Airborne Particle Resuspension

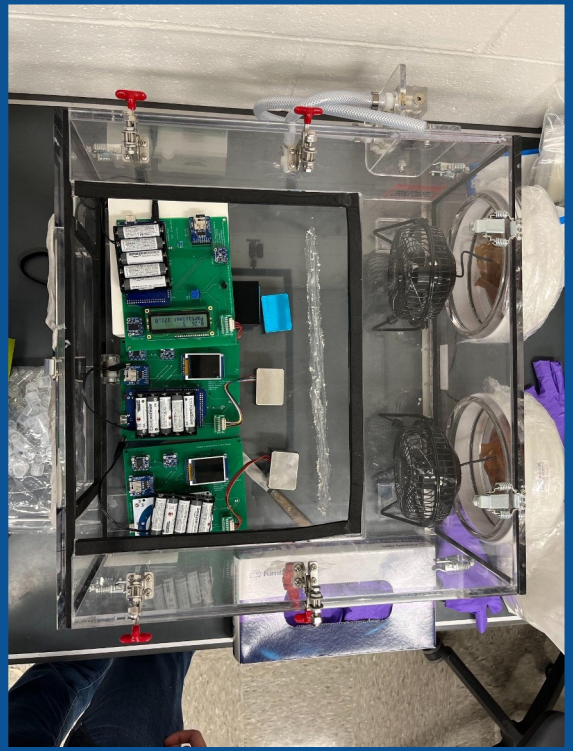
Group 7:
Jake Rosenbaum, Michael Gachich, Nicholas Jung, Samriddhi Bhatia

Department of Physics

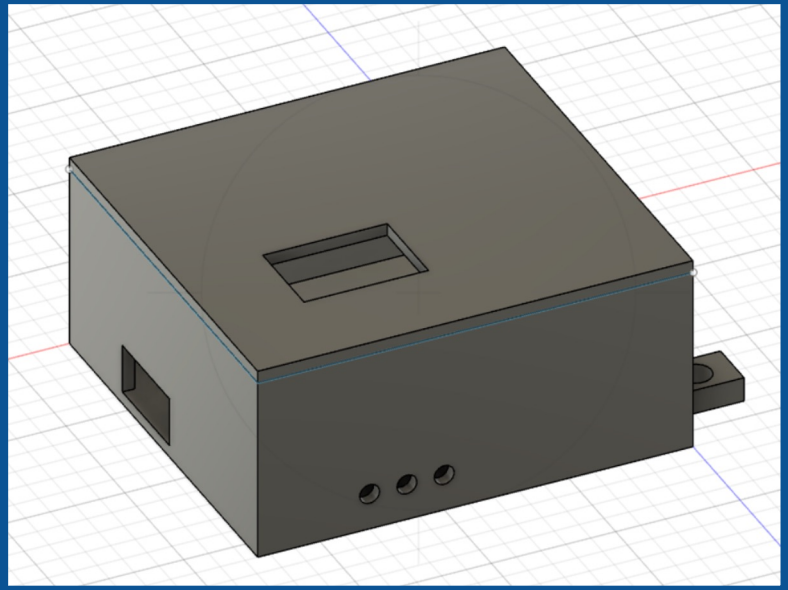
Project Recap

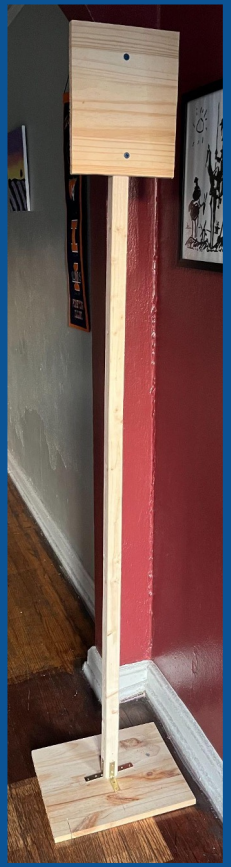
- Measure and characterize particle resuspension, primarily as a function of mechanical disturbance (i.e., car passings, people walking).
- Ultimately to be done in a large control environment and outdoors.
- No model exists for suspension of this nature, and though the creation of such model is beyond the scope of this project, we aim to capture the necessary data.

Experimental Setup



Experimental Setup



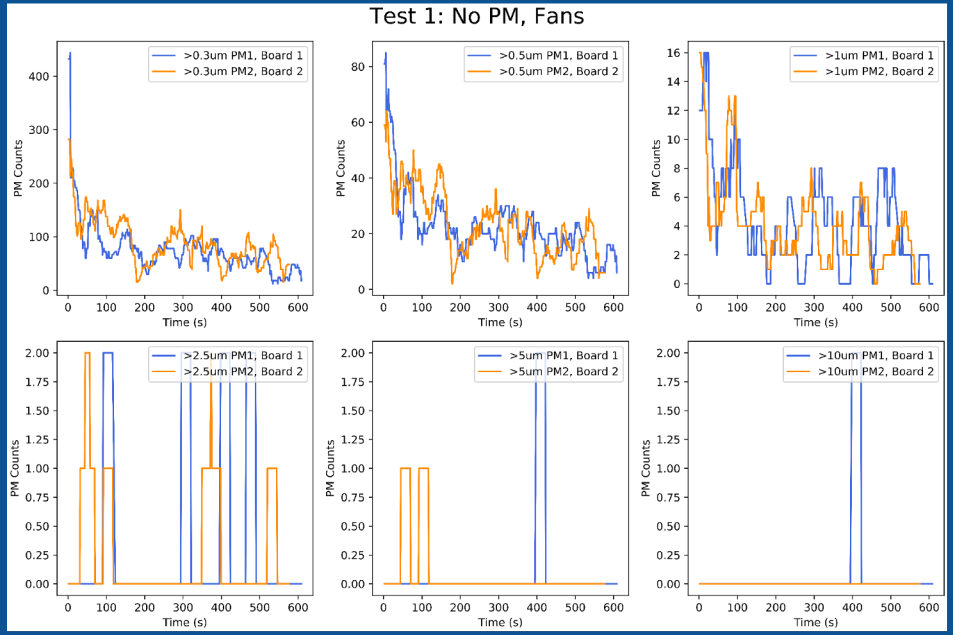


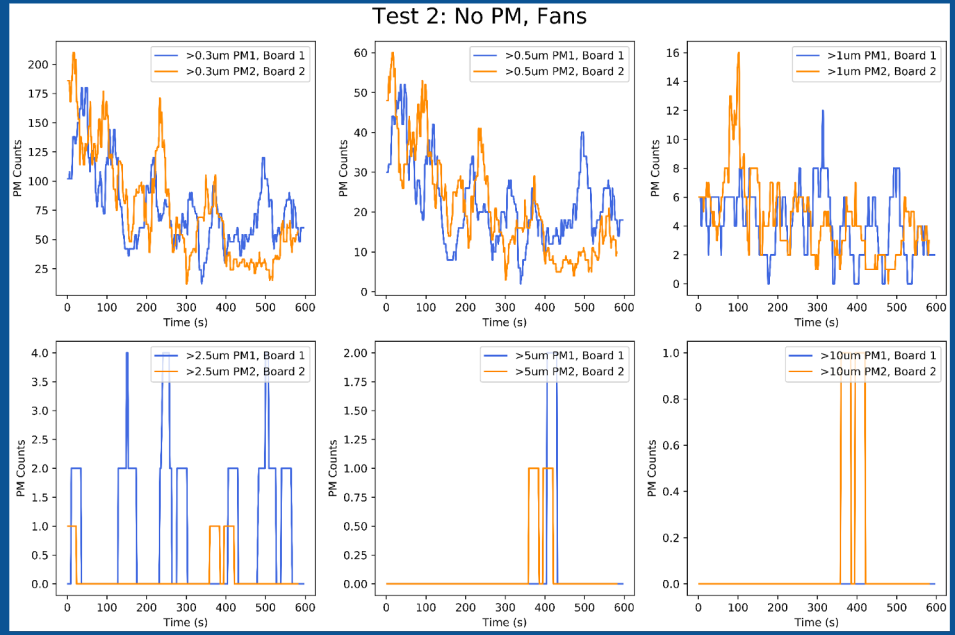
Data Acquisition

- Code begins when battery pack is plugged in
- Initial 30 second plantower warmup
- Introduce variable (Turn on fan, test particle, etc)
- Run for n iterations (Currently 400)
- Wait 1 minute for environment to stabilize
- Repeat with other particles/conditions

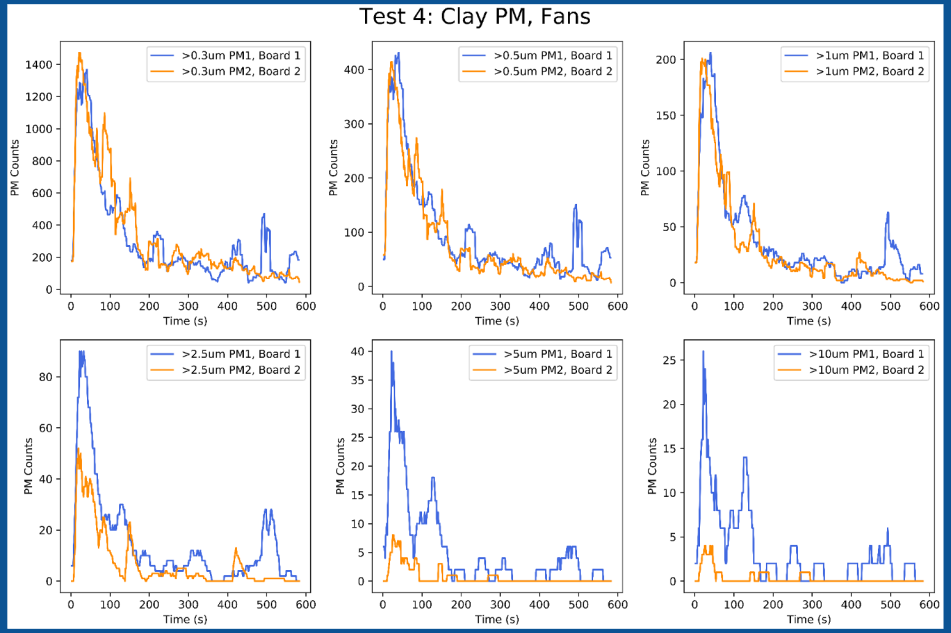
	A	B	C	D	E	F	G	H	I	J	K	L
1	Seconds elapsed	Time	Temperature (*C)	Humidity (%)	Pressure (hPa)	Particles > 0.3um	Particles > 0.5um	Particles > 1.0um	Particles > 2.5um	Particles > 5.0um	Particles > 10um	Wind Speed (m/s)
2	1.9	18:05:50	26.3	28.72	99616	282	59	16	0	0	0	45.35
3	3.23	18:05:51	26.08	28.7	99616	282	59	16	0	0	0	34.95
4	4.55	18:05:52	25.93	28.65	99617	282	59	16	0	0	0	30.5
5	6.17	18:05:54	25.84	28.61	99617	213	53	15	0	0	0	28.03
6	7.49	18:05:55	25.75	28.56	99617	246	64	15	0	0	0	27.04
7	8.81	18:05:57	25.7	28.49	99618	246	64	15	0	0	0	26.94
8	10.5	18:05:58	25.67	28.46	99619	222	60	14	0	0	0	26.94
9	11.82	18:06:00	25.63	28.42	99618	222	60	14	0	0	0	26.64
10	13.14	18:06:01	25.61	28.39	99617	198	53	13	0	0	0	26.44
11	14.84	18:06:03	25.6	28.34	99617	174	47	12	0	0	0	26.64
12	16.19	18:06:04	25.58	28.3	99617	174	47	12	0	0	0	26.14
13	17.53	18:06:05	25.57	28.29	99617	174	47	12	0	0	0	26.54
14	19.13	18:06:07	25.56	28.26	99618	153	40	9	0	0	0	26.64
15	20.48	18:06:08	25.55	28.25	99619	120	35	9	0	0	0	26.54
16	21.83	18:06:10	25.55	28.23	99618	120	35	9	0	0	0	26.94
17	23.46	18:06:11	25.54	28.23	99618	102	27	4	0	0	0	26.64
18	24.81	18:06:13	25.53	28.19	99618	102	27	4	0	0	0	26.54
19	26.17	18:06:14	25.53	28.19	99619	120	35	6	0	0	0	26.54
20	27.8	18:06:16	25.53	28.19	99619	126	39	3	0	0	0	26.44
21	29.15	18:06:17	25.52	28.18	99618	126	39	3	0	0	0	26.44
22	30.5	18:06:18	25.52	28.2	99618	126	39	3	0	0	0	26.44
23	32.06	18:06:20	25.52	28.18	99618	126	37	4	1	0	0	26.34
24	33.37	18:06:21	25.51	28.17	99618	96	27	4	1	0	0	26.34
25	34.68	18:06:23	25.51	28.19	99619	96	27	4	1	0	0	26.44
26	36.4	18:06:24	25.51	28.18	99619	108	29	4	1	0	0	26.34

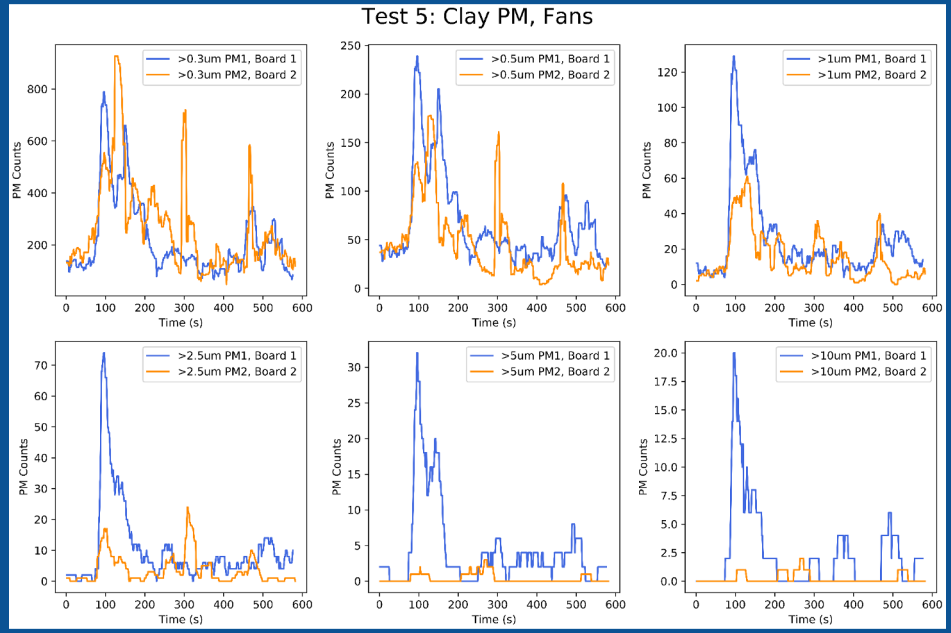
Analysis - Control Tests





Analysis - Particle Tests





Analysis - Basic Statistics

Board 1 Test 1

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	150	12	65.4318
1	>0.5	42	4	19.8942
2	>1	12	0	3.71031
3	>2.5	2	0	0.367688
4	>5	2	0	0.0891365
5	>10	2	0	0.0891365

Board 2 Test 1

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	168	15	80.7493
1	>0.5	50	2	21.3788
2	>1	13	0	3.65181
3	>2.5	2	0	0.220056
4	>5	1	0	0.0696379
5	>10	0	0	0

Board 1 Test 2

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	144	12	70.6128
1	>0.5	42	2	20.2006
2	>1	12	0	4.01671
3	>2.5	4	0	0.852368
4	>5	2	0	0.100279
5	>10	0	0	0

Board 2 Test 2

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	177	12	68.5738
1	>0.5	53	3	19
2	>1	16	0	4.3844
3	>2.5	1	0	0.100279
4	>5	1	0	0.100279
5	>10	1	0	0.100279

Board 1 Test 4

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	870	42	237.259
1	>0.5	263	12	72.4373
2	>1	127	0	26.7409
3	>2.5	42	0	10.468
4	>5	18	0	3.44847
5	>10	14	0	2.39554

Board 2 Test 4

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	1098	45	252.602
1	>0.5	274	7	57.7716
2	>1	115	0	19.4875
3	>2.5	28	0	4.04735
4	>5	4	0	0.32312
5	>10	1	0	0.13649

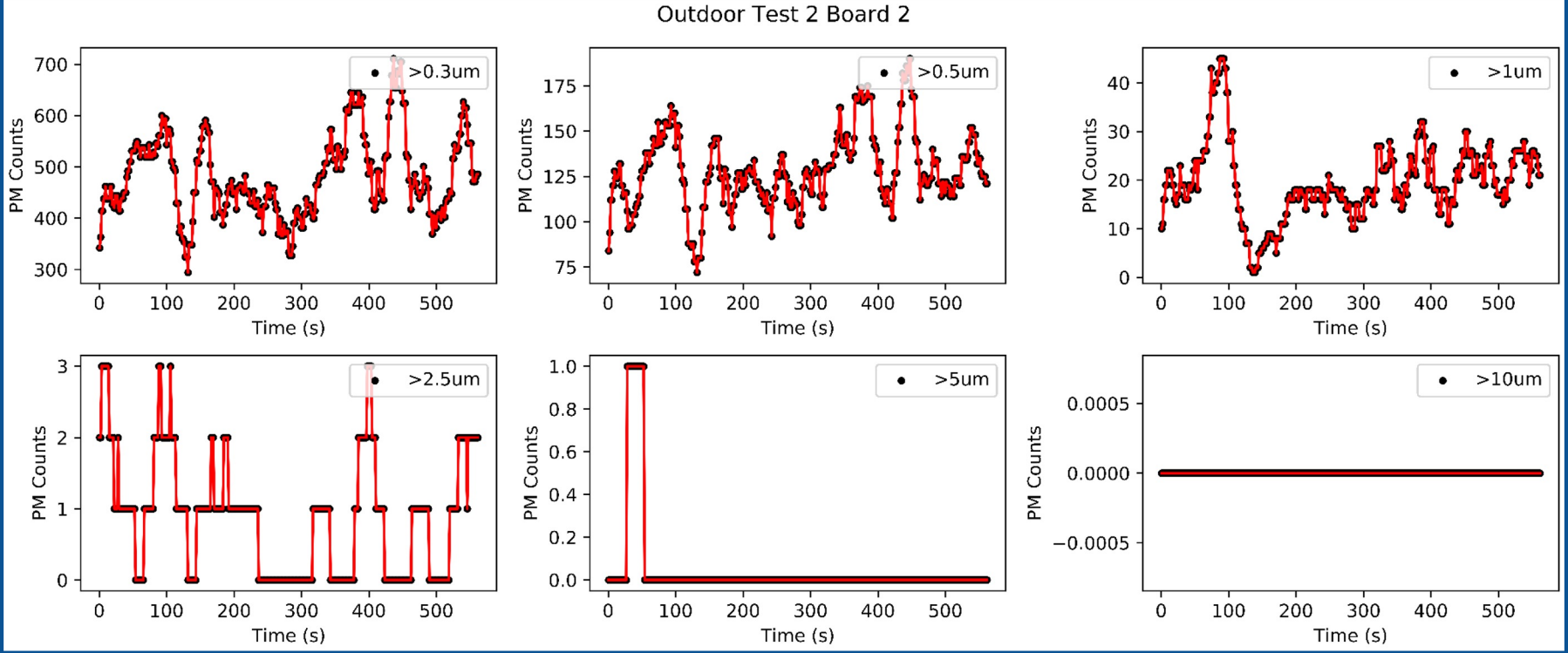
Board 1 Test 5

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	789	66	231.994
1	>0.5	239	20	70.4513
2	>1	129	4	27.5432
3	>2.5	74	0	11.3259
4	>5	32	0	4.88579
5	>10	20	0	2.5961

Board 2 Test 5

	Bin(um)	Maximum	Minimum	Mean
0	>0.3	927	48	275.256
1	>0.5	178	4	47.3705
2	>1	61	0	16.0306
3	>2.5	24	0	4.04735
4	>5	3	0	0.395543
5	>10	2	0	0.245125

Analysis - Outdoor Tests



Future Experiments and Analysis

- Remote trigger start.
- Large scale indoor tests: fans, different seed sizes/materials, mechanical disturbance via different vehicle sizes and speeds.
- Outdoor tests on - Various Surfaces: asphalt, cement, dirt.
  Wind Conditions: predominantly weak, as well as in various locations.
- More devices!
- (Possibly) important statistics: Characteristic decay time, correlation between car size and speed.