

Small Caliber Bore Mapping Systems

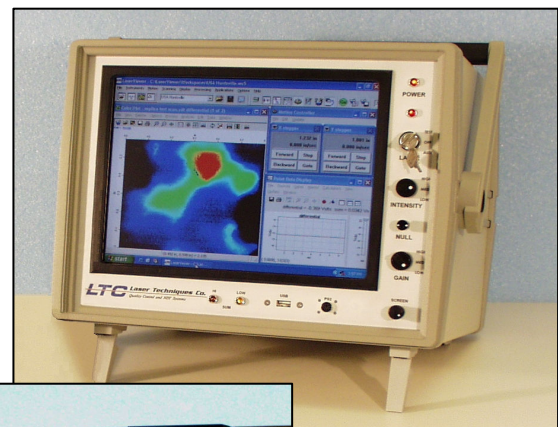
The Challenge

Today, more than ever, both end-users and manufacturers of high-performance gun tubes need reliable and *quantitative* measurement and inspection tools. Unfortunately, most of the commonly used bore mapping tools that are in use today were developed in the 1940's. Air gauges and "star" gauges have been a standard method for verifying dimensions of gun barrels for over 60 years. And although these gauging tools can work well for certain types of simple and repetitive gauging applications, both methods are inherently limited in their range and flexibility — and neither method can generate a full map of a rifled gun bore.



The Solution – LTC's Laser Bore Mapping System

Based on our Laser MicroMap™ system and supported by our LaserViewer™ data acquisition and analysis software, LTC's laser bore mapping systems provide a superior alternative to conventional gauges. Our laser profiling sensors have significantly larger measurement ranges than air gauges and star gauges, can rapidly scan the gun tube surface in a non-contact manner, and generate a high-resolution, three-dimensional image that is quantitative and accurate. These laser sensors project a tiny laser beam onto the part surface and can acquire thousands of samples per scan. Data can be evaluated using our LaserViewer™ analysis software or our LaserViewer 3D™ visualization and analysis software. Test results can also be automatically post-processed and displayed in a tabular summary report.



Bore mapping results are provided in several operator-friendly formats, including:

- Contour view display of the full bore length
- Cross sectional display of the bore at any axial location
- 3D Image
- Tabular summary

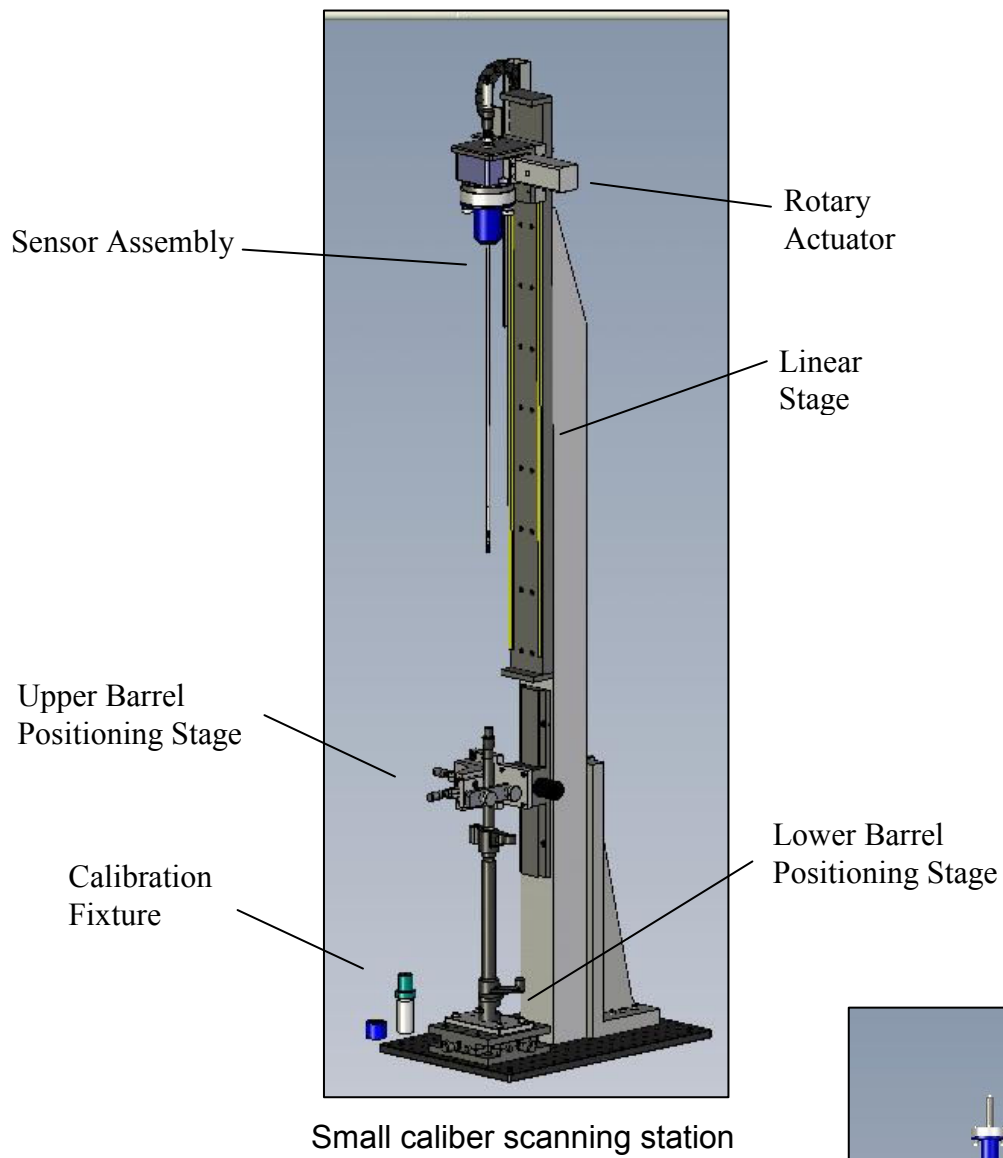
Key advantages of laser mapping include:

- Non-contact measurement
- Automated data acquisition
- Interchangeable sensors
- Full-featured analysis and reporting functions
- Quick changeover to new barrels
- Complete surface characterization
- Full-length bore mapping
- Photograph-quality bore and chamber image using *LaserVideo*[™] imaging

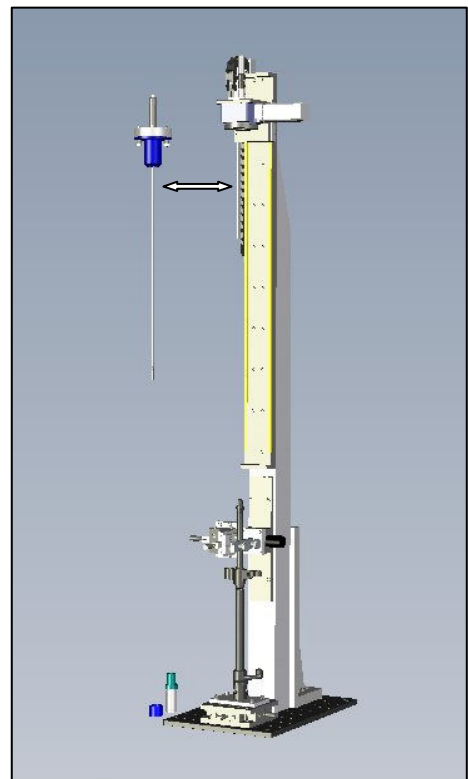
Basic Specifications	
Available bore sizes	5.56 mm, 7.62 mm, 9 mm
Sensor linearity	+/- 0.0127 mm (0.0005 inch)
Laser power	< 5 mW @ 650 nm
Laser Power Classification:	Class I (sensor outside of component) Class IIa (sensor inside of component)
Laser spot size	0.050 mm (0.002 inch)
Angular sampling resolution	Variable – up to 0.5 degrees per sample
Linear sampling resolution	Variable – up to 0.002 inch per sample

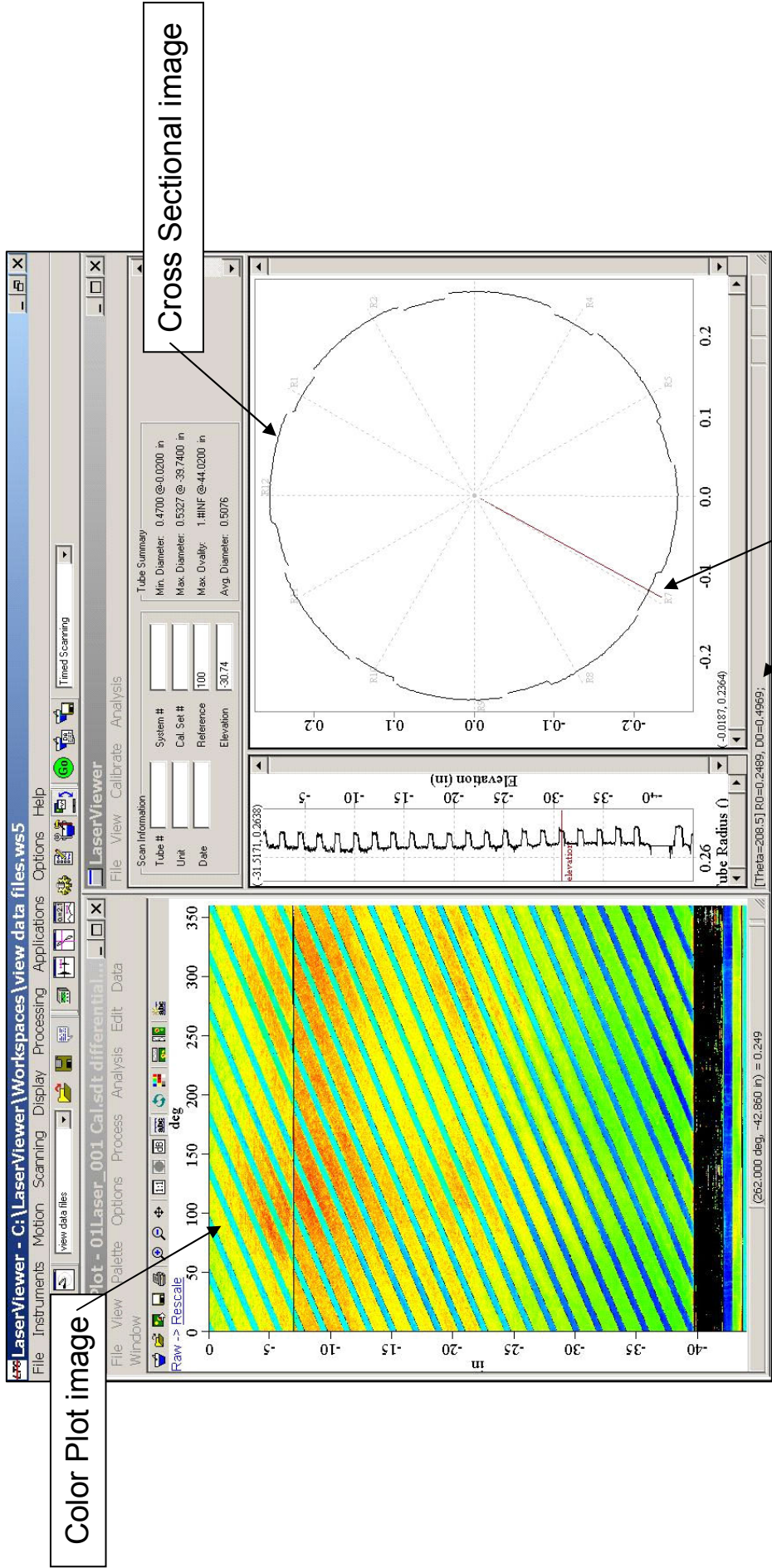
Our *Laser MicroMap*[™] measurement and inspection systems are rapidly replacing antiquated mechanical gauging methods in the US and now we are expanding internationally. In the US alone, our systems are now in use at:

- US Army – Yuma Proving Grounds
- US Army – Aberdeen Test Center
- US Army – Army Research Laboratory
- US Army – ARDEC
- Naval Surface Warfare Center



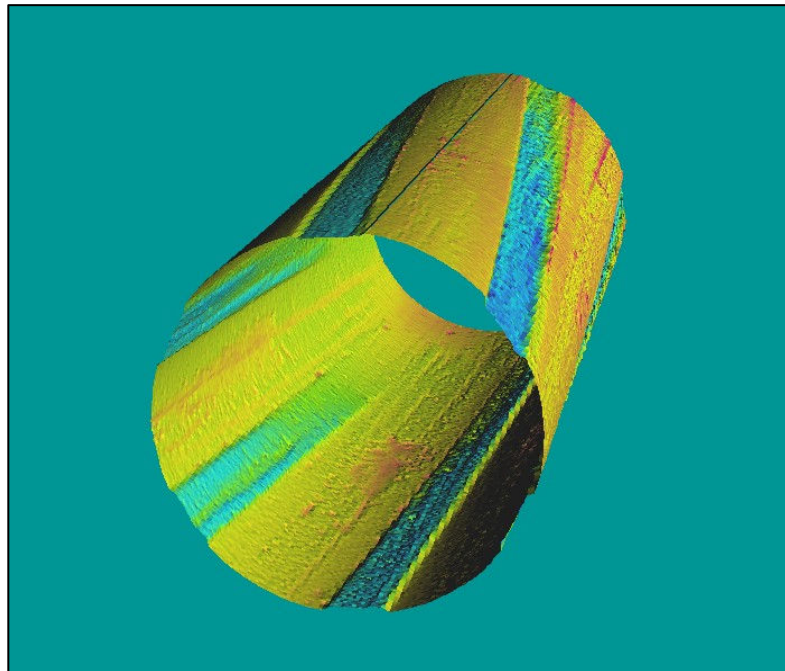
The small caliber scanning station supports multiple sensor and barrel sizes



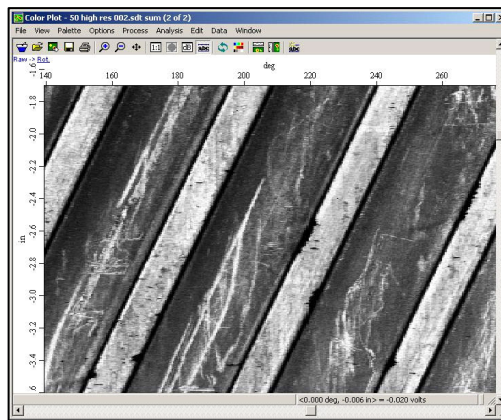


Color Plot image of full gun tube length “sliced” and laid open. False-color map shows slight changes in land and groove diameters over the length of the bore.

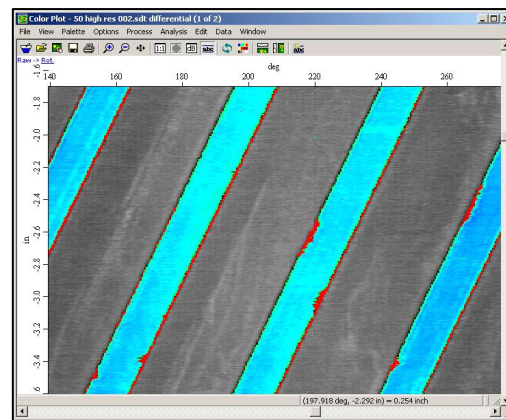
Local diameter reading



3D image of 5.56 mm bore – origin of rifling.



Zoom display of *LaserVideo™* image reveals small chips on edges of lands



Dimensional image confirms presence of chips

LABORATORY SERVICES BRANCH TEST REPORT

DATE OF MEASUREMENT: 10/1/2003 12:59:08 PM

OPERATORS: John Doe

BARREL TYPE: M2 50 Caliber

SERIAL NUMBER: XYZ-123

NUMBER OF ROUNDS: 100

MEASUREMENT TEMP: 82 deg. F

TEST PROGRAM:

TEST DIRECTOR:

SCAN DATA FILENAME: D:\

SCAN DATA ANGULAR RESOLUTION: 0.5 deg

APPROXIMATE CIRCUMFERENTIAL SAMPLE SPACING: 0.002 in

SCAN DATA AXIAL RESOLUTION: 0.02 in

REPORT AXIAL RESOLUTION: 0.5 in

NUMBER OF LAND SAMPLES PER CALCULATION: 15

NUMBER OF GROOVE SAMPLES PER CALCULATION: 31

REPORT GENERATED ON: 1/30/2004

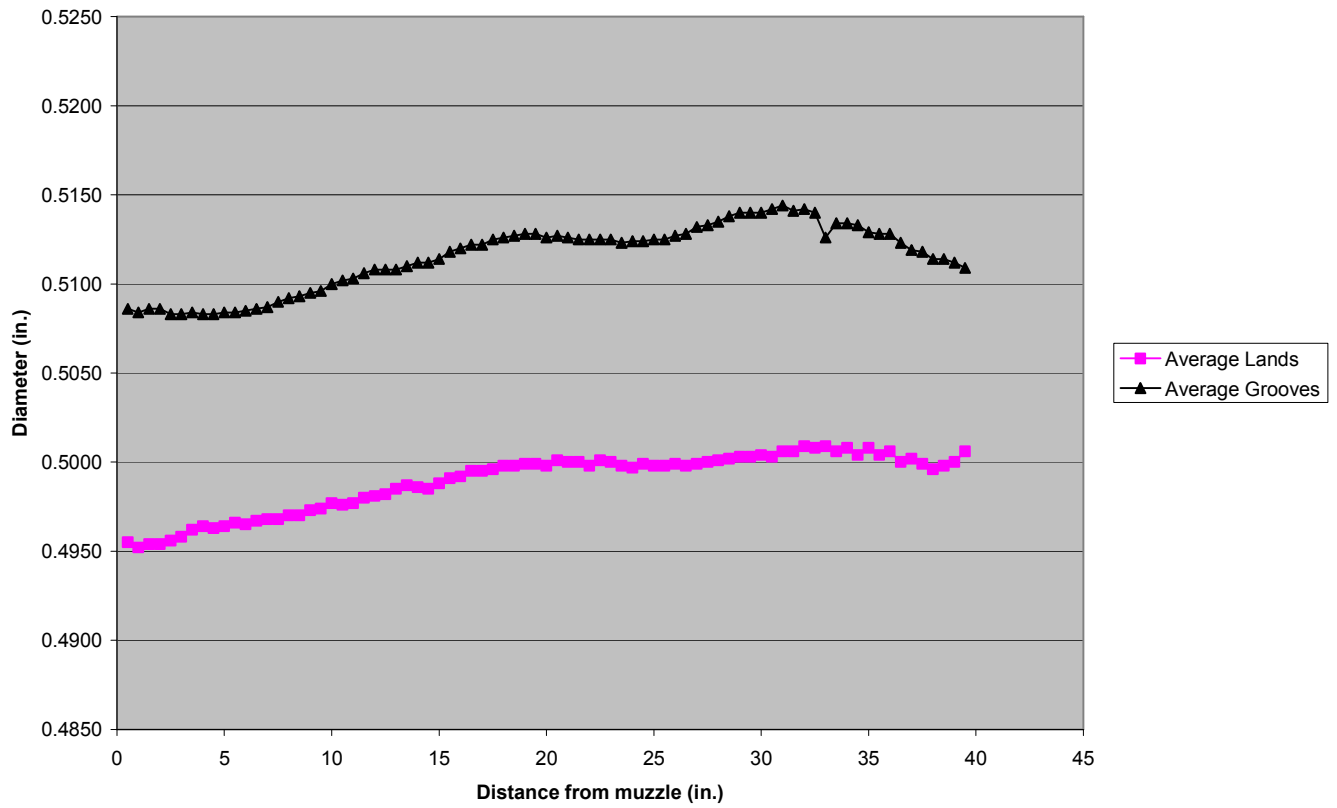
NOTE: Land 1 is the first land above 0 degrees at the muzzle end.

COMMENTS:

Diameter calculations											
Dist. from muzzle	Scan pos.	Lands 1&5	Grooves 1&5	Lands 2&6	Grooves 2&6	Lands 3&7	Grooves 3&7	Lands 4&8	Grooves 4&8	Average Lands	Average Grooves
0.5	-39.22	0.4950	0.5080	0.4965	0.5090	0.4955	0.5090	0.4950	0.5085	0.4955	0.5086
1	-38.72	0.4950	0.5080	0.4955	0.5085	0.4955	0.5090	0.4945	0.5080	0.4952	0.5084
1.5	-38.22	0.4955	0.5085	0.4960	0.5090	0.4950	0.5090	0.4950	0.5080	0.4954	0.5086
2	-37.72	0.4955	0.5090	0.4955	0.5090	0.4950	0.5085	0.4955	0.5080	0.4954	0.5086
2.5	-37.22	0.4960	0.5085	0.4955	0.5085	0.4950	0.5080	0.4955	0.5080	0.4956	0.5083
3	-36.72	0.4965	0.5090	0.4960	0.5085	0.4955	0.5080	0.4955	0.5075	0.4958	0.5083
3.5	-36.22	0.4965	0.5090	0.4960	0.5085	0.4955	0.5080	0.4965	0.5080	0.4962	0.5084
4	-35.72	0.4965	0.5090	0.4960	0.5085	0.4960	0.5080	0.4970	0.5080	0.4964	0.5083
4.5	-35.22	0.4965	0.5085	0.4960	0.5085	0.4965	0.5080	0.4965	0.5085	0.4963	0.5083
5	-34.72	0.4965	0.5085	0.4960	0.5080	0.4965	0.5080	0.4970	0.5085	0.4964	0.5084
5.5	-34.22	0.4965	0.5090	0.4960	0.5080	0.4970	0.5080	0.4970	0.5085	0.4966	0.5084
6	-33.72	0.4965	0.5085	0.4965	0.5080	0.4970	0.5080	0.4965	0.5090	0.4965	0.5085
6.5	-33.22	0.4965	0.5085	0.4965	0.5080	0.4970	0.5090	0.4965	0.5090	0.4967	0.5086
7	-32.72	0.4965	0.5080	0.4970	0.5085	0.4970	0.5090	0.4965	0.5090	0.4968	0.5087
7.5	-32.22	0.4965	0.5090	0.4975	0.5085	0.4970	0.5095	0.4965	0.5090	0.4968	0.5090
8	-31.72	0.4970	0.5085	0.4975	0.5095	0.4970	0.5095	0.4965	0.5090	0.4970	0.5092
8.5	-31.22	0.4970	0.5090	0.4980	0.5095	0.4965	0.5095	0.4965	0.5090	0.4970	0.5093
9	-30.72	0.4975	0.5095	0.4980	0.5100	0.4970	0.5095	0.4965	0.5090	0.4973	0.5095
9.5	-30.22	0.4980	0.5095	0.4975	0.5105	0.4970	0.5095	0.4970	0.5090	0.4974	0.5096
10	-29.72	0.4985	0.5100	0.4980	0.5105	0.4975	0.5100	0.4970	0.5095	0.4977	0.5100
10.5	-29.22	0.4980	0.5105	0.4980	0.5105	0.4970	0.5100	0.4975	0.5100	0.4976	0.5102
11	-28.72	0.4980	0.5105	0.4975	0.5110	0.4975	0.5100	0.4980	0.5100	0.4977	0.5103
11.5	-28.22	0.4985	0.5110	0.4980	0.5110	0.4975	0.5100	0.4980	0.5105	0.4980	0.5106
12	-27.72	0.4985	0.5110	0.4975	0.5105	0.4980	0.5105	0.4985	0.5110	0.4981	0.5108
12.5	-27.22	0.4985	0.5110	0.4980	0.5105	0.4980	0.5105	0.4985	0.5115	0.4982	0.5108
13	-26.72	0.4985	0.5110	0.4985	0.5105	0.4985	0.5105	0.4990	0.5110	0.4985	0.5108
13.5	-26.22	0.4985	0.5110	0.4985	0.5105	0.4990	0.5110	0.4990	0.5110	0.4987	0.5110
14	-25.72	0.4980	0.5110	0.4985	0.5110	0.4990	0.5120	0.4990	0.5110	0.4986	0.5112
14.5	-25.22	0.4980	0.5105	0.4985	0.5105	0.4990	0.5125	0.4985	0.5110	0.4985	0.5112
15	-24.72	0.4985	0.5110	0.4990	0.5110	0.4990	0.5125	0.4985	0.5110	0.4988	0.5114
15.5	-24.22	0.4990	0.5115	0.4995	0.5125	0.4995	0.5125	0.4990	0.5110	0.4991	0.5118
16	-23.72	0.4990	0.5115	0.4995	0.5125	0.4995	0.5125	0.4985	0.5110	0.4992	0.5120
16.5	-23.22	0.4995	0.5120	0.4995	0.5130	0.4995	0.5125	0.4990	0.5115	0.4995	0.5122
17	-22.72	0.4995	0.5125	0.5000	0.5125	0.4995	0.5120	0.4990	0.5115	0.4995	0.5122
17.5	-22.22	0.5000	0.5130	0.5000	0.5130	0.4990	0.5125	0.4990	0.5120	0.4996	0.5125
18	-21.72	0.5005	0.5130	0.5000	0.5130	0.4995	0.5120	0.4995	0.5120	0.4998	0.5126
18.5	-21.22	0.5005	0.5135	0.4995	0.5130	0.4995	0.5120	0.5000	0.5120	0.4998	0.5127
19	-20.72	0.5005	0.5135	0.4995	0.5130	0.4995	0.5120	0.5000	0.5125	0.4999	0.5128
19.5	-20.22	0.5000	0.5135	0.4995	0.5125	0.4995	0.5125	0.5005	0.5130	0.4999	0.5128
20	-19.72	0.5000	0.5135	0.4995	0.5120	0.4995	0.5120	0.5005	0.5130	0.4998	0.5126
20.5	-19.22	0.5000	0.5130	0.4995	0.5120	0.5005	0.5125	0.5005	0.5130	0.5001	0.5127
21	-18.72	0.4995	0.5130	0.4995	0.5120	0.5005	0.5125	0.5005	0.5130	0.5000	0.5126
21.5	-18.22	0.4995	0.5125	0.4995	0.5120	0.5005	0.5125	0.5005	0.5130	0.5000	0.5125
22	-17.72	0.4990	0.5120	0.5000	0.5120	0.5005	0.5125	0.5000	0.5130	0.4998	0.5125

Tabular summary of post-processed bore erosion data.

SCAN DATA FILENAME: D:\50 Cal\Test Scan\.sdt



Plot of average diameters for lands and grooves.