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Experimental Measurement of the Plasma Conductivity of Z93 and Z93P Thermal Control Paint

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EXPERIMENTAL MEASUREMENT OF THE PLASMA CONDUCTIVITY OF Z93 AND Z93P THERMAL CONTROL PAINT

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SUMMARY

Two samples each of Z93 and Z93P thermal control paint were exposed to a simulated space environment in a plasma chamber. The samples were biased through a series of voltages ranging from -200 volts to +300 volts and electron and ion currents measured. By comparing the currents to those of pure metal samples of the same size and shape, the conductivity of the samples was calculated. Measured conductivity was dependent on the bias potential in all cases. For Z93P, conductivity was approximately constant over much of the bias range and we find a value of 0.5 micro-mhos per square meter for both electron and ion current. For Z93, the dependence on bias was much more pronounced but conductivity can be said to be approximately one order of magnitude larger. In addition to presenting these results, this report documents all of the experimental data as well as the statistical analyses performed.

INTRODUCTION

Z93, a paint composed of zinc oxide in a potassium silicate binder, has been widely used in the space program as a thermal control coating. Recently, there has been an increased interest in the electrical properties of this paint because of its anticipated use on surfaces which may be at high electrical potentials with respect to the ionospheric plasma.

In particular, the radiators baselined for Space Station Freedom will be coated with Z93. The measurement of plasma current collection from such surfaces is important because the ground potential of large space structures with respect to the ionosphere can differ significantly from that of the plasma. This occurs as a result of current balance. Because of their large mass and low mobility, ions collected by negatively biased surfaces result in a relatively small plasma current density. The lightweight electrons, on the other hand, are readily collected by positively biased surfaces. Ram and wake effects further complicate the picture. Ram ion energy is considerably higher than ambient thermal energy so ion collection is enhanced on ram facing surfaces relative to surfaces which are oblique to plasma flow. The spacecraft will reach equilibrium at whatever potential results in a net collection current of zero. The most challenging situations occur when the spacecraft power system uses a negative ground as does, for example, Space Station Freedom. In such a configuration, large surfaces are negative and must collect slow moving ions to balance the current from electron collection which now occurs only from relatively small areas of positive surface. In the worst case, parts of the spacecraft will be biased negatively with respect to the ionosphere to a level very near the maximum voltage used on the solar arrays.

An initial assessment of the implications for Space Station Freedom (SSF) was made by a workshop which included most of the recognized experts in NASA, industry, and academia[1]. That assessment showed that plasma effects are expected to have considerable impact on the performance and surface properties of SSF. As a result, a NASA "Tiger Team" was formed to comprehensively evaluate all related issues and to recommend any necessary action[2]. This team, consisting of more than 100 people including most of the experts mentioned above, worked for more than a year to study these issues. Extensive computer modeling and ground based plasma testing were performed and incorporated into an exhaustive set of trade studies.

The Tiger Team concluded that major parts of SSF would "float" at about 140 V negative with respect to the ionosphere, close to the 160 V maximum used by its power system. Such large potentials were expected to involve major difficulties with arcing and sputtering and could not be tolerated. To address this problem a plasma contactor is being added to SSF. Basically a hollow cathode discharge, the contactor will emit a continuous cloud of plasma which will effectively "ground" the structure to the ionosphere. The result will be that as conditions change throughout the orbit, the floating potentials on various parts of the structure will oscillate between positive and negative. The design parameters for the contactor will be chosen to keep the amplitudes of these potentials to within ± 40 volts of plasma ground. In order to properly design the contactor, it is necessary to model the overall system of "station plus contactor plus ionosphere". This in turn requires an understanding of the plasma current collection characteristics of the various surfaces. Because of the large area of the radiators, which comprise about half the surface area of the entire space station, a moderately conducting coating would be expected to considerably affect current balance. During early flight stages (before the plasma contactor is operational) the Z93 coated radiators are the main ion collectors. If these surfaces are conductive, this will help to keep potentials low in early stages.

Within the past year, the binder used to formulate Z93 has become unavailable as it will no longer be made by the current supplier. This binder is a potassium silicate based material made by Sylvania and designated as PS7. An effort has therefore been underway to qualify a replacement. After extensive effort a reformulated product, based on a potassium silicate material made by PQ corporation and known as Kasil 2130, has been approved and is known as Z93P. Although the two formulations are supposed to be as close to identical as possible, the qualification process has concentrated on such issues as sprayability and long term ultraviolet stability. Electrical conductivity in a plasma has not been specifically addressed. The two formulations differ slightly in such parameters as density, amounts of metallic impurities, and the mole fractions of various constituents[3]. It is beyond our scope to relate any difference in conductivity to a single material parameter or combination of them. We simply note that the materials are not identical and will make measurements of both.

A standard measurement of the material conductivity is inadequate for this determination for two reasons. First, plasma is not a standard electrode for bulk conductivity measurements and a measurement made with metal electrodes cannot be expected to produce the same result. Second, since there is no way of knowing how much of the applied bias "drops" over the thickness of the material, one can not easily calculate the plasma current conduction from a knowledge of the bulk conductivity. A direct measurement of the plasma current characteristics of Z93 was therefore undertaken and is reported here.

TEST FACILITY AND PROCEDURES

Testing was done in the Plasma Interaction Facility (PIF) at the Lewis Research Center. The plasma chamber used was a Tenney Corporation space simulation chamber offering a cylindrical volume six feet in diameter by six feet long. A thirty six inch diffusion pump provides an initial pumpdown to approximately 5×10^{-7} torr. Plasma is generated by a tungsten filament source with a continuous flow of Argon. Pressure in the tank during operation of the plasma source was approximately 5×10^{-5} torr.

An electrometer, a Keithley model 237, was used to apply a bias voltage to the test sample and measure the resulting collected current. The measurements were made from -200 volts to +300 volts in 10 volt increments. Ion and electron current sweeps were made separately, always beginning with zero volts and increasing the applied voltage. The negative bias range was restricted to -200 volts to avoid arcing and possible damage to the sample. Precautions were taken to account for systematic drifts in plasma density caused by conditions in the plasma source. Filament sources generally degrade as the tungsten evaporates and the resistance slowly increases. The result is a slow increase in filament temperature and a resulting increase in measured plasma density. To account for this, the plasma density was monitored using a 3/4 inch Langmuir probe. At the beginning of each data run, the plasma source was adjusted to result in a current of 800 microamps when this probe was biased to +100 volts. It was observed that this current would typically increase by two or three percent by the time the run was completed. Plasma conditions corresponding to this value were measured and are shown in Table I. The procedure effectively normalizes all data to the plasma density indicated.

Table I - Plasma Parameters

Electron Density	4.5×10^{5} / cm^{3}
Electron Temp	1.13 eV
Ion Temp	.25 eV
Plasma Potential	3.05 eV

In making a measurement of the conductivity of an insulating paint on a metal surface, it seems intuitively clear that all of the applied voltage will drop over the paint, i.e. that the metal will not account for any significant bias drop. In a plasma, however, a sheath will form over a biased conducting surface which will support a voltage drop. An issue to be resolved is whether the sheath drop is a significant fraction of the total voltage which can be true if the paint is moderately conducting, To determine the conductivity unambiguously we therefore made measurements of the current collection from an identical sample of pure copper. By comparing the voltages at which the two samples collect an identical current, the magnitude of the sheath effect can be determined.

In practice, the metal sample was mounted in the tank to one side of center and the paint sample placed symmetrically on the other side. Five data runs were then taken from both paint and metal. The tank was then opened, the positions of the paint sample and metal sample reversed, and five more runs taken. The monitor probe, whose position never changed, was relied on to reproduce overall plasma conditions. This procedure accounted for small differences in plasma

conditions from one side of the tank to the other caused by the non-symmetric placement of the plasma source. All ten runs were then averaged to produce the final data.

Preliminary work with Z93, reported earlier[4], showed that the material required about one week in vacuum to reach a stable conductivity. Further, an exposure of several days to room humidity only partially restored conductivity. We therefore left all samples in the chamber under high vacuum for two weeks before beginning the tests reported here. When the tank was opened to reposition a sample, the process required a maximum of ten minutes exposure to humidity. These changes were always performed in the afternoon with no data taken until the next day. Samples not under test remained in the chamber at all times. This procedure is believed sufficient to minimize any effects of humidity and to ensure that all samples had an identical history of exposure.

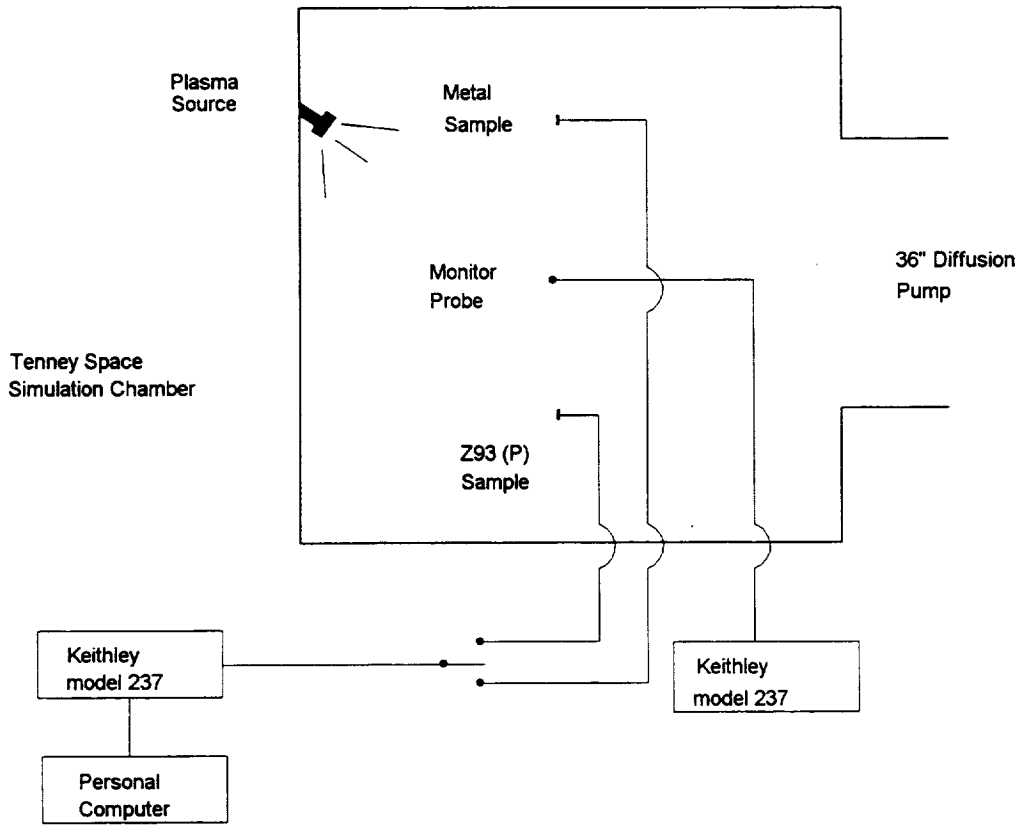

Figure 1 - Block diagram of the Test Facility and layout

Figure 1 shows a schematic representation of the experimental layout. The electrometer used to measure the sample was controlled by a laboratory PC while the one used for the monitor probe was operated from its front panel controls. The samples were provided by the Electro-Physics branch at the Lewis Research Center. They are disks nominally 1 inch in diameter[5] and 1/32 inch thick. The coating is applied to one face of the disk with a nominal thickness of between four and

five mils. Electrical connection is made to the back face and all exposed metal surfaces sealed with a clear silicon sealant.

RESULTS

We show first the results of current collection from the metal samples since these measurements will be used both to normalize the results for the two paint formulations and to assess the significance of voltage drop across the plasma sheaths. The collection currents versus bias are shown in figures 2 and 3 for ion and electron collection respectively.

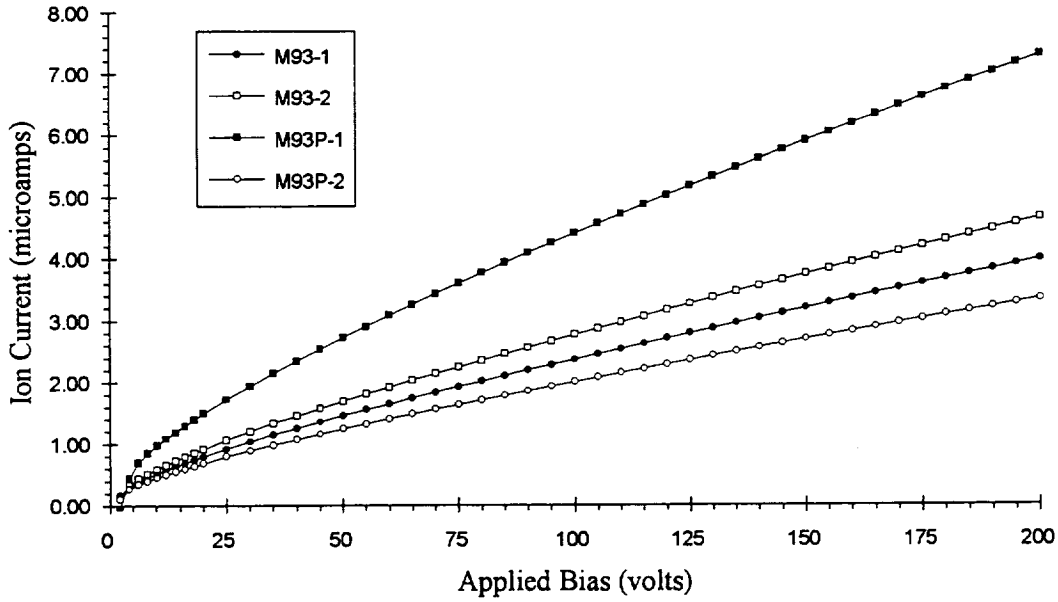

Figure 2 - Metal Sample: Ion Current vs Negative Bias

Recall that the same metal sample was used in all cases and that the designation given in the figures refers to the corresponding paint sample measured at the same time. Despite our best efforts to provide identical plasma conditions from run to run over the period of several weeks that the data were taken, current collection from the metal sample shows small differences. We will arbitrarily choose sample M93-2 to normalize to, i.e. for the paint samples all currents will be multiplied by the ratio of the current collected by their corresponding metal sample and M93-2 at each value of applied bias.

Figures 4 and 5 show normalized ion and electron collection currents for the four paint samples. We point out at this time that collection from our samples was well behaved over most of the voltage range. At higher voltages, however, we see sharp transients and sudden increases in current collection. We take this as evidence of breakdown in either the silicon coating used to cover exposed metal parts or in the paint material itself. Data from these regions is generally judged to be unreliable and is not used in estimating the plasma conductivities. In particular, figure 6 shows that all samples have problems above 200 volts for electron collection. For ion collection, which was limited to 200 volts maximum, figure 4 shows that only one sample had problems over

150 volts. We believe, therefore, that our results are reliable to a maximum of 200 volts for both polarities.

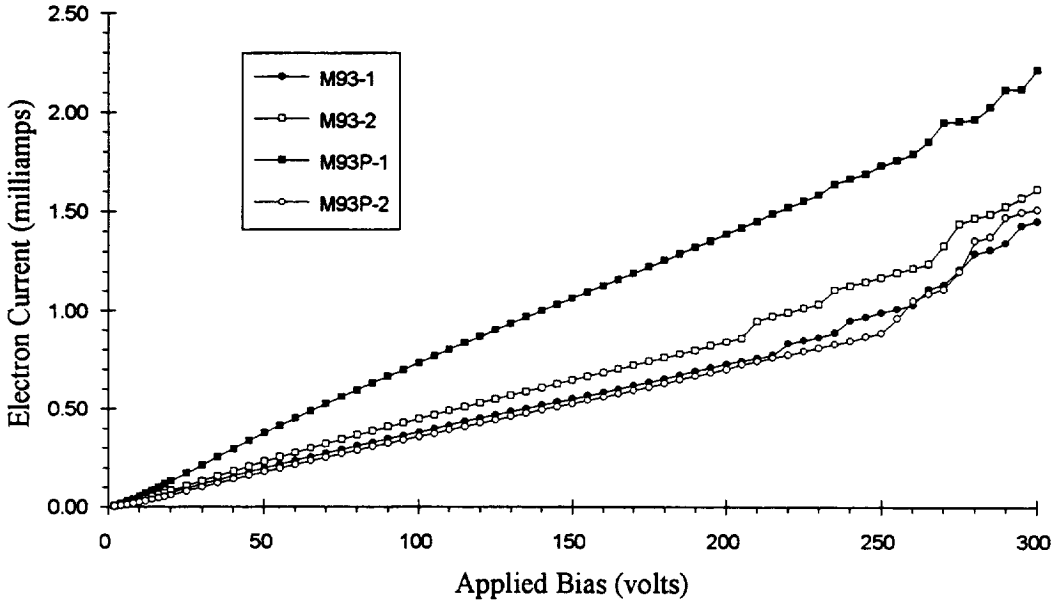

Figure 3 - Metal Sample: Electron Current vs Positive Bias

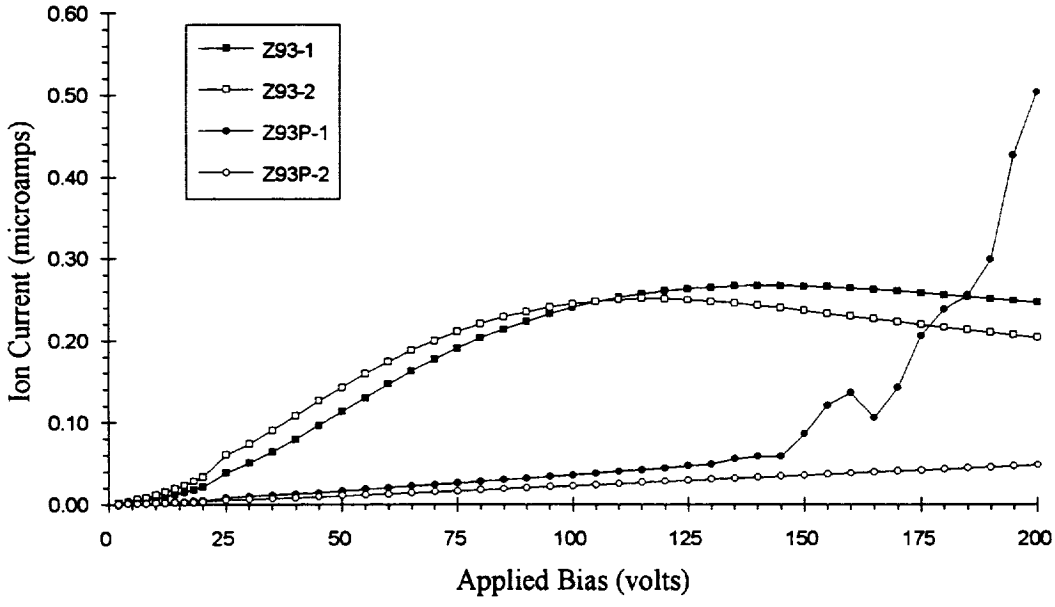

Figure 4 - Paint Samples: Ion Current vs Negative Bias

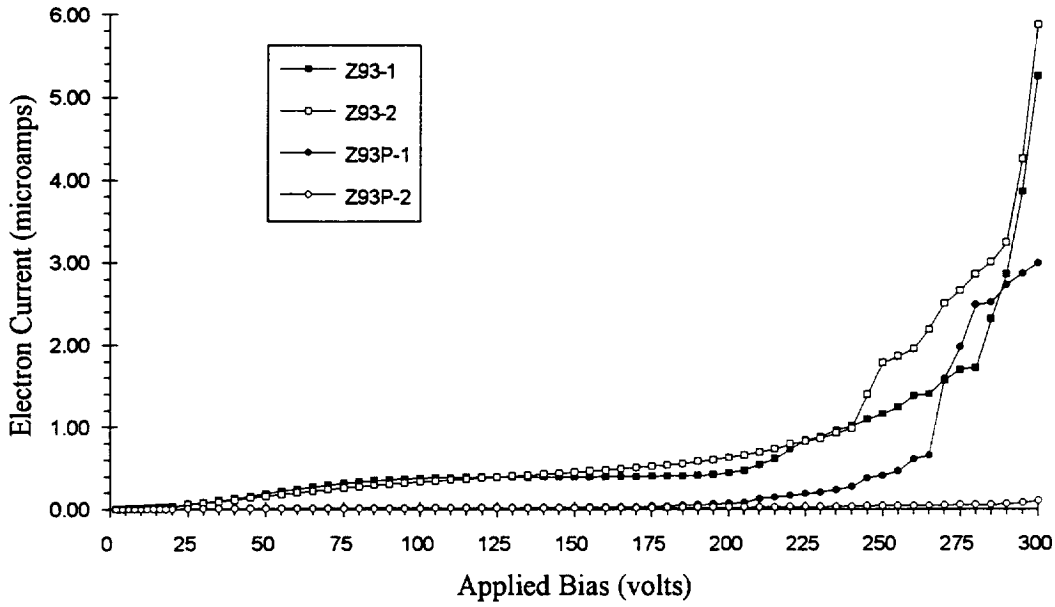

Figure 5 - Paint Samples: Electron Current vs Positive Bias

We now turn our attention to sheath effects. For ion current, we compare figures 2 and 4 showing collection for the metal sample and paint samples respectively. Figure 4 indicates that the maximum currents measured, neglecting the breakdown experienced by sample Z93P-1, is approximately 25 microamps. Referring to figure 2, we note that such a current is collected by the metal sample with the application of between 2 and 3 volts. In principle, one could fit these curves and interpolate to obtain an accurate value. This number would then be a correction to be applied to the voltage for the paint sample effectively shifting the x axis in figure 4 by that amount.

There are several reasons we will not do this. First, the curves in figure 2 are changing slope rapidly in this vicinity. Since data was taken at 2 volts intervals such a fit will not be particularly reliable. Furthermore, the plasma potential, as shown in table 1, was on the order of three volts. The significance of this lies in the fact that out voltage measurements are taken with respect to earth ground which differs from plasma ground by several volts. Although we took great pains to reproduce plasma densities, our apparatus does not allow us to control plasma potential explicitly. This parameter varies from day to day by a volt or so and was not even measured on a daily basis. We simply accept an error of several volts in our voltage scale and note that for the work reported here it is not significant. Since there is no reason to believe that any significant voltage should drop across the metal, the fact that the apparent magnitude lies within our already accepted uncertainty causes us to ignore it.

For electron collection, figures 3 and 5, the case is even more clear cut. The paint sample collects less that one microamp of current while the metal sample is collecting milliamps. Any correction here is truly insignificant.

To convert our current collection results to conductivity, we simply calculate the conductance by dividing current by voltage and dividing the result by the area of our sample, 5.07×10^{-4} m^2.

For convenience, we will display the result in units of 10^{-6} mhos/m^2 in figures 6 and 7. In figure 7 we will limit the voltage scale to 200 volts maximum since we do not believe our results are valid beyond this point and inclusion of the breakdown region forces the y-axis scale to such a large number that the data points for Z93P are pushed close to the x-axis, as they are in figure 5.

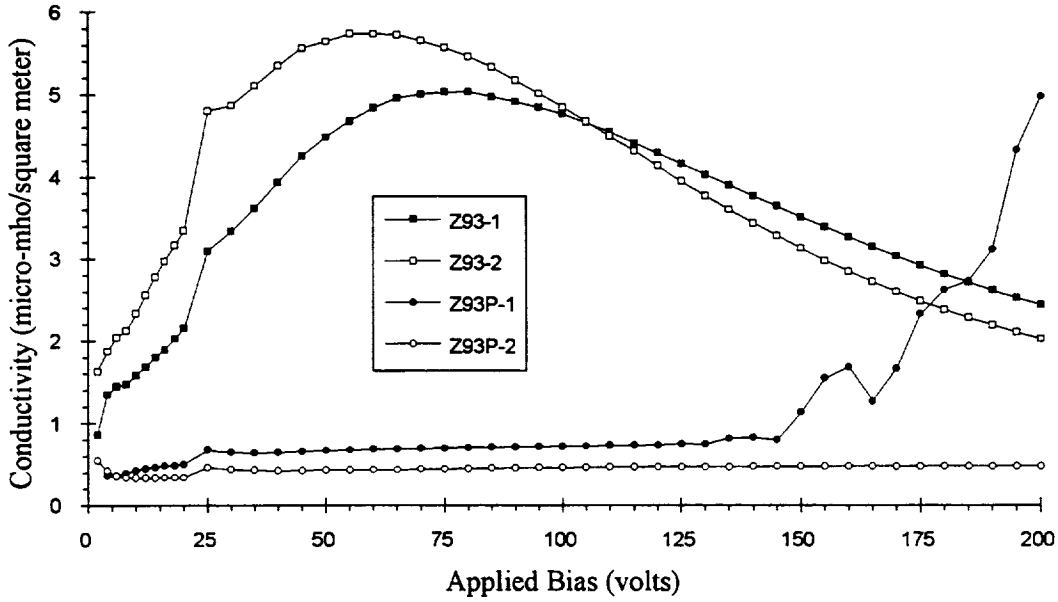

Figure 6 - Paint Samples: Ion Conductivity vs Negative Bias

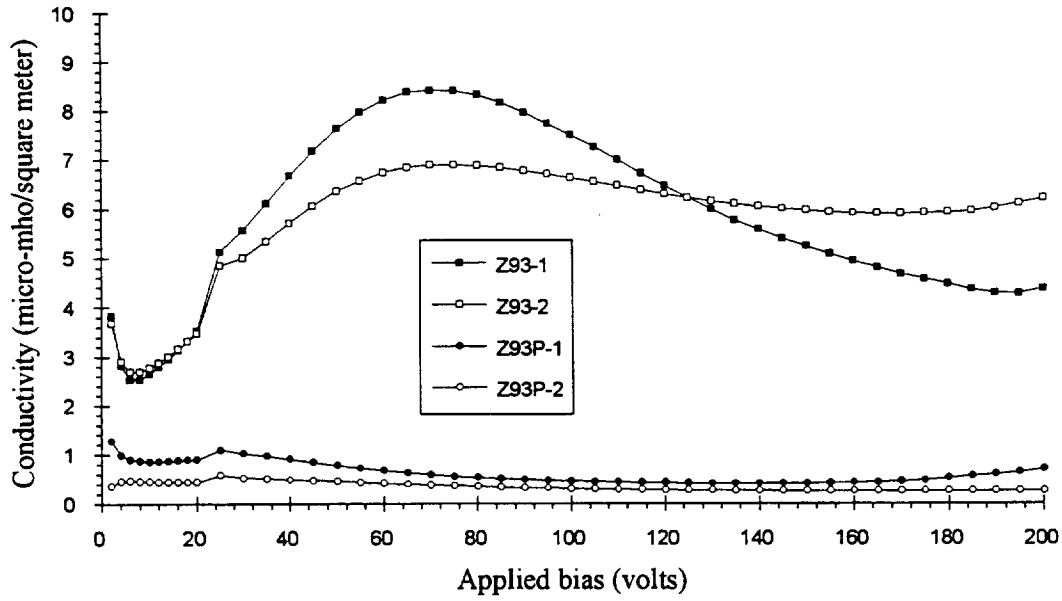

Figure 7 - Paint Samples: Electron Conductivity vs Positive Bias

Examination of figures 6 and 7 show that the conductivity of Z93P is approximately 0.5 micro-mho/square meter for both electrons and ions. In figure 6, we assume that the curve for sample Z93P-1, which closely paralleled that of the second sample up to about 130 volts, would have continued to do so had no breakdown occurred. Over the range of particular interest, 50 volts to 150 volts, the conductivity appears to be essentially constant. Figure 7 supports the same conclusion for electron collection, i.e. a constant value of conductivity.

Conductivity for Z93 shows a more pronounced dependence on voltage for both electron and ion conductivity. While these curves may be used for more accurate estimates, one can say that the conductivity over the 50V to 150V range is approximately a factor of ten larger than for Z93P.

EXPERIMENTAL ERROR

Each of the five run sets of raw data, recorded in appendix II, indicates a mean value and a standard error. Even cursory examination of these data sets allows a number of conclusions to be drawn. First, data from metal samples shows typical standard errors in the 1 to 2 percent range indicating stable, reproducible plasma conditions. Second, data from the paint samples shows much larger errors, generally a few tens of percent in magnitude. These relatively large errors are not, however, randomly distributed but indicate a systematic error in the experiment.

A sample of raw data is reproduced in table II. As can be seen, data from runs 1, 3, and 5 constitute a consistent, reproducible data set while runs 2 and 4 appear to be about twice as large. This effect is seen in all of the data taken. By comparing the data with the order in which runs were taken, it becomes apparent that the history of the sample in the previous ten to fifteen minutes is critical. Since the samples are exposed to active plasma at all times we do not believe this to be a residual charging effect. Apparently, the application of high voltage to this material temporarily alters its bulk properties in a way that requires a significant time to relax. The mechanism is unknown and will be the subject of future research relating to this family of coatings.

Table II Sample Raw Data

SAMPLE A013: Z93-2 ION CURRENT: LEFT

Bias volts	A013NL1 μA	A013NL2 μA	A013NL3 μA	A013NL4 μA	A013NL5 μA	Mean μA	Standard error	fractional error
75	0.0754	0.1950	0.0731	0.2270	0.0894	0.1320	0.0328	0.248
80	0.0779	0.2000	0.0764	0.2340	0.0934	0.1363	0.0335	0.246
85	0.0801	0.2030	0.0795	0.2390	0.0978	0.1399	0.0338	0.241
90	0.0821	0.2050	0.0825	0.2410	0.0936	0.1408	0.0341	0.242
95	0.0838	0.2050	0.0851	0.2420	0.0975	0.1427	0.0336	0.235
100	0.0855	0.2040	0.0877	0.2420	0.1010	0.1440	0.0329	0.228

This effect leads us to believe that our final mean conductivities are accurate to no better than a factor of two. From the sign of the discepancies, the actual value for electron conduction is probably higher than the mean while for ion conduction the true value is probably lower than the reported mean.

CONCLUSIONS

The plasma conductivity of Z93 and Z93P thermal control paints was measured directly in a space simulation chamber. For Z93P, which is assumed to be the baseline formulation for all future applications, the conductivity was found to be a nearly constant 0.5 micro-mhos per square meter. For Z93, the previous formulation, conductivity was approximately an order of magnitude larger and showed a somewhat more pronounced dependence on voltage. As is noted above, there are small differences in the composition of the binder between the two paints which presumably accounts for the measured differences in conductivity.

These results are being incorporated into modeling for Space Station Freedom[6].

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5. J. Dever, Personal Communication, NASA Lewis Research Center, Cleveland, OH, 1992

6. Purvis, C.K., "Environments Workbench Analysis of on-Orbit Floating Potentials of Space Station Freedom", to be presented at the 28th IECEC, Atlanta GA, Aug 8-13, 1993, paper 93IEC-278AP-9.

APPENDIX I - DATA SUMMARY

Summaries are presented for all four metal sample runs as well as all four paint samples. In each case, the mean value is the arithmetic mean of ten data runs, five with the sample positioned on the left side of the plasma chamber and five with it positioned on the right. The standard error is the RMS average of the two separate standard errors calculated from the five run sets. Since there is a systematic variation in plasma density between the two sides of the chamber this number will be large. The five run statistics are recorded with the raw data sets in appendix II. For the paint samples, the scaled data is a normalization based on current collection from the corresponding metal samples so that all data is scaled to sample M93-2.

Metal Sample - Ion Current

	M93-1		M93-2		M93P-1		M93P-2	
Volts	Mean μA	Standard error	Mean μA	Standard error	Mean μA	Standard error	Mean μA	Standard error
2	0.1770	0.0031	0.1223	0.0095	-0.0540	0.0338	0.1140	0.0079
4	0.3152	0.0017	0.3382	0.0039	0.4503	0.0119	0.2740	0.0044
6	0.3927	0.0014	0.4414	0.0038	0.6978	0.0136	0.3465	0.0058
8	0.4587	0.0014	0.5208	0.0041	0.8513	0.0156	0.4035	0.0070
10	0.5201	0.0012	0.5936	0.0041	0.9753	0.0176	0.4561	0.0080
12	0.5794	0.0013	0.6631	0.0044	1.0870	0.0199	0.5061	0.0085
14	0.6363	0.0014	0.7300	0.0046	1.1925	0.0208	0.5539	0.0089
16	0.6917	0.0015	0.7947	0.0048	1.2930	0.0218	0.6001	0.0095
18	0.7449	0.0015	0.8571	0.0050	1.3940	0.0224	0.6447	0.0098
20	0.7962	0.0015	0.9174	0.0047	1.4920	0.0238	0.6877	0.0099
25	0.9208	0.0016	1.0667	0.0050	1.7290	0.0208	0.7991	0.0064
30	1.0369	0.0026	1.2010	0.0058	1.9430	0.0224	0.8917	0.0083
35	1.1470	0.0024	1.3340	0.0058	2.1500	0.0257	0.9836	0.0094
40	1.2530	0.0028	1.4570	0.0075	2.3500	0.0272	1.0726	0.0105
45	1.3580	0.0032	1.5770	0.0068	2.5430	0.0285	1.1597	0.0109
50	1.4610	0.0032	1.6970	0.0089	2.7300	0.0295	1.2448	0.0115
55	1.5590	0.0037	1.8140	0.0073	2.9120	0.0301	1.3273	0.0117
60	1.6540	0.0035	1.9260	0.0085	3.0920	0.0311	1.4083	0.0120
65	1.7490	0.0037	2.0380	0.0081	3.2670	0.0336	1.4877	0.0118
70	1.8430	0.0032	2.1500	0.0079	3.4400	0.0336	1.5661	0.0124
75	1.9350	0.0035	2.2560	0.0089	3.6120	0.0356	1.6431	0.0126
80	2.0250	0.0035	2.3630	0.0095	3.7790	0.0361	1.7189	0.0131
85	2.1150	0.0035	2.4690	0.0092	3.9410	0.0365	1.7946	0.0135
90	2.2050	0.0035	2.5710	0.0089	4.1030	0.0380	1.8690	0.0136
95	2.2920	0.0060	2.6740	0.0092	4.2630	0.0387	1.9423	0.0138
100	2.3760	0.0032	2.7780	0.0105	4.4200	0.0397	2.0146	0.0142
105	2.4640	0.0049	2.8790	0.0124	4.5760	0.0402	2.0868	0.0145
110	2.5490	0.0045	2.9780	0.0122	4.7320	0.0420	2.1584	0.0145
115	2.6340	0.0049	3.0780	0.0125	4.8850	0.0409	2.2301	0.0152
120	2.7200	0.0053	3.1790	0.0126	5.0360	0.0415	2.2997	0.0150
125	2.8020	0.0045	3.2750	0.0141	5.1870	0.0425	2.3688	0.0153
130	2.8840	0.0049	3.3710	0.0127	5.3320	0.0425	2.4362	0.0155
135	2.9650	0.0055	3.4700	0.0139	5.4780	0.0432	2.5051	0.0151
140	3.0460	0.0058	3.5650	0.0141	5.6230	0.0431	2.5725	0.0152
145	3.1280	0.0051	3.6590	0.0148	5.7700	0.0437	2.6398	0.0154
150	3.2080	0.0051	3.7530	0.0150	5.9150	0.0436	2.7068	0.0158
155	3.2880	0.0051	3.8480	0.0160	6.0540	0.0469	2.7732	0.0161
160	3.3690	0.0049	3.9400	0.0152	6.1970	0.0465	2.8391	0.0163
165	3.4490	0.0049	4.0320	0.0170	6.3390	0.0476	2.9050	0.0168
170	3.5290	0.0049	4.1240	0.0162	6.4820	0.0480	2.9703	0.0170
175	3.6070	0.0071	4.2160	0.0169	6.6220	0.0459	3.0352	0.0170
180	3.6840	0.0049	4.3060	0.0179	6.7620	0.0479	3.0996	0.0172
185	3.7640	0.0049	4.3990	0.0177	6.9010	0.0487	3.1658	0.0175
190	3.8410	0.0071	4.4880	0.0189	7.0370	0.0492	3.2290	0.0182
195	3.9200	0.0053	4.5780	0.0206	7.1750	0.0515	3.2931	0.0185
200	3.9970	0.0071	4.6670	0.0204	7.3110	0.0512	3.3565	0.0181

Metal Sample - Electron Current

	M93-1		M93-2		M93P-1		M93P-2	
Volts	Mean mA	Standard error	Mean mA	Standard error	Mean mA	Standard error	Mean mA	Standard error
2	0.0034	0.0002	0.0041	0.0003	0.0066	0.0007	0.0032	0.0005
4	0.0094	0.0004	0.0107	0.0005	0.0174	0.0014	0.0076	0.0009
6	0.0162	0.0006	0.0183	0.0007	0.0297	0.0020	0.0127	0.0012
8	0.0235	0.0007	0.0265	0.0008	0.0431	0.0024	0.0185	0.0015
10	0.0309	0.0008	0.0350	0.0009	0.0570	0.0027	0.0248	0.0016
12	0.0389	0.0009	0.0441	0.0010	0.0716	0.0029	0.0316	0.0018
14	0.0477	0.0008	0.0539	0.0009	0.0869	0.0029	0.0390	0.0019
16	0.0567	0.0007	0.0640	0.0009	0.1029	0.0028	0.0467	0.0019
18	0.0657	0.0006	0.0741	0.0008	0.1187	0.0028	0.0546	0.0018
20	0.0745	0.0006	0.0842	0.0007	0.1349	0.0027	0.0626	0.0018
25	0.0969	0.0004	0.1098	0.0007	0.1757	0.0028	0.0830	0.0016
30	0.1190	0.0005	0.1358	0.0006	0.2172	0.0026	0.1037	0.0013
35	0.1408	0.0004	0.1611	0.0006	0.2583	0.0025	0.1242	0.0011
40	0.1617	0.0005	0.1861	0.0006	0.2985	0.0024	0.1444	0.0010
45	0.1821	0.0005	0.2104	0.0007	0.3380	0.0025	0.1640	0.0009
50	0.2017	0.0005	0.2340	0.0007	0.3767	0.0026	0.1830	0.0009
55	0.2210	0.0006	0.2568	0.0009	0.4146	0.0029	0.2017	0.0009
60	0.2400	0.0006	0.2794	0.0009	0.4519	0.0030	0.2199	0.0009
65	0.2585	0.0004	0.3018	0.0009	0.4890	0.0031	0.2380	0.0009
70	0.2769	0.0005	0.3234	0.0010	0.5250	0.0031	0.2557	0.0010
75	0.2950	0.0006	0.3449	0.0009	0.5608	0.0034	0.2733	0.0010
80	0.3129	0.0007	0.3661	0.0010	0.5963	0.0035	0.2908	0.0010
85	0.3306	0.0007	0.3871	0.0010	0.6313	0.0038	0.3082	0.0010
90	0.3484	0.0007	0.4084	0.0012	0.6660	0.0038	0.3253	0.0010
95	0.3656	0.0008	0.4289	0.0013	0.7004	0.0040	0.3424	0.0010
100	0.3830	0.0008	0.4493	0.0013	0.7345	0.0042	0.3595	0.0011
105	0.4002	0.0009	0.4697	0.0014	0.7685	0.0043	0.3763	0.0011
110	0.4172	0.0009	0.4897	0.0013	0.8019	0.0047	0.3932	0.0011
115	0.4361	0.0034	0.5103	0.0014	0.8371	0.0046	0.4116	0.0023
120	0.4528	0.0036	0.5304	0.0014	0.8700	0.0047	0.4282	0.0025
125	0.4696	0.0037	0.5502	0.0015	0.9034	0.0052	0.4449	0.0027
130	0.4860	0.0039	0.5696	0.0015	0.9359	0.0053	0.4615	0.0028
135	0.5027	0.0040	0.5889	0.0016	0.9683	0.0056	0.4778	0.0030
140	0.5191	0.0044	0.6087	0.0017	1.0009	0.0058	0.4944	0.0032
145	0.5354	0.0048	0.6282	0.0019	1.0332	0.0060	0.5107	0.0035
150	0.5521	0.0051	0.6474	0.0018	1.0655	0.0063	0.5275	0.0039
155	0.5682	0.0055	0.6668	0.0020	1.0975	0.0063	0.5441	0.0042
160	0.5844	0.0057	0.6857	0.0019	1.1297	0.0062	0.5609	0.0050
165	0.6022	0.0082	0.7050	0.0020	1.1616	0.0063	0.5776	0.0053
170	0.6196	0.0115	0.7239	0.0022	1.1936	0.0066	0.5941	0.0055
175	0.6362	0.0125	0.7431	0.0024	1.2261	0.0070	0.6120	0.0077
180	0.6533	0.0148	0.7624	0.0024	1.2583	0.0074	0.6288	0.0083
185	0.6735	0.0212	0.7813	0.0027	1.2921	0.0106	0.6508	0.0190
190	0.6924	0.0230	0.8006	0.0028	1.3243	0.0108	0.6683	0.0190
195	0.7110	0.0274	0.8240	0.0107	1.3558	0.0106	0.6845	0.0188
200	0.7276	0.0290	0.8421	0.0088	1.3909	0.0151	0.7022	0.0202

Metal Sample - Electron Current (continued)

	M93-1		M93-2		M93P-1		M93P-2	
Volts	Mean mA	Standard error	Mean mA	Standard error	Mean mA	Standard error	Mean mA	Standard error
205	0.7442	0.0289	0.8609	0.0085	1.4228	0.0150	0.7254	0.0335
210	0.7595	0.0280	0.9482	0.1383	1.4542	0.0138	0.7429	0.0323
215	0.7752	0.0274	0.9740	0.1368	1.4921	0.0241	0.7618	0.0314
220	0.8334	0.1104	0.9925	0.1380	1.5232	0.0227	0.7758	0.0278
225	0.8494	0.1110	1.0165	0.1396	1.5558	0.0230	0.7938	0.0294
230	0.8660	0.1118	1.0342	0.1408	1.5872	0.0223	0.8121	0.0319
235	0.8889	0.1143	1.1083	0.1872	1.6430	0.0675	0.8297	0.0311
240	0.9523	0.1599	1.1295	0.1886	1.6687	0.0532	0.8470	0.0302
245	0.9689	0.1612	1.1496	0.1902	1.6936	0.0388	0.8693	0.0370
250	0.9937	0.1604	1.1716	0.1926	1.7330	0.0360	0.8878	0.0346
255	1.0111	0.1614	1.1979	0.1949	1.7633	0.0340	0.9638	0.1291
260	1.0321	0.1616	1.2191	0.1976	1.7950	0.0328	1.0543	0.1540
265	1.1113	0.1849	1.2425	0.1987	1.8575	0.0773	1.0887	0.1539
270	1.1372	0.1834	1.3319	0.2196	1.9538	0.1686	1.1137	0.1552
275	1.2115	0.2042	1.4436	0.2040	1.9602	0.1171	1.2054	0.1366
280	1.2926	0.2071	1.4718	0.2009	1.9703	0.0799	1.3586	0.2033
285	1.3122	0.2069	1.4905	0.2062	2.0315	0.1171	1.3779	0.2036
290	1.3484	0.2003	1.5293	0.2073	2.1210	0.1493	1.4750	0.1898
295	1.4343	0.1954	1.5710	0.2054	2.1228	0.1215	1.5014	0.1873
300	1.4549	0.1939	1.6176	0.2099	2.2196	0.1821	1.5151	0.1919

Sample Z93-1

Ion					electron				
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
2	0.0013	0.0015	0.0009	0.867	2	0.0032	0.0007	0.0039	3.836
4	0.0026	0.0016	0.0027	1.353	4	0.0050	0.0007	0.0057	2.829
6	0.0039	0.0018	0.0044	1.450	6	0.0068	0.0009	0.0077	2.536
8	0.0053	0.0018	0.0060	1.476	8	0.0091	0.0017	0.0103	2.541
10	0.0070	0.0021	0.0080	1.584	10	0.0119	0.0027	0.0135	2.662
12	0.0090	0.0024	0.0103	1.689	12	0.0151	0.0039	0.0171	2.807
14	0.0111	0.0028	0.0128	1.799	14	0.0186	0.0054	0.0210	2.962
16	0.0134	0.0033	0.0154	1.897	16	0.0225	0.0071	0.0254	3.134
18	0.0161	0.0038	0.0185	2.032	18	0.0269	0.0090	0.0304	3.327
20	0.0190	0.0044	0.0219	2.155	20	0.0318	0.0111	0.0359	3.541
25	0.0339	0.0069	0.0393	3.099	25	0.0574	0.0222	0.0650	5.129
30	0.0438	0.0092	0.0508	3.338	30	0.0744	0.0302	0.0849	5.583
35	0.0552	0.0110	0.0642	3.621	35	0.0949	0.0405	0.1085	6.117
40	0.0687	0.0141	0.0799	3.940	40	0.1177	0.0515	0.1355	6.681
45	0.0836	0.0175	0.0970	4.254	45	0.1418	0.0630	0.1638	7.179
50	0.0979	0.0215	0.1137	4.484	50	0.1669	0.0735	0.1936	7.638
55	0.1121	0.0257	0.1305	4.678	55	0.1913	0.0834	0.2223	7.972
60	0.1263	0.0289	0.1471	4.836	60	0.2149	0.0918	0.2502	8.226
65	0.1402	0.0319	0.1633	4.957	65	0.2368	0.0984	0.2765	8.389
70	0.1523	0.0344	0.1776	5.005	70	0.2560	0.1033	0.2989	8.423
75	0.1641	0.0369	0.1913	5.032	75	0.2737	0.1068	0.3199	8.414
80	0.1751	0.0389	0.2043	5.037	80	0.2889	0.1084	0.3381	8.335
85	0.1836	0.0407	0.2143	4.973	85	0.3009	0.1083	0.3523	8.176
90	0.1923	0.0423	0.2243	4.915	90	0.3101	0.1068	0.3635	7.966
95	0.2001	0.0434	0.2335	4.848	95	0.3178	0.1042	0.3728	7.741
100	0.2066	0.0443	0.2416	4.765	100	0.3244	0.1007	0.3806	7.506
105	0.2123	0.0448	0.2481	4.660	105	0.3295	0.0965	0.3867	7.264
110	0.2171	0.0450	0.2536	4.547	110	0.3328	0.0921	0.3906	7.004
115	0.2203	0.0453	0.2575	4.416	115	0.3352	0.0873	0.3922	6.727
120	0.2235	0.0450	0.2613	4.294	120	0.3367	0.0824	0.3944	6.483
125	0.2259	0.0446	0.2640	4.165	125	0.3379	0.0775	0.3959	6.247
130	0.2273	0.0441	0.2657	4.032	130	0.3382	0.0729	0.3964	6.014
135	0.2286	0.0432	0.2675	3.909	135	0.3380	0.0681	0.3960	5.785
140	0.2289	0.0422	0.2679	3.774	140	0.3391	0.0637	0.3976	5.602
145	0.2293	0.0409	0.2682	3.648	145	0.3393	0.0596	0.3981	5.415
150	0.2285	0.0397	0.2674	3.516	150	0.3407	0.0557	0.3995	5.253

Sample: Z93-1 (continued)

Ion					electron				
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
155	0.2279	0.0384	0.2668	3.394	155	0.3415	0.0520	0.4008	5.100
160	0.2269	0.0370	0.2654	3.271	160	0.3426	0.0485	0.4020	4.955
165	0.2256	0.0355	0.2637	3.152	165	0.3445	0.0454	0.4033	4.821
170	0.2242	0.0340	0.2619	3.039	170	0.3460	0.0423	0.4042	4.690
175	0.2222	0.0323	0.2597	2.927	175	0.3481	0.0395	0.4066	4.583
180	0.2200	0.0308	0.2571	2.817	180	0.3506	0.0370	0.4091	4.483
185	0.2184	0.0294	0.2552	2.721	185	0.3536	0.0345	0.4102	4.373
190	0.2161	0.0280	0.2524	2.621	190	0.3582	0.0326	0.4142	4.300
195	0.2143	0.0265	0.2502	2.531	195	0.3659	0.0305	0.4241	4.289
200	0.2125	0.0250	0.2481	2.447	200	0.3847	0.0369	0.4452	4.391
					205	0.4086	0.0494	0.4727	4.548
					210	0.4343	0.0591	0.5422	5.093
					215	0.4910	0.0719	0.6169	5.660
					220	0.6138	0.0774	0.7310	6.553
					225	0.7026	0.0376	0.8408	7.371
					230	0.7399	0.0337	0.8836	7.577
					235	0.7725	0.0349	0.9632	8.084
					240	0.8550	0.0770	1.0141	8.334
					245	0.9190	0.0800	1.0904	8.778
					250	0.9828	0.0846	1.1587	9.142
					255	1.0474	0.0871	1.2409	9.598
					260	1.1693	0.0807	1.3812	10.478
					265	1.2530	0.0752	1.4009	10.427
					270	1.3390	0.0779	1.5683	11.456
					275	1.4260	0.0915	1.6992	12.187
					280	1.5140	0.0942	1.7239	12.144
					285	2.0430	0.7494	2.3206	16.060
					290	2.5280	1.3092	2.8672	19.500
					295	3.5300	1.3239	3.8664	25.851
					300	4.7340	1.4530	5.2634	34.605

Sample: Z93-2

Ion					electron				
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
2	0.0017	0.0016	0.0017	1.634	2	0.0037	0.0016	0.0037	3.693
4	0.0038	0.0018	0.0038	1.876	4	0.0059	0.0015	0.0059	2.910
6	0.0062	0.0018	0.0062	2.043	6	0.0082	0.0015	0.0082	2.702
8	0.0086	0.0020	0.0086	2.127	8	0.0110	0.0019	0.0110	2.706
10	0.0118	0.0023	0.0118	2.333	10	0.0141	0.0026	0.0141	2.778
12	0.0156	0.0027	0.0156	2.561	12	0.0176	0.0035	0.0176	2.888
14	0.0198	0.0032	0.0198	2.784	14	0.0214	0.0047	0.0214	3.021
16	0.0241	0.0040	0.0241	2.975	16	0.0257	0.0061	0.0257	3.168
18	0.0289	0.0048	0.0289	3.167	18	0.0303	0.0076	0.0303	3.321
20	0.0339	0.0058	0.0339	3.345	20	0.0352	0.0094	0.0352	3.474
25	0.0609	0.0096	0.0609	4.806	25	0.0615	0.0206	0.0615	4.849
30	0.0740	0.0131	0.0740	4.865	30	0.0763	0.0259	0.0763	5.014
35	0.0907	0.0174	0.0907	5.109	35	0.0949	0.0339	0.0949	5.350
40	0.1085	0.0226	0.1085	5.351	40	0.1161	0.0425	0.1161	5.725
45	0.1269	0.0287	0.1269	5.564	45	0.1386	0.0509	0.1386	6.075
50	0.1431	0.0369	0.1431	5.643	50	0.1615	0.0590	0.1615	6.370
55	0.1601	0.0432	0.1601	5.741	55	0.1833	0.0669	0.1833	6.573
60	0.1745	0.0507	0.1745	5.737	60	0.2052	0.0735	0.2052	6.747
65	0.1888	0.0564	0.1888	5.728	65	0.2257	0.0793	0.2257	6.850
70	0.2006	0.0629	0.2006	5.652	70	0.2448	0.0844	0.2448	6.898
75	0.2117	0.0678	0.2117	5.568	75	0.2624	0.0886	0.2624	6.900
80	0.2216	0.0723	0.2216	5.463	80	0.2793	0.0914	0.2793	6.886
85	0.2299	0.0764	0.2299	5.336	85	0.2949	0.0937	0.2949	6.844
90	0.2359	0.0798	0.2359	5.170	90	0.3095	0.0953	0.3095	6.783
95	0.2414	0.0822	0.2414	5.013	95	0.3235	0.0962	0.3235	6.716
100	0.2458	0.0843	0.2458	4.849	100	0.3367	0.0969	0.3367	6.641
105	0.2489	0.0854	0.2489	4.675	105	0.3493	0.0968	0.3493	6.561
110	0.2507	0.0859	0.2507	4.495	110	0.3614	0.0962	0.3614	6.480
115	0.2519	0.0858	0.2519	4.320	115	0.3729	0.0953	0.3729	6.396
120	0.2518	0.0852	0.2518	4.139	120	0.3841	0.0937	0.3841	6.313
125	0.2506	0.0839	0.2506	3.954	125	0.3957	0.0922	0.3957	6.244
130	0.2489	0.0819	0.2489	3.776	130	0.4067	0.0902	0.4067	6.171
135	0.2470	0.0799	0.2470	3.609	135	0.4187	0.0877	0.4187	6.117
140	0.2444	0.0775	0.2444	3.443	140	0.4309	0.0862	0.4309	6.071
145	0.2416	0.0747	0.2416	3.286	145	0.4429	0.0846	0.4429	6.025
150	0.2382	0.0719	0.2382	3.132	150	0.4553	0.0832	0.4553	5.987

Sample: Z93-2 (continued)

Ion					electron				
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
155	0.2344	0.0690	0.2344	2.983	155	0.4679	0.0822	0.4679	5.954
160	0.2313	0.0661	0.2313	2.852	160	0.4812	0.0813	0.4812	5.932
165	0.2279	0.0631	0.2279	2.724	165	0.4956	0.0810	0.4956	5.924
170	0.2247	0.0601	0.2247	2.607	170	0.5106	0.0818	0.5106	5.924
175	0.2211	0.0573	0.2211	2.492	175	0.5270	0.0835	0.5270	5.940
180	0.2177	0.0546	0.2177	2.385	180	0.5433	0.0856	0.5433	5.953
185	0.2147	0.0521	0.2147	2.289	185	0.5605	0.0889	0.5605	5.976
190	0.2117	0.0496	0.2117	2.198	190	0.5824	0.0936	0.5824	6.046
195	0.2086	0.0471	0.2086	2.110	195	0.6072	0.0984	0.6072	6.142
200	0.2056	0.0448	0.2056	2.028	200	0.6321	0.1017	0.6321	6.234
					205	0.6581	0.1060	0.6581	6.332
					210	0.6938	0.1168	0.6938	6.516
					215	0.7305	0.1334	0.7305	6.702
					220	0.7944	0.1883	0.7944	7.122
					225	0.8275	0.1994	0.8275	7.254
					230	0.8642	0.2147	0.8642	7.411
					235	0.9296	0.2295	0.9296	7.802
					240	0.9869	0.2570	0.9869	8.111
					245	1.3958	0.7871	1.3958	11.237
					250	1.7841	1.2764	1.7841	14.076
					255	1.8613	1.3382	1.8613	14.397
					260	1.9519	1.4137	1.9519	14.807
					265	2.1917	1.6195	2.1917	16.313
					270	2.5067	2.0597	2.5067	18.312
					275	2.6655	2.1142	2.6655	19.118
					280	2.8683	2.2043	2.8683	20.205
					285	3.0090	2.2446	3.0090	20.824
					290	3.2440	2.2946	3.2440	22.064
					295	4.2630	2.2331	4.2630	28.503
					300	5.8890	2.2464	5.8890	38.718

Sample: Z93P-1

	Ion					electron			
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
2	0.0004	0.0002	-0.0010		2	0.0021	0.001	0.0013	1.281
4	0.0010	0.0002	0.0007	0.369	4	0.0033	0.002	0.0020	0.996
6	0.0018	0.0002	0.0011	0.364	6	0.0045	0.002	0.0027	0.902
8	0.0026	0.0003	0.0016	0.397	8	0.0058	0.003	0.0036	0.881
10	0.0035	0.0006	0.0022	0.425	10	0.0071	0.003	0.0044	0.859
12	0.0045	0.0008	0.0027	0.450	12	0.0086	0.004	0.0053	0.868
14	0.0054	0.0010	0.0033	0.463	14	0.0100	0.005	0.0062	0.874
16	0.0064	0.0013	0.0039	0.485	16	0.0115	0.005	0.0072	0.886
18	0.0073	0.0014	0.0045	0.489	18	0.0131	0.006	0.0082	0.893
20	0.0083	0.0017	0.0051	0.503	20	0.0145	0.007	0.0091	0.894
25	0.0140	0.0033	0.0086	0.679	25	0.0223	0.01	0.0139	1.098
30	0.0159	0.0035	0.0098	0.647	30	0.0250	0.011	0.0156	1.026
35	0.0184	0.0040	0.0114	0.642	35	0.0276	0.012	0.0172	0.971
40	0.0212	0.0046	0.0132	0.648	40	0.0296	0.012	0.0184	0.909
45	0.0242	0.0051	0.0150	0.659	45	0.0310	0.012	0.0193	0.847
50	0.0273	0.0056	0.0170	0.669	50	0.0320	0.012	0.0199	0.785
55	0.0303	0.0061	0.0189	0.677	55	0.0327	0.011	0.0202	0.725
60	0.0334	0.0066	0.0208	0.684	60	0.0332	0.011	0.0205	0.674
65	0.0365	0.0071	0.0228	0.691	65	0.0337	0.01	0.0208	0.630
70	0.0395	0.0076	0.0247	0.696	70	0.0341	0.01	0.0210	0.593
75	0.0426	0.0080	0.0266	0.700	75	0.0346	0.009	0.0213	0.560
80	0.0457	0.0085	0.0286	0.705	80	0.0352	0.009	0.0216	0.533
85	0.0488	0.0090	0.0306	0.709	85	0.0360	0.008	0.0220	0.512
90	0.0519	0.0095	0.0325	0.713	90	0.0367	0.008	0.0225	0.493
95	0.0551	0.0100	0.0345	0.717	95	0.0375	0.008	0.0230	0.477
100	0.0581	0.0102	0.0365	0.720	100	0.0384	0.007	0.0235	0.464
105	0.0613	0.0107	0.0386	0.725	105	0.0395	0.007	0.0241	0.453
110	0.0650	0.0114	0.0409	0.733	110	0.0405	0.007	0.0247	0.443
115	0.0678	0.0116	0.0427	0.732	115	0.0416	0.007	0.0253	0.435
120	0.0710	0.0120	0.0448	0.736	120	0.0427	0.007	0.0260	0.428
125	0.0756	0.0133	0.0477	0.753	125	0.0440	0.006	0.0268	0.422
130	0.0782	0.0132	0.0495	0.750	130	0.0452	0.006	0.0275	0.418
135	0.0888	0.0212	0.0563	0.822	135	0.0467	0.006	0.0284	0.415
140	0.0933	0.0219	0.0591	0.833	140	0.0484	0.006	0.0294	0.415
145	0.0932	0.0175	0.0591	0.804	145	0.0504	0.007	0.0306	0.417
150	0.1365	0.0876	0.0866	1.138	150	0.0525	0.007	0.0319	0.419

Sample: Z93P-1 (continued)

Ion					electron				
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
155	0.1918	0.1226	0.1219	1.551	155	0.0548	0.008	0.0333	0.424
160	0.2155	0.1416	0.1370	1.689	160	0.0575	0.008	0.0349	0.430
165	0.1677	0.0910	0.1067	1.275	165	0.0608	0.009	0.0369	0.441
170	0.2262	0.0901	0.1439	1.670	170	0.0654	0.01	0.0396	0.460
175	0.3256	0.2081	0.2073	2.336	175	0.0696	0.011	0.0422	0.475
180	0.3766	0.1719	0.2398	2.628	180	0.0789	0.019	0.0478	0.524
185	0.4027	0.2023	0.2567	2.737	185	0.0881	0.027	0.0532	0.568
190	0.4711	0.2108	0.3005	3.119	190	0.0953	0.032	0.0576	0.598
195	0.6717	0.2776	0.4286	4.335	195	0.1040	0.037	0.0632	0.639
200	0.7926	0.3665	0.5059	4.990	200	0.1179	0.041	0.0714	0.704
					205	0.1311	0.047	0.0793	0.763
					210	0.2035	0.159	0.1327	1.246
					215	0.2266	0.163	0.1479	1.357
					220	0.2522	0.168	0.1643	1.473
					225	0.2905	0.176	0.1898	1.664
					230	0.3191	0.189	0.2079	1.783
					235	0.3548	0.209	0.2393	2.009
					240	0.4078	0.224	0.2760	2.268
					245	0.5613	0.433	0.3810	3.067
					250	0.6069	0.445	0.4103	3.237
					255	0.6800	0.506	0.4620	3.573
					260	0.9030	0.83	0.6133	4.652
					265	0.9825	0.866	0.6572	4.892
					270	2.3352	2.446	1.5919	11.629
					275	2.6895	2.101	1.9807	14.206
					280	3.3344	1.574	2.4908	17.546
					285	3.4394	1.469	2.5235	17.464
					290	3.7930	1.615	2.7349	18.601
					295	3.8840	1.599	2.8744	19.218
					300	4.1070	1.615	2.9931	19.678

Sample: Z93P-2

Ion					electron				
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
2	0.0005	0.0002	0.0006	0.550	2	0.0003	0.0005	0.0004	0.378
4	0.0007	0.0001	0.0009	0.426	4	0.0007	0.0005	0.0009	0.464
6	0.0009	0.0001	0.0011	0.360	6	0.0010	0.0006	0.0014	0.477
8	0.0011	0.0001	0.0014	0.344	8	0.0013	0.0006	0.0019	0.469
10	0.0013	0.0001	0.0017	0.339	10	0.0017	0.0007	0.0024	0.466
12	0.0016	0.0001	0.0021	0.339	12	0.0020	0.0009	0.0027	0.452
14	0.0018	0.0001	0.0024	0.340	14	0.0023	0.0010	0.0032	0.450
16	0.0021	0.0002	0.0028	0.341	16	0.0027	0.0011	0.0036	0.449
18	0.0023	0.0002	0.0031	0.341	18	0.0030	0.0012	0.0041	0.449
20	0.0026	0.0003	0.0035	0.342	20	0.0034	0.0013	0.0045	0.447
25	0.0044	0.0006	0.0059	0.466	25	0.0056	0.0020	0.0075	0.590
30	0.0050	0.0008	0.0067	0.439	30	0.0061	0.0023	0.0080	0.528
35	0.0056	0.0008	0.0076	0.430	35	0.0071	0.0027	0.0091	0.515
40	0.0063	0.0008	0.0086	0.424	40	0.0078	0.0030	0.0101	0.496
45	0.0071	0.0010	0.0097	0.425	45	0.0085	0.0032	0.0109	0.476
50	0.0080	0.0011	0.0110	0.433	50	0.0092	0.0033	0.0117	0.462
55	0.0088	0.0013	0.0121	0.434	55	0.0096	0.0033	0.0123	0.440
60	0.0097	0.0015	0.0132	0.435	60	0.0101	0.0033	0.0128	0.422
65	0.0105	0.0016	0.0144	0.437	65	0.0105	0.0033	0.0133	0.405
70	0.0115	0.0017	0.0158	0.445	70	0.0109	0.0032	0.0138	0.387
75	0.0123	0.0018	0.0169	0.445	75	0.0112	0.0031	0.0141	0.372
80	0.0133	0.0019	0.0183	0.450	80	0.0115	0.0031	0.0145	0.358
85	0.0142	0.0021	0.0195	0.453	85	0.0118	0.0030	0.0148	0.343
90	0.0152	0.0022	0.0208	0.457	90	0.0120	0.0031	0.0151	0.331
95	0.0161	0.0023	0.0222	0.460	95	0.0124	0.0030	0.0155	0.322
100	0.0170	0.0023	0.0235	0.463	100	0.0127	0.0030	0.0159	0.313
105	0.0180	0.0024	0.0248	0.466	105	0.0130	0.0030	0.0162	0.305
110	0.0189	0.0025	0.0261	0.468	110	0.0132	0.0029	0.0165	0.296
115	0.0199	0.0025	0.0274	0.470	115	0.0135	0.0028	0.0168	0.288
120	0.0208	0.0026	0.0288	0.473	120	0.0139	0.0028	0.0172	0.282
125	0.0217	0.0027	0.0300	0.473	125	0.0142	0.0027	0.0176	0.278
130	0.0226	0.0027	0.0313	0.474	130	0.0146	0.0027	0.0181	0.274
135	0.0235	0.0028	0.0326	0.476	135	0.0150	0.0026	0.0185	0.271
140	0.0244	0.0029	0.0338	0.477	140	0.0155	0.0025	0.0191	0.269
145	0.0253	0.0030	0.0351	0.478	145	0.0159	0.0025	0.0196	0.266
150	0.0262	0.0031	0.0364	0.478	150	0.0164	0.0025	0.0201	0.264

Sample: Z93P-2 (continued)

Ion					electron				
Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$	Volts	Raw Current μA	Standard Error	Scaled Current μA	Conductivity $(\mu\Omega\text{-}m^2)^{-1}$
155	0.0271	0.0031	0.0376	0.479	155	0.0168	0.0024	0.0206	0.262
160	0.0280	0.0032	0.0389	0.480	160	0.0173	0.0024	0.0212	0.261
165	0.0289	0.0033	0.0402	0.480	165	0.0179	0.0024	0.0218	0.261
170	0.0298	0.0034	0.0414	0.481	170	0.0185	0.0024	0.0225	0.261
175	0.0307	0.0035	0.0427	0.481	175	0.0191	0.0024	0.0232	0.261
180	0.0316	0.0035	0.0439	0.481	180	0.0198	0.0023	0.0240	0.262
185	0.0326	0.0036	0.0452	0.482	185	0.0204	0.0023	0.0245	0.261
190	0.0335	0.0037	0.0465	0.483	190	0.0211	0.0023	0.0252	0.262
195	0.0344	0.0038	0.0478	0.484	195	0.0218	0.0023	0.0262	0.265
200	0.0353	0.0039	0.0491	0.484	200	0.0226	0.0023	0.0271	0.267
					205	0.0233	0.0024	0.0277	0.266
					210	0.0241	0.0024	0.0308	0.289
					215	0.0249	0.0024	0.0319	0.292
					220	0.0258	0.0024	0.0330	0.296
					225	0.0267	0.0025	0.0341	0.299
					230	0.0276	0.0025	0.0352	0.302
					235	0.0287	0.0026	0.0384	0.322
					240	0.0301	0.0029	0.0402	0.330
					245	0.0317	0.0031	0.0419	0.338
					250	0.0336	0.0032	0.0444	0.350
					255	0.0355	0.0031	0.0441	0.341
					260	0.0375	0.0029	0.0434	0.329
					265	0.0402	0.0024	0.0459	0.342
					270	0.0423	0.0027	0.0506	0.370
					275	0.0456	0.0041	0.0546	0.392
					280	0.0500	0.0048	0.0542	0.382
					285	0.0537	0.0054	0.0581	0.402
					290	0.0645	0.0173	0.0668	0.455
					295	0.0772	0.0194	0.0808	0.540
					300	0.0987	0.0238	0.1054	0.693

APPENDIX II - RAW DATA

Experiment samples are designated in two different ways. They have been referred to by their composition and either specimen # 1 or 2, e.g. Z93-1. They are also identified by a number assigned by the vendor which identifies lot number and specimen number. These two nomenclatures map as follows:

Vendor ID	Composition ID
A004	Z93-1
A013	Z93-2
A096	Z93P-1
A120	Z93P-1

Individual run numbers used the vendor ID. Metal sample runs used the same nomenclature with the "A" replaced by an "M". The runs were denoted as follows:

e.g. run A004NR3

"A004"	"N"	"R"	"3"
Vendor ID "M" = metal sample	Bias polarity "N" = negative "P" = positive	position in tank "L" = left "R" = right	run number five total

SAMPLE: A004 (Z93-1)

Z93 position : RIGHT

Date: 11/17/1992

Run ID	Start Time
A004NR1	14:40
A004PR1	14:43
M004PL1	14:47
M004NL1	14:52
M004PL2	14:54
M004NL2	14:58
A004NR2	15:01
A004PR2	15:04
A004NR3	15:07
A004PR3	15:10
M004PL3	15:14
M004NL3	15:18
M004PL4	15:21
M004NL4	15:24
A004NR4	15:28
A004PR4	15:31
A004PR5	15:34
A004NR5	15:38
M004PL5	15:41
M004NL5	15:44

Z93 position : LEFT

Date: 11/18/1992

Run ID	Start Time
A004NL1	13:10
A004PL1	13:12
M004PR1	13:17
M004NR1	13:21
M004PR2	13:24
M004NR2	13:27
A004PL2	13:31
A004NL2	13:34
A004NL3	13:37
A004PL3	13:40
M004PR3	13:43
M004NR3	13:47
M004NR4	13:49
M004PR4	13:52
A004PL4	13:57
A004NL4	14:00
A004NL5	14:03
A004PL5	14:05
M004PR5	14:09
M004NR5	14:12

SAMPLE A004: Z93-1 ION CURRENT: LEFT

Bias volts	A004NL1 μA	A004NL2 μA	A004NL3 μA	A004NL4 μA	A004NL5 μA	Mean μA	Standard error	fractional error
2	0.0038	0.0042	-0.0016	0.0045	-0.0014	0.0019	0.0014	0.740
4	0.0059	0.0062	0.0000	0.0062	0.0001	0.0037	0.0015	0.404
6	0.0081	0.0085	0.0015	0.0081	0.0014	0.0055	0.0017	0.301
8	0.0101	0.0103	0.0034	0.0095	0.0031	0.0073	0.0017	0.227
10	0.0132	0.0134	0.0053	0.0120	0.0049	0.0098	0.0019	0.196
12	0.0166	0.0167	0.0075	0.0147	0.0069	0.0125	0.0022	0.176
14	0.0205	0.0205	0.0094	0.0178	0.0092	0.0155	0.0026	0.167
16	0.0249	0.0248	0.0123	0.0212	0.0109	0.0188	0.0030	0.161
18	0.0299	0.0297	0.0153	0.0250	0.0136	0.0227	0.0035	0.154
20	0.0354	0.0351	0.0185	0.0293	0.0165	0.0270	0.0040	0.149
25	0.0617	0.0607	0.0357	0.0498	0.0324	0.0481	0.0061	0.127
30	0.0816	0.0801	0.0465	0.0653	0.0420	0.0631	0.0082	0.131
35	0.1010	0.0993	0.0599	0.0852	0.0543	0.0799	0.0098	0.122
40	0.1290	0.1270	0.0747	0.1030	0.0681	0.1004	0.0127	0.127
45	0.1590	0.1560	0.0901	0.1290	0.0825	0.1233	0.0160	0.130
50	0.1880	0.1860	0.0981	0.1550	0.0981	0.1450	0.0200	0.138
55	0.2170	0.2160	0.1140	0.1820	0.1050	0.1668	0.0243	0.145
60	0.2440	0.2440	0.1280	0.2080	0.1190	0.1886	0.0274	0.145
65	0.2700	0.2710	0.1420	0.2330	0.1330	0.2098	0.0303	0.145
70	0.2940	0.2960	0.1550	0.2560	0.1460	0.2294	0.0330	0.144
75	0.3150	0.3190	0.1670	0.2780	0.1580	0.2474	0.0354	0.143
80	0.3340	0.3400	0.1780	0.2980	0.1700	0.2640	0.0375	0.142
85	0.3510	0.3580	0.1880	0.3160	0.1800	0.2786	0.0393	0.141
90	0.3650	0.3740	0.1970	0.3320	0.1890	0.2914	0.0408	0.140
95	0.3770	0.3880	0.2050	0.3450	0.1980	0.3026	0.0419	0.138
100	0.3860	0.3990	0.2120	0.3570	0.2050	0.3118	0.0427	0.137
105	0.3940	0.4090	0.2190	0.3660	0.2120	0.3200	0.0432	0.135
110	0.3990	0.4160	0.2240	0.3740	0.2180	0.3262	0.0435	0.133
115	0.4030	0.4220	0.2290	0.3800	0.2230	0.3314	0.0436	0.131
120	0.4050	0.4260	0.2330	0.3850	0.2280	0.3354	0.0433	0.129
125	0.4050	0.4280	0.2370	0.3880	0.2310	0.3378	0.0429	0.127
130	0.4040	0.4290	0.2390	0.3900	0.2340	0.3392	0.0424	0.125
135	0.4020	0.4290	0.2420	0.3900	0.2370	0.3400	0.0415	0.122
140	0.3980	0.4270	0.2440	0.3890	0.2390	0.3394	0.0405	0.119
145	0.3940	0.4240	0.2460	0.3880	0.2420	0.3388	0.0392	0.116
150	0.3890	0.4200	0.2470	0.3850	0.2430	0.3368	0.0380	0.113
155	0.3840	0.4160	0.2480	0.3820	0.2440	0.3348	0.0368	0.110
160	0.3780	0.4110	0.2490	0.3780	0.2450	0.3322	0.0353	0.106
165	0.3710	0.4050	0.2490	0.3740	0.2460	0.3290	0.0338	0.103
170	0.3650	0.3990	0.2500	0.3690	0.2460	0.3258	0.0323	0.099
175	0.3570	0.3920	0.2500	0.3640	0.2460	0.3218	0.0307	0.095
180	0.3500	0.3850	0.2500	0.3590	0.2470	0.3182	0.0290	0.091
185	0.3440	0.3790	0.2500	0.3540	0.2470	0.3148	0.0277	0.088
190	0.3370	0.3720	0.2490	0.3480	0.2460	0.3104	0.0263	0.085
195	0.3300	0.3650	0.2490	0.3430	0.2460	0.3066	0.0248	0.081
200	0.3230	0.3590	0.2490	0.3380	0.2460	0.3030	0.0234	0.077

SAMPLE A004: Z93-1 ION CURRENT: RIGHT

Bias volts	A004NR1 μA	A004NR2 μA	A004NR3 μA	A004NR4 μA	A004NR5 μA	Mean μA	Standard error	fractional error
2	-0.0015	0.0005	0.0018	0.0006	0.0020	0.0007	0.0006	0.946
4	-0.0008	0.0014	0.0025	0.0016	0.0027	0.0015	0.0006	0.426
6	-0.0001	0.0025	0.0032	0.0028	0.0034	0.0023	0.0006	0.268
8	0.0005	0.0036	0.0039	0.0041	0.0042	0.0033	0.0007	0.215
10	0.0012	0.0050	0.0048	0.0056	0.0050	0.0043	0.0008	0.182
12	0.0020	0.0065	0.0057	0.0074	0.0059	0.0055	0.0009	0.166
14	0.0028	0.0082	0.0067	0.0095	0.0069	0.0068	0.0011	0.163
16	0.0036	0.0094	0.0078	0.0110	0.0080	0.0080	0.0012	0.154
18	0.0045	0.0115	0.0090	0.0134	0.0093	0.0095	0.0015	0.157
20	0.0053	0.0136	0.0099	0.0159	0.0102	0.0110	0.0018	0.164
25	0.0097	0.0242	0.0188	0.0289	0.0172	0.0198	0.0033	0.165
30	0.0120	0.0302	0.0229	0.0362	0.0216	0.0246	0.0041	0.167
35	0.0149	0.0373	0.0282	0.0449	0.0274	0.0305	0.0051	0.166
40	0.0183	0.0448	0.0341	0.0541	0.0340	0.0371	0.0060	0.162
45	0.0219	0.0523	0.0403	0.0634	0.0412	0.0438	0.0069	0.158
50	0.0257	0.0596	0.0466	0.0727	0.0489	0.0507	0.0078	0.153
55	0.0296	0.0665	0.0527	0.0816	0.0568	0.0574	0.0086	0.149
60	0.0335	0.0731	0.0588	0.0901	0.0648	0.0641	0.0093	0.145
65	0.0375	0.0793	0.0644	0.0988	0.0728	0.0706	0.0100	0.142
70	0.0414	0.0849	0.0697	0.0991	0.0806	0.0751	0.0097	0.129
75	0.0452	0.0902	0.0746	0.1060	0.0882	0.0808	0.0102	0.126
80	0.0490	0.0952	0.0790	0.1120	0.0956	0.0862	0.0107	0.124
85	0.0527	0.0930	0.0829	0.1180	0.0963	0.0886	0.0106	0.120
90	0.0562	0.0976	0.0865	0.1230	0.1030	0.0933	0.0110	0.118
95	0.0597	0.1020	0.0896	0.1280	0.1090	0.0977	0.0113	0.116
100	0.0629	0.1050	0.0924	0.1320	0.1150	0.1015	0.0116	0.114
105	0.0661	0.1080	0.0950	0.1350	0.1190	0.1046	0.0117	0.111
110	0.0691	0.1110	0.0976	0.1380	0.1240	0.1079	0.0118	0.109
115	0.0721	0.1130	0.0923	0.1410	0.1280	0.1093	0.0123	0.113
120	0.0748	0.1150	0.0946	0.1430	0.1310	0.1117	0.0123	0.110
125	0.0774	0.1170	0.0962	0.1450	0.1340	0.1139	0.0123	0.108
130	0.0798	0.1180	0.0976	0.1460	0.1360	0.1155	0.0121	0.105
135	0.0822	0.1200	0.0988	0.1470	0.1380	0.1172	0.0120	0.103
140	0.0844	0.1210	0.0997	0.1480	0.1390	0.1184	0.0119	0.100
145	0.0865	0.1220	0.1010	0.1490	0.1400	0.1197	0.0117	0.098
150	0.0884	0.1220	0.1010	0.1490	0.1410	0.1203	0.0115	0.096
155	0.0903	0.1220	0.1020	0.1490	0.1420	0.1211	0.0112	0.093
160	0.0921	0.1230	0.1020	0.1490	0.1420	0.1216	0.0110	0.091
165	0.0938	0.1230	0.1030	0.1490	0.1420	0.1222	0.0107	0.088
170	0.0955	0.1230	0.1030	0.1490	0.1420	0.1225	0.0105	0.085
175	0.0979	0.1220	0.1030	0.1480	0.1420	0.1226	0.0100	0.082
180	0.0946	0.1220	0.1030	0.1480	0.1410	0.1217	0.0104	0.085
185	0.0966	0.1220	0.1030	0.1470	0.1410	0.1219	0.0100	0.082
190	0.0985	0.1210	0.1030	0.1460	0.1400	0.1217	0.0095	0.078
195	0.0998	0.1210	0.1030	0.1460	0.1400	0.1220	0.0094	0.077
200	0.1030	0.1200	0.1030	0.1450	0.1390	0.1220	0.0088	0.072

SAMPLE A004: Z93-1 ELECTRON CURRENT: LEFT

Bias volts	A004PL1 μA	A004PL2 μA	A004PL3 μA	A004PL4 μA	A004PL5 μA	Mean μA	Standard error	fractional error
2	0.0052	0.0037	0.0051	0.0033	0.0050	0.0045	0.0004	0.088
4	0.0077	0.0081	0.0070	0.0069	0.0067	0.0073	0.0003	0.036
6	0.0099	0.0122	0.0092	0.0101	0.0086	0.0100	0.0006	0.062
8	0.0132	0.0187	0.0108	0.0153	0.0100	0.0136	0.0016	0.117
10	0.0169	0.0264	0.0135	0.0214	0.0123	0.0181	0.0026	0.144
12	0.0211	0.0355	0.0164	0.0284	0.0149	0.0233	0.0039	0.166
14	0.0257	0.0461	0.0196	0.0366	0.0177	0.0291	0.0054	0.184
16	0.0310	0.0581	0.0232	0.0458	0.0209	0.0358	0.0071	0.198
18	0.0368	0.0714	0.0272	0.0560	0.0243	0.0431	0.0090	0.208
20	0.0432	0.0861	0.0316	0.0672	0.0281	0.0512	0.0111	0.216
25	0.0743	0.1620	0.0548	0.1270	0.0474	0.0931	0.0221	0.238
30	0.0971	0.2160	0.0697	0.1690	0.0605	0.1225	0.0302	0.246
35	0.1170	0.2830	0.0887	0.2210	0.0772	0.1574	0.0404	0.257
40	0.1480	0.3560	0.1040	0.2780	0.0968	0.1966	0.0514	0.262
45	0.1800	0.4320	0.1280	0.3380	0.1110	0.2378	0.0629	0.265
50	0.2130	0.5070	0.1520	0.3990	0.1340	0.2810	0.0734	0.261
55	0.2450	0.5780	0.1760	0.4580	0.1560	0.3226	0.0833	0.258
60	0.2770	0.6420	0.2010	0.5140	0.1790	0.3626	0.0917	0.253
65	0.3070	0.6960	0.2250	0.5650	0.2020	0.3990	0.0983	0.246
70	0.3340	0.7410	0.2480	0.6090	0.2250	0.4314	0.1032	0.239
75	0.3590	0.7760	0.2690	0.6480	0.2460	0.4596	0.1067	0.232
80	0.3800	0.8000	0.2890	0.6790	0.2660	0.4828	0.1082	0.224
85	0.3980	0.8140	0.3070	0.7030	0.2850	0.5014	0.1081	0.216
90	0.4140	0.8190	0.3240	0.7210	0.3020	0.5160	0.1065	0.206
95	0.4260	0.8160	0.3380	0.7330	0.3180	0.5262	0.1038	0.197
100	0.4360	0.8070	0.3510	0.7390	0.3310	0.5328	0.1002	0.188
105	0.4440	0.7940	0.3610	0.7400	0.3440	0.5366	0.0960	0.179
110	0.4490	0.7780	0.3700	0.7370	0.3540	0.5376	0.0914	0.170
115	0.4530	0.7600	0.3780	0.7310	0.3630	0.5370	0.0866	0.161
120	0.4560	0.7410	0.3840	0.7210	0.3710	0.5346	0.0815	0.153
125	0.4580	0.7220	0.3900	0.7100	0.3780	0.5316	0.0765	0.144
130	0.4580	0.7030	0.3940	0.6970	0.3830	0.5270	0.0718	0.136
135	0.4580	0.6840	0.3970	0.6820	0.3880	0.5218	0.0669	0.128
140	0.4590	0.6680	0.4010	0.6680	0.3930	0.5178	0.0624	0.120
145	0.4580	0.6510	0.4030	0.6530	0.3960	0.5122	0.0581	0.113
150	0.4600	0.6370	0.4070	0.6400	0.4000	0.5088	0.0540	0.106

SAMPLE A004: Z93-1 ELECTRON CURRENT: LEFT (continued)

Bias volts	A004PL1 μA	A004PL2 μA	A004PL3 μA	A004PL4 μA	A004PL5 μA	Mean μA	Standard error	fractional error
155	0.4600	0.6240	0.4100	0.6270	0.4040	0.5050	0.0501	0.099
160	0.4610	0.6120	0.4130	0.6140	0.4070	0.5014	0.0465	0.093
165	0.4620	0.6020	0.4160	0.6020	0.4110	0.4986	0.0431	0.087
170	0.4630	0.5920	0.4190	0.5910	0.4140	0.4958	0.0400	0.081
175	0.4650	0.5840	0.4220	0.5800	0.4170	0.4936	0.0370	0.075
180	0.4680	0.5770	0.4260	0.5720	0.4210	0.4928	0.0343	0.070
185	0.4710	0.5710	0.4300	0.5640	0.4250	0.4922	0.0318	0.065
190	0.4770	0.5690	0.4350	0.5580	0.4300	0.4938	0.0297	0.060
195	0.5100	0.5660	0.4400	0.5540	0.4350	0.5010	0.0276	0.055
200	0.6190	0.5670	0.4470	0.5530	0.4420	0.5256	0.0349	0.066
205	0.7030	0.5800	0.4540	0.5520	0.4490	0.5476	0.0467	0.085
210	0.7620	0.6190	0.4630	0.5680	0.4590	0.5742	0.0561	0.098
215	0.7930	0.8100	0.4870	0.7030	0.4950	0.6576	0.0704	0.107
220	0.8290	0.8740	0.5800	0.7600	0.6960	0.7478	0.0517	0.069
225	0.8660	0.9050	0.7060	0.8220	0.7580	0.8114	0.0359	0.044
230	0.9110	0.9410	0.7700	0.8520	0.8000	0.8548	0.0322	0.038
235	0.9510	0.9850	0.8060	0.8830	0.8370	0.8924	0.0336	0.038
240	1.2600	1.0100	0.8460	0.9220	0.8840	0.9844	0.0741	0.075
245	1.3200	1.0500	0.9010	0.9650	0.9300	1.0332	0.0759	0.073
250	1.3900	1.1600	0.9450	0.9980	0.9770	1.0940	0.0828	0.076
255	1.4700	1.2300	0.9950	1.1100	1.0300	1.1670	0.0858	0.074
260	1.5400	1.2900	1.1200	1.2500	1.1900	1.2780	0.0715	0.056
265	1.6100	1.3600	1.1800	1.3600	1.2500	1.3520	0.0730	0.054
270	1.7100	1.4600	1.2400	1.4300	1.4000	1.4480	0.0757	0.052
275	1.8600	1.5700	1.3200	1.4900	1.4700	1.5420	0.0892	0.058
280	1.9600	1.6600	1.4000	1.6300	1.5600	1.6420	0.0913	0.056
285	5.5800	2.1000	1.7800	1.7700	1.7600	2.5980	0.7482	0.288
290	8.4900	2.2100	1.9800	1.8800	1.9400	3.3000	1.2987	0.394
295	8.2700	5.4000	2.0800	1.9700	7.3600	5.0160	1.3063	0.260
300	8.2900	11.3000	5.7000	2.8700	6.9900	7.0300	1.3946	0.198

SAMPLE A004: Z93-1 ELECTRON CURRENT: RIGHT

Bias volts	A004PR1 μA	A004PR2 μA	A004PR3 μA	A004PR4 μA	A004PR5 μA	Mean μA	Standard error	fractional error
2	0.0026	0.0025	0.0023	0.0028	-0.0002	0.0020	0.0005	0.276
4	0.0035	0.0034	0.0030	0.0037	0.0005	0.0028	0.0006	0.211
6	0.0045	0.0043	0.0039	0.0046	0.0012	0.0037	0.0006	0.170
8	0.0057	0.0054	0.0047	0.0056	0.0021	0.0047	0.0007	0.142
10	0.0069	0.0065	0.0056	0.0068	0.0030	0.0057	0.0007	0.126
12	0.0082	0.0077	0.0066	0.0080	0.0039	0.0069	0.0008	0.115
14	0.0092	0.0091	0.0077	0.0095	0.0049	0.0081	0.0009	0.105
16	0.0108	0.0101	0.0089	0.0105	0.0060	0.0093	0.0009	0.095
18	0.0124	0.0118	0.0097	0.0122	0.0072	0.0107	0.0010	0.093
20	0.0142	0.0135	0.0111	0.0141	0.0085	0.0123	0.0011	0.090
25	0.0272	0.0237	0.0187	0.0232	0.0152	0.0216	0.0021	0.097
30	0.0324	0.0286	0.0225	0.0290	0.0193	0.0264	0.0024	0.090
35	0.0388	0.0346	0.0275	0.0363	0.0246	0.0324	0.0027	0.083
40	0.0452	0.0412	0.0330	0.0444	0.0306	0.0389	0.0030	0.077
45	0.0512	0.0481	0.0388	0.0533	0.0372	0.0457	0.0033	0.071
50	0.0570	0.0552	0.0449	0.0626	0.0442	0.0528	0.0036	0.068
55	0.0626	0.0623	0.0512	0.0724	0.0515	0.0600	0.0040	0.066
60	0.0681	0.0695	0.0576	0.0824	0.0588	0.0673	0.0045	0.066
65	0.0735	0.0766	0.0640	0.0928	0.0661	0.0746	0.0051	0.068
70	0.0789	0.0835	0.0703	0.0966	0.0733	0.0805	0.0046	0.057
75	0.0842	0.0904	0.0766	0.1070	0.0803	0.0877	0.0053	0.061
80	0.0897	0.0977	0.0828	0.1180	0.0871	0.0951	0.0062	0.066
85	0.0953	0.0962	0.0890	0.1280	0.0937	0.1004	0.0070	0.070
90	0.0929	0.1030	0.0952	0.1370	0.0926	0.1041	0.0084	0.081
95	0.0988	0.1090	0.0942	0.1460	0.0992	0.1094	0.0095	0.086
100	0.1040	0.1150	0.1010	0.1550	0.1050	0.1160	0.0100	0.086
105	0.1100	0.1210	0.1070	0.1630	0.1110	0.1224	0.0104	0.085
110	0.1150	0.1260	0.1120	0.1710	0.1160	0.1280	0.0110	0.086
115	0.1200	0.1310	0.1170	0.1780	0.1210	0.1334	0.0114	0.085
120	0.1250	0.1360	0.1230	0.1850	0.1250	0.1388	0.0118	0.085
125	0.1300	0.1410	0.1280	0.1920	0.1300	0.1442	0.0122	0.084
130	0.1340	0.1460	0.1330	0.1990	0.1350	0.1494	0.0126	0.084
135	0.1380	0.1510	0.1380	0.2050	0.1390	0.1542	0.0129	0.084
140	0.1430	0.1570	0.1450	0.2120	0.1450	0.1604	0.0131	0.082
145	0.1470	0.1630	0.1510	0.2190	0.1520	0.1664	0.0134	0.081
150	0.1520	0.1690	0.1580	0.2260	0.1580	0.1726	0.0136	0.079

SAMPLE A004: Z93-1 ELECTRON CURRENT: RIGHT (continued)

Bias volts	A004PR1 μA	A004PR2 μA	A004PR3 μA	A004PR4 μA	A004PR5 μA	Mean μA	Standard error	fractional error
155	0.1560	0.1740	0.1640	0.2320	0.1640	0.1780	0.0138	0.078
160	0.1610	0.1800	0.1710	0.2380	0.1690	0.1838	0.0139	0.076
165	0.1670	0.1870	0.1770	0.2450	0.1760	0.1904	0.0140	0.074
170	0.1720	0.1930	0.1840	0.2500	0.1820	0.1962	0.0139	0.071
175	0.1780	0.2000	0.1910	0.2560	0.1880	0.2026	0.0138	0.068
180	0.1830	0.2060	0.1970	0.2610	0.1950	0.2084	0.0137	0.066
185	0.1890	0.2130	0.2040	0.2670	0.2020	0.2150	0.0136	0.063
190	0.1960	0.2210	0.2120	0.2740	0.2100	0.2226	0.0135	0.060
195	0.2060	0.2290	0.2200	0.2810	0.2180	0.2308	0.0131	0.057
200	0.2300	0.2420	0.2290	0.2910	0.2270	0.2438	0.0121	0.050
205	0.2610	0.2810	0.2430	0.3260	0.2370	0.2696	0.0161	0.060
210	0.2770	0.3040	0.2760	0.3620	0.2530	0.2944	0.0187	0.064
215	0.2980	0.3230	0.3050	0.3810	0.3150	0.3244	0.0148	0.046
220	0.5410	0.5600	0.3380	0.6140	0.3460	0.4798	0.0575	0.120
225	0.5670	0.5840	0.5900	0.6350	0.5930	0.5938	0.0112	0.019
230	0.6010	0.6160	0.6220	0.6610	0.6250	0.6250	0.0099	0.016
235	0.6310	0.6460	0.6480	0.6870	0.6510	0.6526	0.0093	0.014
240	0.7950	0.7470	0.6810	0.7180	0.6870	0.7256	0.0210	0.029
245	0.8590	0.7900	0.7930	0.8580	0.7240	0.8048	0.0252	0.031
250	0.9060	0.8330	0.8400	0.9190	0.8600	0.8716	0.0174	0.020
255	0.9550	0.9010	0.8960	0.9710	0.9160	0.9278	0.0150	0.016
260	1.1000	1.1100	0.9700	1.1500	0.9730	1.0606	0.0373	0.035
265	1.1600	1.1700	1.1100	1.2100	1.1200	1.1540	0.0181	0.016
270	1.2400	1.2300	1.1800	1.2900	1.2100	1.2300	0.0182	0.015
275	1.3600	1.3100	1.2600	1.3500	1.2700	1.3100	0.0202	0.015
280	1.4300	1.4200	1.3200	1.4200	1.3400	1.3860	0.0232	0.017
285	1.5300	1.6100	1.3900	1.5100	1.4000	1.4880	0.0415	0.028
290	1.7100	2.4000	1.6000	1.5900	1.4800	1.7560	0.1651	0.094
295	2.6500	2.4700	1.7800	1.7400	1.5800	2.0440	0.2152	0.105
300	3.9500	2.5900	1.8700	2.1100	1.6700	2.4380	0.4080	0.167

SAMPLE M004: M93-1 ION CURRENT: LEFT

Bias volts	M004NL1 μA	M004NL2 μA	M004NL3 μA	M004NL4 μA	M004NL5 μA	Mean μA	Standard error	fractional error
2	0.2640	0.2590	0.2570	0.2560	0.2560	0.2584	0.0015	0.006
4	0.3720	0.3690	0.3690	0.3680	0.3690	0.3694	0.0007	0.002
6	0.4430	0.4400	0.4410	0.4400	0.4410	0.4410	0.0005	0.001
8	0.5090	0.5060	0.5070	0.5060	0.5070	0.5070	0.0005	0.001
10	0.5710	0.5680	0.5700	0.5690	0.5700	0.5696	0.0005	0.001
12	0.6320	0.6290	0.6300	0.6300	0.6310	0.6304	0.0005	0.001
14	0.6900	0.6870	0.6890	0.6880	0.6890	0.6886	0.0005	0.001
16	0.7470	0.7430	0.7460	0.7450	0.7460	0.7454	0.0007	0.001
18	0.8010	0.7970	0.8000	0.7990	0.8000	0.7994	0.0007	0.001
20	0.8530	0.8490	0.8520	0.8510	0.8520	0.8514	0.0007	0.001
25	0.9810	0.9770	0.9790	0.9780	0.9790	0.9788	0.0007	0.001
30	1.1000	1.0900	1.1000	1.1000	1.1000	1.0980	0.0020	0.002
35	1.2100	1.2100	1.2100	1.2100	1.2100	1.2100	0.0000	0.000
40	1.3200	1.3100	1.3200	1.3200	1.3200	1.3180	0.0020	0.002
45	1.4200	1.4200	1.4200	1.4200	1.4300	1.4220	0.0020	0.001
50	1.5300	1.5200	1.5300	1.5300	1.5300	1.5280	0.0020	0.001
55	1.6300	1.6200	1.6300	1.6300	1.6300	1.6280	0.0020	0.001
60	1.7300	1.7200	1.7200	1.7200	1.7300	1.7240	0.0024	0.001
65	1.8200	1.8100	1.8200	1.8200	1.8200	1.8180	0.0020	0.001
70	1.9200	1.9100	1.9100	1.9100	1.9100	1.9120	0.0020	0.001
75	2.0100	2.0000	2.0100	2.0000	2.0100	2.0060	0.0024	0.001
80	2.1000	2.0900	2.1000	2.0900	2.1000	2.0960	0.0024	0.001
85	2.1900	2.1800	2.1900	2.1800	2.1900	2.1860	0.0024	0.001
90	2.2800	2.2700	2.2800	2.2700	2.2800	2.2760	0.0024	0.001
95	2.3700	2.3500	2.3700	2.3600	2.3700	2.3640	0.0040	0.002
100	2.4500	2.4400	2.4500	2.4500	2.4500	2.4480	0.0020	0.001
105	2.5400	2.5300	2.5400	2.5400	2.5400	2.5380	0.0020	0.001
110	2.6300	2.6100	2.6200	2.6200	2.6300	2.6220	0.0037	0.001
115	2.7100	2.7000	2.7100	2.7100	2.7100	2.7080	0.0020	0.001
120	2.8000	2.7800	2.7900	2.7900	2.8000	2.7920	0.0037	0.001
125	2.8800	2.8700	2.8700	2.8800	2.8800	2.8760	0.0024	0.001
130	2.9600	2.9500	2.9600	2.9600	2.9600	2.9580	0.0020	0.001
135	3.0400	3.0300	3.0400	3.0400	3.0500	3.0400	0.0032	0.001
140	3.1300	3.1100	3.1200	3.1200	3.1300	3.1220	0.0037	0.001
145	3.2100	3.2000	3.2100	3.2000	3.2100	3.2060	0.0024	0.001
150	3.2900	3.2800	3.2900	3.2800	3.2900	3.2860	0.0024	0.001
155	3.3700	3.3600	3.3700	3.3600	3.3700	3.3660	0.0024	0.001
160	3.4500	3.4400	3.4500	3.4500	3.4500	3.4480	0.0020	0.001
165	3.5300	3.5200	3.5300	3.5300	3.5300	3.5280	0.0020	0.001
170	3.6100	3.6000	3.6100	3.6100	3.6100	3.6080	0.0020	0.001
175	3.6900	3.6800	3.6900	3.6900	3.6900	3.6880	0.0020	0.001
180	3.7700	3.7600	3.7700	3.7700	3.7700	3.7680	0.0020	0.001
185	3.8500	3.8400	3.8500	3.8500	3.8500	3.8480	0.0020	0.001
190	3.9300	3.9200	3.9300	3.9200	3.9400	3.9280	0.0037	0.001
195	4.0100	4.0000	4.0100	4.0100	4.0100	4.0080	0.0020	0.000
200	4.0900	4.0800	4.0900	4.0900	4.0900	4.0880	0.0020	0.000

SAMPLE M004: M93-1 ION CURRENT: RIGHT

Bias volts	M004NR1 μA	M004NR2 μA	M004NR3 μA	M004NR4 μA	M004NR5 μA	Mean μA	Standard error	fractional error
2	0.0877	0.0914	0.0972	0.1020	0.0998	0.0956	0.0027	0.028
4	0.2570	0.2580	0.2630	0.2650	0.2620	0.2610	0.0015	0.006
6	0.3410	0.3420	0.3470	0.3470	0.3450	0.3444	0.0012	0.004
8	0.4080	0.4070	0.4130	0.4130	0.4110	0.4104	0.0012	0.003
10	0.4680	0.4680	0.4730	0.4730	0.4710	0.4706	0.0011	0.002
12	0.5260	0.5250	0.5310	0.5310	0.5290	0.5284	0.0012	0.002
14	0.5810	0.5810	0.5870	0.5870	0.5840	0.5840	0.0013	0.002
16	0.6350	0.6350	0.6410	0.6410	0.6380	0.6380	0.0013	0.002
18	0.6870	0.6880	0.6940	0.6930	0.6900	0.6904	0.0014	0.002
20	0.7380	0.7380	0.7450	0.7430	0.7410	0.7410	0.0014	0.002
25	0.8590	0.8600	0.8670	0.8650	0.8630	0.8628	0.0015	0.002
30	0.9720	0.9730	0.9800	0.9790	0.9750	0.9758	0.0016	0.002
35	1.0800	1.0800	1.0900	1.0900	1.0800	1.0840	0.0024	0.002
40	1.1800	1.1900	1.1900	1.1900	1.1900	1.1880	0.0020	0.002
45	1.2900	1.2900	1.3000	1.3000	1.2900	1.2940	0.0024	0.002
50	1.3900	1.3900	1.4000	1.4000	1.3900	1.3940	0.0024	0.002
55	1.4800	1.4900	1.5000	1.4900	1.4900	1.4900	0.0032	0.002
60	1.5800	1.5800	1.5900	1.5900	1.5800	1.5840	0.0024	0.002
65	1.6700	1.6800	1.6900	1.6800	1.6800	1.6800	0.0032	0.002
70	1.7700	1.7700	1.7800	1.7800	1.7700	1.7740	0.0024	0.001
75	1.8600	1.8600	1.8700	1.8700	1.8600	1.8640	0.0024	0.001
80	1.9500	1.9500	1.9600	1.9600	1.9500	1.9540	0.0024	0.001
85	2.0400	2.0400	2.0500	2.0500	2.0400	2.0440	0.0024	0.001
90	2.1300	2.1300	2.1400	2.1400	2.1300	2.1340	0.0024	0.001
95	2.2100	2.2200	2.2300	2.2300	2.2100	2.2200	0.0045	0.002
100	2.3000	2.3000	2.3100	2.3100	2.3000	2.3040	0.0024	0.001
105	2.3800	2.3900	2.4000	2.4000	2.3800	2.3900	0.0045	0.002
110	2.4700	2.4800	2.4800	2.4800	2.4700	2.4760	0.0024	0.001
115	2.5500	2.5600	2.5700	2.5700	2.5500	2.5600	0.0045	0.002
120	2.6400	2.6500	2.6500	2.6600	2.6400	2.6480	0.0037	0.001
125	2.7200	2.7300	2.7300	2.7400	2.7200	2.7280	0.0037	0.001
130	2.8000	2.8100	2.8200	2.8200	2.8000	2.8100	0.0045	0.002
135	2.8800	2.8900	2.9000	2.9000	2.8800	2.8900	0.0045	0.002
140	2.9600	2.9700	2.9800	2.9800	2.9600	2.9700	0.0045	0.002
145	3.0400	3.0500	3.0600	3.0600	3.0400	3.0500	0.0045	0.001
150	3.1200	3.1300	3.1400	3.1400	3.1200	3.1300	0.0045	0.001
155	3.2000	3.2100	3.2200	3.2200	3.2000	3.2100	0.0045	0.001
160	3.2800	3.2900	3.3000	3.3000	3.2800	3.2900	0.0045	0.001
165	3.3600	3.3700	3.3800	3.3800	3.3600	3.3700	0.0045	0.001
170	3.4400	3.4500	3.4600	3.4600	3.4400	3.4500	0.0045	0.001
175	3.5100	3.5300	3.5400	3.5400	3.5100	3.5260	0.0068	0.002
180	3.5900	3.6000	3.6100	3.6100	3.5900	3.6000	0.0045	0.001
185	3.6700	3.6800	3.6900	3.6900	3.6700	3.6800	0.0045	0.001
190	3.7400	3.7600	3.7600	3.7700	3.7400	3.7540	0.0060	0.002
195	3.8200	3.8400	3.8400	3.8400	3.8200	3.8320	0.0049	0.001
200	3.8900	3.9100	3.9200	3.9200	3.8900	3.9060	0.0068	0.002

SAMPLE M004: M93-1 ELECTRON CURRENT: LEFT

Bias volts	M004PL1 μA	M004PL2 μA	M004PL3 μA	M004PL4 μA	M004PL5 μA	Mean μA	Standard error	fractional error
2	0.002	0.003	0.003	0.003	0.003	0.0032	0.0002	0.0696
4	0.008	0.010	0.010	0.010	0.010	0.0097	0.0004	0.0427
6	0.015	0.018	0.018	0.018	0.018	0.0172	0.0006	0.0337
8	0.022	0.026	0.026	0.026	0.026	0.0251	0.0007	0.0283
10	0.030	0.034	0.034	0.034	0.034	0.0331	0.0008	0.0241
12	0.039	0.043	0.042	0.043	0.042	0.0418	0.0008	0.0199
14	0.048	0.052	0.052	0.053	0.052	0.0513	0.0008	0.0148
16	0.059	0.062	0.062	0.062	0.062	0.0611	0.0007	0.0108
18	0.069	0.071	0.071	0.072	0.072	0.0709	0.0006	0.0084
20	0.078	0.081	0.081	0.081	0.081	0.0805	0.0006	0.0071
25	0.103	0.105	0.105	0.105	0.105	0.1046	0.0004	0.0038
30	0.127	0.128	0.129	0.129	0.129	0.1284	0.0004	0.0031
35	0.151	0.152	0.153	0.152	0.152	0.1520	0.0003	0.0021
40	0.173	0.174	0.175	0.175	0.175	0.1744	0.0004	0.0023
45	0.195	0.196	0.197	0.196	0.197	0.1962	0.0004	0.0019
50	0.216	0.217	0.218	0.217	0.217	0.2170	0.0003	0.0015
55	0.237	0.237	0.238	0.237	0.238	0.2374	0.0002	0.0010
60	0.257	0.257	0.258	0.257	0.258	0.2574	0.0002	0.0010
65	0.277	0.277	0.278	0.277	0.277	0.2772	0.0002	0.0007
70	0.296	0.296	0.297	0.296	0.296	0.2962	0.0002	0.0007
75	0.316	0.315	0.316	0.315	0.315	0.3154	0.0002	0.0008
80	0.335	0.334	0.335	0.334	0.334	0.3344	0.0002	0.0007
85	0.353	0.353	0.353	0.352	0.353	0.3528	0.0002	0.0006
90	0.372	0.371	0.372	0.371	0.372	0.3716	0.0002	0.0007
95	0.390	0.389	0.390	0.389	0.390	0.3896	0.0002	0.0006
100	0.409	0.407	0.408	0.407	0.408	0.4078	0.0004	0.0009
105	0.427	0.425	0.426	0.425	0.426	0.4258	0.0004	0.0009
110	0.445	0.443	0.444	0.443	0.444	0.4438	0.0004	0.0008
115	0.477	0.460	0.462	0.460	0.462	0.4642	0.0032	0.0070
120	0.495	0.477	0.479	0.478	0.480	0.4818	0.0033	0.0069
125	0.513	0.494	0.497	0.495	0.497	0.4992	0.0035	0.0070
130	0.531	0.511	0.513	0.512	0.515	0.5164	0.0037	0.0072
135	0.549	0.529	0.530	0.529	0.532	0.5338	0.0038	0.0072
140	0.567	0.545	0.547	0.546	0.549	0.5508	0.0041	0.0075
145	0.586	0.562	0.564	0.562	0.565	0.5678	0.0046	0.0081
150	0.604	0.578	0.581	0.580	0.583	0.5852	0.0048	0.0081

SAMPLE M004: M93-1 ELECTRON CURRENT: LEFT (continued)

Bias volts	M004PL1 μA	M004PL2 μA	M004PL3 μA	M004PL4 μA	M004PL5 μA	Mean μA	Standard error	fractional error
155	0.623	0.595	0.598	0.596	0.599	0.6022	0.0052	0.0087
160	0.640	0.611	0.615	0.612	0.616	0.6188	0.0054	0.0087
165	0.670	0.628	0.631	0.629	0.634	0.6384	0.0080	0.0125
170	0.703	0.644	0.648	0.645	0.650	0.6580	0.0113	0.0172
175	0.724	0.660	0.665	0.661	0.667	0.6754	0.0122	0.0181
180	0.752	0.676	0.681	0.678	0.683	0.6940	0.0145	0.0210
185	0.800	0.693	0.698	0.694	0.700	0.7170	0.0208	0.0290
190	0.816	0.709	0.714	0.710	0.717	0.7332	0.0207	0.0283
195	0.856	0.725	0.731	0.727	0.734	0.7546	0.0254	0.0337
200	0.881	0.741	0.747	0.743	0.750	0.7724	0.0272	0.0352
205	0.891	0.757	0.763	0.759	0.767	0.7874	0.0260	0.0330
210	0.900	0.773	0.779	0.775	0.783	0.8020	0.0246	0.0306
215	0.912	0.789	0.796	0.791	0.800	0.8176	0.0237	0.0290
220	1.358	0.805	0.812	0.807	0.815	0.9194	0.1097	0.1193
225	1.377	0.821	0.827	0.823	0.832	0.9360	0.1103	0.1178
230	1.398	0.837	0.846	0.838	0.850	0.9538	0.1111	0.1165
235	1.419	0.855	0.863	0.854	0.868	0.9718	0.1118	0.1151
240	1.440	0.871	0.880	0.870	0.884	0.9890	0.1128	0.1140
245	1.463	0.886	0.899	0.885	0.901	1.0068	0.1141	0.1133
250	1.486	0.902	0.915	0.902	0.926	1.0262	0.1150	0.1121
255	1.508	0.917	0.930	0.918	0.944	1.0434	0.1163	0.1114
260	1.530	0.932	0.962	0.936	0.974	1.0668	0.1161	0.1088
265	1.552	0.953	1.576	0.951	0.995	1.2054	0.1467	0.1217
270	1.574	0.967	1.594	0.971	1.013	1.2238	0.1473	0.1204
275	1.597	0.982	1.614	0.987	1.037	1.2434	0.1482	0.1192
280	1.619	1.658	1.635	1.003	1.047	1.3924	0.1503	0.1079
285	1.641	1.676	1.655	1.018	1.085	1.4150	0.1489	0.1052
290	1.664	1.695	1.677	1.034	1.097	1.4334	0.1506	0.1051
295	1.686	1.716	1.697	1.053	1.113	1.4530	0.1514	0.1042
300	1.709	1.736	1.717	1.106	1.129	1.4794	0.1479	0.0999

SAMPLE M004: M93-1 ELECTRON CURRENT: RIGHT

Bias volts	M004PR1 μA	M004PR2 μA	M004PR3 μA	M004PR4 μA	M004PR5 μA	Mean μA	Standard error	fractional error
2	0.003	0.004	0.004	0.004	0.004	0.0036	0.0001	0.0223
4	0.009	0.009	0.009	0.009	0.009	0.0091	0.0001	0.0153
6	0.015	0.016	0.015	0.016	0.015	0.0152	0.0002	0.0127
8	0.021	0.022	0.022	0.022	0.022	0.0219	0.0002	0.0109
10	0.028	0.029	0.029	0.029	0.029	0.0287	0.0003	0.0093
12	0.035	0.037	0.036	0.037	0.036	0.0360	0.0003	0.0081
14	0.043	0.045	0.044	0.045	0.044	0.0441	0.0002	0.0054
16	0.052	0.053	0.053	0.053	0.052	0.0523	0.0002	0.0041
18	0.060	0.061	0.061	0.061	0.061	0.0605	0.0002	0.0032
20	0.068	0.069	0.069	0.069	0.069	0.0685	0.0002	0.0028
25	0.089	0.089	0.090	0.089	0.089	0.0891	0.0002	0.0021
30	0.109	0.109	0.110	0.110	0.110	0.1096	0.0002	0.0022
35	0.129	0.129	0.130	0.130	0.130	0.1296	0.0002	0.0019
40	0.149	0.148	0.150	0.149	0.149	0.1490	0.0003	0.0021
45	0.168	0.167	0.169	0.168	0.168	0.1680	0.0003	0.0019
50	0.186	0.185	0.187	0.187	0.187	0.1864	0.0004	0.0021
55	0.204	0.203	0.206	0.205	0.205	0.2046	0.0005	0.0025
60	0.222	0.221	0.224	0.223	0.223	0.2226	0.0005	0.0023
65	0.239	0.239	0.241	0.240	0.240	0.2398	0.0004	0.0016
70	0.257	0.256	0.259	0.258	0.258	0.2576	0.0005	0.0020
75	0.274	0.273	0.276	0.275	0.275	0.2746	0.0005	0.0019
80	0.291	0.289	0.293	0.292	0.292	0.2914	0.0007	0.0023
85	0.308	0.306	0.310	0.309	0.309	0.3084	0.0007	0.0022
90	0.325	0.323	0.327	0.325	0.326	0.3252	0.0007	0.0020
95	0.341	0.339	0.344	0.342	0.342	0.3416	0.0008	0.0024
100	0.358	0.356	0.360	0.359	0.358	0.3582	0.0007	0.0019
105	0.374	0.372	0.377	0.375	0.375	0.3746	0.0008	0.0022
110	0.390	0.388	0.393	0.391	0.391	0.3906	0.0008	0.0021
115	0.410	0.404	0.410	0.408	0.408	0.4080	0.0011	0.0027
120	0.426	0.419	0.426	0.424	0.424	0.4238	0.0013	0.0030
125	0.442	0.435	0.442	0.440	0.441	0.4400	0.0013	0.0030
130	0.458	0.451	0.458	0.455	0.456	0.4556	0.0013	0.0028
135	0.474	0.467	0.474	0.471	0.472	0.4716	0.0013	0.0027
140	0.491	0.482	0.489	0.487	0.488	0.4874	0.0015	0.0031
145	0.507	0.498	0.505	0.502	0.503	0.5030	0.0015	0.0030
150	0.524	0.513	0.521	0.518	0.519	0.5190	0.0018	0.0035

SAMPLE M004: M93-1 ELECTRON CURRENT: RIGHT (continued)

Bias volts	M004PR1 μA	M004PR2 μA	M004PR3 μA	M004PR4 μA	M004PR5 μA	Mean μA	Standard error	fractional error
155	0.539	0.529	0.536	0.533	0.534	0.5342	0.0017	0.0031
160	0.555	0.544	0.552	0.549	0.550	0.5500	0.0018	0.0033
165	0.572	0.559	0.568	0.565	0.566	0.5660	0.0021	0.0037
170	0.588	0.574	0.583	0.580	0.581	0.5812	0.0023	0.0039
175	0.604	0.589	0.599	0.596	0.597	0.5970	0.0024	0.0041
180	0.620	0.604	0.615	0.611	0.613	0.6126	0.0026	0.0043
185	0.646	0.620	0.630	0.626	0.628	0.6300	0.0043	0.0069
190	0.691	0.635	0.646	0.642	0.644	0.6516	0.0100	0.0154
195	0.708	0.650	0.662	0.658	0.659	0.6674	0.0103	0.0155
200	0.722	0.665	0.678	0.674	0.675	0.6828	0.0100	0.0147
205	0.751	0.681	0.693	0.689	0.691	0.7010	0.0127	0.0181
210	0.770	0.696	0.709	0.704	0.706	0.7170	0.0134	0.0187
215	0.787	0.711	0.725	0.720	0.721	0.7328	0.0137	0.0188
220	0.799	0.726	0.740	0.735	0.737	0.7474	0.0131	0.0175
225	0.812	0.742	0.756	0.751	0.753	0.7628	0.0125	0.0164
230	0.826	0.757	0.774	0.766	0.768	0.7782	0.0123	0.0158
235	0.900	0.772	0.790	0.781	0.787	0.8060	0.0237	0.0294
240	1.369	0.791	0.813	0.802	0.803	0.9156	0.1134	0.1239
245	1.386	0.805	0.829	0.817	0.818	0.9310	0.1138	0.1222
250	1.405	0.821	0.902	0.833	0.845	0.9612	0.1118	0.1163
255	1.424	0.836	0.883	0.848	0.903	0.9788	0.1119	0.1144
260	1.444	0.851	0.924	0.865	0.903	0.9974	0.1124	0.1127
265	1.463	0.867	0.921	0.880	0.955	1.0172	0.1125	0.1106
270	1.483	0.883	0.981	0.955	0.951	1.0506	0.1093	0.1040
275	1.504	0.898	0.978	0.979	1.539	1.1796	0.1405	0.1191
280	1.525	0.913	0.994	0.977	1.555	1.1928	0.1425	0.1194
285	1.546	0.928	1.009	0.991	1.573	1.2094	0.1436	0.1188
290	1.568	0.984	1.025	1.148	1.592	1.2634	0.1321	0.1046
295	1.587	1.641	1.041	1.199	1.610	1.4156	0.1235	0.0873
300	1.608	1.656	1.058	1.199	1.631	1.4304	0.1255	0.0877

SAMPLE: A013 (Z93-2)

Z93 position : LEFT

Date: 11/19/1992

Run ID	Start Time
A013NL1	13:54
A013PL1	13:57
M013PR1	14:00
M013NR1	14:04
M013NR2	14:07
M013PR2	14:09
A013PL2	14:13
A013NL2	14:16
A013NL3	14:19
A013PL3	14:25
M013PR3	14:29
M013NR3	14:32
M013NR4	14:35
M013PR4	14:38
A013PL4	14:42
A013NL4	14:46
A013NL5	14:48
A013PL5	14:52
M013PR5	14:55
M013NR5	15:00

Z93 position : RIGHT

Date: 11/20/1992

Run ID	Start Time
M013PL1	14:19
M013NL1	14:23
A013NR1	14:27
A013PR1	14:30
A013PR2	14:33
A013NR2	14:37
M013NL2	14:40
M013PL2	14:42
M013PL3	14:46
M013NL3	14:50
A013NR3	14:52
A013PR3	14:55
A013PR4	14:58
A013NR4	15:02
M013NL4	15:05
M013PL4	15:08
M013PL5	15:11
M013NL5	15:14
A013NR5	15:17
A013PR5	15:20

SAMPLE A013: Z93-2 ION CURRENT: LEFT

Bias volts	A013NL1 μA	A013NL2 μA	A013NL3 μA	A013NL4 μA	A013NL5 μA	Mean μA	Standard error	fractional error
2	0.0004	0.0038	-0.0007	0.0039	-0.0014	0.0012	0.0011	0.939
4	0.0021	0.0060	0.0007	0.0063	0.0002	0.0031	0.0013	0.425
6	0.0042	0.0085	0.0022	0.0091	0.0017	0.0051	0.0016	0.302
8	0.0065	0.0106	0.0039	0.0114	0.0034	0.0071	0.0017	0.233
10	0.0090	0.0139	0.0055	0.0149	0.0051	0.0097	0.0020	0.212
12	0.0107	0.0174	0.0073	0.0188	0.0068	0.0122	0.0025	0.206
14	0.0133	0.0213	0.0091	0.0230	0.0088	0.0151	0.0030	0.199
16	0.0158	0.0256	0.0104	0.0277	0.0101	0.0179	0.0037	0.208
18	0.0182	0.0302	0.0124	0.0327	0.0122	0.0211	0.0044	0.206
20	0.0205	0.0351	0.0144	0.0382	0.0143	0.0245	0.0051	0.209
25	0.0332	0.0585	0.0246	0.0644	0.0313	0.0424	0.0080	0.188
30	0.0378	0.0738	0.0294	0.0816	0.0369	0.0519	0.0107	0.206
35	0.0432	0.0917	0.0351	0.0950	0.0437	0.0617	0.0130	0.211
40	0.0486	0.1030	0.0409	0.1170	0.0507	0.0720	0.0157	0.218
45	0.0535	0.1220	0.0465	0.1380	0.0575	0.0835	0.0192	0.230
50	0.0580	0.1390	0.0519	0.1580	0.0640	0.0942	0.0225	0.238
55	0.0622	0.1540	0.0569	0.1770	0.0700	0.1040	0.0254	0.245
60	0.0661	0.1670	0.0615	0.1930	0.0754	0.1126	0.0279	0.248
65	0.0696	0.1790	0.0657	0.2070	0.0805	0.1204	0.0301	0.250
70	0.0727	0.1880	0.0696	0.2180	0.0851	0.1267	0.0316	0.250
75	0.0754	0.1950	0.0731	0.2270	0.0894	0.1320	0.0328	0.248
80	0.0779	0.2000	0.0764	0.2340	0.0934	0.1363	0.0335	0.246
85	0.0801	0.2030	0.0795	0.2390	0.0978	0.1399	0.0338	0.241
90	0.0821	0.2050	0.0825	0.2410	0.0936	0.1408	0.0341	0.242
95	0.0838	0.2050	0.0851	0.2420	0.0975	0.1427	0.0336	0.235
100	0.0855	0.2040	0.0877	0.2420	0.1010	0.1440	0.0329	0.228
105	0.0870	0.2040	0.0900	0.2410	0.1040	0.1452	0.0322	0.222
110	0.0885	0.2020	0.0923	0.2390	0.1060	0.1456	0.0313	0.215
115	0.0899	0.2000	0.0946	0.2370	0.1090	0.1461	0.0303	0.207
120	0.0912	0.1980	0.0967	0.2340	0.1110	0.1462	0.0292	0.200
125	0.0923	0.1960	0.0934	0.2310	0.1130	0.1451	0.0287	0.198
130	0.0933	0.1940	0.0957	0.2270	0.1150	0.1450	0.0275	0.190
135	0.0944	0.1920	0.0976	0.2240	0.1170	0.1450	0.0265	0.183
140	0.0955	0.1900	0.0992	0.2210	0.1180	0.1447	0.0256	0.177
145	0.0966	0.1870	0.1010	0.2170	0.1200	0.1443	0.0243	0.169
150	0.0977	0.1850	0.1020	0.2140	0.1210	0.1439	0.0235	0.163
155	0.0950	0.1830	0.1030	0.2110	0.1220	0.1428	0.0230	0.161
160	0.0964	0.1810	0.1050	0.2080	0.1240	0.1429	0.0220	0.154
165	0.0975	0.1790	0.1060	0.2050	0.1250	0.1425	0.0211	0.148
170	0.0987	0.1780	0.1070	0.2020	0.1260	0.1423	0.0203	0.143
175	0.0996	0.1750	0.1080	0.1990	0.1260	0.1415	0.0194	0.137
180	0.1010	0.1730	0.1090	0.1970	0.1270	0.1414	0.0187	0.132
185	0.1020	0.1720	0.1100	0.1950	0.1280	0.1414	0.0181	0.128
190	0.1030	0.1700	0.1110	0.1930	0.1290	0.1412	0.0174	0.123
195	0.1040	0.1680	0.1120	0.1900	0.1300	0.1408	0.0165	0.117
200	0.1040	0.1670	0.1130	0.1880	0.1300	0.1404	0.0161	0.114

SAMPLE A013: Z93-2 ION CURRENT: RIGHT

Bias volts	A013NR1 μA	A013NR2 μA	A013NR3 μA	A013NR4 μA	A013NR5 μA	Mean μA	Standard error	fractional error
2	0.0004	0.0052	0.0003	0.0044	0.0003	0.0021	0.0011	0.519
4	0.0026	0.0080	0.0027	0.0068	0.0027	0.0045	0.0012	0.260
6	0.0057	0.0103	0.0061	0.0086	0.0058	0.0073	0.0009	0.126
8	0.0081	0.0140	0.0089	0.0113	0.0083	0.0101	0.0011	0.111
10	0.0118	0.0180	0.0132	0.0147	0.0122	0.0140	0.0011	0.080
12	0.0168	0.0227	0.0192	0.0185	0.0176	0.0190	0.0010	0.054
14	0.0218	0.0281	0.0258	0.0227	0.0237	0.0244	0.0011	0.046
16	0.0266	0.0344	0.0330	0.0274	0.0303	0.0303	0.0015	0.050
18	0.0311	0.0414	0.0407	0.0327	0.0374	0.0367	0.0021	0.057
20	0.0352	0.0494	0.0485	0.0387	0.0449	0.0433	0.0028	0.064
25	0.0665	0.0859	0.0923	0.0663	0.0861	0.0794	0.0054	0.068
30	0.0724	0.1090	0.1140	0.0877	0.0974	0.0961	0.0075	0.078
35	0.0799	0.1450	0.1380	0.1100	0.1250	0.1196	0.0116	0.097
40	0.0870	0.1840	0.1620	0.1410	0.1510	0.1450	0.0162	0.111
45	0.0939	0.2250	0.1830	0.1750	0.1750	0.1704	0.0213	0.125
50	0.0857	0.2660	0.2010	0.2090	0.1980	0.1919	0.0293	0.153
55	0.0927	0.3070	0.2170	0.2450	0.2190	0.2161	0.0349	0.161
60	0.0883	0.3460	0.2310	0.2800	0.2370	0.2365	0.0424	0.179
65	0.0948	0.3820	0.2420	0.3140	0.2530	0.2572	0.0477	0.185
70	0.0916	0.4150	0.2510	0.3470	0.2680	0.2745	0.0543	0.198
75	0.0963	0.4460	0.2580	0.3770	0.2800	0.2915	0.0594	0.204
80	0.1000	0.4730	0.2640	0.4050	0.2920	0.3068	0.0641	0.209
85	0.1030	0.4970	0.2680	0.4310	0.3010	0.3200	0.0685	0.214
90	0.1060	0.5160	0.2710	0.4540	0.3080	0.3310	0.0721	0.218
95	0.1090	0.5310	0.2730	0.4730	0.3150	0.3402	0.0750	0.221
100	0.1110	0.5430	0.2740	0.4900	0.3200	0.3476	0.0777	0.223
105	0.1140	0.5490	0.2740	0.5030	0.3230	0.3526	0.0791	0.224
110	0.1160	0.5510	0.2740	0.5130	0.3250	0.3558	0.0800	0.225
115	0.1180	0.5500	0.2730	0.5200	0.3270	0.3576	0.0803	0.224
120	0.1190	0.5450	0.2710	0.5240	0.3280	0.3574	0.0800	0.224
125	0.1210	0.5370	0.2700	0.5240	0.3280	0.3560	0.0789	0.222
130	0.1230	0.5250	0.2670	0.5220	0.3270	0.3528	0.0772	0.219
135	0.1240	0.5130	0.2650	0.5180	0.3250	0.3490	0.0754	0.216
140	0.1250	0.4980	0.2620	0.5120	0.3230	0.3440	0.0732	0.213
145	0.1270	0.4830	0.2590	0.5040	0.3210	0.3388	0.0706	0.208
150	0.1280	0.4660	0.2550	0.4950	0.3180	0.3324	0.0679	0.204
155	0.1290	0.4500	0.2520	0.4840	0.3150	0.3260	0.0651	0.200
160	0.1300	0.4350	0.2490	0.4730	0.3120	0.3198	0.0624	0.195
165	0.1310	0.4190	0.2460	0.4610	0.3090	0.3132	0.0595	0.190
170	0.1330	0.4040	0.2430	0.4490	0.3060	0.3070	0.0565	0.184
175	0.1340	0.3900	0.2400	0.4370	0.3020	0.3006	0.0539	0.179
180	0.1340	0.3760	0.2370	0.4250	0.2980	0.2940	0.0514	0.175
185	0.1350	0.3630	0.2340	0.4140	0.2940	0.2880	0.0489	0.170
190	0.1360	0.3500	0.2320	0.4030	0.2900	0.2822	0.0464	0.165
195	0.1370	0.3380	0.2290	0.3920	0.2860	0.2764	0.0441	0.160
200	0.1380	0.3260	0.2260	0.3810	0.2830	0.2708	0.0418	0.154

SAMPLE A013: Z93-2 ELECTRON CURRENT: LEFT

Bias volts	A013PL1 μA	A013PL2 μA	A013PL3 μA	A013PL4 μA	A013PL5 μA	Mean μA	Standard error	fractional error
2	0.0032	0.0034	0.0028	0.0035	0.0041	0.0034	0.0002	0.061
4	0.0044	0.0063	0.0043	0.0066	0.0056	0.0054	0.0005	0.088
6	0.0055	0.0090	0.0059	0.0094	0.0072	0.0074	0.0008	0.107
8	0.0067	0.0126	0.0075	0.0137	0.0089	0.0099	0.0014	0.141
10	0.0079	0.0170	0.0092	0.0184	0.0101	0.0125	0.0021	0.172
12	0.0092	0.0219	0.0105	0.0236	0.0119	0.0154	0.0030	0.197
14	0.0102	0.0274	0.0124	0.0294	0.0139	0.0187	0.0040	0.216
16	0.0116	0.0333	0.0144	0.0357	0.0158	0.0222	0.0051	0.230
18	0.0129	0.0398	0.0164	0.0425	0.0179	0.0259	0.0063	0.243
20	0.0143	0.0467	0.0185	0.0498	0.0200	0.0299	0.0076	0.254
25	0.0203	0.0829	0.0284	0.0858	0.0302	0.0495	0.0143	0.289
30	0.0236	0.0980	0.0342	0.1020	0.0362	0.0588	0.0170	0.289
35	0.0277	0.1270	0.0412	0.1320	0.0439	0.0744	0.0227	0.305
40	0.0320	0.1590	0.0487	0.1650	0.0519	0.0913	0.0291	0.318
45	0.0366	0.1910	0.0566	0.1980	0.0607	0.1086	0.0353	0.325
50	0.0413	0.2240	0.0648	0.2330	0.0696	0.1265	0.0419	0.331
55	0.0463	0.2570	0.0729	0.2660	0.0787	0.1442	0.0482	0.334
60	0.0514	0.2890	0.0809	0.2990	0.0880	0.1617	0.0544	0.336
65	0.0566	0.3190	0.0888	0.3290	0.0980	0.1783	0.0599	0.336
70	0.0620	0.3480	0.0971	0.3580	0.1010	0.1932	0.0656	0.340
75	0.0678	0.3750	0.0991	0.3830	0.1110	0.2072	0.0705	0.340
80	0.0738	0.3970	0.1070	0.4060	0.1200	0.2208	0.0742	0.336
85	0.0803	0.4180	0.1140	0.4260	0.1290	0.2335	0.0774	0.331
90	0.0869	0.4350	0.1210	0.4430	0.1370	0.2446	0.0798	0.326
95	0.0939	0.4500	0.1280	0.4580	0.1450	0.2550	0.0817	0.320
100	0.1010	0.4630	0.1340	0.4710	0.1530	0.2644	0.0831	0.314
105	0.1100	0.4730	0.1400	0.4810	0.1610	0.2730	0.0837	0.307
110	0.1190	0.4810	0.1470	0.4900	0.1680	0.2810	0.0839	0.298
115	0.1280	0.4880	0.1530	0.4960	0.1750	0.2880	0.0836	0.290
120	0.1390	0.4920	0.1590	0.5020	0.1820	0.2948	0.0828	0.281
125	0.1490	0.4960	0.1660	0.5070	0.1900	0.3016	0.0819	0.272
130	0.1610	0.4980	0.1730	0.5100	0.1970	0.3078	0.0803	0.261
135	0.1780	0.5000	0.1800	0.5130	0.2050	0.3152	0.0783	0.248
140	0.1930	0.5050	0.1880	0.5180	0.2130	0.3234	0.0769	0.238
145	0.2070	0.5070	0.1970	0.5220	0.2210	0.3308	0.0751	0.227
150	0.2230	0.5110	0.2060	0.5250	0.2290	0.3388	0.0733	0.216

SAMPLE A013: Z93-2 ELECTRON CURRENT: LEFT (continued)

Bias volts	A013PL1 μA	A013PL2 μA	A013PL3 μA	A013PL4 μA	A013PL5 μA	Mean μA	Standard error	fractional error
155	0.2400	0.5130	0.2140	0.5280	0.2380	0.3466	0.0712	0.205
160	0.2610	0.5160	0.2230	0.5310	0.2480	0.3558	0.0688	0.193
165	0.2850	0.5200	0.2330	0.5340	0.2590	0.3662	0.0662	0.181
170	0.3090	0.5230	0.2430	0.5390	0.2700	0.3768	0.0639	0.170
175	0.3330	0.5290	0.2540	0.5440	0.2820	0.3884	0.0618	0.159
180	0.3580	0.5350	0.2660	0.5500	0.2940	0.4006	0.0599	0.149
185	0.3870	0.5420	0.2780	0.5590	0.3070	0.4146	0.0583	0.141
190	0.4240	0.5510	0.2920	0.5760	0.3240	0.4334	0.0575	0.133
195	0.4650	0.5640	0.3090	0.5900	0.3470	0.4550	0.0562	0.124
200	0.5100	0.5790	0.3320	0.6010	0.3660	0.4776	0.0549	0.115
205	0.5540	0.5970	0.3570	0.6210	0.3850	0.5028	0.0550	0.109
210	0.6910	0.6170	0.3790	0.6390	0.4100	0.5472	0.0637	0.116
215	0.8460	0.6320	0.4000	0.6570	0.4320	0.5934	0.0815	0.137
220	1.2600	0.6500	0.4220	0.6790	0.4560	0.6934	0.1505	0.217
225	1.3400	0.6750	0.4500	0.7050	0.4850	0.7310	0.1603	0.219
230	1.4400	0.7010	0.4760	0.7280	0.5130	0.7716	0.1743	0.226
235	1.5300	0.9180	0.5090	0.7610	0.5440	0.8524	0.1850	0.217
240	1.6500	0.9470	0.5400	0.8190	0.5880	0.9088	0.1997	0.220
245	4.0900	0.9820	0.5890	0.8560	0.6390	1.4312	0.6685	0.467
250	6.0300	1.0300	0.6770	0.8920	0.6780	1.8614	1.0443	0.561
255	6.3800	1.0700	0.7210	0.9330	0.7200	1.9648	1.1058	0.563
260	6.8200	1.1100	0.7730	0.9940	0.7640	2.0922	1.1838	0.566
265	8.1200	1.7400	0.8250	1.0400	0.8310	2.5112	1.4122	0.562
270	10.6000	1.7900	0.8880	1.0900	0.8920	3.0520	1.8942	0.621
275	11.0000	1.8600	0.9670	1.2600	1.0500	3.2274	1.9494	0.604
280	11.6000	2.0100	1.1100	1.3500	1.1100	3.4360	2.0476	0.596
285	11.9000	2.2700	1.1700	1.4500	1.1800	3.5940	2.0862	0.580
290	12.2000	2.5300	1.2500	1.5500	1.2900	3.7640	2.1217	0.564
295	12.5000	5.7300	1.3700	3.1700	1.5200	4.8580	2.0654	0.425
300	13.6000	5.6600	1.6600	5.1600	4.0600	6.0280	2.0147	0.334

SAMPLE A013: Z93-2 ELECTRON CURRENT: RIGHT

Bias volts	A013PR1 μA	A013PR2 μA	A013PR3 μA	A013PR4 μA	A013PR5 μA	Mean μA	Standard error	fractional error
2	0.0053	0.0010	0.0069	-0.0003	0.0074	0.0041	0.0016	0.386
4	0.0073	0.0043	0.0087	0.0021	0.0094	0.0064	0.0014	0.216
6	0.0087	0.0083	0.0110	0.0050	0.0122	0.0090	0.0012	0.137
8	0.0106	0.0123	0.0139	0.0083	0.0153	0.0121	0.0012	0.102
10	0.0130	0.0181	0.0171	0.0114	0.0186	0.0156	0.0014	0.093
12	0.0154	0.0247	0.0205	0.0157	0.0223	0.0197	0.0018	0.093
14	0.0180	0.0322	0.0242	0.0204	0.0263	0.0242	0.0025	0.102
16	0.0207	0.0407	0.0284	0.0256	0.0308	0.0292	0.0033	0.114
18	0.0235	0.0500	0.0329	0.0314	0.0358	0.0347	0.0043	0.125
20	0.0264	0.0602	0.0377	0.0376	0.0411	0.0406	0.0055	0.135
25	0.0408	0.1290	0.0619	0.0681	0.0672	0.0734	0.0148	0.201
30	0.0491	0.1670	0.0777	0.0897	0.0852	0.0937	0.0196	0.209
35	0.0593	0.2100	0.0983	0.1090	0.1010	0.1155	0.0251	0.218
40	0.0704	0.2560	0.1130	0.1380	0.1270	0.1409	0.0310	0.220
45	0.0822	0.3030	0.1360	0.1680	0.1540	0.1686	0.0366	0.217
50	0.0951	0.3470	0.1600	0.1980	0.1820	0.1964	0.0415	0.211
55	0.1030	0.3870	0.1840	0.2280	0.2100	0.2224	0.0464	0.209
60	0.1180	0.4220	0.2080	0.2570	0.2390	0.2488	0.0495	0.199
65	0.1320	0.4520	0.2310	0.2840	0.2670	0.2732	0.0519	0.190
70	0.1480	0.4760	0.2540	0.3090	0.2950	0.2964	0.0530	0.179
75	0.1640	0.4960	0.2750	0.3310	0.3220	0.3176	0.0536	0.169
80	0.1810	0.5120	0.2960	0.3510	0.3490	0.3378	0.0534	0.158
85	0.1990	0.5260	0.3150	0.3680	0.3740	0.3564	0.0528	0.148
90	0.2180	0.5400	0.3340	0.3820	0.3980	0.3744	0.0520	0.139
95	0.2390	0.5530	0.3530	0.3940	0.4210	0.3920	0.0508	0.130
100	0.2610	0.5670	0.3710	0.4040	0.4420	0.4090	0.0497	0.122
105	0.2840	0.5810	0.3880	0.4120	0.4630	0.4256	0.0486	0.114
110	0.3090	0.5940	0.4050	0.4180	0.4830	0.4418	0.0471	0.107
115	0.3360	0.6070	0.4210	0.4230	0.5020	0.4578	0.0456	0.100
120	0.3640	0.6180	0.4380	0.4270	0.5200	0.4734	0.0438	0.093
125	0.3940	0.6300	0.4550	0.4310	0.5390	0.4898	0.0424	0.087
130	0.4250	0.6400	0.4730	0.4330	0.5570	0.5056	0.0409	0.081
135	0.4590	0.6490	0.4910	0.4360	0.5760	0.5222	0.0396	0.076
140	0.4920	0.6580	0.5100	0.4390	0.5930	0.5384	0.0388	0.072
145	0.5280	0.6670	0.5280	0.4410	0.6110	0.5550	0.0388	0.070
150	0.5650	0.6750	0.5470	0.4430	0.6290	0.5718	0.0395	0.069

SAMPLE A013: Z93-2 ELECTRON CURRENT: RIGHT (continued)

Bias volts	A013PR1 μA	A013PR2 μA	A013PR3 μA	A013PR4 μA	A013PR5 μA	Mean μA	Standard error	fractional error
155	0.6040	0.6830	0.5670	0.4450	0.6470	0.5892	0.0410	0.070
160	0.6440	0.6900	0.5870	0.4470	0.6650	0.6066	0.0434	0.071
165	0.6860	0.6980	0.6090	0.4490	0.6830	0.6250	0.0467	0.075
170	0.7360	0.7040	0.6300	0.4520	0.7000	0.6444	0.0511	0.079
175	0.7870	0.7120	0.6530	0.4580	0.7180	0.6656	0.0561	0.084
180	0.8340	0.7210	0.6760	0.4640	0.7350	0.6860	0.0612	0.089
185	0.8820	0.7310	0.6980	0.4690	0.7520	0.7064	0.0671	0.095
190	0.9360	0.7520	0.7230	0.4760	0.7700	0.7314	0.0738	0.101
195	0.9880	0.7660	0.7570	0.4830	0.8030	0.7594	0.0808	0.106
200	1.0400	0.7790	0.7890	0.5020	0.8230	0.7866	0.0856	0.109
205	1.0900	0.7950	0.8170	0.5200	0.8450	0.8134	0.0905	0.111
210	1.1500	0.8100	0.8440	0.5330	0.8650	0.8404	0.0980	0.117
215	1.2100	0.8240	0.8720	0.5460	0.8860	0.8676	0.1056	0.122
220	1.2700	0.8410	0.9010	0.5600	0.9050	0.8954	0.1131	0.126
225	1.3200	0.8610	0.9330	0.5770	0.9290	0.9240	0.1186	0.128
230	1.3800	0.8860	0.9710	0.5970	0.9500	0.9568	0.1253	0.131
235	1.4700	0.9340	1.0200	0.6220	0.9880	1.0068	0.1357	0.135
240	1.6500	0.9580	1.0500	0.6570	1.0100	1.0650	0.1618	0.152
245	3.0000	0.9830	1.0900	0.6990	1.0300	1.3604	0.4154	0.305
250	4.6300	1.0100	1.1200	0.7240	1.0500	1.7068	0.7339	0.430
255	4.7600	1.0500	1.1500	0.7490	1.0800	1.7578	0.7537	0.429
260	4.8900	1.1000	1.1900	0.7780	1.1000	1.8116	0.7728	0.427
265	5.0300	1.1500	1.2400	0.8110	1.1300	1.8722	0.7928	0.423
270	5.1800	1.2500	1.3100	0.8470	1.2200	1.9614	0.8087	0.412
275	5.3500	1.5700	1.3800	0.9280	1.2900	2.1036	0.8183	0.389
280	5.5000	1.6500	1.9800	0.9930	1.3800	2.3006	0.8161	0.355
285	5.6800	1.7600	2.0700	1.1400	1.4700	2.4240	0.8284	0.342
290	6.1400	1.8700	2.2900	1.2000	2.1200	2.7240	0.8739	0.321
295	6.3600	4.1500	2.4500	1.3600	4.0200	3.6680	0.8489	0.231
300	6.5400	9.1300	3.6400	5.4700	3.9700	5.7500	0.9937	0.173

SAMPLE M013: M93-2 ION CURRENT: LEFT

Bias volts	M013NL1 μA	M013NL2 μA	M013NL3 μA	M013NL4 μA	M013NL5 μA	Mean μA	Standard error	fractional error
2	0.1390	0.1790	0.1720	0.1950	0.1830	0.1736	0.0094	0.054
4	0.3960	0.4010	0.4110	0.4110	0.4170	0.4072	0.0038	0.009
6	0.5120	0.5100	0.5230	0.5190	0.5290	0.5186	0.0035	0.007
8	0.6010	0.5960	0.6110	0.6060	0.6170	0.6062	0.0037	0.006
10	0.6830	0.6770	0.6930	0.6860	0.6980	0.6874	0.0037	0.005
12	0.7620	0.7540	0.7720	0.7640	0.7760	0.7656	0.0039	0.005
14	0.8370	0.8290	0.8470	0.8390	0.8520	0.8408	0.0040	0.005
16	0.9110	0.9020	0.9200	0.9110	0.9250	0.9138	0.0040	0.004
18	0.9810	0.9720	0.9910	0.9820	0.9960	0.9844	0.0042	0.004
20	1.0500	1.0400	1.0600	1.0500	1.0600	1.0520	0.0037	0.004
25	1.2200	1.2100	1.2300	1.2200	1.2300	1.2220	0.0037	0.003
30	1.3700	1.3600	1.3800	1.3700	1.3800	1.3720	0.0037	0.003
35	1.5200	1.5100	1.5300	1.5100	1.5300	1.5200	0.0045	0.003
40	1.6600	1.6500	1.6700	1.6500	1.6700	1.6600	0.0045	0.003
45	1.7900	1.7800	1.8000	1.7900	1.8100	1.7940	0.0051	0.003
50	1.9300	1.9100	1.9400	1.9200	1.9400	1.9280	0.0058	0.003
55	2.0600	2.0500	2.0700	2.0500	2.0700	2.0600	0.0045	0.002
60	2.1900	2.1700	2.1900	2.1800	2.2000	2.1860	0.0051	0.002
65	2.3100	2.3000	2.3200	2.3000	2.3200	2.3100	0.0045	0.002
70	2.4400	2.4200	2.4400	2.4300	2.4400	2.4340	0.0040	0.002
75	2.5600	2.5400	2.5600	2.5500	2.5600	2.5540	0.0040	0.002
80	2.6800	2.6600	2.6800	2.6600	2.6800	2.6720	0.0049	0.002
85	2.7900	2.7800	2.8000	2.7800	2.8000	2.7900	0.0045	0.002
90	2.9100	2.8900	2.9100	2.9000	2.9100	2.9040	0.0040	0.001
95	3.0200	3.0100	3.0300	3.0100	3.0300	3.0200	0.0045	0.001
100	3.1400	3.1200	3.1400	3.1300	3.1400	3.1340	0.0040	0.001
105	3.2500	3.2300	3.2600	3.2400	3.2600	3.2480	0.0058	0.002
110	3.3600	3.3400	3.3700	3.3500	3.3700	3.3580	0.0058	0.002
115	3.4700	3.4600	3.4800	3.4600	3.4800	3.4700	0.0045	0.001
120	3.5900	3.5700	3.5900	3.5700	3.5900	3.5820	0.0049	0.001
125	3.7000	3.6700	3.7000	3.6800	3.7000	3.6900	0.0063	0.002
130	3.8000	3.7800	3.8100	3.7900	3.8000	3.7960	0.0051	0.001
135	3.9100	3.8900	3.9200	3.9000	3.9100	3.9060	0.0051	0.001
140	4.0200	3.9900	4.0300	4.0000	4.0200	4.0120	0.0073	0.002
145	4.1200	4.1000	4.1300	4.1100	4.1200	4.1160	0.0051	0.001
150	4.2300	4.2000	4.2400	4.2100	4.2200	4.2200	0.0071	0.002
155	4.3300	4.3100	4.3400	4.3200	4.3300	4.3260	0.0051	0.001
160	4.4300	4.4100	4.4400	4.4200	4.4300	4.4260	0.0051	0.001
165	4.5300	4.5100	4.5400	4.5200	4.5300	4.5260	0.0051	0.001
170	4.6400	4.6100	4.6400	4.6200	4.6300	4.6280	0.0058	0.001
175	4.7400	4.7100	4.7400	4.7200	4.7400	4.7300	0.0063	0.001
180	4.8400	4.8100	4.8400	4.8200	4.8300	4.8280	0.0058	0.001
185	4.9400	4.9100	4.9400	4.9200	4.9300	4.9280	0.0058	0.001
190	5.0400	5.0100	5.0400	5.0200	5.0300	5.0280	0.0058	0.001
195	5.1400	5.1000	5.1400	5.1200	5.1300	5.1260	0.0075	0.001
200	5.2300	5.2000	5.2400	5.2200	5.2300	5.2240	0.0068	0.001

SAMPLE M013: M93-2 ION CURRENT: RIGHT

Bias volts	M013NR1 μA	M013NR2 μA	M013NR3 μA	M013NR4 μA	M013NR5 μA	Mean μA	Standard error	fractional error
2	0.0709	0.0738	0.0693	0.0747	0.0667	0.0711	0.0015	0.021
4	0.2670	0.2680	0.2680	0.2720	0.2710	0.2692	0.0010	0.004
6	0.3610	0.3610	0.3640	0.3680	0.3670	0.3642	0.0015	0.004
8	0.4310	0.4320	0.4350	0.4400	0.4390	0.4354	0.0018	0.004
10	0.4960	0.4960	0.4990	0.5040	0.5040	0.4998	0.0018	0.004
12	0.5560	0.5560	0.5600	0.5650	0.5660	0.5606	0.0021	0.004
14	0.6140	0.6140	0.6190	0.6240	0.6250	0.6192	0.0024	0.004
16	0.6700	0.6700	0.6750	0.6810	0.6820	0.6756	0.0026	0.004
18	0.7240	0.7240	0.7290	0.7360	0.7360	0.7298	0.0027	0.004
20	0.7770	0.7760	0.7830	0.7890	0.7890	0.7828	0.0028	0.004
25	0.9040	0.9040	0.9110	0.9190	0.9190	0.9114	0.0034	0.004
30	1.0200	1.0200	1.0300	1.0400	1.0400	1.0300	0.0045	0.004
35	1.1400	1.1400	1.1500	1.1600	1.1500	1.1480	0.0037	0.003
40	1.2400	1.2400	1.2600	1.2700	1.2600	1.2540	0.0060	0.005
45	1.3500	1.3500	1.3600	1.3700	1.3700	1.3600	0.0045	0.003
50	1.4500	1.4500	1.4700	1.4800	1.4800	1.4660	0.0068	0.005
55	1.5500	1.5600	1.5700	1.5800	1.5800	1.5680	0.0058	0.004
60	1.6500	1.6500	1.6700	1.6800	1.6800	1.6660	0.0068	0.004
65	1.7500	1.7500	1.7700	1.7800	1.7800	1.7660	0.0068	0.004
70	1.8500	1.8500	1.8700	1.8800	1.8800	1.8660	0.0068	0.004
75	1.9400	1.9400	1.9600	1.9800	1.9700	1.9580	0.0080	0.004
80	2.0300	2.0400	2.0600	2.0700	2.0700	2.0540	0.0081	0.004
85	2.1300	2.1300	2.1500	2.1700	2.1600	2.1480	0.0080	0.004
90	2.2200	2.2200	2.2400	2.2600	2.2500	2.2380	0.0080	0.004
95	2.3100	2.3100	2.3300	2.3500	2.3400	2.3280	0.0080	0.003
100	2.4000	2.4000	2.4300	2.4500	2.4300	2.4220	0.0097	0.004
105	2.4900	2.4800	2.5200	2.5400	2.5200	2.5100	0.0110	0.004
110	2.5800	2.5700	2.6000	2.6300	2.6100	2.5980	0.0107	0.004
115	2.6600	2.6600	2.6900	2.7200	2.7000	2.6860	0.0117	0.004
120	2.7500	2.7500	2.7800	2.8100	2.7900	2.7760	0.0117	0.004
125	2.8300	2.8300	2.8700	2.8900	2.8800	2.8600	0.0126	0.004
130	2.9200	2.9200	2.9500	2.9800	2.9600	2.9460	0.0117	0.004
135	3.0000	3.0100	3.0400	3.0700	3.0500	3.0340	0.0129	0.004
140	3.0900	3.0900	3.1300	3.1500	3.1300	3.1180	0.0120	0.004
145	3.1700	3.1700	3.2100	3.2400	3.2200	3.2020	0.0139	0.004
150	3.2500	3.2600	3.3000	3.3200	3.3000	3.2860	0.0133	0.004
155	3.3300	3.3400	3.3800	3.4100	3.3900	3.3700	0.0152	0.005
160	3.4200	3.4200	3.4700	3.4900	3.4700	3.4540	0.0144	0.004
165	3.5000	3.5000	3.5500	3.5800	3.5600	3.5380	0.0162	0.005
170	3.5800	3.5900	3.6300	3.6600	3.6400	3.6200	0.0152	0.004
175	3.6600	3.6700	3.7200	3.7400	3.7200	3.7020	0.0156	0.004
180	3.7400	3.7500	3.8000	3.8300	3.8000	3.7840	0.0169	0.004
185	3.8300	3.8300	3.8900	3.9100	3.8900	3.8700	0.0167	0.004
190	3.9000	3.9100	3.9700	3.9900	3.9700	3.9480	0.0180	0.005
195	3.9800	3.9900	4.0500	4.0800	4.0500	4.0300	0.0192	0.005
200	4.0600	4.0700	4.1300	4.1600	4.1300	4.1100	0.0192	0.005

SAMPLE M013: M93-2 ELECTRON CURRENT: LEFT

Bias volts	M013PL1 mA	M013PL2 mA	M013PL3 mA	M013PL4 mA	M013PL5 mA	Mean mA	Standard error	fractional error
2	0.005	0.004	0.005	0.004	0.005	0.0044	0.0002	0.0464
4	0.013	0.011	0.013	0.011	0.013	0.0120	0.0004	0.0315
6	0.021	0.020	0.022	0.020	0.022	0.0208	0.0005	0.0255
8	0.031	0.029	0.032	0.029	0.032	0.0302	0.0006	0.0212
10	0.041	0.038	0.042	0.038	0.042	0.0400	0.0007	0.0185
12	0.051	0.049	0.052	0.049	0.052	0.0503	0.0008	0.0152
14	0.062	0.060	0.063	0.060	0.063	0.0614	0.0007	0.0121
16	0.073	0.071	0.074	0.071	0.074	0.0728	0.0007	0.0091
18	0.085	0.083	0.086	0.083	0.086	0.0844	0.0006	0.0069
20	0.097	0.095	0.097	0.095	0.097	0.0960	0.0005	0.0054
25	0.126	0.124	0.126	0.124	0.126	0.1252	0.0005	0.0039
30	0.156	0.155	0.156	0.154	0.156	0.1554	0.0004	0.0026
35	0.185	0.184	0.185	0.184	0.185	0.1846	0.0002	0.0013
40	0.214	0.214	0.214	0.213	0.213	0.2136	0.0002	0.0011
45	0.243	0.242	0.242	0.241	0.241	0.2418	0.0004	0.0015
50	0.270	0.270	0.269	0.268	0.268	0.2690	0.0004	0.0017
55	0.297	0.296	0.296	0.294	0.294	0.2954	0.0006	0.0020
60	0.323	0.322	0.322	0.320	0.320	0.3214	0.0006	0.0019
65	0.349	0.348	0.347	0.346	0.346	0.3472	0.0006	0.0017
70	0.374	0.373	0.372	0.370	0.370	0.3718	0.0008	0.0022
75	0.398	0.397	0.397	0.395	0.395	0.3964	0.0006	0.0015
80	0.423	0.422	0.421	0.419	0.419	0.4208	0.0008	0.0019
85	0.447	0.446	0.445	0.443	0.443	0.4448	0.0008	0.0018
90	0.471	0.470	0.469	0.467	0.467	0.4688	0.0008	0.0017
95	0.494	0.494	0.493	0.490	0.490	0.4922	0.0009	0.0019
100	0.517	0.517	0.516	0.513	0.513	0.5152	0.0009	0.0018
105	0.540	0.540	0.539	0.536	0.536	0.5382	0.0009	0.0017
110	0.563	0.562	0.562	0.559	0.558	0.5608	0.0010	0.0017
115	0.586	0.586	0.584	0.582	0.581	0.5838	0.0010	0.0017
120	0.608	0.608	0.606	0.605	0.604	0.6062	0.0008	0.0013
125	0.630	0.631	0.629	0.627	0.626	0.6286	0.0009	0.0015
130	0.652	0.653	0.650	0.649	0.648	0.6504	0.0009	0.0014
135	0.673	0.675	0.672	0.671	0.669	0.6720	0.0010	0.0015
140	0.695	0.697	0.694	0.693	0.691	0.6940	0.0010	0.0014
145	0.717	0.719	0.716	0.715	0.713	0.7160	0.0010	0.0014
150	0.739	0.740	0.737	0.736	0.735	0.7374	0.0009	0.0013

SAMPLE M013: M93-2 ELECTRON CURRENT: LEFT (continued)

Bias volts	M013PL1 mA	M013PL2 mA	M013PL3 mA	M013PL4 mA	M013PL5 mA	Mean mA	Standard error	fractional error
155	0.760	0.762	0.759	0.758	0.756	0.7590	0.0010	0.0013
160	0.781	0.783	0.780	0.779	0.777	0.7800	0.0010	0.0013
165	0.802	0.805	0.801	0.801	0.798	0.8014	0.0011	0.0014
170	0.823	0.826	0.822	0.823	0.820	0.8228	0.0010	0.0012
175	0.844	0.848	0.843	0.844	0.841	0.8440	0.0011	0.0014
180	0.865	0.869	0.864	0.866	0.863	0.8654	0.0010	0.0012
185	0.886	0.891	0.884	0.887	0.884	0.8864	0.0013	0.0015
190	0.907	0.913	0.905	0.909	0.906	0.9080	0.0014	0.0016
195	0.928	0.934	0.926	0.931	0.927	0.9292	0.0015	0.0016
200	0.949	0.956	0.947	0.952	0.948	0.9504	0.0016	0.0017
205	0.970	0.978	0.968	0.973	0.969	0.9716	0.0018	0.0019
210	0.992	1.682	0.989	0.996	0.991	1.1300	0.1380	0.1221
215	1.013	1.707	1.023	1.018	1.049	1.1620	0.1364	0.1174
220	1.033	1.733	1.043	1.038	1.069	1.1832	0.1376	0.1163
225	1.055	1.760	1.064	1.062	1.089	1.2060	0.1386	0.1149
230	1.076	1.788	1.084	1.083	1.109	1.2280	0.1401	0.1141
235	1.098	1.817	1.104	1.104	1.129	1.2504	0.1418	0.1134
240	1.122	1.847	1.126	1.126	1.150	1.2742	0.1433	0.1125
245	1.143	1.876	1.145	1.147	1.171	1.2964	0.1450	0.1118
250	1.164	1.911	1.166	1.168	1.192	1.3202	0.1478	0.1119
255	1.185	1.952	1.186	1.193	1.213	1.3458	0.1516	0.1127
260	1.206	1.988	1.210	1.214	1.234	1.3704	0.1545	0.1127
265	1.226	2.018	1.231	1.235	1.255	1.3930	0.1563	0.1122
270	1.252	2.047	1.251	1.266	1.276	1.4184	0.1572	0.1108
275	1.275	2.079	1.272	1.286	1.297	1.4418	0.1594	0.1105
280	1.296	2.111	1.293	1.306	1.318	1.4648	0.1616	0.1103
285	1.318	2.141	1.313	1.368	1.339	1.4958	0.1616	0.1080
290	1.561	2.170	1.336	1.387	1.361	1.5630	0.1568	0.1003
295	1.532	2.199	1.357	1.663	1.382	1.6266	0.1534	0.0943
300	1.858	2.230	1.378	1.624	1.419	1.7018	0.1572	0.0924

SAMPLE M013: M93-2 ELECTRON CURRENT: RIGHT

Bias volts	M013PR1 mA	M013PR2 mA	M013PR3 mA	M013PR4 mA	M013PR5 mA	Mean mA	Standard error	fractional error
2	0.003	0.004	0.004	0.004	0.004	0.0037	0.0002	0.0444
4	0.008	0.010	0.010	0.010	0.010	0.0094	0.0003	0.0325
6	0.014	0.016	0.016	0.016	0.016	0.0158	0.0004	0.0266
8	0.021	0.023	0.023	0.023	0.024	0.0227	0.0005	0.0225
10	0.028	0.030	0.030	0.031	0.031	0.0299	0.0006	0.0190
12	0.035	0.038	0.038	0.038	0.039	0.0378	0.0006	0.0159
14	0.044	0.047	0.047	0.047	0.047	0.0464	0.0006	0.0119
16	0.053	0.056	0.056	0.056	0.056	0.0552	0.0005	0.0097
18	0.062	0.064	0.064	0.064	0.065	0.0638	0.0005	0.0080
20	0.071	0.073	0.073	0.073	0.074	0.0725	0.0005	0.0071
25	0.093	0.095	0.095	0.094	0.096	0.0944	0.0005	0.0055
30	0.115	0.116	0.116	0.116	0.118	0.1162	0.0005	0.0042
35	0.136	0.138	0.138	0.137	0.139	0.1376	0.0005	0.0037
40	0.157	0.159	0.159	0.158	0.160	0.1586	0.0005	0.0032
45	0.178	0.179	0.179	0.178	0.181	0.1790	0.0005	0.0031
50	0.198	0.199	0.199	0.198	0.201	0.1990	0.0005	0.0028
55	0.217	0.218	0.218	0.217	0.221	0.2182	0.0007	0.0034
60	0.237	0.237	0.237	0.236	0.240	0.2374	0.0007	0.0029
65	0.256	0.256	0.256	0.255	0.259	0.2564	0.0007	0.0026
70	0.274	0.275	0.275	0.274	0.277	0.2750	0.0005	0.0020
75	0.293	0.293	0.293	0.292	0.296	0.2934	0.0007	0.0023
80	0.311	0.311	0.311	0.310	0.314	0.3114	0.0007	0.0022
85	0.329	0.329	0.329	0.328	0.332	0.3294	0.0007	0.0021
90	0.347	0.348	0.348	0.346	0.351	0.3480	0.0008	0.0024
95	0.365	0.365	0.365	0.364	0.369	0.3656	0.0009	0.0024
100	0.383	0.383	0.383	0.381	0.387	0.3834	0.0010	0.0026
105	0.400	0.401	0.401	0.399	0.405	0.4012	0.0010	0.0025
110	0.418	0.418	0.418	0.417	0.422	0.4186	0.0009	0.0021
115	0.438	0.436	0.436	0.434	0.440	0.4368	0.0010	0.0023
120	0.456	0.454	0.454	0.451	0.458	0.4546	0.0012	0.0026
125	0.474	0.471	0.471	0.468	0.475	0.4718	0.0012	0.0026
130	0.491	0.488	0.488	0.485	0.492	0.4888	0.0012	0.0025
135	0.508	0.505	0.505	0.502	0.509	0.5058	0.0012	0.0025
140	0.526	0.522	0.522	0.520	0.527	0.5234	0.0013	0.0025
145	0.544	0.539	0.539	0.536	0.544	0.5404	0.0016	0.0029
150	0.561	0.556	0.556	0.553	0.561	0.5574	0.0016	0.0028

SAMPLE M013: M93-2 ELECTRON CURRENT: RIGHT (continued)

Bias volts	M013PR1 mA	M013PR2 mA	M013PR3 mA	M013PR4 mA	M013PR5 mA	Mean mA	Standard error	fractional error
155	0.579	0.573	0.573	0.570	0.578	0.5746	0.0017	0.0029
160	0.596	0.590	0.590	0.587	0.594	0.5914	0.0016	0.0027
165	0.613	0.607	0.607	0.604	0.612	0.6086	0.0017	0.0028
170	0.630	0.623	0.623	0.620	0.629	0.6250	0.0019	0.0031
175	0.648	0.640	0.640	0.637	0.646	0.6422	0.0021	0.0032
180	0.666	0.657	0.657	0.654	0.663	0.6594	0.0022	0.0033
185	0.683	0.674	0.674	0.670	0.680	0.6762	0.0023	0.0034
190	0.701	0.691	0.691	0.687	0.696	0.6932	0.0024	0.0035
195	0.761	0.708	0.708	0.704	0.713	0.7188	0.0106	0.0148
200	0.768	0.725	0.725	0.721	0.730	0.7338	0.0087	0.0118
205	0.783	0.742	0.742	0.737	0.747	0.7502	0.0084	0.0111
210	0.799	0.758	0.758	0.753	0.764	0.7664	0.0083	0.0109
215	0.830	0.775	0.775	0.770	0.780	0.7860	0.0111	0.0141
220	0.842	0.792	0.792	0.786	0.797	0.8018	0.0102	0.0127
225	0.894	0.812	0.812	0.803	0.814	0.8270	0.0169	0.0204
230	0.894	0.829	0.829	0.819	0.831	0.8404	0.0136	0.0161
235	1.455	0.846	0.846	0.836	0.848	0.9662	0.1222	0.1265
240	1.475	0.863	0.863	0.856	0.867	0.9848	0.1226	0.1245
245	1.495	0.881	0.881	0.873	0.884	1.0028	0.1231	0.1227
250	1.517	0.903	0.903	0.890	0.902	1.0230	0.1235	0.1207
255	1.539	0.941	0.941	0.907	0.922	1.0500	0.1224	0.1166
260	1.560	0.958	0.958	0.923	0.940	1.0678	0.1232	0.1154
265	1.582	0.986	0.986	0.949	0.957	1.0920	0.1227	0.1124
270	1.605	1.005	1.005	1.636	0.976	1.2454	0.1533	0.1231
275	1.628	1.134	1.134	1.654	1.677	1.4454	0.1274	0.0881
280	1.651	1.187	1.187	1.674	1.695	1.4788	0.1193	0.0807
285	1.674	1.172	1.172	1.693	1.715	1.4852	0.1280	0.0862
290	1.697	1.164	1.164	1.716	1.737	1.4956	0.1355	0.0906
295	1.719	1.181	1.181	1.737	1.759	1.5154	0.1367	0.0902
300	1.741	1.193	1.193	1.759	1.781	1.5334	0.1391	0.0907

SAMPLE: A096 (Z93P-1)

Z93P position : RIGHT

Date: 11/23/1992

Run ID	Start Time
A096PR1	13:56
A096NR1	13:59
M096NL1	14:03
M096PL1	14:05
M096PL2	14:08
M096NL2	14:12
A096NR2	14:14
A096PR2	14:17
A096PR3	14:21
A096NR3	14:24
M096NL3	14:27
M096PL3	14:29
M096PL4	14:33
M096NL4	14:36
A096NR4	14:39
A096PR4	14:42
A096PR5	14:45
A096NR5	14:48
M096NL5	14:52
M096PL5	14:54

Z93P position : LEFT

Date: 11/24/1992

Run ID	Start Time
M096PR1	14:55
M096NR1	14:58
A096NL1	15:02
A096PL1	15:05
A096PL2	15:09
A096NL2	15:12
M096NR2	15:15
M096PR2	15:18
M096PR3	15:22
M096NR3	15:25
A096NL3	15:28
A096PL3	15:31
A096PL4	15:35
A096NL4	15:38
M096NR4	15:41
M096PR4	15:44
M096PR5	15:48
M096NR5	15:51
A096NL5	15:54
A096PL5	15:57

SAMPLE A096: Z93P-1 ION CURRENT: LEFT

Bias volts	A096NL1 μA	A096NL2 μA	A096NL3 μA	A096NL4 μA	A096NL5 μA	Mean μA	Standard error	fractional error
2	0.0002	0.0008	0.0002	0.0009	0.0002	0.0004	0.0002	0.357
4	0.0012	0.0014	0.0009	0.0015	0.0009	0.0012	0.0001	0.109
6	0.0027	0.0021	0.0019	0.0021	0.0019	0.0021	0.0002	0.074
8	0.0045	0.0027	0.0033	0.0027	0.0032	0.0033	0.0003	0.099
10	0.0064	0.0034	0.0047	0.0034	0.0047	0.0045	0.0006	0.121
12	0.0084	0.0041	0.0063	0.0041	0.0062	0.0058	0.0008	0.137
14	0.0095	0.0049	0.0078	0.0049	0.0078	0.0070	0.0009	0.130
16	0.0116	0.0057	0.0096	0.0057	0.0097	0.0084	0.0012	0.140
18	0.0136	0.0065	0.0104	0.0065	0.0105	0.0095	0.0014	0.142
20	0.0156	0.0074	0.0122	0.0074	0.0123	0.0110	0.0016	0.145
25	0.0272	0.0116	0.0218	0.0117	0.0224	0.0189	0.0031	0.165
30	0.0299	0.0136	0.0247	0.0137	0.0253	0.0214	0.0033	0.154
35	0.0343	0.0161	0.0286	0.0164	0.0295	0.0250	0.0037	0.148
40	0.0393	0.0188	0.0330	0.0192	0.0341	0.0289	0.0042	0.144
45	0.0444	0.0216	0.0375	0.0221	0.0388	0.0329	0.0047	0.141
50	0.0495	0.0244	0.0420	0.0251	0.0435	0.0369	0.0051	0.139
55	0.0549	0.0273	0.0464	0.0281	0.0483	0.0410	0.0056	0.137
60	0.0602	0.0303	0.0508	0.0312	0.0530	0.0451	0.0061	0.134
65	0.0656	0.0332	0.0552	0.0343	0.0577	0.0492	0.0065	0.133
70	0.0709	0.0361	0.0597	0.0374	0.0623	0.0533	0.0070	0.131
75	0.0764	0.0391	0.0639	0.0405	0.0668	0.0573	0.0075	0.130
80	0.0820	0.0421	0.0682	0.0437	0.0712	0.0614	0.0079	0.129
85	0.0875	0.0452	0.0725	0.0468	0.0757	0.0655	0.0084	0.128
90	0.0933	0.0483	0.0767	0.0500	0.0801	0.0697	0.0088	0.127
95	0.0991	0.0514	0.0810	0.0531	0.0844	0.0738	0.0093	0.126
100	0.1030	0.0545	0.0852	0.0564	0.0888	0.0776	0.0095	0.123
105	0.1090	0.0577	0.0903	0.0595	0.0930	0.0819	0.0100	0.123
110	0.1150	0.0609	0.0988	0.0629	0.0975	0.0870	0.0107	0.123
115	0.1210	0.0643	0.1000	0.0662	0.1000	0.0903	0.0109	0.121
120	0.1260	0.0676	0.1050	0.0694	0.1040	0.0944	0.0113	0.120
125	0.1330	0.0709	0.1210	0.0728	0.1090	0.1013	0.0126	0.125
130	0.1380	0.0743	0.1190	0.0765	0.1140	0.1044	0.0125	0.120
135	0.1440	0.0793	0.1890	0.0798	0.1240	0.1232	0.0207	0.168
140	0.1500	0.0823	0.1980	0.0862	0.1320	0.1297	0.0215	0.166
145	0.1560	0.0863	0.1660	0.0875	0.1400	0.1272	0.0170	0.133
150	0.1630	0.0905	0.5560	0.0926	0.1540	0.2112	0.0875	0.414
155	0.1700	0.0954	0.5810	0.0988	0.6520	0.3194	0.1225	0.384
160	0.1860	0.1160	0.7190	0.1010	0.6990	0.3642	0.1415	0.389
165	0.2050	0.1420	0.6160	0.1140	0.2500	0.2654	0.0908	0.342
170	0.4480	0.1330	0.6770	0.3400	0.3010	0.3798	0.0899	0.237
175	0.6890	0.1490	1.3300	0.3180	0.3890	0.5750	0.2080	0.362
180	0.7020	0.4020	1.2700	0.3370	0.5080	0.6438	0.1683	0.261
185	0.6900	0.3610	1.4400	0.3190	0.7080	0.7036	0.2010	0.286
190	0.8650	0.4860	1.3800	0.2710	1.2200	0.8444	0.2104	0.249
195	1.5900	0.5700	1.7400	0.5350	1.7000	1.2270	0.2765	0.225
200	1.9200	0.6370	2.1600	0.5050	2.0800	1.4604	0.3657	0.250

SAMPLE A096: Z93P-1 ION CURRENT: RIGHT

Bias volts	A096NR1 μA	A096NR2 μA	A096NR3 μA	A096NR4 μA	A096NR5 μA	Mean μA	Standard error	fractional error
2	0.0006	0.0000	0.0007	0.0001	0.0008	0.0004	0.0002	0.377
4	0.0009	0.0005	0.0011	0.0005	0.0012	0.0008	0.0001	0.168
6	0.0014	0.0012	0.0016	0.0012	0.0016	0.0014	0.0001	0.071
8	0.0018	0.0020	0.0020	0.0020	0.0020	0.0020	0.0000	0.017
10	0.0023	0.0028	0.0024	0.0028	0.0025	0.0026	0.0001	0.041
12	0.0028	0.0036	0.0029	0.0037	0.0029	0.0032	0.0002	0.065
14	0.0032	0.0045	0.0033	0.0045	0.0033	0.0038	0.0003	0.081
16	0.0037	0.0053	0.0037	0.0054	0.0038	0.0044	0.0004	0.092
18	0.0041	0.0062	0.0042	0.0063	0.0042	0.0050	0.0005	0.101
20	0.0046	0.0070	0.0047	0.0072	0.0047	0.0056	0.0006	0.106
25	0.0073	0.0114	0.0071	0.0119	0.0071	0.0090	0.0011	0.123
30	0.0084	0.0131	0.0084	0.0137	0.0084	0.0104	0.0012	0.119
35	0.0090	0.0153	0.0092	0.0160	0.0092	0.0117	0.0016	0.137
40	0.0103	0.0176	0.0106	0.0185	0.0107	0.0135	0.0018	0.136
45	0.0120	0.0200	0.0124	0.0211	0.0125	0.0156	0.0020	0.130
50	0.0137	0.0224	0.0142	0.0236	0.0143	0.0176	0.0022	0.125
55	0.0153	0.0248	0.0159	0.0261	0.0161	0.0196	0.0024	0.121
60	0.0170	0.0272	0.0177	0.0287	0.0179	0.0217	0.0026	0.118
65	0.0188	0.0296	0.0195	0.0312	0.0197	0.0238	0.0027	0.115
70	0.0205	0.0319	0.0213	0.0337	0.0216	0.0258	0.0029	0.112
75	0.0223	0.0343	0.0231	0.0362	0.0235	0.0279	0.0030	0.109
80	0.0241	0.0367	0.0250	0.0387	0.0254	0.0300	0.0032	0.106
85	0.0259	0.0391	0.0269	0.0411	0.0273	0.0321	0.0033	0.103
90	0.0278	0.0415	0.0288	0.0436	0.0293	0.0342	0.0034	0.100
95	0.0297	0.0439	0.0308	0.0461	0.0313	0.0364	0.0036	0.098
100	0.0317	0.0464	0.0328	0.0486	0.0333	0.0386	0.0037	0.095
105	0.0337	0.0489	0.0348	0.0510	0.0353	0.0407	0.0038	0.093
110	0.0357	0.0513	0.0368	0.0535	0.0374	0.0429	0.0039	0.091
115	0.0379	0.0539	0.0389	0.0560	0.0395	0.0452	0.0040	0.088
120	0.0401	0.0565	0.0410	0.0585	0.0416	0.0475	0.0041	0.086
125	0.0422	0.0591	0.0431	0.0610	0.0438	0.0498	0.0042	0.084
130	0.0444	0.0616	0.0452	0.0634	0.0459	0.0521	0.0043	0.082
135	0.0467	0.0642	0.0474	0.0659	0.0481	0.0545	0.0043	0.080
140	0.0490	0.0668	0.0496	0.0684	0.0502	0.0568	0.0044	0.078
145	0.0514	0.0696	0.0519	0.0711	0.0524	0.0593	0.0045	0.076
150	0.0538	0.0723	0.0542	0.0736	0.0546	0.0617	0.0046	0.075
155	0.0562	0.0750	0.0565	0.0762	0.0569	0.0642	0.0047	0.073
160	0.0588	0.0780	0.0589	0.0789	0.0592	0.0668	0.0048	0.072
165	0.0613	0.0844	0.0613	0.0816	0.0614	0.0700	0.0053	0.076
170	0.0640	0.0871	0.0637	0.0844	0.0638	0.0726	0.0054	0.074
175	0.0665	0.0891	0.0662	0.0926	0.0665	0.0762	0.0060	0.079
180	0.0693	0.0926	0.0687	0.2480	0.0687	0.1095	0.0349	0.319
185	0.0740	0.0992	0.0714	0.1930	0.0712	0.1018	0.0234	0.230
190	0.0750	0.1070	0.0796	0.1400	0.0876	0.0978	0.0119	0.121
195	0.0811	0.1270	0.0881	0.2070	0.0792	0.1165	0.0242	0.208
200	0.0840	0.1900	0.0900	0.1780	0.0818	0.1248	0.0243	0.195

SAMPLE A096: Z93P-1 ELECTRON CURRENT: LEFT

Bias volts	A096PL1 μA	A096PL2 μA	A096PL3 μA	A096PL4 μA	A096PL5 μA	Mean μA	Standard error	fractional error
2	0.0057	0.0008	0.0035	0.0006	0.0033	0.0028	0.0009	0.335
4	0.0090	0.0016	0.0053	0.0012	0.0049	0.0044	0.0014	0.320
6	0.0118	0.0024	0.0072	0.0020	0.0066	0.0060	0.0018	0.299
8	0.0158	0.0032	0.0094	0.0027	0.0085	0.0079	0.0024	0.302
10	0.0200	0.0039	0.0111	0.0034	0.0101	0.0097	0.0030	0.311
12	0.0244	0.0046	0.0137	0.0041	0.0124	0.0118	0.0037	0.313
14	0.0290	0.0053	0.0163	0.0047	0.0148	0.0140	0.0044	0.316
16	0.0334	0.0059	0.0190	0.0054	0.0173	0.0162	0.0051	0.317
18	0.0376	0.0065	0.0218	0.0060	0.0199	0.0184	0.0058	0.317
20	0.0412	0.0071	0.0245	0.0066	0.0226	0.0204	0.0064	0.314
25	0.0604	0.0114	0.0400	0.0101	0.0357	0.0315	0.0095	0.300
30	0.0644	0.0123	0.0454	0.0112	0.0420	0.0351	0.0103	0.292
35	0.0667	0.0137	0.0511	0.0127	0.0490	0.0386	0.0108	0.280
40	0.0663	0.0153	0.0551	0.0142	0.0547	0.0411	0.0110	0.267
45	0.0644	0.0168	0.0578	0.0157	0.0589	0.0427	0.0109	0.254
50	0.0620	0.0183	0.0587	0.0172	0.0617	0.0436	0.0106	0.242
55	0.0600	0.0197	0.0585	0.0186	0.0633	0.0440	0.0102	0.231
60	0.0588	0.0212	0.0577	0.0201	0.0640	0.0444	0.0097	0.220
65	0.0579	0.0226	0.0568	0.0215	0.0640	0.0446	0.0093	0.208
70	0.0573	0.0241	0.0559	0.0229	0.0640	0.0448	0.0088	0.197
75	0.0568	0.0255	0.0551	0.0243	0.0636	0.0451	0.0084	0.185
80	0.0570	0.0269	0.0547	0.0257	0.0631	0.0455	0.0080	0.175
85	0.0577	0.0284	0.0543	0.0272	0.0627	0.0461	0.0076	0.164
90	0.0578	0.0298	0.0544	0.0286	0.0626	0.0466	0.0072	0.155
95	0.0584	0.0313	0.0545	0.0301	0.0625	0.0474	0.0069	0.146
100	0.0592	0.0328	0.0551	0.0316	0.0626	0.0483	0.0067	0.138
105	0.0602	0.0343	0.0558	0.0331	0.0633	0.0493	0.0065	0.132
110	0.0613	0.0359	0.0566	0.0346	0.0635	0.0504	0.0063	0.125
115	0.0625	0.0375	0.0576	0.0363	0.0639	0.0516	0.0061	0.118
120	0.0637	0.0392	0.0585	0.0379	0.0644	0.0527	0.0059	0.112
125	0.0653	0.0409	0.0598	0.0396	0.0652	0.0542	0.0058	0.107
130	0.0673	0.0426	0.0609	0.0414	0.0658	0.0556	0.0057	0.102
135	0.0700	0.0445	0.0621	0.0433	0.0671	0.0574	0.0057	0.099
140	0.0729	0.0466	0.0638	0.0454	0.0690	0.0595	0.0057	0.096
145	0.0787	0.0490	0.0656	0.0476	0.0704	0.0623	0.0061	0.098
150	0.0838	0.0513	0.0678	0.0499	0.0724	0.0650	0.0064	0.099

SAMPLE A096: Z93P-1 ELECTRON CURRENT: LEFT (continued)

Bias volts	A096PL1 μA	A096PL2 μA	A096PL3 μA	A096PL4 μA	A096PL5 μA	Mean μA	Standard error	fractional error
155	0.0908	0.0537	0.0700	0.0524	0.0747	0.0683	0.0071	0.104
160	0.0992	0.0564	0.0732	0.0550	0.0774	0.0722	0.0081	0.112
165	0.1060	0.0595	0.0797	0.0581	0.0833	0.0773	0.0088	0.114
170	0.1160	0.0638	0.0893	0.0625	0.0926	0.0848	0.0100	0.118
175	0.1260	0.0688	0.0967	0.0673	0.0988	0.0915	0.0109	0.119
180	0.1780	0.0804	0.1030	0.0756	0.1050	0.1084	0.0184	0.169
185	0.2320	0.0881	0.1100	0.0831	0.1110	0.1248	0.0274	0.219
190	0.2620	0.0966	0.1180	0.0909	0.1190	0.1373	0.0317	0.231
195	0.2970	0.1050	0.1320	0.0990	0.1290	0.1524	0.0367	0.241
200	0.3310	0.1140	0.1620	0.1080	0.1730	0.1776	0.0404	0.228
205	0.3790	0.1270	0.1810	0.1160	0.1940	0.1994	0.0473	0.237
210	0.9650	0.1430	0.2000	0.1340	0.2350	0.3354	0.1585	0.473
215	1.0200	0.1630	0.2310	0.1690	0.2780	0.3722	0.1633	0.439
220	1.0800	0.2030	0.2780	0.1920	0.3180	0.4142	0.1681	0.406
225	1.1700	0.2430	0.4330	0.2200	0.3510	0.4834	0.1759	0.364
230	1.2700	0.2740	0.4830	0.2540	0.3860	0.5334	0.1887	0.354
235	1.4100	0.3130	0.5410	0.2840	0.4300	0.5956	0.2086	0.350
240	1.5700	0.3560	0.6080	0.4270	0.4820	0.6886	0.2242	0.326
245	2.7000	0.4050	0.7630	0.4700	0.5820	0.9840	0.4333	0.440
250	2.8200	0.4470	0.8500	0.5110	0.6740	1.0604	0.4454	0.420
255	3.1900	0.4960	0.9600	0.5690	0.7520	1.1934	0.5056	0.424
260	4.9200	0.5570	1.1500	0.6330	0.8620	1.6244	0.8303	0.511
265	5.1900	0.6390	1.3100	0.7100	0.9500	1.7598	0.8655	0.492
270	5.3800	0.7430	1.6400	0.7920	13.6000	4.4310	2.4454	0.552
275	9.7300	0.8480	2.7300	0.8780	10.1000	4.8572	2.0936	0.431
280	9.4500	6.5100	3.8600	0.9600	8.5500	5.8660	1.5581	0.266
285	9.2300	7.2800	4.0500	1.0700	7.5500	5.8360	1.4568	0.250
290	11.0000	7.3500	4.3900	1.3800	7.3500	6.2940	1.6148	0.257
295	11.1000	7.4700	4.6000	1.5200	7.3200	6.4020	1.5990	0.250
300	11.5000	7.8600	4.8300	1.8700	7.6700	6.7460	1.6146	0.239

SAMPLE A096: Z93P-1 ELECTRON CURRENT: RIGHT

Bias volts	A096PR1 μA	A096PR2 μA	A096PR3 μA	A096PR4 μA	A096PR5 μA	Mean μA	Standard error	fractional error
2	0.0008	0.0028	0.0006	0.0025	0.0004	0.0014	0.0005	0.356
4	0.0013	0.0040	0.0011	0.0036	0.0008	0.0022	0.0007	0.310
6	0.0018	0.0052	0.0016	0.0047	0.0013	0.0029	0.0008	0.284
8	0.0023	0.0065	0.0021	0.0059	0.0018	0.0037	0.0010	0.272
10	0.0027	0.0078	0.0026	0.0071	0.0023	0.0045	0.0012	0.269
12	0.0032	0.0093	0.0030	0.0084	0.0028	0.0053	0.0014	0.271
14	0.0036	0.0103	0.0035	0.0094	0.0032	0.0060	0.0016	0.263
16	0.0041	0.0119	0.0039	0.0110	0.0036	0.0069	0.0019	0.270
18	0.0045	0.0134	0.0043	0.0125	0.0041	0.0078	0.0021	0.274
20	0.0049	0.0149	0.0048	0.0141	0.0045	0.0086	0.0024	0.278
25	0.0071	0.0223	0.0070	0.0221	0.0067	0.0130	0.0037	0.287
30	0.0081	0.0252	0.0079	0.0255	0.0077	0.0149	0.0043	0.288
35	0.0085	0.0279	0.0083	0.0293	0.0089	0.0166	0.0049	0.296
40	0.0095	0.0298	0.0092	0.0324	0.0093	0.0180	0.0054	0.297
45	0.0108	0.0308	0.0102	0.0345	0.0105	0.0194	0.0055	0.282
50	0.0121	0.0313	0.0115	0.0357	0.0117	0.0205	0.0054	0.262
55	0.0133	0.0315	0.0127	0.0361	0.0128	0.0213	0.0052	0.243
60	0.0144	0.0315	0.0139	0.0363	0.0139	0.0220	0.0049	0.224
65	0.0156	0.0317	0.0151	0.0363	0.0150	0.0227	0.0047	0.205
70	0.0168	0.0319	0.0162	0.0362	0.0161	0.0234	0.0044	0.187
75	0.0179	0.0323	0.0174	0.0363	0.0172	0.0242	0.0042	0.172
80	0.0191	0.0327	0.0185	0.0364	0.0183	0.0250	0.0039	0.158
85	0.0202	0.0332	0.0197	0.0367	0.0194	0.0258	0.0038	0.146
90	0.0214	0.0338	0.0208	0.0371	0.0206	0.0267	0.0036	0.134
95	0.0225	0.0345	0.0220	0.0375	0.0217	0.0276	0.0034	0.125
100	0.0237	0.0352	0.0231	0.0381	0.0228	0.0286	0.0033	0.116
105	0.0249	0.0361	0.0243	0.0388	0.0240	0.0296	0.0032	0.109
110	0.0261	0.0367	0.0255	0.0395	0.0252	0.0306	0.0031	0.101
115	0.0273	0.0376	0.0267	0.0401	0.0263	0.0316	0.0030	0.095
120	0.0285	0.0385	0.0279	0.0408	0.0275	0.0326	0.0029	0.089
125	0.0297	0.0395	0.0292	0.0416	0.0288	0.0338	0.0028	0.083
130	0.0310	0.0406	0.0304	0.0424	0.0300	0.0349	0.0027	0.078
135	0.0323	0.0417	0.0317	0.0433	0.0312	0.0360	0.0027	0.074
140	0.0336	0.0429	0.0330	0.0443	0.0325	0.0373	0.0026	0.070
145	0.0350	0.0441	0.0344	0.0454	0.0338	0.0385	0.0026	0.066
150	0.0364	0.0455	0.0358	0.0465	0.0352	0.0399	0.0025	0.063

SAMPLE A096: Z93P-1 ELECTRON CURRENT: RIGHT (continued)

Bias volts	A096PR1 μA	A096PR2 μA	A096PR3 μA	A096PR4 μA	A096PR5 μA	Mean μA	Standard error	fractional error
155	0.0378	0.0468	0.0373	0.0476	0.0367	0.0412	0.0024	0.059
160	0.0394	0.0483	0.0388	0.0489	0.0381	0.0427	0.0024	0.057
165	0.0411	0.0498	0.0404	0.0504	0.0397	0.0443	0.0024	0.054
170	0.0428	0.0515	0.0420	0.0519	0.0413	0.0459	0.0024	0.052
175	0.0445	0.0532	0.0437	0.0536	0.0429	0.0476	0.0024	0.050
180	0.0463	0.0551	0.0455	0.0553	0.0447	0.0494	0.0024	0.048
185	0.0483	0.0570	0.0473	0.0571	0.0466	0.0513	0.0024	0.046
190	0.0504	0.0591	0.0494	0.0591	0.0486	0.0533	0.0024	0.045
195	0.0526	0.0615	0.0516	0.0615	0.0507	0.0556	0.0024	0.044
200	0.0551	0.0645	0.0539	0.0643	0.0529	0.0581	0.0026	0.044
205	0.0583	0.0744	0.0564	0.0693	0.0552	0.0627	0.0038	0.061
210	0.0645	0.0901	0.0596	0.0859	0.0580	0.0716	0.0068	0.095
215	0.0837	0.0958	0.0702	0.0934	0.0618	0.0810	0.0066	0.081
220	0.0907	0.1030	0.0837	0.0987	0.0751	0.0902	0.0050	0.056
225	0.0962	0.1090	0.0899	0.1070	0.0857	0.0976	0.0046	0.047
230	0.1060	0.1170	0.0955	0.1140	0.0918	0.1049	0.0050	0.047
235	0.1150	0.1280	0.1060	0.1230	0.0977	0.1139	0.0055	0.048
240	0.1290	0.1470	0.1160	0.1330	0.1100	0.1270	0.0065	0.051
245	0.1420	0.1590	0.1250	0.1480	0.1190	0.1386	0.0074	0.053
250	0.1570	0.1710	0.1440	0.1650	0.1300	0.1534	0.0074	0.048
255	0.1720	0.1850	0.1550	0.1780	0.1430	0.1666	0.0077	0.046
260	0.1870	0.2020	0.1680	0.1920	0.1590	0.1816	0.0079	0.044
265	0.2130	0.2450	0.1840	0.2120	0.1720	0.2052	0.0127	0.062
270	0.2560	0.2950	0.2040	0.2540	0.1880	0.2394	0.0193	0.081
275	0.7160	1.1200	0.2370	0.3300	0.2060	0.5218	0.1751	0.336
280	1.1300	1.1600	0.2790	1.2000	0.2450	0.8028	0.2211	0.275
285	1.1700	1.2000	1.3200	1.2300	0.2940	1.0428	0.1889	0.181
290	1.2400	1.2500	1.3700	1.2600	1.3400	1.2920	0.0263	0.020
295	1.3200	1.3800	1.4200	1.3300	1.3800	1.3660	0.0183	0.013
300	1.4200	1.4900	1.4800	1.5200	1.4300	1.4680	0.0188	0.013

SAMPLE M096: M93P-1 ION CURRENT: LEFT

Bias volts	M096NL1 µA	M096NL2 µA	M096NL3 µA	M096NL4 µA	M096NL5 µA	Mean µA	Standard error	fractional error
2	0.1710	0.1150	0.1510	0.1420	0.1510	0.1460	0.0091	0.062
4	0.4580	0.4990	0.5020	0.5190	0.5000	0.4956	0.0101	0.020
6	0.6140	0.6700	0.6700	0.6920	0.6650	0.6622	0.0129	0.020
8	0.7230	0.7860	0.7860	0.8110	0.7790	0.7770	0.0146	0.019
10	0.8180	0.8880	0.8890	0.9170	0.8810	0.8786	0.0164	0.019
12	0.9090	0.9860	0.9870	1.0200	0.9780	0.9760	0.0182	0.019
14	0.9950	1.0800	1.0800	1.1100	1.0700	1.0670	0.0192	0.018
16	1.0800	1.1700	1.1700	1.2000	1.1600	1.1560	0.0201	0.017
18	1.1700	1.2600	1.2600	1.2900	1.2500	1.2460	0.0201	0.016
20	1.2500	1.3400	1.3500	1.3800	1.3400	1.3320	0.0218	0.016
25	1.4800	1.5500	1.5600	1.5900	1.5400	1.5440	0.0181	0.012
30	1.6600	1.7400	1.7500	1.7800	1.7300	1.7320	0.0198	0.011
35	1.8300	1.9200	1.9300	1.9700	1.9200	1.9140	0.0229	0.012
40	2.0000	2.1000	2.1100	2.1500	2.0900	2.0900	0.0247	0.012
45	2.1700	2.2700	2.2900	2.3200	2.2600	2.2620	0.0252	0.011
50	2.3300	2.4300	2.4500	2.4900	2.4300	2.4260	0.0264	0.011
55	2.4900	2.6000	2.6200	2.6500	2.5900	2.5900	0.0270	0.010
60	2.6500	2.7500	2.7800	2.8200	2.7500	2.7500	0.0281	0.010
65	2.8000	2.9100	2.9400	2.9800	2.9000	2.9060	0.0299	0.010
70	2.9500	3.0700	3.0900	3.1300	3.0600	3.0600	0.0300	0.010
75	3.1000	3.2200	3.2500	3.2900	3.2100	3.2140	0.0317	0.010
80	3.2500	3.3700	3.4000	3.4400	3.3600	3.3640	0.0317	0.009
85	3.3900	3.5100	3.5400	3.5900	3.5000	3.5060	0.0330	0.009
90	3.5300	3.6500	3.6900	3.7300	3.6500	3.6500	0.0335	0.009
95	3.6700	3.7900	3.8300	3.8800	3.7900	3.7920	0.0347	0.009
100	3.8100	3.9300	3.9700	4.0200	3.9300	3.9320	0.0347	0.009
105	3.9500	4.0700	4.1100	4.1600	4.0600	4.0700	0.0348	0.009
110	4.0800	4.2100	4.2500	4.3000	4.2000	4.2080	0.0365	0.009
115	4.2200	4.3400	4.3900	4.4300	4.3400	4.3440	0.0353	0.008
120	4.3500	4.4800	4.5200	4.5700	4.4700	4.4780	0.0365	0.008
125	4.4900	4.6100	4.6600	4.7100	4.6100	4.6160	0.0366	0.008
130	4.6200	4.7400	4.7900	4.8400	4.7400	4.7460	0.0366	0.008
135	4.7500	4.8700	4.9200	4.9700	4.8700	4.8760	0.0366	0.007
140	4.8800	5.0000	5.0500	5.1000	5.0000	5.0060	0.0366	0.007
145	5.0100	5.1300	5.1800	5.2300	5.1400	5.1380	0.0365	0.007
150	5.1400	5.2600	5.3200	5.3600	5.2700	5.2700	0.0371	0.007
155	5.2600	5.3800	5.4400	5.5000	5.3900	5.3940	0.0397	0.007
160	5.3900	5.5100	5.5700	5.6300	5.5200	5.5240	0.0397	0.007
165	5.5200	5.6400	5.7000	5.7600	5.6400	5.6520	0.0398	0.007
170	5.6500	5.7600	5.8300	5.8900	5.7700	5.7800	0.0400	0.007
175	5.7800	5.8900	5.9500	6.0100	5.9000	5.9060	0.0380	0.006
180	5.9000	6.0100	6.0800	6.1400	6.0300	6.0320	0.0399	0.007
185	6.0200	6.1400	6.2000	6.2700	6.1500	6.1560	0.0411	0.007
190	6.1400	6.2600	6.3300	6.3900	6.2700	6.2780	0.0416	0.007
195	6.2600	6.3800	6.4600	6.5200	6.3900	6.4020	0.0436	0.007
200	6.3800	6.5000	6.5800	6.6400	6.5100	6.5220	0.0436	0.007

SAMPLE M096: M93P-1 ION CURRENT: RIGHT

Bias volts	M096NR1 μA	M096NR2 μA	M096NR3 μA	M096NR4 μA	M096NR5 μA	Mean μA	Standard error	fractional error
2	-0.2990	-0.1650	-0.3060	-0.1850	-0.3150	-0.2540	0.0325	-0.128
4	0.3920	0.4160	0.3930	0.4240	0.4000	0.4050	0.0064	0.016
6	0.7280	0.7220	0.7310	0.7420	0.7440	0.7334	0.0042	0.006
8	0.9220	0.9070	0.9260	0.9320	0.9410	0.9256	0.0056	0.006
10	1.0700	1.0500	1.0700	1.0800	1.0900	1.0720	0.0066	0.006
12	1.2000	1.1700	1.2000	1.2000	1.2200	1.1980	0.0080	0.007
14	1.3200	1.2900	1.3200	1.3200	1.3400	1.3180	0.0080	0.006
16	1.4300	1.4000	1.4300	1.4400	1.4500	1.4300	0.0084	0.006
18	1.5400	1.5100	1.5400	1.5500	1.5700	1.5420	0.0097	0.006
20	1.6500	1.6200	1.6500	1.6600	1.6800	1.6520	0.0097	0.006
25	1.9100	1.8800	1.9100	1.9300	1.9400	1.9140	0.0103	0.005
30	2.1500	2.1200	2.1500	2.1700	2.1800	2.1540	0.0103	0.005
35	2.3800	2.3500	2.3800	2.4000	2.4200	2.3860	0.0117	0.005
40	2.6100	2.5700	2.6100	2.6200	2.6400	2.6100	0.0114	0.004
45	2.8200	2.7800	2.8200	2.8400	2.8600	2.8240	0.0133	0.005
50	3.0300	2.9900	3.0300	3.0500	3.0700	3.0340	0.0133	0.004
55	3.2300	3.1900	3.2300	3.2500	3.2700	3.2340	0.0133	0.004
60	3.4300	3.3900	3.4300	3.4500	3.4700	3.4340	0.0133	0.004
65	3.6200	3.5800	3.6200	3.6500	3.6700	3.6280	0.0153	0.004
70	3.8200	3.7700	3.8100	3.8400	3.8600	3.8200	0.0152	0.004
75	4.0000	3.9600	4.0000	4.0400	4.0500	4.0100	0.0161	0.004
80	4.1900	4.1400	4.1800	4.2200	4.2400	4.1940	0.0172	0.004
85	4.3700	4.3300	4.3600	4.4000	4.4200	4.3760	0.0157	0.004
90	4.5500	4.5000	4.5400	4.5900	4.6000	4.5560	0.0181	0.004
95	4.7300	4.6800	4.7200	4.7600	4.7800	4.7340	0.0172	0.004
100	4.9000	4.8500	4.8900	4.9400	4.9600	4.9080	0.0193	0.004
105	5.0800	5.0200	5.0600	5.1200	5.1300	5.0820	0.0201	0.004
110	5.2500	5.1900	5.2400	5.3000	5.3000	5.2560	0.0206	0.004
115	5.4200	5.3600	5.4100	5.4700	5.4700	5.4260	0.0206	0.004
120	5.5900	5.5300	5.5800	5.6300	5.6400	5.5940	0.0196	0.004
125	5.7500	5.6900	5.7400	5.8000	5.8100	5.7580	0.0218	0.004
130	5.9100	5.8500	5.9000	5.9600	5.9700	5.9180	0.0218	0.004
135	6.0700	6.0100	6.0600	6.1200	6.1400	6.0800	0.0230	0.004
140	6.2300	6.1700	6.2200	6.2900	6.2900	6.2400	0.0228	0.004
145	6.3900	6.3300	6.3800	6.4500	6.4600	6.4020	0.0240	0.004
150	6.5500	6.4900	6.5400	6.6100	6.6100	6.5600	0.0228	0.003
155	6.7000	6.6400	6.6900	6.7700	6.7700	6.7140	0.0250	0.004
160	6.8500	6.8000	6.8500	6.9200	6.9300	6.8700	0.0243	0.004
165	7.0100	6.9500	7.0000	7.0800	7.0900	7.0260	0.0262	0.004
170	7.1600	7.1100	7.1600	7.2400	7.2500	7.1840	0.0266	0.004
175	7.3200	7.2600	7.3200	7.3900	7.4000	7.3380	0.0258	0.004
180	7.4700	7.4100	7.4800	7.5500	7.5500	7.4920	0.0265	0.004
185	7.6200	7.5700	7.6300	7.7100	7.7000	7.6460	0.0262	0.003
190	7.7700	7.7200	7.7800	7.8600	7.8500	7.7960	0.0262	0.003
195	7.9200	7.8700	7.9300	8.0100	8.0100	7.9480	0.0273	0.003
200	8.0800	8.0200	8.0800	8.1600	8.1600	8.1000	0.0268	0.003

SAMPLE M096: M93P-1 ELECTRON CURRENT: LEFT

Bias volts	M096PL1 mA	M096PL2 mA	M096PL3 mA	M096PL4 mA	M096PL5 mA	Mean mA	Standard error	fractional error
2	0.003	0.006	0.005	0.006	0.006	0.0052	0.0006	0.1120
4	0.010	0.016	0.015	0.017	0.015	0.0146	0.0013	0.0877
6	0.019	0.028	0.026	0.029	0.026	0.0256	0.0018	0.0701
8	0.029	0.040	0.038	0.042	0.038	0.0376	0.0022	0.0575
10	0.041	0.053	0.051	0.055	0.051	0.0501	0.0024	0.0479
12	0.054	0.066	0.064	0.069	0.064	0.0633	0.0025	0.0401
14	0.068	0.080	0.078	0.083	0.078	0.0773	0.0026	0.0331
16	0.082	0.094	0.093	0.097	0.093	0.0919	0.0025	0.0274
18	0.097	0.108	0.108	0.112	0.108	0.1067	0.0024	0.0229
20	0.113	0.123	0.123	0.127	0.123	0.1218	0.0023	0.0191
25	0.150	0.160	0.161	0.164	0.160	0.1590	0.0024	0.0149
30	0.189	0.197	0.199	0.202	0.198	0.1970	0.0022	0.0110
35	0.228	0.234	0.237	0.240	0.236	0.2350	0.0020	0.0085
40	0.266	0.270	0.274	0.277	0.272	0.2718	0.0019	0.0068
45	0.302	0.305	0.311	0.312	0.308	0.3076	0.0019	0.0060
50	0.337	0.340	0.346	0.348	0.343	0.3428	0.0020	0.0058
55	0.371	0.374	0.381	0.382	0.377	0.3770	0.0021	0.0055
60	0.405	0.407	0.414	0.416	0.410	0.4104	0.0021	0.0050
65	0.438	0.440	0.448	0.449	0.443	0.4436	0.0022	0.0049
70	0.470	0.472	0.480	0.481	0.476	0.4758	0.0022	0.0045
75	0.502	0.503	0.513	0.513	0.508	0.5078	0.0024	0.0046
80	0.533	0.535	0.545	0.545	0.539	0.5394	0.0025	0.0046
85	0.564	0.565	0.576	0.577	0.570	0.5704	0.0027	0.0047
90	0.595	0.596	0.607	0.608	0.600	0.6012	0.0027	0.0045
95	0.625	0.626	0.638	0.638	0.631	0.6316	0.0028	0.0044
100	0.655	0.656	0.668	0.669	0.661	0.6618	0.0029	0.0044
105	0.685	0.686	0.699	0.699	0.691	0.6920	0.0030	0.0044
110	0.714	0.715	0.729	0.729	0.720	0.7214	0.0033	0.0045
115	0.758	0.744	0.760	0.758	0.751	0.7542	0.0030	0.0039
120	0.787	0.773	0.789	0.787	0.780	0.7832	0.0030	0.0038
125	0.816	0.801	0.818	0.817	0.810	0.8124	0.0032	0.0039
130	0.844	0.830	0.848	0.845	0.838	0.8410	0.0032	0.0038
135	0.872	0.858	0.877	0.874	0.866	0.8694	0.0034	0.0039
140	0.901	0.886	0.906	0.903	0.895	0.8982	0.0035	0.0039
145	0.929	0.914	0.935	0.931	0.923	0.9264	0.0037	0.0039
150	0.958	0.942	0.964	0.959	0.952	0.9550	0.0038	0.0039

SAMPLE M096: M93P-1 ELECTRON CURRENT: LEFT (continued)

Bias volts	M096PL1 mA	M096PL2 mA	M096PL3 mA	M096PL4 mA	M096PL5 mA	Mean mA	Standard error	fractional error
155	0.986	0.969	0.992	0.988	0.981	0.9832	0.0040	0.0040
160	1.014	1.000	1.020	1.015	1.009	1.0116	0.0034	0.0033
165	1.043	1.027	1.048	1.043	1.036	1.0394	0.0036	0.0035
170	1.072	1.055	1.076	1.071	1.064	1.0676	0.0037	0.0035
175	1.103	1.082	1.105	1.099	1.093	1.0964	0.0041	0.0038
180	1.136	1.109	1.133	1.127	1.121	1.1252	0.0048	0.0043
185	1.189	1.136	1.161	1.154	1.148	1.1576	0.0089	0.0077
190	1.216	1.163	1.190	1.182	1.177	1.1856	0.0088	0.0074
195	1.240	1.190	1.218	1.210	1.205	1.2126	0.0082	0.0068
200	1.298	1.218	1.246	1.238	1.233	1.2466	0.0136	0.0109
205	1.325	1.246	1.274	1.266	1.261	1.2744	0.0134	0.0106
210	1.345	1.273	1.306	1.293	1.290	1.3014	0.0121	0.0093
215	1.430	1.301	1.334	1.320	1.320	1.3410	0.0229	0.0170
220	1.450	1.328	1.363	1.349	1.348	1.3676	0.0213	0.0156
225	1.480	1.356	1.392	1.376	1.377	1.3962	0.0217	0.0156
230	1.503	1.383	1.421	1.405	1.405	1.4234	0.0208	0.0146
235	1.766	1.412	1.450	1.435	1.433	1.4992	0.0670	0.0447
240	1.721	1.439	1.478	1.463	1.461	1.5124	0.0525	0.0347
245	1.674	1.466	1.506	1.491	1.489	1.5252	0.0377	0.0247
250	1.675	1.494	1.624	1.519	1.526	1.5676	0.0348	0.0222
255	1.695	1.521	1.639	1.547	1.553	1.5910	0.0327	0.0206
260	1.717	1.547	1.660	1.574	1.582	1.6160	0.0315	0.0195
265	1.733	1.575	1.681	1.602	1.610	1.6402	0.0291	0.0177
270	1.757	1.603	1.706	1.630	1.637	1.6666	0.0283	0.0170
275	1.787	1.636	1.734	1.660	1.687	1.7008	0.0270	0.0159
280	1.814	1.662	1.763	1.690	1.714	1.7286	0.0270	0.0156
285	2.251	1.688	1.791	1.722	1.740	1.8384	0.1045	0.0568
290	2.240	1.715	1.817	1.756	2.414	1.9884	0.1419	0.0714
295	2.066	1.743	1.852	1.784	2.358	1.9606	0.1139	0.0581
300	1.977	1.771	2.728	1.813	2.282	2.1142	0.1778	0.0841

SAMPLE M096: M93P-1 ELECTRON CURRENT: RIGHT

Bias volts	M096PR1 mA	M096PR2 mA	M096PR3 mA	M096PR4 mA	M096PR5 mA	Mean mA	Standard error	fractional error
2	0.008	0.007	0.009	0.008	0.009	0.0080	0.0003	0.0414
4	0.020	0.018	0.021	0.019	0.022	0.0201	0.0006	0.0323
6	0.034	0.031	0.036	0.033	0.036	0.0339	0.0009	0.0269
8	0.048	0.046	0.051	0.047	0.052	0.0486	0.0011	0.0228
10	0.063	0.060	0.066	0.063	0.067	0.0640	0.0013	0.0198
12	0.079	0.076	0.082	0.079	0.084	0.0800	0.0014	0.0170
14	0.096	0.093	0.099	0.096	0.100	0.0965	0.0013	0.0132
16	0.113	0.110	0.115	0.113	0.118	0.1138	0.0013	0.0116
18	0.130	0.127	0.132	0.130	0.135	0.1308	0.0013	0.0101
20	0.147	0.144	0.149	0.148	0.152	0.1480	0.0013	0.0088
25	0.191	0.188	0.193	0.193	0.197	0.1924	0.0015	0.0076
30	0.236	0.233	0.238	0.238	0.242	0.2374	0.0015	0.0062
35	0.280	0.277	0.282	0.283	0.286	0.2816	0.0015	0.0053
40	0.323	0.321	0.325	0.327	0.330	0.3252	0.0016	0.0048
45	0.366	0.364	0.368	0.371	0.373	0.3684	0.0016	0.0044
50	0.408	0.406	0.410	0.414	0.415	0.4106	0.0017	0.0042
55	0.449	0.447	0.451	0.456	0.458	0.4522	0.0021	0.0046
60	0.490	0.488	0.492	0.498	0.499	0.4934	0.0022	0.0044
65	0.531	0.529	0.533	0.539	0.540	0.5344	0.0022	0.0041
70	0.570	0.569	0.573	0.579	0.580	0.5742	0.0023	0.0039
75	0.610	0.608	0.612	0.619	0.620	0.6138	0.0024	0.0039
80	0.649	0.647	0.652	0.658	0.660	0.6532	0.0025	0.0039
85	0.688	0.686	0.690	0.698	0.699	0.6922	0.0027	0.0038
90	0.726	0.725	0.729	0.737	0.737	0.7308	0.0026	0.0036
95	0.764	0.763	0.767	0.776	0.776	0.7692	0.0029	0.0037
100	0.802	0.801	0.804	0.815	0.814	0.8072	0.0030	0.0037
105	0.839	0.839	0.842	0.853	0.852	0.8450	0.0031	0.0037
110	0.876	0.876	0.879	0.891	0.890	0.8824	0.0034	0.0038
115	0.914	0.913	0.916	0.929	0.928	0.9200	0.0035	0.0038
120	0.950	0.950	0.953	0.966	0.965	0.9568	0.0036	0.0038
125	0.987	0.987	0.989	1.006	1.003	0.9944	0.0042	0.0042
130	1.023	1.024	1.025	1.043	1.039	1.0308	0.0042	0.0041
135	1.059	1.060	1.061	1.080	1.076	1.0672	0.0045	0.0042
140	1.095	1.097	1.097	1.117	1.112	1.1036	0.0045	0.0041
145	1.131	1.133	1.133	1.154	1.149	1.1400	0.0048	0.0042
150	1.167	1.169	1.168	1.191	1.185	1.1760	0.0050	0.0043

SAMPLE M096: M93P-1 ELECTRON CURRENT: RIGHT (continued)

Bias volts	M096PR1 mA	M096PR2 mA	M096PR3 mA	M096PR4 mA	M096PR5 mA	Mean mA	Standard error	fractional error
155	1.203	1.205	1.204	1.227	1.220	1.2118	0.0049	0.0041
160	1.238	1.242	1.239	1.264	1.256	1.2478	0.0052	0.0042
165	1.274	1.278	1.275	1.300	1.292	1.2838	0.0052	0.0040
170	1.310	1.313	1.310	1.337	1.328	1.3196	0.0055	0.0042
175	1.345	1.350	1.346	1.374	1.364	1.3558	0.0057	0.0042
180	1.381	1.386	1.381	1.410	1.399	1.3914	0.0057	0.0041
185	1.416	1.421	1.416	1.446	1.434	1.4266	0.0059	0.0041
190	1.452	1.457	1.451	1.484	1.471	1.4630	0.0063	0.0043
195	1.487	1.493	1.487	1.521	1.507	1.4990	0.0066	0.0044
200	1.523	1.530	1.523	1.557	1.543	1.5352	0.0066	0.0043
205	1.559	1.568	1.558	1.593	1.578	1.5712	0.0065	0.0042
210	1.594	1.605	1.593	1.629	1.614	1.6070	0.0067	0.0042
215	1.629	1.640	1.628	1.669	1.650	1.6432	0.0076	0.0046
220	1.665	1.676	1.663	1.705	1.685	1.6788	0.0077	0.0046
225	1.702	1.713	1.699	1.741	1.722	1.7154	0.0076	0.0044
230	1.737	1.749	1.734	1.778	1.757	1.7510	0.0079	0.0045
235	1.773	1.784	1.769	1.815	1.793	1.7868	0.0082	0.0046
240	1.808	1.821	1.809	1.852	1.835	1.8250	0.0083	0.0046
245	1.845	1.860	1.843	1.891	1.871	1.8620	0.0089	0.0048
250	1.881	1.898	1.878	1.929	1.906	1.8984	0.0093	0.0049
255	1.919	1.939	1.913	1.965	1.942	1.9356	0.0092	0.0048
260	1.959	1.985	1.949	2.000	1.977	1.9740	0.0091	0.0046
265	1.995	2.021	1.985	2.360	2.013	2.0748	0.0716	0.0345
270	2.030	2.890	2.020	2.217	2.048	2.2410	0.1662	0.0742
275	2.067	2.657	2.058	2.233	2.083	2.2196	0.1139	0.0513
280	2.103	2.490	2.094	2.252	2.121	2.2120	0.0752	0.0340
285	2.140	2.399	2.130	2.296	2.158	2.2246	0.0529	0.0238
290	2.177	2.399	2.169	2.328	2.195	2.2536	0.0464	0.0206
295	2.212	2.411	2.207	2.362	2.233	2.2850	0.0424	0.0185
300	2.268	2.441	2.246	2.397	2.273	2.3250	0.0393	0.0169

SAMPLE: A120 (Z93P-2)

Z93P position : RIGHT Date: 12/28/1992		Z93P position : LEFT Date: 12/29/1992	
Run ID	Start Time	Run ID	Start Time
A120PR1	14:27	A120PL1	13:56
A120NR1	14:28	A120NL1	13:59
M120NL1	14:31	M120NR1	14:02
M120PL1	14:31	M120PR1	14:05
M120PL2	14:37	M120PR2	14:09
M120NL2	14:40	M120NR2	14:12
A120NR2	14:43	A120NL2	14:16
A120PR2	14:46	A120PL2	14:20
A120PR3	14:49	A120PL3	14:24
A120NR3	14:53	A120NL3	14:27
M120NL3	14:56	M120NR3	14:30
M120PL3	14:58	M120PR3	14:33
M120PL4	15:02	M120PR4	14:36
M120NL4	15:05	M120NR4	14:39
A120NR4	15:08	A120NL4	14:42
A120PR4	15:10	A120PL4	14:45
A120PR5	15:14	A120PL5	14:48
A120NR5	15:17	A120NL5	14:51
M120NL5	15:20	M120NR5	14:54
M120PL5	15:22	M120PR5	14:57

SAMPLE: A120: Z93P-2 ION CURRENT: LEFT

Bias volts	A120NL1 μA	A120NL2 μA	A120NL3 μA	A120NL4 μA	A120NL5 μA	Mean μA	Standard error	fractional error
2	0.0007	0.0003	0.0009	0.0003	0.0007	0.0006	0.0001	0.216
4	0.0009	0.0005	0.0010	0.0004	0.0009	0.0007	0.0001	0.169
6	0.0011	0.0007	0.0012	0.0006	0.0010	0.0009	0.0001	0.117
8	0.0014	0.0011	0.0014	0.0009	0.0012	0.0012	0.0001	0.077
10	0.0016	0.0016	0.0016	0.0012	0.0014	0.0015	0.0001	0.051
12	0.0019	0.0021	0.0018	0.0016	0.0016	0.0018	0.0001	0.047
14	0.0021	0.0026	0.0020	0.0020	0.0018	0.0021	0.0001	0.060
16	0.0024	0.0031	0.0021	0.0025	0.0020	0.0024	0.0002	0.074
18	0.0027	0.0035	0.0023	0.0029	0.0022	0.0027	0.0002	0.085
20	0.0029	0.0040	0.0025	0.0033	0.0024	0.0030	0.0003	0.094
25	0.0049	0.0070	0.0041	0.0061	0.0039	0.0052	0.0006	0.113
30	0.0056	0.0082	0.0046	0.0070	0.0044	0.0060	0.0007	0.123
35	0.0066	0.0086	0.0053	0.0083	0.0051	0.0068	0.0007	0.108
40	0.0077	0.0096	0.0061	0.0086	0.0059	0.0076	0.0007	0.095
45	0.0081	0.0114	0.0069	0.0095	0.0068	0.0085	0.0009	0.101
50	0.0090	0.0130	0.0079	0.0111	0.0077	0.0097	0.0010	0.105
55	0.0101	0.0146	0.0081	0.0126	0.0088	0.0108	0.0012	0.112
60	0.0115	0.0162	0.0088	0.0140	0.0089	0.0119	0.0014	0.121
65	0.0129	0.0177	0.0097	0.0154	0.0096	0.0130	0.0016	0.122
70	0.0142	0.0193	0.0109	0.0167	0.0108	0.0144	0.0017	0.115
75	0.0155	0.0208	0.0120	0.0180	0.0118	0.0156	0.0017	0.111
80	0.0168	0.0222	0.0131	0.0193	0.0128	0.0169	0.0018	0.108
85	0.0181	0.0237	0.0141	0.0206	0.0139	0.0181	0.0019	0.105
90	0.0194	0.0251	0.0151	0.0219	0.0149	0.0193	0.0020	0.102
95	0.0207	0.0265	0.0162	0.0231	0.0158	0.0205	0.0020	0.100
100	0.0220	0.0278	0.0172	0.0243	0.0168	0.0216	0.0021	0.097
105	0.0232	0.0292	0.0182	0.0255	0.0178	0.0228	0.0022	0.095
110	0.0245	0.0306	0.0192	0.0266	0.0187	0.0239	0.0022	0.094
115	0.0257	0.0319	0.0203	0.0277	0.0197	0.0251	0.0023	0.092
120	0.0270	0.0332	0.0213	0.0288	0.0206	0.0262	0.0024	0.090
125	0.0282	0.0345	0.0222	0.0299	0.0215	0.0273	0.0024	0.089
130	0.0294	0.0358	0.0232	0.0310	0.0225	0.0284	0.0025	0.088
135	0.0306	0.0371	0.0242	0.0320	0.0234	0.0295	0.0026	0.087
140	0.0318	0.0384	0.0252	0.0331	0.0243	0.0305	0.0026	0.086
145	0.0331	0.0397	0.0261	0.0342	0.0251	0.0316	0.0027	0.085
150	0.0342	0.0409	0.0271	0.0352	0.0260	0.0327	0.0028	0.085
155	0.0354	0.0422	0.0280	0.0362	0.0268	0.0337	0.0028	0.084
160	0.0367	0.0435	0.0289	0.0373	0.0277	0.0348	0.0029	0.084
165	0.0378	0.0448	0.0299	0.0383	0.0285	0.0359	0.0030	0.083
170	0.0390	0.0461	0.0308	0.0393	0.0293	0.0369	0.0031	0.083
175	0.0402	0.0473	0.0317	0.0403	0.0302	0.0379	0.0031	0.083
180	0.0413	0.0485	0.0326	0.0413	0.0309	0.0389	0.0032	0.083
185	0.0425	0.0499	0.0335	0.0424	0.0317	0.0400	0.0033	0.083
190	0.0437	0.0512	0.0345	0.0435	0.0325	0.0410	0.0034	0.083
195	0.0448	0.0525	0.0354	0.0445	0.0333	0.0421	0.0035	0.083
200	0.0460	0.0539	0.0362	0.0454	0.0340	0.0431	0.0036	0.084

SAMPLE: A120: Z93P-2 ION CURRENT: RIGHT

Bias volts	A120NR1 μA	A120NR2 μA	A120NR3 μA	A120NR4 μA	A120NR5 μA	Mean μA	Standard error	fractional error
2	0.0005	0.0003	0.0007	0.0002	0.0007	0.0005	0.0001	0.206
4	0.0007	0.0006	0.0008	0.0005	0.0008	0.0007	0.0001	0.087
6	0.0008	0.0006	0.0009	0.0006	0.0010	0.0008	0.0001	0.105
8	0.0010	0.0007	0.0011	0.0008	0.0012	0.0010	0.0001	0.094
10	0.0012	0.0009	0.0013	0.0010	0.0013	0.0011	0.0001	0.076
12	0.0013	0.0011	0.0015	0.0013	0.0015	0.0014	0.0001	0.053
14	0.0015	0.0014	0.0016	0.0016	0.0017	0.0016	0.0001	0.033
16	0.0017	0.0016	0.0018	0.0019	0.0018	0.0018	0.0000	0.026
18	0.0018	0.0019	0.0020	0.0021	0.0020	0.0020	0.0001	0.028
20	0.0020	0.0021	0.0021	0.0024	0.0022	0.0022	0.0001	0.033
25	0.0034	0.0038	0.0034	0.0042	0.0034	0.0036	0.0002	0.042
30	0.0035	0.0042	0.0037	0.0047	0.0038	0.0040	0.0002	0.054
35	0.0039	0.0047	0.0041	0.0055	0.0043	0.0045	0.0003	0.062
40	0.0043	0.0054	0.0046	0.0063	0.0048	0.0051	0.0003	0.068
45	0.0048	0.0061	0.0052	0.0071	0.0054	0.0057	0.0004	0.073
50	0.0052	0.0068	0.0057	0.0080	0.0060	0.0064	0.0005	0.077
55	0.0057	0.0075	0.0063	0.0082	0.0067	0.0069	0.0004	0.063
60	0.0062	0.0082	0.0069	0.0087	0.0073	0.0075	0.0005	0.060
65	0.0067	0.0082	0.0075	0.0093	0.0080	0.0080	0.0004	0.055
70	0.0072	0.0086	0.0082	0.0104	0.0089	0.0087	0.0005	0.059
75	0.0078	0.0092	0.0082	0.0113	0.0088	0.0091	0.0006	0.068
80	0.0084	0.0101	0.0086	0.0122	0.0093	0.0097	0.0007	0.071
85	0.0083	0.0109	0.0091	0.0131	0.0101	0.0103	0.0008	0.080
90	0.0086	0.0116	0.0099	0.0140	0.0109	0.0110	0.0009	0.081
95	0.0091	0.0124	0.0107	0.0148	0.0117	0.0117	0.0009	0.081
100	0.0096	0.0132	0.0114	0.0157	0.0124	0.0124	0.0010	0.080
105	0.0103	0.0139	0.0121	0.0165	0.0131	0.0132	0.0010	0.077
110	0.0110	0.0147	0.0128	0.0173	0.0138	0.0139	0.0010	0.075
115	0.0117	0.0154	0.0135	0.0182	0.0146	0.0147	0.0011	0.073
120	0.0123	0.0162	0.0142	0.0190	0.0153	0.0154	0.0011	0.072
125	0.0130	0.0170	0.0148	0.0198	0.0160	0.0161	0.0011	0.071
130	0.0136	0.0177	0.0155	0.0206	0.0167	0.0168	0.0012	0.069
135	0.0143	0.0185	0.0162	0.0214	0.0175	0.0176	0.0012	0.068
140	0.0149	0.0193	0.0169	0.0223	0.0182	0.0183	0.0012	0.067
145	0.0156	0.0201	0.0176	0.0231	0.0189	0.0190	0.0013	0.066
150	0.0162	0.0209	0.0183	0.0240	0.0196	0.0198	0.0013	0.066
155	0.0169	0.0217	0.0190	0.0248	0.0203	0.0205	0.0013	0.065
160	0.0175	0.0225	0.0197	0.0256	0.0210	0.0213	0.0014	0.064
165	0.0182	0.0233	0.0204	0.0265	0.0217	0.0220	0.0014	0.063
170	0.0189	0.0241	0.0211	0.0273	0.0225	0.0228	0.0014	0.062
175	0.0196	0.0250	0.0218	0.0282	0.0232	0.0236	0.0014	0.062
180	0.0203	0.0258	0.0225	0.0290	0.0238	0.0243	0.0015	0.061
185	0.0211	0.0267	0.0233	0.0299	0.0246	0.0251	0.0015	0.060
190	0.0218	0.0275	0.0240	0.0308	0.0253	0.0259	0.0015	0.060
195	0.0225	0.0284	0.0248	0.0317	0.0260	0.0267	0.0016	0.059
200	0.0233	0.0292	0.0256	0.0326	0.0267	0.0275	0.0016	0.058

SAMPLE: A120: Z93P-2 ELECTRON CURRENT: LEFT

Bias volts	A120PL1 μA	A120PL2 μA	A120PL3 μA	A120PL4 μA	A120PL5 μA	Mean μA	Standard error	fractional error
2	0.0008	0.0008	0.0000	0.0011	-0.0008	0.0004	0.0003	0.900
4	0.0013	0.0014	0.0003	0.0015	-0.0004	0.0008	0.0004	0.466
6	0.0019	0.0021	0.0006	0.0019	-0.0001	0.0013	0.0004	0.344
8	0.0025	0.0028	0.0006	0.0023	0.0002	0.0017	0.0005	0.320
10	0.0031	0.0035	0.0007	0.0028	0.0005	0.0021	0.0006	0.298
12	0.0036	0.0043	0.0009	0.0032	0.0006	0.0025	0.0007	0.296
14	0.0041	0.0051	0.0012	0.0037	0.0007	0.0030	0.0009	0.285
16	0.0046	0.0059	0.0014	0.0043	0.0010	0.0035	0.0010	0.278
18	0.0051	0.0068	0.0017	0.0048	0.0012	0.0039	0.0011	0.273
20	0.0055	0.0077	0.0019	0.0054	0.0014	0.0044	0.0012	0.271
25	0.0086	0.0126	0.0034	0.0088	0.0029	0.0073	0.0018	0.250
30	0.0083	0.0146	0.0037	0.0092	0.0032	0.0078	0.0021	0.266
35	0.0089	0.0169	0.0042	0.0112	0.0036	0.0090	0.0024	0.272
40	0.0096	0.0190	0.0047	0.0130	0.0041	0.0101	0.0028	0.273
45	0.0110	0.0205	0.0052	0.0146	0.0046	0.0112	0.0030	0.266
50	0.0122	0.0214	0.0057	0.0159	0.0051	0.0121	0.0031	0.256
55	0.0132	0.0218	0.0062	0.0170	0.0056	0.0127	0.0031	0.245
60	0.0142	0.0220	0.0066	0.0178	0.0060	0.0133	0.0031	0.234
65	0.0150	0.0220	0.0071	0.0184	0.0065	0.0138	0.0031	0.223
70	0.0158	0.0219	0.0075	0.0188	0.0069	0.0142	0.0030	0.211
75	0.0165	0.0217	0.0080	0.0191	0.0074	0.0145	0.0029	0.200
80	0.0171	0.0215	0.0085	0.0193	0.0078	0.0149	0.0028	0.190
85	0.0177	0.0213	0.0081	0.0196	0.0083	0.0150	0.0028	0.188
90	0.0182	0.0211	0.0083	0.0197	0.0080	0.0151	0.0029	0.190
95	0.0188	0.0209	0.0085	0.0199	0.0088	0.0154	0.0028	0.179
100	0.0193	0.0210	0.0089	0.0201	0.0087	0.0156	0.0028	0.179
105	0.0197	0.0209	0.0092	0.0203	0.0090	0.0158	0.0027	0.174
110	0.0202	0.0209	0.0099	0.0204	0.0093	0.0161	0.0027	0.166
115	0.0206	0.0209	0.0105	0.0205	0.0099	0.0165	0.0026	0.156
120	0.0211	0.0210	0.0110	0.0209	0.0104	0.0169	0.0025	0.149
125	0.0215	0.0211	0.0116	0.0210	0.0110	0.0173	0.0024	0.142
130	0.0220	0.0213	0.0121	0.0212	0.0115	0.0176	0.0024	0.135
135	0.0224	0.0215	0.0126	0.0214	0.0120	0.0180	0.0023	0.129
140	0.0230	0.0218	0.0131	0.0216	0.0125	0.0184	0.0023	0.124
145	0.0235	0.0220	0.0137	0.0218	0.0130	0.0188	0.0022	0.120
150	0.0241	0.0223	0.0142	0.0220	0.0135	0.0192	0.0022	0.115

SAMPLE: A120: Z93P-2 ELECTRON CURRENT: LEFT (continued)

Bias volts	A120PL1 μA	A120PL2 μA	A120PL3 μA	A120PL4 μA	A120PL5 μA	Mean μA	Standard error	fractional error
155	0.0246	0.0226	0.0148	0.0224	0.0141	0.0197	0.0022	0.111
160	0.0252	0.0230	0.0153	0.0226	0.0146	0.0202	0.0022	0.107
165	0.0258	0.0236	0.0159	0.0230	0.0152	0.0207	0.0022	0.104
170	0.0264	0.0242	0.0166	0.0235	0.0157	0.0213	0.0021	0.101
175	0.0270	0.0247	0.0173	0.0239	0.0163	0.0219	0.0021	0.098
180	0.0277	0.0253	0.0181	0.0245	0.0170	0.0225	0.0021	0.094
185	0.0285	0.0260	0.0188	0.0249	0.0178	0.0232	0.0021	0.090
190	0.0293	0.0265	0.0195	0.0255	0.0185	0.0239	0.0021	0.087
195	0.0302	0.0272	0.0203	0.0260	0.0192	0.0246	0.0021	0.085
200	0.0314	0.0279	0.0211	0.0266	0.0200	0.0254	0.0022	0.085
205	0.0324	0.0286	0.0219	0.0273	0.0207	0.0262	0.0022	0.083
210	0.0334	0.0294	0.0227	0.0280	0.0215	0.0270	0.0022	0.082
215	0.0344	0.0302	0.0235	0.0287	0.0223	0.0278	0.0022	0.080
220	0.0353	0.0311	0.0244	0.0295	0.0231	0.0287	0.0022	0.078
225	0.0364	0.0321	0.0253	0.0303	0.0239	0.0296	0.0023	0.077
230	0.0377	0.0333	0.0262	0.0311	0.0248	0.0306	0.0024	0.077
235	0.0390	0.0350	0.0273	0.0320	0.0257	0.0318	0.0024	0.077
240	0.0407	0.0371	0.0284	0.0332	0.0267	0.0332	0.0026	0.079
245	0.0428	0.0392	0.0299	0.0348	0.0278	0.0349	0.0028	0.080
250	0.0447	0.0409	0.0319	0.0374	0.0290	0.0368	0.0029	0.078
255	0.0464	0.0426	0.0349	0.0400	0.0306	0.0389	0.0028	0.072
260	0.0485	0.0441	0.0385	0.0420	0.0329	0.0412	0.0026	0.064
265	0.0511	0.0456	0.0402	0.0437	0.0382	0.0438	0.0023	0.051
270	0.0550	0.0474	0.0417	0.0454	0.0405	0.0460	0.0026	0.056
275	0.0649	0.0523	0.0434	0.0488	0.0421	0.0503	0.0041	0.081
280	0.0721	0.0569	0.0475	0.0522	0.0454	0.0548	0.0048	0.087
285	0.0786	0.0600	0.0504	0.0565	0.0487	0.0589	0.0053	0.091
290	0.1440	0.0666	0.0550	0.0597	0.0528	0.0756	0.0173	0.228
295	0.1593	0.1199	0.0586	0.0912	0.0567	0.0971	0.0194	0.200
300	0.1651	0.1291	0.0641	0.1168	0.0614	0.1073	0.0198	0.185

SAMPLE: A120: Z93P-2 ELECTRON CURRENT: RIGHT

Bias volts	A120PR1 μA	A120PR2 μA	A120PR3 μA	A120PR4 μA	A120PR5 μA	Mean μA	Standard error	fractional error
2	0.0003	0.0009	-0.0006	0.0010	-0.0005	0.0002	0.0003	1.513
4	0.0006	0.0012	-0.0003	0.0013	-0.0002	0.0005	0.0003	0.639
6	0.0006	0.0015	0.0000	0.0016	0.0001	0.0008	0.0003	0.459
8	0.0007	0.0018	0.0002	0.0019	0.0003	0.0010	0.0004	0.365
10	0.0008	0.0021	0.0004	0.0022	0.0006	0.0012	0.0004	0.308
12	0.0010	0.0023	0.0005	0.0026	0.0006	0.0014	0.0004	0.312
14	0.0012	0.0026	0.0007	0.0029	0.0008	0.0016	0.0005	0.291
16	0.0014	0.0029	0.0008	0.0033	0.0009	0.0019	0.0005	0.276
18	0.0015	0.0032	0.0010	0.0037	0.0012	0.0021	0.0006	0.261
20	0.0017	0.0035	0.0012	0.0041	0.0013	0.0024	0.0006	0.250
25	0.0031	0.0055	0.0025	0.0064	0.0026	0.0040	0.0008	0.202
30	0.0032	0.0062	0.0027	0.0074	0.0028	0.0045	0.0010	0.222
35	0.0035	0.0072	0.0030	0.0088	0.0032	0.0051	0.0012	0.234
40	0.0039	0.0081	0.0034	0.0087	0.0036	0.0055	0.0012	0.216
45	0.0042	0.0078	0.0037	0.0090	0.0039	0.0057	0.0011	0.192
50	0.0046	0.0090	0.0041	0.0092	0.0043	0.0063	0.0012	0.187
55	0.0050	0.0084	0.0045	0.0101	0.0047	0.0065	0.0011	0.175
60	0.0053	0.0084	0.0048	0.0108	0.0051	0.0069	0.0012	0.170
65	0.0057	0.0085	0.0052	0.0113	0.0055	0.0072	0.0012	0.164
70	0.0061	0.0086	0.0056	0.0118	0.0058	0.0076	0.0012	0.156
75	0.0064	0.0088	0.0059	0.0121	0.0062	0.0079	0.0012	0.149
80	0.0068	0.0090	0.0063	0.0125	0.0066	0.0082	0.0012	0.142
85	0.0072	0.0093	0.0066	0.0128	0.0069	0.0086	0.0012	0.135
90	0.0076	0.0099	0.0070	0.0131	0.0073	0.0090	0.0012	0.128
95	0.0080	0.0105	0.0074	0.0134	0.0077	0.0094	0.0011	0.121
100	0.0084	0.0110	0.0078	0.0136	0.0081	0.0098	0.0011	0.115
105	0.0089	0.0114	0.0082	0.0139	0.0085	0.0102	0.0011	0.107
110	0.0086	0.0119	0.0087	0.0142	0.0084	0.0104	0.0012	0.112
115	0.0088	0.0123	0.0086	0.0145	0.0086	0.0106	0.0012	0.114
120	0.0091	0.0127	0.0088	0.0148	0.0089	0.0109	0.0012	0.113
125	0.0094	0.0132	0.0091	0.0151	0.0093	0.0112	0.0012	0.110
130	0.0100	0.0136	0.0095	0.0154	0.0099	0.0117	0.0012	0.103
135	0.0105	0.0140	0.0100	0.0158	0.0104	0.0121	0.0012	0.096
140	0.0110	0.0144	0.0105	0.0161	0.0109	0.0126	0.0011	0.090
145	0.0115	0.0149	0.0110	0.0165	0.0113	0.0130	0.0011	0.086
150	0.0120	0.0153	0.0115	0.0168	0.0118	0.0135	0.0011	0.081

SAMPLE: A120: Z93P-2 ELECTRON CURRENT: RIGHT (continued)

Bias volts	A120PR1 μA	A120PR2 μA	A120PR3 μA	A120PR4 μA	A120PR5 μA	Mean μA	Standard error	fractional error
155	0.0125	0.0158	0.0120	0.0172	0.0123	0.0139	0.0011	0.076
160	0.0130	0.0165	0.0125	0.0176	0.0128	0.0145	0.0011	0.073
165	0.0139	0.0171	0.0130	0.0181	0.0133	0.0151	0.0010	0.069
170	0.0146	0.0176	0.0136	0.0188	0.0139	0.0157	0.0011	0.067
175	0.0152	0.0182	0.0142	0.0193	0.0145	0.0163	0.0010	0.064
180	0.0158	0.0188	0.0151	0.0199	0.0154	0.0170	0.0010	0.057
185	0.0164	0.0194	0.0158	0.0205	0.0160	0.0176	0.0010	0.055
190	0.0171	0.0200	0.0165	0.0211	0.0167	0.0183	0.0009	0.052
195	0.0179	0.0207	0.0172	0.0217	0.0174	0.0190	0.0009	0.049
200	0.0186	0.0215	0.0179	0.0224	0.0181	0.0197	0.0009	0.047
205	0.0194	0.0222	0.0186	0.0231	0.0188	0.0204	0.0009	0.045
210	0.0202	0.0230	0.0194	0.0238	0.0196	0.0212	0.0009	0.044
215	0.0210	0.0238	0.0202	0.0246	0.0203	0.0220	0.0009	0.042
220	0.0219	0.0247	0.0211	0.0254	0.0212	0.0228	0.0009	0.040
225	0.0228	0.0256	0.0219	0.0262	0.0220	0.0237	0.0009	0.039
230	0.0237	0.0267	0.0228	0.0271	0.0229	0.0246	0.0009	0.038
235	0.0248	0.0280	0.0237	0.0281	0.0239	0.0257	0.0010	0.038
240	0.0261	0.0299	0.0247	0.0297	0.0248	0.0270	0.0012	0.043
245	0.0279	0.0319	0.0258	0.0311	0.0259	0.0285	0.0013	0.045
250	0.0309	0.0332	0.0272	0.0336	0.0274	0.0305	0.0014	0.045
255	0.0322	0.0345	0.0289	0.0357	0.0291	0.0321	0.0014	0.043
260	0.0338	0.0360	0.0311	0.0371	0.0308	0.0338	0.0013	0.038
265	0.0354	0.0378	0.0357	0.0390	0.0357	0.0367	0.0007	0.020
270	0.0374	0.0398	0.0376	0.0409	0.0375	0.0386	0.0007	0.019
275	0.0401	0.0423	0.0400	0.0430	0.0394	0.0409	0.0007	0.018
280	0.0443	0.0466	0.0441	0.0478	0.0436	0.0453	0.0008	0.018
285	0.0475	0.0499	0.0479	0.0515	0.0463	0.0486	0.0009	0.019
290	0.0523	0.0542	0.0528	0.0558	0.0514	0.0533	0.0008	0.015
295	0.0560	0.0584	0.0565	0.0596	0.0558	0.0573	0.0007	0.013
300	0.0866	0.0646	0.1100	0.1291	0.0604	0.0901	0.0132	0.146

SAMPLE: M120: M93P-2 ION CURRENT: LEFT

Bias volts	M120NL1 μA	M120NL2 μA	M120NL3 μA	M120NL4 μA	M120NL5 μA	Mean μA	Standard error	fractional error
2	0.1935	0.1958	0.1891	0.2034	0.1922	0.1948	0.0024	0.012
4	0.3145	0.3339	0.3290	0.3375	0.3295	0.3289	0.0039	0.012
6	0.3739	0.3979	0.3935	0.4013	0.3937	0.3921	0.0048	0.012
8	0.4253	0.4541	0.4493	0.4576	0.4497	0.4472	0.0057	0.013
10	0.4743	0.5072	0.5023	0.5112	0.5034	0.4997	0.0065	0.013
12	0.5228	0.5576	0.5534	0.5617	0.5541	0.5499	0.0069	0.013
14	0.5694	0.6054	0.6018	0.6095	0.6022	0.5977	0.0072	0.012
16	0.6142	0.6533	0.6490	0.6560	0.6484	0.6441	0.0076	0.012
18	0.6573	0.6983	0.6938	0.7004	0.6939	0.6887	0.0080	0.012
20	0.7000	0.7411	0.7375	0.7433	0.7369	0.7318	0.0080	0.011
25	0.8226	0.8482	0.8475	0.8511	0.8462	0.8431	0.0052	0.006
30	0.9099	0.9424	0.9419	0.9467	0.9404	0.9363	0.0067	0.007
35	0.9980	1.0352	1.0338	1.0386	1.0332	1.0278	0.0075	0.007
40	1.0829	1.1244	1.1236	1.1279	1.1235	1.1165	0.0084	0.008
45	1.1681	1.2124	1.2105	1.2137	1.2103	1.2030	0.0087	0.007
50	1.2514	1.2970	1.2963	1.2981	1.2957	1.2877	0.0091	0.007
55	1.3333	1.3794	1.3778	1.3810	1.3776	1.3698	0.0092	0.007
60	1.4118	1.4601	1.4586	1.4614	1.4570	1.4498	0.0095	0.007
65	1.4918	1.5378	1.5386	1.5399	1.5364	1.5289	0.0093	0.006
70	1.5669	1.6152	1.6165	1.6196	1.6180	1.6072	0.0101	0.006
75	1.6423	1.6913	1.6942	1.6942	1.6922	1.6828	0.0102	0.006
80	1.7162	1.7691	1.7691	1.7691	1.7673	1.7582	0.0105	0.006
85	1.7897	1.8449	1.8444	1.8466	1.8416	1.8334	0.0110	0.006
90	1.8627	1.9198	1.9191	1.9206	1.9163	1.9077	0.0113	0.006
95	1.9359	1.9921	1.9927	1.9955	1.9906	1.9814	0.0114	0.006
100	2.0068	2.0625	2.0668	2.0678	2.0641	2.0536	0.0117	0.006
105	2.0769	2.1340	2.1404	2.1391	2.1371	2.1255	0.0122	0.006
110	2.1498	2.2055	2.2115	2.2106	2.2118	2.1978	0.0121	0.005
115	2.2193	2.2770	2.2862	2.2838	2.2829	2.2698	0.0127	0.006
120	2.2893	2.3481	2.3535	2.3534	2.3546	2.3398	0.0127	0.005
125	2.3584	2.4189	2.4244	2.4228	2.4241	2.4097	0.0129	0.005
130	2.4250	2.4852	2.4926	2.4902	2.4923	2.4771	0.0131	0.005
135	2.4959	2.5550	2.5643	2.5586	2.5617	2.5471	0.0129	0.005
140	2.5618	2.6234	2.6312	2.6277	2.6280	2.6144	0.0132	0.005
145	2.6279	2.6935	2.6979	2.6954	2.6965	2.6822	0.0136	0.005
150	2.6927	2.7584	2.7636	2.7631	2.7644	2.7484	0.0140	0.005
155	2.7573	2.8261	2.8305	2.8311	2.8331	2.8156	0.0146	0.005
160	2.8230	2.8918	2.8971	2.8992	2.9029	2.8828	0.0151	0.005
165	2.8888	2.9580	2.9660	2.9651	2.9688	2.9493	0.0152	0.005
170	2.9537	3.0259	3.0316	3.0325	3.0346	3.0157	0.0156	0.005
175	3.0199	3.0920	3.0970	3.0955	3.1044	3.0818	0.0156	0.005
180	3.0824	3.1568	3.1630	3.1590	3.1666	3.1456	0.0159	0.005
185	3.1485	3.2236	3.2321	3.2262	3.2335	3.2128	0.0162	0.005
190	3.2090	3.2860	3.2965	3.2919	3.2993	3.2765	0.0170	0.005
195	3.2723	3.3504	3.3640	3.3566	3.3627	3.3412	0.0174	0.005
200	3.3378	3.4168	3.4246	3.4230	3.4260	3.4056	0.0170	0.005

SAMPLE: M120: M93P-2 ION CURRENT: RIGHT

Bias volts	M120NR1 μA	M120NR2 μA	M120NR3 μA	M120NR4 μA	M120NR5 μA	Mean μA	Standard error	fractional error
2	0.0616	0.0314	0.0292	0.0164	0.0276	0.0332	0.0075	0.227
4	0.2125	0.2222	0.2187	0.2238	0.2190	0.2192	0.0019	0.009
6	0.2887	0.3033	0.3016	0.3085	0.3024	0.3009	0.0033	0.011
8	0.3446	0.3621	0.3613	0.3689	0.3623	0.3598	0.0040	0.011
10	0.3952	0.4148	0.4142	0.4223	0.4158	0.4124	0.0045	0.011
12	0.4437	0.4644	0.4647	0.4726	0.4663	0.4623	0.0049	0.011
14	0.4898	0.5120	0.5129	0.5208	0.5147	0.5100	0.0053	0.010
16	0.5348	0.5580	0.5592	0.5675	0.5612	0.5561	0.0056	0.010
18	0.5786	0.6021	0.6041	0.6121	0.6060	0.6006	0.0057	0.010
20	0.6212	0.6453	0.6468	0.6555	0.6492	0.6436	0.0059	0.009
25	0.7412	0.7541	0.7575	0.7634	0.7594	0.7551	0.0038	0.005
30	0.8287	0.8467	0.8502	0.8583	0.8521	0.8472	0.0050	0.006
35	0.9183	0.9382	0.9432	0.9518	0.9456	0.9394	0.0057	0.006
40	1.0052	1.0275	1.0337	1.0419	1.0354	1.0287	0.0063	0.006
45	1.0918	1.1146	1.1226	1.1295	1.1230	1.1163	0.0066	0.006
50	1.1751	1.2007	1.2094	1.2147	1.2097	1.2019	0.0071	0.006
55	1.2577	1.2832	1.2902	1.2991	1.2938	1.2848	0.0073	0.006
60	1.3395	1.3653	1.3728	1.3811	1.3755	1.3668	0.0073	0.005
65	1.4189	1.4456	1.4525	1.4607	1.4550	1.4465	0.0073	0.005
70	1.4979	1.5229	1.5315	1.5381	1.5340	1.5249	0.0072	0.005
75	1.5755	1.6004	1.6112	1.6171	1.6127	1.6034	0.0075	0.005
80	1.6510	1.6759	1.6875	1.6940	1.6902	1.6797	0.0078	0.005
85	1.7264	1.7518	1.7658	1.7690	1.7656	1.7557	0.0079	0.005
90	1.8021	1.8266	1.8391	1.8433	1.8408	1.8304	0.0076	0.004
95	1.8745	1.8998	1.9115	1.9168	1.9138	1.9033	0.0078	0.004
100	1.9464	1.9722	1.9828	1.9906	1.9861	1.9756	0.0079	0.004
105	2.0182	2.0473	2.0547	2.0626	2.0572	2.0480	0.0078	0.004
110	2.0884	2.1178	2.1254	2.1325	2.1303	2.1189	0.0080	0.004
115	2.1593	2.1870	2.1997	2.2046	2.2007	2.1903	0.0083	0.004
120	2.2300	2.2552	2.2685	2.2741	2.2706	2.2597	0.0081	0.004
125	2.2986	2.3210	2.3380	2.3435	2.3380	2.3278	0.0082	0.004
130	2.3664	2.3875	2.4063	2.4107	2.4061	2.3954	0.0083	0.003
135	2.4351	2.4560	2.4729	2.4763	2.4752	2.4631	0.0079	0.003
140	2.5044	2.5225	2.5401	2.5439	2.5422	2.5306	0.0076	0.003
145	2.5721	2.5895	2.6069	2.6102	2.6081	2.5974	0.0073	0.003
150	2.6392	2.6591	2.6752	2.6773	2.6750	2.6652	0.0073	0.003
155	2.7079	2.7236	2.7399	2.7418	2.7409	2.7308	0.0066	0.002
160	2.7734	2.7885	2.8042	2.8054	2.8051	2.7953	0.0063	0.002
165	2.8372	2.8515	2.8701	2.8704	2.8737	2.8606	0.0070	0.002
170	2.9018	2.9167	2.9353	2.9362	2.9350	2.9250	0.0069	0.002
175	2.9663	2.9794	2.9974	3.0008	2.9989	2.9886	0.0068	0.002
180	3.0321	3.0438	3.0614	3.0663	3.0647	3.0537	0.0067	0.002
185	3.0965	3.1098	3.1260	3.1313	3.1301	3.1187	0.0068	0.002
190	3.1593	3.1741	3.1893	3.1933	3.1908	3.1814	0.0065	0.002
195	3.2251	3.2358	3.2548	3.2552	3.2545	3.2451	0.0062	0.002
200	3.2881	3.2975	3.3166	3.3184	3.3162	3.3074	0.0061	0.002

SAMPLE: M120: M93P-2 ELECTRON CURRENT: LEFT

Bias volts	M120PL1 mA	M120PL2 mA	M120PL3 mA	M120PL4 mA	M120PL5 mA	Mean mA	Standard error	fractional error
2	0.002	0.004	0.003	0.004	0.003	0.0032	0.0004	0.1186
4	0.005	0.009	0.008	0.009	0.008	0.0081	0.0007	0.0884
6	0.010	0.015	0.014	0.015	0.014	0.0137	0.0010	0.0729
8	0.015	0.022	0.020	0.022	0.021	0.0201	0.0012	0.0606
10	0.022	0.029	0.027	0.029	0.028	0.0270	0.0014	0.0517
12	0.028	0.037	0.035	0.037	0.035	0.0344	0.0015	0.0448
14	0.036	0.045	0.043	0.045	0.043	0.0426	0.0016	0.0381
16	0.045	0.053	0.052	0.054	0.052	0.0511	0.0016	0.0315
18	0.054	0.062	0.060	0.063	0.061	0.0599	0.0016	0.0263
20	0.063	0.070	0.069	0.071	0.070	0.0687	0.0015	0.0223
25	0.086	0.092	0.092	0.093	0.092	0.0910	0.0014	0.0151
30	0.109	0.115	0.114	0.116	0.115	0.1137	0.0012	0.0102
35	0.132	0.137	0.137	0.137	0.137	0.1360	0.0010	0.0072
40	0.154	0.159	0.159	0.159	0.159	0.1579	0.0009	0.0056
45	0.176	0.180	0.180	0.180	0.180	0.1791	0.0008	0.0046
50	0.196	0.201	0.201	0.200	0.200	0.1997	0.0008	0.0042
55	0.217	0.221	0.221	0.221	0.220	0.2199	0.0008	0.0038
60	0.236	0.241	0.241	0.240	0.240	0.2395	0.0008	0.0034
65	0.256	0.260	0.260	0.259	0.259	0.2588	0.0008	0.0032
70	0.275	0.279	0.279	0.278	0.278	0.2779	0.0008	0.0030
75	0.293	0.298	0.298	0.297	0.297	0.2968	0.0008	0.0028
80	0.312	0.316	0.317	0.316	0.316	0.3154	0.0008	0.0026
85	0.331	0.335	0.335	0.334	0.335	0.3340	0.0008	0.0023
90	0.350	0.353	0.354	0.352	0.353	0.3522	0.0007	0.0020
95	0.368	0.372	0.372	0.370	0.371	0.3707	0.0007	0.0018
100	0.386	0.390	0.391	0.388	0.389	0.3889	0.0007	0.0018
105	0.405	0.407	0.408	0.406	0.408	0.4068	0.0007	0.0017
110	0.423	0.425	0.427	0.424	0.425	0.4248	0.0006	0.0014
115	0.453	0.443	0.445	0.442	0.444	0.4454	0.0020	0.0045
120	0.472	0.461	0.462	0.459	0.462	0.4631	0.0022	0.0048
125	0.490	0.478	0.480	0.477	0.479	0.4809	0.0024	0.0049
130	0.508	0.496	0.497	0.494	0.497	0.4985	0.0024	0.0048
135	0.526	0.513	0.514	0.511	0.515	0.5157	0.0026	0.0050
140	0.544	0.531	0.531	0.528	0.532	0.5332	0.0028	0.0052
145	0.562	0.547	0.548	0.545	0.550	0.5506	0.0030	0.0054
150	0.581	0.564	0.566	0.563	0.568	0.5684	0.0033	0.0059

SAMPLE: M120: M93P-2 ELECTRON CURRENT: LEFT (continued)

Bias volts	M120PL1 mA	M120PL2 mA	M120PL3 mA	M120PL4 mA	M120PL5 mA	Mean mA	Standard error	fractional error
155	0.600	0.581	0.583	0.581	0.585	0.5861	0.0037	0.0062
160	0.621	0.598	0.600	0.598	0.603	0.6040	0.0044	0.0073
165	0.640	0.615	0.618	0.615	0.621	0.6218	0.0046	0.0074
170	0.657	0.632	0.636	0.632	0.639	0.6392	0.0047	0.0074
175	0.687	0.650	0.654	0.648	0.658	0.6593	0.0071	0.0108
180	0.707	0.666	0.672	0.665	0.676	0.6775	0.0078	0.0115
185	0.780	0.683	0.690	0.682	0.695	0.7060	0.0187	0.0265
190	0.796	0.700	0.707	0.700	0.713	0.7232	0.0184	0.0254
195	0.813	0.718	0.724	0.716	0.730	0.7402	0.0183	0.0247
200	0.837	0.736	0.743	0.733	0.748	0.7594	0.0196	0.0258
205	0.922	0.752	0.760	0.750	0.766	0.7901	0.0332	0.0420
210	0.930	0.769	0.777	0.767	0.784	0.8053	0.0313	0.0389
215	0.927	0.787	0.794	0.786	0.801	0.8192	0.0271	0.0330
220	0.931	0.807	0.811	0.803	0.820	0.8343	0.0245	0.0293
225	0.952	0.824	0.828	0.821	0.837	0.8523	0.0250	0.0293
230	0.979	0.842	0.846	0.838	0.855	0.8718	0.0269	0.0309
235	0.994	0.859	0.872	0.854	0.874	0.8905	0.0262	0.0294
240	1.009	0.875	0.900	0.871	0.892	0.9096	0.0255	0.0280
245	1.027	0.892	0.917	0.888	0.915	0.9277	0.0255	0.0274
250	1.047	0.909	0.971	0.905	0.934	0.9532	0.0262	0.0274
255	1.067	0.926	1.590	0.921	0.951	1.0911	0.1275	0.1168
260	1.168	0.943	1.611	0.939	1.622	1.2565	0.1526	0.1215
265	1.357	0.960	1.634	0.955	1.642	1.3098	0.1526	0.1165
270	1.367	0.977	1.656	0.972	1.663	1.3270	0.1535	0.1156
275	1.382	1.719	1.679	1.016	1.687	1.4964	0.1347	0.0900
280	1.398	1.738	1.700	1.027	1.711	1.5147	0.1367	0.0903
285	1.410	1.756	1.724	1.043	1.734	1.5334	0.1381	0.0901
290	1.420	1.779	1.749	1.066	1.758	1.5542	0.1390	0.0894
295	1.427	1.803	1.772	1.084	1.784	1.5739	0.1410	0.0896
300	1.430	1.826	1.795	1.101	1.806	1.5915	0.1431	0.0899

SAMPLE: M120: M93P-2 ELECTRON CURRENT: RIGHT

Bias volts	M120PR1 mA	M120PR2 mA	M120PR3 mA	M120PR4 mA	M120PR5 mA	Mean mA	Standard error	fractional error
2	0.002	0.003	0.003	0.004	0.003	0.0031	0.0003	0.0882
4	0.005	0.007	0.007	0.008	0.007	0.0071	0.0005	0.0672
6	0.009	0.012	0.012	0.013	0.012	0.0117	0.0006	0.0544
8	0.014	0.017	0.017	0.019	0.018	0.0169	0.0008	0.0463
10	0.019	0.023	0.023	0.025	0.023	0.0226	0.0009	0.0390
12	0.025	0.029	0.029	0.031	0.029	0.0287	0.0009	0.0327
14	0.032	0.036	0.036	0.037	0.036	0.0353	0.0010	0.0272
16	0.039	0.043	0.043	0.044	0.043	0.0423	0.0009	0.0222
18	0.046	0.050	0.050	0.051	0.050	0.0494	0.0009	0.0181
20	0.053	0.057	0.057	0.058	0.058	0.0566	0.0009	0.0153
25	0.072	0.075	0.075	0.076	0.076	0.0750	0.0008	0.0104
30	0.091	0.094	0.094	0.094	0.095	0.0937	0.0007	0.0070
35	0.110	0.113	0.113	0.113	0.114	0.1124	0.0005	0.0046
40	0.129	0.131	0.131	0.131	0.132	0.1308	0.0004	0.0032
45	0.148	0.149	0.149	0.148	0.150	0.1489	0.0004	0.0027
50	0.165	0.167	0.167	0.166	0.168	0.1663	0.0004	0.0025
55	0.183	0.184	0.184	0.183	0.185	0.1835	0.0004	0.0023
60	0.199	0.201	0.201	0.199	0.202	0.2003	0.0005	0.0023
65	0.216	0.217	0.217	0.216	0.218	0.2171	0.0004	0.0021
70	0.233	0.234	0.234	0.232	0.235	0.2335	0.0005	0.0021
75	0.250	0.250	0.250	0.248	0.251	0.2499	0.0005	0.0022
80	0.266	0.267	0.267	0.264	0.268	0.2661	0.0006	0.0023
85	0.282	0.283	0.283	0.280	0.284	0.2823	0.0007	0.0023
90	0.298	0.299	0.299	0.296	0.300	0.2983	0.0007	0.0024
95	0.314	0.315	0.314	0.311	0.316	0.3142	0.0008	0.0024
100	0.330	0.331	0.330	0.327	0.332	0.3301	0.0008	0.0025
105	0.346	0.346	0.346	0.343	0.348	0.3459	0.0009	0.0025
110	0.362	0.362	0.362	0.358	0.364	0.3615	0.0009	0.0026
115	0.380	0.378	0.378	0.374	0.380	0.3778	0.0011	0.0029
120	0.396	0.394	0.393	0.389	0.395	0.3933	0.0012	0.0030
125	0.412	0.409	0.409	0.404	0.411	0.4090	0.0013	0.0031
130	0.428	0.424	0.425	0.419	0.426	0.4246	0.0014	0.0034
135	0.443	0.440	0.440	0.434	0.442	0.4399	0.0015	0.0035
140	0.459	0.455	0.456	0.450	0.458	0.4555	0.0017	0.0037
145	0.475	0.471	0.471	0.464	0.473	0.4709	0.0018	0.0039
150	0.491	0.486	0.487	0.480	0.489	0.4866	0.0019	0.0040

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13. ABSTRACT (*Maximum 200 words*)

Two samples each of Z93 and Z93P thermal control paint were exposed to a simulated space environment in a plasma chamber. The samples were biased through a series of voltages ranging from -200 volts to +300 volts and electron and ion currents measured. By comparing the currents to those of pure metal samples of the same size and shape, the conductivity of the samples was calculated. Measured conductivity was dependent on the bias potential in all cases. For Z93P, conductivity was approximately constant over much of the bias range and we find a value of 0.5 micro-mhos per square meter for both electron and ion current. For Z93, the dependence on bias was much more pronounced but conductivity can be said to be approximately one order of magnitude larger. In addition to presenting these results, this report documents all of the experimental data as well as the statistical analyses performed.

14. SUBJECT TERMS

Electrical conductivity; Spacecraft floating potential

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SAMPLE: M120: M93P-2 ELECTRON CURRENT: RIGHT (continued)

Bias volts	M120PR1 mA	M120PR2 mA	M120PR3 mA	M120PR4 mA	M120PR5 mA	Mean mA	Standard error	fractional error
155	0.507	0.502	0.503	0.495	0.505	0.5021	0.0021	0.0041
160	0.524	0.517	0.518	0.510	0.520	0.5177	0.0023	0.0044
165	0.541	0.532	0.534	0.525	0.535	0.5334	0.0025	0.0048
170	0.557	0.548	0.549	0.540	0.551	0.5490	0.0027	0.0049
175	0.573	0.564	0.565	0.555	0.566	0.5647	0.0029	0.0051
180	0.588	0.579	0.580	0.571	0.582	0.5801	0.0028	0.0049
185	0.605	0.595	0.596	0.586	0.597	0.5956	0.0030	0.0051
190	0.630	0.610	0.612	0.601	0.614	0.6134	0.0048	0.0078
195	0.644	0.626	0.628	0.616	0.630	0.6287	0.0046	0.0073
200	0.660	0.642	0.645	0.631	0.647	0.6450	0.0046	0.0071
205	0.676	0.657	0.661	0.647	0.663	0.6608	0.0047	0.0072
210	0.710	0.675	0.676	0.662	0.679	0.6804	0.0079	0.0116
215	0.767	0.691	0.692	0.678	0.694	0.7044	0.0159	0.0225
220	0.769	0.706	0.708	0.694	0.710	0.7172	0.0132	0.0184
225	0.797	0.722	0.723	0.710	0.725	0.7354	0.0156	0.0212
230	0.820	0.738	0.739	0.725	0.741	0.7523	0.0171	0.0227
235	0.834	0.754	0.754	0.740	0.762	0.7689	0.0167	0.0217
240	0.848	0.770	0.771	0.756	0.778	0.7844	0.0162	0.0206
245	0.917	0.785	0.786	0.772	0.795	0.8110	0.0268	0.0331
250	0.911	0.801	0.801	0.787	0.811	0.8223	0.0226	0.0275
255	0.918	0.817	0.819	0.803	0.827	0.8365	0.0206	0.0247
260	0.933	0.832	0.834	0.818	0.842	0.8520	0.0207	0.0243
265	0.947	0.848	0.850	0.834	0.858	0.8676	0.0202	0.0233
270	0.961	0.864	0.954	0.850	0.873	0.9003	0.0235	0.0262
275	0.975	0.880	0.962	0.865	0.890	0.9145	0.0225	0.0246
280	1.021	1.573	0.977	0.881	1.561	1.2024	0.1504	0.1251
285	1.056	1.589	0.991	0.897	1.578	1.2224	0.1496	0.1224
290	1.163	1.609	1.007	1.602	1.598	1.3957	0.1293	0.0926
295	1.261	1.629	1.023	1.616	1.617	1.4289	0.1233	0.0863
300	1.231	1.651	1.038	1.634	1.639	1.4386	0.1279	0.0889

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