

Results at the bottom of table...

### Smoothness Calculation for Sample Data

eventA	Odo A	Drift	c= x1-x2	D= D1 - D2	K < D / C	weird?	1st Diff	2nd Diff
fitting	123.31	-62.16						
weld	144.23	-62.05						
weld	189.38	-61.95						
casing	224.41	-62.52						
weld	234.45	-62.05						
weld	279.53	-61.97	45.08	0.08	0.0018		0.08	
casing	304.78	-61.14						
weld	324.62	-61.91	45.09	0.06	0.0013		0.06	-0.02
weld	331.07	-61.93	6.45	0.02	0.0031		-0.02	-0.08
weld	373.51	-61.99	42.44	0.06	0.0014		-0.06	-0.04
weld	418.55	-62.04	45.04	0.05	0.0011		-0.05	0.01
weld	463.57	-62.05	45.02	0.01	0.0002		-0.01	0.04
weld	508.58	-62.05	45.01	0.00	0.0000		0.00	0.01
weld	553.61	-62.13	45.03	0.08	0.0018		-0.08	-0.08
weld	598.60	-62.11	44.99	0.02	0.0004		0.02	0.10
weld	643.66	-62.06	45.06	0.05	0.0011		0.05	0.03
weld	688.68	-62.06	45.02	0.00	0.0000		0.00	-0.05
weld	733.68	-62.04	45.00	0.02	0.0004		0.02	0.02
weld	778.71	-61.97	45.03	0.07	0.0016		0.07	0.05
weld	823.75	-61.86	45.04	0.11	0.0024		0.11	0.04
weld	868.77	-61.78	45.02	0.08	0.0018		0.08	-0.03
weld	913.74	-61.74	44.97	0.04	0.0009		0.04	-0.04
weld	958.82	-61.56	45.08	0.18	0.0040		0.18	0.14
weld	1,003.84	-61.42	45.02	0.14	0.0031		0.14	-0.04
weld	1,048.81	-61.37	44.97	0.05	0.0011		0.05	-0.09
weld	1,093.83	-61.30	45.02	0.07	0.0016		0.07	0.02
weld	1,123.19	-61.20	29.36	0.10	0.0034		0.10	0.03
weld	1,168.36	-61.12	45.17	0.08	0.0018		0.08	-0.02
weld	1,213.39	-61.10	45.03	0.02	0.0004		0.02	-0.06
weld	1,258.39	-61.08	45.00	0.02	0.0004		0.02	0.00
weld	1,303.42	-60.94	45.03	0.14	0.0031		0.14	0.12
weld	1,348.40	-60.92	44.98	0.02	0.0004		0.02	-0.12

weld	1,393.36	-60.84	44.96	0.08	0.0018		0.08	0.06
weld	1,438.35	-60.83	44.99	0.01	0.0002		0.01	-0.07
weld	1,483.38	-60.76	45.03	0.07	0.0016		0.07	0.06
weld	1,528.45	-60.68	45.07	0.08	0.0018		0.08	0.01
weld	1,573.50	-60.54	45.05	0.14	0.0031		0.14	0.06
weld	1,618.51	-60.43	45.01	0.11	0.0024		0.11	-0.03
weld	1,663.54	-60.40	45.03	0.03	0.0007		0.03	-0.08
weld	1,708.64	-60.30	45.10	0.10	0.0022		0.10	0.07
weld	1,753.67	-60.31	45.03	0.01	0.0002		-0.01	-0.11
bend								
weld	1,798.79	-60.20	45.12	0.11	0.0024		0.11	0.12
weld	1,843.88	-60.08	45.09	0.12	0.0027		0.12	0.01
weld	1,888.89	-60.10	45.01	0.02	0.0004		-0.02	-0.14
weld	1,933.90	-60.02	45.01	0.08	0.0018		0.08	0.10
weld	1,978.82	-60.01	44.92	0.01	0.0002		0.01	-0.07
weld	2,023.84	-59.94	45.02	0.07	0.0016		0.07	0.06
weld	2,068.84	-59.82	45.00	0.12	0.0027		0.12	0.05
weld	2,113.79	-59.78	44.95	0.04	0.0009		0.04	-0.08
weld	2,158.77	-59.70	44.98	0.08	0.0018		0.08	0.04
weld	2,203.75	-59.60	44.98	0.10	0.0022		0.10	0.02
weld	2,248.76	-59.44	45.01	0.16	0.0036		0.16	0.06
weld	2,293.69	-59.39	44.93	0.05	0.0011		0.05	-0.11
weld	2,338.62	-59.37	44.93	0.02	0.0004		0.02	-0.03
weld	2,383.55	-59.33	44.93	0.04	0.0009		0.04	0.02
weld	2,428.46	-59.39	44.91	0.06	0.0013		-0.06	-0.10
weld	2,473.35	-59.40	44.89	0.01	0.0002		-0.01	0.05
weld	2,518.22	-59.53	44.87	0.13	0.0029		-0.13	-0.12
weld	2,563.12	-59.72	44.90	0.19	0.0042		-0.19	-0.06
weld	2,607.98	-59.84	44.86	0.12	0.0027		-0.12	0.07
weld	2,652.83	-60.04	44.85	0.20	0.0045		-0.20	-0.08
weld	2,697.70	-60.20	44.87	0.16	0.0036		-0.16	0.04
weld	2,742.63	-60.30	44.93	0.10	0.0022		-0.10	0.06
weld	2,787.51	-60.32	44.88	0.02	0.0004		-0.02	0.08
weld	2,832.43	-60.28	44.92	0.04	0.0009		0.04	0.06

weld	2,877.38	-60.25	44.95	0.03	0.0007		0.03	-0.01
weld	2,922.29	-60.27	44.91	0.02	0.0004		-0.02	-0.05
weld	2,967.17	-60.27	44.88	0.00	0.0000		0.00	0.02
weld	3,012.06	-60.38	44.89	0.11	0.0025		-0.11	-0.11
weld	3,056.94	-60.49	44.88	0.11	0.0025		-0.11	0.00
weld	3,101.91	-60.46	44.97	0.03	0.0007		0.03	0.14
weld	3,146.77	-60.57	44.86	0.11	0.0025		-0.11	-0.14
weld	3,191.73	-60.60	44.96	0.03	0.0007		-0.03	0.08
weld	3,236.69	-60.58	44.96	0.02	0.0004		0.02	0.05
weld	3,281.66	-60.55	44.97	0.03	0.0007		0.03	0.01
weld	3,326.71	-60.50	45.05	0.05	0.0011		0.05	0.02
weld	3,371.69	-60.46	44.98	0.04	0.0009		0.04	-0.01
weld	3,416.72	-60.32	45.03	0.14	0.0031		0.14	0.10
weld	3,461.70	-60.31	44.98	0.01	0.0002		0.01	-0.13
weld	3,506.73	-60.19	45.03	0.12	0.0027		0.12	0.11
weld	3,551.71	-60.20	44.98	0.01	0.0002		-0.01	-0.13
weld	3,596.68	-60.24	44.97	0.04	0.0009		-0.04	-0.03
weld	3,641.68	-60.29	45.00	0.05	0.0011		-0.05	-0.01
weld	3,686.68	-60.31	45.00	0.02	0.0004		-0.02	0.03
weld	3,731.88	-60.12	45.20	0.19	0.0042		0.19	0.21
weld	3,776.94	-60.22	45.06	0.10	0.0022		-0.10	-0.29
weld	3,821.98	-60.11	45.04	0.11	0.0024		0.11	0.21
weld	3,867.03	-59.99	45.05	0.12	0.0027		0.12	0.01
weld	3,912.19	-59.78	45.16	0.21	0.0047		0.21	0.09
weld	3,939.52	-59.67	27.33	0.11	0.0040		0.11	-0.10
weld	3,984.67	-59.52	45.15	0.15	0.0033		0.15	0.04
weld	4,029.72	-59.59	45.05	0.07	0.0016		-0.07	-0.22
weld	4,074.79	-59.57	45.07	0.02	0.0004		0.02	0.09
weld	4,119.75	-59.64	44.96	0.07	0.0016		-0.07	-0.09
weld	4,164.80	-59.58	45.05	0.06	0.0013		0.06	0.13
weld	4,209.77	-59.47	44.97	0.11	0.0024		0.11	0.05
weld	4,254.79	-59.37	45.02	0.10	0.0022		0.10	-0.01
weld	4,299.93	-59.14	45.14	0.23	0.0051		0.23	0.13
weld	4,344.99	-59.12	45.06	0.02	0.0004		0.02	-0.21

weld	4,390.15	-59.11	45.16	0.01	0.0002		0.01	-0.01
weld	4,435.31	-59.06	45.16	0.05	0.0011		0.05	0.04
weld	4,480.51	-58.99	45.20	0.07	0.0015		0.07	0.02
weld	4,525.68	-58.91	45.17	0.08	0.0018		0.08	0.01
weld	4,570.97	-58.79	45.29	0.12	0.0026		0.12	0.04
weld	4,616.30	-58.63	45.33	0.16	0.0035		0.16	0.04
weld	4,661.58	-58.48	45.28	0.15	0.0033		0.15	-0.01
weld	4,706.85	-58.43	45.27	0.05	0.0011		0.05	-0.10
weld	4,752.03	-58.37	45.18	0.06	0.0013		0.06	0.01
weld	4,797.37	-58.24	45.34	0.13	0.0029		0.13	0.07
weld	4,842.69	-58.15	45.32	0.09	0.0020		0.09	-0.04
weld	4,881.44	-58.08	38.75	0.07	0.0018		0.07	-0.02
bend	4,906.69	-59.36				weird		
weld	4,926.57	-58.24	45.13	0.16	0.0035	weird	-0.16	-0.23
weld	4,971.82	-58.22	45.25	0.02	0.0004		0.02	0.18
weld	5,017.10	-58.10	45.28	0.12	0.0027		0.12	0.10
weld	5,051.39	-58.06	34.29	0.04	0.0012		0.04	-0.08
weld	5,096.64	-58.01	45.25	0.05	0.0011		0.05	0.01
weld	5,141.97	-57.89	45.33	0.12	0.0026		0.12	0.07
bend	5,177.37	-58.48						
weld	5,187.24	-57.77	45.27	0.12	0.0027		0.12	0.00
weld	5,232.59	-57.61	45.35	0.16	0.0035		0.16	0.04
weld	5,277.84	-57.55	45.25	0.06	0.0013		0.06	-0.10
weld	5,322.99	-57.53	45.15	0.02	0.0004		0.02	-0.04
weld	5,368.30	-57.40	45.31	0.13	0.0029		0.13	0.11
weld	5,413.55	-57.35	45.25	0.05	0.0011		0.05	-0.08
weld	5,458.75	-57.36	45.20	0.01	0.0002		-0.01	-0.06
weld	5,503.99	-57.31	45.24	0.05	0.0011		0.05	0.06
weld	5,549.40	-57.12	45.41	0.19	0.0042		0.19	0.14
weld	5,594.59	-57.05	45.19	0.07	0.0015		0.07	-0.12
bend	5,625.34	-56.27				weird		
weld	5,639.82	-56.72	45.23	0.33	0.0073	weird	0.33	0.26
agm	5,670.97							
weld	5,678.40	-56.95	38.58	0.23	0.0060		-0.23	-0.56

casing	5,691.37	-57.33				weird		
weld	5,700.47	-56.92	22.07	0.03	0.0014		0.03	0.26
weld	5,723.57	-56.85	23.10	0.07	0.0030		0.07	0.04
casing	5,749.22	-57.01				weird		
weld	5,748.23	-56.83	24.66	0.02	0.0008	weird	0.02	-0.05
weld	5,774.62	-56.78	26.39	0.05	0.0019		0.05	0.03
bend	5,803.41	-59.17				weird		
weld	5,815.94	-56.74	41.32	0.04	0.0010	weird	0.04	-0.01
weld	5,861.09	-56.78	45.15	0.04	0.0009		-0.04	-0.08
weld	5,906.36	-56.77	45.27	0.01	0.0002		0.01	0.05
weld	5,951.66	-56.72	45.30	0.05	0.0011		0.05	0.04
weld	5,996.96	-56.57	45.30	0.15	0.0033		0.15	0.10
weld	6,024.95	-56.51	27.99	0.06	0.0021		0.06	-0.09
weld	6,070.26	-56.32	45.31	0.19	0.0042		0.19	0.13
weld	6,115.44	-56.14	45.18	0.18	0.0040		0.18	-0.01
weld	6,160.74	-55.96	45.30	0.18	0.0040		0.18	0.00
weld	6,205.90	-55.87	45.16	0.09	0.0020		0.09	-0.09
weld	6,251.13	-55.75	45.23	0.12	0.0027		0.12	0.03
weld	6,296.29	-55.72	45.16	0.03	0.0007		0.03	-0.09
weld	6,341.55	-55.58	45.26	0.14	0.0031		0.14	0.11
weld	6,386.81	-55.44	45.26	0.14	0.0031		0.14	0.00
weld	6,432.09	-55.32	45.28	0.12	0.0027		0.12	-0.02
weld	6,465.14	-55.25	33.05	0.07	0.0021		0.07	-0.05
weld	6,508.52	-55.02	43.38	0.23	0.0053		0.23	0.16
weld	6,553.83	-54.78	45.31	0.24	0.0053		0.24	0.01
weld	6,579.72	-54.72	25.89	0.06	0.0023		0.06	-0.18
weld	6,622.65	-54.61	42.93	0.11	0.0026		0.11	0.05
weld	6,630.85	-54.58	8.20	0.03	0.0037		0.03	-0.08
weld	6,638.85	-54.57	8.00	0.01	0.0013		0.01	-0.02
bend	6,669.32	-54.84				weird		
weld	6,678.56	-54.40	39.71	0.17	0.0043	weird	0.17	0.16
bend	6,686.68							
weld	6,719.75	-53.98	41.19	0.42	0.0102	weird	0.42	0.25
pipe	6,719.77							

weld	6,721.76	-52.39				weird	1.59	1.17
weld	6,758.22	-50.89	36.46	1.50	0.0411		1.50	-0.09
misc	6,771.28							
misc	6,790.64							
weld	6,799.29	-50.97	41.07	0.08	0.0019		-0.08	-1.58
weld	6,840.45	-50.92	41.16	0.05	0.0012		0.05	0.13
misc	6,842.73							
weld	6,843.47	-50.89	3.02	0.03	0.0099		0.03	-0.02
pipe	6,843.49							
weld	6,889.24	-50.10	45.77	0.79	0.0173		0.79	0.76
weld	6,935.15	-49.52	45.91	0.58	0.0126		0.58	-0.21
weld	6,980.36	-49.18	45.21	0.34	0.0075		0.34	-0.24
weld	7,025.61	-48.95	45.25	0.23	0.0051		0.23	-0.11
bend	7,055.80	-50.94				weird		
weld	7,068.84	-48.66	43.23	0.29	0.0067	weird	0.29	0.06
bend	7,080.18	-47.66				weird		
weld	7,114.03	-48.57	45.19	0.09	0.0020	weird	0.09	-0.20
weld	7,159.27	-48.44	45.24	0.13	0.0029		0.13	0.04
weld	7,204.59	-48.22	45.32	0.22	0.0049		0.22	0.09
bend	7,240.85	-48.67				weird		
weld	7,249.75	-48.07	45.16	0.15	0.0033	weird	0.15	-0.07
bend	7,285.96	-48.77				weird		
weld	7,295.12	-47.86	45.37	0.21	0.0046	weird	0.21	0.06
weld	7,340.33	-47.83	45.21	0.03	0.0007		0.03	-0.18
weld	7,385.65	-47.64	45.32	0.19	0.0042		0.19	0.16
weld	7,430.90	-47.47	45.25	0.17	0.0038		0.17	-0.02
weld	7,476.21	-47.23	45.31	0.24	0.0053		0.24	0.07
misc	7,521.20							
weld	7,521.49	-47.16	45.28	0.07	0.0015		0.07	-0.17
weld	7,566.78	-47.09	45.29	0.07	0.0015		0.07	0.00
weld	7,611.99	-47.00	45.21	0.09	0.0020		0.09	0.02
weld	7,657.27	-46.77	45.28	0.23	0.0051		0.23	0.14
weld	7,702.51	-46.75	45.24	0.02	0.0004		0.02	-0.21
weld	7,747.85	-46.61	45.34	0.14	0.0031		0.14	0.12

bend	7,784.99							
weld	7,793.10	-46.41	45.25	0.20	0.0045		0.20	0.06
weld	7,838.25	-46.11	45.15	0.30	0.0066		0.30	0.10
weld	7,883.39	-46.08	45.13	0.03	0.0006		0.03	-0.27
weld	7,928.42	-46.18	45.03	0.09	0.0021		-0.09	-0.12
weld	7,973.68	-45.99	45.26	0.19	0.0041		0.19	0.28
bend	8,009.70							
weld	8,018.78	-45.91	45.10	0.08	0.0018		0.08	-0.10
weld	8,060.69	-45.80	41.90	0.11	0.0025		0.11	0.02

### Not-Weird Data - Exclude weird joint boundaries

Drift gets weird after a non-weld because the measurement tolerance, particularly around bends, MUCH larger than weld-to-weld drifts

Lipschitz Constant,  $K$

	0.23	0.0051		0.23	0.13
	0.54	0.0134			
mean		0.0027	weird	mean	0.0008
std	non-weird joint boundaries			std	0.1911
max		0.0411		max	1.17
min		0.0000			

Second Difference of Drift  
non-weird joint boundaries

### All Data - Including weird joint boundaries

		mean	0.0169
		std	0.0756
		max	0.7910
		min	0.0000

Includes bends and casings

AVERAGE	0.0037	MIN	0.0000	MAX	0.0719	COUNTA	177
---------	--------	-----	--------	-----	--------	--------	-----