A FIELD STUDY OF PARTICULATE EMISSIONS FOR MAJOR ROADWAYS IN THE PHOENIX AIRSHED

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16. Abstract
This report describes field experiments conducted to determine particulate emission amounts for PM_{10} along freeways in the greater Phoenix area. A field site at Mile 47 on Loop 101 near the Chaparral Road exit was chosen for experiments conducted in Feb-Mar 2001 and Feb-Mar 2002. Three mobile laboratories with instruments for measuring and sampling aerosol particles and measuring meteorological parameters were deployed, one on each side 3 m from the roadway and, in Mar 2002, one 100 m to the west of the roadway. A 10 m tower was also used to determine the vertical profiles of wind velocity and direction, and aerosol concentration. Soil dust particles dominate the freeway aerosol , but it also has significant concentrations of black carbon (soot) and iron oxide or other metal Many of the iron-rich particles are hypothesized to result from engine wear, although other sources of iron-rich particles are known in the Phoenix area. The measured emission factor for this experiment was 0.1 grams per vehicle kilometer traveled, a value that is similar to an emission factor calculated for roads in southern California through modeling by other investigators. However, emission factors such as this are not constants and can be expected to vary with changes in conditions such as vehicle fleet composition and loading of dust on the road surface. Vertical profiles of wind and aerosol are in disagreement with the assumptions made in current line source models; if the measured vertical profiles are used in the emission factor calculation, the emission factor is reduced to 0.06 grams per vehicle kilometer traveled. Both values are similar to MOBILE6 model results by the Arizona Department of Environmental Quality for freeways in Maricopa County. Low wind conditions are very common in the Phoenix area. When wind speeds are below a critical value (4-5 mph), PM_{10} aerosol concentrations build to high values. This is because the turbulence from passing vehicles becomes more pronounced than the normal surface winds; under such conditions the aerosols are trapped in an essentially narrow, elongate plume above the freeways. When the low wind conditions break down, wind speed increases, and the plume of aerosol is dispersed down wind. The ratio of $PM_{2.5}$ to PM_{10} is dependent on wind speed as well and can be very high when the wind speed is below the critical value. The evidence suggests that new dust is constantly being loaded onto the freeway surface so that the freeway is a perpetual source of PM_{10}. The observations about high PM concentrations during frequent periods of low wind speed have broader implications for urban freeways. The control of noise by building urban freeways below grade, with high sound walls or both can artificially create low wind conditions for longer periods than naturally occur; the consequences of artificially created wind stagnation with regard to PM levels is as yet undetermined.

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SI (MODERN METRIC) CONVERSION FACTORS*

APPROXIMATE CONVERSIONS TO SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: Volumes greater than 1000L shall be shown in m^3.			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000lb)	0.907	megagrams (or "metric ton")	mg (or "t")
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celsius temperature	°C
		ILLUMINATION		
fc	foot candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE AND PRESSURE OR STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS				
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	Square millimeters	0.0016	square inches	in^2
m^2	Square meters	10.764	square feet	ft^2
m^2	Square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	Square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	Cubic meters	35.315	cubic feet	ft^3
m^3	Cubic meters	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams (or "metric ton")	1.102	short tons (2000lb)	T
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8C + 32	Fahrenheit temperature	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
		FORCE AND PRESSURE OR STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380

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I. INTRODUCTION

PROJECT BACKGROUND AND PURPOSE

The determination of of emission factors for suspended dust (crustal material) from the passage of vehicles in major roadways is essential in the planning of freeway and highway systems. This is especially true in urban areas like Phoenix that are in non-compliance with the National Ambient Air Quality Standard for $PM_{10,}$ which governs the allowable mass of particles 10 micrometers (µm) and smaller in diameter per unit volume of air. Unlike emission factors for exhaust particles, which can be measured directly from the point of origin (e.g., tailpipes for automobiles), dust entrained from the road surface by turbulence cannot be easily distinguished from similar crustal material from other sources (agriculture, sand and gravel mining, construction, etc.). In practice, empirical mathematical expressions use more easily measured parameters to estimate dust emission factors. For paved roads the key parameter is “silt loading.” There are serious concerns about the validity of this method, and therefore the emission factors so derived have uncertain validity. However, in the past, direct field measurement of particulate emission factors has proven to be difficult because it requires an experimental design that can separate the background aerosol from the emissions of a particular roadway. Below is a discussion of the results of experiments that were conducted on urban freeways in the Phoenix airshed that have allowed direct measurement of PM_{10} emission factors for the vehicle fleet on Loop 101.

Another major objective of this work was to understand the particulate loading along a freeway during the wind conditions that typify high particulate pollution periods in complex terrain areas like Phoenix. The worst PM_{10} conditions occur when wind speed is very low, below 2.5 meters per second (m/s) or 5 miles per hour (mph), and during brief periods of high wind (e.g., summer monsoon dust storms). All of the current models of particulates from roadways are not applicable to low wind speed conditions, something that occurs at least twice on a typical day in Phoenix or Tucson. Presented here are resultof experiments tracking the buildup of PM_{10} concentrations during these periods of low wind speed, and aspects of the dispersion of aerosols downwind from major roadways when the low wind speed conditions end.

There is a serious disparity between receptor-model and emission-inventory estimates of the contribution that combustion sources make to fine particulates. For the Phoenix area, receptor models estimate that 70% of primary fine particulates come from mobile source combustion. In contrast, emission inventories estimate that 18% come from this source. Part of the disparity is possibly due to overestimates of re-entrained dust. More of the disparity may stem from a lack of knowledge of the composition of re-entrained dust, which may consist of aggregates of soil particles with carbonaceous material rather than just soil particles alone. Along with the challenge of separating freeway particulates from background particulates, this study has employed methods that allow particles re-entrained off the road surface to be distinguished from vehicle exhaust particles such as soot and that allow determination of the extent of aggregation of soot and soil dust.

Although roadway-derived particulates ultimately add to the ambient urban air pollution, the most severe potential impact of re-entrained dust on human health will be in residential areas and schools close to major roadways with significant heavy truck traffic. Little is known about the decay of downwind concentrations of roadway dust in complex terrain areas of the southwest like Phoenix. This is also discussed below.

The size distribution of roadway-derived aerosols is, while secondary to PM_{10} concentrations for strictly regulatory purposes, an important issue with regard to human health. Largely anecdotal evidence in the literature suggests that soil dust particles are reduced in size when driven over by vehicles. If the average particle size of re-entrained dust is smaller than that of soil dust from other sources, then the potential for respiration deep into human lungs is enhanced; also, the contribution to regional PM_{10} is effectively greater because of the reduced average settling velocity.

OBJECTIVES OF STUDY

- To determine PM_{10} emission factors for total vehicle-related particulates on major roadways in the Phoenix urban airshed.
- To determine PM_{10} emission factors for re-entrainment of mineral dust particles from major roadways including data by vehicle type and speed so as to assess the impact on the ambient urban aerosol.
- To determine the downwind contributions of roadway particles to PM_{10} at distances of up to 100 m, so as to assess the local impact of freeways on adjacent residential areas.
- To determine whether re-entrained mineral dust is aggregated with significant amounts of carbonaceous material.
- To determine the size distribution of re-entrained dust and, if reduced from other ambient dust, the mechanism responsible.

CURRENT KNOWLEDGE OF PM_{10} EMISSION FACTORS FROM PAVED ROADS

The equation that the U.S. Environmental Protection Agency (EPA) recommends for determining emission factors for dust emissions from paved roads is AP-42 (USEPA 1984, 1991). AP-42 came from work mostly in the Midwest and involves taking dust samples from the road surface by sweeping a known area, then measuring the fraction of material that is “silt” (particles smaller than 75 µm in diameter). A variety of studies have shown the AP-42 relationship to be of little value in Western urban areas (e.g., Fitz; 1998; Venkatram and Fitz, 1998); it is doubtful the empirical relationship works anywhere other than where it was first derived. AP-42 may not provide accurate emission factors of roadway dust in Arizona or other Western states.

The current state of knowledge about PM_{10} emissions from paved roads, including free-ways, is well summarized by Venkatram et al (1999). Their modeling results, partly based on experiments conducted in Riverside, California, estimate that freeway PM_{10} emission factors are on the order of 0.2 grams per vehicle kilometer traveled (g VKT^{-1}), with an uncertainly on the order of a factor of two. Their field experiments with upwind-downwind measurements were not entirely satisfactory, probably because the complica-tions involved in continually changing wind conditions can only be overcome with real-time measurements. They did, however, add further evidence that the AP-42 emission factors are unsatisfactory.

WIND FIELDS IN COMPLEX TERRAIN

Phoenix, Tucson, and most other urban areas of the West lie in areas with hills, mountains, and valleys). While occasionally the surface winds are driven by pressure gradients due to passing frontal systems (e.g., synoptic flow), more typically the surface flows are driven by the diurnal heating and cooling of uneven terrain, resulting in slope flows and valley flows. (Stull, 1988; Fernando et al., 2001). During the day, surface winds flow either up-slope or up-valley (depending on the dominant topography); with sunset surface cooling begins and flows are either down-slope or down-valley. These thermally driven, terrain-controlled surface winds are low in speed compared to winds in cities with flat terrain. In addition, the transition periods between cooling and heating in the morning and between heating and cooling in the evening result in times when the wind speed drops to near zero. This stagnation during thermal transition is critical to the behavior of particulate concentrations along freeways.

In general, for Phoenix and similar Western urban areas, the typical days on which the complex terrain flows dominate are the days on which the concentrations of pollutants tend to be the highest. Infrequent dust storms cause high particulate levels ; at those times, particulate emissions from paved roadways are of little consequence: the only possible impact that a dust storm could have on the roadway is to occasionally load dust on its surface.Since it is clear from these results that reloading of the roadway surfaces is continually occurring, most likely from track-on of construction dust, the infrequent loading by dust storms is probably not very important on an annual basis.

LIMITATIONS OF THE STUDY

Emission factors for re-entrained dust (from road surface to the air) depend on a number of parameters that are difficult to control in any field experiment. The study team was fortunate to encounter suitable experimental conditions at one of the field sites (Loop 101 near Chaparral Road on the Salt River Pima- Maricopa Indian Community, near the border with Scottsdale), but two other sites on I-10 that would have sampled a different fleet composition were problematic for a variety of reasons, including obstacles that had severe impact on surface wind speeds and directions, and also repeated vandalism. The only suitable sites for unobstructed experiments along I-10 are south of the Phoenix metro area, beyond the study area of this project.

One key parameter in the experiments is the fleet composition passing a site. It was measured in this study by videotaping traffic, since the turbulent wake of a vehicle depends upon its size, shape, and speed. The fleet on Loop 101 has far fewer large multi-axle trucks than do the fleets on I-10 and I-17. Another key parameter is the rate of reloading of dust on the surface from all sources. A third key parameter is the wind field characteristics. The particulate emission factor along a roadway section will depend, in a complex way, on the interaction between these and other parameters.

II. STUDY DESIGN AND METHODS

DESCRIPTION OF SAMPLING EQUIPMENT, GEOMETRY, AND ANALYTICAL TECHNIQUES

Three mobile laboratories mounted in utility trailers were used in the study. Each was equipped with particulate monitoring and meteorological instruments. The primary measurement was real-time PM_{10} concentrations (the mass of particles 10 μm and less in diameter), measured with tapered element oscillating microbalances (TEOM, Rupprecht and Pastashnick Inc.) with PM_{10} inlets. Each TEOM also had a wind-sectored particulate filter sampling system (ACCU system) to collect samples for examining by scanning electron microscope (SEM). Meteorological variables measured at each station were temperature, precipitation, relative humidity, wind speed, and wind direction.

The TEOM has the capability to measure and log real-time fluctuations in particulate concentrations, while the ACCU system allows particulate sampling of discrete sectors of wind direction and wind speed for later analysis and characterization. Also used in the sampling experiment was a 10 m sampling tower, on which were mounted PM_{10} DustTrak (TSI, Inc.) particulate monitors (DustTraks) at 3 and 10 m, as well as a sonic anemometer at 10 m (to acquire 3-dimensional wind data and measure turbulence). During the 2001 and 2002 experiments, a video camera and recorder were placed on one of the trailers to record the traffic load on the freeway. The traffic load and fleet composition were determined by manually counting and classifying vehicles on the videotapes after the experiment.

This equipment was deployed along the Loop 101 Freeway, just south of the Chaparral Road exit in February and March of 2001 and 2002 for a total of approximately 3 weeks. At that location the highway is on the Salt River Pima-Maricopa Indian Community and is flanked on either side by flat agricultural fields with long unobstructed wind fetches to the east and west in excess of 200 m. The setup of the equipment is shown in Figure 1. This site is conducive to this type of experiment, as the freeway direction is due north-south, and the wind pattern in the winter is frequently an east-west slope flow. By placing the three trailers in an east-west array as shown in Figures 1 and 2 , it is possible to quantify the background particulate concentration entering the freeway, and measure the output concentration on the downwind side in real time using the TEOMs. The 10 m tower allowed the research team to quantify the vertical profile of the particulate concentration and measure the wind velocity normal to the freeway, both of which are crucial to understanding the freeway particulate mass flux. The ACCU systems allowed quantification and comparison of the nature of the particles (size, shape, and composition) that originate from the freeway itself with those in the ambient environment.

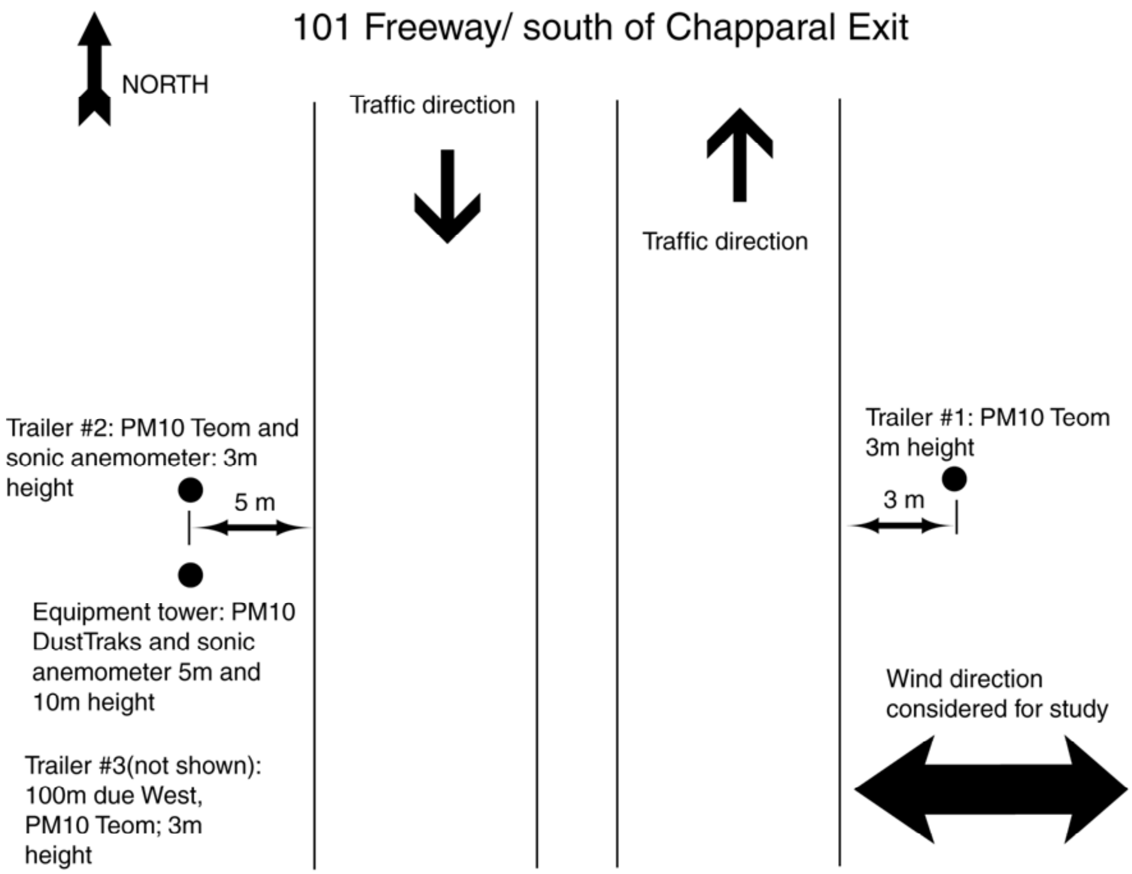

Figure 1: Map view of sampling geometry along the 101 Freeway, at mile 47 near Chaparral Rd. Exit.

Note that the position of Trailer #3 is not shown, but is 100 m due west of Trailer #2. Anemometers were deployed on all trailers at 3 m height, in addition to the sonic anemometers at 3 m on Trailer #2 and at 10 m on the tower. The direction of travel of the traffic is north-south. Traffic was counted and categorized during daylight hours via a video camera looking west on Trailer #1.

Figure 2A. East side trailer with TEOM inlet and anemometer on top, propane generator to side. View looking north.

Figure 2B. West side trailer and tower, view looking north.

Figure 2C. Experimental array, looking east.

Note: From near to far, DustTrak at 200 m from roadway, trailer #3 at 100 m from roadway, trailer #2 and tower at 10 m from roadway, and (barely visible at base of far light pole) trailer #1 on opposite side of roadway.

Figure 2D. Inside one of trailers.

Note: This photo shows (from left to right) TEOM with insulated inlet tubing, TEOM controller and data logger, and ACCU System with 8 filter manifold controlled by TEOM controller. The TEOM controller also logs meteorological data.

Pilot studies were also done in 2001 at two sites along I-10 (near 29th Avenue, at Maricopa County's Greenwood monitoring site, and just north of Chandler Boulevard.) Both sites proved to be unsuitable because nearly buildings and trees deflected surface winds. The equipment was also seriously vandalized at both sites within only a few days of setup. These sites were the most suitable that the team could find along I-10 in the urban area with regard to unobstructed wind fetch, but the study still encountered problems with wind deflection so that, regardless of the vandalism, it would have been difficult to measure dust emission factors at these sites. A number of better sites are located along I-10 as it crosses the Gila River Indian Community, but these are outside of the Phoenix urban area.

The filters used for wind-sectored sampling with the ACCU systems were 47 mm diameter polycarbonate membrane filters with 0.4 µm pores. Polypropylene backing filters with 10 µm pores were used behind the polycarbonate filters to ensure that particles were evenly distributed; otherwise the supporting grid bars of the filter holders can cause uneven distribution.

TEOM DATA

TEOM data was logged every 5 minutes (every 1 second for some periods) and consisted of the following parameters:

1. date
2. time of 5-minute averaged data
3. mass concentration of PM_{10} in units of $\mu g/m^3$, 5-minute average
4. 1-hour average PM_{10} mass concentration, updated every 60 minutes at the hour
5. 8-hour average PM_{10} mass concentration, updated every 60 minutes at the hour
6. ambient temperature in °C
7. ambient pressure in atmospheres
8. wind speed in m/s, 5-minute average
9. wind direction in degrees, 5-minute average
10. active wind sector at end of 5-minute period, based on direction and velocity (see below)

Eight wind sectors were defined for this study. For wind speeds greater than 0.8 m/s and less than 8 m/s, six directional sectors were defined:

Sector 1 = 60-120°
Sector 2 = 120-180°
Sector 3 = 180-240°
Sector 4 = 240-300°
Sector 5 = 300-360°
Sector 6 = 0-60°

Note that the active sector in the data may disagree with logged average wind direction because the logged sector represents the wind direction at the end of the averaging period. The ACCU System filters were operated by solenoid-controlled valves that used the wind speed and direction data as updated every 10 seconds.

Two wind sectors were defined based on wind speed. Sector 7 was defined for wind speeds less than 0.8 m/s. At these low wind speeds, the true wind direction is difficult to determine (the anemometers used are sensitive down to 0.5 m/s). Sector 8 was defined for wind speeds 8 m/s and greater. Above 8 m/s, the generation of wind blown dust from the land surface can become significant; this eliminated contaminating the Sector 1-6 filter samples with dust from high-wind events.

DUSTTRAK DATA

DustTraks were used to measure $PM_{2.5}$ at 3 m height and PM_{10} at 5 m and 10 m on the 10 m tower on the west side of Loop 101. The data are simpler than those from the TEOMs in that only the mass concentration of aerosol in milligrams per cubic meter ($mg/m^{3)}$ is measured. The averaging interval was 5 minutes.

While a TEOM directly measures mass, a DustTrak estimates mass based upon the measurement of light scattering: particles pass along a path with a laser and photodectector. DustTraks do not have the warm-up time associated with the TEOMs. However, since particulate concentrations are measured at ambient temperature and relative humidity, particle size and resultant light scattering, and therefore apparent PM_{10} contribution, for hygroscopic species (e.g., ammonium sulfate) will be affected if the relative humidity is sufficiently high. With normal soil dust, hygroscopicity is not an issue. Another issue with the DustTrak is that it is calibrated for standard soil dust with a high single-scatter albedo, so optically absorptive materials like soot with low single-scatter albedo will be undercounted.

When DustTrak measurements of PM_{10} were compared with TEOM values, the two values were generally less the 5 $\mu g/m^3$ apart, and in any event in the field there was short-term fluctuation of particle concentrations due to vehicle turbulence. However, there was no real-time reference for $PM_{2.5}$ with which to compare the DustTrak measurements. Some problems with the measurement of the optically absorptive part of the fine particulates were expected.

SCANNING ELECTRON MICROSCOPE METHODS

Individual-particle samples were analyzed with an automated scanning electron microscope (SEM) (Anderson et al., 1992, 1996). The specific instrument used was a JEOL 5800 SEM with a NORAN Voyager 4 automation/image analysis/X-ray analysis system. A roughly 1 cm square section was cut from near the center of each filter and mounted with conductive carbon tabs on 12 mm aluminum stubs. A carbon film of ~20 nm was deposited on the sample by vacuum evaporation to provide electrical conductivity. Backscattered electron (BSE) images were acquired using an annular, split-ring, semi-conductor detector mounted 10 mm above the sample. Images were digitized and stored in the Voyager system's image memory. X-ray spectra were acquired with a NORAN energy dispersive spectrometer (EDS) with an ultrathin window.

Normal operating conditions are an accelerating voltage of 15 kilovolts (kV) and beam current of 400 picoamperes (pA). Counting times for X-ray spectra acquisition are 60 seconds live-time; relative dead-times are 20-30%. Long counting times allow analysis of many elements in concentrations down to nominal detection limits of 0.1-0.2% by weight (relative to flat, infinitely thick samples); the counting time strongly affects the smallest detectable particle size with respect to composition. For these samples, magnification is 2000x and the smallest particle diameter analyzed was about 0.2 µm. Smaller particles can be analyzed by using higher magnification, but for this study it was important to focus on the larger particles that contribute most to the PM_{10} mass. Image resolution is 1024 x 1024 pixels, with a relative gray-level scale of 0 to 511 (8 bits). Pixel size at this magnification and resolution is 54 nm.

Standard X-ray spectra are acquired by analyzing flat, polished samples of metals, simple oxides, simple salts, and a few well-characterized minerals. Reference spectra are fitted to particle spectra. The values produced, "k-ratios," are then corrected with NORAN's ZAF program to obtain weight percents of the elements, from which atomic fractions of the elements are calculated. The use of flat-sample corrections introduces some systematic error into the particle compositions, but this has little effect on clustering and characterization of particle types. The study compared the results from flat-sample corrections with those from particle correction methods and found no significant difference for average composition of a group of particles of a single type. Elements routinely analyzed are sodium (Na), magnesium (Mg), aluminum (Al), silicon (Si), phosphorus (P), sulfur (S), chlorine (Cl), potassium (K), calcium (Ca), titanium (Ti), vanadium (V), chromium (Cr), manganese (Mn), iron (Fe), nickel (Ni), copper (Cu), zinc (Zn), gallium (Ga), germanium (Ge), arsenic (As), selenium (Se), bromine (Br), zirconium (Zr), cadmium (Cd), Sn (tin), antimony (Sb), barium (Ba), and lead (Pb). Anderson et al. (1992, 1996) discuss further details of the analytical methods for automated microanalysis of particles.

For the automated analysis, approximately 1000 particles 0.2 µm and larger were analyzed for chemical composition, size, and shape. These data were used to determine size distributions, shape distributions, and the relative abundance of chemically different particle types.

A Hitachi Cold Field Emission SEM Model S-4700 was used for high resolution imaging. This instrument has a spatial resolution of 1 nm and has an EDS X-ray detector that was used to qualitatively identify particles by chemical composition.

CLUSTER ANALYSIS OF SEM DATA

Cluster analysis of the SEM data was used to determine the chemically distinct types of particles present in a set of aerosol samples. Clustering of particle data is done with the program EXPLOR (Saucy et al., 1987, 1991; Shattuck et al., 1985, 1991). The Forgy k-means algorithm is the basis for cluster analysis. A similarity measure that represents the angle between vectors from the origin to two points in 24-dimensional composition space is used (Killeen et al., 1981). This measure, s_4, is advantageous in the cluster analysis of chemical data from submicron particles because of their semi-transparency to the electron beam (Saucy et al., 1987). For the SEM results in this study, the value of s_4 used was 20˚.

III. PM_{10} RESULTS FROM LOOP 101 AND OTHER SITES

RESULTS: TEOM, DUSTTRAK, AND SEM DATA

Rather than present all the data in hard copy, examples are presented in this report and the other archived data will be available from the research team upon request.

An example of a data file from one of the Loop 101 trailers (east side, starting Feb 22, 2002 and ending Feb 23, 2002) is shown in Appendix A. Initially the mass concentration data is null (or, if other than 0, invalid) until the instrument reaches its operating temperature of 50°Celsius(C). The start and end of TEOM data files signify times when the power was switched off in order to service the electrical generators.

The field experiment in 2002 on Loop 101 produced the most useful data. TEOM data from both east and west measurement sites are archived from Feb 19 to Mar 14 when synoptic weather conditions were suitable.

An example of a DustTrak log is presented in Appendix B. The data log for $PM_{2.5}$ with an inlet at 3 m starts March 3, 2002, at 14:54:50 and ends March 6, 2002, at 12:14:50. The last column is the mass concentration of $PM_{2.5}$ in mg/m^3 and can be converted to more standard units of $\mu g/m^3$ by multiplying by 1000. For this time period, the minimum $PM_{2.5}$ was 7 $\mu g/m^3$ and the maximum was 88 $\mu g/m^3$, a fairly high value.

A total of 23,819 individual particles between 0.2 and 10 μm in diameter were analyzed from samples collected at the Loop 101 site in February 2000 and March 2001. Measured parameters include composition, size, and shape. Because the compositions are determined by fitting sample spectra from small irregular particles to standard spectra from polished flat materials of known composition, the particle compositions never total 100% (most particles are smaller than the X-ray excitation volume and therefore have decreasing total weight percent with decreasing volume). The cluster analysis used partly compensates for this; when expressed as atomic fractions, the centroid compositions have nominal errors on the order of 10% or less. Note that while carbon (C) and oxygen (O) are analyzed, because the filter material is polycarbonate and also has C and O, these two elements are not used. The automated methods always undercount submicron black carbon (primarily soot), so manual imaging as was done in this study is needed to evaluate the abundance, morphology, and mixing state of black carbon. Despite the limitations, individual particle analysis by SEM is very effective in determining that chemically distinct types of inorganic particles are present.

Appendix C has composition, size, and shape data for one of the analyzed samples (the listing of data from all of analyzed samples would take in excess of 1000 printed pages).

PARTICULATE CONCENTRATION BEHAVIOR ALONG ROADWAYS UNDER TYPICAL WIND CONDITIONS

For the purpose of the study objectives, the most interesting periods with regard to freeway PM_{10} emissions come from the frequent intervals when wind speeds are relatively low to moderate (typically less than 6 m/s [12 mph], very common for complex terrain areas in the desert Southwest). Necessary conditions for examining freeway emission factors were wind speeds below 6 m/s, but for reasons described below, not less than 2.5 m/s, and wind directions that came across the roadway at no more than a 45˚ deviation from perpendicular. The influence of the turbulence of passing vehicles makes it difficult to treat the emission data when the wind is closer than 45˚ to parallel with the roadway. The conditions of lowest wind speed (<2.0-2.5 m/s) are a special class that occur for periods on most days at the transition from heating to cooling and from cooling to heating; such conditions of stagnation can also occur at other times, especially at night. While wind conditions (direction, velocity, and stability) have a significant effect on the success of experiments, emissions from the roadway surface occur whenever there is traffic regardless of wind direction or wind velocity.

Evaluation of the PM_{10} TEOM and meteorological data from the Loop 101/Chaparral Road site indicates that there is measurable re-entrainment of particles from the freeway at this site with residual particle concentrations (downwind concentration minus upwind “background” concentration) with speeds in the range 2.5-6 m/s (as low as 2.3 m/s in some cases). Figures 3 and 4 show the wind direction from both trailers overlain by the TEOM particle concentration and wind speed respectively for two typical 24-hour periods. For cross-roadway winds when wind speed is in excess of 2.5 m/s, the wind directions on both sides of roadway are similar and the difference in PM_{10} approaches averages of 20-30 $\mu g/m^3$, except in periods of low traffic where the difference is less. This difference is the contribution of re-entrained dust from the roadway surface plus particles from exhaust and abrasion of vehicle components (the SEM data indicate that dust is dominant). However, note that the wind directions diverge for the two trailers during the morning rush hour when wind speeds are below 2.5 m/s, and also that there is a peak in particle concentration (sometimes reaching >250 μg/m3) that is seen for both sides of the freeway. The wind direction divergence shows that the wind direction measured on the west side of the road is strongly influenced by turbulence of vehicles traveling north, while the east side is affected by the turbulent wakes of southbound vehicles. During the evening rush hour, with higher wind speeds, the two wind direction measurements do not diverge and no significant PM_{10} peak occurs, just the typical cross-roadway difference in PM_{10}. This pattern is a common one for all of the days sampled, broken only by weather conditions when stronger winds(> 6 m/s) are present.

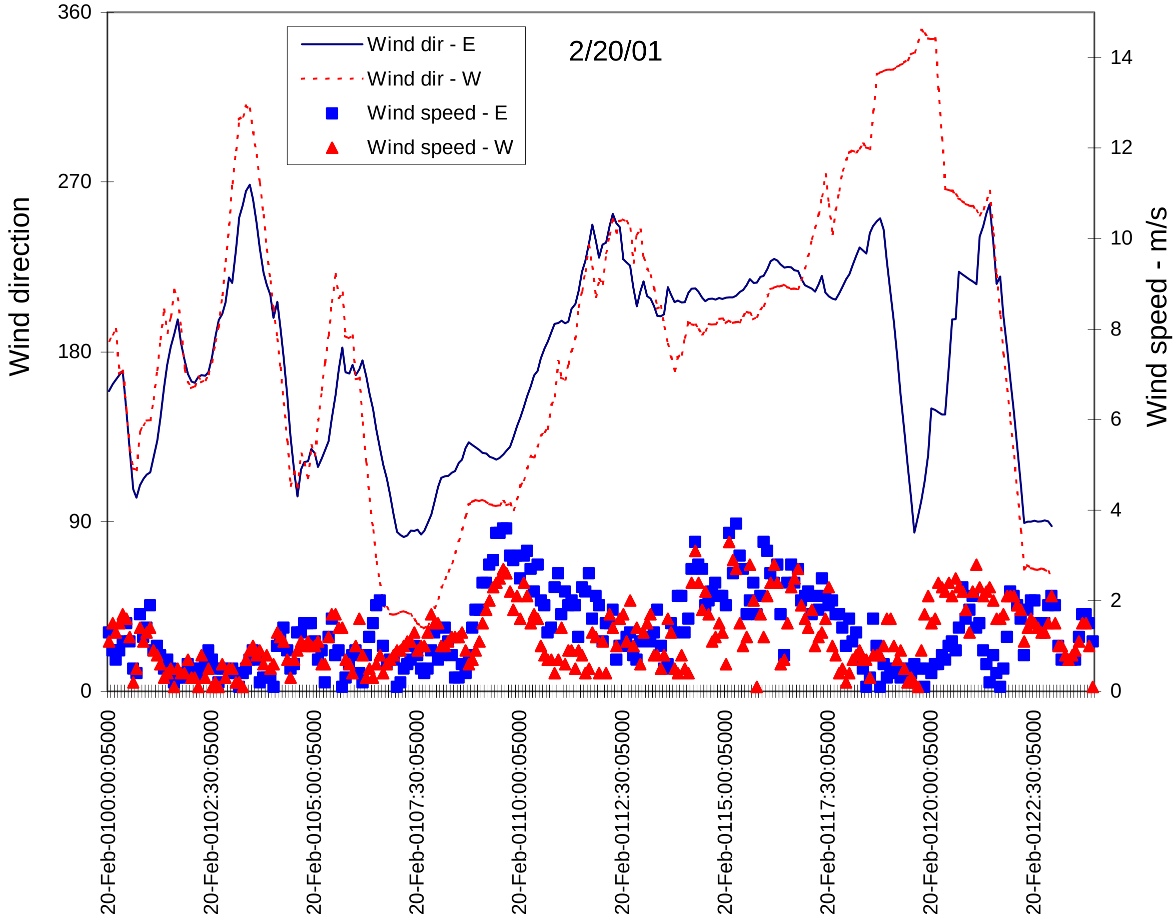

Figure 3. Wind direction and speed during a 24-hour period Feb 20, 2001, Loop 101 Chaparral site.

Note: divergence of wind direction on east and west sides of roadway when wind speed is below about 2 m/s. This is a typical day for this time of year with wind below 2 m/s for most of the day.

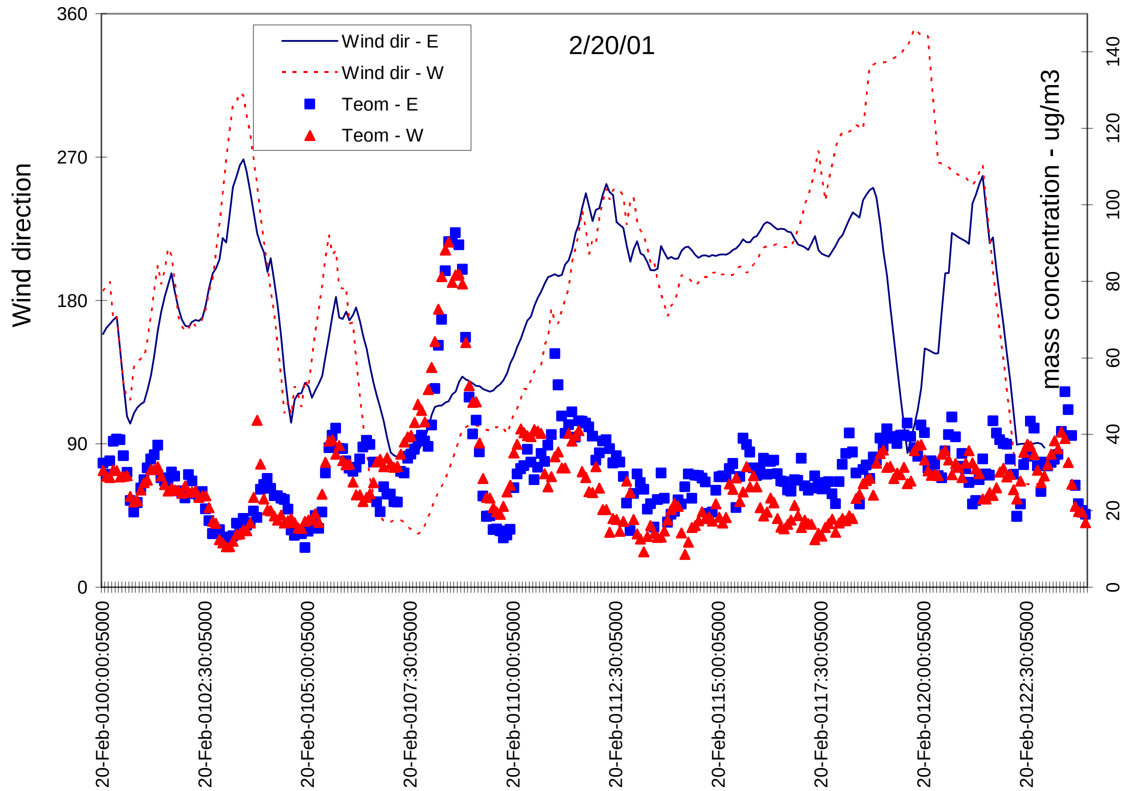

Figure 4. Time versus wind direction (left axis) and PM_{10} concentration in $\mu g/m^3$ (right axis).

Figure 5 shows the wind direction measured by two anemometers at 3 m height closest to the freeways as a function of wind velocity. There was a small error (~5˚) in initial alignment of the anemometers, which accounts for the deviation of the residual from 0˚ above 2.5 m/s.   It shows that there is a critical ambient wind velocity (~2.5 m/s) necessary to consistently dominate the local velocity regime created by the turbulence of the passing vehicles. However, there are also times when the wind speed is below 2.0 m/s and the wind directions on the two sides agree. The peak PM_{10} concentrations only occur when the wind directions are dominated by vehicle turbulence.

Although typical transportation line-source models assume that the zone of mixing of the roadway extends no more than 3 m from the edge of the pavement, the data indicate the zone of mixing extends at least to the 8-10 m distance from the paved surface that the trailers were placed (because of safety considerations). Otherwise, the influence of the turbulent wakes during low wind speed would not have been observed.   There is sonic anemometer data to support this conclusion, although the sonic anemometer measurements were part of a graduate student thesis project that is not yet completed. These observations suggest an important shortcoming in current line-source models; a more detailed study of the zone of turbulence and its structure than was done here is essential for a complete understanding of freeway emissions.

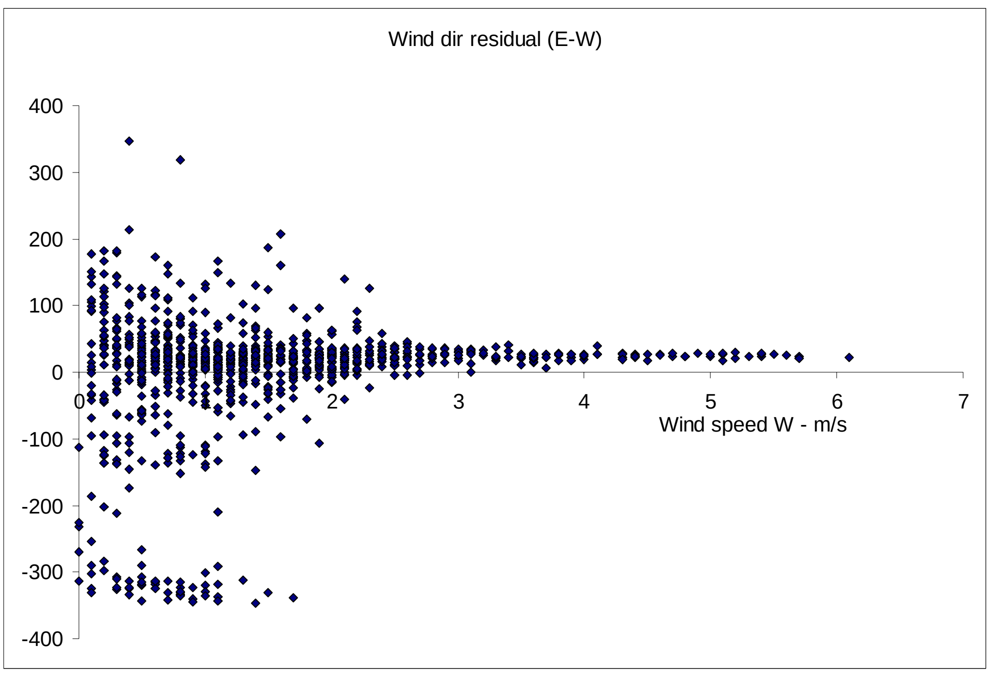

Figure 5. Difference in direction between wind directions (Y-axis) on east and west sides of roadway versus wind speed (X-axis) on the west side.
Note: Above 2.5 m/s, the two directions always agree (a slight error in aligning the anemometer on one side is responsible for the deviation from 0 directional difference above 2.5 m/s). In many cases the wind directions agree below 2.0 m/s, but this generally occurs when traffic is light or traffic speed is very low.

HORIZONTAL DISPERSION OF PM_{10} AND $PM_{2.5}$ PARTICULATE PLUME NORMAL TO THE FREEWAY CORRIDOR

During the 2002 experiment, a third trailer (Chap W2) was placed ~100 m to the west of the 101 freeway to measure the horizontal distribution of particulates away from the road. Unfortunately, only 5 days of sporadic data were successfully collected, due to mechanical difficulties and the subsequent burglary of the equipment from this trailer. Enough data was collected however to determine the magnitude of the decrease in PM_{10} concentration away from the road. Figure 6 shows the TEOM results for all three trailers for the evening rush hour on March 9, 2002, in. The average wind direction for the period shown is approximately 120 degrees (ESE) with an average velocity of 1.8 m/s. The ambient particulate concentration is well measured by the east trailer (Chap E) and is typical at an average of 15 μg/m3 and does not show a peak in concentration associated with the rush hour traffic, indicating that the prevailing wind is dominating and the particulate concentration measurements are not influenced by turbulence. In contrast, the west trailer (Chap W) next to the freeway shows a peak in concentration at 100 μg/m3, resulting in a residual concentration of ~85 μg/m3 for the rush hour. The ChapW2 trailer also shows a peak in concentration correlating in time with that of ChapW, but is significantly smaller at ~35 μg/m3. This shows that over 50% of the PM_{10} concentration coming from the freeway has dispersed by the time it has traveled 100 m from the roadbed at moderate (~2 m/s) wind velocities normal to the traffic direction.

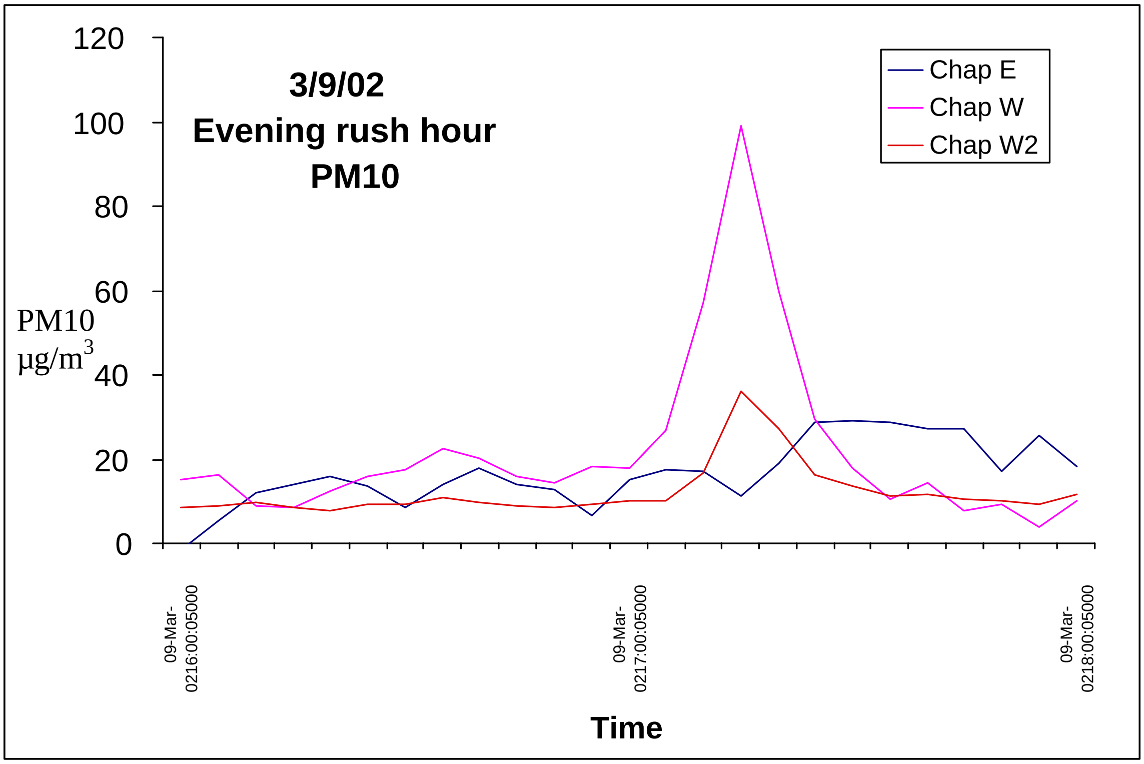

Figure 6. PM_{10} concentration for evening rush hour on Mar 9, 2002.
Note: Average wind velocity was ~120° (ESE), with an average velocity of 1.8 m/s. Note also the flat ambient background measured by trailer E and the significant decrease in concentration at trailer W2 (100 m west of freeway)

The $PM_{2.5}$ (particles smaller than 2.5 microns) concentration was also monitored at this time in ChapW and ChapW2 trailers using DustTraks. The results are more ambiguous than those for PM_{10} however. The $PM_{2.5}$ concentration for the same evening rush hour period on March 9, 2002, is shown in Figure 7. Also shown is the $PM_{2.5}$ data for the 24-hour period that includes the evening rush hour. The concentration levels of $PM_{2.5}$ next to the freeway are not significantly different from those found 100 m away. The differences, especially at low concentrations, mostly are within the error of the DustTraks.

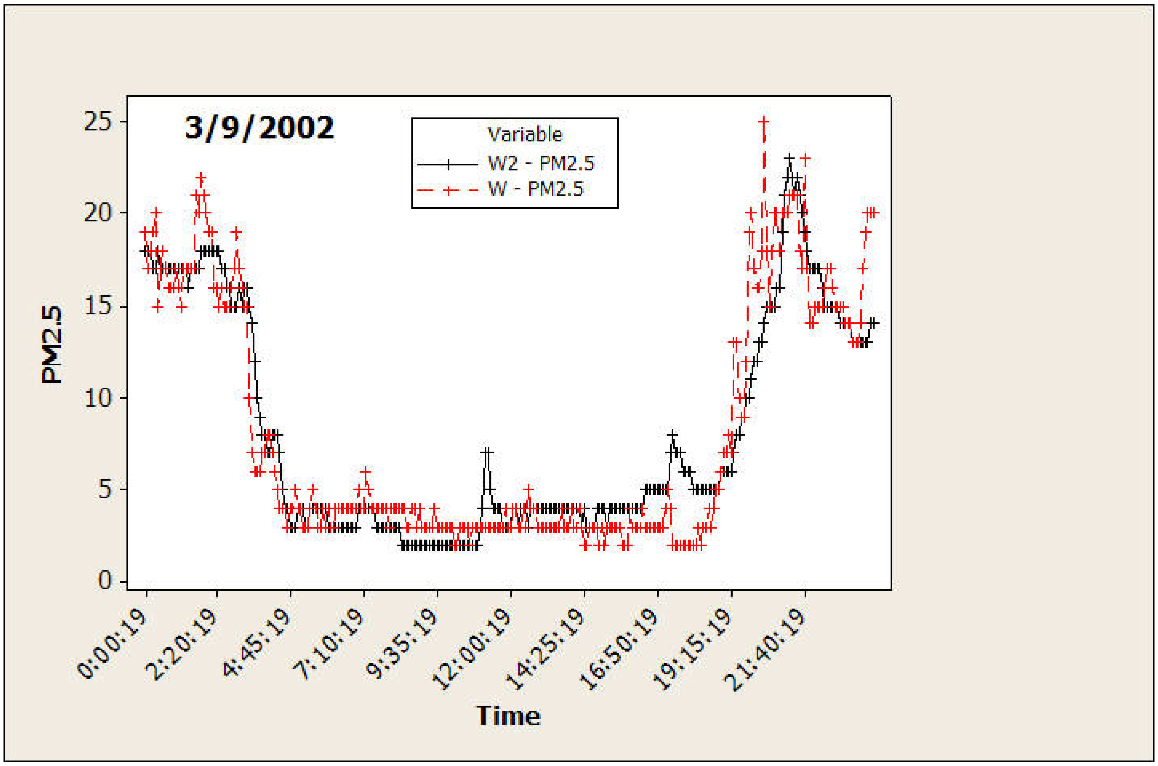

Figure 7A. $PM_{2.5}$ concentrations as measured by DustTraks at ChapW and ChapW2.

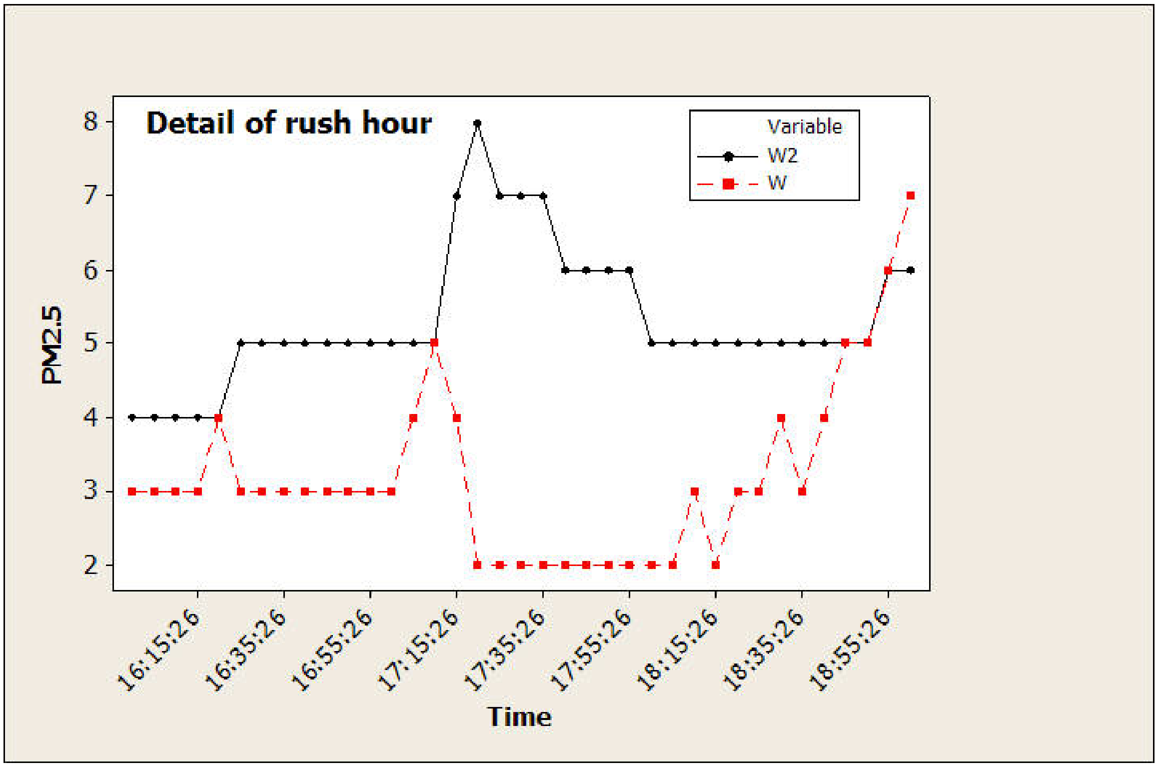

Figure 7B. Detail of evening rush hour.

THE RATIO OF $PM_{2.5}$ TO PM_{10}

Smaller particles have lower settling velocities, so at least under some circumstances, the lack of a horizontal gradient for $PM_{2.5}$ when a strong PM_{10} gradient is present is reasonable. However, the ratio of $PM_{2.5}$ to PM_{10} suggests some complexity that needs further examination. (Again, possible problems with DustTrak measurements of fine, optically absorptive particles like soot from exhaust need to be kept in mind.)

Simultaneous measurement of $PM_{2.5}$ and PM_{10} was done on the west edge of the roadway, using trailer ChapW, in March 2002. Good data without large gaps were obtained over 1066 5-minute intervals during the period of March 6-11. Scatterplots of PM_{10} and $PM_{2.5}$ versus wind speed (Figure 8) reinforce the hypothesis that high concentrations occur during periods when the wind speed is below a critical value. In this period, the critical value for PM_{10} is about 2.0 m/s, but for $PM_{2.5}$ is about 2.5 m/s. Although low wind speed is a necessary condition for high aerosol concentrations, high concentrations do not always accompany low wind speeds. Other factors, including traffic count, vehicle fleet composition, and vehicle speed must be important. However, periods were observed when conditions seemed appropriate for high aerosol concentrations but a concentration peak did not occur.

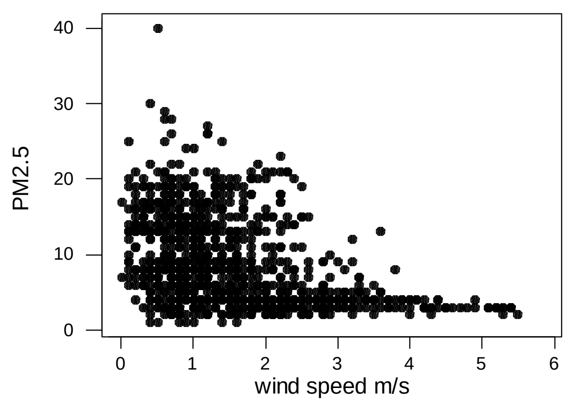

Figure 8A. Scatter plot of $PM_{2.5}$ concentration versus wind speed for 1066 5-minute intervals for Mar 6-11, 2002.

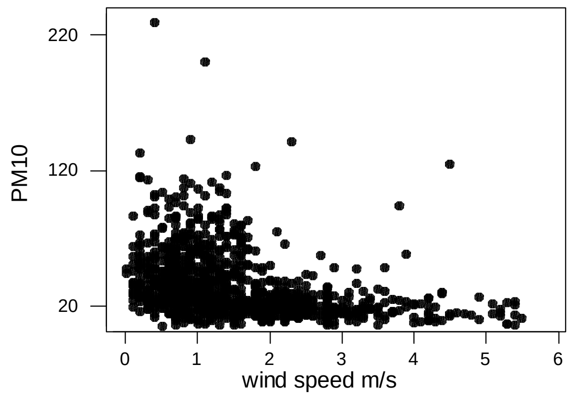

Figure 8B. Scatter plot of PM_{10} versus wind speed for 1066 5-minute intervals for Mar 6-11, 2002.

The ratio of $PM_{2.5}$ to PM_{10} for March 6-11 is shown in Figure 9. The range of values is from less than 0.1 to 1.0. When wind speeds were higher than the threshold, $PM_{2.5}/PM_{10}$ is low. The ratio is also low during some periods of low wind speed. All of the high $PM_{2.5}/PM_{10}$ values occurred during low winds speeds and such conditions sometimes lasted for several hours.

At least two sources of fine particulates could be contributing to freeway $PM_{2.5}$. During low wind speed periods with heavy traffic, the vehicle turbulence could trap exhaust particles, soot plus organics that were not measured, and allow their concentration to build up. Also, since many large soil-dust particles are aggregates of smaller particles, the mechanical action of vehicles passing over particles on the pavement could tend to disaggregate soil dust particles into smaller component particles. Additional measurements including direct determination of elemental carbon concentrations are needed to resolve the questions that remain concerning $PM_{2.5}$ behavior during low wind speed.

The variability of the ratio during low wind periods may be due to variability in the settling rate of large particles. The continuity and strength of the turbulence from passing vehicles should be strongly influenced by both the frequency of larger vehicles and their speed; the latter was not measured. A careful study of the turbulence during low wind periods would be needed to better understand this issue.

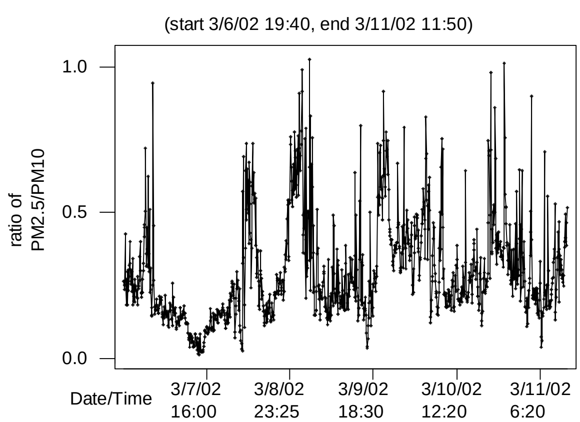

Figure 9. Plot of $PM_{2.5}/PM_{10}$ versus time for Mar 6-11, 2002.

DETERMINATION OF VERTICAL PROFILES OF PARTICLE CONCENTRATION AND WIND VELOCITY

Important to the understanding of the particulate behavior near major urban freeways is the vertical distribution of particulates, and the influence of wind velocity changes as a function of height. Using the TEOM measurements at 3 m as well as DustTrak determinations at 5 and 10 m, a model for the vertical distribution of PM_{10} particulates has been developed and is shown in Figure 10. The values at 3 and 5 m have been averaged and normalized to the values measured at 10 m. There is no significant difference in the concentration between 5 and 10 m, while there is an increase of a factor of ~4 between 3 and 5 m. This indicates a strong gradient in particulate concentration at about 3-5 m. The wind velocity was measured both at 3 and 10 m and the model for the vertical gradient is shown in Figure 11. A no-slip boundary at the ground is assumed.

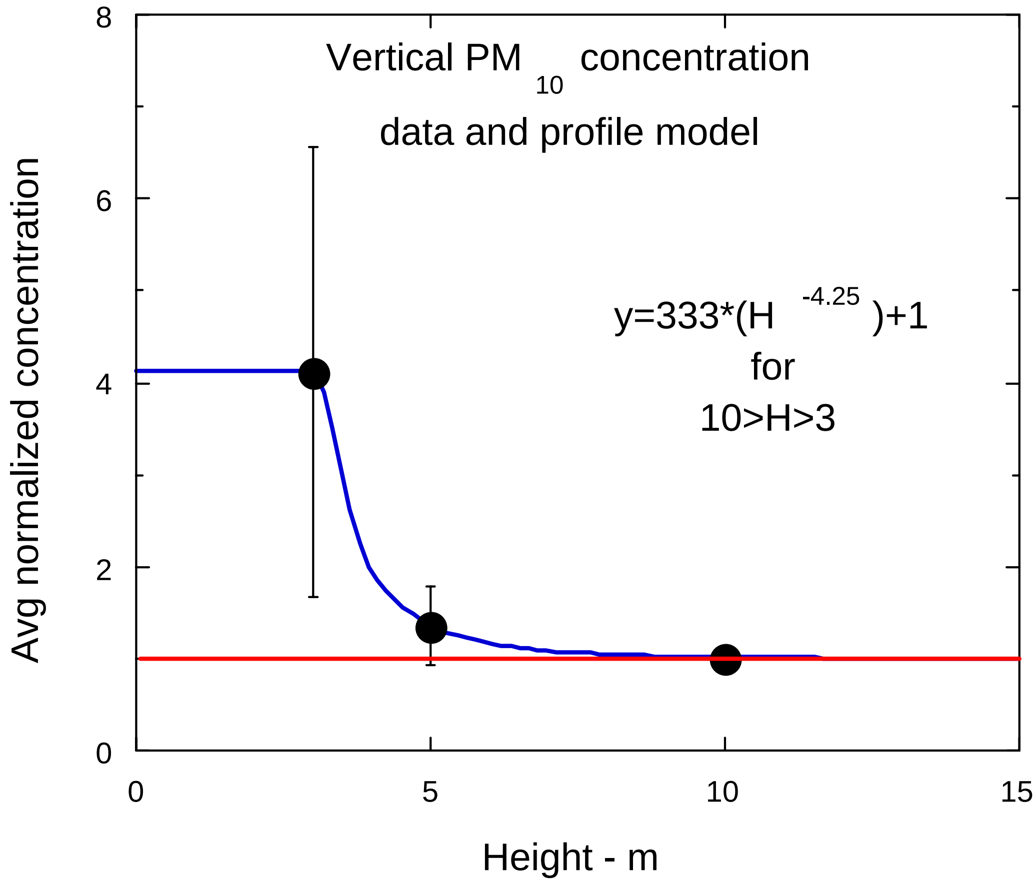

Figure 10: Average normalized vertical distribution of PM_{10} particulates to 10 m.

Note: Error bars are 1 std deviation.

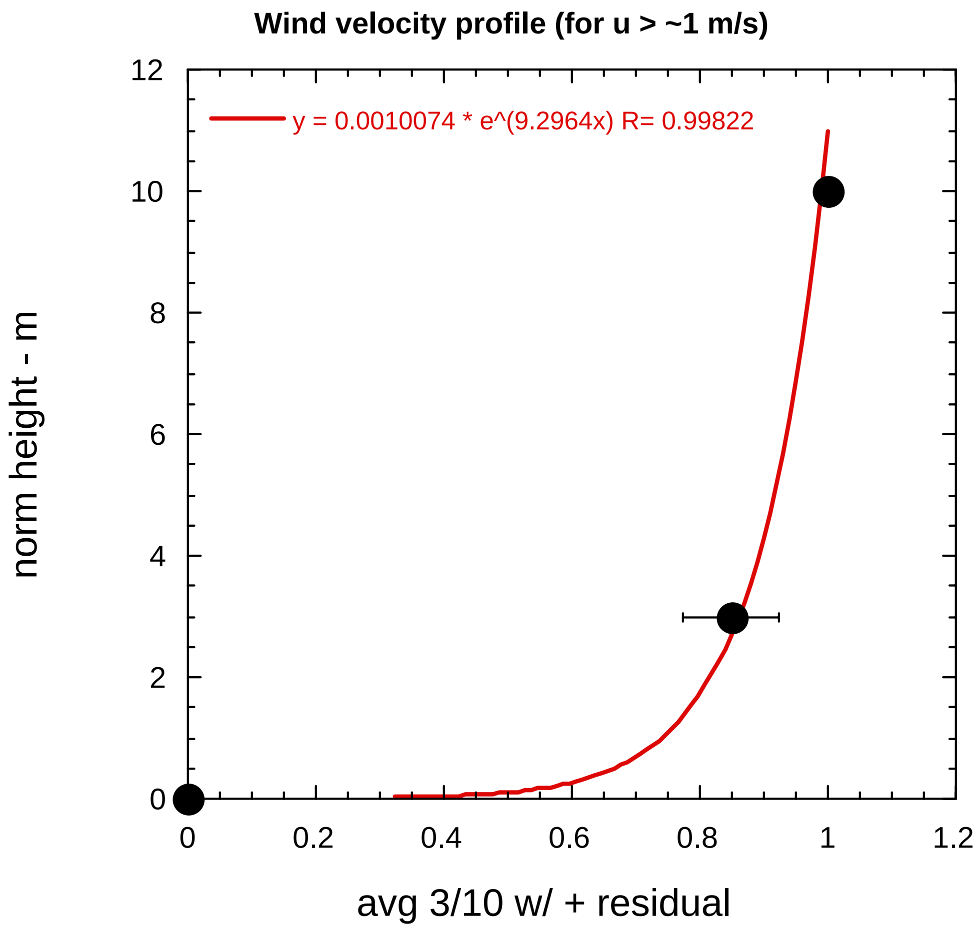

Figure 11. Average normalized wind velocity as a function of height to 10 m.

Note: A no-slip condition is assumed (v=0 at 0 m) and all values are normalized to velocity at 10 m. Error bars are 1 std deviation.

Table 1. One hour average simple emission factors for 101 freeway.

*- highlights wind speeds below threshold value (and therefore not true emission factors)

Date/1 hr period	E $gVKT^{-1}$	Total vehicles	Avg wind speed m/s	Avg wind direction (E side) deg	Avg wind direction (W side) deg
3/7/02					
7-8 am	0.007*	15846	1.0*	118	47
8-9	0.026*	11792	1.0*	85	64
9-10	0.040*	9606	1.9*	143	138
2-3 pm	0.255*	10266	1.9*	253	260
3-4	0.120	11714	2.3	265	269
4-5	0.085	11764	2.6	264	276
3/9/02					
11-12 pm	0.180	9290	4.4	68	67
12-1	0.109	9042	2.5	76	73
1-2	0.042*	8644	1.8*	85	69
2-3	0.039*	8882	2.1*	103	65
3-4	0.001*	9122	1.2*	159	176
4-5	0.013*	9270	1.5*	158	140
3/11/02					
7-8 am	0.067*	12650	1.1*	220	245
8-9	0.037*	10274	0.9*	143	120
9-10	0.013*	8590	1.0*	188	191
3/12/02					
10-11 am	0.094*	8338	1.8*	106	96
11-12 pm	0.059*	8668	1.5*	123	111
12-1	0.037*	8438	2.2*	187	191
1-2	0.001*	8774	2.2*	186	193
3-4	0.023*	11192	2.1*	204	222
4-5	0.058*	11696	1.8*	262	280
5-6	0.044*	11308	1.8*	287	287
3/13/02					
7-8 am	0.018*	12198	1.3*	50	32
8-9	0.020*	11208	0.8*	114	51
9-10	0.090*	9177	1.8*	148	141
12-1 pm	0.010	9086	3.6	191	200
1-2	0.110	8970	2.8	223	230
2-3	0.200	9944	3.8	267	270
3-4	0.001	11406	5.4	239	240
4-5	0.120	11560	5.6	233	237

CALCULATION OF EMISSION FACTORS

Several parameters are necessary for the calculation of PM_{10} emission factors for the site. These include 1) an accurate count of the traffic load in both directions, 2) a measure of the freeway contribution to the particulate concentration, 3) wind direction, 4) wind velocity, and 5) an estimate of the vertical profiles of particulate concentration and wind velocity. All of these parameters have been successfully measured and the results of the calculations are presented here.

Simple Emission Factor

The simplest emission factor calculation is carried out by assuming that there is no vertical change in the particulate concentration or the wind velocity. The formula for this calculation is:

$$E = \frac{\Delta C * (|v \sin \Theta|) * h * w * 3600}{T}$$

where E is the emission factor in $gVKT^{-1}$, ΔC is the absolute residual particulate concentration between the east and west trailers (i.e., the freeway contribution to the concentration), v is 1 hr average wind velocity at 3 m, Θ is the 1 hr average wind direction in degrees (0-360), h and w are the height and width of the box being considered (10 and 1000 m respectively), and T is the total number of vehicles per hour. A factor of 3600 seconds per hour (s/hr) is also needed to convert the wind velocity from m/s to m/hr. The results for periods in which the traffic load was determined are given in Table 1.This method for calculating the emission factors assumes that there is no vertical dependence in the distribution of either the wind velocity normal to the freeway or the PM_{10} concentration. Using the vertical profiles described in the previous section, but assuming a linear behavior between the three measuring heights (3, 5, 10 m), calculations of the emission factor have been made that integrate the profile over these three heights.

The emission factor calculated for low wind speed periods is only an apparent emission factor. Because the transport of aerosols is in the direction of traffic at least at some times during low wind speed events, any measurement of the emission factor must be suspect. When the vehicle turbulence domination stops, even if only briefly, then a high apparent emission factor may also occur as the plume of previously trapped aerosol is transported to one side. The calculated emission values during low wind periods and immediately after low wind periods are only apparent emission factors and cannot be included in a regression versus wind speed.

Eight of the above periods had average wind speeds of at least 2.3 m/s (although this does not guarantee stable conditions of wind speed and direction). The average of these values is about 0.1 $gVKT^{-1}$, a value reasonably close to the modeled value of 0.2 $gVKT^{-1}$ of Venkatram et al. (1999) given that they estimated an uncertainty of about a factor of 2. If the two low outliers of the eight values are eliminated, the simple emission factor is 1.3 $gVKT^{-1}$.

When the vertical profiles of wind speed and PM_{10} concentration are taken into consideration, the calculated emission factor is about 60% of the simple emission factor. This “profiled” emission factor of about 0.06 1 $gVKT^{-1}$ should be a more accurate representation of actual emission per vehicle. However, since current line source models use that simple assumption of homogeneity up to 10 m, in such cases the simple emission factor may be more appropriate.

There is no expectation that the emission factor is constant. It can depend upon factors such as fleet composition and speed, plus of course the amount of loading of entrainable particles on the roadway surface. One of the objectives was to evaluate fleet composition and vehicle speed effects. One would do this by making measurements of the emission factor over enough periods for which the fleet composition varies, particularly with regard to high-profile trucks. Then the relative emission factors for cars and trucks could be determined by a regression of the variables. However, the number of acceptable measurements of the PM_{10} emission factor was limited by the presence of wind speeds below the critical threshold for the majority of the time the field experiments were conducted in both 2000 and 2001. Also, the vehicle fleet composition did not change much along Loop 101 except at night when the video camera was not operational. The experiment would need to be repeated with the addition of video cameras that could operate under low light conditions to meet this objective.

For peak traffic periods with a volume of 11,000 vehicles per hour, the mass of PM_{10} generated by re-entrainment and vehicle exhaust along 1 km of freeway would be 1100 g for the simple case or 600 g for the case in which the vertical profile is considered. Since much of this appears to be soil dust, some mechanism (e.g., track-on of dust by construction vehicles – observed at night, but not measured due to video camera limitations) must frequently reload the roadway surface. Otherwise, the dust on the roadway surface would soon be lost and the emission factor would gradually drop.

COMPARISON WITH MODELED EMISSION FACTORS

Paved roadway emissions are the sum of exhaust, brake and tire wear, and re-entrained road dust. The experimental work presented here has shown that the emission factor that accounts for all three vehicular sources is within the range of 0.061 g/VKT to 0.1 g/VKT, the former value based on measured vertical dispersion through the 10 m boundary layer and the latter assuming equal concentrations throughout the 10 m. These measurements compare favorably with the estimates from the standard models, which provide values of 0.054 g/VKT to 0.061 g/VKT, depending on the percentage of heavy-duty diesel truck traffic. These modeled values are discussed below.

The sixth version of the U. S. Environmental Protection Agency’s vehicular emissions model, MOBILE6.2, is the one presently in regulatory use (EPA, 2003). For particulate emissions, the model provides emission factors for tailpipe and brake and tire wear, but not for re-entrained dust, whose estimates depend on a simple equation based mostly on silt loading (EPA, 2003). In this comparison, MOBILE6.2 was run at a speed of 55 mph, with full Maricopa County Inspection and Maintenance credit, and for calendar year

2002. Notice that heavy-duty diesel trucks emit nearly 20 times as much particulates as light duty gas vehicles. The overall exhaust emission factors double from 0.017 to 0.035 g/VKT as the percentage of diesels increases from 2 to 10%.

Table 2. Exhaust, brake and tire wear, and re-entrained dust emission factors from freeways.

Exhaust, brake & tire wear EF	g/VKT
Heavy-duty diesel vehicles (HDDV)	0.237
Light-duty gasoline vehicles (LDGV)	0.012
HDDV percentage in traffic stream	
HDDV 2%; LDGV 98%	0.017
HDDV 5%; LDGV 95%	0.024
HDDV 10%; LDGV 90%	0.035

The exhaust, brake, and tire wear emission factor for the Loop 101 was in the range of 0.012 to 0.024 g/VKT, depending on the degree of heavy diesel traffic.

The quantity of particulate emissions from resuspension of loose material on the road surface due to vehicle travel on a dry paved road may be estimated using the following empirical expression:

$$E = k * (sL / 2)^{0.65} * (W/3)^{1.5} - C$$, where

E = particulate emission factor in g/VKT,

k = particle size multiplier for particle size range and units of interest (k = 4.5 for PM_{10} and g/VKT),

sL = road surface silt loading (grams per square meter) (g/m^2),

W = average weight (tons) of the vehicles traveling the road (national average is 3 tons), and

C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear (for PM_{10} and g/VKT, C = 0.1317).

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA’s MOBILE6.2 model.

The only variable of concern in this equation is the silt loading. Silt, defined as 75 microns and smaller, is usually measured by carefully vacuuming and weighing the particles from a measured pavement area. Arizona measurements are given in Table 3. Generally, the higher the traffic is, the lower the silt loading. Silt loading on freeways would be expected to be quite low. Choosing a value from the lowest end of the Arizona measurements would not be workable, however, since a value of 0.0177 g/m^2 is necessary to counter the constant and at least produce a zero emission rate. Values higher up the distribution produce the following emission rates:

Silt loading (g/m^2)	Emission Factor (g/VKT)
0.02	0.018
0.025	0.053
0.03	0.087

Table 3. Silt loading from paved roads in Arizona (grams per square meter).

E. McKellips & Olive	0.014	busy arterial
Anklam Rd, St Mary's Rd.	0.014	mod arterial
Oracle Rd S. of Kanmar	0.014	busy arterial
Ina Rd E. of La Cholla	0.021	busy arterial
17th Ave and Highland	0.028	local
22nd St E. of Camino Seco	0.028	busy arterial
Indian School/28th St.	0.035	busy arterial
28th St & Glenrosa	0.035	local
43rd Ave & Vista	0.042	busy arterial
3rd & Miller	0.070	local
South Central	0.084	mod arterial
59th Ave & Peoria	0.098	busy arterial
Mesa Drive	0.098	mod arterial
La Canada, N. of Orange Grove	0.105	local
Ft. Lowell E. of Alvernon	0.112	mod arterial
51st Ave S. of Bridge	0.120	busy arterial
Broadway/Central	0.126	busy arterial
Orange Grove E. of C. dl Tierra	0.160	mod arterial
W. Broadway 38th Dr	0.240	mod arterial
Apache (9th/10th Streets)	0.279	busy arterial
19th Ave S. Lower Buckeye	0.380	busy arterial
Speedway Blvd E. of Pantano	0.398	busy arterial
Avalon & 25th	0.523	local
19th Ave S. River N Broadway	0.570	busy arterial
6th Ave & 28th St	1.269	arterial
Lower Buckeye W. 35th Ave	2.100	mod arterial

Adding the re-entrained emission rate from the 0.025 silt loading of 0.053 to the exhaust, and brake and tire wear emission rate with 2% heavy-duty diesel vehicles of 0.017, gives a combined emission rate of 0.07 g/VKT, within the 0.061 – 0.1 g/VKT ranges determined experimentally. Comparison of the Loop 101 emission factors with recent work in California is also reassuring.

Table 4. Combined Paved Road Emission Factors in g/VKT (ARB, 2001).

	PM_{10}	$PM_{2.5}$
Local	0.076	0.058
Collector	0.032	0.024
Arterial	0.075	0.037
Freeway	0.055	0.035

In summary, the experimentally determined emission factor for PM_{10} from paved roads in this work is consistent with both the standard models and other experimental work.

PARTICLE TYPES FROM SEM ANALYSIS

The particle types found in the analyzed PM_{10} samples from the Loop 101 site are listed in Table 5. The relative concentrations are in particle number and not mass (this analysis method does not directly measure mass; particle volume can serve as a proxy for mass, and is approximated by multiplying the 2-dimensional particle areas by the corresponding "widths," the smaller of the two measured particle axes).

Table 5. Particle types in east-west sectors from 20 analyzed samples at Loop 101 site.

Percents are relative number concentrations, 23,819 total particles.

Particle type	**Number %**	**Comments**
a. Carbonaceous	8.2 %	Soot, rubber fragments, etc.
b. Aluminosilicates	34.2 %	Soil dust – clays and other minerals
c. SiO2	7.0 %	Soil dust - quartz
d. Ca-Si dominant	4.0 %	Concrete and aggregates of soil dust and CaCO3
e. Fe dominant	15.4 %	Multiple origins possible: engine wear, natural Fe oxide, and Fe oxide from foundries
f. Ca dominant	3.6 %	Cement and natural CaCO3
g. Ca sulfate	1.2%	Agriculture and natural soil component
h. Na dominant	16.5 %	Interpreted as Na from fuel additive. Manual SEM observations indicate these are soot aggregates with minor Na.
i. Na with Cl	1.2%	Appears to be sea salt from long-range transport, some of which is partially reacted to Na sulfate. Common minor type in Phoenix area.
j. Na-Cr and Na-Cu	0.9%	Unusual types not previously observed in Phoenix area, possibly of vehicle origin
k. Ca-Na	1.6 %	Possibly aggregates of Na and Ca types
l. Na-S	4.4%	Reaction products and (h) or (i) with sulfate
m. Fe-Cu-Ba-Ti	1.3%	Unusual type not previously observed in Phoenix area
n. Sulfate	0.4 %	Ammonium sulfate from photo-oxidation of SO2

Because the soil-dust types have significantly larger mean volumes than most of the other types, the particle volume is dominated by soil dust types and therefore the mass is also dominated by soil dust. For instance, samples from sector 4 on the east and west sides of Loop 101 on March 9, 2002, have average volumes for silicates ([b] and [c] in Table 5) of 11.42 μm^3 on the east side and 11.64 μm^3 on the west side (sector 4 faces west, so that particles collected on the east side have come across the freeway or originated from freeway emissions). The number concentrations of silicates on the two sides differ by 14%, probably not a statistically significant difference given all the complicating factors. Type (h) (soot with minor Na as the only detectable element other than C and O) particles have average volumes of 0.62 μm^3 on the east side and 2.81 μm^3 on the west side, but the number concentration of Type (h) particles is 226% higher on the east side compared to the west. This suggests that either Type (h) particles are reduced in size by some process involving the freeway or that the freeway is a source of small Type (h) particles. This is also complicated by a number of other factors. Aggregation of major particle types is observed to be common and there is indirect evidence that the aggregation of soot and mineral dust occurs in the turbulent zone of the freeway; Figure 12 is a secondary electron image of a typical aggregate. Other examples are in the images in Appendix D.

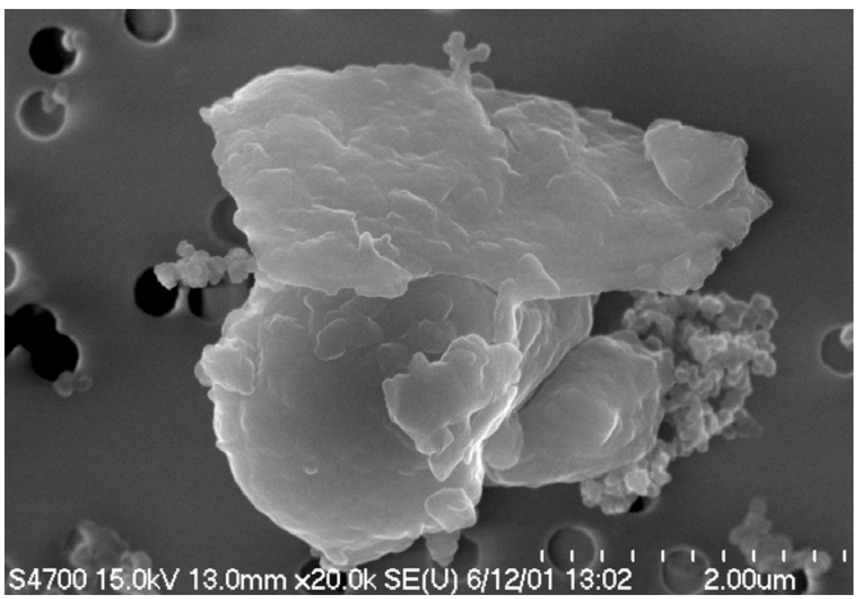

Figure 12. Secondary electron image of aggregate soil dust particle with attached elemental carbon (soot).

Note: Sample also contains at least two other types of elemental carbon as separate particles. Holes are 0.4 µm holes in filter. February 21, 2001, Loop 101. (Enlargement of this image is in Appendix D.)

There are many types of carbonaceous particles; however, not all are soot. Figure 13 is an image of a rubber fragment, typical of tire wear. Soot is formed by many different types of combustion and so can vary in both morphology and composition with regard to minor elements. Some of the key minor elements are K, Na, Fe, and Mg. Soot from biomass burning tends to contain K. Soot from coal combustion frequently has Fe and Mg. Because Na is used as a Pb substitute in some vehicle fuel mixtures, minor Na in soot may be indicative of vehicle exhaust. The high concentrations of soot with Na in the freeway samples suggest this is the case.

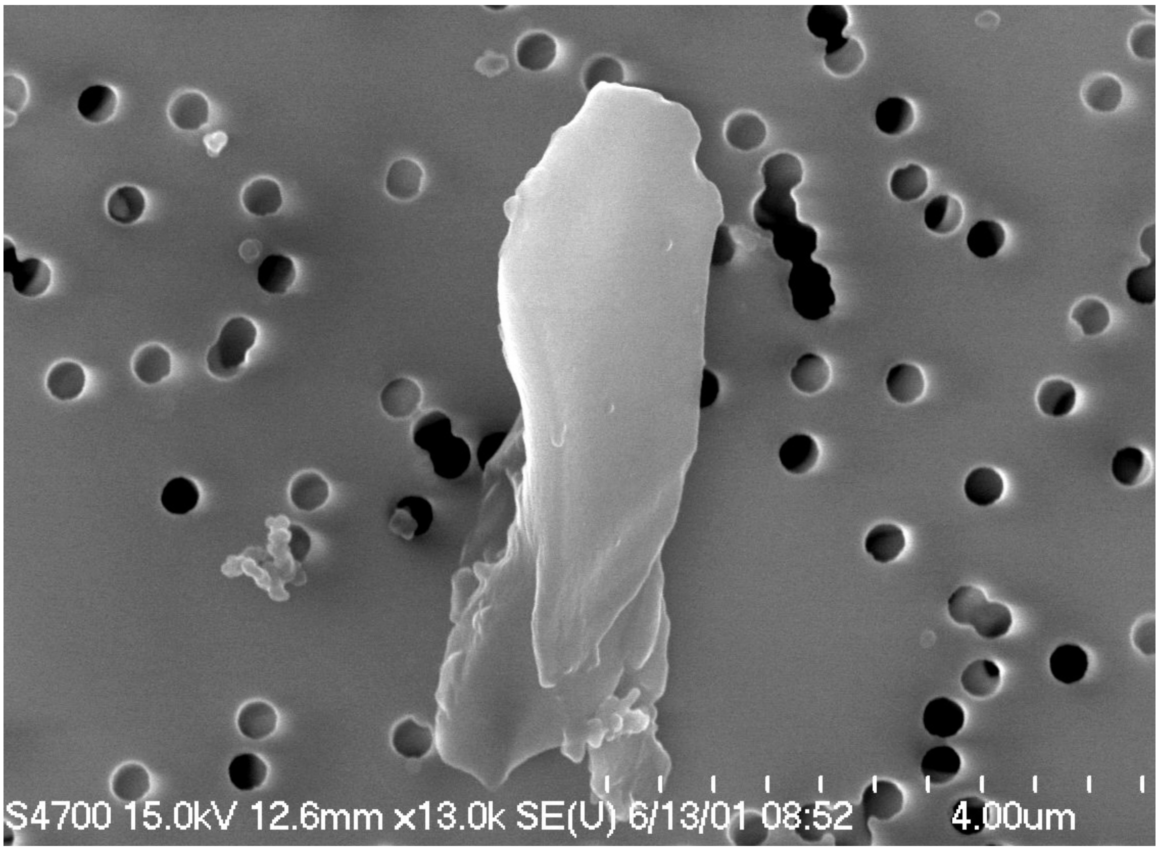

Figure 13. Secondary electron image of rubber fragment (large central particle) with smaller EC particles both aggregated and as separate particles. Feb 21, 2001, Loop 101.

Fe-rich particles have at least three possible sources. A small amount of Fe oxide is in normal soil. There are also industrial sources of Fe oxide and recent work from the Arizona Department of Environmental Quality (Anderson, unpublished data) shows that spherical Fe oxide particles are abundant in SW Phoenix. The hypothesized source is a scrap metal foundry. The third possible source is from vehicles, predominantly from engine wear and perhaps also from tire wear. An Fe dominant particle that is non-spherical and does not appear to be from soil dust is shown in one of the images in Appendix D; many similar particles are present in the aerosol are hypothesized to be of vehicular origin.

Particles with high Ca and Si can result from wear of the concrete road surface, from cement block and pipe manufacture (or other use of cement), or from the natural aggregation of calcium carbonate and silicate minerals. The concentration of Ca-Si particles in these samples is not significantly greater than that observed in other studies have conducted in Arizona. With the exception of the unusual type (m) (Fe-Cu-Ba-Ti), the other minor aerosol types are commonly found in the Phoenix aerosol. Type (m) is of unknown origin.

The particle types that set the freeway aerosols apart from others are the Na-bearing carbonaceous types and the non-spherical Fe-dominant types, both probably directly related to vehicles. However, as already stated, the silicate and aluminosilicate types dominate the PM_{10} mass because they have larger diameters combined with high number concentrations. The majority of soil dust particles observed with high-resolution imaging have at least some small soot attached to them. In the supermicron particles of all types, aggregation of multiple particle species is extremely common.

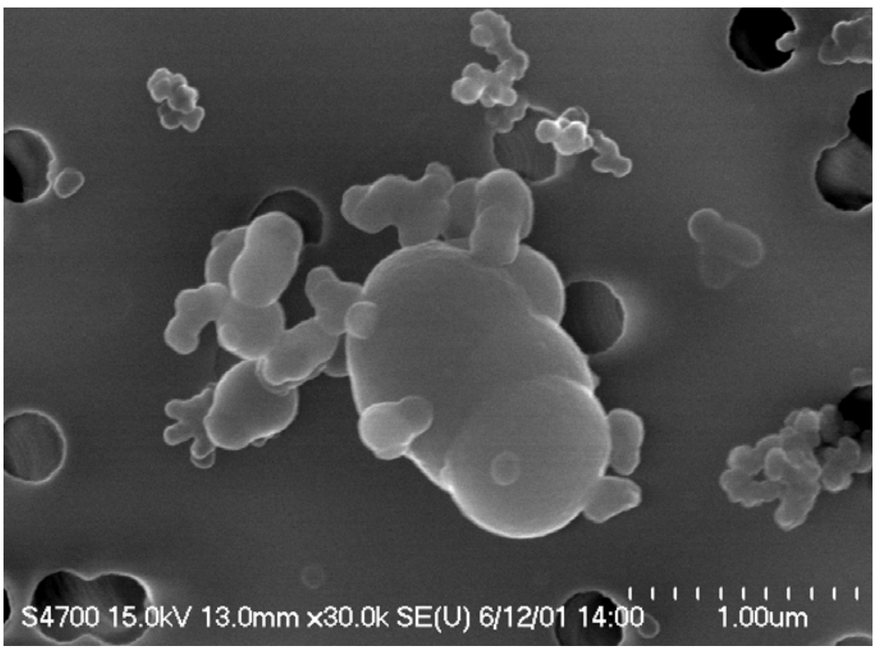

Figure 14. Secondary electron image of two types of EC (soot).
Feb 21, 2001, Loop 101.

Figure 15 is a normalized size distribution of the difference between size distributions on the upwind and downwind side for Sector 4 on Feb 21, 2001. For this sample, most of this residual (which represents the aerosol emitted from the freeway) is mineral dust. Note that most of the particles are smaller than 2 μm diameter and therefore will be part of both PM_{10} and $PM_{2.5}$. These and similar data suggest the disaggregating of larger soil particles discussed earlier. The generation of particles in the $PM_{2.5}$ size range is of significance because these particles can stay suspended in the boundary layer for a longer time and therefore make more impact on the regional aerosol than if the particles were larger.

The ability to use the sectored samples to determine the size, shape, and composition of re-entrained particles from the roadway surface is limited because of the frequent low sine speed periods. In any future experiment, it would be better to take unsectored samples for short time intervals (10-15 minutes) for SEM analysis and then choose those samples for which the wind conditions are favorable.

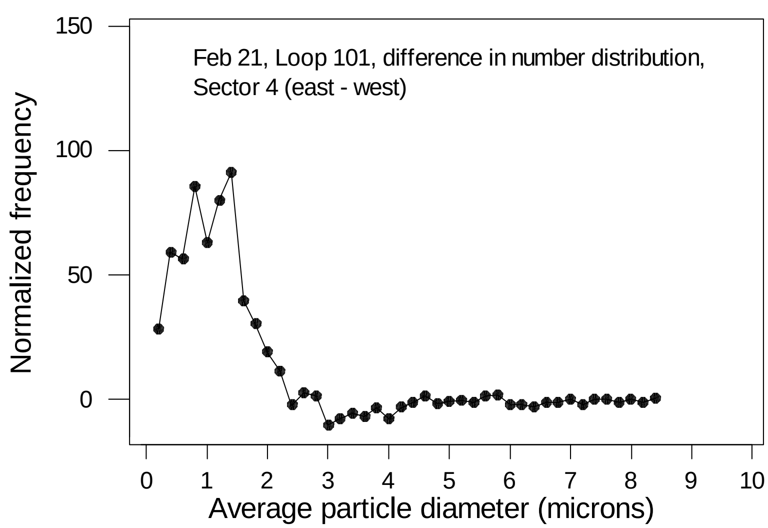

Figure 15. Size distribution of emitted freeway particles determined by subtracting the upwind background size distribution from the downwind size distribution for Sector 4.

IV. CONCLUSIONS

With regard to the project objectives, the following conclusions can be made:

Objective 1: *To determine* PM_{10} *emissions factors for total vehicle-related particulates on major roadways in the Phoenix urban airshed.* The total vehicle-related emission factor measured at the Loop 101/Chaparral Road site was about 0.1 $gVKT^{-1}$, assuming a simple model of uniform mixing to 10 m height and uniform wind speed. The emission factor is not a constant and could be higher or lower, especially if the loading of the roadway surface with dust varied. If the true vertical profile of wind speed and aerosol concentration is considered, the emission factor is about 0.06 $gVKT^{-1}$.

Objective 2: *To determine* PM_{10} *emissions factors for re-entrainment of mineral dust particles from major roadways including data by vehicle type and speed so as to assess the impact on the ambient urban aerosol.* The periods when the experiments were run were strongly dominated by low wind speeds. That, coupled with the relative homogeneity of the vehicle fleet composition on Loop 101 during daylight hours, made it impossible to perform the data regressions needed to quantify the effects of vehicle type and speed. An experimental site with more variability in fleet composition and better experimental wind conditions are needed if this is to be accomplished in future research.

Objective 3: *To determine the downwind contributions of roadway particles to* PM_{10} *at distances of up to 100 m, so as to assess the local impact of freeways on adjacent residential areas.* There are significant horizontal PM_{10} gradients on the down wind side of the freeway when the concentration along the roadway is significantly higher than the background level. At 100 m from the roadway, the concentration is 50% or less of the concentration 3 m from the roadway. $PM_{2.5}$ does not seem to behave in the same manner. During the times when we were able to make $PM_{2.5}$ measurements at 100 and 200 m from the roadway, no significant horizontal gradients were observed.

Objective 4: *To determine whether re-entrained mineral dust is aggregated with significant amounts of carbonaceous material.* Almost all mineral dust particles have at least a few small (< 100 nm) particles of black carbon (soot) attached to them. A significant fraction of mineral dust particles are aggregated with soot particles larger than 100 nm. There are many forms of soot present in the samples. The mixing of soot with other aerosols in hot exhaust gases in the highly turbulent freeway environment may be responsible for the Black Carbon/soil-dust aggregation. The simple aggregation of dust particles is common in Arizona soils.

Objective 5: *To determine the size distribution of re-entrained dust and, if reduced from other ambient dust, the mechanism responsible.* The re-entrained dust is smaller in size than that in ambient aerosol arriving at the roadway. The most likely mechanism is disaggregation of larger soil dust particles. Re-entrained soil dust tends to be smaller than 2 μm and therefore contributes to $PM_{2.5}$ as well as PM_{10}.

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APPENDIX A: EXAMPLE OF TEOM DATA FILE

Example of TEOM data, from trailer on east side of Loop 101, Feb 21-22, 2002

(1 = 5 minute ave. PM_{10}; 2 = 1 hour ave. PM_{10}; 3 = 8 hour ave. PM_{10}; 4 = wind speed m/s; 5 = wind direction; 6 = active sector)

Date	Time	(1)	(2)	(3)	T	P	(4)	(5)	(6)
21-Feb-02	10:45:05	0.0	0.0	0.0	23.9	0.965	1.1	280.1	4
21-Feb-02	10:50:05	0.0	0.0	0.0	23.4	0.965	0.5	241.7	7
21-Feb-02	10:55:05	13.5	0.0	0.0	24.4	0.964	0.8	281.7	4
21-Feb-02	11:00:05	19.0	0.0	0.0	24.2	0.964	0.5	271.0	7
21-Feb-02	11:21:51	0.0	0.0	0.0	24.2	0.964	0.9	17.5	6
21-Feb-02	11:25:05	0.0	0.0	0.0	25.2	0.965	1.0	324.3	5
21-Feb-02	11:30:05	0.0	0.0	0.0	24.0	0.964	1.0	359.5	5
21-Feb-02	11:35:05	0.0	0.0	0.0	25.2	0.964	1.7	5.7	6
21-Feb-02	11:40:05	0.0	0.0	0.0	24.5	0.963	0.4	243.9	3
21-Feb-02	11:45:05	0.0	0.0	0.0	24.2	0.963	2.3	38.3	6
21-Feb-02	11:50:05	0.0	0.0	0.0	24.4	0.962	4.2	72.4	1
21-Feb-02	11:55:05	0.0	0.0	0.0	24.3	0.962	4.4	63.4	6
21-Feb-02	12:00:05	0.0	0.0	0.0	24.3	0.962	5.9	73.9	1
21-Feb-02	12:05:05	0.0	0.0	0.0	24.6	0.961	4.9	74.5	1
21-Feb-02	12:10:05	0.0	0.0	0.0	24.6	0.961	4.2	61.1	6
21-Feb-02	12:15:05	0.0	0.0	0.0	24.5	0.961	3.3	81.9	1
21-Feb-02	12:20:05	0.0	0.0	0.0	24.6	0.960	3.7	85.8	1
21-Feb-02	12:25:05	25.6	0.0	0.0	24.4	0.960	3.4	93.7	1
21-Feb-02	12:30:05	27.0	0.0	0.0	25.1	0.960	4.2	65.0	6
21-Feb-02	12:35:05	13.9	0.0	0.0	24.7	0.960	2.2	58.6	6
21-Feb-02	12:40:05	11.9	0.0	0.0	24.6	0.960	3.1	42.9	6
21-Feb-02	12:45:05	9.3	0.0	0.0	25.2	0.960	3.3	60.0	6
21-Feb-02	12:50:05	33.7	0.0	0.0	25.0	0.959	1.5	45.0	6
21-Feb-02	12:55:05	36.1	0.0	0.0	25.8	0.959	3.0	128.1	2
21-Feb-02	13:00:05	30.5	0.0	0.0	24.7	0.959	2.5	160.2	2
21-Feb-02	13:05:05	26.7	0.0	0.0	25.1	0.958	2.8	113.8	2
21-Feb-02	13:10:05	16.9	0.0	0.0	25.7	0.958	3.0	141.3	2
21-Feb-02	13:15:05	18.1	0.0	0.0	25.6	0.958	2.0	144.7	2
21-Feb-02	13:20:05	14.7	0.0	0.0	24.7	0.958	2.8	172.3	2
21-Feb-02	13:25:05	12.8	0.0	0.0	24.3	0.957	2.6	130.9	2
21-Feb-02	13:30:05	9.5	0.0	0.0	25.7	0.957	3.3	144.0	2
21-Feb-02	13:35:05	22.2	0.0	0.0	26.0	0.957	1.0	128.3	2
21-Feb-02	13:40:05	22.2	0.0	0.0	25.1	0.957	3.3	188.0	3
21-Feb-02	13:45:05	11.7	0.0	0.0	25.2	0.957	3.1	152.0	2
21-Feb-02	13:50:05	11.7	0.0	0.0	25.8	0.957	3.0	150.4	2
21-Feb-02	13:55:05	12.2	0.0	0.0	26.2	0.956	2.1	174.1	2
21-Feb-02	14:00:05	13.7	15.3	0.0	26.5	0.956	1.6	166.1	2
21-Feb-02	14:05:05	5.6	15.3	0.0	25.6	0.956	2.2	178.5	2
21-Feb-02	14:10:05	2.2	15.3	0.0	26.6	0.956	1.7	115.4	2
21-Feb-02	14:15:05	4.8	15.3	0.0	27.0	0.956	1.1	162.4	2
21-Feb-02	14:20:05	18.5	15.3	0.0	27.1	0.956	1.8	202.9	3
21-Feb-02	14:25:05	19.7	15.3	0.0	26.1	0.956	1.3	191.2	3
21-Feb-02	14:30:05	12.2	15.3	0.0	27.3	0.955	1.7	120.0	2
21-Feb-02	14:35:05	21.1	15.3	0.0	27.7	0.955	0.9	143.5	2
21-Feb-02	14:40:05	16.6	15.3	0.0	26.8	0.955	1.5	204.9	3
21-Feb-02	14:45:05	12.7	15.3	0.0	27.5	0.955	1.6	84.9	1
21-Feb-02	14:50:05	20.8	15.3	0.0	27.5	0.955	1.2	14.4	6
21-Feb-02	14:55:05	25.3	15.3	0.0	27.2	0.955	1.0	291.5	4

21-Feb-02	15:00:05	17.9	15.2	0.0	27.2	0.955	1.1	4.9	6
21-Feb-02	15:05:05	18.9	15.2	0.0	27.7	0.955	1.1	41.1	6
21-Feb-02	15:10:05	20.9	15.2	0.0	27.7	0.954	1.5	181.7	3
21-Feb-02	15:15:05	18.7	15.2	0.0	27.8	0.954	0.6	92.7	7
21-Feb-02	15:20:05	21.0	15.2	0.0	28.2	0.954	0.5	89.4	7
21-Feb-02	15:25:05	23.0	15.2	0.0	27.6	0.954	0.7	12.0	6
21-Feb-02	15:30:05	24.0	15.2	0.0	28.2	0.954	1.4	13.9	6
21-Feb-02	15:35:05	24.1	15.2	0.0	28.2	0.954	0.5	323.9	5
21-Feb-02	15:40:05	20.4	15.2	0.0	26.8	0.954	1.4	233.7	3
21-Feb-02	15:45:05	13.6	15.2	0.0	27.5	0.953	1.6	77.6	1
21-Feb-02	15:50:05	14.3	15.2	0.0	27.3	0.953	0.8	100.2	1
21-Feb-02	15:55:05	11.9	15.2	0.0	27.3	0.953	1.1	185.7	3
21-Feb-02	16:00:05	11.6	18.1	0.0	26.9	0.953	0.9	138.0	2
21-Feb-02	16:05:05	10.8	18.1	0.0	27.9	0.953	1.5	103.3	1
21-Feb-02	16:10:05	24.8	18.1	0.0	28.2	0.953	0.6	135.6	7
21-Feb-02	16:15:05	22.2	18.1	0.0	27.6	0.953	1.4	242.0	3
21-Feb-02	16:20:05	19.3	18.1	0.0	28.6	0.953	1.8	0.2	6
21-Feb-02	16:25:05	21.3	18.1	0.0	28.3	0.953	0.6	253.6	7
21-Feb-02	16:30:05	8.9	18.1	0.0	27.6	0.953	0.8	346.9	5
21-Feb-02	16:35:05	7.5	18.1	0.0	28.2	0.953	2.0	21.9	6
21-Feb-02	16:40:05	16.8	18.1	0.0	27.1	0.953	2.0	12.9	6
21-Feb-02	16:45:05	16.7	18.1	0.0	27.5	0.953	2.6	45.5	6
21-Feb-02	16:50:05	13.9	18.1	0.0	27.5	0.953	0.9	26.8	6
21-Feb-02	16:55:05	15.4	18.1	0.0	27.3	0.952	2.3	47.4	6
21-Feb-02	17:00:05	7.2	14.7	0.0	27.1	0.953	3.9	42.6	6
21-Feb-02	17:05:05	17.5	14.7	0.0	27.3	0.953	4.8	20.6	6
21-Feb-02	17:10:05	68.0	14.7	0.0	27.0	0.953	4.8	24.4	6
21-Feb-02	17:15:05	60.4	14.7	0.0	26.8	0.953	6.2	26.7	6
21-Feb-02	17:20:05	43.1	14.7	0.0	26.8	0.953	5.6	33.9	6
21-Feb-02	17:25:05	23.5	14.7	0.0	26.8	0.953	5.4	32.6	6
21-Feb-02	17:30:05	14.4	14.7	0.0	26.7	0.953	4.7	29.5	6
21-Feb-02	17:35:05	14.3	14.7	0.0	26.5	0.953	3.9	38.7	6
21-Feb-02	17:40:05	28.0	14.7	0.0	26.4	0.953	4.2	35.5	6
21-Feb-02	17:45:05	27.7	14.7	0.0	26.1	0.953	5.5	35.1	6
21-Feb-02	17:50:05	23.1	14.7	0.0	25.2	0.953	5.1	35.9	6
21-Feb-02	17:55:05	21.5	14.7	0.0	25.3	0.954	4.6	39.5	6
21-Feb-02	18:00:05	28.7	31.6	0.0	25.2	0.954	4.4	33.1	6
21-Feb-02	18:05:05	29.5	31.6	0.0	24.5	0.954	3.7	30.6	6
21-Feb-02	18:10:05	40.8	31.6	0.0	24.5	0.954	3.5	26.6	6
21-Feb-02	18:15:05	45.7	31.6	0.0	24.1	0.954	3.3	19.5	6
21-Feb-02	18:20:05	38.1	31.6	0.0	23.5	0.955	4.1	21.4	6
21-Feb-02	18:25:05	39.1	31.6	0.0	23.2	0.955	3.6	24.2	6
21-Feb-02	18:30:05	50.5	31.6	0.0	22.7	0.955	3.3	25.2	6
21-Feb-02	18:35:05	85.0	31.6	0.0	22.4	0.956	2.7	14.1	6
21-Feb-02	18:40:05	52.2	31.6	0.0	21.8	0.956	1.6	13.3	6
21-Feb-02	18:45:05	29.5	31.6	0.0	22.2	0.956	2.3	15.9	6
21-Feb-02	18:50:05	21.2	31.6	0.0	22.2	0.957	3.2	18.0	6
21-Feb-02	18:55:05	18.9	31.6	0.0	22.1	0.957	3.4	16.6	6
21-Feb-02	19:00:05	17.5	38.6	0.0	21.9	0.957	3.5	18.2	6
21-Feb-02	19:05:05	25.7	38.6	0.0	21.6	0.957	3.3	21.3	6
21-Feb-02	19:10:05	31.1	38.6	0.0	21.6	0.958	3.0	17.1	6
21-Feb-02	19:15:05	27.2	38.6	0.0	21.6	0.958	3.1	19.1	6
21-Feb-02	19:20:05	31.0	38.6	0.0	21.4	0.958	3.4	26.6	6
21-Feb-02	19:25:05	24.7	38.6	0.0	21.5	0.958	4.3	43.9	6
21-Feb-02	19:30:05	20.0	38.6	0.0	21.4	0.959	3.4	23.4	6
21-Feb-02	19:35:05	21.0	38.6	0.0	21.3	0.959	3.5	23.8	6
21-Feb-02	19:40:05	19.6	38.6	0.0	20.9	0.959	3.7	24.9	6

21-Feb-02	19:45:05	14.4	38.6	0.0	20.7	0.959	3.1	18.3	6
21-Feb-02	19:50:05	11.1	38.6	0.0	21.0	0.960	2.9	15.7	6
21-Feb-02	19:55:05	13.9	38.6	0.0	21.2	0.960	3.3	16.4	6
21-Feb-02	20:00:05	20.0	21.6	0.0	20.7	0.960	2.7	6.1	6
21-Feb-02	20:05:05	19.7	21.6	0.0	21.0	0.960	2.5	6.8	6
21-Feb-02	20:10:05	15.9	21.6	0.0	20.6	0.960	2.4	359.0	5
21-Feb-02	20:15:05	14.0	21.6	0.0	20.2	0.960	3.3	5.2	6
21-Feb-02	20:20:05	13.9	21.6	0.0	19.9	0.960	2.6	5.9	6
21-Feb-02	20:25:05	21.0	21.6	0.0	20.5	0.961	1.9	10.2	6
21-Feb-02	20:30:05	27.2	21.6	0.0	20.1	0.961	3.2	15.9	6
21-Feb-02	20:35:05	23.4	21.6	0.0	20.0	0.961	3.5	21.5	6
21-Feb-02	20:40:05	21.1	21.6	0.0	19.6	0.961	3.1	29.1	6
21-Feb-02	20:45:05	15.8	21.6	0.0	19.3	0.961	2.9	37.4	6
21-Feb-02	20:50:05	9.9	21.6	0.0	19.5	0.961	3.3	33.8	6
21-Feb-02	20:55:05	8.6	21.6	0.0	19.4	0.961	3.6	32.5	6
21-Feb-02	21:00:05	15.7	17.0	21.1	19.6	0.962	4.0	31.2	6
21-Feb-02	21:05:05	16.0	17.0	21.1	19.9	0.962	4.0	30.2	6
21-Feb-02	21:10:05	13.9	17.0	21.1	19.8	0.962	3.9	29.1	6
21-Feb-02	21:15:05	15.4	17.0	21.1	19.7	0.962	3.8	25.9	6
21-Feb-02	21:20:05	16.9	17.0	21.1	19.3	0.962	4.0	21.4	6
21-Feb-02	21:25:05	17.6	17.0	21.1	20.1	0.962	3.0	12.5	6
21-Feb-02	21:30:05	36.1	17.0	21.1	18.1	0.963	1.5	349.8	5
21-Feb-02	21:35:05	31.5	17.0	21.1	17.8	0.963	1.3	304.1	5
21-Feb-02	21:40:05	29.2	17.0	21.1	18.2	0.963	2.1	310.0	5
21-Feb-02	21:45:05	27.9	17.0	21.1	18.9	0.963	2.9	330.7	5
21-Feb-02	21:50:05	26.4	17.0	21.1	19.3	0.963	3.3	340.2	5
21-Feb-02	21:55:05	21.9	17.0	21.1	19.6	0.963	2.7	340.6	5
21-Feb-02	22:00:05	20.0	22.7	22.0	19.5	0.963	2.3	343.1	5
21-Feb-02	22:05:05	20.2	22.7	22.0	19.2	0.963	2.5	340.2	5
21-Feb-02	22:10:05	18.5	22.7	22.0	19.0	0.963	1.5	355.1	5
21-Feb-02	22:15:05	15.8	22.7	22.0	18.1	0.963	2.1	2.0	6
21-Feb-02	22:20:05	7.4	22.7	22.0	18.2	0.964	1.6	11.6	6
21-Feb-02	22:25:05	5.5	22.7	22.0	18.7	0.964	3.2	16.5	6
21-Feb-02	22:30:05	8.6	22.7	22.0	19.1	0.964	3.4	23.2	6
21-Feb-02	22:35:05	10.2	22.7	22.0	19.4	0.964	3.9	29.8	6
21-Feb-02	22:40:05	8.7	22.7	22.0	20.0	0.964	4.7	30.2	6
21-Feb-02	22:45:05	11.4	22.7	22.0	19.3	0.964	4.5	34.8	6
21-Feb-02	22:50:05	11.5	22.7	22.0	20.2	0.964	3.2	33.0	6
21-Feb-02	22:55:05	18.1	22.7	22.0	20.1	0.964	4.1	42.4	6
21-Feb-02	23:00:05	14.2	12.5	21.8	20.5	0.964	5.0	40.1	6
21-Feb-02	23:05:05	25.7	12.5	21.8	20.6	0.964	5.1	38.6	6
21-Feb-02	23:10:05	20.2	12.5	21.8	20.7	0.964	5.2	34.4	6
21-Feb-02	23:15:05	19.3	12.5	21.8	19.7	0.964	4.6	30.6	6
21-Feb-02	23:20:05	12.0	12.5	21.8	19.9	0.964	4.5	39.3	6
21-Feb-02	23:25:05	10.9	12.5	21.8	19.7	0.964	3.5	42.1	6
21-Feb-02	23:30:05	13.1	12.5	21.8	19.5	0.964	4.1	27.7	6
21-Feb-02	23:35:05	10.2	12.5	21.8	19.7	0.964	3.5	31.5	6
21-Feb-02	23:40:05	10.3	12.5	21.8	19.0	0.964	3.5	28.7	6
21-Feb-02	23:45:05	12.1	12.5	21.8	19.0	0.964	2.6	13.6	6
21-Feb-02	23:50:05	13.9	12.5	21.8	18.5	0.964	2.6	13.9	6
21-Feb-02	23:55:05	13.0	12.5	21.8	18.9	0.964	3.5	28.5	6
22-Feb-02	0:00:05	9.0	14.1	21.2	18.6	0.964	3.4	29.0	6
22-Feb-02	0:05:05	8.6	14.1	21.2	18.9	0.964	3.0	29.8	6
22-Feb-02	0:10:05	8.3	14.1	21.2	17.7	0.964	2.6	36.3	6
22-Feb-02	0:15:05	8.3	14.1	21.2	18.6	0.965	1.4	62.9	6
22-Feb-02	0:20:05	14.2	14.1	21.2	18.9	0.965	1.2	50.3	6
22-Feb-02	0:25:05	16.3	14.1	21.2	17.9	0.965	1.6	60.2	6

22-Feb-02	0:30:05	15.3	14.1	21.2	17.5	0.965	1.3	106.4	1
22-Feb-02	0:35:05	16.8	14.1	21.2	17.6	0.964	1.4	142.4	2
22-Feb-02	0:40:05	15.3	14.1	21.2	17.0	0.964	0.8	104.3	1
22-Feb-02	0:45:05	19.0	14.1	21.2	17.2	0.964	1.1	89.7	1
22-Feb-02	0:50:05	17.5	14.1	21.2	17.2	0.964	1.1	92.6	1
22-Feb-02	0:55:05	23.4	14.1	21.2	16.6	0.965	2.2	67.5	6
22-Feb-02	1:00:05	27.3	16.5	21.4	16.7	0.965	3.0	53.5	6
22-Feb-02	1:05:05	26.4	16.5	21.4	17.0	0.965	2.4	54.2	6
22-Feb-02	1:10:05	19.3	16.5	21.4	17.5	0.965	2.5	56.9	6
22-Feb-02	1:15:05	17.1	16.5	21.4	17.3	0.965	2.3	47.4	6
22-Feb-02	1:20:05	18.1	16.5	21.4	17.1	0.965	2.1	63.1	6
22-Feb-02	1:25:05	18.1	16.5	21.4	16.3	0.965	2.1	64.3	6
22-Feb-02	1:30:05	20.1	16.5	21.4	15.6	0.965	2.2	53.7	6
22-Feb-02	1:35:05	16.2	16.5	21.4	15.0	0.965	1.5	65.5	6
22-Feb-02	1:40:05	21.3	16.5	21.4	15.7	0.965	1.3	85.2	1
22-Feb-02	1:45:05	25.4	16.5	21.4	15.6	0.965	1.6	66.2	6
22-Feb-02	1:50:05	34.1	16.5	21.4	16.4	0.966	2.2	64.7	6
22-Feb-02	1:55:05	30.0	16.5	21.4	15.0	0.966	2.1	52.1	6
22-Feb-02	2:00:05	25.3	22.6	20.3	15.7	0.966	1.3	170.4	2
22-Feb-02	2:05:05	20.4	22.6	20.3	16.9	0.966	1.0	151.4	2
22-Feb-02	2:10:05	20.7	22.6	20.3	16.4	0.965	0.9	152.0	2
22-Feb-02	2:15:05	15.4	22.6	20.3	16.4	0.965	1.1	144.3	2
22-Feb-02	2:20:05	11.6	22.6	20.3	16.3	0.965	1.3	126.3	2
22-Feb-02	2:25:05	12.5	22.6	20.3	16.6	0.965	1.6	93.9	1
22-Feb-02	2:30:05	12.7	22.6	20.3	16.3	0.965	2.2	98.7	1
22-Feb-02	2:35:05	11.7	22.6	20.3	15.4	0.965	2.0	73.1	1
22-Feb-02	2:40:05	9.5	22.6	20.3	14.9	0.965	2.3	83.6	1
22-Feb-02	2:45:05	4.5	22.6	20.3	13.7	0.965	2.6	97.4	1
22-Feb-02	2:50:05	5.9	22.6	20.3	14.5	0.965	3.3	105.3	1
22-Feb-02	2:55:05	7.4	22.6	20.3	13.6	0.965	3.5	88.2	1
22-Feb-02	3:00:05	6.6	10.8	16.9	14.7	0.965	3.0	84.1	1
22-Feb-02	3:05:05	10.0	10.8	16.9	13.6	0.965	3.4	77.1	1
22-Feb-02	3:10:05	12.8	10.8	16.9	14.7	0.965	3.1	69.9	1
22-Feb-02	3:15:05	21.0	10.8	16.9	14.5	0.966	3.5	74.6	1
22-Feb-02	3:20:05	24.4	10.8	16.9	15.2	0.966	3.0	76.2	1
22-Feb-02	3:25:05	16.8	10.8	16.9	14.6	0.966	3.8	67.5	6
22-Feb-02	3:30:05	10.8	10.8	16.9	14.9	0.966	3.5	77.5	1
22-Feb-02	3:35:05	13.1	10.8	16.9	14.6	0.966	3.5	82.4	1
22-Feb-02	3:40:05	12.3	10.8	16.9	14.5	0.966	3.7	84.5	1
22-Feb-02	3:45:05	9.7	10.8	16.9	14.6	0.966	3.4	84.3	1
22-Feb-02	3:50:05	9.2	10.8	16.9	15.0	0.966	3.6	89.6	1
22-Feb-02	3:55:05	10.6	10.8	16.9	15.3	0.966	4.0	92.0	1
22-Feb-02	4:00:05	12.9	14.1	16.1	14.5	0.966	4.0	95.5	1
22-Feb-02	4:05:05	8.9	14.1	16.1	14.4	0.966	3.8	106.2	1
22-Feb-02	4:10:05	7.9	14.1	16.1	14.4	0.966	3.7	104.5	1
22-Feb-02	4:15:05	10.0	14.1	16.1	14.1	0.966	3.5	111.3	1
22-Feb-02	4:20:05	4.3	14.1	16.1	12.8	0.966	3.0	110.9	1
22-Feb-02	4:25:05	5.3	14.1	16.1	12.2	0.966	2.5	137.0	2
22-Feb-02	4:30:05	6.9	14.1	16.1	12.1	0.967	2.8	144.6	2
22-Feb-02	4:35:05	13.2	14.1	16.1	12.8	0.967	2.9	144.8	2
22-Feb-02	4:40:05	15.6	14.1	16.1	12.8	0.967	2.6	124.4	2
22-Feb-02	4:45:05	13.1	14.1	16.1	12.3	0.967	2.7	103.9	1
22-Feb-02	4:50:05	15.0	14.1	16.1	12.7	0.967	2.6	84.0	1
22-Feb-02	4:55:05	19.1	14.1	16.1	13.2	0.967	3.2	96.6	1
22-Feb-02	5:00:05	19.5	12.1	15.4	13.0	0.967	3.7	101.4	1
22-Feb-02	5:05:05	14.7	12.1	15.4	12.1	0.967	3.9	97.2	1
22-Feb-02	5:10:05	14.5	12.1	15.4	11.5	0.967	3.4	103.4	1

22-Feb-02	5:15:05	9.7	12.1	15.4	10.9	0.967	3.1	109.9	1
22-Feb-02	5:20:05	9.9	12.1	15.4	10.5	0.967	2.8	118.5	2
22-Feb-02	5:25:05	12.5	12.1	15.4	11.0	0.967	2.9	126.4	2
22-Feb-02	5:30:05	12.0	12.1	15.4	10.6	0.967	3.1	108.9	1
22-Feb-02	5:35:05	8.3	12.1	15.4	10.4	0.967	2.7	97.8	1
22-Feb-02	5:40:05	10.3	12.1	15.4	10.7	0.968	2.1	91.4	1
22-Feb-02	5:45:05	10.0	12.1	15.4	11.0	0.968	2.2	98.0	1
22-Feb-02	5:50:05	10.5	12.1	15.4	10.9	0.968	2.1	101.8	1
22-Feb-02	5:55:05	10.6	12.1	15.4	10.9	0.968	1.8	108.5	1
22-Feb-02	6:00:05	10.8	10.6	13.9	10.4	0.968	1.3	106.8	1
22-Feb-02	6:05:05	14.4	10.6	13.9	10.7	0.968	1.4	44.1	6
22-Feb-02	6:10:05	18.3	10.6	13.9	10.6	0.968	2.8	33.9	6
22-Feb-02	6:15:05	26.9	10.6	13.9	11.9	0.969	4.0	45.9	6
22-Feb-02	6:20:05	29.9	10.6	13.9	13.2	0.969	4.8	45.6	6
22-Feb-02	6:25:05	27.1	10.6	13.9	13.7	0.969	5.4	44.1	6
22-Feb-02	6:30:05	24.7	10.6	13.9	13.5	0.969	5.6	46.1	6
22-Feb-02	6:35:05	20.4	10.6	13.9	13.4	0.969	5.4	44.2	6
22-Feb-02	6:40:05	19.6	10.6	13.9	12.8	0.969	4.9	42.3	6
22-Feb-02	6:45:05	20.3	10.6	13.9	13.0	0.969	4.4	47.0	6
22-Feb-02	6:50:05	20.6	10.6	13.9	13.0	0.969	4.6	44.6	6
22-Feb-02	6:55:05	30.7	10.6	13.9	12.8	0.969	4.9	45.5	6
22-Feb-02	7:00:05	35.3	25.1	15.6	12.9	0.969	4.9	47.7	6
22-Feb-02	7:05:05	43.6	25.1	15.6	12.5	0.969	5.2	48.0	6
22-Feb-02	7:10:05	90.4	25.1	15.6	12.9	0.969	4.9	51.0	6
22-Feb-02	7:15:05	139.2	25.1	15.6	11.9	0.969	4.9	53.4	6
22-Feb-02	7:20:05	154.9	25.1	15.6	11.9	0.969	4.4	56.9	6
22-Feb-02	7:25:05	140.6	25.1	15.6	11.3	0.969	4.1	57.4	6
22-Feb-02	7:30:05	115.7	25.1	15.6	11.6	0.969	3.6	54.7	6
22-Feb-02	7:35:05	102.0	25.1	15.6	12.1	0.969	3.4	51.6	6
22-Feb-02	7:40:05	120.8	25.1	15.6	12.3	0.969	3.5	47.9	6
22-Feb-02	7:45:05	152.9	25.1	15.6	13.1	0.969	3.5	48.7	6
22-Feb-02	7:50:05	122.2	25.1	15.6	14.5	0.969	3.6	42.6	6
22-Feb-02	7:55:05	85.9	25.1	15.6	14.6	0.969	3.8	37.2	6
22-Feb-02	8:00:05	77.3	114.0	28.2	14.4	0.969	3.6	38.1	6
22-Feb-02	8:05:05	67.6	114.0	28.2	14.9	0.969	3.6	27.6	6
22-Feb-02	8:10:05	59.3	114.0	28.2	15.8	0.969	3.7	30.8	6
22-Feb-02	8:15:05	49.7	114.0	28.2	16.0	0.969	4.1	35.8	6
22-Feb-02	8:20:05	36.0	114.0	28.2	16.8	0.969	3.6	39.8	6
22-Feb-02	8:25:05	29.0	114.0	28.2	17.1	0.969	3.8	38.7	6
22-Feb-02	8:30:05	26.8	114.0	28.2	17.3	0.969	3.8	39.7	6
22-Feb-02	8:35:05	31.5	114.0	28.2	17.2	0.968	3.5	42.7	6
22-Feb-02	8:40:05	37.5	114.0	28.2	17.5	0.968	3.2	48.6	6
22-Feb-02	8:45:05	43.4	114.0	28.2	17.8	0.968	3.4	46.4	6
22-Feb-02	8:50:05	47.6	114.0	28.2	18.1	0.968	3.6	48.3	6
22-Feb-02	8:55:05	44.0	114.0	28.2	18.4	0.968	3.2	48.6	6
22-Feb-02	9:00:05	33.8	40.4	31.6	18.6	0.967	2.9	50.8	6
22-Feb-02	9:05:05	33.2	40.4	31.6	18.8	0.967	3.7	51.8	6
22-Feb-02	9:10:05	31.5	40.4	31.6	19.0	0.967	4.6	57.6	6
22-Feb-02	9:15:05	53.2	40.4	31.6	19.0	0.967	4.9	51.7	6
22-Feb-02	9:20:05	53.7	40.4	31.6	19.4	0.967	5.5	51.8	6
22-Feb-02	9:25:05	54.4	40.4	31.6	19.3	0.966	5.2	56.9	6
22-Feb-02	9:30:05	72.4	40.4	31.6	19.3	0.966	5.2	62.9	6
22-Feb-02	9:35:05	84.7	40.4	31.6	19.4	0.966	5.7	60.4	6
22-Feb-02	9:40:05	166.7	40.4	31.6	19.2	0.966	5.4	66.2	6
22-Feb-02	9:45:05	207.7	40.4	31.6	19.6	0.965	6.4	64.2	6
22-Feb-02	9:50:05	218.8	40.4	31.6	20.1	0.965	5.5	68.1	1
22-Feb-02	9:55:05	172.9	40.4	31.6	20.2	0.965	5.4	67.4	6

22-Feb-02	10:00:05	118.6	109.4	42.7	19.9	0.964	5.3	67.9	1
22-Feb-02	10:05:05	89.9	109.4	42.7	20.1	0.964	5.6	72.3	1
22-Feb-02	10:10:05	87.8	109.4	42.7	20.5	0.964	5.6	69.8	1
22-Feb-02	10:15:05	101.8	109.4	42.7	20.7	0.963	5.4	70.8	1
22-Feb-02	10:20:05	125.6	109.4	42.7	20.5	0.963	5.6	69.7	1
22-Feb-02	10:25:05	108.4	109.4	42.7	20.9	0.963	5.6	71.6	1
22-Feb-02	10:30:05	148.1	109.4	42.7	20.8	0.963	5.1	74.5	1

APPENDIX B: EXAMPLE OF DUSTTRACK DATA FILE

Example of DustTrak aerosol data, $PM_{2.5}$ measured at 3 m, Mar 5-6, 2002.

Site: Loop 101 Chaparral site, west side $PM_{2.5}$

Model: Dust Trak
Serial Number: 22347
Test ID: 004
Test Abbreviation:
Start Date: 03/05/2002
Start Time: 15:31:26
Duration (dd:hh:mm:ss): 00:20:40:00
Time constant (seconds): 10
Log Interval (mm:ss): 05:00
Number of points: 248
Notes:

Statistics Channel: Aerosol
    Units: mg/m^3
    Average: 0.012
    Minimum: 0.000
    Time of Minimum: 15:36:26
    Date of Minimum: 03/05/2002
    Maximum: 0.068
    Time of Maximum: 01:01:26
    Date of Maximum: 03/06/2002

Calibration Sensor: Aerosol
    Cal. date 06/13/2000

Date Time Aerosol
mm/dd/yyyy hh:mm:ss mg/m^3
03/05/2002 15:36:26 0.000
03/05/2002 15:41:26 0.000
03/05/2002 15:46:26 0.001
03/05/2002 15:51:26 0.001
03/05/2002 15:56:26 0.002
03/05/2002 16:01:26 0.001
03/05/2002 16:06:26 0.001
03/05/2002 16:11:26 0.000
03/05/2002 16:16:26 0.000
03/05/2002 16:21:26 0.000
03/05/2002 16:26:26 0.001
03/05/2002 16:31:26 0.000

03/05/2002 16:36:26 0.000
03/05/2002 16:41:26 0.000
03/05/2002 16:46:26 0.001
03/05/2002 16:51:26 0.000
03/05/2002 16:56:26 0.000
03/05/2002 17:01:26 0.000
03/05/2002 17:06:26 0.000
03/05/2002 17:11:26 0.000
03/05/2002 17:16:26 0.000
03/05/2002 17:21:26 0.000
03/05/2002 17:26:26 0.000
03/05/2002 17:31:26 0.001
03/05/2002 17:36:26 0.000
03/05/2002 17:41:26 0.000
03/05/2002 17:46:26 0.000
03/05/2002 17:51:26 0.000
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APPENDIX C: EXAMPLE OF AUTOMATED SEM DATA

Example of automated SEM data file, sample from east side of Loop 101, Mar 9, 2002, Sector 1. All size and shape parameters are from the 2-dimensional back-scattered electron images. The parameters are:

Frame – the image number in which the particle is located.

Particle – the particle number in a particular image.

Area – area of the particle as determined from the sum of pixels, in μm^2.

Cumulative particle – the running total of particles analyzed.

Aspect ratio – the ratio of length to width.

Length – the largest axis.

Width – the shortest axis.

Perimeter – the perimeter of the particles determined from the exterior pixels.

Circularity – a measure of shape.

Cluster – the assigned cluster number based upon composition. Particles with the same cluster assignment are compositionally similar.

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
1	1	0.057073	1	2.31155	0.369059	0.225237	1.04741	1.52964	40
1	2	0.028536	2	5.12311	0.237281	0.056309	0.530095	0.783603	38
1	3	0.120488	3	1.80814	0.394911	0.337855	1.37299	1.24503	2
1	4	3.37365	4	1.64376	2.27084	1.63297	7.06405	1.17705	1
1	5	1.2778	5	1.49016	1.46148	1.06987	4.21863	1.10833	2
1	6	1.60756	6	1.46841	1.51499	1.2388	4.94823	1.21206	1
1	7	0.986096	7	1.4015	1.32595	0.957256	3.57721	1.03267	0
1	8	0.510487	8	1.1842	0.99632	0.844638	3.01739	1.41928	37
1	9	0.244146	9	1.43417	1.73288	0.563092	3.74755	4.57757	40
1	10	0.104634	10	1.38002	0.447133	0.337855	1.08756	0.89954	37
1	11	0.47878	11	1.5	0.748391	0.67571	2.75769	1.26399	26
1	12	0.149024	12	1.29461	0.517633	0.394164	1.38228	1.02029	2
1	13	4.03951	13	1.18501	2.23979	2.25237	8.08662	1.28824	15
1	14	0.672194	14	1.86674	1.05464	0.67571	3.38401	1.35569	3
1	15	7.27999	15	1.33848	3.11806	2.81546	10.6351	1.23634	11
2	1	0.91634	16	1.52559	1.26791	0.900947	3.4847	1.05454	44
2	2	0.072926	17	1.46491	0.367826	0.281546	0.941152	0.966547	42
2	3	1.15414	18	1.79686	1.19263	0.957256	4.26773	1.25581	46
2	4	0.532682	19	1.31887	0.934126	0.788329	2.74637	1.12678	38
2	5	0.041219	20	1.09443	0.300333	0.281546	0.875158	1.47863	38
2	6	0.034878	21	1.31066	0.223214	0.225237	0.758935	1.31416	37
2	7	0.26317	22	1.4	1.28761	0.563092	2.98399	2.69246	38
2	8	0.088780	23	3.02075	0.390799	0.168928	1.09679	1.07825	38
2	9	2.15609	24	1.29911	2.68838	1.63297	6.98076	1.79857	23
2	10	3.8778	25	1.32235	2.21262	2.08344	7.8075	1.25092	2
2	11	2.54926	26	1.18365	1.71087	1.74559	6.36891	1.26621	48
2	12	0.47878	27	1.27109	0.914985	0.73202	2.52383	1.05871	46
2	13	0.199756	28	1.72077	0.589668	0.394164	1.63454	1.06435	7
2	14	3.3039	29	1.15862	2.19528	2.08344	7.06528	1.20233	44
2	15	0.155366	30	2.63311	0.593302	0.281546	1.71034	1.4983	6
2	16	1.06219	31	1.71531	1.11689	0.957256	4.10669	1.26348	0
2	17	2.0039	32	1.95394	1.5896	1.12618	5.70046	1.29043	38
3	1	0.069756	33	1.46491	0.333709	0.281546	1.00298	1.14761	7
3	2	6.40487	34	1.20641	7.24751	3.32224	16.2625	3.2859	37
3	3	2.93609	35	1.23833	2.14977	1.80189	6.5362	1.1579	21
3	4	0.529511	36	1.72057	0.803384	0.67571	2.893	1.2578	37
3	5	0.025365	37	2.56155	0.222002	0.112618	0.520072	0.848532	37
3	6	0.031707	38	8.07107	0.2978	0.056309	0.808544	1.64074	8
3	7	5.82145	39	1.21739	2.87999	2.59022	9.4198	1.21295	37
3	8	0.700731	40	1.45023	2.13295	0.900947	4.92294	2.75226	38
3	9	0.028536	41	2.56155	0.237281	0.112618	0.530095	0.783603	11
3	10	5.00658	42	2.38732	4.6527	1.74559	11.4575	2.08656	1
3	11	1.97219	43	1.31414	1.78928	1.52035	5.78301	1.34943	29
3	12	0.168049	44	1.375	0.491838	0.450474	1.59749	1.20846	14
3	13	5.28877	45	1.81265	4.4129	2.08344	11.2228	1.89511	40
3	14	2.14024	46	1.3285	1.93928	1.46404	5.32032	1.05245	38
3	15	0.031707	47	2	0.196153	0.168928	0.708145	1.25856	42
3	16	0.637316	48	1.1305	1.05013	0.900947	2.92937	1.07148	44
4	1	0.069756	49	1.83114	0.367155	0.225237	0.871554	0.866557	0
4	2	3.30707	50	1.23852	2.22779	1.91451	7.02547	1.18768	35
4	3	0.615121	51	1.23095	0.939805	0.844638	3.05776	1.20958	15
4	4	1.90561	52	1.46689	1.75419	1.35142	5.22189	1.13871	20
4	5	0.539024	53	1.58565	0.939106	0.67571	2.76394	1.12782	40
4	6	0.091951	54	1.72315	0.414275	0.281546	1.05017	0.954443	37

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
4	7	0.13	55	1.74781	0.448403	0.337855	1.38233	1.1697	46
4	8	0.082438	56	1.46491	0.396553	0.281546	0.96773	0.903996	13
4	9	0.250487	57	1.35337	0.67183	0.506783	1.78917	1.01697	38
4	10	0.022195	58	2.56155	0.207603	0.112618	0.487075	0.850598	2
4	11	4.77194	59	1.90211	3.77207	2.02713	10.0743	1.69248	6
4	12	2.67292	60	1.65187	1.97952	1.52035	6.34847	1.19989	38
4	13	0.060243	61	1.77069	0.415905	0.225237	1.12151	1.66144	1
4	14	2.56829	62	1.67218	1.77745	1.40773	6.44476	1.28694	37
4	15	2.65707	63	1.17623	4.60654	2.08344	10.3667	3.21861	1
4	16	2.44463	64	1.31732	1.91331	1.63297	6.04339	1.18888	2
4	17	2.31146	65	1.35432	2.25211	1.63297	6.55693	1.48015	0
4	18	2.0578	66	1.60736	1.89996	1.35142	5.96607	1.37646	40
5	1	0.060243	67	1.48062	0.263172	0.281546	0.984172	1.27944	13
5	2	1.84853	68	1.6538	1.67756	1.2388	5.23433	1.17947	44
5	3	0.028536	69	3	0.190552	0.112618	0.669291	1.24916	5
5	4	3.40219	70	1.76482	2.2017	1.57666	7.49391	1.31356	18
5	5	3.5639	71	1.15053	2.26957	2.13975	7.67973	1.31691	15
5	6	1.44902	72	1.43431	1.36676	1.18249	4.76331	1.24604	38
5	7	0.044390	73	2.73607	0.296791	0.112618	0.646317	0.748849	0
5	8	0.726096	74	1.22507	1.09511	0.900947	3.19605	1.1195	23
5	9	2.29878	75	1.21145	1.98057	1.63297	5.60417	1.08722	33
5	10	0.504146	76	1.39363	1.10104	0.73202	3.11784	1.53441	35
5	11	0.488292	77	1.06667	0.82121	0.844638	2.83162	1.30671	38
5	12	0.044390	78	1.59629	0.334812	0.225237	0.934789	1.5665	38
5	13	0.044390	79	1.82405	0.281338	0.168928	0.758935	1.03255	44
5	14	0.87195	80	1.34489	1.25503	0.900947	3.33176	1.01309	16
5	15	0.43756	81	2.1142	0.830678	0.506783	2.52181	1.15658	3
5	16	7.35291	82	1.10254	3.97074	3.49117	11.645	1.46761	38
5	17	0.057073	83	1.5	0.334074	0.225237	0.768959	0.824451	0
5	18	1.02097	84	1.10493	1.21187	1.18249	3.9381	1.20878	38
5	19	0.025365	85	3.04951	0.185701	0.112618	0.626327	1.23068	29
5	20	0.114146	86	2.01108	0.450441	0.281546	1.2196	1.03697	46
6	1	0.050731	87	1.70774	0.474106	0.225237	1.16222	2.1188	44
6	2	0.117317	88	1.38002	0.473191	0.337855	1.15349	0.902527	46
6	3	0.034878	89	3.04951	0.255865	0.112618	0.642713	0.942482	38
6	4	0.025365	90	3	0.207699	0.112618	0.58967	1.09084	0
6	5	1.58536	91	1.25287	1.63258	1.35142	4.68701	1.10269	40
6	6	0.031707	92	3.04951	0.244476	0.112618	0.609716	0.933011	29
6	7	0.034878	93	1.82405	0.253271	0.168928	0.65634	0.982871	13
6	8	0.903657	94	2.59681	2.01874	0.788329	4.93274	2.14271	29
6	9	0.805365	95	1.52726	3.54936	1.06987	7.55253	5.63615	37
6	10	4.07121	96	1.06001	2.59668	2.25237	7.55951	1.117	2
6	11	5.27609	97	1.69231	3.08638	2.19606	9.59171	1.38762	33
6	12	2.42878	98	1.33377	1.99309	1.57666	5.86781	1.12812	0
6	13	0.031707	99	5.12311	0.249815	0.056309	0.563092	0.795775	4
6	14	0.253658	100	1.21803	0.660891	0.563092	1.85297	1.07715	37
6	15	0.266341	101	1.36491	0.809731	0.563092	2.27731	1.54952	46
6	16	3.12634	102	1.43119	4.81006	1.97082	10.92	3.03531	0
6	17	0.345609	103	1.36364	0.731028	0.619401	2.25406	1.16986	0
6	18	0.336097	104	1.90617	0.719293	0.506783	2.22551	1.17269	22
6	19	5.7517	105	1.23808	3.92558	2.75915	10.7815	1.60825	37
6	20	0.041219	106	2.03301	0.255186	0.168928	0.773576	1.1553	34
7	1	1.36341	107	1.22552	1.55797	1.2388	4.21058	1.03478	6
7	2	3.44658	108	1.58317	2.98499	1.8582	8.27926	1.58265	44
7	3	0.079268	109	1.83114	0.389909	0.225237	0.941152	0.889223	12

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
7	4	0.586584	110	1.29409	0.99796	0.788329	2.83793	1.0926	0
7	5	2.30512	111	1.28205	1.93242	1.52035	5.73673	1.13612	2
7	6	3.63048	112	1.66255	3.09984	1.80189	8.54205	1.59937	41
7	7	0.072926	113	1.27703	0.378285	0.281546	0.861531	0.809926	38
7	8	0.022195	114	1.38743	0.207603	0.168928	0.487075	0.850598	29
7	9	1.13512	115	2.13763	2.10546	0.844638	5.28918	1.96121	4
7	10	0.250487	116	1.24018	0.736864	0.563092	2.1536	1.47345	46
7	11	2.01341	117	1.25982	1.7707	1.52035	5.42973	1.16524	38
8	1	0.053902	118	2	0.327043	0.168928	0.712311	0.74907	18
8	2	0.634145	119	1.35913	1.05853	0.788329	2.88596	1.04516	32
8	3	0.770487	120	2.53702	1.2181	0.619401	3.70126	1.4149	0
8	4	0.028536	121	2.08114	0.238854	0.112618	0.487075	0.661576	29
8	5	0.041219	122	5.52494	0.485002	0.112618	1.13998	2.50889	7
8	6	0.69756	123	1.87106	1.04805	0.73202	3.18552	1.15763	40
8	7	0.564389	124	1.31727	1.01203	0.73202	2.6708	1.00576	15
8	8	0.497804	125	1.35718	0.919437	0.73202	2.6141	1.09238	37
8	9	0.957559	126	1.71255	1.79726	0.900947	4.66009	1.80474	38
8	10	0.079268	127	2.76247	0.540208	0.225237	1.37389	1.89493	38
8	11	0.025365	128	4.16228	0.225237	0.056309	0.450474	0.63662	37
8	12	0.022195	129						38
8	13	0.025365	130	0.848528	0.251401	0.281546	0.704597	1.55748	38
8	14	0.028536	131						38
8	15	0.091951	132	4.00832	0.787177	0.225237	1.80798	2.82891	38
8	16	0.028536	133	5.12311	0.237281	0.056309	0.530095	0.783603	38
8	17	0.038048	134	11.0499	0.494545	0.056309	1.14296	2.73222	38
8	18	0.079268	135	2.40907	0.743811	0.281546	1.70076	2.90388	38
8	19	0.025365	136						38
8	20	0.856096	137	2.37584	4.59141	0.900947	9.55573	8.4878	4
8	21	0.038048	138	9.06226	0.381135	0.056309	0.96193	1.93525	38
8	22	0.085609	139	2.51385	0.328812	0.225237	1.16003	1.25084	38
8	23	0.234634	140	3	2.75281	0.112618	5.67608	10.9269	38
8	24	0.028536	141	8.07107	0.310192	0.056309	0.804377	1.8043	37
8	25	0.038048	142	4.03553	0.311716	0.112618	0.867556	1.57415	38
8	26	0.025365	143	2.30278	0.224424	0.112618	0.487075	0.744273	38
8	27	0.022195	144	2.56155	0.203543	0.112618	0.515905	0.954273	38
8	28	2.68561	145	3.52414	8.32392	1.2388	17.2931	8.86124	38
8	29	1.16683	146	1.48997	5.92413	1.40773	12.2422	10.2212	38
8	30	0.034878	147	9.24621	0.37874	0.056309	0.941659	2.02314	37
8	31	0.079268	148	5.01189	0.772877	0.168928	1.75088	3.07754	38
8	32	0.079268	149	8.06637	0.768263	0.112618	1.74288	3.04949	38
8	33	0.183902	150	2.87214	2.01439	0.394164	4.21137	7.67448	38
8	34	4.89243	151	4.22605	12.5852	1.68928	25.948	10.9515	38
8	35	0.034878	152	3.5	0.234347	0.112618	0.712311	1.15765	38
8	36	0.025365	153	3	0.207699	0.112618	0.58967	1.09084	38
8	37	0.047560	154	3.33333	0.559644	0.168928	1.28926	2.78111	38
8	38	0.022195	155						38
8	39	4.48975	156	3.26725	10.1361	1.74559	21.158	7.93447	38
8	40	0.079268	157	5.67707	0.908585	0.168928	1.99166	3.98217	38
8	41	0.025365	158	7.08276	0.244008	0.056309	0.695925	1.51938	37
8	42	0.082438	159	4.3472	0.650995	0.168928	1.55526	2.33488	38
8	43	0.104634	160	1.86634	0.535719	0.337855	1.46207	1.62575	38
8	44	0.057073	161	2.87192	0.431136	0.168928	1.12703	1.77104	38
8	45	0.031707	162	7.08276	0.196153	0.056309	0.708145	1.25856	38
8	46	0.031707	163						38
8	47	0.050731	164	6.02268	0.533245	0.112618	1.25677	2.47753	37

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
8	48	0.050731	165	6.02268	0.558459	0.112618	1.2986	2.64523	38
8	49	0.028536	166	3.04951	0.218603	0.112618	0.629931	1.10656	38
8	50	0.050731	167	3.68329	0.549351	0.168928	1.2834	2.58366	38
8	51	0.028536	168	0.782624	0.312188	0.225237	0.807192	1.81695	38
8	52	0.098292	169	6.66667	1.13427	0.168928	2.44185	4.82733	38
8	53	0.025365	170	2.56155	0.223882	0.112618	0.497098	0.77522	38
8	54	0.025365	171						38
8	55	0.031707	172	9.06226	0.372762	0.056309	0.915644	2.10419	38
8	56	1.00829	173	2.74082	3.52267	0.844638	7.61779	4.57997	29
8	57	0.047560	174	2.44152	0.366821	0.168928	0.992957	1.64968	37
8	58	0.022195	175						38
8	59	0.025365	176	3	0.205451	0.112618	0.595526	1.11261	38
8	60	0.028536	177	0.875	0.340514	0.450474	0.848636	2.00831	37
8	61	0.114146	178	3.82946	1.15141	0.225237	2.50109	4.361	38
8	62	0.076097	179	3.82946	0.836308	0.225237	1.8546	3.59684	38
8	63	0.323414	180	2.67099	2.56416	0.563092	5.38057	7.12341	38
8	64	2.66341	181	2.92945	13.7231	1.57666	27.8344	23.1482	38
8	65	15.137	182	3.4643	26.2977	3.32224	53.7465	15.1862	4
8	66	0.031707	183	9.06226	0.372762	0.056309	0.915644	2.10419	38
8	67	0.025365	184	7.08276	0.242282	0.056309	0.693955	1.51079	38
8	68	0.031707	185	4.03553	0.304468	0.112618	0.817215	1.67612	38
8	69	0.041219	186	2.69036	0.366376	0.168928	0.957763	1.77094	46
8	70	0.459755	187	1.50245	1.32115	0.67571	3.33829	1.92891	1
8	71	2.97414	188	1.1609	2.14629	1.91451	6.60924	1.16878	0
8	72	0.161707	189	1.125	0.551202	0.450474	1.38233	0.940346	16
9	1	1.58219	190	1.29236	1.58644	1.35142	4.78234	1.1503	18
9	2	1.6139	191	2.24771	1.81829	1.01357	5.41177	1.44408	1
9	3	0.69756	192	1.41656	1.08826	0.844638	3.09481	1.09264	33
9	4	0.034878	193	2.73607	0.261283	0.112618	0.599693	0.820534	14
9	5	1.69317	194	1.31642	1.66698	1.35142	4.89282	1.12514	40
9	6	0.088780	195	1.36619	0.414815	0.281546	0.977809	0.857002	44
9	7	1.64561	196	1.21575	1.70604	1.35142	4.64602	1.04382	34
9	8	0.909999	197	1.61626	1.41941	0.957256	4.12105	1.48513	7
9	9	4.60707	198	1.2381	2.42373	2.36499	8.50241	1.24868	6
9	10	3.13902	199	1.73402	3.59482	1.80189	8.93605	2.02436	19
9	11	1.04951	200	1.25282	1.34597	1.06987	3.7641	1.0743	15
9	12	0.409024	201	1.55677	0.811164	0.619401	2.42248	1.14172	8
9	13	3.78902	202	1.21781	2.0584	2.13975	7.79832	1.27722	38
9	14	0.117317	203	1.25861	0.734206	0.394164	1.78799	2.16849	38
9	15	0.69756	204	1.46101	2.92889	1.01357	6.33411	4.57699	7
9	16	9.0112	205	1.71101	6.37623	3.0407	15.579	2.1433	37
10	1	0.326585	206	1.46015	0.777157	0.563092	2.39477	1.39741	15
10	2	1.17634	207	1.89087	1.28149	0.957256	4.39888	1.309	0
10	3	0.681706	208	1.58832	1.90329	0.900947	4.52292	2.38798	4
10	4	0.034878	209	1.36803	0.253213	0.225237	0.78191	1.39493	1
10	5	2.09268	210	1.50697	1.97695	1.40773	6.07098	1.40154	2
10	6	7.1595	211	1.65609	3.52771	2.47761	11.1144	1.37303	8
10	7	4.66731	212	1.63606	2.27432	1.91451	8.62888	1.2695	29
10	8	0.053902	213	2.66667	0.303561	0.168928	0.857364	1.08521	44
10	9	0.133171	214	1.23082	0.473304	0.394164	1.35807	1.10211	37
10	10	0.370975	215	1.55677	0.843875	0.619401	2.56697	1.41347	12
11	1	0.954389	216	1.6645	1.12853	0.900947	3.85104	1.23658	21
11	2	0.627804	217	1.6038	0.979485	0.73202	3.24088	1.33135	29
11	3	0.104634	218	1.60039	0.539646	0.337855	1.46708	1.63691	44
11	4	0.142683	219	2.01108	0.506014	0.281546	1.35446	1.02318	22

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
11	5	1.34439	220	1.32547	1.37537	1.2388	4.53638	1.21811	6
11	6	0.722926	221	1.68767	0.913255	0.788329	3.39088	1.26568	40
11	7	0.022195	222	4.16228	0.210681	0.056309	0.417476	0.624881	37
11	8	0.377316	223	1.44237	0.732529	0.619401	2.39894	1.21373	46
11	9	1.80731	224	1.48805	1.52323	1.35142	5.3219	1.24707	46
11	10	0.076097	225	1.41655	0.379291	0.281546	0.941152	0.926274	1
11	11	1.26512	226	1.26167	1.47349	1.18249	4.14543	1.08093	13
11	12	0.938535	227	1.70102	1.13497	0.844638	3.80476	1.22742	8
12	1	4.1917	228	1.41084	2.945	2.13975	8.73665	1.44907	2
12	2	4.38511	229	1.13981	2.728	2.36499	7.76099	1.09306	38
12	3	0.025365	230	1.27614	0.224672	0.168928	0.417476	0.546771	4
12	4	0.193414	231	1.35337	0.96198	0.506783	2.32608	2.22613	29
12	5	0.034878	232	1.53518	0.264112	0.168928	0.530095	0.64113	5
12	6	9.69925	233	1.71767	6.55755	3.15332	16.0733	2.11964	38
12	7	0.044390	234	1.36803	0.302153	0.225237	0.898132	1.44605	38
12	8	0.041219	235	1.5	0.313358	0.225237	0.889798	1.52852	38
12	9	0.072926	236	2.62171	0.570268	0.225237	1.3963	2.12746	38
12	10	0.038048	237	1.53518	0.275561	0.168928	0.576719	0.69563	9
12	11	2.89804	238	1.2536	2.14296	1.80189	6.48029	1.15312	37
12	12	0.266341	239	1.51657	0.640561	0.506783	1.98073	1.17221	37
12	13	0.038048	240	1.36803	0.335737	0.225237	0.898132	1.68706	7
12	14	7.95218	241	1.27081	3.59035	3.0407	11.6105	1.34897	7
12	15	2.27024	242	1.31447	2.09711	1.57666	6.35934	1.41756	38
12	16	0.088780	243	1.41655	0.412407	0.281546	0.997799	0.8924	29
12	17	0.745121	244	1.44104	1.11362	0.844638	3.22742	1.11243	4
12	18	0.231463	245	2.60895	1.23657	0.394164	2.8475	2.78764	38
12	19	0.038048	246	2	0.271964	0.168928	0.636294	0.846771	38
13	1	0.072926	247	1.83114	0.373747	0.225237	0.904551	0.892832	38
13	2	0.069756	248	1.77069	0.356249	0.225237	0.936985	1.00155	46
13	3	1.3761	249	2.3203	1.78075	0.900947	5.10702	1.50826	29
13	4	0.139512	250	1.70326	0.489968	0.337855	1.37468	1.0779	0
13	5	0.187073	251	1.43004	0.576768	0.450474	1.56089	1.03639	32
13	6	1.13512	252	1.91058	1.09757	0.844638	4.25968	1.27204	3
13	7	1.79463	253	1.2183	1.54145	1.46404	5.2858	1.2389	29
13	8	0.240975	254	1.6302	0.64205	0.450474	1.8122	1.0845	38
13	9	0.367804	255	1.31058	0.825267	0.619401	2.11762	0.970218	13
13	10	1.08122	256	1.32671	1.33057	1.06987	3.91338	1.12715	26
13	11	0.764145	257	1.72669	1.70416	0.900947	4.30512	1.93012	38
13	12	0.539024	258	1.60402	0.827976	0.67571	2.95798	1.29173	38
13	13	0.034878	259	2.73607	0.261283	0.112618	0.599693	0.820534	38
13	14	0.060243	260	2.69036	0.322951	0.168928	0.900384	1.07086	38
13	15	0.079268	261	2.79951	0.597349	0.225237	1.4601	2.1402	2
13	16	6.07828	262	1.29555	4.65523	2.75915	11.9218	1.86078	40
14	1	0.022195	263	1.91421	0.209477	0.112618	0.4641	0.772249	40
14	2	0.069756	264	1.4	0.365456	0.281546	0.885237	0.89398	13
14	3	8.51974	265	1.37647	5.1738	3.09701	13.641	1.73803	13
14	4	3.53536	266	1.94761	2.84459	1.68928	8.17486	1.50424	38
14	5	1.60756	267	1.21579	2.43622	1.46404	6.19215	1.89805	37
14	6	1.06536	268	1.5898	2.18097	1.06987	5.3389	2.1291	7
14	7	7.96804	269	1.37514	4.70887	3.09701	12.802	1.6368	40
14	8	0.028536	270	1.53518	0.238696	0.168928	0.497098	0.689084	29
14	9	0.031707	271	3.5	0.205266	0.112618	0.702288	1.23783	29
14	10	0.355121	272	1.02815	1.60362	0.844638	3.65013	2.98559	2
14	11	1.13195	273	1.64739	1.31103	1.01357	4.34887	1.32959	37
14	12	1.00829	274	1.73194	2.4644	0.957256	5.74709	2.60675	40

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
14	13	0.513658	275	2.07639	0.804904	0.619401	2.88613	1.29047	29
14	14	0.136341	276	2.01108	0.506056	0.281546	1.26972	0.940971	37
14	15	0.022195	277						37
14	16	0.025365	278	2.08114	0.220394	0.112618	0.533699	0.89358	4
14	17	0.076097	279	1.41655	0.383726	0.281546	0.908155	0.862462	33
14	18	1.67097	280	1.30491	1.93559	1.40773	5.59775	1.49227	29
15	1	0.266341	281	1.49284	0.707376	0.563092	2.16779	1.40406	2
15	2	3.82707	282	1.54958	2.62473	1.97082	8.16562	1.38645	0
15	3	0.684877	283	2.10062	1.10534	0.67571	3.4499	1.3829	15
15	4	3.63682	284	1.25855	2.52682	2.19606	7.93222	1.37676	29
15	5	0.104634	285	1.17301	0.515688	0.394164	1.43718	1.57087	29
15	6	0.038048	286	2.27698	0.251481	0.168928	0.805559	1.3572	44
15	7	0.047560	287	2.36092	0.289436	0.168928	0.791933	1.04934	33
15	8	1.64244	288	1.95975	1.87086	1.06987	5.49752	1.46432	26
15	9	0.935364	289	1.79743	1.17965	0.844638	3.94514	1.32414	0
15	10	1.25878	290	1.36244	1.41408	1.12618	4.26751	1.1513	44
15	11	0.047560	291	1.31066	0.306647	0.225237	0.679314	0.772114	35
15	12	0.374146	292	1.47028	0.903188	0.67571	2.63488	1.47662	35
15	13	0.158536	293	1.49057	0.541549	0.394164	1.39163	0.972089	33
15	14	0.180731	294	1.30425	0.569613	0.450474	1.52395	1.02258	35
15	15	0.618292	295	2.3362	1.69316	0.619401	4.11665	2.18115	15
15	16	1.73122	296	1.34231	1.51131	1.40773	5.19368	1.23991	7
15	17	10.6949	297	1.76309	5.84652	3.37855	15.3516	1.75356	46
16	1	0.060243	298	1.36619	0.403028	0.281546	1.10501	1.61292	40
16	2	0.098292	299	1.81245	0.394908	0.281546	1.19297	1.1522	8
16	3	4.77828	300	1.55016	2.51062	2.08344	8.62865	1.23995	38
16	4	0.025365	301	1.27614	0.224672	0.168928	0.417476	0.546771	7
16	5	4.91146	302	1.29645	2.34015	2.36499	8.85001	1.26902	38
16	6	0.079268	303	1.27703	0.393537	0.281546	0.908155	0.827963	6
16	7	1.7217	304	1.16965	1.6809	1.46404	4.93404	1.12522	8
16	8	1.1161	305	1.3	1.31699	1.12618	4.04497	1.16659	44
16	9	0.057073	306	1.5	0.335172	0.225237	0.755332	0.795489	37
16	10	0.726096	307	1.26471	1.12108	0.900947	3.53751	1.37149	38
16	11	0.688048	308	1.50542	1.57942	0.900947	4.03011	1.87847	16
16	12	0.412194	309	1.68117	0.910287	0.619401	2.72621	1.43485	15
16	13	0.526341	310	1.91136	0.910018	0.619401	2.76777	1.1582	13
16	14	3.23097	311	1.306	2.24113	1.80189	6.88166	1.16639	35
17	1	0.060243	312	1.2	0.344231	0.281546	0.777743	0.799005	38
17	2	0.025365	313	4.16228	0.225237	0.056309	0.450474	0.63662	40
17	3	0.044390	314	1.82405	0.286644	0.168928	0.735961	0.970987	16
17	4	3.92536	315	1.92573	3.48142	1.91451	9.21787	1.72255	26
17	5	2.18146	316	1.637	2.51612	1.40773	6.76623	1.67008	8
17	6	4.60707	317	1.30769	2.61932	2.19606	8.30673	1.19186	7
17	7	4.72755	318	1.33333	2.73134	2.36499	8.92439	1.34064	14
17	8	1.45853	319	1.89561	1.44522	1.01357	4.90887	1.31473	37
18	1	0.180731	320	1.94987	0.75217	0.394164	1.9849	1.73474	23
18	2	4.35658	321	1.24948	5.47468	2.36499	12.5409	2.87278	10
18	3	5.61536	322	1.35352	3.44832	2.53391	10.1535	1.46098	38
18	4	0.060243	323	1.77069	0.338813	0.225237	0.828534	0.906772	16
18	5	1.45853	324	2.27312	1.87699	0.957256	5.3081	1.53728	37
18	6	0.39317	325	1.21679	0.679387	0.67571	2.49855	1.26353	37
18	7	0.30756	326	1.9706	0.709763	0.450474	2.08693	1.12688	38
18	8	0.025365	327	1.27614	0.224672	0.168928	0.417476	0.546771	13
18	9	1.54414	328	1.16744	1.5768	1.35142	4.70537	1.14101	0
18	10	0.808535	329	2.17792	0.934395	0.73202	3.5994	1.27512	7

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
18	11	2.60951	330	1.47555	2.24445	1.68928	6.8142	1.41599	2
18	12	5.02243	331	1.18738	2.82687	2.47761	8.51986	1.15012	23
18	13	1.22707	332	1.48178	1.43281	1.12618	4.13242	1.10746	35
18	14	0.145853	333	1.6759	0.515231	0.337855	1.35446	1.00094	0
18	15	0.447072	334	1.28518	0.891315	0.67571	2.41414	1.03738	46
18	16	1.37292	335	1.53475	1.52263	1.06987	4.84862	1.36263	7
18	17	8.84316	336	1.87234	4.84239	2.64653	13.3372	1.6007	38
18	18	0.022195	337	6.09902	0.162209	0.056309	0.59333	1.26219	21
18	19	0.513658	338	1.9451	0.837575	0.619401	2.8167	1.22913	37
18	20	0.672194	339	2.15527	1.96117	0.73202	4.60784	2.51356	16
18	21	1.67414	340	1.39118	1.71698	1.35142	5.38406	1.3779	38
19	1	0.088780	341	1.61421	0.4141	0.281546	0.984172	0.868192	40
19	2	0.091951	342	1.65602	0.399616	0.281546	1.11042	1.0671	40
19	3	0.13	343	1.25861	0.497371	0.394164	1.21943	0.910254	8
19	4	4.23609	344	1.38458	2.97215	2.13975	8.79482	1.45304	4
19	5	0.028536	345	2.56155	0.237032	0.112618	0.533699	0.794294	38
19	6	0.028536	346	2.56155	0.237281	0.112618	0.530095	0.783603	40
19	7	0.104634	347	1.70326	0.488379	0.337855	1.40525	1.50185	2
19	8	7.68267	348	1.05723	5.42167	3.6601	13.6774	1.93769	44
19	9	0.047560	349	1.59629	0.299061	0.225237	0.748912	0.938431	18
19	10	2.89804	350	1.98042	3.30096	1.57666	8.35781	1.91809	38
19	11	2.15292	351	1.23009	2.70916	1.68928	7.00768	1.81514	6
19	12	2.14658	352	1.50303	1.69105	1.46404	5.92086	1.29961	38
19	13	2.08	353	2.41759	4.5389	1.18249	9.99432	3.8215	37
19	14	0.177561	354	1.22222	0.729557	0.506783	1.94588	1.69697	38
20	1	0.085609	355	1.46491	0.40682	0.281546	0.964858	0.865356	38
20	2	1.47439	356	1.47611	3.06651	1.40773	7.09462	2.71667	37
20	3	0.050731	357	4.53113	0.447728	0.112618	1.12207	1.97494	38
20	4	0.209268	358	1.67063	1.2361	0.506783	2.81079	3.0043	23
20	5	1.46488	359	1.43594	1.58334	1.18249	5.01704	1.36736	35
20	6	0.158536	360	1.49812	0.520492	0.394164	1.47068	1.08568	38
20	7	0.028536	361	2.56155	0.237281	0.112618	0.530095	0.783603	29
20	8	0.047560	362	1.52475	0.305713	0.225237	0.692941	0.803402	46
20	9	0.202927	363	1.59972	0.617068	0.394164	1.55087	0.943194	2
20	10	10.6505	364	1.11873	7.09451	4.2795	17.1915	2.20825	16
20	11	1.21439	365	1.11533	1.43571	1.2388	4.08388	1.0929	15
20	12	0.447072	366	1.52831	0.98883	0.619401	2.88191	1.47833	38
20	13	0.149024	367	1.18566	0.440382	0.450474	1.52609	1.24364	44
20	14	0.47878	368	1.23077	0.853436	0.73202	2.66438	1.17991	38
21	1	1.37292	369	1.57005	2.6004	1.2388	6.25674	2.26903	40
21	2	0.053902	370	1.77069	0.305536	0.225237	0.851508	1.07043	16
21	3	0.183902	371	1.57143	0.584827	0.394164	1.49079	0.961688	20
21	4	0.459755	372	1.82047	0.794178	0.563092	2.66314	1.22759	20
21	5	0.551706	373	1.30033	0.904923	0.788329	2.87667	1.19361	40
21	6	0.025365	374	1.53518	0.223882	0.168928	0.497098	0.77522	40
21	7	0.034878	375	2.73607	0.257467	0.112618	0.63269	0.913316	38
21	8	0.091951	376	1.54164	0.415911	0.281546	1.04082	0.937528	15
22	1	0.91634	377	1.38594	1.22602	0.957256	3.60019	1.1256	27
22	2	1.87707	378	1.75711	1.99001	1.2388	5.86652	1.45905	33
22	3	0.288536	379	1.31058	1.64259	0.619401	3.6365	3.64719	26
22	4	7.6256	380	1.32902	4.54444	3.0407	12.4449	1.61621	2
22	5	15.8188	381	1.41701	7.39067	4.50474	19.0621	1.82792	46
22	6	0.688048	382	1.88748	1.24832	0.73202	3.599	1.49808	35
22	7	0.250487	383	1.4	0.979801	0.563092	2.4709	1.93962	1
22	8	1.12561	384	1.69429	1.19765	0.957256	4.27499	1.29203	0

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
22	9	0.123658	385	1.29461	0.630243	0.394164	1.6529	1.75817	8
22	10	2.66024	386	1.73252	2.0194	1.46404	6.67349	1.33222	33
22	11	0.599267	387	2.18379	1.57202	0.619401	3.90645	2.02644	0
22	12	0.041219	388	3.66228	0.255186	0.112618	0.773576	1.1553	33
22	13	0.190244	389	1.22776	0.57275	0.506783	1.60352	1.07554	21
22	14	0.386829	390	1.33333	0.774415	0.67571	2.38295	1.16816	38
22	15	0.022195	391	2.08114	0.210681	0.112618	0.417476	0.624881	40
22	16	0.091951	392	1.22076	0.422257	0.337855	0.994195	0.855415	13
22	17	0.361463	393	1.29668	1.06393	0.67571	2.80735	1.73508	1
23	1	1.43317	394	2.04929	1.76453	0.957256	5.15347	1.47466	40
23	2	4.75926	395	1.12213	2.46134	2.47761	8.64307	1.24907	23
23	3	2.46048	396	1.19534	1.75383	1.74559	6.3135	1.28917	7
23	4	1.78512	397	1.30301	1.68195	1.40773	5.08585	1.15305	40
23	5	0.364634	398	1.24083	0.791064	0.619401	2.22551	1.08092	13
23	6	0.332926	399	1.51421	0.760938	0.563092	2.1112	1.06537	0
23	7	1.18585	400	1.16994	1.44571	1.2388	4.53193	1.37825	38
23	8	0.034878	401	3.04951	0.255865	0.112618	0.642713	0.942482	38
23	9	0.025365	402	3.19258	0.222443	0.112618	0.672951	1.42072	8
23	10	2.36536	403	1.67218	1.66232	1.40773	6.12993	1.26417	0
24	1	0.30439	404	1.31058	1.34679	0.619401	3.1456	2.58683	38
24	2	0.025365	405	3	0.207699	0.112618	0.58967	1.09084	38
24	3	1.26829	406	1.04945	1.42865	1.35142	4.2652	1.14143	33
24	4	0.998779	407	1.14772	1.26823	1.12618	3.78409	1.14089	37
24	5	0.707072	408	1.47256	1.98807	0.900947	4.68746	2.47287	0
24	6	0.199756	409	1.55022	0.774773	0.450474	2.0652	1.69908	46
24	7	1.53463	410	1.17487	1.73475	1.46404	5.23878	1.42314	44
24	8	0.057073	411	2.36092	0.328589	0.168928	0.814344	0.924644	19
24	9	2.67292	412	1.40412	3.61605	1.80189	8.71047	2.25885	0
24	10	0.145853	413	2.04881	0.961246	0.394164	2.22596	2.70338	38
24	11	1.47439	414	1.36582	2.73912	1.29511	6.55479	2.31897	14
25	1	0.865608	415	1.74926	1.71928	0.844638	4.4455	1.81681	25
25	2	4.1156	416	1.11331	2.50124	2.4213	8.29333	1.32989	38
25	3	0.050731	417	3.3518	0.429174	0.168928	1.09476	1.87997	4
25	4	0.253658	418	2.28571	0.590885	0.394164	1.97719	1.22641	38
25	5	0.041219	419	3.54138	0.283062	0.112618	0.857364	1.41912	38
25	6	1.01463	420	1.50958	2.48965	1.01357	5.79439	2.63328	29
25	7	0.057073	421	1.52475	0.330401	0.225237	0.801956	0.896726	38
25	8	0.060243	422	2.66667	0.330886	0.168928	0.871554	1.00338	13
25	9	3.55438	423	1.79338	2.43297	1.68928	7.78779	1.35786	40
25	10	5.52975	424	1.55196	4.13062	2.4213	10.9387	1.72193	2
25	11	3.65268	425	1.64662	2.98268	1.8582	8.41462	1.54258	18
25	12	2.25756	426	1.60818	1.61349	1.40773	5.99231	1.26573	38
26	1	0.022195	427	2.5	0.207603	0.112618	0.487075	0.850598	13
26	2	1.43951	428	1.3084	1.46774	1.2388	4.63813	1.18922	29
26	3	0.069756	429	1.27703	0.369468	0.281546	0.84858	0.821474	44
26	4	0.079268	430	2.15394	0.345903	0.225237	1.0862	1.18444	33
26	5	1.7217	431	1.13836	1.75742	1.40773	4.70627	1.02373	0
26	6	0.072926	432	2.07003	0.361334	0.225237	0.969982	1.02667	38
26	7	0.107805	433	1.23082	0.394801	0.394164	1.27844	1.20647	37
26	8	0.500975	434	1.15192	1.21049	0.844638	3.2487	1.67646	0
26	9	0.992437	435	2.83116	1.73413	0.73202	4.61285	1.70618	37
26	10	1.55683	436	2.09647	2.69982	1.06987	6.55293	2.19493	6
26	11	2.5239	437	1.27341	2.0651	1.68928	5.90013	1.0976	8
26	12	5.08267	438	1.51707	5.50365	2.53391	12.8543	2.587	37
26	13	1.00829	439	2.76685	2.57898	0.788329	5.93989	2.78459	46

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
26	14	0.405853	440	1.3444	0.892305	0.67571	2.69428	1.42334	37
27	1	1.73122	441	1.2615	2.12045	1.52035	5.87378	1.58589	13
27	2	8.39291	442	1.88231	5.18293	2.59022	13.6045	1.75487	9
27	3	1.26512	443	1.10952	1.31361	1.2388	4.42129	1.22958	5
27	4	2.84731	444	1.19174	1.74228	1.8582	6.75305	1.27454	38
27	5	0.082438	445	1.61421	0.558245	0.281546	1.41184	1.92411	38
27	6	0.494633	446	1.61992	1.33786	0.67571	3.41515	1.87641	41
27	7	0.13	447	1.28571	0.4905	0.394164	1.25964	0.971266	0
27	8	0.507316	448	1.90909	1.04697	0.619401	3.06305	1.4717	23
27	9	1.06219	449	1.09632	1.35463	1.18249	3.7851	1.07335	44
28	1	0.079268	450	1.48062	0.315252	0.281546	1.13339	1.28959	40
28	2	0.041219	451	1.31066	0.284783	0.225237	0.642713	0.797485	29
28	3	0.041219	452	1.31066	0.284783	0.225237	0.642713	0.797485	27
28	4	1.10341	453	1.45357	2.08035	1.12618	5.2215	1.96626	25
28	5	3.22463	454	1.91135	2.86801	1.52035	7.9847	1.57336	20
28	6	0.409024	455	1.27649	0.841107	0.67571	2.34731	1.07197	0
28	7	0.586584	456	1.47006	1.01385	0.73202	2.79001	1.05602	15
28	8	2.20683	457	1.99758	2.33507	1.29511	6.5603	1.55192	46
28	9	0.662682	458	1.22124	1.9152	1.06987	4.52242	2.45599	21
28	10	0.418536	459	1.41914	2.21457	0.788329	4.80712	4.39366	40
28	11	0.088780	460	1.72315	0.405373	0.281546	1.04082	0.971011	29
28	12	0.542194	461	2.34171	1.42256	0.619401	3.60739	1.90995	15
28	13	1.30634	462	1.46978	1.49513	1.06987	4.21869	1.08415	26
28	14	0.580243	463	3.11933	1.20108	0.506783	3.36836	1.55603	46
28	15	0.025365	464	6.09902	0.205451	0.056309	0.595526	1.11261	20
28	16	0.339268	465	1.79253	0.693107	0.506783	2.27647	1.21554	40
28	17	0.063414	466	1.77069	0.273579	0.225237	1.01075	1.282	46
28	18	0.022195	467	2.08114	0.210681	0.112618	0.417476	0.624881	29
29	1	0.145853	468	1.42061	0.675848	0.394164	1.78331	1.73512	2
29	2	5.9356	469	1.32791	2.59425	2.47761	9.76447	1.27827	35
29	3	0.025365	470	2.56155	0.222002	0.112618	0.520072	0.848532	0
29	4	1.24292	471	0.894427	4.38242	0.168928	9.33207	5.57572	38
29	5	0.17439	472	1.39975	0.537264	0.450474	1.56495	1.11755	44
29	6	0.069756	473	1.70774	0.370286	0.225237	0.838557	0.802183	38
29	7	0.149024	474	1.84165	0.517944	0.337855	1.38104	1.01846	37
29	8	0.596097	475	1.38851	0.929204	0.788329	3.14143	1.31744	26
29	9	1.13512	476	1.659	1.26243	0.957256	4.16987	1.21897	38
29	10	0.034878	477	1.53518	0.264112	0.168928	0.530095	0.64113	1
29	11	1.5378	478	1.31899	1.5938	1.2388	4.65103	1.11941	46
29	12	0.022195	479	4.16228	0.210681	0.056309	0.417476	0.624881	38
30	1	0.624633	480	1.54048	0.971785	0.73202	3.22911	1.3284	2
30	2	3.19609	481	1.36886	2.23031	1.91451	7.32667	1.33655	38
30	3	0.082438	482	1.41655	0.395066	0.281546	0.977753	0.922819	38
30	4	0.028536	483	5.12311	0.237281	0.056309	0.530095	0.783603	38
30	5	0.158536	484	1.45993	0.548168	0.394164	1.3539	0.920097	37
30	6	0.856096	485	1.51997	1.72977	0.957256	4.44938	1.84021	37
30	7	0.34878	486	1.93347	0.866599	0.506783	2.53814	1.46984	38
30	8	0.069756	487	1.77069	0.369468	0.225237	0.84858	0.821474	9
30	9	5.10804	488	1.05292	2.82071	2.59022	8.64786	1.16507	46
30	10	0.640487	489	1.3121	0.966869	0.844638	3.11041	1.20203	44
31	1	0.475609	490	1.48025	0.884278	0.67571	2.59141	1.1236	18
31	2	2.02927	491	1.19904	1.83314	1.57666	5.88026	1.35595	16
31	3	2.0039	492	1.42101	1.61829	1.40773	5.59364	1.24252	38
31	4	0.044390	493	3.02075	0.384167	0.168928	0.999432	1.79065	33
31	5	0.196585	494	1.35611	0.607196	0.450474	1.52733	0.944291	21

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
31	6	0.034878	495	4.03553	0.281445	0.112618	0.81074	1.49969	40
31	7	0.038048	496	1.7077	0.267581	0.168928	0.669291	0.936872	0
31	8	0.919511	497	1.21159	1.2656	1.01357	3.50542	1.06344	37
31	9	1.05585	498	1.31194	1.95521	1.12618	4.99046	1.87702	1
31	10	1.46488	499	1.18473	1.52488	1.29511	4.60474	1.15186	44
32	1	0.025365	500	2.08114	0.22523	0.112618	0.454077	0.646846	38
32	2	0.047560	501	2.03301	0.305713	0.168928	0.692941	0.803402	37
32	3	0.554877	502	1.50778	1.1051	0.73202	3.21441	1.48182	37
32	4	0.615121	503	3.76934	1.39786	0.450474	3.67581	1.74798	4
32	5	0.345609	504	1.6	0.729004	0.563092	2.25744	1.17337	7
32	6	3.65585	505	1.41208	2.61558	1.91451	8.0266	1.40238	46
32	7	0.145853	506	1.84165	0.498025	0.337855	1.41404	1.09093	0
32	8	1.49975	507	1.32	1.75331	1.40773	5.21739	1.44436	2
32	9	2.72682	508	1.12857	2.10281	1.80189	6.2372	1.1353	33
32	10	1.37927	509	1.70883	2.22444	1.18249	5.68898	1.86728	40
32	11	0.069756	510	1.83114	0.360848	0.225237	0.914574	0.954215	44
32	12	0.225122	511	1.52254	0.643796	0.450474	1.66585	0.980947	1
32	13	0.456585	512	1.40095	0.904375	0.67571	2.42608	1.02584	0
32	14	0.180731	513	1.84165	0.549274	0.337855	1.58747	1.1096	20
32	15	0.050731	514	1.36803	0.31736	0.225237	0.689337	0.745375	29
32	16	0.814877	515	1.13425	1.13839	1.01357	3.70841	1.34299	8
33	1	1.28097	516	1.20699	1.43864	1.2388	4.28051	1.13826	0
33	2	1.25878	517	2.4114	1.63466	0.844638	4.80943	1.46227	24
34	1	1.34756	518	1.10641	1.51437	1.35142	4.2965	1.09012	37
34	2	0.618292	519	1.31922	0.948504	0.844638	3.20073	1.31854	1
34	3	2.28926	520	1.39332	1.85939	1.52035	5.83651	1.18413	44
34	4	0.025365	521	4.16228	0.225237	0.056309	0.450474	0.63662	38
34	5	0.053902	522	1.36803	0.327908	0.225237	0.689337	0.70153	23
34	6	0.951218	523	1.1629	1.2945	1.06987	3.54129	1.04914	38
34	7	0.025365	524	1.53518	0.218929	0.168928	0.543722	0.927459	38
34	8	0.570731	525	1.48088	2.05532	0.844638	4.66601	3.03563	1
34	9	2.26073	526	1.52862	1.73867	1.40773	5.92559	1.23596	15
35	1	0.713413	527	1.87271	1.07922	0.73202	3.48053	1.35126	46
35	2	1.64561	528	1.67783	2.0383	1.18249	5.69128	1.56633	37
35	3	0.596097	529	1.07693	1.38007	1.01357	3.624	1.75328	38
35	4	0.053902	530	3.18133	0.51848	0.168928	1.24488	2.28792	23
35	5	3.46243	531	1.18162	2.34438	2.08344	7.07936	1.15185	6
35	6	2.00707	532	1.87025	1.49142	1.18249	5.65851	1.2695	4
35	7	0.031707	533	5.12311	0.249815	0.056309	0.563092	0.795775	38
35	8	0.091951	534	2.0868	0.631338	0.281546	1.55397	2.08985	0
35	9	0.050731	535	2.12839	0.312873	0.168928	0.745309	0.871332	24
35	10	5.52975	536	1.8864	3.68275	2.02713	10.3686	1.54711	13
35	11	1.39195	537	1.43839	1.43228	1.18249	4.57625	1.19725	38
35	12	0.244146	538	1.27115	0.584612	0.506783	1.93478	1.22013	37
35	13	0.282195	539	1.21803	0.681366	0.563092	1.9956	1.12302	22
35	14	5.81828	540	2.19413	4.43414	1.91451	11.4926	1.80647	38
35	15	0.510487	541	1.10803	1.03951	0.844638	3.06119	1.46079	29
35	16	0.155366	542	1.37176	0.528601	0.394164	1.41111	1.0199	13
36	1	0.748291	543	1.84783	1.05092	0.73202	3.35428	1.19652	14
36	2	2.17195	544	1.59232	1.91506	1.35142	6.0984	1.36261	29
36	3	0.034878	545	1.82405	0.433196	0.168928	1.02742	2.40842	37
36	4	0.339268	546	1.31058	0.734162	0.619401	2.21543	1.15123	0
36	5	2.34317	547	1.2153	2.62982	1.74559	7.04164	1.68397	22
36	6	3.86512	548	1.96367	2.66933	1.63297	8.2346	1.39609	22
36	7	1.64561	549	1.12192	2.28013	1.57666	6.00369	1.74301	37

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
36	8	2.99317	550	1.46075	4.10783	1.74559	9.67296	2.48759	13
36	9	8.86852	551	2.50038	8.82846	2.59022	19.666	3.47033	38
36	10	0.060243	552	1.52475	0.344843	0.225237	0.768959	0.781058	22
36	11	1.45853	553	1.19134	1.55991	1.29511	4.51087	1.11018	7
36	12	2.13073	554	1.52127	1.83959	1.35142	5.55254	1.15145	37
36	13	0.43756	555	1.68628	1.23768	0.67571	3.18243	1.84191	4
36	14	0.047560	556	1.36803	0.302415	0.225237	0.725938	0.881738	19
36	15	5.29511	557	1.29809	2.67924	2.4213	9.31118	1.30294	0
37	1	0.279024	558	1.76912	0.712055	0.450474	1.87588	1.0036	2
37	2	4.77194	559	1.21583	2.31	2.53391	8.72258	1.26877	44
37	3	0.288536	560	1.27047	0.724457	0.563092	1.90601	1.00194	33
37	4	0.424877	561	1.32914	0.81658	0.73202	2.67379	1.339	13
37	5	0.881462	562	1.60993	1.2796	0.900947	3.93691	1.39926	38
37	6	0.044390	563	2.27698	0.274082	0.168928	0.78191	1.09601	38
37	7	0.025365	564	1.33333	0.223882	0.168928	0.497098	0.77522	29
37	8	0.272682	565	1.27047	0.710124	0.563092	1.82566	0.972683	37
37	9	1.62975	566	1.25645	3.06145	1.35142	7.18759	2.52252	20
37	10	1.04951	567	1.32671	1.19689	1.06987	4.14751	1.3043	1
38	1	2.90439	568	1.52487	1.7742	1.74559	6.82242	1.2753	44
38	2	0.044390	569	1.36803	0.296245	0.225237	0.65634	0.772256	6
38	3	3.23414	570	1.60531	2.81494	1.74559	7.92772	1.54642	46
38	4	1.16366	571	1.50072	1.185	1.06987	4.29155	1.25949	0
38	5	0.396341	572	1.16478	0.733336	0.73202	2.5476	1.30312	20
38	6	0.171219	573	1.49812	0.561646	0.394164	1.45188	0.979709	8
38	7	1.42366	574	1.37584	1.46859	1.18249	4.59917	1.18234	4
38	8	0.13	575	1.18287	0.48306	0.394164	1.29263	1.02282	20
38	9	0.279024	576	5.41536	1.40629	0.281546	3.2094	2.93762	20
38	10	0.21878	577	1.22222	0.625412	0.506783	1.68173	1.02872	38
38	11	0.044390	578	1.36803	0.294522	0.225237	0.679314	0.827265	29
39	1	0.025365	579	5.12311	0.222002	0.056309	0.520072	0.848532	29
39	2	0.202927	580	1.55022	0.580046	0.450474	1.68697	1.116	0
39	3	0.155366	581	1.83333	0.519919	0.337855	1.44191	1.06491	1
39	4	1.39512	582	1.66285	1.24545	1.06987	4.71719	1.26925	2
39	5	3.93804	583	1.66386	2.73769	1.8582	8.35229	1.40968	33
39	6	0.865608	584	1.16667	1.16305	1.01357	3.5566	1.16289	37
39	7	0.076097	585	1.54164	0.322656	0.281546	1.11701	1.30476	38
39	8	0.072926	586	1.92705	0.392277	0.225237	1.15637	1.45913	38
39	9	0.022195	587	4.16228	0.210681	0.056309	0.417476	0.624881	46
39	10	0.025365	588						38
39	11	0.405853	589	1.5	2.55116	0.788329	5.42049	5.76101	38
39	12	1.95634	590	1.181	1.78808	1.52035	5.26784	1.12878	26
39	13	6.29389	591	1.4309	3.87938	2.70284	11.0036	1.53086	46
39	14	0.380487	592	1.21679	0.702644	0.67571	2.4883	1.29496	37
39	15	0.285365	593	1.31655	0.558534	0.563092	2.13891	1.27577	38
39	16	0.034878	594	1.15139	0.260334	0.225237	0.609716	0.848192	38
39	17	0.26317	595	1.70198	0.898653	0.506783	2.38301	1.71713	0
39	18	0.364634	596	1.25511	0.82024	0.619401	2.11576	0.976938	46
40	1	0.120488	597	1.34518	0.39593	0.337855	1.37226	1.24371	0
40	2	0.272682	598	1.07424	0.712202	0.619401	1.81496	0.961316	35
40	3	0.234634	599	1.50567	0.649858	0.450474	1.73308	1.01868	1
40	4	5.4378	600	1.7041	3.59307	2.19606	10.213	1.52641	46
40	5	0.488292	601	1.37701	0.945022	0.67571	2.46803	0.992687	2
40	6	5.74536	602	1.24445	2.98499	2.64653	9.81948	1.33552	13
40	7	0.751462	603	1.54397	1.0939	0.788329	3.29471	1.14952	44
40	8	0.48195	604	1.19694	0.899743	0.73202	2.58527	1.10357	15

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
40	9	2.32414	605	4.92437	3.69665	0.788329	8.65073	2.56232	44
40	10	0.063414	606	1.5	0.3549	0.225237	0.768959	0.742006	5
40	11	3.18341	607	1.29869	3.67082	2.19606	9.07609	2.05918	29
40	12	0.107805	608	1.66667	0.441119	0.337855	1.37102	1.38752	23
40	13	2.49853	609	1.69287	2.34775	1.57666	6.82394	1.48312	44
41	1	0.114146	610	1.17301	0.455663	0.394164	1.19882	1.00193	7
41	2	4.27414	611	1.4254	2.34934	2.08344	8.17942	1.24562	37
41	3	0.976584	612	1.18358	1.30023	1.12618	4.10263	1.37153	37
41	4	0.323414	613	1.07988	1.1084	0.73202	2.80037	1.92958	6
41	5	4.65463	614	1.37515	3.15656	2.19606	9.2623	1.46671	46
41	6	0.085609	615	1.54164	0.407224	0.281546	0.961254	0.858903	44
41	7	0.453414	616	1.23077	0.800694	0.73202	2.63234	1.21613	29
41	8	0.085609	617	2.26556	0.387221	0.225237	1.21662	1.37586	10
41	9	3.62731	618	1.15501	2.25325	2.19606	7.45776	1.22017	38
41	10	0.034878	619	2.56155	0.26163	0.112618	0.595526	0.809171	46
41	11	0.196585	620	1.375	0.599947	0.450474	1.56449	0.990805	29
41	12	1.31902	621	1.57883	3.11855	1.2388	7.08302	3.02674	38
41	13	0.592926	622	1.31887	0.973444	0.788329	2.92312	1.14679	38
41	14	0.031707	623	2.73607	0.248676	0.112618	0.576719	0.834756	38
41	15	0.275853	624	1.33837	0.69127	0.506783	1.92606	1.07016	38
41	16	0.878291	625	1.54812	0.952679	0.957256	3.74817	1.27289	14
42	1	2.33683	626	1.36315	2.02291	1.52035	6.35618	1.3758	6
42	2	2.27975	627	1.90443	2.08446	1.29511	6.3563	1.4103	38
42	3	0.022195	628	2.08114	0.210681	0.112618	0.417476	0.624881	1
42	4	1.53146	629	1.21417	1.57259	1.29511	4.68127	1.1387	13
42	5	3.89365	630	1.92042	2.60485	1.68928	8.19924	1.37398	38
42	6	0.123658	631	1.51038	0.484975	0.337855	1.1901	0.911444	12
42	7	0.453414	632	1.25362	0.858226	0.73202	2.54174	1.13386	38
42	8	0.044390	633	1.28078	0.2936	0.225237	0.688774	0.850466	38
42	9	0.028536	634	1.38743	0.238611	0.168928	0.500701	0.699112	13
42	10	2.6	635	1.86822	2.31285	1.40773	6.874	1.44623	40
43	1	0.034878	636	1.53518	0.263356	0.168928	0.566696	0.732721	0
43	2	2.21317	637	2.45838	4.15575	1.29511	9.37661	3.16131	46
43	3	0.149024	638	2.11745	0.538685	0.337855	1.63066	1.41991	38
43	4	0.028536	639	2.56155	0.237281	0.112618	0.530095	0.783603	38
43	5	0.038048	640	1.7077	0.275561	0.168928	0.576719	0.69563	13
43	6	2.2639	641	1.14083	1.73409	1.74559	5.93454	1.23796	0
43	7	0.396341	642	1.71555	0.802801	0.563092	2.37552	1.13302	13
43	8	3.06292	643	1.18814	2.33064	2.02713	7.28968	1.38061	0
43	9	0.897316	644	1.60866	1.32286	0.900947	4.00235	1.42061	20
44	1	0.180731	645	1.35611	0.542474	0.450474	1.60335	1.13191	40
44	2	0.206097	646	1.39975	0.606513	0.450474	1.63415	1.0311	7
44	3	2.08634	647	1.24138	1.74482	1.63297	5.8811	1.31924	40
44	4	2.78073	648	1.13656	2.24203	1.91451	6.9646	1.38811	37
44	5	0.688048	649	1.71584	1.67571	0.788329	4.17262	2.01368	37
44	6	0.272682	650	1.12743	0.622634	0.619401	2.12117	1.31305	38
44	7	1.59805	651	1.40207	3.00108	1.35142	7.06714	2.48707	7
44	8	0.624633	652	2.0847	1.02508	0.619401	3.26886	1.36131	37
44	9	0.247317	653	1.33837	0.618283	0.506783	1.90697	1.1701	46
44	10	0.811706	654	1.55336	1.86169	0.900947	4.59539	2.07032	33
44	11	0.738779	655	1.1555	1.36711	1.01357	3.815	1.56771	7
44	12	0.662682	656	1.32453	0.975804	0.844638	3.17336	1.20927	38
44	13	0.053902	657	1.2	0.315072	0.281546	0.814907	0.980389	33
44	14	2.47951	658	1.32137	4.11491	1.74559	9.43495	2.85695	40
45	1	0.025365	659	2.08114	0.22523	0.112618	0.454077	0.646846	37

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
45	2	0.472438	660	1.38688	0.771323	0.73202	2.76765	1.29023	11
45	3	5.61219	661	2.4392	4.70543	1.91451	11.7963	1.97309	37
45	4	0.244146	662	1.46284	0.634745	0.506783	1.85392	1.12027	25
45	5	1.27463	663	1.79117	1.16842	1.01357	4.51864	1.27474	6
46	1	0.47878	664	1.38504	0.926976	0.67571	2.48093	1.02302	6
46	2	3.19292	665	2.24327	2.58922	1.40773	7.64476	1.45657	32
46	3	3.77951	666	1.26344	2.09792	2.13975	7.79894	1.28064	16
46	4	0.351951	667	2.07687	0.925358	0.506783	2.6114	1.54189	2
46	5	6.99779	668	1.27292	3.12461	2.92808	10.7284	1.30887	35
46	6	3.44024	669	1.09677	2.45603	2.02713	6.75423	1.05525	2
46	7	4.56902	670	1.72586	3.87555	2.02713	10.109	1.77984	18
46	8	3.27853	671	1.09367	2.73249	2.30868	7.86465	1.50131	6
46	9	0.967072	672	1.51523	1.22066	0.957256	3.77418	1.17213	46
46	10	0.069756	673	1.2	0.37123	0.281546	0.82493	0.776323	1
46	11	0.342438	674	1.40384	0.795472	0.563092	2.04746	0.974177	1
46	12	1.47122	675	1.30958	1.36822	1.29511	4.80565	1.24916	29
46	13	0.031707	676	2.73607	0.246845	0.112618	0.59333	0.883536	29
47	1	0.044390	677	1.82405	0.256969	0.168928	0.815583	1.19245	38
47	2	0.060243	678	1.2	0.345632	0.281546	0.755332	0.753621	13
47	3	1.43	679	2.00712	1.34784	0.957256	4.81759	1.29156	38
47	4	0.028536	680	1.27614	0.23853	0.168928	0.450474	0.565884	37
47	5	0.510487	681	1.48025	0.800422	0.67571	2.83421	1.25219	37
47	6	0.21878	682	1.31296	0.538643	0.506783	1.88962	1.29877	38
47	7	0.884633	683	1.33816	1.55078	1.01357	4.24245	1.61905	38
47	8	0.034878	684	4	0.288309	0.112618	0.818567	1.52879	44
47	9	2.69829	685	1.18094	1.81022	1.74559	6.53226	1.25843	0
47	10	0.310731	686	1.4	0.746032	0.563092	2.00157	1.026	13
47	11	2.50804	687	1.76709	3.00268	1.46404	7.6759	1.86945	0
47	12	2.15292	688	1.33756	1.82523	1.52035	5.62467	1.16938	2
47	13	1.75341	689	1.67644	1.57894	1.18249	5.17161	1.21383	44
48	1	0.063414	690	2.15394	0.65978	0.225237	1.51179	2.86803	0
48	2	0.669023	691	1.50778	1.07848	0.73202	2.99345	1.06584	0
48	3	0.028536	692	1.53518	0.227766	0.168928	0.599693	1.00288	1
48	4	1.99122	693	1.09675	1.86385	1.63297	5.15387	1.06155	8
48	5	7.89511	694	1.58929	5.61959	2.70284	14.049	1.98941	6
48	6	2.08634	695	1.17275	1.99001	1.74559	6.07683	1.40851	0
48	7	1.52195	696	2.92045	4.91971	1.06987	10.4581	5.71872	45
48	8	1.01146	697	1.37382	1.86284	1.12618	4.81162	1.82148	45
48	9	0.409024	698	1.35023	1.29543	0.73202	3.22235	2.02017	44
49	1	0.038048	699	1.82405	0.26371	0.168928	0.689337	0.993833	2
49	2	3.25634	700	1.26641	2.21172	1.97082	7.36806	1.32668	9
49	3	3.27853	701	1.16174	2.35115	1.97082	6.73126	1.09977	0
49	4	1.20171	702	1.72222	1.25886	1.01357	4.42692	1.29776	1
49	5	3.65902	703	1.15053	2.3385	2.13975	7.39689	1.18994	37
50	1	0.050731	704	1.52475	0.3096	0.225237	0.769015	0.927643	38
50	2	0.022195	705	2.5	0.207603	0.112618	0.487075	0.850598	26
50	3	3.85877	706	1.8413	3.51867	1.74559	9.23066	1.75714	6
50	4	5.71682	707	1.24507	3.35246	2.75915	10.1154	1.42431	46
50	5	2.74585	708	1.19129	2.11373	1.80189	6.25117	1.13249	0
50	6	0.447072	709	1.67857	0.70706	0.619401	2.66984	1.26877	38
50	7	0.145853	710	1.74781	0.514261	0.337855	1.35863	1.00711	38
50	8	1.16683	711	1.45528	3.10694	1.2388	6.965	3.30846	8
50	9	3.48463	712	1.28002	2.37085	1.91451	7.06405	1.13957	18
51	1	3.3356	713	1.24707	2.28051	1.91451	6.98628	1.16442	40
51	2	0.034878	714	1.82405	0.386906	0.168928	0.954103	2.07697	44

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
51	3	0.228292	715	1.1	0.649143	0.563092	1.67351	0.976237	2
51	4	7.7334	716	1.22228	3.37182	2.98439	10.7922	1.1985	40
51	5	0.022195	717	4.16228	0.210681	0.056309	0.417476	0.624881	44
51	6	0.171219	718	1.43004	0.485824	0.450474	1.62407	1.22588	46
51	7	0.047560	719	2.12839	0.302415	0.168928	0.725938	0.881738	7
51	8	10.1622	720	1.67774	4.83822	2.98439	13.8772	1.50803	1
51	9	1.81366	721	1.28	2.0229	1.46404	5.83893	1.4959	19
51	10	4.62926	722	1.42656	4.35762	2.59022	10.8399	2.0199	38
51	11	0.948047	723	1.2802	1.75881	1.06987	4.59568	1.7728	46
51	12	0.424877	724	1.79894	0.917572	0.619401	2.76123	1.42802	37
51	13	0.206097	725	1.02195	0.592516	0.563092	1.67948	1.0891	20
51	14	0.158536	726	1.193	0.534002	0.450474	1.4253	1.0197	38
51	15	0.053902	727	1.36803	0.32628	0.225237	0.725938	0.778004	38
51	16	0.041219	728	2	0.242951	0.168928	0.791933	1.21078	20
51	17	0.336097	729	1.6903	0.732871	0.506783	2.20085	1.14684	1
51	18	3.11682	730	1.30447	2.23124	1.8582	6.70322	1.14721	0
52	1	0.022195	731	5.12311	0.203543	0.056309	0.515905	0.954273	44
52	2	0.091951	732	2.01777	0.40617	0.225237	1.0875	1.02351	2
52	3	5.28243	733	1.25495	3.40182	2.64653	9.90929	1.47925	2
52	4	7.09609	734	1.5774	5.40948	2.92808	13.4425	2.02644	2
52	5	5.44414	735	1.05815	4.16982	2.98439	10.9508	1.7529	44
52	6	0.085609	736	2.26556	0.378015	0.225237	1.09262	1.10971	44
52	7	0.244146	737	1.70614	0.516521	0.450474	1.97431	1.27049	44
52	8	0.095121	738	1.18046	0.423907	0.337855	1.05321	0.927978	7
52	9	6.3795	739	1.06857	3.89945	3.20962	11.0709	1.52886	44
52	10	0.095121	740	1.23385	0.432012	0.337855	0.984172	0.810312	40
52	11	0.079268	741	1.36619	0.392931	0.281546	0.914574	0.83971	0
52	12	1.25561	742	1.2419	1.46164	1.18249	4.14774	1.09033	40
52	13	0.022195	743	1.91421	0.209945	0.112618	0.384479	0.530004	0
52	14	1.93414	744	1.34782	1.75652	1.40773	5.2827	1.14819	37
52	15	0.050731	745	2.03301	0.312939	0.168928	0.744746	0.870016	11
52	16	2.53658	746	1.10638	1.90331	1.8582	6.21541	1.21194	40
53	1	0.038048	747	2.03301	0.267581	0.168928	0.669291	0.936872	40
53	2	0.079268	748	1.33137	0.392931	0.281546	0.914574	0.83971	2
53	3	5.75804	749	2.18123	4.4988	2.02713	11.5574	1.84602	0
53	4	1.88024	750	1.82554	1.91519	1.18249	5.79388	1.42074	38
53	5	0.022195	751	2.08114	0.210681	0.112618	0.417476	0.624881	13
53	6	0.317073	752	1.15108	0.751823	0.619401	2.02865	1.03287	40
53	7	0.044390	753	1.36803	0.288506	0.225237	0.725938	0.944719	0
53	8	0.082438	754	1.48062	0.364819	0.281546	1.0862	1.13889	15
53	9	0.710243	755	1.24835	1.0971	0.900947	3.12556	1.09456	46
53	10	0.025365	756	3.04951	0.205451	0.112618	0.595526	1.11261	44
53	11	0.076097	757	1.36619	0.377621	0.281546	0.951175	0.946109	44
54	1	0.275853	758	1.4	0.676846	0.563092	1.96553	1.11448	40
54	2	0.025365	759	5.47214	0.214436	0.056309	0.566696	1.00749	13
55	1	0.275853	760	1.41163	0.716159	0.506783	1.82639	0.962274	16
55	2	2.15292	761	1.30282	1.90441	1.52035	5.45693	1.10067	46
55	3	0.117317	762	1.81245	0.465266	0.281546	1.20006	0.97687	38
55	4	0.022195	763	2.08114	0.210367	0.112618	0.444054	0.706978	18
55	5	1.75341	764	1.28964	1.58227	1.40773	5.16778	1.21203	37
55	6	0.072926	765	1.22076	0.344807	0.337855	1.01801	1.13087	23
55	7	4.71804	766	1.03582	2.75811	2.59022	8.22098	1.13992	27
55	8	0.900486	767	1.5638	1.19211	0.900947	3.61685	1.15604	38
55	9	0.123658	768	1.29461	0.625608	0.394164	1.64654	1.74466	13
55	10	5.24121	769	1.43478	4.1165	2.59022	10.7794	1.76421	4

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
55	11	2.6	770	1.78407	2.39401	1.52035	6.9601	1.48268	16
55	12	0.646828	771	1.26852	1.06377	0.844638	2.93264	1.05808	38
56	1	0.938535	772	1.24587	2.08013	1.06987	5.06265	2.17318	2
56	2	3.53536	773	1.65335	2.4253	1.68928	7.766	1.35753	19
56	3	2.65073	774	1.97502	2.13532	1.35142	6.75339	1.36921	44
56	4	0.031707	775	3	0.244476	0.112618	0.609716	0.933011	15
56	5	0.583414	776	1.34318	0.899059	0.788329	2.99565	1.22404	23
56	6	3.9539	777	1.61217	2.31023	1.8582	7.82709	1.23301	13
56	7	1.43634	778	1.44814	1.55309	1.18249	4.46352	1.10379	0
56	8	0.954389	779	1.28909	1.28073	1.01357	3.59782	1.0793	33
57	1	0.063414	780	1.70774	0.352866	0.225237	0.801956	0.807053	22
57	2	0.573902	781	1.26024	0.886947	0.788329	2.97577	1.22787	5
57	3	3.26268	782	1.74199	2.76849	1.63297	7.89399	1.51988	15
57	4	0.783169	783	1.40006	1.10356	0.900947	3.38779	1.16618	18
57	5	2.38439	784	1.31034	1.9081	1.63297	5.94028	1.17768	37
57	6	0.358292	785	1.28663	0.647908	0.619401	2.40181	1.28124	44
57	7	0.053902	786	2.12839	0.312996	0.168928	0.824367	1.00328	18
58	1	2.5017	787	1.16877	1.8427	1.80189	6.22144	1.23122	44
58	2	0.047560	788	2.12839	0.286309	0.168928	0.801956	1.07607	2
58	3	4.69268	789	1.39557	2.69237	2.08344	8.30809	1.1705	2
58	4	3.55438	790	1.58333	2.15907	1.74559	7.44684	1.24156	38
58	5	0.025365	791	1.53518	0.223882	0.168928	0.497098	0.77522	29
58	6	0.063414	792	2.44152	0.34478	0.168928	0.86795	0.945346	29
58	7	0.050731	793	2.44152	0.416596	0.168928	1.07674	1.8186	15
58	8	0.618292	794	1.29361	1.17256	0.900947	3.39972	1.48759	6
58	9	5.3395	795	1.07375	2.61671	2.75915	9.3145	1.29303	0
59	1	0.13	796	1.59067	0.488578	0.337855	1.26898	0.985734	1
59	2	5.55828	797	1.71873	4.55255	2.19606	11.5469	1.9089	7
59	3	4.09024	798	1.38594	2.4652	1.97082	7.83092	1.19307	37
59	4	0.288536	799	1.31655	0.703108	0.563092	1.98141	1.08277	34
59	5	1.09707	800	2.08194	1.61445	0.900947	4.58796	1.52684	37
59	6	0.069756	801	1.64222	0.512522	0.281546	1.29725	1.9198	1
59	7	4.18536	802	1.67883	3.63906	1.91451	9.57836	1.74438	13
59	8	1.72488	803	1.75461	1.59815	1.18249	5.35489	1.32292	2
59	9	2.38439	804	2.77121	2.74815	1.12618	7.23157	1.74533	38
59	10	0.022195	805	1.91421	0.210681	0.112618	0.417476	0.624881	40
59	11	0.057073	806	1.52475	0.334903	0.225237	0.758935	0.803098	7
59	12	3.4339	807	1.24324	2.33905	2.08344	7.61424	1.34356	37
59	13	0.066585	808	1.59629	0.362937	0.225237	0.801956	0.768622	29
59	14	0.025365	809	4.16228	0.225237	0.056309	0.450474	0.63662	44
59	15	0.294878	810	1.44907	0.727149	0.506783	1.9483	1.02438	38
59	16	0.072926	811	1.77069	0.376507	0.225237	0.881014	0.846972	7
59	17	7.08657	812	1.05954	4.3378	3.43486	11.943	1.60169	7
59	18	2.21317	813	1.44953	1.88261	1.46404	5.64365	1.14524	38
59	19	0.034878	814	1.53518	0.264112	0.168928	0.530095	0.64113	40
60	1	0.091951	815	1.22076	0.393005	0.337855	1.12922	1.10356	18
60	2	2.14975	816	1.37801	1.82545	1.46404	5.61786	1.16827	29
60	3	0.212439	817	2.1736	0.503054	0.337855	1.83512	1.26149	38
60	4	0.031707	818	2.73607	0.245998	0.112618	0.599693	0.902588	38
60	5	0.063414	819	3.08207	0.407001	0.168928	1.12562	1.58996	40
60	6	0.225122	820	1.72077	0.633299	0.394164	1.71011	1.03376	29
61	1	0.025365	821	2.08114	0.22523	0.112618	0.454077	0.646846	44
61	2	0.110975	822	1.43596	0.449756	0.337855	1.18002	0.998479	2
61	3	4.38194	823	1.07569	2.56684	2.4213	8.08341	1.18662	0
61	4	0.722926	824	1.5	1.09578	0.788329	3.18175	1.11437	33

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
61	5	0.776828	825	1.48909	1.74141	0.900947	4.375	1.96075	3
61	6	6.22097	826	2.75123	5.2316	1.91451	12.8414	2.1094	0
61	7	0.206097	827	1.1355	0.601389	0.506783	1.65234	1.05418	32
61	8	4.28999	828	1.04254	2.64282	2.4213	7.81189	1.132	40
62	1	0.044390	829	2	0.296245	0.168928	0.65634	0.772256	38
62	2	0.925852	830	1.56199	1.75613	0.957256	4.56668	1.79246	38
62	3	0.234634	831	1.41195	0.660656	0.450474	1.68353	0.961264	20
62	4	0.244146	832	1.58809	0.643602	0.450474	1.83151	1.09335	37
62	5	0.285365	833	1.57255	0.730804	0.506783	2.24257	1.40243	29
62	6	0.120488	834	1.37176	0.892502	0.394164	2.055	2.78916	37
62	7	0.386829	835	1.12319	0.97086	0.73202	2.7386	1.54287	40
62	8	0.275853	836	1.20454	0.709327	0.563092	1.85939	0.997359	37
63	1	0.840243	837	1.41304	1.56352	0.957256	4.20185	1.67212	16
63	2	1.86439	838	1.56024	1.66769	1.29511	5.28225	1.19095	18
63	3	2.84414	839	1.25639	2.02927	1.80189	6.56481	1.20582	36
63	4	0.269512	840	1.37797	0.705152	0.506783	1.81913	0.977097	29
63	5	0.091951	841	1.23385	0.373898	0.337855	1.23965	1.32993	46
63	6	0.063414	842	1.77069	0.344878	0.225237	0.867387	0.94412	38
63	7	0.060243	843	1.59629	0.344843	0.225237	0.768959	0.781058	2
63	8	2.18146	844	1.21951	1.81087	1.63297	5.70373	1.18675	7
63	9	6.95657	845	1.91693	4.2845	2.36499	11.8163	1.5972	33
63	10	2.35902	846	2.10959	2.80715	1.40773	7.29503	1.7952	15
63	11	1.18268	847	1.32475	1.2964	1.12618	4.24774	1.21406	29
63	12	0.088780	848	1.739	0.724523	0.337855	1.69412	2.57253	40
63	13	0.320243	849	1.57255	0.75201	0.506783	2.05163	1.04594	37
63	14	0.076097	850	1.54164	0.352626	0.281546	1.03902	1.12893	37
63	15	0.485121	851	1.18946	0.779575	0.788329	2.76332	1.25257	46
64	1	0.139512	852	1.74781	0.443691	0.337855	1.46066	1.21696	38
64	2	0.041219	853	2.03301	0.281084	0.168928	0.679314	0.890901	2
64	3	4.40731	854	1.55195	2.81654	2.13975	8.76267	1.3864	38
64	4	0.034878	855	1.7077	0.263356	0.168928	0.566696	0.732721	38
64	5	0.057073	856	3.54138	0.330401	0.112618	0.801956	0.896726	44
64	6	0.101463	857	1.64222	0.435673	0.281546	1.10039	0.949682	37
64	7	0.665853	858	2.3196	2.60252	0.73202	5.71674	3.90578	15
64	8	2.21634	859	1.0625	1.89982	1.80189	5.61442	1.13179	44
64	9	0.13	860	1.54104	0.467487	0.337855	1.34219	1.10274	0
64	10	1.41731	861	1.23867	1.67852	1.40773	5.04581	1.42951	38
64	11	2.1339	862	1.81758	2.4888	1.29511	6.69241	1.67025	15
64	12	1.52512	863	1.2847	1.65332	1.35142	5.15156	1.38473	13
64	13	3.6717	864	1.7957	2.77509	1.8582	8.19637	1.45601	20
64	14	2.62536	865	2.28798	2.34377	1.2388	6.92783	1.45478	16
65	1	2.5778	866	2.13767	2.31371	1.29511	6.8557	1.45092	0
65	2	0.662682	867	1.43607	1.05338	0.788329	3.03574	1.10666	38
65	3	0.022195	868	2.5	0.207603	0.112618	0.487075	0.850598	38
65	4	0.044390	869	2.03301	0.281338	0.168928	0.758935	1.03255	7
65	5	4.71804	870	1.67102	3.54067	2.08344	9.74639	1.6022	38
65	6	0.082438	871	1.72315	0.353346	0.281546	1.10681	1.18252	38
65	7	0.038048	872	4	0.268866	0.112618	0.820763	1.40892	37
65	8	0.031707	873	3.54138	0.233933	0.112618	0.738946	1.37043	38
65	9	0.028536	874	3.54138	0.227587	0.112618	0.705949	1.38974	38
65	10	0.022195	875						41
65	11	0.047560	876	6	0.539963	0.112618	1.25609	2.63986	38
65	12	0.022195	877						38
65	13	0.050731	878	4.01512	0.549047	0.168928	1.28289	2.58162	38
65	14	0.022195	879						38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
65	15	0.041219	880	9.06226	0.340692	0.056309	0.923358	1.646	38
65	16	0.031707	881	4.03553	0.296262	0.112618	0.806573	1.63275	38
65	17	0.038048	882	4.5	0.352704	0.112618	0.921162	1.77469	37
65	18	0.022195	883						38
65	19	0.114146	884	3.62345	1.41633	0.281546	2.99385	6.24868	38
65	20	0.104634	885	6.0098	1.25806	0.168928	2.68246	5.47247	40
65	21	0.038048	886	1.82405	0.274142	0.168928	0.609716	0.777509	13
65	22	0.862438	887	1.36094	1.17674	0.957256	3.51994	1.14323	40
65	23	0.025365	888	1.38743	0.225131	0.168928	0.4641	0.675718	29
65	24	0.789511	889	1.32017	2.04507	1.06987	4.86224	2.3829	0
65	25	0.139512	890	1.36343	0.505908	0.394164	1.31566	0.987345	44
65	26	0.110975	891	1.36852	0.448262	0.337855	1.18643	1.00937	40
65	27	0.038048	892	2.73607	0.27471	0.112618	0.599693	0.752156	44
65	28	0.022195	893	2.08114	0.210681	0.112618	0.417476	0.624881	18
65	29	4.18219	894	1.73675	2.40766	1.74559	8.28939	1.30747	38
66	1	0.168049	895	1.193	0.567935	0.450474	1.36865	0.887036	38
66	2	0.069756	896	1.33137	0.367155	0.281546	0.871554	0.866557	13
66	3	0.139512	897	1.90672	0.711709	0.337855	1.81547	1.87999	8
66	4	8.17413	898	1.42703	4.89107	2.98439	13.1246	1.67695	37
66	5	0.431219	899	1.40095	0.856125	0.67571	2.43194	1.09143	4
66	6	7.63194	900	1.93806	7.32687	2.64653	16.737	2.92086	0
66	7	0.729267	901	2.07114	0.99751	0.67571	3.35665	1.22946	29
66	8	1.95317	902	1.55274	1.6121	1.29511	5.51109	1.23745	4
66	9	0.110975	903	1.25861	0.425023	0.394164	1.37226	1.35031	38
66	10	0.041219	904	1.7077	0.286537	0.168928	0.609716	0.717701	6
66	11	0.700731	905	1.86114	1.03093	0.73202	3.22573	1.18167	44
66	12	0.171219	906	1.57855	0.550051	0.394164	1.49951	1.04505	2
66	13	8.67194	907	2.41725	7.73696	2.4213	17.7156	2.87996	37
66	14	0.168049	908	1.71429	0.553	0.394164	1.71377	1.39079	40
66	15	0.177561	909	1.63433	0.545454	0.394164	1.57091	1.10598	29
66	16	0.269512	910	1.71599	0.919807	0.450474	2.42563	1.73725	1
66	17	4.02048	911	1.18241	2.48663	2.13975	7.69916	1.17327	29
67	1	0.038048	912	2.03301	0.265782	0.168928	0.679314	0.965143	44
67	2	0.202927	913	1.22776	0.531438	0.506783	1.76552	1.22235	8
67	3	6.65218	914	1.69259	3.83696	2.53391	11.1413	1.48491	1
67	4	0.669023	915	1.29594	0.980367	0.844638	3.18862	1.20936	21
67	5	1.33171	916	1.89398	2.67793	1.06987	6.35044	2.40985	24
67	6	1.95	917	1.30282	1.73878	1.52035	5.72051	1.33544	38
67	7	0.932194	918	2.17169	1.96125	0.844638	4.87311	2.0272	38
67	8	0.034878	919						46
67	9	0.133171	920	1.36343	0.498373	0.394164	1.26482	0.955956	34
67	10	0.539024	921	1.77098	1.14098	0.73202	3.2268	1.53719	38
67	11	0.031707	922	1.53518	0.251684	0.168928	0.520072	0.678825	37
67	12	0.833901	923	1.69957	3.14302	0.957256	6.81668	4.43426	13
67	13	1.23975	924	1.43431	1.46518	1.18249	4.62265	1.37163	29
67	14	0.050731	925	2.12839	0.311608	0.168928	0.755332	0.894925	38
67	15	0.025365	926						37
68	1	0.221951	927	1.43004	0.584517	0.450474	1.80854	1.17271	38
68	2	0.491463	928	1.1558	1.64294	0.900947	3.88415	2.44282	0
68	3	1.77878	929	1.24618	1.63779	1.46404	5.44775	1.32771	0
68	4	0.110975	930	1.36852	0.437997	0.337855	1.22304	1.07261	2
68	5	5.86267	931	1.3095	4.03609	2.59022	10.9773	1.63563	13
68	6	2.82829	932	2.05421	2.28247	1.35142	7.04321	1.39575	33
68	7	0.332926	933	1.85028	0.70394	0.506783	2.23328	1.19214	7
69	1	5.64706	934	1.93945	5.28553	2.30868	12.7079	2.27569	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
69	2	0.757804	935	1.45357	3.33168	1.12618	7.11827	5.32087	5
69	3	2.85365	936	1.43967	2.51602	1.68928	7.30043	1.48623	2
69	4	3.2056	937	1.4568	2.32944	1.8582	7.41114	1.36348	38
69	5	0.063414	938	2.25	0.315808	0.225237	1.03322	1.33963	38
69	6	0.028536	939	1.66667	0.237318	0.168928	0.529532	0.781939	37
69	7	0.253658	940	1.37797	0.638186	0.506783	1.90894	1.14321	38
69	8	0.050731	941	1.5	0.316619	0.225237	0.702964	0.775136	37
69	9	0.041219	942	1.15139	0.287119	0.225237	0.576719	0.64212	38
69	10	0.050731	943	1.75	0.299941	0.225237	0.814344	1.04022	5
69	11	4.79414	944	1.69468	3.24537	2.02713	9.44519	1.48082	40
70	1	0.025365	945	4.16228	0.225237	0.056309	0.450474	0.63662	1
70	2	0.735609	946	1.3611	1.1268	0.844638	3.15146	1.0744	46
70	3	0.466097	947	1.46275	0.878973	0.67571	2.55694	1.11624	0
70	4	2.06097	948	1.25194	1.81439	1.52035	5.45079	1.14719	46
70	5	0.063414	949	1.27703	0.350741	0.281546	0.82493	0.853956	37
70	6	0.700731	950	1.81522	1.55205	0.788329	4.00708	1.82345	38
70	7	0.865608	951	1.14987	1.233	1.01357	3.38452	1.05308	15
70	8	2.39707	952	1.71093	2.11542	1.40773	6.49713	1.40137	38
70	9	0.025365	953						38
70	10	0.031707	954						38
70	11	0.022195	955	2.08114	0.21017	0.112618	0.449911	0.725748	38
70	12	0.034878	956						38
70	13	0.022195	957						38
70	14	0.028536	958	3	0.227766	0.112618	0.599693	1.00288	38
70	15	0.025365	959	4.16228	0.225237	0.056309	0.450474	0.63662	38
70	16	0.057073	960	14.0384	0.677319	0.056309	1.52316	3.23484	37
70	17	0.022195	961	6.09902	0.162209	0.056309	0.59333	1.26219	38
70	18	0.038048	962	3.54138	0.244041	0.112618	0.745309	1.16178	37
70	19	0.063414	963	7.0192	0.770311	0.112618	1.70527	3.64911	38
70	20	0.095121	964	2.2	0.809481	0.281546	1.85398	2.87555	37
70	21	0.104634	965	2.22822	1.08106	0.337855	2.3557	4.22042	38
70	22	0.050731	966	5.02769	0.427618	0.112618	1.09251	1.87225	38
70	23	0.066585	967	7.07647	0.669868	0.112618	1.53854	2.82897	38
70	24	0.028536	968	7.08276	0.258333	0.056309	0.737594	1.51713	38
70	25	0.022195	969						38
70	26	0.050731	970	2.69036	0.639483	0.168928	1.43763	3.24195	38
70	27	0.234634	971	8.26561	1.92931	0.225237	4.10184	5.70634	37
70	28	0.034878	972	7.32456	0.200768	0.056309	0.744746	1.26548	38
70	29	0.060243	973	4.62311	0.393032	0.112618	1.09262	1.57695	38
70	30	1.0939	974	3.3125	6.424	0.900947	13.1886	12.6534	38
70	31	0.025365	975	3.04951	0.205451	0.112618	0.595526	1.11261	38
70	32	0.022195	976	2.08114	0.210681	0.112618	0.417476	0.624881	38
70	33	0.13	977	2.18826	1.22448	0.394164	2.66129	4.33541	38
70	34	0.047560	978	4.53113	0.428544	0.112618	1.07905	1.94817	37
70	35	0.028536	979	1.7077	0.215926	0.168928	0.636294	1.12903	37
70	36	0.30756	980	2.78009	2.62353	0.506783	5.48153	7.77434	38
70	37	0.044390	981	5.02769	0.414005	0.112618	1.04245	1.94812	37
70	38	0.072926	982	7.0192	0.705152	0.112618	1.61714	2.85365	37
70	39	0.022195	983	4.16228	0.184671	0.056309	0.609716	1.33287	38
70	40	0.022195	984	2.56155	0.207603	0.112618	0.487075	0.850598	2
70	41	4.17902	985	1.52796	2.78709	1.97082	8.57302	1.39953	40
70	42	0.041219	986	2	0.284508	0.168928	0.646317	0.806453	6
70	43	2.47634	987	1.11663	2.07074	1.74559	5.77209	1.07065	2
70	44	1.83902	988	1.52535	1.66908	1.2388	5.2273	1.18238	44
71	1	0.041219	989	1.74755	0.286537	0.168928	0.609716	0.717701	44

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
71	2	0.187073	990	1.35611	0.577257	0.450474	1.55909	1.034	37
71	3	0.053902	991	1.59629	0.298057	0.225237	0.871554	1.12143	33
71	4	2.43195	992	2.02248	3.72688	1.35142	8.75884	2.51032	26
71	5	0.285365	993	1.12743	0.621724	0.619401	2.16143	1.30278	0
71	6	0.726096	994	1.60579	0.975574	0.844638	3.366	1.24172	0
71	7	2.52073	995	1.10602	2.02579	1.74559	5.9882	1.13203	29
71	8	0.104634	996	1.84924	0.426945	0.281546	1.18244	1.06334	38
71	9	0.320243	997	1.86156	0.703824	0.450474	2.16954	1.16962	38
71	10	1.40463	998	1.46823	1.49357	1.18249	4.86804	1.34257	37
71	11	5.56463	999	1.17714	5.56674	2.53391	13.1327	2.4664	38
71	12	0.120488	1000	1.15301	0.470955	0.394164	1.21887	0.98121	38
72	1	0.079268	1001	1.27703	0.395593	0.281546	0.881577	0.78021	0
72	2	4.25512	1002	1.27083	4.4451	2.70284	10.8047	2.18326	16
72	3	3.32926	1003	1.42457	2.3313	1.8582	7.51874	1.35124	2
72	4	2.48585	1004	2.03558	2.60378	1.35142	7.11698	1.62146	38
72	5	0.133171	1005	1.59067	0.499937	0.337855	1.25603	0.942723	37
72	6	0.412194	1006	1.18632	0.96518	0.73202	2.78449	1.49685	38
72	7	0.228292	1007	1.52254	0.604581	0.450474	1.81271	1.14539	8
72	8	1.18585	1008	1.19444	1.42814	1.18249	4.00888	1.07846	38
72	9	0.044390	1009	2	0.296245	0.168928	0.65634	0.772256	33
73	1	2.06731	1010	1.12761	2.01003	1.74559	6.07706	1.42158	38
73	2	0.098292	1011	1.60039	0.566104	0.337855	1.47947	1.77207	46
73	3	0.091951	1012	1.8	0.39811	0.281546	1.11503	1.07599	38
73	4	0.142683	1013	1.86634	0.469722	0.337855	1.44827	1.16982	46
73	5	0.022195	1014	2.08114	0.21	0.112618	0.454077	0.739253	37
73	6	0.145853	1015	4.2578	1.06419	0.225237	2.40249	3.14917	29
73	7	0.142683	1016	1.28571	0.481686	0.394164	1.4253	1.133	44
73	8	0.577072	1017	1.5705	0.927104	0.73202	2.93979	1.19177	33
73	9	0.237804	1018	1.25507	0.648716	0.506783	1.76552	1.04307	33
73	10	0.098292	1019	1.43596	0.402712	0.337855	1.17641	1.12044	5
73	11	2.55878	1020	1.69052	2.36356	1.46404	6.8923	1.47736	38
73	12	0.050731	1021	1.52475	0.303323	0.225237	0.941152	1.38941	40
73	13	0.253658	1022	1.12743	0.689533	0.619401	2.1148	1.40308	32
73	14	1.7978	1023	1.12632	1.77606	1.46404	4.8806	1.05437	38
73	15	0.025365	1024	2.08114	0.224424	0.112618	0.487075	0.744273	0
73	16	0.17439	1025	1.49812	0.563961	0.394164	1.47851	0.997511	38
73	17	0.076097	1026	2.26556	0.36849	0.225237	1.15	1.38299	13
74	1	0.447072	1027	1.52831	0.884775	0.619401	2.43684	1.05698	11
74	2	2.28609	1028	1.81042	1.77308	1.35142	5.93645	1.22673	38
74	3	0.034878	1029	2.56155	0.263356	0.112618	0.566696	0.732721	37
74	4	0.142683	1030	1.35504	0.461794	0.394164	1.46066	1.18992	23
74	5	2.7078	1031	1.33422	2.02712	1.74559	6.34019	1.18135	1
74	6	1.92463	1032	1.24288	1.72574	1.52035	5.31812	1.16939	29
74	7	0.466097	1033	1.69962	1.85657	0.73202	4.21525	3.03362	38
74	8	0.063414	1034	1.36619	0.304973	0.281546	0.977753	1.19966	2
74	9	6.43023	1035	1.25045	2.84455	2.81546	10.0567	1.25163	16
74	10	1.29366	1036	1.8048	1.43333	0.957256	4.32663	1.15152	0
74	11	0.031707	1037	1.53518	0.251455	0.168928	0.530095	0.705243	2
74	12	5.62487	1038	1.45339	3.73272	2.59022	10.4793	1.5536	46
75	1	0.187073	1039	1.39975	0.577257	0.450474	1.55909	1.034	38
75	2	0.028536	1040	1.38743	0.238854	0.168928	0.487075	0.661576	37
75	3	1.98805	1041	1.31414	3.12585	1.52035	7.5237	2.26583	38
75	4	0.031707	1042	2.56155	0.249543	0.112618	0.566696	0.805993	38
75	5	0.34878	1043	1.46015	0.740331	0.563092	2.25389	1.15905	6
75	6	0.43439	1044	1.67857	0.771592	0.619401	2.58898	1.22792	44

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
75	7	0.155366	1045	2.23961	0.501352	0.281546	1.49005	1.13721	13
75	8	0.859267	1046	1.78066	1.19805	0.844638	3.83055	1.35889	29
75	9	0.041219	1047	1.7077	0.284824	0.168928	0.64215	0.796088	2
75	10	2.54292	1048	1.19802	1.97546	1.74559	6.12661	1.17462	40
75	11	0.069756	1049	1.27703	0.361981	0.281546	0.908155	0.940868	38
75	12	0.041219	1050	1.7077	0.285969	0.168928	0.623343	0.750139	14
75	13	3.20243	1051	1.50038	2.21575	1.68928	7.32211	1.33224	38
75	14	0.047560	1052	2.03301	0.289436	0.168928	0.791933	1.04934	29
75	15	0.117317	1053	1.64222	0.435299	0.281546	1.29556	1.13853	38
75	16	0.060243	1054	2.44152	0.322951	0.168928	0.900384	1.07086	38
75	17	0.136341	1055	1.63433	0.486995	0.394164	1.53392	1.37331	8
75	18	3.48146	1056	1.52173	2.16773	1.74559	7.34469	1.23304	29
75	19	0.13	1057	1.23082	0.4905	0.394164	1.25964	0.971266	37
76	1	0.060243	1058	2.01777	0.300358	0.225237	0.948697	1.18887	38
76	2	0.069756	1059	3.08207	0.298564	0.168928	1.046	1.24816	38
76	3	0.044390	1060	1.82405	0.289118	0.168928	0.722334	0.935363	18
76	4	3.28487	1061	1.46511	1.97899	1.74559	7.2158	1.26136	47
76	5	0.028536	1062	3	0.227766	0.112618	0.599693	1.00288	13
76	6	2.6	1063	1.49773	2.49511	1.68928	7.07429	1.53174	38
76	7	0.044390	1064	2.36092	0.386296	0.168928	1.00242	1.80136	14
76	8	1.13829	1065	1.57688	1.35362	0.957256	4.04035	1.14124	46
76	9	0.149024	1066	1.07697	0.537519	0.450474	1.26606	0.855932	38
76	10	0.063414	1067	1.2	0.344139	0.281546	0.871554	0.953213	38
76	11	0.459755	1068	1.31965	0.768986	0.73202	2.6837	1.24661	40
76	12	0.041219	1069	1.59629	0.276337	0.225237	0.851001	1.39813	38
76	13	0.022195	1070						13
76	14	0.30439	1071	1.55556	0.668317	0.506783	2.14195	1.19944	37
76	15	0.237804	1072	1.30781	0.659981	0.506783	1.72013	0.990135	38
76	16	0.047560	1073	1.36803	0.299061	0.225237	0.748912	0.938431	38
76	17	0.044390	1074	1.5	0.281338	0.225237	0.758935	1.03255	38
77	1	0.025365	1075	1.91421	0.224672	0.112618	0.417476	0.546771	38
77	2	0.038048	1076	3.04951	0.267581	0.112618	0.669291	0.936872	38
77	3	0.028536	1077	8.07107	0.318584	0.056309	0.816315	1.85825	38
77	4	0.025365	1078	7.08276	0.251401	0.056309	0.704597	1.55748	38
77	5	0.063414	1079	8.5	0.837999	0.112618	1.82735	4.19028	37
77	6	0.076097	1080	2.26556	0.356627	0.225237	1.02956	1.10846	19
77	7	2.9678	1081	1.80747	1.89108	1.52035	6.85424	1.25972	46
77	8	0.161707	1082	1.20543	0.736036	0.506783	1.91147	1.79803	38
77	9	0.053902	1083	1.83114	0.289865	0.225237	0.888165	1.16458	38
77	10	0.057073	1084	1.36619	0.266199	0.281546	0.961198	1.2882	38
77	11	0.101463	1085	1.59067	0.42782	0.337855	1.32997	1.38728	38
77	12	0.063414	1086	1.75	0.34916	0.225237	0.838557	0.882401	38
77	13	0.053902	1087	1.59629	0.275575	0.225237	0.908155	1.21759	38
77	14	0.095121	1088	1.2847	0.428812	0.337855	1.01717	0.865559	44
77	15	3.84609	1089	1.11106	2.91445	2.30868	8.46823	1.48373	40
77	16	0.145853	1090	1.37176	0.511804	0.394164	1.36865	1.02202	8
77	17	4.02365	1091	1.5806	3.04876	2.02713	8.73705	1.50973	29
77	18	0.107805	1092	1.74781	0.862307	0.337855	1.97465	2.87828	38
77	19	0.069756	1093	1.72315	0.571826	0.281546	1.38763	2.19662	4
77	20	0.643657	1094	1.73746	1.26712	0.73202	3.55018	1.55825	38
77	21	0.031707	1095	1.7077	0.250251	0.168928	0.556673	0.777734	38
78	1	0.025365	1096	5.12311	0.222002	0.056309	0.520072	0.848532	37
78	2	0.047560	1097	1.59629	0.302415	0.225237	0.725938	0.881738	38
78	3	0.022195	1098	2.08114	0.21	0.112618	0.454077	0.739253	38
78	4	0.025365	1099	3	0.205451	0.112618	0.595526	1.11261	37

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
78	5	0.117317	1100	1.36852	0.46966	0.337855	1.17641	0.938747	47
78	6	0.038048	1101	1.25	0.256537	0.225237	0.715915	1.07195	31
78	7	0.028536	1102	2.08114	0.238804	0.112618	0.4641	0.600638	40
78	8	0.095121	1103	1.2847	0.416867	0.337855	1.09037	0.994624	2
78	9	5.47902	1104	1.40599	2.86891	2.36499	9.04078	1.18713	38
78	10	0.149024	1105	1.08995	0.906801	0.563092	2.14228	2.45068	38
78	11	3.3039	1106	1.31188	5.0755	2.08344	11.4529	3.15933	40
78	12	0.053902	1107	3.54138	0.317564	0.112618	0.801956	0.949474	46
78	13	0.028536	1108	2.30278	0.238696	0.112618	0.497098	0.689084	37
79	1	0.142683	1109	1.43004	0.622761	0.450474	1.70375	1.61893	40
79	2	0.025365	1110	1.66667	0.22206	0.168928	0.519509	0.846695	40
79	3	0.145853	1111	2.33973	0.751106	0.337855	1.89058	1.95013	38
79	4	0.30756	1112	1.80715	0.764993	0.506783	2.33407	1.40958	38
79	5	0.025365	1113	2.56155	0.223882	0.112618	0.497098	0.77522	38
79	6	0.063414	1114	1.2	0.350741	0.281546	0.82493	0.853956	38
79	7	0.047560	1115	2.33333	0.277148	0.168928	0.82493	1.13861	2
79	8	3.20243	1116	1.23299	2.05913	1.97082	7.06095	1.2389	12
79	9	3.87146	1117	1.46994	2.52007	1.8582	7.39993	1.12557	32
79	10	4.23609	1118	1.70384	2.61636	1.8582	8.47088	1.34797	16
79	11	0.903657	1119	2.18069	1.37267	0.788329	4.06198	1.45299	37
79	12	0.932194	1120	1.35428	1.17948	0.957256	3.73476	1.19072	0
80	1	0.13	1121	1.60039	0.429268	0.337855	1.40891	1.21511	29
80	2	0.025365	1122	7.08276	0.242282	0.056309	0.693955	1.51079	29
80	3	0.028536	1123	3.19258	0.196066	0.112618	0.665124	1.23366	29
80	4	0.440731	1124	1.86674	1.58368	0.67571	3.72395	2.50395	1
80	5	1.79463	1125	1.40398	1.48204	1.35142	5.38592	1.28628	0
80	6	0.044390	1126	2.03301	0.274082	0.168928	0.78191	1.09601	40
80	7	1.16683	1127	1.93542	1.26004	0.900947	4.37213	1.30367	40
80	8	0.155366	1128	1.32089	0.537159	0.394164	1.37226	0.964506	41
80	9	0.047560	1129	1.36803	0.301073	0.225237	0.735961	0.906254	46
80	10	0.060243	1130	1.52475	0.340535	0.225237	0.815583	0.878645	38
80	11	0.028536	1131	5.12311	0.237281	0.056309	0.530095	0.783603	4
80	12	0.570731	1132	1.72057	0.919145	0.67571	2.92757	1.19502	16
80	13	5.64706	1133	1.2015	2.62448	2.64653	9.44716	1.25768	46
80	14	0.107805	1134	1.81245	0.41756	0.281546	1.24134	1.13745	22
80	15	19.037	1135	1.36341	13.5097	5.68723	29.8377	3.72152	22
81	1	1.42049	1136	1.45782	2.23582	1.18249	5.7423	1.84725	40
81	2	0.047560	1137	3.04951	0.305982	0.112618	0.689337	0.795067	0
81	3	0.158536	1138	1.15578	0.522504	0.450474	1.46483	1.07705	38
81	4	0.107805	1139	1.18287	0.460096	0.394164	1.38881	1.42376	46
81	5	0.272682	1140	1.21803	0.700624	0.563092	1.86811	1.01845	24
81	6	6.52218	1141	1.16856	3.09608	2.81546	9.91166	1.19864	7
81	7	3.66536	1142	2.32765	3.30405	1.52035	8.82681	1.69153	7
81	8	1.36024	1143	1.56162	1.49094	1.12618	4.80655	1.35158	1
81	9	2.62219	1144	1.38405	1.85736	1.68928	6.53829	1.29734	44
81	10	0.079268	1145	1.46491	0.389122	0.281546	0.947008	0.900324	33
81	11	1.84219	1146	2.04123	2.39064	1.12618	6.32245	1.72674	0
81	12	0.180731	1147	1.77168	0.451977	0.394164	1.70369	1.27802	8
81	13	3.94755	1148	1.0743	2.39116	2.30868	7.73356	1.20565	16
82	1	2.07366	1149	1.25025	1.86643	1.52035	5.36227	1.10345	15
82	2	0.519999	1150	1.15234	0.959509	0.788329	2.60993	1.04243	3
82	3	6.64267	1151	1.23431	3.22991	2.75915	9.83801	1.15948	11
82	4	1.86122	1152	1.25194	1.61444	1.52035	5.34172	1.21999	29
82	5	0.171219	1153	2.27485	0.58099	0.337855	1.75139	1.42561	7
82	6	2.75853	1154	1.81312	2.24107	1.46404	6.94394	1.39099	14

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
82	7	2.70463	1155	1.46	1.93885	1.63297	6.44684	1.22286	44
82	8	0.076097	1156	2.69036	0.36262	0.168928	1.013	1.0731	1
82	9	3.65585	1157	1.48473	3.42836	2.08344	8.98943	1.759	1
82	10	1.44902	1158	1.29937	1.54044	1.2388	4.53013	1.12703	19
82	11	4.04585	1159	1.5492	3.35916	2.08344	9.12716	1.63852	38
82	12	0.440731	1160	1.71714	1.02547	0.619401	2.91051	1.52952	37
82	13	1.2239	1161	1.43981	2.23869	1.2388	5.57078	2.01779	46
83	1	0.050731	1162	2.44152	0.303133	0.168928	0.801956	1.00882	16
83	2	0.358292	1163	1.54222	0.708386	0.563092	2.34365	1.21994	37
83	3	0.240975	1164	1.14403	0.634028	0.563092	1.8336	1.11026	40
83	4	0.155366	1165	1.36343	0.521057	0.394164	1.43825	1.05951	37
83	5	0.450243	1166	1.25362	0.75798	0.73202	2.70397	1.29225	18
83	6	6.16072	1167	1.10921	3.10729	2.87177	9.48027	1.16091	37
83	7	0.355121	1168	1.31397	0.797516	0.619401	2.4856	1.38445	37
83	8	0.072926	1169	1.83114	0.371072	0.225237	0.922795	0.929211	38
83	9	0.221951	1170	1.47129	0.642867	0.450474	1.63573	0.9593	19
83	10	5.51389	1171	1.34904	2.92674	2.4213	8.99162	1.16683	38
83	11	0.038048	1172	1.53518	0.275798	0.168928	0.563092	0.663146	2
83	12	3.71292	1173	1.26083	2.30336	2.08344	7.51902	1.21171	0
83	13	0.187073	1174	1.54984	0.589593	0.394164	1.50492	0.963399	16
84	1	1.54731	1175	1.60964	1.43886	1.18249	4.90189	1.23577	2
84	2	13.558	1176	1.51915	4.64478	3.6601	15.1275	1.34316	0
84	3	0.890974	1177	2.3075	1.71124	0.788329	4.4638	1.77965	37
84	4	0.415365	1178	1.39363	2.05934	0.73202	4.52208	3.91775	37
84	5	2.33683	1179	1.09268	2.03849	1.68928	5.51673	1.0364	38
84	6	0.110975	1180	1.2847	0.463446	0.337855	1.09623	0.861717	10
84	7	3.78585	1181	1.64733	3.78051	1.91451	9.56384	1.92261	38
85	1	0.022195	1182						7
85	2	2.32414	1183	1.2521	1.98777	1.57666	5.64534	1.09121	1
85	3	1.24292	1184	1.55143	1.44751	1.01357	4.14492	1.09996	38
85	4	0.038048	1185	1.36803	0.260365	0.225237	0.70302	1.03368	38
85	5	0.025365	1186	2.5	0.223882	0.112618	0.497098	0.77522	38
85	6	0.038048	1187	0.848528	0.241949	0.281546	0.748912	1.17304	38
85	7	0.028536	1188						38
85	8	0.022195	1189						38
85	9	1.38244	1190	1.22457	2.12829	1.40773	5.55569	1.77673	37
85	10	0.336097	1191	1.26184	1.16461	0.67571	2.9064	2.00003	0
85	11	0.104634	1192	1.65602	0.421404	0.281546	1.19882	1.09302	37
85	12	1.21756	1193	1.18807	3.47114	1.35142	7.64381	3.81873	6
85	13	2.11487	1194	1.39567	1.79404	1.57666	5.94575	1.3302	33
85	14	1.99122	1195	1.50202	2.49138	1.46404	6.58125	1.73097	38
85	15	0.025365	1196						38
85	16	0.025365	1197						37
85	17	0.022195	1198	4.16228	0.210681	0.056309	0.417476	0.624881	38
85	18	0.050731	1199	2.36092	0.309609	0.168928	0.768959	0.927507	38
85	19	0.022195	1200						38
85	20	0.022195	1201						37
85	21	0.044390	1202	1.52475	0.265546	0.225237	0.801393	1.15131	46
86	1	0.142683	1203	1.6759	0.517042	0.337855	1.30266	0.946409	2
86	2	2.92658	1204	2.05292	1.99272	1.35142	6.92271	1.30311	16
86	3	4.29633	1205	1.70942	3.15684	2.02713	9.0356	1.51219	40
86	4	0.126829	1206	2.23961	0.457659	0.281546	1.33582	1.11962	38
86	5	0.044390	1207	2.33333	0.271803	0.168928	0.787766	1.11249	2
86	6	6.58243	1208	1.6773	4.55522	2.47761	12.0005	1.74102	38
86	7	0.231463	1209	2.74976	1.55579	0.394164	3.40913	3.99572	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
86	8	0.025365	1210	2.5	0.223882	0.112618	0.497098	0.77522	38
86	9	0.022195	1211						38
86	10	0.031707	1212	2.73607	0.249543	0.112618	0.566696	0.805993	38
86	11	0.025365	1213	7.08276	0.244008	0.056309	0.695925	1.51938	38
86	12	0.031707	1214	4.14005	0.373636	0.112618	0.916995	2.1104	38
86	13	0.025365	1215	2.08114	0.22523	0.112618	0.454077	0.646846	38
86	14	0.069756	1216	3.68329	0.647924	0.168928	1.51117	2.60517	38
86	15	0.139512	1217	2.29047	1.3297	0.394164	2.86924	4.69582	38
86	16	0.076097	1218	4.38851	0.961629	0.168928	2.08153	4.53089	38
86	17	0.022195	1219						38
86	18	0.025365	1220						38
86	19	0.031707	1221						38
86	20	0.031707	1222						38
86	21	0.025365	1223	7.08276	0.244008	0.056309	0.695925	1.51938	38
86	22	0.091951	1224	8.07107	1.06382	0.056309	2.30051	4.58018	38
86	23	0.025365	1225						38
86	24	0.028536	1226	3.5	0.227587	0.112618	0.705949	1.38974	38
86	25	0.066585	1227	7	0.642354	0.112618	1.49203	2.66051	38
86	26	0.025365	1228						38
86	27	0.044390	1229	4.03553	0.254635	0.112618	0.857927	1.31948	38
86	28	0.034878	1230	7.08276	0.234347	0.056309	0.712311	1.15765	38
86	29	0.031707	1231	2.56155	0.250251	0.112618	0.556673	0.777734	38
86	30	0.028536	1232	6.09902	0.229908	0.056309	0.58967	0.969632	38
86	31	0.038048	1233						38
86	32	0.076097	1234	4.3472	0.742714	0.168928	1.69035	2.98794	38
86	33	0.063414	1235	16.1327	0.776483	0.056309	1.7163	3.69649	38
86	34	0.063414	1236	1.59629	0.352866	0.225237	0.801956	0.807053	29
86	35	0.025365	1237						29
86	36	0.028536	1238						38
86	37	0.025365	1239						38
86	38	0.022195	1240	4.16228	0.210681	0.056309	0.417476	0.624881	37
86	39	0.028536	1241	1.74755	0.232207	0.168928	0.576719	0.927507	38
86	40	0.047560	1242	2.36092	0.285949	0.168928	0.904551	1.36901	37
86	41	0.104634	1243	5.34443	0.989151	0.168928	2.18986	3.64714	38
86	42	0.038048	1244	10.0554	0.432455	0.056309	1.04088	2.26594	38
86	43	0.034878	1245	0.909137	0.441117	0.394164	1.04037	2.46952	38
86	44	0.120488	1246	2.28806	0.398324	0.281546	1.37045	1.24044	37
86	45	0.022195	1247						37
86	46	0.025365	1248	3	0.205451	0.112618	0.595526	1.11261	46
86	47	0.142683	1249	1.29461	0.507617	0.394164	1.34804	1.01351	4
86	48	2.16244	1250	2.58398	3.22504	1.18249	7.79111	2.23381	0
86	49	2.32414	1251	1.19801	2.09119	1.80189	6.40517	1.40472	38
86	50	0.022195	1252						38
86	51	0.022195	1253	5.12311	0.207603	0.056309	0.487075	0.850598	38
86	52	0.110975	1254	1.65602	0.463383	0.281546	1.09679	0.862603	20
86	53	0.199756	1255	1.15933	0.603378	0.506783	1.5833	0.998662	16
86	54	13.6627	1256	1.39895	8.66146	4.11057	20.4777	2.44241	13
86	55	2.97097	1257	1.58057	3.09285	1.80189	8.10689	1.76036	46
86	56	0.183902	1258	1.50567	0.512857	0.450474	1.67312	1.21131	38
86	57	0.022195	1259	2.56155	0.203543	0.112618	0.515905	0.954273	8
86	58	6.39218	1260	1.36478	3.17648	2.53391	9.63586	1.1559	38
86	59	0.034878	1261	4.14005	0.348273	0.112618	0.896837	1.83512	38
86	60	0.031707	1262						38
86	61	0.028536	1263						38
86	62	0.034878	1264	8.07107	0.40394	0.056309	0.980568	2.19379	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
86	63	0.038048	1265						38
86	64	0.022195	1266	2.5	0.207603	0.112618	0.487075	0.850598	38
86	65	0.066585	1267	9.51388	0.94785	0.112618	2.0362	4.95509	38
86	66	0.038048	1268	3.54138	0.254328	0.112618	0.722334	1.09126	37
86	67	0.095121	1269	1.34518	0.340916	0.337855	1.22596	1.25738	29
86	68	0.675365	1270	1.11109	0.940869	0.957256	3.24628	1.24172	46
86	69	1.93097	1271	1.24344	3.46232	1.52035	8.04005	2.66399	38
86	70	0.095121	1272	1.98885	0.61578	0.281546	1.54051	1.98535	38
86	71	0.025365	1273	0.745356	0.183125	0.168928	0.628523	1.23932	38
87	1	0.034878	1274	1.53518	0.267272	0.168928	0.795536	1.44397	37
87	2	0.041219	1275	4	0.242459	0.112618	0.82493	1.31378	38
87	3	0.025365	1276	6.09902	0.185701	0.056309	0.626327	1.23068	38
87	4	0.117317	1277	1.43596	0.455136	0.337855	1.24184	1.04608	38
87	5	0.066585	1278	4.38851	0.609996	0.168928	1.43831	2.47238	37
87	6	0.986096	1279	1.44888	1.62102	1.01357	4.45868	1.60429	38
87	7	0.047560	1280	1.36803	0.306647	0.225237	0.679314	0.772114	37
87	8	0.022195	1281	0.883883	0.162209	0.225237	0.59333	1.26219	29
87	9	0.114146	1282	1.84924	0.450487	0.281546	1.21943	1.03668	38
87	10	0.044390	1283	5.02769	0.414005	0.112618	1.04245	1.94812	38
87	11	0.022195	1284	5.12311	0.207603	0.056309	0.487075	0.850598	38
87	12	0.022195	1285						38
87	13	1.3761	1286	1.24424	3.44026	1.35142	7.68052	3.41132	35
87	14	0.358292	1287	1.75529	0.974439	0.563092	2.68426	1.6003	46
87	15	0.066585	1288	1.77069	0.355597	0.225237	0.875158	0.915345	37
87	16	0.288536	1289	1.23137	0.720827	0.563092	1.92116	1.01793	38
87	17	0.053902	1290	1.36803	0.326501	0.225237	0.722334	0.770299	46
87	18	0.643657	1291	1.46825	1.74987	0.844638	4.23541	2.21782	38
87	19	0.022195	1292	2.08114	0.21017	0.112618	0.449911	0.725748	38
87	20	0.063414	1293	2.44152	0.344139	0.168928	0.871554	0.953213	11
87	21	3.39902	1294	1.69697	3.14909	1.8582	8.45691	1.6744	18
87	22	2.48268	1295	1.29911	1.98146	1.63297	6.00172	1.15457	29
87	23	0.025365	1296	1.53518	0.211841	0.168928	0.576719	1.04345	38
87	24	0.095121	1297	1.41655	0.429832	0.281546	1.00782	0.849724	38
87	25	0.022195	1298	0.883883	0.162209	0.225237	0.59333	1.26219	46
87	26	0.323414	1299	1.41529	0.758688	0.563092	2.05112	1.03517	38
87	27	0.050731	1300	3.54138	0.309609	0.112618	0.768959	0.927507	37
87	28	0.101463	1301	1.34518	0.437234	0.337855	1.33858	1.40531	38
87	29	0.057073	1302	1.59629	0.360228	0.225237	1.03733	1.50035	37
87	30	0.856096	1303	1.6218	2.12728	0.957256	5.05944	2.37943	38
87	31	0.069756	1304	5.02769	0.353216	0.112618	1.10141	1.3839	16
87	32	5.38389	1305	1.36995	4.73036	2.64653	11.737	2.03615	35
87	33	0.60878	1306	2.03432	1.02086	0.619401	3.2344	1.36747	38
87	34	0.025365	1307	6.09902	0.207699	0.056309	0.58967	1.09084	38
88	1	0.050731	1308	1.52475	0.312939	0.225237	0.744746	0.870016	40
88	2	4.28365	1309	1.05521	3.22181	2.59022	9.10278	1.5393	38
88	3	0.022195	1310	2.08114	0.210681	0.112618	0.417476	0.624881	40
88	4	0.126829	1311	1.51038	0.475607	0.337855	1.28261	1.03219	13
88	5	1.69634	1312	1.3171	1.4142	1.35142	5.18867	1.26296	37
88	6	0.038048	1313	1.7077	0.269559	0.168928	0.65634	0.900965	6
88	7	3.36414	1314	1.43576	2.26123	1.80189	7.06422	1.18044	37
88	8	0.041219	1315	1.52475	0.27131	0.225237	0.730556	1.03037	38
88	9	0.041219	1316	2.76004	0.395072	0.168928	0.998813	1.926	37
88	10	0.025365	1317	2.08114	0.22523	0.112618	0.454077	0.646846	38
88	11	1.29683	1318	1.51031	2.11591	1.12618	5.4576	1.82773	8
88	12	2.47	1319	1.49797	1.81735	1.46404	6.19379	1.23597	37

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
88	13	0.034878	1320	3.66228	0.325416	0.112618	0.865191	1.7079	38
88	14	0.022195	1321	0.894427	0.209477	0.168928	0.4641	0.772249	40
89	1	0.031707	1322	1.53518	0.251455	0.168928	0.530095	0.705243	38
89	2	0.063414	1323	1.85078	0.329862	0.225237	0.928201	1.08115	38
89	3	0.079268	1324	1.36619	0.394211	0.281546	0.900384	0.813855	13
89	4	0.909999	1325	1.71255	1.20135	0.900947	3.91766	1.34215	0
89	5	1.25244	1326	3.70538	3.03247	0.73202	6.89095	3.01712	44
89	6	0.050731	1327	1.5	0.330248	0.225237	0.96773	1.46899	5
89	7	3.09463	1328	1.25804	1.91742	1.91451	7.06275	1.28271	38
89	8	0.031707	1329	1.53518	0.251455	0.168928	0.530095	0.705243	38
89	9	0.057073	1330	2.69036	0.315856	0.168928	0.871554	1.05913	37
89	10	0.038048	1331	3.04951	0.267581	0.112618	0.669291	0.936872	38
89	11	0.133171	1332	2.19425	0.910459	0.337855	2.11345	2.66912	38
89	12	0.028536	1333	3	0.227766	0.112618	0.599693	1.00288	38
89	13	0.028536	1334	1.27614	0.23853	0.168928	0.450474	0.565884	38
90	1	0.500975	1335	1.20587	0.9432	0.844638	2.94869	1.38112	1
90	2	0.881462	1336	1.85552	1.21845	0.844638	3.88376	1.36173	38
90	3	0.079268	1337	1.6	0.375889	0.281546	1.01441	1.03304	38
90	4	0.022195	1338	1.38743	0.199704	0.168928	0.533699	1.02123	40
90	5	0.13	1339	1.51038	0.49683	0.337855	1.22309	0.915727	38
90	6	0.066585	1340	1.59629	0.360441	0.225237	0.834953	0.833175	38
90	7	0.177561	1341	1.20029	0.584446	0.450474	1.40165	0.880484	40
90	8	0.057073	1342	1.59629	0.315856	0.225237	0.871554	1.05913	40
90	9	0.269512	1343	1.16667	1.13396	0.67571	2.74327	2.22203	42
90	10	5.21267	1344	1.57143	4.95333	2.36499	12.0114	2.20249	6
90	11	5.87536	1345	1.04056	3.77911	3.15332	10.6676	1.54131	16
90	12	0.890974	1346	1.52559	1.20586	0.900947	3.55688	1.12996	44
90	13	0.101463	1347	1.23385	0.441262	0.337855	1.06379	0.887557	44
90	14	0.269512	1348	1.3083	0.683724	0.563092	1.90241	1.06861	38
91	1	0.057073	1349	2.07003	0.356529	0.225237	1.03322	1.48848	40
91	2	0.098292	1350	1.48062	0.418672	0.281546	1.12922	1.03236	38
91	3	0.120488	1351	1.81245	0.454831	0.281546	1.27901	1.08042	46
91	4	0.542194	1352	1.72692	1.03575	0.67571	3.11846	1.4273	29
91	5	0.136341	1353	1.59067	0.509844	0.337855	1.24545	0.905343	24
91	6	2.68878	1354	1.50033	3.69894	1.80189	8.85169	2.31893	37
91	7	0.082438	1355	1.72315	0.316656	0.281546	1.14167	1.25817	38
91	8	0.038048	1356	2.56155	0.269559	0.112618	0.65634	0.900965	0
91	9	0.757804	1357	1.32803	1.13724	0.900947	3.21745	1.08707	38
91	10	0.187073	1358	1.1355	0.560871	0.506783	1.60988	1.10247	38
91	11	0.811706	1359	1.37416	1.91021	0.957256	4.67029	2.13835	38
91	12	0.076097	1360	1.38002	0.65914	0.337855	1.54918	2.50971	13
91	13	3.18975	1361	1.28604	2.57868	1.97082	7.63131	1.45288	44
91	14	0.504146	1362	1.27109	0.962487	0.73202	2.49737	0.984464	16
91	15	2.25122	1363	1.1823	1.86765	1.63297	5.74956	1.16854	38
91	16	0.088780	1364	1.65602	0.406418	0.281546	1.03541	0.960951	38
91	17	1.58536	1365	1.63311	2.54656	1.2388	6.33822	2.01649	13
92	1	6.10365	1366	1.59058	4.96296	2.53391	12.3856	2.00002	16
92	2	5.07633	1367	1.20388	3.58569	2.59022	10.0028	1.5685	34
92	3	0.345609	1368	1.90272	0.853061	0.506783	2.5164	1.45802	37
92	4	0.453414	1369	1.40095	1.1072	0.67571	3.03343	1.61497	37
92	5	0.646828	1370	1.54397	1.12342	0.788329	3.39837	1.42083	46
92	6	0.155366	1371	1.6759	0.535156	0.337855	1.38233	0.978727	37
92	7	0.310731	1372	1.37656	0.832803	0.619401	2.41184	1.48971	23
92	8	5.14292	1373	1.93517	3.4335	1.97082	9.86273	1.50513	38
92	9	0.060243	1374	1.83114	0.338813	0.225237	0.828534	0.906772	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
92	10	0.580243	1375	1.42033	0.917479	0.73202	3.09982	1.31781	13
92	11	1.91512	1376	1.8597	2.78024	1.29511	6.93814	2.00023	9
92	12	3.71292	1377	1.20542	2.5005	2.08344	7.16743	1.10104	21
92	13	0.78634	1378	2.21561	1.57087	0.73202	4.14289	1.73695	37
92	14	0.025365	1379	2.56155	0.219124	0.112618	0.542483	0.923237	1
92	15	9.19828	1380	1.81767	5.8226	2.98439	14.8047	1.8962	37
92	16	0.025365	1381	0.894427	0.244008	0.168928	0.695925	1.51938	29
92	17	0.038048	1382	1.7077	0.274142	0.168928	0.609716	0.777509	1
92	18	0.646828	1383	1.20196	1.08215	0.844638	2.86462	1.00957	37
93	1	0.028536	1384	2.56155	0.237032	0.112618	0.533699	0.794294	13
93	2	1.93097	1385	1.52248	2.42915	1.57666	6.44814	1.71349	46
93	3	0.025365	1386	1.66667	0.218617	0.168928	0.669291	1.40531	38
93	4	0.044390	1387	2.12839	0.289118	0.168928	0.722334	0.935363	44
93	5	0.155366	1388	1.60039	0.541344	0.337855	1.34861	0.931548	40
93	6	0.136341	1389	1.59067	0.487892	0.337855	1.34804	1.06064	44
93	7	0.418536	1390	1.17021	0.776855	0.73202	2.52029	1.2077	29
93	8	0.088780	1391	2.05278	0.412877	0.225237	0.994195	0.885965	40
93	9	0.091951	1392	1.34518	0.380921	0.337855	1.1558	1.15611	37
93	10	0.640487	1393	1.45832	0.890134	0.788329	3.17832	1.25509	9
93	11	5.99584	1394	1.35352	4.39868	2.87177	11.5236	1.76244	40
93	12	0.025365	1395	1.66667	0.222625	0.168928	0.513653	0.827714	37
93	13	0.025365	1396	5.12311	0.223882	0.056309	0.497098	0.77522	40
93	14	0.145853	1397	1.39975	0.907527	0.450474	2.13648	2.49042	6
93	15	3.2278	1398	1.72132	2.49623	1.63297	7.5786	1.41599	41
93	16	0.053902	1399	2.12839	0.312996	0.168928	0.824367	1.00328	26
93	17	0.358292	1400	1.53178	0.787132	0.563092	2.19719	1.07223	16
93	18	0.805365	1401	1.42323	1.10486	0.957256	3.45874	1.18204	29
93	19	0.031707	1402	1.53518	0.251684	0.168928	0.520072	0.678825	37
94	1	0.149024	1403	1.49812	0.45414	0.394164	1.51427	1.22444	2
94	2	4.59438	1404	1.40001	2.53489	2.19606	8.39429	1.22048	46
94	3	0.206097	1405	1.43004	0.59205	0.450474	1.68077	1.09078	0
94	4	1.91829	1406	1.24557	1.59945	1.46404	5.59759	1.2998	38
94	5	0.149024	1407	1.42857	0.522339	0.394164	1.36223	0.990914	38
94	6	0.041219	1408	3.04951	0.282312	0.112618	0.669291	0.864805	38
94	7	0.028536	1409	1.38743	0.238854	0.168928	0.487075	0.661576	0
94	8	0.310731	1410	1.44536	0.729225	0.563092	2.05743	1.08406	37
94	9	0.440731	1411	1.51598	2.10937	0.788329	4.63661	3.88167	41
94	10	0.101463	1412	1.33333	0.418625	0.337855	1.16999	1.07361	38
94	11	0.126829	1413	1.66667	0.408067	0.337855	1.43774	1.29698	38
94	12	0.145853	1414	1.60039	0.510875	0.337855	1.37226	1.02741	40
94	13	0.085609	1415	3.34233	0.991622	0.225237	2.15591	4.32045	44
94	14	0.104634	1416	2.28806	0.59182	0.281546	1.53724	1.79722	29
94	15	0.060243	1417	2	0.283246	0.225237	0.967786	1.23719	38
94	16	0.234634	1418	1.08489	0.667857	0.563092	1.64057	0.912827	38
94	17	0.133171	1419	1.32089	0.501858	0.394164	1.53443	1.40693	46
94	18	0.199756	1420	1.27744	0.518846	0.450474	1.75966	1.23353	20
94	19	0.646828	1421	1.34918	1.03447	0.788329	3.01451	1.11798	38
94	20	0.424877	1422	1.08662	1.00832	0.788329	2.85938	1.53134	46
94	21	0.079268	1423	1.77069	0.358358	0.225237	1.06379	1.13607	0
95	1	0.072926	1424	1.83114	0.376449	0.225237	0.881577	0.848055	38
95	2	1.05268	1425	1.41801	2.48729	1.06987	5.82102	2.56148	44
95	3	0.053902	1426	1.59629	0.322417	0.225237	0.768959	0.872948	37
95	4	0.326585	1427	1.44237	0.947416	0.619401	2.58425	1.62729	40
95	5	0.13	1428	1.38002	0.470138	0.337855	1.33509	1.09111	15
95	6	0.26317	1429	2.31879	0.626068	0.394164	2.09284	1.32442	21

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
95	7	0.034878	1430	8.07107	0.281445	0.056309	0.81074	1.49969	34
95	8	0.028536	1431	2.73607	0.210861	0.112618	0.646317	1.16488	21
95	9	1.96902	1432	2.01765	5.12705	1.35142	11.0222	4.90993	37
95	10	0.025365	1433	4.16228	0.225237	0.056309	0.450474	0.63662	46
95	11	0.031707	1434	1.66667	0.251345	0.168928	0.533699	0.714864	40
95	12	0.072926	1435	1.33137	0.374289	0.281546	0.900384	0.884625	33
95	13	0.193414	1436	1.63433	0.533794	0.394164	1.706	1.19746	9
95	14	3.26268	1437	1.3127	2.89153	1.97082	8.03977	1.57653	0
95	15	0.060243	1438	1.59629	0.34208	0.225237	0.801956	0.84953	41
95	16	0.187073	1439	1.20029	0.589829	0.450474	1.50368	0.961813	46
95	17	0.294878	1440	1.24083	1.05947	0.619401	2.67559	1.93191	37
96	1	0.225122	1441	1.35337	0.545023	0.506783	1.87284	1.23987	8
96	2	1.04951	1442	1.625	1.23703	0.900947	3.98241	1.20253	38
96	3	0.26	1443	1.63538	0.658534	0.450474	1.90472	1.1104	7
96	4	3.76365	1444	1.21374	2.27098	2.13975	7.62089	1.22798	38
96	5	0.022195	1445	4.16228	0.210681	0.056309	0.417476	0.624881	13
96	6	0.640487	1446	1.08758	1.07032	0.900947	2.87656	1.02808	4
96	7	0.063414	1447	1.83114	0.345862	0.225237	0.861531	0.931414	6
96	8	1.61707	1448	1.40149	1.63348	1.2388	4.77147	1.12038	40
97	1	0.640487	1449	1.29971	2.29982	0.957256	5.15663	3.30378	46
97	2	0.034878	1450	3.66228	0.238119	0.112618	0.769184	1.34989	2
97	3	8.46267	1451	1.23163	3.79716	3.26593	12.0517	1.36577	29
97	4	0.440731	1452	1.22047	0.864483	0.73202	2.46144	1.09395	3
97	5	4.80999	1453	1.41134	2.41605	2.13975	8.8138	1.2852	15
97	6	1.0178	1454	1.3761	1.29656	1.01357	3.78398	1.1195	21
97	7	0.583414	1455	1.248	0.824642	0.844638	3.06423	1.28073	46
97	8	0.399512	1456	1.21679	0.806146	0.67571	2.38469	1.13273	40
97	9	0.038048	1457	0.857143	0.252814	0.394164	0.806629	1.36081	38
97	10	4.2139	1458	1.40507	4.4982	2.13975	10.87	2.23133	38
97	11	0.025365	1459	2.08114	0.225131	0.112618	0.4641	0.675718	38
97	12	0.022195	1460	4.16228	0.210681	0.056309	0.417476	0.624881	38
97	13	0.022195	1461						38
97	14	0.031707	1462	2.56155	0.250251	0.112618	0.556673	0.777734	38
97	15	0.022195	1463	2.5	0.207603	0.112618	0.487075	0.850598	38
97	16	0.022195	1464	5.12311	0.203543	0.056309	0.515905	0.954273	38
97	17	0.063414	1465	1.84924	0.382388	0.281546	1.09645	1.50862	38
97	18	1.59488	1466	1.74779	3.13158	1.12618	7.28174	2.64566	38
97	19	0.022195	1467	2.08114	0.210681	0.112618	0.417476	0.624881	38
97	20	0.076097	1468	1.34518	0.564942	0.337855	1.39928	2.04754	38
97	21	0.031707	1469						38
97	22	0.104634	1470	1.15301	0.425672	0.394164	1.18643	1.07055	37
97	23	0.123658	1471	1.98885	0.42855	0.281546	1.36173	1.19329	38
97	24	0.025365	1472	0.894427	0.244008	0.168928	0.695925	1.51938	43
97	25	0.649999	1473	1.44538	1.02574	0.788329	3.04717	1.13677	38
97	26	0.031707	1474	0.888889	0.401378	0.506783	0.960748	2.31659	38
97	27	0.076097	1475	5	0.769897	0.168928	1.73748	3.15688	41
97	28	0.082438	1476	3.5	0.806306	0.225237	1.8171	3.18724	38
97	29	0.053902	1477	3.3518	0.391996	0.168928	1.05901	1.65569	38
97	30	0.022195	1478						38
97	31	0.044390	1479	9.06226	0.358147	0.056309	0.964183	1.66656	37
97	32	1.43634	1480	1.62332	3.38477	1.2388	7.61824	3.21546	6
97	33	2.16878	1481	1.17607	1.89588	1.63297	5.51594	1.11638	38
97	34	0.028536	1482	5.12311	0.237281	0.056309	0.530095	0.783603	38
97	35	0.091951	1483	1.34518	0.448718	0.337855	1.30727	1.479	38
97	36	0.072926	1484	1.2198	0.379241	0.281546	0.84858	0.785758	4

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
97	37	0.025365	1485	2.73607	0.216615	0.112618	0.556673	0.972168	38
97	38	0.022195	1486						38
98	1	0.063414	1487	2.36092	0.360269	0.168928	1.07258	1.44364	38
98	2	0.022195	1488	4.16228	0.210681	0.056309	0.417476	0.624881	38
98	3	0.028536	1489	1.82405	0.210861	0.168928	0.646317	1.16488	40
98	4	0.294878	1490	1.46284	0.736931	0.506783	1.90601	0.98039	46
98	5	0.196585	1491	2.67222	0.636488	0.337855	1.89069	1.44705	29
98	6	0.149024	1492	1.1652	0.720452	0.506783	1.8546	1.83668	37
98	7	0.022195	1493	4.16228	0.210681	0.056309	0.417476	0.624881	13
98	8	1.19536	1494	1.51499	1.34612	1.06987	4.21367	1.18198	38
98	9	0.253658	1495	1.46284	0.719987	0.506783	2.14459	1.44288	38
98	10	0.104634	1496	1.15301	0.430149	0.394164	1.17168	1.04409	38
98	11	0.792682	1497	1.46701	1.56799	0.900947	4.14706	1.72652	38
98	12	0.126829	1498	1.81245	0.484116	0.281546	1.24601	0.974124	38
98	13	0.028536	1499						38
98	14	0.107805	1500	1.2847	0.4585	0.337855	1.06379	0.835347	27
98	15	3.07243	1501	1.08661	2.02609	2.08344	7.08505	1.30015	2
98	16	6.74731	1502	1.19248	3.39908	2.98439	10.7682	1.36757	38
98	17	0.025365	1503	2.56155	0.222002	0.112618	0.520072	0.848532	44
98	18	2.99634	1504	5.56286	5.13099	0.900947	11.4299	3.46965	33
98	19	1.23024	1505	1.44613	1.43288	1.06987	4.14222	1.10985	44
98	20	0.041219	1506	2.33333	0.234919	0.168928	0.820763	1.30054	46
98	21	0.022195	1507	6.09902	0.174111	0.056309	0.585503	1.22911	40
98	22	0.041219	1508	1.83114	0.50484	0.225237	1.17298	2.65624	4
98	23	9.04291	1509	1.56631	5.69456	3.09701	14.5651	1.86685	38
98	24	0.063414	1510	1.59629	0.351747	0.225237	0.814907	0.83333	46
98	25	0.767316	1511	1.2301	0.98786	0.900947	3.47073	1.24927	38
99	1	0.079268	1512	1.33137	0.391151	0.281546	0.931129	0.870384	14
99	2	2.28292	1513	1.07949	1.90366	1.68928	5.74838	1.15183	16
99	3	2.25122	1514	1.51078	1.79964	1.40773	5.8476	1.20873	40
99	4	0.155366	1515	1.25861	0.543359	0.394164	1.33565	0.913742	38
99	5	0.072926	1516	1.41655	0.346406	0.281546	1.01441	1.12287	4
99	6	0.091951	1517	1.81245	0.406485	0.281546	1.08626	1.02118	19
99	7	1.15732	1518	1.44613	1.40105	1.06987	3.98816	1.09366	38
99	8	0.104634	1519	1.81245	0.402587	0.281546	1.23965	1.16873	38
99	9	0.057073	1520	2.69036	0.277688	0.168928	0.966435	1.30228	35
99	10	1.19536	1521	1.7053	1.47776	1.06987	4.57332	1.39237	29
99	11	0.101463	1522	1.36343	0.617248	0.394164	1.56326	1.91664	38
99	12	0.13	1523	1.5	0.491205	0.337855	1.25603	0.965717	40
99	13	0.139512	1524	1.43648	0.47046	0.394164	1.4213	1.15226	46
99	14	0.022195	1525						29
99	15	0.114146	1526	1.65738	0.458282	0.337855	1.41471	1.39529	38
99	16	0.025365	1527	1.38743	0.220394	0.168928	0.533699	0.89358	29
99	17	0.025365	1528	2.08114	0.225131	0.112618	0.4641	0.675718	38
99	18	0.228292	1529	1.30781	0.595547	0.506783	1.95776	1.33603	38
100	1	0.063414	1530	1.27703	0.337082	0.281546	0.903988	1.02548	38
100	2	0.402682	1531	1.39253	0.853383	0.619401	2.26211	1.01124	38
100	3	0.104634	1532	1.76205	0.491573	0.281546	1.40886	1.50956	12
100	4	0.811706	1533	1.14028	1.21019	0.957256	3.21751	1.01492	37
100	5	0.313902	1534	2.15985	1.07684	0.450474	2.73668	1.89865	37
100	6	0.063414	1535	1.75	0.351683	0.225237	0.815583	0.834713	46
100	7	0.104634	1536	1.43596	0.422897	0.337855	1.19466	1.08543	37
100	8	0.117317	1537	1.25861	0.71056	0.394164	1.75133	2.08049	38
100	9	0.025365	1538	6.09902	0.207699	0.056309	0.58967	1.09084	40
100	10	0.120488	1539	1.17301	0.482768	0.394164	1.14341	0.863486	29

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
100	11	0.139512	1540	2.23961	0.493214	0.281546	1.36465	1.06224	46
100	12	0.215609	1541	1.38123	0.617796	0.450474	1.68077	1.04266	46
100	13	0.285365	1542	1.55982	0.704184	0.506783	1.95556	1.06643	0
100	14	1.25561	1543	1.28296	1.40213	1.18249	4.28108	1.16156	29
100	15	0.028536	1544	5.12311	0.237281	0.056309	0.530095	0.783603	38
100	16	1.06853	1545	1.09632	1.34215	1.18249	3.8431	1.09993	40
100	17	0.025365	1546	1.38743	0.22523	0.168928	0.454077	0.646846	38
100	18	0.044390	1547	1.36803	0.296245	0.225237	0.65634	0.772256	37
100	19	0.120488	1548	1.84165	1.01085	0.337855	2.26008	3.37362	40
100	20	0.095121	1549	1.61421	0.428812	0.281546	1.01717	0.865559	40
101	1	0.114146	1550	1.9088	0.45565	0.281546	1.19888	1.00203	38
101	2	0.050731	1551	1.82405	0.316619	0.168928	0.702964	0.775136	38
101	3	0.177561	1552	1.81496	0.691812	0.394164	1.89694	1.6127	29
101	4	0.091951	1553	1.46837	0.34497	0.337855	1.22304	1.29453	32
101	5	2.00073	1554	1.41928	1.81152	1.40773	5.31992	1.12567	15
101	6	0.849755	1555	1.77869	1.60951	0.900947	4.27494	1.71142	17
101	7	1.93731	1556	1.28964	1.77324	1.40773	5.25556	1.13456	37
101	8	0.345609	1557	1.26184	1.0156	0.67571	2.7118	1.69324	38
101	9	0.177561	1558	1.02736	0.568509	0.506783	1.49433	1.00078	38
101	10	0.025365	1559	1.53518	0.223882	0.168928	0.497098	0.77522	16
101	11	2.01341	1560	1.92894	2.24423	1.2388	6.28276	1.56012	38
101	12	0.110975	1561	2.09737	0.404053	0.281546	1.29263	1.19816	44
101	13	0.332926	1562	1.36491	0.764913	0.563092	2.09819	1.05228	40
101	14	0.78634	1563	1.32485	2.51187	1.01357	5.64984	3.23037	46
102	1	0.031707	1564	3	0.244476	0.112618	0.609716	0.933011	0
102	2	0.031707	1565	2.73607	0.246845	0.112618	0.59333	0.883536	38
102	3	0.069756	1566	2.04391	0.602294	0.281546	1.43622	2.35316	0
102	4	0.462926	1567	1.32914	0.826706	0.73202	2.77334	1.32216	38
102	5	0.072926	1568	2.15394	0.466767	0.225237	1.24601	1.69413	38
102	6	0.13	1569	1.03501	0.494663	0.450474	1.23678	0.93633	40
102	7	0.034878	1570	0.970725	0.340737	0.225237	0.886194	1.79183	29
102	8	0.022195	1571	4.16228	0.210681	0.056309	0.417476	0.624881	38
102	9	0.266341	1572	1.41163	0.661854	0.506783	1.93895	1.12327	38
102	10	0.057073	1573	1.52475	0.324201	0.225237	0.838557	0.980446	2
102	11	5.77072	1574	1.89032	4.03501	2.08344	10.9303	1.64751	38
102	12	0.025365	1575	2.56155	0.217416	0.112618	0.552506	0.957669	8
102	13	1.89609	1576	1.12192	1.76518	1.57666	5.17515	1.12403	38
102	14	0.104634	1577	1.38002	0.437253	0.337855	1.14341	0.994317	0
102	15	2.04195	1578	1.3619	1.76785	1.46404	5.49386	1.17625	38
102	16	0.028536	1579	2.30278	0.238696	0.112618	0.497098	0.689084	29
102	17	0.072926	1580	1.83114	0.376449	0.225237	0.881577	0.848055	38
102	18	0.044390	1581	1.36803	0.288506	0.225237	0.725938	0.944719	15
103	1	4.73707	1582	1.3436	2.49267	2.19606	8.59684	1.24153	44
103	2	0.044390	1583	1.04853	0.278461	0.281546	0.768959	1.06001	15
103	3	2.79658	1584	1.43428	2.79278	1.74559	7.58828	1.63851	38
103	4	0.447072	1585	1.33715	1.41977	0.788329	3.46932	2.14241	6
103	5	4.01097	1586	1.54775	2.71512	1.91451	8.38478	1.39484	40
103	6	0.098292	1587	2.01108	0.399254	0.281546	1.29089	1.34911	37
103	7	0.028536	1588	1.66667	0.237675	0.168928	0.523676	0.764739	44
103	8	0.066585	1589	1.4	0.407815	0.281546	1.14218	1.55911	13
103	9	2.60317	1590	1.1361	1.91009	1.80189	6.31649	1.21966	0
103	10	0.025365	1591	4.16228	0.225237	0.056309	0.450474	0.63662	27
103	11	1.67414	1592	1.27483	1.5781	1.40773	5.00865	1.19244	44
103	12	0.025365	1593	2.08114	0.22523	0.112618	0.454077	0.646846	37
103	13	0.320243	1594	1.10055	0.739434	0.67571	2.09115	1.08663	40

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
103	14	0.26317	1595	1.18182	0.639457	0.619401	1.96429	1.16671	46
103	15	0.158536	1596	1.32089	0.545782	0.394164	1.36865	0.940258	37
104	1	0.126829	1597	1.36343	0.574942	0.394164	1.59107	1.58837	40
104	2	0.060243	1598	1.5	0.345632	0.225237	0.755332	0.753621	40
104	3	0.072926	1599	1.77069	0.360226	0.225237	0.974149	1.03551	1
104	4	3.10731	1600	1.584	2.42611	1.74559	7.41378	1.40762	38
104	5	0.022195	1601	1.61803	0.209945	0.112618	0.384479	0.530004	0
104	6	0.91634	1602	1.66805	1.25808	0.844638	3.516	1.07357	0
104	7	0.202927	1603	1.36819	0.727281	0.506783	2.0126	1.58843	37
104	8	0.120488	1604	1.54984	0.58328	0.394164	1.5797	1.64815	40
104	9	0.044390	1605	1.36803	0.302153	0.225237	0.898132	1.44605	37
104	10	0.120488	1606	1.43596	0.456964	0.337855	1.27259	1.0696	1
104	11	3.88731	1607	2.3884	3.21872	1.46404	8.85288	1.60439	16
104	12	6.6934	1608	1.89892	4.49498	2.4213	11.9681	1.70292	8
104	13	3.90316	1609	1.75709	2.67898	1.80189	8.27188	1.39502	38
104	14	0.161707	1610	1.13278	0.547799	0.450474	1.40109	0.96603	0
104	15	0.370975	1611	1.41457	0.79339	0.619401	2.25755	1.09325	1
104	16	4.60389	1612	1.42125	3.02101	2.30868	9.08994	1.42819	37
104	17	0.047560	1613	6	0.539963	0.112618	1.25609	2.63986	38
104	18	0.057073	1614	1.6	0.279729	0.281546	0.938393	1.2278	38
104	19	0.025365	1615	1.91421	0.224672	0.112618	0.417476	0.546771	20
104	20	0.041219	1616	2.03301	0.276856	0.168928	0.705892	0.961977	38
104	21	0.025365	1617	0.848528	0.251401	0.281546	0.704597	1.55748	18
104	22	2.30195	1618	1.17253	1.87529	1.68928	5.83594	1.17738	33
104	23	0.428048	1619	1.12319	0.872712	0.73202	2.36014	1.03556	6
105	1	2.53658	1620	1.82213	2.03047	1.40773	6.55946	1.34982	46
105	2	0.047560	1621	1.75	0.305939	0.225237	0.922795	1.42479	44
105	3	0.462926	1622	1.46367	1.07396	0.73202	3.01001	1.55745	40
105	4	0.025365	1623	4.16228	0.225237	0.056309	0.450474	0.63662	44
105	5	0.285365	1624	1.41163	0.722624	0.506783	1.88591	0.991813	15
105	6	0.65634	1625	1.77098	1.01153	0.73202	3.32078	1.33703	38
105	7	0.088780	1626	1.23082	0.58639	0.394164	1.47558	1.95164	38
105	8	0.025365	1627	1.53518	0.24591	0.168928	0.698122	1.52899	40
105	9	0.060243	1628	1.2	0.274089	0.281546	0.974149	1.25351	37
105	10	0.047560	1629	2.33333	0.227136	0.168928	0.871554	1.27095	38
105	11	0.022195	1630	1.38743	0.207603	0.168928	0.487075	0.850598	16
105	12	2.38756	1631	1.18726	1.85487	1.74559	6.28411	1.3162	4
105	13	0.038048	1632	1.7077	0.275561	0.168928	0.576719	0.69563	2
105	14	4.78146	1633	1.32462	2.71161	2.13975	8.39649	1.17334	38
106	1	0.034878	1634	1.66667	0.263996	0.168928	0.543722	0.674516	8
106	2	3.96975	1635	1.44711	2.28714	1.97082	7.86578	1.24025	38
106	3	0.979755	1636	1.43585	1.20833	0.957256	4.03833	1.32457	15
106	4	0.630975	1637	1.20302	1.01931	0.900947	2.98298	1.12222	0
106	5	0.022195	1638	2.08114	0.210681	0.112618	0.417476	0.624881	35
106	6	0.031707	1639	3.04951	0.244476	0.112618	0.609716	0.933011	44
106	7	0.123658	1640	1.38002	0.471404	0.337855	1.25964	1.02107	1
106	8	1.32219	1641	1.10396	1.47617	1.35142	4.31661	1.12145	29
106	9	0.161707	1642	2.03006	0.419056	0.337855	1.60988	1.27541	44
106	10	0.034878	1643	7.08276	0.382633	0.056309	0.947571	2.04862	15
106	11	1.08122	1644	1.20434	1.26353	1.12618	4.03163	1.19629	20
106	12	0.057073	1645	2.03301	0.334903	0.168928	0.758935	0.803098	38
106	13	0.069756	1646	1.33137	0.360951	0.281546	0.914011	0.953041	38
106	14	0.038048	1647	3.54138	0.219299	0.112618	0.773294	1.25066	40
106	15	0.047560	1648	10.0554	0.40425	0.056309	1.0438	1.82296	46
106	16	0.789511	1649	1.49184	1.07437	0.844638	3.4522	1.20123	40

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
106	17	0.041219	1650	1.53518	0.286537	0.168928	0.609716	0.717701	38
107	1	0.066585	1651	1.59629	0.351695	0.225237	0.898132	0.964034	13
107	2	0.976584	1652	1.71321	1.23292	0.844638	3.78201	1.16554	38
107	3	1.30634	1653	1.19216	1.57668	1.29511	4.81044	1.40962	38
107	4	0.047560	1654	1.75	0.293342	0.225237	0.77718	1.01061	38
107	5	0.038048	1655	1.82405	0.274142	0.168928	0.609716	0.777509	37
107	6	0.104634	1656	1.54104	0.416977	0.337855	1.33582	1.35711	2
107	7	4.92731	1657	1.1036	2.86099	2.53391	8.30606	1.11422	38
107	8	0.038048	1658	1.7077	0.27471	0.168928	0.599693	0.752156	38
107	9	0.592926	1659	1.35913	0.943548	0.788329	2.97442	1.18739	38
107	10	0.031707	1660	3.5	0.196153	0.112618	0.708145	1.25856	38
107	11	0.247317	1661	1.37797	0.822916	0.506783	2.24691	1.62445	40
107	12	1.13512	1662	1.05756	1.2619	1.29511	4.17043	1.2193	8
107	13	10.4539	1663	1.07608	3.57313	3.82903	12.8526	1.25746	4
107	14	0.193414	1664	1.39975	0.560879	0.450474	1.65932	1.13282	2
108	1	4.62292	1665	1.53692	2.69645	2.08344	8.82179	1.33964	16
108	2	0.643657	1666	1.40665	1.09454	0.844638	3.36521	1.4001	37
108	3	0.469268	1667	1.36506	1.16058	0.788329	3.12983	1.66116	37
108	4	0.776828	1668	1.37786	2.53606	1.06987	5.68475	3.31046	38
108	5	0.234634	1669	1.6302	0.61728	0.450474	1.82864	1.13411	37
108	6	0.152195	1670	1.65738	0.500696	0.337855	1.46483	1.12192	37
108	7	0.789511	1671	1.87929	1.31484	0.73202	3.8306	1.47899	38
108	8	0.025365	1672	5.12311	0.222002	0.056309	0.520072	0.848532	13
108	9	0.475609	1673	1.27357	0.919892	0.73202	2.48791	1.03564	44
108	10	0.044390	1674	2.03301	0.294522	0.168928	0.679314	0.827265	44
108	11	0.26	1675	1.37797	0.678577	0.506783	1.84514	1.04202	20
108	12	0.177561	1676	1.49812	0.577631	0.394164	1.44827	0.940035	8
108	13	7.40048	1677	1.62942	3.53033	2.4213	11.2532	1.3617	29
108	14	0.022195	1678	5.12311	0.207603	0.056309	0.487075	0.850598	29
108	15	0.028536	1679	1.53518	0.23368	0.168928	0.566696	0.895548	29
109	1	0.155366	1680	1.68148	0.574203	0.394164	1.68956	1.46211	37
109	2	0.053902	1681	2.44152	0.312005	0.168928	0.828534	1.01345	38
109	3	0.101463	1682	1.43596	0.431915	0.337855	1.11976	0.983411	16
109	4	0.944877	1683	1.62302	1.2563	0.844638	3.62879	1.10902	37
109	5	0.339268	1684	1.53178	0.649402	0.563092	2.31234	1.25415	38
109	6	0.161707	1685	1.45993	0.547788	0.394164	1.40114	0.966107	2
109	7	1.77878	1686	1.47364	1.45953	1.29511	5.35653	1.28362	38
109	8	0.085609	1687	1.65602	0.391843	0.281546	1.0496	1.02404	6
109	9	1.56634	1688	1.43594	1.4781	1.18249	4.90341	1.22152	37
109	10	0.057073	1689	2.44152	0.32682	0.168928	0.82493	0.94884	37
109	11	0.751462	1690	1.62729	1.64965	0.844638	4.21035	1.87724	16
109	12	5.78658	1691	1.4952	4.35032	2.59022	11.3609	1.775	13
109	13	0.691218	1692	1.72853	1.09039	0.73202	3.06052	1.07836	44
109	14	2.03244	1693	1.67739	1.69918	1.2388	5.56876	1.2142	1
109	15	0.580243	1694	1.35913	0.973473	0.788329	2.86963	1.12936	9
109	16	2.23853	1695	3.98284	3.80169	0.957256	8.78103	2.74105	38
110	1	0.038048	1696	1.15139	0.269559	0.225237	0.65634	0.900965	38
110	2	0.076097	1697	1.46491	0.367215	0.281546	0.997855	1.04125	38
110	3	0.028536	1698	2.56155	0.237032	0.112618	0.533699	0.794294	46
110	4	0.085609	1699	1.16667	0.402369	0.337855	0.997799	0.925452	6
110	5	3.38951	1700	1.13283	2.12361	2.13975	7.26006	1.23747	38
110	6	0.034878	1701	1.7077	0.247522	0.168928	0.679314	1.05288	38
110	7	0.072926	1702	1.36619	0.377745	0.281546	0.86795	0.82204	5
110	8	8.7956	1703	1.13208	3.15491	3.26593	11.8856	1.27811	29
110	9	0.494633	1704	1.25362	0.935693	0.73202	2.54591	1.04278	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
110	10	0.098292	1705	2.01108	0.387022	0.281546	1.20671	1.17889	41
110	11	0.034878	1706	6.09902	0.255865	0.056309	0.642713	0.942482	38
110	12	0.095121	1707	2.55489	0.379626	0.225237	1.1888	1.1823	38
110	13	0.291707	1708	1.50333	0.670097	0.506783	2.07336	1.17272	23
110	14	3.27219	1709	1.44006	2.12337	1.68928	7.32881	1.30623	16
110	15	1.61073	1710	1.76828	1.75146	1.12618	5.34222	1.40998	38
110	16	0.022195	1711	2.08114	0.210681	0.112618	0.417476	0.624881	38
110	17	0.022195	1712	2.08114	0.210681	0.112618	0.417476	0.624881	38
110	18	0.031707	1713	7.08276	0.205266	0.056309	0.702288	1.23783	38
110	19	0.053902	1714	1.59629	0.320741	0.225237	0.78191	0.9026	38
110	20	0.107805	1715	1.84924	0.433625	0.281546	1.19939	1.06187	38
110	21	0.091951	1716	1.22076	0.406184	0.337855	1.08744	1.0234	38
110	22	0.063414	1717	1.75	0.325033	0.225237	0.941152	1.11153	38
110	23	0.120488	1718	1.51038	0.422377	0.337855	1.41528	1.32291	37
110	24	0.646828	1719	1.32592	1.68027	0.957256	4.13045	2.09892	0
110	25	1.89609	1720	1.51834	2.16067	1.35142	6.07644	1.54963	38
110	26	0.266341	1721	1.48924	0.734192	0.563092	2.19392	1.43811	25
110	27	1.41097	1722	1.1129	1.54083	1.29511	4.41999	1.10183	1
110	28	1.7217	1723	1.3312	1.65367	1.40773	4.99114	1.15141	29
110	29	0.155366	1724	1.45993	0.537288	0.394164	1.37158	0.963557	38
110	30	0.022195	1725	2.5	0.207603	0.112618	0.487075	0.850598	38
110	31	0.022195	1726						38
110	32	0.031707	1727	2.03301	0.239092	0.168928	0.636294	1.01612	37
111	1	0.028536	1728	1.53518	0.224228	0.168928	0.61332	1.04897	38
111	2	0.044390	1729	1.82405	0.29014	0.168928	0.715915	0.918812	20
111	3	0.47878	1730	1.61992	0.802955	0.67571	2.72452	1.23377	38
111	4	0.079268	1731	1.77069	0.389909	0.225237	0.941152	0.889223	7
111	5	6.7156	1732	1.65561	3.54046	2.47761	10.8745	1.40129	16
111	6	3.45926	1733	1.85163	2.88784	1.63297	8.17142	1.53604	18
111	7	4.23292	1734	1.22213	2.39498	2.25237	8.09445	1.23176	34
111	8	0.472438	1735	1.52189	0.858991	0.67571	2.62795	1.16327	0
111	9	0.050731	1736	2.03301	0.314882	0.168928	0.725938	0.826629	44
111	10	0.117317	1737	1.34518	0.448403	0.337855	1.26324	1.08244	0
111	11	3.03439	1738	1.04009	2.18628	2.08344	6.64319	1.15737	13
111	12	2.95512	1739	1.90005	2.73486	1.57666	7.6308	1.56803	40
111	13	0.050731	1740	1.36803	0.315199	0.225237	0.722334	0.818442	42
111	14	1.17634	1741	1.44613	1.29304	1.06987	4.2362	1.21398	37
111	15	0.053902	1742	1.70774	0.591144	0.225237	1.36465	2.74933	44
111	16	0.171219	1743	1.57855	0.528097	0.394164	1.56038	1.13162	40
111	17	0.028536	1744	1.38743	0.238804	0.168928	0.4641	0.600638	38
111	18	0.114146	1745	1.54104	0.457092	0.337855	1.19246	0.991326	29
111	19	0.351951	1746	1.3797	1.04824	0.67571	2.76799	1.73236	40
112	1	0.149024	1747	1.86634	0.410439	0.337855	1.54085	1.2678	38
112	2	0.028536	1748	1.38743	0.238854	0.168928	0.487075	0.661576	16
112	3	1.49975	1749	1.27323	1.5349	1.29511	4.67428	1.15931	46
112	4	0.066585	1750	1.36619	0.318256	0.281546	0.993632	1.17995	11
112	5	0.519999	1751	1.16174	0.964915	0.788329	2.58994	1.02652	38
112	6	0.028536	1752	5.12311	0.237281	0.056309	0.530095	0.783603	2
112	7	4.78146	1753	1.57737	2.67666	2.02713	8.92602	1.32601	38
112	8	0.031707	1754	1.15139	0.249543	0.225237	0.566696	0.805993	44
112	9	0.190244	1755	1.31085	0.510237	0.450474	1.71371	1.22845	13
112	10	3.71292	1756	1.43534	2.24772	1.91451	7.79916	1.30368	2
113	1	3.22463	1757	1.44131	2.10833	1.80189	7.04805	1.22588	38
113	2	0.038048	1758	1.25	0.273906	0.225237	0.61332	0.786727	44
113	3	0.941706	1759	1.30401	1.1933	1.01357	3.74225	1.18343	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
113	4	0.047560	1760	2.03301	0.305982	0.168928	0.689337	0.795067	38
113	5	0.053902	1761	2.36092	0.319247	0.168928	0.791933	0.925889	37
113	6	0.063414	1762	1.70774	0.343461	0.225237	0.875214	0.961236	26
113	7	0.783169	1763	1.446	1.12425	0.900947	3.34831	1.13917	44
113	8	0.120488	1764	1.5	0.383144	0.337855	1.39523	1.2857	0
113	9	0.342438	1765	1.58661	0.923766	0.563092	2.58893	1.55757	33
113	10	1.10341	1766	1.7226	1.8712	0.957256	4.92176	1.747	46
113	11	0.082438	1767	1.36619	0.389641	0.281546	1.00782	0.980451	37
113	12	0.079268	1768	1.48062	0.358358	0.281546	1.06379	1.13607	7
113	13	3.35463	1769	1.53333	2.31161	1.68928	6.96049	1.14928	38
113	14	0.022195	1770	1.91421	0.210681	0.112618	0.417476	0.624881	38
113	15	0.025365	1771	4.16228	0.225237	0.056309	0.450474	0.63662	46
113	16	0.076097	1772	2.01777	0.375312	0.225237	0.963563	0.970913	7
113	17	3.12317	1773	1.51753	1.90728	1.74559	7.08955	1.28066	38
114	1	0.041219	1774	1.36803	0.282772	0.225237	0.665124	0.85407	38
114	2	0.034878	1775	1.15139	0.263356	0.225237	0.566696	0.732721	38
114	3	0.041219	1776	1.31066	0.27229	0.225237	0.847341	1.38613	7
114	4	2.63804	1777	1.59303	1.97323	1.52035	6.29802	1.19651	38
114	5	0.120488	1778	1.18566	0.595949	0.450474	1.59625	1.68287	0
114	6	0.17439	1779	2.1736	0.483582	0.337855	1.64519	1.23509	38
114	7	0.044390	1780	1.82405	0.296245	0.168928	0.65634	0.772256	42
114	8	0.301219	1781	1.3083	0.735274	0.563092	1.96778	1.02297	1
114	9	0.60878	1782	1.20587	1.05118	0.844638	2.7734	1.00544	46
114	10	0.164878	1783	1.29461	0.560792	0.394164	1.36871	0.904169	0
114	11	4.25194	1784	1.31896	2.49369	2.08344	8.01089	1.20106	40
114	12	0.038048	1785	1.7077	0.27471	0.168928	0.599693	0.752156	38
114	13	0.158536	1786	1.80814	0.534452	0.337855	1.4235	1.01712	40
115	1	0.196585	1787	1.55022	0.587394	0.450474	1.6136	1.05397	46
115	2	0.275853	1788	1.46284	0.716826	0.506783	1.82284	0.958539	7
115	3	1.91195	1789	1.52238	1.67859	1.29511	5.3634	1.19727	32
115	4	2.53341	1790	1.70858	2.87833	1.57666	7.517	1.7749	29
115	5	0.107805	1791	1.36852	0.407844	0.337855	1.25964	1.17123	44
115	6	0.554877	1792	1.292	0.881424	0.788329	2.9167	1.22005	38
115	7	0.031707	1793	2.56155	0.250953	0.112618	0.543722	0.741967	41
115	8	0.294878	1794	1.51657	0.688441	0.506783	2.05748	1.14241	18
115	9	1.95634	1795	1.21049	1.74334	1.57666	5.35585	1.16682	46
115	10	0.662682	1796	1.81239	1.47905	0.73202	3.8542	1.78383	21
115	11	0.26	1797	1.31296	0.676742	0.506783	1.85156	1.04928	16
115	12	1.54097	1798	1.0869	1.50949	1.40773	4.81162	1.19558	38
115	13	0.057073	1799	1.36619	0.374478	0.281546	1.05377	1.54828	1
115	14	2.36536	1800	1.26928	1.99437	1.57666	5.72451	1.10247	37
115	15	0.865608	1801	1.17777	2.19022	1.06987	5.17087	2.45808	44
115	16	0.101463	1802	1.10117	0.411313	0.394164	1.19004	1.11072	38
115	17	0.022195	1803	2.08114	0.210681	0.112618	0.417476	0.624881	6
116	1	5.83731	1804	1.50881	3.029	2.36499	9.91228	1.33944	38
116	2	0.193414	1805	1.55022	0.882868	0.450474	2.20389	1.99839	22
116	3	1.70268	1806	1.10988	1.58579	1.46404	5.05904	1.19617	7
116	4	1.6678	1807	1.61399	1.76556	1.18249	5.42038	1.40186	37
116	5	0.114146	1808	1.65738	0.472627	0.337855	1.42828	1.42219	40
116	6	0.136341	1809	1.23082	0.513191	0.394164	1.21943	0.867917	38
116	7	0.038048	1810	1.36803	0.244353	0.225237	0.744746	1.16002	38
116	8	0.031707	1811	1.7077	0.237576	0.168928	0.64215	1.03491	0
116	9	1.89609	1812	1.56462	1.72689	1.2388	5.25382	1.15846	11
116	10	1.15097	1813	1.37004	1.37254	1.12618	4.03827	1.1275	38
116	11	0.069756	1814	3.68329	0.544357	0.168928	1.345	2.06374	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
116	12	0.063414	1815	1.4	0.323535	0.281546	0.944756	1.12006	38
116	13	2.17829	1816	1.20759	2.28193	1.68928	6.47302	1.5307	38
116	14	0.038048	1817	1.82405	0.274142	0.168928	0.609716	0.777509	38
116	15	1.2239	1818	1.53007	2.1984	1.06987	5.51025	1.97418	38
116	16	1.3	1819	1.07665	1.42376	1.35142	4.67366	1.3371	40
116	17	0.031707	1820	3.04951	0.244476	0.112618	0.609716	0.933011	40
116	18	0.022195	1821	4.16228	0.210681	0.056309	0.417476	0.624881	40
116	19	0.643657	1822	1.27405	1.00485	0.844638	3.06345	1.16026	15
116	20	0.542194	1823	2.30907	1.28494	0.563092	3.4138	1.71046	0
116	21	0.358292	1824	1.24858	0.944755	0.73202	2.648	1.55736	0
116	22	0.821218	1825	1.27904	1.74328	1.01357	4.42872	1.90059	37
117	1	0.488292	1826	1.42704	0.852667	0.67571	2.70442	1.19195	38
117	2	0.339268	1827	1.28663	0.763168	0.619401	2.41544	1.36848	13
117	3	0.681706	1828	1.10118	0.961821	0.957256	3.24775	1.23128	38
117	4	0.028536	1829	1.53518	0.237032	0.168928	0.533699	0.794294	38
117	5	0.215609	1830	1.21105	0.611473	0.506783	1.70178	1.06888	38
117	6	0.041219	1831	3.04951	0.263624	0.112618	0.754769	1.0998	37
117	7	0.088780	1832	2.01108	0.481868	0.281546	1.33222	1.59083	44
117	8	0.13	1833	1.61366	0.795073	0.394164	1.91716	2.2499	43
117	9	0.022195	1834	0.894427	0.209477	0.168928	0.4641	0.772249	38
117	10	0.025365	1835	2.56155	0.222002	0.112618	0.520072	0.848532	0
117	11	1.71219	1836	1.29532	1.66978	1.29511	4.93483	1.13183	29
117	12	0.038048	1837	1.53518	0.275561	0.168928	0.576719	0.69563	38
117	13	0.066585	1838	1.85078	0.356137	0.225237	1.0862	1.41005	10
117	14	0.859267	1839	1.29552	1.17078	0.957256	3.52107	1.14818	36
117	15	0.494633	1840	1.23077	0.920816	0.73202	2.5936	1.08221	2
117	16	10.0639	1841	2.01429	8.02525	3.09701	18.5586	2.72341	15
117	17	0.256829	1842	2.0648	0.659779	0.394164	1.87938	1.09439	5
117	18	3.57975	1843	1.32975	2.24713	1.97082	7.39937	1.2171	38
117	19	0.624633	1844	2.17166	1.76713	0.67571	4.24121	2.29163	38
117	20	0.101463	1845	1.38002	0.402867	0.337855	1.20885	1.1461	3
117	21	0.65317	1846	1.38268	1.01799	0.788329	3.07527	1.15221	2
118	1	5.95462	1847	2.22438	5.02884	2.08344	12.4259	2.06343	33
118	2	1.14463	1848	1.11533	2.60712	1.2388	6.09232	2.58041	44
118	3	0.091951	1849	2.15394	0.399795	0.225237	1.10985	1.06602	33
118	4	0.963901	1850	1.07778	1.2162	1.18249	3.77204	1.17466	38
118	5	0.044390	1851	2	0.293541	0.168928	0.689337	0.851857	15
118	6	2.49536	1852	1.69544	2.07875	1.46404	6.55833	1.37165	38
118	7	0.079268	1853	1.16667	0.38943	0.337855	0.944756	0.896046	29
118	8	0.072926	1854	2.76004	0.412718	0.168928	1.17883	1.51638	46
118	9	0.041219	1855	2	0.269805	0.168928	0.736018	1.04584	0
118	10	0.076097	1856	1.85078	0.364276	0.225237	1.00782	1.06215	0
118	11	1.55049	1857	1.21417	1.65021	1.29511	4.52968	1.05307	8
118	12	7.27682	1858	1.41593	3.33812	2.59022	10.3698	1.17595	16
118	13	3.51951	1859	1.30586	2.06535	2.02713	7.53885	1.28504	25
118	14	0.805365	1860	1.47931	1.13451	0.844638	3.40676	1.14678	38
118	15	0.085609	1861	2.5	0.343894	0.225237	1.14803	1.22511	38
119	1	0.076097	1862	1.36619	0.384122	0.281546	0.904551	0.855631	8
119	2	1.78512	1863	1.53773	2.15365	1.40773	5.96506	1.58618	38
119	3	0.275853	1864	1.9706	0.653505	0.450474	2.15124	1.33502	15
119	4	1.12561	1865	1.60016	1.4587	1.01357	4.4607	1.40673	38
119	5	0.031707	1866	1.66667	0.248676	0.168928	0.576719	0.834756	3
119	6	4.27731	1867	1.21346	2.58027	2.19606	7.91505	1.16554	1
119	7	10.1495	1868	1.79606	5.46839	2.98439	14.6488	1.68249	15
119	8	0.402682	1869	1.24104	0.817812	0.67571	2.37467	1.11438	13

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
119	9	0.967072	1870	1.44556	1.26955	1.01357	3.67468	1.11115	44
119	10	0.320243	1871	1.91473	0.74783	0.450474	2.0657	1.06034	46
119	11	0.323414	1872	1.31655	0.764756	0.563092	2.02741	1.01138	38
119	12	0.057073	1873	3.54138	0.330401	0.112618	0.801956	0.896726	40
119	13	0.060243	1874	1.41655	0.291883	0.281546	0.99656	1.31185	37
119	14	0.180731	1875	1.31296	0.757489	0.506783	1.99216	1.74746	44
119	15	0.225122	1876	1.86605	0.609634	0.450474	1.95781	1.35493	40
119	16	0.022195	1877	2.5	0.207603	0.112618	0.487075	0.850598	40
119	17	0.038048	1878	1.28078	0.251554	0.225237	0.729542	1.11314	19
120	1	5.8278	1879	1.17283	4.4996	3.09701	11.5896	1.83409	1
120	2	0.649999	1880	1.38463	0.984091	0.788329	3.11981	1.19161	38
120	3	0.168049	1881	1.37176	0.54513	0.394164	1.48487	1.04408	38
120	4	0.65634	1882	2.02877	1.20039	0.67571	3.49432	1.48043	1
120	5	1.23341	1883	1.5504	1.43142	1.01357	4.15568	1.1142	4
120	6	0.215609	1884	2.02185	0.588714	0.394164	1.75927	1.14232	29
120	7	0.038048	1885	2.56155	0.275561	0.112618	0.576719	0.69563	37
120	8	1.62341	1886	1.33426	3.93597	1.57666	8.69684	3.70753	2
120	9	5.45048	1887	1.1022	2.99617	2.64653	8.76644	1.12202	37
120	10	0.079268	1888	1.92705	0.389909	0.225237	0.941152	0.889223	38
120	11	0.060243	1889	1.77069	0.333931	0.225237	0.857364	0.970975	38
120	12	0.104634	1890	1.72315	0.437253	0.281546	1.14341	0.994317	8
120	13	3.91268	1891	1.6972	2.39415	1.80189	8.05683	1.32022	38
120	14	0.098292	1892	1.54164	0.435243	0.281546	1.03958	0.874955	7
120	15	10.2732	1893	1.82204	5.03432	2.87177	14.1499	1.55093	36
120	16	1.97853	1894	1.2643	1.76955	1.52035	5.35653	1.15402	1
121	1	1.08756	1895	1.14772	1.40515	1.12618	3.70622	1.00508	0
121	2	0.332926	1896	1.43417	0.771209	0.563092	2.07567	1.02981	38
121	3	0.294878	1897	1.19687	0.686657	0.619401	2.06109	1.14641	38
121	4	0.031707	1898	1.7077	0.249543	0.168928	0.566696	0.805993	37
121	5	0.025365	1899	2.56155	0.223882	0.112618	0.497098	0.77522	38
121	6	0.031707	1900	0.883883	0.236408	0.225237	0.646317	1.04839	38
121	7	0.041219	1901	3.04951	0.281084	0.112618	0.679314	0.890901	38
121	8	0.025365	1902						12
121	9	2.64756	1903	1.81687	1.732	1.46404	6.52123	1.27821	38
121	10	0.104634	1904	1.65602	0.448916	0.281546	1.07382	0.876956	35
121	11	1.44268	1905	1.23331	2.79108	1.40773	6.61594	2.41436	38
121	12	0.047560	1906	2.76004	0.249605	0.168928	0.861531	1.24189	38
121	13	0.072926	1907	1.92705	0.345188	0.225237	1.01717	1.12899	21
122	1	0.028536	1908	2.56155	0.237032	0.112618	0.533699	0.794294	37
122	2	0.028536	1909	2.56155	0.237281	0.112618	0.530095	0.783603	38
122	3	0.104634	1910	2.26556	0.396297	0.225237	1.24961	1.1876	37
122	4	0.802194	1911	1.58824	1.90085	0.957256	4.64573	2.14101	38
122	5	0.231463	1912	3.6176	0.798456	0.281546	2.17669	1.62892	46
122	6	0.275853	1913	1.3083	0.704549	0.563092	1.87949	1.01904	38
122	7	0.076097	1914	1.46491	0.382537	0.281546	0.918178	0.881604	29
122	8	0.076097	1915	1.77069	0.385995	0.225237	0.885181	0.819377	38
122	9	0.060243	1916	1.4	0.328379	0.281546	0.881746	1.02699	11
122	10	2.56829	1917	1.69275	1.96517	1.46404	6.18838	1.18659	38
122	11	0.085609	1918	1.92705	0.317201	0.225237	1.16583	1.26338	44
122	12	0.837072	1919	1.04568	1.20803	1.06987	3.34302	1.06244	46
122	13	0.110975	1920	1.72315	0.456305	0.281546	1.14702	0.943418	40
122	14	0.038048	1921	1.53518	0.27471	0.168928	0.599693	0.752156	38
122	15	0.057073	1922	1.59629	0.319989	0.225237	0.856801	1.02357	38
122	16	0.053902	1923	1.36803	0.326534	0.225237	0.721771	0.769098	15
122	17	0.52317	1924	1.16616	0.890485	0.844638	2.7877	1.18206	37

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
122	18	0.053902	1925	1.09443	0.326501	0.281546	0.722334	0.770299	37
123	1	0.076097	1926	2.76004	0.377621	0.168928	0.951175	0.946109	26
123	2	0.526341	1927	1.31965	0.972552	0.73202	2.59878	1.02109	38
123	3	0.028536	1928	1.38743	0.238696	0.168928	0.497098	0.689084	38
123	4	0.082438	1929	1.85078	0.393428	0.225237	0.987776	0.941835	38
123	5	0.117317	1930	1.10117	0.478575	0.394164	1.10681	0.830957	38
123	6	0.041219	1931	2.56155	0.286537	0.112618	0.609716	0.717701	13
123	7	0.558048	1932	1.20081	0.984801	0.788329	2.73449	1.06628	44
123	8	0.085609	1933	2.09737	0.628205	0.281546	1.52896	2.17301	44
123	9	0.120488	1934	1.43596	0.482768	0.337855	1.14341	0.863486	38
123	10	0.050731	1935	2.69036	0.322836	0.168928	0.959959	1.4455	38
123	11	0.076097	1936	1.33137	0.375775	0.281546	0.961198	0.966153	38
123	12	0.034878	1937	2.03301	0.251302	0.168928	0.665124	1.00936	40
123	13	0.142683	1938	1.32089	0.502345	0.394164	1.36809	1.04387	37
123	14	0.361463	1939	1.11182	1.13235	0.73202	2.90313	1.8555	5
123	15	8.68462	1940	1.26993	3.30959	3.20962	11.8673	1.29046	7
123	16	4.28365	1941	1.88981	3.33498	1.91451	9.23888	1.58568	29
123	17	0.513658	1942	1.78923	0.93711	0.619401	2.97048	1.367	20
123	18	0.110975	1943	1.66667	0.435788	0.337855	1.22957	1.0841	38
123	19	0.041219	1944	1.28078	0.284824	0.225237	0.64215	0.796088	1
124	1	1.91195	1945	1.15369	1.80782	1.52035	5.10651	1.08533	38
124	2	0.041219	1946	3.04951	0.282312	0.112618	0.669291	0.864805	38
124	3	0.041219	1947	1.82405	0.284783	0.168928	0.642713	0.797485	16
124	4	2.70146	1948	1.80015	2.25963	1.46404	6.91032	1.40666	38
124	5	0.034878	1949	3.54138	0.234347	0.112618	0.712311	1.15765	38
124	6	0.025365	1950	3	0.205451	0.112618	0.595526	1.11261	38
124	7	0.031707	1951	1.53518	0.251455	0.168928	0.530095	0.705243	38
124	8	0.342438	1952	1.50357	0.746798	0.563092	2.20681	1.13172	38
124	9	0.088780	1953	1.41655	0.410578	0.281546	1.01075	0.915716	38
124	10	0.034878	1954	1.53518	0.264112	0.168928	0.530095	0.64113	38
124	11	0.095121	1955	1.34518	0.40515	0.337855	1.13339	1.07466	46
124	12	0.199756	1956	1.15933	0.593892	0.506783	1.62047	1.04609	37
124	13	0.038048	1957	3.04951	0.244353	0.112618	0.744746	1.16002	37
124	14	0.028536	1958	1.7077	0.235377	0.168928	0.552506	0.851261	29
125	1	0.161707	1959	1.61366	0.521901	0.394164	1.66349	1.36176	23
125	2	2.20048	1960	1.1238	1.72539	1.74559	5.83741	1.23229	44
125	3	0.031707	1961	2.56155	0.250953	0.112618	0.543722	0.741967	34
125	4	0.117317	1962	1.64222	0.466672	0.281546	1.19297	0.965353	44
125	5	0.022195	1963	0.883883	0.162209	0.225237	0.59333	1.26219	38
125	6	0.456585	1964	1.28096	1.09689	0.73202	3.02628	1.5962	8
125	7	1.02732	1965	1.32453	1.27167	1.06987	3.86619	1.15785	40
125	8	0.072926	1966	1.33137	0.376449	0.281546	0.881577	0.848055	38
125	9	0.022195	1967	2.08114	0.210681	0.112618	0.417476	0.624881	38
126	1	0.031707	1968	1.7077	0.249543	0.168928	0.566696	0.805993	44
126	2	0.107805	1969	1.38002	0.439148	0.337855	1.18002	1.02785	16
126	3	2.77122	1970	1.67757	2.50587	1.52035	7.22351	1.49836	8
126	4	5.3078	1971	1.76923	4.52195	2.19606	11.3915	1.94552	38
126	5	0.041219	1972	1.36803	0.265746	0.225237	0.748912	1.0828	29
126	6	0.044390	1973	2	0.296245	0.168928	0.65634	0.772256	8
126	7	8.07267	1974	1.28267	3.26043	3.0407	11.2176	1.24044	38
126	8	0.250487	1975	1.35337	0.639599	0.506783	1.88546	1.12937	0
126	9	0.491463	1976	1.35809	0.948801	0.67571	2.47276	0.990067	38
126	10	0.221951	1977	1.22222	0.646209	0.506783	1.61686	0.937302	38
126	11	0.028536	1978	2.56155	0.237281	0.112618	0.530095	0.783603	37
126	12	0.101463	1979	1.17301	0.637131	0.394164	1.59276	1.98968	46

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
126	13	0.266341	1980	1.50333	0.804827	0.506783	2.27151	1.54164	44
126	14	0.234634	1981	1.29224	0.639645	0.506783	1.76969	1.06216	46
126	15	0.041219	1982	3.54138	0.246272	0.112618	0.787766	1.19807	38
126	16	0.076097	1983	2.20998	0.482112	0.281546	1.27991	1.71308	38
126	17	0.038048	1984	1.7077	0.273156	0.168928	0.623343	0.812651	38
126	18	0.158536	1985	1.49812	0.645076	0.394164	1.78168	1.59338	41
126	19	0.072926	1986	1.48062	0.392277	0.281546	1.15637	1.45913	38
126	20	0.095121	1987	1.2847	0.604624	0.337855	1.5239	1.94277	41
126	21	0.621462	1988	2.30225	1.5294	0.67571	3.87148	1.91924	40
127	1	0.107805	1989	1.84924	0.394341	0.281546	1.27901	1.20753	34
127	2	0.30439	1990	2.25367	0.680376	0.450474	2.25552	1.33001	38
127	3	0.079268	1991	1.36619	0.38309	0.281546	1.18002	1.39787	37
127	4	0.364634	1992	1.32741	0.745862	0.619401	2.32349	1.17819	16
127	5	2.07048	1993	1.12675	1.69901	1.68928	5.63796	1.22169	44
127	6	0.627804	1994	1.17622	1.05445	0.844638	2.86715	1.042	38
127	7	0.649999	1995	1.42641	1.45125	0.844638	3.79828	1.76625	29
128	1	0.190244	1996	1.43004	0.587342	0.450474	1.5516	1.00702	38
128	2	0.025365	1997	2.08114	0.22523	0.112618	0.454077	0.646846	38
128	3	0.031707	1998	1.53518	0.251455	0.168928	0.530095	0.705243	15
128	4	0.995608	1999	1.62875	1.22832	0.900947	3.84581	1.18216	2
128	5	3.40536	2000	1.07433	2.38736	2.13975	6.88301	1.10709	38
128	6	0.034878	2001	3.04951	0.256918	0.112618	0.636294	0.92375	38
128	7	0.025365	2002	6.09902	0.185701	0.056309	0.626327	1.23068	38
128	8	0.589755	2003	1.41656	1.59036	0.844638	3.92239	2.07596	37
128	9	0.038048	2004						38
128	10	0.047560	2005	4.03553	0.238835	0.112618	0.86795	1.26046	38
128	11	0.022195	2006	6.09902	0.174111	0.056309	0.585503	1.22911	38
128	12	0.104634	2007	1.36852	0.448341	0.337855	1.07843	0.884513	38
128	13	0.098292	2008	1.60039	0.636639	0.337855	1.58206	2.02636	38
128	14	0.034878	2009	1.7077	0.262882	0.168928	0.576719	0.758869	37
128	15	0.932194	2010	2.04544	2.20857	0.844638	5.26131	2.36304	37
128	16	0.022195	2011						38
128	17	0.069756	2012	1.61421	0.346661	0.281546	0.971446	1.07658	38
128	18	0.025365	2013	7.08276	0.244008	0.056309	0.695925	1.51938	38
128	19	0.079268	2014	1.18046	0.387092	0.337855	0.960691	0.926529	44
129	1	0.332926	2015	1.15108	0.79114	0.619401	1.98203	0.938991	38
129	2	0.221951	2016	1.10499	0.556331	0.563092	1.91057	1.30876	9
129	3	5.94828	2017	1.44163	2.59312	2.36499	9.77398	1.27803	5
129	4	1.40146	2018	1.50835	1.5385	1.06987	4.39752	1.09806	42
129	5	2.27658	2019	2.97214	3.02001	1.06987	7.54769	1.99129	40
129	6	0.110975	2020	1.2847	0.456918	0.337855	1.14341	0.937499	38
129	7	0.031707	2021	1.66667	0.251345	0.168928	0.533699	0.714864	38
129	8	0.038048	2022	3.19258	0.265782	0.112618	0.679314	0.965143	38
129	9	0.041219	2023	2.33333	0.267846	0.168928	0.742549	1.06448	21
129	10	0.424877	2024	1.33611	0.86951	0.67571	2.7163	1.38192	44
129	11	0.117317	2025	1.54104	0.465517	0.337855	1.19882	0.974854	40
129	12	0.171219	2026	1.74781	0.535098	0.337855	1.54394	1.1079	43
129	13	0.047560	2027	1.2	0.291228	0.281546	0.785513	1.0324	40
129	14	0.085609	2028	1.41655	0.407912	0.281546	0.954779	0.84737	21
129	15	0.377316	2029	1.48155	0.914658	0.619401	2.65436	1.48595	6
129	16	4.13463	2030	1.52442	2.42849	1.97082	8.26208	1.31381	40
129	17	2.00073	2031	1.09577	1.835	1.57666	5.26277	1.10162	37
129	18	0.028536	2032	1.7077	0.229908	0.168928	0.58967	0.969632	26
129	19	0.935364	2033	1.179	1.23295	1.06987	3.65008	1.13348	38
130	1	0.069756	2034	1.83114	0.282257	0.225237	1.05377	1.26678	0

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
130	2	11.3988	2035	2.64937	6.09972	2.47761	15.9369	1.77313	38
130	3	0.044390	2036	1.82405	0.288506	0.168928	0.725938	0.944719	38
130	4	0.076097	2037	1.52475	0.387742	0.225237	0.861531	0.776179	38
130	5	0.053902	2038	1	0.415437	0.337855	1.09037	1.75522	38
130	6	0.957559	2039	1.56802	2.18282	1.06987	5.24301	2.28447	38
130	7	0.310731	2040	1.60596	0.682432	0.506783	2.15416	1.1884	2
130	8	2.83146	2041	1.38748	2.09068	1.74559	6.45467	1.17092	38
130	9	0.057073	2042	1.46491	0.434416	0.281546	1.13159	1.78541	2
130	10	2.3178	2043	1.6224	1.67731	1.46404	6.11833	1.28523	38
130	11	0.076097	2044	1.70774	0.385144	0.225237	0.894528	0.836774	37
130	12	0.082438	2045	1.36619	0.403058	0.281546	0.904551	0.789813	41
130	13	0.101463	2046	2.25913	0.563589	0.281546	1.48724	1.73477	2
130	14	0.792682	2047	1.08935	1.08901	1.06987	3.6338	1.3256	40
130	15	0.050731	2048	2.44152	0.295606	0.168928	0.828534	1.07679	0
130	16	1.2239	2049	1.65336	1.6275	1.06987	4.75903	1.47259	1
130	17	4.02999	2050	1.70027	2.48245	1.8582	8.21168	1.33153	38
130	18	0.025365	2051	2.08114	0.225131	0.112618	0.4641	0.675718	38
130	19	0.034878	2052	2.73607	0.26163	0.112618	0.595526	0.809171	37
131	1	0.053902	2053	1.52475	0.312005	0.225237	0.828534	1.01345	38
131	2	0.053902	2054	2.01777	0.265375	0.225237	0.936985	1.29613	11
131	3	2.8917	2055	1.36776	2.08064	1.74559	6.5732	1.18902	38
131	4	0.022195	2056	4.16228	0.210681	0.056309	0.417476	0.624881	5
131	5	5.4917	2057	1.42768	3.61095	2.53391	10.2636	1.52645	15
131	6	0.48195	2058	1.96011	0.81948	0.563092	2.72035	1.22191	2
131	7	1.29683	2059	1.26167	1.42753	1.18249	4.34611	1.15907	38
131	8	0.050731	2060	1.33137	0.336159	0.281546	0.974149	1.48855	34
131	9	1.01463	2061	1.39812	1.03205	1.01357	4.02791	1.27245	37
131	10	0.041219	2062	2	0.284508	0.168928	0.646317	0.806453	23
131	11	4.0617	2063	1.32235	2.51854	2.08344	7.70569	1.16334	38
131	12	0.041219	2064	1.7077	0.286537	0.168928	0.609716	0.717701	38
131	13	0.123658	2065	1.27744	1.18986	0.450474	2.58758	4.30877	38
131	14	0.136341	2066	2.18826	0.92602	0.394164	2.14651	2.68923	15
131	15	1.17951	2067	1.62982	1.58776	1.06987	4.66128	1.46588	38
131	16	0.085609	2068	1.81245	0.365365	0.281546	1.1192	1.16435	5
131	17	4.37243	2069	1.52262	3.06535	2.13975	8.98351	1.46879	38
131	18	0.034878	2070	2.30278	0.263996	0.112618	0.543722	0.674516	43
131	19	0.066585	2071	1.66421	0.33799	0.225237	0.951175	1.08127	6
131	20	2.07366	2072	2.01619	1.58212	1.18249	5.7856	1.28455	23
131	21	1.00512	2073	1.44336	1.31949	0.957256	3.67665	1.07023	4
132	1	0.313902	2074	1.62239	0.72309	0.506783	2.09408	1.11169	0
132	2	0.088780	2075	4	0.47006	0.168928	1.31786	1.55673	38
132	3	0.041219	2076	1.36803	0.261987	0.225237	0.758935	1.11198	46
132	4	1.00512	2077	2.72938	1.6138	0.73202	4.47326	1.58424	0
132	5	0.025365	2078	5.12311	0.222002	0.056309	0.520072	0.848532	37
132	6	1.56951	2079	1.49502	1.56355	1.2388	5.13472	1.33678	38
132	7	0.110975	2080	1.81245	0.413548	0.281546	1.27844	1.172	21
132	8	0.732438	2081	1.30527	1.2505	0.957256	3.67243	1.4653	38
132	9	0.072926	2082	1.54164	0.357351	0.281546	0.984172	1.05693	46
132	10	1.23658	2083	1.11049	1.38849	1.2388	4.25382	1.16446	33
132	11	1.69634	2084	1.60347	3.02247	1.35142	7.16743	2.40993	37
132	12	1.57902	2085	1.64414	2.62797	1.2388	6.45765	2.10161	38
132	13	0.120488	2086	1.38002	0.363159	0.337855	1.3869	1.27038	38
132	14	0.082438	2087	1.33137	0.398707	0.281546	0.951175	0.873331	2
132	15	6.25267	2088	1.28163	3.00411	2.64653	10.171	1.31658	38
132	16	0.044390	2089	1.52475	0.26842	0.225237	0.795536	1.13455	1

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
132	17	2.01975	2090	1.55789	2.00208	1.40773	6.02182	1.42872	40
133	1	0.320243	2091	1.05516	0.769587	0.67571	1.97837	0.972577	38
133	2	0.053902	2092	1.70774	0.309408	0.225237	0.838557	1.03812	38
133	3	0.038048	2093	3.19258	0.265782	0.112618	0.679314	0.965143	15
133	4	0.34878	2094	1.08333	0.780691	0.67571	2.15495	1.05953	38
133	5	0.107805	2095	1.60039	0.52201	0.337855	1.45706	1.56713	38
133	6	0.196585	2096	2.43358	0.636379	0.337855	1.89058	1.44687	46
133	7	0.313902	2097	1.51421	0.762956	0.563092	2.34877	1.39855	37
133	8	0.038048	2098	2	0.257683	0.168928	0.712311	1.06118	38
133	9	0.066585	2099	1.33137	0.270982	0.281546	1.0308	1.26987	46
134	1	0.234634	2100	1.33837	0.609102	0.506783	1.84514	1.15467	38
134	2	0.028536	2101	3	0.227766	0.112618	0.599693	1.00288	38
134	3	0.022195	2102						38
134	4	0.104634	2103	3.94121	0.933392	0.225237	2.09099	3.32521	38
134	5	0.240975	2104	1.75	0.852537	0.450474	2.27039	1.70223	38
134	6	0.044390	2105	1.5	0.331764	0.225237	0.931129	1.55426	38
134	7	0.060243	2106	1.36619	0.408093	0.281546	1.11143	1.63171	0
134	8	0.351951	2107	1.30379	0.745709	0.619401	2.26036	1.15522	38
134	9	0.091951	2108	1.65738	0.809976	0.337855	1.847	2.95234	38
134	10	0.022195	2109	1.61803	0.209945	0.112618	0.384479	0.530004	16
134	11	3.40219	2110	2.05503	1.95155	1.46404	7.36479	1.26868	38
134	12	0.057073	2111	1.2198	0.289967	0.281546	0.973586	1.32162	46
134	13	0.142683	2112	1.59067	0.517258	0.337855	1.30142	0.94461	16
134	14	0.792682	2113	1.95012	0.977802	0.73202	3.54213	1.25956	13
134	15	0.884633	2114	1.35828	1.1214	0.957256	3.6735	1.21391	40
134	16	0.091951	2115	1.23385	0.380252	0.337855	1.15704	1.15859	37
134	17	1.63609	2116	1.04142	1.67767	1.46404	4.70829	1.07822	6
134	18	4.38194	2117	1.21377	2.48757	2.30868	8.18505	1.21665	46
134	19	0.149024	2118	1.13278	0.516887	0.450474	1.38521	1.02462	37
134	20	0.326585	2119	1.28663	0.673349	0.619401	2.31673	1.30781	33
134	21	0.428048	2120	1.50733	1.0009	0.67571	2.85713	1.5176	38
135	1	0.031707	2121	1.53518	0.251455	0.168928	0.530095	0.705243	38
135	2	0.022195	2122	2.5	0.207603	0.112618	0.487075	0.850598	38
135	3	0.044390	2123	1.36803	0.29696	0.225237	0.642713	0.740522	38
135	4	0.063414	2124	1.46491	0.3293	0.281546	1.04375	1.36707	38
135	5	0.161707	2125	1.37176	0.542167	0.394164	1.42766	1.00303	12
135	6	0.561219	2126	1.29409	0.990727	0.788329	2.73218	1.05846	38
135	7	0.133171	2127	1.18287	0.508835	0.394164	1.19004	0.846261	37
135	8	0.107805	2128	1.23385	0.447385	0.337855	1.14341	0.965073	2
135	9	5.25072	2129	1.50019	3.63504	2.36499	10.159	1.56414	38
135	10	0.053902	2130	1.5	0.326501	0.225237	0.722334	0.770299	16
135	11	8.50706	2131	1.62001	5.16095	2.92808	13.6186	1.73491	38
135	12	0.142683	2132	1.29461	0.512658	0.394164	1.32563	0.980086	38
135	13	0.149024	2133	2.25913	0.514193	0.281546	1.39529	1.03958	38
135	14	0.149024	2134	1.24303	0.463252	0.450474	1.50424	1.20829	38
135	15	0.025365	2135	2.5	0.223882	0.112618	0.497098	0.77522	38
135	16	0.050731	2136	2.03301	0.315199	0.168928	0.722334	0.818442	44
135	17	0.586584	2137	1.20985	1.75556	0.900947	4.17938	2.36965	38
135	18	0.050731	2138	2.12839	0.311684	0.168928	0.754769	0.893591	38
135	19	0.069756	2139	2.26556	0.535958	0.225237	1.33222	2.0247	38
135	20	0.028536	2140	3.54138	0.258333	0.112618	0.737594	1.51713	37
135	21	0.282195	2141	2.78702	2.63514	0.506783	5.48446	8.48221	1
136	1	4.12194	2142	1.05342	2.5983	2.30868	7.64015	1.12692	38
136	2	0.034878	2143	6.09902	0.255865	0.056309	0.642713	0.942482	38
136	3	0.041219	2144	1.7077	0.286537	0.168928	0.609716	0.717701	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
136	4	0.050731	2145	2.03301	0.31391	0.168928	0.735961	0.849613	37
136	5	0.30756	2146	1.353	0.692575	0.563092	2.27332	1.33715	37
136	6	0.513658	2147	1.91098	1.4448	0.67571	3.60064	2.00851	38
136	7	0.418536	2148	1.36639	1.22668	0.73202	3.13575	1.86956	38
136	8	0.050731	2149	1.36803	0.311112	0.225237	0.758935	0.903485	38
136	9	0.133171	2150	1.93836	0.782116	0.337855	1.90477	2.16804	4
136	10	0.624633	2151	1.5705	0.973525	0.73202	3.04526	1.18144	38
136	11	0.396341	2152	1.28663	0.838323	0.619401	2.2763	1.04035	13
136	12	1.92146	2153	1.45421	1.57516	1.40773	5.48424	1.24564	38
136	13	0.833901	2154	1.19546	1.32343	1.01357	3.90707	1.45673	8
136	14	3.7478	2155	2.50447	3.08529	1.40773	8.60005	1.57042	40
136	15	0.034878	2156	1.7077	0.26268	0.168928	0.580323	0.768383	23
136	16	1.97536	2157	1.1566	1.68983	1.57666	5.47269	1.20655	2
136	17	6.6395	2158	1.46244	3.73956	2.59022	11.0301	1.45818	44
136	18	0.355121	2159	1.32741	0.770536	0.619401	2.22376	1.10813	46
136	19	0.076097	2160	1.33137	0.375775	0.281546	0.961198	0.966153	37
136	20	0.088780	2161	1.65602	0.372672	0.281546	1.2218	1.33805	16
136	21	5.03194	2162	1.5834	3.12323	2.13975	9.46873	1.41787	2
136	22	6.15121	2163	1.09648	3.05865	2.81546	9.55072	1.18005	38
137	1	0.044390	2164	2.03301	0.292039	0.168928	0.702288	0.884167	38
137	2	0.025365	2165	4.16228	0.225237	0.056309	0.450474	0.63662	38
137	3	0.047560	2166	2.12839	0.302856	0.168928	0.722334	0.873005	13
137	4	1.6139	2167	1.63341	1.46275	1.18249	5.0118	1.23851	38
137	5	0.066585	2168	1.27703	0.354602	0.281546	0.881577	0.928822	44
137	6	0.897316	2169	1.38094	1.2247	0.900947	3.5352	1.10834	38
137	7	0.022195	2170	2.08114	0.210681	0.112618	0.417476	0.624881	38
137	8	0.095121	2171	1.2847	0.418653	0.337855	1.08204	0.979478	15
137	9	1.34756	2172	1.48332	1.44318	1.18249	4.75385	1.33454	7
137	10	3.92219	2173	1.16518	2.28028	2.25237	7.81307	1.23853	3
137	11	2.9456	2174	2.09651	2.83425	1.52035	7.74708	1.6214	40
137	12	0.117317	2175	1.81245	0.46966	0.281546	1.17641	0.938747	13
137	13	0.34878	2176	1.09713	0.797357	0.67571	2.09183	0.99837	40
137	14	0.069756	2177	1.33137	0.360179	0.281546	0.918178	0.96175	29
137	15	0.034878	2178	1.53518	0.255228	0.168928	0.646317	0.953081	1
137	16	5.4917	2179	1.28264	2.7133	2.53391	9.47459	1.30078	37
137	17	0.374146	2180	1.38297	0.847978	0.619401	2.5784	1.414	13
137	18	1.38561	2181	1.51373	1.35959	1.12618	4.75745	1.29987	29
137	19	0.409024	2182	1.91987	0.819656	0.506783	2.40407	1.12443	20
137	20	0.155366	2183	1.13278	0.535167	0.450474	1.38228	0.978647	37
137	21	0.799023	2184	1.28709	1.50091	0.957256	4.06654	1.64695	38
137	22	0.504146	2185	1.09328	1.69324	0.900947	3.98196	2.50281	37
137	23	0.022195	2186	2.56155	0.207603	0.112618	0.487075	0.850598	16
137	24	1.27146	2187	1.50774	1.60072	1.12618	4.79006	1.43604	40
137	25	0.085609	2188	1.54164	0.402929	0.281546	0.994195	0.918779	46
137	26	0.206097	2189	1.61366	0.604128	0.394164	1.64288	1.04215	44
137	27	0.034878	2190	1.82405	0.255228	0.168928	0.646317	0.953081	38
138	1	0.076097	2191	1.46491	0.35613	0.281546	1.0308	1.11113	38
138	2	0.031707	2192	3.04951	0.238161	0.112618	0.639954	1.02785	38
138	3	0.072926	2193	1.27703	0.366772	0.281546	0.946445	0.97745	2
138	4	3.16439	2194	1.32062	2.62267	1.97082	7.65845	1.47497	26
138	5	0.684877	2195	1.3611	1.04299	0.844638	3.14791	1.15139	38
138	6	0.063414	2196	1.2	0.347825	0.281546	0.84858	0.903622	15
138	7	0.250487	2197	1.65082	0.651881	0.450474	1.85522	1.09344	38
138	8	0.076097	2198	1.36619	0.384122	0.281546	0.904551	0.855631	38
138	9	0.034878	2199	2	0.247522	0.168928	0.679314	1.05288	1

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
138	10	0.675365	2200	1.33158	0.872593	0.844638	3.28052	1.26805	2
138	11	5.66609	2201	1.09586	2.87114	2.75915	9.25723	1.20356	9
138	12	1.39512	2202	1.10733	1.4889	1.40773	4.85183	1.34273	37
139	1	0.041219	2203	4.03553	0.242459	0.112618	0.82493	1.31378	37
139	2	0.082438	2204	1.46491	0.399843	0.281546	0.941152	0.855023	42
139	3	0.691218	2205	1.34729	1.08568	0.844638	3.07409	1.08795	44
139	4	0.050731	2206	1.36803	0.317781	0.225237	0.679314	0.723857	38
139	5	0.028536	2207	1.53518	0.238696	0.168928	0.497098	0.689084	38
139	6	0.028536	2208	2.30278	0.238696	0.112618	0.497098	0.689084	7
139	7	2.25439	2209	2.44008	2.29717	1.12618	6.55709	1.5177	29
139	8	0.545365	2210	1.24175	1.46726	0.900947	3.67789	1.97379	2
139	9	1.94048	2211	1.55147	1.71923	1.35142	5.69585	1.33044	44
140	1	0.288536	2212	1.7629	1.09216	0.506783	2.7127	2.02951	38
140	2	0.101463	2213	1.66667	0.410347	0.337855	1.1924	1.11514	38
140	3	0.713413	2214	1.5781	1.4914	0.844638	3.9395	1.73114	2
140	4	3.79219	2215	1.34788	2.82128	2.13975	8.33083	1.45639	38
140	5	0.107805	2216	1.38002	0.425409	0.337855	1.22304	1.10416	29
140	6	0.057073	2217	1.59629	0.315856	0.225237	0.871554	1.05913	46
140	7	0.050731	2218	2.36092	0.307371	0.168928	0.78191	0.959013	38
140	8	0.053902	2219	2.03301	0.323537	0.168928	0.758935	0.850339	6
140	9	2.42561	2220	1.15204	2.02371	1.74559	5.78616	1.09838	15
140	10	0.539024	2221	2.95694	1.41834	0.506783	3.59675	1.90987	38
140	11	2.07683	2222	1.1804	1.84373	1.52035	5.42449	1.12748	38
140	12	0.592926	2223	2.15527	2.23788	0.73202	5.00566	3.36289	29
140	13	0.034878	2224	2.56155	0.262882	0.112618	0.576719	0.758869	29
140	14	0.069756	2225	2.31155	0.408582	0.225237	1.15862	1.5314	29
140	15	0.13	2226	1.29461	0.510455	0.394164	1.53026	1.43343	13
141	1	5.97682	2227	1.17741	2.58823	2.81546	9.76109	1.26858	0
141	2	3.83975	2228	1.48749	2.76201	2.08344	8.30443	1.42924	6
141	3	2.61902	2229	1.64144	1.98959	1.46404	6.24154	1.18368	29
141	4	0.922681	2230	1.22354	1.13637	1.01357	3.7614	1.22022	33
141	5	0.849755	2231	1.41304	1.53998	0.957256	4.18355	1.63903	41
141	6	0.076097	2232	3.02075	0.352372	0.168928	1.03958	1.13015	8
141	7	4.03633	2233	1.24412	2.80694	2.25237	8.48985	1.42103	46
141	8	0.285365	2234	1.55982	0.605124	0.506783	2.1148	1.24718	38
141	9	0.060243	2235	1.52475	0.338813	0.225237	0.828534	0.906772	40
141	10	1.30951	2236	1.11995	1.41108	1.29511	4.40693	1.18019	0
141	11	0.87195	2237	1.20086	1.22413	1.01357	3.43903	1.07937	38
142	1	0.022195	2238	2.5	0.207603	0.112618	0.487075	0.850598	1
142	2	5.5678	2239	1.29728	2.99819	2.47761	8.92653	1.13886	38
142	3	0.022195	2240	2.08114	0.210681	0.112618	0.417476	0.624881	1
142	4	2.71731	2241	1.39862	2.17741	1.63297	6.02035	1.06144	1
142	5	4.5595	2242	1.8337	4.29114	2.13975	10.7074	2.00096	7
142	6	3.3356	2243	1.20027	3.97348	2.25237	9.62589	2.21053	13
142	7	1.29683	2244	1.20237	1.61765	1.35142	4.83865	1.43667	38
142	8	0.091951	2245	1.43596	0.382138	0.337855	1.15349	1.1515	40
142	9	0.104634	2246	1.51038	0.383599	0.337855	1.31274	1.31061	7
142	10	8.00291	2247	1.083	3.42	3.26593	10.9918	1.20139	37
142	11	0.332926	2248	1.55982	0.701342	0.506783	2.23688	1.19599	16
142	12	2.25439	2249	1.33069	1.64046	1.63297	5.97733	1.26118	33
142	13	0.649999	2250	1.04	1.01494	1.01357	3.06891	1.15304	40
142	14	0.066585	2251	1.59629	0.354602	0.225237	0.881577	0.928822	19
142	15	5.57731	2252	1.26852	3.80722	2.81546	10.5443	1.58636	37
143	1	0.060243	2253	1.4	0.370461	0.281546	1.06616	1.50149	38
143	2	0.038048	2254	4	0.364343	0.112618	0.937548	1.83839	38

Frame	Particle	Area	Cum. #	Aspect R	Length	Width	Perim.	Circ.	Cluster
143	3	0.038048	2255	1.28078	0.272909	0.225237	0.626271	0.820304	38
143	4	0.025365	2256	6.09902	0.205451	0.056309	0.595526	1.11261	38
143	5	0.456585	2257	1.32217	0.841333	0.67571	2.58893	1.16818	37
143	6	0.634145	2258	1.85283	1.40765	0.73202	3.71629	1.73309	22
143	7	0.83073	2259	1.13425	1.21796	1.01357	3.27979	1.03044	40
143	8	0.21878	2260	1.27115	0.631438	0.506783	1.65707	0.998763	38
143	9	0.031707	2261	2.44152	0.302277	0.168928	0.814344	1.66436	38
143	10	0.053902	2262	1.52475	0.32628	0.225237	0.725938	0.778004	41
143	11	0.091951	2263	1.2847	0.396688	0.337855	1.1192	1.08405	29
144	1	0.028536	2264	2.30278	0.238071	0.112618	0.515905	0.742212	40
144	2	0.022195	2265	3.82843	0.209945	0.056309	0.384479	0.530004	40
144	3	0.025365	2266	1.66667	0.218617	0.168928	0.669291	1.40531	38
144	4	0.076097	2267	1.65602	0.586723	0.281546	1.43284	2.14693	38
144	5	0.022195	2268	2.08114	0.210681	0.112618	0.417476	0.624881	37
144	6	0.345609	2269	1.61327	0.663853	0.563092	2.36893	1.29214	46
144	7	0.209268	2270	1.22776	0.592829	0.506783	1.70369	1.10375	34
144	8	0.989267	2271	1.17951	2.02415	1.18249	5.02577	2.0318	37
144	9	0.041219	2272	1.36803	0.261987	0.225237	0.758935	1.11198	18
144	10	2.90121	2273	1.14139	2.04349	1.97082	6.63773	1.20851	9
144	11	1.27146	2274	1.13537	1.27896	1.35142	4.46284	1.24655	38
144	12	0.272682	2275	1.24018	0.641689	0.563092	2.01441	1.1842	2
144	13	3.64634	2276	1.76386	3.2589	1.80189	8.75557	1.67303	38
144	14	0.028536	2277	5.12311	0.237281	0.056309	0.530095	0.783603	15
144	15	0.900486	2278	1.8967	1.22593	0.788329	3.92092	1.35859	13

APPENDIX D: HIGH RESOLUTION SEM IMAGES

High-resolution secondary electron images of aerosol particles sampled at the Loop 101 site. Scale bars are in microns and the values indicated encompass the ten ticks shown. Holes are the nominally 0.4 μm pores in the polycarbonate filters.

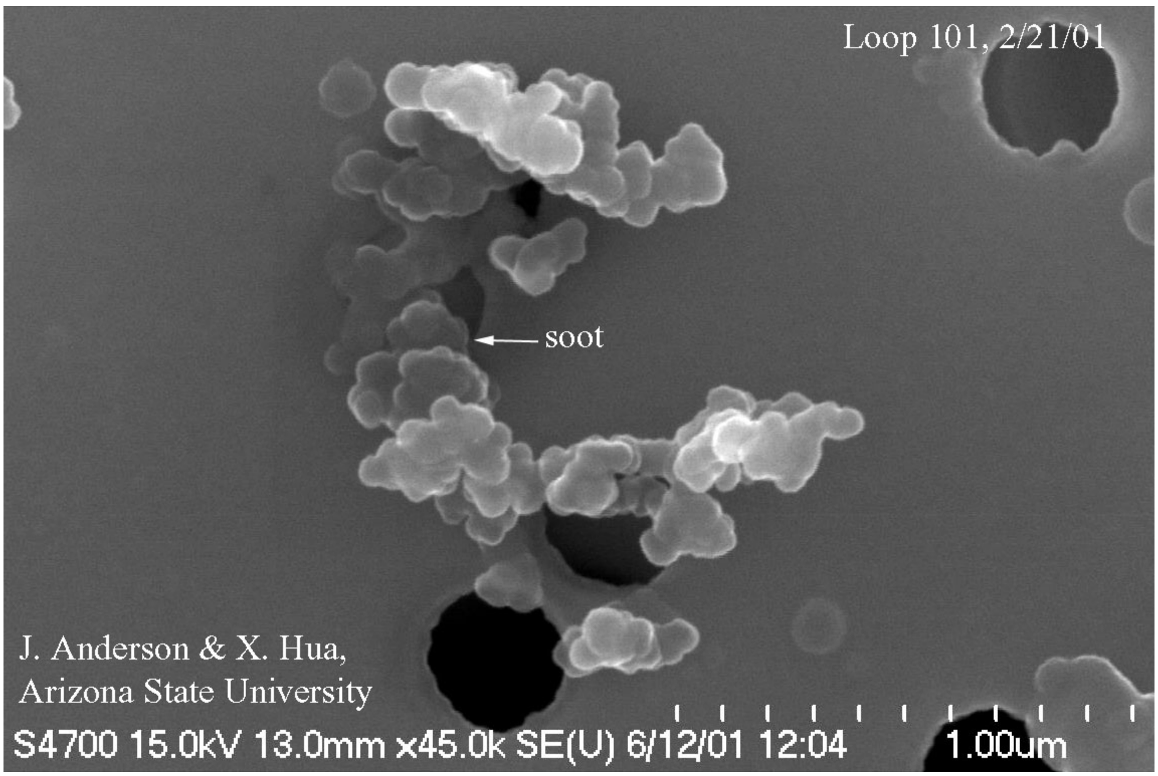

Figure D-1: Typical branching-chain soot, may be from diesel exhaust.

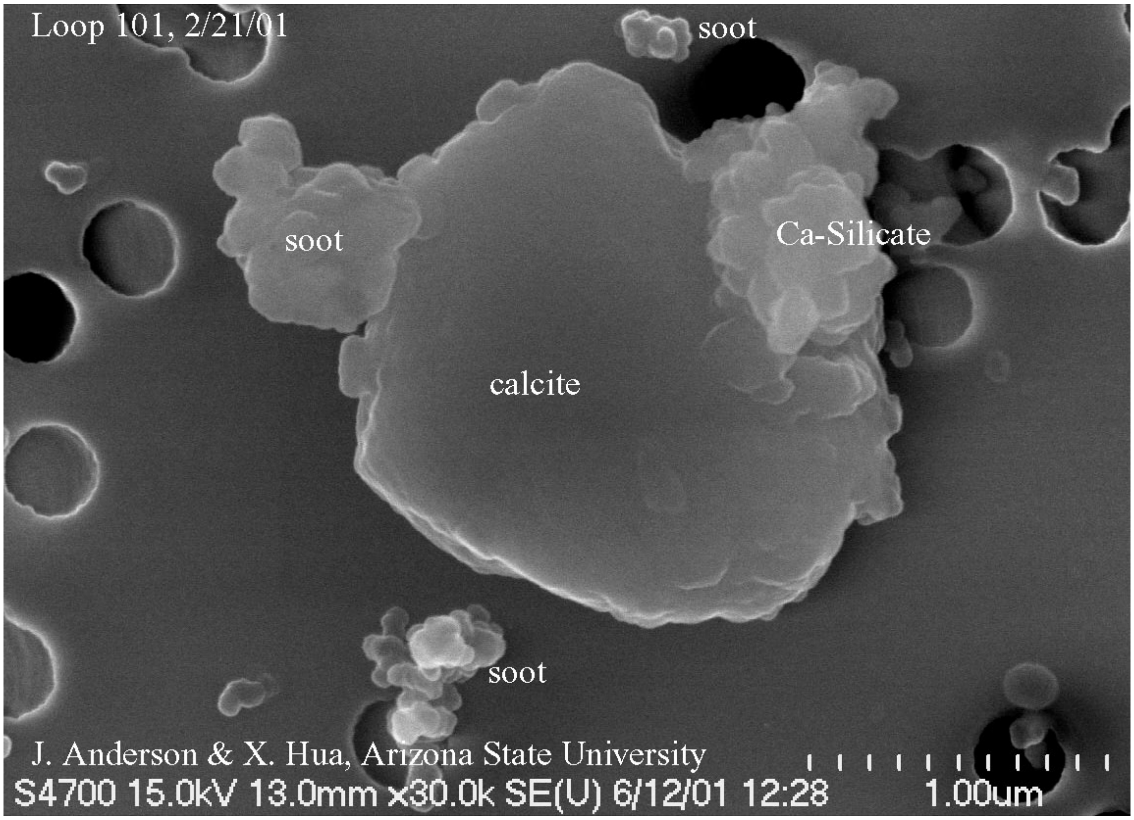

Figure D-2: Aggregate of soil particles (calcite and Ca-silicate) with soot.

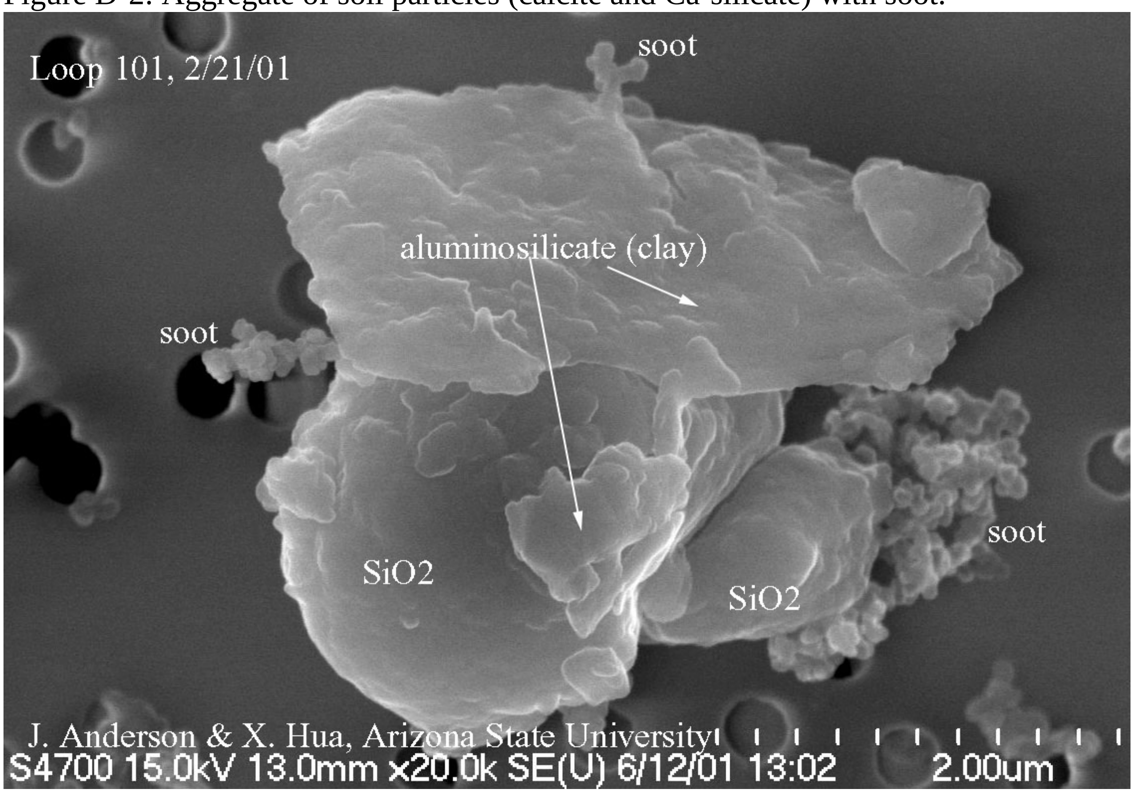

Figure D-3: Aggregate of soil particles (clay and quartz) with soot.

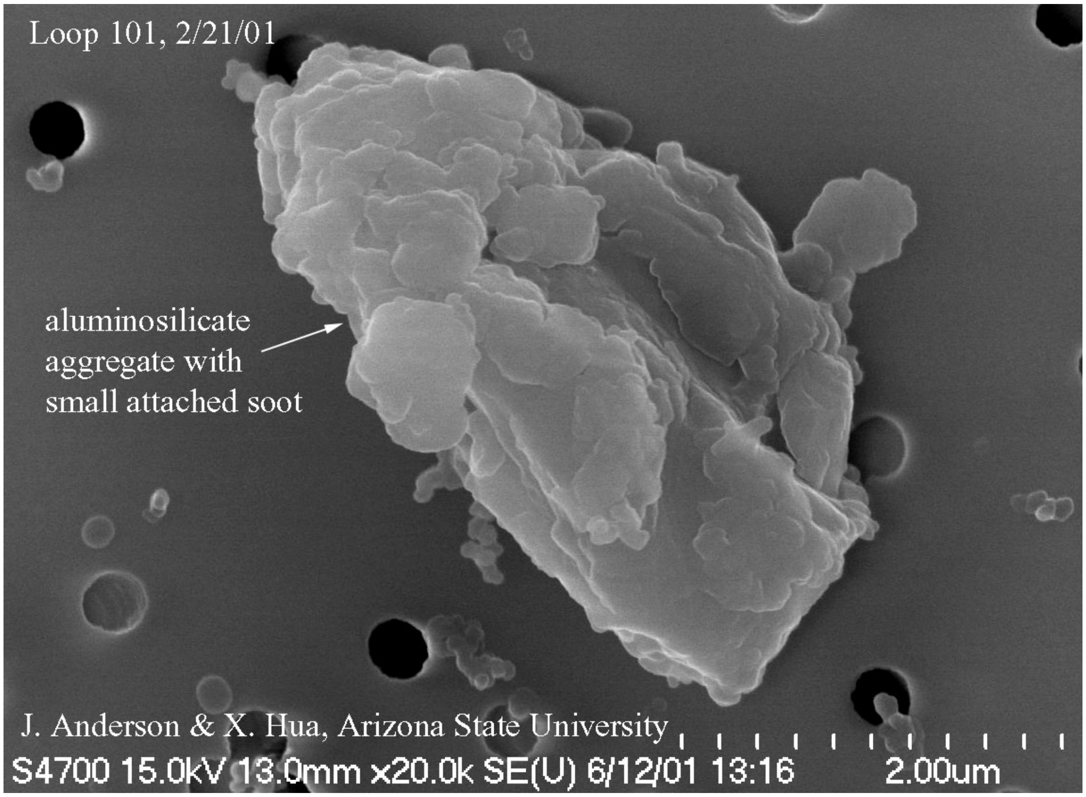

Figure D-4: Aggregate of soil particles (aluminosilicates) with small soot particles.

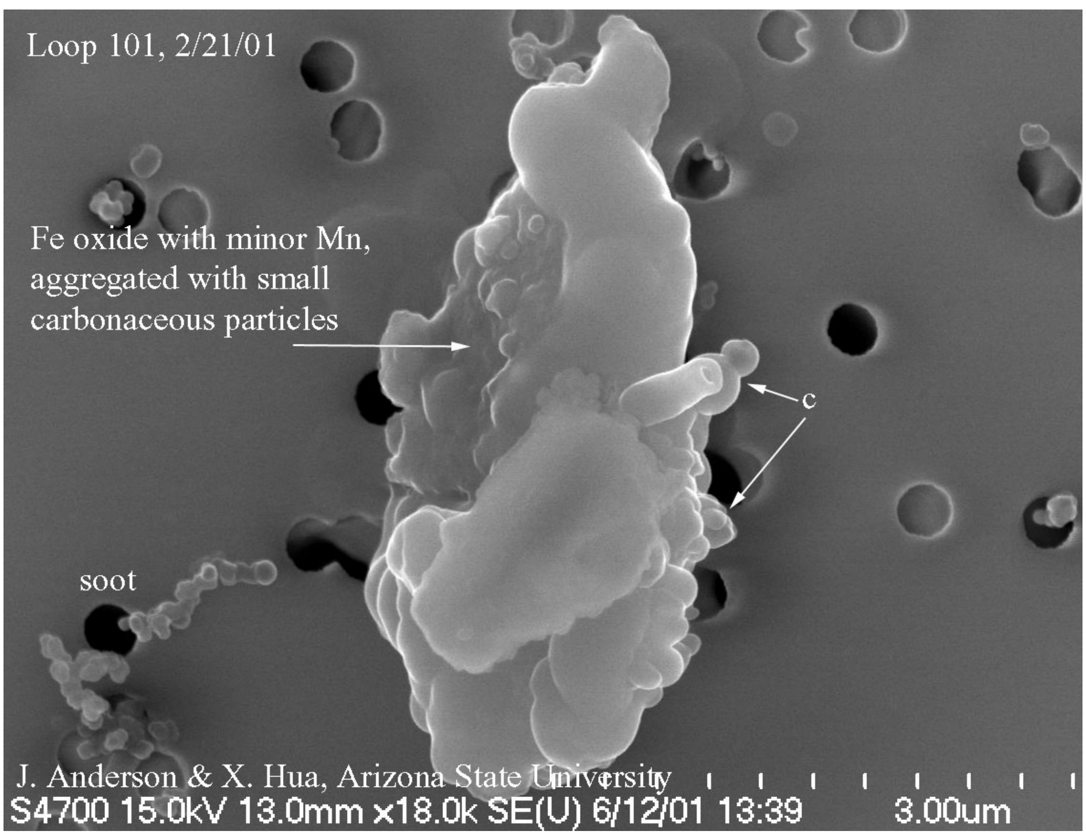

Figure D-5: Fe oxide with tubular carbon attached. Possibly engine wear particle.

Figure D-6: Large compact soot of unknown origin (common in Loop 101 samples).

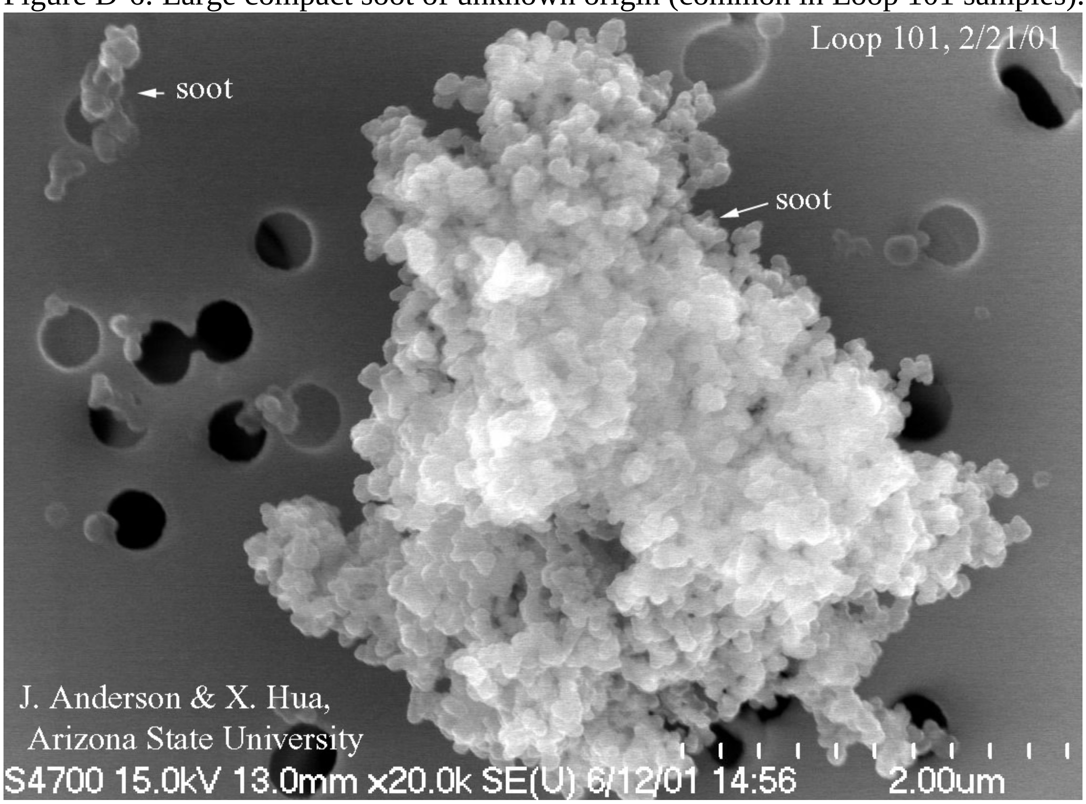

Figure D-7: Another large compact soot particle, plus numerous small soot.

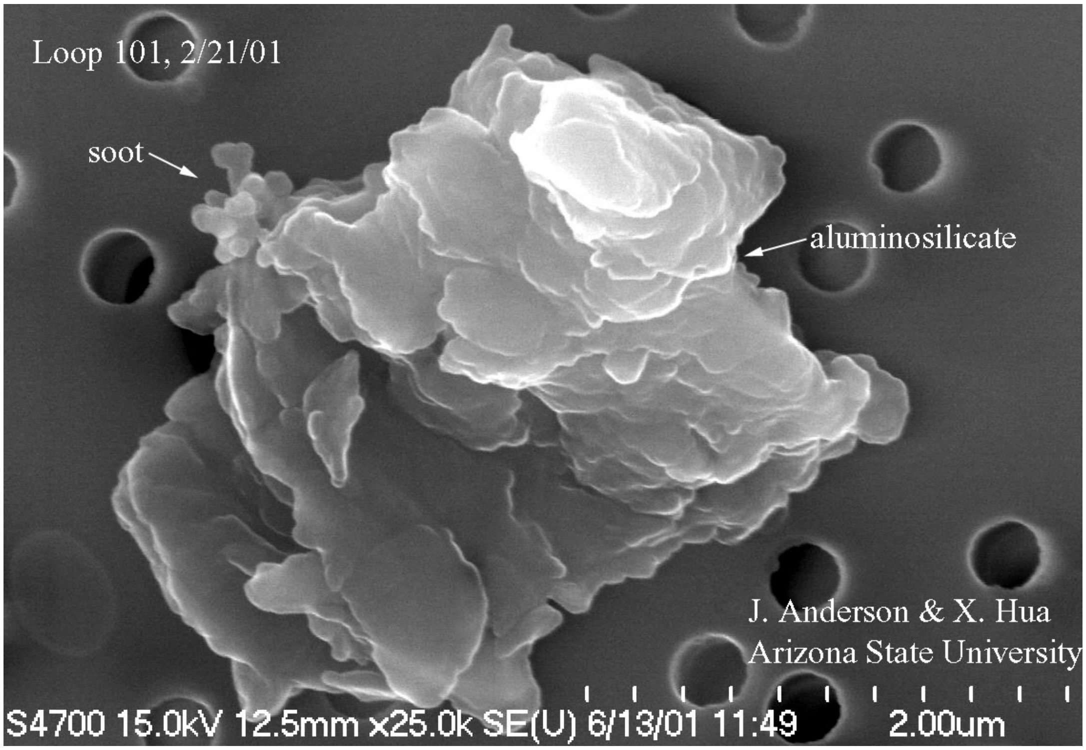

Figure D-8: Aluminosilicate particle (clay) aggregated with soot.