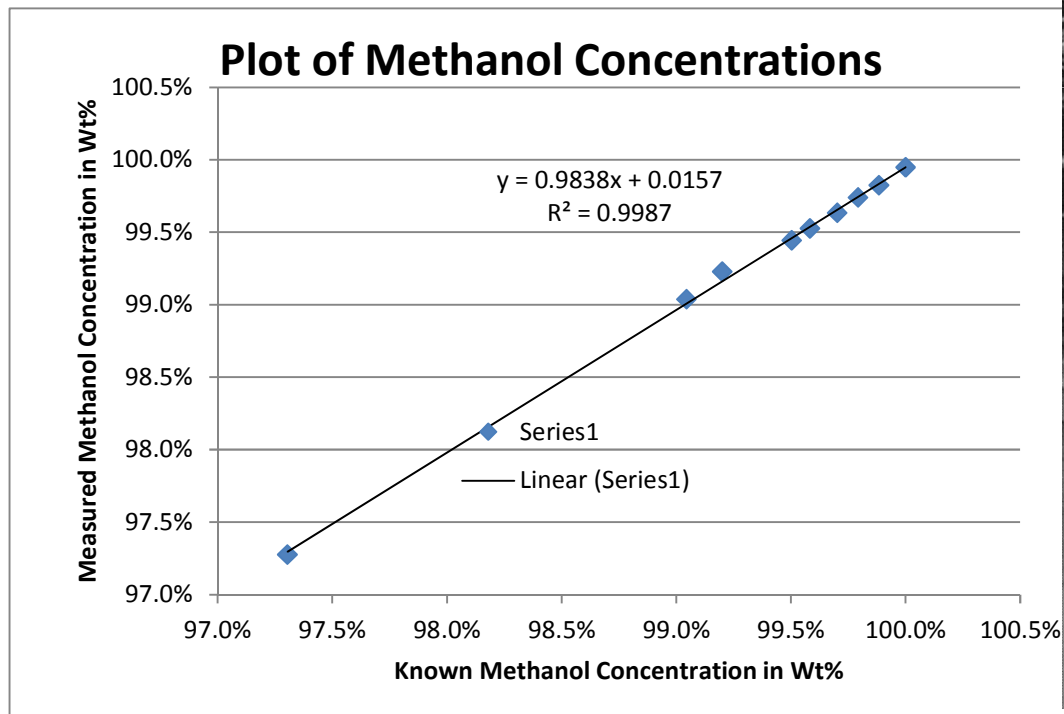


- Various amounts of kerosene and toluene were added to 87 and 93 octane gasoline.
- Fuel density and fuel viscosity were measured
- Density and viscosity measurements can be combined to detect changes in fuel



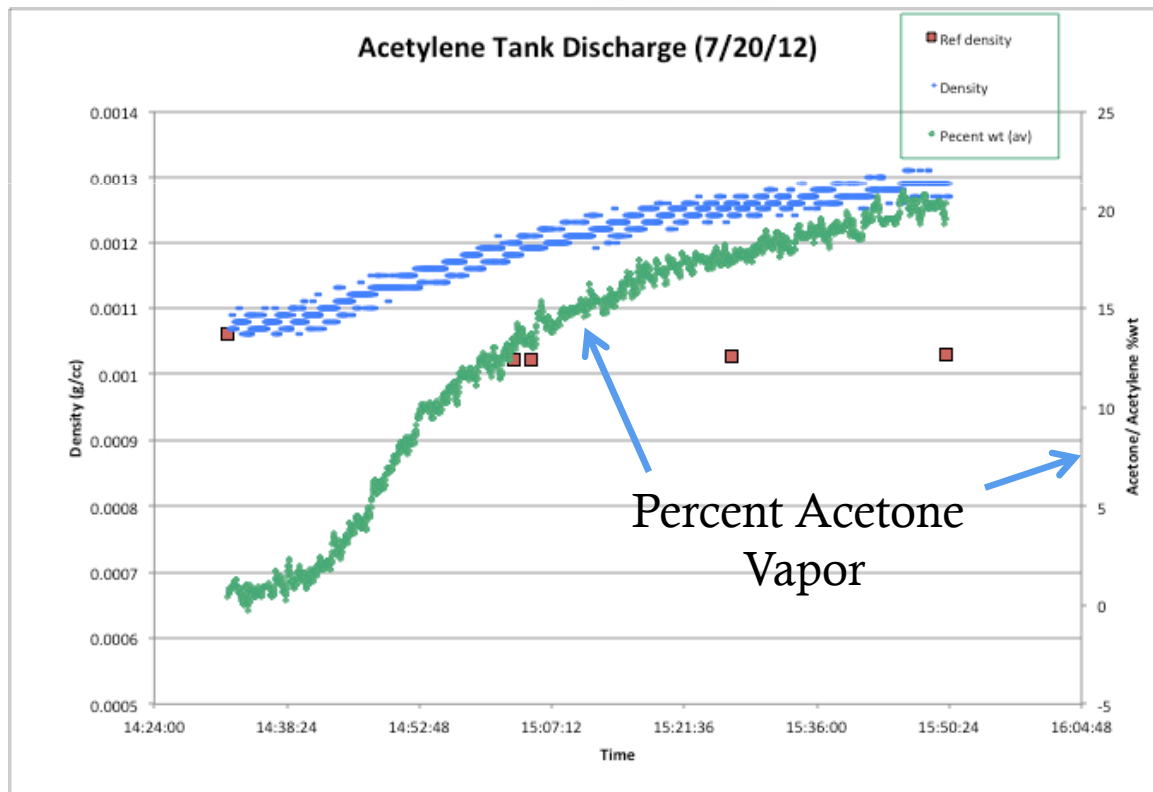
ISSYS for Monitoring the Performance of Mole Sieve Solvent Dehydration

Using density and temperature for concentration measurement



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ISSYS Gas Density to Measure Acetone Vapor in Acetylene



Using average molecular weight
to determine acetone vapor in
acetylene

Acetone= 58mw
Acetylene = 26mw

Biogas Concentration Measurements

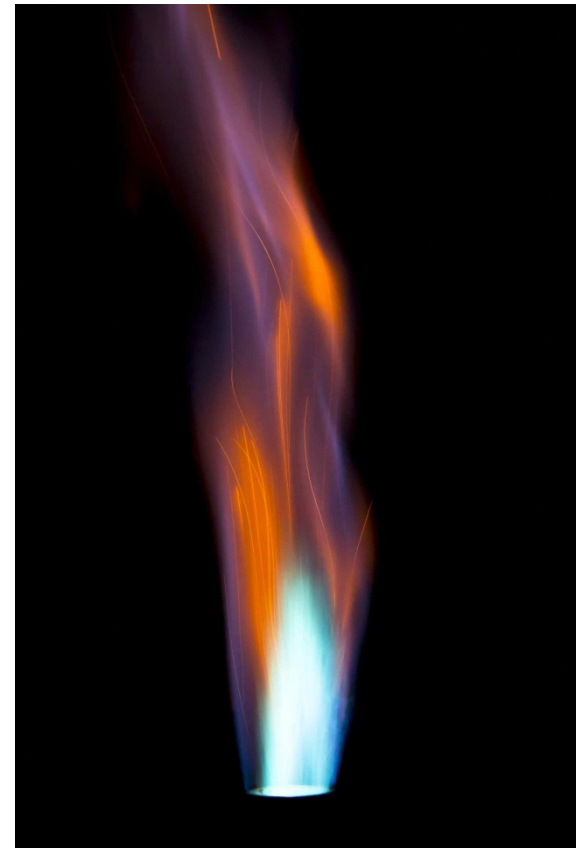
- Biogas is composed of primarily methane and carbon dioxide
- Gas average molecular weight can be used to measure the ratio of methane to carbon dioxide.
- Avg mol weight = $a(\text{mw methane}) + (1-a)(\text{mw carbon dioxide})$

Biogas to
Generator
CO2 and Methane



Hydrogen Rich Fuel Gas High Speed Burner Control

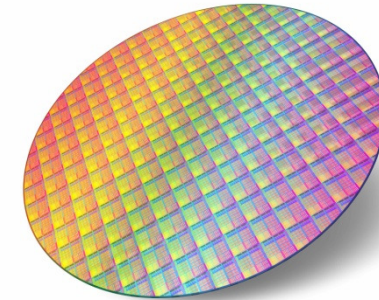
- Gas specific gravity can be used to monitor the heating value of hydrogen rich streams
- Speed is important because a slug of hydrogen can destroy burners
- ISSYS gas density meter has a 3 millisecond response to detect rapidly any changes in hydrogen concentration in fuel gas



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Semiconductor Gas Blending Control

- Semiconductor industry is replacing blended bottles of specialty gases with a central source of blended gas.
 - Example is forming gas, nitrogen and hydrogen blends
- ISSYS gas density can be used to calculate the concentration of binary gases
 - More stable than thermal conductivity
- ISSYS gas density can be used to monitor the concentration of vapor in a carrier gas



Jet Fuel Custody Transfer

- 💧 Carbon tax in EU based on mass of fuel burned
- 💧 Upgrade from hygrometer to improve mass loading measurement
- 💧 Density used to load precise mass onto plane
- 💧 Accurate billing of fuel and pay accurate tax



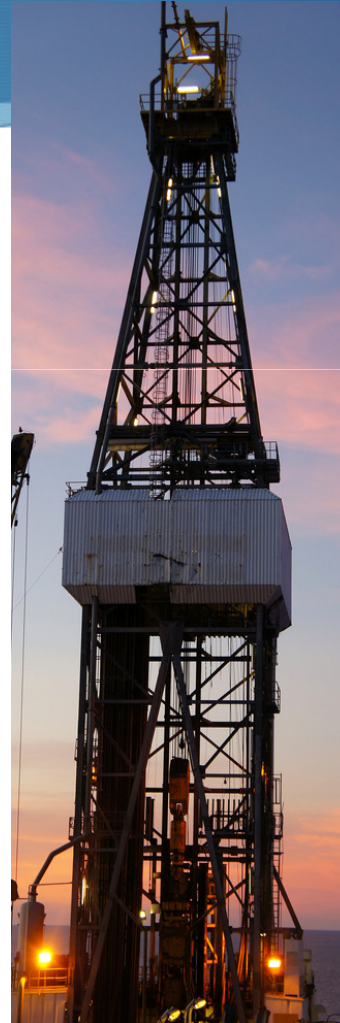
Telecom Fuel Adulteration Detection

- The majority of the world's cell phone towers are powered by diesel generators
- Temptation to steal diesel fuel and replace with kerosene
- ISSYS allows detection if there is a problem with fuel



Oil Field Water Treatment

- Production of shale gas and oil produces water that contains high content of salt
- Water must be treated before released to the environment
- ISSYS density meter can be used to monitor salt content during the treating process



Wine Production

- Density can be used to monitor the conversion of grape must into wine alcohol
- Rate of sugar conversion to alcohol can help optimize the quality of the wine
- ISSYS can be used to replace the traditional and slow glass hygrometer method of density measurement

