Field Evaluation of Naneos Partector Sensor

South Coast AQMD

AQ-SPEC
Air Quality Sensor Performance Evaluation Center

Background

- From 08/05/2015 to 10/12/2015, three **Naneos Partector** monitors were deployed in Rubidoux and were run side-by-side SCAQMD Federal Equivalent Method (FEM) instruments measuring the same pollutants

- Partector (*3 units tested*):
  - Based on a "*novel non-contact electrical detection*" principle by Fierz et al., 2014
  - Each unit measures: Lung Deposited Surface Area (LDSA) of nanoparticles, internal Temp and RH
  - Unit cost: ~$7,000
  - Time resolution: 1-min
  - Units IDs: 106, 107, 109

- SCAQMD FEM instruments:
  - GRIMM (reference method):
    - Optical particle counter (FEM); Uses proprietary algorithms to calculate total PM, $PM_{2.5}$, and $PM_{1.0}$ from particle number measurements
  - Cost: ~$25,000 and up

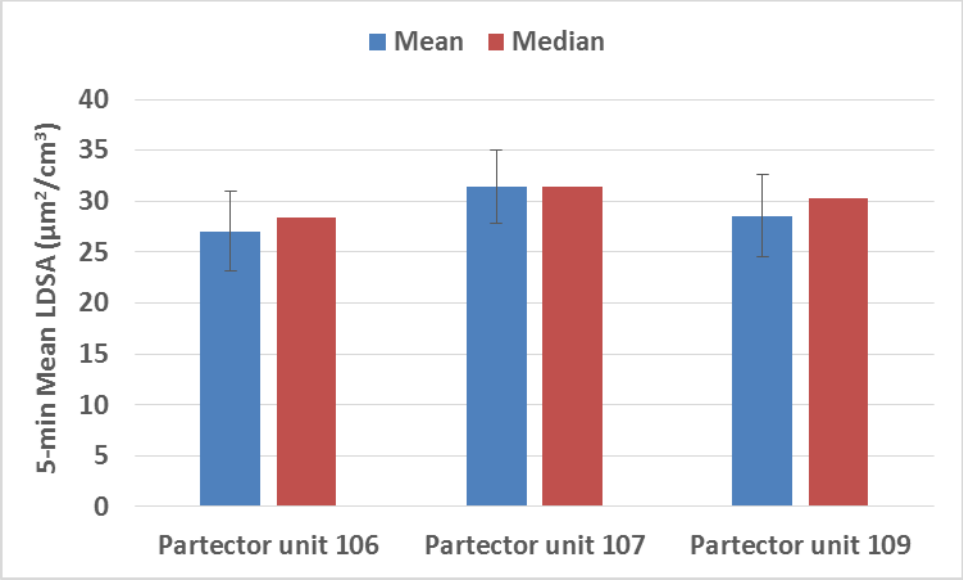
Fierz M, Meier D, Steigmeier P, Burtscher H. **2014**. Aerosol Measurement by Induced Currents. Aerosol Sci. Technol., 48(4): 350-357

Data validation & recovery

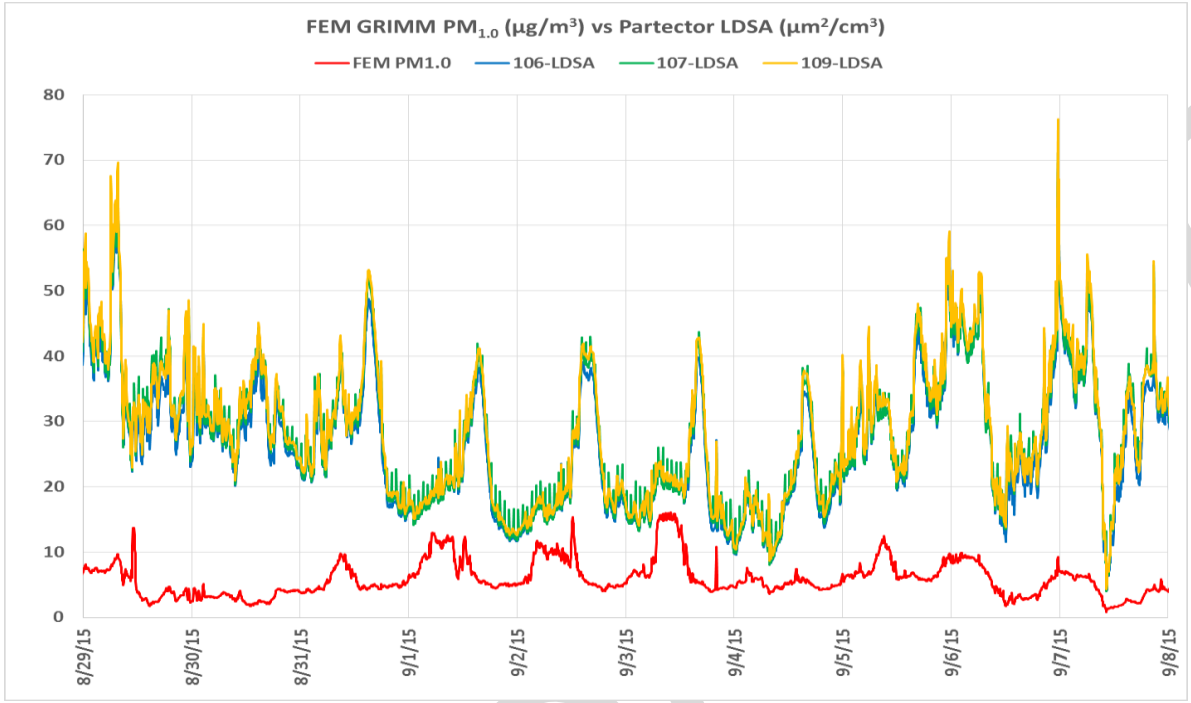
- Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, and invalid data-points were eliminated from the data-set)
- LDSA and internal Temperature and RH data recovery for all three Partector sensors was 99.99%

Partector; intra-model variability

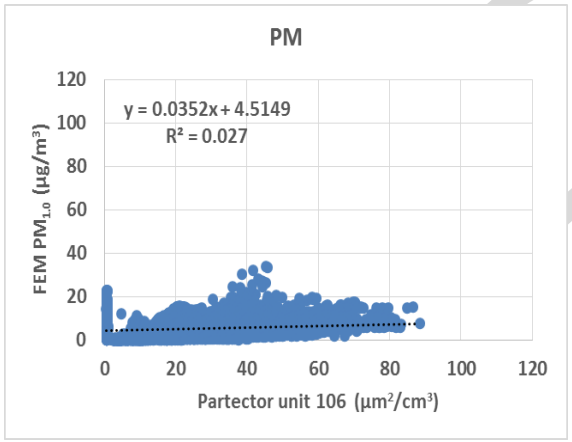
- Very low measurement variations were observed between the three Partector units for LDSA

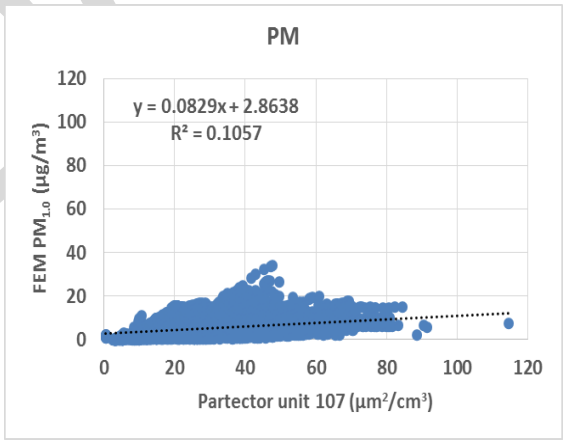


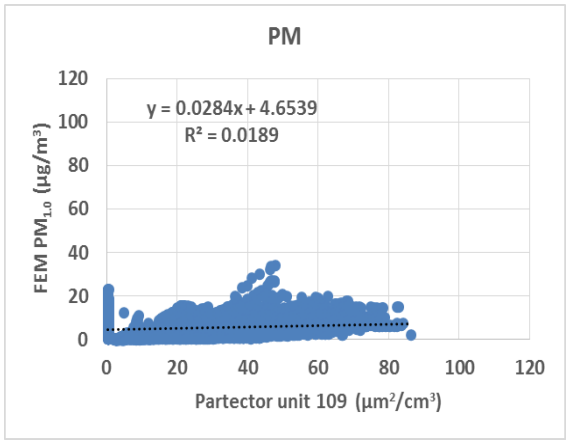
Partector vs FEM GRIMM $PM_{1.0}$ Mass Conc. (5-min mean)



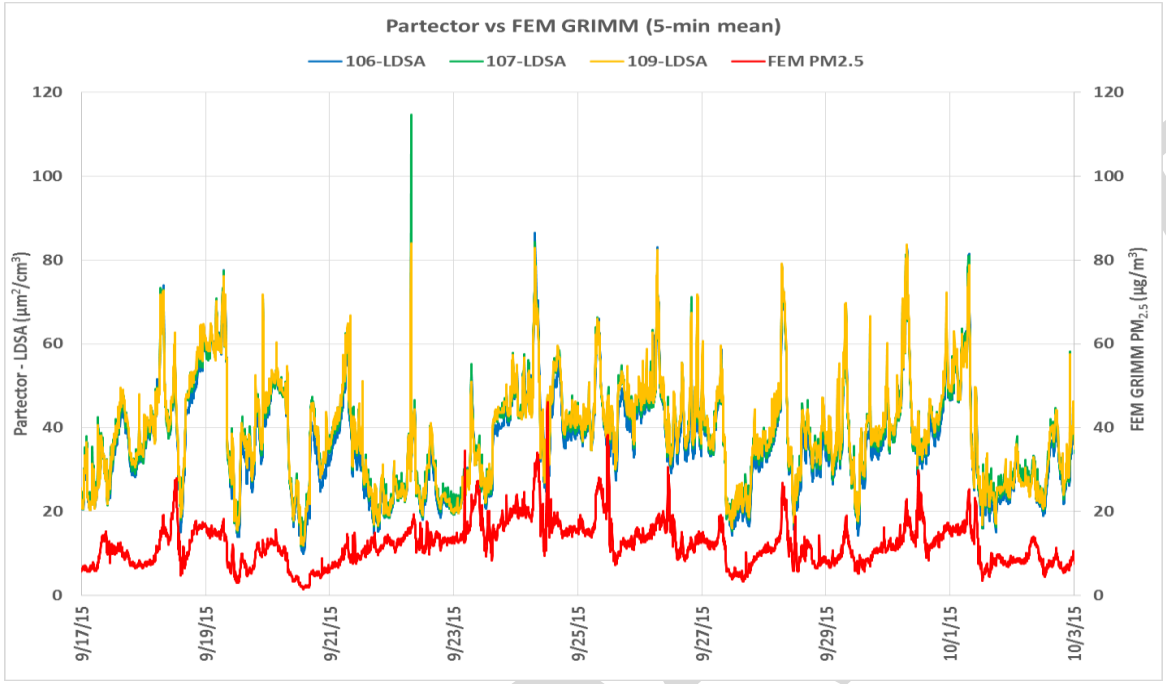
- Partector LDSA measurements do not track well the typical $PM_{1.0}$ (ug/m^3) diurnal variations recorded by the FEM GRIMM instrument
- Partectors correlate poorly with the FEM GRIMM $PM_{1.0}$ (ug/m^3) measurements data (R^2~0.1)



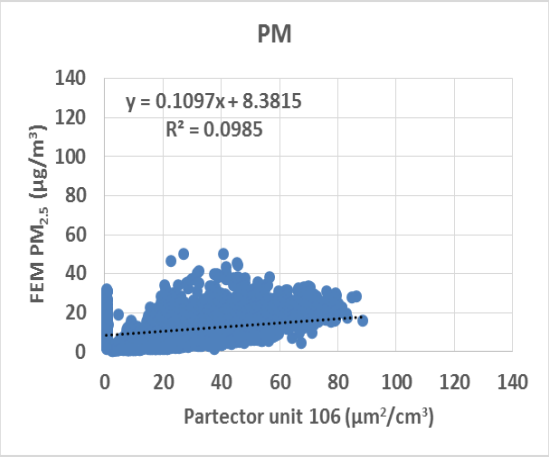


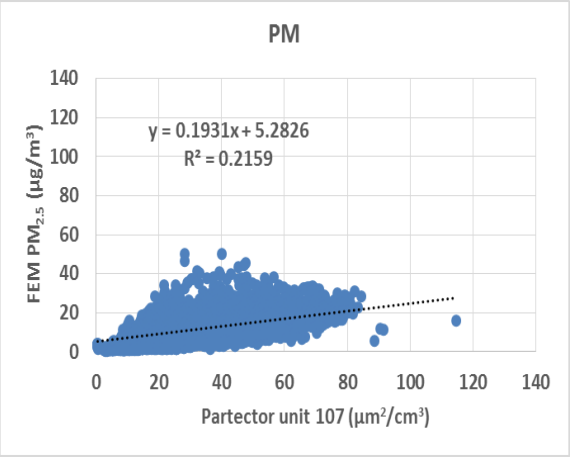


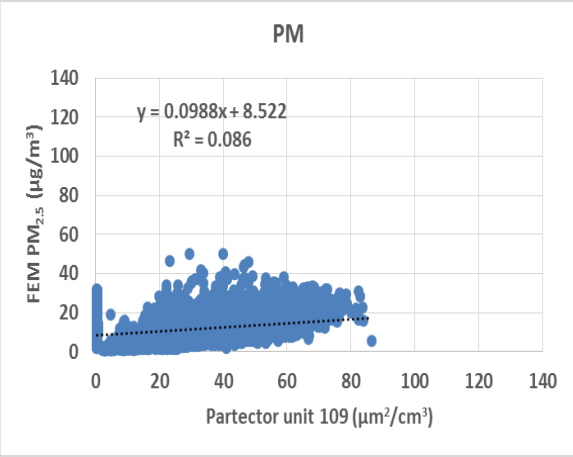
Partector vs FEM GRIMM $PM_{2.5}$ Mass Conc. (5-min mean)



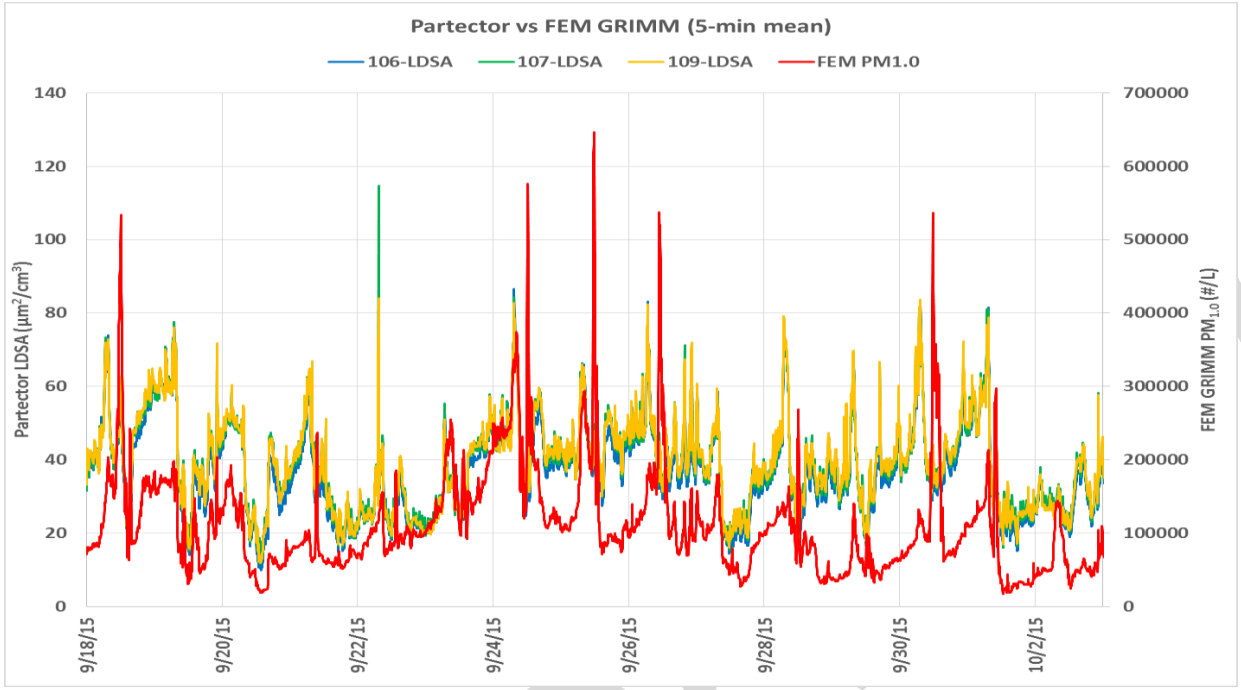
- Partector LDSA measurements do not seem to track the typical $PM_{2.5}$ (ug/m^3) diurnal variations recorded by the GRIMM FEM instruments
- Partectors correlate poorly with the FEM GRIMM $PM_{2.5}$ (ug/m^3) measurements data (R^2~0.2)



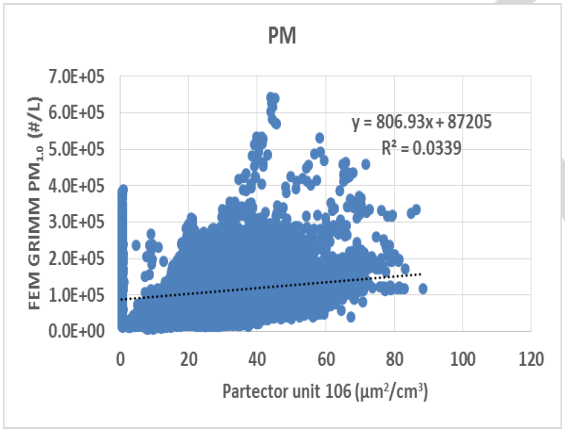


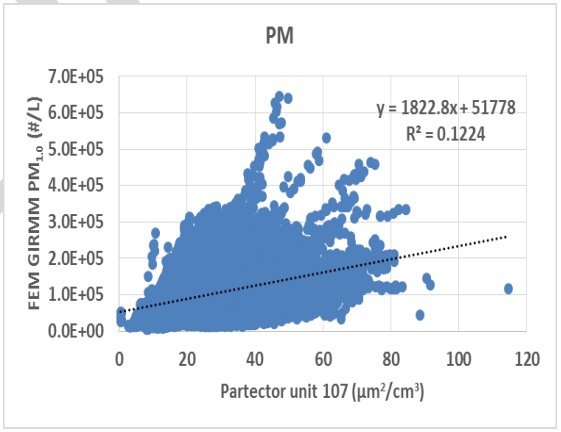


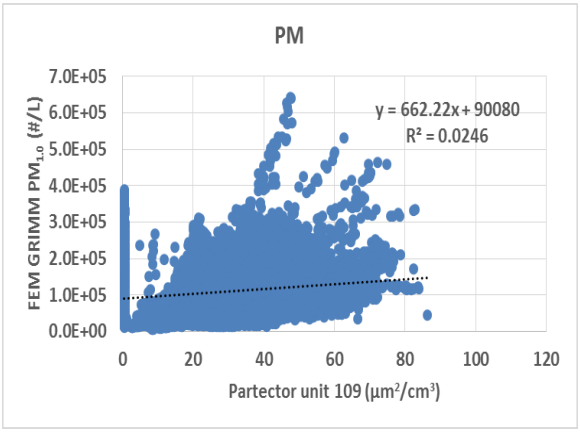
Partector vs FEM GRIMM $PM_{1.0}$ Count Conc. (5-min mean)



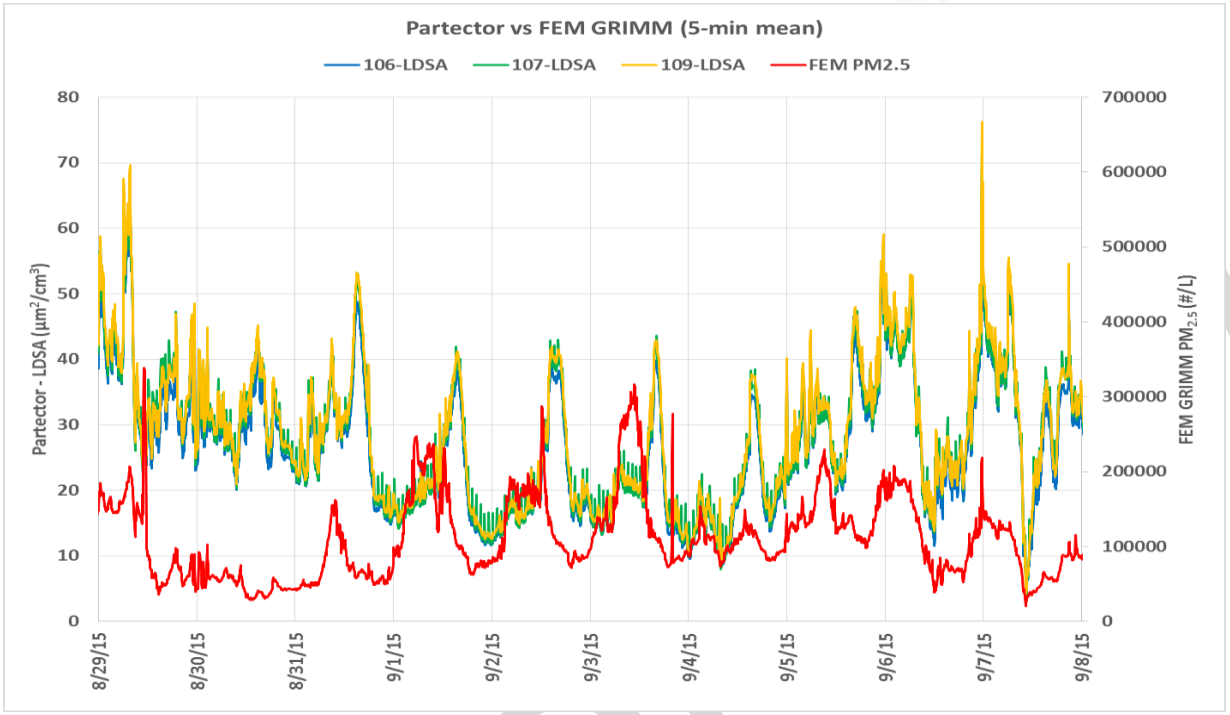
- Partector LDSA measurements seem to track fairly well the typical $PM_{1.0}$ (particles / L) diurnal variations recorded by the GRIMM FEM instrument
- Partectors correlate poorly with the FEM GRIMM $PM_{1.0}$ (particles / L) measurements data (R^2~0.1)



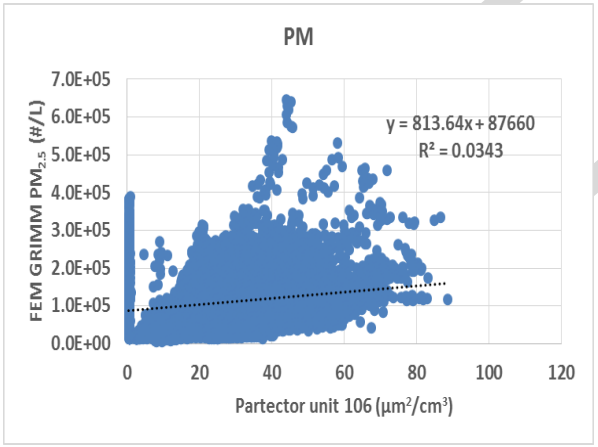


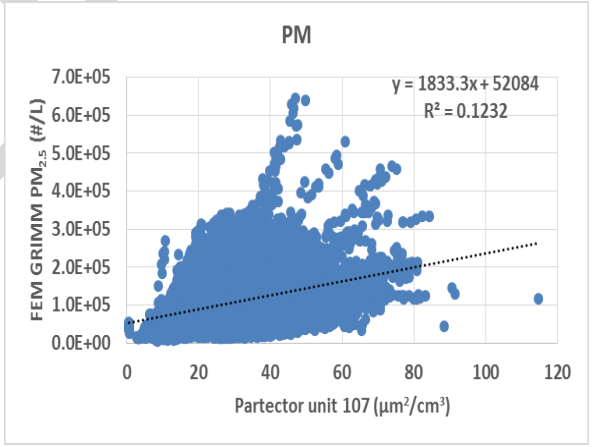


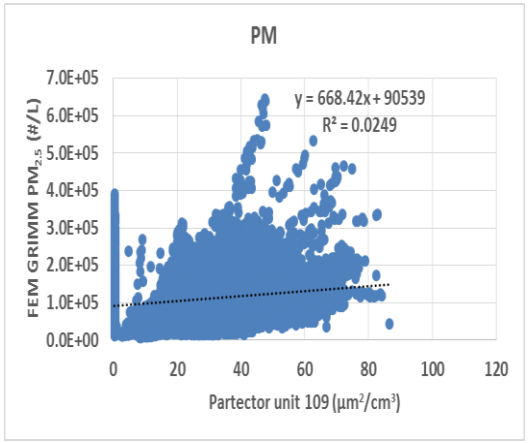
Partector vs FEM GRIMM $PM_{2.5}$ Count Conc. (5-min mean)



- Partector LDSA measurements do not seem to track the typical PM2.5 (particles / L) diurnal variations recorded by the GRIMM FEM instrument
- Partectors correlate poorly with the FEM GRIMM $PM_{2.5}$ (particles / L) measurements data (R^2~0.1)







Discussion

- Overall, the three **Partector** monitors were reliable (i.e. no down time over a period of about two months) and were characterized by very low intra-model variability.
- The Lung Deposited Surface Area (LDSA) measurement data from all three Partectors correlated poorly with the FEM GRIMM measurement data:
  - $PM_{1.0}$ (ug/m^3): (R^2~0.1)
  - $PM_{2.5}$ (ug/m^3):(R^2~0.2)
  - $PM_{1.0}$ (particles/L):(R^2~0.1)
  - $PM_{2.5}$ (particles/L): (R^2~0.1)
- The three Partectors (LDSA data) only track well the diurnal variations of the FEM GRIMM $PM_{1.0}$ count concentration measurement data
- A comparison between Partectors and FEM BAM $PM_{2.5}$ measurement data was not performed due to the already poor correlation with the FEM GRIMM $PM_{2.5}$ mass and count concentration data
- No sensor calibration had been performed prior to the beginning of this field testing
- Laboratory chamber testing is necessary to fully evaluate the performance of these sensors under controlled temperature/relative humidity conditions and known aerosol concentrations.
- All results are still preliminary