

**A Low-Cost, High Performance,
Industrial Grade Particle Counter
for Simultaneous PM_{1} , $PM_{2.5}$, PM_{4}
and PM_{10} Measurement**

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Outline

- Specifications
- Field Data
- Summary

ES-405 Particulate Profiler



Specifications

Model Number	ES-405
Operation	Right angle light scatter detection, using a laser diode as light source.
Measurement Resolution	0.1 $\mu\text{g}/\text{m}^3$
Number of Mass Channels	4 (PM ₁ , PM _{2.5} , PM ₄ , PM ₁₀)
Measurement Range	PM ₁₀ : 10,000 $\mu\text{g}/\text{m}^3$; PM _{4.0} : 4,000 $\mu\text{g}/\text{m}^3$; PM _{2.5} : 2,000 $\mu\text{g}/\text{m}^3$; PM _{1.0} : 300 $\mu\text{g}/\text{m}^3$
Data Storage Intervals	1, 5, 10, 15, 30, or 60 minutes
Sample Air Flow Rate	1.0 LPM
Sheath Air Flow Rate	1.0 LPM
Flow Control	Active volumetric flow control
Communications Connections	RS-485, RS-232, USB, Optional CCS Modem
Operating Temperature	0° to +50° C
Storage Temperature	-20° to +60° C
Ambient Humidity Range	0 to 95%, non-condensing
User Interface	Menu-driven interface with 4 x 20 character OLED display and dynamic keypad.
Power Supply	Universal 100 - 240 VAC input, 50/ 60 Hz.
Power Consumption	12 VDC. Max operating current 1300 mA.
Alarm Contact	Normally open/ normally closed contact closure relay output. Contact rating 1.0 A @ 30 VDC max.
Closure Weight	8.5 lbs without power supply, 10 lbs with power supply.
Dimensions Communications Protocol	Height: 20" Width: 8" Depth: 6" Terminal Command Set, Modbus 7500 Protocol

Applications

- Indicative monitoring applications
- Augment criteria/regulatory monitoring
- Construction sites
- Emergency responder applications
- Community monitoring

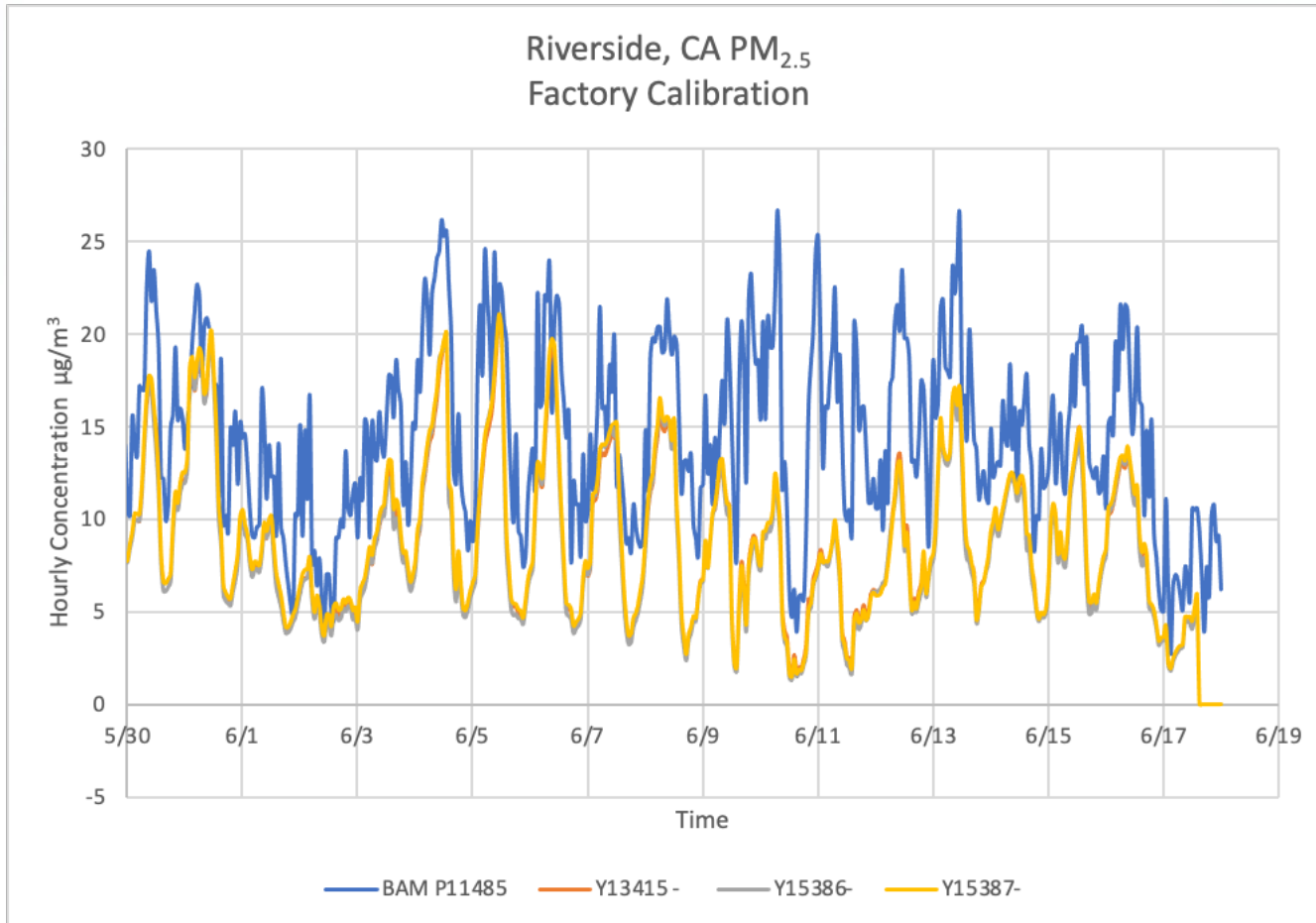
ES-405 Overview

- Price: ~\$5,000 depending on how equipped
- No mechanical separator needed
- On-board moisture control
- On-board logger
 - Data may be sent directly to the cloud via modem
 - Accepts inputs from a variety of met sensors
- Sheath air system
- Simultaneously measures and logs PM_1 , $PM_{2.5}$, PM_4 and PM_{10} .

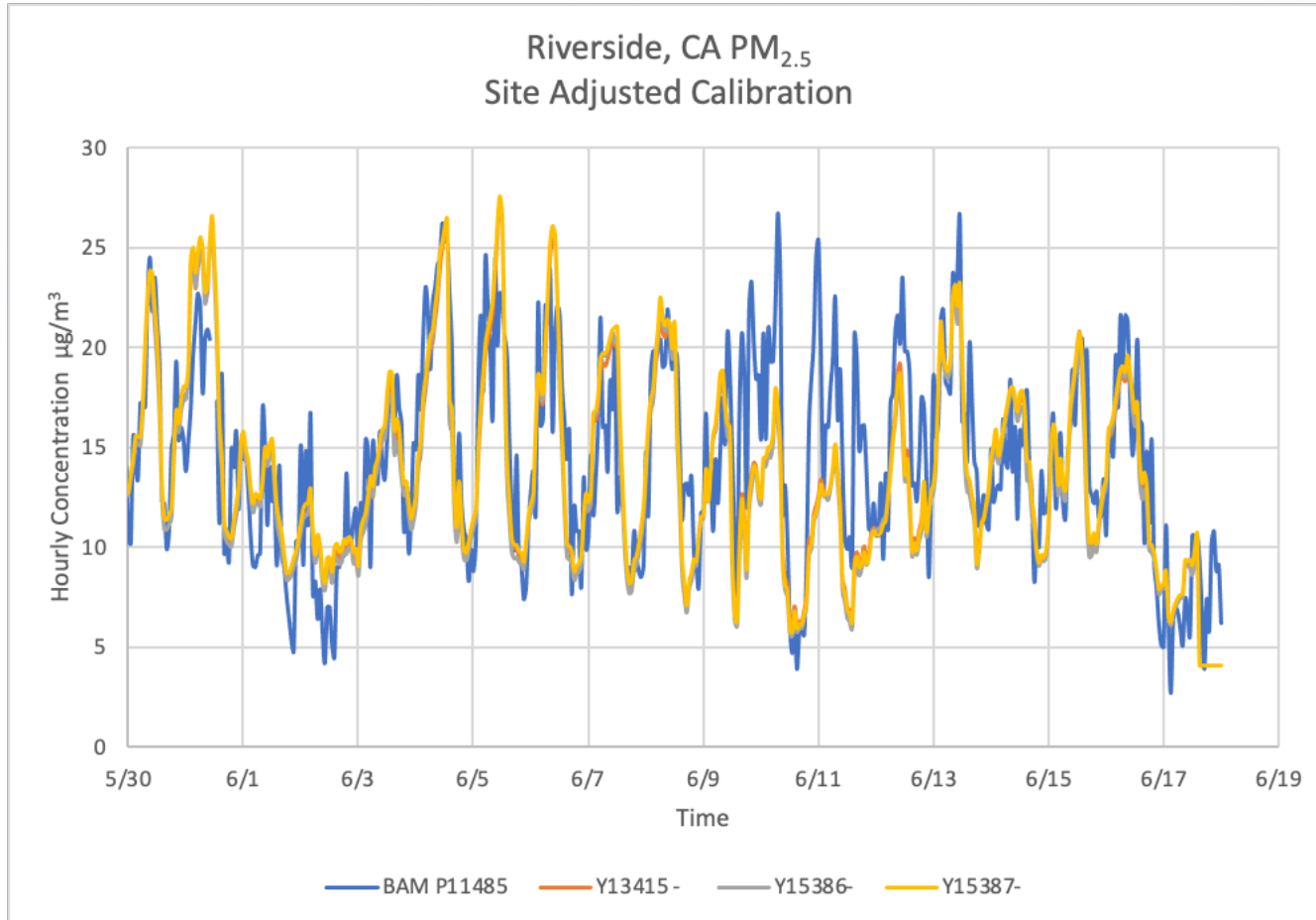
Field Testing

- MOI conducted field tests in metro Los Angeles and Salt Lake City UT
- All analyzers were given factory default calibration factors for all reported cut points
- BAM-1020 monitors operated as US-EPA designated equivalent methods for PM_{2.5} and PM₁₀ were collocated as referees

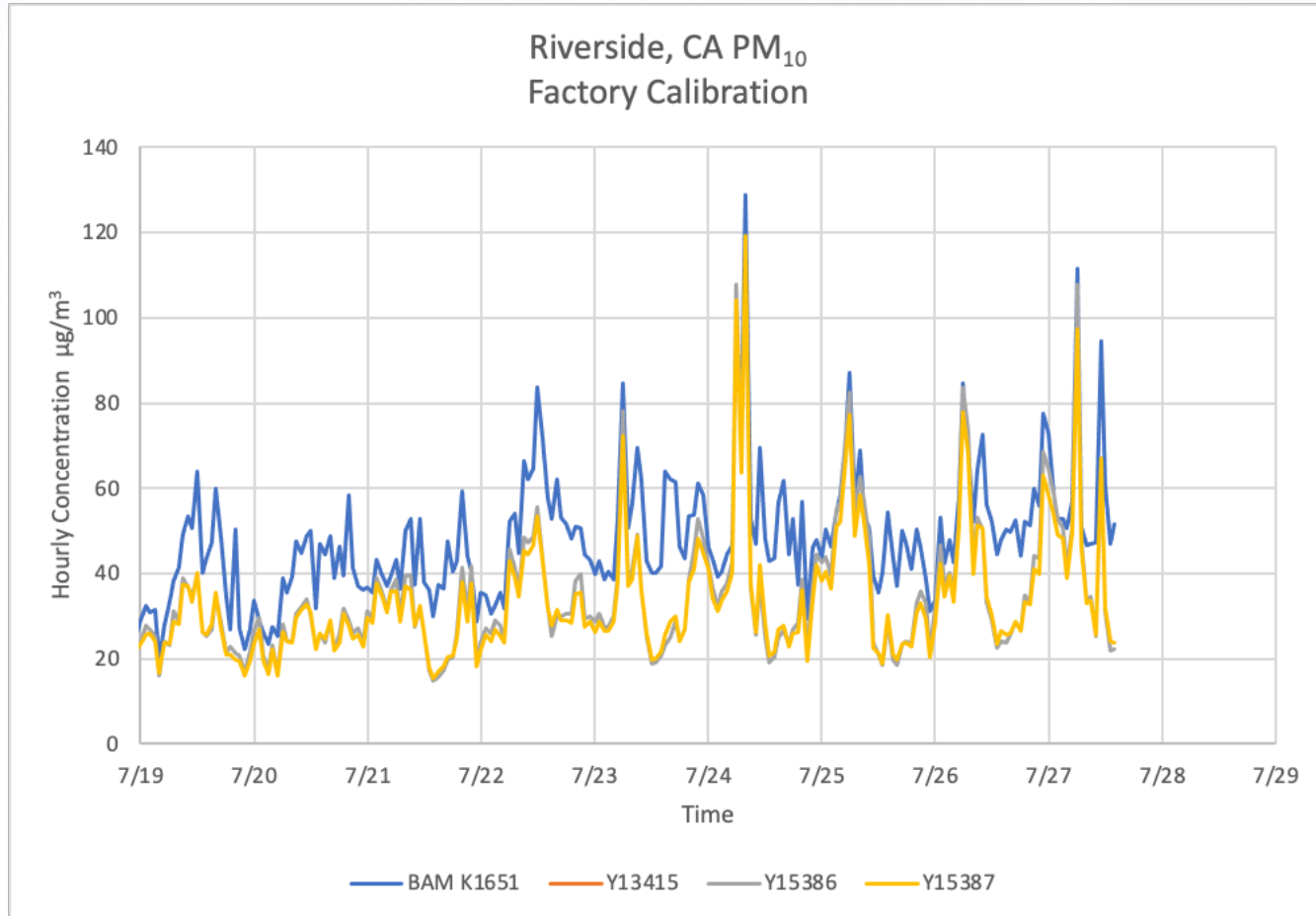
Results – Riverside PM_{2.5}



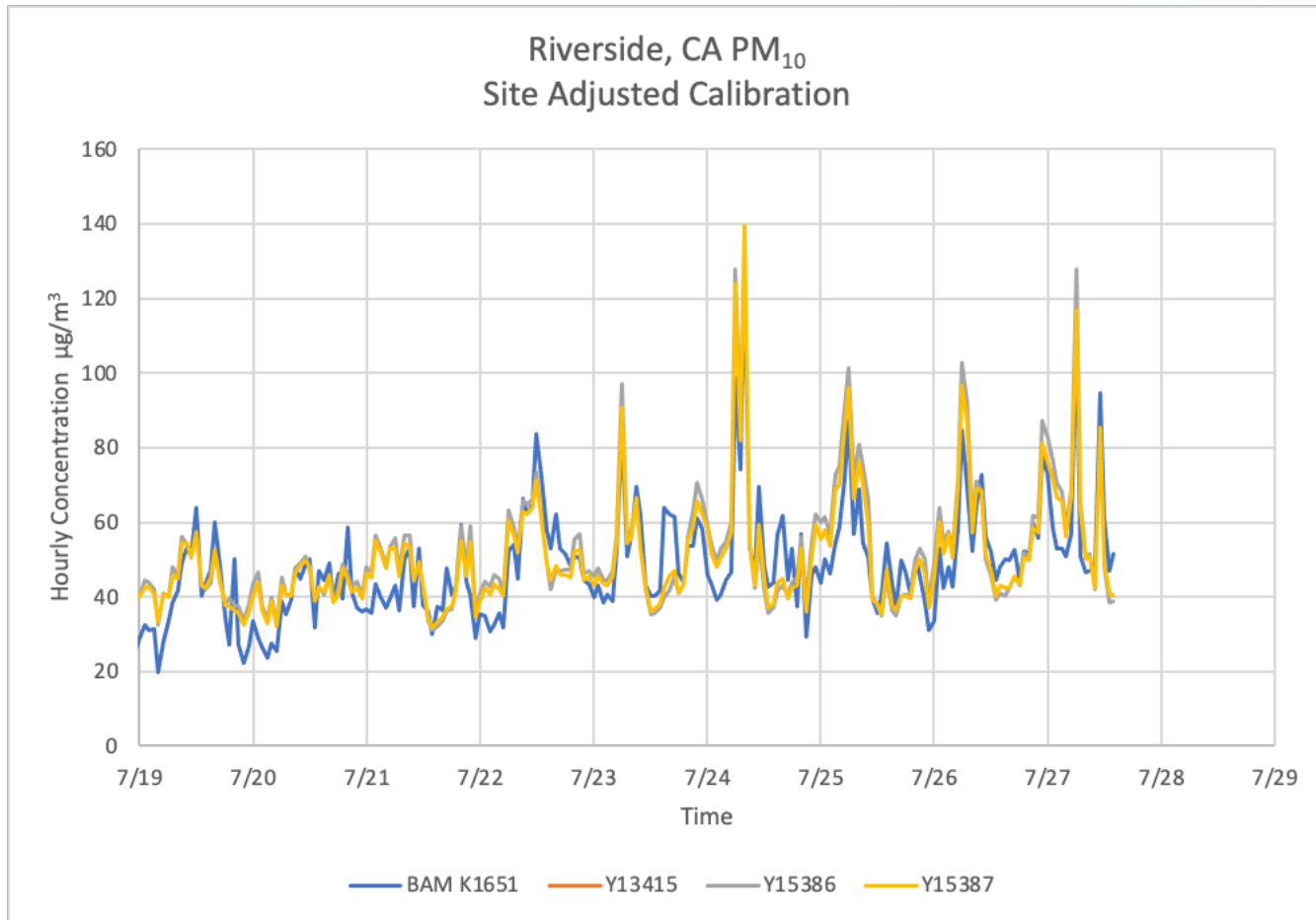
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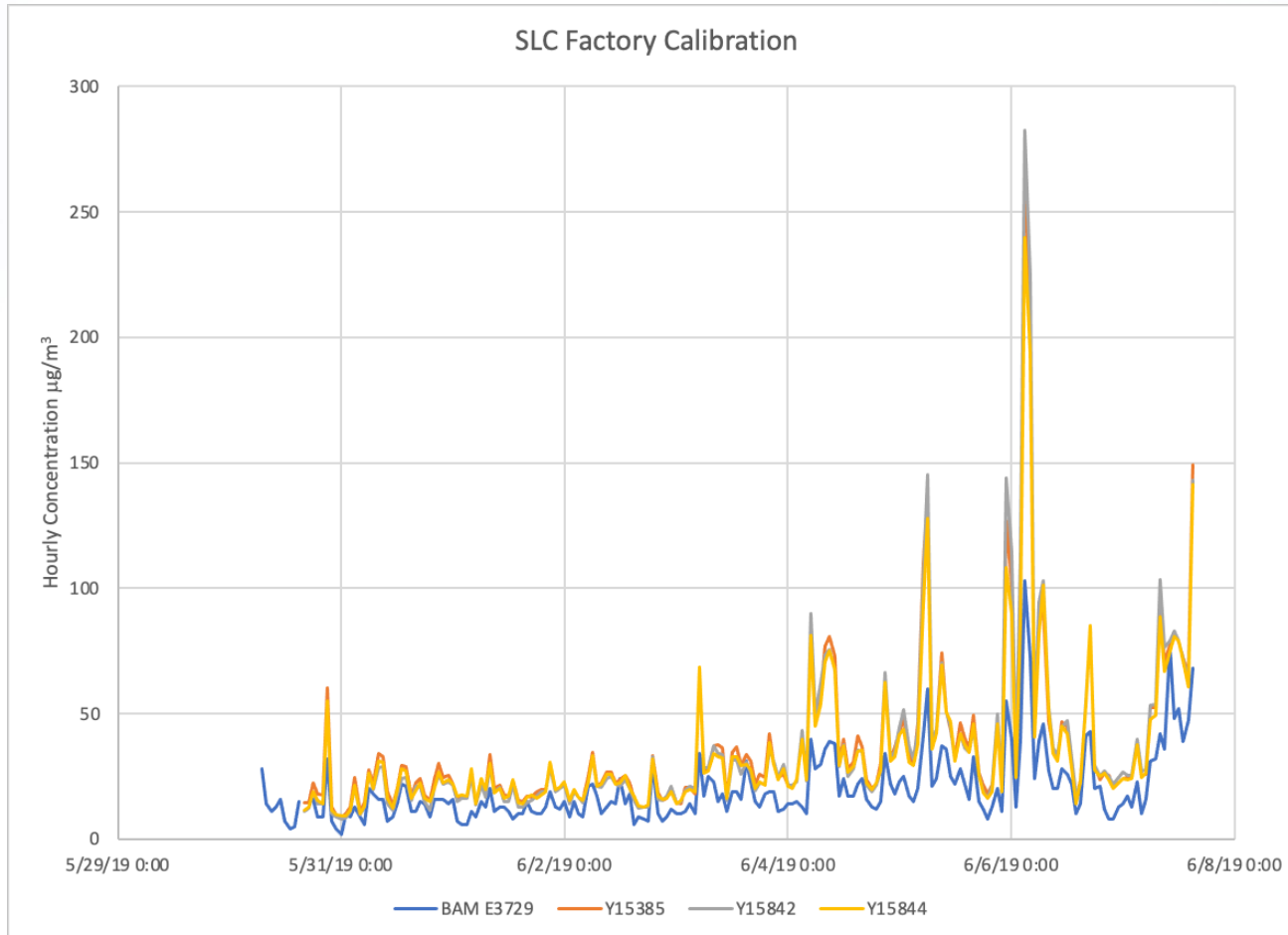
Results – Riverside PM₁₀



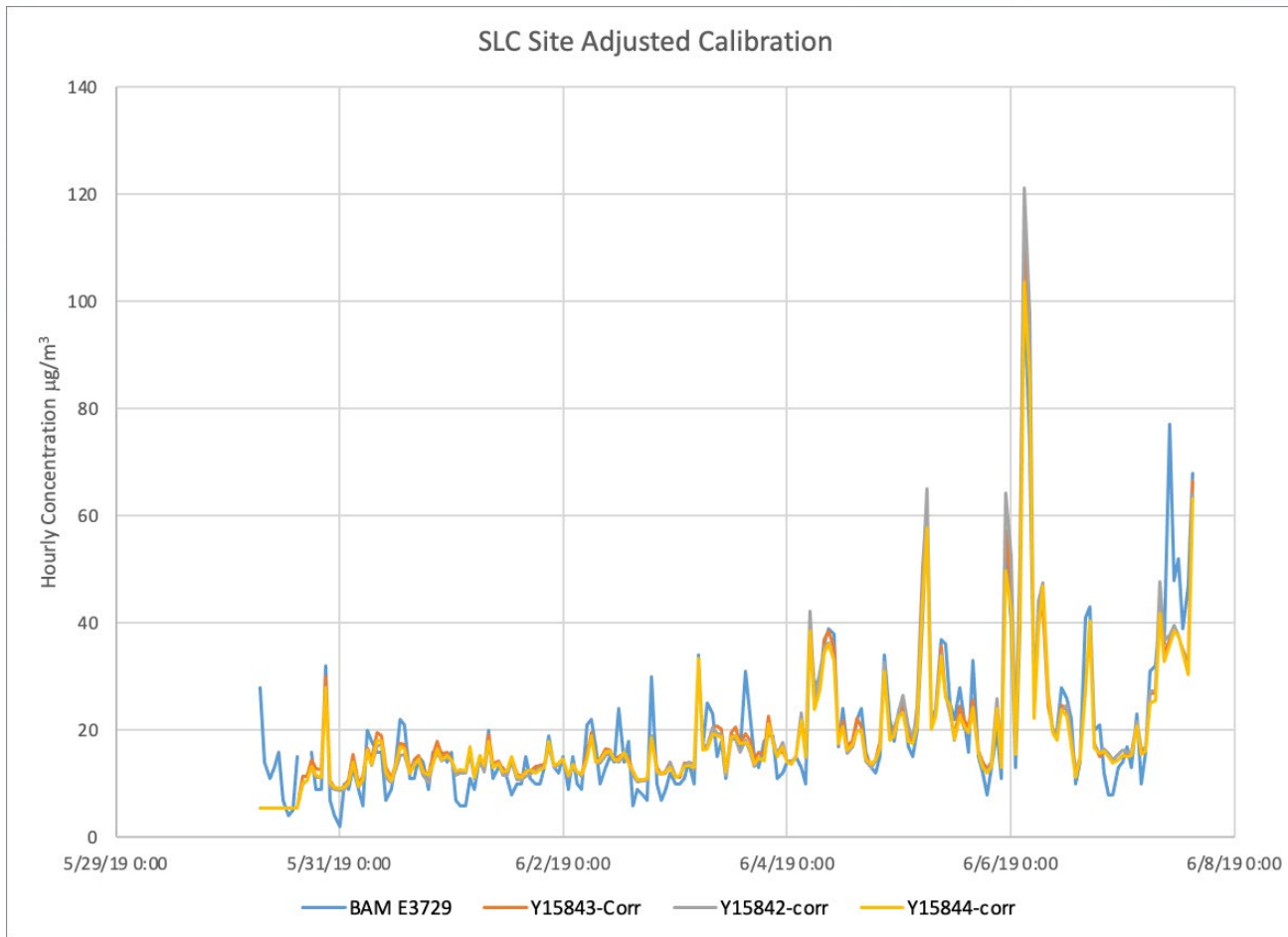
Results – Riverside PM₁₀



Results – SLC PM₁₀



Results – SLC PM₁₀



Summary

- Factory calibrated units typically produced results that were within 35-40% of the site reference (BAM-1020) for all cutpoints
- Field calibrated units typically produced results that were within 10-20% of the site reference for all cutpoints
- Field calibration factors vary according to site and cutpoint.