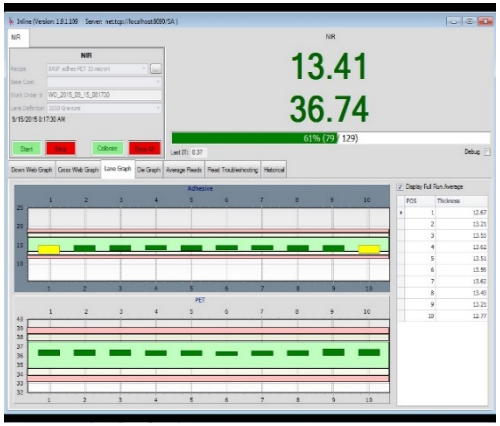
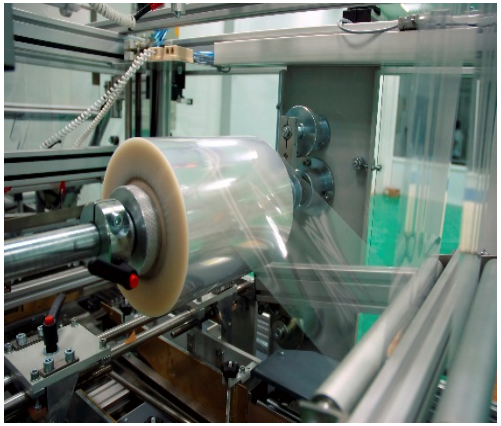
Coating and Film Thickness Measurement Solutions for Coated Materials

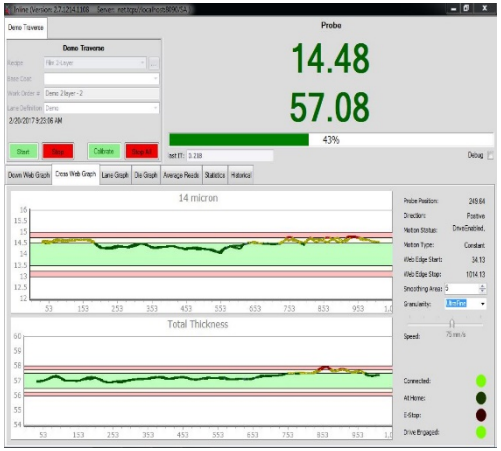




Industry, Technology and Product Overview

specMETRIX

Technology by SENSORY ANALYTICS



Sensory Analytics
The Sensory Building
405 Pomona Drive
Greensboro, NC 27407

A Next Generation of Coating Thickness Measurement & Control

SpecMetrix® systems help film plants reduce production costs, improve process control and streamline coating QA processes

SpecMetrix In-line film weight measurement systems can accurately measure thinner coatings and separate layers

- AIMCAL Technology of the Year - Coating industry award
- MetPack (EU) Innovation Award - quality/process impact
- ICE Asia Innovation Award - thinner coatings/adhesive control

Delivers immediate cost-saving impact to labs, pilot lines and film plant coating or converting lines: ROI < 6 months

Broad Industrial Utilization of SA Technology

- Flexible packaging
- Electronics
- Protective films
- Nano coatings & thin films
- Metal coils and foils
- Rigid packaging
- Medical devices
- Automotive & aerospace

New Opportunities for Improved Finish & Coating Quality

- Fast & Non-Destructive Test Method
- Non-Contact Optical Measurement
- Measurement of Wet or Dry Coatings
- Automatic Data Capture & Storage
- Measurement of Layers or Total Thickness

SpecMetrix® customer base includes global leaders:

Films
Foils
Paper

Brand Owners

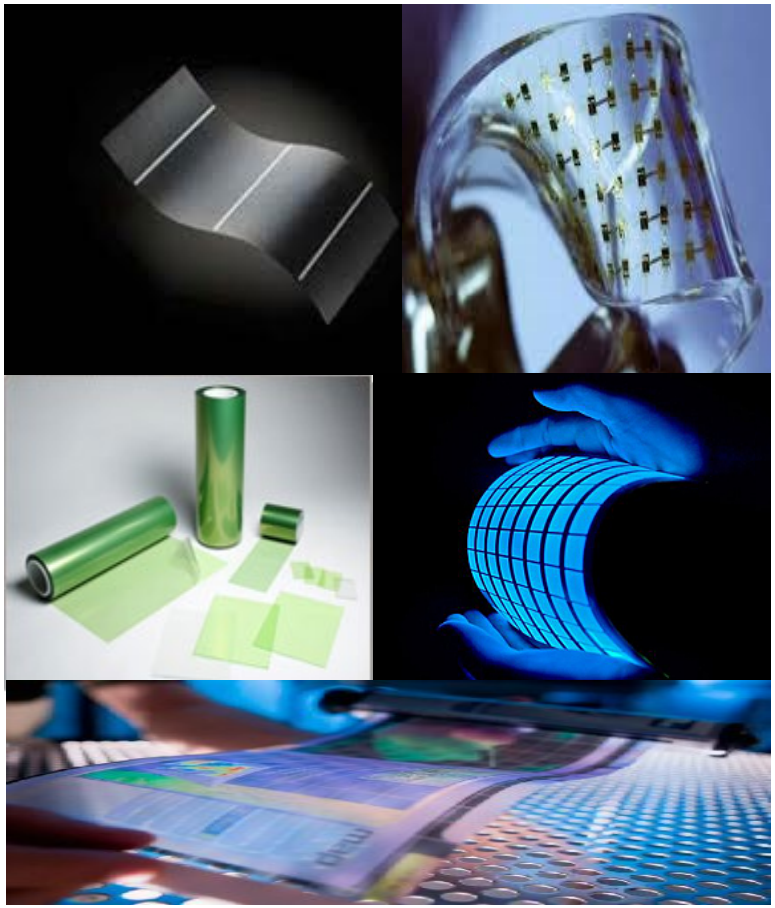
Material supplier

Selected *SpecMetrix®* Certified Films & Coatings

Clear Films and top coats	TiO2
Conformal coatings	Organic coatings
Polycarbonate films	Membranes
Anti-reflective coatings	Polyethylene
Adhesive layers	Tape coatings
Barrier coatings	Silicone coatings
Scratch resistant coatings	Electronic inks
UV coatings	Optical films
Solar control films	Release liners

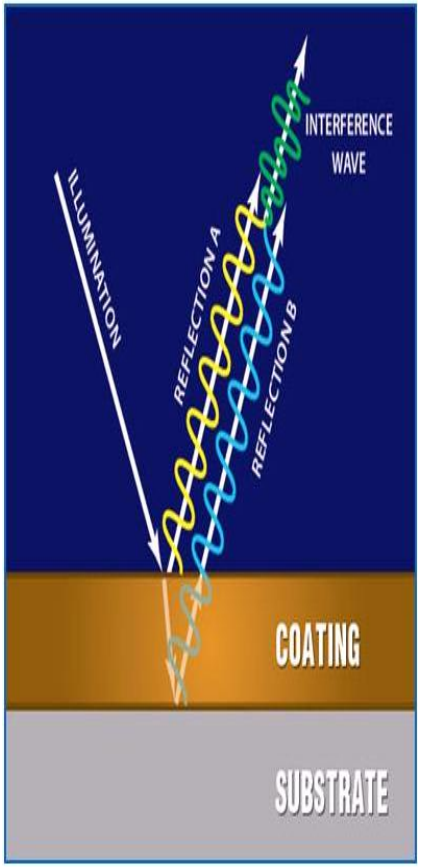
Expanding Opportunities for SpecMetrix systems

- Transparent conductors
- Flexible electronics
- Thermal transfer ribbons
- Touch screen displays
- Organic LEDs
- Conformal coatings
- Passive (nano) barrier films
- Lubricious coatings & pretreatments



Exclusive ROI Optical Measurement Technology

- Proprietary 'ruggedized optical interference' technology
- Absolute thickness measurements
- Offline and inline measurement of wet or dry coatings
- Highly precise measurement of clear and opaque coatings
- Flexible for ease of use in multiple system configurations
- Data not affected by base colors or printed substrates
- Thickness range : 0.20 to 250 microns



Technical advantages: ROI optical measurement method

- **Discrete layer measurements**
  - Not another differential measurement method
  - No need to invest in dual ‘before and after’ measurement systems
  - Multi-probe configurations can measure multiple layers in process
- **Absolute thickness measurements**
  - Highly precise and real-time measurement results
  - No necessity to calibrate on thickness/coat weight standards
- **Takes wet or dry in-process coating/layer measurements**
  - Ability to monitor immediately after coating is applied
  - Fixed probe and scanning configurations to meet QA needs
- **Non-radioactive, non-contact and non-destructive method**
  - Reduced administration and plant safety burdens
  - Continuous readings eliminate end-of-roll weight samples
  - Sample integrity maintained

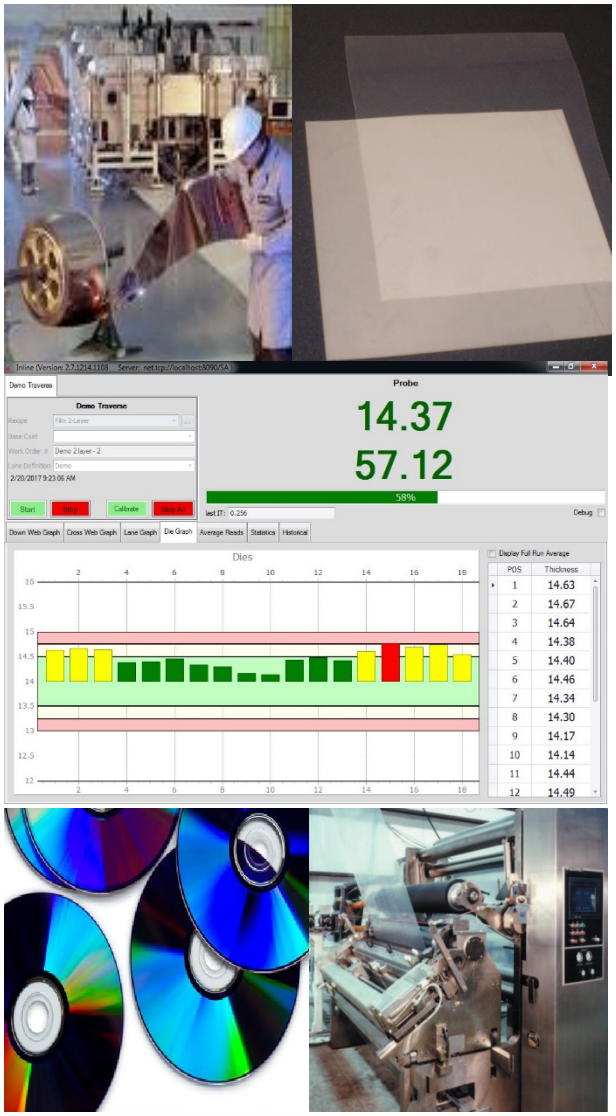
Precise coating measurement delivered to where needed most:

Corporate Quality Teams

- QA Labs and R&D Centers
- Incoming roll inspection
- Pilot lines

Process Engineering

- Production floor
- QA work stations
- Coating and material suppliers
- In-process coating measurements



SpecMetrix Systems - Superior Gage R&R Results

Gage R&R Study - ANOVA Method

Gage R&R for Measurements

Gage name: Specmetrix Gage R&R
Date of study: 01/05/2011
Reported by: V.G
Tolerance:
Misc:

SpecMetrix Thickness Measurement System
Gage R&R
Statistical Interpretation

Two-Way ANOVA Table With Interaction

Source	DF	SS	MS	F	P
Parts	2	6535.41	3267.70	151533	0.000
Operators	2	0.04	0.02	1	0.460
Parts * Operators	4	0.09	0.02	0	0.818
Repeatability	18	1.01	0.06		
Total	26	6536.55			

Alpha to remove interaction term = 0.25

Two-Way ANOVA Table Without Interaction

Source	DF	SS	MS	F	P
Parts	2	6535.41	3267.70	65305.5	0.000
Operators	2	0.04	0.02	0.4	0.669
Repeatability	22	1.10	0.05		
Total	26	6536.55			

Gage R&R

Source	VarComp	%Contribution (of VarComp)
Total Gage R&R	0.050	0.01
Repeatability	0.050	0.01
Reproducibility	0.000	0.00
Operators	0.000	0.00
Part-To-Part	363.073	99.99
Total Variation	363.123	100.00

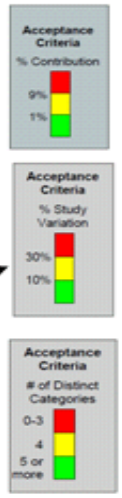
0.01% of the total variation is from the measurement system
0.01% of the total variation from repeatability problems
0.00
0.00
99.99% of the total variation is from part to part.

Source	StdDev (SD)	Study Var (6 * SD)	%Study Var (%SV)
Total Gage R&R	0.2237	1.342	1.17
Repeatability	0.2237	1.342	1.17
Reproducibility	0.0000	0.000	0.00
Operators	0.0000	0.000	0.00
Part-To-Part	19.0545	114.327	99.99
Total Variation	19.0558	114.335	100.00

1.342% Measurement System STDV (R&R) as a % of Total Observed Process STDV

Number of Distinct Categories = 120

The number of distinct categories within the process data that the measurement system can discern



All SpecMetrix systems ship with verified Gage R&R results of <5%

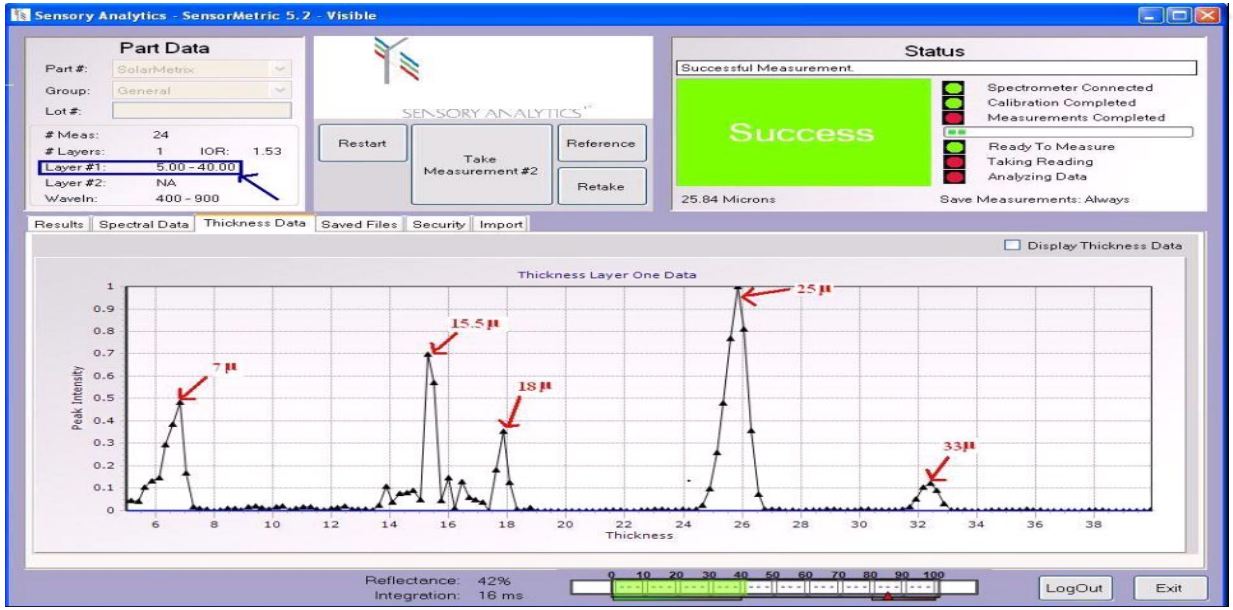
Product Configurations for Coated Films and Related Applications

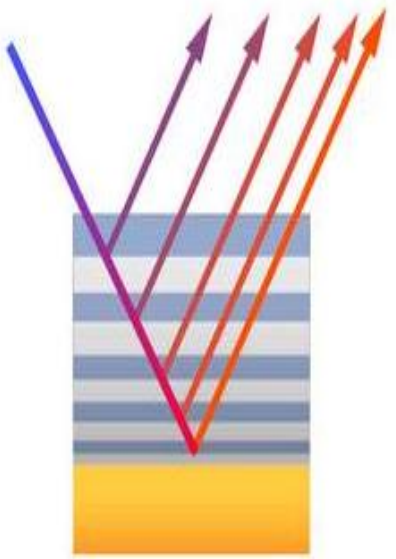
SpecMetrix® Lab systems with flexible fixture designs

Test sample stand *Flat sheet / wide film arm* *Thin film stage*

- Non-Contact and non-destructive film package and coating QA analysis
- Preferred lab ‘forensic tool’ for determining coating or layer thickness defects
- Enhanced Lab system adds In-line software with one ruggedized probe
- Flexible designs enables future upgrade into *SpecMetrix In-line* configuration

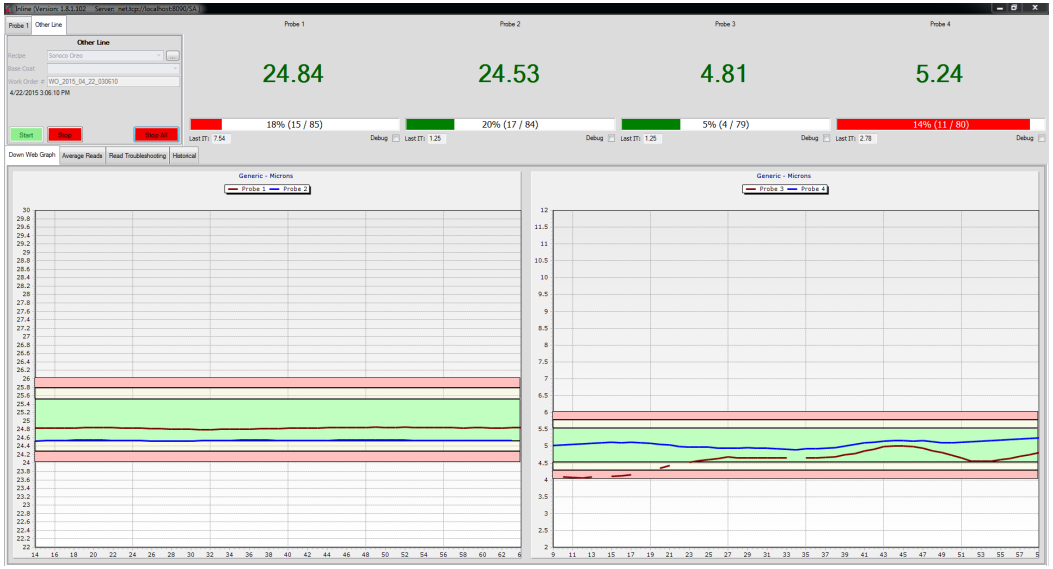
Lab system: View of multiple layer coating stack





- Simultaneous measurement of multiple coated layers
- Reflection is generated from each interface of multi-layer surfaces
- Thickness peaks shown for individual layers and combination of layers
- Suitable for adjacent layers with dissimilar refractive index values
- Well-suited for ‘film weight forensics’: review of finished coated products
- QA data can be collected without wasteful destruction of sample

Technology Implementation: Multi-Channel fixed

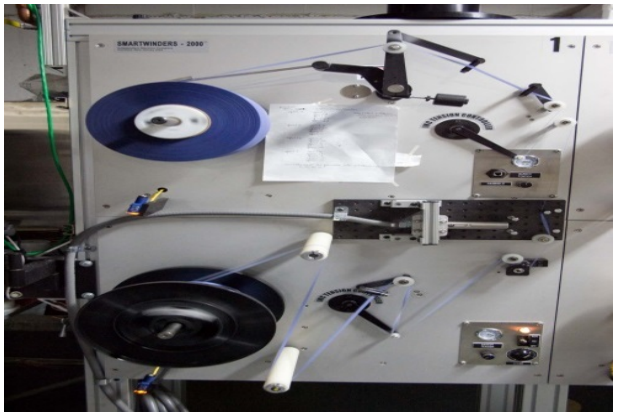


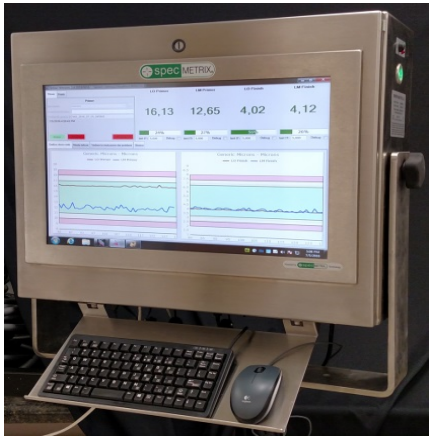
Regularly used for in-process coating measurement on metal and webs

Flexible *SpecMetrix® In-line* System Designs

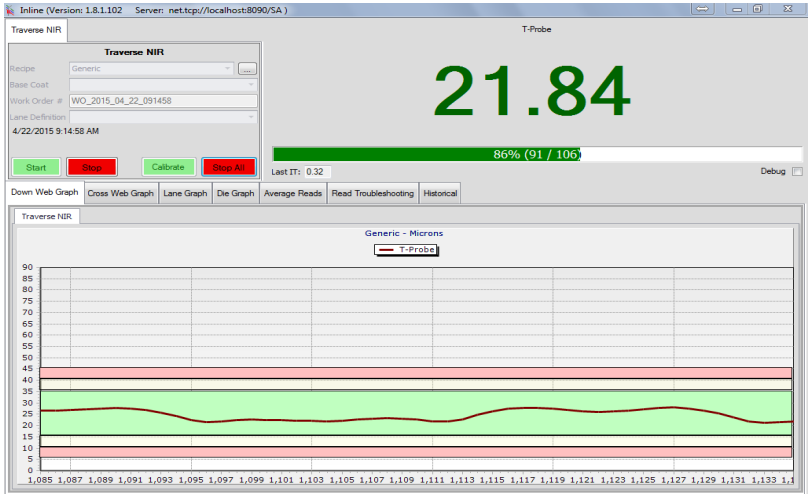
Fixed Probe Configurations

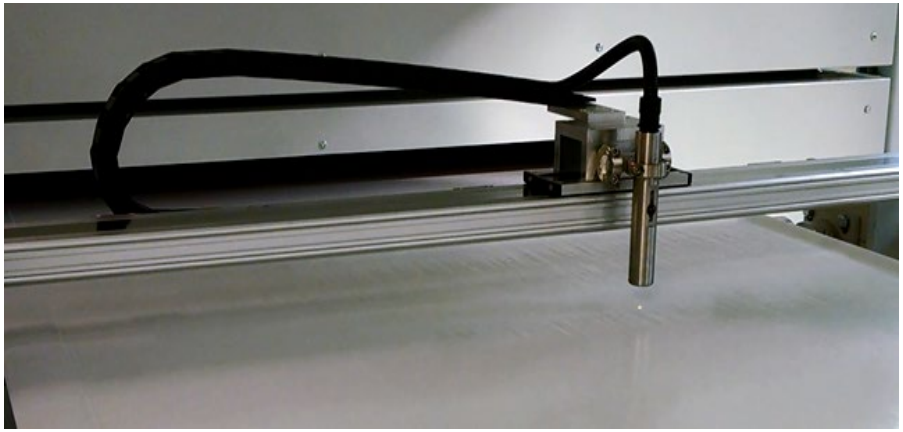
- In-process inspection of wet or dry films & coatings
- Flexible for multiple film and web applications
- Current line speeds up to 1,800 feet per minute
- Takes 100+ measurements per second per probe

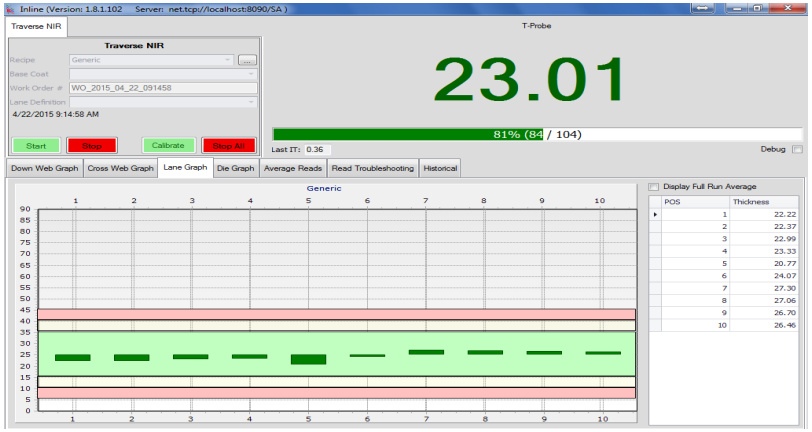




Technology Implementation - Scanning systems



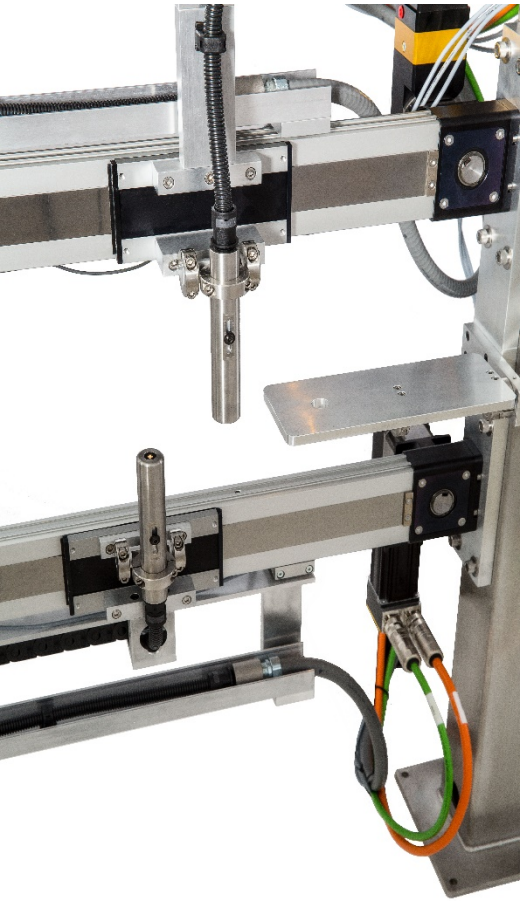




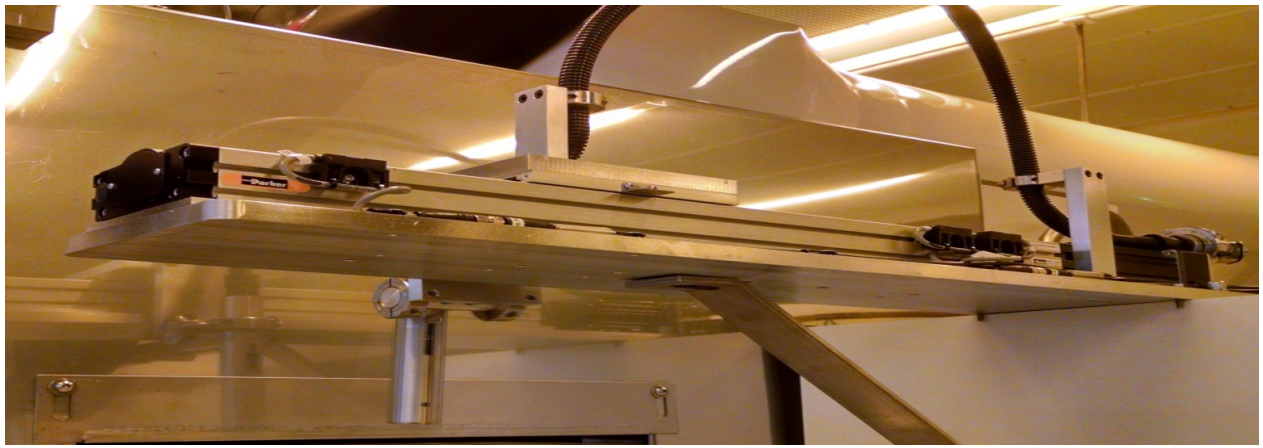
Provides full side-to-side coating thickness characterization on Films & Foils

Flexible *SpecMetrix® In-line* System Designs

Traversing Configurations



- In-process inspection of wet or dry film coatings
- Traversing systems for cross and down web QA
- Measurement pattern selected by plant team
- Small system footprint enables flexible plant use
- OEM integration or direct SA installation options



In-Process Coating Measurement Control Systems - Split

- In-line inspection of wet or dry films or coatings on **2 adjacent coaters**
- Replaces need to buy two systems
- Can be used with a single operator station with 2nd View-Only monitor or two full control stations
- Lines share one centrally located processor and electronics cabinet
- Split system takes 1 measurement per second from 4 probes mounted on <u>two</u> lines
- Running average shown – with all data saved or ported to data system

In-Process Film Weight Control Systems - **Tandem**

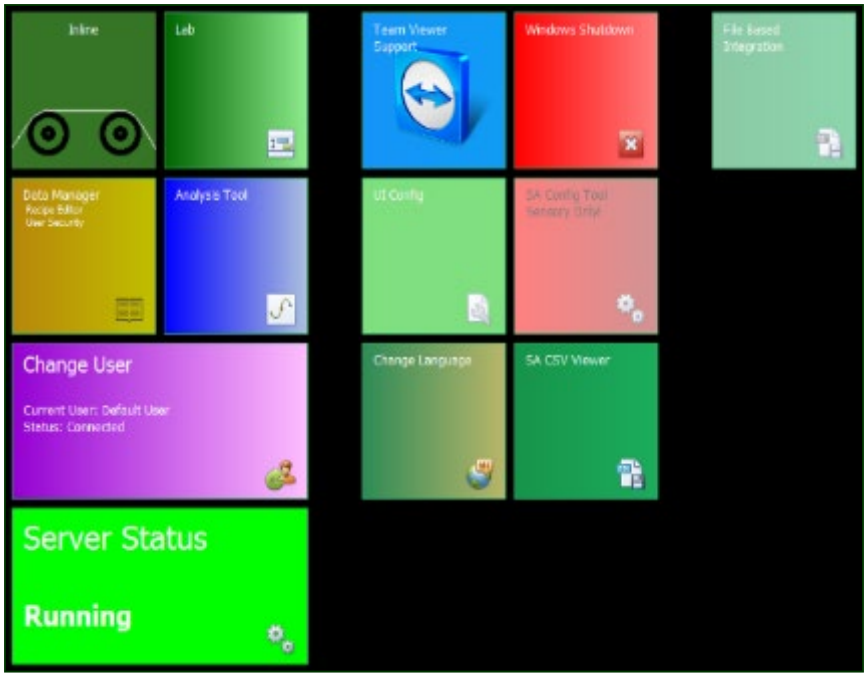
- In-line inspection of wet or dry films or coatings on **two coaters on a tandem coating line**
- Replaces need to buy two systems
- System includes two full control stations
- Lines share a common processor and electronics cabinet
- Running average shown – with all data saved or ported to data system
- Tandem systems take 1 measurement per second from 4 probes mounted on two coaters on one tandem coating line

SpecMetrix® Certified Facility Award Initiative

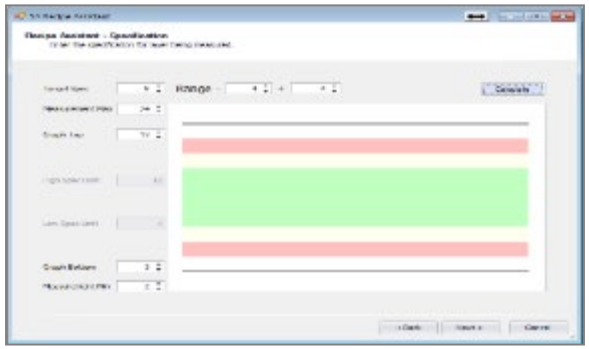
- Exclusive use of SpecMetrix systems on all plant coating and print varnish lines
- Elimination of all off-line capacitance and hover probe type gauging systems
- Training of plant champion and all other plant coater operators
- "SpecMetrix Certified" status is then awarded
- Multiple global leaders are in active process
- Significant benefits to plant:
  - ✓ Highest level of film weight quality attained
  - ✓ Better trained and engaged plant team
  - ✓ Global customer recognition for quality
  - ✓ Reduced plant costs and increased sales

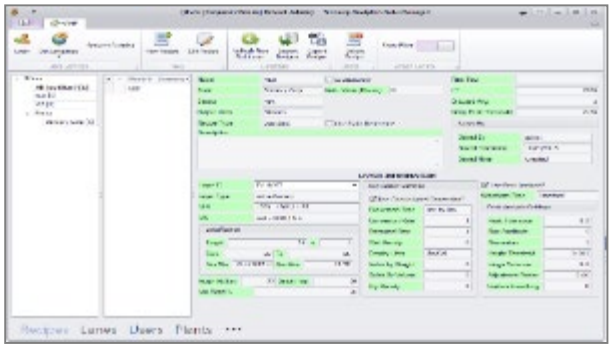
SpecMetrix® Software and Integration

SpecMetrix In-line Systems – Operating Software Features



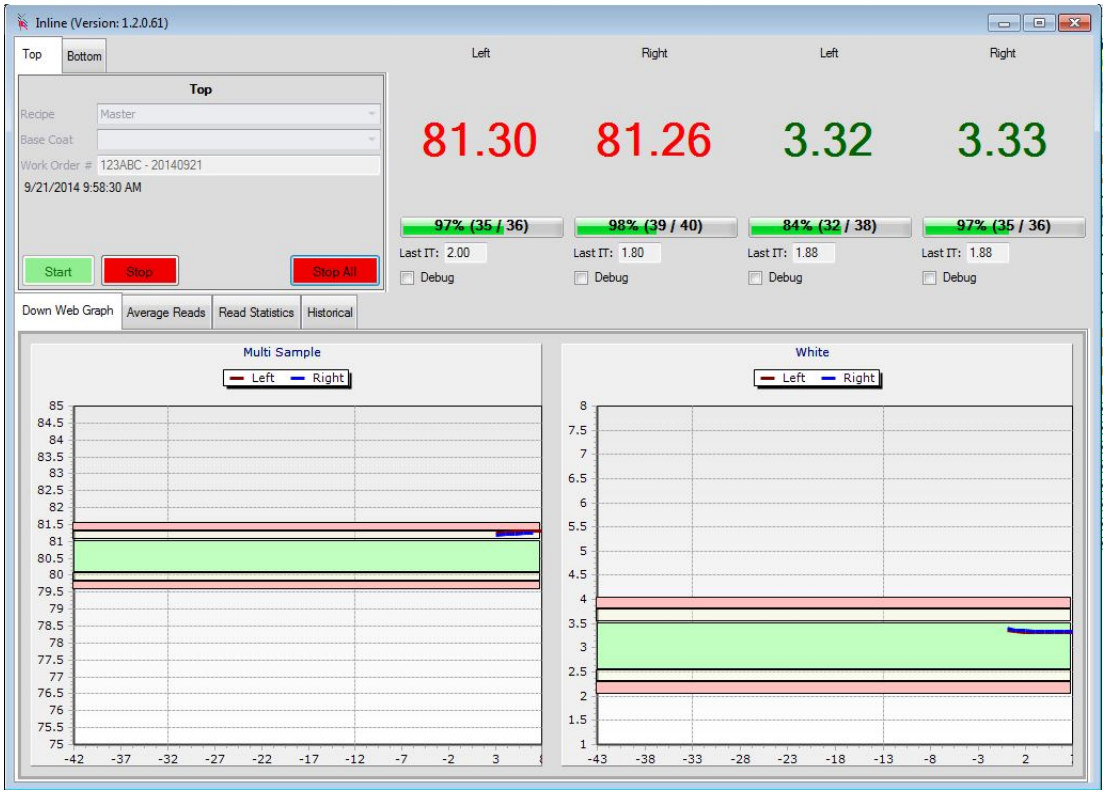
- User friendly system navigation
- Host country language options
- Easy to use coating Recipe Editor
- Available Recipe Wizard feature
- Secured User/Administrative levels
- Corporate database functionality
- On-line Support and S/W updates





SpecMetrix® In-line Coating Measurement Systems

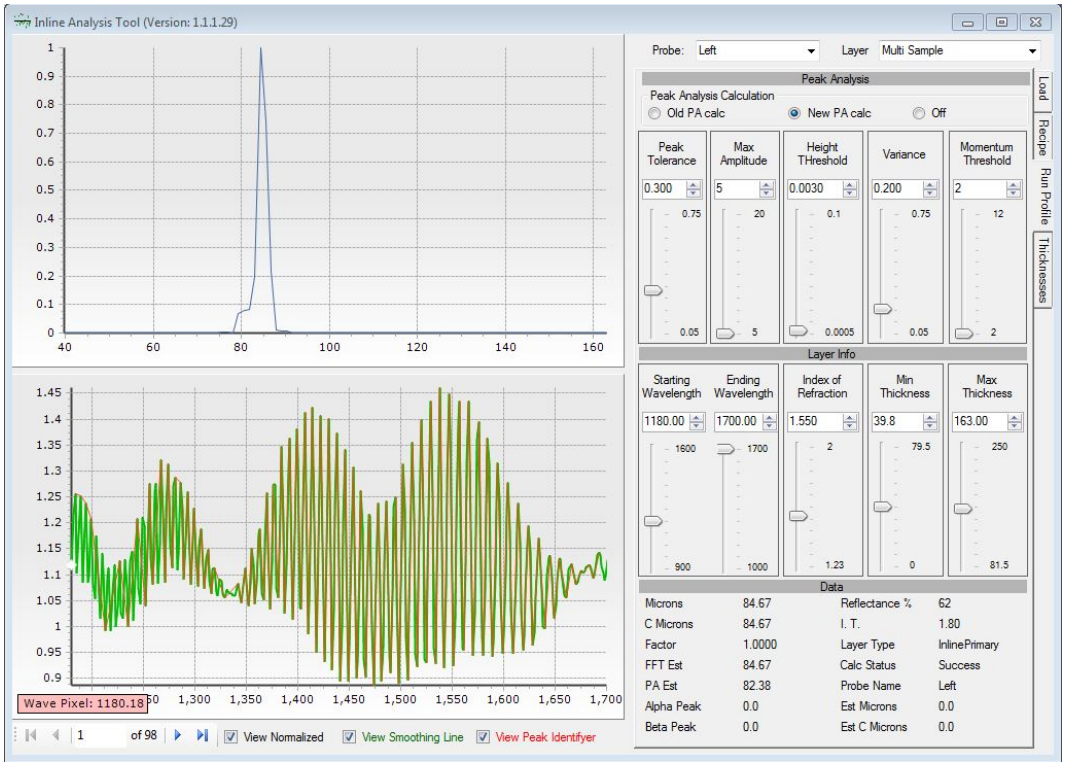
Top and Bottom Multi-Probe Setup



Multiple recipes can be defined for different probe sets, top and bottom

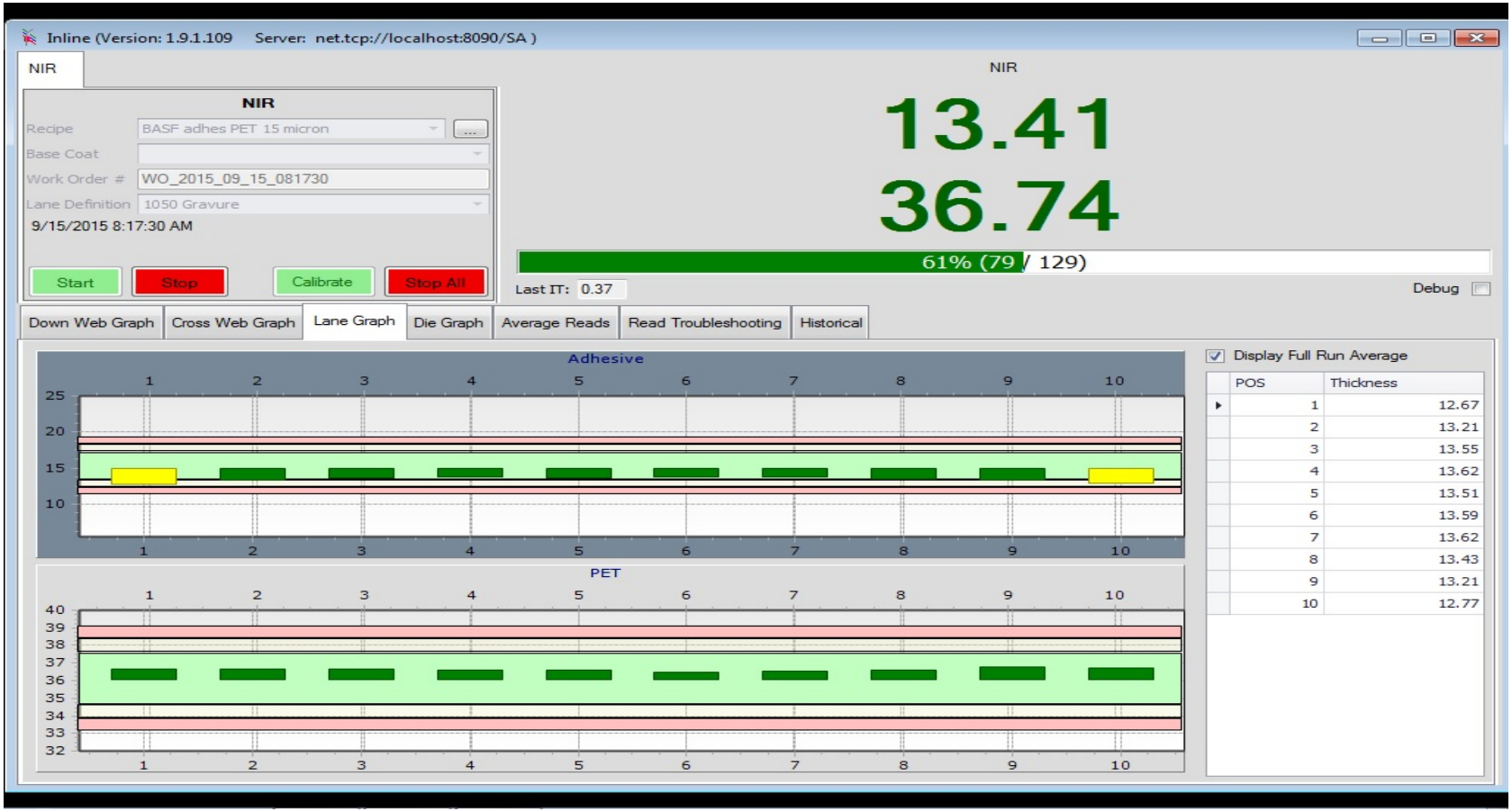
SpecMetrix® In-line Coating Measurement Systems

In-Line Analysis Tool



Review recipe setup dynamically by changing variables

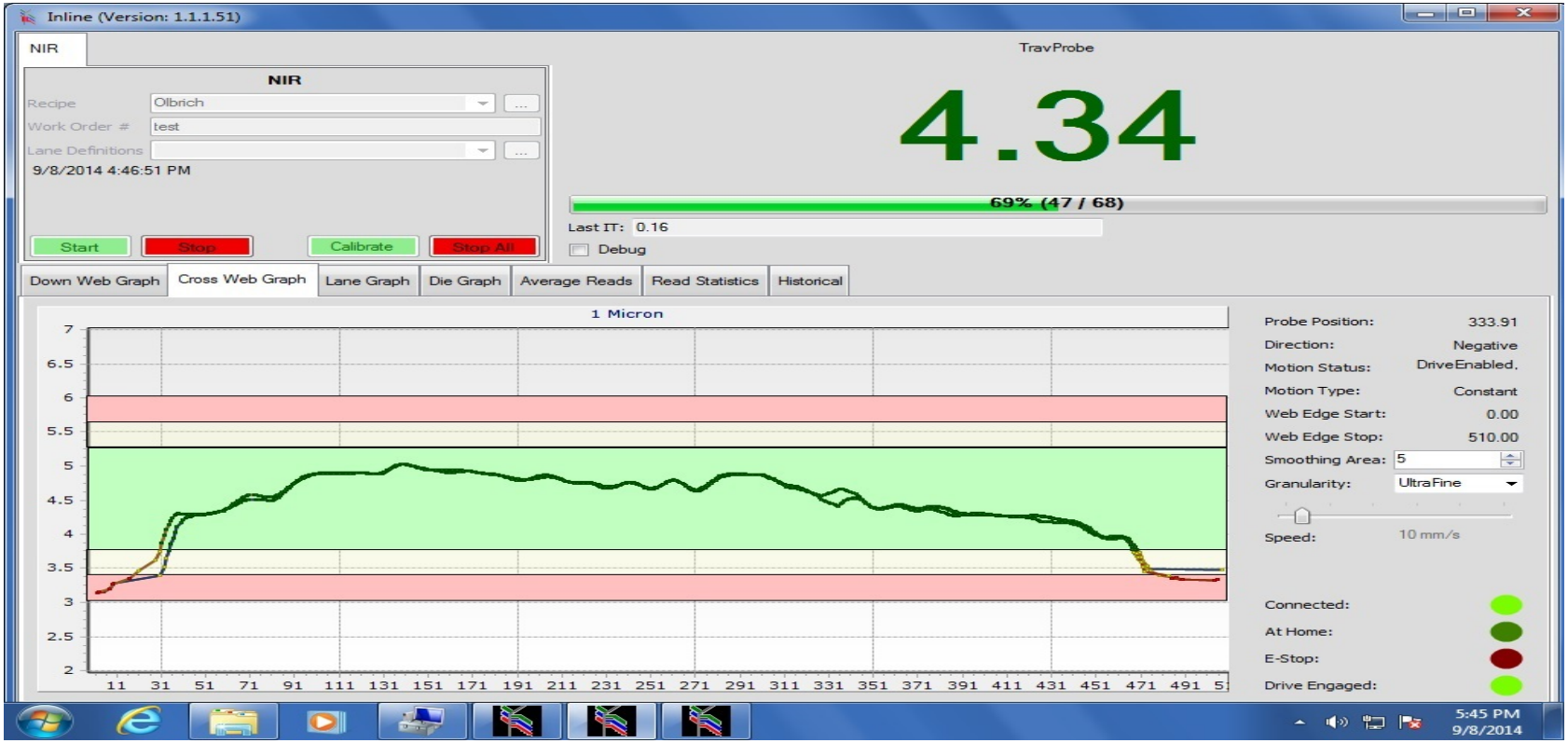
SpecMetrix® In-line Coating Measurement Systems



In-process measurement of base film and applied wet adhesive layer

SpecMetrix® In-line Coating Measurement Systems

UV coating variations vs Weight checks



Weight checks can miss web variations that can be detected with in-line tools

Easy Data Integration to Coater and Plant Systems

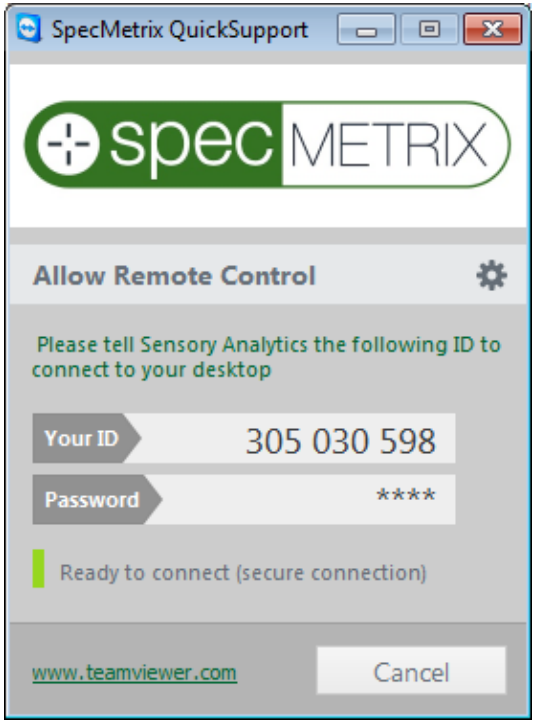
- OPC and PLC communication are available through Kepware standard interface software with standard tag ID's.
  - Many options available – Allen-Bradley, Siemens, GE, Wonderware, OPC
  - Sensory will provide list of field names, customer is responsible for programming their PLC side
  - Sensory will assist with final communication testing

- SpecMetrix will monitor a port for Incoming messages if customer wants to control startup of measurements and recipes from another system
  - Coating ID
  - Batch ID
  - Start/Stop commands

- SpecMetrix will send the following Outgoing messages:
  - Heartbeat telegram every 10 seconds
  - Data telegram with measurement data every 5 seconds
  - Status telegram with any signal errors

Remote Assistance

- Sensory Analytics is always available to help! 24/7 customer support line to assist with recipe or hardware questions
- Teamviewer remote desktop support is also provided with every system
- Allows Sensory technicians to quickly diagnose problems
- Sensory can modify recipes remotely during a live batch to keep production up and running



Summary: SpecMetrix® Systems Benefits

- Robust and accurate real-time absolute thickness measurements, with e-record of web data
- Non-contact, non-destructive and low maintenance alternative
- Ability to measure wet or dry and discrete layers in-process – even in sub-micron range
- Better throughput, with no need to stop the line for off-line testing
- Data integration and batch start/stop coordination
- Direct remote assistance for recipe questions, analysis
- Improve product quality, minimize process control issues
- Reduced costs through minimizing over application and waste stream
- Discrete layer measurement

Improving the performance of all coated products

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See all of these specMETRIX systems firsthand at www.specmetrix.com

White papers	Gage R&R reports	Product videos