# CINRG Systems Inc.

**Innovation in Automation**

For Commercial Oil Analysis Laboratories

# CS-APC-2 Automated Auto-Diluting Particle Counter

# ASTM D7647-10

Standard Test Method for
Automatic Particle Counting of Lubricating and Hydraulic Fluids Using Dilution Techniques to Eliminate the Contribution of Water and Interfering Soft Particles by Light Extinction.

## Benefits of Automation and Auto-Dilution

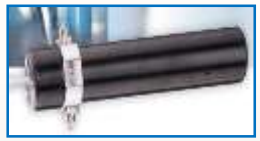
- **Sample Dilution allows for a fully automated system with significant cost and quality benefits.**
  - Labor reduced by more than 80%
  - Elimination of operator differences
  - Simplified sample preparation - No ultrasonic or vacuum treatment.
  - Reduced error from particle co-incidence.

- **Appropriate solvent will eliminate interference from "soft particles".**
  - Water ( up to 2% can be effectively masked by a mixed solvent of 25% IPA/ 75% Toluene).
  - Additives – Silicones, specialized EP additives.
  - Varnish.

- **Highly viscous sample can be analyzed without an issue**
  - 1000 cSt @ 40 @ 1:1 dilution ratio.

# System Components

KLOTZ
PC Hardware



GILSON
Automation

BAUMER
UNCK 09T9114/D1
Ultrasonic Distance Sensor

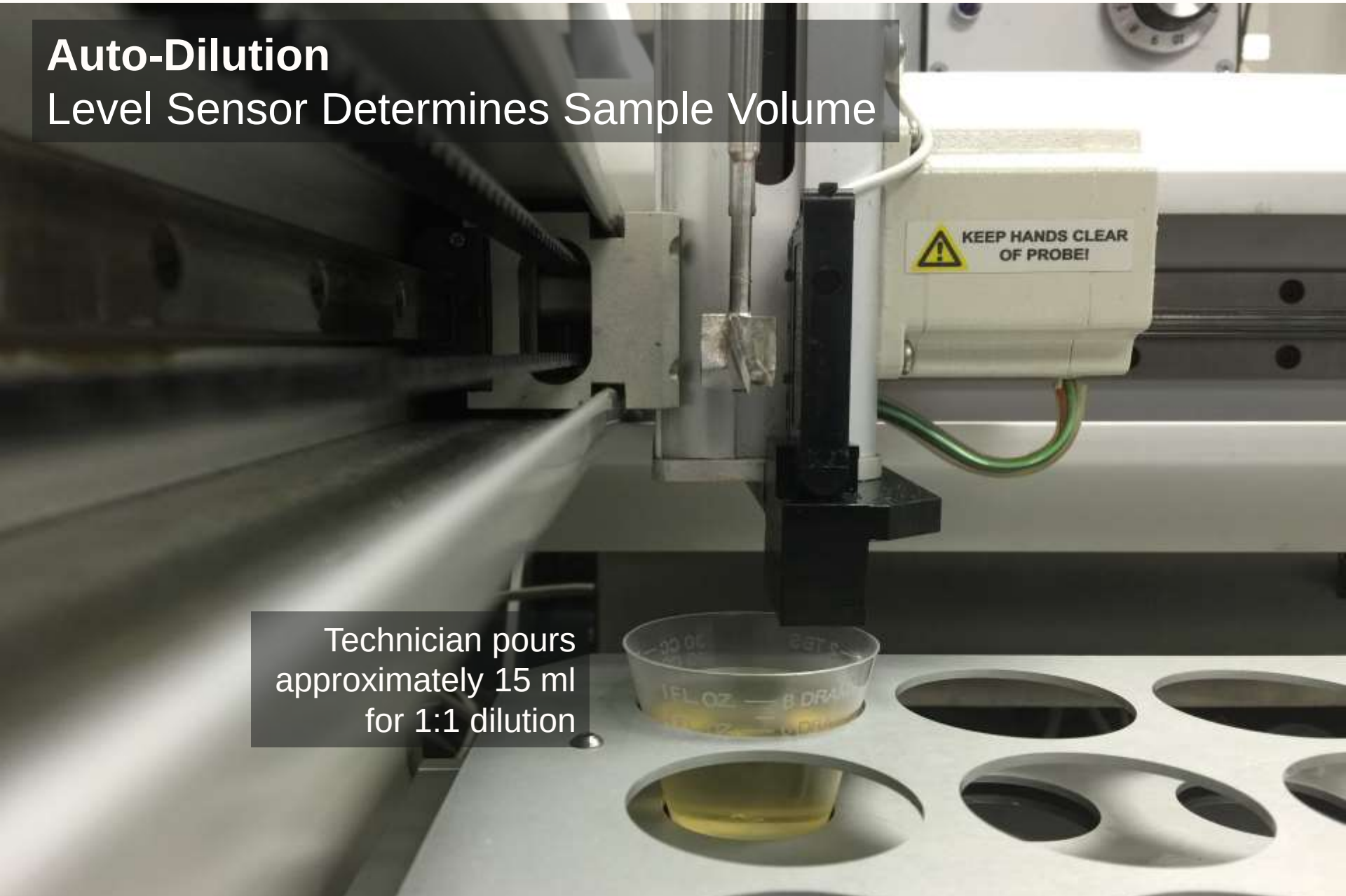

B&B Electronics
Industrial USB Hub
and RS232 Convertor

CINRG
Custom Hardware and Software


Large Sample Volume
104 position sample tray

# Auto-Dilution

## Level Sensor Determines Sample Volume



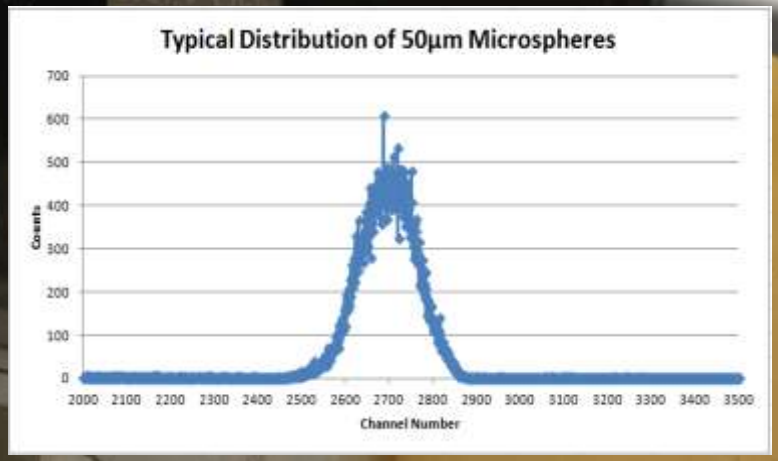

Technician pours approximately 15 ml for 1:1 dilution

# Analysis Completed in Sample Cup

Dilute / Stir / Analyze / Wash / Remove to Waste

# Accurate Particle Counts
## High Quality Laser Sensor

Multi-channel Sensor
(4096 channels)

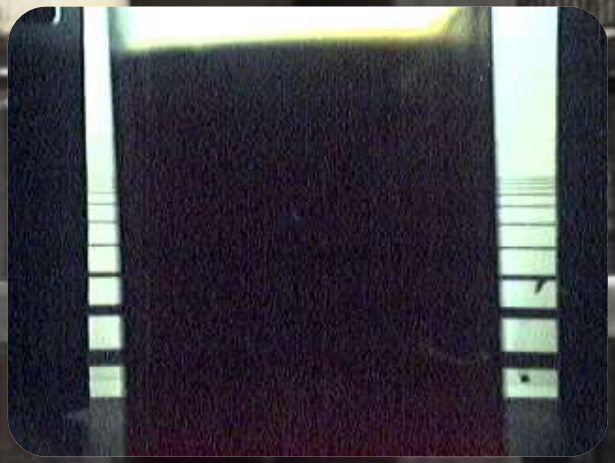


# Sample Processing
## Water Contamination

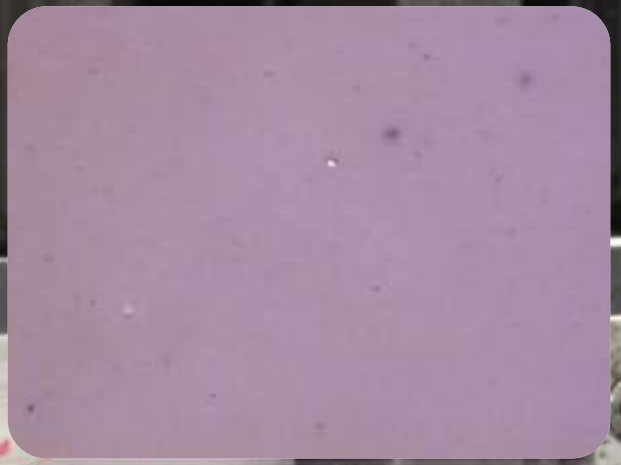
0.35% water


Process samples with up to 2.0% water with 1:1 dilution

# Sample Processing
## Opaque Samples

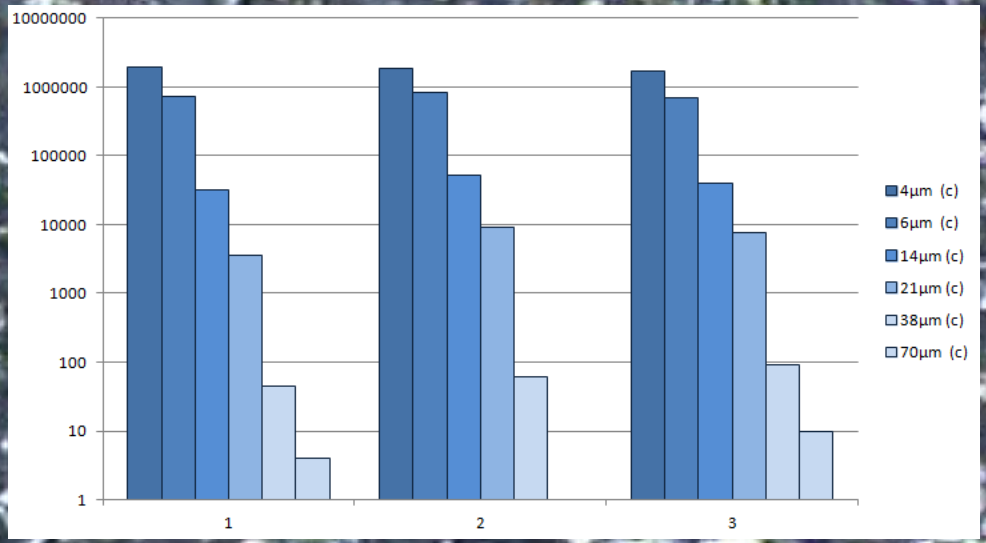


Undiluted: 23/22/14
Diluted: 19/15/12

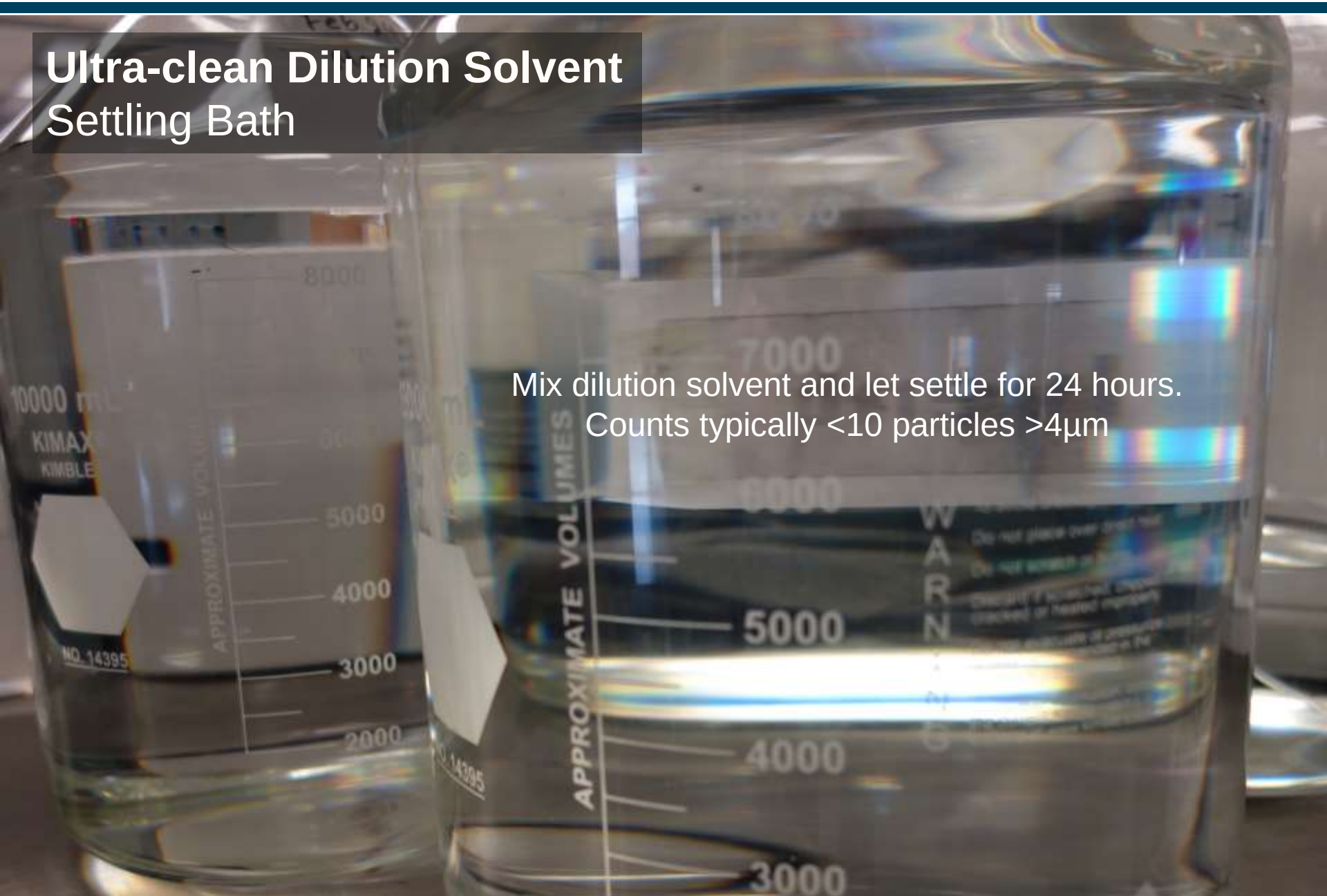


# Sample Processing
## Highly Contaminated Samples

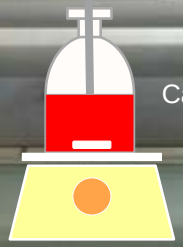
Sample Trend on Gearbox with ISO 28/27/23



# Ultra-clean Dilution Solvent
## Settling Bath

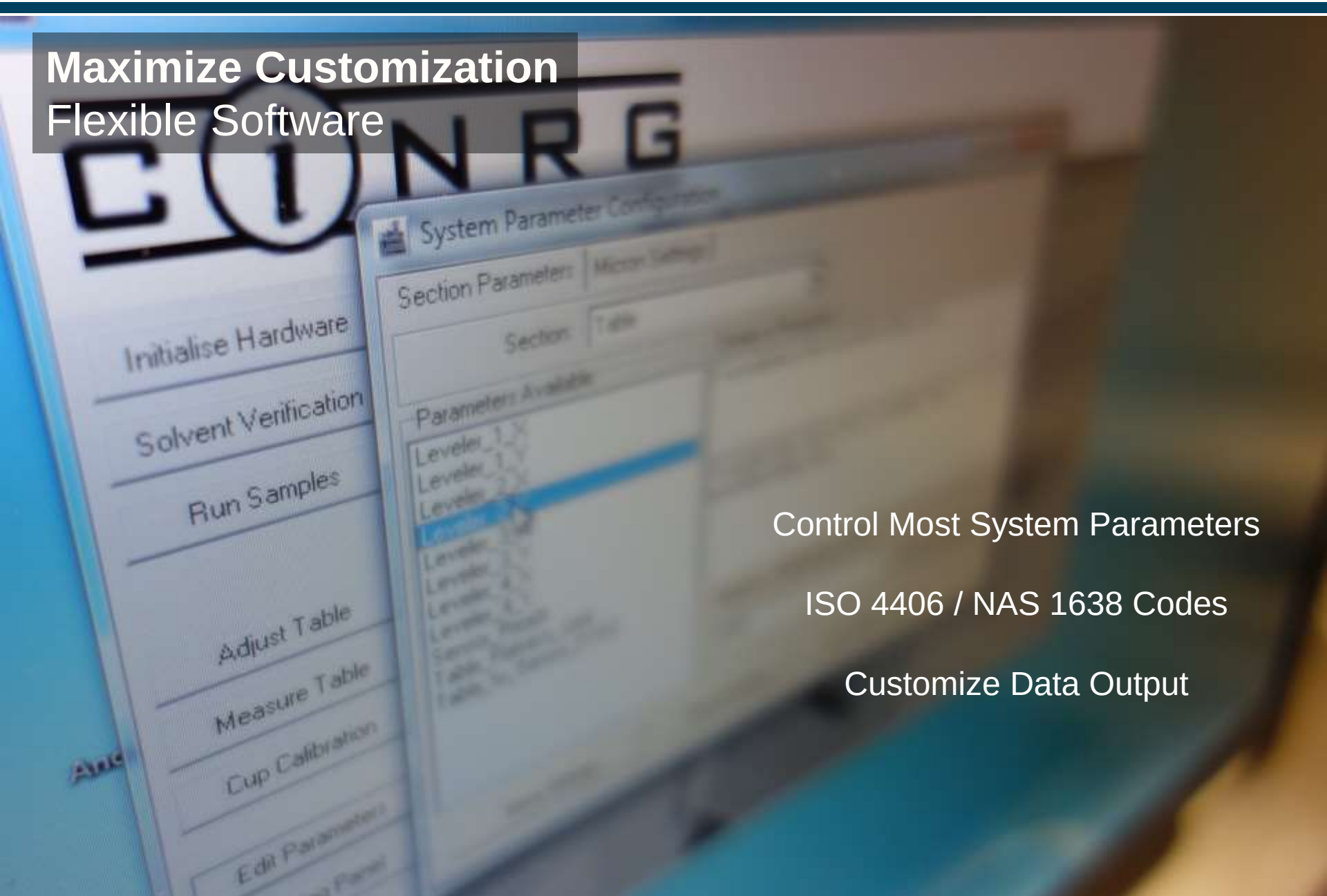


# In-house Calibration
ISO 11171




Requires 30 – 45 minutes to calibrate

# Maximize Customization
## Flexible Software

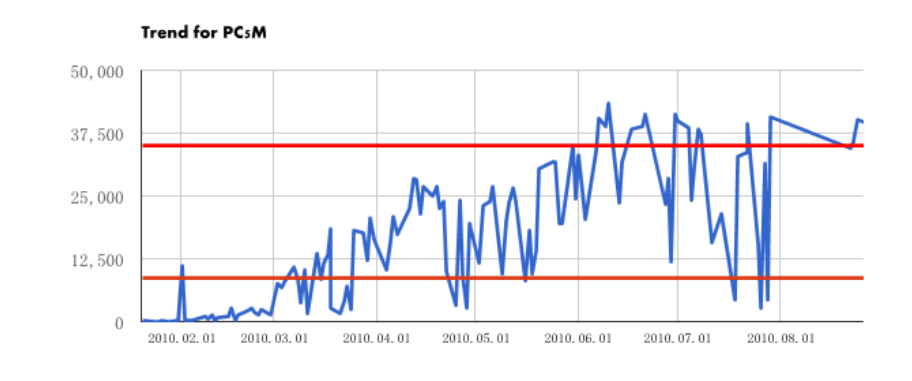


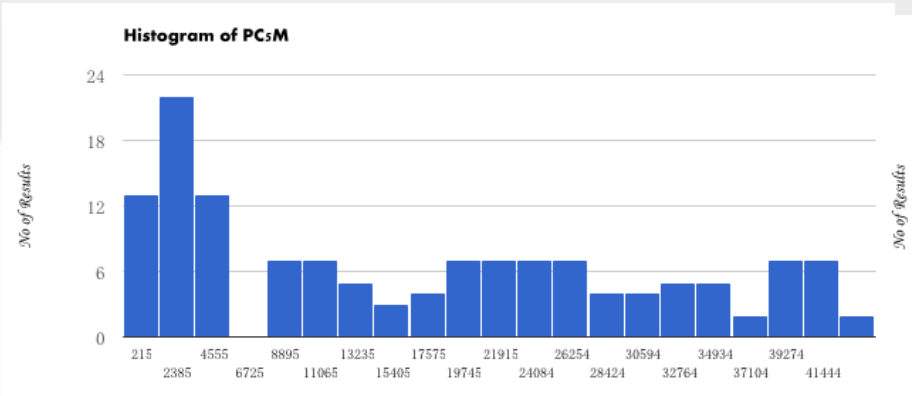

Control Most System Parameters

ISO 4406 / NAS 1638 Codes

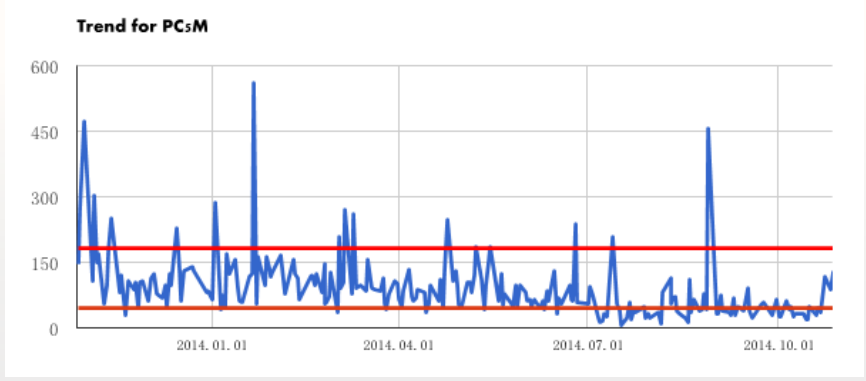
Customize Data Output

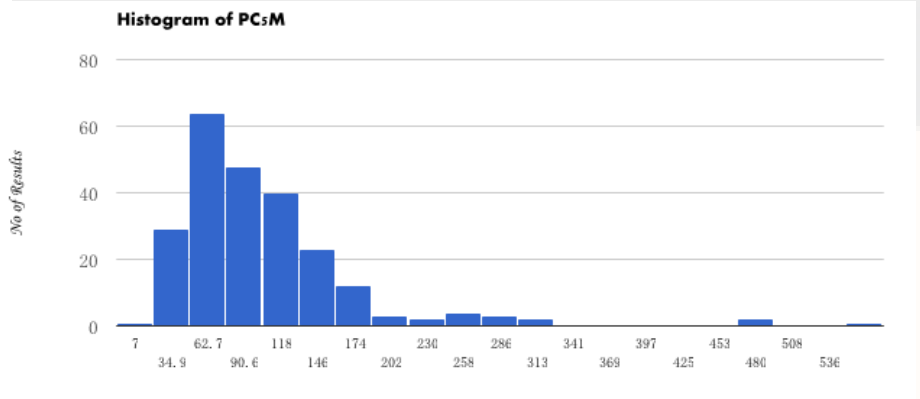
## Internal Standard 2010 n:149




## Internal Standard 2014 n:247




# CS-HVA-1 Houillon Viscometer Automation System

# ASTM D7279-14

Standard Test Method for
Kinematic Viscosity of Transparent and Opaque Liquids by
Automated Houillon Viscometer.

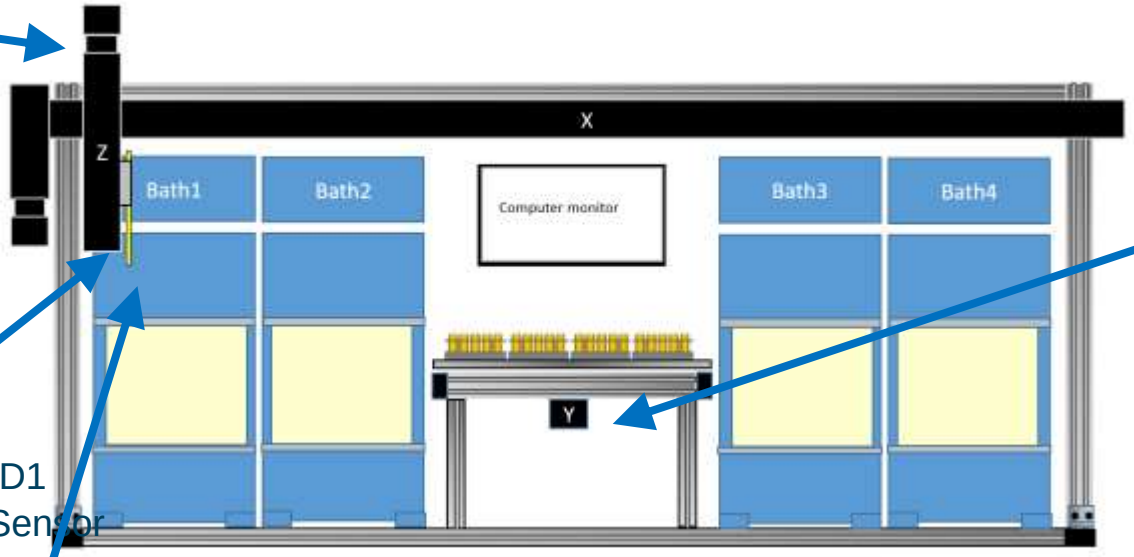
## Benefits of Robotic Automation

- **Robotic Automation allows for a fully automated system with significant cost and quality benefits.**
  - Labor reduced by more than 90%
  - Elimination of operator differences
  - Consistent and correct tube selection for anticipated viscosity.
  - Reduced error from selecting incorrect viscometer tube.

- **Fuzzy logic system optimizes sample flow without result quality degradation.**
  - System waits for appropriate factor viscometer tube to be available for each sample.
  - Skips sample where no appropriate tubes are currently available.
  - Processes skipped samples when appropriate factor tube is available.

- **Automated Wash Solvent Filling**
  - Maintains appropriate solvent fill level to ensure optimal tube cleaning.

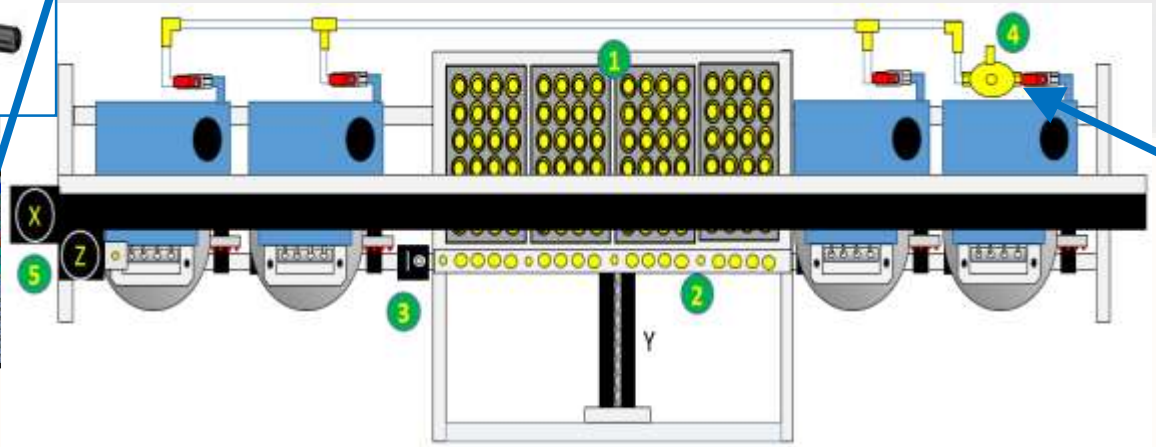
## ZABER
XYZ Robotic Axes




## BAUMER
UNCK 09T9114/D1
Ultrasonic Distance Sensor


## B&B Electronics
Industrial USB Hub
and RS232 Convertor

## CINRG
Custom Hardware
and Software



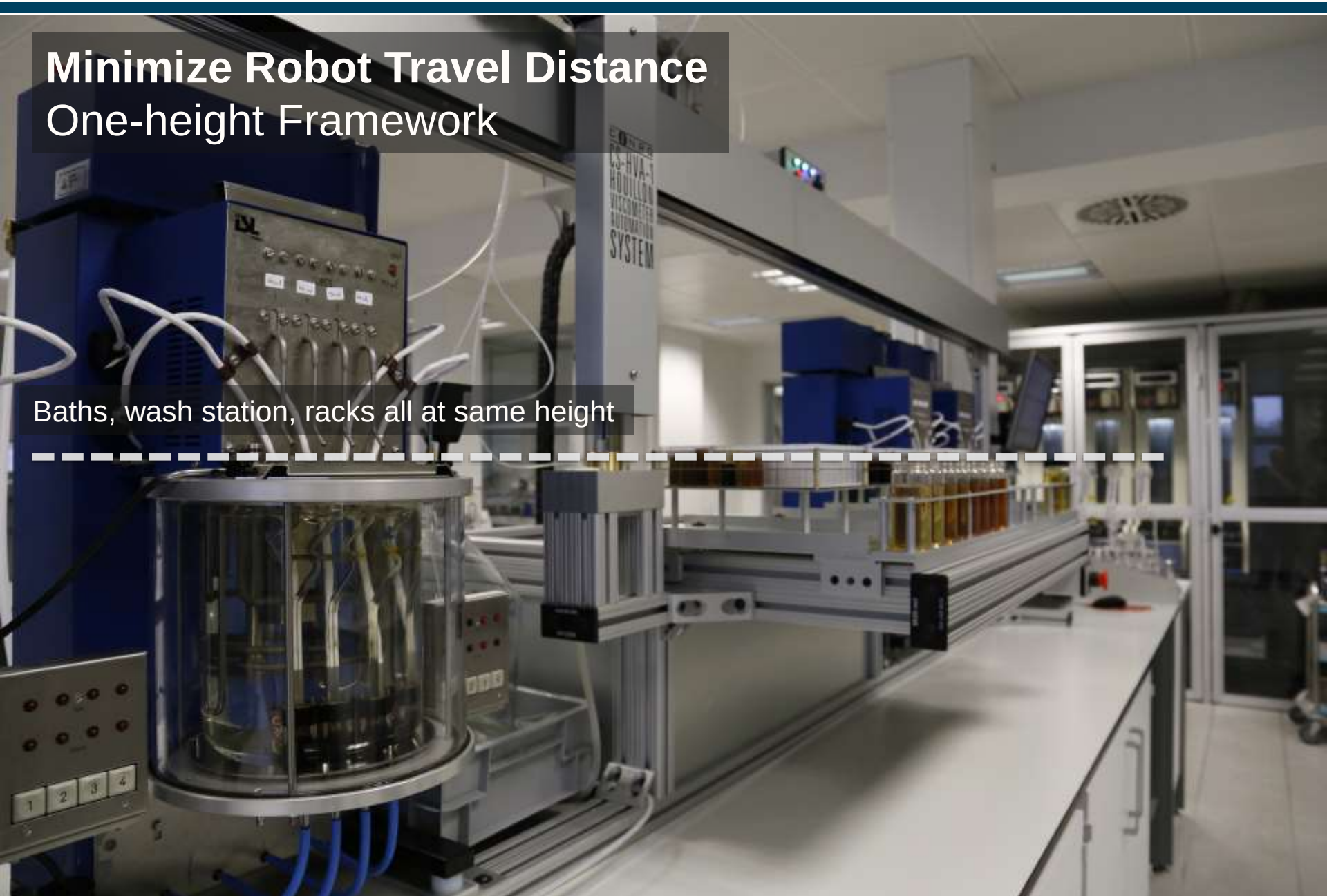

## GILSON
Automation for
Solvent Pump

# Integrate with Existing Houillon Instrumentation

## Robotic Automation Framework

# Minimize Robot Travel Distance

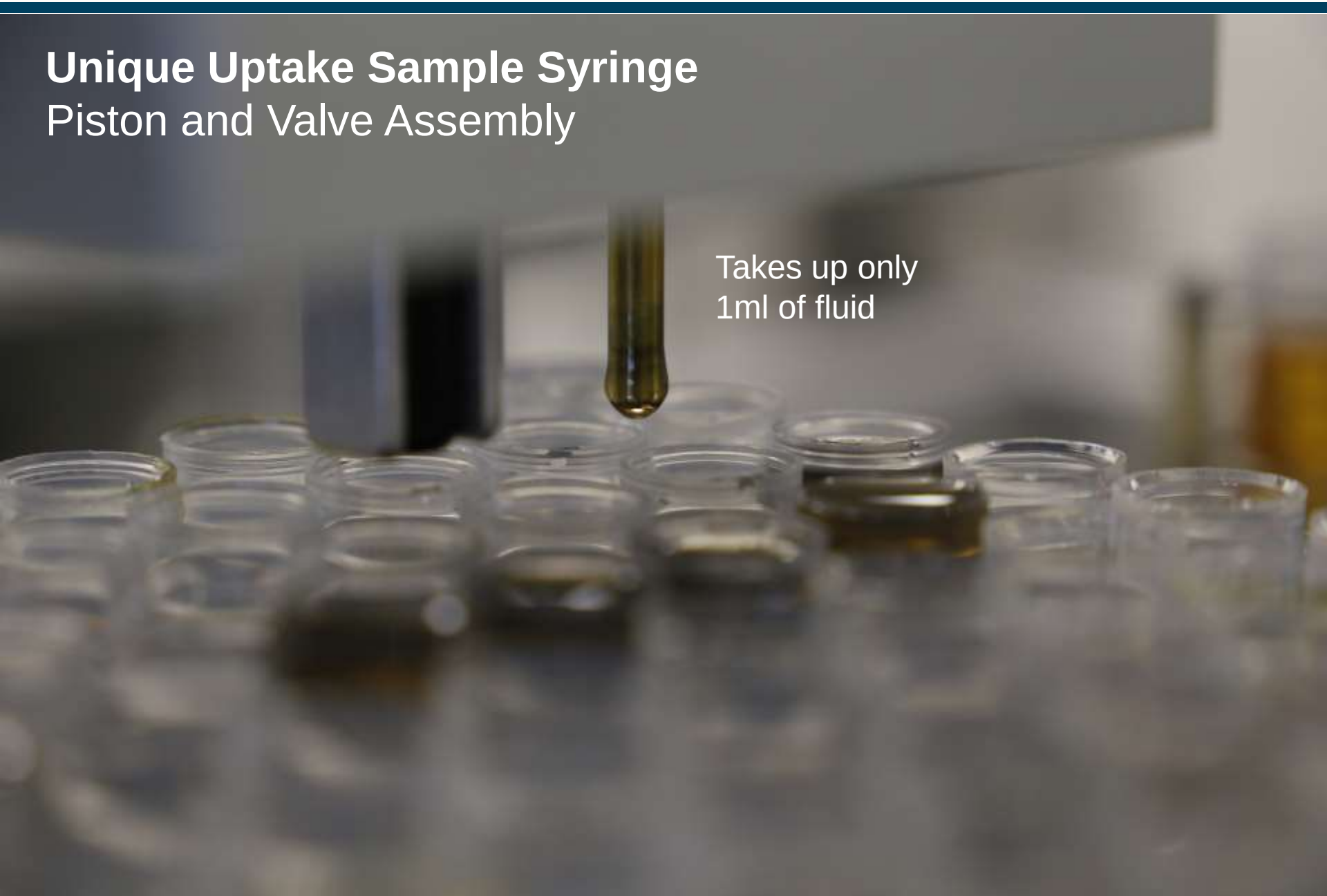
## One-height Framework



Baths, wash station, racks all at same height

# Unique Uptake Sample Syringe

## Piston and Valve Assembly



# Eliminate Sample Carry-over

## Level Sensor

Minimize syringe
penetration into sample

# Eliminate Sample Carry-over

## Level Sensor

Minimize syringe
penetration into sample

# Eliminate Sample Carry-over

## Wash Station

# Eliminate Sample Carry-over

## Wash Station

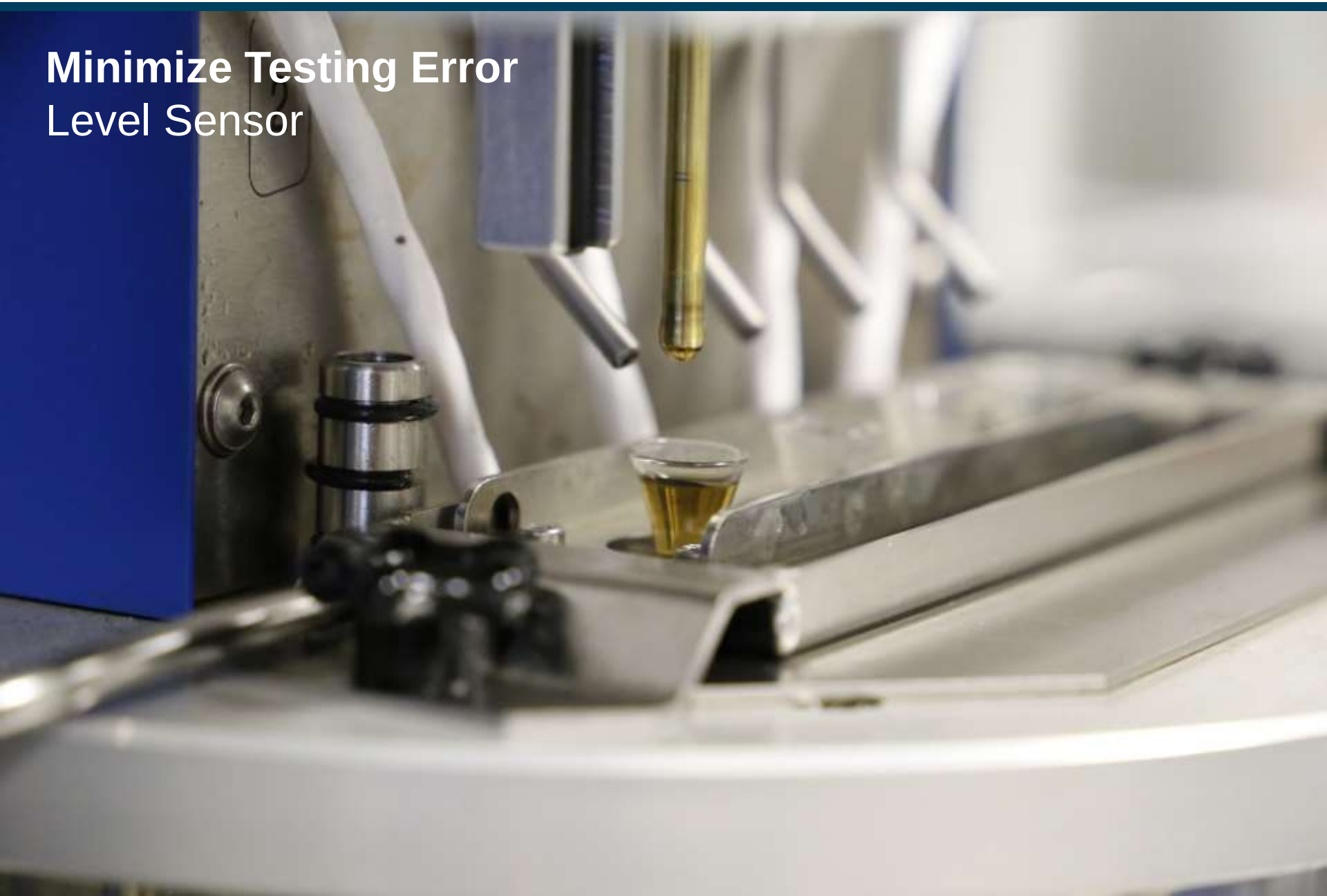
# Eliminate Sample Carry-over

## Wash Station

Solvent Drying Pad

# Minimize Testing Error

## Level Sensor

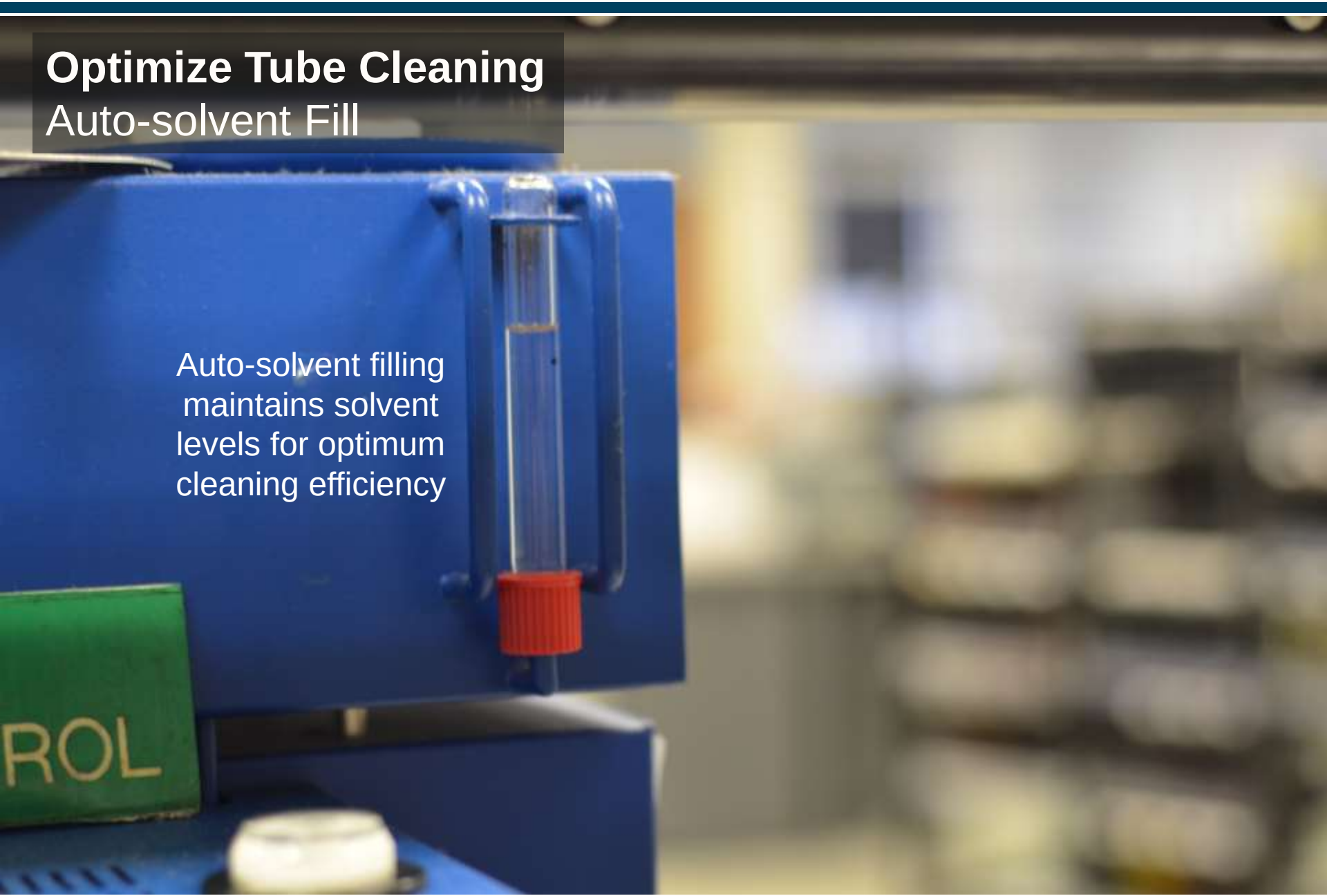


# Minimize Testing Error

## Level Sensor

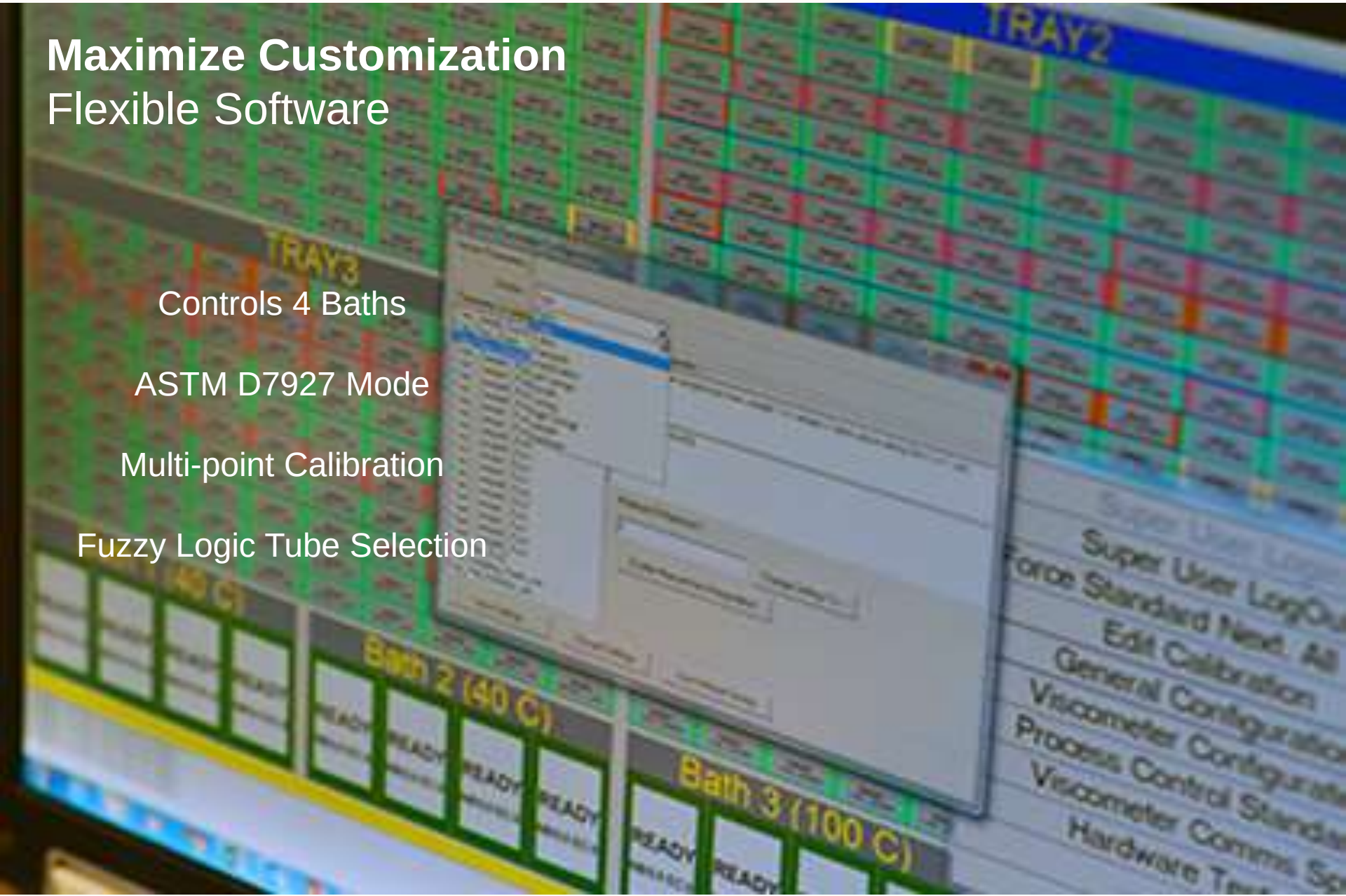
Determines if sample tube has been filled

# Optimize Tube Cleaning
## Auto-solvent Fill



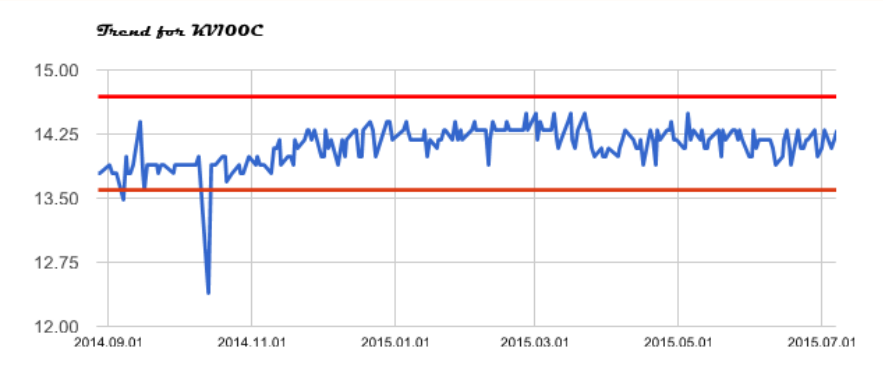

Auto-solvent filling maintains solvent levels for optimum cleaning efficiency

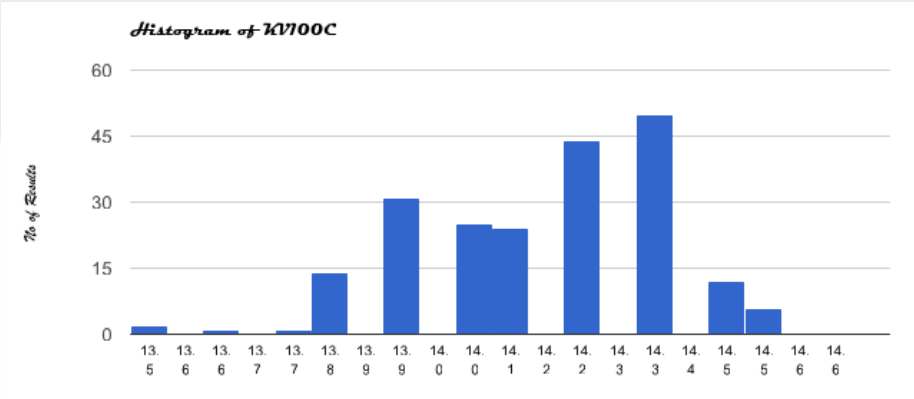
# Maximize Customization
## Flexible Software



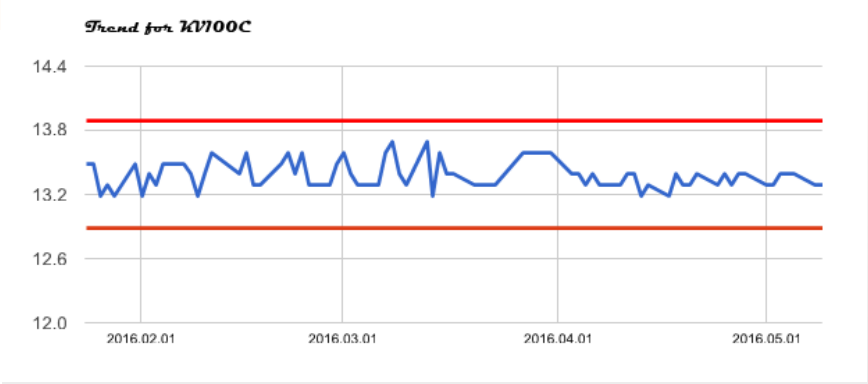

- Controls 4 Baths
- ASTM D7927 Mode
- Multi-point Calibration
- Fuzzy Logic Tube Selection

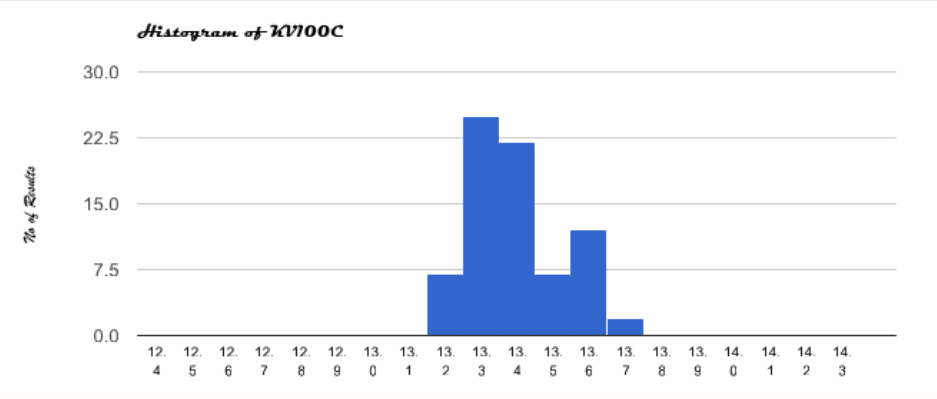
## Internal Standard 2014 n:210




## Internal Standard 2016 n:75



# CINRG Systems Inc.

**Innovation in Automation**

For Commercial Oil Analysis Laboratories