Spectro Scientific
Confidence in knowing

TruVu360
Insight. On-site.

Enterprise Fluid Intelligence
for Predictive Maintenance

A Holistic Approach to On-site Oil Analysis

TruVu 360™ Enterprise Fluid Intelligence simplifies and streamlines the on-site oil analysis process, so high-quality information and actionable intelligence lead to effective decision making.

- Closes the gap between recommendations on the oil analysis report, maintenance actions taken and findings for continuous improvement
- Offers an intelligence dashboard so management has visibility into the effectiveness of the global program

TruVu360

Insight. On-site.

The TruVu 360™ platform manages process, information flow and an intelligence dashboard with two components:
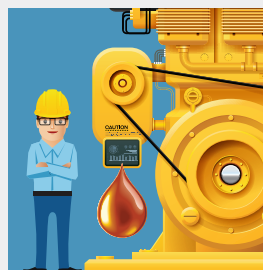
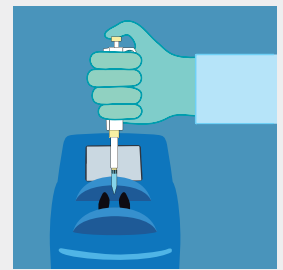TruVu 360 Cloud Based Software

TruVu 360 Device Console (TDC) with Minilab Test System

TruVu 360 Process Flow

COLLECT A REPRESENTATIVE OIL SAMPLE FROM ASSET

ON-SITE TESTS WITH MINILAB & TRUVU 360 DEVICE CONSOLE (TDC)

TruVu 360 Enterprise Fluid Intelligence platform delivers real benefits that meet business goals and objectives:

Speed

- Real-time reporting enables immediate decision making
- Rapid feedback for continuous improvement

Quality

- Highest quality information from freshly collected samples
- Simple process with fewer hand offs ensure higher quality data
- Lab-quality results on-site without the complexity of a traditional lab
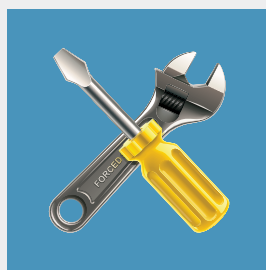
Simplicity

- Intuitive interface with built-in intelligence
- Simple flow minimizes human error
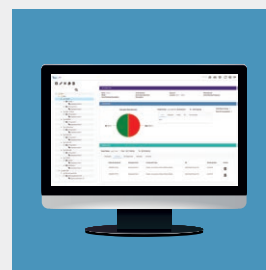
Intelligence

- Closed loop feedback improves diagnostic accuracy over time
- Dashboard for management views of cost savings and program key performance indicators (KPIs)

DIAGNOSTICS AND RECOMMENDATIONS WITH TRIVECTOR

ACTION & CLOSED LOOP FEEDBACK

ARCHIVE FOR FUTURE REVIEW

Achieve More with Global Access to Local Intelligence
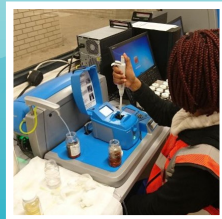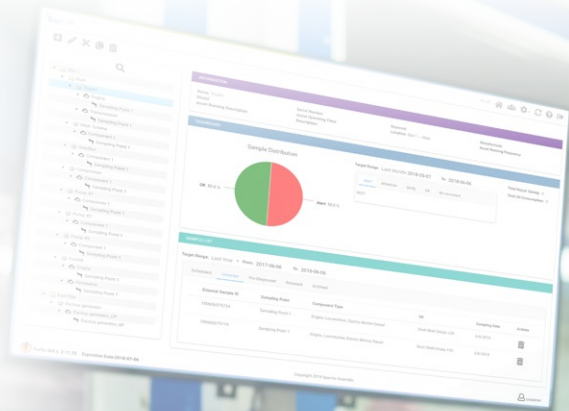
TruVu 360 Enterprise Fluid Intelligence addresses the need for standardizing workflows on a global scale and sharing data and intelligence across the enterprise.
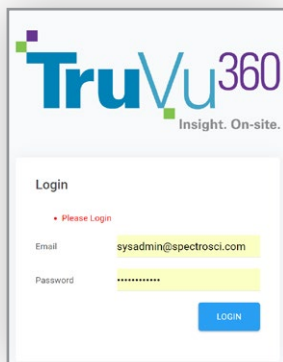
- One, standard on-site oil analysis process
- High-quality, actionable information applied locally to improve productivity and reduce costs
- Global intelligence accessible by users and management for continuous improvement

A True View of Process, Information and Intelligence

ASSET & TOOL BAR

- Create asset database with provided templates of component types
- Customize your own or import existing asset structure
- Assign pre-configured alarm limits that can be adjusted at the component level based upon operating history.
- Assess alarm trends to refine alarm limits.

TruVu 360 login screen

TruVu 360 Enterprise cloud software

en_US

DASHBOARD

Dashboards bring visibility of lubricant management and savings at the asset, plant and corporate level:

- Oil analysis results by category
- Total repair savings
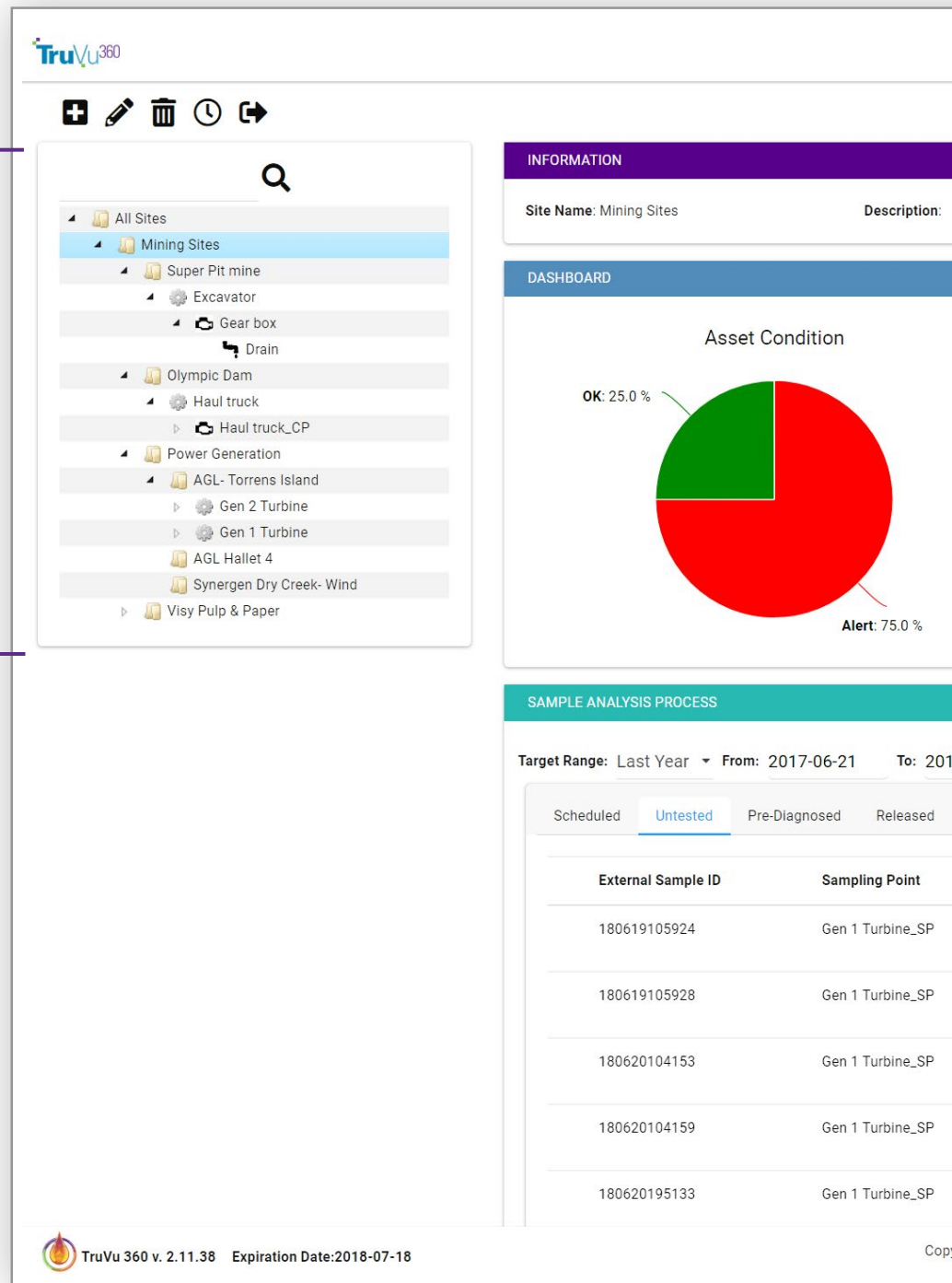- Total oil consumption

| Target Range: Last Year | 2017-06-21 | To: | 2018-06-21 | | Total Repair Saving: 0 |
| | | | | | Total Oil Consumption: 0 |

| Alert | Attention | Verify | OK | No comment |

| Gen 2 Turbine | Excavator | Gen 1 Turbine |

SAMPLE ANALYSIS PROCESS

- Track samples that are planned, in process and tested.
- Review results and software-generated observations and recommendations.
- Add additional notes and observations before sample report is released.

8-06-21

Archived

	Component Type	Oil	Sampling Date	Actions
	Turbine, Steam	Mobil Mobil DTE 732	6/19/2018	🗑
	Turbine, Steam	Mobil Mobil DTE 732	6/19/2018	🗑
	Turbine, Steam	Mobil Mobil DTE 732	6/20/2018	🗑
	Turbine, Steam	Mobil Mobil DTE 732	6/20/2018	🗑
	Turbine, Steam	Mobil Mobil DTE 732	6/20/2018	🗑

yright 2018 Spectro Scientific

sysadmin

A Simple Path from Data to Intelligence

Intuitive TriVector™

Representation of oil analysis diagnostics.

► Is the oil dry?

► Is the oil clean/ free of dirt?

► Is the machine healthy?

► Can I predict when the machinery will fail?

► Is it the right oil?

► Is the oil fit for use?

Adaptive Rules Engine

Open architecture allows user to easily customize rules for continuous improvement.

- Built-in limit tables for common components, customizable for each asset.
- Automate alarm codes, diagnostics and recommendation from rules engine.

⚙ ADAPTIVE RULES ENGINE (BETA) - DIAGNOSTIC STATEMENTS

Turbine, Steam

TriVector	Parameter	Diagnostic
Wear	Iron	Suspect source to be wear of shaft, reduction gear, bearings, piping, or structural components.
Wear	Lead	Suspect source to be wear of bearings, piping, or structural components.
Wear	Copper	Suspect source to be wear of bearings, bushings, or oil coolers.
Wear	Tin	Suspect source to be wear of shaft, reduction gear, bearings, piping, or structural components.
Wear	Total Ferrous	Suspect source to be wear of shaft, reduction gear, bearings, piping, or structural components.
Wear	Large Iron	Suspect source to be wear o...
Wear	Fe Wear Severity Index	Suspect source to be wear o...
Contamination	Boron	Suspect source to be contam...
Contamination	Silicon	Suspect source to be contam...
Contamination	Water, ppm	Suspect source to be water i...
Contamination	ISO 4406 Code (>4µm)	Suspect source of particulat... Secondary sources include fi...
Contamination	ISO 4406 Code (>6µm)	Suspect source of particulat... Secondary sources include fi...
Contamination	ISO 4406 Code (>14µm)	Suspect source of particulat... Secondary sources include fi...
Chemistry	Calcium	Suspect contamination from...
Chemistry	Phosphorus	Suspect contamination from... system.
Chemistry	Zinc	Suspect contamination from...
Chemistry	TAN	Suspect TAN increase due to... localized hot spots.
Chemistry	Oxidation	Suspect oxidation rise due t...
Chemistry	Visc 40	Oil may be contaminated, se...

TruVu 360 limit table grouped by Trivector parameters

⚙ ADAPTIVE RULE ENGINE (BETA)

Wear	Contamination	Chemistry			Turbine, Steam	

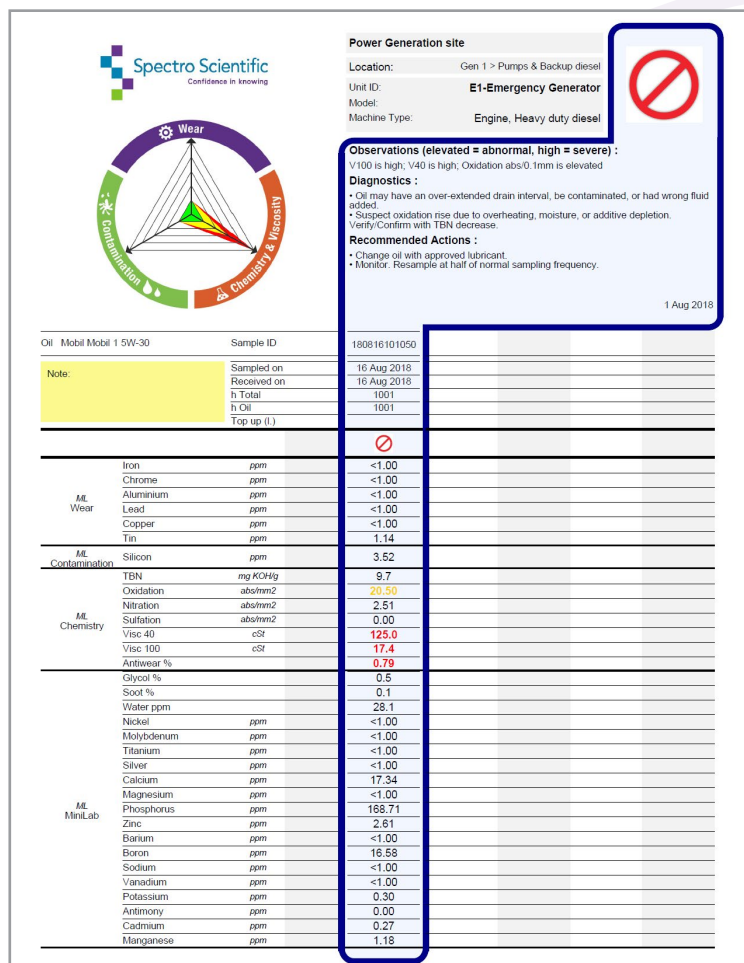| Parameter	Limit Type	Abnormal	Severe	Reference Value	Maintenance Actions (Abnormal)	Maintenance Actions (Severe)
Iron	Absolute	5	10		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Lead	Absolute	3	5		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Copper	Absolute	2	5		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Tin	Absolute	5	10		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Total Ferrous	Absolute	10	20		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Large Iron	Absolute	0.1	0.2		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Fe Wear Severity Index	Absolute	1	4		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Boron	Absolute	15	20		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Silicon	Absolute	5	10		• Monitor. Resample at half of normal sampling frequency.	• Investigate equipment urgently.
Water, ppm	Absolute	100	200		• Monitor. Resample at half of normal sampling frequency. Check integrity of seals, breather, or cooler system coupling.	• Install a water removal system (vacuum dehydration) system. Check integrity of seals, breather, or cooler system coupling.
ISO 4406 Code (>4µm)	Absolute	17	18		• Monitor. Resample at half of normal sampling frequency.	• Clean system oil by filtration or centrifuging.
ISO 4406 Code (>6µm)	Absolute	14	15		• Monitor. Resample at half of normal sampling frequency.	• Clean system oil by filtration or centrifuging.
ISO 4406 Code (>14µm)	Absolute	11	12		• Monitor. Resample at half of normal sampling frequency.	• Clean system oil by filtration or centrifuging.
Calcium	Absolute	15	20		• Feed and bleed reservoir with correct lubricant.	• Change oil with approved lubricant. Check seal integrity.
Phosphorus	Absolute	100	200		• Monitor. Resample at half of normal sampling frequency.	• Change oil with approved lubricant. Check seal integrity.
Zinc	Absolute	10	25		• Monitor. Consider feed and bleed. Resample at half of normal	• Investigate equipment urgently.

TruVu 360 Report

Includes TriVector chart, historical data showing trending, diagnostics and recommendations.

Power Generation site

Location:	Gen 1 > Pumps & Backup diesel
Unit ID:	**E1-Emergency Generator**
Model:	
Machine Type:	Engine, Heavy duty diesel

Observations (elevated = abnormal, high = severe) :
V100 is high; V40 is high; Oxidation abs/0.1mm is elevated

Diagnostics :
• Oil may have an over-extended drain interval, be contaminated, or had wrong fluid added.
• Suspect oxidation rise due to overheating, moisture, or additive depletion. Verify/Confirm with TBN decrease.

Recommended Actions :
• Change oil with approved lubricant.
• Monitor. Resample at half of normal sampling frequency.

1 Aug 2018

Oil Mobil Mobil 1 5W-30	Sample ID	180816101050
Note:	Sampled on	16 Aug 2018
	Received on	16 Aug 2018
	h Total	1001
	h Oil	1001
	Top up (l.)	

ML Wear	Iron	ppm	<1.00
	Chrome	ppm	<1.00
	Aluminium	ppm	<1.00
	Lead	ppm	<1.00
	Copper	ppm	<1.00
	Tin	ppm	1.14
ML Contamination	Silicon	ppm	3.52
ML Chemistry	TBN	mg KOH/g	9.7
	Oxidation	abs/mm2	20.50
	Nitration	abs/mm2	2.51
	Sulfation	abs/mm2	0.00
	Visc 40	cSt	125.0
	Visc 100	cSt	17.4
	Antiwear %		0.79
ML MiniLab	Glycol %		0.5
	Soot %		0.1
	Water ppm		28.1
	Nickel	ppm	<1.00
	Molybdenum	ppm	<1.00
	Titanium	ppm	<1.00
	Silver	ppm	<1.00
	Calcium	ppm	17.34
	Magnesium	ppm	<1.00
	Phosphorus	ppm	168.71
	Zinc	ppm	2.61
	Barium	ppm	<1.00
	Boron	ppm	16.58
	Sodium	ppm	<1.00
	Vanadium	ppm	<1.00
	Potassium	ppm	0.30
	Antimony	ppm	0.00
	Cadmium	ppm	0.27
	Manganese	ppm	1.18

TruVu 360 trending chart and historical sample data

TriVector chart, diagnostics and recommendations for the last sample is also shown.

ADAPTIVE RULE ENGINE (BETA)

DATA

Spectro Scientific Demo
US Office
Boston Site
Turbine Unit-One
U1-Turbine
U1-Boiler Feed Pump A
U1-Boiler Feed Pump B
U1-ID Fan A
U1-ID Fan B
U1-CCWP A
U1-CCWP B
U1-A Mill
U1-B Mill
U1-C Mill
U1-D Mill
U1-E Mill
U1-PA Fan A
U1-PA Fan B
U1-Preheater A
U1-Preheater B
U1-Preheater gear reducer A
U1-Preheater gear reducer B
U1-Preheater Upper A
U1-Preheater Upper B
U1-General Service Water Pmp
U1-Economizer Sonic Blower
U1-Conveyor Gearboxes
Scrubber - Waste Water
Water Treatment Plant

Last Sample: 180816101050
Scheduling Is Set: false
Diagnostics:
• Oil may have an over-extended drain interval, be contaminated, or had wrong fluid added.
• Suspect oxidation rise due to overheating, moisture, or additive depletion. Verify/Confirm with TBN decrease.

Notes:

Number of Samples: 4
Next Scheduled Sample Date:
Observations:
• Oxidation abs/0.1mm is elevated.
• V100 is high.
• V40 is high.

Limit: Engine, Heavy duty diesel

Actions:
• Change oil with approved lubricant.
• Monitor. Resample at half of normal sampling frequency.

Trend Chart

Parameter	TriVector	Sample				Parameter
		180816101050	180816100647	180816100640	180816100633	
drawingDate		8/16/2018	8/16/2018	8/16/2018	8/16/2018	drawingDate
oil		Mobil Mobil 1 5W-30	Mobil Mobil 1 5W-30	Mobil Mobil 1 5W-30	Mobil Mobil 1 5W-30	oil

Lab Quality On-site Without a Conventional Lab

MiniLab Series
for Industrial and
Power Plants
ELEMENTAL
CHEMISTRY & WATER
VISCOSITY
FERROUS
PARTICLE COUNT

MiniLab EL Series
for Racing, Railway,
Aerospace and Gen Set
ELEMENTAL
CHEMISTRY & WATER
VISCOSITY
TOTAL FERROUS
FUEL DILUTION

TruVu 360 solutions address common hurdles in implementing on-site oil analysis.

Conventional On-Site Lab	TruVu 360 Solutions
High capital investment	TruVu 360 enabled MiniLab costs about 1/3 of a full size laboratory
Large space and special facilities needed	Tabletop with no special facility requirements
Uses Hazmat chemicals	No hazardous chemicals and reagents, small sample volume, minimum waste stream
Lubricant experience required	TriVector report, built-in oil scheduling, easy-to-use interface, default component and alarm limit templates, open rule engine for quick startup and continuous improvement
Start up time can take months	TruVu 360 based MiniLab start up is less than one week

MiniLab tests are all compliant to ASTM standards

TEST	METHOD	TITLE
Elemental Analysis	D6595	Standard Test Method for Determination of Wear Metals and Contaminants in Used Lubricating Oils or Used Hydraulic Fluids by Rotating Disc Electrode Atomic Emission Spectrometry
Particle Analysis	D7596	Standard Test Method for Automatic Particle Counting and Particle Shape Classification of Oils Using a Direct Imaging Integrated Tester
InfraRed Analysis	D7889	Standard Test Method for Field Determination of In-Service Fluid Properties Using IR Spectroscopy
Fuel Dilution	D8004	Standard Test Method for Fuel Dilution of In-Service Lubricants Using Surface Acoustic Wave Sensing
Viscosity	D8092	Standard Test Method for Field Determination of Kinematic Viscosity Using a Microchannel Viscometer
Total Ferrous	D8120	Standard Test Method for Ferrous Debris Quantification

TruVu 360 Device Console Simplifies On-Site Testing

SAMPLE LIST

Target Range: Last Year ▾ From: 2017-06-06 To: 2018-06-06

Scheduled | Untested | Pre-Diagnosed | Released | Archived

External Sample ID	Sampling Point	Component Type	Oil	Sampling Date	Actions
180606075724	Sampling Point 1	Engine, Locomotive, Electro Motive Diesel	Shell Shell Omala 150	6/6/2018	🗑
180606075719	Sampling Point 1	Engine, Locomotive, Electro Motive Diesel	Shell Shell Omala 150	6/6/2018	🗑

1 Download sample list and component types

Sample list from TruVu 360 cloud software

2 Test

3 Upload test results

4 Trivector chart from rules engine

TruVu360 POWER GENERATION → PHILADELPHIA → UNIT ONE → UNIT 1 TURBINE>TURBINE THRUST BEARING>AFTER FILTER

Rotating Machine Test Sample/Equipment ID

Instrument Control

ELEMENTAL ANALYSIS — Ready
VISCOSITY — Viscosity Index 0 — Ready
INFRARED — Category / Substance — Ready
PARTICLE ANALYSIS — Dilution Ratio 0 — Ready

ELEMENTAL ANALYSIS		VISCOSITY	
Aluminum (Al)	0	v40	98.83
Antimony (Sb)	0		
Cadmium (Cd)	7.37	**INFRARED**	
Chromium (Cr)	0	Total Acid	1.16
Copper (Cu)	0.31	PPM Water	322.1
Iron (Fe)	0.48	Oxidation	2.87
Lead (Pb)	2.44		
Manganese (Mn)	2.24	**PARTICLE ANALYSIS**	
Nickel (Ni)	0.7	ISO 4/6/14	16/14/10
Silver (Ag)	0	Cnts >4	953.23
Tin (Sn)	6.63	Cnts >6	205.32
Titanium (Ti)	0	Cnts >14	10.33
Potassium (K)	1.78	Total Fe	84.3
Sodium (Na)	0.9	Large Fe	0.2
Vanadium (V)	0.81	% Large Ferrous	0.24
Silicon (Si)	1.4	Fe Wear Severity Index	16.86
Boron (B)	10.22	Cutting >20	4
Calcium (Ca)	62.18	Sliding >20	7
Barium (Ba)	8.03	Fatigue >20	3
Magnesium (Mg)	9.97	Oxide >20	3.68
Molybdenum (Mo)	0		
Phosphorus (P)	86.23	**MANUAL PROPERTIES**	
Zinc (Zn)	3.36	Flash Point	N/A

NOTES

Fatigue | Cutting
Sliding | Non-Metallic
Unknown | Water

Results Display

TruVu 360 Device Console 2.0.4.31   Copyright © 2018 Spectro Scientific. All rights reserved.   MiniLab 153

TruVu 360 Device Console

TruVu 360 User Community

Continuous education is important for a successful on-site lubricant program. With ever growing articles, videos, and structured learning modules, TruVu 360 user community is a digital community for users to share, communicate and learn the best practices of doing oil analysis on site.
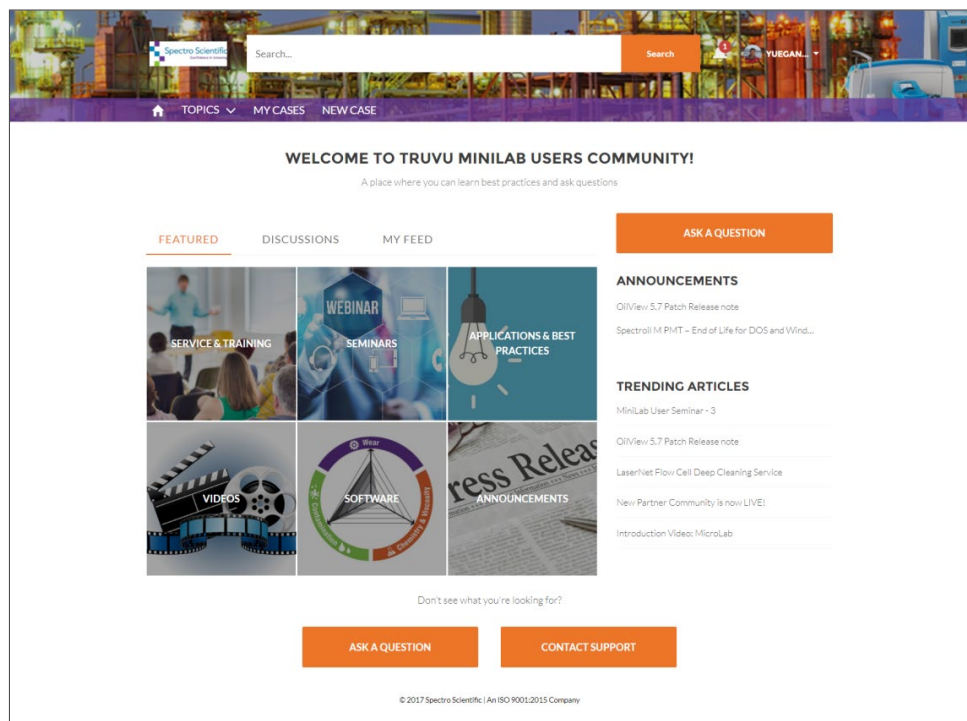
SpectroCare

SpectroCare is a service designed to provide the best customer experience using TruVu 360 enabled solutions, which include:

- Onboarding/startup service
- Expedited customer support response
- Unlimited software upgrade
- Annual preventive maintenance and calibration
- Extended warranty
- Off-site laboratory support for emergency and special diagnostics from our partner labs worldwide

TruVu 360 Product Information

PART NUMBER*	
750-00138	TruVu 360 Software Suite
100-00741	TruVu 360 Site license, 1 year
100-00744	TruVu 360 Enterprise license, 1 year
100-00747	TruVu 360 Site Reader license, 1 year
100-00795	TruVu 360 Hosted Services (1 year)
SYSTEM REQUIREMENTS	
Computer	Quad core microprocessor speed 2.6 GHz or higher and 8 GB RAM minimum.
Operating System	Windows 7 Pro or Win 10, 32 or 64 bit, US English version.

*MiniLab with TruVu 360 part numbers are in the corresponding MiniLab brochures.