Key Stats for Laboratory Management

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Dairy Practices Council

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Dairy labs collect a significant amount of data as part of their on-going quality control activities. This data is recorded and stored in the lab records.

Traditionally these results are used to identify an immediate problem at which time corrective action is taken. The records are then filed away for review by the Assessor and generally are not used for any other purpose.

This PASS or FAIL approach to quality control is effective however there are additional ways to take advantage of the quality control data at hand. REACTIVE APPROACH TO QC

This session is designed to demonstrate how QC data can be analyzed to spot trends and make management decisions to improve lab operations. PROACTIVE APPROACH TO QC

Examples:

- The homogenization efficiency check fails. A new homogenizer is ordered, installed and tested. The instrument is down for three days.

REACTIVE APPROACH TO QC

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- By analyzing the lab's QC data to monitor the degradation of equipment, the Manager determines that a homogenizer will be needed within the next month. The part is ordered and held in inventory. The homogenization efficiency check fails, the new part is installed and tested. The instrument is down for one hour.

PROATIVE APPROACH TO QC

Homogenization Efficiency Check (IR):

First Five Results	Second Five Results
3.801	3.829
3.801	3.830
3.800	3.829
3.802	3.829
3.801	3.831
Avg 3.801	Avg 3.829

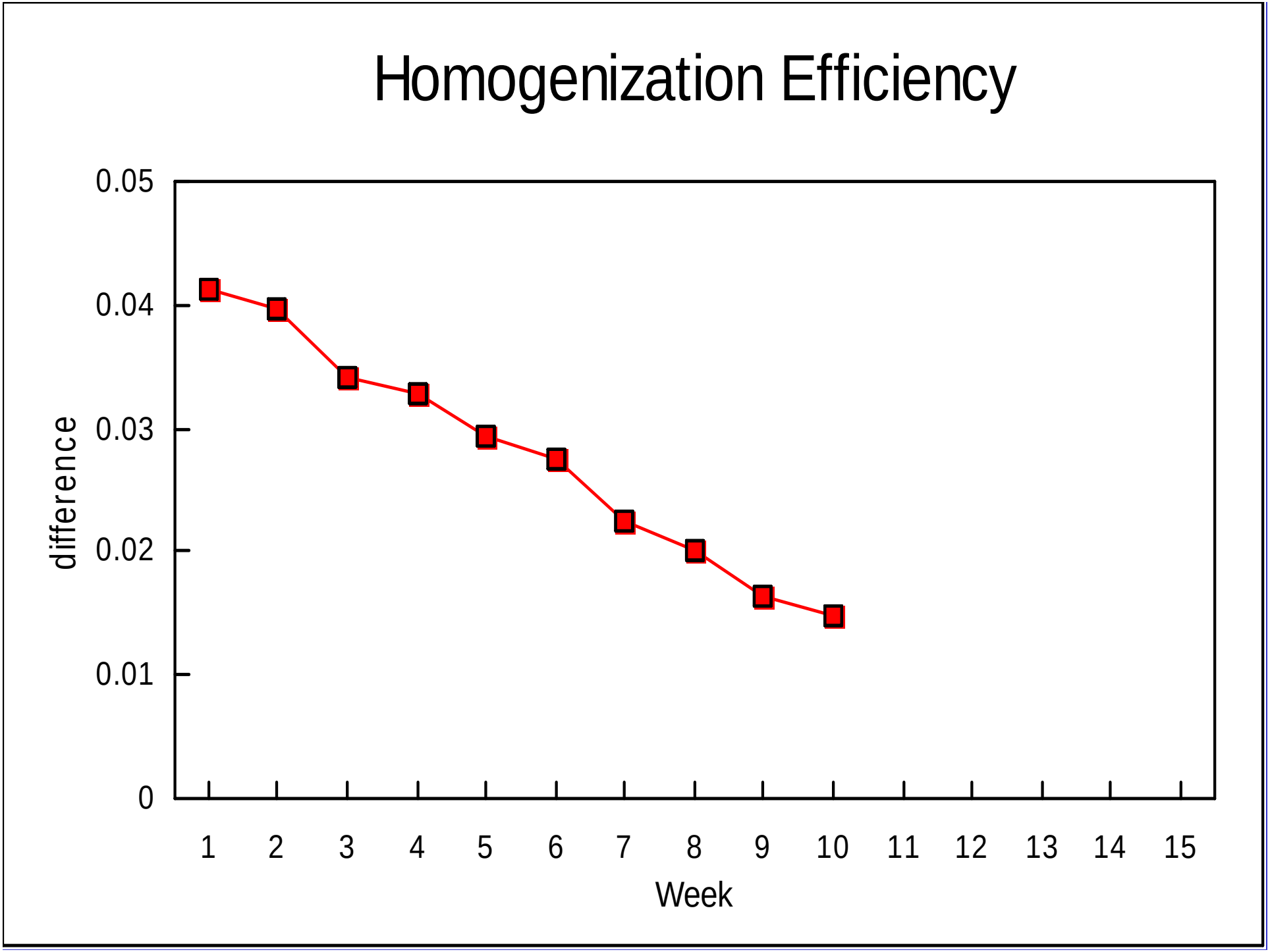
Difference: 3.829 - 3.801 = 0.028

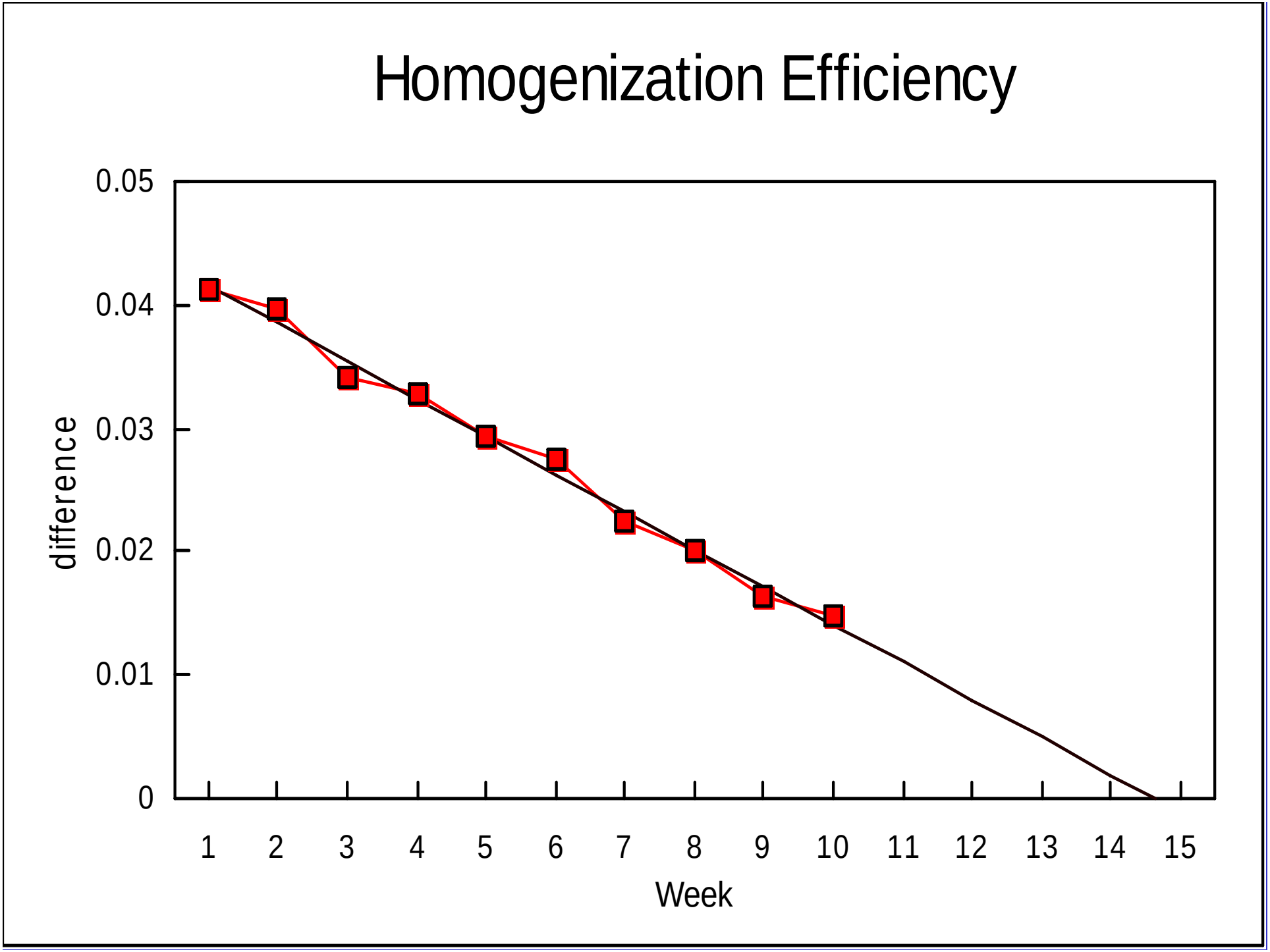
Allowable Difference: 3.801 x 0.0143 = 0.054

Status: PASS

Homogenization Efficiency (trend analysis):

Week	Avg 1	Avg 2	Diff.	Allowable	Status	Allowable - Actual
1	3.236	3.241	0.005	0.046	pass	0.041
2	3.476	3.492	0.010	0.050	pass	0.040
3	4.138	4.157	0.025	0.059	pass	0.034
4	3.687	3.710	0.020	0.053	pass	0.033
5	3.801	3.829	0.025	0.054	pass	0.029
6	3.386	3.417	0.021	0.048	pass	0.027
7	4.026	4.061	0.035	0.058	pass	0.023
8	3.720	3.757	0.033	0.053	pass	0.020
9	3.600	3.639	0.035	0.051	pass	0.016
10	3.964	4.006	0.042	0.057	pass	0.015
11						
12						
13						
14						
15						


Homogenization Efficiency
0.05
0.04
0.03
0.02
0.01
0
difference
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Week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0.05
0.04
0.03
0.02
0.01
0
difference
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Week

Examples:

- The IR zeros are checked hourly and, when necessary, adjusted to ensure that biases are not introduced into the test results.

REACTIVE APPROACH TO QC

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- The Manager plots the zero drift and notices a trend. Fat and protein zeros are both drifting down during the working day. Every morning there is a large positive adjustment to account for the previous days drift. He investigates and determines that the temperature and humidity in the lab are not well controlled and increase significantly throughout the working day. The problem is corrected, zeros stabilize and more accurate test results are generated.

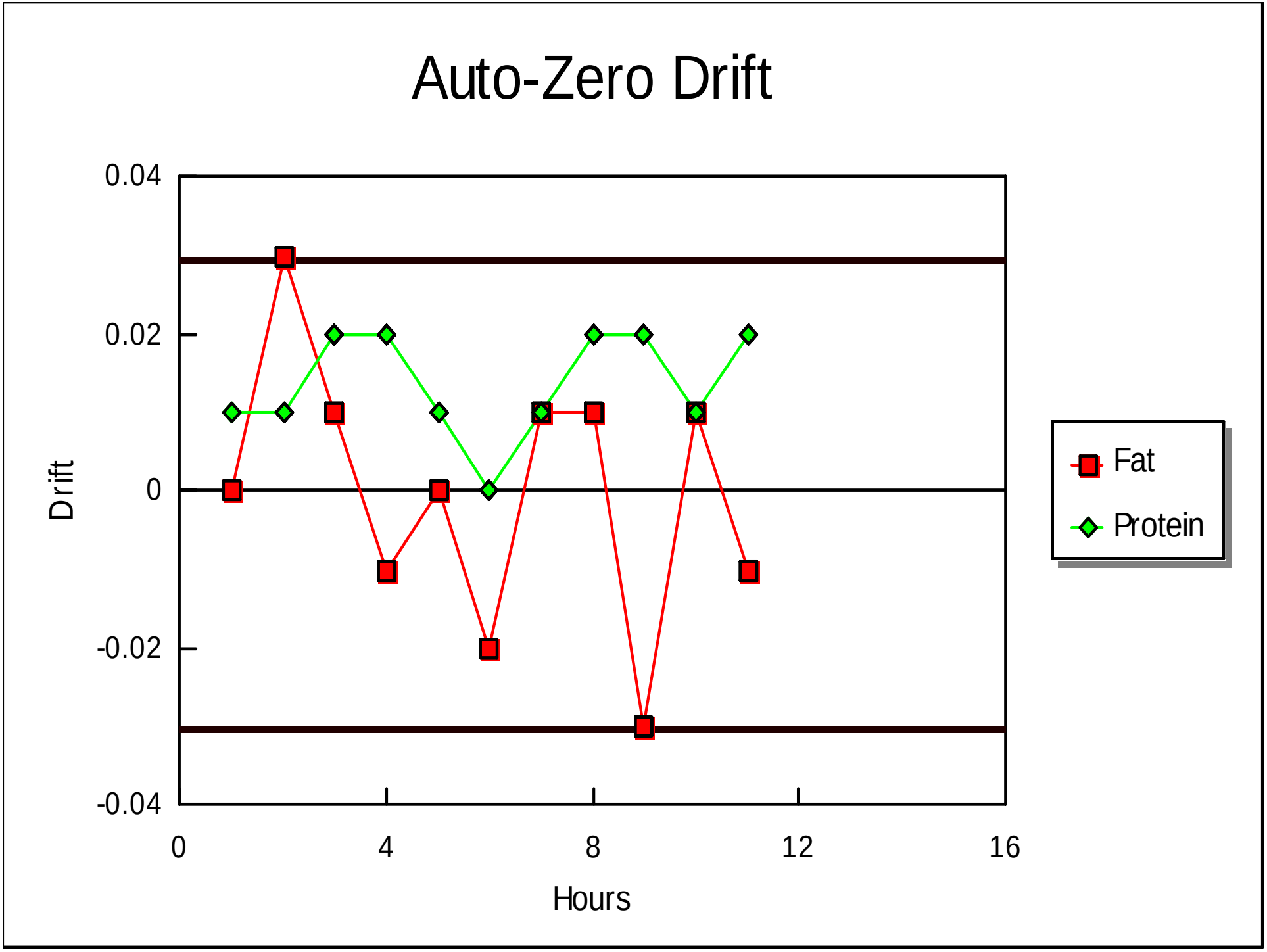
PROATIVE APPROACH TO QC

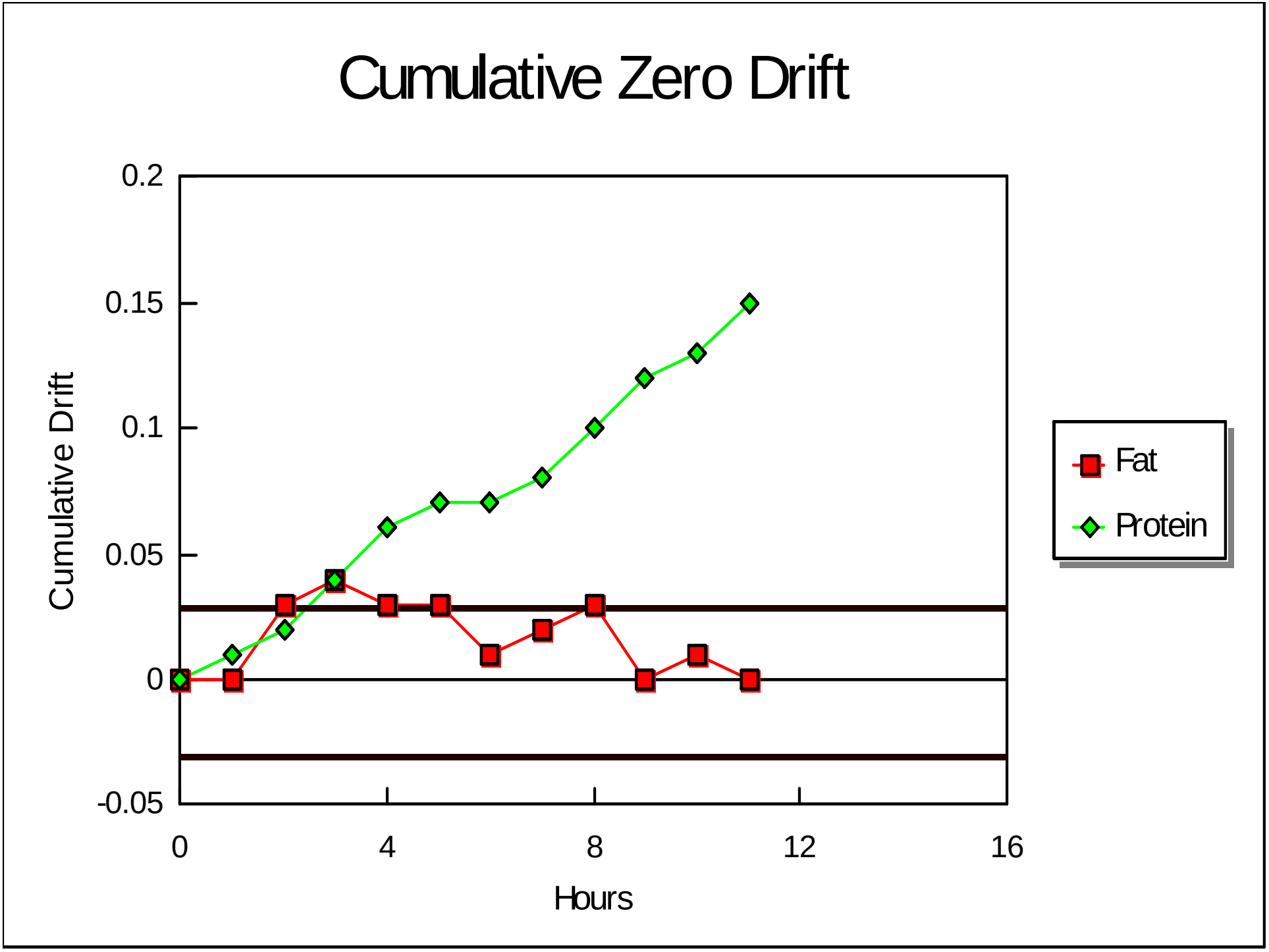
Record of IR Auto-Zeros (IR) - Tolerances +/- 0.03%

Hour	F Zero	P Zero	Status
1	0.000	0.010	pass
2	0.030	0.010	pass
3	0.010	0.020	pass
4	-0.010	0.020	pass
5	0.000	0.010	pass
6	-0.020	0.000	pass
7	0.010	0.010	pass
8	0.010	0.020	pass
9	-0.030	0.020	pass
10	0.010	0.010	pass
11	-0.010	0.020	pass
12			
13			
14			
15			

Record of IR Auto-Zeros (IR) - Tolerances +/- 0.03%

Hour	F Zero	P Zero	Status	Cum. F	Cum. P
1	0.000	0.010	pass	0.000	0.010
2	0.030	0.010	pass	0.030	0.020
3	0.010	0.020	pass	0.040	0.040
4	-0.010	0.020	pass	0.030	0.060
5	0.000	0.010	pass	0.030	0.070
6	-0.020	0.000	pass	0.010	0.070
7	0.010	0.010	pass	0.020	0.080
8	0.010	0.020	pass	0.030	0.100
9	-0.030	0.020	pass	0.000	0.120
10	0.010	0.010	pass	0.010	0.130
11	-0.010	0.020	pass	0.000	0.150
12					
13					
14					
15					


Auto-Zero Drift
0.04
0.02
0
-0.02
-0.04
Drift
0
4
8
12
16
Hours
Fat
Protein


Cumulative Zero Drift
0.2
0.15
0.1
0.05
0
-0.05
Cumulative Drift
0
4
8
12
16
Hours
Fat
Protein

Examples:

- The lab operates three test lines. Calibration samples are received and the required adjustments are made to all machines.

REACTIVE APPROACH TO QC

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- The calibration samples are tested on all lines. The Manager reviews the results and notices that all his machines appear to be testing .03% low on protein. He contacts the supplier of the calibration samples who investigates and confirms that there is in fact an error in the protein data. New reference results are issued and the Manager determines that none of his analyzers need to be adjusted.

PROATIVE APPROACH TO QC

These examples have shown how management decisions based on appropriate use of the QC data can be of significant value.

Example #1 (failing homogenizer)

- reduced down time
- $

Example #2 (temperature problem in the lab)

- increased instrument stability
- provide more reliable results to the customers
- $

Example #3 (error in the calibration samples)

- avoided making improper calibration adjustments
- maintained accuracy of the instruments
- ensured value for $ from the supplier of the calibration standards
- $

What QC data is collected?

Weekly

- Calibration checks (MD, SDD, M%D, SD%D)
- Calibration adjustments (slope, intercept)
- Homogenization efficiency (allowable vs actual)
- Purging efficiencies (milk to water, water to milk)

Daily

- Repeatability checks (range, allowable range)
- Zero checks (SCC)

Hourly

- Zero checks (IR)
- Pilot sample checks (actual - target)

Other

- purge volumes
- voltages
- temperatures (sample, bath)
- throughput (samples / hour)

Mean Difference (MD)

Differences are calculated for each sample in the set of 12.

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IR	REF.	DIFF.
3.54	3.56	-0.02
3.87	3.89	-0.02
3.37	3.33	0.04
3.98	4.00	-0.02
4.25	4.26	-0.01
3.68	3.69	-0.01
3.50	3.47	0.03
4.54	4.55	-0.01
5.02	5.04	-0.02
4.86	4.85	0.01
3.36	3.39	-0.03
3.60	3.62	-0.02

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3.60	3.62	-0.02

The difference is the IR result minus the reference value.

3.87 - 3.89 = -0.02

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MD = -0.007

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SCC	DMSCC	% DIFF.
250	252	-1%
1214	1103	9%
356	343	4%
762	726	5%
559	563	-1%
862	860	0%
1033	993	4%
129	132	-2%
463	459	1%
258	250	3%
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$$\frac{(1214-1103)}{1214} \times 100 = 9\%$$

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Average all of the percent differences to get the mean percent difference.

M%D = 2%

Standard Deviation (SD)

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500	103
503	847
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513	312

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	513	312
Average	505	505

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The averages are identical but...

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SDD = 0.022

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SD%D = 3%

Rolling Mean Difference (RMD)

The rolling mean difference is the average of the mean differences across several trials.

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	MD
January	0.03
February	-0.02
March	-0.03
April	0.01
May	-0.05
June	-0.02

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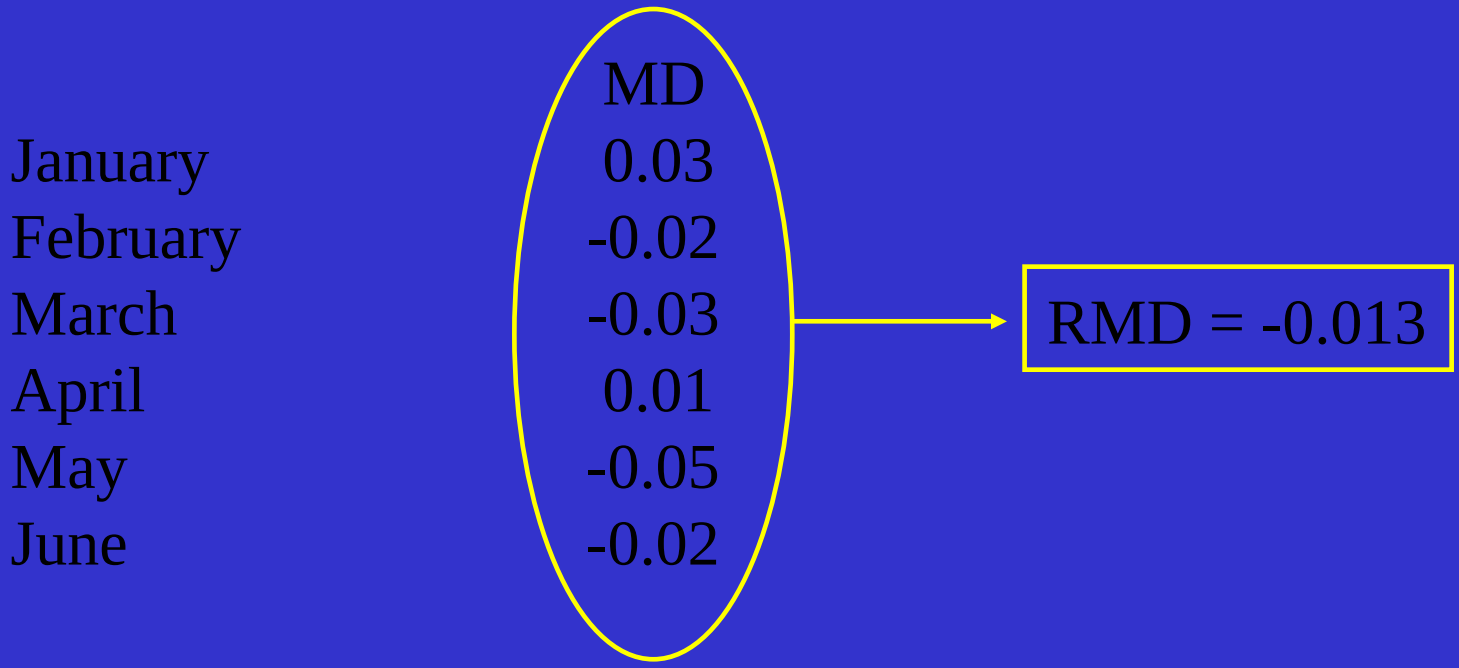
The rolling mean difference is the average of the mean differences across several trials.



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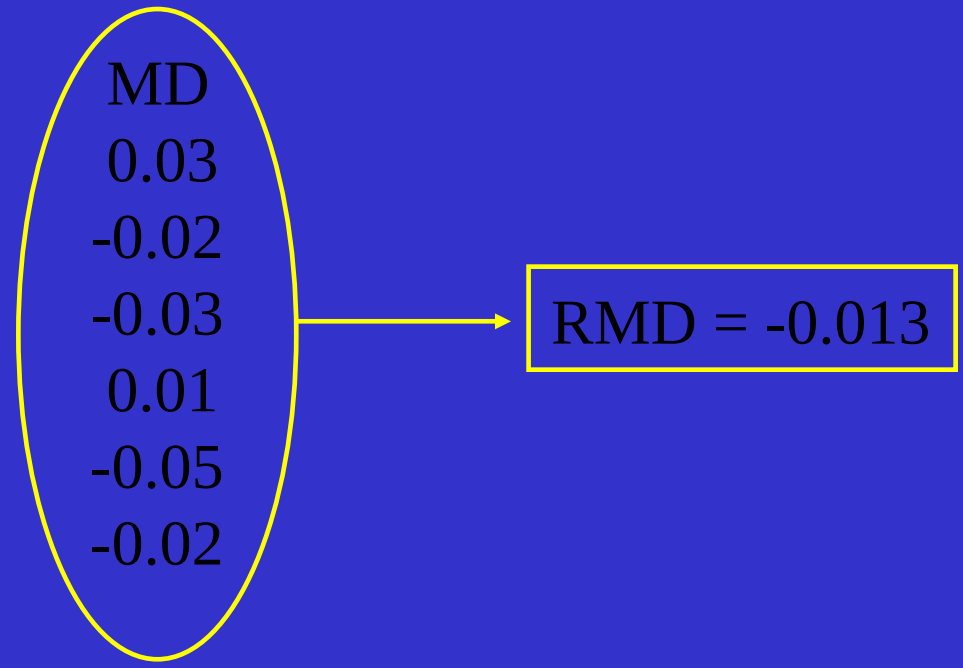

It is an indicator of long-term performance.

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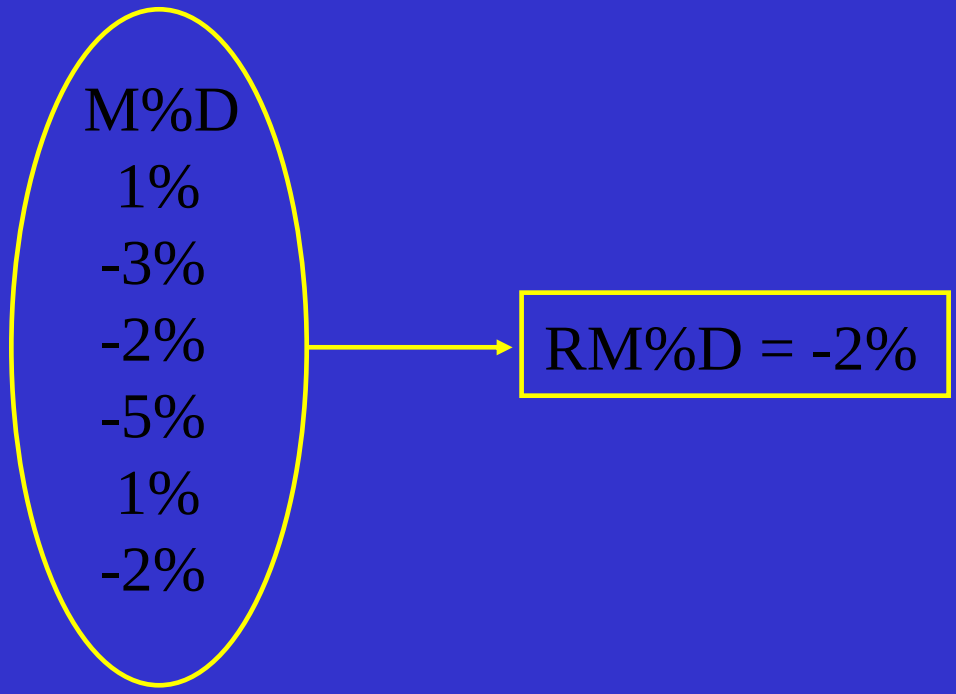

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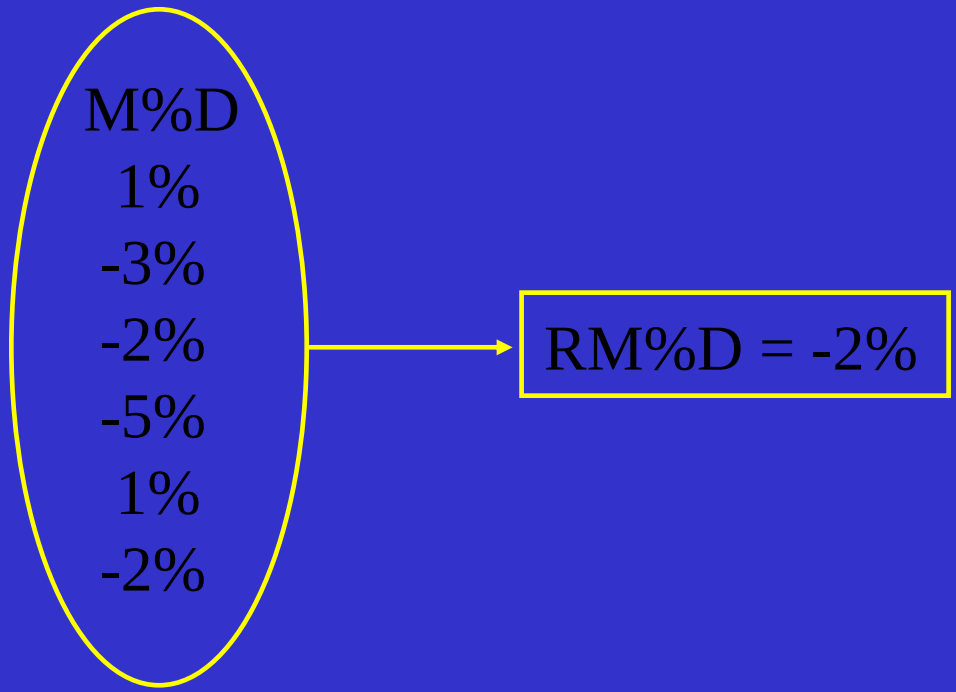

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Quality Certification Services
Quality Assurance Program
Sample Unknowns

Run Batch 143 On 10/5/2009

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Go

Quality Certification Services Inc.

Quality Certification Services
P.O. Box 930399
421 S. Nine Mound Rd.
Verona, WI 53593
Phone: 608-848-6455 - Fax: 608-848-7675
E-mail: sjsievert@dhia.org

Welcome To Quality Certification Services, Inc.

Please Enter Your User ID and Password

User ID:

Password:

Login Reset

Internet

Quality Certification Services, Inc.

Welcome Eastern Laboratory Services
Lab Code 829
To Our Web Site

Current Batch Selected is 143
Please Make Selection

Unknown Entry Is not allowed at this time

- Select Batch
- Change Lab Info
- Manage Email Accounts
- Test Instrument Identification
- Batch Entry Confirmation
- Batch Certification Report
- Email Batch Certification Report
- Batch Comparison Report
- Test Instrument History
- LogOff

Return To Login Page

Quality Certification Services, Inc.

Eastern Laboratory Services Instruments

CL10	Milk Urea Nitrogen
Station 1 Foss 6000	Butterfat, Protein, Milk Urea Nitrogen, SCC
Station 2 Foss 6500	Butterfat, Protein, Milk Urea Nitrogen, SCC
	Butterfat and Protein
	Butterfat and Protein

Submit Changes Reset

Return Without Changing

Sample Number	Lab/Instrument Avg			Instr Result		Prec Stats		Accuracy Stats	
	Ref	Inst	Diff	Rep1	Rep2	Range	SD Reps	IR Mean	Diff
1	4.857	4.863	0.006	4.84	4.84	0.000	0.000	4.840	-0.017
2	5.453	5.462	0.009	5.47	5.46	0.010	0.007	5.465	0.012
3	3.86	3.872	0.012	3.89	3.90	0.010	0.007	3.895	0.035
4	4.113	4.112	-0.001	4.13	4.14	0.010	0.007	4.135	0.022
5	3.807	3.811	0.004	3.78	3.78	0.000	0.000	3.780	-0.027
6	4.690	4.722	0.032	4.71	4.72	0.010	0.007	4.715	0.025
7	3.880	3.889	0.009	3.89	3.90	0.010	0.007	3.895	0.015
8	3.163	3.152	-0.011	3.15	3.15	0.000	0.000	3.150	-0.013
9	3.963	3.975	0.012	3.98	3.97	0.010	0.007	3.975	0.012
10	3.960	3.972	0.012	3.98	3.99	0.010	0.007	3.985	0.025
11	3.357	3.359	0.002	3.35	3.35	0.000	0.000	3.350	-0.007
12	3.573	3.560	-0.013	3.54	3.54	0.000	0.000	3.540	-0.033
		MD	0.022			SDA	0.005	MD	0.010
		SDD	0.014					SDD	0.024

Sample Number	Lab/Instrument Avg			Instr Result		Prec Stats		Accuracy Stats	
	Ref	Inst	Diff	Rep1	Rep2	Range	SD Reps	IR Mean	Diff
1	4.857	4.863	0.006	4.84	4.84	0.000	0.000	4.840	-0.017
2	5.453	5.462	0.009	5.47	5.46	0.010	0.007	5.465	0.012
3	3.86	3.872	0.012	3.89	3.90	0.010	0.007	3.895	0.035
4	4.113	4.112	-0.001	4.13	4.14	0.010	0.007	4.135	0.022
5	3.807	3.811	0.004	3.78	3.78	0.000	0.000	3.780	-0.027
6	4.690	4.722	0.032	4.71	4.72	0.010	0.007	4.715	0.025
7	3.880	3.889	0.009	3.89	3.90	0.010	0.007	3.895	0.015
8	3.163	3.152	-0.011	3.15	3.15	0.000	0.000	3.150	-0.013
9	3.963	3.975	0.012	3.98	3.97	0.010	0.007	3.975	0.012
10	3.960	3.972	0.012	3.98	3.99	0.010	0.007	3.985	0.025
11	3.357	3.359	0.002	3.35	3.35	0.000	0.000	3.350	-0.007
12	3.573	3.560	-0.013	3.54	3.54	0.000	0.000	3.540	-0.033
		MD	0.022			SDA	0.005	MD	0.010
		SDD	0.014					SDD	0.024

The mean difference for the analyzer is found here.

Sample Number	Lab/Instrument Avg			Instr Result		Prec Stats		Accuracy Stats	
	Ref	Inst	Diff	Rep1	Rep2	Range	SD Reps	IR Mean	Diff
1	4.857	4.863	0.006	4.84	4.84	0.000	0.000	4.840	-0.017
2	5.453	5.462	0.009	5.47	5.46	0.010	0.007	5.465	0.012
3	3.86	3.872	0.012	3.89	3.90	0.010	0.007	3.895	0.035
4	4.113	4.112	-0.001	4.13	4.14	0.010	0.007	4.135	0.022
5	3.807	3.811	0.004	3.78	3.78	0.000	0.000	3.780	-0.027
6	4.690	4.722	0.032	4.71	4.72	0.010	0.007	4.715	0.025
7	3.880	3.889	0.009	3.89	3.90	0.010	0.007	3.895	0.015
8	3.163	3.152	-0.011	3.15	3.15	0.000	0.000	3.150	-0.013
9	3.963	3.975	0.012	3.98	3.97	0.010	0.007	3.975	0.012
10	3.960	3.972	0.012	3.98	3.99	0.010	0.007	3.985	0.025
11	3.357	3.359	0.002	3.35	3.35	0.000	0.000	3.350	-0.007
12	3.573	3.560	-0.013	3.54	3.54	0.000	0.000	3.540	-0.033
		MD	0.022			SDA	0.005	MD	0.010
		SDD	0.014					SDD	0.024

Sample Number	Lab/Instrument Avg			Instr Result		Prec Stats		Accuracy Stats	
	Ref	Inst	Diff	Rep1	Rep2	Range	SD Reps	IR Mean	Diff
1	4.857	4.863	0.006	4.84	4.84	0.000	0.000	4.840	-0.017
2	5.453	5.462	0.009	5.47	5.46	0.010	0.007	5.465	0.012
3	3.86	3.872	0.012	3.89	3.90	0.010	0.007	3.895	0.035
4	4.113	4.112	-0.001	4.13	4.14	0.010	0.007	4.135	0.022
5	3.807	3.811	0.004	3.78	3.78	0.000	0.000	3.780	-0.027
6	4.690	4.722	0.032	4.71	4.72	0.010	0.007	4.715	0.025
7	3.880	3.889	0.009	3.89	3.90	0.010	0.007	3.895	0.015
8	3.163	3.152	-0.011	3.15	3.15	0.000	0.000	3.150	-0.013
9	3.963	3.975	0.012	3.98	3.97	0.010	0.007	3.975	0.012
10	3.960	3.972	0.012	3.98	3.99	0.010	0.007	3.985	0.025
11	3.357	3.359	0.002	3.35	3.35	0.000	0.000	3.350	-0.007
12	3.573	3.560	-0.013	3.54	3.54	0.000	0.000	3.540	-0.033
		MD	0.022			SDA	0.005	MD	0.010
		SDD	0.014					SDD	0.024

The standard deviation of differences for the analyzer is found here.

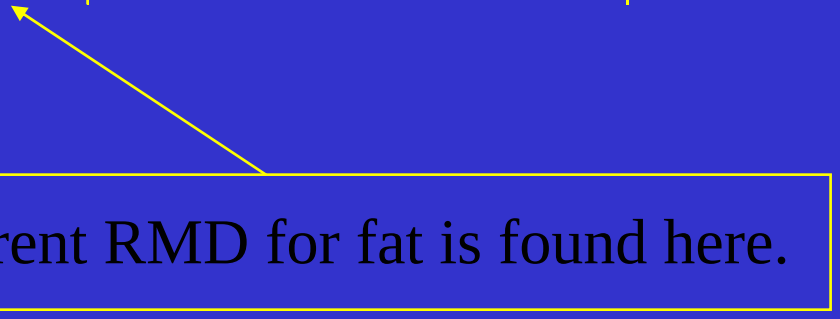
Sample Number	Lab/Instrument Avg			Instr Result		Prec Stats		Accuracy Stats	
	Ref	Inst	Diff	Rep1	Rep2	Range	SD Reps	IR Mean	Diff
1	4.857	4.863	0.006	4.84	4.84	0.000	0.000	4.840	-0.017
2	5.453	5.462	0.009	5.47	5.46	0.010	0.007	5.465	0.012
3	3.86	3.872	0.012	3.89	3.90	0.010	0.007	3.895	0.035
4	4.113	4.112	-0.001	4.13	4.14	0.010	0.007	4.135	0.022
5	3.807	3.811	0.004	3.78	3.78	0.000	0.000	3.780	-0.027
6	4.690	4.722	0.032	4.71	4.72	0.010	0.007	4.715	0.025
7	3.880	3.889	0.009	3.89	3.90	0.010	0.007	3.895	0.015
8	3.163	3.152	-0.011	3.15	3.15	0.000	0.000	3.150	-0.013
9	3.963	3.975	0.012	3.98	3.97	0.010	0.007	3.975	0.012
10	3.960	3.972	0.012	3.98	3.99	0.010	0.007	3.985	0.025
11	3.357	3.359	0.002	3.35	3.35	0.000	0.000	3.350	-0.007
12	3.573	3.560	-0.013	3.54	3.54	0.000	0.000	3.540	-0.033
		MD	0.022			SDA	0.005	MD	0.010
		SDD	0.014					SDD	0.024

Sample Number	Lab/Instrument Avg			Instr Result		Prec Stats		Accuracy Stats	
	Ref	Inst	Diff	Rep1	Rep2	Range	SD Reps	IR Mean	Diff
1	4.857	4.863	0.006	4.84	4.84	0.000	0.000	4.840	-0.017
2	5.453	5.462	0.009	5.47	5.46	0.010	0.007	5.465	0.012
3	3.86	3.872	0.012	3.89	3.90	0.010	0.007	3.895	0.035
4	4.113	4.112	-0.001	4.13	4.14	0.010	0.007	4.135	0.022
5	3.807	3.811	0.004	3.78	3.78	0.000	0.000	3.780	-0.027
6	4.690	4.722	0.032	4.71	4.72	0.010	0.007	4.715	0.025
7	3.880	3.889	0.009	3.89	3.90	0.010	0.007	3.895	0.015
8	3.163	3.152	-0.011	3.15	3.15	0.000	0.000	3.150	-0.013
9	3.963	3.975	0.012	3.98	3.97	0.010	0.007	3.975	0.012
10	3.960	3.972	0.012	3.98	3.99	0.010	0.007	3.985	0.025
11	3.357	3.359	0.002	3.35	3.35	0.000	0.000	3.350	-0.007
12	3.573	3.560	-0.013	3.54	3.54	0.000	0.000	3.540	-0.033
		MD	0.022			SDA	0.005	MD	0.010
		SDD	0.014					SDD	0.024

MD must be less than +/- 0.04% AND SDD must be less than 0.04% in at least three of the last four trials.

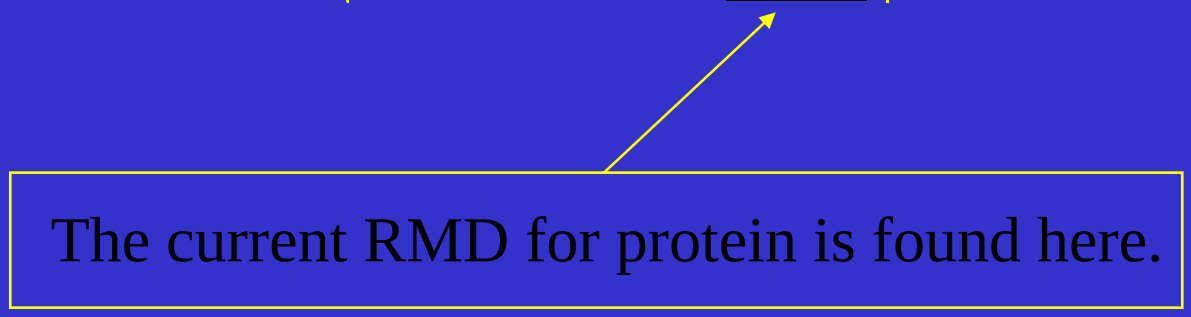
Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0

Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0



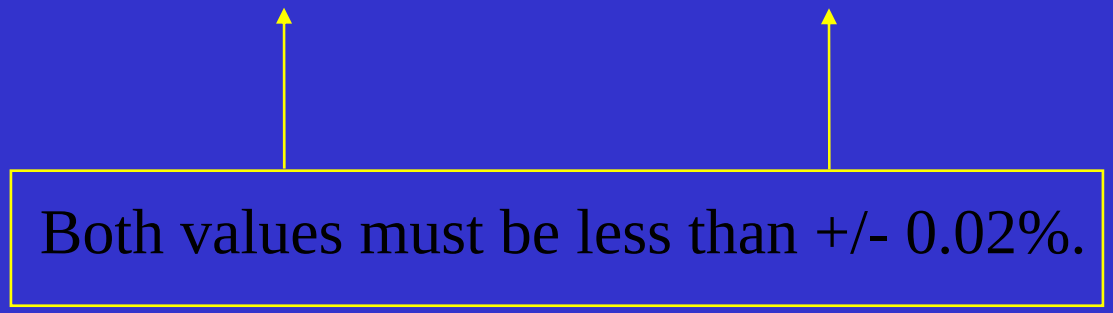
Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0

Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0



Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0

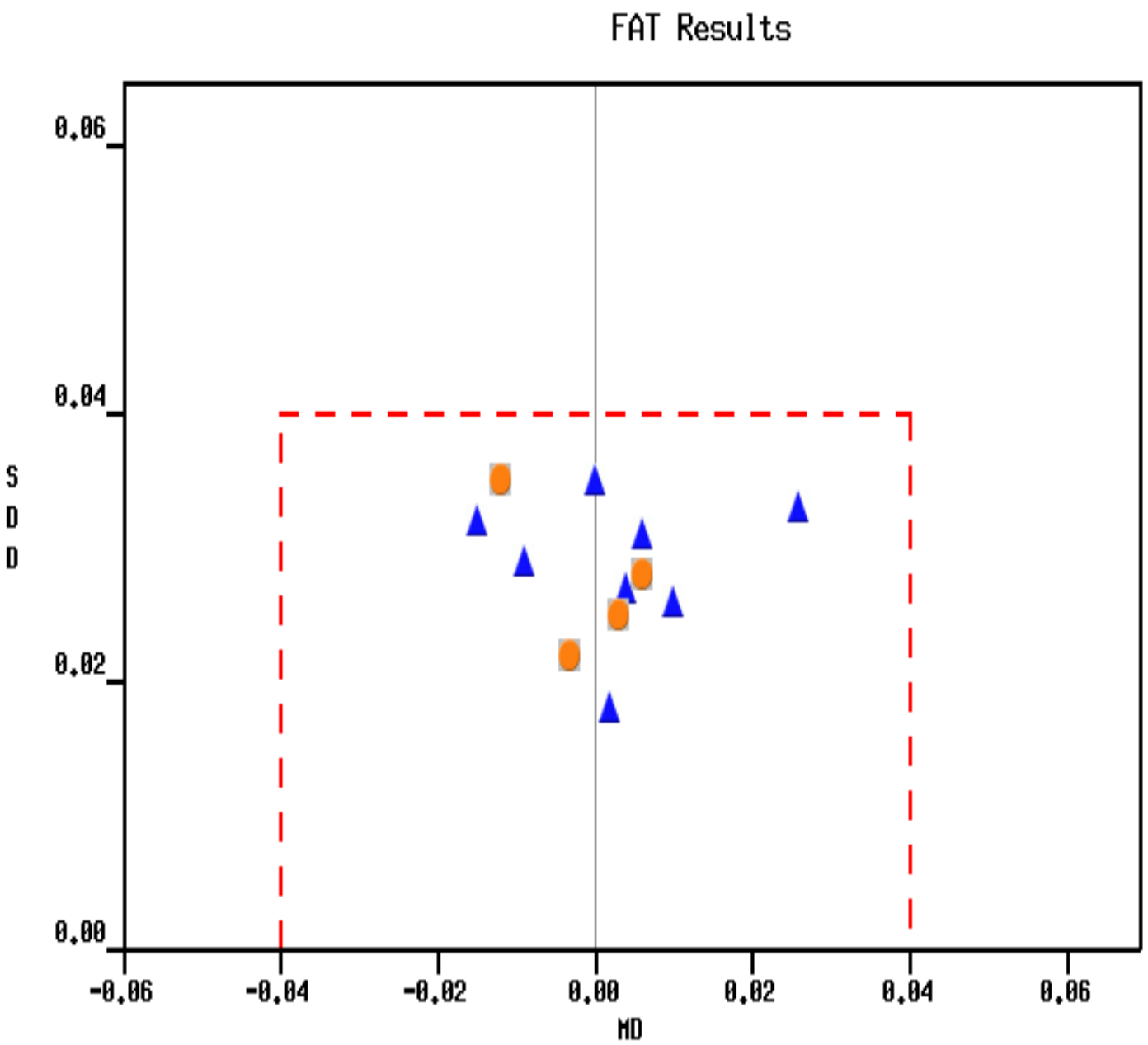
Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0



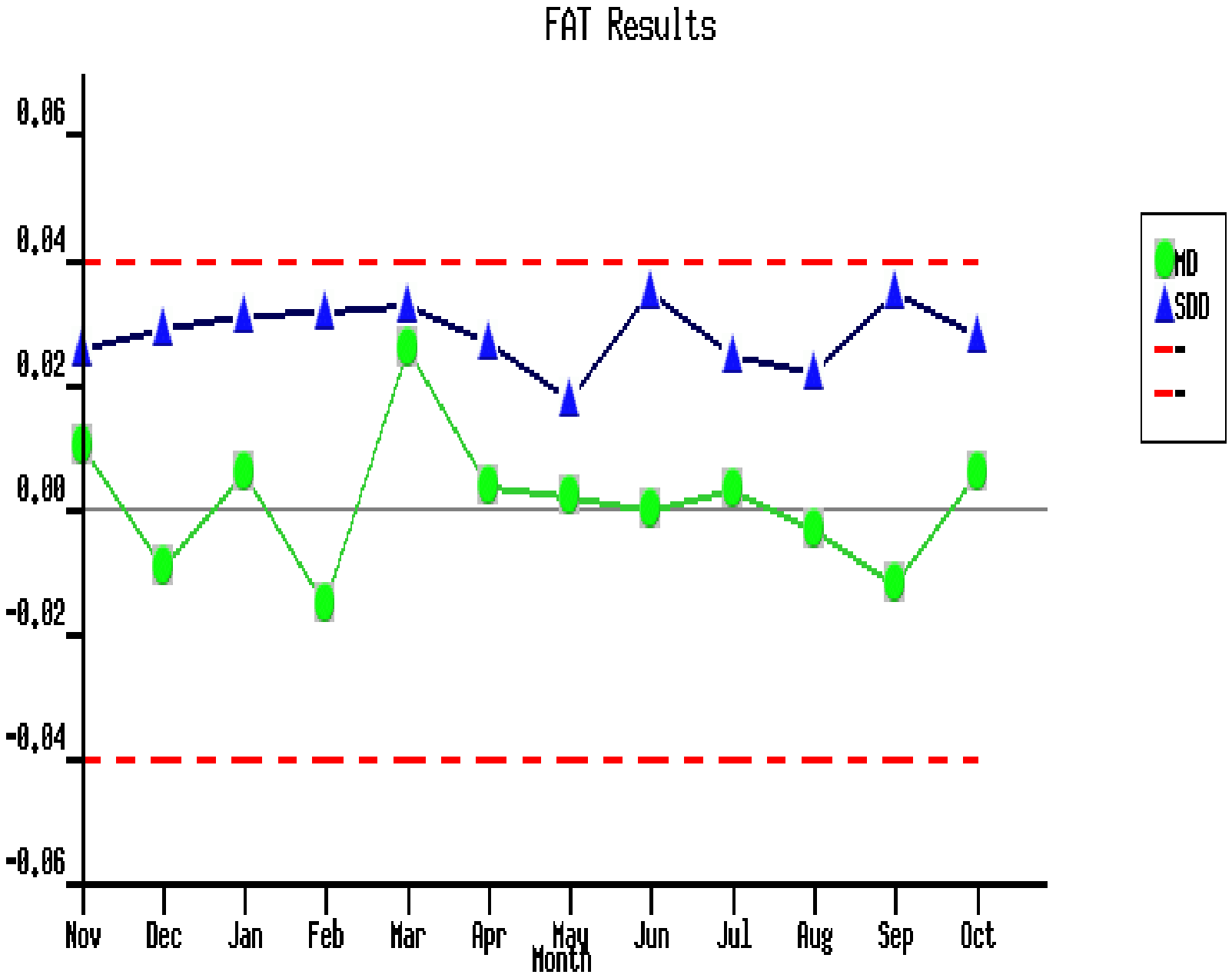
Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0

Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0

Month	FAT Results			PRO Results			SCC Results		
	MD	SDD	RMD	MD	SDD	RMD	M%D	SD%D	RM%D
Jan	-0.024	0.045	-0.024	-0.026	0.020	-0.026	2	5	2
Feb	0.021	0.045	-0.001	0.018	0.026	-0.004	2	6	2
Mar	0.002	0.04	0.000	-0.018	0.028	-0.009	3	5	2
Apr	-0.032	0.049	-0.008	-0.021	0.034	-0.012	1	5	2
May	0.031	0.033	0.000	0.002	0.029	-0.009	-3	5	1
Jun	0.007	0.046	0.001	-0.023	0.012	-0.011	0	3	1
Jul	0.031	0.02	0.005	0.017	0.017	-0.007	2	3	1
Aug	0.023	0.018	0.007	0.014	0.012	-0.005	-2	4	1
Sep	0.021	0.026	0.009	0.017	0.016	-0.002	-4	8	0
Oct	0.013	0.019	0.009	0.015	0.017	0.000	-1	5	0
Nov	-0.008	0.028	0.008	-0.027	0.016	-0.003	0	5	0



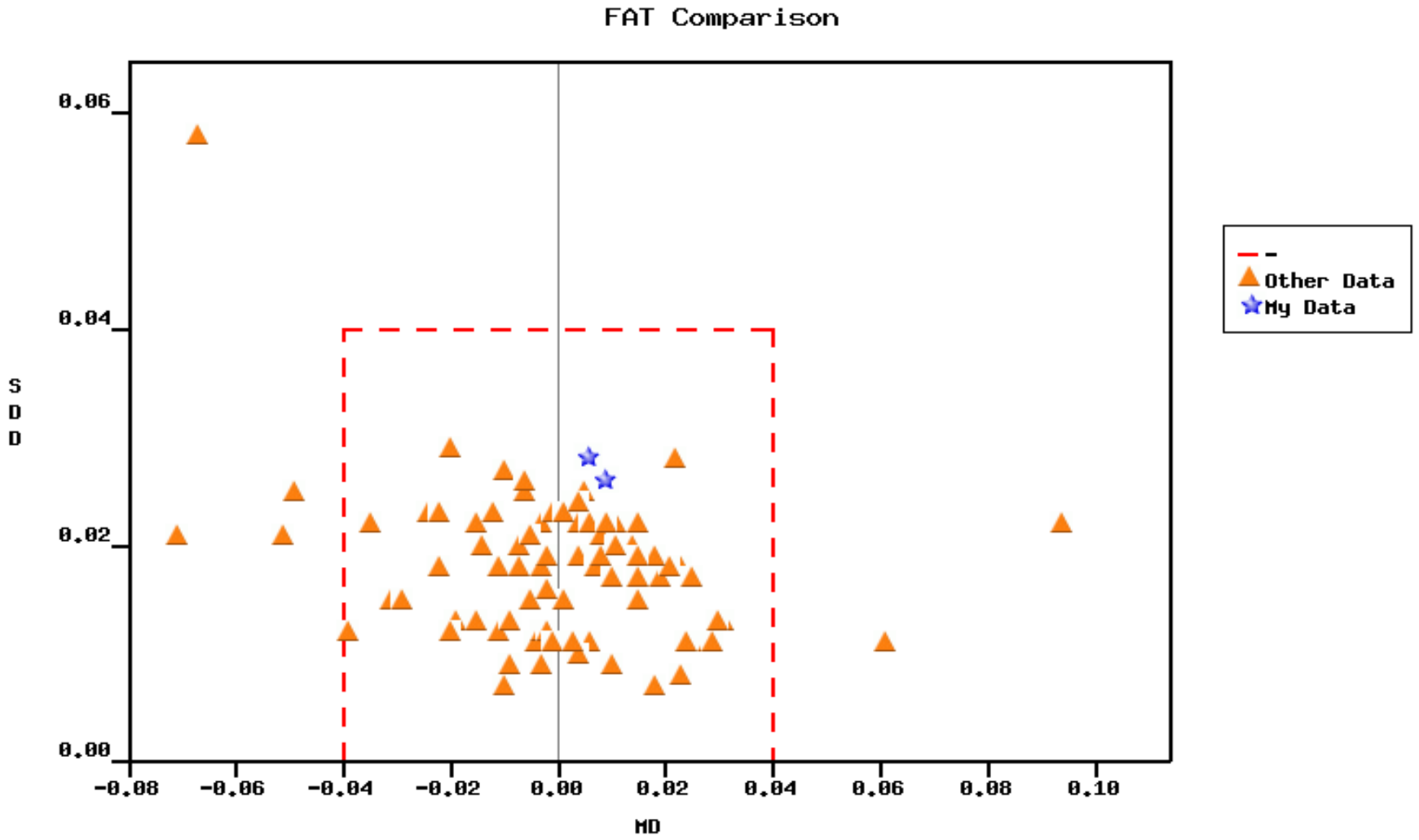
Month	MD	SDD	RMD
Nov	0.010	0.026	0.006
Dec	-0.009	0.029	0.002
Jan	0.006	0.031	0.002
Feb	-0.015	0.032	0.002
Mar	0.026	0.033	0.003
Apr	0.004	0.027	0.004
May	0.002	0.018	0.002
Jun	0.000	0.035	0.004
Jul	0.003	0.025	0.003
Aug	-0.003	0.022	0.005
Sept	-0.012	0.035	-0.001
Oct	0.006	0.028	-0.001

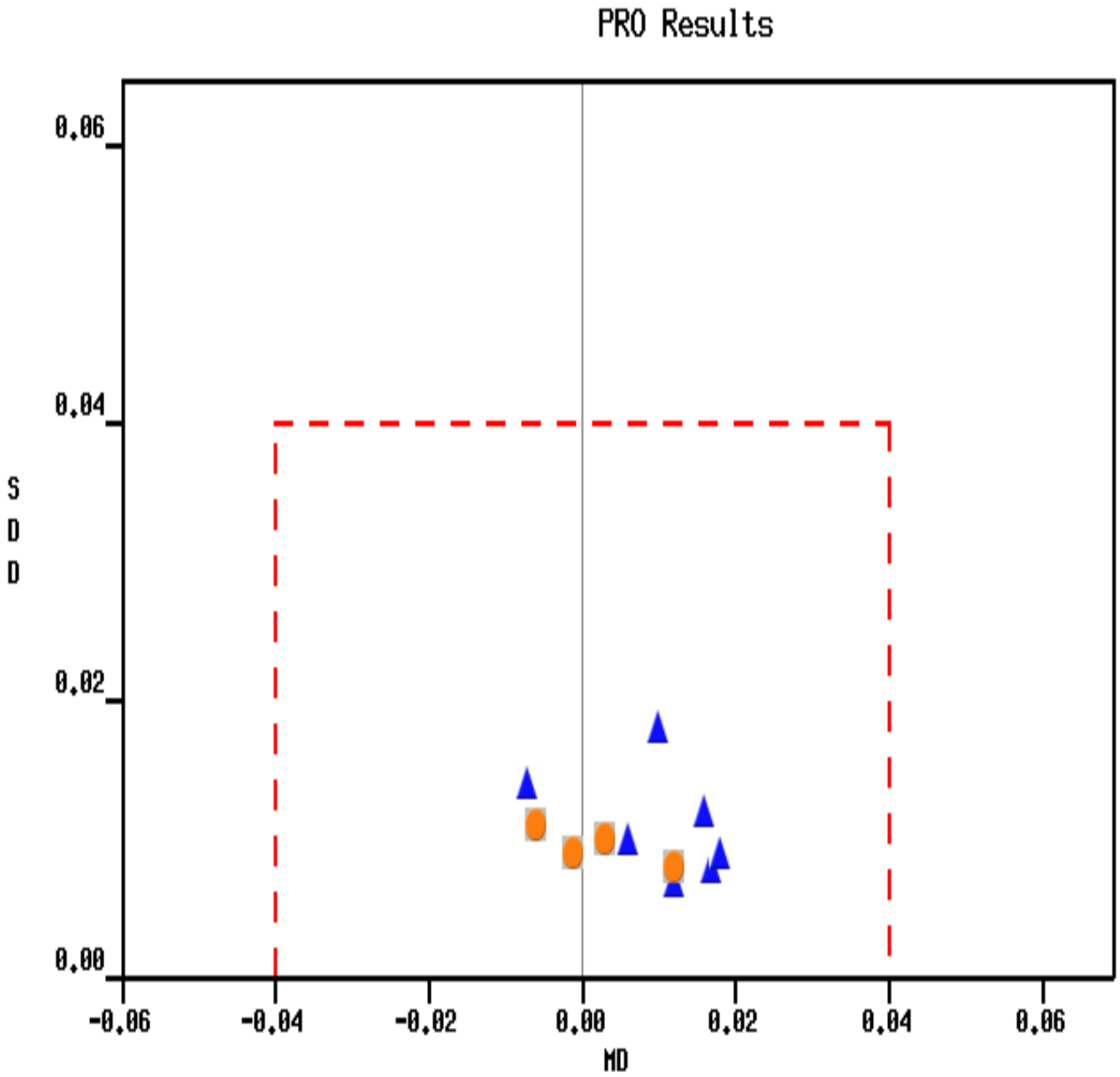

FAT Results
0,06
0,04
0,02
0,00
-0,02
-0,04
-0,06
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Month
MD
SDD

Butterfat

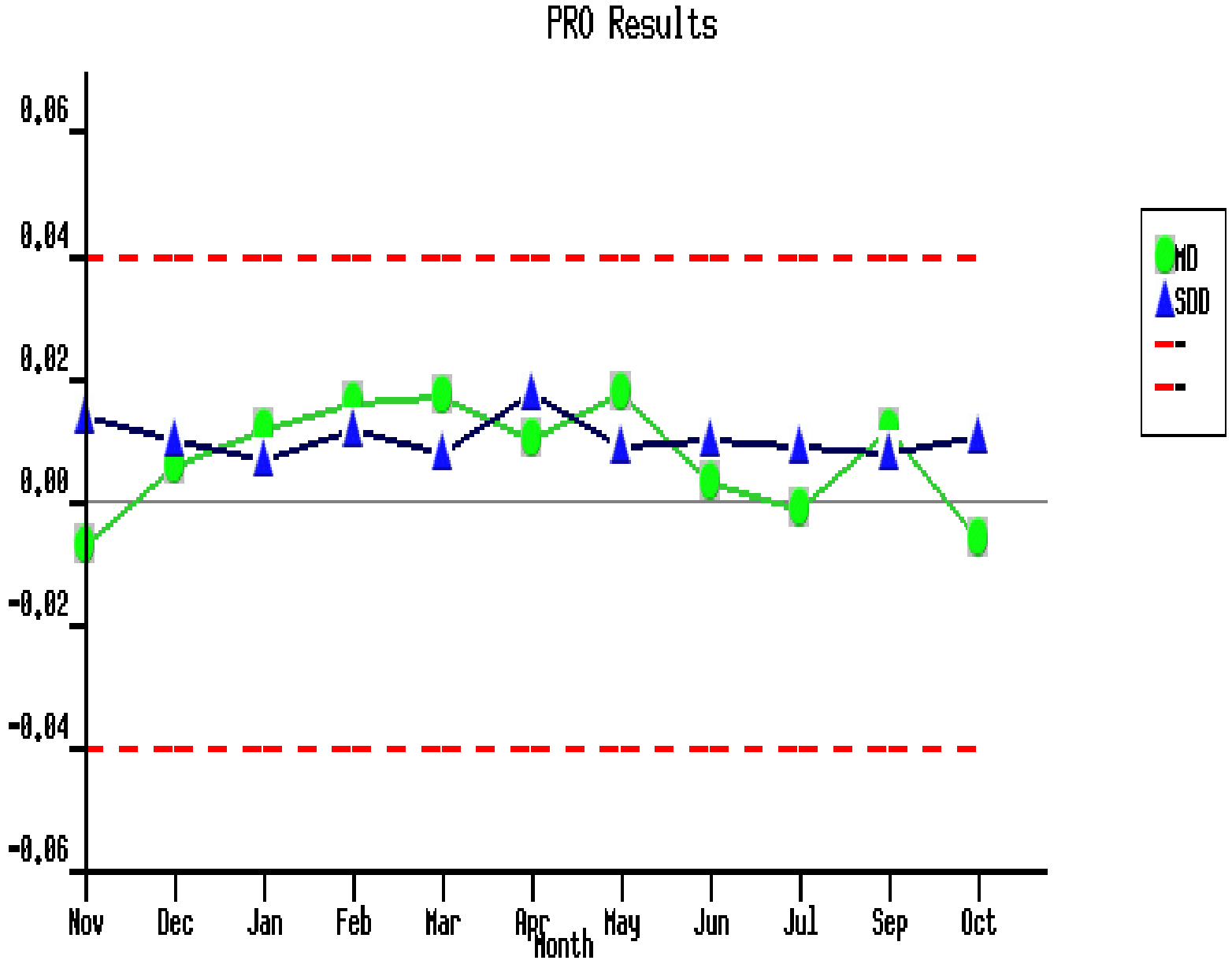
Station Foss 6000
MD: 0.006
SDD: 0.028

Station 2 Foss 6500
MD: 0.009
SDD: 0.026





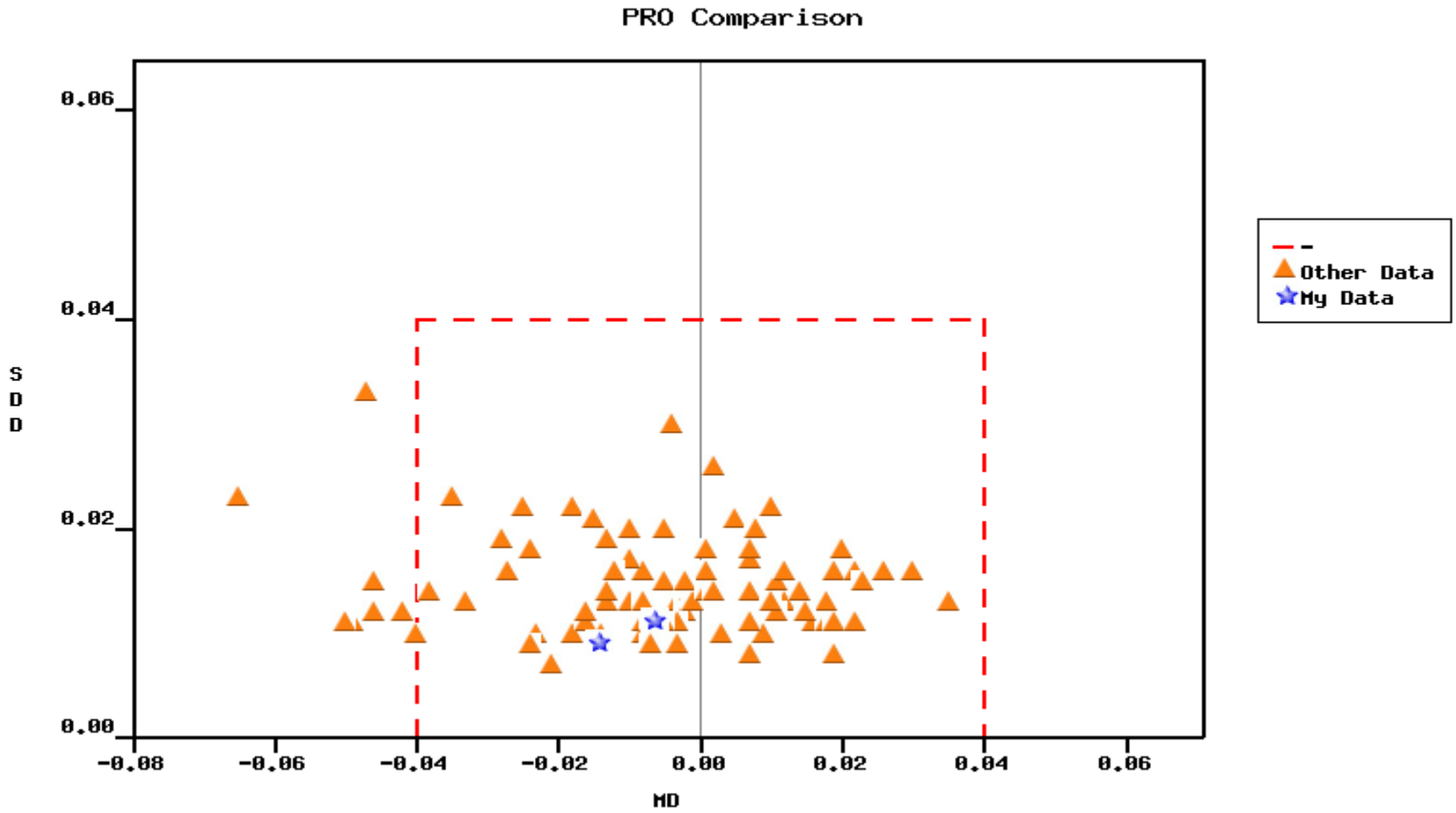
Month	MD	SDD	RMD
Nov	-0.007	0.014	-0.008
Dec	0.006	0.010	-0.007
Jan	0.012	0.007	-0.005
Feb	0.016	0.012	0.003
Mar	0.017	0.008	0.007
Apr	0.010	0.018	0.009
May	0.018	0.009	0.013
Jun	0.003	0.010	0.013
Jul	-0.001	0.009	0.011
Aug			
Sept	0.012	0.008	0.010
Oct	-0.006	0.011	0.006

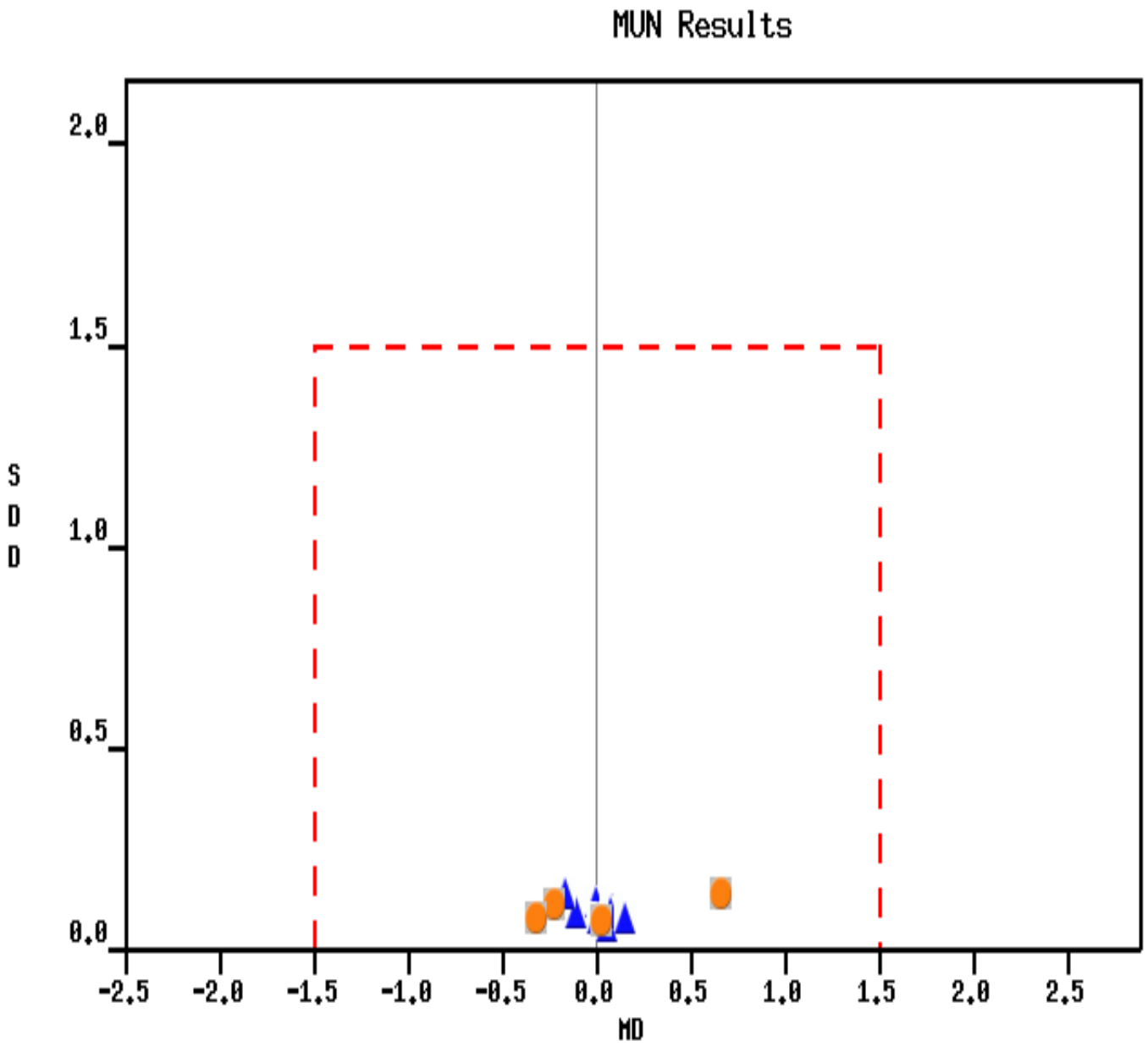

PRO Results
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Sep
Oct
Month
MD
SDD

Protein

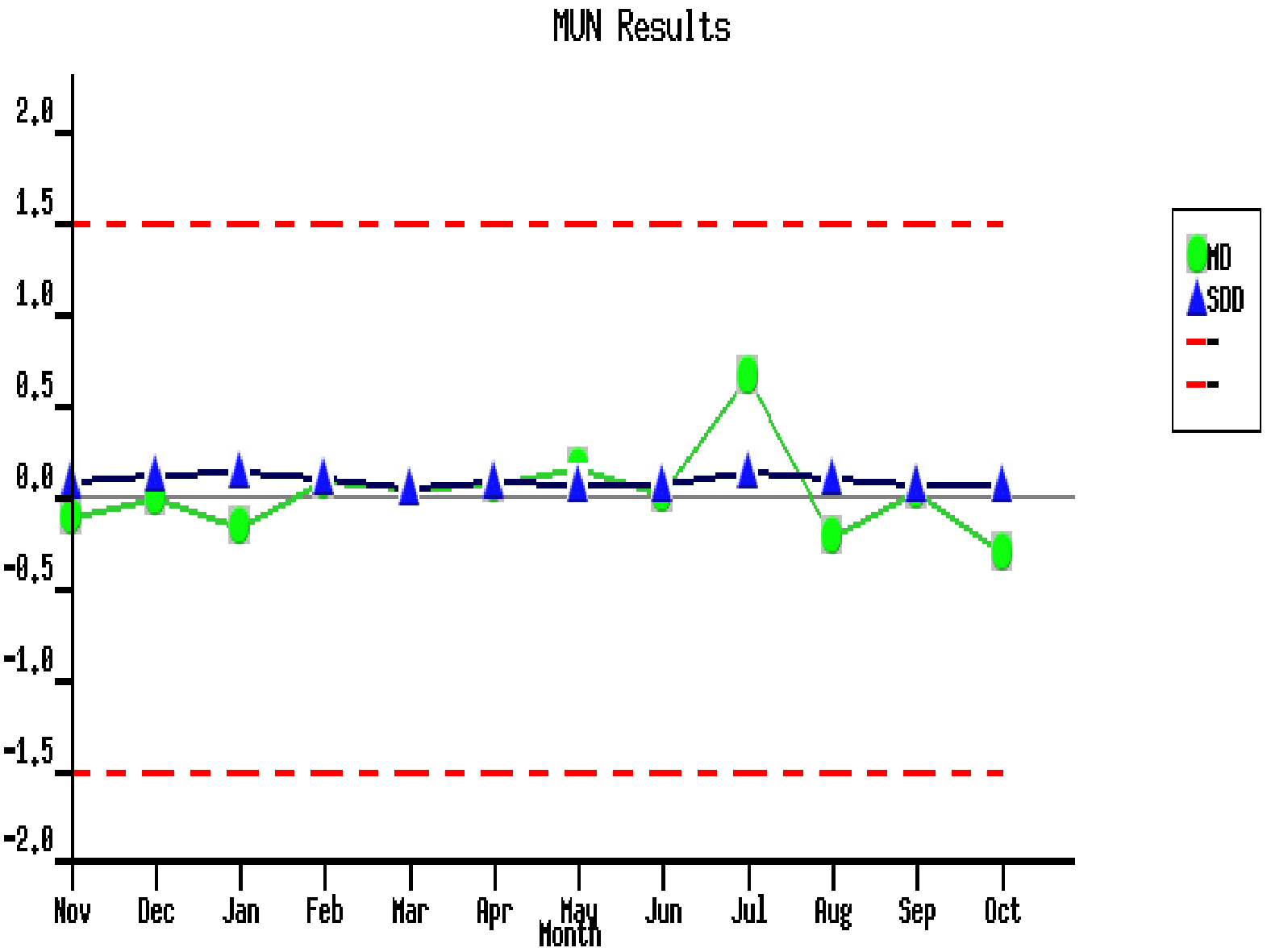
Station 1 Foss 6000
MD: -0.006
SDD: 0.011

Station 2 Foss 6500
MD:-0.014
SDD: 0.009





Month	MD	SDD	RMD
Nov	-0.10	0.09	-0.15
Dec	0.00	0.12	-0.10
Jan	-0.16	0.14	-0.07
Feb	0.09	0.10	-0.03
Mar	0.06	0.06	-0.04
Apr	0.08	0.09	-0.01
May	0.16	0.08	0.04
June	0.01	0.08	0.04
Jul	0.67	0.14	0.18
Aug	-0.22	0.11	0.13
Sept	0.03	0.07	0.12
Oct	-0.31	0.08	0.06

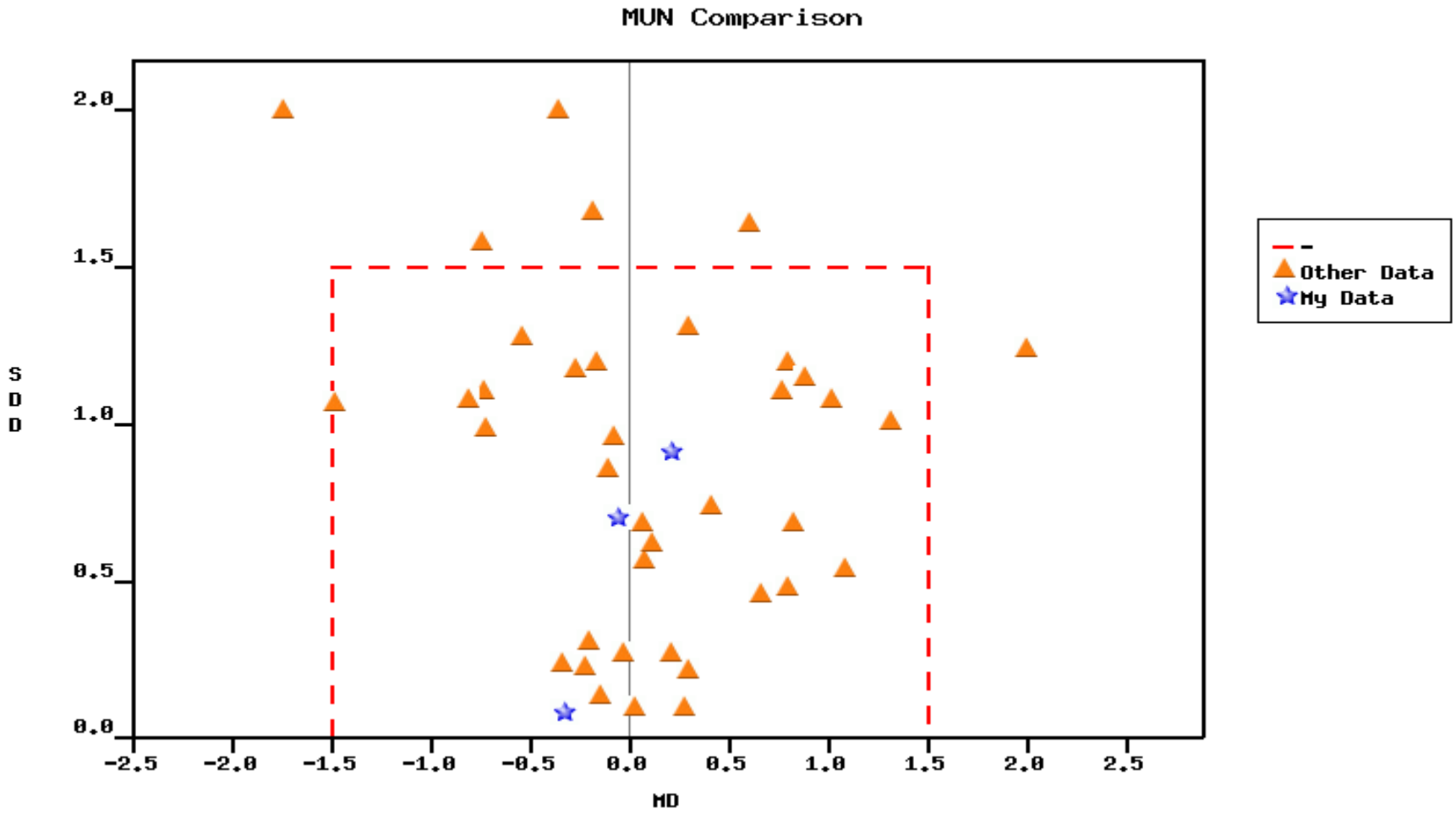

MUN Results
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Month
MD
SDD

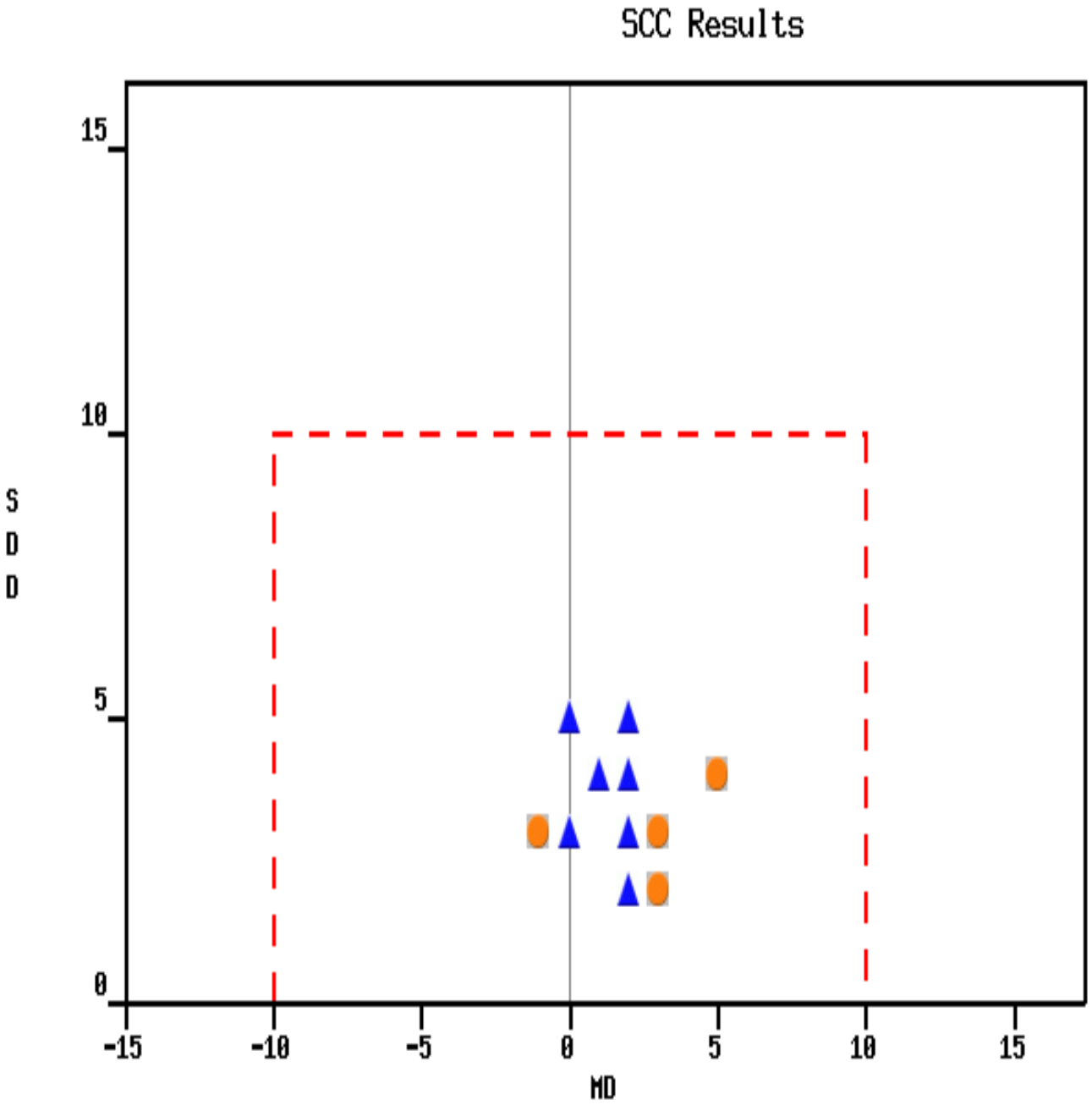
MUN

CL10
MD: -0.31
SDD: 0.08

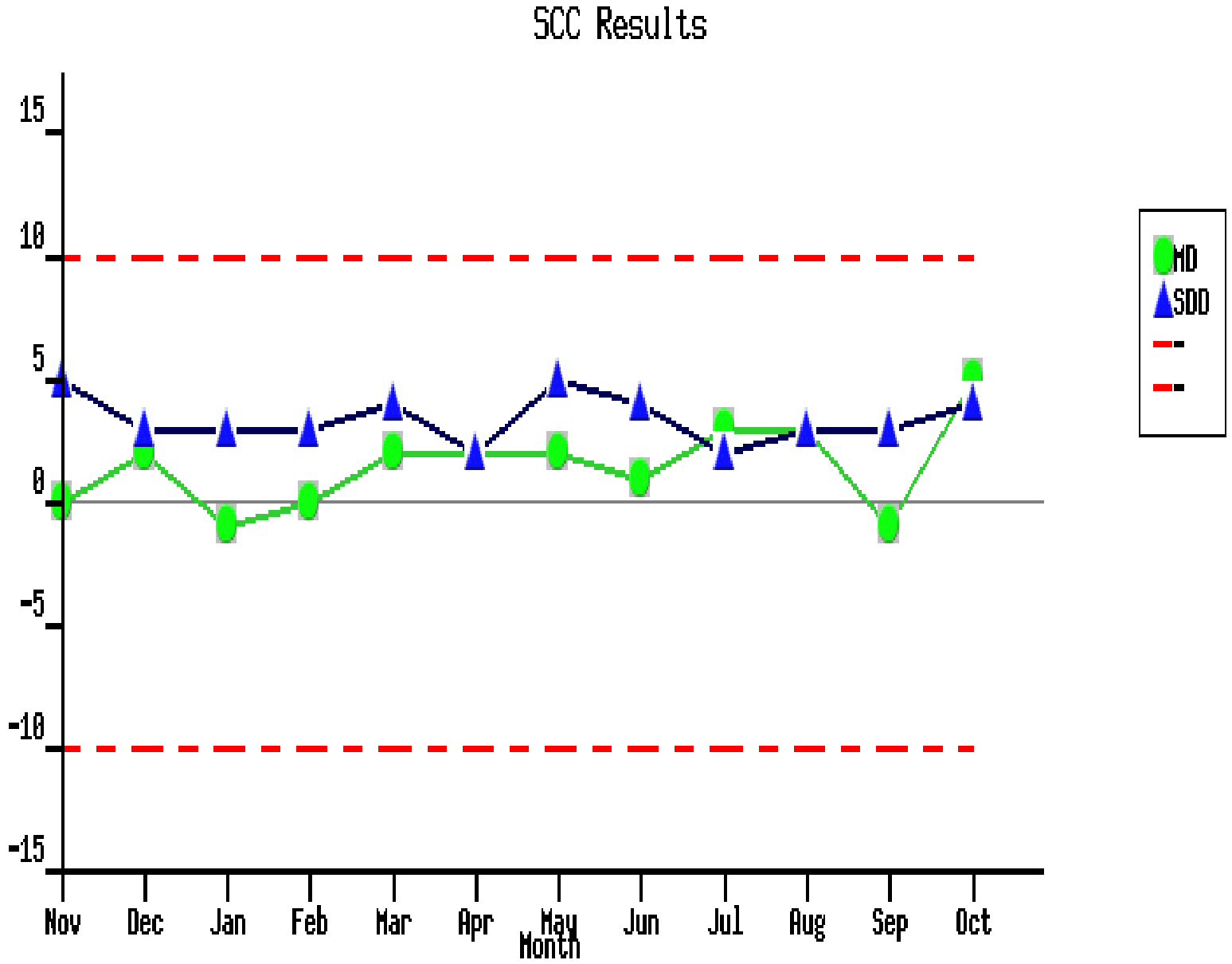
Station 1 Foss 6000
MD: 0.23
SDD 0.91

Station 2 Foss 6500
MD: -0.04
SDD: 0.70





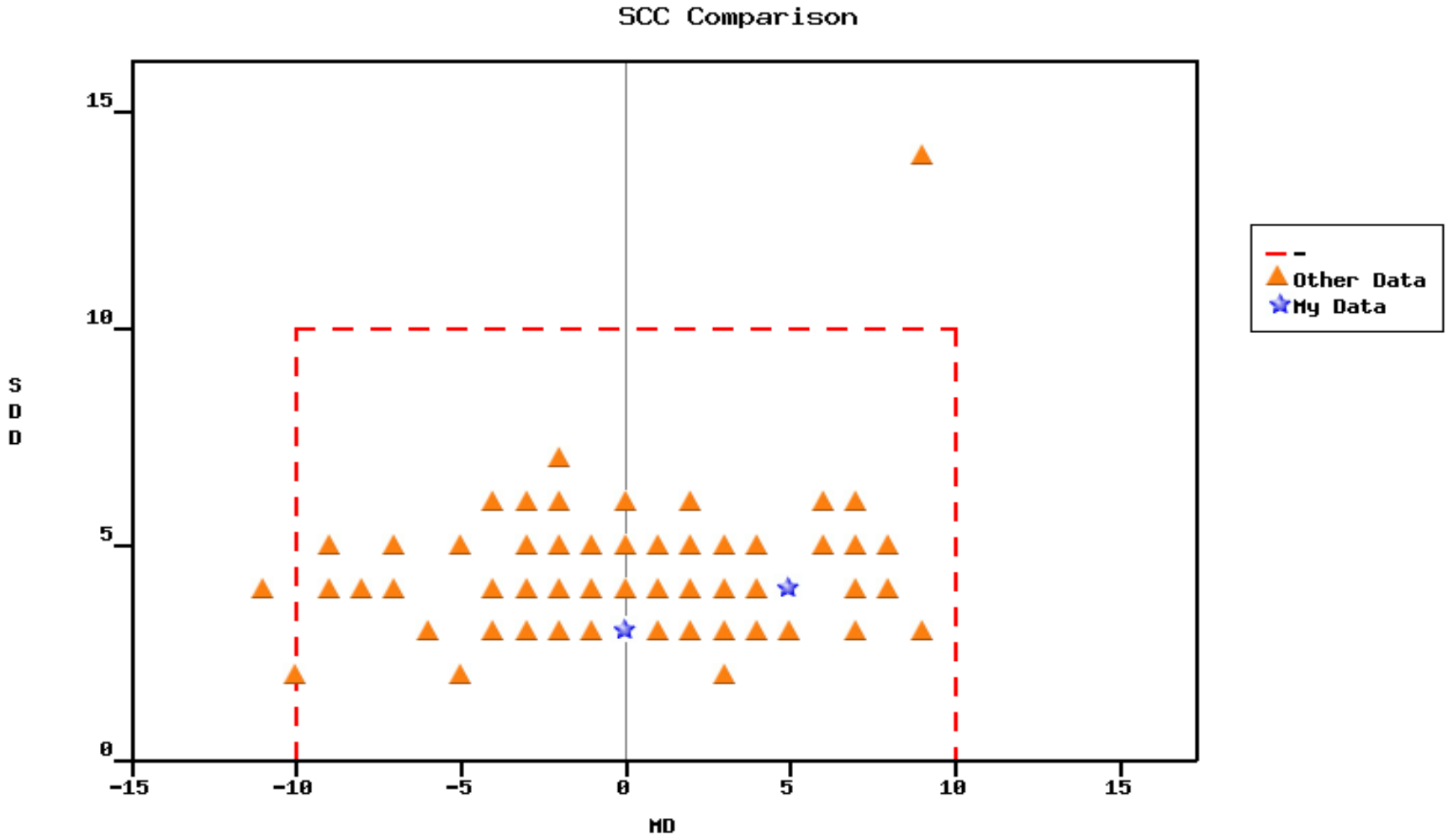
Month	MD	SDD	RMD
Nov	0	5	0
Dec	2	3	0
Jan	-1	3	0
Feb	0	3	-1
Mar	2	4	0
Apr	2	2	1
May	2	5	1
Jun	1	4	1
Jul	3	2	2
Aug	3	3	2
Sept	-1	3	2
Oct	5	4	2


SCC Results
15
10
5
0
-5
-10
-15
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Month
MD
SDD

SCC

Station 1 Foss 6000
MD: 5
SDD: 4

Station 2 Foss 6500
MD: 0
SDD: 3



Instrument History

Eastern Laboratory Services

Station 1 Foss 6000

	FAT			PRO			SCC		
	MD	SDD	RMD	MD	SDD	RMD	MD	SDD	RMD
Jun	0.000	0.035	0.004	0.003	0.010	0.013	1	4	1
Jul	0.003	0.025	0.003	-0.001	0.009	0.011	3	2	2
Aug	-0.003	0.022	0.005				3	3	2
Sep	-0.012	0.035	-0.001	0.012	0.008	0.010	-1	3	2
Oct	0.006	0.028	-0.001	-0.006	0.011	0.006	5	4	2
Nov									

Station 2 Foss 6500

	FAT			PRO			SCC		
	MD	SDD	RMD	MD	SDD	RMD	MD	SDD	RMD
Jun	-0.013	0.040	-0.016	0.004	0.012	0.006	-5	3	-2
Jul	-0.004	0.027	-0.013	-0.001	0.009	0.007	-6	4	-3
Aug	-0.004	0.041	-0.009				-3	2	-4
Sep	0.015	0.032	-0.007	-0.003	0.018	0.003	6	4	-3
Oct	0.009	0.026	-0.002	-0.014	0.009	0.001	0	3	-2
Nov									

Green = OK ***Red = Exceeded Limit***

For an instrument to fail one of the following must occur:

ButterFat and Protein:

MD* exceeded +/- 0.04 in three of four previous batches

SDD** exceeded 0.04 in three of four previous batches

RMD*** of the previous six batches exceeded +/- 0.02

Somatic Cell Count:

MD* exceeded +/- 10% in three of four previous batches

SDD** exceeded 10 in three of four previous batches

RMD*** of the previous six batches exceeded +/- 5%

*MD - Mean Difference **SDD - Standard Deviation Of Differences ***RMD - Rolling Mean Difference

THANKS