



Automotive Presentation



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R&D / HQ: Manufacturing



Medford, OR

- ★ Manufacturing Operations
- ★ Service & Repair Center
- ★ Central Calibration Lab
- ★ RMA Center



Fremont, CA

- ★ Research & Development
- ★ Engineering
- ★ Pilot Production
- ★ Executive Management



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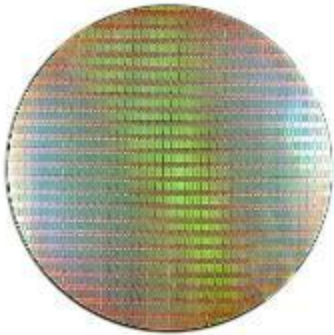
New Headquarters: **Silicon Valley**





Industries:

Semiconductor



Flat Panel



Aerospace



Pharmaceutical

**High Technology Industries
Needing Contamination Control**



Data Storage



Industries:

Automotive



Food/Beverage



Defense/Homeland Security

High Technology Industries
Needing Contamination Control



Medical



Air Quality



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Semiconductor Customers





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Aerospace and Defense Customers

BAE SYSTEMS

Raytheon

**GENERAL
DYNAMICS**



**THE AEROSPACE
CORPORATION**





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Industrial: Paint, Lithium Ion Battery, and Plastics

SABIC
Innovative
Plastics™



NOKIA
Connecting People



A123
SYSTEMS





Lighthouse Focus on Quality

ISO 9001:2000 Facilities



United States:
Medford, OR
San Jose, CA



The Netherlands:
Alphen



Singapore



Thailand

5 Lighthouse Locations are ISO 9000 Registered



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Monitoring Solutions

Contamination: *"Any foreign material or energy that has a detrimental effect on a product or process"*



Monitoring Solutions

General Monitoring

- ✓ Air Particle
- ✓ Liquid Particle
- ✓ Temperature
- ✓ Humidity
- ✓ Differential Pressure
- ✓ Electrostatic Charge
- ✓ TOC

Specific Applications

- ✓ Current on FFU's
- ✓ Chillers
- ✓ Door Switches
- ✓ Oven Temp
- ✓ Dry Box Humidity
- ✓ Gas Purity
- ✓ Large LCD Displays



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Lighthouse Family of Products



World's Number One Particle Counters!



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Particle Counters: **HANDHELD**



- ★ Handheld 2016
- ★ Handheld 3016
- ★ Handheld 5016
- ★ Handheld 3016 IAQ



Touch Screen Interface



Removable Battery



Temp/Hum Probe



Portable Particle Counters: SOLAIR



SOLAIR 5100+/3100+

0.5/0.3 Micron

1.0 CFM



Touch Screen Interface



SOLAIR 5200+/3200+

0.5/0.3 Micron

2.0 CFM or 50 Liters per Minute



Removable Battery



SOLAIR 1100+

0.1 Micron

1.0 CFM



Alphanumeric Location Labels



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Products: Boulder Counter



- ★ 0.5 Micron Detection
- ★ 1.0 CFM
- ★ Range: 0.5 – 100 micron
- ★ USB Download
- ★ Concentration Limits of
>500,000 Particles / Ft³
@ 5% Coincidence Error
- ★ Suitable for ISO Class
Cleanrooms 1-7
- ★ USB Key Interface



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Particle Counters: Remotes (External Vacuum)



**Class 1 Div 2
Rated**

Remote Counters

- ★ 0.1 to 100 Micron
- ★ 0.1 or 1.0 CFM
- ★ 2, 4, or 6 Channel Sizes
- ★ Class 1, DIV 2 Rated
- ★ External Vacuum
- ★ 20 Year Laser Life
- ★ Communications
 - ★ 4 – 20mA
 - ★ Ethernet
 - ★ MODBUS



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Particle Counters: Remotes (Internal Vacuum)



Worlds Only
Remote that
goes from 0.5 to
100 micron

Remote Counters

- ★ 0.1 to 100 Micron
- ★ 0.1 or 1.0 CFM
- ★ 2, 4, or 6 Channel Sizes
- ★ Class 1, DIV 2 Rated
- ★ Internal Vacuum
- ★ 20 Year Laser Life
- ★ Communications
 - ★ 4 – 20mA
 - ★ Ethernet
 - ★ MODBUS



Environmental Parameters



★ Temperature/Humidity Sensors

- ★ Room

- ★ Ovens

- ★ Freezers



★ Differential Pressure

- ★ Room to Room

- ★ Mini Environment



★ Air Velocity

- ★ Cleanroom

- ★ Ducts



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Alarm Lights



Ceiling Mounted



Tool Mounted



Flush Mounted

★ **Ceiling Mount Alarm Lights**

★ **Flush Mount Alarm Lights**



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Automotive



Auto Industry: The industry is moving to cleaner manufacturing to decrease re-work caused by contamination issues

- ★ **Painting Process (Class 10k and beyond)**
- ★ **Stamping Process (Class 100K)**
- ★ **Fuel Injectors (Class 10K)**
- ★ **Lithium Ion Batteries (Class 1k)**
- ★ **Headlights (Class 1K)**
- ★ **Dashboards (Class 100k)**



TOKAI RIKAI GROUP





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Paint Booth: The Process

Case Study: Auto Manufacturer

Body is assembled then washed with a phosphate wash and clean water rinse. (water is from an R.O. system, filters are changed regularly but no particle counts are taken)



The body is then sent to a cleanroom where it is taped and prepared for paint. Clean air is blowing on the car during this process to remove any particles. This is a critical step and there is current interest in real time systems in this location.

The body is then sent through the automated paint process. There are 5 coatings applied to the car (E.D. coat, primer, 2 color coats, and clear). There are bake processes in between all coats except the final color and clear.





Paint Booth: Problems

Case Study: Auto Manufacturer

5 ~15 micron particles on the surface to be painted will cause defects on the final painted surface.

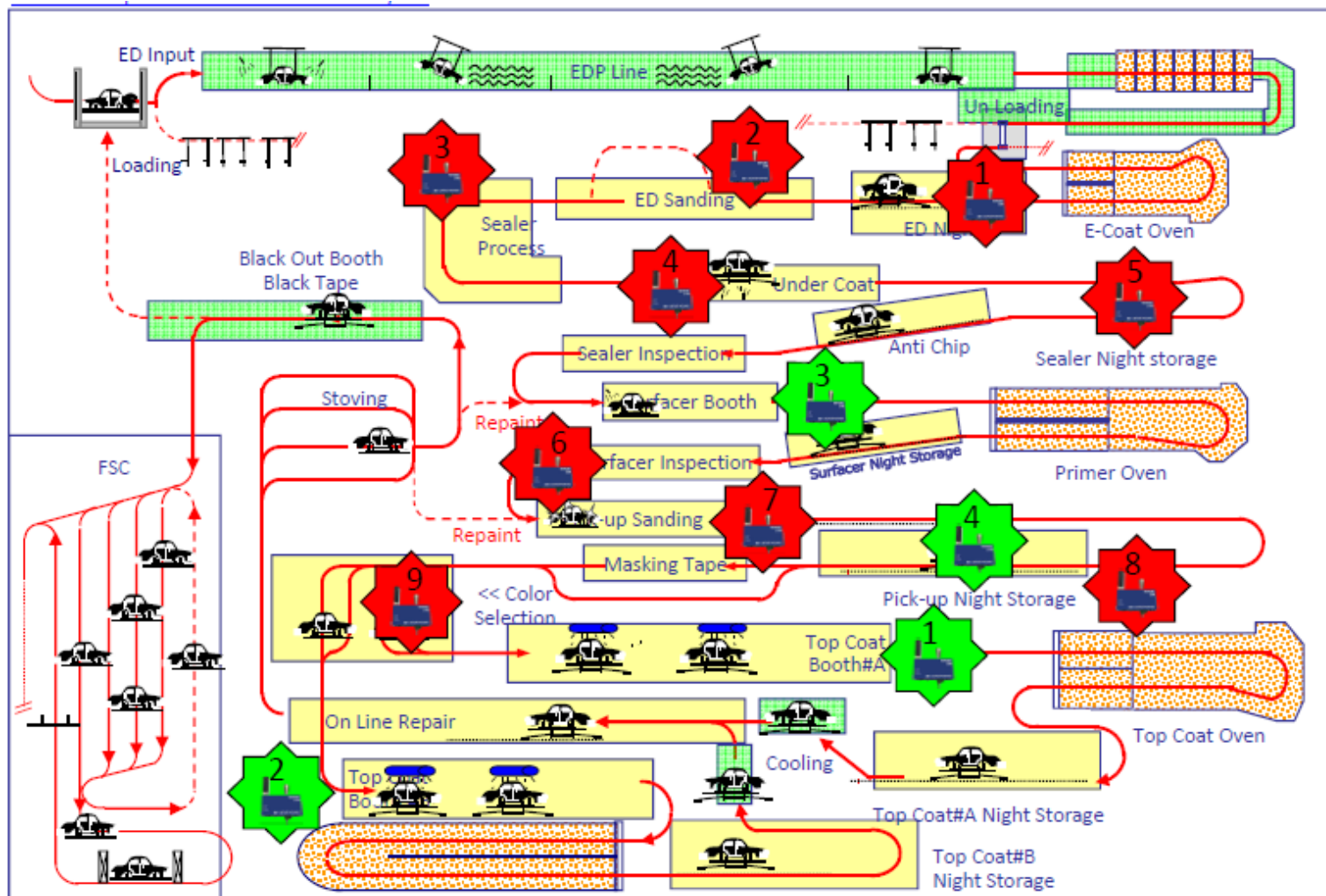
There are multiple layers in the painting process. E.D. coat, primer, two paint layers, and clear coat.

The 15 micron particle defect grows with each paint coating, eventually ending in a visible defect on the surface of the car.





Paint Shop Contamination Control Layout



Green : Installed
1. Top Coat Booth#A
2. Top Coat Booth#B
3. Surfacers Night Storage
4. Pick-up Night Storage

Red : New Installation
1. ED Night Storage
2. ED Sanding
3. Sealer Process
4. Under Coat (PVC)
5. Sealer Night Storage
6. Surfacers Inspection
7. Pick-up Sanding
8. Pick-up Night Storage
9. Color Selection



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R50104





Hardware installation





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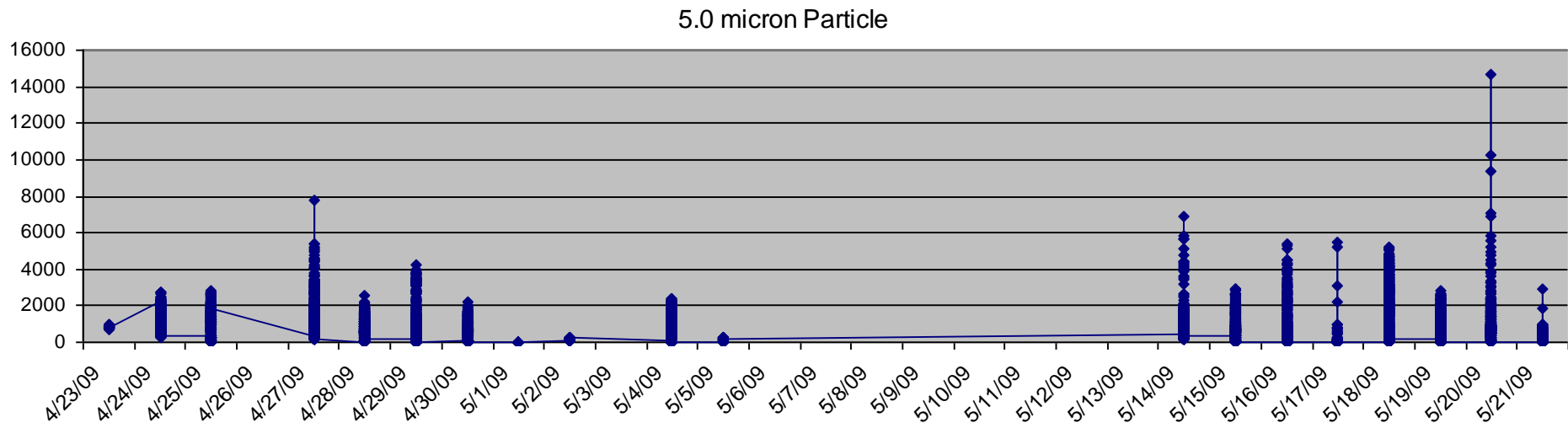
Venturi Vacuum Pump



- ★ Vacuum Gauge
- ★ Silencer
- ★ No Moving Parts
- ★ No Power Required
- ★ Low Maintenance
- ★ Low Operation Cost
- ★ Compressed Air Required



Data of 5 um particle by day

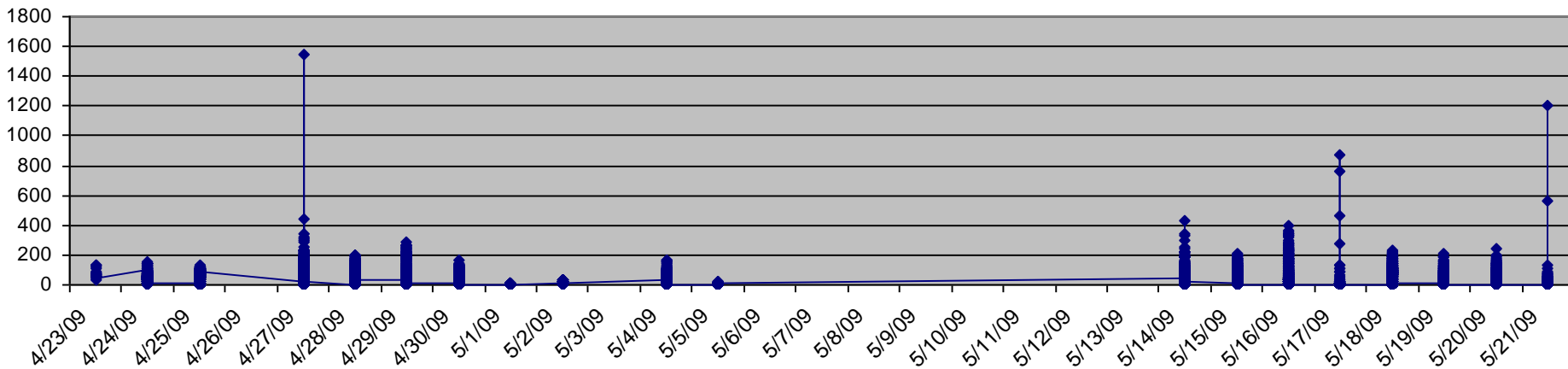


- Particle is high on the working day and low or zero on non-working day (and/or no data collection day)
- Average particle counts per minute on working day is 1,000 - 2500 counts



Data of 10 um particle by day

10.0 micron Particle

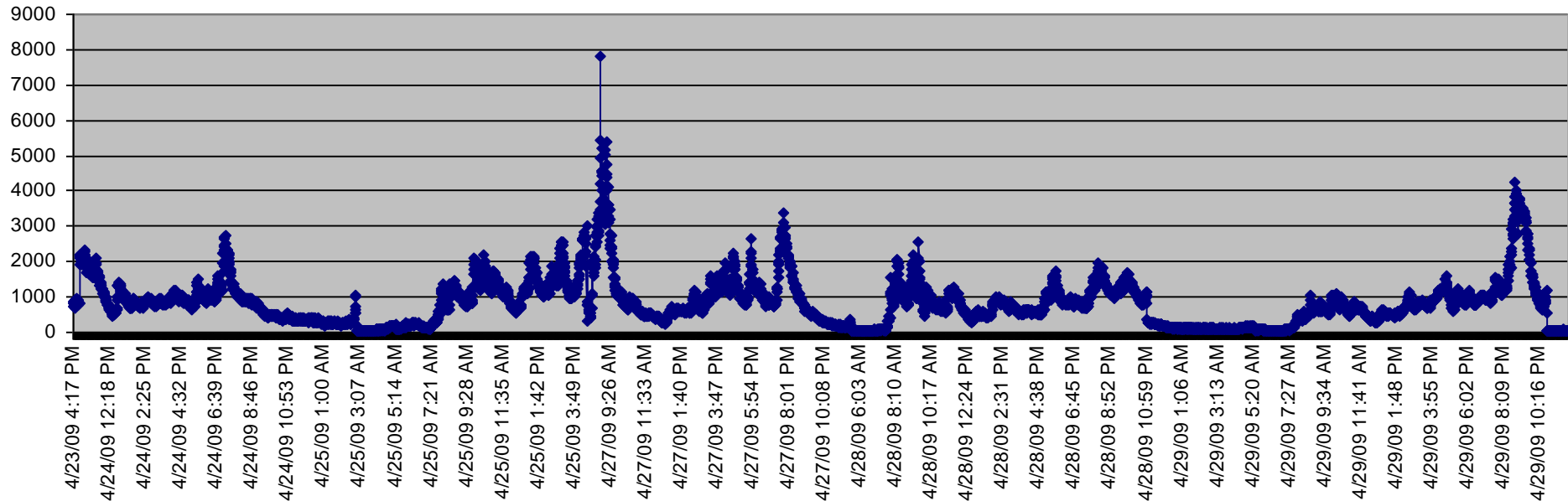


- Same trend as 5 um particle is observed, however 10 um particle is less in count.
- Average particle per minute is 100 - 180 counts
- There is no particle size 50 and 100 um found during the demo period.



Zoomed data from 4/24/09 – 4/30/09

5.0 micron



- High particle is observed during 8 AM to 10 PM
- Low particle is observed during 1 AM to 7 AM
- Is this time match with Toyota working hour?



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Benefits of a Cleanroom Monitoring System

- ★ **View conditions of all cleanrooms real-time**
- ★ **Alarms on catastrophic events**
- ★ **Provides visual, audible, electronic or pager notification to engineers and operators**
- ★ **Automates sensor data collection**
- ★ **Analyze and measure cleanroom performance**



Benefits of a Cleanroom Monitoring System

- ★ **Highlights contamination problems**
- ★ **Correlates problems to other parameters and yields**
- ★ **Identifies trends and provides early warnings**
- ★ **Reduces failure analysis times**
- ★ **Assists in post-mortem analyses**
- ★ **Allows for historical analyses**



Benefit of Particle Monitoring



ED powder seed



Paint seed



Dust seed



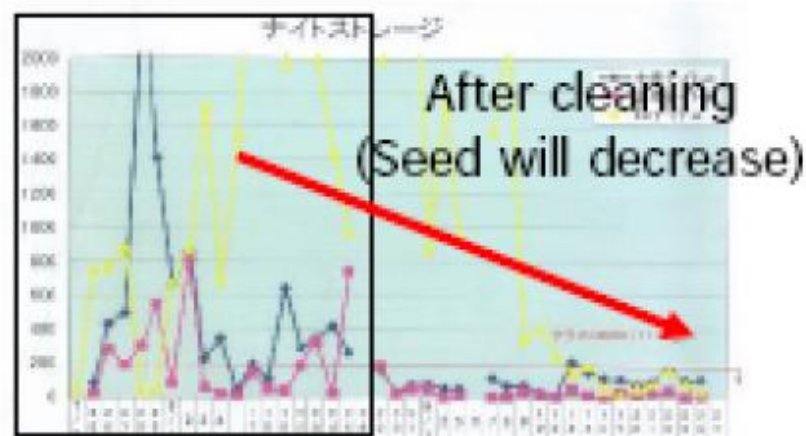
Yarn seed



Oven seed

- **Seed defect - caused from dust or small particle**
- **Level of particle and clean area is unknown.**
- **Need equipment to measure and classify clean area to improve quality.**

Before cleaning





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Systems

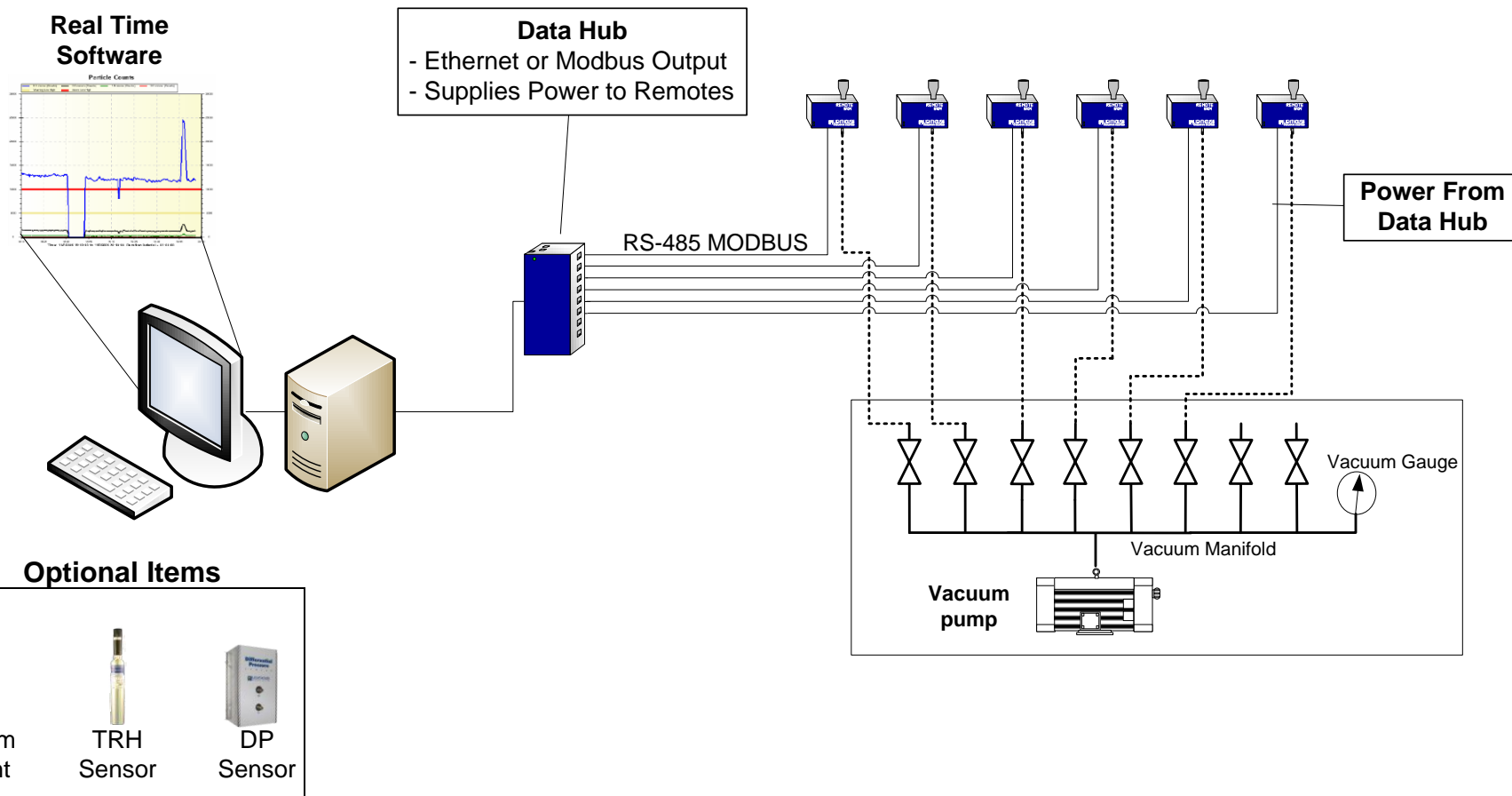


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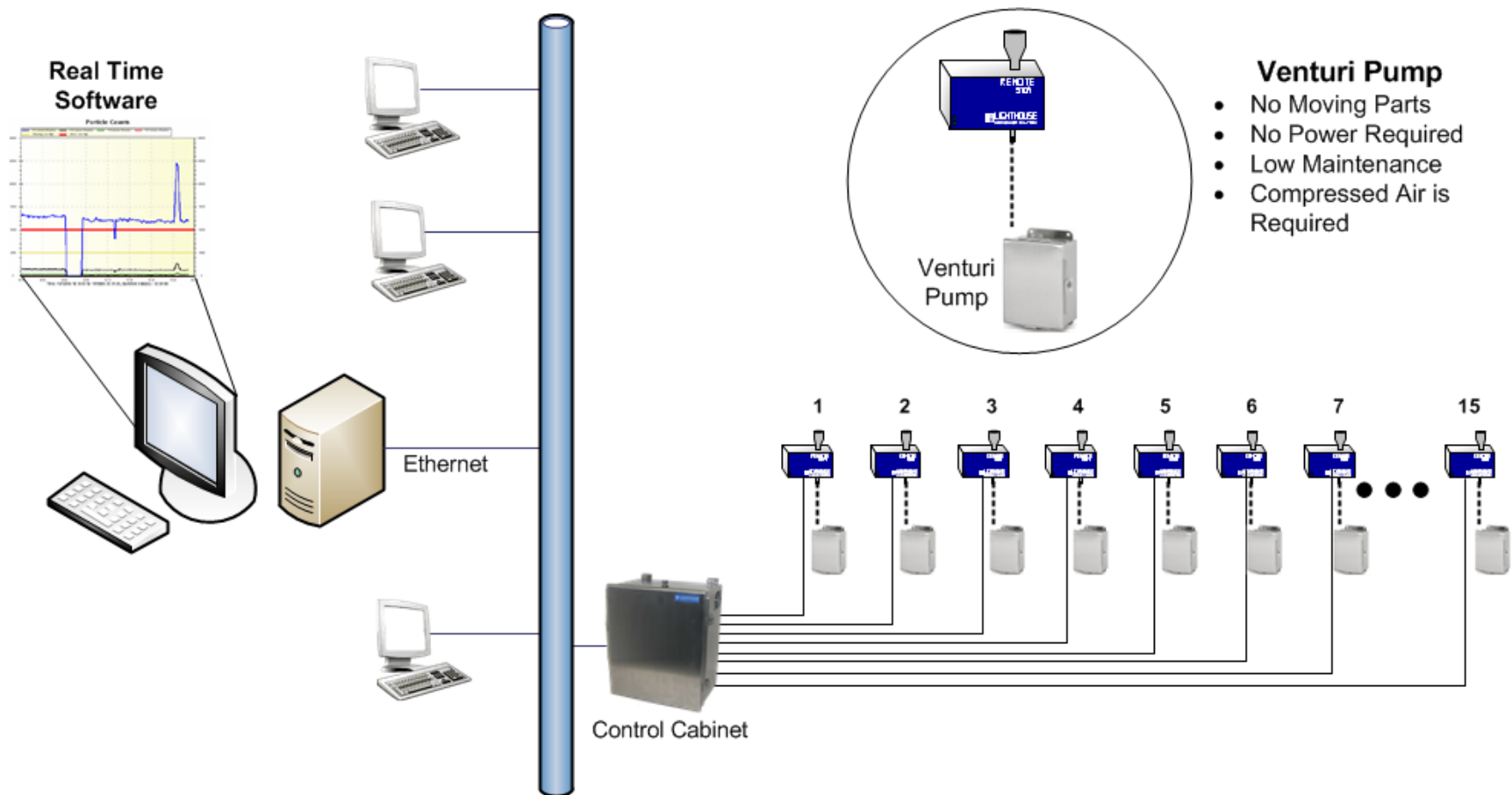
Online Systems – Star Configuration

6 Real Time Particle Counters with External Vacuum Pump





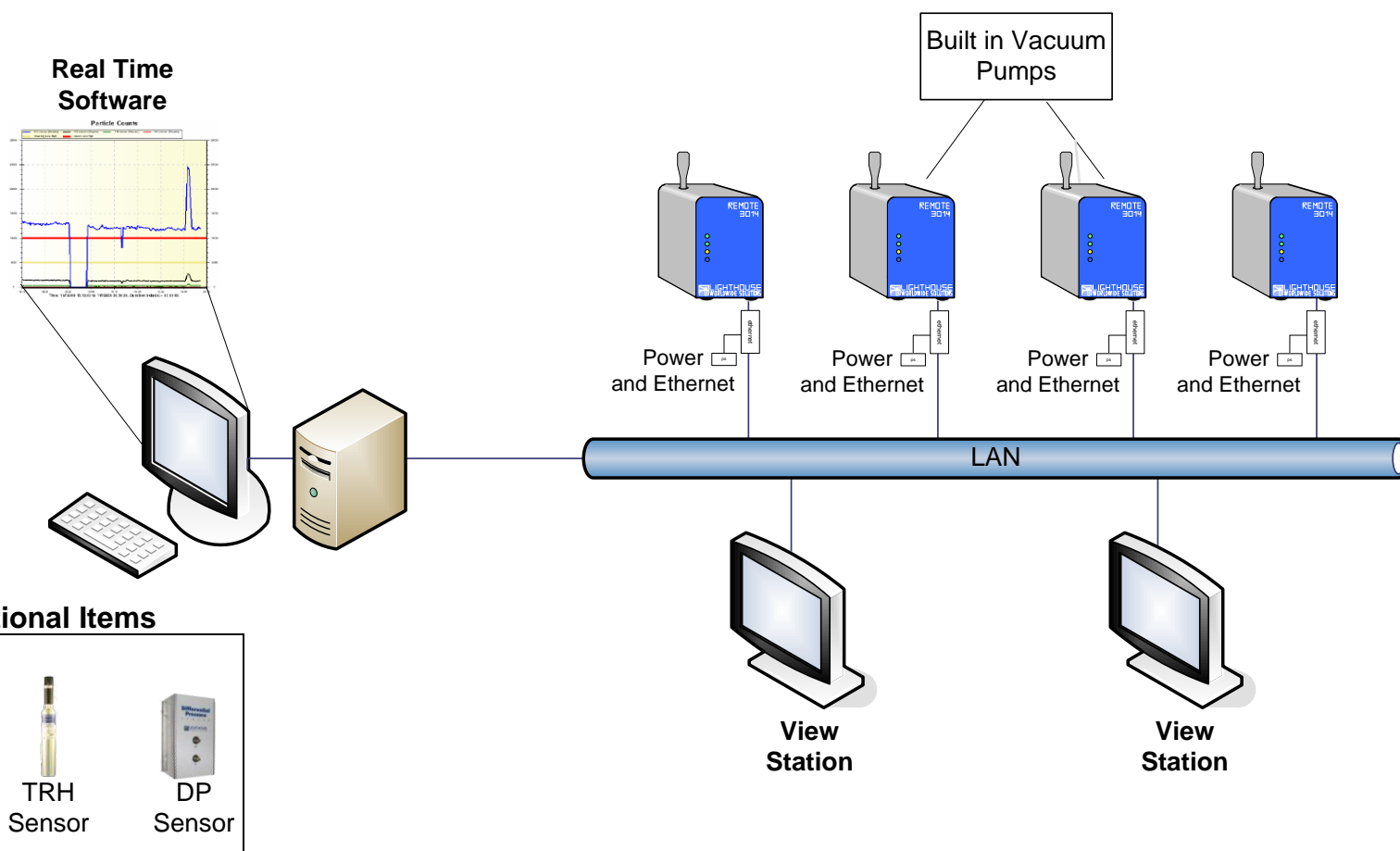
System Structure





Online Systems- Network Configuration

4 Real Time Particle Counters with Built in Vacuum Pump Over Ethernet

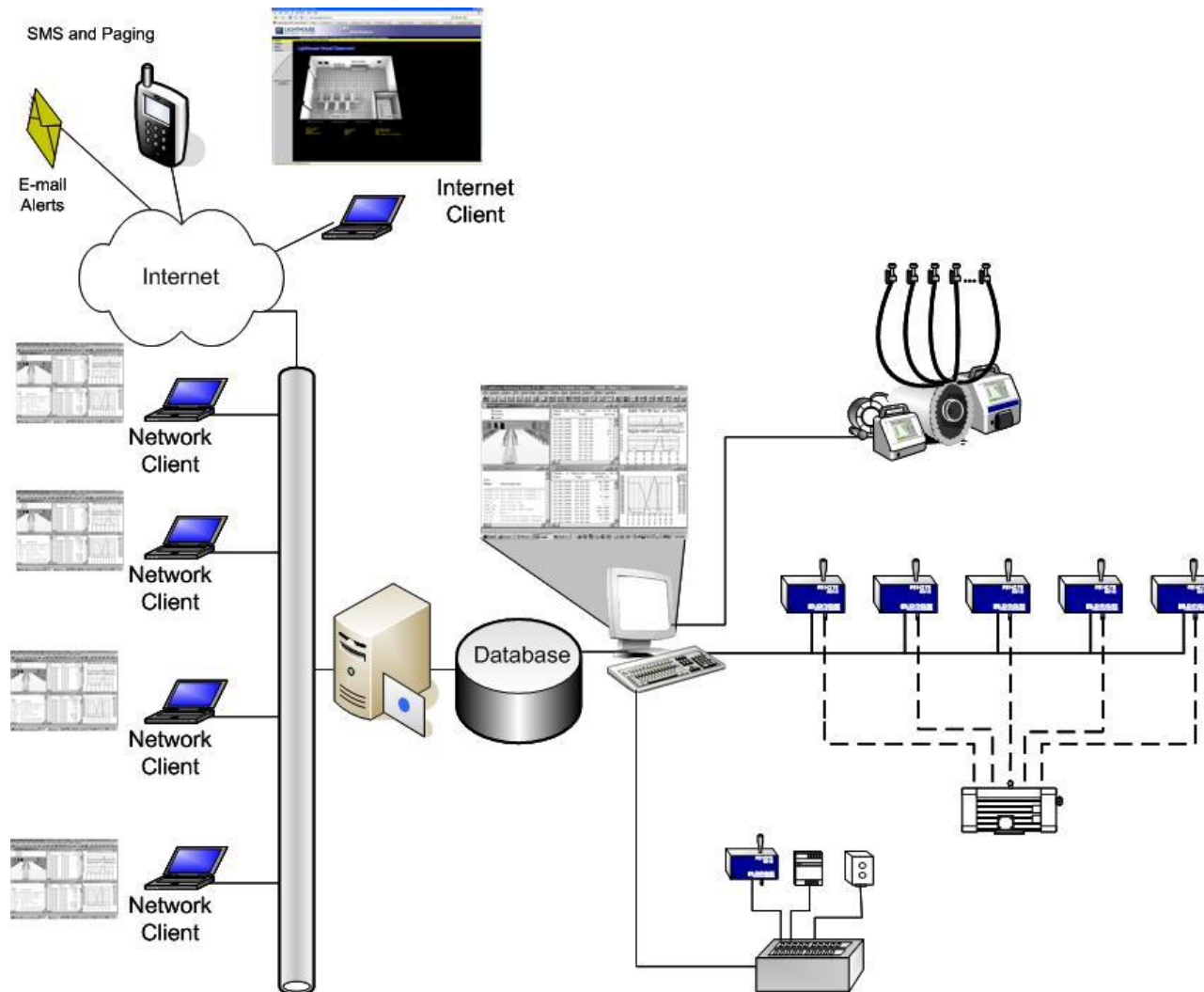




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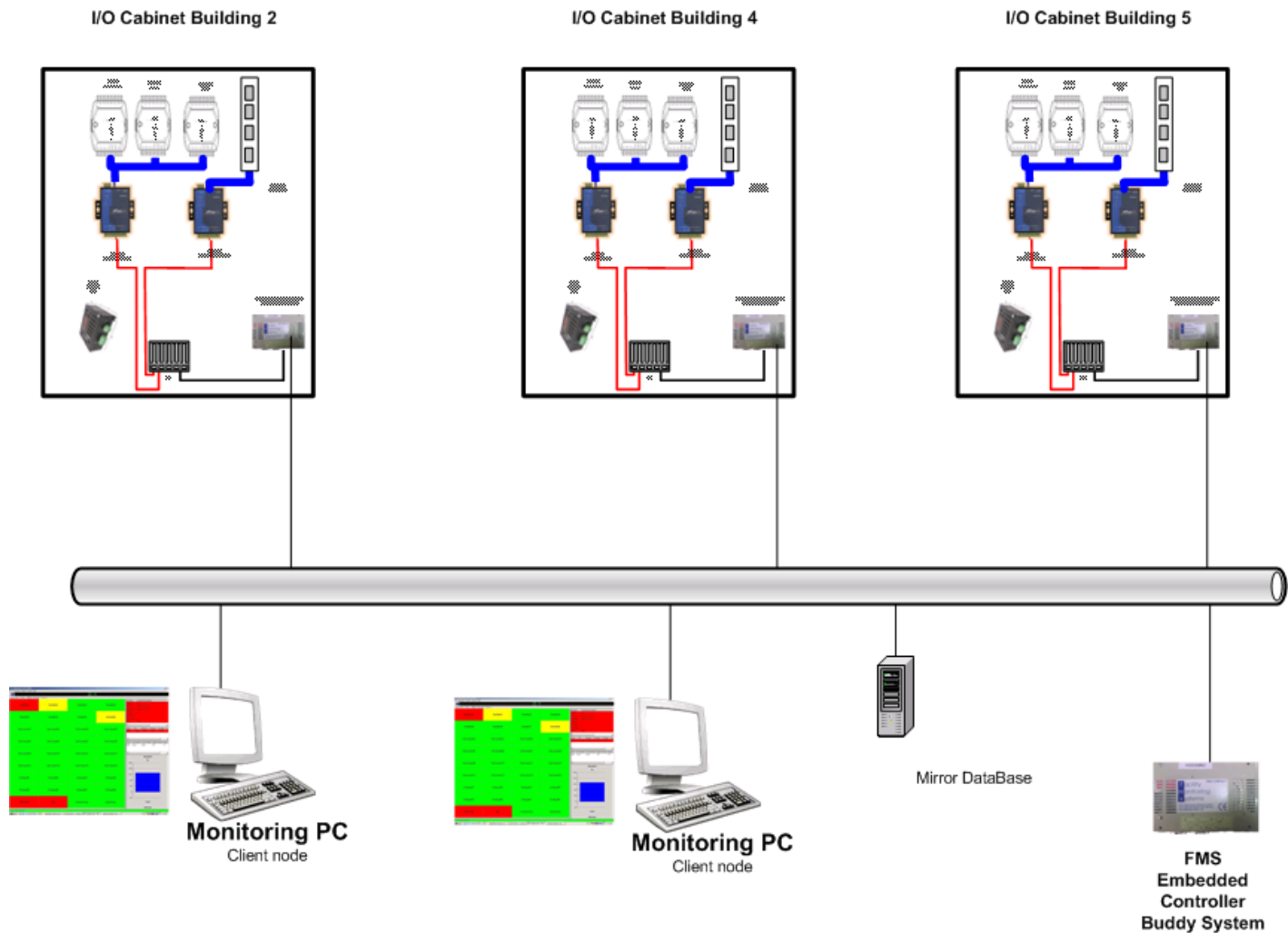


Online System with Server





Online System with Server





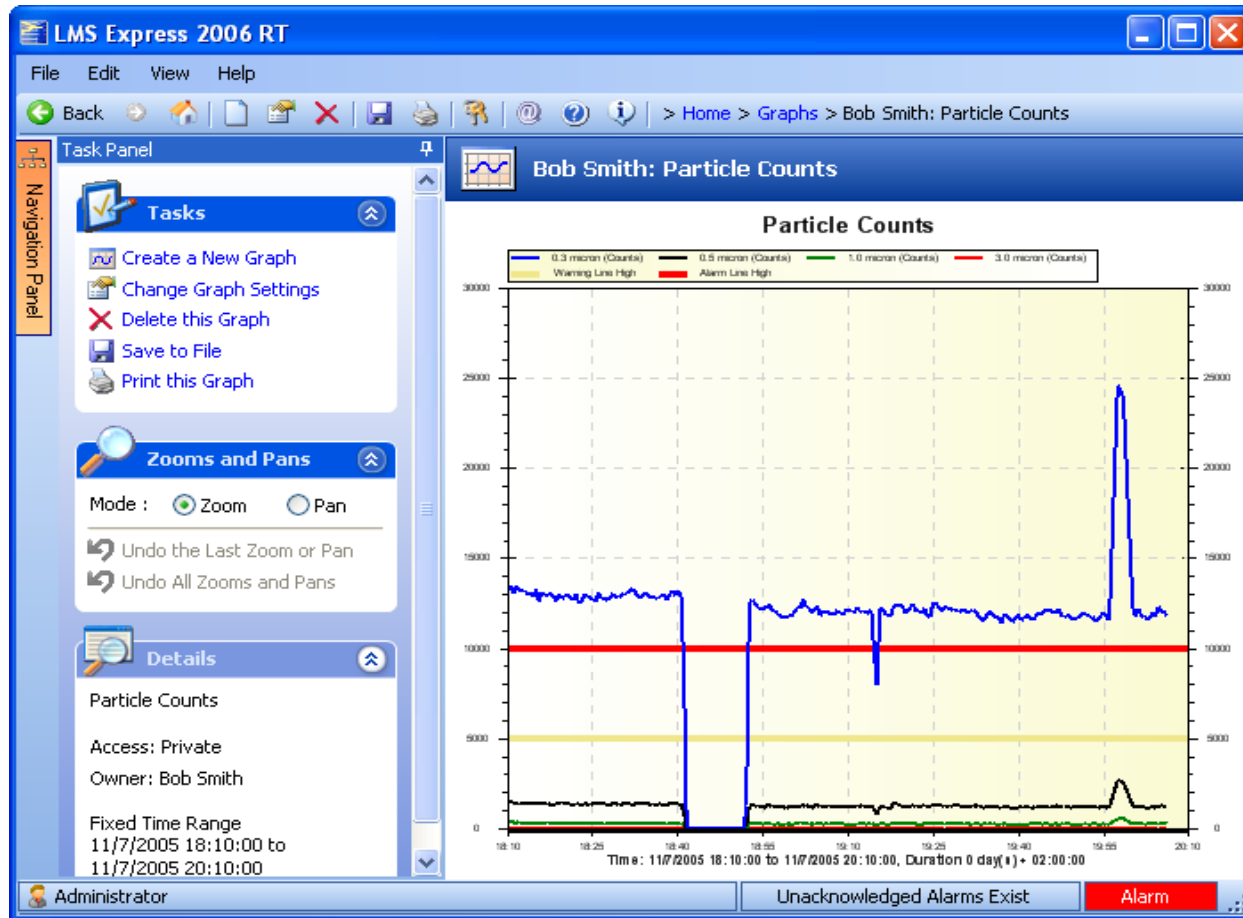
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Software



LMS Express RT and RT+



LMS Express RT

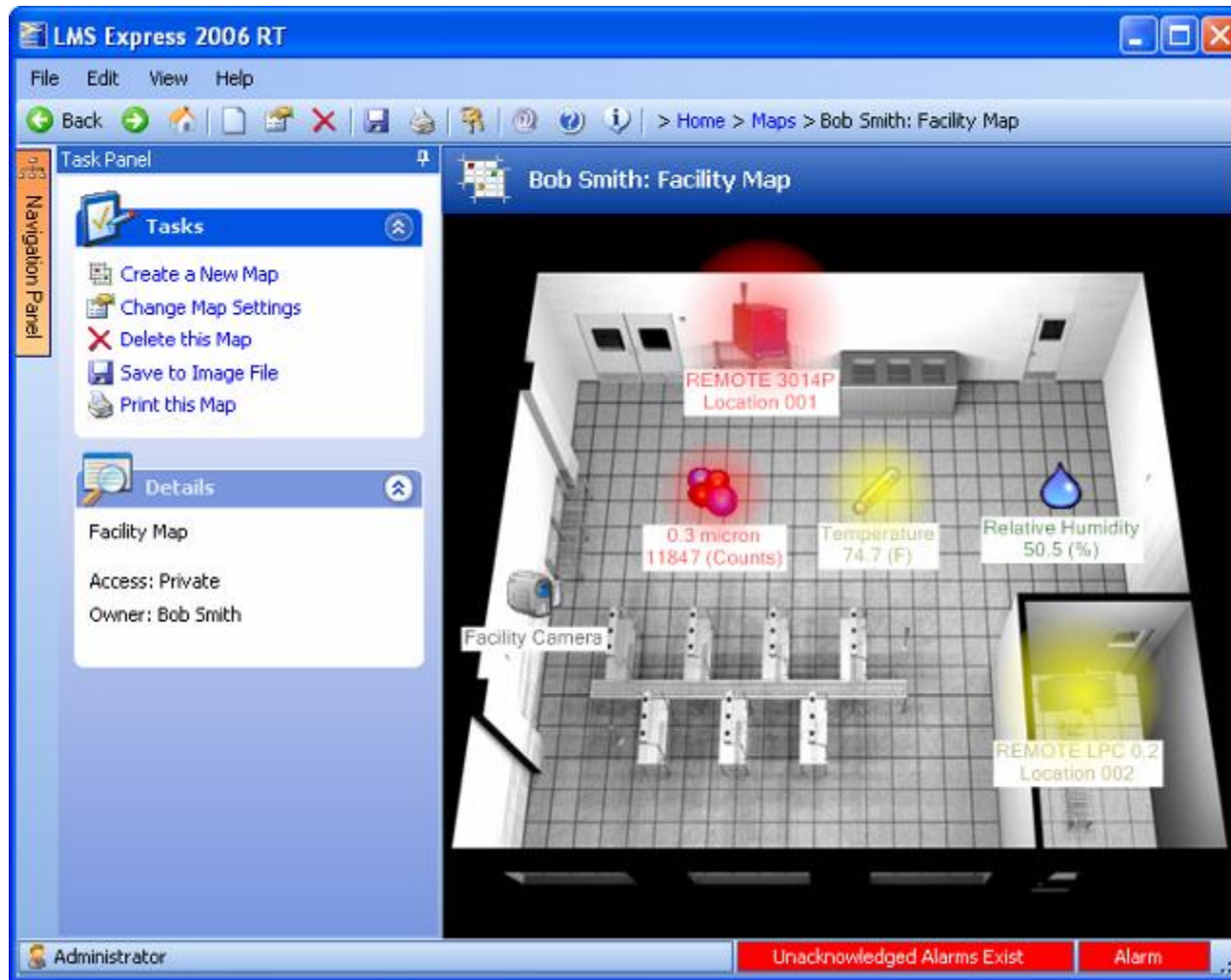
★ Up to (8) “4”
Series Sensors
w/ Accessories

LMS Express RT+

★ Up to (16) “4”
Series Sensors w/
Accessories



Example of Facility Map



★ Unique Map for Each Building or Room

★ Changes State Based Upon Condition

- Normal
- Alarm
- Warning
- Fault

★ Supports Internet Cameras

★ Icons for Each Type Of Sensor



Example of Real-time Screen Grid

LMS Express 2006 RT

File Edit View Help

Back Home Real-Time Status Options Real-Time Data Status

Real-Time Data Status

View Mode: Grid

REMOTE 3014P Gowning 0.3 micron (Counts) 11594 (Counts)	REMOTE 3014P Gowning 0.3 micron (Normalized) 231880.0 (p/ft³)	REMOTE 3014P Gowning 0.5 micron (Counts) 1204 (Counts)	REMOTE 3014P Gowning 0.5 micron (Normalized) 24080.0 (p/ft³)	REMOTE 3014P Gowning 1.0 micron (Counts) 271 (Counts)
REMOTE 3014P Gowning 1.0 micron (Normalized) 5420.0 (p/ft³)	REMOTE 3014P Gowning 3.0 micron (Counts) 14 (Counts)	REMOTE 3014P Gowning 3.0 micron (Normalized) 280.0 (p/ft³)	REMOTE 3014P Gowning Sample Time 30 (s)	REMOTE 3014P Gowning Sample Volume 0.1 (ft³)
REMOTE LPC 0.2 Wash Area 0.3 micron (Counts) 101 (Counts)	REMOTE LPC 0.2 Wash Area 0.3 micron (Normalized) 2.5 (p/ml)	REMOTE LPC 0.2 Wash Area 0.5 micron (Counts) 22 (Counts)	REMOTE LPC 0.2 Wash Area 0.5 micron (Normalized) 0.6 (p/ml)	REMOTE LPC 0.2 Wash Area 1.0 micron (Counts) 19 (Counts)
REMOTE LPC 0.2 Wash Area 1.0 micron (Normalized) 0.5 (p/ml)	REMOTE LPC 0.2 Wash Area 10.0 micron (Counts) 1 (Counts)	REMOTE LPC 0.2 Wash Area 10.0 micron (Normalized) 0.0 (p/ml)	REMOTE LPC 0.2 Wash Area Analog 1 Temperature 75.2 (F)	REMOTE LPC 0.2 Wash Area Analog 2 Relative Humidity 50.2 (%)
REMOTE LPC 0.2 Wash Area Calibration Reference 100.0 (%)	REMOTE LPC 0.2 Wash Area Sample Time 30 (s)			

Bob Smith

Unacknowledged Alarms Exist Alarm

★ Multiple Views

★ Grid View

★ View Sensor Data
In Real Time

★ Status Displayed
in Color

★ Green = OK
★ Red = Alarm
★ Yellow = Warning
★ Blue = Fault



Data Tables

LMS Express 2006 RT

File Edit View Help

Back Home > Data Tables > Jane Doe: Remote 3014P Counts

Task Panel

Tasks

- Create a New Data Table
- Change Data Table Settings
- Delete the Data Table
- Save to File
- Print the Data Table

Details

Remote 3014P Counts

Access: Private

Owner: Jane Doe

Fixed Time Range
11/7/2005 12:00:00 to 11/7/2005 16:00:00

Jane Doe: Remote 3014P Counts

Signature: Jane Doe

11/7/2005 12:00:00 to 11/7/2005 16:00:00

Time Stamp	Gowning Area 0.3 micron (Counts)	Gowning Area 0.5 micron (Counts)
11/7/2005 15:55:10	13261	1332
11/7/2005 15:55:40	13242	1423
11/7/2005 15:56:10	13342	1333
11/7/2005 15:56:40	13282	1313
11/7/2005 15:57:10	13151	1288
11/7/2005 15:57:40	13377	1317
11/7/2005 15:58:10	13105	1302
11/7/2005 15:58:40	13109	1336
11/7/2005 15:59:10	13305	1301
11/7/2005 15:59:40	13225	1321
Average	14475.4	1505.8
Maximum	17627	1999
Minimum	13067	1279
Standard Deviation	842.2	127.1

Jane Doe

Unacknowledged Alarms Exist

Warning

**Show Data in
Table Format**

**Date/Time
Stamp**

**Export to MS
Excel or CSV
Formats**

**Bottom of Table
Statistics:**

- ★ Average
- ★ Maximum
- ★ Standard Deviation



Alarms

LMS Express 2006 RT

File Edit View Help

Back Home > Administrator Options > Alarm Triggers

Alarm Triggers

View Mode : Details

Name	Data Type	Units	Alarm High	Warning High	Warning Low	Alarm Low
0.3 APC Alarm	0.3 micron (Airborne Counts)	Counts	10000.000	5000.000	-----	-----
0.3 LPC Normalized Alarm	0.3 micron (Liquid Normalized)	p/ml	20.000	10.000	-----	-----
0.5 APC Alarm	0.5 micron (Airborne Counts)	Counts	2000.000	1000.000	-----	-----
0.5 LPC Normalized Alarm	0.5 micron (Liquid Normalized)	p/ml	10.000	5.000	-----	-----
1.0 APC Alarm	1.0 micron (Airborne Counts)	Counts	1000.000	500.000	-----	-----
1.0 LPC Normalized Alarm	1.0 micron (Liquid Normalized)	p/ml	5.000	3.000	-----	-----
10.0 LPC Normalized Alarm	10.0 micron (Liquid Normalized)	p/ml	1.000	0.000	-----	-----
3.0 APC Alarm	3.0 micron (Airborne Counts)	Counts	200.000	100.000	-----	-----
LPC Calibration Warning	Calibration Reference	%	-----	150.000	75.000	-----
Relative Humidity Alarm	Relative Humidity	%	55.000	45.000	-----	-----
Temperature Alarm	Temperature	F	82.000	80.000	75.000	73.000

Administrator

Unacknowledged Alarms Exist

Warning

★ Configurable Alarm Triggers for **ANY** Input

★ Grouping of Sensors via Type, Level...



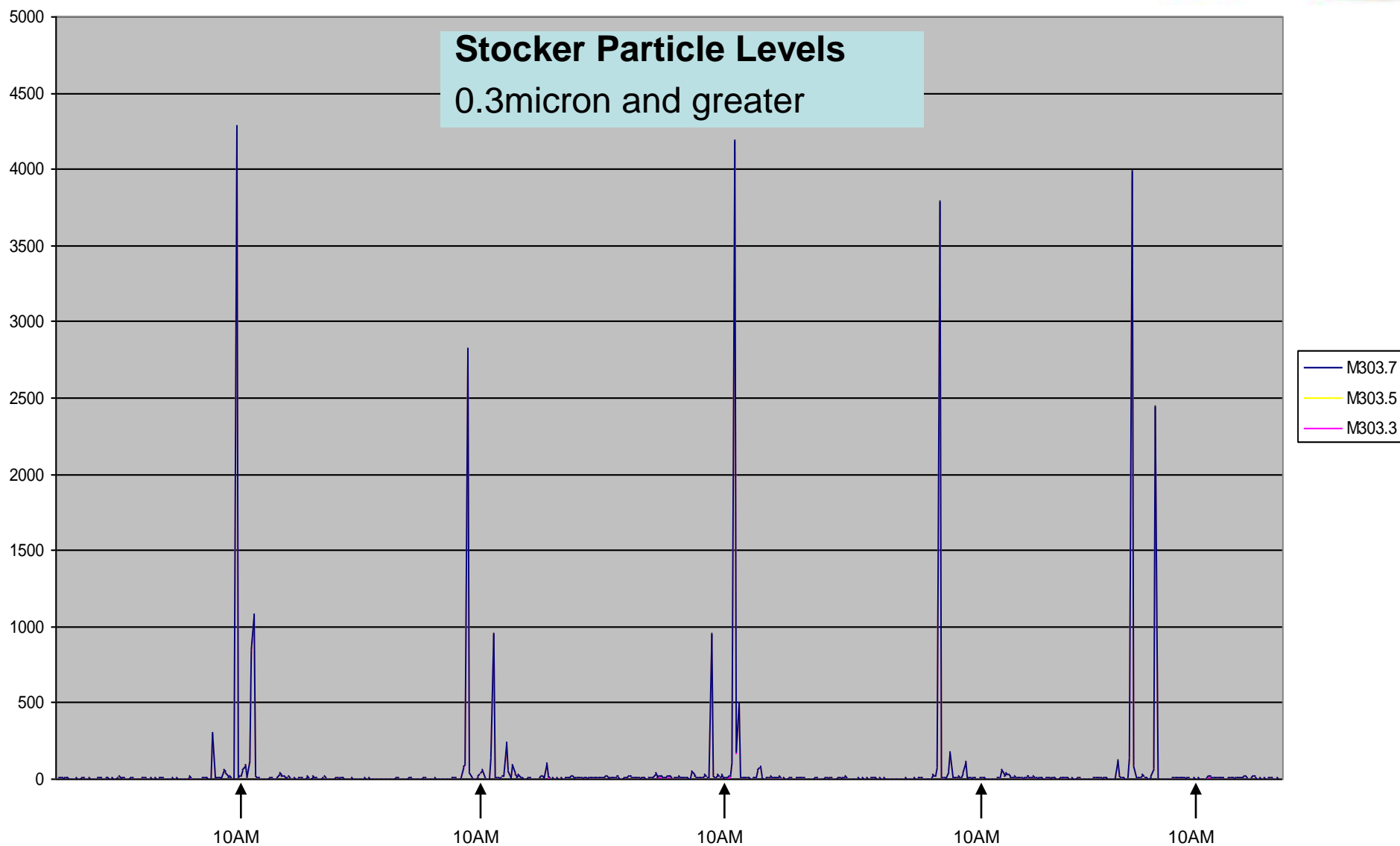
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Problems Identified

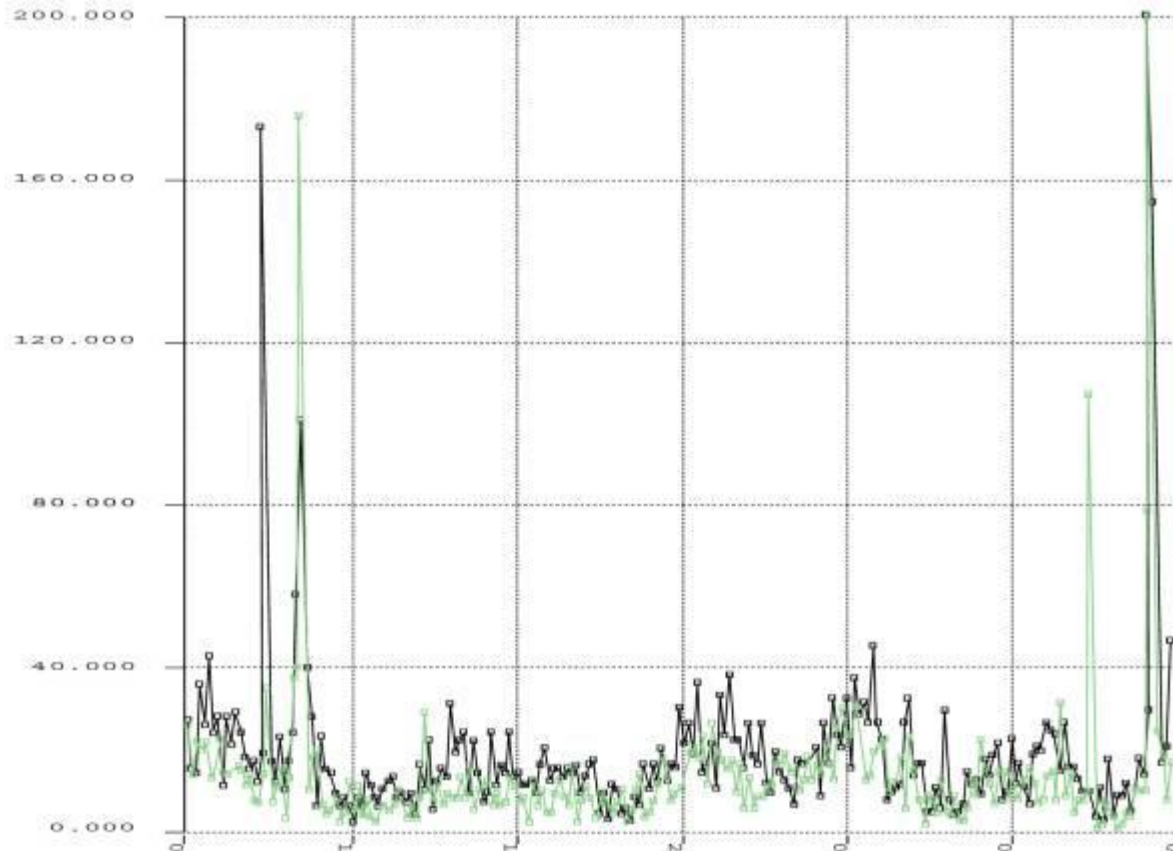


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Particle Monitoring



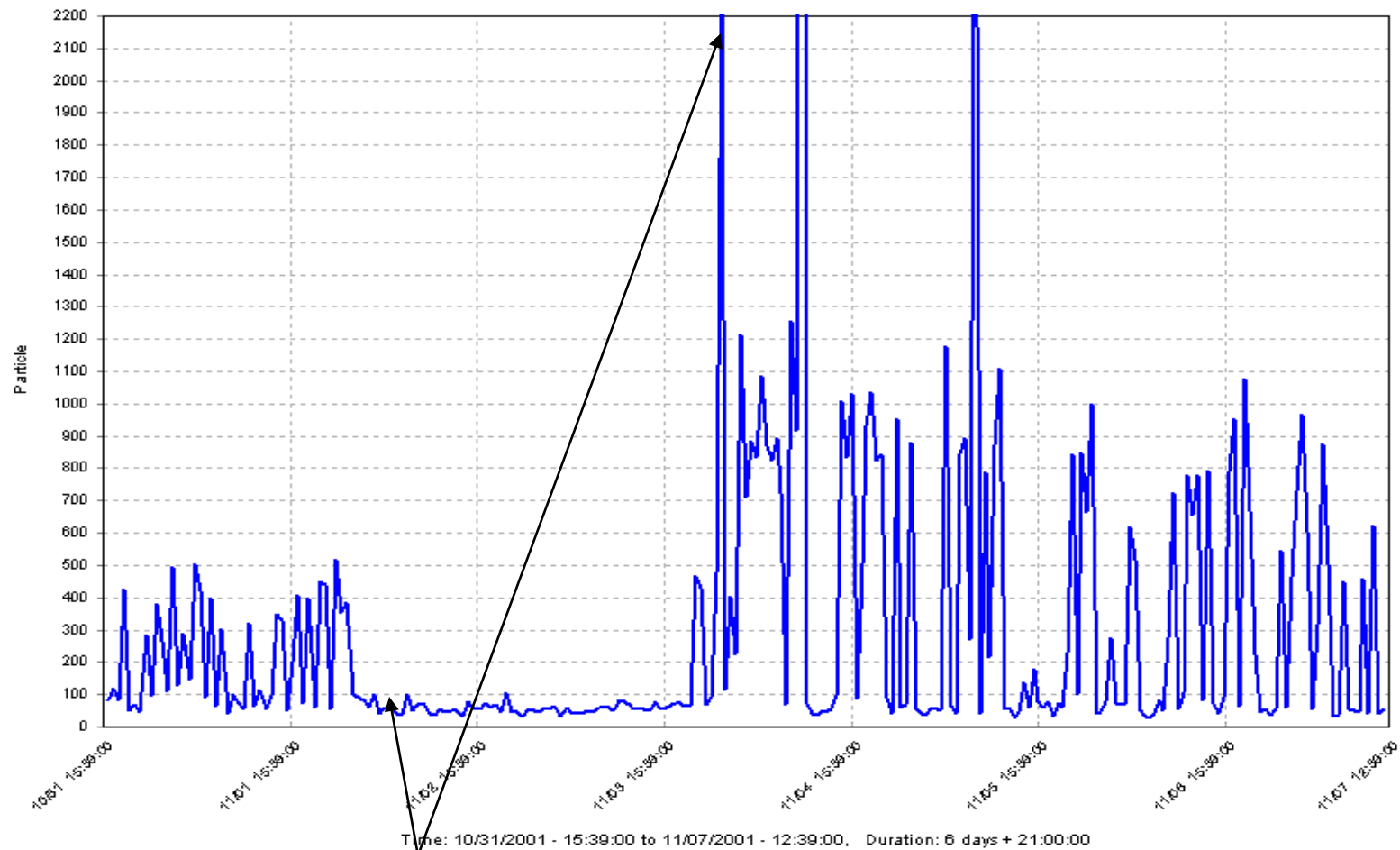
200 MM Stocker

Particle data from two sample points inside of a ISO Class 4 environment

An Average of 15 Particles at 0.1 micron over 24 hrs



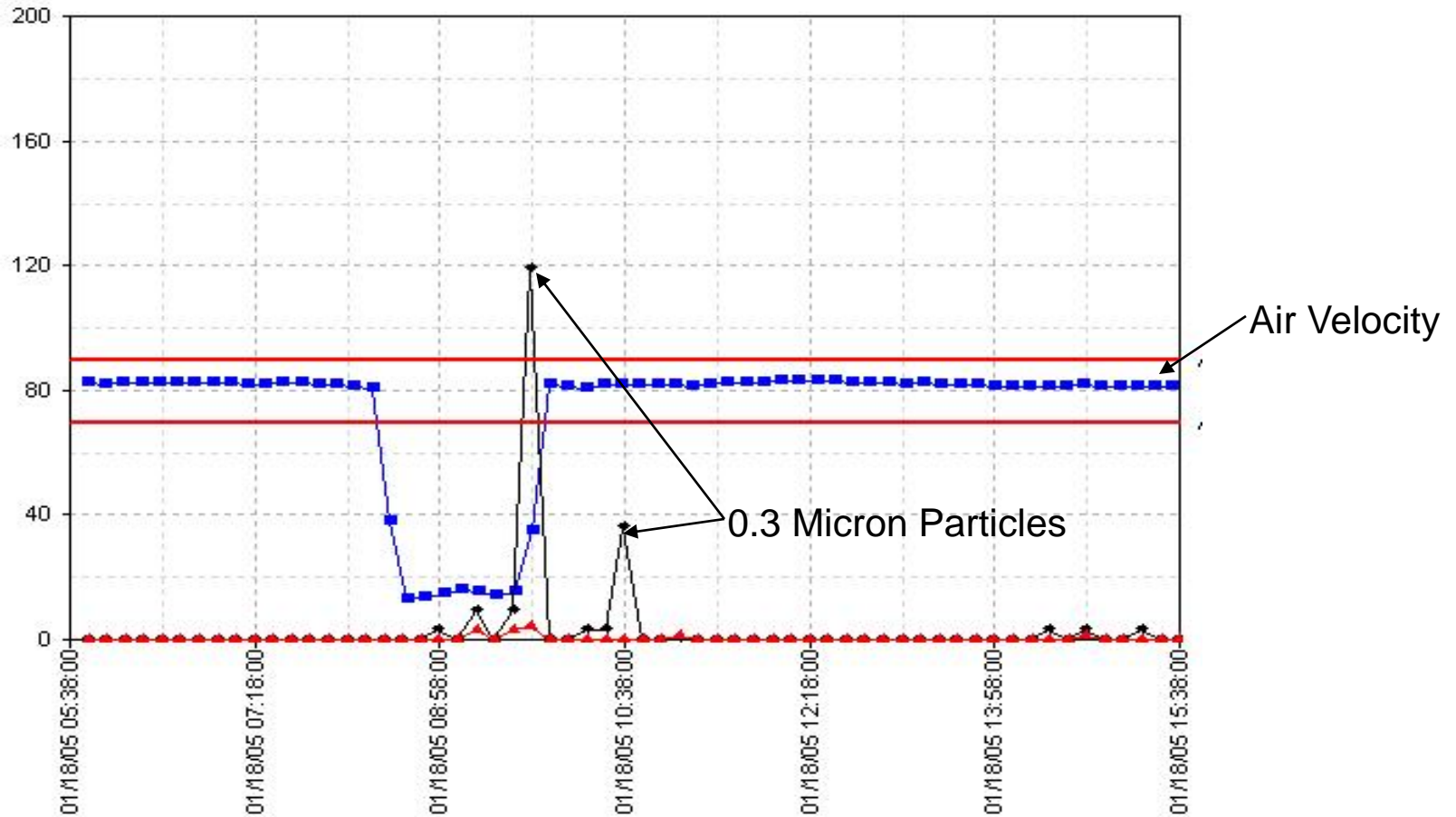
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Major shifts in particle concentration where identified using the Lighthouse Monitoring System.



Air Velocity and Particle Data



A Change in air velocity inside of this tool had an effect on particle count concentration inside the tool.

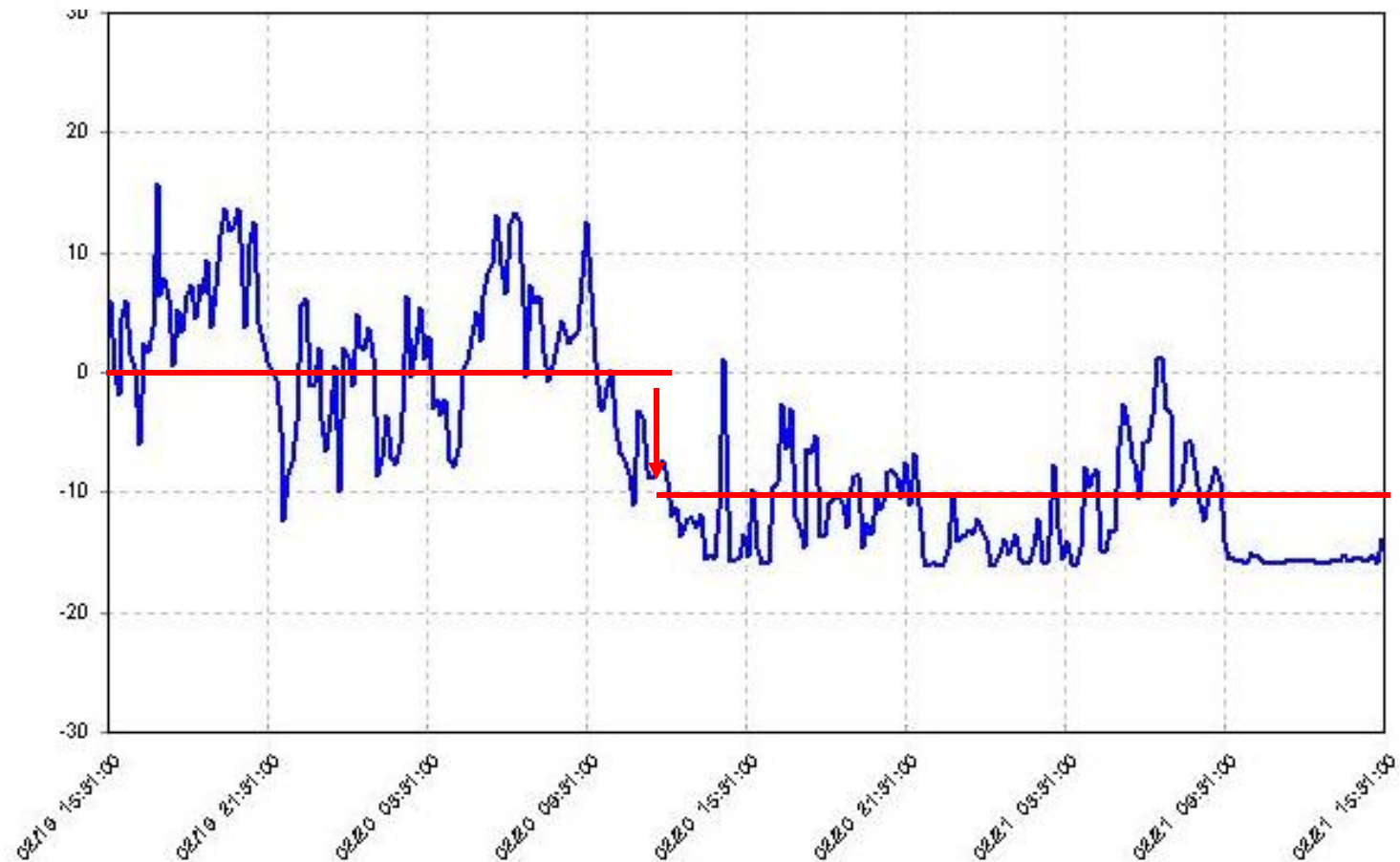


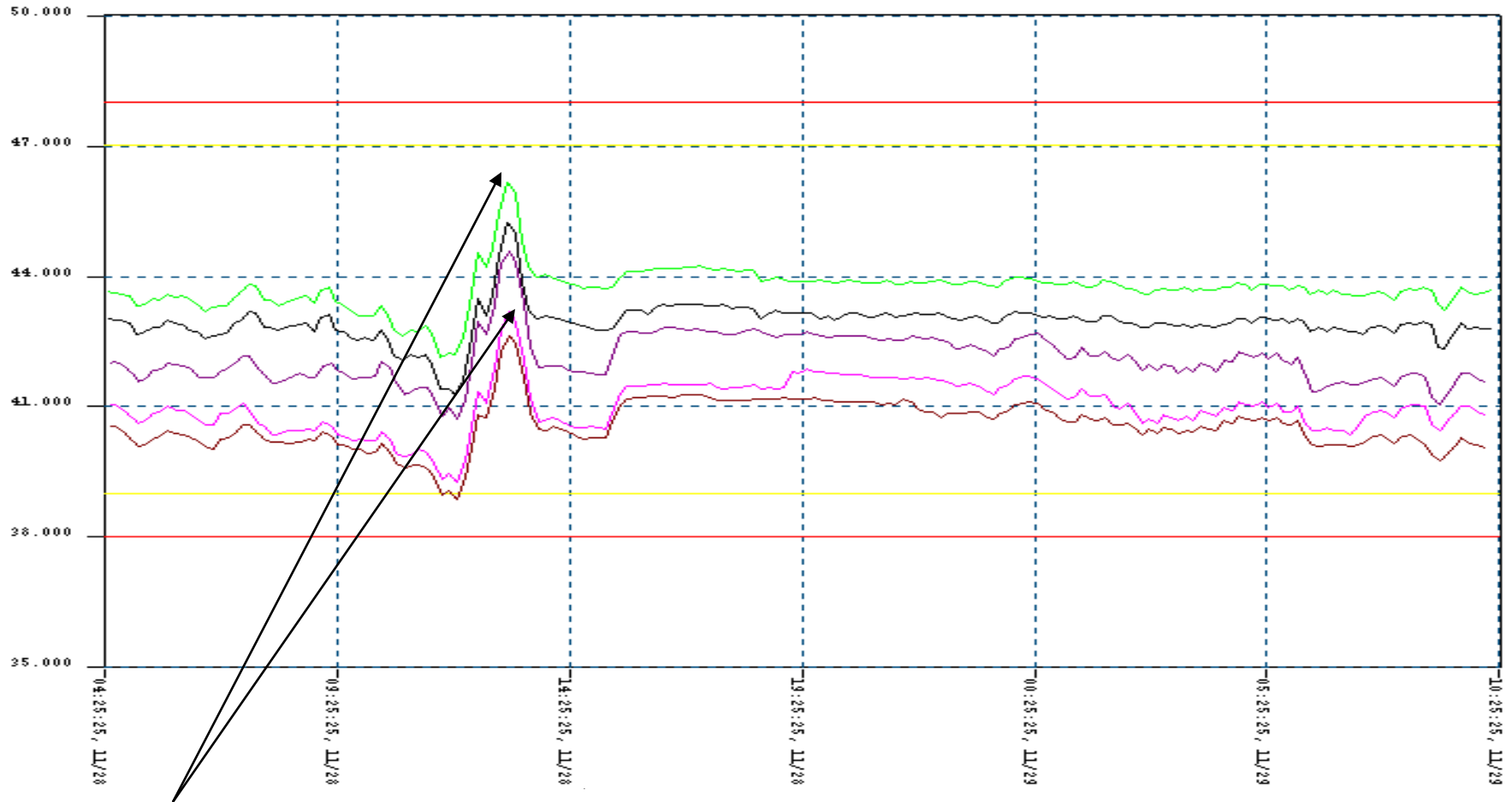
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Differential Pressure

Major Shifts in Differential Pressure Between Two Rooms





The Humidity Control System was accidentally reset to increase the humidity levels in the cleanroom. Their Lighthouse system identified the problem and corrective action was taken.



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Installation and Service



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Installation Services



- ★ Direct Factory Trained Installation Team
- ★ Cable Installation
- ★ Tubing Installation
- ★ Vacuum System Installation
 - ★ Single or Duplex Systems
 - ★ Skids
 - ★ Exhaust Filters



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Installation Services



- ★ Software Installation
- ★ Sensor Location
- ★ Tool Integrated Probes
- ★ Wall Mounted Fixtures
- ★ Non-Viable & Viable Probes
- ★ System Commissioning



Validation Services



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INSTALLATION QUALIFICATION PROTOCOL

Device Name: [Blank]
Device ID: [Blank]
Device Location: [Blank]
Device Description: [Blank]
Device Manufacturer: [Blank]
Device Model: [Blank]
Device Version: [Blank]
Device Serial: [Blank]
Device Part: [Blank]
Device Component: [Blank]
Device Assembly: [Blank]
Device Disassembly: [Blank]
Device Maintenance: [Blank]
Device Repair: [Blank]
Device Replacement: [Blank]
Device Upgrade: [Blank]
Device Downgrade: [Blank]
Device Migration: [Blank]
Device Integration: [Blank]
Device Decommission: [Blank]
Device Decommission Date: [Blank]
Device Decommission Reason: [Blank]
Device Decommission Status: [Blank]
Device Decommission Notes: [Blank]

Device History

Device	Date	Implemented By	Details
1	11/11/2006	Marina Clark	Installation
2	11/11/2006	Marina Clark	Installation
3	11/11/2006	Marina Clark	Installation

Device Approval

Device	Date	Implemented By	Details
1	11/11/2006	Marina Clark	Installation
2	11/11/2006	Marina Clark	Installation
3	11/11/2006	Marina Clark	Installation

★ Requirements Documents

★ Design Qualification

★ Installation Qualification

★ Operational Qualification

★ Performance Qualification

★ SOPs



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OPERATIONAL QUALIFICATION PROTOCOL

Device Name: [Blank]
Device ID: [Blank]
Device Location: [Blank]
Device Description: [Blank]
Device Manufacturer: [Blank]
Device Model: [Blank]
Device Version: [Blank]
Device Serial: [Blank]
Device Part: [Blank]
Device Component: [Blank]
Device Assembly: [Blank]
Device Disassembly: [Blank]
Device Maintenance: [Blank]
Device Repair: [Blank]
Device Replacement: [Blank]
Device Upgrade: [Blank]
Device Downgrade: [Blank]
Device Migration: [Blank]
Device Integration: [Blank]
Device Decommission: [Blank]
Device Decommission Date: [Blank]
Device Decommission Reason: [Blank]
Device Decommission Status: [Blank]
Device Decommission Notes: [Blank]

Device History

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3	11/11/2006	Marina Clark	Installation



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Training Services



- ★ **Monitoring System Training**
 - ★ **User Level**
 - ★ **Administer Level**
 - ★ **Service**
- ★ **Calibration Training (Optional)**
- ★ **Contamination Training**
- ★ **Cleanroom Protocol Training**





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Questions?



**Thank You
for
Your Attention**