

**Wheat Quality Council**  
**Hard Spring Wheat Technical Committee**  
**2007 Crop**



**February 19 – 21, 2008**



**Kansas City, MO**

**Wheat Quality Council**  
**Hard Spring Wheat Technical Committee**  
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**Sponsored by the Wheat Quality Council**  
**February 19-21, 2008**  
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# Wheat Quality Council

## Hard Spring Wheat Technical Committee

### Introduction

Breeders' experimental lines of wheat are evaluated for overall quality before being released for commercial production. The Hard Spring Wheat Technical Committee provides milling and baking quality data on breeders' experimental lines of wheat that are annually submitted to the Wheat Quality Council (WQC). The impact is to provide high quality wheat for commercial production and processing.

Twelve experimental lines of hard spring wheat were grown at up to five locations in 2007 and evaluated for kernel, milling, and bread baking quality against the check variety Glenn. To avoid any bias in the test procedures, code numbers were assigned to the experimental lines and maintained throughout the growing and harvesting of the plots and the milling and baking trials. Samples of wheat were milled at the USDA Hard Red Spring and Durum Wheat Quality Laboratory (WQL), Fargo, ND. Flour samples were shipped to independent laboratories and tested for bread baking quality.

From this report:

The WQC makes no representation regarding the accuracy or conclusiveness of the data developed by and received from the participating laboratories. The data has been scientifically determined and accurately reported from the perspective of the Hard Spring Wheat Technical Committee.

The results relate only to test samples that were volunteered for testing in the 2007 crop year. Test results from additional experimentation in other crop years may differ from those reported herein.

The Hard Spring Wheat Technical Committee, by compilation of data and issuance of this report, does not make or intend any general recommendations or conclusions on its part with respect to the desirability of any wheat included in the tests. Mention of a vendor, product, proprietary product, or procedure does not constitute a guarantee or warranty of the vendor, product, or procedure by the Hard Spring Wheat Technical Committee or by cooperating laboratories, and does not imply its approval to the exclusion of other vendors, products, or procedures that may also be suitable. Data reported herein are not to be used in any publication or literature or for advertising or publicity purposes.

Quality Trait	Crookston		Minot		
	Glenn Check	CS 3100L	Glenn Check	CS 3100L	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	15.6	13.4	16.5	15.7
2	Flour Protein (12%mb)	15.0	12.5	15.6	15.2
3	Market Value (Score 1-6)	4.6	2.3	3.5	3.4
4	Market Value (Score 1-10)	10	3.4	10	7.4
5	Test Weight (lb/bu)	64.8	57.8	59.4	61.9
6	1000 Kernel Weight (g)	31.3	19.8	20.9	27.2
7	Kernel Size % Large	71	6	9	23
8	Kernel Size % Small	3	34	22	16
9	Wheat Moisture (%)	12.4	11.6	12.1	12.8
10	Wheat Ash (14%mb)	1.56	1.75	1.37	1.43
11	Wheat Falling Number (sec)	430	478	388	310
12	Vitreous Kernels (%)	99	74	86	87
Flour Extraction (%)					
13	Tempered Wheat Basis (%)	67.0	71.3	70.5	66.6
14	Total Product Basis (%)	69.7	74.2	73.4	70.3
15	Flour /Bu Wheat (lbs)	45.1	43.2	43.8	42.5
16	Flour Color Brightness (L*)	90.2	91	90.5	89.8
	Flour Color Yellowness (b*)	9.2	11.7	9.0	9.7
17	Flour Moisture (%)	12.8	12.8	12.2	12.5
18	Flour Ash (14%mb)	0.415	0.531	0.406	0.489
19	Flour Falling Number (Malted) (sec)	267	256	264	255
Farinograph					
20	Water Absorption (500bu)	67.5	58.8	65.1	63.3
21	Water Absorption (14%mb)	66.1	57.4	63.0	61.6
22	Arrival Time (min)	2.3	2.2	5.2	4.7
23	Peak Time (min)	6.7	6.0	9.4	8.5
24	Dough Stability (min)	12.8	10.0	10.8	10.8
25	MTI (bu)	17	23	26	23
26	TTB (min)	14.9	12.0	15.3	14.3
<b>II. Cooperator Evaluation</b>					
27	Bake Absorption (Avg %)	65.3±2.9	59.2±2.8	63.2±1.7	62.7±2.8
28	Loaf Volume (Avg % of Check)		95.7±9.3		101.5±5.5

Quality Trait	II. Cooperator Results/Evaluation	Crookston		Minot	
		Glenn Check	CS 3100L	Glenn Check	CS 3100L
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short	3.7±0.9	3.2±1.1	3.7±1.0	3.8±1.0
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	4.2±0.7	2.8±1.2	4.0±0.7	3.9±0.8
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		2.8±0.7		2.9±0.3
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.3±1.1		3.0±0.7
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.3±1.1		3.0±0.5
	III. Cooperator Quality Assessment				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		1.2±0.4		
	1 Much Poorer Than Check				2.7±0.5
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.1±1.3		2.7±1.0
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.3±1.2		3.4±0.5
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.0±0.9		3.0±0.0

Quality Trait	Casselton		Crookston		
	Glenn Check	MN01311-A-1	Glenn Check	MN01311-A-1	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	15.0	14.3	15.6	15.4
2	Flour Protein (12%mb)	14.1	13.0	15.0	14.5
3	Market Value (Score 1-6)	4.1	4.1	4.6	5.2
4	Market Value (Score 1-10)	10	8.8	10	8.4
5	Test Weight (lb/bu)	62.8	61.2	64.8	62.6
6	1000 Kernel Weight (g)	27.2	35.3	31.3	41.0
7	Kernel Size % Large	50	65	71	89
8	Kernel Size % Small	7	6	3	2
9	Wheat Moisture (%)	12.7	11.8	12.4	12.2
10	Wheat Ash (14%mb)	1.73	1.62	1.56	1.49
11	Wheat Falling Number (sec)	425	501	430	484
12	Vitreous Kernels (%)	90	61	99	93
Flour Extraction (%)					
13	Tempered Wheat Basis (%)	68.8	71.2	67.0	71.1
14	Total Product Basis (%)	71.2	74.4	69.7	73.8
15	Flour /Bu Wheat (lbs)	44.8	45.7	45.1	46.5
16	Flour Color Brightness (L*)	90.1	89.7	90.2	89.8
	Flour Color Yellowness (b*)	9.4	12.7	9.2	11.6
17	Flour Moisture (%)	12.8	13.1	12.8	13.1
18	Flour Ash (14%mb)	0.423	0.444	0.415	0.405
19	Flour Falling Number (Malted) (sec)	258	273	267	248
Farinograph					
20	Water Absorption (500bu)	65.3	61.9	67.5	66.5
21	Water Absorption (14%mb)	64.0	60.9	66.1	65.5
22	Arrival Time (min)	1.8	2.8	2.3	4.1
23	Peak Time (min)	3.8	5.8	6.7	8.0
24	Dough Stability (min)	8.5	8.4	12.8	8.2
25	MTI (bu)	22	26	17	34
26	TTB (min)	9.4	11.3	14.9	12.3
<b>II. Cooperator Evaluation</b>					
27	Bake Absorption (Avg %)	64.3±1.9	61.6±1.9	65.3±2.9	64.5±2.0
28	Loaf Volume (Avg % of Check)		98.1±4.3		98.4±4.3

Quality Trait	II. Cooperator Results/Evaluation	Casselton		Crookston	
		Glenn Check	MN01311-A-1	Glenn Check	MN01311-A-1
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short	3.9±0.9	3.6±0.9	3.7±0.9	3.0±1.3
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	3.7±1.0	3.7±1.2	4.2±0.7	3.3±1.3
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		2.7±0.5		2.6±0.9
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.6±0.9		2.8±0.8
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.2±1.2		3.3±0.7
	<b>III. Cooperator Quality Assessment</b>				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.1±0.6		2.9±0.3
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.0±0.7		3.9±0.8
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.7±1.0		2.8±1.0
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.6±0.7		2.9±1.1

Quality Trait	Casselton		Minot		Williston		
	Glenn Check	NDSW0449	Glenn Check	NDSW0449	Glenn Check	NDSW0449	
<b>I. USDA/ARS WQL Evaluation</b>							
1	Wheat Protein (12%mb)	15.0	14.8	16.5	16.3	17.6	18.9
2	Flour Protein (12%mb)	14.1	13.6	15.6	15.8	16.9	18.0
3	Market Value (Score 1-6)	4.1	3.3	3.5	3.4	4.1	3.5
4	Market Value (Score 1-10)	10	8.4	10	9.6	10	7.6
5	Test Weight (lb/bu)	62.8	59.8	59.4	59.6	58.2	54.9
6	1000 Kernel Weight (g)	27.2	23.1	20.9	23.0	22.4	20.4
7	Kernel Size % Large	50	23	9	13	7	4
8	Kernel Size % Small	7	18	22	19	17	36
9	Wheat Moisture (%)	12.7	12.1	12.1	12.4	11.7	11.6
10	Wheat Ash (14%mb)	1.73	1.75	1.37	1.39	1.46	1.74
11	Wheat Falling Number (sec)	425	446	388	359	437	429
12	Vitreous Kernels (%)	90	62	86	87	100	98
Flour Extraction (%)							
13	Tempered Wheat Basis (%)	68.8	70.8	70.5	69.1	69.6	68.0
14	Total Product Basis (%)	71.2	73.7	73.4	72.4	72.8	71.5
15	Flour /Bu Wheat (lbs)	44.8	44.1	43.8	42.9	42.5	39.4
16	Flour Color Brightness (L*)	90.1	88.4	90.5	90.1	90.3	89.6
	Flour Color Yellowness (b*)	9.4	10.6	9.0	9.7	10.0	10.6
17	Flour Moisture (%)	12.8	12.5	12.2	12.4	12.2	12.6
18	Flour Ash (14%mb)	0.423	0.501	0.406	0.460	0.472	0.538
19	Flour Falling Number (Malted) (sec)	258	253	264	252	258	266
Farinograph							
20	Water Absorption (500bu)	65.3	62.0	65.1	63.8	67.1	66.5
21	Water Absorption (14%mb)	64.0	60.3	63.0	62.0	65.2	64.9
22	Arrival Time (min)	1.8	3.0	5.2	4.5	5.2	5.1
23	Peak Time (min)	3.8	6.8	9.4	7.5	9.4	8.7
24	Dough Stability (min)	8.5	8.7	10.8	7.2	14.8	14.2
25	MTI (bu)	22	34	26	39	16	17
26	TTB (min)	9.4	11.6	15.3	11.5	18.3	18.3
<b>II. Cooperator Evaluation</b>							
27	Bake Absorption (Avg %)	64.3±1.9	61.4±2.1	63.2±1.7	62.7±2.4	65.6±1.9	65.2±1.8
28	Loaf Volume (Avg % of Check)		99.0±4.8		96.6±7.7		99.5±3.1



Quality Trait	II. Cooperator Results/Evaluation	Casselton		Minot		Williston	
		Glenn Check	NDSW0449	Glenn Check	NDSW0449	Glenn Check	NDSW0449
29	Mixing Requirement						
	5 Very Long						
	4 Long						
	3 Medium						
	2 Short						
	1 Very Short	3.9±0.9	3.7±1.0	3.7±1.0	3.1±1.5	4.0±0.9	3.7±1.0
30	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky	3.7±1.0	3.8±0.8	4.0±0.7	3.2±1.5	3.9±0.9	4.0±0.9
31	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check						
	1 Much Less Tolerance Than Check		2.7±0.7		2.4±0.9		2.8±0.4
32	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.6±0.7		2.4±0.5		2.6±0.9
33	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.2±1.1		3.2±0.8		2.8±0.8
	<b>III. Cooperator Quality Assessment</b>						
	Quality Trait 1-2: Protein						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.8±0.4		3.1±0.3		4.0±0.7
	Quality Trait 3-19: Milling						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.0±0.5		2.7±0.5		2.4±1.3
	Quality Trait 20-33: Baking						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.4±1.1		2.6±1.0		2.9±0.6
	Quality Trait 1-33: Overall Comparison						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.3±0.9		2.2±1.0		2.7±0.7

Quality Trait	Brookings		Casselton		
	Glenn Check	SD3868	Glenn Check	SD3868	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	12.8	11.5	15.0	14.4
2	Flour Protein (12%mb)	12.0	10.4	14.1	13.3
3	Market Value (Score 1-6)	3.7	3.5	4.1	3.6
4	Market Value (Score 1-10)	10	7.8	10	8.4
5	Test Weight (lb/bu)	65.7	61.0	62.8	59.3
6	1000 Kernel Weight (g)	31.3	33.9	27.2	31.5
7	Kernel Size % Large	62	73	50	60
8	Kernel Size % Small	5	5	7	7
9	Wheat Moisture (%)	12.3	12.1	12.7	12.0
10	Wheat Ash (14%mb)	1.75	1.56	1.73	1.59
11	Wheat Falling Number (sec)	407	428	425	443
12	Vitreous Kernels (%)	97	71	90	56
Flour Extraction (%)					
13	Tempered Wheat Basis (%)	66.5	68.9	68.8	70.3
14	Total Product Basis (%)	68.8	72.4	71.2	73.4
15	Flour /Bu Wheat (lbs)	45.3	43.7	44.8	43.6
16	Flour Color Brightness (L*)	90.5	90.8	90.1	90.5
	Flour Color Yellowness (b*)	9.4	10.5	9.4	10.0
17	Flour Moisture (%)	12.5	12.4	12.8	13.1
18	Flour Ash (14%mb)	0.527	0.520	0.423	0.444
19	Flour Falling Number (Malted) (sec)	265	259	258	250
Farinograph					
20	Water Absorption (500bu)	64.5	61.0	65.3	61.7
21	Water Absorption (14%mb)	62.8	59.2	64.0	60.8
22	Arrival Time (min)	1.6	1.6	1.8	2.4
23	Peak Time (min)	2.9	2.5	3.8	5.5
24	Dough Stability (min)	5.0	5.6	8.5	8.5
25	MTI (bu)	39	32	22	29
26	TTB (min)	6.6	7.2	9.4	11.0
<b>II. Cooperator Evaluation</b>					
27	Bake Absorption (Avg %)	62.5±2.6	59.9±2.1	64.3±1.9	61.7±2.1
28	Loaf Volume (Avg % of Check)		95.0±6.2		97.9±3.9

Quality Trait	II. Cooperator Results/Evaluation	Brookings		Casselton	
		Glenn Check	SD3868	Glenn Check	SD3868
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____		_____	_____
	2 Short		_____		
	1 Very Short	3.2±1.3	2.2±0.7	3.9±0.9	3.2±0.4
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable	_____	_____	_____	_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	3.9±0.9	3.0±0.7	3.7±1.0	3.2±0.7
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check		_____		_____
	1 Much Less Tolerance Than Check		2.6±1.1		2.6±0.7
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				_____
	1 Much Poorer Than Check		2.7±0.9		2.9±0.6
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				_____
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.8±0.8		3.0±1.2
	<b>III. Cooperator Quality Assessment</b>				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		1.6±0.5		_____
	1 Much Poorer Than Check		_____		2.1±0.3
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				_____
	1 Much Poorer Than Check		2.2±0.4		2.4±0.5
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				_____
	1 Much Poorer Than Check		2.2±0.8		2.7±1.1
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.3±1.0		2.4±0.9

Quality Trait	Crookston		Minot		
	Glenn Check	CS 3100Q	Glenn Check	CS 3100Q	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	15.6	13.8	16.5	16.1
2	Flour Protein (12%mb)	15.0	12.7	15.6	15.2
3	Market Value (Score 1-6)	4.6	3.2	3.5	2.6
4	Market Value (Score 1-10)	10	5.6	10	7.8
5	Test Weight (lb/bu)	64.8	60.3	59.4	59.4
6	1000 Kernel Weight (g)	31.3	25.8	20.9	24.8
7	Kernel Size % Large	71	27	9	11
8	Kernel Size % Small	3	13	22	17
9	Wheat Moisture (%)	12.4	11.9	12.1	12.2
10	Wheat Ash (14%mb)	1.56	1.72	1.37	1.40
11	Wheat Falling Number (sec)	430	468	388	271
12	Vitreous Kernels (%)	99	77	86	19
Flour Extraction (%)					
13	Tempered Wheat Basis (%)	67.0	70.4	70.5	69.6
14	Total Product Basis (%)	69.7	73.2	73.4	73.0
15	Flour /Bu Wheat (lbs)	45.1	44.5	43.8	43.3
16	Flour Color Brightness (L*)	90.2	91.6	90.5	90.8
	Flour Color Yellowness (b*)	9.2	8.8	9.0	8.4
17	Flour Moisture (%)	12.8	13.1	12.2	12.1
18	Flour Ash (14%mb)	0.415	0.454	0.406	0.448
19	Flour Falling Number (Malted) (sec)	267	261	264	257
Farinograph					
20	Water Absorption (500bu)	67.5	60.8	65.1	63.1
21	Water Absorption (14%mb)	66.1	59.8	63.0	61.0
22	Arrival Time (min)	2.3	2.1	5.2	4.1
23	Peak Time (min)	6.7	6.9	9.4	7.3
24	Dough Stability (min)	12.8	10.6	10.8	9.1
25	MTI (bu)	17	26	26	29
26	TTB (min)	14.9	12.9	15.3	12.5
<b>II. Cooperator Evaluation</b>					
27	Bake Absorption (Avg %)	65.3±2.9	60.7±2.4	63.2±1.7	62.1±2.6
28	Loaf Volume (Avg % of Check)		100.1±9.8		100.4±2.6

Quality Trait	II. Cooperator Results/Evaluation	Crookston		Minot	
		Glenn Check	CS 3100Q	Glenn Check	CS 3100Q
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short	3.7±0.9	3.8±0.8	3.7±1.0	3.2±1.2
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic	_____	_____	_____	_____
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	4.2±0.7	3.6±1.2	4.0±0.7	3.6±1.1
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check		_____		_____
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		3.0±0.7		2.8±0.7
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check		_____		_____
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		4.0±0.7		3.7±0.7
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.6±1.0		3.2±0.8
	<b>III. Cooperator Quality Assessment</b>				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		1.3±0.5		_____
	1 Much Poorer Than Check		_____		2.8±0.4
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.8±0.8		2.6±0.5
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.8±0.8		3.2±0.8
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.7±0.7		3.0±0.7

Quality Trait	Casselton		Minot		
	Glenn Check	CA905-749	Glenn Check	CA905-749	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	15.0	15.3	16.5	16.3
2	Flour Protein (12%mb)	14.1	13.8	15.6	16.2
3	Market Value (Score 1-6)	4.1	4.4	3.5	3.7
4	Market Value (Score 1-10)	10	10	10	8
5	Test Weight (lb/bu)	62.8	63.3	59.4	61.6
6	1000 Kernel Weight (g)	27.2	29.9	20.9	25.4
7	Kernel Size % Large	50	57	9	20
8	Kernel Size % Small	7	6	22	13
9	Wheat Moisture (%)	12.7	11.8	12.1	12.0
10	Wheat Ash (14%mb)	1.73	1.68	1.37	1.25
11	Wheat Falling Number (sec)	425	428	388	308
12	Vitreous Kernels (%)	90	68	86	71
Flour Extraction (%)					
13	Tempered Wheat Basis (%)	68.8	71.0	70.5	68.9
14	Total Product Basis (%)	71.2	74.3	73.4	72.1
15	Flour /Bu Wheat (lbs)	44.8	46.9	43.8	44.4
16	Flour Color Brightness (L*)	90.1	90.7	90.5	90.3
	Flour Color Yellowness (b*)	9.4	9.9	9.0	8.8
17	Flour Moisture (%)	12.8	12.9	12.2	12.4
18	Flour Ash (14%mb)	0.423	0.511	0.406	0.402
19	Flour Falling Number (Malted) (sec)	258	268	264	251
Farinograph					
20	Water Absorption (500bu)	65.3	65.2	65.1	64.1
21	Water Absorption (14%mb)	64.0	63.9	63.0	62.3
22	Arrival Time (min)	1.8	2.5	5.2	5.2
23	Peak Time (min)	3.8	6.7	9.4	9.3
24	Dough Stability (min)	8.5	9.4	10.8	10.4
25	MTI (bu)	22	30	26	27
26	TTB (min)	9.4	11.6	15.3	14.4
<b>II. Cooperator Evaluation</b>					
27	Bake Absorption (Avg %)	64.3±1.9	63.8±1.8	63.2±1.7	63.3±2.3
28	Loaf Volume (Avg % of Check)		97.4±5.5		102.6±6.7

Quality Trait	II. Cooperator Results/Evaluation	Casselton		Minot	
		Glenn Check	CA905-749	Glenn Check	CA905-749
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium	_____	_____	_____	_____
	2 Short				
	1 Very Short	3.9±0.9	3.8±0.8	3.7±1.0	3.8±1.1
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable	_____	_____	_____	_____
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	3.7±1.0	3.9±0.8	4.0±0.7	3.7±0.9
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check		_____		_____
	1 Much Less Tolerance Than Check		2.9±0.6		3.0±0.7
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.8±0.7		3.6±0.9
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.1±1.1		3.0±1.0
	III. Cooperator Quality Assessment				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.9±0.6		3.2±0.7
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check		_____		_____
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.4±1.0		3.2±0.7
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.7±1.0		3.4±1.0
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check		_____		_____
	1 Much Poorer Than Check		2.7±0.7		3.3±0.7

Quality Trait	Casselton		Williston		
	Glenn Check	06 Inc 2	Glenn Check	06 Inc 2	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	15.0	16.2	17.6	18.6
2	Flour Protein (12%mb)	14.1	15.1	16.9	17.4
3	Market Value (Score 1-6)	4.1	4.1	4.1	3.8
4	Market Value (Score 1-10)	10	8.4	10	9.4
5	Test Weight (lb/bu)	62.8	59.4	58.2	56.8
6	1000 Kernel Weight (g)	27.2	33.6	22.4	26.2
7	Kernel Size % Large	50	64	7	23
8	Kernel Size % Small	7	6	17	9
9	Wheat Moisture (%)	12.7	11.4	11.7	11.4
10	Wheat Ash (14%mb)	1.73	1.75	1.46	1.64
11	Wheat Falling Number (sec)	425	462	437	489
12	Vitreous Kernels (%)	90	54	100	95
Flour Extraction (%)					
13	Tempered Wheat Basis (%)	68.8	71.0	69.6	69.4
14	Total Product Basis (%)	71.2	74.2	72.8	72.8
15	Flour /Bu Wheat (lbs)	44.8	44.3	42.5	41.4
16	Flour Color Brightness (L*)	90.1	90.1	90.3	89.8
	Flour Color Yellowness (b*)	9.4	9.6	10.0	10.3
17	Flour Moisture (%)	12.8	12.9	12.2	12.0
18	Flour Ash (14%mb)	0.423	0.526	0.472	0.613
19	Flour Falling Number (Malted) (sec)	258	259	258	274
Farinograph					
20	Water Absorption (500bu)	65.3	61.5	67.1	65.4
21	Water Absorption (14%mb)	64.0	60.2	65.2	63.1
22	Arrival Time (min)	1.8	2.5	5.2	5.4
23	Peak Time (min)	3.8	8.0	9.4	10.8
24	Dough Stability (min)	8.5	15.6	14.8	14.5
25	MTI (bu)	22	19	16	7
26	TTB (min)	9.4	15.4	18.3	20.0
<b>II. Cooperator Evaluation</b>					
27	Bake Absorption (Avg %)	64.3±1.9	62.0±2.9	65.6±1.9	63.9±1.9
28	Loaf Volume (Avg % of Check)		95.8±8.1		91.1±14.0



Quality Trait	II. Cooperator Results/Evaluation	Casselton		Williston	
		Glenn Check	06 Inc 2	Glenn Check	06 Inc 2
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short	3.9±0.9	4.7±0.5	4.0±0.9	4.6±0.7
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	3.7±1.0	4.4±1.0	3.9±0.9	4.2±1.0
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		3.6±1.2		3.1±0.9
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.9±0.6		3.0±1.1
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.4±0.9		2.8±1.1
	<b>III. Cooperator Quality Assessment</b>				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		4.2±1.0		3.8±0.7
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.3±0.5		2.8±1.2
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.6±1.1		2.9±1.3
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.3±1.0		2.6±1.1

Quality Trait	Brookings		Casselton		Crookston		
	Glenn		Glenn		Glenn		
	Check	00S0120-3W	Check	00S0120-3W	Check	00S0120-3W	
<b>I. USDA/ARS WQL Evaluation</b>							
1	Wheat Protein (12%mb)	12.8	12.4	15.0	14.7	15.6	13.4
2	Flour Protein (12%mb)	12.0	11.3	14.1	13.6	15.0	12.6
3	Market Value (Score 1-6)	3.7	3.6	4.1	2.9	4.6	4.0
4	Market Value (Score 1-10)	10	8.2	10	8	10	6.8
5	Test Weight (lb/bu)	65.7	61.9	62.8	59.4	64.8	62.0
6	1000 Kernel Weight (g)	31.3	33.4	27.2	27.8	31.3	31.1
7	Kernel Size % Large	62	43	50	37	71	41
8	Kernel Size % Small	5	12	7	12	3	7
9	Wheat Moisture (%)	12.3	12.2	12.7	12.5	12.4	11.4
10	Wheat Ash (14%mb)	1.75	1.76	1.73	1.63	1.56	1.45
11	Wheat Falling Number (sec)	407	454	425	374	430	467
12	Vitreous Kernels (%)	97	91	90	15	99	83
	Flour Extraction (%)						
13	Tempered Wheat Basis (%)	66.5	67.7	68.8	70.8	67.0	68.0
14	Total Product Basis (%)	68.8	70.6	71.2	73.6	69.7	70.9
15	Flour /Bu Wheat (lbs)	45.3	43.7	44.8	43.7	45.1	44.5
16	Flour Color Brightness (L*)	90.5	91.5	90.1	91.8	90.2	91.1
	Flour Color Yellowness (b*)	9.4	10.1	9.4	10.6	9.2	10.3
17	Flour Moisture (%)	12.5	12.3	12.8	12.5	12.8	12.5
18	Flour Ash (14%mb)	0.527	0.493	0.423	0.464	0.415	0.418
19	Flour Falling Number (Malted) (sec)	265	250	258	255	267	250
	Farinograph						
20	Water Absorption (500bu)	64.5	64.4	65.3	64.2	67.5	67.6
21	Water Absorption (14%mb)	62.8	62.5	64.0	62.5	66.1	65.9
22	Arrival Time (min)	1.6	1.3	1.8	2.6	2.3	1.9
23	Peak Time (min)	2.9	2.7	3.8	6.7	6.7	3.7
24	Dough Stability (min)	5.0	4.5	8.5	8.7	12.8	6.9
25	MTI (bu)	39	48	22	34	17	29
26	TTB (min)	6.6	5.8	9.4	10.6	14.9	8.3
	<b>II. Cooperator Evaluation</b>						
27	Bake Absorption (Avg %)	62.5±2.6	61.7±2.7	64.3±1.9	63.1±2.1	65.3±2.9	64.6±2.9
28	Loaf Volume (Avg % of Check)		99.3±4.7		99.3±6.5		96.1±5.8

Quality Trait	II. Cooperator Results/Evaluation	Brookings		Casselton		Crookston	
		Glenn Check	00S0120-3W	Glenn Check	00S0120-3W	Glenn Check	00S0120-3W
29	Mixing Requirement						
	5 Very Long						
	4 Long						
	3 Medium	_____	_____	_____	_____	_____	_____
	2 Short						
	1 Very Short	3.2±1.3	3.3±1.4	3.9±0.9	3.7±1.1	3.7±0.9	3.0±1.5
30	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic	_____	_____	_____	_____	_____	_____
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky	3.9±0.9	4.0±0.9	3.7±1.0	3.8±0.8	4.2±0.7	3.2±1.6
31	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check						
	1 Much Less Tolerance Than Check		3.0±0.5		2.8±0.4		2.4±1.0
32	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.3±0.5		3.0±1.0		2.7±1.0
33	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.0±0.5		3.2±1.3		3.1±0.6
	III. Cooperator Quality Assessment						
	Quality Trait 1-2: Protein						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						1.3±0.5
	1 Much Poorer Than Check		2.2±0.4		2.9±0.6		_____
	Quality Trait 3-19: Milling						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.2±0.4		2.2±0.7		2.9±0.3
	Quality Trait 20-33: Baking						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.8±0.8		3.2±1.0		2.4±1.0
	Quality Trait 1-33: Overall Comparison						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.7±0.5		2.8±0.8		2.3±1.0

Quality Trait		Casselton		Minot		Williston	
		Glenn	ND 901	Glenn	ND 901	Glenn	ND 901
		Check		Check		Check	
<b>I. USDA/ARS WQL Evaluation</b>							
1	Wheat Protein (12%mb)	15.0	16.5	16.5	16.4	17.6	18.6
2	Flour Protein (12%mb)	14.1	15.3	15.6	15.8	16.9	18.2
3	Market Value (Score 1-6)	4.1	3.9	3.5	3.4	4.1	3.7
4	Market Value (Score 1-10)	10	9.2	10	9.6	10	9.6
5	Test Weight (lb/bu)	62.8	61.0	59.4	58.8	58.2	58.0
6	1000 Kernel Weight (g)	27.2	28.4	20.9	23.9	22.4	21.1
7	Kernel Size % Large	50	54	9	13	7	7
8	Kernel Size % Small	7	6	22	19	17	26
9	Wheat Moisture (%)	12.7	12.4	12.1	12.1	11.7	11.5
10	Wheat Ash (14%mb)	1.73	1.95	1.37	1.39	1.46	1.69
11	Wheat Falling Number (sec)	425	509	388	350	437	473
12	Vitreous Kernels (%)	90	77	86	86	100	98
	Flour Extraction (%)						
13	Tempered Wheat Basis (%)	68.8	71.2	70.5	66.1	69.6	68.1
14	Total Product Basis (%)	71.2	73.9	73.4	69.2	72.8	71.2
15	Flour /Bu Wheat (lbs)	44.8	45.1	43.8	40.7	42.5	41.6
16	Flour Color Brightness (L*)	90.1	90.6	90.5	90.3	90.3	89.8
	Flour Color Yellowness (b*)	9.4	10.5	9.0	10.1	10.0	11.1
17	Flour Moisture (%)	12.8	12.7	12.2	11.9	12.2	12.6
18	Flour Ash (14%mb)	0.423	0.477	0.406	0.414	0.472	0.445
19	Flour Falling Number (Malted) (sec)	258	250	264	252	258	249
	Farinograph						
20	Water Absorption (500bu)	65.3	66.8	65.1	64.6	67.1	68.6
21	Water Absorption (14%mb)	64.0	65.3	63.0	62.2	65.2	67.0
22	Arrival Time (min)	1.8	5.0	5.2	5.7	5.2	5.3
23	Peak Time (min)	3.8	8.9	9.4	10.5	9.4	8.2
24	Dough Stability (min)	8.5	9.9	10.8	11.1	14.8	14.7
25	MTI (bu)	22	25	26	28	16	13
26	TTB (min)	9.4	15.1	15.3	16.1	18.3	20.0
	<b>II. Cooperator Evaluation</b>						
27	Bake Absorption (Avg %)	64.3±1.9	64.8±1.8	63.2±1.7	62.9±2.2	65.6±1.9	66.5±1.7
28	Loaf Volume (Avg % of Check)		105.3±4.6		107.1±9.1		102.8±4.4

Quality Trait	II. Cooperator Results/Evaluation	Casselton		Minot		Williston	
		Glenn Check	ND 901	Glenn Check	ND 901	Glenn Check	ND 901
29	Mixing Requirement						
	5 Very Long						
	4 Long						
	3 Medium						
	2 Short						
	1 Very Short	3.9±0.9	3.3±0.7	3.7±1.0	3.8±1.1	4.0±0.9	3.8±1.0
30	Dough Characteristics						
	5 Bucky-Tough						
	4 Strong-Elastic						
	3 Medium-Pliable						
	2 Mellow-Very Pliable						
	1 Weak-Short or Sticky	3.7±1.0	3.6±0.9	4.0±0.7	3.9±1.1	3.9±0.9	4.1±0.6
31	Mixing Tolerance						
	5 Much More Tolerance Than Check						
	4 More Tolerance Than Check						
	3 Tolerance Equivalent To Check						
	2 Less Tolerance Than Check						
	1 Much Less Tolerance Than Check		2.7±0.7		3.1±0.6		2.8±0.4
32	Internal Crumb Color						
	5 Much Brighter Than Check						
	4 Brighter Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.8±0.7		2.9±0.6		2.7±1.0
33	Internal Grain and Texture						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		2.9±1.4		2.9±1.1		2.9±1.2
	<b>III. Cooperator Quality Assessment</b>						
	Quality Trait 1-2: Protein						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		4.2±1.0		3.2±0.4		3.9±0.6
	Quality Trait 3-19: Milling						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.0±0.5		2.3±0.7		3.2±0.8
	Quality Trait 20-33: Baking						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.1±1.1		3.4±0.9		3.3±0.9
	Quality Trait 1-33: Overall Comparison						
	5 Much Better Than Check						
	4 Better Than Check						
	3 Equivalent To Check						
	2 Poorer Than Check						
	1 Much Poorer Than Check		3.1±1.1		3.2±0.4		3.3±0.5

Quality Trait	Casselton		Minot		
	Glenn Check	CA905-750	Glenn Check	CA905-750	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	15.0	15.6	16.5	16.4
2	Flour Protein (12%mb)	14.1	14.2	15.6	15.7
3	Market Value (Score 1-6)	4.1	4.3	3.5	3.9
4	Market Value (Score 1-10)	10	10	10	10
5	Test Weight (lb/bu)	62.8	62.2	59.4	59.4
6	1000 Kernel Weight (g)	27.2	29.2	20.9	24.8
7	Kernel Size % Large	50	56	9	17
8	Kernel Size % Small	7	7	22	17
9	Wheat Moisture (%)	12.7	12.1	12.1	12.2
10	Wheat Ash (14%mb)	1.73	1.68	1.37	1.30
11	Wheat Falling Number (sec)	425	468	388	412
12	Vitreous Kernels (%)	90	87	86	87
	Flour Extraction (%)				
13	Tempered Wheat Basis (%)	68.8	70.2	70.5	69.6
14	Total Product Basis (%)	71.2	73.7	73.4	72.7
15	Flour /Bu Wheat (lbs)	44.8	45.4	43.8	43.1
16	Flour Color Brightness (L*)	90.1	90.3	90.5	90.2
	Flour Color Yellowness (b*)	9.4	9.8	9.0	9.5
17	Flour Moisture (%)	12.8	12.6	12.2	12.1
18	Flour Ash (14%mb)	0.423	0.527	0.406	0.436
19	Flour Falling Number (Malted) (sec)	258	262	264	248
	Farinograph				
20	Water Absorption (500bu)	65.3	66.7	65.1	65.0
21	Water Absorption (14%mb)	64.0	65.1	63.0	62.8
22	Arrival Time (min)	1.8	3.2	5.2	4.5
23	Peak Time (min)	3.8	7.5	9.4	8.3
24	Dough Stability (min)	8.5	10.2	10.8	8.8
25	MTI (bu)	22	27	26	33
26	TTB (min)	9.4	12.3	15.3	12.6
	<b>II. Cooperator Evaluation</b>				
27	Bake Absorption (Avg %)	64.3±1.9	64.8±2.0	63.2±1.7	63.5±1.9
28	Loaf Volume (Avg % of Check)		95.5±7.5		103.8±6.3

Quality Trait	II. Cooperator Results/Evaluation	Casselton		Minot	
		Glenn Check	CA905-750	Glenn Check	CA905-750
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short	3.9±0.9	3.6±0.7	3.7±1.0	3.3±1.1
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	3.7±1.0	3.4±1.2	4.0±0.7	3.7±1.3
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		2.7±1.1		2.4±1.1
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.4±0.7		3.2±0.7
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.2±1.1		3.1±0.6
	<b>III. Cooperator Quality Assessment</b>				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.6±0.5		3.1±0.3
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.9±0.6		2.7±0.7
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.3±1.0		3.3±1.0
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.4±0.9		2.9±1.1

Quality Trait	Casselton		Crookston		Minot		Williston		
	Glenn Check	ND 809	Glenn Check	ND 809	Glenn Check	ND 809	Glenn Check	ND 809	
<b>I. USDA/ARS WQL Evaluation</b>									
1	Wheat Protein (12%mb)	15.0	15.7	15.6	13.8	16.5	16.4	17.6	17.7
2	Flour Protein (12%mb)	14.1	14.1	15.0	12.9	15.6	15.8	16.9	16.7
3	Market Value (Score 1-6)	4.1	4.2	4.6	4.5	3.5	3.9	4.1	3.7
4	Market Value (Score 1-10)	10	9.6	10	7.4	10	10	10	9.6
5	Test Weight (lb/bu)	62.8	61.6	64.8	63.1	59.4	59.7	58.2	56.8
6	1000 Kernel Weight (g)	27.2	28.8	31.3	36.1	20.9	22.2	22.4	24.7
7	Kernel Size % Large	50	63	71	80	9	20	7	10
8	Kernel Size % Small	7	4	3	2	22	15	17	18
9	Wheat Moisture (%)	12.7	12.4	12.4	13.1	12.1	12.3	11.7	11.6
10	Wheat Ash (14%mb)	1.73	1.66	1.56	1.59	1.37	1.40	1.46	1.55
11	Wheat Falling Number (sec)	425	439	430	434	388	413	437	454
12	Vitreous Kernels (%)	90	74	99	49	86	96	100	100
Flour Extraction (%)									
13	Tempered Wheat Basis (%)	68.8	70.6	67.0	70.4	70.5	66.7	69.6	69.2
14	Total Product Basis (%)	71.2	73.5	69.7	73.6	73.4	69.5	72.8	72.5
15	Flour /Bu Wheat (lbs)	44.8	45.2	45.1	46.0	43.8	41.5	42.5	41.2
16	Flour Color Brightness (L*)	90.1	89.8	90.2	89.9	90.5	90.1	90.3	90.1
	Flour Color Yellowness (b*)	9.4	9.7	9.2	9.4	9.0	9.4	10.0	10.6
17	Flour Moisture (%)	12.8	13.0	12.8	12.7	12.2	12.7	12.2	12.4
18	Flour Ash (14%mb)	0.423	0.463	0.415	0.429	0.406	0.426	0.472	0.478
19	Flour Falling Number (Malted)	258	244	267	260	264	256	258	256
Farinograph									
20	Water Absorption (500bu)	65.3	67.0	67.5	67.0	65.1	66.3	67.1	69.1
21	Water Absorption (14%mb)	64.0	66.1	66.1	65.5	63.0	64.9	65.2	67.3
22	Arrival Time (min)	1.8	3.2	2.3	2.2	5.2	5.0	5.2	6.0
23	Peak Time (min)	3.8	5.7	6.7	4.2	9.4	8.9	9.4	10.7
24	Dough Stability (min)	8.5	11.7	12.8	11.9	10.8	11.3	14.8	11.6
25	MTI (bu)	22	16	17	7	26	21	16	24
26	TTB (min)	9.4	15.0	14.9	14.1	15.3	15.9	18.3	17.8
<b>II. Cooperator Evaluation</b>									
27	Bake Absorption (Avg %)	64.3±1.9	65.2±2.0	65.3±2.9	64.5±2.6	63.2±1.7	64.6±1.7	65.6±1.9	66.4±1.9
28	Loaf Volume (Avg % of Check)		103.2±6.7		95.4±7.9		104.4±8.6		100.6±5.2



Quality Trait	II. Cooperator Results/Evaluation	Casselton		Crookston		Minot		Williston	
		Glenn Check	ND 809	Glenn Check	ND 809	Glenn Check	ND 809	Glenn Check	ND 809
29	Mixing Requirement								
	5 Very Long								
	4 Long								
	3 Medium								
	2 Short								
	1 Very Short	3.9±0.9	3.3±0.9	3.7±0.9	3.3±1.0	3.7±1.0	3.7±1.0	4.0±0.9	3.9±0.8
30	Dough Characteristics								
	5 Bucky-Tough								
	4 Strong-Elastic								
	3 Medium-Pliable								
	2 Mellow-Very Pliable								
	1 Weak-Short or Sticky	3.7±1.0	3.3±1.1	4.2±0.7	3.3±1.1	4.0±0.7	3.8±1.0	3.9±0.9	3.6±1.4
31	Mixing Tolerance								
	5 Much More Tolerance Than Check								
	4 More Tolerance Than Check								
	3 Tolerance Equivalent To Check								
	2 Less Tolerance Than Check								
	1 Much Less Tolerance Than Check		2.6±1.3		2.8±0.8		3.3±0.5		2.8±1.0
32	Internal Crumb Color								
	5 Much Brighter Than Check								
	4 Brighter Than Check								
	3 Equivalent To Check								
	2 Poorer Than Check								
	1 Much Poorer Than Check		3.3±0.7		3.1±0.6		3.1±0.8		3.7±0.9
33	Internal Grain and Texture								
	5 Much Better Than Check								
	4 Better Than Check								
	3 Equivalent To Check								
	2 Poorer Than Check								
	1 Much Poorer Than Check		3.1±1.1		3.0±0.5		3.0±1.0		3.6±0.9
	III. Cooperator Quality Assessment								
	Quality Trait 1-2: Protein								
	5 Much Better Than Check								
	4 Better Than Check								
	3 Equivalent To Check								
	2 Poorer Than Check				1.4±0.5				
	1 Much Poorer Than Check		3.4±0.5				3.1±0.3		3.1±0.3
	Quality Trait 3-19: Milling								
	5 Much Better Than Check								
	4 Better Than Check								
	3 Equivalent To Check								
	2 Poorer Than Check								
	1 Much Poorer Than Check		3.1±0.6		3.3±0.5		2.3±0.9		2.8±1.1
	Quality Trait 20-33: Baking								
	5 Much Better Than Check								
	4 Better Than Check								
	3 Equivalent To Check								
	2 Poorer Than Check								
	1 Much Poorer Than Check		3.1±0.9		3.0±1.0		3.6±0.7		3.3±1.0
	Quality Trait 1-33: Overall Comparison								
	5 Much Better Than Check								
	4 Better Than Check								
	3 Equivalent To Check								
	2 Poorer Than Check								
	1 Much Poorer Than Check		3.0±0.7		3.0±0.7		2.9±0.8		3.2±0.8

Quality Trait	Casselton		Williston		
	Glenn Check	06 Inc1	Glenn Check	06 Inc1	
<b>I. USDA/ARS WQL Evaluation</b>					
1	Wheat Protein (12%mb)	15.0	15.2	17.6	19.2
2	Flour Protein (12%mb)	14.1	14.4	16.9	17.5
3	Market Value (Score 1-6)	4.1	4.5	4.1	3.8
4	Market Value (Score 1-10)	10	10	10	9.2
5	Test Weight (lb/bu)	62.8	62.4	58.2	56.3
6	1000 Kernel Weight (g)	27.2	29.7	22.4	21.1
7	Kernel Size % Large	50	41	7	2
8	Kernel Size % Small	7	12	17	41
9	Wheat Moisture (%)	12.7	12.2	11.7	11.3
10	Wheat Ash (14%mb)	1.73	1.48	1.46	1.70
11	Wheat Falling Number (sec)	425	488	437	498
12	Vitreous Kernels (%)	90	59	100	97
Flour Extraction (%)					
13	Tempered Wheat Basis (%)	68.8	72.0	69.6	69.2
14	Total Product Basis (%)	71.2	75.0	72.8	72.0
15	Flour /Bu Wheat (lbs)	44.8	46.6	42.5	40.8
16	Flour Color Brightness(L*)	90.1	91.1	90.3	89.7
	Flour Color Yellowness (b*)	9.4	9.9	10.0	10.4
17	Flour Moisture (%)	12.8	12.8	12.2	12.5
18	Flour Ash (14%mb)	0.423	0.430	0.472	0.435
19	Flour Falling Number (Malted) (sec)	258	248	258	246
Farinograph					
20	Water Absorption (500bu)	65.3	65.1	67.1	67.0
21	Water Absorption (14%mb)	64.0	60.2	65.2	65.3
22	Arrival Time (min)	1.8	2.6	5.2	4.3
23	Peak Time (min)	3.8	7.8	9.4	7.9
24	Dough Stability (min)	8.5	9.8	14.8	12.5
25	MTI (bu)	22	34	16	18
26	TTB (min)	9.4	12.1	18.3	17.9
<b>II. Cooperator Evaluation</b>					
27	Bake Absorption (Avg %)	64.3±1.9	62.0±2.4	65.6±1.9	65.5±2.0
28	Loaf Volume (Avg % of Check)		101.0±5.5		97.5±5.4

Quality Trait	II. Cooperator Results/Evaluation	Casselton		Williston	
		Glenn Check	06 Inc1	Glenn Check	06 Inc1
29	Mixing Requirement				
	5 Very Long				
	4 Long				
	3 Medium				
	2 Short				
	1 Very Short	3.9±0.9	3.1±0.6	4.0±0.9	3.6±1.2
30	Dough Characteristics				
	5 Bucky-Tough				
	4 Strong-Elastic				
	3 Medium-Pliable				
	2 Mellow-Very Pliable				
	1 Weak-Short or Sticky	3.7±1.0	3.4±0.5	3.9±0.9	3.7±1.3
31	Mixing Tolerance				
	5 Much More Tolerance Than Check				
	4 More Tolerance Than Check				
	3 Tolerance Equivalent To Check				
	2 Less Tolerance Than Check				
	1 Much Less Tolerance Than Check		2.7±1.1		2.4±0.7
32	Internal Crumb Color				
	5 Much Brighter Than Check				
	4 Brighter Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.9±1.2		2.9±0.8
33	Internal Grain and Texture				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.1±1.2		3.2±1.0
	<b>III. Cooperator Quality Assessment</b>				
	Quality Trait 1-2: Protein				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.1±0.3		4.0±0.9
	Quality Trait 3-19: Milling				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		3.3±1.0		2.9±1.3
	Quality Trait 20-33: Baking				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.8±1.0		3.0±0.9
	Quality Trait 1-33: Overall Comparison				
	5 Much Better Than Check				
	4 Better Than Check				
	3 Equivalent To Check				
	2 Poorer Than Check				
	1 Much Poorer Than Check		2.8±0.8		2.9±1.1

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### Source of Wheat

<u>Source – Breeding Program</u>	<u>Code#</u>	<u>Identification</u>
Meridian	1	CS 3100L*
University of Minnesota	2	MN01311-A-1
North Dakota State University	3	NDSW0449
South Dakota State University	4	SD3868
Meridian	5	CS 3100Q*
Westbred	6	CA905-749
Trigen	7	06 Inc 2
AgriPro	9	00S0120-3W
North Dakota State University	10	ND901
Westbred	11	CA905-750
North Dakota State University	12	ND809
Trigen	13	06 Inc 1
 Glenn Check	 8	

\*Second year of testing in WQC trials

## Field Plot Locations and Procedures

The experimental lines and check variety were grown at the following locations in the spring wheat region:

South Dakota State University, Brookings, SD – Jack Ingmanson  
 Northwest Experiment Station, Crookston, MN – John Wiersma  
 Agronomy Seed Farm, Casselton, ND – Tom Teigen  
 North Central Agricultural Experiment Station, Minot, ND – Jay Fisher  
 Williston Agricultural Experiment Station, Williston, ND

Wheat was seeded in large-scale plots of ½ acre in size to approximate commercial production. Cultural practices such as tillage and weed control common to each area were used. Consideration was also given to germination, seed size, and planting depth to provide stand uniformity. Based on soil test results from each location, nitrogen fertilizer was applied to the test plots at rates approaching higher levels than used commercially to more fully express the potential of each experimental line. Levels of phosphorus and potassium were applied in sufficient amounts so as not to be limiting factors. Each plot was individually harvested and the grain produced was thoroughly blended to obtain a uniform sample representing the entire plot.

### 2007 Hard Spring Wheat Production Sites

Entry #	Entry	Reference	Brookings	Casselton	Crookston	Minot	Williston
1	CS 3100L	Meridian			X	X	
2	MN01311-A-1	Un of MN		X	X		
3	NDSW0449	NDSU		X		X	X
4	SD3868	SDSU	X	X			
5	CS 3100Q	Meridian			X	X	
6	CA905-749	Westbred		X		X	
7	06 Inc 2	Trigen		X			X
8	Glenn	Check	X	X	X	X	X
9	00S0120-3W	AgriPro	X	X	X	na	
10	ND 901	NDSU		X		X	X
11	CA905-750	Westbred		X		X	
12	ND 809	NDSU		X	X	X	X
13	06 Inc1	Trigen		X			X

## Descriptions of 2007 Experimental Lines

### CS 3100L – SWQAC 1

CS 3100L hard white spring wheat was bred and developed by New Zealand Crop and has been extensively tested in the USA by Meridian Seeds LLC. It will be released in 2007. CS 3100L has short-intermediate height and intermediate straw strength. The variety has full season maturity and good test weight with intermediate protein concentration. Suitable for milling for hard white wheat programs.

### MN01311-A-1 – SWQAC 2

MN01311-A-1, pedigree 97T-1003 (Verde/Sonja)/Verde, was released as 'Tom' in 2008. Tom has medium maturity, height, and straw strength. Tom has shown consistently high grain yields, especially in northern locations, moderate leaf rust resistance, and Fusarium head blight resistance comparable to Alsen. Tom is resistant to the Ug99 race of stem rust. Tom has large kernels, above average test weight and grain protein content, and very good resistance to preharvest sprouting. The name 'Tom' was chosen to honor the contributions to the wheat industry of Tom Anderson, who passed away in 2007. Tom Anderson was a visionary leader for agriculture at the local, regional, and national levels. Tom farmed near Barnesville, MN, served as co-chair of the U.S. Wheat and Barley Scab Initiative and as a grower representative on numerous research and search committees.

### NDSW0449 – SWQAC 3

NDSW0449 was selected from the cross (Ernest//ND622/Keene /3/\*2//SD3310/SD3414). It is a hard red spring wheat developed primarily for its resistance to the wheat stem sawfly. It is medium-tall height, awned, and matures approximately 2 days later than Reeder. NDSW0449 is susceptible to FHB, moderately susceptible to leaf rust, and resistant to moderately resistant to stem rust. It has excellent resistance to wheat stem sawfly infestation despite exhibiting less stem-solidity compared with the variety Choteau. NDSW0449 has exhibited excellent milling and baking characteristics, with generally better than average grain protein content, higher loaf volume, and stronger mix characteristics compared with other hard red spring wheat varieties.

### SD3868 – SWQAC 4

SD3868 is an F<sub>4</sub> derived line from the cross ND 2897/SD3479//SD3411. SD3868 was first included in our AYT trials during the 2004 growing season. During this testing period, SD3868 was consistently among those entries able to produce the most grain. Test weight, protein concentration, and heading date measures for SD3868 are approximately average when tested with other SD derived entries. It is slightly taller than Briggs, Granger, and Traverse. Our plan was to further increase seed of SD3868 during the 2008 growing season in anticipation of release as a cultivar in 2009. During the 2007 growing season, however, SD3868 was found to be very susceptible to leaf rust infection. SD3868 will not be further considered for cultivar release as it has been discarded from the program.

## **CS 3100Q – SWQAC 5**

CS 3100Q hard white spring wheat was bred and developed by New Zealand Crop and found and has been extensively tested in the USA by Meridian Seeds LLC. It will be released in 2007. CS 3100Q is a medium-tall variety with intermediate straw strength. The variety has early-medium maturity and good test weight with good protein concentration. Suitable for milling for hard white wheat programs.

## **CA905-749 – SWQAC 6**

CA905-749 is a good standing, medium tall, medium maturity wheat that can achieve high yield of high test weight, medium protein grain in the hard red spring wheat growing areas of the Northern Great Plains. It has spikes that are oblong and tan in color. CA905-749 is resistant to stem rust and moderately resistant to moderately susceptible to leaf rust and foliar disease (tan spot and *Septoria tritici*). It is moderately resistant to *Fusarium* head blight, and is moderately susceptible to susceptible to stripe rust. Quality of CA905-749 is good based on the test weight, protein and flour SDS sedimentation values.

## **06 Inc 2 – SWQAC 7**

06 Inc 2 is a semi-dwarf hard red spring wheat adapted to the Northern Plains. It heads early but is somewhat later maturing than entry 06 Inc 1. It is derived from a cross between the Brazilian variety BRS 177 and the Argentine variety Prointa Granar. Its yield and test weight are quite similar to those of Freyr, but it is somewhat shorter with better straw strength. It also has excellent protein content. We had hoped it would be a niche variety, but in light of the performance of newer varieties, our assessment today is that its future usefulness is as a parent.

## **00S0120-3W – SWQAC 9**

00S0120-3W is a hard white spring wheat developed by AgriPro. It was derived from the cross "Sunelg/Russ/3/Russ//China Scab #22/N92-0248". It has exhibited good yield and test weight over three years of testing in the Northern Plains. Yields have been competitive with the majority of hard red spring varieties. It is a semidwarf with medium-early heading. It is moderately susceptible to leaf rust and it has average tolerance to other foliar diseases. Its rating for FHB is moderately resistant, similar to Freyr. Limited quantities of Foundation seed was produced in 2007. Our release decision is pending industry interest.

## **ND901 - SWQAC 10**

ND901CF is the first NDSU HRSW 'Clearfield' herbicide resistant line. ND901CF is selected from the first HRSW generation with the Clearfield resistance based on 2 genes system. It includes in its parentage "Grandin" and "Kulm", two NDSU HRSW adapted to Western regions of ND. It is recommended for rain-fed and dryland regions. Grain yield of ND901CF is higher than AP 603CL, the HRSW Clearfield resistant released by AgriPro in 2006. Average yield of ND 901 across ND in 2006 and 2007 was comparable to Alsen and slightly lower than Reeder. ND901CF is a semi dwarf (similar to Glenn and AP 603CL) with medium earliness (similar to Parshall and Steele-ND) but earlier than

AP603CL. It has a very good straw strength. ND901CF has excellent milling and baking properties in general. It is a very high protein (very close to Dapps) cultivar with good test weight (similar to Alsen). ND901CF is in general resistant to medium resistant to leaf rust; medium susceptible to medium resistant to stem rust and susceptible to scab. That is why ND 901CL is recommended for Western regions where diseases may not be so critical under normal growing conditions.

### **CA905-750 – SWQAC 11**

CA905-750 is a good standing, medium tall, medium maturity wheat that can achieve high yield of high test weight, medium protein grain in the hard red spring wheat growing areas of the Northern Great Plains. It has spikes that are tapering in shape and tan in color. CA905-750 is resistant to stem rust and moderately resistant to moderately susceptible to leaf rust and foliar disease (tan spot, and Septoria tritici). It is moderately resistant to Fusarium head blight, and is moderately susceptible to susceptible to stripe rust. Quality of CA905-750 is good based on the test weight, protein, and flour SDS sedimentation values

### **ND809 – SWQAC 12**

ND 809 was selected from a 3-way cross involving an NDSU experimental line (ND 2831) that is derived from "Sumai 3", a major source of resistance to Fusarium head blight (FHB) or scab. Therefore, ND 809 has medium resistance to FHB. It has very good resistance to other foliar diseases including stem and leaf rusts. It is an early line with medium straw strength and semi-dwarf. ND 809 has high grain yield comparable to Faller but superior to Alsen, Reeder, and Parshall. It has high test weight and grain protein content compared to Alsen. ND 809 has high protein and very good milling and baking characteristics.

### **06 Inc 1 – SWQAC 13**

06 Inc 1 is an attractive, medium-early maturing, awned, semi-dwarf hard red spring wheat with hollow stem internodes from Trigen Seed LLC adapted to the Northern Plains. It is derived from a cross between the Brazilian variety Ruby and the Argentine variety Pronta Real. Especially notable are its above average yield potential, strong straw and good tolerance to Fusarium Head Blight. For these reasons, we have called it Hat Trick and will release it in 2008. It also has a broad array of resistance to leaf rust and about an average response to leaf diseases. Powdery Mildew has been observed on Hat Trick, but ordinarily, this disease causes little damage in the Northern Plains. Test weight and protein values are good, as is its falling number with timely harvest. It also has the same set of high molecular weight glutenin sub units as are found in Alsen, Glenn, Howard, and other high quality bread varieties. Depending on growing conditions, there are about 12,000 to 14,000 kernels per pound.

### **Grain Cleaning and Milling Procedures**

Wheat (approximately 6 bu/variety) was cleaned in a Carter-Day Bulldog seed cleaner that was equipped with two rotating indent cylinders (#24 – coarse and #16 fine), a sizer cylinder (#5), vibrator, and air aspiration. Sixty pounds of cleaned wheat was tempered to 16.5% moisture basis and conditioned 16-18 hours. The tempered wheat



was milled in a Buhler Experimental Mill, MLU, at an average feed rate of 175 g/min. Flour from three break (B1, B2, B3) and three reduction (R1, R2, R3) sections of the mill were combined to straight grade flour. Prior to milling the experimental lines, the Buhler Experimental Mill was adjusted to optimize mill extraction of the Glenn check that was grown at Crookston, which represented the highest quality check among the 5 growing locations. No further adjustments were made to optimize mill extraction for the experimental lines, thus, flour extraction of individual samples was relative to flour extraction of the Crookston Glenn check.

## Methods of Analyses

Wheat Market Value Score

Test Weight (AACC Method 55-10)

Wheat and Flour Protein (AACC46-30 – combustion method)

Wheat and Flour Ash (AACC Method 08-01)

Kernel Size (Sieving according to USDA/ARS WQL)

Wheat Falling Number (Perten Falling Number Instrument)

Vitreous Kernel Content (DHV analyses by FGIS grain testing service)

Flour Color (Minolta Colorimeter L\* b\* values)

Flour Extraction: % Total Product Basis (TPB), % Tempered Wheat Basis (TWB), and Pounds Patent Flour Per Bushel Wheat.

Farinograph

Water Absorption (Brabender Computerized Farinograph w/50 g bowl) – 14%mb and 500 bu.

Arrival Time: time required for the top of the curve to reach the 500 BU line after addition of water.

Peak Time: time between addition of water and development of the maximum consistency of the dough

Stability: difference in time between the point at which the top of the curve first intercepts the 500 BU line (arrival time) and the point at which the top of the curve leaves the 500 BU line (departure time).

Mechanical Tolerance Index (MTI): difference in BU between the top of the curve at the peak and the top of the curve measured 5 min after the peak is reached.

Time to Breakdown (TTB): time from the start of mixing to the time at which consistency has decreased 30 BU from the peak point.

#### Bake Cooperator Results/Evaluation:

- Bake Absorption (Actual - %)
- Loaf Volume (% of Check)
- Mixing Requirement
- Dough Characteristics
- Mixing Tolerance
- Internal Crumb Color
- Internal Crumb Grain and Texture

#### Bake Cooperator Quality Assessment:

- Protein Content
- Milling
- Baking
- Overall Comparison

### C-Cell (Images – Pages 69-103)

#### Cell

This displays the individual cells within the product slice. Each one is colour coded according to its prominence. This is based on a combination of its area and depth. Small cells are colored in dark blue and larger ones are shown in lighter shades of blue, green and yellow. Cells large enough to be classified as holes are outlined in red.

#### Volume contours

This displays contours of the coarseness of the texture, based on volume measurements of cells. The coarsest 50% of the slice area is shaded in red and the finest regions are shaded in blue. The range of values displayed in this image is used for calculation of cell size measurements on the Coarse/Fine Clustering. The shape of the red and blue regions is used for calculation of the Circularity measurement.

#### Brightness correction

This image shows a view of the slice, corrected to remove any differences in overall product reflectance. The image is shaded in brown to avoid confusion with the raw image.

#### Elongation

This image represents the orientation and elongation of cells. Short red lines are drawn parallel to the long axis of cells at each point in the slice. The length of the lines indicates the degree of elongation of the cells. For regions that show some curvature, green lines are also drawn that point towards the centre of the curvature. The length of the green lines indicates the degree of local curvature. Yellow lines are also shown that divide regions of the slice that show curvature in opposite directions. Regions of the slice that show a complete 360 degree rotational structure are shaded in bright blue. Those that show a rotational structure that turns through 180 degrees are shaded in pale blue. Those showing no full rotation are left in grey.

#### Shape

This shows a view of the slice with particular shape features shown in color. A white rectangular box is shown enclosing the slice. The corners of the slice are also identified

and are connected by white lines to each other and to the centre of the slice. Concavities in the sides of the slice are shown in blue for the bottom, green for the sides and red for the top. Where oven spring is detected, this is shown in yellow. The points used for measuring the slice height are marked as yellow points on the top edge. High points are identified at either side of the top edge and the lowest point between them is also marked. Where there is no clear dip in the top, some of these points may coincide and it may not be possible to see three distinct points.

### Raw Image

A raw image of a slice selected for analysis

## Test Bake Procedures

Samples of flour were shipped to the following cooperators for evaluation of baking properties. The flour had been uniformly malted to a falling number of approximately 250 sec. Bleach was not added to the flour. Each cooperator test baked the flour according to their standard method using the straight dough, sponge and dough, or other test bake method. Cooperator data were returned to the WQL for compilation of results.

## Bake Cooperators

ADM Milling	Olathe, Kansas
Bay State Milling Company	Winona, Minnesota
Cargill (Horizon Milling)	Minnetonka, Minnesota
Cereal Food Processors, Inc.	Wichita, Kansas
General Mills, Inc	Minneapolis, Minnesota
North Dakota State Mill	Grand Forks, North Dakota
North Dakota State University	
Department of Cereal Science	Fargo, North Dakota
USDA/ARS Grain Marketing &	
Production Research Center	Manhattan, Kansas
USDA/ARS Hard Red Spring & Durum	
Wheat Quality Laboratory	Fargo, North Dakota

## 2007 Spring Wheat Field Production Data

Location					
Variable	Brookings	Casselton	Crookston	Minot	Williston
Planting Date	4/27/2007	5/11/2007	4/27/2007	5/24/2007	5/10/2007
Harvest Date	8/1/	8/16/2007	8/9/2007	8/17/2007	8/16/2007
Fertilizer (lbs/A)					
N	60	82@NH <sub>2</sub> +25@20-20-10	42 + 138	200lbs urea	50 plus 140 lb Urea
P	100	25	14	30lbs 11-52-0	17
K	180	10	242		29.5
Herbicide/rate					
Broadleaf	Bronate Advanced/0.8 Pt	Widematch 1 pt+ MCPA@ .5pt	Bronate/1 pt/A	Widematch, 2/10oz Harmon	/10pt Puma-1pt Bronate Adv
Grass	Puma/10 oz.	Puma/ 1/2 pt.	Puma/1/2 pt/A	.66 pt Puma	0
Fungicide	Quilt/7 oz.	*	*	*	0
* = No Application					
Climatologic Data					
Month	Average Temperature (°F)/Precipitation (in)				
	Brookings	Casselton	Crookston	Minot	Williston
April	/	49.6/2.57	41.6/1.33		44.4 - 0.26
May	60/1.85	59.0/4.03	58.1/3.72	67.1 deg /8.07"rain	58.6 - 4.95
June	69/2.99	68.7/4.01	68.1/4.86	77.0 deg / 2.16"rain	67.4 - 2.64
July	72/0.14	72.9/1.13	71.5/1.88	87.2 deg /1.10"rain	77.2 - 1.13
August	/	66.6/1.63	65.8/3.05	80.4 deg / .33"rain	71.5 - 0.45
* = Not Applicable					
Yield Data					
Cultivar	Yield (bu/acre) / Test Wt / % Moisture/(heading date - Casselton site only)				
	Brookings	Casselton	Crookston <sup>1</sup>	Minot	Williston
SWQAC 1	*	*	40.4/57/13.4	41#	*
SWQAC 2	*	50.04/57/12.1/7-2	64.7/59/13.2	*	*
SWQAC 3	*	47.89/57/11.1/7-3	*	96#	**
SWQAC 4	37.1/59.3/11.2	67.91/58/11.1/6-28	*	*	*
SWQAC 5	*	*	43.8/59/13.1	144#	*
SWQAC 6	*	61.97/62/13.8/7-1	*	120#	*
SWQAC 7	*	58.52/58/11.6/6-28	*	*	**
SWQAC 8	33.9/62.3/12.2	62.6/57/11.6/6-28	63.5/62/13.0	118#	**
SWQAC 9	34.6/60.2/11.5	54.19/57/11.5/7-1	48.2/60/13.2	122#	*
SWQAC 10	*	58.53/56/11.6/6-28	*	146#	**
SWQAC 11	*	60.18/60/13.8/7-1	*	138#	*
SWQAC 12	*	66.26/60/12.3/6-28	42.6/58/15.8	168#	**
SWQAC 13	*	56.43/59/11.0/7-3	*	*	**

\* Not Increased at this site \*\* = No data available <sup>1</sup> = adjusted to 13.5% moisture (Crookston).

## Production as related to climate, disease, and field conditions

<b>At Planting</b>	Planting conditions were less than ideal because of excess moisture. Poor stands.	Seeded into an ideal seedbed 3 days after a 2.5 inch rain	The 2007 Spring Wheat Quality Trial was planted into some of our lighter soil. The soil conditions were moist at planting and made for an excellent seed bed.	Extremely wet conditions at time of planting. Stand establishment was slow but the plants compensated. This lead to shallow root development.	Marginal moisture. Showers started after planting.
<b>During Growth</b>	No moisture after June 18th. Good early moisture.	Moist early season, then drier than normal July and Aug.	The spring wheat trial continued to develop with no apparent problems observed.	Adequate rainfall early in the season. From June through the rest of the summer the rainfall was significantly less.	Above average rainfall. Good growing conditions. Headed between 7/4 to 7/9.
<b>At Flowering</b>	Dry-No heavy dews or lengthy wet periods.	No rain until 0.33 inch at completion of flowering, relatively disease free conditions.	The plants progressed rapidly and the environment at flowering and previous to that time was not conducive to the development of leaf diseases or Fusarium head blight.	Dry warm conditions caused a severe decrease in yield. Grain fill in the head was poor which caused overall poor yields in the Minot area.	Subsoil moisture adequate temperature was hot. No further rain this growing season.
<b>During Maturation</b>	Dry-Moderate drought 3rd driest July on record.	Unremarkable	During this time period it remained dry which was a benefit for good quality and color.	Warm and dry.	Very hot - dry conditions
<b>At Harvest</b>	DRY No rain for seven weeks	Unremarkable	There were no apparent problems at harvest and the trial was taken off in a timely manner to ensure the best possible grain quality.	Warm and dry. Good harvest conditions.	Hot and dry. Great harvest conditions.

## Wheat Marketing Score

The development of a Wheat Marketing Score (WMS) or Export Marketing Score was discussed at the Hard Spring Wheat planning meeting in March, 2004. The purpose for developing a WMS was to facilitate a better understanding of wheat quality in marketing systems. Two WMS methods were developed and tested. For each method, the quality variables of TW, 1000 KWT, FN, Wheat Protein, and Wheat Ash were incorporated for calculating the WMS. Method #1 was developed on a scale of 0 to 6 where the Glenn Check was evaluated along with the experimental lines for each growing location. Method #2 was developed on a scale of 0 to 10 where the experimental lines were evaluated against the Glenn Check for each growing location.

Wheat Marketing Score – Method #1

WHEAT MARKETING SCORE or EXPORT MARKETING SCORE						
		Test Weight	1000 KWT	Falling Number	Wheat Protein	Wheat Ash
Variation(+/-) from Target Value:	SCORE	1lb/bu	3 g up, 4 g down	25 sec	1.0%	0.1%
	6	63 lb/bu	39 g	425 sec	16.5%	1.35%
	5	62 lb/bu	36 g	400 sec	15.5%	1.45%
	4	61 lb/bu	33g	375 sec	14.5%	1.55%
TARGET VALUE:	3	60 lb/bu	30 g	350 sec	13.5%	1.65%
	2	59 lb/bu	26 g	325 sec	12.5%	1.75%
	1	58 lb/bu	22 g	300 sec	11.5%	1.85%
	0	57 lb/bu	18 g	275 sec	10.5%	1.95%

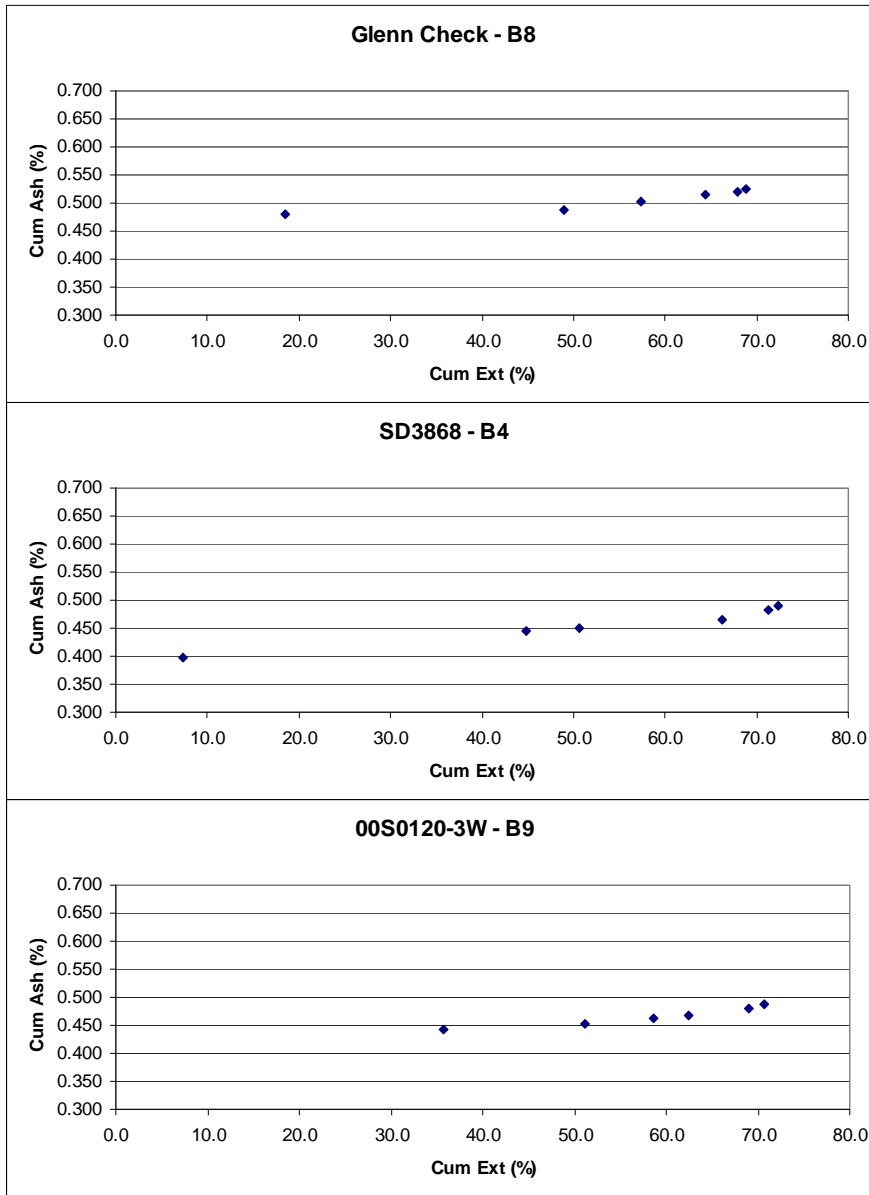
$$\text{Wheat Marketing Score} = (\text{TW} \times 2) + (1000\text{KWT} \times 2) + (\text{FN} \times 2) + (\text{Protein} \times 3) + (\text{Ash} \times 1) / 10$$

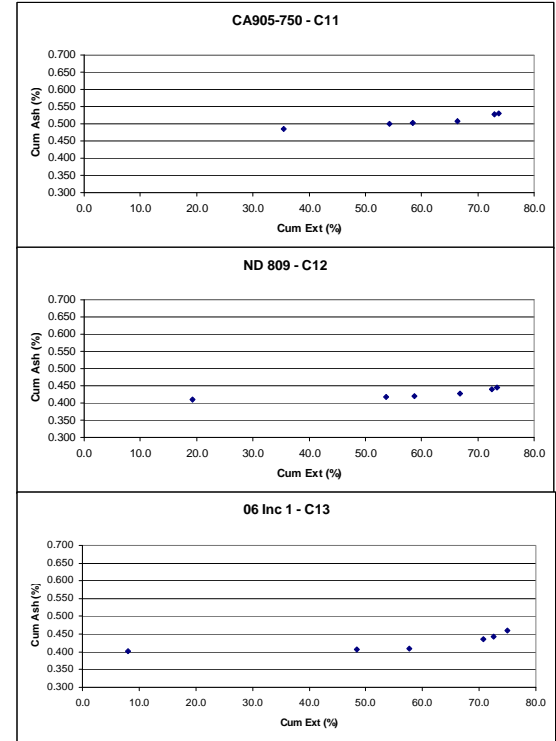
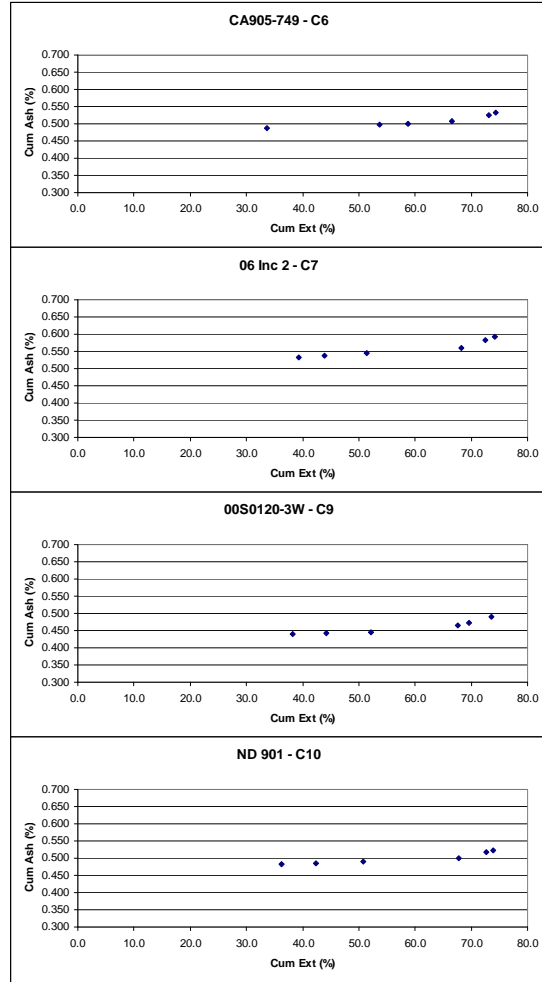
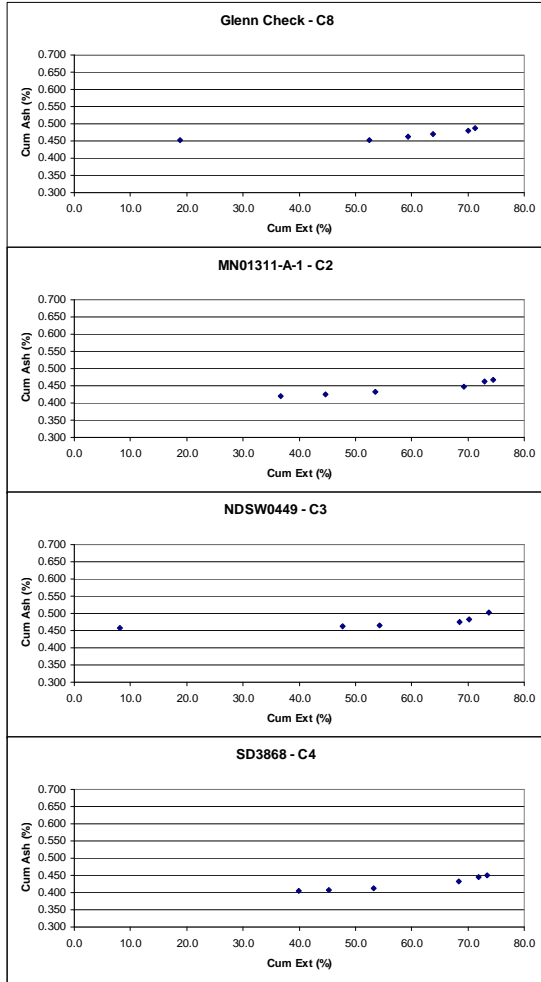
## Wheat Marketing Score – Method #2

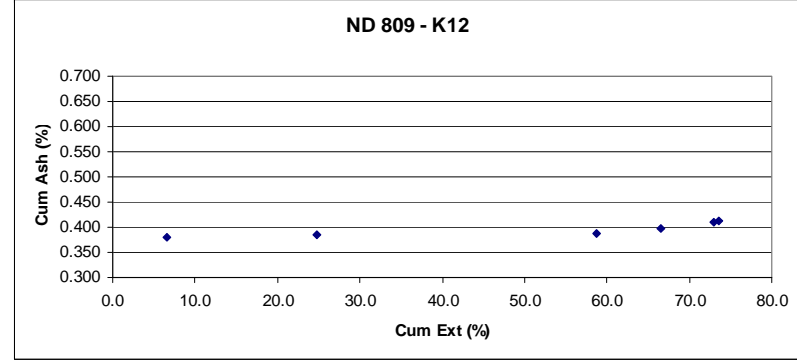
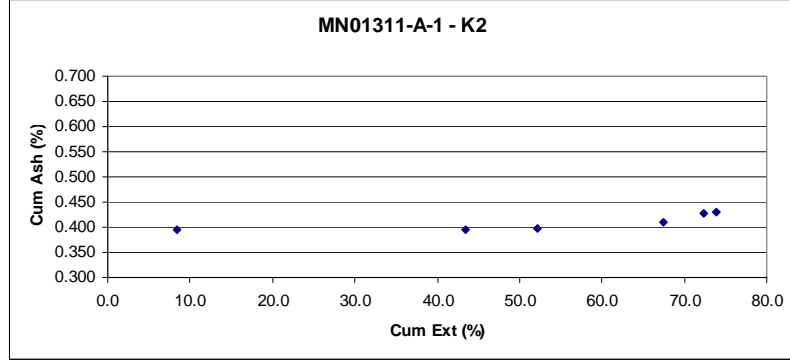
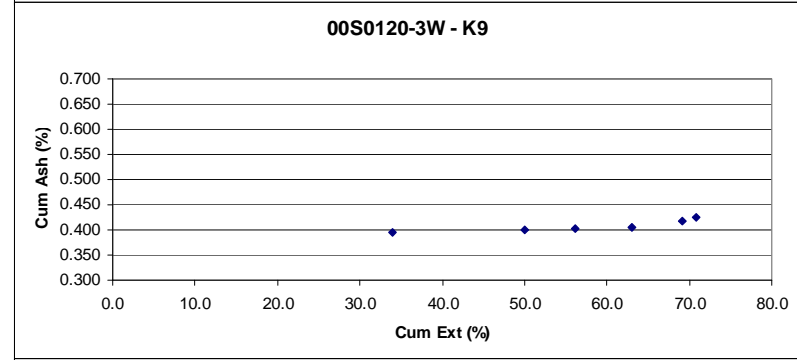
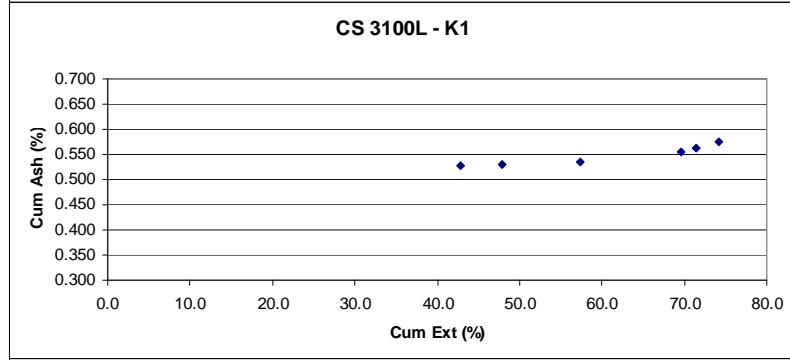
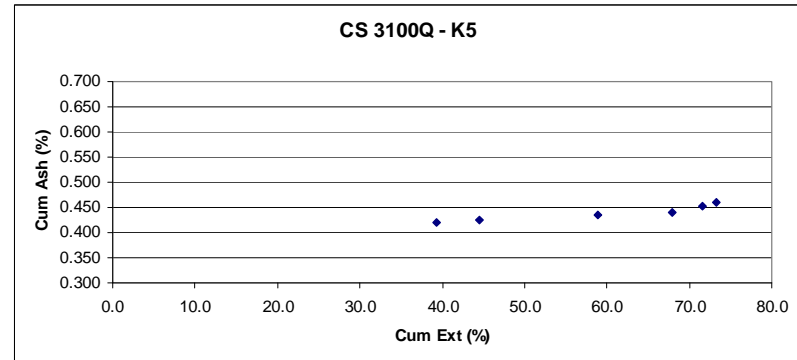
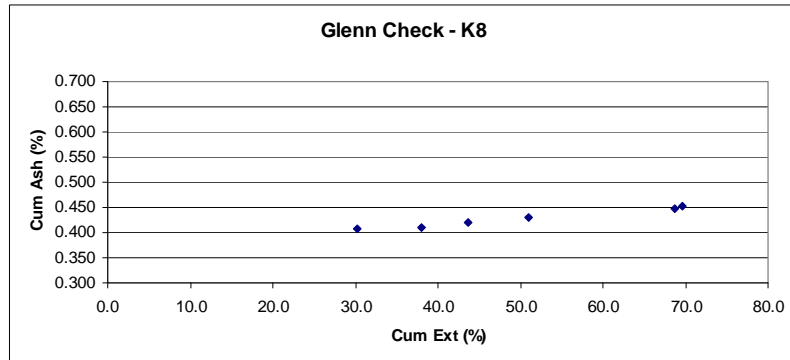
### Rules for Score Calculation

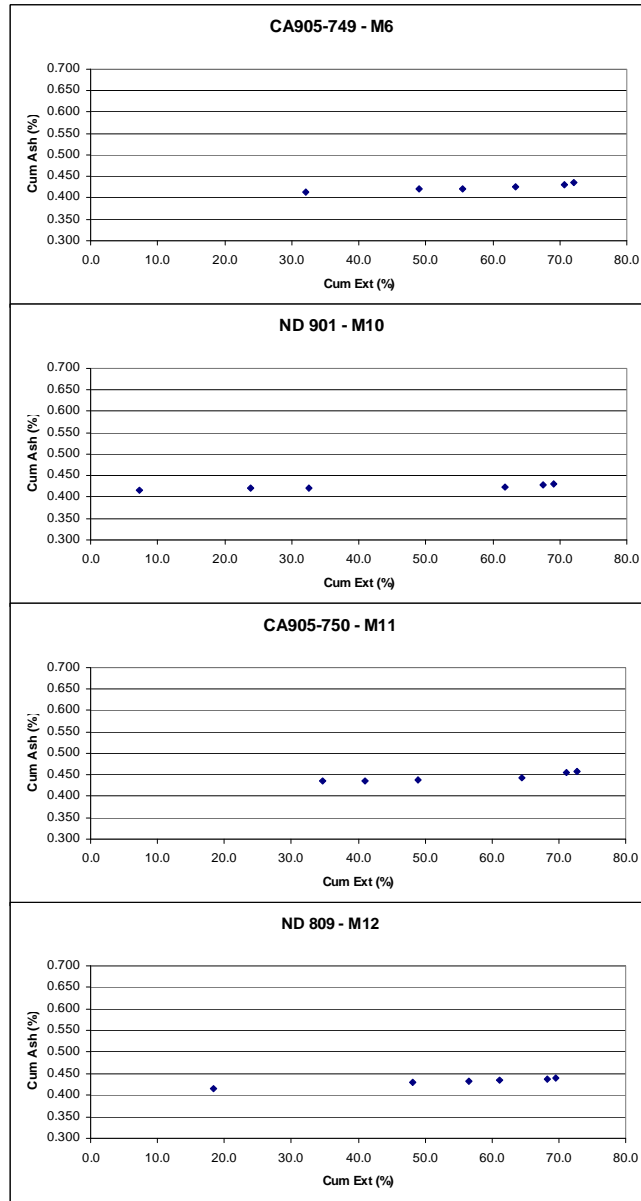
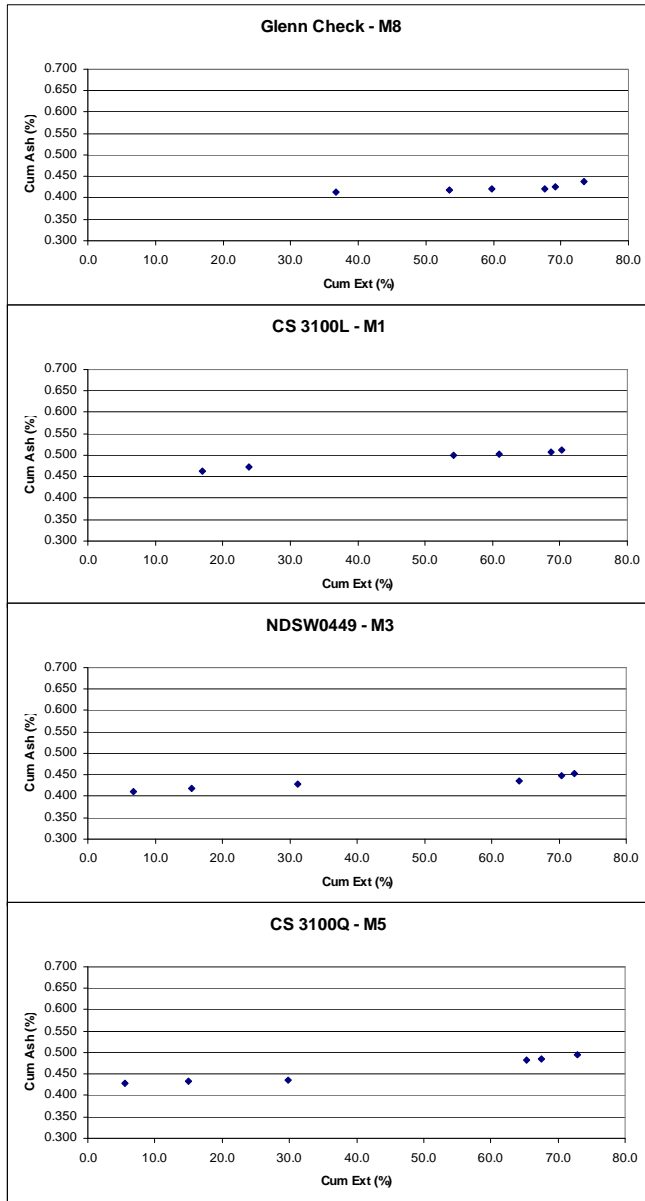
Weight of each Factor	Weighting					
Protein	0.3					
Test Weight (TW)	0.2					
Falling Number	0.2					
Thousand Kernel Weight (TKW)	0.2					
Wheat Ash	0.1					
Component Score	Entered Line minus Check value equals difference (Diff)					
	0	2	4	6	8	
Protein	Diff<-2.5	-2.501<Diff<-2	-2.001<Diff<-1.5	-1.501<Diff<-1	-1.001<Diff<-0.5	
TestWeight	Diff<-5	-5.001<Diff<-4	-4.001<Diff<-3	-3.001<Diff<-2	-2.001<Diff<-1	
Falling Number	Diff<-125	-125.01<Diff<-100	-100.01<Diff<75	-75.01<Diff<50	-50.01<Diff<-25	
Thousand Kernel Weight	Diff<-10	-10.001<Diff<-8	-8.001<Diff<-6	-6.001<Diff<-4	-4.001<Diff<-2	
Wheat Ash						
Component Score	10	8	6	4	2	0
Protein	-0.501<Di 2<Diff<3.001		3<Diff<4.001	4<Diff<5.001	5<Diff<6.001	Diff>6
TestWeight	-1.001<Di 2<Diff<4.001		4<Diff<6.001	6<Diff<8.001	8<Diff<10.001	Diff>10
Falling Number	-25.01<Diff					
Thousand Kernel Weight	-2.001<Di 4<Diff<8.001		8<Diff<12.001	12<Diff<16.001	16<Diff<20.001	Diff>20
Wheat Ash	Diff<0.1010.1<Diff<0.201		0.2<Diff<0.301	0.3<Diff<0.401	0.4<Diff<0.501	Diff>0.5

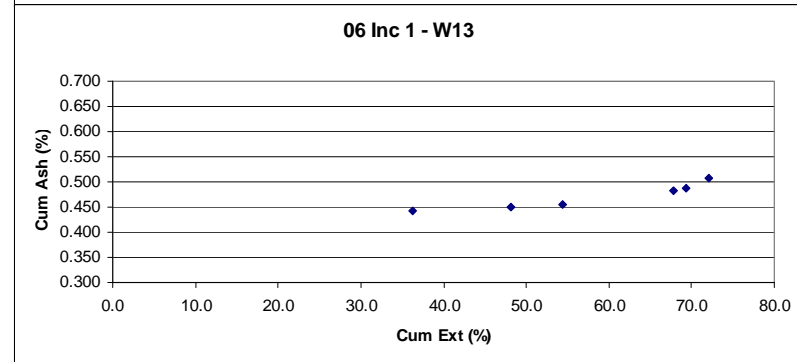
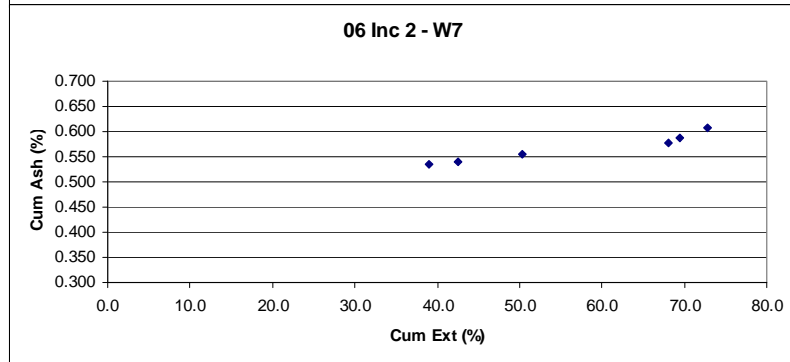
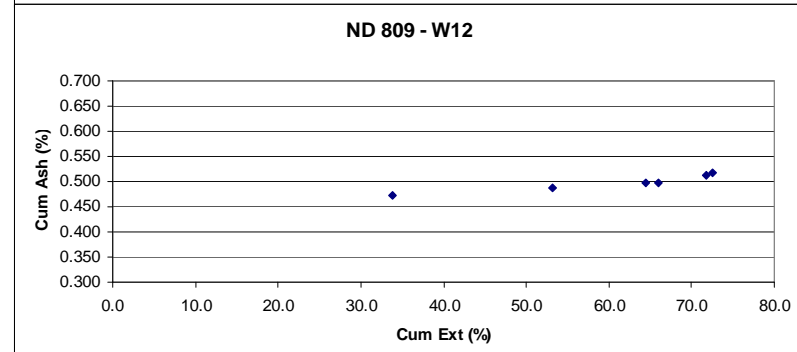
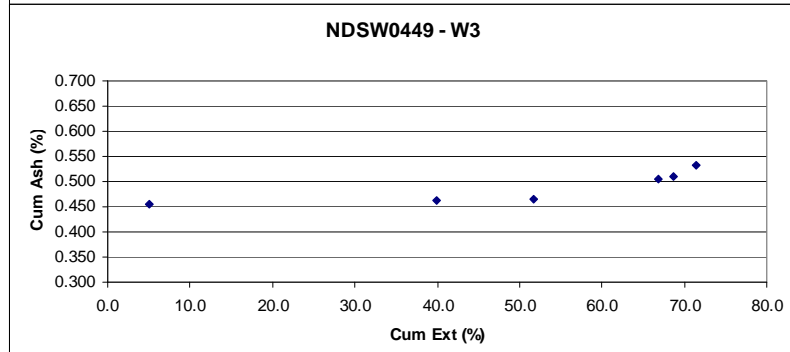
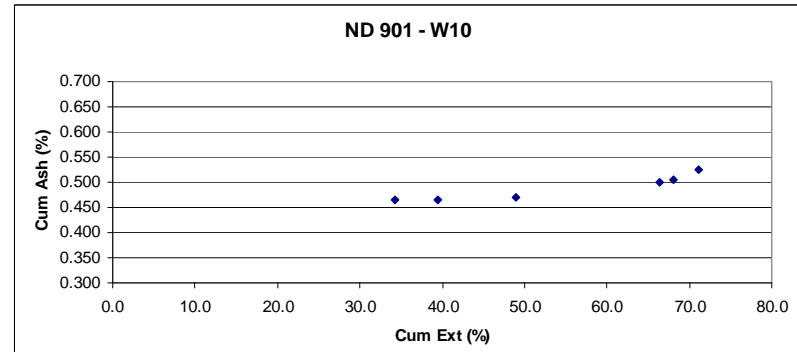
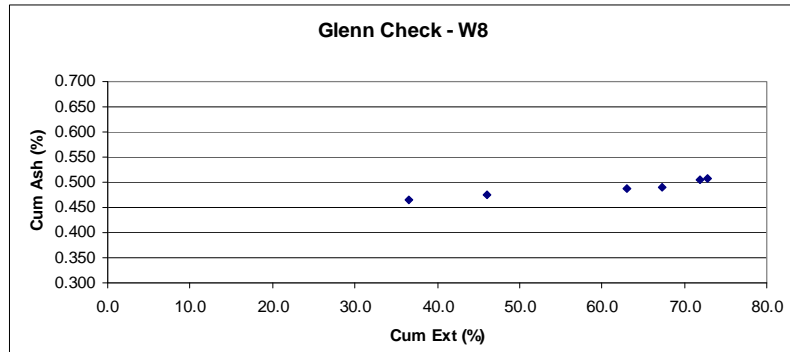




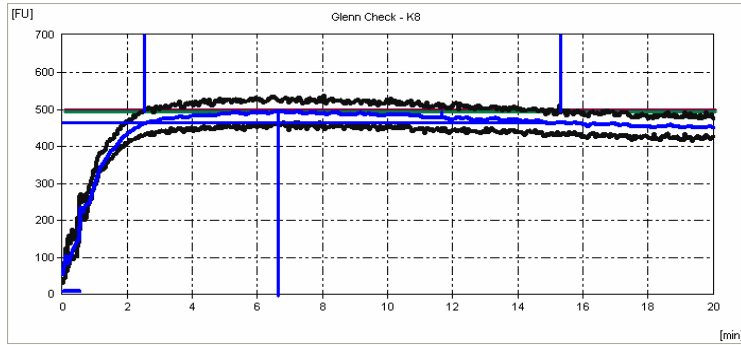




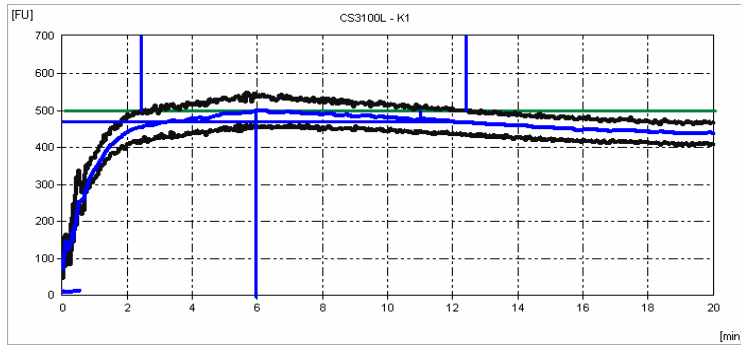




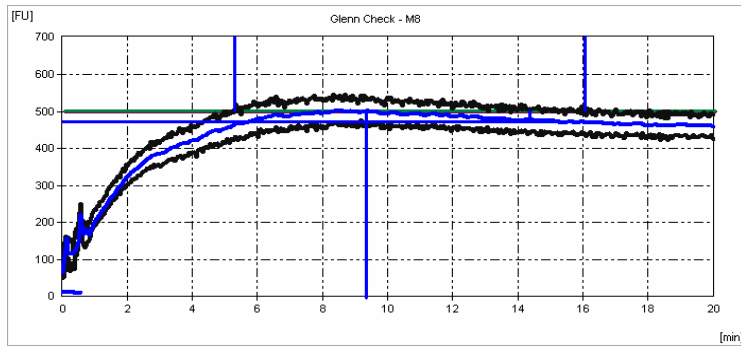
		Farinograph						
Cultivar	Location	Water Abs	Water Abs	Arrival Time	Peak Time	Dough Stability	MTI	TTB
		500 bu	14%mb					
		%	%	min	min	min	bu	min
Glenn	B8	64.5	62.8	1.6	2.9	5.0	39	6.6
SD3868	B4	61.0	59.2	1.6	2.5	5.6	32	7.2
00S0120-3W	B9	64.4	62.5	1.3	2.7	4.5	48	5.8
Glenn	C8	65.3	64.0	1.8	3.8	8.5	22	9.4
MN01311-A-1	C2	61.9	60.9	2.8	5.8	8.4	26	11.3
NDSW0449	C3	62.0	60.3	3.0	6.8	8.7	34	11.6
SD3868	C4	61.7	60.8	2.4	5.5	8.5	29	11.0
CA905-749	C6	65.2	63.9	2.5	6.7	9.4	30	11.6
06 Inc 2	C7	61.5	60.2	2.5	8.0	15.6	19	15.4
00S0120-3W	C9	64.2	62.5	2.6	6.7	8.7	34	10.6
ND 901	C10	66.8	65.3	5.0	8.9	9.9	25	15.1
CA905-750	C11	66.7	65.1	3.2	7.5	10.2	27	12.3
ND 809	C12	67.0	66.1	3.2	5.7	11.7	16	15.0
06 Inc1	C13	65.1	60.2	2.6	7.8	9.8	34	12.1
Glenn	K8	67.5	66.1	2.3	6.7	12.8	17	14.9
CS 3100L	K1	58.8	57.4	2.2	6.0	10.0	23	12.0
MN01311-A-1	K2	66.5	65.5	4.1	8.0	8.2	34	12.3
CS 3100Q	K5	60.8	59.8	2.1	6.9	10.6	26	12.9
00S0120-3W	K9	67.6	65.9	1.9	3.7	6.9	29	8.3
ND 809	K12	67.0	65.5	2.2	4.2	11.9	7	14.1
Glenn	M8	65.1	63.0	5.2	9.4	10.8	26	15.3
CS 3100L	M1	63.3	61.6	4.7	8.5	10.8	23	14.3
NDSW0449	M3	63.8	62.0	4.5	7.5	7.2	39	11.5
CS 3100Q	M5	63.1	61.0	4.1	7.3	9.1	29	12.5
CA905-749	M6	64.1	62.3	5.2	9.3	10.4	27	14.4
ND 901	M10	64.6	62.2	5.7	10.5	11.1	28	16.1
CA905-750	M11	65.0	62.8	4.5	8.3	8.8	33	12.6
ND 809	M12	66.3	64.9	5.0	8.9	11.3	21	15.9
Glenn	W8	67.1	65.2	5.2	9.4	14.8	16	18.3
NDSW0449	W3	66.5	64.9	5.1	8.7	14.2	17	18.3
06 Inc 2	W7	65.4	63.1	5.4	10.8	14.5	7	20.0
ND 901	W10	68.6	67.0	5.3	8.2	14.7	13	20.0
ND 809	W12	69.1	67.3	6.0	10.7	11.6	24	17.8
06 Inc1	W13	67.0	65.3	4.3	7.9	12.5	18	17.9



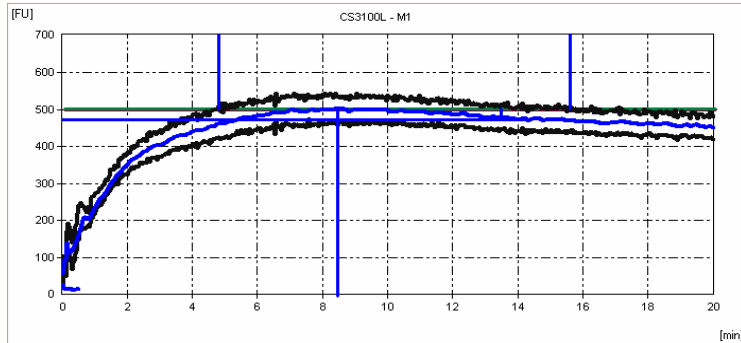
Glenn Check  
K8



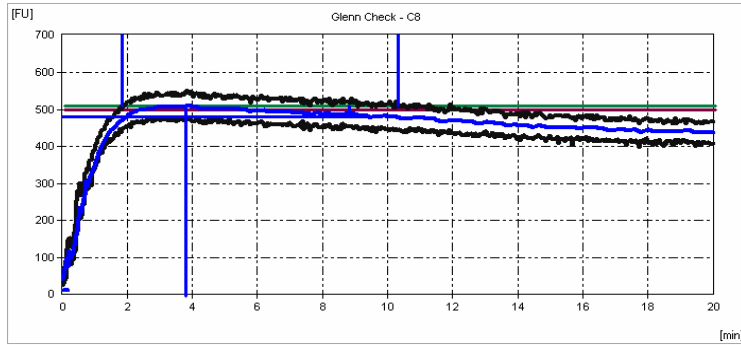
CS 3100L  
K1



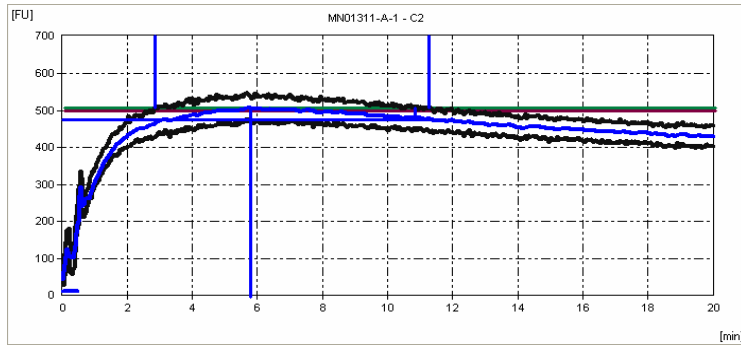
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M8



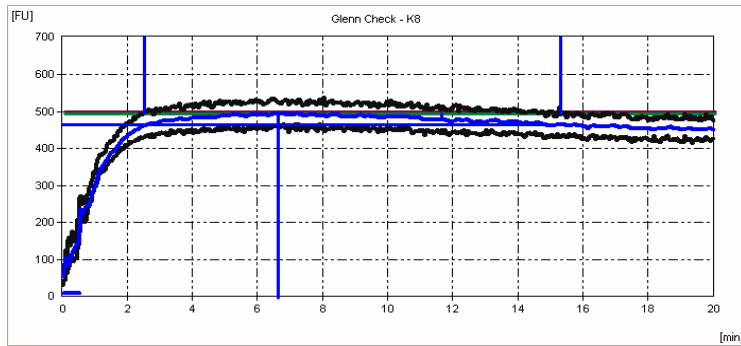
CS 3100L  
M1



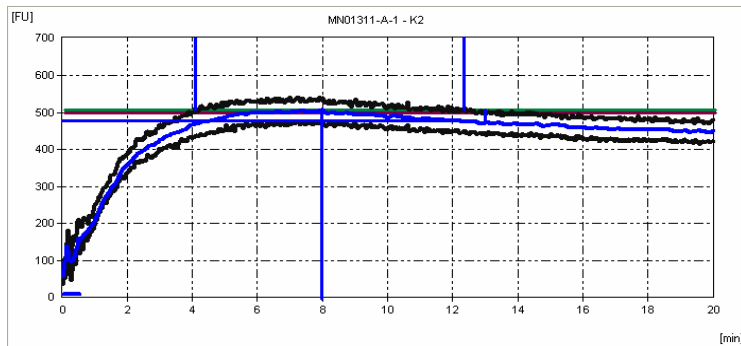
Glenn Check  
C8



MN01311-A-1  
C2

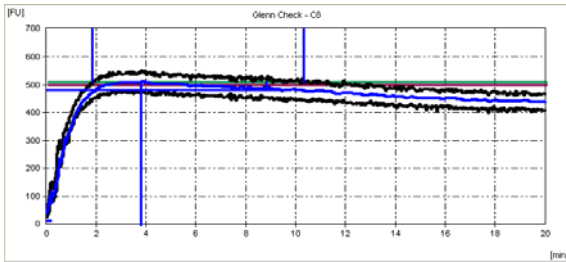


Glenn Check  
K8

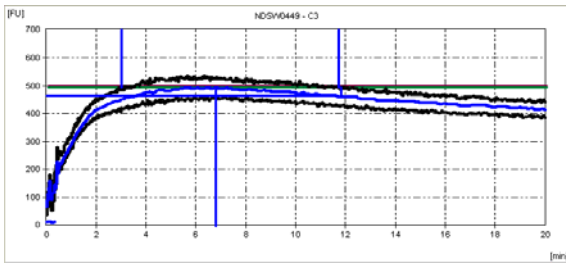


MN01311-A-1  
K2

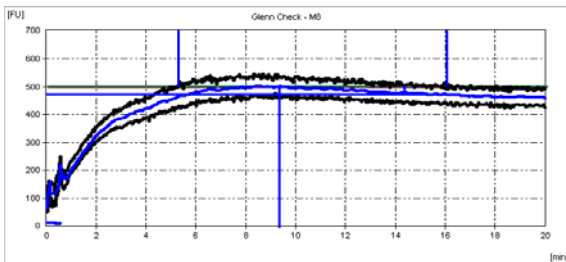




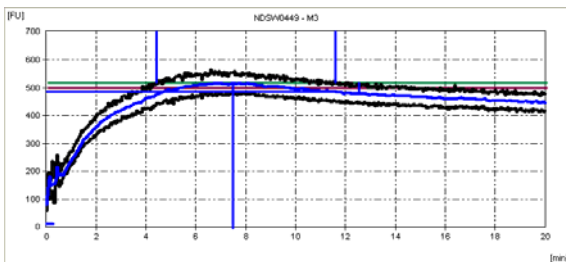
Glenn Check  
C8



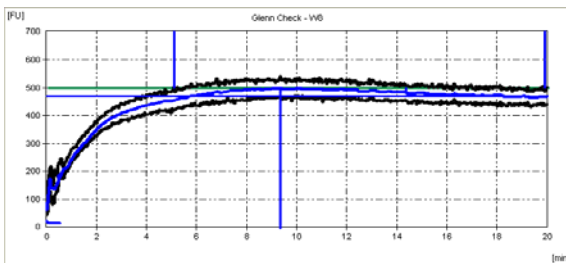
NDSW0449  
C3



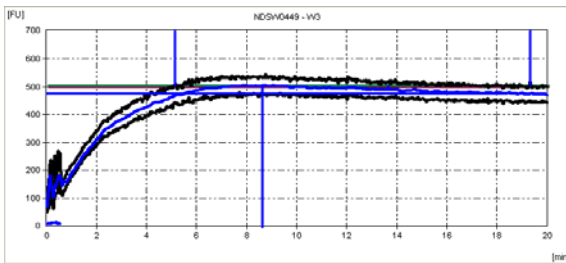
Glenn Check  
M8



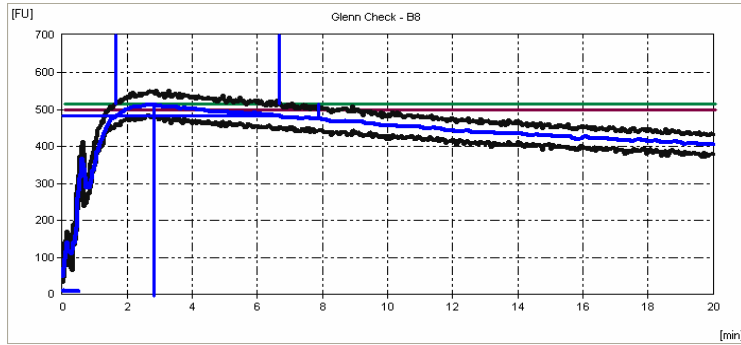
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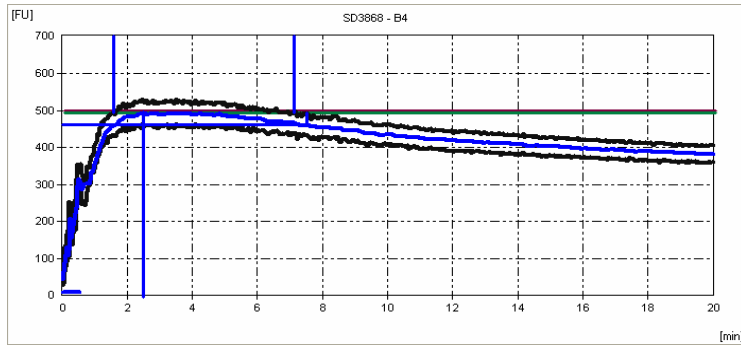
Glenn Check  
W8



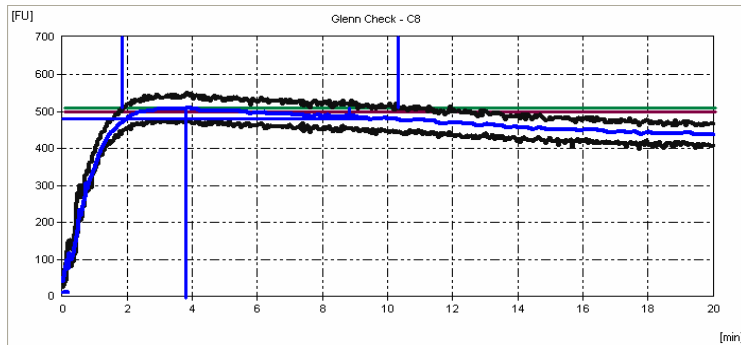
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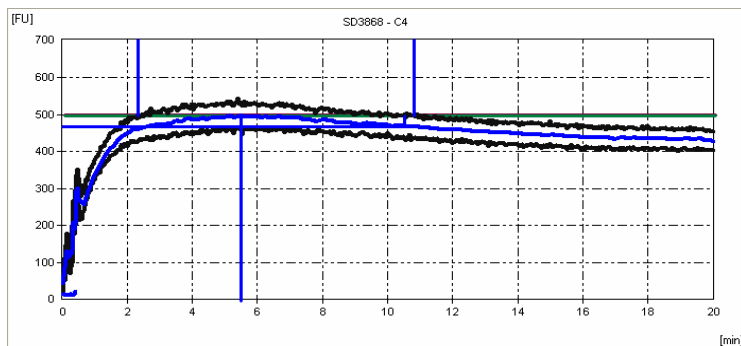
Glenn Check  
B8



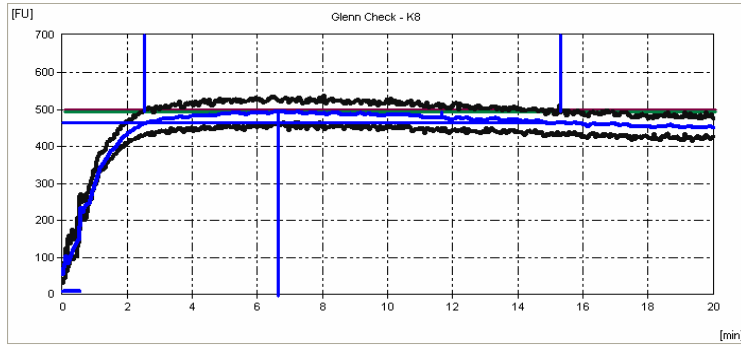
SD3868  
B4



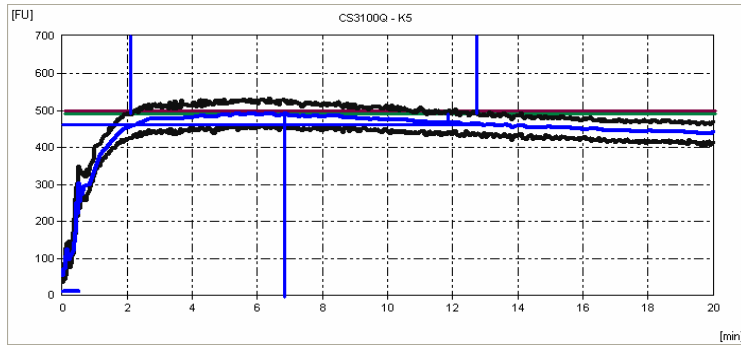
Glenn Check  
C8



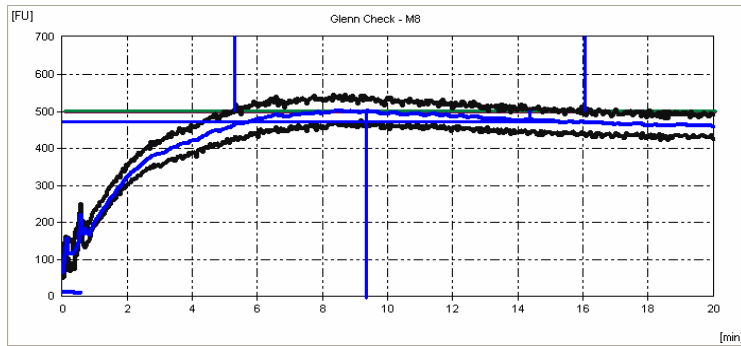
SD3868  
C4



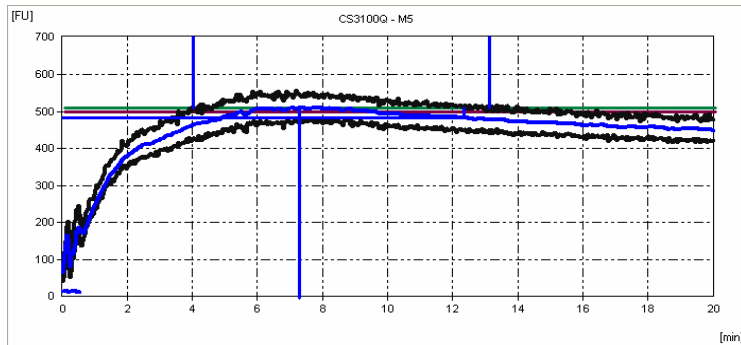
Glenn Check  
K8



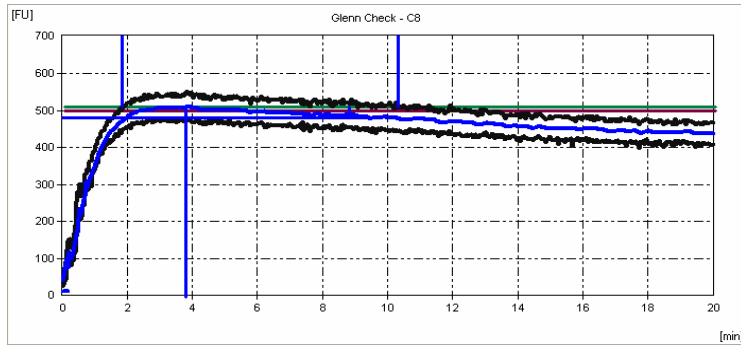
CS3100Q  
K5



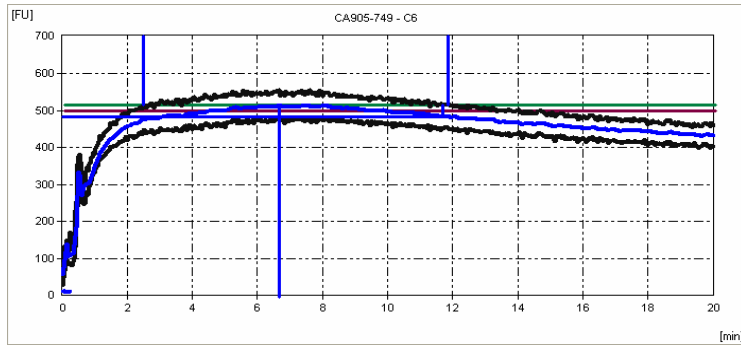
Glenn Check  
M8



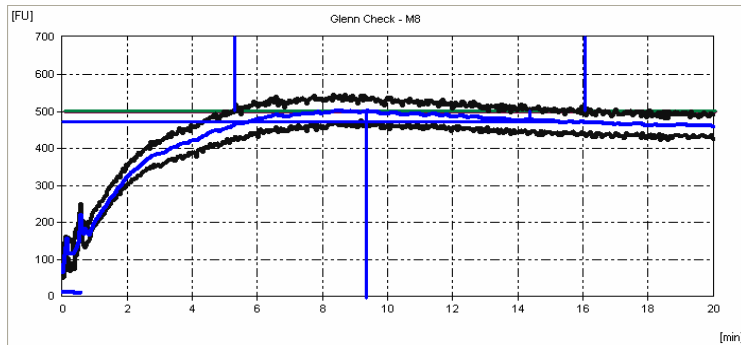
CS3100Q  
M5



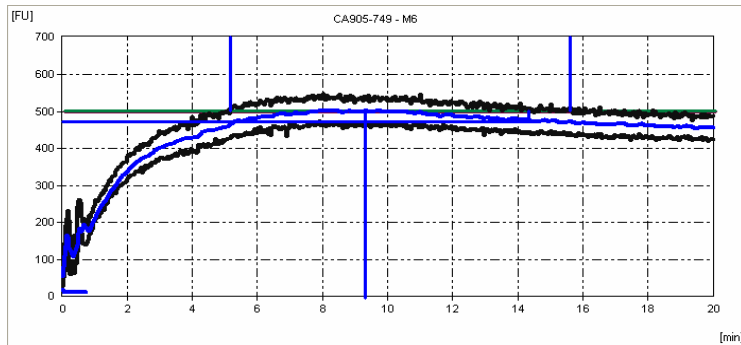
Glenn Check  
C8



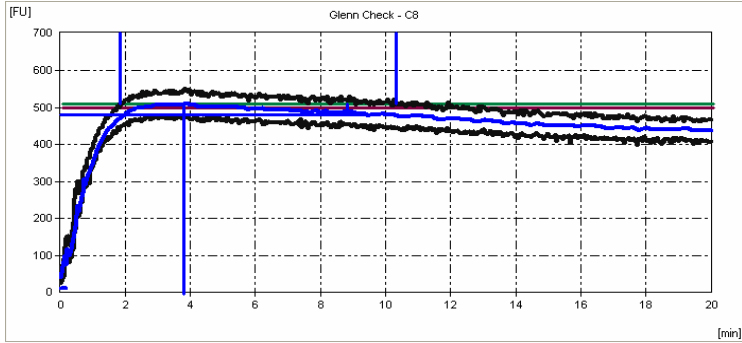
CA905-749  
C6



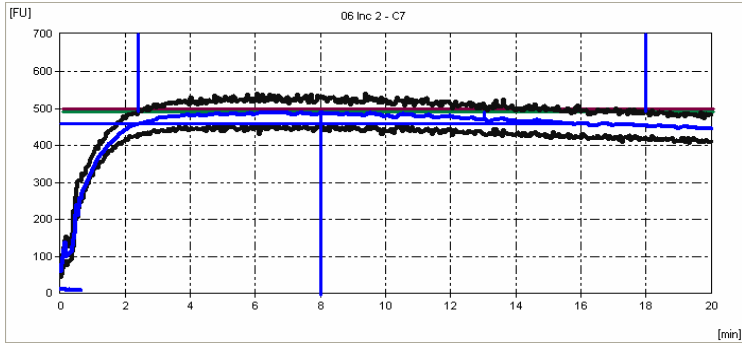
Glenn Check  
M8



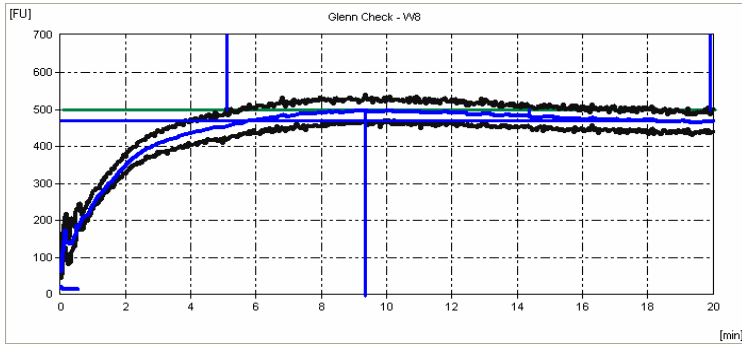
CA905-749  
M6



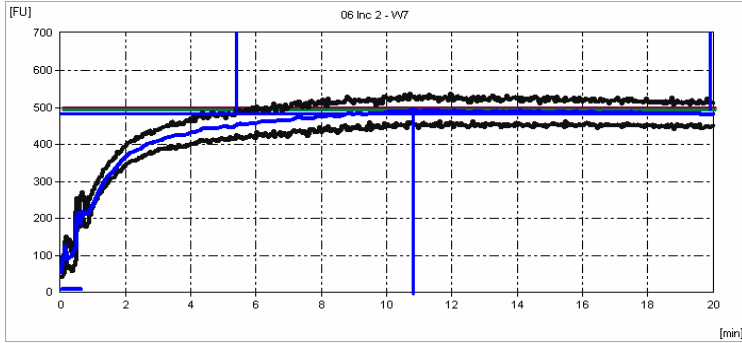
Glenn Check  
C8



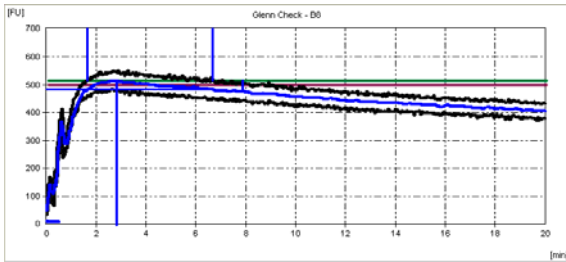
06 Inc 2  
C7



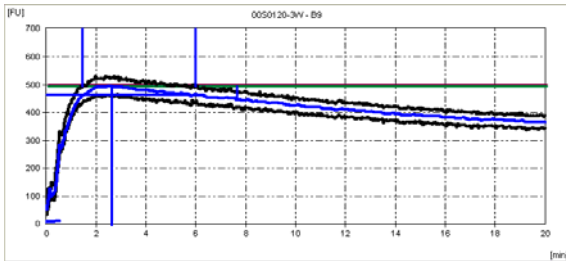
Glenn Check  
W8



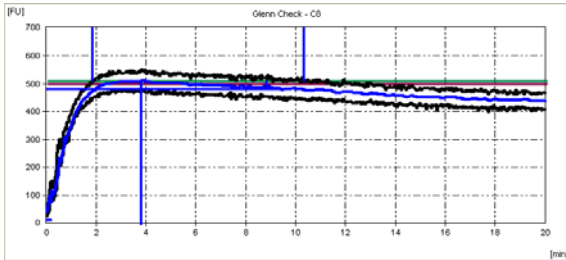
06 Inc 2  
W7



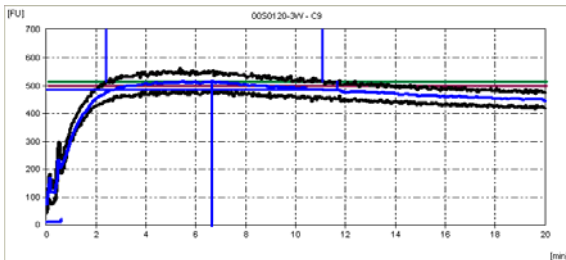
Glenn Check  
B8



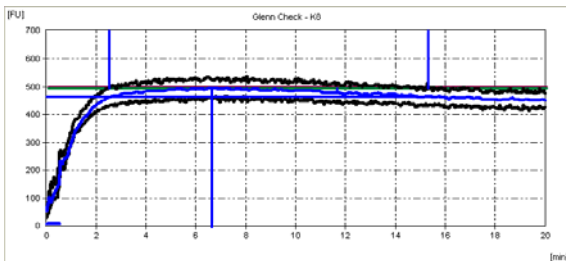
00S0120-3W  
B9



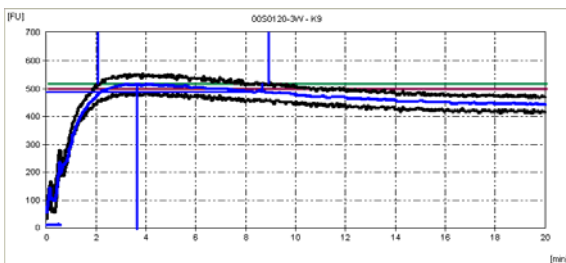
Glenn Check  
C8



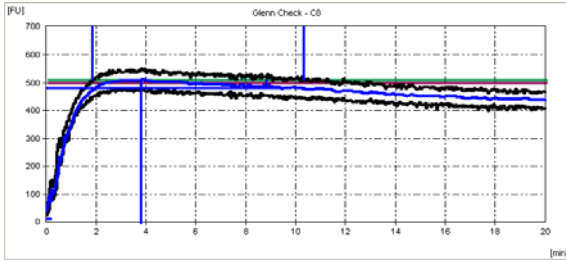
00S0120-3W  
C9



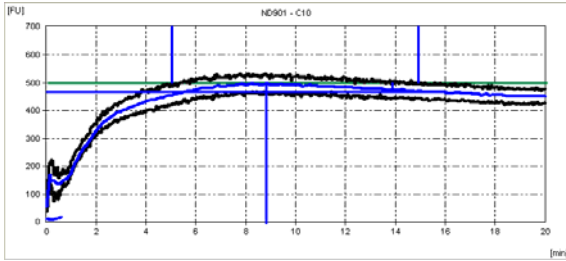
Glenn Check  
K8



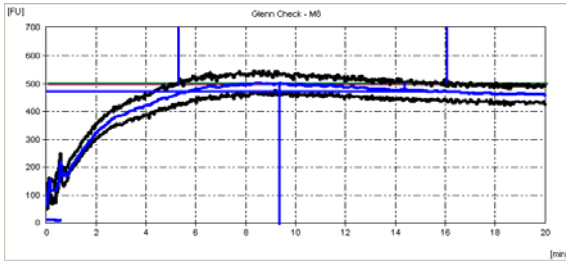
00S0120-3W  
K9



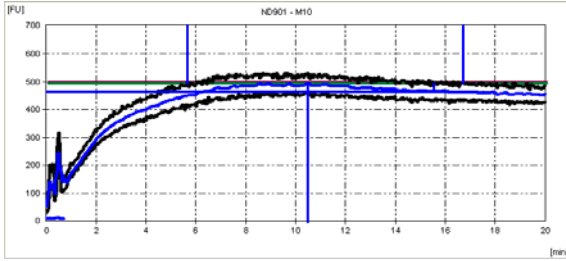
Glenn Check  
C8



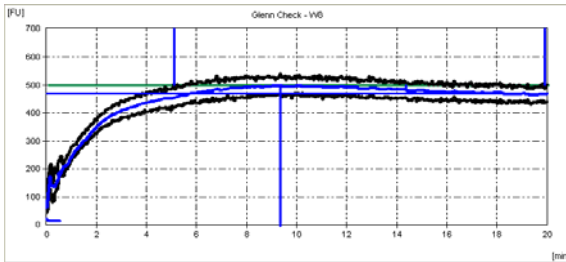
ND901  
C10



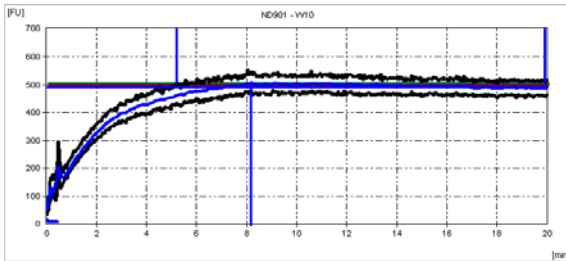
Glenn Check  
M8



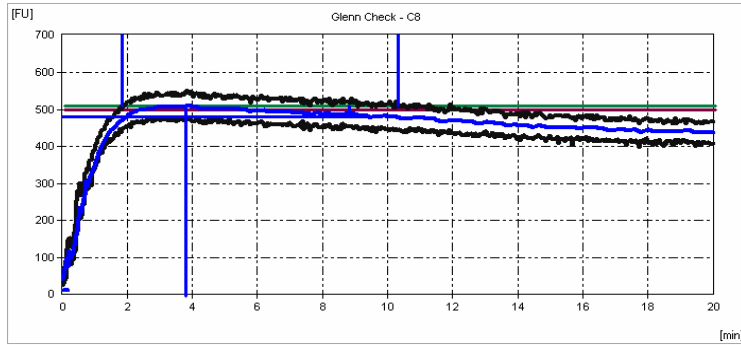
ND901  
M10



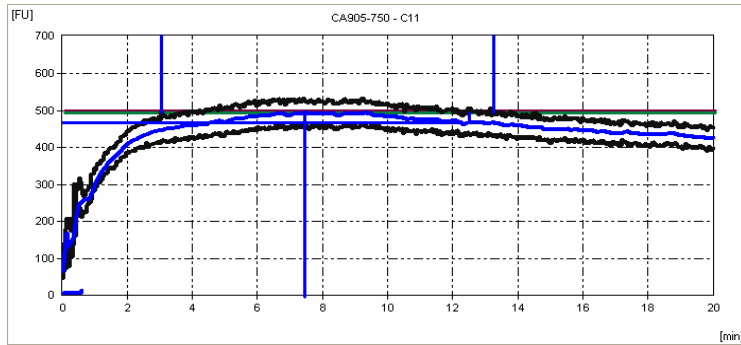
Glenn Check  
W8



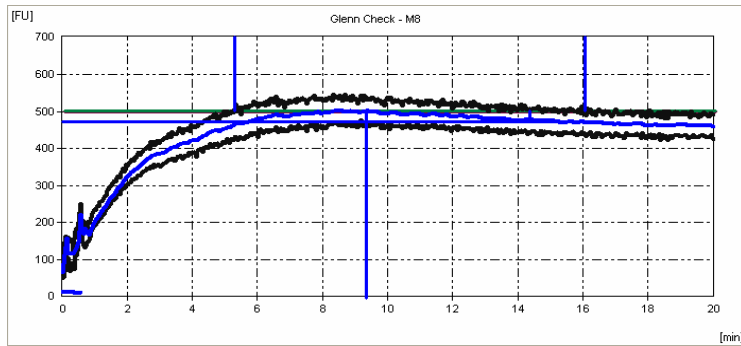
ND901  
W10



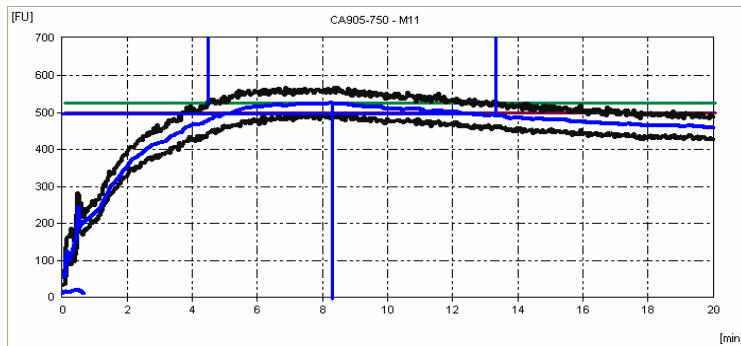
Glenn Check  
C8



CA905-750  
C11

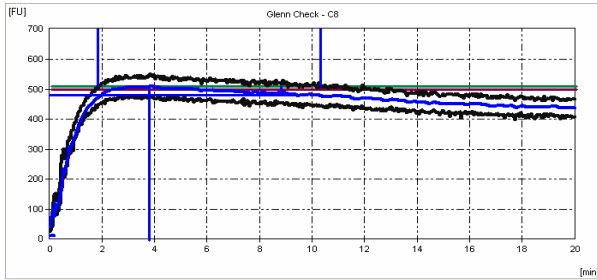


Glenn Check  
M8

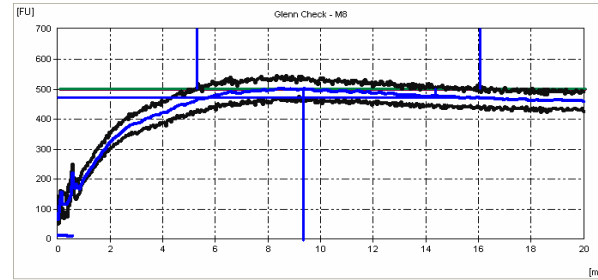


CA905-750  
M11

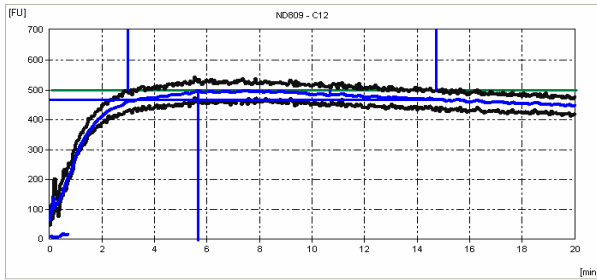




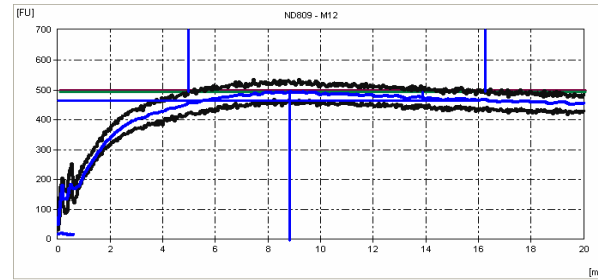
Glenn Check  
C8



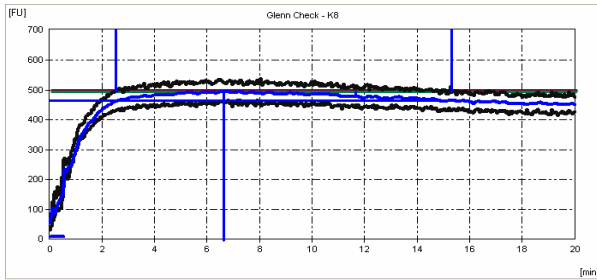
Glenn Check  
M8



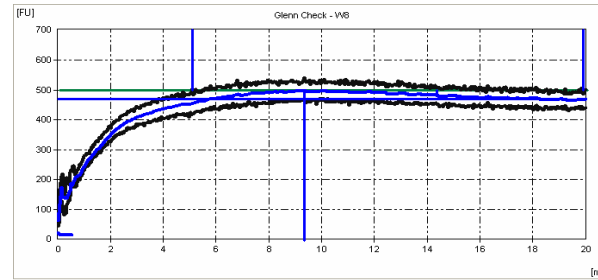
ND809  
C12



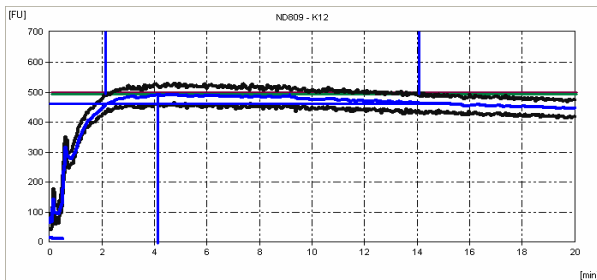
ND809  
M12



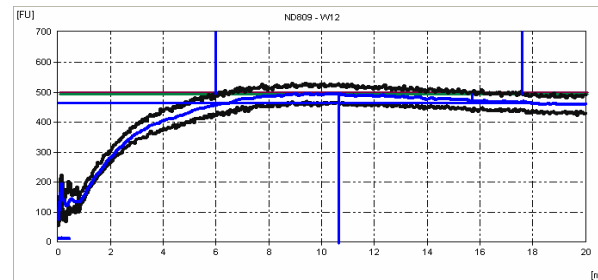
Glenn Check  
K8



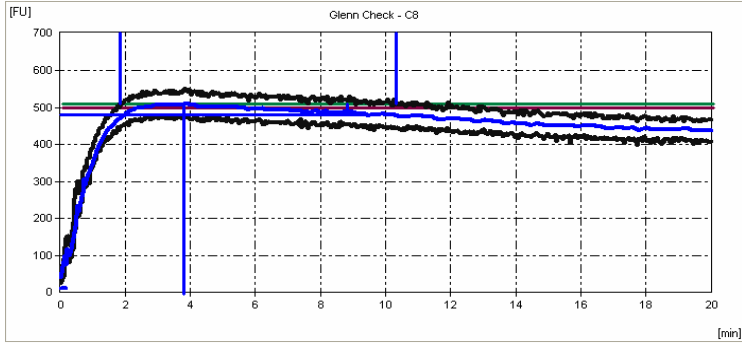
Glenn Check  
W8



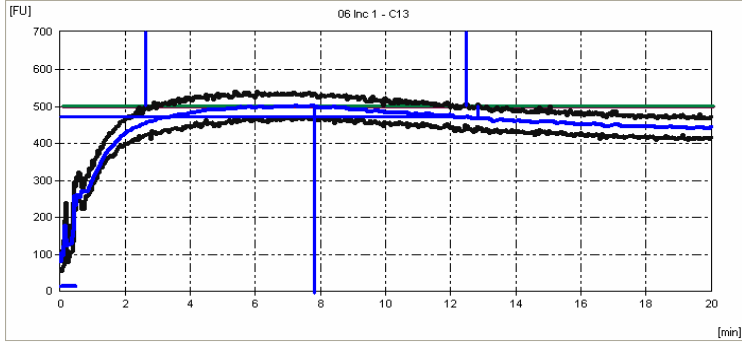
ND809  
K12



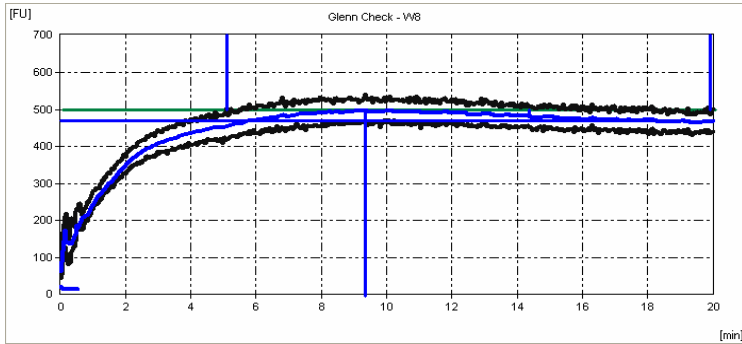
ND809  
W12



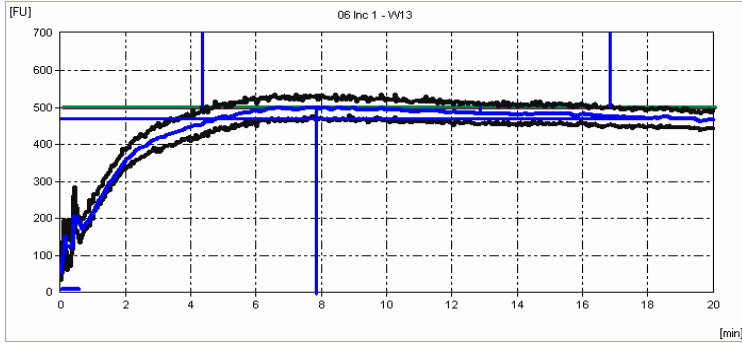
Glenn Check  
C8



06 Inc 1  
C13

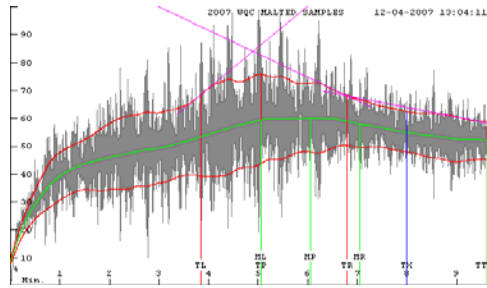


Glenn Check  
W8

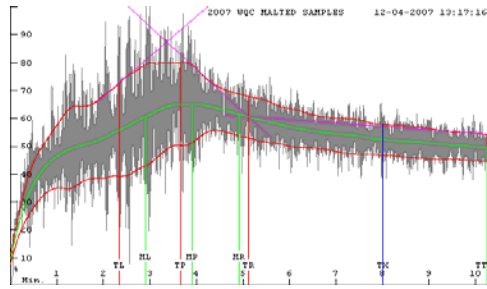


06 Inc 1  
W13

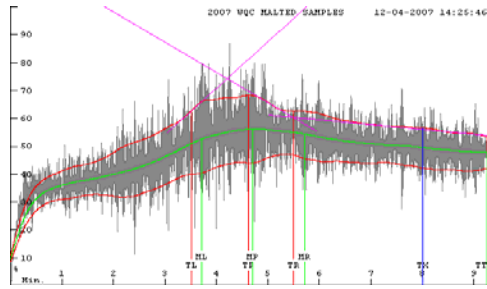
Cultivar	Location	Mixograph						
		ENVELOPE	ENVELOPE	ENVELOPE	MID LINE	MID LINE	MID LINE	MID LINE
		PEAK TIME MINUTES	PEAK VALUE %	PEAK WIDTH %	PEAK TIME MINUTES	PEAK VALUE %	PEAK WIDTH %	PEAK INTEGRAL %TQ*MIN.
Glenn	B-8	5.1	76.5	41.1	6.1	56.1	23.7	281.8
SD3868	B-4	4.4	54.0	14.1	4.5	46.6	13.9	180.1
00S0120-3W	B-9	5.0	55.3	19.7	5.1	45.3	19.6	209.1
Glenn	C-8	7.5	61.3	25.5	9.4	49.4	17.4	399.5
MN01311-A-1	C-2	5.2	60.0	21.9	5.5	49.0	18.3	222.3
NDSW0449	C-3	5.7	60.4	23.1	5.3	48.8	19.3	210.0
SD3868	C-4	4.8	58.9	19.9	5.1	48.9	17.0	203.6
CA905-749	C-6	4.5	76.8	32.1	5.0	61.0	28.3	228.2
06 Inc 2	C-7	9.1	62.9	26.1	10.0	50.4	22.6	399.0
00S0120-3W	C-9	5.5	60.2	23.0	6.4	48.9	16.0	267.1
ND 901	C-10	3.4	67.9	25.2	4.2	56.9	19.7	185.3
CA905-750	C-11	5.1	65.6	21.0	5.2	54.7	20.2	225.4
ND 809	C-12	3.3	74.2	28.2	4.1	61.6	22.1	195.5
06 Inc1	C-13	4.8	63.4	20.8	5.0	52.9	18.5	206.9
Glenn	K-8	5.1	75.7	32.0	6.1	60.0	24.7	290.4
CS 3100L	K-1	3.7	80.1	29.7	3.9	64.9	27.8	198.9
MN01311-A-1	K-2	3.3	64.6	18.7	3.7	55.8	17.1	159.5
CS 3100Q	K-5	5.0	53.3	20.6	6.2	44.4	14.4	243.7
00S0120-3W	K-9	4.2	59.3	21.7	4.8	48.6	15.6	209.5
ND 809	K-12	5.6	60.7	22.2	6.1	49.9	16.1	269.9
Glenn	M-8	4.6	68.2	24.3	4.7	56.0	24.2	198.7
CS 3100L	M-1	3.9	85.3	35.2	4.3	68.6	28.9	195.9
NDSW0449	M-3	3.7	79.0	28.5	3.9	64.2	27.0	173.5
CS 3100Q	M-5	4.0	73.0	28.3	4.2	59.2	24.9	183.3
CA905-749	M-6	4.1	72.9	29.7	4.8	61.1	20.0	204.3
ND 901	M-10	3.9	75.9	27.2	4.0	62.1	26.7	173.1
CA905-750	M-11	3.3	88.5	37.6	3.7	70.3	28.7	179.0
ND 809	M-12	3.5	85.2	32.8	3.8	70.1	28.9	182.4
Glenn	W-8	4.8	71.3	26.4	5.1	58.0	24.0	217.3
NDSW0449	W-3	4.8	60.7	17.3	4.5	51.8	15.4	176.3
06 Inc 2	W-7	8.5	64.5	27.5	10.1	53.3	18.9	393.9
ND 901	W-10	4.1	68.8	25.1	5.1	56.7	20.3	227.7
ND 809	W-12	3.8	80.7	30.4	3.9	65.8	30.0	180.2
06 Inc1	W-13	2.7	66.8	30.3	3.7	55.7	16.7	160.8



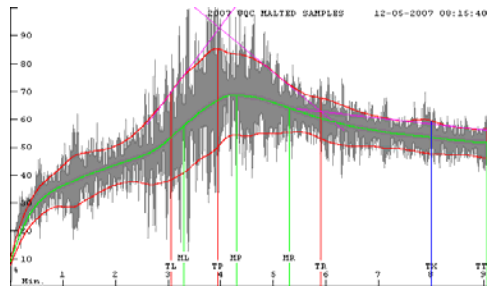
Glenn Check  
K8



CS 3100L  
K1

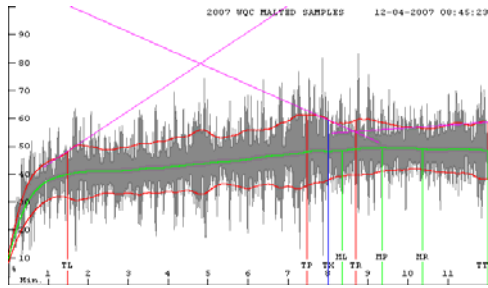


Glenn Check  
M8

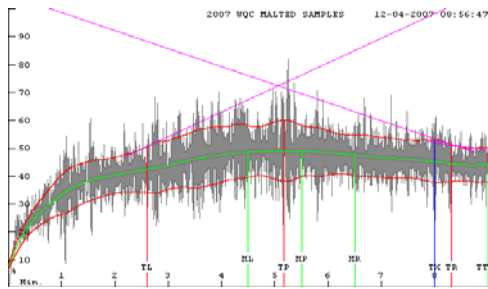


CS 3100L  
M1

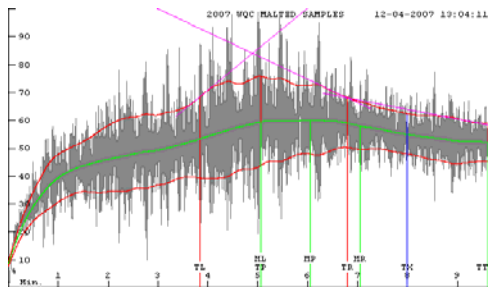
**MN01311-A-1  
SWQAC #2**



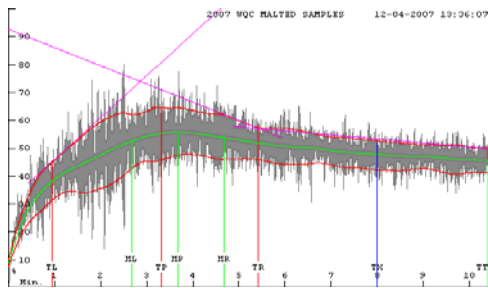
**Glenn Check  
C8**



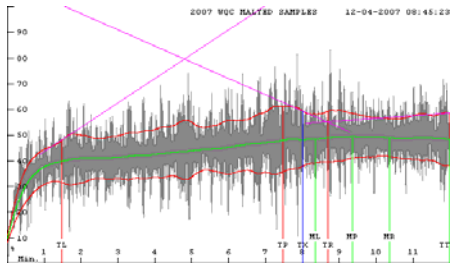
**MN01311-A-1  
C2**



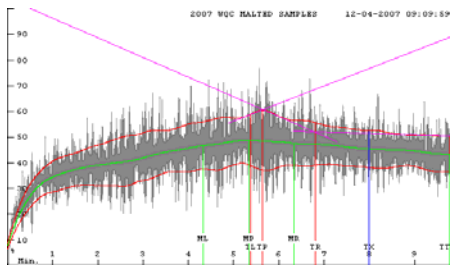
**Glenn Check  
K8**



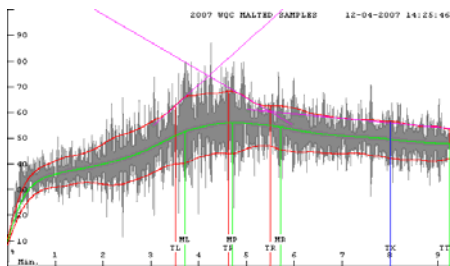
**MN01311-A-1  
K2**



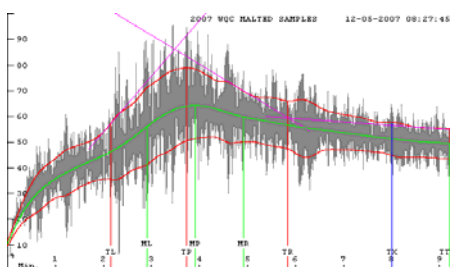
Glenn Check  
C8



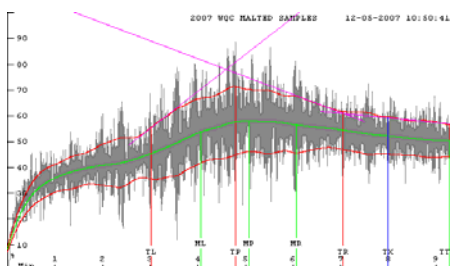
NDSW0449  
C3



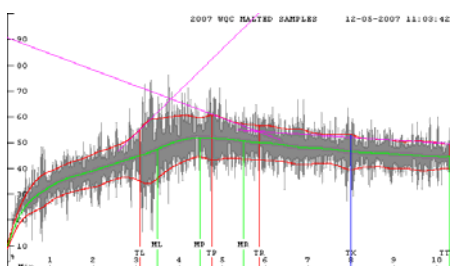
Glenn Check  
M8



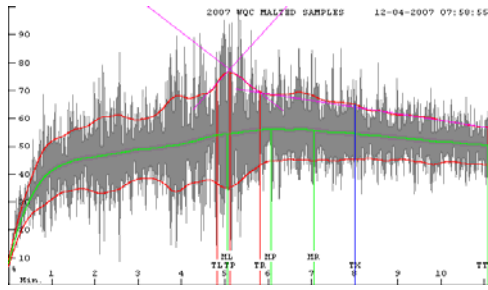
NDSW0449  
M3



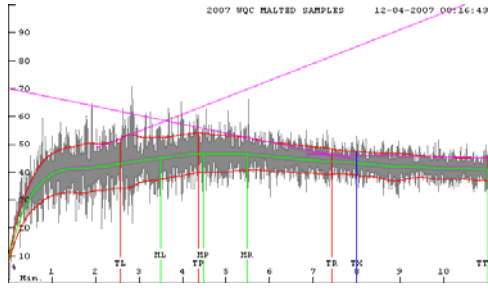
Glenn Check  
W8



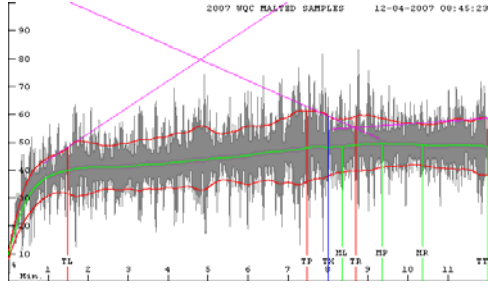
NDSW0449  
W3



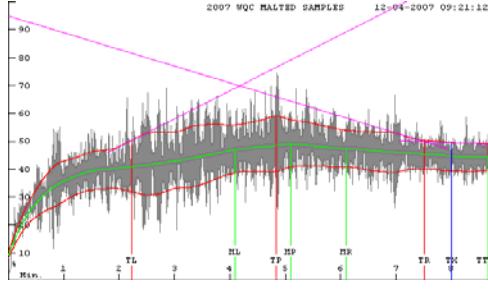
Glenn Check  
B8



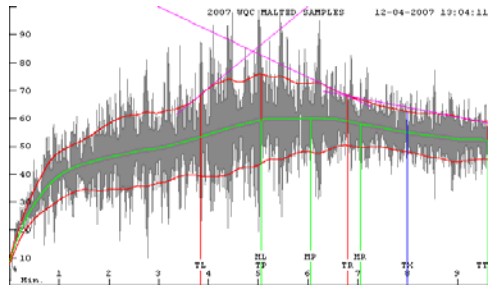
SD3868  
B4



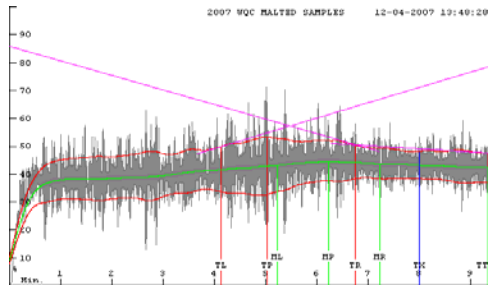
Glenn Check  
C8



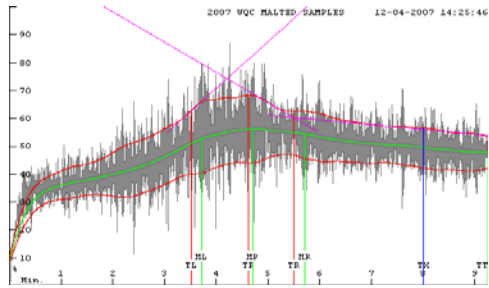
SD3868  
C4



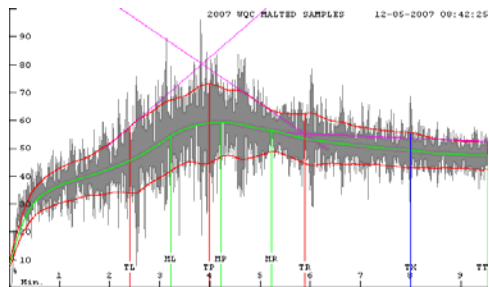
Glenn Check  
K8



CS3100Q  
K5

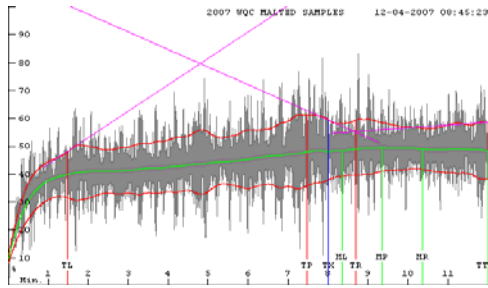


Glenn Check  
M8

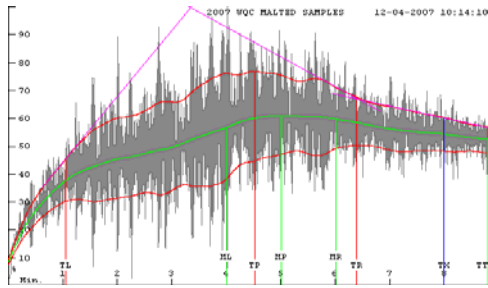


CS3100Q  
M5

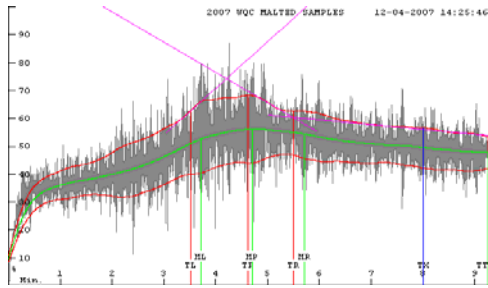




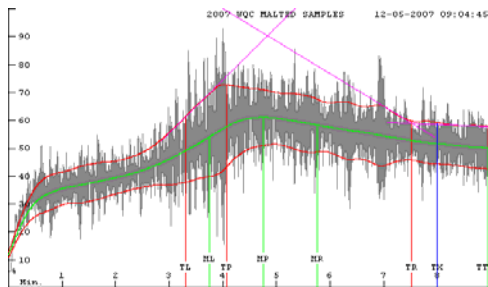
Glenn Check  
C8



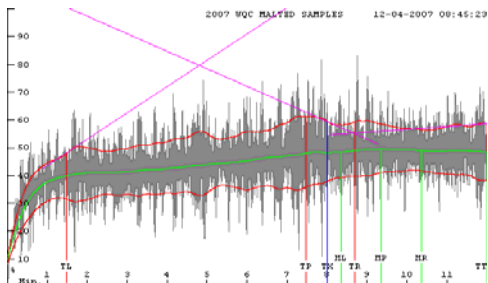
CA905-749  
C6



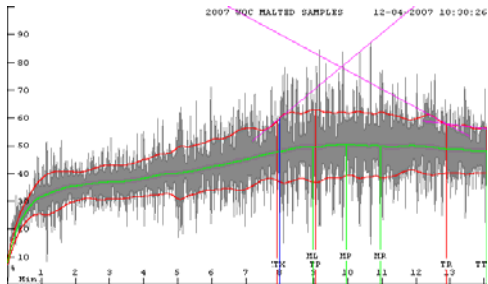
Glenn Check  
M8



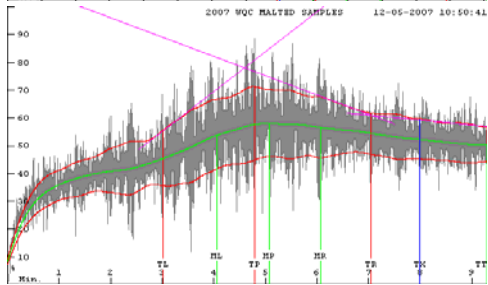
CA905-749  
M6



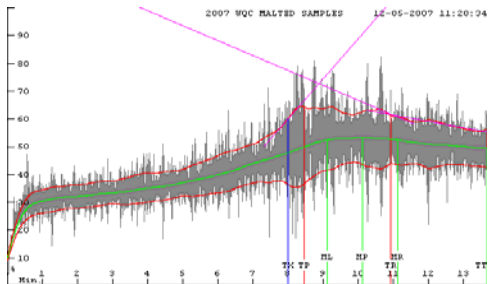
Glenn Check  
C8



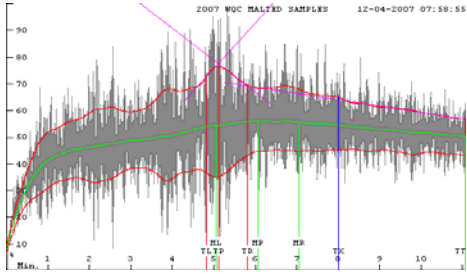
06 Inc 2  
C7



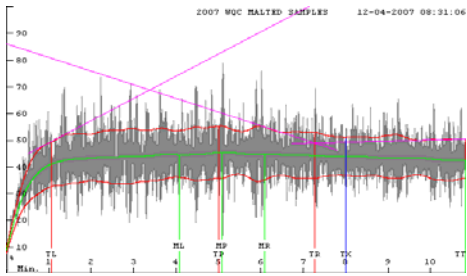
Glenn Check  
W8



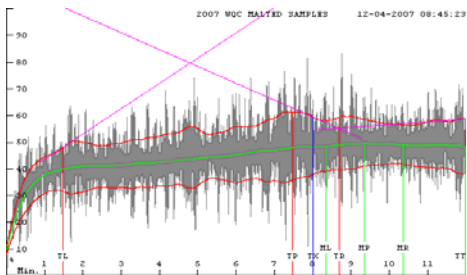
06 Inc 2  
W7



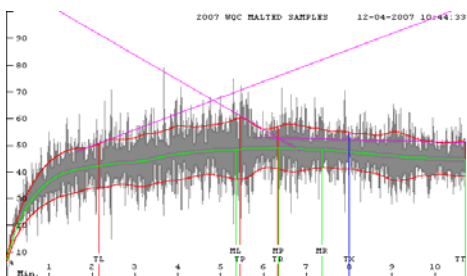
Glenn Check  
B8



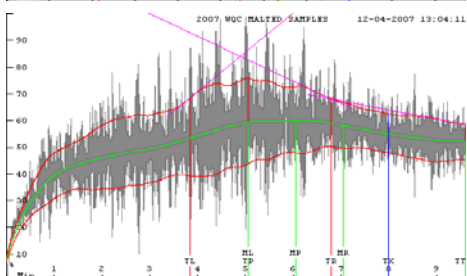
00S0120-3W  
B9



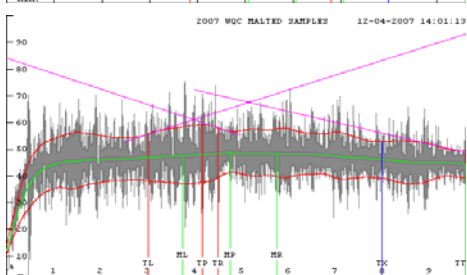
Glenn Check  
C8



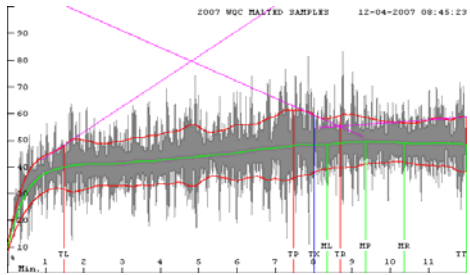
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C9



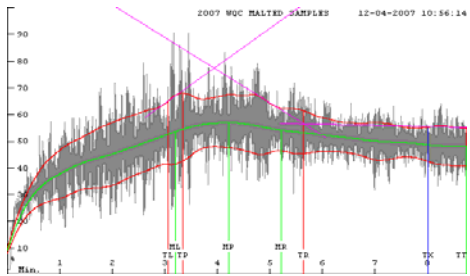
Glenn Check  
K8



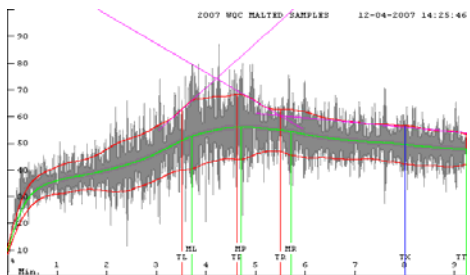
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K9



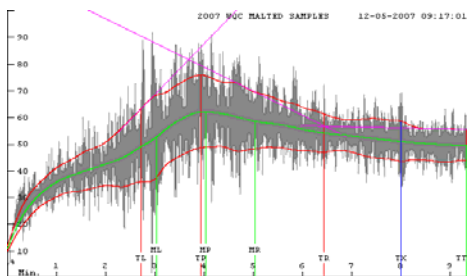
Glenn Check  
C8



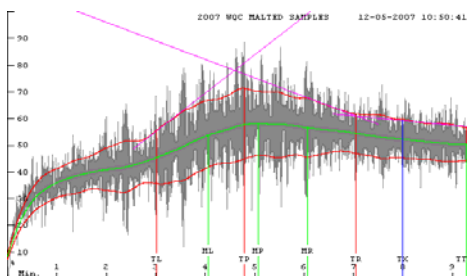
ND901  
C10



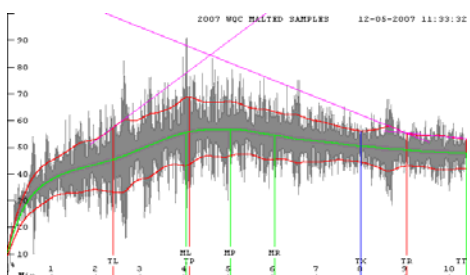
Glenn Check  
M8



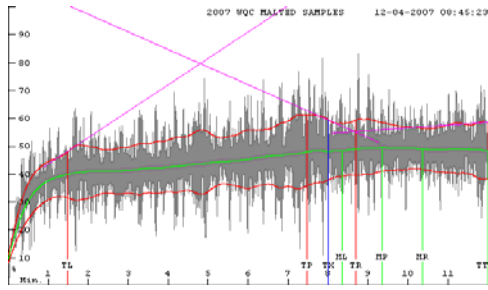
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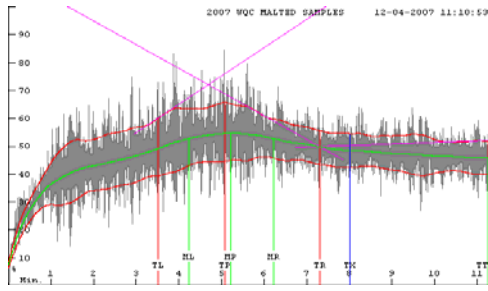
Glenn Check  
W8



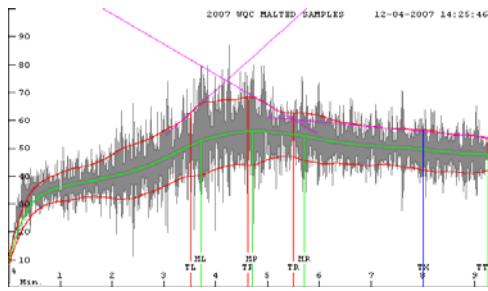
ND901  
W10



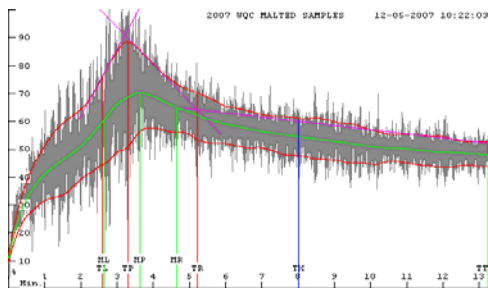
Glenn Check  
C8



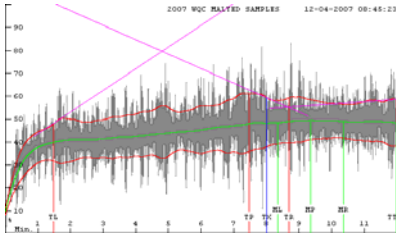
CA905-750  
C11



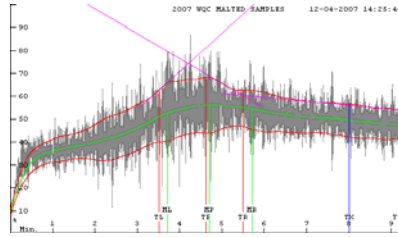
Glenn Check  
M8



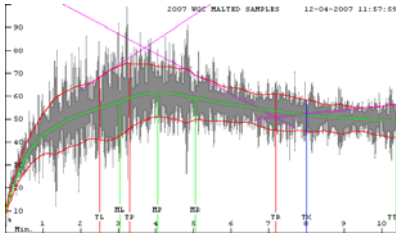
CA905-750  
M11



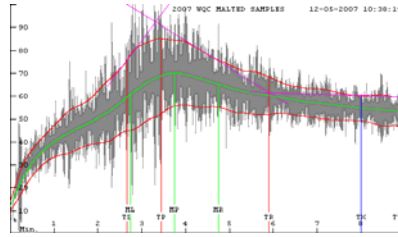
Glenn Check  
C8



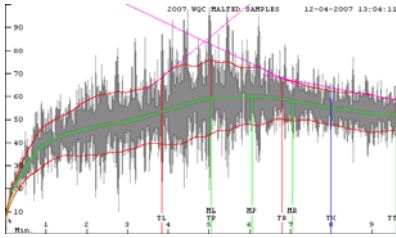
Glenn Check  
M8



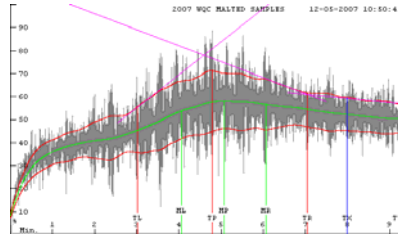
ND809  
C12



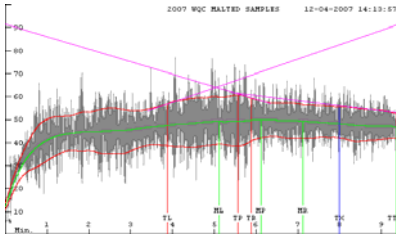
ND809  
M12



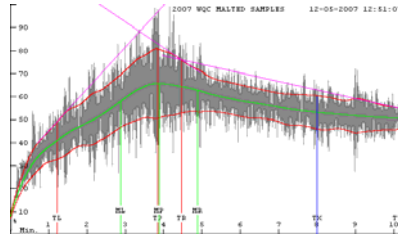
Glenn Check  
K8



Glenn Check  
W8

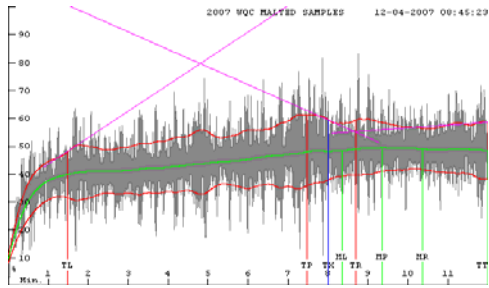


ND809  
K12

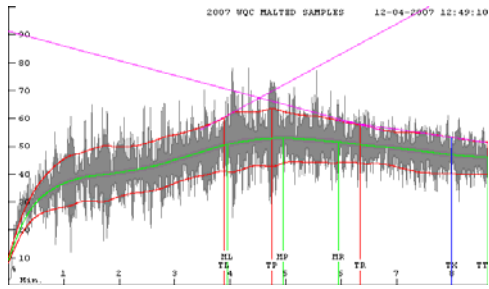


ND809  
W12

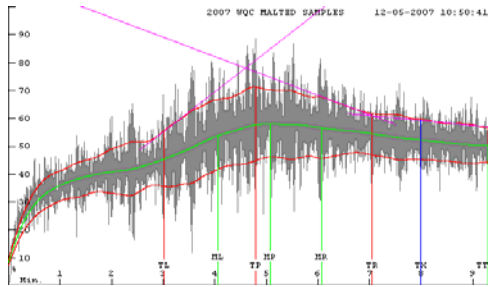
**06 Inc 1  
SWQAC #13**



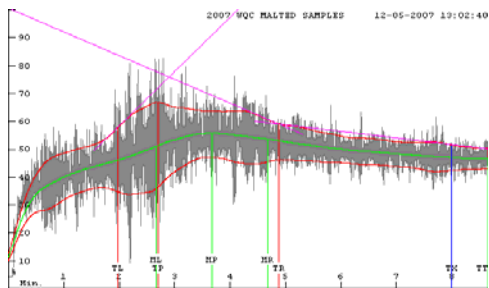
**Glenn Check  
C8**



**06 Inc 1  
C13**



**Glenn Check  
W8**

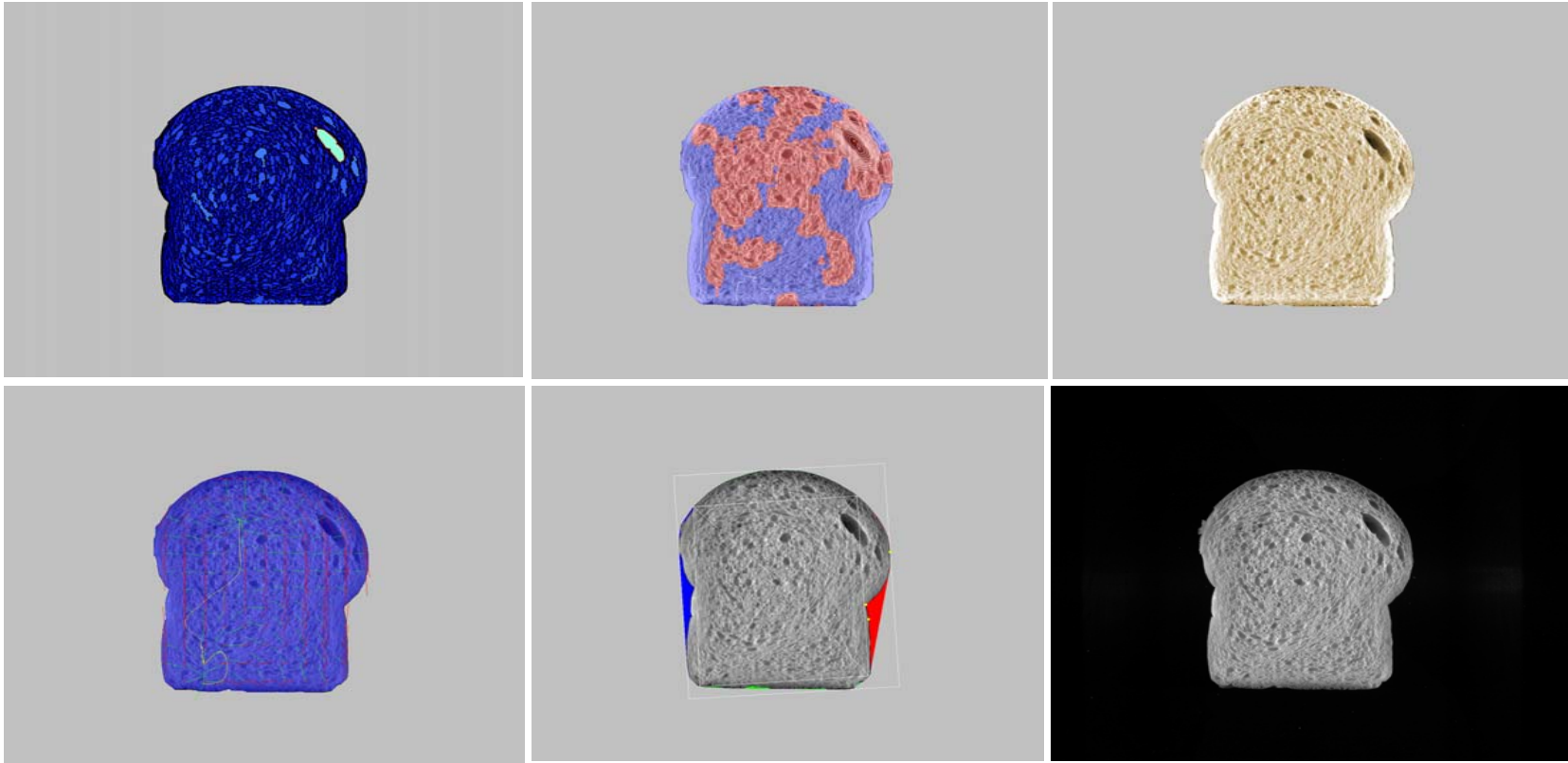


**06 Inc 1  
W13**

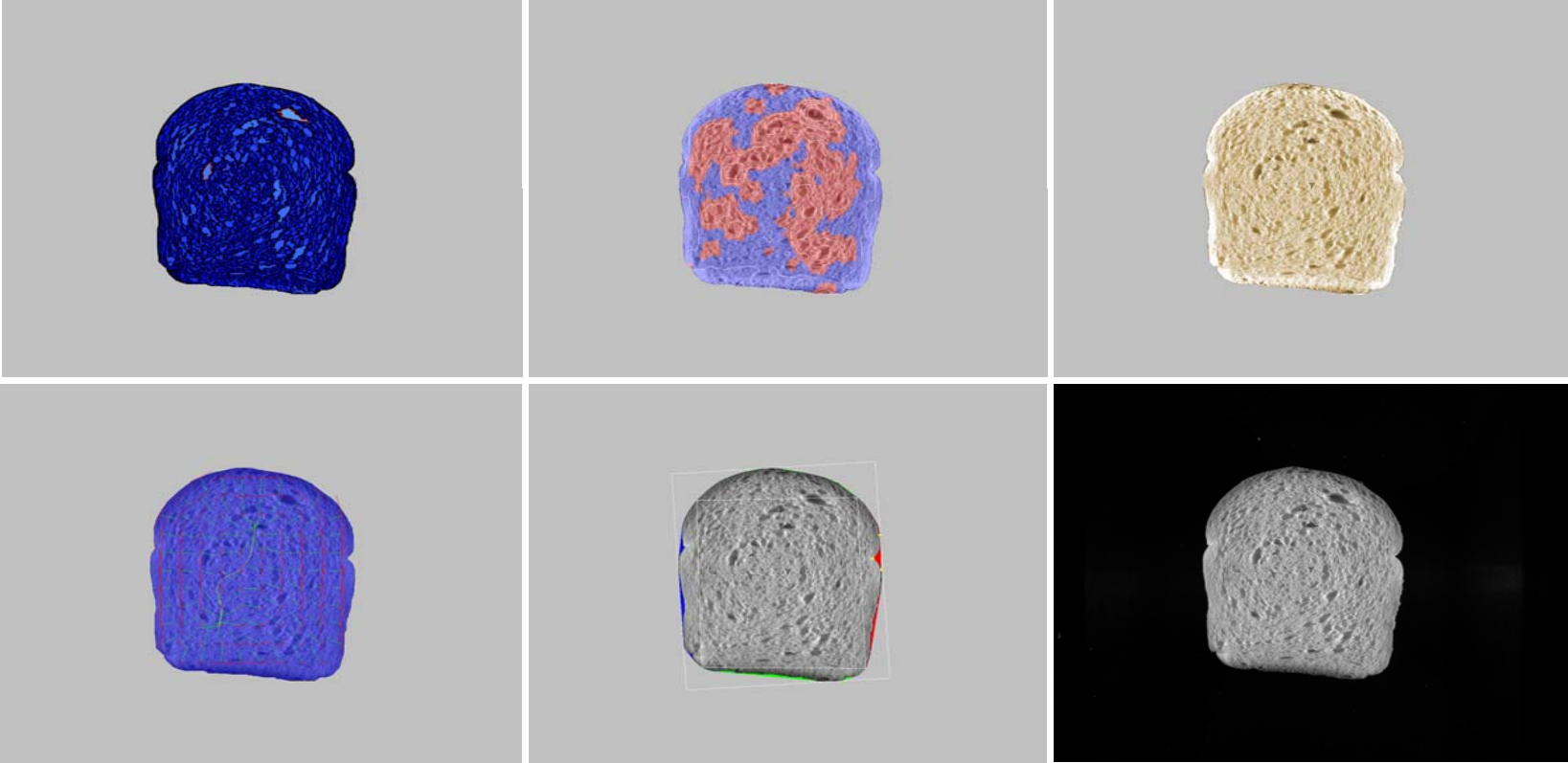
Cultivar	ID	Slice_Area Pixel Units	Wrapper_Length Pixel Units	Slice_Brightness 0-240 Gray Scale
Glenn	B8	269611	1941	141.5
SD3868	B4	248768	1829	147.7
00S0120-3W	B9	268728	1928	149.3
Glenn	C8	280551	1997	140.4
MN01311-A-1	C2	278120	1986	146.3
NDSW0449	C3	272417	1950	141.6
SD3868	C4	291689	2040	143.8
CA905-749	C6	277279	1975	140.3
06 Inc 2	C7	260401	1906	142.5
00S0120-3W	C9	304327	2086	142.0
ND 901	C10	303407	2073	135.5
CA905-750	C11	284418	2025	141.0
ND 809	C12	313851	2144	137.5
06 Inc1	C13	297051	2063	141.1
Glenn	K8	306444	2106	140.4
CS 3100L	K1	246752	1849	143.0
MN01311-A-1	K2	292343	2028	145.5
CS 3100Q	K5	272207	1949	149.1
00S0120-3W	K9	294345	2066	144.4
ND 809	K12	285774	2026	142.5
Glenn	M8	281630	2016	137.5
CS 3100L	M1	312306	2129	141.4
NDSW0449	M3	305678	2083	142.8
CS 3100Q	M5	309482	2087	143.7
CA905-749	M6	312358	2103	147.7
ND 901	M10	343688	2212	141.1
CA905-750	M11	326374	2153	139.0
ND 809	M12	328745	2178	142.4
Glenn	W8	309279	2131	136.4
NDSW0449	W3	332160	2165	129.5
06 Inc 2	W7	194230	1593	139.6
ND 901	W10	363551	2257	132.7
ND 809	W12	365699	2294	123.1
06 Inc1	W13	338022	2199	130.4

The following C-Cell images depict bake test results at the USDA/ARS Wheat Quality Laboratory using a straight dough method, 100 g flour. Because of differences in baking methods, these results may vary among cooperating laboratories.

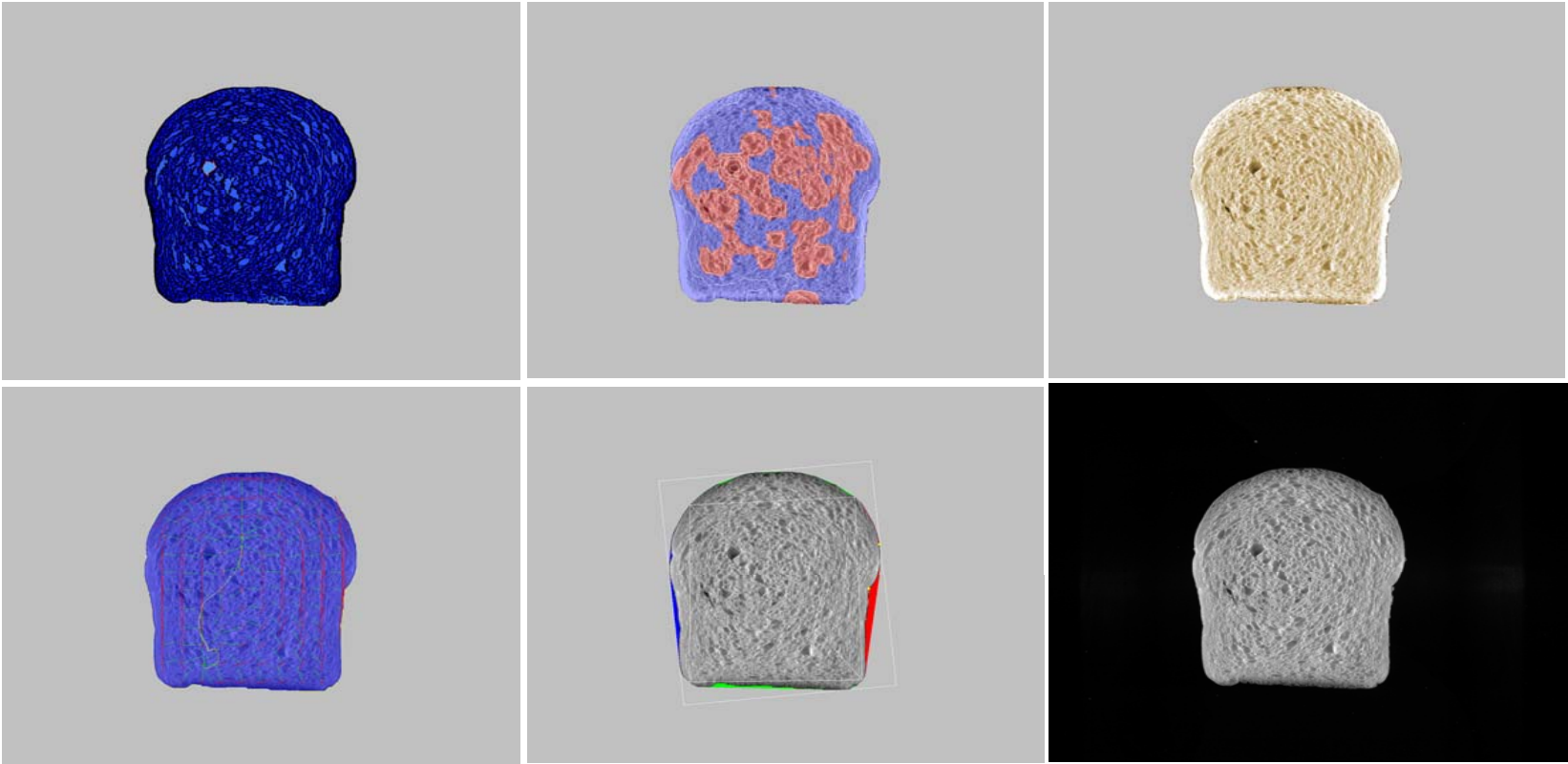




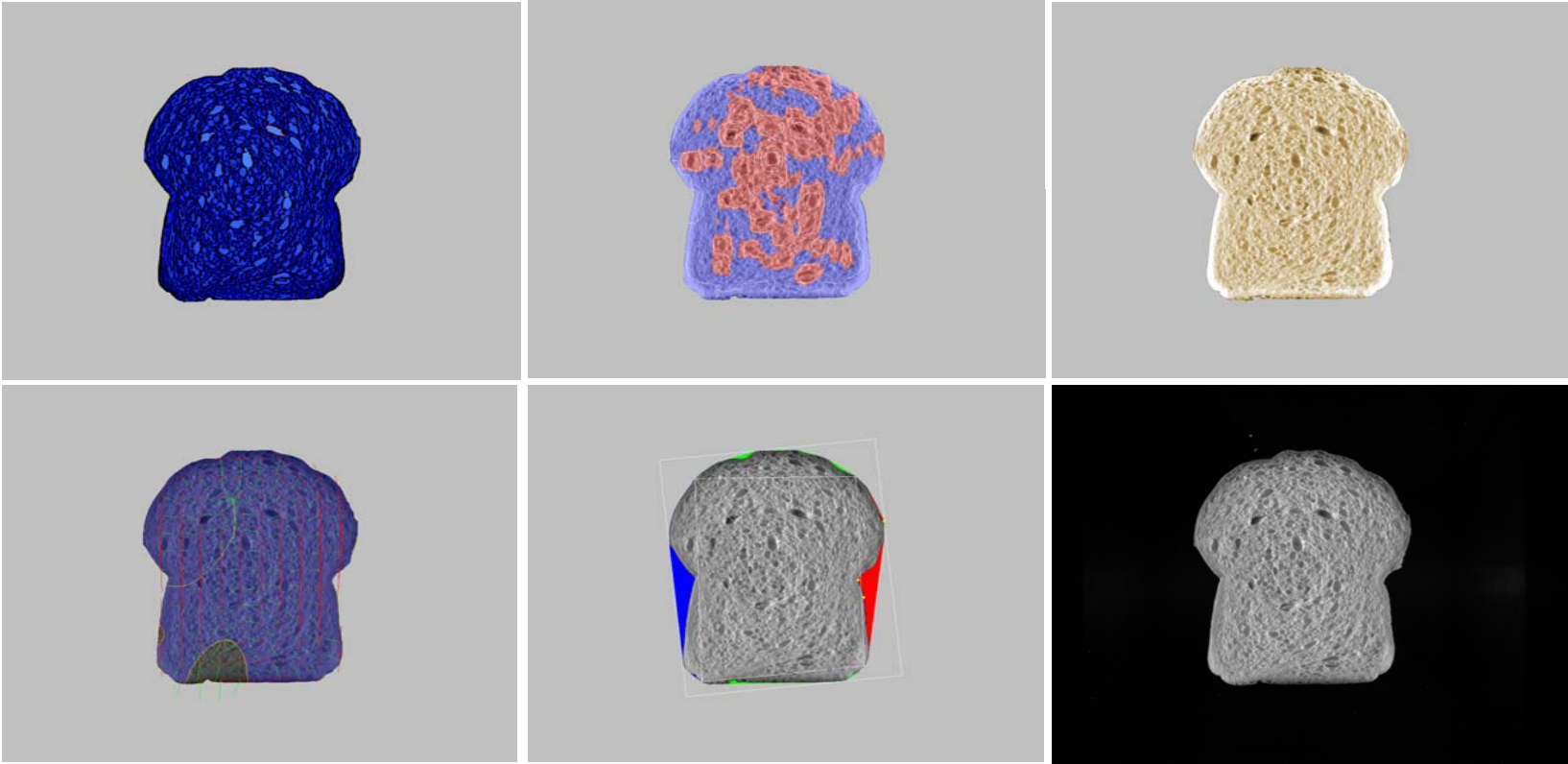
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



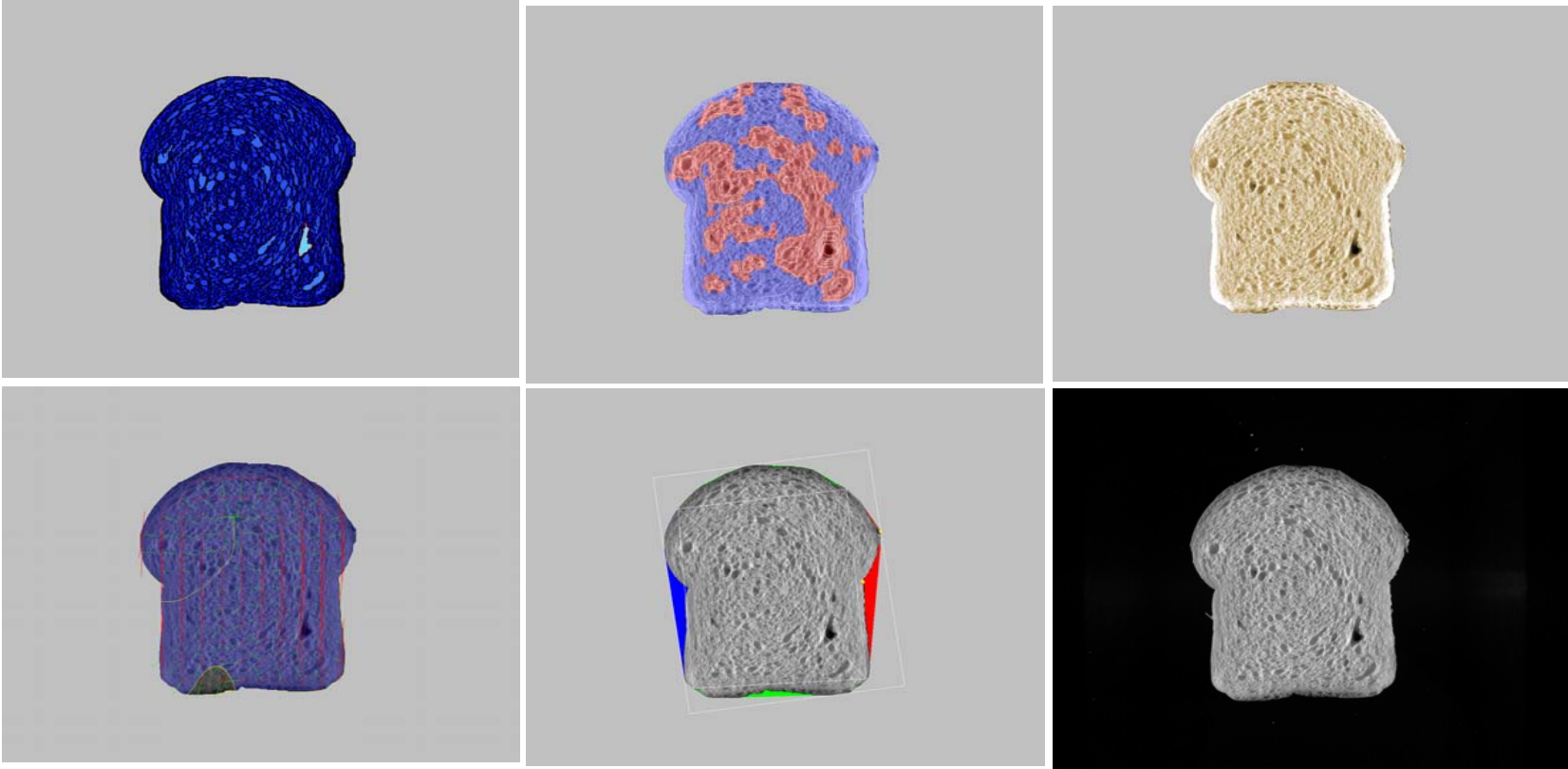
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



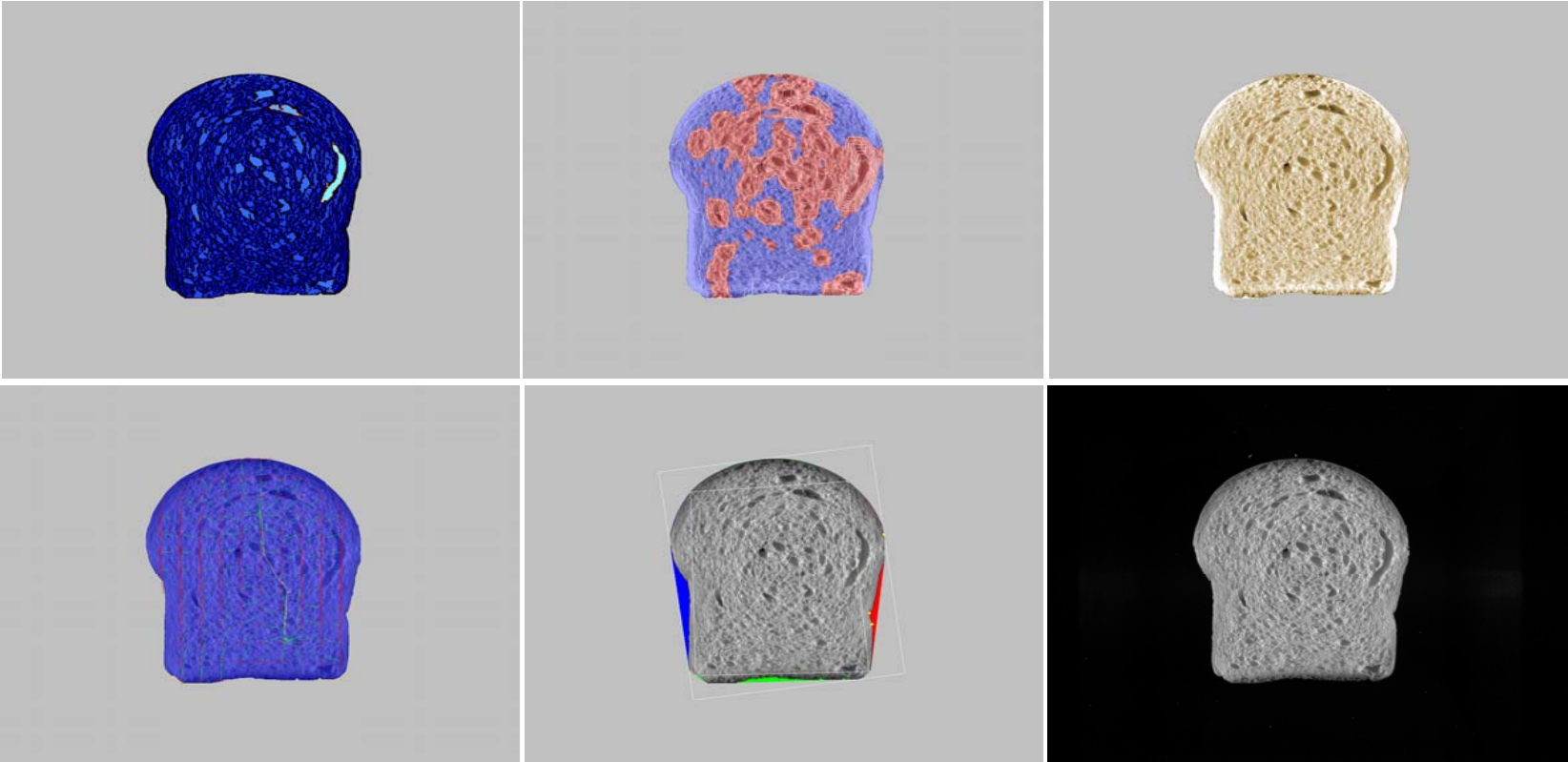
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

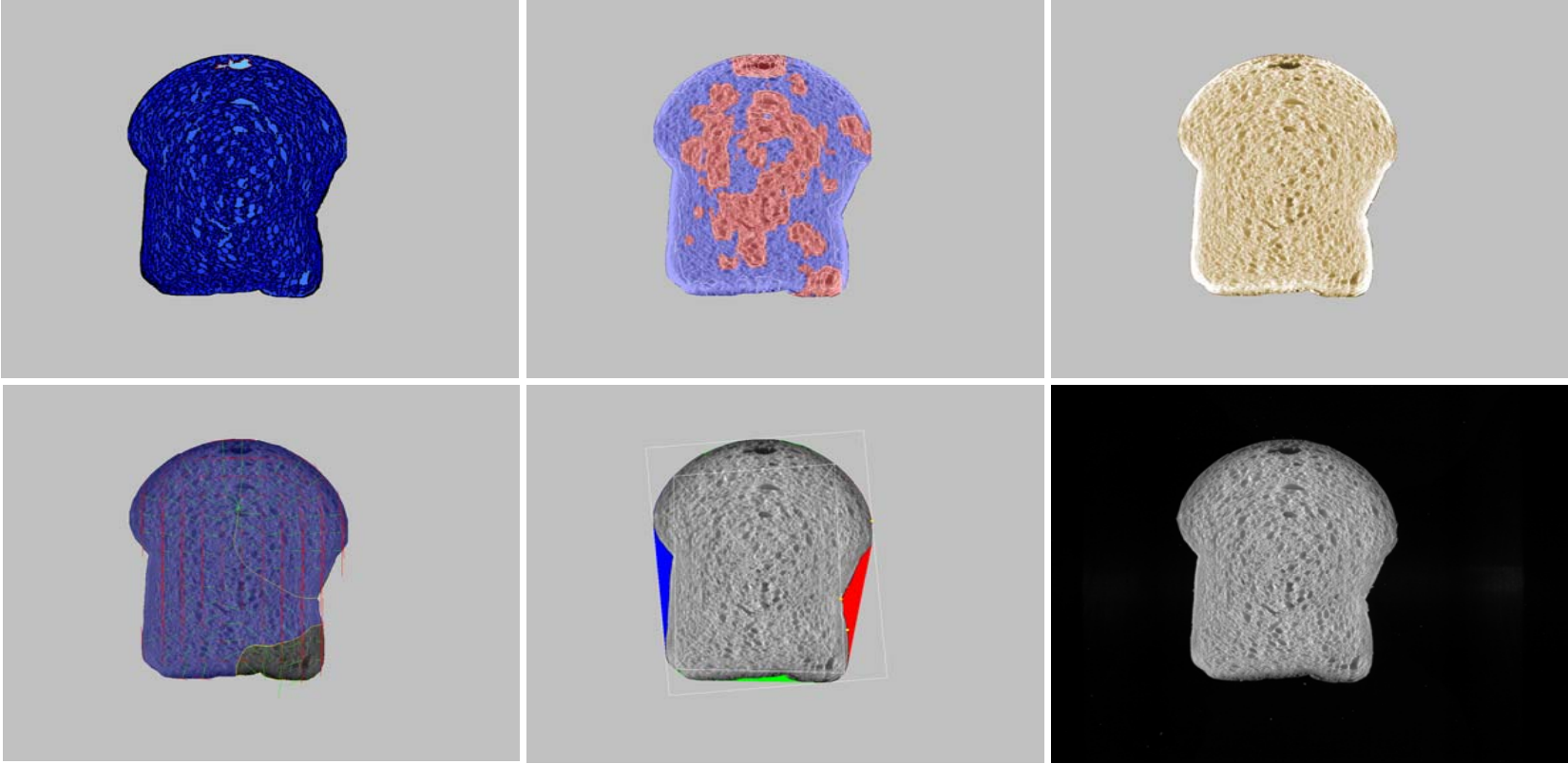


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

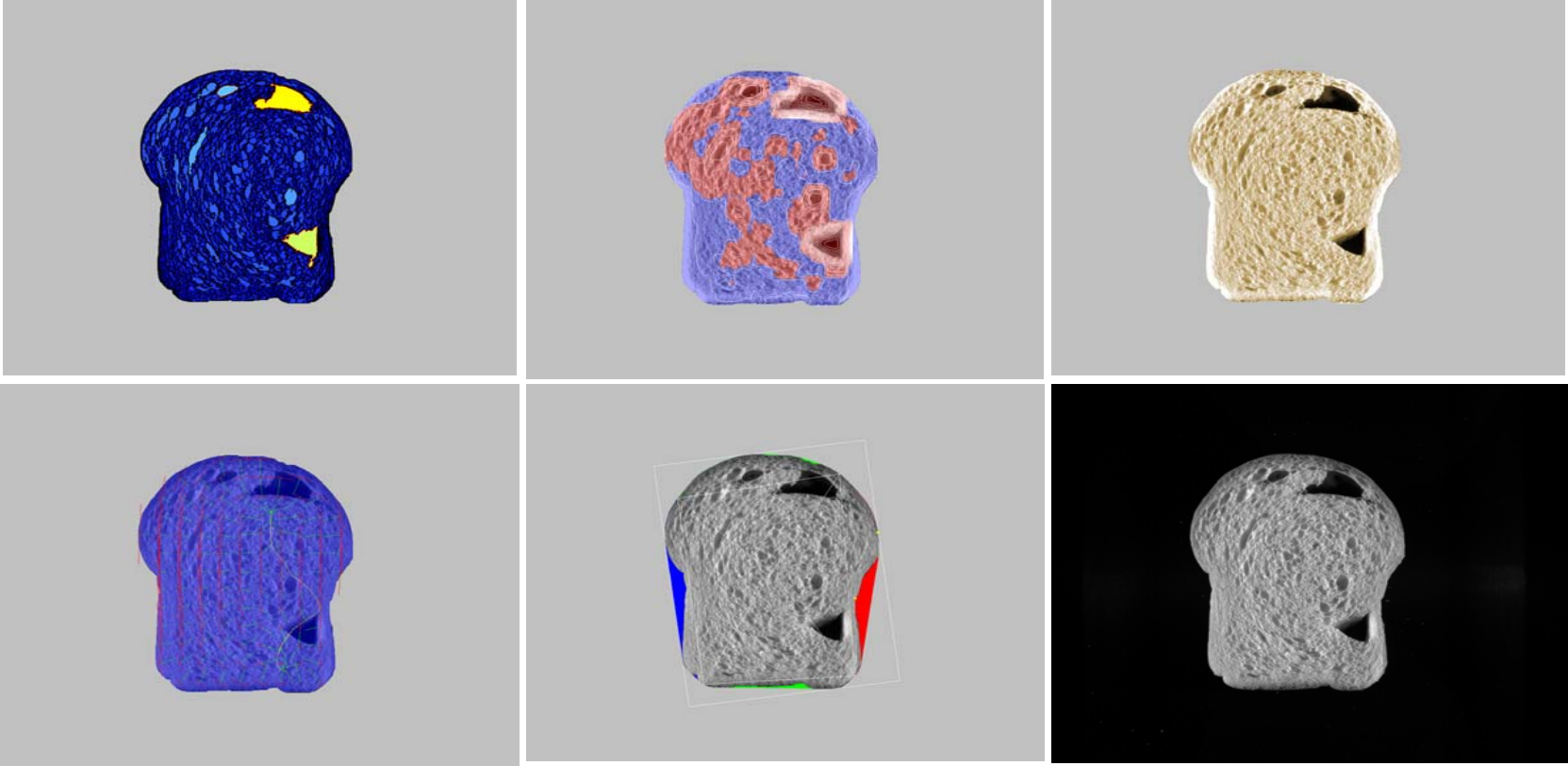


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



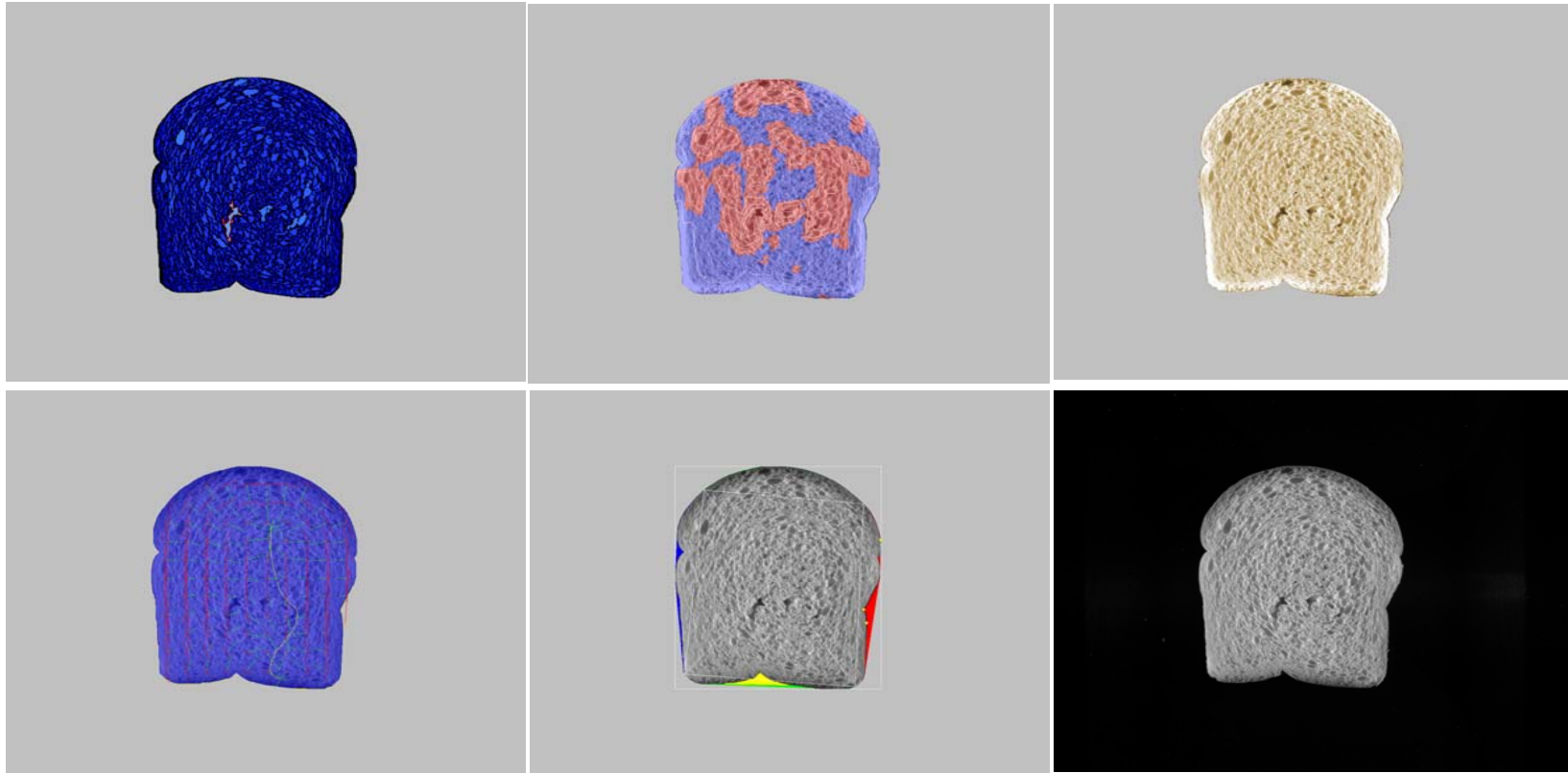


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



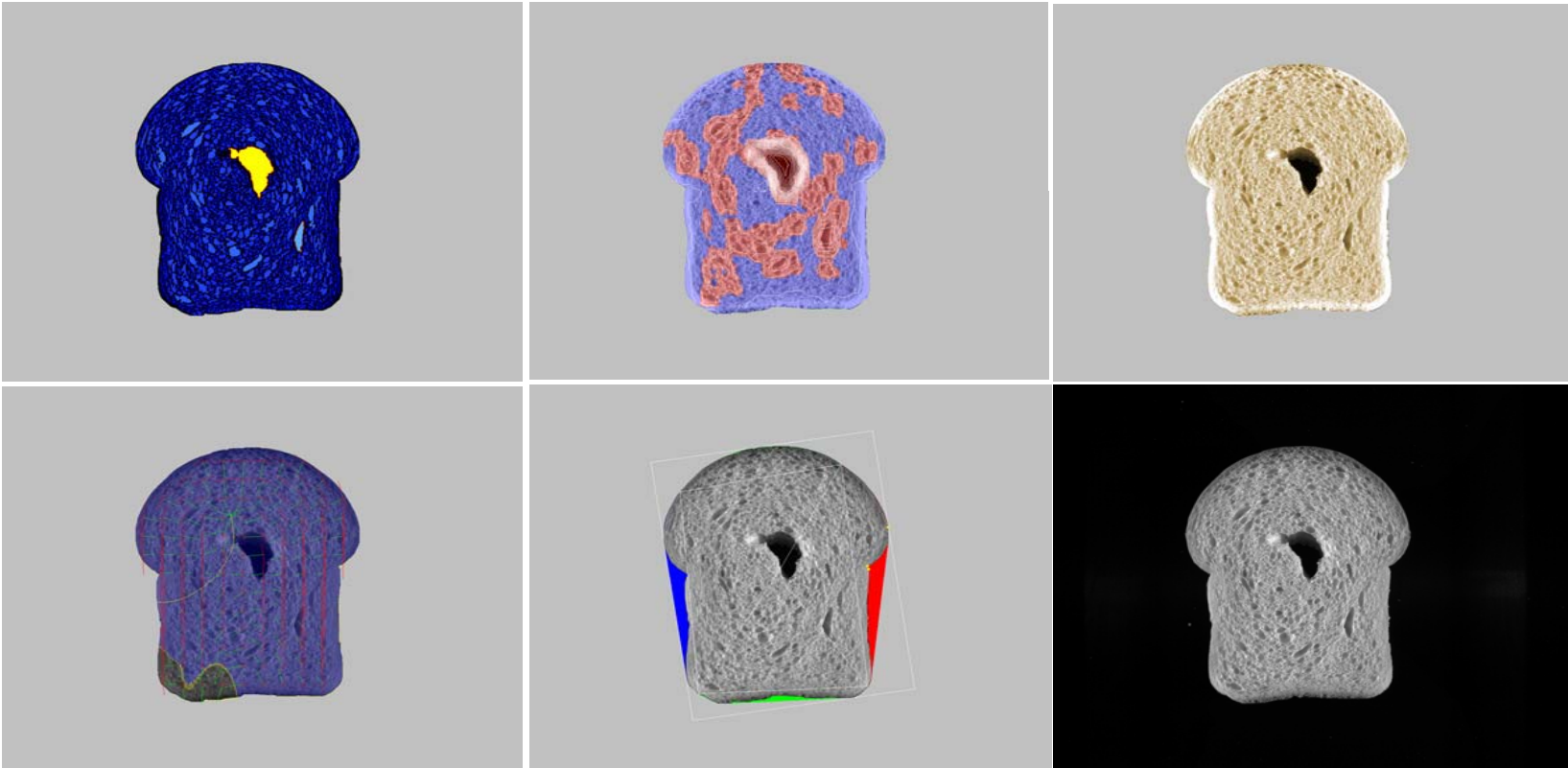
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



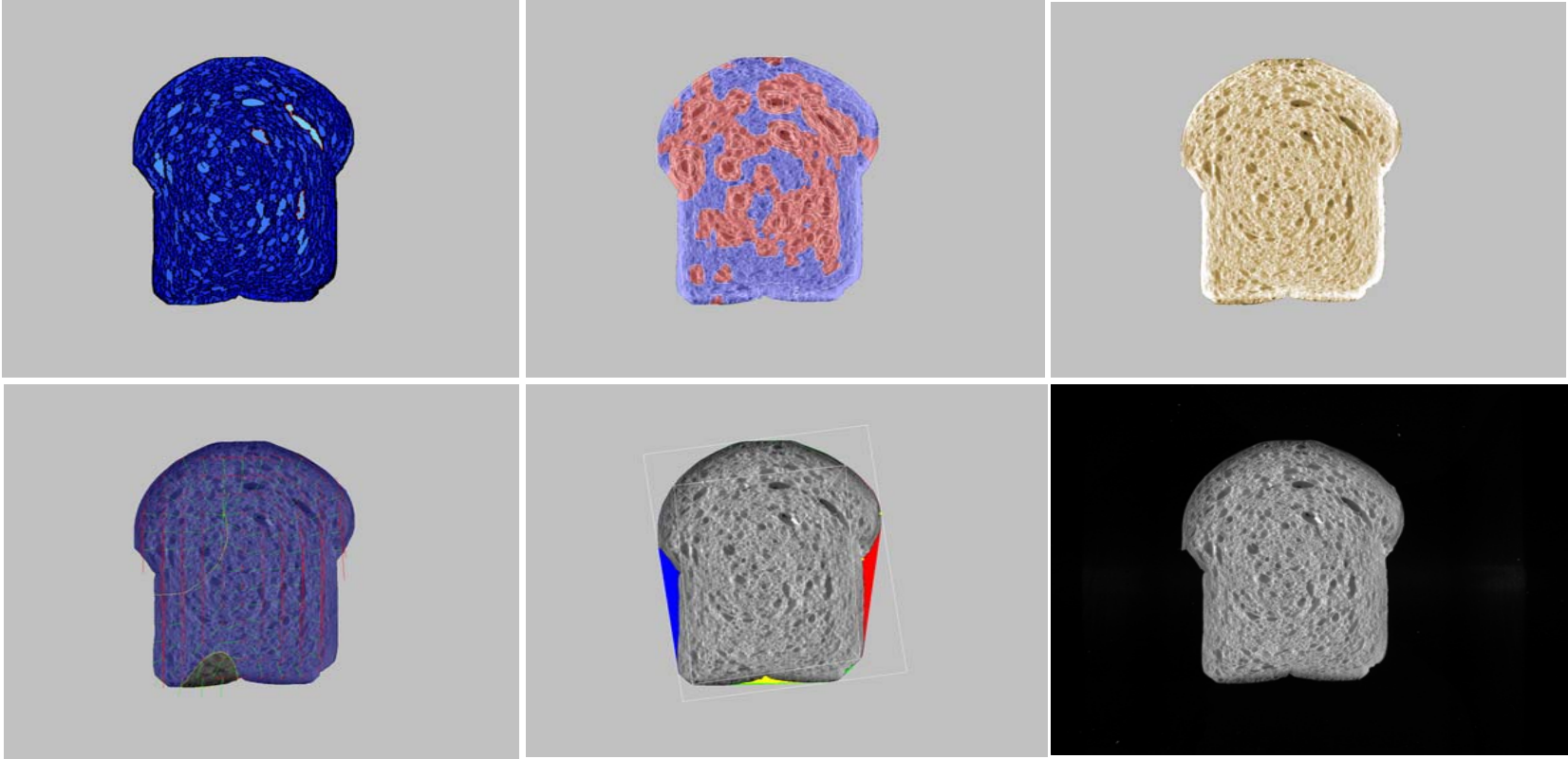


Top Left to Right: Cell, Volume Contours, Brightness Correction

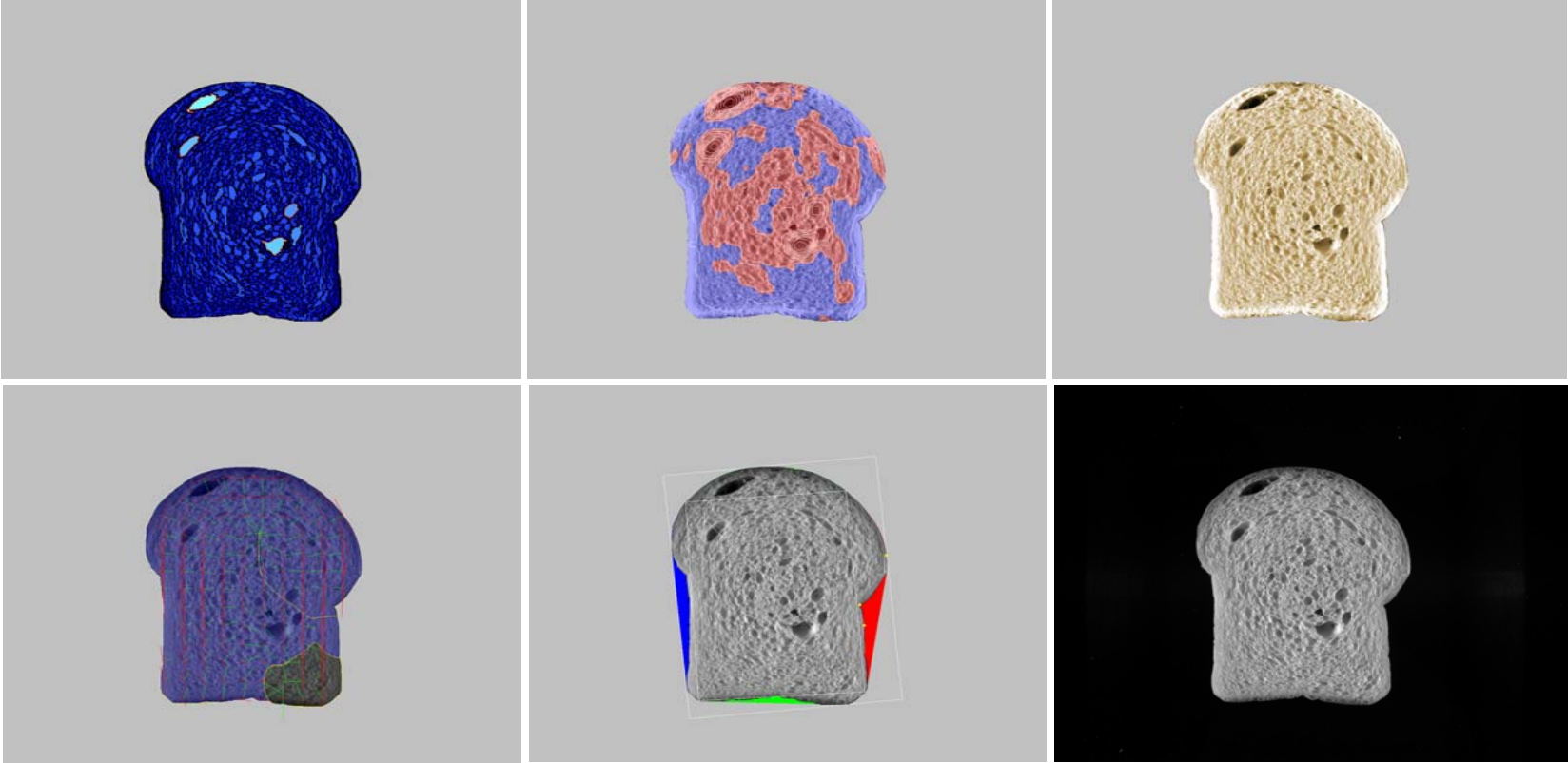
Bottom Left to Right: Elongation, Shape, Raw Image



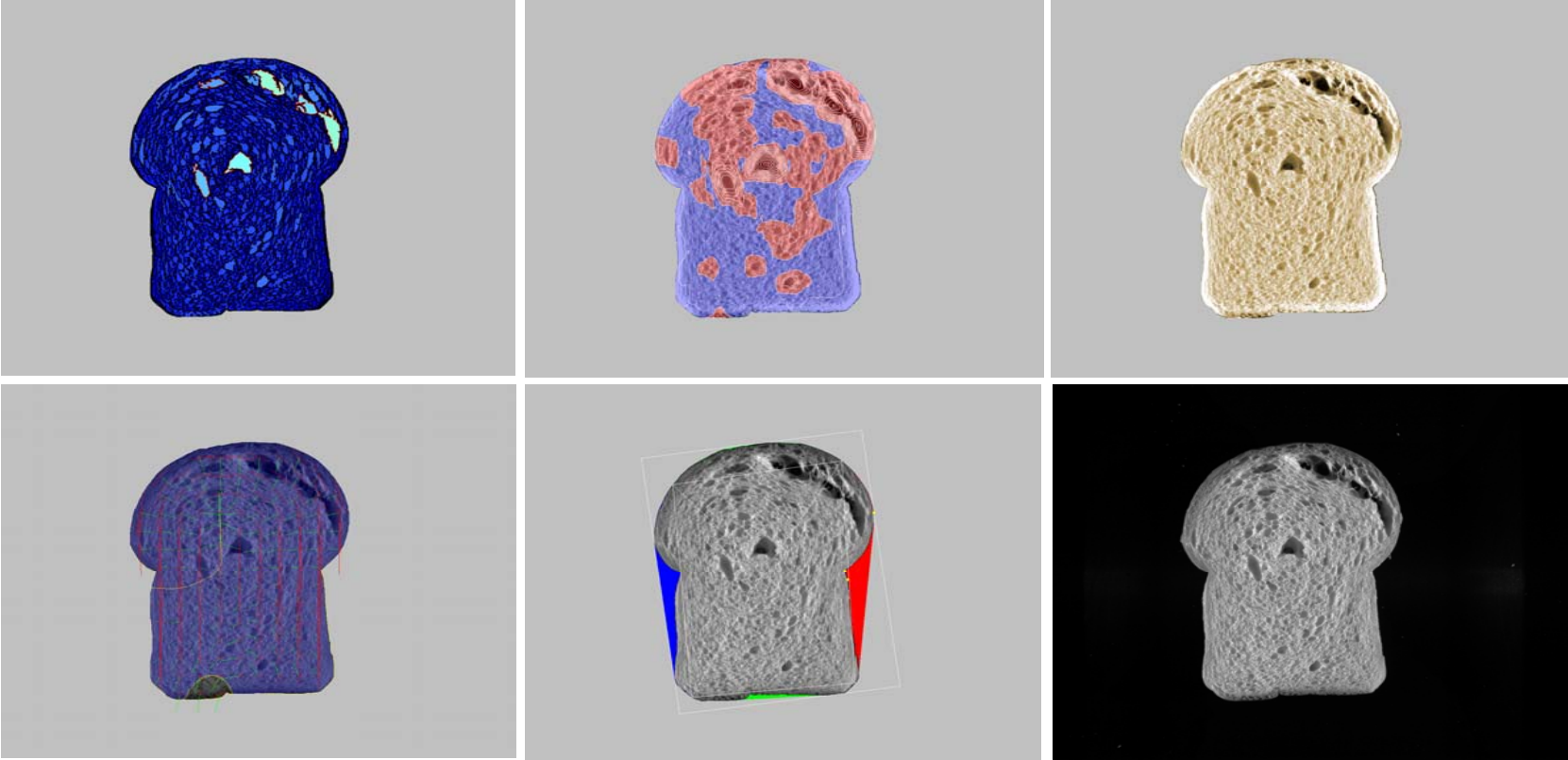
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



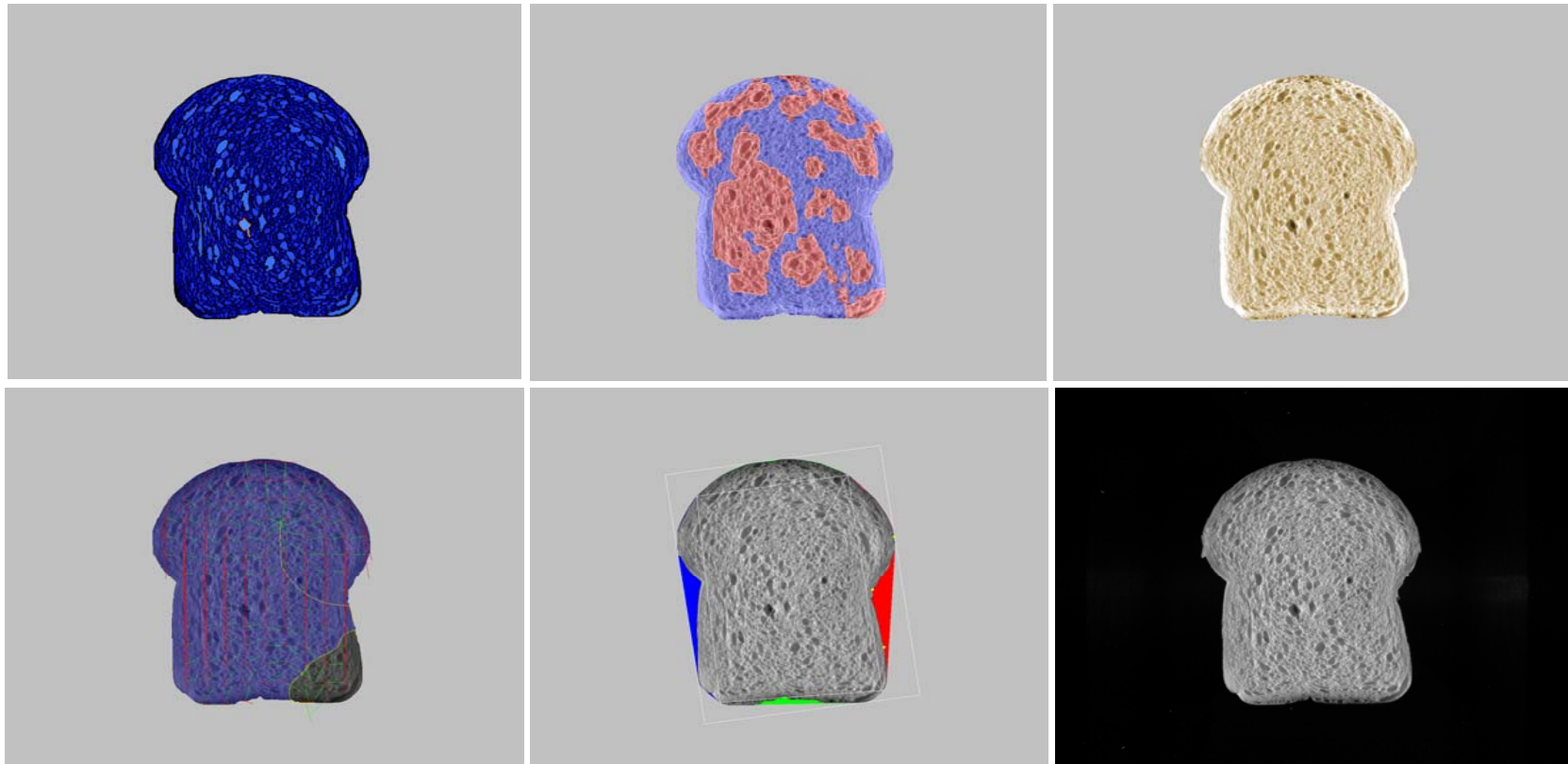
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

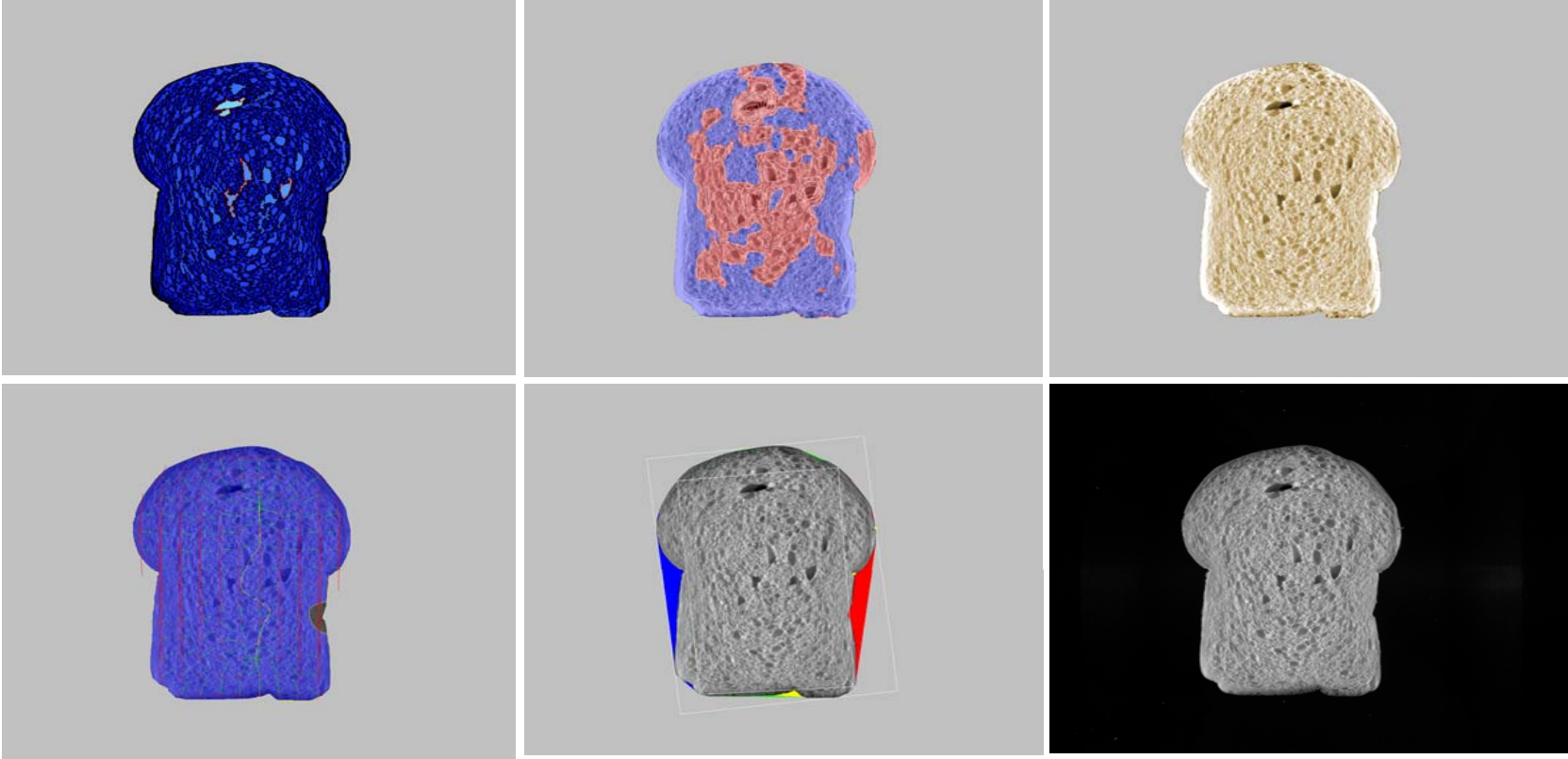


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

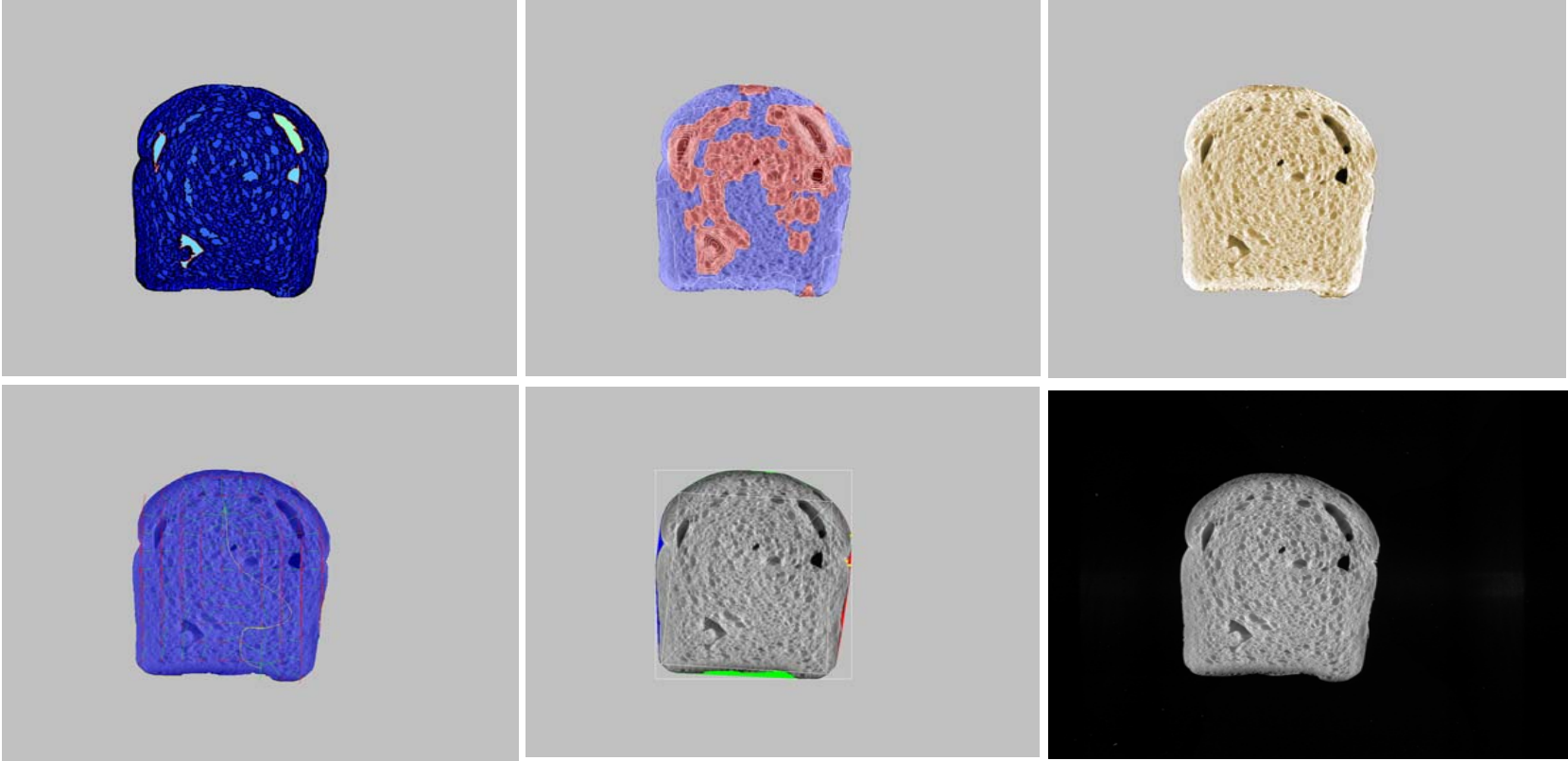


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



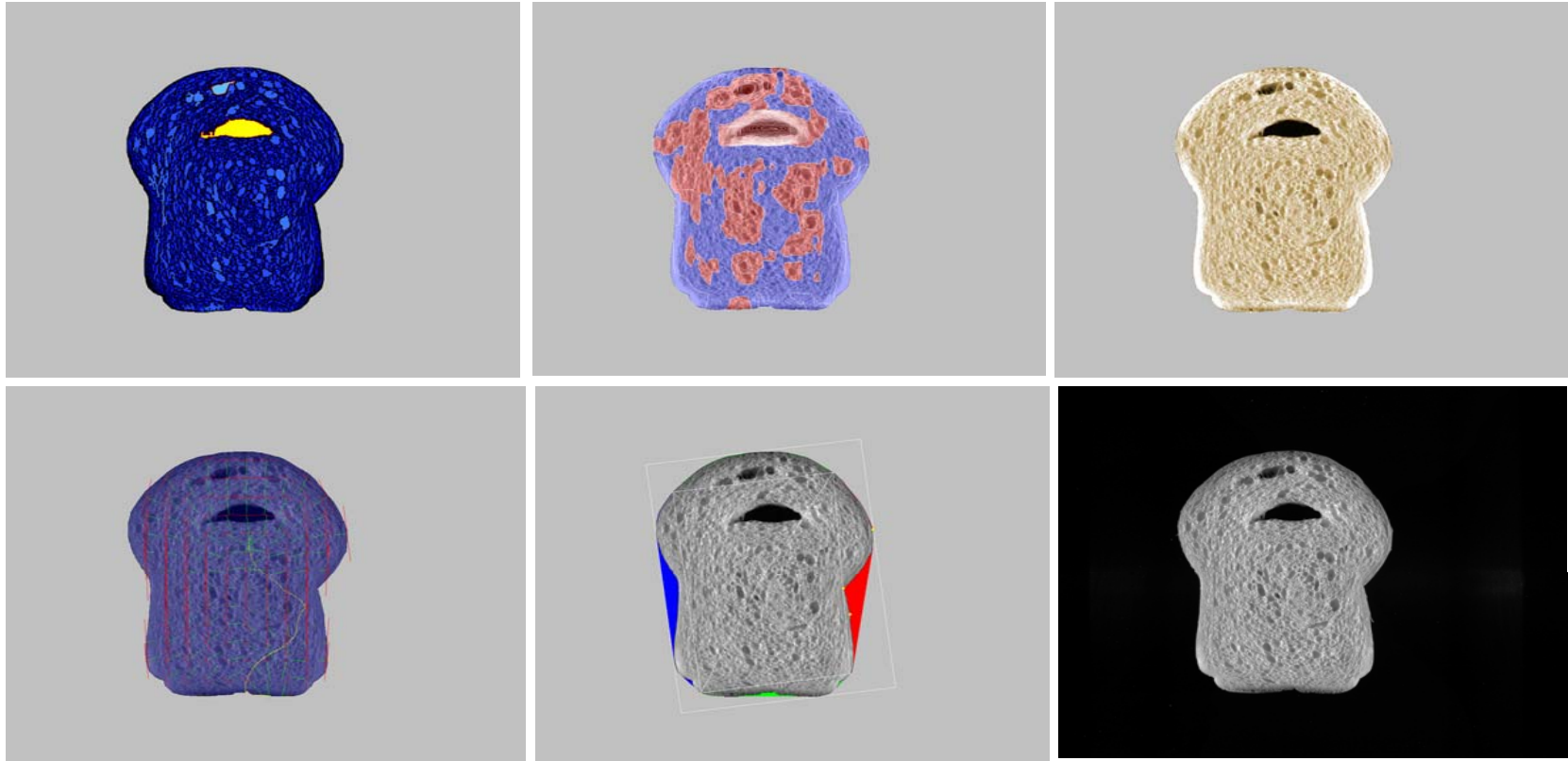


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

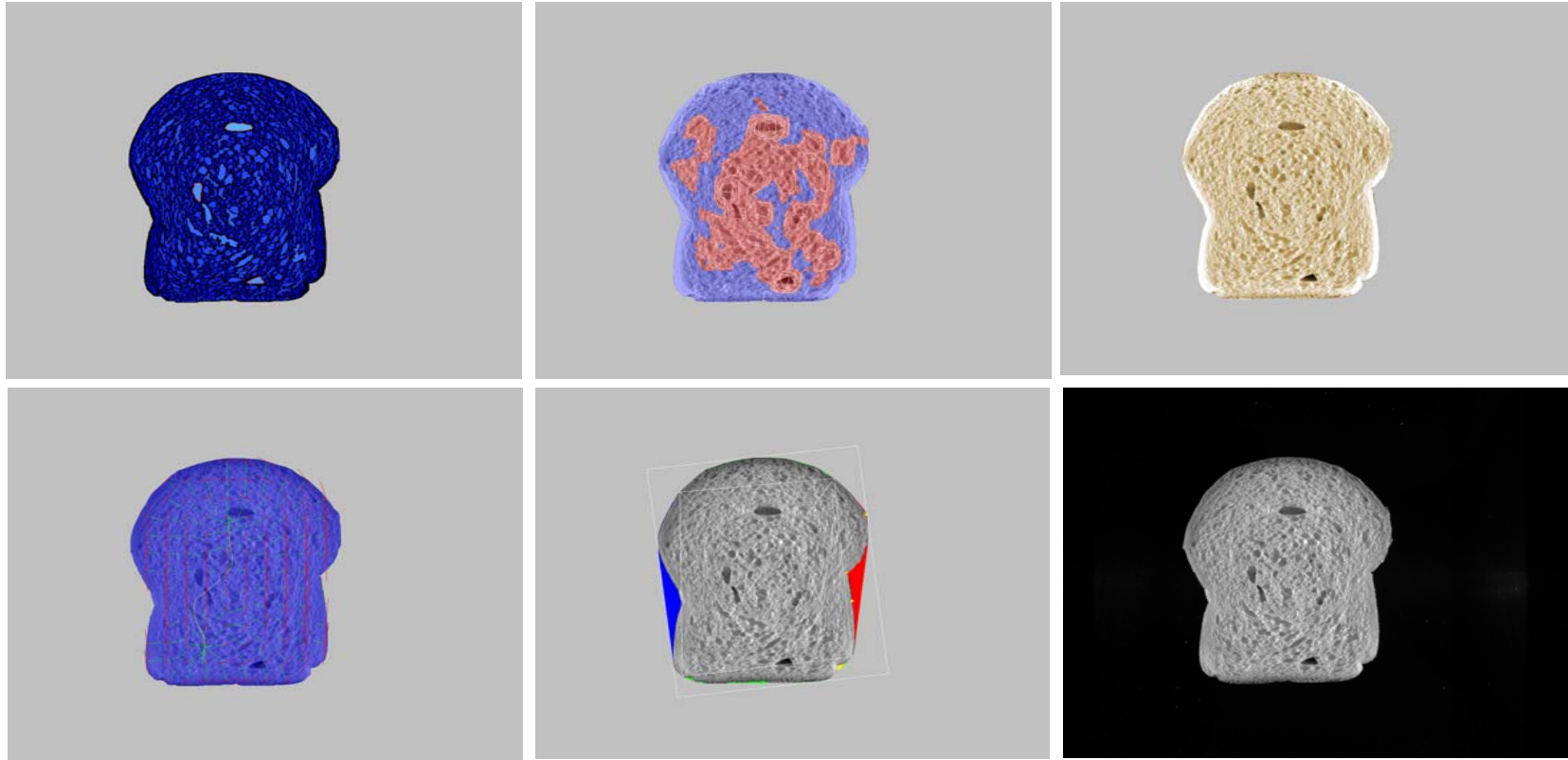


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

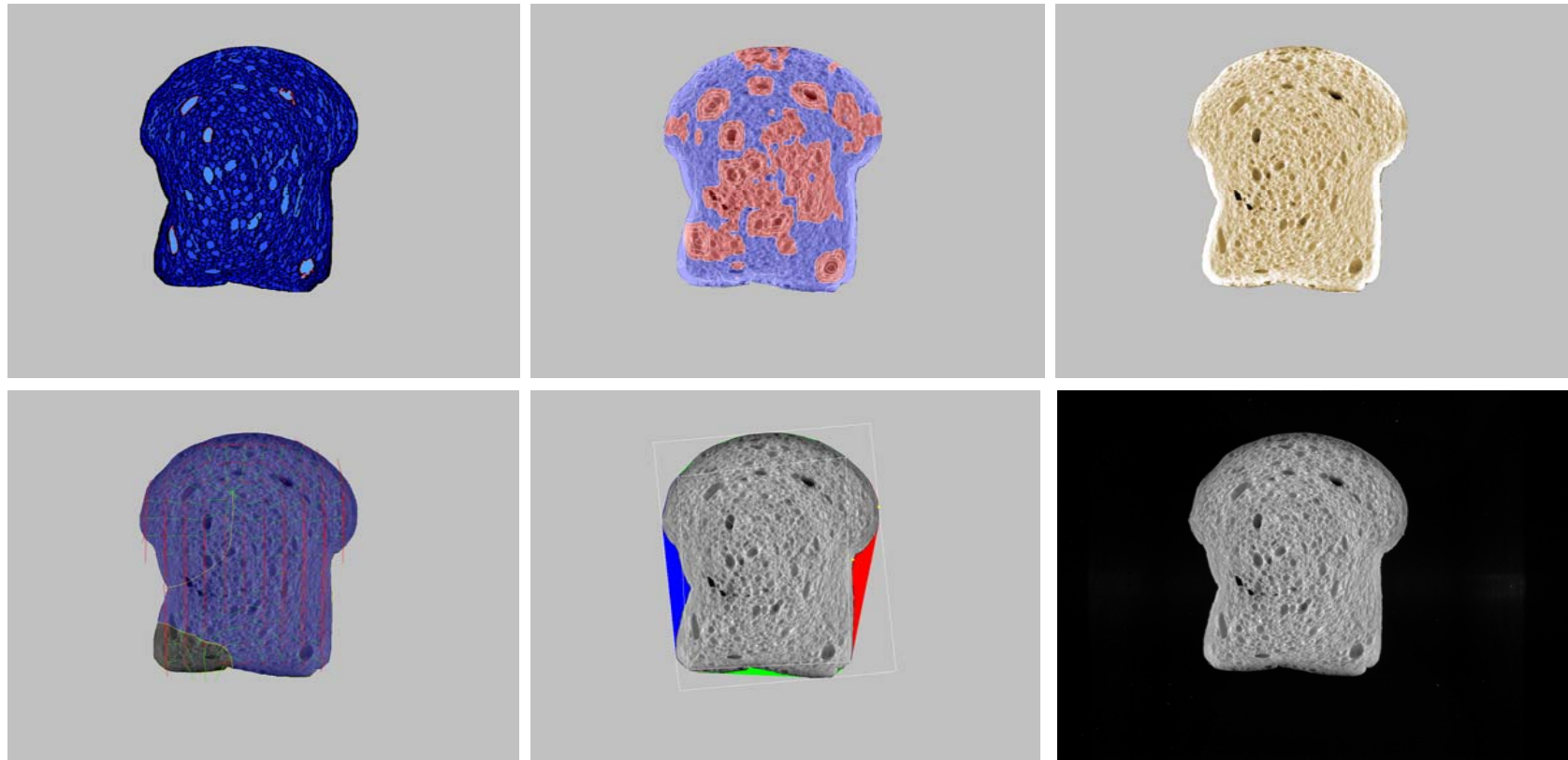




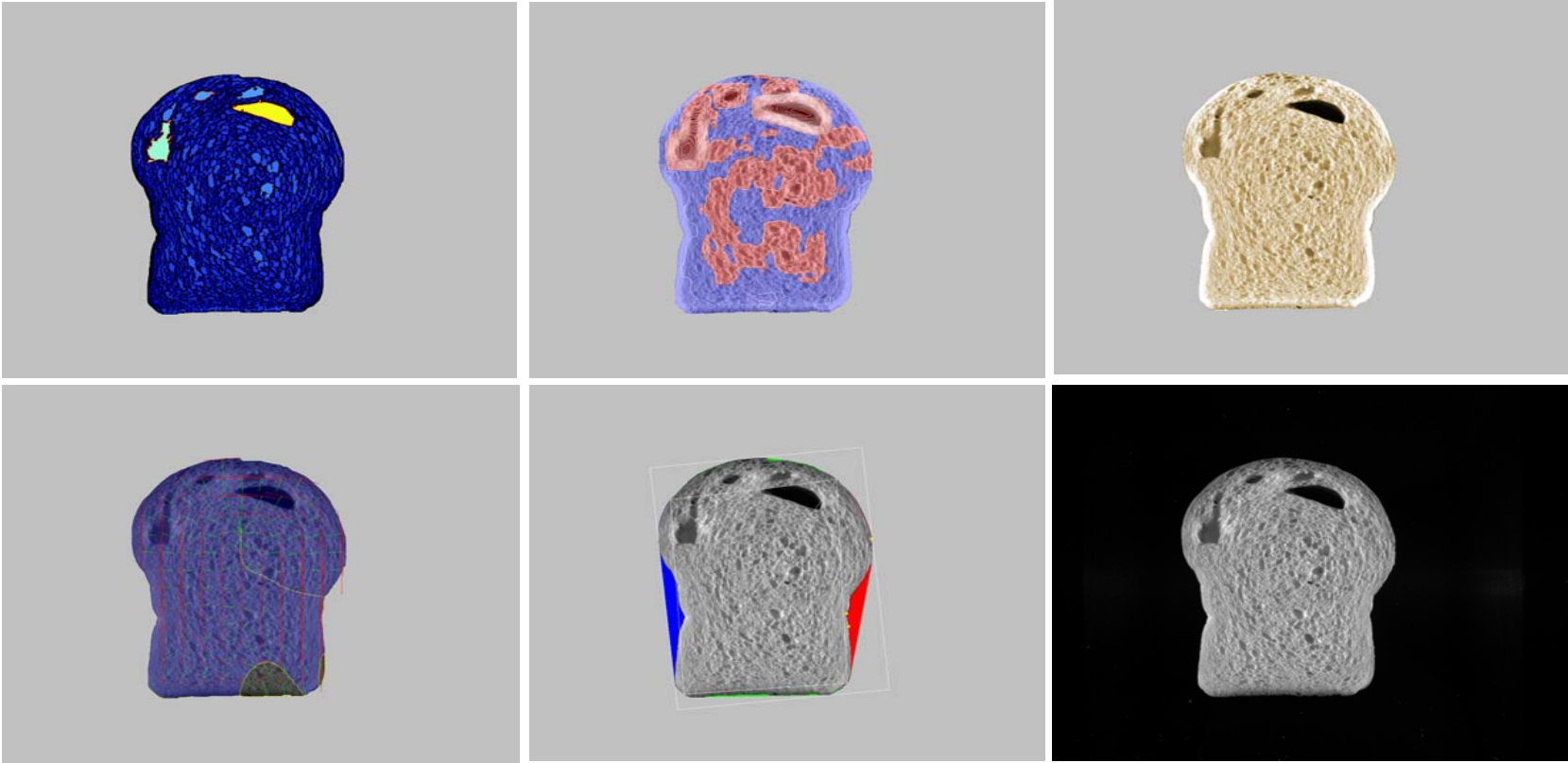
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



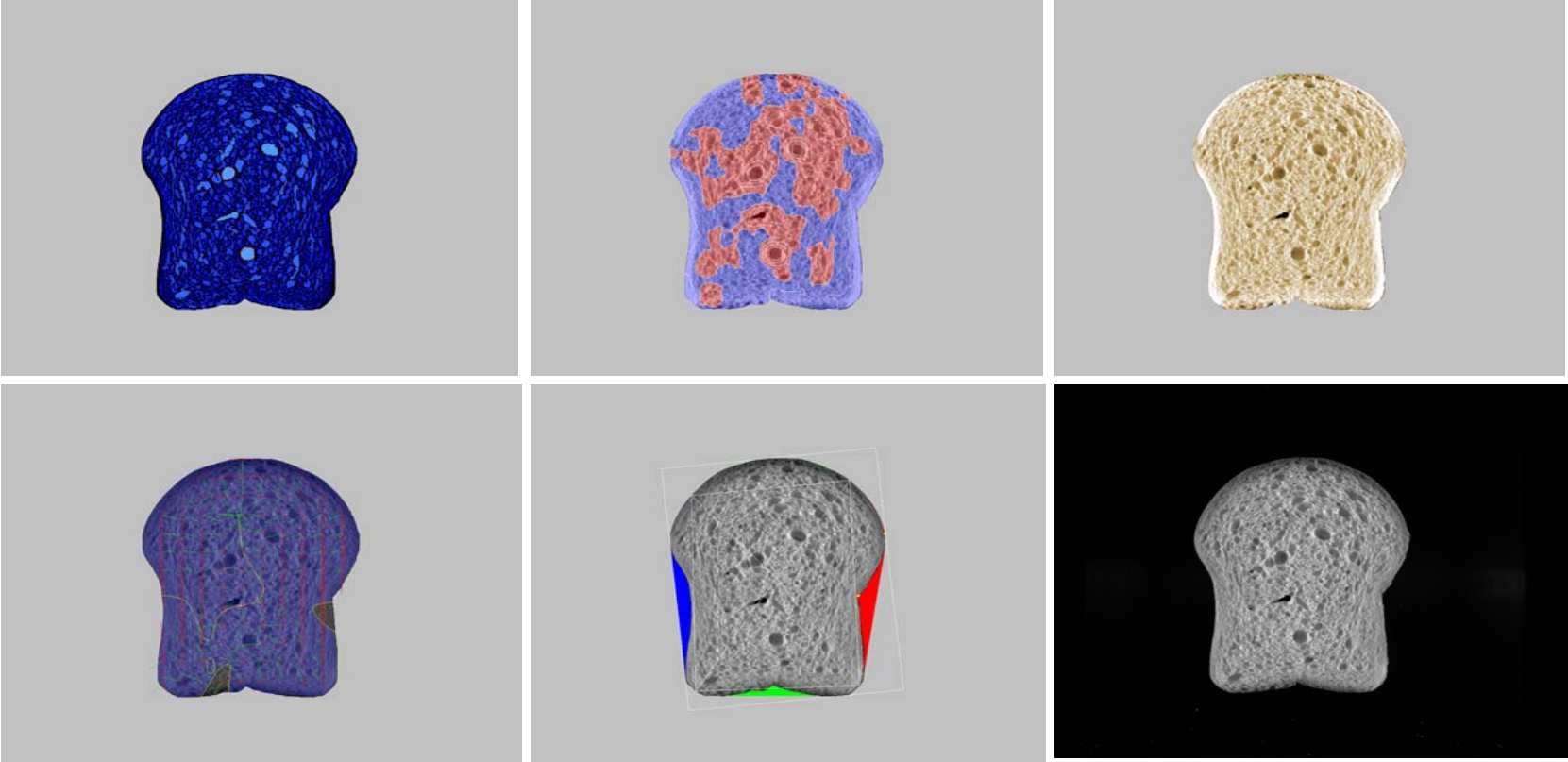
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



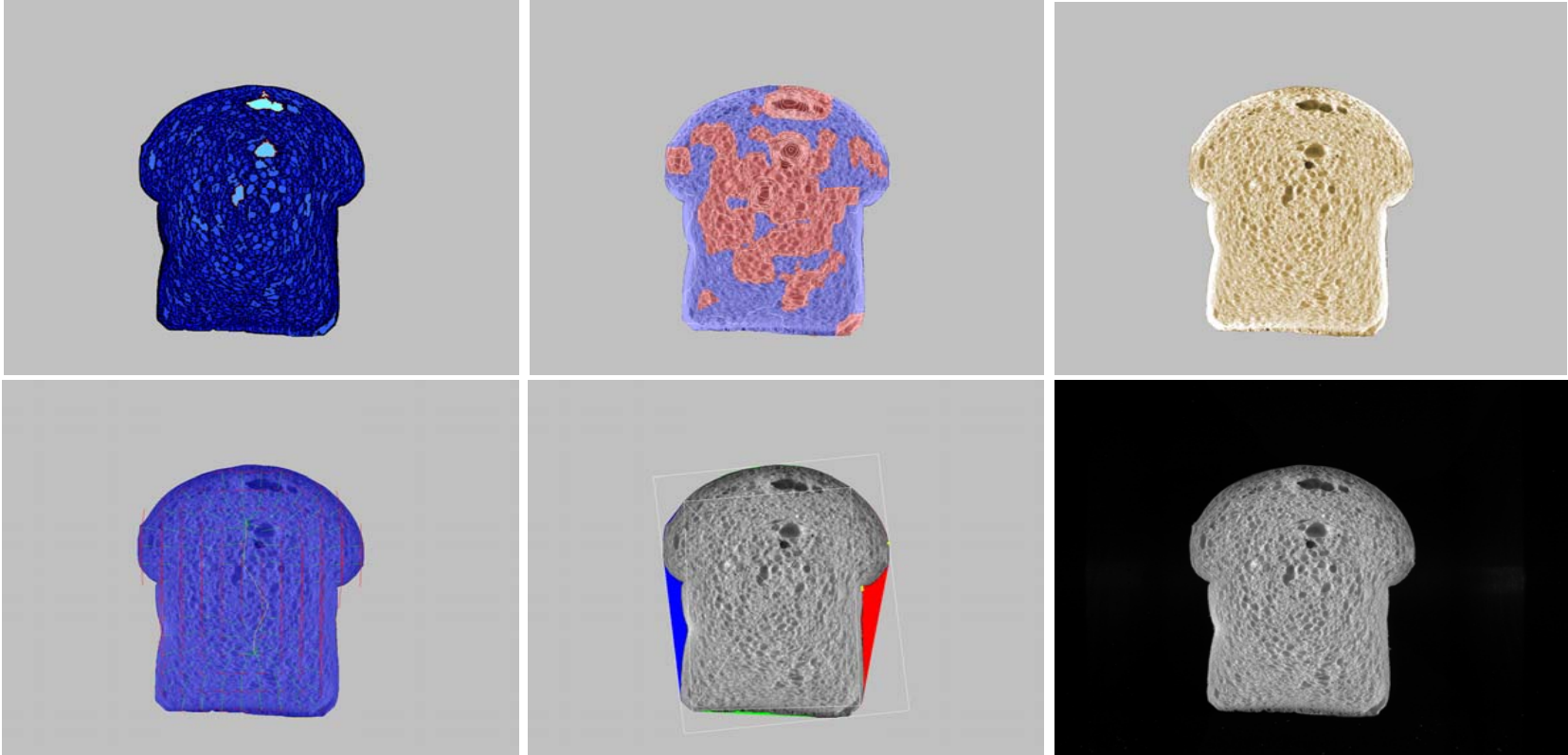
Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

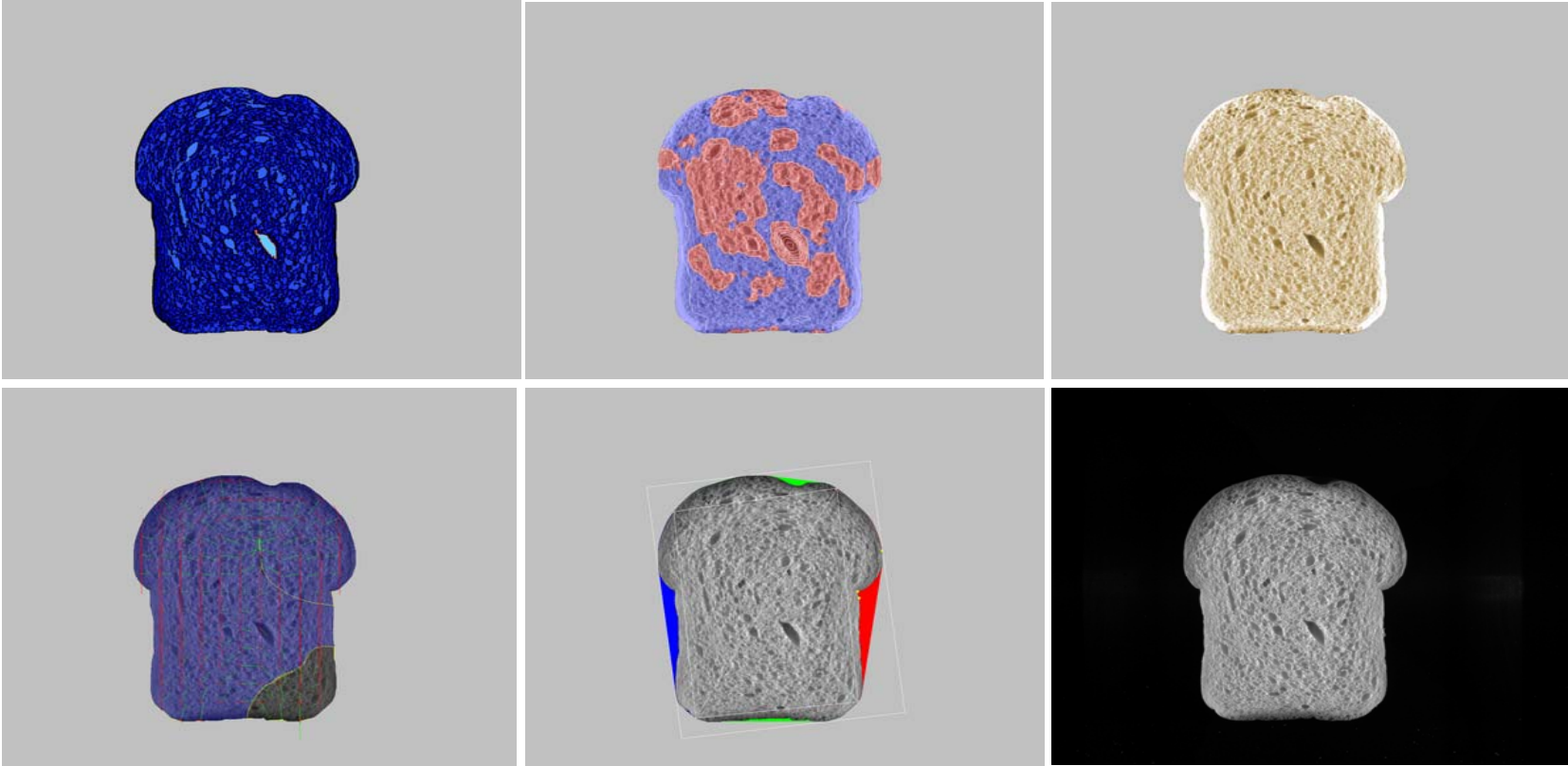


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

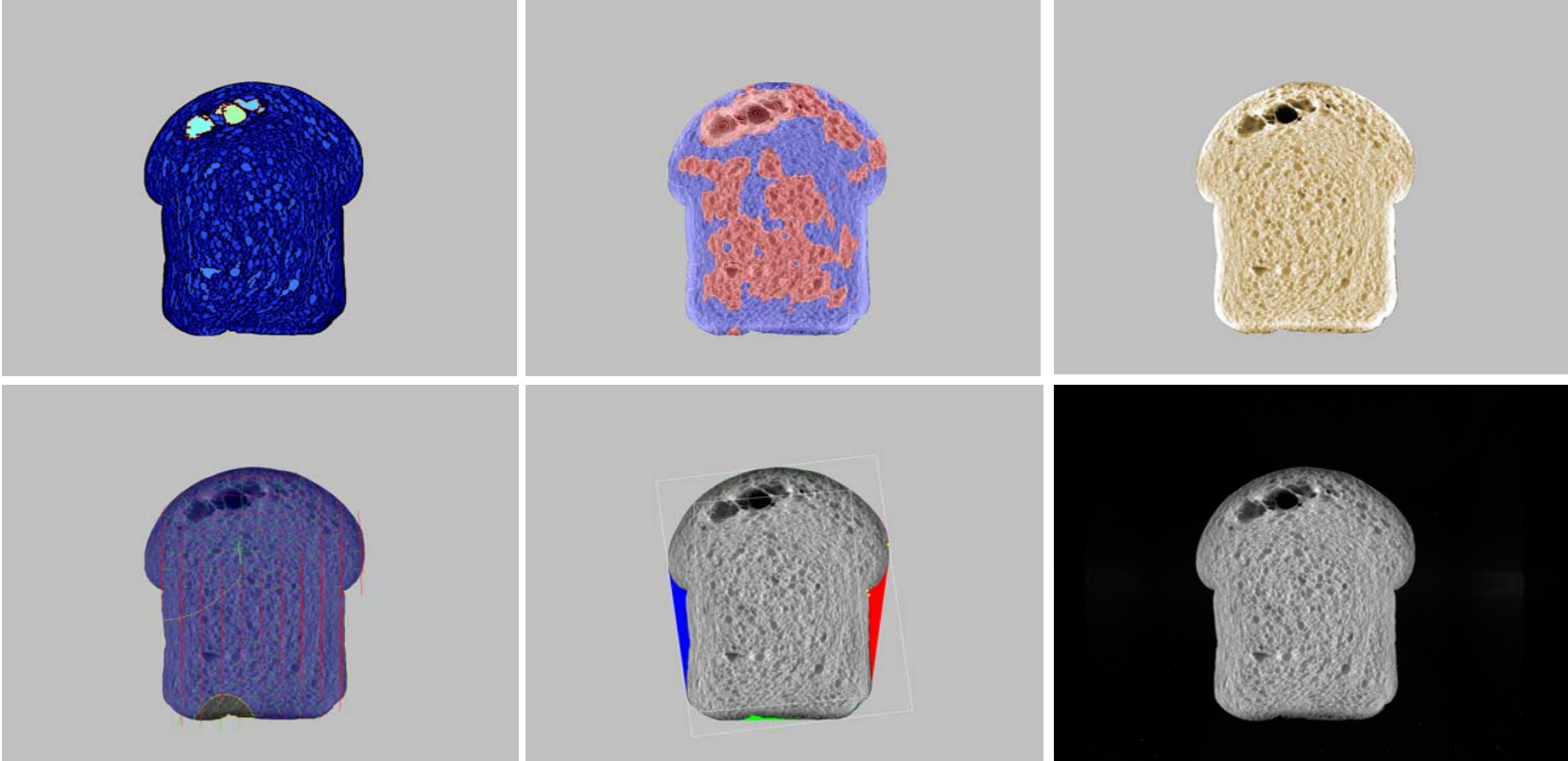


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



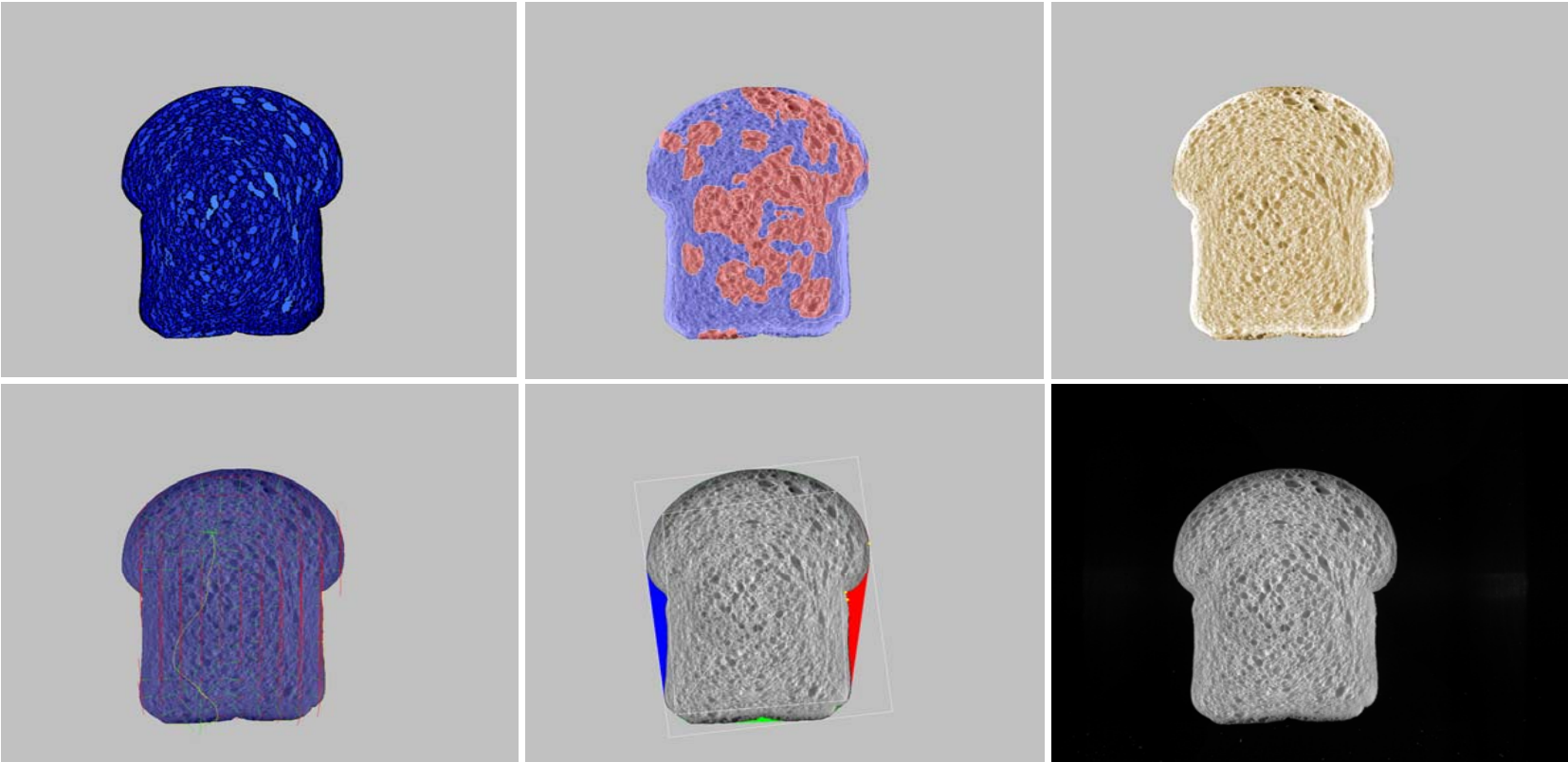


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

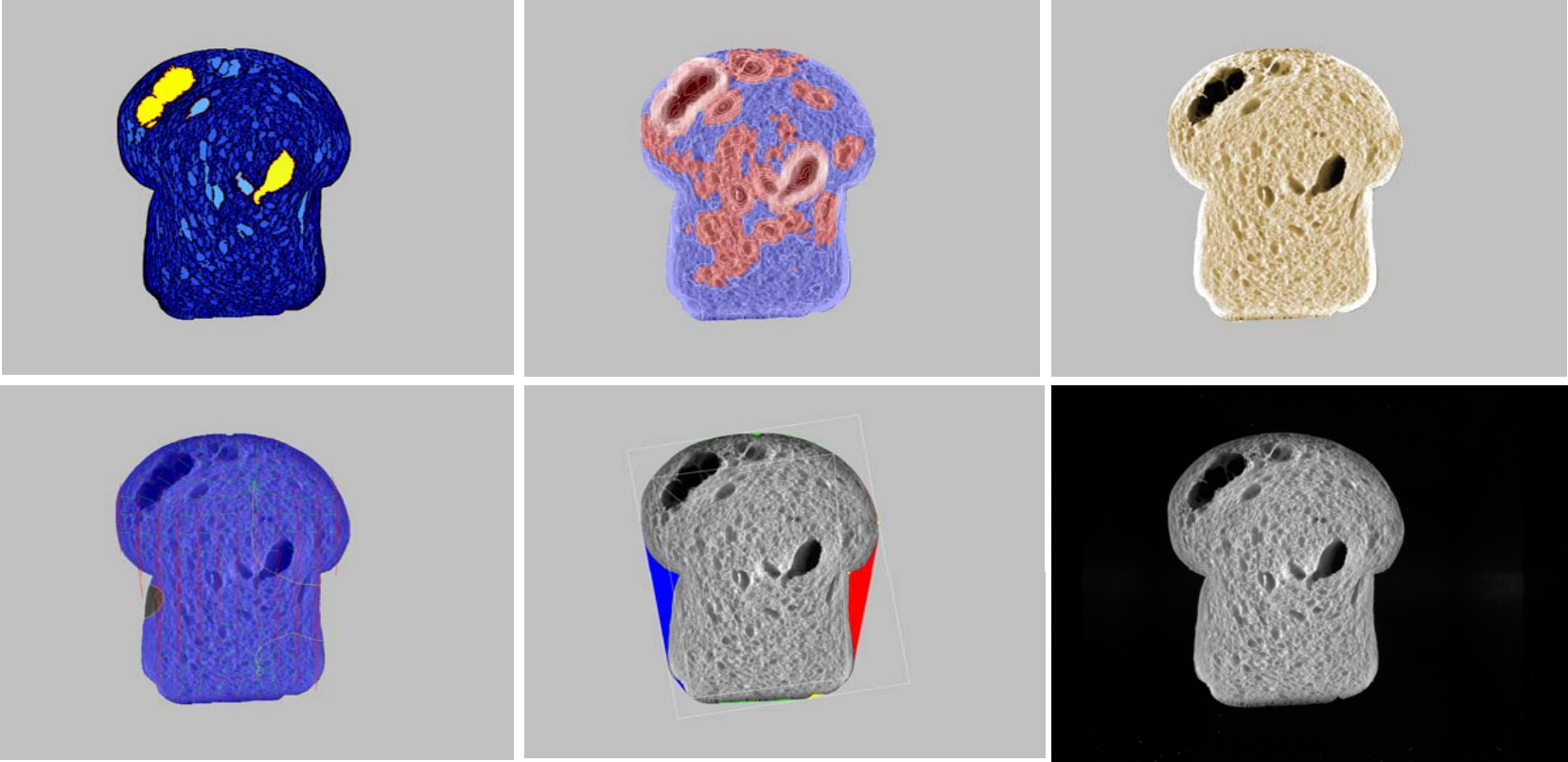


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

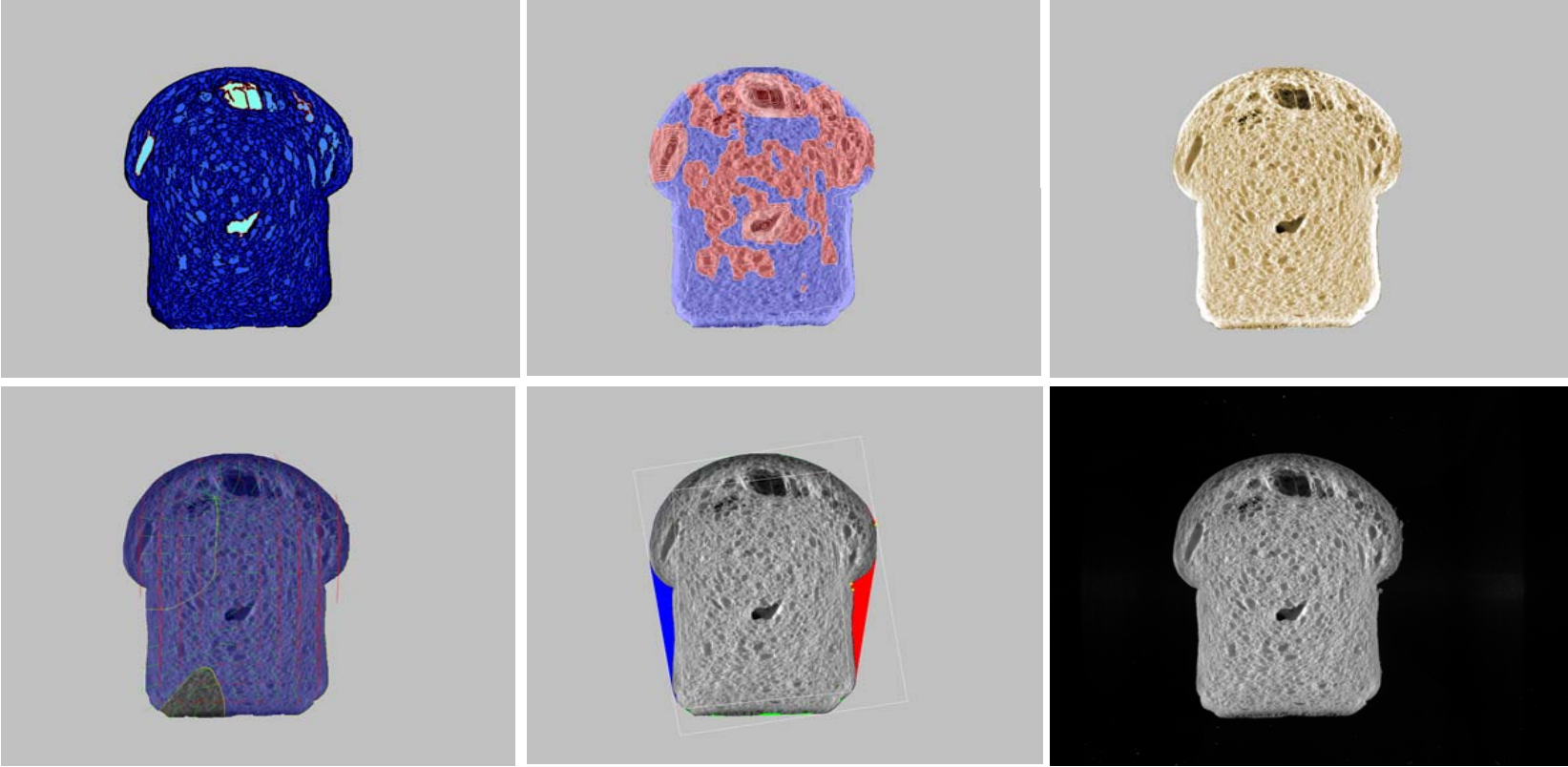




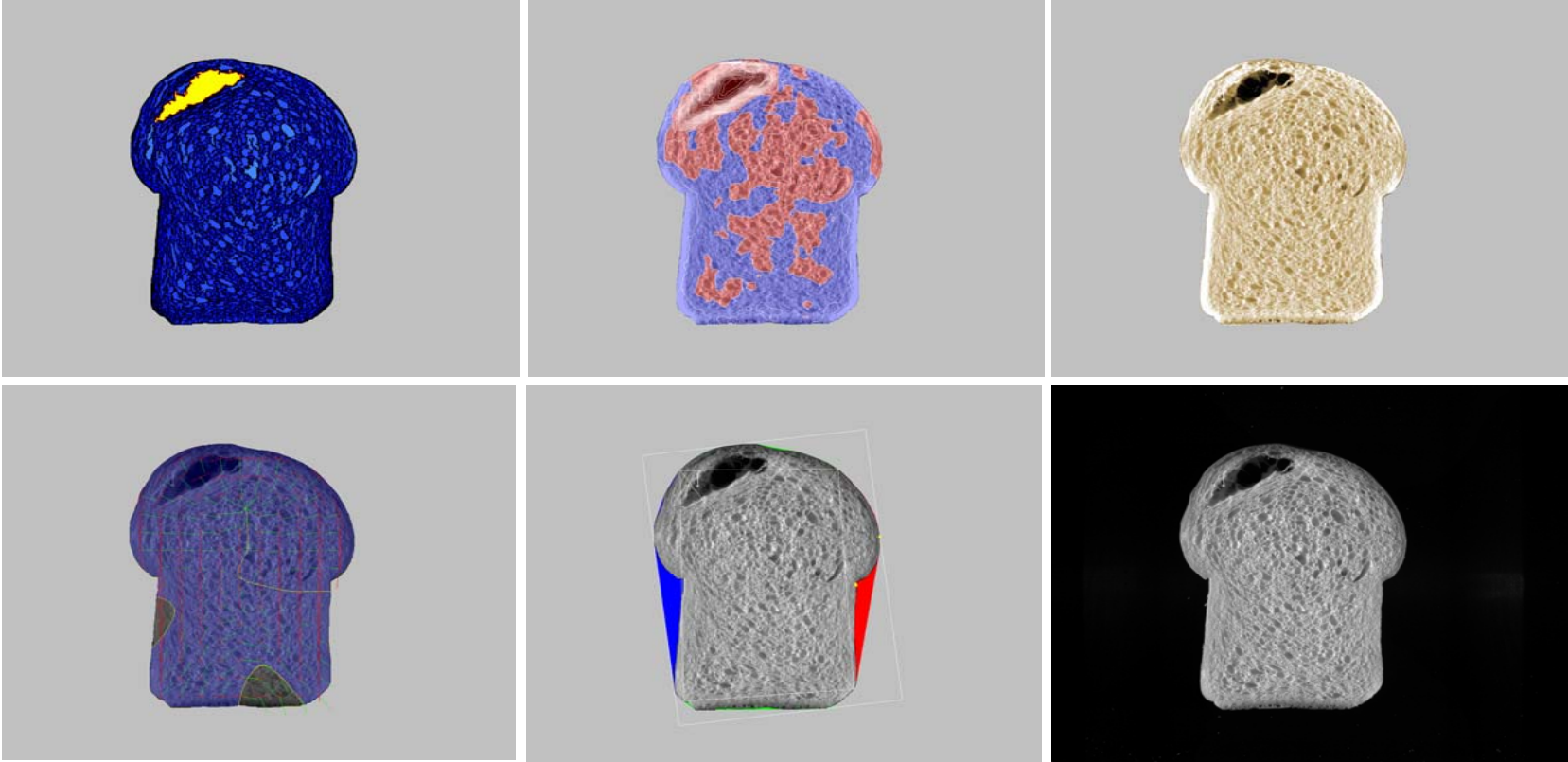
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Bottom Left to Right: Elongation, Shape, Raw Image



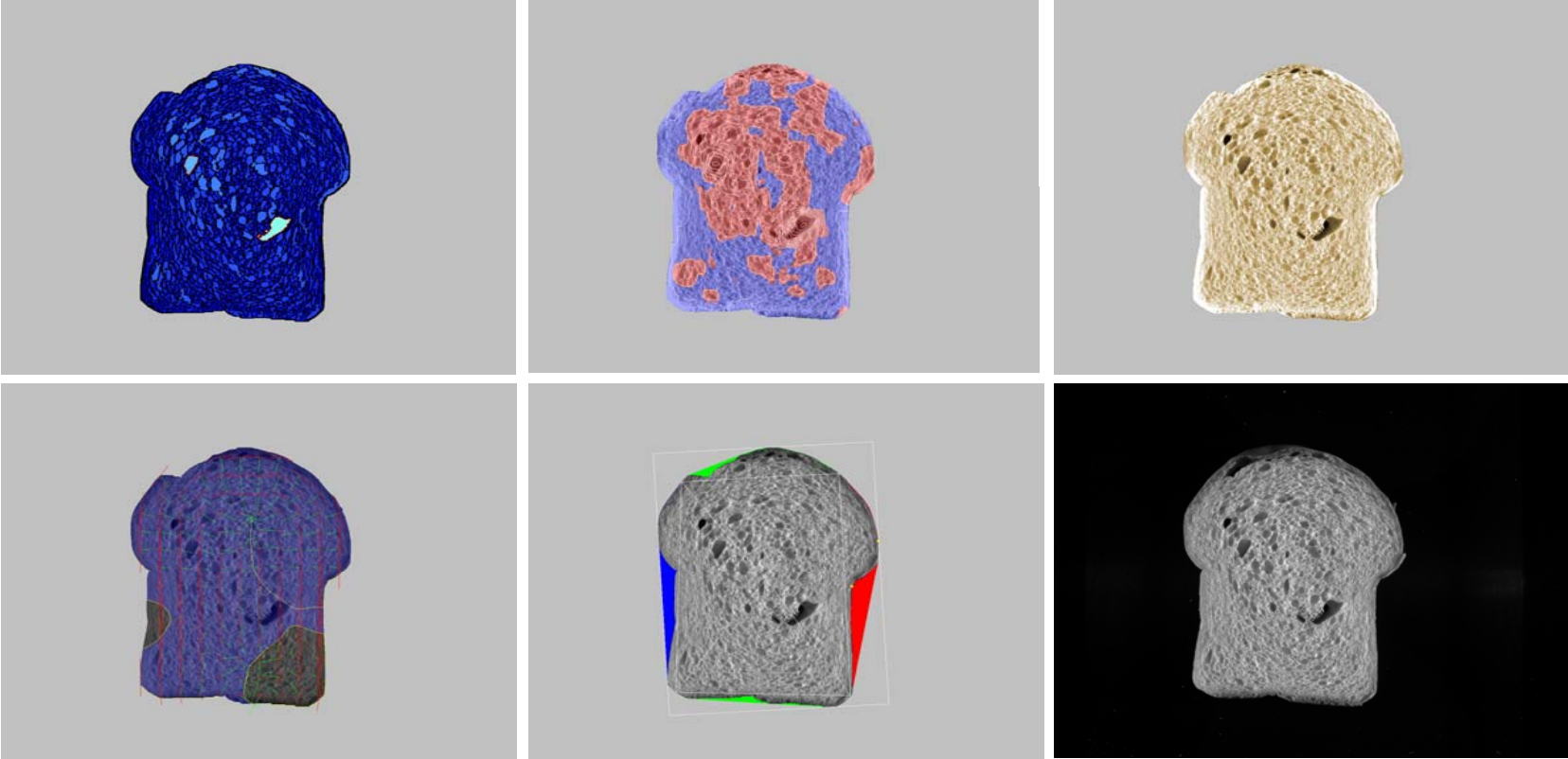
Top Left to Right: Cell, Volume Contours, Brightness Correction  
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Top Left to Right: Cell, Volume Contours, Brightness Correction  
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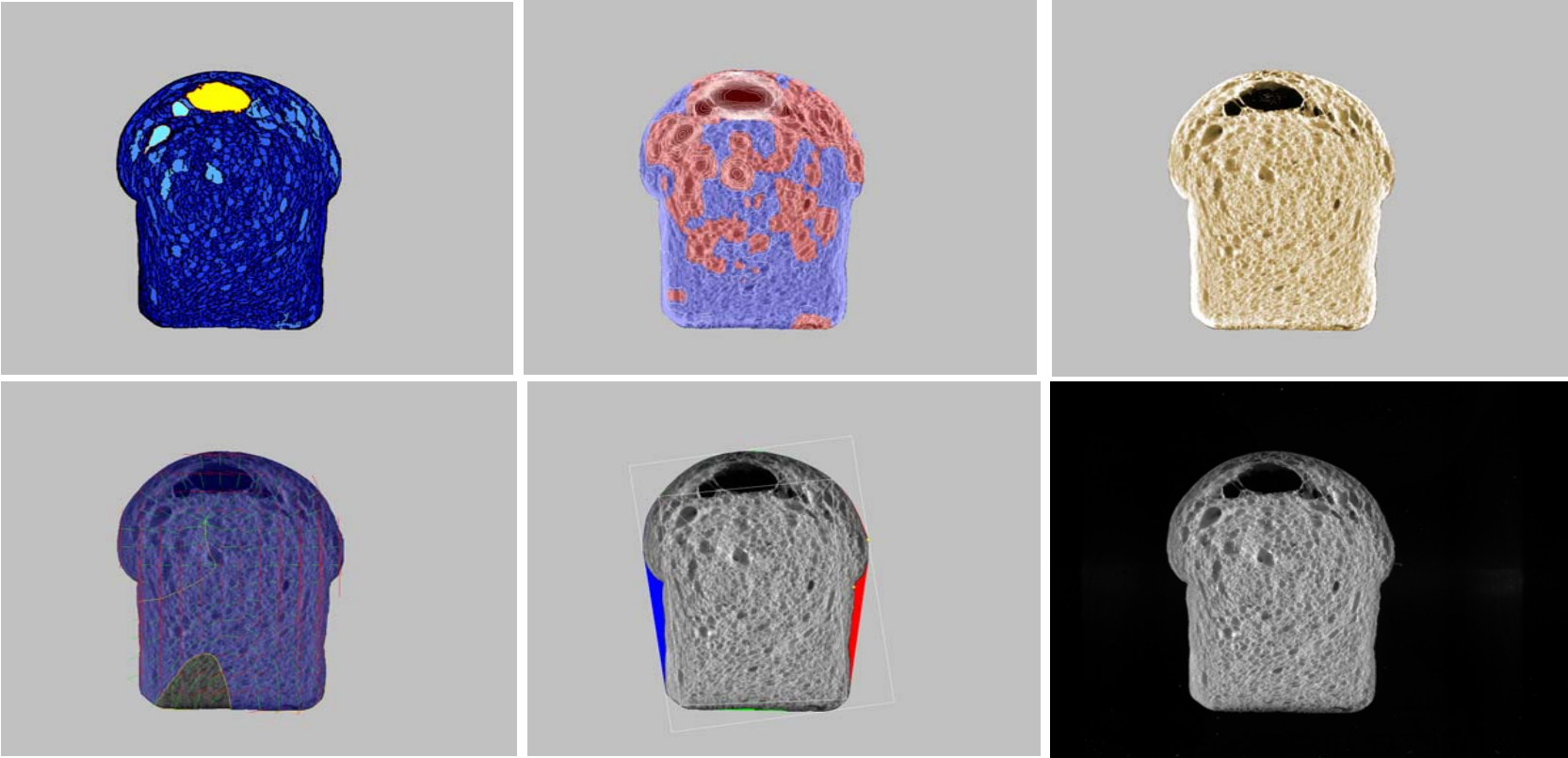


Top Left to Right: Cell, Volume Contours, Brightness Correction  
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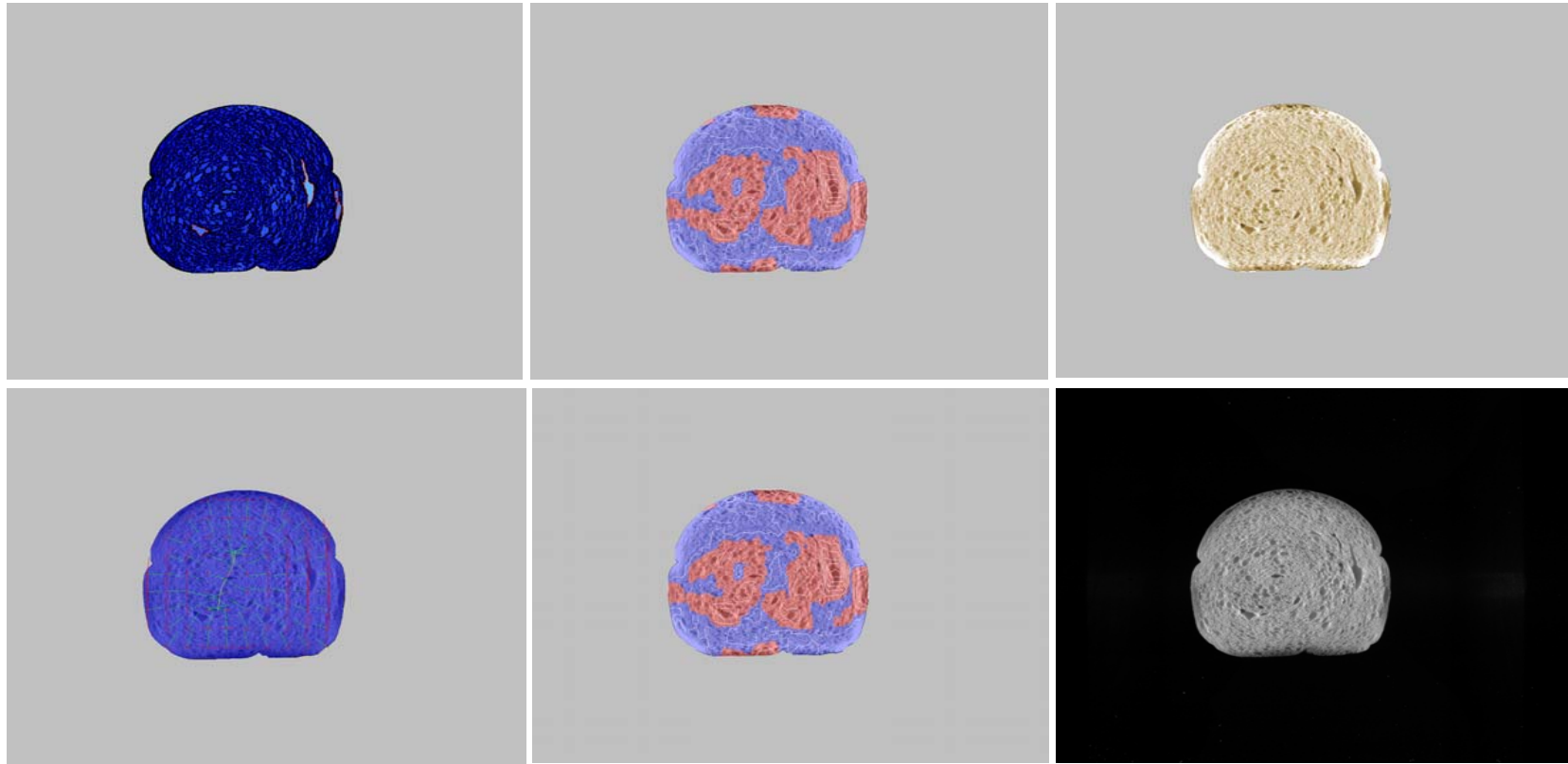


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



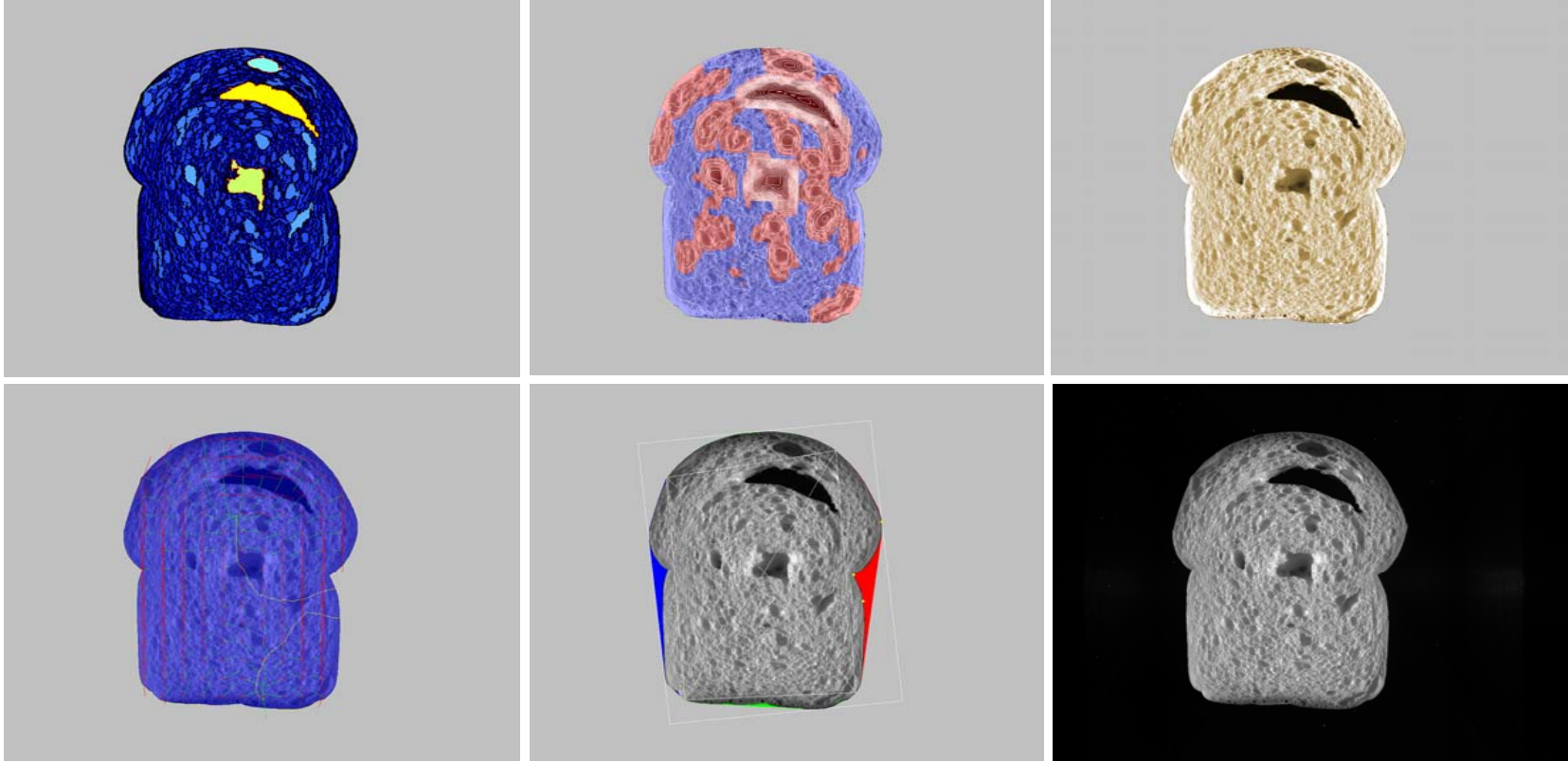


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



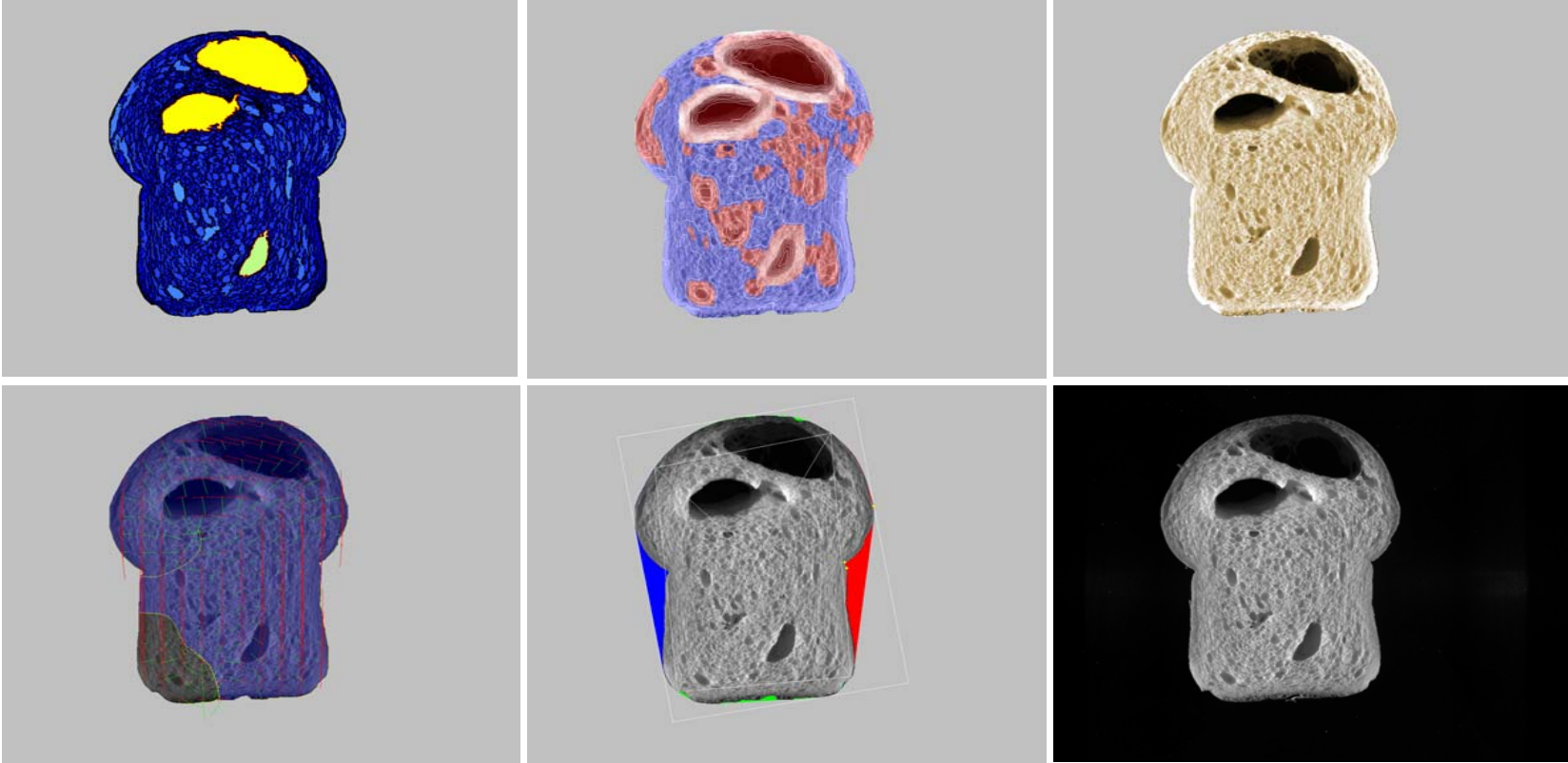
Top Left to Right: Cell, Volume Contours, Brightness Correction

Bottom Left to Right: Elongation, Shape, Raw Image

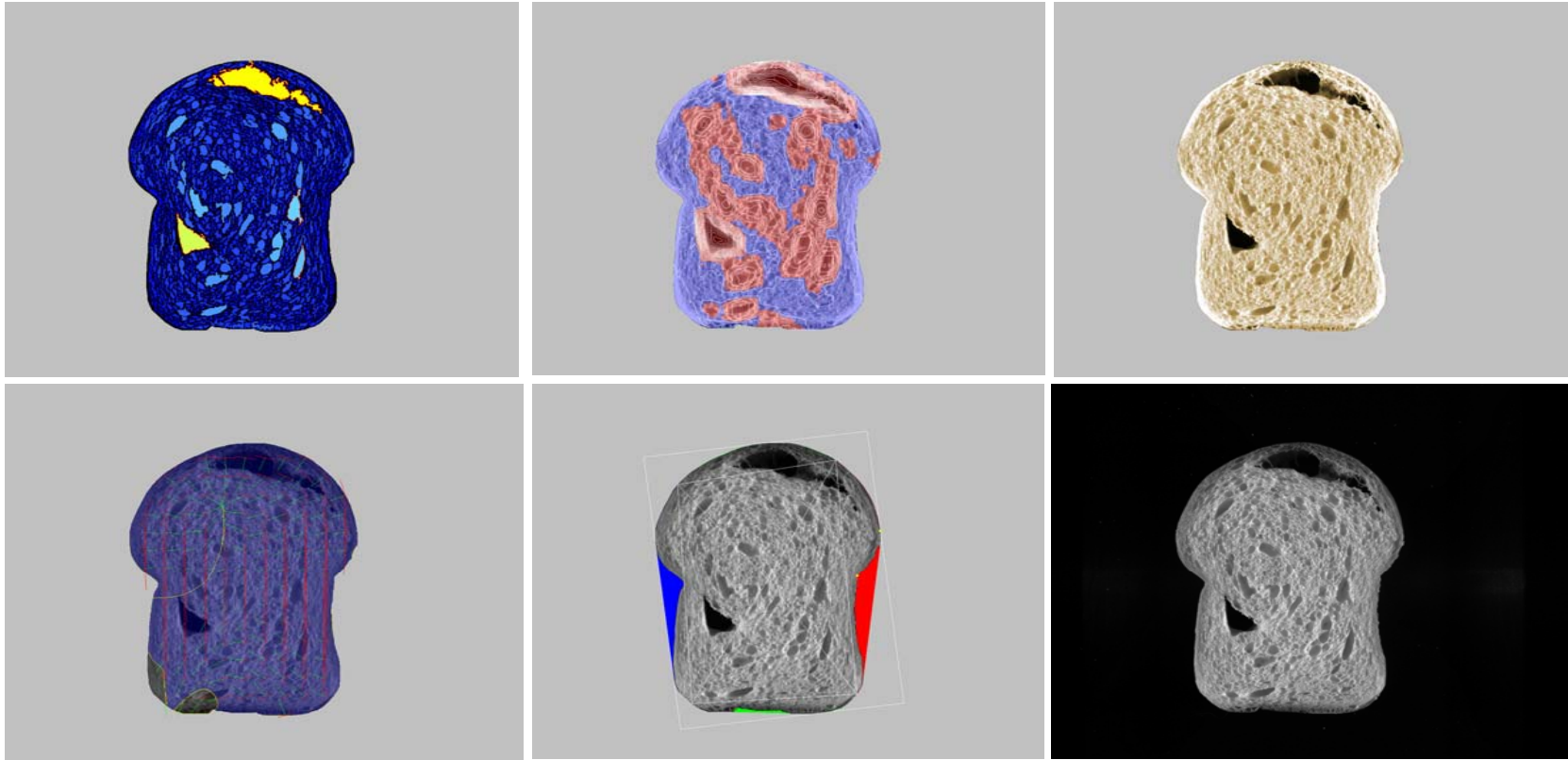


Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image





Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image



Top Left to Right: Cell, Volume Contours, Brightness Correction  
Bottom Left to Right: Elongation, Shape, Raw Image

B8		2007 Hard Spring Wheat Crop				2006 Hard Spring Wheat Crop			
Brookings		Bake	Loaf	Mixing	Dough	Bake	Loaf	Mixing	Dough
Cooperator	Bake Method	Absorption	Volume	Requirement	Characteristic	Absorption	Volume	Requirement	Characteristic
1	Sponge/Dough	58.0	2850	5	5	61.0	2850	3	3
2	Straight Dough -lb	60.7	2700	2	3	64.3	3050	3	2
3	Sponge/Dough	61.0	887	2	4	64.0	993	5	5
4	Sponge/Dough	63.0	3104	5	5	66.0	3015	5	5
5	Straight Dough	64.8	2925	2	3	69.7	2900	4	3
6	Straight Dough	62.0	2450	2	3	66.0	2800	4	3
7	Straight Dough	61.3	870	4	4	65.3	1070	4	5
8	Straight Dough	65.5	778	4	3	70.7	895	5	5
9	Straight Dough	65.8	725	3	5	67.9	800	3	3
<b>Average</b>		<b>62.5</b>		<b>3.2</b>	<b>3.9</b>	<b>66.2</b>		<b>3.9</b>	<b>3.7</b>
<b>± 1 Std Dev from Mean</b>		<b>2.6</b>		<b>1.3</b>	<b>0.9</b>	<b>2.8</b>		<b>0.9</b>	<b>1.2</b>
C8		2007 Hard Spring Wheat Crop				2006 Hard Spring Wheat Crop			
Casselton		Bake	Loaf	Mixing	Dough	Bake	Loaf	Mixing	Dough
Cooperator	Bake Method	Absorption	Volume	Requirement	Characteristic	Absorption	Volume	Requirement	Characteristic
1	Sponge/Dough	62.0	2975	5	5	61.0	2700	4	5
2	Straight Dough -lb	62.9	3400	3	2	63.6	2950	4	3
3	Sponge/Dough	64.0	998	4	4	64.0	993	4	4
4	Sponge/Dough	63.0	2986	5	5	66.0	2986	5	4
5	Straight Dough	66.0	3075	3	3	67.6	2950	3	3
6	Straight Dough	64.0	2850	3	3	64.0	2800	4	4
7	Straight Dough	62.5	1005	4	4	64.1	1060	3	5
8	Straight Dough	67.2	918	5	3	69.9	878	4	5
9	Straight Dough	66.7	800	3	4	66.6	845	3	3
<b>Average</b>		<b>64.3</b>		<b>3.9</b>	<b>3.7</b>	<b>65.2</b>		<b>3.7</b>	<b>3.9</b>
<b>± 1 Std Dev from Mean</b>		<b>1.9</b>		<b>0.9</b>	<b>1.0</b>	<b>2.5</b>		<b>0.7</b>	<b>0.9</b>
K8		2007 Hard Spring Wheat Crop				2006 Hard Spring Wheat Crop			
Crookston		Bake	Loaf	Mixing	Dough	Bake	Loaf	Mixing	Dough
Cooperator	Bake Method	Absorption	Volume	Requirement	Characteristic	Absorption	Volume	Requirement	Characteristic
1	Sponge/Dough	61.0	3000	5	5	60.0	2700	3	3
2	Straight Dough -lb	64.3	3350	3	3	65.0	3200	4	3
3	Sponge/Dough	62.0	923	3	4	63.0	918	5	5
4	Sponge/Dough	66.0	2986	5	5	66.0	3045	5	5
5	Straight Dough	68.1	3300	3	4	69.0	3050	3	3
6	Straight Dough	64.0	2450	4	4	64.0	2700	3	4
7	Straight Dough	64.6	1045	3	4	65.5	980	4	5
8	Straight Dough	69.8	983	4	5	66.8	810	5	4
9	Straight Dough	68.0	880	3	4	66.7	775	3	3
<b>Average</b>		<b>65.3</b>		<b>3.7</b>	<b>4.2</b>	<b>65.3</b>		<b>3.8</b>	<b>3.8</b>
<b>± 1 Std Dev from Mean</b>		<b>2.9</b>		<b>0.9</b>	<b>0.7</b>	<b>2.5</b>		<b>0.9</b>	<b>0.9</b>
M8		2007 Hard Spring Wheat Crop				2006 Hard Spring Wheat Crop			
Minot		Bake	Loaf	Mixing	Dough	Bake	Loaf	Mixing	Dough
Cooperator	Bake Method	Absorption	Volume	Requirement	Characteristic	Absorption	Volume	Requirement	Characteristic
1	Sponge/Dough	64.0	2875	5	5	62.0	2800	4	5
2	Straight Dough -lb	60.7	3050	4	3	65.7	3000	4	2
3	Sponge/Dough	64.0	930	3	4	64.0	988	5	4
4	Sponge/Dough	61.0	3015	5	5	66.0	3074	5	5
5	Straight Dough	65.0	3275	2	4	68.7	2900	3	3
6	Straight Dough	63.0	2600	4	4	65.0	2700	3	3
7	Straight Dough	61.5	1050	3	3	66.1	1250	3	3
8	Straight Dough	65.5	1098	4	4	71.8	1043	4	4
9	Straight Dough	64.0	780	3	4	67.0	960	3	3
<b>Average</b>		<b>63.2</b>		<b>3.7</b>	<b>4.0</b>	<b>66.5</b>		<b>3.7</b>	<b>3.5</b>
<b>± 1 Std Dev from Mean</b>		<b>1.7</b>		<b>1.0</b>	<b>0.7</b>	<b>2.7</b>		<b>0.8</b>	<b>1.0</b>
W8		2007 Hard Spring Wheat Crop				2006 Hard Spring Wheat Crop			
Williston		Bake	Loaf	Mixing	Dough	Bake	Loaf	Mixing	Dough
Cooperator	Bake Method	Absorption	Volume	Requirement	Characteristic	Absorption	Volume	Requirement	Characteristic
1	Sponge/Dough	65.0	2925	5	5				
2	Straight Dough -lb	65.2	3400	3	3				
3	Sponge/Dough	64.0	1008	4	4				
4	Sponge/Dough	65.0	3045	5	5				
5	Straight Dough	67.2	3200	4	3				
6	Straight Dough	65.0	2600	5	5				
7	Straight Dough	63.7	1150	3	3				
8	Straight Dough	70.0	1073	4	3				
9	Straight Dough	65.6	890	3	4				
<b>Average</b>		<b>65.6</b>		<b>4.0</b>	<b>3.9</b>				
<b>± 1 Std Dev from Mean</b>		<b>1.9</b>		<b>0.9</b>	<b>0.9</b>				

Crookston - K1		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check					
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking
1	Sponge/Dough	58.0	3000	100.0	4	4	3	4	3	2	2	3	2
2	Straight Dough -lb	55.7	2950	88.1	3	2	3	4	4	1	1	2	2
3	Sponge/Dough	64.0	968	104.9	3	3	3	2	3	1	1	3	2
4	Sponge/Dough	59.0	3045	102.0	5	5	3	2	3	1	3	2	2
5	Straight Dough	59.4	3225	97.7	1	1	4	1	5	1	2	2	2
6	Straight Dough	58.0	2550	104.1	3	3	2	3	3	1	5	2	2
7	Straight Dough	55.9	995	95.2	3	2	2	2	2	1	1	1	1
8	Straight Dough	63.1	918	93.4	4	2	2	2	5	2	2	5	4
9	Straight Dough	59.7	665	75.6	3	3	3	1	2	1	2	1	1
<b>Average</b>		<b>59.2</b>		<b>95.7</b>	<b>3.2</b>	<b>2.8</b>	<b>2.8</b>	<b>2.3</b>	<b>3.3</b>	<b>1.2</b>	<b>2.1</b>	<b>2.3</b>	<b>2.0</b>
<b>± 1 Std Dev from Mean</b>		<b>2.8</b>		<b>9.3</b>	<b>1.1</b>	<b>1.2</b>	<b>0.7</b>	<b>1.1</b>	<b>1.1</b>	<b>0.4</b>	<b>1.3</b>	<b>1.2</b>	<b>0.9</b>

Minot - M1		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check					
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking
1	Sponge/Dough	63.0	2825	98.3	5	5	3	3	3	3	3	3	3
2	Straight Dough -lb	59.3	3000	98.4	4	3	3	3	3	2	2	3	3
3	Sponge/Dough	64.0	902	97.0	4	4	3	3	2	3	4	3	3
4	Sponge/Dough	61.0	2986	99.0	5	5	3	4	4	2	2	4	3
5	Straight Dough	63.6	3250	99.2	2	4	3	2	3	3	3	3	3
6	Straight Dough	61.0	2750	105.8	4	4	3	3	3	3	1	4	3
7	Straight Dough	60.1	1135	108.1	3	3	3	3	3	3	2	3	3
8	Straight Dough	68.7	1058	96.4	4	3	2	2	3	2	4	4	3
9	Straight Dough	63.3	870	111.5	3	4	3	4	3	3	3	4	3
<b>Average</b>		<b>62.7</b>		<b>101.5</b>	<b>3.8</b>	<b>3.9</b>	<b>2.9</b>	<b>3.0</b>	<b>3.0</b>	<b>2.7</b>	<b>2.7</b>	<b>3.4</b>	<b>3.0</b>
<b>± 1 Std Dev from Mean</b>		<b>2.8</b>		<b>5.5</b>	<b>1.0</b>	<b>0.8</b>	<b>0.3</b>	<b>0.7</b>	<b>0.5</b>	<b>0.5</b>	<b>1.0</b>	<b>0.5</b>	<b>0.0</b>

		Factors Compared to Glenn Check											
Casselton - C2	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &				
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	61.0	3000	100.8	5	5	3	2	2	2	3	3	3
2	Straight Dough -lb	59.3	3100	91.2	3	3	2	3	3	1	4	2	2
3	Sponge/Dough	64.0	953	95.5	3	4	2	3	4	2	3	2	2
4	Sponge/Dough	61.0	3162	105.9	5	5	3	1	2	2	3	2	2
5	Straight Dough	62.9	3100	100.8	3	1	3	3	5	3	2	2	2
6	Straight Dough	60.0	2700	94.7	3	3	3	3	3	2	3	3	3
7	Straight Dough	59.4	1005	100.0	3	4	3	2	3	2	4	2	2
8	Straight Dough	64.3	888	96.7	4	4	2	4	5	2	2	5	4
9	Straight Dough	62.4	775	96.9	3	4	3	2	2	3	3	3	3
<b>Average</b>		<b>61.6</b>		<b>98.1</b>	<b>3.6</b>	<b>3.7</b>	<b>2.7</b>	<b>2.6</b>	<b>3.2</b>	<b>2.1</b>	<b>3.0</b>	<b>2.7</b>	<b>2.6</b>
<b>± 1 Std Dev from Mean</b>		<b>1.9</b>		<b>4.3</b>	<b>0.9</b>	<b>1.2</b>	<b>0.5</b>	<b>0.9</b>	<b>1.2</b>	<b>0.6</b>	<b>0.7</b>	<b>1.0</b>	<b>0.7</b>

		Factors Compared to Glenn Check											
Crookston - K2	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &				
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	61.0	3100	103.3	5	5	3	4	3	3	4	3	3
2	Straight Dough -lb	63.6	3150	94.0	3	3	3	4	3	3	5	4	4
3	Sponge/Dough	63.0	932	101.0	3	4	3	3	3	3	4	3	3
4	Sponge/Dough	65.0	3045	102.0	5	5	3	2	3	3	4	3	4
5	Straight Dough	67.5	3075	93.2	1	1	4	3	5	3	4	2	2
6	Straight Dough	64.0	2550	104.1	2	2	1	3	3	3	5	1	1
7	Straight Dough	64.0	995	95.2	2	3	2	2	3	2	3	2	2
8	Straight Dough	66.4	960	97.7	3	3	2	2	4	3	3	4	4
9	Straight Dough	66.3	835	94.9	3	4	2	2	3	3	3	3	3
<b>Average</b>		<b>64.5</b>		<b>98.4</b>	<b>3.0</b>	<b>3.3</b>	<b>2.6</b>	<b>2.8</b>	<b>3.3</b>	<b>2.9</b>	<b>3.9</b>	<b>2.8</b>	<b>2.9</b>
<b>± 1 Std Dev from Mean</b>		<b>2.0</b>		<b>4.3</b>	<b>1.3</b>	<b>1.3</b>	<b>0.9</b>	<b>0.8</b>	<b>0.7</b>	<b>0.3</b>	<b>0.8</b>	<b>1.0</b>	<b>1.1</b>

Casselton - C3		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
Cooperator														
1	Sponge/Dough	61.0	3000	100.8	5	4	3	3	3	3	2	3	3	3
2	Straight Dough -lb	58.6	3050	89.7	3	3	3	2	3	3	2	1	1	1
3	Sponge/Dough	64.0	953	95.5	3	4	2	3	3	3	2	2	2	2
4	Sponge/Dough	61.0	3045	102.0	5	5	2	2	2	3	3	2	2	2
5	Straight Dough	62.3	3125	101.6	3	4	4	4	5	2	2	2	2	2
6	Straight Dough	60.0	2900	101.8	3	2	2	2	2	3	2	2	2	2
7	Straight Dough	58.8	1040	103.5	3	4	3	2	3	3	1	2	2	2
8	Straight Dough	64.7	943	102.7	5	4	2	3	5	2	2	5	4	4
9	Straight Dough	62.3	750	93.8	3	4	3	2	3	3	2	3	3	3
<b>Average</b>		<b>61.4</b>		<b>99.0</b>	<b>3.7</b>	<b>3.8</b>	<b>2.7</b>	<b>2.6</b>	<b>3.2</b>	<b>2.8</b>	<b>2.0</b>	<b>2.4</b>	<b>2.3</b>	
<b>± 1 Std Dev from Mean</b>		<b>2.1</b>		<b>4.8</b>	<b>1.0</b>	<b>0.8</b>	<b>0.7</b>	<b>0.7</b>	<b>1.1</b>	<b>0.4</b>	<b>0.5</b>	<b>1.1</b>	<b>0.9</b>	

Minot - M3		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
Cooperator														
1	Sponge/Dough	64.0	2800	97.4	5	5	3	2	3	3	3	3	3	2
2	Straight Dough -lb	60.0	2700	88.5	3	2	3	2	3	3	2	2	2	2
3	Sponge/Dough	64.0	885	95.2	3	4	2	2	3	3	3	2	2	2
4	Sponge/Dough	61.0	3045	101.0	5	5	3	3	4	3	3	4	4	4
5	Straight Dough	64.0	2800	85.5	1	1	4	3	5	3	3	1	1	1
6	Straight Dough	61.0	2550	98.1	1	2	1	2	2	3	2	2	1	1
7	Straight Dough	60.5	1035	98.6	3	2	2	3	3	3	2	2	2	2
8	Straight Dough	67.4	1025	93.4	4	4	2	2	3	4	3	3	3	3
9	Straight Dough	62.6	875	112.2	3	4	2	3	3	3	3	4	3	3
<b>Average</b>		<b>62.7</b>		<b>96.6</b>	<b>3.1</b>	<b>3.2</b>	<b>2.4</b>	<b>2.4</b>	<b>3.2</b>	<b>3.1</b>	<b>2.7</b>	<b>2.6</b>	<b>2.2</b>	
<b>± 1 Std Dev from Mean</b>		<b>2.4</b>		<b>7.7</b>	<b>1.5</b>	<b>1.5</b>	<b>0.9</b>	<b>0.5</b>	<b>0.8</b>	<b>0.3</b>	<b>0.5</b>	<b>1.0</b>	<b>1.0</b>	

Williston - W3		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
Cooperator														
1	Sponge/Dough	66.0	2925	100.0	5	5	3	3	3	3	3	3	3	3
2	Straight Dough -lb	62.9	3450	101.5	3	3	3	3	3	5	1	3	3	3
3	Sponge/Dough	64.0	923	91.6	3	4	2	2	3	3	1	2	2	2
4	Sponge/Dough	65.0	3074	101.0	5	5	3	2	3	4	2	3	2	2
5	Straight Dough	66.9	3175	99.2	3	4	3	3	1	4	4	3	3	3
6	Straight Dough	65.0	2600	100.0	5	5	3	3	3	4	5	3	3	3
7	Straight Dough	63.4	1160	100.9	3	3	3	1	3	5	2	2	2	2
8	Straight Dough	68.7	1075	100.2	3	3	2	4	4	4	2	4	4	4
9	Straight Dough	65.0	900	101.1	3	4	3	2	2	4	2	3	2	2
<b>Average</b>		<b>65.2</b>		<b>99.5</b>	<b>3.7</b>	<b>4.0</b>	<b>2.8</b>	<b>2.6</b>	<b>2.8</b>	<b>4.0</b>	<b>2.4</b>	<b>2.9</b>	<b>2.7</b>	
<b>± 1 Std Dev from Mean</b>		<b>1.8</b>		<b>3.1</b>	<b>1.0</b>	<b>0.9</b>	<b>0.4</b>	<b>0.9</b>	<b>0.8</b>	<b>0.7</b>	<b>1.3</b>	<b>0.6</b>	<b>0.7</b>	

Brookings - B4		Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check					Overall
									Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	
1	Sponge/Dough		56.0	2700	95.0	2	2	1	2	3	2	3	2	2
2	Straight Dough -lb		59.2	2650	98.1	2	4	3	3	3	1	2	2	2
3	Sponge/Dough		60.0	795	89.6	1	2	2	3	2	2	2	2	2
4	Sponge/Dough		60.0	2927	94.3	2	3	1	1	4	2	3	2	2
5	Straight Dough		61.2	2500	85.5	2	4	3	3	2	1	2	1	2
6	Straight Dough		60.0	2600	106.1	2	3	4	3	3	1	2	3	4
7	Straight Dough		57.7	845	97.1	3	3	4	2	2	1	2	2	1
8	Straight Dough		63.0	773	99.4	3	3	2	4	4	2	2	4	4
9	Straight Dough		62.0	650	89.7	3	3	3	3	2	2	2	2	2
<b>Average</b>			<b>59.9</b>		<b>95.0</b>	<b>2.2</b>	<b>3.0</b>	<b>2.6</b>	<b>2.7</b>	<b>2.8</b>	<b>1.6</b>	<b>2.2</b>	<b>2.2</b>	<b>2.3</b>
<b>± 1 Std Dev from Mean</b>			<b>2.1</b>		<b>6.2</b>	<b>0.7</b>	<b>0.7</b>	<b>1.1</b>	<b>0.9</b>	<b>0.8</b>	<b>0.5</b>	<b>0.4</b>	<b>0.8</b>	<b>1.0</b>

Casselton - C4		Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check					Overall
									Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	
1	Sponge/Dough		61.0	2900	97.5	3	3	2	3	3	2	2	3	3
2	Straight Dough -lb		59.3	3050	89.7	3	3	3	3	3	2	2	2	2
3	Sponge/Dough		64.0	972	97.4	3	3	3	3	4	2	3	3	3
4	Sponge/Dough		61.0	3045	102.0	4	4	1	2	1	2	3	1	1
5	Straight Dough		62.8	3025	98.4	3	3	3	3	4	2	2	2	2
6	Straight Dough		60.0	2750	96.5	3	3	3	3	3	2	3	3	3
7	Straight Dough		59.3	965	96.0	3	4	3	2	2	2	3	2	2
8	Straight Dough		65.3	920.0	100.2	4	2	2	4	5	2	2	5	4
9	Straight Dough		62.8	825	103.1	3	4	3	3	2	3	2	3	2
<b>Average</b>			<b>61.7</b>		<b>97.9</b>	<b>3.2</b>	<b>3.2</b>	<b>2.6</b>	<b>2.9</b>	<b>3.0</b>	<b>2.1</b>	<b>2.4</b>	<b>2.7</b>	<b>2.4</b>
<b>± 1 Std Dev from Mean</b>			<b>2.1</b>		<b>3.9</b>	<b>0.4</b>	<b>0.7</b>	<b>0.7</b>	<b>0.6</b>	<b>1.2</b>	<b>0.3</b>	<b>0.5</b>	<b>1.1</b>	<b>0.9</b>

Crookston - K5		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check					
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking
1	Sponge/Dough	59.0	3100	103.3	5	5	3	4	2	2	3	3	3
2	Straight Dough -lb	57.9	3050	91.0	3	3	3	4	3	1	3	2	2
3	Sponge/Dough	64.0	1022	110.7	4	4	4	5	4	1	2	4	3
4	Sponge/Dough	60.0	3104	104.0	5	5	3	4	2	1	4	2	2
5	Straight Dough	61.8	3375	102.3	3	1	4	4	1	2	3	3	3
6	Straight Dough	59.0	2850	116.3	4	4	3	3	3	1	4	3	3
7	Straight Dough	58.3	930	89.0	3	3	2	4	2	1	2	2	2
8	Straight Dough	64.4	943	95.9	4	3	2	5	4	2	2	4	4
9	Straight Dough	62.1	775	88.1	3	4	3	3	2	1	2	2	2
<b>Average</b>		<b>60.7</b>		<b>100.1</b>	<b>3.8</b>	<b>3.6</b>	<b>3.0</b>	<b>4.0</b>	<b>2.6</b>	<b>1.3</b>	<b>2.8</b>	<b>2.8</b>	<b>2.7</b>
<b>± 1 Std Dev from Mean</b>		<b>2.4</b>		<b>9.8</b>	<b>0.8</b>	<b>1.2</b>	<b>0.7</b>	<b>0.7</b>	<b>1.0</b>	<b>0.5</b>	<b>0.8</b>	<b>0.8</b>	<b>0.7</b>

Minot - M5		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check					
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking
1	Sponge/Dough	63.0	2900	100.9	5	5	3	3	2	3	3	3	3
2	Straight Dough -lb	58.6	2850	93.4	3	2	3	4	4	3	3	2	2
3	Sponge/Dough	64.0	955	102.7	2	4	2	3	4	3	2	2	2
4	Sponge/Dough	61.0	3104	103.0	5	5	3	4	4	2	2	4	3
5	Straight Dough	63.0	3150	96.2	2	3	4	3	2	3	3	4	4
6	Straight Dough	61.0	2350	90.4	2	3	2	3	3	3	2	4	3
7	Straight Dough	59.5	1150	109.5	3	2	2	4	3	3	2	3	3
8	Straight Dough	67.2	1050	95.6	4	4	3	5	4	2	3	3	4
9	Straight Dough	61.6	875	112.2	3	4	3	4	3	3	3	4	3
<b>Average</b>		<b>62.1</b>		<b>100.4</b>	<b>3.2</b>	<b>3.6</b>	<b>2.8</b>	<b>3.7</b>	<b>3.2</b>	<b>2.8</b>	<b>2.6</b>	<b>3.2</b>	<b>3.0</b>
<b>± 1 Std Dev from Mean</b>		<b>2.6</b>		<b>7.3</b>	<b>1.2</b>	<b>1.1</b>	<b>0.7</b>	<b>0.7</b>	<b>0.8</b>	<b>0.4</b>	<b>0.5</b>	<b>0.8</b>	<b>0.7</b>



		Factors Compared to Glenn Check											
Casselton - C6	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &				
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	62.0	2925	98.3	5	5	3	3	3	3	3	3	3
2	Straight Dough -lb	62.1	3050	89.7	3	3	3	3	4	3	5	3	3
3	Sponge/Dough	64.0	920	92.2	4	4	2	3	3	3	4	2	2
4	Sponge/Dough	63.0	3104	104.0	5	5	2	2	2	4	4	2	2
5	Straight Dough	65.9	3050	99.2	4	4	3	3	4	2	2	2	2
6	Straight Dough	63.0	2550	89.5	3	3	3	2	2	3	2	2	2
7	Straight Dough	62.4	1025	102.0	3	4	4	2	2	3	4	2	3
8	Straight Dough	66.8	928	101.1	4	3	3	4	5	2	4	5	4
9	Straight Dough	65.3	805	100.6	3	4	3	3	3	3	3	3	3
<b>Average</b>		<b>63.8</b>		<b>97.4</b>	<b>3.8</b>	<b>3.9</b>	<b>2.9</b>	<b>2.8</b>	<b>3.1</b>	<b>2.9</b>	<b>3.4</b>	<b>2.7</b>	<b>2.7</b>
<b>± 1 Std Dev from Mean</b>		<b>1.8</b>		<b>5.5</b>	<b>0.8</b>	<b>0.8</b>	<b>0.6</b>	<b>0.7</b>	<b>1.1</b>	<b>0.6</b>	<b>1.0</b>	<b>1.0</b>	<b>0.7</b>

		Factors Compared to Glenn Check											
Minot - M6	Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &				
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	64.0	2900	100.9	5	5	3	4	4	3	3	3	4
2	Straight Dough -lb	60.0	3350	109.8	4	3	3	4	4	3	4	4	4
3	Sponge/Dough	64.0	925	99.5	5	4	4	3	2	3	4	2	3
4	Sponge/Dough	63.0	3074	102.0	5	5	3	4	4	3	3	4	4
5	Straight Dough	65.3	3275	100.0	2	3	4	2	1	3	3	2	3
6	Straight Dough	62.0	2550	98.1	3	3	2	3	3	3	2	4	2
7	Straight Dough	60.8	1105	105.2	3	3	3	3	3	3	3	3	3
8	Straight Dough	67.4	1018	92.7	4	3	2	5	3	5	4	4	3
9	Straight Dough	62.8	900	115.4	3	4	3	4	3	3	3	5	4
<b>Average</b>		<b>63.3</b>		<b>102.6</b>	<b>3.8</b>	<b>3.7</b>	<b>3.0</b>	<b>3.6</b>	<b>3.0</b>	<b>3.2</b>	<b>3.2</b>	<b>3.4</b>	<b>3.3</b>
<b>± 1 Std Dev from Mean</b>		<b>2.3</b>		<b>6.7</b>	<b>1.1</b>	<b>0.9</b>	<b>0.7</b>	<b>0.9</b>	<b>1.0</b>	<b>0.7</b>	<b>0.7</b>	<b>1.0</b>	<b>0.7</b>

Casselton - C7		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
1	Sponge/Dough	63.0	3000	100.8	5	5	3	3	2	4	2	3	2	
2	Straight Dough -lb	58.6	2750	80.9	4	2	3	3	4	5	2	1	1	
3	Sponge/Dough	64.0	918	92.0	5	5	4	3	4	4	3	2	3	
4	Sponge/Dough	61.0	3104	104.0	5	5	3	2	3	5	3	3	3	
5	Straight Dough	62.2	3250	105.7	5	5	1	3	4	2	2	2	1	
6	Straight Dough	60.0	2550	89.5	5	4	4	3	3	5	3	3	3	
7	Straight Dough	58.7	990	98.5	4	5	5	3	3	5	2	2	2	
8	Straight Dough	67.7	923	100.5	5	5	5	4	5	4	2	5	4	
9	Straight Dough	62.5	725	90.6	4	4	4	2	3	4	2	2	2	
<b>Average</b>		<b>62.0</b>		<b>95.8</b>	<b>4.7</b>	<b>4.4</b>	<b>3.6</b>	<b>2.9</b>	<b>3.4</b>	<b>4.2</b>	<b>2.3</b>	<b>2.6</b>	<b>2.3</b>	
<b>± 1 Std Dev from Mean</b>		<b>2.9</b>		<b>8.1</b>	<b>0.5</b>	<b>1.0</b>	<b>1.2</b>	<b>0.6</b>	<b>0.9</b>	<b>1.0</b>	<b>0.5</b>	<b>1.1</b>	<b>1.0</b>	

Williston - W7		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
1	Sponge/Dough	65.0	3025	103.4	5	5	3	3	3	3	3	3	3	
2	Straight Dough -lb	61.4	2900	85.3	5	4	4	2	3	5	2	2	2	
3	Sponge/Dough	64.0	940	93.3	5	5	4	5	4	3	2	3	3	
4	Sponge/Dough	63.0	3104	101.9	5	5	3	4	4	4	2	4	3	
5	Straight Dough	65.1	2925	91.4	3	4	1	3	2	4	4	2	2	
6	Straight Dough	63.0	2850	109.6	5	4	3	2	2	4	5	5	4	
7	Straight Dough	61.6	965	83.9	4	5	3	2	2	4	1	2	1	
8	Straight Dough	67.5	955	89.0	5	4	4	4	4	4	3	4	4	
9	Straight Dough	64.9	550	61.8	4	2	3	2	1	3	3	1	1	
<b>Average</b>		<b>63.9</b>		<b>91.1</b>	<b>4.6</b>	<b>4.2</b>	<b>3.1</b>	<b>3.0</b>	<b>2.8</b>	<b>3.8</b>	<b>2.8</b>	<b>2.9</b>	<b>2.6</b>	
<b>± 1 Std Dev from Mean</b>		<b>1.9</b>		<b>14.0</b>	<b>0.7</b>	<b>1.0</b>	<b>0.9</b>	<b>1.1</b>	<b>1.1</b>	<b>0.7</b>	<b>1.2</b>	<b>1.3</b>	<b>1.1</b>	

Brookings - B9		Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
									Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
1	Sponge/Dough		57.0	2775	97.0	5	5	3	2	3	2	3	3	3	
2	Straight Dough -lb		60.0	2550	94.4	2	3	3	3	3	2	2	1	2	
3	Sponge/Dough		60.0	888	100.1	2	4	3	2	4	3	2	4	3	
4	Sponge/Dough		61.0	3104	100.0	5	5	3	2	3	2	3	3	3	
5	Straight Dough		64.5	2775	94.9	2	4	4	2	2	2	2	2	2	
6	Straight Dough		62.0	2450	100.0	2	3	3	3	3	2	2	3	3	
7	Straight Dough		61.0	880	101.1	4	3	2	2	3	2	2	3	2	
8	Straight Dough		64.5	855	109.9	5	4	3	3	3	2	2	3	3	
9	Straight Dough		65.6	700	96.6	3	5	3	2	3	3	2	3	3	
<b>Average</b>			<b>61.7</b>		<b>99.3</b>	<b>3.3</b>	<b>4.0</b>	<b>3.0</b>	<b>2.3</b>	<b>3.0</b>	<b>2.2</b>	<b>2.2</b>	<b>2.8</b>	<b>2.7</b>	
<b>± 1 Std Dev from Mean</b>			<b>2.7</b>		<b>4.7</b>	<b>1.4</b>	<b>0.9</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>0.4</b>	<b>0.4</b>	<b>0.8</b>	<b>0.5</b>	

Casselton - C9		Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
									Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
1	Sponge/Dough		61.0	2950	99.2	5	5	3	3	2	3	3	3	3	
2	Straight Dough -lb		60.7	3100	91.2	3	3	3	4	4	3	2	4	3	
3	Sponge/Dough		64.0	998	100.0	4	4	3	3	4	3	2	4	4	
4	Sponge/Dough		63.0	3104	104.0	5	5	2	1	2	2	3	2	2	
5	Straight Dough		64.5	3150	102.4	2	4	3	4	5	4	2	2	2	
6	Straight Dough		62.0	2450	86.0	3	3	3	3	3	3	3	3	3	
7	Straight Dough		61.0	1040	103.5	3	3	3	3	2	3	1	3	2	
8	Straight Dough		66.8	943	102.7	5	3	2	4	5	2	2	5	4	
9	Straight Dough		64.7	840	105.0	3	4	3	2	2	3	2	3	2	
<b>Average</b>			<b>63.1</b>		<b>99.3</b>	<b>3.7</b>	<b>3.8</b>	<b>2.8</b>	<b>3.0</b>	<b>3.2</b>	<b>2.9</b>	<b>2.2</b>	<b>3.2</b>	<b>2.8</b>	
<b>± 1 Std Dev from Mean</b>			<b>2.1</b>		<b>6.5</b>	<b>1.1</b>	<b>0.8</b>	<b>0.4</b>	<b>1.0</b>	<b>1.3</b>	<b>0.6</b>	<b>0.7</b>	<b>1.0</b>	<b>0.8</b>	

Crookston - K9		Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
									Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
1	Sponge/Dough		59.0	2800	93.3	5	5	3	4	3	2	3	3	3	
2	Straight Dough -lb		63.6	3100	92.5	2	2	3	3	4	1	3	3	3	
3	Sponge/Dough		62.0	898	97.3	3	5	3	4	3	1	3	3	3	
4	Sponge/Dough		66.0	3045	102.0	5	5	3	1	2	1	3	2	2	
5	Straight Dough		67.9	3000	90.9	1	1	4	3	3	2	3	1	2	
6	Straight Dough		64.0	2650	108.2	1	1	1	3	3	1	3	1	1	
7	Straight Dough		64.4	975	93.3	3	3	1	2	3	1	2	2	1	
8	Straight Dough		66.2	890	90.5	4	3	2	2	4	2	3	4	4	
9	Straight Dough		68.2	850	96.6	3	4	2	2	3	1	3	3	2	
<b>Average</b>			<b>64.6</b>		<b>96.1</b>	<b>3.0</b>	<b>3.2</b>	<b>2.4</b>	<b>2.7</b>	<b>3.1</b>	<b>1.3</b>	<b>2.9</b>	<b>2.4</b>	<b>2.3</b>	
<b>± 1 Std Dev from Mean</b>			<b>2.9</b>		<b>5.8</b>	<b>1.5</b>	<b>1.6</b>	<b>1.0</b>	<b>1.0</b>	<b>0.6</b>	<b>0.5</b>	<b>0.3</b>	<b>1.0</b>	<b>1.0</b>	

Casselton - C10		Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	63.0	3000	100.8	3	3	2	3	3	4	3	3	3
2	Straight Dough -lb	62.9	3550	104.4	3	2	3	2	2	5	3	3	3
3	Sponge/Dough	64.0	1052	105.4	4	4	3	3	3	4	3	4	5
4	Sponge/Dough	65.0	3162	105.9	5	5	2	3	1	5	4	2	2
5	Straight Dough	67.3	3100	100.8	3	4	2	4	5	2	2	2	2
6	Straight Dough	64.0	2950	103.5	3	3	3	3	3	5	3	3	3
7	Straight Dough	63.8	1030	102.5	3	3	4	2	2	5	3	2	2
8	Straight Dough	67.9	1058	115.3	3	4	2	3	5	4	3	5	4
9	Straight Dough	65.3	875	109.4	3	4	3	2	2	4	3	4	4
<b>Average</b>		<b>64.8</b>		<b>105.3</b>	<b>3.3</b>	<b>3.6</b>	<b>2.7</b>	<b>2.8</b>	<b>2.9</b>	<b>4.2</b>	<b>3.0</b>	<b>3.1</b>	<b>3.1</b>
<b>± 1 Std Dev from Mean</b>		<b>1.8</b>		<b>4.6</b>	<b>0.7</b>	<b>0.9</b>	<b>0.7</b>	<b>0.7</b>	<b>1.4</b>	<b>1.0</b>	<b>0.5</b>	<b>1.1</b>	<b>1.1</b>

Minot - M10		Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	64.0	2925	101.7	5	5	3	3	2	3	3	3	3
2	Straight Dough -lb	60.0	3450	113.115	5	2	4	3	3	3	1	4	4
3	Sponge/Dough	64.0	943	101.398	3	4	3	3	4	3	3	3	3
4	Sponge/Dough	61.0	3104	103.0	5	5	3	4	4	3	2	4	3
5	Straight Dough	64.2	3400	103.8	2	3	4	2	1	4	3	3	3
6	Straight Dough	62.0	2650	101.9	4	4	3	3	4	3	2	4	3
7	Straight Dough	60.7	1140	108.6	3	3	3	2	3	3	2	3	3
8	Straight Dough	67.0	1115	101.5	4	5	2	3	3	4	2	2	3
9	Straight Dough	63.1	1005	128.8	3	4	3	3	2	3	3	5	4
<b>Average</b>		<b>62.9</b>		<b>107.1</b>	<b>3.8</b>	<b>3.9</b>	<b>3.1</b>	<b>2.9</b>	<b>2.9</b>	<b>3.2</b>	<b>2.3</b>	<b>3.4</b>	<b>3.2</b>
<b>± 1 Std Dev from Mean</b>		<b>2.2</b>		<b>9.1</b>	<b>1.1</b>	<b>1.1</b>	<b>0.6</b>	<b>0.6</b>	<b>1.1</b>	<b>0.4</b>	<b>0.7</b>	<b>0.9</b>	<b>0.4</b>

Williston - W10		Factors Compared to Glenn Check											
Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	66.0	3050	104.3	5	5	3	3	3	3	3	3	3
2	Straight Dough -lb	65.0	3350	98.5	3	3	3	2	3	5	2	3	3
3	Sponge/Dough	64.0	1010	100.2	3	4	2	4	4	3	3	3	3
4	Sponge/Dough	66.0	3104	101.9	5	5	3	2	2	4	3	3	3
5	Straight Dough	69.0	3225	100.8	4	4	2	3	3	4	4	4	4
6	Straight Dough	66.0	2950	113.5	5	4	3	3	3	4	5	5	4
7	Straight Dough	65.5	1150	100.0	3	4	3	1	2	4	3	2	3
8	Straight Dough	69.1	1103	102.8	3	4	3	4	5	4	3	4	4
9	Straight Dough	67.6	920	103.4	3	4	3	2	1	4	3	3	3
<b>Average</b>		<b>66.5</b>		<b>102.8</b>	<b>3.8</b>	<b>4.1</b>	<b>2.8</b>	<b>2.7</b>	<b>2.9</b>	<b>3.9</b>	<b>3.2</b>	<b>3.3</b>	<b>3.3</b>
<b>± 1 Std Dev from Mean</b>		<b>1.7</b>		<b>4.4</b>	<b>1.0</b>	<b>0.6</b>	<b>0.4</b>	<b>1.0</b>	<b>1.2</b>	<b>0.6</b>	<b>0.8</b>	<b>0.9</b>	<b>0.5</b>

		Factors Compared to Glenn Check											
Casselton - C11		Bake	Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &			
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	62.0	2600	87.4	4	4	2	2	2	3	2	1	1
2	Straight Dough -lb	62.9	3050	89.7	3	2	3	3	4	4	3	3	3
3	Sponge/Dough	64.0	917	91.9	3	4	2	3	4	4	4	1	2
4	Sponge/Dough	65.0	2839	95.1	5	5	1	1	2	4	3	2	2
5	Straight Dough	67.1	2900	94.3	3	1	2	3	5	4	2	2	2
6	Straight Dough	64.0	2550	89.5	4	4	4	3	3	4	3	3	3
7	Straight Dough	63.6	1120	111.4	3	3	4	2	2	3	3	2	2
8	Straight Dough	67.8	918	100.0	4	4	2	3	4	3	3	4	4
9	Straight Dough	66.8	805	100.6	3	4	4	2	3	3	3	3	3
<b>Average</b>		<b>64.8</b>		<b>95.5</b>	<b>3.6</b>	<b>3.4</b>	<b>2.7</b>	<b>2.4</b>	<b>3.2</b>	<b>3.6</b>	<b>2.9</b>	<b>2.3</b>	<b>2.4</b>
<b>± 1 Std Dev from Mean</b>		<b>2.0</b>		<b>7.5</b>	<b>0.7</b>	<b>1.2</b>	<b>1.1</b>	<b>0.7</b>	<b>1.1</b>	<b>0.5</b>	<b>0.6</b>	<b>1.0</b>	<b>0.9</b>

		Factors Compared to Glenn Check											
Minot - 11		Bake	Loaf	LV	Mixing	Dough	Mix	Crumb	Grain &				
Cooperator	Method	Absorption	Volume	% of CK	Requirement	Characteristic	Tolerance	Color	Texture	Protein	Milling	Baking	Overall
1	Sponge/Dough	64.0	2900	100.9	5	5	3	3	3	3	3	3	3
2	Straight Dough -lb	60.7	3300	108.2	3	2	2	3	3	3	2	4	4
3	Sponge/Dough	64.0	923	99.2	3	4	2	3	4	3	3	2	2
4	Sponge/Dough	63.0	3104	103.0	5	5	3	5	4	3	3	4	4
5	Straight Dough	64.8	3350	103.1	2	4	5	3	3	3	3	4	3
6	Straight Dough	63.0	2500	96.2	2	1	1	3	3	3	1	3	1
7	Straight Dough	61.3	1135	108.1	3	4	2	3	3	3	3	2	3
8	Straight Dough	67.1	1090	99.3	4	4	2	3	2	4	3	3	2
9	Straight Dough	63.5	910	116.7	3	4	2	3	3	3	3	5	4
<b>Average</b>		<b>63.5</b>		<b>103.8</b>	<b>3.3</b>	<b>3.7</b>	<b>2.4</b>	<b>3.2</b>	<b>3.1</b>	<b>3.1</b>	<b>2.7</b>	<b>3.3</b>	<b>2.9</b>
<b>± 1 Std Dev from Mean</b>		<b>1.9</b>		<b>6.3</b>	<b>1.1</b>	<b>1.3</b>	<b>1.1</b>	<b>0.7</b>	<b>0.6</b>	<b>0.3</b>	<b>0.7</b>	<b>1.0</b>	<b>1.1</b>

		Factors Compared to Glenn Check												
Casselton - C12	Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix		Crumb		Grain &		Overall
								Tolerance	Color	Texture	Protein	Milling	Baking	
1	Sponge/Dough	62.0	2800	94.1	2	3	1	3	2	3	3	2	2	
2	Straight Dough -lb	64.3	3350	98.5	3	2	3	4	4	4	3	4	3	
3	Sponge/Dough	64.0	1013	101.5	4	4	3	3	4	4	4	3	3	
4	Sponge/Dough	66.0	3074	102.9	5	4	1	2	2	4	4	3	4	
5	Straight Dough	67.1	3250	105.7	3	1	1	4	5	3	2	2	2	
6	Straight Dough	64.0	2750	96.5	4	4	4	3	3	4	3	3	3	
7	Straight Dough	64.6	1050	104.5	3	4	4	3	3	3	3	3	3	
8	Straight Dough	68.4	1008	109.8	3	4	2	4	2	3	3	3	3	
9	Straight Dough	66.8	925	115.6	3	4	4	4	3	3	3	5	4	
<b>Average</b>		<b>65.2</b>		<b>103.2</b>	<b>3.3</b>	<b>3.3</b>	<b>2.6</b>	<b>3.3</b>	<b>3.1</b>	<b>3.4</b>	<b>3.1</b>	<b>3.1</b>	<b>3.0</b>	
<b>± 1 Std Dev from Mean</b>		<b>2.0</b>		<b>6.7</b>	<b>0.9</b>	<b>1.1</b>	<b>1.3</b>	<b>0.7</b>	<b>1.1</b>	<b>0.5</b>	<b>0.6</b>	<b>0.9</b>	<b>0.7</b>	

		Factors Compared to Glenn Check												
Crookston - K12	Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix		Crumb		Grain &		Overall
								Tolerance	Color	Texture	Protein	Milling	Baking	
1	Sponge/Dough	59.0	2850	95.0	3	3	2	3	3	2	3	4	3	
2	Straight Dough -lb	63.6	3050	91.0	2	3	3	3	3	1	4	3	3	
3	Sponge/Dough	64.0	945	102.4	4	4	4	2	3	1	3	4	3	
4	Sponge/Dough	66.0	3045	102.0	5	5	3	4	2	1	4	2	3	
5	Straight Dough	67.5	3125	94.7	2	1	2	3	3	2	3	2	3	
6	Straight Dough	64.0	2700	110.2	4	4	4	3	3	2	4	4	4	
7	Straight Dough	64.0	915	87.6	3	3	2	4	3	1	3	2	2	
8	Straight Dough	64.9	855	87.0	4	3	2	3	4	2	3	4	4	
9	Straight Dough	67.8	785	89.2	3	4	3	3	3	1	3	2	2	
<b>Average</b>		<b>64.5</b>		<b>95.4</b>	<b>3.3</b>	<b>3.3</b>	<b>2.8</b>	<b>3.1</b>	<b>3.0</b>	<b>1.4</b>	<b>3.3</b>	<b>3.0</b>	<b>3.0</b>	
<b>± 1 Std Dev from Mean</b>		<b>2.6</b>		<b>7.9</b>	<b>1.0</b>	<b>1.1</b>	<b>0.8</b>	<b>0.6</b>	<b>0.5</b>	<b>0.5</b>	<b>0.5</b>	<b>1.0</b>	<b>0.7</b>	

		Factors Compared to Glenn Check												
Minot - M12	Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix		Crumb		Grain &		Overall
								Tolerance	Color	Texture	Protein	Milling	Baking	
1	Sponge/Dough	64.0	2900	100.9	5	5	3	2	2	3	3	3	2	
2	Straight Dough -lb	62.9	3050	100.0	4	2	3	3	3	3	1	3	3	
3	Sponge/Dough	64.0	945	101.6	3	4	4	4	5	3	3	4	4	
4	Sponge/Dough	65.0	2956	98.0	5	5	3	4	3	3	2	3	3	
5	Straight Dough	66.9	3175	113.4	2	4	4	2	2	3	3	4	3	
6	Straight Dough	63.0	2500	96.2	4	4	4	3	4	3	1	4	2	
7	Straight Dough	63.4	1145	109.0	3	3	3	3	3	3	2	3	3	
8	Straight Dough	67.7	1080	98.4	4	3	3	3	2	4	3	3	2	
9	Straight Dough	64.8	950	121.8	3	4	3	4	3	3	3	5	4	
<b>Average</b>		<b>64.6</b>		<b>104.4</b>	<b>3.7</b>	<b>3.8</b>	<b>3.3</b>	<b>3.1</b>	<b>3.0</b>	<b>3.1</b>	<b>2.3</b>	<b>3.6</b>	<b>2.9</b>	
<b>± 1 Std Dev from Mean</b>		<b>1.7</b>		<b>8.6</b>	<b>1.0</b>	<b>1.0</b>	<b>0.5</b>	<b>0.8</b>	<b>1.0</b>	<b>0.3</b>	<b>0.9</b>	<b>0.7</b>	<b>0.8</b>	

		Factors Compared to Glenn Check												
Williston - W12	Cooperator	Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Mix		Crumb		Grain &		Overall
								Tolerance	Color	Texture	Protein	Milling	Baking	
1	Sponge/Dough	65.0	2875	98.3	5	5	3	3	3	3	3	3	3	
2	Straight Dough -lb	65.0	3450	101.5	4	2	4	3	3	3	1	3	3	
3	Sponge/Dough	64.0	960	95.2	4	4	2	4	3	3	2	3	3	
4	Sponge/Dough	66.0	3074	101.0	5	5	3	5	4	4	3	4	4	
5	Straight Dough	69.3	3300	103.1	3	1	4	5	5	3	3	4	4	
6	Straight Dough	66.0	2550	98.1	4	5	3	3	3	3	5	2	2	
7	Straight Dough	65.8	1090	94.8	3	3	1	3	3	3	3	2	2	
8	Straight Dough	69.2	1088	101.4	4	3	3	4	5	3	2	4	4	
9	Straight Dough	67.6	1000	112.4	3	4	2	3	3	3	3	5	4	
<b>Average</b>		<b>66.4</b>		<b>100.6</b>	<b>3.9</b>	<b>3.6</b>	<b>2.8</b>	<b>3.7</b>	<b>3.6</b>	<b>3.1</b>	<b>2.8</b>	<b>3.3</b>	<b>3.2</b>	
<b>± 1 Std Dev from Mean</b>		<b>1.9</b>		<b>5.3</b>	<b>0.8</b>	<b>1.4</b>	<b>1.0</b>	<b>0.9</b>	<b>0.9</b>	<b>0.3</b>	<b>1.1</b>	<b>1.0</b>	<b>0.8</b>	

Casselton - 13		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
Cooperator														
1	Sponge/Dough	62.0	2900	97.5	2	3	1	2	2	3	3	2	2	
2	Straight Dough -lb	57.9	3100	91.2	3	3	3	4	5	3	5	4	4	
3	Sponge/Dough	64.0	975	97.7	4	4	3	3	4	3	4	3	3	
4	Sponge/Dough	61.0	2897	97.0	4	3	1	2	2	3	4	2	2	
5	Straight Dough	62.2	3275	106.5	3	4	4	5	4	3	2	2	2	
6	Straight Dough	63.0	2950	103.5	3	3	3	2	2	3	2	2	2	
7	Straight Dough	58.7	1065	106.0	3	3	4	2	3	4	4	2	3	
8	Straight Dough	65.1	938	102.2	3	4	2	4	4	3	3	4	4	
9	Straight Dough	64.0	860	107.5	3	4	3	2	2	3	3	4	3	
<b>Average</b>		<b>62.0</b>		<b>101.0</b>	<b>3.1</b>	<b>3.4</b>	<b>2.7</b>	<b>2.9</b>	<b>3.1</b>	<b>3.1</b>	<b>3.3</b>	<b>2.8</b>	<b>2.8</b>	
<b>± 1 Std Dev from Mean</b>		<b>2.4</b>		<b>5.5</b>	<b>0.6</b>	<b>0.5</b>	<b>1.1</b>	<b>1.2</b>	<b>1.2</b>	<b>0.3</b>	<b>1.0</b>	<b>1.0</b>	<b>0.8</b>	

Williston - W13		Bake Method	Bake Absorption	Loaf Volume	LV % of CK	Mixing Requirement	Dough Characteristic	Factors Compared to Glenn Check						Overall
								Mix Tolerance	Crumb Color	Grain & Texture	Protein	Milling	Baking	
Cooperator														
1	Sponge/Dough	66.0	2825	96.6	5	5	3	3	3	3	3	3	3	
2	Straight Dough -lb	62.9	3450	101.5	3	1	3	3	3	5	1	3	3	
3	Sponge/Dough	64.0	888	88.1	2	3	1	2	2	3	2	2	1	
4	Sponge/Dough	65.0	3074	101.0	5	5	3	2	2	5	3	2	2	
5	Straight Dough	67.3	3275	102.3	5	3	3	4	5	4	4	4	4	
6	Straight Dough	65.0	2700	103.8	4	5	3	3	3	4	5	4	4	
7	Straight Dough	63.8	1040	90.4	2	4	2	2	4	5	2	2	2	
8	Straight Dough	69.4	1053	98.1	3	3	2	4	4	4	4	4	4	
9	Straight Dough	65.7	850	95.5	3	4	2	3	3	3	2	3	3	
<b>Average</b>		<b>65.5</b>		<b>97.5</b>	<b>3.6</b>	<b>3.7</b>	<b>2.4</b>	<b>2.9</b>	<b>3.2</b>	<b>4.0</b>	<b>2.9</b>	<b>3.0</b>	<b>2.9</b>	
<b>± 1 Std Dev from Mean</b>		<b>2.0</b>		<b>5.4</b>	<b>1.2</b>	<b>1.3</b>	<b>0.7</b>	<b>0.8</b>	<b>1.0</b>	<b>0.9</b>	<b>1.3</b>	<b>0.9</b>	<b>1.1</b>	