数据分析及辅助工具

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专业IC测试网

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集成电路技术分享博客

2015-04-18

主要内容

1. 数据分析常见内容
2. 测试BIN信息
3. CP Mapping 及 复测数据
4. 多工位测试项分析
5. Data Correlation
6. G&R&R 测试
7. Production Lots

前言

- 为什么要分析测试数据？
- 大家常用的数据分析工具有哪些？
- 你愿意花多少时间在分析测试数据上？效果如何？
- 如何合理利用工具，进行快速有效的数据分析？

数据基本信息

ID	名称	批号	程序	良率	大小	上传日期
120	24113100_24113100_12_ETS142817_09012014.std_1	24113100	A[illegible]_XX_Q_EC0	98.6607%	8.89 MB	2015-04-12
121	24113100_24113100_09_ETS115803_09012014.std_1	24113100	A[illegible]_XX_Q_EC0	98.5401%	8.88 MB	2015-04-12
122	24113100_24113100_05_ETS021144_09012014.std_1	24113100	A[illegible]_XX_Q_EC0	98.4496%	8.89 MB	2015-04-12
123	24113100_24113100_18_ETS192007_09012014.std_1	24113100	A[illegible]_XX_Q_EC0	98.534%	8.89 MB	2015-04-12
124	24113100_24113100_19_ETS200826_09012014.std_1	24113100	A[illegible]_XX_Q_EC0	98.4737%	8.89 MB	2015-04-12
127	7404825_3_w007.std	7404825	A[illegible]_C0_D_C1.Default	97.511%	20.58 MB	2015-04-12
128	T404825_3_w008.std	T404825	A[illegible]_C0_D_C1.Default	98.0438%	20.2 MB	2015-04-12
129	T404825_3_w009.std	T404825	A[illegible]_C0_D_C1.Default	97.5157%	20.3 MB	2015-04-12
130	T404825_3_w010.std	T404825	A[illegible]_C0_D_C1.Default	97.1549%	20.38 MB	2015-04-12
131	7404825_3_w006.std	7404825	A[illegible]_C0_D_C1.Default	96.7296%	20.48 MB	2015-04-12
133	_23259850_10_ETS122812_08162013.std_1		A[illegible]_C3_	98.2173%	12.77 MB	2015-04-12
134	_23189850_01_ETS231028_07022013.std_1		A[illegible]_C3_	98.3634%	12.01 MB	2015-04-12
135	_23189850_03_ETS060506_07032013.std_1		A[illegible]_C3_	96.2593%	12.01 MB	2015-04-12
136	_23189850_02_ETS002529_07032013.std_1		A[illegible]_C3_	97.9426%	12.18 MB	2015-04-12
138	_23189850_04_ETS070252_07032013.std_1		A[illegible]_C3_	97.3523%	12.39 MB	2015-04-12
139	_22459620_17_ETS120704_02082013.std_1		A[illegible]_C1	93.4537%	12.41 MB	2015-04-12
140	23209970_23209970_12.std_1	23209970	A[illegible]_C0	98.1816%	9.26 MB	2015-04-12
141	23209970_23209970_06.std_1	23209970	A[illegible]_C0	98.5147%	9.27 MB	2015-04-12
142	23209970_23209970_07.std_1	23209970	A[illegible]_C0	97.5891%	9.27 MB	2015-04-12
143	23209970_23209970_14.std_1	23209970	A[illegible]_C0	94.6632%	9.26 MB	2015-04-12

常见分析内容

名称:	3337282_3337280_06_ETS031603_03082014.std_1					测试日期:	2014-03-08 07:14:21
程序:	[redacted]Q_CP_Active_Hi	工位数:	4	测试数量:	35993	上传日期:	2015-04-12
Tester:	ETS-11	Handler:	TSK UF190	批号:	NO_LOTNUM	子批:	3337280_06

Series	Number	TestItems	L.Limit	U.Limit	Units	Min	Max	Exec Qty	Failures	Yield	Mean	Stdev	CPU	CPL	CPK
0	100001	Cont-EN	-1.0	-0.2	VOLTS	-10.23367	-0.42335	35993	14	99.96%	-0.43839	0.19334	0.41101	0.96829	0.41101
1	100002	Cont-FLG	-1.0	-0.2	VOLTS	-10.23396	-0.42411	35993	10	99.97%	-0.43709	0.16342	0.48359	1.14815	0.48359
2	100003	Cont-VOUT	-1.0	-0.2	VOLTS	-9.77778	-0.12467	35993	12	99.97%	-0.68268	0.1443	1.11498	0.73299	0.73299
3	100004	Cont-VIN	-1.0	-0.2	VOLTS	-0.68011	-0.11647	35993	1	100.00%	-0.44684	0.00681	12.08299	27.07764	12.08299
4	200001	Vout_No_Load	4.5	5.1	VOLTS	-0.00041	6.83813	35968	1057	96.99%	4.85751	0.82085	0.09847	0.14518	0.09847
5	200002	Vout_Load	4.5	5.1	VOLTS	-4.84363	5.90167	35968	1426	95.97%	4.78481	1.02191	0.10281	0.0929	0.0929
6	300001	I_limit_pre	1.76	3.1	AMPS	-0.24978	3.66374	34542	605	94.29%	2.42174	0.19512	1.15873	1.1305	1.1305
7	300002	Fuse_step				0.0	8.0	33937	0	94.29%	2.95539	1.20101			
8	400001	I_limit_post	2.45	3.1	AMPS	-0.13522	3.46709	33937	1951	88.87%	2.77995	0.1598	0.66759	0.68824	0.66759
9	600001	Vout_UVLO_Hi	2.0	2.5	VOLTS	2.38936	2.39038	31986	0	88.87%	2.39009	0.00018	203.92111	723.73708	203.92111
10	600002	Vout_UVLO_Low	-0.5	0.5	VOLTS	-0.00026	1.61001	31986	2	88.86%	0.0	0.01277	13.05067	13.0509	13.05067
11	700001	ShutDown Current	-9.0E-7	9.0E-7	AMPS	0.0	0.00001	31984	499	87.48%	0.0	0.0	0.18096	0.29564	0.18096
12	700002	Quiescent Current	2.5E-5	9.0E-5	AMPS	0.00004	0.0001	31984	307	88.01%	0.00006	0.00001	1.27559	1.11279	1.11279
13	700003	Input Leakage	-9.0E-7	9.0E-7	AMPS	0.0	0.00001	31984	500	87.47%	0.0	0.0	0.18233	0.29498	0.18233
14	700004	Output Leakage	-9.0E-7	9.0E-7	AMPS	0.0	0.0	31984	0	88.86%	0.0	0.0	5280.5054	5282.0190	5280.5054

常见分析内容

STDEV，标准偏差，反映数值相对于平均值(mean) 的离散程度

CPK，制程能力指数，是某个工程或制程水准的量化。

CPK = MIN(CPU, CPL)　　$Cpu = \frac{USL - \overline{X}}{3\sigma}$　　$Cpl = \frac{\overline{X} - LSL}{3\sigma}$

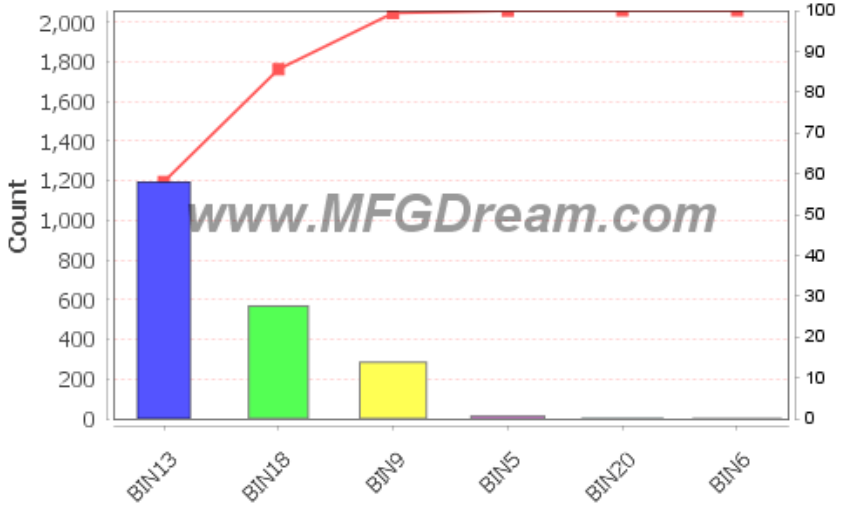
Cpk	Sigma	DPMO （百万机会的缺陷数）	Yield
0.50	1.5	500,000	50%
1.00	3.0	66,800	93.320%
1.17	3.5	22,700	97.730%
1.33	4.0	6,210	99.3790%
1.50	4.5	1,350	99.8650%
1.67	5.0	230	99.9770%
2.00	6.0	3.4	99.99966%

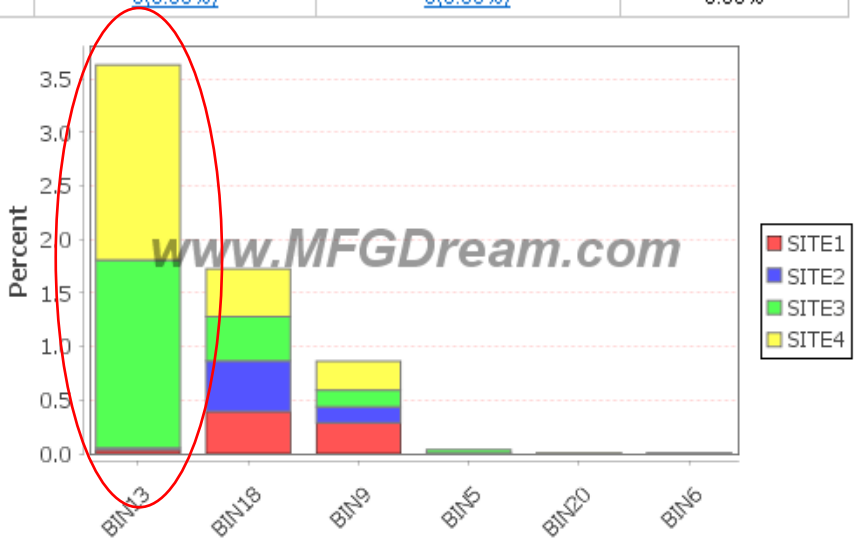
CPK 评级标准			
A++ 级	CPK ≥ 2.0	特优	可以考虑成本的降低
A+ 级	2.0 ＞ CPK ≥ 1.67	优	应当保持
A 级	1.67 ＞ CPK ≥ 1.33	良	能力良好状态稳定，应尽力提升为A+
B 级	1.33 ＞ CPK ≥ 1.0	一般	状态一般，制程因素稍有不良的危险
C 级	1.0 ＞ CPK ≥ 0.67	差	制程不良较多，必须提升能力
D 级	0.67 ＞ CPK	不可接受	能力太差，应考虑重新整改设计制程

测试BIN信息

名称:	3337282_3337280_06_ETS031603_03082014.std_1					测试日期:	2014-03-08 07:14:21
程序:	[redacted]Q_CP_Active_Hi	工位数:	4	测试数量:	35993	上传日期:	2015-04-12
Tester:	ETS-11	Handler:	TSK UF190	批号:	NO_LOTNUM	子批:	3337280_06

BIN	Site1	Site2	Site3	Site4	All Site	% of failures
1	7972(24.24%)	8006(24.34%)	7455(22.67%)	7396(22.49%)	30829(93.74%)	
13	11(0.03%)	6(0.02%)	578(1.76%)	600(1.82%)	1195(3.63%)	58.01%
18	129(0.39%)	156(0.47%)	136(0.41%)	147(0.45%)	568(1.73%)	27.57%
9	95(0.29%)	49(0.15%)	51(0.16%)	89(0.27%)	284(0.86%)	13.79%
5	0(0.00%)	0(0.00%)	12(0.04%)	0(0.00%)	12(0.04%)	0.58%
20	0(0.00%)	0(0.00%)	0(0.00%)	1(0.00%)	1(0.00%)	0.05%
6	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0(0.00%)	0.00%

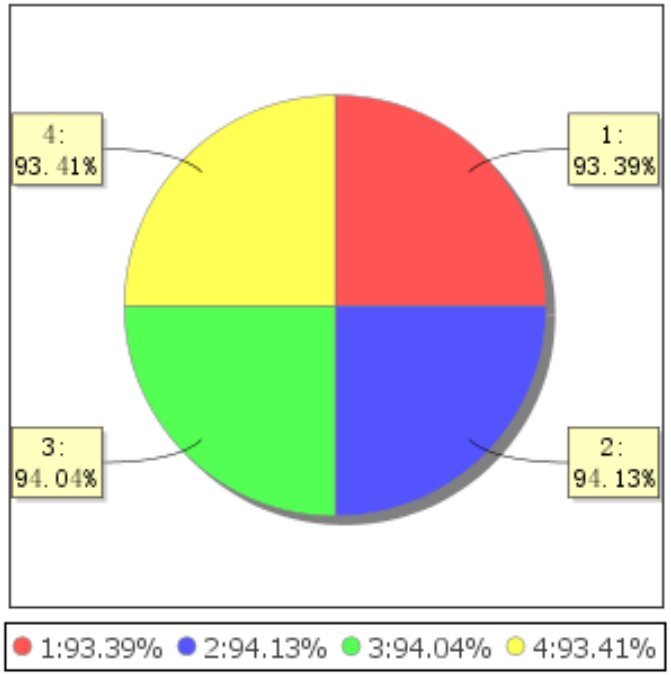


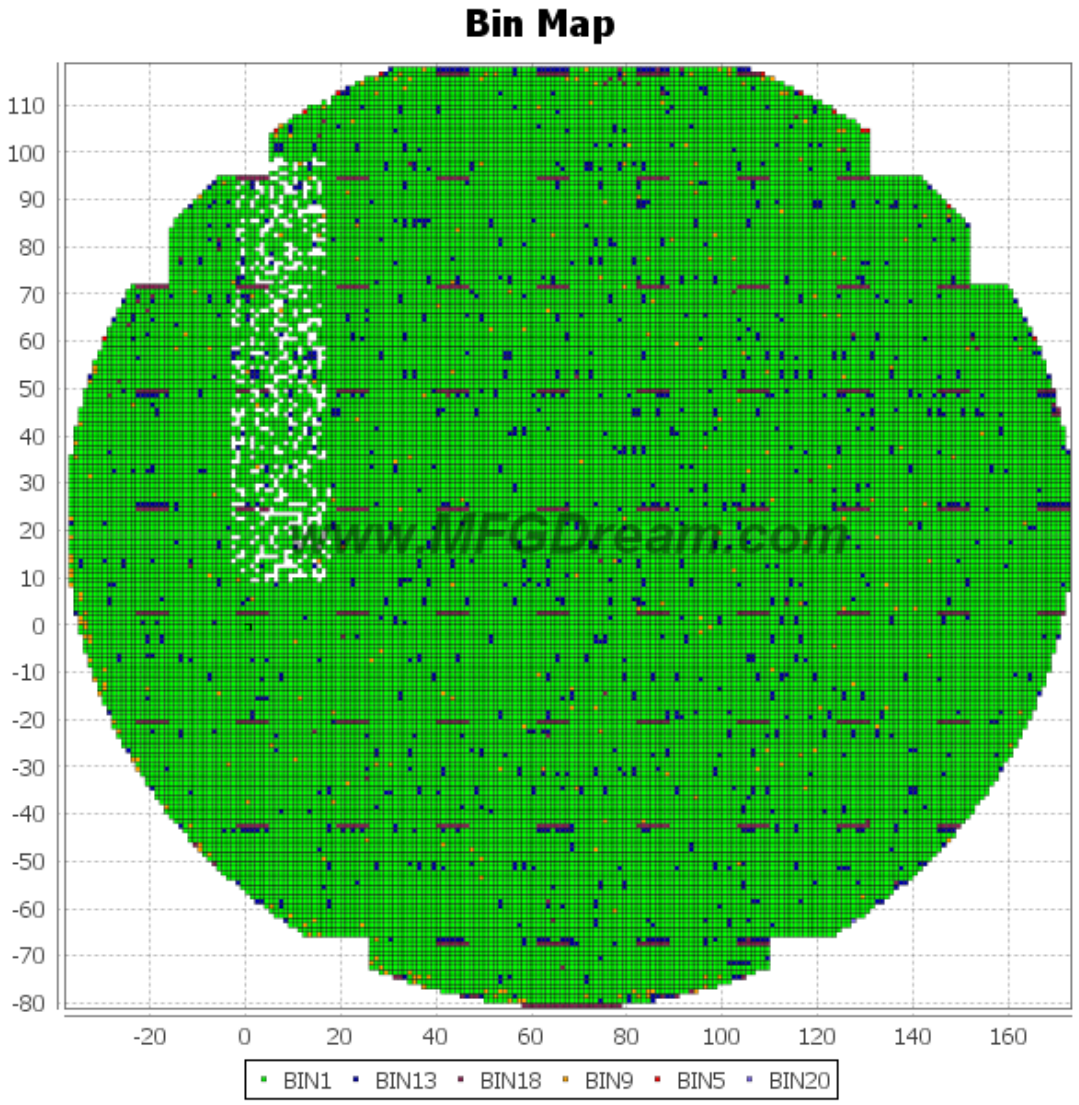


CP 测试数据

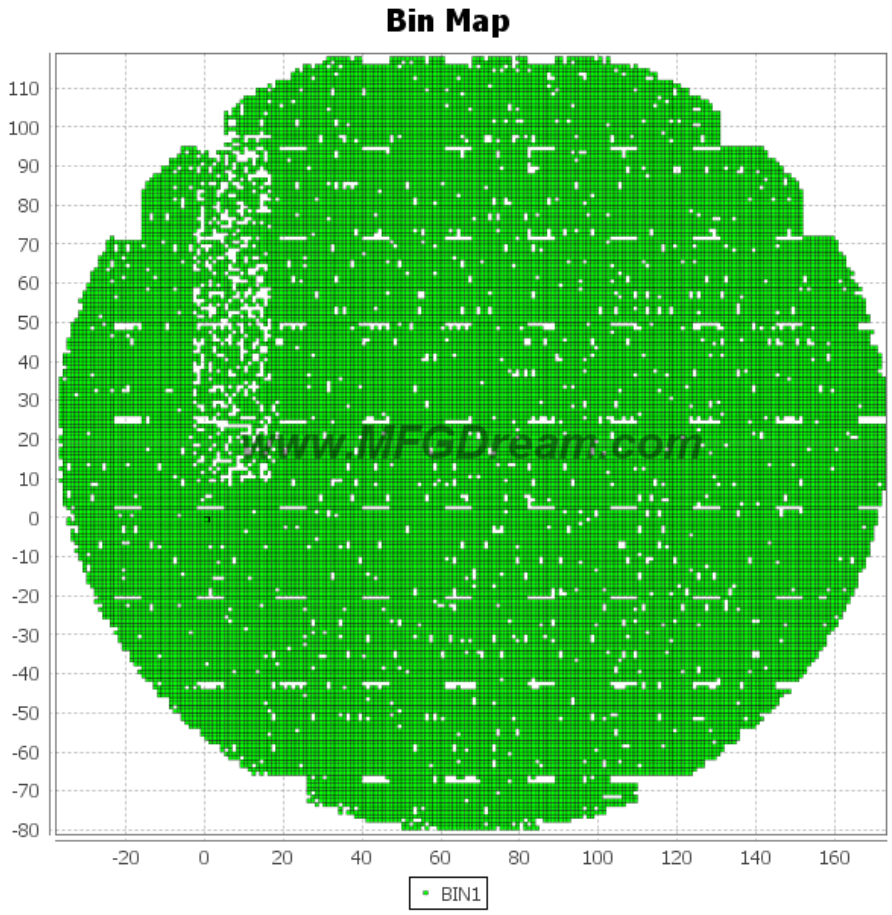
Test Name					IN_OS	POK_OS	VCC_OS	EN_OS	FB_OS	OUT_OS
Test Number					1.1	1.2	1.3	1.4	1.5	1.6
Lower Limit					-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
Upper Limit					-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Units					V	V	V	V	V	V
Site #	Serial #	Bin	XCoord	YCoord						
1	1	8	-49	-40	-0.4386	-0.4419	-0.4318	-0.4303	-0.4291	-0.4394
1	2	17	-49	-40	-0.4391	-0.4418	-0.4318	-0.4302	-0.4291	-0.4391
1	3	1	-48	-40	-0.4371	-0.4396	-0.4305	-0.429	-0.4281	-0.4376
1	4	1	-47	-40	-0.4355	-0.4389	-0.4296	-0.4274	-0.4269	-0.4367
1	5	1	-46	-40	-0.4346	-0.4377	-0.4284	-0.4271	-0.4266	-0.4357
1	6	1	-45	-40	-0.4342	-0.4371	-0.428	-0.4264	-0.4262	-0.4354
1	7	1	-44	-40	-0.4339	-0.4375	-0.4286	-0.427	-0.4264	-0.4349
1	8	1	-43	-40	-0.4335	-0.4374	-0.4276	-0.4263	-0.4263	-0.4347
1	9	1	-42	-40	-0.4338	-0.4372	-0.4288	-0.4267	-0.4264	-0.4349
1	10	1	-41	-40	-0.4336	-0.4375	-0.4283	-0.4264	-0.4266	-0.4349
1	11	1	-40	-40	-0.4339	-0.4375	-0.4283	-0.4271	-0.4265	-0.4349
1	12	1	-39	-40	-0.4335	-0.4374	-0.4283	-0.4264	-0.4257	-0.4346
1	13	1	-38	-40	-0.433	-0.4372	-0.4278	-0.4257	-0.4247	-0.4341
1	14	1	-37	-40	-0.4319	-0.4364	-0.4268	-0.4253	-0.424	-0.4328
1	15	1	-36	-40	-0.432	-0.4353	-0.4267	-0.4249	-0.4256	-0.4335
1	16	1	-35	-40	-0.4326	-0.4362	-0.427	-0.4251	-0.425	-0.4339
1	17	1	-34	-40	-0.4329	-0.4361	-0.427	-0.4253	-0.4255	-0.4343
1	18	1	-33	-40	-0.4334	-0.4371	-0.4282	-0.4262	-0.4267	-0.4349

CP Bin Mapping





CP Bin Map


Bin Map
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50
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30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-20
0
20
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60
80
100
120
140
160
BIN1
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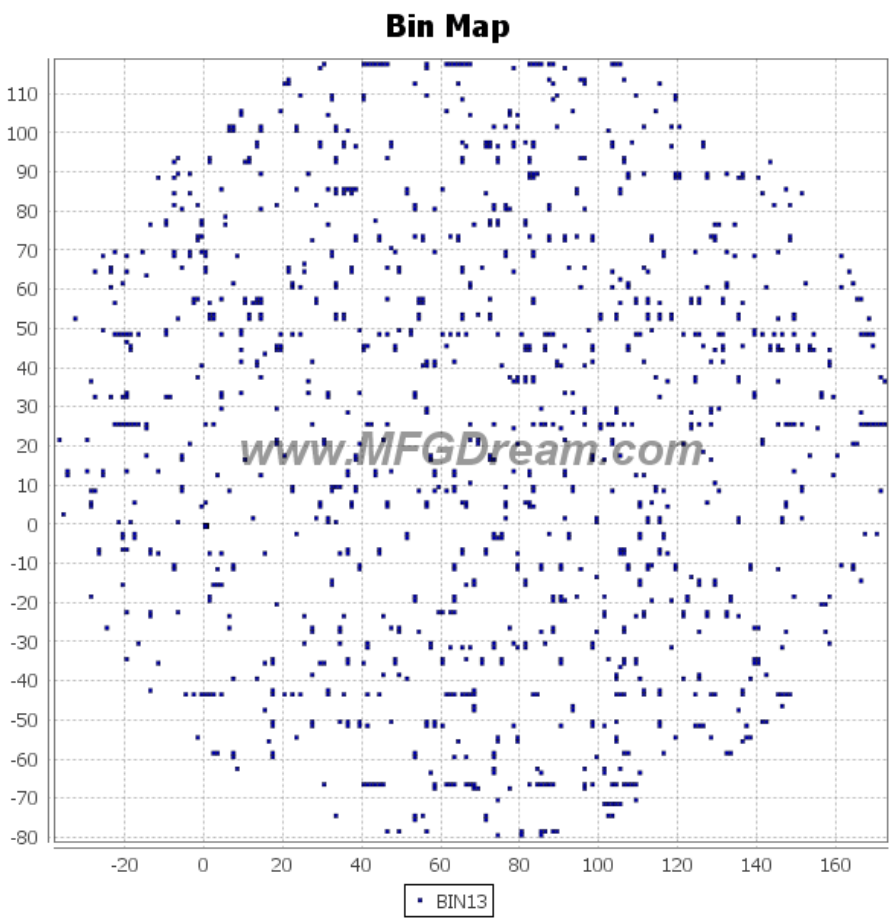
Bin Map
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-10
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-40
-50
-60
-70
-80
-20
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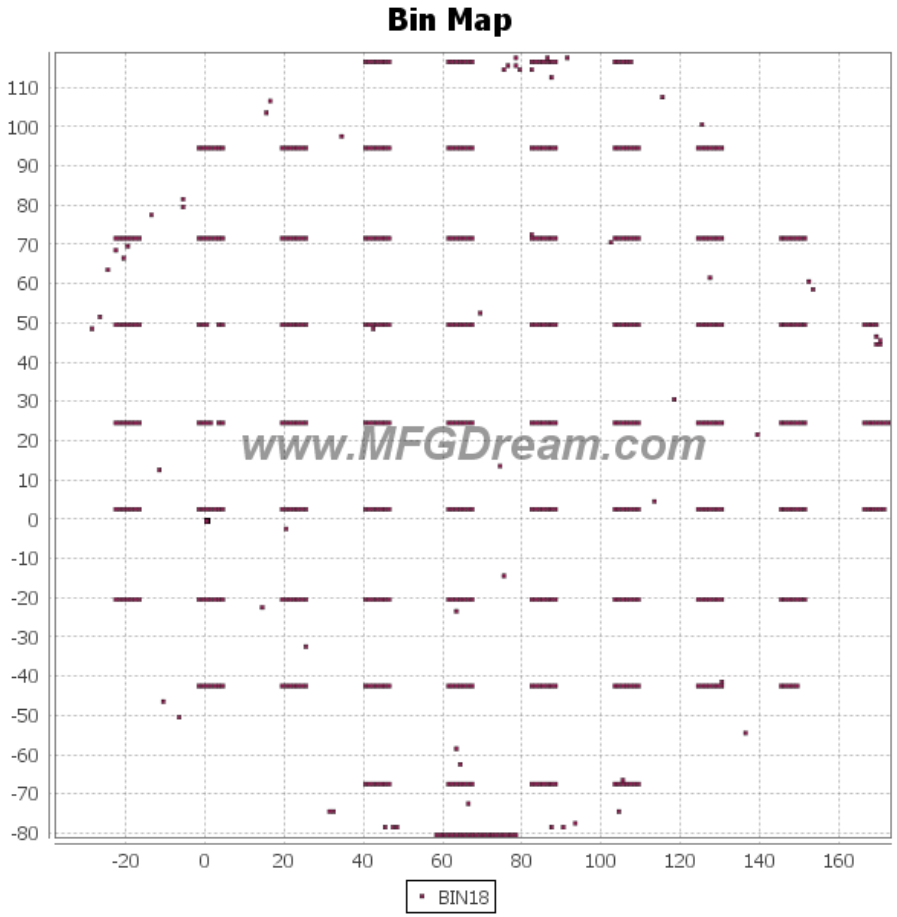
60
80
100
120
140
160
BIN13
www.MFGDream.com

CP Bin Map


Bin Map
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-20
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100
120
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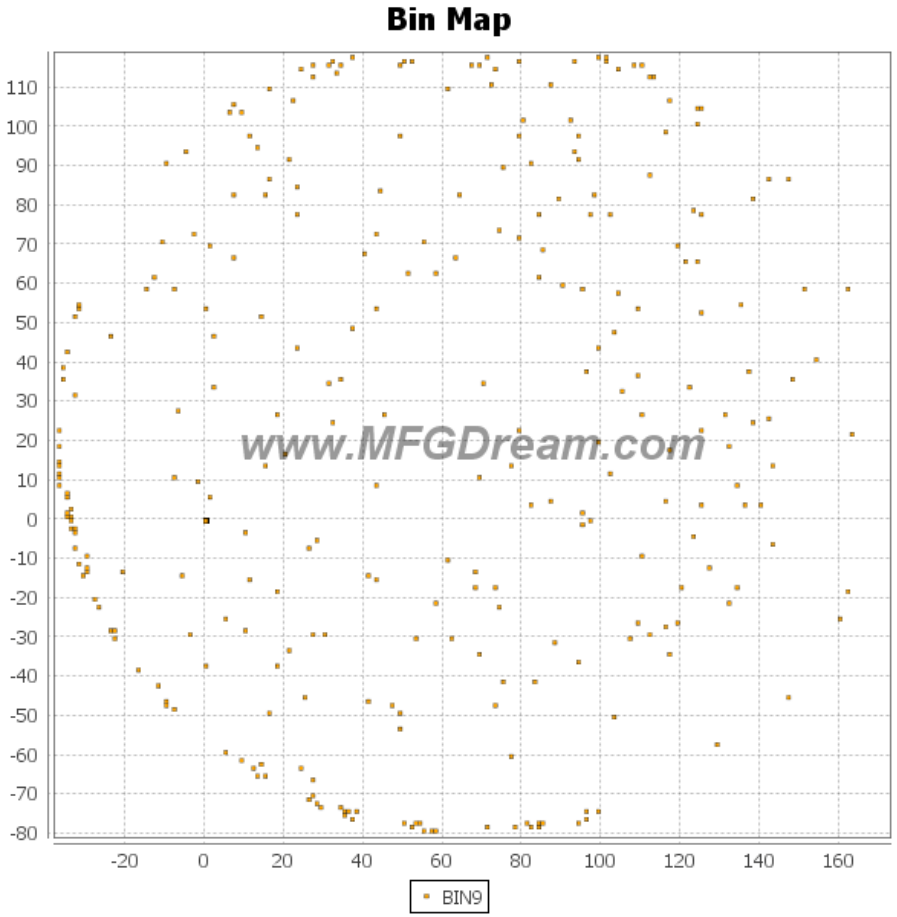
160
www.MFGDream.com
BIN18


Bin Map
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80
70
60
50
40
30
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10
0
-10
-20
-30
-40
-50
-60
-70
-80
-20
0
20
40
60
80
100
120
140
160
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BIN9

复测分析

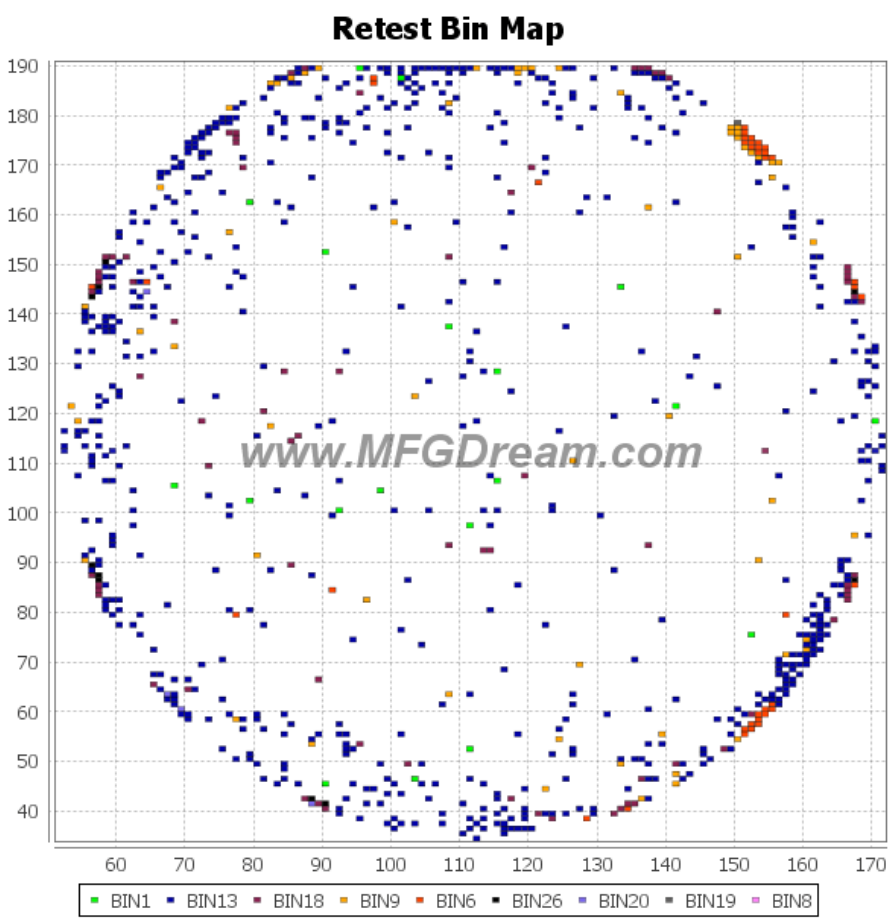
初测数据

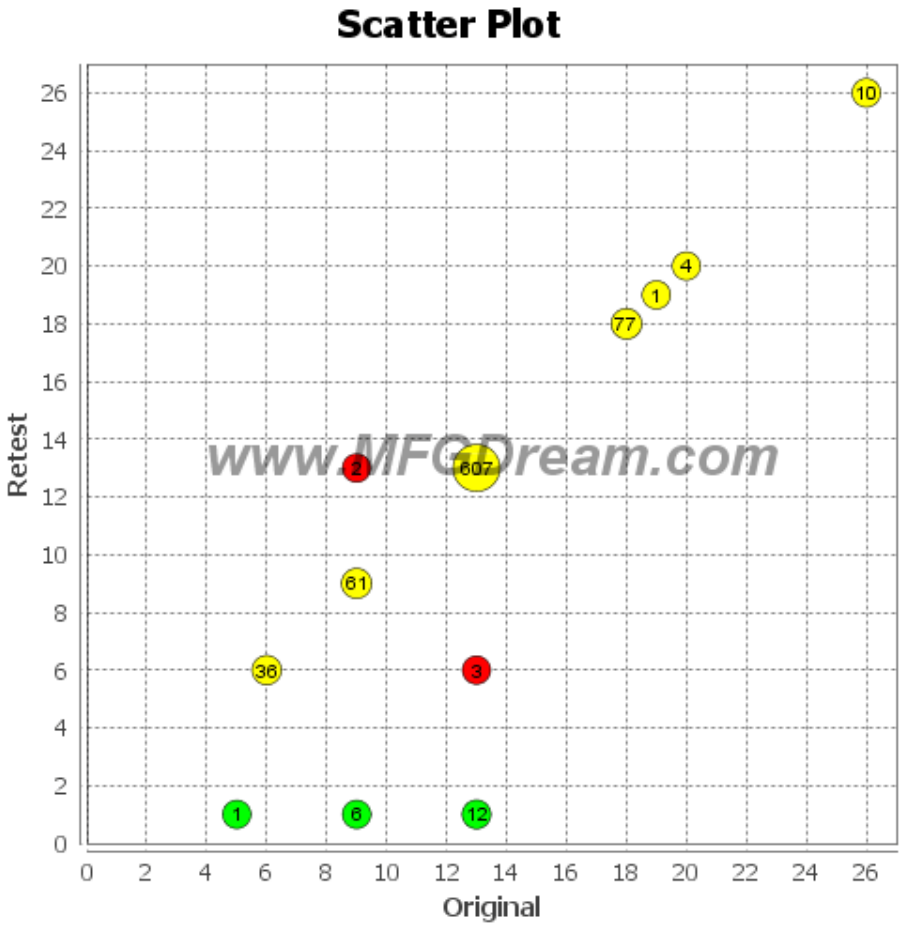
复测数据

Original.Bin	Original.Site1	Original.Site2	Original.Site3	Original.Site4	Original.All	Retest.Bin	Retest.Site1	Retest.Site2	Retest.Site3	Retest.Site4	Retest.All
1	0	0	0	0	0	1	5	2	5	7	19
13	148	157	146	171	622	13	146	155	142	166	609
18	15	19	23	20	77	18	15	19	23	20	77
9	21	14	12	22	69	9	18	13	10	20	61
6	9	10	8	9	36	6	9	11	9	10	39
26	4	2	1	3	10	26	4	2	1	3	10
20	0	1	2	1	4	20	0	1	2	1	4
5	0	0	0	1	1	19	1	0	0	0	1
19	1	0	0	0	1	8	0	0	0	0	0

Original.Bin	Original.Site1	Original.Site2	Original.Site3	Original.Site4	Original.All	Retest.Bin	Retest.Site1	Retest.Site2	Retest.Site3	Retest.Site4	Retest.All
5	0	0	0	1	1	1	0	0	0	1	1
6	9	10	8	9	36	6	9	10	8	9	36
9	2	0	2	2	6	1	2	0	2	2	6
9	18	13	10	20	61	9	18	13	10	20	61
9	1	1	0	0	2	13	1	1	0	0	2
13	3	2	3	4	12	1	3	2	3	4	12
13	0	1	1	1	3	6	0	1	1	1	3
13	145	154	142	166	607	13	145	154	142	166	607
18	15	19	23	20	77	18	15	19	23	20	77
19	1	0	0	0	1	19	1	0	0	0	1
20	0	1	2	1	4	20	0	1	2	1	4
26	4	2	1	3	10	26	4	2	1	3	10

复测分析


Retest Bin Map
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
60 70 80 90 100 110 120 130 140 150 160 170
BIN1 BIN13 BIN18 BIN9 BIN6 BIN26 BIN20 BIN19 BIN8
www.MFGDream.com


Scatter Plot
Retest
Original
0 2 4 6 8 10 12 14 16 18 20 22 24 26
10
4
1
77
2
607
61
36
3
1
6
12
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多工位测试项

测试数据 -项目分析

名称:	3337282_3337280_06_ETS031603_03082014.std_1					测试日期:	2014-03-08 07:14:21
程序:	[redacted]_Q_CP_Active_Hi	工位数:	4	测试数量:	35993	上传日期:	2015-04-12
Tester:	ETS-11	Handler:	TSK UF190	批号:	NO_LOTNUM	子批:	3337280_06

Series	Number	TestItems	L.Limit	U.Limit	Units	Min	Max	Exec Qty	Failures	Yield	Mean	Stdev	CPU	CPL	CPK
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1	100002	Cont-FLG	-1.0	-0.2	VOLTS	-10.23396	-0.42411	35993	10	99.97%	-0.43709	0.16342	0.48359	1.14815	0.48359
2	100003	Cont-VOUT	-1.0	-0.2	VOLTS	-9.77778	-0.12467	35993	12	99.97%	-0.68268	0.1443	1.11498	0.73299	0.73299
3	100004	Cont-VIN	-1.0	-0.2	VOLTS	-0.68011	-0.11647	35993	1	100.00%	-0.44684	0.00681	12.08299	27.07764	12.08299
4	200001	Vout_No_Load	4.5	5.1	VOLTS	-0.00041	6.83813	35968	1057	96.99%	4.85751	0.82085	0.09847	0.14518	0.09847
5	200002	Vout_Load	4.5	5.1	VOLTS	-4.84363	5.90167	35968	1426	95.97%	4.78481	1.02191	0.10281	0.0929	0.0929
6	300001	I_limit_pre	1.76	3.1	AMPS	-0.24978	3.66374	34542	605	94.29%	2.42174	0.19512	1.15873	1.1305	1.1305
7	300002	Fuse_step				0.0	8.0	33937	0	94.29%	2.95539	1.20101			
8	400001	I_limit_post	2.45	3.1	AMPS	-0.13522	3.46709	33937	1951	88.87%	2.77995	0.1598	0.66759	0.68824	0.66759
9	600001	Vout_UVLO_Hi	2.0	2.5	VOLTS	2.38936	2.39038	31986	0	88.87%	2.39009	0.00018	203.92111	723.73708	203.92111
10	600002	Vout_UVLO_Low	-0.5	0.5	VOLTS	-0.00026	1.61001	31986	2	88.86%	0.0	0.01277	13.05067	13.0509	13.05067
11	700001	ShutDown Current	-9.0E-7	9.0E-7	AMPS	0.0	0.00001	31984	499	87.48%	0.0	0.0	0.18096	0.29564	0.18096
12	700002	Quiescent Current	2.5E-5	9.0E-5	AMPS	0.00004	0.0001	31984	307	88.01%	0.00006	0.00001	1.27559	1.11279	1.11279
13	700003	Input Leakage	-9.0E-7	9.0E-7	AMPS	0.0	0.00001	31984	500	87.47%	0.0	0.0	0.18233	0.29498	0.18233
14	700004	Output Leakage	-9.0E-7	9.0E-7	AMPS	0.0	0.0	31984	0	88.86%	0.0	0.0	5280.5054	5282.0190	5280.5054

多工位测试项

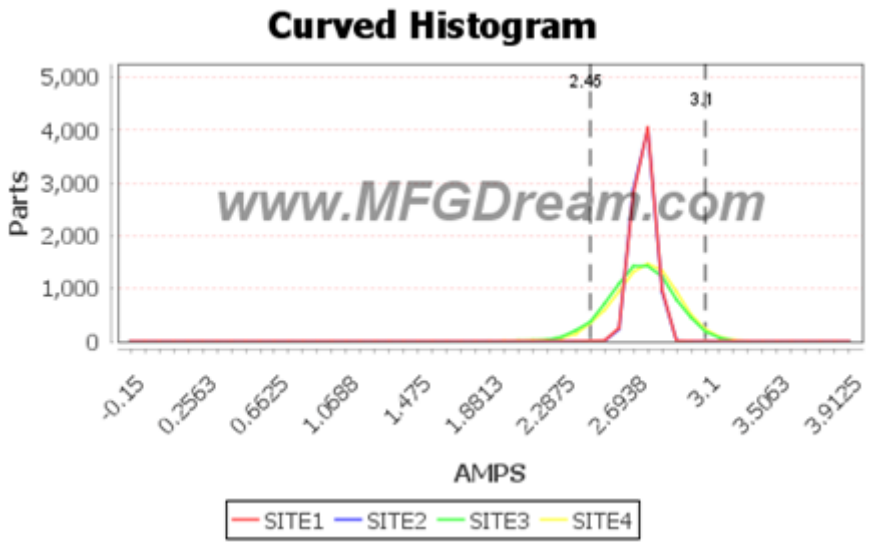
测试数据 - 项目分析

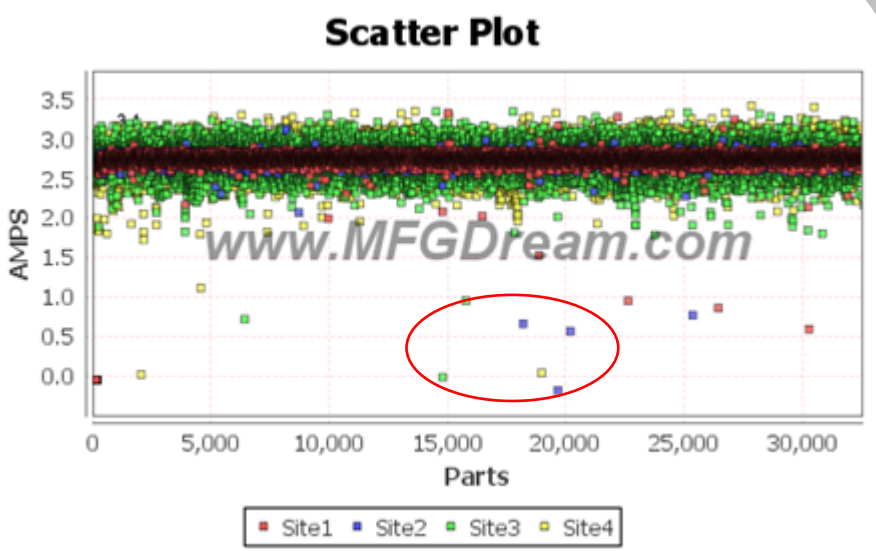
名称:	3337282_3337280_06_ETS031603_03082014.std_1					测试日期:	2014-03-08 07:14:21
程序:	[redacted]_Q_CP_Active_Hi	工位数:	4	测试数量:	35993	上传日期:	2015-04-12
Tester:	ETS-11	Handler:	TSK UF190	批号:	NO_LOTNUM	子批:	3337280_06

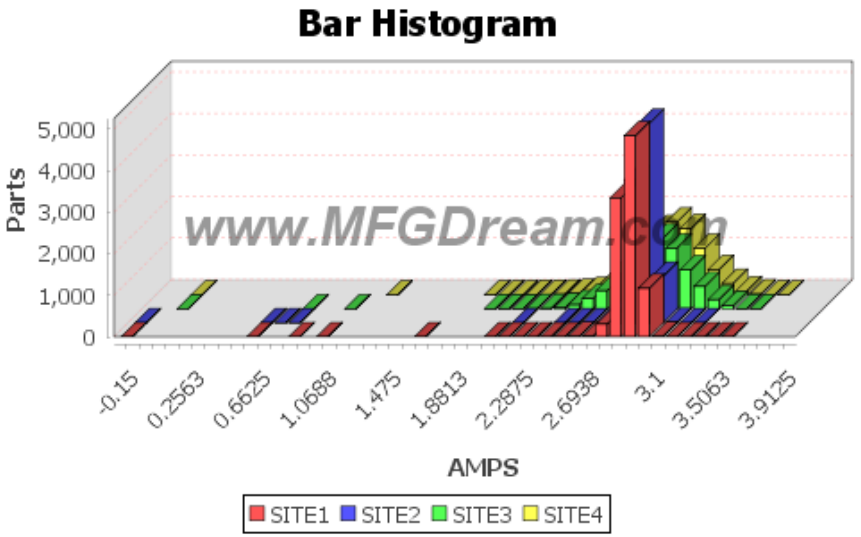
Number	TestItems	L Limit	U Limit	Min Fliter	Max Fliter	Units
400001	I_limit_post	2.45	3.1	N/A	N/A	AMPS

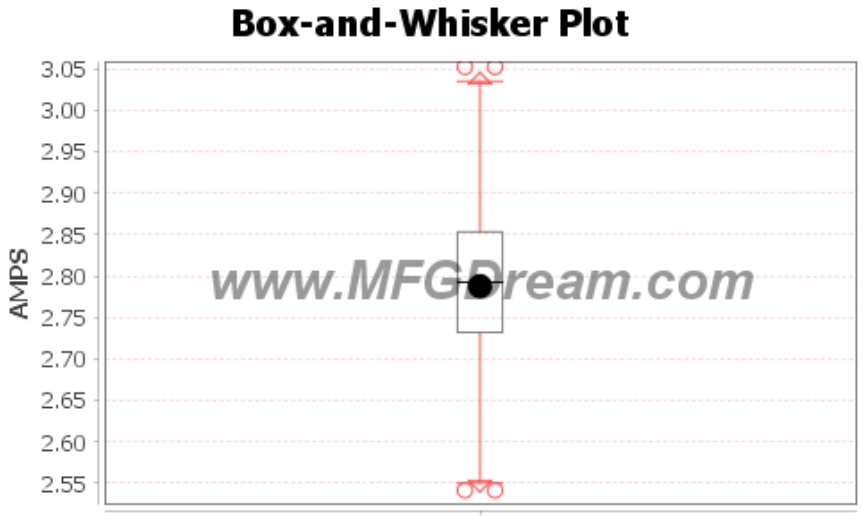
SITE	Exec Qty	Failures	Datalog.Yield	Exec.Yield	Min	Max	Mean	Stdev	CPU	CPL	CPK
ALL	32493	1312	86.63%	95.96%	-0.13522	3.46709	2.78793	0.14707	0.70732	0.76595	0.70732
Site1	8130	18	22.54%	99.78%	-0.08547	3.37262	2.79108	0.078	1.32011	1.45756	1.32011
Site2	8102	12	22.48%	99.85%	-0.13522	3.17479	2.79129	0.0758	1.35756	1.50079	1.35756
Site3	8137	632	20.85%	92.23%	0.02857	3.38903	2.7741	0.1902	0.57116	0.568	0.568
Site4	8124	650	20.77%	92.00%	0.067	3.46709	2.7953	0.19543	0.5197	0.58895	0.5197

多工位测试项

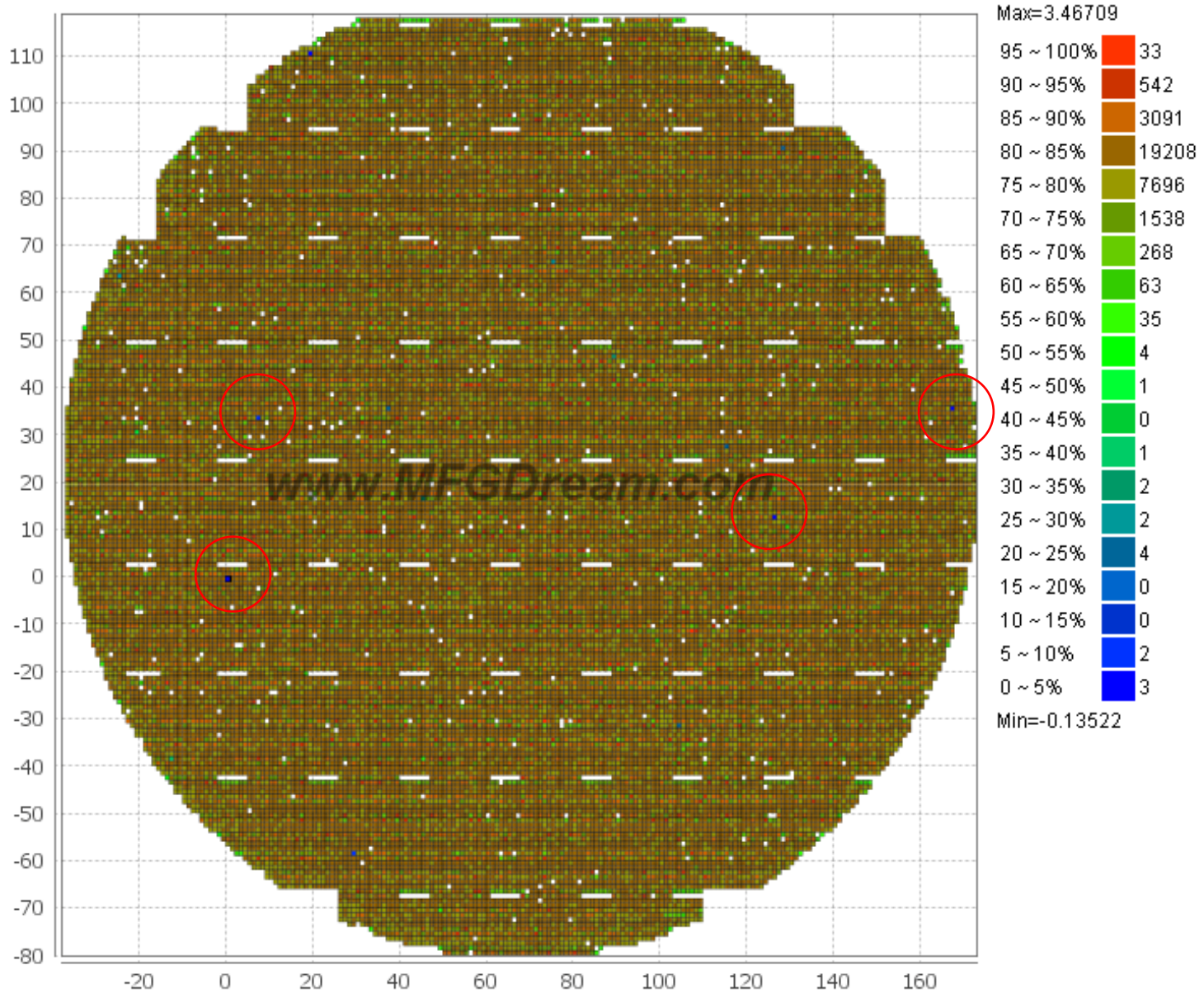

Curved Histogram
Parts
AMPS
SITE1 SITE2 SITE3 SITE4
www.MFGDream.com


Scatter Plot
AMPS
Parts
Site1 Site2 Site3 Site4
www.MFGDream.com


Bar Histogram
Parts
AMPS
SITE1 SITE2 SITE3 SITE4
www.MFGDream.com


Box-and-Whisker Plot
AMPS
www.MFGDream.com

多工位测试项


Max=3.46709
95 ~ 100% 33
90 ~ 95% 542
85 ~ 90% 3091
80 ~ 85% 19208
75 ~ 80% 7696
70 ~ 75% 1538
65 ~ 70% 268
60 ~ 65% 63
55 ~ 60% 35
50 ~ 55% 4
45 ~ 50% 1
40 ~ 45% 0
35 ~ 40% 1
30 ~ 35% 2
25 ~ 30% 2
20 ~ 25% 4
15 ~ 20% 0
10 ~ 15% 0
5 ~ 10% 2
0 ~ 5% 3
Min=-0.13522
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-20
0
20
40
60
80
100
120
140
160
www.MFGDream.com

多工位测试项

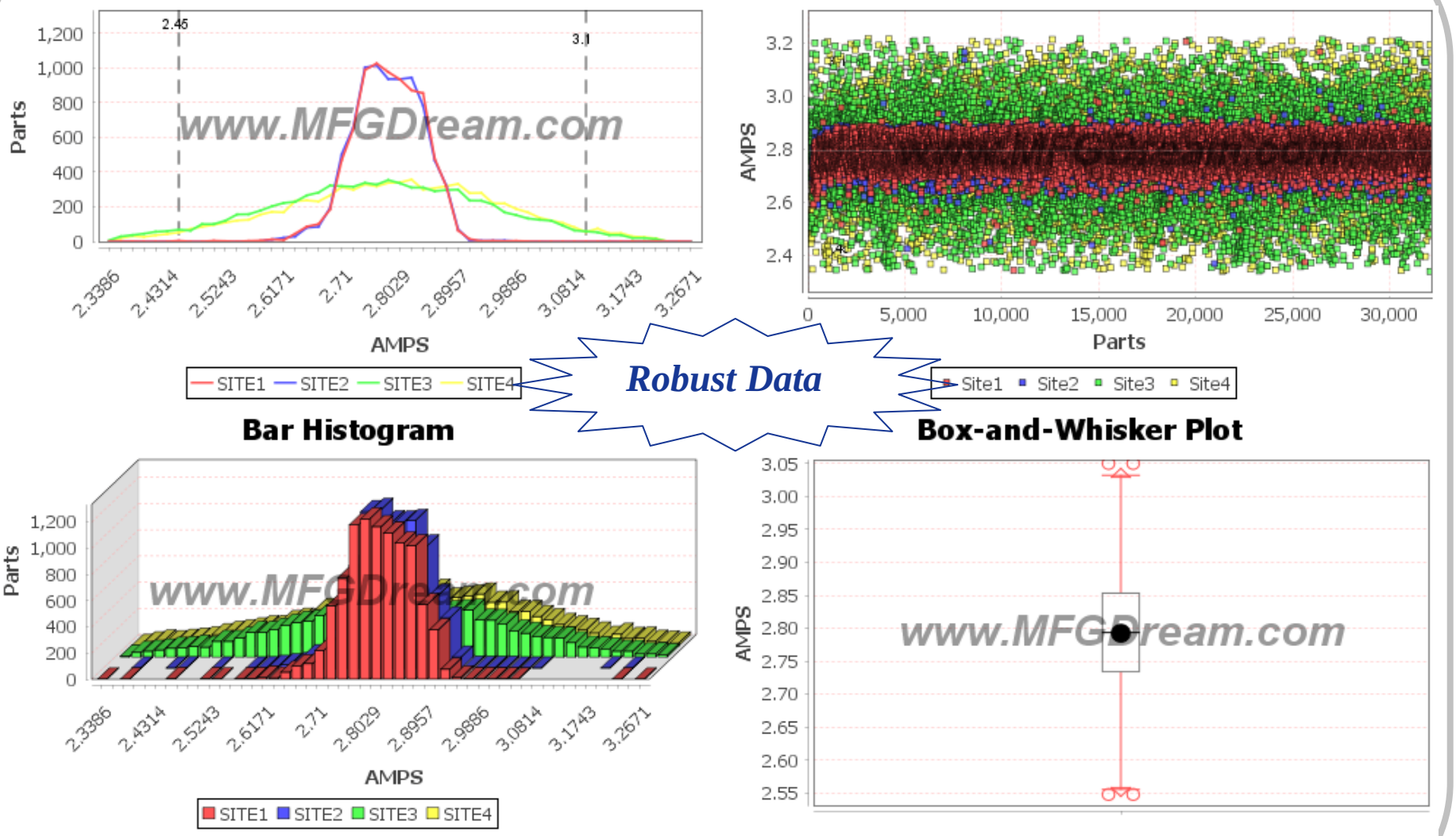
离群值(outlier)是指在数据中有一个或几个值与其他数值相比差异较大。

四分位数（Quartile），即统计学中，把所有数值由小到大排列，并分成四等份，处于三个分割点位置的数值就是四分位数。

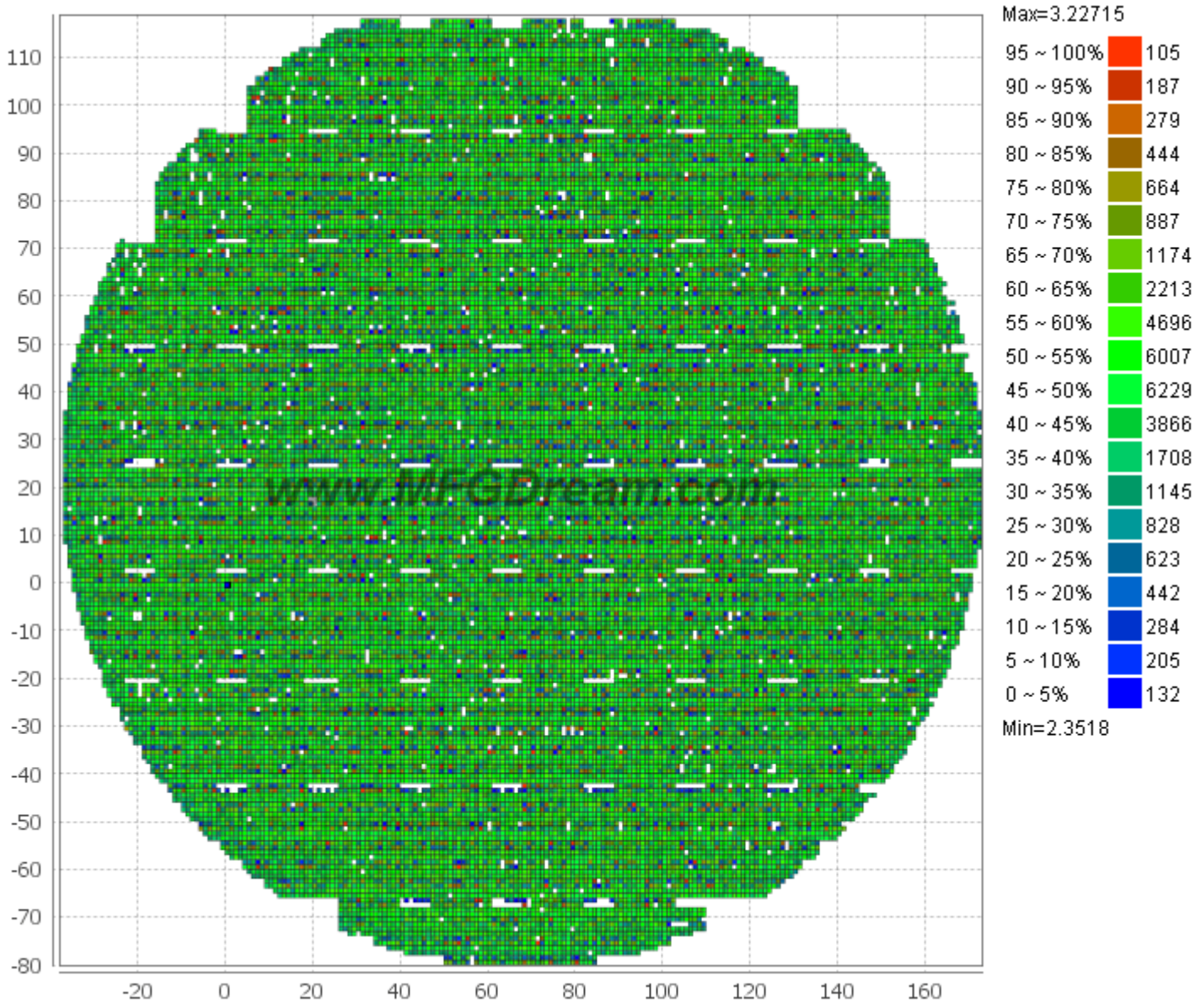
第一四分位数 (Q1)，等于该样本中所有数值由小到大排列后第25%的数字。
第二四分位数 (Q2)，等于该样本中所有数值由小到大排列后第50%的数字。
第三四分位数 (Q3)，等于该样本中所有数值由小到大排列后第75%的数字。
Inter Quartile Range, IQR = Q3 – Q1，称为四分位距。

极限离群值是任何值3倍大于剩下所有的值的IQR。

多工位测试项


Parts
AMPS
SITE1 SITE2 SITE3 SITE4
Bar Histogram
Parts
AMPS
Site1 Site2 Site3 Site4
Box-and-Whisker Plot
Robust Data
www.MFGDream.com

多工位测试项


Max=3.22715
95 ~ 100% 105
90 ~ 95% 187
85 ~ 90% 279
80 ~ 85% 444
75 ~ 80% 664
70 ~ 75% 887
65 ~ 70% 1174
60 ~ 65% 2213
55 ~ 60% 4696
50 ~ 55% 6007
45 ~ 50% 6229
40 ~ 45% 3866
35 ~ 40% 1708
30 ~ 35% 1145
25 ~ 30% 828
20 ~ 25% 623
15 ~ 20% 442
10 ~ 15% 284
5 ~ 10% 205
0 ~ 5% 132
Min=2.3518
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-20
0
20
40
60
80
100
120
140
160

多工位测试项

测试数据 - 项目分析

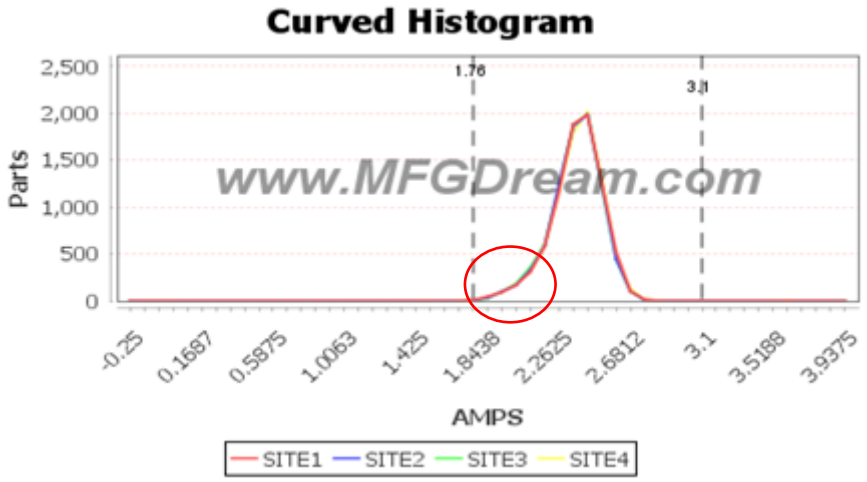
名称:	3337282_3337280_06_ETS031603_03082014.std_1					测试日期:	2014-03-08 07:14:21
程序:	[redacted]_Q_CP_Active_Hi	工位数:	4	测试数量:	35993	上传日期:	2015-04-12
Tester:	ETS-11	Handler:	TSK UF190	批号:	NO_LOTNUM	子批:	3337280_06

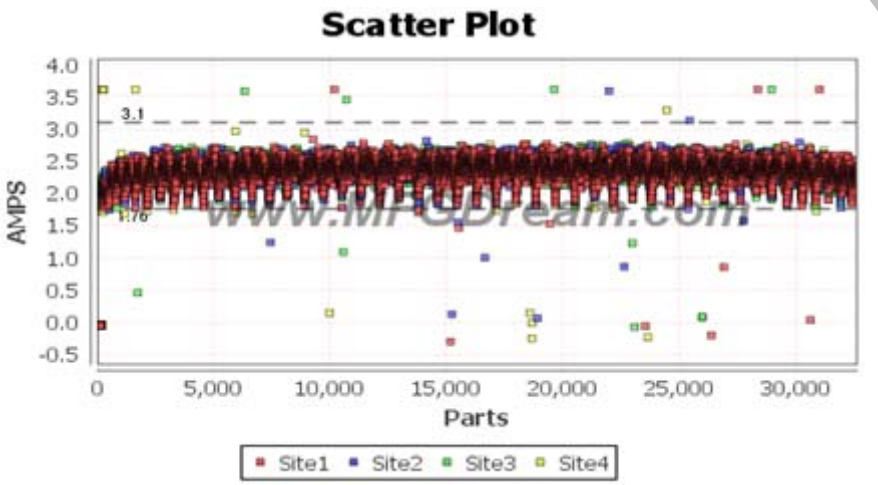
Number	TestItems	L Limit	U Limit	Min Fliter	Max Fliter	Units
300001	I_limit_pre	2.45	3.1	N/A	N/A	AMPS

SITE	Exec Qty	Failures	Datalog.Yield	Exec.Yield	Min	Max	Mean	Stdev	CPU	CPL	CPK
ALL	32539	46	90.28%	99.86%	-0.24978	3.66374	2.40346	0.16083	1.44362	1.3336	1.3336
Site1	8141	11	22.59%	99.86%	-0.24978	3.66374	2.40549	0.16253	1.42433	1.32381	1.32381
Site2	8111	9	22.51%	99.89%	0.10794	3.6403	2.40185	0.15512	1.5002	1.37921	1.37921
Site3	8148	11	22.61%	99.86%	-0.02456	3.66297	2.39975	0.15935	1.46478	1.33824	1.33824
Site4	8139	15	22.57%	99.82%	-0.2008	3.66085	2.40674	0.16603	1.39182	1.29843	1.29843

说明：Trimming 之前的 I_limit 测试数据，未发现明显异常。

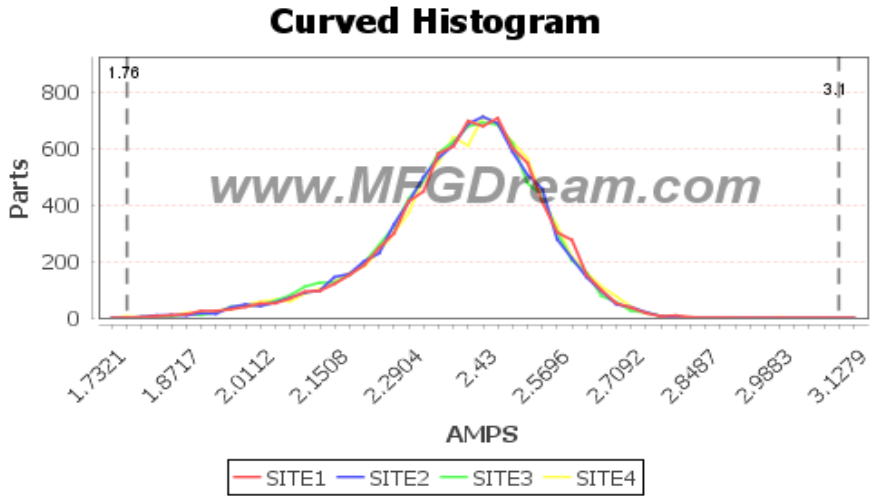
多工位测试项

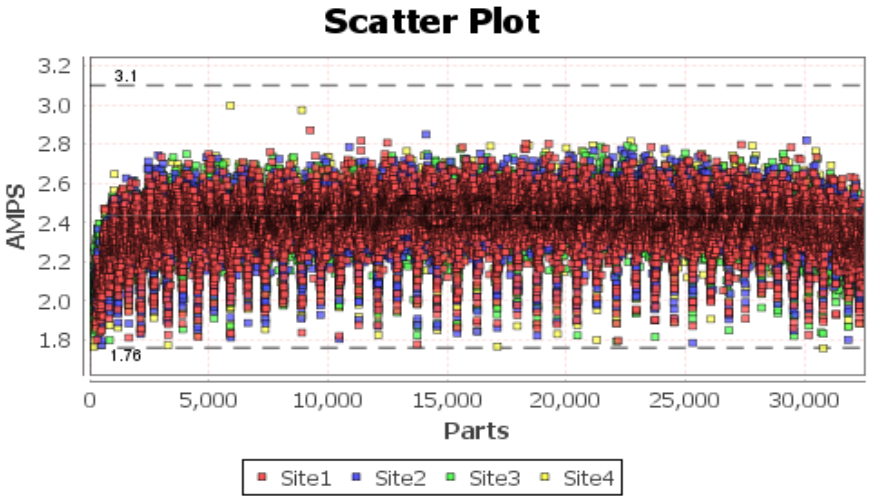




（从曲线分布图上看，异常不明显。）

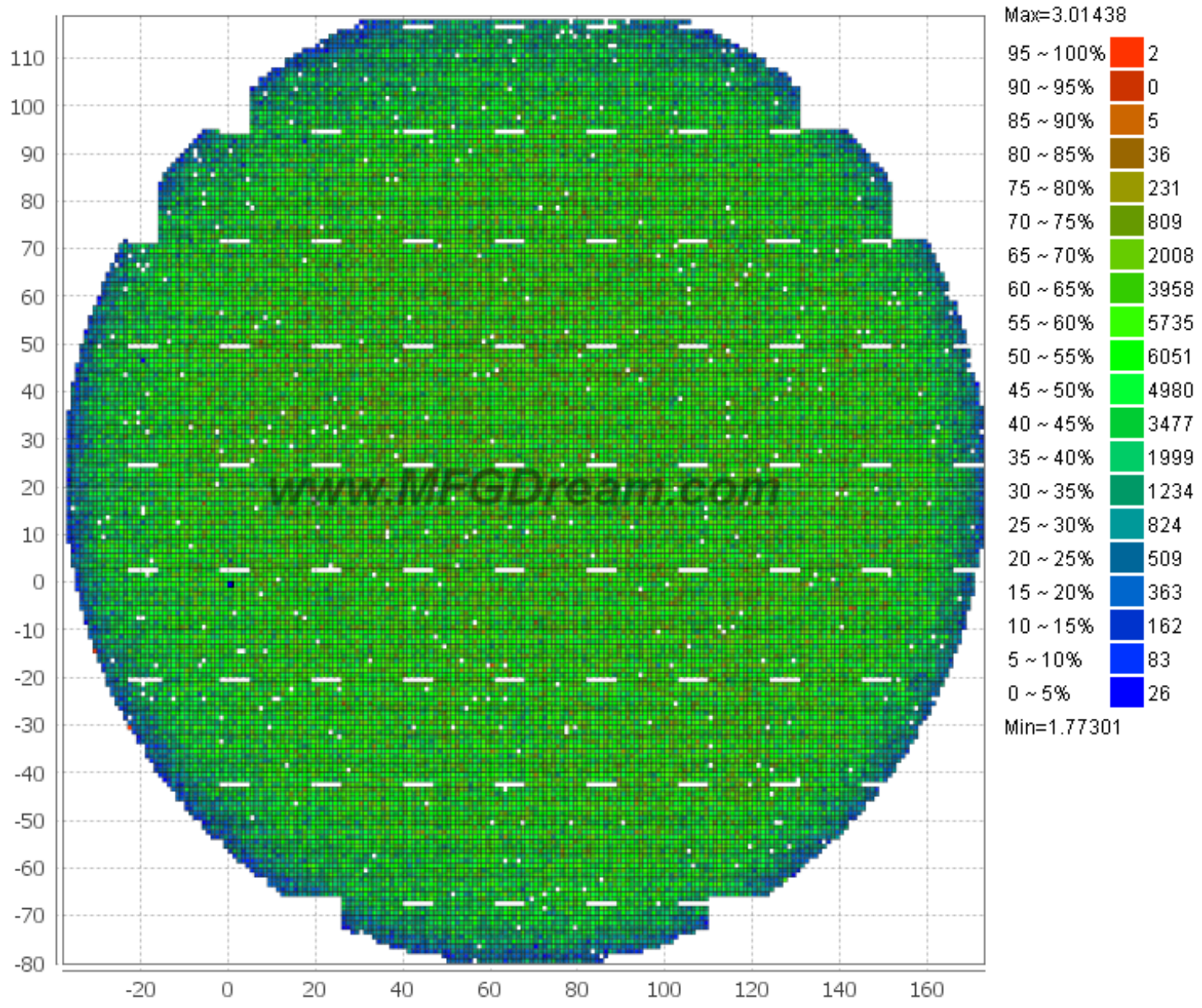
（从右图中可以看到数据分布有明显异常。）



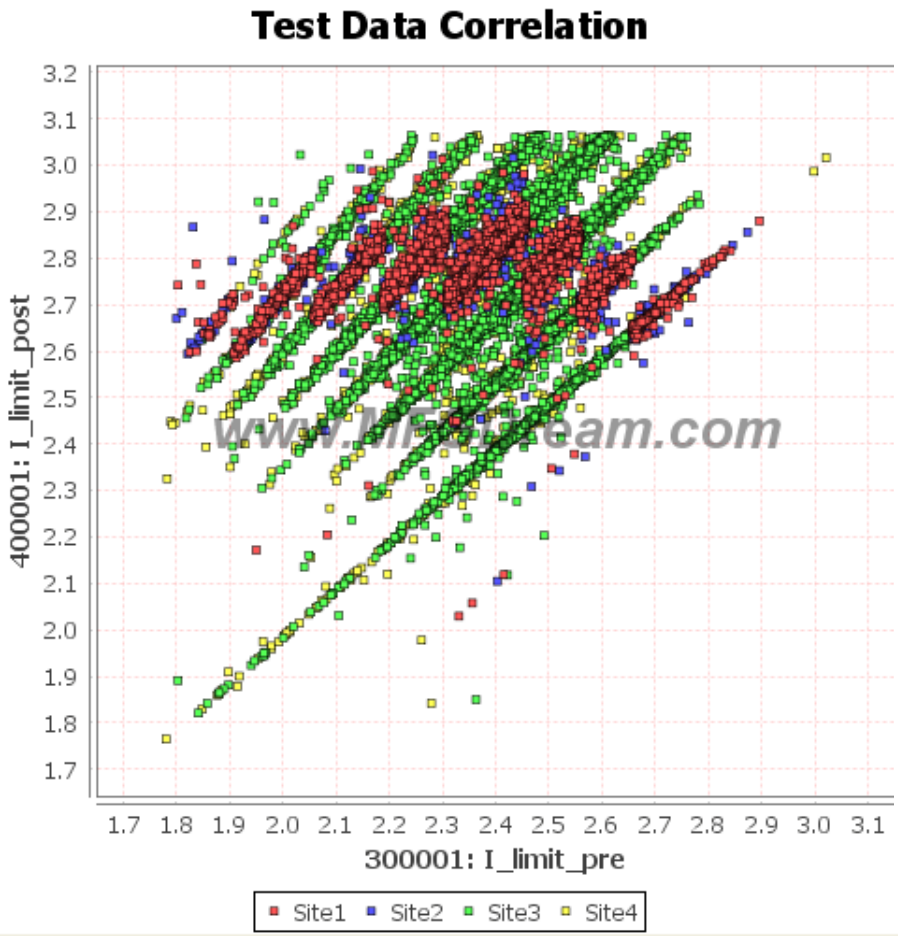


（去除离群值，使图形更加清楚。）

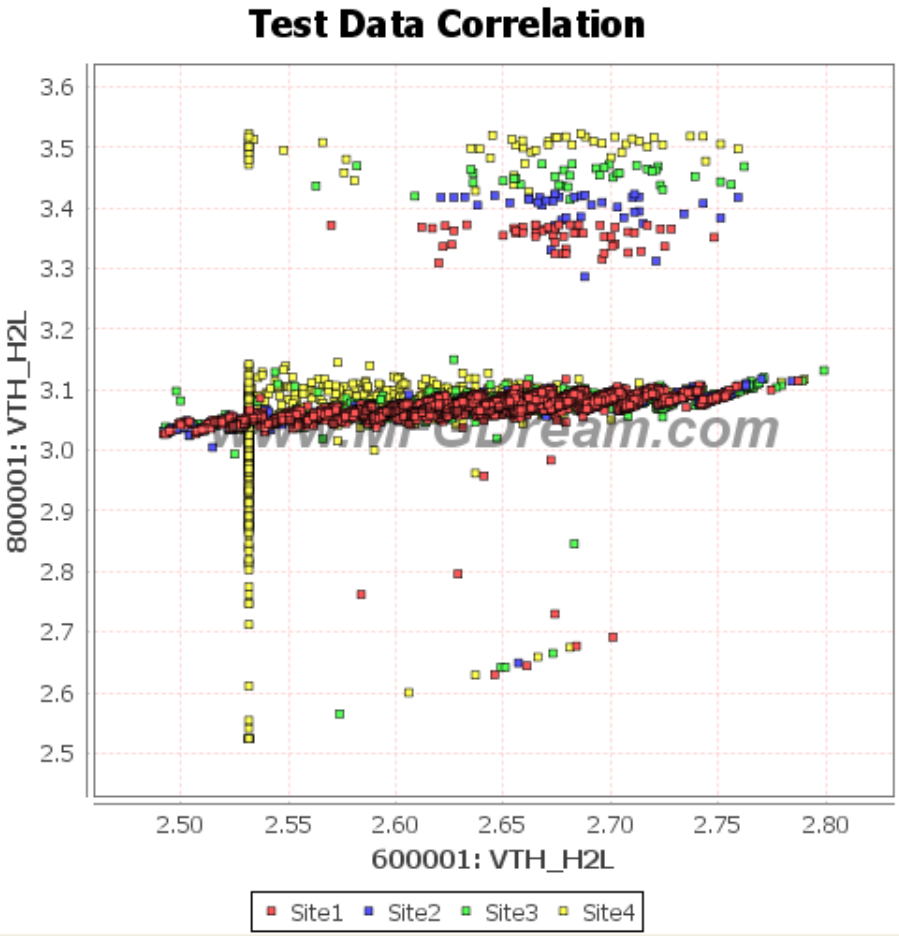
多工位测试项


Max=3.01438
95 ~ 100% 2
90 ~ 95% 0
85 ~ 90% 5
80 ~ 85% 36
75 ~ 80% 231
70 ~ 75% 809
65 ~ 70% 2008
60 ~ 65% 3958
55 ~ 60% 5735
50 ~ 55% 6051
45 ~ 50% 4980
40 ~ 45% 3477
35 ~ 40% 1999
30 ~ 35% 1234
25 ~ 30% 824
20 ~ 25% 509
15 ~ 20% 363
10 ~ 15% 162
5 ~ 10% 83
0 ~ 5% 26
Min=1.77301
110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80
-20 0 20 40 60 80 100 120 140 160
www.MFGDream.com

Data Correlation

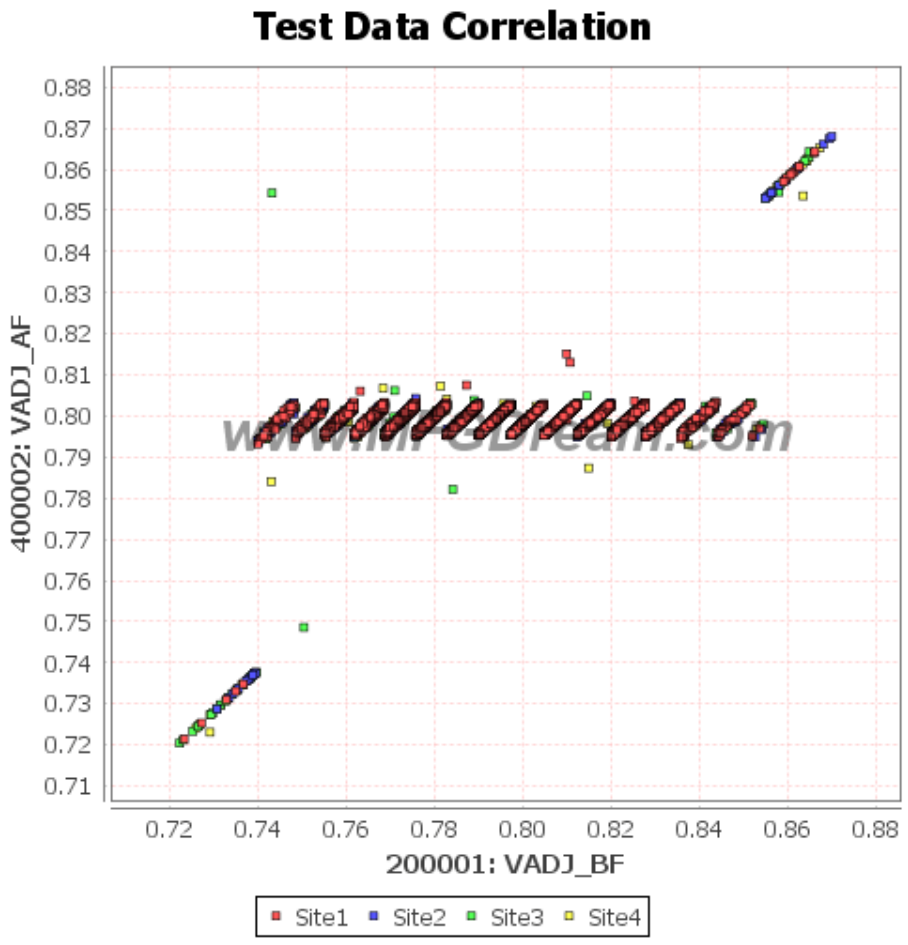


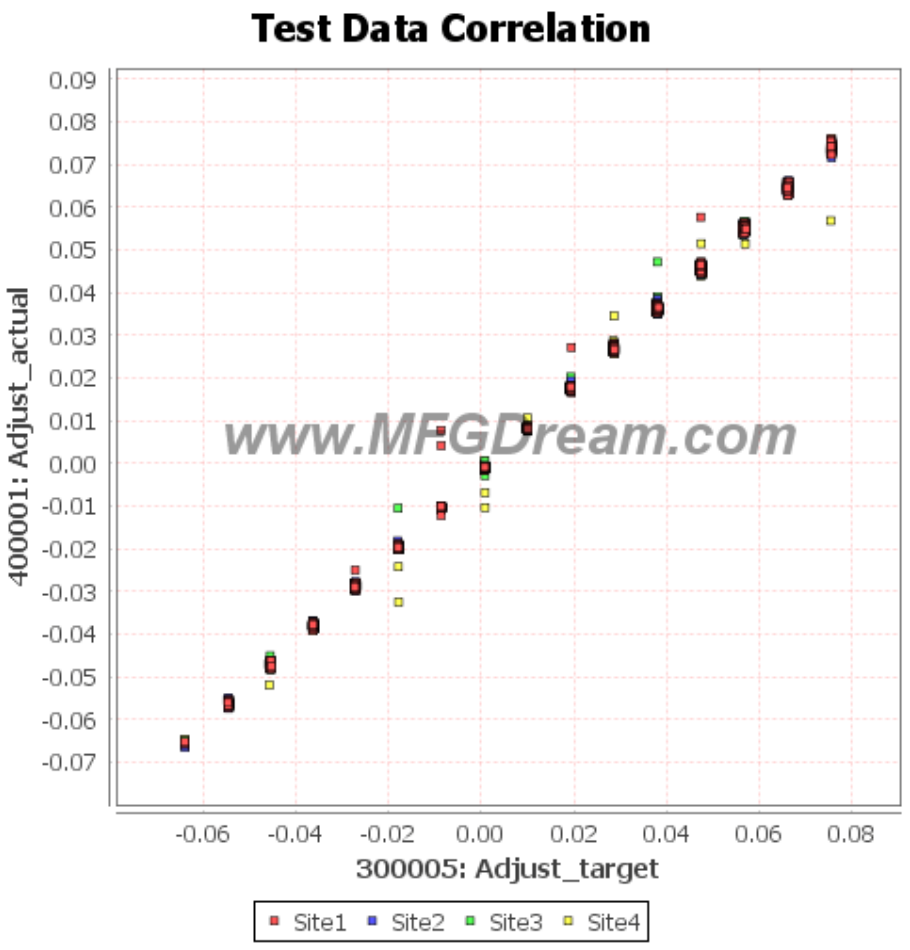
（Trimming 有异常）



（另一种 Trimming 异常）

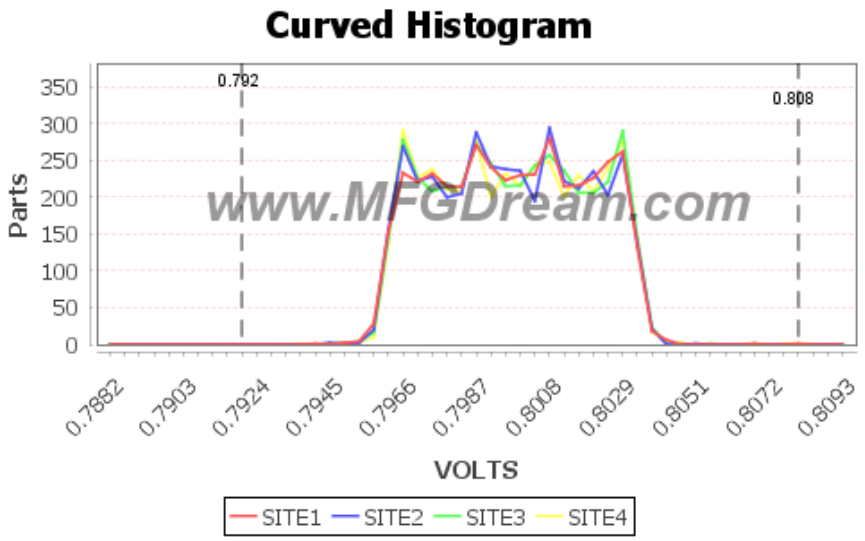
Data Correlation

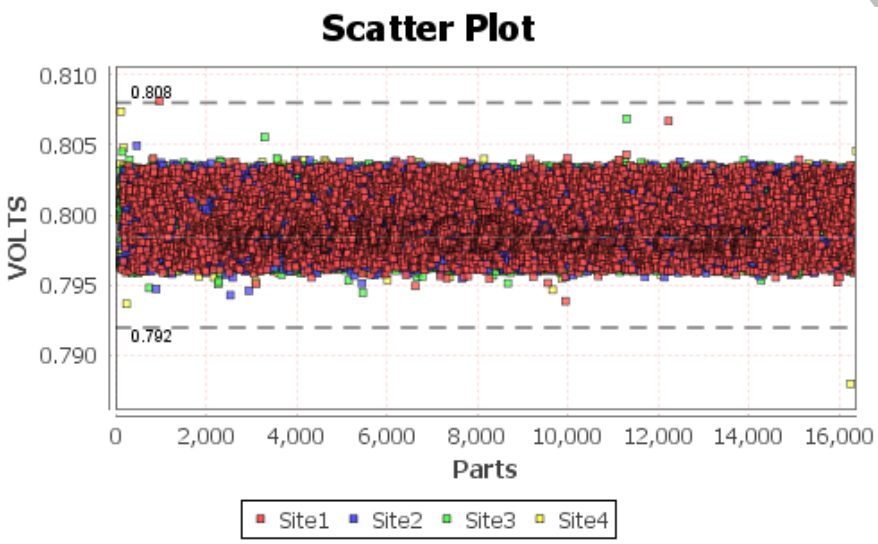


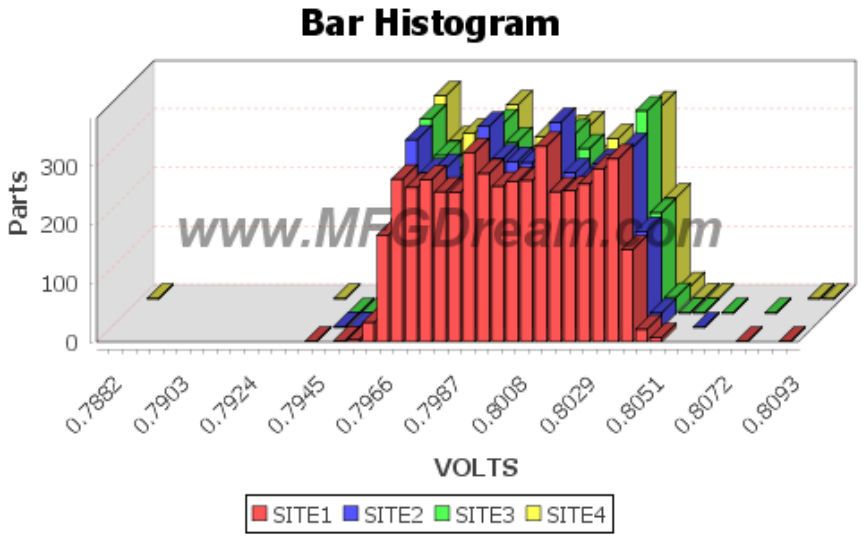


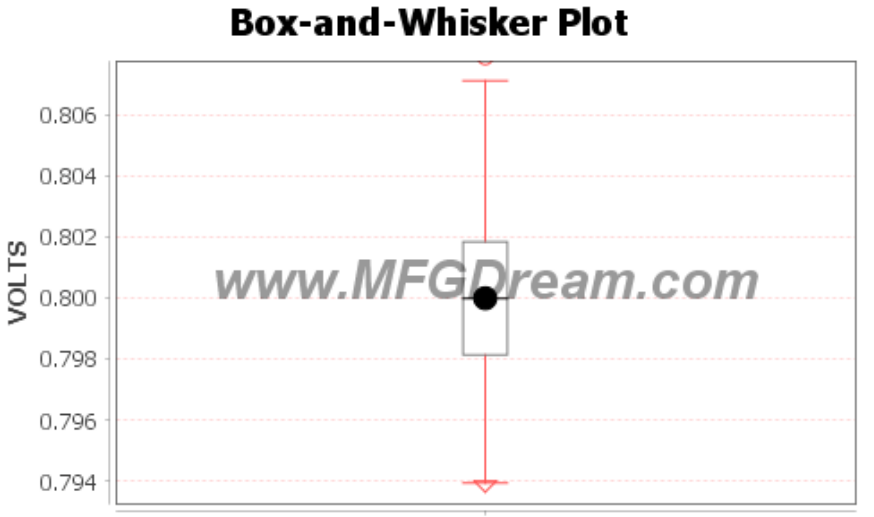
（Trimming正常的图形）

Data Correlation









（已经去除离群值）

G R & R

Gauge Repeatability and Reproducibility

指测量系统的重复性和再现性。

目的：分析测量系统的变差，使测量系统处于受控状态，以确保测量系统所测得的数据有效可靠。

重复性 $EV = \overline{\overline{R}} \times K1$

再现性 $AV = \sqrt{(\bar{X}_{DIFF} \times K_2)^2 - \frac{(EV)^2}{nr}}$

过程变差 $PV = R_p \times K_3$

$GRR = \sqrt{EV^2 + AV^2}$

总变差 $TV = \sqrt{(GRR^2) + PV^2}$

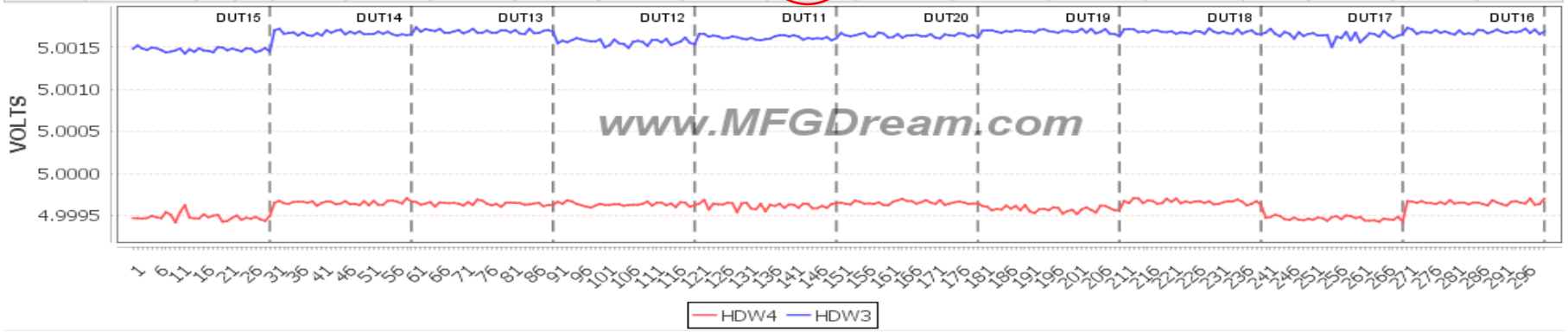
相对总变差

%(TV)	%(Tolerance)
$\%EV = \frac{EV}{TV} \times 100$	$\%EV = \frac{EV}{tolerance} \times 100$
$\%AV = \frac{AV}{TV} \times 100$	$\%AV = \frac{AV}{tolerance} \times 100$
$\%GRR = \frac{GRR}{TV} \times 100$	$\%GRR = \frac{GRR}{tolerance} \times 100$
$\%PV = \frac{PV}{TV} \times 100$	

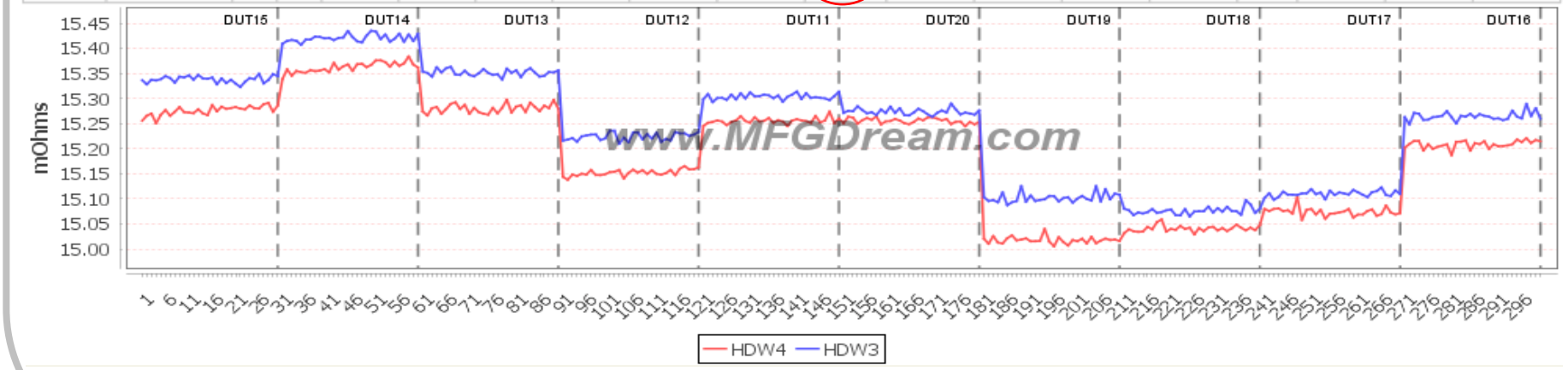
G R&R 评判标准	
%GR&R ＜ 10%	测试系统很好。
10% ＜ %GR&R ＜ 25%	测试系统可以接受，视被测量参数的重要程度和成本等因素决定是否改善。
25% ＜ %GR&R	测试系统需要改进。

G & R & R

Number	TestItems	L L	U L	Units	R.PT	R.PD	O.E	New L L	New U L	%GR&R	CPU	CPL	CPK	CP	EXECS	MEAN	MIN	MAX
200006	Vout_V_5V	4.9	5.1	VOLTS	0.00003	0.00143	0.00143	4.90143	5.09857	4.3%	32.56507	32.97121	32.56507	32.76814	600	5.00062	4.99942	5.00174



Number	TestItems	L L	U L	Units	R.PT	R.PD	O.E	New L L	New U L	%GR&R	CPU	CPL	CPK	CP	EXECS	MEAN	MIN	MAX
1500006	Ron_3V3_-1A	10.0	28.0	mOhms	0.00732	0.04062	0.04127	10.04127	27.95873	1.4%	37.34543	15.25186	15.25186	26.29864	600	15.21954	15.00548	15.43546



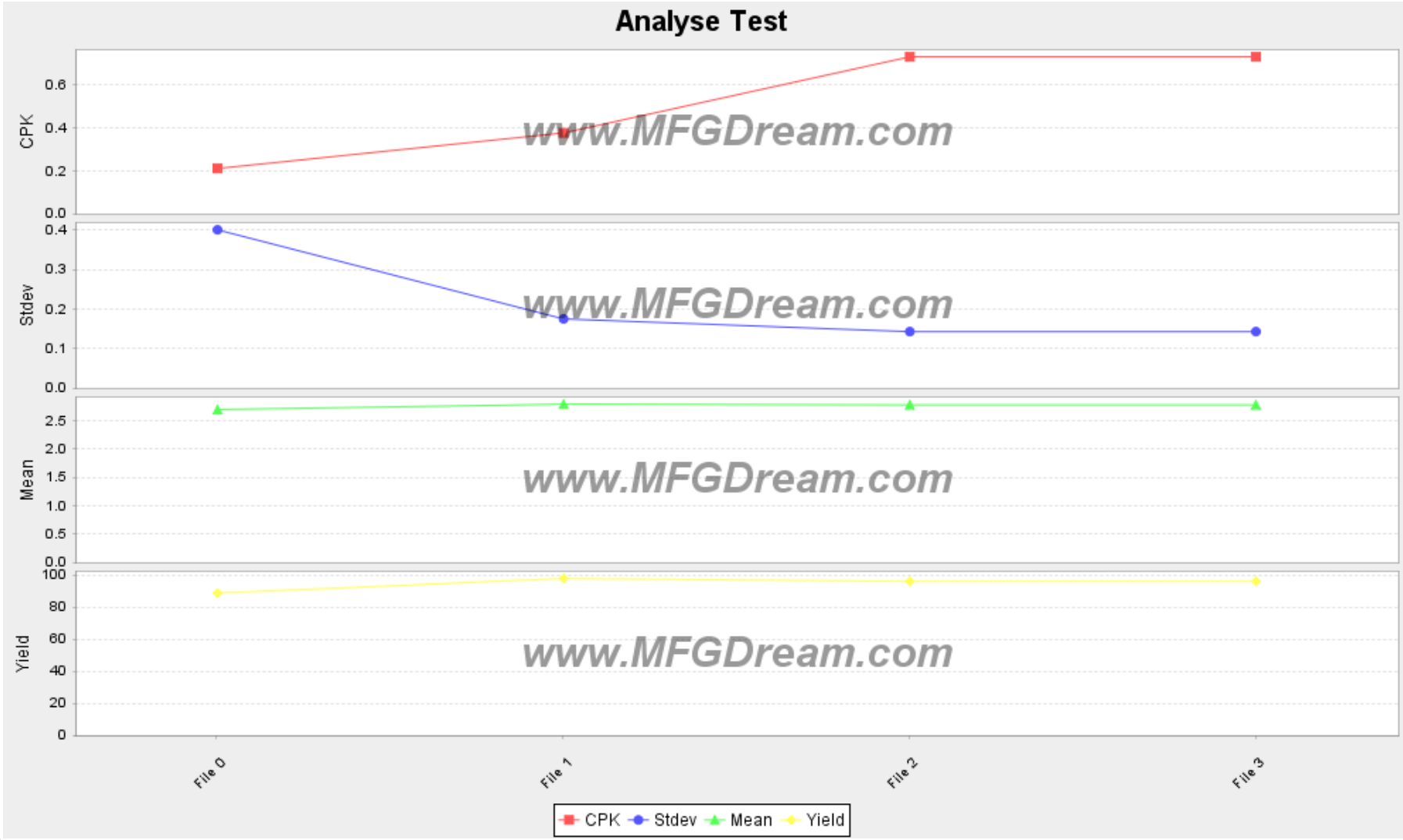
Lots Compare

ID	名称:	批号:	程序:	测试数量:	Tester:	Handler:	工位数:	测试日期:
File0	3337282_3337280_09.std_1	3337282	A[redacted]Q_CP_Active_Low	33407	ETS-11	TSK UF190	4	2014-03-08 15:20:26
File1	3337280_3337280_08.std_1	3337280	A[redacted]C_Q_CP_ENG_2	35435	ETS	TSK UF190	4	2014-04-30 01:24:31
File2	3337283_05.std_1	NO_LOTNUM	A[redacted]Q_CP_Active_Hi	36532	ETS-11	TSK UF190	4	2014-03-08 00:06:25
File3	3337280_05_ETS222853_03072014.std_1	NO_LOTNUM	A[redacted]_Q_CP_Active_Hi	36532	ETS-11	TSK UF190	4	2014-03-08 00:06:25

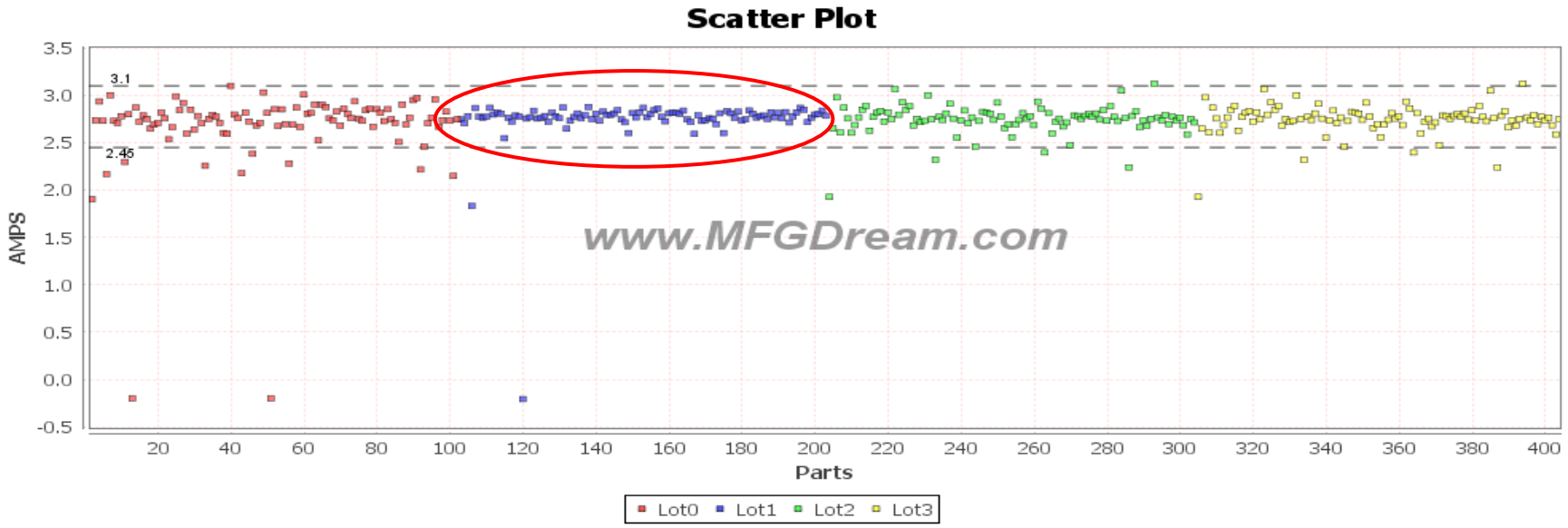
Number	TestItems	L Limit	U Limit	Min Fliter	Max Fliter	Units
400001	I_limit_post	2.45	3.1	N/A	N/A	AMPS

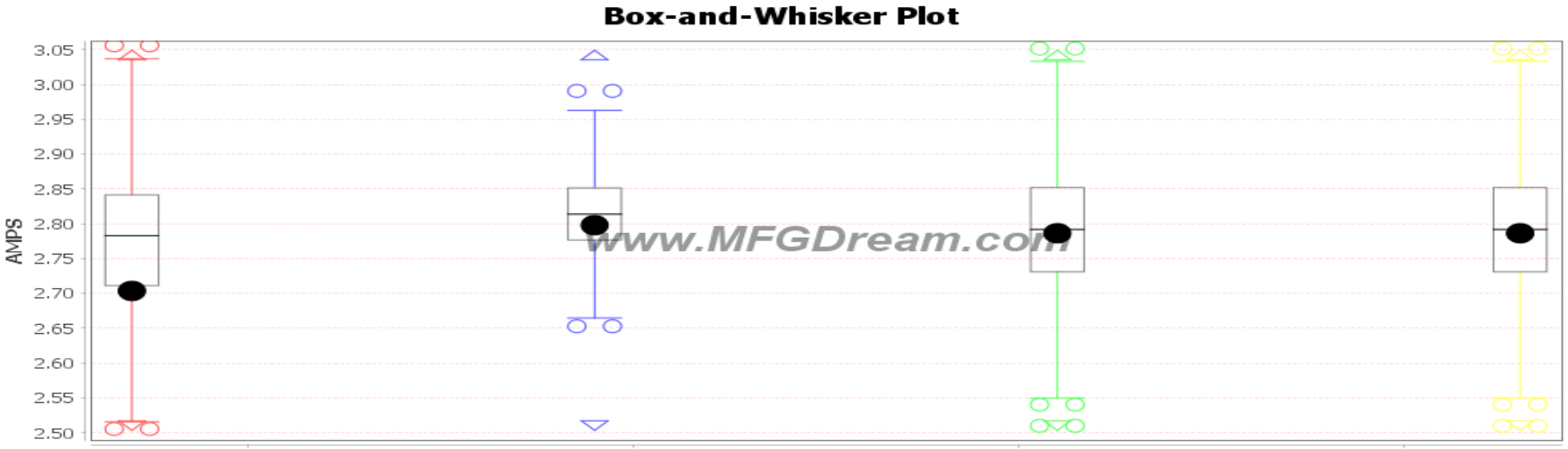
ID	Exec Qty	Failures	Datalog.Yield	Exec.Yield	Min	Max	Mean	Stdev	CPU	CPL	CPK
File0	26958	3016	71.67%	88.81%	-0.33018	3.46954	2.70355	0.40101	0.32954	0.21076	0.21076
File1	32484	679	89.76%	97.91%	-0.18943	3.38725	2.79796	0.17498	0.38487	0.37711	0.37711
File2	32577	1265	85.71%	96.12%	-0.00135	3.66232	2.78637	0.14265	0.7329	0.78602	0.7329
File3	32577	1265	85.71%	96.12%	-0.00135	3.66232	2.78637	0.14265	0.7329	0.78602	0.7329

Lots Compare



Lots Compare





Lots Compare

去离群值前：

Number	TestItems	L Limit	U Limit	Min Fliter	Max Fliter	Units
400001	I_limit_post	2.45	3.1	N/A	N/A	AMPS

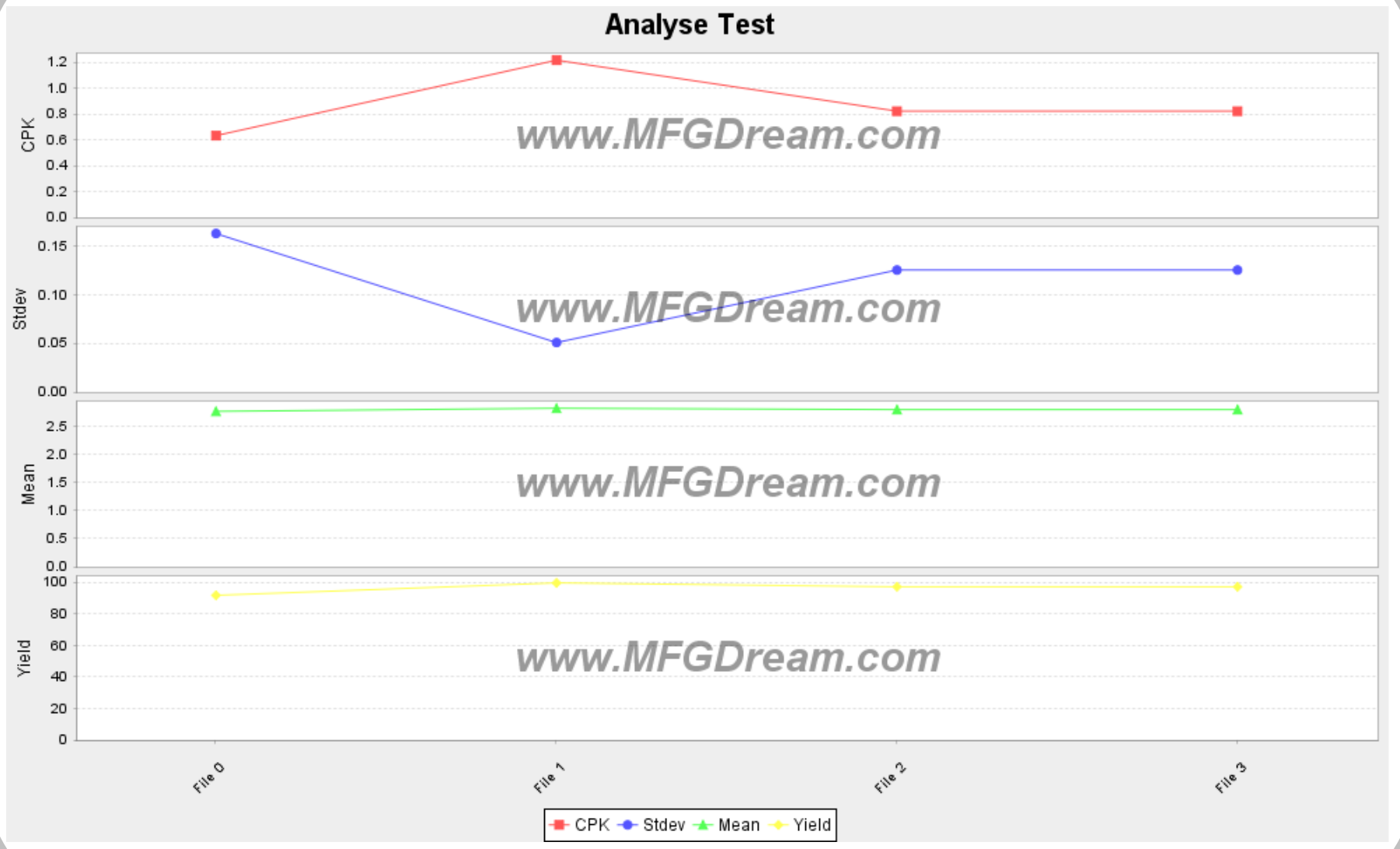
ID	Exec Qty	Failures	Datalog.Yield	Exec.Yield	Min	Max	Mean	Stdev	CPU	CPL	CPK
File0	26958	3016	71.67%	88.81%	-0.33018	3.46954	2.70355	0.40101	0.32954	0.21076	0.21076
File1	32484	679	89.76%	97.91%	-0.18943	3.38725	2.79796	0.17498	0.38487	0.37711	0.37711
File2	32577	1265	85.71%	96.12%	-0.00135	3.66232	2.78637	0.14265	0.7329	0.78602	0.7329
File3	32577	1265	85.71%	96.12%	-0.00135	3.66232	2.78637	0.14265	0.7329	0.78602	0.7329

去离群值后：

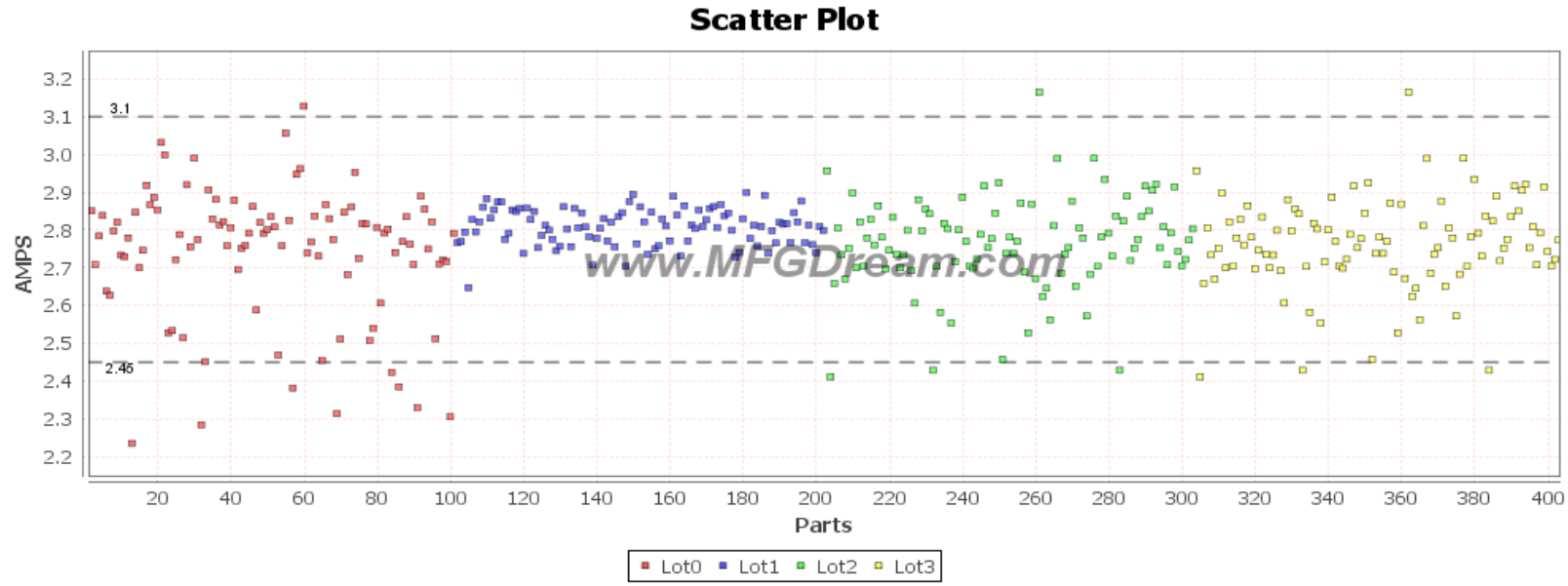
Number	TestItems	L Limit	U Limit	Min Fliter	Max Fliter	Units
400001	I_limit_post	2.45	3.1	N/A	N/A	AMPS

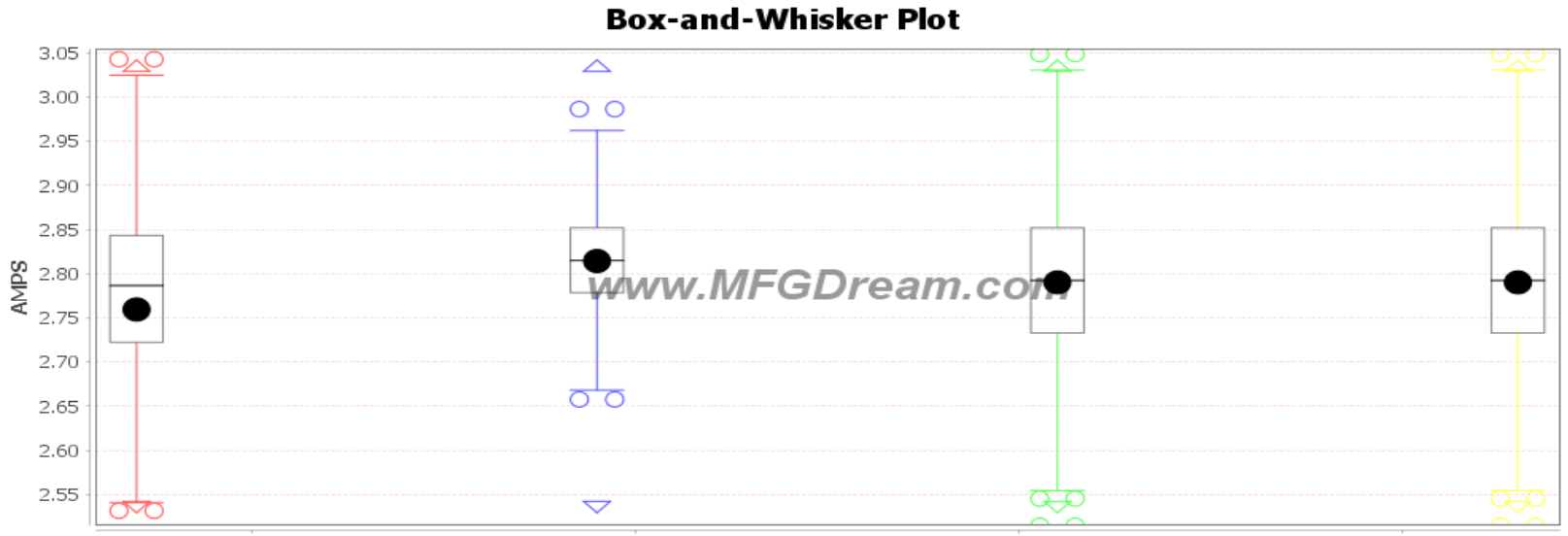
ID	Exec Qty	Failures	Datalog.Yield	Exec.Yield	Min	Max	Mean	Stdev	CPU	CPL	CPK
File0	26100	2158	71.67%	91.73%	2.1648	3.33888	2.75943	0.16306	0.69619	0.63255	0.63255
File1	31925	120	89.76%	99.62%	2.54793	3.0706	2.81437	0.05082	1.21754	1.40605	1.21754
File2	32233	921	85.71%	97.14%	2.34797	3.22824	2.79015	0.12555	0.82267	0.90313	0.82267
File3	32233	921	85.71%	97.14%	2.34797	3.22824	2.79015	0.12555	0.82267	0.90313	0.82267

Lots Compare



Lots Compare





谢谢！

Thank You !

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感谢：

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集成电路技术分享博客 —— www.KanWoDa.com

多工位测试项

去离群值前：

Number	TestItems	L Limit	U Limit	Min Fliter	Max Fliter	Units
400001	I_limit_post	2.45	3.1	N/A	N/A	AMPS

SITE	Exec Qty	Failures	Datalog.Yield	Exec.Yield	Min	Max	Mean	Stdev	CPU	CPL	CPK
ALL	32493	1312	86.63%	95.96%	-0.13522	3.46709	2.78793	0.14707	0.70732	0.76595	0.70732
Site1	8130	18	22.54%	99.78%	-0.08547	3.37262	2.79108	0.078	1.32011	1.45756	1.32011
Site2	8102	12	22.48%	99.85%	-0.13522	3.17479	2.79129	0.0758	1.35756	1.50079	1.35756
Site3	8137	632	20.85%	92.23%	0.02857	3.38903	2.7741	0.1902	0.57116	0.568	0.568
Site4	8124	650	20.77%	92.00%	0.067	3.46709	2.7953	0.19543	0.5197	0.58895	0.5197

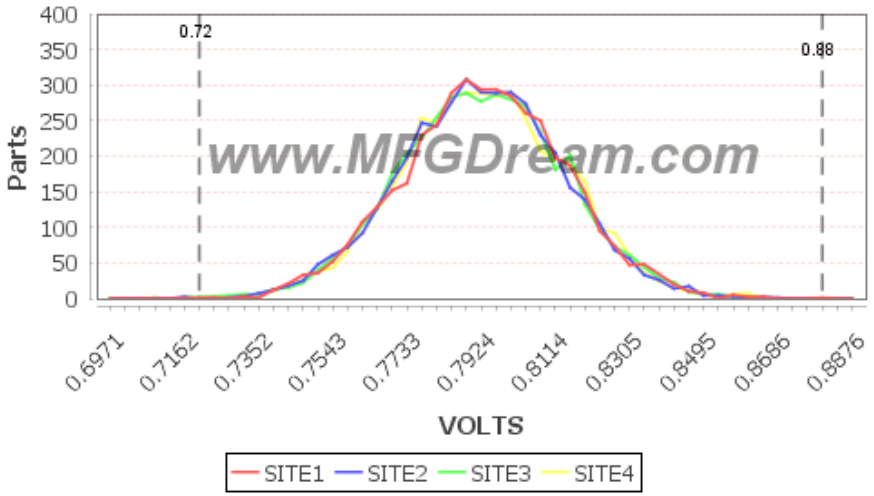
去离群值后：

Number	TestItems	L Limit	U Limit	Min Fliter	Max Fliter	Units
400001	I_limit_post	2.45	3.1	N/A	N/A	AMPS

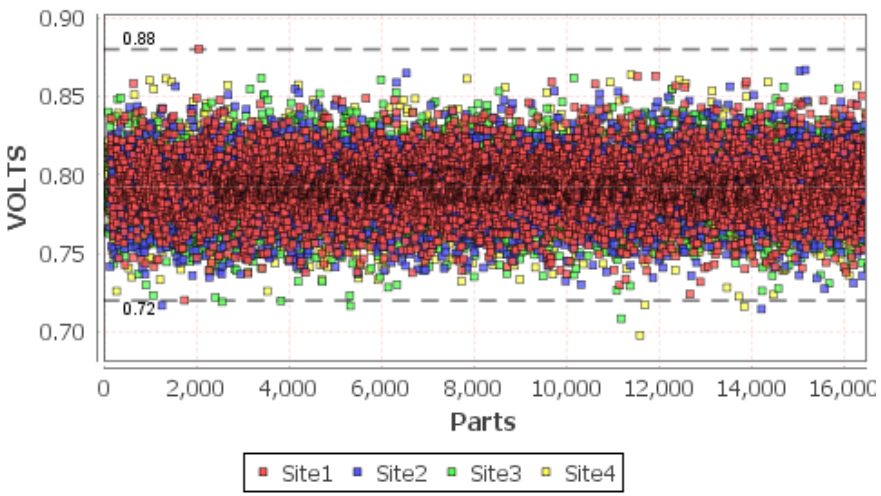
SITE	Exec Qty	Failures	Datalog.Yield	Exec.Yield	Min	Max	Mean	Stdev	CPU	CPL	CPK
ALL	32118	937	86.63%	97.08%	2.3518	3.22715	2.79256	0.12575	0.81495	0.90803	0.81495
Site1	8116	4	22.54%	99.95%	2.35561	3.2164	2.79257	0.05544	1.84844	2.05978	1.84844
Site2	8095	5	22.48%	99.94%	2.38092	3.17479	2.79261	0.05455	1.87832	2.0936	1.87832
Site3	7978	473	20.85%	94.07%	2.3518	3.22493	2.78185	0.16999	0.62385	0.65072	0.62385
Site4	7929	455	20.77%	94.26%	2.35209	3.22715	2.80326	0.16903	0.58519	0.69663	0.58519

Data Correlation

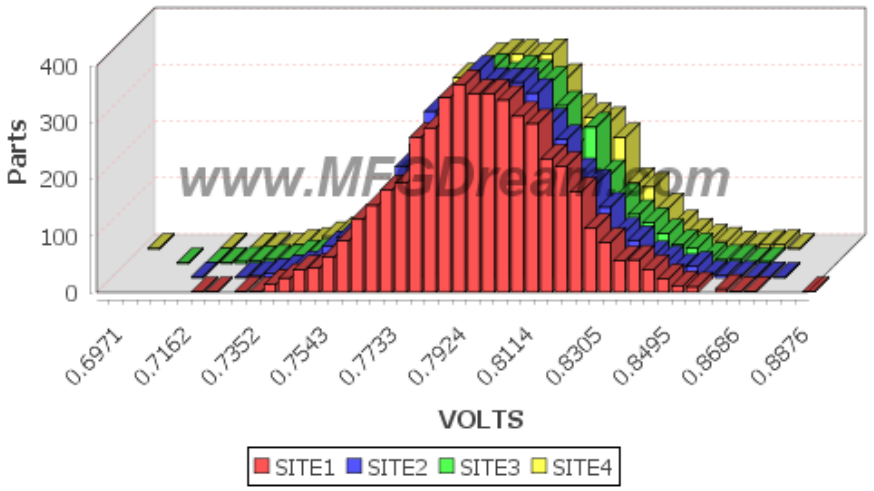
Curved Histogram



Scatter Plot



Bar Histogram



Box-and-Whisker Plot