Commercial Aircraft Particle Emissions:
Preliminary APEX-2 Taxi-way Observations

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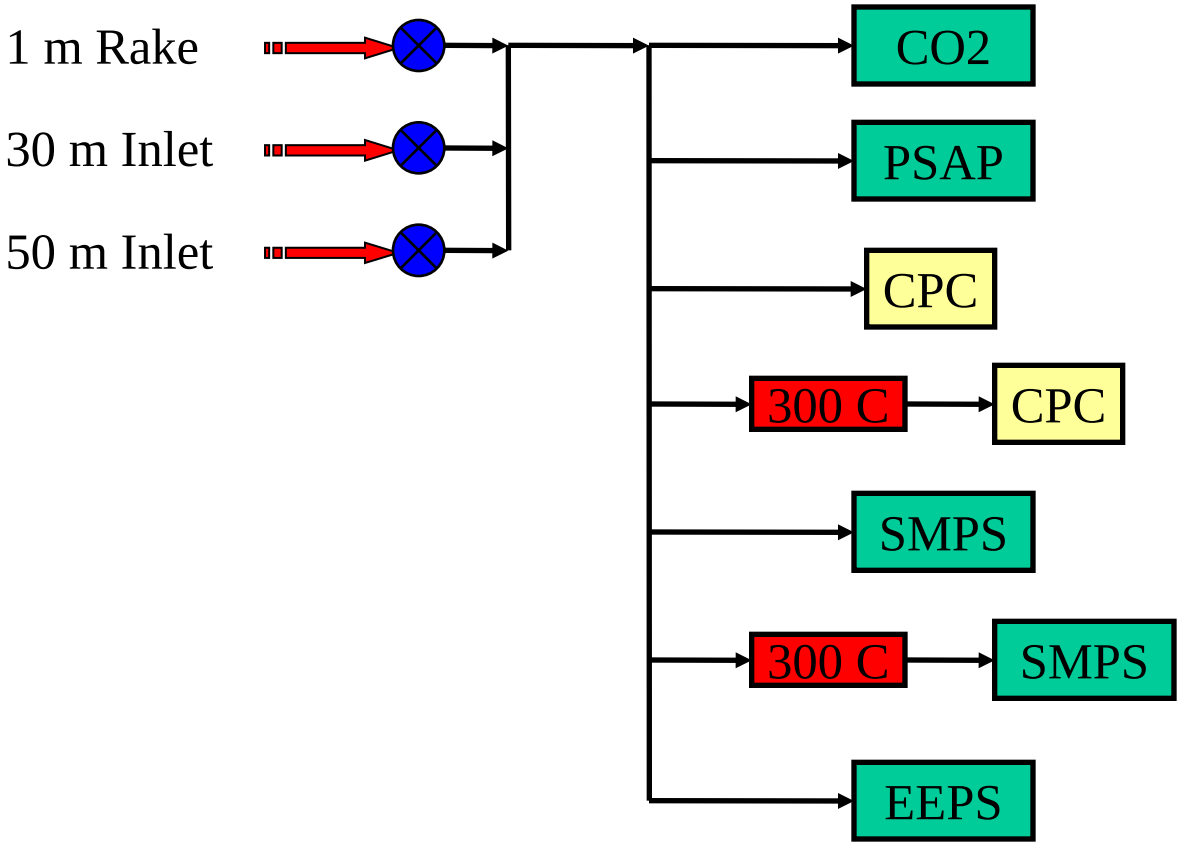
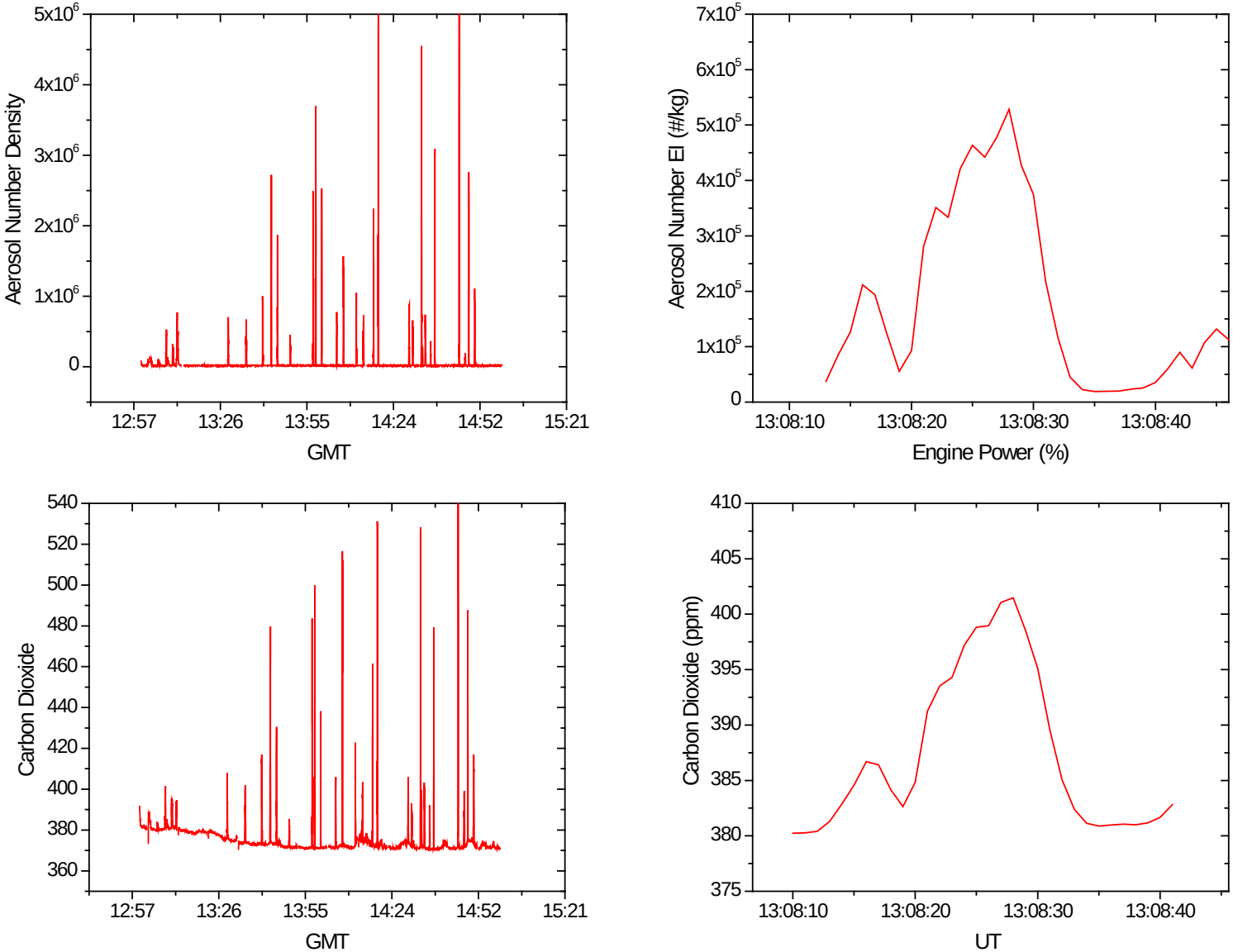
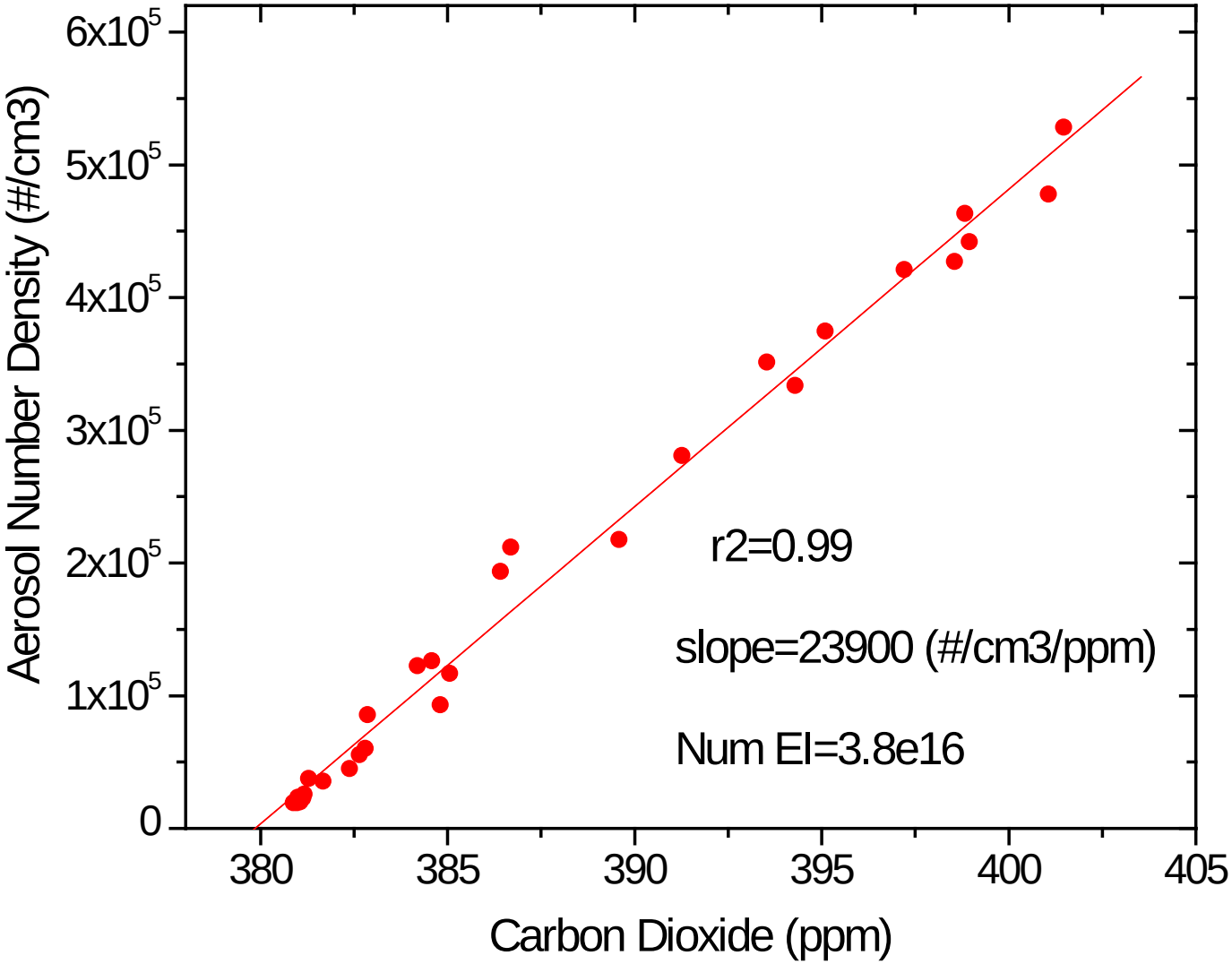
NASA Aerosol Characterization Instruments



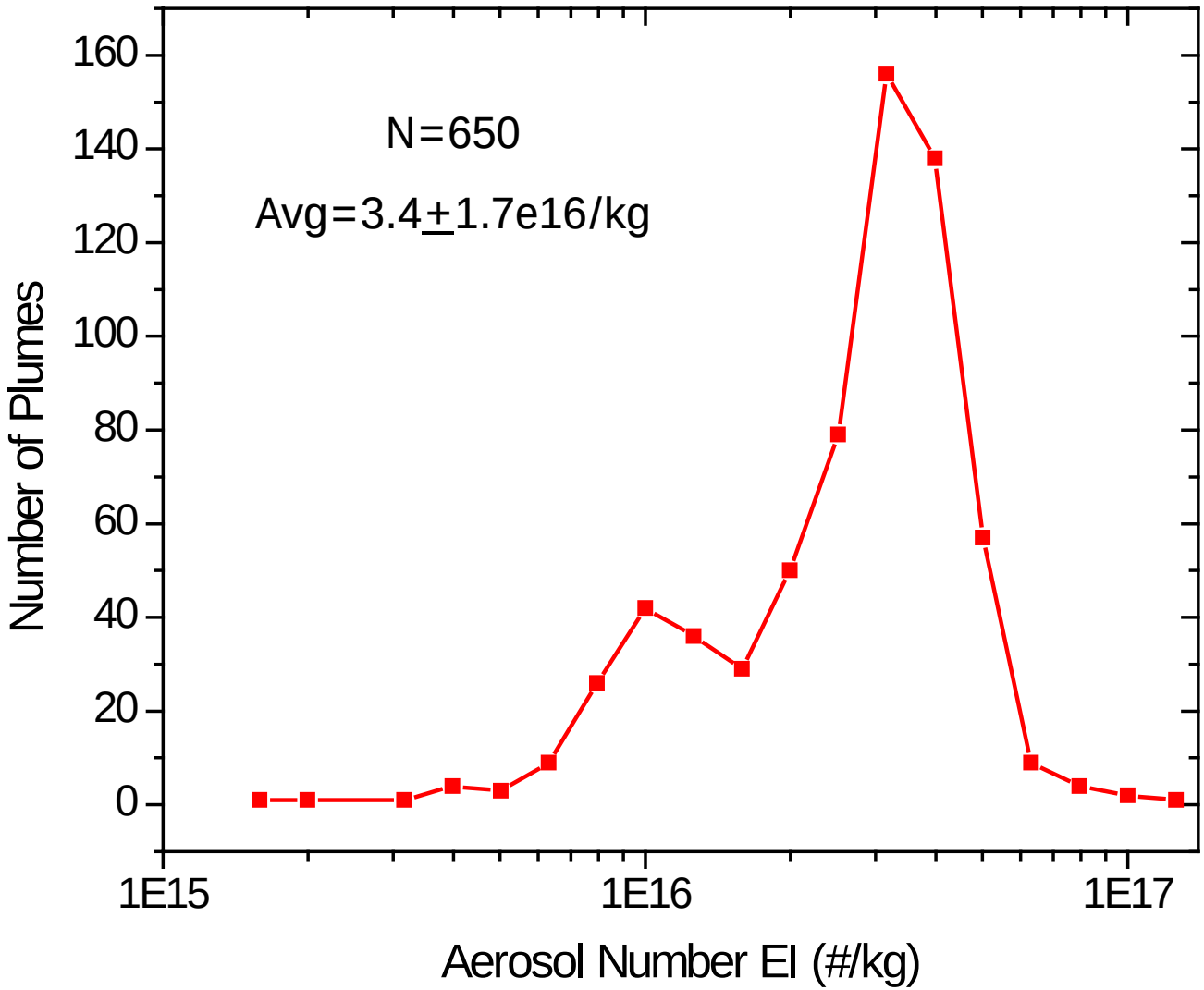
Taxiway Exhaust Plumes



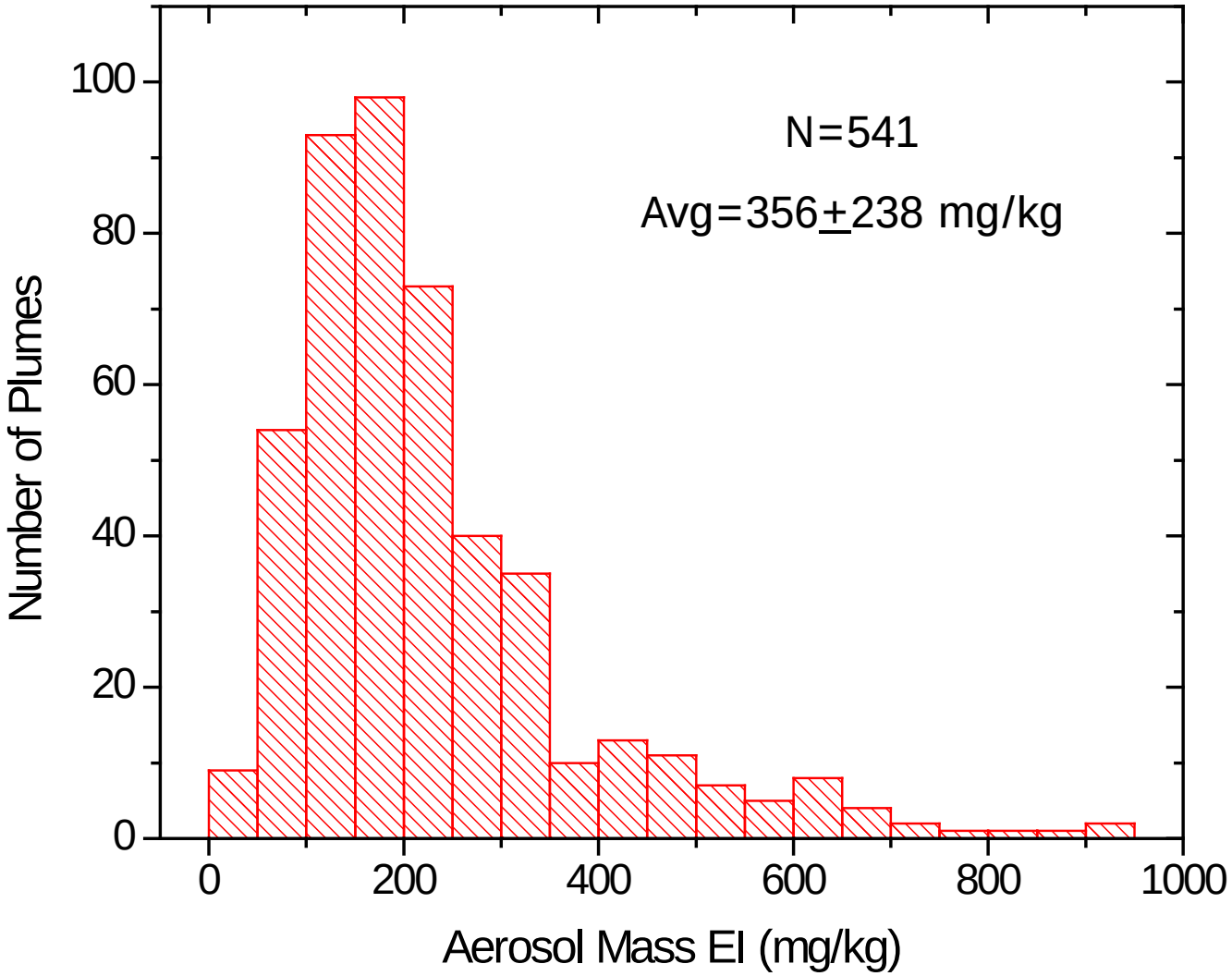
Exhaust Plume Analysis



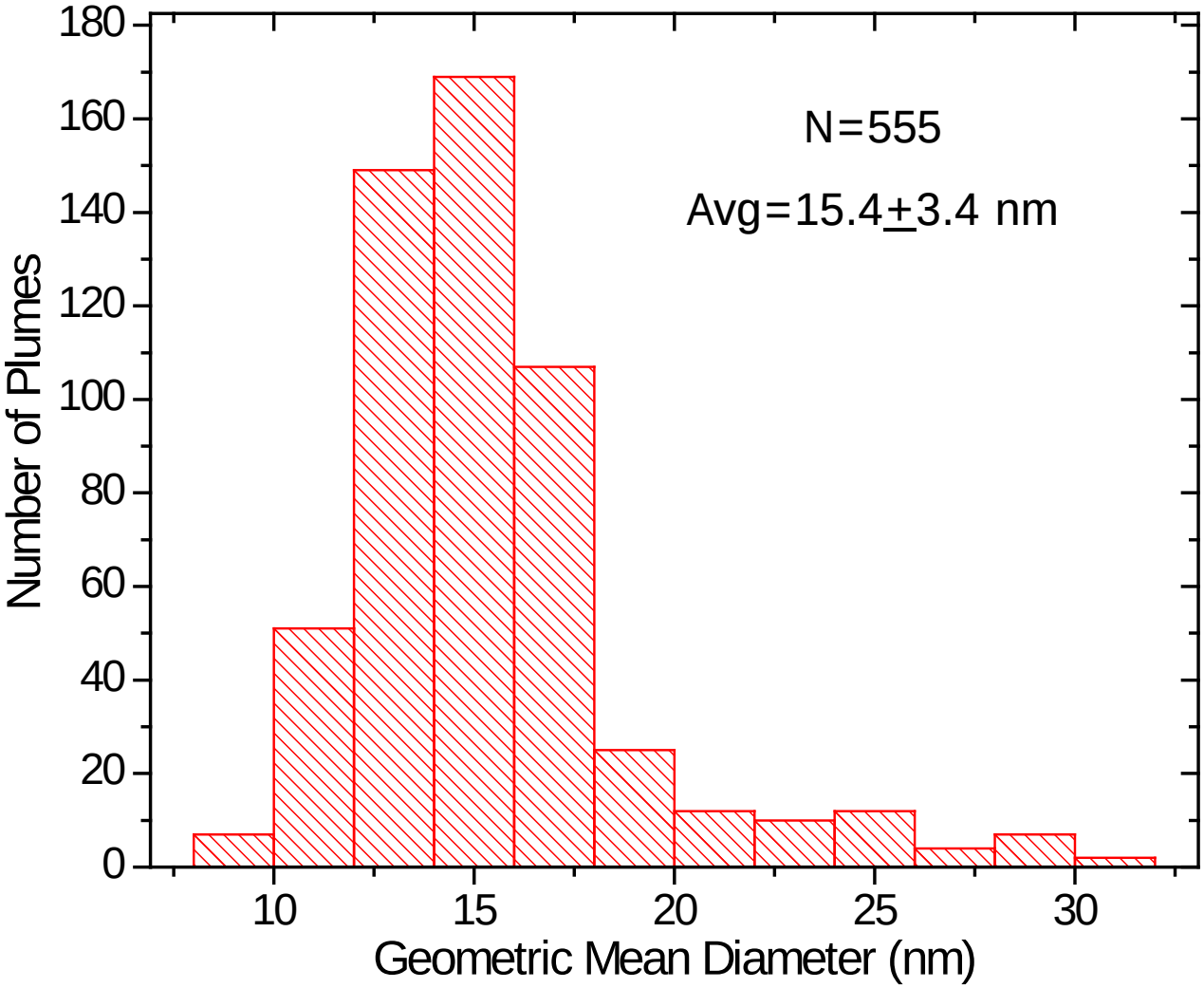
Idle Plume Aerosol Number EIs



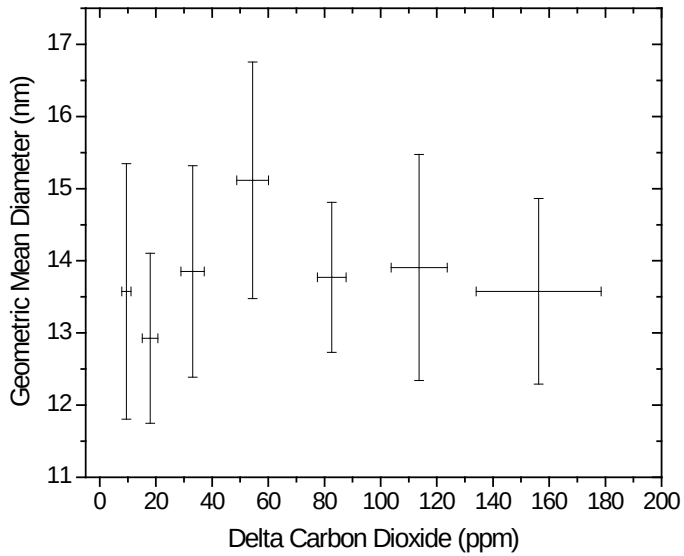
Idle Plume Aerosol Mass EIs

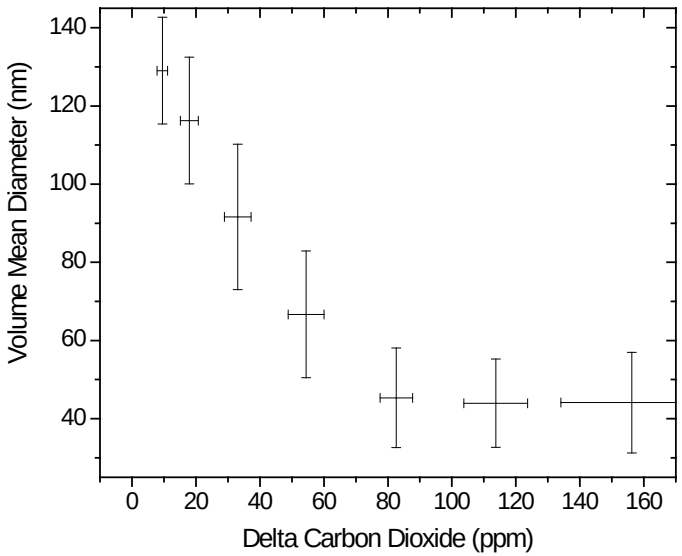


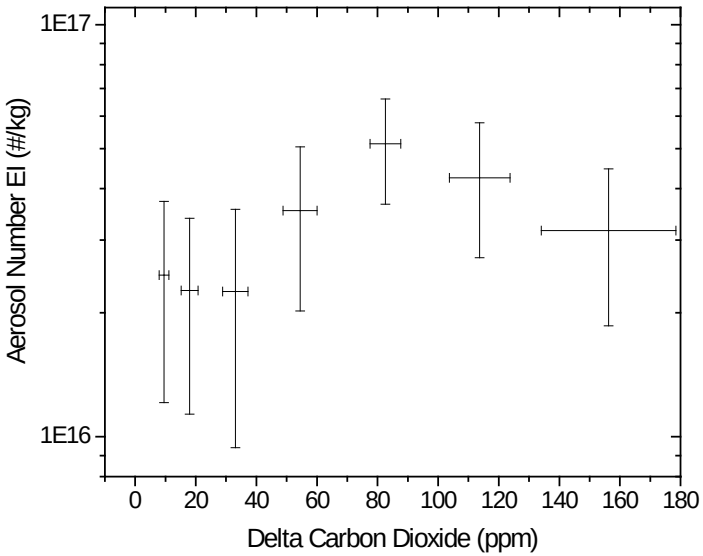
Idle Plume Aerosol Size Diameter

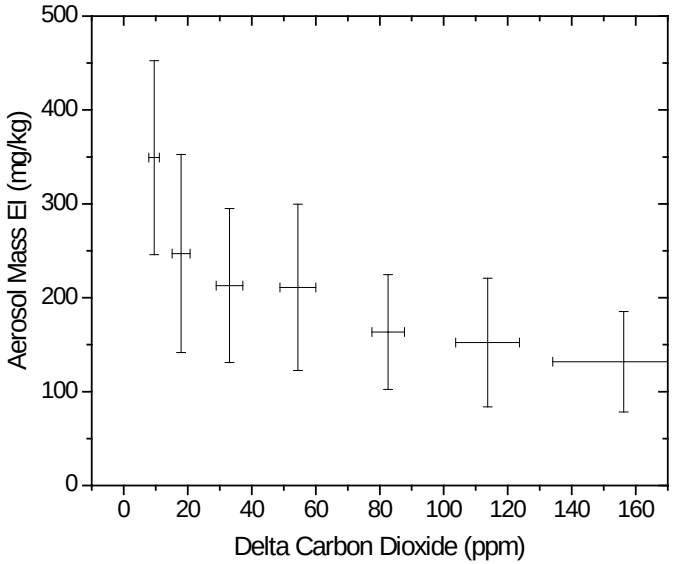


Idle Plume Aging Effects

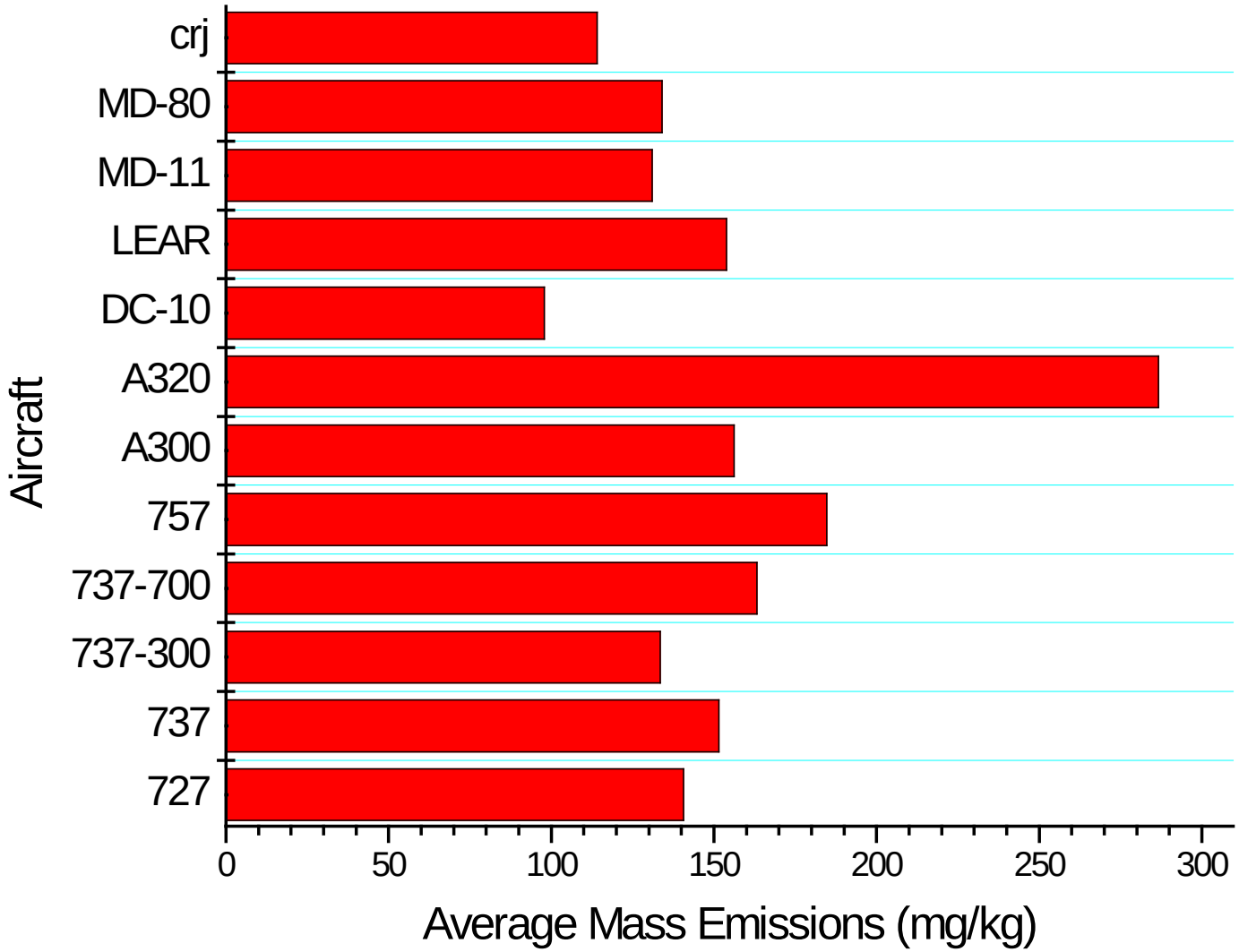




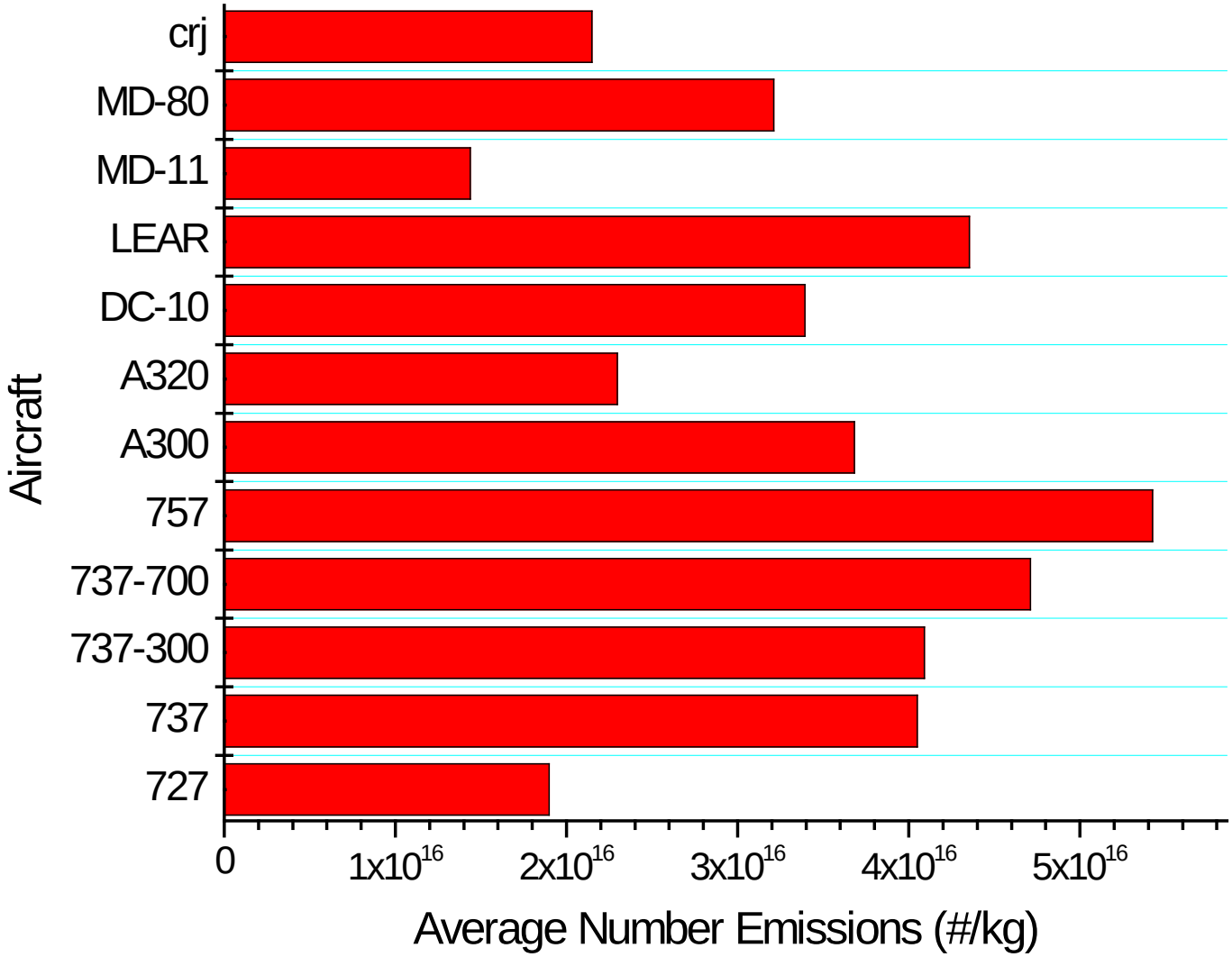




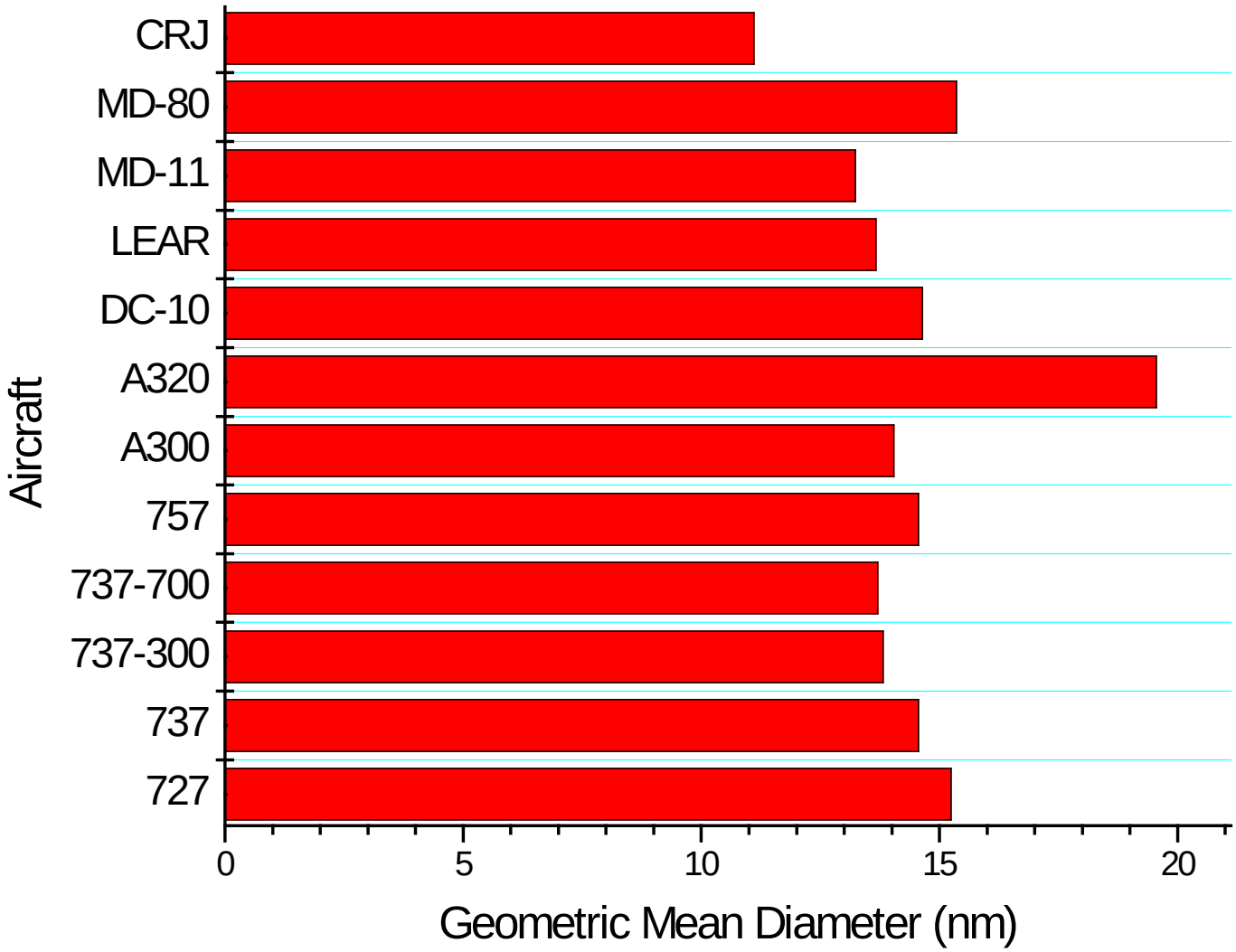
Aircraft Mass Emissions at Idle



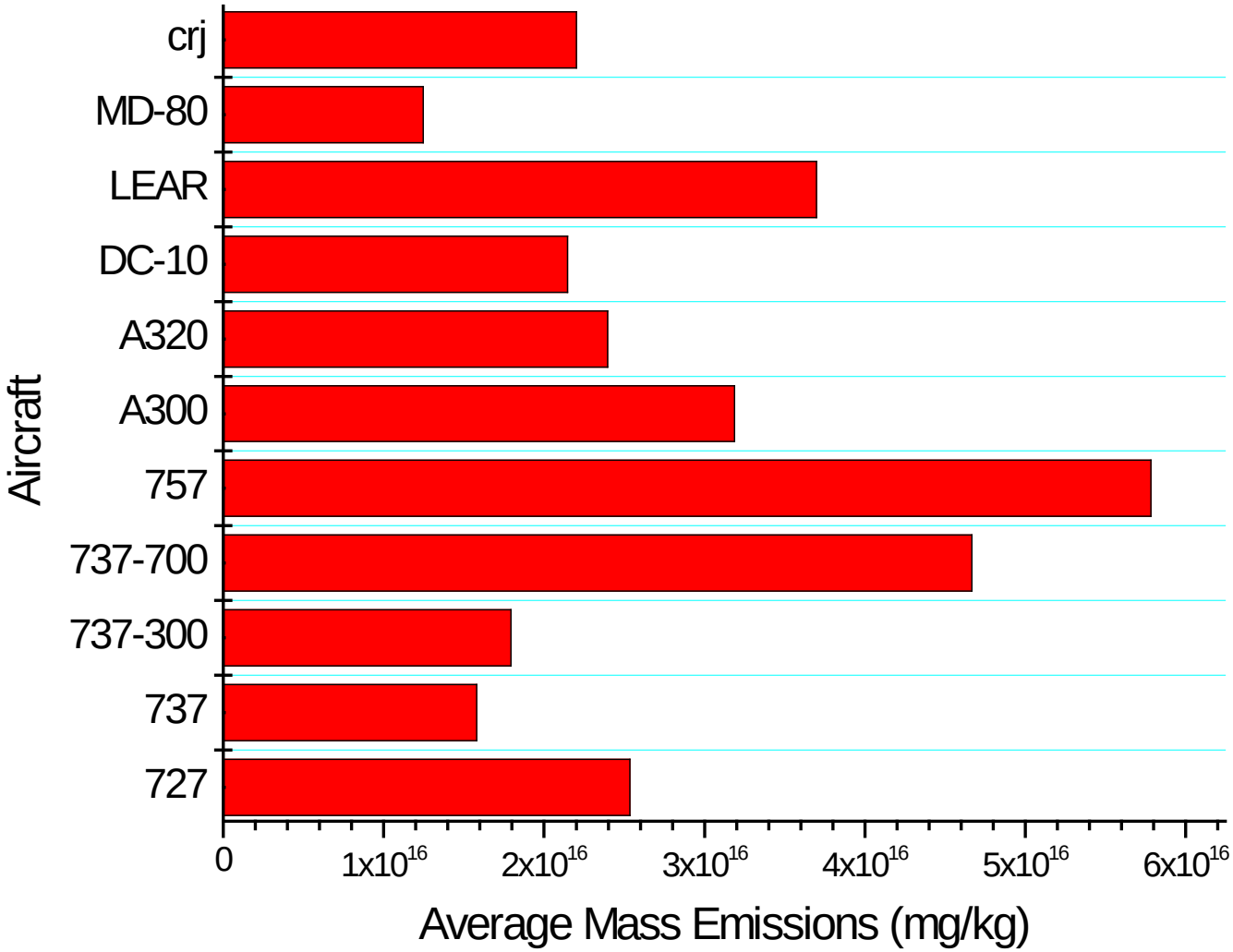
Aerosol Number Emissions at Idle



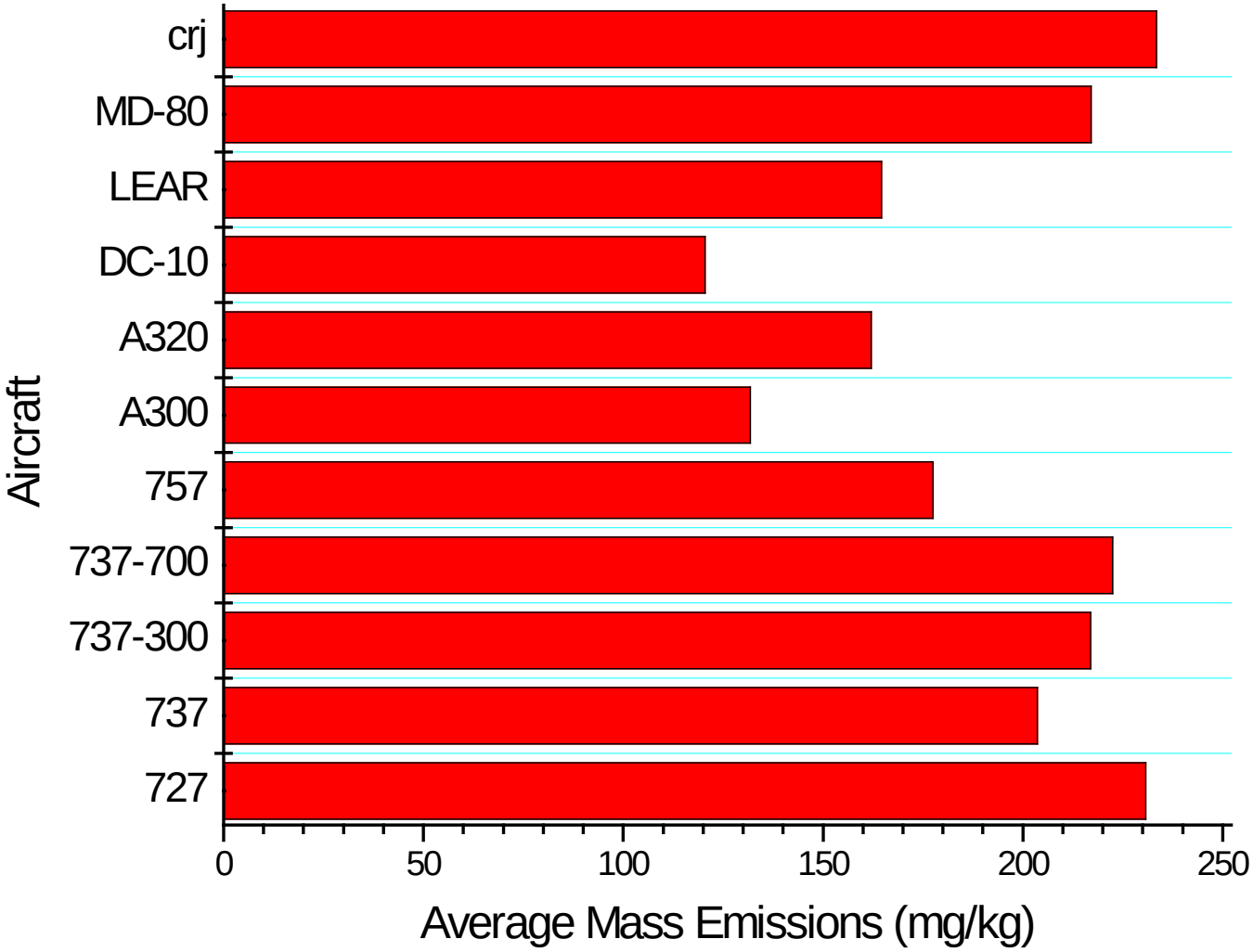
Average Particle Size Diameter



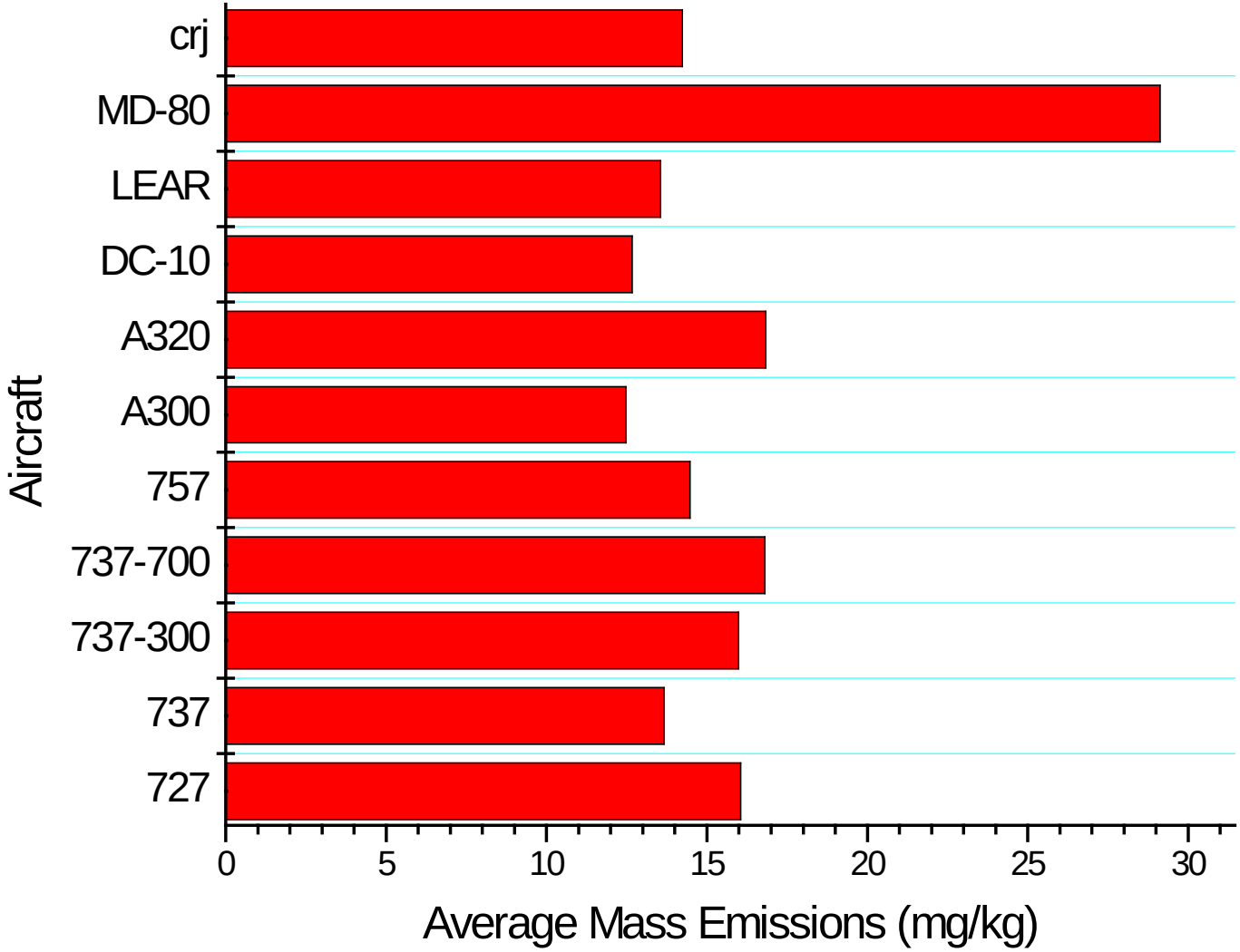
Aerosol Number Emissions



Aerosol Mass Emissions



Aerosol Size Diameter



CFM56 Particle Emissions

Engine Condition	Time sec	Fuel Burn kg/s	EI SO4 g/kg	EI HC g/kg	EI Soot g/kg	FOA EI g/kg	OBS EI g/kg	FOA Mass g	OBS Mass g
Idle	1560	0.1	1.8	4	0.05	5.85	0.3	912.6	46.8
Approach	240	0.3	1.8	0.3	0.05	2.15	0.3	154.8	21.6
Climb	132	0.8	1.8	0.2	0.3	2.3	0.3	242.88	31.68
Takeoff	50	1	1.8	0.2	0.3	2.3	0.3	115	15
Totals	1982							1425.28	115.08

Estimated Emissions a Factor of 10 less than FOA

More Simple-minded Hand Waving

For 1000 Aircraft w/2 engines

Estimate from Observations = 230 kg/day

FOA=2850 kg/day

For 3 km x 5 km x 1 km box with 2 m/s wind

Delta PM2.5 = 0.5 ug/m3 from observations

Delta PM2.5 = 4.5 ug/m3 from FOA