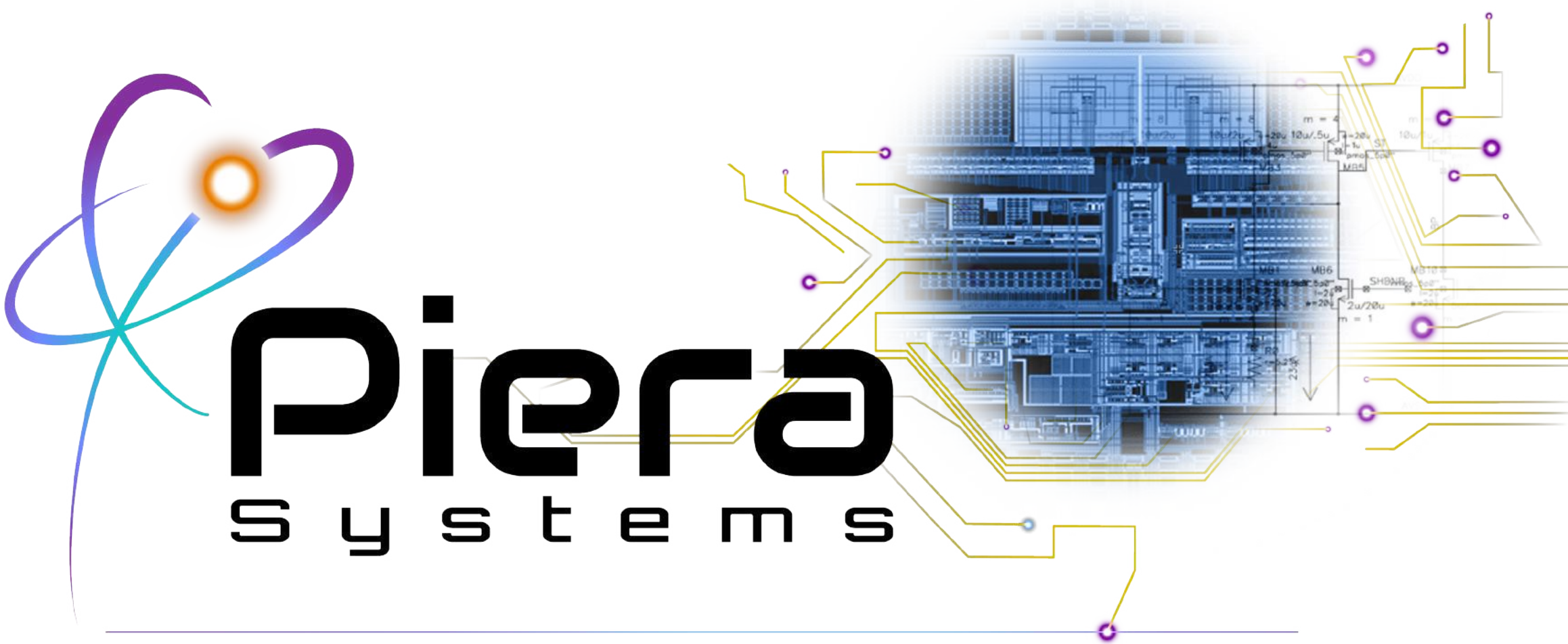


What's in your AIR ?

Measuring Air Quality with Particle Sensors

Why Measure Air Quality, why now ?

UN environment programme

Pollution

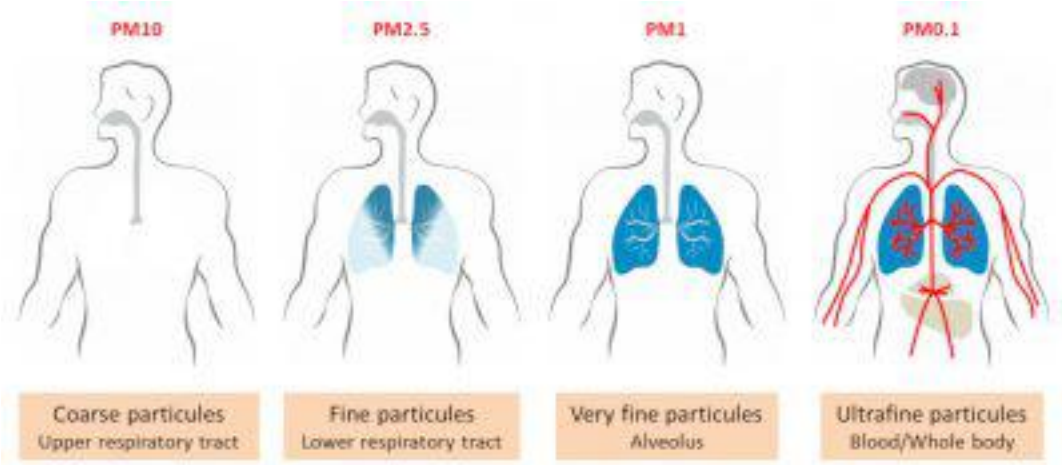
Wildfires

Covid

- Severe Health Threat, life span, deaths
- Worsening due to Climate Change
- Measure locally vs regionally
- Measure indoors and outdoors
- You can't fix what you can't Measure

Air pollution costs the global economy more than US $5 trillion a year in welfare costs and $225 billion in lost income
Source: World Bank

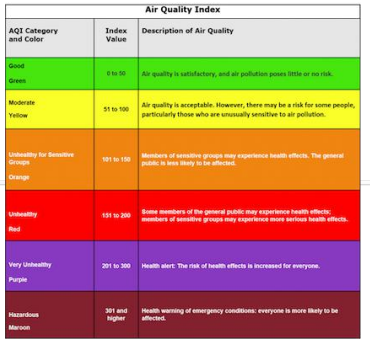
Encyclopedia of the Environment



"Among the various air pollutants, fine suspended particles are the main cause of the health effects of pollution."

Piera Systems

Why aren't we Measuring ?



- EPA Monitoring Stations expensive, not real-time, far apart (1970's)
- Reference Instruments are expensive, hard to use
- EPA: Low-Cost Sensors (<$100) inaccurate, limited data
  - "Reported sensor performance attributes are highly variable"
  - "Environmental Conditions (temp, humidity, VOC's) impact results"
  - "No sensor measures mass concentration, they are all estimates"
- Piera: Next Generation Intelligent Particle Sensor
  - Accurate, real-time measure from PM 0.1-10+ at low cost
  - Detailed data on particle size, count can identify sources
  - **Software-Defined Sensor** delivers broad family of devices, OTA updates

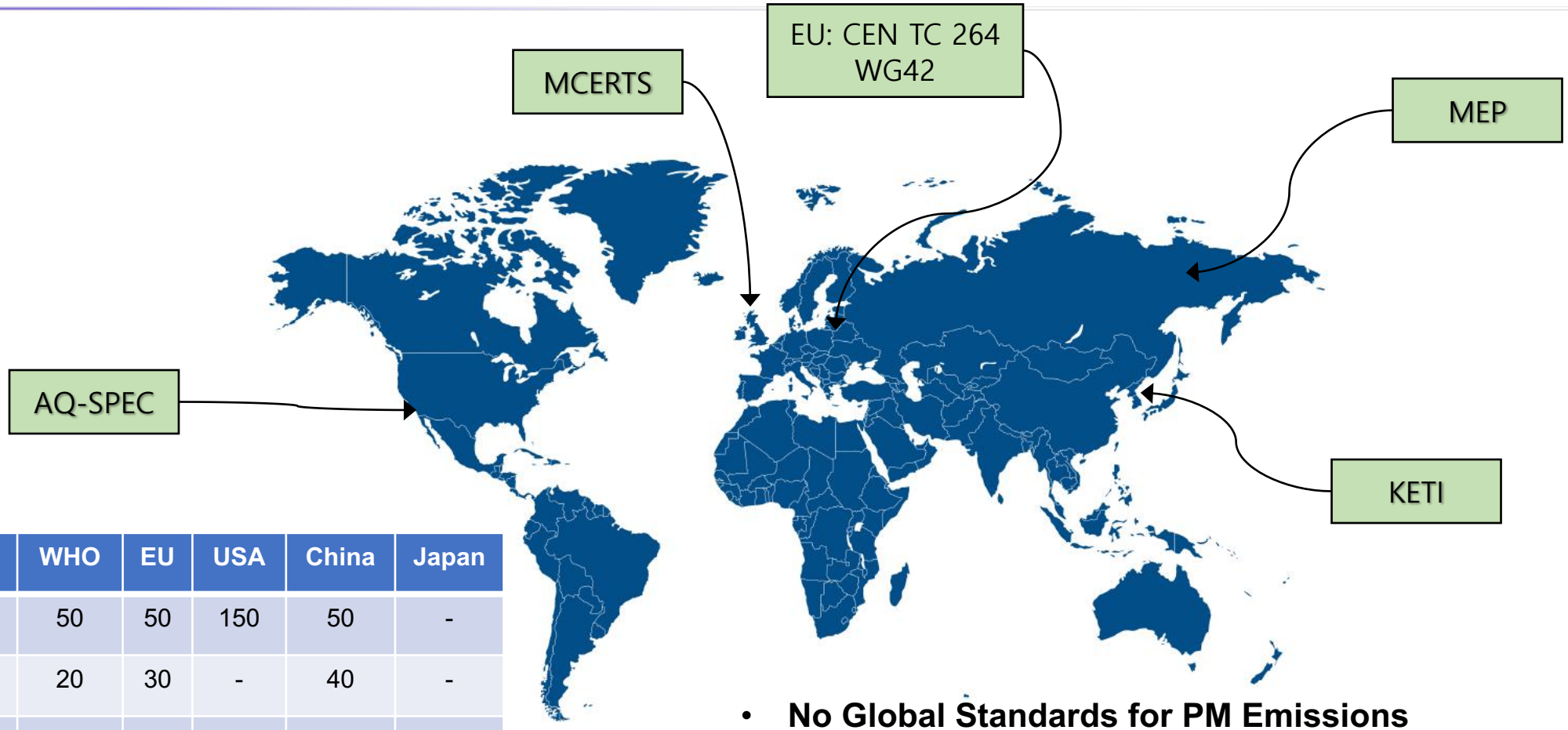
Reference Instrument
Grimm 11-D

$$$

$$

$

WW Environmental Monitoring and Certification



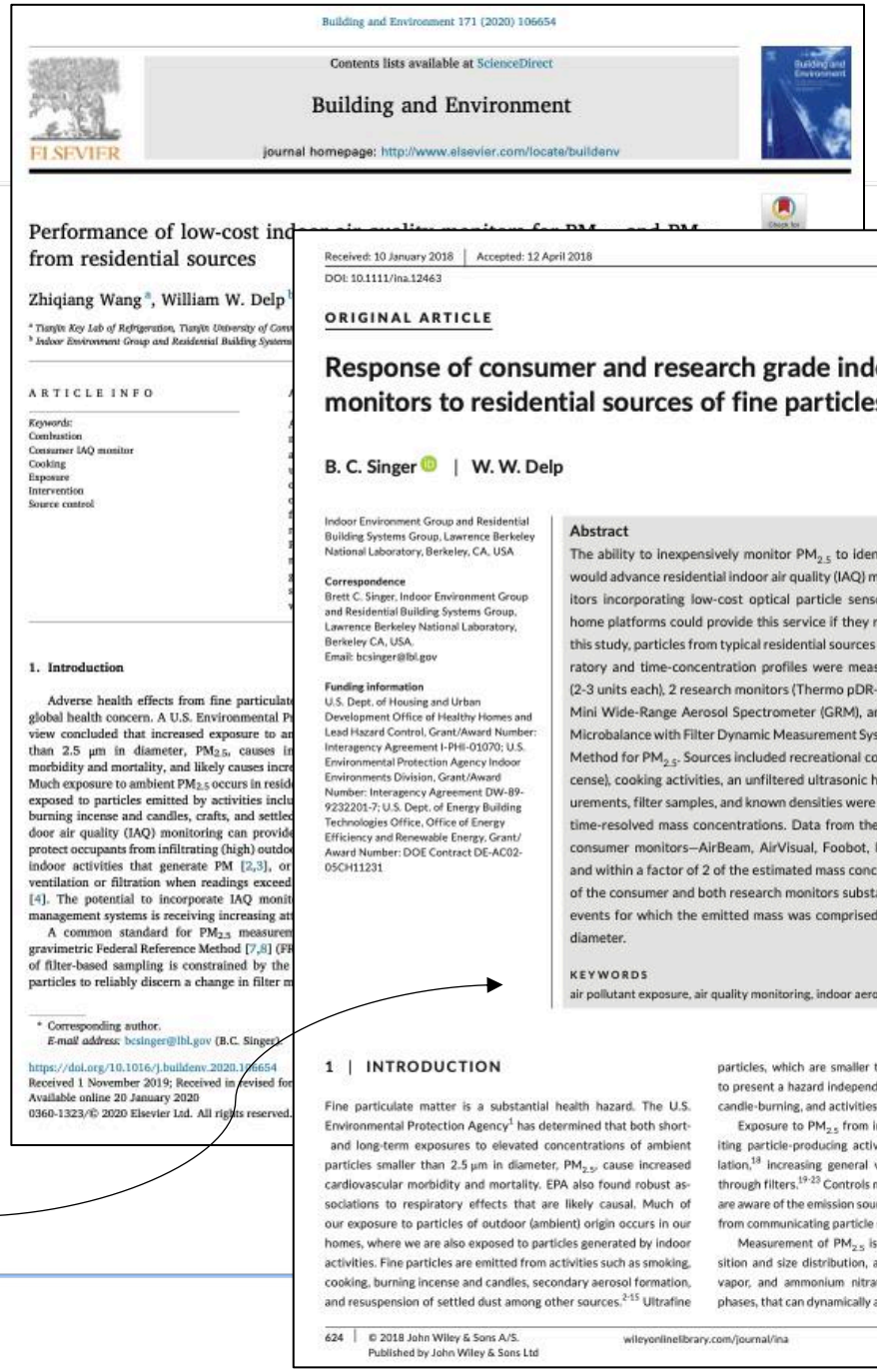
PM ug/m³	WHO	EU	USA	China	Japan
PM10 Daily	50	50	150	50	-
PM10 Yrly	20	30	-	40	-
PM2.5 Daily	25	25	35	35	-
PM2.5 Yrly	10	20	12	15	15

- **No Global Standards for PM Emissions**
- **Ultra-Fine Particles (<PM1.0) not defined… yet**
- **Patchwork of certifications and organizations**
- **A US reduction from 12 to 9 ug saves 12,150 lives annually**

Indoor Air Quality

- EPA focus is outdoor AQ
- IAQ negatively impacts health as well
- Low cost AQM's emerging (<$300)
- All have limitations due to PM Sensors
- IPS addresses ALL known limitations
  - PM0.1-10.0+
  - Accuracy, Resolution, complete PM data
  - Real-time, low power
  - Data to classify sources of PM emissions
  - Measure Ultra-Fine Particles (<PM1.0)

All 7 of the consumer and both research monitors substantially under-reported or missed events for which the emitted mass was comprised of particles smaller than 0.3 µm diameter.



Building and Environment 171 (2020) 106654

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Performance of low-cost ind… from residential sources

Zhiqiang Wang*, William W. Delp

ARTICLE INFO

Keywords:
Combustion
Consumer IAQ monitor
Cooking
Exposure
Intervention
Source control

1. Introduction

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ORIGINAL ARTICLE

WILEY

Response of consumer and research grade indoor air quality monitors to residential sources of fine particles

B. C. Singer | W. W. Delp

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Funding information
U.S. Dept. of Housing and Urban Development Office of Healthy Homes and Lead Hazard Control, Grant/Award Number: Interagency Agreement I-PHI-01070; U.S. Environmental Protection Agency Indoor Environments Division, Grant/Award Number: Interagency Agreement DW-89-9232201-7; U.S. Dept. of Energy Building Technologies Office, Office of Energy Efficiency and Renewable Energy, Grant/Award Number: DOE Contract DE-AC02-05CH11231

Abstract

The ability to inexpensively monitor $PM_{2.5}$ to identify sources and enable controls would advance residential indoor air quality (IAQ) management. Consumer IAQ monitors incorporating low-cost optical particle sensors and connections with smart home platforms could provide this service if they reliably detect $PM_{2.5}$ in homes. In this study, particles from typical residential sources were generated in a 120 m^3 laboratory and time-concentration profiles were measured with 7 consumer monitors (2-3 units each), 2 research monitors (Thermo pDR-1500, MetOne BT-645), a Grimm Mini Wide-Range Aerosol Spectrometer (GRM), and a Tapered Element Oscillating Microbalance with Filter Dynamic Measurement System (FDMS), a Federal Equivalent Method for $PM_{2.5}$. Sources included recreational combustion (candles, cigarettes, incense), cooking activities, an unfiltered ultrasonic humidifier, and dust. FDMS measurements, filter samples, and known densities were used to adjust the GRM to obtain time-resolved mass concentrations. Data from the research monitors and 4 of the consumer monitors—AirBeam, AirVisual, Foobot, Purple Air—were time correlated and within a factor of 2 of the estimated mass concentrations for most sources. All 7 of the consumer and both research monitors substantially under-reported or missed events for which the emitted mass was comprised of particles smaller than 0.3 µm diameter.

KEYWORDS
air pollutant exposure, air quality monitoring, indoor aerosol, $PM_{2.5}$, ultrafine particles

1 | INTRODUCTION

Fine particulate matter is a substantial health hazard. The U.S. Environmental Protection Agency[1] has determined that both short- and long-term exposures to elevated concentrations of ambient particles smaller than 2.5 µm in diameter, $PM_{2.5}$, cause increased cardiovascular morbidity and mortality. EPA also found robust associations to respiratory effects that are likely causal. Much of our exposure to particles of outdoor (ambient) origin occurs in our homes, where we are also exposed to particles generated by indoor activities. Fine particles are emitted from activities such as smoking, cooking, burning incense and candles, secondary aerosol formation, and resuspension of settled dust among other sources.[2-15] Ultrafine particles, which are smaller than 100 nm in diameter and thought to present a hazard independent of $PM_{2.5}$, are emitted by smoking, candle-burning, and activities related to cooking.[7,11,16,17]

Exposure to $PM_{2.5}$ from indoor sources can be reduced by limiting particle-producing activities, providing source control ventilation,[18] increasing general ventilation, and circulating indoor air through filters.[19-23] Controls may be activated manually if occupants are aware of the emission sources or automatically using information from communicating particle sensors.

Measurement of $PM_{2.5}$ is complicated by variations in composition and size distribution, and by partitioning of organics, water vapor, and ammonium nitrate between condensed and gaseous phases, that can dynamically affect airborne particle concentrations.

624 | © 2018 John Wiley & Sons A/S. Published by John Wiley & Sons Ltd

wileyonlinelibrary.com/journal/ina

Indoor Air. 2018;28:624–639.

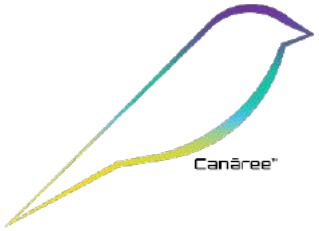
Piera Systems

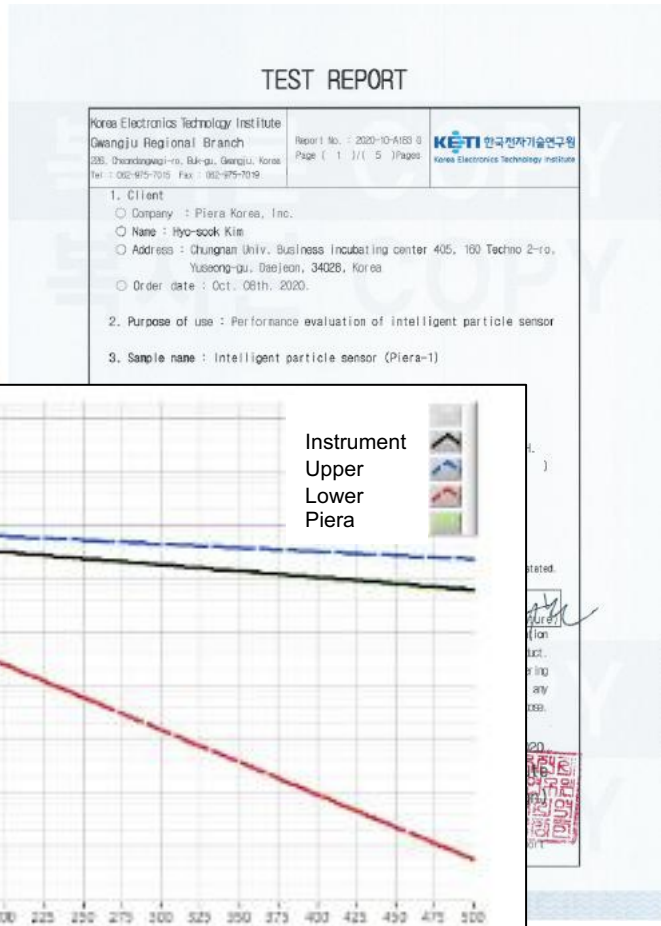
Piera's Technology and Products

- Extremely accurate particle-counting mixed signal IC (PCS-1)

- Accurate, cost-effective Intelligent Particle Sensors (IPS Family)

- (Canāree) - > Air Quality Monitors




TEST REPORT

Korea Electronics Technology Institute
Gwangju Regional Branch

1. Client
Company : Piera Korea, Inc.
Name : Hyo-sook Kim
Address : Chungnam Univ. Business Incubating center 405, 160 Techno 2-ro, Yuseong-gu, Daejeon, 34028, Korea
Order date : Oct. 08th. 2020.

2. Purpose of use : Performance evaluation of intelligent particle sensor

3. Sample name : Intelligent particle sensor (Piera-1)

<u>The Only Certified Sensor that counts every particle from 0.1um-10.0 um in real-time</u>

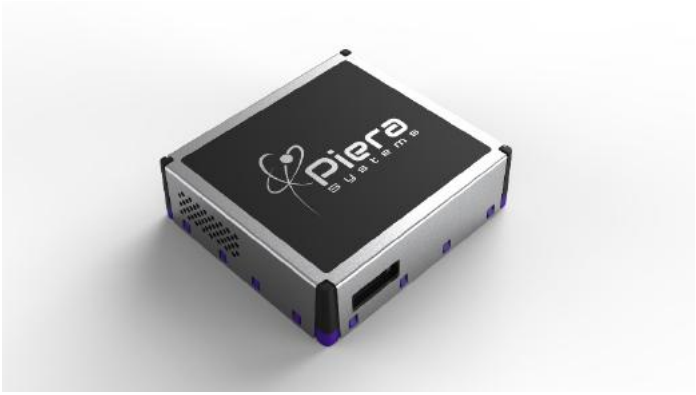
Intelligent Particle Sensor (IPS) Family

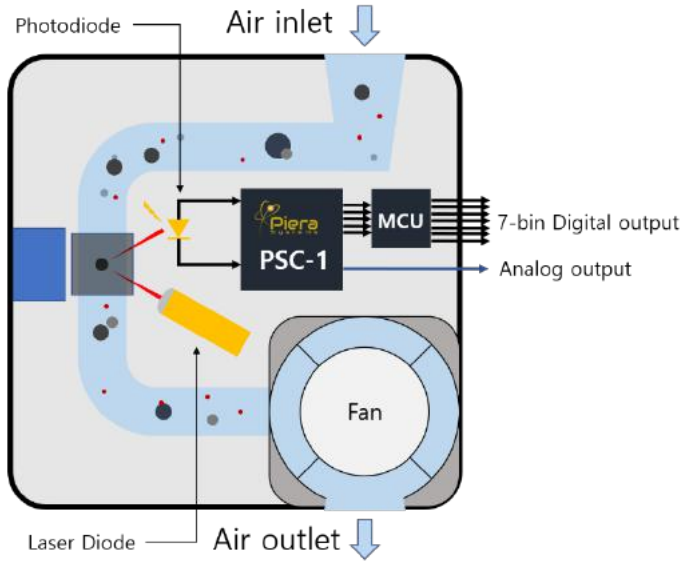
Features

- Family of devices with range of price, specifications
- Programmable bin sizes and range allows for Software-Defined Features, Specifications
- Ultra-high sensitivity, wide range (PM0.1-PM10+)
- Fast Response Time: ≤ 0.5 seconds
- Low power (<50ma, idle/sleep modes)
- OTA Firmware Updates
- Dimensions: 4.6 x 4.15 x 1.24 cm

Applications

- Air quality monitoring & management
- Air purifiers/ air treatment systems
- Pollen, silica dust, vape/smoke detection
- Chemical detection

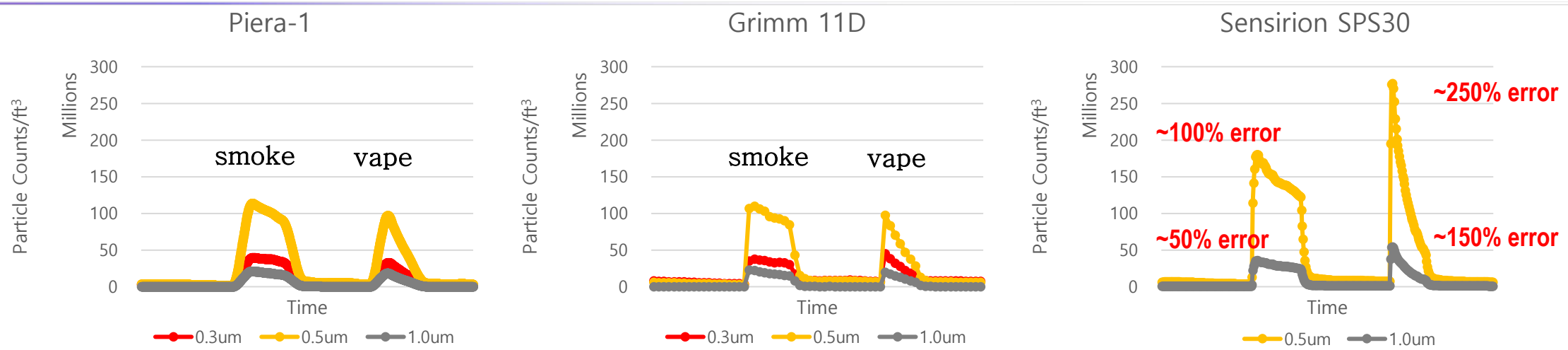


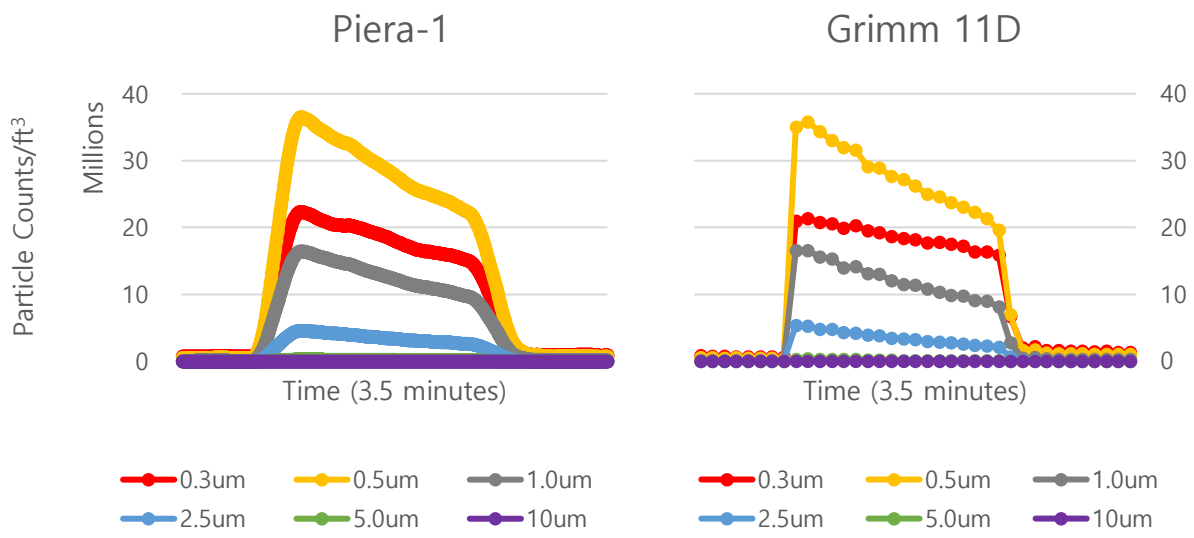


IPS: A Software Defined Sensor Family

IPS Family			Eval	Series 3		Series 5			Series 7	Series X	
			Piera-1	Piera-305	Piera-3100	Piera-525	Piera-5100	Piera-5500	Piera-7100	Piera-X7	Piera-X7U
# of Particle Bins			7	3	3	5	5	5	7	7	7
Dynamic Range	Binning Output in Mass Concentration (PM)	<0.1	X*	X		X			X	X	
		0.3	X	X		X			X		
		0.5	X	X		X	X		X		
		1.0	X		X	X	X	X	X		X
		2.5	X		X	X	X	X	X		
		5.0	X				X	X	X		
		10	X		X		X	X	X		
		50						X			
		100									
Features	Output in Particle Counts		X	X	X	X	X	X	X	X	X
	Serial Key for Networking		X			X	X	X	X	X	X
	Firmware Upload Capability		X			X	X	X	X	X	X
	Limited Programmability		X				X	X	X		
	Full Range Programmability									X	X
Release Date			Q3 2020	Q1 2021	Q1 2021	Q1 2021	Q1 2021	Q3 2021	Q4 2020	Q1 2022	Q1 2022
Pricing ($) MOQ of 1,000			199	40	30	60	50	60	70	95	95

Certified in Korea, Correlated to Reference Instruments

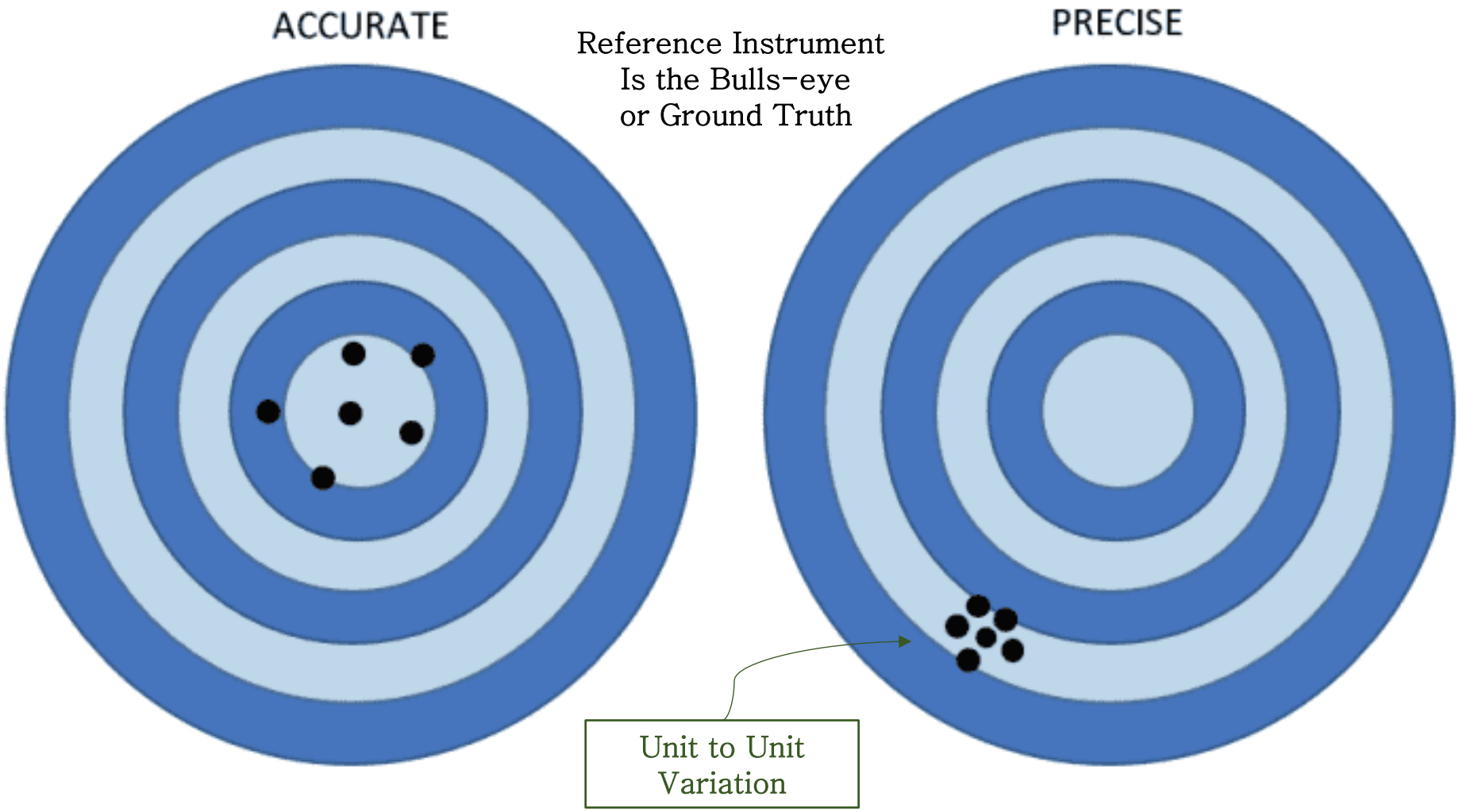




KETI Korea Electronics Technology Institute

- **Korea considered Gold Standard**
- **Accurate across entire range**
- **Every particle counted vs estimated**
- **Particle Data can identify sources**
- **Smoke and vape events accurately detected**

Accuracy vs Precision



Optical v Gravimetric: Mass Concentration v Particle Count

	Federal Equivalence Methods – FEM's	Federal Reference Methods – FRM's
	Optical Method	**Gravimetric Method**
Particle Count	Direct Measurement	Interpolated Estimation Usually distinguishes only PM10 from PM2.5 based on pre-filtering before particle accumulation
Mass Concentration	Interpolated Estimation Calculated from particle count number and assumed density of different sized particles	Direct Measurement

EPA Uses BOTH Methods at their Air Quality Monitoring Stations

Mass Concentration and Particle Size, Count are Needed

Air Quality Index		
AQI Category and Color	**Index Value**	**Description of Air Quality**
Good Green	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Moderate Yellow	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups Orange	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Unhealthy Red	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy Purple	201 to 300	Health alert: The risk of health effects is increased for everyone.
Hazardous Maroon	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

Source: EPA

MC +

- Simple
- Easy to understand
- Easy to calculate
- Historical Data

MC -

- Slow
- Labor Intensive
- Expensive
- Can't quickly identify PM type

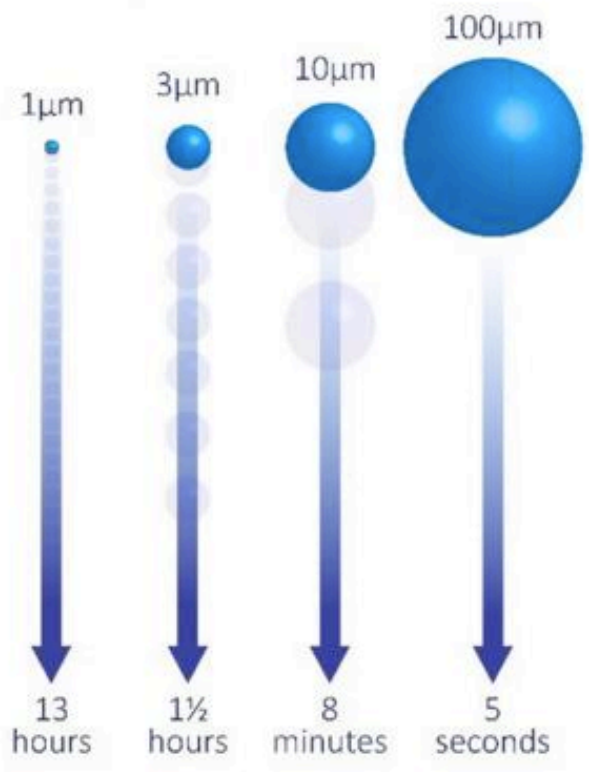
Particle Count +

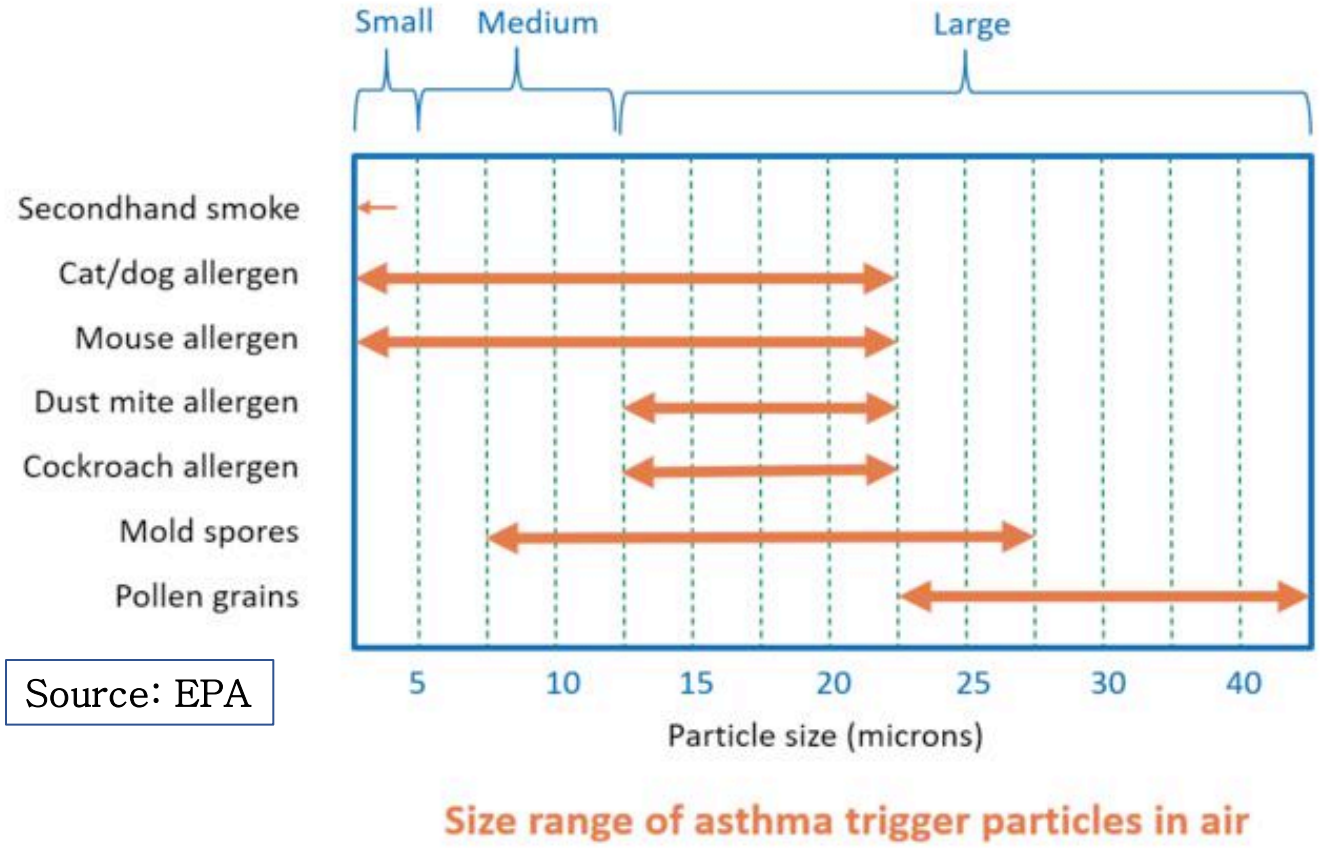
- Fast
- Identifies PM type
- Less Expensive
- Compensate for RH

Particle Count -

- Calibration required
- Fluctuations
- Longer sampling at Lower Concentrations

Particle Size of Asthma Triggers





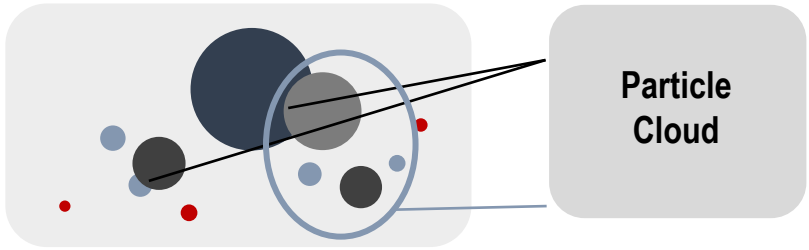
Source: EPA

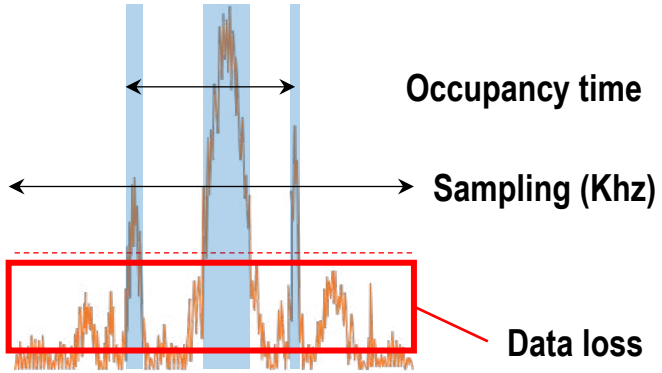
Size range of asthma trigger particles in air

Piera-1's range is programmable and can detect particles >10 um unlike other sensors

Current Sensors vs Piera

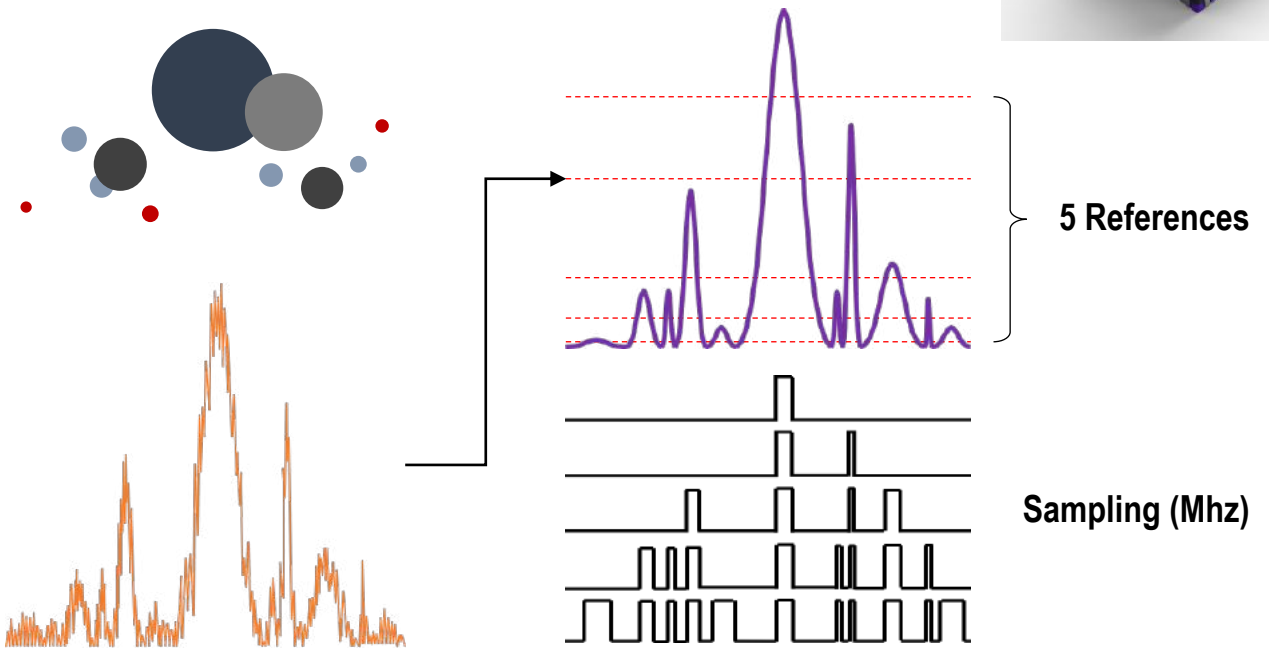
Competition





Estimated Concentration
PM2.5 only

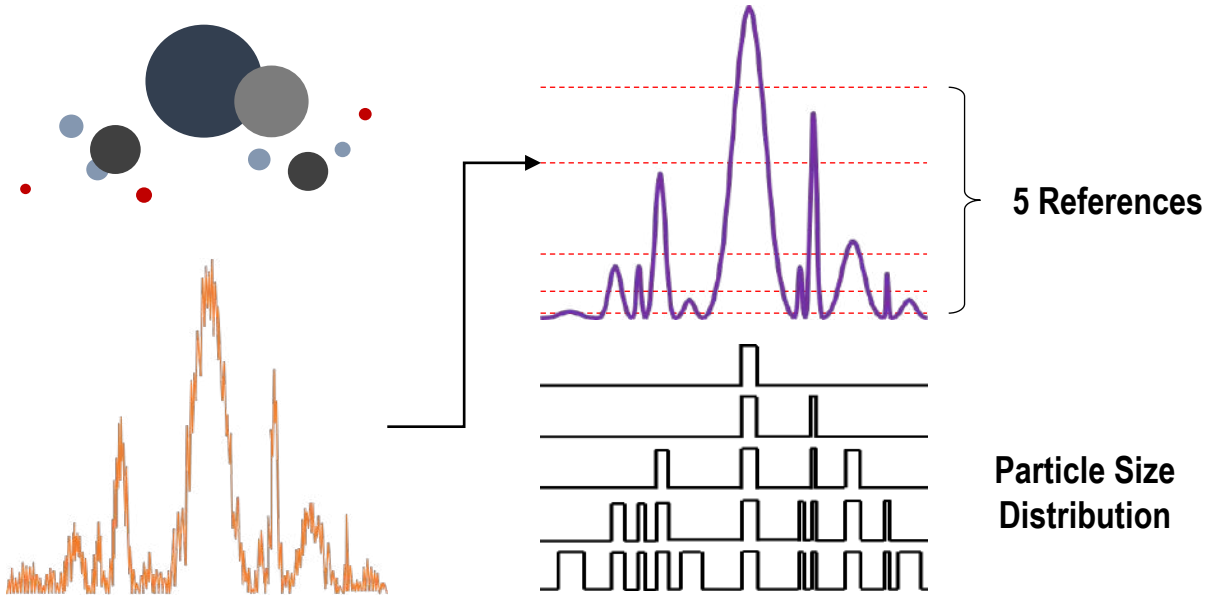
Piera



Software–Defined bin sizes
count every particle from 0.1-10+um

Piera Sensors correct for Humidity

A particle size distribution–based correction algorithm, founded on *κ*-Köhler theory, was developed to account for the influence of *RH* on sensor measurements. T he application of the correction algorithm, which assumed physically reasonable *κ* values, resulted in a significant improvement, with the overestimation of PM measurements reduced from a factor of ~5 before correction to 1.05 after correction. We conclude that a correction based on particle size distribution, rather than PM mass, is required to properly account for *RH* effects and enable low cost optical PM sensors to provide reliable ambient PM measurements.



We are developing RH correction factos using this approach

sensors MDPI

Sensors (Basel). 2018 Sep; 18(9): 2790. PMCID: PMC6164928
Published online 2018 Aug 24. doi: 10.3390/s18092790 PMID: 30149560

Developing a Relative Humidity Correction for Low-Cost Sensors Measuring Ambient Particulate Matter

Andrea Di Antonio,[1,*] Olalekan A. M. Popoola,[1] Bin Ouyang,[1] John Saffell,[2] and Roderic L. Jones[1]

Abstract

Go to: Go to:

There is increasing concern about the health impacts of ambient Particulate Matter (PM) exposure. Traditional monitoring networks, because of their sparseness, cannot provide sufficient spatial-temporal measurements characteristic of ambient PM. Recent studies have shown portable low-cost devices (e.g., optical particle counters, OPCs) can help address this issue; however, their application under ambient conditions can be affected by high relative humidity (*RH*) conditions. Here, we show how, by exploiting the measured particle size distribution information rather than PM as has been suggested elsewhere, a correction can be derived which not only significantly improves sensor performance but which also retains fundamental information on particle composition. A particle size distribution–based correction algorithm, founded on *κ*-Köhler theory, was developed to account for the influence of *RH* on sensor measurements. The application of the correction algorithm, which assumed physically reasonable *κ* values, resulted in a significant improvement, with the overestimation of PM measurements reduced from a factor of ~5 before correction to 1.05 after correction. We conclude that a correction based on particle size distribution, rather than PM mass, is required to properly account for *RH* effects and enable low cost optical PM sensors to provide reliable ambient PM measurements.

Keywords: air pollution, environmental monitoring, low cost sensors, particulate matter, relative humidity correction

1. Introduction

Go to: Go to:

There has been a growing interest in air quality monitoring in recent years with a large number of epidemiological studies demonstrating a link between human health diseases and air pollution (e.g.,

Competition

Low cost sensor market segment (<$100 / Unit)

Make	Detection Capability	Response Time	Accuracy	Particle Categorization	Cost Effectiveness
Piera Systems					
Omron Electronics					
Plantower Technology					
Wuhan Cubic Optoelectronics					
Sensirion					
Winsen Electronics Technology					
Sharp Microelectronics					

Performance Level : Good  Mediocre  Bad 

Low-cost Sensor Specification Comparison

	Amphenol	Cubic	Honeywell	Omron	Panasonic	Plantower	Sensirion	Sharp	Winsen	Piera
Photo										
Model	**SM-UART-04L**	**PM2105**	**480NPMA115C0**	**B5W-LD101**	**SN-GCJA5L**	**PMS5003**	**SPS30**	**GP2Y1023AU0F**	**ZH03**	**IPS**
Unit price (US$) MOQ: 1,000	18	28	35	8	19	24	20	8	35	$30-$95
Number of bins	2	3	4	1	3	3	4	1	3	3,5,7
PM categorization (PM)	2.5, 10	1, 2.5, 10	1, 2.5, 4, 10	2.5	1, 2.5, 10	1, 2.5, 10	1, 2.5, 4, 10	2.5	1, 2.5, 10	0.1 – 10+
Data independence				✓				✓		✓
Output type	UART	PWM, I^2C, UART	UART	PWM	I^2C, UART	I^2C, UART	I^2C, UART	PWM	PWM, UART	Analog, I^2C, UART,USB
Light source	Laser	Laser	Laser	LED	Laser	Laser	Laser	Infrared	Laser	Laser
Airflow control	Fan	Fan	Fan	Heater resistor	Fan	Fan	Fan	Heater resistor	Fan	Fan
Boot / sampling time (s)	5 / 1	8 / 1	- / ≤ 6	- / 20	8 / 1	10 / 1	8 / 1	- / -	90 / 45	≤ 6 s / 0.2 sec *
Max power consumption (mA)	100	120	80	90	100	100	60	25	140	65 *
Sensitivity (ug/m^3)	-	-	15	-	10	1	10	-	-	0.1 *
Effective range (ug/m^3)	0 – 999	0 – 5,000	0 – 1,000	0 – 999	0 – 2,000	0 – 2,000	0 – 1,000	0 – 999	0 – 1,000	0 – 5,000 ug/m^3 *
Consistency error	10 %	10 - 30 %	15 – 25 %	15 %	15 %	10 %	10 %	15 %	15 – 25 %	5 % *

Requirements for PM Sensors and Software

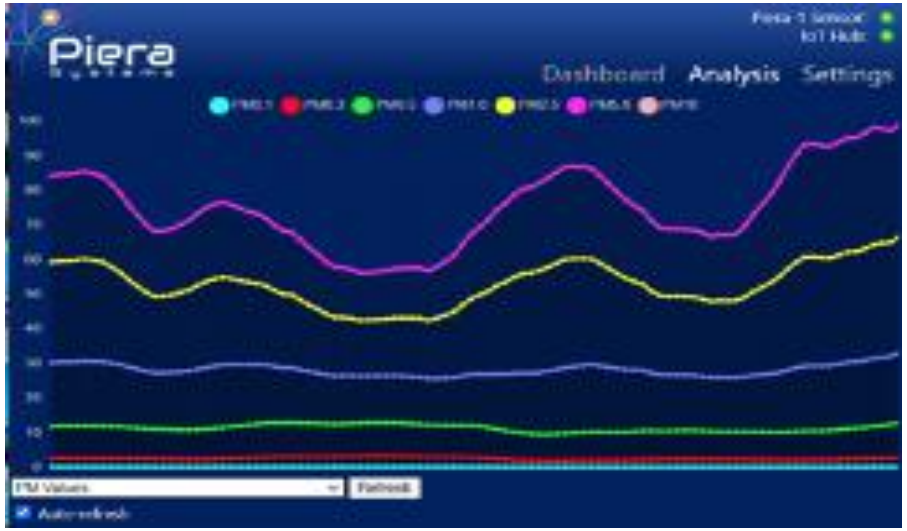
Factors		IPS Family	FRM's ~$25k	Premium	Low-cost
1	Accuracy (% deviation to Reference Instruments)	✓	✓		
2	Precision (unit to unit reproducibility, variation)	✓	✓	✓	
3	Fast data readout (real-time)	✓		✓	
4	Low power consumption	✓			✓
5	Wide range of PM Detection (01.-10+ um)	✓	✓		
6	Multiple, programmable PM bins with Particle Count	✓	✓	✓	
7	OTA updates	✓	✓		
8	Data vs. Empirical Estimates	✓	✓		
9	Cleaning mode	✓	✓	✓	
10	Accuracy across environmental conditions (RH)	✓	✓		
11	Software to analyze data from Sensor	✓	✓	✓	

SenseiAQ Software

Analyzes data from IPS Sensors

- Displays Real-Time PM count, mass concentration
- Auto Calculates and displays latest AQI scores every 60 seconds
- Dashboard shows PM1.0, PM2.5, PM10.0 values in ug/m3, AQI
- AQI Values correspond to EPA Guidelines for PM concentration
- Fast data acquisition and sampling (1 sec.)
- Windows, MacOS, Android OS
- IoT-Enables USB-connected Piera sensors
- Export to CSV
- Cloud-Enabled Version Available

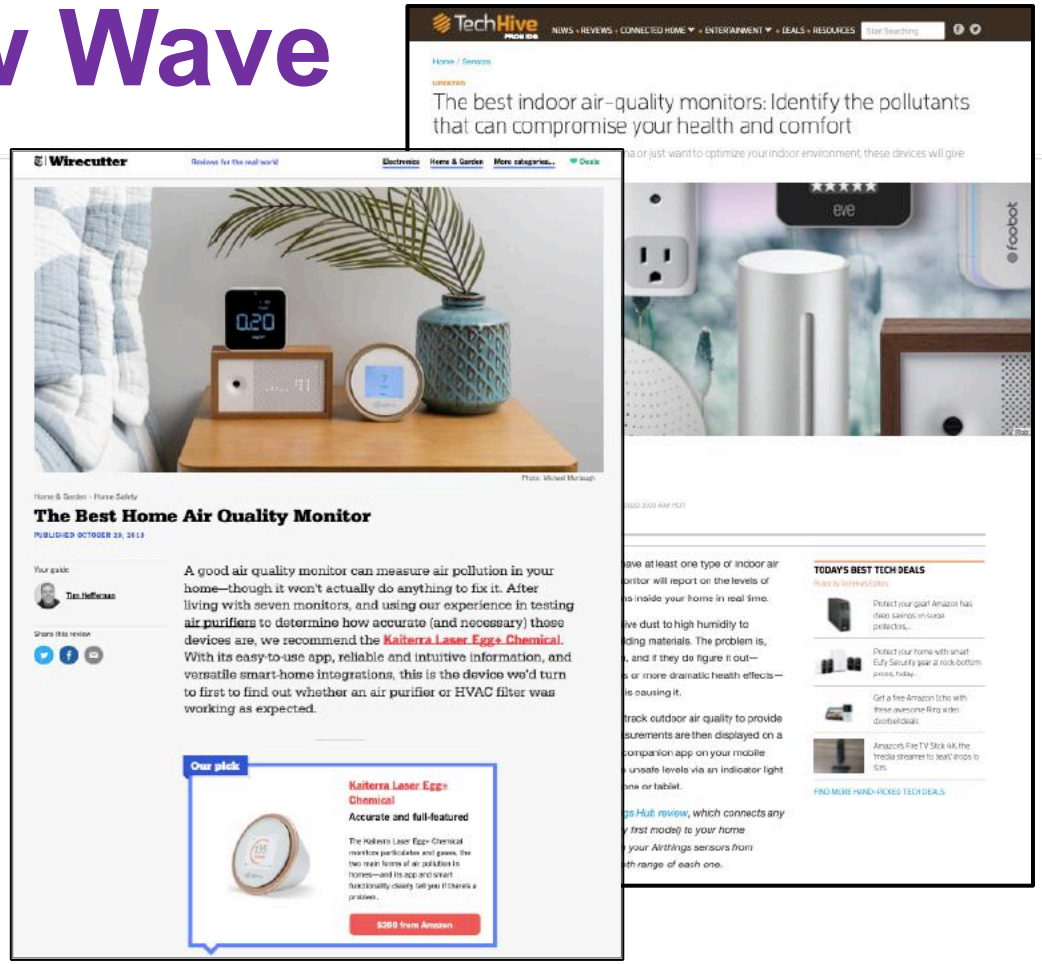
SenseiAQ Dashboard



SenseiAQ Analysis Charts

Air Quality Monitors: A New Wave

- Existing Consumer, Personal, Commercial Products
  - Utilize inaccurate PM sensors, little differentiation,
  - Calibrated only for PM2.5, estimate PM1.0, 10
- **A new Generation of AQMS with Piera sensors are more accurate and can identify sources**
- **Indoor Use Cases:**
  - Smart Spaces (Homes, Office, Commercial, Retail)
  - Industrial, Construction, Recycling, Warehouses
  - Medical Centers (Hospitals, clinics, Dr's offices)
- **Outdoor Use Cases**
  - Smart Cities, Clean Air Zones
  - Outdoor Activities: sports, retail, dining, shopping
  - Personal Use: biking, hiking, running, walking
  - Regulatory Bodies: EPA, etc.



"We insisted that all of our selections be capable of measuring one specific form of air pollution: particulate matter of 2.5 microns or smaller, better known simply as PM2.5. We favored those that also measured volatile organic compounds, better known as VOCs (in practice, gases and odors). " Source: Wirecutter

Canāree: Next Generation Air Quality Monitors

Canāree PM

Canāree PRO:
PM, VOC, Temp, Humidity, CO2

PARTNER SOLUTION OVERVIEW

ARUBA & Piera Systems

Indoor Air Quality Monitoring and Reporting

THE NEED FOR INDOOR AIR QUALITY MONITORING

Employees, customers and the general public are now aware of the need to Monitor, Measure and Improve Indoor Air Quality. Wildfires, Climate Change, Covid-19 and the increasing amount of time spent indoors has created a 'tipping point' for companies to take action. The source of most poor Air Quality is due to Particulate Matter (PM) a mixture of airborne solid particles and liquid droplets that can be inhaled and causes serious health problems. The World Health Organization (WHO) reports airborne particulate matter (particulate from 0.1-10 micrometer in size) as a Group 1 carcinogen and as the biggest environmental risk to health, with responsibility for about one in every nine deaths annually.

The EPA monitors and reports Outdoor Air Quality but not Indoors and their monitoring stations are quite far apart, expensive and do not update in real-time. The EPA's Air Quality Index (AQI) is a simple, easy to follow metric for classifying Air Quality and can be applied indoors. However, it doesn't classify sources of poor Air Quality. To do so requires more detailed information about particle size and count. A new class of Air Quality Monitors based on more accurate, higher resolution, real-time data about particle size and count has been developed by Piera Systems leveraging existing wireless access points from Aruba to quickly and cost effectively allow monitoring of Indoor Air Quality.

A BREAKTHROUGH IN AIR QUALITY MONITORING: CANĀREE

Canāree™ PM is a low cost, Air Quality Monitor that when connected to Aruba Access Points operates as an IOT device that measures Air Quality instantly, calculating EPA's AQI and can leverage MS Azure cloud services for secure data storage and remote access to data. Piera's **SenseiAQ™** software application running on Azure is a Real-time dashboard that reports AQI together with additional analytics and alerts about Indoor Air Quality. Canāree PM installs by simply plugging into an existing Access Points side USB connector without the need to remove the AP to install. Power and secure IoT communications are provided by the AP and Mobility Manager. Data is logged and stored on Azure IoT Hub for easy integration with existing Building Management Systems. Canāree is easy to install, configure, maintain and update and a network of Canāree sensors monitored by SenseiAQ can be easily reconfigured as needed.

WHY ARUBA AND Piera Systems

- Highly accurate Indoor Air quality monitoring & management
- Leverage existing wireless access points to reduce costs, simplify installation and deliver real-time analytics
- SenseiAQ™ application provides real-time dashboard, alerts and insight to take action and improve indoor air quality
- Vape/Smoke detection in real-time
- Secure, Cloud-based storage and analytics integrates with existing IT and Facilities Management applications
- Flexible business models allow own/rent/lease for short or long-term business requirements

Figure 1 Canāree PM

Canāree utilizes Piera Systems **Intelligent Particle Sensor (IPS)**, an optoelectrical sensor based on laser scattering. IPS utilizes Piera's proprietary **Particle Counting Integrated Circuit, (PCIC)** a custom ASIC specifically developed for photon-counting and processing (3 granted US patents). PCIC can identify different sized particles and their concentration by directly counting pulses of different levels of photon energy, featuring superior accuracy, resolution and true real-time data acquisition compared to other sensors using a less accurate, slower LPO technique that 'estimates' overall Air Quality.

Canāree PM's real-time data on PM is stored on Microsoft's Azure IOT hub and SenseiAQ can classify its components and take actions to improve it. Canāree can identify uniquely vape and cigarette smoke using proprietary ML/AI algorithms. Alerts identify it's presence, concentration and persistence (how long it remains in the air). Knowing the source of PM, its location and severity provides insight and mitigation including changing HVAC systems, adding air purifiers, removal of the source or limiting access to areas with poor Air Quality.

- **Air Quality Monitoring as a Service**
  - **Indoors and Outdoors**
- **Canāree AQMS include Piera 7100-N**
  - **PM: IoT-enabled via Access Points**
  - **PRO – Stand Alone IOT**
- **SenseiAQ Software & Dashboard**
- **Purchase, Lease Models**
- **Jointly Promoted with HPE/Aruba**
- **Available Direct, VAR's, White Label**

Canāree PM:

Features

- IOT Device connected to Azure IOT Hub
- USB-A, C, Firewire
- USB plug on existing Access Points
- Easy to install, maintain, update
- IPS 7100 sensor with 7 bins
- Ultra-high sensitivity detects PM0.1-PM10
- Fast Response Time: ≤ 0.5 seconds
- Bin sizes PM0.1, 0.3, 0.5, 1.0, 2.5, 5.0 10
- Mass Concentration and Particle Count, Size
- Low power (<50ma, idle/sleep modes)
- Self-cleaning mode

Applications

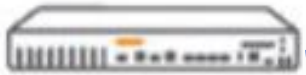
- Indoor Air quality monitoring & management
- Data to control and manage HVAC, Air purifiers
- Vape/Smoke detection
- Identify changes in real time and sources of PM

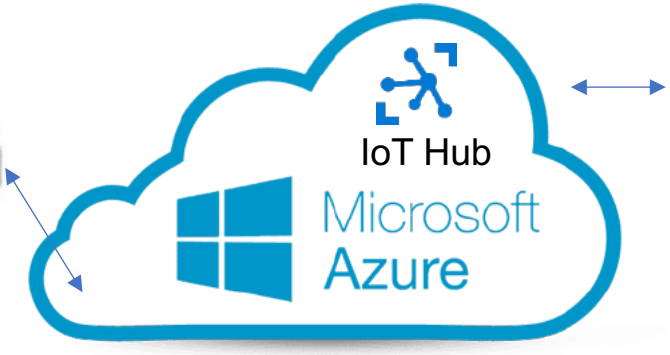
Specifications of Canāree PM	
Size	7cm x 5cm x 1.4cm (2.75” x 2” x 0.5”)
Weight (g)	35 grams (~1.2 ounces)
Power	5 VDC @ 0.50 ma (0.25 W over USB, continuo us)
Coverage	~ 10 m^2, 100 ft^2
# supported sensors	unlimited
Communications Protocol	USB to AP, proprietary from AP to MS Azure
Certifications	CE, KETI
Temp	-10 to + 60 C
Humidity	0 – 95 % RH (non-condensing)
Accuracy	+/- 10 % variance from Reference Instruments
Sampling Time (adjustable)	>0.5 seconds
Lifetime (24 h/day operation)	8.0 years (may vary due to conditions)

Canaree PM, PRO Deployed

Aruba AP
8.8 or above

Aruba MC/vMC
8.8 or above

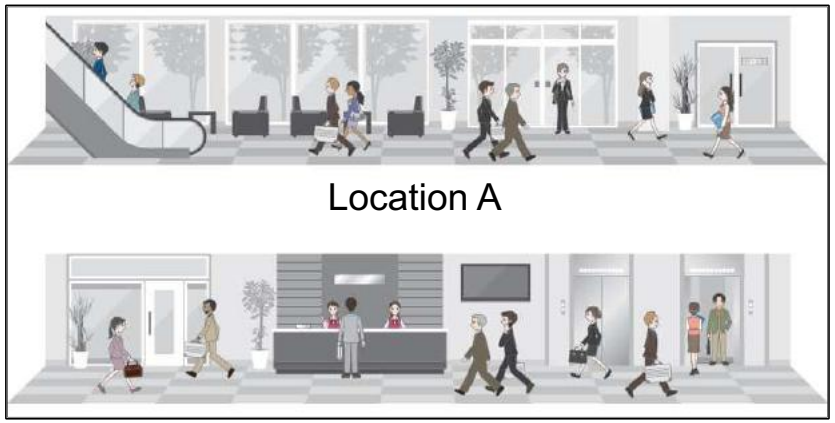




wss://sensei.pierasystems.com

SenseiAQ Dashboard

https://portal.pierasystems.com



Location A

Location B

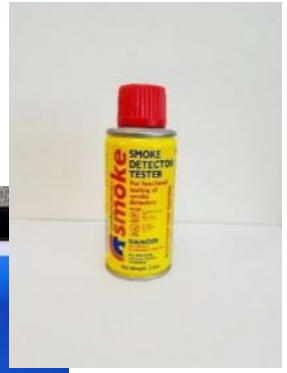
Wifi AP

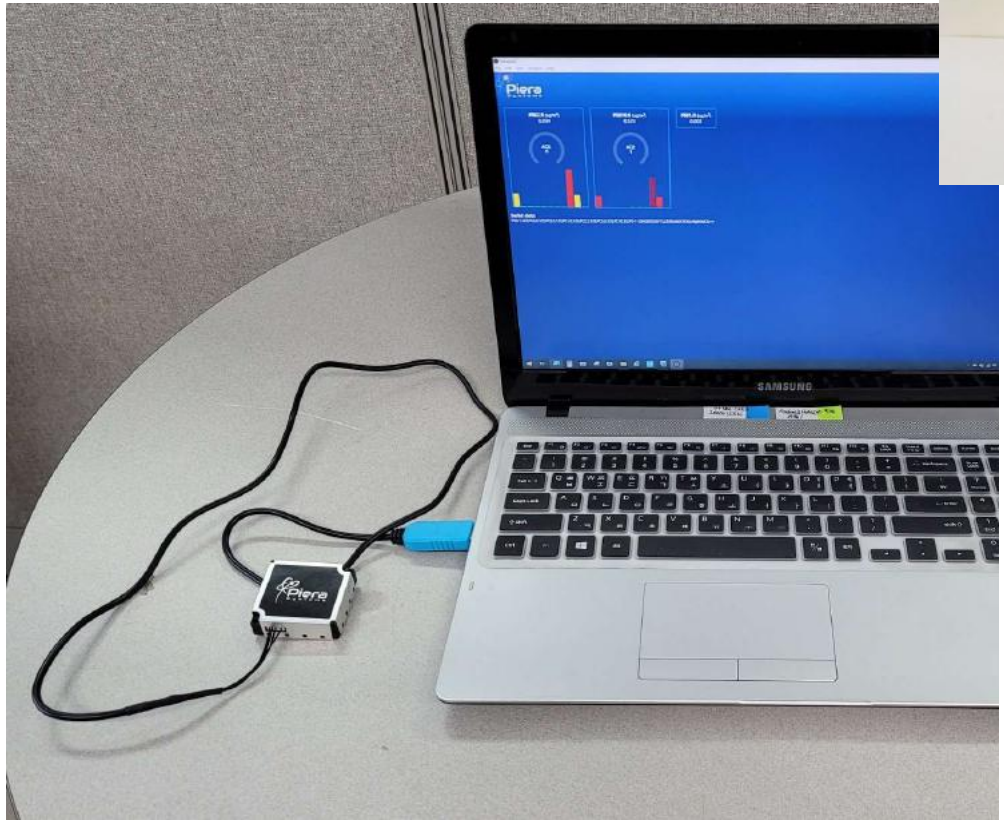
Network of PM, PRO devices at indoor locations

IPS Evaluation Kit Gets You Started

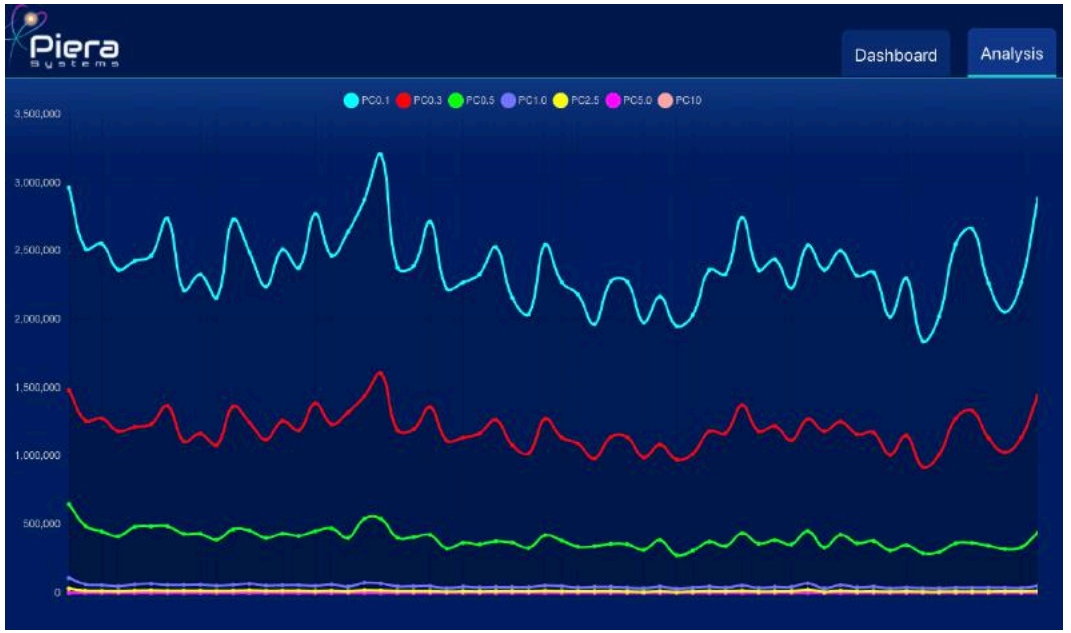
Smoke detector test spray

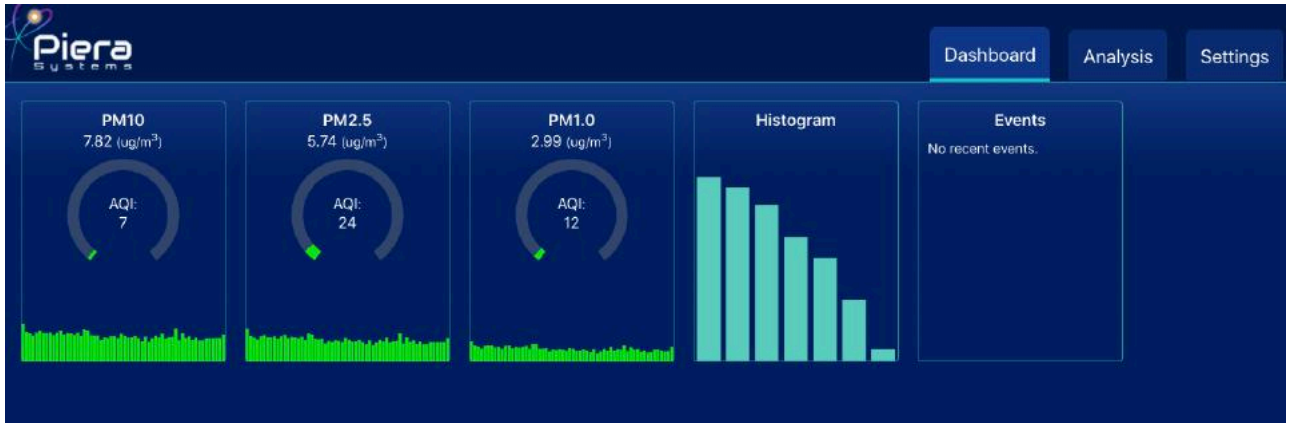
Smoke Centurion M8





The evaluation kit connected to a PC via USB





Canāree PM Evaluation Kit

Smoke detector test spray

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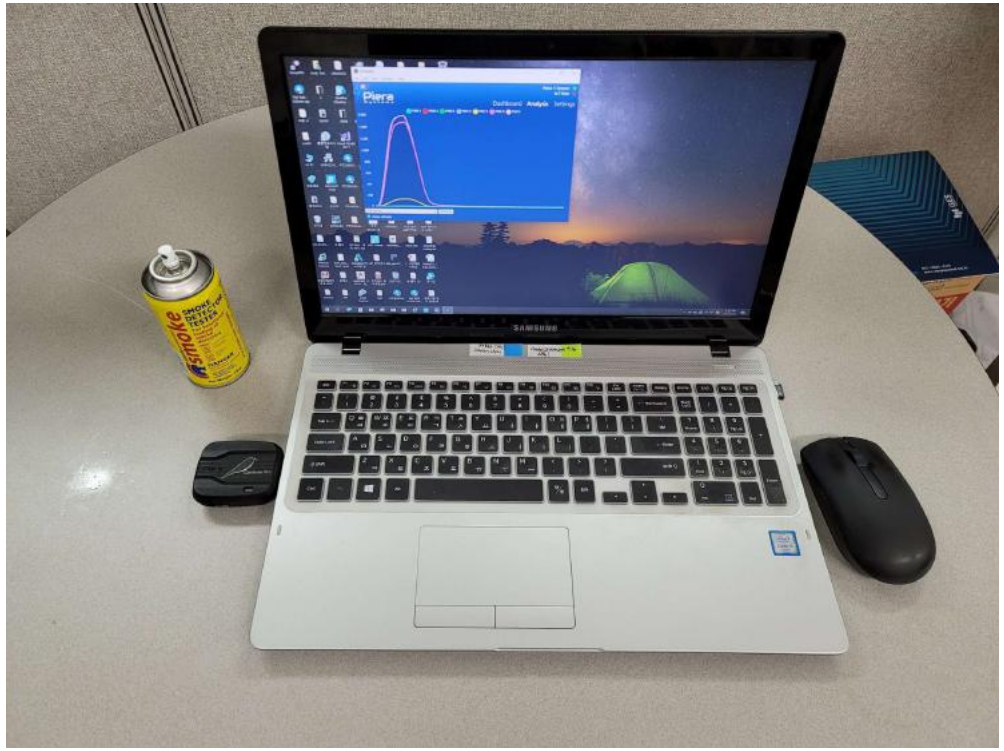

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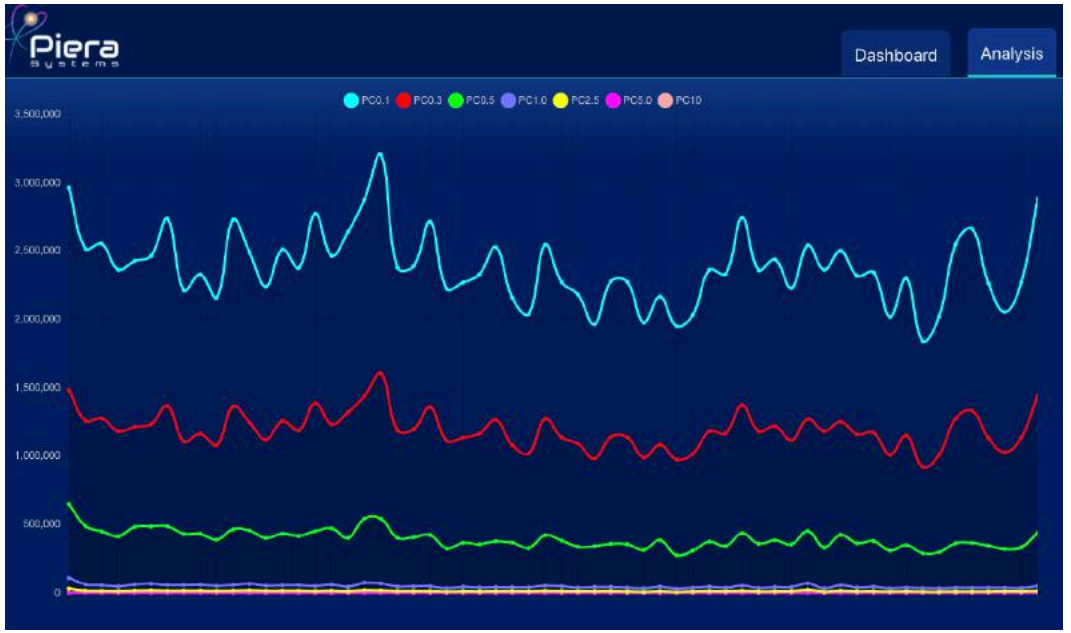
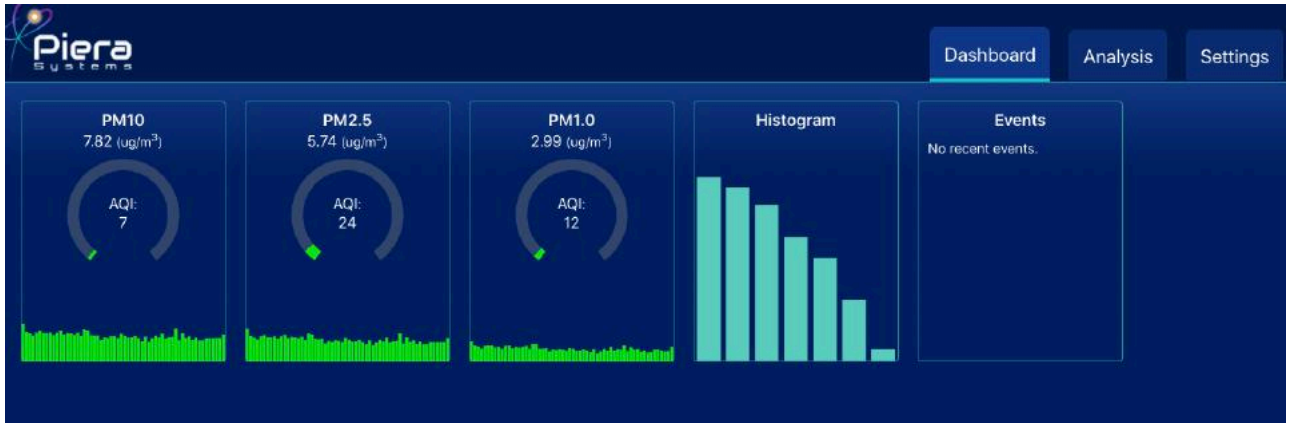
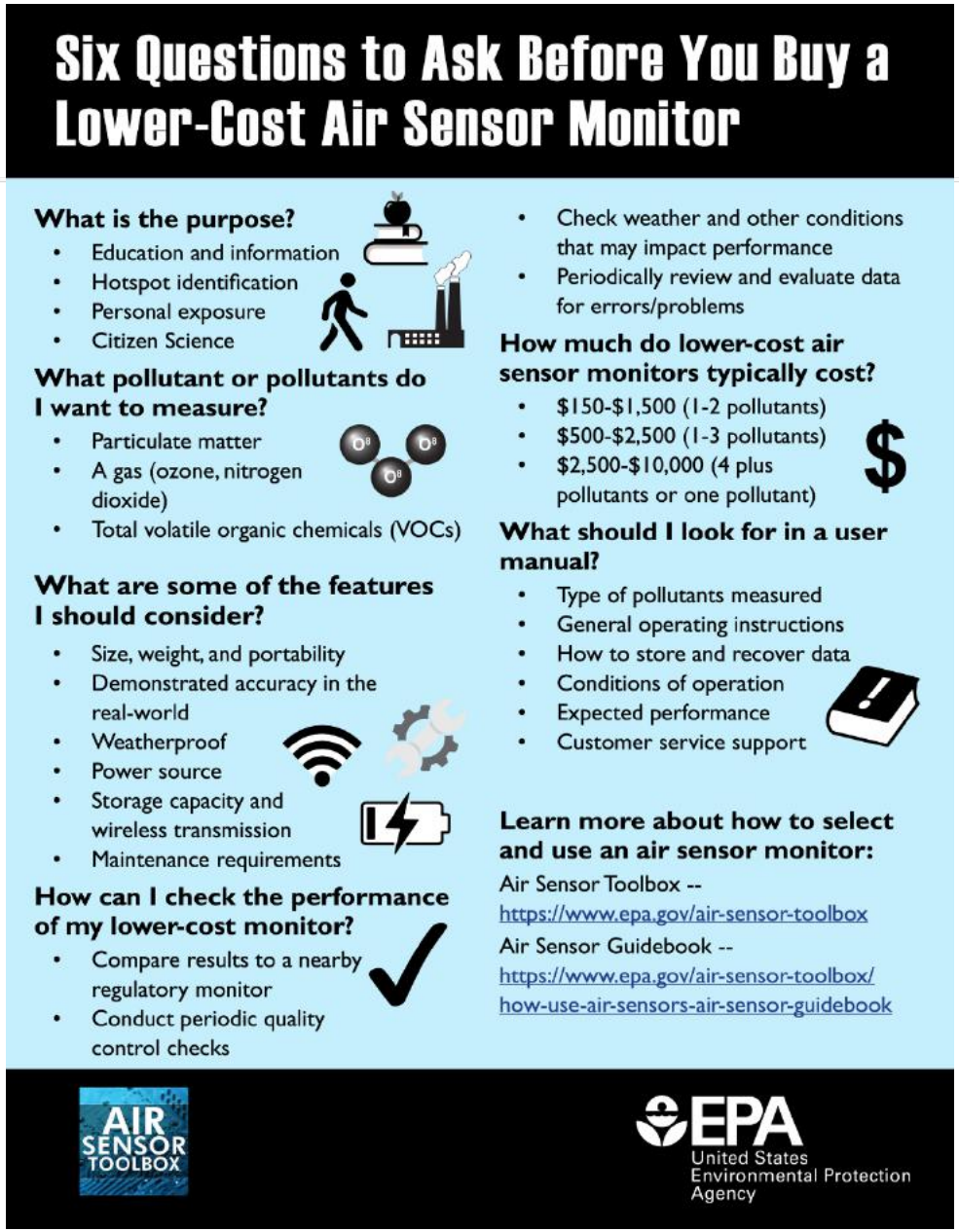
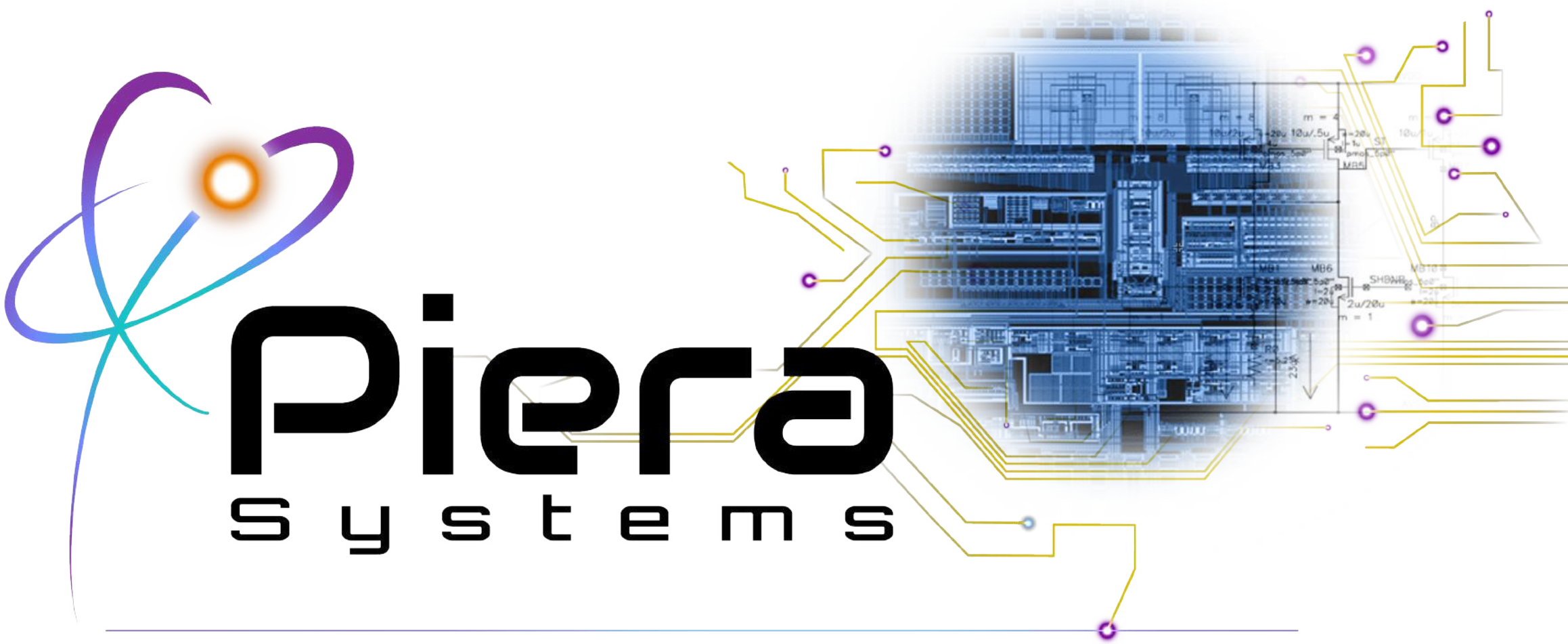




What Does the EPA Say?

1. Purpose ?
   - Piera meets all
2. Pollutants ?
   - IPS, Canāree PM, PRO,
3. Features ?
   - IPS, Canāree PM, PRO
4. How do I check the performance ?
   - Piera's SenseiAQ Software
5. Cost ?
   - Piera ($30-$299)
6. What should I look for ?
   - Piera Systems





What's in your AIR ?